Communications Marketplace Report

Collected Appendices

A. Mobile Wireless Market Appendices

APPENDIX A-1: TOTAL MOBILE WIRELESS CONNECTIONS

Appendix Figure II.A.1
***Estimated* Total Mobile Wireless Connections: 2003–2017**

	NRUF			CTIA
Year	Connections (millions)	Increase from previous year (millions)	Connections Per 100 People	Estimated Connections (millions)
2003	160.6	18.8	54	158.7
2004	184.7	24.1	62	182.1
2005	213.0	28.3	71	207.9
2006	241.8	28.8	80	233.0
2007	263.0	21.2	86	255.4
2008	279.6	16.6	91	270.3
2009	290.7	11.1	94	285.6
2010	301.8	11.1	97	296.3
2011	317.3	15.5	101	316.0
2012	329.2	11.9	105	326.5
2013	339.2	10.0	108	335.7
2014	357.1	17.2	114	355.4
2015	378.2	21.1	121	377.9
2016	398.4	20.2	127	395.9
2017	410.7	12.3	126	400.2

Source: NRUF 2003–2017; CTIA Wireless Industry Year-End Indices; Census data.

APPENDIX A-2: PENETRATION RATES BY EA
Appendix Figure II.A.2
PENETRATION RATES BY EA: 2013-2017

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
1	82	Biloxi-Gulfport-Pascagoula, MS	436,438	204%	168%	126%	106%
2	102	Davenport-Moline-Rock Island, IA-IL	557,998	186%	158%	117%	103%
3	101	Peoria-Pekin, IL	519,880	178%	161%	126%	108%
4	57	Detroit-Ann Arbor-Flint, MI	6,831,311	177%	174%	161%	150%
5	55	Cleveland-Akron, OH-PA	4,521,868	159%	153%	143%	141%
6	84	Baton Rouge, LA-MS	865,489	143%	142%	131%	118%
7	8	Buffalo-Niagara Falls, NY-PA	1,448,276	139%	131%	120%	111%
8	73	Memphis, TN-AR-MS-KY	2,008,738	139%	131%	118%	113%
9	51	Columbus, OH	2,763,581	137%	135%	128%	126%
10	88	Shreveport-Bossier City, LA-AR	586,915	137%	123%	114%	115%
11	40	Atlanta, GA-AL-NC	7,354,214	136%	130%	122%	114%
12	99	Kansas City, MO-KS	2,814,986	136%	132%	124%	116%
13	50	Dayton-Springfield, OH	1,118,228	136%	133%	127%	121%
14	10	New York-North New Jersey-Long Island, NY-NJ-CT-PA	27,438,740	134%	130%	124%	119%
15	31	Miami-Fort Lauderdale, FL	6,959,355	133%	131%	124%	110%
16	155	Farmington, NM-CO	224,752	133%	138%	127%	117%
17	83	New Orleans, LA-MS	1,720,674	133%	136%	129%	121%
18	3	Boston-Worcester-Lawrence-Lowewell-Brockton, MA-NH	8,566,759	131%	127%	121%	117%
19	160	Los Angeles-Riverside-Orange County, CA-AZ	20,824,439	130%	128%	120%	109%
20	94	Springfield, MO	1,013,648	129%	122%	112%	103%
21	12	Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD	7,892,279	129%	125%	119%	113%
22	13	Washington-Baltimore, DC-MD-VA-WV-PA	10,229,209	129%	126%	121%	117%
23	64	Chicago-Gary-Kenosha, IL-IN-WI	10,799,978	129%	126%	119%	115%
24	161	San Diego, CA	3,337,685	128%	126%	121%	111%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
25	85	Lafayette, LA	659,736	128%	124%	121%	119%
26	97	Springfield, IL-MO	508,944	127%	124%	117%	112%
27	142	Scottsbluff, NE-WY	89,593	127%	127%	123%	119%
28	135	Odessa-Midland, TX	481,713	126%	120%	120%	122%
29	87	Beaumont-Port Arthur, TX	469,537	126%	124%	119%	117%
30	116	Sioux Falls, SD-IA-MN-NE	594,401	126%	121%	111%	108%
31	86	Lake Charles, LA	564,006	126%	120%	117%	113%
32	163	San Francisco-Oakland-San Jose, CA	10,515,482	125%	123%	116%	108%
33	78	Birmingham, AL	1,720,001	125%	119%	114%	111%
34	172	Honolulu, HI	1,427,538	125%	120%	114%	111%
35	93	Joplin, MO-KS-OK	280,818	124%	120%	114%	110%
36	44	Knoxville, TN	1,156,968	124%	124%	119%	114%
37	49	Cincinnati-Hamilton, OH-KY-IN	2,376,858	124%	122%	118%	111%
38	53	Pittsburgh, PA-WV	2,887,694	124%	120%	113%	109%
39	89	Monroe, LA	336,404	124%	124%	122%	116%
40	20	Norfolk-Virginia Beach-Newport News, VA-NC	1,878,745	123%	122%	122%	118%
41	22	Fayetteville, NC	587,839	123%	125%	116%	113%
42	69	Evansville-Henderson, IN-KY-IL	879,608	123%	118%	111%	109%
43	17	Roanoke, VA-NC-WV	898,251	123%	120%	119%	113%
44	79	Montgomery, AL	499,729	122%	118%	115%	112%
45	132	Corpus Christi, TX	597,631	122%	117%	115%	111%
46	63	Milwaukee-Racine, WI	2,363,834	122%	120%	113%	108%
47	131	Houston-Galveston-Brazoria, TX	7,974,985	122%	118%	116%	112%
48	90	Little Rock-North Little Rock, AR	1,737,645	122%	121%	117%	115%
49	37	Albany, GA	492,918	122%	121%	113%	111%
50	127	Dallas-Fort Worth, TX-AR-OK	10,169,082	122%	119%	116%	112%
51	107	Minneapolis-St. Paul, MN-WI-IA		122%	119%	114%	109%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
			5,162,587				
52	56	Toledo, OH	1,260,824	122%	120%	112%	111%
53	70	Louisville, KY-IN	1,621,381	121%	118%	113%	109%
54	34	Tampa-St. Petersburg-Clearwater, FL	3,091,399	121%	121%	118%	113%
55	38	Macon, GA	840,416	120%	118%	111%	107%
56	126	Western Oklahoma, OK	141,104	120%	117%	109%	100%
57	115	Rapid City, SD-MT-ND-NE	230,360	120%	113%	105%	95%
58	80	Mobile, AL	749,159	120%	117%	114%	110%
59	96	St. Louis, MO-IL	3,694,893	119%	116%	111%	108%
60	29	Jacksonville, FL-GA	2,407,609	119%	117%	113%	109%
61	5	Albany-Schenectady-Troy, NY	1,228,034	119%	124%	117%	105%
62	74	Huntsville, AL-TN	1,141,428	118%	116%	112%	107%
63	141	Denver-Boulder-Greeley, CO-KS-NE	5,251,183	118%	116%	113%	110%
64	124	Tulsa, OK-KS	1,523,908	118%	116%	112%	110%
65	152	Salt Lake City-Ogden, UT-ID	2,863,934	118%	113%	109%	106%
66	77	Jackson, MS-AL-LA	1,471,367	117%	116%	116%	108%
67	133	McAllen-Edinburg-Mission, TX	1,370,424	117%	114%	111%	104%
68	58	Northern Michigan, MI	260,612	117%	115%	*	*
69	125	Oklahoma City, OK	2,011,327	117%	115%	110%	109%
70	81	Pensacola, FL	759,130	117%	115%	112%	108%
71	170	Seattle-Tacoma-Bremerton, WA	5,203,886	117%	116%	112%	108%
72	45	Johnson City-Kingsport-Bristol, TN-VA	608,176	117%	117%	113%	107%
73	27	Augusta-Aiken, GA-SC	687,551	117%	116%	112%	108%
74	134	San Antonio, TX	3,021,065	117%	113%	111%	107%
75	165	Redding, CA-OR	363,494	116%	112%	103%	97%
76	23	Charlotte-Gastonia-Rock Hill, NC-SC	2,848,436	116%	114%	109%	106%
77	67	Indianapolis, IN-IL	3,488,733	116%	113%	108%	104%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
78	171	Anchorage, AK	731,593	116%	113%	111%	107%
79	100	Des Moines, IA-IL-MO	1,821,507	115%	112%	106%	100%
80	128	Abilene, TX	228,855	115%	114%	111%	108%
81	91	Fort Smith, AR-OK	355,317	115%	113%	108%	107%
82	24	Columbia, SC	1,109,251	115%	112%	106%	104%
83	95	Jonesboro, AR-MO	314,428	115%	112%	106%	102%
84	76	Greenville, MS	194,904	115%	114%	113%	99%
85	157	El Paso, TX-NM	1,158,956	115%	113%	110%	103%
86	15	Richmond-Petersburg, VA	1,730,301	115%	115%	115%	110%
87	117	Sioux City, IA-NE-SD	251,423	115%	109%	102%	95%
88	129	San Angelo, TX	217,503	115%	112%	104%	101%
89	72	Paducah, KY-IL	230,026	114%	111%	107%	102%
90	121	North Platte, NE-CO	59,964	114%	117%	115%	103%
91	60	Appleton-Oshkosh-Neenah, WI	482,134	114%	109%	102%	95%
92	159	Tucson, AZ	1,193,737	114%	114%	114%	111%
93	71	Nashville, TN-KY	3,151,635	114%	117%	113%	111%
94	137	Lubbock, TX	428,609	114%	112%	109%	104%
95	42	Asheville, NC	547,368	114%	112%	106%	102%
96	156	Albuquerque, NM-AZ	1,102,134	114%	109%	104%	99%
97	35	Tallahassee, FL-GA	826,154	114%	115%	112%	105%
98	106	Rochester, MN-IA-WI	351,315	114%	111%	106%	101%
99	7	Rochester, NY-PA	1,494,379	114%	111%	107%	103%
100	153	Las Vegas, NV-AZ-UT	2,695,558	114%	112%	108%	107%
101	118	Omaha, NE-IA-MO	1,193,449	113%	109%	105%	99%
102	28	Savannah, GA-SC	869,672	113%	110%	104%	103%
103	139	Santa Fe, NM	276,170	113%	107%	104%	99%
104	36	Dothan, AL-FL-GA		113%	109%	106%	99%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
			357,859				
105	110	Grand Forks, ND-MN	225,370	112%	110%	104%	98%
106	6	Syracuse, NY-PA	1,883,125	112%	111%	105%	101%
107	30	Orlando, FL	5,190,137	112%	111%	107%	104%
108	39	Columbus, GA-AL	557,562	112%	109%	105%	102%
109	164	Sacramento-Yolo, CA	2,916,196	112%	111%	107%	99%
110	66	Fort Wayne, IN	762,072	112%	110%	104%	100%
111	130	Austin-San Marcos, TX	2,237,703	112%	110%	108%	104%
112	147	Spokane, WA-ID	999,565	112%	108%	103%	99%
113	9	State College, PA	792,309	112%	109%	101%	101%
114	18	Greensboro-Winston-Salem-High Point, NC-VA	2,108,673	111%	110%	106%	103%
115	98	Columbia, MO	422,738	111%	108%	103%	97%
116	59	Green Bay, WI-MI	690,731	111%	107%	103%	99%
117	43	Chattanooga, TN-GA	837,458	111%	111%	106%	103%
118	108	Wausau, WI	491,187	111%	106%	102%	87%
119	61	Traverse City, MI	309,010	111%	107%	*	*
120	148	Idaho Falls, ID-WY	384,240	111%	109%	105%	102%
121	143	Casper, WY-ID-UT	478,994	111%	107%	109%	104%
122	75	Tupelo, MS-AL-TN	633,017	111%	110%	107%	101%
123	140	Pueblo, CO-NM	295,680	111%	106%	104%	100%
124	41	Greenville-Spartanburg-Anderson, SC-NC	1,489,869	111%	109%	105%	103%
125	162	Fresno, CA	1,760,739	111%	110%	103%	94%
126	167	Portland-Salem, OR-WA	3,635,116	111%	108%	105%	101%
127	158	Phoenix-Mesa, AZ-NM	4,893,762	110%	109%	106%	104%
128	109	Duluth-Superior, MN-WI	352,369	110%	108%	104%	99%
129	65	Elkhart-Goshen, IN-MI	962,546	110%	108%	100%	96%
130	16	Staunton, VA-WV	370,434	110%	111%	112%	104%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
131	52	Wheeling, WV-OH	297,682	110%	107%	102%	98%
132	62	Grand Rapids-Muskegon-Holland, MI	2,047,495	110%	107%	103%	99%
133	1	Bangor, ME	534,752	110%	106%	101%	94%
134	166	Eugene-Springfield, OR-CA	902,011	110%	109%	104%	99%
135	136	Hobbs, NM-TX	219,828	110%	104%	103%	99%
136	144	Billings, MT-WY	488,883	110%	107%	105%	101%
137	169	Richland-Kennewick-Pasco, WA	861,578	109%	107%	103%	98%
138	4	Burlington, VT-NY	624,942	109%	107%	103%	98%
139	119	Lincoln, NE	437,943	109%	107%	103%	99%
140	2	Portland, ME	801,155	109%	108%	104%	101%
141	103	Cedar Rapids, IA	457,887	109%	108%	104%	101%
142	68	Champaign-Urbana, IL	637,967	109%	105%	99%	95%
143	149	Twin Falls, ID	196,712	109%	107%	102%	99%
144	11	Harrisburg-Lebanon-Carlisle, PA	1,284,585	109%	107%	102%	98%
145	138	Amarillo, TX-NM	521,079	108%	108%	105%	101%
146	154	Flagstaff, AZ-UT	500,823	108%	102%	101%	101%
147	48	Charleston, WV-KY-OH	1,145,657	108%	110%	107%	100%
148	123	Topeka, KS	476,687	107%	105%	100%	96%
149	54	Erie, PA	497,876	107%	104%	100%	96%
150	19	Raleigh-Durham-Chapel Hill, NC	2,582,353	107%	107%	103%	99%
151	113	Fargo-Moorhead, ND-MN	433,580	107%	104%	101%	98%
152	168	Pendleton, OR-WA	212,494	107%	105%	96%	90%
153	151	Reno, NV-CA	825,446	107%	105%	103%	101%
154	150	Boise City, ID-OR	822,607	106%	105%	101%	95%
155	46	Hickory-Morganton, NC-TN	561,814	105%	98%	94%	90%
156	32	Fort Myers-Cape Coral, FL	1,112,104	104%	102%	98%	95%
157	26	Charleston-North Charleston, SC		104%	103%	100%	98%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
			813,442				
158	104	Madison, WI-IA-IL	1,069,213	104%	102%	99%	94%
159	25	Wilmington, NC-SC	1,168,787	104%	104%	101%	100%
160	21	Greenville, NC	955,192	103%	102%	98%	93%
161	33	Sarasota-Bradenton, FL	1,023,585	101%	100%	98%	96%
162	47	Lexington, KY-TN-VA-WV	1,943,075	101%	99%	96%	93%
163	145	Great Falls, MT	164,950	101%	97%	96%	92%
164	105	La Crosse, WI-MN	263,319	100%	97%	94%	89%
165	92	Fayetteville-Springdale-Rogers, AR-MO-OK	601,974	100%	97%	91%	88%
166	14	Salisbury, MD-DE-VA	450,244	99%	98%	95%	92%
	111	Minot, ND	144,596	*	114%	115%	121%
	112	Bismarck, ND-MT-SD	211,845	*	*	*	101%
	114	Aberdeen, SD	82,331	*	*	*	*
	146	Missoula, MT	474,578	*	*	*	*
	120	Grand Island, NE	291,516	*	*	*	*
	122	Wichita, KS-OK	1,209,412	*	**	192%	151%

Source: Based on NRUF and 2017 Census Population Estimates; EAs as defined in 1995. Asterisks are used to withhold data to maintain firm confidentiality or where there are concerns about data reliability.

APPENDIX A-3: CPI

Appendix Figure II.A.3
Change in CPI, 1997-2017

Year	CPI		Wireless Telephone Services CPI		Telephone Services CPI		Land-line Telephone Services CPI	
	Annual Index Average	Annual Change	Annual Index Average	Annual Change	Annual Index Average	Annual Change	Annual Index Average	Annual Change
1997	100.0		100.0		100.0			
1998	101.6	1.6%	95.1		100.7			
1999	103.8	2.2%	84.9	-10.7%	100.1	-0.6%		
2000	107.3	3.4%	76.0	-10.5%	98.5	-1.6%		
2001	110.3	2.8%	68.1	-10.4%	99.3	0.8%		
2002	112.1	1.6%	67.4	-1.0%	99.7	0.4%		
2003	114.6	2.3%	66.8	-0.9%	98.3	-1.4%		
2004	117.7	2.7%	66.2	-0.9%	95.8	-2.5%		
2005	121.7	3.4%	65.0	-1.8%	94.9	-0.9%		
2006	125.6	3.2%	64.6	-0.6%	95.8	0.9%		
2007	129.2	2.9%	64.4	-0.3%	98.2	2.6%		
2008	134.1	3.8%	64.2	-0.2%	100.5	2.2%		
2009	133.7	-0.4%	64.3	0.0%	102.4	1.9%	100.0	
2010	135.8	1.6%	62.4	-2.9%	102.4	0.0%	101.6	
2011	140.1	3.2%	60.1	-3.6%	101.2	-1.1%	103.3	1.7%
2012	143.0	2.1%	59.7	-0.8%	101.7	0.5%	105.6	2.2%
2013	145.1	1.5%	58.6	-1.8%	101.6	-0.1%	108.1	2.4%
2014	147.5	1.6%	57.4	-2.1%	101.1	-0.4%	111.1	2.7%
2015	147.7	0.1%	55.2	-3.8%	99.3	-1.8%	113.4	2.1%
2016	149.5	1.3%	54.7	-1.0%	98.8	-0.5%	114.5	1.0%
2017	152.1	1.7%	48.8	-10.8%	91.8	-7.1%	116.1	1.4%
1997 to 2017		**52.1%**		**-51.2%**		**-8.2%**		**13.9%**

Source: Data from Bureau of Labor Statistics. All CPI figures were taken from BLS databases. Bureau of Labor Statistics, http://www.bls.gov. Beginning in January 2010, the CPIs for local telephone service and long-distance telephone service were discontinued and replaced by a new CPI for land-line telephone services.[1]

[1] All CPI figures were taken from BLS databases: Bureau of Labor Statistics, http://www.bls.gov. The index used in this analysis, the CPI for All Urban Consumers (CPI-U), represents about 87% of the total U.S. population. Bureau of Labor Statistics, Consumer Price Index: Frequently Asked Questions, https://www.bls.gov/cpi/questions-and-answers.htm. The CPI category "Telephone Services" has two components: wireless telephone services and landline telephone services. Additional information can be found at Bureau of Labor Statistics, Consumer Price Index: How the Consumer Price Index Measures Price Change for Telephone Services, https://www.bls.gov/cpi/factsheets/telephone-services.htm.

APPENDIX A-4: ARPU

Appendix Figure II.A.4
Annualized Average Revenue Per Reported Subscriber Unit (ARPU): 1993–2017

Year	Total Annual	Percentage	Average Reported	Average Monthly
1993	$10,895,175		11,861,362	$76.55
1994	$14,229,922	30.6%	18,299,487	$64.80
1995	$19,081,239	34.1%	26,757,320	$59.43
1996	$23,634,971	23.9%	35,554,818	$55.40
1997	$27,485,633	16.3%	46,375,849	$49.39
1998	$33,133,175	20.6%	58,455,471	$47.23
1999	$40,018,489	20.8%	71,885,076	$46.39
2000	$52,466,020	31.1%	90,048,320	$48.55
2001	$65,316,235	24.5%	109,318,848	$49.79
2002	$76,508,187	17.1%	125,002,023	$51.00
2003	$87,624,093	14.5%	141,658,059	$51.55
2004	$102,121,210	16.5%	161,980,026	$52.54
2005	$113,538,221	11.2%	186,801,940	$50.65
2006	$125,456,825	10.5%	213,077,033	$49.07
2007	$138,869,304	10.7%	234,921,960	$49.26
2008	$148,084,170	6.6%	252,539,475	$48.87
2009	$152,551,854	3.0%	265,038,212	$47.97
2010	$159,929,648	4.9%	280,392,201	$47.53
2011	$169,767,314	6.2%	306,840,648	$46.11
2012	$185,013,936	9.0%	314,685,754	$48.99
2013	$189,192,812	2.3%	323,133,932	$48.79
2014	$187,848,477	(0.7%)	335,606,098	$46.64
2015	$191,949,025	2.2%	358,228,494	$44.65
2016	$188,524,256	(1.8%)	378,554,642	$41.50
2017	$179,091,135	(5.0%)	386,013,771	$38.66

Source: Based on CTIA Wireless Industry Indices Year-End 2017.

APPENDIX A-5: MOBILE WIRELESS SPEED

In this Appendix, we present information on another speed metric, CalSPEED. Mean and median LTE download and upload speed measurements for the state of California, estimated using CalSPEED data collected from the second half of 2016 through the second half of 2017, are presented in the Appendix Figures below.[2]

Appendix Figure II.A.5
CalSPEED--Estimated LTE Download Speeds by Service Provider, California Only

Service Provider	Fall 2016			Spring 2017			Fall 2017		
	Mean LTE DL Speed (Mbps)	Median LTE DL Speed (Mbps)	Number of Tests	Mean LTE DL Speed (Mbps)	Median LTE DL Speed (Mbps)	Number of Tests	Mean LTE DL Speed (Mbps)	Median LTE DL Speed (Mbps)	Number of Tests
AT&T	14.04	14.40	1,517	14.90	15.49	1,517	15.50	16.75	1,552
Sprint	9.54	8.11	1,045	9.99	7.95	1,172	11.54	10.11	1,219
T-Mobile	11.97	11.27	1,216	13.20	13.01	1,419	13.08	13.00	1,488
Verizon	16.69	18.43	1,626	14.68	15.51	1,714	16.88	18.62	1,722
Total	13.50	13.70	5,404	13.44	13.31	5,822	14.49	15.38	5,981

Source: CalSPEED. Fall 2016 tests were taken between the dates of Sept. 29, 2016 to Nov. 4, 2016. Spring 2017 tests were taken between the dates of May 25, 2017 to June 30, 2017. Fall 2017 tests were taken between the dates of Oct. 5, 2017 to Nov. 15, 2017.

Appendix Figure II.A.6
CalSPEED - Estimated LTE Upload Speeds by Service Provider, California Only

Service Provider	Fall 2016			Spring 2017			Fall 2017		
	Mean LTE Upload Speed (Mbps)	Median LTE Upload Speed (Mbps)	Number of Tests	Mean LTE Upload Speed (Mbps)	Median LTE Upload Speed (Mbps)	Number of Tests	Mean LTE Upload Speed (Mbps)	Median LTE Upload Speed (Mbps)	Number of Tests
AT&T	6.89	6.44	1,516	7.08	6.25	1,517	7.45	6.82	1,552
Sprint	3.95	3.20	1,045	4.02	3.07	1,172	3.37	2.62	1,219
T-Mobile	7.93	8.40	1,216	8.27	7.77	1,419	8.11	7.38	1,488
Verizon	8.16	8.77	1,626	8.52	8.97	1,714	8.59	9.00	1,722

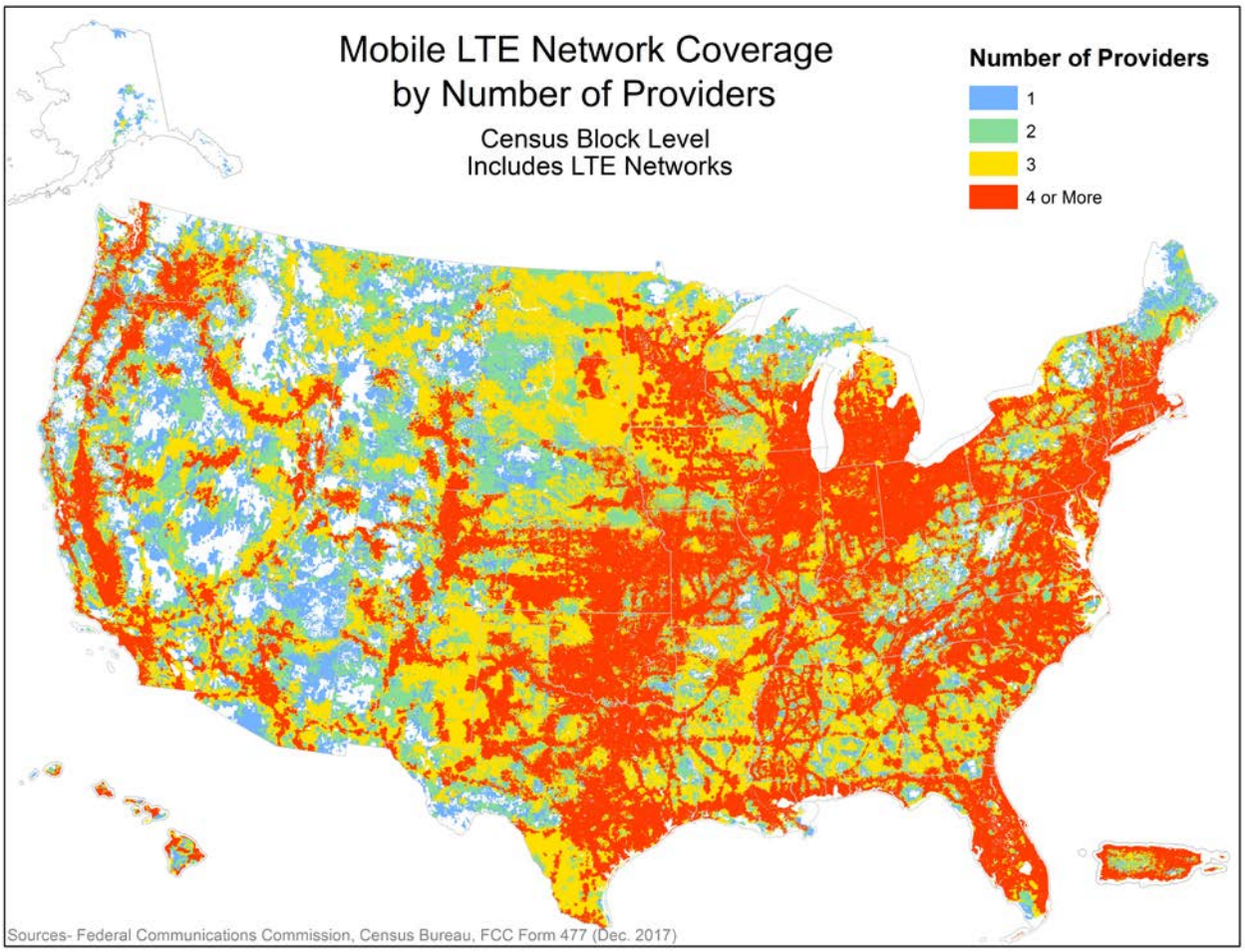
Source: The estimated speeds are based on the CalSPEED data. Fall 2016 tests were taken between the dates of Sept. 29, 2016 and Nov. 4, 2016. Spring 2017 tests were taken between the dates of May 25, 2017 to June 30, 2017. Fall 2017 tests were taken between the dates of Oct. 5, 2017 to Nov. 15, 2017.

[2] CalSPEED is an open source, non-proprietary, network performance measurement tool and methodology created for the CPUC with the assistance of a grant from the National Telecommunications and Information Administration (NTIA). The CalSPEED data presented in this *Report* are the result of a structured sampling program of nearly 2,000 locations scattered throughout California. CPUC, Mobile Broadband Testing, http://cpuc.ca.gov/General.aspx?id=1778. For more discussion regarding CalSPEED, *see Seventeenth Report*, 29 FCC Rcd at 15469-70, Appendix VI., paras. 12-16.

APPENDIX A-6: MOBILE WIRELESS COVERAGE MAPS

The maps presented below are based on Commission estimates derived from census block analysis of December 2017 Form 477 coverage maps, using the centroid methodology.[3] These maps will be published in interactive form on the *Communications Marketplace Report*'s website upon release of the *Communications Marketplace Report*.

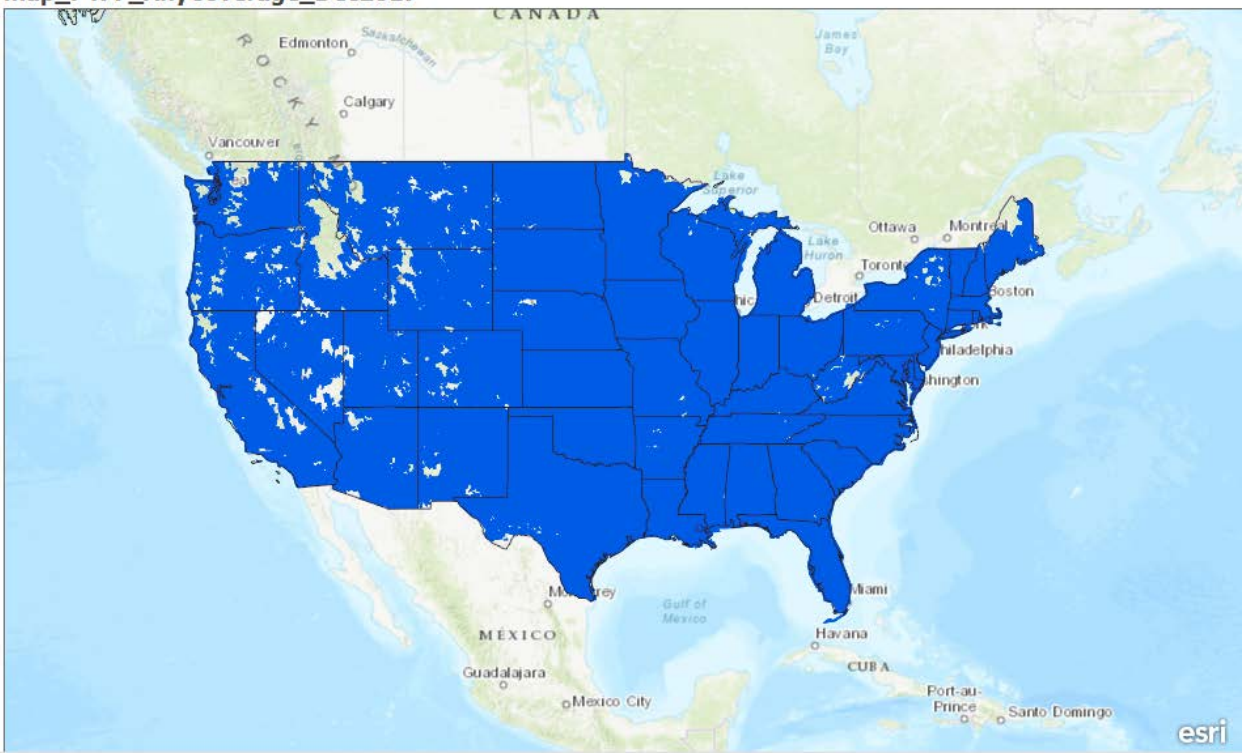
LTE Coverage Nationwide by Number of Service Providers
Form 477, Centroid Method, December 2017



[3] The centroid methodology provides estimates of the percentage of the population located in census blocks with a certain number of service providers and represents network coverage. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block. In addition, the fact that a service provider reports coverage in a particular census block does not mean that it necessarily provides coverage everywhere in the census block. This is likely to be particularly relevant in larger rural census blocks. For both these reasons, the number of service providers in a census block does not necessarily reflect the number of choices available to a particular individual or household.

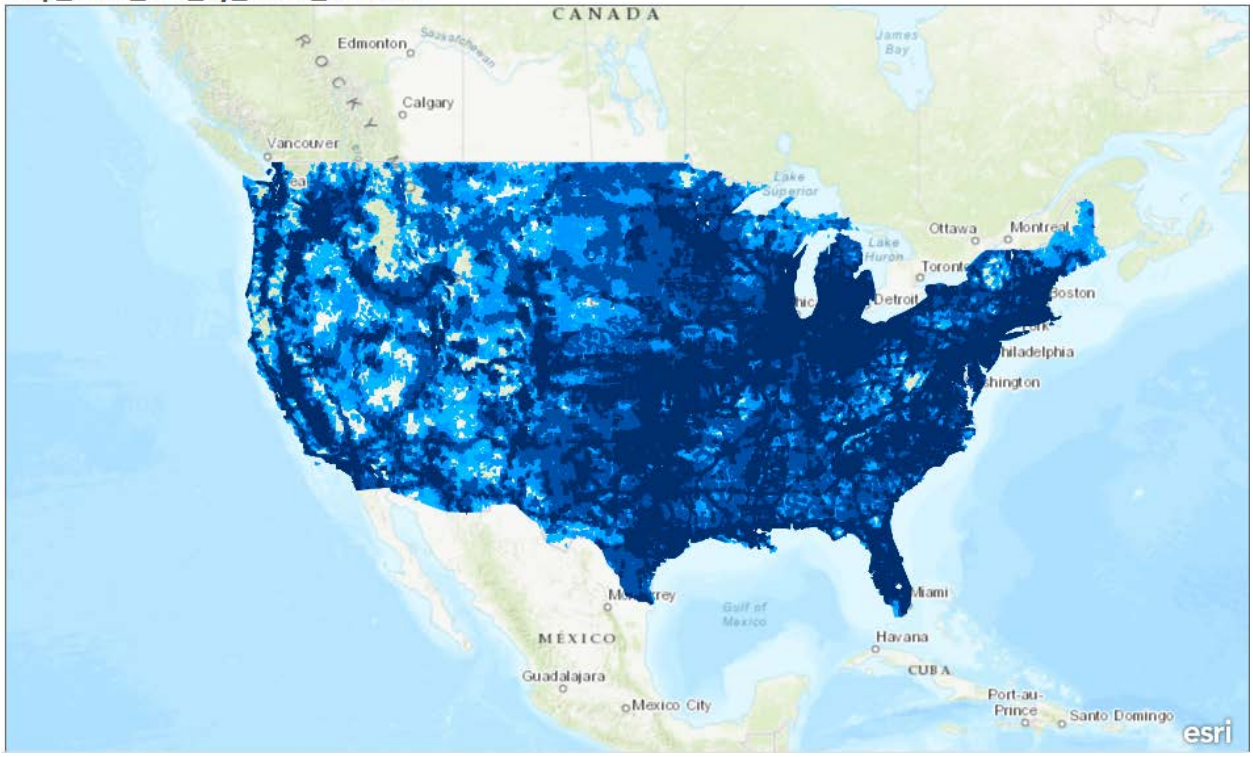
Nationwide Mobile Wireless Coverage, Year-End 2017 (Form 477)

map_F477_AnyCoverage_Dec2017



Nationwide LTE Coverage, Year-End 2017 (Form 477)

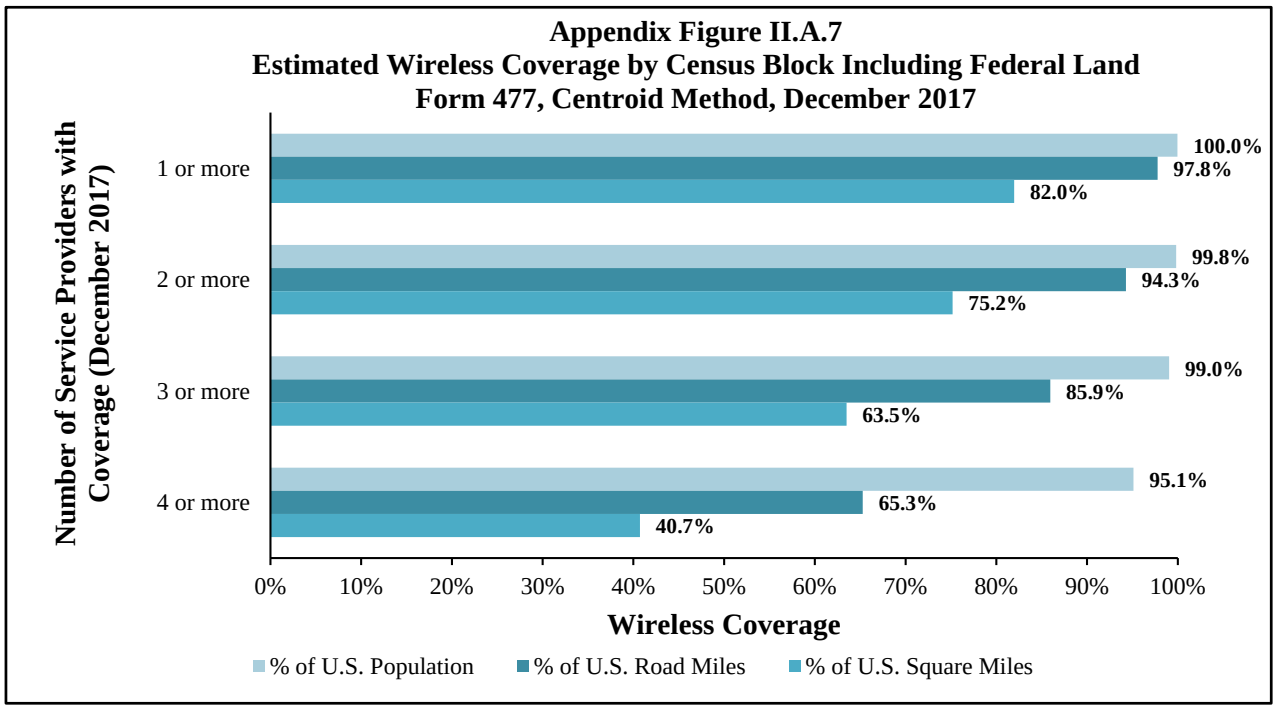
map_F477_LTE_by_Block_Dec2017



APPENDIX A-7: MOBILE WIRELESS COVERAGE

The figures presented below are based on Commission estimates derived from census block analysis of December 2017 Form 477 coverage maps, using both the centroid and the actual area coverage methodologies.[4] We report those based on the centroid analysis first, before moving on to those associated with the actual area methodology.

Centroid methodology. The centroid methodology is applied to U.S. census blocks overlaid on service provider coverage maps. Under this methodology, if the geometric center point, or centroid, of a census block is within the coverage boundary of a coverage map, then we consider that block to be "covered" by that service provider and/or technology. We then aggregate the population, land area, and road miles of the covered census blocks to generate our total coverage estimates. We note that these coverage estimates represent deployment of mobile networks and do not indicate the extent to which service providers affirmatively offer service to residents in the covered areas. While we recognize that this analysis likely overstates the coverage experienced by some consumers, especially in large or irregularly shaped census blocks, we find that it is nonetheless useful because estimated coverage can be compared across network technologies and service providers.[5]



Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

[4] Since we do not know the distribution of either the population or road miles at the sub-census block level, as noted above, we must approximate the percentage that is covered by each technology. To do this, we assume that both population and road miles are distributed uniformly across each census block. The fraction of the population or road miles covered in a census block is assumed to be proportional to the fraction of the actual area covered. We then sum the estimated covered population (road miles) across blocks to estimate the total covered population (road miles) within the United States.

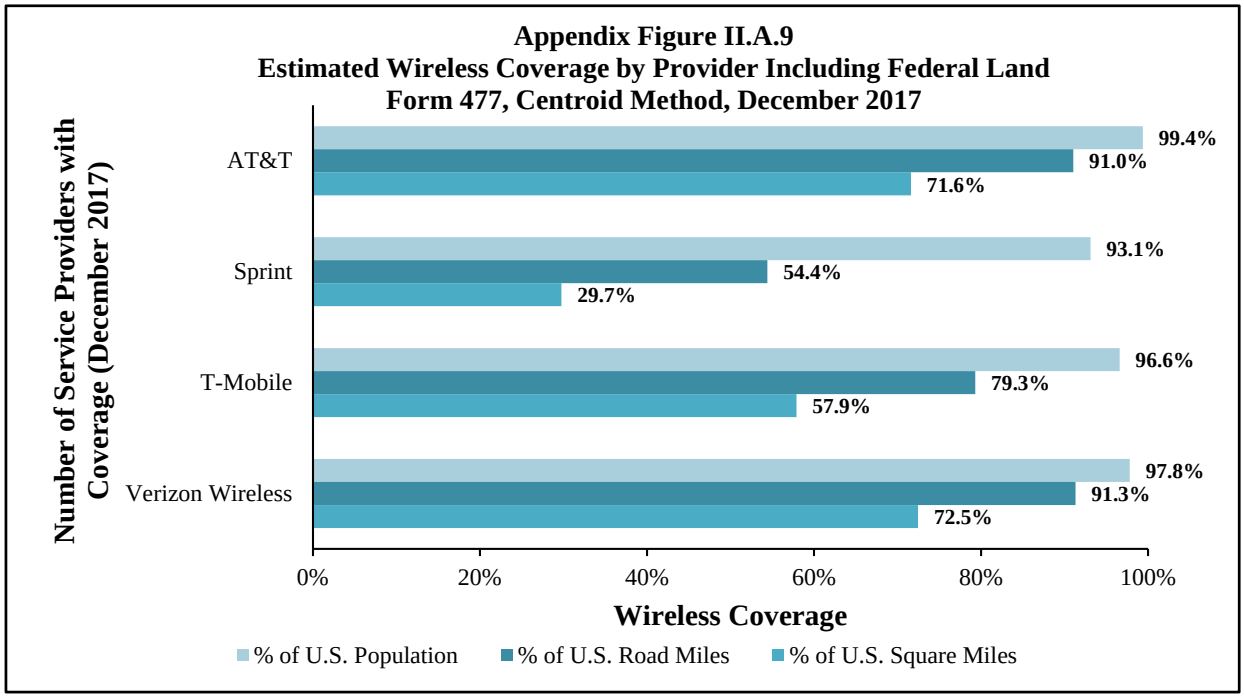
[5] For a more detailed discussion of the centroid methodology, *see Twentieth Report*, 32 FCC Rcd at 9016, para. 71.

Appendix Figure II.A.8
***Estimated* Overall Wireless Coverage by Census Block Including Federal Land**
Form 477, Centroid Method, December 2017

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	10,523,237	312,366,922	100.0%	2,910,344	82.0%	6,666,052	97.8%
2 or more	10,376,889	311,900,707	99.8%	2,669,667	75.2%	6,427,859	94.3%
3 or more	9,957,038	309,463,821	99.0%	2,254,761	63.5%	5,859,529	85.9%
4 or more	8,607,858	297,226,261	95.1%	1,445,926	40.7%	4,449,977	65.3%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.9
Estimated Wireless Coverage by Provider Including Federal Land
Form 477, Centroid Method, December 2017

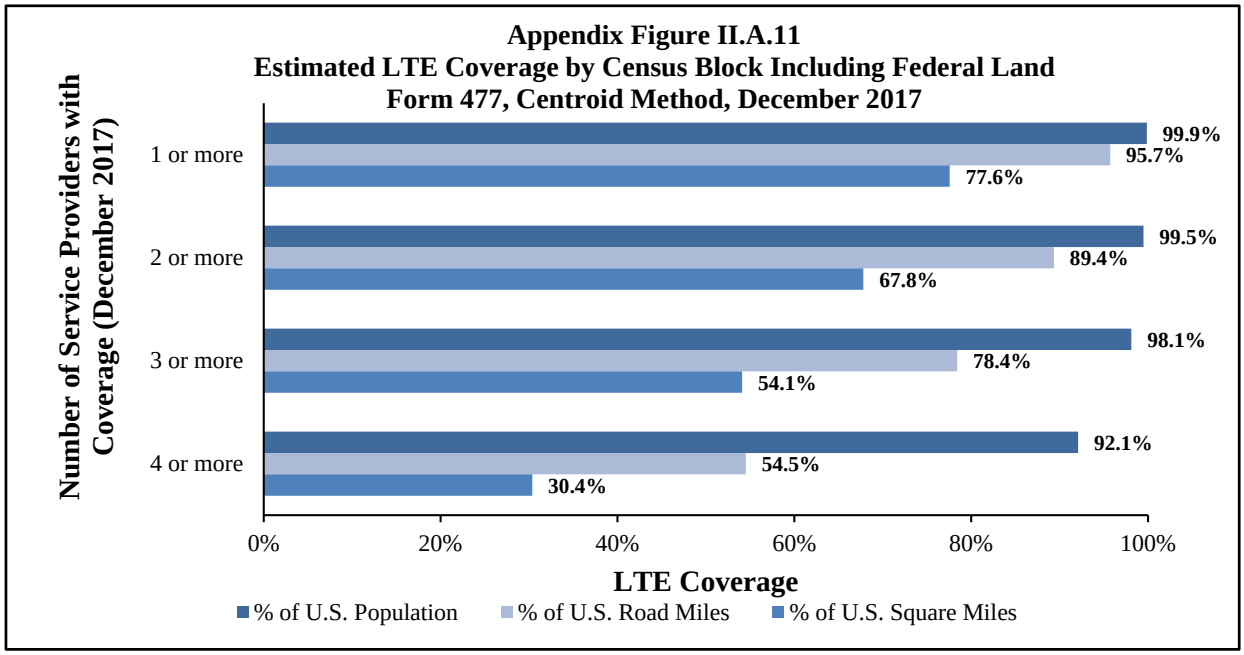


Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.10
***Estimated* Overall Wireless Coverage in the U.S. by Service Provider**
Form 477, Centroid Method, December 2017

Provider	Number of Blocks	POPS in those Blocks	% Total US POPs	Square Miles in those Blocks	% Total US Square Miles	Road Miles in those Blocks	% Total US Road Miles
U.S. Total	*10,609,302*	*312,471,32*	*100.0%*	*3,550,85*	*100.0%*	*6,817,73*	*100.0%*
AT&T	10,158,469	310,402,44	99.3%	2,553,42	71.9%	6,204,98	91.0%
Sprint	7,654,799	287,660,63	92.1%	976,639	27.5%	3,525,82	51.7%
T-Mobile	8,849,655	297,340,33	95.2%	1,690,97	47.6%	4,834,57	70.9%
Verizon	9,859,047	304,313,31	97.4%	2,377,38	67.0%	5,945,34	87.2%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

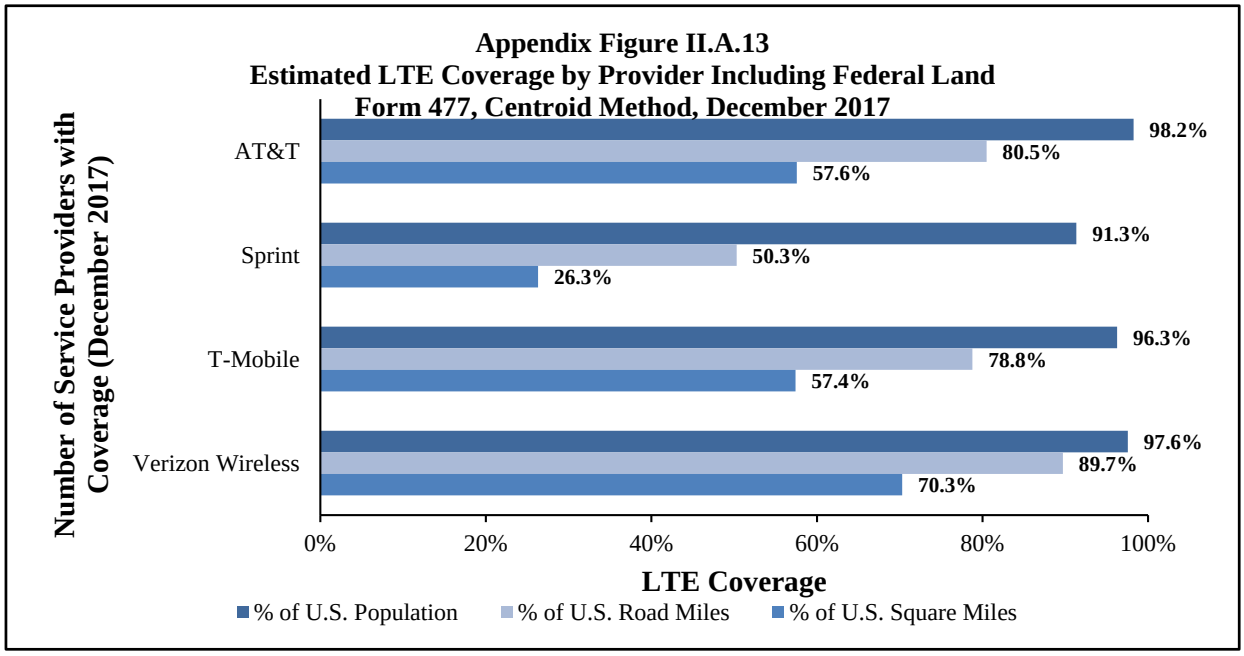


Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.12
***Estimated* LTE Coverage by Census Block Including Federal Land**
Form 477, Centroid Method, December 2017

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	10,433,138	312,044,388	99.9%	2,754,031	77.6%	6,525,357	95.7%
2 or more	10,147,846	310,840,536	99.5%	2,407,597	67.8%	6,091,677	89.4%
3 or more	9,540,945	306,564,207	98.1%	1,920,661	54.1%	5,345,812	78.4%
4 or more	7,837,391	287,707,338	92.1%	1,078,014	30.4%	3,715,965	54.5%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

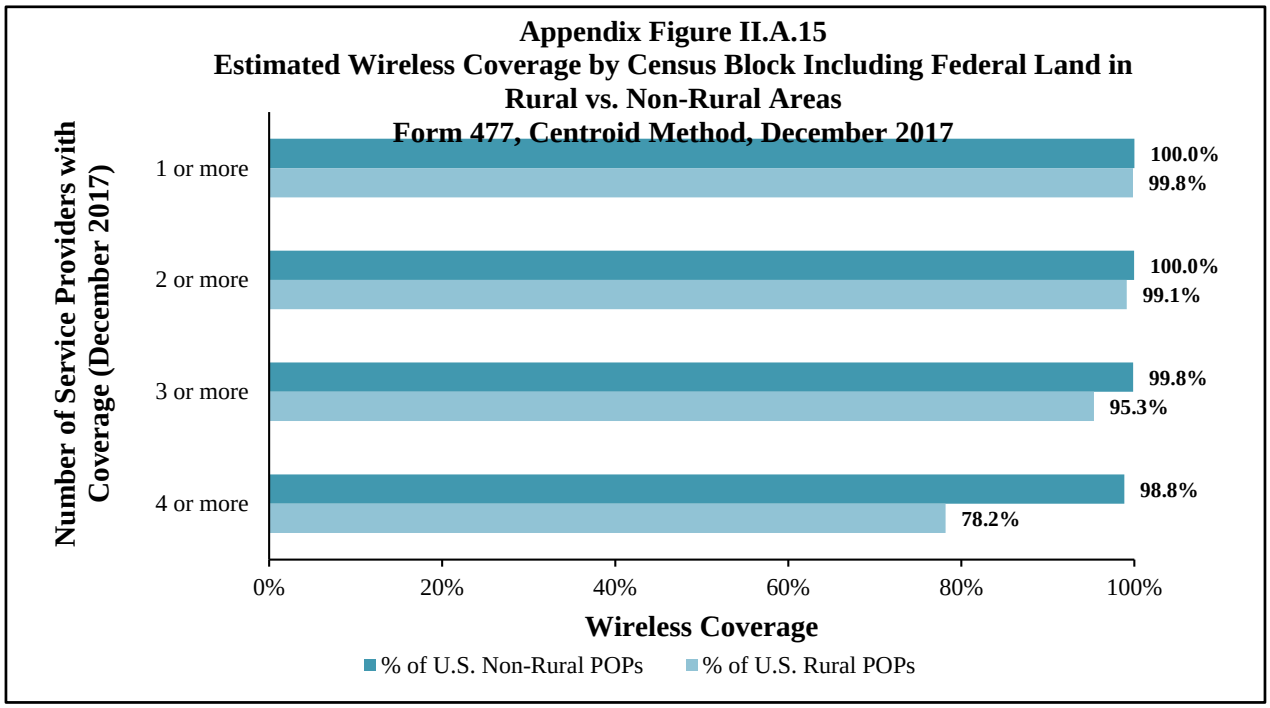


Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.14
***Estimated* LTE Coverage in the U.S. by Service Provider**
Form 477, Centroid Method, December 2017

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	9,614,934	307,000,222	98.2%	2,044,185	57.6%	5,487,898	80.5%
Sprint	7,535,705	285,385,219	91.3%	934,117	26.3%	3,428,669	50.3%
T-Mobile	9,292,861	300,756,476	96.3%	2,038,678	57.4%	5,370,112	78.8%
Verizon	9,992,604	304,842,225	97.6%	2,495,691	70.3%	6,116,214	89.7%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.



Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.16
***Estimated* Overall Wireless Coverage in Rural Areas by Census Block Including Federal Land**
Form 477, Centroid Method, December 2017

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Rural US POPs	Square Miles Contained in Those Blocks	% of Total Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Rural US Rural Road Miles
US Total	*4,937,330*	*56,094,552*	*100.0%*	*2,987,281*	*100.0%*	*4,518,876*	*100.0%*
1 or more	4,855,542	56,000,060	99.8%	2,352,992	78.8%	4,372,818	96.8%
2 or more	4,720,318	55,601,116	99.1%	2,123,031	71.1%	4,146,973	91.8%
3 or more	4,333,770	53,472,672	95.3%	1,733,764	58.0%	3,615,513	80.0%
4 or more	3,143,515	43,854,700	78.2%	993,559	33.3%	2,337,027	51.7%

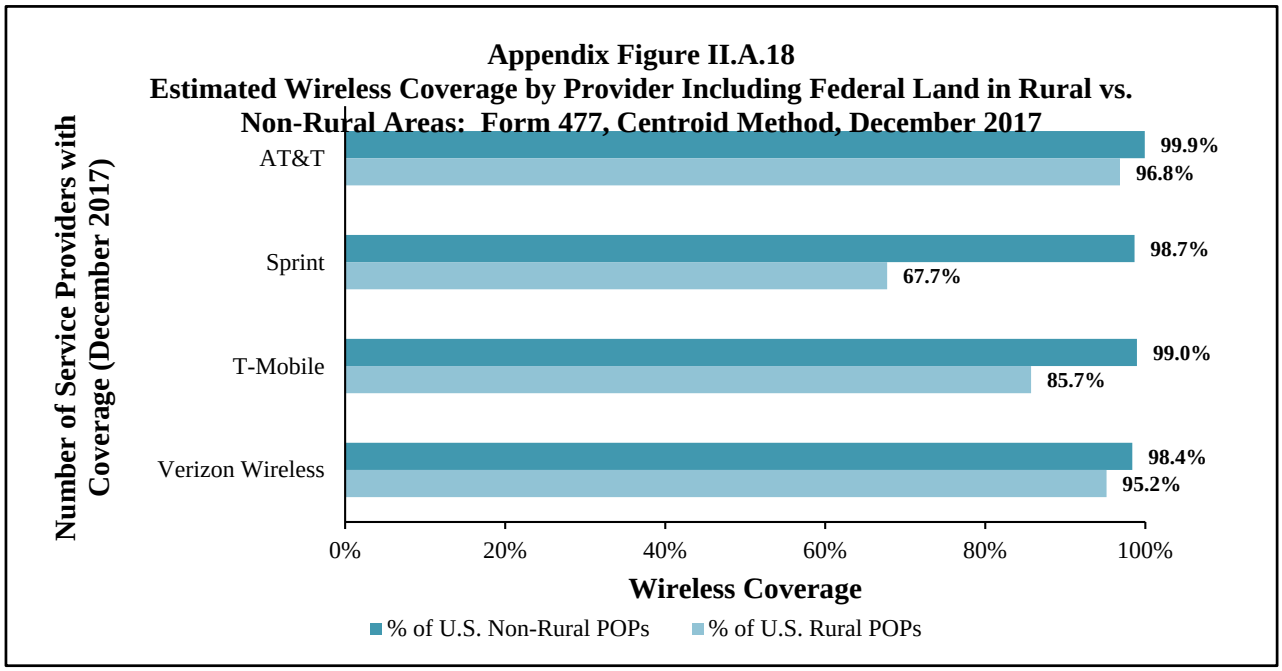
Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.17
***Estimated* Overall Wireless Coverage in Non-Rural Areas by Census Block Including Federal Land**
Form 477, Centroid Method, December 2017

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Non-Rural US POPs	Square Miles Contained in Those Blocks	% of Total Non-Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*563,570*	*100.0%*	*2,298,858*	*100.0%*
1 or more	5,667,695	256,366,864	100.0%	557,353	98.9%	2,293,234	99.8%
2 or more	5,656,571	256,299,584	100.0%	546,637	97.0%	2,280,887	99.2%
3 or more	5,623,268	255,991,152	99.8%	520,998	92.4%	2,244,016	97.6%
4 or more	5,464,343	253,371,568	98.8%	452,368	80.3%	2,112,950	91.9%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.18
Estimated Wireless Coverage by Provider Including Federal Land in Rural vs. Non-Rural Areas: Form 477, Centroid Method, December 2017



Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.19
***Estimated* Rural Wireless Coverage in the U.S. by Service Provider**
Form 477, Centroid Method, December 2017

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Rural US POPs	Road Miles Contained in Those Blocks	% of Total US Rural Road Miles
US Total	*4,937,330*	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	4,517,284	54,318,840	96.8%	3,932,114	87.0%
Sprint	2,433,438	37,993,681	67.7%	1,615,636	35.8%
T-Mobile	3,806,863	48,090,252	85.7%	3,212,222	71.1%
Verizon	4,506,266	53,382,645	95.2%	3,980,776	88.1%

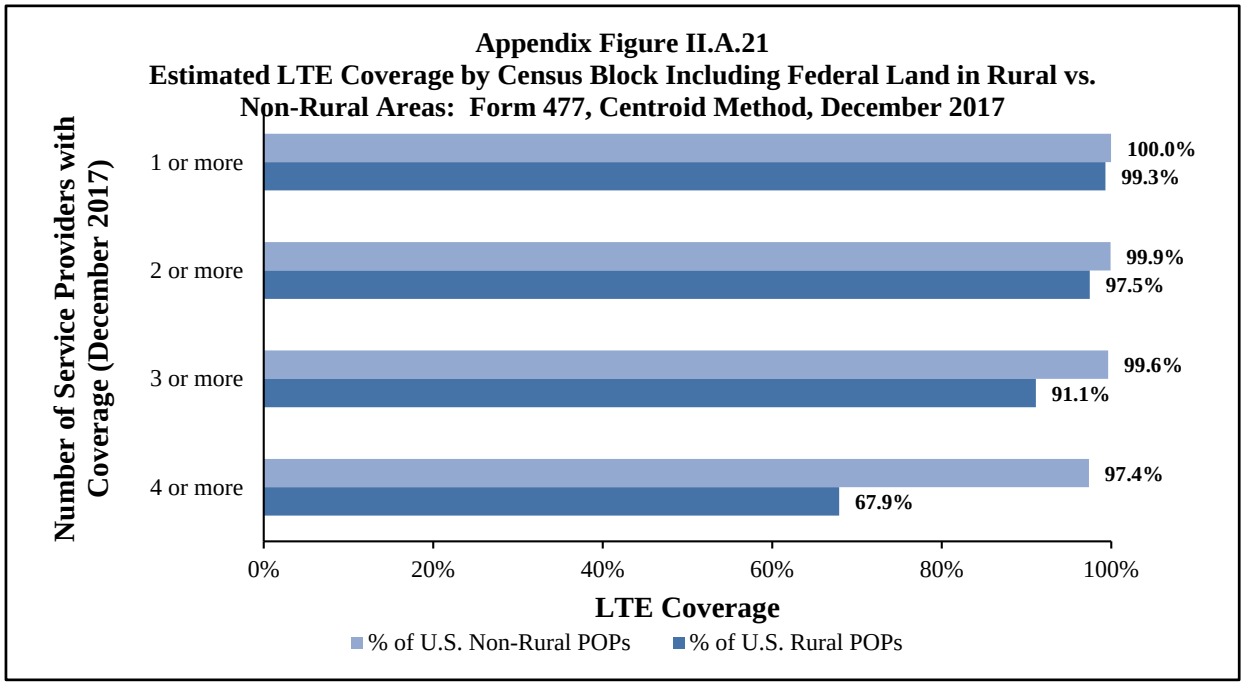
Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.20
***Estimated* Non-Rural Wireless Coverage in the U.S. by Service Provider**
Form 477, Centroid Method, December 2017

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Non-Rural US POPs	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	5,650,652	256,192,975	99.9%	2,274,979	99.0%
Sprint	5,447,986	252,930,917	98.7%	2,094,551	91.1%
T-Mobile	5,533,901	253,718,966	99.0%	2,194,456	95.5%
Verizon	5,564,286	252,234,658	98.4%	2,244,736	97.6%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.21
Estimated LTE Coverage by Census Block Including Federal Land in Rural vs. Non-Rural Areas: Form 477, Centroid Method, December 2017



Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.22
***Estimated* LTE Coverage in Rural Areas by Census Block Including Federal Land**
Form 477, Centroid, December 2017

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Non-Rural US POPs	Square Miles Contained in Those Blocks	% of Total Non-Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*563,570*	*100.0%*	*2,298,858*	*100.0%*
1 or more	5,662,241	256,336,800	100.0%	550,122	97.6%	2,286,095	99.4%
2 or more	5,637,995	256,163,024	99.9%	527,851	93.7%	2,256,943	98.2%
3 or more	5,578,692	255,463,328	99.6%	494,473	87.7%	2,199,456	95.7%
4 or more	5,301,951	249,623,104	97.4%	407,162	72.2%	1,995,748	86.8%

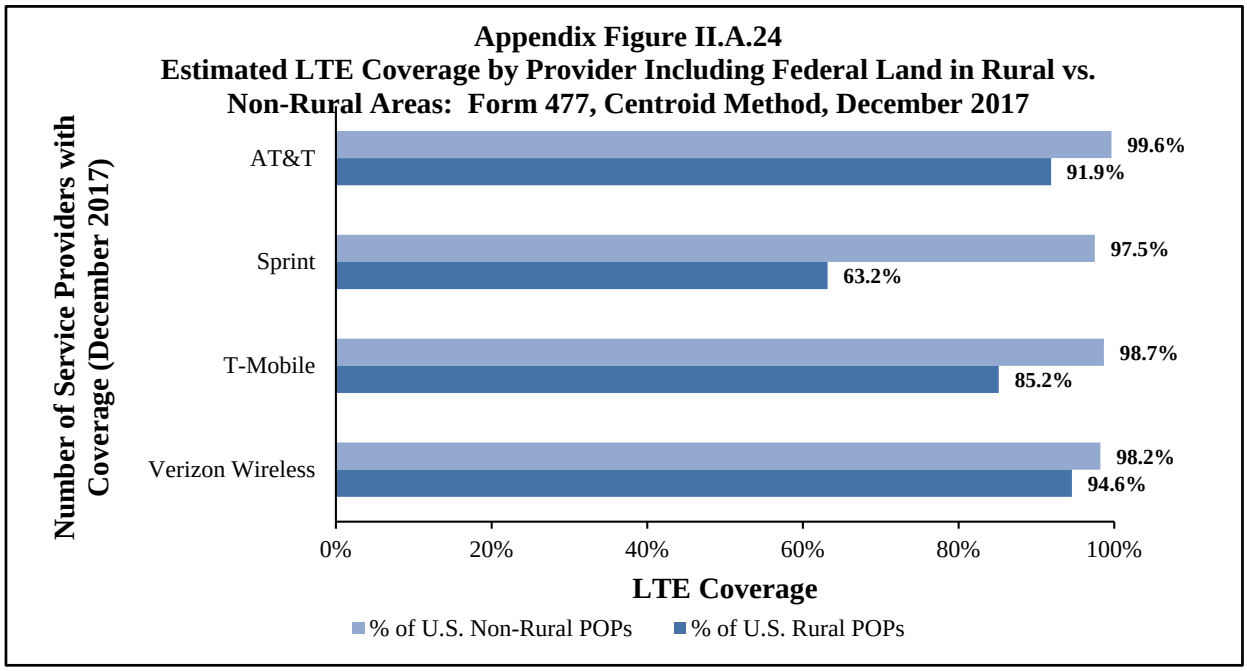
Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.23
***Estimated* LTE Coverage in Non-Rural Areas by Census Block Including Federal Land**
Form 477, Centroid Method, December 2017

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	10,433,138	312,044,380	99.9%	2,754,031	77.6%	6,525,357	95.7%
2 or more	10,147,846	310,840,536	99.5%	2,407,597	67.8%	6,091,677	89.4%
3 or more	9,540,945	306,564,200	98.1%	1,920,662	54.1%	5,345,812	78.4%
4 or more	7,837,391	287,707,336	92.1%	1,078,014	30.4%	3,715,965	54.5%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.24
Estimated LTE Coverage by Provider Including Federal Land in Rural vs. Non-Rural Areas: Form 477, Centroid Method, December 2017



Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.25
***Estimated* Rural LTE Coverage in the U.S. by Service Provider**
Form 477, Centroid Method, December 2017

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Rural US POPs	Road Miles Contained in Those Blocks	% of Total US Rural Road Miles
US Total	*4,937,330*	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	4,029,157	51,536,845	91.9%	3,280,816	72.6%
Sprint	2,209,889	35,438,910	63.2%	1,418,951	31.4%
T-Mobile	3,781,024	47,768,704	85.2%	3,187,527	70.5%
Verizon	4,445,141	53,042,528	94.6%	3,883,903	85.9%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.26
***Estimated* Non-Rural LTE Coverage in the U.S. by Service Provider**
Form 477, Centroid Method, December 2017

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Non-Rural US POPs	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	5,585,777	255,463,377	99.6%	2,207,082	96.0%
Sprint	5,325,816	249,946,309	97.5%	2,009,718	87.4%
T-Mobile	5,511,837	252,987,772	98.7%	2,182,585	94.9%
Verizon	5,547,463	251,799,697	98.2%	2,232,311	97.1%

Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area.

Appendix Figure II.A.27
***Estimated* Overall Wireless Coverage in the U.S. by Service Provider**
Form 477, Actual Area Coverage Method, December 2017

Provider	Covered POPs	% of Total US POPs	Covered Square Miles	% of Total US Square Miles	Covered Road Miles	% of Total US Road Miles
US Total	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	310,408,682	99.3%	2,533,825	71.4%	6,188,828	90.8%
Sprint	290,734,898	93.0%	1,054,528	29.7%	3,699,433	54.3%
T-Mobile	301,714,590	96.6%	2,055,223	57.9%	5,400,147	79.2%
Verizon	305,479,257	97.8%	2,551,552	71.9%	6,198,465	90.9%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.28
***Estimated* LTE Coverage by Census Block Including Federal Land**
Form 477, Actual Area Coverage Method, December 2017

Number of Providers with Coverage in a Block	Covered POPs	% of Total US POPs	Covered Square Miles	% of Total US Square Miles	Covered Road Miles	% of Total US Road Miles
US Total	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	312,008,352	99.9%	2,746,233	77.3%	6,510,130	95.5%
2 or more	310,709,888	99.4%	2,396,544	67.5%	6,071,729	89.1%
3 or more	306,358,944	98.0%	1,912,953	53.9%	5,327,027	78.1%
4 or more	287,446,016	92.0%	1,074,287	30.3%	3,702,785	54.3%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.29
***Estimated* LTE Coverage in the U.S. by Service Provider**
Form 477, Actual Area Coverage Method, December 2017

Provider	Covered POPs	% of Total US POPs	Covered Square Miles	% of Total US Square Miles	Covered Road Miles	% of Total US Road Miles
US Total	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	306,808,300	98.2%	2,033,640	57.3%	5,466,237	80.2%
Sprint	285,162,942	91.3%	933,056	26.3%	3,418,661	50.1%
T-Mobile	300,661,495	96.2%	2,039,867	57.4%	5,364,722	78.7%
Verizon	304,719,091	97.5%	2,476,676	69.7%	6,091,236	89.3%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.30
***Estimated* Rural Wireless Coverage in the U.S. by Service Provider**
Form 477, Actual Area Coverage Method, December 2017

Provider	Covered POPs	% of Total Rural US POPs	Covered Road Miles	% of Total US Rural Road Miles
US Total	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	54,267,818	96.7%	3,915,430	86.6%
Sprint	37,892,940	67.6%	1,608,033	35.6%
T-Mobile	48,043,725	85.6%	3,205,650	70.9%
Verizon	53,305,256	95.0%	3,956,139	87.5%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.31
***Estimated* Non-Rural Wireless Coverage in the U.S. by Service Provider**
Form 477, Actual Area Coverage Method, December 2017

Provider	Covered POPs	% of Total Non-Rural US POPs	Covered Road Miles	% of Total Non-Rural US Road Miles
US Total	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	256,140,865	99.9%	2,273,398	98.9%
Sprint	252,841,958	98.6%	2,091,400	91.0%
T-Mobile	252,174,001	98.9%	2,194,497	95.5%
Verizon	251,981,080	98.4%	2,242,326	97.5%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.32
***Estimated* LTE Coverage in Rural Areas by Census Block Including Federal Land**
Form 477, Actual Area Coverage Method, December 2017

Number of Providers with Coverage in a Block	Covered POPs	% of Total Rural US POPs	Covered Road Miles	% of Total Rural US Road Miles
US Total	56,094,552	100.0%	4,518,876	100.0%
1 or more	55,676,272	99.3%	4,225,027	93.5%
2 or more	54,603,672	97.3%	3,816,131	84.4%
3 or more	50,992,188	90.9%	3,130,544	69.3%
4 or more	37,989,484	67.7%	1,711,274	37.9%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.33
***Estimated* LTE Coverage in Non-Rural Areas by Census Block Including Federal Land**
Form 477, Actual Area Coverage Method, December 2017

Number of Providers with Coverage in a Block	Covered POPs	% of Total Non-Rural US POPs	Covered Road Miles	% of Total Non-Rural US Road Miles
US Total	256,376,773	100.0%	2,298,858	100.0%
1 or more	256,332,080	100.0%	2,285,103	99.4%
2 or more	256,106,224	99.9%	2,255,598	98.1%
3 or more	255,366,768	99.6%	2,196,483	95.5%
4 or more	249,456,544	97.3%	1,991,511	86.6%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.34
***Estimated* Rural LTE Coverage in the U.S. by Service Provider**
Form 477, Actual Area Coverage Method, December 2017

Provider	Covered POPs	% of Total Rural US POPs	Covered Road Miles	% of Total US Rural Road Miles
US Total	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	54,267,818	91.7%	3,262,217	72.2%
Sprint	37,892,940	63.0%	1,412,671	31.3%
T-Mobile	48,043,725	85.1%	3,182,022	70.4%
Verizon	53,305,256	94.4%	3,861,668	85.5%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

Appendix Figure A.II.35
***Estimated* Non-Rural LTE Coverage in the U.S. by Service Provider**
Form 477, Actual Area Coverage Method, December 2017

Provider	Covered POPs	% of Total Non-Rural US POPs	Covered Road Miles	% of Total Non-Rural US Road Miles
US Total	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	255,377,712	99.6%	2,204,019	95.9%
Sprint	249,811,940	97.4%	2,005,989	87.3%
T-Mobile	252,933,205	98.7%	2,182,700	94.9%
Verizon	251,749,455	98.2%	2,229,568	97.0%

Source: Based on actual area analysis of December 2017 Form 477 and 2010 Census data. Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results.

B. Video and Audio Market Appendices

APPENDIX B-1
REPORT ON CABLE INDUSTRY PRICES

TABLE OF CONTENTS

I. INTRODUCTION AND EXECUTIVE SUMMARY

1. Section 623(k) of the Communications Act of 1934, as amended by the Cable Television Consumer Protection Act of 1992 (Cable Act)[1] and the Consolidated Appropriations Act of 2018,[2]

[1] Section 623(k), adopted as Section 3(k) of the Cable Act, Pub. L. No. 102-385, 106 Stat. 1460, codified at 47 U.S.C. § 543(k).

[2] The Consolidated Appropriations Act of 2018 included the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM'S Act of 2018), which amended Section 13 of the Communications Act of 1934 to require the Federal Communications Commission (Commission) to publish a single, biennial "*Communications Marketplace Report*," in lieu of several individual reports that separately assessed competition among providers of various communications services, including voice, video, audio, and data services. Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, Div. P—RAY BAUM'S Act of 2018, §§ 401-404, 132 Stat. 348, 1087-90 (2018) (RAY BAUM'S Act of 2018). Among the previous reports now included in the *Communications Marketplace Report* is information that in the past was submitted to Congress as the annual report on cable industry prices required by section 623(k) of the Communications Act. Initially, section 623(k) was adopted as Section 3(k) of the 1992 Cable Act, Pub. L. No. 102-385, 106 Stat. 1460, codified at 47 U.S.C. § 543(k). The prior annual reports provided statistical data on the average rates for basic cable service, cable programming service, and equipment, as well as a comparison of the average rates of cable systems that the Commission has found are subject to effective competition with those of systems that the Commission has found are not subject to (continued….)

requires the Federal Communications Commission (or Commission) to publish a statistical report (Report)[3] on the average rates cable operators charge for basic cable service and other cable programming, and cable equipment to access such programming.[4] The statute requires the Commission to compare the rates of operators subject to effective competition to the rates of operators not subject to effective competition under a statutorily defined standard (herein after referred to as "effective competition").[5] In addition, section 110 of the STELA Reauthorization Act of 2014 requires the Commission to report on retransmission consent fees paid by cable operators to broadcast stations or groups.[6] This Report fulfills the statutory directives and presents findings as of January 1, 2017.[7]

(Continued from previous page)
effective competition. The instant report fulfills this statutory requirement, as amended by the recent RAY BAUM'S Act.

[3] 47 U.S.C. § 543(k)(1) (cross-referencing 47 U.S.C. § 543(a)(2)). Citations to prior annual reports on cable industry prices: *Implementation of Section 3 of the Cable Television Consumer Protection and Competition Act of 1992, Statistical Report on Average Rates for Basic Service, Cable Programming Service, and Equipment,* 12 FCC Rcd 3239 (1997) (*1997 Report*); 14 FCC Rcd 8331 (1999) (*1998 Report*); 15 FCC Rcd 10927 (2000) (*1999 Report*); 16 FCC Rcd 4346 (2001) (*2000 Report*); 17 FCC Rcd 6301 (2002) (*2001 Report*); 18 FCC Rcd 13284 (2003) (*2002 Report*); 20 FCC Rcd 2718 (2005) (*2003-2004 Report*); 21 FCC Rcd 15087 (2006) (*2005 Report*); 24 FCC Rcd 259 (2009) (*2006-2008 Report*); 25 FCC Rcd 13350 (2010) (*2009 Report*); 27 FCC Rcd 2427 (2012) (*2011 Report*); 28 FCC Rcd 9857 (2013) (*2012 Report*); 29 FCC Rcd 5280 (2014) (*2013 Report*); 29 FCC Rcd 14895 (2015) (*2014 Report*); 31 FCC Rcd 11498 (2016) (*2015 Report*); and 33 FCC Rcd 1268 (2018) (*2016 Report*).

[4] 47 U.S.C. § 522(5) (defining cable operator). Cable operators include operators of traditional coaxial and fiber cable systems, municipalities, and telephone companies including Verizon FiOS. Direct broadcast satellite (DBS) providers and AT&T U-verse systems are not registered with the Commission, and thus these systems' prices are not part of the Report, although DBS and AT&T U-verse are competitors for purposes of assessing effective competition. "Service tier" (service) refers to a cable service for which a separate rate applies. 47 U.S.C. § 522(l7). Operators must provide a separately available "basic cable service" (basic service) to which customers must subscribe before accessing any other tier of service. 47 U.S.C. § 543(b)(7). "Other cable programming" service means any video programming other than programming offered with the basic service or programming offered on a per channel or per program basis. *Id.* § 543(l)(2). Section II, Part C defines other cable programming for the purpose of the Report.

[5] Commission findings of effective competition generally are made in reference to a "cable community identifier" (CUID). The Commission assigns a unique CUID to each operator for each community the operator serves. As discussed in Section II, Part A, the Commission recently changed its process and presumption for determining effective competition. In 2015, the Commission adopted a rebuttable presumption that cable operators in all cable communities are subject to effective competition. *Amendment to the Commission's Rules Concerning Effective Competition, Implementation of Section 111 of the STELA Reauthorization Act, Report and Order,* 30 FCC Rcd 6574 (2015). As a result of this change, operators in nearly all communities are now subject to effective competition. Rates of an operator subject to effective competition are not subject to regulation by a local franchising authority (LFA). 47 U.S.C. § 543(a)(2); 47 CFR § 76.905(a). An LFA may elect to regulate the rate of basic service of an operator not subject to effective competition. *Id.*

[6] Section 110 of the STELA Reauthorization Act of 2014 (STELAR). *See* Pub. L. No. 113-200, 128 Stat. 2059 (2014) enacted December 4, 2014 (H.R. 5728, 113th Cong.). Specifically, STELAR instructs the Commission to include in its now-biennial report on cable industry prices "the aggregate average total amount paid by cable systems in compensation under section 325 [of the Communications Act of 1934, as amended,]" and to report such information "in a manner substantially similar to the way other comparable information is published" in the report. 47 U.S.C. § 543(k)(2), as amended.

[7] Consistent with past practice, the current survey and report collects data as of January 1 of a year prior to the current year. We will report on 2018 in a future report.

2. For the Report, Media Bureau staff surveyed a stratified random sample of cable communities nationwide in order to collect data on the cable rates (prices) in effect in communities as of January 1, 2017.[8] In the Report, we refer to the communities in which the operator is subject to effective competition as the "effective competition group" and to communities in which the operator is not subject to effective competition as the "noncompetitive group." Our sample includes communities from both groups. We collected data on monthly prices to purchase basic service, expanded basic service, the next most popular service, and cable equipment, as well as other information, as described in greater detail in the Overview Section below.[9] The Report presents the average annual changes in prices and other variables by cable service tier.

A. Summary of Findings

3. *Average price over all communities (regardless of effective competition standing).* The average monthly price paid by subscribers who take only basic service grew by an average of 5.2 percent, to $25.06, over the 12 months ending January 1, 2017. The average price for expanded basic service rose by 3.2 percent over the same one-year period to $75.21. Over the five years ending January 1, 2017, the price of expanded basic service rose, on average, by 4.1 percent annually. Average price per channel (price divided by the number of channels offered with expanded basic service) fell by 10.1 percent to 49 cents per channel over the 12 months ending January 1, 2017. Over the last five years, price per channel has decreased, on average, by 0.8 percent annually. For comparison, the rate of general inflation measured by the Consumer Price Index (all items) rose by 2.5 percent over the 12 months ending January 1, 2017, and at an average annual rate of 1.4 percent over the last five years.

4. *Average price in the communities with a finding of effective competition compared to price in communities without a finding of effective competition.* On January 1, 2017, the average price of basic service was more than 50 percent higher in effective competition communities than in noncompetitive communities. However, the *increase* in the average price of basic service was smaller in effective competition communities than in non-effective competition communities. Specifically, over the 12 months ending January 1, 2017, the average price of basic service in effective competition communities rose by 5.2 percent to $25.17. In noncompetitive communities, the average price of basic service grew by 9.8 percent, to $16.61. The differences between these groups in both absolute price levels and in the change in prices over time likely reflect a complicated mix of factors, with operators providing different service offerings in reaction to competition and regulation.

5. On January 1, 2017, the average price of expanded basic service in effective competition communities was about 3 percent lower than the average price of expanded basic in the noncompetitive communities. Over the 12 months ending January 1, 2017, the average price of expanded basic service in effective competition communities rose by 3.2 percent to $75.19. In noncompetitive communities, the average price of expanded basic service grew by 3.6 percent, to $77.24. In contrast to the average price of expanded basic service, the average price per channel was higher in effective competition communities (49 cents per channel) than in noncompetitive communities (39 cents per channel). Although operators in noncompetitive communities charged slightly more for expanded basic service than operators in effective competition communities, operators in the effective competition group offered fewer channels. Operators

[8] *See* the Survey Methodology Appendix for a detailed description of the sampling and stratification methodology.

[9] The prices collected exclude state and local taxes as well as franchise fees.

in effective competition communities offered an average of 195 video channels while operators in noncompetitive communities offered an average of 212 channels.

6. *Average price in effective competition subgroups compared to price in noncompetitive communities.* As in prior years, we divided operators subject to effective competition into subgroups.[10] Compared to the noncompetitive communities, the average price of basic service was higher in every effective competition subgroup, and the difference was statistically significant in all subgroups except the rival subgroup.[11] Compared to the average price of expanded basic service charged in noncompetitive communities ($77.24), the average prices charged by incumbent operators and rival operators were each about 6 percent lower ($72.87 and $72.40 respectively). These differences are statistically significant. Looking at the other effective competition subgroups, the average price charged by operators of small systems was $71.73 (7.1 percent lower), the average price charged by operators of midsize systems was $75.35 (2.4 percent lower), and the average price charged by operators of large systems was $76.25 (1.3 percent lower). The difference between the small systems subgroup and the noncompetitive group is statistically significant, but the other two differences are not statistically significant.

7. *Broadcast retransmission consent compensation fees.* From 2015 to 2016,[12] total retransmission consent fees paid by cable systems to television broadcast stations increased, on average, by 31.8 percent per year.[13] Similarly, these same fees calculated on a per-subscriber basis increased on average by 30 percent, rising from $55.82 to $72.59 over the same period. Average monthly retransmission consent fees per subscriber per broadcast station increased by about 25 percent annually increasing from $0.50 to $0.63 from 2014 to 2016. Over the period 2013-2016, the compound average annual increase in retransmission consent fees was 42.3 percent, and the compound average annual increase in fees calculated on a per-subscriber basis was 37.8 percent.

8. *Comparison of DBS to cable programming services.* Direct broadcast satellite (DBS) providers DIRECTV and DISH offer multichannel video services similar to those offered by cable operators.[14] Accordingly, we compared DBS services to the most popular cable offering as part of the Report even though the statute does not explicitly require it.[15] We looked at the DBS services which appeared most comparable to cable's expanded basic cable service: DIRECTV's Choice and DISH's

[10] We provide an overview of the sampling groups and subgroups in Section II, Part B.

[11] Throughout this report, we determine statistical significance using a 95% confidence level. A difference that is statistically significant at the 95% confidence level is unlikely to be due to random sampling error. Instead, the difference may therefore likely reflect a true difference between survey groups.

[12] The data for retransmission consent fees are collected somewhat differently than the rest of the data in the report. Retransmission data are collected for complete years, whereas all the rest of the data are collected as of a certain date (January 1). As a result, the retransmission consent fee data are for the *complete years* 2015 and 2016 (the latest two years for which annual retransmission consent data were available at the time of the 2017 survey), whereas the other data in the survey, by contrast, are snapshots as of January 1, 2016 or January 1, 2017.

[13] More recent estimates show that growth in retransmission consent fees has slowed. From 2016 to 2017, SNL Kagan estimates that total retransmission consent fees paid to television stations increased by 17.7 percent. SNL Kagan, U.S. TV station industry total revenue projections, 2006-2023 (accessed December 7, 2017).

[14] DIRECTV Group Holdings LLC (DIRECTV) and DISH NETWORK Corporation (DISH).

[15] Attachment 16 reports our DBS survey sample methodology, data sources, and detailed statistics. We surveyed DBS services in 40 communities, separately from our cable survey, based on publicly available information. DBS prices vary only slightly nationwide.

America's Top 120 Plus (AT120+). Though generally comparable, there were differences in the types of channels carried by cable operators and DBS providers. These differences are discussed further below.[16]

9. As of January 2017, the average price for cable's expanded basic service was $75.21. This was below the price DIRECTV charged for Choice service ($78.99) and similar in price to DISH's AT120+ service ($74.99).[17] Each cable and DBS service offered a core package of channels along with local broadcast channels (locals). DISH divided its price of $74.99 into separate fees of $64.99 for the core channel package and $10.00 for the locals. In terms of average annual change in prices, from 2016 to 2017, expanded basic cable service increased by 3.2 percent, which was lower than the increases of 5.3 percent for DIRECTV service and 7.1 percent for DISH service.[18] We also calculated an average price per channel, which is the service price divided by the number of channels.[19] The average cable price per channel was 49 cents and was significantly higher than DIRECTV's average of 33 cents per channel and DISH's average of 41 cents per channel.[20]

10. Looking at the average number of channels each DBS service offered, compared to the 195 channels offered with cable's expanded basic service, DIRECTV's Choice service offered more channels (239 channels) and DISH's AT120+ service offered fewer channels (182 channels).[21] As stated, each service offered a core channel package and local broadcast channels. The cable operators carried on average 37 broadcast channels, compared to the DIRECTV and DISH averages of 20 and 21 broadcast channels, respectively.[22] The difference is primarily a result of cable operators carrying relatively more broadcast multicast channels. Another difference is related to regional sports networks (RSNs). With expanded basic service, cable operators offered, on average, 3.1 RSNs,[23] while DBS providers offered RSNs through a separately priced add-on package.

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[16] In comparing cable and DBS, we further note that DBS satellite service is not local-facilities-based and DBS providers can therefore add subscribers anywhere with minimal incremental infrastructure cost. *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming,* Fifteenth Report, 28 FCC Rcd 10496, 10546 at 112 (2014).

[17] *See* Table 1 and Attachment 16. DBS prices do not include equipment fees. Similarly, most cable operators sold programming and equipment separately, but about one third of operators bundled programming and equipment together in a single price. The average cable price reported reflects prices reported by both cable operators who bundle equipment and those who do not bundle equipment. Operators who sold programming and equipment separately reported only the programming price, while operators who bundled programming and equipment reported the price of the bundle. None of the prices reported include taxes, franchise fees, or other surcharges.

[18] *Id.*

[19] Cable price per channel is not calculable directly from the price and channels averages discussed herein because of statistical weighting of observations. We discuss cable price per channel in Sections II(C) and III(B) and in the Methodology Appendix.

[20] *See* Table 3 and Attachment 16. Our method of calculating the cable price per channel adds an equipment fee to the price component. In contrast, DBS price per channel does not include an equipment fee. Calculating cable price per channel without adding the equipment fee results in an average cable price per channel of 45 cents, still higher than the DBS average price per channel.

[21] *See* Table 5 and Attachment 16. We counted each separate channel viewable in digital format in either standard definition (SD), high definition (HD), and in the case of several DIRECTV channels, in 4K format. A network carried in both SD and HD formats counted as two channels.

[22] *See* Table 6 and Attachment 16. A network carried in both SD and HD format was counted as two channels.

[23] *See* Table 7.

II. OVERVIEW OF THE SURVEY

11. The basis of information and analysis in the Report is the Commission's 2017 survey of cable industry prices (survey). The Commission directed cable operators serving a randomly selected sample of cable communities nationwide to respond to a survey questionnaire requesting prices and other information as of January 1, 2016 and January 1, 2017.[24] As noted, we selected communities that were subject to effective competition, as well as communities that are not subject to effective competition. We used the information collected to estimate average values and make comparisons across groups and subgroups of cable communities. We calculated annual changes in average values based on the data collected in the 2017 survey.[25] We calculated average values for each survey question by subgroup, by larger sample group, and for the full sample of communities. For each community selected for the sample, we asked the cable operator to complete a questionnaire that included questions on the prices of basic cable service and other cable programming service offerings.

12. In Part A of this section, we discuss effective competition communities and how the process for establishing effective competition has changed. In Part B, we provide an overview of the survey methodology, which is described in more detail in the Methodology Appendix. In Part C, we provide definitions of specific cable services. In Part D, we review survey accuracy and reliability.

A. Effective Competition Communities

13. The Commission recently changed its effective competition process by adopting a rebuttable presumption that all cable operators qualify for the type of effective competition known as competing provider effective competition, which is verified through the "50/15" test.[26] In the 2015 proceeding, the Commission concluded that the ubiquitous nature of DBS services made it appropriate to presume that competing provider effective competition is present in all communities, unless a showing is made to the contrary to rebut this presumption. In a community where competing provider effective competition does not exist, the local franchising authority (LFA) must certify the lack of effective competition by showing that the 50/15 test is not met. The certification is valid unless and until the

[24] *Implementation of Section 3 of the Cable Television Consumer Protection and Competition Act of 1992, Statistical Report on Average Prices for Basic Service, Cable Programming Services, and Equipment*, MM Docket No. 92-266, Order, 32 FCC Rcd 2984 (2017).

[25] Each annual change calculated is not a comparison of data from the 2016 survey and data from the 2017 survey because each survey includes a different sample of communities. To calculate the annual changes, the 2017 survey collected data from the sample of communities for January 1, 2016 and January 1, 2017 so as not to introduce random sampling variation that may occur between independent samples. While tables in the Report generally report the 2017 statistics and annual changes based on data collected in the 2017 survey, Table 4 reports a historical price series based on data from previous survey years.

[26] *Amendment to the Commission's Rules Concerning Effective Competition, Implementation of Section 111 of the STELA Reauthorization Act*, Report and Order, 30 FCC Rcd 6574 (2015). The 50/15 test requires that at least two unaffiliated MVPDs offer comparable programming each of which offers its service to at least 50 percent of households in the market, and the percent of households taking service from MVPDs other than the largest MVPD exceeds 15 percent. Effective competition can also be found based on one of the following three tests: (1) fewer than 30 percent of households subscribe to the operator's programming service (low penetration test); (2) a franchising authority operates as an MVPD in that franchise area and offers programming to at least 50 percent of households (municipal test); or (3) a local exchange carrier (LEC) or its affiliate (or an MVPD using the facilities of an LEC or affiliate) offers service by means other than DBS in the franchise area of an unaffiliated operator that is offering comparable programming (LEC test). 47 U.S.C. § 543(l)(1).

Media Bureau issues a decision denying the certification request. LFAs with a valid certification may regulate basic cable rates. Few LFAs have filed certifications to date. As a result, operators are now found subject to effective competition, and basic cable rates are unregulated in nearly all communities in the country. Thus far, only in Massachusetts and Hawaii have LFAs successfully certified the lack of effective competition. The 118 certified communities in these states fail to meet the 50/15 test because less than the required percentage of households subscribe to DBS service in these communities.

B. Overview of Survey Methodology

14. We selected the sample of effective competition communities from five subgroups.[27] The first two subgroups are composed of the communities in which the Commission has made a finding of effective competition because a second wireline MVPD served the same area as the incumbent cable provider.[28] The first subgroup is made up of the *incumbent* cable system operators in areas with a second wireline MVPD overbuilding the incumbent. The incumbent is the operator who provided service prior to the rival MVPD's arrival in the market. The second subgroup is made up of the *rival* MVPDs in these communities. The basis of findings of effective competition for the incumbent subgroup is either (a) the 50/15 test, resulting from the presence of at least two MVPDs, or (b) the local exchange carrier (LEC) test resulting from the presence of at least two MVPDs, one of which is a LEC or an entity affiliated with or using the LEC's facilities.[29]

15. The remaining effective competition communities were selected from three subgroups based on system size. We define small systems as cable systems serving 10,000 or fewer subscribers, midsize systems as cable systems serving between 10,000 and 75,000 subscribers, and large systems as cable systems serving more than 75,000 subscribers.[30]

16. We did not divide the noncompetitive group into subgroups. The noncompetitive group is a sample of 33 communities drawn from the population of 118 noncompetitive communities.

C. Programming Services

17. We next define the programming services referenced in the Report. Service prices in the Report reflect the non-promotional rates and exclude taxes and fees. Prices also exclude fees subscribers

[27] These subgroups are designed to achieve desirable levels of statistical precision, and, thus, are not necessarily selected proportionately from the universe of communities belonging to each subgroup. *See* Attachment 1 and the Survey Methodology Appendix for a more complete description of our sampling methodology.

[28] The Commission made these findings of effective competition before it changed the presumption of effective competition.

[29] The incumbent subgroup uses publicly sourced data to account for communities also served by AT&T U-verse. As noted above, (*supra* note 4), the Commission considers AT&T U-verse to be a competing MVPD for the purpose of assessing effective competition. However, AT&T U-verse systems do not have cable community identifiers, which are assigned to each registered cable operator for each individual community an operator serves, and are therefore not part of the database from which the survey samples are drawn. The rival subgroup includes telephone companies that do have CUIDs, and these range from large national systems like Verizon FiOS, to small municipal telecommunication systems.

[30] The first two subgroups (those of an incumbent or a rival in a community where at least two wireline competitors serve one community) also fall into one of the size strata groups (small, medium, or large), but the first two subgroups are selected separately from the size subgroups. This is to assure we draw a statistically significant sample for all five subgroups.

may incur in leasing cable equipment unless the customer received equipment along with programming without incurring a separate lease charge. We collected information on the basic service and other cable programming services not offered on a per channel or per program basis, as well as cable equipment. The other programming services on which the survey collected information are expanded basic service and the next most popular service.

18. *Basic service.* The Cable Act requires operators to offer a separately available basic cable service to which customers must subscribe before purchasing any other service.[31] A basic service tier includes local broadcast stations entitled to carriage under the Cable Act; public, educational, and governmental access channels that a local franchising authority requires; and other channels the operator chooses to add.[32]

19. *Expanded basic service.* Expanded basic service includes basic service channels in addition to the next most highly subscribed tier of channels, generally the tier that includes the most popular national cable networks.

20. *Next most popular service.* The next most popular service is the most highly subscribed service after expanded basic service. It generally consists of the channels offered with expanded basic service plus at least seven additional video channels. These additional channels could offer any type of content, for example, general entertainment, sports, or Spanish-language programming.[33]

21. *Equipment lease charge.* Subscribers may incur a separate monthly charge to lease cable equipment such as a cable signal converter box and remote-control unit, cable card, or other equipment necessary to access programming. We collect data on such charges to the extent that respondents charge a separate monthly fee to lease such equipment. Specifically, we asked the survey respondents to report the price of the most commonly leased equipment at each service level (basic service, expanded basic service, and the next most popular service) unless the equipment was included at no extra charge or was not necessary to view all of the channels offered with the service.

22. *Price per channel.* Price per channel equals the price of the service divided by the number of channels the service offers. If equipment is necessary to view all channels in the service's channel lineup and is not included in the service price, the charge to lease equipment is added to the price component of price per channel. Price per channel is a proxy for quality adjusted price and declines as the number of channels increases, all else equal.

D. Survey Accuracy and Reliability

[31] *Supra* note 4.

[32] 47 U.S.C. § 543(b)(7), 534-35.

[33] As of January 1, 2017, on average, 87.8 percent of subscribers took at least expanded basic service, and 12.2 percent took only basic service. This 87.8 percent includes subscribers whose operators do not offer a separate expanded basic service tier but instead offer a basic service tier that includes many of the popular national networks typically associated with expanded basic service. In addition, on average, 56.4 percent of subscribers took the next most popular programming service as an additional tier. (We did not collect information on additional tiers beyond the next most popular.)

23. The data and analysis presented in this Report are consistent with the Commission's information quality guidelines.[34] Consistent with prior reports, we took steps to ensure the accuracy and reliability of the survey data. We provided the questionnaires to respondents to complete and submit on the Commission's website. Many survey questions have built-in checks for reasonableness, which prompted the respondents to recheck seemingly unreasonable or inconsistent responses. After receiving the submitted surveys, we examined responses using a computer program designed to identify apparent inaccuracies. If a response lay outside of its statistically expected range or was inconsistent with the answers to other questions, the program flagged that response for further review. We then asked the cable operator to review the response and make any necessary corrections. The Survey Methodology Appendix contains more detail on our data validation process.

III. SURVEY RESULTS

24. Tables in this section report results from our survey of cable operators in communities nationwide, as well as other publicly sourced data. Results are presented for the full sample and are further broken down into noncompetitive and effective competition sample groups, as well as effective competition subgroups. For our survey, we sampled 750 communities from the universe of 33,883 communities. In the universe of registered cable communities nationwide there are 118 noncompetitive communities and 33,765 competitive communities, and nearly all subscribers (98.7%) receive service in a competitive community. From the noncompetitive group, we sample 33 of the 118 communities to create a statistically significant sample. Looking within the effective competition group, the Incumbent subgroup accounted for 745 communities and 10 percent of subscribers nationwide. The Rival subgroup contained 557 communities and 3.3 percent of subscribers. Most effective competition communities were in one of the three subgroups stratified by system size.[35] The Large Systems subgroup had 8,837 communities and served 49.3 percent of subscribers. The Midsize Systems subgroup had 10,252 communities and served 28.8 percent of subscribers. Finally, the Small Systems subgroup had 13,374 communities and served 7.3 percent of subscribers.

A. Cable Programming Services

25. Table 1 reports the average prices of basic service, expanded basic service, and the next most popular service on January 1, 2017. In the full sample, average prices for basic service, expanded basic service, and the next most popular service were $25.06, $75.21, and $89.28, respectively. Table 1 also reports the percent change in price from January 1, 2016 to January 1, 2017. In the full sample, the average price for each service increased by a statistically significant amount from January 1, 2016 to January 1, 2017. The average price for basic service increased by 5.2% ($1.24), while the average price for expanded basic service increased by 3.2% ($2.33), and the average price for the next most popular service increased by 2.8% ($2.43).

[34] *Implementation of Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Pursuant to Section 515 of Public Law No. 105-554, Information Quality Guidelines*, 17 FCC Rcd 19890 (2002).

[35] See fn. 30, supra, and the Appendix for details.

Table 1
Monthly Price of Programming
by Status of Effective Competition
January 1, 2017

Cable Service	Full Sample	Non-competitive Group	Effective Competition Group	Effective Competition Subgroups				
				Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
				Incumbent	Rival			
Basic	**$25.06**	**$16.61**	**$25.17**	**$23.02**	**$17.98**	**$30.41**	**$26.91**	**$24.31**
Annual change	5.2%*	9.8%*	5.2%*	9.7%*	3.1%	2.6%	5.5%*	4.9%
Expanded basic	**$75.21**	**$77.24**	**$75.19**	**$72.87**	**$72.40**	**$71.73**	**$75.35**	**$76.25**
Annual change	3.2%*	3.6%*	3.2%*	2.4%	1.5%	3.7%*	3.4%*	3.2%*
Next most popular	**$89.28**	**$93.28**	**$89.23**	**$85.34**	**$85.94**	**$84.68**	**$90.14**	**$90.32**
Annual change	2.8%*	3.0%*	2.8%*	2.4%	1.9%	3.1%*	3.0%*	2.8%*

Source: Attachment 2. * Indicates annual change is statistically significant at the 95% confidence level.

26. Table 2 reports the average price per channel by service tier on January 1, 2017. As stated, price per channel is calculated as the sum of the programming and equipment prices (if equipment is necessary to view all channels) divided by the number of channels offered. Average price per channel in the full sample is highest for the basic service tier (58 cents), lower for the expanded basic tier (49 cents), and is lowest for the next most popular service tier (37 cents). In the full sample, average price per channel decreased by a statistically significant amount from January 1, 2016 to January 1, 2017 for all three service tiers. This decrease ranged from 6.4 percent for the next most popular service to 10.1 percent for basic and expanded basic services. The decrease in price per channel comes from an increase in the number of channels offered on all service tiers (*see* Table 5) and contrasts to the increase in programming price shown in Table 1.

Table 2
Price per Channel
by Status of Effective Competition
January 1, 2017

Cable Service	Full Sample	Non-competitive Group	Effective Competition Group	Effective Competition Subgroups				
				Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
				Incumbent	Rival			
Basic	**$0.58**	**$0.30**	**$0.59**	**$0.45**	**$0.58**	**$1.33**	**$0.63**	**$0.48**

Annual change	-10.1%*	-3.7%	-10.2%*	-2.1%	1.4%	-2.5%	-10.4%	-14.3%*
Expanded basic	**$0.49**	**$0.39**	**$0.49**	**$0.54**	**$0.39**	**$0.83**	**$0.49**	**$0.44**
Annual change	-10.1%*	-5.4%	-10.2%*	-8.4%*	3.3%	-0.2%	-8.7%	-14.3%*
Next most popular	**$0.37**	**$0.34**	**$0.38**	**$0.38**	**$0.30**	**$0.64**	**$0.39**	**$0.34**
Annual change	-6.4%*	1.7%	-6.5%*	-3.0%	1.3%	-0.6%	-4.9%	-9.8%*

Source: Attachment 6. * Indicates annual change is statistically significant at the 95% confidence level.

27. Table 3 uses the results presented in Tables 1 and 2 to report the percent difference in average price between the effective competition group and subgroups and the noncompetitive group for each of the three service tiers. The average price of basic service in the effective competition group is 51.5 percent higher than the average price of basic service in the noncompetitive group. All the effective competition subgroups have a higher average basic service price than the noncompetitive group, and the difference is statistically significant in all subgroups except the rival subgroup. By contrast, the average price of expanded basic service is 2.7 percent lower and the average price of the next most popular service is 4.3 percent lower in the effective competition group than in the noncompetitive group. These tiers are not subject to rate regulation by local franchising authorities. Table 3 also reports the percent difference between the effective competition subgroups and the noncompetitive group in expanded basic price per channel. The average price per channel for expanded basic service is 26 percent higher in the effective competition group than in the noncompetitive group. These differences likely reflect a complicated mix of factors, including inherent differences in the types of systems included in both and different service offerings in reaction to competition and regulation.

Table 3
Percent Difference in Average Price
Effective Competition Group and Subgroups compared to Noncompetitive Group
January 1, 2017

Cable Service	Effective Competition Group	Effective Competition Subgroups				
		Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
		Incumbent	Rival			
Basic	51.5%*	38.6%*	8.2%	83.1%*	62.0%*	46.3%*
Expanded basic	-2.7%*	-5.6%*	-6.3%*	-7.1%*	-2.4%	-1.3%
Next most popular	-4.3%*	-8.5%*	-7.9%*	-9.2%*	-3.4%*	-3.2%*
Expanded Basic Price per Channel	26.0%*	38.3%*	1.0%	114.7%*	26.0%*	12.4%*

Source: Attachments 3 and 7. * Indicates annual change is statistically significant at the 95% confidence level. *See* Attachments 3 and 7 also for comparisons between all subgroups.

28. Table 4 reports a historical series of basic service prices for all the communities surveyed; expanded basic service prices, channels, and price per channel; and the next most popular service prices. Table 4 also reports the compound average annual change in prices and channels over the latest five and ten years.[36] Using this measure, we compare the average annual increase in prices and channels over the five and ten-year periods to the annual increase from January 1, 2016 to January 1, 2017 reported in this survey. The price of basic service grew annually by 4.0 percent over the five-year period and by 5.0 percent over the ten-year period; these growth rates are somewhat smaller than the increase of 5.2 percent (*see* Table 1) observed over the 12-month period ending January 1, 2017. The price of expanded basic cable service grew annually by 4.1 percent over the five-year period and by 4.8 percent over the ten-year period; these growth rates are larger than the increase of 3.2 percent (*see* Table 1) observed over the 12-month period ending January 1, 2017. The average number of channels offered by cable operators with expanded basic service grew annually by 5.4 percent over the five year period and by 7.5 percent over the ten year period; these growth rates are substantially smaller than the one-year increase of 12.5 percent (*see* Table 5) observed over the 12-month period ending January 1, 2017.[37] [38] Average price per channel for expanded basic service declined by 0.8 percent annually over the five-year period and by 1.6 percent annually over the ten-year period. This compares to a 10.1 percent decrease (*see* Table 2) observed over the 12-month period ending January 1, 2017.[39] The price of the next most popular service (and lease of equipment if not included in the programming price) increased by 3.8 percent over the five-year period and by 4.7 percent over the ten-year period. This compares to an increase of 5.0 percent (*see* Attachment 4) observed over the 12-month period ending January 1, 2017.

[36] The compound average annual change smooths and summarizes the annual changes observed over the period. It is the constant annual rate at which price would have changed over the period to result in the observed growth.

[37] Year 2010 was the start of a new data series for channels and price per channel, reflecting a change to the survey questionnaire. The channel and price per channel indices in Attachment 8 adjust for this change and are the basis of the compound average annual change, as discussed in the Appendix.

[38] The large one-year increase in number of channels offered may reflect changes after mergers and acquisitions that took place during this period.

[39] The large decrease in price per channel results from a large increase in the number of channels offered.

Table 4
Historical Price Series
2006–2017

Year	Basic Service Price	Expanded Basic Service			Next Most Popular Service and Equipment	CPI	
		Price	Channels	Price per Channel		All Items	Cable (CSR Index)
2006	$14.59	$45.26	71.0	$0.650	$59.09	132.2	174.4
2007	$15.33	$47.27	72.6	$0.670	$60.27	135.0	179.0
2008	$16.11	$49.65	72.8	$0.680	$63.66	140.8	183.9
2009	$17.65	$52.37	78.2	$0.710	$67.92	140.8	186.5
2010	$17.93	$54.44	117	$0.560	$71.39	144.5	191.9
2011	$19.33	$57.46	124.2	$0.569	$75.37	146.9	192.0
2012	$20.55	$61.63	149.9	$0.505	$78.91	151.2	199.8
2013	$22.63	$64.41	159.6	$0.484	$81.64	153.6	206.5
2014	$22.78	$66.61	167.3	$0.496	$84.65	156.0	212.0
2015	$23.79	$69.03	181.3	$0.456	$86.83	155.8	216.4
2016	$25.40	$71.37	181.0	$0.469	$90.42	158.0	220.1
2017	$25.06	$75.21	195.1	$0.487	$95.13	161.9	231.7
Compound Average Annual Rate of Change							
5-year average	4.0%	4.1%	5.4%	-0.8%	3.8%	1.4%	3.0%
10-year average	5.0%	4.8%	7.5%	-1.6%	4.7%	1.8%	2.6%

Source: Attachment 8. Attachment 8 shows the series back to 1995. Rates of change for channels and price per channel are based on the indices shown in Attachment 7 and cannot be calculated from this table.

29. Table 4 also reports the Consumer Price Index (CPI) for all items, published by the Bureau of Labor Statistics (BLS), which serves as a measure of general price inflation and a basis for comparison.[40] The CPI (all items) grew at an average annual rate of 1.4 percent over the last five years and by 1.8 percent annually over the last ten years. Over the 12 months ending January 1, 2017, the CPI grew by 2.5 percent. Table 4 also reports a BLS price index for Cable and Satellite Television and Radio Services (CSR Index).[41] The CSR Index grew annually by 3.0 percent and 2.6 percent over the last five and ten years respectively, and by 5.3 percent for the 12-month period ending January 1, 2017. Because this index covers a different mix of services and is adjusted for changes in the number of programming channels, the CSR Index is not directly comparable to changes in cable programming prices in the Report.[42]

[40] BLS, Department of Labor (BLS), *Consumer Price Index, All Urban Consumers, U.S. City Average, Not Seasonally Adjusted, All Items (1982-84=100).* Series ID: CUUR0000SA0. (Accessed February 21, 2018).

[41] BLS, *Cable and Satellite Television and Radio Service (Dec. 1983=100),* Series ID: CUUR0000SERA02 (accessed February 21, 2018). This index is a sub-component of the overall CPI.

[42] BLS bases the CSR Index on a survey of items on consumers' monthly cable bills, including premium services and installation costs, which are not included in our monthly average. When an item shows a significant change in

(continued….)

B. Cable Programming Channels

30. Table 5 shows the average number of video channels offered as of January 1, 2017, and the annual percent change in the number of channels. The number of channels offered under each service tier includes the channels offered under each lower tier. Also, the channel figures given here include video channels in all formats but exclude audio-only channels. In the full sample, an average of 67 channels were offered with the basic service tier, while the expanded basic and next most popular tiers offered 195 and 282 channels on average. A total of 512 video channels were offered by cable operators on average. This total includes pay and pay-per-view channels and other programming tiers not included in the Report.

Table 5
Number of Video Channels
by Status of Effective Competition
January 1, 2017

Cable Service	Full Sample	Non-competitive Group	Effective Competition Group	Effective Competition Subgroups				
				Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
				Incumbent	Rival			
Basic	**67.2**	**65.2**	**67.3**	**83.6**	**57.4**	**36.6**	**60.2**	**73.2**
Annual change	12.8%*	2.2%	13.0%*	-3.6%	0.6%	3.9%	10.6%*	20.4%*
Expanded basic	**195.1**	**211.8**	**194.9**	**169.1**	**241.9**	**122.5**	**192.5**	**208.8**
Annual change	12.5%*	10.0%*	12.5%*	-1.0%	5.1%	7.7%	11.9%*	16.5%*
Next most popular	**281.7**	**285.7**	**281.7**	**263.6**	**336.0**	**173.5**	**272.3**	**302.0**
Annual change	9.4%*	0.3%	9.5%*	2.2%	0.9%	5.9%	7.5%*	12.9%*
All channels	**512.4**	**500.7**	**512.6**	**552.3**	**577.2**	**329.2**	**486.4**	**541.9**
Annual change	0.8%	0.7%	1.1%	-1.7%	0.4%	10.5%*	7.5%*	10.0%*

Source: Attachment 9. * Indicates annual change is statistically significant at 95% confidence level. See Attachment 10 for comparisons of channel counts between subgroups.

31.

32. Table 6 categorizes the channels available with basic service. The table reports the average number of channels in each category available with basic service. The categories are local broadcast; public, educational, and governmental (PEG) access; local commercial leased access; non-premium regional sports networks; and other non-premium channels. Over half of the channels offered

(Continued from previous page)
price, BLS makes a quality adjustment and may change the observed price depending on the change in the quality of the product or service in question. In the case of cable service, BLS generally perceives additional channels as an improvement in quality and adjusts the observed price downward. BLS, *How BLS Measures Price Change in the Consumer Price Index for Cable and Satellite Television and Radio.* https://www.bls.gov/cpi/factsheets/cable-and-satellite-television-and-radio.htm. (Last modified February 23, 2018).

with basic service are broadcast channels. It is important to note that a broadcast channel is an individual channel – standard definition, high definition, or multicast – and not a broadcast television station. For example, if the primary signal of a broadcast television station is carried by a cable system in both standard and high definition on separate channels, this would count as two channels. In addition, any multicast subchannels carried count as additional channels.

Table 6
Basic Service Channel Composition
January 1, 2017

Video Channel Category	Full Sample	Non-competitive Group	Effective Competition Group	Effective Competition Subgroups				
				Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
				Incumbent	Rival			
Broadcast	37.2	40.5	37.2	40.9	47.3	17.8	32.6	41.3
PEG	4.7	3.2	4.7	4.4	5.0	2.1	3.6	5.7
Leased access	1.3	1.0	1.3	1.6	0.5	0.5	1.1	1.5
Regional sports	0.2	0.0	0.2	1.5	0.0	0.1	0.1	0.1
Other channels	23.9	20.5	23.9	35.3	4.5	16.5	22.9	24.6
Total	**67.2**	**65.2**	**67.3**	**83.6**	**57.4**	**36.6**	**60.2**	**73.2**

Source: 2017 survey. See Attachment 11 for comparisons of channel composition between subgroups.

33. Table 7 reports the average number of regional sports networks (RSNs) included with each service tier. The survey defines RSNs as networks that carry a substantial number of live games from at least one nearby professional sports team that is a member of the National Football League, Major League Baseball, National Basketball Association, or National Hockey League. No pay-per-view channel is considered an RSN. The average number of RSNs offered with basic service, expanded basic service, and the next most popular service are 0.2 channels, 3.3 channels, and 3.6 channels, respectively.
34.

Table 7
Regional Sports Networks
By Status of Effective Competition
January 1, 2017

Cable Service	Full Sample	Non-competitive Group	Effective Competition Group	Effective Competition Subgroups				
				Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
				Incumbent	Rival			
Basic	0.2	0.0	0.2	1.5	0.0	0.1	0.1	0.1
Expanded basic	3.3	4.5	3.3	3.3	7.1	2.2	3.5	3.1
Next most popular	3.6	4.5	3.6	3.3	8.0	2.4	3.6	3.6

Source: 2017 survey. *See* Attachment 12 for comparisons of RSN carriage between subgroups.

C. Cable Equipment

35. Table 8 reports the average equipment lease fee for each service tier.[43] Specifically, this is the monthly fee to lease the equipment most commonly leased by subscribers of each service tier. This equipment may be a converter box or other equipment necessary to view all channels offered with the service tier. The equipment lease fees reported represent the fee to lease a single piece of equipment, not the total amount paid for all equipment leased by a household. In the full sample, the average equipment lease fee was about $9 for all service tiers, and this fee had not increased significantly over the previous year.

Table 8
Average Equipment Lease Fee
Most Commonly Leased Equipment
January 1, 2017

Cable Service	Full Sample	Non-Competitive Group	Effective Competition Group	Effective Competition Subgroups				
				Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
				Incumbent	Rival			
Basic	**$9.17**	**$7.11**	**$9.18**	**$9.63**	**$10.33**	**$8.78**	**$8.51**	**$9.36**
Annual change	1.6%	1.3%	1.6%	5.7%*	-0.1%	1.5%	0.8%	0.9%
Expanded basic	**$9.29**	**$7.10**	**$9.31**	**$9.63**	**$10.95**	**$8.83**	**$8.69**	**$9.46**
Annual change	1.6%	1.3%	1.6%	5.9%*	-0.1%	1.5%	0.8%	0.9%
Next most popular	**$9.38**	**$7.11**	**$9.39**	**$9.67**	**$10.92**	**$9.21**	**$8.88**	**$9.45**
Annual change	1.8%	1.3%	1.8%	5.7%*	0.0%	2.6%	1.4%	0.9%

Source: Attachment 13. * Indicates annual change is statistically significant at the 95% confidence level. *See* Attachment 14 for comparisons between subgroups.

36. Table 9 shows the percentage of subscribers who have access to the following particular features with the most commonly leased equipment by service level: digital video recorder (DVR); high definition (HD); interactive programming guide (IPG); and remote-control unit (RCU).[44] In the full sample and for all service levels, DVR and HD capabilities were not widely available with the most commonly leased equipment. In contrast, an IPG and an RCU were almost universally available to subscribers with the most commonly leased equipment.

[43] Some operators do not charge an additional fee for equipment. Instead these operators bundle cable service and equipment. The average equipment lease fees reported in Table 8 are the average fees for operators who did not bundle cable service and equipment and priced cable service and equipment separately. In our sample, in most communities (65 percent), the operator did not bundle cable service and equipment.

[44] This is not the percentage of subscribers who receive a particular feature. Instead, we ask operators whether each feature is available with the most commonly leased equipment for each service level. The percentages above are the percentages of subscribers in communities where the feature is available with the most commonly leased equipment at a particular service level. Because one subscriber may lease multiple pieces of equipment for multiple television sets, the percentages reported in Table 9 are likely to be different from the percentages of subscribers who receive a particular feature.

Table 9
Equipment Features Offered
Most Commonly Leased Equipment
January 1, 2017

Cable Service	Feature	Full Sample	Non-competitive Group	Effective Competition Group	Effective Competition Subgroups				
					Overbuilt Communities		Small Systems	Midsize Systems	Large Systems
					Incumbent	Rival			
Basic	**DVR**	12%	0%	12%	46%	4%	30%	8%	7%
	HD	27%	0%	28%	49%	83%	59%	17%	22%
	IPG	94%	100%	94%	91%	85%	84%	94%	97%
	RCU	96%	100%	96%	92%	100%	88%	95%	99%
Expanded basic	**DVR**	12%	0%	12%	46%	4%	30%	8%	6%
	HD	27%	0%	28%	49%	85%	61%	17%	22%
	IPG	95%	100%	95%	91%	97%	86%	94%	98%
	RCU	96%	100%	95%	92%	98%	88%	95%	97%
Next most popular	**DVR**	13%	0%	13%	46%	4%	32%	9%	6%
	HD	28%	0%	28%	49%	85%	60%	18%	22%
	IPG	95%	100%	95%	92%	97%	86%	95%	97%
	RCU	95%	100%	95%	92%	98%	83%	96%	97%

Source: 2017 survey.

D. Broadcast Retransmission Consent

37. Section 110 of the STELA Reauthorization Act of 2014 (STELAR) requires the Commission to report on retransmission consent fees paid by cable operators to broadcast stations.[45] Therefore, the survey asked operators to report total retransmission consent fees paid to broadcasters and the number of subscribers covered by retransmission consent payments in 2015 and 2016. The instructions requested that respondents exclude other fees such as copyright fees. In addition, operators reported the number of broadcast stations carried pursuant to retransmission consent agreements.

38. Table 10 presents information on retransmission consent compensation. Average annual retransmission consent fees calculated on a per subscriber basis increased by 30 percent, rising from $55.82 to $72.59, from 2015 to 2016.[46] The number of broadcast stations carried per cable system pursuant to retransmission consent agreements did not change between 2015 and 2016: about eleven broadcast stations were carried per cable system pursuant to retransmission consent each year. Average monthly retransmission consent fees paid by cable systems to broadcast stations on a per subscriber per station basis increased from $0.50 to $0.63 from 2015 to 2016. In the sample, a total of $2.4 billion in retransmission consent fees was reported for 2015. In 2016, the total reported was $3.3 billion.

[45] See fn. 6, supra.

[46] To calculate annual retransmission consent fees on a per subscriber basis, we divided total retransmission consent fees reported per cable system by the number of subscribers subject to retransmission consent—those who received stations carried pursuant to retransmission consent—per cable system.

Operators in the sample reported fees covering about 46.1 million subscribers in 2015 and 47.6 million subscribers in 2016.

Table 10
Retransmission Consent Fees and Subscribers

	2015	2016	Percent Change
Average Annual Retransmission Consent Fees Paid per Cable System	$30,941,686	$40,771,516	31.8%*
Average Number of Subscribers Pursuant to Retransmission Consent per Cable System[47]	614,359	601,530	-2.1%
Average Annual Retransmission Consent Fees Paid per Subscriber	$55.82	$72.59	30.0%*
Average Number of Stations Carried Pursuant to Retransmission Consent per Cable System	11.09	11.37	2.5%
Average Monthly Retransmission Consent Fees Paid per Subscriber per Station	$0.50	$0.63	25.9%*
Total Retransmission Consent Fees Reported in Sample	$2,382,129,408	$3,252,965,120	36.6%
Total Subscribers under Retransmission Consent Reported in Sample	46,071,184	47,576,100	3.3%

Source: 2017 survey. * Indicates annual change is statistically significant at the 95% confidence level. Note: No test of statistical significance can be applied to total retransmission consent fees or total subscribers under retransmission consent. In the sample, total retransmission consent fees and total subscribers are known quantities.

39. To track changes in retransmission consent fees over time, Table 11 provides an index that reflects the annual changes reported in the three surveys that have collected retransmission consent data.[48] The base year of the index is 2013, and the index's value for 2014 reflects the increase in retransmission consent fees from 2013 to 2014 as reported in the 2015 survey, the first survey that

[47] In this table, cable system is not strictly defined. Retransmission consent fees and subscriber counts per cable system were reported at various system levels ranging from an individual cable community to a broad geographic region encompassing multiple markets. Respondents may vary this level of aggregation from year to year, and thus the "Fees Paid per Cable System" cannot be directly compared across surveys. However, the index reported on the next page adjusts for these issues and thus is comparable over time.

[48] Retransmission consent fee estimates are not directly comparable across surveys because of sampling variance and differences in reporting levels used by operators.

collected data on retransmission consent fees.[49] The index shows that the growth of retransmission consent fees has slowed. Over the 2013-2014 period, retransmission consent fees per subscriber increased by 50 percent, while the 2014-2015 period showed an increase of 34.1 percent, and the 2015-2016 period showed an increase of 30.0 percent. Over the 2013-2016 period, the compound average annual rate of increase was 42.3 percent and 37.8 percent for retransmission consent fees and fees per subscriber, respectively.

Table 11
Change in Retransmission Consent Fees
2013-2016

Year	Retransmission Consent Fee Index	Retransmission Consent Fees per Subscriber Index
2013	100	100
2014	163.2	150.0
2015	218.5	201.2
2016	287.9	261.6
Compound Average Annual Rate of Change		
2013-2016	42.3%	37.8%

40. Table 12 reports information on retransmission consent fees by system size. The noncompetitive, incumbent, and rival subgroup communities were added to the system size subgroups detailed in the Appendix. As before, a small system has 10,000 or fewer subscribers; a midsize system has 10,001 to 75,000 subscribers; and a large system has more than 75,000 subscribers. Table 12 shows that retransmission consent fees are higher for small systems. On average, small systems paid $93.37 annually per subscriber in 2016, while midsize and large systems paid $71.22 and $70.88, respectively. The differences in fees paid per subscriber between small and midsize systems and between small and large systems are statistically significant (*see* Attachment 15). However, the difference in fees paid per subscriber between midsize and large systems is not statistically significant. Small systems also carry fewer stations pursuant to retransmission consent than midsize and large systems, and therefore, when retransmission consent fees are calculated per subscriber per station, fees are again highest for small systems. Midsize systems carry about one fewer station under retransmission consent than large systems, and, consequently, have higher fees than large systems when retransmission consent fees are calculated per subscriber, per station.

Table 12
Retransmission Consent Fees by System Size
2016

	Small Systems	Midsize Systems	Large Systems

[49] The index's value for each of the following years is calculated analogously. The index's value for 2016 reflects the increase in retransmission consent fees from 2015 to 2016 as reported in the 2017 survey.

Average Annual Retransmission Consent Fees Paid per Subscriber	**$93.37**	**$71.22**	**$70.88**
Annual Change	19.9%*	27.8%*	33.2%*
Average Number of Stations Carried under Retransmission Consent per Cable System	**7.56**	**11.06**	**11.99**
Annual Change	2.3%	2.1%	2.8%
Average Monthly Retransmission Consent Fees Paid per Subscriber per Station	**$1.20**	**$0.64**	**$0.55**
Annual Change	20.4%*	26.5%*	27.4%*

Source: 2017 survey. * Indicates annual change is statistically significant at the 95% confidence level. See Attachment 15 for comparisons of retransmission consent fees between system size groups.

IV. CONCLUSIONS

41. Cable service prices increased over the period covered by this report. Basic service prices grew 5.2 percent, while prices for expanded basic service increased by 3.2 percent over the 12 months ending January 1, 2017. These price increases are larger than the 2.5 percent increase in general inflation as measured by the CPI (All Items) for the same one-year period. Over the five-year period, 2012-2017, on average basic service prices increased by 4.0 percent annually and expanded basic service prices increased by 4.1 percent annually, while the average annual increase in inflation was 1.4 percent over the same period.

42. Basic service prices were about 50 percent higher in effective competition communities than in noncompetitive communities (where basic service rates may be subject to regulation by local franchising authorities), while expanded basic service prices were slightly lower in effective competition communities. Expanded basic price per channel, however, was about 25 percent higher in effective competition communities.

43. Annual retransmission consent fees paid by cable systems to television broadcasters increased by about 30 percent from 2015 to 2016 on average. Average annual retransmission consent fees paid by cable systems to television broadcast stations calculated on a per-subscriber basis increased from $55.82 to $72.59 over the same period. During the 2013-2016 period, the average annual increase in retransmission consent fees was 42.3 percent, and the average annual increase in fees per subscriber was 37.8 percent. Small system operators pay about 30 percent more in retransmission consent fees calculated on a per subscriber basis than midsize and large system operators.

44. DBS providers offer programming services similar to those offered by cable operators. Accordingly, the Report compared expanded basic service to the DBS services found to be the most comparable. As of January 1, 2017, the average price of expanded basic ($75.21) was less than the average price for DIRECTV's Choice package ($78.99), and slightly more than DISH's AT120+ ($74.99). Cable operators, on average, offered 195 channels with expanded basic service, while the comparable services of DIRECTV and DISH offered 239 and 182 channels respectively. Expanded basic service had, on average, a higher price per channel (49 cents per channel) than DIRECTV's service (33 cents per channel) and DISH's service (41 cents per channel).

Attachment 1
Cable Price Survey
Sampling Groups
January 1, 2017

Sampling Groups and Subgroups	Number of Cable Communities	Percent of National Subscribers	Survey Sample Size	Number of Survey Responses
Sampling Groups				
Noncompetitive group	118	1.3%	33	33
Effective competition	33,765	98.7%	717	713
Full sample	33,883	100%	750	746
Effective Competition Subgroups				
Large Systems: More than 75,000 subscribers	8,837	49.3%	230	230
Midsize Systems: 10,001 – 75,000 subscribers	10,252	28.8%	200	200
Small Systems: 10,000 and fewer subscribers	13,374	7.3%	175	171
Incumbents	745	10.0%	56	56
Rivals	557	3.3%	56	56

Sources: Federal Communications Commission, Cable Community Registration, FCC Form 322; Annual Cable Operator Report, FCC Form 325, and S&P Global, MediaCensus, Operator Subscribers by Geography 2016 Q3. See 47 CFR §§ 76.1801, 403. The Commission assigns a "cable community unit identifier" (CUID) to each registered cable operator for each individual community the operator serves. In cable overbuild communities, the table shows more incumbents than rivals. This is primarily because the communities of one rival, AT&T, do not have CUIDs. The Commission however considers AT&T U-verse as a competing service for the purpose of findings of effective competition.

Attachment 2
Average Price of Programming
by Subgroup and Programming Service

Sample Group	Subgroup	Service	Year	n	Sample Mean	Standard Error	Annual Change
Full sample	---	Basic service	2017	746	$25.06	0.265	5.2%*
			2016	737	$23.81	0.266	
		Expanded basic	2017	746	$75.21	0.261	3.2%*
			2016	737	$72.90	0.226	
		Next most popular	2017	736	$89.28	0.377	2.8%*
			2016	727	$86.82	0.315	
Non-competitive Group	---	Basic service	2017	33	$16.61	0.215	9.8%*
			2016	33	$15.13	0.228	
		Expanded basic	2017	33	$77.24	0.721	3.6%*
			2016	33	$74.54	0.536	
		Next most popular	2017	33	$93.28	0.981	3.0%*
			2016	33	$90.59	0.786	
Effective Competition Group	---	Basic service	2017	713	$25.17	0.269	5.2%*
			2016	704	$23.93	0.270	
		Expanded basic	2017	713	$75.19	0.264	3.2%*
			2016	704	$72.87	0.229	
		Next most popular	2017	703	$89.23	0.381	2.8%*
			2016	694	$86.77	0.319	
	Overbuilt Communities incumbents	Basic service	2017	56	$23.02	0.500	9.7%*
			2016	56	$20.98	0.620	
		Expanded basic	2017	56	$72.87	0.720	2.4%
			2016	56	$71.15	0.547	
		Next most popular	2017	56	$85.34	1.016	2.4%
			2016	56	$83.38	0.824	
	Overbuilt Communities rivals	Basic service	2017	56	$17.98	0.988	3.1%
			2016	55	$17.44	0.875	
		Expanded basic	2017	56	$72.40	0.717	1.5%
			2016	55	$71.33	0.875	
		Next most popular	2017	55	$85.94	1.696	1.9%
			2016	54	$84.30	1.438	
	Small Systems	Basic service	2017	171	$30.41	0.753	2.6%
			2016	171	$29.63	0.696	
		Expanded basic	2017	171	$71.73	0.721	3.7%*
			2016	171	$69.15	0.680	
		Next most popular	2017	162	$84.68	0.896	3.1%*
			2016	162	$82.11	0.790	
	Midsize Systems	Basic service	2017	200	$26.91	0.363	5.5%*
			2016	200	$25.52	0.380	
		Expanded basic	2017	200	$75.35	0.525	3.4%*
			2016	200	$72.88	0.455	
		Next most popular	2017	200	$90.14	0.677	3.0%*
			2016	200	$87.50	0.586	
	Large Systems	Basic service	2017	230	$24.31	0.458	4.9%
			2016	222	$23.18	0.457	
		Expanded basic	2017	230	$76.25	0.384	3.2%*
			2016	222	$73.89	0.333	
		Next most popular	2017	230	$90.32	0.587	2.8%*
			2016	222	$87.86	0.484	

Source: 2017 survey. * Indicates annual change is statistically significant at the 95% confidence level. Price does not include equipment, unless the operator bundles the programming service and equipment in a single price.

Attachment 3
Differences between Subgroups: Average Price of Programming
January 1, 2017

Service	Subgroup 1	Average Price 1	Subgroup 2	Average Price 2	Is Difference Statistically Significant?
Basic	Large Systems	$24.31	Midsize	$26.91	Yes
			Small	$30.41	Yes
			Incumbent	$23.02	No
			Rival	$17.98	Yes
			Noncompetitive	$16.61	Yes
	Midsize Systems	$26.91	Small	$30.41	Yes
			Incumbent	$23.02	Yes
			Rival	$17.98	Yes
			Noncompetitive	$16.61	Yes
	Small Systems	$30.41	Incumbent	$23.02	Yes
			Rival	$17.98	Yes
			Noncompetitive	$16.61	Yes
	Incumbent	$23.02	Rival	$17.98	Yes
			Noncompetitive	$16.61	Yes
	Rival	$17.98	Noncompetitive	$16.61	No
Expanded Basic	Large Systems	$76.25	Midsize	$75.35	No
			Small	$71.73	Yes
			Incumbent	$72.87	Yes
			Rival	$72.40	Yes
			Noncompetitive	$77.24	No
	Midsize Systems	$75.35	Small	$71.73	Yes
			Incumbent	$72.87	Yes
			Rival	$72.40	Yes
			Noncompetitive	$77.24	No
	Small Systems	$71.73	Incumbent	$72.87	No
			Rival	$72.40	No
			Noncompetitive	$77.24	Yes
	Incumbent	$72.87	Rival	$72.40	No
			Noncompetitive	$77.24	Yes
	Rival	$72.40	Noncompetitive	$77.24	Yes
Next Most Popular	Large Systems	$90.32	Midsize	$90.14	No
			Small	$84.68	Yes
			Incumbent	$85.34	Yes
			Rival	$85.94	Yes
			Noncompetitive	$93.28	Yes
	Midsize Systems	$90.14	Small	$84.68	Yes
			Incumbent	$85.34	Yes
			Rival	$85.94	Yes
			Noncompetitive	$93.28	Yes
	Small Systems	$84.68	Incumbent	$85.34	No
			Rival	$85.94	No
			Noncompetitive	$93.28	Yes
	Incumbent	$85.34	Rival	$85.94	No
			Noncompetitive	$93.28	Yes
	Rival	$85.94	Noncompetitive	$93.28	Yes

Source: 2017 survey.

Attachment 4
Average Price of Cable Programming and Equipment (Total Price)
by Subgroup and Programming Service

Sample Group	Subgroup	Service	Year	n	Sample Mean	Standard Error	Annual Change
Full sample	---	Basic service	2017	746	$30.73	0.245	5.0%*
			2016	737	$29.28	0.267	
		Expanded basic	2017	746	$81.01	0.232	3.2%*
			2016	737	$78.51	0.244	
		Next most popular	2017	736	$95.13	0.292	2.8%*
			2016	727	$92.50	0.253	
Non-competitive Group	---	Basic service	2017	33	$18.96	0.404	8.7%*
			2016	33	$17.45	0.476	
		Expanded basic	2017	33	$79.58	0.399	3.5%*
			2016	33	$76.86	0.261	
		Next most popular	2017	33	$95.63	0.642	2.9%*
			2016	33	$92.91	0.458	
Effective Competition Group	---	Basic service	2017	713	$30.88	0.248	4.9%*
			2016	704	$29.44	0.270	
		Expanded basic	2017	713	$81.02	0.235	3.2%*
			2016	704	$78.54	0.247	
		Next most popular	2017	703	$95.12	0.296	2.8%*
			2016	694	$92.49	0.256	
	Overbuilt Communities incumbents	Basic service	2017	56	$30.99	0.431	9.2%*
			2016	56	$28.37	0.583	
		Expanded basic	2017	56	$80.84	0.527	2.8%*
			2016	56	$78.68	0.455	
		Next most popular	2017	56	$93.50	0.795	2.6%*
			2016	56	$91.10	0.649	
	Overbuilt Communities rivals	Basic service	2017	56	$27.85	0.652	2.0%
			2016	55	$27.31	0.539	
		Expanded basic	2017	56	$82.87	0.895	1.3%
			2016	55	$81.80	1.077	
		Next most popular	2017	55	$96.86	1.532	1.7%
			2016	54	$95.22	1.283	
	Small Systems	Basic service	2017	171	$36.37	0.852	2.7%
			2016	171	$35.40	0.816	
		Expanded basic	2017	171	$78.03	0.762	3.7%*
			2016	171	$75.25	0.765	
		Next most popular	2017	162	$91.79	0.875	3.0%*
			2016	162	$89.09	0.805	
	Midsize Systems	Basic service	2017	200	$31.59	0.427	4.9%*
			2016	200	$30.12	0.456	
		Expanded basic	2017	200	$80.17	0.462	3.3%*
			2016	200	$77.62	0.446	
		Next most popular	2017	200	$95.07	0.534	2.9%*
			2016	200	$92.36	0.467	
	Large Systems	Basic service	2017	230	$29.86	0.392	4.8%*
			2016	222	$28.50	0.434	
		Expanded basic	2017	230	$81.86	0.343	3.2%*
			2016	222	$79.32	0.386	
		Next most popular	2017	230	$95.81	0.444	2.8%*
			2016	222	$93.16	0.384	

Source: 2017 survey. * Indicates annual change is statistically significant at the 95% confidence level. Equipment price added to programming price if equipment is necessary to receive all channels.

Attachment 5
Differences between Subgroups: Average Total Price*
January 1, 2017

Service	Subgroup 1	Total Price 1	Subgroup 2	Total Price 2	Is Difference Statistically Significant?
Basic	Large Systems	$29.86	Midsize	$31.59	Yes
			Small	$36.37	Yes
			Incumbent	$30.99	No
			Rival	$27.85	Yes
			Noncompetitive	$18.96	Yes
	Midsize Systems	$31.59	Small	$36.37	Yes
			Incumbent	$30.99	No
			Rival	$27.85	Yes
			Noncompetitive	$18.96	Yes
	Small Systems	$36.37	Incumbent	$30.99	Yes
			Rival	$27.85	Yes
			Noncompetitive	$18.96	Yes
	Incumbent	$30.99	Rival	$27.85	Yes
			Noncompetitive	$18.96	Yes
	Rival	$27.85	Noncompetitive	$18.96	Yes
Expanded Basic	Large Systems	$81.86	Midsize	$80.17	Yes
			Small	$78.03	Yes
			Incumbent	$80.84	No
			Rival	$82.87	No
			Noncompetitive	$79.58	Yes
	Midsize Systems	$80.17	Small	$78.03	Yes
			Incumbent	$80.84	No
			Rival	$82.87	Yes
			Noncompetitive	$79.58	No
	Small Systems	$78.03	Incumbent	$80.84	Yes
			Rival	$82.87	Yes
			Noncompetitive	$79.58	No
	Incumbent	$80.84	Rival	$82.87	No
			Noncompetitive	$79.58	No
	Rival	$82.87	Noncompetitive	$79.58	Yes
Next Most Popular	Large Systems	$95.81	Midsize	$95.07	No
			Small	$91.79	Yes
			Incumbent	$93.50	Yes
			Rival	$96.86	No
			Noncompetitive	$95.63	No
	Midsize Systems	$95.07	Small	$91.79	Yes
			Incumbent	$93.50	No
			Rival	$96.86	No
			Noncompetitive	$95.63	No
	Small Systems	$91.79	Incumbent	$93.50	No
			Rival	$96.86	Yes
			Noncompetitive	$95.63	Yes
	Incumbent	$93.50	Rival	$96.86	No
			Noncompetitive	$95.63	No
	Rival	$96.86	Noncompetitive	$95.63	No

Source: 2017 survey. * As with Attachment 4, "Average Total Price" refers to average price of cable programming and equipment.

Attachment 6
Average Price per Channel
by Subgroup and Programming Service

Sample Group	Subgroup	Service	Year	n	Sample Mean	Standard Error	Annual Change
Full sample	---	Basic service	2017	746	$0.58	0.012	-10.1%*
			2016	737	$0.65	0.015	
		Expanded basic	2017	746	$0.49	0.008	-10.1%*
			2016	737	$0.54	0.010	
		Next most popular	2017	736	$0.37	0.005	-6.4%*
			2016	727	$0.40	0.005	
Non-competitive Group	---	Basic service	2017	33	$0.30	0.008	-3.7%
			2016	33	$0.31	0.017	
		Expanded basic	2017	33	$0.39	0.008	-5.4%
			2016	33	$0.41	0.011	
		Next most popular	2017	33	$0.34	0.003	1.7%
			2016	33	$0.33	0.005	
Effective Competition Group	---	Basic service	2017	713	$0.59	0.012	-10.2%*
			2016	704	$0.65	0.015	
		Expanded basic	2017	713	$0.49	0.008	-10.2%*
			2016	704	$0.54	0.010	
		Next most popular	2017	703	$0.38	0.005	-6.5%*
			2016	694	$0.40	0.005	
	Overbuilt Communities incumbents	Basic service	2017	56	$0.45	0.018	-2.1%
			2016	56	$0.46	0.023	
		Expanded basic	2017	56	$0.54	0.014	-8.4%*
			2016	56	$0.59	0.017	
		Next most popular	2017	56	$0.38	0.008	-3.0%
			2016	56	$0.39	0.009	
	Overbuilt Communities rivals	Basic service	2017	56	$0.58	0.034	1.4%
			2016	55	$0.57	0.032	
		Expanded basic	2017	56	$0.39	0.034	3.3%
			2016	55	$0.38	0.016	
		Next most popular	2017	55	$0.30	0.009	1.3%
			2016	54	$0.29	0.008	
	Small Systems	Basic service	2017	171	$1.33	0.067	-2.5%
			2016	171	$1.37	0.068	
		Expanded basic	2017	171	$0.83	0.041	-0.2%
			2016	171	$0.83	0.040	
		Next most popular	2017	162	$0.64	0.023	-0.6%
			2016	162	$0.64	0.023	
	Midsize Systems	Basic service	2017	200	$0.63	0.024	-10.4%
			2016	200	$0.70	0.030	
		Expanded basic	2017	200	$0.49	0.018	-8.7%
			2016	200	$0.54	0.020	
		Next most popular	2017	200	$0.39	0.011	-4.9%
			2016	200	$0.41	0.012	
	Large Systems	Basic service	2017	230	$0.48	0.015	-14.3%*
			2016	222	$0.56	0.021	
		Expanded basic	2017	230	$0.44	0.010	-14.3%*
			2016	222	$0.51	0.014	
		Next most popular	2017	230	$0.34	0.005	-9.8%*
			2016	222	$0.38	0.007	

Source: 2017 survey. * Indicates annual change is statistically significant at the 95% confidence level. Price per channel is equal to sum of the programming price and the price of the most commonly leased equipment divided by the number of channels the service offers.

Attachment 7
Differences between Subgroups: Average Price per Channel
January 1, 2017

Service	Subgroup 1	Price per Channel 1	Subgroup 2	Price per Channel 2	Is Difference Statistically Significant?
Basic	Large Systems	$0.48	Midsize	$0.63	Yes
			Small	$1.33	Yes
			Incumbent	$0.45	No
			Rival	$0.58	Yes
			Noncompetitive	$0.30	Yes
	Midsize Systems	$0.63	Small	$1.33	Yes
			Incumbent	$0.45	Yes
			Rival	$0.58	No
			Noncompetitive	$0.30	Yes
	Small Systems	$1.33	Incumbent	$0.45	Yes
			Rival	$0.58	Yes
			Noncompetitive	$0.30	Yes
	Incumbent	$0.45	Rival	$0.58	Yes
			Noncompetitive	$0.30	Yes
	Rival	$0.58	Noncompetitive	$0.30	Yes
Expanded Basic	Large Systems	$0.44	Midsize	$0.49	Yes
			Small	$0.83	Yes
			Incumbent	$0.54	Yes
			Rival	$0.39	No
			Noncompetitive	$0.39	Yes
	Midsize Systems	$0.49	Small	$0.83	Yes
			Incumbent	$0.54	Yes
			Rival	$0.39	Yes
			Noncompetitive	$0.39	Yes
	Small Systems	$0.83	Incumbent	$0.54	Yes
			Rival	$0.39	Yes
			Noncompetitive	$0.39	Yes
	Incumbent	$0.54	Rival	$0.39	Yes
			Noncompetitive	$0.39	Yes
	Rival	$0.39	Noncompetitive	$0.39	No
Next Most Popular	Large Systems	$0.34	Midsize	$0.39	Yes
			Small	$0.64	Yes
			Incumbent	$0.38	Yes
			Rival	$0.30	Yes
			Noncompetitive	$0.34	No
	Midsize Systems	$0.39	Small	$0.64	Yes
			Incumbent	$0.38	No
			Rival	$0.30	Yes
			Noncompetitive	$0.34	Yes
	Small Systems	$0.64	Incumbent	$0.38	Yes
			Rival	$0.30	Yes
			Noncompetitive	$0.34	Yes
	Incumbent	$0.38	Rival	$0.30	Yes
			Noncompetitive	$0.34	Yes
	Rival	$0.30	Noncompetitive	$0.34	Yes

Source: 2017 survey.

Attachment 8 Historical Price Series 1995-2017									
Year	Basic Service Price	Expanded Basic Service					Next Most Popular Service and Equipment	CPI	
		Price	Channels		Price per Channel			All Items	Cable
			No.	Index	Dollars	Index			
Jul. 1995	---	$22.35	44.0	100.0	$0.600	100.0	---	1000	100.0
Jul. 1996	---	$24.28	47.0	106.8	$0.610	101.7	---	103.0	106.9
Jul. 1997	---	$26.31	49.4	112.3	$0.630	105.0	---	105.2	114.9
Jul. 1998	$12.06	$27.88	50.1	113.9	$0.650	108.3	$38.58	107.0	122.6
Jul. 1999	$12.58	$28.94	51.1	116.1	$0.650	108.3	$38.43	109.3	127
Jul. 2000	$12.84	$31.22	54.8	124.5	$0.660	110.0	$39.64	113.3	132.9
Jul. 2001	$12.84	$33.75	59.4	135.0	$0.600	100.0	$45.33	116.4	139.1
Jul. 2002	$14.45	$36.47	62.7	142.5	$0.660	110.0	$46.59	118.1	147.8
Jan. 2003	$13.45	$38.95	67.5	153.4	$0.650	108.3	$49.03	121.2	157.1
Jan. 2004	$13.80	$41.04	70.3	159.8	$0.660	110.0	$51.76	123.5	163.1
Jan. 2005	$14.30	$43.04	70.5	160.2	$0.620	103.3	$56.03	127.2	169.6
Jan. 2006	$14.59	$45.26	71.0	161.4	$0.650	108.3	$59.09	132.2	174.4
Jan. 2007	$15.33	$47.27	72.6	165.0	$0.670	111.7	$60.27	135.0	179.0
Jan. 2008	$16.11	$49.65	72.8	165.5	$0.680	113.3	$63.66	140.8	183.9
Jan. 2009	$17.65	$52.37	78.2	177.7	$0.710	118.3	$67.92	140.8	186.5
Jan. 2010	$17.93	$54.44	117.0	204.7	$0.560	110.3	$71.39	144.5	191.9
Jan. 2011	$19.33	$57.46	124.2	217.3	$0.569	112.0	$75.37	146.9	192.0
Jan. 2012	$20.55	$61.63	149.9	262.2	$0.505	99.4	$78.91	151.2	199.8
Jan. 2013	$22.63	$64.41	159.6	279.2	$0.484	95.3	$81.64	153.6	206.5
Jan. 2014	$22.78	$66.61	167.3	292.6	$0.496	97.6	$84.65	156.0	212.0
Jan. 2015	$23.79	$69.03	181.3	317.1	$0.456	89.3	$86.83	155.8	216.4
Jan. 2016	$25.40	$71.37	181.0	316.5	$0.469	91.8	$90.42	158.0	220.1
Jan. 2017	$25.06	$75.21	195.1	341.3	$0.487	95.4	$95.13	161.9	231.7
Compound Average Annual Rate of Change									
5 year average	4.0%	4.1%	---	5.4%	---	-0.8%	3.8%	1.4%	3.0%
10 year average	5.0%	4.8%		7.5%		-1.6%	4.7%	1.8%	2.6%
1995-2017	---	5.7%	---	5.7%	---	-0.2%	---	2.2%	3.9%

Sources: 1995-2017 survey reports**.** *See supra* note 2. Consumer price indices (CPIs) are from BLS, Department of Labor, *Consumer Price Index, All Urban Consumers, U.S. City Average, Not Seasonally Adjusted, All Items (1982-84=100).* Series ID: CUUR0000SA0. (Accessed February 21, 2018); Series ID: CUUR0000SERA02 (accessed February 21, 2018). We re-based these CPI series to July 1995 = 100 for the purpose of this report. This attachment is described in the Methodology Appendix.

Attachment 9
Average Number of Channels
by Sample and Programming Service

Sample Group	Subgroup	Service	Year	n	Sample Mean	Standard Error	Annual Change
Full sample	---	Basic service	2017	746	67.2	1.227	12.8%*
			2016	737	59.6	1.039	
		Expanded basic	2017	746	195.1	2.494	12.5%*
			2016	737	173.4	2.190	
		Next most popular	2017	736	281.7	3.134	9.4%*
			2016	727	257.6	2.724	
Non-competitive Group	---	Basic service	2017	33	65.2	1.073	2.2%
			2016	33	63.8	1.806	
		Expanded basic	2017	33	211.8	3.566	10.0%*
			2016	33	192.6	2.876	
		Next most popular	2017	33	285.7	1.285	0.3%
			2016	33	284.9	2.968	
Effective Competition Group	---	Basic service	2017	713	67.3	1.243	13.0%*
			2016	704	59.5	1.053	
		Expanded basic	2017	713	194.9	2.526	12.5%*
			2016	704	173.2	2.219	
		Next most popular	2017	703	281.7	3.175	9.5%*
			2016	694	257.3	2.760	
	Overbuilt Communities incumbents	Basic service	2017	56	83.6	4.664	-3.6%
			2016	56	86.7	5.731	
		Expanded basic	2017	56	169.1	6.390	-1.0%
			2016	56	170.8	6.647	
		Next most popular	2017	56	263.6	8.239	2.2%
			2016	56	258.0	9.021	
	Overbuilt Communities rivals	Basic service	2017	56	57.4	1.616	0.6%
			2016	55	57.0	1.645	
		Expanded basic	2017	56	241.9	5.919	5.1%
			2016	55	230.3	5.242	
		Next most popular	2017	55	336.0	5.274	0.9%
			2016	54	333.0	5.175	
	Small Systems	Basic service	2017	171	36.6	1.744	3.9%
			2016	171	35.3	1.777	
		Expanded basic	2017	171	122.5	4.418	7.7%
			2016	171	113.8	3.674	
		Next most popular	2017	162	173.5	5.782	5.9%
			2016	162	163.9	4.976	
	Midsize Systems	Basic service	2017	200	60.2	1.677	10.6%*
			2016	200	54.4	1.623	
		Expanded basic	2017	200	192.5	4.220	11.9%*
			2016	200	172.1	3.750	
		Next most popular	2017	200	272.3	5.082	7.5%*
			2016	200	253.3	4.794	
	Large Systems	Basic service	2017	230	73.2	2.008	20.4%*
			2016	222	60.8	1.363	
		Expanded basic	2017	230	208.8	4.047	16.5%*
			2016	222	179.3	3.535	
		Next most popular	2017	230	302.0	5.092	12.9%*
			2016	222	267.6	4.213	

Source: 2017 survey.

Attachment 10
Differences between Subgroups: Average Number of Channels
January 1, 2017

Service	Subgroup 1	Number of Channels 1	Subgroup 2	Number of Channels 2	Is Difference Statistically Significant?
Basic	Large Systems	73.2	Midsize	60.2	Yes
			Small	36.6	Yes
			Incumbent	83.6	No
			Rival	57.4	Yes
			Noncompetitive	65.2	Yes
	Midsize Systems	60.2	Small	36.6	Yes
			Incumbent	83.6	Yes
			Rival	57.4	No
			Noncompetitive	65.2	Yes
	Small Systems	36.6	Incumbent	83.6	Yes
			Rival	57.4	Yes
			Noncompetitive	65.2	Yes
	Incumbent	83.6	Rival	57.4	Yes
			Noncompetitive	65.2	Yes
	Rival	57.4	Noncompetitive	65.2	Yes
Expanded Basic	Large Systems	208.8	Midsize	192.5	Yes
			Small	122.5	Yes
			Incumbent	169.1	Yes
			Rival	241.9	Yes
			Noncompetitive	211.8	No
	Midsize Systems	192.5	Small	122.5	Yes
			Incumbent	169.1	Yes
			Rival	241.9	Yes
			Noncompetitive	211.8	Yes
	Small Systems	122.5	Incumbent	169.1	Yes
			Rival	241.9	Yes
			Noncompetitive	211.8	Yes
	Incumbent	169.1	Rival	241.9	Yes
			Noncompetitive	211.8	Yes
	Rival	241.9	Noncompetitive	211.8	Yes
Next Most Popular	Large Systems	302.0	Midsize	272.3	Yes
			Small	173.5	Yes
			Incumbent	263.6	Yes
			Rival	336.0	Yes
			Noncompetitive	285.7	Yes
	Midsize Systems	272.3	Small	173.5	Yes
			Incumbent	263.6	No
			Rival	336.0	Yes
			Noncompetitive	285.7	Yes
	Small Systems	173.5	Incumbent	263.6	Yes
			Rival	336.0	Yes
			Noncompetitive	285.7	Yes
	Incumbent	263.6	Rival	336.0	Yes
			Noncompetitive	285.7	Yes
	Rival	336.0	Noncompetitive	285.7	Yes
All Channels	Large Systems	541.9	Midsize	486.4	Yes
			Small	329.2	Yes
			Incumbent	552.3	No
			Rival	577.2	Yes
			Noncompetitive	500.7	Yes
	Midsize Systems	486.4	Small	329.2	Yes
			Incumbent	552.3	Yes
			Rival	577.2	Yes
			Noncompetitive	500.7	No
	Small Systems	329.2	Incumbent	552.3	Yes
			Rival	577.2	Yes
			Noncompetitive	500.7	Yes
	Incumbent	552.3	Rival	577.2	No
			Noncompetitive	500.7	Yes
	Rival	577.2	Noncompetitive	500.7	Yes

Source: 2017 survey.

Attachment 11
Differences between Subgroups: Channel Composition
January 1, 2017

Channel Type	Subgroup 1	Number of Channels 1	Subgroup 2	Number of Channels 2	Is Difference Statistically Significant?
Broadcast	Large Systems	41.3	Midsize	32.6	Yes
			Small	17.8	Yes
			Incumbent	40.9	No
			Rival	47.3	Yes
			Noncompetitive	40.5	No
	Midsize Systems	32.6	Small	17.8	Yes
			Incumbent	40.9	Yes
			Rival	47.3	Yes
			Noncompetitive	40.5	Yes
	Small Systems	17.8	Incumbent	40.9	Yes
			Rival	47.3	Yes
			Noncompetitive	40.5	Yes
	Incumbent	40.9	Rival	47.3	Yes
			Noncompetitive	40.5	No
	Rival	47.3	Noncompetitive	40.5	Yes
PEG	Large Systems	5.7	Midsize	3.6	Yes
			Small	2.1	Yes
			Incumbent	4.4	Yes
			Rival	5.0	No
			Noncompetitive	3.2	Yes
	Midsize Systems	3.6	Small	2.1	Yes
			Incumbent	4.4	Yes
			Rival	5.0	Yes
			Noncompetitive	3.2	No
	Small Systems	2.1	Incumbent	4.4	Yes
			Rival	5.0	Yes
			Noncompetitive	3.2	Yes
	Incumbent	4.4	Rival	5.0	No
			Noncompetitive	3.2	Yes
	Rival	5.0	Noncompetitive	3.2	Yes
Leased Access	Large Systems	1.5	Midsize	1.1	Yes
			Small	0.5	Yes
			Incumbent	1.6	No
			Rival	0.5	Yes
			Noncompetitive	1.0	Yes
	Midsize Systems	1.1	Small	0.5	Yes
			Incumbent	1.6	Yes
			Rival	0.5	Yes
			Noncompetitive	1.0	No
	Small Systems	0.5	Incumbent	1.6	Yes
			Rival	0.5	No
			Noncompetitive	1.0	Yes
	Incumbent	1.6	Rival	0.5	Yes
			Noncompetitive	1.0	Yes
	Rival	0.5	Noncompetitive	1.0	Yes
Regional Sports Networks	Large Systems	0.1	Midsize	0.1	No
			Small	0.1	No
			Incumbent	1.5	Yes
			Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Midsize Systems	0.1	Small	0.1	No
			Incumbent	1.5	Yes
			Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Small Systems	0.1	Incumbent	1.5	Yes
			Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Incumbent	1.5	Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Rival	0.0	Noncompetitive	0.0	Yes

Source: 2017 survey

Attachment 12
Differences between Subgroups: Regional Sports Networks
January 1, 2017

Service	Subgroup 1	Number of RSNs 1	Subgroup 2	Number of RSNs 2	Is Difference Statistically Significant?
Basic	Large Systems	0.1	Midsize	0.1	No
			Small	0.1	No
			Incumbent	1.5	Yes
			Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Midsize Systems	0.1	Small	0.1	No
			Incumbent	1.5	Yes
			Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Small Systems	0.1	Incumbent	1.5	Yes
			Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Incumbent	1.5	Rival	0.0	Yes
			Noncompetitive	0.0	Yes
	Rival	0.0	Noncompetitive	0.0	Yes
Expanded Basic	Large Systems	3.1	Midsize	3.5	No
			Small	2.2	Yes
			Incumbent	3.3	No
			Rival	7.1	Yes
			Noncompetitive	4.5	Yes
	Midsize Systems	3.5	Small	2.2	Yes
			Incumbent	3.3	No
			Rival	7.1	Yes
			Noncompetitive	4.5	No
	Small Systems	2.2	Incumbent	3.3	Yes
			Rival	7.1	Yes
			Noncompetitive	4.5	Yes
	Incumbent	3.3	Rival	7.1	Yes
			Noncompetitive	4.5	Yes
	Rival	7.1	Noncompetitive	4.5	Yes
Next Most Popular	Large Systems	3.6	Midsize	3.6	No
			Small	2.4	Yes
			Incumbent	3.3	No
			Rival	8.0	Yes
			Noncompetitive	4.5	No
	Midsize Systems	3.6	Small	2.4	Yes
			Incumbent	3.3	No
			Rival	8.0	Yes
			Noncompetitive	4.5	No
	Small Systems	2.4	Incumbent	3.3	Yes
			Rival	8.0	Yes
			Noncompetitive	4.5	Yes
	Incumbent	3.3	Rival	8.0	Yes
			Noncompetitive	4.5	Yes
	Rival	8.0	Noncompetitive	4.5	Yes

Source: 2017 survey

Attachment 13
Average Equipment Lease Fee
by Subgroup and Programming Service

Sample Group	Subgroup	Service	Year	n	Sample Mean	Standard Error	Annual Change
Full sample	---	Basic service	2017	472	$9.17	0.125	1.6%
			2016	458	$9.02	0.124	
		Expanded basic	2017	479	$9.29	0.115	1.6%
			2016	467	$9.15	0.114	
		Next most popular	2017	482	$9.38	0.111	1.8%
			2016	474	$9.21	0.110	
Non-competitive Group	---	Basic service	2017	11	$7.11	0.103	1.3%
			2016	11	$7.01	0.023	
		Expanded basic	2017	11	$7.10	0.104	1.3%
			2016	11	$7.01	0.023	
		Next most popular	2017	11	$7.11	0.103	1.3%
			2016	11	$7.01	0.023	
Effective Competition Group	---	Basic service	2017	461	$9.18	0.125	1.6%
			2016	447	$9.04	0.125	
		Expanded basic	2017	468	$9.31	0.116	1.6%
			2016	456	$9.17	0.114	
		Next most popular	2017	471	$9.39	0.112	1.8%
			2016	463	$9.22	0.111	
	Overbuilt Communities incumbents	Basic service	2017	45	$9.63	0.128	5.7%*
			2016	44	$9.10	0.109	
		Expanded basic	2017	45	$9.63	0.128	5.9%*
			2016	45	$9.09	0.107	
		Next most popular	2017	46	$9.67	0.134	5.7%*
			2016	46	$9.15	0.119	
	Overbuilt Communities rivals	Basic service	2017	53	$10.33	0.372	-0.1%
			2016	52	$10.33	0.378	
		Expanded basic	2017	53	$10.95	0.207	-0.1%
			2016	52	$10.96	0.210	
		Next most popular	2017	55	$10.92	0.204	0.0%
			2016	54	$10.92	0.207	
	Small Systems	Basic service	2017	116	$8.78	0.427	1.5%
			2016	114	$8.65	0.394	
		Expanded basic	2017	122	$8.83	0.406	1.5%
			2016	120	$8.70	0.375	
		Next most popular	2017	125	$9.21	0.369	2.6%
			2016	126	$8.98	0.340	
	Midsize Systems	Basic service	2017	110	$8.51	0.296	0.8%
			2016	109	$8.44	0.276	
		Expanded basic	2017	111	$8.69	0.288	0.8%
			2016	110	$8.62	0.268	
		Next most popular	2017	111	$8.88	0.263	1.4%
			2016	111	$8.76	0.247	
	Large Systems	Basic service	2017	137	$9.36	0.187	0.9%
			2016	128	$9.27	0.198	
		Expanded basic	2017	137	$9.46	0.166	0.9%
			2016	129	$9.38	0.175	
		Next most popular	2017	134	$9.45	0.170	0.9%
			2016	126	$9.37	0.179	

Source: 2017 survey. * Indicates the annual change is statistically significant at the 95% confidence level. Equipment refers to a set-top converter box or other digital gateway. The average equipment lease fees reported are the average fees for operators who priced cable service and equipment separately Because features vary, differences in price may reflect quality differences.

Attachment 14
Differences between Subgroups: Average Equipment Lease Fee
January 1, 2017

Service	Subgroup 1	Lease Fee 1	Subgroup 2	Lease Fee 2	Is Difference Statistically Significant?
Basic	Large Systems	$9.36	Midsize	$8.51	Yes
			Small	$8.78	No
			Incumbent	$9.63	No
			Rival	$10.33	Yes
			Noncompetitive	$7.11	Yes
	Midsize Systems	$8.51	Small	$8.78	No
			Incumbent	$9.63	Yes
			Rival	$10.33	Yes
			Noncompetitive	$7.11	Yes
	Small Systems	$8.78	Incumbent	$9.63	No
			Rival	$10.33	Yes
			Noncompetitive	$7.11	Yes
	Incumbent	$9.63	Rival	$10.33	No
			Noncompetitive	$7.11	Yes
	Rival	$10.33	Noncompetitive	$7.11	Yes
Expanded Basic	Large Systems	$9.46	Midsize	$8.69	Yes
			Small	$8.83	No
			Incumbent	$9.63	No
			Rival	$10.95	Yes
			Noncompetitive	$7.10	Yes
	Midsize Systems	$8.69	Small	$8.83	No
			Incumbent	$9.63	Yes
			Rival	$10.95	Yes
			Noncompetitive	$7.10	Yes
	Small Systems	$8.83	Incumbent	$9.63	No
			Rival	$10.95	Yes
			Noncompetitive	$7.10	Yes
	Incumbent	$9.63	Rival	$10.95	Yes
			Noncompetitive	$7.10	Yes
	Rival	$10.95	Noncompetitive	$7.10	Yes
Next Most Popular	Large Systems	$9.45	Midsize	$8.88	No
			Small	$9.21	No
			Incumbent	$9.67	No
			Rival	$10.92	Yes
			Noncompetitive	$7.11	Yes
	Midsize Systems	$8.88	Small	$9.21	No
			Incumbent	$9.67	Yes
			Rival	$10.92	Yes
			Noncompetitive	$7.11	Yes
	Small Systems	$9.21	Incumbent	$9.67	No
			Rival	$10.92	Yes
			Noncompetitive	$7.11	Yes
	Incumbent	$9.67	Rival	$10.92	Yes
			Noncompetitive	$7.11	Yes
	Rival	$10.92	Noncompetitive	$7.11	Yes

Source: 2017 survey.

Attachment 15 **Differences between System Size Groups: Retransmission Consent** 2016				
Size Group 1	Fees per Subscriber 1	Size Group 2	Fees per Subscriber 2	Is Difference Statistically Significant?
Small Systems	$93.37	Midsize Systems Large Systems	$71.22 $70.88	Yes Yes
Midsize Systems	$71.22	Large Systems	$70.88	No
Size Group 1	Number of Stations 1	Size Group 2	Number of Stations 2	Is Difference Statistically Significant?
Small Systems	7.56	Midsize Systems Large Systems	11.06 11.99	Yes Yes
Midsize Systems	11.06	Large Systems	11.99	Yes
Size Group 1	Fees per Subscriber per Station 1	Size Group 2	Fees per Subscriber per Station 2	Is Difference Statistically Significant?
Small Systems	$1.20	Midsize Systems Large Systems	$0.64 $0.55	Yes Yes
Midsize Systems	$0.64	Large Systems	$0.55	Yes

Attachment 16
Comparison of Cable to DBS Averages
Price, Channels, and Price per Channel
January 2017

Statistic	Cable Expanded Basic Service	DBS DIRECTV Choice Service	DBS DISH Network America's Top 120 Plus
Mean price of programming	$75.21	$78.99	$74.99
Number of sample observations	746	40	40
Standard error of the mean	0.261	0.000	0.000
Independent samples t-statistic	---	14.483 *	-0.843
Mean number of video channels	195.1	238.9	182.2
Number of sample observations	746	40	40
Standard error of the mean	2.494	1.495	1.372
Independent samples t-statistic	---	15.989 *	-4.836 *
Mean price per channel	0.49	0.331	0.413
Number of sample observations	746	40	40
Standard error of the mean	0.008	0.002	0.003
Independent samples t-statistic	---	-72.632 *	-24.859 *
Mean no. of broadcast channels	37.2	19.7	21.0
Number of sample observations	746	40	40
Standard error of the mean		1.464	1.342
Mean number of other channels	157.9	219.2	161.2
Number of sample observations	746	40	40
Standard error of the mean		0.084	0.084

* The difference in the cable and DBS means is statistically significant at the 95-percent confidence level.

Notes: This table is discussed in Section I(A) of the Report. Data in the column "Cable Expanded Basic Service" are from Attachments 2, 6 and 9, and Tables 5 and 6 of the Report. The DIRECTV data are from DIRECTV Group Holdings LLC (DIRECTV). http://www.directv.com. The DISH data are from DISH NETWORK Corporation (DISH). http://www.dish.com. DIRECTV and DISH prices became effective, respectively on Jan. 22, 1017 and Jan. 16, 2017.

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APPENDIX B-1.1
Survey Methodology

A. Sampling Procedure

1. We conducted the 2017 survey to fulfill the reporting requirements of the Cable Act.[1] We selected communities nationwide at random to be part of the survey sample.[2] In choosing our sample, we divided the communities into two groups: an effective competition group and a noncompetitive group.[3] We divided the effective competition group into strata or subgroups and selected a sample of communities from each stratum. The noncompetitive group was not divided into subgroups; instead, the sample was selected from the full noncompetitive group. For each community, we asked the operator to complete a survey questionnaire on the prices charged for video programming service offerings as well as other aspects of the operator's system. We used the information collected to estimate and compare mean prices, and other statistics, across the different strata of communities.

2. The survey divided the effective competition group into strata to compare subgroups of communities and to achieve desirable levels of statistical precision. We stratified the effective competition communities into five strata. Two of the strata consisted of operators in cable overbuild locales – locations where an effective competition finding was made on the basis of the presence of a second "rival" cable operator. The first stratum consisted of incumbent operators and the second consisted of the rival cable operators in these overbuild areas. Cable operators in the incumbent stratum have sometimes cited municipals as rivals. Municipals cited as such are included in this rival stratum and a number are included in our survey. Other municipals, in communities where the Commission did not make a finding, are in the effective competition group, generally within the small system stratum, discussed below, and are also in our sample. Some incumbents in overbuild areas cited AT&T U-verse as a rival service; however the survey did not collect prices of U-verse, because these systems are not registered cable operators with the Commission. The Commission, however, considers U-verse as a competing service for assessing effective competition.

3. Because there is a positive correlation between system size and price, the remaining effective competition communities were stratified according to the size of the cable system. Doing so creates strata in which prices are less disparate than in the full group and tends to increase the efficiency of sampling through reducing sampling variance.[4] We define small systems as cable systems serving 10,000 or fewer subscribers, midsize systems as cable systems serving between 10,000 and 75,000 subscribers, and large systems as cable systems serving more than 75,000 subscribers.

4. We determined that 750 observations of communities, divided between the two sampling groups, were required for statistical precision. To determine the number to allocate to each group, we used a standard sampling size formula calibrated to yield sample price means within one percent of the

[1] *See supra* note 1, Section I.

[2] The Commission assigns a unique community unit identifier (CUID) code to each registered cable operator for each community the operator serves; *i.e.*, even if two unaffiliated cable operators serve an overlapping area, the Commission assigns two CUIDs. 47 CFR § 76.1801

[3] *See supra* Section II, Part A for a description of the recent change in the effective competition process.

[4] *See e.g.*, W. G. Cochran, *Sampling Techniques,* 2nd ed. (1977) at 87-107; G. W. Snedecor and W. G. Cochran, *Statistical Methods* at 434-59, 7th ed. (1980).

actual price means at a 95 percent confidence level.[5] After determining the overall sample size for each group, we allocated the number of selections among the strata. Allocation methods generally emphasize two criteria. First, selections allocated to a stratum are higher relative to other strata in proportion to the population or other size measure; in our case, the number of cable subscribers. Second, more selections are allocated the higher the dispersion of price. The sampling size formula we employed accounted for these criteria. In addition, we adjusted each allocation by a non-response factor.[6] Attachment 1 reports sample sizes for all strata.

5. After allocating the number of sample selections using the process described above, we drew independent samples of communities from the strata,[7] using probability proportional to size (PPS) sampling without replacement.[8] A PPS design is efficient for our survey because there is a correlation between the number of subscribers in the community and our key survey study variable, price.[9] Using the PPS method of sampling, we assigned a selection probability to each community within individual strata in direct proportion to its relative number of subscribers. The greater the number of subscribers in a community, relative to others in the same stratum, the higher the likelihood of selection. PPS sampling requires sampling selection probability not exceed one (or 100 percent). Thus, we took the standard approach and sub-stratified communities whose probability exceeded one into one-unit strata with selection probability equal to one.[10]

6. The PPS sample design requires an estimate of the relative number of subscribers in each community. We estimated subscriber counts using 2016 county-level operator subscriber estimates and population estimates.[11] This is the first survey to use updated subscriber counts. In previous surveys, we

[5] The formula was from B. J. Mandel, S*tatistics for Management* (1984) at 258. *See also, e.g.*, C. A. Boneau, *Effects of Violations of Assumptions Underlying the t-Test*, Psychological Bulletin, 57 (1960) at 49-64.

[6] Because previous surveys suggest not all selections will respond to the survey questionnaire for various reasons -- e.g., the system no longer operates -- the non-response factor adjusts selections by the expected number of non-responses. Our non-response factor equals $[1+ [NR_h / (NR_h + R_h)]]$, where in stratum *h*, NR equals the number of non-responses and R equals responses to our survey.

[7] To prevent sampling bias, we draw the samples independently, including separate samples for incumbents and rivals in locations with a second cable operator; *i.e.*, selection of an incumbent did not require that the rival would be selected and *vice versa*.

[8] We generated the samples using the SurveySelect procedure, PPS Method without Replacement, SAS software, Version SAS/STAT 9.4, SAS Institute Inc., Cary, NC (2016).

[9] *See, e.g.*, F. Yates and P. M. Grundy, *Selection without Replacement from Within Strata with Probability Proportional to Size, Journal of the Royal Statistical Society*, 15 (1953) at 253-261; and B. K. Som, *Practical Sampling Techniques*, 2nd ed. (1996).

[10] We applied the following algorithm to sub-stratify each community (or unit) with selection probability greater than one. For a sampling stratum, where Z represents the total number of subscribers, z_i is the number of subscribers in unit (i); n is the sample size, $\pi_i = n\ (z_i / Z)$ is the selection probability of unit i; and k is the number of units for which the sampling probability exceeds one. We sub-stratify each unit for which the sampling probability exceeds one, which reduces the sample size in the stratum to n-k. This then requires recalculating sampling probability π_i for each of the remaining communities in the stratum. We repeat the process until there are no communities left in the stratum with a sampling probability greater than one.

[11] Estimates of operator subscribers at the county level come from S&P Global, MediaCensus, *Operator Subscribers by Geography* (accessed November 15, 2016). The estimates refer to the second and third quarters of 2016. Population estimates come from Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2015, U.S. Census Bureau, Population Division, May 2016 (accessed March 16, 2018).

used the FCC's 1994 census of cable communities, the first and only such census. Using more recent subscriber counts improves the quality of the Report because our sample and the resulting estimates better reflect current cable subscribership.

B. Data Quality Control

7. To improve the quality of the survey data and reduce the burden on operators, the survey questionnaire is web-based.[12] After the samples were drawn, we notified operators serving the selected communities and instructed them to complete the survey questionnaire on the Commission's website. We took steps to ensure the reliability and accuracy of the data collected. Computer checks notified respondents in real time of inconsistent responses. In addition, we asked a responsible party within each company to certify the completeness and accuracy of the company's responses. The survey response rate (ratio of completed to requested questionnaires) was 99.5 percent or 746 of the 750 communities in the sample. The four non-responses were cable operators that had either ceased operating in that community or had yet to commence operation.

8. We systematically examined all survey responses using algorithms designed to identify potentially inaccurate responses. When a particular response was deemed unreasonable or was inconsistent with responses to other questions, we contacted the operator and asked him to verify the answer or make a correction. The percentage of survey responses that require follow-up inquiries varies over time based on such factors as the familiarity of the respondents with the survey, the complexity of the questions, and introduction of new questions to the survey instrument. For the 2017 survey, we contacted approximately 10 percent of parent operators with follow-up inquiries via email or telephone calls. Each operator replied with a correction or explanation of the particular response. In the case of missing data, some operators provided these data and others explained that they did not collect that particular information or were not serving the community at the time.

C. Estimation of Means

9. The report presents the average (mean) levels of the survey data by cable service level for the full sample, sample groups, and subgroups of cable operators. The report tables summarize these findings and the attachments to the report display detailed statistics. After we collected and checked the responses, we estimated the population means and variances from the sample data. We estimated the means and variances of cable prices and the other variables on a subscriber basis rather than a cable community basis. We choose this level of analysis because we are interested in understanding the price paid by the average subscriber rather than the price charged in the average community. The two methods of analysis yield different results when there is a correlation between the size of a community (number of subscribers) and the level of price. To produce per-subscriber means, we use the Horvitz-Thompson ratio estimator.[13] This estimator weights the price in each of the sampled communities by its number of

[12] In our web-based questionnaire we include features that ease the respondent's filing burden. For example, the questionnaire pre-fills some survey questions based on information already on file with the Commission and asks the respondent to verify the information.

[13] The Horvitz-Thompson ratio estimator is a well-known, unbiased method of estimation applicable to probability sampling. *See* D. G. Horvitz and D. J. Thompson, *A Generalization of Sampling without Replacement from a Finite Universe*, Journal of the American Statistical Association, 47 (1952) at 663-685; W. S. Overton and S. V. Stehman, *The Horvitz-Thompson Theorem as a Unifying Perspective for Probability Sampling: With Examples from Natural Resource Sampling*, The American Statistician, 49(3) (1995); and Cochran (1977) at 259. We began using the Horvitz-Thompson ratio estimator with the 2009 Report. Prior to the 2009 Report, we applied the unweighted mean in each stratum.

subscribers. The numerator of the ratio sums the weighted product of price and subscriber count across communities in the sample and is equivalent to total revenues from purchases of the cable service. The denominator of the ratio sums weighted subscriber counts across communities in the sample. The result is an estimate of service revenue per subscriber. For any price (X), the mean price (service revenue per subscriber) equals

$$\frac{\sum_{i=1}^{N} \frac{1}{\pi_i} X_i \cdot Sub_i}{\sum_{1=1}^{N} \frac{1}{\pi_i} Sub_i},$$

where X_i is the price within an individual community i, Sub_i is the number of subscribers in community i, and π_i is the size weighted probability of community i.[14]

D. Historical Price Series

10. Attachment 7 reports average prices and channel counts for all annual survey reports to date. For example, the 2016 averages in Attachment 7 are from the 2016 survey, and the 2017 averages are from the 2017 survey. Note that 2016 averages in the other attachments of this report are from the 2017 survey (each year we collect two years of data) and may not match the 2016 numbers shown in Attachment 7 due to random variance between the 2016 and 2017 survey samples. With some exceptions, averages in Attachment 7 come from each year's survey report for the full sample. Indices reflect the year to year percentage changes in these averages.

11. The exceptions to the rule above are described here. The 1995-2000 prices and 2000-2001 channels are for the noncompetitive sample group of operators. The 1995 price of expanded basic programming is the price of programming and equipment less an estimate of the equipment portion. In 2003, the survey changed from a July to a January collection date. To account for the change, the 2003 index values reflect the changes in the January 2002 to January 2003 averages reported in the 2003 survey. In 2010, we began collecting data on a more expansive set of channels. To account for this change, the 2010 channel and price per channel index values reflect the changes in the 2009 to 2010 averages reported in the 2010 survey.

E. Survey Accuracy

12. Because the basis of our survey is a sample of communities rather than a 100 percent census, the average prices in this Report are subject to sampling variance. Expanding the survey to include all communities might increase accuracy, but would also increase the cost and burden of collecting the information. The attachments to the Report include estimates of sampling variance or statistical standard error for each average price. Standard errors express the degree of confidence that the true mean falls within a range around a sample mean. Most commonly, standard errors indicate whether price differences are statistically significant (meaning statistically different from zero) at a given confidence level. The discussion above refers to within-sample variance. To prevent random variance that may occur across samples when measuring annual percentage change, the survey collected two years

[14] We conducted the data analysis using Stata Software, StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.

of data rather than comparing estimates from two different surveys. The exception is the historical time series table, which reports means collected for that particular survey year.

In addition to the sampling variance discussed above, changes in the composition of sample subgroups affect the estimated means.[15] The composition of communities making up the strata changes every year due to operators starting, ceasing, merging, and transferring operations. Composition of the strata changes further as a result of findings of effective competition. Many communities that had been part of the noncompetitive group in the 2016 survey were in the effective competition group in the 2017 survey because of a change in the effective competition process.[16] Finally, the change in underlying sampling weights this year also led to a change in the sample composition.

[15] *See, e.g.*, D. Holt and C. J. Skinner, *Components of Change in Repeated Surveys*, International Statistical Review, 57 (1989) at 1-18.

[16] *See* Section II, part A.

C. Fixed Communications Market Appendices

APPENDIX C-1

Percentage of State Population with Zero, One, Two, or More Than Two Provider Options for 10 Mbps/1 Mbps Fixed Terrestrial Services (December 31, 2017)

	Zero	One	Two	More Than Two
United States	2.7%	14.5%	39.6%	43.1%
Alaska	14.9%	21.8%	52.5%	10.9%
Alabama	7.6%	30.4%	39.4%	22.5%
Arkansas	11.0%	32.5%	44.4%	12.2%
Arizona	3.4%	8.5%	18.5%	69.7%
California	1.6%	14.2%	49.3%	34.8%
Colorado	2.4%	8.9%	20.4%	68.3%
Connecticut	0.0%	0.3%	11.5%	88.2%
District of Columbia	0.0%	1.6%	2.5%	95.9%
Delaware	2.0%	18.3%	68.8%	10.9%
Florida	2.5%	14.8%	53.4%	29.2%
Georgia	4.8%	24.4%	60.0%	10.7%
Hawaii	3.0%	18.4%	75.8%	2.9%
Iowa	3.3%	17.1%	36.9%	42.7%
Idaho	2.2%	8.7%	17.8%	71.3%
Illinois	1.9%	12.3%	43.4%	42.5%
Indiana	3.8%	15.0%	45.0%	36.2%
Kansas	2.0%	13.1%	22.6%	62.3%
Kentucky	2.8%	26.6%	54.3%	16.3%
Louisiana	6.3%	31.5%	37.9%	24.3%
Massachusetts	1.6%	15.9%	59.9%	22.6%
Maryland	0.0%	2.1%	10.2%	87.7%
Maine	1.7%	17.8%	57.9%	22.6%
Michigan	3.9%	22.0%	45.7%	28.4%
Minnesota	2.3%	13.7%	63.4%	20.6%
Missouri	4.7%	14.5%	18.5%	62.3%
Mississippi	11.9%	27.5%	28.4%	32.2%
Montana	5.3%	22.5%	30.1%	42.1%
North Carolina	2.5%	22.9%	63.6%	11.0%
North Dakota	5.2%	42.5%	32.0%	20.3%
Nebraska	2.6%	11.0%	16.5%	69.9%
New Hampshire	1.4%	12.5%	82.8%	3.3%
New Jersey	0.0%	0.8%	15.8%	83.4%
New Mexico	5.6%	13.2%	20.9%	60.4%
Nevada	4.1%	14.0%	59.6%	22.2%

	Zero	One	Two	More Than Two
New York	0.0%	1.1%	11.7%	87.3%
Ohio	1.9%	19.4%	52.9%	25.8%
Oklahoma	11.2%	33.8%	40.0%	15.0%
Oregon	3.5%	11.3%	52.9%	32.2%
Pennsylvania	0.0%	2.7%	18.3%	79.0%
Rhode Island	0.0%	1.5%	6.7%	91.8%
South Carolina	5.1%	34.5%	48.6%	11.8%
South Dakota	4.7%	31.8%	27.4%	36.1%
Tennessee	4.1%	19.7%	49.8%	26.4%
Texas	3.5%	15.0%	39.6%	41.9%
Utah	2.6%	7.2%	17.4%	72.8%
Virginia	0.0%	5.0%	17.7%	77.3%
Vermont	2.4%	20.0%	63.9%	13.7%
Washington	1.7%	8.7%	44.5%	45.1%
Wisconsin	3.7%	19.4%	45.0%	31.9%
West Virginia	5.5%	19.3%	49.6%	25.6%
Wyoming	8.2%	20.1%	25.8%	45.9%

APPENDIX C-2

Percentage of Population with Zero, One, Two, or More Than Two Provider Options for 25 Mbps/3 Mbps Fixed Terrestrial Services by State (December 31, 2017)

	Zero	One	Two	More Than Two
United States	6.0%	23.7%	42.4%	28.0%
Alaska	19.5%	40.3%	35.4%	4.7%
Alabama	13.9%	32.5%	40.2%	13.5%
Arkansas	22.6%	38.3%	35.6%	3.5%
Arizona	13.1%	29.5%	55.5%	1.9%
California	3.0%	22.4%	49.8%	24.8%
Colorado	7.1%	20.5%	25.5%	46.9%
Connecticut	0.0%	0.9%	93.2%	5.9%
District of Columbia	0.0%	1.9%	11.9%	86.1%
Delaware	2.4%	33.8%	56.5%	7.3%
Florida	3.8%	20.4%	50.8%	25.0%
Georgia	7.5%	26.0%	57.1%	9.3%
Hawaii	3.9%	46.5%	47.9%	1.7%
Iowa	9.3%	39.0%	40.2%	11.4%
Idaho	14.7%	31.7%	44.8%	8.8%
Illinois	5.3%	24.3%	40.4%	30.0%
Indiana	10.1%	26.4%	50.7%	12.8%
Kansas	8.8%	30.3%	22.1%	38.7%
Kentucky	9.1%	42.5%	46.0%	2.5%
Louisiana	12.4%	40.0%	35.8%	11.7%
Massachusetts	2.1%	39.1%	45.2%	13.6%
Maryland	0.0%	2.4%	17.9%	79.7%
Maine	6.7%	76.0%	16.9%	0.5%
Michigan	8.0%	30.8%	39.9%	21.3%
Minnesota	5.2%	28.3%	54.6%	11.9%
Missouri	11.3%	26.5%	37.7%	24.4%
Mississippi	20.4%	26.3%	33.4%	19.9%
Montana	13.9%	31.6%	37.7%	16.8%
North Carolina	5.2%	36.9%	51.5%	6.4%
North Dakota	6.9%	52.6%	27.4%	13.1%
Nebraska	12.7%	42.1%	41.1%	4.1%
New Hampshire	5.3%	64.1%	30.3%	0.3%
New Jersey	0.0%	0.9%	29.0%	70.1%
New Mexico	16.6%	22.4%	22.6%	38.4%

	Zero	One	Two	More Than Two
Nevada	7.3%	37.2%	54.8%	0.7%
New York	0.0%	1.6%	27.2%	71.2%
Ohio	5.3%	36.3%	42.9%	15.5%
Oklahoma	21.0%	37.6%	33.0%	8.3%
Oregon	7.6%	25.1%	54.9%	12.4%
Pennsylvania	0.0%	4.7%	37.1%	58.2%
Rhode Island	0.0%	1.7%	9.9%	88.4%
South Carolina	10.1%	37.5%	44.4%	8.0%
South Dakota	11.1%	39.5%	36.7%	12.6%
Tennessee	8.7%	26.2%	51.2%	13.8%
Texas	7.3%	22.3%	40.3%	30.1%
Utah	5.8%	24.1%	37.5%	32.6%
Virginia	0.0%	8.3%	37.0%	54.7%
Vermont	10.7%	59.5%	28.2%	1.6%
Washington	2.7%	17.2%	44.5%	35.6%
Wisconsin	8.7%	28.2%	40.0%	23.1%
West Virginia	15.4%	59.5%	23.0%	2.2%
Wyoming	18.7%	31.5%	30.2%	19.6%

APPENDIX C-3

Percentage of Population with Zero, One, Two, or More Than Two Provider Options for 50 Mbps/ 5 Mbps Fixed Terrestrial Services by State (December 31, 2017)

	Zero	One	Two	More Than Two
United States	7.7%	27.5%	43.8%	20.9%
Alaska	23.8%	65.0%	11.2%	0.0%
Alabama	14.9%	35.8%	37.1%	12.3%
Arkansas	30.3%	38.2%	29.4%	2.1%
Arizona	13.6%	31.3%	53.6%	1.5%
California	5.3%	26.6%	57.0%	11.1%
Colorado	8.0%	21.1%	25.1%	45.8%
Connecticut	0.0%	0.9%	93.2%	5.9%
District of Columbia	0.0%	1.9%	11.9%	86.1%
Delaware	2.6%	38.0%	54.1%	5.2%
Florida	4.0%	21.6%	50.3%	24.1%
Georgia	9.0%	27.7%	54.8%	8.5%
Hawaii	3.9%	46.5%	48.6%	1.0%
Iowa	11.9%	46.2%	36.8%	5.2%
Idaho	17.7%	40.5%	38.7%	3.1%
Illinois	6.7%	31.1%	47.4%	14.9%
Indiana	12.8%	33.9%	47.3%	6.0%
Kansas	14.7%	36.5%	24.2%	24.6%
Kentucky	11.1%	45.6%	41.2%	2.1%
Louisiana	12.8%	41.9%	34.4%	11.0%
Massachusetts	2.1%	39.3%	45.1%	13.6%
Maryland	0.0%	3.3%	31.8%	64.9%
Maine	9.3%	78.5%	12.0%	0.2%
Michigan	9.4%	33.7%	38.8%	18.1%
Minnesota	6.7%	32.6%	52.5%	8.2%
Missouri	13.1%	28.7%	35.8%	22.3%
Mississippi	22.8%	29.4%	32.3%	15.5%
Montana	27.5%	55.2%	15.4%	2.0%
North Carolina	6.0%	41.4%	48.1%	4.5%
North Dakota	8.3%	53.6%	26.0%	12.1%
Nebraska	15.1%	41.1%	40.0%	3.8%
New Hampshire	5.5%	65.2%	29.1%	0.3%
New Jersey	0.0%	0.9%	29.1%	70.0%
New Mexico	18.9%	23.8%	27.5%	29.8%

	Zero	One	Two	More Than Two
Nevada	8.5%	40.8%	50.0%	0.6%
New York	0.0%	1.7%	30.2%	68.1%
Ohio	6.6%	42.9%	37.9%	12.6%
Oklahoma	25.6%	42.7%	31.1%	0.6%
Oregon	10.2%	31.8%	54.8%	3.2%
Pennsylvania	0.0%	5.6%	37.8%	56.6%
Rhode Island	0.0%	1.7%	9.9%	88.4%
South Carolina	11.9%	39.2%	41.6%	7.3%
South Dakota	14.3%	41.6%	36.1%	8.0%
Tennessee	10.4%	31.1%	49.4%	9.1%
Texas	12.0%	30.0%	49.0%	9.1%
Utah	7.0%	25.0%	36.8%	31.2%
Virginia	0.0%	9.8%	38.7%	51.4%
Vermont	12.4%	62.7%	23.6%	1.2%
Washington	6.4%	30.9%	51.9%	10.9%
Wisconsin	13.7%	39.1%	46.5%	0.8%
West Virginia	23.6%	68.4%	7.8%	0.2%
Wyoming	23.1%	38.0%	26.6%	12.3%

APPENDIX C-4

Percentage of Population with Zero, One, Two, or More Than Two Provider Options for 100 Mbps/10 Mbps Fixed Terrestrial Services by State (December 31, 2017)

	Zero	One	Two	More Than Two
United States	10.7%	34.7%	36.7%	17.8%
Alaska	24.6%	69.9%	5.4%	0.0%
Alabama	20.1%	45.0%	27.5%	7.4%
Arkansas	44.6%	36.6%	17.8%	1.0%
Arizona	15.5%	43.2%	40.1%	1.1%
California	7.3%	38.1%	46.6%	7.9%
Colorado	11.4%	25.0%	31.0%	32.6%
Connecticut	0.0%	0.9%	93.2%	5.9%
District of Columbia	0.0%	1.9%	11.9%	86.1%
Delaware	2.6%	38.0%	54.1%	5.2%
Florida	5.0%	28.6%	47.6%	18.9%
Georgia	14.6%	35.3%	44.8%	5.3%
Hawaii	3.9%	46.8%	48.6%	0.6%
Iowa	18.2%	52.1%	26.5%	3.2%
Idaho	21.0%	51.1%	27.8%	0.1%
Illinois	7.5%	45.0%	38.7%	8.8%
Indiana	14.1%	45.4%	36.9%	3.6%
Kansas	18.6%	40.6%	17.6%	23.2%
Kentucky	17.0%	56.8%	25.5%	0.7%
Louisiana	23.8%	48.4%	25.9%	2.0%
Massachusetts	3.0%	42.8%	44.2%	10.0%
Maryland	0.0%	3.3%	31.8%	64.8%
Maine	11.3%	84.3%	4.2%	0.1%
Michigan	15.5%	42.1%	29.9%	12.6%
Minnesota	8.5%	40.6%	44.5%	6.4%
Missouri	15.2%	35.9%	31.2%	17.7%
Mississippi	31.0%	33.9%	25.6%	9.5%
Montana	35.9%	52.7%	10.3%	1.1%
North Carolina	10.0%	53.3%	33.8%	2.9%
North Dakota	9.6%	54.5%	27.1%	8.8%
Nebraska	22.0%	48.6%	26.6%	2.8%
New Hampshire	5.9%	65.6%	28.3%	0.3%
New Jersey	0.0%	0.9%	29.4%	69.7%
New Mexico	23.3%	44.7%	30.1%	1.9%

	Zero	One	Two	More Than Two
Nevada	22.6%	55.7%	21.6%	0.1%
New York	0.0%	1.9%	30.5%	67.6%
Ohio	8.2%	53.7%	29.6%	8.5%
Oklahoma	31.2%	49.2%	19.5%	0.2%
Oregon	11.7%	35.4%	50.5%	2.3%
Pennsylvania	0.0%	6.8%	40.0%	53.2%
Rhode Island	0.0%	1.7%	9.9%	88.4%
South Carolina	30.7%	42.8%	21.5%	5.0%
South Dakota	18.2%	41.0%	34.9%	5.9%
Tennessee	12.3%	41.5%	39.7%	6.5%
Texas	15.3%	38.9%	39.2%	6.6%
Utah	8.0%	33.1%	32.7%	26.1%
Virginia	0.0%	10.7%	39.2%	50.1%
Vermont	16.8%	64.8%	18.3%	0.2%
Washington	7.2%	37.0%	46.3%	9.5%
Wisconsin	22.2%	54.7%	23.0%	0.1%
West Virginia	28.0%	65.5%	6.4%	0.1%
Wyoming	38.7%	35.7%	16.9%	8.6%

APPENDIX C-5

Percentage of Population with Zero, One, Two, or More Than Two Provider Options for 250 Mbps/25 Mbps Fixed Terrestrial Services by State (December 31, 2017)

	Zero	One	Two	More Than Two
United States	37.0%	38.1%	15.4%	9.5%
Alaska	27.5%	68.2%	4.3%	0.0%
Alabama	57.7%	34.2%	5.2%	2.9%
Arkansas	55.4%	39.3%	4.9%	0.4%
Arizona	22.2%	73.1%	4.6%	0.1%
California	53.9%	39.9%	5.8%	0.4%
Colorado	23.0%	63.5%	12.9%	0.6%
Connecticut	0.0%	61.5%	38.1%	0.5%
District of Columbia	0.0%	2.2%	46.6%	51.2%
Delaware	4.1%	51.2%	44.3%	0.3%
Florida	55.7%	33.9%	9.9%	0.5%
Georgia	30.8%	44.0%	24.4%	0.7%
Hawaii	28.7%	24.7%	46.7%	0.0%
Iowa	22.8%	63.8%	12.4%	1.0%
Idaho	34.1%	61.2%	4.7%	0.0%
Illinois	15.1%	65.7%	18.3%	0.9%
Indiana	30.9%	57.1%	11.6%	0.5%
Kansas	28.5%	46.8%	16.0%	8.7%
Kentucky	69.5%	23.5%	6.9%	0.1%
Louisiana	44.0%	46.2%	9.5%	0.3%
Massachusetts	22.1%	50.1%	27.3%	0.6%
Maryland	0.0%	11.3%	45.3%	43.5%
Maine	91.7%	7.4%	0.8%	0.0%
Michigan	67.5%	29.4%	3.1%	0.1%
Minnesota	24.6%	56.9%	17.3%	1.2%
Missouri	52.5%	25.8%	19.1%	2.6%
Mississippi	48.0%	43.3%	8.5%	0.2%
Montana	92.5%	7.5%	0.0%	0.0%
North Carolina	41.0%	40.5%	17.0%	1.5%
North Dakota	45.0%	52.3%	2.4%	0.3%
Nebraska	53.2%	38.1%	8.7%	0.0%
New Hampshire	33.5%	62.2%	4.3%	0.0%
New Jersey	0.0%	1.9%	39.2%	58.9%

	Zero	One	Two	More Than Two
New Mexico	36.9%	58.9%	4.2%	0.0%
Nevada	30.5%	55.5%	14.0%	0.0%
New York	0.0%	25.4%	19.9%	54.7%
Ohio	63.1%	25.9%	11.0%	0.1%
Oklahoma	40.4%	51.8%	7.8%	0.0%
Oregon	37.6%	46.5%	15.4%	0.5%
Pennsylvania	0.0%	29.3%	36.8%	33.9%
Rhode Island	0.0%	2.1%	27.2%	70.6%
South Carolina	75.2%	22.2%	2.4%	0.2%
South Dakota	85.5%	11.8%	2.6%	0.0%
Tennessee	49.1%	31.1%	18.1%	1.8%
Texas	46.5%	36.5%	14.1%	2.9%
Utah	18.9%	54.8%	13.7%	12.6%
Virginia	0.0%	21.7%	33.6%	44.7%
Vermont	81.3%	18.7%	0.1%	0.0%
Washington	23.0%	63.0%	13.7%	0.3%
Wisconsin	88.9%	10.9%	0.2%	0.0%
West Virginia	52.1%	43.3%	4.5%	0.1%
Wyoming	87.0%	12.7%	0.4%	0.0%

D. Broadband Deployment Appendices

APPENDIX D-1

Deployment (Millions) of Fixed 25 Mbps/3 Mbps; Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps; and Mobile LTE with a Median Speed of 10 Mbps/3 Mbps by State and District of Columbia (December 31, 2017)

	Pop. Evaluated	Fixed 25 Mbps/ 3 Mbps		Mobile LTE 5 Mbps /1 Mbps		Pop. Evaluated	Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.		Pop.	% of Pop.
United States	325.716	306.328	94.0%	325.117	99.8%	302.940	269.494	89.0%
Rural Areas	63.783	48.288	75.7%	63.204	99.1%	47.555	32.966	69.3%
Urban Areas	261.933	258.040	98.5%	261.912	100%	255.385	236.528	92.6%
Alabama	4.875	4.199	86.1%	4.871	99.9%	4.192	3.438	82.0%
Rural Areas	2.010	1.401	69.7%	2.006	99.8%	1.468	1.082	73.7%
Urban Areas	2.865	2.799	97.7%	2.865	100%	2.724	2.356	86.5%
Alaska	0.740	0.595	80.5%	0.661	89.4%	0.666	0.431	64.8%
Rural Areas	0.263	0.135	51.6%	0.196	74.5%	0.219	0.076	34.7%
Urban Areas	0.477	0.460	96.4%	0.465	97.6%	0.447	0.355	79.5%
Arizona	7.016	6.098	86.9%	6.991	99.6%	6.898	5.772	83.7%
Rural Areas	0.832	0.331	39.8%	0.808	97.1%	0.769	0.420	54.6%
Urban Areas	6.184	5.767	93.3%	6.183	100%	6.129	5.352	87.3%
Arkansas	3.004	2.324	77.4%	2.998	99.8%	2.262	1.508	66.7%
Rural Areas	1.331	0.745	55.9%	1.325	99.5%	0.799	0.464	58.1%
Urban Areas	1.673	1.580	94.4%	1.673	100%	1.463	1.044	71.3%
California	39.536	38.365	97.0%	39.510	99.9%	39.434	37.422	94.9%
Rural Areas	2.347	1.579	67.3%	2.320	98.9%	2.280	1.731	75.9%
Urban Areas	37.190	36.785	98.9%	37.190	100%	37.154	35.692	96.1%
Colorado	5.606	5.211	92.9%	5.597	99.8%	5.153	4.810	93.3%
Rural Areas	0.869	0.549	63.2%	0.859	98.9%	0.584	0.460	78.8%
Urban Areas	4.738	4.662	98.4%	4.738	100%	4.569	4.350	95.2%
Connecticut	3.588	3.588	100%	3.588	100%	3.588	3.588	100%
Rural Areas	0.433	0.433	100%	0.433	100%	0.433	0.433	100%
Urban Areas	3.155	3.155	100%	3.155	100%	3.155	3.155	100%
Delaware	0.962	0.939	97.6%	0.962	100%	0.962	0.737	76.6%
Rural Areas	0.170	0.160	93.8%	0.170	100%	0.170	0.076	44.8%
Urban Areas	0.792	0.780	98.5%	0.792	100%	0.792	0.660	83.4%
District of Columbia	0.694	0.694	100%	0.694	100%	0.694	0.694	100%
Florida	20.984	20.187	96.2%	20.980	100%	20.662	19.893	96.3%
Rural Areas	2.032	1.583	77.9%	2.028	99.8%	1.797	1.422	79.1%
Urban Areas	18.952	18.604	98.2%	18.952	100%	18.865	18.471	97.9%

	Pop. Evaluated	Fixed 25 Mbps/ 3 Mbps		Mobile LTE 5 Mbps /1 Mbps		Pop. Evaluated	Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.		Pop.	% of Pop.
Georgia	10.429	9.643	92.5%	10.425	100%	8.990	8.621	95.9%
Rural Areas	2.558	1.986	77.6%	2.554	99.8%	1.533	1.329	86.7%
Urban Areas	7.871	7.658	97.3%	7.871	100%	7.457	7.292	97.8%
Hawaii	1.428	1.372	96.1%	1.426	99.9%	1.427	1.426	99.9%
Rural Areas	0.132	0.094	71.5%	0.131	99.2%	0.132	0.131	99.2%
Urban Areas	1.296	1.278	98.6%	1.296	100%	1.296	1.296	100%
Idaho	1.717	1.465	85.3%	1.704	99.3%	1.389	0.818	58.9%
Rural Areas	0.531	0.311	58.6%	0.518	97.6%	0.322	0.140	43.5%
Urban Areas	1.186	1.154	97.3%	1.186	100%	1.067	0.678	63.6%
Illinois	12.802	12.119	94.7%	12.801	100%	12.019	11.589	96.4%
Rural Areas	1.473	0.900	61.1%	1.472	99.9%	0.972	0.817	84.1%
Urban Areas	11.329	11.219	99.0%	11.329	100%	11.048	10.772	97.5%
Indiana	6.666	5.993	89.9%	6.666	100%	5.962	5.453	91.5%
Rural Areas	1.841	1.242	67.4%	1.841	100%	1.338	1.058	79.1%
Urban Areas	4.826	4.752	98.5%	4.826	100%	4.624	4.395	95.0%
Iowa	3.145	2.851	90.7%	3.141	99.9%	2.124	1.692	79.7%
Rural Areas	1.136	0.880	77.5%	1.132	99.6%	0.444	0.329	74.3%
Urban Areas	2.009	1.971	98.1%	2.009	100%	1.681	1.363	81.1%
Kansas	2.913	2.655	91.2%	2.913	100%	2.292	2.241	97.8%
Rural Areas	0.756	0.543	71.9%	0.756	100%	0.344	0.328	95.3%
Urban Areas	2.157	2.112	97.9%	2.157	100%	1.948	1.913	98.2%
Kentucky	4.454	4.050	90.9%	4.399	98.8%	3.423	3.003	87.7%
Rural Areas	1.830	1.458	79.7%	1.775	97.0%	0.964	0.691	71.7%
Urban Areas	2.624	2.591	98.7%	2.624	100%	2.459	2.312	94.0%
Louisiana	4.684	4.104	87.6%	4.684	100%	4.247	3.471	81.7%
Rural Areas	1.256	0.795	63.3%	1.255	100%	0.942	0.649	68.9%
Urban Areas	3.428	3.309	96.5%	3.428	100%	3.304	2.821	85.4%
Maine	1.336	1.247	93.3%	1.316	98.5%	1.236	0.122	9.9%
Rural Areas	0.829	0.743	89.6%	0.809	97.6%	0.736	0.077	10.5%
Urban Areas	0.507	0.504	99.4%	0.507	100%	0.500	0.045	8.9%
Maryland	6.052	6.052	100%	6.052	100%	5.912	5.331	90.2%
Rural Areas	0.802	0.802	100%	0.802	100%	0.707	0.485	68.6%
Urban Areas	5.250	5.250	100%	5.250	100%	5.205	4.846	93.1%
Massachusetts	6.860	6.718	97.9%	6.859	100%	6.849	6.831	99.7%
Rural Areas	0.551	0.508	92.3%	0.550	99.9%	0.548	0.541	98.6%
Urban Areas	6.309	6.210	98.4%	6.309	100%	6.300	6.290	99.8%
Michigan	9.962	9.169	92.0%	9.956	99.9%	9.478	8.515	89.8%

	Pop. Evaluated	Fixed 25 Mbps/ 3 Mbps		Mobile LTE 5 Mbps /1 Mbps		Pop. Evaluated	Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.		Pop.	% of Pop.
Rural Areas	2.556	1.868	73.1%	2.550	99.8%	2.221	1.523	68.6%
Urban Areas	7.406	7.300	98.6%	7.406	100%	7.257	6.991	96.3%
Minnesota	5.576	5.288	94.8%	5.573	99.9%	4.905	4.803	97.9%
Rural Areas	1.485	1.242	83.7%	1.482	99.8%	1.016	0.959	94.4%
Urban Areas	4.092	4.046	98.9%	4.092	100%	3.889	3.843	98.8%
Mississippi	2.984	2.374	79.6%	2.981	99.9%	1.980	1.009	51.0%
Rural Areas	1.515	0.948	62.6%	1.511	99.8%	0.751	0.305	40.6%
Urban Areas	1.469	1.426	97.0%	1.469	100%	1.229	0.705	57.3%
Missouri	6.113	5.423	88.7%	6.103	99.8%	5.118	4.322	84.4%
Rural Areas	1.828	1.189	65.1%	1.818	99.5%	1.088	0.719	66.1%
Urban Areas	4.286	4.233	98.8%	4.286	100%	4.030	3.603	89.4%
Montana	1.050	0.905	86.1%	1.025	97.5%	0.698	0.563	80.7%
Rural Areas	0.480	0.349	72.6%	0.457	95.1%	0.248	0.168	67.9%
Urban Areas	0.570	0.556	97.5%	0.568	99.6%	0.450	0.395	87.8%
Nebraska	1.920	1.675	87.3%	1.918	99.9%	1.301	1.083	83.3%
Rural Areas	0.514	0.298	58.0%	0.512	99.6%	0.143	0.081	56.4%
Urban Areas	1.406	1.378	97.9%	1.406	100%	1.158	1.002	86.6%
Nevada	2.998	2.778	92.7%	2.990	99.7%	2.923	2.769	94.7%
Rural Areas	0.208	0.097	46.5%	0.200	96.3%	0.170	0.128	75.4%
Urban Areas	2.790	2.682	96.1%	2.790	100%	2.754	2.641	95.9%
New Hampshire	1.343	1.271	94.7%	1.341	99.9%	1.269	0.716	56.4%
Rural Areas	0.533	0.475	89.1%	0.532	99.8%	0.485	0.164	33.9%
Urban Areas	0.810	0.796	98.3%	0.810	100%	0.784	0.552	70.4%
New Jersey	9.005	9.005	100%	9.005	100%	9.005	9.005	100%
Rural Areas	0.466	0.466	100%	0.466	100%	0.466	0.466	100%
Urban Areas	8.539	8.539	100%	8.539	100%	8.539	8.539	100%
New Mexico	2.088	1.741	83.4%	2.078	99.5%	1.856	0.895	48.2%
Rural Areas	0.502	0.237	47.3%	0.492	98.0%	0.376	0.075	19.8%
Urban Areas	1.586	1.504	94.8%	1.586	100%	1.480	0.821	55.4%
New York	19.849	19.849	100%	19.836	99.9%	19.385	17.958	92.6%
Rural Areas	2.354	2.354	100%	2.341	99.4%	2.017	1.209	60.0%
Urban Areas	17.495	17.495	100%	17.495	100%	17.368	16.749	96.4%
North Carolina	10.273	9.736	94.8%	10.243	99.7%	9.569	7.376	77.1%
Rural Areas	3.416	2.896	84.8%	3.389	99.2%	2.828	1.592	56.3%
Urban Areas	6.857	6.841	99.8%	6.854	100%	6.741	5.783	85.8%
North Dakota	0.755	0.703	93.1%	0.753	99.7%	0.460	0.458	99.6%
Rural Areas	0.335	0.293	87.3%	0.333	99.4%	0.121	0.120	98.4%

	Pop. Evaluated	Fixed 25 Mbps/ 3 Mbps		Mobile LTE 5 Mbps /1 Mbps		Pop. Evaluated	Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.		Pop.	% of Pop.
Urban Areas	0.420	0.410	97.6%	0.420	100%	0.338	0.338	100%
Ohio	11.658	11.036	94.7%	11.648	99.9%	11.150	10.725	96.2%
Rural Areas	2.579	2.021	78.4%	2.569	99.6%	2.207	1.971	89.3%
Urban Areas	9.079	9.015	99.3%	9.079	100%	8.943	8.754	97.9%
Oklahoma	3.931	3.104	79.0%	3.925	99.9%	3.535	2.329	65.9%
Rural Areas	1.348	0.651	48.3%	1.343	99.6%	1.053	0.439	41.7%
Urban Areas	2.582	2.453	95.0%	2.582	100%	2.482	1.890	76.2%
Oregon	4.143	3.826	92.4%	4.126	99.6%	3.958	3.558	89.9%
Rural Areas	0.836	0.575	68.9%	0.818	97.9%	0.734	0.577	78.6%
Urban Areas	3.307	3.251	98.3%	3.307	100%	3.224	2.981	92.5%
Pennsylvania	12.805	12.805	100%	12.795	99.9%	12.204	11.622	95.2%
Rural Areas	2.731	2.731	100%	2.721	99.6%	2.307	1.965	85.2%
Urban Areas	10.074	10.074	100%	10.074	100%	9.898	9.657	97.6%
Rhode Island	1.060	1.060	100%	1.060	100%	1.060	1.060	100%
Rural Areas	0.098	0.098	100%	0.098	100%	0.098	0.098	100%
Urban Areas	0.962	0.962	100%	0.962	100%	0.962	0.962	100%
South Carolina	5.024	4.516	89.9%	5.024	100%	4.527	4.363	96.4%
Rural Areas	1.707	1.257	73.7%	1.706	100%	1.334	1.264	94.8%
Urban Areas	3.318	3.259	98.2%	3.318	100%	3.193	3.098	97.0%
South Dakota	0.869	0.773	88.9%	0.867	99.8%	0.391	0.389	99.5%
Rural Areas	0.388	0.295	76.1%	0.386	99.5%	0.092	0.090	97.7%
Urban Areas	0.481	0.477	99.2%	0.481	100%	0.299	0.299	100%
Tennessee	6.716	6.130	91.3%	6.698	99.7%	5.766	5.520	95.7%
Rural Areas	2.263	1.743	77.0%	2.245	99.2%	1.496	1.347	90.0%
Urban Areas	4.452	4.387	98.5%	4.452	100%	4.270	4.173	97.7%
Texas	28.304	26.232	92.7%	28.298	100%	27.198	21.161	77.8%
Rural Areas	4.659	3.209	68.9%	4.653	99.9%	3.966	2.214	55.8%
Urban Areas	23.645	23.023	97.4%	23.645	100%	23.231	18.947	81.6%
Utah	3.102	2.923	94.2%	3.093	99.7%	2.938	2.594	88.3%
Rural Areas	0.383	0.245	64.0%	0.374	97.8%	0.279	0.170	61.1%
Urban Areas	325.716	306.328	94.0%	325.117	99.8%	302.940	269.494	89.0%
Vermont	63.783	48.288	75.7%	63.204	99.1%	47.555	32.966	69.3%
Rural Areas	261.933	258.040	98.5%	261.912	100%	255.385	236.528	92.6%
Urban Areas	4.875	4.199	86.1%	4.871	99.9%	4.192	3.438	82.0%
Virginia	2.010	1.401	69.7%	2.006	99.8%	1.468	1.082	73.7%
Rural Areas	2.865	2.799	97.7%	2.865	100%	2.724	2.356	86.5%
Urban Areas	0.740	0.595	80.5%	0.661	89.4%	0.666	0.431	64.8%

	Pop. Evaluated	Fixed 25 Mbps/ 3 Mbps		Mobile LTE 5 Mbps /1 Mbps		Pop. Evaluated	Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.		Pop.	% of Pop.
Washington	0.263	0.135	51.6%	0.196	74.5%	0.219	0.076	34.7%
Rural Areas	0.477	0.460	96.4%	0.465	97.6%	0.447	0.355	79.5%
Urban Areas	7.016	6.098	86.9%	6.991	99.6%	6.898	5.772	83.7%
West Virginia	0.832	0.331	39.8%	0.808	97.1%	0.769	0.420	54.6%
Rural Areas	6.184	5.767	93.3%	6.183	100%	6.129	5.352	87.3%
Urban Areas	3.004	2.324	77.4%	2.998	99.8%	2.262	1.508	66.7%
Wisconsin	1.331	0.745	55.9%	1.325	99.5%	0.799	0.464	58.1%
Rural Areas	1.673	1.580	94.4%	1.673	100%	1.463	1.044	71.3%
Urban Areas	39.536	38.365	97.0%	39.510	99.9%	39.434	37.422	94.9%
Wyoming	2.347	1.579	67.3%	2.320	98.9%	2.280	1.731	75.9%
Rural Areas	37.190	36.785	98.9%	37.190	100%	37.154	35.692	96.1%
Urban Areas	5.606	5.211	92.9%	5.597	99.8%	5.153	4.810	93.3%

APPENDIX D-2

Deployment (Millions) of Fixed 25 Mbps/3 Mbps and Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps; and Fixed 25 Mbps/3 Mbps and Mobile LTE with a Median Speed of 10 Mbps/3 Mbps by State and District of Columbia (December 31 ,2017)

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
United States	325.716	306.054	94.0%	302.940	260.927	86.1%
Rural Areas	63.783	48.020	75.3%	47.555	27.185	57.2%
Urban Areas	261.933	258.034	98.5%	255.385	233.743	91.5%
Alabama	4.875	4.199	86.1%	4.192	3.193	76.2%
Rural Areas	2.010	1.400	69.7%	1.468	0.872	59.4%
Urban Areas	2.865	2.799	97.7%	2.724	2.321	85.2%
Alaska	0.740	0.590	79.8%	0.666	0.416	62.5%
Rural Areas	0.263	0.130	49.7%	0.219	0.062	28.1%
Urban Areas	0.477	0.459	96.3%	0.447	0.355	79.4%
Arizona	7.016	6.098	86.9%	6.898	5.240	76.0%
Rural Areas	0.832	0.331	39.8%	0.769	0.196	25.5%
Urban Areas	6.184	5.767	93.3%	6.129	5.044	82.3%
Arkansas	3.004	2.323	77.3%	2.262	1.372	60.6%
Rural Areas	1.331	0.744	55.9%	0.799	0.354	44.3%
Urban Areas	1.673	1.580	94.4%	1.463	1.018	69.6%
California	39.536	38.359	97.0%	39.434	36.491	92.5%
Rural Areas	2.347	1.574	67.1%	2.280	1.166	51.1%
Urban Areas	37.190	36.785	98.9%	37.154	35.326	95.1%
Colorado	5.606	5.209	92.9%	5.153	4.575	88.8%
Rural Areas	0.869	0.547	62.9%	0.584	0.284	48.6%
Urban Areas	4.738	4.662	98.4%	4.569	4.291	93.9%
Connecticut	3.588	3.588	100%	3.588	3.588	100%
Rural Areas	0.433	0.433	100%	0.433	0.433	100%
Urban Areas	3.155	3.155	100%	3.155	3.155	100%
Delaware	0.962	0.939	97.6%	0.962	0.721	74.9%
Rural Areas	0.170	0.160	93.8%	0.170	0.071	41.8%
Urban Areas	0.792	0.780	98.5%	0.792	0.650	82.0%
District of Columbia	0.694	0.694	100%	0.694	0.694	100%
Florida	20.984	20.186	96.2%	20.662	19.358	93.7%
Rural Areas	2.032	1.582	77.9%	1.797	1.200	66.8%
Urban Areas	18.952	18.604	98.2%	18.865	18.158	96.3%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
Georgia	10.429	9.640	92.4%	8.990	8.315	92.5%
Rural Areas	2.558	1.983	77.5%	1.533	1.181	77.0%
Urban Areas	7.871	7.658	97.3%	7.457	7.134	95.7%
Hawaii	1.428	1.372	96.1%	1.427	1.372	96.1%
Rural Areas	0.132	0.094	71.2%	0.132	0.094	71.2%
Urban Areas	1.296	1.278	98.6%	1.296	1.278	98.6%
Idaho	1.717	1.461	85.1%	1.389	0.747	53.8%
Rural Areas	0.531	0.307	57.9%	0.322	0.076	23.6%
Urban Areas	1.186	1.154	97.3%	1.067	0.671	62.9%
Illinois	12.802	12.119	94.7%	12.019	11.249	93.6%
Rural Areas	1.473	0.900	61.1%	0.972	0.568	58.5%
Urban Areas	11.329	11.219	99.0%	11.048	10.681	96.7%
Indiana	6.666	5.993	89.9%	5.962	5.075	85.1%
Rural Areas	1.841	1.242	67.4%	1.338	0.750	56.0%
Urban Areas	4.826	4.752	98.5%	4.624	4.326	93.5%
Iowa	3.145	2.849	90.6%	2.124	1.600	75.3%
Rural Areas	1.136	0.878	77.3%	0.444	0.265	59.6%
Urban Areas	2.009	1.971	98.1%	1.681	1.336	79.5%
Kansas	2.913	2.655	91.2%	2.292	2.138	93.3%
Rural Areas	0.756	0.543	71.9%	0.344	0.252	73.1%
Urban Areas	2.157	2.112	97.9%	1.948	1.886	96.8%
Kentucky	4.454	4.006	89.9%	3.423	2.869	83.8%
Rural Areas	1.830	1.415	77.4%	0.964	0.574	59.6%
Urban Areas	2.624	2.591	98.7%	2.459	2.294	93.3%
Louisiana	4.684	4.104	87.6%	4.247	3.259	76.7%
Rural Areas	1.256	0.795	63.3%	0.942	0.524	55.6%
Urban Areas	3.428	3.309	96.5%	3.304	2.736	82.8%
Maine	1.336	1.230	92.1%	1.236	0.121	9.8%
Rural Areas	0.829	0.726	87.6%	0.736	0.077	10.4%
Urban Areas	0.507	0.504	99.4%	0.500	0.044	8.8%
Maryland	6.052	6.052	100%	5.912	5.331	90.2%
Rural Areas	0.802	0.802	100%	0.707	0.485	68.6%
Urban Areas	5.250	5.250	100%	5.205	4.846	93.1%
Massachusetts	6.860	6.718	97.9%	6.849	6.691	97.7%
Rural Areas	0.551	0.508	92.3%	0.548	0.499	91.0%
Urban Areas	6.309	6.210	98.4%	6.300	6.192	98.3%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
Michigan	9.962	9.167	92.0%	9.478	8.106	85.5%
Rural Areas	2.556	1.867	73.0%	2.221	1.209	54.5%
Urban Areas	7.406	7.300	98.6%	7.257	6.897	95.0%
Minnesota	5.576	5.286	94.8%	4.905	4.603	93.8%
Rural Areas	1.485	1.241	83.6%	1.016	0.804	79.1%
Urban Areas	4.092	4.046	98.9%	3.889	3.799	97.7%
Mississippi	2.984	2.374	79.6%	1.980	0.919	46.4%
Rural Areas	1.515	0.948	62.6%	0.751	0.234	31.2%
Urban Areas	1.469	1.426	97.0%	1.229	0.685	55.7%
Missouri	6.113	5.419	88.6%	5.118	4.145	81.0%
Rural Areas	1.828	1.186	64.9%	1.088	0.558	51.3%
Urban Areas	4.286	4.233	98.8%	4.030	3.587	89.0%
Montana	1.050	0.893	85.0%	0.698	0.539	77.1%
Rural Areas	0.480	0.339	70.5%	0.248	0.144	57.9%
Urban Areas	0.570	0.554	97.2%	0.450	0.395	87.8%
Nebraska	1.920	1.675	87.2%	1.301	1.039	79.8%
Rural Areas	0.514	0.297	57.9%	0.143	0.053	36.9%
Urban Areas	1.406	1.378	97.9%	1.158	0.986	85.1%
Nevada	2.998	2.775	92.6%	2.923	2.598	88.9%
Rural Areas	0.208	0.093	44.9%	0.170	0.051	30.0%
Urban Areas	2.790	2.682	96.1%	2.754	2.547	92.5%
New Hampshire	1.343	1.270	94.6%	1.269	0.703	55.4%
Rural Areas	0.533	0.474	89.0%	0.485	0.158	32.6%
Urban Areas	0.810	0.796	98.3%	0.784	0.545	69.5%
New Jersey	9.005	9.005	100%	9.005	9.005	100%
Rural Areas	0.466	0.466	100%	0.466	0.466	100%
Urban Areas	8.539	8.539	100%	8.539	8.539	100%
New Mexico	2.088	1.740	83.3%	1.856	0.860	46.3%
Rural Areas	0.502	0.236	47.1%	0.376	0.049	13.1%
Urban Areas	1.586	1.504	94.8%	1.480	0.811	54.8%
New York	19.849	19.836	99.9%	19.385	17.958	92.6%
Rural Areas	2.354	2.341	99.4%	2.017	1.209	60.0%
Urban Areas	17.495	17.495	100%	17.368	16.749	96.4%
North Carolina	10.273	9.711	94.5%	9.569	7.246	75.7%
Rural Areas	3.416	2.872	84.1%	2.828	1.466	51.8%
Urban Areas	6.857	6.839	99.7%	6.741	5.780	85.7%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
North Dakota	0.755	0.701	92.8%	0.460	0.428	93.2%
Rural Areas	0.335	0.291	86.8%	0.121	0.099	81.1%
Urban Areas	0.420	0.410	97.6%	0.338	0.330	97.5%
Ohio	11.658	11.034	94.6%	11.150	10.326	92.6%
Rural Areas	2.579	2.019	78.3%	2.207	1.635	74.0%
Urban Areas	9.079	9.015	99.3%	8.943	8.691	97.2%
Oklahoma	3.931	3.104	79.0%	3.535	2.059	58.3%
Rural Areas	1.348	0.651	48.3%	1.053	0.236	22.5%
Urban Areas	2.582	2.453	95.0%	2.482	1.823	73.5%
Oregon	4.143	3.824	92.3%	3.958	3.365	85.0%
Rural Areas	0.836	0.573	68.6%	0.734	0.432	58.8%
Urban Areas	3.307	3.251	98.3%	3.224	2.934	91.0%
Pennsylvania	12.805	12.795	99.9%	12.204	11.622	95.2%
Rural Areas	2.731	2.721	99.6%	2.307	1.965	85.2%
Urban Areas	10.074	10.074	100%	9.898	9.657	97.6%
Rhode Island	1.060	1.060	100%	1.060	1.060	100%
Rural Areas	0.098	0.098	100%	0.098	0.098	100%
Urban Areas	0.962	0.962	100%	0.962	0.962	100%
South Carolina	5.024	4.516	89.9%	4.527	4.039	89.2%
Rural Areas	1.707	1.257	73.6%	1.334	0.981	73.6%
Urban Areas	3.318	3.259	98.2%	3.193	3.057	95.8%
South Dakota	0.869	0.771	88.7%	0.391	0.367	93.9%
Rural Areas	0.388	0.294	75.8%	0.092	0.070	76.2%
Urban Areas	0.481	0.477	99.2%	0.299	0.297	99.3%
Tennessee	6.716	6.119	91.1%	5.766	5.225	90.6%
Rural Areas	2.263	1.732	76.5%	1.496	1.110	74.2%
Urban Areas	4.452	4.387	98.5%	4.270	4.115	96.4%
Texas	28.304	26.229	92.7%	27.198	20.391	75.0%
Rural Areas	4.659	3.207	68.8%	3.966	1.809	45.6%
Urban Areas	23.645	23.023	97.4%	23.231	18.583	80.0%
Utah	3.102	2.922	94.2%	2.938	2.487	84.6%
Rural Areas	0.383	0.244	63.7%	0.279	0.100	35.8%
Urban Areas	2.719	2.678	98.5%	2.659	2.387	89.8%
Vermont	0.624	0.553	88.6%	0.383	0.159	41.4%
Rural Areas	0.383	0.315	82.2%	0.188	0.042	22.5%
Urban Areas	0.241	0.237	98.7%	0.195	0.116	59.7%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps and Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
Virginia	8.475	8.456	99.8%	7.529	5.863	77.9%
Rural Areas	2.078	2.060	99.1%	1.380	0.498	36.1%
Urban Areas	6.397	6.397	100%	6.149	5.366	87.3%
Washington	7.406	7.193	97.1%	7.289	6.460	88.6%
Rural Areas	1.269	1.117	88.0%	1.193	0.840	70.4%
Urban Areas	6.137	6.076	99.0%	6.096	5.620	92.2%
West Virginia	1.816	1.486	81.9%	1.113	0.421	37.8%
Rural Areas	0.926	0.622	67.2%	0.423	0.113	26.6%
Urban Areas	0.890	0.864	97.1%	0.690	0.308	44.7%
Wisconsin	5.795	5.286	91.2%	5.234	4.519	86.3%
Rural Areas	1.744	1.254	71.9%	1.287	0.775	60.2%
Urban Areas	4.051	4.032	99.5%	3.947	3.744	94.8%
Wyoming	0.579	0.467	80.7%	0.335	0.000	0.0%
Rural Areas	0.220	0.112	51.2%	0.085	0.000	0.0%
Urban Areas	0.360	0.355	98.7%	0.250	0.000	0.0%

APPENDIX D-3

Deployment (Millions) of Fixed 25 Mbps/3 Mbps or Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps; and Fixed 25 Mbps/3 Mbps or Mobile LTE with a Median Speed of 10 Mbps/3 Mbps by State and District of Columbia (December 31, 2017)

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
United States	325.716	325.390	99.9%	302.940	298.449	98.5%
Rural Areas	63.783	63.472	99.5%	47.555	43.652	91.8%
Urban Areas	261.933	261.919	100%	255.385	254.796	99.8%
Alabama	4.875	4.871	99.9%	4.192	4.060	96.9%
Rural Areas	2.010	2.007	99.8%	1.468	1.350	91.9%
Urban Areas	2.865	2.865	100%	2.724	2.710	99.5%
Alaska	0.740	0.666	90.1%	0.666	0.559	84.0%
Rural Areas	0.263	0.201	76.4%	0.219	0.125	57.1%
Urban Areas	0.477	0.466	97.7%	0.447	0.434	97.2%
Arizona	7.016	6.991	99.6%	6.898	6.587	95.5%
Rural Areas	0.832	0.808	97.1%	0.769	0.548	71.3%
Urban Areas	6.184	6.183	100%	6.129	6.038	98.5%
Arkansas	3.004	2.998	99.8%	2.262	2.094	92.6%
Rural Areas	1.331	1.326	99.6%	0.799	0.657	82.2%
Urban Areas	1.673	1.673	100%	1.463	1.438	98.3%
California	39.536	39.516	99.9%	39.434	39.238	99.5%
Rural Areas	2.347	2.326	99.1%	2.280	2.117	92.8%
Urban Areas	37.190	37.190	100%	37.154	37.122	99.9%
Colorado	5.606	5.599	99.9%	5.153	5.103	99.0%
Rural Areas	0.869	0.861	99.2%	0.584	0.543	93.0%
Urban Areas	4.738	4.738	100%	4.569	4.560	99.8%
Connecticut	3.588	3.588	100%	3.588	3.588	100%
Rural Areas	0.433	0.433	100%	0.433	0.433	100%
Urban Areas	3.155	3.155	100%	3.155	3.155	100%
Delaware	0.962	0.962	100%	0.962	0.955	99.3%
Rural Areas	0.170	0.170	100%	0.170	0.165	96.8%
Urban Areas	0.792	0.792	100%	0.792	0.790	99.8%
District of Columbia	0.694	0.694	100%	0.694	0.694	100%
Florida	20.984	20.982	100%	20.662	20.524	99.3%
Rural Areas	2.032	2.029	99.9%	1.797	1.680	93.5%
Urban Areas	18.952	18.952	100%	18.865	18.844	99.9%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
Georgia	10.429	10.427	100%	8.990	8.919	99.2%
Rural Areas	2.558	2.557	99.9%	1.533	1.475	96.2%
Urban Areas	7.871	7.871	100%	7.457	7.444	99.8%
Hawaii	1.428	1.427	100%	1.427	1.427	100%
Rural Areas	0.132	0.131	99.5%	0.132	0.131	99.5%
Urban Areas	1.296	1.296	100%	1.296	1.296	100%
Idaho	1.717	1.708	99.5%	1.389	1.334	96.1%
Rural Areas	0.531	0.522	98.3%	0.322	0.275	85.5%
Urban Areas	1.186	1.186	100%	1.067	1.058	99.2%
Illinois	12.802	12.801	100%	12.019	11.944	99.4%
Rural Areas	1.473	1.472	100%	0.972	0.902	92.8%
Urban Areas	11.329	11.329	100%	11.048	11.042	100%
Indiana	6.666	6.666	100%	5.962	5.873	98.5%
Rural Areas	1.841	1.841	100%	1.338	1.251	93.6%
Urban Areas	4.826	4.826	100%	4.624	4.622	100%
Iowa	3.145	3.143	99.9%	2.124	2.101	98.9%
Rural Areas	1.136	1.134	99.8%	0.444	0.427	96.3%
Urban Areas	2.009	2.009	100%	1.681	1.674	99.6%
Kansas	2.913	2.913	100%	2.292	2.276	99.3%
Rural Areas	0.756	0.756	100%	0.344	0.335	97.4%
Urban Areas	2.157	2.157	100%	1.948	1.940	99.6%
Kentucky	4.454	4.442	99.7%	3.423	3.369	98.4%
Rural Areas	1.830	1.818	99.4%	0.964	0.912	94.6%
Urban Areas	2.624	2.624	100%	2.459	2.456	99.9%
Louisiana	4.684	4.684	100%	4.247	4.092	96.4%
Rural Areas	1.256	1.255	100%	0.942	0.812	86.2%
Urban Areas	3.428	3.428	100%	3.304	3.280	99.3%
Maine	1.336	1.332	99.7%	1.236	1.169	94.6%
Rural Areas	0.829	0.825	99.5%	0.736	0.671	91.2%
Urban Areas	0.507	0.507	100%	0.500	0.497	99.5%
Maryland	6.052	6.052	100%	5.912	5.912	100%
Rural Areas	0.802	0.802	100%	0.707	0.707	100%
Urban Areas	5.250	5.250	100%	5.205	5.205	100%
Massachusetts	6.860	6.859	100%	6.849	6.847	100%
Rural Areas	0.551	0.550	99.9%	0.548	0.547	99.9%
Urban Areas	6.309	6.309	100%	6.300	6.299	100%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
Michigan	9.962	9.958	100%	9.478	9.253	97.6%
Rural Areas	2.556	2.552	99.9%	2.221	1.998	90.0%
Urban Areas	7.406	7.406	100%	7.257	7.255	100%
Minnesota	5.576	5.575	100%	4.905	4.889	99.7%
Rural Areas	1.485	1.484	99.9%	1.016	1.001	98.5%
Urban Areas	4.092	4.092	100%	3.889	3.889	100%
Mississippi	2.984	2.981	99.9%	1.980	1.861	94.0%
Rural Areas	1.515	1.511	99.8%	0.751	0.645	85.9%
Urban Areas	1.469	1.469	100%	1.229	1.216	98.9%
Missouri	6.113	6.107	99.9%	5.118	5.000	97.7%
Rural Areas	1.828	1.821	99.6%	1.088	0.977	89.8%
Urban Areas	4.286	4.286	100%	4.030	4.024	99.8%
Montana	1.050	1.036	98.6%	0.698	0.683	97.8%
Rural Areas	0.480	0.467	97.2%	0.248	0.234	94.3%
Urban Areas	0.570	0.569	99.8%	0.450	0.449	99.8%
Nebraska	1.920	1.919	99.9%	1.301	1.277	98.1%
Rural Areas	0.514	0.512	99.7%	0.143	0.119	83.3%
Urban Areas	1.406	1.406	100%	1.158	1.158	100%
Nevada	2.998	2.994	99.9%	2.923	2.913	99.6%
Rural Areas	0.208	0.203	97.9%	0.170	0.159	93.9%
Urban Areas	2.790	2.790	100%	2.754	2.753	100%
New Hampshire	1.343	1.342	100%	1.269	1.225	96.5%
Rural Areas	0.533	0.533	99.9%	0.485	0.447	92.2%
Urban Areas	0.810	0.810	100%	0.784	0.778	99.2%
New Jersey	9.005	9.005	100%	9.005	9.005	100%
Rural Areas	0.466	0.466	100%	0.466	0.466	100%
Urban Areas	8.539	8.539	100%	8.539	8.539	100%
New Mexico	2.088	2.079	99.6%	1.856	1.649	88.8%
Rural Areas	0.502	0.492	98.2%	0.376	0.216	57.5%
Urban Areas	1.586	1.586	100%	1.480	1.433	96.8%
New York	19.849	19.849	100%	19.385	19.385	100%
Rural Areas	2.354	2.354	100%	2.017	2.017	100%
Urban Areas	17.495	17.495	100%	17.368	17.368	100%
North Carolina	10.273	10.269	100%	9.569	9.315	97.3%
Rural Areas	3.416	3.412	99.9%	2.828	2.583	91.3%
Urban Areas	6.857	6.856	100%	6.741	6.732	99.9%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
North Dakota	0.755	0.755	99.9%	0.460	0.459	99.9%
Rural Areas	0.335	0.335	99.9%	0.121	0.121	99.7%
Urban Areas	0.420	0.420	100%	0.338	0.338	100%
Ohio	11.658	11.650	99.9%	11.150	11.071	99.3%
Rural Areas	2.579	2.571	99.7%	2.207	2.129	96.4%
Urban Areas	9.079	9.079	100%	8.943	8.942	100%
Oklahoma	3.931	3.925	99.9%	3.535	3.187	90.2%
Rural Areas	1.348	1.343	99.6%	1.053	0.742	70.5%
Urban Areas	2.582	2.582	100%	2.482	2.445	98.5%
Oregon	4.143	4.128	99.6%	3.958	3.881	98.1%
Rural Areas	0.836	0.821	98.3%	0.734	0.662	90.2%
Urban Areas	3.307	3.307	100%	3.224	3.219	99.8%
Pennsylvania	12.805	12.805	100%	12.204	12.204	100%
Rural Areas	2.731	2.731	100%	2.307	2.307	100%
Urban Areas	10.074	10.074	100%	9.898	9.898	100%
Rhode Island	1.060	1.060	100%	1.060	1.060	100%
Rural Areas	0.098	0.098	100%	0.098	0.098	100%
Urban Areas	0.962	0.962	100%	0.962	0.962	100%
South Carolina	5.024	5.024	100%	4.527	4.515	99.7%
Rural Areas	1.707	1.707	100%	1.334	1.322	99.1%
Urban Areas	3.318	3.318	100%	3.193	3.193	100%
South Dakota	0.869	0.868	99.9%	0.391	0.390	99.7%
Rural Areas	0.388	0.387	99.7%	0.092	0.091	98.9%
Urban Areas	0.481	0.481	100%	0.299	0.299	100%
Tennessee	6.716	6.709	99.9%	5.766	5.724	99.3%
Rural Areas	2.263	2.256	99.7%	1.496	1.459	97.5%
Urban Areas	4.452	4.452	100%	4.270	4.265	99.9%
Texas	28.304	28.300	100%	27.198	26.324	96.8%
Rural Areas	4.659	4.655	99.9%	3.966	3.249	81.9%
Urban Areas	23.645	23.645	100%	23.231	23.075	99.3%
Utah	3.102	3.094	99.8%	2.938	2.907	98.9%
Rural Areas	0.383	0.375	98.1%	0.279	0.251	90.0%
Urban Areas	2.719	2.719	100%	2.659	2.655	99.9%
Vermont	0.624	0.620	99.4%	0.383	0.362	94.4%
Rural Areas	0.383	0.379	99.0%	0.188	0.167	88.9%
Urban Areas	0.241	0.241	100%	0.195	0.194	99.6%

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps		Pop. Evaluated	Fixed 25 Mbps/3 Mbps or Mobile LTE 10 Mbps/3 Mbps	
		Pop.	% of Pop.		Pop.	% of Pop.
Virginia	8.475	8.475	100%	7.529	7.529	100%
Rural Areas	2.078	2.078	100%	1.380	1.380	100%
Urban Areas	6.397	6.397	100%	6.149	6.149	100%
Washington	7.406	7.400	99.9%	7.289	7.236	99.3%
Rural Areas	1.269	1.263	99.6%	1.193	1.146	96.0%
Urban Areas	6.137	6.137	100%	6.096	6.090	99.9%
West Virginia	1.816	1.778	97.9%	1.113	1.044	93.8%
Rural Areas	0.926	0.888	95.9%	0.423	0.361	85.1%
Urban Areas	0.890	0.889	100%	0.690	0.684	99.1%
Wisconsin	5.795	5.785	99.8%	5.234	5.131	98.0%
Rural Areas	1.744	1.734	99.4%	1.287	1.186	92.1%
Urban Areas	4.051	4.051	100%	3.947	3.945	100%
Wyoming	0.579	0.576	99.4%	0.335	0.304	90.8%
Rural Areas	0.220	0.216	98.4%	0.085	0.055	64.6%
Urban Areas	0.360	0.360	100%	0.250	0.249	99.7%

APPENDIX D-4

Deployment of Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps Services by U.S. Territory (December 31, 2017)

	Pop. Evaluated	Fixed 25 Mbps/3 Mbps		Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps & Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mpbs or Mobile LTE 5 Mbps/1 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.	Pop.	% of Pop.	Pop.	% of Pop.
U.S. Territories	3,715,570	3,191,589	85.9%	3,657,920	98.4%	3,188,149	85.8%	3,661,360	98.5%
Rural Areas	245,734	151,456	61.6%	233,019	94.8%	148,153	60.3%	236,322	96.2%
Urban Areas	3,469,836	3,040,133	87.6%	3,424,901	98.7%	3,039,996	87.6%	3,425,038	98.7%
American Samoa	51,504	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Rural Areas	7,741	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Urban Areas	43,763	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guam	167,358	2,610	1.6%	166,684	99.6%	2,610	1.6%	166,684	99.6%
Rural Areas	11,166	142	1.3%	11,058	99.0%	142	1.3%	11,058	99.0%
Urban Areas	156,192	2,468	1.6%	155,626	99.6%	2,468	1.6%	155,626	99.6%
Northern Mariana Isl.	52,263	792	1.5%	52,075	99.6%	792	1.5%	52,075	99.6%
Rural Areas	5,784	4	0.1%	5,596	96.7%	4	0.1%	5,596	96.7%
Urban Areas	46,479	788	1.7%	46,479	100%	788	1.7%	46,479	100%
Puerto Rico	3,337,177	3,080,928	92.3%	3,332,516	99.9%	3,078,111	92.2%	3,335,333	99.9%
Rural Areas	214,478	144,754	67.5%	210,385	98.1%	142,036	66.2%	213,103	99.4%
Urban Areas	3,122,699	2,936,174	94.0%	3,122,131	100%	2,936,075	94.0%	3,122,230	100%
U.S. Virgin Isl.	107,268	107,259	100%	106,645	99.4%	106,636	99.4%	107,268	100%
Rural Areas	6,565	6,556	99.9%	5,980	91.1%	5,971	91.0%	6,565	100%
Urban Areas	100,703	100,703	100%	100,665	100%	100,665	100%	100,703	100%

APPENDIX D-5

Deployment of Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps Services By State and County (December 31, 2017)

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Alabama	**4,874,678**	**86.1%**	**99.9%**	**86.1%**	**96.251**	**.**
Autauga County	55,504	80.9%	100.0%	80.9%	93.373	$26,168
Baldwin County	212,628	87.6%	99.9%	87.6%	133.746	$28,069
Barbour County	25,270	59.0%	99.7%	59.0%	28.558	$17,249
Bibb County	22,668	29.3%	99.7%	29.3%	36.410	$18,988
Blount County	58,013	68.7%	100.0%	68.7%	89.974	$21,033
Bullock County	10,309	5.6%	99.9%	5.6%	16.553	$17,909
Butler County	19,825	78.0%	99.3%	77.5%	25.520	$19,011
Calhoun County	114,728	92.5%	100.0%	92.5%	189.361	$22,231
Chambers County	33,713	81.9%	100.0%	81.9%	56.515	$21,532
Cherokee County	25,857	98.7%	100.0%	98.7%	46.699	$22,544
Chilton County	44,067	65.8%	100.0%	65.8%	63.602	$22,045
Choctaw County	12,945	22.8%	99.6%	22.8%	14.171	$20,773
Clarke County	24,083	62.6%	98.4%	61.9%	19.446	$20,543
Clay County	13,367	40.4%	99.2%	40.4%	22.132	$21,115
Cleburne County	14,900	12.9%	98.3%	12.9%	26.602	$19,791
Coffee County	51,871	90.1%	100.0%	90.1%	76.396	$25,325
Colbert County	54,500	80.1%	100.0%	80.1%	91.965	$23,318
Conecuh County	12,468	40.0%	99.9%	40.0%	14.666	$16,004
Coosa County	10,754	76.2%	100.0%	76.2%	16.521	$18,080
Covington County	37,092	84.2%	100.0%	84.2%	35.996	$21,738
Crenshaw County	13,871	75.4%	99.4%	75.4%	22.783	$20,455
Cullman County	82,755	77.3%	100.0%	77.3%	112.616	$21,041
Dale County	49,226	93.1%	100.0%	93.1%	87.723	$22,834
Dallas County	39,215	76.3%	99.9%	76.3%	40.069	$17,611
DeKalb County	71,617	97.9%	100.0%	97.9%	92.160	$18,685
Elmore County	81,677	92.4%	100.0%	92.4%	132.060	$24,771
Escambia County	37,447	74.2%	99.6%	74.2%	39.623	$17,420
Etowah County	102,755	95.6%	100.0%	95.6%	192.069	$21,287
Fayette County	16,468	37.8%	99.2%	37.8%	26.237	$20,201
Franklin County	31,495	64.0%	99.8%	64.0%	49.691	$18,193
Geneva County	26,421	54.0%	100.0%	54.0%	45.997	$20,189
Greene County	8,330	0.2%	99.0%	0.2%	12.873	$13,679
Hale County	14,812	53.7%	100.0%	53.7%	23.002	$19,296
Henry County	17,147	59.2%	99.6%	59.2%	30.524	$22,825

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Houston County	104,346	87.2%	100.0%	87.2%	179.961	$24,086
Jackson County	51,909	83.4%	99.5%	83.4%	48.159	$20,487
Jefferson County	659,197	99.0%	100.0%	99.0%	593.189	$28,162
Lamar County	13,946	34.1%	99.3%	34.1%	23.057	$20,206
Lauderdale County	92,536	78.6%	99.9%	78.6%	138.590	$24,893
Lawrence County	33,049	55.0%	99.8%	55.0%	47.850	$21,911
Lee County	161,602	96.3%	100.0%	96.3%	265.996	$24,951
Limestone County	94,373	91.4%	100.0%	91.4%	168.542	$26,086
Lowndes County	10,076	12.6%	100.0%	12.6%	14.074	$18,434
Macon County	18,755	60.6%	100.0%	60.6%	30.802	$18,385
Madison County	361,024	96.2%	100.0%	96.2%	450.383	$33,264
Marengo County	19,375	12.8%	100.0%	12.8%	19.834	$20,359
Marion County	29,833	48.2%	100.0%	48.2%	40.190	$20,998
Marshall County	95,548	95.2%	100.0%	95.2%	168.860	$21,767
Mobile County	413,955	95.0%	100.0%	95.0%	336.703	$23,318
Monroe County	21,327	60.2%	99.2%	60.2%	20.793	$16,556
Montgomery County	226,646	97.7%	100.0%	97.7%	288.998	$26,255
Morgan County	118,818	90.7%	100.0%	90.7%	205.093	$24,415
Perry County	9,339	0.0%	99.7%	0.0%	12.977	$14,033
Pickens County	20,176	27.0%	99.4%	27.0%	22.891	$19,188
Pike County	33,267	92.0%	98.6%	91.1%	49.498	$20,180
Randolph County	22,670	49.8%	99.4%	49.8%	39.049	$19,584
Russell County	57,045	89.3%	99.9%	89.3%	88.974	$20,760
Shelby County	213,599	95.2%	100.0%	95.2%	272.125	$34,117
St. Clair County	88,195	78.4%	100.0%	78.4%	139.571	$24,474
Sumter County	12,687	43.8%	99.9%	43.8%	14.036	$13,929
Talladega County	80,065	76.2%	100.0%	76.2%	108.669	$20,430
Tallapoosa County	40,681	91.5%	100.0%	91.5%	56.776	$21,410
Tuscaloosa County	207,811	91.7%	100.0%	91.7%	157.224	$23,896
Walker County	64,058	75.5%	100.0%	75.5%	80.964	$20,410
Washington County	16,531	30.4%	98.2%	29.8%	15.304	$19,598
Wilcox County	10,719	41.6%	100.0%	41.6%	12.064	$14,800
Winston County	23,722	49.1%	99.8%	49.1%	38.700	$19,299
Alaska	**739,515**	**80.5%**	**89.4%**	**79.8%**	**1.296**	**.**
Aleutians East Borough	3,370	0.0%	0.0%	0.0%	0.483	$31,025
Aleutians West Census Area	5,763	0.0%	51.3%	0.0%	1.313	$35,083

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Anchorage Municipality	294,356	99.4%	99.8%	99.2%	172.675	$37,864
Bethel Census Area	18,076	0.0%	0.0%	0.0%	0.446	$18,231
Bristol Bay Borough	867	0.0%	0.0%	0.0%	1.721	$41,420
Denali Borough	2,074	36.6%	81.6%	30.5%	0.163	$38,337
Dillingham Census Area	4,932	0.0%	0.0%	0.0%	0.266	$23,520
Fairbanks North Star Borough	99,703	88.1%	99.6%	88.1%	13.587	$34,182
Haines Borough	2,526	92.2%	77.3%	74.0%	1.089	$32,673
Hoonah-Angoon Census Area	2,145	25.1%	18.9%	17.8%	0.285	$31,451
Juneau City and Borough	32,094	99.3%	99.7%	99.2%	11.878	$40,592
Kenai Peninsula Borough	58,617	61.4%	96.9%	59.3%	3.646	$32,556
Ketchikan Gateway Borough	13,856	98.9%	99.6%	98.7%	2.852	$32,694
Kodiak Island Borough	13,448	85.0%	93.2%	85.0%	2.053	$32,066
Lake and Peninsula Borough	1,620	0.0%	0.0%	0.0%	0.068	$22,684
Matanuska-Susitna Borough	106,532	87.4%	99.1%	86.9%	4.329	$30,078
Nome Census Area	9,921	0.0%	19.5%	0.0%	0.432	$20,033
North Slope Borough	9,782	0.0%	73.3%	0.0%	0.110	$49,982
Northwest Arctic Borough	7,684	0.0%	0.0%	0.0%	0.216	$21,028
Petersburg Borough	7,996	0.0%	7.5%	0.0%	0.468	.
Petersburg Census Area	3,281	80.2%	58.9%	55.6%	1.000	$34,788
Prince of Wales-Hyder Census Area	6,369	0.0%	39.7%	0.0%	1.624	$25,564
Sitka City and Borough	8,689	97.8%	94.6%	94.1%	3.027	$35,655
Skagway Municipality	1,157	97.8%	80.0%	79.9%	2.558	$39,412
Southeast Fairbanks Census Area	6,888	36.9%	83.2%	35.6%	0.278	$30,757

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Valdez-Cordova Census Area	9,278	86.5%	95.0%	84.4%	0.271	$35,457
Wrangell City and Borough	2,521	89.7%	70.2%	67.0%	0.992	$29,782
Yakutat City and Borough	605	0.0%	0.0%	0.0%	0.079	$31,084
Yukon-Koyukuk Census Area	5,365	0.0%	12.6%	0.0%	0.037	$20,812
Arizona	**7,016,206**	**86.9%**	**99.6%**	**86.9%**	**61.766**	**.**
Apache County	71,606	0.2%	86.8%	0.2%	6.395	$13,428
Cochise County	124,756	58.6%	100.0%	58.6%	20.234	$23,757
Coconino County	140,776	62.3%	99.4%	62.3%	7.561	$24,711
Gila County	53,501	71.3%	99.7%	71.3%	11.245	$21,470
Graham County	37,466	68.0%	99.8%	68.0%	8.105	$17,710
Greenlee County	9,455	54.7%	99.5%	54.7%	5.130	$23,778
La Paz County	20,601	47.0%	100.0%	47.0%	4.578	$21,447
Maricopa County	4,306,978	92.7%	100.0%	92.7%	468.143	$28,791
Mohave County	207,198	78.8%	99.8%	78.8%	15.566	$22,026
Navajo County	108,956	46.6%	87.4%	46.6%	10.950	$16,564
Pima County	1,022,763	91.8%	100.0%	91.8%	111.327	$26,204
Pinal County	430,237	67.8%	100.0%	67.8%	80.184	$21,982
Santa Cruz County	46,212	82.7%	99.9%	82.7%	37.361	$18,860
Yavapai County	228,167	87.0%	100.0%	87.0%	28.087	$26,584
Yuma County	207,534	89.6%	100.0%	89.6%	37.638	$19,483
Arkansas	**3,004,116**	**77.4%**	**99.8%**	**77.3%**	**57.732**	**.**
Arkansas County	17,967	9.9%	100.0%	9.9%	18.171	$23,287
Ashley County	20,283	51.9%	100.0%	51.9%	21.919	$20,290
Baxter County	41,355	76.9%	99.3%	76.8%	74.610	$23,068
Benton County	266,250	95.1%	100.0%	95.1%	314.212	$28,996
Boone County	37,380	70.8%	100.0%	70.8%	63.331	$21,719
Bradley County	10,864	62.2%	100.0%	62.2%	16.734	$20,465
Calhoun County	5,247	6.9%	100.0%	6.9%	8.347	$21,093
Carroll County	27,943	100.0%	100.0%	100.0%	44.348	$20,888
Chicot County	10,636	53.8%	100.0%	53.8%	16.508	$18,853
Clark County	22,293	76.0%	100.0%	76.0%	25.740	$19,500
Clay County	14,920	65.5%	100.0%	65.5%	23.332	$19,192
Cleburne County	25,048	53.1%	99.3%	53.1%	45.238	$25,078
Cleveland County	8,202	83.1%	100.0%	83.1%	13.721	$21,485
Columbia County	23,627	68.1%	100.0%	68.1%	30.843	$19,922

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Conway County	20,916	45.3%	99.7%	45.3%	37.874	$21,896
Craighead County	107,096	86.1%	100.0%	86.1%	151.435	$24,226
Crawford County	62,996	85.8%	99.9%	85.8%	106.216	$20,889
Crittenden County	48,750	79.4%	100.0%	79.4%	79.949	$20,133
Cross County	16,863	57.1%	100.0%	57.1%	27.358	$20,692
Dallas County	7,393	37.7%	98.5%	37.4%	11.078	$17,803
Desha County	11,764	69.8%	100.0%	69.8%	15.315	$17,324
Drew County	18,547	68.2%	100.0%	68.2%	22.390	$18,373
Faulkner County	123,647	91.8%	100.0%	91.8%	190.847	$24,809
Franklin County	17,889	21.4%	99.8%	21.4%	29.381	$19,811
Fulton County	12,055	26.7%	99.5%	26.7%	19.500	$19,082
Garland County	98,657	97.2%	99.8%	97.1%	145.559	$24,602
Grant County	18,163	43.2%	100.0%	43.2%	28.748	$24,696
Greene County	45,048	73.0%	100.0%	73.0%	77.978	$21,643
Hempstead County	21,861	63.7%	100.0%	63.7%	30.049	$17,813
Hot Spring County	33,570	55.8%	99.8%	55.8%	54.567	$20,522
Howard County	13,478	16.5%	99.5%	16.5%	22.900	$22,587
Independence County	37,501	65.7%	99.9%	65.7%	49.088	$22,035
Izard County	13,685	44.4%	99.4%	44.4%	23.571	$18,964
Jackson County	17,135	77.7%	99.7%	77.4%	27.029	$18,316
Jefferson County	69,115	56.6%	100.0%	56.6%	79.375	$19,691
Johnson County	26,551	53.3%	98.9%	53.3%	40.241	$18,871
Lafayette County	6,862	13.7%	100.0%	13.7%	12.990	$24,171
Lawrence County	16,525	45.6%	99.8%	45.6%	28.122	$18,010
Lee County	9,176	29.8%	100.0%	29.8%	15.227	$14,292
Lincoln County	13,646	17.2%	100.0%	17.2%	24.302	$12,610
Little River County	12,359	57.7%	100.0%	57.7%	23.220	$20,237
Logan County	21,722	22.2%	100.0%	22.2%	30.675	$20,340
Lonoke County	72,894	76.9%	100.0%	76.9%	94.578	$24,501
Madison County	16,339	34.0%	99.7%	34.0%	19.585	$22,637
Marion County	16,428	42.2%	98.9%	41.4%	27.517	$18,706
Miller County	43,980	91.8%	100.0%	91.8%	70.303	$21,217
Mississippi County	42,159	72.4%	100.0%	72.4%	46.813	$19,159
Monroe County	7,085	12.8%	100.0%	12.8%	11.670	$19,849
Montgomery County	8,917	42.9%	99.2%	42.8%	11.434	$20,375
Nevada County	8,327	46.6%	100.0%	46.6%	13.478	$17,595
Newton County	7,828	1.0%	91.0%	1.0%	9.536	$17,790
Ouachita County	23,868	57.6%	100.0%	57.6%	32.572	$20,033

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Perry County	10,346	65.8%	97.3%	65.1%	18.763	$22,474
Phillips County	18,572	84.3%	100.0%	84.3%	26.697	$16,684
Pike County	10,726	42.4%	98.6%	42.3%	17.858	$19,686
Poinsett County	24,154	62.8%	100.0%	62.8%	31.849	$17,710
Polk County	20,118	63.0%	99.7%	63.0%	23.456	$18,097
Pope County	63,835	87.0%	99.2%	86.7%	78.561	$20,912
Prairie County	8,248	36.4%	100.0%	36.4%	12.729	$21,035
Pulaski County	393,948	96.8%	100.0%	96.8%	518.514	$28,421
Randolph County	17,557	63.1%	96.9%	62.9%	26.920	$20,059
Saline County	119,312	91.3%	100.0%	91.3%	164.886	$26,963
Scott County	10,436	47.9%	99.0%	47.9%	11.695	$17,934
Searcy County	7,938	31.8%	93.8%	31.4%	11.917	$20,618
Sebastian County	128,105	94.4%	100.0%	94.4%	240.839	$23,383
Sevier County	17,115	74.3%	100.0%	74.3%	30.285	$17,458
Sharp County	17,393	40.9%	99.1%	40.9%	28.775	$19,404
St. Francis County	25,930	36.3%	100.0%	36.3%	40.849	$16,540
Stone County	12,537	0.7%	94.4%	0.7%	20.674	$19,616
Union County	39,449	72.5%	100.0%	72.5%	37.960	$22,240
Van Buren County	16,506	39.0%	96.9%	39.0%	23.309	$19,883
Washington County	231,971	92.6%	100.0%	92.6%	246.262	$25,249
White County	79,016	63.6%	99.9%	63.6%	76.338	$22,510
Woodruff County	6,571	37.3%	100.0%	37.3%	11.198	$18,382
Yell County	21,523	80.0%	99.1%	79.5%	23.143	$18,981
California	**39,536,394**	**97.0%**	**99.9%**	**97.0%**	**253.798**	**.**
Alameda County	1,663,187	98.8%	100.0%	98.8%	2,250.538	$39,042
Alpine County	1,120	9.1%	96.1%	7.4%	1.517	$26,783
Amador County	38,623	68.2%	99.8%	68.2%	64.958	$27,496
Butte County	229,292	87.7%	99.5%	87.7%	140.114	$25,077
Calaveras County	45,669	89.6%	99.5%	89.5%	44.773	$30,577
Colusa County	21,800	34.3%	99.7%	34.3%	18.944	$25,745
Contra Costa County	1,147,436	97.8%	100.0%	97.8%	1,602.705	$40,792
Del Norte County	27,470	93.8%	95.8%	91.4%	27.296	$20,282
El Dorado County	188,985	98.6%	99.9%	98.5%	110.655	$37,089
Fresno County	989,250	98.0%	99.9%	98.0%	166.037	$21,057
Glenn County	28,094	69.5%	99.9%	69.5%	21.381	$20,362
Humboldt County	136,754	82.6%	98.7%	82.6%	38.328	$24,038
Imperial County	182,829	81.6%	100.0%	81.6%	43.775	$16,311
Inyo County	18,026	86.7%	96.9%	86.7%	1.771	$28,678

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Kern County	893,108	95.3%	100.0%	95.3%	109.827	$21,094
Kings County	150,101	88.9%	100.0%	88.9%	108.031	$19,123
Lake County	64,246	83.8%	99.7%	83.8%	51.132	$21,799
Lassen County	31,163	48.2%	100.0%	48.2%	6.862	$20,072
Los Angeles County	10,163,482	99.4%	100.0%	99.4%	2,504.626	$29,301
Madera County	156,890	98.6%	100.0%	98.6%	73.414	$19,021
Marin County	260,955	97.1%	100.0%	97.1%	501.542	$63,608
Mariposa County	17,569	50.3%	96.6%	50.0%	12.126	$27,832
Mendocino County	88,018	75.3%	96.4%	75.2%	25.103	$25,278
Merced County	272,668	99.9%	100.0%	99.9%	140.916	$19,130
Modoc County	8,859	13.5%	99.1%	13.3%	2.261	$21,899
Mono County	14,167	75.9%	98.4%	75.9%	4.646	$31,059
Monterey County	437,901	98.8%	99.6%	98.5%	133.482	$25,947
Napa County	140,973	93.3%	100.0%	93.3%	188.376	$38,057
Nevada County	99,814	75.7%	99.8%	75.7%	104.215	$33,385
Orange County	3,190,372	98.2%	100.0%	98.2%	4,035.545	$35,939
Placer County	386,159	96.7%	99.9%	96.7%	274.454	$37,914
Plumas County	18,742	18.3%	97.9%	18.3%	7.341	$31,292
Riverside County	2,423,237	96.1%	100.0%	96.1%	336.258	$24,443
Sacramento County	1,530,614	97.3%	100.0%	97.3%	1,586.714	$28,292
San Benito County	60,309	99.1%	99.6%	98.9%	43.428	$27,848
San Bernardino County	2,157,390	94.2%	100.0%	94.2%	107.563	$21,857
San Diego County	3,337,681	97.6%	100.0%	97.6%	793.434	$32,482
San Francisco County	884,357	98.7%	100.0%	98.7%	18,867.172	$55,567
San Joaquin County	745,409	99.9%	100.0%	99.9%	535.756	$23,477
San Luis Obispo County	283,404	97.2%	99.9%	97.1%	85.917	$32,335
San Mateo County	771,408	99.1%	99.9%	99.0%	1,720.325	$50,262
Santa Barbara County	448,148	91.6%	99.9%	91.6%	163.852	$31,098
Santa Clara County	1,938,122	100.0%	100.0%	100.0%	1,502.304	$46,034
Santa Cruz County	275,888	100.0%	99.9%	99.9%	619.736	$34,732
Shasta County	179,920	74.9%	99.8%	74.9%	47.656	$25,094
Sierra County	2,999	11.4%	74.8%	11.4%	3.146	$31,873
Siskiyou County	43,853	17.9%	96.9%	17.9%	6.985	$23,542
Solano County	445,454	94.8%	100.0%	94.8%	542.070	$30,251

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Sonoma County	504,217	95.6%	99.9%	95.5%	319.965	$35,639
Stanislaus County	547,893	99.6%	100.0%	99.6%	366.526	$22,915
Sutter County	96,648	90.7%	100.0%	90.7%	160.435	$24,335
Tehama County	63,925	49.2%	99.5%	49.2%	21.672	$21,521
Trinity County	12,709	20.8%	85.4%	20.8%	3.997	$22,387
Tulare County	464,475	97.1%	99.8%	97.1%	96.280	$18,257
Tuolumne County	54,248	91.6%	99.4%	91.3%	24.426	$29,431
Ventura County	854,219	98.1%	100.0%	98.0%	463.460	$34,331
Yolo County	219,115	96.5%	100.0%	96.5%	215.943	$28,996
Yuba County	77,030	79.5%	99.4%	79.5%	121.914	$21,418
Colorado	**5,606,368**	**92.9%**	**99.8%**	**92.9%**	**54.094**	**.**
Adams County	503,059	97.9%	100.0%	97.9%	430.829	$26,051
Alamosa County	16,545	72.2%	100.0%	72.2%	22.895	$18,133
Arapahoe County	642,995	98.9%	100.0%	98.9%	805.657	$35,250
Archuleta County	13,315	35.2%	99.3%	35.2%	9.862	$28,649
Baca County	3,562	53.9%	99.7%	53.8%	1.394	$22,113
Bent County	5,933	48.5%	100.0%	48.5%	3.922	$13,772
Boulder County	322,501	95.1%	100.0%	95.1%	444.039	$40,097
Broomfield County	68,280	96.8%	100.0%	96.8%	2,066.964	$41,698
Chaffee County	19,638	69.4%	98.9%	68.4%	19.378	$27,848
Cheyenne County	1,845	82.0%	100.0%	82.0%	1.038	$23,916
Clear Creek County	9,574	76.6%	100.0%	76.6%	24.224	$42,355
Conejos County	8,183	9.9%	99.2%	9.9%	6.356	$18,221
Costilla County	3,775	59.0%	99.5%	59.0%	3.077	$20,238
Crowley County	5,809	66.7%	100.0%	66.7%	7.377	$12,513
Custer County	4,874	27.6%	99.1%	27.2%	6.599	$22,333
Delta County	30,568	92.0%	99.7%	91.8%	26.766	$24,261
Denver County	704,336	100.0%	100.0%	100.0%	4,603.498	$36,616
Dolores County	2,067	11.1%	83.4%	10.9%	1.937	$21,112
Douglas County	335,284	98.2%	100.0%	98.2%	399.030	$47,062
Eagle County	54,770	83.6%	99.6%	83.6%	32.514	$38,604
El Paso County	699,195	94.0%	100.0%	94.0%	328.754	$30,261
Elbert County	25,632	79.5%	100.0%	79.5%	13.849	$39,360
Fremont County	47,559	83.8%	99.4%	83.8%	31.022	$19,427
Garfield County	59,118	80.2%	99.1%	80.2%	20.057	$29,179
Gilpin County	6,013	38.8%	100.0%	38.8%	40.114	$37,027
Grand County	15,321	70.1%	99.8%	70.1%	8.298	$32,348
Gunnison County	16,939	89.5%	92.6%	87.3%	5.230	$25,920
Hinsdale County	794	44.5%	3.1%	0.0%	0.711	$29,958

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Huerfano County	6,662	55.4%	99.2%	55.4%	4.187	$25,062
Jackson County	1,385	77.8%	97.5%	77.8%	0.858	$26,798
Jefferson County	574,611	98.6%	100.0%	98.6%	751.904	$38,367
Kiowa County	1,376	53.1%	98.6%	51.9%	0.778	$21,602
Kit Carson County	7,158	92.6%	100.0%	92.6%	3.313	$24,327
La Plata County	55,589	82.2%	100.0%	82.2%	32.852	$32,953
Lake County	7,778	88.7%	99.8%	88.7%	20.636	$26,693
Larimer County	343,976	87.9%	99.8%	87.8%	132.502	$32,433
Las Animas County	14,238	67.3%	99.5%	67.0%	2.983	$23,857
Lincoln County	5,546	19.4%	100.0%	19.4%	2.152	$14,210
Logan County	21,896	92.9%	100.0%	92.9%	11.909	$23,692
Mesa County	151,616	91.7%	99.5%	91.7%	45.544	$26,731
Mineral County	701	82.0%	71.3%	60.1%	0.801	$35,041
Moffat County	13,131	95.4%	98.3%	95.1%	2.768	$26,344
Montezuma County	26,140	58.4%	99.8%	58.3%	12.880	$22,738
Montrose County	41,784	93.3%	99.6%	93.2%	18.648	$23,276
Morgan County	28,192	85.5%	100.0%	85.5%	22.018	$23,408
Otero County	18,326	86.9%	99.8%	86.9%	14.522	$19,842
Ouray County	4,794	99.9%	100.0%	99.9%	8.852	$34,993
Park County	17,905	59.2%	98.5%	58.7%	8.161	$34,442
Phillips County	4,291	99.8%	100.0%	99.8%	6.238	$26,290
Pitkin County	17,890	87.4%	96.9%	86.3%	18.430	$59,229
Prowers County	12,069	72.1%	100.0%	72.1%	7.366	$20,589
Pueblo County	166,475	90.9%	100.0%	90.9%	69.769	$22,431
Rio Blanco County	6,420	70.1%	91.4%	70.1%	1.993	$27,419
Rio Grande County	11,301	78.9%	99.8%	78.9%	12.392	$22,918
Routt County	25,220	96.1%	99.3%	95.8%	10.677	$36,692
Saguache County	6,626	70.6%	88.4%	69.8%	2.091	$21,356
San Juan County	715	39.9%	94.8%	39.6%	1.845	$29,427
San Miguel County	7,967	65.6%	97.1%	65.3%	6.192	$35,701
Sedgwick County	2,344	77.9%	100.0%	77.9%	4.277	$24,247
Summit County	30,576	90.6%	99.8%	90.6%	50.260	$36,545
Teller County	24,644	78.2%	100.0%	78.2%	44.240	$34,230
Washington County	4,937	80.5%	100.0%	80.5%	1.961	$25,744
Weld County	304,530	78.5%	100.0%	78.5%	76.376	$27,808
Yuma County	10,075	97.7%	100.0%	97.7%	4.261	$23,905
Connecticut	**3,588,175**	**100.0%**	**100.0%**	**100.0%**	**740.998**	**.**

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Fairfield County	949,916	100.0%	100.0%	100.0%	1,520.134	$51,719
Hartford County	895,384	100.0%	100.0%	100.0%	1,218.049	$36,570
Litchfield County	182,177	100.0%	100.0%	100.0%	197.898	$38,859
Middlesex County	163,410	100.0%	100.0%	100.0%	442.484	$42,573
New Haven County	860,435	100.0%	100.0%	100.0%	1,423.369	$33,706
New London County	269,033	100.0%	100.0%	100.0%	404.635	$35,531
Tolland County	151,461	100.0%	100.0%	100.0%	369.225	$36,364
Windham County	116,359	100.0%	100.0%	100.0%	226.861	$28,663
Delaware	**961,901**	**97.6%**	**100.0%**	**97.6%**	**493.651**	**.**
Kent County	176,823	96.0%	100.0%	96.0%	301.654	$26,118
New Castle County	559,792	98.4%	100.0%	98.4%	1,313.185	$33,240
Sussex County	225,286	97.0%	100.0%	97.0%	240.670	$29,630
District of Columbia	**693,881**	**100.0%**	**100.0%**	**100.0%**	**11,366.076**	**$48,781**
Florida	**20,983,857**	**96.2%**	**100.0%**	**96.2%**	**391.309**	**.**
Alachua County	266,935	84.4%	100.0%	84.4%	305.062	$25,758
Baker County	28,283	83.6%	97.5%	82.1%	48.328	$21,222
Bay County	183,563	94.5%	100.0%	94.5%	242.021	$25,695
Bradford County	27,038	100.0%	100.0%	100.0%	91.978	$19,852
Brevard County	589,160	100.0%	100.0%	100.0%	580.074	$28,189
Broward County	1,935,869	98.2%	100.0%	98.2%	1,600.176	$28,987
Calhoun County	14,483	69.7%	100.0%	69.7%	25.528	$16,560
Charlotte County	182,027	90.3%	100.0%	90.3%	267.577	$27,860
Citrus County	145,647	94.3%	100.0%	94.3%	250.383	$24,188
Clay County	212,204	100.0%	100.0%	100.0%	351.122	$27,159
Collier County	372,870	95.2%	100.0%	95.2%	186.591	$39,616
Columbia County	69,612	81.7%	100.0%	81.7%	87.280	$21,875
DeSoto County	36,854	67.1%	100.0%	67.1%	57.850	$16,710
Dixie County	16,673	0.8%	99.8%	0.8%	23.648	$18,490
Duval County	937,925	100.0%	100.0%	100.0%	1,230.563	$27,235
Escambia County	313,512	95.8%	100.0%	95.8%	477.579	$24,532
Flagler County	110,507	96.2%	100.0%	96.2%	227.633	$25,314
Franklin County	11,727	95.7%	99.6%	95.4%	21.931	$21,515
Gadsden County	46,070	89.0%	99.6%	88.7%	89.226	$18,187
Gilchrist County	17,733	23.2%	100.0%	23.2%	50.713	$21,620
Glades County	13,754	73.0%	100.0%	73.0%	17.064	$17,798
Gulf County	16,159	89.2%	100.0%	89.2%	28.650	$20,050
Hamilton County	14,184	59.4%	100.0%	59.4%	27.607	$15,970
Hardee County	27,410	93.6%	100.0%	93.6%	42.977	$17,179

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Hendry County	40,340	76.8%	100.0%	76.8%	34.995	$18,027
Hernando County	186,534	97.7%	100.0%	97.7%	394.749	$22,435
Highlands County	102,876	87.1%	100.0%	87.1%	101.195	$21,916
Hillsborough County	1,408,519	99.7%	100.0%	99.7%	1,380.612	$28,727
Holmes County	19,558	40.6%	100.0%	40.6%	40.850	$17,854
Indian River County	154,379	100.0%	100.0%	100.0%	306.995	$32,208
Jackson County	48,330	53.3%	100.0%	53.3%	52.661	$17,222
Jefferson County	14,144	28.6%	100.0%	28.6%	23.648	$21,311
Lafayette County	8,451	50.8%	99.9%	50.7%	15.552	$19,341
Lake County	346,008	100.0%	100.0%	100.0%	368.729	$24,760
Lee County	739,207	91.8%	100.0%	91.8%	942.250	$28,949
Leon County	290,286	95.4%	100.0%	95.4%	435.308	$27,190
Levy County	40,354	19.6%	99.9%	19.6%	36.088	$20,555
Liberty County	8,242	32.5%	96.4%	30.1%	9.864	$17,218
Madison County	18,447	62.7%	100.0%	62.7%	26.506	$16,486
Manatee County	385,558	99.0%	100.0%	99.0%	518.969	$29,140
Marion County	354,342	91.5%	99.9%	91.4%	223.624	$22,390
Martin County	159,915	100.0%	100.0%	100.0%	294.251	$35,892
Miami-Dade County	2,751,790	96.3%	100.0%	96.3%	1,450.054	$24,515
Monroe County	77,013	95.4%	100.0%	95.4%	78.322	$36,771
Nassau County	82,721	91.2%	100.0%	91.2%	127.530	$31,141
Okaloosa County	202,963	91.9%	99.8%	91.9%	218.182	$29,603
Okeechobee County	41,603	81.1%	100.0%	81.1%	54.107	$17,173
Orange County	1,348,928	100.0%	100.0%	100.0%	1,493.120	$26,210
Osceola County	352,139	100.0%	100.0%	100.0%	265.274	$19,482
Palm Beach County	1,471,143	97.0%	100.0%	97.0%	746.863	$34,846
Pasco County	525,602	98.5%	100.0%	98.5%	703.724	$25,225
Pinellas County	970,626	99.9%	100.0%	99.9%	3,545.032	$31,035
Polk County	686,437	95.3%	100.0%	95.3%	381.813	$21,669
Putnam County	73,461	81.3%	100.0%	81.3%	100.960	$18,561
Santa Rosa County	174,257	91.6%	99.4%	91.6%	172.258	$28,219
Sarasota County	419,095	96.5%	100.0%	96.5%	753.947	$35,210
Seminole County	462,639	100.0%	100.0%	100.0%	1,496.142	$30,097
St. Johns County	243,799	100.0%	100.0%	100.0%	405.888	$38,362
St. Lucie County	313,506	100.0%	100.0%	100.0%	548.159	$24,104
Sumter County	125,165	92.2%	100.0%	92.2%	228.849	$31,591
Suwannee County	44,183	81.3%	100.0%	81.3%	64.168	$19,322

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Taylor County	21,833	65.5%	100.0%	65.5%	20.927	$16,081
Union County	15,517	50.6%	100.0%	50.6%	63.710	$12,943
Volusia County	538,689	100.0%	100.0%	100.0%	489.258	$24,834
Wakulla County	32,120	92.9%	99.5%	92.8%	52.967	$22,129
Walton County	68,372	75.3%	100.0%	75.3%	65.893	$28,475
Washington County	24,567	36.6%	100.0%	36.6%	42.153	$18,239
Georgia	**10,428,987**	**92.5%**	**100.0%**	**92.4%**	**181.331**	**.**
Appling County	18,521	48.0%	99.7%	48.0%	36.525	$19,607
Atkinson County	8,342	59.2%	100.0%	59.2%	24.580	$19,002
Bacon County	11,319	65.8%	99.8%	65.8%	43.774	$18,299
Baker County	3,200	1.8%	100.0%	1.8%	9.358	$23,001
Baldwin County	44,906	93.3%	100.0%	93.3%	174.160	$19,147
Banks County	18,628	69.1%	100.0%	69.1%	80.262	$18,890
Barrow County	79,060	98.6%	100.0%	98.6%	493.172	$21,978
Bartow County	105,054	94.8%	100.0%	94.8%	228.605	$23,376
Ben Hill County	16,996	90.0%	100.0%	90.0%	67.951	$15,311
Berrien County	19,185	82.1%	100.0%	82.1%	42.454	$17,007
Bibb County	152,862	96.9%	100.0%	96.9%	612.032	$22,175
Bleckley County	12,830	43.2%	100.0%	43.2%	59.434	$19,511
Brantley County	18,720	99.5%	100.0%	99.5%	42.318	$17,320
Brooks County	15,587	78.6%	100.0%	78.6%	31.614	$19,665
Bryan County	37,060	95.9%	100.0%	95.9%	85.007	$29,056
Bulloch County	76,148	98.2%	100.0%	98.2%	113.179	$19,544
Burke County	22,522	72.4%	99.9%	72.4%	27.234	$18,667
Butts County	24,056	78.0%	100.0%	78.0%	130.460	$19,529
Calhoun County	6,454	42.0%	100.0%	42.0%	23.020	$16,778
Camden County	53,044	94.3%	100.0%	94.3%	86.528	$24,368
Candler County	10,797	100.0%	100.0%	100.0%	44.424	$17,750
Carroll County	117,811	91.6%	100.0%	91.6%	236.058	$22,002
Catoosa County	66,550	99.1%	100.0%	99.1%	410.399	$23,834
Charlton County	12,715	59.9%	99.9%	59.9%	16.437	$18,693
Chatham County	290,501	95.6%	100.0%	95.6%	681.229	$27,204
Chattahoochee County	10,343	57.1%	100.0%	57.1%	41.582	$19,708
Chattooga County	24,770	96.5%	98.7%	95.9%	79.052	$17,381
Cherokee County	247,565	97.3%	100.0%	97.3%	587.101	$32,002
Clarke County	127,052	99.4%	100.0%	99.4%	1,065.869	$20,195
Clay County	2,962	62.6%	99.2%	62.6%	15.160	$13,533
Clayton County	285,141	98.4%	100.0%	98.4%	2,014.136	$18,728

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Clinch County	6,727	63.1%	100.0%	63.1%	8.406	$16,912
Cobb County	755,747	97.9%	100.0%	97.9%	2,225.736	$34,891
Coffee County	43,012	89.2%	100.0%	89.2%	74.791	$18,060
Colquitt County	45,832	87.7%	100.0%	87.7%	84.226	$17,477
Columbia County	151,547	98.3%	100.0%	98.3%	522.414	$31,004
Cook County	17,277	83.5%	100.0%	83.5%	76.056	$17,564
Coweta County	143,107	95.6%	100.0%	95.6%	324.585	$29,769
Crawford County	12,295	92.8%	100.0%	92.8%	37.844	$22,183
Crisp County	22,736	81.6%	100.0%	81.6%	83.409	$19,943
Dade County	16,285	90.9%	100.0%	90.9%	93.602	$21,997
Dawson County	24,379	79.6%	100.0%	79.6%	115.634	$29,958
DeKalb County	753,209	98.6%	100.0%	98.6%	2,814.873	$30,517
Decatur County	26,716	67.6%	100.0%	67.6%	44.740	$18,972
Dodge County	20,728	63.9%	100.0%	63.9%	41.800	$18,481
Dooly County	13,737	65.8%	100.0%	65.8%	35.049	$16,109
Dougherty County	89,502	97.1%	100.0%	97.1%	272.300	$20,403
Douglas County	143,876	97.3%	100.0%	97.3%	719.139	$24,471
Early County	10,296	38.3%	99.9%	38.2%	20.086	$17,338
Echols County	3,936	0.0%	100.0%	0.0%	9.487	$17,989
Effingham County	59,982	93.7%	100.0%	93.7%	125.564	$25,553
Elbert County	19,109	67.3%	99.2%	67.3%	54.433	$21,039
Emanuel County	22,530	94.1%	99.7%	93.8%	33.103	$16,681
Evans County	10,775	60.2%	100.0%	60.2%	58.927	$20,710
Fannin County	25,322	82.9%	97.6%	81.2%	65.478	$22,425
Fayette County	112,547	98.1%	100.0%	98.1%	579.118	$38,493
Floyd County	97,609	94.2%	100.0%	94.2%	191.424	$22,284
Forsyth County	227,952	99.1%	100.0%	99.1%	1,017.549	$37,686
Franklin County	22,817	59.9%	100.0%	59.9%	87.255	$18,642
Fulton County	1,041,348	96.4%	100.0%	96.4%	1,977.364	$39,101
Gilmer County	30,671	81.5%	98.1%	79.8%	71.907	$22,893
Glascock County	3,062	1.0%	97.7%	1.0%	21.302	$19,037
Glynn County	85,282	96.4%	100.0%	96.4%	203.172	$27,819
Gordon County	57,089	89.1%	100.0%	89.1%	160.449	$20,009
Grady County	24,819	80.7%	100.0%	80.7%	54.604	$17,764
Greene County	17,281	67.0%	99.6%	66.9%	44.604	$31,485
Gwinnett County	920,251	99.0%	100.0%	99.0%	2,138.213	$26,749
Habersham County	44,566	71.2%	100.0%	71.2%	161.040	$19,171
Hall County	199,326	97.8%	100.0%	97.8%	507.473	$24,099

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Hancock County	8,561	8.1%	99.3%	8.1%	18.144	$13,898
Haralson County	29,255	100.0%	99.9%	99.9%	103.680	$21,838
Harris County	33,913	88.7%	100.0%	88.7%	73.109	$30,703
Hart County	25,793	67.9%	100.0%	67.9%	110.988	$20,866
Heard County	11,730	58.0%	98.8%	58.0%	39.624	$20,494
Henry County	225,797	99.5%	100.0%	99.5%	700.957	$25,727
Houston County	153,477	97.7%	100.0%	97.7%	408.683	$25,289
Irwin County	9,409	57.1%	100.0%	57.1%	26.553	$18,514
Jackson County	67,506	80.3%	100.0%	80.3%	198.744	$23,982
Jasper County	13,964	60.5%	100.0%	60.5%	37.929	$20,685
Jeff Davis County	15,022	67.7%	100.0%	67.7%	45.419	$17,981
Jefferson County	15,648	8.9%	100.0%	8.9%	29.722	$16,986
Jenkins County	8,767	54.6%	99.4%	54.6%	25.245	$18,288
Johnson County	9,787	30.0%	98.8%	28.8%	32.299	$16,693
Jones County	28,470	83.9%	99.3%	83.2%	72.271	$26,602
Lamar County	18,599	70.3%	100.0%	70.3%	101.357	$19,143
Lanier County	10,425	82.6%	100.0%	82.6%	56.272	$17,403
Laurens County	47,330	60.2%	99.9%	60.2%	58.628	$19,826
Lee County	29,468	91.8%	100.0%	91.8%	82.826	$28,175
Liberty County	61,386	93.9%	100.0%	93.9%	125.328	$20,065
Lincoln County	7,880	100.0%	95.6%	95.6%	37.456	$23,582
Long County	19,005	82.4%	100.0%	82.4%	47.478	$19,176
Lowndes County	115,485	88.6%	100.0%	88.6%	232.802	$20,428
Lumpkin County	32,865	70.2%	99.8%	70.1%	116.158	$21,814
Macon County	13,314	62.9%	100.0%	62.9%	33.232	$14,039
Madison County	29,300	81.8%	100.0%	81.8%	103.786	$21,883
Marion County	8,450	64.4%	94.8%	61.0%	23.087	$17,522
McDuffie County	21,498	84.6%	100.0%	84.6%	83.500	$19,497
McIntosh County	14,106	97.3%	100.0%	97.3%	33.245	$23,826
Meriwether County	21,049	50.9%	100.0%	50.9%	41.995	$19,626
Miller County	5,838	11.9%	100.0%	11.9%	20.671	$21,093
Mitchell County	22,292	62.3%	100.0%	62.3%	43.532	$15,027
Monroe County	27,113	42.9%	100.0%	42.9%	68.526	$29,053
Montgomery County	9,031	32.5%	100.0%	32.5%	37.704	$19,131
Morgan County	18,409	42.7%	100.0%	42.7%	52.998	$26,298
Murray County	39,779	97.9%	99.9%	97.9%	115.480	$17,856
Muscogee County	194,058	98.6%	100.0%	98.6%	896.817	$23,747
Newton County	108,075	96.7%	100.0%	96.7%	397.099	$22,478
Oconee County	38,025	91.3%	100.0%	91.3%	206.333	$37,054

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Oglethorpe County	14,877	69.1%	99.6%	69.0%	33.887	$20,987
Paulding County	159,438	98.8%	100.0%	98.8%	510.661	$25,655
Peach County	27,096	83.4%	100.0%	83.4%	180.319	$20,746
Pickens County	31,585	88.8%	100.0%	88.8%	136.109	$28,637
Pierce County	19,307	73.1%	100.0%	73.1%	61.003	$23,470
Pike County	18,212	29.5%	100.0%	29.5%	84.281	$23,783
Polk County	42,085	96.9%	100.0%	96.9%	135.613	$21,582
Pulaski County	11,201	72.2%	100.0%	72.2%	44.978	$17,587
Putnam County	21,730	87.9%	100.0%	87.9%	63.051	$25,164
Quitman County	2,358	63.1%	99.5%	62.8%	15.591	$18,499
Rabun County	16,601	87.5%	100.0%	87.5%	44.868	$24,374
Randolph County	7,075	79.6%	99.5%	79.6%	16.521	$26,198
Richmond County	201,799	96.0%	100.0%	96.0%	622.211	$20,956
Rockdale County	90,309	98.3%	100.0%	98.3%	695.794	$23,003
Schley County	5,213	76.2%	100.0%	76.2%	31.233	$21,202
Screven County	13,953	98.5%	100.0%	98.5%	21.629	$19,801
Seminole County	8,292	74.8%	100.0%	74.8%	35.251	$21,484
Spalding County	65,378	95.7%	100.0%	95.7%	332.765	$19,899
Stephens County	25,890	89.7%	100.0%	89.7%	144.531	$20,125
Stewart County	5,984	56.2%	98.5%	56.2%	13.045	$13,883
Sumter County	29,847	73.1%	100.0%	73.1%	61.834	$18,487
Talbot County	6,249	83.2%	100.0%	83.2%	15.966	$20,366
Taliaferro County	1,628	91.1%	98.9%	90.0%	8.366	$15,469
Tattnall County	25,334	70.8%	100.0%	70.8%	52.845	$15,632
Taylor County	8,142	85.9%	99.6%	85.6%	21.615	$17,321
Telfair County	15,989	71.4%	100.0%	71.4%	36.563	$12,440
Terrell County	8,729	74.6%	99.9%	74.6%	26.023	$17,246
Thomas County	44,779	88.2%	100.0%	88.2%	82.224	$22,178
Tift County	40,598	86.5%	100.0%	86.5%	156.801	$20,642
Toombs County	26,999	44.2%	100.0%	44.2%	74.172	$20,309
Towns County	11,505	92.7%	99.7%	92.4%	69.073	$21,671
Treutlen County	6,740	12.8%	100.0%	12.8%	33.795	$21,307
Troup County	69,786	91.6%	100.0%	91.6%	168.570	$21,942
Turner County	7,961	72.6%	100.0%	72.6%	27.895	$17,149
Twiggs County	8,174	37.3%	99.9%	37.3%	22.807	$18,255
Union County	23,459	92.1%	99.6%	91.9%	72.871	$23,603
Upson County	26,135	92.4%	100.0%	92.4%	80.804	$19,511
Walker County	68,937	95.4%	99.8%	95.3%	154.436	$21,588
Walton County	91,597	89.5%	100.0%	89.5%	281.248	$24,141

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Ware County	35,871	82.5%	99.9%	82.5%	40.193	$18,396
Warren County	5,303	0.1%	99.7%	0.1%	18.653	$18,381
Washington County	20,313	67.1%	99.1%	66.9%	29.940	$18,662
Wayne County	29,817	79.3%	100.0%	79.3%	46.460	$18,663
Webster County	2,605	43.4%	99.3%	43.4%	12.457	$20,834
Wheeler County	7,952	43.3%	100.0%	43.3%	26.912	$9,688
White County	29,451	82.8%	99.9%	82.8%	122.363	$22,055
Whitfield County	104,658	100.0%	100.0%	100.0%	360.314	$21,158
Wilcox County	8,800	60.1%	99.8%	60.1%	23.299	$14,536
Wilkes County	9,892	100.0%	99.2%	99.2%	21.070	$19,129
Wilkinson County	8,959	54.9%	100.0%	54.9%	20.029	$19,173
Worth County	20,533	69.9%	99.9%	69.8%	35.979	$20,068
Hawaii	**1,427,538**	**96.1%**	**99.9%**	**96.1%**	**222.267**	**.**
Hawaii County	200,381	86.9%	99.8%	86.7%	49.742	$25,827
Honolulu County	988,650	98.8%	100.0%	98.8%	1,645.712	$32,194
Kalawao County	88	5.7%	87.5%	5.7%	7.339	$45,812
Kauai County	72,159	91.3%	99.8%	91.3%	116.394	$28,791
Maui County	166,260	93.2%	99.7%	93.2%	143.140	$30,599
Idaho	**1,716,792**	**85.3%**	**99.3%**	**85.1%**	**20.774**	**.**
Ada County	456,812	96.9%	100.0%	96.9%	433.994	$30,086
Adams County	4,145	34.5%	96.2%	34.5%	3.041	$22,741
Bannock County	85,265	90.0%	100.0%	90.0%	76.678	$22,885
Bear Lake County	6,028	80.9%	97.3%	80.7%	6.184	$22,985
Benewah County	9,184	27.3%	84.8%	26.4%	11.826	$22,055
Bingham County	45,921	75.0%	99.9%	75.0%	21.930	$20,199
Blaine County	22,024	81.8%	98.1%	80.3%	8.331	$34,330
Boise County	7,290	29.3%	71.3%	22.7%	3.838	$28,273
Bonner County	43,557	98.9%	99.6%	98.6%	25.111	$24,507
Bonneville County	114,578	90.2%	99.6%	89.9%	61.400	$24,889
Boundary County	11,922	94.6%	94.9%	90.5%	9.398	$22,822
Butte County	2,599	46.8%	98.0%	46.0%	1.165	$25,209
Camas County	1,102	0.0%	98.6%	0.0%	1.026	$26,544
Canyon County	216,668	90.9%	100.0%	90.9%	368.878	$18,639
Caribou County	7,034	69.5%	97.8%	68.4%	3.987	$25,146
Cassia County	23,662	75.8%	99.9%	75.8%	9.225	$18,785
Clark County	873	93.0%	98.5%	93.0%	0.495	$14,622
Clearwater County	8,546	0.0%	91.0%	0.0%	3.478	$21,316
Custer County	4,172	59.4%	86.9%	50.1%	0.848	$23,624

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Elmore County	26,822	77.6%	99.6%	77.6%	8.723	$22,045
Franklin County	13,563	57.0%	98.4%	56.4%	20.437	$19,985
Fremont County	13,093	43.9%	100.0%	43.9%	7.026	$21,196
Gem County	17,377	83.2%	99.9%	83.2%	30.981	$18,745
Gooding County	15,124	54.7%	100.0%	54.7%	20.747	$20,418
Idaho County	16,369	0.9%	94.0%	0.9%	1.931	$19,524
Jefferson County	28,430	64.6%	100.0%	64.6%	25.999	$20,750
Jerome County	23,619	64.3%	100.0%	64.3%	39.551	$18,214
Kootenai County	157,632	99.1%	99.7%	99.0%	126.701	$26,514
Latah County	39,333	79.8%	95.6%	77.6%	36.555	$22,717
Lemhi County	7,875	35.1%	93.8%	34.8%	1.726	$21,953
Lewis County	3,887	21.5%	99.8%	21.5%	8.118	$22,589
Lincoln County	5,317	32.6%	100.0%	32.6%	4.426	$18,239
Madison County	39,140	79.8%	100.0%	79.8%	83.418	$15,103
Minidoka County	20,729	63.4%	100.0%	63.4%	27.362	$22,103
Nez Perce County	40,383	84.3%	98.7%	84.1%	47.616	$25,179
Oneida County	4,427	81.6%	99.7%	81.3%	3.689	$19,073
Owyhee County	11,628	46.6%	99.0%	46.6%	1.517	$18,135
Payette County	23,212	87.1%	100.0%	87.1%	57.051	$21,700
Power County	7,600	81.0%	100.0%	81.0%	5.412	$20,431
Shoshone County	12,542	57.6%	95.5%	56.6%	4.769	$21,875
Teton County	11,381	84.7%	100.0%	84.7%	25.322	$29,251
Twin Falls County	85,119	83.0%	99.9%	83.0%	44.305	$21,682
Valley County	10,687	71.0%	99.4%	71.0%	2.916	$28,133
Washington County	10,121	73.3%	99.9%	73.3%	6.966	$19,559
Illinois	**12,801,838**	**94.7%**	**100.0%**	**94.7%**	**230.585**	**.**
Adams County	66,234	88.3%	100.0%	88.3%	77.448	$26,053
Alexander County	6,315	0.3%	99.5%	0.3%	26.814	$16,067
Bond County	16,946	42.5%	100.0%	42.5%	44.562	$23,660
Boone County	53,513	96.3%	100.0%	96.3%	190.628	$27,825
Brown County	6,716	46.8%	99.6%	46.8%	21.976	$21,822
Bureau County	33,243	69.0%	100.0%	69.0%	38.253	$27,332
Calhoun County	4,833	0.6%	95.6%	0.6%	19.041	$25,341
Carroll County	14,518	74.8%	100.0%	74.8%	32.639	$27,325
Cass County	12,505	78.2%	99.9%	78.2%	33.274	$25,010
Champaign County	209,389	92.1%	100.0%	92.1%	210.174	$27,373
Christian County	33,102	85.3%	100.0%	85.3%	46.663	$23,823

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Clark County	15,767	70.7%	99.9%	70.7%	31.445	$25,806
Clay County	13,269	86.1%	100.0%	86.1%	28.333	$23,843
Clinton County	37,614	71.9%	100.0%	71.9%	79.340	$29,512
Coles County	51,979	83.7%	100.0%	83.7%	102.262	$23,944
Cook County	5,211,243	99.3%	100.0%	99.3%	5,512.640	$32,179
Crawford County	18,961	66.5%	100.0%	66.5%	42.741	$26,245
Cumberland County	10,907	44.0%	100.0%	44.0%	31.521	$22,786
De Witt County	15,942	72.7%	100.0%	72.7%	40.104	$28,294
DeKalb County	104,731	97.1%	100.0%	97.1%	165.896	$25,172
Douglas County	19,747	74.6%	100.0%	74.6%	47.393	$26,309
DuPage County	930,125	99.6%	100.0%	99.6%	2,840.085	$40,547
Edgar County	17,328	88.3%	100.0%	88.3%	27.797	$25,122
Edwards County	6,486	67.4%	100.0%	67.4%	29.162	$25,235
Effingham County	34,132	66.5%	100.0%	66.5%	71.290	$27,680
Fayette County	21,784	50.7%	100.0%	50.7%	30.404	$21,665
Ford County	13,280	64.5%	100.0%	64.5%	27.347	$25,524
Franklin County	39,039	77.9%	100.0%	77.9%	95.476	$22,119
Fulton County	35,110	67.0%	100.0%	67.0%	40.562	$22,969
Gallatin County	5,080	67.1%	100.0%	67.1%	15.724	$23,109
Greene County	13,173	53.5%	99.8%	53.5%	24.259	$21,916
Grundy County	50,577	100.0%	100.0%	100.0%	120.985	$30,232
Hamilton County	8,189	60.1%	100.0%	60.1%	18.840	$24,309
Hancock County	18,020	72.9%	100.0%	72.9%	22.703	$25,647
Hardin County	4,046	100.0%	97.3%	97.3%	22.791	$21,573
Henderson County	6,795	40.8%	99.6%	40.4%	17.935	$26,504
Henry County	49,328	86.5%	100.0%	86.5%	59.938	$27,777
Iroquois County	27,876	46.2%	100.0%	46.2%	24.949	$25,562
Jackson County	58,284	90.8%	99.9%	90.8%	99.787	$21,948
Jasper County	9,578	30.6%	100.0%	30.6%	19.369	$25,811
Jefferson County	38,179	58.5%	100.0%	58.5%	66.844	$23,054
Jersey County	21,941	53.1%	98.9%	53.1%	59.417	$26,346
Jo Daviess County	21,594	74.0%	100.0%	74.0%	35.925	$29,892
Johnson County	12,900	13.3%	99.9%	13.2%	37.509	$20,928
Kane County	534,643	98.8%	100.0%	98.8%	1,028.045	$31,774
Kankakee County	109,605	94.9%	100.0%	94.9%	162.004	$25,111
Kendall County	126,204	98.8%	100.0%	98.8%	393.975	$31,920
Knox County	50,638	89.3%	100.0%	89.3%	70.684	$22,939
LaSalle County	110,067	97.1%	100.0%	97.1%	96.965	$26,228

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Lake County	703,514	100.0%	100.0%	100.0%	1,585.670	$40,655
Lawrence County	16,168	55.2%	100.0%	55.2%	43.442	$16,417
Lee County	34,404	65.0%	100.0%	65.0%	47.461	$27,021
Livingston County	36,518	81.6%	100.0%	81.6%	34.969	$26,777
Logan County	29,245	78.4%	100.0%	78.4%	47.318	$23,410
Macon County	105,801	92.0%	100.0%	92.0%	182.199	$27,010
Macoupin County	45,446	72.6%	100.0%	72.6%	52.666	$26,779
Madison County	265,428	97.7%	100.0%	97.7%	370.926	$29,100
Marion County	37,902	74.4%	100.0%	74.4%	66.220	$23,366
Marshall County	11,730	66.1%	100.0%	66.1%	30.327	$28,279
Mason County	13,714	64.8%	100.0%	64.8%	25.432	$25,166
Massac County	14,344	60.7%	100.0%	60.7%	60.468	$23,673
McDonough County	30,823	95.9%	100.0%	95.9%	52.295	$22,387
McHenry County	309,090	99.8%	100.0%	99.8%	512.441	$34,589
McLean County	172,290	89.3%	100.0%	89.3%	145.592	$31,752
Menard County	12,245	53.5%	100.0%	53.5%	38.943	$31,323
Mercer County	15,618	59.8%	100.0%	59.8%	27.830	$27,566
Monroe County	34,097	91.9%	99.8%	91.8%	88.561	$35,699
Montgomery County	28,790	69.1%	100.0%	69.1%	40.913	$21,072
Morgan County	33,798	68.9%	100.0%	68.9%	59.421	$25,201
Moultrie County	14,688	69.0%	100.0%	69.0%	43.722	$25,351
Ogle County	51,063	77.4%	100.0%	77.4%	67.314	$28,026
Peoria County	183,011	94.4%	100.0%	94.4%	295.556	$29,055
Perry County	21,285	82.5%	100.0%	82.5%	48.182	$22,650
Piatt County	16,445	72.9%	100.0%	72.9%	37.443	$33,197
Pike County	15,821	47.1%	100.0%	47.1%	19.030	$22,048
Pope County	4,325	77.4%	100.0%	77.4%	11.728	$21,427
Pulaski County	5,509	28.8%	100.0%	28.8%	27.658	$18,924
Putnam County	5,726	54.8%	100.0%	54.8%	35.752	$32,584
Randolph County	32,423	85.3%	100.0%	85.3%	56.339	$23,424
Richland County	15,901	75.5%	100.0%	75.5%	44.171	$23,972
Rock Island County	144,807	96.6%	100.0%	96.6%	338.622	$26,893
Saline County	24,102	74.9%	100.0%	74.9%	63.457	$21,917
Sangamon County	196,452	90.6%	100.0%	90.6%	226.248	$31,904
Schuyler County	7,034	54.2%	99.2%	53.7%	16.086	$24,323
Scott County	5,002	50.4%	100.0%	50.4%	19.935	$25,568
Shelby County	21,719	49.9%	100.0%	49.9%	28.633	$23,974
St. Clair County	262,479	98.6%	100.0%	98.6%	399.050	$27,683

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Stark County	5,434	58.0%	100.0%	58.0%	18.863	$28,545
Stephenson County	45,054	81.4%	100.0%	81.4%	79.809	$24,529
Tazewell County	133,526	92.5%	100.0%	92.5%	205.749	$30,700
Union County	17,000	55.4%	100.0%	55.4%	41.117	$24,296
Vermilion County	77,909	87.6%	100.0%	87.6%	86.723	$22,733
Wabash County	11,489	66.0%	100.0%	66.0%	51.462	$24,697
Warren County	17,167	69.5%	100.0%	69.5%	31.650	$23,350
Washington County	14,030	47.1%	100.0%	47.1%	24.939	$29,548
Wayne County	16,495	79.8%	100.0%	79.8%	23.108	$24,342
White County	13,938	68.0%	100.0%	68.0%	28.171	$25,065
Whiteside County	56,118	82.9%	100.0%	82.9%	82.014	$26,155
Will County	692,614	99.7%	100.0%	99.7%	827.587	$32,311
Williamson County	67,328	84.1%	100.0%	84.1%	160.248	$25,238
Winnebago County	284,778	96.5%	100.0%	96.5%	554.731	$26,187
Woodford County	38,726	83.5%	100.0%	83.5%	73.373	$32,360
Indiana	**6,666,478**	**89.9%**	**100.0%**	**89.9%**	**186.079**	**.**
Adams County	35,485	93.4%	100.0%	93.4%	104.667	$21,173
Allen County	372,855	96.0%	100.0%	96.0%	567.245	$26,058
Bartholomew County	82,036	88.3%	100.0%	88.3%	201.608	$28,631
Benton County	8,613	17.4%	100.0%	17.4%	21.192	$23,181
Blackford County	11,976	83.5%	100.0%	83.5%	72.547	$21,980
Boone County	65,865	79.9%	100.0%	79.9%	155.741	$40,487
Brown County	15,035	74.7%	100.0%	74.7%	48.192	$30,279
Carroll County	20,039	62.6%	100.0%	62.6%	53.836	$25,647
Cass County	37,993	83.7%	100.0%	83.7%	92.181	$22,625
Clark County	116,965	94.8%	100.0%	94.8%	313.701	$25,693
Clay County	26,198	75.9%	100.0%	75.9%	73.273	$22,913
Clinton County	32,317	69.9%	100.0%	69.9%	79.781	$23,260
Crawford County	10,566	0.1%	99.5%	0.1%	34.570	$19,756
Daviess County	33,113	63.5%	100.0%	63.5%	77.099	$21,472
DeKalb County	42,832	80.7%	100.0%	80.7%	118.052	$25,132
Dearborn County	49,741	92.4%	99.9%	92.4%	163.067	$28,471
Decatur County	26,732	62.6%	100.0%	62.6%	71.751	$24,175
Delaware County	115,184	92.1%	100.0%	92.1%	293.744	$21,566
Dubois County	42,558	69.4%	100.0%	69.4%	99.605	$27,331
Elkhart County	205,024	94.6%	100.0%	94.6%	442.654	$22,387
Fayette County	23,209	76.6%	100.0%	76.6%	107.942	$21,716
Floyd County	77,070	97.7%	100.0%	97.7%	520.973	$29,350

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Fountain County	16,505	74.7%	100.0%	74.7%	41.716	$25,086
Franklin County	22,619	37.4%	100.0%	37.4%	58.838	$24,748
Fulton County	20,059	100.0%	100.0%	100.0%	54.451	$23,507
Gibson County	33,576	71.3%	100.0%	71.3%	68.876	$25,990
Grant County	66,491	81.4%	100.0%	81.4%	160.578	$20,348
Greene County	32,177	78.9%	100.0%	78.9%	59.313	$23,189
Hamilton County	323,677	95.6%	100.0%	95.6%	820.958	$42,361
Hancock County	74,955	98.9%	100.0%	98.9%	244.938	$30,011
Harrison County	39,898	79.7%	100.0%	79.7%	82.346	$25,319
Hendricks County	163,652	94.4%	100.0%	94.4%	402.181	$31,335
Henry County	48,476	92.1%	100.0%	92.1%	123.702	$22,182
Howard County	82,363	91.4%	100.0%	91.4%	281.048	$25,507
Huntington County	36,337	77.9%	100.0%	77.9%	94.961	$23,396
Jackson County	43,884	76.7%	100.0%	76.7%	86.163	$23,098
Jasper County	33,444	81.5%	100.0%	81.5%	59.761	$24,839
Jay County	20,945	82.1%	100.0%	82.1%	54.558	$20,234
Jefferson County	32,089	68.5%	100.0%	68.5%	88.980	$23,006
Jennings County	27,626	65.3%	100.0%	65.3%	73.360	$22,374
Johnson County	153,884	95.0%	100.0%	95.0%	480.246	$29,877
Knox County	37,508	86.1%	100.0%	86.1%	72.686	$22,976
Kosciusko County	79,206	98.4%	100.0%	98.4%	149.057	$26,854
LaGrange County	39,301	49.0%	100.0%	49.0%	103.526	$21,774
LaPorte County	110,029	99.7%	100.0%	99.7%	183.903	$24,340
Lake County	485,640	99.6%	100.0%	99.6%	973.302	$25,483
Lawrence County	45,666	78.9%	100.0%	78.9%	101.668	$23,743
Madison County	129,498	88.8%	100.0%	88.8%	286.554	$22,997
Marion County	950,029	98.3%	100.0%	98.3%	2,397.257	$25,208
Marshall County	46,498	100.0%	100.0%	100.0%	104.813	$23,372
Martin County	10,215	59.5%	100.0%	59.5%	30.426	$23,913
Miami County	35,845	72.8%	100.0%	72.8%	95.883	$21,940
Monroe County	146,982	94.0%	100.0%	94.0%	372.570	$25,488
Montgomery County	38,520	61.7%	100.0%	61.7%	76.336	$24,095
Morgan County	69,711	87.8%	100.0%	87.8%	172.565	$26,556
Newton County	14,125	87.2%	100.0%	87.2%	35.158	$24,061
Noble County	47,452	71.5%	100.0%	71.5%	115.499	$23,792
Ohio County	5,828	65.8%	99.5%	65.8%	67.657	$25,278
Orange County	19,426	79.6%	99.9%	79.6%	48.762	$21,295
Owen County	20,838	78.1%	100.0%	78.1%	54.084	$22,675

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Parke County	16,885	72.3%	99.8%	72.3%	37.973	$22,247
Perry County	19,081	88.7%	99.9%	88.6%	49.986	$21,634
Pike County	12,365	57.8%	100.0%	57.8%	36.995	$24,367
Porter County	168,402	99.3%	100.0%	99.3%	402.728	$30,615
Posey County	25,593	67.7%	100.0%	67.7%	62.487	$30,396
Pulaski County	12,534	77.6%	100.0%	77.6%	28.904	$23,958
Putnam County	37,699	73.3%	100.0%	73.3%	78.453	$23,040
Randolph County	24,922	66.3%	100.0%	66.3%	55.091	$22,817
Ripley County	28,442	54.3%	100.0%	54.3%	63.711	$23,980
Rush County	16,645	53.0%	100.0%	53.0%	40.784	$24,267
Scott County	23,867	78.4%	100.0%	78.4%	125.354	$23,103
Shelby County	44,395	74.9%	100.0%	74.9%	107.978	$25,478
Spencer County	20,394	48.8%	100.0%	48.8%	51.403	$25,914
St. Joseph County	270,434	100.0%	100.0%	100.0%	590.660	$24,748
Starke County	22,893	96.2%	100.0%	96.2%	74.055	$21,343
Steuben County	34,477	74.1%	100.0%	74.1%	111.598	$25,497
Sullivan County	20,746	56.0%	100.0%	56.0%	46.397	$20,219
Switzerland County	10,694	38.2%	100.0%	38.2%	48.470	$20,698
Tippecanoe County	190,565	89.5%	100.0%	89.5%	381.278	$24,221
Tipton County	15,128	79.1%	100.0%	79.1%	58.064	$27,556
Union County	7,200	48.1%	100.0%	48.1%	44.658	$22,918
Vanderburgh County	181,615	98.5%	100.0%	98.5%	777.877	$25,666
Vermillion County	15,505	95.6%	100.0%	95.6%	60.359	$22,932
Vigo County	107,516	93.9%	100.0%	93.9%	266.582	$22,079
Wabash County	31,443	70.1%	100.0%	70.1%	76.238	$23,745
Warren County	8,201	31.7%	100.0%	31.7%	22.488	$28,690
Warrick County	62,530	82.4%	100.0%	82.4%	162.493	$31,021
Washington County	27,827	90.3%	100.0%	90.3%	54.167	$22,096
Wayne County	66,185	85.7%	100.0%	85.7%	164.746	$22,227
Wells County	27,981	71.7%	100.0%	71.7%	76.017	$24,544
White County	24,181	84.6%	100.0%	84.6%	47.871	$25,859
Whitley County	33,753	70.8%	100.0%	70.8%	100.584	$27,062
Iowa	**3,145,498**	**90.7%**	**99.9%**	**90.6%**	**56.313**	**.**
Adair County	7,054	79.3%	100.0%	79.3%	12.391	$27,358
Adams County	3,686	61.2%	100.0%	61.2%	8.705	$26,991
Allamakee County	13,882	77.0%	96.7%	76.1%	21.722	$27,027
Appanoose County	12,352	75.5%	97.2%	74.4%	24.839	$23,617

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Audubon County	5,578	72.9%	100.0%	72.9%	12.593	$30,085
Benton County	25,642	79.2%	100.0%	79.2%	35.800	$30,888
Black Hawk County	132,648	99.4%	100.0%	99.4%	234.456	$26,571
Boone County	26,484	96.4%	100.0%	96.4%	46.336	$28,412
Bremer County	24,908	99.8%	100.0%	99.8%	57.197	$31,001
Buchanan County	21,195	69.3%	100.0%	69.3%	37.118	$30,216
Buena Vista County	20,110	76.2%	100.0%	76.2%	34.979	$25,035
Butler County	14,606	83.5%	100.0%	83.5%	25.177	$27,085
Calhoun County	9,738	78.1%	100.0%	78.1%	17.085	$26,210
Carroll County	20,320	94.3%	100.0%	94.3%	35.684	$28,307
Cass County	13,145	92.8%	100.0%	92.8%	23.296	$26,411
Cedar County	18,542	84.6%	100.0%	84.6%	32.000	$29,271
Cerro Gordo County	43,006	100.0%	100.0%	100.0%	75.673	$28,763
Cherokee County	11,316	73.3%	100.0%	73.3%	19.615	$28,783
Chickasaw County	12,005	100.0%	100.0%	100.0%	23.801	$26,915
Clarke County	9,369	81.3%	99.6%	81.2%	21.729	$23,742
Clay County	16,170	85.1%	100.0%	85.1%	28.507	$27,883
Clayton County	17,637	72.8%	98.6%	72.1%	22.654	$26,960
Clinton County	47,010	94.7%	100.0%	94.7%	67.649	$27,116
Crawford County	17,048	68.1%	100.0%	68.1%	23.870	$26,693
Dallas County	87,210	90.8%	100.0%	90.7%	148.204	$40,468
Davis County	8,966	77.4%	93.7%	74.0%	17.854	$24,405
Decatur County	7,950	85.6%	100.0%	85.6%	14.947	$20,808
Delaware County	17,153	91.4%	98.9%	90.5%	29.689	$29,978
Des Moines County	39,417	95.1%	100.0%	95.1%	94.724	$25,151
Dickinson County	17,199	93.9%	100.0%	93.9%	45.188	$36,042
Dubuque County	97,040	98.6%	100.0%	98.6%	159.525	$28,526
Emmet County	9,432	99.2%	100.0%	99.2%	23.825	$27,807
Fayette County	19,796	88.8%	99.6%	88.4%	27.088	$26,002
Floyd County	15,744	100.0%	100.0%	100.0%	31.448	$26,929
Franklin County	10,164	95.3%	100.0%	95.3%	17.465	$24,909
Fremont County	6,948	66.2%	100.0%	66.2%	13.593	$29,553
Greene County	8,981	94.4%	100.0%	94.4%	15.768	$26,103
Grundy County	12,332	78.7%	100.0%	78.7%	24.573	$32,953
Guthrie County	10,669	83.5%	100.0%	83.5%	18.064	$29,938
Hamilton County	15,115	84.4%	100.0%	84.4%	26.207	$28,076
Hancock County	10,771	94.7%	100.0%	94.7%	18.863	$27,732
Hardin County	17,048	89.6%	100.0%	89.5%	29.945	$27,657
Harrison County	14,136	68.0%	100.0%	68.0%	20.286	$27,984

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Henry County	19,861	90.8%	99.9%	90.7%	45.728	$24,380
Howard County	9,228	100.0%	99.1%	99.1%	19.499	$25,567
Humboldt County	9,561	72.2%	100.0%	72.2%	22.012	$28,654
Ida County	6,865	34.5%	100.0%	34.5%	15.909	$29,750
Iowa County	16,103	77.3%	99.8%	77.2%	27.458	$28,640
Jackson County	19,366	85.0%	99.9%	85.0%	30.448	$25,865
Jasper County	36,962	86.7%	100.0%	86.7%	50.604	$26,507
Jefferson County	18,421	99.9%	99.6%	99.5%	42.298	$25,120
Johnson County	149,165	93.8%	100.0%	93.8%	242.924	$31,981
Jones County	20,534	90.9%	99.8%	90.8%	35.673	$27,891
Keokuk County	10,153	64.9%	99.2%	64.3%	17.530	$24,650
Kossuth County	14,999	73.8%	100.0%	73.8%	15.420	$29,086
Lee County	34,295	91.4%	100.0%	91.4%	66.268	$23,470
Linn County	224,101	97.1%	100.0%	97.1%	312.606	$31,854
Louisa County	11,184	70.3%	100.0%	70.3%	27.837	$26,093
Lucas County	8,534	69.1%	98.3%	68.4%	19.819	$26,119
Lyon County	11,790	84.7%	100.0%	84.7%	20.063	$27,874
Madison County	16,007	80.7%	99.9%	80.6%	28.533	$29,430
Mahaska County	22,235	78.0%	100.0%	78.0%	38.950	$25,823
Marion County	33,105	87.8%	99.2%	87.4%	59.699	$27,020
Marshall County	40,288	98.2%	100.0%	98.2%	70.372	$25,197
Mills County	15,068	73.0%	100.0%	73.0%	34.446	$29,492
Mitchell County	10,631	100.0%	100.0%	100.0%	22.661	$25,990
Monona County	8,740	57.5%	100.0%	57.5%	12.592	$26,394
Monroe County	7,845	73.0%	96.3%	71.3%	18.088	$25,233
Montgomery County	10,137	90.3%	100.0%	90.3%	23.903	$23,626
Muscatine County	42,880	88.8%	100.0%	88.8%	98.018	$27,029
O'Brien County	13,801	86.6%	100.0%	86.6%	24.084	$30,933
Osceola County	6,045	81.3%	100.0%	81.3%	15.162	$25,936
Page County	15,224	86.5%	100.0%	86.5%	28.459	$25,461
Palo Alto County	9,092	59.3%	100.0%	59.3%	16.125	$26,776
Plymouth County	25,220	67.7%	100.0%	67.7%	29.227	$28,975
Pocahontas County	6,846	68.0%	100.0%	68.0%	11.860	$27,599
Polk County	481,778	97.1%	100.0%	97.1%	839.635	$32,232
Pottawattamie County	93,386	88.1%	100.0%	88.1%	98.272	$27,948
Poweshiek County	18,314	72.6%	100.0%	72.6%	31.310	$26,583
Ringgold County	5,034	58.0%	100.0%	58.0%	9.401	$26,175

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Sac County	9,817	50.1%	100.0%	50.1%	17.073	$27,088
Scott County	172,509	96.4%	100.0%	96.4%	376.584	$30,037
Shelby County	11,628	92.0%	100.0%	92.0%	19.682	$28,178
Sioux County	34,860	81.6%	100.0%	81.6%	45.371	$27,037
Story County	97,494	94.2%	100.0%	94.2%	170.201	$26,032
Tama County	17,058	80.8%	100.0%	80.8%	23.658	$26,144
Taylor County	6,178	67.6%	100.0%	67.6%	11.615	$26,188
Union County	12,450	86.8%	100.0%	86.8%	29.388	$25,140
Van Buren County	7,157	79.1%	93.9%	73.8%	14.763	$23,765
Wapello County	35,044	88.3%	99.4%	88.3%	81.152	$23,116
Warren County	50,153	88.7%	99.1%	88.0%	88.014	$31,525
Washington County	22,281	88.4%	99.7%	88.2%	39.170	$27,933
Wayne County	6,474	86.0%	100.0%	86.0%	12.321	$22,461
Webster County	36,605	94.2%	99.9%	94.0%	51.152	$23,921
Winnebago County	10,587	98.7%	100.0%	98.7%	26.435	$25,917
Winneshiek County	20,201	89.3%	99.1%	89.2%	29.282	$27,240
Woodbury County	102,429	89.5%	100.0%	89.5%	117.352	$24,469
Worth County	7,469	100.0%	100.0%	100.0%	18.667	$25,661
Wright County	12,784	83.5%	100.0%	83.5%	22.025	$27,111
Kansas	**2,912,953**	**91.2%**	**100.0%**	**91.2%**	**35.629**	**.**
Allen County	12,519	95.7%	100.0%	95.7%	25.023	$21,577
Anderson County	7,833	97.9%	100.0%	97.9%	13.513	$21,851
Atchison County	16,332	76.9%	100.0%	76.9%	37.878	$23,151
Barber County	4,586	81.1%	100.0%	81.1%	4.044	$26,040
Barton County	26,476	89.9%	100.0%	89.9%	29.569	$25,474
Bourbon County	14,751	88.9%	99.5%	88.3%	23.213	$21,158
Brown County	9,641	71.8%	100.0%	71.8%	16.888	$23,247
Butler County	66,878	72.0%	100.0%	72.0%	46.772	$27,888
Chase County	2,682	13.0%	100.0%	13.0%	3.469	$24,353
Chautauqua County	3,363	18.1%	96.3%	18.1%	5.264	$23,398
Cherokee County	20,115	84.8%	100.0%	84.8%	34.234	$20,371
Cheyenne County	2,683	1.8%	100.0%	1.8%	2.631	$27,608
Clark County	2,004	0.5%	100.0%	0.5%	2.056	$24,322
Clay County	7,958	92.1%	100.0%	92.1%	12.332	$27,715
Cloud County	8,991	93.6%	100.0%	93.6%	12.569	$24,677
Coffey County	8,224	99.5%	100.0%	99.5%	13.118	$30,242

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Comanche County	1,790	52.0%	100.0%	52.0%	2.271	$24,574
Cowley County	35,361	84.5%	100.0%	84.5%	31.411	$22,249
Crawford County	39,034	93.1%	100.0%	93.1%	66.187	$20,642
Decatur County	2,884	16.9%	99.8%	16.9%	3.228	$29,729
Dickinson County	18,902	61.6%	100.0%	61.6%	22.315	$24,454
Doniphan County	7,727	81.7%	100.0%	81.7%	19.641	$23,986
Douglas County	120,777	100.0%	100.0%	100.0%	264.937	$28,302
Edwards County	2,893	69.9%	100.0%	69.9%	4.652	$26,567
Elk County	2,498	58.9%	99.7%	58.9%	3.877	$22,040
Ellis County	28,689	97.7%	100.0%	97.7%	31.880	$27,103
Ellsworth County	6,330	63.7%	100.0%	63.7%	8.843	$23,851
Finney County	37,079	99.3%	100.0%	99.3%	28.479	$22,551
Ford County	34,377	79.6%	100.0%	79.6%	31.301	$20,749
Franklin County	25,732	100.0%	100.0%	100.0%	45.005	$24,597
Geary County	33,855	81.8%	100.0%	81.8%	88.022	$21,309
Gove County	2,631	72.4%	100.0%	72.4%	2.455	$26,746
Graham County	2,495	98.6%	100.0%	98.6%	2.777	$27,569
Grant County	7,526	100.0%	100.0%	100.0%	13.093	$24,173
Gray County	5,958	7.0%	100.0%	7.0%	6.857	$26,536
Greeley County	1,249	92.1%	100.0%	92.1%	1.604	$26,040
Greenwood County	6,123	65.6%	99.9%	65.6%	5.356	$23,972
Hamilton County	2,637	100.0%	100.0%	100.0%	2.646	$21,863
Harper County	5,590	47.7%	99.9%	47.6%	6.976	$25,944
Harvey County	34,544	84.5%	100.0%	84.5%	63.999	$25,320
Haskell County	4,049	98.4%	100.0%	98.4%	7.011	$22,886
Hodgeman County	1,842	40.7%	100.0%	40.7%	2.142	$33,661
Jackson County	13,316	62.0%	100.0%	62.0%	20.292	$26,027
Jefferson County	18,997	97.0%	100.0%	97.0%	35.670	$26,328
Jewell County	2,850	89.5%	100.0%	89.5%	3.133	$23,282
Johnson County	591,143	100.0%	100.0%	100.0%	1,248.785	$41,415
Kearny County	3,959	100.0%	100.0%	100.0%	4.548	$23,213
Kingman County	7,360	48.9%	100.0%	48.9%	8.525	$28,911
Kiowa County	2,485	0.1%	99.4%	0.1%	3.439	$24,895
Labette County	20,145	65.8%	100.0%	65.8%	31.218	$21,648
Lane County	1,559	98.0%	100.0%	98.0%	2.173	$31,329
Leavenworth County	81,085	100.0%	100.0%	100.0%	175.194	$28,743
Lincoln County	3,043	34.1%	100.0%	34.1%	4.230	$25,070
Linn County	9,725	100.0%	100.0%	100.0%	16.370	$27,368

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Logan County	2,821	89.4%	100.0%	89.4%	2.629	$27,837
Lyon County	33,392	97.9%	100.0%	97.9%	39.402	$23,317
Marion County	11,986	51.6%	100.0%	51.6%	12.693	$24,234
Marshall County	9,745	43.6%	100.0%	43.6%	10.826	$26,978
McPherson County	28,708	74.9%	100.0%	74.9%	31.959	$28,722
Meade County	4,303	0.0%	100.0%	0.0%	4.399	$24,253
Miami County	33,451	100.0%	100.0%	100.0%	58.109	$30,184
Mitchell County	6,128	96.5%	100.0%	96.5%	8.732	$27,432
Montgomery County	32,556	87.4%	100.0%	87.4%	50.590	$22,181
Morris County	5,455	96.4%	100.0%	96.4%	7.846	$25,135
Morton County	2,740	100.0%	100.0%	100.0%	3.755	$23,115
Nemaha County	10,118	63.4%	100.0%	63.3%	14.103	$26,208
Neosho County	16,015	83.0%	100.0%	83.0%	28.024	$22,759
Ness County	2,869	73.2%	100.0%	73.2%	2.669	$28,184
Norton County	5,441	87.2%	100.0%	87.2%	6.196	$23,039
Osage County	15,772	100.0%	100.0%	100.0%	22.355	$25,880
Osborne County	3,610	97.8%	100.0%	97.8%	4.045	$27,824
Ottawa County	5,863	53.0%	100.0%	53.0%	8.135	$26,749
Pawnee County	6,680	71.4%	100.0%	71.4%	8.856	$25,193
Phillips County	5,370	70.1%	100.0%	70.1%	6.062	$25,364
Pottawatomie County	23,905	94.4%	100.0%	94.4%	28.424	$27,199
Pratt County	9,547	75.3%	100.0%	75.3%	12.988	$25,745
Rawlins County	2,497	46.5%	99.8%	46.3%	2.335	$27,250
Reno County	62,510	80.1%	100.0%	80.1%	49.795	$24,313
Republic County	4,691	68.2%	100.0%	68.2%	6.539	$26,029
Rice County	9,660	75.8%	100.0%	75.8%	13.301	$22,596
Riley County	74,150	87.0%	100.0%	87.0%	121.603	$25,087
Rooks County	5,043	86.3%	100.0%	86.3%	5.663	$24,919
Rush County	3,099	79.5%	100.0%	79.5%	4.318	$25,002
Russell County	6,915	98.7%	100.0%	98.7%	7.802	$24,181
Saline County	54,734	86.6%	100.0%	86.6%	75.996	$26,477
Scott County	4,961	100.0%	100.0%	100.0%	6.914	$31,280
Sedgwick County	513,671	94.5%	100.0%	94.5%	514.952	$26,672
Seward County	22,159	58.4%	100.0%	58.4%	34.651	$20,844
Shawnee County	178,184	100.0%	100.0%	100.0%	327.534	$27,534
Sheridan County	2,527	76.1%	100.0%	76.1%	2.820	$29,604
Sherman County	5,930	85.5%	100.0%	85.5%	5.615	$24,494
Smith County	3,666	84.8%	100.0%	84.8%	4.094	$27,870
Stafford County	4,207	29.0%	100.0%	29.0%	5.312	$25,046

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Stanton County	2,059	100.0%	100.0%	100.0%	3.026	$22,383
Stevens County	5,612	98.8%	100.0%	98.8%	7.716	$23,579
Sumner County	23,159	100.0%	100.0%	100.0%	19.594	$24,764
Thomas County	7,788	90.2%	100.0%	90.2%	7.247	$26,241
Trego County	2,884	86.4%	100.0%	86.4%	3.242	$29,651
Wabaunsee County	6,874	65.8%	100.0%	65.8%	8.654	$25,194
Wallace County	1,521	47.5%	99.7%	47.4%	1.665	$28,875
Washington County	5,485	55.5%	100.0%	55.5%	6.130	$24,241
Wichita County	2,124	95.2%	100.0%	95.2%	2.956	$26,194
Wilson County	8,675	70.1%	100.0%	70.1%	15.208	$23,869
Woodson County	3,147	72.4%	99.9%	72.3%	6.322	$20,499
Wyandotte County	165,271	100.0%	100.0%	100.0%	1,090.178	$19,282
Kentucky	**4,454,128**	**90.9%**	**98.8%**	**89.9%**	**112.802**	**.**
Adair County	19,484	75.4%	95.6%	73.7%	48.075	$18,463
Allen County	20,933	98.9%	99.7%	98.6%	60.792	$20,607
Anderson County	22,542	80.6%	100.0%	80.6%	111.687	$24,891
Ballard County	8,039	100.0%	100.0%	100.0%	32.592	$24,459
Barren County	43,801	81.1%	99.1%	80.9%	89.841	$20,130
Bath County	12,378	80.0%	100.0%	80.0%	44.399	$19,590
Bell County	26,894	98.4%	98.6%	97.4%	74.914	$13,654
Boone County	130,726	99.1%	100.0%	99.1%	530.632	$31,593
Bourbon County	20,029	87.6%	100.0%	87.6%	69.132	$24,433
Boyd County	47,979	95.7%	99.7%	95.5%	300.124	$25,939
Boyle County	29,924	98.6%	99.7%	98.4%	166.089	$23,276
Bracken County	8,267	73.6%	100.0%	73.6%	40.207	$21,569
Breathitt County	12,946	53.3%	81.5%	49.4%	26.291	$15,798
Breckinridge County	20,111	65.5%	99.9%	65.5%	35.458	$19,984
Bullitt County	80,245	99.1%	100.0%	99.1%	270.163	$25,805
Butler County	12,831	52.2%	99.9%	52.2%	30.114	$20,591
Caldwell County	12,639	75.5%	100.0%	75.5%	36.657	$23,308
Calloway County	38,913	98.1%	100.0%	98.1%	101.067	$21,109
Campbell County	92,488	99.2%	100.0%	99.2%	611.255	$29,834
Carlisle County	4,846	94.1%	100.0%	94.1%	25.581	$23,456
Carroll County	10,713	73.4%	100.0%	73.4%	83.325	$21,639
Carter County	27,144	75.2%	95.4%	72.8%	66.286	$19,170
Casey County	15,750	90.7%	95.7%	87.4%	35.455	$18,146
Christian County	70,416	88.3%	99.7%	88.3%	98.140	$19,962
Clark County	36,046	81.5%	100.0%	81.5%	142.777	$25,674

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Clay County	20,366	89.8%	88.2%	79.2%	43.401	$14,255
Clinton County	10,276	92.4%	100.0%	92.4%	52.097	$18,444
Crittenden County	9,084	67.1%	100.0%	67.1%	25.237	$21,735
Cumberland County	6,706	69.0%	96.7%	68.2%	21.974	$18,362
Daviess County	100,373	93.0%	100.0%	93.0%	218.989	$25,026
Edmonson County	12,226	85.2%	97.2%	82.4%	40.365	$20,194
Elliott County	7,523	100.0%	37.6%	37.6%	32.106	$14,218
Estill County	14,277	96.4%	97.0%	93.5%	56.413	$16,763
Fayette County	321,947	99.5%	100.0%	99.5%	1,135.017	$30,502
Fleming County	14,446	79.3%	100.0%	79.3%	41.447	$22,222
Floyd County	36,271	88.2%	94.3%	83.5%	92.212	$18,345
Franklin County	50,485	97.5%	100.0%	97.5%	243.012	$27,252
Fulton County	6,192	60.6%	100.0%	60.6%	30.131	$18,067
Gallatin County	8,776	73.1%	100.0%	73.1%	86.690	$21,452
Garrard County	17,523	84.0%	100.0%	84.0%	76.161	$23,796
Grant County	24,984	92.6%	100.0%	92.6%	96.851	$19,395
Graves County	37,120	94.8%	100.0%	94.8%	67.278	$21,277
Grayson County	26,358	89.1%	98.9%	88.0%	53.066	$20,783
Green County	11,065	82.7%	99.2%	82.1%	38.684	$20,974
Greenup County	35,518	92.5%	95.6%	89.7%	103.131	$24,446
Hancock County	8,801	21.2%	99.8%	21.2%	46.901	$22,041
Hardin County	108,070	99.3%	99.9%	99.1%	173.390	$25,561
Harlan County	26,713	84.3%	82.3%	71.5%	57.345	$16,080
Harrison County	18,779	46.7%	100.0%	46.7%	61.296	$22,024
Hart County	18,757	89.8%	100.0%	89.8%	45.517	$19,566
Henderson County	45,928	94.2%	100.0%	94.2%	105.178	$23,752
Henry County	16,006	65.9%	100.0%	65.9%	55.911	$22,499
Hickman County	4,520	32.5%	100.0%	32.5%	18.657	$18,416
Hopkins County	45,547	85.8%	100.0%	85.8%	84.036	$22,672
Jackson County	13,431	100.0%	91.0%	91.0%	38.908	$16,713
Jefferson County	771,156	99.9%	100.0%	99.9%	2,027.136	$29,758
Jessamine County	53,368	97.3%	100.0%	97.3%	310.071	$27,409
Johnson County	22,594	85.3%	93.5%	78.9%	86.252	$18,290
Kenton County	165,399	99.4%	100.0%	99.4%	1,032.133	$28,785
Knott County	15,291	60.1%	90.8%	52.7%	43.500	$17,761
Knox County	31,227	84.0%	98.6%	82.6%	80.837	$15,479
Larue County	14,197	84.4%	99.8%	84.2%	54.287	$21,204
Laurel County	60,174	98.0%	99.7%	97.8%	138.665	$19,383
Lawrence County	15,719	100.0%	81.5%	81.5%	37.823	$18,410

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Lee County	6,570	26.8%	99.0%	26.1%	31.457	$13,873
Leslie County	10,334	48.2%	76.8%	31.5%	25.781	$14,653
Letcher County	22,339	89.7%	86.3%	78.9%	66.109	$17,181
Lewis County	13,339	71.8%	97.0%	70.6%	27.626	$17,753
Lincoln County	24,456	86.7%	100.0%	86.7%	73.201	$18,720
Livingston County	9,269	69.8%	100.0%	69.8%	29.601	$24,203
Logan County	27,060	82.4%	100.0%	82.4%	49.010	$20,385
Lyon County	8,082	26.2%	100.0%	26.2%	37.795	$26,105
Madison County	91,226	94.9%	100.0%	94.9%	208.615	$22,271
Magoffin County	12,538	100.0%	89.4%	89.4%	40.649	$15,710
Marion County	19,392	86.6%	97.9%	85.8%	56.535	$20,450
Marshall County	31,382	97.9%	100.0%	97.9%	104.172	$25,138
Martin County	11,452	77.9%	97.7%	75.7%	49.877	$14,938
Mason County	17,174	39.9%	100.0%	39.9%	71.520	$24,124
McCracken County	65,384	98.0%	100.0%	98.0%	262.857	$28,926
McCreary County	17,465	100.0%	96.6%	96.6%	40.921	$11,114
McLean County	9,201	48.8%	100.0%	48.8%	36.443	$21,623
Meade County	28,154	85.3%	99.6%	85.3%	92.180	$24,018
Menifee County	6,455	100.0%	100.0%	100.0%	31.707	$18,995
Mercer County	21,521	82.4%	99.9%	82.4%	86.500	$24,079
Metcalfe County	10,107	74.4%	96.8%	71.5%	34.894	$18,141
Monroe County	10,659	87.0%	91.1%	80.2%	32.361	$19,969
Montgomery County	27,928	92.6%	100.0%	92.6%	141.504	$20,437
Morgan County	13,188	100.0%	89.4%	89.4%	34.603	$16,780
Muhlenberg County	30,816	80.1%	99.9%	80.1%	65.976	$19,934
Nelson County	45,640	65.7%	100.0%	65.6%	109.314	$26,353
Nicholas County	7,130	43.5%	100.0%	43.5%	36.532	$22,438
Ohio County	24,182	55.7%	100.0%	55.7%	41.177	$19,963
Oldham County	66,415	98.3%	100.0%	98.3%	354.746	$35,795
Owen County	10,764	60.7%	99.1%	60.7%	30.658	$22,151
Owsley County	4,435	100.0%	94.9%	94.9%	22.466	$16,533
Pendleton County	14,573	71.9%	100.0%	71.9%	52.580	$23,578
Perry County	26,553	94.7%	80.7%	77.3%	78.173	$19,697
Pike County	58,883	72.4%	92.6%	66.7%	74.835	$20,128
Powell County	12,374	41.2%	100.0%	41.2%	69.136	$18,158
Pulaski County	64,449	97.1%	99.8%	97.0%	97.886	$21,083
Robertson County	2,134	45.1%	100.0%	45.1%	21.359	$22,702
Rockcastle County	16,698	93.3%	99.6%	92.9%	52.751	$17,930
Rowan County	24,517	98.1%	98.4%	96.6%	87.625	$18,743

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Russell County	17,775	87.2%	100.0%	87.2%	70.075	$17,702
Scott County	54,872	83.5%	100.0%	83.5%	194.743	$29,345
Shelby County	47,420	85.4%	100.0%	85.4%	124.909	$28,502
Simpson County	18,108	67.1%	100.0%	67.1%	77.317	$21,122
Spencer County	18,506	79.8%	100.0%	79.8%	99.134	$27,227
Taylor County	25,466	90.8%	99.1%	90.0%	95.619	$18,613
Todd County	12,243	57.4%	97.8%	56.3%	32.692	$19,165
Trigg County	14,444	77.4%	100.0%	77.4%	32.721	$26,068
Trimble County	8,561	81.7%	100.0%	81.7%	56.453	$24,515
Union County	14,668	81.0%	100.0%	81.0%	42.783	$21,063
Warren County	128,845	92.9%	100.0%	92.9%	237.897	$24,060
Washington County	12,126	78.6%	99.6%	78.6%	40.792	$20,834
Wayne County	20,715	74.5%	93.1%	70.3%	45.212	$16,104
Webster County	13,018	60.8%	100.0%	60.8%	39.218	$20,117
Whitley County	36,214	96.4%	99.8%	96.3%	82.713	$17,520
Wolfe County	7,264	100.0%	100.0%	100.0%	32.696	$14,274
Woodford County	26,368	97.9%	100.0%	97.9%	139.673	$30,786
Louisiana	**4,684,286**	**87.6%**	**100.0%**	**87.6%**	**108.423**	**.**
Acadia Parish	62,590	71.9%	100.0%	71.9%	95.540	$20,887
Allen Parish	25,621	63.1%	100.0%	63.1%	33.630	$20,296
Ascension Parish	122,947	98.7%	100.0%	98.7%	423.983	$30,094
Assumption Parish	22,526	98.8%	100.0%	98.8%	66.515	$24,207
Avoyelles Parish	40,980	74.6%	100.0%	74.6%	49.229	$19,595
Beauregard Parish	36,928	50.2%	100.0%	50.2%	31.908	$23,141
Bienville Parish	13,638	4.5%	99.2%	4.5%	16.811	$22,123
Bossier Parish	127,630	90.7%	100.0%	90.7%	151.930	$27,210
Caddo Parish	246,581	96.1%	100.0%	96.1%	280.672	$25,206
Calcasieu Parish	202,439	91.7%	100.0%	91.7%	190.323	$25,249
Caldwell Parish	9,950	51.4%	100.0%	51.4%	18.794	$19,774
Cameron Parish	6,912	12.9%	100.0%	12.9%	5.379	$31,007
Catahoula Parish	9,875	26.2%	100.0%	26.2%	13.947	$21,870
Claiborne Parish	15,969	40.2%	99.5%	40.2%	21.154	$16,417
Concordia Parish	19,866	81.5%	100.0%	81.5%	28.505	$17,110
De Soto Parish	27,340	69.6%	99.9%	69.6%	31.225	$23,284
East Baton Rouge Parish	446,268	100.0%	100.0%	100.0%	980.004	$29,146
East Carroll Parish	7,126	63.0%	100.0%	63.0%	16.938	$11,133
East Feliciana Parish	19,412	17.7%	100.0%	17.7%	42.813	$21,850

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Evangeline Parish	33,708	46.4%	100.0%	46.4%	50.889	$18,440
Franklin Parish	20,260	50.0%	100.0%	50.0%	32.438	$18,178
Grant Parish	22,336	37.2%	100.0%	37.2%	34.736	$18,376
Iberia Parish	72,176	93.6%	100.0%	93.6%	125.718	$23,737
Iberville Parish	33,027	80.8%	100.0%	80.8%	53.388	$22,397
Jackson Parish	15,846	57.9%	100.0%	57.9%	27.840	$19,293
Jefferson Davis Parish	31,477	75.8%	100.0%	75.8%	48.327	$22,665
Jefferson Parish	439,035	97.8%	100.0%	97.8%	1,485.074	$28,067
La Salle Parish	14,933	45.3%	100.0%	45.3%	23.905	$19,434
Lafayette Parish	242,481	97.4%	100.0%	97.4%	902.357	$30,403
Lafourche Parish	98,418	72.0%	100.0%	72.0%	92.133	$25,299
Lincoln Parish	47,744	82.3%	100.0%	82.3%	101.208	$21,452
Livingston Parish	138,228	98.4%	100.0%	98.4%	213.259	$26,558
Madison Parish	11,316	68.7%	100.0%	68.7%	18.122	$14,564
Morehouse Parish	25,641	91.7%	100.0%	91.7%	32.255	$18,222
Natchitoches Parish	39,021	68.0%	99.9%	68.0%	31.161	$19,178
Orleans Parish	393,284	92.3%	100.0%	92.3%	2,321.315	$28,444
Ouachita Parish	155,874	97.1%	99.9%	97.1%	255.361	$21,866
Plaquemines Parish	23,348	68.5%	100.0%	68.5%	29.937	$25,359
Pointe Coupee Parish	22,268	65.8%	100.0%	65.8%	39.954	$25,670
Rapides Parish	131,648	87.3%	100.0%	87.3%	99.888	$22,904
Red River Parish	8,536	21.1%	100.0%	21.1%	21.938	$23,748
Richland Parish	20,411	47.7%	100.0%	47.7%	36.511	$19,347
Sabine Parish	24,018	6.3%	100.0%	6.3%	27.713	$22,725
St. Bernard Parish	46,202	93.6%	100.0%	93.6%	122.384	$19,990
St. Charles Parish	52,749	97.3%	100.0%	97.3%	189.009	$28,146
St. Helena Parish	10,363	35.5%	100.0%	35.5%	25.374	$19,134
St. James Parish	21,367	99.5%	100.0%	99.5%	88.463	$25,275
St. John the Baptist Parish	43,441	100.0%	100.0%	100.0%	203.880	$22,775
St. Landry Parish	83,497	81.8%	100.0%	81.8%	90.377	$19,008
St. Martin Parish	54,170	93.6%	100.0%	93.6%	73.436	$23,597
St. Mary Parish	50,973	89.6%	100.0%	89.6%	91.781	$21,989
St. Tammany Parish	256,325	98.5%	100.0%	98.5%	303.146	$31,792
Tangipahoa Parish	132,489	88.7%	100.0%	88.7%	167.437	$22,554
Tensas Parish	4,615	0.5%	100.0%	0.5%	7.656	$16,171
Terrebonne Parish	112,086	99.6%	100.0%	99.6%	90.993	$24,069

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Union Parish	22,571	38.0%	99.9%	38.0%	25.737	$20,090
Vermilion Parish	60,136	96.1%	100.0%	96.1%	51.258	$23,521
Vernon Parish	50,725	69.7%	100.0%	69.7%	38.199	$22,297
Washington Parish	46,633	37.6%	100.0%	37.6%	69.651	$17,957
Webster Parish	39,378	74.8%	100.0%	74.8%	66.401	$19,512
West Baton Rouge Parish	26,262	88.1%	100.0%	88.1%	136.501	$27,245
West Carroll Parish	10,981	31.5%	100.0%	31.5%	30.533	$21,459
West Feliciana Parish	15,380	32.1%	100.0%	32.1%	38.144	$22,335
Winn Parish	14,311	46.5%	99.9%	46.5%	15.063	$18,358
Maine	**1,335,904**	**93.3%**	**98.5%**	**92.1%**	**43.313**	**.**
Androscoggin County	107,651	99.8%	100.0%	99.8%	230.059	$25,788
Aroostook County	67,653	84.1%	91.1%	75.9%	10.141	$22,483
Cumberland County	292,499	99.6%	100.0%	99.6%	350.197	$35,066
Franklin County	29,988	76.7%	99.7%	76.6%	17.675	$23,596
Hancock County	54,497	85.5%	98.5%	84.3%	34.342	$30,042
Kennebec County	121,821	99.2%	100.0%	99.2%	140.424	$26,418
Knox County	39,790	97.6%	99.7%	97.3%	108.974	$28,413
Lincoln County	34,204	95.1%	99.9%	95.1%	75.039	$30,022
Oxford County	57,439	88.5%	99.7%	88.5%	27.657	$21,674
Penobscot County	151,957	91.3%	99.8%	91.2%	44.728	$25,035
Piscataquis County	16,773	42.4%	99.8%	42.4%	4.235	$22,398
Sagadahoc County	35,392	96.0%	100.0%	96.0%	139.506	$31,085
Somerset County	50,626	83.5%	99.4%	83.5%	12.900	$21,961
Waldo County	39,831	71.5%	99.8%	71.4%	54.569	$25,270
Washington County	31,593	81.9%	61.4%	51.8%	12.328	$23,113
York County	204,190	98.8%	100.0%	98.8%	206.104	$31,574
Maryland	**6,052,124**	**100.0%**	**100.0%**	**100.0%**	**623.465**	**.**
Allegany County	71,615	100.0%	100.0%	100.0%	168.840	$22,029
Anne Arundel County	573,232	100.0%	100.0%	100.0%	1,381.609	$42,382
Baltimore County	832,463	100.0%	100.0%	100.0%	1,391.376	$35,777
Baltimore city	611,648	100.0%	100.0%	100.0%	7,556.461	$27,129
Calvert County	91,502	100.0%	100.0%	100.0%	429.281	$39,897
Caroline County	33,190	100.0%	100.0%	100.0%	103.907	$24,311
Carroll County	167,781	100.0%	100.0%	100.0%	374.850	$38,408
Cecil County	102,746	100.0%	100.0%	100.0%	296.720	$30,676
Charles County	159,700	100.0%	100.0%	100.0%	348.881	$37,680
Dorchester County	32,162	100.0%	100.0%	100.0%	59.475	$28,055

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Frederick County	252,019	100.0%	100.0%	100.0%	381.719	$38,280
Garrett County	29,233	100.0%	100.0%	100.0%	45.175	$25,096
Harford County	252,157	100.0%	100.0%	100.0%	576.901	$36,411
Howard County	321,112	100.0%	100.0%	100.0%	1,280.652	$49,667
Kent County	19,384	100.0%	100.0%	100.0%	69.971	$30,080
Montgomery County	1,058,790	100.0%	100.0%	100.0%	2,155.278	$49,906
Prince George's County	912,755	100.0%	100.0%	100.0%	1,890.972	$33,220
Queen Anne's County	49,758	100.0%	100.0%	100.0%	133.791	$39,593
Somerset County	25,918	100.0%	99.9%	99.9%	81.064	$17,143
St. Mary's County	112,667	100.0%	100.0%	100.0%	315.435	$36,814
Talbot County	37,103	100.0%	100.0%	100.0%	138.166	$40,533
Washington County	150,577	100.0%	100.0%	100.0%	328.929	$27,586
Wicomico County	102,923	100.0%	100.0%	100.0%	274.869	$26,498
Worcester County	51,689	100.0%	100.0%	100.0%	110.380	$32,988
Massachusetts	**6,859,742**	**97.9%**	**100.0%**	**97.9%**	**879.448**	**.**
Barnstable County	213,444	98.6%	100.0%	98.6%	542.117	$39,104
Berkshire County	126,313	91.9%	99.8%	91.8%	136.286	$31,417
Bristol County	561,468	98.4%	100.0%	98.4%	1,015.137	$30,525
Dukes County	17,325	91.5%	100.0%	91.5%	167.804	$40,051
Essex County	785,200	98.8%	100.0%	98.8%	1,594.111	$37,210
Franklin County	70,701	79.9%	99.8%	79.9%	101.100	$31,689
Hampden County	469,816	100.0%	100.0%	100.0%	761.279	$27,057
Hampshire County	161,832	87.0%	100.0%	87.0%	306.933	$31,051
Middlesex County	1,602,935	98.6%	100.0%	98.6%	1,960.018	$45,579
Nantucket County	11,229	98.9%	100.0%	98.9%	249.701	$46,009
Norfolk County	700,317	97.9%	100.0%	97.9%	1,768.006	$47,306
Plymouth County	515,141	97.9%	100.0%	97.9%	781.612	$37,188
Suffolk County	797,907	98.4%	100.0%	98.4%	13,720.520	$35,844
Worcester County	826,114	98.5%	100.0%	98.5%	546.816	$33,272
Michigan	**9,961,988**	**92.0%**	**99.9%**	**92.0%**	**176.197**	**.**
Alcona County	10,351	65.9%	100.0%	65.8%	15.344	$23,380
Alger County	9,121	74.4%	89.6%	68.7%	9.968	$20,993
Allegan County	116,432	78.8%	100.0%	78.8%	141.090	$25,840
Alpena County	28,462	91.9%	100.0%	91.9%	49.771	$22,776
Antrim County	23,292	92.7%	100.0%	92.7%	48.963	$28,180
Arenac County	15,045	54.4%	100.0%	54.4%	41.424	$21,602
Baraga County	8,441	62.4%	94.3%	62.4%	9.397	$17,664
Barry County	60,568	61.1%	100.0%	61.1%	109.508	$25,909

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Bay County	104,239	92.4%	99.9%	92.4%	235.674	$24,753
Benzie County	17,573	80.2%	100.0%	80.2%	54.967	$25,506
Berrien County	154,257	93.3%	100.0%	93.3%	271.700	$26,309
Branch County	43,410	69.6%	100.0%	69.6%	85.728	$21,838
Calhoun County	134,128	88.4%	100.0%	88.4%	189.920	$23,812
Cass County	51,381	93.3%	100.0%	93.3%	104.846	$25,955
Charlevoix County	26,139	92.2%	99.9%	92.2%	62.783	$29,581
Cheboygan County	25,369	62.5%	100.0%	62.5%	35.468	$24,220
Chippewa County	37,709	77.0%	99.3%	76.7%	24.197	$20,839
Clare County	30,645	76.6%	100.0%	76.6%	54.305	$20,418
Clinton County	78,436	82.1%	100.0%	82.1%	138.480	$31,170
Crawford County	13,906	53.1%	100.0%	53.1%	24.998	$22,348
Delta County	35,965	84.0%	97.7%	83.3%	30.711	$24,182
Dickinson County	25,415	72.6%	99.2%	72.6%	33.379	$25,136
Eaton County	109,027	88.8%	100.0%	88.8%	189.555	$28,624
Emmet County	33,193	91.0%	100.0%	91.0%	71.002	$30,250
Genesee County	407,385	98.6%	100.0%	98.6%	639.560	$23,755
Gladwin County	25,234	65.4%	100.0%	65.4%	50.289	$22,255
Gogebic County	15,342	84.7%	99.2%	84.3%	13.924	$21,464
Grand Traverse County	91,807	97.5%	100.0%	97.5%	197.719	$30,024
Gratiot County	41,018	100.0%	100.0%	100.0%	72.156	$20,358
Hillsdale County	45,879	62.7%	100.0%	62.7%	76.704	$22,435
Houghton County	36,305	87.9%	99.4%	87.9%	35.978	$20,248
Huron County	31,280	68.9%	99.7%	68.6%	37.429	$24,455
Ingham County	290,171	94.2%	100.0%	94.2%	521.778	$26,083
Ionia County	64,291	89.2%	100.0%	89.2%	112.534	$21,526
Iosco County	25,162	86.3%	99.6%	85.9%	45.824	$23,723
Iron County	11,124	15.6%	97.8%	15.6%	9.539	$22,454
Isabella County	71,063	98.5%	100.0%	98.5%	124.089	$21,387
Jackson County	158,639	84.0%	100.0%	84.0%	226.089	$24,444
Kalamazoo County	262,979	98.2%	100.0%	98.2%	468.219	$27,370
Kalkaska County	17,629	82.7%	100.0%	82.7%	31.488	$22,508
Kent County	648,559	96.7%	100.0%	96.7%	765.760	$28,070
Keweenaw County	2,105	77.5%	87.1%	69.4%	3.897	$26,328
Lake County	12,013	4.9%	100.0%	4.9%	21.173	$17,178
Lapeer County	88,174	76.7%	100.0%	76.7%	137.126	$25,373
Leelanau County	21,657	87.1%	100.0%	87.1%	62.381	$35,954
Lenawee County	98,623	81.4%	100.0%	81.4%	131.575	$24,512

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Livingston County	189,632	97.9%	100.0%	97.9%	335.481	$35,156
Luce County	6,358	0.0%	97.4%	0.0%	7.072	$18,444
Mackinac County	10,712	50.1%	99.4%	50.1%	10.486	$25,604
Macomb County	871,339	98.4%	100.0%	98.4%	1,818.231	$28,588
Manistee County	24,427	71.7%	100.0%	71.7%	45.056	$23,290
Marquette County	66,502	90.3%	99.6%	90.3%	36.774	$24,275
Mason County	29,073	85.8%	100.0%	85.8%	58.725	$24,643
Mecosta County	43,387	85.4%	100.0%	85.4%	78.165	$20,690
Menominee County	23,046	71.3%	98.7%	71.1%	22.073	$24,789
Midland County	83,411	95.7%	100.0%	95.7%	161.570	$31,135
Missaukee County	14,998	25.5%	100.0%	25.5%	26.558	$21,124
Monroe County	149,646	92.9%	100.0%	92.9%	272.384	$27,809
Montcalm County	63,546	93.0%	100.0%	93.0%	90.085	$20,504
Montmorency County	9,250	0.5%	99.8%	0.5%	16.921	$21,621
Muskegon County	173,693	93.8%	100.0%	93.8%	347.911	$21,614
Newaygo County	48,229	39.1%	100.0%	39.1%	59.307	$21,905
Oakland County	1,250,785	99.4%	100.0%	99.4%	1,441.556	$38,992
Oceana County	26,438	46.5%	100.0%	46.5%	51.630	$20,760
Ogemaw County	20,981	72.2%	100.0%	72.2%	37.234	$21,515
Ontonagon County	5,881	65.0%	89.3%	57.1%	4.485	$22,428
Osceola County	23,259	28.1%	100.0%	28.1%	41.065	$19,853
Oscoda County	8,287	1.6%	100.0%	1.6%	14.648	$20,047
Otsego County	24,537	70.7%	100.0%	70.7%	47.647	$25,655
Ottawa County	286,345	97.2%	100.0%	97.2%	508.184	$27,696
Presque Isle County	12,791	29.2%	100.0%	29.2%	19.418	$23,862
Roscommon County	23,892	93.1%	100.0%	93.1%	45.978	$21,807
Saginaw County	191,934	95.4%	100.0%	95.4%	239.883	$24,020
Sanilac County	41,269	42.8%	100.0%	42.8%	42.874	$22,510
Schoolcraft County	8,048	56.5%	97.5%	56.5%	6.871	$20,975
Shiawassee County	68,446	85.7%	100.0%	85.7%	128.981	$23,927
St. Clair County	159,350	84.5%	100.0%	84.4%	220.960	$26,377
St. Joseph County	60,946	81.1%	100.0%	81.1%	121.748	$22,182
Tuscola County	52,764	66.6%	99.9%	66.5%	65.698	$22,511
Van Buren County	75,352	74.1%	100.0%	74.1%	124.041	$23,943
Washtenaw County	367,603	92.2%	100.0%	92.2%	520.710	$35,888
Wayne County	1,753,616	98.9%	100.0%	98.9%	2,865.011	$23,666
Wexford County	33,272	64.8%	100.0%	64.8%	58.888	$21,200

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Minnesota	**5,576,260**	**94.8%**	**99.9%**	**94.8%**	**70.030**	**.**
Aitkin County	15,826	48.1%	100.0%	48.1%	8.688	$25,780
Anoka County	351,342	98.1%	100.0%	98.1%	830.577	$33,051
Becker County	34,097	88.5%	99.9%	88.4%	25.925	$27,188
Beltrami County	46,505	99.5%	99.0%	98.5%	18.565	$22,845
Benton County	39,937	88.8%	100.0%	88.8%	97.813	$25,984
Big Stone County	5,026	87.9%	100.0%	87.9%	10.072	$27,820
Blue Earth County	66,964	100.0%	100.0%	100.0%	89.543	$27,324
Brown County	25,194	95.5%	100.0%	95.5%	41.228	$28,444
Carlton County	35,498	78.5%	100.0%	78.5%	41.211	$25,714
Carver County	102,103	97.7%	100.0%	97.7%	288.162	$41,759
Cass County	29,354	77.4%	100.0%	77.4%	14.521	$26,844
Chippewa County	11,980	100.0%	100.0%	100.0%	20.615	$27,781
Chisago County	55,304	75.3%	100.0%	75.3%	133.307	$30,455
Clay County	63,565	95.6%	100.0%	95.6%	60.806	$27,165
Clearwater County	8,878	99.8%	99.3%	99.1%	8.887	$23,777
Cook County	5,398	91.8%	92.1%	85.0%	3.717	$32,774
Cottonwood County	11,295	100.0%	100.0%	100.0%	17.687	$25,967
Crow Wing County	64,422	93.4%	100.0%	93.4%	64.480	$29,106
Dakota County	421,744	99.2%	100.0%	99.2%	750.210	$37,266
Dodge County	20,754	100.0%	100.0%	100.0%	47.246	$30,495
Douglas County	37,575	87.7%	100.0%	87.7%	58.960	$31,640
Faribault County	13,784	100.0%	100.0%	100.0%	19.347	$28,168
Fillmore County	20,980	93.0%	98.6%	92.3%	24.359	$27,777
Freeborn County	30,535	100.0%	100.0%	100.0%	43.184	$27,332
Goodhue County	46,304	99.8%	100.0%	99.8%	61.181	$31,830
Grant County	5,941	89.1%	100.0%	89.1%	10.838	$29,446
Hennepin County	1,252,001	98.5%	100.0%	98.5%	2,261.600	$39,939
Houston County	18,660	79.4%	97.9%	78.6%	33.801	$29,007
Hubbard County	21,015	95.5%	100.0%	95.5%	22.702	$26,417
Isanti County	39,576	77.0%	100.0%	77.0%	90.814	$28,676
Itasca County	45,137	83.6%	99.9%	83.5%	16.920	$25,862
Jackson County	9,946	100.0%	100.0%	100.0%	14.148	$28,958
Kanabec County	16,022	73.9%	100.0%	73.9%	30.718	$24,582
Kandiyohi County	42,739	100.0%	100.0%	100.0%	53.639	$28,165
Kittson County	4,250	46.6%	98.9%	46.6%	3.868	$29,939
Koochiching County	12,528	74.8%	99.6%	74.8%	4.036	$26,814

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Lac qui Parle County	6,685	99.3%	100.0%	99.3%	8.738	$30,816
Lake County	10,524	89.3%	99.2%	89.1%	4.989	$31,215
Lake of the Woods County	3,744	51.3%	98.2%	51.3%	2.885	$23,234
Le Sueur County	28,103	100.0%	100.0%	100.0%	62.624	$29,714
Lincoln County	5,678	93.9%	100.0%	93.9%	10.578	$27,946
Lyon County	25,829	99.6%	100.0%	99.6%	36.147	$28,860
Mahnomen County	5,595	80.3%	99.5%	80.0%	10.029	$20,233
Marshall County	9,356	53.4%	99.8%	53.4%	5.271	$28,194
Martin County	19,850	100.0%	100.0%	100.0%	27.866	$29,034
McLeod County	35,884	84.8%	100.0%	84.8%	73.013	$28,241
Meeker County	23,129	91.0%	100.0%	91.0%	38.030	$27,974
Mille Lacs County	25,872	59.6%	100.0%	59.6%	45.206	$24,489
Morrison County	33,059	80.3%	100.0%	80.3%	29.384	$26,442
Mower County	39,559	100.0%	100.0%	100.0%	55.613	$27,459
Murray County	8,346	91.6%	100.0%	91.6%	11.843	$29,084
Nicollet County	33,962	100.0%	100.0%	100.0%	75.725	$28,089
Nobles County	21,941	96.9%	100.0%	96.9%	30.682	$24,188
Norman County	6,597	90.4%	100.0%	90.4%	7.559	$26,270
Olmsted County	154,916	100.0%	100.0%	100.0%	237.111	$36,143
Otter Tail County	58,344	93.5%	100.0%	93.5%	29.585	$28,781
Pennington County	14,236	92.1%	99.9%	91.9%	23.089	$26,992
Pine County	29,198	50.5%	100.0%	50.5%	20.689	$22,817
Pipestone County	9,087	97.9%	100.0%	97.9%	19.540	$27,489
Polk County	31,619	94.8%	100.0%	94.8%	16.041	$27,231
Pope County	10,970	69.5%	100.0%	69.5%	16.380	$30,485
Ramsey County	547,910	98.7%	100.0%	98.7%	3,599.641	$31,256
Red Lake County	4,029	100.0%	100.0%	100.0%	9.318	$25,732
Redwood County	15,272	99.3%	100.0%	99.3%	17.383	$26,716
Renville County	14,645	98.9%	100.0%	98.9%	14.900	$30,089
Rice County	65,961	99.7%	100.0%	99.7%	133.071	$27,856
Rock County	9,490	99.7%	100.0%	99.7%	19.670	$27,634
Roseau County	15,327	60.4%	99.8%	60.4%	9.169	$27,307
Scott County	145,788	96.4%	100.0%	96.4%	408.970	$37,113
Sherburne County	94,562	89.0%	100.0%	89.0%	218.430	$31,182
Sibley County	14,868	99.7%	100.0%	99.7%	25.252	$28,811
St. Louis County	200,000	86.5%	99.9%	86.5%	32.013	$28,013
Stearns County	157,809	90.0%	100.0%	90.0%	117.493	$27,792

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Steele County	36,887	100.0%	100.0%	100.0%	85.855	$28,736
Stevens County	9,634	98.0%	100.0%	98.0%	17.094	$26,625
Swift County	9,407	99.7%	100.0%	99.7%	12.676	$28,969
Todd County	24,510	62.8%	100.0%	62.8%	25.937	$24,410
Traverse County	3,319	63.2%	100.0%	63.2%	5.783	$30,992
Wabasha County	21,606	100.0%	99.3%	99.3%	41.313	$31,464
Wadena County	13,669	90.7%	100.0%	90.7%	25.489	$22,283
Waseca County	18,787	100.0%	100.0%	100.0%	44.376	$27,179
Washington County	256,336	97.4%	100.0%	97.4%	667.052	$39,873
Watonwan County	10,840	100.0%	100.0%	100.0%	24.923	$26,273
Wilkin County	6,324	83.3%	100.0%	83.3%	8.421	$27,814
Winona County	50,873	99.2%	99.3%	98.5%	81.240	$25,967
Wright County	134,278	89.9%	100.0%	89.9%	203.003	$31,154
Yellow Medicine County	9,867	99.9%	100.0%	99.9%	12.998	$27,686
Mississippi	**2,984,070**	**79.6%**	**99.9%**	**79.6%**	**63.595**	**.**
Adams County	31,003	86.3%	100.0%	86.3%	67.047	$18,091
Alcorn County	37,210	100.0%	100.0%	100.0%	93.016	$20,006
Amite County	12,447	22.5%	99.9%	22.5%	17.048	$17,954
Attala County	18,477	51.9%	100.0%	51.9%	25.139	$20,283
Benton County	8,312	92.4%	100.0%	92.4%	20.442	$20,261
Bolivar County	31,945	79.7%	100.0%	79.7%	36.443	$16,595
Calhoun County	14,492	76.3%	100.0%	76.3%	24.706	$17,203
Carroll County	10,139	34.9%	99.9%	34.9%	16.139	$22,519
Chickasaw County	17,146	55.9%	100.0%	55.9%	34.170	$18,514
Choctaw County	8,277	26.9%	100.0%	26.9%	19.793	$18,434
Claiborne County	8,950	51.6%	98.1%	51.6%	18.363	$12,944
Clarke County	15,828	60.4%	91.8%	60.3%	22.888	$20,431
Clay County	19,640	66.4%	100.0%	66.4%	47.893	$19,097
Coahoma County	23,154	75.5%	100.0%	75.5%	41.912	$16,066
Copiah County	28,516	53.3%	99.9%	53.3%	36.689	$18,188
Covington County	19,079	22.6%	99.5%	22.6%	46.108	$16,941
DeSoto County	178,741	95.9%	100.0%	95.9%	375.392	$27,135
Forrest County	75,471	88.9%	100.0%	88.9%	161.846	$20,194
Franklin County	7,765	27.6%	99.6%	27.6%	13.773	$22,769
George County	24,092	77.0%	100.0%	77.0%	50.327	$20,640
Greene County	13,345	22.8%	100.0%	22.8%	18.723	$15,659
Grenada County	21,087	84.0%	100.0%	84.0%	49.957	$20,562

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Hancock County	47,053	84.4%	100.0%	84.4%	99.321	$23,221
Harrison County	205,024	95.6%	100.0%	95.6%	357.188	$22,517
Hinds County	239,497	93.2%	100.0%	93.2%	275.366	$21,672
Holmes County	17,739	67.3%	99.7%	67.3%	23.443	$12,408
Humphreys County	8,342	86.2%	100.0%	86.2%	19.934	$13,977
Issaquena County	1,339	1.6%	100.0%	1.6%	3.242	$17,282
Itawamba County	23,508	78.1%	100.0%	78.1%	44.123	$19,707
Jackson County	142,149	96.2%	100.0%	96.2%	196.677	$24,350
Jasper County	16,582	60.3%	100.0%	60.3%	24.521	$19,363
Jefferson County	7,262	54.5%	99.5%	54.5%	13.967	$13,703
Jefferson Davis County	11,314	51.6%	99.6%	51.6%	27.700	$16,859
Jones County	67,930	77.8%	100.0%	77.8%	97.770	$20,957
Kemper County	9,883	11.6%	99.7%	11.6%	12.899	$14,715
Lafayette County	54,374	83.6%	100.0%	83.6%	86.075	$23,833
Lamar County	61,372	75.9%	100.0%	75.9%	123.471	$28,101
Lauderdale County	76,155	89.7%	100.0%	89.7%	108.231	$21,575
Lawrence County	12,643	4.1%	100.0%	4.1%	29.357	$20,700
Leake County	22,715	48.3%	100.0%	48.3%	38.962	$18,178
Lee County	84,933	96.3%	100.0%	96.3%	188.761	$22,741
Leflore County	29,223	89.5%	100.0%	89.5%	49.318	$15,370
Lincoln County	34,347	65.6%	100.0%	65.6%	58.601	$19,418
Lowndes County	59,186	88.5%	100.0%	88.5%	117.082	$22,143
Madison County	104,618	92.5%	100.0%	92.5%	146.420	$35,435
Marion County	25,069	56.7%	99.7%	56.7%	46.220	$19,707
Marshall County	35,619	68.0%	100.0%	68.0%	50.438	$19,104
Monroe County	35,872	66.4%	99.9%	66.4%	46.886	$19,905
Montgomery County	10,173	78.9%	99.8%	78.9%	24.996	$19,706
Neshoba County	29,369	62.4%	100.0%	62.4%	51.512	$19,030
Newton County	21,185	42.8%	99.9%	42.8%	36.646	$20,896
Noxubee County	10,742	43.8%	100.0%	43.8%	15.453	$16,108
Oktibbeha County	49,799	78.6%	100.0%	78.6%	108.684	$20,128
Panola County	33,994	71.3%	100.0%	71.3%	49.616	$20,098
Pearl River County	55,270	82.4%	100.0%	82.4%	68.162	$20,653
Perry County	12,032	23.4%	97.2%	23.4%	18.589	$18,188
Pike County	39,468	71.8%	100.0%	71.8%	96.495	$17,316
Pontotoc County	31,640	59.1%	100.0%	59.1%	63.574	$19,743
Prentiss County	25,261	100.0%	100.0%	100.0%	60.873	$18,313

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Quitman County	7,269	61.2%	100.0%	61.2%	17.948	$14,928
Rankin County	152,077	93.1%	100.0%	93.1%	196.106	$27,822
Scott County	28,420	50.9%	99.9%	50.9%	46.653	$17,203
Sharkey County	4,435	42.6%	100.0%	42.6%	10.273	$15,430
Simpson County	26,947	53.2%	100.0%	53.2%	45.738	$18,495
Smith County	16,078	16.3%	98.6%	16.3%	25.270	$22,129
Stone County	18,112	67.9%	100.0%	67.9%	40.657	$19,588
Sunflower County	25,981	75.2%	100.0%	75.2%	37.235	$14,111
Tallahatchie County	14,125	52.6%	100.0%	52.6%	21.889	$12,747
Tate County	28,436	70.6%	100.0%	70.6%	70.254	$20,948
Tippah County	21,969	65.5%	99.5%	65.0%	47.987	$19,453
Tishomingo County	19,542	97.6%	100.0%	97.6%	46.062	$18,790
Tunica County	10,024	66.2%	100.0%	66.2%	22.047	$16,950
Union County	28,555	80.5%	100.0%	80.5%	68.708	$19,723
Walthall County	14,499	24.9%	99.8%	24.9%	35.894	$18,255
Warren County	46,768	94.3%	99.8%	94.3%	79.470	$22,110
Washington County	46,221	92.1%	100.0%	92.1%	63.776	$17,800
Wayne County	20,446	60.5%	97.5%	60.3%	25.219	$20,460
Webster County	9,765	46.1%	99.9%	46.1%	23.198	$20,722
Wilkinson County	8,804	36.4%	99.0%	36.4%	12.983	$14,183
Winston County	18,246	65.8%	99.9%	65.8%	30.047	$21,943
Yalobusha County	12,497	65.3%	99.8%	65.3%	26.753	$18,802
Yazoo County	27,057	63.4%	99.8%	63.4%	29.316	$16,756
Missouri	**6,113,350**	**88.7%**	**99.8%**	**88.6%**	**88.932**	**.**
Adair County	25,377	80.3%	99.6%	80.3%	44.731	$19,804
Andrew County	17,554	87.9%	100.0%	87.9%	40.568	$26,661
Atchison County	5,275	76.2%	100.0%	76.2%	9.638	$26,710
Audrain County	25,641	67.5%	100.0%	67.5%	37.041	$19,692
Barry County	35,668	100.0%	100.0%	100.0%	45.831	$19,431
Barton County	11,850	72.8%	100.0%	72.8%	20.020	$22,513
Bates County	16,334	51.5%	100.0%	51.5%	19.522	$22,250
Benton County	19,070	36.9%	99.8%	36.9%	27.086	$19,487
Bollinger County	12,302	21.2%	100.0%	21.2%	19.909	$19,987
Boone County	178,269	92.7%	100.0%	92.7%	260.090	$27,689
Buchanan County	89,065	94.4%	100.0%	94.4%	218.282	$23,189
Butler County	42,666	68.4%	100.0%	68.4%	61.419	$20,042
Caldwell County	9,099	42.2%	100.0%	42.2%	21.339	$23,273

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Callaway County	45,032	94.5%	100.0%	94.5%	53.958	$23,475
Camden County	45,630	93.7%	99.2%	93.4%	69.566	$24,484
Cape Girardeau County	78,161	85.5%	100.0%	85.5%	135.102	$25,348
Carroll County	8,796	66.6%	100.0%	66.6%	12.663	$24,484
Carter County	6,169	7.3%	99.7%	7.3%	12.159	$21,296
Cass County	103,721	100.0%	100.0%	100.0%	148.846	$29,197
Cedar County	14,073	53.2%	100.0%	53.2%	29.660	$18,932
Chariton County	7,480	39.2%	99.7%	39.1%	9.958	$23,029
Christian County	85,425	100.0%	99.8%	99.8%	151.828	$25,342
Clark County	6,723	31.2%	99.9%	31.2%	13.321	$25,149
Clay County	242,856	100.0%	100.0%	100.0%	611.269	$30,531
Clinton County	20,554	68.7%	100.0%	68.7%	49.060	$26,551
Cole County	76,708	88.3%	100.0%	88.3%	194.814	$26,557
Cooper County	17,644	100.0%	100.0%	100.0%	31.241	$22,822
Crawford County	24,102	82.1%	98.1%	82.1%	32.460	$20,373
Dade County	7,588	42.2%	100.0%	42.2%	15.485	$20,624
Dallas County	16,670	100.0%	99.5%	99.5%	30.826	$17,378
Daviess County	8,357	54.3%	100.0%	54.3%	14.837	$21,356
DeKalb County	12,588	71.5%	100.0%	71.5%	29.875	$17,584
Dent County	15,477	54.9%	95.3%	54.9%	20.560	$19,929
Douglas County	13,300	100.0%	93.4%	93.4%	16.346	$17,261
Dunklin County	30,119	82.8%	100.0%	82.8%	55.666	$18,203
Franklin County	103,330	74.9%	99.8%	74.8%	111.989	$26,272
Gasconade County	14,726	26.9%	99.4%	26.9%	28.439	$24,355
Gentry County	6,665	77.8%	100.0%	77.8%	13.563	$20,726
Greene County	289,801	100.0%	100.0%	100.0%	429.141	$24,537
Grundy County	9,949	38.4%	100.0%	38.4%	22.857	$20,746
Harrison County	8,524	58.8%	99.7%	58.8%	11.798	$20,434
Henry County	21,717	41.9%	100.0%	41.9%	31.160	$23,510
Hickory County	9,475	10.5%	99.9%	10.5%	23.741	$18,694
Holt County	4,413	33.7%	100.0%	33.7%	9.538	$23,949
Howard County	10,139	24.3%	100.0%	24.3%	21.858	$22,192
Howell County	40,103	47.4%	99.6%	47.4%	43.249	$19,293
Iron County	10,224	44.9%	97.4%	44.9%	18.580	$19,270
Jackson County	698,869	100.0%	100.0%	100.0%	1,156.183	$27,665
Jasper County	120,193	94.1%	100.0%	94.1%	188.246	$22,767
Jefferson County	223,810	93.4%	100.0%	93.4%	340.847	$26,021
Johnson County	53,897	58.3%	100.0%	58.3%	64.992	$22,589
Knox County	3,976	3.7%	99.7%	3.7%	7.889	$21,471

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Laclede County	35,443	100.0%	100.0%	100.0%	46.348	$19,552
Lafayette County	32,641	28.3%	100.0%	28.3%	51.940	$25,008
Lawrence County	38,434	100.0%	100.0%	100.0%	62.828	$19,973
Lewis County	9,967	29.6%	99.8%	29.4%	19.735	$20,646
Lincoln County	56,179	68.6%	100.0%	68.6%	89.663	$22,833
Linn County	12,193	57.0%	99.9%	57.0%	19.808	$20,860
Livingston County	15,173	72.7%	100.0%	72.7%	28.503	$22,804
Macon County	15,250	74.5%	98.5%	74.2%	19.033	$19,941
Madison County	12,243	56.5%	99.8%	56.5%	24.764	$19,009
Maries County	8,867	31.9%	100.0%	31.9%	16.826	$20,922
Marion County	28,634	83.8%	99.7%	83.8%	65.535	$22,303
McDonald County	22,827	71.3%	100.0%	71.3%	42.313	$18,761
Mercer County	3,678	51.3%	99.9%	51.2%	8.104	$20,701
Miller County	25,228	60.3%	100.0%	60.3%	42.572	$22,397
Mississippi County	13,586	87.4%	100.0%	87.4%	33.009	$17,049
Moniteau County	16,063	98.7%	100.0%	98.7%	38.704	$21,068
Monroe County	8,612	52.6%	100.0%	52.6%	13.297	$21,069
Montgomery County	11,438	54.2%	99.8%	54.1%	21.330	$21,301
Morgan County	20,145	95.9%	99.6%	95.5%	33.708	$19,555
New Madrid County	17,582	81.8%	100.0%	81.8%	26.054	$19,011
Newton County	58,290	83.3%	100.0%	83.3%	93.299	$23,874
Nodaway County	22,472	89.1%	100.0%	89.1%	25.625	$19,378
Oregon County	10,558	34.2%	90.6%	31.6%	13.368	$18,080
Osage County	13,662	34.3%	99.8%	34.3%	22.606	$24,097
Ozark County	9,186	10.2%	98.3%	10.2%	12.331	$16,706
Pemiscot County	16,826	74.8%	100.0%	74.8%	34.161	$17,681
Perry County	19,225	59.3%	100.0%	59.3%	40.529	$24,658
Pettis County	42,551	66.8%	100.0%	66.8%	62.371	$20,643
Phelps County	44,743	87.3%	99.9%	87.3%	66.603	$22,400
Pike County	18,567	31.7%	100.0%	31.7%	27.694	$19,900
Platte County	101,157	89.7%	100.0%	89.7%	240.741	$36,160
Polk County	31,784	100.0%	100.0%	100.0%	50.012	$20,553
Pulaski County	52,059	94.6%	99.9%	94.6%	95.155	$20,464
Putnam County	4,811	71.3%	99.8%	71.1%	9.300	$20,636
Ralls County	10,224	78.5%	100.0%	78.5%	21.763	$24,099
Randolph County	24,945	72.6%	99.8%	72.5%	51.680	$18,615
Ray County	22,854	62.8%	100.0%	62.8%	40.179	$24,429

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Reynolds County	6,275	24.5%	80.7%	23.3%	7.762	$20,792
Ripley County	13,564	31.8%	95.6%	30.8%	21.546	$17,986
Saline County	22,660	58.9%	100.0%	58.9%	29.993	$20,446
Schuyler County	4,508	0.3%	100.0%	0.3%	14.670	$19,152
Scotland County	4,961	80.4%	99.6%	80.4%	11.361	$23,626
Scott County	38,541	87.5%	100.0%	87.5%	91.766	$22,034
Shannon County	8,249	25.1%	90.4%	25.1%	8.218	$19,290
Shelby County	6,021	37.3%	96.7%	37.2%	12.021	$21,521
St. Charles County	395,503	97.6%	100.0%	97.6%	705.707	$34,021
St. Clair County	9,362	28.0%	99.9%	28.0%	13.973	$19,370
St. Francois County	66,705	86.8%	100.0%	86.8%	147.614	$20,016
St. Louis County	996,726	99.7%	100.0%	99.7%	1,962.833	$36,518
St. Louis city	308,626	100.0%	100.0%	100.0%	4,985.168	$25,434
Ste. Genevieve County	17,843	51.5%	100.0%	51.5%	35.747	$24,013
Stoddard County	29,369	69.3%	100.0%	69.3%	35.676	$21,174
Stone County	31,695	100.0%	100.0%	100.0%	68.303	$23,705
Sullivan County	6,229	64.3%	100.0%	64.3%	9.613	$20,579
Taney County	55,355	97.8%	100.0%	97.8%	87.527	$20,929
Texas County	25,735	76.9%	96.2%	73.4%	21.860	$17,367
Vernon County	20,437	68.5%	100.0%	68.5%	24.730	$21,246
Warren County	34,366	77.3%	100.0%	77.3%	80.182	$24,870
Washington County	25,022	26.6%	99.8%	26.6%	32.927	$18,472
Wayne County	13,296	30.0%	99.5%	30.0%	17.514	$18,378
Webster County	38,663	100.0%	100.0%	100.0%	65.247	$20,424
Worth County	2,057	56.3%	99.8%	56.3%	7.715	$23,292
Wright County	18,331	100.0%	97.7%	97.7%	26.887	$18,502
Montana	**1,050,463**	**86.1%**	**97.5%**	**85.0%**	**7.217**	**.**
Beaverhead County	9,434	67.8%	94.3%	67.4%	1.702	$26,609
Big Horn County	13,359	81.5%	91.2%	78.2%	2.674	$17,352
Blaine County	6,708	96.3%	78.3%	75.6%	1.587	$17,080
Broadwater County	5,934	28.9%	99.4%	28.9%	4.976	$29,598
Carbon County	10,696	95.6%	99.8%	95.5%	5.221	$30,461
Carter County	1,222	47.8%	14.7%	6.8%	0.366	$30,728
Cascade County	81,653	99.6%	99.8%	99.5%	30.262	$26,578
Chouteau County	5,765	98.2%	96.5%	94.7%	1.451	$22,247
Custer County	11,721	90.8%	96.2%	90.3%	3.098	$26,742
Daniels County	1,737	98.4%	74.0%	73.5%	1.218	$33,909

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Dawson County	8,950	86.1%	95.2%	82.3%	3.773	$28,438
Deer Lodge County	9,106	77.1%	98.7%	76.6%	12.363	$23,192
Fallon County	3,009	61.1%	94.1%	59.8%	1.857	$31,902
Fergus County	11,291	80.9%	96.5%	77.6%	2.602	$25,788
Flathead County	99,995	90.5%	99.6%	90.5%	19.654	$27,083
Gallatin County	107,808	92.3%	99.5%	92.1%	41.422	$31,909
Garfield County	1,293	43.3%	73.4%	35.2%	0.277	$28,159
Glacier County	13,640	25.6%	99.6%	25.6%	4.553	$16,284
Golden Valley County	822	55.2%	99.5%	55.2%	0.699	$25,714
Granite County	3,358	15.5%	95.2%	14.3%	1.944	$26,720
Hill County	16,463	96.1%	99.7%	95.8%	5.679	$21,070
Jefferson County	11,891	80.8%	99.7%	80.6%	7.179	$31,801
Judith Basin County	1,960	83.1%	96.5%	80.3%	1.048	$28,741
Lake County	30,271	66.0%	99.2%	65.7%	20.314	$23,191
Lewis and Clark County	67,773	99.3%	99.6%	99.0%	19.594	$29,892
Liberty County	2,425	83.4%	85.6%	70.1%	1.696	$32,427
Lincoln County	19,440	22.6%	91.4%	21.0%	5.381	$22,404
Madison County	8,174	83.3%	95.9%	80.0%	2.278	$30,030
McCone County	1,718	45.6%	83.5%	43.9%	0.650	$28,736
Meagher County	1,851	97.0%	93.9%	91.3%	0.774	$19,989
Mineral County	4,255	18.2%	97.9%	18.2%	3.489	$21,447
Missoula County	117,432	93.3%	98.8%	93.1%	45.281	$27,956
Musselshell County	4,639	50.2%	98.1%	49.2%	2.483	$23,167
Park County	16,352	98.8%	98.5%	98.2%	5.834	$27,597
Petroleum County	523	39.6%	89.3%	39.4%	0.316	$26,822
Phillips County	4,119	82.2%	92.8%	80.4%	0.801	$22,772
Pondera County	5,960	19.4%	99.7%	19.4%	3.673	$21,995
Powder River County	1,752	36.6%	60.6%	28.3%	0.531	$29,393
Powell County	6,795	54.1%	96.4%	54.0%	2.921	$23,620
Prairie County	1,109	62.2%	95.9%	61.2%	0.639	$24,431
Ravalli County	42,561	97.1%	97.3%	95.9%	17.802	$23,042
Richland County	11,039	77.7%	92.3%	74.8%	5.297	$33,949
Roosevelt County	11,098	71.0%	69.9%	53.9%	4.713	$16,885
Rosebud County	9,248	43.6%	73.0%	32.1%	1.846	$23,387
Sanders County	11,711	14.4%	92.6%	13.0%	4.242	$20,810
Sheridan County	3,469	83.9%	80.3%	67.9%	2.068	$31,997

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Silver Bow County	34,601	90.5%	99.9%	90.5%	48.159	$25,583
Stillwater County	9,419	94.1%	97.3%	92.2%	5.246	$30,958
Sweet Grass County	3,691	92.7%	98.5%	91.8%	1.990	$26,935
Teton County	6,085	32.8%	99.1%	32.7%	2.678	$25,740
Toole County	4,886	28.9%	98.1%	28.9%	2.551	$23,705
Treasure County	679	53.3%	97.6%	53.3%	0.695	$21,255
Valley County	7,433	80.2%	88.1%	72.4%	1.509	$27,820
Wheatland County	2,140	81.8%	99.8%	81.8%	1.504	$19,407
Wibaux County	1,020	8.5%	73.5%	5.8%	1.147	$23,985
Yellowstone County	158,980	99.5%	100.0%	99.4%	60.373	$30,519
Nebraska	**1,919,905**	**87.3%**	**99.9%**	**87.2%**	**24.991**	**.**
Adams County	31,678	91.7%	100.0%	91.7%	56.239	$27,609
Antelope County	6,361	55.7%	99.9%	55.7%	7.421	$27,048
Arthur County	457	72.4%	97.8%	70.2%	0.639	$21,174
Banner County	742	19.0%	99.7%	19.0%	0.994	$30,095
Blaine County	482	35.3%	94.6%	31.3%	0.678	$23,001
Boone County	5,352	54.0%	100.0%	54.0%	7.795	$28,288
Box Butte County	10,886	97.0%	100.0%	97.0%	10.124	$27,751
Boyd County	1,977	99.2%	99.4%	98.6%	3.662	$25,507
Brown County	3,014	80.2%	97.1%	79.1%	2.468	$30,135
Buffalo County	49,726	91.3%	100.0%	91.3%	51.364	$27,218
Burt County	6,535	74.8%	100.0%	74.8%	13.294	$24,613
Butler County	8,053	62.6%	100.0%	62.6%	13.768	$28,045
Cass County	25,887	73.6%	100.0%	73.6%	46.439	$30,637
Cedar County	8,530	68.4%	100.0%	68.4%	11.522	$28,663
Chase County	3,971	83.9%	100.0%	83.9%	4.440	$29,239
Cherry County	5,818	61.7%	92.1%	59.4%	0.976	$27,891
Cheyenne County	9,676	92.1%	100.0%	92.1%	8.088	$30,929
Clay County	6,204	61.9%	99.8%	61.9%	10.841	$25,472
Colfax County	10,582	46.3%	99.9%	46.3%	25.706	$23,619
Cuming County	9,042	65.2%	100.0%	65.2%	15.846	$26,061
Custer County	10,897	41.0%	99.7%	41.0%	4.231	$29,986
Dakota County	20,186	90.5%	100.0%	90.5%	76.388	$21,710
Dawes County	8,890	80.5%	100.0%	80.5%	6.366	$23,307
Dawson County	23,709	82.1%	99.9%	82.1%	23.403	$24,042
Deuel County	1,883	2.3%	100.0%	2.3%	4.281	$28,640
Dixon County	5,754	86.0%	100.0%	86.0%	12.082	$24,983
Dodge County	36,707	90.8%	100.0%	90.8%	69.428	$26,141

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Douglas County	561,543	97.7%	100.0%	97.7%	1,709.652	$30,548
Dundy County	1,801	78.6%	99.4%	78.3%	1.958	$28,161
Fillmore County	5,582	60.7%	99.9%	60.7%	9.702	$29,361
Franklin County	2,990	46.9%	99.2%	46.5%	5.193	$28,373
Frontier County	2,631	10.7%	98.5%	10.4%	2.700	$26,798
Furnas County	4,780	25.3%	100.0%	25.3%	6.647	$23,307
Gage County	21,601	71.1%	100.0%	71.1%	25.368	$26,347
Garden County	1,906	85.5%	98.0%	85.5%	1.118	$30,900
Garfield County	2,016	0.6%	98.8%	0.6%	3.538	$24,379
Gosper County	2,026	13.0%	100.0%	13.0%	4.422	$29,393
Grant County	649	25.4%	99.5%	25.1%	0.836	$21,925
Greeley County	2,374	18.7%	99.8%	18.7%	4.166	$25,054
Hall County	61,518	90.4%	100.0%	90.4%	112.611	$24,617
Hamilton County	9,207	9.5%	99.9%	9.5%	16.960	$31,565
Harlan County	3,443	2.6%	98.9%	2.5%	6.221	$25,997
Hayes County	893	33.0%	99.8%	32.8%	1.252	$27,080
Hitchcock County	2,834	67.2%	100.0%	67.2%	3.992	$23,967
Holt County	10,202	59.4%	99.4%	59.1%	4.229	$26,267
Hooker County	674	21.1%	97.8%	19.1%	0.935	$22,094
Howard County	6,437	43.8%	100.0%	43.8%	11.306	$28,301
Jefferson County	7,178	63.7%	97.6%	63.4%	12.589	$26,305
Johnson County	5,184	48.6%	100.0%	48.6%	13.785	$21,890
Kearney County	6,530	86.8%	100.0%	86.8%	12.649	$31,563
Keith County	8,072	80.4%	100.0%	80.4%	7.604	$26,699
Keya Paha County	793	96.8%	94.3%	91.9%	1.026	$28,086
Kimball County	3,619	94.4%	99.9%	94.4%	3.802	$23,727
Knox County	8,472	62.8%	99.5%	62.6%	7.644	$26,675
Lancaster County	314,328	95.2%	100.0%	95.2%	375.295	$28,600
Lincoln County	35,280	85.7%	99.9%	85.6%	13.759	$27,474
Logan County	768	43.2%	100.0%	43.2%	1.346	$24,693
Loup County	609	3.3%	98.2%	1.5%	1.072	$28,063
Madison County	35,140	89.8%	100.0%	89.8%	61.354	$24,458
McPherson County	499	43.3%	94.6%	43.3%	0.581	$25,352
Merrick County	7,880	57.3%	100.0%	57.3%	16.251	$26,102
Morrill County	4,836	80.9%	99.5%	80.9%	3.396	$24,216
Nance County	3,606	48.1%	99.8%	48.1%	8.165	$26,179
Nemaha County	6,949	73.4%	99.7%	73.2%	17.058	$28,690
Nuckolls County	4,274	54.7%	100.0%	54.7%	7.431	$24,096
Otoe County	16,027	72.6%	99.9%	72.5%	26.033	$27,251

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Pawnee County	2,641	54.4%	100.0%	54.4%	6.127	$27,039
Perkins County	2,901	63.0%	99.4%	63.0%	3.284	$30,429
Phelps County	9,060	81.2%	100.0%	81.2%	16.784	$27,882
Pierce County	7,138	72.7%	100.0%	72.7%	12.452	$27,386
Platte County	33,172	78.9%	99.9%	78.9%	49.212	$27,052
Polk County	5,321	51.5%	100.0%	51.5%	12.139	$30,947
Red Willow County	10,728	88.6%	99.9%	88.5%	14.963	$24,529
Richardson County	7,969	92.0%	99.8%	91.9%	14.441	$26,638
Rock County	1,436	77.4%	95.8%	74.8%	1.424	$30,247
Saline County	14,433	78.2%	99.4%	78.1%	25.144	$21,880
Sarpy County	181,430	94.5%	100.0%	94.5%	759.152	$31,906
Saunders County	21,056	73.7%	100.0%	73.7%	28.066	$30,348
Scotts Bluff County	36,363	98.5%	100.0%	98.4%	49.179	$25,863
Seward County	17,161	73.2%	100.0%	73.2%	30.032	$28,491
Sheridan County	5,289	61.1%	97.3%	60.9%	2.167	$25,077
Sherman County	3,085	51.4%	100.0%	51.4%	5.452	$26,348
Sioux County	1,203	76.6%	97.4%	74.8%	0.582	$27,279
Stanton County	5,986	83.0%	100.0%	83.0%	13.988	$29,282
Thayer County	5,045	66.9%	99.9%	66.9%	8.792	$30,057
Thomas County	725	32.7%	99.7%	32.7%	1.016	$30,746
Thurston County	7,222	44.7%	100.0%	44.7%	18.349	$19,100
Valley County	4,209	52.1%	99.9%	52.1%	7.410	$26,384
Washington County	20,720	69.0%	99.9%	69.0%	53.134	$31,776
Wayne County	9,318	71.4%	100.0%	71.4%	21.038	$26,732
Webster County	3,524	72.4%	99.7%	72.2%	6.130	$24,534
Wheeler County	814	52.0%	99.6%	51.7%	1.415	$30,800
York County	13,806	80.6%	100.0%	80.6%	24.115	$27,962
Nevada	**2,998,018**	**92.7%**	**99.7%**	**92.6%**	**27.309**	**.**
Carson City	54,745	99.3%	100.0%	99.3%	378.434	$26,553
Churchill County	24,230	89.0%	99.4%	89.0%	4.914	$23,951
Clark County	2,204,066	95.5%	100.0%	95.5%	279.299	$26,661
Douglas County	48,309	94.3%	100.0%	94.3%	68.068	$35,243
Elko County	52,649	8.6%	98.1%	8.5%	3.066	$31,378
Esmeralda County	850	72.1%	99.6%	71.8%	0.237	$22,415
Eureka County	1,961	28.3%	97.9%	28.3%	0.470	$34,031
Humboldt County	16,826	1.1%	98.6%	1.1%	1.745	$27,580
Lander County	5,693	5.1%	97.0%	4.7%	1.037	$30,044
Lincoln County	5,223	79.4%	25.5%	19.2%	0.491	$25,505

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Lyon County	54,120	73.1%	99.9%	73.1%	27.044	$23,519
Mineral County	4,457	82.3%	100.0%	82.3%	1.188	$24,146
Nye County	44,202	91.5%	99.0%	91.5%	2.431	$23,075
Pershing County	6,508	27.0%	98.9%	27.0%	1.078	$17,631
Storey County	4,006	70.7%	100.0%	70.7%	15.237	$34,967
Washoe County	460,581	97.2%	99.7%	97.2%	73.081	$29,942
White Pine County	9,592	47.0%	98.6%	47.0%	1.081	$24,186
New Hampshire	**1,342,777**	**94.7%**	**99.9%**	**94.6%**	**149.987**	**.**
Belknap County	60,785	97.2%	100.0%	97.2%	151.874	$32,501
Carroll County	48,062	95.3%	100.0%	95.3%	51.621	$33,481
Cheshire County	75,960	70.6%	100.0%	70.6%	107.492	$30,935
Coos County	31,634	74.3%	97.0%	73.1%	17.626	$25,467
Grafton County	89,385	90.1%	99.6%	89.8%	52.310	$33,964
Hillsborough County	409,694	97.6%	100.0%	97.6%	467.613	$36,012
Merrimack County	149,213	96.6%	100.0%	96.6%	159.737	$32,848
Rockingham County	306,354	99.0%	100.0%	99.0%	440.975	$41,449
Strafford County	128,613	97.6%	100.0%	97.6%	348.568	$30,598
Sullivan County	43,077	83.0%	100.0%	83.0%	80.171	$30,552
New Jersey	**9,005,410**	**100.0%**	**100.0%**	**100.0%**	**1,224.523**	**.**
Atlantic County	269,918	100.0%	100.0%	100.0%	485.722	$28,575
Bergen County	948,395	100.0%	100.0%	100.0%	4,070.210	$44,978
Burlington County	448,596	100.0%	100.0%	100.0%	561.745	$38,137
Camden County	510,719	100.0%	100.0%	100.0%	2,308.202	$31,736
Cape May County	93,553	100.0%	100.0%	100.0%	372.091	$34,550
Cumberland County	152,538	100.0%	100.0%	100.0%	315.355	$22,303
Essex County	808,261	100.0%	100.0%	100.0%	6,403.982	$33,482
Gloucester County	292,205	100.0%	100.0%	100.0%	907.454	$34,886
Hudson County	691,606	100.0%	100.0%	100.0%	14,972.741	$34,468
Hunterdon County	125,059	100.0%	100.0%	100.0%	292.318	$53,222
Mercer County	374,712	100.0%	100.0%	100.0%	1,668.668	$38,652
Middlesex County	842,762	100.0%	100.0%	100.0%	2,728.146	$35,209
Monmouth County	626,350	100.0%	100.0%	100.0%	1,336.092	$44,504
Morris County	499,692	100.0%	100.0%	100.0%	1,085.870	$51,182
Ocean County	597,935	100.0%	100.0%	100.0%	950.943	$31,903
Passaic County	512,590	100.0%	100.0%	100.0%	2,776.869	$28,661
Salem County	62,792	100.0%	100.0%	100.0%	189.190	$30,295
Somerset County	335,411	100.0%	100.0%	100.0%	1,111.320	$50,034

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Sussex County	141,682	100.0%	100.0%	100.0%	272.983	$39,667
Union County	563,836	100.0%	100.0%	100.0%	5,481.855	$36,374
Warren County	106,798	100.0%	100.0%	100.0%	299.223	$35,386
New Mexico	**2,088,060**	**83.4%**	**99.5%**	**83.3%**	**17.214**	**.**
Bernalillo County	676,773	98.7%	100.0%	98.7%	583.009	$27,402
Catron County	3,587	0.0%	65.9%	0.0%	0.518	$20,762
Chaves County	64,866	85.8%	100.0%	85.8%	10.695	$21,015
Cibola County	26,853	13.7%	97.9%	13.7%	5.915	$16,885
Colfax County	12,174	9.8%	100.0%	9.8%	3.239	$20,911
Curry County	49,812	92.8%	100.0%	92.8%	35.459	$21,502
De Baca County	1,829	64.9%	100.0%	64.9%	0.787	$28,232
Dona Ana County	215,578	84.9%	100.0%	84.9%	56.619	$20,143
Eddy County	56,997	85.0%	99.9%	84.9%	13.650	$27,974
Grant County	27,687	77.6%	99.5%	77.6%	6.989	$24,882
Guadalupe County	4,429	52.4%	100.0%	52.4%	1.461	$16,034
Harding County	692	47.3%	100.0%	47.3%	0.326	$23,339
Hidalgo County	4,305	3.0%	97.7%	2.4%	1.253	$18,077
Lea County	68,759	85.1%	100.0%	85.1%	15.659	$24,126
Lincoln County	19,395	78.6%	100.0%	78.6%	4.015	$25,230
Los Alamos County	18,738	99.6%	100.0%	99.6%	171.646	$51,066
Luna County	24,078	62.3%	99.9%	62.3%	8.120	$15,650
McKinley County	72,564	36.5%	98.8%	36.5%	13.315	$12,882
Mora County	4,551	30.3%	97.6%	30.3%	2.356	$13,826
Otero County	65,815	78.7%	98.1%	78.5%	9.952	$20,652
Quay County	8,306	43.0%	100.0%	43.0%	2.890	$18,285
Rio Arriba County	39,159	83.1%	97.8%	82.1%	6.681	$19,600
Roosevelt County	18,847	74.9%	100.0%	74.9%	7.701	$18,447
San Juan County	126,920	65.9%	99.8%	65.9%	23.022	$22,927
San Miguel County	27,748	47.6%	98.8%	47.6%	5.884	$16,990
Sandoval County	142,506	89.0%	99.9%	89.0%	38.405	$27,060
Santa Fe County	148,750	97.5%	100.0%	97.5%	77.903	$34,176
Sierra County	11,116	77.9%	98.2%	76.7%	2.660	$20,495
Socorro County	16,798	2.1%	92.2%	2.1%	2.527	$17,277
Taos County	32,795	57.5%	91.8%	57.0%	14.886	$22,302
Torrance County	15,506	45.4%	100.0%	45.4%	4.636	$18,967
Union County	4,187	71.5%	99.7%	71.5%	1.095	$21,091
Valencia County	75,940	86.1%	100.0%	86.1%	71.227	$19,842

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New York	**19,849,178**	**100.0%**	**99.9%**	**99.9%**	**421.190**	**.**
Albany County	309,612	100.0%	100.0%	100.0%	592.214	$33,888
Allegany County	46,894	100.0%	99.9%	99.9%	45.559	$21,478
Bronx County	1,471,140	100.0%	100.0%	100.0%	34,947.016	$18,896
Broome County	193,639	100.0%	100.0%	100.0%	274.367	$25,880
Cattaraugus County	77,348	100.0%	99.9%	99.9%	59.119	$22,832
Cayuga County	77,603	100.0%	100.0%	100.0%	112.211	$26,596
Chautauqua County	129,046	100.0%	100.0%	100.0%	121.716	$23,249
Chemung County	85,557	100.0%	99.4%	99.4%	210.032	$26,196
Chenango County	47,863	100.0%	96.6%	96.6%	53.565	$23,805
Clinton County	80,980	100.0%	99.3%	99.3%	78.027	$25,024
Columbia County	60,604	100.0%	100.0%	100.0%	95.484	$33,864
Cortland County	47,786	100.0%	99.9%	99.9%	95.810	$24,665
Delaware County	45,001	100.0%	98.3%	98.3%	31.198	$24,753
Dutchess County	295,568	100.0%	100.0%	100.0%	371.489	$35,101
Erie County	925,525	100.0%	100.0%	100.0%	887.629	$29,940
Essex County	37,956	100.0%	96.9%	96.9%	21.154	$28,155
Franklin County	51,115	100.0%	98.2%	98.2%	31.376	$23,660
Fulton County	53,877	100.0%	99.2%	99.2%	108.739	$25,092
Genesee County	57,956	100.0%	100.0%	100.0%	117.573	$26,381
Greene County	47,470	100.0%	99.5%	99.5%	73.351	$26,307
Hamilton County	4,485	100.0%	89.9%	89.9%	2.612	$27,371
Herkimer County	62,240	100.0%	99.3%	99.3%	44.096	$24,678
Jefferson County	114,185	100.0%	100.0%	100.0%	90.009	$24,172
Kings County	2,648,702	100.0%	100.0%	100.0%	37,402.710	$28,134
Lewis County	26,551	100.0%	98.5%	98.5%	20.830	$25,230
Livingston County	63,799	100.0%	100.0%	100.0%	100.986	$24,596
Madison County	70,965	100.0%	100.0%	100.0%	108.370	$26,824
Monroe County	747,642	100.0%	100.0%	100.0%	1,137.608	$30,194
Montgomery County	49,258	100.0%	100.0%	100.0%	122.215	$23,885
Nassau County	1,369,509	100.0%	100.0%	100.0%	4,810.087	$44,548
New York County	1,664,727	100.0%	100.0%	100.0%	72,922.581	$66,522
Niagara County	211,328	100.0%	100.0%	100.0%	404.565	$27,487
Oneida County	231,331	100.0%	100.0%	100.0%	190.800	$26,577
Onondaga County	465,398	100.0%	100.0%	100.0%	597.898	$30,225
Ontario County	109,897	100.0%	100.0%	100.0%	170.630	$31,524
Orange County	382,224	100.0%	100.0%	100.0%	470.901	$31,272
Orleans County	40,983	100.0%	100.0%	100.0%	104.746	$23,332
Oswego County	118,478	100.0%	100.0%	100.0%	124.497	$24,284

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Otsego County	60,094	100.0%	99.6%	99.6%	59.992	$24,989
Putnam County	99,323	100.0%	100.0%	100.0%	431.255	$41,993
Queens County	2,358,477	100.0%	100.0%	100.0%	21,730.679	$27,631
Rensselaer County	159,722	100.0%	100.0%	100.0%	244.810	$31,529
Richmond County	479,458	100.0%	100.0%	100.0%	8,214.067	$32,678
Rockland County	328,868	100.0%	100.0%	100.0%	1,894.944	$35,557
Saratoga County	229,869	100.0%	99.4%	99.4%	283.794	$37,583
Schenectady County	155,563	100.0%	100.0%	100.0%	760.640	$29,212
Schoharie County	31,420	100.0%	99.8%	99.8%	50.529	$25,638
Schuyler County	18,000	100.0%	100.0%	100.0%	54.822	$25,004
Seneca County	34,498	100.0%	100.0%	100.0%	106.572	$25,680
St. Lawrence County	109,623	100.0%	99.7%	99.7%	40.898	$23,313
Steuben County	96,281	100.0%	99.9%	99.9%	69.239	$26,830
Suffolk County	1,492,952	100.0%	100.0%	100.0%	1,636.917	$38,779
Sullivan County	75,485	100.0%	99.8%	99.8%	77.970	$27,068
Tioga County	48,578	100.0%	99.9%	99.9%	93.671	$29,654
Tompkins County	104,800	100.0%	100.0%	100.0%	220.795	$28,888
Ulster County	179,417	100.0%	99.0%	99.0%	159.590	$31,760
Warren County	64,532	100.0%	97.8%	97.8%	74.435	$31,652
Washington County	61,620	100.0%	99.7%	99.7%	74.135	$25,200
Wayne County	90,670	100.0%	100.0%	100.0%	150.159	$26,209
Westchester County	980,238	100.0%	100.0%	100.0%	2,276.991	$49,938
Wyoming County	40,493	100.0%	100.0%	100.0%	68.314	$24,610
Yates County	24,955	100.0%	100.0%	100.0%	73.800	$26,001
North Carolina	**10,273,122**	**94.8%**	**99.7%**	**94.5%**	**211.303**	**.**
Alamance County	162,380	98.6%	100.0%	98.6%	383.023	$23,989
Alexander County	37,286	86.5%	100.0%	86.5%	143.411	$20,567
Alleghany County	11,029	94.4%	63.8%	60.3%	46.920	$21,059
Anson County	24,991	83.0%	100.0%	83.0%	47.024	$17,548
Ashe County	26,957	92.5%	44.0%	40.9%	63.259	$22,343
Avery County	17,536	96.0%	99.5%	95.5%	70.971	$21,548
Beaufort County	47,088	88.4%	99.9%	88.4%	56.925	$23,716
Bertie County	19,224	82.3%	100.0%	82.3%	27.492	$17,244
Bladen County	33,478	70.1%	100.0%	70.1%	38.290	$19,510
Brunswick County	130,896	89.9%	100.0%	89.8%	154.546	$28,694
Buncombe County	257,607	98.8%	99.9%	98.7%	392.292	$28,087
Burke County	89,293	97.3%	100.0%	97.3%	176.086	$20,775

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Cabarrus County	206,864	99.3%	100.0%	99.3%	571.844	$27,728
Caldwell County	81,981	97.4%	100.0%	97.3%	173.848	$20,587
Camden County	10,581	96.7%	100.0%	96.7%	43.986	$26,420
Carteret County	68,881	99.8%	99.9%	99.8%	136.061	$29,349
Caswell County	22,646	53.1%	99.2%	52.3%	53.295	$20,235
Catawba County	157,956	99.5%	100.0%	99.5%	396.156	$24,220
Chatham County	71,472	79.4%	100.0%	79.4%	104.769	$35,109
Cherokee County	28,087	71.3%	97.9%	70.7%	61.672	$19,285
Chowan County	14,105	91.2%	100.0%	91.2%	81.781	$22,173
Clay County	11,074	58.7%	98.0%	58.7%	51.567	$23,076
Cleveland County	97,334	95.1%	100.0%	95.1%	209.657	$20,677
Columbus County	55,936	83.3%	100.0%	83.3%	59.678	$21,133
Craven County	102,578	94.4%	100.0%	94.4%	144.688	$25,230
Cumberland County	332,542	99.5%	100.0%	99.5%	509.788	$23,148
Currituck County	26,331	96.6%	100.0%	96.6%	100.557	$28,202
Dare County	36,099	99.3%	99.7%	99.0%	94.150	$29,746
Davidson County	165,463	99.6%	100.0%	99.6%	299.386	$23,146
Davie County	42,456	99.4%	100.0%	99.4%	160.754	$28,178
Duplin County	59,039	64.6%	100.0%	64.6%	72.332	$17,960
Durham County	311,597	99.2%	100.0%	99.2%	1,089.594	$31,473
Edgecombe County	52,747	87.8%	100.0%	87.8%	104.380	$18,009
Forsyth County	376,310	100.0%	100.0%	100.0%	921.995	$27,593
Franklin County	66,166	85.0%	98.9%	84.6%	134.571	$22,394
Gaston County	220,181	99.8%	100.0%	99.8%	618.439	$23,710
Gates County	11,544	60.7%	100.0%	60.7%	33.909	$23,602
Graham County	8,541	46.3%	100.0%	46.3%	29.242	$18,783
Granville County	59,557	87.4%	100.0%	87.4%	112.040	$23,563
Greene County	21,015	33.4%	100.0%	33.4%	79.025	$18,682
Guilford County	526,947	99.8%	100.0%	99.8%	816.082	$27,531
Halifax County	51,310	83.8%	100.0%	83.8%	70.862	$20,134
Harnett County	132,735	95.1%	100.0%	95.1%	223.089	$21,214
Haywood County	61,084	80.5%	99.5%	80.5%	110.321	$26,483
Henderson County	115,698	90.8%	100.0%	90.8%	310.126	$26,534
Hertford County	23,906	81.1%	100.0%	81.1%	67.711	$17,650
Hoke County	54,104	88.2%	100.0%	88.2%	138.464	$18,715
Hyde County	5,363	20.9%	99.9%	20.9%	8.753	$18,770
Iredell County	175,699	97.7%	100.0%	97.7%	306.185	$28,268
Jackson County	42,971	35.3%	99.1%	35.3%	87.561	$21,903

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Johnston County	196,691	100.0%	100.0%	100.0%	248.567	$23,171
Jones County	9,597	54.4%	100.0%	54.4%	20.388	$20,348
Lee County	60,429	96.8%	100.0%	96.8%	237.014	$22,389
Lenoir County	56,883	88.1%	100.0%	88.1%	141.998	$20,773
Lincoln County	82,401	98.7%	100.0%	98.7%	276.571	$26,352
Macon County	34,732	54.8%	100.0%	54.8%	67.368	$25,195
Madison County	21,745	100.0%	90.3%	90.3%	48.368	$22,278
Martin County	22,789	79.4%	100.0%	79.4%	49.411	$21,149
McDowell County	45,159	76.2%	100.0%	76.2%	102.492	$19,233
Mecklenburg County	1,076,818	100.0%	100.0%	100.0%	2,055.614	$34,091
Mitchell County	15,072	89.8%	98.2%	88.4%	68.068	$22,130
Montgomery County	27,435	56.5%	100.0%	56.5%	55.789	$20,007
Moore County	97,249	88.7%	100.0%	88.7%	139.357	$29,679
Nash County	93,991	92.8%	100.0%	92.8%	173.926	$24,106
New Hanover County	227,191	99.8%	100.0%	99.8%	1,186.163	$30,375
Northampton County	19,862	79.8%	100.0%	79.8%	37.015	$18,836
Onslow County	193,886	97.4%	100.0%	97.4%	254.195	$22,590
Orange County	144,931	93.9%	100.0%	93.9%	364.187	$37,103
Pamlico County	12,689	84.7%	99.8%	84.6%	37.705	$24,332
Pasquotank County	39,743	99.9%	100.0%	99.9%	175.172	$22,549
Pender County	60,951	78.3%	100.0%	78.3%	70.075	$24,031
Perquimans County	13,473	92.1%	100.0%	92.1%	54.527	$25,407
Person County	39,370	91.1%	100.0%	91.1%	100.351	$22,049
Pitt County	179,042	95.7%	100.0%	95.7%	274.615	$24,066
Polk County	20,557	73.0%	100.0%	73.0%	86.451	$28,175
Randolph County	143,282	94.9%	100.0%	94.9%	183.104	$21,731
Richmond County	44,798	93.5%	100.0%	93.5%	94.546	$19,411
Robeson County	132,606	84.2%	100.0%	84.2%	139.700	$16,221
Rockingham County	90,949	96.9%	100.0%	96.9%	160.815	$21,298
Rowan County	140,641	97.9%	100.0%	97.9%	275.026	$22,463
Rutherford County	66,550	67.7%	99.5%	67.7%	117.965	$19,688
Sampson County	63,430	58.8%	100.0%	58.8%	67.140	$19,871
Scotland County	35,093	90.5%	100.0%	90.5%	110.063	$16,192
Stanly County	61,482	97.8%	100.0%	97.8%	155.617	$22,103
Stokes County	45,717	96.6%	100.0%	96.6%	101.852	$22,013

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Surry County	72,222	98.5%	98.1%	96.7%	135.713	$21,411
Swain County	14,294	45.9%	96.6%	45.9%	27.072	$20,256
Transylvania County	33,956	76.9%	99.3%	76.6%	89.705	$25,394
Tyrrell County	4,052	82.1%	99.2%	81.3%	10.416	$17,042
Union County	231,357	98.6%	100.0%	98.6%	366.349	$31,185
Vance County	44,211	96.1%	100.0%	96.1%	174.390	$18,703
Wake County	1,072,182	99.8%	100.0%	99.8%	1,283.714	$35,752
Warren County	19,883	67.8%	99.8%	67.8%	46.406	$19,563
Washington County	12,012	92.0%	100.0%	92.0%	34.504	$20,423
Watauga County	55,120	97.6%	100.0%	97.6%	176.353	$22,892
Wayne County	124,170	96.7%	100.0%	96.7%	224.504	$21,674
Wilkes County	68,576	99.3%	96.1%	95.4%	90.916	$20,145
Wilson County	81,671	98.3%	100.0%	98.3%	221.827	$22,519
Yadkin County	37,773	99.3%	100.0%	99.3%	112.813	$21,820
Yancey County	17,744	90.5%	96.7%	87.7%	56.763	$21,508
North Dakota	**755,345**	**93.1%**	**99.7%**	**92.8%**	**10.947**	**.**
Adams County	2,318	100.0%	98.2%	98.2%	2.347	$32,594
Barnes County	10,734	91.6%	100.0%	91.6%	7.197	$34,244
Benson County	6,934	44.5%	100.0%	44.5%	4.993	$20,561
Billings County	940	56.2%	93.1%	54.4%	0.818	$40,549
Bottineau County	6,530	90.0%	100.0%	90.0%	3.914	$32,661
Bowman County	3,166	100.0%	98.6%	98.6%	2.725	$34,388
Burke County	2,131	55.6%	98.8%	54.4%	1.931	$35,857
Burleigh County	95,021	98.4%	100.0%	98.4%	58.200	$36,093
Cass County	177,752	93.6%	100.0%	93.6%	100.713	$32,485
Cavalier County	3,762	100.0%	100.0%	100.0%	2.527	$39,779
Dickey County	4,861	99.8%	100.0%	99.8%	4.296	$28,843
Divide County	2,288	94.4%	89.9%	86.2%	1.815	$41,063
Dunn County	4,289	98.3%	99.2%	97.5%	2.135	$40,102
Eddy County	2,316	84.5%	99.5%	84.0%	3.675	$33,785
Emmons County	3,301	100.0%	100.0%	100.0%	2.185	$29,467
Foster County	3,257	100.0%	100.0%	100.0%	5.125	$30,310
Golden Valley County	1,789	3.0%	97.4%	1.7%	1.788	$26,536
Grand Forks County	70,795	92.0%	100.0%	92.0%	49.287	$29,376
Grant County	2,376	96.1%	91.5%	90.2%	1.432	$32,200
Griggs County	2,258	92.6%	99.8%	92.4%	3.186	$31,866

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Hettinger County	2,483	100.0%	99.8%	99.8%	2.193	$31,074
Kidder County	2,482	100.0%	99.5%	99.5%	1.837	$36,779
LaMoure County	4,087	100.0%	99.1%	99.1%	3.566	$36,493
Logan County	1,918	100.0%	98.9%	98.9%	1.932	$33,272
McHenry County	5,900	77.4%	100.0%	77.4%	3.148	$36,072
McIntosh County	2,606	100.0%	100.0%	100.0%	2.674	$30,620
McKenzie County	12,724	73.5%	96.8%	70.8%	4.610	$37,938
McLean County	9,685	90.3%	99.7%	90.0%	4.588	$34,218
Mercer County	8,465	100.0%	100.0%	100.0%	8.116	$34,194
Morton County	30,796	93.1%	100.0%	93.1%	15.987	$34,715
Mountrail County	10,265	86.2%	99.9%	86.2%	5.624	$39,285
Nelson County	2,937	100.0%	100.0%	100.0%	2.992	$33,895
Oliver County	1,938	92.2%	99.9%	92.1%	2.682	$35,524
Pembina County	6,972	100.0%	100.0%	100.0%	6.232	$32,779
Pierce County	4,099	97.8%	100.0%	97.8%	4.024	$27,926
Ramsey County	11,519	100.0%	100.0%	100.0%	9.705	$30,372
Ransom County	5,297	99.3%	100.0%	99.3%	6.142	$30,822
Renville County	2,463	88.9%	100.0%	88.9%	2.808	$31,646
Richland County	16,351	89.8%	100.0%	89.8%	11.388	$28,534
Rolette County	14,531	91.7%	99.8%	91.6%	16.091	$17,744
Sargent County	3,858	100.0%	100.0%	100.0%	4.494	$33,072
Sheridan County	1,353	94.5%	99.2%	93.6%	1.391	$31,244
Sioux County	4,376	97.7%	97.2%	96.2%	4.000	$15,338
Slope County	771	98.3%	77.4%	76.4%	0.635	$36,168
Stark County	30,209	98.0%	99.9%	97.9%	22.633	$37,681
Steele County	1,917	70.2%	99.6%	69.7%	2.692	$36,802
Stutsman County	21,087	98.2%	100.0%	98.2%	9.491	$30,623
Towner County	2,253	86.2%	100.0%	86.2%	2.199	$33,785
Traill County	8,013	86.3%	100.0%	86.3%	9.296	$31,188
Walsh County	10,855	90.9%	100.0%	90.9%	8.468	$30,266
Ward County	68,946	94.2%	100.0%	94.2%	34.246	$32,395
Wells County	4,022	96.7%	100.0%	96.7%	3.164	$30,260
Williams County	33,349	88.8%	99.0%	88.1%	16.053	$45,442
Ohio	**11,658,365**	**94.7%**	**99.9%**	**94.6%**	**285.320**	**.**
Adams County	27,726	51.1%	99.7%	51.1%	47.487	$18,901
Allen County	103,198	95.7%	100.0%	95.7%	256.395	$23,600
Ashland County	53,628	80.9%	100.0%	80.9%	126.795	$22,604
Ashtabula County	97,807	92.0%	100.0%	92.0%	139.340	$20,978
Athens County	66,597	73.7%	99.7%	73.6%	132.242	$18,602

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Auglaize County	45,778	93.6%	100.0%	93.6%	114.050	$26,690
Belmont County	68,029	81.5%	99.9%	81.5%	127.843	$24,533
Brown County	43,576	65.8%	100.0%	65.8%	88.928	$23,776
Butler County	380,570	99.7%	100.0%	99.6%	814.828	$28,556
Carroll County	27,385	53.0%	99.8%	53.0%	69.398	$25,093
Champaign County	38,840	82.3%	100.0%	82.3%	90.606	$24,715
Clark County	134,557	99.2%	100.0%	99.2%	338.531	$23,992
Clermont County	204,214	99.3%	100.0%	99.3%	451.701	$30,060
Clinton County	42,009	77.9%	100.0%	77.9%	102.791	$23,612
Columbiana County	103,077	80.9%	100.0%	80.9%	193.793	$23,785
Coshocton County	36,544	67.6%	99.4%	67.6%	64.804	$21,521
Crawford County	41,746	99.0%	100.0%	99.0%	103.901	$22,631
Cuyahoga County	1,248,514	99.3%	100.0%	99.3%	2,730.837	$29,143
Darke County	51,536	84.7%	100.0%	84.7%	86.166	$23,589
Defiance County	38,156	98.4%	100.0%	98.4%	92.733	$24,703
Delaware County	200,434	96.7%	100.0%	96.7%	452.347	$42,985
Erie County	74,817	96.5%	100.0%	96.5%	297.415	$28,684
Fairfield County	154,708	94.2%	100.0%	94.2%	306.710	$28,746
Fayette County	28,752	88.8%	100.0%	88.8%	70.756	$22,728
Franklin County	1,291,947	100.0%	100.0%	100.0%	2,427.613	$30,098
Fulton County	42,289	97.8%	100.0%	97.8%	104.303	$27,010
Gallia County	29,973	85.7%	97.8%	84.7%	64.247	$20,914
Geauga County	93,918	87.9%	100.0%	87.9%	234.699	$37,537
Greene County	166,741	96.6%	100.0%	96.6%	403.019	$31,877
Guernsey County	39,093	58.4%	99.7%	58.3%	74.854	$22,280
Hamilton County	813,816	100.0%	100.0%	100.0%	2,004.916	$31,303
Hancock County	75,754	95.6%	100.0%	95.6%	142.567	$28,244
Hardin County	31,364	85.5%	100.0%	85.5%	66.674	$20,994
Harrison County	15,216	49.1%	100.0%	49.1%	37.819	$22,639
Henry County	27,185	99.8%	100.0%	99.8%	65.347	$26,288
Highland County	42,971	71.0%	99.9%	71.0%	77.693	$21,134
Hocking County	28,470	58.2%	99.8%	58.2%	67.573	$22,091
Holmes County	43,957	43.4%	99.9%	43.2%	104.032	$19,517
Huron County	58,494	95.1%	100.0%	95.1%	119.012	$23,698
Jackson County	32,449	70.3%	99.8%	70.3%	77.204	$20,583
Jefferson County	66,359	86.2%	99.9%	86.2%	162.514	$23,356
Knox County	61,256	74.5%	100.0%	74.5%	116.568	$23,426
Lake County	230,116	99.8%	100.0%	99.8%	1,011.531	$31,053
Lawrence County	60,249	85.7%	95.6%	85.2%	132.891	$22,567

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Licking County	173,443	94.6%	100.0%	94.6%	254.129	$27,934
Logan County	45,325	82.4%	100.0%	82.4%	98.870	$25,877
Lorain County	307,906	90.2%	100.0%	90.2%	626.970	$27,537
Lucas County	430,887	98.9%	100.0%	98.9%	1,264.135	$25,977
Madison County	44,036	91.6%	100.0%	91.6%	94.523	$25,687
Mahoning County	229,796	98.6%	100.0%	98.6%	558.268	$24,651
Marion County	64,967	95.8%	100.0%	95.8%	160.906	$21,177
Medina County	178,348	98.2%	100.0%	98.2%	423.270	$32,911
Meigs County	23,080	61.4%	98.0%	60.5%	53.662	$21,317
Mercer County	40,873	100.0%	100.0%	100.0%	88.384	$26,236
Miami County	105,118	95.9%	100.0%	95.9%	258.542	$27,247
Monroe County	13,946	0.3%	98.0%	0.3%	30.602	$22,100
Montgomery County	531,539	99.8%	100.0%	99.8%	1,151.631	$26,392
Morgan County	14,709	52.5%	96.8%	52.2%	35.322	$20,301
Morrow County	34,994	74.6%	100.0%	74.6%	86.175	$23,630
Muskingum County	86,149	88.2%	98.3%	88.1%	129.629	$21,945
Noble County	14,406	50.3%	98.9%	50.3%	36.195	$21,188
Ottawa County	40,657	100.0%	100.0%	100.0%	159.491	$30,403
Paulding County	18,845	93.5%	100.0%	93.5%	45.253	$24,174
Perry County	36,024	57.9%	99.2%	57.9%	88.300	$20,852
Pickaway County	57,828	81.9%	100.0%	81.9%	115.351	$24,779
Pike County	28,268	74.4%	99.6%	74.4%	64.204	$21,375
Portage County	162,275	96.4%	100.0%	96.4%	332.953	$26,769
Preble County	41,120	98.4%	100.0%	98.4%	96.954	$24,605
Putnam County	33,878	89.6%	100.0%	89.6%	70.210	$27,367
Richland County	120,589	93.7%	100.0%	93.7%	243.482	$22,520
Ross County	77,310	92.7%	100.0%	92.6%	112.176	$22,158
Sandusky County	59,195	99.9%	100.0%	99.9%	144.925	$24,467
Scioto County	75,929	84.0%	98.5%	83.5%	124.430	$20,728
Seneca County	55,243	95.7%	100.0%	95.7%	100.256	$23,900
Shelby County	48,759	92.2%	100.0%	92.2%	119.603	$27,330
Stark County	372,542	99.1%	100.0%	99.1%	647.594	$26,442
Summit County	541,226	100.0%	100.0%	100.0%	1,311.274	$29,643
Trumbull County	200,380	96.3%	100.0%	96.3%	324.084	$24,445
Tuscarawas County	92,297	84.4%	100.0%	84.4%	162.599	$24,173
Union County	56,739	79.8%	100.0%	79.8%	131.422	$30,431
Van Wert County	28,217	99.1%	100.0%	99.1%	68.964	$25,316
Vinton County	13,091	38.2%	99.9%	38.2%	31.746	$19,431

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Warren County	228,859	97.2%	100.0%	97.2%	570.274	$36,057
Washington County	60,418	79.0%	97.8%	78.5%	95.602	$25,462
Wayne County	116,038	90.8%	100.0%	90.8%	209.104	$24,311
Williams County	36,784	98.4%	100.0%	98.4%	87.380	$22,757
Wood County	130,488	100.0%	100.0%	100.0%	211.418	$28,843
Wyandot County	22,029	69.2%	100.0%	69.2%	54.143	$25,064
Oklahoma	**3,930,571**	**79.0%**	**99.9%**	**79.0%**	**57.301**	**.**
Adair County	21,909	14.5%	100.0%	14.5%	38.204	$16,018
Alfalfa County	5,906	99.1%	100.0%	99.1%	6.816	$27,807
Atoka County	13,887	30.0%	99.7%	30.0%	14.236	$19,159
Beaver County	5,315	67.0%	98.2%	65.6%	2.929	$26,738
Beckham County	21,793	69.1%	100.0%	69.1%	24.166	$25,269
Blaine County	9,498	63.9%	99.6%	63.8%	10.230	$20,848
Bryan County	46,318	71.6%	100.0%	71.6%	51.210	$21,273
Caddo County	29,173	43.5%	100.0%	43.5%	22.822	$20,499
Canadian County	139,865	83.4%	100.0%	83.4%	155.990	$28,724
Carter County	48,190	71.3%	100.0%	71.3%	58.613	$24,272
Cherokee County	48,887	60.1%	99.7%	60.0%	65.234	$19,627
Choctaw County	14,863	0.0%	100.0%	0.0%	19.294	$19,085
Cimarron County	2,154	69.5%	98.7%	69.0%	1.174	$26,309
Cleveland County	279,628	80.6%	100.0%	80.6%	519.015	$28,378
Coal County	5,642	40.7%	100.0%	40.7%	10.920	$23,716
Comanche County	121,518	87.6%	100.0%	87.6%	113.644	$23,925
Cotton County	5,823	43.9%	100.0%	43.9%	9.204	$22,411
Craig County	14,327	98.3%	100.0%	98.3%	18.818	$20,130
Creek County	71,697	65.8%	100.0%	65.8%	75.459	$23,336
Custer County	28,800	79.9%	100.0%	79.9%	29.126	$23,540
Delaware County	42,589	82.9%	100.0%	82.9%	57.695	$22,267
Dewey County	4,877	20.6%	100.0%	20.6%	4.880	$25,708
Ellis County	3,966	56.0%	99.0%	56.0%	3.220	$28,610
Garfield County	61,581	89.9%	100.0%	89.9%	58.179	$24,968
Garvin County	27,909	55.7%	100.0%	55.7%	34.794	$22,208
Grady County	54,935	56.6%	100.0%	56.6%	49.918	$26,250
Grant County	4,395	99.5%	100.0%	99.5%	4.391	$29,559
Greer County	5,843	50.2%	100.0%	50.2%	9.139	$20,147
Harmon County	2,689	59.2%	100.0%	59.2%	5.006	$21,227
Harper County	3,805	76.5%	99.6%	76.5%	3.662	$24,948
Haskell County	12,763	37.7%	100.0%	37.7%	22.138	$18,981

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Hughes County	13,302	42.9%	100.0%	42.9%	16.531	$16,672
Jackson County	25,125	79.8%	100.0%	79.8%	31.303	$23,616
Jefferson County	6,183	27.3%	100.0%	27.3%	8.148	$19,651
Johnston County	11,060	48.0%	100.0%	48.0%	17.202	$19,602
Kay County	44,544	99.9%	100.0%	99.9%	48.432	$23,514
Kingfisher County	15,669	58.2%	100.0%	58.2%	17.446	$30,011
Kiowa County	8,893	70.7%	100.0%	70.7%	8.760	$22,857
Latimer County	10,411	48.1%	94.2%	47.8%	14.418	$22,560
Le Flore County	49,731	46.7%	99.6%	46.7%	31.293	$19,138
Lincoln County	35,139	41.7%	100.0%	41.7%	36.899	$23,878
Logan County	46,775	65.8%	100.0%	65.8%	62.884	$27,483
Love County	10,034	30.9%	100.0%	30.9%	19.522	$20,440
Major County	7,693	42.3%	99.9%	42.3%	8.056	$27,797
Marshall County	16,432	72.7%	100.0%	72.7%	44.282	$21,394
Mayes County	40,920	88.0%	100.0%	88.0%	62.437	$21,756
McClain County	39,310	67.4%	100.0%	67.4%	68.880	$27,217
McCurtain County	32,808	14.6%	95.1%	14.6%	17.734	$18,507
McIntosh County	19,742	35.1%	100.0%	35.1%	31.919	$21,456
Murray County	13,853	63.0%	100.0%	63.0%	33.264	$24,454
Muskogee County	69,086	70.2%	100.0%	70.2%	85.244	$21,109
Noble County	11,277	56.7%	100.0%	56.7%	15.408	$26,701
Nowata County	10,306	84.9%	100.0%	84.9%	18.216	$21,085
Okfuskee County	12,140	35.1%	100.0%	35.1%	19.626	$17,381
Oklahoma County	787,901	93.5%	100.0%	93.5%	1,111.569	$28,059
Okmulgee County	38,930	60.9%	100.0%	60.9%	55.826	$20,721
Osage County	47,233	62.1%	99.7%	62.1%	21.026	$23,416
Ottawa County	31,312	99.2%	100.0%	99.2%	66.505	$18,616
Pawnee County	16,472	0.0%	100.0%	0.0%	29.002	$22,750
Payne County	81,569	74.2%	100.0%	74.2%	119.131	$22,409
Pittsburg County	44,184	66.9%	100.0%	66.9%	33.845	$23,339
Pontotoc County	38,224	73.6%	100.0%	73.6%	53.057	$22,710
Pottawatomie County	72,224	80.8%	100.0%	80.8%	91.693	$21,422
Pushmataha County	11,173	0.1%	77.4%	0.1%	8.005	$22,207
Roger Mills County	3,714	13.3%	99.8%	13.3%	3.255	$27,869
Rogers County	91,444	97.3%	100.0%	97.3%	135.346	$28,938
Seminole County	24,878	46.0%	100.0%	46.0%	39.312	$19,374
Sequoyah County	41,252	31.1%	100.0%	31.1%	61.271	$18,698
Stephens County	43,332	71.9%	100.0%	71.9%	49.793	$24,555

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Texas County	20,900	82.4%	100.0%	82.4%	10.239	$22,923
Tillman County	7,433	83.4%	100.0%	83.4%	8.533	$20,549
Tulsa County	646,214	97.7%	100.0%	97.7%	1,133.219	$28,970
Wagoner County	78,648	86.1%	100.0%	86.1%	140.054	$26,159
Washington County	51,932	83.6%	100.0%	83.6%	125.001	$28,528
Washita County	11,134	60.5%	100.0%	60.5%	11.099	$25,032
Woods County	9,031	84.0%	99.9%	84.0%	7.020	$27,464
Woodward County	20,459	12.5%	99.9%	12.5%	16.467	$27,308
Oregon	**4,142,693**	**92.4%**	**99.6%**	**92.3%**	**43.158**	**.**
Baker County	16,054	70.4%	99.5%	70.2%	5.232	$24,776
Benton County	90,947	98.9%	99.8%	98.7%	134.549	$28,986
Clackamas County	412,657	93.8%	99.9%	93.7%	220.634	$35,506
Clatsop County	39,179	82.3%	99.6%	82.3%	47.258	$27,071
Columbia County	51,782	69.8%	99.8%	69.8%	78.773	$27,449
Coos County	63,888	88.6%	98.9%	88.5%	40.026	$24,261
Crook County	23,119	93.4%	99.1%	93.4%	7.760	$22,346
Curry County	22,669	93.8%	98.6%	93.5%	13.929	$24,908
Deschutes County	186,867	96.1%	100.0%	96.1%	61.914	$30,177
Douglas County	109,404	89.1%	98.5%	89.0%	21.724	$23,608
Gilliam County	1,855	51.2%	96.8%	51.2%	1.540	$23,360
Grant County	7,190	56.2%	91.4%	55.9%	1.588	$23,960
Harney County	7,289	15.7%	98.4%	15.7%	0.719	$22,795
Hood River County	23,377	95.5%	100.0%	95.5%	44.788	$28,347
Jackson County	217,478	91.3%	98.3%	90.9%	78.130	$25,612
Jefferson County	23,754	82.6%	99.1%	82.5%	13.339	$21,630
Josephine County	86,351	76.5%	98.7%	76.5%	52.664	$23,004
Klamath County	66,933	82.4%	99.9%	82.4%	11.266	$23,071
Lake County	7,863	46.3%	98.8%	46.2%	0.966	$20,327
Lane County	374,743	88.9%	99.2%	88.8%	82.305	$25,612
Lincoln County	48,919	88.9%	98.7%	88.4%	49.929	$24,593
Linn County	125,045	97.0%	99.6%	97.0%	54.602	$22,934
Malheur County	30,480	77.9%	99.4%	77.7%	3.083	$17,150
Marion County	341,286	97.4%	99.9%	97.4%	288.656	$23,348
Morrow County	11,166	60.5%	98.5%	60.5%	5.496	$21,279
Multnomah County	807,538	97.7%	100.0%	97.7%	1,872.348	$33,255
Polk County	83,696	95.8%	99.5%	95.8%	112.983	$24,827
Sherman County	1,758	30.8%	100.0%	30.8%	2.134	$32,223

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Tillamook County	26,688	92.6%	96.6%	91.4%	24.205	$23,688
Umatilla County	76,985	86.1%	99.7%	86.1%	23.942	$21,528
Union County	26,222	64.6%	99.0%	64.6%	12.875	$25,458
Wallowa County	7,051	90.8%	94.1%	88.3%	2.241	$24,956
Wasco County	26,436	79.4%	99.8%	79.4%	11.100	$22,931
Washington County	588,947	96.7%	100.0%	96.7%	813.204	$33,433
Wheeler County	1,357	0.0%	55.3%	0.0%	0.791	$22,723
Yamhill County	105,720	81.9%	100.0%	81.9%	147.682	$26,523
Pennsylvania	**12,805,451**	**100.0%**	**99.9%**	**99.9%**	**286.202**	**.**
Adams County	102,334	100.0%	99.9%	99.9%	197.302	$28,515
Allegheny County	1,223,048	100.0%	100.0%	100.0%	1,675.237	$33,830
Armstrong County	65,642	100.0%	99.8%	99.8%	100.493	$24,634
Beaver County	166,140	100.0%	100.0%	100.0%	382.184	$28,018
Bedford County	48,480	100.0%	98.5%	98.5%	47.891	$23,632
Berks County	417,853	100.0%	100.0%	100.0%	487.857	$27,844
Blair County	123,457	100.0%	100.0%	100.0%	234.798	$24,466
Bradford County	60,853	100.0%	97.9%	97.9%	53.036	$26,255
Bucks County	628,333	100.0%	100.0%	100.0%	1,039.757	$39,958
Butler County	187,108	100.0%	100.0%	100.0%	237.265	$33,406
Cambria County	133,054	100.0%	99.8%	99.8%	193.294	$23,993
Cameron County	4,592	100.0%	90.4%	90.4%	11.589	$25,716
Carbon County	63,853	100.0%	100.0%	100.0%	167.391	$25,743
Centre County	162,660	100.0%	99.8%	99.8%	146.551	$27,584
Chester County	519,288	100.0%	100.0%	100.0%	691.916	$44,299
Clarion County	38,458	100.0%	100.0%	100.0%	64.008	$22,451
Clearfield County	79,685	100.0%	99.4%	99.4%	69.611	$21,650
Clinton County	38,998	100.0%	99.7%	99.7%	43.917	$22,084
Columbia County	65,932	100.0%	100.0%	100.0%	136.475	$24,155
Crawford County	86,159	100.0%	100.0%	100.0%	85.112	$23,578
Cumberland County	250,066	100.0%	100.0%	100.0%	458.451	$33,079
Dauphin County	275,710	100.0%	100.0%	100.0%	525.115	$30,068
Delaware County	564,692	100.0%	100.0%	100.0%	3,071.592	$34,857
Elk County	30,197	100.0%	99.3%	99.3%	36.498	$25,753
Erie County	274,541	100.0%	100.0%	100.0%	343.540	$25,555
Fayette County	131,504	100.0%	100.0%	100.0%	166.389	$22,863
Forest County	7,297	100.0%	99.6%	99.6%	17.082	$13,283
Franklin County	154,234	100.0%	99.8%	99.8%	199.727	$27,706
Fulton County	14,590	100.0%	100.0%	100.0%	33.345	$24,327

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Greene County	36,770	100.0%	96.0%	96.0%	63.842	$24,389
Huntingdon County	45,491	100.0%	98.1%	98.1%	52.011	$22,217
Indiana County	84,953	100.0%	99.9%	99.9%	102.721	$23,886
Jefferson County	43,804	100.0%	99.0%	99.0%	67.140	$22,841
Juniata County	24,514	100.0%	99.8%	99.8%	62.640	$23,461
Lackawanna County	210,761	100.0%	100.0%	100.0%	459.096	$26,179
Lancaster County	542,903	100.0%	100.0%	100.0%	575.225	$28,152
Lawrence County	87,069	100.0%	100.0%	100.0%	243.091	$25,614
Lebanon County	139,754	100.0%	100.0%	100.0%	386.239	$27,051
Lehigh County	366,490	100.0%	100.0%	100.0%	1,061.779	$29,587
Luzerne County	317,343	100.0%	99.9%	99.9%	356.432	$25,899
Lycoming County	113,841	100.0%	99.1%	99.1%	92.660	$24,855
McKean County	41,330	100.0%	99.8%	99.8%	42.208	$24,303
Mercer County	111,750	100.0%	100.0%	100.0%	166.153	$24,399
Mifflin County	46,388	100.0%	99.4%	99.4%	112.858	$21,665
Monroe County	168,046	100.0%	100.0%	100.0%	276.262	$26,128
Montgomery County	826,038	100.0%	100.0%	100.0%	1,710.083	$42,995
Montour County	18,272	100.0%	100.0%	100.0%	140.292	$31,293
Northampton County	303,404	100.0%	100.0%	100.0%	820.740	$31,086
Northumberland County	92,029	100.0%	100.0%	100.0%	200.776	$23,512
Perry County	46,127	100.0%	100.0%	100.0%	83.647	$27,648
Philadelphia County	1,580,843	100.0%	100.0%	100.0%	11,788.412	$23,696
Pike County	55,691	100.0%	100.0%	100.0%	102.193	$29,695
Potter County	16,802	100.0%	99.1%	99.1%	15.538	$22,929
Schuylkill County	142,569	100.0%	100.0%	100.0%	183.102	$24,275
Snyder County	40,800	100.0%	100.0%	100.0%	124.123	$24,708
Somerset County	74,501	100.0%	99.9%	99.9%	69.344	$23,402
Sullivan County	6,089	100.0%	95.9%	95.9%	13.533	$26,154
Susquehanna County	40,985	100.0%	99.3%	99.3%	49.773	$26,551
Tioga County	40,793	100.0%	99.3%	99.3%	35.979	$24,626
Union County	44,595	100.0%	100.0%	100.0%	141.131	$23,316
Venango County	51,762	100.0%	100.0%	100.0%	76.766	$24,257
Warren County	39,659	100.0%	99.5%	99.5%	44.856	$25,414
Washington County	207,298	100.0%	100.0%	100.0%	241.891	$31,561
Wayne County	51,204	100.0%	99.9%	99.9%	70.567	$24,962

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Westmoreland County	352,627	100.0%	100.0%	100.0%	343.171	$30,153
Wyoming County	27,322	100.0%	99.6%	99.6%	68.765	$26,823
York County	446,076	100.0%	100.0%	100.0%	493.348	$28,975
Rhode Island	**1,059,625**	**100.0%**	**100.0%**	**100.0%**	**1,024.967**	**.**
Bristol County	48,912	100.0%	100.0%	100.0%	2,024.153	$40,998
Kent County	163,760	100.0%	100.0%	100.0%	971.710	$35,323
Newport County	83,459	100.0%	100.0%	100.0%	815.141	$42,086
Providence County	637,344	100.0%	100.0%	100.0%	1,556.389	$27,809
Washington County	126,150	100.0%	100.0%	100.0%	383.161	$37,692
South Carolina	**5,024,279**	**89.9%**	**100.0%**	**89.9%**	**167.138**	**.**
Abbeville County	24,722	94.6%	100.0%	94.6%	50.403	$18,460
Aiken County	168,179	88.3%	100.0%	88.3%	157.025	$25,602
Allendale County	9,002	45.6%	98.8%	45.3%	22.059	$12,649
Anderson County	198,757	95.0%	100.0%	95.0%	277.816	$23,341
Bamberg County	14,381	61.6%	100.0%	61.6%	36.559	$18,260
Barnwell County	21,345	76.5%	100.0%	76.5%	38.923	$19,652
Beaufort County	186,835	86.4%	100.0%	86.4%	324.209	$33,877
Berkeley County	217,921	91.6%	100.0%	91.6%	198.316	$25,992
Calhoun County	14,704	68.5%	100.0%	68.5%	38.578	$22,964
Charleston County	401,432	94.5%	100.0%	94.5%	438.202	$33,700
Cherokee County	57,103	87.1%	100.0%	87.1%	145.426	$19,940
Chester County	32,301	70.4%	100.0%	70.4%	55.628	$19,858
Chesterfield County	45,948	44.3%	100.0%	44.3%	57.501	$19,088
Clarendon County	34,057	91.9%	100.0%	91.9%	56.113	$18,765
Colleton County	37,611	80.9%	100.0%	80.9%	35.600	$20,297
Darlington County	67,265	88.6%	100.0%	88.6%	119.869	$20,144
Dillon County	30,666	75.7%	100.0%	75.7%	75.742	$15,729
Dorchester County	156,433	92.2%	100.0%	92.2%	272.896	$26,288
Edgefield County	26,693	64.4%	99.8%	64.4%	53.343	$22,695
Fairfield County	22,607	58.4%	100.0%	58.4%	32.942	$20,762
Florence County	138,566	93.3%	100.0%	93.3%	173.215	$23,420
Georgetown County	61,607	88.2%	100.0%	88.2%	75.726	$26,601
Greenville County	506,827	98.3%	100.0%	98.3%	645.541	$28,065
Greenwood County	70,355	86.8%	100.0%	86.8%	154.720	$21,887
Hampton County	19,602	52.7%	100.0%	52.7%	35.010	$20,291
Horry County	333,267	99.2%	100.0%	99.2%	293.913	$24,986

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Jasper County	28,458	65.6%	100.0%	65.6%	43.426	$18,921
Kershaw County	65,032	82.0%	100.0%	82.0%	89.506	$23,149
Lancaster County	92,545	87.4%	100.0%	87.4%	168.521	$24,528
Laurens County	66,848	83.8%	100.0%	83.8%	93.650	$20,417
Lee County	17,350	84.9%	100.0%	84.9%	42.298	$15,545
Lexington County	290,638	94.0%	100.0%	94.0%	415.843	$28,141
Marion County	31,293	70.5%	100.0%	70.5%	63.964	$18,373
Marlboro County	26,825	0.6%	100.0%	0.6%	55.923	$15,849
McCormick County	9,545	40.4%	97.5%	38.2%	26.578	$22,454
Newberry County	38,487	70.9%	100.0%	70.9%	61.087	$21,883
Oconee County	77,270	78.3%	100.0%	78.3%	123.369	$25,944
Orangeburg County	87,476	57.4%	100.0%	57.4%	79.085	$18,490
Pickens County	123,479	93.3%	100.0%	93.3%	248.746	$22,258
Richland County	411,592	97.4%	100.0%	97.4%	543.666	$26,852
Saluda County	20,451	32.2%	100.0%	32.2%	45.168	$21,468
Spartanburg County	306,854	95.2%	100.0%	95.2%	379.805	$23,277
Sumter County	106,847	96.1%	100.0%	96.1%	160.656	$20,916
Union County	27,537	79.5%	100.0%	79.5%	53.556	$19,614
Williamsburg County	31,133	77.7%	100.0%	77.7%	33.327	$16,650
York County	266,433	96.0%	100.0%	96.0%	391.471	$28,830
South Dakota	**869,371**	**88.9%**	**99.8%**	**88.7%**	**11.468**	**.**
Aurora County	2,738	91.5%	100.0%	91.5%	3.865	$28,385
Beadle County	18,155	87.4%	100.0%	87.4%	14.424	$24,532
Bennett County	3,454	90.6%	100.0%	90.6%	2.915	$15,011
Bon Homme County	6,984	66.9%	100.0%	66.9%	12.390	$23,359
Brookings County	34,249	97.2%	100.0%	97.2%	43.232	$26,589
Brown County	39,173	94.0%	100.0%	94.0%	22.868	$29,463
Brule County	5,310	100.0%	100.0%	100.0%	6.497	$24,496
Buffalo County	1,999	100.0%	100.0%	100.0%	4.241	$10,763
Butte County	10,107	99.4%	100.0%	99.4%	4.492	$26,067
Campbell County	1,378	73.5%	100.0%	73.5%	1.878	$32,814
Charles Mix County	9,427	35.1%	100.0%	35.1%	8.590	$21,323
Clark County	3,668	87.2%	100.0%	87.2%	3.830	$26,291
Clay County	13,990	76.8%	100.0%	76.8%	33.941	$23,046
Codington County	28,098	86.3%	100.0%	86.3%	40.811	$27,294
Corson County	4,202	81.2%	82.7%	67.7%	1.701	$13,830
Custer County	8,691	55.4%	97.7%	54.9%	5.582	$31,275

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Davison County	19,704	95.8%	100.0%	95.8%	45.239	$26,416
Day County	5,521	74.6%	100.0%	74.6%	5.371	$28,811
Deuel County	4,280	97.7%	100.0%	97.7%	6.873	$29,953
Dewey County	5,833	58.2%	100.0%	58.2%	2.533	$16,305
Douglas County	2,931	81.0%	100.0%	81.0%	6.788	$27,397
Edmunds County	3,919	99.3%	100.0%	99.3%	3.481	$30,123
Fall River County	6,687	90.4%	99.8%	90.4%	3.843	$25,591
Faulk County	2,329	99.5%	100.0%	99.5%	2.372	$28,975
Grant County	7,061	70.8%	100.0%	70.8%	10.362	$28,059
Gregory County	4,226	91.1%	99.7%	90.8%	4.164	$24,738
Haakon County	1,943	95.3%	99.3%	94.6%	1.073	$22,643
Hamlin County	5,948	69.4%	100.0%	69.4%	11.726	$26,140
Hand County	3,277	82.5%	100.0%	82.5%	2.281	$33,496
Hanson County	3,423	85.4%	100.0%	85.4%	7.878	$24,159
Harding County	1,242	100.0%	97.9%	97.9%	0.465	$27,239
Hughes County	17,663	93.7%	100.0%	93.7%	23.819	$30,863
Hutchinson County	7,358	99.7%	100.0%	99.7%	9.051	$28,594
Hyde County	1,318	100.0%	100.0%	100.0%	1.532	$28,343
Jackson County	3,289	72.9%	100.0%	72.9%	1.765	$17,601
Jerauld County	2,026	100.0%	100.0%	100.0%	3.850	$36,494
Jones County	936	50.2%	100.0%	50.2%	0.965	$25,229
Kingsbury County	4,952	66.6%	100.0%	66.6%	5.950	$31,524
Lake County	12,809	99.8%	100.0%	99.8%	22.740	$29,526
Lawrence County	25,428	93.0%	99.9%	93.0%	31.784	$27,002
Lincoln County	56,635	85.2%	100.0%	85.2%	98.107	$36,896
Lyman County	3,904	76.2%	100.0%	76.2%	2.378	$20,695
Marshall County	4,804	84.5%	100.0%	84.5%	5.732	$27,441
McCook County	5,499	76.9%	100.0%	76.9%	9.577	$28,424
McPherson County	2,426	85.5%	100.0%	85.5%	2.134	$25,302
Meade County	28,016	92.1%	99.9%	92.1%	8.071	$25,884
Mellette County	2,088	58.2%	100.0%	58.2%	1.597	$13,934
Miner County	2,228	100.0%	100.0%	100.0%	3.907	$28,242
Minnehaha County	188,585	97.6%	100.0%	97.6%	233.644	$28,337
Moody County	6,579	71.6%	100.0%	71.6%	12.667	$27,324
Oglala Lakota County	14,155	69.0%	100.0%	69.0%	6.760	.
Pennington County	110,140	92.4%	99.6%	92.4%	39.668	$27,964
Perkins County	2,974	84.3%	97.2%	83.1%	1.036	$28,576

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Potter County	2,231	100.0%	100.0%	100.0%	2.591	$30,294
Roberts County	10,278	66.6%	100.0%	66.6%	9.335	$24,426
Sanborn County	2,446	100.0%	100.0%	100.0%	4.296	$31,991
Spink County	6,410	88.4%	100.0%	88.4%	4.262	$29,158
Stanley County	3,011	91.4%	99.3%	90.7%	2.085	$33,470
Sully County	1,407	100.0%	100.0%	100.0%	1.397	$40,042
Todd County	10,065	62.1%	99.0%	62.1%	7.249	$11,821
Tripp County	5,460	89.9%	100.0%	89.9%	3.386	$26,270
Turner County	8,315	60.5%	100.0%	60.5%	13.475	$27,405
Union County	15,029	84.5%	100.0%	84.5%	32.633	$35,565
Walworth County	5,543	98.9%	100.0%	98.9%	7.822	$29,199
Yankton County	22,661	85.6%	100.0%	85.6%	43.482	$28,067
Ziebach County	2,756	97.9%	87.9%	85.8%	1.405	$14,047
Tennessee	**6,715,859**	**91.3%**	**99.7%**	**91.1%**	**162.868**	**.**
Anderson County	76,256	97.1%	98.9%	95.9%	226.170	$26,072
Bedford County	48,116	95.5%	100.0%	95.5%	101.589	$21,949
Benton County	15,986	36.7%	98.8%	36.7%	40.559	$20,504
Bledsoe County	14,717	39.3%	99.2%	39.2%	36.211	$18,962
Blount County	129,929	98.0%	99.6%	97.6%	232.553	$26,772
Bradley County	105,559	97.4%	100.0%	97.4%	321.081	$24,099
Campbell County	39,648	85.0%	99.6%	84.6%	82.567	$19,948
Cannon County	14,214	99.5%	100.0%	99.5%	53.509	$22,571
Carroll County	27,860	68.1%	100.0%	68.1%	46.491	$19,851
Carter County	56,488	96.8%	98.9%	96.2%	165.555	$20,118
Cheatham County	40,329	93.3%	100.0%	93.3%	133.347	$24,279
Chester County	17,119	49.6%	100.0%	49.6%	59.912	$19,987
Claiborne County	31,609	93.3%	100.0%	93.3%	72.735	$19,215
Clay County	7,703	95.4%	85.0%	80.4%	32.566	$16,470
Cocke County	35,556	75.7%	95.6%	75.7%	81.820	$18,959
Coffee County	55,033	83.0%	100.0%	83.0%	128.295	$23,404
Crockett County	14,473	68.1%	100.0%	68.1%	54.505	$20,542
Cumberland County	59,077	57.7%	99.6%	57.7%	86.747	$22,606
Davidson County	691,236	97.2%	100.0%	97.2%	1,371.411	$30,595
DeKalb County	19,848	98.6%	100.0%	98.6%	65.215	$25,273
Decatur County	11,751	58.8%	99.4%	58.8%	35.199	$21,977
Dickson County	52,853	84.9%	100.0%	84.9%	107.886	$23,426
Dyer County	37,463	90.8%	100.0%	90.8%	73.123	$23,936
Fayette County	40,036	79.9%	100.0%	79.9%	56.806	$29,018

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Fentress County	18,136	98.7%	97.6%	96.4%	36.373	$17,487
Franklin County	41,652	79.5%	99.6%	79.3%	75.111	$23,797
Gibson County	49,111	74.0%	100.0%	74.0%	81.479	$20,948
Giles County	29,401	54.7%	100.0%	54.7%	48.125	$21,487
Grainger County	23,144	65.1%	100.0%	65.1%	82.480	$19,850
Greene County	68,808	100.0%	100.0%	100.0%	110.594	$21,525
Grundy County	13,361	78.5%	99.5%	78.4%	37.059	$16,132
Hamblen County	64,277	100.0%	100.0%	100.0%	398.793	$20,642
Hamilton County	361,605	98.8%	100.0%	98.8%	666.638	$28,456
Hancock County	6,600	56.8%	94.5%	52.2%	29.684	$16,351
Hardeman County	25,447	51.4%	100.0%	51.4%	38.108	$16,178
Hardin County	25,846	95.9%	99.3%	95.8%	44.769	$22,928
Hawkins County	56,459	73.4%	100.0%	73.4%	115.938	$21,394
Haywood County	17,573	62.1%	100.0%	62.1%	32.963	$19,956
Henderson County	27,751	63.3%	100.0%	63.3%	53.360	$20,479
Henry County	32,449	84.9%	100.0%	84.8%	57.729	$23,090
Hickman County	24,864	62.1%	98.8%	61.9%	40.594	$18,410
Houston County	8,213	46.2%	94.6%	43.1%	41.006	$18,256
Humphreys County	18,484	38.0%	99.0%	37.9%	34.811	$23,221
Jackson County	11,677	93.4%	86.9%	82.2%	37.873	$17,675
Jefferson County	53,801	75.0%	100.0%	75.0%	196.298	$22,674
Johnson County	17,691	94.5%	98.7%	93.7%	59.271	$17,834
Knox County	461,852	98.3%	100.0%	98.3%	908.773	$28,980
Lake County	7,468	62.9%	100.0%	62.9%	45.047	$13,330
Lauderdale County	25,274	75.0%	100.0%	75.0%	53.548	$16,217
Lawrence County	43,394	70.8%	100.0%	70.8%	70.316	$19,802
Lewis County	12,032	87.6%	98.6%	87.5%	42.653	$19,877
Lincoln County	33,749	77.7%	100.0%	77.7%	59.174	$22,541
Loudon County	52,148	93.1%	100.0%	93.1%	227.506	$28,660
Macon County	24,079	89.9%	97.0%	87.2%	78.397	$19,437
Madison County	97,643	94.2%	99.9%	94.1%	175.265	$23,724
Marion County	28,425	84.7%	100.0%	84.7%	57.060	$22,056
Marshall County	32,926	90.7%	100.0%	90.7%	87.695	$23,407
Maury County	92,158	92.9%	100.0%	92.9%	150.305	$24,986
McMinn County	52,877	79.5%	99.9%	79.5%	122.934	$20,472
McNairy County	26,004	81.8%	100.0%	81.8%	46.200	$18,285
Meigs County	12,068	54.8%	100.0%	54.8%	61.849	$19,976
Monroe County	46,239	68.6%	96.2%	67.9%	72.753	$19,840
Montgomery County	200,176	93.0%	100.0%	93.0%	371.262	$23,384

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Moore County	6,384	44.5%	100.0%	44.5%	49.403	$30,126
Morgan County	21,636	100.0%	97.5%	97.5%	41.434	$18,281
Obion County	30,385	71.5%	100.0%	71.5%	55.780	$21,650
Overton County	22,012	86.3%	99.0%	85.5%	50.779	$19,827
Perry County	7,975	38.9%	96.0%	38.2%	19.229	$18,611
Pickett County	5,073	95.8%	95.3%	91.1%	31.127	$20,664
Polk County	16,757	82.8%	92.2%	76.8%	38.551	$22,768
Putnam County	77,670	93.9%	100.0%	93.9%	193.641	$22,555
Rhea County	32,691	83.7%	100.0%	83.7%	103.657	$20,888
Roane County	53,036	92.5%	100.0%	92.5%	147.033	$23,942
Robertson County	70,171	83.8%	100.0%	83.8%	147.329	$25,534
Rutherford County	317,137	97.6%	100.0%	97.6%	512.037	$26,373
Scott County	21,989	99.9%	97.4%	97.3%	41.310	$21,011
Sequatchie County	14,736	52.3%	98.9%	52.2%	55.428	$21,605
Sevier County	97,637	92.1%	99.9%	92.1%	164.788	$22,773
Shelby County	936,959	98.2%	100.0%	98.2%	1,227.713	$26,963
Smith County	19,636	87.5%	94.4%	82.0%	62.478	$23,108
Stewart County	13,355	76.5%	99.0%	76.4%	29.075	$21,652
Sullivan County	157,158	100.0%	100.0%	100.0%	380.194	$24,680
Sumner County	183,536	97.8%	100.0%	97.7%	346.654	$29,313
Tipton County	61,366	90.9%	100.0%	90.9%	133.880	$24,969
Trousdale County	10,081	68.8%	98.8%	68.2%	88.280	$23,319
Unicoi County	17,759	95.8%	98.5%	94.5%	95.394	$20,958
Union County	19,442	77.8%	100.0%	77.8%	86.970	$19,030
Van Buren County	5,742	48.6%	99.4%	48.5%	21.001	$21,348
Warren County	40,651	81.0%	99.9%	81.0%	93.952	$20,749
Washington County	127,805	97.9%	100.0%	97.9%	391.482	$26,662
Wayne County	16,583	49.5%	97.3%	49.5%	22.590	$17,735
Weakley County	33,337	57.4%	99.7%	57.3%	57.442	$19,847
White County	26,753	67.1%	100.0%	67.1%	71.024	$18,785
Williamson County	226,250	93.3%	100.0%	93.3%	388.346	$46,494
Wilson County	136,436	95.2%	100.0%	95.2%	239.015	$29,762
Texas	**28,303,961**	**92.7%**	**100.0%**	**92.7%**	**108.348**	**.**
Anderson County	57,741	52.2%	99.6%	52.2%	54.339	$18,087
Andrews County	17,722	83.0%	100.0%	83.0%	11.809	$29,240
Angelina County	87,805	84.8%	100.0%	84.8%	110.062	$21,486
Aransas County	25,572	99.5%	98.8%	98.3%	101.446	$29,426

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Archer County	8,809	87.5%	100.0%	87.5%	9.754	$29,086
Armstrong County	1,879	52.5%	99.3%	51.8%	2.067	$28,542
Atascosa County	48,980	94.4%	100.0%	94.4%	40.163	$23,416
Austin County	29,786	53.1%	100.0%	53.1%	46.072	$28,351
Bailey County	7,077	74.3%	100.0%	74.3%	8.560	$17,710
Bandera County	22,351	33.9%	95.3%	29.7%	28.258	$28,547
Bastrop County	84,759	99.8%	100.0%	99.8%	95.433	$25,242
Baylor County	3,581	99.6%	100.0%	99.6%	4.128	$30,495
Bee County	32,563	100.0%	100.0%	100.0%	36.993	$17,504
Bell County	347,829	95.8%	100.0%	95.8%	330.946	$24,213
Bexar County	1,958,557	99.8%	100.0%	99.8%	1,579.710	$25,317
Blanco County	11,626	24.0%	100.0%	24.0%	16.392	$30,982
Borden County	673	29.9%	100.0%	29.9%	0.750	$42,236
Bosque County	18,326	100.0%	100.0%	100.0%	18.643	$24,815
Bowie County	94,012	91.0%	100.0%	91.0%	106.228	$23,705
Brazoria County	362,452	82.5%	100.0%	82.5%	266.960	$31,180
Brazos County	222,803	98.5%	100.0%	98.5%	380.570	$24,157
Brewster County	9,337	66.1%	86.5%	63.4%	1.510	$26,156
Briscoe County	1,528	68.9%	99.9%	68.9%	1.698	$22,906
Brooks County	7,235	99.1%	100.0%	99.1%	7.669	$14,885
Brown County	38,053	99.6%	100.0%	99.6%	40.292	$22,090
Burleson County	18,011	6.1%	100.0%	6.1%	27.330	$25,833
Burnet County	46,804	48.0%	100.0%	48.0%	47.074	$27,434
Caldwell County	42,332	100.0%	100.0%	100.0%	77.637	$21,485
Calhoun County	21,744	85.7%	100.0%	85.7%	42.901	$25,181
Callahan County	13,946	59.0%	100.0%	59.0%	15.506	$22,557
Cameron County	423,712	99.5%	99.9%	99.4%	475.588	$15,457
Camp County	12,855	50.5%	100.0%	50.5%	65.645	$20,034
Carson County	6,032	64.0%	100.0%	64.0%	6.555	$28,943
Cass County	30,012	51.7%	100.0%	51.7%	32.031	$21,608
Castro County	7,843	52.8%	100.0%	52.8%	8.769	$21,230
Chambers County	41,433	59.2%	100.0%	59.2%	69.386	$29,729
Cherokee County	52,240	40.9%	99.9%	40.9%	49.615	$19,871
Childress County	7,067	94.3%	100.0%	94.3%	10.148	$18,745
Clay County	10,421	18.6%	100.0%	18.6%	9.572	$26,696
Cochran County	2,851	65.3%	100.0%	65.3%	3.678	$20,408
Coke County	3,306	70.0%	99.7%	70.0%	3.627	$27,755
Coleman County	8,430	27.0%	99.9%	27.0%	6.680	$25,178
Collin County	969,509	96.7%	100.0%	96.7%	1,152.497	$39,933

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Collingsworth County	2,987	49.0%	100.0%	49.0%	3.252	$21,116
Colorado County	21,232	88.7%	100.0%	88.7%	22.110	$26,161
Comal County	141,003	95.9%	100.0%	95.9%	252.027	$33,872
Comanche County	13,573	29.9%	100.0%	29.9%	14.474	$21,681
Concho County	2,717	14.3%	100.0%	14.3%	2.762	$16,599
Cooke County	39,895	95.6%	100.0%	95.6%	45.607	$28,045
Coryell County	74,913	94.0%	100.0%	94.0%	71.206	$20,555
Cottle County	1,387	85.4%	100.0%	85.4%	1.540	$20,397
Crane County	4,740	0.7%	100.0%	0.7%	6.038	$25,367
Crockett County	3,564	0.0%	99.2%	0.0%	1.270	$23,861
Crosby County	5,899	66.0%	100.0%	66.0%	6.553	$19,651
Culberson County	2,231	82.8%	100.0%	82.8%	0.585	$18,862
Dallam County	7,206	96.3%	100.0%	96.3%	4.794	$19,908
Dallas County	2,618,140	99.9%	100.0%	99.9%	3,004.938	$28,552
Dawson County	12,813	56.3%	100.0%	56.3%	14.232	$21,193
DeWitt County	20,226	99.9%	100.0%	99.9%	22.251	$27,370
Deaf Smith County	18,836	86.8%	100.0%	86.8%	12.584	$19,823
Delta County	5,298	16.9%	100.0%	16.9%	20.629	$20,822
Denton County	836,181	99.9%	100.0%	99.9%	951.901	$36,238
Dickens County	2,209	90.0%	100.0%	90.0%	2.450	$22,526
Dimmit County	10,418	80.3%	100.0%	80.3%	7.840	$19,528
Donley County	3,311	40.1%	100.0%	40.1%	3.572	$22,454
Duval County	11,273	68.9%	100.0%	68.9%	6.286	$19,853
Eastland County	18,411	92.7%	100.0%	92.7%	19.872	$21,577
Ector County	157,087	75.6%	100.0%	75.6%	174.991	$27,295
Edwards County	1,953	42.0%	99.6%	42.0%	0.922	$27,333
El Paso County	840,407	97.8%	100.0%	97.8%	829.873	$19,145
Ellis County	173,620	100.0%	100.0%	100.0%	185.593	$27,313
Erath County	41,969	99.5%	100.0%	99.5%	38.750	$22,781
Falls County	17,436	42.7%	100.0%	42.7%	22.778	$17,257
Fannin County	34,443	61.0%	99.9%	61.0%	38.664	$21,429
Fayette County	25,272	93.6%	100.0%	93.6%	26.602	$28,665
Fisher County	3,880	8.4%	100.0%	8.4%	4.316	$26,796
Floyd County	5,855	48.7%	100.0%	48.7%	5.901	$23,133
Foard County	1,222	99.3%	100.0%	99.3%	1.735	$23,323
Fort Bend County	764,799	89.8%	100.0%	89.8%	887.772	$37,134
Franklin County	10,766	69.3%	100.0%	69.3%	37.856	$25,250
Freestone County	19,625	33.6%	100.0%	33.6%	22.359	$23,370

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Frio County	19,600	99.4%	100.0%	99.4%	17.292	$17,547
Gaines County	20,638	62.3%	100.0%	62.3%	13.737	$22,837
Galveston County	335,035	93.8%	100.0%	93.8%	885.497	$32,756
Garza County	6,528	88.7%	100.0%	88.7%	7.307	$19,043
Gillespie County	26,646	87.4%	98.8%	87.4%	25.180	$30,939
Glasscock County	1,348	77.9%	100.0%	77.9%	1.497	$34,834
Goliad County	7,562	94.4%	100.0%	94.4%	8.875	$30,581
Gonzales County	20,893	99.9%	100.0%	99.9%	19.587	$22,631
Gray County	22,404	80.7%	100.0%	80.7%	24.195	$22,409
Grayson County	131,139	99.8%	100.0%	99.8%	140.586	$25,541
Gregg County	123,367	91.4%	100.0%	91.4%	451.393	$24,386
Grimes County	28,082	83.1%	100.0%	83.1%	35.662	$21,173
Guadalupe County	159,657	100.0%	100.0%	100.0%	224.458	$28,310
Hale County	34,134	88.0%	100.0%	88.0%	33.975	$18,888
Hall County	3,071	55.7%	100.0%	55.7%	3.476	$18,453
Hamilton County	8,422	96.6%	100.0%	96.6%	10.075	$26,183
Hansford County	5,447	59.8%	100.0%	59.8%	5.922	$23,605
Hardeman County	3,994	12.5%	100.0%	12.5%	5.746	$19,493
Hardin County	57,139	77.8%	100.0%	77.8%	64.160	$28,321
Harris County	4,652,967	94.1%	100.0%	94.1%	2,731.452	$29,850
Harrison County	66,661	77.3%	100.0%	77.3%	74.072	$23,836
Hartley County	5,691	89.0%	100.0%	89.0%	3.893	$21,642
Haskell County	5,746	95.9%	100.0%	95.9%	6.362	$21,072
Hays County	214,342	95.4%	100.0%	95.4%	316.149	$28,396
Hemphill County	4,024	0.0%	99.8%	0.0%	4.440	$29,110
Henderson County	81,058	68.7%	100.0%	68.7%	92.770	$23,605
Hidalgo County	860,652	99.4%	100.0%	99.4%	547.884	$15,240
Hill County	35,849	100.0%	100.0%	100.0%	37.387	$22,154
Hockley County	23,088	45.2%	100.0%	45.2%	25.416	$22,718
Hood County	58,273	100.0%	100.0%	100.0%	138.534	$31,508
Hopkins County	36,496	60.1%	100.0%	60.1%	47.572	$23,063
Houston County	23,021	55.9%	98.9%	55.8%	18.702	$17,624
Howard County	36,040	93.9%	100.0%	93.9%	40.009	$23,054
Hudspeth County	4,407	29.7%	99.3%	29.4%	0.964	$14,776
Hunt County	93,872	43.7%	100.0%	43.7%	111.710	$22,229
Hutchinson County	21,375	89.3%	100.0%	89.3%	24.087	$25,117
Irion County	1,516	0.0%	99.9%	0.0%	1.442	$31,096
Jack County	8,832	99.4%	99.9%	99.3%	9.698	$24,677
Jackson County	14,805	60.7%	100.0%	60.7%	17.850	$25,594

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Jasper County	35,561	36.0%	100.0%	36.0%	37.877	$21,116
Jeff Davis County	2,280	28.3%	90.4%	28.3%	1.007	$26,493
Jefferson County	256,296	93.7%	100.0%	93.7%	292.477	$24,738
Jim Hogg County	5,202	96.3%	100.0%	96.3%	4.579	$16,637
Jim Wells County	40,871	98.6%	100.0%	98.6%	47.252	$21,556
Johnson County	167,300	100.0%	100.0%	100.0%	230.857	$25,721
Jones County	19,983	45.2%	100.0%	45.2%	21.521	$17,279
Karnes County	15,187	100.0%	100.0%	100.0%	20.316	$25,306
Kaufman County	122,879	66.6%	100.0%	66.6%	157.396	$25,445
Kendall County	44,024	88.8%	100.0%	88.8%	66.456	$36,724
Kenedy County	417	6.5%	100.0%	6.5%	0.286	$13,822
Kent County	763	79.4%	100.0%	79.4%	0.845	$27,434
Kerr County	51,720	89.9%	99.9%	89.9%	46.877	$26,210
Kimble County	4,410	58.0%	99.2%	58.0%	3.525	$26,969
King County	296	43.9%	100.0%	43.9%	0.325	$30,016
Kinney County	3,745	77.3%	99.3%	77.3%	2.754	$17,818
Kleberg County	31,088	99.6%	100.0%	99.6%	35.275	$19,700
Knox County	3,710	99.9%	100.0%	99.9%	4.362	$19,673
La Salle County	7,584	74.9%	100.0%	74.9%	5.101	$23,939
Lamar County	49,587	71.1%	100.0%	71.1%	54.660	$22,438
Lamb County	13,210	62.1%	100.0%	62.1%	13.000	$20,933
Lampasas County	21,026	99.8%	100.0%	99.8%	29.496	$24,382
Lavaca County	20,062	93.8%	100.0%	93.8%	20.689	$28,491
Lee County	17,183	52.8%	100.0%	52.8%	27.317	$25,549
Leon County	17,243	55.8%	97.1%	54.1%	16.068	$27,271
Liberty County	83,656	58.5%	100.0%	58.5%	72.216	$22,065
Limestone County	23,527	24.9%	100.0%	24.9%	25.988	$20,506
Lipscomb County	3,378	74.6%	100.0%	74.6%	3.624	$29,103
Live Oak County	12,174	100.0%	100.0%	100.0%	11.709	$22,047
Llano County	21,210	0.4%	100.0%	0.4%	22.708	$34,633
Loving County	134	18.7%	100.0%	18.7%	0.200	$32,707
Lubbock County	305,225	91.0%	100.0%	91.0%	340.805	$25,139
Lynn County	5,859	75.9%	100.0%	75.9%	6.569	$24,299
Madison County	14,222	14.5%	100.0%	14.5%	30.515	$17,698
Marion County	10,064	57.5%	100.0%	57.5%	26.423	$22,536
Martin County	5,626	80.9%	100.0%	80.9%	6.149	$27,692
Mason County	4,222	72.8%	99.9%	72.8%	4.546	$25,834
Matagorda County	36,840	71.5%	100.0%	71.5%	33.483	$22,939
Maverick County	58,216	93.3%	100.0%	93.3%	45.508	$16,086

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McCulloch County	7,957	1.7%	100.0%	1.7%	7.467	$22,049
McLennan County	251,255	100.0%	100.0%	100.0%	242.267	$22,878
McMullen County	778	99.7%	100.0%	99.7%	0.683	$27,971
Medina County	50,063	74.8%	99.8%	74.6%	37.773	$24,731
Menard County	2,124	1.9%	98.0%	1.9%	2.355	$23,331
Midland County	165,049	94.0%	100.0%	94.0%	183.327	$36,869
Milam County	25,053	25.5%	100.0%	25.5%	24.636	$22,132
Mills County	4,921	60.6%	100.0%	60.6%	6.577	$24,099
Mitchell County	8,468	7.2%	100.0%	7.2%	9.294	$19,334
Montague County	19,538	95.6%	99.8%	95.6%	20.988	$25,403
Montgomery County	570,926	99.2%	100.0%	99.2%	548.053	$35,912
Moore County	22,097	82.3%	100.0%	82.3%	24.561	$20,159
Morris County	12,467	65.8%	100.0%	65.8%	49.475	$21,616
Motley County	1,230	72.8%	99.8%	72.8%	1.243	$23,131
Nacogdoches County	65,580	81.8%	100.0%	81.8%	69.284	$21,343
Navarro County	48,701	94.3%	100.0%	94.3%	48.237	$21,347
Newton County	13,952	23.6%	99.8%	23.6%	14.943	$19,293
Nolan County	14,770	77.2%	100.0%	77.2%	16.195	$22,240
Nueces County	361,221	99.9%	100.0%	99.9%	430.804	$25,826
Ochiltree County	10,073	86.6%	100.0%	86.6%	10.977	$24,997
Oldham County	2,114	49.9%	100.0%	49.9%	1.409	$23,644
Orange County	85,047	86.9%	100.0%	86.9%	254.885	$26,611
Palo Pinto County	28,569	100.0%	100.0%	100.0%	30.016	$24,891
Panola County	23,243	49.1%	100.0%	49.1%	28.990	$25,345
Parker County	133,462	100.0%	100.0%	100.0%	147.720	$32,274
Parmer County	9,842	49.6%	100.0%	49.6%	11.174	$21,655
Pecos County	15,634	69.7%	99.8%	69.7%	3.282	$19,738
Polk County	49,162	43.8%	100.0%	43.8%	46.507	$21,411
Potter County	120,458	91.5%	100.0%	91.5%	132.609	$20,984
Presidio County	7,156	15.8%	97.6%	15.7%	1.856	$16,326
Rains County	11,762	8.6%	100.0%	8.6%	51.261	$23,577
Randall County	134,421	95.8%	100.0%	95.8%	147.465	$31,383
Reagan County	3,710	1.6%	99.9%	1.6%	3.157	$25,754
Real County	3,429	65.5%	94.4%	60.4%	4.904	$21,135
Red River County	12,229	71.0%	99.8%	70.8%	11.797	$20,798
Reeves County	15,281	61.9%	100.0%	61.9%	5.798	$18,458
Refugio County	7,224	87.9%	100.0%	87.9%	9.376	$24,776

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Roberts County	938	62.7%	100.0%	62.7%	1.015	$31,655
Robertson County	17,200	43.8%	100.0%	43.8%	20.101	$22,980
Rockwall County	96,743	94.6%	100.0%	94.6%	761.543	$37,231
Runnels County	10,266	69.5%	100.0%	69.5%	9.768	$22,856
Rusk County	52,833	58.8%	100.0%	58.8%	57.177	$22,704
Sabine County	10,461	57.1%	98.6%	57.1%	21.289	$20,120
San Augustine County	8,253	13.3%	98.9%	13.3%	15.552	$19,251
San Jacinto County	28,270	44.0%	100.0%	44.0%	49.662	$22,563
San Patricio County	67,215	100.0%	100.0%	100.0%	96.928	$24,008
San Saba County	5,959	71.9%	99.9%	71.9%	5.249	$19,583
Schleicher County	3,001	0.0%	99.2%	0.0%	2.290	$26,408
Scurry County	17,050	76.8%	100.0%	76.8%	18.831	$23,758
Shackelford County	3,328	39.6%	100.0%	39.6%	3.640	$24,190
Shelby County	25,513	11.9%	99.2%	11.9%	32.068	$20,233
Sherman County	3,067	40.1%	100.0%	40.1%	3.323	$23,863
Smith County	227,725	90.1%	100.0%	90.1%	247.137	$25,299
Somervell County	8,845	100.0%	100.0%	100.0%	47.436	$26,547
Starr County	64,454	91.1%	100.0%	91.1%	52.694	$12,663
Stephens County	9,337	99.0%	100.0%	99.0%	10.412	$22,307
Sterling County	1,295	0.0%	99.6%	0.0%	1.402	$25,104
Stonewall County	1,388	80.0%	100.0%	80.0%	1.515	$24,285
Sutton County	3,767	0.0%	99.6%	0.0%	2.591	$28,140
Swisher County	7,515	78.3%	100.0%	78.3%	8.442	$18,699
Tarrant County	2,054,462	99.9%	100.0%	99.9%	2,378.928	$29,791
Taylor County	136,290	97.0%	100.0%	97.0%	148.861	$24,328
Terrell County	810	4.9%	96.7%	4.4%	0.344	$25,147
Terry County	12,715	47.0%	100.0%	47.0%	14.305	$21,936
Throckmorton County	1,527	60.0%	99.8%	60.0%	1.673	$28,860
Titus County	32,904	65.2%	100.0%	65.2%	81.034	$20,043
Tom Green County	118,018	87.8%	100.0%	87.8%	77.543	$26,252
Travis County	1,226,677	99.7%	100.0%	99.7%	1,238.814	$36,649
Trinity County	14,667	57.3%	100.0%	57.3%	21.146	$19,661
Tyler County	21,539	36.0%	100.0%	36.0%	23.298	$20,720
Upshur County	41,280	86.0%	100.0%	86.0%	70.813	$23,215
Upton County	3,663	0.4%	100.0%	0.4%	2.951	$24,254
Uvalde County	27,132	98.3%	99.8%	98.3%	17.483	$18,294

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Val Verde County	49,205	96.9%	99.8%	96.9%	15.647	$19,522
Van Zandt County	55,180	16.6%	100.0%	16.6%	65.491	$24,399
Victoria County	92,084	98.8%	100.0%	98.8%	104.387	$27,509
Walker County	72,245	84.9%	100.0%	84.9%	92.129	$16,419
Waller County	51,304	36.7%	100.0%	36.7%	99.924	$23,338
Ward County	11,472	44.2%	100.0%	44.2%	13.729	$26,091
Washington County	35,043	56.0%	100.0%	56.0%	58.023	$25,976
Webb County	274,792	93.9%	100.0%	93.9%	81.747	$15,691
Wharton County	41,966	61.4%	100.0%	61.4%	38.637	$23,245
Wheeler County	5,358	23.6%	100.0%	23.6%	5.859	$26,736
Wichita County	132,000	92.9%	100.0%	92.9%	210.266	$23,239
Wilbarger County	12,764	81.5%	100.0%	81.5%	13.147	$21,638
Willacy County	21,584	100.0%	100.0%	100.0%	36.549	$12,564
Williamson County	547,512	92.8%	100.0%	92.8%	489.592	$32,705
Wilson County	49,300	100.0%	100.0%	100.0%	61.339	$28,419
Winkler County	7,574	22.7%	100.0%	22.7%	9.005	$23,051
Wise County	66,173	100.0%	100.0%	100.0%	73.166	$27,104
Wood County	44,314	63.2%	100.0%	63.2%	68.679	$25,353
Yoakum County	8,567	72.7%	100.0%	72.7%	10.713	$22,871
Young County	17,979	98.3%	100.0%	98.3%	19.661	$25,837
Zapata County	14,322	81.0%	100.0%	81.0%	14.345	$16,007
Zavala County	11,948	69.9%	100.0%	69.9%	9.209	$13,393
Utah	**3,101,763**	**94.2%**	**99.7%**	**94.2%**	**37.748**	**.**
Beaver County	6,386	92.2%	99.9%	92.2%	2.466	$21,394
Box Elder County	54,077	89.9%	100.0%	89.9%	9.412	$21,854
Cache County	124,436	93.0%	100.0%	93.0%	106.829	$21,055
Carbon County	20,295	92.6%	99.2%	92.6%	13.727	$21,953
Daggett County	1,029	0.0%	75.8%	0.0%	1.476	$27,182
Davis County	347,635	97.4%	100.0%	97.4%	1,163.522	$27,059
Duchesne County	20,026	64.3%	99.6%	64.3%	6.179	$22,941
Emery County	10,077	85.4%	98.4%	85.1%	2.258	$20,280
Garfield County	5,078	97.6%	97.7%	96.6%	0.981	$21,006
Grand County	9,673	51.8%	92.9%	51.8%	2.635	$23,927
Iron County	51,001	96.5%	99.9%	96.5%	15.470	$19,085
Juab County	11,250	86.0%	95.3%	86.0%	3.316	$19,194
Kane County	7,567	93.9%	99.6%	93.6%	1.896	$24,488
Millard County	12,863	52.6%	99.2%	52.6%	1.957	$21,643
Morgan County	11,871	87.0%	95.6%	82.7%	19.486	$27,850

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Piute County	1,420	100.0%	100.0%	100.0%	1.874	$17,416
Rich County	2,391	54.8%	99.2%	54.8%	2.324	$19,749
Salt Lake County	1,135,642	98.8%	100.0%	98.8%	1,529.934	$28,578
San Juan County	15,356	15.9%	89.3%	15.9%	1.964	$15,817
Sanpete County	30,035	87.9%	99.6%	87.9%	18.888	$16,924
Sevier County	21,316	86.7%	99.9%	86.7%	11.157	$20,074
Summit County	41,104	89.1%	99.5%	88.8%	21.961	$49,143
Tooele County	67,447	83.3%	99.0%	83.3%	9.717	$22,978
Uintah County	35,150	74.5%	95.3%	74.5%	7.847	$25,488
Utah County	606,401	92.7%	99.8%	92.7%	302.678	$22,088
Wasatch County	32,103	82.7%	99.2%	82.4%	27.310	$28,818
Washington County	165,647	97.5%	100.0%	97.5%	68.270	$23,549
Wayne County	2,719	90.0%	99.8%	90.0%	1.105	$21,501
Weber County	251,768	94.5%	100.0%	94.5%	437.033	$24,226
Vermont	**623,655**	**89.3%**	**98.6%**	**88.6%**	**67.666**	**.**
Addison County	36,776	94.6%	99.4%	94.2%	47.990	$30,154
Bennington County	35,594	95.1%	97.8%	94.1%	52.733	$30,197
Caledonia County	30,164	77.1%	97.9%	76.1%	46.487	$24,948
Chittenden County	162,371	98.0%	99.8%	97.8%	302.605	$34,658
Essex County	6,230	42.5%	94.5%	42.4%	9.388	$22,191
Franklin County	49,025	85.2%	98.1%	83.9%	77.362	$28,892
Grand Isle County	6,997	63.1%	100.0%	63.1%	85.526	$35,613
Lamoille County	25,337	84.7%	98.4%	83.8%	55.225	$29,180
Orange County	28,974	66.0%	96.6%	65.4%	42.173	$28,691
Orleans County	26,841	72.5%	95.4%	71.8%	38.717	$24,204
Rutland County	59,087	98.6%	98.4%	96.9%	63.547	$27,795
Washington County	58,290	92.5%	98.1%	91.0%	84.818	$31,464
Windham County	42,869	77.5%	99.6%	77.5%	54.589	$28,923
Windsor County	55,100	94.1%	99.2%	93.4%	56.843	$33,257
Virginia	**8,475,166**	**100.0%**	**99.8%**	**99.8%**	**214.615**	**.**
Accomack County	32,545	100.0%	100.0%	100.0%	72.403	$23,337
Albemarle County	107,700	100.0%	100.0%	100.0%	149.438	$38,039
Alexandria city	159,968	100.0%	100.0%	100.0%	10,645.376	$55,534
Alleghany County	15,122	100.0%	98.0%	98.0%	33.947	$25,220
Amelia County	13,020	100.0%	100.0%	100.0%	36.648	$25,335
Amherst County	31,594	100.0%	99.9%	99.9%	66.663	$23,372
Appomattox County	15,678	100.0%	100.0%	100.0%	47.011	$24,902

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Arlington County	234,935	100.0%	100.0%	100.0%	9,044.842	$64,746
Augusta County	75,144	100.0%	99.4%	99.4%	77.708	$28,601
Bath County	4,297	100.0%	90.6%	90.6%	8.120	$28,210
Bedford County	77,643	100.0%	100.0%	100.0%	103.109	$29,561
Bedford city	5,935	100.0%	100.0%	100.0%	862.885	.
Bland County	6,350	100.0%	98.8%	98.8%	17.751	$22,249
Botetourt County	33,192	100.0%	99.7%	99.7%	61.330	$32,518
Bristol city	16,790	100.0%	100.0%	100.0%	1,290.248	$21,865
Brunswick County	16,244	100.0%	100.0%	100.0%	28.691	$19,461
Buchanan County	21,514	100.0%	81.9%	81.9%	42.792	$18,160
Buckingham County	17,065	100.0%	100.0%	100.0%	29.440	$19,264
Buena Vista city	6,327	100.0%	100.0%	100.0%	943.822	$16,405
Campbell County	55,010	100.0%	100.0%	100.0%	109.176	$25,219
Caroline County	30,458	100.0%	100.0%	100.0%	57.739	$26,577
Carroll County	29,706	100.0%	98.8%	98.8%	62.580	$21,484
Charles City County	7,004	100.0%	100.0%	100.0%	38.312	$30,477
Charlotte County	12,119	100.0%	94.3%	94.3%	25.499	$18,150
Charlottesville city	48,002	100.0%	100.0%	100.0%	4,688.423	$30,729
Chesapeake city	240,387	100.0%	100.0%	100.0%	705.360	$30,764
Chesterfield County	343,587	100.0%	100.0%	100.0%	811.693	$33,848
Clarke County	14,507	100.0%	100.0%	100.0%	82.343	$37,630
Colonial Heights city	17,830	100.0%	100.0%	100.0%	2,371.069	$27,209
Covington city	5,527	100.0%	100.0%	100.0%	1,010.698	$21,512
Craig County	5,062	100.0%	77.9%	77.9%	15.361	$22,371
Culpeper County	51,278	100.0%	100.0%	100.0%	135.215	$28,969
Cumberland County	9,810	100.0%	100.0%	100.0%	32.979	$22,126
Danville city	41,130	100.0%	100.0%	100.0%	957.981	$21,742
Dickenson County	14,782	100.0%	88.9%	88.9%	44.722	$20,757
Dinwiddie County	28,208	100.0%	100.0%	100.0%	56.000	$24,001
Emporia city	5,282	100.0%	100.0%	100.0%	766.194	$18,608
Essex County	11,028	100.0%	100.0%	100.0%	42.890	$25,477
Fairfax County	1,148,418	100.0%	100.0%	100.0%	2,937.365	$51,851
Fairfax city	24,097	100.0%	100.0%	100.0%	3,862.191	$45,222
Falls Church city	14,554	100.0%	100.0%	100.0%	7,281.446	$66,104
Fauquier County	69,463	100.0%	100.0%	100.0%	107.287	$41,921
Floyd County	15,752	100.0%	99.9%	99.9%	41.407	$24,121
Fluvanna County	26,449	100.0%	100.0%	100.0%	92.477	$30,230
Franklin County	56,444	100.0%	100.0%	100.0%	81.752	$26,188

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Franklin city	8,176	100.0%	100.0%	100.0%	996.370	$23,182
Frederick County	86,480	100.0%	100.0%	100.0%	209.143	$31,555
Fredericksburg city	28,360	100.0%	100.0%	100.0%	2,716.432	$30,480
Galax city	6,625	100.0%	100.0%	100.0%	804.045	$20,796
Giles County	16,837	100.0%	99.6%	99.6%	47.324	$25,333
Gloucester County	37,292	100.0%	100.0%	100.0%	171.216	$31,072
Goochland County	22,685	100.0%	100.0%	100.0%	80.610	$45,995
Grayson County	15,662	100.0%	78.0%	78.0%	35.420	$20,190
Greene County	19,612	100.0%	99.6%	99.6%	125.520	$28,647
Greensville County	11,679	100.0%	99.9%	99.9%	39.559	$15,988
Halifax County	34,563	100.0%	99.7%	99.7%	42.261	$20,706
Hampton city	134,669	100.0%	100.0%	100.0%	2,619.337	$25,943
Hanover County	105,922	100.0%	100.0%	100.0%	226.070	$35,881
Harrisonburg city	54,211	100.0%	100.0%	100.0%	3,112.341	$18,892
Henrico County	327,898	100.0%	100.0%	100.0%	1,403.092	$34,993
Henry County	51,227	100.0%	100.0%	100.0%	133.985	$20,645
Highland County	2,212	100.0%	81.7%	81.7%	5.328	$28,736
Hopewell city	22,621	100.0%	100.0%	100.0%	2,200.864	$21,827
Isle of Wight County	36,552	100.0%	100.0%	100.0%	115.813	$32,090
James City County	75,505	100.0%	100.0%	100.0%	530.095	$41,314
King George County	26,337	100.0%	100.0%	100.0%	146.613	$35,201
King William County	16,708	100.0%	100.0%	100.0%	60.991	$29,311
King and Queen County	7,003	100.0%	100.0%	100.0%	22.222	$25,392
Lancaster County	10,788	100.0%	99.9%	99.9%	80.961	$32,013
Lee County	23,758	100.0%	95.9%	95.9%	54.551	$17,820
Lexington city	7,106	100.0%	100.0%	100.0%	2,845.929	$15,745
Loudoun County	398,055	100.0%	100.0%	100.0%	772.081	$48,578
Louisa County	35,858	100.0%	100.0%	100.0%	72.251	$28,767
Lunenburg County	12,235	100.0%	100.0%	100.0%	28.343	$18,383
Lynchburg city	80,990	100.0%	100.0%	100.0%	1,648.567	$22,016
Madison County	13,277	100.0%	99.4%	99.4%	41.402	$27,144
Manassas Park city	16,541	100.0%	100.0%	100.0%	6,528.257	$28,851
Manassas city	41,501	100.0%	100.0%	100.0%	4,200.214	$29,365
Martinsville city	13,142	100.0%	100.0%	100.0%	1,199.495	$22,221
Mathews County	8,779	100.0%	100.0%	100.0%	102.166	$34,918
Mecklenburg County	30,686	100.0%	100.0%	100.0%	49.060	$21,492

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Middlesex County	10,679	100.0%	100.0%	100.0%	81.953	$29,391
Montgomery County	98,558	100.0%	100.0%	100.0%	254.663	$26,819
Nelson County	14,943	100.0%	99.8%	99.8%	31.736	$29,769
New Kent County	21,679	100.0%	100.0%	100.0%	103.367	$35,723
Newport News city	179,388	100.0%	100.0%	100.0%	2,610.657	$25,520
Norfolk city	244,703	100.0%	100.0%	100.0%	4,521.452	$25,450
Northampton County	11,846	100.0%	100.0%	100.0%	55.980	$23,331
Northumberland County	12,274	100.0%	100.0%	100.0%	64.163	$32,238
Norton city	3,930	100.0%	100.0%	100.0%	525.341	$19,522
Nottoway County	15,434	100.0%	100.0%	100.0%	49.092	$19,256
Orange County	36,064	100.0%	100.0%	100.0%	105.827	$30,361
Page County	23,731	100.0%	100.0%	100.0%	76.341	$22,683
Patrick County	17,665	100.0%	96.0%	96.0%	36.566	$20,526
Petersburg city	31,750	100.0%	100.0%	100.0%	1,384.541	$20,464
Pittsylvania County	61,258	100.0%	99.9%	99.9%	63.222	$22,650
Poquoson city	12,053	100.0%	100.0%	100.0%	786.923	$39,020
Portsmouth city	94,572	100.0%	100.0%	100.0%	2,810.239	$23,878
Powhatan County	28,601	100.0%	100.0%	100.0%	109.910	$32,770
Prince Edward County	22,703	100.0%	100.0%	100.0%	64.873	$18,789
Prince George County	37,809	100.0%	100.0%	100.0%	142.592	$26,721
Prince William County	462,957	100.0%	100.0%	100.0%	1,376.203	$37,063
Pulaski County	34,184	100.0%	100.0%	100.0%	106.873	$25,738
Radford city	17,655	100.0%	100.0%	100.0%	1,788.476	$18,108
Rappahannock County	7,320	100.0%	96.7%	96.7%	27.495	$34,886
Richmond County	8,939	100.0%	100.0%	100.0%	46.681	$19,191
Richmond city	227,015	100.0%	100.0%	100.0%	3,795.908	$29,011
Roanoke County	93,730	100.0%	99.8%	99.8%	374.145	$32,220
Roanoke city	99,837	100.0%	100.0%	100.0%	2,345.703	$23,611
Rockbridge County	22,657	100.0%	99.8%	99.8%	37.916	$29,603
Rockingham County	80,227	100.0%	99.9%	99.9%	94.486	$27,160
Russell County	27,048	100.0%	99.2%	99.2%	57.085	$21,171
Salem city	25,854	100.0%	100.0%	100.0%	1,790.867	$28,892
Scott County	21,865	100.0%	98.4%	98.4%	40.829	$20,935

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Shenandoah County	43,225	100.0%	100.0%	100.0%	84.959	$26,444
Smyth County	30,656	100.0%	95.9%	95.9%	67.984	$22,161
Southampton County	17,750	100.0%	100.0%	100.0%	29.626	$24,018
Spotsylvania County	133,032	100.0%	100.0%	100.0%	331.341	$32,367
Stafford County	146,649	100.0%	100.0%	100.0%	545.253	$37,782
Staunton city	24,523	100.0%	100.0%	100.0%	1,227.673	$26,678
Suffolk city	90,237	100.0%	100.0%	100.0%	225.498	$30,331
Surry County	6,540	100.0%	100.0%	100.0%	23.445	$25,838
Sussex County	11,373	100.0%	100.0%	100.0%	23.200	$16,653
Tazewell County	41,095	100.0%	99.2%	99.2%	79.205	$23,548
Virginia Beach city	450,435	100.0%	100.0%	100.0%	1,808.858	$33,250
Warren County	39,561	100.0%	100.0%	100.0%	185.328	$29,179
Washington County	54,386	100.0%	98.6%	98.6%	96.949	$25,287
Waynesboro city	22,320	100.0%	100.0%	100.0%	1,484.142	$22,967
Westmoreland County	17,780	100.0%	100.0%	100.0%	77.515	$29,824
Williamsburg city	15,031	100.0%	100.0%	100.0%	1,666.031	$25,548
Winchester city	27,929	100.0%	100.0%	100.0%	3,025.005	$26,984
Wise County	38,586	100.0%	99.6%	99.6%	95.702	$20,896
Wythe County	28,882	100.0%	99.9%	99.9%	62.539	$24,431
York County	67,739	100.0%	100.0%	100.0%	646.487	$36,722
Washington	**7,405,569**	**97.3%**	**99.8%**	**97.1%**	**111.436**	**.**
Adams County	19,498	100.0%	99.9%	99.9%	10.129	$17,781
Asotin County	22,535	93.2%	98.8%	93.2%	35.421	$25,760
Benton County	198,171	100.0%	100.0%	100.0%	116.545	$29,529
Chelan County	76,532	94.0%	99.6%	93.9%	26.205	$26,109
Clallam County	75,474	81.5%	99.7%	81.5%	43.418	$26,967
Clark County	474,639	100.0%	100.0%	100.0%	754.588	$30,207
Columbia County	4,047	96.5%	99.2%	96.1%	4.659	$26,536
Cowlitz County	106,908	92.4%	99.3%	92.3%	93.769	$24,756
Douglas County	41,942	100.0%	99.8%	99.8%	23.054	$23,966
Ferry County	7,594	99.9%	88.0%	87.8%	3.447	$21,146
Franklin County	92,112	100.0%	99.7%	99.7%	74.154	$20,997
Garfield County	2,210	11.9%	99.9%	11.9%	3.110	$23,313
Grant County	95,149	100.0%	99.9%	99.9%	35.510	$20,409
Grays Harbor County	72,695	86.3%	99.9%	86.2%	38.220	$23,799
Island County	83,159	100.0%	100.0%	100.0%	398.942	$32,503

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Jefferson County	31,234	84.0%	100.0%	84.0%	17.317	$30,871
King County	2,188,610	97.4%	99.9%	97.3%	1,034.527	$43,629
Kitsap County	266,408	97.3%	100.0%	97.3%	674.551	$32,801
Kittitas County	46,205	100.0%	99.5%	99.5%	20.113	$25,147
Klickitat County	21,809	41.0%	93.9%	40.0%	11.654	$23,227
Lewis County	78,192	71.1%	98.8%	70.5%	32.542	$22,947
Lincoln County	10,579	100.0%	99.0%	99.0%	4.579	$25,382
Mason County	63,702	88.8%	99.9%	88.8%	66.397	$25,628
Okanogan County	41,741	94.9%	95.1%	91.2%	7.924	$22,544
Pacific County	21,626	85.7%	99.7%	85.5%	23.187	$22,187
Pend Oreille County	13,354	100.0%	99.0%	99.0%	9.539	$24,163
Pierce County	876,759	97.5%	100.0%	97.5%	525.160	$29,750
San Juan County	16,715	100.0%	100.0%	100.0%	96.110	$40,327
Skagit County	125,618	100.0%	99.8%	99.8%	72.561	$28,586
Skamania County	11,835	47.2%	97.3%	45.5%	7.148	$28,556
Snohomish County	801,607	99.4%	99.9%	99.3%	384.045	$33,883
Spokane County	506,135	100.0%	100.0%	100.0%	286.959	$26,860
Stevens County	44,730	100.0%	98.1%	98.1%	18.053	$22,745
Thurston County	280,582	97.7%	99.9%	97.7%	388.638	$30,583
Wahkiakum County	4,264	20.7%	94.0%	18.9%	16.190	$27,619
Walla Walla County	60,566	99.9%	99.9%	99.8%	47.685	$24,736
Whatcom County	221,400	99.9%	99.5%	99.4%	105.085	$27,810
Whitman County	49,046	100.0%	99.6%	99.6%	22.716	$20,957
Yakima County	250,187	100.0%	99.3%	99.3%	58.245	$20,653
West Virginia	**1,815,853**	**84.6%**	**95.1%**	**81.9%**	**75.540**	**.**
Barbour County	16,497	100.0%	98.3%	98.3%	48.370	$18,602
Berkeley County	114,920	95.0%	100.0%	95.0%	357.848	$27,015
Boone County	22,349	86.4%	83.5%	73.1%	44.560	$20,711
Braxton County	14,237	99.9%	95.0%	94.9%	27.871	$20,178
Brooke County	22,443	87.4%	100.0%	87.4%	251.590	$24,428
Cabell County	94,958	94.8%	99.8%	94.6%	337.908	$23,853
Calhoun County	7,307	28.9%	80.3%	25.8%	26.167	$20,640
Clay County	8,764	24.1%	85.3%	14.5%	25.633	$16,980
Doddridge County	8,559	70.8%	83.2%	56.4%	26.770	$19,703
Fayette County	43,521	75.9%	97.9%	74.3%	65.786	$20,286
Gilmer County	8,005	100.0%	77.9%	77.9%	23.648	$17,361
Grant County	11,670	46.9%	97.3%	46.5%	24.446	$20,648

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Greenbrier County	35,287	69.4%	95.8%	69.0%	34.610	$23,204
Hampshire County	23,469	27.4%	98.4%	27.2%	36.656	$19,997
Hancock County	29,448	94.7%	100.0%	94.7%	356.473	$24,041
Hardy County	13,717	87.1%	92.7%	80.8%	23.556	$21,956
Harrison County	67,811	100.0%	99.2%	99.2%	163.004	$25,702
Jackson County	28,976	65.5%	99.5%	65.5%	62.402	$22,591
Jefferson County	56,338	98.1%	100.0%	98.1%	268.744	$32,227
Kanawha County	183,293	94.8%	99.5%	94.4%	203.300	$28,030
Lewis County	16,226	100.0%	91.4%	91.4%	42.157	$20,954
Lincoln County	20,825	78.0%	69.1%	57.2%	47.650	$19,416
Logan County	32,925	71.1%	89.1%	65.0%	72.564	$20,843
Marion County	56,337	100.0%	99.5%	99.5%	182.477	$24,250
Marshall County	31,190	79.3%	97.0%	77.4%	102.118	$23,166
Mason County	26,801	57.0%	98.3%	56.7%	62.220	$20,253
McDowell County	18,456	83.4%	51.3%	46.0%	34.597	$14,259
Mercer County	59,753	96.1%	99.7%	95.9%	142.611	$21,190
Mineral County	27,222	68.4%	100.0%	68.4%	83.037	$20,093
Mingo County	24,127	68.1%	71.0%	51.9%	57.023	$19,502
Monongalia County	105,029	98.1%	99.2%	97.3%	291.697	$28,041
Monroe County	13,402	86.3%	91.8%	85.3%	28.349	$21,257
Morgan County	17,686	68.9%	98.3%	68.9%	77.207	$23,966
Nicholas County	25,043	55.4%	95.0%	52.0%	38.717	$24,244
Ohio County	42,035	94.9%	100.0%	94.9%	397.231	$28,160
Pendleton County	6,996	25.2%	52.9%	23.3%	10.051	$23,325
Pleasants County	7,512	59.2%	93.2%	57.4%	57.739	$23,580
Pocahontas County	8,456	42.2%	22.4%	19.4%	8.993	$22,328
Preston County	33,679	57.5%	99.0%	57.3%	51.909	$21,716
Putnam County	56,792	85.2%	99.8%	85.2%	164.296	$29,173
Raleigh County	75,022	93.7%	96.4%	90.4%	123.931	$22,590
Randolph County	28,785	100.0%	90.6%	90.6%	27.686	$22,079
Ritchie County	9,774	16.5%	78.7%	16.5%	21.624	$20,711
Roane County	14,043	37.3%	90.9%	36.3%	29.041	$18,954
Summers County	12,993	57.6%	100.0%	57.6%	36.046	$19,652
Taylor County	16,930	86.8%	100.0%	86.8%	97.991	$22,915
Tucker County	6,915	54.1%	95.1%	54.0%	16.507	$22,958
Tyler County	8,795	30.9%	90.4%	30.9%	34.316	$22,083
Upshur County	24,465	100.0%	95.1%	95.1%	68.986	$21,361
Wayne County	40,153	81.1%	92.2%	76.4%	79.357	$20,450

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Webster County	8,372	64.3%	79.0%	59.2%	15.126	$18,652
Wetzel County	15,437	45.5%	75.3%	44.9%	43.113	$21,484
Wirt County	5,794	46.7%	81.8%	46.6%	24.919	$22,021
Wood County	85,104	93.3%	99.7%	93.3%	232.360	$25,465
Wyoming County	21,210	93.2%	67.3%	64.4%	42.466	$19,833
Wisconsin	**5,795,276**	**91.3%**	**99.7%**	**91.2%**	**107.007**	**.**
Adams County	19,973	57.3%	100.0%	57.3%	30.935	$23,668
Ashland County	15,500	69.9%	97.2%	69.1%	14.832	$22,270
Barron County	45,251	68.6%	99.9%	68.6%	52.452	$25,426
Bayfield County	15,008	85.2%	96.0%	83.2%	10.155	$27,321
Brown County	262,021	100.0%	100.0%	100.0%	494.651	$28,787
Buffalo County	13,167	90.9%	94.3%	85.7%	19.604	$26,973
Burnett County	15,351	52.8%	100.0%	52.8%	18.679	$25,073
Calumet County	50,057	100.0%	100.0%	100.0%	157.295	$30,856
Chippewa County	63,810	85.0%	100.0%	85.0%	63.280	$26,299
Clark County	34,676	47.1%	99.4%	46.9%	28.662	$22,560
Columbia County	57,244	65.5%	99.9%	65.5%	74.777	$29,936
Crawford County	16,214	75.6%	93.6%	72.7%	28.413	$23,466
Dane County	536,397	96.2%	100.0%	96.2%	448.028	$35,687
Dodge County	87,786	92.3%	100.0%	92.3%	100.255	$25,617
Door County	27,483	68.6%	99.7%	68.6%	57.021	$32,767
Douglas County	43,284	79.6%	100.0%	79.6%	33.190	$26,036
Dunn County	44,693	73.2%	100.0%	73.2%	52.573	$25,120
Eau Claire County	103,667	91.3%	100.0%	91.3%	162.492	$26,795
Florence County	4,371	87.7%	93.3%	84.0%	8.953	$28,358
Fond du Lac County	102,543	97.6%	100.0%	97.6%	142.509	$28,036
Forest County	8,970	54.6%	97.4%	54.1%	8.846	$22,559
Grant County	51,999	82.4%	99.5%	82.1%	45.341	$23,103
Green County	36,851	87.0%	100.0%	87.0%	63.106	$28,867
Green Lake County	18,759	67.3%	100.0%	67.3%	53.684	$26,115
Iowa County	23,715	76.7%	98.0%	76.3%	31.098	$29,610
Iron County	5,671	57.8%	97.1%	56.8%	7.480	$25,536
Jackson County	20,529	53.8%	95.8%	53.6%	20.784	$24,074
Jefferson County	84,831	92.2%	100.0%	92.2%	152.444	$27,272
Juneau County	26,576	69.8%	99.7%	69.7%	34.653	$23,519
Kenosha County	168,516	100.0%	100.0%	100.0%	619.566	$27,335
Kewaunee County	20,445	99.1%	100.0%	99.1%	59.690	$27,539

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
La Crosse County	118,271	96.2%	99.6%	95.9%	261.843	$28,240
Lafayette County	16,741	68.0%	100.0%	68.0%	26.423	$25,877
Langlade County	19,160	91.9%	99.7%	91.6%	22.007	$24,772
Lincoln County	27,838	75.6%	99.6%	75.6%	31.671	$27,322
Manitowoc County	79,175	100.0%	100.0%	100.0%	134.404	$26,751
Marathon County	135,731	93.1%	99.9%	93.0%	87.853	$28,773
Marinette County	40,310	82.4%	98.7%	81.7%	28.806	$25,231
Marquette County	15,308	70.5%	99.8%	70.5%	33.600	$25,268
Menominee County	4,615	94.4%	97.0%	91.4%	12.905	$15,171
Milwaukee County	952,079	100.0%	100.0%	100.0%	3,943.953	$25,881
Monroe County	45,624	70.4%	98.9%	69.9%	50.650	$24,971
Oconto County	37,553	98.6%	99.9%	98.4%	37.629	$27,623
Oneida County	35,254	69.6%	99.7%	69.6%	31.676	$28,084
Outagamie County	186,024	99.5%	100.0%	99.5%	291.792	$29,663
Ozaukee County	88,428	100.0%	100.0%	100.0%	379.394	$44,369
Pepin County	7,254	96.0%	100.0%	96.0%	31.269	$26,280
Pierce County	41,893	85.1%	100.0%	85.1%	73.016	$30,009
Polk County	43,450	59.8%	100.0%	59.8%	47.540	$27,066
Portage County	70,474	88.2%	100.0%	88.2%	88.018	$26,832
Price County	13,442	40.3%	94.9%	39.4%	10.716	$27,987
Racine County	196,062	100.0%	100.0%	100.0%	589.659	$28,436
Richland County	17,516	50.9%	96.6%	50.3%	29.883	$24,961
Rock County	162,305	96.1%	100.0%	96.1%	226.007	$25,884
Rusk County	14,151	48.8%	99.4%	48.8%	15.490	$22,651
Sauk County	63,981	82.8%	99.9%	82.8%	77.002	$26,736
Sawyer County	16,417	75.3%	97.7%	74.7%	13.057	$25,680
Shawano County	40,935	99.4%	100.0%	99.4%	45.837	$25,286
Sheboygan County	115,344	100.0%	100.0%	100.0%	225.605	$27,796
St. Croix County	88,697	48.9%	100.0%	48.9%	122.793	$34,679
Taylor County	20,321	45.1%	96.6%	44.2%	20.845	$24,907
Trempealeau County	29,472	65.2%	97.7%	64.5%	40.209	$26,002
Vernon County	30,759	51.1%	89.4%	49.5%	38.858	$24,414
Vilas County	21,680	44.9%	98.9%	44.4%	25.309	$27,537
Walworth County	103,082	95.7%	100.0%	95.7%	185.691	$28,085
Washburn County	15,756	55.4%	100.0%	55.4%	19.766	$26,570
Washington County	135,092	100.0%	100.0%	100.0%	313.655	$34,722
Waukesha County	400,602	99.9%	100.0%	99.9%	728.932	$40,174

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Waupaca County	51,225	82.0%	99.9%	82.0%	68.509	$28,145
Waushara County	24,363	42.8%	99.9%	42.8%	38.909	$24,861
Winnebago County	170,409	95.7%	100.0%	95.7%	392.207	$28,446
Wood County	73,125	84.8%	100.0%	84.8%	92.200	$27,687
Wyoming	**579,313**	**81.3%**	**98.8%**	**80.7%**	**5.967**	**.**
Albany County	38,332	95.3%	98.8%	95.2%	8.969	$25,227
Big Horn County	11,906	31.9%	98.8%	31.4%	3.795	$23,041
Campbell County	46,242	90.4%	99.7%	90.3%	9.628	$33,317
Carbon County	15,303	75.0%	97.0%	74.7%	1.938	$27,399
Converse County	13,809	89.6%	99.3%	89.6%	3.245	$31,470
Crook County	7,410	38.2%	97.2%	38.0%	2.596	$32,817
Fremont County	39,803	60.9%	94.2%	55.9%	4.334	$26,606
Goshen County	13,378	97.8%	99.0%	96.9%	6.012	$25,883
Hot Springs County	4,696	76.7%	99.1%	76.7%	2.343	$29,499
Johnson County	8,476	80.2%	99.8%	80.2%	2.040	$31,888
Laramie County	98,327	88.4%	100.0%	88.4%	36.608	$30,249
Lincoln County	19,264	67.2%	94.9%	62.8%	4.726	$29,748
Natrona County	79,547	92.0%	99.7%	92.0%	14.895	$30,902
Niobrara County	2,397	84.9%	98.4%	84.9%	0.913	$23,356
Park County	29,567	68.1%	98.1%	68.0%	4.259	$30,179
Platte County	8,562	72.7%	99.9%	72.7%	4.108	$30,054
Sheridan County	30,210	88.1%	99.9%	88.1%	11.969	$29,630
Sublette County	9,799	18.8%	99.3%	18.8%	2.005	$30,295
Sweetwater County	43,534	93.1%	99.5%	93.1%	4.175	$30,945
Teton County	23,265	94.2%	97.6%	92.9%	5.823	$46,499
Uinta County	20,495	65.5%	99.8%	65.5%	9.847	$25,636
Washakie County	8,064	76.2%	99.5%	76.1%	3.602	$26,325
Weston County	6,927	34.1%	97.7%	34.1%	2.889	$29,493
American Samoa	**51,504**	**0.0%**	**0.0%**	**0.0%**	**673.643**	**.**
Eastern District	21,365	0.0%	0.0%	0.0%	831.596	.
Manu'a District	1,060	0.0%	0.0%	0.0%	47.561	.
Swains Island	16	0.0%	0.0%	0.0%	17.035	.
Western District	29,063	0.0%	0.0%	0.0%	1,056.592	.
Guam	**167,358**	**1.6%**	**99.6%**	**1.6%**	**797.688**	**.**
Northern Mariana Islands	**52,263**	**1.5%**	**99.6%**	**1.5%**	**286.639**	**.**
Rota Municipality	2,451	0.2%	94.5%	0.2%	74.596	.
Saipan Municipality	46,770	1.7%	100.0%	1.7%	1,019.178	.

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Tinian Municipality	3,042	0.0%	98.2%	0.0%	72.791	.
Puerto Rico	**3,337,177**	**92.3%**	**99.9%**	**92.2%**	**974.707**	**.**
Adjuntas Municipio	17,971	56.2%	100.0%	56.2%	269.472	$7,124
Aguada Municipio	38,118	99.1%	100.0%	99.1%	1,235.543	$8,592
Aguadilla Municipio	53,164	100.0%	100.0%	100.0%	1,455.407	$10,335
Aguas Buenas Municipio	25,850	56.1%	100.0%	56.1%	859.236	$9,647
Aibonito Municipio	23,108	77.2%	100.0%	77.2%	738.021	$9,262
Anasco Municipio	27,059	92.0%	100.0%	92.0%	688.786	$8,673
Arecibo Municipio	86,066	94.6%	99.9%	94.5%	683.352	$9,438
Arroyo Municipio	17,881	97.9%	99.9%	97.9%	1,191.465	$7,655
Barceloneta Municipio	24,240	99.9%	100.0%	99.9%	1,296.746	$8,245
Barranquitas Municipio	28,511	72.4%	100.0%	72.4%	832.373	$7,369
Bayamon Municipio	179,565	91.0%	100.0%	91.0%	4,051.193	$13,472
Cabo Rojo Municipio	48,824	97.7%	100.0%	97.7%	693.783	$9,833
Caguas Municipio	129,604	99.2%	100.0%	99.2%	2,211.773	$13,911
Camuy Municipio	31,732	89.0%	100.0%	89.0%	684.546	$9,271
Canovanas Municipio	45,823	93.6%	100.0%	93.6%	1,394.276	$10,664
Carolina Municipio	154,489	99.5%	100.0%	99.5%	3,408.803	$15,403
Catano Municipio	24,374	100.0%	100.0%	100.0%	5,031.216	$11,039
Cayey Municipio	44,027	92.5%	100.0%	92.5%	847.744	$12,441
Ceiba Municipio	11,602	98.4%	100.0%	98.4%	399.583	$10,584
Ciales Municipio	16,627	87.2%	98.7%	87.0%	249.920	$7,080
Cidra Municipio	39,813	82.4%	100.0%	82.4%	1,105.264	$11,107
Coamo Municipio	39,071	93.0%	100.0%	93.0%	500.831	$9,699
Comerio Municipio	19,343	67.0%	100.0%	67.0%	681.078	$6,975
Corozal Municipio	33,694	68.6%	100.0%	68.6%	791.444	$7,793
Culebra Municipio	1,769	0.0%	100.0%	0.0%	152.187	$10,069
Dorado Municipio	37,026	99.0%	100.0%	99.0%	1,603.646	$14,504
Fajardo Municipio	31,324	99.7%	100.0%	99.7%	1,048.888	$10,784
Florida Municipio	11,775	93.8%	100.0%	93.8%	774.205	$7,451
Guanica Municipio	16,363	99.1%	100.0%	99.1%	441.643	$7,223
Guayama Municipio	41,281	93.6%	99.3%	93.6%	635.173	$9,034
Guayanilla Municipio	18,611	84.6%	99.3%	84.6%	440.286	$7,864

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Guaynabo Municipio	87,328	87.6%	100.0%	87.6%	3,166.514	$23,834
Gurabo Municipio	47,109	99.1%	100.0%	99.1%	1,689.254	$16,238
Hatillo Municipio	40,111	95.6%	100.0%	95.6%	960.037	$10,116
Hormigueros Municipio	16,032	100.0%	100.0%	100.0%	1,413.259	$11,432
Humacao Municipio	52,771	99.8%	100.0%	99.8%	1,179.117	$10,994
Isabela Municipio	41,949	94.3%	100.0%	94.3%	758.521	$8,578
Jayuya Municipio	14,625	93.5%	95.3%	91.6%	328.407	$7,258
Juana Diaz Municipio	46,400	99.0%	100.0%	99.0%	769.777	$10,053
Juncos Municipio	39,101	98.7%	100.0%	98.7%	1,476.138	$9,282
Lajas Municipio	22,929	96.3%	100.0%	96.3%	382.452	$7,097
Lares Municipio	25,772	84.6%	99.1%	83.7%	419.396	$7,958
Las Marias Municipio	8,402	52.5%	100.0%	52.5%	181.234	$6,730
Las Piedras Municipio	37,659	90.9%	100.0%	90.9%	1,111.547	$9,906
Loiza Municipio	25,926	100.0%	100.0%	100.0%	1,338.723	$8,694
Luquillo Municipio	18,311	100.0%	100.0%	100.0%	709.413	$10,617
Manati Municipio	39,103	98.2%	100.0%	98.2%	866.488	$10,216
Maricao Municipio	5,665	63.1%	97.7%	60.7%	154.686	$5,663
Maunabo Municipio	10,808	91.5%	100.0%	91.5%	513.047	$8,552
Mayaguez Municipio	75,525	98.9%	100.0%	98.9%	972.693	$10,133
Moca Municipio	36,328	99.0%	99.6%	98.5%	721.600	$7,621
Morovis Municipio	31,092	85.1%	100.0%	85.1%	799.874	$8,294
Naguabo Municipio	26,177	99.0%	100.0%	99.0%	506.711	$9,809
Naranjito Municipio	28,306	64.7%	100.0%	64.7%	1,033.015	$9,886
Orocovis Municipio	21,109	60.3%	97.0%	59.4%	331.801	$7,187
Patillas Municipio	17,004	94.8%	92.7%	87.5%	364.116	$8,127
Penuelas Municipio	20,447	89.5%	100.0%	89.5%	458.274	$7,581
Ponce Municipio	140,859	98.5%	100.0%	98.5%	1,227.400	$10,587
Quebradillas Municipio	23,734	95.7%	100.0%	95.7%	1,046.351	$8,499
Rincon Municipio	14,128	100.0%	100.0%	100.0%	988.815	$9,445
Rio Grande Municipio	50,128	97.8%	100.0%	97.8%	826.887	$10,648
Sabana Grande Municipio	22,690	93.8%	100.0%	93.8%	633.220	$8,638

State, County or County Equivalent	Population Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile	Population Density	Per Capita Income ($2016)
Salinas Municipio	28,216	85.9%	100.0%	85.9%	406.775	$8,535
San German Municipio	31,654	83.1%	100.0%	83.1%	580.832	$9,445
San Juan Municipio	337,288	100.0%	100.0%	100.0%	7,049.311	$17,348
San Lorenzo Municipio	37,379	62.1%	100.0%	62.1%	703.836	$10,671
San Sebastian Municipio	37,306	84.6%	100.0%	84.6%	529.741	$7,578
Santa Isabel Municipio	21,863	98.6%	100.0%	98.6%	642.589	$9,545
Toa Alta Municipio	73,217	66.7%	100.0%	66.7%	2,710.093	$13,816
Toa Baja Municipio	78,092	96.8%	100.0%	96.8%	3,360.125	$12,008
Trujillo Alto Municipio	66,675	100.0%	100.0%	100.0%	3,211.062	$15,760
Utuado Municipio	28,791	85.9%	99.1%	85.8%	253.599	$7,841
Vega Alta Municipio	37,566	95.5%	100.0%	95.5%	1,354.797	$10,448
Vega Baja Municipio	52,436	95.6%	100.0%	95.6%	1,143.490	$9,632
Vieques Municipio	8,669	17.1%	100.0%	17.1%	170.757	$9,808
Villalba Municipio	22,528	90.4%	99.6%	90.4%	632.158	$8,733
Yabucoa Municipio	33,629	84.2%	100.0%	84.2%	609.060	$8,531
Yauco Municipio	35,635	88.4%	98.8%	87.2%	522.571	$7,998
U.S. Virgin Islands	**107,268**	**100.0%**	**99.4%**	**99.4%**	**798.588**	**.**
St. Croix Island	51,011	100.0%	99.3%	99.3%	612.230	.
St. John Island	4,204	100.0%	93.2%	93.2%	213.496	.
St. Thomas Island	52,053	100.0%	100.0%	100.0%	1,662.460	.

APPENDIX D-6

Deployment of Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps Services By County - Segmented by Urban and Rural Areas (December 31, 2017)

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Alabama	**2,864,832**	**97.7%**	**100.0%**	**97.7%**	**2,009,846**	**69.7%**	**99.8%**	**69.7%**
Autauga County	31,769	100.0%	100.0%	100.0%	23,735	55.4%	100.0%	55.4%
Baldwin County	117,970	92.7%	100.0%	92.7%	94,658	81.4%	99.7%	81.4%
Barbour County	8,474	100.0%	100.0%	100.0%	16,796	38.4%	99.6%	38.4%
Bibb County	7,144	23.0%	100.0%	23.0%	15,524	32.2%	99.5%	32.2%
Blount County	5,777	95.9%	100.0%	95.9%	52,236	65.7%	100.0%	65.7%
Bullock County	4,716	2.1%	100.0%	2.1%	5,593	8.6%	99.7%	8.6%
Butler County	5,650	100.0%	100.0%	100.0%	14,175	69.2%	99.0%	68.5%
Calhoun County	76,469	98.0%	100.0%	98.0%	38,259	81.5%	99.9%	81.5%
Chambers County	17,173	99.9%	100.0%	99.9%	16,540	63.2%	100.0%	63.2%
Cherokee County	3,624	100.0%	100.0%	100.0%	22,233	98.5%	100.0%	98.5%
Chilton County	5,800	79.9%	100.0%	79.9%	38,267	63.7%	100.0%	63.7%
Choctaw County	.	.	.	.	12,945	22.8%	99.6%	22.8%
Clarke County	5,885	99.3%	100.0%	99.3%	18,198	50.8%	97.9%	49.8%
Clay County	.	.	.	.	13,367	40.4%	99.2%	40.4%
Cleburne County	.	.	.	.	14,900	12.9%	98.3%	12.9%
Coffee County	26,793	100.0%	100.0%	100.0%	25,078	79.5%	100.0%	79.5%
Colbert County	30,552	97.9%	100.0%	97.9%	23,948	57.3%	100.0%	57.3%
Conecuh County	1,902	96.7%	100.0%	96.7%	10,566	29.8%	99.8%	29.8%
Coosa County	.	.	.	.	10,754	76.2%	100.0%	76.2%
Covington County	11,225	99.2%	100.0%	99.2%	25,867	77.8%	100.0%	77.8%
Crenshaw County	.	.	.	.	13,871	75.4%	99.4%	75.4%
Cullman County	22,031	99.8%	100.0%	99.8%	60,724	69.2%	100.0%	69.2%
Dale County	23,850	100.0%	100.0%	100.0%	25,376	86.6%	100.0%	86.6%
Dallas County	21,281	99.8%	100.0%	99.8%	17,934	48.4%	99.7%	48.4%
DeKalb County	6,981	100.0%	100.0%	100.0%	64,636	97.7%	100.0%	97.7%
Elmore County	37,034	99.8%	100.0%	99.8%	44,643	86.3%	100.0%	86.3%
Escambia County	13,640	97.9%	100.0%	97.9%	23,807	60.6%	99.4%	60.6%
Etowah County	64,010	99.1%	100.0%	99.1%	38,745	89.8%	100.0%	89.8%
Fayette County	2,917	89.5%	100.0%	89.5%	13,551	26.7%	99.1%	26.7%
Franklin County	9,335	99.9%	100.0%	99.9%	22,160	48.8%	99.7%	48.8%
Geneva County	2,762	100.0%	100.0%	100.0%	23,659	48.7%	100.0%	48.7%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Greene County	.	.	.	.	8,330	0.2%	99.0%	0.2%
Hale County	1,499	100.0%	100.0%	100.0%	13,313	48.5%	100.0%	48.5%
Henry County	2,096	94.8%	100.0%	94.8%	15,051	54.2%	99.6%	54.2%
Houston County	68,584	99.5%	100.0%	99.5%	35,762	63.5%	100.0%	63.5%
Jackson County	11,546	99.9%	100.0%	99.9%	40,363	78.7%	99.4%	78.7%
Jefferson County	594,243	99.8%	100.0%	99.8%	64,954	91.1%	100.0%	91.1%
Lamar County	.	.	.	.	13,946	34.1%	99.3%	34.1%
Lauderdale County	46,587	97.5%	100.0%	97.5%	45,949	59.4%	99.8%	59.3%
Lawrence County	2,510	100.0%	100.0%	100.0%	30,539	51.3%	99.8%	51.3%
Lee County	113,062	99.8%	100.0%	99.8%	48,540	88.1%	100.0%	88.1%
Limestone County	38,645	99.6%	100.0%	99.6%	55,728	85.7%	100.0%	85.7%
Lowndes County	.	.	.	.	10,076	12.6%	100.0%	12.6%
Macon County	7,333	99.1%	100.0%	99.1%	11,422	35.9%	100.0%	35.9%
Madison County	295,754	96.6%	100.0%	96.6%	65,270	94.3%	100.0%	94.3%
Marengo County	5,595	0.3%	100.0%	0.3%	13,780	17.9%	100.0%	17.9%
Marion County	3,195	67.3%	100.0%	67.3%	26,638	45.9%	100.0%	45.9%
Marshall County	44,454	99.6%	100.0%	99.6%	51,094	91.3%	100.0%	91.3%
Mobile County	330,516	97.1%	100.0%	97.1%	83,439	86.6%	100.0%	86.6%
Monroe County	4,247	98.0%	100.0%	98.0%	17,080	50.8%	99.1%	50.8%
Montgomery County	202,334	100.0%	100.0%	100.0%	24,312	79.0%	100.0%	79.0%
Morgan County	72,699	99.6%	100.0%	99.6%	46,119	76.6%	100.0%	76.6%
Perry County	.	.	.	.	9,339	0.0%	99.7%	0.0%
Pickens County	.	.	.	.	20,176	27.0%	99.4%	27.0%
Pike County	15,487	99.7%	100.0%	99.7%	17,780	85.3%	97.5%	83.6%
Randolph County	4,119	100.0%	100.0%	100.0%	18,551	38.7%	99.2%	38.7%
Russell County	34,889	100.0%	100.0%	100.0%	22,156	72.5%	99.6%	72.5%
Shelby County	159,865	99.7%	100.0%	99.7%	53,734	81.6%	100.0%	81.6%
St. Clair County	23,576	83.3%	100.0%	83.3%	64,619	76.7%	100.0%	76.7%
Sumter County	.	.	.	.	12,687	43.8%	99.9%	43.8%
Talladega County	34,773	99.8%	100.0%	99.8%	45,292	58.1%	100.0%	58.1%
Tallapoosa County	10,519	100.0%	100.0%	100.0%	30,162	88.5%	100.0%	88.5%
Tuscaloosa County	152,015	95.5%	100.0%	95.5%	55,796	81.3%	99.9%	81.3%
Walker County	16,448	99.8%	100.0%	99.8%	47,610	67.1%	99.9%	67.1%
Washington County	.	.	.	.	16,531	30.4%	98.2%	29.8%
Wilcox County	.	.	.	.	10,719	41.6%	100.0%	41.6%
Winston County	3,478	67.5%	100.0%	67.5%	20,244	46.0%	99.8%	46.0%

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Alaska	**476,908**	**96.4%**	**97.6%**	**96.3%**	**262,607**	**51.6%**	**74.5%**	**49.7%**
Aleutians East Borough	.	.	.	.	3,370	0.0%	0.0%	0.0%
Aleutians West Census Area	.	.	.	.	5,763	0.0%	51.3%	0.0%
Anchorage Municipality	281,475	99.9%	100.0%	99.9%	12,881	88.4%	96.1%	84.5%
Bethel Census Area	4,567	0.0%	0.0%	0.0%	13,509	0.0%	0.0%	0.0%
Bristol Bay Borough	.	.	.	.	867	0.0%	0.0%	0.0%
Denali Borough	.	.	.	.	2,074	36.6%	81.6%	30.5%
Dillingham Census Area	.	.	.	.	4,932	0.0%	0.0%	0.0%
Fairbanks North Star Borough	68,221	98.4%	100.0%	98.4%	31,482	65.6%	98.6%	65.6%
Haines Borough	.	.	.	.	2,526	92.2%	77.3%	74.0%
Hoonah-Angoon Census Area	.	.	.	.	2,145	25.1%	18.9%	17.8%
Juneau City and Borough	25,153	100.0%	100.0%	100.0%	6,941	96.7%	98.8%	96.5%
Kenai Peninsula Borough	11,731	96.0%	100.0%	96.0%	46,886	52.7%	96.1%	50.1%
Ketchikan Gateway Borough	10,583	100.0%	99.9%	99.9%	3,273	95.6%	98.5%	94.6%
Kodiak Island Borough	9,080	100.0%	100.0%	100.0%	4,368	53.8%	79.0%	53.8%
Lake and Peninsula Borough	.	.	.	.	1,620	0.0%	0.0%	0.0%
Matanuska-Susitna Borough	48,834	99.4%	100.0%	99.4%	57,698	77.3%	98.4%	76.3%
Nome Census Area	3,321	0.0%	0.0%	0.0%	6,600	0.0%	29.2%	0.0%
North Slope Borough	3,846	0.0%	100.0%	0.0%	5,936	0.0%	56.0%	0.0%
Northwest Arctic Borough	3,251	0.0%	0.0%	0.0%	4,433	0.0%	0.0%	0.0%
Petersburg Borough	.	.	.	.	7,996	0.0%	7.5%	0.0%
Petersburg Census Area	.	.	.	.	3,281	80.2%	58.9%	55.6%
Prince of Wales-Hyder Census Area	.	.	.	.	6,369	0.0%	39.7%	0.0%

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Sitka City and Borough	6,846	100.0%	95.4%	95.4%	1,843	89.4%	91.3%	89.1%
Skagway Municipality	.	.	.	.	1,157	97.8%	80.0%	79.9%
Southeast Fairbanks Census Area	.	.	.	.	6,888	36.9%	83.2%	35.6%
Valdez-Cordova Census Area	.	.	.	.	9,278	86.5%	95.0%	84.4%
Wrangell City and Borough	.	.	.	.	2,521	89.7%	70.2%	67.0%
Yakutat City and Borough	.	.	.	.	605	0.0%	0.0%	0.0%
Yukon-Koyukuk Census Area	.	.	.	.	5,365	0.0%	12.6%	0.0%
Arizona	**6,184,127**	**93.3%**	**100.0%**	**93.3%**	**832,079**	**39.8%**	**97.1%**	**39.8%**
Apache County	17,204	0.0%	100.0%	0.0%	54,402	0.3%	82.7%	0.3%
Cochise County	78,975	76.4%	100.0%	76.4%	45,781	28.0%	99.9%	28.0%
Coconino County	92,346	79.5%	100.0%	79.5%	48,430	29.6%	98.3%	29.5%
Gila County	31,441	84.3%	100.0%	84.3%	22,060	52.7%	99.4%	52.7%
Graham County	19,997	94.6%	100.0%	94.6%	17,469	37.5%	99.5%	37.5%
Greenlee County	4,547	98.0%	100.0%	98.0%	4,908	14.6%	99.1%	14.6%
La Paz County	8,846	66.0%	100.0%	66.0%	11,755	32.7%	100.0%	32.7%
Maricopa County	4,123,933	94.5%	100.0%	94.5%	183,045	51.7%	99.9%	51.7%
Mohave County	155,541	94.4%	100.0%	94.4%	51,657	31.7%	99.1%	31.7%
Navajo County	48,230	75.8%	97.7%	75.8%	60,726	23.5%	79.1%	23.5%
Pima County	933,544	95.2%	100.0%	95.2%	89,219	56.0%	99.8%	56.0%
Pinal County	308,560	83.0%	100.0%	83.0%	121,677	29.2%	100.0%	29.2%
Santa Cruz County	33,252	97.0%	100.0%	97.0%	12,960	46.1%	99.8%	46.1%
Yavapai County	145,994	97.5%	100.0%	97.5%	82,173	68.3%	99.9%	68.3%
Yuma County	181,717	97.7%	100.0%	97.7%	25,817	32.3%	99.9%	32.3%
Arkansas	**1,672,850**	**94.4%**	**100.0%**	**94.4%**	**1,331,266**	**55.9%**	**99.5%**	**55.9%**
Arkansas County	11,284	2.3%	100.0%	2.3%	6,683	22.9%	100.0%	22.9%
Ashley County	9,590	74.5%	100.0%	74.5%	10,693	31.6%	100.0%	31.6%
Baxter County	13,910	99.3%	100.0%	99.3%	27,445	65.6%	99.0%	65.5%
Benton County	190,159	98.5%	100.0%	98.5%	76,091	86.6%	100.0%	86.6%
Boone County	14,043	99.3%	100.0%	99.3%	23,337	53.7%	100.0%	53.7%
Bradley County	5,474	98.2%	100.0%	98.2%	5,390	25.7%	100.0%	25.7%

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Calhoun County	.	.	.	.	5,247	6.9%	100.0%	6.9%
Carroll County	7,462	100.0%	100.0%	100.0%	20,481	100.0%	100.0%	100.0%
Chicot County	4,406	96.3%	100.0%	96.3%	6,230	23.7%	100.0%	23.7%
Clark County	9,799	99.5%	100.0%	99.5%	12,494	57.5%	100.0%	57.5%
Clay County	5,771	82.9%	100.0%	82.9%	9,149	54.5%	100.0%	54.5%
Cleburne County	6,036	99.9%	100.0%	99.9%	19,012	38.3%	99.0%	38.3%
Cleveland County	.	.	.	.	8,202	83.1%	100.0%	83.1%
Columbia County	9,556	97.7%	100.0%	97.7%	14,071	48.1%	100.0%	48.0%
Conway County	6,168	99.9%	100.0%	99.9%	14,748	22.5%	99.6%	22.5%
Craighead County	70,184	97.3%	100.0%	97.3%	36,912	64.9%	100.0%	64.9%
Crawford County	29,895	98.8%	100.0%	98.8%	33,101	74.0%	99.9%	74.0%
Crittenden County	37,960	97.1%	100.0%	97.1%	10,790	17.4%	100.0%	17.4%
Cross County	7,492	81.5%	100.0%	81.5%	9,371	37.5%	100.0%	37.5%
Dallas County	3,371	34.3%	100.0%	34.3%	4,022	40.5%	97.3%	40.0%
Desha County	7,675	96.5%	100.0%	96.5%	4,089	19.5%	100.0%	19.5%
Drew County	9,490	96.1%	100.0%	96.1%	9,057	38.9%	100.0%	38.9%
Faulkner County	73,837	99.6%	100.0%	99.6%	49,810	80.3%	100.0%	80.3%
Franklin County	2,622	52.7%	100.0%	52.7%	15,267	16.0%	99.8%	16.0%
Fulton County	861	85.1%	100.0%	85.1%	11,194	22.2%	99.5%	22.2%
Garland County	61,791	99.7%	100.0%	99.7%	36,866	92.9%	99.5%	92.9%
Grant County	4,473	49.1%	100.0%	49.1%	13,690	41.2%	100.0%	41.2%
Greene County	25,420	100.0%	100.0%	100.0%	19,628	38.0%	100.0%	38.0%
Hempstead County	9,404	78.2%	100.0%	78.2%	12,457	52.7%	100.0%	52.7%
Hot Spring County	11,285	86.6%	100.0%	86.6%	22,285	40.1%	99.7%	40.1%
Howard County	4,186	0.0%	100.0%	0.0%	9,292	24.0%	99.3%	24.0%
Independence County	11,648	99.7%	100.0%	99.7%	25,853	50.4%	99.9%	50.4%
Izard County	.	.	.	.	13,685	44.4%	99.4%	44.4%
Jackson County	5,832	97.4%	100.0%	97.4%	11,303	67.6%	99.6%	67.2%
Jefferson County	48,144	71.3%	100.0%	71.3%	20,971	22.7%	100.0%	22.7%
Johnson County	6,934	98.2%	100.0%	98.2%	19,617	37.5%	98.5%	37.5%
Lafayette County	.	.	.	.	6,862	13.7%	100.0%	13.7%
Lawrence County	6,035	99.5%	100.0%	99.5%	10,490	14.6%	99.7%	14.6%
Lee County	3,329	61.9%	100.0%	61.9%	5,847	11.5%	100.0%	11.5%
Lincoln County	.	.	.	.	13,646	17.2%	100.0%	17.2%
Little River County	3,668	97.6%	100.0%	97.6%	8,691	40.8%	100.0%	40.8%
Logan County	6,388	48.7%	100.0%	48.7%	15,334	11.1%	100.0%	11.1%

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Lonoke County	39,115	81.1%	100.0%	81.1%	33,779	72.0%	100.0%	72.0%
Madison County	.	.	.	.	16,339	34.0%	99.7%	34.0%
Marion County	.	.	.	.	16,428	42.2%	98.9%	41.4%
Miller County	26,192	99.1%	100.0%	99.1%	17,788	81.2%	100.0%	81.2%
Mississippi County	26,136	86.8%	100.0%	86.8%	16,023	48.9%	100.0%	48.9%
Monroe County	2,260	4.1%	100.0%	4.1%	4,825	16.9%	100.0%	16.9%
Montgomery County	.	.	.	.	8,917	42.9%	99.2%	42.8%
Nevada County	2,344	88.5%	100.0%	88.5%	5,983	30.3%	100.0%	30.3%
Newton County	.	.	.	.	7,828	1.0%	91.0%	1.0%
Ouachita County	9,968	80.7%	100.0%	80.7%	13,900	41.0%	100.0%	41.0%
Perry County	.	.	.	.	10,346	65.8%	97.3%	65.1%
Phillips County	9,605	98.8%	100.0%	98.8%	8,967	68.7%	100.0%	68.7%
Pike County	.	.	.	.	10,726	42.4%	98.6%	42.3%
Poinsett County	6,876	96.9%	100.0%	96.9%	17,278	49.2%	100.0%	49.2%
Polk County	5,279	99.6%	100.0%	99.6%	14,839	50.0%	99.6%	50.0%
Pope County	28,508	98.6%	100.0%	98.6%	35,327	77.7%	98.5%	77.0%
Prairie County	.	.	.	.	8,248	36.4%	100.0%	36.4%
Pulaski County	344,544	97.9%	100.0%	97.9%	49,404	89.1%	100.0%	89.1%
Randolph County	5,662	99.9%	100.0%	99.9%	11,895	45.6%	95.4%	45.3%
Saline County	73,919	99.2%	100.0%	99.2%	45,393	78.4%	100.0%	78.4%
Scott County	2,755	87.1%	100.0%	87.1%	7,681	33.9%	98.7%	33.9%
Searcy County	.	.	.	.	7,938	31.8%	93.8%	31.4%
Sebastian County	100,724	99.0%	100.0%	99.0%	27,381	77.4%	100.0%	77.4%
Sevier County	5,854	98.8%	100.0%	98.8%	11,261	61.5%	100.0%	61.5%
Sharp County	3,408	100.0%	100.0%	100.0%	13,985	26.5%	98.9%	26.5%
St. Francis County	11,911	59.7%	100.0%	59.7%	14,019	16.3%	100.0%	16.3%
Stone County	.	.	.	.	12,537	0.7%	94.4%	0.7%
Union County	17,587	98.8%	100.0%	98.8%	21,862	51.2%	100.0%	51.2%
Van Buren County	.	.	.	.	16,506	39.0%	96.9%	39.0%
Washington County	164,298	98.7%	100.0%	98.7%	67,673	77.9%	100.0%	77.9%
White County	35,745	88.0%	100.0%	88.0%	43,271	43.5%	99.8%	43.5%
Woodruff County	.	.	.	.	6,571	37.3%	100.0%	37.3%
Yell County	4,578	98.8%	100.0%	98.8%	16,945	74.9%	98.8%	74.3%
California	**37,189,761**	**98.9%**	**100.0%**	**98.9%**	**2,346,633**	**67.3%**	**98.9%**	**67.1%**
Alameda County	1,649,866	98.9%	100.0%	98.9%	13,321	92.0%	96.5%	88.5%

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Alpine County	.	.	.	.	1,120	9.1%	96.1%	7.4%
Amador County	14,571	99.5%	100.0%	99.5%	24,052	49.3%	99.7%	49.3%
Butte County	182,968	99.1%	100.0%	99.1%	46,324	42.7%	97.3%	42.7%
Calaveras County	11,023	100.0%	100.0%	100.0%	34,646	86.2%	99.3%	86.2%
Colusa County	14,593	47.6%	100.0%	47.6%	7,207	7.4%	99.0%	7.4%
Contra Costa County	1,128,012	98.8%	100.0%	98.8%	19,424	39.0%	99.5%	39.0%
Del Norte County	18,332	99.9%	100.0%	99.9%	9,138	81.6%	87.3%	74.4%
El Dorado County	121,103	99.7%	100.0%	99.7%	67,882	96.5%	99.9%	96.4%
Fresno County	862,036	99.1%	100.0%	99.1%	127,214	90.4%	99.5%	90.4%
Glenn County	16,482	91.5%	100.0%	91.5%	11,612	38.3%	99.8%	38.3%
Humboldt County	94,868	98.7%	100.0%	98.7%	41,886	46.2%	95.8%	46.2%
Imperial County	146,089	97.0%	100.0%	97.0%	36,740	20.6%	99.9%	20.6%
Inyo County	9,604	99.6%	100.0%	99.6%	8,422	72.0%	93.3%	72.0%
Kern County	769,479	99.6%	100.0%	99.6%	123,629	68.5%	99.7%	68.4%
Kings County	133,128	88.9%	100.0%	88.9%	16,973	88.6%	100.0%	88.6%
Lake County	42,391	90.8%	100.0%	90.8%	21,855	70.2%	99.0%	70.2%
Lassen County	10,246	90.5%	100.0%	90.5%	20,917	27.5%	99.9%	27.5%
Los Angeles County	10,072,357	99.8%	100.0%	99.8%	91,125	57.2%	98.8%	56.4%
Madera County	102,740	100.0%	100.0%	100.0%	54,150	96.0%	99.9%	96.0%
Marin County	242,908	99.3%	100.0%	99.3%	18,047	67.6%	99.8%	67.6%
Mariposa County	.	.	.	.	17,569	50.3%	96.6%	50.0%
Mendocino County	47,804	96.4%	100.0%	96.4%	40,214	50.2%	92.1%	50.0%
Merced County	226,962	100.0%	100.0%	100.0%	45,706	99.4%	99.9%	99.4%
Modoc County	2,550	0.0%	100.0%	0.0%	6,309	18.9%	98.7%	18.6%
Mono County	7,276	95.6%	100.0%	95.6%	6,891	55.1%	96.8%	55.1%
Monterey County	384,389	100.0%	100.0%	100.0%	53,512	90.5%	96.5%	88.0%
Napa County	121,198	97.3%	100.0%	97.3%	19,775	68.5%	99.7%	68.5%
Nevada County	57,053	94.1%	100.0%	94.1%	42,761	51.2%	99.6%	51.2%
Orange County	3,180,836	98.3%	100.0%	98.3%	9,536	78.1%	100.0%	78.1%
Placer County	322,110	98.7%	100.0%	98.7%	64,049	86.7%	99.7%	86.7%
Plumas County	4,872	31.7%	100.0%	31.7%	13,870	13.5%	97.2%	13.5%
Riverside County	2,258,576	98.9%	100.0%	98.9%	164,661	57.9%	99.7%	57.9%
Sacramento County	1,493,167	97.9%	100.0%	97.9%	37,447	74.4%	100.0%	74.4%
San Benito County	43,060	100.0%	100.0%	100.0%	17,249	97.0%	98.7%	96.3%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
San Bernardino County	2,002,560	98.8%	100.0%	98.8%	154,830	34.5%	99.6%	34.5%
San Diego County	3,188,327	98.0%	100.0%	98.0%	149,354	87.9%	99.9%	87.8%
San Francisco County	884,355	98.7%	100.0%	98.7%	2	50.0%	100.0%	50.0%
San Joaquin County	675,783	100.0%	100.0%	100.0%	69,626	98.6%	99.9%	98.6%
San Luis Obispo County	230,528	99.5%	100.0%	99.5%	52,876	87.0%	99.3%	86.4%
San Mateo County	753,787	99.4%	100.0%	99.4%	17,621	87.5%	94.9%	82.7%
Santa Barbara County	417,613	95.4%	100.0%	95.4%	30,535	38.3%	98.9%	38.3%
Santa Clara County	1,906,904	100.0%	100.0%	100.0%	31,218	98.5%	98.9%	97.4%
Santa Cruz County	239,751	100.0%	100.0%	100.0%	36,137	99.8%	99.3%	99.2%
Shasta County	126,126	98.6%	100.0%	98.6%	53,794	19.4%	99.4%	19.4%
Sierra County	9	100.0%	100.0%	100.0%	2,990	11.2%	74.7%	11.2%
Siskiyou County	14,072	19.5%	100.0%	19.5%	29,781	17.1%	95.4%	17.1%
Solano County	419,658	96.3%	100.0%	96.3%	25,796	70.6%	100.0%	70.6%
Sonoma County	435,775	98.7%	100.0%	98.7%	68,442	75.2%	99.0%	75.2%
Stanislaus County	501,579	100.0%	100.0%	100.0%	46,314	95.3%	99.7%	95.3%
Sutter County	81,434	99.3%	100.0%	99.3%	15,214	44.5%	100.0%	44.5%
Tehama County	30,629	83.6%	100.0%	83.6%	33,296	17.5%	99.1%	17.5%
Trinity County	.	.	.	.	12,709	20.8%	85.4%	20.8%
Tulare County	385,794	100.0%	100.0%	100.0%	78,681	83.0%	98.9%	83.0%
Tuolumne County	27,455	99.7%	100.0%	99.7%	26,793	83.4%	98.9%	82.6%
Ventura County	821,214	99.4%	100.0%	99.4%	33,005	64.1%	99.3%	64.0%
Yolo County	199,149	99.7%	100.0%	99.7%	19,966	64.5%	100.0%	64.5%
Yuba County	54,610	99.3%	100.0%	99.3%	22,420	31.4%	97.8%	31.4%
Colorado	**4,737,835**	**98.4%**	**100.0%**	**98.4%**	**868,533**	**63.2%**	**98.9%**	**62.9%**
Adams County	473,966	99.7%	100.0%	99.7%	29,093	69.7%	100.0%	69.7%
Alamosa County	10,002	98.0%	100.0%	98.0%	6,543	32.7%	100.0%	32.7%
Arapahoe County	627,622	99.9%	100.0%	99.9%	15,373	58.6%	100.0%	58.6%
Archuleta County	5,125	38.6%	100.0%	38.6%	8,190	33.1%	98.9%	33.1%
Baca County	.	.	.	.	3,562	53.9%	99.7%	53.8%
Bent County	3,604	61.3%	100.0%	61.3%	2,329	28.7%	99.9%	28.7%
Boulder County	289,358	98.2%	100.0%	98.2%	33,143	67.7%	99.9%	67.7%
Broomfield County	67,253	97.3%	100.0%	97.3%	1,027	65.3%	100.0%	65.3%

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Chaffee County	11,844	86.7%	100.0%	86.7%	7,794	43.0%	97.3%	40.6%
Cheyenne County	.	.	.	.	1,845	82.0%	100.0%	82.0%
Clear Creek County	.	.	.	.	9,574	76.6%	100.0%	76.6%
Conejos County	.	.	.	.	8,183	9.9%	99.2%	9.9%
Costilla County	.	.	.	.	3,775	59.0%	99.5%	59.0%
Crowley County	.	.	.	.	5,809	66.7%	100.0%	66.7%
Custer County	.	.	.	.	4,874	27.6%	99.1%	27.2%
Delta County	11,281	99.4%	100.0%	99.4%	19,287	87.6%	99.6%	87.4%
Denver County	700,657	100.0%	100.0%	100.0%	3,679	99.6%	100.0%	99.6%
Dolores County	.	.	.	.	2,067	11.1%	83.4%	10.9%
Douglas County	288,307	99.6%	100.0%	99.6%	46,977	89.2%	100.0%	89.2%
Eagle County	42,100	88.6%	100.0%	88.6%	12,670	67.0%	98.2%	67.0%
El Paso County	614,985	97.9%	100.0%	97.9%	84,210	65.9%	100.0%	65.9%
Elbert County	.	.	.	.	25,632	79.5%	100.0%	79.5%
Fremont County	33,963	93.8%	100.0%	93.8%	13,596	58.8%	97.9%	58.8%
Garfield County	43,360	92.6%	100.0%	92.6%	15,758	46.2%	96.5%	46.2%
Gilpin County	.	.	.	.	6,013	38.8%	100.0%	38.8%
Grand County	2,425	99.1%	100.0%	99.1%	12,896	64.6%	99.7%	64.6%
Gunnison County	6,522	100.0%	100.0%	100.0%	10,417	83.0%	88.0%	79.4%
Hinsdale County	.	.	.	.	794	44.5%	3.1%	0.0%
Huerfano County	2,872	99.6%	100.0%	99.6%	3,790	21.9%	98.5%	21.9%
Jackson County	.	.	.	.	1,385	77.8%	97.5%	77.8%
Jefferson County	526,279	99.9%	100.0%	99.9%	48,332	83.9%	100.0%	83.9%
Kiowa County	.	.	.	.	1,376	53.1%	98.6%	51.9%
Kit Carson County	2,927	100.0%	100.0%	100.0%	4,231	87.5%	100.0%	87.5%
La Plata County	21,369	92.1%	100.0%	92.1%	34,220	76.0%	100.0%	76.0%
Lake County	5,174	98.5%	100.0%	98.5%	2,604	69.4%	99.5%	69.4%
Larimer County	287,669	95.5%	100.0%	95.5%	56,307	48.9%	98.6%	48.4%
Las Animas County	8,518	97.0%	100.0%	97.0%	5,720	23.0%	98.7%	22.3%
Lincoln County	.	.	.	.	5,546	19.4%	100.0%	19.4%
Logan County	14,911	100.0%	100.0%	100.0%	6,985	77.9%	100.0%	77.9%
Mesa County	131,263	99.3%	100.0%	99.3%	20,353	42.7%	96.3%	42.6%
Mineral County	.	.	.	.	701	82.0%	71.3%	60.1%
Moffat County	9,340	100.0%	100.0%	100.0%	3,791	84.0%	94.2%	83.1%
Montezuma County	8,192	91.9%	100.0%	91.9%	17,948	43.1%	99.7%	43.0%
Montrose County	22,482	100.0%	100.0%	100.0%	19,302	85.5%	99.1%	85.2%

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Morgan County	18,764	99.0%	100.0%	99.0%	9,428	58.7%	100.0%	58.7%
Otero County	11,906	99.4%	100.0%	99.4%	6,420	63.6%	99.5%	63.6%
Ouray County	.	.	.	.	4,794	99.9%	100.0%	99.9%
Park County	.	.	.	.	17,905	59.2%	98.5%	58.7%
Phillips County	.	.	.	.	4,291	99.8%	100.0%	99.8%
Pitkin County	9,848	96.0%	100.0%	96.0%	8,042	76.7%	93.1%	74.3%
Prowers County	7,224	100.0%	100.0%	100.0%	4,845	30.6%	100.0%	30.6%
Pueblo County	140,182	96.0%	100.0%	96.0%	26,293	63.7%	99.7%	63.7%
Rio Blanco County	.	.	.	.	6,420	70.1%	91.4%	70.1%
Rio Grande County	4,294	99.1%	100.0%	99.1%	7,007	66.6%	99.6%	66.6%
Routt County	12,795	100.0%	100.0%	100.0%	12,425	92.0%	98.7%	91.6%
Saguache County	.	.	.	.	6,626	70.6%	88.4%	69.8%
San Juan County	.	.	.	.	715	39.9%	94.8%	39.6%
San Miguel County	.	.	.	.	7,967	65.6%	97.1%	65.3%
Sedgwick County	.	.	.	.	2,344	77.9%	100.0%	77.9%
Summit County	22,452	97.3%	100.0%	97.3%	8,124	72.1%	99.2%	72.1%
Teller County	8,846	98.2%	100.0%	98.2%	15,798	67.0%	100.0%	67.0%
Washington County	.	.	.	.	4,937	80.5%	100.0%	80.5%
Weld County	224,724	94.7%	100.0%	94.7%	79,806	33.0%	100.0%	33.0%
Yuma County	3,430	100.0%	100.0%	100.0%	6,645	96.6%	100.0%	96.6%
Connecticut	**3,155,048**	**100.0%**	**100.0%**	**100.0%**	**433,127**	**100.0%**	**100.0%**	**100.0%**
Fairfield County	904,674	100.0%	100.0%	100.0%	45,242	100.0%	100.0%	100.0%
Hartford County	846,369	100.0%	100.0%	100.0%	49,015	100.0%	100.0%	100.0%
Litchfield County	104,445	100.0%	100.0%	100.0%	77,732	100.0%	100.0%	100.0%
Middlesex County	122,629	100.0%	100.0%	100.0%	40,781	100.0%	100.0%	100.0%
New Haven County	828,656	100.0%	100.0%	100.0%	31,779	100.0%	100.0%	100.0%
New London County	197,919	100.0%	100.0%	100.0%	71,114	100.0%	100.0%	100.0%
Tolland County	92,897	100.0%	100.0%	100.0%	58,564	100.0%	100.0%	100.0%
Windham County	57,459	100.0%	100.0%	100.0%	58,900	100.0%	100.0%	100.0%
Delaware	**791,712**	**98.5%**	**100.0%**	**98.5%**	**170,189**	**93.8%**	**100.0%**	**93.8%**
Kent County	127,821	97.5%	100.0%	97.5%	49,002	91.9%	100.0%	91.9%
New Castle County	532,616	98.5%	100.0%	98.5%	27,176	95.9%	100.0%	95.9%
Sussex County	131,275	99.0%	100.0%	99.0%	94,011	94.1%	100.0%	94.1%

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District of Columbia	**693,881**	**100.0%**	**100.0%**	**100.0%**	**.**	**.**	**.**	**.**
Florida	**18,952,277**	**98.2%**	**100.0%**	**98.2%**	**2,031,580**	**77.9%**	**99.8%**	**77.9%**
Alachua County	204,881	90.0%	100.0%	90.0%	62,054	65.9%	100.0%	65.9%
Baker County	11,280	96.6%	100.0%	96.6%	17,003	74.9%	95.9%	72.4%
Bay County	157,729	98.6%	100.0%	98.6%	25,834	69.1%	100.0%	69.1%
Bradford County	6,932	100.0%	100.0%	100.0%	20,106	100.0%	100.0%	100.0%
Brevard County	555,461	100.0%	100.0%	100.0%	33,699	100.0%	100.0%	100.0%
Broward County	1,934,985	98.2%	100.0%	98.2%	884	19.3%	100.0%	19.3%
Calhoun County	4,666	99.8%	100.0%	99.8%	9,817	55.5%	100.0%	55.5%
Charlotte County	162,936	93.2%	100.0%	93.2%	19,091	65.5%	100.0%	65.5%
Citrus County	94,603	98.8%	100.0%	98.8%	51,044	86.0%	100.0%	86.0%
Clay County	174,564	100.0%	100.0%	100.0%	37,640	100.0%	100.0%	100.0%
Collier County	329,352	98.3%	100.0%	98.3%	43,518	71.2%	100.0%	71.2%
Columbia County	26,223	83.5%	100.0%	83.5%	43,389	80.6%	100.0%	80.6%
DeSoto County	19,258	71.2%	100.0%	71.2%	17,596	62.7%	100.0%	62.7%
Dixie County	3,736	0.0%	100.0%	0.0%	12,937	1.0%	99.7%	1.0%
Duval County	908,013	100.0%	100.0%	100.0%	29,912	100.0%	100.0%	100.0%
Escambia County	285,558	98.4%	100.0%	98.4%	27,954	69.3%	100.0%	69.3%
Flagler County	94,665	99.9%	100.0%	99.9%	15,842	74.2%	100.0%	74.2%
Franklin County	3,733	99.1%	100.0%	99.1%	7,994	94.1%	99.5%	93.6%
Gadsden County	15,337	94.0%	100.0%	94.0%	30,733	86.5%	99.5%	86.0%
Gilchrist County	2,758	0.0%	100.0%	0.0%	14,975	27.5%	100.0%	27.5%
Glades County	3,866	86.2%	100.0%	86.2%	9,888	67.8%	100.0%	67.8%
Gulf County	3,661	99.9%	100.0%	99.9%	12,498	86.1%	100.0%	86.1%
Hamilton County	3,881	43.0%	100.0%	43.0%	10,303	65.6%	100.0%	65.6%
Hardee County	14,368	95.5%	100.0%	95.5%	13,042	91.6%	100.0%	91.6%
Hendry County	24,716	93.1%	100.0%	93.1%	15,624	51.0%	100.0%	51.0%
Hernando County	148,498	100.0%	100.0%	100.0%	38,036	88.9%	100.0%	88.9%
Highlands County	79,667	92.6%	100.0%	92.6%	23,209	68.2%	100.0%	68.2%
Hillsborough County	1,352,113	99.9%	100.0%	99.9%	56,406	94.7%	100.0%	94.7%
Holmes County	4,002	98.0%	100.0%	98.0%	15,556	25.8%	100.0%	25.8%
Indian River County	143,604	100.0%	100.0%	100.0%	10,775	100.0%	100.0%	100.0%
Jackson County	11,530	82.4%	100.0%	82.4%	36,800	44.2%	99.9%	44.2%
Jefferson County	.	.	.	.	14,144	28.6%	100.0%	28.6%
Lafayette County	.	.	.	.	8,451	50.8%	99.9%	50.7%

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Lake County	275,471	100.0%	100.0%	100.0%	70,537	100.0%	100.0%	100.0%
Lee County	687,576	92.5%	100.0%	92.5%	51,631	82.7%	99.4%	82.1%
Leon County	251,807	96.5%	100.0%	96.5%	38,479	88.4%	100.0%	88.4%
Levy County	3,158	59.4%	100.0%	59.4%	37,196	16.2%	99.9%	16.2%
Liberty County	.	.	.	.	8,242	32.5%	96.4%	30.1%
Madison County	3,621	99.2%	100.0%	99.2%	14,826	53.8%	100.0%	53.8%
Manatee County	356,812	99.6%	100.0%	99.6%	28,746	91.3%	100.0%	91.3%
Marion County	241,575	96.1%	100.0%	96.1%	112,767	81.6%	99.8%	81.4%
Martin County	143,924	100.0%	100.0%	100.0%	15,991	100.0%	100.0%	100.0%
Miami-Dade County	2,727,758	96.7%	100.0%	96.7%	24,032	58.3%	100.0%	58.3%
Monroe County	69,531	95.9%	100.0%	95.9%	7,482	91.1%	99.7%	91.1%
Nassau County	41,506	94.7%	100.0%	94.7%	41,215	87.8%	100.0%	87.8%
Okaloosa County	174,272	95.3%	100.0%	95.3%	28,691	71.3%	98.4%	71.3%
Okeechobee County	25,638	97.1%	100.0%	97.1%	15,965	55.4%	100.0%	55.4%
Orange County	1,303,820	100.0%	100.0%	100.0%	45,108	100.0%	100.0%	100.0%
Osceola County	305,972	100.0%	100.0%	100.0%	46,167	100.0%	100.0%	100.0%
Palm Beach County	1,439,972	98.0%	100.0%	98.0%	31,171	50.2%	100.0%	50.2%
Pasco County	472,908	99.4%	100.0%	99.4%	52,694	91.1%	100.0%	91.1%
Pinellas County	967,852	99.9%	100.0%	99.9%	2,774	99.5%	100.0%	99.5%
Polk County	584,019	99.1%	100.0%	99.1%	102,418	73.7%	100.0%	73.7%
Putnam County	32,290	93.0%	100.0%	93.0%	41,171	72.2%	99.9%	72.2%
Santa Rosa County	131,208	98.8%	100.0%	98.8%	43,049	69.7%	97.7%	69.7%
Sarasota County	397,745	97.6%	100.0%	97.6%	21,350	75.9%	100.0%	75.9%
Seminole County	446,164	100.0%	100.0%	100.0%	16,475	100.0%	100.0%	100.0%
St. Johns County	177,818	100.0%	100.0%	100.0%	65,981	100.0%	100.0%	100.0%
St. Lucie County	295,603	100.0%	100.0%	100.0%	17,903	100.0%	100.0%	100.0%
Sumter County	69,973	96.9%	100.0%	96.9%	55,192	86.4%	100.0%	86.4%
Suwannee County	7,191	93.5%	100.0%	93.5%	36,992	78.9%	100.0%	78.9%
Taylor County	6,913	98.1%	100.0%	98.1%	14,920	50.3%	100.0%	50.3%
Union County	4,880	31.9%	100.0%	31.9%	10,637	59.2%	100.0%	59.2%
Volusia County	480,282	100.0%	100.0%	100.0%	58,407	100.0%	100.0%	100.0%
Wakulla County	12,031	98.9%	100.0%	98.9%	20,089	89.3%	99.2%	89.2%
Walton County	22,598	99.1%	100.0%	99.1%	45,774	63.5%	100.0%	63.5%
Washington County	3,813	100.0%	100.0%	100.0%	20,754	25.0%	100.0%	25.0%
Georgia	**7,870,547**	**97.3%**	**100.0%**	**97.3%**	**2,558,440**	**77.6%**	**99.8%**	**77.5%**

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Appling County	5,260	100.0%	100.0%	100.0%	13,261	27.4%	99.6%	27.4%
Atkinson County	.	.	.	.	8,342	59.2%	100.0%	59.2%
Bacon County	3,426	100.0%	100.0%	100.0%	7,893	51.0%	99.7%	51.0%
Baker County	.	.	.	.	3,200	1.8%	100.0%	1.8%
Baldwin County	28,867	94.5%	100.0%	94.5%	16,039	91.1%	100.0%	91.1%
Banks County	1,141	71.6%	100.0%	71.6%	17,487	69.0%	100.0%	69.0%
Barrow County	54,637	99.2%	100.0%	99.2%	24,423	97.2%	100.0%	97.2%
Bartow County	67,187	99.2%	100.0%	99.2%	37,867	87.0%	100.0%	87.0%
Ben Hill County	11,197	96.4%	100.0%	96.4%	5,799	77.5%	100.0%	77.5%
Berrien County	4,510	98.6%	100.0%	98.6%	14,675	77.0%	100.0%	77.0%
Bibb County	131,399	97.0%	100.0%	97.0%	21,463	96.3%	100.0%	96.3%
Bleckley County	6,163	49.7%	100.0%	49.7%	6,667	37.3%	100.0%	37.3%
Brantley County	103	100.0%	100.0%	100.0%	18,617	99.5%	100.0%	99.5%
Brooks County	4,443	98.9%	100.0%	98.9%	11,144	70.5%	100.0%	70.5%
Bryan County	16,388	94.0%	100.0%	94.0%	20,672	97.4%	100.0%	97.4%
Bulloch County	36,981	96.8%	100.0%	96.8%	39,167	99.6%	100.0%	99.6%
Burke County	5,369	99.0%	100.0%	99.0%	17,153	64.1%	99.9%	64.1%
Butts County	5,254	100.0%	100.0%	100.0%	18,802	71.8%	100.0%	71.8%
Calhoun County	.	.	.	.	6,454	42.0%	100.0%	42.0%
Camden County	34,922	97.0%	100.0%	97.0%	18,122	89.2%	100.0%	89.2%
Candler County	3,484	100.0%	100.0%	100.0%	7,313	100.0%	100.0%	100.0%
Carroll County	67,406	99.7%	100.0%	99.7%	50,405	80.8%	100.0%	80.8%
Catoosa County	47,673	99.7%	100.0%	99.7%	18,877	97.5%	100.0%	97.5%
Charlton County	5,544	64.9%	100.0%	64.9%	7,171	56.0%	99.9%	56.0%
Chatham County	275,929	95.8%	100.0%	95.8%	14,572	91.8%	100.0%	91.8%
Chattahoochee County	5,691	99.6%	100.0%	99.6%	4,652	5.1%	100.0%	5.1%
Chattooga County	10,405	100.0%	100.0%	100.0%	14,365	94.0%	97.8%	92.9%
Cherokee County	201,856	98.5%	100.0%	98.5%	45,709	92.1%	100.0%	92.1%
Clarke County	118,947	99.8%	100.0%	99.8%	8,105	93.2%	100.0%	93.2%
Clay County	.	.	.	.	2,962	62.6%	99.2%	62.6%
Clayton County	282,134	98.4%	100.0%	98.4%	3,007	98.1%	100.0%	98.1%
Clinch County	2,611	81.1%	100.0%	81.1%	4,116	51.6%	100.0%	51.6%
Cobb County	753,757	97.9%	100.0%	97.9%	1,990	95.8%	100.0%	95.8%
Coffee County	14,227	96.1%	100.0%	96.1%	28,785	85.8%	99.9%	85.8%
Colquitt County	18,553	98.3%	100.0%	98.3%	27,279	80.4%	100.0%	80.4%
Columbia County	123,558	99.2%	100.0%	99.2%	27,989	94.1%	100.0%	94.1%

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Cook County	6,823	97.2%	100.0%	97.2%	10,454	74.6%	100.0%	74.6%
Coweta County	93,725	96.8%	100.0%	96.8%	49,382	93.4%	100.0%	93.4%
Crawford County	.	.	.	.	12,295	92.8%	100.0%	92.8%
Crisp County	11,937	99.3%	100.0%	99.3%	10,799	62.1%	100.0%	62.1%
Dade County	4,528	99.8%	100.0%	99.8%	11,757	87.4%	100.0%	87.4%
Dawson County	4,623	89.5%	100.0%	89.5%	19,756	77.3%	100.0%	77.3%
DeKalb County	751,006	98.6%	100.0%	98.6%	2,203	98.0%	100.0%	98.0%
Decatur County	11,607	98.6%	100.0%	98.6%	15,109	43.8%	100.0%	43.8%
Dodge County	5,687	98.4%	100.0%	98.4%	15,041	50.8%	100.0%	50.8%
Dooly County	6,062	96.8%	100.0%	96.8%	7,675	41.3%	99.9%	41.3%
Dougherty County	76,703	97.1%	100.0%	97.1%	12,799	97.0%	100.0%	97.0%
Douglas County	120,546	97.4%	100.0%	97.4%	23,330	96.7%	100.0%	96.7%
Early County	3,462	52.1%	100.0%	52.1%	6,834	31.3%	99.9%	31.2%
Echols County	.	.	.	.	3,936	0.0%	100.0%	0.0%
Effingham County	19,001	98.7%	100.0%	98.7%	40,981	91.3%	100.0%	91.3%
Elbert County	5,654	99.9%	100.0%	99.9%	13,455	53.5%	98.9%	53.5%
Emanuel County	7,359	100.0%	100.0%	100.0%	15,171	91.2%	99.6%	90.8%
Evans County	4,023	94.6%	100.0%	94.6%	6,752	39.7%	100.0%	39.7%
Fannin County	.	.	.	.	25,322	82.9%	97.6%	81.2%
Fayette County	91,945	98.5%	100.0%	98.5%	20,602	96.6%	100.0%	96.6%
Floyd County	61,498	96.6%	100.0%	96.6%	36,111	90.1%	99.9%	90.1%
Forsyth County	203,752	99.1%	100.0%	99.1%	24,200	98.3%	100.0%	98.3%
Franklin County	2,497	88.6%	100.0%	88.6%	20,320	56.4%	100.0%	56.4%
Fulton County	1,027,415	96.7%	100.0%	96.7%	13,933	77.2%	100.0%	77.2%
Gilmer County	3,669	81.6%	100.0%	81.6%	27,002	81.5%	97.9%	79.6%
Glascock County	.	.	.	.	3,062	1.0%	97.7%	1.0%
Glynn County	66,827	97.2%	100.0%	97.2%	18,455	93.2%	100.0%	93.2%
Gordon County	27,522	97.7%	100.0%	97.7%	29,567	81.0%	100.0%	81.0%
Grady County	9,209	98.6%	100.0%	98.6%	15,610	70.1%	100.0%	70.1%
Greene County	2,865	99.7%	100.0%	99.7%	14,416	60.5%	99.6%	60.3%
Gwinnett County	914,928	99.0%	100.0%	99.0%	5,323	95.8%	100.0%	95.8%
Habersham County	18,151	59.3%	100.0%	59.3%	26,415	79.4%	100.0%	79.4%
Hall County	156,572	99.5%	100.0%	99.5%	42,754	91.6%	100.0%	91.6%
Hancock County	2,863	7.9%	100.0%	7.9%	5,698	8.3%	98.9%	8.3%
Haralson County	6,489	100.0%	100.0%	100.0%	22,766	100.0%	99.9%	99.9%
Harris County	1,101	99.8%	100.0%	99.8%	32,812	88.4%	100.0%	88.4%

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Hart County	6,454	78.1%	100.0%	78.1%	19,339	64.5%	100.0%	64.5%
Heard County	.	.	.	.	11,730	58.0%	98.8%	58.0%
Henry County	193,323	99.8%	100.0%	99.8%	32,474	97.7%	100.0%	97.7%
Houston County	134,768	97.5%	100.0%	97.5%	18,709	98.7%	100.0%	98.7%
Irwin County	3,014	96.1%	100.0%	96.1%	6,395	38.6%	100.0%	38.6%
Jackson County	26,436	76.6%	100.0%	76.6%	41,070	82.6%	100.0%	82.6%
Jasper County	2,514	84.8%	100.0%	84.8%	11,450	55.2%	99.9%	55.2%
Jeff Davis County	4,565	90.4%	100.0%	90.4%	10,457	57.9%	100.0%	57.9%
Jefferson County	2,908	0.0%	100.0%	0.0%	12,740	10.9%	100.0%	10.9%
Jenkins County	2,711	98.1%	100.0%	98.1%	6,056	35.1%	99.1%	35.1%
Johnson County	3,304	0.0%	100.0%	0.0%	6,483	45.3%	98.2%	43.5%
Jones County	9,053	97.0%	100.0%	97.0%	19,417	77.7%	99.0%	76.8%
Lamar County	7,144	97.3%	100.0%	97.3%	11,455	53.5%	100.0%	53.5%
Lanier County	2,984	94.8%	100.0%	94.8%	7,441	77.7%	100.0%	77.7%
Laurens County	20,329	98.7%	100.0%	98.7%	27,001	31.1%	99.9%	31.1%
Lee County	18,405	98.0%	100.0%	98.0%	11,063	81.4%	100.0%	81.4%
Liberty County	44,511	96.8%	100.0%	96.8%	16,875	86.3%	100.0%	86.3%
Lincoln County	.	.	.	.	7,880	100.0%	95.6%	95.6%
Long County	3,029	92.4%	100.0%	92.4%	15,976	80.4%	100.0%	80.4%
Lowndes County	82,819	93.1%	100.0%	93.1%	32,666	77.2%	100.0%	77.2%
Lumpkin County	5,033	55.2%	100.0%	55.2%	27,832	72.9%	99.8%	72.8%
Macon County	5,820	63.5%	100.0%	63.5%	7,494	62.4%	100.0%	62.4%
Madison County	2,331	99.4%	100.0%	99.4%	26,969	80.3%	100.0%	80.3%
Marion County	.	.	.	.	8,450	64.4%	94.8%	61.0%
McDuffie County	8,436	99.3%	100.0%	99.3%	13,062	75.1%	100.0%	75.1%
McIntosh County	3,670	99.7%	100.0%	99.7%	10,436	96.5%	100.0%	96.5%
Meriwether County	3,578	99.9%	100.0%	99.9%	17,471	40.9%	100.0%	40.9%
Miller County	.	.	.	.	5,838	11.9%	100.0%	11.9%
Mitchell County	9,766	83.9%	100.0%	83.9%	12,526	45.4%	100.0%	45.4%
Monroe County	5,286	71.8%	100.0%	71.8%	21,827	35.9%	100.0%	35.9%
Montgomery County	118	0.0%	100.0%	0.0%	8,913	32.9%	100.0%	32.9%
Morgan County	4,087	99.8%	100.0%	99.8%	14,322	26.4%	100.0%	26.4%
Murray County	11,905	99.8%	100.0%	99.8%	27,874	97.1%	99.9%	97.0%
Muscogee County	187,504	98.8%	100.0%	98.8%	6,554	93.2%	100.0%	93.2%
Newton County	73,735	99.9%	100.0%	99.9%	34,340	89.9%	100.0%	89.9%
Oconee County	18,530	99.8%	100.0%	99.8%	19,495	83.1%	100.0%	83.1%

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Oglethorpe County	113	97.3%	100.0%	97.3%	14,764	68.9%	99.6%	68.7%
Paulding County	126,212	99.2%	100.0%	99.2%	33,226	97.3%	100.0%	97.3%
Peach County	16,363	93.3%	100.0%	93.3%	10,733	68.3%	100.0%	68.3%
Pickens County	8,334	96.3%	100.0%	96.3%	23,251	86.0%	100.0%	86.0%
Pierce County	3,961	100.0%	100.0%	100.0%	15,346	66.2%	99.9%	66.2%
Pike County	191	100.0%	100.0%	100.0%	18,021	28.8%	100.0%	28.8%
Polk County	20,258	99.8%	100.0%	99.8%	21,827	94.2%	100.0%	94.2%
Pulaski County	3,954	100.0%	100.0%	100.0%	7,247	57.0%	100.0%	57.0%
Putnam County	4,124	100.0%	100.0%	100.0%	17,606	85.0%	100.0%	85.0%
Quitman County	638	100.0%	100.0%	100.0%	1,720	49.4%	99.3%	49.1%
Rabun County	3,367	95.9%	100.0%	95.9%	13,234	85.4%	100.0%	85.4%
Randolph County	3,214	98.3%	100.0%	98.3%	3,861	64.0%	99.0%	64.0%
Richmond County	182,904	95.9%	100.0%	95.9%	18,895	96.8%	100.0%	96.8%
Rockdale County	76,564	98.1%	100.0%	98.1%	13,745	99.4%	100.0%	99.4%
Schley County	.	.	.	.	5,213	76.2%	100.0%	76.2%
Screven County	2,897	92.8%	100.0%	92.8%	11,056	100.0%	100.0%	100.0%
Seminole County	2,578	92.7%	100.0%	92.7%	5,714	66.7%	100.0%	66.7%
Spalding County	37,945	98.0%	100.0%	98.0%	27,433	92.6%	100.0%	92.6%
Stephens County	10,573	94.5%	100.0%	94.5%	15,317	86.5%	100.0%	86.5%
Stewart County	.	.	.	.	5,984	56.2%	98.5%	56.2%
Sumter County	16,785	96.5%	100.0%	96.5%	13,062	42.9%	100.0%	42.9%
Talbot County	377	97.3%	100.0%	97.3%	5,872	82.3%	100.0%	82.3%
Taliaferro County	.	.	.	.	1,628	91.1%	98.9%	90.0%
Tattnall County	7,921	70.6%	100.0%	70.6%	17,413	70.9%	100.0%	70.9%
Taylor County	.	.	.	.	8,142	85.9%	99.6%	85.6%
Telfair County	8,086	86.4%	100.0%	86.4%	7,903	56.0%	100.0%	56.0%
Terrell County	4,241	96.4%	100.0%	96.4%	4,488	53.9%	99.7%	53.9%
Thomas County	23,938	98.9%	100.0%	98.9%	20,841	75.9%	100.0%	75.9%
Tift County	23,505	95.3%	100.0%	95.3%	17,093	74.2%	100.0%	74.2%
Toombs County	13,190	58.7%	100.0%	58.7%	13,809	30.3%	100.0%	30.3%
Towns County	.	.	.	.	11,505	92.7%	99.7%	92.4%
Treutlen County	2,616	19.8%	100.0%	19.8%	4,124	8.3%	100.0%	8.3%
Troup County	38,604	99.9%	100.0%	99.9%	31,182	81.4%	100.0%	81.4%
Turner County	3,719	99.3%	100.0%	99.3%	4,242	49.2%	100.0%	49.2%
Twiggs County	.	.	.	.	8,174	37.3%	99.9%	37.3%
Union County	.	.	.	.	23,459	92.1%	99.6%	91.9%

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Upson County	13,444	100.0%	100.0%	100.0%	12,691	84.4%	100.0%	84.4%
Walker County	38,350	99.0%	100.0%	99.0%	30,587	91.0%	99.6%	90.6%
Walton County	51,712	89.2%	100.0%	89.2%	39,885	89.8%	100.0%	89.8%
Ware County	25,321	93.1%	100.0%	93.1%	10,550	57.2%	99.8%	57.2%
Warren County	.	.	.	.	5,303	0.1%	99.7%	0.1%
Washington County	6,893	100.0%	100.0%	100.0%	13,420	50.3%	98.6%	49.9%
Wayne County	12,290	82.7%	100.0%	82.7%	17,527	76.9%	100.0%	76.9%
Webster County	.	.	.	.	2,605	43.4%	99.3%	43.4%
Wheeler County	.	.	.	.	7,952	43.3%	100.0%	43.3%
White County	4,588	85.9%	100.0%	85.9%	24,863	82.2%	99.9%	82.2%
Whitfield County	74,138	100.0%	100.0%	100.0%	30,520	100.0%	100.0%	100.0%
Wilcox County	.	.	.	.	8,800	60.1%	99.8%	60.1%
Wilkes County	3,130	100.0%	100.0%	100.0%	6,762	100.0%	98.9%	98.9%
Wilkinson County	.	.	.	.	8,959	54.9%	100.0%	54.9%
Worth County	6,368	96.9%	100.0%	96.9%	14,165	57.8%	99.9%	57.7%
Hawaii	**1,295,612**	**98.6%**	**100.0%**	**98.6%**	**131,926**	**71.5%**	**99.2%**	**71.2%**
Hawaii County	119,205	95.4%	100.0%	95.4%	81,176	74.4%	99.5%	74.0%
Honolulu County	977,538	99.1%	100.0%	99.1%	11,112	78.5%	100.0%	78.5%
Kalawao County	.	.	.	.	88	5.7%	87.5%	5.7%
Kauai County	61,310	96.4%	100.0%	96.4%	10,849	62.2%	98.7%	62.2%
Maui County	137,559	99.3%	100.0%	99.3%	28,701	64.4%	98.2%	63.9%
Idaho	**1,186,061**	**97.3%**	**100.0%**	**97.3%**	**530,731**	**58.6%**	**97.6%**	**57.9%**
Ada County	422,533	99.3%	100.0%	99.3%	34,279	67.8%	99.9%	67.8%
Adams County	.	.	.	.	4,145	34.5%	96.2%	34.5%
Bannock County	70,533	97.0%	100.0%	97.0%	14,732	56.8%	99.7%	56.8%
Bear Lake County	.	.	.	.	6,028	80.9%	97.3%	80.7%
Benewah County	2,541	0.0%	100.0%	0.0%	6,643	37.7%	78.9%	36.5%
Bingham County	19,518	98.6%	100.0%	98.6%	26,403	57.5%	99.8%	57.5%
Blaine County	14,513	91.3%	100.0%	91.3%	7,511	63.6%	94.4%	59.2%
Boise County	.	.	.	.	7,290	29.3%	71.3%	22.7%
Bonner County	11,424	100.0%	100.0%	100.0%	32,133	98.6%	99.5%	98.1%
Bonneville County	94,885	98.4%	100.0%	98.4%	19,693	50.9%	97.4%	49.2%
Boundary County	2,744	100.0%	100.0%	100.0%	9,178	93.0%	93.4%	87.7%
Butte County	.	.	.	.	2,599	46.8%	98.0%	46.0%
Camas County	.	.	.	.	1,102	0.0%	98.6%	0.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Canyon County	164,780	97.5%	100.0%	97.5%	51,888	69.9%	100.0%	69.9%
Caribou County	2,604	99.8%	100.0%	99.8%	4,430	51.6%	96.5%	49.9%
Cassia County	11,186	98.7%	100.0%	98.7%	12,476	55.3%	99.8%	55.3%
Clark County	.	.	.	.	873	93.0%	98.5%	93.0%
Clearwater County	3,526	0.0%	100.0%	0.0%	5,020	0.0%	84.6%	0.0%
Custer County	.	.	.	.	4,172	59.4%	86.9%	50.1%
Elmore County	18,616	91.5%	100.0%	91.5%	8,206	46.1%	98.7%	46.1%
Franklin County	4,375	96.6%	100.0%	96.6%	9,188	38.2%	97.7%	37.3%
Fremont County	3,594	94.0%	100.0%	94.0%	9,499	24.9%	99.9%	24.9%
Gem County	9,273	98.8%	100.0%	98.8%	8,104	65.4%	99.8%	65.4%
Gooding County	6,309	97.5%	100.0%	97.5%	8,815	24.0%	100.0%	24.0%
Idaho County	3,172	0.0%	100.0%	0.0%	13,197	1.1%	92.5%	1.1%
Jefferson County	8,970	95.6%	100.0%	95.6%	19,460	50.3%	100.0%	50.3%
Jerome County	11,019	97.9%	100.0%	97.9%	12,600	35.0%	100.0%	35.0%
Kootenai County	113,941	100.0%	100.0%	100.0%	43,691	96.6%	99.0%	96.2%
Latah County	24,287	100.0%	100.0%	100.0%	15,046	47.1%	88.5%	41.4%
Lemhi County	2,552	65.1%	100.0%	65.1%	5,323	20.6%	90.8%	20.3%
Lewis County	.	.	.	.	3,887	21.5%	99.8%	21.5%
Lincoln County	.	.	.	.	5,317	32.6%	100.0%	32.6%
Madison County	26,973	94.5%	100.0%	94.5%	12,167	47.2%	100.0%	47.2%
Minidoka County	11,245	95.5%	100.0%	95.5%	9,484	25.4%	100.0%	25.4%
Nez Perce County	32,192	99.5%	100.0%	99.5%	8,191	24.8%	93.6%	23.8%
Oneida County	.	.	.	.	4,427	81.6%	99.7%	81.3%
Owyhee County	2,579	98.5%	100.0%	98.5%	9,049	31.9%	98.7%	31.9%
Payette County	12,972	97.9%	100.0%	97.9%	10,240	73.6%	100.0%	73.6%
Power County	4,325	97.5%	100.0%	97.5%	3,275	59.2%	100.0%	59.2%
Shoshone County	5,504	53.8%	100.0%	53.8%	7,038	60.5%	92.0%	58.8%
Teton County	.	.	.	.	11,381	84.7%	100.0%	84.7%
Twin Falls County	58,038	97.6%	100.0%	97.6%	27,081	51.8%	99.7%	51.8%
Valley County	.	.	.	.	10,687	71.0%	99.4%	71.0%
Washington County	5,338	98.8%	100.0%	98.8%	4,783	44.9%	99.8%	44.8%
Illinois	**11,328,965**	**99.0%**	**100.0%**	**99.0%**	**1,472,873**	**61.1%**	**99.9%**	**61.1%**
Adams County	44,503	99.7%	100.0%	99.7%	21,731	64.8%	99.9%	64.8%
Alexander County	2,535	0.6%	100.0%	0.6%	3,780	0.0%	99.1%	0.0%
Bond County	6,193	96.5%	100.0%	96.5%	10,753	11.3%	100.0%	11.3%
Boone County	43,022	99.7%	100.0%	99.7%	10,491	82.5%	100.0%	82.5%

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Brown County	3,943	48.9%	100.0%	48.9%	2,773	43.9%	99.1%	43.7%
Bureau County	13,663	98.0%	100.0%	98.0%	19,580	48.7%	100.0%	48.7%
Calhoun County	.	.	.	.	4,833	0.6%	95.6%	0.6%
Carroll County	2,469	98.9%	100.0%	98.9%	12,049	69.9%	100.0%	69.9%
Cass County	6,198	96.1%	100.0%	96.1%	6,307	60.6%	99.9%	60.6%
Champaign County	180,377	98.4%	100.0%	98.4%	29,012	52.5%	100.0%	52.5%
Christian County	18,177	98.9%	100.0%	98.9%	14,925	68.7%	100.0%	68.7%
Clark County	6,289	97.9%	100.0%	97.9%	9,478	52.6%	99.9%	52.6%
Clay County	4,524	100.0%	100.0%	100.0%	8,745	78.9%	100.0%	78.9%
Clinton County	19,139	99.9%	100.0%	99.9%	18,475	43.0%	100.0%	43.0%
Coles County	38,953	94.2%	100.0%	94.2%	13,026	52.3%	100.0%	52.3%
Cook County	5,208,741	99.3%	100.0%	99.3%	2,502	95.9%	100.0%	95.9%
Crawford County	7,227	99.3%	100.0%	99.3%	11,734	46.4%	100.0%	46.4%
Cumberland County	.	.	.	.	10,907	44.0%	100.0%	44.0%
De Witt County	8,024	95.6%	100.0%	95.6%	7,918	49.4%	100.0%	49.4%
DeKalb County	83,000	99.7%	100.0%	99.7%	21,731	86.9%	100.0%	86.9%
Douglas County	7,486	97.0%	100.0%	97.0%	12,261	61.0%	100.0%	61.0%
DuPage County	929,591	99.6%	100.0%	99.6%	534	66.9%	100.0%	66.9%
Edgar County	8,312	98.7%	100.0%	98.7%	9,016	78.7%	100.0%	78.7%
Edwards County	.	.	.	.	6,486	67.4%	100.0%	67.4%
Effingham County	13,592	98.8%	100.0%	98.8%	20,540	45.2%	100.0%	45.2%
Fayette County	6,913	80.8%	100.0%	80.8%	14,871	36.7%	100.0%	36.7%
Ford County	7,436	98.8%	100.0%	98.8%	5,844	20.8%	100.0%	20.8%
Franklin County	19,788	95.9%	100.0%	95.9%	19,251	59.3%	100.0%	59.3%
Fulton County	13,096	89.3%	100.0%	89.3%	22,014	53.7%	100.0%	53.7%
Gallatin County	.	.	.	.	5,080	67.1%	100.0%	67.1%
Greene County	3,762	97.7%	100.0%	97.7%	9,411	35.8%	99.7%	35.8%
Grundy County	38,148	100.0%	100.0%	100.0%	12,429	100.0%	100.0%	100.0%
Hamilton County	2,439	99.3%	100.0%	99.3%	5,750	43.5%	100.0%	43.5%
Hancock County	4,886	95.0%	100.0%	95.0%	13,134	64.6%	100.0%	64.6%
Hardin County	.	.	.	.	4,046	100.0%	97.3%	97.3%
Henderson County	26	0.0%	100.0%	0.0%	6,769	40.9%	99.6%	40.6%
Henry County	24,506	98.9%	100.0%	98.9%	24,822	74.3%	100.0%	74.3%
Iroquois County	7,747	61.5%	100.0%	61.5%	20,129	40.4%	100.0%	40.4%
Jackson County	35,481	90.9%	100.0%	90.9%	22,803	90.8%	99.7%	90.8%

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Jasper County	2,468	98.3%	100.0%	98.3%	7,110	7.1%	100.0%	7.1%
Jefferson County	15,355	100.0%	100.0%	100.0%	22,824	30.6%	100.0%	30.6%
Jersey County	8,912	98.9%	100.0%	98.9%	13,029	21.8%	98.1%	21.8%
Jo Daviess County	5,734	98.6%	100.0%	98.6%	15,860	65.1%	100.0%	65.1%
Johnson County	.	.	.	.	12,900	13.3%	99.9%	13.2%
Kane County	514,055	99.1%	100.0%	99.1%	20,588	91.1%	100.0%	91.1%
Kankakee County	81,802	98.9%	100.0%	98.9%	27,803	83.2%	100.0%	83.2%
Kendall County	109,575	99.5%	100.0%	99.5%	16,629	93.9%	100.0%	93.9%
Knox County	37,738	99.7%	100.0%	99.7%	12,900	59.0%	100.0%	59.0%
LaSalle County	77,163	99.8%	100.0%	99.8%	32,904	90.8%	100.0%	90.8%
Lake County	694,437	100.0%	100.0%	100.0%	9,077	99.3%	100.0%	99.3%
Lawrence County	6,711	94.4%	100.0%	94.4%	9,457	27.4%	100.0%	27.4%
Lee County	15,526	88.6%	100.0%	88.6%	18,878	45.6%	100.0%	45.6%
Livingston County	20,638	98.0%	100.0%	98.0%	15,880	60.5%	100.0%	60.5%
Logan County	17,158	97.2%	100.0%	97.2%	12,087	51.7%	100.0%	51.7%
Macon County	88,902	99.5%	100.0%	99.5%	16,899	52.8%	100.0%	52.8%
Macoupin County	18,789	98.4%	100.0%	98.4%	26,657	54.5%	100.0%	54.5%
Madison County	229,530	99.9%	100.0%	99.9%	35,898	83.7%	100.0%	83.7%
Marion County	20,267	99.9%	100.0%	99.9%	17,635	45.1%	100.0%	45.1%
Marshall County	.	.	.	.	11,730	66.1%	100.0%	66.1%
Mason County	2,996	99.4%	100.0%	99.4%	10,718	55.1%	100.0%	55.1%
Massac County	7,146	96.8%	100.0%	96.8%	7,198	24.9%	100.0%	24.9%
McDonough County	21,180	98.7%	100.0%	98.7%	9,643	89.6%	99.9%	89.5%
McHenry County	277,920	100.0%	100.0%	100.0%	31,170	98.4%	100.0%	98.4%
McLean County	141,673	96.3%	100.0%	96.3%	30,617	56.6%	100.0%	56.6%
Menard County	2,927	96.1%	100.0%	96.1%	9,318	40.2%	100.0%	40.2%
Mercer County	3,540	99.7%	100.0%	99.7%	12,078	48.2%	100.0%	48.2%
Monroe County	19,769	100.0%	100.0%	100.0%	14,328	80.8%	99.6%	80.4%
Montgomery County	16,574	91.6%	100.0%	91.6%	12,216	38.5%	99.9%	38.5%
Morgan County	20,848	96.7%	100.0%	96.7%	12,950	24.1%	100.0%	24.1%
Moultrie County	4,460	98.6%	100.0%	98.6%	10,228	56.0%	100.0%	56.0%
Ogle County	26,413	97.6%	100.0%	97.6%	24,650	55.8%	100.0%	55.8%
Peoria County	155,060	99.0%	100.0%	99.0%	27,951	69.0%	100.0%	69.0%
Perry County	11,945	98.4%	100.0%	98.4%	9,340	62.1%	100.0%	62.1%
Piatt County	5,191	98.1%	100.0%	98.1%	11,254	61.3%	100.0%	61.3%
Pike County	4,121	99.3%	100.0%	99.3%	11,700	28.7%	100.0%	28.7%

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Pope County	.	.	.	.	4,325	77.4%	100.0%	77.4%
Pulaski County	.	.	.	.	5,509	28.8%	100.0%	28.8%
Putnam County	.	.	.	.	5,726	54.8%	100.0%	54.8%
Randolph County	18,101	97.9%	100.0%	97.9%	14,322	69.3%	100.0%	69.3%
Richland County	8,873	99.5%	100.0%	99.5%	7,028	45.3%	100.0%	45.3%
Rock Island County	128,621	98.6%	100.0%	98.6%	16,186	81.0%	100.0%	81.0%
Saline County	13,465	96.9%	100.0%	96.9%	10,637	46.9%	100.0%	46.9%
Sangamon County	168,116	94.8%	100.0%	94.8%	28,336	65.7%	100.0%	65.7%
Schuyler County	3,031	99.7%	100.0%	99.7%	4,003	19.7%	98.5%	18.9%
Scott County	.	.	.	.	5,002	50.4%	100.0%	50.4%
Shelby County	4,631	97.8%	100.0%	97.8%	17,088	36.9%	100.0%	36.9%
St. Clair County	236,128	99.8%	100.0%	99.8%	26,351	88.3%	100.0%	88.3%
Stark County	.	.	.	.	5,434	58.0%	100.0%	58.0%
Stephenson County	26,204	99.2%	100.0%	99.2%	18,850	56.8%	100.0%	56.8%
Tazewell County	105,576	97.6%	100.0%	97.6%	27,950	73.3%	100.0%	73.3%
Union County	5,630	93.2%	100.0%	93.2%	11,370	36.7%	100.0%	36.7%
Vermilion County	52,539	96.9%	100.0%	96.9%	25,370	68.2%	100.0%	68.2%
Wabash County	6,864	98.1%	100.0%	98.1%	4,625	18.3%	100.0%	18.3%
Warren County	8,912	98.9%	100.0%	98.9%	8,255	37.8%	100.0%	37.8%
Washington County	3,510	84.3%	100.0%	84.3%	10,520	34.7%	100.0%	34.7%
Wayne County	4,875	99.6%	100.0%	99.6%	11,620	71.5%	100.0%	71.5%
White County	5,072	98.0%	100.0%	98.0%	8,866	50.8%	100.0%	50.8%
Whiteside County	35,084	97.3%	100.0%	97.3%	21,034	58.8%	100.0%	58.8%
Will County	664,141	99.8%	100.0%	99.8%	28,473	96.5%	100.0%	96.5%
Williamson County	43,708	96.9%	100.0%	96.9%	23,620	60.6%	100.0%	60.6%
Winnebago County	261,990	99.1%	100.0%	99.1%	22,788	66.1%	100.0%	66.1%
Woodford County	17,185	97.7%	100.0%	97.7%	21,541	72.1%	100.0%	72.1%
Indiana	**4,825,643**	**98.5%**	**100.0%**	**98.5%**	**1,840,835**	**67.4%**	**100.0%**	**67.4%**
Adams County	16,263	99.9%	100.0%	99.9%	19,222	87.8%	100.0%	87.8%
Allen County	327,376	99.3%	100.0%	99.3%	45,479	71.7%	100.0%	71.7%
Bartholomew County	53,233	97.3%	100.0%	97.3%	28,803	71.8%	100.0%	71.8%
Benton County	.	.	.	.	8,613	17.4%	100.0%	17.4%
Blackford County	5,607	99.1%	100.0%	99.1%	6,369	69.6%	100.0%	69.6%
Boone County	40,450	99.7%	100.0%	99.7%	25,415	48.5%	100.0%	48.5%
Brown County	.	.	.	.	15,035	74.7%	100.0%	74.7%

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Carroll County	3,722	99.7%	100.0%	99.7%	16,317	54.1%	100.0%	54.1%
Cass County	20,750	98.9%	100.0%	98.9%	17,243	65.5%	100.0%	65.5%
Clark County	91,105	100.0%	100.0%	100.0%	25,860	76.6%	100.0%	76.6%
Clay County	10,080	98.9%	100.0%	98.9%	16,118	61.5%	100.0%	61.5%
Clinton County	16,012	98.3%	100.0%	98.3%	16,305	42.0%	100.0%	42.0%
Crawford County	.	.	.	.	10,566	0.1%	99.5%	0.1%
Daviess County	12,890	98.8%	100.0%	98.8%	20,223	41.0%	100.0%	41.0%
DeKalb County	24,594	97.5%	100.0%	97.5%	18,238	58.0%	100.0%	58.0%
Dearborn County	23,137	97.8%	100.0%	97.8%	26,604	87.7%	99.9%	87.7%
Decatur County	12,110	99.2%	100.0%	99.2%	14,622	32.2%	100.0%	32.2%
Delaware County	88,291	98.5%	100.0%	98.5%	26,893	71.1%	100.0%	71.1%
Dubois County	21,352	99.4%	100.0%	99.4%	21,206	39.2%	100.0%	39.2%
Elkhart County	162,415	95.7%	100.0%	95.7%	42,609	90.6%	100.0%	90.6%
Fayette County	14,466	98.7%	100.0%	98.7%	8,743	40.0%	100.0%	40.0%
Floyd County	61,279	100.0%	100.0%	100.0%	15,791	89.1%	100.0%	89.1%
Fountain County	5,377	99.3%	100.0%	99.3%	11,128	62.9%	100.0%	62.9%
Franklin County	2,479	64.3%	100.0%	64.3%	20,140	34.1%	100.0%	34.1%
Fulton County	6,611	100.0%	100.0%	100.0%	13,448	100.0%	100.0%	100.0%
Gibson County	15,487	99.5%	100.0%	99.5%	18,089	47.2%	100.0%	47.2%
Grant County	46,357	96.0%	100.0%	96.0%	20,134	47.9%	100.0%	47.9%
Greene County	8,191	99.5%	100.0%	99.5%	23,986	71.9%	100.0%	71.9%
Hamilton County	299,722	98.8%	100.0%	98.8%	23,955	55.2%	100.0%	55.2%
Hancock County	51,705	99.6%	100.0%	99.6%	23,250	97.5%	100.0%	97.5%
Harrison County	5,615	99.2%	100.0%	99.2%	34,283	76.5%	100.0%	76.5%
Hendricks County	132,414	97.3%	100.0%	97.3%	31,238	82.5%	100.0%	82.5%
Henry County	27,327	99.9%	100.0%	99.9%	21,149	82.0%	100.0%	82.0%
Howard County	64,531	97.6%	100.0%	97.6%	17,832	69.2%	100.0%	69.2%
Huntington County	17,662	100.0%	100.0%	100.0%	18,675	57.1%	100.0%	57.1%
Jackson County	24,359	99.7%	100.0%	99.7%	19,525	48.0%	100.0%	48.0%
Jasper County	10,660	99.6%	100.0%	99.6%	22,784	73.0%	100.0%	73.0%
Jay County	9,059	99.9%	100.0%	99.9%	11,886	68.6%	100.0%	68.6%
Jefferson County	17,351	99.9%	100.0%	99.9%	14,738	31.4%	100.0%	31.4%
Jennings County	10,582	99.6%	100.0%	99.6%	17,044	44.0%	100.0%	44.0%
Johnson County	128,646	99.0%	100.0%	99.0%	25,238	74.6%	100.0%	74.6%
Knox County	23,539	99.9%	100.0%	99.9%	13,969	62.8%	100.0%	62.8%
Kosciusko County	42,046	99.5%	100.0%	99.5%	37,160	97.1%	100.0%	97.1%

State, County or County Equivalent	Urban Areas				Rural Areas			
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LaGrange County	3,272	93.1%	100.0%	93.1%	36,029	44.9%	100.0%	44.9%
LaPorte County	70,079	99.7%	100.0%	99.7%	39,950	99.6%	100.0%	99.6%
Lake County	465,561	99.6%	100.0%	99.6%	20,079	99.6%	100.0%	99.6%
Lawrence County	19,108	99.7%	100.0%	99.7%	26,558	63.8%	100.0%	63.8%
Madison County	98,924	96.6%	100.0%	96.6%	30,574	63.6%	100.0%	63.6%
Marion County	944,071	98.3%	100.0%	98.3%	5,958	97.5%	100.0%	97.5%
Marshall County	16,917	100.0%	100.0%	100.0%	29,581	100.0%	100.0%	100.0%
Martin County	2,670	99.7%	100.0%	99.7%	7,545	45.2%	100.0%	45.2%
Miami County	18,997	83.0%	100.0%	83.0%	16,848	61.4%	100.0%	61.4%
Monroe County	114,531	93.2%	100.0%	93.2%	32,451	96.8%	100.0%	96.8%
Montgomery County	17,919	98.8%	100.0%	98.8%	20,601	29.5%	100.0%	29.5%
Morgan County	35,442	98.8%	100.0%	98.8%	34,269	76.3%	100.0%	76.3%
Newton County	.	.	.	.	14,125	87.2%	100.0%	87.2%
Noble County	15,010	99.5%	100.0%	99.5%	32,442	58.5%	100.0%	58.5%
Ohio County	.	.	.	.	5,828	65.8%	99.5%	65.8%
Orange County	3,009	99.9%	100.0%	99.9%	16,417	75.9%	99.9%	75.9%
Owen County	.	.	.	.	20,838	78.1%	100.0%	78.1%
Parke County	4,078	98.8%	100.0%	98.8%	12,807	63.8%	99.8%	63.8%
Perry County	8,657	99.1%	100.0%	99.1%	10,424	80.0%	99.9%	79.9%
Pike County	.	.	.	.	12,365	57.8%	100.0%	57.8%
Porter County	133,286	99.3%	100.0%	99.3%	35,116	99.2%	100.0%	99.2%
Posey County	8,452	90.5%	100.0%	90.5%	17,141	56.5%	100.0%	56.5%
Pulaski County	2,211	100.0%	100.0%	100.0%	10,323	72.9%	100.0%	72.9%
Putnam County	13,080	98.8%	100.0%	98.8%	24,619	59.8%	100.0%	59.8%
Randolph County	9,044	99.5%	100.0%	99.5%	15,878	47.4%	100.0%	47.4%
Ripley County	4,552	86.4%	100.0%	86.4%	23,890	48.1%	100.0%	48.1%
Rush County	6,245	99.8%	100.0%	99.8%	10,400	24.8%	100.0%	24.8%
Scott County	11,076	100.0%	100.0%	100.0%	12,791	59.7%	100.0%	59.7%
Shelby County	21,088	97.1%	100.0%	97.1%	23,307	54.9%	100.0%	54.9%
Spencer County	.	.	.	.	20,394	48.8%	100.0%	48.8%
St. Joseph County	245,915	100.0%	100.0%	100.0%	24,519	100.0%	100.0%	100.0%
Starke County	3,946	100.0%	100.0%	100.0%	18,947	95.4%	100.0%	95.4%
Steuben County	11,126	97.5%	100.0%	97.5%	23,351	63.0%	100.0%	63.0%
Sullivan County	4,298	100.0%	100.0%	100.0%	16,448	44.5%	100.0%	44.5%
Switzerland County	.	.	.	.	10,694	38.2%	100.0%	38.2%

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Tippecanoe County	159,588	95.4%	100.0%	95.4%	30,977	59.1%	100.0%	59.1%
Tipton County	5,449	98.4%	100.0%	98.4%	9,679	68.2%	100.0%	68.2%
Union County	.	.	.	.	7,200	48.1%	100.0%	48.1%
Vanderburgh County	164,793	100.0%	100.0%	100.0%	16,822	84.3%	100.0%	84.3%
Vermillion County	6,063	98.9%	100.0%	98.9%	9,442	93.6%	100.0%	93.6%
Vigo County	81,307	100.0%	100.0%	100.0%	26,209	75.1%	100.0%	75.1%
Wabash County	15,043	100.0%	100.0%	100.0%	16,400	42.6%	100.0%	42.6%
Warren County	1,724	93.4%	100.0%	93.4%	6,477	15.2%	100.0%	15.2%
Warrick County	43,531	99.9%	100.0%	99.9%	18,999	42.1%	100.0%	42.1%
Washington County	6,313	100.0%	100.0%	100.0%	21,514	87.5%	100.0%	87.5%
Wayne County	43,408	99.2%	100.0%	99.2%	22,777	59.9%	100.0%	59.9%
Wells County	13,796	97.9%	100.0%	97.9%	14,185	46.2%	100.0%	46.2%
White County	7,557	97.4%	100.0%	97.4%	16,624	78.7%	100.0%	78.7%
Whitley County	9,655	97.9%	100.0%	97.9%	24,098	59.9%	100.0%	59.9%
Iowa	**2,009,343**	**98.1%**	**100.0%**	**98.1%**	**1,136,155**	**77.5%**	**99.6%**	**77.3%**
Adair County	.	.	.	.	7,054	79.3%	100.0%	79.3%
Adams County	.	.	.	.	3,686	61.2%	100.0%	61.2%
Allamakee County	3,463	100.0%	100.0%	100.0%	10,419	69.4%	95.7%	68.2%
Appanoose County	4,930	99.7%	100.0%	99.7%	7,422	59.4%	95.4%	57.6%
Audubon County	.	.	.	.	5,578	72.9%	100.0%	72.9%
Benton County	4,796	98.0%	100.0%	98.0%	20,846	74.9%	100.0%	74.9%
Black Hawk County	114,197	99.9%	100.0%	99.9%	18,451	96.1%	100.0%	96.1%
Boone County	12,991	100.0%	100.0%	100.0%	13,493	93.0%	100.0%	93.0%
Bremer County	8,733	100.0%	100.0%	100.0%	16,175	99.7%	100.0%	99.7%
Buchanan County	6,559	99.3%	100.0%	99.3%	14,636	55.8%	100.0%	55.8%
Buena Vista County	11,022	95.8%	100.0%	95.8%	9,088	52.4%	100.0%	52.4%
Butler County	.	.	.	.	14,606	83.5%	100.0%	83.5%
Calhoun County	.	.	.	.	9,738	78.1%	100.0%	78.1%
Carroll County	9,635	100.0%	100.0%	100.0%	10,685	89.2%	100.0%	89.2%
Cass County	5,929	98.2%	100.0%	98.2%	7,216	88.3%	100.0%	88.3%
Cedar County	3,062	95.9%	100.0%	95.9%	15,480	82.4%	100.0%	82.4%
Cerro Gordo County	33,991	100.0%	100.0%	100.0%	9,015	100.0%	100.0%	100.0%
Cherokee County	4,197	97.5%	100.0%	97.5%	7,119	59.1%	100.0%	59.1%
Chickasaw County	3,004	100.0%	100.0%	100.0%	9,001	100.0%	100.0%	100.0%
Clarke County	4,737	95.8%	100.0%	95.8%	4,632	66.4%	99.2%	66.2%

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Clay County	10,471	99.9%	100.0%	99.9%	5,699	57.9%	100.0%	57.9%
Clayton County	595	98.8%	100.0%	98.8%	17,042	71.8%	98.6%	71.2%
Clinton County	31,702	99.1%	100.0%	99.1%	15,308	85.5%	100.0%	85.5%
Crawford County	7,895	96.0%	100.0%	96.0%	9,153	44.1%	100.0%	44.1%
Dallas County	54,251	96.5%	100.0%	96.5%	32,959	81.4%	99.9%	81.3%
Davis County	.	.	.	.	8,966	77.4%	93.7%	74.0%
Decatur County	.	.	.	.	7,950	85.6%	100.0%	85.6%
Delaware County	4,731	98.4%	100.0%	98.4%	12,422	88.8%	98.5%	87.5%
Des Moines County	28,501	98.1%	100.0%	98.1%	10,916	87.3%	99.9%	87.3%
Dickinson County	11,008	100.0%	100.0%	100.0%	6,191	83.1%	100.0%	83.1%
Dubuque County	70,080	99.2%	100.0%	99.2%	26,960	97.0%	99.9%	96.9%
Emmet County	5,374	100.0%	100.0%	100.0%	4,058	98.2%	100.0%	98.2%
Fayette County	5,774	98.9%	100.0%	98.9%	14,022	84.6%	99.4%	84.1%
Floyd County	7,265	100.0%	100.0%	100.0%	8,479	100.0%	100.0%	100.0%
Franklin County	3,901	100.0%	100.0%	100.0%	6,263	92.4%	100.0%	92.4%
Fremont County	1	0.0%	100.0%	0.0%	6,947	66.2%	100.0%	66.2%
Greene County	3,613	100.0%	100.0%	100.0%	5,368	90.6%	100.0%	90.6%
Grundy County	.	.	.	.	12,332	78.7%	100.0%	78.7%
Guthrie County	.	.	.	.	10,669	83.5%	100.0%	83.5%
Hamilton County	7,280	97.7%	100.0%	97.7%	7,835	71.9%	100.0%	71.9%
Hancock County	3,039	100.0%	100.0%	100.0%	7,732	92.6%	100.0%	92.6%
Hardin County	4,787	99.8%	100.0%	99.8%	12,261	85.6%	99.9%	85.5%
Harrison County	2,578	88.5%	100.0%	88.5%	11,558	63.4%	100.0%	63.4%
Henry County	8,177	97.2%	100.0%	97.2%	11,684	86.2%	99.8%	86.1%
Howard County	3,373	100.0%	100.0%	100.0%	5,855	100.0%	98.6%	98.6%
Humboldt County	5,015	98.2%	100.0%	98.2%	4,546	43.6%	100.0%	43.6%
Ida County	.	.	.	.	6,865	34.5%	100.0%	34.5%
Iowa County	2,695	94.9%	100.0%	94.9%	13,408	73.8%	99.8%	73.6%
Jackson County	8,872	98.2%	100.0%	98.2%	10,494	73.8%	99.9%	73.8%
Jasper County	15,474	97.5%	100.0%	97.5%	21,488	78.9%	100.0%	78.9%
Jefferson County	10,772	100.0%	100.0%	100.0%	7,649	99.8%	99.0%	98.8%
Johnson County	116,111	98.1%	100.0%	98.1%	33,054	78.9%	100.0%	78.9%
Jones County	8,494	99.4%	100.0%	99.4%	12,040	84.9%	99.7%	84.8%
Keokuk County	.	.	.	.	10,153	64.9%	99.2%	64.3%
Kossuth County	5,088	99.6%	100.0%	99.6%	9,911	60.5%	100.0%	60.5%
Lee County	20,086	98.9%	100.0%	98.9%	14,209	80.8%	100.0%	80.8%

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Linn County	192,658	98.8%	100.0%	98.8%	31,443	86.4%	100.0%	86.4%
Louisa County	.	.	.	.	11,184	70.3%	100.0%	70.3%
Lucas County	3,654	99.8%	100.0%	99.8%	4,880	46.0%	97.1%	44.8%
Lyon County	.	.	.	.	11,790	84.7%	100.0%	84.7%
Madison County	4,935	97.4%	100.0%	97.4%	11,072	73.3%	99.9%	73.2%
Mahaska County	12,290	99.1%	100.0%	99.1%	9,945	51.9%	99.9%	51.9%
Marion County	16,819	99.5%	100.0%	99.5%	16,286	75.7%	98.3%	74.9%
Marshall County	26,239	100.0%	100.0%	100.0%	14,049	94.7%	100.0%	94.7%
Mills County	5,941	92.0%	100.0%	92.0%	9,127	60.6%	100.0%	60.6%
Mitchell County	3,382	100.0%	100.0%	100.0%	7,249	100.0%	100.0%	100.0%
Monona County	2,412	96.8%	100.0%	96.8%	6,328	42.5%	100.0%	42.5%
Monroe County	3,436	98.0%	100.0%	98.0%	4,409	53.6%	93.4%	50.6%
Montgomery County	5,077	98.1%	100.0%	98.1%	5,060	82.4%	100.0%	82.4%
Muscatine County	31,811	92.9%	100.0%	92.9%	11,069	76.8%	100.0%	76.8%
O'Brien County	4,302	94.2%	100.0%	94.2%	9,499	83.2%	100.0%	83.2%
Osceola County	2,381	98.0%	100.0%	98.0%	3,664	70.5%	100.0%	70.5%
Page County	9,932	97.6%	100.0%	97.6%	5,292	65.8%	100.0%	65.8%
Palo Alto County	3,235	99.4%	100.0%	99.4%	5,857	37.2%	100.0%	37.2%
Plymouth County	9,249	99.9%	100.0%	99.9%	15,971	49.0%	100.0%	49.0%
Pocahontas County	.	.	.	.	6,846	68.0%	100.0%	68.0%
Polk County	453,270	97.7%	100.0%	97.7%	28,508	86.5%	100.0%	86.5%
Pottawattamie County	68,360	97.8%	100.0%	97.8%	25,026	61.8%	100.0%	61.8%
Poweshiek County	8,506	99.4%	100.0%	99.4%	9,808	49.3%	100.0%	49.3%
Ringgold County	.	.	.	.	5,034	58.0%	100.0%	58.0%
Sac County	.	.	.	.	9,817	50.1%	100.0%	50.1%
Scott County	148,072	97.4%	100.0%	97.4%	24,437	90.3%	100.0%	90.3%
Shelby County	4,431	97.7%	100.0%	97.7%	7,197	88.5%	100.0%	88.5%
Sioux County	16,803	99.8%	100.0%	99.8%	18,057	64.6%	100.0%	64.6%
Story County	77,943	97.2%	100.0%	97.2%	19,551	82.2%	100.0%	82.2%
Tama County	4,653	96.6%	100.0%	96.6%	12,405	74.8%	100.0%	74.8%
Taylor County	.	.	.	.	6,178	67.6%	100.0%	67.6%
Union County	7,499	99.5%	100.0%	99.5%	4,951	67.5%	100.0%	67.5%
Van Buren County	.	.	.	.	7,157	79.1%	93.9%	73.8%
Wapello County	24,184	97.1%	100.0%	97.1%	10,860	68.7%	97.9%	68.7%
Warren County	28,057	97.6%	100.0%	97.6%	22,096	77.4%	98.0%	75.8%

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Washington County	6,713	99.9%	100.0%	99.9%	15,568	83.5%	99.6%	83.1%
Wayne County	.	.	.	.	6,474	86.0%	100.0%	86.0%
Webster County	23,847	95.0%	100.0%	95.0%	12,758	92.5%	99.7%	92.2%
Winnebago County	3,385	100.0%	100.0%	100.0%	7,202	98.2%	100.0%	98.2%
Winneshiek County	7,823	100.0%	100.0%	100.0%	12,378	82.5%	98.6%	82.4%
Woodbury County	84,271	97.3%	100.0%	97.3%	18,158	53.5%	100.0%	53.5%
Worth County	.	.	.	.	7,469	100.0%	100.0%	100.0%
Wright County	5,524	98.2%	100.0%	98.2%	7,260	72.4%	100.0%	72.4%
Kansas	**2,157,135**	**97.9%**	**100.0%**	**97.9%**	**755,818**	**71.9%**	**100.0%**	**71.9%**
Allen County	5,010	100.0%	100.0%	100.0%	7,509	92.8%	100.0%	92.8%
Anderson County	2,906	100.0%	100.0%	100.0%	4,927	96.7%	100.0%	96.7%
Atchison County	10,568	98.0%	100.0%	98.0%	5,764	38.2%	100.0%	38.2%
Barber County	.	.	.	.	4,586	81.1%	100.0%	81.1%
Barton County	18,089	99.1%	100.0%	99.1%	8,387	70.1%	100.0%	70.1%
Bourbon County	7,508	99.9%	100.0%	99.9%	7,243	77.5%	98.9%	76.4%
Brown County	2,909	100.0%	100.0%	100.0%	6,732	59.6%	100.0%	59.6%
Butler County	39,060	98.4%	100.0%	98.4%	27,818	35.1%	100.0%	35.1%
Chase County	.	.	.	.	2,682	13.0%	100.0%	13.0%
Chautauqua County	.	.	.	.	3,363	18.1%	96.3%	18.1%
Cherokee County	10,069	89.4%	100.0%	89.4%	10,046	80.2%	100.0%	80.2%
Cheyenne County	.	.	.	.	2,683	1.8%	100.0%	1.8%
Clark County	.	.	.	.	2,004	0.5%	100.0%	0.5%
Clay County	4,021	100.0%	100.0%	100.0%	3,937	84.1%	100.0%	84.1%
Cloud County	4,808	99.8%	100.0%	99.8%	4,183	86.5%	100.0%	86.5%
Coffey County	2,379	100.0%	100.0%	100.0%	5,845	99.2%	100.0%	99.2%
Comanche County	.	.	.	.	1,790	52.0%	100.0%	52.0%
Cowley County	23,968	97.2%	100.0%	97.2%	11,393	58.0%	99.9%	58.0%
Crawford County	25,293	98.4%	100.0%	98.4%	13,741	83.3%	100.0%	83.3%
Decatur County	.	.	.	.	2,884	16.9%	99.8%	16.9%
Dickinson County	6,495	68.8%	100.0%	68.8%	12,407	57.9%	100.0%	57.9%
Doniphan County	2,209	100.0%	100.0%	100.0%	5,518	74.4%	100.0%	74.4%
Douglas County	103,992	100.0%	100.0%	100.0%	16,785	100.0%	100.0%	100.0%
Edwards County	.	.	.	.	2,893	69.9%	100.0%	69.9%
Elk County	.	.	.	.	2,498	58.9%	99.7%	58.9%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Ellis County	20,979	100.0%	100.0%	100.0%	7,710	91.6%	100.0%	91.6%
Ellsworth County	2,811	57.9%	100.0%	57.9%	3,519	68.3%	100.0%	68.3%
Finney County	29,816	100.0%	100.0%	100.0%	7,263	96.4%	100.0%	96.4%
Ford County	26,848	93.2%	100.0%	93.2%	7,529	31.4%	100.0%	31.4%
Franklin County	11,902	100.0%	100.0%	100.0%	13,830	100.0%	100.0%	100.0%
Geary County	28,350	86.5%	100.0%	86.5%	5,505	58.1%	100.0%	58.1%
Gove County	.	.	.	.	2,631	72.4%	100.0%	72.4%
Graham County	.	.	.	.	2,495	98.6%	100.0%	98.6%
Grant County	5,721	100.0%	100.0%	100.0%	1,805	100.0%	100.0%	100.0%
Gray County	.	.	.	.	5,958	7.0%	100.0%	7.0%
Greeley County	.	.	.	.	1,249	92.1%	100.0%	92.1%
Greenwood County	2,251	100.0%	100.0%	100.0%	3,872	45.6%	99.8%	45.6%
Hamilton County	.	.	.	.	2,637	100.0%	100.0%	100.0%
Harper County	.	.	.	.	5,590	47.7%	99.9%	47.6%
Harvey County	23,487	98.3%	100.0%	98.3%	11,057	55.4%	100.0%	55.4%
Haskell County	.	.	.	.	4,049	98.4%	100.0%	98.4%
Hodgeman County	.	.	.	.	1,842	40.7%	100.0%	40.7%
Jackson County	3,161	100.0%	100.0%	100.0%	10,155	50.2%	100.0%	50.2%
Jefferson County	227	100.0%	100.0%	100.0%	18,770	97.0%	100.0%	97.0%
Jewell County	.	.	.	.	2,850	89.5%	100.0%	89.5%
Johnson County	563,640	100.0%	100.0%	100.0%	27,503	100.0%	100.0%	100.0%
Kearny County	.	.	.	.	3,959	100.0%	100.0%	100.0%
Kingman County	2,658	98.4%	100.0%	98.4%	4,702	20.9%	100.0%	20.9%
Kiowa County	.	.	.	.	2,485	0.1%	99.4%	0.1%
Labette County	9,129	98.8%	100.0%	98.8%	11,016	38.5%	100.0%	38.5%
Lane County	.	.	.	.	1,559	98.0%	100.0%	98.0%
Leavenworth County	56,067	100.0%	100.0%	100.0%	25,018	100.0%	100.0%	100.0%
Lincoln County	.	.	.	.	3,043	34.1%	100.0%	34.1%
Linn County	.	.	.	.	9,725	100.0%	100.0%	100.0%
Logan County	.	.	.	.	2,821	89.4%	100.0%	89.4%
Lyon County	24,319	100.0%	100.0%	100.0%	9,073	92.4%	100.0%	92.4%
Marion County	2,357	55.0%	100.0%	55.0%	9,629	50.8%	100.0%	50.8%
Marshall County	2,710	0.0%	100.0%	0.0%	7,035	60.4%	100.0%	60.4%
McPherson County	15,496	98.5%	100.0%	98.5%	13,212	47.1%	100.0%	47.1%
Meade County	.	.	.	.	4,303	0.0%	100.0%	0.0%
Miami County	16,030	100.0%	100.0%	100.0%	17,421	100.0%	100.0%	100.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Mitchell County	3,210	100.0%	100.0%	100.0%	2,918	92.7%	100.0%	92.7%
Montgomery County	17,928	99.5%	100.0%	99.5%	14,628	72.5%	100.0%	72.5%
Morris County	.	.	.	.	5,455	96.4%	100.0%	96.4%
Morton County	.	.	.	.	2,740	100.0%	100.0%	100.0%
Nemaha County	2,408	98.5%	100.0%	98.5%	7,710	52.4%	100.0%	52.4%
Neosho County	8,640	100.0%	100.0%	100.0%	7,375	63.1%	100.0%	63.1%
Ness County	.	.	.	.	2,869	73.2%	100.0%	73.2%
Norton County	2,729	100.0%	100.0%	100.0%	2,712	74.2%	100.0%	74.2%
Osage County	2,399	100.0%	100.0%	100.0%	13,373	100.0%	100.0%	100.0%
Osborne County	.	.	.	.	3,610	97.8%	100.0%	97.8%
Ottawa County	.	.	.	.	5,863	53.0%	100.0%	53.0%
Pawnee County	4,504	86.7%	100.0%	86.7%	2,176	39.9%	100.0%	39.9%
Phillips County	2,415	100.0%	100.0%	100.0%	2,955	45.8%	100.0%	45.8%
Pottawatomie County	9,204	96.6%	100.0%	96.6%	14,701	93.0%	99.9%	93.0%
Pratt County	6,382	96.7%	100.0%	96.7%	3,165	32.3%	100.0%	32.3%
Rawlins County	.	.	.	.	2,497	46.5%	99.8%	46.3%
Reno County	41,780	97.5%	100.0%	97.5%	20,730	45.0%	100.0%	45.0%
Republic County	.	.	.	.	4,691	68.2%	100.0%	68.2%
Rice County	3,320	97.8%	100.0%	97.8%	6,340	64.3%	100.0%	64.3%
Riley County	60,692	88.6%	100.0%	88.6%	13,458	79.8%	100.0%	79.8%
Rooks County	.	.	.	.	5,043	86.3%	100.0%	86.3%
Rush County	.	.	.	.	3,099	79.5%	100.0%	79.5%
Russell County	4,018	100.0%	100.0%	100.0%	2,897	96.8%	100.0%	96.8%
Saline County	46,582	98.3%	100.0%	98.3%	8,152	19.3%	100.0%	19.3%
Scott County	3,557	100.0%	100.0%	100.0%	1,404	99.9%	100.0%	99.9%
Sedgwick County	471,909	97.7%	100.0%	97.7%	41,762	58.8%	100.0%	58.8%
Seward County	19,551	62.1%	100.0%	62.1%	2,608	31.1%	100.0%	31.1%
Shawnee County	149,762	100.0%	100.0%	100.0%	28,422	100.0%	100.0%	100.0%
Sheridan County	.	.	.	.	2,527	76.1%	100.0%	76.1%
Sherman County	4,425	100.0%	100.0%	100.0%	1,505	42.7%	100.0%	42.7%
Smith County	.	.	.	.	3,666	84.8%	100.0%	84.8%
Stafford County	.	.	.	.	4,207	29.0%	100.0%	29.0%
Stanton County	.	.	.	.	2,059	100.0%	100.0%	100.0%
Stevens County	3,774	100.0%	100.0%	100.0%	1,838	96.2%	100.0%	96.2%
Sumner County	8,470	100.0%	100.0%	100.0%	14,689	100.0%	100.0%	100.0%
Thomas County	5,303	100.0%	100.0%	100.0%	2,485	69.2%	100.0%	69.2%

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Trego County	.	.	.	.	2,884	86.4%	100.0%	86.4%
Wabaunsee County	.	.	.	.	6,874	65.8%	100.0%	65.8%
Wallace County	.	.	.	.	1,521	47.5%	99.7%	47.4%
Washington County	.	.	.	.	5,485	55.5%	100.0%	55.5%
Wichita County	.	.	.	.	2,124	95.2%	100.0%	95.2%
Wilson County	2,278	100.0%	100.0%	100.0%	6,397	59.4%	100.0%	59.4%
Woodson County	.	.	.	.	3,147	72.4%	99.9%	72.3%
Wyandotte County	154,652	100.0%	100.0%	100.0%	10,619	100.0%	100.0%	100.0%
Kentucky	**2,624,295**	**98.7%**	**100.0%**	**98.7%**	**1,829,833**	**79.7%**	**97.0%**	**77.4%**
Adair County	4,669	99.4%	100.0%	99.4%	14,815	67.9%	94.2%	65.6%
Allen County	4,404	100.0%	100.0%	100.0%	16,529	98.6%	99.6%	98.3%
Anderson County	12,868	100.0%	100.0%	100.0%	9,674	54.8%	100.0%	54.8%
Ballard County	.	.	.	.	8,039	100.0%	100.0%	100.0%
Barren County	15,830	89.2%	100.0%	89.2%	27,971	76.6%	98.6%	76.3%
Bath County	.	.	.	.	12,378	80.0%	100.0%	80.0%
Bell County	10,609	100.0%	100.0%	100.0%	16,285	97.4%	97.7%	95.7%
Boone County	111,530	99.5%	100.0%	99.5%	19,196	97.0%	100.0%	97.0%
Bourbon County	11,041	100.0%	100.0%	100.0%	8,988	72.4%	100.0%	72.4%
Boyd County	35,770	99.3%	100.0%	99.3%	12,209	85.2%	98.9%	84.5%
Boyle County	19,233	100.0%	100.0%	100.0%	10,691	96.1%	99.1%	95.6%
Bracken County	.	.	.	.	8,267	73.6%	100.0%	73.6%
Breathitt County	2,431	46.2%	100.0%	46.2%	10,515	55.0%	77.2%	50.1%
Breckinridge County	.	.	.	.	20,111	65.5%	99.9%	65.5%
Bullitt County	55,079	100.0%	100.0%	100.0%	25,166	97.1%	100.0%	97.1%
Butler County	.	.	.	.	12,831	52.2%	99.9%	52.2%
Caldwell County	5,635	99.9%	100.0%	99.9%	7,004	55.8%	100.0%	55.8%
Calloway County	19,474	99.8%	100.0%	99.8%	19,439	96.3%	100.0%	96.3%
Campbell County	78,012	100.0%	100.0%	100.0%	14,476	95.1%	100.0%	95.1%
Carlisle County	.	.	.	.	4,846	94.1%	100.0%	94.1%
Carroll County	5,036	100.0%	100.0%	100.0%	5,677	49.8%	100.0%	49.8%
Carter County	5,674	57.1%	100.0%	57.1%	21,470	79.9%	94.1%	76.9%
Casey County	.	.	.	.	15,750	90.7%	95.7%	87.4%
Christian County	48,457	97.0%	100.0%	97.0%	21,959	69.2%	99.0%	69.2%
Clark County	25,928	99.9%	100.0%	99.9%	10,118	34.5%	100.0%	34.5%
Clay County	4,453	86.9%	100.0%	86.9%	15,913	90.7%	84.9%	77.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Clinton County	.	.	.	.	10,276	92.4%	100.0%	92.4%
Crittenden County	2,657	99.4%	100.0%	99.4%	6,427	53.8%	100.0%	53.8%
Cumberland County	.	.	.	.	6,706	69.0%	96.7%	68.2%
Daviess County	72,685	100.0%	100.0%	100.0%	27,688	74.6%	100.0%	74.6%
Edmonson County	.	.	.	.	12,226	85.2%	97.2%	82.4%
Elliott County	.	.	.	.	7,523	100.0%	37.6%	37.6%
Estill County	3,443	98.6%	100.0%	98.6%	10,834	95.7%	96.0%	91.9%
Fayette County	310,126	100.0%	100.0%	100.0%	11,821	86.7%	100.0%	86.7%
Fleming County	2,799	98.2%	100.0%	98.2%	11,647	74.8%	100.0%	74.8%
Floyd County	6,343	96.3%	100.0%	96.3%	29,928	86.4%	93.1%	80.8%
Franklin County	36,419	99.8%	100.0%	99.8%	14,066	91.6%	100.0%	91.6%
Fulton County	2,327	96.9%	100.0%	96.9%	3,865	38.8%	100.0%	38.8%
Gallatin County	.	.	.	.	8,776	73.1%	100.0%	73.1%
Garrard County	3,778	95.8%	100.0%	95.8%	13,745	80.7%	99.9%	80.7%
Grant County	8,636	100.0%	100.0%	100.0%	16,348	88.7%	100.0%	88.7%
Graves County	11,064	99.4%	100.0%	99.4%	26,056	92.8%	100.0%	92.8%
Grayson County	6,889	97.9%	100.0%	97.9%	19,469	86.0%	98.5%	84.4%
Green County	.	.	.	.	11,065	82.7%	99.2%	82.1%
Greenup County	21,531	99.5%	100.0%	99.5%	13,987	81.8%	88.8%	74.4%
Hancock County	935	0.0%	100.0%	0.0%	7,866	23.7%	99.8%	23.7%
Hardin County	69,957	99.8%	100.0%	99.8%	38,113	98.2%	99.6%	97.8%
Harlan County	12,843	93.7%	95.8%	90.1%	13,870	75.6%	69.8%	54.2%
Harrison County	6,355	100.0%	100.0%	100.0%	12,424	19.5%	100.0%	19.5%
Hart County	2,400	99.5%	100.0%	99.5%	16,357	88.4%	100.0%	88.4%
Henderson County	28,234	99.9%	100.0%	99.9%	17,694	85.2%	100.0%	85.2%
Henry County	.	.	.	.	16,006	65.9%	100.0%	65.9%
Hickman County	.	.	.	.	4,520	32.5%	100.0%	32.5%
Hopkins County	23,389	99.7%	100.0%	99.7%	22,158	71.1%	100.0%	71.1%
Jackson County	.	.	.	.	13,431	100.0%	91.0%	91.0%
Jefferson County	759,657	100.0%	100.0%	100.0%	11,499	96.8%	100.0%	96.8%
Jessamine County	38,729	99.8%	100.0%	99.8%	14,639	90.5%	100.0%	90.5%
Johnson County	6,137	96.5%	100.0%	96.5%	16,457	81.2%	91.1%	72.3%
Kenton County	153,337	100.0%	100.0%	100.0%	12,062	92.8%	100.0%	92.8%
Knott County	.	.	.	.	15,291	60.1%	90.8%	52.7%
Knox County	11,479	83.0%	100.0%	83.0%	19,748	84.6%	97.8%	82.4%
Larue County	3,392	97.4%	100.0%	97.4%	10,805	80.3%	99.7%	80.1%

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Laurel County	26,095	99.5%	100.0%	99.5%	34,079	96.9%	99.5%	96.5%
Lawrence County	3,611	100.0%	100.0%	100.0%	12,108	100.0%	76.0%	76.0%
Lee County	.	.	.	.	6,570	26.8%	99.0%	26.1%
Leslie County	.	.	.	.	10,334	48.2%	76.8%	31.5%
Letcher County	.	.	.	.	22,339	89.7%	86.3%	78.9%
Lewis County	.	.	.	.	13,339	71.8%	97.0%	70.6%
Lincoln County	4,512	100.0%	100.0%	100.0%	19,944	83.6%	100.0%	83.6%
Livingston County	421	100.0%	100.0%	100.0%	8,848	68.4%	100.0%	68.4%
Logan County	6,687	100.0%	100.0%	100.0%	20,373	76.6%	100.0%	76.6%
Lyon County	.	.	.	.	8,082	26.2%	100.0%	26.2%
Madison County	54,832	99.7%	100.0%	99.7%	36,394	87.6%	99.9%	87.6%
Magoffin County	.	.	.	.	12,538	100.0%	89.4%	89.4%
Marion County	5,407	100.0%	100.0%	100.0%	13,985	81.4%	97.0%	80.3%
Marshall County	4,432	99.9%	100.0%	99.9%	26,950	97.6%	100.0%	97.6%
Martin County	.	.	.	.	11,452	77.9%	97.7%	75.7%
Mason County	7,631	15.6%	100.0%	15.6%	9,543	59.3%	100.0%	59.3%
McCracken County	46,969	98.6%	100.0%	98.6%	18,415	96.5%	100.0%	96.5%
McCreary County	.	.	.	.	17,465	100.0%	96.6%	96.6%
McLean County	.	.	.	.	9,201	48.8%	100.0%	48.8%
Meade County	4,040	99.3%	100.0%	99.3%	24,114	83.0%	99.5%	83.0%
Menifee County	.	.	.	.	6,455	100.0%	100.0%	100.0%
Mercer County	8,752	100.0%	100.0%	100.0%	12,769	70.4%	99.8%	70.4%
Metcalfe County	.	.	.	.	10,107	74.4%	96.8%	71.5%
Monroe County	.	.	.	.	10,659	87.0%	91.1%	80.2%
Montgomery County	11,189	99.0%	100.0%	99.0%	16,739	88.3%	100.0%	88.3%
Morgan County	.	.	.	.	13,188	100.0%	89.4%	89.4%
Muhlenberg County	9,724	97.5%	100.0%	97.5%	21,092	72.1%	99.8%	72.0%
Nelson County	19,344	79.4%	100.0%	79.4%	26,296	55.5%	99.9%	55.5%
Nicholas County	.	.	.	.	7,130	43.5%	100.0%	43.5%
Ohio County	6,351	100.0%	100.0%	100.0%	17,831	39.9%	100.0%	39.9%
Oldham County	52,229	99.8%	100.0%	99.8%	14,186	92.5%	100.0%	92.5%
Owen County	.	.	.	.	10,764	60.7%	99.1%	60.7%
Owsley County	.	.	.	.	4,435	100.0%	94.9%	94.9%
Pendleton County	.	.	.	.	14,573	71.9%	100.0%	71.9%
Perry County	7,169	93.8%	99.3%	93.1%	19,384	95.1%	73.8%	71.5%
Pike County	7,844	73.5%	100.0%	73.5%	51,039	72.2%	91.4%	65.7%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Powell County	4,123	65.9%	100.0%	65.9%	8,251	28.8%	100.0%	28.8%
Pulaski County	29,431	99.9%	100.0%	99.9%	35,018	94.8%	99.7%	94.5%
Robertson County	.	.	.	.	2,134	45.1%	100.0%	45.1%
Rockcastle County	2,773	99.4%	100.0%	99.4%	13,925	92.1%	99.5%	91.6%
Rowan County	7,265	100.0%	100.0%	100.0%	17,252	97.4%	97.8%	95.2%
Russell County	.	.	.	.	17,775	87.2%	100.0%	87.2%
Scott County	35,435	99.8%	100.0%	99.8%	19,437	53.8%	100.0%	53.8%
Shelby County	23,994	99.9%	100.0%	99.9%	23,426	70.6%	100.0%	70.6%
Simpson County	9,753	97.7%	100.0%	97.7%	8,355	31.4%	100.0%	31.4%
Spencer County	.	.	.	.	18,506	79.8%	100.0%	79.8%
Taylor County	12,121	99.4%	100.0%	99.4%	13,345	83.0%	98.4%	81.5%
Todd County	.	.	.	.	12,243	57.4%	97.8%	56.3%
Trigg County	2,956	93.4%	100.0%	93.4%	11,488	73.3%	100.0%	73.3%
Trimble County	465	98.7%	100.0%	98.7%	8,096	80.7%	100.0%	80.7%
Union County	4,887	99.6%	100.0%	99.6%	9,781	71.6%	100.0%	71.6%
Warren County	86,262	100.0%	100.0%	100.0%	42,583	78.7%	100.0%	78.7%
Washington County	.	.	.	.	12,126	78.6%	99.6%	78.6%
Wayne County	6,753	65.1%	100.0%	65.1%	13,962	79.1%	89.7%	72.8%
Webster County	.	.	.	.	13,018	60.8%	100.0%	60.8%
Whitley County	12,590	99.9%	100.0%	99.9%	23,624	94.6%	99.7%	94.4%
Wolfe County	.	.	.	.	7,264	100.0%	100.0%	100.0%
Woodford County	16,574	99.9%	100.0%	99.9%	9,794	94.5%	100.0%	94.5%
Louisiana	**3,428,436**	**96.5%**	**100.0%**	**96.5%**	**1,255,850**	**63.3%**	**100.0%**	**63.3%**
Acadia Parish	30,195	97.2%	100.0%	97.2%	32,395	48.4%	100.0%	48.4%
Allen Parish	7,830	100.0%	100.0%	100.0%	17,791	46.9%	100.0%	46.9%
Ascension Parish	104,411	99.7%	100.0%	99.7%	18,536	92.8%	100.0%	92.8%
Assumption Parish	12,443	100.0%	100.0%	100.0%	10,083	97.4%	100.0%	97.4%
Avoyelles Parish	14,616	99.6%	100.0%	99.6%	26,364	60.7%	100.0%	60.7%
Beauregard Parish	12,093	92.2%	100.0%	92.2%	24,835	29.7%	100.0%	29.7%
Bienville Parish	2,524	0.0%	100.0%	0.0%	11,114	5.5%	99.0%	5.5%
Bossier Parish	93,071	99.4%	100.0%	99.4%	34,559	67.3%	100.0%	67.3%
Caddo Parish	210,334	98.7%	100.0%	98.7%	36,247	80.9%	100.0%	80.9%
Calcasieu Parish	159,837	97.5%	100.0%	97.5%	42,602	69.9%	100.0%	69.9%
Caldwell Parish	.	.	.	.	9,950	51.4%	100.0%	51.4%
Cameron Parish	.	.	.	.	6,912	12.9%	100.0%	12.9%
Catahoula Parish	.	.	.	.	9,875	26.2%	100.0%	26.2%

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Claiborne Parish	2,766	99.0%	100.0%	99.0%	13,203	27.9%	99.4%	27.9%
Concordia Parish	12,931	100.0%	100.0%	100.0%	6,935	47.0%	100.0%	47.0%
De Soto Parish	6,127	97.4%	100.0%	97.4%	21,213	61.6%	99.8%	61.6%
East Baton Rouge Parish	415,408	100.0%	100.0%	100.0%	30,860	100.0%	100.0%	100.0%
East Carroll Parish	4,661	84.6%	100.0%	84.6%	2,465	22.2%	100.0%	22.2%
East Feliciana Parish	.	.	.	.	19,412	17.7%	100.0%	17.7%
Evangeline Parish	13,144	41.5%	100.0%	41.5%	20,564	49.5%	100.0%	49.5%
Franklin Parish	5,173	98.7%	100.0%	98.7%	15,087	33.2%	100.0%	33.2%
Grant Parish	3,210	99.7%	100.0%	99.7%	19,126	26.7%	100.0%	26.7%
Iberia Parish	51,659	96.5%	100.0%	96.5%	20,517	86.3%	100.0%	86.3%
Iberville Parish	13,595	90.9%	100.0%	90.9%	19,432	73.7%	100.0%	73.7%
Jackson Parish	5,453	88.0%	100.0%	88.0%	10,393	42.0%	100.0%	42.0%
Jefferson Davis Parish	15,462	98.8%	100.0%	98.8%	16,015	53.5%	100.0%	53.5%
Jefferson Parish	433,811	98.1%	100.0%	98.1%	5,224	70.4%	100.0%	70.4%
La Salle Parish	3,938	100.0%	100.0%	100.0%	10,995	25.7%	100.0%	25.7%
Lafayette Parish	221,166	97.8%	100.0%	97.8%	21,315	93.4%	100.0%	93.4%
Lafourche Parish	74,287	69.5%	100.0%	69.5%	24,131	79.9%	100.0%	79.9%
Lincoln Parish	28,167	99.5%	100.0%	99.5%	19,577	57.5%	100.0%	57.5%
Livingston Parish	78,845	99.1%	100.0%	99.1%	59,383	97.5%	100.0%	97.5%
Madison Parish	8,429	87.5%	100.0%	87.5%	2,887	13.7%	100.0%	13.7%
Morehouse Parish	13,312	100.0%	100.0%	100.0%	12,329	82.7%	100.0%	82.7%
Natchitoches Parish	19,388	99.8%	100.0%	99.8%	19,633	36.7%	99.8%	36.7%
Orleans Parish	389,655	92.5%	100.0%	92.5%	3,629	65.9%	100.0%	65.9%
Ouachita Parish	117,665	98.0%	100.0%	98.0%	38,209	94.3%	99.7%	94.3%
Plaquemines Parish	18,582	78.2%	100.0%	78.2%	4,766	30.6%	100.0%	30.6%
Pointe Coupee Parish	9,424	82.4%	100.0%	82.4%	12,844	53.6%	100.0%	53.6%
Rapides Parish	79,810	98.6%	100.0%	98.6%	51,838	69.8%	100.0%	69.8%
Red River Parish	.	.	.	.	8,536	21.1%	100.0%	21.1%
Richland Parish	6,868	98.4%	100.0%	98.4%	13,543	21.9%	100.0%	21.9%
Sabine Parish	2,711	51.3%	100.0%	51.3%	21,307	0.5%	100.0%	0.5%
St. Bernard Parish	43,346	94.5%	100.0%	94.5%	2,856	79.6%	99.8%	79.6%
St. Charles Parish	46,586	98.7%	100.0%	98.7%	6,163	86.4%	100.0%	86.4%
St. Helena Parish	.	.	.	.	10,363	35.5%	100.0%	35.5%

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St. James Parish	15,446	99.8%	100.0%	99.8%	5,921	98.6%	100.0%	98.6%
St. John the Baptist Parish	38,970	100.0%	100.0%	100.0%	4,471	99.7%	100.0%	99.7%
St. Landry Parish	43,155	99.0%	100.0%	99.0%	40,342	63.4%	100.0%	63.4%
St. Martin Parish	27,025	96.8%	100.0%	96.8%	27,145	90.5%	100.0%	90.5%
St. Mary Parish	44,801	94.7%	100.0%	94.7%	6,172	52.8%	100.0%	52.8%
St. Tammany Parish	191,226	99.9%	100.0%	99.9%	65,099	94.6%	100.0%	94.6%
Tangipahoa Parish	76,275	99.8%	100.0%	99.8%	56,214	73.5%	100.0%	73.5%
Tensas Parish	.	.	.	.	4,615	0.5%	100.0%	0.5%
Terrebonne Parish	88,576	99.8%	100.0%	99.8%	23,510	99.1%	100.0%	99.1%
Union Parish	3,746	89.4%	100.0%	89.4%	18,825	27.7%	99.9%	27.7%
Vermilion Parish	27,144	98.4%	100.0%	98.4%	32,992	94.1%	100.0%	94.1%
Vernon Parish	22,562	94.7%	100.0%	94.7%	28,163	49.6%	100.0%	49.6%
Washington Parish	15,736	61.9%	100.0%	61.9%	30,897	25.2%	100.0%	25.2%
Webster Parish	18,297	97.9%	100.0%	97.9%	21,081	54.8%	100.0%	54.8%
West Baton Rouge Parish	17,742	91.7%	100.0%	91.7%	8,520	80.6%	100.0%	80.6%
West Carroll Parish	.	.	.	.	10,981	31.5%	100.0%	31.5%
West Feliciana Parish	.	.	.	.	15,380	32.1%	100.0%	32.1%
Winn Parish	4,802	100.0%	100.0%	100.0%	9,509	19.5%	99.9%	19.5%
Maine	**507,125**	**99.4%**	**100.0%**	**99.4%**	**828,779**	**89.6%**	**97.6%**	**87.6%**
Androscoggin County	60,854	100.0%	100.0%	100.0%	46,797	99.6%	100.0%	99.6%
Aroostook County	13,277	100.0%	100.0%	100.0%	54,376	80.3%	89.0%	70.0%
Cumberland County	184,360	99.9%	100.0%	99.9%	108,139	99.2%	99.9%	99.1%
Franklin County	4,951	91.5%	100.0%	91.5%	25,037	73.8%	99.6%	73.7%
Hancock County	5,361	100.0%	100.0%	100.0%	49,136	83.9%	98.3%	82.6%
Kennebec County	44,585	99.1%	100.0%	99.1%	77,236	99.2%	100.0%	99.2%
Knox County	12,739	100.0%	100.0%	100.0%	27,051	96.4%	99.6%	96.1%
Lincoln County	.	.	.	.	34,204	95.1%	99.9%	95.1%
Oxford County	9,682	100.0%	100.0%	100.0%	47,757	86.2%	99.7%	86.1%
Penobscot County	63,650	97.5%	100.0%	97.5%	88,307	86.7%	99.6%	86.6%
Piscataquis County	.	.	.	.	16,773	42.4%	99.8%	42.4%
Sagadahoc County	13,041	99.4%	100.0%	99.4%	22,351	94.1%	100.0%	94.0%
Somerset County	9,853	99.5%	100.0%	99.5%	40,773	79.6%	99.2%	79.6%

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Waldo County	3,425	100.0%	100.0%	100.0%	36,406	68.9%	99.8%	68.7%
Washington County	2,416	100.0%	100.0%	100.0%	29,177	80.4%	58.2%	47.8%
York County	78,931	99.3%	100.0%	99.3%	125,259	98.4%	100.0%	98.4%
Maryland	**5,250,227**	**100.0%**	**100.0%**	**100.0%**	**801,897**	**100.0%**	**100.0%**	**100.0%**
Allegany County	52,300	100.0%	100.0%	100.0%	19,315	100.0%	99.8%	99.8%
Anne Arundel County	541,272	100.0%	100.0%	100.0%	31,960	100.0%	100.0%	100.0%
Baltimore County	773,921	100.0%	100.0%	100.0%	58,542	100.0%	100.0%	100.0%
Baltimore city	611,648	100.0%	100.0%	100.0%	.	.	.	.
Calvert County	55,603	100.0%	100.0%	100.0%	35,899	100.0%	100.0%	100.0%
Caroline County	7,775	100.0%	100.0%	100.0%	25,415	100.0%	100.0%	100.0%
Carroll County	101,210	100.0%	100.0%	100.0%	66,571	100.0%	100.0%	100.0%
Cecil County	59,125	100.0%	100.0%	100.0%	43,621	100.0%	100.0%	100.0%
Charles County	107,861	100.0%	100.0%	100.0%	51,839	100.0%	100.0%	100.0%
Dorchester County	13,892	100.0%	100.0%	100.0%	18,270	100.0%	99.9%	99.9%
Frederick County	183,217	100.0%	100.0%	100.0%	68,802	100.0%	100.0%	100.0%
Garrett County	4,739	100.0%	100.0%	100.0%	24,494	100.0%	100.0%	100.0%
Harford County	205,644	100.0%	100.0%	100.0%	46,513	100.0%	100.0%	100.0%
Howard County	286,336	100.0%	100.0%	100.0%	34,776	100.0%	100.0%	100.0%
Kent County	4,831	100.0%	100.0%	100.0%	14,553	100.0%	100.0%	100.0%
Montgomery County	1,029,965	100.0%	100.0%	100.0%	28,825	100.0%	100.0%	100.0%
Prince George's County	889,680	100.0%	100.0%	100.0%	23,075	100.0%	100.0%	100.0%
Queen Anne's County	22,260	100.0%	100.0%	100.0%	27,498	100.0%	100.0%	100.0%
Somerset County	13,716	100.0%	99.9%	99.9%	12,202	100.0%	99.9%	99.9%
St. Mary's County	54,752	100.0%	100.0%	100.0%	57,915	100.0%	100.0%	100.0%
Talbot County	16,557	100.0%	100.0%	100.0%	20,546	100.0%	100.0%	100.0%
Washington County	105,396	100.0%	100.0%	100.0%	45,181	100.0%	100.0%	100.0%
Wicomico County	75,327	100.0%	100.0%	100.0%	27,596	100.0%	100.0%	100.0%
Worcester County	33,200	100.0%	100.0%	100.0%	18,489	100.0%	100.0%	100.0%
Massachusetts	**6,309,137**	**98.4%**	**100.0%**	**98.4%**	**550,605**	**92.3%**	**99.9%**	**92.3%**
Barnstable County	197,419	98.6%	100.0%	98.6%	16,025	98.7%	100.0%	98.7%
Berkshire County	86,134	99.9%	100.0%	99.9%	40,179	74.6%	99.5%	74.5%
Bristol County	505,735	98.3%	100.0%	98.3%	55,733	99.5%	100.0%	99.5%
Dukes County	10,244	88.9%	100.0%	88.9%	7,081	95.3%	100.0%	95.3%
Essex County	750,500	98.8%	100.0%	98.8%	34,700	99.0%	100.0%	99.0%

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Franklin County	31,794	98.7%	100.0%	98.7%	38,907	64.4%	99.7%	64.4%
Hampden County	428,915	100.0%	100.0%	100.0%	40,901	100.0%	100.0%	100.0%
Hampshire County	116,740	87.3%	100.0%	87.3%	45,092	86.1%	99.9%	86.1%
Middlesex County	1,552,294	98.6%	100.0%	98.6%	50,641	99.5%	100.0%	99.5%
Nantucket County	8,803	99.5%	100.0%	99.5%	2,426	96.9%	100.0%	96.9%
Norfolk County	691,449	97.8%	100.0%	97.8%	8,868	98.7%	100.0%	98.7%
Plymouth County	460,564	98.0%	100.0%	98.0%	54,577	97.6%	100.0%	97.6%
Suffolk County	797,278	98.5%	100.0%	98.5%	629	0.8%	100.0%	0.8%
Worcester County	671,268	99.4%	100.0%	99.4%	154,846	94.5%	100.0%	94.5%
Michigan	**7,406,442**	**98.6%**	**100.0%**	**98.6%**	**2,555,546**	**73.1%**	**99.8%**	**73.0%**
Alcona County	99	100.0%	100.0%	100.0%	10,252	65.5%	100.0%	65.5%
Alger County	2,838	99.8%	100.0%	99.8%	6,283	62.9%	84.8%	54.6%
Allegan County	40,809	98.9%	100.0%	98.9%	75,623	67.9%	100.0%	67.9%
Alpena County	13,806	100.0%	100.0%	100.0%	14,656	84.3%	100.0%	84.3%
Antrim County	.	.	.	.	23,292	92.7%	100.0%	92.7%
Arenac County	.	.	.	.	15,045	54.4%	100.0%	54.4%
Baraga County	.	.	.	.	8,441	62.4%	94.3%	62.4%
Barry County	13,761	99.1%	100.0%	99.1%	46,807	49.9%	100.0%	49.9%
Bay County	71,753	100.0%	100.0%	100.0%	32,486	75.8%	99.8%	75.7%
Benzie County	.	.	.	.	17,573	80.2%	100.0%	80.2%
Berrien County	102,873	97.3%	100.0%	97.3%	51,384	85.4%	100.0%	85.4%
Branch County	15,084	99.5%	100.0%	99.5%	28,326	53.7%	100.0%	53.7%
Calhoun County	91,800	97.7%	100.0%	97.7%	42,328	68.4%	100.0%	68.4%
Cass County	14,477	96.0%	100.0%	96.0%	36,904	92.2%	100.0%	92.2%
Charlevoix County	7,555	100.0%	100.0%	100.0%	18,584	89.0%	99.9%	89.0%
Cheboygan County	4,296	100.0%	100.0%	100.0%	21,073	54.8%	100.0%	54.8%
Chippewa County	18,824	100.0%	100.0%	100.0%	18,885	54.1%	98.6%	53.5%
Clare County	8,630	100.0%	100.0%	100.0%	22,015	67.4%	100.0%	67.4%
Clinton County	36,546	96.2%	100.0%	96.2%	41,890	69.8%	100.0%	69.8%
Crawford County	3,653	99.3%	100.0%	99.3%	10,253	36.6%	100.0%	36.6%
Delta County	20,155	100.0%	100.0%	100.0%	15,810	63.7%	94.7%	62.0%
Dickinson County	17,234	83.5%	100.0%	83.5%	8,181	49.8%	97.5%	49.8%
Eaton County	67,449	96.9%	100.0%	96.9%	41,578	75.6%	100.0%	75.6%
Emmet County	8,210	99.9%	100.0%	99.9%	24,983	88.1%	100.0%	88.1%
Genesee County	336,377	99.2%	100.0%	99.2%	71,008	96.0%	100.0%	96.0%
Gladwin County	2,647	100.0%	100.0%	100.0%	22,587	61.3%	100.0%	61.3%

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Gogebic County	5,120	99.9%	100.0%	99.9%	10,222	77.0%	98.8%	76.5%
Grand Traverse County	46,479	100.0%	100.0%	100.0%	45,328	94.9%	100.0%	94.9%
Gratiot County	15,619	100.0%	100.0%	100.0%	25,399	100.0%	100.0%	100.0%
Hillsdale County	13,668	97.6%	100.0%	97.6%	32,211	47.9%	100.0%	47.9%
Houghton County	22,529	99.2%	100.0%	99.2%	13,776	69.5%	98.5%	69.5%
Huron County	2,787	98.9%	100.0%	98.9%	28,493	65.9%	99.7%	65.6%
Ingham County	250,918	96.6%	100.0%	96.6%	39,253	78.9%	100.0%	78.9%
Ionia County	25,297	98.8%	100.0%	98.8%	38,994	83.0%	100.0%	83.0%
Iosco County	10,162	99.9%	100.0%	99.9%	15,000	77.0%	99.4%	76.4%
Iron County	3,197	0.0%	100.0%	0.0%	7,927	21.9%	96.9%	21.9%
Isabella County	37,184	100.0%	100.0%	100.0%	33,879	96.8%	100.0%	96.8%
Jackson County	91,618	93.2%	100.0%	93.2%	67,021	71.4%	100.0%	71.4%
Kalamazoo County	215,688	99.3%	100.0%	99.3%	47,291	93.5%	100.0%	93.5%
Kalkaska County	2,631	100.0%	100.0%	100.0%	14,998	79.7%	100.0%	79.7%
Kent County	541,475	98.4%	100.0%	98.4%	107,084	88.1%	100.0%	88.1%
Keweenaw County	.	.	.	.	2,105	77.5%	87.1%	69.4%
Lake County	.	.	.	.	12,013	4.9%	100.0%	4.9%
Lapeer County	19,907	100.0%	100.0%	100.0%	68,267	69.9%	100.0%	69.9%
Leelanau County	1,868	100.0%	100.0%	100.0%	19,789	85.9%	100.0%	85.9%
Lenawee County	47,006	92.2%	100.0%	92.2%	51,617	71.5%	100.0%	71.5%
Livingston County	118,985	99.3%	100.0%	99.3%	70,647	95.6%	100.0%	95.6%
Luce County	3,079	0.0%	100.0%	0.0%	3,279	0.0%	94.9%	0.0%
Mackinac County	2,358	99.6%	100.0%	99.6%	8,354	36.2%	99.2%	36.2%
Macomb County	846,049	99.1%	100.0%	99.1%	25,290	75.6%	100.0%	75.6%
Manistee County	9,358	100.0%	100.0%	100.0%	15,069	54.1%	100.0%	54.1%
Marquette County	38,120	99.9%	100.0%	99.9%	28,382	77.4%	99.0%	77.3%
Mason County	10,793	100.0%	100.0%	100.0%	18,280	77.4%	100.0%	77.4%
Mecosta County	14,043	99.7%	100.0%	99.7%	29,344	78.5%	100.0%	78.5%
Menominee County	8,275	100.0%	100.0%	100.0%	14,771	55.2%	98.0%	54.9%
Midland County	47,470	99.9%	100.0%	99.9%	35,941	90.2%	100.0%	90.2%
Missaukee County	.	.	.	.	14,998	25.5%	100.0%	25.5%
Monroe County	92,764	99.0%	100.0%	99.0%	56,882	83.0%	100.0%	83.0%
Montcalm County	9,649	100.0%	100.0%	100.0%	53,897	91.7%	100.0%	91.7%
Montmorency County	.	.	.	.	9,250	0.5%	99.8%	0.5%
Muskegon County	132,598	98.8%	100.0%	98.8%	41,095	77.4%	100.0%	77.4%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Newaygo County	7,722	99.5%	100.0%	99.5%	40,507	27.6%	100.0%	27.6%
Oakland County	1,189,927	99.4%	100.0%	99.4%	60,858	98.8%	100.0%	98.8%
Oceana County	2,655	93.5%	100.0%	93.5%	23,783	41.2%	100.0%	41.2%
Ogemaw County	.	.	.	.	20,981	72.2%	100.0%	72.2%
Ontonagon County	.	.	.	.	5,881	65.0%	89.3%	57.1%
Osceola County	.	.	.	.	23,259	28.1%	100.0%	28.1%
Oscoda County	.	.	.	.	8,287	1.6%	100.0%	1.6%
Otsego County	8,347	100.0%	100.0%	100.0%	16,190	55.6%	100.0%	55.6%
Ottawa County	225,369	99.8%	100.0%	99.8%	60,976	87.7%	100.0%	87.7%
Presque Isle County	2,420	100.0%	100.0%	100.0%	10,371	12.7%	100.0%	12.7%
Roscommon County	8,107	100.0%	100.0%	100.0%	15,785	89.6%	100.0%	89.6%
Saginaw County	129,327	99.8%	100.0%	99.8%	62,607	86.1%	100.0%	86.1%
Sanilac County	3,662	65.2%	100.0%	65.2%	37,607	40.6%	100.0%	40.6%
Schoolcraft County	3,267	100.0%	100.0%	100.0%	4,781	26.8%	95.7%	26.8%
Shiawassee County	29,920	100.0%	100.0%	100.0%	38,526	74.6%	100.0%	74.6%
St. Clair County	96,475	98.7%	99.9%	98.7%	62,875	62.6%	100.0%	62.6%
St. Joseph County	27,574	97.0%	100.0%	97.0%	33,372	67.9%	100.0%	67.9%
Tuscola County	7,454	99.9%	100.0%	99.9%	45,310	61.1%	99.9%	61.1%
Van Buren County	21,699	97.8%	100.0%	97.8%	53,653	64.5%	100.0%	64.5%
Washtenaw County	303,984	96.0%	100.0%	96.0%	63,619	74.2%	100.0%	74.2%
Wayne County	1,741,196	98.9%	100.0%	98.9%	12,420	99.0%	100.0%	99.0%
Wexford County	11,767	99.8%	100.0%	99.8%	21,505	45.7%	100.0%	45.7%
Minnesota	**4,091,665**	**98.9%**	**100.0%**	**98.9%**	**1,484,595**	**83.7%**	**99.8%**	**83.6%**
Aitkin County	.	.	.	.	15,826	48.1%	100.0%	48.1%
Anoka County	300,880	98.6%	100.0%	98.6%	50,462	95.5%	100.0%	95.5%
Becker County	8,069	100.0%	100.0%	100.0%	26,028	85.0%	99.9%	84.9%
Beltrami County	14,884	100.0%	100.0%	100.0%	31,621	99.2%	98.5%	97.8%
Benton County	23,392	100.0%	100.0%	100.0%	16,545	73.0%	100.0%	73.0%
Big Stone County	.	.	.	.	5,026	87.9%	100.0%	87.9%
Blue Earth County	47,835	100.0%	100.0%	100.0%	19,129	100.0%	100.0%	100.0%
Brown County	16,114	99.9%	100.0%	99.9%	9,080	87.6%	100.0%	87.6%
Carlton County	15,682	96.4%	100.0%	96.4%	19,816	64.3%	100.0%	64.3%
Carver County	79,680	98.0%	100.0%	98.0%	22,423	96.5%	100.0%	96.5%
Cass County	.	.	.	.	29,354	77.4%	100.0%	77.4%
Chippewa County	5,795	100.0%	100.0%	100.0%	6,185	100.0%	100.0%	100.0%

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Chisago County	24,233	96.9%	100.0%	96.9%	31,071	58.4%	100.0%	58.4%
Clay County	43,945	99.0%	100.0%	99.0%	19,620	88.2%	100.0%	88.2%
Clearwater County	.	.	.	.	8,878	99.8%	99.3%	99.1%
Cook County	.	.	.	.	5,398	91.8%	92.1%	85.0%
Cottonwood County	4,051	100.0%	100.0%	100.0%	7,244	100.0%	100.0%	100.0%
Crow Wing County	23,686	100.0%	100.0%	100.0%	40,736	89.6%	100.0%	89.6%
Dakota County	399,075	99.3%	100.0%	99.3%	22,669	96.4%	100.0%	96.4%
Dodge County	9,851	100.0%	100.0%	100.0%	10,903	100.0%	100.0%	100.0%
Douglas County	16,908	97.9%	100.0%	97.9%	20,667	79.4%	100.0%	79.4%
Faribault County	2,825	100.0%	100.0%	100.0%	10,959	100.0%	100.0%	100.0%
Fillmore County	1,394	100.0%	100.0%	100.0%	19,586	92.5%	98.5%	91.7%
Freeborn County	17,186	100.0%	100.0%	100.0%	13,349	100.0%	100.0%	100.0%
Goodhue County	24,291	100.0%	100.0%	100.0%	22,013	99.6%	100.0%	99.6%
Grant County	.	.	.	.	5,941	89.1%	100.0%	89.1%
Hennepin County	1,221,303	98.8%	100.0%	98.8%	30,698	89.3%	100.0%	89.3%
Houston County	7,870	100.0%	100.0%	100.0%	10,790	64.4%	96.4%	62.9%
Hubbard County	3,400	100.0%	100.0%	100.0%	17,615	94.7%	100.0%	94.7%
Isanti County	14,560	97.2%	100.0%	97.2%	25,016	65.2%	100.0%	65.2%
Itasca County	9,231	100.0%	100.0%	100.0%	35,906	79.4%	99.9%	79.3%
Jackson County	2,821	100.0%	100.0%	100.0%	7,125	100.0%	100.0%	100.0%
Kanabec County	3,329	95.7%	100.0%	95.7%	12,693	68.1%	100.0%	68.1%
Kandiyohi County	23,485	100.0%	100.0%	100.0%	19,254	100.0%	100.0%	100.0%
Kittson County	.	.	.	.	4,250	46.6%	98.9%	46.6%
Koochiching County	6,608	96.3%	100.0%	96.3%	5,920	50.7%	99.1%	50.7%
Lac qui Parle County	.	.	.	.	6,685	99.3%	100.0%	99.3%
Lake County	3,514	99.9%	100.0%	99.9%	7,010	84.1%	98.8%	83.7%
Lake of the Woods County	.	.	.	.	3,744	51.3%	98.2%	51.3%
Le Sueur County	10,456	100.0%	100.0%	100.0%	17,647	100.0%	100.0%	100.0%
Lincoln County	.	.	.	.	5,678	93.9%	100.0%	93.9%
Lyon County	13,136	100.0%	100.0%	100.0%	12,693	99.2%	100.0%	99.2%
Mahnomen County	.	.	.	.	5,595	80.3%	99.5%	80.0%
Marshall County	.	.	.	.	9,356	53.4%	99.8%	53.4%
Martin County	8,880	100.0%	100.0%	100.0%	10,970	100.0%	100.0%	100.0%

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McLeod County	19,002	79.4%	100.0%	79.4%	16,882	90.9%	100.0%	90.9%
Meeker County	7,837	99.4%	100.0%	99.4%	15,292	86.7%	100.0%	86.7%
Mille Lacs County	7,406	97.9%	100.0%	97.9%	18,466	44.2%	100.0%	44.2%
Morrison County	8,811	99.2%	100.0%	99.2%	24,248	73.5%	100.0%	73.5%
Mower County	25,155	100.0%	100.0%	100.0%	14,404	100.0%	100.0%	100.0%
Murray County	.	.	.	.	8,346	91.6%	100.0%	91.6%
Nicollet County	24,334	100.0%	100.0%	100.0%	9,628	100.0%	100.0%	100.0%
Nobles County	12,592	100.0%	100.0%	100.0%	9,349	92.8%	100.0%	92.8%
Norman County	.	.	.	.	6,597	90.4%	100.0%	90.4%
Olmsted County	125,854	100.0%	100.0%	100.0%	29,062	100.0%	100.0%	100.0%
Otter Tail County	15,238	100.0%	100.0%	100.0%	43,106	91.2%	100.0%	91.2%
Pennington County	8,935	99.2%	100.0%	99.2%	5,301	80.1%	99.6%	79.8%
Pine County	3,081	96.3%	100.0%	96.3%	26,117	45.1%	100.0%	45.1%
Pipestone County	3,724	100.0%	100.0%	100.0%	5,363	96.5%	100.0%	96.5%
Polk County	16,057	96.5%	100.0%	96.5%	15,562	93.0%	100.0%	93.0%
Pope County	.	.	.	.	10,970	69.5%	100.0%	69.5%
Ramsey County	546,751	98.7%	100.0%	98.7%	1,159	97.6%	100.0%	97.6%
Red Lake County	.	.	.	.	4,029	100.0%	100.0%	100.0%
Redwood County	4,325	98.4%	100.0%	98.4%	10,947	99.7%	100.0%	99.7%
Renville County	.	.	.	.	14,645	98.9%	100.0%	98.9%
Rice County	48,225	100.0%	100.0%	100.0%	17,736	98.7%	100.0%	98.7%
Rock County	4,394	99.4%	100.0%	99.4%	5,096	100.0%	100.0%	100.0%
Roseau County	2,508	100.0%	100.0%	100.0%	12,819	52.7%	99.7%	52.7%
Scott County	118,732	98.7%	100.0%	98.7%	27,056	86.1%	100.0%	86.1%
Sherburne County	52,054	98.9%	100.0%	98.9%	42,508	76.9%	100.0%	76.9%
Sibley County	.	.	.	.	14,868	99.7%	100.0%	99.7%
St. Louis County	125,413	99.0%	100.0%	99.0%	74,587	65.4%	99.6%	65.4%
Stearns County	97,394	99.8%	100.0%	99.8%	60,415	74.4%	100.0%	74.4%
Steele County	25,339	100.0%	100.0%	100.0%	11,548	100.0%	100.0%	100.0%
Stevens County	4,975	99.7%	100.0%	99.7%	4,659	96.2%	100.0%	96.2%
Swift County	2,918	100.0%	100.0%	100.0%	6,489	99.5%	100.0%	99.5%
Todd County	4,861	100.0%	100.0%	100.0%	19,649	53.6%	100.0%	53.6%
Traverse County	.	.	.	.	3,319	63.2%	100.0%	63.2%
Wabasha County	7,501	100.0%	100.0%	100.0%	14,105	100.0%	99.0%	99.0%
Wadena County	4,396	96.5%	100.0%	96.5%	9,273	87.9%	100.0%	87.9%
Waseca County	9,314	100.0%	100.0%	100.0%	9,473	100.0%	100.0%	100.0%

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Washington County	215,295	98.6%	100.0%	98.6%	41,041	91.0%	100.0%	91.0%
Watonwan County	4,314	100.0%	100.0%	100.0%	6,526	100.0%	100.0%	100.0%
Wilkin County	3,012	95.7%	100.0%	95.7%	3,312	72.0%	100.0%	72.0%
Winona County	33,337	100.0%	100.0%	100.0%	17,536	97.8%	97.8%	95.8%
Wright County	88,552	99.5%	100.0%	99.5%	45,726	71.2%	100.0%	71.2%
Yellow Medicine County	1,660	100.0%	100.0%	100.0%	8,207	99.9%	100.0%	99.9%
Mississippi	**1,469,332**	**97.0%**	**100.0%**	**97.0%**	**1,514,738**	**62.6%**	**99.8%**	**62.6%**
Adams County	19,698	99.3%	100.0%	99.3%	11,305	63.6%	100.0%	63.6%
Alcorn County	12,524	100.0%	100.0%	100.0%	24,686	100.0%	100.0%	100.0%
Amite County	.	.	.	.	12,447	22.5%	99.9%	22.5%
Attala County	5,986	98.3%	100.0%	98.3%	12,491	29.7%	100.0%	29.7%
Benton County	.	.	.	.	8,312	92.4%	100.0%	92.4%
Bolivar County	13,875	98.0%	100.0%	98.0%	18,070	65.8%	100.0%	65.8%
Calhoun County	.	.	.	.	14,492	76.3%	100.0%	76.3%
Carroll County	.	.	.	.	10,139	34.9%	99.9%	34.9%
Chickasaw County	2,534	99.5%	100.0%	99.5%	14,612	48.4%	100.0%	48.4%
Choctaw County	.	.	.	.	8,277	26.9%	100.0%	26.9%
Claiborne County	.	.	.	.	8,950	51.6%	98.1%	51.6%
Clarke County	.	.	.	.	15,828	60.4%	91.8%	60.3%
Clay County	8,527	99.3%	100.0%	99.3%	11,113	41.1%	99.9%	41.1%
Coahoma County	15,737	97.7%	100.0%	97.7%	7,417	28.4%	100.0%	28.4%
Copiah County	9,500	80.7%	100.0%	80.7%	19,016	39.6%	99.8%	39.6%
Covington County	.	.	.	.	19,079	22.6%	99.5%	22.6%
DeSoto County	139,816	98.7%	100.0%	98.7%	38,925	85.9%	100.0%	85.9%
Forrest County	52,507	96.4%	100.0%	96.4%	22,964	71.9%	100.0%	71.9%
Franklin County	.	.	.	.	7,765	27.6%	99.6%	27.6%
George County	2,718	99.4%	100.0%	99.4%	21,374	74.2%	100.0%	74.2%
Greene County	.	.	.	.	13,345	22.8%	100.0%	22.8%
Grenada County	10,048	99.3%	100.0%	99.3%	11,039	70.1%	100.0%	70.1%
Hancock County	26,437	95.8%	100.0%	95.8%	20,616	69.6%	100.0%	69.6%
Harrison County	156,718	97.0%	100.0%	97.0%	48,306	91.3%	100.0%	91.3%
Hinds County	201,773	97.5%	100.0%	97.5%	37,724	69.9%	100.0%	69.9%
Holmes County	2,160	99.7%	100.0%	99.7%	15,579	62.8%	99.7%	62.8%
Humphreys County	4,071	100.0%	100.0%	100.0%	4,271	73.0%	100.0%	73.0%
Issaquena County	.	.	.	.	1,339	1.6%	100.0%	1.6%

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Itawamba County	3,206	95.9%	100.0%	95.9%	20,302	75.2%	100.0%	75.2%
Jackson County	103,313	98.2%	100.0%	98.2%	38,836	90.8%	100.0%	90.8%
Jasper County	.	.	.	.	16,582	60.3%	100.0%	60.3%
Jefferson County	.	.	.	.	7,262	54.5%	99.5%	54.5%
Jefferson Davis County	.	.	.	.	11,314	51.6%	99.6%	51.6%
Jones County	25,716	94.8%	100.0%	94.8%	42,214	67.4%	100.0%	67.4%
Kemper County	.	.	.	.	9,883	11.6%	99.7%	11.6%
Lafayette County	27,905	94.9%	100.0%	94.9%	26,469	71.7%	100.0%	71.7%
Lamar County	29,294	99.1%	100.0%	99.1%	32,078	54.7%	100.0%	54.7%
Lauderdale County	38,612	96.1%	100.0%	96.1%	37,543	83.1%	99.9%	83.1%
Lawrence County	.	.	.	.	12,643	4.1%	100.0%	4.1%
Leake County	4,046	90.3%	100.0%	90.3%	18,669	39.1%	100.0%	39.1%
Lee County	45,822	98.7%	100.0%	98.7%	39,111	93.6%	100.0%	93.6%
Leflore County	23,827	99.8%	100.0%	99.8%	5,396	43.9%	100.0%	43.9%
Lincoln County	10,406	98.8%	100.0%	98.8%	23,941	51.2%	100.0%	51.2%
Lowndes County	33,884	97.9%	100.0%	97.9%	25,302	75.8%	100.0%	75.8%
Madison County	72,553	96.9%	100.0%	96.9%	32,065	82.6%	100.0%	82.6%
Marion County	6,561	100.0%	100.0%	100.0%	18,508	41.4%	99.6%	41.4%
Marshall County	5,726	81.7%	100.0%	81.7%	29,893	65.4%	100.0%	65.4%
Monroe County	10,596	98.7%	100.0%	98.7%	25,276	52.9%	99.9%	52.9%
Montgomery County	3,919	99.1%	100.0%	99.1%	6,254	66.2%	99.6%	66.2%
Neshoba County	7,663	98.2%	100.0%	98.2%	21,706	49.7%	100.0%	49.7%
Newton County	2,790	95.4%	100.0%	95.4%	18,395	34.8%	99.8%	34.8%
Noxubee County	2,786	76.3%	100.0%	76.3%	7,956	32.4%	100.0%	32.4%
Oktibbeha County	30,922	88.8%	100.0%	88.8%	18,877	61.8%	100.0%	61.8%
Panola County	7,000	96.0%	100.0%	96.0%	26,994	64.9%	100.0%	64.9%
Pearl River County	16,554	99.7%	100.0%	99.7%	38,716	75.0%	100.0%	75.0%
Perry County	.	.	.	.	12,032	23.4%	97.2%	23.4%
Pike County	15,878	98.2%	100.0%	98.2%	23,590	54.0%	100.0%	54.0%
Pontotoc County	4,943	98.7%	100.0%	98.7%	26,697	51.7%	100.0%	51.7%
Prentiss County	5,988	100.0%	100.0%	100.0%	19,273	100.0%	100.0%	100.0%
Quitman County	3,107	96.6%	100.0%	96.6%	4,162	34.9%	100.0%	34.9%
Rankin County	98,509	96.8%	100.0%	96.8%	53,568	86.3%	100.0%	86.3%
Scott County	7,743	98.4%	100.0%	98.4%	20,677	33.2%	99.9%	33.2%
Sharkey County	.	.	.	.	4,435	42.6%	100.0%	42.6%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Simpson County	3,737	89.7%	100.0%	89.7%	23,210	47.3%	100.0%	47.3%
Smith County	.	.	.	.	16,078	16.3%	98.6%	16.3%
Stone County	3,793	97.1%	100.0%	97.1%	14,319	60.1%	100.0%	60.1%
Sunflower County	14,681	99.5%	100.0%	99.5%	11,300	43.6%	100.0%	43.6%
Tallahatchie County	2,498	98.7%	100.0%	98.7%	11,627	42.8%	100.0%	42.8%
Tate County	6,346	90.3%	100.0%	90.3%	22,090	65.0%	100.0%	65.0%
Tippah County	3,531	29.5%	100.0%	29.5%	18,438	72.4%	99.4%	71.8%
Tishomingo County	.	.	.	.	19,542	97.6%	100.0%	97.6%
Tunica County	3,483	93.9%	100.0%	93.9%	6,541	51.5%	100.0%	51.5%
Union County	6,866	95.8%	100.0%	95.8%	21,689	75.7%	100.0%	75.7%
Walthall County	.	.	.	.	14,499	24.9%	99.8%	24.9%
Warren County	27,850	96.3%	100.0%	96.3%	18,918	91.2%	99.4%	91.2%
Washington County	37,275	99.9%	100.0%	99.9%	8,946	59.3%	100.0%	59.3%
Wayne County	4,132	99.7%	100.0%	99.7%	16,314	50.6%	96.9%	50.3%
Webster County	.	.	.	.	9,765	46.1%	99.9%	46.1%
Wilkinson County	.	.	.	.	8,804	36.4%	99.0%	36.4%
Winston County	4,214	99.6%	100.0%	99.6%	14,032	55.7%	99.9%	55.7%
Yalobusha County	2,520	98.2%	100.0%	98.2%	9,977	57.0%	99.8%	57.0%
Yazoo County	14,508	97.4%	100.0%	97.4%	12,549	24.1%	99.5%	24.1%
Missouri	**4,285,707**	**98.8%**	**100.0%**	**98.8%**	**1,827,643**	**65.1%**	**99.5%**	**64.9%**
Adair County	15,680	93.9%	100.0%	93.9%	9,697	58.5%	98.8%	58.5%
Andrew County	6,664	100.0%	100.0%	100.0%	10,890	80.5%	100.0%	80.5%
Atchison County	.	.	.	.	5,275	76.2%	100.0%	76.2%
Audrain County	14,644	88.7%	100.0%	88.7%	10,997	39.2%	99.9%	39.2%
Barry County	9,502	100.0%	100.0%	100.0%	26,166	100.0%	100.0%	100.0%
Barton County	3,358	92.2%	100.0%	92.2%	8,492	65.2%	100.0%	65.2%
Bates County	3,414	97.1%	100.0%	97.1%	12,920	39.5%	100.0%	39.5%
Benton County	2,561	26.2%	100.0%	26.2%	16,509	38.6%	99.8%	38.6%
Bollinger County	.	.	.	.	12,302	21.2%	100.0%	21.2%
Boone County	139,615	96.9%	100.0%	96.9%	38,654	77.7%	100.0%	77.7%
Buchanan County	76,853	99.9%	100.0%	99.9%	12,212	59.6%	100.0%	59.6%
Butler County	20,372	98.7%	100.0%	98.7%	22,294	40.8%	100.0%	40.8%
Caldwell County	.	.	.	.	9,099	42.2%	100.0%	42.2%
Callaway County	16,871	98.8%	100.0%	98.8%	28,161	91.9%	100.0%	91.9%
Camden County	11,617	99.9%	100.0%	99.9%	34,013	91.6%	98.9%	91.2%

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Cape Girardeau County	53,456	99.8%	100.0%	99.8%	24,705	54.5%	100.0%	54.5%
Carroll County	3,050	97.4%	100.0%	97.4%	5,746	50.2%	100.0%	50.2%
Carter County	.	.	.	.	6,169	7.3%	99.7%	7.3%
Cass County	68,991	100.0%	100.0%	100.0%	34,730	100.0%	100.0%	100.0%
Cedar County	3,406	99.9%	100.0%	99.9%	10,667	38.3%	100.0%	38.3%
Chariton County	.	.	.	.	7,480	39.2%	99.7%	39.1%
Christian County	45,129	100.0%	100.0%	100.0%	40,296	100.0%	99.5%	99.5%
Clark County	.	.	.	.	6,723	31.2%	99.9%	31.2%
Clay County	215,977	100.0%	100.0%	100.0%	26,879	100.0%	100.0%	100.0%
Clinton County	4,822	100.0%	100.0%	100.0%	15,732	59.1%	100.0%	59.1%
Cole County	54,145	98.9%	100.0%	98.9%	22,563	62.8%	100.0%	62.8%
Cooper County	8,170	100.0%	100.0%	100.0%	9,474	100.0%	100.0%	100.0%
Crawford County	6,541	100.0%	100.0%	100.0%	17,561	75.5%	97.4%	75.5%
Dade County	.	.	.	.	7,588	42.2%	100.0%	42.2%
Dallas County	2,841	100.0%	100.0%	100.0%	13,829	100.0%	99.4%	99.4%
Daviess County	.	.	.	.	8,357	54.3%	100.0%	54.3%
DeKalb County	4,659	69.1%	100.0%	69.1%	7,929	72.9%	100.0%	72.9%
Dent County	4,798	100.0%	100.0%	100.0%	10,679	34.6%	93.2%	34.6%
Douglas County	2,628	100.0%	100.0%	100.0%	10,672	100.0%	91.8%	91.8%
Dunklin County	14,667	99.5%	100.0%	99.5%	15,452	66.9%	100.0%	66.9%
Franklin County	45,372	98.5%	100.0%	98.5%	57,958	56.5%	99.7%	56.3%
Gasconade County	2,809	8.1%	100.0%	8.1%	11,917	31.3%	99.3%	31.3%
Gentry County	.	.	.	.	6,665	77.8%	100.0%	77.8%
Greene County	245,787	100.0%	100.0%	100.0%	44,014	100.0%	100.0%	100.0%
Grundy County	5,167	32.0%	100.0%	32.0%	4,782	45.3%	100.0%	45.3%
Harrison County	2,254	100.0%	100.0%	100.0%	6,270	44.0%	99.6%	44.0%
Henry County	10,673	76.9%	100.0%	76.9%	11,044	8.1%	100.0%	8.1%
Hickory County	.	.	.	.	9,475	10.5%	99.9%	10.5%
Holt County	.	.	.	.	4,413	33.7%	100.0%	33.7%
Howard County	3,505	47.0%	100.0%	47.0%	6,634	12.4%	100.0%	12.4%
Howell County	11,030	100.0%	100.0%	100.0%	29,073	27.5%	99.4%	27.5%
Iron County	2,604	99.2%	100.0%	99.2%	7,620	26.3%	96.5%	26.3%
Jackson County	670,087	100.0%	100.0%	100.0%	28,782	100.0%	100.0%	100.0%
Jasper County	89,795	99.6%	100.0%	99.6%	30,398	77.8%	100.0%	77.8%
Jefferson County	155,068	99.3%	100.0%	99.3%	68,742	80.1%	100.0%	80.1%
Johnson County	25,775	99.7%	100.0%	99.7%	28,122	20.2%	100.0%	20.2%

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Knox County	.	.	.	.	3,976	3.7%	99.7%	3.7%
Laclede County	13,873	100.0%	100.0%	100.0%	21,570	100.0%	99.9%	99.9%
Lafayette County	13,810	43.4%	100.0%	43.4%	18,831	17.3%	100.0%	17.3%
Lawrence County	15,576	100.0%	100.0%	100.0%	22,858	100.0%	100.0%	100.0%
Lewis County	.	.	.	.	9,967	29.6%	99.8%	29.4%
Lincoln County	13,642	99.9%	100.0%	99.9%	42,537	58.6%	100.0%	58.6%
Linn County	3,972	21.8%	100.0%	21.8%	8,221	73.9%	99.8%	73.9%
Livingston County	9,398	91.5%	100.0%	91.5%	5,775	42.0%	100.0%	42.0%
Macon County	4,654	100.0%	100.0%	100.0%	10,596	63.3%	97.8%	62.8%
Madison County	4,102	100.0%	100.0%	100.0%	8,141	34.6%	99.7%	34.6%
Maries County	.	.	.	.	8,867	31.9%	100.0%	31.9%
Marion County	21,425	100.0%	100.0%	100.0%	7,209	35.6%	98.7%	35.6%
McDonald County	3	0.0%	100.0%	0.0%	22,824	71.4%	100.0%	71.4%
Mercer County	.	.	.	.	3,678	51.3%	99.9%	51.2%
Miller County	5,031	99.7%	100.0%	99.7%	20,197	50.4%	100.0%	50.4%
Mississippi County	9,073	99.9%	100.0%	99.9%	4,513	62.2%	100.0%	62.2%
Moniteau County	7,463	100.0%	100.0%	100.0%	8,600	97.6%	100.0%	97.6%
Monroe County	.	.	.	.	8,612	52.6%	100.0%	52.6%
Montgomery County	2,191	100.0%	100.0%	100.0%	9,247	43.4%	99.8%	43.3%
Morgan County	.	.	.	.	20,145	95.9%	99.6%	95.5%
New Madrid County	7,243	99.6%	100.0%	99.6%	10,339	69.3%	100.0%	69.3%
Newton County	20,489	99.1%	100.0%	99.1%	37,801	74.8%	100.0%	74.8%
Nodaway County	12,327	100.0%	100.0%	100.0%	10,145	75.8%	100.0%	75.8%
Oregon County	2,063	84.0%	100.0%	84.0%	8,495	22.2%	88.3%	18.9%
Osage County	.	.	.	.	13,662	34.3%	99.8%	34.3%
Ozark County	.	.	.	.	9,186	10.2%	98.3%	10.2%
Pemiscot County	8,056	98.3%	100.0%	98.3%	8,770	53.1%	100.0%	53.1%
Perry County	8,386	99.2%	100.0%	99.2%	10,839	28.4%	99.9%	28.4%
Pettis County	26,241	95.4%	100.0%	95.4%	16,310	20.9%	100.0%	20.9%
Phelps County	23,789	100.0%	100.0%	100.0%	20,954	72.9%	99.7%	72.9%
Pike County	8,298	37.2%	100.0%	37.2%	10,269	27.2%	100.0%	27.2%
Platte County	82,589	99.2%	100.0%	99.2%	18,568	47.7%	100.0%	47.7%
Polk County	9,609	100.0%	100.0%	100.0%	22,175	100.0%	100.0%	100.0%
Pulaski County	28,609	99.3%	100.0%	99.3%	23,450	89.0%	99.8%	89.0%
Putnam County	.	.	.	.	4,811	71.3%	99.8%	71.1%

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Ralls County	404	98.0%	100.0%	98.0%	9,820	77.7%	100.0%	77.7%
Randolph County	13,330	100.0%	100.0%	100.0%	11,615	41.2%	99.5%	40.9%
Ray County	5,664	97.7%	100.0%	97.7%	17,190	51.3%	100.0%	51.3%
Reynolds County	.	.	.	.	6,275	24.5%	80.7%	23.3%
Ripley County	.	.	.	.	13,564	31.8%	95.6%	30.8%
Saline County	11,801	100.0%	100.0%	100.0%	10,859	14.3%	100.0%	14.3%
Schuyler County	.	.	.	.	4,508	0.3%	100.0%	0.3%
Scotland County	.	.	.	.	4,961	80.4%	99.6%	80.4%
Scott County	22,439	100.0%	100.0%	100.0%	16,102	70.1%	100.0%	70.1%
Shannon County	.	.	.	.	8,249	25.1%	90.4%	25.1%
Shelby County	.	.	.	.	6,021	37.3%	96.7%	37.2%
St. Charles County	366,866	99.7%	100.0%	99.7%	28,637	70.7%	100.0%	70.7%
St. Clair County	.	.	.	.	9,362	28.0%	99.9%	28.0%
St. Francois County	39,759	99.9%	100.0%	99.9%	26,946	67.5%	100.0%	67.5%
St. Louis County	985,139	99.8%	100.0%	99.8%	11,587	91.5%	100.0%	91.5%
St. Louis city	308,625	100.0%	100.0%	100.0%	1	100.0%	100.0%	100.0%
Ste. Genevieve County	4,220	100.0%	100.0%	100.0%	13,623	36.5%	100.0%	36.5%
Stoddard County	8,805	99.2%	100.0%	99.2%	20,564	56.5%	100.0%	56.5%
Stone County	3,441	100.0%	100.0%	100.0%	28,254	100.0%	100.0%	100.0%
Sullivan County	.	.	.	.	6,229	64.3%	100.0%	64.3%
Taney County	29,965	99.9%	100.0%	99.9%	25,390	95.3%	99.9%	95.2%
Texas County	205	100.0%	100.0%	100.0%	25,530	76.7%	96.2%	73.2%
Vernon County	8,023	100.0%	100.0%	100.0%	12,414	48.2%	100.0%	48.2%
Warren County	12,222	96.2%	100.0%	96.2%	22,144	66.9%	100.0%	66.9%
Washington County	4,809	11.2%	100.0%	11.2%	20,213	30.2%	99.7%	30.2%
Wayne County	.	.	.	.	13,296	30.0%	99.5%	30.0%
Webster County	9,635	100.0%	100.0%	100.0%	29,028	100.0%	99.9%	99.9%
Worth County	.	.	.	.	2,057	56.3%	99.8%	56.3%
Wright County	4,086	100.0%	100.0%	100.0%	14,245	100.0%	97.0%	97.0%
Montana	**570,026**	**97.5%**	**99.6%**	**97.2%**	**480,437**	**72.6%**	**95.1%**	**70.5%**
Beaverhead County	4,514	99.2%	100.0%	99.2%	4,920	39.0%	89.0%	38.3%
Big Horn County	3,464	100.0%	100.0%	100.0%	9,895	75.0%	88.1%	70.5%
Blaine County	.	.	.	.	6,708	96.3%	78.3%	75.6%
Broadwater County	.	.	.	.	5,934	28.9%	99.4%	28.9%

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Carbon County	.	.	.	.	10,696	95.6%	99.8%	95.5%
Carter County	.	.	.	.	1,222	47.8%	14.7%	6.8%
Cascade County	65,059	100.0%	100.0%	100.0%	16,594	98.0%	99.1%	97.7%
Chouteau County	.	.	.	.	5,765	98.2%	96.5%	94.7%
Custer County	9,321	100.0%	100.0%	100.0%	2,400	54.9%	81.5%	52.7%
Daniels County	.	.	.	.	1,737	98.4%	74.0%	73.5%
Dawson County	6,061	100.0%	100.0%	100.0%	2,889	57.0%	85.2%	45.3%
Deer Lodge County	6,138	99.3%	100.0%	99.3%	2,968	31.2%	96.0%	29.6%
Fallon County	.	.	.	.	3,009	61.1%	94.1%	59.8%
Fergus County	6,047	100.0%	100.0%	100.0%	5,244	58.9%	92.4%	51.8%
Flathead County	46,289	100.0%	100.0%	100.0%	53,706	82.3%	99.2%	82.3%
Gallatin County	65,755	100.0%	100.0%	100.0%	42,053	80.2%	98.7%	79.9%
Garfield County	.	.	.	.	1,293	43.3%	73.4%	35.2%
Glacier County	7,453	38.9%	100.0%	38.9%	6,187	9.5%	99.0%	9.5%
Golden Valley County	.	.	.	.	822	55.2%	99.5%	55.2%
Granite County	.	.	.	.	3,358	15.5%	95.2%	14.3%
Hill County	9,693	99.9%	100.0%	99.9%	6,770	90.6%	99.3%	90.0%
Jefferson County	.	.	.	.	11,891	80.8%	99.7%	80.6%
Judith Basin County	.	.	.	.	1,960	83.1%	96.5%	80.3%
Lake County	4,857	99.6%	100.0%	99.6%	25,414	59.6%	99.1%	59.2%
Lewis and Clark County	46,155	100.0%	100.0%	100.0%	21,618	97.7%	98.7%	97.0%
Liberty County	.	.	.	.	2,425	83.4%	85.6%	70.1%
Lincoln County	3,861	0.0%	100.0%	0.0%	15,579	28.2%	89.2%	26.3%
Madison County	.	.	.	.	8,174	83.3%	95.9%	80.0%
McCone County	.	.	.	.	1,718	45.6%	83.5%	43.9%
Meagher County	.	.	.	.	1,851	97.0%	93.9%	91.3%
Mineral County	.	.	.	.	4,255	18.2%	97.9%	18.2%
Missoula County	88,511	100.0%	100.0%	100.0%	28,921	72.7%	95.2%	72.1%
Musselshell County	.	.	.	.	4,639	50.2%	98.1%	49.2%
Park County	8,277	100.0%	100.0%	100.0%	8,075	97.6%	96.9%	96.4%
Petroleum County	.	.	.	.	523	39.6%	89.3%	39.4%
Phillips County	.	.	.	.	4,119	82.2%	92.8%	80.4%
Pondera County	2,388	0.1%	100.0%	0.1%	3,572	32.4%	99.5%	32.3%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Powder River County	.	.	.	.	1,752	36.6%	60.6%	28.3%
Powell County	3,164	99.8%	100.0%	99.8%	3,631	14.2%	93.3%	14.1%
Prairie County	.	.	.	.	1,109	62.2%	95.9%	61.2%
Ravalli County	6,329	100.0%	100.0%	100.0%	36,232	96.5%	96.9%	95.1%
Richland County	5,063	100.0%	100.0%	100.0%	5,976	58.8%	85.7%	53.4%
Roosevelt County	6,171	81.1%	59.4%	57.4%	4,927	58.4%	82.9%	49.5%
Rosebud County	.	.	.	.	9,248	43.6%	73.0%	32.1%
Sanders County	.	.	.	.	11,711	14.4%	92.6%	13.0%
Sheridan County	.	.	.	.	3,469	83.9%	80.3%	67.9%
Silver Bow County	30,128	98.8%	100.0%	98.8%	4,473	34.8%	98.9%	34.8%
Stillwater County	.	.	.	.	9,419	94.1%	97.3%	92.2%
Sweet Grass County	.	.	.	.	3,691	92.7%	98.5%	91.8%
Teton County	.	.	.	.	6,085	32.8%	99.1%	32.7%
Toole County	2,862	38.8%	100.0%	38.8%	2,024	14.8%	95.3%	14.8%
Treasure County	.	.	.	.	679	53.3%	97.6%	53.3%
Valley County	3,202	98.4%	100.0%	98.4%	4,231	66.4%	79.1%	52.7%
Wheatland County	.	.	.	.	2,140	81.8%	99.8%	81.8%
Wibaux County	.	.	.	.	1,020	8.5%	73.5%	5.8%
Yellowstone County	129,264	100.0%	100.0%	100.0%	29,716	97.1%	99.9%	97.0%
Nebraska	**1,406,401**	**97.9%**	**100.0%**	**97.9%**	**513,504**	**58.0%**	**99.6%**	**57.9%**
Adams County	24,242	100.0%	100.0%	100.0%	7,436	64.6%	99.8%	64.6%
Antelope County	.	.	.	.	6,361	55.7%	99.9%	55.7%
Arthur County	.	.	.	.	457	72.4%	97.8%	70.2%
Banner County	.	.	.	.	742	19.0%	99.7%	19.0%
Blaine County	.	.	.	.	482	35.3%	94.6%	31.3%
Boone County	.	.	.	.	5,352	54.0%	100.0%	54.0%
Box Butte County	8,096	100.0%	100.0%	100.0%	2,790	88.1%	100.0%	88.1%
Boyd County	.	.	.	.	1,977	99.2%	99.4%	98.6%
Brown County	.	.	.	.	3,014	80.2%	97.1%	79.1%
Buffalo County	32,233	100.0%	100.0%	100.0%	17,493	75.2%	99.9%	75.2%
Burt County	.	.	.	.	6,535	74.8%	100.0%	74.8%
Butler County	2,601	100.0%	100.0%	100.0%	5,452	44.8%	100.0%	44.8%
Cass County	6,880	98.7%	100.0%	98.7%	19,007	64.5%	100.0%	64.5%
Cedar County	.	.	.	.	8,530	68.4%	100.0%	68.4%
Chase County	.	.	.	.	3,971	83.9%	100.0%	83.9%

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Cherry County	2,691	99.6%	100.0%	99.6%	3,127	29.0%	85.4%	24.8%
Cheyenne County	5,911	100.0%	100.0%	100.0%	3,765	79.6%	100.0%	79.6%
Clay County	.	.	.	.	6,204	61.9%	99.8%	61.9%
Colfax County	6,059	34.9%	100.0%	34.9%	4,523	61.5%	99.8%	61.4%
Cuming County	3,001	99.2%	100.0%	99.2%	6,041	48.3%	100.0%	48.3%
Custer County	3,438	95.3%	100.0%	95.3%	7,459	16.0%	99.6%	15.9%
Dakota County	15,726	94.5%	100.0%	94.5%	4,460	76.4%	100.0%	76.4%
Dawes County	5,277	86.7%	100.0%	86.7%	3,613	71.5%	100.0%	71.5%
Dawson County	17,269	100.0%	100.0%	100.0%	6,440	33.9%	99.5%	33.9%
Deuel County	.	.	.	.	1,883	2.3%	100.0%	2.3%
Dixon County	.	.	.	.	5,754	86.0%	100.0%	86.0%
Dodge County	27,206	98.9%	100.0%	98.9%	9,501	67.4%	100.0%	67.4%
Douglas County	546,377	98.4%	100.0%	98.4%	15,166	71.5%	100.0%	71.5%
Dundy County	.	.	.	.	1,801	78.6%	99.4%	78.3%
Fillmore County	.	.	.	.	5,582	60.7%	99.9%	60.7%
Franklin County	.	.	.	.	2,990	46.9%	99.2%	46.5%
Frontier County	.	.	.	.	2,631	10.7%	98.5%	10.4%
Furnas County	.	.	.	.	4,780	25.3%	100.0%	25.3%
Gage County	11,461	100.0%	100.0%	100.0%	10,140	38.5%	100.0%	38.5%
Garden County	.	.	.	.	1,906	85.5%	98.0%	85.5%
Garfield County	.	.	.	.	2,016	0.6%	98.8%	0.6%
Gosper County	.	.	.	.	2,026	13.0%	100.0%	13.0%
Grant County	.	.	.	.	649	25.4%	99.5%	25.1%
Greeley County	.	.	.	.	2,374	18.7%	99.8%	18.7%
Hall County	51,221	99.8%	100.0%	99.8%	10,297	43.7%	100.0%	43.7%
Hamilton County	4,417	0.0%	100.0%	0.0%	4,790	18.3%	99.8%	18.3%
Harlan County	.	.	.	.	3,443	2.6%	98.9%	2.5%
Hayes County	.	.	.	.	893	33.0%	99.8%	32.8%
Hitchcock County	.	.	.	.	2,834	67.2%	100.0%	67.2%
Holt County	3,470	100.0%	100.0%	100.0%	6,732	38.4%	99.0%	38.0%
Hooker County	.	.	.	.	674	21.1%	97.8%	19.1%
Howard County	.	.	.	.	6,437	43.8%	100.0%	43.8%
Jefferson County	3,550	100.0%	100.0%	100.0%	3,628	28.1%	95.2%	27.6%
Johnson County	.	.	.	.	5,184	48.6%	100.0%	48.6%
Kearney County	2,913	99.9%	100.0%	99.9%	3,617	76.3%	100.0%	76.3%
Keith County	4,287	100.0%	100.0%	100.0%	3,785	58.2%	99.9%	58.1%

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Keya Paha County	.	.	.	.	793	96.8%	94.3%	91.9%
Kimball County	.	.	.	.	3,619	94.4%	99.9%	94.4%
Knox County	.	.	.	.	8,472	62.8%	99.5%	62.6%
Lancaster County	281,281	99.6%	100.0%	99.6%	33,047	57.7%	100.0%	57.7%
Lincoln County	24,465	100.0%	100.0%	100.0%	10,815	53.3%	99.7%	53.2%
Logan County	.	.	.	.	768	43.2%	100.0%	43.2%
Loup County	.	.	.	.	609	3.3%	98.2%	1.5%
Madison County	25,121	98.8%	100.0%	98.8%	10,019	67.2%	100.0%	67.2%
McPherson County	.	.	.	.	499	43.3%	94.6%	43.3%
Merrick County	3,104	86.3%	100.0%	86.3%	4,776	38.5%	100.0%	38.5%
Morrill County	.	.	.	.	4,836	80.9%	99.5%	80.9%
Nance County	.	.	.	.	3,606	48.1%	99.8%	48.1%
Nemaha County	3,280	99.9%	100.0%	99.9%	3,669	49.7%	99.5%	49.4%
Nuckolls County	.	.	.	.	4,274	54.7%	100.0%	54.7%
Otoe County	7,088	99.9%	100.0%	99.9%	8,939	50.9%	99.8%	50.8%
Pawnee County	.	.	.	.	2,641	54.4%	100.0%	54.4%
Perkins County	.	.	.	.	2,901	63.0%	99.4%	63.0%
Phelps County	5,215	99.8%	100.0%	99.8%	3,845	56.1%	100.0%	56.1%
Pierce County	.	.	.	.	7,138	72.7%	100.0%	72.7%
Platte County	22,371	99.3%	100.0%	99.3%	10,801	36.6%	99.8%	36.6%
Polk County	.	.	.	.	5,321	51.5%	100.0%	51.5%
Red Willow County	7,307	98.7%	100.0%	98.7%	3,421	67.0%	99.6%	66.6%
Richardson County	3,858	100.0%	100.0%	100.0%	4,111	84.5%	99.7%	84.2%
Rock County	.	.	.	.	1,436	77.4%	95.8%	74.8%
Saline County	6,855	100.0%	100.0%	100.0%	7,578	58.6%	98.9%	58.4%
Sarpy County	167,898	95.8%	100.0%	95.8%	13,532	78.8%	100.0%	78.8%
Saunders County	6,976	99.9%	100.0%	99.9%	14,080	60.7%	100.0%	60.7%
Scotts Bluff County	25,216	100.0%	100.0%	100.0%	11,147	95.0%	100.0%	94.9%
Seward County	6,582	99.9%	100.0%	99.9%	10,579	56.6%	100.0%	56.6%
Sheridan County	.	.	.	.	5,289	61.1%	97.3%	60.9%
Sherman County	.	.	.	.	3,085	51.4%	100.0%	51.4%
Sioux County	.	.	.	.	1,203	76.6%	97.4%	74.8%
Stanton County	1,456	87.7%	100.0%	87.7%	4,530	81.5%	100.0%	81.5%
Thayer County	.	.	.	.	5,045	66.9%	99.9%	66.9%
Thomas County	.	.	.	.	725	32.7%	99.7%	32.7%
Thurston County	.	.	.	.	7,222	44.7%	100.0%	44.7%

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Valley County	.	.	.	.	4,209	52.1%	99.9%	52.1%
Washington County	7,873	93.8%	100.0%	93.8%	12,847	53.9%	99.9%	53.9%
Wayne County	4,665	99.9%	100.0%	99.9%	4,653	42.8%	100.0%	42.8%
Webster County	.	.	.	.	3,524	72.4%	99.7%	72.2%
Wheeler County	.	.	.	.	814	52.0%	99.6%	51.7%
York County	7,464	100.0%	100.0%	100.0%	6,342	57.8%	99.9%	57.8%
Nevada	**2,790,285**	**96.1%**	**100.0%**	**96.1%**	**207,733**	**46.5%**	**96.3%**	**44.9%**
Carson City	51,957	99.7%	100.0%	99.7%	2,788	92.0%	100.0%	92.0%
Churchill County	15,382	99.8%	100.0%	99.8%	8,848	70.2%	98.3%	70.2%
Clark County	2,147,749	97.0%	100.0%	97.0%	56,317	38.8%	99.6%	38.8%
Douglas County	32,533	99.9%	100.0%	99.9%	15,776	82.7%	100.0%	82.7%
Elko County	29,815	13.8%	100.0%	13.8%	22,834	1.7%	95.6%	1.7%
Esmeralda County	.	.	.	.	850	72.1%	99.6%	71.8%
Eureka County	.	.	.	.	1,961	28.3%	97.9%	28.3%
Humboldt County	9,873	0.0%	100.0%	0.0%	6,953	2.7%	96.7%	2.7%
Lander County	3,406	0.0%	100.0%	0.0%	2,287	12.7%	92.5%	11.6%
Lincoln County	.	.	.	.	5,223	79.4%	25.5%	19.2%
Lyon County	32,665	89.3%	100.0%	89.3%	21,455	48.4%	99.9%	48.4%
Mineral County	3,124	100.0%	100.0%	100.0%	1,333	40.8%	99.9%	40.8%
Nye County	28,127	98.7%	100.0%	98.7%	16,075	79.0%	97.1%	78.8%
Pershing County	.	.	.	.	6,508	27.0%	98.9%	27.0%
Storey County	287	100.0%	100.0%	100.0%	3,719	68.4%	100.0%	68.4%
Washoe County	430,858	99.7%	100.0%	99.7%	29,723	61.3%	95.9%	61.3%
White Pine County	4,509	88.7%	100.0%	88.7%	5,083	10.1%	97.4%	10.1%
New Hampshire	**809,520**	**98.3%**	**100.0%**	**98.3%**	**533,257**	**89.1%**	**99.8%**	**89.0%**
Belknap County	20,384	97.0%	100.0%	97.0%	40,401	97.3%	100.0%	97.3%
Carroll County	4,647	100.0%	100.0%	100.0%	43,415	94.8%	100.0%	94.8%
Cheshire County	26,284	99.0%	100.0%	99.0%	49,676	55.5%	100.0%	55.5%
Coos County	10,214	100.0%	100.0%	100.0%	21,420	62.1%	95.5%	60.3%
Grafton County	27,436	95.1%	100.0%	95.1%	61,949	87.9%	99.4%	87.4%
Hillsborough County	321,398	98.6%	100.0%	98.6%	88,296	93.9%	100.0%	93.9%
Merrimack County	67,251	97.4%	100.0%	97.4%	81,962	96.0%	100.0%	96.0%
Rockingham County	230,161	99.1%	100.0%	99.1%	76,193	98.9%	100.0%	98.9%
Strafford County	86,440	97.4%	100.0%	97.4%	42,173	97.9%	100.0%	97.9%
Sullivan County	15,305	96.1%	100.0%	96.1%	27,772	75.8%	100.0%	75.8%

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New Jersey	**8,539,312**	**100.0%**	**100.0%**	**100.0%**	**466,098**	**100.0%**	**100.0%**	**100.0%**
Atlantic County	234,920	100.0%	100.0%	100.0%	34,998	100.0%	100.0%	100.0%
Bergen County	947,330	100.0%	100.0%	100.0%	1,065	100.0%	100.0%	100.0%
Burlington County	418,492	100.0%	100.0%	100.0%	30,104	100.0%	100.0%	100.0%
Camden County	502,569	100.0%	100.0%	100.0%	8,150	100.0%	100.0%	100.0%
Cape May County	77,231	100.0%	100.0%	100.0%	16,322	100.0%	100.0%	100.0%
Cumberland County	118,994	100.0%	100.0%	100.0%	33,544	100.0%	100.0%	100.0%
Essex County	808,127	100.0%	100.0%	100.0%	134	100.0%	100.0%	100.0%
Gloucester County	267,751	100.0%	100.0%	100.0%	24,454	100.0%	100.0%	100.0%
Hudson County	691,606	100.0%	100.0%	100.0%	.	.	.	.
Hunterdon County	62,731	100.0%	100.0%	100.0%	62,328	100.0%	100.0%	100.0%
Mercer County	361,354	100.0%	100.0%	100.0%	13,358	100.0%	100.0%	100.0%
Middlesex County	836,803	100.0%	100.0%	100.0%	5,959	100.0%	100.0%	100.0%
Monmouth County	602,792	100.0%	100.0%	100.0%	23,558	100.0%	100.0%	100.0%
Morris County	465,541	100.0%	100.0%	100.0%	34,151	100.0%	100.0%	100.0%
Ocean County	580,057	100.0%	100.0%	100.0%	17,878	100.0%	100.0%	100.0%
Passaic County	499,740	100.0%	100.0%	100.0%	12,850	100.0%	100.0%	100.0%
Salem County	33,879	100.0%	100.0%	100.0%	28,913	100.0%	100.0%	100.0%
Somerset County	315,179	100.0%	100.0%	100.0%	20,232	100.0%	100.0%	100.0%
Sussex County	84,367	100.0%	100.0%	100.0%	57,315	100.0%	100.0%	100.0%
Union County	563,836	100.0%	100.0%	100.0%	.	.	.	.
Warren County	66,013	100.0%	100.0%	100.0%	40,785	100.0%	100.0%	100.0%
New Mexico	**1,586,350**	**94.8%**	**100.0%**	**94.8%**	**501,710**	**47.3%**	**98.0%**	**47.1%**
Bernalillo County	644,884	99.7%	100.0%	99.7%	31,889	78.5%	99.9%	78.5%
Catron County	.	.	.	.	3,587	0.0%	65.9%	0.0%
Chaves County	48,837	98.5%	100.0%	98.5%	16,029	46.8%	99.9%	46.8%
Cibola County	11,364	3.8%	100.0%	3.8%	15,489	21.0%	96.3%	21.0%
Colfax County	5,926	15.8%	100.0%	15.8%	6,248	4.1%	100.0%	4.1%
Curry County	41,765	99.0%	100.0%	99.0%	8,047	60.9%	100.0%	60.9%
De Baca County	.	.	.	.	1,829	64.9%	100.0%	64.9%
Dona Ana County	170,173	92.2%	100.0%	92.2%	45,405	57.5%	100.0%	57.5%
Eddy County	42,695	97.5%	100.0%	97.5%	14,302	47.4%	99.5%	47.4%
Grant County	15,948	96.8%	100.0%	96.8%	11,739	51.5%	98.9%	51.5%
Guadalupe County	1,904	98.0%	100.0%	98.0%	2,525	18.0%	100.0%	18.0%
Harding County	.	.	.	.	692	47.3%	100.0%	47.3%

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Hidalgo County	.	.	.	.	4,305	3.0%	97.7%	2.4%
Lea County	50,913	97.5%	100.0%	97.5%	17,846	50.0%	100.0%	50.0%
Lincoln County	8,841	92.8%	100.0%	92.8%	10,554	66.6%	100.0%	66.6%
Los Alamos County	16,350	100.0%	100.0%	100.0%	2,388	96.7%	100.0%	96.7%
Luna County	13,624	91.9%	100.0%	91.9%	10,454	23.7%	99.9%	23.6%
McKinley County	26,427	81.4%	100.0%	81.4%	46,137	10.8%	98.1%	10.8%
Mora County	.	.	.	.	4,551	30.3%	97.6%	30.3%
Otero County	44,846	87.7%	100.0%	87.7%	20,969	59.4%	94.2%	59.0%
Quay County	5,022	45.6%	100.0%	45.6%	3,284	39.0%	100.0%	39.0%
Rio Arriba County	19,491	99.7%	100.0%	99.7%	19,668	66.6%	95.7%	64.7%
Roosevelt County	11,149	98.3%	100.0%	98.3%	7,698	40.9%	100.0%	40.9%
San Juan County	77,059	88.2%	100.0%	88.2%	49,861	31.3%	99.5%	31.3%
San Miguel County	14,647	63.1%	100.0%	63.1%	13,101	30.4%	97.5%	30.4%
Sandoval County	112,596	97.7%	100.0%	97.7%	29,910	56.4%	99.6%	56.2%
Santa Fe County	109,603	100.0%	100.0%	100.0%	39,147	90.4%	100.0%	90.4%
Sierra County	7,477	93.6%	100.0%	93.6%	3,639	45.5%	94.4%	41.9%
Socorro County	8,106	4.2%	100.0%	4.2%	8,692	0.2%	85.0%	0.2%
Taos County	13,476	86.0%	100.0%	86.0%	19,319	37.7%	86.1%	36.9%
Torrance County	200	100.0%	100.0%	100.0%	15,306	44.7%	100.0%	44.7%
Union County	.	.	.	.	4,187	71.5%	99.7%	71.5%
Valencia County	63,027	92.0%	100.0%	92.0%	12,913	57.8%	100.0%	57.8%
New York	**17,494,694**	**100.0%**	**100.0%**	**100.0%**	**2,354,484**	**100.0%**	**99.4%**	**99.4%**
Albany County	278,968	100.0%	100.0%	100.0%	30,644	100.0%	99.8%	99.8%
Allegany County	8,986	100.0%	100.0%	100.0%	37,908	100.0%	99.9%	99.9%
Bronx County	1,471,098	100.0%	100.0%	100.0%	42	100.0%	100.0%	100.0%
Broome County	141,477	100.0%	100.0%	100.0%	52,162	100.0%	99.9%	99.9%
Cattaraugus County	28,715	100.0%	100.0%	100.0%	48,633	100.0%	99.9%	99.9%
Cayuga County	33,893	100.0%	100.0%	100.0%	43,710	100.0%	100.0%	100.0%
Chautauqua County	71,107	100.0%	100.0%	100.0%	57,939	100.0%	100.0%	100.0%
Chemung County	63,947	100.0%	100.0%	100.0%	21,610	100.0%	97.7%	97.7%
Chenango County	7,447	100.0%	100.0%	100.0%	40,416	100.0%	95.9%	95.9%
Clinton County	28,863	100.0%	100.0%	100.0%	52,117	100.0%	99.0%	99.0%
Columbia County	15,366	100.0%	100.0%	100.0%	45,238	100.0%	100.0%	100.0%
Cortland County	26,019	100.0%	100.0%	100.0%	21,767	100.0%	99.8%	99.8%
Delaware County	8,402	100.0%	100.0%	100.0%	36,599	100.0%	97.9%	97.9%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Dutchess County	219,459	100.0%	100.0%	100.0%	76,109	100.0%	100.0%	100.0%
Erie County	837,493	100.0%	100.0%	100.0%	88,032	100.0%	100.0%	100.0%
Essex County	9,405	100.0%	100.0%	100.0%	28,551	100.0%	95.9%	95.9%
Franklin County	18,153	100.0%	100.0%	100.0%	32,962	100.0%	97.3%	97.3%
Fulton County	26,838	100.0%	100.0%	100.0%	27,039	100.0%	98.4%	98.4%
Genesee County	22,225	100.0%	100.0%	100.0%	35,731	100.0%	100.0%	100.0%
Greene County	11,839	100.0%	100.0%	100.0%	35,631	100.0%	99.3%	99.3%
Hamilton County	.	.	.	.	4,485	100.0%	89.9%	89.9%
Herkimer County	29,008	100.0%	100.0%	100.0%	33,232	100.0%	98.8%	98.8%
Jefferson County	56,003	100.0%	100.0%	100.0%	58,182	100.0%	100.0%	100.0%
Kings County	2,648,578	100.0%	100.0%	100.0%	124	100.0%	100.0%	100.0%
Lewis County	3,257	100.0%	100.0%	100.0%	23,294	100.0%	98.3%	98.3%
Livingston County	28,490	100.0%	100.0%	100.0%	35,309	100.0%	100.0%	100.0%
Madison County	28,649	100.0%	100.0%	100.0%	42,316	100.0%	100.0%	100.0%
Monroe County	698,951	100.0%	100.0%	100.0%	48,691	100.0%	100.0%	100.0%
Montgomery County	28,739	100.0%	100.0%	100.0%	20,519	100.0%	100.0%	100.0%
Nassau County	1,366,764	100.0%	100.0%	100.0%	2,745	100.0%	100.0%	100.0%
New York County	1,664,727	100.0%	100.0%	100.0%	.	.	.	.
Niagara County	163,355	100.0%	100.0%	100.0%	47,973	100.0%	100.0%	100.0%
Oneida County	153,950	100.0%	100.0%	100.0%	77,381	100.0%	100.0%	100.0%
Onondaga County	406,245	100.0%	100.0%	100.0%	59,153	100.0%	100.0%	100.0%
Ontario County	57,449	100.0%	100.0%	100.0%	52,448	100.0%	100.0%	100.0%
Orange County	295,146	100.0%	100.0%	100.0%	87,078	100.0%	100.0%	100.0%
Orleans County	15,262	100.0%	100.0%	100.0%	25,721	100.0%	100.0%	100.0%
Oswego County	43,376	100.0%	100.0%	100.0%	75,102	100.0%	100.0%	100.0%
Otsego County	16,346	100.0%	100.0%	100.0%	43,748	100.0%	99.5%	99.5%
Putnam County	78,774	100.0%	100.0%	100.0%	20,549	100.0%	100.0%	100.0%
Queens County	2,358,465	100.0%	100.0%	100.0%	12	100.0%	100.0%	100.0%
Rensselaer County	110,645	100.0%	100.0%	100.0%	49,077	100.0%	100.0%	100.0%
Richmond County	479,458	100.0%	100.0%	100.0%	.	.	.	.
Rockland County	326,306	100.0%	100.0%	100.0%	2,562	100.0%	100.0%	100.0%
Saratoga County	159,938	100.0%	100.0%	100.0%	69,931	100.0%	98.2%	98.2%
Schenectady County	142,709	100.0%	100.0%	100.0%	12,854	100.0%	100.0%	100.0%
Schoharie County	4,648	100.0%	100.0%	100.0%	26,772	100.0%	99.8%	99.8%
Schuyler County	3,319	100.0%	100.0%	100.0%	14,681	100.0%	100.0%	100.0%
Seneca County	14,198	100.0%	100.0%	100.0%	20,300	100.0%	100.0%	100.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
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St. Lawrence County	40,164	100.0%	100.0%	100.0%	69,459	100.0%	99.5%	99.5%
Steuben County	37,049	100.0%	100.0%	100.0%	59,232	100.0%	99.8%	99.8%
Suffolk County	1,452,912	100.0%	100.0%	100.0%	40,040	100.0%	100.0%	100.0%
Sullivan County	18,620	100.0%	100.0%	100.0%	56,865	100.0%	99.7%	99.7%
Tioga County	15,931	100.0%	100.0%	100.0%	32,647	100.0%	99.9%	99.9%
Tompkins County	58,519	100.0%	100.0%	100.0%	46,281	100.0%	100.0%	100.0%
Ulster County	95,572	100.0%	100.0%	100.0%	83,845	100.0%	97.9%	97.9%
Warren County	42,395	100.0%	100.0%	100.0%	22,137	100.0%	93.5%	93.5%
Washington County	19,578	100.0%	100.0%	100.0%	42,042	100.0%	99.5%	99.5%
Wayne County	34,555	100.0%	100.0%	100.0%	56,115	100.0%	100.0%	100.0%
Westchester County	946,387	100.0%	100.0%	100.0%	33,851	100.0%	100.0%	100.0%
Wyoming County	13,589	100.0%	100.0%	100.0%	26,904	100.0%	100.0%	100.0%
Yates County	6,968	100.0%	100.0%	100.0%	17,987	100.0%	100.0%	100.0%
North Carolina	**6,856,927**	**99.8%**	**100.0%**	**99.7%**	**3,416,195**	**84.8%**	**99.2%**	**84.1%**
Alamance County	115,104	100.0%	100.0%	100.0%	47,276	95.3%	100.0%	95.3%
Alexander County	10,144	99.9%	100.0%	99.9%	27,142	81.5%	100.0%	81.5%
Alleghany County	.	.	.	.	11,029	94.4%	63.8%	60.3%
Anson County	5,487	100.0%	100.0%	100.0%	19,504	78.2%	100.0%	78.2%
Ashe County	4,126	71.8%	28.5%	19.3%	22,831	96.3%	46.8%	44.8%
Avery County	1,974	99.8%	100.0%	99.8%	15,562	95.5%	99.4%	94.9%
Beaufort County	15,964	99.8%	100.0%	99.8%	31,124	82.6%	99.8%	82.6%
Bertie County	2,610	94.3%	100.0%	94.3%	16,614	80.4%	100.0%	80.4%
Bladen County	2,951	100.0%	100.0%	100.0%	30,527	67.2%	100.0%	67.2%
Brunswick County	70,589	99.8%	100.0%	99.8%	60,307	78.2%	100.0%	78.2%
Buncombe County	192,591	99.9%	100.0%	99.9%	65,016	95.4%	99.8%	95.2%
Burke County	51,437	99.9%	100.0%	99.9%	37,856	93.7%	100.0%	93.7%
Cabarrus County	164,583	100.0%	100.0%	100.0%	42,281	96.6%	100.0%	96.6%
Caldwell County	53,646	99.4%	100.0%	99.4%	28,335	93.6%	99.9%	93.5%
Camden County	47	85.1%	100.0%	85.1%	10,534	96.7%	100.0%	96.7%
Carteret County	46,405	100.0%	100.0%	100.0%	22,476	99.5%	99.8%	99.3%
Caswell County	190	92.1%	100.0%	92.1%	22,456	52.7%	99.2%	52.0%
Catawba County	109,971	99.9%	100.0%	99.9%	47,985	98.6%	100.0%	98.6%
Chatham County	23,471	98.9%	100.0%	98.9%	48,001	69.9%	100.0%	69.9%
Cherokee County	.	.	.	.	28,087	71.3%	97.9%	70.7%
Chowan County	4,345	99.0%	100.0%	99.0%	9,760	87.7%	100.0%	87.7%

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Clay County	.	.	.	.	11,074	58.7%	98.0%	58.7%
Cleveland County	42,911	100.0%	100.0%	100.0%	54,423	91.2%	100.0%	91.2%
Columbus County	9,517	94.2%	100.0%	94.2%	46,419	81.1%	100.0%	81.1%
Craven County	73,429	99.9%	100.0%	99.9%	29,149	80.7%	100.0%	80.7%
Cumberland County	286,634	100.0%	100.0%	100.0%	45,908	96.6%	100.0%	96.6%
Currituck County	443	97.7%	100.0%	97.7%	25,888	96.6%	100.0%	96.6%
Dare County	25,549	99.9%	100.0%	99.9%	10,550	97.8%	98.9%	96.7%
Davidson County	86,845	100.0%	100.0%	100.0%	78,618	99.1%	100.0%	99.1%
Davie County	12,570	100.0%	100.0%	100.0%	29,886	99.1%	100.0%	99.1%
Duplin County	7,908	95.9%	100.0%	95.9%	51,131	59.8%	100.0%	59.8%
Durham County	290,591	99.9%	100.0%	99.9%	21,006	88.6%	100.0%	88.6%
Edgecombe County	28,148	99.8%	100.0%	99.8%	24,599	74.1%	100.0%	74.1%
Forsyth County	347,431	100.0%	100.0%	100.0%	28,879	99.7%	100.0%	99.7%
Franklin County	9,537	99.5%	100.0%	99.5%	56,629	82.5%	98.7%	82.1%
Gaston County	176,235	100.0%	100.0%	100.0%	43,946	99.2%	100.0%	99.2%
Gates County	.	.	.	.	11,544	60.7%	100.0%	60.7%
Graham County	.	.	.	.	8,541	46.3%	100.0%	46.3%
Granville County	26,042	99.5%	100.0%	99.5%	33,515	77.9%	100.0%	77.9%
Greene County	.	.	.	.	21,015	33.4%	100.0%	33.4%
Guilford County	456,789	100.0%	100.0%	100.0%	70,158	98.2%	100.0%	98.2%
Halifax County	24,102	99.9%	100.0%	99.9%	27,208	69.5%	100.0%	69.5%
Harnett County	57,788	99.8%	100.0%	99.8%	74,947	91.5%	100.0%	91.5%
Haywood County	26,944	99.3%	100.0%	99.3%	34,140	65.6%	99.2%	65.6%
Henderson County	76,179	98.5%	100.0%	98.5%	39,519	76.0%	100.0%	76.0%
Hertford County	7,369	100.0%	100.0%	100.0%	16,537	72.7%	100.0%	72.7%
Hoke County	29,569	99.8%	100.0%	99.8%	24,535	74.2%	100.0%	74.2%
Hyde County	.	.	.	.	5,363	20.9%	99.9%	20.9%
Iredell County	107,257	100.0%	100.0%	100.0%	68,442	94.1%	100.0%	94.1%
Jackson County	11,001	97.3%	100.0%	97.3%	31,970	14.0%	98.8%	14.0%
Johnston County	92,952	100.0%	100.0%	100.0%	103,739	100.0%	100.0%	100.0%
Jones County	.	.	.	.	9,597	54.4%	100.0%	54.4%
Lee County	34,068	99.9%	100.0%	99.9%	26,361	92.6%	100.0%	92.6%
Lenoir County	30,917	98.2%	100.0%	98.2%	25,966	76.0%	100.0%	76.0%
Lincoln County	37,334	99.7%	100.0%	99.7%	45,067	97.8%	100.0%	97.8%
Macon County	6,839	99.9%	100.0%	99.9%	27,893	43.7%	100.0%	43.7%
Madison County	1,965	100.0%	100.0%	100.0%	19,780	100.0%	89.4%	89.4%

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Martin County	4,685	100.0%	100.0%	100.0%	18,104	74.1%	100.0%	74.1%
McDowell County	13,351	99.6%	100.0%	99.6%	31,808	66.4%	99.9%	66.4%
Mecklenburg County	1,061,896	100.0%	100.0%	100.0%	14,922	99.8%	100.0%	99.8%
Mitchell County	2,600	96.1%	100.0%	96.1%	12,472	88.5%	97.8%	86.8%
Montgomery County	6,319	69.4%	100.0%	69.4%	21,116	52.6%	100.0%	52.6%
Moore County	47,227	100.0%	100.0%	100.0%	50,022	78.0%	100.0%	78.0%
Nash County	48,159	99.9%	100.0%	99.9%	45,832	85.4%	100.0%	85.4%
New Hanover County	221,424	100.0%	100.0%	100.0%	5,767	94.0%	100.0%	94.0%
Northampton County	2,176	99.5%	100.0%	99.5%	17,686	77.4%	100.0%	77.4%
Onslow County	136,208	100.0%	100.0%	100.0%	57,678	91.2%	100.0%	91.2%
Orange County	100,910	100.0%	100.0%	100.0%	44,021	80.0%	100.0%	80.0%
Pamlico County	.	.	.	.	12,689	84.7%	99.8%	84.6%
Pasquotank County	23,515	100.0%	100.0%	100.0%	16,228	99.7%	100.0%	99.7%
Pender County	18,238	100.0%	100.0%	100.0%	42,713	69.1%	100.0%	69.1%
Perquimans County	.	.	.	.	13,473	92.1%	100.0%	92.1%
Person County	9,541	99.9%	100.0%	99.9%	29,829	88.3%	100.0%	88.3%
Pitt County	131,889	99.5%	100.0%	99.5%	47,153	84.9%	100.0%	84.9%
Polk County	1,576	99.9%	100.0%	99.9%	18,981	70.8%	100.0%	70.8%
Randolph County	62,643	100.0%	100.0%	100.0%	80,639	90.9%	100.0%	90.8%
Richmond County	24,659	100.0%	100.0%	100.0%	20,139	85.6%	100.0%	85.6%
Robeson County	48,705	99.9%	100.0%	99.9%	83,901	75.0%	100.0%	75.0%
Rockingham County	34,541	100.0%	100.0%	100.0%	56,408	94.9%	100.0%	94.9%
Rowan County	85,772	100.0%	100.0%	100.0%	54,869	94.7%	100.0%	94.7%
Rutherford County	24,816	94.2%	100.0%	94.2%	41,734	51.9%	99.2%	51.9%
Sampson County	9,465	65.1%	100.0%	65.1%	53,965	57.7%	100.0%	57.7%
Scotland County	17,949	100.0%	100.0%	100.0%	17,144	80.6%	100.0%	80.6%
Stanly County	19,853	100.0%	100.0%	100.0%	41,629	96.8%	100.0%	96.8%
Stokes County	10,849	100.0%	100.0%	100.0%	34,868	95.5%	100.0%	95.5%
Surry County	21,960	100.0%	100.0%	100.0%	50,262	97.8%	97.3%	95.2%
Swain County	.	.	.	.	14,294	45.9%	96.6%	45.9%
Transylvania County	13,645	90.8%	100.0%	90.8%	20,311	67.6%	98.9%	67.0%

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Tyrrell County	.	.	.	.	4,052	82.1%	99.2%	81.3%
Union County	166,217	100.0%	100.0%	100.0%	65,140	95.0%	100.0%	95.0%
Vance County	20,623	99.7%	100.0%	99.7%	23,588	92.8%	100.0%	92.8%
Wake County	997,083	100.0%	100.0%	100.0%	75,099	97.4%	100.0%	97.4%
Warren County	.	.	.	.	19,883	67.8%	99.8%	67.8%
Washington County	3,954	99.4%	100.0%	99.4%	8,058	88.3%	100.0%	88.3%
Watauga County	23,357	100.0%	100.0%	100.0%	31,763	95.9%	100.0%	95.9%
Wayne County	66,662	100.0%	100.0%	100.0%	57,508	93.0%	100.0%	93.0%
Wilkes County	18,398	99.9%	100.0%	99.9%	50,178	99.0%	94.7%	93.7%
Wilson County	49,814	99.1%	100.0%	99.1%	31,857	97.0%	100.0%	97.0%
Yadkin County	5,750	100.0%	100.0%	100.0%	32,023	99.1%	100.0%	99.1%
Yancey County	.	.	.	.	17,744	90.5%	96.7%	87.7%
North Dakota	**420,281**	**97.6%**	**100.0%**	**97.6%**	**335,064**	**87.3%**	**99.4%**	**86.8%**
Adams County	.	.	.	.	2,318	100.0%	98.2%	98.2%
Barnes County	6,135	100.0%	100.0%	100.0%	4,599	80.5%	99.9%	80.4%
Benson County	.	.	.	.	6,934	44.5%	100.0%	44.5%
Billings County	.	.	.	.	940	56.2%	93.1%	54.4%
Bottineau County	.	.	.	.	6,530	90.0%	100.0%	90.0%
Bowman County	.	.	.	.	3,166	100.0%	98.6%	98.6%
Burke County	.	.	.	.	2,131	55.6%	98.8%	54.4%
Burleigh County	70,245	98.6%	100.0%	98.6%	24,776	97.9%	100.0%	97.9%
Cass County	148,273	98.2%	100.0%	98.2%	29,479	70.7%	100.0%	70.7%
Cavalier County	.	.	.	.	3,762	100.0%	100.0%	100.0%
Dickey County	.	.	.	.	4,861	99.8%	100.0%	99.8%
Divide County	.	.	.	.	2,288	94.4%	89.9%	86.2%
Dunn County	.	.	.	.	4,289	98.3%	99.2%	97.5%
Eddy County	.	.	.	.	2,316	84.5%	99.5%	84.0%
Emmons County	.	.	.	.	3,301	100.0%	100.0%	100.0%
Foster County	.	.	.	.	3,257	100.0%	100.0%	100.0%
Golden Valley County	.	.	.	.	1,789	3.0%	97.4%	1.7%
Grand Forks County	56,383	94.5%	100.0%	94.5%	14,412	82.2%	100.0%	82.2%
Grant County	.	.	.	.	2,376	96.1%	91.5%	90.2%
Griggs County	.	.	.	.	2,258	92.6%	99.8%	92.4%
Hettinger County	.	.	.	.	2,483	100.0%	99.8%	99.8%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Kidder County	.	.	.	.	2,482	100.0%	99.5%	99.5%
LaMoure County	.	.	.	.	4,087	100.0%	99.1%	99.1%
Logan County	.	.	.	.	1,918	100.0%	98.9%	98.9%
McHenry County	.	.	.	.	5,900	77.4%	100.0%	77.4%
McIntosh County	.	.	.	.	2,606	100.0%	100.0%	100.0%
McKenzie County	.	.	.	.	12,724	73.5%	96.8%	70.8%
McLean County	.	.	.	.	9,685	90.3%	99.7%	90.0%
Mercer County	2,785	100.0%	100.0%	100.0%	5,680	100.0%	99.9%	99.9%
Morton County	19,025	98.5%	100.0%	98.5%	11,771	84.3%	99.9%	84.2%
Mountrail County	.	.	.	.	10,265	86.2%	99.9%	86.2%
Nelson County	.	.	.	.	2,937	100.0%	100.0%	100.0%
Oliver County	.	.	.	.	1,938	92.2%	99.9%	92.1%
Pembina County	.	.	.	.	6,972	100.0%	100.0%	100.0%
Pierce County	2,282	100.0%	100.0%	100.0%	1,817	95.0%	100.0%	95.0%
Ramsey County	7,377	100.0%	100.0%	100.0%	4,142	99.9%	100.0%	99.9%
Ransom County	.	.	.	.	5,297	99.3%	100.0%	99.3%
Renville County	.	.	.	.	2,463	88.9%	100.0%	88.9%
Richland County	7,718	86.9%	100.0%	86.9%	8,633	92.3%	100.0%	92.3%
Rolette County	.	.	.	.	14,531	91.7%	99.8%	91.6%
Sargent County	.	.	.	.	3,858	100.0%	100.0%	100.0%
Sheridan County	.	.	.	.	1,353	94.5%	99.2%	93.6%
Sioux County	.	.	.	.	4,376	97.7%	97.2%	96.2%
Slope County	.	.	.	.	771	98.3%	77.4%	76.4%
Stark County	17,556	100.0%	100.0%	100.0%	12,653	95.4%	99.7%	95.1%
Steele County	.	.	.	.	1,917	70.2%	99.6%	69.7%
Stutsman County	15,118	100.0%	100.0%	100.0%	5,969	93.6%	100.0%	93.6%
Towner County	.	.	.	.	2,253	86.2%	100.0%	86.2%
Traill County	.	.	.	.	8,013	86.3%	100.0%	86.3%
Walsh County	3,968	97.4%	100.0%	97.4%	6,887	87.2%	100.0%	87.2%
Ward County	49,117	97.2%	100.0%	97.2%	19,829	86.8%	99.9%	86.7%
Wells County	.	.	.	.	4,022	96.7%	100.0%	96.7%
Williams County	14,299	97.6%	100.0%	97.6%	19,050	82.2%	98.3%	80.9%
Ohio	**9,079,234**	**99.3%**	**100.0%**	**99.3%**	**2,579,131**	**78.4%**	**99.6%**	**78.3%**
Adams County	2,855	100.0%	100.0%	100.0%	24,871	45.5%	99.7%	45.5%
Allen County	75,733	100.0%	100.0%	100.0%	27,465	84.0%	100.0%	84.0%
Ashland County	20,273	86.4%	100.0%	86.4%	33,355	77.6%	100.0%	77.6%

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Ashtabula County	51,265	100.0%	100.0%	100.0%	46,542	83.3%	100.0%	83.3%
Athens County	36,820	79.8%	100.0%	79.8%	29,777	66.3%	99.2%	65.9%
Auglaize County	27,750	100.0%	100.0%	100.0%	18,028	83.9%	100.0%	83.9%
Belmont County	31,151	93.7%	100.0%	93.7%	36,878	71.2%	99.9%	71.1%
Brown County	9,956	83.7%	100.0%	83.7%	33,620	60.5%	100.0%	60.5%
Butler County	344,497	100.0%	100.0%	100.0%	36,073	96.3%	100.0%	96.3%
Carroll County	7,463	100.0%	100.0%	100.0%	19,922	35.4%	99.7%	35.4%
Champaign County	10,992	100.0%	100.0%	100.0%	27,848	75.3%	100.0%	75.3%
Clark County	102,453	100.0%	100.0%	100.0%	32,104	96.8%	100.0%	96.8%
Clermont County	156,920	100.0%	100.0%	100.0%	47,294	97.1%	100.0%	97.1%
Clinton County	19,033	100.0%	100.0%	100.0%	22,976	59.5%	100.0%	59.5%
Columbiana County	56,386	96.9%	100.0%	96.9%	46,691	61.6%	100.0%	61.6%
Coshocton County	14,007	100.0%	100.0%	100.0%	22,537	47.4%	99.0%	47.4%
Crawford County	26,422	100.0%	100.0%	100.0%	15,324	97.3%	100.0%	97.3%
Cuyahoga County	1,241,037	99.3%	100.0%	99.3%	7,477	100.0%	100.0%	100.0%
Darke County	16,714	100.0%	100.0%	100.0%	34,822	77.4%	100.0%	77.4%
Defiance County	21,020	100.0%	100.0%	100.0%	17,136	96.4%	100.0%	96.4%
Delaware County	159,766	100.0%	100.0%	100.0%	40,668	83.5%	100.0%	83.5%
Erie County	54,506	98.3%	100.0%	98.3%	20,311	91.8%	100.0%	91.8%
Fairfield County	99,920	99.9%	100.0%	99.9%	54,788	83.7%	100.0%	83.7%
Fayette County	14,939	100.0%	100.0%	100.0%	13,813	76.7%	100.0%	76.7%
Franklin County	1,272,964	100.0%	100.0%	100.0%	18,983	98.9%	100.0%	98.9%
Fulton County	18,082	100.0%	100.0%	100.0%	24,207	96.2%	100.0%	96.2%
Gallia County	5,507	100.0%	100.0%	100.0%	24,466	82.5%	97.3%	81.3%
Geauga County	33,832	99.6%	100.0%	99.6%	60,086	81.3%	100.0%	81.3%
Greene County	140,956	100.0%	100.0%	100.0%	25,785	78.0%	100.0%	78.0%
Guernsey County	14,970	81.5%	100.0%	81.5%	24,123	44.1%	99.5%	43.8%
Hamilton County	794,936	100.0%	100.0%	100.0%	18,880	99.8%	100.0%	99.8%
Hancock County	51,643	100.0%	100.0%	100.0%	24,111	86.1%	100.0%	86.1%
Hardin County	13,627	99.5%	100.0%	99.5%	17,737	74.7%	100.0%	74.7%
Harrison County	2,276	99.5%	100.0%	99.5%	12,940	40.2%	100.0%	40.2%
Henry County	7,882	100.0%	100.0%	100.0%	19,303	99.7%	100.0%	99.7%
Highland County	11,424	100.0%	100.0%	100.0%	31,547	60.5%	99.8%	60.5%
Hocking County	7,894	100.0%	100.0%	100.0%	20,576	42.2%	99.7%	42.2%
Holmes County	3,018	99.9%	100.0%	99.9%	40,939	39.2%	99.8%	39.1%
Huron County	28,570	100.0%	100.0%	100.0%	29,924	90.4%	100.0%	90.4%

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Jackson County	11,553	99.4%	100.0%	99.4%	20,896	54.2%	99.7%	54.2%
Jefferson County	39,373	97.7%	100.0%	97.7%	26,986	69.5%	99.9%	69.5%
Knox County	26,551	100.0%	100.0%	100.0%	34,705	55.1%	100.0%	55.1%
Lake County	215,016	100.0%	100.0%	100.0%	15,100	98.0%	100.0%	98.0%
Lawrence County	33,171	94.6%	100.0%	94.6%	27,078	74.8%	90.1%	73.7%
Licking County	109,735	100.0%	100.0%	100.0%	63,708	85.2%	100.0%	85.2%
Logan County	19,255	100.0%	100.0%	100.0%	26,070	69.4%	100.0%	69.4%
Lorain County	271,575	92.7%	100.0%	92.7%	36,331	72.1%	100.0%	72.1%
Lucas County	410,298	98.9%	100.0%	98.9%	20,589	98.1%	100.0%	98.1%
Madison County	21,915	99.8%	100.0%	99.8%	22,121	83.5%	100.0%	83.5%
Mahoning County	193,857	99.1%	100.0%	99.1%	35,939	95.5%	100.0%	95.5%
Marion County	44,904	100.0%	100.0%	100.0%	20,063	86.6%	100.0%	86.6%
Medina County	124,871	99.7%	100.0%	99.7%	53,477	94.6%	100.0%	94.6%
Meigs County	4,283	99.1%	100.0%	99.1%	18,797	52.7%	97.5%	51.7%
Mercer County	15,723	100.0%	100.0%	100.0%	25,150	100.0%	100.0%	100.0%
Miami County	72,274	100.0%	100.0%	100.0%	32,844	87.0%	100.0%	87.0%
Monroe County	220	0.0%	100.0%	0.0%	13,726	0.3%	98.0%	0.3%
Montgomery County	508,254	100.0%	100.0%	100.0%	23,285	95.5%	100.0%	95.5%
Morgan County	2,670	100.0%	100.0%	100.0%	12,039	41.9%	96.0%	41.6%
Morrow County	3,906	100.0%	100.0%	100.0%	31,088	71.4%	100.0%	71.4%
Muskingum County	44,836	100.0%	100.0%	100.0%	41,313	75.4%	96.6%	75.1%
Noble County	5,282	100.0%	100.0%	100.0%	9,124	21.6%	98.2%	21.6%
Ottawa County	20,495	100.0%	100.0%	100.0%	20,162	100.0%	100.0%	100.0%
Paulding County	3,263	100.0%	100.0%	100.0%	15,582	92.2%	100.0%	92.2%
Perry County	8,892	99.9%	100.0%	99.9%	27,132	44.2%	98.9%	44.2%
Pickaway County	28,641	99.8%	100.0%	99.8%	29,187	64.3%	100.0%	64.3%
Pike County	7,245	97.9%	100.0%	97.9%	21,023	66.3%	99.5%	66.3%
Portage County	108,457	99.9%	100.0%	99.9%	53,818	89.3%	100.0%	89.3%
Preble County	12,715	100.0%	100.0%	100.0%	28,405	97.7%	100.0%	97.7%
Putnam County	4,929	100.0%	100.0%	100.0%	28,949	87.9%	100.0%	87.9%
Richland County	80,798	97.1%	100.0%	97.1%	39,791	86.9%	100.0%	86.9%
Ross County	31,734	100.0%	100.0%	100.0%	45,576	87.5%	99.9%	87.5%
Sandusky County	32,553	100.0%	100.0%	100.0%	26,642	99.7%	100.0%	99.7%
Scioto County	33,813	100.0%	100.0%	100.0%	42,116	71.3%	97.3%	70.3%
Seneca County	28,518	100.0%	100.0%	100.0%	26,725	91.1%	100.0%	91.1%
Shelby County	23,567	100.0%	100.0%	100.0%	25,192	84.8%	100.0%	84.8%

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Stark County	321,536	100.0%	100.0%	100.0%	51,006	94.0%	100.0%	94.0%
Summit County	520,107	100.0%	100.0%	100.0%	21,119	99.5%	100.0%	99.5%
Trumbull County	144,570	98.9%	100.0%	98.9%	55,810	89.7%	100.0%	89.7%
Tuscarawas County	53,881	99.9%	100.0%	99.9%	38,416	62.5%	100.0%	62.5%
Union County	27,426	100.0%	100.0%	100.0%	29,313	61.0%	100.0%	61.0%
Van Wert County	13,573	100.0%	100.0%	100.0%	14,644	98.3%	100.0%	98.3%
Vinton County	.	.	.	.	13,091	38.2%	99.9%	38.2%
Warren County	188,194	100.0%	100.0%	100.0%	40,665	84.6%	100.0%	84.6%
Washington County	26,033	97.0%	100.0%	97.0%	34,385	65.3%	96.1%	64.4%
Wayne County	56,125	99.1%	100.0%	99.1%	59,913	83.0%	100.0%	83.0%
Williams County	13,240	100.0%	100.0%	100.0%	23,544	97.5%	100.0%	97.5%
Wood County	90,855	100.0%	100.0%	100.0%	39,633	100.0%	100.0%	100.0%
Wyandot County	9,093	100.0%	100.0%	100.0%	12,936	47.6%	100.0%	47.6%
Oklahoma	**2,582,135**	**95.0%**	**100.0%**	**95.0%**	**1,348,436**	**48.3%**	**99.6%**	**48.3%**
Adair County	3,500	59.8%	100.0%	59.8%	18,409	5.8%	100.0%	5.8%
Alfalfa County	.	.	.	.	5,906	99.1%	100.0%	99.1%
Atoka County	.	.	.	.	13,887	30.0%	99.7%	30.0%
Beaver County	.	.	.	.	5,315	67.0%	98.2%	65.6%
Beckham County	13,449	95.2%	100.0%	95.2%	8,344	27.2%	100.0%	27.2%
Blaine County	2,658	62.9%	100.0%	62.9%	6,840	64.3%	99.4%	64.2%
Bryan County	17,065	97.0%	100.0%	97.0%	29,253	56.8%	100.0%	56.8%
Caddo County	5,780	1.2%	100.0%	1.2%	23,393	54.0%	100.0%	54.0%
Canadian County	99,232	95.4%	100.0%	95.4%	40,633	54.0%	100.0%	54.0%
Carter County	21,023	97.6%	100.0%	97.6%	27,167	51.0%	100.0%	51.0%
Cherokee County	19,043	81.5%	100.0%	81.5%	29,844	46.4%	99.5%	46.2%
Choctaw County	4,824	0.0%	100.0%	0.0%	10,039	0.0%	100.0%	0.0%
Cimarron County	.	.	.	.	2,154	69.5%	98.7%	69.0%
Cleveland County	225,764	93.4%	100.0%	93.4%	53,864	26.6%	100.0%	26.6%
Coal County	.	.	.	.	5,642	40.7%	100.0%	40.7%
Comanche County	95,423	96.6%	100.0%	96.6%	26,095	54.7%	100.0%	54.7%
Cotton County	2,273	16.6%	100.0%	16.6%	3,550	61.4%	100.0%	61.4%
Craig County	5,263	100.0%	100.0%	100.0%	9,064	97.4%	100.0%	97.4%
Creek County	32,583	87.9%	100.0%	87.9%	39,114	47.3%	100.0%	47.3%
Custer County	18,870	98.0%	100.0%	98.0%	9,930	45.5%	100.0%	45.5%
Delaware County	7,897	96.2%	100.0%	96.2%	34,692	79.9%	100.0%	79.9%
Dewey County	.	.	.	.	4,877	20.6%	100.0%	20.6%

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Ellis County	.	.	.	.	3,966	56.0%	99.0%	56.0%
Garfield County	47,016	99.3%	100.0%	99.3%	14,565	59.5%	100.0%	59.5%
Garvin County	8,201	98.2%	100.0%	98.2%	19,708	37.9%	100.0%	37.9%
Grady County	19,370	95.8%	100.0%	95.8%	35,565	35.2%	100.0%	35.2%
Grant County	.	.	.	.	4,395	99.5%	100.0%	99.5%
Greer County	2,782	98.8%	100.0%	98.8%	3,061	6.0%	100.0%	6.0%
Harmon County	.	.	.	.	2,689	59.2%	100.0%	59.2%
Harper County	.	.	.	.	3,805	76.5%	99.6%	76.5%
Haskell County	2,803	96.1%	100.0%	96.1%	9,960	21.3%	100.0%	21.3%
Hughes County	5,096	96.3%	100.0%	96.3%	8,206	9.8%	100.0%	9.8%
Jackson County	18,599	99.1%	100.0%	99.1%	6,526	24.6%	100.0%	24.6%
Jefferson County	.	.	.	.	6,183	27.3%	100.0%	27.3%
Johnston County	.	.	.	.	11,060	48.0%	100.0%	48.0%
Kay County	33,242	100.0%	100.0%	100.0%	11,302	99.7%	100.0%	99.7%
Kingfisher County	4,166	70.0%	100.0%	70.0%	11,503	53.9%	100.0%	53.9%
Kiowa County	3,326	97.5%	100.0%	97.5%	5,567	54.6%	100.0%	54.6%
Latimer County	2,743	90.0%	100.0%	90.0%	7,668	33.2%	92.1%	32.7%
Le Flore County	13,461	82.4%	100.0%	82.4%	36,270	33.4%	99.5%	33.4%
Lincoln County	2,721	93.3%	100.0%	93.3%	32,418	37.3%	100.0%	37.3%
Logan County	19,545	94.1%	100.0%	94.1%	27,230	45.4%	100.0%	45.4%
Love County	.	.	.	.	10,034	30.9%	100.0%	30.9%
Major County	.	.	.	.	7,693	42.3%	99.9%	42.3%
Marshall County	4,482	98.4%	100.0%	98.4%	11,950	63.1%	100.0%	63.1%
Mayes County	9,152	100.0%	100.0%	100.0%	31,768	84.5%	100.0%	84.5%
McClain County	8,349	58.2%	100.0%	58.2%	30,961	69.9%	100.0%	69.9%
McCurtain County	9,794	40.7%	100.0%	40.7%	23,014	3.4%	93.0%	3.4%
McIntosh County	2,406	97.8%	100.0%	97.8%	17,336	26.4%	100.0%	26.4%
Murray County	7,417	98.8%	100.0%	98.8%	6,436	21.8%	100.0%	21.8%
Muskogee County	38,386	98.8%	100.0%	98.8%	30,700	34.5%	100.0%	34.5%
Noble County	4,842	99.8%	100.0%	99.8%	6,435	24.2%	100.0%	24.2%
Nowata County	4,216	100.0%	100.0%	100.0%	6,090	74.4%	100.0%	74.4%
Okfuskee County	3,081	97.4%	100.0%	97.4%	9,059	14.0%	100.0%	14.0%
Oklahoma County	728,950	96.6%	100.0%	96.6%	58,951	55.0%	100.0%	55.0%
Okmulgee County	19,637	96.0%	100.0%	96.0%	19,293	25.2%	100.0%	25.2%
Osage County	18,554	84.3%	100.0%	84.3%	28,679	47.8%	99.5%	47.8%
Ottawa County	15,625	100.0%	100.0%	100.0%	15,687	98.4%	100.0%	98.4%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Pawnee County	3,034	0.0%	100.0%	0.0%	13,438	0.1%	100.0%	0.1%
Payne County	52,335	93.6%	100.0%	93.6%	29,234	39.5%	100.0%	39.5%
Pittsburg County	20,547	94.9%	100.0%	94.9%	23,637	42.5%	100.0%	42.5%
Pontotoc County	17,562	98.8%	100.0%	98.8%	20,662	52.2%	100.0%	52.2%
Pottawatomie County	34,824	96.8%	100.0%	96.8%	37,400	66.0%	100.0%	66.0%
Pushmataha County	.	.	.	.	11,173	0.1%	77.4%	0.1%
Roger Mills County	.	.	.	.	3,714	13.3%	99.8%	13.3%
Rogers County	44,419	99.6%	100.0%	99.6%	47,025	95.1%	100.0%	95.1%
Seminole County	8,631	98.9%	100.0%	98.9%	16,247	18.0%	100.0%	18.0%
Sequoyah County	13,204	37.6%	100.0%	37.6%	28,048	28.0%	100.0%	28.0%
Stephens County	23,658	99.8%	100.0%	99.8%	19,674	38.3%	100.0%	38.3%
Texas County	10,793	92.4%	100.0%	92.4%	10,107	71.8%	100.0%	71.8%
Tillman County	3,551	99.7%	100.0%	99.7%	3,882	68.4%	100.0%	68.4%
Tulsa County	612,286	99.0%	100.0%	99.0%	33,928	74.2%	100.0%	74.2%
Wagoner County	46,145	99.4%	100.0%	99.4%	32,503	67.3%	100.0%	67.3%
Washington County	39,170	98.7%	100.0%	98.7%	12,762	37.2%	100.0%	37.2%
Washita County	2,829	98.4%	100.0%	98.4%	8,305	47.6%	100.0%	47.6%
Woods County	5,349	99.9%	100.0%	99.9%	3,682	60.8%	99.7%	60.8%
Woodward County	11,189	0.0%	100.0%	0.0%	9,270	27.6%	99.8%	27.6%
Oregon	**3,307,148**	**98.3%**	**100.0%**	**98.3%**	**835,545**	**68.9%**	**97.9%**	**68.6%**
Baker County	8,787	99.8%	100.0%	99.8%	7,267	35.0%	98.9%	34.4%
Benton County	71,468	100.0%	100.0%	100.0%	19,479	94.8%	98.9%	94.1%
Clackamas County	331,492	98.0%	100.0%	98.0%	81,165	76.4%	99.7%	76.1%
Clatsop County	23,072	100.0%	100.0%	100.0%	16,107	57.0%	99.1%	57.0%
Columbia County	28,432	90.7%	100.0%	90.7%	23,350	44.4%	99.5%	44.4%
Coos County	38,904	99.8%	100.0%	99.8%	24,984	71.1%	97.2%	70.8%
Crook County	11,048	100.0%	100.0%	100.0%	12,071	87.4%	98.2%	87.4%
Curry County	13,610	99.9%	100.0%	99.9%	9,059	84.6%	96.4%	84.0%
Deschutes County	129,809	99.7%	100.0%	99.7%	57,058	88.1%	100.0%	88.1%
Douglas County	62,989	100.0%	100.0%	100.0%	46,415	74.4%	96.5%	74.0%
Gilliam County	.	.	.	.	1,855	51.2%	96.8%	51.2%
Grant County	.	.	.	.	7,190	56.2%	91.4%	55.9%
Harney County	4,070	26.5%	100.0%	26.5%	3,219	2.0%	96.3%	2.0%

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Hood River County	10,982	100.0%	100.0%	100.0%	12,395	91.6%	100.0%	91.6%
Jackson County	169,544	98.9%	100.0%	98.9%	47,934	64.2%	92.4%	62.7%
Jefferson County	8,231	100.0%	100.0%	100.0%	15,523	73.3%	98.7%	73.3%
Josephine County	46,556	99.8%	100.0%	99.8%	39,795	49.3%	97.2%	49.3%
Klamath County	40,229	100.0%	100.0%	100.0%	26,704	55.9%	99.7%	55.9%
Lake County	1,999	100.0%	100.0%	100.0%	5,864	28.1%	98.3%	27.9%
Lane County	302,101	96.3%	100.0%	96.3%	72,642	58.1%	96.0%	57.9%
Lincoln County	29,649	96.7%	100.0%	96.7%	19,270	77.0%	96.7%	75.8%
Linn County	82,260	99.8%	100.0%	99.8%	42,785	91.7%	98.9%	91.5%
Malheur County	15,603	98.2%	100.0%	98.2%	14,877	56.7%	98.8%	56.2%
Marion County	289,579	99.3%	100.0%	99.3%	51,707	86.8%	99.7%	86.8%
Morrow County	5,943	91.0%	100.0%	91.0%	5,223	25.8%	96.7%	25.8%
Multnomah County	795,274	97.9%	100.0%	97.9%	12,264	83.8%	100.0%	83.8%
Polk County	63,456	99.8%	100.0%	99.8%	20,240	83.2%	97.9%	83.0%
Sherman County	.	.	.	.	1,758	30.8%	100.0%	30.8%
Tillamook County	7,693	99.1%	100.0%	99.1%	18,995	90.0%	95.3%	88.2%
Umatilla County	53,570	97.3%	100.0%	97.3%	23,415	60.3%	99.1%	60.3%
Union County	13,718	99.9%	100.0%	99.9%	12,504	25.8%	97.8%	25.8%
Wallowa County	.	.	.	.	7,051	90.8%	94.1%	88.3%
Wasco County	17,200	99.5%	100.0%	99.5%	9,236	41.8%	99.3%	41.8%
Washington County	550,520	99.2%	100.0%	99.2%	38,427	60.7%	100.0%	60.7%
Wheeler County	.	.	.	.	1,357	0.0%	55.3%	0.0%
Yamhill County	79,360	95.8%	100.0%	95.8%	26,360	40.2%	99.9%	40.2%
Pennsylvania	**10,074,358**	**100.0%**	**100.0%**	**100.0%**	**2,731,093**	**100.0%**	**99.6%**	**99.6%**
Adams County	47,203	100.0%	100.0%	100.0%	55,131	100.0%	99.9%	99.9%
Allegheny County	1,192,077	100.0%	100.0%	100.0%	30,971	100.0%	100.0%	100.0%
Armstrong County	21,741	100.0%	100.0%	100.0%	43,901	100.0%	99.7%	99.7%
Beaver County	122,428	100.0%	100.0%	100.0%	43,712	100.0%	100.0%	100.0%
Bedford County	7,945	100.0%	100.0%	100.0%	40,535	100.0%	98.2%	98.2%
Berks County	317,499	100.0%	100.0%	100.0%	100,354	100.0%	100.0%	100.0%
Blair County	94,562	100.0%	100.0%	100.0%	28,895	100.0%	100.0%	100.0%
Bradford County	16,371	100.0%	100.0%	100.0%	44,482	100.0%	97.1%	97.1%
Bucks County	572,389	100.0%	100.0%	100.0%	55,944	100.0%	100.0%	100.0%
Butler County	108,181	100.0%	100.0%	100.0%	78,927	100.0%	100.0%	100.0%

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Cambria County	89,506	100.0%	100.0%	100.0%	43,548	100.0%	99.4%	99.4%
Cameron County	2,482	100.0%	100.0%	100.0%	2,110	100.0%	79.0%	79.0%
Carbon County	34,532	100.0%	100.0%	100.0%	29,321	100.0%	100.0%	100.0%
Centre County	107,399	100.0%	100.0%	100.0%	55,261	100.0%	99.4%	99.4%
Chester County	448,648	100.0%	100.0%	100.0%	70,640	100.0%	100.0%	100.0%
Clarion County	8,010	100.0%	100.0%	100.0%	30,448	100.0%	100.0%	100.0%
Clearfield County	35,922	100.0%	100.0%	100.0%	43,763	100.0%	98.9%	98.9%
Clinton County	20,863	100.0%	100.0%	100.0%	18,135	100.0%	99.3%	99.3%
Columbia County	38,421	100.0%	100.0%	100.0%	27,511	100.0%	99.9%	99.9%
Crawford County	29,588	100.0%	100.0%	100.0%	56,571	100.0%	100.0%	100.0%
Cumberland County	192,089	100.0%	100.0%	100.0%	57,977	100.0%	100.0%	100.0%
Dauphin County	238,110	100.0%	100.0%	100.0%	37,600	100.0%	100.0%	100.0%
Delaware County	562,003	100.0%	100.0%	100.0%	2,689	100.0%	100.0%	100.0%
Elk County	12,892	100.0%	100.0%	100.0%	17,305	100.0%	98.7%	98.7%
Erie County	218,090	100.0%	100.0%	100.0%	56,451	100.0%	100.0%	100.0%
Fayette County	67,787	100.0%	100.0%	100.0%	63,717	100.0%	100.0%	100.0%
Forest County	.	.	.	.	7,297	100.0%	99.6%	99.6%
Franklin County	91,156	100.0%	100.0%	100.0%	63,078	100.0%	99.6%	99.6%
Fulton County	.	.	.	.	14,590	100.0%	100.0%	100.0%
Greene County	11,232	100.0%	100.0%	100.0%	25,538	100.0%	94.2%	94.2%
Huntingdon County	14,155	100.0%	100.0%	100.0%	31,336	100.0%	97.2%	97.2%
Indiana County	31,582	100.0%	100.0%	100.0%	53,371	100.0%	99.9%	99.9%
Jefferson County	16,365	100.0%	100.0%	100.0%	27,439	100.0%	98.4%	98.4%
Juniata County	4,334	100.0%	100.0%	100.0%	20,180	100.0%	99.7%	99.7%
Lackawanna County	175,822	100.0%	100.0%	100.0%	34,939	100.0%	100.0%	100.0%
Lancaster County	425,078	100.0%	100.0%	100.0%	117,825	100.0%	100.0%	100.0%
Lawrence County	51,357	100.0%	100.0%	100.0%	35,712	100.0%	100.0%	100.0%
Lebanon County	101,825	100.0%	100.0%	100.0%	37,929	100.0%	100.0%	100.0%
Lehigh County	336,684	100.0%	100.0%	100.0%	29,806	100.0%	100.0%	100.0%
Luzerne County	253,602	100.0%	100.0%	100.0%	63,741	100.0%	99.7%	99.7%
Lycoming County	71,401	100.0%	100.0%	100.0%	42,440	100.0%	97.7%	97.7%
McKean County	15,051	100.0%	100.0%	100.0%	26,279	100.0%	99.7%	99.7%
Mercer County	60,348	100.0%	100.0%	100.0%	51,402	100.0%	100.0%	100.0%
Mifflin County	23,025	100.0%	100.0%	100.0%	23,363	100.0%	98.8%	98.8%
Monroe County	104,137	100.0%	100.0%	100.0%	63,909	100.0%	100.0%	100.0%
Montgomery County	801,352	100.0%	100.0%	100.0%	24,686	100.0%	100.0%	100.0%

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Montour County	8,437	100.0%	100.0%	100.0%	9,835	100.0%	100.0%	100.0%
Northampton County	264,230	100.0%	100.0%	100.0%	39,174	100.0%	100.0%	100.0%
Northumberland County	59,439	100.0%	100.0%	100.0%	32,590	100.0%	100.0%	100.0%
Perry County	5,324	100.0%	100.0%	100.0%	40,803	100.0%	100.0%	100.0%
Philadelphia County	1,580,843	100.0%	100.0%	100.0%	.	.	.	.
Pike County	16,400	100.0%	100.0%	100.0%	39,291	100.0%	100.0%	100.0%
Potter County	.	.	.	.	16,802	100.0%	99.1%	99.1%
Schuylkill County	88,863	100.0%	100.0%	100.0%	53,706	100.0%	100.0%	100.0%
Snyder County	13,246	100.0%	100.0%	100.0%	27,554	100.0%	100.0%	100.0%
Somerset County	19,445	100.0%	100.0%	100.0%	55,056	100.0%	99.9%	99.9%
Sullivan County	.	.	.	.	6,089	100.0%	95.9%	95.9%
Susquehanna County	6,155	100.0%	100.0%	100.0%	34,830	100.0%	99.2%	99.2%
Tioga County	3,117	100.0%	100.0%	100.0%	37,676	100.0%	99.2%	99.2%
Union County	24,724	100.0%	100.0%	100.0%	19,871	100.0%	100.0%	100.0%
Venango County	23,044	100.0%	100.0%	100.0%	28,718	100.0%	100.0%	100.0%
Warren County	17,534	100.0%	100.0%	100.0%	22,125	100.0%	99.1%	99.1%
Washington County	143,027	100.0%	100.0%	100.0%	64,271	100.0%	100.0%	100.0%
Wayne County	6,189	100.0%	100.0%	100.0%	45,015	100.0%	99.8%	99.8%
Westmoreland County	260,188	100.0%	100.0%	100.0%	92,439	100.0%	100.0%	100.0%
Wyoming County	4,434	100.0%	100.0%	100.0%	22,888	100.0%	99.6%	99.6%
York County	334,475	100.0%	100.0%	100.0%	111,601	100.0%	100.0%	100.0%
Rhode Island	**961,675**	**100.0%**	**100.0%**	**100.0%**	**97,950**	**100.0%**	**100.0%**	**100.0%**
Bristol County	48,349	100.0%	100.0%	100.0%	563	100.0%	100.0%	100.0%
Kent County	150,851	100.0%	100.0%	100.0%	12,909	100.0%	100.0%	100.0%
Newport County	73,372	100.0%	100.0%	100.0%	10,087	100.0%	100.0%	100.0%
Providence County	601,898	100.0%	100.0%	100.0%	35,446	100.0%	100.0%	100.0%
Washington County	87,205	100.0%	100.0%	100.0%	38,945	100.0%	100.0%	100.0%
South Carolina	**3,317,503**	**98.2%**	**100.0%**	**98.2%**	**1,706,776**	**73.7%**	**100.0%**	**73.6%**
Abbeville County	5,102	99.5%	100.0%	99.5%	19,620	93.3%	100.0%	93.3%
Aiken County	104,570	98.2%	100.0%	98.2%	63,609	72.0%	100.0%	72.0%
Allendale County	2,822	98.4%	100.0%	98.4%	6,180	21.5%	98.3%	21.1%
Anderson County	122,539	99.5%	100.0%	99.5%	76,218	87.8%	100.0%	87.8%
Bamberg County	6,036	93.7%	100.0%	93.7%	8,345	38.4%	100.0%	38.4%

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Barnwell County	3,799	98.3%	100.0%	98.3%	17,546	71.7%	100.0%	71.7%
Beaufort County	146,185	93.5%	100.0%	93.5%	40,650	61.0%	100.0%	61.0%
Berkeley County	145,298	97.4%	100.0%	97.4%	72,623	79.8%	100.0%	79.8%
Calhoun County	.	.	.	.	14,704	68.5%	100.0%	68.5%
Charleston County	348,047	97.1%	100.0%	97.1%	53,385	77.4%	100.0%	77.4%
Cherokee County	22,163	99.6%	100.0%	99.6%	34,940	79.1%	100.0%	79.1%
Chester County	9,016	98.9%	100.0%	98.9%	23,285	59.3%	100.0%	59.3%
Chesterfield County	11,795	74.0%	100.0%	74.0%	34,153	34.1%	100.0%	34.1%
Clarendon County	4,672	100.0%	100.0%	100.0%	29,385	90.7%	100.0%	90.7%
Colleton County	9,030	99.2%	100.0%	99.2%	28,581	75.1%	100.0%	75.1%
Darlington County	28,420	100.0%	100.0%	100.0%	38,845	80.3%	100.0%	80.3%
Dillon County	9,559	99.3%	100.0%	99.3%	21,107	64.9%	100.0%	64.9%
Dorchester County	120,685	99.9%	100.0%	99.9%	35,748	66.5%	100.0%	66.5%
Edgefield County	7,050	66.8%	100.0%	66.8%	19,643	63.6%	99.7%	63.6%
Fairfield County	4,920	96.6%	100.0%	96.6%	17,687	47.8%	100.0%	47.8%
Florence County	84,652	100.0%	100.0%	100.0%	53,914	82.9%	100.0%	82.9%
Georgetown County	35,167	100.0%	100.0%	100.0%	26,440	72.6%	100.0%	72.6%
Greenville County	436,974	99.4%	100.0%	99.4%	69,853	91.3%	100.0%	91.3%
Greenwood County	41,715	96.1%	100.0%	96.1%	28,640	73.1%	100.0%	73.1%
Hampton County	4,254	96.9%	100.0%	96.9%	15,348	40.5%	100.0%	40.5%
Horry County	226,982	100.0%	100.0%	100.0%	106,285	97.6%	100.0%	97.6%
Jasper County	8,764	72.3%	100.0%	72.3%	19,694	62.7%	100.0%	62.7%
Kershaw County	27,414	99.5%	100.0%	99.5%	37,618	69.2%	100.0%	69.2%
Lancaster County	43,892	99.8%	100.0%	99.8%	48,653	76.3%	100.0%	76.3%
Laurens County	23,922	99.7%	100.0%	99.7%	42,926	74.9%	100.0%	74.9%
Lee County	3,964	100.0%	100.0%	100.0%	13,386	80.4%	100.0%	80.4%
Lexington County	214,915	99.9%	100.0%	99.9%	75,723	77.1%	100.0%	77.1%
Marion County	12,237	100.0%	100.0%	100.0%	19,056	51.6%	100.0%	51.6%
Marlboro County	10,954	0.0%	100.0%	0.0%	15,871	1.0%	100.0%	1.0%
McCormick County	.	.	.	.	9,545	40.4%	97.5%	38.2%
Newberry County	12,341	99.4%	100.0%	99.4%	26,146	57.5%	100.0%	57.5%
Oconee County	26,672	87.7%	100.0%	87.7%	50,598	73.3%	100.0%	73.3%
Orangeburg County	29,453	100.0%	100.0%	100.0%	58,023	35.7%	100.0%	35.7%
Pickens County	77,919	95.9%	100.0%	95.9%	45,560	88.8%	100.0%	88.8%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Richland County	370,435	100.0%	100.0%	100.0%	41,157	73.8%	100.0%	73.8%
Saluda County	3,911	86.5%	100.0%	86.5%	16,540	19.3%	100.0%	19.3%
Spartanburg County	221,221	99.7%	100.0%	99.7%	85,633	83.4%	100.0%	83.4%
Sumter County	72,679	100.0%	100.0%	100.0%	34,168	87.7%	100.0%	87.7%
Union County	9,676	99.8%	100.0%	99.8%	17,861	68.5%	100.0%	68.5%
Williamsburg County	5,768	99.9%	100.0%	99.9%	25,365	72.7%	100.0%	72.7%
York County	199,914	99.9%	100.0%	99.9%	66,519	84.2%	100.0%	84.2%
South Dakota	**480,989**	**99.2%**	**100.0%**	**99.2%**	**388,382**	**76.1%**	**99.5%**	**75.8%**
Aurora County	.	.	.	.	2,738	91.5%	100.0%	91.5%
Beadle County	12,479	98.1%	100.0%	98.1%	5,676	63.8%	100.0%	63.8%
Bennett County	.	.	.	.	3,454	90.6%	100.0%	90.6%
Bon Homme County	.	.	.	.	6,984	66.9%	100.0%	66.9%
Brookings County	23,114	99.9%	100.0%	99.9%	11,135	91.5%	100.0%	91.5%
Brown County	26,647	100.0%	100.0%	100.0%	12,526	81.1%	100.0%	81.1%
Brule County	.	.	.	.	5,310	100.0%	100.0%	100.0%
Buffalo County	.	.	.	.	1,999	100.0%	100.0%	100.0%
Butte County	5,003	99.8%	100.0%	99.8%	5,104	99.0%	100.0%	99.0%
Campbell County	.	.	.	.	1,378	73.5%	100.0%	73.5%
Charles Mix County	.	.	.	.	9,427	35.1%	100.0%	35.1%
Clark County	.	.	.	.	3,668	87.2%	100.0%	87.2%
Clay County	10,263	88.6%	100.0%	88.6%	3,727	44.4%	100.0%	44.4%
Codington County	21,395	99.9%	100.0%	99.9%	6,703	42.7%	100.0%	42.7%
Corson County	.	.	.	.	4,202	81.2%	82.7%	67.7%
Custer County	.	.	.	.	8,691	55.4%	97.7%	54.9%
Davison County	14,929	100.0%	100.0%	100.0%	4,775	83.0%	100.0%	83.0%
Day County	.	.	.	.	5,521	74.6%	100.0%	74.6%
Deuel County	.	.	.	.	4,280	97.7%	100.0%	97.7%
Dewey County	1,969	92.8%	100.0%	92.8%	3,864	40.5%	100.0%	40.5%
Douglas County	.	.	.	.	2,931	81.0%	100.0%	81.0%
Edmunds County	.	.	.	.	3,919	99.3%	100.0%	99.3%
Fall River County	3,246	99.8%	100.0%	99.8%	3,441	81.6%	99.5%	81.6%
Faulk County	.	.	.	.	2,329	99.5%	100.0%	99.5%
Grant County	3,050	100.0%	100.0%	100.0%	4,011	48.5%	100.0%	48.5%
Gregory County	.	.	.	.	4,226	91.1%	99.7%	90.8%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Haakon County	.	.	.	.	1,943	95.3%	99.3%	94.6%
Hamlin County	.	.	.	.	5,948	69.4%	100.0%	69.4%
Hand County	.	.	.	.	3,277	82.5%	100.0%	82.5%
Hanson County	.	.	.	.	3,423	85.4%	100.0%	85.4%
Harding County	.	.	.	.	1,242	100.0%	97.9%	97.9%
Hughes County	12,870	99.8%	100.0%	99.8%	4,793	77.4%	100.0%	77.4%
Hutchinson County	.	.	.	.	7,358	99.7%	100.0%	99.7%
Hyde County	.	.	.	.	1,318	100.0%	100.0%	100.0%
Jackson County	.	.	.	.	3,289	72.9%	100.0%	72.9%
Jerauld County	.	.	.	.	2,026	100.0%	100.0%	100.0%
Jones County	.	.	.	.	936	50.2%	100.0%	50.2%
Kingsbury County	.	.	.	.	4,952	66.6%	100.0%	66.6%
Lake County	6,478	100.0%	100.0%	100.0%	6,331	99.5%	100.0%	99.5%
Lawrence County	15,401	99.9%	100.0%	99.9%	10,027	82.3%	99.7%	82.3%
Lincoln County	35,282	99.0%	100.0%	99.0%	21,353	62.4%	100.0%	62.4%
Lyman County	.	.	.	.	3,904	76.2%	100.0%	76.2%
Marshall County	.	.	.	.	4,804	84.5%	100.0%	84.5%
McCook County	.	.	.	.	5,499	76.9%	100.0%	76.9%
McPherson County	.	.	.	.	2,426	85.5%	100.0%	85.5%
Meade County	16,436	99.2%	100.0%	99.2%	11,580	82.0%	99.7%	82.0%
Mellette County	.	.	.	.	2,088	58.2%	100.0%	58.2%
Miner County	.	.	.	.	2,228	100.0%	100.0%	100.0%
Minnehaha County	157,401	99.3%	100.0%	99.3%	31,184	88.9%	100.0%	88.9%
Moody County	.	.	.	.	6,579	71.6%	100.0%	71.6%
Oglala Lakota County	2,750	97.2%	100.0%	97.2%	11,405	62.2%	100.0%	62.2%
Pennington County	83,565	99.4%	100.0%	99.4%	26,575	70.5%	98.2%	70.4%
Perkins County	.	.	.	.	2,974	84.3%	97.2%	83.1%
Potter County	.	.	.	.	2,231	100.0%	100.0%	100.0%
Roberts County	.	.	.	.	10,278	66.6%	100.0%	66.6%
Sanborn County	.	.	.	.	2,446	100.0%	100.0%	100.0%
Spink County	.	.	.	.	6,410	88.4%	100.0%	88.4%
Stanley County	1,691	99.7%	100.0%	99.7%	1,320	80.7%	98.5%	79.2%
Sully County	.	.	.	.	1,407	100.0%	100.0%	100.0%
Todd County	.	.	.	.	10,065	62.1%	99.0%	62.1%
Tripp County	2,701	100.0%	100.0%	100.0%	2,759	79.9%	100.0%	79.9%

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Turner County	.	.	.	.	8,315	60.5%	100.0%	60.5%
Union County	5,621	98.0%	100.0%	98.0%	9,408	76.4%	100.0%	76.4%
Walworth County	3,348	100.0%	100.0%	100.0%	2,195	97.3%	100.0%	97.3%
Yankton County	14,629	99.9%	100.0%	99.9%	8,032	59.5%	100.0%	59.5%
Ziebach County	721	100.0%	100.0%	100.0%	2,035	97.1%	83.6%	80.7%
Tennessee	**4,452,482**	**98.5%**	**100.0%**	**98.5%**	**2,263,377**	**77.0%**	**99.2%**	**76.5%**
Anderson County	49,245	97.9%	100.0%	97.9%	27,011	95.5%	96.8%	92.3%
Bedford County	20,840	100.0%	100.0%	100.0%	27,276	92.0%	100.0%	92.0%
Benton County	3,391	99.9%	100.0%	99.9%	12,595	19.7%	98.5%	19.7%
Bledsoe County	.	.	.	.	14,717	39.3%	99.2%	39.2%
Blount County	86,942	99.7%	100.0%	99.7%	42,987	94.4%	98.9%	93.4%
Bradley County	70,575	99.8%	100.0%	99.8%	34,984	92.6%	100.0%	92.6%
Campbell County	17,929	98.7%	100.0%	98.7%	21,719	73.8%	99.2%	73.0%
Cannon County	2,623	100.0%	100.0%	100.0%	11,591	99.4%	100.0%	99.4%
Carroll County	4,371	100.0%	100.0%	100.0%	23,489	62.2%	100.0%	62.2%
Carter County	33,463	99.8%	100.0%	99.8%	23,025	92.5%	97.3%	90.9%
Cheatham County	6,865	98.6%	100.0%	98.6%	33,464	92.3%	100.0%	92.3%
Chester County	5,724	100.0%	100.0%	100.0%	11,395	24.3%	100.0%	24.3%
Claiborne County	8,708	98.4%	100.0%	98.4%	22,901	91.4%	100.0%	91.4%
Clay County	.	.	.	.	7,703	95.4%	85.0%	80.4%
Cocke County	11,488	99.6%	100.0%	99.6%	24,068	64.3%	93.6%	64.2%
Coffee County	28,745	99.8%	100.0%	99.8%	26,288	64.6%	100.0%	64.6%
Crockett County	4,590	100.0%	100.0%	100.0%	9,883	53.3%	100.0%	53.3%
Cumberland County	22,707	98.3%	100.0%	98.3%	36,370	32.3%	99.3%	32.3%
Davidson County	666,271	97.2%	100.0%	97.2%	24,965	97.8%	100.0%	97.8%
DeKalb County	4,172	100.0%	100.0%	100.0%	15,676	98.3%	100.0%	98.3%
Decatur County	.	.	.	.	11,751	58.8%	99.4%	58.8%
Dickson County	16,892	98.2%	100.0%	98.2%	35,961	78.6%	100.0%	78.6%
Dyer County	21,271	98.9%	100.0%	98.9%	16,192	80.1%	100.0%	80.1%
Fayette County	8,247	99.4%	100.0%	99.4%	31,789	74.8%	100.0%	74.8%
Fentress County	.	.	.	.	18,136	98.7%	97.6%	96.4%
Franklin County	12,535	98.7%	100.0%	98.7%	29,117	71.3%	99.4%	70.9%
Gibson County	25,067	84.6%	100.0%	84.6%	24,044	62.9%	100.0%	62.9%
Giles County	7,628	100.0%	100.0%	100.0%	21,773	38.9%	100.0%	38.9%
Grainger County	.	.	.	.	23,144	65.1%	100.0%	65.1%
Greene County	23,478	100.0%	100.0%	100.0%	45,330	100.0%	99.9%	99.9%

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Grundy County	.	.	.	.	13,361	78.5%	99.5%	78.4%
Hamblen County	49,943	100.0%	100.0%	100.0%	14,334	100.0%	100.0%	100.0%
Hamilton County	323,740	99.2%	100.0%	99.2%	37,865	95.9%	100.0%	95.9%
Hancock County	.	.	.	.	6,600	56.8%	94.5%	52.2%
Hardeman County	5,180	97.7%	100.0%	97.7%	20,267	39.6%	100.0%	39.6%
Hardin County	7,957	100.0%	100.0%	100.0%	17,889	94.0%	99.0%	94.0%
Hawkins County	23,643	99.0%	100.0%	99.0%	32,816	54.9%	99.9%	54.9%
Haywood County	8,721	100.0%	100.0%	100.0%	8,852	24.8%	100.0%	24.8%
Henderson County	6,515	100.0%	100.0%	100.0%	21,236	52.0%	100.0%	52.0%
Henry County	10,656	99.9%	100.0%	99.9%	21,793	77.5%	100.0%	77.4%
Hickman County	.	.	.	.	24,864	62.1%	98.8%	61.9%
Houston County	.	.	.	.	8,213	46.2%	94.6%	43.1%
Humphreys County	3,206	94.1%	100.0%	94.1%	15,278	26.3%	98.8%	26.1%
Jackson County	.	.	.	.	11,677	93.4%	86.9%	82.2%
Jefferson County	21,214	98.2%	100.0%	98.2%	32,587	59.9%	100.0%	59.9%
Johnson County	2,641	99.8%	100.0%	99.8%	15,050	93.5%	98.4%	92.6%
Knox County	409,625	98.6%	100.0%	98.6%	52,227	95.8%	100.0%	95.8%
Lake County	.	.	.	.	7,468	62.9%	100.0%	62.9%
Lauderdale County	10,536	100.0%	100.0%	100.0%	14,738	57.2%	99.9%	57.2%
Lawrence County	10,332	99.9%	100.0%	99.9%	33,062	61.7%	100.0%	61.7%
Lewis County	3,591	100.0%	100.0%	100.0%	8,441	82.3%	98.0%	82.2%
Lincoln County	9,251	99.7%	100.0%	99.7%	24,498	69.3%	100.0%	69.3%
Loudon County	30,172	99.5%	100.0%	99.5%	21,976	84.3%	100.0%	84.3%
Macon County	4,829	100.0%	100.0%	100.0%	19,250	87.3%	96.2%	84.0%
Madison County	71,962	99.8%	100.0%	99.8%	25,681	78.4%	99.7%	78.2%
Marion County	6,514	99.3%	100.0%	99.3%	21,911	80.3%	100.0%	80.3%
Marshall County	10,876	99.9%	100.0%	99.9%	22,050	86.2%	100.0%	86.2%
Maury County	51,825	100.0%	100.0%	100.0%	40,333	83.9%	100.0%	83.9%
McMinn County	20,943	98.9%	100.0%	98.9%	31,934	66.7%	99.9%	66.7%
McNairy County	3,789	99.6%	100.0%	99.6%	22,215	78.7%	100.0%	78.7%
Meigs County	.	.	.	.	12,068	54.8%	100.0%	54.8%
Monroe County	10,937	99.0%	100.0%	99.0%	35,302	59.1%	95.0%	58.2%
Montgomery County	155,675	96.9%	100.0%	96.9%	44,501	79.1%	100.0%	79.1%
Moore County	8	100.0%	100.0%	100.0%	6,376	44.4%	100.0%	44.4%
Morgan County	27	100.0%	100.0%	100.0%	21,609	100.0%	97.5%	97.5%
Obion County	11,296	98.9%	100.0%	98.9%	19,089	55.2%	100.0%	55.2%

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Overton County	3,497	99.9%	100.0%	99.9%	18,515	83.7%	98.9%	82.7%
Perry County	.	.	.	.	7,975	38.9%	96.0%	38.2%
Pickett County	.	.	.	.	5,073	95.8%	95.3%	91.1%
Polk County	.	.	.	.	16,757	82.8%	92.2%	76.8%
Putnam County	49,690	98.9%	100.0%	98.9%	27,980	84.9%	100.0%	84.9%
Rhea County	10,286	100.0%	100.0%	100.0%	22,405	76.3%	100.0%	76.3%
Roane County	25,511	99.2%	100.0%	99.2%	27,525	86.3%	100.0%	86.3%
Robertson County	32,285	99.1%	100.0%	99.1%	37,886	70.8%	100.0%	70.8%
Rutherford County	256,879	98.9%	100.0%	98.9%	60,258	92.3%	100.0%	92.3%
Scott County	4,269	100.0%	100.0%	100.0%	17,720	99.9%	96.8%	96.6%
Sequatchie County	3,802	66.0%	100.0%	66.0%	10,934	47.5%	98.5%	47.4%
Sevier County	40,942	99.5%	100.0%	99.5%	56,695	86.8%	99.8%	86.8%
Shelby County	910,582	98.7%	100.0%	98.7%	26,377	79.7%	100.0%	79.7%
Smith County	3,337	100.0%	100.0%	100.0%	16,299	84.9%	93.3%	78.3%
Stewart County	.	.	.	.	13,355	76.5%	99.0%	76.4%
Sullivan County	116,870	100.0%	100.0%	100.0%	40,288	100.0%	100.0%	100.0%
Sumner County	128,876	98.6%	100.0%	98.6%	54,660	95.8%	99.9%	95.7%
Tipton County	27,508	98.9%	100.0%	98.9%	33,858	84.3%	100.0%	84.3%
Trousdale County	.	.	.	.	10,081	68.8%	98.8%	68.2%
Unicoi County	9,938	99.3%	100.0%	99.3%	7,821	91.5%	96.7%	88.4%
Union County	.	.	.	.	19,442	77.8%	100.0%	77.8%
Van Buren County	.	.	.	.	5,742	48.6%	99.4%	48.5%
Warren County	15,524	99.5%	100.0%	99.5%	25,127	69.6%	99.9%	69.6%
Washington County	93,693	99.2%	100.0%	99.2%	34,112	94.3%	100.0%	94.3%
Wayne County	.	.	.	.	16,583	49.5%	97.3%	49.5%
Weakley County	9,912	96.3%	100.0%	96.3%	23,425	40.9%	99.6%	40.8%
White County	5,816	99.9%	100.0%	99.9%	20,937	58.0%	100.0%	58.0%
Williamson County	174,202	97.4%	100.0%	97.4%	52,048	79.4%	100.0%	79.4%
Wilson County	79,692	99.7%	100.0%	99.7%	56,744	88.9%	100.0%	88.9%
Texas	**23,645,434**	**97.4%**	**100.0%**	**97.4%**	**4,658,527**	**68.9%**	**99.9%**	**68.8%**
Anderson County	19,106	86.5%	100.0%	86.5%	38,635	35.2%	99.4%	35.2%
Andrews County	12,651	100.0%	100.0%	100.0%	5,071	40.5%	100.0%	40.5%
Angelina County	49,678	97.8%	100.0%	97.8%	38,127	67.9%	100.0%	67.9%
Aransas County	18,377	100.0%	98.4%	98.4%	7,195	98.2%	99.8%	98.0%
Archer County	875	100.0%	100.0%	100.0%	7,934	86.2%	100.0%	86.2%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Armstrong County	.	.	.	.	1,879	52.5%	99.3%	51.8%
Atascosa County	18,542	99.7%	100.0%	99.7%	30,438	91.2%	100.0%	91.2%
Austin County	9,718	99.2%	100.0%	99.2%	20,068	30.9%	100.0%	30.9%
Bailey County	4,751	97.2%	100.0%	97.2%	2,326	27.7%	100.0%	27.7%
Bandera County	.	.	.	.	22,351	33.9%	95.3%	29.7%
Bastrop County	29,351	100.0%	100.0%	100.0%	55,408	99.7%	100.0%	99.7%
Baylor County	.	.	.	.	3,581	99.6%	100.0%	99.6%
Bee County	18,222	100.0%	100.0%	100.0%	14,341	100.0%	100.0%	100.0%
Bell County	284,493	99.7%	100.0%	99.7%	63,336	77.9%	100.0%	77.9%
Bexar County	1,844,810	100.0%	100.0%	100.0%	113,747	95.9%	100.0%	95.9%
Blanco County	.	.	.	.	11,626	24.0%	100.0%	24.0%
Borden County	.	.	.	.	673	29.9%	100.0%	29.9%
Bosque County	3,397	100.0%	100.0%	100.0%	14,929	99.9%	100.0%	99.9%
Bowie County	60,501	99.1%	100.0%	99.1%	33,511	76.2%	100.0%	76.2%
Brazoria County	267,582	94.5%	100.0%	94.5%	94,870	48.5%	100.0%	48.5%
Brazos County	188,501	100.0%	100.0%	100.0%	34,302	90.6%	100.0%	90.6%
Brewster County	5,822	94.5%	100.0%	94.5%	3,515	18.9%	64.2%	11.7%
Briscoe County	.	.	.	.	1,528	68.9%	99.9%	68.9%
Brooks County	4,894	100.0%	100.0%	100.0%	2,341	97.2%	100.0%	97.2%
Brown County	22,272	100.0%	100.0%	100.0%	15,781	98.9%	100.0%	98.9%
Burleson County	4,029	0.0%	100.0%	0.0%	13,982	7.9%	100.0%	7.9%
Burnet County	19,911	59.5%	100.0%	59.5%	26,893	39.5%	100.0%	39.5%
Caldwell County	22,885	100.0%	100.0%	100.0%	19,447	100.0%	100.0%	100.0%
Calhoun County	11,761	99.4%	100.0%	99.4%	9,983	69.6%	100.0%	69.6%
Callahan County	3,767	52.3%	100.0%	52.3%	10,179	61.4%	100.0%	61.4%
Cameron County	384,125	99.9%	99.9%	99.8%	39,587	95.5%	100.0%	95.5%
Camp County	4,852	98.3%	100.0%	98.3%	8,003	21.6%	100.0%	21.6%
Carson County	302	53.6%	100.0%	53.6%	5,730	64.6%	100.0%	64.6%
Cass County	7,530	99.2%	100.0%	99.2%	22,482	35.7%	100.0%	35.7%
Castro County	3,893	64.7%	100.0%	64.7%	3,950	41.0%	100.0%	41.0%
Chambers County	20,698	63.3%	100.0%	63.3%	20,735	55.0%	100.0%	55.0%
Cherokee County	18,908	75.9%	100.0%	75.9%	33,332	21.0%	99.8%	21.0%
Childress County	4,673	100.0%	100.0%	100.0%	2,394	83.2%	100.0%	83.2%
Clay County	2,708	28.8%	100.0%	28.8%	7,713	15.0%	100.0%	15.0%
Cochran County	.	.	.	.	2,851	65.3%	100.0%	65.3%
Coke County	.	.	.	.	3,306	70.0%	99.7%	70.0%

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Coleman County	3,988	0.0%	100.0%	0.0%	4,442	51.3%	99.8%	51.3%
Collin County	896,368	99.4%	100.0%	99.4%	73,141	63.5%	100.0%	63.5%
Collingsworth County	.	.	.	.	2,987	49.0%	100.0%	49.0%
Colorado County	7,724	100.0%	100.0%	100.0%	13,508	82.3%	100.0%	82.3%
Comal County	69,400	94.9%	100.0%	94.9%	71,603	96.9%	100.0%	96.9%
Comanche County	3,828	0.4%	100.0%	0.4%	9,745	41.4%	100.0%	41.4%
Concho County	.	.	.	.	2,717	14.3%	100.0%	14.3%
Cooke County	15,824	100.0%	100.0%	100.0%	24,071	92.7%	100.0%	92.7%
Coryell County	59,542	96.7%	100.0%	96.7%	15,371	83.4%	100.0%	83.4%
Cottle County	.	.	.	.	1,387	85.4%	100.0%	85.4%
Crane County	3,741	0.6%	100.0%	0.6%	999	0.9%	100.0%	0.9%
Crockett County	2,740	0.0%	100.0%	0.0%	824	0.1%	96.5%	0.1%
Crosby County	.	.	.	.	5,899	66.0%	100.0%	66.0%
Culberson County	.	.	.	.	2,231	82.8%	100.0%	82.8%
Dallam County	5,176	99.2%	100.0%	99.2%	2,030	88.7%	100.0%	88.7%
Dallas County	2,592,522	99.9%	100.0%	99.9%	25,618	99.9%	100.0%	99.9%
Dawson County	10,322	54.5%	100.0%	54.5%	2,491	63.8%	100.0%	63.8%
DeWitt County	9,620	100.0%	100.0%	100.0%	10,606	99.8%	100.0%	99.8%
Deaf Smith County	15,334	99.9%	100.0%	99.9%	3,502	29.4%	100.0%	29.4%
Delta County	.	.	.	.	5,298	16.9%	100.0%	16.9%
Denton County	736,855	99.9%	100.0%	99.9%	99,326	99.8%	100.0%	99.8%
Dickens County	.	.	.	.	2,209	90.0%	100.0%	90.0%
Dimmit County	5,663	100.0%	100.0%	100.0%	4,755	56.9%	100.0%	56.9%
Donley County	.	.	.	.	3,311	40.1%	100.0%	40.1%
Duval County	3,428	100.0%	100.0%	100.0%	7,845	55.3%	100.0%	55.3%
Eastland County	7,151	100.0%	100.0%	100.0%	11,260	88.1%	100.0%	88.1%
Ector County	134,305	85.7%	100.0%	85.7%	22,782	16.1%	100.0%	16.1%
Edwards County	.	.	.	.	1,953	42.0%	99.6%	42.0%
El Paso County	808,700	99.5%	100.0%	99.5%	31,707	53.8%	100.0%	53.8%
Ellis County	111,353	100.0%	100.0%	100.0%	62,267	100.0%	100.0%	100.0%
Erath County	20,744	100.0%	100.0%	100.0%	21,225	99.1%	100.0%	99.1%
Falls County	5,501	0.0%	100.0%	0.0%	11,935	62.4%	100.0%	62.4%
Fannin County	9,731	99.7%	100.0%	99.7%	24,712	45.7%	99.8%	45.7%
Fayette County	8,117	95.9%	100.0%	95.9%	17,155	92.5%	100.0%	92.5%
Fisher County	.	.	.	.	3,880	8.4%	100.0%	8.4%
Floyd County	2,680	99.8%	100.0%	99.8%	3,175	5.5%	100.0%	5.5%

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Foard County	.	.	.	.	1,222	99.3%	100.0%	99.3%
Fort Bend County	682,815	95.2%	100.0%	95.2%	81,984	44.5%	100.0%	44.5%
Franklin County	3,279	99.7%	100.0%	99.7%	7,487	56.0%	100.0%	56.0%
Freestone County	6,563	31.5%	100.0%	31.5%	13,062	34.7%	100.0%	34.7%
Frio County	13,585	100.0%	100.0%	100.0%	6,015	98.0%	100.0%	98.0%
Gaines County	6,718	98.3%	100.0%	98.3%	13,920	44.9%	100.0%	44.9%
Galveston County	307,851	96.1%	100.0%	96.1%	27,184	67.2%	100.0%	67.2%
Garza County	4,896	100.0%	100.0%	100.0%	1,632	54.7%	100.0%	54.7%
Gillespie County	11,375	100.0%	100.0%	100.0%	15,271	78.1%	97.9%	78.1%
Glasscock County	.	.	.	.	1,348	77.9%	100.0%	77.9%
Goliad County	.	.	.	.	7,562	94.4%	100.0%	94.4%
Gonzales County	6,993	100.0%	100.0%	100.0%	13,900	99.9%	100.0%	99.9%
Gray County	17,797	98.9%	100.0%	98.9%	4,607	10.6%	100.0%	10.6%
Grayson County	71,906	100.0%	100.0%	100.0%	59,233	99.4%	100.0%	99.4%
Gregg County	106,328	95.5%	100.0%	95.5%	17,039	66.0%	100.0%	66.0%
Grimes County	8,453	98.7%	100.0%	98.7%	19,629	76.4%	100.0%	76.4%
Guadalupe County	110,313	100.0%	100.0%	100.0%	49,344	100.0%	100.0%	100.0%
Hale County	25,660	97.9%	100.0%	97.9%	8,474	58.0%	100.0%	58.0%
Hall County	.	.	.	.	3,071	55.7%	100.0%	55.7%
Hamilton County	2,802	100.0%	100.0%	100.0%	5,620	94.9%	100.0%	94.9%
Hansford County	3,166	100.0%	100.0%	100.0%	2,281	4.1%	100.0%	4.1%
Hardeman County	.	.	.	.	3,994	12.5%	100.0%	12.5%
Hardin County	26,924	97.4%	100.0%	97.4%	30,215	60.4%	100.0%	60.4%
Harris County	4,576,220	94.2%	100.0%	94.2%	76,747	84.1%	100.0%	84.1%
Harrison County	29,117	99.5%	100.0%	99.5%	37,544	60.2%	100.0%	60.2%
Hartley County	2,385	99.8%	100.0%	99.8%	3,306	81.2%	100.0%	81.2%
Haskell County	2,784	100.0%	100.0%	100.0%	2,962	92.1%	100.0%	92.1%
Hays County	134,429	99.3%	100.0%	99.3%	79,913	88.6%	100.0%	88.6%
Hemphill County	2,644	0.0%	100.0%	0.0%	1,380	0.0%	99.4%	0.0%
Henderson County	31,808	91.6%	100.0%	91.6%	49,250	53.9%	100.0%	53.9%
Hidalgo County	804,382	99.9%	100.0%	99.9%	56,270	91.6%	100.0%	91.6%
Hill County	8,182	100.0%	100.0%	100.0%	27,667	100.0%	100.0%	100.0%
Hockley County	13,346	44.5%	100.0%	44.5%	9,742	46.3%	100.0%	46.3%
Hood County	37,100	100.0%	100.0%	100.0%	21,173	100.0%	100.0%	100.0%
Hopkins County	14,453	99.8%	100.0%	99.8%	22,043	34.1%	100.0%	34.1%
Houston County	5,700	71.4%	100.0%	71.4%	17,321	50.8%	98.5%	50.7%

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Howard County	27,486	99.9%	100.0%	99.9%	8,554	74.6%	100.0%	74.6%
Hudspeth County	.	.	.	.	4,407	29.7%	99.3%	29.4%
Hunt County	38,823	82.5%	100.0%	82.5%	55,049	16.3%	100.0%	16.3%
Hutchinson County	16,606	97.0%	100.0%	97.0%	4,769	62.4%	100.0%	62.4%
Irion County	.	.	.	.	1,516	0.0%	99.9%	0.0%
Jack County	4,050	100.0%	100.0%	100.0%	4,782	98.8%	99.8%	98.6%
Jackson County	5,454	98.3%	100.0%	98.3%	9,351	38.7%	100.0%	38.7%
Jasper County	7,641	98.4%	100.0%	98.4%	27,920	19.0%	100.0%	19.0%
Jeff Davis County	.	.	.	.	2,280	28.3%	90.4%	28.3%
Jefferson County	233,671	97.2%	100.0%	97.2%	22,625	57.6%	100.0%	57.6%
Jim Hogg County	4,048	100.0%	100.0%	100.0%	1,154	83.3%	99.9%	83.3%
Jim Wells County	24,058	100.0%	100.0%	100.0%	16,813	96.6%	100.0%	96.6%
Johnson County	100,801	100.0%	100.0%	100.0%	66,499	100.0%	100.0%	100.0%
Jones County	3,027	0.0%	100.0%	0.0%	16,956	53.2%	100.0%	53.2%
Karnes County	9,046	100.0%	100.0%	100.0%	6,141	99.9%	100.0%	99.9%
Kaufman County	56,731	97.3%	100.0%	97.3%	66,148	40.3%	100.0%	40.3%
Kendall County	15,715	97.4%	100.0%	97.4%	28,309	84.1%	100.0%	84.1%
Kenedy County	.	.	.	.	417	6.5%	100.0%	6.5%
Kent County	.	.	.	.	763	79.4%	100.0%	79.4%
Kerr County	29,549	98.4%	100.0%	98.4%	22,171	78.7%	99.8%	78.6%
Kimble County	2,428	97.4%	100.0%	97.4%	1,982	9.8%	98.2%	9.8%
King County	.	.	.	.	296	43.9%	100.0%	43.9%
Kinney County	2,790	88.1%	100.0%	88.1%	955	45.7%	97.1%	45.7%
Kleberg County	24,935	100.0%	100.0%	100.0%	6,153	98.0%	100.0%	98.0%
Knox County	.	.	.	.	3,710	99.9%	100.0%	99.9%
La Salle County	3,721	100.0%	100.0%	100.0%	3,863	50.8%	100.0%	50.8%
Lamar County	26,018	100.0%	100.0%	100.0%	23,569	39.2%	100.0%	39.2%
Lamb County	5,301	57.2%	100.0%	57.2%	7,909	65.4%	100.0%	65.4%
Lampasas County	6,506	100.0%	100.0%	100.0%	14,520	99.7%	99.9%	99.6%
Lavaca County	3,618	100.0%	100.0%	100.0%	16,444	92.4%	100.0%	92.4%
Lee County	5,083	92.3%	100.0%	92.3%	12,100	36.2%	100.0%	36.2%
Leon County	.	.	.	.	17,243	55.8%	97.1%	54.1%
Liberty County	29,596	76.3%	100.0%	76.3%	54,060	48.7%	100.0%	48.7%
Limestone County	10,485	24.2%	100.0%	24.2%	13,042	25.6%	100.0%	25.6%
Lipscomb County	.	.	.	.	3,378	74.6%	100.0%	74.6%
Live Oak County	.	.	.	.	12,174	100.0%	100.0%	100.0%

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Llano County	10,933	0.5%	100.0%	0.5%	10,277	0.3%	100.0%	0.3%
Loving County	.	.	.	.	134	18.7%	100.0%	18.7%
Lubbock County	264,932	96.1%	100.0%	96.1%	40,293	57.4%	100.0%	57.4%
Lynn County	2,487	76.0%	100.0%	76.0%	3,372	75.8%	100.0%	75.8%
Madison County	4,536	0.0%	100.0%	0.0%	9,686	21.2%	100.0%	21.2%
Marion County	.	.	.	.	10,064	57.5%	100.0%	57.5%
Martin County	.	.	.	.	5,626	80.9%	100.0%	80.9%
Mason County	.	.	.	.	4,222	72.8%	99.9%	72.8%
Matagorda County	21,965	96.1%	100.0%	96.1%	14,875	35.2%	100.0%	35.2%
Maverick County	50,268	100.0%	100.0%	100.0%	7,948	50.7%	100.0%	50.7%
McCulloch County	5,064	0.1%	100.0%	0.1%	2,893	4.7%	100.0%	4.7%
McLennan County	189,952	100.0%	100.0%	100.0%	61,303	100.0%	100.0%	100.0%
McMullen County	.	.	.	.	778	99.7%	100.0%	99.7%
Medina County	18,243	94.0%	100.0%	94.0%	31,820	63.8%	99.8%	63.5%
Menard County	.	.	.	.	2,124	1.9%	98.0%	1.9%
Midland County	140,165	98.6%	100.0%	98.6%	24,884	67.9%	100.0%	67.9%
Milam County	10,598	27.5%	100.0%	27.5%	14,455	24.0%	100.0%	24.0%
Mills County	.	.	.	.	4,921	60.6%	100.0%	60.6%
Mitchell County	5,175	0.0%	100.0%	0.0%	3,293	18.6%	100.0%	18.6%
Montague County	7,813	100.0%	100.0%	100.0%	11,725	92.7%	99.6%	92.7%
Montgomery County	426,871	99.5%	100.0%	99.5%	144,055	98.5%	100.0%	98.5%
Moore County	17,983	84.2%	100.0%	84.2%	4,114	74.0%	100.0%	74.0%
Morris County	2,761	98.7%	100.0%	98.7%	9,706	56.4%	100.0%	56.4%
Motley County	.	.	.	.	1,230	72.8%	99.8%	72.8%
Nacogdoches County	34,424	99.8%	100.0%	99.8%	31,156	62.0%	100.0%	62.0%
Navarro County	22,791	100.0%	100.0%	100.0%	25,910	89.2%	100.0%	89.2%
Newton County	.	.	.	.	13,952	23.6%	99.8%	23.6%
Nolan County	9,848	100.0%	100.0%	100.0%	4,922	31.6%	100.0%	31.6%
Nueces County	333,403	100.0%	100.0%	100.0%	27,818	98.8%	100.0%	98.8%
Ochiltree County	8,320	100.0%	100.0%	100.0%	1,753	22.9%	100.0%	22.9%
Oldham County	.	.	.	.	2,114	49.9%	100.0%	49.9%
Orange County	54,801	99.2%	100.0%	99.2%	30,246	64.5%	100.0%	64.5%
Palo Pinto County	13,911	100.0%	100.0%	100.0%	14,658	100.0%	100.0%	100.0%
Panola County	6,067	99.8%	100.0%	99.8%	17,176	31.2%	100.0%	31.2%
Parker County	56,602	100.0%	100.0%	100.0%	76,860	100.0%	100.0%	100.0%

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	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Parmer County	3,750	42.1%	100.0%	42.1%	6,092	54.2%	100.0%	54.2%
Pecos County	9,185	88.4%	100.0%	88.4%	6,449	43.1%	99.5%	43.1%
Polk County	10,731	54.0%	100.0%	54.0%	38,431	40.9%	100.0%	40.9%
Potter County	109,151	94.8%	100.0%	94.8%	11,307	59.6%	100.0%	59.6%
Presidio County	4,078	0.2%	100.0%	0.2%	3,078	36.4%	94.5%	36.2%
Rains County	782	0.0%	100.0%	0.0%	10,980	9.2%	100.0%	9.2%
Randall County	110,961	99.7%	100.0%	99.7%	23,460	77.2%	100.0%	77.2%
Reagan County	2,867	0.0%	100.0%	0.0%	843	7.2%	99.8%	7.2%
Real County	.	.	.	.	3,429	65.5%	94.4%	60.4%
Red River County	2,823	99.2%	100.0%	99.2%	9,406	62.5%	99.8%	62.3%
Reeves County	12,028	64.8%	100.0%	64.8%	3,253	50.8%	100.0%	50.8%
Refugio County	2,844	100.0%	100.0%	100.0%	4,380	80.0%	100.0%	80.0%
Roberts County	.	.	.	.	938	62.7%	100.0%	62.7%
Robertson County	4,167	42.6%	100.0%	42.6%	13,033	44.2%	100.0%	44.2%
Rockwall County	77,721	98.9%	100.0%	98.9%	19,022	77.0%	100.0%	77.0%
Runnels County	5,923	99.4%	100.0%	99.4%	4,343	28.8%	100.0%	28.8%
Rusk County	17,776	99.6%	100.0%	99.6%	35,057	38.2%	100.0%	38.2%
Sabine County	.	.	.	.	10,461	57.1%	98.6%	57.1%
San Augustine County	.	.	.	.	8,253	13.3%	98.9%	13.3%
San Jacinto County	.	.	.	.	28,270	44.0%	100.0%	44.0%
San Patricio County	53,020	100.0%	100.0%	100.0%	14,195	100.0%	100.0%	100.0%
San Saba County	2,784	100.0%	100.0%	100.0%	3,175	47.3%	99.8%	47.3%
Schleicher County	.	.	.	.	3,001	0.0%	99.2%	0.0%
Scurry County	11,326	98.0%	100.0%	98.0%	5,724	34.7%	100.0%	34.7%
Shackelford County	.	.	.	.	3,328	39.6%	100.0%	39.6%
Shelby County	5,058	5.8%	100.0%	5.8%	20,455	13.4%	99.0%	13.4%
Sherman County	.	.	.	.	3,067	40.1%	100.0%	40.1%
Smith County	153,471	99.6%	100.0%	99.6%	74,254	70.4%	100.0%	70.4%
Somervell County	.	.	.	.	8,845	100.0%	100.0%	100.0%
Starr County	47,579	98.6%	100.0%	98.6%	16,875	69.7%	100.0%	69.7%
Stephens County	5,616	100.0%	100.0%	100.0%	3,721	97.5%	100.0%	97.5%
Sterling County	.	.	.	.	1,295	0.0%	99.6%	0.0%
Stonewall County	.	.	.	.	1,388	80.0%	100.0%	80.0%
Sutton County	2,786	0.0%	100.0%	0.0%	981	0.0%	98.5%	0.0%
Swisher County	4,434	91.6%	100.0%	91.6%	3,081	59.1%	100.0%	59.1%

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Tarrant County	2,021,604	99.9%	100.0%	99.9%	32,858	100.0%	100.0%	100.0%
Taylor County	112,843	99.5%	100.0%	99.5%	23,447	84.5%	100.0%	84.5%
Terrell County	.	.	.	.	810	4.9%	96.7%	4.4%
Terry County	9,438	45.1%	100.0%	45.1%	3,277	52.5%	100.0%	52.5%
Throckmorton County	.	.	.	.	1,527	60.0%	99.8%	60.0%
Titus County	16,095	98.6%	100.0%	98.6%	16,809	33.3%	100.0%	33.3%
Tom Green County	96,033	99.9%	100.0%	99.9%	21,985	34.6%	100.0%	34.6%
Travis County	1,132,897	100.0%	100.0%	100.0%	93,780	96.7%	100.0%	96.7%
Trinity County	3,354	61.7%	100.0%	61.7%	11,313	55.9%	100.0%	55.9%
Tyler County	4,678	99.4%	100.0%	99.4%	16,861	18.5%	100.0%	18.5%
Upshur County	8,456	91.2%	100.0%	91.2%	32,824	84.6%	100.0%	84.6%
Upton County	.	.	.	.	3,663	0.4%	100.0%	0.4%
Uvalde County	18,096	100.0%	100.0%	100.0%	9,036	94.8%	99.3%	94.8%
Val Verde County	43,750	100.0%	100.0%	100.0%	5,455	71.8%	97.8%	71.8%
Van Zandt County	13,401	48.0%	100.0%	48.0%	41,779	6.6%	100.0%	6.6%
Victoria County	65,406	100.0%	100.0%	100.0%	26,678	95.9%	100.0%	95.9%
Walker County	38,107	100.0%	100.0%	100.0%	34,138	68.1%	100.0%	68.1%
Waller County	18,781	59.6%	100.0%	59.6%	32,523	23.6%	100.0%	23.6%
Ward County	7,553	40.6%	100.0%	40.6%	3,919	51.2%	100.0%	51.2%
Washington County	15,859	94.9%	100.0%	94.9%	19,184	23.8%	100.0%	23.8%
Webb County	255,542	99.3%	100.0%	99.3%	19,250	21.8%	99.8%	21.8%
Wharton County	20,637	97.6%	100.0%	97.6%	21,329	26.4%	100.0%	26.4%
Wheeler County	.	.	.	.	5,358	23.6%	100.0%	23.6%
Wichita County	117,878	97.7%	100.0%	97.7%	14,122	53.4%	100.0%	53.4%
Wilbarger County	9,796	89.1%	100.0%	89.1%	2,968	56.2%	100.0%	56.2%
Willacy County	14,040	100.0%	100.0%	100.0%	7,544	99.9%	100.0%	99.9%
Williamson County	444,904	99.6%	100.0%	99.6%	102,608	63.4%	100.0%	63.4%
Wilson County	6,406	100.0%	100.0%	100.0%	42,894	100.0%	100.0%	100.0%
Winkler County	5,509	16.1%	100.0%	16.1%	2,065	40.2%	100.0%	40.2%
Wise County	17,467	100.0%	100.0%	100.0%	48,706	100.0%	100.0%	100.0%
Wood County	11,177	92.3%	100.0%	92.3%	33,137	53.4%	100.0%	53.4%
Yoakum County	4,920	99.8%	100.0%	99.8%	3,647	36.2%	100.0%	36.2%
Young County	12,017	99.2%	100.0%	99.2%	5,962	96.4%	100.0%	96.4%
Zapata County	9,803	100.0%	100.0%	100.0%	4,519	39.7%	100.0%	39.7%

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Zavala County	7,110	100.0%	100.0%	100.0%	4,838	25.6%	100.0%	25.6%
Utah	**2,719,180**	**98.5%**	**100.0%**	**98.5%**	**382,583**	**64.0%**	**97.8%**	**63.7%**
Beaver County	2,624	100.0%	100.0%	100.0%	3,762	86.8%	99.9%	86.8%
Box Elder County	34,765	99.6%	100.0%	99.6%	19,312	72.3%	100.0%	72.3%
Cache County	101,236	97.7%	100.0%	97.7%	23,200	72.6%	100.0%	72.6%
Carbon County	13,178	100.0%	100.0%	100.0%	7,117	78.8%	97.6%	78.8%
Daggett County	.	.	.	.	1,029	0.0%	75.8%	0.0%
Davis County	342,806	97.8%	100.0%	97.8%	4,829	69.2%	100.0%	69.2%
Duchesne County	4,411	99.1%	100.0%	99.1%	15,615	54.5%	99.5%	54.5%
Emery County	1,887	100.0%	100.0%	100.0%	8,190	82.0%	98.0%	81.7%
Garfield County	.	.	.	.	5,078	97.6%	97.7%	96.6%
Grand County	4,219	99.8%	100.0%	99.8%	5,454	14.6%	87.4%	14.6%
Iron County	36,137	100.0%	100.0%	100.0%	14,864	88.0%	99.6%	88.0%
Juab County	5,409	99.6%	100.0%	99.6%	5,841	73.5%	91.0%	73.3%
Kane County	3,062	100.0%	100.0%	100.0%	4,505	89.8%	99.4%	89.3%
Millard County	2,820	98.2%	100.0%	98.2%	10,043	39.7%	99.0%	39.7%
Morgan County	3,695	100.0%	100.0%	100.0%	8,176	81.1%	93.6%	74.8%
Piute County	.	.	.	.	1,420	100.0%	100.0%	100.0%
Rich County	.	.	.	.	2,391	54.8%	99.2%	54.8%
Salt Lake County	1,118,710	99.1%	100.0%	99.1%	16,932	77.4%	100.0%	77.4%
San Juan County	2,280	71.1%	100.0%	71.1%	13,076	6.3%	87.4%	6.3%
Sanpete County	16,500	99.9%	100.0%	99.9%	13,535	73.1%	99.1%	73.1%
Sevier County	6,203	99.9%	100.0%	99.9%	15,113	81.3%	99.9%	81.3%
Summit County	22,926	91.9%	100.0%	91.9%	18,178	85.6%	98.8%	84.9%
Tooele County	49,035	98.7%	100.0%	98.7%	18,412	42.4%	96.2%	42.4%
Uintah County	14,540	99.9%	100.0%	99.9%	20,610	56.5%	92.1%	56.5%
Utah County	547,059	98.8%	100.0%	98.8%	59,342	36.0%	98.4%	35.8%
Wasatch County	19,843	94.4%	100.0%	94.4%	12,260	63.8%	97.8%	63.0%
Washington County	130,498	98.2%	100.0%	98.2%	35,149	94.9%	100.0%	94.9%
Wayne County	.	.	.	.	2,719	90.0%	99.8%	90.0%
Weber County	235,337	96.9%	100.0%	96.9%	16,431	60.0%	99.4%	60.0%
Vermont	**240,612**	**98.7%**	**100.0%**	**98.7%**	**383,043**	**83.4%**	**97.8%**	**82.2%**
Addison County	7,883	99.5%	100.0%	99.5%	28,893	93.2%	99.2%	92.8%
Bennington County	12,123	99.6%	100.0%	99.6%	23,471	92.8%	96.7%	91.2%
Caledonia County	7,447	99.8%	100.0%	99.8%	22,717	69.7%	97.2%	68.3%

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Chittenden County	118,673	98.1%	100.0%	98.1%	43,698	97.6%	99.3%	96.9%
Essex County	.	.	.	.	6,230	42.5%	94.5%	42.4%
Franklin County	13,661	99.8%	100.0%	99.8%	35,364	79.6%	97.3%	77.7%
Grand Isle County	.	.	.	.	6,997	63.1%	100.0%	63.1%
Lamoille County	.	.	.	.	25,337	84.7%	98.4%	83.8%
Orange County	797	100.0%	100.0%	100.0%	28,177	65.1%	96.6%	64.4%
Orleans County	3,796	99.9%	100.0%	99.9%	23,045	68.0%	94.6%	67.2%
Rutland County	22,343	99.7%	100.0%	99.7%	36,744	97.9%	97.4%	95.3%
Washington County	27,395	99.2%	100.0%	99.2%	30,895	86.4%	96.5%	83.7%
Windham County	13,291	99.6%	100.0%	99.6%	29,578	67.6%	99.4%	67.6%
Windsor County	13,203	96.7%	100.0%	96.7%	41,897	93.2%	99.0%	92.4%
Virginia	**6,396,667**	**100.0%**	**100.0%**	**100.0%**	**2,078,499**	**100.0%**	**99.1%**	**99.1%**
Accomack County	.	.	.	.	32,545	100.0%	100.0%	100.0%
Albemarle County	55,926	100.0%	100.0%	100.0%	51,774	100.0%	100.0%	100.0%
Alexandria city	159,968	100.0%	100.0%	100.0%	.	.	.	.
Alleghany County	7,087	100.0%	100.0%	100.0%	8,035	100.0%	96.3%	96.3%
Amelia County	.	.	.	.	13,020	100.0%	100.0%	100.0%
Amherst County	11,072	100.0%	100.0%	100.0%	20,522	100.0%	99.9%	99.9%
Appomattox County	.	.	.	.	15,678	100.0%	100.0%	100.0%
Arlington County	234,935	100.0%	100.0%	100.0%	.	.	.	.
Augusta County	24,633	100.0%	100.0%	100.0%	50,511	100.0%	99.0%	99.0%
Bath County	.	.	.	.	4,297	100.0%	90.6%	90.6%
Bedford County	15,638	100.0%	100.0%	100.0%	62,005	100.0%	100.0%	100.0%
Bedford city	5,807	100.0%	100.0%	100.0%	128	100.0%	100.0%	100.0%
Bland County	.	.	.	.	6,350	100.0%	98.8%	98.8%
Botetourt County	11,797	100.0%	100.0%	100.0%	21,395	100.0%	99.6%	99.6%
Bristol city	16,783	100.0%	100.0%	100.0%	7	100.0%	100.0%	100.0%
Brunswick County	3,394	100.0%	100.0%	100.0%	12,850	100.0%	99.9%	99.9%
Buchanan County	.	.	.	.	21,514	100.0%	81.9%	81.9%
Buckingham County	.	.	.	.	17,065	100.0%	100.0%	100.0%
Buena Vista city	6,078	100.0%	100.0%	100.0%	249	100.0%	100.0%	100.0%
Campbell County	21,341	100.0%	100.0%	100.0%	33,669	100.0%	100.0%	100.0%
Caroline County	6,273	100.0%	100.0%	100.0%	24,185	100.0%	100.0%	100.0%
Carroll County	809	100.0%	100.0%	100.0%	28,897	100.0%	98.7%	98.7%
Charles City County	.	.	.	.	7,004	100.0%	100.0%	100.0%

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Charlotte County	.	.	.	.	12,119	100.0%	94.3%	94.3%
Charlottesville city	48,002	100.0%	100.0%	100.0%	.	.	.	.
Chesapeake city	219,583	100.0%	100.0%	100.0%	20,804	100.0%	100.0%	100.0%
Chesterfield County	319,644	100.0%	100.0%	100.0%	23,943	100.0%	100.0%	100.0%
Clarke County	4,293	100.0%	100.0%	100.0%	10,214	100.0%	100.0%	100.0%
Colonial Heights city	17,830	100.0%	100.0%	100.0%	.	.	.	.
Covington city	5,527	100.0%	100.0%	100.0%	.	.	.	.
Craig County	.	.	.	.	5,062	100.0%	77.9%	77.9%
Culpeper County	18,421	100.0%	100.0%	100.0%	32,857	100.0%	100.0%	100.0%
Cumberland County	362	100.0%	100.0%	100.0%	9,448	100.0%	100.0%	100.0%
Danville city	39,299	100.0%	100.0%	100.0%	1,831	100.0%	100.0%	100.0%
Dickenson County	.	.	.	.	14,782	100.0%	88.9%	88.9%
Dinwiddie County	7,932	100.0%	100.0%	100.0%	20,276	100.0%	100.0%	100.0%
Emporia city	4,918	100.0%	100.0%	100.0%	364	100.0%	100.0%	100.0%
Essex County	2,484	100.0%	100.0%	100.0%	8,544	100.0%	100.0%	100.0%
Fairfax County	1,131,104	100.0%	100.0%	100.0%	17,314	100.0%	100.0%	100.0%
Fairfax city	24,097	100.0%	100.0%	100.0%	.	.	.	.
Falls Church city	14,554	100.0%	100.0%	100.0%	.	.	.	.
Fauquier County	28,384	100.0%	100.0%	100.0%	41,079	100.0%	100.0%	100.0%
Floyd County	.	.	.	.	15,752	100.0%	99.9%	99.9%
Fluvanna County	9,626	100.0%	100.0%	100.0%	16,823	100.0%	100.0%	100.0%
Franklin County	6,024	100.0%	100.0%	100.0%	50,420	100.0%	100.0%	100.0%
Franklin city	7,892	100.0%	100.0%	100.0%	284	100.0%	100.0%	100.0%
Frederick County	45,152	100.0%	100.0%	100.0%	41,328	100.0%	100.0%	100.0%
Fredericksburg city	27,992	100.0%	100.0%	100.0%	368	100.0%	100.0%	100.0%
Galax city	5,679	100.0%	100.0%	100.0%	946	100.0%	100.0%	100.0%
Giles County	5,708	100.0%	100.0%	100.0%	11,129	100.0%	99.4%	99.4%
Gloucester County	13,089	100.0%	100.0%	100.0%	24,203	100.0%	100.0%	100.0%
Goochland County	647	100.0%	100.0%	100.0%	22,038	100.0%	100.0%	100.0%
Grayson County	19	100.0%	100.0%	100.0%	15,643	100.0%	77.9%	77.9%
Greene County	9,240	100.0%	100.0%	100.0%	10,372	100.0%	99.3%	99.3%
Greensville County	1,220	100.0%	100.0%	100.0%	10,459	100.0%	99.9%	99.9%
Halifax County	7,647	100.0%	100.0%	100.0%	26,916	100.0%	99.6%	99.6%
Hampton city	134,314	100.0%	100.0%	100.0%	355	100.0%	100.0%	100.0%
Hanover County	62,629	100.0%	100.0%	100.0%	43,293	100.0%	100.0%	100.0%
Harrisonburg city	54,211	100.0%	100.0%	100.0%	.	.	.	.

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Henrico County	312,804	100.0%	100.0%	100.0%	15,094	100.0%	100.0%	100.0%
Henry County	19,139	100.0%	100.0%	100.0%	32,088	100.0%	100.0%	100.0%
Highland County	.	.	.	.	2,212	100.0%	81.7%	81.7%
Hopewell city	22,609	100.0%	100.0%	100.0%	12	100.0%	100.0%	100.0%
Isle of Wight County	15,311	100.0%	100.0%	100.0%	21,241	100.0%	100.0%	100.0%
James City County	61,895	100.0%	100.0%	100.0%	13,610	100.0%	100.0%	100.0%
King George County	6,837	100.0%	100.0%	100.0%	19,500	100.0%	100.0%	100.0%
King William County	2,734	100.0%	100.0%	100.0%	13,974	100.0%	100.0%	100.0%
King and Queen County	.	.	.	.	7,003	100.0%	100.0%	100.0%
Lancaster County	.	.	.	.	10,788	100.0%	99.9%	99.9%
Lee County	112	100.0%	100.0%	100.0%	23,646	100.0%	95.8%	95.8%
Lexington city	7,106	100.0%	100.0%	100.0%	.	.	.	.
Loudoun County	326,560	100.0%	100.0%	100.0%	71,495	100.0%	100.0%	100.0%
Louisa County	.	.	.	.	35,858	100.0%	100.0%	100.0%
Lunenburg County	.	.	.	.	12,235	100.0%	100.0%	100.0%
Lynchburg city	78,498	100.0%	100.0%	100.0%	2,492	100.0%	100.0%	100.0%
Madison County	.	.	.	.	13,277	100.0%	99.4%	99.4%
Manassas Park city	16,541	100.0%	100.0%	100.0%	.	.	.	.
Manassas city	41,501	100.0%	100.0%	100.0%	.	.	.	.
Martinsville city	13,142	100.0%	100.0%	100.0%	.	.	.	.
Mathews County	.	.	.	.	8,779	100.0%	100.0%	100.0%
Mecklenburg County	6,926	100.0%	100.0%	100.0%	23,760	100.0%	100.0%	100.0%
Middlesex County	.	.	.	.	10,679	100.0%	100.0%	100.0%
Montgomery County	72,788	100.0%	100.0%	100.0%	25,770	100.0%	99.9%	99.9%
Nelson County	.	.	.	.	14,943	100.0%	99.8%	99.8%
New Kent County	.	.	.	.	21,679	100.0%	100.0%	100.0%
Newport News city	179,319	100.0%	100.0%	100.0%	69	100.0%	100.0%	100.0%
Norfolk city	244,703	100.0%	100.0%	100.0%	.	.	.	.
Northampton County	.	.	.	.	11,846	100.0%	100.0%	100.0%
Northumberland County	.	.	.	.	12,274	100.0%	100.0%	100.0%
Norton city	3,818	100.0%	100.0%	100.0%	112	100.0%	100.0%	100.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Nottoway County	7,109	100.0%	100.0%	100.0%	8,325	100.0%	100.0%	100.0%
Orange County	14,542	100.0%	100.0%	100.0%	21,522	100.0%	100.0%	100.0%
Page County	4,749	100.0%	100.0%	100.0%	18,982	100.0%	100.0%	100.0%
Patrick County	.	.	.	.	17,665	100.0%	96.0%	96.0%
Petersburg city	31,062	100.0%	100.0%	100.0%	688	100.0%	100.0%	100.0%
Pittsylvania County	8,085	100.0%	100.0%	100.0%	53,173	100.0%	99.9%	99.9%
Poquoson city	11,272	100.0%	100.0%	100.0%	781	100.0%	100.0%	100.0%
Portsmouth city	94,572	100.0%	100.0%	100.0%	.	.	.	.
Powhatan County	97	100.0%	100.0%	100.0%	28,504	100.0%	100.0%	100.0%
Prince Edward County	7,829	100.0%	100.0%	100.0%	14,874	100.0%	100.0%	100.0%
Prince George County	16,524	100.0%	100.0%	100.0%	21,285	100.0%	100.0%	100.0%
Prince William County	436,246	100.0%	100.0%	100.0%	26,711	100.0%	100.0%	100.0%
Pulaski County	18,169	100.0%	100.0%	100.0%	16,015	100.0%	100.0%	100.0%
Radford city	17,086	100.0%	100.0%	100.0%	569	100.0%	100.0%	100.0%
Rappahannock County	.	.	.	.	7,320	100.0%	96.7%	96.7%
Richmond County	.	.	.	.	8,939	100.0%	100.0%	100.0%
Richmond city	227,015	100.0%	100.0%	100.0%	.	.	.	.
Roanoke County	75,860	100.0%	100.0%	100.0%	17,870	100.0%	98.9%	98.9%
Roanoke city	99,824	100.0%	100.0%	100.0%	13	100.0%	100.0%	100.0%
Rockbridge County	1,890	100.0%	100.0%	100.0%	20,767	100.0%	99.8%	99.8%
Rockingham County	31,723	100.0%	100.0%	100.0%	48,504	100.0%	99.9%	99.9%
Russell County	3,131	100.0%	100.0%	100.0%	23,917	100.0%	99.1%	99.1%
Salem city	25,854	100.0%	100.0%	100.0%	.	.	.	.
Scott County	3,769	100.0%	100.0%	100.0%	18,096	100.0%	98.0%	98.0%
Shenandoah County	14,267	100.0%	100.0%	100.0%	28,958	100.0%	100.0%	100.0%
Smyth County	7,766	100.0%	100.0%	100.0%	22,890	100.0%	94.6%	94.6%
Southampton County	376	100.0%	100.0%	100.0%	17,374	100.0%	100.0%	100.0%
Spotsylvania County	86,707	100.0%	100.0%	100.0%	46,325	100.0%	100.0%	100.0%
Stafford County	114,826	100.0%	100.0%	100.0%	31,823	100.0%	100.0%	100.0%
Staunton city	23,573	100.0%	100.0%	100.0%	950	100.0%	100.0%	100.0%
Suffolk city	69,067	100.0%	100.0%	100.0%	21,170	100.0%	100.0%	100.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
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Surry County	.	.	.	.	6,540	100.0%	100.0%	100.0%
Sussex County	.	.	.	.	11,373	100.0%	100.0%	100.0%
Tazewell County	20,101	100.0%	100.0%	100.0%	20,994	100.0%	98.5%	98.5%
Virginia Beach city	442,867	100.0%	100.0%	100.0%	7,568	100.0%	100.0%	100.0%
Warren County	19,154	100.0%	100.0%	100.0%	20,407	100.0%	100.0%	100.0%
Washington County	15,197	100.0%	100.0%	100.0%	39,189	100.0%	98.1%	98.1%
Waynesboro city	21,706	100.0%	100.0%	100.0%	614	100.0%	100.0%	100.0%
Westmoreland County	3,702	100.0%	100.0%	100.0%	14,078	100.0%	100.0%	100.0%
Williamsburg city	15,031	100.0%	100.0%	100.0%	.	.	.	.
Winchester city	27,929	100.0%	100.0%	100.0%	.	.	.	.
Wise County	16,166	100.0%	100.0%	100.0%	22,420	100.0%	99.3%	99.3%
Wythe County	7,048	100.0%	100.0%	100.0%	21,834	100.0%	99.8%	99.8%
York County	63,369	100.0%	100.0%	100.0%	4,370	100.0%	100.0%	100.0%
Washington	**6,136,751**	**99.0%**	**100.0%**	**99.0%**	**1,268,818**	**88.9%**	**98.7%**	**88.0%**
Adams County	11,330	100.0%	100.0%	100.0%	8,168	100.0%	99.8%	99.8%
Asotin County	20,571	98.2%	100.0%	98.2%	1,964	40.0%	86.6%	40.0%
Benton County	168,999	100.0%	100.0%	100.0%	29,172	100.0%	100.0%	100.0%
Chelan County	54,267	99.3%	100.0%	99.3%	22,265	81.3%	98.6%	80.9%
Clallam County	47,289	93.3%	100.0%	93.3%	28,185	61.7%	99.2%	61.7%
Clark County	401,887	100.0%	100.0%	100.0%	72,752	100.0%	100.0%	100.0%
Columbia County	2,524	100.0%	100.0%	100.0%	1,523	90.7%	97.9%	89.7%
Cowlitz County	74,138	99.7%	100.0%	99.7%	32,770	76.0%	97.9%	75.5%
Douglas County	28,998	100.0%	100.0%	100.0%	12,944	100.0%	99.4%	99.4%
Ferry County	.	.	.	.	7,594	99.9%	88.0%	87.8%
Franklin County	74,810	100.0%	100.0%	100.0%	17,302	100.0%	98.2%	98.2%
Garfield County	.	.	.	.	2,210	11.9%	99.9%	11.9%
Grant County	56,125	100.0%	100.0%	100.0%	39,024	100.0%	99.7%	99.7%
Grays Harbor County	43,596	96.1%	100.0%	96.1%	29,099	71.5%	99.7%	71.4%
Island County	42,993	100.0%	100.0%	100.0%	40,166	100.0%	100.0%	100.0%
Jefferson County	13,000	98.5%	100.0%	98.5%	18,234	73.6%	100.0%	73.6%
King County	2,085,880	98.4%	100.0%	98.4%	102,730	76.7%	97.4%	75.6%
Kitsap County	220,414	98.0%	100.0%	98.0%	45,994	94.0%	100.0%	94.0%
Kittitas County	25,570	100.0%	100.0%	100.0%	20,635	100.0%	98.8%	98.8%
Klickitat County	8,226	59.0%	100.0%	59.0%	13,583	30.1%	90.3%	28.4%
Lewis County	29,752	93.7%	100.0%	93.7%	48,440	57.2%	98.1%	56.2%

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Lincoln County	.	.	.	.	10,579	100.0%	99.0%	99.0%
Mason County	22,538	98.3%	100.0%	98.3%	41,164	83.7%	99.8%	83.7%
Okanogan County	8,231	100.0%	100.0%	100.0%	33,510	93.6%	93.9%	89.0%
Pacific County	7,443	99.4%	100.0%	99.4%	14,183	78.6%	99.5%	78.3%
Pend Oreille County	2,208	100.0%	100.0%	100.0%	11,146	100.0%	98.8%	98.8%
Pierce County	808,621	99.2%	100.0%	99.2%	68,138	77.1%	99.7%	77.0%
San Juan County	.	.	.	.	16,715	100.0%	100.0%	100.0%
Skagit County	87,038	100.0%	100.0%	100.0%	38,580	100.0%	99.3%	99.3%
Skamania County	.	.	.	.	11,835	47.2%	97.3%	45.5%
Snohomish County	704,050	99.7%	100.0%	99.7%	97,557	97.2%	99.3%	96.5%
Spokane County	430,448	100.0%	100.0%	100.0%	75,687	100.0%	99.9%	99.9%
Stevens County	8,891	100.0%	100.0%	100.0%	35,839	100.0%	97.6%	97.6%
Thurston County	216,530	99.1%	100.0%	99.1%	64,052	93.0%	99.7%	92.8%
Wahkiakum County	.	.	.	.	4,264	20.7%	94.0%	18.9%
Walla Walla County	49,395	100.0%	100.0%	100.0%	11,171	99.4%	99.7%	99.1%
Whatcom County	159,141	100.0%	100.0%	100.0%	62,259	99.6%	98.3%	98.0%
Whitman County	33,166	100.0%	100.0%	100.0%	15,880	100.0%	98.9%	98.9%
Yakima County	188,682	100.0%	100.0%	100.0%	61,505	100.0%	97.2%	97.2%
West Virginia	**889,563**	**97.2%**	**99.9%**	**97.1%**	**926,290**	**72.5%**	**90.6%**	**67.2%**
Barbour County	2,324	100.0%	100.0%	100.0%	14,173	100.0%	98.0%	98.0%
Berkeley County	76,909	98.2%	100.0%	98.2%	38,011	88.7%	100.0%	88.7%
Boone County	4,565	90.2%	100.0%	90.2%	17,784	85.5%	79.3%	68.8%
Braxton County	.	.	.	.	14,237	99.9%	95.0%	94.9%
Brooke County	13,444	99.2%	100.0%	99.2%	8,999	69.7%	100.0%	69.7%
Cabell County	74,263	97.7%	100.0%	97.7%	20,695	84.6%	98.9%	83.7%
Calhoun County	.	.	.	.	7,307	28.9%	80.3%	25.8%
Clay County	.	.	.	.	8,764	24.1%	85.3%	14.5%
Doddridge County	.	.	.	.	8,559	70.8%	83.2%	56.4%
Fayette County	18,986	94.2%	100.0%	94.2%	24,535	61.8%	96.2%	58.9%
Gilmer County	2,838	100.0%	100.0%	100.0%	5,167	100.0%	65.7%	65.7%
Grant County	2,475	99.9%	100.0%	99.9%	9,195	32.7%	96.6%	32.1%
Greenbrier County	10,602	96.6%	100.0%	96.6%	24,685	57.6%	94.0%	57.1%
Hampshire County	.	.	.	.	23,469	27.4%	98.4%	27.2%
Hancock County	20,531	98.8%	100.0%	98.8%	8,917	85.2%	100.0%	85.2%
Hardy County	2,627	100.0%	100.0%	100.0%	11,090	84.1%	91.0%	76.2%

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Harrison County	42,840	100.0%	100.0%	100.0%	24,971	100.0%	97.9%	97.9%
Jackson County	8,298	97.6%	100.0%	97.6%	20,678	52.6%	99.3%	52.6%
Jefferson County	28,804	99.0%	100.0%	99.0%	27,534	97.1%	100.0%	97.1%
Kanawha County	136,757	98.2%	100.0%	98.2%	46,536	85.0%	98.0%	83.4%
Lewis County	5,035	100.0%	100.0%	100.0%	11,191	100.0%	87.5%	87.5%
Lincoln County	.	.	.	.	20,825	78.0%	69.1%	57.2%
Logan County	10,505	75.8%	93.4%	70.6%	22,420	68.9%	87.1%	62.4%
Marion County	32,886	100.0%	100.0%	100.0%	23,451	100.0%	98.7%	98.7%
Marshall County	16,622	97.2%	99.8%	97.2%	14,568	58.9%	93.9%	54.9%
Mason County	9,376	84.5%	100.0%	84.5%	17,425	42.2%	97.4%	41.7%
McDowell County	2,449	97.7%	100.0%	97.7%	16,007	81.3%	43.8%	38.1%
Mercer County	35,089	97.8%	100.0%	97.8%	24,664	93.8%	99.4%	93.3%
Mineral County	9,690	90.5%	100.0%	90.5%	17,532	56.2%	100.0%	56.2%
Mingo County	2,774	99.4%	100.0%	99.4%	21,353	64.0%	67.2%	45.7%
Monongalia County	74,876	97.3%	100.0%	97.3%	30,153	100.0%	97.2%	97.2%
Monroe County	1,542	98.2%	100.0%	98.2%	11,860	84.7%	90.7%	83.7%
Morgan County	.	.	.	.	17,686	68.9%	98.3%	68.9%
Nicholas County	3,110	100.0%	100.0%	100.0%	21,933	49.1%	94.3%	45.2%
Ohio County	32,319	98.4%	100.0%	98.4%	9,716	83.3%	100.0%	83.3%
Pendleton County	.	.	.	.	6,996	25.2%	52.9%	23.3%
Pleasants County	3,356	81.7%	100.0%	81.7%	4,156	41.1%	87.7%	37.8%
Pocahontas County	.	.	.	.	8,456	42.2%	22.4%	19.4%
Preston County	3,167	85.5%	100.0%	85.5%	30,512	54.6%	98.9%	54.3%
Putnam County	36,114	96.7%	100.0%	96.7%	20,678	65.1%	99.5%	65.1%
Raleigh County	45,074	95.2%	100.0%	95.2%	29,948	91.3%	90.9%	83.2%
Randolph County	10,844	100.0%	100.0%	100.0%	17,941	100.0%	84.9%	84.9%
Ritchie County	.	.	.	.	9,774	16.5%	78.7%	16.5%
Roane County	2,727	98.3%	100.0%	98.3%	11,316	22.6%	88.7%	21.4%
Summers County	3,528	76.2%	100.0%	76.2%	9,465	50.7%	100.0%	50.7%
Taylor County	6,721	97.1%	100.0%	97.1%	10,209	79.9%	100.0%	79.9%
Tucker County	.	.	.	.	6,915	54.1%	95.1%	54.0%
Tyler County	824	100.0%	100.0%	100.0%	7,971	23.7%	89.4%	23.7%
Upshur County	8,664	100.0%	100.0%	100.0%	15,801	100.0%	92.3%	92.3%
Wayne County	14,188	89.8%	100.0%	89.8%	25,965	76.4%	87.9%	69.1%
Webster County	.	.	.	.	8,372	64.3%	79.0%	59.2%
Wetzel County	6,872	93.9%	100.0%	93.9%	8,565	6.6%	55.6%	5.6%

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Wirt County	.	.	.	.	5,794	46.7%	81.8%	46.6%
Wood County	62,345	99.8%	100.0%	99.8%	22,759	75.5%	98.8%	75.5%
Wyoming County	2,603	99.6%	90.4%	90.0%	18,607	92.4%	64.1%	60.8%
Wisconsin	**4,050,955**	**99.5%**	**100.0%**	**99.5%**	**1,744,321**	**72.1%**	**99.2%**	**71.9%**
Adams County	.	.	.	.	19,973	57.3%	100.0%	57.3%
Ashland County	6,705	99.7%	100.0%	99.7%	8,795	47.2%	95.1%	45.9%
Barron County	15,163	99.9%	100.0%	99.9%	30,088	52.8%	99.9%	52.8%
Bayfield County	.	.	.	.	15,008	85.2%	96.0%	83.2%
Brown County	221,389	100.0%	100.0%	100.0%	40,632	100.0%	100.0%	100.0%
Buffalo County	.	.	.	.	13,167	90.9%	94.3%	85.7%
Burnett County	.	.	.	.	15,351	52.8%	100.0%	52.8%
Calumet County	35,836	100.0%	100.0%	100.0%	14,221	100.0%	100.0%	100.0%
Chippewa County	33,946	100.0%	100.0%	100.0%	29,864	68.1%	100.0%	68.1%
Clark County	2,734	99.8%	100.0%	99.8%	31,942	42.5%	99.4%	42.3%
Columbia County	22,267	92.2%	100.0%	92.2%	34,977	48.5%	99.9%	48.4%
Crawford County	6,062	98.6%	100.0%	98.6%	10,152	61.8%	89.8%	57.2%
Dane County	456,129	99.6%	100.0%	99.6%	80,268	76.5%	99.9%	76.5%
Dodge County	44,677	100.0%	100.0%	100.0%	43,109	84.3%	100.0%	84.3%
Door County	8,258	100.0%	100.0%	100.0%	19,225	55.1%	99.6%	55.1%
Douglas County	26,427	99.8%	100.0%	99.8%	16,857	47.9%	100.0%	47.9%
Dunn County	18,004	99.5%	100.0%	99.5%	26,689	55.4%	100.0%	55.4%
Eau Claire County	78,959	99.9%	100.0%	99.9%	24,708	63.8%	99.9%	63.8%
Florence County	.	.	.	.	4,371	87.7%	93.3%	84.0%
Fond du Lac County	66,230	100.0%	100.0%	100.0%	36,313	93.4%	100.0%	93.4%
Forest County	.	.	.	.	8,970	54.6%	97.4%	54.1%
Grant County	17,973	95.7%	100.0%	95.7%	34,026	75.4%	99.2%	75.0%
Green County	14,509	99.8%	100.0%	99.8%	22,342	78.7%	100.0%	78.7%
Green Lake County	4,807	100.0%	100.0%	100.0%	13,952	56.1%	100.0%	56.1%
Iowa County	4,682	100.0%	100.0%	100.0%	19,033	71.0%	97.6%	70.4%
Iron County	1,801	100.0%	100.0%	100.0%	3,870	38.2%	95.8%	36.6%
Jackson County	5,633	99.7%	100.0%	99.7%	14,896	36.4%	94.2%	36.2%
Jefferson County	55,698	100.0%	100.0%	100.0%	29,133	77.3%	100.0%	77.3%
Juneau County	4,161	94.8%	100.0%	94.8%	22,415	65.1%	99.6%	65.0%
Kenosha County	150,160	100.0%	100.0%	100.0%	18,356	99.9%	100.0%	99.9%
Kewaunee County	5,613	100.0%	100.0%	100.0%	14,832	98.8%	100.0%	98.8%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
La Crosse County	97,783	99.7%	100.0%	99.7%	20,488	79.4%	97.5%	78.1%
Lafayette County	.	.	.	.	16,741	68.0%	100.0%	68.0%
Langlade County	7,526	100.0%	100.0%	100.0%	11,634	86.7%	99.4%	86.1%
Lincoln County	12,532	97.6%	100.0%	97.6%	15,306	57.6%	99.3%	57.6%
Manitowoc County	47,642	100.0%	100.0%	100.0%	31,533	100.0%	100.0%	100.0%
Marathon County	76,964	99.9%	100.0%	99.9%	58,767	84.1%	99.7%	83.9%
Marinette County	15,006	100.0%	100.0%	100.0%	25,304	72.0%	98.0%	70.9%
Marquette County	.	.	.	.	15,308	70.5%	99.8%	70.5%
Menominee County	.	.	.	.	4,615	94.4%	97.0%	91.4%
Milwaukee County	950,221	100.0%	100.0%	100.0%	1,858	100.0%	100.0%	100.0%
Monroe County	19,112	100.0%	100.0%	100.0%	26,512	49.0%	98.1%	48.3%
Oconto County	7,019	100.0%	100.0%	100.0%	30,534	98.2%	99.8%	98.1%
Oneida County	8,769	99.9%	100.0%	99.9%	26,485	59.6%	99.6%	59.6%
Outagamie County	138,858	100.0%	100.0%	100.0%	47,166	98.1%	100.0%	98.1%
Ozaukee County	66,252	100.0%	100.0%	100.0%	22,176	100.0%	100.0%	100.0%
Pepin County	.	.	.	.	7,254	96.0%	100.0%	96.0%
Pierce County	19,025	95.1%	100.0%	95.1%	22,868	76.8%	100.0%	76.8%
Polk County	5,947	99.8%	100.0%	99.8%	37,503	53.5%	100.0%	53.5%
Portage County	44,927	99.9%	100.0%	99.9%	25,547	67.7%	100.0%	67.7%
Price County	.	.	.	.	13,442	40.3%	94.9%	39.4%
Racine County	171,727	100.0%	100.0%	100.0%	24,335	100.0%	100.0%	100.0%
Richland County	4,640	100.0%	100.0%	100.0%	12,876	33.2%	95.4%	32.4%
Rock County	128,804	99.9%	100.0%	99.9%	33,501	81.5%	100.0%	81.5%
Rusk County	3,121	99.9%	100.0%	99.9%	11,030	34.4%	99.3%	34.3%
Sauk County	33,886	98.9%	100.0%	98.9%	30,095	64.7%	99.7%	64.6%
Sawyer County	2,573	100.0%	100.0%	100.0%	13,844	70.7%	97.3%	70.1%
Shawano County	10,326	100.0%	100.0%	100.0%	30,609	99.2%	100.0%	99.2%
Sheboygan County	82,564	100.0%	100.0%	100.0%	32,780	100.0%	100.0%	100.0%
St. Croix County	40,882	76.3%	100.0%	76.3%	47,815	25.4%	100.0%	25.4%
Taylor County	3,820	99.2%	100.0%	99.2%	16,501	32.6%	95.8%	31.5%
Trempealeau County	2,988	60.8%	100.0%	60.8%	26,484	65.7%	97.4%	64.9%
Vernon County	4,299	96.1%	100.0%	96.1%	26,460	43.8%	87.7%	41.9%
Vilas County	.	.	.	.	21,680	44.9%	98.9%	44.4%
Walworth County	67,329	99.2%	100.0%	99.2%	35,753	89.1%	100.0%	89.1%
Washburn County	2,637	100.0%	100.0%	100.0%	13,119	46.5%	100.0%	46.5%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Washington County	93,087	100.0%	100.0%	100.0%	42,005	100.0%	100.0%	100.0%
Waukesha County	360,529	100.0%	100.0%	100.0%	40,073	99.4%	100.0%	99.4%
Waupaca County	17,346	99.3%	100.0%	99.3%	33,879	73.2%	99.9%	73.1%
Waushara County	2,356	99.9%	100.0%	99.9%	22,007	36.7%	99.9%	36.7%
Winnebago County	146,845	100.0%	100.0%	100.0%	23,564	69.1%	100.0%	69.1%
Wood County	45,790	99.9%	100.0%	99.9%	27,335	59.5%	99.9%	59.5%
Wyoming	**359,500**	**98.7%**	**100.0%**	**98.7%**	**219,813**	**52.8%**	**96.8%**	**51.2%**
Albany County	32,342	100.0%	100.0%	100.0%	5,990	70.2%	92.3%	69.1%
Big Horn County	.	.	.	.	11,906	31.9%	98.8%	31.4%
Campbell County	31,454	99.2%	100.0%	99.2%	14,788	71.5%	99.0%	71.3%
Carbon County	8,550	99.9%	100.0%	99.9%	6,753	43.5%	93.2%	42.8%
Converse County	6,028	100.0%	100.0%	100.0%	7,781	81.5%	98.7%	81.5%
Crook County	.	.	.	.	7,410	38.2%	97.2%	38.0%
Fremont County	19,164	99.2%	100.0%	99.2%	20,639	25.3%	88.9%	15.7%
Goshen County	7,129	100.0%	100.0%	100.0%	6,249	95.4%	97.9%	93.5%
Hot Springs County	3,193	99.9%	100.0%	99.9%	1,503	27.3%	97.2%	27.3%
Johnson County	4,266	99.8%	100.0%	99.8%	4,210	60.3%	99.7%	60.3%
Laramie County	75,263	99.5%	100.0%	99.5%	23,064	52.1%	99.8%	52.1%
Lincoln County	3,157	33.5%	100.0%	33.5%	16,107	73.8%	93.8%	68.5%
Natrona County	61,319	100.0%	100.0%	100.0%	18,228	65.0%	98.9%	65.0%
Niobrara County	.	.	.	.	2,397	84.9%	98.4%	84.9%
Park County	15,902	100.0%	100.0%	100.0%	13,665	31.0%	95.8%	30.8%
Platte County	3,440	91.5%	100.0%	91.5%	5,122	60.0%	99.8%	60.0%
Sheridan County	19,060	99.8%	100.0%	99.8%	11,150	68.1%	99.6%	68.1%
Sublette County	.	.	.	.	9,799	18.8%	99.3%	18.8%
Sweetwater County	37,792	99.8%	100.0%	99.8%	5,742	48.5%	96.5%	48.5%
Teton County	11,878	99.9%	100.0%	99.9%	11,387	88.3%	95.0%	85.6%
Uinta County	11,440	100.0%	100.0%	100.0%	9,055	21.9%	99.6%	21.9%
Washakie County	5,002	100.0%	100.0%	100.0%	3,062	37.2%	98.8%	37.0%
Weston County	3,121	54.4%	100.0%	54.4%	3,806	17.4%	95.9%	17.4%
American Samoa	**43,763**	**0.0%**	**0.0%**	**0.0%**	**7,741**	**0.0%**	**0.0%**	**0.0%**
Eastern District	18,247	0.0%	0.0%	0.0%	3,118	0.0%	0.0%	0.0%
Manu'a District	.	.	.	.	1,060	0.0%	0.0%	0.0%
Swains Island	.	.	.	.	16	0.0%	0.0%	0.0%
Western District	25,516	0.0%	0.0%	0.0%	3,547	0.0%	0.0%	0.0%
Guam	**156,192**	**1.6%**	**99.6%**	**1.6%**	**11,166**	**1.3%**	**99.0%**	**1.3%**

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Northern Mariana Islands	**46,479**	**1.7%**	**100.0%**	**1.7%**	**5,784**	**0.1%**	**96.7%**	**0.1%**
Rota Municipality	.	.	.	.	2,451	0.2%	94.5%	0.2%
Saipan Municipality	43,922	1.8%	100.0%	1.8%	2,848	0.0%	100.0%	0.0%
Tinian Municipality	2,557	0.0%	100.0%	0.0%	485	0.0%	88.9%	0.0%
Puerto Rico	**3,122,699**	**94.0%**	**100.0%**	**94.0%**	**214,478**	**67.5%**	**98.1%**	**66.2%**
Adjuntas Municipio	9,892	74.1%	100.0%	74.1%	8,079	34.4%	100.0%	34.4%
Aguada Municipio	38,118	99.1%	100.0%	99.1%	.	.	.	.
Aguadilla Municipio	53,121	100.0%	100.0%	100.0%	43	100.0%	100.0%	100.0%
Aguas Buenas Municipio	22,939	60.9%	100.0%	60.9%	2,911	17.6%	100.0%	17.6%
Aibonito Municipio	20,311	81.5%	100.0%	81.5%	2,797	46.0%	100.0%	46.0%
Anasco Municipio	23,374	96.5%	100.0%	96.5%	3,685	63.3%	100.0%	63.3%
Arecibo Municipio	78,201	96.0%	99.9%	96.0%	7,865	80.2%	100.0%	80.2%
Arroyo Municipio	17,147	98.7%	99.9%	98.7%	734	78.9%	99.9%	78.9%
Barceloneta Municipio	23,740	99.9%	100.0%	99.9%	500	99.4%	100.0%	99.4%
Barranquitas Municipio	27,613	72.0%	100.0%	72.0%	898	85.6%	100.0%	85.6%
Bayamon Municipio	179,541	91.0%	100.0%	91.0%	24	83.3%	100.0%	83.3%
Cabo Rojo Municipio	46,525	98.3%	100.0%	98.3%	2,299	85.6%	100.0%	85.6%
Caguas Municipio	128,421	99.3%	100.0%	99.3%	1,183	84.2%	100.0%	84.2%
Camuy Municipio	27,481	90.8%	100.0%	90.8%	4,251	77.0%	100.0%	77.0%
Canovanas Municipio	44,756	94.5%	100.0%	94.5%	1,067	56.3%	100.0%	56.3%
Carolina Municipio	154,199	99.5%	100.0%	99.5%	290	100.0%	100.0%	100.0%
Catano Municipio	24,370	100.0%	100.0%	100.0%	4	100.0%	100.0%	100.0%
Cayey Municipio	39,620	97.3%	100.0%	97.3%	4,407	49.1%	99.9%	49.1%
Ceiba Municipio	10,349	99.9%	100.0%	99.9%	1,253	86.0%	100.0%	86.0%
Ciales Municipio	9,913	98.6%	100.0%	98.6%	6,714	70.3%	96.9%	69.8%
Cidra Municipio	38,205	82.9%	100.0%	82.9%	1,608	71.4%	100.0%	71.4%
Coamo Municipio	31,626	96.2%	100.0%	96.2%	7,445	79.3%	100.0%	79.3%
Comerio Municipio	16,885	71.0%	100.0%	71.0%	2,458	39.6%	100.0%	39.6%
Corozal Municipio	31,761	70.7%	100.0%	70.7%	1,933	34.1%	100.0%	34.1%
Culebra Municipio	.	.	.	.	1,769	0.0%	100.0%	0.0%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Dorado Municipio	37,016	99.0%	100.0%	99.0%	10	90.0%	100.0%	90.0%
Fajardo Municipio	30,503	100.0%	100.0%	100.0%	821	90.3%	100.0%	90.3%
Florida Municipio	9,699	95.7%	100.0%	95.7%	2,076	85.0%	100.0%	85.0%
Guanica Municipio	14,859	100.0%	100.0%	100.0%	1,504	90.2%	100.0%	90.2%
Guayama Municipio	37,157	97.1%	100.0%	97.1%	4,124	62.2%	92.7%	62.2%
Guayanilla Municipio	16,372	90.3%	99.8%	90.3%	2,239	42.6%	95.2%	42.6%
Guaynabo Municipio	87,315	87.6%	100.0%	87.6%	13	0.0%	100.0%	0.0%
Gurabo Municipio	46,931	99.1%	100.0%	99.1%	178	100.0%	100.0%	100.0%
Hatillo Municipio	35,854	97.4%	100.0%	97.4%	4,257	80.6%	100.0%	80.6%
Hormigueros Municipio	15,998	100.0%	100.0%	100.0%	34	100.0%	100.0%	100.0%
Humacao Municipio	52,489	99.8%	100.0%	99.8%	282	100.0%	100.0%	100.0%
Isabela Municipio	39,136	95.9%	100.0%	95.9%	2,813	72.8%	100.0%	72.8%
Jayuya Municipio	9,697	93.4%	96.7%	93.4%	4,928	93.6%	92.5%	88.1%
Juana Diaz Municipio	43,692	99.6%	100.0%	99.6%	2,708	89.5%	99.8%	89.5%
Juncos Municipio	37,861	99.4%	100.0%	99.4%	1,240	75.7%	100.0%	75.7%
Lajas Municipio	18,549	99.8%	100.0%	99.8%	4,380	81.9%	100.0%	81.9%
Lares Municipio	18,881	83.4%	100.0%	83.4%	6,891	87.7%	96.7%	84.5%
Las Marias Municipio	2,803	79.0%	100.0%	79.0%	5,599	39.1%	100.0%	39.1%
Las Piedras Municipio	36,738	91.7%	100.0%	91.7%	921	60.4%	100.0%	60.4%
Loiza Municipio	25,705	100.0%	100.0%	100.0%	221	100.0%	100.0%	100.0%
Luquillo Municipio	16,574	99.9%	100.0%	99.9%	1,737	100.0%	100.0%	100.0%
Manati Municipio	36,181	99.9%	100.0%	99.9%	2,922	77.3%	100.0%	77.3%
Maricao Municipio	2,401	49.0%	100.0%	49.0%	3,264	73.4%	95.9%	69.3%
Maunabo Municipio	8,189	94.0%	100.0%	94.0%	2,619	83.8%	100.0%	83.8%
Mayaguez Municipio	72,238	99.6%	100.0%	99.6%	3,287	83.0%	99.7%	83.0%
Moca Municipio	31,728	99.2%	100.0%	99.2%	4,600	97.2%	96.5%	93.7%
Morovis Municipio	27,556	92.2%	100.0%	92.2%	3,536	29.5%	100.0%	29.5%
Naguabo Municipio	23,962	99.2%	100.0%	99.2%	2,215	96.8%	100.0%	96.8%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
Naranjito Municipio	28,306	64.7%	100.0%	64.7%	.	.	.	.
Orocovis Municipio	13,264	77.8%	100.0%	77.8%	7,845	30.8%	91.9%	28.2%
Patillas Municipio	12,634	98.5%	100.0%	98.5%	4,370	84.1%	71.6%	55.7%
Penuelas Municipio	17,208	95.0%	100.0%	95.0%	3,239	59.8%	100.0%	59.8%
Ponce Municipio	133,634	99.3%	100.0%	99.3%	7,225	84.2%	99.8%	84.1%
Quebradillas Municipio	21,837	97.0%	100.0%	97.0%	1,897	79.9%	100.0%	79.9%
Rincon Municipio	14,128	100.0%	100.0%	100.0%	.	.	.	.
Rio Grande Municipio	48,740	98.0%	99.9%	98.0%	1,388	90.7%	100.0%	90.7%
Sabana Grande Municipio	20,709	97.9%	100.0%	97.9%	1,981	50.7%	100.0%	50.7%
Salinas Municipio	24,389	91.6%	100.0%	91.6%	3,827	49.9%	100.0%	49.9%
San German Municipio	28,533	86.4%	100.0%	86.4%	3,121	53.0%	100.0%	53.0%
San Juan Municipio	337,288	100.0%	100.0%	100.0%	.	.	.	.
San Lorenzo Municipio	33,066	69.3%	100.0%	69.3%	4,313	6.4%	100.0%	6.4%
San Sebastian Municipio	32,364	88.0%	100.0%	88.0%	4,942	62.5%	100.0%	62.5%
Santa Isabel Municipio	18,949	100.0%	100.0%	100.0%	2,914	89.1%	100.0%	89.1%
Toa Alta Municipio	73,217	66.7%	100.0%	66.7%	.	.	.	.
Toa Baja Municipio	78,092	96.8%	100.0%	96.8%	.	.	.	.
Trujillo Alto Municipio	66,675	100.0%	100.0%	100.0%	.	.	.	.
Utuado Municipio	14,649	97.2%	100.0%	97.2%	14,142	74.1%	98.3%	73.9%
Vega Alta Municipio	36,873	95.4%	100.0%	95.4%	693	99.4%	100.0%	99.4%
Vega Baja Municipio	50,312	96.3%	100.0%	96.3%	2,124	79.6%	100.0%	79.6%
Vieques Municipio	7,626	13.9%	100.0%	13.9%	1,043	39.9%	100.0%	39.9%
Villalba Municipio	19,088	92.1%	99.5%	92.1%	3,440	80.9%	99.9%	80.9%
Yabucoa Municipio	28,490	84.9%	100.0%	84.9%	5,139	80.3%	100.0%	80.3%
Yauco Municipio	28,436	92.0%	100.0%	92.0%	7,199	74.1%	94.0%	68.4%
U.S. Virgin Islands	**100,703**	**100.0%**	**100.0%**	**100.0%**	**6,565**	**99.9%**	**91.1%**	**91.0%**
St. Croix Island	46,381	100.0%	100.0%	100.0%	4,630	100.0%	92.7%	92.7%
St. John Island	3,096	100.0%	98.8%	98.8%	1,108	100.0%	77.6%	77.6%

State, County or County Equivalent	Urban Areas				Rural Areas			
	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/ 1 Mbps	% of Pop. with Fixed & Mobile LTE	Pop. Evaluated	% of Pop. with Fixed 25 Mbps/ 3 Mbps	% of Pop. with Mobile LTE 5 Mbps/1 Mbps	% of Pop. with Fixed & Mobile LTE
St. Thomas Island	51,226	100.0%	100.0%	100.0%	827	98.9%	100.0%	98.9%

APPENDIX D-7

Deployment (Thousands) of Fixed Terrestrial 25 Mbps/3 Mbps Services and/or Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps by Tribal Lands and State (December 31,2017)

	Total Pop.	Fixed 25 Mbps/3 Mbps		Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps & Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps	
		Pop. with Access	% of Pop.	Pop. with Access	% of Pop.	Pop. with Access	% of Pop.	Pop. with Access	% of Pop.
Tribal Lands	4,017.35	2,731.25	68.0%	3,895.72	97.0%	2,719.59	67.7%	3,907.37	97.3%
Alaskan Villages	265.34	153.96	58.0%	197.17	74.3%	151.15	57.0%	199.98	75.4%
Hawaiian Homelands	33.56	30.00	89.4%	33.54	99.9%	30.00	89.4%	33.54	99.9%
Lower 48 States	1,117.11	606.71	54.3%	1,068.87	95.7%	597.98	53.5%	1,077.60	96.5%
Alabama	0.28	0.15	51.9%	0.28	100.0%	0.15	51.9%	0.28	100.0%
Alaska	1.54	0.00	0.0%	0.87	56.6%	0.00	0.0%	0.87	56.6%
Arizona	198.26	20.49	10.3%	173.92	87.7%	20.49	10.3%	173.92	87.7%
California	72.24	49.61	68.7%	70.71	97.9%	49.54	68.6%	70.77	98.0%
Colorado	16.26	9.76	60.0%	16.24	99.9%	9.76	60.0%	16.24	99.9%
Connecticut	0.35	0.35	100.0%	0.35	100.0%	0.35	100.0%	0.35	100.0%
Florida	5.03	4.14	82.2%	5.03	100.0%	4.14	82.2%	5.03	100.0%
Idaho	33.74	8.32	24.7%	33.33	98.8%	8.25	24.5%	33.40	99.0%
Iowa	0.96	0.68	70.6%	0.96	100.0%	0.68	70.6%	0.96	100.0%
Kansas	5.69	3.52	61.9%	5.69	100.0%	3.52	61.9%	5.69	100.0%
Louisiana	0.77	0.22	28.3%	0.77	100.0%	0.22	28.3%	0.77	100.0%
Maine	2.37	1.87	79.0%	1.05	44.1%	1.03	43.3%	1.89	79.8%
Massachusetts	0.08	0.07	97.3%	0.08	100.0%	0.07	97.3%	0.08	100.0%
Michigan	34.66	33.82	97.6%	34.55	99.7%	33.82	97.6%	34.55	99.7%
Minnesota	39.37	32.04	81.4%	38.76	98.4%	31.64	80.4%	39.16	99.5%
Mississippi	7.07	4.79	67.8%	7.07	100.0%	4.79	67.8%	7.07	100.0%
Montana	69.72	38.13	54.7%	61.60	88.4%	33.53	48.1%	66.21	95.0%
Nebraska	8.66	3.87	44.7%	8.64	99.7%	3.87	44.7%	8.64	99.7%
Nevada	14.14	5.45	38.6%	13.96	98.7%	5.45	38.6%	13.96	98.7%
New Mexico	148.07	53.61	36.2%	144.04	97.3%	53.61	36.2%	144.04	97.3%
New York	13.61	13.61	100.0%	13.61	100.0%	13.61	100.0%	13.61	100.0%
North Carolina	9.23	0.21	2.2%	8.75	94.8%	0.21	2.2%	8.75	94.8%
North Dakota	25.09	20.09	80.1%	24.92	99.3%	19.99	79.7%	25.02	99.7%
Oklahoma	90.38	62.61	69.3%	90.23	99.8%	62.61	69.3%	90.23	99.8%

	Total Pop.	Fixed 25 Mbps/3 Mbps		Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps & Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps	
		Pop. with Access	% of Pop.	Pop. with Access	% of Pop.	Pop. with Access	% of Pop.	Pop. with Access	% of Pop.
Oregon	9.49	3.34	35.2%	9.47	99.8%	3.34	35.2%	9.47	99.8%
Rhode Island	0.00	0.00	100.0%	0.00	100.0%	0.00	100.0%	0.00	100.0%
South Carolina	1.01	1.01	100.0%	1.01	100.0%	1.01	100.0%	1.01	100.0%
South Dakota	65.05	41.59	63.9%	63.88	98.2%	40.69	62.6%	64.78	99.6%
Texas	1.90	1.41	74.0%	1.90	100.0%	1.41	74.0%	1.90	100.0%
Utah	36.80	17.46	47.4%	34.33	93.3%	17.37	47.2%	34.42	93.5%
Washington	139.17	128.25	92.2%	137.37	98.7%	127.02	91.3%	138.60	99.6%
Wisconsin	39.97	32.41	81.1%	39.66	99.2%	32.17	80.5%	39.89	99.8%
Wyoming	26.16	13.85	52.9%	25.86	98.8%	13.67	52.3%	26.04	99.5%
Tribal Statistical Areas	2,601.35	1,940.59	74.6%	2,596.14	99.8%	1,940.48	74.6%	2,596.25	99.8%
California	3.19	3.18	99.7%	3.19	100.0%	3.18	99.7%	3.19	100.0%
New York	2.71	2.71	100.0%	2.71	100.0%	2.71	100.0%	2.71	100.0%
Oklahoma	2,555.79	1,895.05	74.1%	2,550.59	99.8%	1,894.94	74.1%	2,550.70	99.8%
Washington	39.65	39.65	100.0%	39.65	100.0%	39.65	100.0%	39.65	100.0%

APPENDIX D-8

Adoption Rate for Fixed Terrestrial Services in the United States and District of Columbia (Data as of December 2017)[1]

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
United States	69.4%	59.8%	54.4%	29.4%	3.8%
Alabama	55.4%	45.7%	40.2%	16.9%	1.7%
Alaska	65.8%	*	*	*	*
Arizona	67.3%	61.0%	52.7%	30.5%	8.0%
Arkansas	49.0%	37.7%	33.5%	17.0%	4.2%
California	76.8%	64.5%	61.8%	34.3%	3.1%
Colorado	70.2%	67.8%	60.0%	28.1%	2.6%
Connecticut	77.1%	63.0%	55.5%	30.3%	*
Delaware	86.2%	83.9%	74.9%	32.6%	*
District of Columbia	79.1%	75.3%	*	*	*
Florida	82.9%	70.1%	64.8%	35.5%	4.4%
Georgia	68.2%	55.2%	50.7%	22.8%	4.5%
Hawaii	*	*	*	*	*
Idaho	47.5%	42.7%	16.6%	9.6%	0.4%
Illinois	68.5%	56.6%	52.7%	20.0%	1.0%
Indiana	61.5%	50.5%	45.8%	23.4%	1.3%
Iowa	51.4%	46.3%	39.5%	17.2%	0.8%
Kansas	60.4%	46.1%	43.0%	27.3%	10.1%
Kentucky	54.0%	41.0%	36.1%	30.6%	1.9%
Louisiana	58.0%	45.5%	42.7%	19.1%	6.1%
Maine	63.4%	44.6%	34.8%	27.1%	*
Maryland	79.4%	75.1%	66.2%	29.7%	*
Massachusetts	84.3%	81.6%	70.8%	33.3%	2.1%
Michigan	67.5%	57.6%	51.9%	18.0%	1.2%
Minnesota	62.3%	56.7%	50.7%	16.0%	1.0%
Mississippi	44.3%	31.7%	23.5%	9.7%	0.8%
Missouri	56.9%	47.0%	43.7%	19.9%	10.2%

[1] * Withheld to maintain confidentiality.

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
Montana	55.9%	52.4%	53.4%	17.7%	*
Nebraska	59.7%	51.2%	46.5%	29.4%	8.5%
Nevada	75.1%	61.0%	58.4%	*	*
New Hampshire	76.6%	72.3%	61.7%	32.8%	*
New Jersey	85.6%	82.8%	75.9%	42.6%	*
New Mexico	44.7%	42.8%	36.4%	12.6%	0.8%
New York	77.2%	70.1%	65.1%	43.7%	*
North Carolina	66.1%	59.4%	57.1%	40.5%	5.6%
North Dakota	70.1%	61.9%	51.4%	16.9%	4.4%
Ohio	66.0%	48.1%	36.0%	28.4%	1.5%
Oklahoma	53.8%	41.5%	37.6%	19.9%	5.7%
Oregon	68.5%	64.3%	57.0%	24.7%	1.3%
Pennsylvania	68.6%	61.2%	51.7%	25.9%	2.1%
Rhode Island	*	*	*	*	*
South Carolina	67.9%	50.5%	43.0%	20.4%	5.8%
South Dakota	68.2%	64.4%	51.0%	8.8%	1.5%
Tennessee	63.2%	53.4%	50.8%	23.4%	6.0%
Texas	66.7%	53.8%	50.1%	32.5%	4.9%
Utah	68.5%	62.0%	55.9%	24.6%	6.4%
Vermont	66.0%	58.7%	47.2%	25.4%	*
Virginia	68.8%	63.0%	56.5%	27.7%	5.6%
Washington	71.7%	66.6%	64.1%	30.4%	1.8%
West Virginia	51.0%	46.3%	44.9%	25.1%	1.8%
Wisconsin	62.7%	48.9%	44.5%	20.3%	1.5%
Wyoming	59.4%	55.3%	47.8%	11.3%	0.7%

APPENDIX D-9

Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017)

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
10 Mbps/1 Mbps								
United States	317.953	100.0%	320.289	100.0%	322.518	100.0%	325.627	100.0%
Rural Areas	61.642	100.0%	62.261	100.0%	62.926	100.0%	63.710	99.9%
Urban Areas	256.312	100.0%	258.028	100.0%	259.592	100.0%	261.917	100.0%
U.S. Territories	3.549	90.9%	3.442	89.3%	3.462	91.4%	3.674	98.9%
Rural Areas	0.153	60.5%	0.146	58.2%	0.162	65.5%	0.237	96.6%
Urban Areas	3.396	93.0%	3.296	91.5%	3.299	93.3%	3.437	99.0%
25 Mbps/3 Mbps								
United States	284.277	89.4%	287.853	89.9%	307.642	95.4%	325.616	100.0%
Rural Areas	37.202	60.4%	38.271	61.5%	51.001	81.0%	63.700	99.9%
Urban Areas	247.075	96.4%	249.582	96.7%	256.641	98.9%	261.917	100.0%
U.S. Territories	3.217	82.4%	2.368	61.5%	3.151	83.2%	3.448	92.8%
Rural Areas	0.135	53.5%	0.095	38.1%	0.143	57.9%	0.221	90.0%
Urban Areas	3.082	84.4%	2.273	63.1%	3.008	85.0%	3.227	93.0%
50 Mbps/5 Mbps								
United States	270.771	85.2%	283.329	88.5%	291.380	90.3%	300.474	92.3%
Rural Areas	32.127	52.1%	35.316	56.7%	39.260	62.4%	43.985	69.0%
Urban Areas	238.644	93.1%	248.013	96.1%	252.119	97.1%	256.489	97.9%
U.S. Territories	3.151	80.7%	0.104	2.7%	3.027	80.0%	2.264	60.9%
Rural Areas	0.110	43.5%	0.000	0.1%	0.091	37.0%	0.040	16.3%
Urban Areas	3.041	83.2%	0.104	2.9%	2.936	83.0%	2.224	64.1%
100 Mbps/10 Mbps								
United States	201.905	63.5%	215.582	67.3%	244.297	75.7%	290.884	89.3%
Rural Areas	16.484	26.7%	20.481	32.9%	25.925	41.2%	39.160	61.4%
Urban Areas	185.422	72.3%	195.101	75.6%	218.372	84.1%	251.724	96.1%
U.S. Territories	0.069	1.8%	0.096	2.5%	3.027	80.0%	0.191	5.1%
Rural Areas	0.000	0.0%	0.000	0.0%	0.091	37.0%	0.007	2.8%
Urban Areas	0.069	1.9%	0.096	2.7%	2.935	83.0%	0.184	5.3%
250 Mbps/25 Mbps								
United States	15.674	4.9%	67.912	21.2%	140.795	43.7%	205.237	63.0%

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Rural Areas	2.020	3.3%	5.460	8.8%	10.029	15.9%	23.870	37.4%
Urban Areas	13.654	5.3%	62.452	24.2%	130.766	50.4%	181.367	69.2%
U.S. Territories	0.067	1.7%	0.095	2.5%	0.093	2.5%	0.191	5.1%
Rural Areas	0.000	0.0%	0.000	0.0%	0.000	0.0%	0.007	2.8%
Urban Areas	0.067	1.8%	0.095	2.6%	0.093	2.6%	0.184	5.3%

E. International Broadband Data Appendices

APPENDIX E-1

Country List

1. In the Table below, we list the United States and the 28 foreign countries selected for purposes of the IBDR and identify the countries that are excluded in an Appendix with an "X."

Countries	**Appendix E-2** Broadband Speed Comparison	**Appendix E-3** Broadband Price Comparison	**Appendix E-4** High-Speed Broadband Deployment Comparison with Europe	**Appendix E-5** Demographics Dataset
Australia		X	X	
Austria		X		
Belgium		X		
Canada		X	X	
Chile		X	X	
Czech Republic		X		
Denmark				
Estonia				
Finland		X		
France				
Germany				
Greece		X		
Iceland		X		
Ireland		X		
Italy		X		
Japan		X	X	
Latvia		X		
Luxembourg		X		
Mexico			X	
Netherlands		X		
New Zealand		X	X	
Norway		X		
Portugal		X		
South Korea			X	
Spain		X		
Sweden		X		
Switzerland		X		
United Kingdom				
United States			X	

APPENDIX E-2

Broadband Speed Comparison

2. We present information on "data transmission speeds" for broadband service capability for both fixed and mobile broadband.[1] We present data on actual fixed and mobile broadband speeds based on data gathered by Ookla for the United States and 28 comparison countries for a ranking of fastest actual speed (1st) to slowest (29th).[2] The data are aggregated at the city level and include observations in 2016 and 2017 for both U.S. and international cities.[3] As a historical overview, we also present available data on U.S. fixed download speeds and rankings from 2012 to 2017, which show how actual speeds have evolved over time.

I. OVERVIEW AND DATA HIGHLIGHTS

3. *Fixed Broadband Speed Results*. In 2017, the United States ranked 5th out of 29 countries (73.79 Mbps) in terms of mean (weighted) fixed download speeds.[4] Iceland had the highest mean fixed download speed, and Greece had the lowest. Iceland's mean fixed download speeds were 131.07 in 2017 and 89.83 Mbps in 2016. By contrast, Greece's mean fixed download speeds were 13.85 Mbps in 2017 and 11.83 Mbps in 2016.

4. Given the large population density and area of several U.S. states, we also compare U.S. states to foreign countries.[5] In 2017, the highest ranked state is Delaware, which ranked 3rd out of 78 states and countries with a mean fixed download speed of 91.19 Mbps. In 2017, the highest ranked U.S. state capital is Salt Lake City, Utah, which ranked of 3rd out of 79 capital cities with a mean fixed

[1] 47 U.S.C. § 1303(b)(1); *see also* 47 U.S.C. § 163.

[2] We obtained speed data through a contractual arrangement with Ookla, proprietor of speedtest.net, whose data are collected primarily from software-based tests on an end user's device. Ookla, *Ookla Speedtest*, http://www.speedtest.net (last visited Sept. 14, 2018). Ookla aggregates consumer-initiated tests on Speedtest after the tests undergo a "sample construction" process that creates standardized data points for advanced statistical analysis. Each sample represents the cumulative test results for each unique device/user per location, per calendar day, with the goal of ensuring that each unique user is fairly represented in the data. Among other things, this methodology prevents repeated testing from the same device during a short time period from having an outsized impact. Ookla, *Speedtest Awards Methodology*, https://www.speedtest.net/awards/methodology/ (last visited Nov. 6, 2018). *Id.* We rely on the fixed and mobile speed testing methodology used in the *2018 Sixth IBDR*, and the data caveats identified in the *2018 Sixth IBDR* similarly apply here. *2018 Sixth IBDR*, 33 FCC Rcd at 997-98, Appx. B, paras. 7-12. We include annual, city-level observations with average download speeds for 256 kbps and higher.

[3] We also present data on median (weighted) fixed and mobile download speeds. Our calculations are based on the median of the city-level averages reported by Ookla. Because the data are aggregated at the city level and do not include individual speed test records, we cannot compute a true median. Here, the median refers to the median of the aggregated (average) annual city speed tests weighted by sample size, and average refers to the averages at the city level as provided by Ookla. Therefore, we took the median of the city level averages reported by Ookla. *2018 Sixth IBDR*, 33 FCC Rcd at 982-83, para. 9, n.31; 1001, Appx. B, para. 15, n.14.

[4] The *2018 Sixth IBDR* reported speeds for 28 comparison countries because the Ookla dataset did not include data for Latvia. *Id.* at 982, n.26. The *2018 Sixth IBDR* observed that the United States ranked 10th out of 28 countries in 2016 in terms of actual fixed download speeds. *Id*. at 982, para. 9; 996, Appx. B, para. 2. Since release of that report, Ookla has recompiled the data for 2016, which now contain data for Latvia as well as some minor variations from speeds reported in the *2018 Sixth IBDR.* As a result, there are slight variations in the 2016 speed data and rankings for fixed and mobile broadband speed between this analysis and the *2018 Sixth IBDR*.

[5] We present a comparison of U.S. state capitals with the capitals of the comparison countries, as directed by the BDIA that "[t]he Commission shall include in the comparison under this subsection . . . communities including the capital cities of such countries." 47 U.S.C. § 1303(b)(2).

download speed of 120.90 Mbps.

5. *Historical Overview of U.S. Fixed Broadband Speed*. Based on data from past International Broadband Data Reports, we present U.S. mean fixed download speeds and rankings from 2012 to 2017 to illustrate how speeds and U.S. rankings have evolved over time. We note that due to differences in the Ookla data from 2012 to 2013 and the data from 2014 to 2016, the earlier data are not directly comparable to the later data.[6] Nevertheless, the data indicate that for the United States, both fixed speeds and international rank have been on a rising trend since 2012.[7]

6. *Mobile Broadband Speed Results*. In 2017, the United States ranked 23rd out of 29 countries in terms of mean mobile download speeds. In 2017, mean mobile download speeds ranged from a high of 63.59 Mbps in Norway to a low of 17.15 Mbps in Chile. The highest-ranked country in 2016 was South Korea, with a mean mobile download speed of 39.19 Mbps in 2016.

7. We also compare U.S. states to foreign countries. In 2017, the highest ranked state is Minnesota, which ranked 12th out of 78 states and countries with a mean mobile download speed of 34.73 Mbps. In addition, we present a comparison of U.S. state capitals with the capitals of the comparison countries. In 2017, the highest ranked U.S. state capital is Saint Paul, Minnesota, which ranked 14th out of 79 capital cities with a mean mobile download speed of 35.77 Mbps.

[6] The *Fourth International Broadband Data Report* and the *Fifth International Broadband Data Report* relied on Ookla speed data for 2012 to 2014 that consisted of daily speed test results for all cities (previous methodology). The *2018 Sixth IBDR* relied on Ookla speed data for 2014 to 2016 that consist of city speed test results averaged up to the yearly level, which has far fewer observations than the previous methodology (new methodology). Additional discussion of these methodologies is provided in the *2018 Sixth IBDR*. *2018 Sixth IBDR*, 33 FCC Rcd at 1018-19, paras. 24-25.

[7] *See infra* Tbl. 11 and Fig. 1.

Table 1

Fixed Broadband Summary Statistics (2016-2017)

All Available Data	2016	2017
Number of Countries	29	29
Number of Cities	129,141	186,196
Mean Tests Per City	2361.75	2916.77
Median Tests Per City	249	102
Download (Mbps)		
Minimum	0.27	0.26
Maximum	924.20	759.87
Mean	44.15	54.04
Median	42.63	55.03
Upload (Mbps)		
Minimum	0.01	0.00
Maximum	931.10	416.26
Mean	16.44	21.82
Median	10.31	12.94

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: The cities that make up the complete set of observations and the number of mean and median tests for each city vary from year to year, though some do repeat.

Table 2
Mean (Weighted) Fixed Download Speed by Country (2016-2017)

Country	2016		2017	
	Rank	Mbps	Rank	Mbps
Iceland	3	89.83	1	131.07
South Korea	4	86.95	2	120.16
Sweden	6	73.79	3	82.83
Switzerland	5	79.47	4	77.60
United States	**11**	**55.07**	**5**	**73.79**
Netherlands	7	67.62	6	72.88
Norway	13	54.64	7	69.54
Denmark	8	61.44	8	68.09
Japan	2	102.40	9	68.07
Canada	18	44.19	10	64.23
Spain	10	57.89	11	62.59
New Zealand	17	45.00	12	61.01
France	12	54.82	13	59.23
Luxembourg[1]	1	377.56	14	57.30
Belgium	14	48.65	15	53.36
Latvia	9	58.75	16	51.68
Ireland	21	40.46	17	51.51
Portugal	16	46.15	18	50.63
United Kingdom	19	42.14	19	48.86
Germany	20	41.98	20	47.65
Finland	15	47.97	21	46.12
Estonia	23	34.96	22	42.60
Chile	25	24.33	23	34.30
Czech Republic	22	37.07	24	34.17
Austria	24	32.60	25	32.77
Italy	28	17.24	26	26.88
Australia	26	20.04	27	23.89
Mexico	27	18.91	28	19.13
Greece	29	11.83	29	13.85

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

[1] We note that Luxembourg had substantially higher speeds in 2014 and 2015 than in 2017 with mean download speed in the range of 200 to 350 Mbps. *2018 Sixth IBDR*, 33 FCC Rcd at 1000, 1002, Appx. B, Tbl. 2.

Table 3
Median (Weighted) Fixed Download Speed by Country (2016-2017)

Country	2016		2017	
	Rank	Mbps	Rank	Mbps
Iceland	2	96.37	1	133.05
South Korea	4	87.85	2	127.49
Sweden	6	74.98	3	83.93
Switzerland	5	77.22	4	76.76
United States	**11**	**55.44**	**5**	**73.99**
Norway	12	55.27	6	73.03
Netherlands	7	65.03	7	72.20
Denmark	10	58.45	8	69.22
Japan	3	95.62	9	67.69
Spain	9	58.82	10	64.74
Canada	18	42.75	11	64.30
New Zealand	16	44.63	12	60.16
Ireland	22	37.00	13	59.64
Luxembourg	1	355.81	14	59.17
Latvia	8	64.22	15	55.61
France	14	47.25	16	55.49
Belgium	15	47.17	17	53.67
Portugal	13	51.20	18	52.70
United Kingdom	20	39.93	19	51.93
Germany	19	40.88	20	48.41
Estonia	21	37.40	21	48.19
Finland	17	43.18	22	44.17
Austria	24	35.45	23	35.61
Czech Republic	23	35.73	24	34.06
Chile	25	22.99	25	33.22
Italy	28	15.32	26	26.07
Australia	26	18.94	27	23.56
Mexico	27	15.97	28	19.20
Greece	29	11.83	29	13.74

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 4
Mean (Weighted) Fixed Download Speeds by U.S. States and Countries (2016-2017)

Country/U.S. State	2016		2017	
	Rank	Mbps	Rank	Mbps
Iceland	3	89.83	1	131.07
South Korea	4	86.95	2	120.16
Delaware	22	58.23	3	91.19
North Carolina	13	62.57	4	90.04
New Jersey	24	57.69	5	89.40
Kansas	5	80.69	6	87.41
Maryland	27	56.63	7	87.41
Tennessee	11	64.79	8	87.37
Virginia	41	49.10	9	85.94
New York	33	53.18	10	84.61
Georgia	20	59.32	11	83.23
Utah	12	64.24	12	82.93
Sweden	8	73.79	13	82.83
Hawaii	7	75.95	14	82.78
Massachusetts	26	56.79	15	81.56
Colorado	25	57.28	16	80.37
Washington	19	59.64	17	80.19
Texas	9	69.01	18	80.12
Nevada	18	60.52	19	79.51
Missouri	16	62.17	20	78.56
Switzerland	6	79.47	21	77.60
Pennsylvania	47	46.07	22	75.75
Arizona	15	62.36	23	74.85
California	14	62.46	24	74.49
Oklahoma	37	51.29	25	74.33
South Dakota	45	46.93	26	74.17
North Dakota	32	53.29	27	73.29
Netherlands	10	67.62	28	72.88
Louisiana	31	53.30	29	72.40
Oregon	38	50.61	30	71.63

Source: Ookla SPEEDTEST intelligence data,
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 4 (continued)

Country/U.S. State	2016		2017	
	Rank	Mbps	Rank	Mbps
New Hampshire	36	51.43	31	71.12
Norway	30	54.64	32	69.54
Rhode Island	35	51.46	33	68.31
Denmark	17	61.44	34	68.09
Japan	2	102.40	35	68.07
Florida	34	51.85	36	67.66
Canada	52	44.19	37	64.23
Connecticut	39	49.88	38	64.21
Illinois	44	47.43	39	63.88
Arkansas	61	39.25	40	63.74
New Mexico	48	45.87	41	63.51
Alaska	28	55.93	42	62.84
Kentucky	53	43.00	43	62.66
Spain	23	57.89	44	62.59
Indiana	54	42.89	45	61.28
New Zealand	51	45.00	46	61.01
Iowa	64	37.25	47	59.95
West Virginia	49	45.55	48	59.61
France	29	54.82	49	59.23
Nebraska	62	38.98	50	59.23
Minnesota	50	45.11	51	58.73
Mississippi	58	40.55	52	57.99
Luxembourg	1	377.56	53	57.30
Michigan	57	41.12	54	57.10
Alabama	60	39.52	55	53.64
Belgium	42	48.65	56	53.36
Idaho	63	38.14	57	52.95
Latvia	21	58.75	58	51.68
Ireland	59	40.46	59	51.51
Portugal	46	46.15	60	50.63
South Carolina	66	36.33	61	50.30

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 4 (continued)

Country/U.S. State	2016		2017	
	Rank	Mbps	Rank	Mbps
United Kingdom	55	42.14	62	48.86
Ohio	71	29.42	63	48.82
Germany	56	41.98	64	47.65
Vermont	40	49.12	65	46.94
Finland	43	47.97	66	46.12
Wisconsin	72	28.61	67	44.00
Estonia	67	34.96	68	42.60
Montana	70	30.61	69	38.65
Wyoming	68	33.13	70	36.93
Chile	73	24.33	71	34.30
Czech Republic	65	37.07	72	34.17
Austria	69	32.60	73	32.77
Maine	74	21.28	74	32.33
Italy	77	17.24	75	26.88
Australia	75	20.04	76	23.89
Mexico	76	18.91	77	19.13
Greece	78	11.83	78	13.85

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 5
Mean (Weighted) Fixed Download Speed
by Country Capital and U.S. State Capital Cities (2016-2017)

City, Country	2016			2017		
	Rank	Mbps	Number of Tests	Rank	Mbps	Number of Tests
Reykjavik, Iceland	4	96.37	75,652	1	133.05	162,989
Seoul, South Korea	6	87.85	370,776	2	127.49	1,349,931
Salt Lake City, UT, United States	12	72.47	235,863	3	120.90	237,341
Austin, TX, United States	2	111.21	558,711	4	118.43	1,311,796
Paris, France	3	96.83	957,635	5	115.89	2,179,639
Raleigh, NC, United States	24	58.41	142,812	6	104.93	484,534
Stockholm, Sweden	5	89.48	149,363	7	97.58	323,891
Atlanta, GA, United States	18	64.61	270,571	8	97.00	467,873
Boston, MA, United States	32	55.24	128,906	9	96.06	414,145
Dover, DE, United States	20	63.48	17,416	10	95.35	15,841
Trenton, NJ, United States	29	56.63	41,252	11	93.96	13,547
Nashville, TN, United States	13	69.97	103,238	12	93.69	504,623
Wellington, New Zealand	31	55.50	55,734	13	89.05	268,053
Washington, DC, United States	30	55.96	231,571	14	88.67	439,301
Oklahoma City, OK, United States	14	67.45	77,986	15	87.24	473,572
Concord, NH, United States	25	57.77	14,174	16	87.00	26,094
Madrid, Spain	16	64.92	865,586	17	83.96	2,452,461
Salem, OR, United States	17	64.82	46,273	18	82.09	79,054
Richmond, VA, United States	45	47.46	59,914	19	82.03	80,012
Olympia, WA, United States	19	63.89	35,538	20	80.74	28,574
Annapolis, MD, United States	28	56.80	19,298	21	78.57	21,064
Phoenix, AZ, United States	7	85.71	155,096	22	77.74	1,440,209
Harrisburg, PA, United States	37	51.24	29,134	23	77.69	13,824
Honolulu, HI, United States	15	65.12	168,095	24	77.62	477,058
Denver, CO, United States	26	57.74	418,686	25	77.45	654,172
Lansing, MI, United States	22	60.40	47,122	26	75.59	68,857
Oslo, Norway	10	77.31	256,096	27	73.03	934,548
Jackson, MS, United States	8	80.86	10,006	28	72.48	28,430
Amsterdam, Netherlands	23	59.69	282,992	29	71.66	1,029,924

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla. We note that we cannot draw statistical conclusions from cities with less than 300 tests per year.
Note: City-year observations are collapsed to the country/state-year level and are weighted by the number of tests.

Table 5 (continued)

City, Country	2016			2017		
	Rank	Mbps	Number of Tests	Rank	Mbps	Number of Tests
Copenhagen, Denmark	27	57.58	141,230	30	71.12	578,398
Sacramento, CA, United States	36	51.53	233,290	31	70.82	362,069
Bismarck, ND, United States	33	53.29	6,851	32	70.73	22,288
Bern, Switzerland	21	60.95	39,865	33	69.66	85,914
Baton Rouge, LA, United States	48	46.76	101,267	34	69.05	187,676
Tokyo, Japan	9	80.15	863,042	35	67.69	1,422,396
Ottawa, Canada	53	42.95	186,252	36	67.61	1,270,321
Indianapolis, IN, United States	39	50.66	149,018	37	65.91	462,782
Providence, RI, United States	41	49.94	42,608	38	64.60	71,081
Lincoln, NE, United States	66	34.34	122,440	39	63.54	325,948
Pierre, SD, United States	68	33.59	1,456	40	62.53	2,938
Saint Paul, MN, United States	42	48.75	55,328	41	60.42	107,167
Santa Fe, NM, United States	44	48.18	36,427	42	60.30	52,596
Des Moines, IA, United States	38	51.17	44,604	43	59.77	157,108
Dublin, Ireland	51	43.82	139,841	44	59.64	1,153,573
Luxembourg City, Luxembourg	1	303.23	25,925	45	59.17	91,455
Boise, ID, United States	35	51.74	56,697	46	59.13	206,292
Jefferson City, MO, United States	67	34.00	26,811	47	57.49	56,843
Charleston, WV, United States	59	39.63	7,443	48	56.65	40,402
Montgomery, AL, United States	50	45.34	10,454	49	56.33	71,147
Riga, Latvia	11	75.27	291,925	50	55.61	890,237
Columbus, OH, United States	54	41.80	238,021	51	55.03	666,659
Little Rock, AR, United States	49	45.45	29,632	52	54.33	92,377
Topeka, KS, United States	69	31.98	13,403	53	53.11	75,734
Lisbon, Portugal	34	51.95	329,982	54	52.70	938,815

Source: Ookla SPEEDTEST intelligence data, We note that we cannot draw statistical conclusions from cities with less than 300 tests per year.
Note: City-year observations are collapsed to the country/state-year level and are weighted by the number of tests.

Table 5 (continued)

City, Country	2016			2017		
	Rank		Number of Tests	Rank	Mbps	Number of Tests
Hartford, CT, United States	47	46.90	19,826	55	52.51	29,400
Tallahassee, FL, United States	56	41.42	81,718	56	51.40	90,303
Springfield, IL, United States	46	47.23	30,924	57	51.21	26,452
Madison, WI, United States	58	40.64	96,407	58	51.03	200,334
Carson City, NV, United States	65	34.46	11,563	59	51.00	31,626
Tallinn, Estonia	40	50.42	159,501	60	48.19	615,656
London, United Kingdom	63	34.90	700,791	61	48.03	4,711,717
Cheyenne, WY, United States	57	40.92	25,809	62	47.39	36,070
Montpelier, VT, United States	64	34.66	5,167	63	44.51	2,669
Helsinki, Finland	52	43.18	358,716	64	44.17	1,373,567
Berlin, Germany	62	36.12	305,662	65	44.07	2,186,811
Juneau, AK, United States	72	28.28	1,077	66	43.68	8,582
Prague, Czech Republic	43	48.64	333,744	67	43.49	1,064,988
Columbia, SC, United States	73	27.97	50,034	68	42.36	75,620
Brussels, Belgium	60	39.20	176,281	69	42.10	419,449
Helena, MT, United States	61	39.14	18,258	70	40.58	14,826
Vienna, Austria	55	41.57	481,363	71	39.49	2,708,139
Albany, NY, United States	70	31.40	39,062	72	38.18	45,464
Santiago, Chile	75	22.80	943,474	73	36.47	231,104
Augusta, ME, United States	77	18.73	4,832	74	33.94	11,290
Rome, Italy	76	20.85	614,404	75	29.29	5,366,916
Canberra, Australia	71	30.28	3,500	76	29.10	4,301
Frankfort, KY, United States	78	14.03	12,432	77	29.07	15,145
Mexico City, Mexico	74	27.04	905,111	78	23.63	10,626,917
Athens, Greece	79	11.94	809,196	79	13.74	2,579,156

Source: Ookla SPEEDTEST intelligence data, We note that we cannot draw statistical conclusions from cities with less than 300 tests per year.
Note: City-year observations are collapsed to the country/state-year level and are weighted by the number of tests.

Table 6
Mobile Broadband Summary Statistics (2016-2017)

All Available Data	2016	2017
Number of Countries	29	29
Number of Cities	120,417	164,468
Mean Tests Per City	526.55	351.54
Median Tests Per City	46	17
Download (Mbps)		
Minimum	0.26	0.26
Maximum	190.41	252.61
Mean	22.75	28.11
Median	21.91	26.34
Upload (Mbps)		
Minimum	0.00	0.00
Maximum	72.54	69.55
Mean	9.11	10.54
Median	9.12	10.38

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: The cities that make up the complete set of observations and the number of mean and median tests for each city vary from year to year, though some do repeat.

Table 7
Mean (Weighted) Mobile Download Speed by Country (2016-2017)

Country	2016		2017	
	Rank	Mbps	Rank	Mbps
Norway	3	38.03	1	63.59
Netherlands	2	39.08	2	50.19
Iceland	8	30.93	3	46.89
Australia	4	36.57	4	45.35
South Korea	1	39.19	5	41.37
Luxembourg	6	32.47	6	38.65
Denmark	5	33.12	7	38.58
Canada	17	26.02	8	38.20
Sweden	16	26.16	9	37.55
Belgium	12	27.22	10	37.07
New Zealand	9	30.36	11	35.72
Switzerland	11	28.07	12	34.51
Finland	14	26.61	13	33.88
Austria	7	31.09	14	33.58
Greece	10	29.34	15	33.10
Spain	19	24.14	16	32.53
Czech Republic	21	23.13	17	31.66
Estonia	18	24.27	18	30.98
Italy	23	22.03	19	30.20
Latvia	15	26.25	20	28.47
France	13	26.87	21	27.98
United Kingdom	20	24.00	22	26.64
United States	**25**	**19.97**	**23**	**24.78**
Germany	22	22.85	24	23.46
Portugal	24	20.31	25	23.02
Ireland	26	16.33	26	23.01
Mexico	29	15.24	27	20.28
Japan	27	15.95	28	19.53
Chile	28	15.60	29	17.15

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 8
Median (Weighted) Mobile Download Speed by Country (2016-2017)

Country	2016		2017	
	Rank	Mbps	Rank	Mbps
Norway	2	40.68	1	64.75
Netherlands	1	41.73	2	52.13
Iceland	9	32.01	3	48.11
Australia	4	37.01	4	45.27
Luxembourg	8	32.43	5	40.21
South Korea	3	38.91	6	39.96
Canada	18	26.55	7	39.08
Denmark	7	32.60	8	38.22
Sweden	16	27.29	9	38.19
Belgium	17	26.77	10	37.46
New Zealand	6	33.24	11	37.29
Switzerland	12	28.90	12	36.22
Finland	13	27.97	13	35.48
Austria	5	33.26	14	34.55
Estonia	15	27.31	15	34.47
Spain	19	25.63	16	33.01
Greece	14	27.66	17	32.56
Czech Republic	22	23.36	18	31.73
Italy	23	22.65	19	31.09
Latvia	11	29.21	20	30.05
France	10	29.64	21	28.98
United Kingdom	20	23.51	22	25.56
United States	**25**	**19.62**	**23**	**24.66**
Germany	21	23.42	24	24.11
Portugal	24	21.63	25	22.80
Ireland	26	16.51	26	22.62
Japan	28	15.97	27	19.56
Mexico	27	16.15	28	19.50
Chile	29	15.27	29	15.92

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 9
Mean (Weighted) Mobile Download Speeds
by U.S. States and Countries (2016-2017)

Country/U.S. State	2016		2017	
	Rank	Mbps	Rank	Mbps
Norway	3	38.03	1	63.59
Netherlands	2	39.08	2	50.19
Iceland	8	30.93	3	46.89
Australia	4	36.57	4	45.35
South Korea	1	39.19	5	41.37
Luxembourg	6	32.47	6	38.65
Denmark	5	33.12	7	38.58
Canada	17	26.02	8	38.20
Sweden	16	26.16	9	37.55
Belgium	12	27.22	10	37.07
New Zealand	9	30.36	11	35.72
Minnesota	18	24.47	12	34.73
Switzerland	11	28.07	13	34.51
Finland	14	26.61	14	33.88
Austria	7	31.09	15	33.58
Greece	10	29.34	16	33.10
Spain	21	24.14	17	32.53
Czech Republic	24	23.13	18	31.66
Estonia	19	24.27	19	30.98
Italy	27	22.03	20	30.20
Michigan	25	23.10	21	29.97
Washington	20	24.19	22	29.81
Georgia	23	23.77	23	28.95
Kansas	38	20.93	24	28.78
Ohio	30	21.65	25	28.54
Latvia	15	26.25	26	28.47
Illinois	33	21.39	27	28.45
Indiana	37	21.05	28	28.39
France	13	26.87	29	27.98
Rhode Island	29	21.70	30	26.97

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Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 9 (continued)

Country/U.S. State	2016		2017	
	Rank	Mbps	Rank	Mbps
United Kingdom	22	24.00	31	26.64
Massachusetts	45	20.22	32	26.46
Oregon	32	21.46	33	26.01
Missouri	47	19.09	34	25.90
Florida	40	20.90	35	25.81
North Dakota	39	20.92	36	25.81
New Jersey	34	21.27	37	25.78
Connecticut	35	21.17	38	25.52
New York	36	21.09	39	25.33
Pennsylvania	43	20.36	40	25.26
South Dakota	28	21.70	41	25.09
Alabama	31	21.52	42	24.80
California	42	20.53	43	24.15
Wisconsin	41	20.58	44	23.73
Germany	26	22.85	45	23.46
Maryland	50	18.74	46	23.44
Portugal	44	20.31	47	23.02
Ireland	65	16.33	48	23.01
Texas	52	18.28	49	22.78
Virginia	55	18.08	50	22.74
Kentucky	49	18.83	51	22.71
Tennessee	53	18.27	52	22.34
Delaware	46	20.02	53	22.14
South Carolina	61	17.24	54	22.05
New Hampshire	54	18.24	55	21.69
North Carolina	60	17.28	56	21.64
Colorado	71	14.69	57	21.47
Arizona	63	16.51	58	21.42
Arkansas	51	18.28	59	21.35
Louisiana	57	17.77	60	21.33
Utah	59	17.35	61	21.08
Iowa	48	19.05	62	20.76
Hawaii	56	17.80	63	20.34

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Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 9 (continued)

Country/U.S. State	2016		2017	
	Rank	Mbps	Rank	Mbps
Mexico	69	15.24	64	20.28
Nebraska	58	17.48	65	20.22
Japan	66	15.95	66	19.53
Montana	70	14.77	67	19.46
New Mexico	73	14.11	68	19.36
Nevada	62	16.62	69	19.33
Oklahoma	64	16.41	70	18.99
Chile	67	15.60	71	17.15
Mississippi	68	15.38	72	16.87
Idaho	72	14.40	73	16.86
Alaska	75	13.32	74	16.04
West Virginia	74	13.77	75	15.84
Vermont	77	12.48	76	14.81
Maine	76	12.73	77	14.42
Wyoming	78	9.90	78	11.64

Source: Ookla SPEEDTEST intelligence data, © 2017 Ookla, LLC. All rights reserved. Published with permission of Ookla.
Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

Table 10
Mean (Weighted) Mobile Download Speed
by Country Capital and U.S. State Capital Cities (2016-2017)

City, Country	2016			2017		
	Rank	Mbps	Number of Tests	Rank	Mbps	Number of Tests
Oslo, Norway	2	40.68	119,217	1	64.75	88,650
Amsterdam, Netherlands	1	42.07	61,000	2	48.28	64,270
Reykjavik, Iceland	7	32.01	13,160	3	48.11	16,785
Prague, Czech Republic	16	27.74	79,886	4	41.66	69,010
Canberra, Australia	19	26.42	14,528	5	40.98	3,012
Luxembourg City, Luxembourg	5	32.43	17,018	6	40.21	11,079
Seoul, South Korea	3	38.91	92,812	7	39.96	81,569
Wellington, New Zealand	9	30.53	9,077	8	39.44	10,151
Stockholm, Sweden	8	31.42	24,710	9	39.30	24,079
Copenhagen, Denmark	10	30.21	100,778	10	37.42	102,148
Madrid, Spain	14	28.35	200,330	11	36.53	162,705
Bern, Switzerland	13	28.90	13,588	12	36.42	15,143
Brussels, Belgium	20	26.31	28,546	13	35.95	12,049
Saint Paul, MN, United States	23	25.14	28,216	14	35.77	26,341
Helsinki, Finland	6	32.38	347,676	15	35.48	447,171
Vienna, Austria	4	34.77	450,644	16	34.55	454,378
Tallinn, Estonia	18	27.31	123,540	17	34.47	121,449
Athens, Greece	17	27.66	138,488	18	32.56	185,961
Ottawa, Canada	31	22.49	46,039	19	32.37	45,625
Bismarck, ND, United States	32	22.37	1,926	20	31.96	1,592
Annapolis, MD, United States	41	20.08	4,620	21	31.75	2,271
Dover, DE, United States	33	22.31	2,742	22	31.51	2,329
Rome, Italy	26	24.11	537,626	23	31.09	637,839
Lansing, MI, United States	21	26.16	12,964	24	30.98	11,384
Salem, OR, United States	22	25.61	11,700	25	30.94	9,580
Atlanta, GA, United States	34	22.28	170,471	26	30.75	109,901
Montgomery, AL, United States	25	24.54	11,003	27	30.43	11,163
Riga, Latvia	12	29.21	148,845	28	30.05	166,305
Indianapolis, IN, United States	35	22.05	72,218	29	30.02	80,438
Little Rock, AR, United States	28	23.32	13,844	30	29.58	15,230

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Note: City-year observations are collapsed to the country/state-year level and are weighted by the number of tests. We note that we cannot draw statistical conclusions from cities with less than 300 tests per year.

Table 10 (continued)

City, Country	2016			2017		
	Rank	Mbps	Number of Tests	Rank	Mbps	Number of Tests
Paris, France	11	29.64	366,806	31	28.98	626,148
Lisbon, Portugal	15	28.26	50,622	32	27.87	82,323
Columbus, OH, United States	36	22.02	88,165	33	27.40	83,801
Austin, TX, United States	44	19.62	111,128	34	26.10	111,199
Tallahassee, FL, United States	30	23.08	12,244	35	26.06	11,892
Springfield, IL, United States	29	23.10	8,443	36	25.97	7,125
Providence, RI, United States	45	19.54	16,818	37	25.76	11,996
London, United Kingdom	27	23.48	794,560	38	25.08	817,799
Raleigh, NC, United States	50	19.00	40,699	39	25.03	38,307
Berlin, Germany	24	24.75	172,721	40	25.02	204,579
Boston, MA, United States	53	18.25	88,039	41	24.73	92,405
Pierre, SD, United States	38	20.51	317	42	24.41	270
Washington, DC, United States	43	19.67	109,894	43	24.17	122,672
Richmond, VA, United States	58	17.63	32,270	44	24.07	16,339
Baton Rouge, LA, United States	57	17.70	20,941	45	23.57	17,267
Lincoln, NE, United States	42	19.99	16,143	46	23.46	20,199
Des Moines, IA, United States	39	20.36	20,494	47	23.45	24,164
Dublin, Ireland	40	20.26	170,265	48	22.62	167,521
Nashville, TN, United States	56	17.75	80,705	49	22.50	90,396
Topeka, KS, United States	71	15.56	7,240	50	22.48	9,154
Albany, NY, United States	51	18.92	10,275	51	22.36	8,089
Hartford, CT, United States	49	19.04	16,463	52	22.31	11,720
Harrisburg, PA, United States	37	21.41	7,399	53	22.18	3,563
Phoenix, AZ, United States	62	17.02	183,819	54	22.15	156,251

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Note: City-year observations are collapsed to the country/state-year level and are weighted by the number of tests. We note that we cannot draw statistical conclusions from cities with less than 300 tests per year.

Table 10 (continued)

City, Country	2016			2017		
	Rank	Mbps	Number of Tests	Rank	Mbps	Number of Tests
Sacramento, CA, United States	46	19.21	111,809	55	22.04	83,911
Denver, CO, United States	73	14.16	140,760	56	21.55	132,369
Frankfort, KY, United States	55	18.10	2,797	57	21.42	2,965
Columbia, SC, United States	67	16.07	13,674	58	21.33	13,455
Salt Lake City, UT, United States	54	18.23	88,701	59	20.66	37,652
Boise, ID, United States	68	16.02	14,845	60	20.65	12,466
Oklahoma City, OK, United States	70	15.93	71,115	61	20.61	85,568
Honolulu, HI, United States	59	17.25	118,987	62	20.20	89,283
Tokyo, Japan	69	15.97	664,877	63	19.56	219,758
Mexico City, Mexico	66	16.15	576,975	64	19.24	563,491
Helena, MT, United States	61	17.13	1,529	65	19.15	1,701
Olympia, WA, United States	52	18.58	4,688	66	19.12	4,073
Madison, WI, United States	63	16.71	16,139	67	18.82	18,350
Jackson, MS, United States	65	16.66	5,511	68	17.70	6,851
Jefferson City, MO, United States	64	16.70	3,351	69	17.62	4,090
Juneau, AK, United States	47	19.09	662	70	17.58	541
Trenton, NJ, United States	48	19.07	6,216	71	17.47	3,454
Montpelier, VT, United States	75	13.39	307	72	17.29	259
Augusta, ME, United States	74	13.66	968	73	17.14	1,473
Concord, NH, United States	78	11.33	1,443	74	16.28	1,936
Carson City, NV, United States	60	17.14	2,945	75	15.94	2,901
Santiago, Chile	72	15.27	488,563	76	15.92	433,865
Cheyenne, WY, United States	76	12.08	3,574	77	15.91	3,513
Charleston, WV, United States	77	11.93	4,657	78	15.84	3,217
Santa Fe, NM, United States	79	11.28	6,725	79	13.97	7,463

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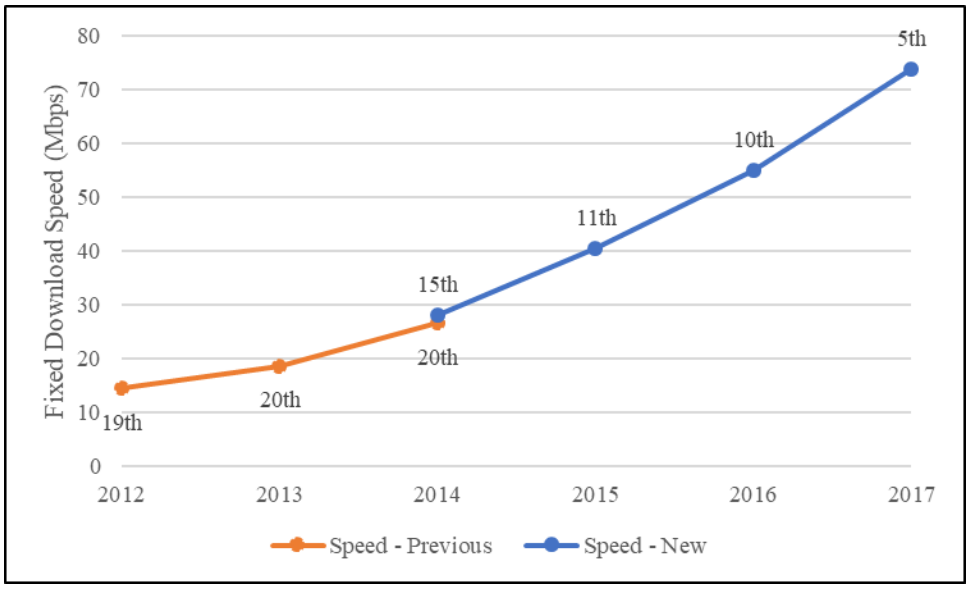
Note: City-year observations are collapsed to the country/state-year level and are weighted by the number of tests. We note that we cannot draw statistical conclusions from cities with less than 300 tests per year.

Table 11
U.S. Fixed Download Speeds and Rankings[1]

Year	Speed (Mbps) (Previous Methodology)	Speed (Mbps) (New Methodology)	U.S. Rank (Previous Methodology)	U.S. Rank (New Methodology)
2012	14.5		19	
2013	18.67		20	
2014	26.68	28.09	20	15
2015		40.38		11
2016		55.07		10
2017		73.79		5

Figure 1
U.S. Fixed Download Speed with Ranking, 2012-2017



[1] Table 11 and Figure 1 provide fixed download speed data for the United States and the comparison countries for which we have data for every year from 2012 to 2017. The sole comparison country not included is Latvia.

APPENDIX E-3

Broadband Price Comparison

8. We present information on "price for broadband service capability" for both fixed and mobile broadband plans in the United States and select comparison countries.[1] For the analysis, we include a comparison of "a geographically diverse selection of countries" and "communities including the capital cities of such countries."[2]

II. OVERVIEW

9. *Assessing Whether Prices Changed Since the 2018 Sixth IBDR.* As with earlier IBDRs, the *2018 Sixth IBDR* ranked countries by fixed and mobile broadband prices from the least expensive (1st) to most expensive (e.g., 29th) according to unweighted average prices for standalone fixed broadband plans within certain download speed ranges and mobile broadband plans within bands of data usage allowances.[3] For the first time, to more closely match the characteristics of the comparison communities and their broadband offerings with those in the United States, the *2018 Sixth IBDR* presented country rankings by two additional methodologies: a broadband price index and a hedonic price index.[4] The *2018 Sixth IBDR* stated that the hedonic price index "allows an adjustment for observable differences in broadband quality across countries (e.g., speed and usage limits) and generates prices for a set of standardized broadband plans in every country to produce a price index that accounts for all of these factors and is comparable across countries."[5] A summary of all the results for each of the methodologies can be found in the *2018 Sixth IBDR*.[6]

10. Here, we conduct statistical tests for both fixed and mobile broadband prices and focus on whether there were indications of statistically significant changes in broadband prices from 2017 to 2018 by assessing a smaller subset of countries.[7] The expectation from this analysis was that we could potentially draw inferences from the data about pricing trends reported in the *2018 Sixth IBDR*. To conduct this analysis, for fixed broadband plans, we collected prices from the selected eight countries and ten cities for comparison. For mobile broadband plans, we collected prices at the national level from the eight countries. In contrast to the *2018 Sixth IBDR*, we do not rank countries by price.

III. BROADBAND PRICING ANALYSIS

A. Hedonic Price Indexes and Statistical Results

11. Below, we provide the results of our analysis for fixed and mobile broadband prices, respectively, in the selected eight countries. In Table 1a and 1b, the "Index" represents the country-specific hedonic index calculated from the original data collection. We then calculated a 95% confidence interval for each country to determine if the relative price change (from 2017 to 2018) is statistically

[1] 47 U.S.C. § 1303(b)(1); *see also* 47 U.S.C. § 163.

[2] 47 U.S.C. § 1303(b)(2).

[3] *2018 Sixth IBDR*, 33 FCC Rcd at 1020, Appx. C, para. 2.

[4] *Id*. at 984, para. 13 ("Our additional assessments seek to better assess how the U.S. market is performing relative to other markets after accounting for quality differences as well as market-level cost and demographic differences that are known to affect pricing, such as population density, income, and education levels.").

[5] *Id*.

[6] *Id*. at 983-85, paras. 12-15.

[7] Specifically, we are estimating whether the quality-adjusted prices of 2017 plans have changed relative to the predicted quality-adjusted prices of 2017 plans had they been offered in 2018.

different than zero. The lower and upper bounds of the 95% confidence interval are represented by "95% CI LB" and "95% CI UB," respectively. If zero is within the lower and upper bounds of the confidence interval, we cannot conclude there has been a price change. If zero is *not* within the lower and upper confidence interval bounds, this suggests quality-adjusted prices have changed.

12. In Table 1a, Germany displays a statistically significant change in fixed broadband prices from 2017 to 2018.

Table 1a
Fixed Broadband - Hedonic Index by Country

Country	Index	95% CI LB	95% CI UB
Denmark	-5.3%	-14.5%	6.2%
Estonia	-6.3%	-12.8%	1.7%
France	13.7%	-2.9%	42.4%
Germany	**-15.8%**	**-21.4%**	**-9.0%**
Mexico	12.7%	-3.6%	33.5%
South Korea	0.6%	-1.7%	3.0%
United Kingdom	-5.7%	-11.6%	0.4%
United States	-1.6%	-6.2%	4.0%

Note: Statistically signficiant results are bolded. The 95% Confidence Interval calculated using bootstrapping resampling.

13. In Table 1b, Denmark, Estonia, Germany, and South Korea display statistically significant changes in mobile broadband prices from 2017 to 2018.

Table 1b
Mobile Broadband - Hedonic Index by Country

Country	Index	95% CI LB	95% CI UB
Denmark	**-23.7%**	**-31.8%**	**-14.8%**
Estonia	**-14.9%**	**-23.8%**	**-4.0%**
France	-12.9%	-27.2%	11.8%
Germany	**-18.1%**	**-29.2%**	**-4.9%**
Mexico	-4.3%	-18.9%	20.7%
South Korea	**-7.4%**	**-11.9%**	**-0.7%**
United Kingdom	-2.2%	-11.9%	10.5%
United States	-7.7%	-18.3%	7.4%

Note: Statistically signficiant results are bolded. The 95% Confidence Interval calculated using bootstrapping resampling.

B. Data Collection and Methodology

1. Data Collection

14. *Country Selection and General Data Collection*. We selected eight countries, which are a subset of the countries selected in the *2018 Sixth IBDR*, based on geographical diversity. For each of the countries, we selected the capital cities and added two additional cities for the United States and Mexico for the reasons noted below.[8] Similar to the *2018 Sixth IBDR*, staff also collected data from broadband providers with market shares of at least 10%[9] and based on data availability.

15. *Fixed Broadband Data Collection.* To obtain the raw price data, we relied largely on the sampling methodology and data collection methodology used in the *2018 Sixth IBDR*,[10] with certain differences. With the exception of Mexico and the United States, we collected plan prices and terms at ten randomly sampled addresses for the capital city in each country between June and August 2018. We took this approach because we observed that the data collected for the *2018 Sixth IBDR* generally did not show variation in the plan prices across the cities selected within countries.[11] Also, in the United States and Mexico not all of the providers in our sample offer broadband service in the capital city. To improve our analysis, we collected plan prices and terms for two cities in Mexico and in the United States: the capital city and a city where those providers do offer broadband service and is represented in the 2017 data collection.[12] In addition, we simplified certain variables for the 2018 data collection[13] and made minor corrections to the 2017 data collection.

16. *Mobile Broadband Data Collection.* To obtain the raw price data, we relied largely on the sampling methodology and data collection methodology used in the *2018 Sixth IBDR*,[14] with certain differences. We collected mobile broadband plan prices and terms in the same eight countries at the national level between June and August 2018. We eliminated certain variables from the 2018 data

[8] The *2018 Sixth IBDR* generally captured fixed broadband prices in two or three cities per country with the expectation that the report would find price variation between cities. *Id.* at 1027, Appx. C, para. 14.

[9] Similar to the *2018 Sixth IBDR*, we rely on the TeleGeography GlobalComms Database to select providers with broadband market shares of at least 10% as of March 2017 and March 2018, with certain exceptions. *Id.* For example, Verizon is estimated to have a national broadband market share below 10% in the United States, but it was sampled due to being the largest FTTP provider as well as the second largest ILEC. *Id.* at para. 14, n.41.

[10] *Id.* at 1027-29, paras. 14-18.

[11] Certain fees, such as Regional Sports Network fees, associated with fixed broadband plans may vary across cities in a country. We assume, however, that such fees do not vary significantly from year to year in a city.

[12] *See supra* Section II.H, para. 271, note 821. While we observe that fixed broadband plan prices generally do not vary across cities within a country, the availability of a provider's fixed broadband plans may vary across cities in that country. For example, in 2017 and 2018, 50 Mbps was the highest download speed offered by AT&T at the ten addresses sampled in Los Angeles. In other U.S. cities, AT&T offered speeds up to 1 Gbps in 2017. For each provider, we compared 2017 and 2018 broadband price data pertaining to the same city for each year to ensure that the availability of broadband plans is consistent from year to year.

[13] In the *2018 Sixth IBDR*, advertised download speeds were recorded as minimum, maximum, and/or typical, but we simplified this variable by collecting one of these because most providers did not report more than one download speed metric. Similarly, we simplified advertised upload speeds to collect either minimum or maximum (rather than record both) because most providers did not report more than one upload speed metric. We also clarified the definitions of Installation Fee and Activation Fee as one-time fees and of Set-Top Box Price and Modem/Router Price as recurring monthly prices.

[14] *See 2018 Sixth IBDR*, 33 FCC Rcd at 1040-42, Appx. C, paras. 40-44.

collection and clarified the definitions of other variables.[15] We also modified the framework of the data collection to better distinguish pricing and product characteristics between single line plans and plans with multiple lines and made corrections to the 2017 data to fit this framework.[16]

17. *Data Caveats.* We note certain limitations and inconsistencies in the data. Given the limited scope of our methodology and analysis, as well as any data collection issues, we do not draw conclusions regarding our observations or as to the competitiveness of broadband pricing across the United States and the comparison countries in 2018 relative to 2017. There may be various factors that affect these results, such as changes in promotional prices or availability of certain broadband plans.

2. Hedonic Price Indexes and Statistical Tests

18. For both fixed and mobile broadband, we conducted a statistical test using a hedonic price index to assess whether there were statistically significant changes in broadband prices between 2017 and 2018 for the eight countries examined. To make such an assessment, we first computed a hedonic price index, which is a measure of price change for plans in 2017 had they been offered in 2018 relative to 2017.[17] This approach is preferable to directly comparing country-level weighted average prices because changes may occur in plan offerings and plan characteristics from year to year. For example, the fastest plan offered by a carrier might have been 50 Mbps in 2017 but in 2018 that carrier may no longer offer a 50 Mbps plan and instead offer a 100 Mbps plan. Without controlling for such changes in the availability of plans, the resulting country-level average price would suggest a larger price increase from year-to-year than if product characteristics had been controlled for in the analysis. Second, for our statistical test, we then calculated a 95% confidence interval for each country to determine if the relative price change is statistically different than zero. If zero is within the lower and upper bounds of the confidence interval, we cannot conclude that quality-adjusted prices have changed from 2017 to 2018.

19. *Fixed Broadband Hedonic Price Index and Statistical Test.* We calculate a hedonic index.[18] To calculate this index, we undertake several steps. First, we estimate two identical regression models[19]: one regression model uses only the 2017 plans and the other regression model uses only the 2018 plans:

$$\log(price) = \beta_0 + \beta_1 * \log(DownloadSpeed) + \beta_2 * Bundle + \beta_3 * Provider + \beta_4 * Country + \varepsilon$$

[15] Specifically, we did not collect variables with respect to technology, data cap overage fees and data amounts, promotional data and duration, text price if not unlimited, and zero-rated offers because these variables were not used in the analysis in the *2018 Sixth IBDR*. We also clarified the definitions of Access Fee to signify a monthly fee and Activation Fee to signify a one-time fee.

[16] For example, we observe that some providers increase the data cap if additional lines are added to a plan, while some providers allow subscribers of a shared plan to use a fixed amount of data regardless of how many lines are included in the plan.

[17] By estimating separate 2017 and 2018 hedonic regression models, we predict the price of 2017 plans using the 2018 model to predict what the plans offered in 2017 would have cost if they had been offered in 2018. With the predicted prices, we calculate the ratio of each 2017 plan's predicted 2018 price to its predicted 2017 price.

[18] We use the approach discussed in Ariel Pakes' *A Reconsideration of Hedonic Price Indexes with an Application to PC's*. *See* Ariel Pakes, A Reconsideration of Hedonic Price Indexes with an Application to PC's (2003), https://scholar.harvard.edu/files/pakes/files/hedonics_8-03.pdf.

[19] We cluster at the provider.

We use the two regression models to predict the price of 2017 plans. Then, we calculate the ratio of the predicted 2018 price to the predicted 2017 price of each 2017 plan. Next, we calculate the weighted average of the ratios using the plan weights for each country to produce the hedonic index:

$$H = \sum_i \frac{h^{18}(x_i^{17})}{h^{17}(x_i^{17})} * w_i^{17}$$

where $h^{18}(x_i^{17})$ is a predicted price (or, fitted left-hand-side variable) for a 2017 plan using the 2018 hedonic regression model, $h^{17}(x_i^{17})$ is a predicted price for a 2017 plan using the 2017 hedonic regression model, and w_i^{17} is the 2017 plan weight. This hedonic index estimates the relative change in prices for 2017 plans. Finally, to calculate a 95% confidence interval for the hedonic index, we use a bootstrapping resampling method.[20] We generate 500 stratified (by country and year) random samples of the full data set[21] and then repeat the steps described above to produce 500 estimates of the hedonic index. The lower bound of the 95% confidence interval is the 5th percentile of the estimates and the upper bound is the 95th percentile of the estimates.

20. *Mobile Broadband Hedonic Price Index.* We follow the same approach as the fixed broadband statistical test, except we use slightly modified regression models[22]:

$$\log(price) = \beta_0 + \beta_1 * \log(DataCap) * \beta_2 * UnlimitedData * \beta_3 * Bundle + \beta_4 * Provider + \beta_5 * Country + \varepsilon$$

We include a dummy variable to represent plans with unlimited data caps without a specified soft data cap.[23] This regression model allows a different coefficient on data cap for each country. After estimating the two regression models, we use an approach identical to that of the fixed broadband statistical test.

3. Calculation of Plan Weights for Hedonic Price Index

21. Ideally, to calculate the hedonic price index discussed above, we would have the following data specific to each year: the prices at which consumers purchase all of the fixed and mobile broadband plans and the number of consumers that subscribe to each plan. Because we do not have these data, we then must consider that the broadband plans offered by any single provider may not have equally proportionate numbers of subscribers.[24] Therefore, we created weights to apply in the regression models to give greater weight to plans with a larger number of subscribers than those plans with a fewer number of subscribers. The weights represent the estimated percentage of consumers that purchase each of the

[20] In this context, bootstrapping means that we sample with replacement 100 times and calculate our hedonic price index for each sample. Each sample will produce a different hedonic price index, resulting in a distribution of hedonic price indexes. This distribution can be used for a 95% confidence interval.

[21] For each sample, we recalculate the plan weights to ensure the weights sum to one for each sample.

[22] We cluster at the provider.

[23] When soft data caps were available, we recorded these as the data cap. For unlimited data plans without soft data caps, we set their data caps to two times the maximum data cap in that year.

[24] For example, approximately 40% of fixed broadband plans offered in the United States in 2017 had download speeds of 100 Mbps or higher. However, only about 12% of U.S. consumers have fixed broadband plans with speeds of 100 Mbps or higher as of December 2016. OECD Broadband Portal, Fixed Broadband Subscriptions per 100 Inhabitants, per Speed Tiers (Dec. 2016) (*2016 OECD Fixed Broadband Subscriptions per 100 Inhabitants, per Speed Tiers*), http://www.oecd.org/sti/broadband/broadband-statistics/.

broadband plans in our data collection in a given country and year.[25]

22. While our data collections consist of advertised prices and terms for fixed and mobile broadband plans collected in 2017 and 2018, there may be consumers with existing subscriptions to broadband plans that are no longer offered by a provider in 2017 or 2018. Consequently, such broadband plans are not captured in our data collections. As a result, the broadband plans in our data collections might not represent the prices and terms of these earlier, unobserved broadband plans. To represent in our analysis how much consumers actually pay for their broadband plans in each selected country, we assume that the earlier, unobserved broadband plans are similarly priced as the broadband plans collected in 2017 and 2018.[26] Therefore, our analysis focuses on prices and price changes of new plans, but we must assume that consumers purchase these products in the same distribution as plans that consumers have historically purchased. Consumers are most likely switching to higher speed or higher data cap plans over time within a given country, but we do not know the distribution of these newly purchased plans.

23. We determine the plan weights by calculating the product of: (1) annual national provider market shares,[27] (2) an estimated percentage of bundle shares, which refers to the percentage of consumers that bundle fixed broadband with television or that bundle mobile broadband with multiple lines,[28] and (3) the product share, which represents the national percentage of consumers that subscribe to certain speed tiers for fixed broadband or certain data cap tiers for mobile broadband in each selected country.[29]

24. *National Provider Market Shares*. We use the TeleGeography GlobalComms Database to collect annual national provider market shares.[30] As discussed in the *2018 Sixth IBDR*, we select providers with broadband market shares of at least ten percent, with certain exceptions.[31] The national provider market shares may vary each year. We use national provider market shares as of March 2017 and March 2018 for our analysis.

25. *Bundle Shares*. Because we do not have data at the country level or the year level on the percentage of consumers that purchase fixed broadband bundled with television or purchase mobile broadband bundled with multiple lines on a single plan,[32] we assume that the percentage of consumers that purchase such bundles in each comparison country is equal to the percentage of customers that

[25] The *2018 Sixth IBDR* used U.S. weights for all countries to make comparisons across countries. For this analysis, each country has its own set of weights.

[26] Ideally, we would have data on which and how many new consumers purchase each available plan collected, so that we could use the distribution of newly purchased plans.

[27] *TeleGeography GlobalComms Database*. We use data on national provider market shares as of March 2017 and March 2018.

[28] *See 2018 Sixth IBDR*, 33 FCC Rcd at 1021-22, paras. 4-5 & n.18. We observe that consumers usually receive discounts when they bundle broadband and television or purchase multiple mobile broadband plans, rather than when they purchase these services separately.

[29] *2016 OECD Fixed Broadband Subscriptions per 100 Inhabitants, per Speed Tiers*; OECD Broadband Portal, Mobile Data Usage per Mobile Broadband Subscription (Dec. 2017) (*2017 OECD Mobile Data Usage per Mobile Broadband Subscription*), http://www.oecd.org/sti/broadband/broadband-statistics/.

[30] *TeleGeography GlobalComms Database*.

[31] *See supra* note 9. *See also 2018 Sixth IBDR*, 33 FCC Rcd at 1027, Appx. C, para. 14 & n.41.

[32] In other words, a "bundled" mobile offering consists of a multi-line package rather than a combination of broadband and video. *See id.* at 1022, Appx. C, para. 5, n.18.

purchase these bundles in the United States.[33] For this, we rely on estimates that 75% of U.S. subscribers bundle fixed broadband with video service and, for mobile broadband, that 75% of U.S. subscribers bundle multiple lines.[34]

26. *Product Shares*. We categorize each plan into one of four products (i.e., product categories) based on download speed tiers for fixed broadband or data cap tiers for mobile broadband. Where a provider offers multiple broadband plans in a product category, the plan weight is distributed equally among the plans in that product category. We use the OECD's Broadband Portal to collect product shares for fixed broadband.[35] We use the approach in the *2018 Sixth IBDR* to determine product shares for mobile broadband, except that we use data usage means obtained from the OECD,[36] which is specific for each country, as the log-normal distribution's location parameter, and assume that the scale parameter of all countries is the same as the United States' scale parameter of 0.95.[37]

27. *Fixed Broadband Product Share Results.* In Table 2a below, we identify the four product categories and product shares based on download speed tiers for fixed broadband.

Table 2a
Fixed Broadband Product Shares by Country

Country	Product 1	Product 2	Product 3	Product 4
	0.256 ≤ Mbps < 10	10 ≤ Mbps < 25	25 ≤ Mbps < 100	100 ≤ Mbps
Denmark	10.8%	44.8%	33.6%	10.8%
Estonia	15.0%	18.0%	38.0%	29.0%
France	4.5%	78.5%	6.5%	10.5%
Germany	29.0%	43.0%	21.0%	7.0%
Mexico	25.9%	60.8%	13.1%	0.2%
South Korea	24.2%	0.0%	0.0%	75.8%
United Kingdom	7.0%	51.3%	33.0%	8.7%
United States	24.4%	25.7%	37.5%	12.4%

Note: Two lowest reported tiers are combined into Product 1.

Source: OECD Broadband Portal, Speeds, 5.1 Fixed Broadband Subscriptions per 100 inhabitants, per speed tiers (Dec. 2016)

28. *Mobile Broadband Product Share Results.* In Table 2b below, we identify the four product categories and product shares based on data cap tiers for mobile broadband.[38]

[33] *See id.* at 1021, Appx. C, para. 4 & n.7 (noting that Kagan, a media research group within S&P Global Market Intelligence, estimates that 75% of U.S. broadband subscribers from the top 5 publicly reported MSOs subscribe to double or triple-play bundles); *id.* at 1039, Appx. C, para. 33 (noting that Cisco estimates that 75% of subscribers in the United States obtain their mobile service through shared data plans (i.e., "family plans")).

[34] *Id.* We note that Section II.B observes that in a recent survey, 56% of MVPD subscribers responded that a top reason for keeping the video service was because it was bundled with Internet service. *See supra* Section II.B at para. 63.

[35] *2016 OECD Fixed Broadband Subscriptions per 100 Inhabitants, per Speed Tiers*.

[36] *2017 OECD Mobile Data Usage per Mobile Broadband Subscription*.

[37] *See 2018 Sixth IBDR*, 33 FCC Rcd at 1044, Appx. C, para. 50 & Tbl. 6.

[38] We assume that consumers choose mobile broadband plans with data caps approximately equal to their expected data usage.

Table 2b
Mobile Broadband Product Shares by Country

Country	Data Usage per Subscription	Product 1	Product 2	Product 3	Product 4
		0 < Data (GB) ≤ 2	2 < Data (GB) ≤ 5	5 < Data (GB) ≤ 10	10 < Data (GB)
Denmark	5.70	13.5%	31.0%	27.8%	27.7%
Estonia	7.16	9.0%	26.3%	28.5%	36.3%
France	3.39	28.9%	36.9%	21.4%	12.7%
Germany	1.77	55.2%	31.1%	10.3%	3.4%
Mexico	1.23	16.2%	32.9%	26.9%	24.0%
South Korea	5.11	69.6%	23.4%	5.6%	1.4%
United Kingdom	2.53	40.3%	36.1%	16.2%	7.4%
United States	3.03	33.1%	37.0%	19.5%	10.4%

Note: Product Shares calculated assuming a log-normal distribution with a country-specific mean and constant US standard deviation.

Source: OECD Broadband Portal, 1.14 Mobile data usage per mobile broadband subscription (Dec. 2017)

APPENDIX E-4

High-Speed Broadband Deployment Comparison with Europe

29. In this Appendix, we compare fixed high-speed and mobile broadband deployment[1] in the United States and 21 European countries (EU21).[2] To conduct the comparison, we rely on the European Commission (EC) deployment data published in the *EC Broadband Report*. To match the EC definition of fixed high-speed broadband, we examine U.S. fixed broadband deployment with download speeds of 30 Mbps or higher.[3] To match the fixed technologies used in the *EC Broadband Report*, we do not include satellite technology.[4] We also compare mobile high-speed broadband deployment in the United States and EU21 by focusing exclusively on LTE, which is the baseline industry standard for the marketing of mobile broadband service.[5] For our primary fixed and mobile analysis, we rely on data gathered by the FCC and the EC in June 2016 and June 2017. We also present a historical overview of fixed deployment in the United States and the EU21 countries from 2012 to 2017. Finally, we provide maps that show fixed high-speed broadband deployment in the United States and Europe.

I. FIXED HIGH-SPEED BROADBAND COMPARISON

A. Total and Rural Household Fixed High-Speed Broadband Deployment

[1] Prior International Broadband Data Reports released by the International Bureau as part of the annual Broadband Deployment Report included comparisons of broadband deployment in the United States and Europe. *See, e.g.*, *2018 Sixth IBDR*, 33 FCC at 1072-90, Appx. D; *see also* RAY BAUM'S Act of 2018 § 402(c), 132 Stat. at 1089.

[2] We refer to the set of countries that we compare here as the EU21, as we selected only 21 of the 31 European countries addressed in the *EC Broadband Report* for our analysis. The *EC Broadband Report* discusses the 28 member countries of the European Union (EU), as well as Iceland, Norway, and Switzerland. *EC Broadband Report* at 5. The 21 countries included in our analysis are: Austria (AT), Belgium (BE), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Ireland (IE), Italy (IT), Latvia (LV), Luxembourg (LU), Netherlands (NL), Portugal (PT), Spain (ES), Sweden (SE), United Kingdom (UK), Iceland (IS), Norway (NO), and Switzerland (CH). We corrected an error in the information provided in the *2018 Sixth IBDR*, which presented broadband deployment data associated with Lithuania instead of Latvia. *2018 Sixth IBDR*, 33 FCC Rcd at 1072-88, Appx. D.

[3] *EC Broadband Report* at 5. We rely on the same data sources, technologies, and methodology as described in the *2018 Sixth IBDR*. *2018 Sixth IBDR*, 33 FCC Rcd at 1073-75, 1078, Appx. D, paras. 5-9 & n.27. As in the *2018 Sixth IBDR*, we rely on the FCC's Form 477 fixed and mobile LTE deployment data to estimate U.S. broadband deployment as of June 2015, 2016, and 2017. FCC, Fixed Broadband Deployment Data from FCC Form 477, https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477; FCC, Mobile Broadband Deployment Data from FCC Form 477, https://www.fcc.gov/mobile-deployment-form-477-data. For fixed historical analysis, we also rely on data from the State Broadband Initiative (SBI) as of December 2012, 2013, and 2014, which the Commission relied on prior to the revision of the Form 477 data collection. For U.S. fixed technologies capable of at least 30 Mbps download speed, we include: DSL—Asymmetric xDSL, ADSL2, symmetric xDSL, VDSL; Cable Modem—DOCSIS 1, 1.1, 2, 3.0, and 3.1; Optical Carrier/Fiber to the End User; Copper Wireline; and Fixed Wireless. We also note that our analysis does not include U.S. territories.

[4] *EC Broadband Report* at 11.

[5] *Twentieth Mobile Wireless Competition Report*, 32 FCC Rcd at 9018, para. 73. In this Appendix, we analyze mobile LTE coverage regardless of minimum advertised speeds or actual speeds to match the *EC Broadband Report*.

Figure 1
Fixed High-Speed Broadband Deployment
All Households (June 2016 and June 2017)

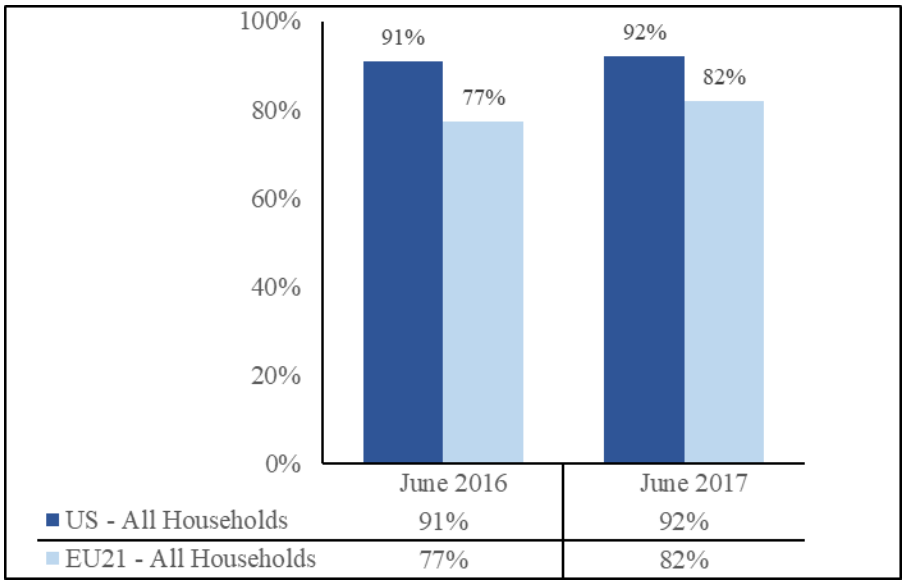
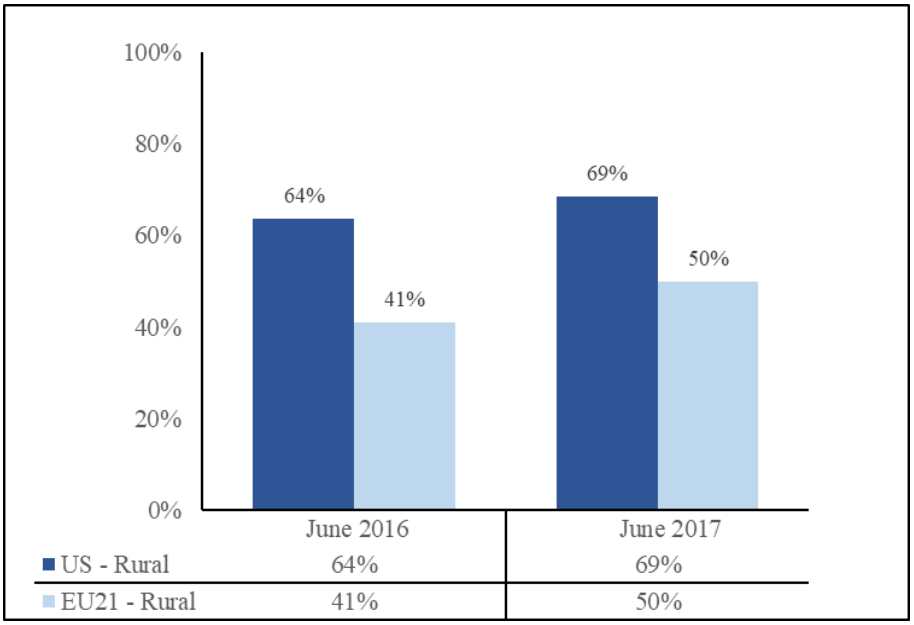


Figure 2
Fixed High-Speed Broadband Deployment
All Rural Households (June 2016 and June 2017)



B. High Speed Rural and Non-Rural Household Broadband Deployment

Figure 3
United States and EU21 Rural vs. Non-Rural (Households)
Fixed High-Speed Broadband Deployment (June 2016)

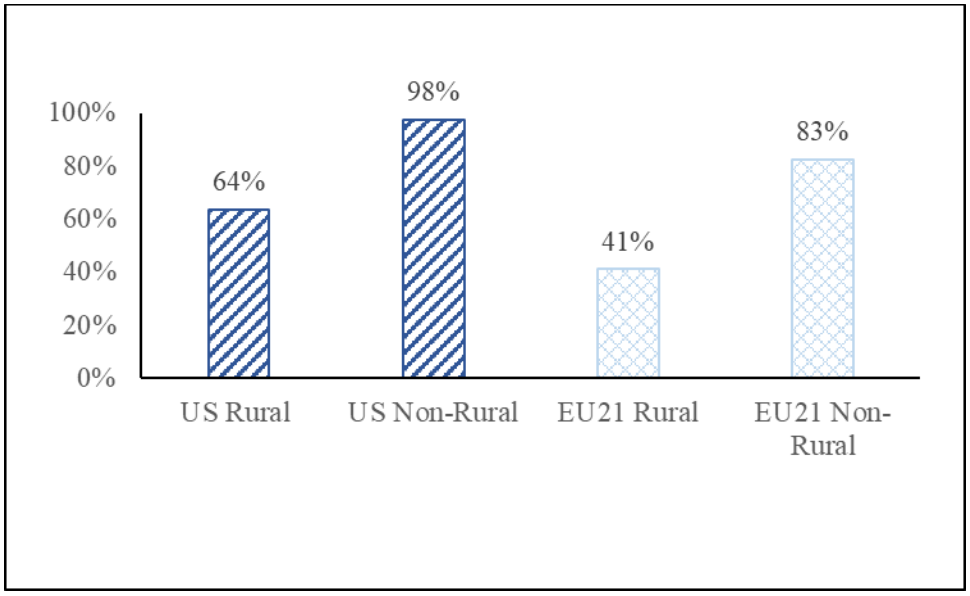
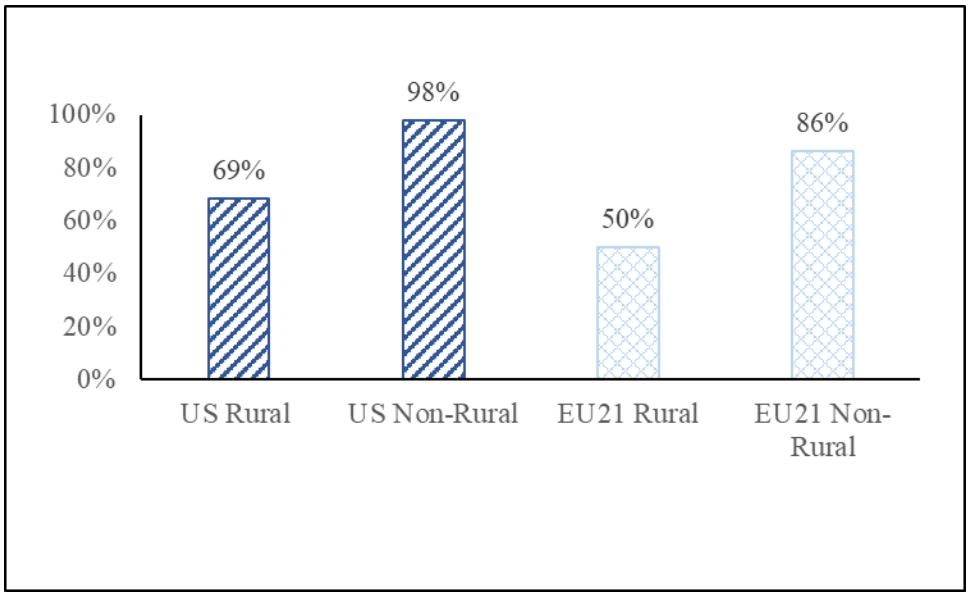
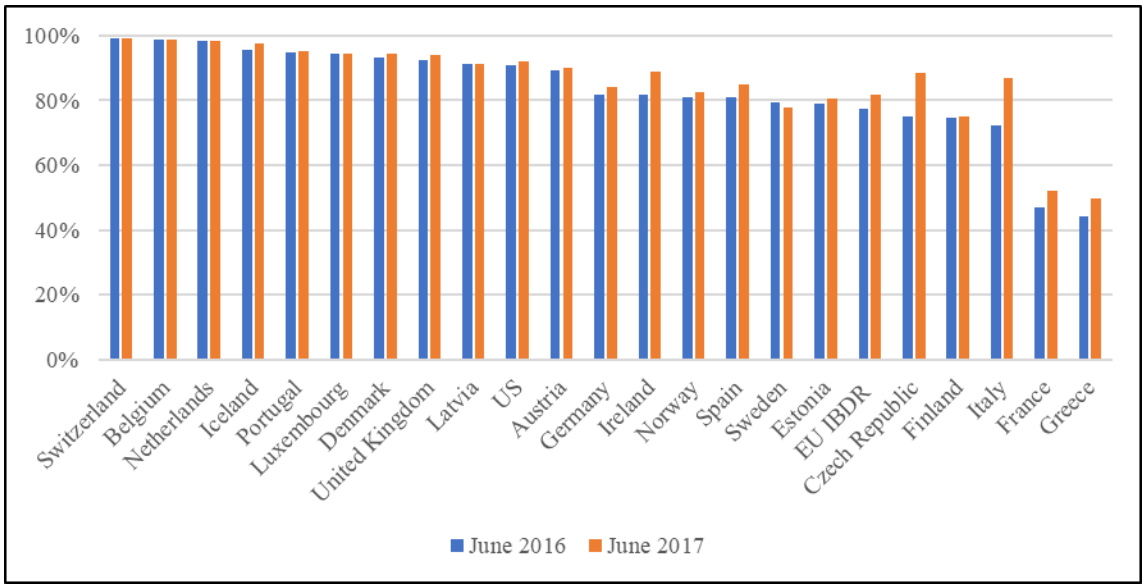


Figure 4
United States and EU21 Rural vs. Non-Rural (Households)
Fixed High-Speed Broadband Deployment (June 2017)



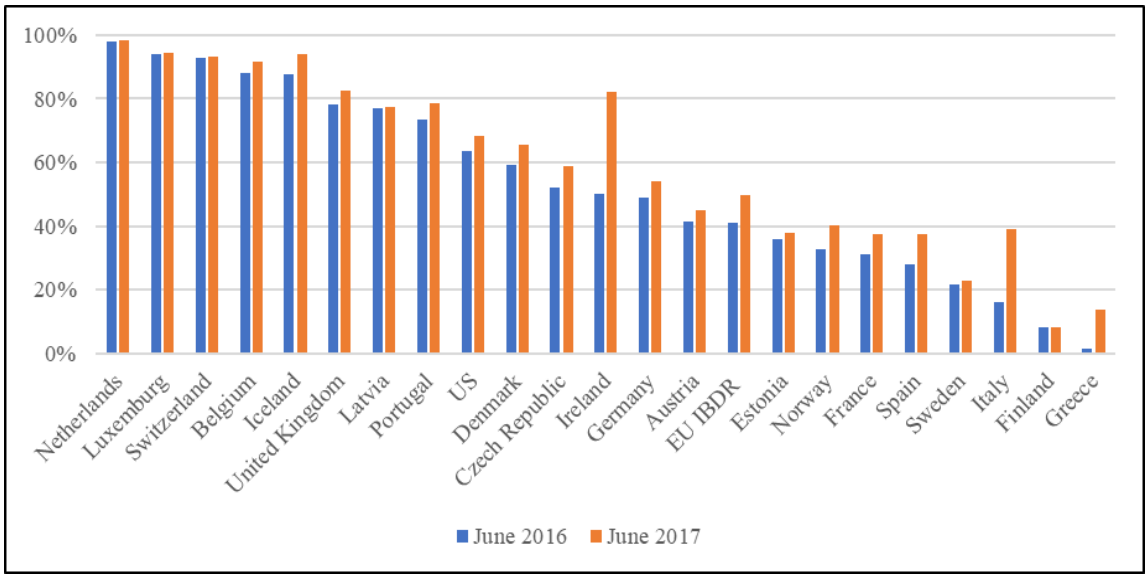
C. Total High-Speed Broadband Deployment by Country

Figure 5
Fixed High-Speed Broadband Deployment by Country for All Households (June 2016 and June 2017)



D. Rural High-Speed Broadband Deployment by Country

Figure 6
Fixed High-Speed Broadband Deployment by Country for All Rural Households (June 2016 and June 2017)



E. High-Speed Fixed Broadband Deployment by Technology and Technology Combination

Figure 7
Fixed High-Speed Broadband Deployment for All Households by Technology (June 2016)

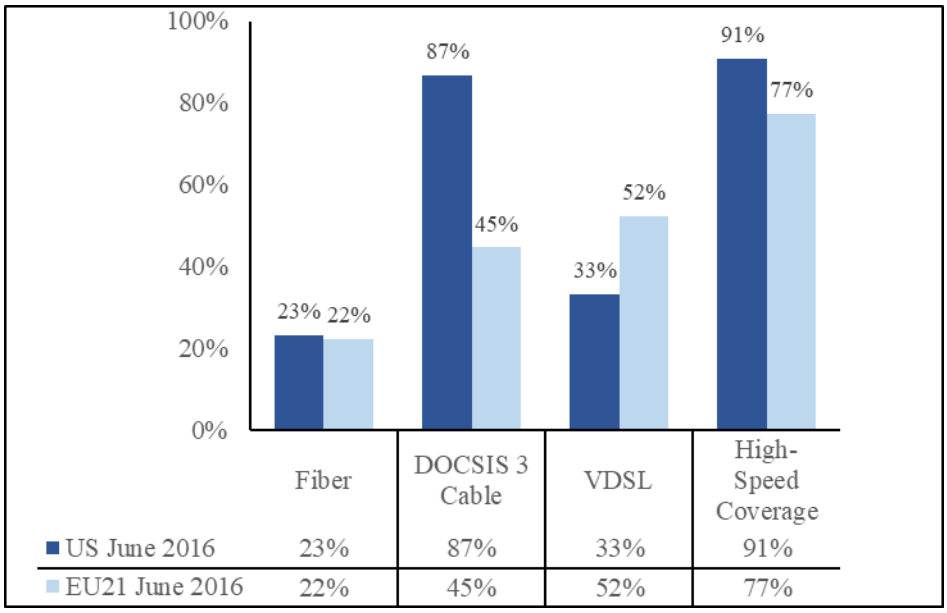
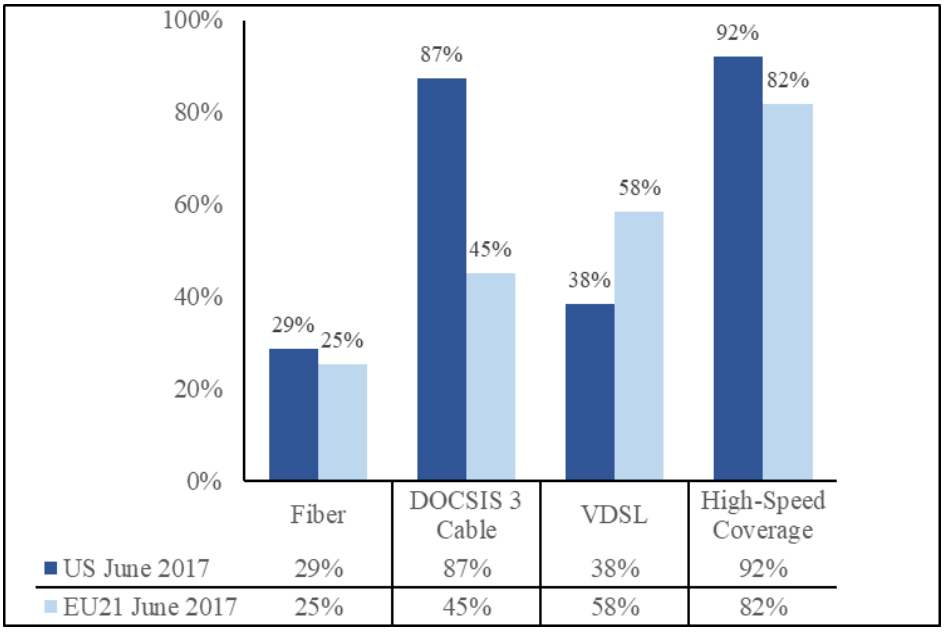


Figure 8
Fixed High-Speed Broadband Deployment for All Households by Technology (June 2017)



F. Comparison of 2 Mbps, 30 Mbps, and 100 Mbps Fixed Broadband Deployment in the United States and the EU21

Figure 9
Fixed High-Speed Broadband Deployment for
All Households by Speed (June 2016)

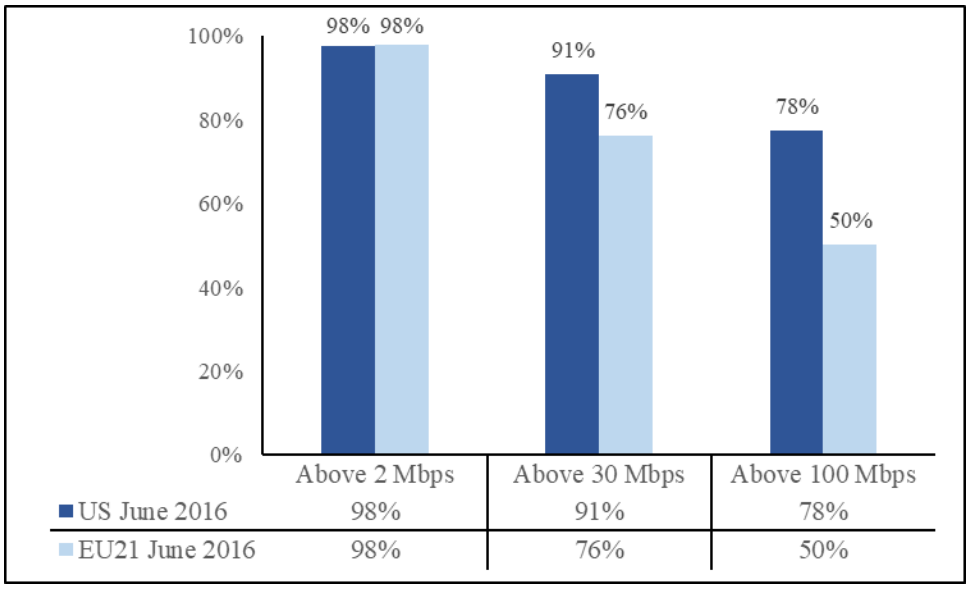
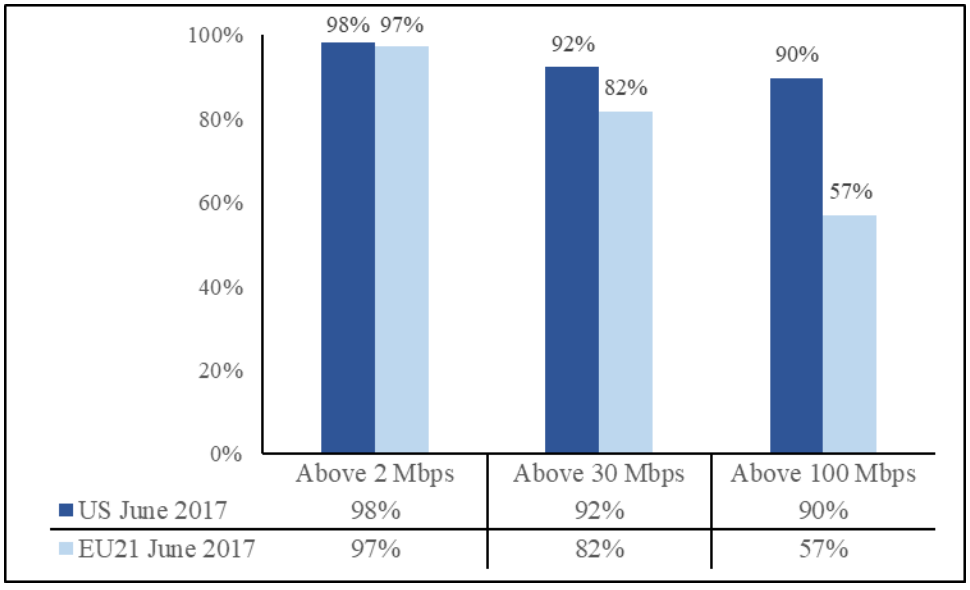


Figure 10
Fixed High-Speed Broadband Deployment for
All Households by Speed (June 2017)



II. MOBILE HIGH-SPEED BROADBAND COMPARISON

Figure 11
Mobile LTE Broadband Deployment for
All Households (June 2016 and June 2017)

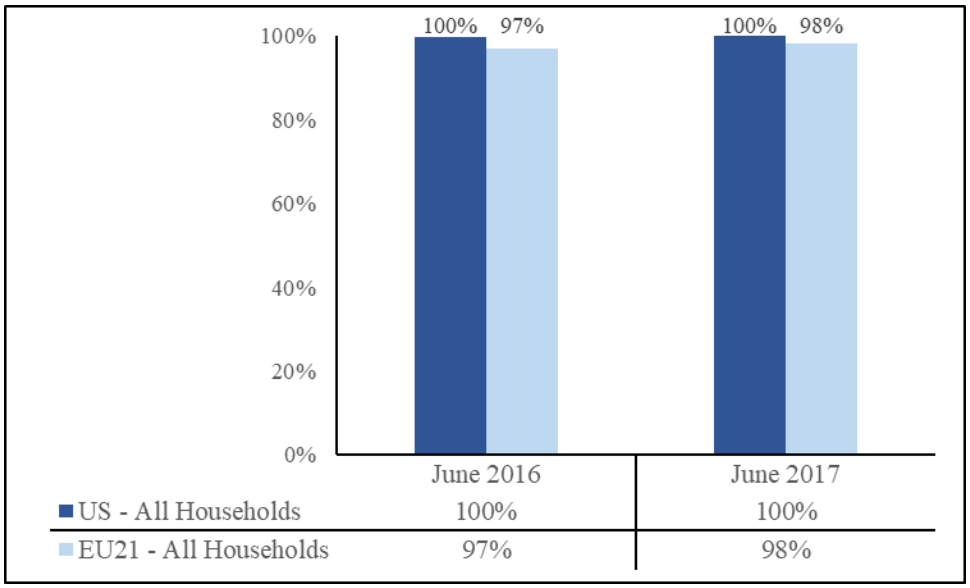
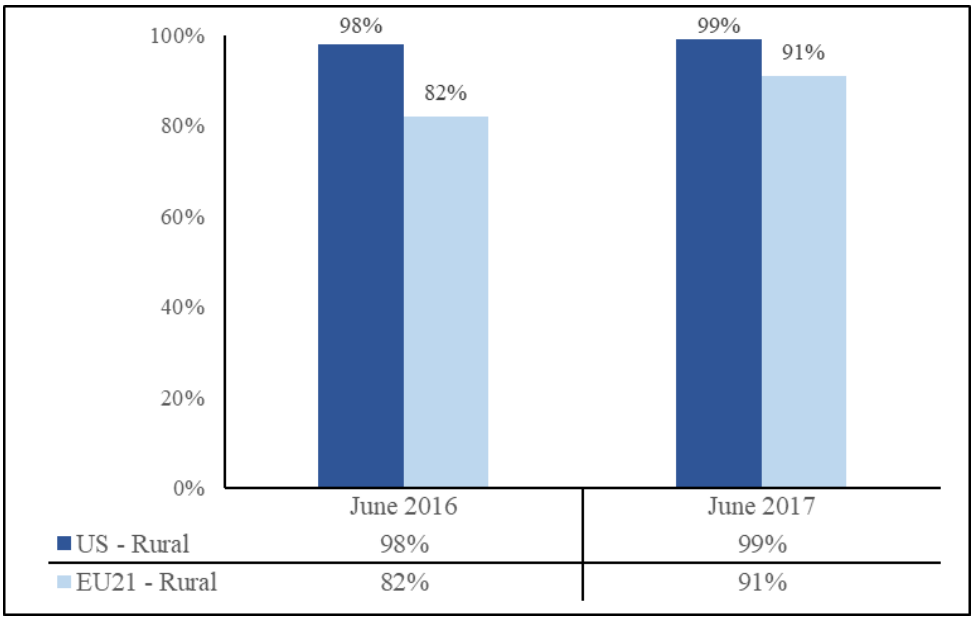


Figure 12
Mobile LTE Broadband Deployment for
All Rural Households (June 2016 and June 2017)



III. HISTORICAL OVERVIEW OF FIXED HIGH-SPEED DEPLOYMENT, 2012-2017

Figure 13
Fixed High-Speed Deployment
All Households

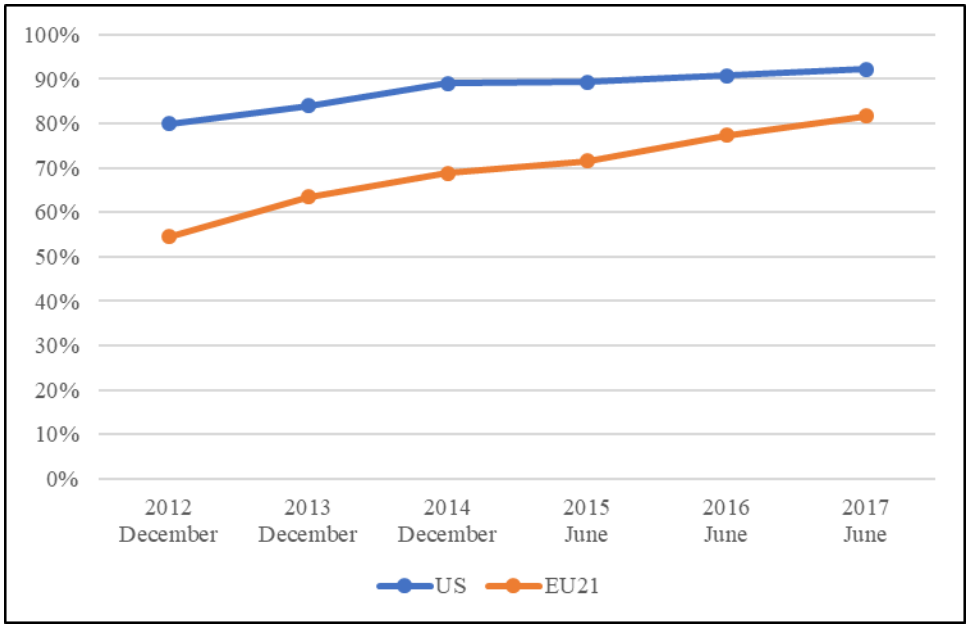


Figure 14
Fixed High-Speed Deployment
All Rural Households

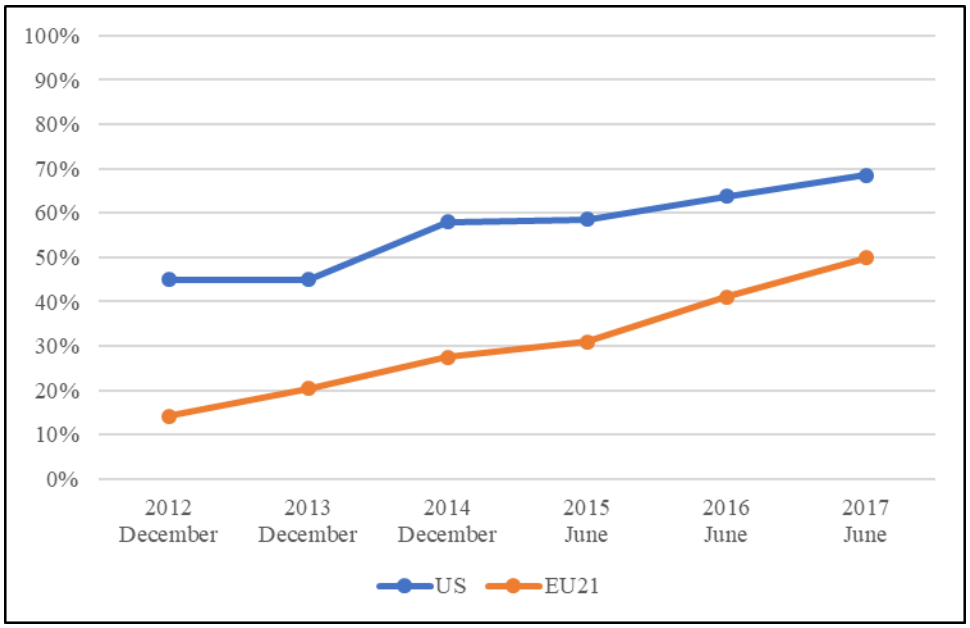
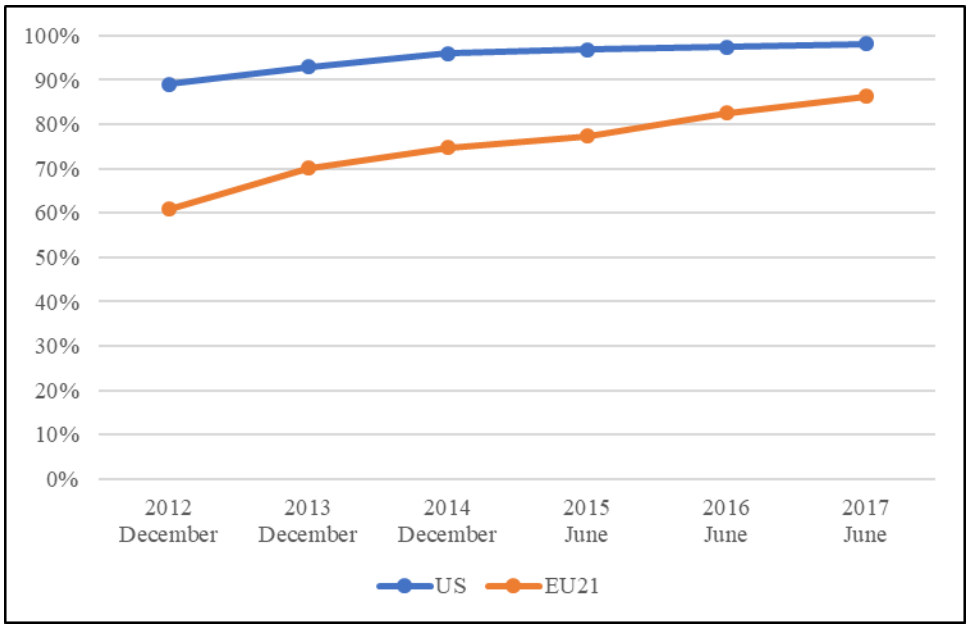


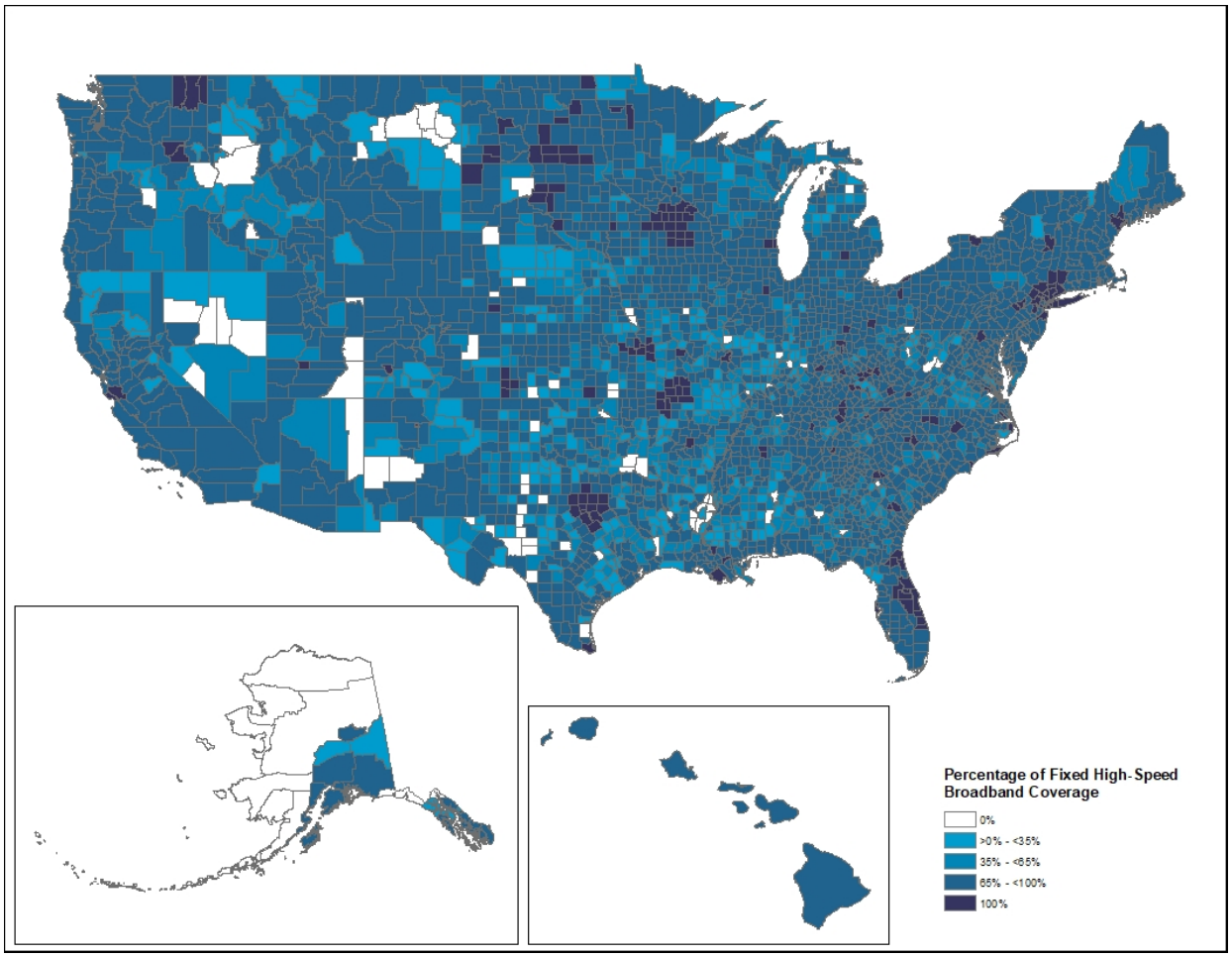
Figure 15
Fixed High-Speed Deployment
Non-Rural Households



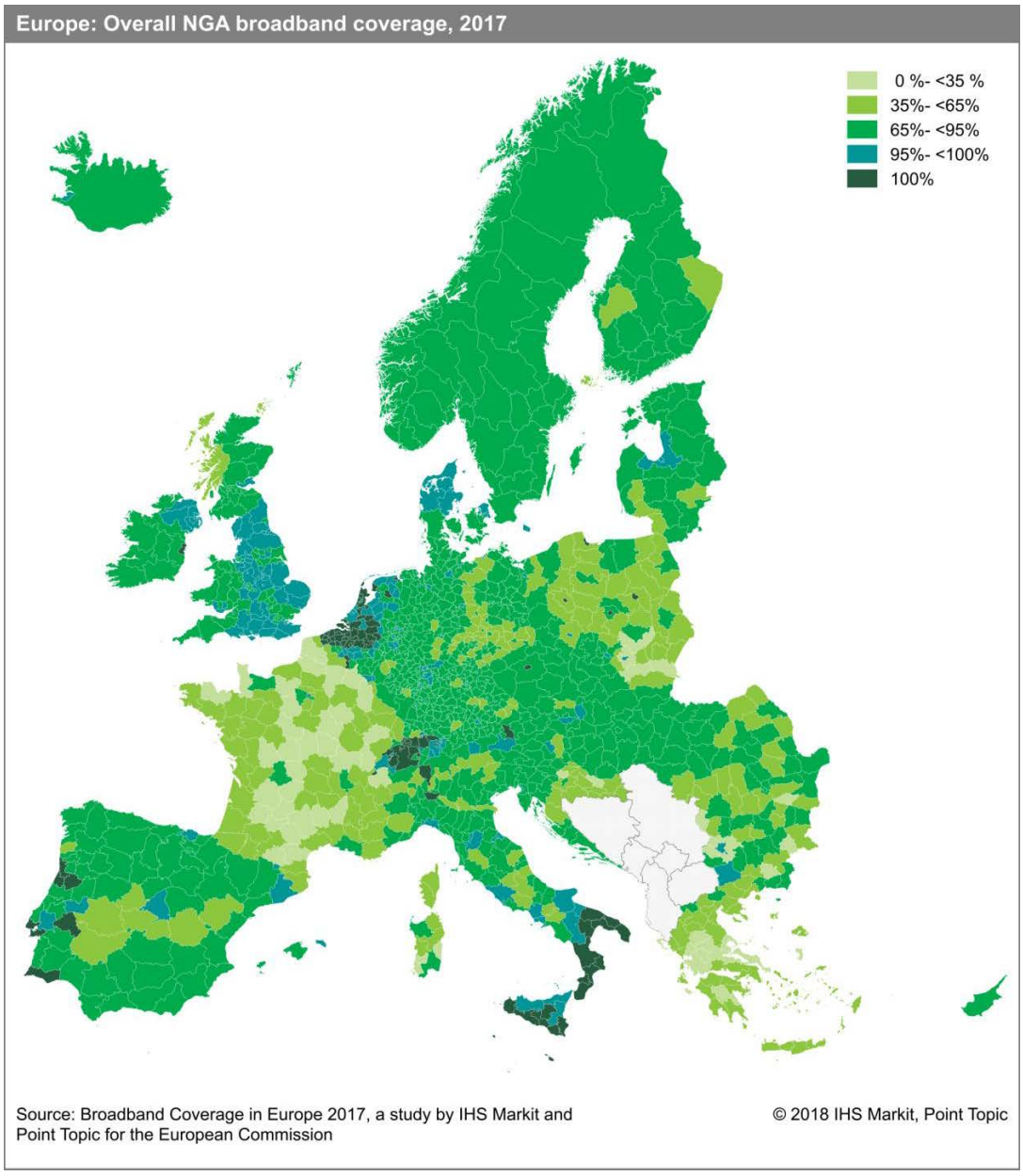
IV. FIXED HIGH-SPEED BROADBAND COVERAGE MAPS FOR THE UNITED STATES AND EUROPE

30. Below are maps of fixed high-speed fixed terrestrial broadband coverage at 30 Mbps in the United States and the Europe as of June 2017. Given that the *EC Broadband Report* already provides a map of its data, we reproduce that map below.

Map 1
United States Fixed High-Speed Broadband Coverage Map
June 2017



Map 2
Europe Fixed High-Speed Broadband Coverage (30 Mbps)
June 2017[1]



[1] *EC Broadband Report* at 48.

APPENDIX E-5
Demographics Dataset

31. As part of its assessment, the Commission compares broadband development in communities comparable to U.S. communities in terms of population size, population density, topography, and demographic profile.[1] In this Appendix, we present updated data[2] since the release of the *2018 Sixth IBDR*.[3] For the comparison countries excluding the United States and Canada, we present the Organization for Economic Cooperation and Development's (OECD's) most recent published data ranging from 2012 to 2017, depending on the data category.[4] For the United States, we present 2017 data from the U.S. Census Bureau.[5] For Canada, we present 2016 data from the Canadian Radio-television

[1] 47 U.S.C. § 1303(b)(2).

[2] Certain data, such as population data for certain countries or data on households with broadband (%) for almost all countries, have not been updated since the release of the *2018 Sixth IBDR*. For such data, we include data available as of the most recent year for each country. The province/county communities are based on the OECD classification of the subnational territorial levels of OECD Member countries. OECD, *OECD.Stats: Regions and Cities* (*OECD Regions and Cities*), http://stats.oecd.org/ (last visited Nov. 30, 2018).

[3] 47 U.S.C. § 1303(b)(2). We incorporate by reference the topography information contained in the *2018 Sixth IBDR* for the United States and the 28 comparison countries. *2018 Sixth IBDR*, 33 FCC Rcd at 1104-05, Tbl. 2. The topography information was based on Central Intelligence Agency's The World Factbook. Central Intelligence Agency, The World Factbook (2017), https://www.cia.gov/library/publications/download/download-2017/index.html. We note some inadvertent errors in the information provided in the *2018 Sixth IBDR*. We clarify that the CIA World Factbook states that: (1) Canada is the second largest country in the world rather than third as indicated in the *2018 Sixth IBDR*; (2) Latvia is slightly larger than West Virginia rather than slightly smaller as indicated in the *2018 Sixth IBDR*; (3) the reference is to "metropolitan France" rather than "French metropole" as indicated in the *2018 Sixth IBDR*; and (4) the location of the United Kingdom is described as "Western Europe, islands—including the northern one-sixth of the island of Ireland—between the North Atlantic Ocean and the North Sea" rather than "Atlantic archipelago" as indicated in the *2018 Sixth IBDR*. *See 2018 CIA World Factbook* (last updated Sept. 19, 2018).

[4] *OECD Regions and Cities*. Not all OECD data have been updated since the release of the *2018 Sixth IBDR*. *See* Table 1a. For instance, only Mexico and South Korea have updated their OECD data on households with broadband, updating that metric as of 2016. We note that the OECD data do not include any data on household broadband penetration for 2017. To access the online OECD data on households with broadband (%), population size, population density, GDP total, GDP per capita, and educational attainment, select the left-hand column titled "Data by Theme," then "Regions and Cities," and then "Regional Statistics." For data on households with broadband (%), select "Regional Social and Environmental Indicators," and then "Internet Broadband Access." For data on population size, select "Regional Demography," then "Population (Large Regions TL2)," and then "Indicator" – "Population, All ages." For data on population density, select "Regional Demography," then "Population Density and Regional Area," and then "Indicator" – "Population density (pop. per km2)." For data on GDP total, select "Regional Economy," then "Regional Gross Domestic Product (Large regions TL2)," and then "Measure" – "Millions USD, constant prices, constant PPP, base year 2010." For data on GDP per capita, select "Regional Economy," then "Regional Gross Domestic Product (Large regions TL2)," and then "Measure" – "USD per head, constant prices, constant PPP, base year 2010." For data on educational attainment, select "Regional Innovation," then "Educational Attainments of the Labour Force," and then "Indicator" – "Share of Labour Force with Tertiary Education (in % of labour force"). In Table 1a below, we identify the sources. The term PPP refers to Purchasing Power Parity.

[5] U.S. Census Bureau, *Percent Of Households With A Broadband Internet Subscription*, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_1YR_GCT2801.US01PR&prodType=table (last visited Sept. 18, 2018). In Table 1, the data for the percentage of households with broadband in all of the communities except Canada represent households with fixed and/or mobile broadband subscriptions.

and Communications Commission, the latest available data by province/territory.[6]

Table 1
Demographics Dataset

Community	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)[7]
Australia (AUS)	**86***	**24,598,900**	**3**	**1,105,430**	**45,817**	**46**
New South Wales (AU1)	85	7,861,070	10	363,316	47,026	49
Victoria (AU2)	86	6,323,610	28	256,100	42,205	50
Queensland (AU3)	86	4,928,460	3	205,998	42,522	40
South Australia (AU4)	82	1,723,550	2	65,092	38,106	44
Western Australia (AU5)	88	2,580,350	1	156,048	59,625	44
Tasmania (AU6)	81	520,877	8	18,451	35,543	35
Northern Territory (AU7)	89	246,105	0.2	16,369	66,846	42
Australian Capital Territory (AU8)	94	410,301	175	24,057	60,728	61
Austria (AUT)	**85**	**8,772,870**	**106**	**376,914**	**43,142**	**34**
Burgenland (AT) (AT11**)**	83	291,942	80	8,707	29,870	32
Lower Austria (AT12)	83	1,665,750	88	58,636	35,329	34
Vienna (AT13)	88	1,867,580	4,728	96,134	51,855	44
Carinthia (AT21)	84	561,077	60	20,550	36,645	32
Styria (AT22)	82	1,237,300	76	47,243	38,264	30
Upper Austria (AT31)	86	1,465,050	125	63,964	43,826	30
Salzburg (AT32)	86	549,263	78	28,467	51,990	33
Tyrol (AT33)	84	746,153	60	34,650	46,657	30
Vorarlberg (AT34)	88	388,752	153	18,425	47,676	29

[6] Canadian Radio-television and Communications Commission (CRTC), 2018 Communications Monitoring Report at 6 (2018) (*2018 Communications Report*), https://crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2018/cmr2018-cdn.pdf; CRTC, 2017 Communications Monitoring Report at 279 (2017) (*2017 Communications Report*),

https://crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2017/cmr2017.pdf. In Table 1, the data for the percentage of households with broadband in Canada by province/territory represent fixed broadband subscription. *2017 Communications Report* at 279. The data for the percentage of households with broadband in Canada at the national level represent all broadband subscriptions. *2018 Communications Report* at 10 & n.5.

[7] As of November 30, 2018, OECD data on Share of Labour Force with Tertiary Education (in % of labour force) for subnational communities in Japan are not available at http://stats.oecd.org/. The *2018 Sixth IBDR* presented OECD data as of 2010 on Share of Labour Force with Tertiary Education (in % of labour force) for subnational communities in Japan (data accessed in Sept. 2017). *See 2018 Sixth IBDR*, 33 FCC Rcd at 1096-97, Appx E, Tbl. 1.

Community	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)[7]
Belgium (BEL)	**82**	**11,351,700**	**374**	**465,730**	**41,101**	**45**
Brussels Capital Region (BE1)	86	1,199,100	7,448	83,550	69,614	52
Flemish Region (BE2)	84	6,526,060	488	273,848	42,072	45
Wallonia BE3	79	3,626,570	216	108,130	29,852	43
Canada (CAN)	**87**	**36,264,600**	**4**	**1,542,120**	**42,524**	**65**
Newfoundland and Labrador (CA10)	84	530,128	1	23,571	44,462	64
Prince Edward Island (CA11)	83	149,472	26	4,789	32,039	60
Nova Scotia (CA12)	79	953,869	18	31,612	33,324	65
New Brunswick (CA13)	86	757,384	11	25,929	34,234	60
Quebec (CA24)	80	8,394,030	6	299,119	35,944	68
Ontario (CA35)	84	14,193,400	15	602,176	43,085	66
Manitoba (CA46)	79	1,338,110	2	51,414	39,006	56
Saskatchewan (CA47)	76	1,163,930	2	57,019	49,642	57
Alberta (CA48)	87	4,286,130	7	238,605	56,323	62
British Columbia (CA59)	88	4,757,660	5	199,787	41,993	61
Yukon (CA60)	--	38,459	0.8	2,121	55,698	--
Northwest Territories (CA61)	--	44,617	0.04	3,590	80,470	--
Nunavut (CA62)	--	37,996	0.02	1,851	49,785	--
Chile (CHL)	**53***	**18,373,900**	**25**	**382,058**	**21,002**	**24**
Tarapacá (CL01)	56	352,712	8	8,086	23,455	23
Antofagasta (CL02)	73	640,950	5	33,048	52,301	24
Atacama (CL03)	57	320,799	4	8,024	25,336	19
Coquimbo (CL04)	48	794,359	20	10,367	13,244	21
Valparaíso (CL05)	56	1,859,670	113	32,251	17,500	26
O'Higgins (CL06)	47	934,671	57	17,245	18,606	19
Maule (CL07)	38	1,057,530	35	12,697	12,089	14
Bio-Bío (CL08)	49	2,141,040	58	28,787	13,528	23
Araucanía (CL09)	39	1,001,980	31	9,975	10,015	19
Los Lagos (CL10)	46	853,663	18	11,937	14,085	17
Aysén (CL11)	53	110,288	1	2,550	23,331	24
Magallanes y Antártica (CL12)	67	166,395	1	4,007	24,206	25
Santiago Metropolitan (CL13)	62	7,482,640	486	162,165	21,917	27
Los Ríos (CL14)	42	410,097	22	5,155	12,656	21

Community	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)[7]
Arica y Parinacota (CL15)	57	247,129	15	2,792	11,481	23
Czech Republic (CZE)	**80**	**10,578,800**	**137**	**323,445**	**30,611**	**24**
Prague (CZ01)	91	1,280,510	2640	80,856	63,467	45
Central Bohemian Region (CZ02)	84	1,338,980	124	37,436	28,086	22
Southwest (CZ03)	82	1,217,410	71	32,697	26,891	20
Northwest (CZ04)	75	1,118,130	132	24,646	22,018	15
Northeast (CZ05)	79	1,508,530	123	38,101	25,268	21
Southeast (CZ06)	78	1,687,760	123	47,691	28,284	26
Central Moravia (CZ07)	74	1,217,620	134	30,391	24,941	20
Moravia-Silesia (CZ08)	79	1,209,880	228	31,626	26,102	22
Denmark (DNK)	**92**	**5,748,770**	**134**	**257,709**	**44,991**	**37**
Capital (DK)	93	1,807,400	706	103,847	57,748	47
Zealand (DK02)	91	832,553	115	26,158	31,515	30
Southern Denmark (DK03)	89	1,217,220	99	49,699	40,922	31
Central Jutland (DK04)	92	1,304,250	100	52,497	40,420	34
Northern Jutland (DK05)	92	587,335	75	22,071	37,637	30
Estonia (EST)	**85**	**1,315,640**	**30**	**35,135**	**26,702**	**40**
Estonia (EE00)	85	1,315,640	30	35,135	26,702	40
Finland (FIN)	**91**	**5,503,300**	**18**	**211,916**	**38,563**	**42**
Western Finland (FI19)	88	1,380,590	24	47,259	34,249	40
Helsinki-Uusimaa (FI1B)	95	1,638,290	180	82,564	50,675	49
Southern Finland (FI1C)	93	1,159,170	37	39,470	34,031	39
Eastern and Northern Finland (FI1D)	89	1,296,020	6	41,222	31,777	38
Åland (FI20)	--	29,214	19	1,345	46,204	27
France (FRA)	**79**	**66,989,100**	**106**	**2,485,250**	**37,171**	**38**
Île de France (FR10)	85	12,193,900	1015	759,021	62,387	50
Champagne-Ardenne (FR21)	75	1,334,450	52	40,020	29,966	29
Picardy (FR22)	73	1,934,170	100	53,963	27,903	27
Upper Normandy (FR23)	81	1,865,330	151	59,359	31,845	31
Centre-Val de Loire (FR24)	79	2,582,300	66	79,098	30,641	33
Lower Normandy (FR25)	80	1,477,290	84	43,518	29,442	26
Burgundy (FR26)	77	1,637,370	52	49,258	30,063	33
Nord-Pas-de-Calais (FR30)	76	4,087,130	329	121,089	29,641	35

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Lorraine (FR41)	82	2,330,670	99	67,214	28,804	35
Alsace (FR42)	80	1,888,940	228	63,754	33,794	36
Franche-Comté (FR43)	74	1,179,900	73	34,304	29,072	36
Pays de la Loire (FR51)	77	3,765,800	117	123,912	33,006	36
Brittany (FR52)	74	3,323,130	122	105,114	31,697	37
Poitou-Charentes (FR53)	79	1,811,210	70	52,704	29,131	32
Aquitaine (FR61)	83	3,422,180	83	112,467	32,988	37
Midi-Pyrénées (FR62)	82	3,046,470	67	103,493	34,095	42
Limousin (F 63)	71	735,908	43	22,127	30,045	33
Rhône-Alpes (FR71)	81	6,621,560	152	241,407	36,602	41
Auvergne (FR72)	78	1,365,260	52	43,026	31,530	31
Languedoc-Roussillon (FR 81)	76	2,815,940	103	76,287	27,193	35
Provence-Alpes-Côte d'Azur (FR82)	81	5,047,940	161	173,010	34,340	39
Corsica (FR83)	62	334,283	39	10,144	30,505	42
Germany (DEU)	**90**	**82,521,700**	**231**	**3,550,020**	**43,110**	**29**
Baden-Württemberg (DE1)	89	10,951,900	306	540,276	49,495	30
Bavaria (DE2)	89	12,930,800	183	643,639	49,944	30
Berlin (DE3)	91	3,574,830	4,008	146,700	41,354	42
Brandenburg (DE4)	84	2,494,650	84	77,635	31,182	28
Bremen (DE5)	91	678,753	1,620	36,556	54,148	29
Hamburg (DE6)	94	1,810,440	2,398	125,418	69,719	36
Hesse (DE7)	91	6,213,090	294	305,280	49,281	32
Mecklenburg-Vorpommern (DE8)	89	1,610,670	69	46,949	29,133	27
Lower Saxony (DE9)	92	7,945,690	167	299,270	37,710	24
North Rhine-Westphalia (DEA)	90	17,890,100	524	758,892	42,449	27
Rhineland-Palatinate (DEB)	91	4,066,050	205	158,031	38,929	26
Saarland (DEC)	88	996,651	388	39,780	39,935	23
Saxony (DED)	88	4,081,780	222	134,238	32,875	29
Saxony-Anhalt (DEE)	88	2,236,250	109	67,288	30,028	23
Schleswig-Holstein (DEF)	90	2,881,930	182	101,114	35,227	24
Thuringia (DEG)	88	2,158,130	133	68,949	31,856	28
Greece (GRC)	**68**	**10,768,200**	**82**	**255,907**	**23,748**	**34**
Attica (EL30)	--	3,773,560	991	122,620	32,461	42
North Aegean (EL41)	--	203,700	53	3,543	17,701	26

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South Aegean (EL42)	--	338,383	64	8,650	25,698	22
Crete (EL43)	--	632,674	76	12,713	20,108	29
Eastern Macedonia, Thrace (EL51)	--	602,799	43	9,856	16,327	28
Central Macedonia (EL52)	--	1,880,120	100	35,037	18,619	34
Western Macedonia (EL53)	--	271,488	29	5,654	20,737	28
Epirus (EL54)	--	335,250	37	5,646	16,800	33
Thessaly (EL61)	--	725,874	52	13,230	18,182	32
Ionian Islands EL62	--	205,431	89	4,501	21,873	22
Western Greece (EL63)	--	663,970	60	11,528	17,306	25
Central Greece (EL64)	--	555,761	36	11,644	20,949	27
Peloponnese (EL65)	--	579,182	37	11,287	19,457	25
Iceland (ISL)	**93**	**338,349**	**3**	**14,962**	**44,603**	**37**
Capital Region (IS01)	93	216,878	220	--	--	41
Other Regions (IS02)	91	121,471	1	--	--	25
Ireland (IRL)	**86**	**4,784,380**	**70**	**295,670**	**62,559**	**48**
Border, Midland and Western (IE01)	82	1,274,990	40	36,241	28,770	41
Southern and Eastern (IE02)	87	3,509,400	97	259,429	74,836	48
Italy (ITA)	**77**	**60,589,400**	**205**	**2,033,280**	**33,537**	**21**
Piedmont (ITC1)	78	4,392,530	177	156,468	35,574	20
Aosta Valley (ITC2)	75	126,883	39	5,367	42,225	19
Liguria (ITC3)	76	1,565,310	294	58,423	37,255	22
Lombardy (ITC4)	82	10,019,200	439	443,482	44,287	22
Abruzzo (ITF1)	78	1,322,250	124	38,668	29,197	20
Molise (ITF2)	73	310,449	71	7,541	24,230	22
Campania ITF3	70	5,839,080	436	129,162	22,098	19
Apulia (ITF4)	70	4,063,890	212	87,605	21,522	18
Basilicata (ITF5)	70	570,365	59	14,255	24,920	20
Calabria (ITF6)	68	1,965,130	133	39,992	20,323	19
Sicily (ITG1)	69	5,056,640	199	105,260	20,780	18
Sardinia (ITG2)	79	1,653,140	69	40,600	24,522	20
Province of Bolzano-Bozen (ITH1)	76	524,256	71	26,947	51,567	17
Province of Trento (ITH2)	82	538,604	88	22,785	42,319	22
Veneto (ITH3)	80	4,907,530	279	188,159	38,311	19
Friuli-Venezia Giulia (ITH4)	80	1,217,870	161	44,688	36,643	21

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Emilia-Romagna (ITH5)	81	4,448,840	207	186,323	41,884	22
Tuscany (ITI1)	79	3,742,440	165	135,799	36,277	22
Umbria (ITI2)	79	888,908	108	25,821	29,011	23
Marche (ITI3)	78	1,538,060	161	49,592	32,184	23
Lazio (ITI4)	80	5,898,120	349	224,965	38,173	28
Japan (JPN)	**62***	**126,933,000**	**340**	**4,759,750**	**37,498**	**42**
Hokkaido (JPA)	51	5,352,000	64	167,356	30,992	--
Tohoku (JPB)	57	8,915,000	134	295,007	32,648	--
Northern-Kanto, Koshin (JPC)	64	9,756,000	276	351,345	35,760	--
Southern-Kanto (JPD)	77	36,294,000	2768	1,504,590	41,885	--
Hokuriku (JPE)	67	5,280,000	161	188,949	35,457	--
Toukai (JPF)	67	15,025,000	673	600,248	39,947	--
Kansai region (JPG)	71	20,681,000	788	731,016	35,230	--
Chugoku (JPH)	58	7,406,000	235	259,039	34,836	--
Shikoku (JPI)	54	3,818,000	205	124,857	32,196	--
Kyushu, Okinawa (JPJ)	53	14,405,000	330	433,922	29,967	--
Latvia (LVA)	**75**	**1,950,120**	**31**	**44,805**	**22,865**	**35**
Latvia (LV00)	75	1,950,120	31	44,742	22,833	35
Luxembourg (LUX)	**97**	**590,667**	**228**	**51,605**	**88,446**	**43**
Luxembourg (LU00)	97	590,667	228	51,605	88,446	43
Mexico (MEX)	**48***	**123,518,000**	**63**	**2,074,810**	**16,969**	24
Aguascalientes (ME01)	47	1,321,450	235	28,195	21,609	26
Baja California Norte (ME02)	68	3,584,610	50	69,424	19,641	23
Baja California Sur (ME03)	75	809,833	11	16,963	21,557	25
Campeche (ME04)	54	935,047	16	45,136	48,980	26
Coahuila (ME05)	52	3,029,740	20	75,965	25,361	27
Colima (ME06)	54	747,801	133	12,603	17,130	26
Chiapas (ME07)	13	5,382,080	73	35,291	6,636	17
Chihuahua (ME08)	47	3,782,020	15	70,943	18,937	23
Federal District (MX)	68	8,811,270	5,938	352,095	39,859	38
Durango (ME10)	46	1,799,320	15	25,761	14,454	23
Guanajuato (ME11)	40	5,908,850	193	87,579	14,935	17
Guerrero (ME12)	33	3,607,210	57	29,745	8,289	19
Hidalgo (ME13)	38	2,947,210	141	32,613	11,195	20

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Jalisco (ME14)	59	8,110,940	103	148,070	18,458	24
Mexico (ME15)	45	17,363,400	777	184,964	10,805	21
Michoacan (ME16)	34	4,658,160	79	50,896	10,998	18
Morelos (ME17)	53	1,965,490	402	23,900	12,300	21
Nayarit (ME18)	46	1,268,460	46	14,887	11,946	24
Nuevo Leon (ME19)	67	5,229,490	81	152,117	29,493	30
Oaxaca (ME20)	20	4,061,500	44	31,590	7,825	17
Puebla (ME21)	29	6,313,790	184	69,768	11,155	21
Queretaro (ME22)	54	2,063,150	177	48,281	23,736	26
Quintana Roo (ME23)	62	1,664,670	39	33,324	20,574	22
San Luis Potosi (ME24)	51	2,801,840	46	44,428	15,993	23
Sinaloa (ME25)	41	3,034,940	53	47,532	15,792	29
Sonora (ME26)	72	3,011,810	17	71,864	24,176	27
Tabasco (ME27)	62	2,431,340	98	48,718	20,233	25
Tamaulipas (ME28)	56	3,622,610	45	61,421	17,141	25
Tlaxcala (ME29)	28	1,313,070	329	12,118	9,351	21
Veracruz (ME30)	30	8,163,960	114	97,555	12,035	21
Yucatan (ME31)	59	2,172,840	55	30,780	14,344	23
Zacatecas (ME32)	33	1,600,410	21	20,290	12,773	22
Netherlands (NLD)	**95**	**17,081,500**	**507**	**787,655**	**46,250**	**36**
Groningen (NL11)	98	583,581	251	27,018	46,292	36
Friesland (NL12)	95	646,874	195	20,829	32,220	28
Drenthe (NL13)	95	491,792	187	15,827	32,287	28
Overijssel (NL21)	95	1,147,690	345	43,785	38,207	33
Gelderland (NL22)	96	2,047,900	412	79,354	38,868	33
Flevoland (NL23)	100	407,818	289	14,527	35,786	31
Utrecht (NL31)	96	1,284,500	929	68,887	53,858	47
North Holland (NL32)	94	2,809,480	1,054	166,179	59,410	43
South Holland (NL33)	95	3,650,220	1,301	168,905	46,450	37
Zeeland (NL34)	92	381,568	214	13,723	35,980	28
North Brabant (NL41)	96	2,512,530	511	120,942	48,268	34
Limburg (NL42)	93	1,117,550	520	44,088	39,473	31
New Zealand (NZL)	**75**	**4,692,700**	**18**	**163,025**	**34,740**	32
Northland Region (NZ11)	60	171,400	14	4,210	24,561	24
Auckland Region (NZ12)	80	1,614,400	361	61,077	37,832	37

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Waikato Region (NZ13)	71	449,200	19	13,726	30,556	29
Bay of Plenty Region (NZ14)	69	293,500	24	8,658	29,500	24
Gisborne Region (NZ15)	68	47,800	6	5,640	26,945	22
Hawke's Bay Region (NZ16)	68	161,500	11	--	--	--
Taranaki Region (NZ17)	69	116,700	17	5,012	42,950	21
Manawatu-Wanganui Region (NZ18)	66	236,900	11	6,175	26,066	23
Wellington Region (NZ19)	80	504,800	63	21,451	42,495	40
Tasman-Nelson-Marlborough (NZ21)	75	146,300	7	5,552	31,052	25
West Coast Region (NZ22)	75	32,500	1	--	--	--
Canterbury Region (NZ23)	75	599,900	13	21,048	35,085	28
Otago Region (NZ24)	73	219,200	7	7,050	32,162	29
Southland Region (NZ25)	76	98,000	3	3,426	34,958	23
Norway (NOR)	**96**	**5,258,320**	**17**	**312,530**	**59,706**	**43**
Oslo and Akershus (NO01)	96	1,271,130	254	87,152	69,091	54
Hedmark and Oppland (NO02)	93	385,669	8	15,165	39,395	37
South-Eastern Norway (NO03)	97	992,962	29	39,806	40,254	36
Agder and Rogaland (NO04)	98	772,813	33	39,086	50,729	39
Western Norway (NO05)	99	896,503	19	46,649	52,203	41
Trøndelag (NO06)	99	454,596	12	21,885	48,414	41
Northern Norway (NO07)	91	484,647	5	23,036	47,676	38
Portugal (PRT)	**73**	**10,309,600**	**112**	**280,837**	**27,198**	**25**
North (PT) (PT11)	70	3,584,580	168	82,595	22,980	22
Algarve (PT15)	71	441,469	88	12,622	28,577	22
Central Portugal (PT16)	68	2,243,930	80	53,495	23,774	23
Metropolitan area of Lisbon (PT17)	82	2,821,350	936	100,884	35,812	34
Alentejo (PT18)	62	718,087	23	18,446	25,575	20
Autonomous Region of the Azores (PT20)	79	245,283	106	5,956	24,257	18
Autonomous Region of Madeira (PT30)	78	254,876	318	6,602	25,823	22
South Korea (KOR)	**99***	**50,976,500**	**513**	**1,792,290**	**34,975**	**45**
Capital Region (KR01)	100	25,383,400	2,169	887,938	34,999	49
Gyeongnam Region (KR02)	99	7,834,440	635	285,168	35,816	42
Gyeonbuk Region (KR03)	99	5,087,010	256	162,718	31,590	40
Jeolla Region (KR04)	99	5,071,450	247	163,015	31,735	38

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Chungcheong Region (KR05)	99	5,485,190	331	229,217	41,775	41
Gangwon Region (KR06)	98	1,515,680	91	45,706	30,073	37
Jeju (KR07)	99	599,333	325	18,531	29,959	44
Spain (ESP)	**81**	**46,528,000**	**93**	**1,522,520**	**32,754**	**39**
Galicia (ES11)	78	2,710,220	92	79,560	29,302	41
Asturias (ES12)	79	1,034,300	98	29,440	28,373	47
Cantabria (ES13)	77	581,490	110	17,074	29,336	44
Basque Country (ES21)	82	2,167,320	302	93,673	43,253	54
Navarra (ES22)	82	640,353	62	26,070	40,803	48
La Rioja (ES23)	79	312,624	62	10,774	34,452	40
Aragon (ES24)	80	1,316,070	28	46,782	35,513	39
Madrid (ES30)	88	6,476,840	813	287,930	44,637	49
Castile and León (ES41)	77	2,435,950	26	75,591	30,914	38
Castile-La Mancha (ES42)	78	2,040,980	26	52,413	25,630	30
Extremadura (ES43)	78	1,077,530	26	24,368	22,537	30
Catalonia (ES51)	82	7,441,280	233	290,977	39,190	42
Valencia (ES52)	80	4,935,180	213	142,424	28,867	35
Balearic Island (ES53)	81	1,150,960	231	39,000	34,113	32
Andalusia (ES61)	80	8,408,980	97	203,519	24,210	32
Murcia (ES62)	81	1,472,990	130	39,707	27,017	32
Ceuta (ES63)	83	85,034	4,475	2,216	26,120	--
Melilla (ES64)	85	84,946	6,534	2,028	23,900	--
Canary Islands (ES70)	81	2,154,980	290	57,796	26,944	32
Sweden (SWE)	**89**	**9,995,150**	**25**	**447,954**	**45,143**	**40**
Stockholm (SE11)	90	2,269,060	348	142,346	63,258	49
East Middle Sweden (SE12)	89	1,664,150	43	64,325	38,950	37
Småland with Islands (SE21)	83	847,667	26	32,268	38,370	32
South Sweden (SE22)	93	1,483,020	107	55,779	37,908	43
West Sweden (SE23)	89	1,992,120	68	87,498	44,240	38
North Middle Sweden (SE31)	87	848,451	13	30,484	36,136	32
Central Norrland (SE32)	82	374,245	5	14,151	37,962	32
Upper Norrland (SE33)	85	516,451	3	21,001	40,796	36
Switzerland (CHE)	**86**	**8,419,550**	**211**	**457,169**	**54,598**	**40**
Lake Geneva Region (CH01)	85	1,613,520	195	81,090	51,251	40

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Espace Mittelland (CH02)	81	1,859,560	190	92,264	50,301	37
Northwestern Switzerland (CH03)	87	1,142,160	586	63,297	56,367	41
Zurich (CH04)	93	1,487,970	896	97,063	66,646	49
Eastern Switzerland (CH05)	87	1,162,680	103	55,002	47,868	34
Central Switzerland (CH06)	87	799,287	187	42,270	53,750	40
Ticino (CH07)	77	354,375	129	19,979	56,897	38
United Kingdom (GBR)	**92**	**65,808,600**	**271**	**2,543,670**	**38,778**	**43**
North East England (UKC)	91	2,639,010	308	73,757	27,984	36
North West England (UKD)	92	7,214,940	512	242,399	33,661	39
Yorkshire and The Humber (UKE)	91	5,430,000	352	163,297	30,138	37
East Midlands (UKF)	89	4,727,210	303	145,675	30,926	37
West Midlands (UKG)	89	5,806,360	447	184,247	31,826	35
East of England (UKH)	92	6,151,440	322	214,512	35,003	38
Greater London (UKI)	93	8,868,070	5,641	594,534	67,455	59
South East England (UKJ)	95	9,056,700	475	376,827	41,755	44
South West England (UKK)	93	5,526,650	232	185,388	33,649	42
Wales (UKL)	89	3,112,810	150	86,724	27,892	38
Scotland (UKM)	92	5,400,160	69	195,090	36,206	48
Northern Ireland (UKN)	88	1,875,230	138	54,198	29,031	38
United States (USA)	**84**	**323,128,000**	**35**	**16,817,700**	**52,047**	**36**
Alabama (US01)	78	4,863,300	37	186,810	38,412	31
Alaska (US02)	86	741,894	1	45,792	61,723	32
Arizona (US04)	86	6,931,070	24	277,864	40,090	32
Arkansas (US05)	73	2,988,250	22	110,276	36,903	28
California (US06)	88	39,250,000	97	2,382,750	60,707	37
Colorado (US08)	88	5,540,550	21	293,122	52,905	44
Connecticut (US09)	86	3,576,450	285	236,135	66,025	44
Delaware (US10)	86	952,065	188	64,915	68,183	35
District of Columbia (US11)	83	681,170	4284	114,905	168,688	67
Florida (US12)	83	20,612,400	148	841,315	40,816	32
Georgia (US13)	83	10,310,400	69	482,688	46,816	36
Hawaii (US15)	85	1,428,560	86	76,924	53,847	35
Idaho (US16)	83	1,683,140	8	62,121	36,907	31
Illinois (US17)	84	12,801,500	89	723,177	56,491	40
Indiana (US18)	81	6,633,050	71	315,476	47,561	31

Community	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)[7]
Iowa (US19)	82	3,134,690	22	168,239	53,670	33
Kansas (US20)	83	2,907,290	14	136,798	47,054	38
Kentucky (US21)	79	4,436,970	43	178,685	40,272	30
Louisiana (US22)	76	4,681,670	42	215,313	45,991	29
Maine (US23)	82	1,331,480	17	53,870	40,458	35
Maryland (US24)	88	6,016,450	238	347,444	57,749	44
Massachusetts (US25)	87	6,811,780	335	459,497	67,456	49
Michigan (US26)	83	9,928,300	67	445,381	44,860	34
Minnesota (US27)	86	5,519,950	27	308,069	55,810	39
Mississippi (US28)	73	2,988,730	25	98,568	32,980	27
Missouri (US29)	81	6,093,000	34	271,744	44,599	34
Montana (US30)	81	1,042,520	3	41,997	40,284	35
Nebraska (US31)	84	1,907,120	10	106,700	55,948	36
Nevada (US32)	83	2,940,060	10	132,894	45,201	25
New Hampshire (US33)	88	1,334,800	57	70,143	52,550	40
New Jersey (US34)	87	8,944,470	466	522,688	58,437	44
New Mexico (US35)	76	2,081,020	7	85,030	40,860	30
New York (US36)	83	19,745,300	161	1,362,800	69,019	42
North Carolina (US37)	82	10,146,800	80	473,892	46,704	36
North Dakota (US38)	81	757,952	4	48,562	64,070	34
Ohio (US39)	83	11,614,400	110	569,286	49,016	33
Oklahoma (US40)	80	3,923,560	22	164,691	41,975	30
Oregon (US41)	87	4,093,470	16	207,943	50,799	37
Pennsylvania (US42)	82	12,784,200	110	653,969	51,154	38
Rhode Island (US44)	86	1,056,430	390	52,265	49,473	40
South Carolina (US45)	79	4,961,120	64	190,657	38,430	32
South Dakota (US46)	81	865,454	4	43,930	50,759	33
Tennessee (US47)	79	6,651,190	62	301,502	45,330	32
Texas (US48)	83	27,862,600	41	1,452,950	52,147	33
Utah (US49)	88	3,051,220	14	143,244	46,947	35
Vermont (US50)	81	624,594	26	28,246	45,223	40
Virginia (US51)	85	8,411,810	82	447,829	53,238	44
Washington (US53)	89	7,288,000	42	433,145	59,433	39
West Virginia (US54)	76	1,831,100	29	66,194	36,150	28
Wisconsin (US55)	83	5,778,710	41	284,440	49,222	34

Community	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)[7]
Wyoming (US 56)	84	585,501	2	34,821	59,472	30

Figures marked with an asterisk (*) were calculated by FCC staff using simple averages of OECD data.

Table 1a
Sources for Demographics Dataset

Country	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP[1] (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)
Australia	2015, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2015, OECD
Austria	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Belgium	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Canada	2016, CRTC	2016, OECD (national/subnational) 2017, OECD (subnational)	2016, OECD (national/subnational) 2017, OECD (subnational)	2016, OECD	2016, OECD	2016, OECD
Chile	2013, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2015, OECD
Czech Republic	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Denmark	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Estonia	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Finland	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
France	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Germany	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Greece	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Iceland	2012, OECD (subnational) 2014, OECD (national)	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2012, OECD (subnational) 2017, OECD (national)
Ireland	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Italy	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Japan	2015, OECD	2016, OECD	2016, OECD	2014, OECD (subnational) 2016, OECD (national)	2014, OECD (subnational) 2016, OECD (national)	2010, OECD

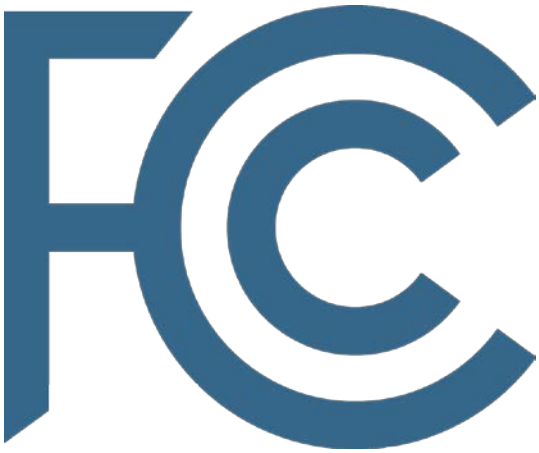
Country	Households with Broadband (%)	Population Total	Population Density (Persons per Square km)	GDP Total (US$mm), PPP[1] (Constant Real Prices 2010)	GDP Per Capita, (US$) PPP (Constant Real Prices 2010)	Education (% of Labor Force with Tertiary Education)
Latvia	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Luxembourg	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Mexico	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2015, OECD
Netherlands	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
New Zealand	2012, OECD	2016, OECD	2016, OECD	2016, OECD	2016, OECD	2016, OECD
Norway	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Portugal	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Spain	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
South Korea	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2016, OECD
Sweden	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
Switzerland	2014, OECD	2017, OECD	2017, OECD	2015 OECD (subnational) 2016, OECD (national)	2015 OECD (subnational) 2016, OECD (national)	2017, OECD
United Kingdom	2016, OECD	2017, OECD	2017, OECD	2016, OECD	2016, OECD	2017, OECD
United States	**2017, Census Bureau**	**2016, OECD**	**2016, OECD**	**2016, OECD**	**2016, OECD**	**2016, OECD**

F. Measuring Broadband America Reports

APPENDIX F-1

Seventh Measuring Broadband America Fixed Broadband Report

A Report on Consumer Fixed Broadband Performance in the United States



Federal Communications Commission
Office of Engineering and Technology

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1. EXECUTIVE SUMMARY

The Seventh Measuring Broadband America Fixed Broadband Report ("Seventh Report") discusses data collected and validated in September 2016 from fixed Internet Service Providers (ISPs) as part of the Federal Communication Commission's (FCC) Measuring Broadband America (MBA) program. This program is an ongoing, rigorous, nationwide study of consumer broadband performance in the United States. We measure the network performance delivered on selected service tiers to a representative sample set of the population. The thousands of volunteer panelists are drawn from subscribers of Internet service providers serving over 80% of the residential marketplace.[1]

The initial Measuring Broadband America Fixed Broadband Report was published in August 2011,[2] and presented the first broad-scale study of directly measured consumer broadband performance throughout the United States. As part of an open data program, all methodologies used in the program are fully documented and all data collected is published for public use without restriction. Including this latest report, seven reports have now been issued.[3] These reports provide a snapshot of fixed broadband Internet access service performance in the United States. They present analysis of broadband information in a variety of ways and have evolved to make the information more understandable and useful, and to reflect the changing applications supported by the nation's broadband infrastructure.

A. Major FINDINGS of the SEVENTH Report

The key findings of this report, based on measurements taken in September 2016[4] are as follows:

- The maximum advertised download speeds amongst the service tiers measured by the FCC were between 3-200 Mbps for the period covered by this report.
- The median speed experienced by subscribers of the participating ISPs was 57 Mbps.
- For most of the major broadband providers that were tested, measured download speeds were 100% of advertised speeds or better during the peak hours (7 p.m. to 11 p.m. local time).
- Fourteen ISPs were evaluated in this report. Of these, AT&T, Cincinnati Bell, Frontier and Verizon employed multiple different technologies to provide service across the country. Overall, 18 different ISP/technology configurations were evaluated in this report. Of those, 11 met or exceeded their advertised download speeds, all performed better than 75% of their advertised download speed, and only three performed below 90% of their advertised download speed.

[1] In 2016, we added a large regional operator, Cincinnati Bell, to the MBA program for the first time. Cincinnati Bell primarily serves northern Kentucky and southwestern Ohio.

[2] All reports can be found at https://www.fcc.gov/general/measuring-broadband-america.

[3] The First Report (2011) was based on measurements taken in March 2011, the Second Report (2012) on measurements taken in April 2012, and the Third (2013) through Sixth (2016) Reports on measurements taken in September of the previous year.

[4] The actual dates used for measurements for this Seventh Report were September 1-11, 2016 inclusive and September 21-October 9, 2016 inclusive.

- In addition to providing download and upload speed measurements of ISPs, this report also presents a measure of how consistently ISPs provide their advertised speed with the use of our "80/80" metric. The 80/80 metric measures the minimum speed that at least 80% of subscribers' experience at least 80% of the time over peak periods.

These and other findings are described in greater detail within this report.

B. Use Of median speeds and subscriber-weighted speeds

The Seventh Report retains two changes made in the 2016 Report affecting how metrics are calculated and presented, namely the use of median speeds and subscriber-weighted speeds. First, consistent with the 2016 Report, we continue to present ISP broadband performance as the median,[5] rather than mean (average), of speeds experienced by panelists within a specific service tier.[6] Our focus in these reports is on the most common service tiers used by an ISP's subscribers.[7]
Second, consistent with the 2016 Report, we continue to compute ISP performance by weighting the median for each service tier by the number of subscribers in that tier. Similarly, in calculating the overall average speed of all ISPs in a specific year, the median speed of each ISP is used and weighted by the number of subscribers of that ISP as a fraction of the total number of subscribers across all ISPs.

In calculating weighted medians, we have drawn on two sources for determining the number of subscribers per service tier. ISPs can voluntarily contribute their data per surveyed service tier as the most recent and authoritative data. Many ISPs have chosen to do so.[8] When such information has not been provided by an ISP, we rely on the FCC's Form 477 data.[9] All facilities-based broadband providers are required to file data with the FCC twice a year (Form 477) regarding deployment of broadband services, including subscriber counts. For this report, we used the June 2016 Form 477 data. It should be noted that the Form 477 subscriber data values are for a month that generally lags the measurement month, and therefore, there are likely to be small inaccuracies in the tier ratios. It is for this reason that we encourage ISPs to provide us with subscriber numbers for the measurement month.

C. USE OF OTHER PERFORMANCE METRICS

As in our previous reports, we found that for most ISPs, actual speeds experienced by subscribers nearly meet or exceed advertised service tier speeds. However, since we started our MBA program, consumers have changed their Internet usage habits. In 2011, consumers mainly browsed the web and downloaded

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[5] We first determine the mean value over all the measurements for each individual panelist's "whitebox." (Panelists are sent "whiteboxes" that run pre-installed software on off-the-shelf routers that measure thirteen broadband performance metrics, including download speed, upload speed, and latency.) For individual speed tiers, we then compute the median of the mean values of all the panelists/whiteboxes. The median is that value separating the top half of values in a sample set with the lower half of values in a sample set; it can be thought of as the middle value in an ordered list of values. For calculations involving multiple speed tiers, we compute the weighted average of the medians for each tier. The weightings are based on the relative subscriber numbers for the individual tiers.

[6] *See* 2016 Report at https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-fixed-broadband-report-2016.

[7] As described more fully in section 2, a service tier is initially added to this report only if it contains at least 30,000 subscribers and has 5% or more of an ISP's total number of broadband subscribers.

[8] The ISPs that provided SamKnows, the FCC's contractor supporting the MBA program, with weights for each of their tiers were: AT&T, Cincinnati Bell, CenturyLink, Charter, Comcast, Cox, Hughes, Mediacom, Optimum, Time-Warner Cable, and Verizon.

[9] *See* https://transition.fcc.gov/form477/477inst.pdf (explaining FCC Form 477 filing requirements and required data).

files; thus, we reported average speeds since they were likely to closely mirror user satisfaction. By contrast, by September 2016, the measurement period for this report, many consumers streamed video for entertainment and education.[10] Both the median measured speed and how consistently the service performs are likely to influence the perception and usefulness of Internet access service and we have expanded our network performance analytics to better capture this.

Specifically, we use two kinds of metrics to reflect the consistency of service delivered to the consumer: First, we report the minimum actual speed experienced by at least 80% of panelists during at least 80% of the daily peak usage period ("80/80 consistent speed" measure). Second, we show what fraction of consumers obtains median speeds greater than 95%, between 80% and 95%, and less than 80% of advertised speeds.

Although download and upload speeds remain the network performance metric of greatest interest to the consumer, we also spotlight two other key network performance metrics in this report: latency and packet loss. These metrics can significantly affect the overall quality of Internet applications.

Latency (or delay) is the time it takes for a data packet to travel across a network from one point on the network to another. High latencies may affect the perceived quality of some interactive services such as phone calls over the Internet, video chat and video conferencing, or online multiplayer games. All network access technologies have a minimum latency that is largely determined by the technology. In addition, network congestion can lead to an increase in measured latency. Technology-determined latencies are typically small for terrestrial broadband services and are thus unlikely to affect the perceived quality of applications. The higher latencies of geostationary satellite-based broadband services may impair the perceived quality of such highly interactive applications. Not all applications are affected by high latencies; for example, entertainment video streaming applications are tolerant of relatively high latencies.

Packet loss measures the fraction of data packets sent that fail to be delivered to the intended destination. Packet loss may affect the perceived quality of applications that do not request retransmission of lost packets, such as phone calls over the Internet, video chat, some online multiplayer games, and some video streaming. High packet loss also degrades the achievable throughput of download and streaming applications. However, packet losses of a few tenths of a percent are unlikely to significantly affect the perceived quality of most Internet applications and are common. During network congestion, both latency and packet loss typically increase.

The Internet is continuing to evolve in architecture, performance, and services. We will therefore continue to adapt our measurement and analysis methodologies to help consumers understand the performance characteristics of their broadband Internet access service, and thus make informed choices about their use of such services.

[10] Video traffic comprised 70% of Internet traffic in 2015, and some expect it to grow to 82% by 2020. *See Cisco Visual Networking Index: Forecast and Methodology, 2014-2020 White Paper*, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white_paper_c11-481360.html (last accessed May 7, 2018).

2. SUMMARY OF KEY FINDINGS

A. Most Popular Advertised Service Tiers

A list of the offered ISP download and upload service tiers that were measured in this report are shown in Table 1. It should be noted that while upload and downloads speeds are measured independently and shown separately, they are typically offered by the ISP as a set of combined configurations. Together, these plans serve the majority of Internet users of the participating ISPs. Generally, service tiers are initially added to this report when five percent or more of an ISP's customers subscribe to that tier and there are at least 30,000 subscribers in that tier. Each tier requires a certain number of panelists to meet the program's target sample size, and it becomes difficult and costly to recruit panelists for tiers with few subscribers or across a very large number of tiers.

Tech-nology	Company	Speed Tiers (Download)							Speed Tiers (Upload)					
DSL	AT&T DSL	1.5*	3	6					0.256*	0.384	0.512			
	AT&T IPBB		3	6	12	18	24	45		0.768	1	1.5	3	6
	CenturyLink	1.5	3	7	10	12	20	40	0.512	0.768	0.896	5		
	Cincinnati Bell DSL	5	10	30						0.768	1			
	Frontier DSL	3	6	12					0.384	0.768	1			
	Verizon DSL	(0.5 - 1)	(1.1-3)						0.384	(0.384 - 0.768)				
	Windstream	3	6	12					0.768					
Cable	Optimum	25	50	101					5	25	35			
	Charter	60	100						4*	5				
	Comcast	25	75	105	150				5	10	20			
	Cox	5*	15	25*	50	100			1	2*	5	10		
	Mediacom	15	50	100					1	5	10			
	Time Warner Cable	15	20	30	50	100	200		1	2	5	10	20	
Fiber	Cincinnati Bell Fiber	10*	30						1*	3				
	Frontier Fiber	25	50	75					10*	25*	50	75		
	Verizon Fiber	25	50	75	100				25	50	75	100		
Satellite	Hughes	5	10						1					
	ViaSat	12							3					

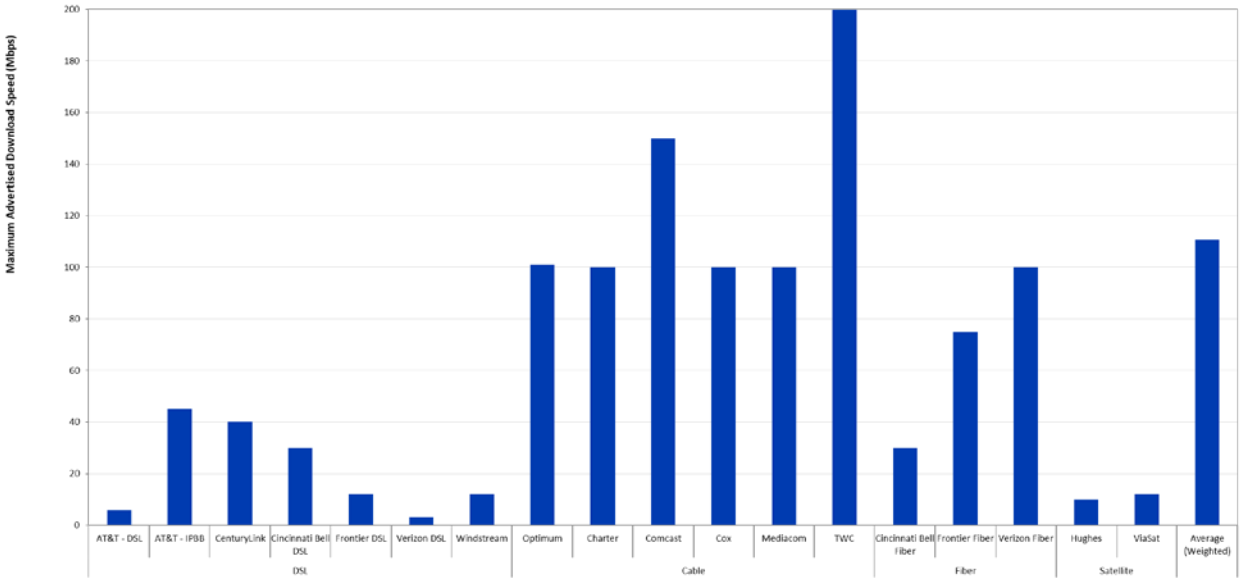
Table 1: List of ISP service tiers whose broadband performance was measured in this report

*Tiers that lack sufficient panelists to meet the program's target sample size. Note, in the case of Charter, there was an upgrade of the 4 Mbps upload tier to 5 Mbps that occurred during the September 2016 measurement period.

Chart 1 (below) displays the maximum advertised download speeds among the measured service tiers for each participating ISP for September 2016, grouped by the access technology used to offer the broadband

Internet access service (DSL, cable, fiber, or satellite). In September 2016, the weighted average maximum advertised download speed was 111 Mbps among the measured service tiers. Maximum advertised download speed among the measured service tiers varies by both ISP and technology.

Chart 1: Maximum advertised download speed among the measured service tiers[11]



The maximum advertised download speed tier included in this report for ISPs using satellite technology is between 10-12 Mbps. Similarly, the maximum advertised download speed included in this report for DSL providers ranges between 3-45 Mbps. In contrast, ISPs using cable and fiber technology offer much higher maximum advertised download speeds. The maximum advertised download speeds included in this report for cable technology are between 100-200 Mbps. Among participating ISPs, only Cincinnati Bell, Frontier, and Verizon use fiber as the access technology for a substantial number of their customers and their maximum speed offerings included in this report are between 30-100 Mbps. A key differentiator between the providers using fiber technology and those using other technologies is that two of the fiber ISPs offer symmetric maximum advertised upload and download speeds. This is in sharp contrast to the asymmetric offerings of providers using other technologies, for which the maximum advertised upload speeds are typically 5 to 10 times below the maximum advertised download speeds. Chart 2 plots the migration of panelists to a higher service tier based on their access technology.[12] Specifically, the horizontal axis of Chart 2 partitions the September 2015 panelists by the advertised download speed of the service tier to which they were subscribed. For each such set of panelists who also participated in the September 2016 collection of data,[13] the vertical axis of Chart 2 displays the percentage of panelists that migrated by September 2016 to a service tier with a higher advertised download speed. There are two ways that such a migration could occur: (1) if a panelist changed their broadband plan during the intervening year to a service tier with a higher advertised download speed, or (2) if a panelist

[11] This chart lists only the most populous service tiers of the ISPs tested. It should be noted that ISPs may offer other tiers at higher or lower speeds.

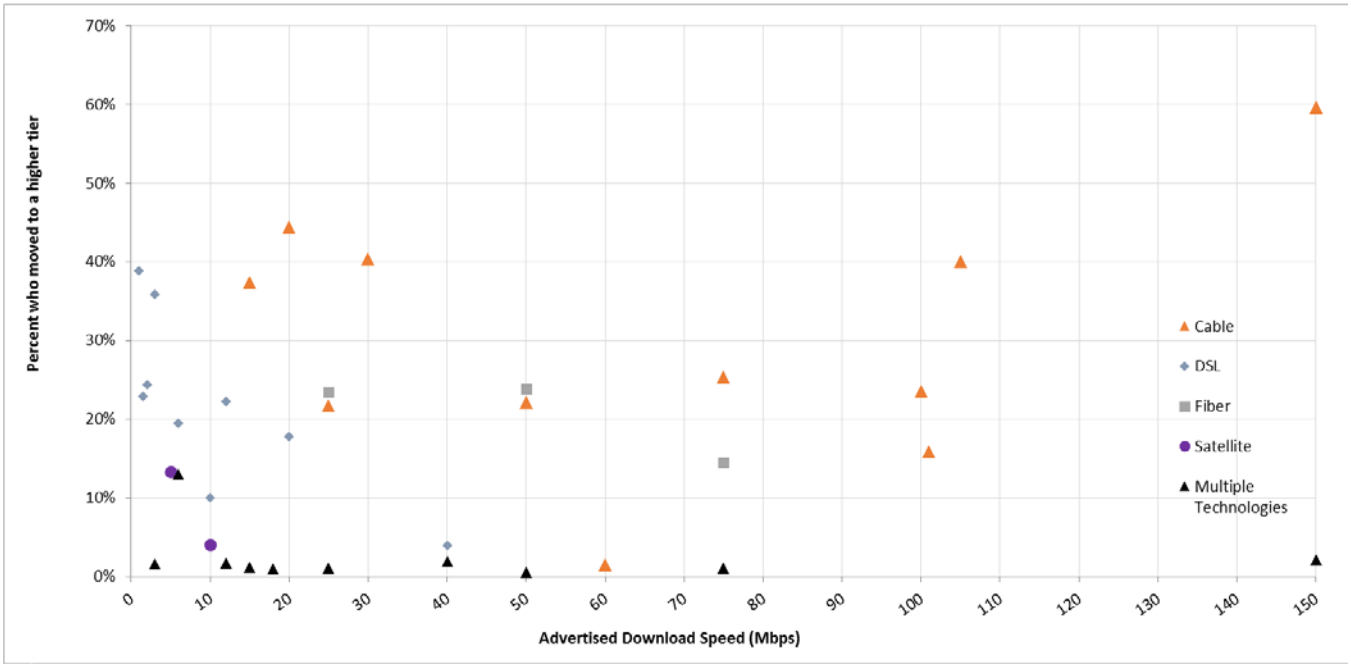
[12] Where several technologies are plotted at the same point in the chart, this is identified as "Multiple Technologies."

[13] Of the 6,241 panelists who participated in the September 2015 collection of data, 4,707 panelists continued to participate in the September 2016 collection of data.

did not change their broadband plan but the panelist's ISP increased the advertised download speed of the panelist's subscribed plan.[14]

Chart 2 shows that the percentage of panelists subscribed in September 2015 who moved to higher tiers in September 2016 did so in larger numbers (40% to 60%) for the low-speed tiers (0-30 Mbps) and the high-speed tiers (100 – 150 Mbps) as compared to about 15-20% for mid-range speeds between 30 Mbps and 100 Mbps.

Chart 2: Consumer migration to higher advertised download speeds



B. Median download speeds

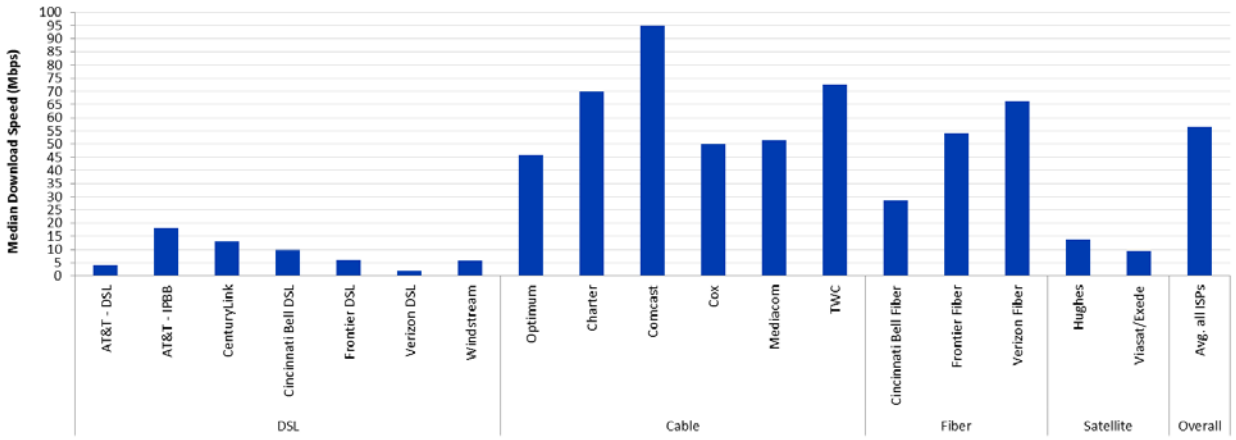
Advertised download speeds may differ from the speeds that subscribers experience. Some ISPs more consistently meet network service objectives than others or meet them unevenly across their geographic coverage area. Also, speeds experienced by a consumer may vary during the day if the network cannot carry the aggregate user demand during busy hours. Unless stated otherwise, all actual speeds are measured only during peak usage periods, which we define as 7 p.m. to 11 p.m. local time.

To compute the average ISP performance, we weigh the median speed for each tier by its subscriber count. Subscriber counts for the weightings were provided from the ISPs themselves or, if unavailable, from FCC Form 477 data.

Chart 3 shows the median download speeds experienced by the subscribers of the ISPs participating in MBA, averaged across all analyzed service tiers, geography, and time, for 2016. The median download speed, averaged across all participating ISPs, was approximately 57 Mbps in September 2016. As shown in this chart, there is considerable variance of median download speed by both ISP and by technology. While most cable and fiber providers had median speeds ranging from 46 to 95 Mbps, the DSL and satellite providers had median download speeds ranging from 2 to 18 Mbps.

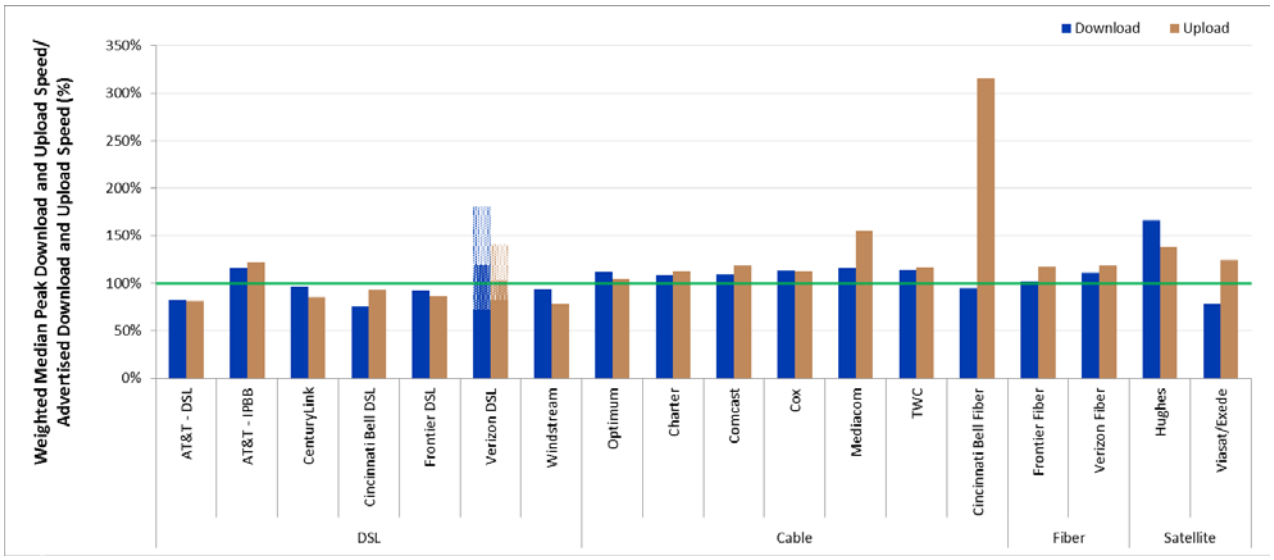
[14] We do not attempt here to distinguish between these two cases.

Chart 3: Median download speeds by ISP



However, as we observed above when examining advertised download speeds, the increase in median download speeds is not uniform across access technologies and companies.
Chart 4 shows the ratio of the weighted median speeds experienced by an ISP's subscribers to that ISP's advertised speeds. The ratios for both download and upload speeds to the advertised download and upload speeds are illustrated. The actual speeds experienced by most ISPs' subscribers are close to or exceed the advertised speeds. However, DSL broadband ISPs continue to advertise "up-to" speeds that on average exceed the actual speeds experienced by their subscribers. Verizon, instead, advertises a speed range for DSL performance and has requested that we include this range in relevant charts; we indicate this speed range with shading on all bar charts describing Verizon DSL performance. Out of the 18 ISP/technology configurations shown, 11 met or exceeded their advertised download speed and all reached at least 75% of their advertised download speed. Only AT&T-DSL (at 82%), Cincinnati-DSL (at 76%) and ViaSat (at 78%) performed below 90% of their advertised download speed.

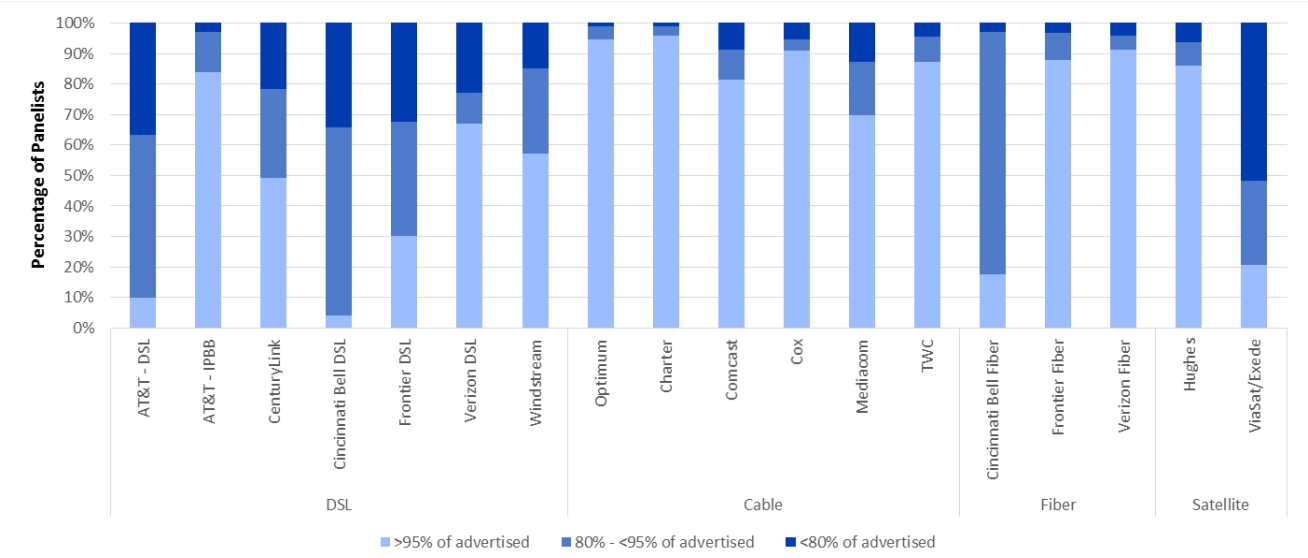
Chart 4: The ratio of weighted median speed to advertised speed for each ISP



C. Variations In Speeds

As discussed earlier, actual speeds experienced by individual consumers may vary by location and time of day. Chart 5 shows, for each ISP, the percentage of panelists who experienced a median download speed (averaged over the peak usage period during our measurement period) that was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed.

Chart 5: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed

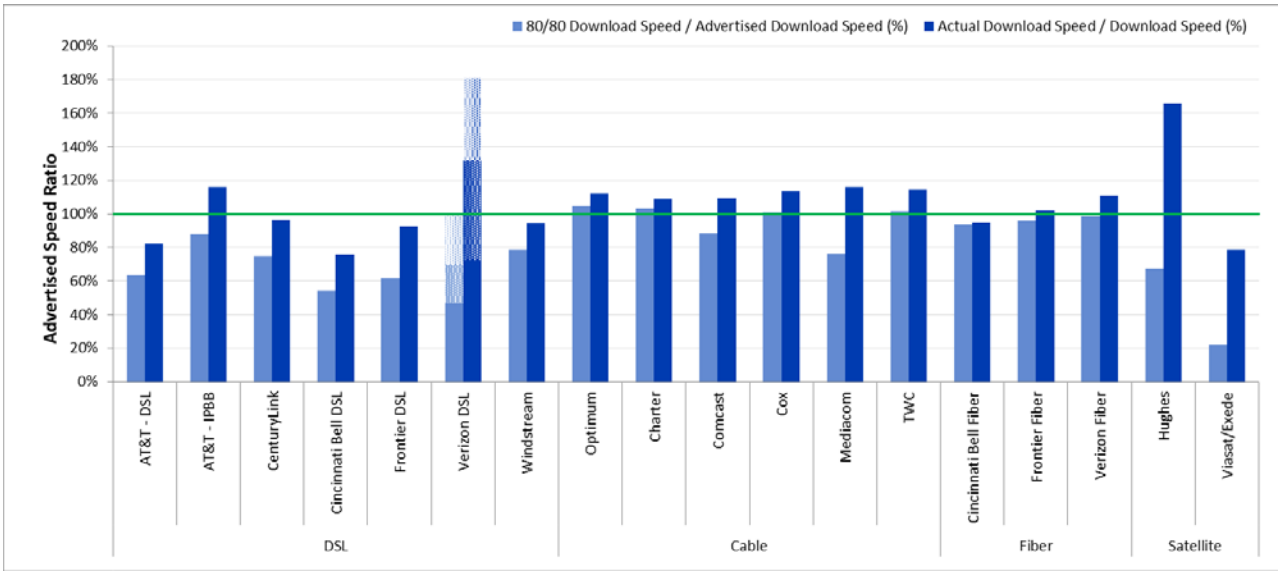


Even though the median download speeds experienced by most ISPs' subscribers nearly meet or exceed the advertised download speeds, for each ISP, there are some customers for whom the median download speed falls significantly short of the advertised download speed. Relatively few subscribers of cable or fiber broadband service experience this. The best performing ISPs, when measured by this metric, are Optimum, Charter, Cox, TWC, Frontier-Fiber, Verizon-Fiber and Hughes; more than 85% of their panelists were able to attain an actual median download speed of at least 95% of the advertised download speed.

In addition to variation based on a subscriber's location, speeds experienced by a particular consumer may fluctuate during the day. This is typically caused by increased traffic demand and the resulting stress on different parts of the network infrastructure. In order to examine this aspect of performance, we use the term "80/80 consistent speed" to refer to a metric designed to assess temporal and spatial variations in measured values of the download speed.[15] Consistency of speed is in itself an intrinsically valuable service characteristic and its impact on consumers will hinge on variations in usage patterns and needs. Chart 6 summarizes, for each ISP, the ratio of 80/80 consistent median download speed to advertised download speed, and, for comparison, the ratio of median download speed to advertised download speed shown previously in Chart 4. The ratio of 80/80 consistent median download speed to advertised download speed is less than the ratio of median download speed to advertised download speed for all participating ISPs due to congestion periods when median download speeds are lower than the overall average. When the difference between the two ratios is small, the median download speed is fairly insensitive to both geography and time. When the difference between the two ratios is large, there is a greater variability in median download speed, either based on location or variations during the peak usage period.

[15] For a detailed definition and discussion of this metric, please refer to the Technical Appendix.

Chart 6: The ratio of 80/80 consistent median download speed to advertised download speed.



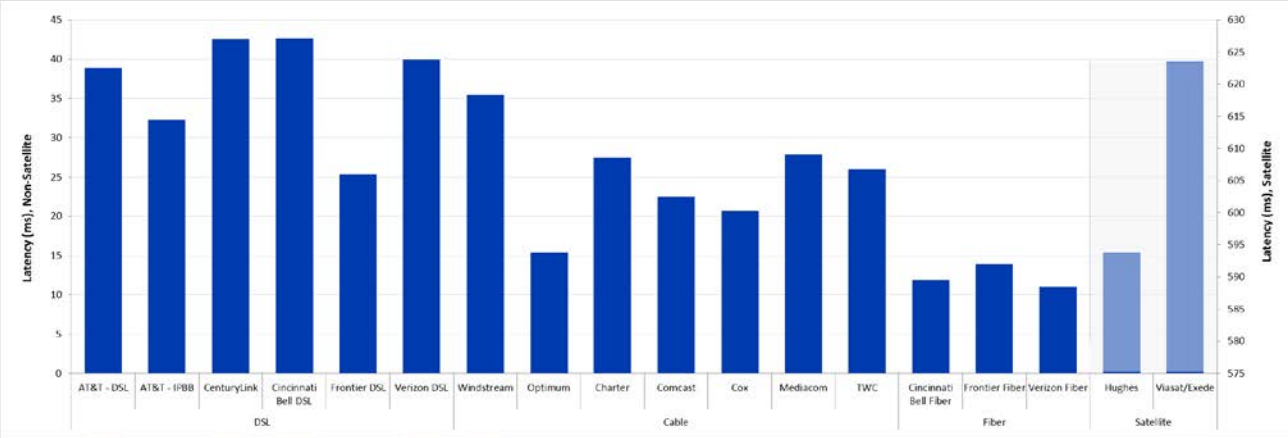
Customers of Optimum, Charter, Cox, Time-Warner Cable and Verizon Fiber (Fios) experienced median download speeds that were very consistent; with each provider delivering in excess of 90% of the advertised speed to at least 80% of the panelists for at least 80% of the peak usage period. As shown in Chart 6, DSL and satellite ISPs performed poorly compared to cable and fiber ISPs with respect to their 80/80 consistent speeds. For example, for September 2016, the 80/80 consistent download speed for Viasat was 22% of its advertised speed. Similarly, AT&T-DSL and Cincinnati Bell DSL had an 80/80 consistent download speed of 64% and 54%, respectively, of the advertised speed.

D. Latency

Latency is the time it takes for a data packet to travel from one point to another in a network. It has a fixed component that depends on the distance, the transmission speed, and transmission technology between the source and destination, and a variable component that increases as the network path congests with traffic. The MBA program measures latency by measuring the round-trip time from the consumer's home to the closest measurement server and back.

Chart 7 shows the median latency for each participating ISP. In general, higher-speed service tiers have lower latency, as it takes less time to transmit each packet. Satellite technologies inherently experience longer latencies since packets must travel approximately 44,500 miles from an earth station to the satellite and back. Therefore, the median latencies of satellite-based broadband services are much higher, at 594 ms to 624 ms, than those for terrestrial-based broadband services, which range from 11 ms to 43 ms in our measurements.

Chart 7: Latency by ISP



Amongst terrestrial technologies, DSL latencies (between 25 ms to 43 ms) were slightly larger than cable (15 ms to 35 ms). Fiber ISPs showed the lowest latency (11 ms to 14 ms). The differences in median latencies among terrestrial-based broadband services are relatively small, and are unlikely to affect the perceived quality of highly interactive applications.

E. Packet Loss

Packet loss is the percentage of packets that are sent by the source but not received at the destination. The most common reason that a packet is not received is that it encountered congestion along the route. A small amount of packet loss is expected, and indeed some Internet protocols use the packet loss to infer Internet congestion and to adjust the sending rate accordingly. The MBA program considers a packet lost if the round-trip latency exceeds 3 seconds.

Chart 8 shows the average peak-period packet loss for each participating ISP, grouped into bins. We have broken the packet loss performance into three bands which allows a more granular view of the packet loss performance of the ISP network. The breakpoints for the three bins used to classify packet loss have been chosen with an eye towards commonly accepted packet loss standards; provider packet loss SLAs; and various standards. Specifically, the 1% standard for packet loss is referred to in international documents and commonly accepted as the point at which highly interactive applications such as VoIP will experience significant degradation and quality.[16] The 0.4% breakpoint was chosen as a generic breakpoint between highly desired performance of 0% packet loss described in many documents and the 1% unacceptable on the high side. The specific value of 0.4% is based upon a compromise value between those two limits and generally supported by many network performance and service level agreements (SLAs) provided by major ISPs. Indeed, most SLAs support 0.1% to 0.3% SLA packet loss guarantees,[17] but these are generally for enterprise level services which generally have more stringent requirements for higher-level performance.

[16] *See* VoIP-Info, QoS (last visited July 2, 2018), https://www.voip-info.org/wiki/view/QoS and http://www.ciscopress.com/articles/article.asp?p=357102.

[17] *See* ITU, RECOMMENDATION ITU-R M.1079-2: PERFORMANCE AND QUALITY OF SERVICES REQUIREMENTS FOR INTERNATIONAL MOBILE TELECOMMUNCIATIONS-2000 (IMT-2000) ACCESS NETWORKS, www.itu.int/dms_pubrec/itu-r/rec/m/r-rec-m.1079-2-200306-i!!msw-e.doc.

Chart 8: Percentage of consumers whose peak-period packet loss was less than 0.4%, between 0.4% to 1%, and greater than 1%.

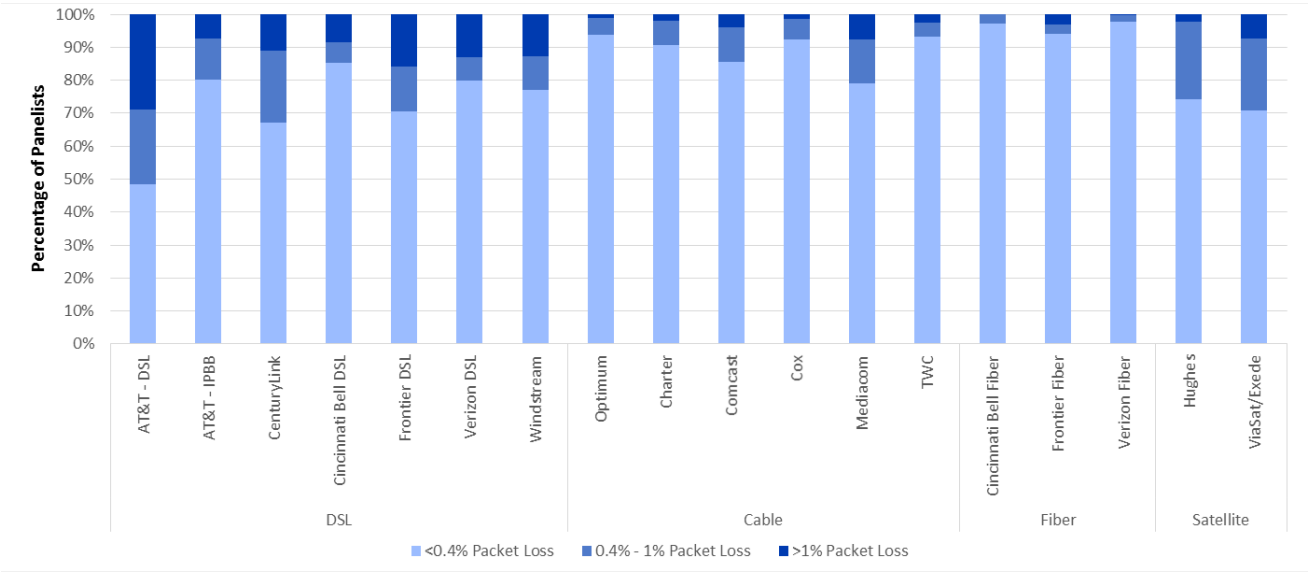
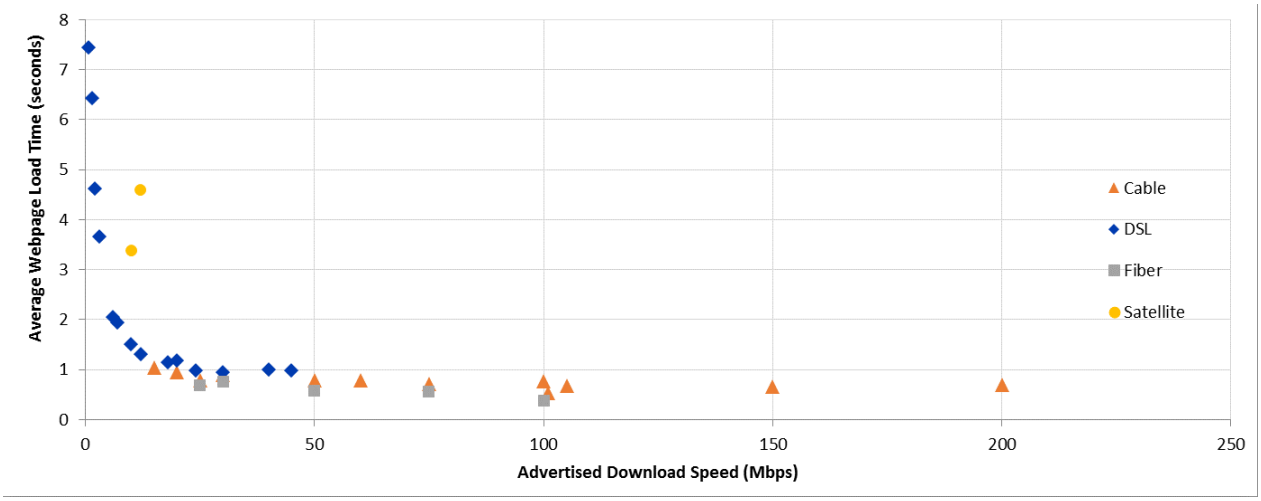


Chart 8 shows that ISPs using fiber technology had the lowest packet loss, and that ISPs using DSL and satellite technology tended to have the highest packet loss. Within a technology class, packet loss varied as well among companies.

F. Web browsing performance

The MBA program also conducts a specific test to gauge web browsing performance. The web browsing test accesses nine popular websites that include text and images, but not streaming video. The time required to download a webpage depends on many factors, including the consumer's in-home network, the download speed within an ISP's network, the web server's speed, congestion in other networks outside the consumer's ISP's network (if any), and the time required to look up the network address of the webserver. Only some of these factors are under control of the consumer's ISP. Chart 9 displays the average webpage download time as a function of the advertised download speed. As shown by this chart, webpage download time decreases as download speed increases, from about 7.4 seconds at 0.5 Mbps download speed to about 0.8 seconds for 25 Mbps download speed. Subscribers to service tiers exceeding 25 Mbps do not experience further significant decreases in webpage download times. These download times assume that a single user is using the Internet connection when the webpage is downloaded, and does not account for more typical scenarios where multiple users within a household are simultaneously using the Internet connection for viewing web pages as well as other applications such as real-time gaming or video streaming.

Chart 9: Average webpage download time, by advertised download speed.


Average Webpage Load Time (seconds)
0
1
2
3
4
5
6
7
8
0
50
100
150
200
250
Advertised Download Speed (Mbps)
Cable
DSL
Fiber
Satellite

3. METHODOLOGY

A. Participants

Fourteen ISPs participated in the Fixed MBA program in September 2016.[18] They are:

- AT&T
- CenturyLink
- Charter Communications
- Cincinnati Bell
- Comcast
- Cox Communications
- Frontier Communications Company
- Hughes Network Systems
- Mediacom Communications Corporation
- Optimum
- Time Warner Cable
- Verizon
- ViaSat
- Windstream Communications

The methodologies and assumptions underlying the measurements described in this Report are reviewed at meetings that are open to all interested parties, and documented in public ex parte letters filed in the GN Docket No. 12-264. Policy decisions regarding the MBA program involving issues such as inclusion of tiers, test periods, mitigation of operational issues affecting the measurement infrastructure, and terms-of-use notifications to panelists were discussed at these meetings prior to adoption. Participation in the MBA program is open and voluntary. Participants are drawn from academia, consumer equipment vendors, telecommunications vendors, network service providers, consumer policy groups as well as our contractor for this project, SamKnows. In 2016-2017, participants at these meetings (collectively and informally referred to as "the broadband collaborative"), included all fourteen participating ISPs and the following additional organizations:

- Center for Applied Data Analysis (CAIDA)
- *International Technology and Trade Associates (*ITTA)
- Internet Society (ISOC)
- Level 3 Communications ("Level 3")
- Massachusetts Institute of Technology ("MIT")
- M-Lab
- NCTA – The Internet and Television Association
- New America Foundation
- Practicum Team, NCSU, Institute for Advanced Analytics
- Princeton University
- United States Telecom Association ("US Telecom")
- University of California - Santa Cruz

[18] The 2014 Report and earlier reports also included Insight Communications, which has merged with Time Warner Cable, and Qwest Communications, which is part of CenturyLink. Hughes Network Systems joined the program in 2014. ViaSat operates under the brand name Exede Internet.

Participants have contributed in important ways to the integrity of this program and provide valuable input to FCC decisions for this program. Initial proposals for test metrics and testing platforms were discussed and critiqued within the broadband collaborative. M-Lab and Level 3 contributed their core network testing infrastructure, and both parties continue to provide invaluable assistance in helping to define and implement the FCC testing platform. We thank the participants for their continued contributions to the MBA program.

B. Measurement process

The measurements that provided the underlying data for this report relied both on measurement clients and measurement servers. The measurement clients (i.e., whiteboxes) resided in the homes of 6,193 panelists who received service from one of the 14 participating ISPs. The participating ISPs collectively accounted for over 80% of U.S. residential broadband Internet connections. After the measurement data was processed, as described in greater detail in the Appendix, test results from 4,545 panelists were used in this report.

The measurement servers were hosted by M-Lab and Level 3 Communications, and were located in nine cities across the United States near a point of interconnection between the ISP's network and the network on which the measurement server resided.[19]

The measurement clients collected data throughout the year, and this data is available as described below. However, only data collected from September 1 through 11 and September 21 through October 9, 2016, referred to throughout this report as the "September 2016" reporting period, were used to generate the charts in this Report.[20]

Broadband performance varies with the time of day. At peak hours, more people are attempting to use their broadband Internet connections, giving rise to a greater potential for congestion and degraded user performance. Unless otherwise stated, this Report focuses on performance during peak usage period, which is defined as weeknights between 7:00 p.m. to 11:00 p.m. local time at the subscriber's location. Focusing on peak usage period provides the most useful information because it demonstrates the performance users can expect when the Internet in their local area is experiencing the highest demand from users.

Our methodology focuses on the network performance of each of the participating ISPs. The metrics discussed in this Report are derived from traffic flowing between a measurement client, located within the modem or router within a panelist's home, and a measurement server, located outside the ISP's network. For each panelist, the tests automatically choose the measurement server that has the lowest latency to the measurement client. Thus, the metrics measure performance along a path within each ISP's network, through a point of interconnection between the ISP's network and the network on which the chosen measurement server resides.

However, the service performance that a consumer experiences may differ from our measured values for several reasons. First, as noted, we measure performance only to a single measurement server rather than to multiple servers, following the approach chosen by most network measurement tools. ISPs, in general, attempt to maintain consistent performance throughout their network. However, at times, some paths or interconnection points within an ISP's network may be more congested than others and this can affect a specific consumer's service.

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[19] For this report, we excluded some measurements using the M-Lab measurement servers, due to a problem with the architecture of those servers that affected the higher service tiers.

[20] The period of September 12-20, 2016 was omitted because the release of Apple's iOS 10 operating system caused widespread network congestion. This determination was made consistent with the FCC's data collection policy for fixed MBA data. *See* FCC, Measuring Fixed Broadband, Data Collection Policy, https://www.fcc.gov/general/measuring-broadband-america-measuring-fixed-broadband (explaining that the FCC has developed policies to deal with impairments in the data collection process with potential impact for the validity of the data collected).

Congestion beyond an ISP's network and not measured in our study, can affect the overall performance a consumer experiences with their service. A consumer's home network rather than the ISP's network, may be the bottleneck. We measure the performance of the ISP's service delivered to the consumer's home network, but this connection is often shared among simultaneous users and applications within the home. This in-home network, which typically includes Wi-Fi, may not have sufficient capacity to support peak loads.[21]

In addition, consumers typically experience performance through the set of applications that they utilize, not as raw speed, latency or packet loss. The performance of an application depends on both the network performance and on the architecture and implementation of the application itself and the operating system and hardware on which it runs. While network performance is considered in this Report, application performance is generally not.

C. Measurement Tests And Performance Metrics

This Report is based on the following measurement tests:

- Download speed: This test measures the download speed of each whitebox over a 10-second period, once every hour during the peak hours (7 p.m. to 11 p.m.) and once during each of the following periods: midnight to 6 a.m., 6 a.m. to noon, and noon to 6 p.m. The results of each whitebox are then averaged across the measurement month; the median value for these average speeds across the set of whiteboxes is used to determine the *median download speed* for a service tier. The overall ISP download speed is computed as the weighted median for each service tier, using the subscriber counts for the tiers as weights.
- Upload speed: This test measures the upload speed of each whitebox over a 10-second period, with the same measurement intervals as the download speed. The speed measured in the last five seconds of the 10-second interval is retained, the results of each whitebox are then averaged over the measurement period, and the median value for the average speed taken over the set of whiteboxes is used to determine the *median upload speed* for a service tier. The ISP upload speed is computed in the same manner as the download speed.
- Latency and packet loss: These tests measure the round-trip times for approximately 2,000 packets per hour sent at randomly distributed intervals. Response times less than three seconds are used to determine the mean latency. If the whitebox does not receive a response within three seconds, the packet is counted as lost.
- Web browsing: The web browsing test measures the total time it takes to request and receive webpages, including the text and images, from nine popular websites and is performed once every hour. The measurement includes the time required to translate the web server name (URL) into the webserver's network (IP) address.

This Report focuses on three key performance metrics of interest to consumers of broadband Internet access service, as they are likely to influence how well a wide range of consumer applications work: download and upload speed, latency, and packet loss. Download and upload speeds are also the primary network performance characteristic advertised by ISPs. However, as discussed above, the performance observed by a user in any given circumstance depends not only on the actual speed of the ISP's network, but also on the performance of other parts of the Internet and on that of the application itself.[22]

The Technical Appendix to this Report describes each test in more detail, including additional tests not

[21] Independent research, drawing on the FCC's MBA test platform (*see* https://www.fcc.gov/general/mba-assisted-research-studies), suggests that home networks are a significant source of end-to-end service congestion. *See* Srikanth Sundaresan et al., *Home Network or Access Link? Locating Last-Mile Downstream Throughput Bottlenecks*, PAM 2016 - Passive and Active Measurement Conference, at 111-123 (March 2016).

[22] Performance observed by a user may also depend on other factors, including the capabilities of their device and the performance of network devices within their home.

contained in this Report.

D. Availability Of Data

The Validated Data Set[23] on which this Report is based, as well as the full results of all tests, are available at http://www.fcc.gov/measuring-broadband-america. To encourage additional research, we also provide raw data for the reference month and other months. Previous reports of the MBA program, as well as the data used to produce them, are also available there.

Both the Commission and SamKnows, the Commission's contractor for this program, recognize that, while the methodology descriptions included in this document provide an overview of the project, interested parties may be willing to contribute to the project by reviewing the software used in the testing. SamKnows welcomes review of its software and technical platform, consistent with the Commission's goals of openness and transparency for this program.[24]

[23] The September 2016 data set was validated to remove anomalies that would have produced errors in the Report. This data validation process is described in the Technical Appendix.

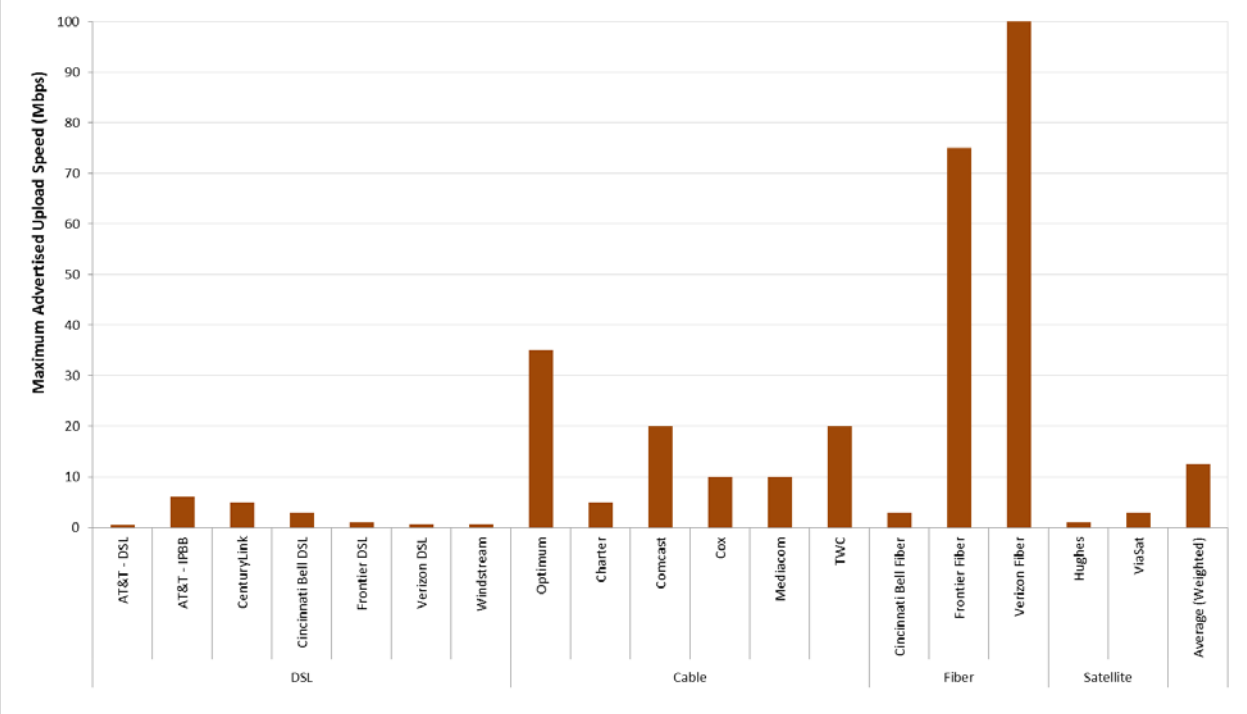
[24] The software that was used for the MBA program will be made available for noncommercial purposes. To apply for noncommercial review of the code, interested parties may contact SamKnows directly at team@samknows.com, with the subject heading "Academic Code Review."

4. TEST RESULTS

A. Most Popular Advertised Service Tiers

Chart 1 above summarized the maximum advertised download speeds among the measured service tiers[1] for each participating ISP, for September 2016, grouped by the access technology used to offer the broadband Internet access service (DSL, cable, fiber, or satellite). Chart 10 below shows the corresponding maximum advertised upload speeds among the measured service tiers. As shown in Chart 10, the maximum upload speed of ISPs using DSL and satellite technology lags behind ISPs using cable and fiber technologies. In particular, the maximum advertised upload speed for ISPs using DSL technology is between 0.5 to 6 Mbps and for ISPs using satellite technology is 1 to 3 Mbps. In contrast, among cable-based broadband providers, the maximum advertised upload speeds among the measured service tiers is 5-35 Mbps. Similarly, for ISPs using fiber technology the maximum upload speed ranged from 3 to 100 Mbps. As was previously noted, except for Cincinnati Bell fiber, the upload and download speed offerings for fiber technologies are symmetric. The computed weighted average of the maximum upload speed of all participating ISPs is 13 Mbps.

Chart 10: Maximum advertised upload speed among the measured service tiers.



B. Observed Median download and upload Speeds

Chart 3 above showed the median download speeds experienced by each ISP's participating subscribers in September 2016. Chart 11 below shows the corresponding median upload speeds. The median upload

[1] As discussed above, measured service tiers were tiers which constituted 5% or more of an ISP's broadband subscriber base and had at least 30,000 subscribers.

speed for this period across all consumers was 12 Mbps.

Chart 11: Median upload speeds by ISP.

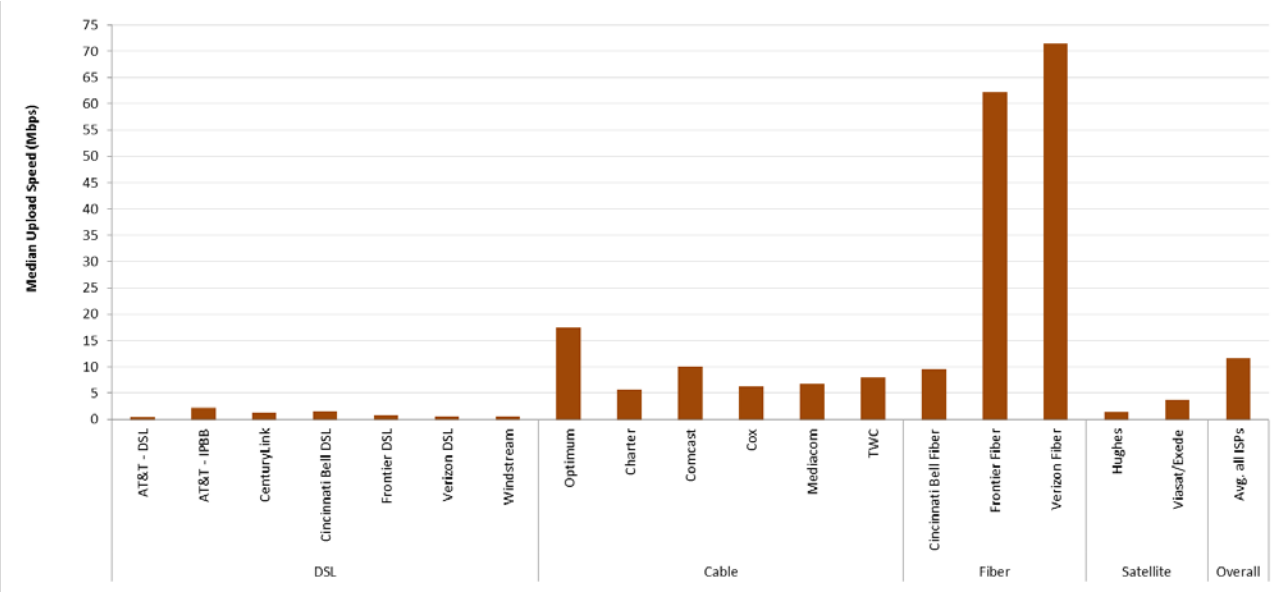


Chart 12 shows the median download and upload speeds by technology for September 2016. As shown the median download speeds for DSL and satellite technologies, which are respectively 14 and 12 Mbps, lag behind the median download speeds for cable and fiber technologies, which are 79 and 63 Mbps. Similarly, the median upload speeds for DSL and satellite technologies, which are respectively 2 to 3 Mbps, lag behind the median upload speeds of cable and fiber technologies, which are 9 and 69 Mbps. Observing both the download and upload speeds, fiber technology is more symmetric in its actual upload and download speeds. Other technologies tend to be far more asymmetric with the upload speed values lower than the download speed values. This asymmetry is reflective of actual usage in that consumers typically download significantly more data than they upload.

Chart 12: Median download and upload speeds by technology

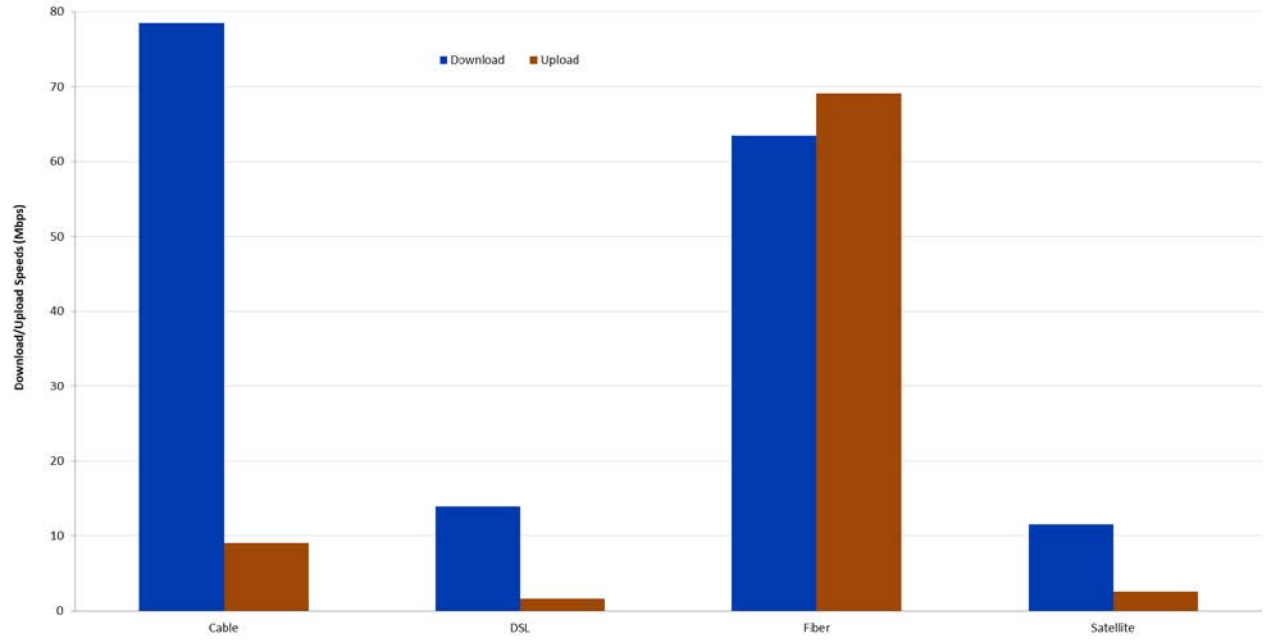


Chart 4 (in Section 2.B above) showed the ratio in September 2016 of the weighted median of both download and upload speeds of each ISP's subscribers to advertised speeds. Charts 13.1 and 13.2 below show the same ratios separately for download speed and upload speed.[2] The median download speeds of most ISPs' subscribers have been close to, or have exceeded, the advertised speeds. Exceptions to this were the following DSL providers: AT&T-DSL, CenturyLink, Cincinnati Bell, Frontier DSL and Windstream with their median download speed at 81%, 85%, 93%, 86% and 94%, respectively, of their advertised download speed.

Chart 13.1: The ratio of median download speed to advertised download speed.

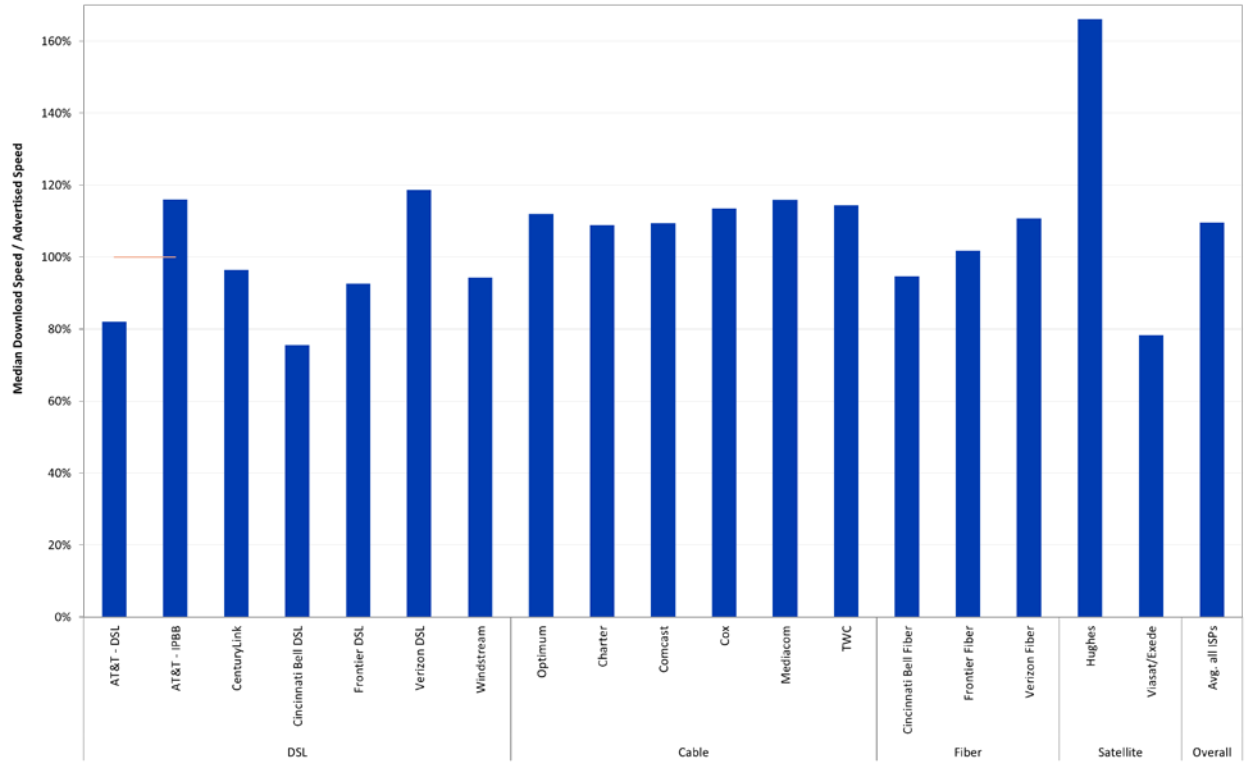
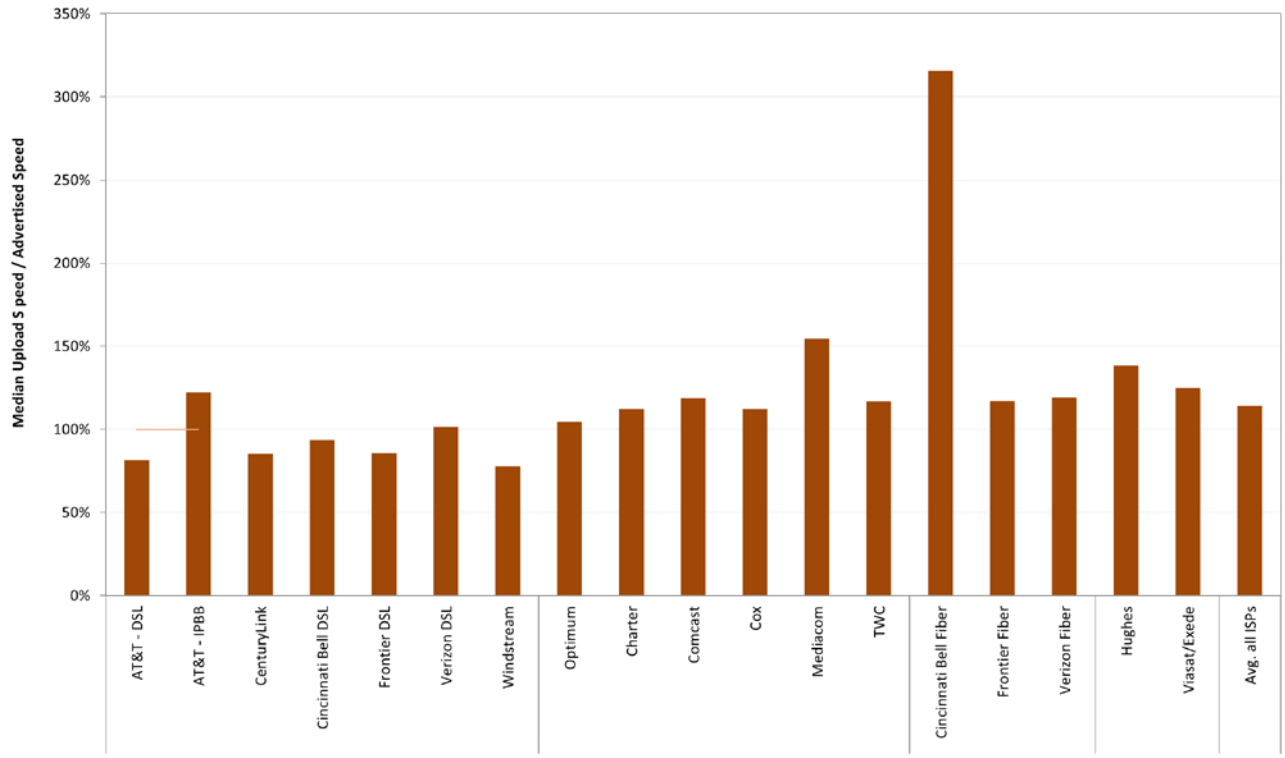


Chart 13.2 shows the median upload speed as a percentage of the advertised upload speed. As was the case with download speeds, most ISPs meet or exceed their advertised speeds except for most DSL providers: AT&T-DSL, CenturyLink, Cincinnati Bell DSL, Frontier DSL and Windstream which had values of 81%, 85%, 93%, 86% and 78%, respectively.

[2] In these charts, we show Verizon's median speed as a percentage of the mid-point between their lower and upper advertised speed range.

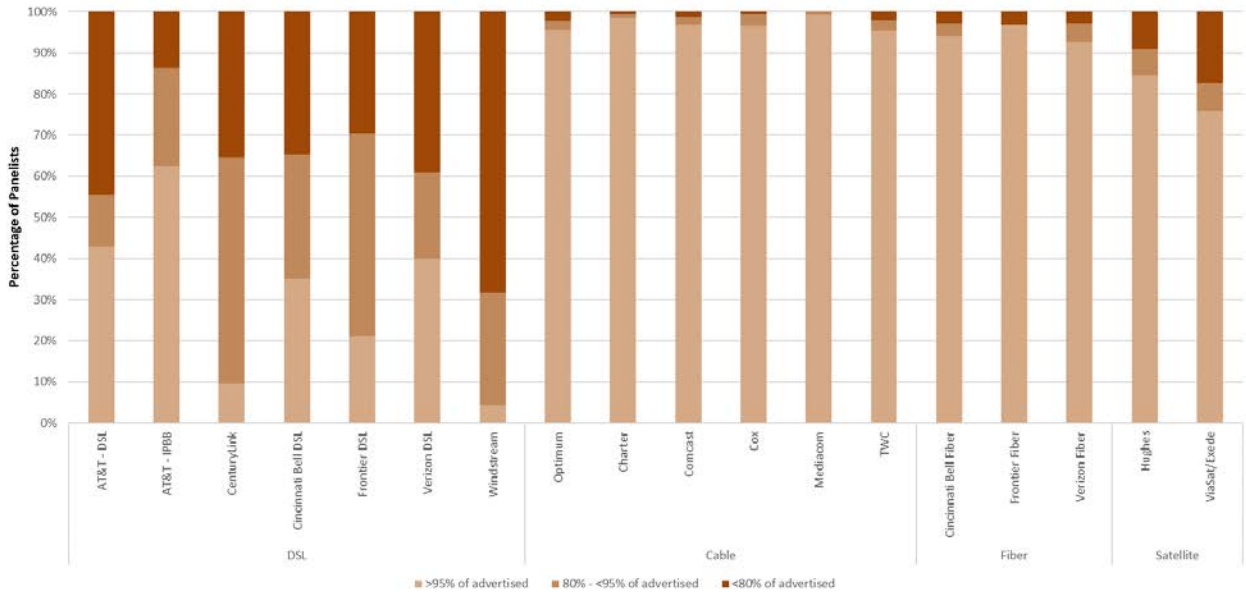
Chart 13.2: The ratio of median upload speed to advertised upload speed.



C. Variations In Speeds

As noted, median speeds experienced by consumers may vary based on location and time of day. Chart 5 above showed, for each ISP, the percentage of consumers (across the ISP's service territory) who experienced a median download speed over the peak usage period that was either greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed. Chart 14 below shows the corresponding percentage of consumers whose median upload speed fell in each of these ranges.

Chart 14: The percentage of consumers whose median upload speed was (a) greater than 95%, (b) between 80% and 95%, or (c) less than 80% of the advertised upload speed.



Even though the median upload speeds experienced by most subscribers were close to or exceeded the advertised upload speeds, for each ISP, there were some subscribers whose median upload speed fell significantly short of the advertised upload speed. This issue was most prevalent for ISPs using DSL technology. ISPs using cable and fiber technology generally showed very good consistency in service based on this metric.

We can learn more about the variation in network performance by separately examining variation across geography and across time. We start by examining the variation across geography within each participating ISP's service territory. For each ISP, we first calculate the ratio of the median download speed (over the peak usage period) to the advertised download speed for each panelist subscribing to that ISP. We then examine the distribution of this ratio across the ISP's service territory.

Charts 15.1 and 15.2 show the complementary cumulative distribution of the ratio of median download speed (over the peak usage period) to advertised download speed for each participating ISP. For each ratio of actual to advertised download speed on the horizontal axis, the curves show the percentage of panelists subscribing to each ISP that experienced at least this ratio.[3] For example, the Cincinnati Bell fiber curve in Chart 15.1 shows that 90% of its subscribers experienced a median download speed exceeding 92% of the advertised download speed, while 70% experienced a median download speed exceeding 94% of the advertised download speed and 50% experienced a median download speed exceeding 95% of the advertised download speed.

[3] In Reports prior to the 2015 MBA Report, for each ratio of actual to advertised download speed on the horizontal axis, the cumulative distribution function curves showed the percentage of measurements, rather than panelists subscribing to each ISP, that experienced at least this ratio. The methodology used in both this and last year's Report, i.e., using panelists subscribing to each ISP, more accurately illustrates performance from the point of view of the consumer.

Chart 15.1: Complementary cumulative distribution of the ratio of median download speed to advertised download speed.

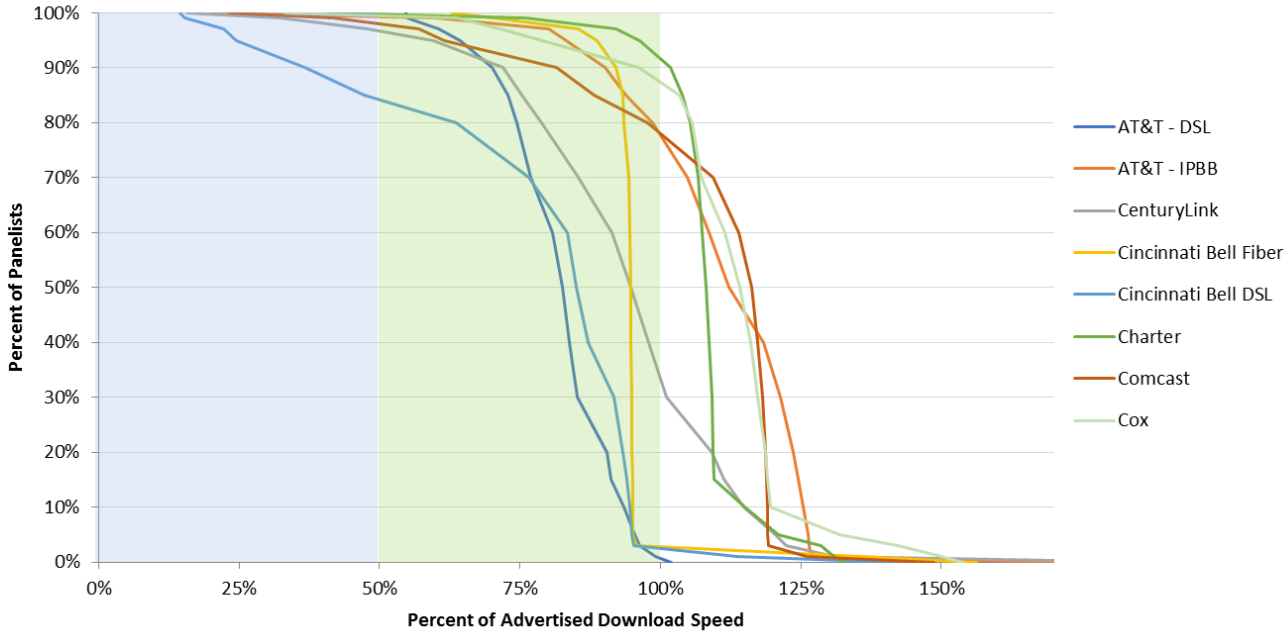
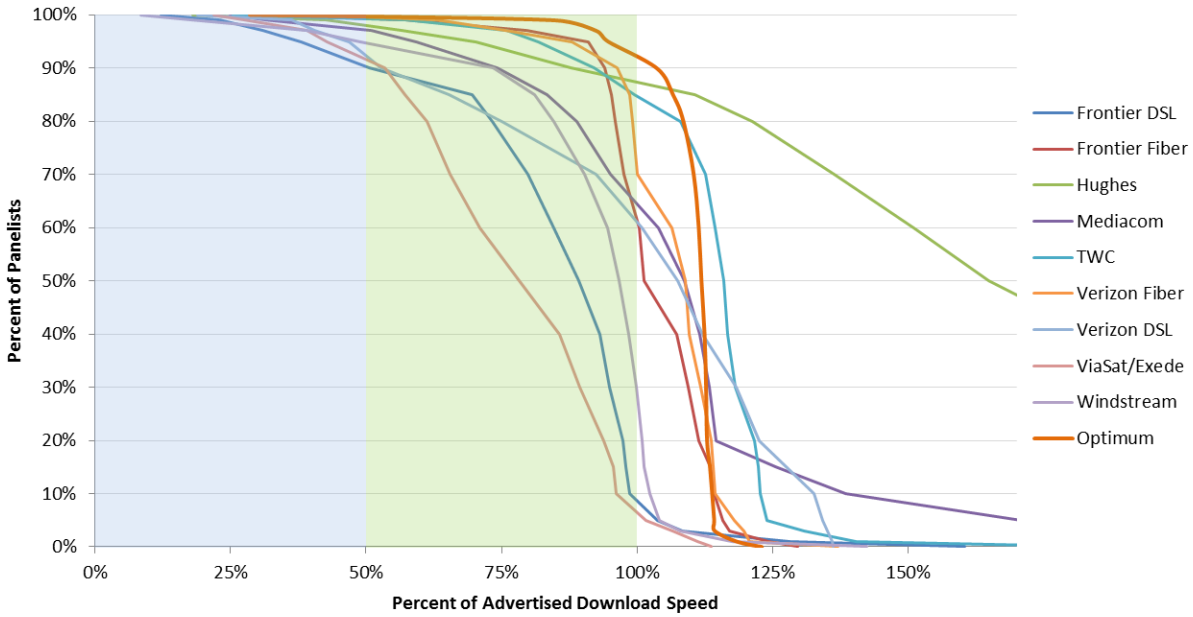


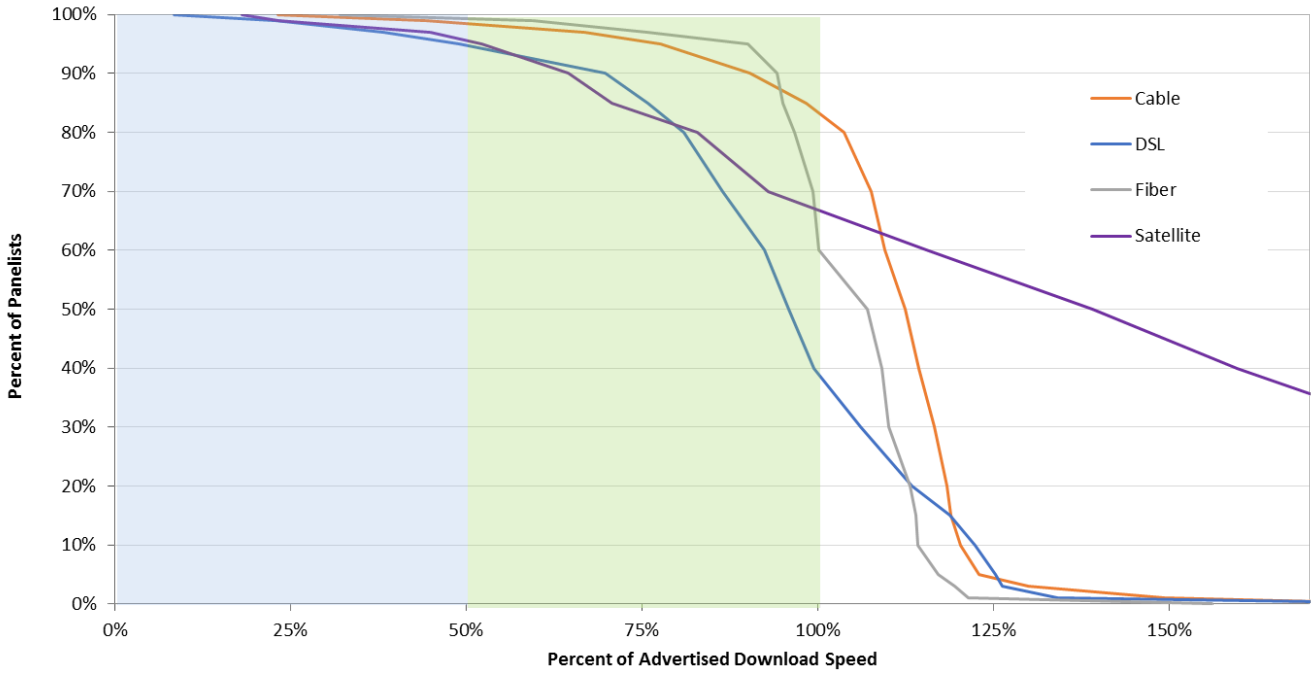
Chart 15.2: Complementary cumulative distribution of the ratio of median download speed to advertised download speed (continued).



The curves for cable-based broadband and fiber-based broadband are steeper than those for DSL-based broadband and satellite-based broadband. This can be more clearly seen in Chart 15.3, which plots aggregate curves for each technology. Approximately 82% of subscribers to cable and 66% of subscribers to fiber-based technologies experience median download speeds exceeding the advertised download speed. In contrast, only 38% of subscribers to DSL-based services experience median download speeds exceeding the advertised download speed.[4]

[4] The speed achievable by DSL depends on the distance between the subscriber and the central office. Thus, the complementary cumulative distribution function will fall slowly unless the broadband ISP adjusts its advertised rate based on the subscriber's location. (Chart 17 illustrates that the performance during non-busy hours is similar to the busy hour, making congestion less likely as an explanation.)

Chart 15.3: Complementary cumulative distribution of the ratio of median download speed to advertised download speed, by technology.



Charts 15.4 to 15.6 show the complementary cumulative distribution of the ratio of median upload speed (over the peak usage period) to advertised upload speed for each participating ISP (Charts 15.4 and 15.5) and by access technology (Chart 15.6).

Chart 15.4: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed.

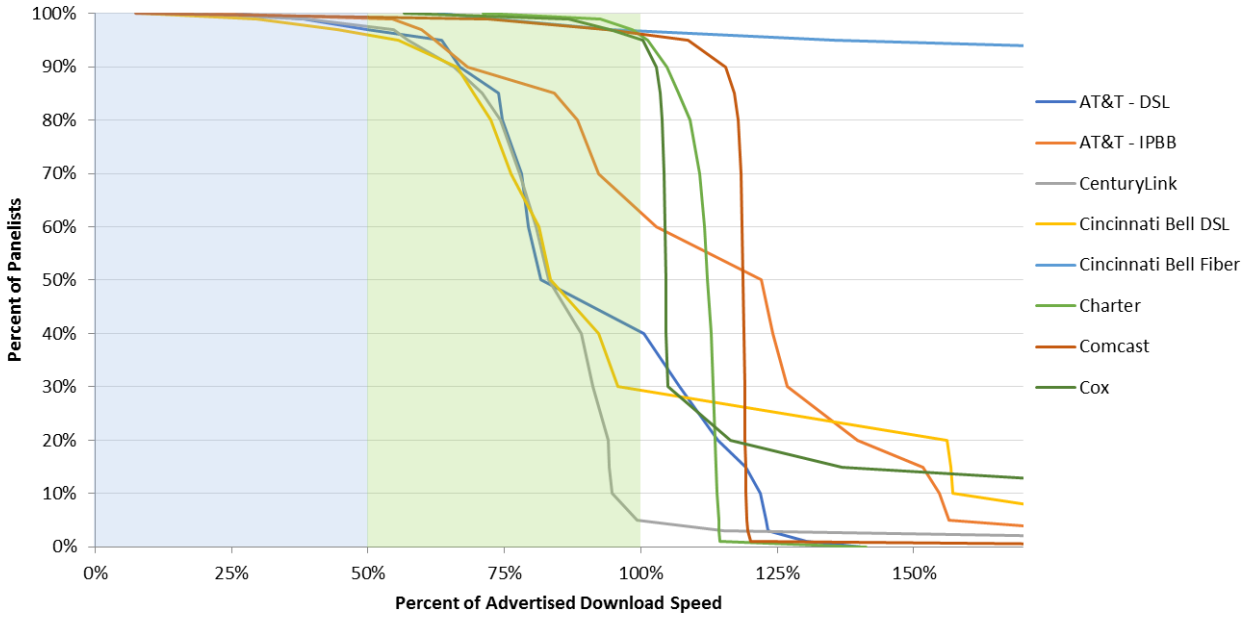


Chart 15.5: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed (continued).

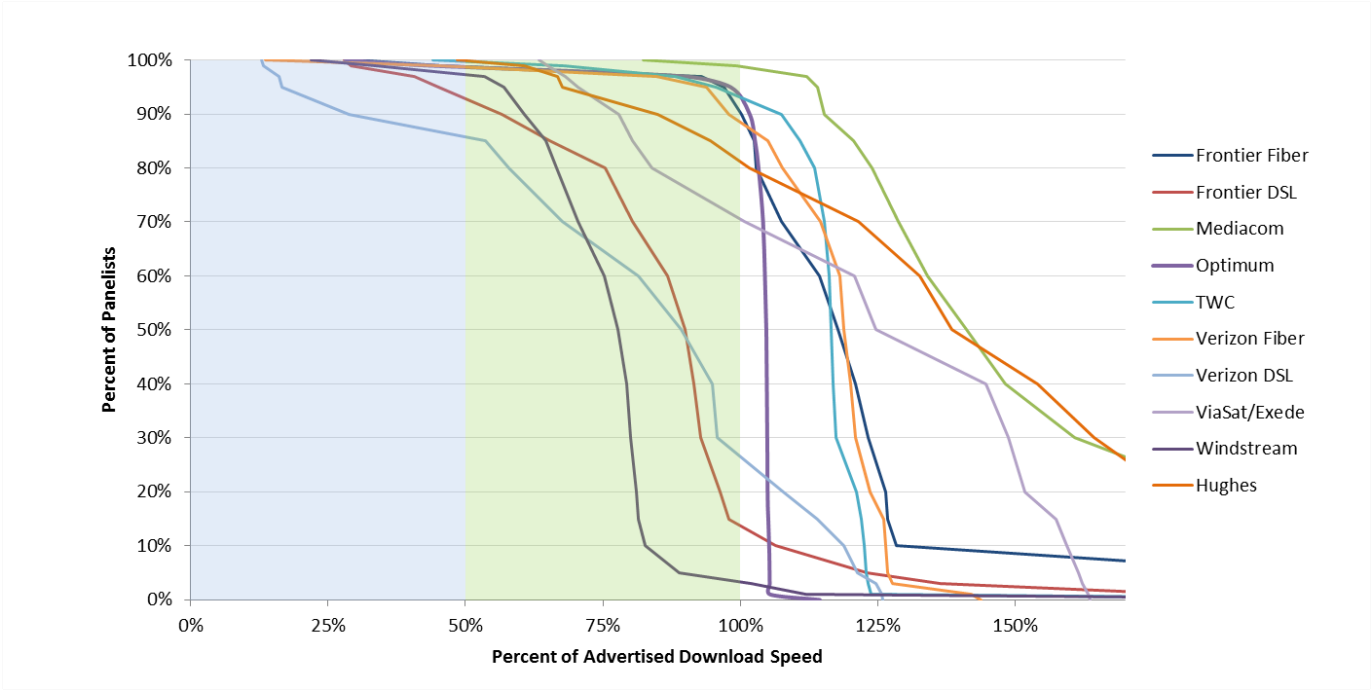
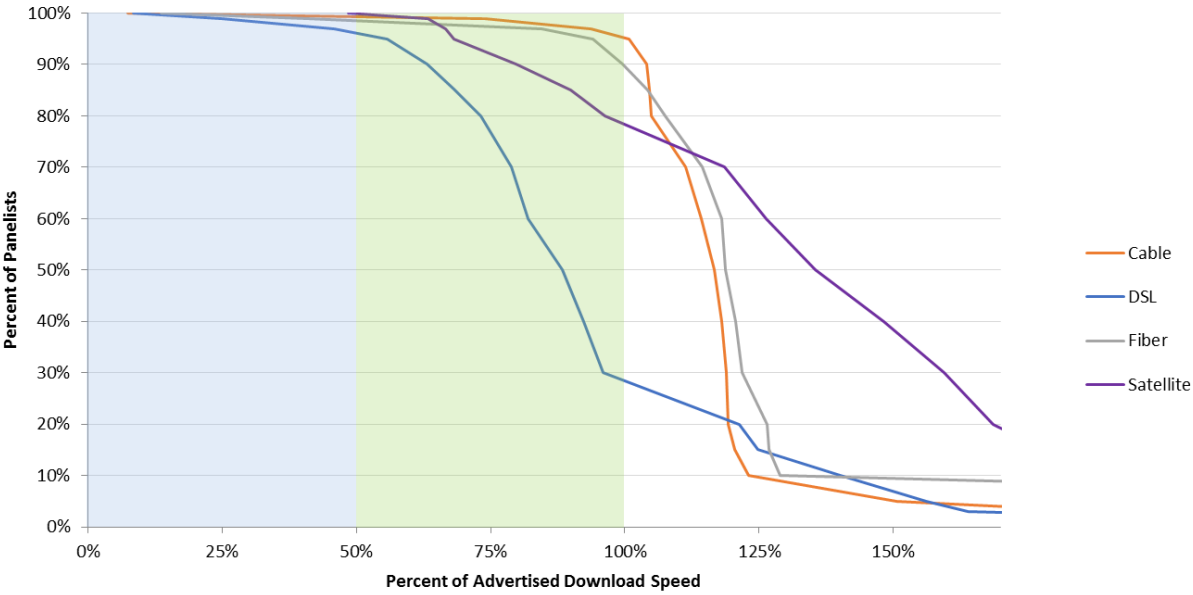


Chart 15.6: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed, by technology.



All actual speeds discussed above are measured only during peak usage periods. In contrast, Charts 16.1 and 16.2 below compare the ratio of actual speed to advertised speed during peak and off-peak times.[5] Charts 16.1 and 16.2 show that while most ISPs show only a slight degradation from off-peak to peak hour performance, satellite ISPs show a markedly larger degradation. Hughes customers experience a drop from 243% to 166% in the ratio of median download speed to advertised speed from off-peak hours to peak hours. Similarly, ViaSat customers experience a corresponding drop from 106% to 78%.

Chart 16.1: The ratio of median download speed to advertised download speed, peak versus off-peak.

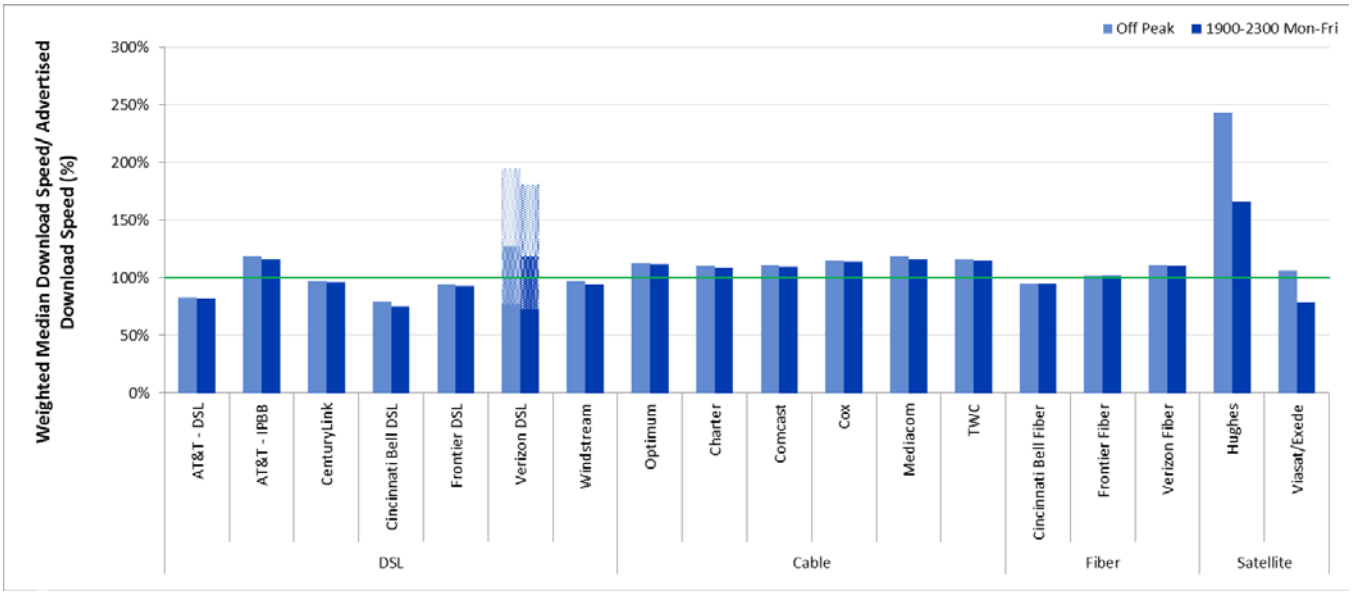
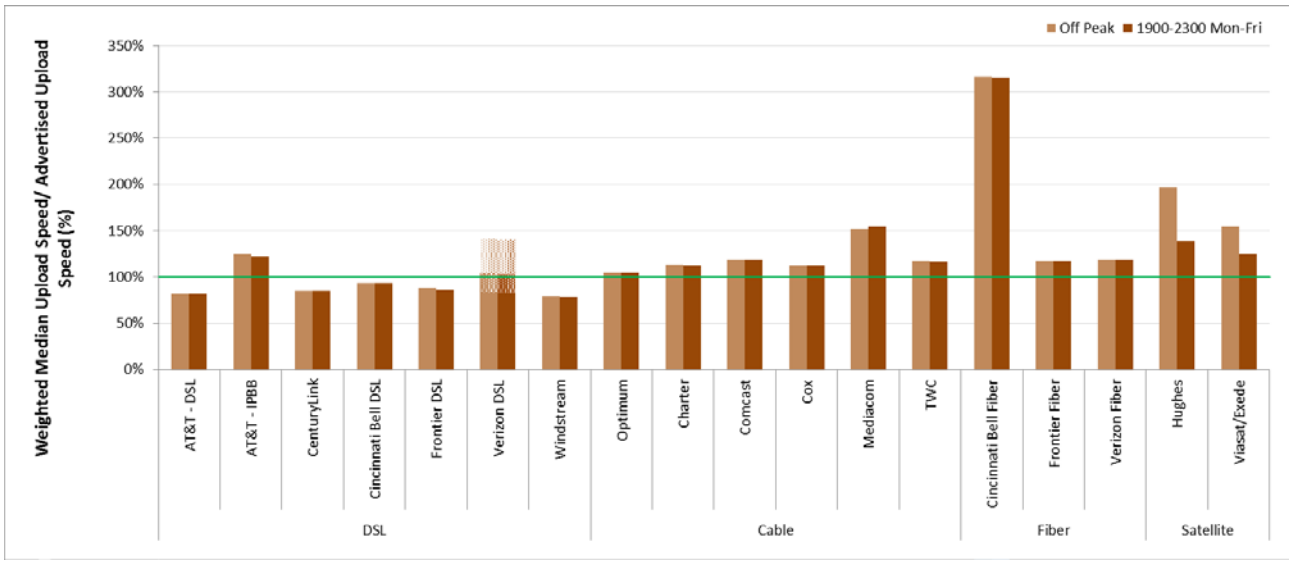


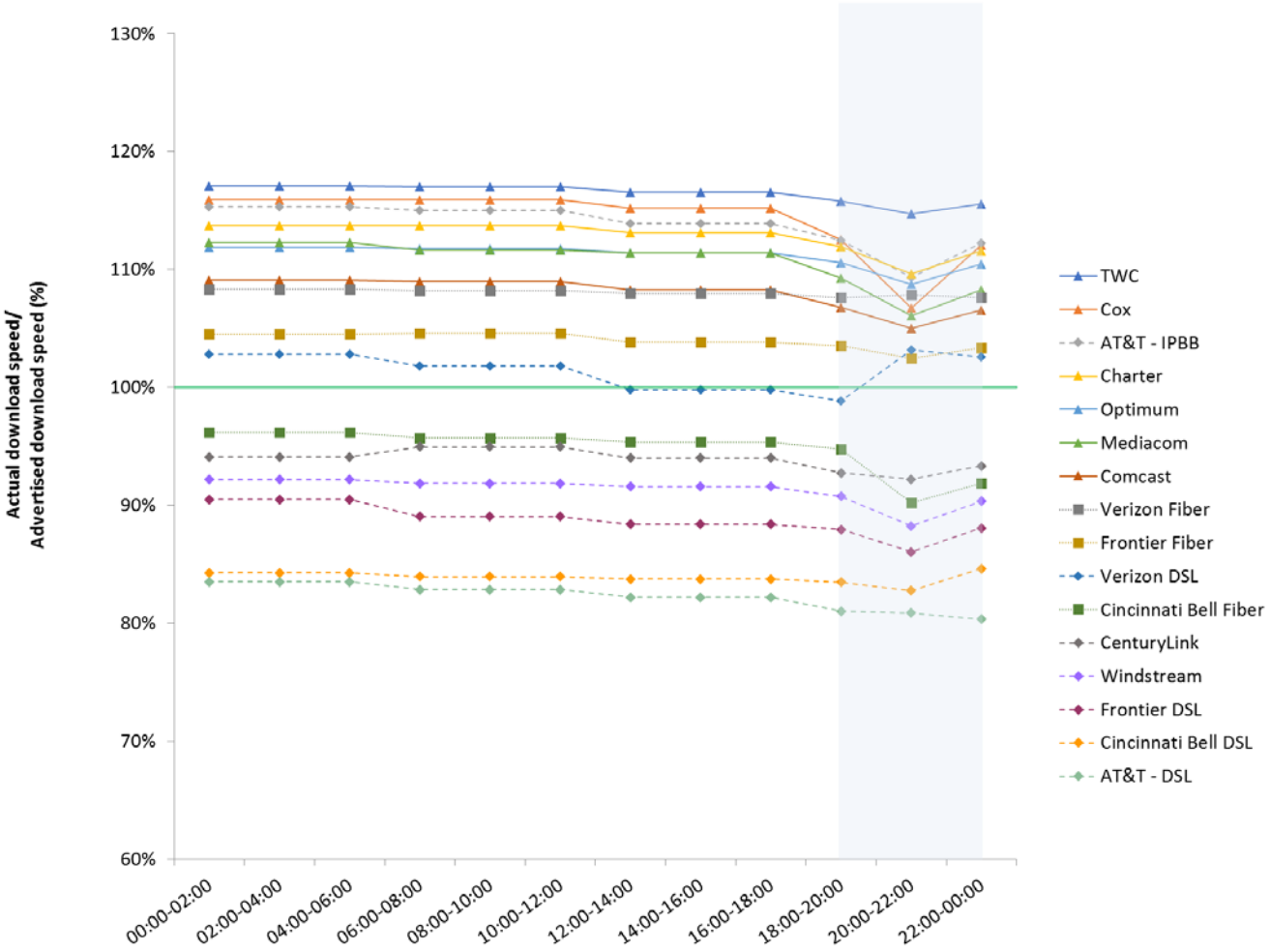
Chart 16.2: The ratio of median upload speed to advertised upload speed, peak versus off-peak.



[5] Verizon DSL download and upload results are shown as a range because Verizon advertises its DSL speed as a range rather than as a specific speed.

Charts 17.1[6] and 17.2 below show the download ratio in each two-hour time block during weekdays for each ISP. The ratio is lowest during the busiest four-hour time block (7:00 p.m. to 11:00 p.m.).

Chart 17.1: The ratio of median download speed to advertised download speed, Monday-to-Friday two-hour time blocks, terrestrial ISPs.



[6] In this chart, we have shown the median download speed of Verizon-DSL as a percentage of the midpoint of the advertised speed range for its tier.

Chart 17.2: The ratio of median download speed to advertised download speed, Monday-to-Friday two-hour time blocks, satellite ISPs.

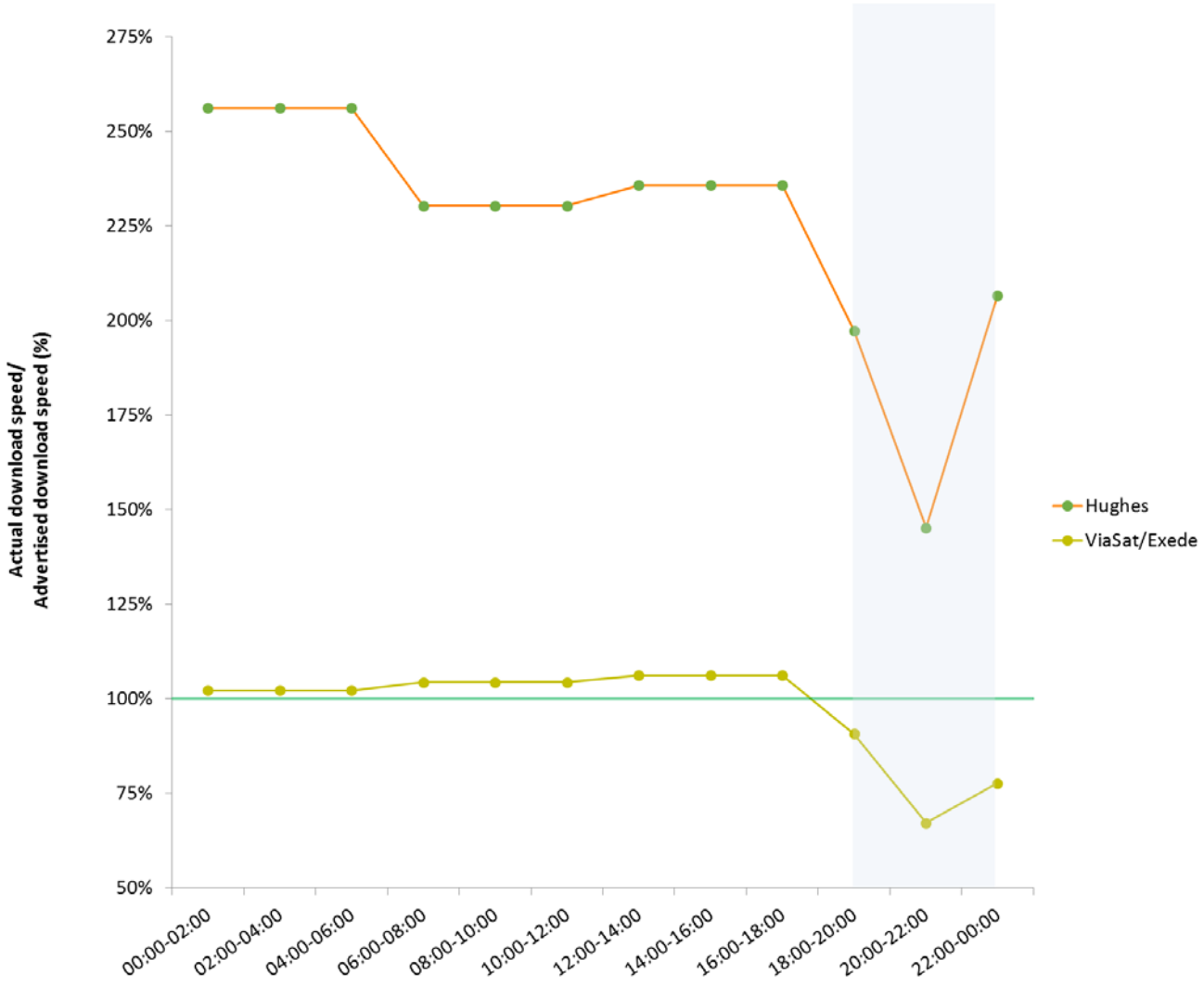
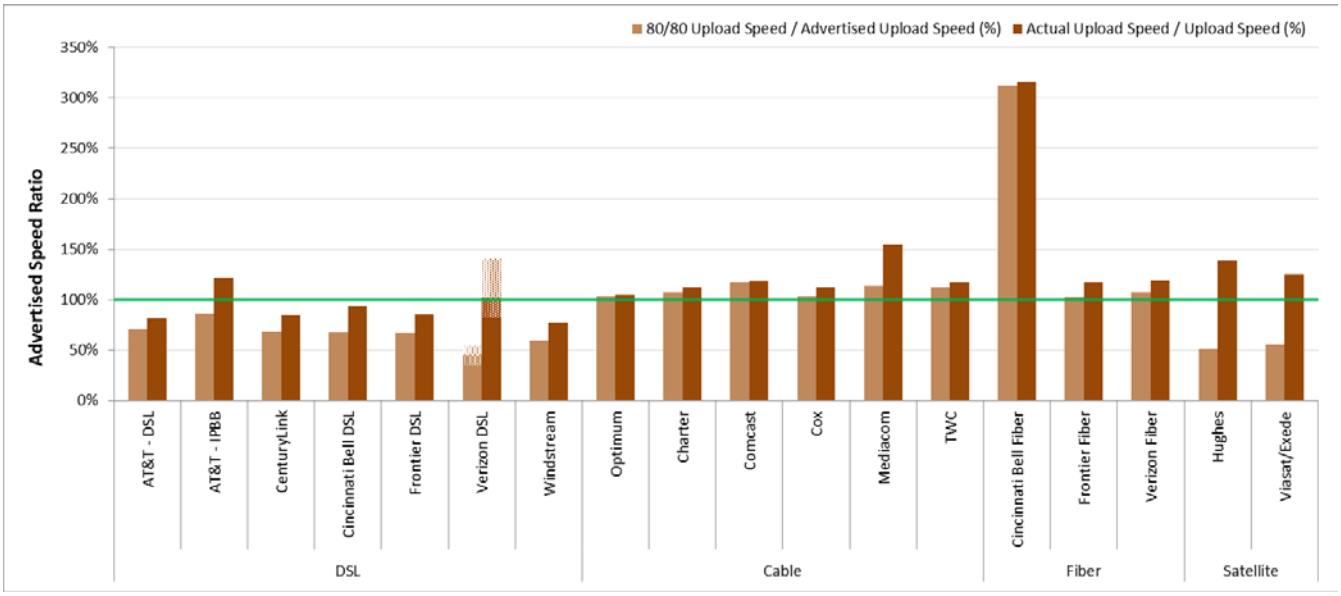


Chart 6 (in section 2.C above) illustrated, for each ISP, the ratio of the 80/80 consistent median download speed to advertised download speed, and for comparison, the ratio of median download speed to advertised download speed shown previously in Chart 4.
Chart 18.1 illustrates information for 80/80 consistent upload speed. For all ISPs, the upload 80/80 speed is lower than the median upload speed. For most ISPs, the upload 80/80 speed is slightly lower than the median speed. However, in the case of Hughes, ViaSatand Verizon DSL, the 80/80 upload speed was considerably lower than the median speed.

Chart 18.1: The ratio of 80/80 consistent upload speed to advertised upload speed.



Charts 18.2 and 18.3 below illustrate similar consistency metrics for 70/70 consistent speeds, i.e., the minimum speed (as a percentage of the advertised speed) experienced by at least 70% of panelists during at least 70% of the peak usage period. The ratios for 70/70 consistent speeds are higher than the corresponding ratios for 80/80 consistent speeds. In fact, for many ISPs, the 70/70 consistent download speed is close to the median download speed. Once again, ISPs using satellite technology showed a considerably smaller value for the 70/70 download and upload speed as compared to the download and upload median speed, respectively.

Chart 18.2: The ratio of 70/70 consistent download speed to advertised download speed.

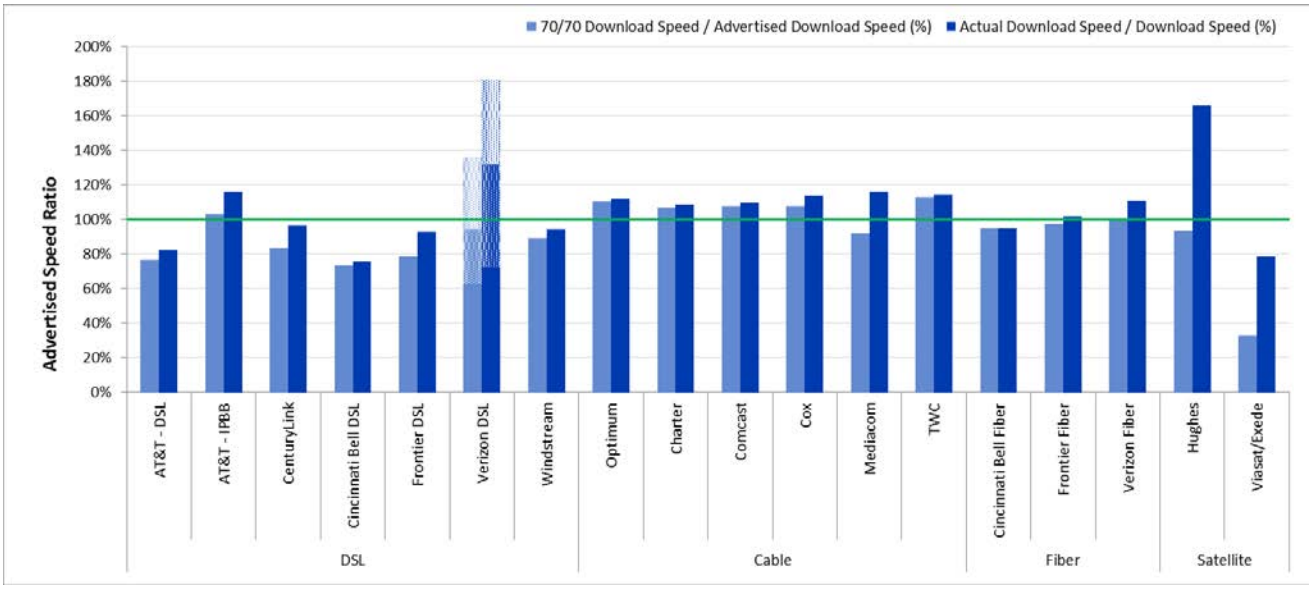
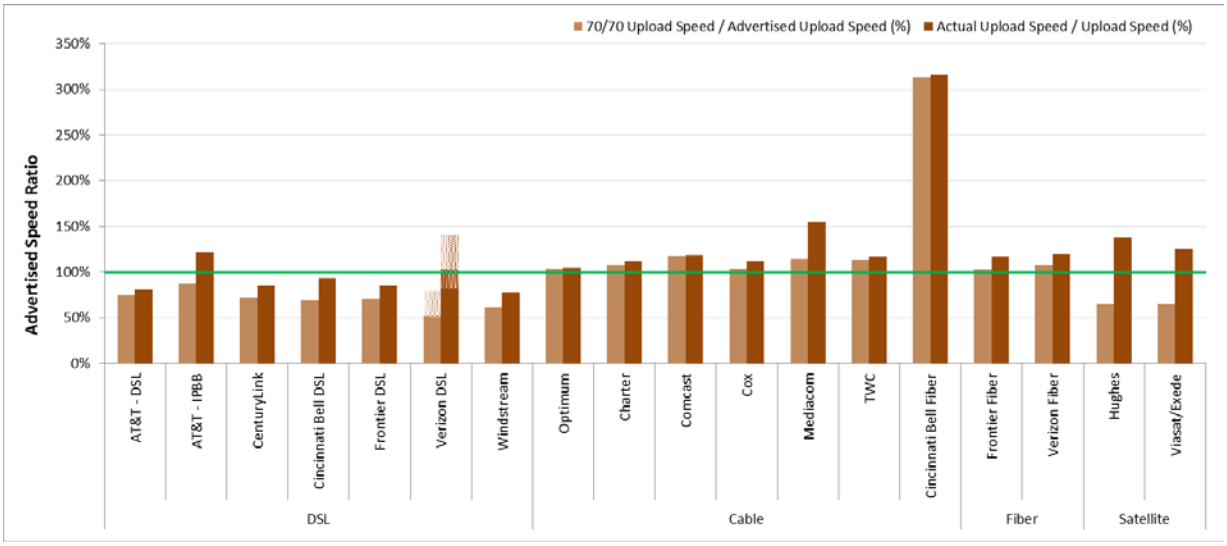


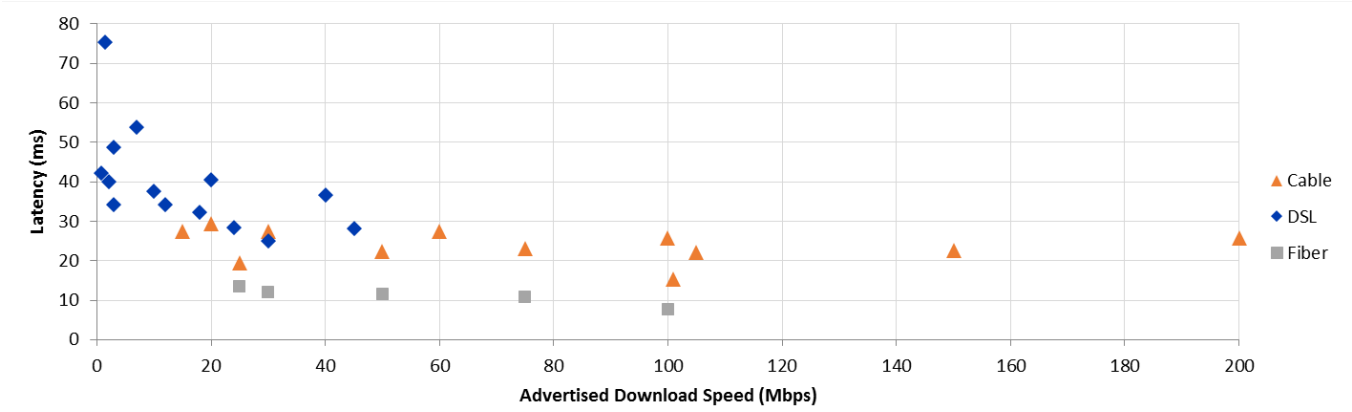
Chart 18.3: The ratio of 70/70 consistent upload speed to advertised upload speed.



D. Latency

Chart 19 below shows the weighted median latency, by technology and by advertised download speed for terrestrial technologies. For a given technology, latency varies little with advertised download speed. DSL service has typically higher latency than cable and fiber.

Chart 19: Latency for Terrestrial ISPs, by technology and by advertised download speed.



5. ADDITIONAL TEST RESULTS

A. Actual Speed, By Service Tier

As shown in Charts 20.1-20.6, peak usage period performance varied by service tier among participating ISPs during the September 2016 period. On average, during peak periods, the ratio of median download speed to advertised download speed for all ISPs was 66% or better, and 90% or better for most ISPs. However, the ratio of median download speed to advertised download speed varies among service tiers. It should be noted that for Verizon-DSL, which advertises a range of speeds, we have calculated a range of values corresponding to its advertised range.

Chart 20.1: The ratio of median download speed to advertised download speed, by ISP (0-5 Mbps).

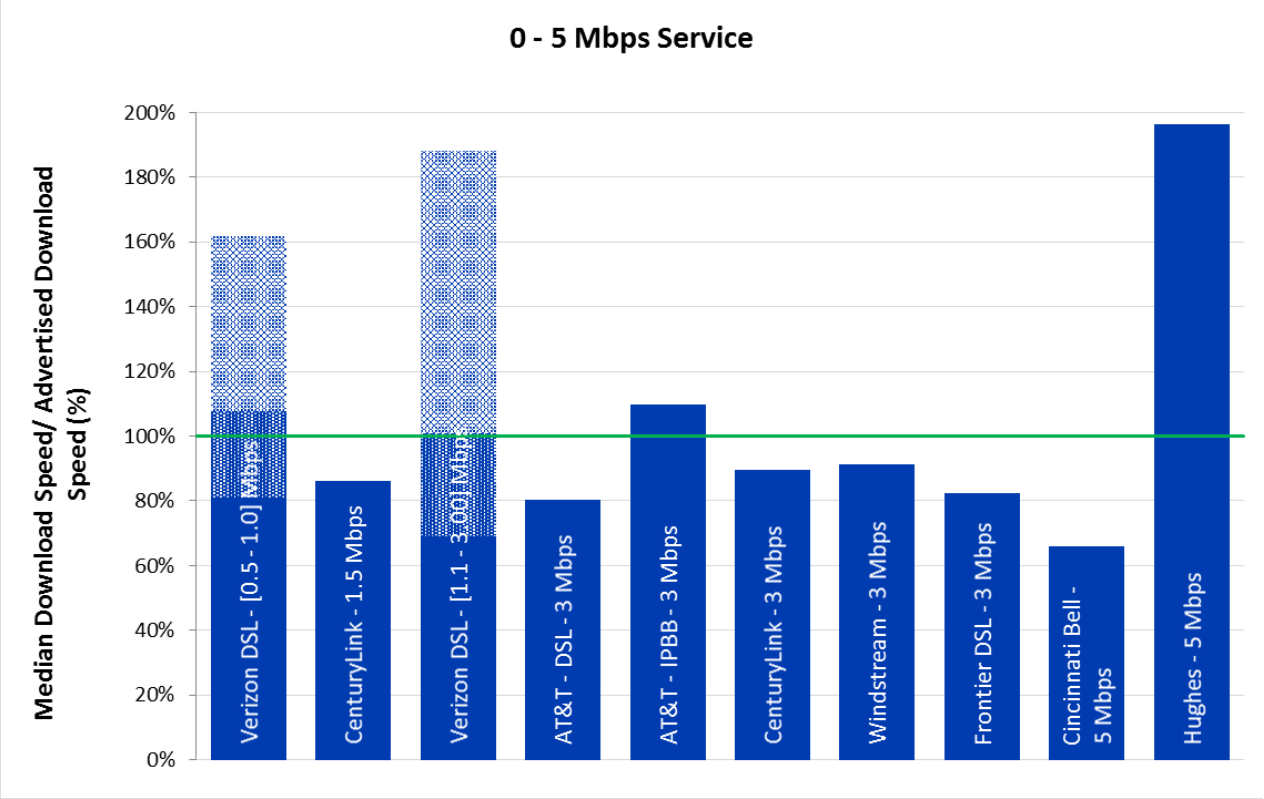


Chart 20.2: The ratio of median download speed to advertised download speed, by ISP (6-10 Mbps).

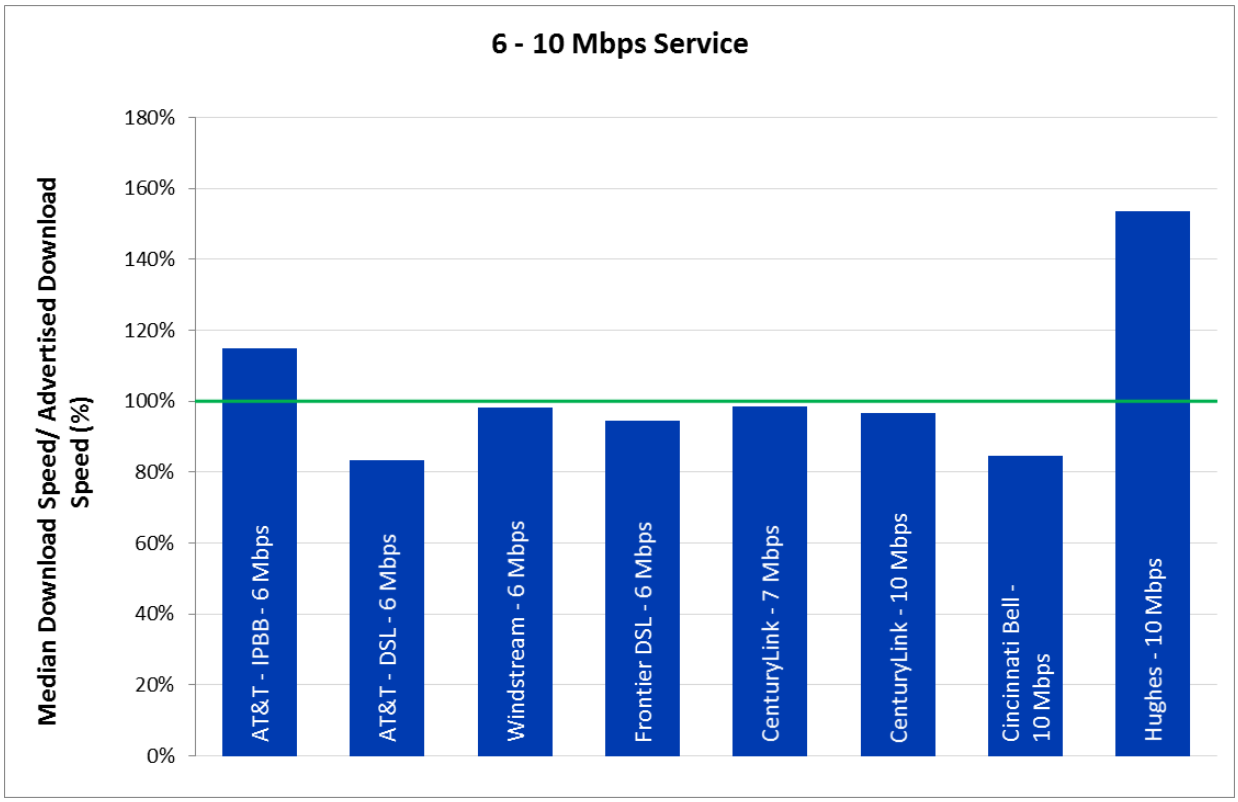


Chart 20.3: The ratio of median download speed to advertised download speed, by ISP (12-15 Mbps).

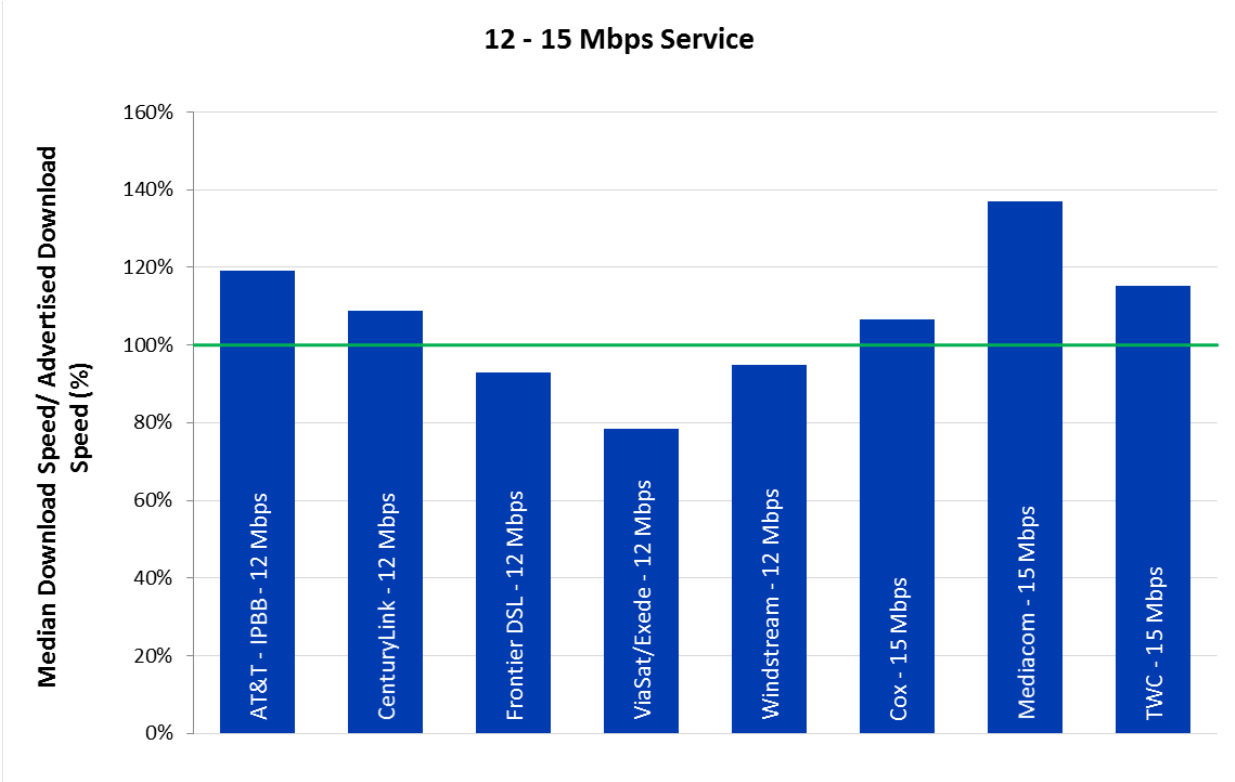


Chart 20.4: The ratio of median download speed to advertised download speed, by ISP (18-25 Mbps).

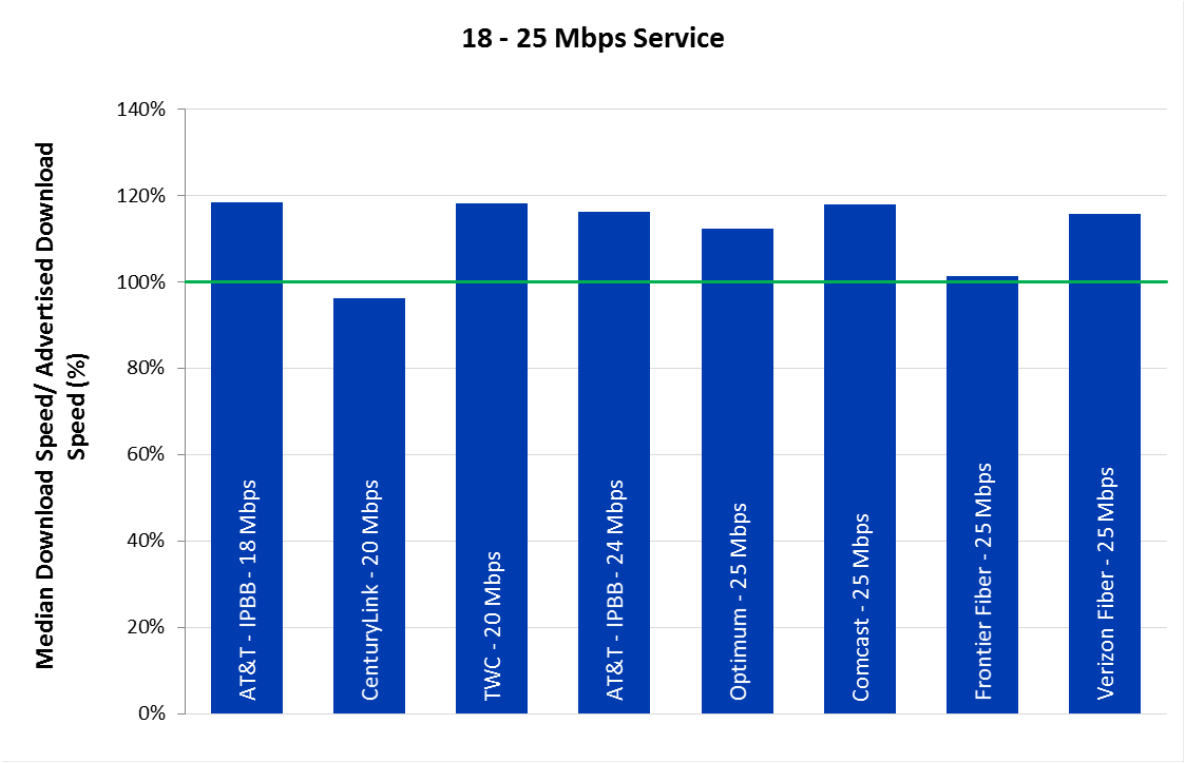


Chart 20.5: The ratio of median download speed to advertised download speed, by ISP (30-50 Mbps).

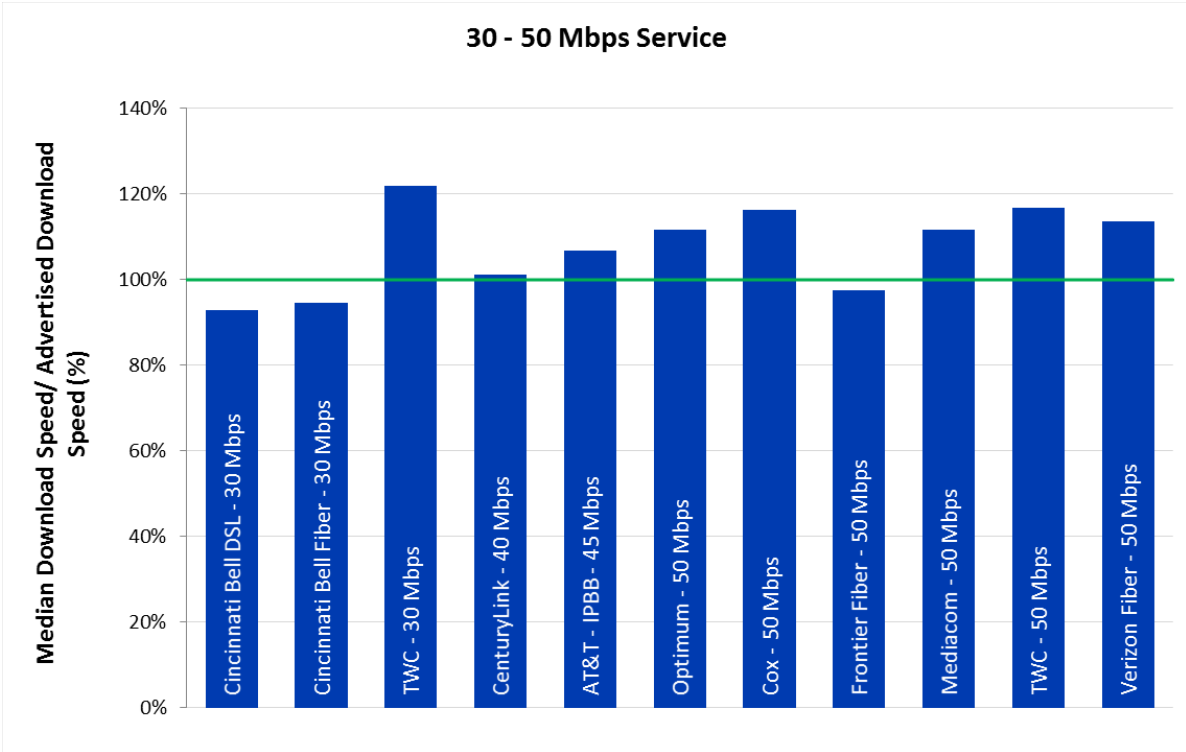
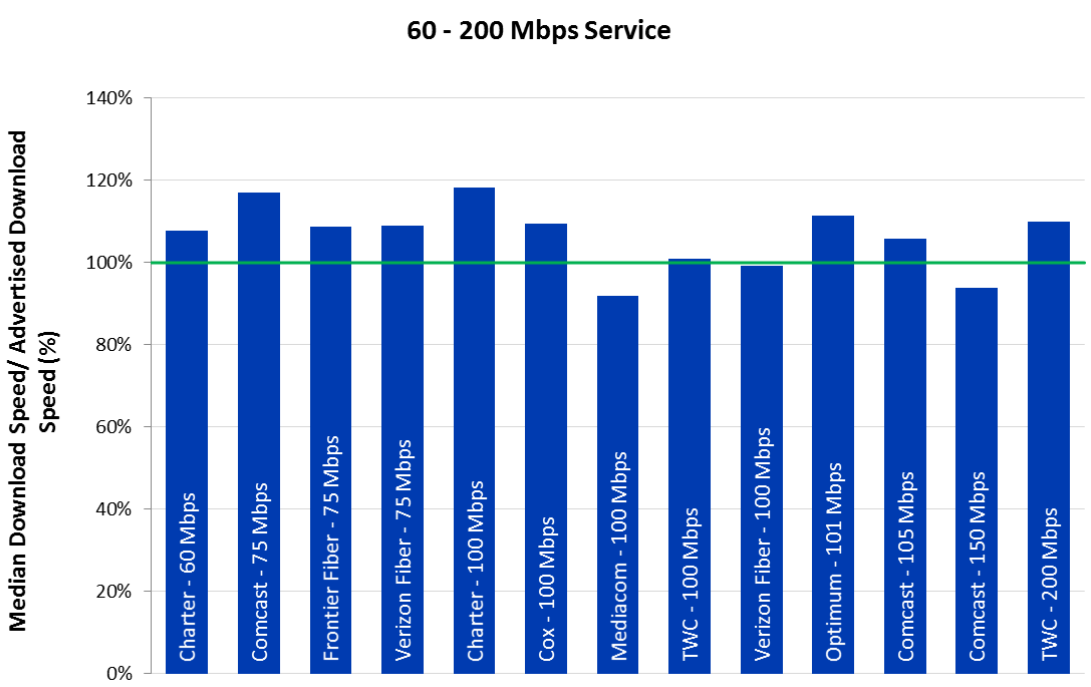


Chart 20.6: The ratio of median download speed to advertised download speed, by ISP (60-200 Mbps).



Charts 21.1 –21.5 depict the ratio of median upload speeds to advertised upload speeds for each ISP by service tier.

Chart 21.1: The ratio of median upload speed to advertised upload speed, by ISP (0.256-0.64 Mbps).

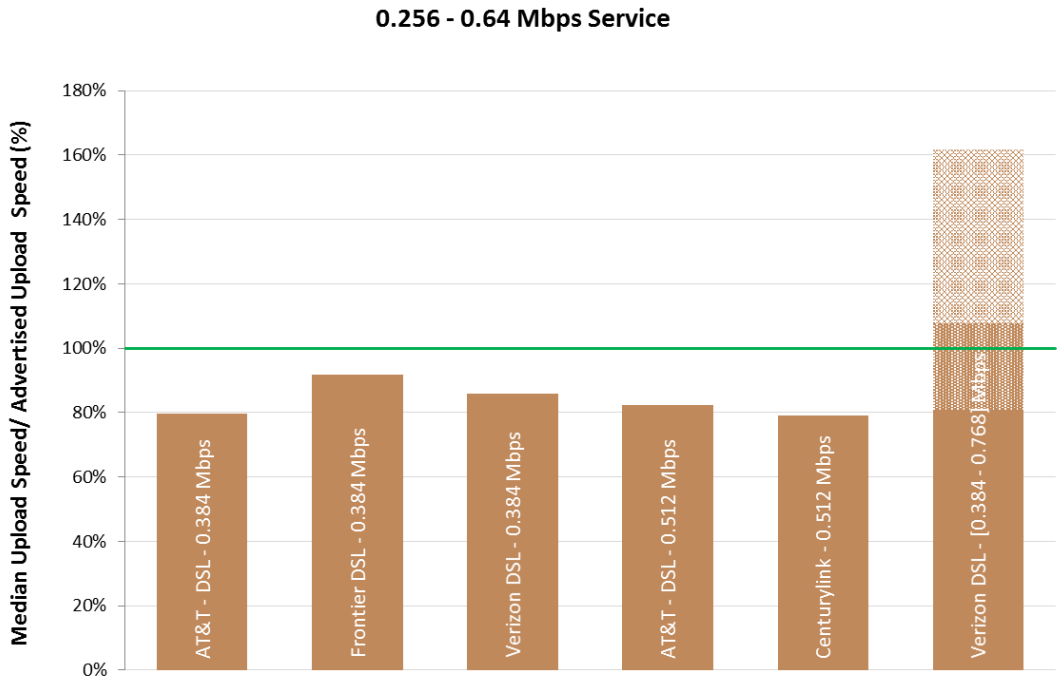


Chart 21.2: The ratio of median upload speed to advertised upload speed, by ISP (0.768-1.5 Mbps).

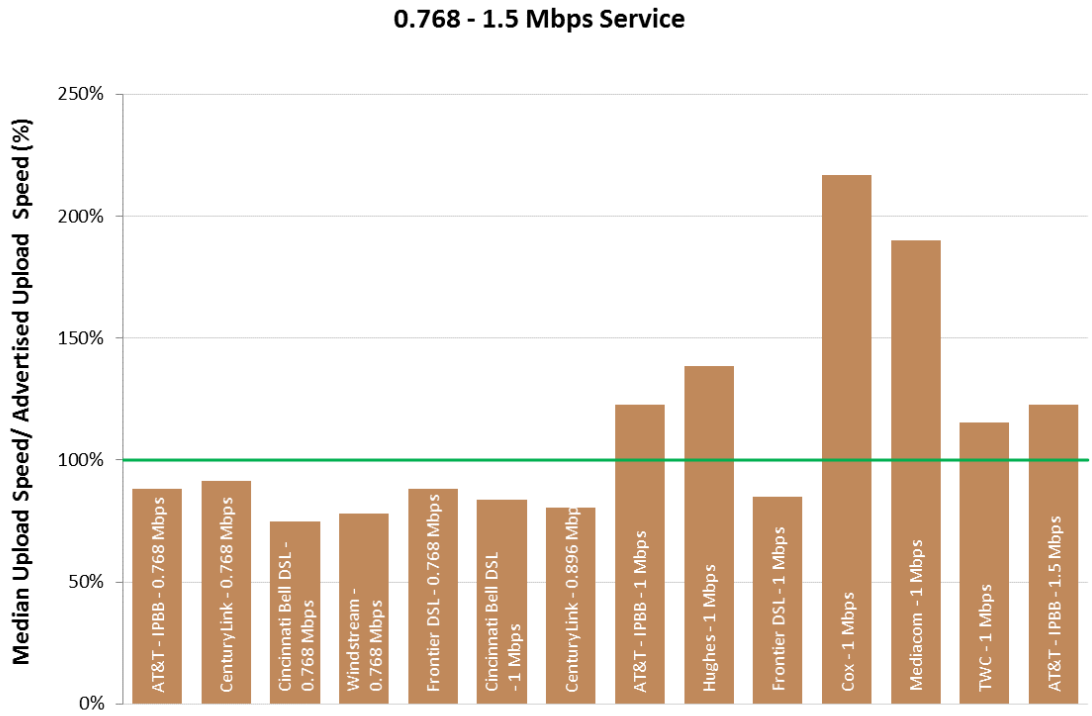


Chart 21.3: The ratio of median upload speed to advertised upload speed, by ISP (2-5 Mbps).

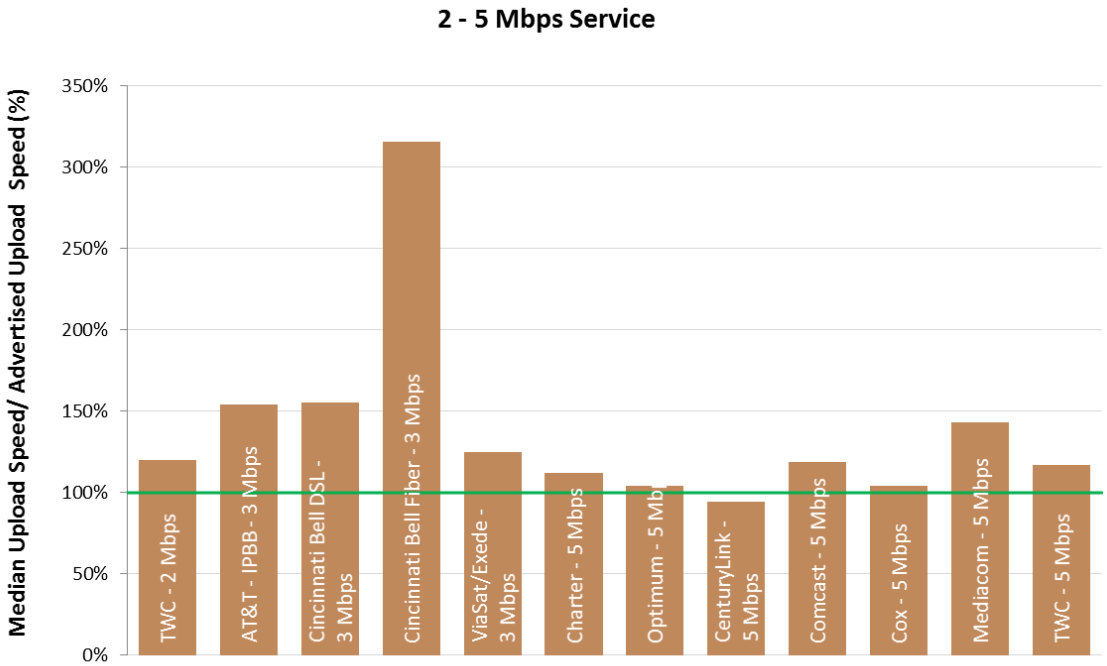


Chart 21.4: The ratio of median upload speed to advertised upload speed, by ISP (6-10 Mbps).

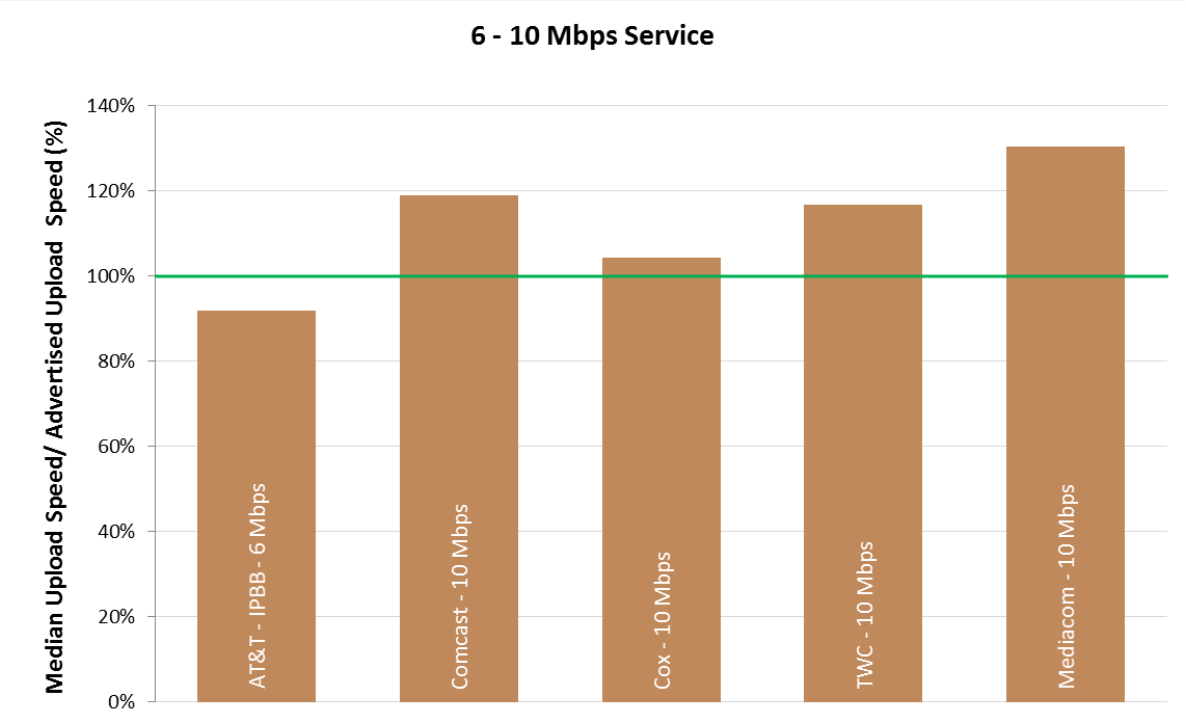


Chart 21.5: The ratio of median upload speed to advertised upload speed, by ISP (20-100 Mbps).

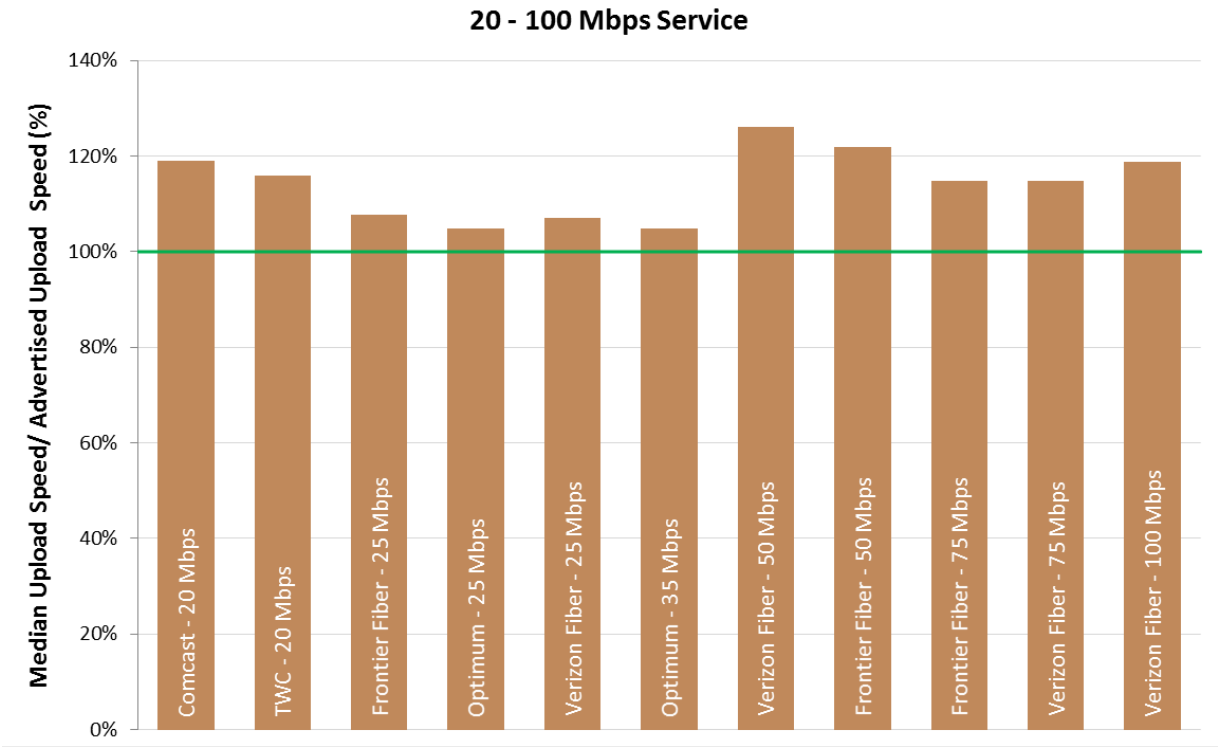


Table 2 lists the advertised download service tiers included in this study and compares this with the ISP's median download speed results. As in past reports, we note that the download speeds listed here are based on national averages and may not represent the performance experienced by any particular consumer at any given time or place.

Table 2: Peak period median download speed, sorted by actual download speed

Download Median Speed (Mbps)	Advertised Download Speed (Mbps)	ISP	Actual Speed / Advertised Speed (%)
0.81	0.5 - 1	Verizon DSL	81 - 162
2.07	1.1 - 3	Verizon DSL	69 - 188
1.29	1.5	CenturyLink	86
2.41	3	AT&T DSL	80
3.29	3	AT&T IPBB	110
2.68	3	CenturyLink	89
2.74	3	Windstream	91
2.48	3	Frontier DSL	82
3.30	5	Cincinnati Bell DSL	66
9.81	5	Hughes	196
5.00	6	AT&T DSL	83
6.90	6	AT&T IPBB	115
5.89	6	Windstream	98
5.67	6	Frontier DSL	94
6.89	7	CenturyLink	98
9.66	10	CenturyLink	97
8.47	10	Cincinnati Bell DSL	85
15.35	10	Hughes	154
14.31	12	AT&T IPBB	119
13.06	12	CenturyLink	109
11.15	12	Frontier DSL	93
9.40	12	ViaSat	78
11.38	12	Windstream	95
15.98	15	Cox	107
20.54	15	Mediacom	137
17.30	15	TWC	116
21.29	18	AT&T IPBB	118
19.22	20	CenturyLink	96
23.62	20	TWC	118
27.87	24	AT&T IPBB	116
28.07	25	Optimum	112
29.49	25	Comcast	118
25.32	25	Frontier Fiber	101

28.90	25	Verizon Fiber	116
27.89	30	Cincinnati Bell DSL	93
28.40	30	Cincinnati Bell Fiber	95
36.61	30	TWC	122
40.52	40	CenturyLink	101
48.05	45	AT&T IPBB	107
55.89	50	Optimum	112
58.16	50	Cox	116
48.77	50	Frontier Fiber	98
55.79	50	Mediacom	112
58.35	50	TWC	117
56.81	50	Verizon Fiber	114
64.67	60	Charter	108
87.74	75	Comcast	117
81.65	75	Frontier Fiber	109
81.81	75	Verizon Fiber	109
118.29	100	Charter	118
109.45	100	Cox	109
91.81	100	Mediacom	92
100.90	100	TWC	101
99.31	100	Verizon Fiber	99
112.66	101	Optimum	112
111.08	105	Comcast	106
140.72	150	Comcast	94

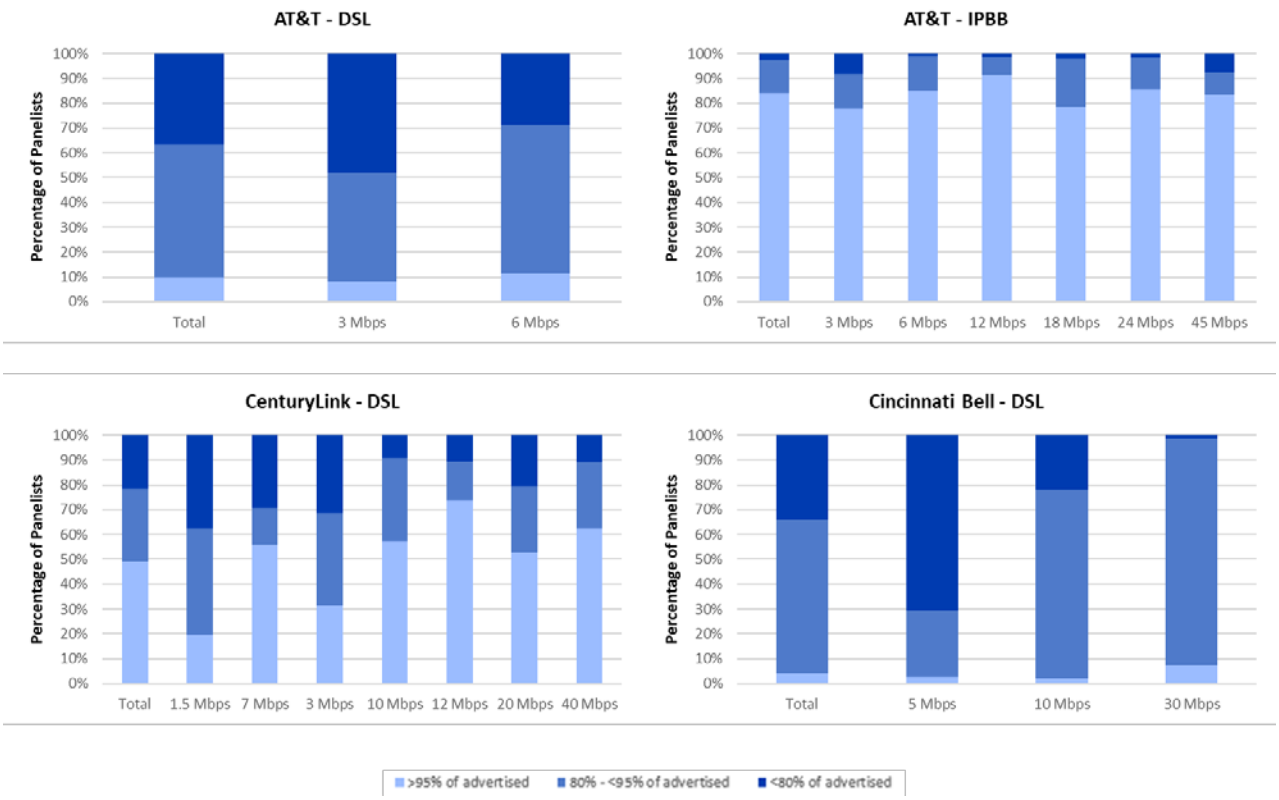
B. Variations In Speed

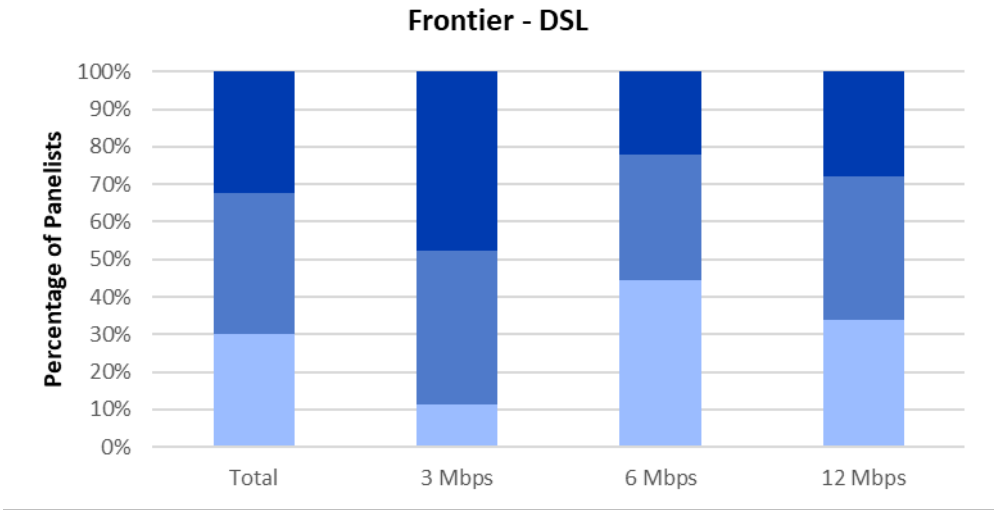
In Section 3.C above, we presented speed consistency metrics for each ISP based on test results averaged across all service tiers. In this section, we provide detailed results for each individual service tier for each ISP. Consistency of speed is important for services such as video streaming. A significant reduction in speed for more than a few seconds can force a reduction in video resolution or an intermittent loss of service.

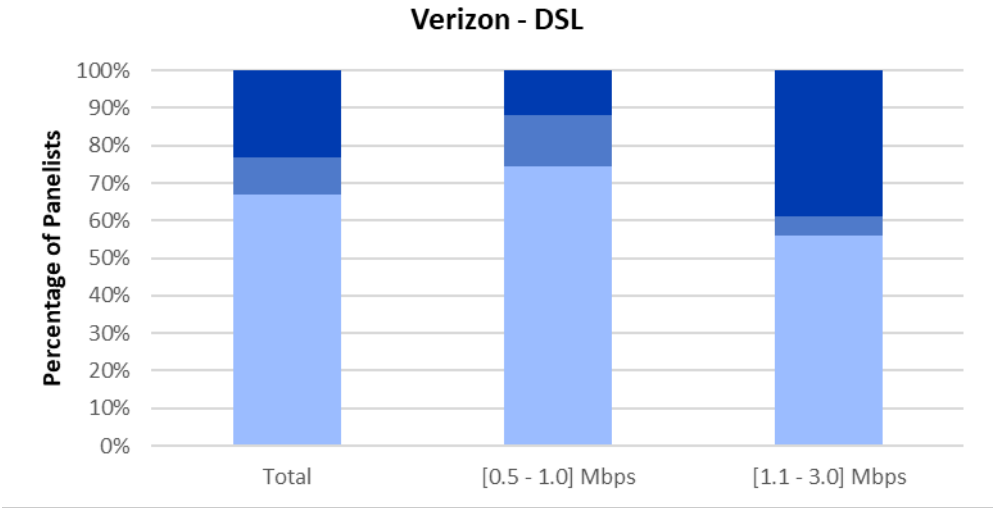
Charts 22.1 – 22.3 below show the percentage of consumers that achieved greater than 95%, between 85% and 95%, or less than 80% of the advertised download speed for each ISP speed tier. Consistent with past performance, ViaSat/Exede showed low consistency of speed with 52% of consumers experiencing an average service speed of 80% or less of advertised speed. ISPs using DSL technology also frequently fail to deliver advertised service rates. ISPs quote a single 'up-to' speed, but the actual speed of DSL depends on the distance between the subscriber and the serving central office.

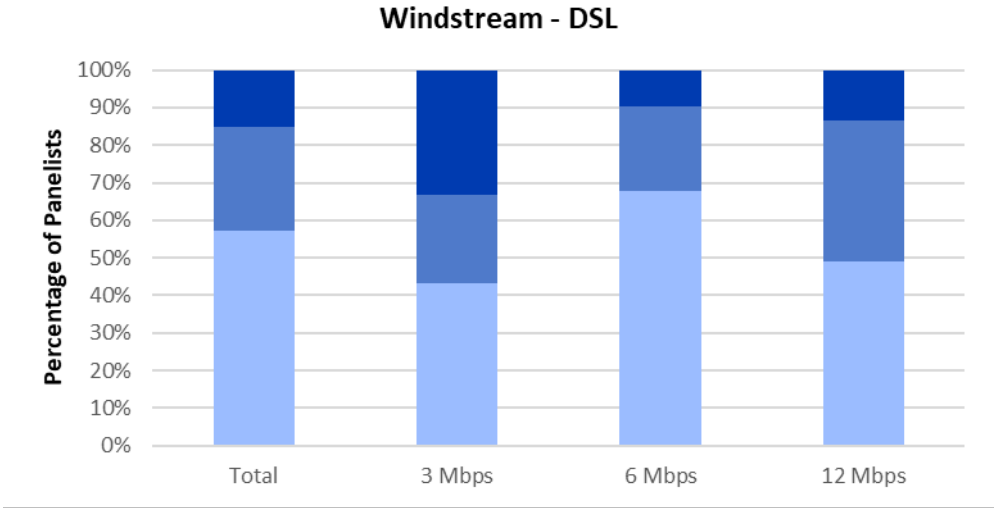
Cable companies, in general, show a high consistency of speed. However, tiers of 100 Mbps and above appear to provide a somewhat lower level of consistency. Fiber-based systems, in general, offer a high level of consistency of speed.

Chart 22.1: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed, by service tier (DSL).


AT&T - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
3 Mbps
6 Mbps
AT&T - IPBB
Total
3 Mbps
6 Mbps
12 Mbps
18 Mbps
24 Mbps
45 Mbps
CenturyLink - DSL
Total
1.5 Mbps
7 Mbps
3 Mbps
10 Mbps
12 Mbps
20 Mbps
40 Mbps
Cincinnati Bell - DSL
Total
5 Mbps
10 Mbps
30 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised


Frontier - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
3 Mbps
6 Mbps
12 Mbps


Verizon - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
[0.5 - 1.0] Mbps
[1.1 - 3.0] Mbps


Windstream - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
3 Mbps
6 Mbps
12 Mbps


>95% of advertised
80% - <95% of advertised
<80% of advertised

Chart 22.2: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed (cable).

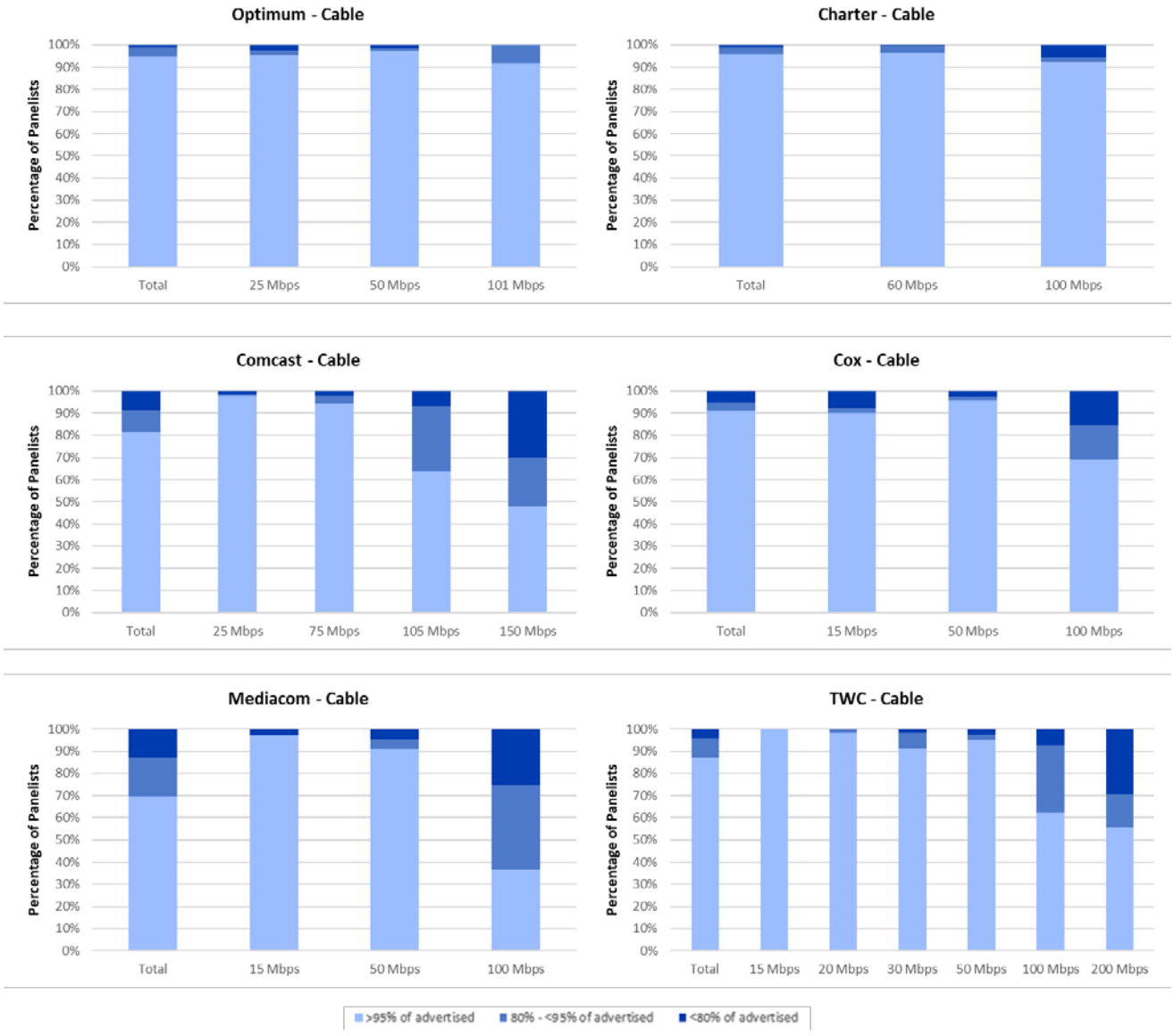
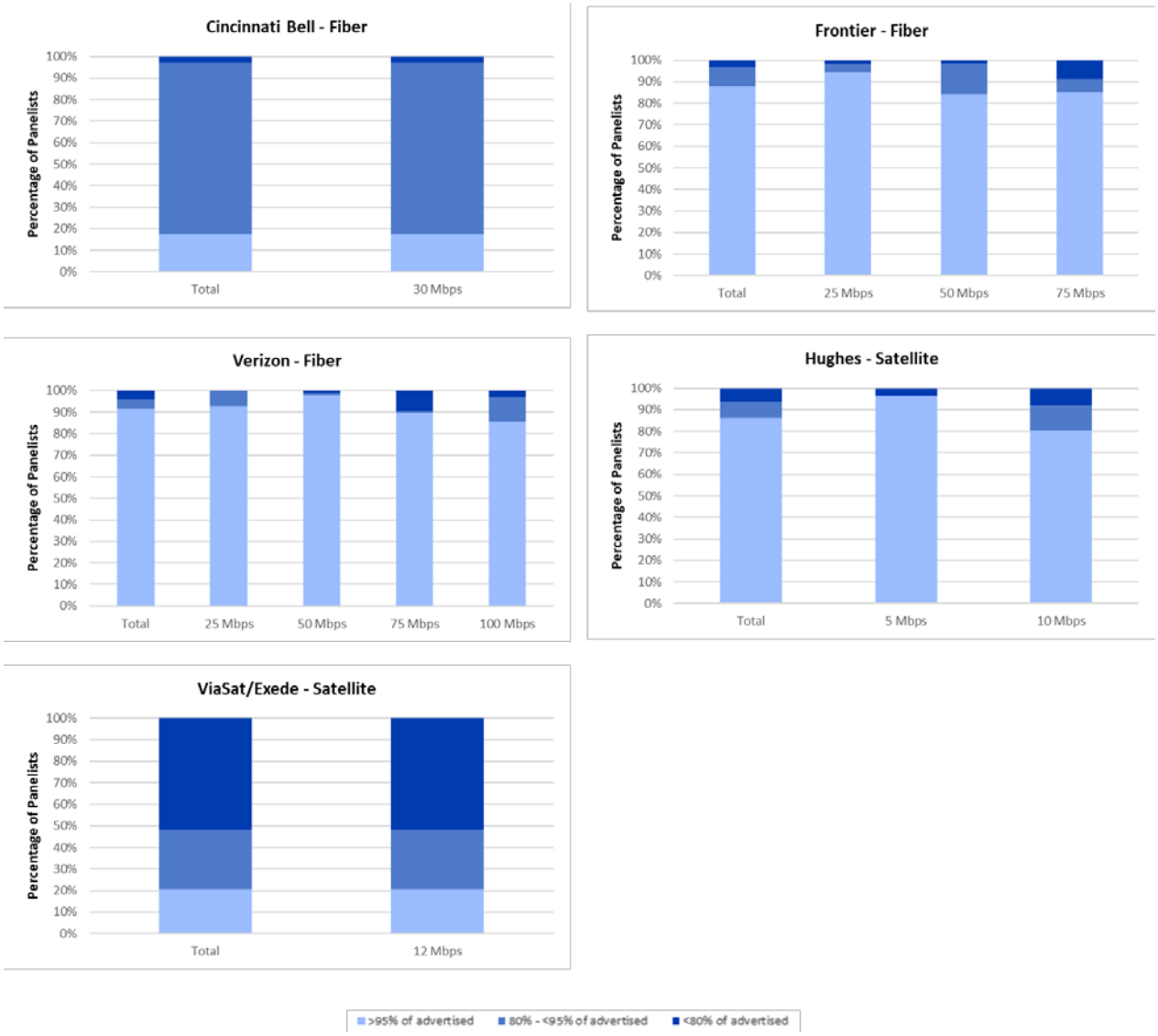
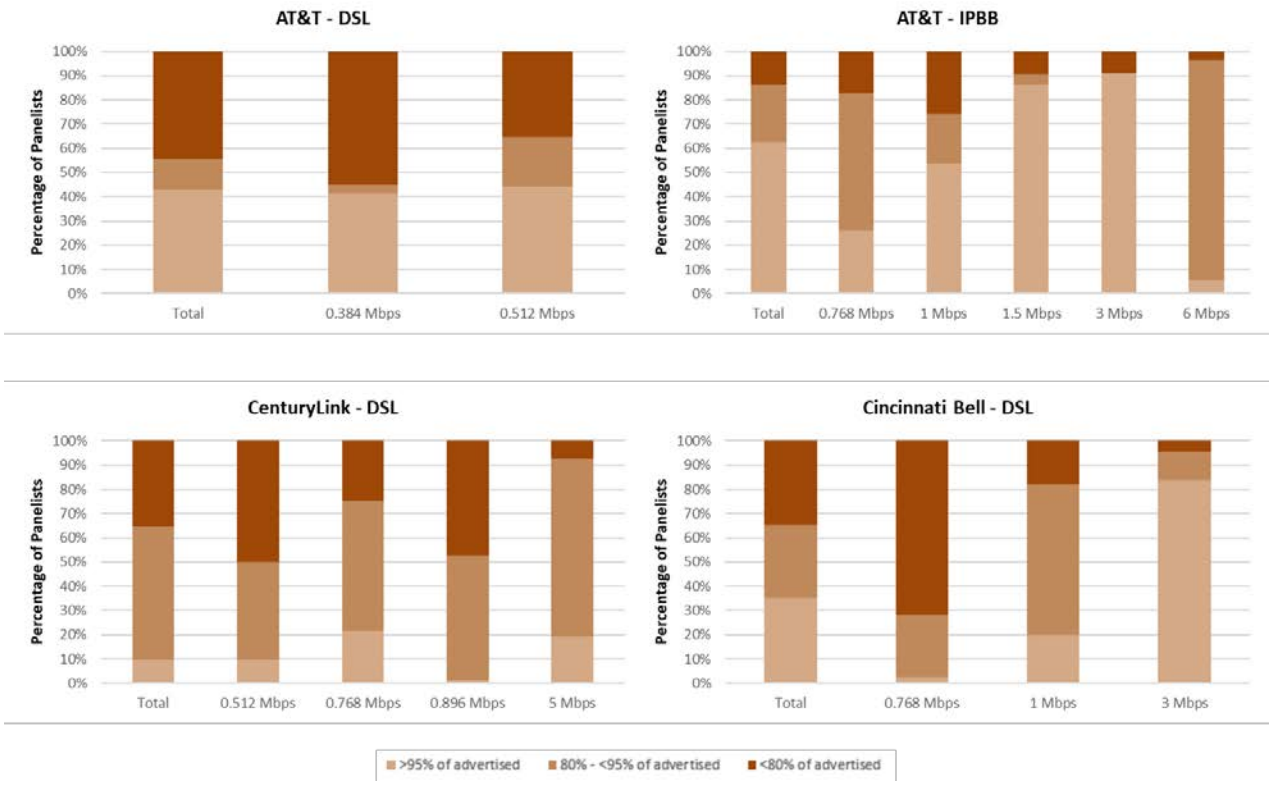


Chart 22.3: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed (fiber and satellite).



Similarly, Charts 23.1 to 23.3 show the percentage of consumers that achieved greater than 95%, between 85% and 95%, or less than 80% of the advertised upload speed for each ISP speed tier.

Chart 23.1: The percentage of consumers whose median upload speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised upload speed (DSL).



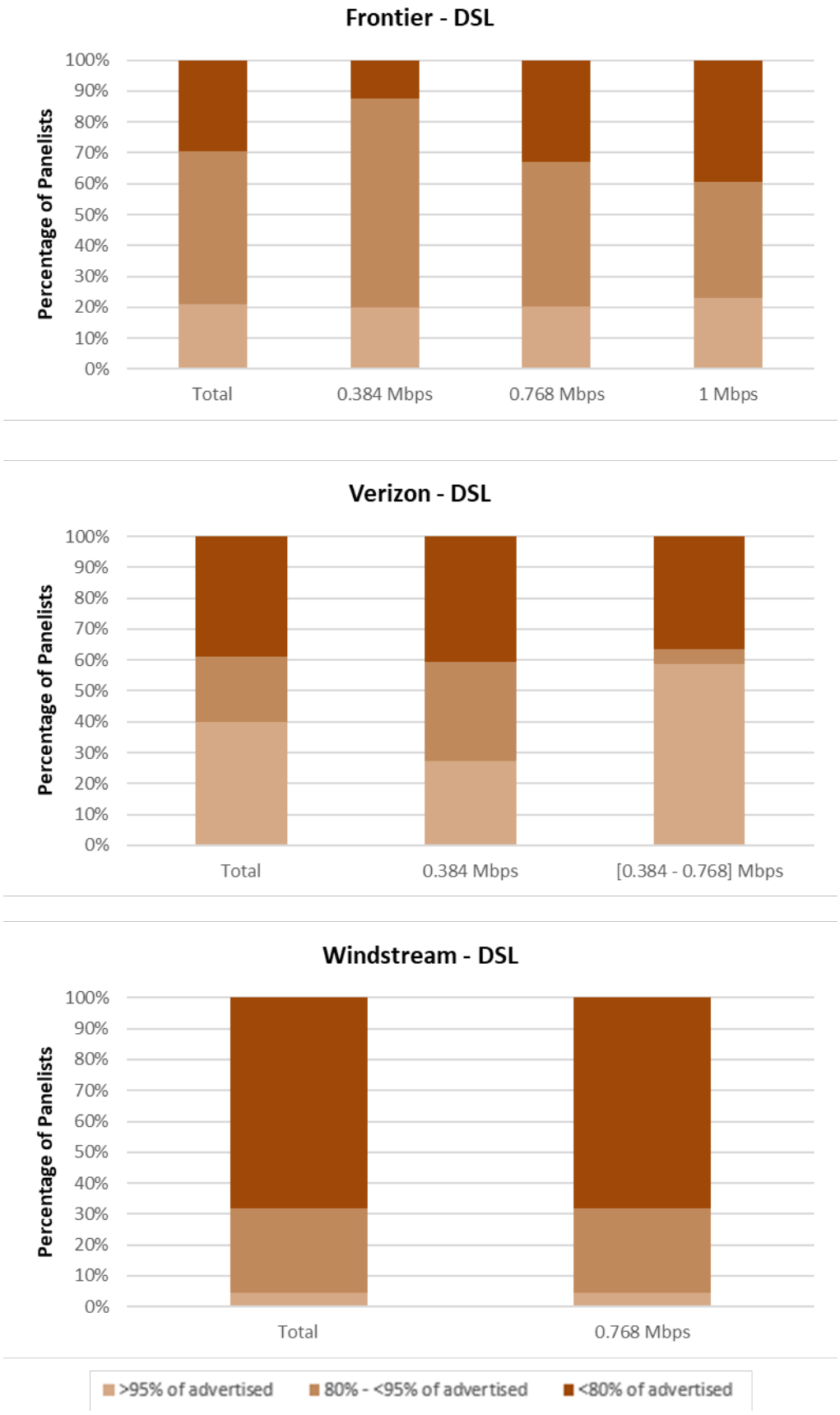

Frontier - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
0.384 Mbps
0.768 Mbps
1 Mbps
Verizon - DSL
Percentage of Panelists
Total
0.384 Mbps
[0.384 - 0.768] Mbps
Windstream - DSL
Percentage of Panelists
Total
0.768 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised

Chart 23.2: The percentage of consumers whose median upload speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised upload speed (cable).

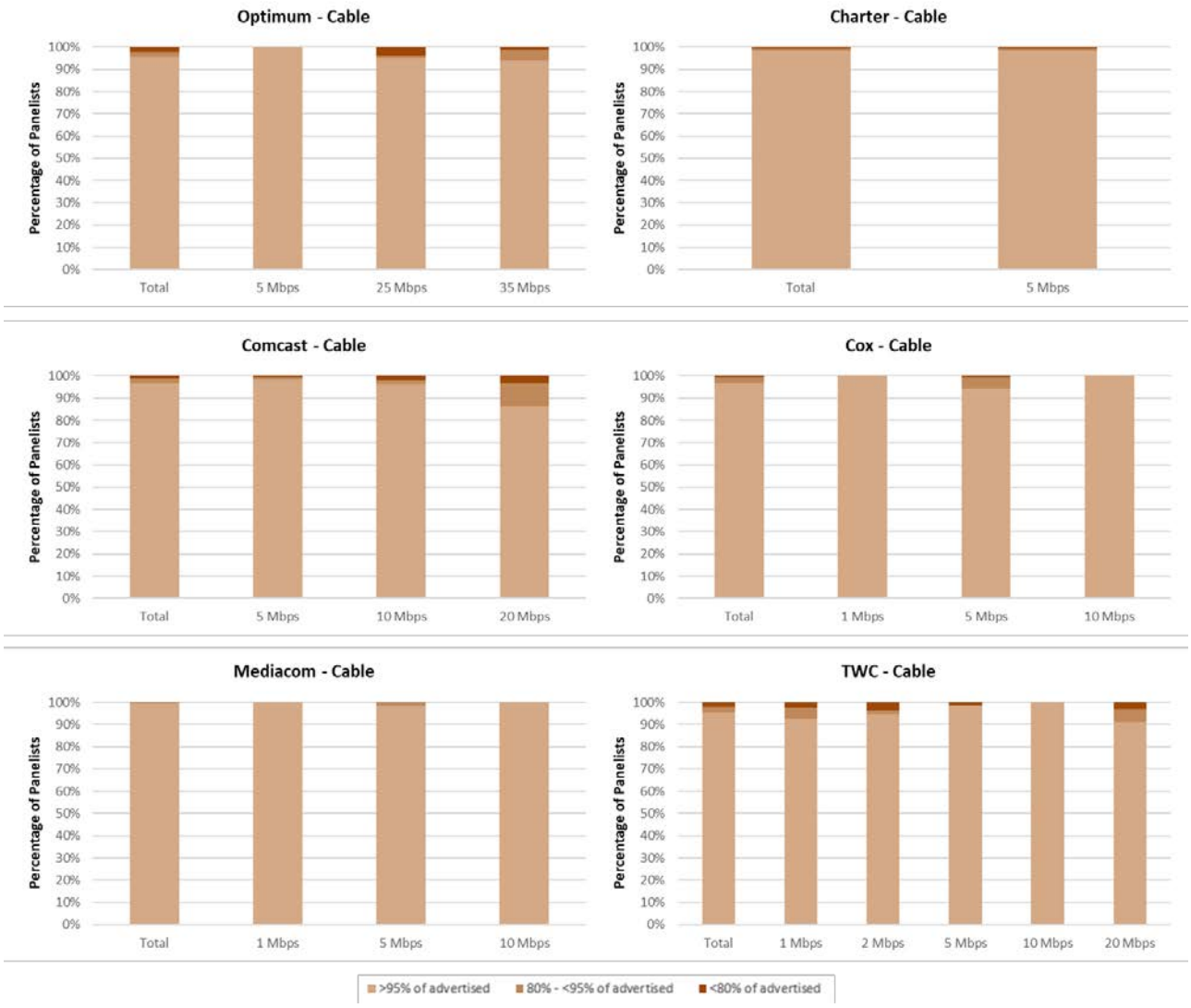
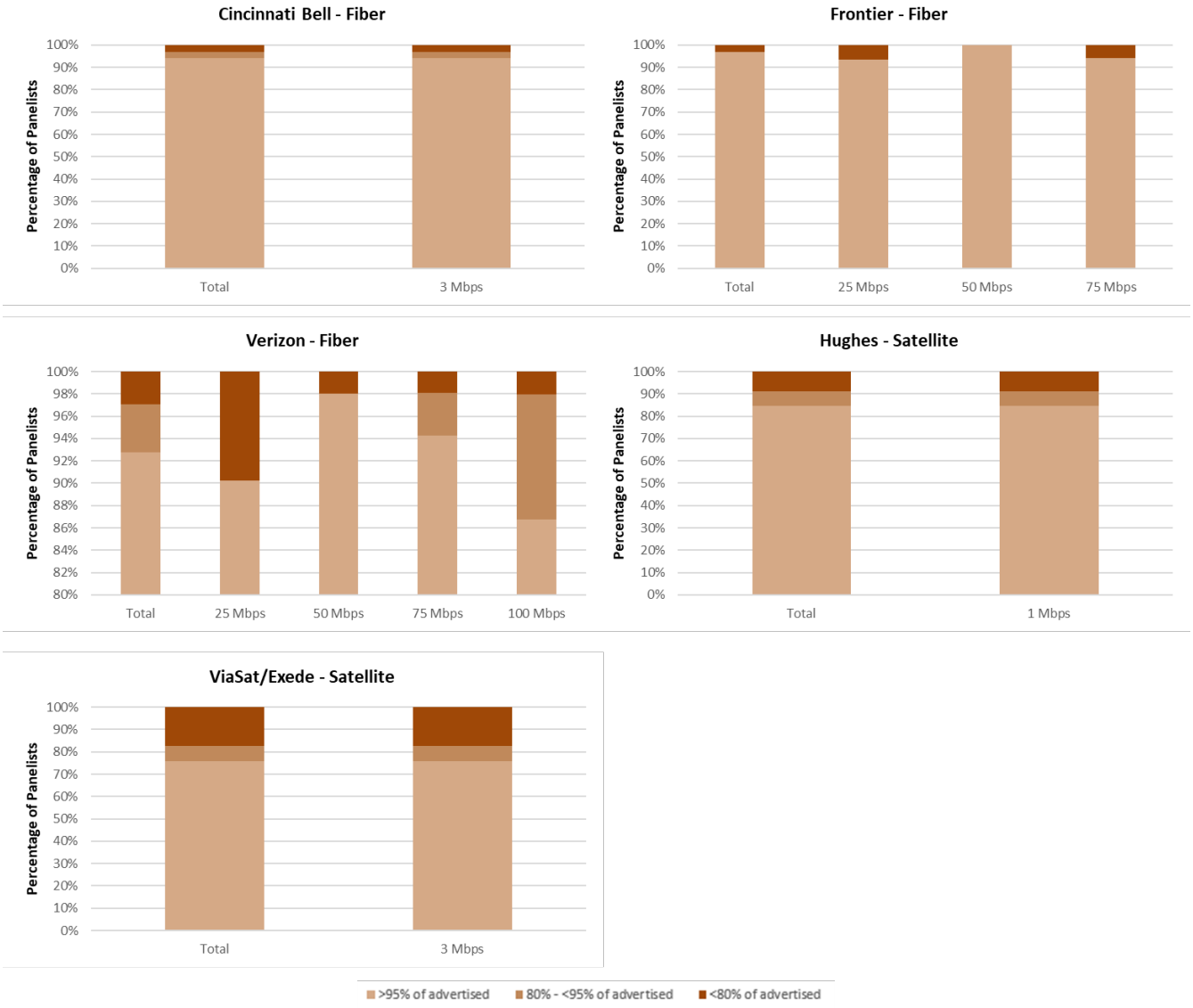


Chart 23.3: The percentage of consumers whose median upload speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised upload speed (fiber and satellite).



In Section 3.C above, we presented complementary cumulative distributions for each ISP based on test results across all service tiers. Below, we provide tables showing selected points on these distributions by each individual ISP and technology. Overall, performance depends less on a specific technology and more on the engineering and marketing choices made by each provider. For example, Optimum and Charter, which are cable-based companies, provided average download speeds over 95% and 96%, respectively, of advertised rates to 95% of their panelists. Cox and Mediacom, also cable-based companies, provided median speeds of at least 79% and 59% of advertised speed to 95% of their panelists. Verizon's fiber-based service provided speeds of 88% or better to 95% of its panelists whereas Frontier Fiber provided speeds of 91% or better to 95% of its panelists.

Table 3: Complementary cumulative distribution of the ratio of median download speed to advertised download speed, by technology, by ISP

ISP	20%	50%	70%	80%	90%	95%
AT&T - DSL	90%	83%	77%	74%	70%	64%
AT&T - IPBB	124%	112%	105%	99%	90%	83%
CenturyLink	109%	95%	85%	79%	72%	60%
Cincinnati Bell Fiber	95%	95%	94%	94%	92%	89%
Cincinnati Bell DSL	93%	85%	77%	64%	37%	25%
Charter	109%	108%	107%	105%	102%	96%
Comcast	119%	116%	109%	98%	82%	62%
Cox	119%	114%	107%	106%	96%	79%
Frontier Fiber	111%	101%	98%	96%	94%	91%
Hughes	212%	165%	136%	121%	88%	70%
Frontier DSL	97%	89%	80%	73%	51%	38%
Mediacom	115%	109%	95%	89%	74%	59%
Optimum	113%	112%	110%	109%	104%	95%
TWC	122%	116%	113%	108%	92%	82%
Verizon Fiber	114%	109%	100%	99%	96%	88%
Verizon DSL	123%	108%	92%	75%	53%	47%
ViaSat/Exede	94%	78%	66%	61%	54%	43%
Windstream	101%	97%	90%	85%	73%	49%

Table 4: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed, by technology, by ISP

ISP	20%	50%	70%	80%	90%	95%
AT&T - DSL	114%	82%	78%	75%	67%	64%
AT&T - IPBB	140%	122%	92%	88%	68%	62%
Optimum	105%	105%	104%	103%	102%	98%
CenturyLink	94%	83%	78%	74%	66%	57%
Cincinnati Bell DSL	156%	83%	76%	73%	66%	56%
Cincinnati Bell Fiber	316%	316%	315%	314%	307%	135%
Charter	114%	112%	111%	109%	105%	101%
Comcast	119%	119%	118%	118%	116%	109%
Cox	116%	105%	104%	104%	103%	100%
Frontier Fiber	127%	118%	108%	103%	100%	97%
Hughes	178%	138%	121%	102%	85%	68%
Frontier DSL	96%	90%	80%	75%	57%	45%
Mediacom	187%	141%	129%	124%	115%	114%
Optimum	105%	105%	104%	103%	102%	98%
TWC	121%	117%	115%	113%	107%	96%
Verizon Fiber	124%	119%	115%	108%	98%	94%
Verizon DSL	108	89	68	58	29	17
ViaSat/Exede	152	125	101	84	78	70
Windstream	81	78	70	67	61	57

C. Web Browsing Performance, By Service Tier

Below, we provide the detailed results of the webpage download time for each individual service tier of each ISP. Generally, website loading time decreases steadily until the speed tier reaches 15 Mbps and does not change markedly above that.

Chart 24.1: Average webpage download time, by ISP (1-3 Mbps).

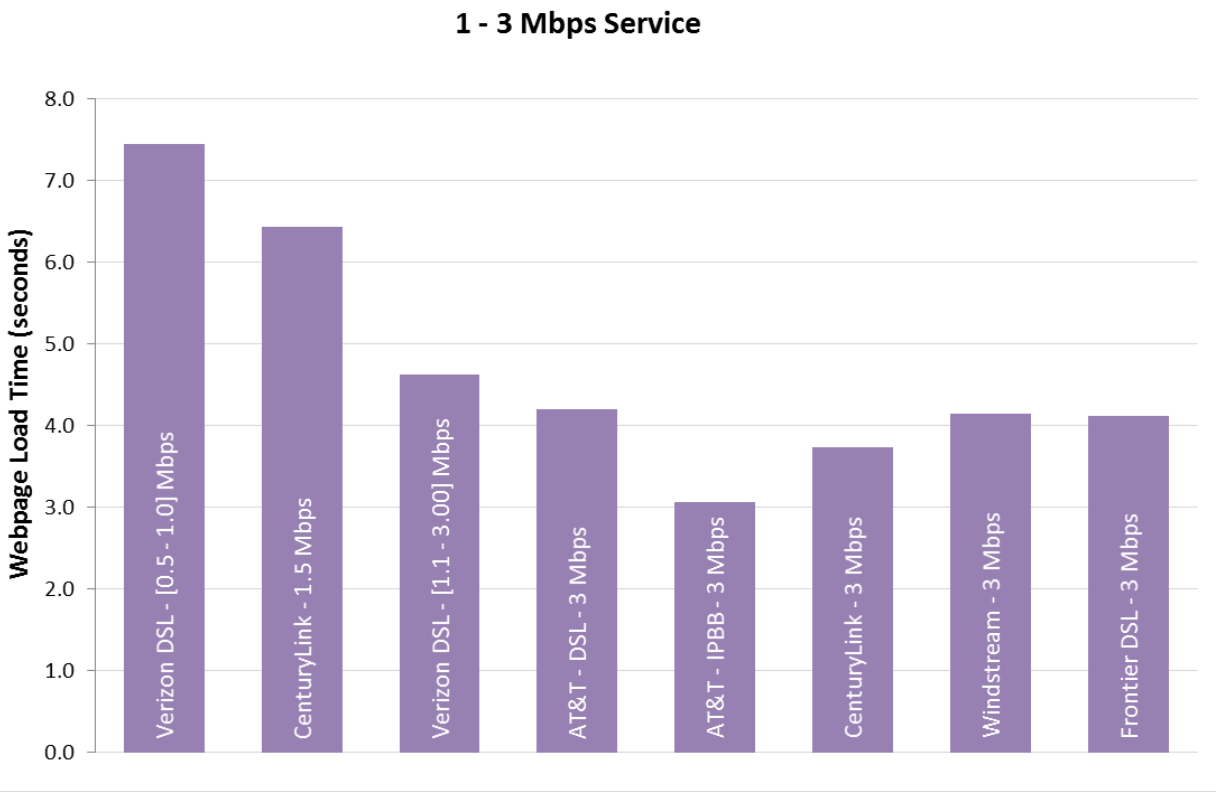


Chart 24.2: Average webpage download time, by ISP (5-10 Mbps),

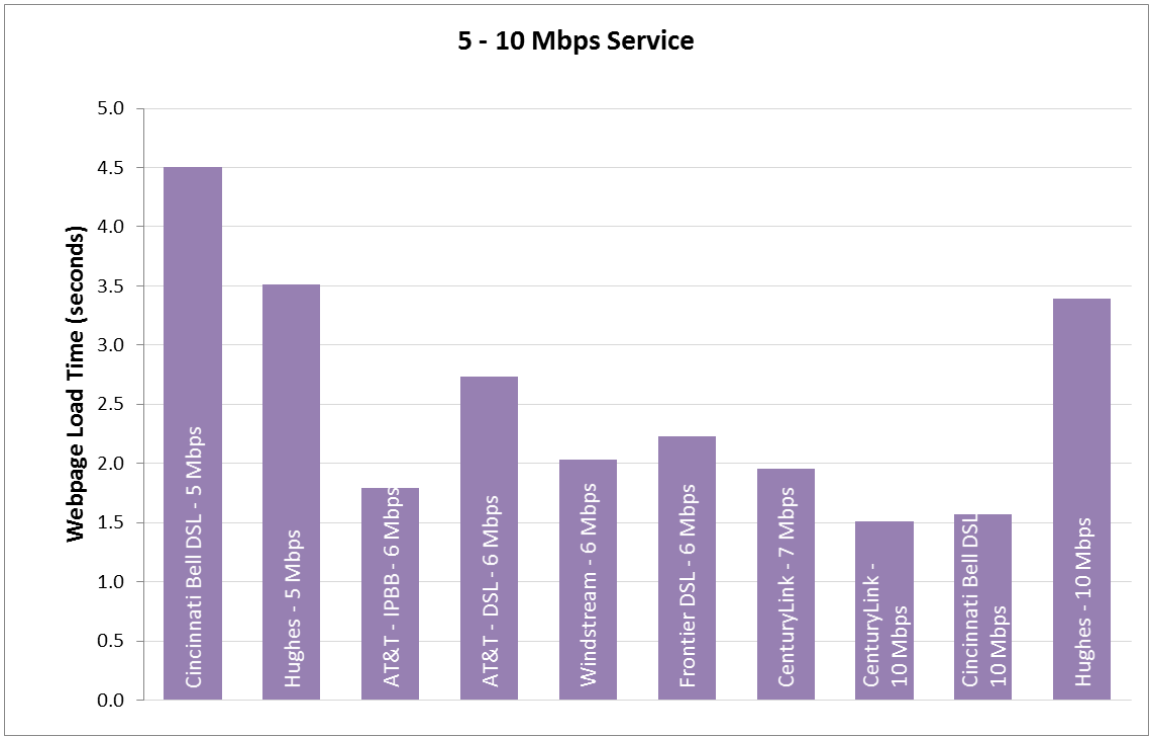


Chart 24.3: Average webpage download time, by ISP (12-15 Mbps).

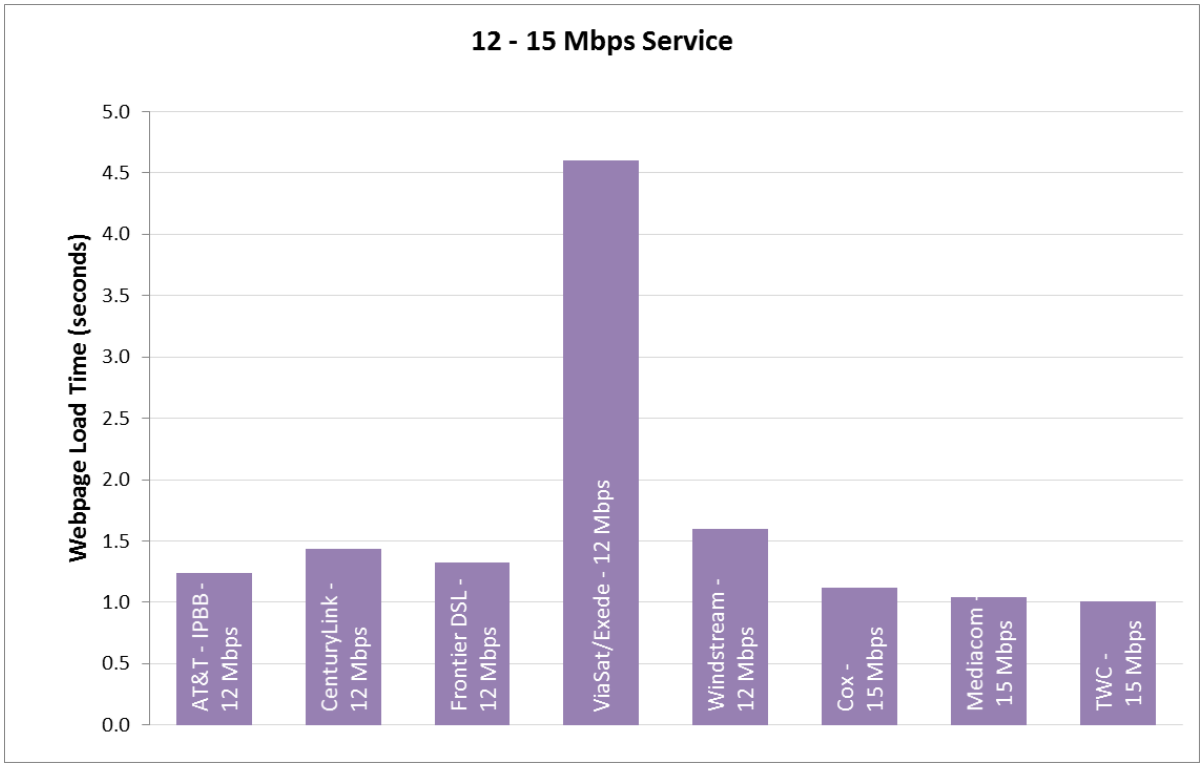


Chart 24.4: Average webpage download time, by ISP (18-25 Mbps).

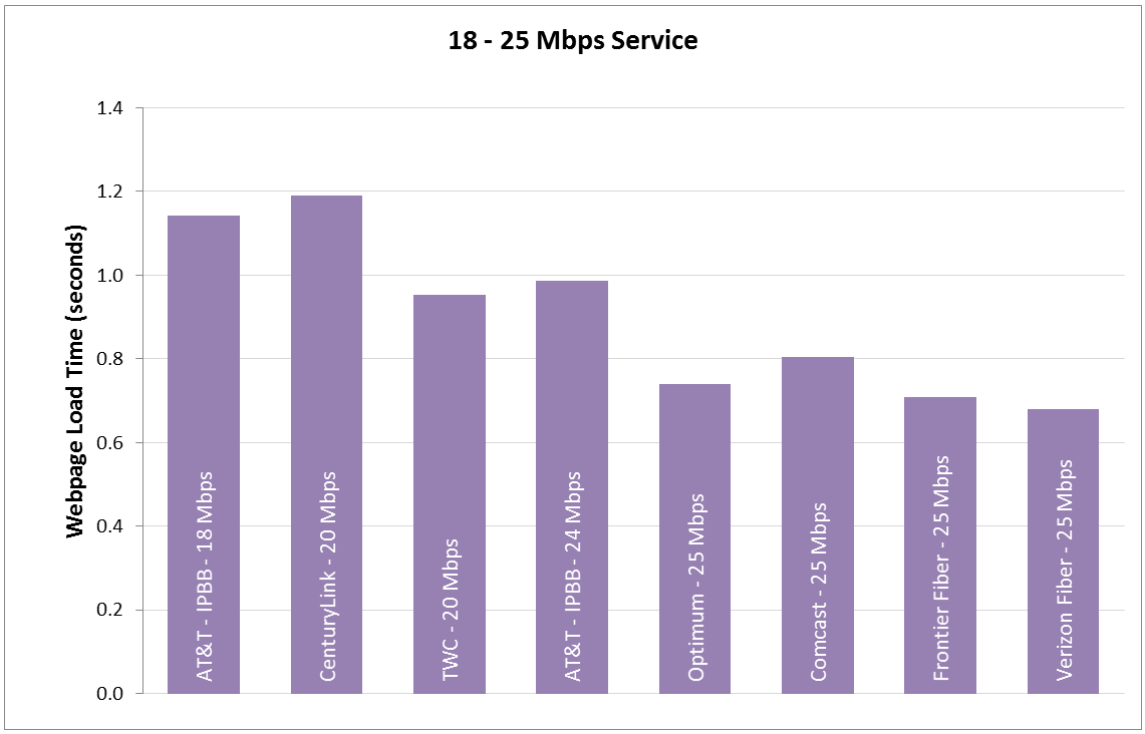


Chart 24.5: Average webpage download time, by ISP (30-50 Mbps).

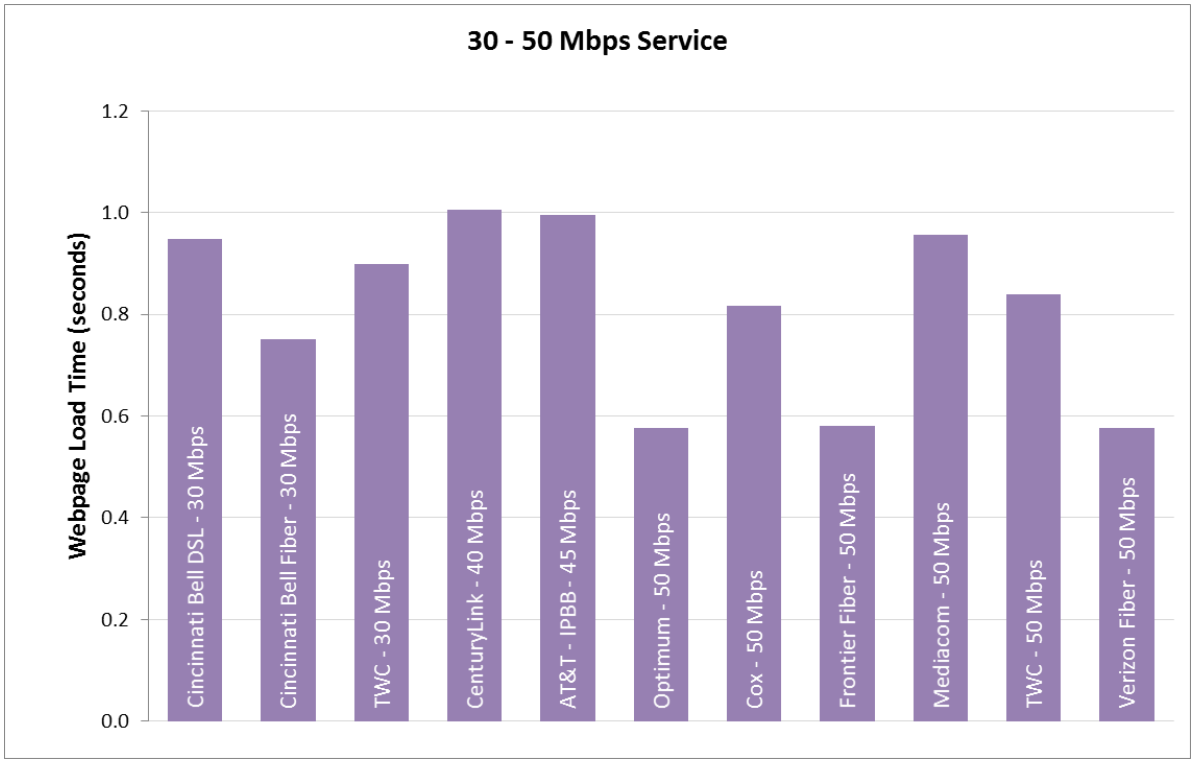
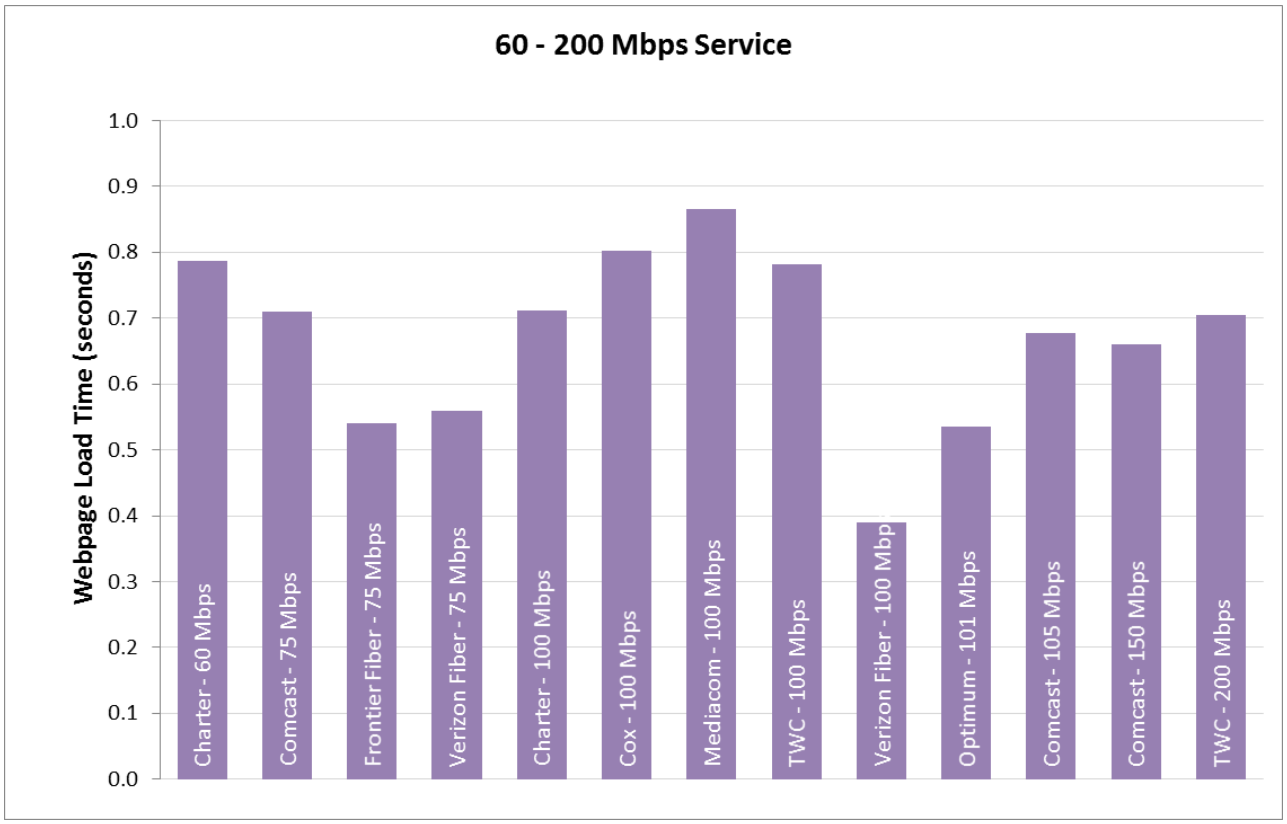


Chart 24.6: Average webpage download time, by ISP (60-200 Mbps).

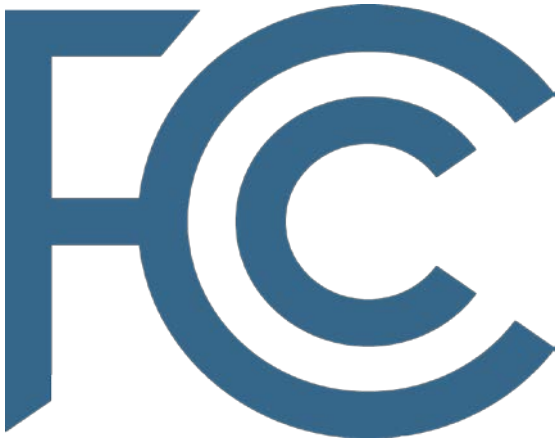


APPENDIX F-1.1

Technical Appendix to the Seventh MBA Report

Measuring Broadband America Fixed Broadband

A Report on Consumer Fixed Broadband Performance in the U.S.



FCC's Office of Engineering and Technology

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A.

V. 1 – INTRODUCTION AND SUMMARY

This Appendix to the Seventh Measuring Broadband America Report, a Report on Consumer Wireline Broadband Performance in the United States, provides detailed technical background information on the methodology that produced the Report. It covers the process by which the panel of consumer participants was originally recruited and selected for the August 2011 MBA Report, and then maintained over the last seven years. This Appendix also discusses the testing methodology used for the Report and describes how the test data was analyzed.

VI. 2 - PANEL CONSTRUCTION

This section describes the background of the study, as well as the methods employed to design the target panel, select volunteers for participation, and manage the panel to maintain the operational goals of the program.

The study aims to measure fixed broadband service performance in the United States as delivered by an Internet Service Provider (ISP) to the consumer's broadband modem. Many factors contribute to end-to-end broadband performance, only some of which are under the control of the consumer's ISP. The methodology outlined here is focused on the measurement of broadband performance within the scope of an ISP's network, and specifically focuses on measuring performance from the consumer Internet access point, or consumer gateway, to a close major Internet gateway point. The actual quality of experience seen by consumers depends on many other factors beyond the consumer's ISP, including the performance of the consumer's in-home network, the Internet backbone, interconnection points, content distribution networks (CDN) and the infrastructure deployed by the providers of content and services. The design of the study methodology allows it to be integrated with other technical measurement approaches that, in the future, could focus on other aspects of broadband performance.

A. 2.1 - USE OF AN ALL VOLUNTEER PANEL

During a 2008 residential broadband speed and performance test in the United Kingdom[1], SamKnows[2] determined that attrition rates of an all-volunteer panel was lower than a panel maintained with an incentive scheme of monthly payments. Consequently, in designing the methodology for this broadband performance study, the Commission relied entirely on volunteer consumer broadband subscribers. The volunteers were selected from a large pool of prospective participants according to a plan designed to generate a representative sample of desired consumer demographics, including geographical location, ISP, and speed tier. As an incentive for participation, volunteers were given access to a personal reporting suite which allowed them to monitor the performance of their broadband service. They were also provided with a measurement device referred to in the study as a "Whitebox," configured to run custom SamKnows software.[3]

B. 2.2 - SAMPLE SIZE AND VOLUNTEER SELECTION

The 2016 study relied on data gathered from 4,545 volunteer panelists across the United States The methodological factors and considerations that influenced the selection of the sample size and makeup

[1] *See* **http://www.samknows.com/broadband/pm/PM_Summer_08.pdf,** (last accessed June 21, 2016).

[2] SamKnows is a company that specializes in broadband availability measurement and was retained under contract by the FCC to assist in this study. *See* **http://www.samknows.com/**

[3] The Whiteboxes are named after the appearance of the first hardware implementation. The Whiteboxes remain in consumer homes and continue to run the tests described in this report. Participants may remain in the measurement project as long as it continues, and may retain their Whitebox when they end their participation.

included:

- The panel of U.S. broadband subscribers was initially drawn from a pool of over 175,000 volunteers during a recruitment campaign that ran in May 2010. Since then additional panelists have been recruited through email solicitations by the ISPs.
- The volunteer sample was originally organized with a goal of covering major ISPs in the 48 contiguous states across five broadband technologies: DSL, cable, fiber-to-the-home, fixed terrestrial wireless, and satellite.[4]
- Target numbers for volunteers were also set across the four Census Regions—Northeast, Midwest, South, and West—to help ensure geographic diversity in the volunteer panel and compensate for differences in networks across the United States.[5]
- A target plan for allocation of Whiteboxes was developed based on the market share of participating ISPs. Initial market share information was based principally on FCC Form 477[6] data filed by participating ISPs for June 2011. This data is further enhanced by the ISPs who brief SamKnows on new products and changes in subscribership numbers which may have occurred after the submission of the 477 data. A speed tier may be included if it has at least 30,000 subscribers and constitutes at least 5% of the subscriber base of the participating ISP. This threshold ensures that we are measuring the ISP's most popular speed tiers and that it is possible to recruit sufficient panelists.
- An initial set of prospective participants was selected from volunteers who had responded directly to SamKnows as a result of media solicitations, as described in detail in Section 2.3. Where gaps existed in the sample plan, SamKnows worked with participating ISPs via email solicitations targeted at underrepresented cells. A miscellaneous cell was created across fiber-to-the-home, DSL, cable and satellite technologies, and across all regions and service tiers, to allow additional units to be allocated to accommodate volunteers who did not fit into other cells or who changed ISPs or service tiers during the trial.
- Since the initial panel was created in 2011, participating ISPs have contacted random subsets of their subscribers by email to replenish cells that were falling short of their desired panel size.

The sample plan is designed prior to the reporting period and is sent to each ISP by SamKnows. ISPs review this and respond directly to SamKnows with feedback on speed tiers that ought to be included based on the threshold criteria stated above. SamKnows will include all relevant tiers in the final report, assuming a target sample size is available. As this may not be known until after the reporting period is over, a final sample description containing all included tiers is produced and shared with the FCC and ISPs once the reporting period has finished and the data has been processed. Test results from a total of 4,545 panelists were used in the 2017 Report. This figure includes only panelists that are subscribed to the tiers that were tested as part of the sample plan.

The recruitment campaign resulted in the coverage needed to ensure balanced representation of users across the United States. Table 1 shows the number of volunteers for the months of September/October 2016 listed by ISP, as well as the percentage of total volunteers subscribed to each ISP.

[4] At the request of, and with the cooperation of the Department of Commerce and Consumer Affairs, Hawaii, we have begun to collect data from the state of Hawaii. Data from Hawaii is not included in this year's report. However, data collected from all operating whiteboxes are included in the detailed data files released to the public in the Raw Bulk Data Set and may cover states and other geographic areas not included in our reports.

[5] Although the Commission's volunteer recruitment was guided by Census Region to ensure the widest possible distribution of panelists throughout the United States, as discussed below, a sufficient number of testing devices were not deployed to enable, in every case, the evaluation of regional differences in broadband performance. The States associated with each Census Region are described in Table 4.

[6] The FCC Form 477 data collects information about broadband connections to end user locations, wired and wireless local telephone services, and interconnected Voice over Internet Protocol (VoIP) services. *See https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477* for further information.

Table 2: ISPs, Sample Sizes and Percentages of Total Volunteers

ISP	Sample Size	% of total volunteers
AT&T	505	11.11%
CenturyLink	461	10.14%
Charter	357	7.85%
Cincinnati Bell	236	5.19%
Comcast	692	15.23%
Cox	254	5.59%
Frontier DSL	165	3.63%
Frontier Fiber	164	3.61%
Hughes	91	2.00%
Mediacom	167	3.67%
Optimum	227	4.99%
Time Warner Cable	563	12.39%
Verizon DSL	100	2.20%
Verizon Fiber	343	7.55%
Wildblue/ViaSat	43	0.95%
Windstream	177	3.89%
Total	**4545**	100%

Table 3: Distribution of Whiteboxes by State

State	Total boxes	% of total boxes	% of total US broadband
Alabama	51	1.12%	1.6%
Arkansas	31	0.68%	1.0%
Arizona	138	3.04%	2.0%
California	413	9.09%	10.8%
Colorado	101	2.22%	1.7%

Connecticut	66	1.45%	1.1%
District of Columbia	14	0.31%	0.2%
Delaware	16	0.35%	0.3%
Florida	145	3.19%	6.2%
Georgia	125	2.75%	3.0%
Hawaii	11	0.24%	0.5%
Iowa	160	3.52%	1.0%
Idaho	22	0.48%	0.5%
Illinois	134	2.95%	4.0%
Indiana	66	1.45%	2.1%
Kansas	23	0.51%	0.9%
Kentucky	116	2.55%	1.4%
Louisiana	29	0.64%	1.5%
Massachusetts	92	2.02%	2.2%
Maryland	85	1.87%	1.8%
Maine	12	0.26%	0.5%
Michigan	129	2.84%	3.2%
Minnesota	118	2.60%	1.8%
Missouri	111	2.44%	2.0%
Mississippi	13	0.29%	0.9%
Montana	5	0.11%	0.3%
North Carolina	157	3.45%	3.2%
North Dakota	2	0.04%	0.3%
Nebraska	40	0.88%	0.6%
New Hampshire	18	0.40%	0.4%
New Jersey	202	4.44%	2.7%
New Mexico	42	0.92%	0.6%
Nevada	31	0.68%	0.9%
New York	303	6.67%	6.1%
Ohio	336	7.39%	3.9%
Oklahoma	48	1.06%	1.2%
Oregon	127	2.79%	1.3%

Pennsylvania	162	3.56%	4.2%
Rhode Island	11	0.24%	0.3%
South Carolina	49	1.08%	1.5%
South Dakota	2	0.04%	0.3%
Tennessee	57	1.25%	2.1%
Texas	210	4.62%	7.7%
Utah	38	0.84%	0.8%
Virginia	178	3.92%	2.6%
Vermont	3	0.07%	0.2%
Washington	153	3.37%	2.3%
Wisconsin	134	2.95%	1.9%
West Virginia	14	0.31%	0.6%
Wyoming	1	0.02%	0.2%
	4544		

The distribution of Whiteboxes by Census Region is found in the table on the next page.

Table 4: Distribution of Whiteboxes by Census Region

Census region	total boxes	% total boxes	% total U.S. broadband subscribers
Midwest	1255	27.62%	22.17%
Northeast	869	19.12%	17.80%
South	1338	29.45%	36.93%
West	1082	23.81%	21.96%

The distribution of states associated with the four Census Regions used to define the panel strata are included in the table below.

Table 5: Panelists States Associated with Census Regions

Census region	States
Northeast	CT MA ME NH NJ NY PA RI VT
Midwest	IA IL IN KS MI MN MO ND M NE OH SD WI
South	AL AR DC DE FL GA KY LA MD MS NC OK SC TN

	TX VA WV
West	AK AZ CA CO HI ID MT NM NV OR UT WA WY

C. 2.3 - PANELIST RECRUITMENT PROTOCOL

Panelists were recruited in the 2011- 2016 panels using the following method:

- Several thousand volunteers were recruited through an initial public relations and social media campaign led by the FCC. This campaign included discussion on the FCC website and on technology blogs, as well as articles in the press. The composition of this initial panel were reviewed to identify any deficiencies with regard to the sample plan described above. These goals were set to targets for sets of volunteers for demographics based on ISP, speed tier, technology type, and region. Where the pool of volunteers fell short of the desired goal, ISPs sent out email messages to their customers asking them to participate in the MBA program. The messages directed interested volunteers to contact SamKnows to request participation in the trial. The ISPs did not know which of the email recipients would volunteer. In almost all cases, this ISP outreach allowed us to meet desired demographic targets.

The mix of panelists recruited using the above methodologies varied by ISP.

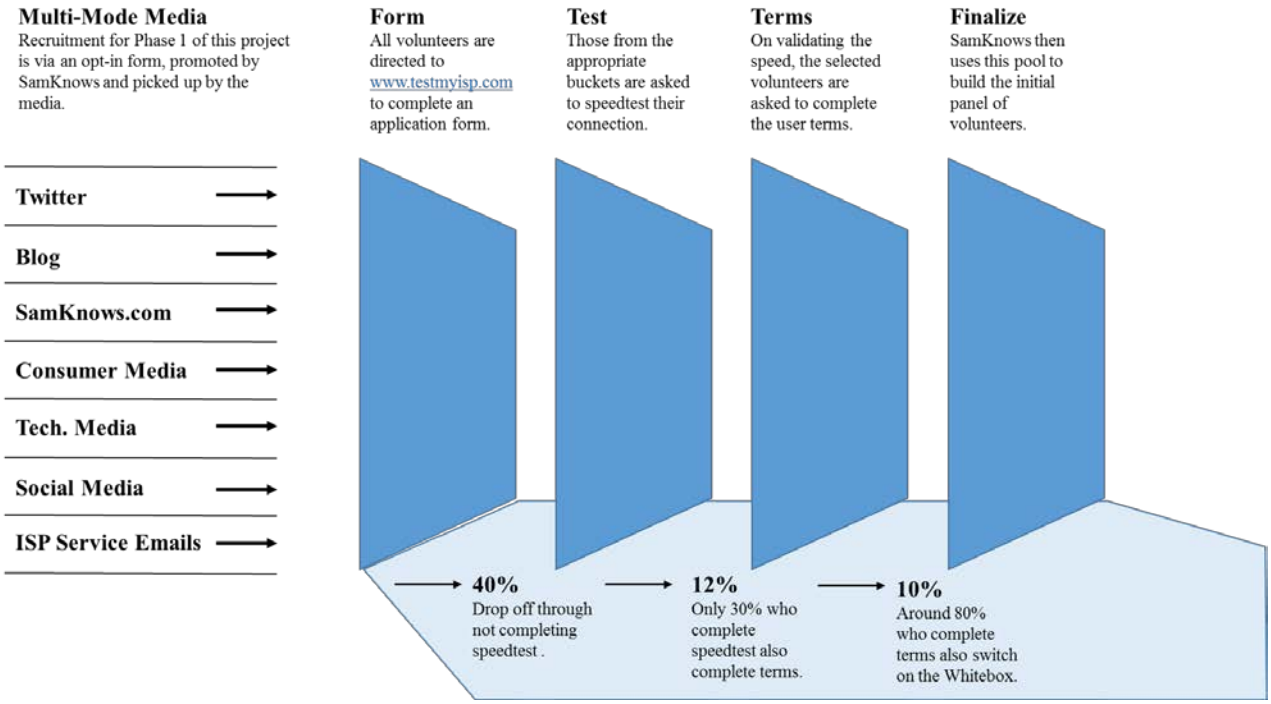
A multi-mode strategy was used to qualify volunteers for this trial. The key stages of this process were as follows:

1. Volunteers were directed to complete an online form which provided information on the study and required volunteers to submit a small amount of information.
2. Volunteers were selected from respondents to this follow-up email based on the target requirements of the panel. Selected volunteers were then asked to agree to the *User Terms and Conditions* that outlined the permissions to be granted by the volunteer in key areas such as privacy.[7]
3. From among the volunteers who agreed to the User Terms and Conditions, SamKnows selected the first panel of 13,000 participants,[8] each of whom received a Whitebox for self-installation. SamKnows provided full support during the Whitebox installation phase.

The graphic in Figure 1 illustrates the study recruitment methodology.

Figure 1: Panelist Recruitment Protocol

[7] The *User Terms and Conditions* is found in the Reference Documents at the end of this Appendix.
[8] Over 15,000 Whiteboxes have been shipped to targeted volunteers since 2011, of which 6,193 were online and reporting data used in the 2017 Report from the months of September/October 2016.



D. 2.4 - VALIDATION OF VOLUNTEERS' SERVICE TIER

The methodology employed in this study included verifying each panelist's service tier and ISP against the customer records of participating ISPs.[9] Initial throughput tests were used to confirm reported speeds. The broadband service tier reported by each panelist was validated as follows:

- When the panelist installed the Whitebox, the device automatically ran an IP address test to check that the ISP identified by the volunteer was correct.
- The Whitebox also ran an initial test which flooded each panelist's connection in order to accurately detect the throughput speed when their deployed Whitebox connected to a test node.
- Each ISP was asked to confirm the broadband service tier reported by each selected panelist.
- SamKnows then took the validated speed tier information that was provided by the ISPs and compared this to both the panelist-provided information, and the actual test results obtained, in order to ensure accurate tier validation.

SamKnows manually completed the following four steps for each panelist:

- Verified that the IP address was in a valid range for those served by the ISP.
- Reviewed data for each panelist and removed data where speed changes such as tier upgrade or downgrade appeared to have occurred, either due to a service change on the part of the consumer or a network change on the part of the ISP.

[9] Past FCC studies found that a high rate of consumers could not reliably report information about their broadband service, and the validation of subscriber information ensured the accuracy of expected speed and other subscription details against which observed performance was measured. *See* John Horrigan and Ellen Satterwhite, *Americans' Perspectives on Online Connection Speeds for Home and Mobile Devices*, 1 (FCC 2010), available at **http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-298516A1.doc** (finding that 80 percent of broadband consumers did not know what speed they had purchased).

- Identified panelists whose throughput appeared inconsistent with the provisioned service tier. Such anomalies were re-certified with the consumer's ISP.[10]
- Verified that the resulting downstream-upstream test results corresponded to the ISP-provided speed tiers, and updated accordingly if required.

Of the more than 15,000 Whiteboxes that were shipped to panelists since 2011, 6,193[11] units were reporting data in September/October 2016. The participating ISPs validated 5,848 units of these panelists, of which 7.1 percent were reallocated to a different tier following the steps listed above. Of these 5,848 units, 1,303 boxes were excluded for the following reasons:

- 352 units had insufficient data or changed ISP or service plan during reporting period.
- 97 units were on commercial accounts and were test units issued to ISP employees.
- 854 units were validated, but subscribed to plans that are not part of this study.

With those units removed, the 2017 Report relies on data provided by 4,545 volunteers.

E. 2.5 - PROTECTION OF VOLUNTEERS' PRIVACY

Protecting the panelists' privacy is a major concern for this program. The panel was comprised entirely of volunteers who knowingly and explicitly opted in to the testing program. For audit purposes, we retain the correspondence with panelists documenting their opt-in.

All personal data was processed in conformity with relevant U.S. law and in accordance with policies developed to govern the conduct of the parties handling the data. The data were processed solely for the purposes of this study and are presented here and in all online data sets with all personally identifiable information (PII) removed.

A set of materials was created both to inform each panelist regarding the details of the trial, and to gain the explicit consent of each panelist to obtain subscription data from the participating ISPs. These documents were reviewed by the Office of General Counsel of the FCC and the participating ISPs and other stakeholders involved in the study.

[10] For example, when a panelist's upload or download speed was observed to be significantly higher than that of the rest of the tier, it could be inferred that a mischaracterization of the panelist's service tier had occurred. Such anomalies, when not resolved in cooperation with the service provider, were excluded from the 2017 Report, but will be included in the raw bulk data set.

[11] This figure represents the total number of boxes reporting during September/October 2016, the month chosen for the 2017 Report. Shipment of boxes continued in succeeding months and these results will be included in the raw bulk data set.

VII. 3 - BROADBAND PERFORMANCE TESTING METHODOLOGY

This section describes the system architecture and network programming features of the tests, and other technical aspects of the methods employed to measure broadband performance during this study.

A. 3.1 – RATIONALE FOR HARDWARE-BASED MEASUREMENT APPROACH

Either a hardware or software approach can be used to measure broadband performance. Software approaches are by far the most common and allow for measurements to easily and cost-effectively include a very large sample size. Web-based speed tests fall into this category and typically use Flash applets, Java applets or JavaScript that execute within the user's web browser. These clients download content from remote web servers and measure the throughput. Some web-based performance tests also measure upload speed or round-trip latency.

Other, less common, software-based approaches to performance measurement install applications on the user's computer. These applications run tests periodically while the computer is on.

All software solutions implemented on a consumer's computer, smart phone, or other device connected to the Internet suffer from the following disadvantages:

- The software and computing platform running the software may not be capable of reliably recording the higher service tiers currently available.
- The software typically cannot know if other devices on the home network are accessing the Internet when the measurements are being taken. The lack of awareness as to other, non-measurement related network activity can produce inconsistent and misleading measurement data.
- Software measurements may be affected by the performance, quality and configuration of the device.
- Potential bottlenecks, such as Wi-Fi networks and other in-home networks, are generally not accounted for and may result in unreliable data.
- If the device hosting the software uses in-home WIFI access to fixed broadband service, differing locations in the home may impact measurements.
- The tests can only run when the computer is turned on, limiting the ability to provide a 24-hour profile.
- If software tests are performed manually, panelists might only run tests when they experience problems and thus bias the results.

In contrast, the hardware approach used in the MBA program requires the placement of the previously described Whitebox inside the user's home, directly connected to the consumer's service interconnection device (router), via Ethernet cable. The measurement device therefore directly accesses fixed Internet service to the home over this dedicated interface and periodically runs tests to remote targets over the Internet. The use of hardware devices avoids the disadvantages listed earlier with the software approach. However, hardware approaches are much more expensive than the software alternative, are thus more constrained in the achievable panel size, and require correct installation of the device by the consumer or a third party. This is still subject to unintentional errors due to misconfigurations i.e. connecting the Whitebox incorrectly but these can often be detected in the validation process that follows installation. The FCC chose the hardware approach since its advantages far outweigh these disadvantages.

B. 3.2 - DESIGN OBJECTIVES AND TECHNICAL APPROACH

For this test of broadband performance, as in previous Reports, the FCC used design principles that were previously developed by SamKnows in conjunction with their study of broadband performance in the U.K. The design principles comprise 17 technical objectives:

Table 6: Design Objectives and Methods

#	Technical objectives	Methodological accommodations
1	Must not change during the monitoring period.	The Whitebox measurement process is designed to provide automatic and consistent monitoring throughout the measurement period.
2	Must be accurate and reliable.	The hardware solution provides a uniform and consistent measurement of data across a broad range of participants.
3	Must not interrupt or unduly degrade the consumer's use of the broadband connection.	The volume of data produced by tests is controlled to avoid interfering with panelists' overall broadband experience, and tests only execute when consumer is not making heavy use of the connection.
4	Must not allow collected data to be distorted by any use of the broadband connection by other applications on the host PC and other devices in the home.	The hardware solution is designed not to interfere with the host PC and is not dependent on that PC.
5	Must not rely on the knowledge, skills and participation of the consumer for its ongoing operation once installed.	The Whitebox is "plug-and-play." Instructions are graphics-based and the installation process has been substantially field tested.
6	Must not collect data that might be deemed to be personal to the consumer without consent.	The data collection process is explained in plain language and consumers are asked for their consent regarding the use of their personal data as defined by any relevant data protection legislation.
7	Must be easy for a consumer to completely remove any hardware and/or software components if they do not wish to continue with the research program.	Whiteboxes can be disconnected at any time from the home network. As soon as the route is reconnected the reporting is resumed as before.
8	Must be compatible with a wide range of DSL, cable, satellite and fiber-to-the-home modems.	Whiteboxes can be connected to all modem types commonly used to support broadband services in the U.S. either in an in-line or bridging mode.
9	Where applicable, must be compatible with a range of computer operating systems, including, without limitation, Windows XP, Windows Vista, Windows 7, Mac OS and Linux.	Whiteboxes are independent of the PC operating system and therefore able to provide testing with all devices regardless of operating system.
10	Must not expose the volunteer's home network to increased security risk, i.e., it should not be susceptible to viruses, and should not degrade the effectiveness of the user's existing firewalls, antivirus and spyware software.	Most user firewalls, antivirus and spyware systems are PC-based. The Whitebox is plugged in to the broadband connection "before" the PC. Its activity is transparent and does not interfere with those protections.
11	Must be upgradeable from the remote control center if it contains any software or firmware components.	The Whitebox can be completely controlled remotely for updates without involvement of the consumer PC, providing the Whitebox is switched on and connected.

12	Must identify when a user changes broadband provider or package (e.g., by a reverse look up of the consumer's IP address to check provider, and by capturing changes in modem connection speed to identify changes in package).	Ensures regular data pool monitoring for changes in speed, ISP, IP address or performance, and flags when a panelist should notify and confirm any change to their broadband service since the last test execution.
13	Must permit, in the event of a merger between ISPs, separate analysis of the customers of each of the merged ISP's predecessors.	Data are stored based on the ISP of the panelist, and therefore can be analyzed by individual ISP or as an aggregated dataset.
14	Must identify if the consumer's computer is being used on a number of different fixed networks (e.g., if it is a laptop).	The Whiteboxes are broadband dependent, not PC or laptop dependent.
15	Must identify when a specific household stops providing data.	The Whitebox needs to be connected and switched on to push data. If it is switched off or disconnected its absence is detected at the next data push process.
16	Must not require an amount of data to be downloaded which may materially impact any data limits, usage policy, or traffic shaping applicable to the broadband service.	The data volume generated by the information collected does not exceed any policies set by ISPs. Panelists with bandwidth restrictions can have their tests set accordingly.
17	Must limit the possibility for ISPs to identify the broadband connections which form their panel and therefore potentially "game" the data by providing different quality of service to the panel members and to the wider customer base.	ISPs signed a Code of Conduct[12] to protect against gaming test results. While the identity of each panelist was made known to the ISP as part of the speed tier validation process, the actual Unit ID for the associated Whitebox was not released to the ISP and specific test results were not directly assignable against a specific panelist. Moreover, most ISPs had hundreds, and some had more than 1,000, participating subscribers spread throughout their service territory, making it difficult to improve service for participating subscribers without improving service for all subscribers.

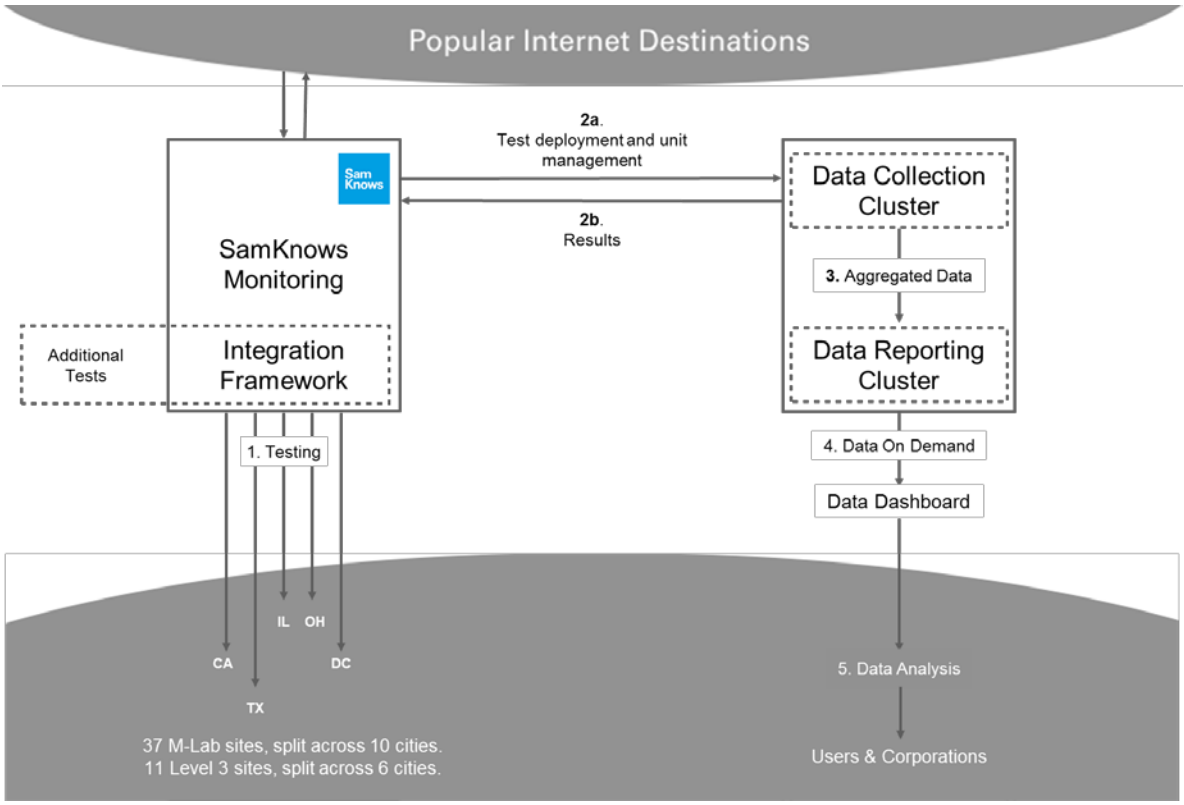
[12] Signatories to the Code of Conduct are: AT&T, CenturyLink, Charter, Cincinnati Bell, Comcast, Cox, Frontier, Hughes, Level3, Measurement Lab, Mediacom, NCTA, Optimum, Time Warner Cable, Verizon, ViaSat, and Windstream. A copy of the Code of Conduct is included as a Reference Document attached to this Appendix.

C. 3.3 - TESTING ARCHITECTURE

1. Overview of Testing Architecture

As illustrated in Figure 2, the performance monitoring system comprises a distributed network of Whiteboxes in the homes of members of the volunteer consumer panel. The Whiteboxes are controlled by a cluster of servers, which hosts the test scheduler and the reporting database. The data was collated on the reporting platform and accessed via a reporting interface[13] and secure FTP site. The system also included a series of speed-test servers, which the Whiteboxes called upon according to the test schedule.

Figure 2: Testing Architecture



2. Approach to Testing and Measurement

Any network monitoring system needs to be capable of monitoring and executing tests 24 hours a day, seven days a week. Similar to the method used by the television audience measurement industry, each panelist is equipped with a Whitebox, which is self-installed by each panelist and conducts the performance measurements. Since 2011, the project has used three different hardware platforms, described below. The software on each of the Whiteboxes was programmed to execute a series of tests designed to measure key performance indicators (KPIs) of a broadband connection. The tests comprise a suite of applications, written by SamKnows in the programming language C, which were rigorously

[13] Each reporting interface included a data dashboard for the consumer volunteers, which provided performance metrics associated with their Whitebox.

tested by the ISPs and other stakeholders. The 2017 Report incorporates data from all three types of Whiteboxes and we use the term Whitebox generically. Testing has found that they produce results that are indistinguishable.

During the initial testing period in 2011, the Whitebox provided used hardware manufactured by NETGEAR, Inc. (NETGEAR) and operated as a broadband router. It was intended to replace the panelist's existing router and be directly connected to the cable or DSL modem, ensuring that tests could be run at any time the network was connected and powered, even if all home computers were switched off. Firmware for the Whitebox routers was developed by SamKnows with the cooperation of NETGEAR. In addition to running the latest versions of the SamKnows testing software, the routers retained all of the native functionality of the NETGEAR consumer router.

A second Whitebox model was introduced starting with the 2012 testing period. This version is based upon hardware produced by TP-Link and operates as a bridge rather than as a router. It connects to the customer's existing router, rather than replacing it, and all home devices connect to LAN ports on the TP-Link Whitebox. The TP-Link Whitebox passively monitors wireless network activity in order to determine when the network is active and defer measurements. It runs a modified version of OpenWrt, an open source router platform based on Linux. All Whiteboxes deployed since 2012 use the TP-Link or SamKnows hardware.

SamKnows Whiteboxes have been shown to provide accurate information about broadband connections with throughput rates of up to 1 Gbps.

3. Home Deployment of the NETGEAR Based Whitebox

This study was initiated by using existing NETGEAR firmware, and all of its features were intended to allow panelists to replace their existing routers with the Whitebox. If the panelist did not have an existing router and used only a modem, they were asked to install the Whitebox according to the usual NETGEAR instructions.

However, this architecture could not easily accommodate scenarios where the panelist had a combined modem/router supplied by their ISP that had specific features that the Whitebox could not provide. For example, some Verizon FiOS gateways connect via a MoCA (Multimedia over Cable) interface and AT&T IPBB gateways provide U-Verse specific features, such as IPTV.

In these cases, the Whitebox was connected to the existing router/gateway and all home devices plugged into the Whitebox. In order to prevent a double-NAT configuration, in which multiple routers on the same network perform network address translation (NAT) and make access to the SamKnows router difficult, the Whitebox was set to dynamically switch to operate as a transparent Ethernet bridge when deployed in these scenarios. All consumer configurations were evaluated and tested by participating ISPs to confirm their suitability.[14]

4. Home Deployment of the TP-Link Based Whitebox

The TP-Link-based Whitebox, which operates as a bridge, was introduced in response to the increased deployment of integrated modem/gateway devices. To use the TP-Link-based Whitebox, panelists are required to have an existing router. Custom instructions guided these panelists to connect the Whitebox to their existing router and then connect all of their home devices to the Whitebox. This allows the Whitebox to measure traffic volumes from wired devices in the home and defer tests accordingly. As an Ethernet bridge, the Whitebox does not provide services such as network address translation (NAT) or DHCP.

5. Home Deployment of the SamKnows Whitebox 8.0

The Whitebox 8.0 was manufactured by SamKnows and deployed starting in August 2016. Like the TP-Link device, this Whitebox works as a bridge, rather than a router, and operates in a similar manner. Unlike the NETGEAR and TP-Link hardware, it can handle bandwidths of up to 1 Gbps.

6. Internet Activity Detection

No tests are performed if the Whiteboxes detect wired or wireless traffic beyond a defined bandwidth threshold. This ensures both that testing does not interfere with consumer use of their Internet service and that any such use does not interfere with testing or invalidate test results.

Panelists were not asked to change their wireless network configurations. Since the TP-Link Whiteboxes and Whitebox 8.0 attach to the panelist's router that may contain a built-in wireless (Wi-Fi) access point, these devices measure the strongest wireless signal. Since they only count packets, they do not need access to the Wi-Fi encryption keys and do not inspect packet content.

7. Test Nodes (Off-Net and On-Net)

For the tests in this study, SamKnows employed nine core measurement servers as test nodes that were distributed geographically across ten locations, outside the network boundaries of the participating ISPs. These so-called off-net measurement points were supplemented by additional measurement points located within the networks of some of the ISPs participating in this study, called on-net servers. The core measurement servers were used to measure consumers' broadband performance between the Whitebox and an available reference point that was closest in roundtrip time to the consumer's network address.

[14] The use of legacy equipment has the potential to impede some panelists from receiving the provisioned speed from their ISP, and this impact is captured by the survey.

The distribution of off-net primary reference points operated by M-Lab and Level 3 and on-net secondary reference points operated by broadband providers provided additional validity checks and insight into broadband service performance within an ISP's network. In total, the following 133 measurement servers were deployed for the 2017 Report:

Table 7: Overall Number of Testing Servers

Operated by	Number of servers
AT&T	11
CenturyLink	13
Charter	5
Cincinnati Bell	1
Comcast	33
Cox	2
Frontier	5
Level 3 (off-net)	10
M-Lab (off-net)	35
Mediacom	1
Optimum	2
Qwest	4
Time Warner Cable	6
Verizon	5
Windstream	4

8. Test Node Locations

Off-Net Test Nodes

The M-Lab test nodes were located in the following major U.S. Internet peering locations:

- New York City, New York (two locations)
- Chicago, Illinois
- Atlanta, Georgia
- Miami, Florida
- Washington, DC
- Mountain View, California (two locations)
- Seattle, Washington
- Los Angeles, California
- Dallas, Texas

- Denver, Colorado

The Level 3 nodes were located in the following major U.S. Internet peering locations:

- Chicago, Illinois (two locations)
- Dallas, Texas
- New York City, New York
- San Jose, California (two locations)
- Washington D.C. (two locations)
- Los Angeles, California (two locations)

On-Net Test Nodes

In addition to off-net nodes, some ISPs deployed their own on-net servers to cross-check the results provided by off-net nodes. Whiteboxes were instructed to test against the off-net M-Lab and Level 3 nodes and the on-net ISP nodes, when available.

The following ISPs provided on-net test nodes:

- AT&T
- CenturyLink[15]
- Charter
- Cincinnati Bell
- Comcast
- Cox
- Frontier
- Mediacom
- Optimum
- Qwest (now part of CenturyLink)
- Time Warner Cable
- Verizon
- Windstream

The same suite of tests was scheduled for these on-net nodes as for the off-net nodes and the same server software developed by SamKnows was used regardless of whether the Whitebox was interacting with on-net or off-net nodes. Off-net test nodes are continually monitored for load and congestion.

While these on-net test nodes were included in the testing, the results from these tests were used as a control set; the results presented in the Report are based only on tests performed using off-net nodes. Results from both on-net and off-net nodes are included in the raw bulk data set that will be released to the public.

9. Test Node Selection

Each Whitebox fetches a complete list of off-net test nodes and on-net test nodes hosted by the serving ISP from a SamKnows server and measures the round trip time to each. This list of test servers is loaded

[15] QWest was reported separately from Centurylink in reports prior to 2016. The entities completed merging their test infrastructure in 2016.

at startup and refreshed weekly. It then selects the on-net and off-net test nodes with lowest round trip time to test against. The selected nodes may not be the geographically closest node.
Technical details for the minimum requirements for hardware and software, connectivity, and systems and network management are available in the **5.3 - Test Node Briefing** provided in the Reference Document section of this Technical Appendix.

D. 3.4 – TESTS METHODOLOGY

Each deployed Whitebox performs the following tests.[16] All tests are conducted with both the on-net and off-net servers except as noted, and are described in more detail in the next section.

Table 8: List of tests performed by SamKnows

Metric	Primary metric(s)
Download speed	Throughput in Megabits per second (Mbps) utilizing three concurrent TCP connections
Upload speed	Throughput in Mbps utilizing three concurrent TCP connections
Web browsing	Total page fetch time and all its embedded resources from a popular website
UDP latency	Average round trip time of a series of randomly transmitted UDP packets distributed over a long timeframe
UDP packet loss	Fraction of UDP packets lost from UDP latency test
Voice over IP	Upstream packet loss, downstream packet loss, upstream jitter, downstream jitter, round trip latency
DNS resolution	Time taken for the ISP's recursive DNS resolver to return an A record[17] for a popular website domain name
DNS failures	Percentage of DNS requests performed in the DNS resolution test that failed
ICMP latency	Round trip time of five evenly spaced ICMP packets
ICMP packet loss	Percentage of packets lost in the ICMP latency test
UDP Latency under load	Average round trip time for a series of evenly spaced UDP packets sent during downstream/upstream sustained tests
Consumption[18]	A count of the total bytes downloaded and uploaded by the router, this is no longer collected from all whiteboxes

E. 3.5 - TEST DESCRIPTIONS

The following sub-sections detail the methodology used for the individual tests. As noted earlier, all tests only measure the performance of the part of the network between the Whitebox and the target (which may be a test node). In particular, the VoIP tests can only approximate the behavior of real applications and do not reflect the impact of specific consumer hardware, software, media codecs, bandwidth adjustment algorithms, Internet backbones and in-home networks.

1. Download speed and upload speed

These tests measure the download and upload throughput by performing multiple simultaneous HTTP GET and HTTP POST requests to a target test node.
Binary, non-zero content—herein referred to as the payload—is hosted on a web server on the target test node. The test operates for a fixed duration of 10 seconds. It records the average throughput achieved

[16] Specific questions on test procedures may be addressed to **team@samknows.com**
[17] An "A record" is the numeric IP address associated with a domain address such as **www.fcc.gov**
[18] While all other tests are active, the consumption metric is passive.

during this 10 second period. The client attempts to download as much of the payload as possible for the duration of the test.
The test uses three concurrent TCP connections (and therefore three concurrent HTTP requests) to ensure that the line is saturated. Each connection used in the test counts the numbers of bytes transferred and is sampled periodically by a controlling thread. The sum of these counters (a value in bytes) divided by the time elapsed (in microseconds) and converted to Mbps is taken as the total throughput of the user's broadband service.
Factors such as TCP slow start and congestion are taken into account by repeatedly transferring small chunks (256 kilobytes, or kB) of the target payload before the real testing begins. This "warm-up" period is completed when three consecutive chunks are transferred at within 10 percent of the speed of one another. All three connections are required to have completed the warm-up period before the timed testing begins. The warm-up period is excluded from the measurement results.
Downloaded content is discarded as soon as it is received, and is not written to the file system. Uploaded content is generated and streamed on the fly from a random source.
The test is performed for both IPv4 and IPv6, where available, but only IPv4 results are reported.

2. Web Browsing

The test records the averaged time taken to sequentially download the HTML and referenced resources for the home page of each of the target websites, the number of bytes transferred, and the calculated rate per second. The primary measure for this test is the total time taken to download the HTML front page for each web site and all associated images, JavaScript, and stylesheet resources. This test does not test against the centralized testing nodes; instead it tests against actual websites, ensuring that the effects of content distribution networks and other performance enhancing factors can be taken into account.
Each Whitebox tests against the following nine websites:[19]

- http://www.cnn.com
- http://www.youtube.com
- http://www.msn.com
- http://www.amazon.com
- http://www.yahoo.com
- http://www.ebay.com
- http://www.wikipedia.org
- http://www.facebook.com
- http://www.google.com

The results include the time needed for DNS resolution. The test uses up to eight concurrent TCP connections to fetch resources from targets. The test pools TCP connections and utilizes persistent connections where the remote HTTP server supports them.
The client advertises the user agent as Microsoft Internet Explorer 10. Each website is tested in sequence and the results summed and reported across all sites.

3. UDP Latency and Packet Loss

These tests measure the round-trip time of small UDP packets between the Whitebox and a target test node.
Each packet consists of an 8-byte sequence number and an 8-byte timestamp. If a response packet is not received within three seconds of sending, it is treated as being lost. The test records the number of packets sent each hour, the average round trip time and the total number of packets lost. The test computes the summarized minimum, maximum, standard deviation and mean from the lowest 99 percent of results, effectively trimming the top (i.e., slowest) 1 percent of outliers.
The test operates continuously in the background. It is configured to randomly distribute the sending of

[19] These websites were chosen based on a list by Alexa, http://www.alexa.com/, of the top twenty websites in October 2010.

the requests over a fixed interval of one hour (using a Poisson distribution), reporting the summarized results once the interval has elapsed. Approximately two thousand packets are sent within a one hour period, with fewer packets sent if the line is not idle.
This test is started when the Whitebox boots and runs permanently as a background test. The test is performed for both IPv4 and IPv6, where available, but only IPv4 results are reported.

4. Voice over IP

The Voice over IP (VoIP) test operates over UDP and utilizes bidirectional traffic, as is typical for voice calls.
The Whitebox handshakes with the server, and each initiates a UDP stream with the other. The test uses a 64 kbps stream with the same characteristics and properties (i.e., packet sizes, delays, bitrate) as the G.711 codec. 160 byte packets are used. The test measures jitter, delay, and loss.
Jitter is calculated using the Packet Delay Variation (PDV) approach described in section 4.2 of RFC 5481. The 99th percentile is recorded and used in all calculations when deriving the PDV.

5. DNS Resolutions and DNS Failures

These tests measure the DNS resolution time of an A record query for the domains of the websites used in the web browsing test, and the percentage of DNS requests performed in the DNS resolution test that failed.
The DNS resolution test is targeted directly at the ISP's recursive resolvers. This circumvents any caching introduced by the panelist's home equipment (such as another gateway running in front of the Whitebox) and also accounts for panelists that might have configured the Whitebox (or upstream devices) to use non-ISP provided DNS servers. ISPs provide lists of their recursive DNS servers for the purposes of this study.

6. ICMP Latency and Packet Loss

These tests measure the round trip time (RTT) of ICMP echo requests in microseconds from the Whitebox to a target test node. The client sends five ICMP echo requests of 56 bytes to the target test node, waiting up to three seconds for a response to each. Packets that are not received in response are treated as lost. The mean, minimum, maximum, and standard deviation of the successful results are recorded. The number of packets sent and received are recorded too.

7. Latency Under Load

The latency under load test operates for the duration of the 10-second downstream and upstream speed tests, with results for upstream and downstream recorded separately. While the speed tests are running, the latency under load test sends UDP datagrams to the target server and measures the round trip time and number of packets lost. Packets are spaced five hundred milliseconds (ms) apart, and a three second timeout is used. The test records the mean, minimum, and maximum round trip times in microseconds. The number of lost UDP packets is also recorded.
This test represents an updated version of the methodology used in the initial August 2011 Report and aligns it with the methodology for the regular latency and packet loss metrics.

8. Traceroute

A traceroute client is used to send UDP probes to each hop in the path between client and destination. Three probes are sent to each hop. The round-trip times, the standard deviation of the round-trip times of the responses from each hop and the packet loss are recorded. The open source traceroute client "mtr" (https://github.com/traviscross/mtr) is used for carrying out the traceroute measurements.

Table 9: Estimated Total Traffic Volume Generated by Test

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
Web browsing	10 popular US websites	Every 2 hours, 24x7	Est. 30 seconds	80 MB
Voice over IP	1 off-net test node	Hourly, 24x7	Fixed 10 seconds at 64k	1.8 MB
	1 on-net test node	Hourly, 24x7	Fixed 10 seconds at 64k	1.8 MB
Download speed (Capacity – 8x parallel TCP connections)	1 off-net test node	Once 12 am - 6 am Once 6 am - 12 pm Once 12 pm - 6 pm Hourly thereafter	Fixed 10 seconds	107 MB at 10 Mbps
	1 on-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Once 6pm-8pm, Once 8pm-10pm, Once 10pm-12am	Fixed 10 seconds	70 MB at 10 Mbps
Download speed (Single TCP connection)	1 off-net test node 1 on-net test node	Once in peak hours, once in off-peak hours	Fixed 10 seconds	46 MB at 10 Mbps
Upload speed (Capacity – 8x parallel TCP connections on terrestrial, 3x on satellite)	1 off-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Hourly thereafter	Fixed 10 seconds	11 MB at 1 Mbps
	1 on-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Once 6pm-8pm, Once 8pm-10pm, Once 10pm-12am	Fixed 10 seconds	7 MB at 1 Mbps
Upload speed (Single TCP connection)	1 off-net test node 1 on-net test node	Once in peak hours, once in off-peak hours	Fixed 10 seconds	6 MB at 1 Mbps
UDP latency	2 off-net test nodes (Level3/MLab)	Hourly, 24x7	Permanent	5.8 MB
	1 on-net test node	Hourly, 24x7	Permanent	2.9 MB
UDP packet loss	2 off-net test node	Hourly, 24x7	Permanent	N/A (uses above)
	1 on-net test nodes	Hourly, 24x7	Permanent	N/A (uses above)
Consumption	N/A	24x7	N/A	N/A

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
DNS resolution	10 popular US websites	Hourly, 24x7	Est. 3 seconds	0.3 MB
ICMP latency	1 off-net test node 1 on-net test node	Hourly, 24x7	Est. 5 seconds	0.3 MB
ICMP Packet loss	1 off-net test node 1 on-net test node	Hourly, 24x7	N/A (As IMCP latency)	N/A (uses above)
Traceroute	1 off-net test node 1 on-net test node	Three times a day, 24x7	N/A	N/A
Download speed IPv6^^	1 off-net test node	Three times a day	Fixed 10 seconds	180 MB at 50 Mbps 72 MB at 20 Mbps 11 MB at 3 Mbps 5.4 MB at 1.5 Mbps
Upload speed IPv6^^	1 off-net test node	Three times a day	Fixed 10 seconds	172 MB at 2 Mbps 3.6MB at 1 Mbps 1.8MB at 0.5 Mbps
UDP Latency / Loss IPv6^^	2 off-net test nodes (Level3/MLab)	Hourly, 24x7	Permanent	5.8 MB

**Download/upload daily volumes are estimates based upon likely line speeds. All tests will operate at maximum line rate so actual consumption may vary.

^Currently in beta testing.

^^Only carried out on broadband connections that support IPv6.

Tests to the off-net destinations alternate randomly between Level3 and M-Lab, except that latency and loss tests operate continuously to both Level3 and M-Lab off-net servers. All tests are also performed to the closest on-net server, where available.

9. Consumption

For Whiteboxes other than the NETGEAR version, the consumption measurement does not include any Wi-Fi data directly delivered from an access point integrated into the router to home devices as these bypass the Whitebox.

10. Cross-Talk Testing and Threshold Manager Service

In addition to the tests described above, for 60 seconds prior to and during testing, a ”threshold manager” service on the Whitebox monitors the inbound and outbound traffic across the WAN interface to calculate if a panelist is actively using the Internet connection. The threshold for traffic is set to 64 kbps

downstream and 32 kbps upstream. Metrics are sampled and computed every 10 seconds. If either of these thresholds is exceeded, the test is delayed for a minute and the process repeated. If the connection is being actively used for an extended period of time, this pause and retry process continues for up to five times before the test is abandoned.

VIII. 4 - DATA PROCESSING AND ANALYSIS OF TEST RESULTS

This section describes the background for the categorization of data gathered for the 2017 Report, and the methods employed to collect and analyze the test results.

A. 4.1 -BACKGROUND

1. Time of Day

Most of the metrics reported in the 2017 Report draw on data gathered during the so-called peak usage period of 7:00 p.m. to 11:00 p.m. local time[20]. This time period is generally considered to experience the highest amount of Internet usage.

2. ISP and Service Tier

A sufficient sample size is necessary for analysis and the ability to robustly compare the performance of specific ISP speed tiers. In order for a speed tier to be considered for the fixed line MBA Report, it must meet the following criteria:

(a) The speed tier must have a subscribership of at least 5% of the ISP's total number of subscribers,
(b) There must be a minimum of 25 panelists that are recruited for that tier who have provided valid data for the tier within the validation period and
(c) Each panelist must have a minimum of five days of valid data within the validation period.

The study achieved target sample sizes for the following download and upload speeds[21] (listed in alphabetical order by ISP):

Download Speeds:

AT&T DSL: 3 and 6 Mbps tiers;
AT&T IP-BB: 3, 6, 12, 18, 24 and 45 Mbps tiers;
CenturyLink: 1.5, 3, 7, 10, 12, 20 and 40 Mbps tiers;
Charter: 60 Mbps and 100 Mbps tiers;
Cincinnati Bell DSL: 5, 10, and 30 Mbps tiers;
Cincinnati Bell Fiber: 30 Mbps tier;
Comcast: 25, 75, 105 and 150 Mbps tiers;
Cox: 15, 50 and 100 Mbps tiers;
Frontier DSL: 3, 6 and 12 Mbps tiers;
Frontier Fiber: 25, 50 and 75 Mbps tiers;
Hughes: 5 and 10 Mbps tier;
Mediacom: 15, 50 and 100 Mbps tiers;
Optimum: 25, 50 and 101 Mbps tiers;
Time Warner Cable: 15, 20, 30, 50, 100 and 200 Mbps tiers;
Verizon DSL: [0.5 - 1.0] Mbps and [1.1 - 3.0] Mbps tiers;
Verizon Fiber: 25, 50, 75 and 100 Mbps tiers;
Viasat/Excede: 12 Mbps tier;

[20] This period of time was agreed to by ISP participants in open meetings conducted at the beginning of the program.

[21] Due to the large number of different combinations of upload/download speed tiers supported by ISPs where, for example, a single download speed might be offered paired with multiple upload speeds or vice versa, upload and download test results were analyzed separately.

Windstream: 3, 6, and 12 Mbps tiers.

Upload Speeds:

AT&T DSL: 384 kbps, and 512 kbps tiers;
AT&T IP-BB: 0.768, 1, 1.5, 3 and 6 Mbps tiers;
CenturyLink: 512, 768, and 896 kbps and 5 Mbps tiers;
Cincinnatti Bell DSL: 768 kbps, 1 Mbps and 3 Mbps tiers;
Cincinnati Bell Fiber: 3 Mbps tier;
Charter: 5 Mbps tier;
Comcast: 5, 10 and 20 Mbps tiers;
Cox: 1, 5, and 10 Mbps tiers;
Frontier DSL: 384 kbps, 768 kbps and 1 Mbps tiers;
Frontier Fiber: 25, 50 and 75 Mbps tiers;
Hughes: 1 Mbps tier;
Mediacom: 1, 5, and 10 Mbps tiers;
Optimum: 5, 25 and 35 Mbps tiers;
Time Warner Cable: 1, 2, 5, 10 and 20 Mbps tiers;
Verizon DSL: 384 kbps and [384 – 768] kbps tiers;
Verizon Fiber: 25, 50, 75 and 100 Mbps tiers;
Viasat/Excede: 3 Mbps tier;
Windstream: 768 kbps tier.

A file containing averages for each metric from the validated September/October 2016 data can be found on FCC's Measuring Broadband America website.[22] Some charts and tables are divided into speed bands, to group together products with similar levels of advertised performance. The results within these bands are further broken out by ISP and service tier. Where an ISP does not offer a service tier within a specific band or a representative sample could not be formed for tier(s) in that band, the ISP will not appear in that speed band.

[22] See: http://data.fcc.gov/download/measuring-broadband-america/2016/statistical-averages-Sept-2015.xlsx

B. 4.2 - DATA COLLECTION AND ANALYSIS METHODOLOGY

1. Data Integrity

To ensure the integrity of the data collected, the following validity checks were developed:

1. *Change of ISP intra-month*: By checking the WHOIS results once a day for the user's IP address, we found units that changed ISP during the month. We only kept data for the ISP where the panelist was active the most.
2. *Change of service tier intra-month*: This validity check found units that changed service tier intra-month by comparing the average sustained throughput observed for the first three days in the reporting period against that for the final three days in the reporting period. If a unit was not online at the start or end of that period, we used the first or final three days when they were actually online. If this difference was over 50 percent, the downstream and upstream charts for this unit were individually reviewed. Where an obvious step change was observed (e.g., from 1 Mbps to 3 Mbps), the data for the shorter period was flagged for removal.
3. *Removal of any failed or irrelevant tests*: This validity check removed any failed or irrelevant tests by removing measurements against any nodes other than the US-based off-net nodes. We also removed measurements using any off-net server that showed a failure rate of 10 percent or greater during a specific one hour period, to avoid using any out-of-service test nodes.
4. *Removal of any problem Whiteboxes*: We removed measurements for any Whitebox that exhibited greater than or equal to 10 percent failures in a particular one hour period. This removed periods when the Whitebox was unable to reach the Internet.

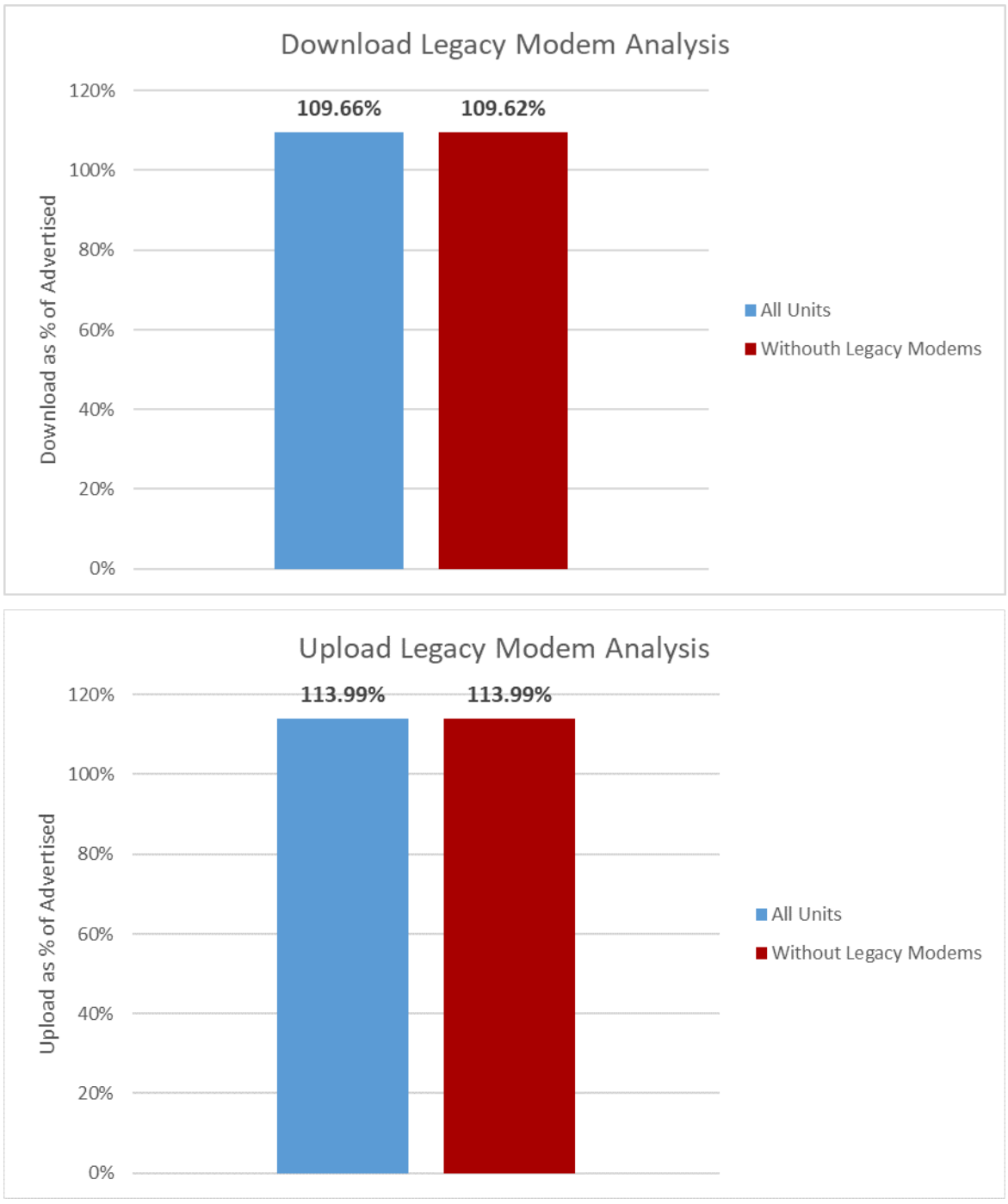
2. Legacy Equipment

In previous Reports, we discussed the challenges ISPs face in improving network performance where equipment under the control of the subscriber limits the end-to-end performance achievable by the subscriber.[23] Simply, some consumer controlled equipment may not be capable of operating fully at new, higher service tiers. Working in open collaboration with all service providers we developed a policy permitting changes in ISP panelists when their installed modems were not capable of meeting the delivered service speed that included several conditions on participating ISPs. First, proposed changes in consumer panelists would only be considered where an ISP was offering free upgrades for modems they owned and leased to the consumer. Second, each ISP needed to disclose its policy regarding the treatment of legacy modems and its efforts to inform consumers regarding the impact such modems may have on their service.

While the issue of DOCSIS 3 modems and network upgrades affect the cable industry today, we may see other cases in the future where customer premises equipment affects the achievable network performance. In accordance with the above stated policy we checked for the effect of inclusion of legacy cable modem on the download speed as a percentage of the advertised speed. The problems for legacy modems were observed this year only for Mediacom and affected a limited number (20) of units, mainly comprising the 15Mbps download tier. The difference in the download speed as a percentage of advertised speed was 0.04%, while the exclusion had no discernible effect in upload speeds. The results are shown in Figure 3 below:

[23] See pgs. 8-9, 2014 Report, pg. 8 of the 2013 Report, as well as endnote 14. http://www.fcc.gov/measuring-broadband-america/2012/july

Figure 3 – Download and Upload Speeds – legacy modem analysis



3. Collation of Results and Outlier Control

All measurement data were collated and stored for analysis purposes as monthly trimmed averages during three time intervals (24 hours, 7:00 p.m. to 11:00 p.m. local time Monday through Friday, 12:00 a.m. to

12:00 a.m. local time Saturday and Sunday). Only participants who provided a minimum of five days of valid measurements and had valid data in each of the three time intervals were included in the September / October 2016 test results. In addition, the top and bottom 1 percent of measurements were trimmed to control for outliers that may have been anomalous or otherwise not representative of actual broadband performance. All results were computed on the trimmed data.[24]

Data was only charted when results from at least 25 separate Whiteboxes was available for individual ISP download speed tiers. Service tiers of 50 or fewer Whiteboxes were noted for possible future panel augmentation.

The resulting final validated sample of data for September/October 2016 was collected from 4,545 participants.

4. Peak Hours Adjusted to Local Time

Peak hours were defined as weekdays (Mondays through Fridays) between 7:00 p.m. to 11:00 p.m. (inclusive) for the purposes of the study. All times were adjusted to the panelist's local time zone. Since some tests are performed only once every two hours on each Whitebox, the duration of the peak period had to be a multiple of two hours.

5. Congestion in the Home Not Measured

Download, upload, latency, and packet loss measurements were taken between the panelist's home gateway and the dedicated test nodes provided by M-Lab and Level 3. Web browsing measurements were taken between the panelist's home gateway and nine popular United States-hosted websites. Any congestion within the user's home network is, therefore, not measured by this study. The web browsing measurements are subject to possible congestion at the content provider's side, although the choice of nine popular websites configured to serve high traffic loads reduced that risk.

6. Traffic Shaping Not Studied

The effect of traffic shaping is not studied in the 2018 Report, although test results were subject to any bandwidth management policies put in place by ISPs. The effects of bandwidth management policies, which may be used by ISPs to maintain consumer traffic rates within advertised service tiers, may be most readily seen in those charts in the 2016 Report that show performance over 24-hour periods, where tested rates for some ISPs and service tiers flatten for periods at a time.

7. Analysis of PowerBoost and Other "Enhancing" Services

The use of transient speed enhancing services marketed under names such as "PowerBoost" on cable connections presented a technical challenge when measuring throughput. These services will deliver a far higher throughput for the earlier portion of a connection, with the duration varying by ISP, service tier, and potentially other factors. For example, a user with a contracted 6 Mbps service tier may receive 18 Mbps for the first 10 MB of a data transfer. Once the "burst window" is exceeded, throughput will return to the contracted rate, with the result that the burst speed will have no effect on very long sustained transfers.

Existing speed tests transfer a quantity of data and divide this quantity by the duration of the transfer to compute the transfer rate, typically expressed in Mbps. Without accounting for burst speed techniques, speed tests employing the mechanism described here will produce highly variable results depending on how much data they transfer or how long they are run. Burst speed techniques will have a dominant effect on short speed tests: a speed test running for two seconds on a connection employing burst speed techniques would likely record the burst speed rate, whereas a speed test running for two hours will reduce the effect of burst speed techniques to a negligible level.

The earlier speed test configuration employed in this study isolated the effects of transient performance enhancing burst speed techniques from the long-term sustained speed by running for a fixed 30 seconds and recording the average throughput at 5 second intervals. The throughput at the 0-5 second interval is

[24] These methods were reviewed with statistical experts by the participating ISPs.

referred to as the burst speed and the throughput at the 25-30 second interval is referred to as the actual speed. Testing was conducted prior to the start of trial to estimate the length of time during which the effects of burst speed techniques might be seen. Even though the precise parameters used for burst speed techniques are not known, their effects were no longer observable in testing after 20 seconds of data transfer.

In the 2016 report we noted that the use of this technology by providers was on the decline. For the 2017 report, we no longer provide the results of burst-speed since these techniques are now rarely used. The speed test configuration has been altered to shorten the test duration to 10 seconds, as there is no need to run it for 30 seconds any more.

8. Consistency of Speed Measurements

In addition to reporting on the median speed of panelists, the MBA Report also provides a measure of the consistency of speed that panelists experience in each tier. For purposes of discussion we use the term "80/80 consistent speed" to refer to the minimum speed that was experienced by at least 80% of panelists for at least 80% of the time during the peak periods. The process used in defining this metric for a specific ISP tier is to take each panelist's set of download or upload speed data during the peak period across all the days of the validated measurement period and arrange it in increasing order. The speed that corresponds to the 20th percentile represents the minimum speed that the panelist experienced at least 80% of the time. The 20 percentile values of all the panelists on a specific tier are then arranged in an increasing order. The speed that corresponds to the 20th percentile now represents the minimum speed that at least 80% of panelists experienced 80% of the time. This is the value reported as the 80/80 consistent speed for that ISP's tier. We also report on the 70/70 consistent speed for an ISP's tier, which is the minimum speed that at least 70% of the panelists experience at least 70% of the time. We typically report the 70/70 and the 80/80 consistent speeds as a percentage of the advertised speed.

When reporting on these values for an ISP, we weigh the 80/80 or 70/70 consistent speed results (as a percentage of the advertised speed) of each of the ISP's tier based on the number of subscribers to that tier; so as to get a weighted average across all the tiers for that ISP.

9. Latencies Attributable to Propagation Delay

The speeds at which signals can traverse networks are limited at a fundamental level by the speed of light. While the speed of light is not believed to be a significant limitation in the context of the other technical factors addressed by the testing methodology, a delay of approximately 5 ms per 1000 km of distance traveled can be attributed solely to the speed of light (depending on the transmission medium). The geographic distribution and the testing methodology's selection of the nearest test servers are believed to minimize any significant effect. However, propagation delay is not explicitly accounted for in the results.

10. Limiting Factors

A total of 11,529,355,630 measurements were taken across 192,319,443 unique tests.

All scheduled tests were run, aside from when monitoring units detected concurrent use of bandwidth. Schedules were adjusted when required for specific tests to avoid triggering data usage limits applied by some ISPs.

C. 4.3 DATA PROCESSING OF RAW AND VALIDATED DATA

The data collected in this program are made available as open data for review and use by the public. Raw and processed data sets, testing software, and the methodologies used to process and analyze data are freely and publicly available. Researchers and developers interested in working with measurement data in raw form will need skills in database management, SQL programming, and statistics, depending on the analysis. A developer FAQ for database configuration and data importing instructions for MySQL and PostgreSQL are available at http://www.fcc.gov/measuring-broadband-america/database-setup-and-importing-measuring-broadband-america-data

The process flow below describes how the raw collected data was processed for the production of the *Measuring Broadband America Report*. Researchers and developers interested in replicating or extending the results of the Report are encouraged to review the process below and supporting files that provide

details.

Raw Data:	Raw data for the chosen period is collected from the measurement database. The ISPs and products that panelists were on are exported to a "unit profile" file, and those that changed during the period are flagged. 2017 Raw Data Links
Validated Data Cleansing:	Data is cleaned. This includes removing measurements when a user changed ISP or tier during the period. Anomalies and significant outliers are also removed at this point. A data cleansing document describes the process in detail. 2017 Data Cleansing Document Link
SQL Processing:	Per-unit results are generated for each metric. Time-of-day averages are computed and a trimmed median is calculated for each metric. The SQL scripts used here are contained in SQL processing scripts available with the release of each report. 2017 SQL Processing Links
SPSS Processing:	The per-unit CSV data is processed by SPSS scripts coupled with the unit profile data. This process removes ISPs and tiers with low sample sizes and computes averages for the remainder that can be used in the report. 2017 SPSS Scripts Links
Unit Profile:	This document identifies the various details of each test unit, including ISP, technology, service tier, and general location. Each unit represents one volunteer panelists. The unit ID's were randomly generated, which served to protect the anonymity of the volunteer panelists. 2017 Unit Profile link
Excluded Units:	A listing of units excluded from the analysis due to insufficient sample size for that particular ISP's speed tier. 2017 Excluded Units Link
Unit Census Block:	This step identifies the census block (for blocks containing more than 1,000 people) in which each unit running tests is located. Census block is from 2010 census and is in the FIPS code format. We have used block FIPS codes for blocks that contains more than 1,000 people. For blocks with fewer than 1,000 people we have aggregated to the next highest level, i.e., tract, and used the Tract FIPS code, provided there are more than 1,000 people in the tract. In cases where there are less than 1,000 people in a tract we have aggregated to Regional level. 2017 Unit Census Block Link.
Excel Tables & Charts:	Summary data tables and charts in Excel are produced from the averages. These are used directly in the report. 2017 Statistical Averages Links

The raw data collected for each active metric is made available by month in tarred gzipped files. The files in the archive containing active metrics are described in table 9.

Table 10: Test to Data File Cross-Reference List

Test	Validated Data File Name
Download speed	curr_httpgetmt.csv — IPv4 Tests curr_httpgetmt6.csv — IPv6 Tests
Upload speed	curr_httppostmt.csv — IPv4 Tests curr_httppostmt6.csv — IPv6 Tests
Web browsing	curr_webget.csv

UDP latency	curr_udplatency.csv — IPv4 Tests curr_udplatency6.csv — IPv6 Tests
UDP packet loss	curr_udplatency.csv — IPv4 Tests curr_udplatency6.csv — IPv6 Tests
Voice over IP	curr_udpjitter.csv
DNS resolution	curr_dns.csv
DNS failures	curr_dns.csv
ICMP latency	curr_ping.csv
ICMP packet loss	curr_ping.csv
Latency under load	curr_dlping.csv – Downstream latency under load results curr_ulping.csv – Upstream latency under load results
Consumption[25]	curr_netusage.csv
Traceroute	curr_traceroute.csv

Table 11: Validated Data Files - Dictionary

The following Data Dictionary file describes the schema for each active metric test for row level results stored in the files described in table 9.[26] All `dtime` entries are in the UTC timezone. All durations are in microseconds unless otherwise noted. The `location_id` field should be ignored.

curr_dlping.csv	
`unit_id`	Unique identifier for an individual unit
`dtime`	Time test finished
`target`	Target hostname or IP address
`rtt_avg`	Average RTT
`rtt_min`	Minimum RTT
`rtt_max`	Maximum RTT
`rtt_std`	Standard deviation in measured RTT
`successes`	Number of successes
`failiures`	Number of failures
`location_id`	Internal key mapping to unit profile data
curr_dns.csv	
`unit_id`	Unique identifier for an individual unit
`dtime`	Time test finished
`nameserver`	Name server used to handle the DNS request

[25] While this metric is not an active test it is included in this description as a passive test.

[26] This data dictionary is also available on the FCC Measuring Broadband America website, located with the other validated data files available for download.

lookup_host	Hostname to be resolved
response_ip	Field currently unused
rtt	DNS resolution time
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_httpgetmt.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
address	The IP address of the server (resolved by the client's DNS)
fetch_time	Time the test ran for
bytes_total	Total bytes downloaded across all connections
bytes_sec	Running total of throughput, which is sum of speeds measured for each stream (in bytes/sec), from the start of the test to the current interval
bytes_sec_interval	Throughput at this specific interval (e.g., Throughput between 25-30 seconds)
warmup_time	Time consumed for all the TCP streams to arrive at optimal window size
warmup_bytes	Bytes transferred for all the TCP streams during the warm-up phase
sequence	The interval that this row refers to (e.g., in the US, sequence=0 implies result is for 0-5 seconds of the test)
threads	The number of concurrent TCP connections used in the test
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_httppostmt.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
address	The IP address of the server (resolved by the client's DNS)
fetch_time	Time the test ran for
bytes_total	Total bytes downloaded across all connections

bytes_sec	Running total of throughput, which is sum of speeds measured for each stream (in bytes/sec), from the start of the test to the current interval
bytes_sec_interval	Throughput at this specific interval (e.g., throughput between 25-30 seconds)
warmup_time	Time consumed for all the TCP streams to arrive at optimal window size
warmup_bytes	Bytes transferred for all the TCP streams during the warm-up phase.
sequence	The interval that this row refers to (e.g., in the US, sequence=0 implies result is for 0-5 seconds of the test)
threads	The number of concurrent TCP connections used in the test
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_ping.csv	ICMP based
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
rtt_avg	Average RTT
rtt_min	Minimum RTT
rtt_max	Maximum RTT
rtt_std	Standard deviation in measured RTT
successes	Number of successes
failiures	Number of failures
location_id	Internal key mapping to unit profile data
curr_udpjitter.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
packet_size	Size of each UDP Datagram (bytes)
stream_rate	Rate at which the UDP stream is generated (bits/sec)
duration	Total duration of test
packets_up_sent	Number of packets sent in upstream (measured by client)
packets_down_sent	Number of packets sent in downstream (measured by server)

packets_up_recv	Number of packets received in upstream (measured by server)
packets_down_recv	Number of packets received in downstream (measured by client)
jitter_up	Upstream Jitter measured
jitter_down	Downstream Jitter measured
latency	99th percentile of round trip times for all packets
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_udplatency.csv	UDP based
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
rtt_avg	Average RTT
rtt_min	Minimum RTT
rtt_max	Maximum RTT
rtt_std	Standard deviation in measured RTT
successes	Number of successes (note: use failures/(successes + failures)) for packet loss)
failiures	Number of failures (packets lost)
location_id	Internal key mapping to unit profile data
curr_ulping.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
rtt_avg	Average RTT
rtt_min	Minimum RTT
rtt_max	Maximum RTT
rtt_std	Standard deviation in measured RTT
successes	Number of successes
failures	Number of failures
location_id	Internal key mapping to unit profile data
curr_webget.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	URL to fetch

address	IP address used to fetch content from initial URL
fetch_time	Sum of time consumed to download HTML content and then concurrently download all resources
bytes_total	Sum of HTML content size and all resources size (bytes)
bytes_sec	Average speed of downloading HTML content and then concurrently downloading all resources (bytes/sec)
objects	Number of resources (images, CSS, …) downloaded
threads	Maximum number of concurrent threads allowed
requests	Total number of HTTP requests made
connections	Total number of TCP connections established
reused_connections	Number of TCP connections re-used
lookups	Number of DNS lookups performed
request_total_time	Total duration of all requests summed together, if made sequentially
request_min_time	Shortest request duration
request_avg_time	Average request duration
request_max_time	Longest request duration
ttfb_total_time	Total duration of the time-to-first-byte summed together, if made sequentially
ttfb_min_time	Shortest time-to-first-byte duration
ttfb_avg_time	Average time-to-first-byte duration
ttfb_max_time	Longest time-to-first-byte duration
lookup_total_time	Total duration of all DNS lookups summed together, if made sequentially
lookup_min_time	Shortest DNS lookup duration
lookup_avg_time	Average DNS lookup duration
lookup_max_time	Longest DNS lookup duration
successes	Number of successes
failures	Number of failures
location_id	Internal key mapping to unit profile data
curr_netusage.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
wan_rx_bytes	Total bytes received via the WAN interface on the unit (incl. Ethernet and IP headers)
wan_tx_bytes	Total bytes transmitted via the WAN interface on

	the unit (incl. Ethernet and IP headers)
sk_rx_bytes	Bytes received as a result of active performance measurements
sk_tx_bytes	Bytes transmitted as a result of active performance measurements
location_id	Internal key mapping to unit profile data

IX. 5 - Reference Documents

A. 5.1 - USER TERMS AND CONDITIONS

The following document was agreed to by each volunteer panelist who agreed to participate in the broadband measurement study:

User Terms and Conditions

PLEASE READ THESE TERMS AND CONDITIONS CAREFULLY. BY APPLYING TO BECOME A PARTICIPANT IN THE BROADBAND COMMUNITY PANEL AND/OR INSTALLING THE WHITEBOX, YOU ARE AGREEING TO THESE TERMS AND CONDITIONS.

YOUR ATTENTION IS DRAWN PARTICULARLY TO CONDITIONS 3.5 (PERTAINING TO YOUR CONSENT TO YOUR ISPS PROVIDING CERTAIN INFORMATION AND YOUR WAIVER OF CLAIMS), 6 (LIMITATIONS OF LIABILITY) AND 7 (DATA PROTECTION).

1. Interpretation

1.1. The following definitions and rules of interpretation apply to these terms & conditions.

Connection: the Participant's own broadband internet connection, provided by an Internet Service Provider ("ISP").

Connection Equipment: the Participant's broadband router or cable modem, used to provide the Participant's Connection.

Intellectual Property Rights: all patents, rights to inventions, utility models, copyright and related rights, trademarks, service marks, trade, business and domain names, rights in trade dress or get-up, rights in goodwill or to sue for passing off, unfair competition rights, rights in designs, rights in computer software, database right, moral rights, rights in confidential information (including know-how and trade secrets) and any other intellectual property rights, in each case whether registered or unregistered and including all applications for and renewals or extensions of such rights, and all similar or equivalent rights or forms of protection in any part of the world.

ISP: the company providing broadband internet connection to the Participant during the term of this Program.

Participant/You/Your: the person who volunteers to participate in the Program, under these terms and conditions. The Participant must be the named account holder on the Internet service account with the ISP.

Open Source Software: the software in the Whitebox device that is licensed under an open source license (including the GPL).

Participant's Equipment: any equipment, systems, cabling or facilities provided by the Participant and used directly or indirectly in support of the Services, excluding the Connection Equipment.

Parties: both the Participant and SamKnows.

Party: one of either the Participant or SamKnows.

Requirements: the requirements specified by SamKnows as part of the sign-up process that the Participant must fulfil in order to be selected to receive the Services.

SamKnows/We/Our: the organization providing the Services and conducting the Program, namely:

SamKnows Limited (Co. No. 6510477) of 25 Harley Street, London W1G 9BR

Services / Program: the performance and measurement of certain broadband and Internet services and research program (Broadband Community Panel), as sponsored by the Federal Communications Committee (FCC), in respect of measuring broadband Internet Connections.

Software: the software that has been installed and/or remotely uploaded onto the Whitebox, by SamKnows as updated by SamKnows, from time to time, but not including any Open Source Software.

Test Results: Information concerning the Participant's ISP service results.

Whitebox: the hardware supplied to the Participant by SamKnows with the Software.

1.2. Headings in these terms and conditions shall not affect their interpretation.

1.3. A person includes a natural person, corporate or unincorporated body (whether or not having separate legal personality).

1.4. The schedules form part of these terms and conditions.

1.5. A reference to writing or written includes faxes and e-mails.

1.6.Any obligation in these terms and conditions on a person not to do something includes, without limitation, an obligation not to agree, allow, permit or acquiesce in that thing being done.

2. SamKnows' Commitment to You

2.1 Subject to the Participant complying fully with these terms and conditions, SamKnows shall use reasonable care to:

(a) provide the Participant with the Measurement Services under these terms and conditions;

(b) supply the Participant with the Whitebox and instructions detailing how it should be connected to the Participant's Connection Equipment; and

(c) if requested, SamKnows will provide a pre-paid postage label for the Whitebox to be returned.

(d) comply with all applicable United States, European Union, and United Kingdom privacy laws and directives, and will access, collect, process and distribute the information according to the following principles:

Fairness: We will process data fairly and lawfully;

Specific purpose: We will access, collect, process, store and distribute data for the purposes and reasons

specified in this agreement and not in ways incompatible with those purposes;

Restricted: We will restrict our data collection and use practices to those adequate and relevant, and not excessive in relation to the purposes for which we collect the information;

Accurate: We will work to ensure that the data we collect is accurate and up-to-date, working with Participant and his/her ISP;

Destroyed when obsolete: We will not maintain personal data longer than is necessary for the purposes for which we collect and process the information;

Security: We will collect and process the information associated with this trial with adequate security through technical and organizational measures to protect personal data against destruction or loss, alteration, unauthorized disclosure or access, in particular where the processing involves the transmission of data over a network.

2.2 In addition, SamKnows shall:

(a) provide Participant with access to a Program-specific customer services email address, which the Participant may use for questions and to give feedback and comments;

(b) provide Participant with a unique login and password in order to access to an online reporting system for access to Participant's broadband performance statistics.

(c) provide Participant with a monthly email with their specific data from the Program or notifying Participant that their individual data is ready for viewing;

(d) provide Participant with support and troubleshooting services in case of problems or issues with their Whitebox;

(e) notify Participant of the end of the FCC-sponsored Program and provide a mechanism for Participant to opt out of any further performance/measuring services and research before collecting any data after termination of the Program;

(f) use only data generated by SamKnows through the Whitebox, and not use any Participant data for measuring performance without Participant's prior written consent; and

(g) not monitor/track Participant's Internet activity without Participant's prior written consent.

2.3 While SamKnows will make all reasonable efforts to ensure that the Services cause no disruption to the performance of the Participant's broadband Connection, including only running tests when there is no concurrent network activity generated by users at the Participant's location. The Participant acknowledges that the Services may occasionally impact the performance of the Connection and agrees to hold SamKnows and their ISP harmless for any impact the Services may have on the performance of their Connection.

3. Participant's Obligations

3.1 The Participant is not required to pay any fee for the provision of the Services by SamKnows or to participate in the Program.

3.2 The Participant agrees to use reasonable endeavors to:

(a) connect the Whitebox to their Connection Equipment within 14 days of receiving it;

(b) not to unplug or disconnect the Whitebox unless (i) they will be absent from the property in which it is connected for more than 3 days and/or (ii) it is reasonably necessary for maintenance of the Participant's Equipment and the Participant agrees that they shall use reasonable endeavors to minimize the length of time the Whitebox is unplugged or disconnected;

(c) in no way reverse engineer, tamper with, dispose of or damage the Whitebox, or attempt to do so;

(d) notify SamKnows within 7 days in the event that they change their ISP or their Connection tier or package (for example, downgrading/upgrading to a different broadband package), to the email address provided by SamKnows;

(e) inform SamKnows of a change of postal or email address by email; within 7 days of the change, to the email address provided by SamKnows;

(f) agrees that the Whitebox may be upgraded to incorporate changes to the Software and/or additional tests at the discretion of SamKnows, whether by remote uploads or otherwise;

(g) on completion or termination of the Services, return the Whitebox to SamKnows by mail, if requested by SamKnows. SamKnows will provide a pre-paid postage label for the Whitebox to be returned;

(h) be an active part of the Program and as such will use all reasonable endeavors to complete the market research surveys received within a reasonable period of time;

(i) not publish data, give press or other interviews regarding the Program without the prior written permission of SamKnows; and

(k) contact SamKnows directly, and not your ISP, in the event of any issues or problems with the Whitebox, by using the email address provided by SamKnows.

3.3 You will not give the Whitebox or the Software to any third party, including (without limitation) to any ISP. You may give the Open Source Software to any person in accordance with the terms of the relevant open source licence.

3.4 The Participant acknowledges that he/she is not an employee or agent of, or relative of, an employee or agent of an ISP or any affiliate of any ISP. In the event that they become one, they will inform SamKnows, who at its complete discretion may ask for the immediate return of the Whitebox.

3.5 THE PARTICIPANT'S ATTENTION IS PARTICULARLY DRAWN TO THIS CONDITION. The Participant expressly consents to having their ISP provide to SamKnows and the Federal Communications (FCC) information about the Participant's broadband service, for example: service address, speed tier, local loop length (for DSL customers), equipment identifiers and other similar information, and hereby waives any claim that its ISPs disclosure of such information to SamKnows or the FCC constitutes a violation of any right or any other right or privilege that the Participant may have under any federal, state or local statute, law, ordinance, court order, administrative rule, order or regulation, or other applicable law, including, without limitation, under 47 U.S.C**.** §§ 222 and 631 (each a "Privacy Law"). If notwithstanding Participant's consent under this Section 3.5, Participant, the FCC or any other party brings any claim or action against any ISP under a Privacy Law, upon the applicable ISPs request SamKnows promptly shall cease collecting data from such Participant and remove from its records all data collected with respect to such Participant prior to the date of such request, and shall not provide such data in any form to the FCC. The Participant further consents to transmission of information from this

Program Internationally, including the information provided by the Participant's ISP, specifically the transfer of this information to SamKnows in the United Kingdom, SamKnows' processing of it there and return to the United States.

4. Intellectual Property Rights

4.1 All Intellectual Property Rights relating to the Whitebox are the property of its manufacturer. The Participant shall use the Whitebox only to allow SamKnows to provide the Services.

4.2 As between SamKnows and the Participant, SamKnows owns all Intellectual Property Rights in the Software. The Participant shall not translate, copy, adapt, vary or alter the Software. The Participant shall use the Software only for the purposes of SamKnows providing the Services and shall not disclose or otherwise use the Software.

4.3 Participation in the Broadband Community Panel gives the participant no Intellectual Property Rights in the Test Results. Ownership of all such rights is governed by Federal Acquisition Regulation Section 52.227-17, which has been incorporated by reference in the relevant contract between SamKnows and the FCC. The Participant hereby acknowledges and agrees that SamKnows may make such use of the Test Results as is required for the Program.

4.4 Certain core testing technology and aspects of the architectures, products and services are developed and maintained directly by SamKnows. SamKnows also implements various technical features of the measurement services using particular technical components from a variety of vendor partners including: NetGear, Measurement Lab, TP-Link.

5. SamKnows' Property

The Whitebox and Software will remain the property of SamKnows. SamKnows may at any time ask the Participant to return the Whitebox, which they must do within 28 days of such a request being sent. Once SamKnows has safely received the Whitebox, SamKnows will reimburse the Participant's reasonable postage costs for doing so.

6. Limitations of Liability - THE PARTICIPANT'S ATTENTION IS PARTICULARLY DRAWN TO THIS CONDITION

6.1 This condition 6 sets out the entire financial liability of SamKnows (including any liability for the acts or omissions of its employees, agents, consultants, and subcontractors) to the Participant, including and without limitation, in respect of:

(a) any use made by the Participant of the Services, the Whitebox and the Software or any part of them; and

(b) any representation, statement or tortious act or omission (including negligence) arising under or in connection with these terms and conditions.

6.2 All implied warranties, conditions and other terms implied by statute or other law are, to the fullest extent permitted by law, waived and excluded from these terms and conditions.

6.3 Notwithstanding the foregoing, nothing in these terms and conditions limits or excludes the liability of SamKnows:

(a) for death or personal injury resulting from its negligence or willful misconduct;

(b) for any damage or liability incurred by the Participant as a result of fraud or fraudulent misrepresentation by SamKnows;

(c) for any violations of U.S. consumer protection laws;

(d) in relation to any other liabilities which may not be excluded or limited by applicable law.

6.4 Subject to condition 6.2 and condition 6.3, SamKnows' total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation, restitution or otherwise arising in connection with the performance, or contemplated performance, of these terms and conditions shall be limited to $100.

6.5 In the event of any defect or modification in the Whitebox, the Participant's sole remedy shall be the repair or replacement of the Whitebox at SamKnows' reasonable cost, provided that the defective Whitebox is safely returned to SamKnows, in which case SamKnows shall pay the Participant's reasonable postage costs.

6.6 The Participant acknowledges and agrees that these limitations of liability are reasonable in all the circumstances, particularly given that no fee is being charged by SamKnows for the Services or participation in the Program.

6.7 It is the Participant's responsibility to pay all service and other charges owed to its ISP in a timely manner and to comply with all other ISP applicable terms. The Participant shall ensure that their broadband traffic, including the data pushed by SamKnows during the Program, does not exceed the data allowance included in the Participant's broadband package. If usage allowances are accidentally exceeded and the Participant is billed additional charges from the ISP as a result, SamKnows is not under any obligation to cover these charges although it may choose to do so at its discretion.

7. Data protection - the participation's attention is particularly drawn to this condition.

7.1 The Participant acknowledges and agrees that his/her personal data, such as service tier, address and line performance, will be processed by SamKnows in connection with the program.

7.2 Except as required by law or regulation, SamKnows will not provide the Participant's personal data to any third party without obtaining Participant's prior consent. However, for the avoidance of doubt, the Participant acknowledges and agrees that subject to the privacy polices discussed below, the specific technical characteristics of tests and other technical features associated with the Internet Protocol environment of architecture, including the client's IP address, may be shared with third parties as necessary to conduct the Program and all aggregate statistical data produced as a result of the Services (including the Test Results) may be provided to third parties.

7.3 You acknowledge and agree that SamKnows may share some of Your information with Your ISP, and request information about You from Your ISP so that they may confirm Your service tiers and other information relevant to the Program. Accordingly You hereby expressly waive claim that any disclosure by Your ISP to SamKnows constitutes a violation of any right or privilege that you may have under any law, wherever it might apply.

8. Term and Termination

8.1 This Agreement shall continue until terminated in accordance with this clause.

8.2 Each party may terminate the Services immediately by written notice to the other party at any time.

Notice of termination may be given by email. Notices sent by email shall be deemed to be served on the day of transmission if transmitted before 5.00 pm Eastern Time on a working day, but otherwise on the next following working day.

8.3 On termination of the Services for any reason:

(a) SamKnows shall have no further obligation to provide the Services; and

(b) the Participant shall safely return the Whitebox to SamKnows, if requested by SamKnows, in which case SamKnows shall pay the Participant's reasonable postage costs.

8.4 Notwithstanding termination of the Services and/or these terms and conditions, clauses 1, 3.3 and 4 to 14 (inclusive) shall continue to apply.

9. Severance

If any provision of these terms and conditions, or part of any provision, is found by any court or other authority of competent jurisdiction to be invalid, illegal or unenforceable, that provision or part-provision shall, to the extent required, be deemed not to form part of these terms and conditions, and the validity and enforceability of the other provisions these terms and conditions shall not be affected.

10. Entire agreement

10.1 These terms and conditions constitute the whole agreement between the parties and replace and supersede any previous agreements or undertakings between the parties.

10.2 Each party acknowledges that, in entering into these terms and conditions, it has not relied on, and shall have no right or remedy in respect of, any statement, representation, assurance or warranty.

11. Assignment

11.1 The Participant shall not, without the prior written consent of SamKnows, assign, transfer, charge, mortgage, subcontract all or any of its rights or obligations under these terms and conditions.

11.2 Each party that has rights under these terms and conditions acknowledges that they are acting on their own behalf and not for the benefit of another person.

12. No Partnership or Agency

Nothing in these terms and conditions is intended to, or shall be deemed to, constitute a partnership or joint venture of any kind between any of the parties, nor make any party the agent of another party for any purpose. No party shall have authority to act as agent for, or to bind, the other party in any way.

13. Rights of third parties

Except for the rights and protections conferred on ISPs under these Terms and Conditions which they may defend, a person who is not a party to these terms and conditions shall not have any rights under or in connection with these Terms and Conditions.

14. Privacy and Paperwork Reduction Acts

14.1 For the avoidance of doubt, the release of IP protocol addresses of client's Whiteboxes are not PII for the purposes of this program and the client expressly consents to the release of IP address and other

technical IP protocol characteristics that may be gathered within the context of the testing architecture. SamKnows, on behalf of the FCC, is collecting and storing broadband performance information, including various personally identifiable information (PII) such as the street addresses, email addresses, sum of data transferred, and broadband performance information, from those individuals who are participating voluntarily in this test. PII not necessary to conduct this study will not be collected. Certain information provided by or collected from you will be confirmed with a third party, including your ISP, to ensure a representative study and otherwise shared with third parties as necessary to conduct the program. SamKnows will not release, disclose to the public, or share any PII with any outside entities, including the FCC, except as is consistent with the SamKnows privacy policy or these Terms and Conditions. See https://www.measuringbroadbandamerica.com/privacy/. The broadband performance information that is made available to the public and the FCC, will be in an aggregated form and with all PII removed. For more information, see the Privacy Act of 1974, as amended (5 U.S.C. § 552a), and the SamKnows privacy policy.

14.2 The FCC is soliciting and collecting this information authorized by OMB Control No. 3060-1139 in accordance with the requirements and authority of the Paperwork Reduction Act, Pub. L. No. 96-511, 94 Stat. 2812 (Dec. 11, 1980); the Broadband Data Improvement Act of 2008, Pub. L. No. 110-385, Stat 4096 § 103(c)(1); American Reinvestment and Recovery Act of 2009 (ARRA), Pub. L. No. 111-5, 123 Stat 115 (2009); and Section 154(i) of the Communications Act of 1934, as amended.

14.3 *Paperwork Reduction Act of 1995 Notice*. We have estimated that each Participant of this study will assume a one hour time burden over the course of the Program. Our estimate includes the time to sign-up online, connect the Whitebox in the home, and periodic validation of the hardware. If you have any comments on this estimate, or on how we can improve the collection and reduce the burden it causes you, please write the Federal Communications Commission, Office of Managing Director, AMD-PERM, Washington, DC 20554, Paperwork Reduction Act Project (3060-1139). We will also accept your comments via the Internet if you send an e-mail to PRA@fcc.gov. Please DO NOT SEND COMPLETED APPLICATION FORMS TO THIS ADDRESS. You are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection, unless it displays a currently valid OMB control number and provides you with this notice. This collection has been assigned an OMB control number of 3060-1139. THIS NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104-13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507. This notice may also be found at https://www.measuringbroadbandamerica.com/paperwork-reduction-act/.

15. Jurisdiction

These terms and conditions shall be governed by the laws of the state of New York.

SCHEDULE

THE SERVICES

Subject to the Participant complying with its obligations under these terms and conditions, SamKnows shall use reasonable endeavors to test the Connection so that the following information is recorded:

1. Web browsing
2. Video streaming
3. Voice over IP
4. Download speed

5. Upload speed
6. UDP latency
7. UDP packet loss
8. Consumption
9. Availability
10. DNS resolution
11. ICMP latency
12. ICMP packet loss

In performing these tests, the Whitebox will require a variable download capacity and upload capacity per month, which will be available to the Participant in motion 2.3. The Participant acknowledges that this may impact on the performance of the Connection.

1. SamKnows will perform tests on the Participant's Connection by using SamKnows' own data and will not monitor the Participant's content or internet activity. The purpose of this study is to measure the Connection and compare this data with other consumers to create a representative index of US broadband performance.

B. 5.2 – CODE OF CONDUCT

The following Code of Conduct, available at http://data.fcc.gov/download/measuring-broadband-america/2016/Code-of-Conduct-fixed.pdf*, was signed by ISPs and other entities participating in the study:*

FCC MEASURING BROADBAND AMERICA PROGRAM

FIXED TESTING AND MEASUREMENT
STAKEHOLDERS CODE OF CONDUCT

WHEREAS the Federal Communications Commission of the United States of America (FCC) is conducting a Broadband Testing and Measurement Program, with support from its contractor SamKnows, the purpose of which is to establish a technical platform for the Measuring Broadband America Program Fixed Broadband Testing and Measurement and further to use that platform to collect data;

WHEREAS volunteer panelists have been recruited, and in so doing have agreed to provide broadband performance information measured on their Whiteboxes to support the collection of broadband performance data; and steps have been taken to protect the privacy of panelists to the program's effort to measure broadband performance. WE, THE UNDERSIGNED, as participants and stakeholders in that Fixed Broadband Testing and Measurement, do hereby agree to be bound by and conduct ourselves in accordance with the following principles and shall:

1. At all times act in good faith;
2. Not act, nor fail to act, if the intended consequence of such act or omission is inconsistent with the privacy policies of the program;
3. Not act, nor fail to act, if the intended consequence of such act or omission is to enhance, degrade, or tamper with the results of any test for any individual panelist or broadband provider, except that:
   - 3.1. It shall not be a violation of this principle for broadband providers to:
     - 3.1.1. Operate and manage their business, including modifying or improving services delivered to any class of subscribers that may or may not include panelists among them, provided that such actions are consistent with normal business practices, and

3.1.2. Address service issues for individual panelists at the request of the panelist or based on information not derived from the trial;

3.2. It shall not be a violation of this principle for academic and research purposes to simulate or observe tests and components of the testing architecture, provided that no impact to MBA data or the Internet Service of the subscriber volunteer panelist occurs; and

4. Not publish any data generated by the tests, nor make any public statement based on such data, until such time as the FCC releases data, or except where expressly permitted by the FCC; and

5. Not publish or make use of any test data or testing infrastructure in a manner that would significantly reduce the anonymity of collected data, compromise panelists privacy, or compromise the MBA privacy policy governing collection and analysis of data except that:

5.1. It shall not be a violation of this principle for stakeholder signatories under the direction of the FCC to:

5.1.1. Make use of test data or testing infrastructure to support the writing of FCC fixed Measuring Broadband America Reports;

5.1.2. Make use of test data or testing infrastructure to support various aspects of the testing and architecture for the program including to facilitate data processing or analysis;

5.1.3. Make use of test data or testing infrastructure to support the analysis of collected data or testing infrastructure for privacy risks or concerns, and plan for future measurement efforts;

6. Ensure that their employees, agents, and representatives, as appropriate, act in accordance with this Code of Conduct.

Signatories:

_____

Printed: _____

Date: _____

C. 5.3 - TEST NODE BRIEFING

Test Node Briefing
DOCUMENT REFERENCE:
SQ302-002-EN

TEST NODE BRIEFING
Technical information relating to the SamKnows test nodes

August 2013

Important Notice

1 - SamKnows Test Nodes

In order to gauge an Internet Service Provider's broadband performance at a User's access point, the SamKnows Whiteboxes need to measure the service performance (e.g. upload/download speeds, latency, etc.) from the Whitebox to a specific test node. SamKnows supports a number of "test nodes" for this purpose.

The test nodes run special software designed specifically for measuring the network performance when communicating with the Whiteboxes.

It is critical that these test nodes be deployed near to the customer (and their Whitebox). The further the test node is from the customer, the higher the latency and the greater the possibility that third party networks may need to be traversed, making it difficult to isolate the individual ISP's performance. This is why SamKnows operates so many test nodes all around the world—locality to the customer is critical.

1.1 Test node definition

When referring to "test nodes," we are specifically referring to either the dedicated servers that are under SamKnows' control, or the virtual machines that may be provided to us. In the case of virtual machines provided by Measurement-Lab, Level3, and others, the host operating system is under the control of and maintained by these entities and not by SamKnows.

1.2 Test node selection

The SamKnows Whiteboxes select the nearest node by running round-trip latency checks to all test nodes

before measurement begins. Note that when we use the term "nearest" we are referring to the test node nearest to the Whitebox from the point of view of network delay, which may not necessarily always be the one nearest geographically.
Alternatively, it is possible to override test node selection based on latency and implement a static configuration so that the Whitebox will only test against the test node chosen by the Administrator. This is so that the Administrator can choose to test any particular test node that is of interest to the specific project and also to maintain configuration consistency. Similarly, test node selection may be done on a scheduled basis, alternating between servers, to collect test data from multiple test nodes for comparison purposes.

1.3 Test node positioning—on-net versus off-net

It is important that measurements collected by the test architecture support the comparison of ISP performance in an unbiased manner. Measurements taken from using the standardized set of "off-net" measurement test nodes (off-net here refers to a test node located outside a specific ISP's network) ensure that the performance of all ISPs can be measured under the same conditions and would avoid artificially biasing results for any one ISP over another. Test nodes located on a particular ISP's network ("on-net" test nodes), might introduce bias with respect to the ISP's own network performance. Thus data to be used to compare ISP performance are collected using "off-net" test nodes, because they reside outside the ISP network.
However, it is also very useful to have test nodes inside the ISP network ("on-net" test nodes). This allows us to:

- Determine what degradation in performance occurs when traffic leaves the ISP network; and
- Check that the off-net test nodes are performing properly (and vice versa).
- By having both on-net and off-net measurement data for each Whitebox, we can have a great deal of confidence in the quality of the data.

2.3 Data that is stored on test nodes

No measurement data collected by SamKnows is stored on test nodes.[27] The test nodes provide a "dumb" endpoint for the Whiteboxes to test against. All measurement performance results are recorded by the Whiteboxes, which are then transmitted from the Whitebox to data collection servers managed by SamKnows.

Note that Measurement-Lab run sidestream measurements for all TCP connections against their test nodes, and publish this data in accordance with their data embargo policy.

2 - Test Node Hosting and Locations

SamKnows test nodes reside in major peering locations around the world. Test nodes are carefully sited to ensure optimal connectivity on a market-by-market basis. SamKnows' test infrastructure utilizes nodes made available by Level3, Measurement-Lab and various network operators, as well as under contract with select hosting providers.

2.1 Global test nodes

Level3 has provided SamKnows with 11 test nodes to use for the FCC's Measuring Broadband America Program. These test nodes are virtual servers meeting SamKnows specifications. Similarly, Measurement-

[27] Note that Measurement-Lab runs sidestream measurements for all TCP connections against their test nodes and publishes these data in accordance with their data embargo policy.

Lab has also provided SamKnows with test nodes in various cities and countries for use with the Program's fixed measurement efforts. Measurement-Lab provides location hosting for at least three test nodes per site. Furthermore, SamKnows maintains its own test nodes, which are separate from the test nodes provided by Measurement-Lab and Level3.

Table 1 below shows the locations of the SamKnows test node architecture supporting the Measuring Broadband America Program.[28] All of these listed test nodes reside outside individual ISP networks and therefore are designated as off-net test nodes. Note, that in many locations there are multiple test nodes installed which may be connected to different providers.

Location	SamKnows	Level3	Measurement-Lab
Atlanta, Georgia			✓
Chicago, Illinois		✓	✓
Dallas, Texas		✓	✓
Los Angeles, California	✓	✓	✓
Miami, Florida			✓
Mountain View, California			✓
New York City, New York	✓	✓	✓
San Jose, California		✓	
Seattle, Washington			✓
Washington D.C	✓	✓	
Washington, Virginia			✓
Denver, Colorado			✓

Table 1: Test Node Locations

SamKnows also has access to many test nodes donated by ISPs around the world. These particular test nodes reside within individual ISP networks and are therefore considered on-net test nodes.

ISPs have the advantage of measuring to both on-net and off-net test nodes, which allows them to segment end-to-end network performance and determine the performance of their own network versus third party networks. For example, an ISP can see what impact third party networks have on their end-users Quality of Experience ('QoE') by placing test nodes within their own network and at major National and International peering locations.

[28] In addition to the test nodes used to support the Measuring Broadband America Program, SamKnows utilizes a diverse fleet of nodes in locations around the globe for other international programs.

Diagram 1 below shows this set-up.

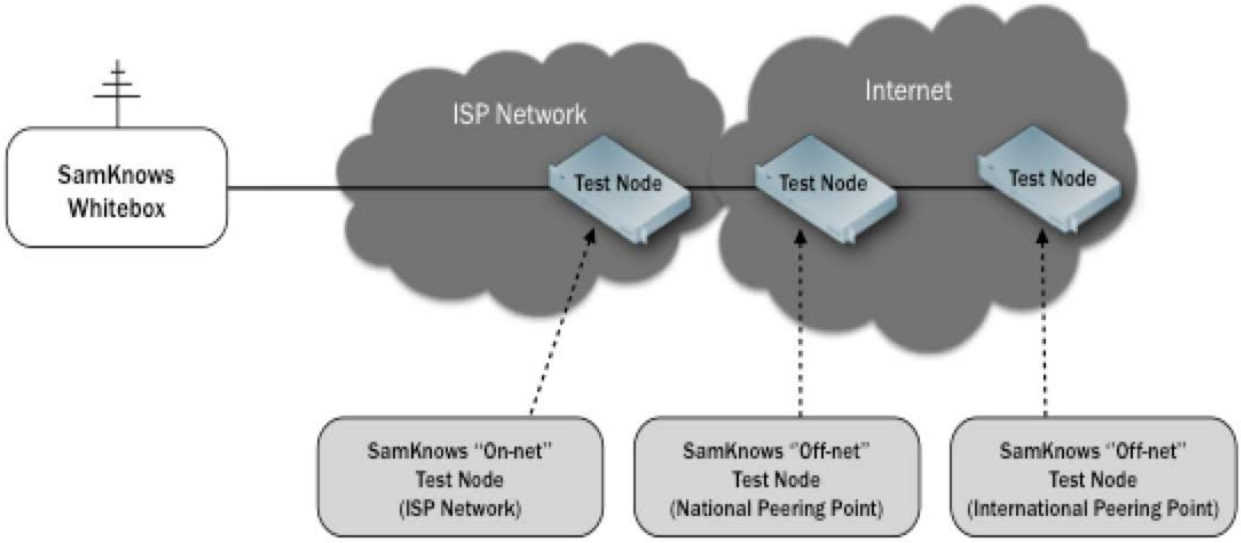


Diagram 1: On-net and Off-net Testing

Both the on-net and off-net test nodes are monitored by SamKnows as part of the global test node fleet. Test node management is explained in more detail within the next section of this document.

3 - Test Node Management

SamKnows test node infrastructure is a critical element of the SamKnows global measurement platform and includes extensive monitoring in place. SamKnows uses a management tool to control and configure the test nodes, while the platform is closely scrutinized using the Nagios monitoring application. System alerts are also in place to ensure the test node infrastructure is always available and operating well within expected threshold bounds.

The SamKnows Operations team continuously checks all test nodes to monitor capacity and overall health. Also included is data analysis to safeguard data accuracy and integrity. This level of oversight not only helps to maintain a healthy, robust platform but also allows us to spot and flag actual network issues and events as they happen. Diagnostic information also supports the Program managers' decision-making process for managing the impact of data accuracy and integrity incidents. This monitoring and administration is fully separate from any monitoring and administration of operating systems and platforms that may be necessary by hosting entities with which SamKnows may be engaged.

3.1 Seamless test node management

SamKnows controls its network of test nodes via a popular open-source management tool called Puppet (**https://puppetlabs.com**). Puppet allows the SamKnows Operations team to easily manage hundreds of test nodes and ensure that each group of test nodes is configured properly as per each project requirement. Coded in Python, Puppet uses a low-overhead agent installed on each test node that regularly communicates with the controlling SamKnows server to check for updates and ensure the integrity of the configuration.

This method of managing our test nodes allows us to deal with the large number of test nodes without affecting the user's performance in any way. We are also able to quickly and safely make changes to large parts of our test node fleet while ensuring that only the relevant test nodes are updated. This also allows us to keep a record of changes and rapidly troubleshoot any potential problems.

3.2 Proactive test node monitoring

While Puppet handles the configuration and management of the test nodes, Nagios (the most popular online monitoring application) is used by SamKnows to monitor the test nodes. Each test node is configured to send Nagios regular status updates on core metrics such as CPU usage, disk space, free memory, and SamKnows-specific applications. Nagios will also perform active checks of each test nodes where possible, providing us with connectivity information—both via "ping" and connections to any webserver that may be running on the target host.

4 - Test Node Specification and Connectivity

SamKnows maintains a standard specification for all test nodes to ensure consistency and accuracy across the fleet.

4.1 SamKnows test node specifications

All dedicated test nodes must meet the following minimum specifications:

- CPU: Dual core Xeon (2 GHz+)
- RAM: 4 GB
- Disk: 80 GB
- Operating System: CentOS/RHEL 6.x
- Connectivity: Gigabit Ethernet connectivity, with gigabit upstream link.

4.2 Level3 test node specifications

All test nodes provided by level3 meet the following minimum specifications:

- CPU: 2.2 GHz Dual Core
- RAM: 4GB
- Disk: 10 GB
- Operating System: CentOS 6 (64bit)
- Connectivity: 4x1 Gigabit Ethernet (LAG protocol)

4.3 Measurement-Lab test node specifications

All test nodes provided by Measurement-Lab meet the following minimum specifications:

- CPU: 2 GHz 8-core CPU
- RAM: 8 GB
- Disk: 2x100 GB
- OS: CentOS 6.4
- Connectivity: minimum 1 Gbps dedicated upstream

4.4 Test node connectivity

Measurement test nodes must be connected to a Tier-1 or equivalently neutral peering point. Each test node must be able to sustain 1 Gbps throughput.

At minimum, one publicly routable IPv4 address must be provisioned per-test node. The test node must not be presented with a NAT'd address. It is highly preferable for any new test nodes to also be provisioned with an IPv6 address at installation time.
It is preferred that the test nodes do not sit behind a firewall. If a firewall is used, then care must be taken to ensure that it can sustain the throughput required above.

4.5 Test node security

Each of the SamKnows test nodes is firewalled using the IPTables linux firewall. We close any ports that are not required, restrict remote administration to SSH only, and ensure access is only granted from a limited number of specified IP addresses. Only ports that require access from the outside world—for example TCP Port 80 on a webserver—would have that port fully open. SamKnows regularly checks its rulesets to ensure that there are no outdated rules and that the access restriction is up to date.
SamKnows accounts on each test node are restricted to the systems administration team by default. When required for further work, an authorized SamKnows employee will have an account added.

5 - Test Node Provisioning

SamKnows also has a policy of accepting test nodes provided by network operators providing that

- The test node meets the specifications outlined earlier
- Minimum of 1 Gbps upstream is provided and downstream connectivity to national peering locations

Please note that donated test nodes may also be subject to additional local requirements.

5.1 Installation and qualification

ISPs are requested to complete an information form for each test node they wish to provision. This will be used by SamKnows to configure the test node on the management system.
SamKnows will then provide an installation script and an associated installation guide. This will require minimal effort from the ISPs involved and will take a very similar form to the package used on existing test nodes.
Once the ISP has completed installation, SamKnows will verify the test node meets performance requirements by running server-to-server tests from known-good servers. These server-to-server measurements will be periodically repeated to verify performance levels.

5.2 Test node access and maintenance

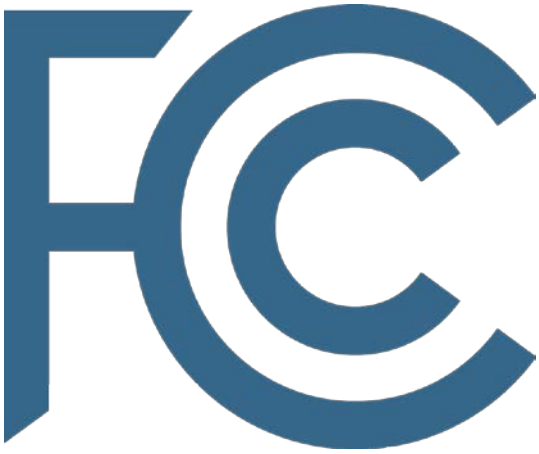
ISPs donating test nodes are free to maintain and monitor the test nodes using their existing toolsets, providing that these do not interfere with the SamKnows measurement applications or system monitoring tools. ISPs must not run resource intensive processes on the test nodes (e.g. packet captures), as this may affect measurements.
ISPs donating test nodes must ensure that these test nodes are only accessed by maintenance staff when absolutely necessary.
SamKnows requests SSH access to the test nodes, with sudo abilities. sudo is a system administration tool that allows elevated privileges in a controlled granular manner. This has greatly helped diagnosis of performance issues with ISP-provided test nodes historically and would enable SamKnows to be far more responsive in investigating issues.

[DOCUMENT ENDS]

APPENDIX F-2

Eighth Measuring Broadband America Fixed Broadband Report

A Report on Consumer Fixed Broadband Performance in the United States



Federal Communications Commission
Office of Engineering and Technology

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1. EXECUTIVE SUMMARY

The Eighth Measuring Broadband America Fixed Broadband Report ("Eighth Report" or "Report") contains validated data collected in September 2017[1] from fixed Internet Service Providers (ISPs) as part of the Federal Communication Commission's (FCC) Measuring Broadband America (MBA) program. This program is an ongoing, rigorous, nationwide study of consumer broadband performance in the United States. We measure the network performance delivered on selected service tiers to a representative sample set of the population. The thousands of volunteer panelists are drawn from subscribers of Internet service providers serving over 80% of the residential marketplace[2].
The initial Measuring Broadband America Fixed Broadband Report was published in August 2011,[3] and presented the first broad-scale study of directly measured consumer broadband performance throughout the United States. As part of an open data program, all methodologies used in the program are fully documented and all data collected is published for public use without restriction. Including this current Report, eight reports have now been issued.[4] These reports provide a snapshot of fixed broadband Internet access service performance in the United States. These reports present analysis of broadband information in a variety of ways and have evolved to make the information more understandable and useful, as well as, to reflect the evolving applications supported by the nation's broadband infrastructure.

D. Major FINDINGS of the EIGHTH Report

The key findings of this report are:

- The maximum advertised download speeds amongst the service tiers measured by the FCC were between 3-200 Mbps for the period covered by this report.
- The median speed experienced by subscribers of the participating ISPs was 72 Mbps.
- For most of the major broadband providers that were tested, measured download speeds were 100% or better of advertised speeds during the peak hours (7 p.m. to 11 p.m. local time).
- Fourteen ISPs were evaluated in this report. Of these AT&T, Cincinnati Bell, Frontier and Verizon employed multiple different broadband technologies across the USA. Overall 17 different ISP/technology configurations were evaluated in this report. Out of these only two performed below 90% for actual-to-advertised download speed.

[1] The actual dates used for measurements for this Eighth Report were September 1-6, 2017 inclusive and September 28-October 21, 2017 inclusive.

[2] This year, at the request of and with the assistance of the Hawaiian Department of Commerce and Consumer Affairs (DCCA) we added the state of Hawaii to the MBA program. The ISPs whose performance were measured in the State of Hawaii were Hawaiian Telecom and Time Warner Oceanic (which is now a part of Charter Spectrum).

[3] All reports can be found at https://www.fcc.gov/general/measuring-broadband-america.

[4] The First Report (2011) was based on measurements taken in March 2011, the Second Report (2012) on measurements taken in April 2012, and the Third (2013) through Seventh (2017) Reports on measurements taken in September of the year prior to the reports' release dates. In order to avoid confusion between the date of release of the report and the measurement dates we have shifted last year to numbering the reports. Thus, this year's report is termed the Eighth MBA Report instead of 2018 MBA Report. Going forward we will continue with a numbered approach and the next report will be termed as the Ninth Report.

- In addition to providing download and upload speed measurements of ISPs, this report also presents a measure of how consistently ISPs provide their advertised speed with the use of our "80/80" metric. The 80/80 metric measures the minimum speed that at least 80% of subscribers experience at least 80% of the time over peak periods.

These and other findings are described in greater detail within this report.

E. Use Of median speeds and subscriber-weighted speeds

The Eighth Report retains two changes that were first made in the 2016 Report (Sixth Report) and were also included in the Seventh report. These changes affect how the median speeds and subscriber-weighted speeds are calculated and presented. First, we continue to present ISP broadband performance as a median,[5] rather than a mean (average), of speeds experienced by panelists within a specific service tier.[6] Our focus in these reports is on the most common service tiers used by an ISP's subscribers.[7] Second, consistent with the Sixth and Seventh Reports, we continue to compute ISP performance by weighting the median for each service tier by the number of subscribers in that tier. Similarly, in calculating the overall average speed of all ISPs in a specific year, the median speed of each ISP is used and weighted by the number of subscribers of that ISP as a fraction of the total number of subscribers across all ISPs.

In calculating weighted medians, we have drawn on two sources for determining the number of subscribers per service tier. ISPs can voluntarily contribute their data per surveyed service tier as the most recent and authoritative data. Many ISPs have chosen to do so.[8] When such information has not been provided by an ISP, we rely on the FCC's Form 477 data.[9] All facilities-based broadband providers are required to file data with the FCC twice a year (Form 477) regarding deployment of broadband services, including subscriber counts. For this report, we used the June 2017 Form 477 data. It should be noted that the Form 477 subscriber data values are for a month that generally lags the reporting month, and therefore, there are likely to be small inaccuracies in the tier ratios. It is for this reason that we encourage ISPs to provide us with subscriber numbers for the measurement month.

F. USE OF OTHER PERFORMANCE METRICS

As in our previous reports, we found that for most ISPs, the actual speeds experienced by subscribers either nearly met or exceeded advertised service tier speeds. However, since we started our MBA

[5] We first determine the mean value over all the measurements for each individual panelist's "whitebox." (Panelists are sent "whiteboxes" that run pre-installed software on off-the-shelf routers that measure thirteen broadband performance metrics, including download speed, upload speed, and latency.) Then for each ISP's speed tiers, we compute a median of from the set of mean values for all the panelists/whiteboxes. The median is that value separating the top half of values in a sample set with the lower half of values in a sample set; it can be thought of as the middle value in an ordered list of values. For calculations involving multiple speed tiers, we compute the weighted average of the medians for each tier. The weightings are based on the relative subscriber numbers for the individual tiers.

[6] *See* 2016 Report at https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-fixed-broadband-report-2016.

[7] As described more fully in section 2, a service tier is initially added to this report only if it contains at least 30,000 subscribers and has 5% or more of an ISP's total number of broadband subscribers.

[8] The ISPs that provided SamKnows, the FCC's contractor supporting the MBA program, with weights for each of their tiers were: AT&T, Cincinnati Bell, CenturyLink, Charter, Comcast, Cox, Mediacom, Optimum and Verizon.

[9] For an explanation of Form 477 filing requirements and required data see: https://transition.fcc.gov/form477/477inst.pdf (Last accessed 5/2/2018).

program, consumers have changed their Internet usage habits. In 2011, consumers mainly browsed the web and downloaded files; thus, we reported average broadband speeds since these were likely to closely mirror user satisfaction. By contrast, in September 2017 (the measurement period for this report) consumer internet usage had become dominated by video consumption, with consumers regularly streaming video for entertainment and education.[10] Both the median measured speed and how consistently the service performs are likely to influence the perception and usefulness of Internet access service and we have expanded our network performance analytics to better capture this.

Specifically, we use two kinds of metrics to reflect the consistency of service delivered to the consumer: First, we report the minimum actual speed experienced by at least 80% of panelists during at least 80% of the daily peak usage period ("80/80 consistent speed" measure). Second, we show what fraction of consumers obtains median speeds greater than 95%, between 80% and 95%, and less than 80% of advertised speeds.

Although download and upload speeds remain the network performance metric of greatest interest to the consumer, we also spotlight two other key network performance metrics in this report: latency and packet loss. These metrics can significantly affect the overall quality of Internet applications.

Latency (or delay) is the time it takes for a data packet to travel across a network from one point on the network to another. High latencies may affect the perceived quality of some interactive services such as phone calls over the Internet, video chat and video conferencing, or online multiplayer games. All network access technologies have a minimum latency that is largely determined by the technology. In addition, network congestion will lead to an increase in measured latency. Technology-determined latencies are typically small for terrestrial broadband services and are thus unlikely to affect the perceived quality of applications. The higher latencies of geostationary satellite-based broadband services may impair the perceived quality of such highly interactive applications. Not all applications are affected by high latencies; for example, entertainment video streaming applications are tolerant of relatively high latencies.

Packet loss measures the fraction of data packets sent that fail to be delivered to the intended destination. Packet loss may affect the perceived quality of applications that do not request retransmission of lost packets, such as phone calls over the Internet, video chat, some online multiplayer games, and some video streaming. High packet loss also degrades the achievable throughput of download and streaming applications. However, packet loss of a few tenths of a percent are unlikely to significantly affect the perceived quality of most Internet applications and are common. During network congestion, both latency and packet loss typically increase.

The Internet is continuing to evolve in its architectures, performances, and services. Accordingly, we will continue to adapt our measurement and analysis methodologies to help consumers understand the performance characteristics of their broadband Internet access service, and thus make informed choices about their use of such services.

[10] Video traffic comprised 73% of Internet traffic in 2016, and some expect it to grow to 82% by 2021. *See Cisco Visual Networking Index: Forecast and Methodology, 2016-2021 White Paper*, https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html (Last accessed July 19, 2018).

2. SUMMARY OF KEY FINDINGS

G. Most Popular Advertised Service Tiers

A list of the offered ISP download and upload service tiers that were measured in this report are shown in Table 1. It should be noted that while upload and downloads speeds are measured independently and shown separately, they are typically offered by an ISP in a paired configuration. Together, these plans serve the majority of Internet users of the participating ISPs. Generally, a service tier becomes part of this report when five percent or more of an ISP's customers subscribe to that tier and there are at least 30,000 subscribers in that tier. Each tier requires a certain number of panelists to meet the program's target sample size, and it becomes difficult and costly to recruit panelists for tiers with few (i.e., less than 30,000) subscribers or across a very large number of tiers.

Table 12: List of ISP service tiers whose broadband performance was measured in this report

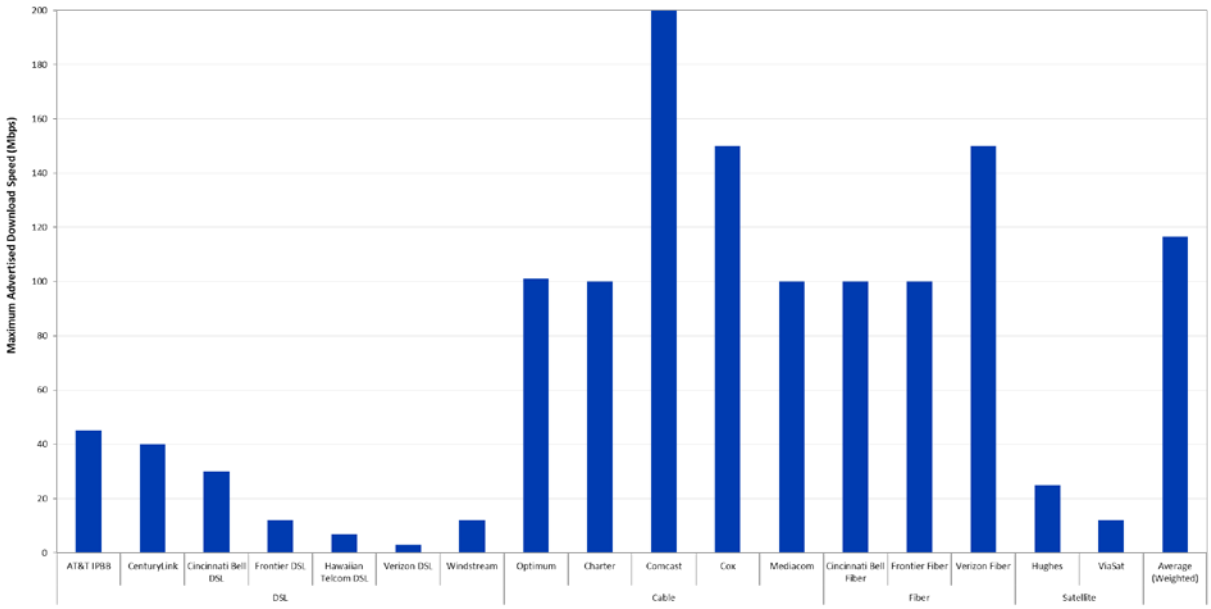
Tech-nology	Company	Speed Tiers (Download)							Speed Tiers (Upload)					
DSL	AT&T IPBB		3	6	12	18	24	45		0.768	1	1.5	3	6
	CenturyLink	1.5	3	7	10	12	20	40	0.512	0.64	0.768	0.896	5	
	Cincinnati Bell DSL	5	10	30						0.768	1	3		
	Frontier DSL	3	6	12					0.384	0.768	1			
	Hawaiian Telecom DSL	7							1					
	Verizon DSL	(0.5 - 1)	(1.1-3)						0.384	(0.384 - 0.768)				
	Windstream	3	6	12					0.384	0.768	1.5			
Cable	Optimum	60	101						25					
	Charter	20	30	60	100				2	5	10	20		
	Comcast	25	75	100	200				5	10	20			
	Cox	50	100	150					5	10				
	Mediacom	60	100						5	10				
Fiber	Cincinnati Bell Fiber	50	100						10	20				
	Frontier Fiber	25	50	75	100				50	75	100			
	Verizon Fiber	25	50	75	100	150			25	50	75	100	150	
Satellite	Hughes	5	10	25					1	3				
	ViaSat	12							3					

*Tiers that lack sufficient panelists to meet the program's target sample size.

Chart 1 (below) displays the maximum advertised download speeds among the measured service tiers for each participating ISP for September 2017, grouped by the access technology used to offer the broadband Internet access service (DSL, cable, fiber, or satellite). In September 2017, the weighted average maximum advertised download speed was 117 Mbps among the measured service tiers.

Maximum advertised download speed among the measured service tiers varies both by ISP and technology.

Chart 13: Maximum advertised download speed among the measured service tiers[11]



The maximum offered download speed tier included in this report for ISPs using satellite technology is between 12-25 Megabits per second (Mbps). Similarly, the maximum download speed included in this report for DSL providers ranges between 3-45 Mbps. In contrast, ISPs using Cable and Fiber technology offer much higher maximum download speeds. The maximum download speeds included in this report forISPs using Cable technology are between 100-200 Mbps. Among participating broadband ISPs, only Cincinnati Bell, Frontier, and Verizon use fiber as the access technology for a substantial number of their customers and their maximum speed offerings included in this report are between 100-150 Mbps. A key difference between the fiber vendors and other technology vendors is that two of the fiber vendors offer symmetric maximum upload and download speeds. This is in sharp contrast to the asymmetric offerings for all the other technologies where the maximum upload speeds offered are typically 5 to 10 times below the maximum download speeds offered.

Chart 2 plots the migration of panelists to a higher service tier based on their access technology.[12] Specifically, the horizontal axis of Chart 2 partitions the September 2016 panelists by the advertised download speed of the service tier to which they were subscribed. For each such set of panelists who also participated in the September 2017 collection of data,[13] the vertical axis of Chart 2 displays the percentage of panelists that migrated by September 2017 to a service tier with a higher advertised download speed. There are two ways that such a migration could occur: (1) if a panelist changed their broadband plan during the intervening year to a service tier with a higher advertised download speed, or (2) if a panelist did not change their broadband plan but the panelist's ISP increased the advertised download speed of the

[11] This chart lists only the most populous service tiers of the ISPs tested. It should be noted that ISPs may offer other tiers at higher or lower speeds.

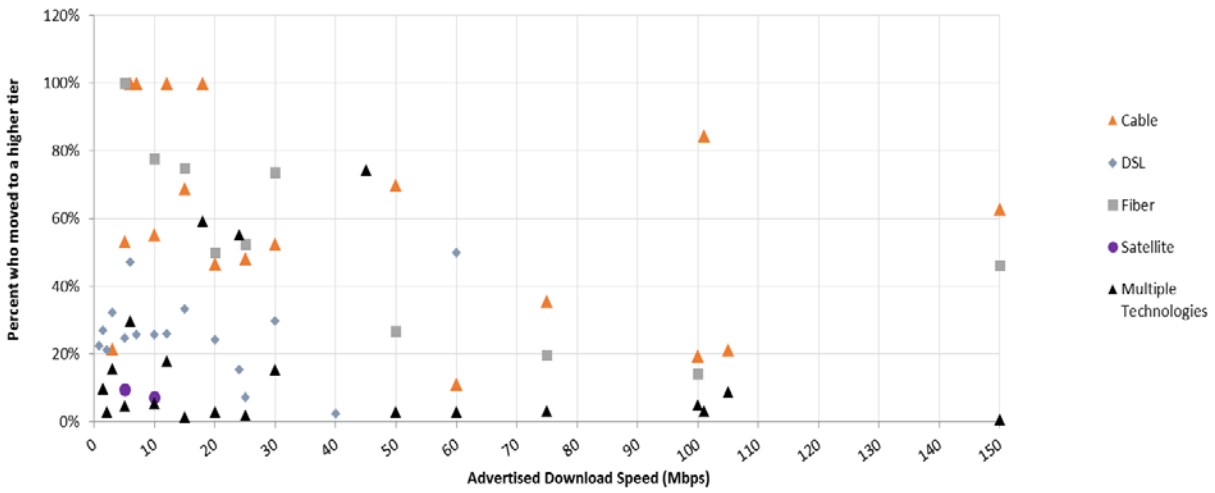
[12] Where several technologies are plotted at the same point in the chart, this is identified as "Multiple Technologies."

[13] Of the 4,545 panelists who participated in the September 2016 collection of data, 4,355 panelists continued to participate in the September 2017 collection of data.

panelist's subscribed plan.[14]

Chart 2 shows that the percentage of panelists subscribed in September 2016 who moved to higher tiers in September 2017. Between 2% to 50% of DSL subscribers, 4% to 100% of cable subscribers and 14% to 80% of fiber subscribers moved to higher speed tiers. There were also between 1% to 75% subscribers who migrated to a higher speed tier using a different technology from what they had in September 2016.

Chart 14: Consumer migration to higher advertised download speeds



H. Median download speeds

Advertised download speeds may differ from the speeds that subscribers actually experience. Some ISPs more consistently meet network service objectives than others or meet them unevenly across their geographic coverage area. Also, speeds experienced by a consumer may vary during the day if the network cannot carry the aggregate user demand during busy hours. Unless stated otherwise, all actual speeds were measured only during peak usage periods, which we define as 7 p.m. to 11 p.m. local time. To compute the average ISP performance, we weigh the median speed for each tier by its subscriber count. Subscriber counts for the weightings were provided from the ISPs themselves or, if unavailable, from FCC Form 477 data.

Chart 3 shows the median download speeds experienced by the subscribers of the ISPs participating in MBA, averaged across all analyzed service tiers, geography, and time, for 2017. The median download speed, averaged across all participating ISPs, was approximately 72 Mbps in September 2017. As can be seen in this chart there is considerable variance of median speed by both ISP and by technology. While cable and fiber providers had median speeds ranging from 78 to 120 Mbps (with only one outlier provider with 56 Mbps median speed); the DSL and satellite providers had median speeds that ranged from 2 to 20 Mbps. However, as we observed above while examining advertised download speeds, the increase in median download speed is not uniform across access technologies and ISPs.

[14] We do not attempt here to distinguish between these two cases.

Chart 15: Median download speeds by ISP

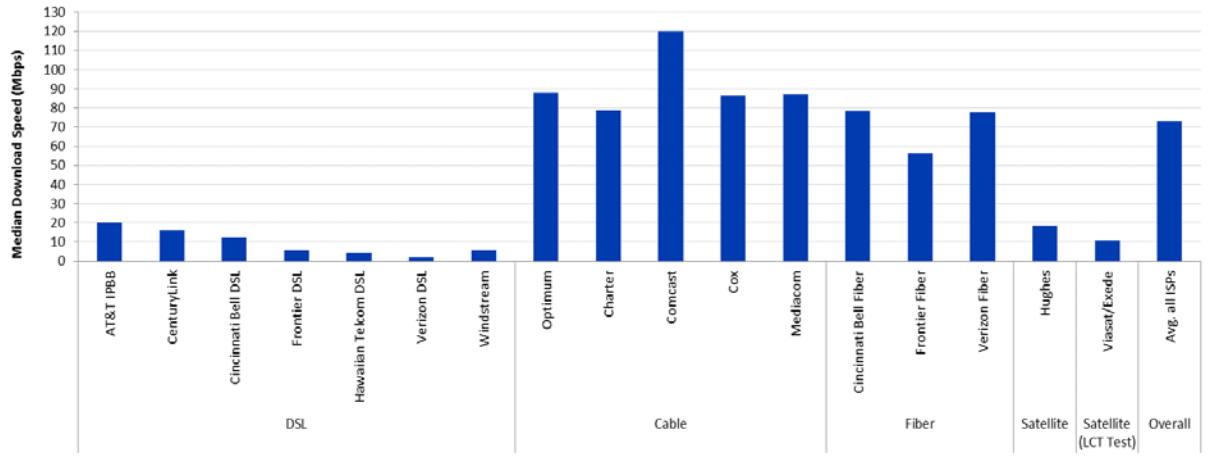
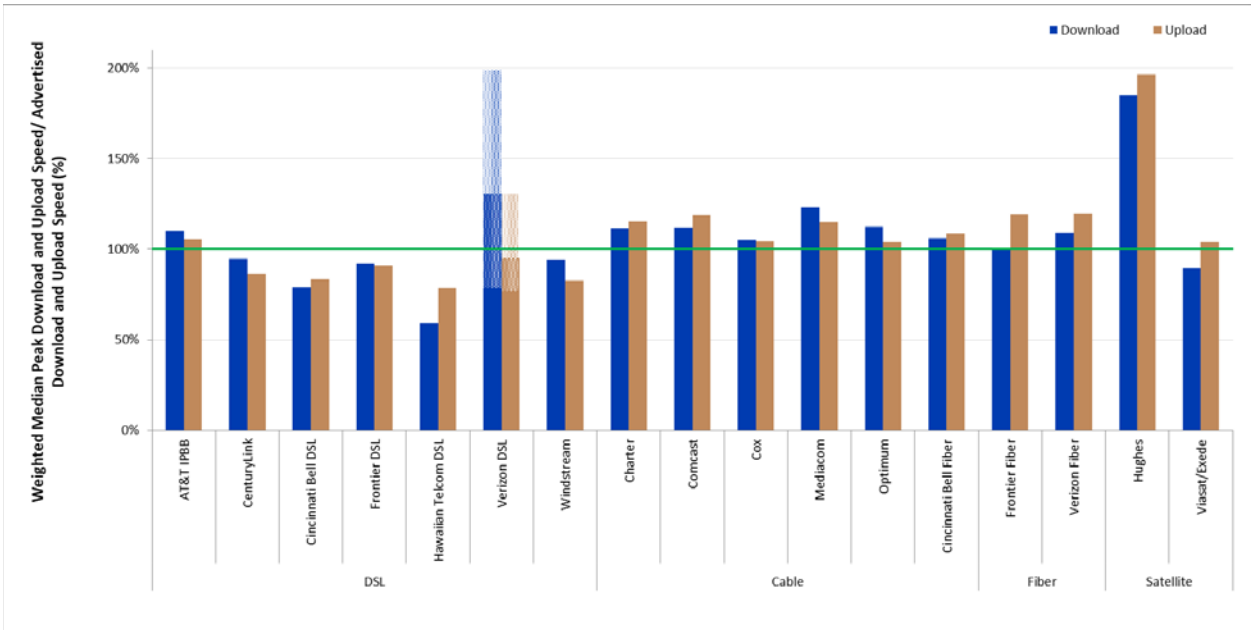


Chart 4 shows the ratio of the weighted median speeds experienced by an ISP's subscribers to that ISP's advertised speeds. The ratios for both download and upload speeds to the advertised download and upload speeds are shown. The actual speeds experienced by most ISPs' subscribers are close to or exceed the advertised speeds. However, DSL broadband ISPs continue to advertise "up-to" speeds that on average exceed the actual speeds experienced by their subscribers. Verizon, instead, advertises a speed range for DSL performance and has requested that we include this range in relevant charts; we indicate this speed range by shading on all bar charts describing Verizon DSL performance. Out of the 17 ISP/technology configurations shown, 11 met or exceeded their advertised download speed and four reached at least 90% of their advertised download speed. Only Cincinnati-DSL (at 79%) and Hawaiian Telecom (at 59%) performed below 90% of their advertised download speed.

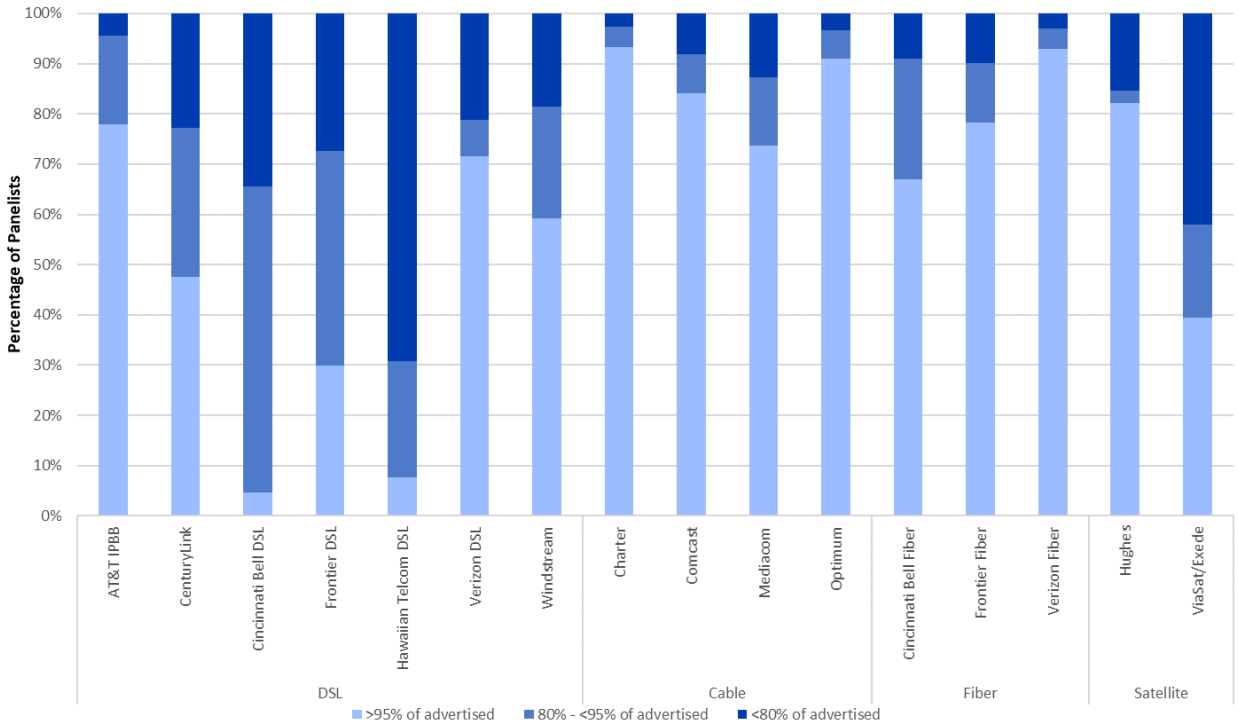
Chart 16: The ratio of weighted median speed (download and upload) to advertised speed for each ISP



I. Variations In Speeds

As discussed earlier, actual speeds experienced by individual consumers may vary by location and time of day. Chart 5 shows, for each ISP, the percentage of panelists who experienced a median download speed (averaged over the peak usage period during our measurement period) that was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed. [15]

Chart 17: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed

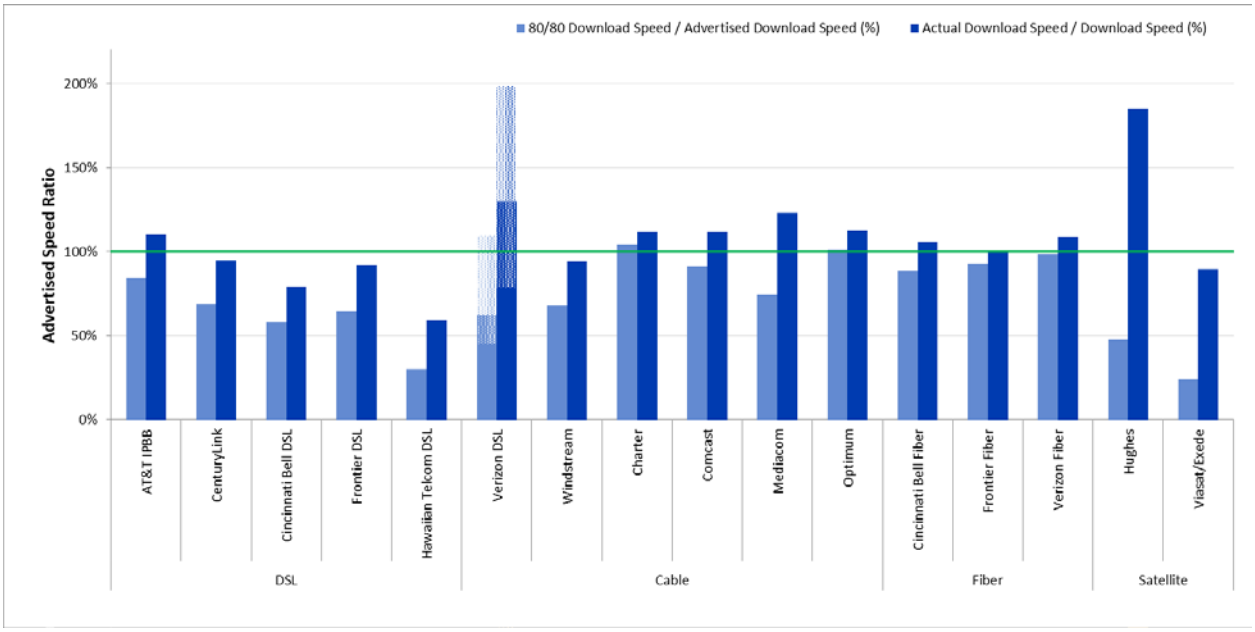


Even though the median download speeds experienced by most ISPs' subscribers nearly met or exceeded the advertised download speeds, there are some customers of each ISP for whom the median download speed fell significantly short of the advertised download speed. Relatively few subscribers of cable or fiber broadband service experienced this. The best performing ISPs, when measured by this metric, are Optimum, Charter and Verizon-Fiber; more than 90% of their panelists were able to attain an actual

[15] Charts 5 and 6 exclude Cox due to a sampling issue affecting a subset of test results that understated Cox's nationwide download speeds. Specifically, a local transit link carrying less than 3% of Cox's nationwide traffic was used for approximately 54% of Cox's MBA tests from Arizona, and during two weeks that overlapped with the testing period, a delay in upgrading the transit link negatively affected test results for Arizona panelists from a subset of MBA servers. Other MBA test results for these same panelists and for panelists in all other markets showed higher performance within the same peak period and day when tests were routed over the network paths used by 97% of Cox's traffic. With respect to Chart 5, omitting the affected test results would show that the percentage of Cox subscribers whose median download speed was greater than 95%, between 80% and 95%, and less than 80% of the advertised download speed was 82%, 10%, and 8%, respectively. Including the affected test results would show that these percentages were 66%, 17%, and 17%, respectively. With respect to Chart 6, omitting the affected test results would show that the 80/80 consistent download speed for Cox was 85% of its advertised download speed, and including the affected test results would show that that figure was 37%. Unless otherwise noted, other charts and tables in this report include the affected test results, but would likely show similar changes if adjusted.

median download speed of at least 95% of the advertised download speed.
In addition to variation based on a subscriber's location, speeds experienced by a consumer may fluctuate during the day. This is typically caused by increased traffic demand and the resulting stress on different parts of the network infrastructure. To examine this aspect of performance, we use the term "80/80 consistent speed". This metric is designed to assess temporal and spatial variations in measured values of a user's download speed.[16] Consistency of speed is in itself an intrinsically valuable service characteristic and its impact on consumers will hinge on variations in usage patterns and needs.
Chart 6 summarizes, for each ISP, the ratio of 80/80 consistent median download speed to advertised download speed, and, for comparison, the ratio of median download speed to advertised download speed shown previously in Chart 4. The ratio of 80/80 consistent median download speed to advertised download speed is less than the ratio of median download speed to advertised download speed for all participating ISPs due to congestion periods when median download speeds are lower than the overall average. When the difference between the two ratios is small, the median download speed is fairly insensitive to both geography and time. When the difference between the two ratios is large, there is a greater variability in median download speed, either across a set of different locations or across different times during the peak usage period at the same location.

Chart 18: The ratio of 80/80 consistent median download speed to advertised download speed.



Customers of Charter, Comcast, Cincinnati Bell Fiber, Frontier Fiber, Optimum and Verizon Fiber (Fios) experienced median download speeds that were very consistent; with each provider delivering in excess of 90% of the advertised speed to at least 80% of the panelists for at least 80% of the peak usage period. In particular, Charter and Optimum provided 80/80 consistent speeds that were in excess of 100% of the advertised speed. As can be seen in chart 6, cable and fiber ISPs performed better than DSL and satellite ISPs with respect to their 80/80 consistent speeds. For example, for September 2017, the 80/80 consistent download speed for Viasat satellite was 24% of its advertised speed. Similarly, Cincinnati Bell DSL and Hawaiian Telecom DSL had an 80/80 consistent download speed of respectively 58% and 30% of the advertised speed.

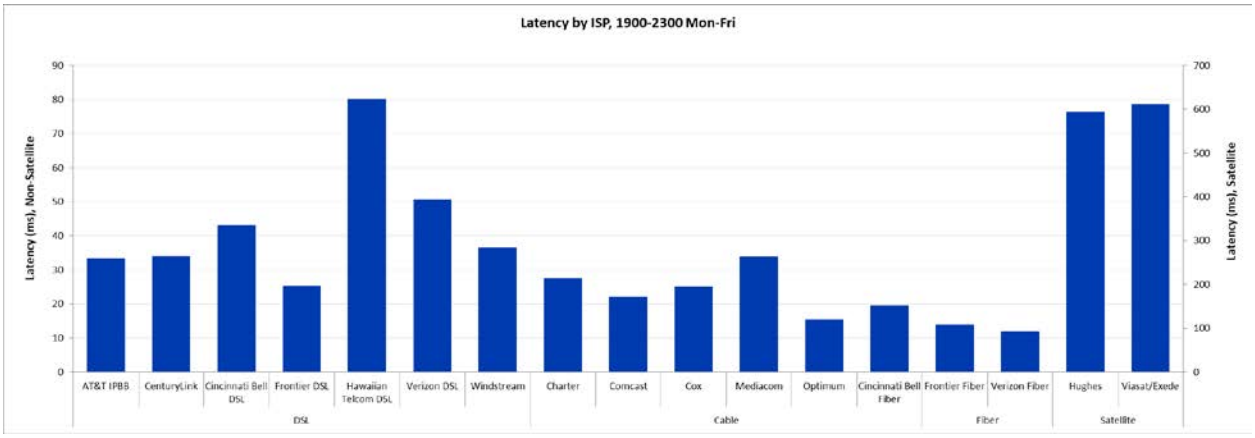
[16] For a detailed definition and discussion of this metric, please refer to the Technical Appendix.

J. Latency

Latency is the time it takes for a data packet to travel from one point to another in a network. It has a fixed component that depends on the distance, the transmission speed, and transmission technology between the source and destination, and a variable component that increases as the network path congests with traffic. The MBA program measures latency by measuring the round-trip time from the consumer's home to the closest measurement server and back.

Chart 7 shows the median latency for each participating ISP. In general, higher-speed service tiers have lower latency, as it takes less time to transmit each packet. Satellite technologies inherently experience longer latencies since packets must travel approximately 44,500 miles from an earth station to the satellite and back. Therefore, the median latencies for satellite-based broadband services are much higher, at 594 ms to 612 ms, than those for terrestrial-based broadband services, which range from 12 ms to 37 ms in our measurements (with the exception of Verizon DSL and Hawaiian Telecom DSL with latencies of 51 ms and 80 ms respectively).

Chart 19: Latency by ISP



Among terrestrial technologies, DSL latencies (between 25 ms to 80 ms) were slightly higher than those for cable (15 ms to 34 ms). Fiber ISPs showed the lowest latencies (12 ms to 20 ms). The differences in median latencies among terrestrial-based broadband services are relatively small and are unlikely to affect the perceived quality of highly interactive applications.

K. Packet Loss

Packet loss is the percentage of packets that are sent by a source but not received at the intended destination. The most common reason that a packet is not received is that it encountered congestion along the network route. A small amount of packet loss is expected, and indeed packet loss is commonly used by some Internet protocols to infer Internet congestion and to adjust the sending rate to mitigate for the congestion. The MBA program considers a packet lost if the packet's round-trip latency exceeds 3 seconds.

Chart 8 shows the average peak-period packet loss for each participating ISP, grouped into bins. We have broken the packet loss performance into three bands, allowing a more granular view of the packet loss performance of the ISP network. The breakpoints for the three bins used to classify packet loss have been chosen with an eye towards commonly accepted packet loss standards; provider packet loss Service Level Agreements (SLAs); and various standards. Specifically, the 1% standard for packet loss is referred to in international documents and commonly accepted as the point at which highly interactive applications such as VoIP will experience significant degradation and quality[17]. The 0.4% breakpoint was chosen as a

[17] See: https://www.voip-info.org/wiki/view/QoS and

(continued….)

generic breakpoint between the highly desired performance of 0% packet loss described in many documents and the 1% unacceptable limit on the high side. The specific value of 0.4% is based upon a compromise value between those two limits and is generally supported by many network performance and SLAs provided by major ISPs. Indeed, most SLAs support 0.1% to 0.3% SLA packet loss guarantees,[18] but these are generally for enterprise level services which generally have more stringent requirements for higher-level performance.

Chart 20: Percentage of consumers whose peak-period packet loss was less than 0.4%, between 0.4% to 1%, and greater than 1%.

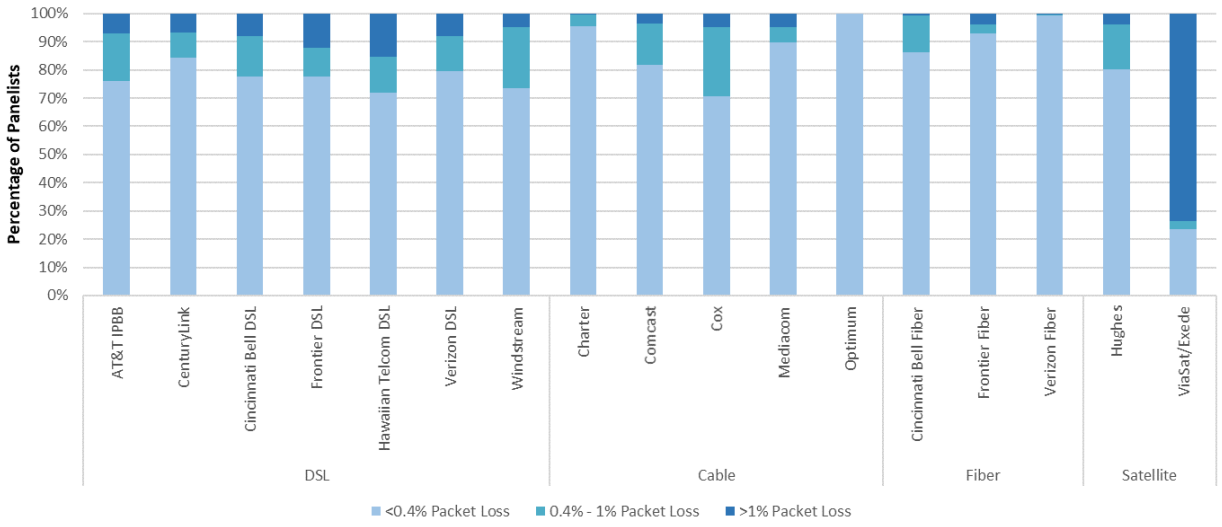


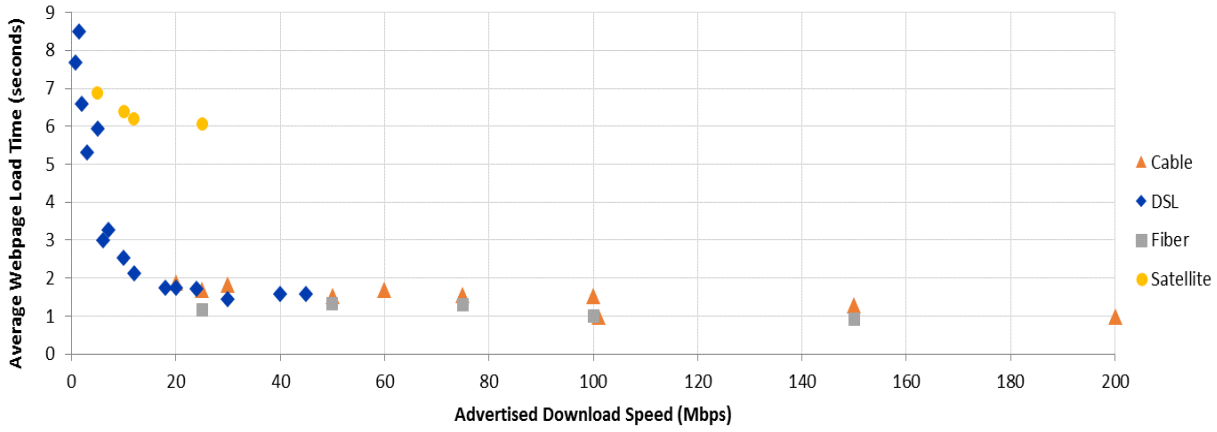
Chart 8 shows that ISPs using fiber technology had the lowest packet loss, and that ISPs using DSL and satellite technology tended to have the highest packet loss. Within a given technology class, packet loss also varied among ISPs.

L. Web browsing performance

The MBA program also conducts a specific test to gauge web browsing performance. The web browsing test accesses nine popular websites that include text and images, but not streaming video. The time required to download a webpage depends on many factors, including the consumer's in-home network, the download speed within an ISP's network, the web server's speed, congestion in other networks outside the consumer's ISP's network (if any), and the time required to look up the network address of the webserver. Only some of these factors are under control of the consumer's ISP. Chart 9 displays the average webpage download time as a function of the advertised download speed. As shown by this chart, webpage download time decreases as download speed increases, from about 7.7 seconds at 0.5 Mbps download speed to about 1.7 seconds for 25 Mbps download speed. Subscribers to service tiers exceeding 25 Mbps experience slightly smaller webpage download times decreasing to 1 second at about 200 Mbps. These download times assume that only a single user is using the Internet connection when the webpage is downloaded and does not account for more common scenarios where multiple users within a household are simultaneously using the Internet connection for viewing web pages as well as other applications such as real-time gaming or video streaming.

(Continued from previous page)
http://www.ciscopress.com/articles/article.asp?p=357102
[18] See: http://www.itu.int/dms_pubrec/itu-r/rec/m/r-rec-m.1079-2-200306-i!!msw-e.doc

Chart 21: Average webpage download time, by advertised download speed.



3. METHODOLOGY

M. Participants

Thirteen ISPs participated in the Fixed MBA program in September 2017.[19] They were:

- AT&T
- CenturyLink
- Charter Communications
- Cincinnati Bell
- Comcast
- Cox Communications
- Frontier Communications Company
- Hawaiian Telecom
- Hughes Network Systems
- Mediacom Communications Corporation
- Optimum
- Verizon
- Windstream Communications

The methodologies and assumptions underlying the measurements described in this Report are reviewed at meetings that are open to all interested parties and documented in public ex parte letters filed in the GN Docket No. 12-264. Policy decisions regarding the MBA program were discussed at these meetings prior to adoption, and involved issues such as inclusion of tiers, test periods, mitigation of operational issues affecting the measurement infrastructure, and terms-of-use notifications to panelists. Participation in the MBA program is open and voluntary. Participants include members of academia, consumer equipment vendors, telecommunications vendors, network service providers, consumer policy groups as well as our contractor for this project, SamKnows. In 2017-2018, participants at these meetings (collectively and informally referred to as "the broadband collaborative"), included all thirteen participating ISPs and the following additional organizations:

- Center for Applied Data Analysis (CAIDA)
- International Technology and Trade Associates (ITTA)
- Internet Society (ISOC)
- Level 3 Communications ("Level 3")
- Massachusetts Institute of Technology ("MIT")
- M-Lab
- NCTA – The Internet and Television Association
- New America Foundation
- Princeton University
- United States Telecom Association ("US Telecom")
- University of California - Santa Cruz

Participants have contributed in important ways to the integrity of this program and have provided

[19] Viasat, operating under the brand name Exede internet, left the program as a participating ISP this year and consequently no longer provide panelists with an increased data allowance to offset the data used by the MBA measurements. We, however, continue reporting results for ViaSat Exede tiers by using lightweight tests aimed at reducing the data burden on Viasat panelists. These tests are described in greater detail in the Technical Appendix.

valuable input to FCC decisions for this program. Initial proposals for test metrics and testing platforms were discussed and critiqued within the broadband collaborative. M-Lab and Level 3 contributed their core network testing infrastructure, and both parties continue to provide invaluable assistance in helping to define and implement the FCC testing platform. We thank all the participants for their continued contributions to the MBA program.

N. Measurement process

The measurements that provided the underlying data for this report relied both on measurement clients and measurement servers. The measurement clients (i.e., whiteboxes) resided in the homes of 6,034 panelists who received service from one of the 13 participating ISPs plus Viasat. The participating ISPs collectively accounted for over 80% of U.S. residential broadband Internet connections. After the measurement data was processed (as described in greater detail in the Technical Appendix) test results from 4,378 panelists were used in this report.

The measurement servers were hosted by M-Lab and Level 3 Communications, and were located in ten cities across the United States near a point of interconnection between the ISP's network and the network on which the measurement server resided.

The measurement clients collected data throughout the year, and this data is available as described below. However, only data collected from September 1 through 6 and September 28 through October 21, 2017, referred to throughout this report as the "September 2017" reporting period, were used to generate the charts in this Report.[20]

Broadband performance varies with the time of day. At peak hours, more people are attempting to use their broadband Internet connections, giving rise to a greater potential for network congestion and degraded user performance. Unless otherwise stated, this Report focuses on performance during peak usage period, which is defined as weeknights between 7:00 p.m. to 11:00 p.m. local time at the subscriber's location. Focusing on peak usage period provides the most useful information because it demonstrates the performance users can expect when the Internet in their local area is experiencing the highest demand from users.

Our methodology focuses on the network performance of each of the participating ISPs. The metrics discussed in this Report are derived from traffic flowing between a measurement client, located within the modem or router within a panelist's home, and a measurement server, located outside the ISP's network. For each panelist, the tests automatically choose the measurement server that has the lowest latency to the measurement client. Thus, the metrics measure performance along a path within each ISP's network, through a point of interconnection between the ISP's network and the network on which the chosen measurement server resides.

However, the service performance that a consumer experiences could differ from our measured values for several reasons. First, as noted, we measure performance only to a single measurement server rather than to multiple servers, following the approach chosen by most network measurement tools. ISPs, in general, attempt to maintain consistent performance throughout their network. However, at times, some paths or interconnection points within an ISP's network may be more congested than others and this can affect a specific consumer's service.

Congestion beyond an ISP's network is not measured in our study and can affect the overall performance a consumer experiences with their service. A consumer's home network, rather than the ISP's network,

[20] The period of September 7-27 2017 was omitted because of hurricanes Harvey and Irma that widespread network congestion in parts of Florida and Texas. Additionally, there were some residual effects of congestion due to Apple's release of its iOS 11 on September 19. Omitting dates during these periods was done consistent with the FCC's data collection policy for fixed MBA data. *See* FCC, Measuring Fixed Broadband, Data Collection Policy, https://www.fcc.gov/general/measuring-broadband-america-measuring-fixed-broadband (explaining that the FCC has developed policies to deal with impairments in the data collection process with potential impact for the validity of the data collected).

may be the bottleneck with respect to network congestion. We measure the performance of the ISP's service delivered to the consumer's home network, but this connection is often shared simultaneously among multiple users and applications within the home. In-home networks, which typically includes Wi-Fi, may not have sufficient capacities to support peak loads.[21]

In addition, consumers typically experience performance through the set of applications that they utilize, not as raw speed, latency or packet loss. The overall performance of an application depends not only on the network performance but also on the application's architecture and implementation and on the operating system and hardware on which it runs. While network performance is considered in this Report, application performance is generally not.

O. Measurement Tests And Performance Metrics

This Report is based on the following measurement tests:

- Download speed: This test measures the download speed of each whitebox over a 10-second period, once per hour during peak hours (7 p.m. to 11 p.m.) and once during each of the following periods: midnight to 6 a.m., 6 a.m. to noon, and noon to 6 p.m. The measurement results from each whitebox are then averaged across the measurement month; and the median value for these average speeds across the entire set of whiteboxes is used to determine the *median download speed* for a service tier. The overall ISP download speed is computed as the weighted median for each service tier, using the subscriber counts for the tiers as weights.
- Upload speed: This test measures the upload speed of each whitebox over a 10-second period, (the same measurement interval as the download speed). The speed measured in the last five seconds of the 10-second interval is retained, the results of each whitebox are then averaged over the measurement period, and the median value for the average speed taken over the entire set of whiteboxes is used to determine the *median upload speed* for a service tier. The ISP upload speed is computed in the same manner as the download speed.
- Latency and packet loss: These tests measure the round-trip times for approximately 2,000 packets per hour sent at randomly distributed intervals. Response times less than three seconds are used to determine the mean latency. If the whitebox does not receive a response within three seconds, the packet is counted as lost.
- Web browsing: The web browsing test measures the total time it takes to request and receive webpages, including the text and images, from nine popular websites and is performed once every hour. The measurement includes the time required to translate the web server name (URL) into the webserver's network (IP) address.

This Report focuses on three key performance metrics of interest to consumers of broadband Internet access service, as they are likely to influence how well a wide range of consumer applications work: download and upload speed, latency, and packet loss. Download and upload speeds are also the primary network performance characteristic advertised by ISPs. However, as discussed above, the performance observed by a user in any given circumstance depends not only on the actual speed of the ISP's network, but also on the performance of other parts of the Internet and on that of the application itself.

The standard speed tests use TCP with 8 concurrent TCP sessions. This year we also introduced a single TCP speed test (termed as Lightweight tests), which ran less frequently and thereby provided less strain on consumer accounts that are data-capped. The Lightweight tests were used exclusively to provide broadband performance results for Viasat. The Technical Appendix to this Report describes each test in

[21] Independent research, drawing on the FCC's MBA test platform [numerous instances of research supported by the fixed MBA test platform are described at https://www.fcc.gov/general/mba-assisted-research-studies], suggests that home networks are a significant source of end-to-end service congestion. *See* Srikanth Sundaresan et al., *Home Network or Access Link? Locating Last-Mile Downstream Throughput Bottlenecks*, PAM 2016 - Passive and Active Measurement Conference, at 111-123 (March 2016).

more detail, including additional tests not contained in this Report.

P. Availability Of Data

The Validated Data Set[22] on which this Report is based, as well as the full results of all tests, are available at http://www.fcc.gov/measuring-broadband-america. To encourage additional research, we also provide raw data for the reference month and other months. Previous reports of the MBA program, as well as the data used to produce them, are also available there.

Both the Commission and SamKnows, the Commission's contractor for this program, recognize that, while the methodology descriptions included in this document provide an overview of the project, interested parties may be willing to contribute to the project by reviewing the software used in the testing. SamKnows welcomes review of its software and technical platform, consistent with the Commission's goals of openness and transparency for this program.[23]

[22] The September 2017 data set was validated to remove anomalies that would have produced errors in the Report. This data validation process is described in the Technical Appendix.

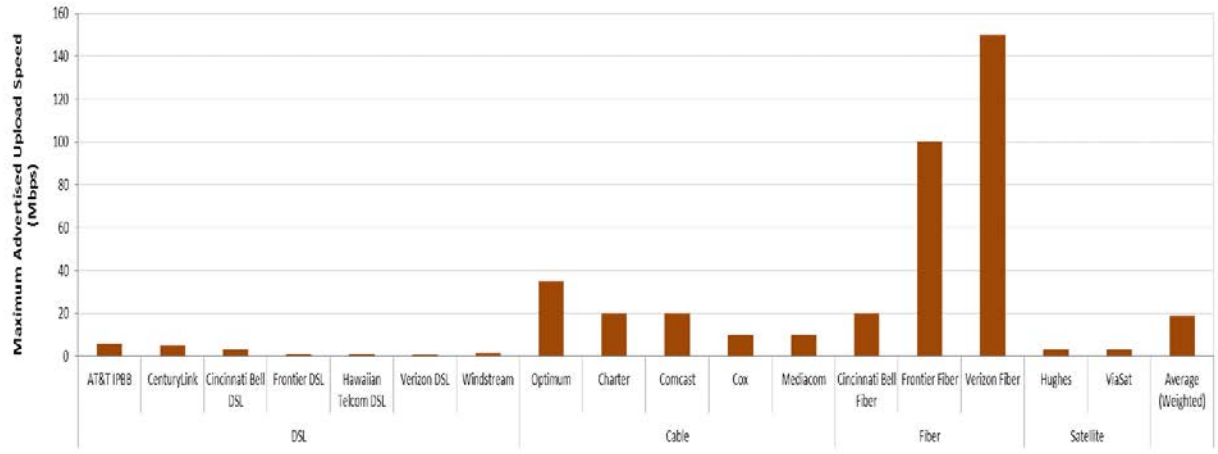
[23] The software that was used for the MBA program will be made available for noncommercial purposes. To apply for noncommercial review of the code, interested parties may contact SamKnows directly at team@samknows.com, with the subject heading "Academic Code Review."

4. TEST RESULTS

Q. Most Popular Advertised Service Tiers

Chart 1 above summarized the maximum advertised download speeds among the measured service tiers[24] for each participating ISP, for September 2017, grouped by the access technology used to offer the broadband Internet access service (DSL, cable, fiber, or satellite). Chart 10 below shows the corresponding maximum advertised upload speeds among the measured service tiers. As shown in Chart 10, the maximum upload speed of ISPs using DSL and satellite technology lags ISPs using cable and fiber technologies. The maximum advertised upload speed is between 0.8 to 6 Mbps for ISPs using DSL technology, and 3 Mbps for ISPs using satellite technology. In contrast, among cable-based broadband providers, the maximum advertised upload speeds among the measured service tiers is 10 to 35 Mbps. Similarly, for ISPs using fiber technology the maximum upload speed ranged from 20 to 150 Mbps. As noted previously, except for Cincinnati Bell fiber, the upload and download speed offerings for fiber technologies are symmetric. The computed weighted average of the maximum upload speed of all the ISPs is 18 Mbps.

Chart 22: Maximum advertised upload speed among the measured service tiers.



R. Observed Median download and upload Speeds

Chart 3 above showed the median download speeds experienced by each ISP's participating subscribers in September 2017. Chart 11 below shows the corresponding median upload speeds. The median upload speed for this period across all consumers was 14 Mbps.

[24] As discussed previously, measured service tiers were tiers which constituted 5% or more of an ISP's broadband subscriber base and had at least 30,000 subscribers.

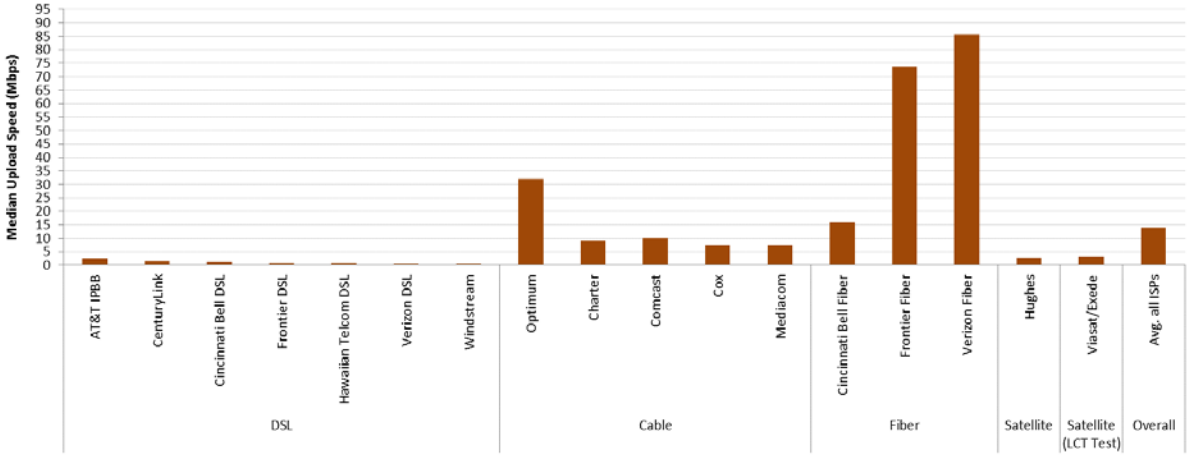


Chart 23: Median upload speeds by ISP.

Chart 12 below show the median download and upload speeds by technology for September 2017. As seen in the chart, the median download speeds for DSL and satellite technologies, which are both 16 Mbps, lag the median download speeds for cable and fiber technologies which are respectively 97 and 73 Mbps. Similarly, the median upload speeds for DSL and satellite technologies, which are respectively 2 to 3 Mbps, lag the median upload speeds of cable and fiber technologies which are respectively 11 and 82 Mbps.

Observing both the download and upload speeds, it is clear that fiber service tiers are generally symmetric in their actual upload and download speeds. This results from the fact that fiber technology has significantly more capacity than other technologies and it can be engineered to have symmetric upload and download speeds. For other technologies with more limited capacity, higher capacity is usually allocated to download speeds than to upload speeds, typically in ratios ranging from 5:1 to 10:1. This resulting asymmetry in download/upload speeds is reflective of actual usage because consumers typically download significantly more data than they upload.

Chart 24: Median download and upload speeds by technology.

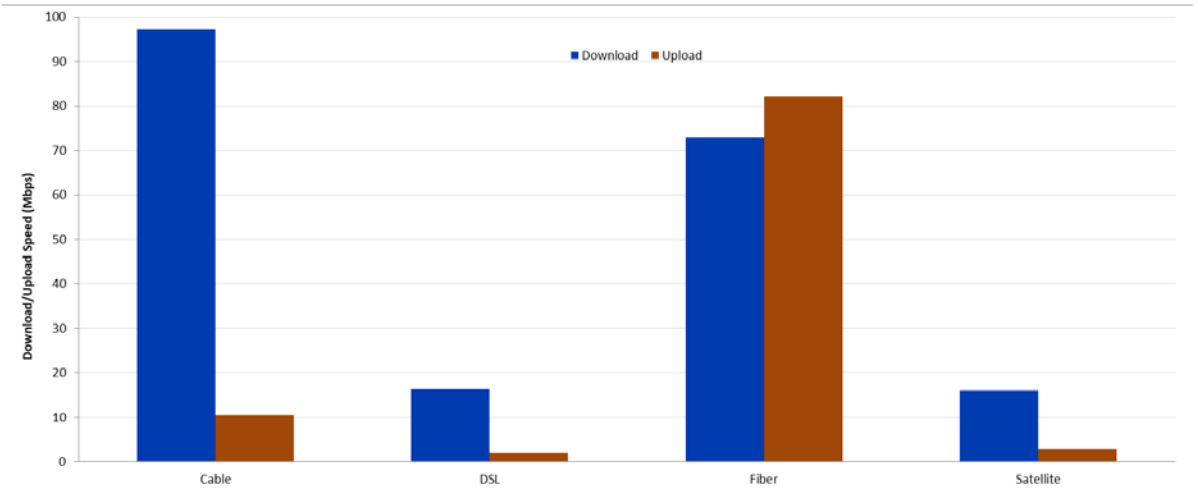


Chart 4 (in Section 2.B) showed the ratio in September 2017 of the weighted median of both download

and upload speeds of each ISP's subscribers to advertised speeds. Charts 13.1 and 13.2 below show the same ratios separately for download speed and for upload speed.[25] The median download speeds of most ISPs' subscribers have been close to, or have exceeded, the advertised speeds. Exceptions to this were the following DSL providers: CenturyLink, Cincinnati Bell, Frontier DSL, Hawaiian Telecom DSL, Windstream and Viasat with respective ratios of 95%, 79%, 92%, 59%, 94% and 90%.

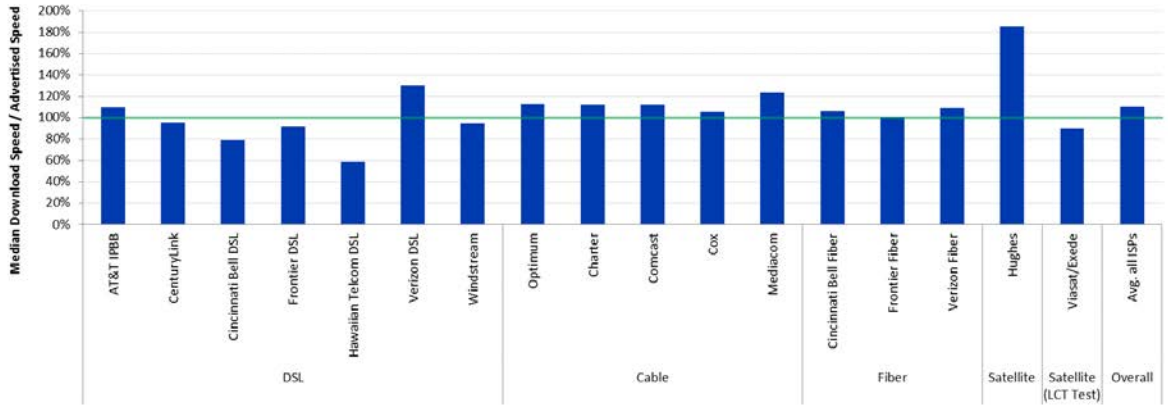
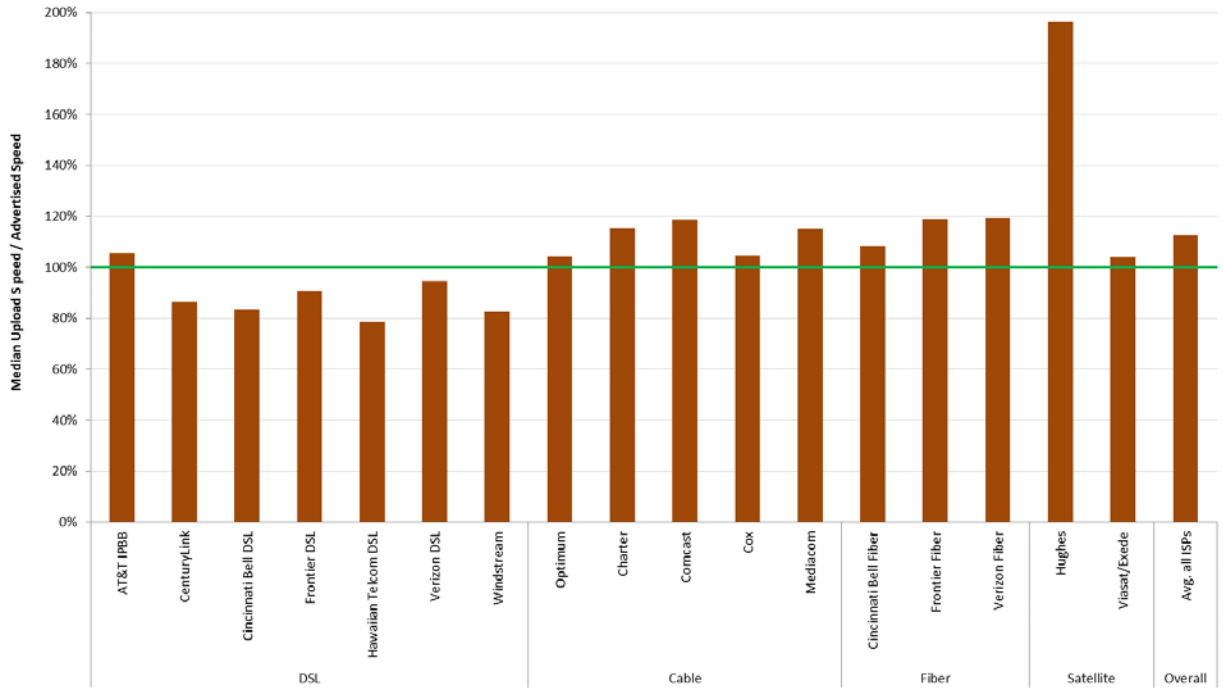


Chart 13.1: The ratio of median download speed to advertised download speed.

Chart 13.2 shows the median upload speed as a percentage of the advertised speed. As was the case with download speeds most ISPs meet or exceed the advertised rates except for a number of DSL providers: CenturyLink, Cincinnati Bell DSL, Frontier DSL, Hawaiian Telecom DSL, Verizon DSL and Windstream which had respective ratios of 87%, 83%, 91%, 79%, 95% and 83%.

[25] In these charts, we show Verizon's median speed as a percentage of the mid-point between their lower and upper advertised speed range.

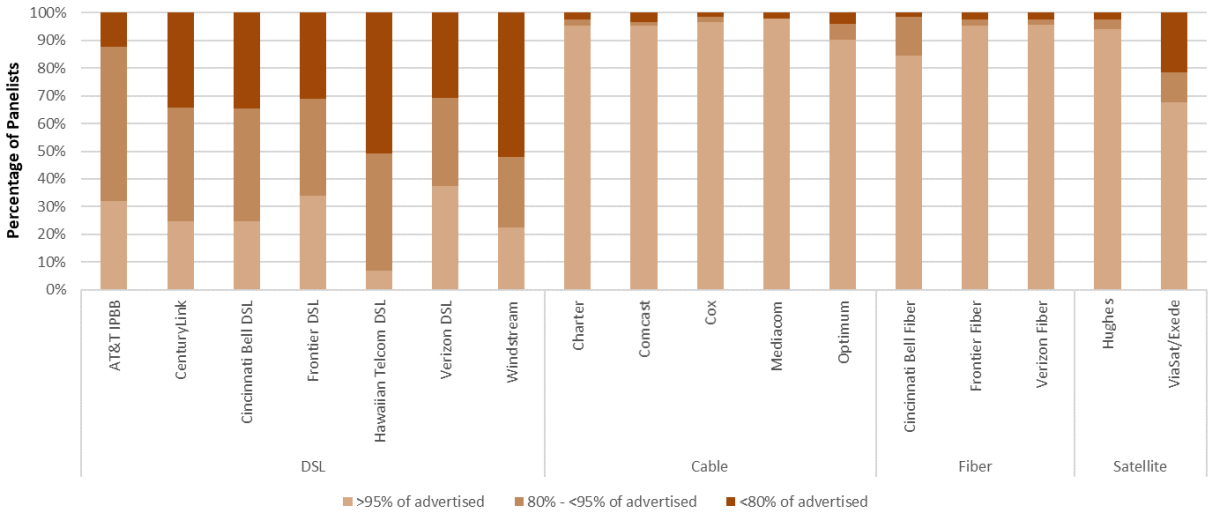
Chart 13.2: The ratio of median upload speed to advertised upload speed.



S. Variations In Speeds

As noted, median speeds experienced by consumers may vary based on location and time of day. Chart 5 above showed, for each ISP, the percentage of consumers (across the ISP's service territory) who experienced a median download speed over the peak usage period that was either greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed. Chart 14 below shows the corresponding percentage of consumers whose median upload speed fell in each of these ranges.

Chart 14: The percentage of consumers whose median upload speed was (a) greater than 95%, (b) between 80% and 95%, or (c) less than 80% of the advertised upload speed.



Even though the median upload speeds experienced by most subscribers were close to or exceeded the advertised upload speeds there were some subscribers, for each ISP, whose median upload speed fell significantly short of the advertised upload speed. This issue was most prevalent for ISPs using DSL technology. On the other hand, ISPs using cable and fiber technology generally showed very good consistency based on this metric.

We can learn more about the variation in network performance by separately examining variations across geography and across time. We start by examining the variation across geography within each participating ISP's service territory. For each ISP, we first calculate the ratio of the median download speed (over the peak usage period) to the advertised download speed for each panelist subscribing to that ISP. We then examine the distribution of this ratio across the ISP's service territory.

Charts 15.1 and 15.2 show the complementary cumulative distribution of the ratio of median download speed (over the peak usage period) to advertised download speed for each participating ISP. For each ratio of actual to advertised download speed on the horizontal axis, the curves show the percentage of panelists subscribing to each ISP that experienced at least this ratio.[26] For example, the Cincinnati Bell fiber curve in Chart 15.1 shows that 90% of its subscribers experienced a median download speed exceeding 83% of the advertised download speed, while 70% experienced a median download speed exceeding 95% of the advertised download speed, and 50% experienced a median download speed exceeding 106% of the advertised download speed.

[26] In Reports prior to the 2015 MBA Report, for each ratio of actual to advertised download speed on the horizontal axis, the cumulative distribution function curves showed the percentage of measurements, rather than panelists subscribing to each ISP, that experienced at least this ratio. The methodology used since then, i.e., using panelists subscribing to each ISP, more accurately illustrates ISP performance from a consumer's point of view.

Chart 15.1: Complementary cumulative distribution of the ratio of median download speed to advertised download speed.

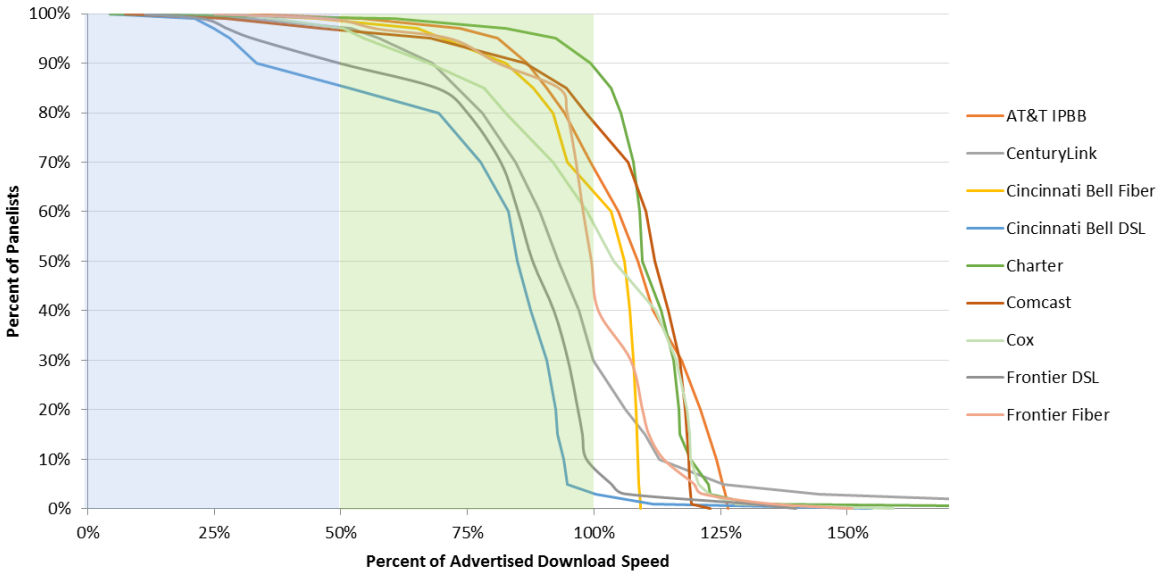
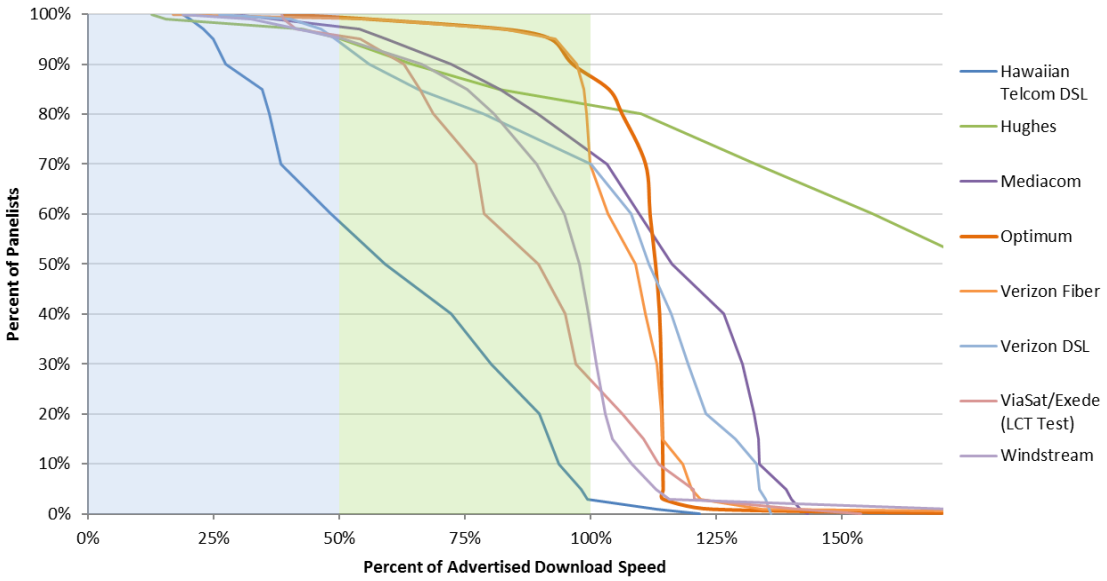


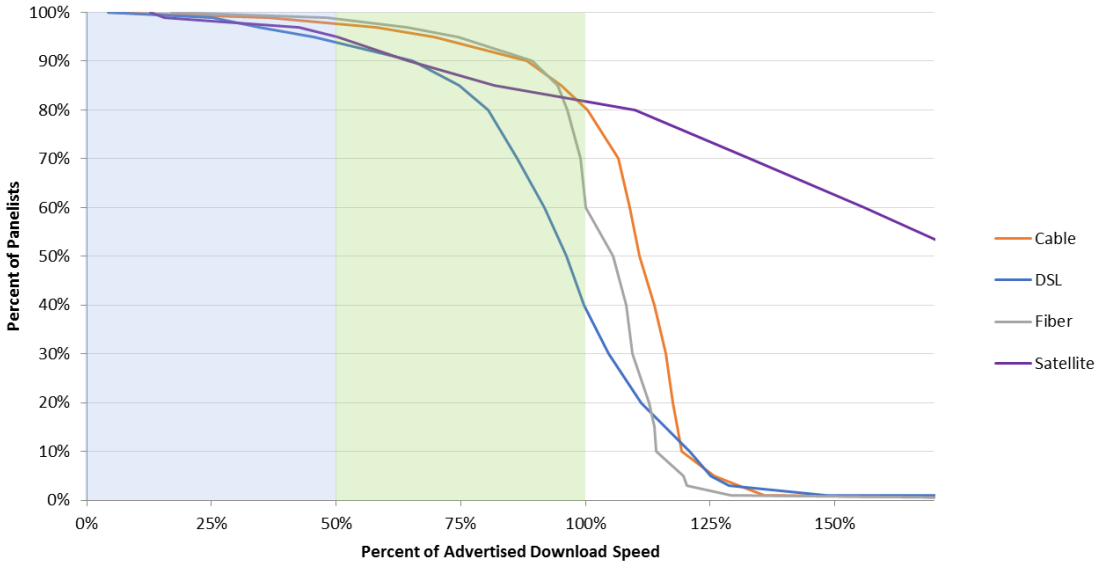
Chart 15.2: Complementary cumulative distribution of the ratio of median download speed to advertised download speed (continued).



The curves for cable-based broadband and fiber-based broadband are steeper than those for DSL-based broadband and satellite-based broadband. This can be seen more clearly in Chart 15.3, which plots aggregate curves for each technology. Approximately 80% of subscribers to cable and 60% of subscribers to fiber-based technologies experience median download speeds exceeding the advertised download speed. In contrast, only 40% of subscribers to DSL-based services experience median download speeds exceeding the advertised download speed.[27]

[27] The speed achievable by DSL depends on the distance between the subscriber and the central office. Thus, the complementary cumulative distribution function will fall slowly unless the broadband ISP adjusts its advertised rate based on the subscriber's location. (Chart 17 illustrates that the performance during non-busy hours is similar to the busy hour, making congestion less likely as an explanation.)

Chart 15.3: Complementary cumulative distribution of the ratio of median download speed to advertised download speed, by technology.



Charts 15.4 to 15.6 show the complementary cumulative distribution of the ratio of median upload speed (over the peak usage period) to advertised upload speed for each participating ISP (Charts 15.4 and 15.5) and by access technology (Chart 15.6).

Chart 15.4: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed.

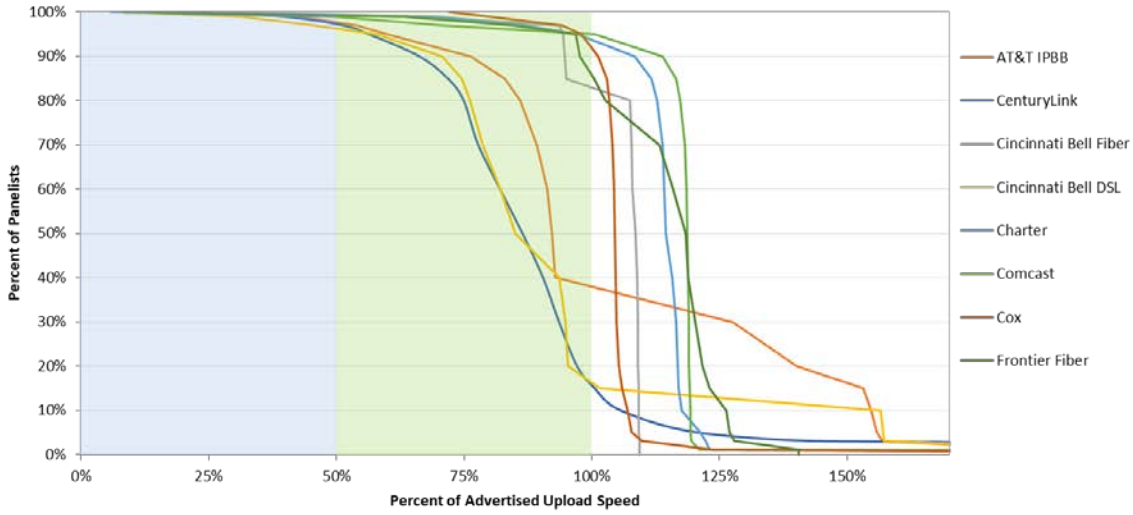


Chart 15.5: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed (continued).

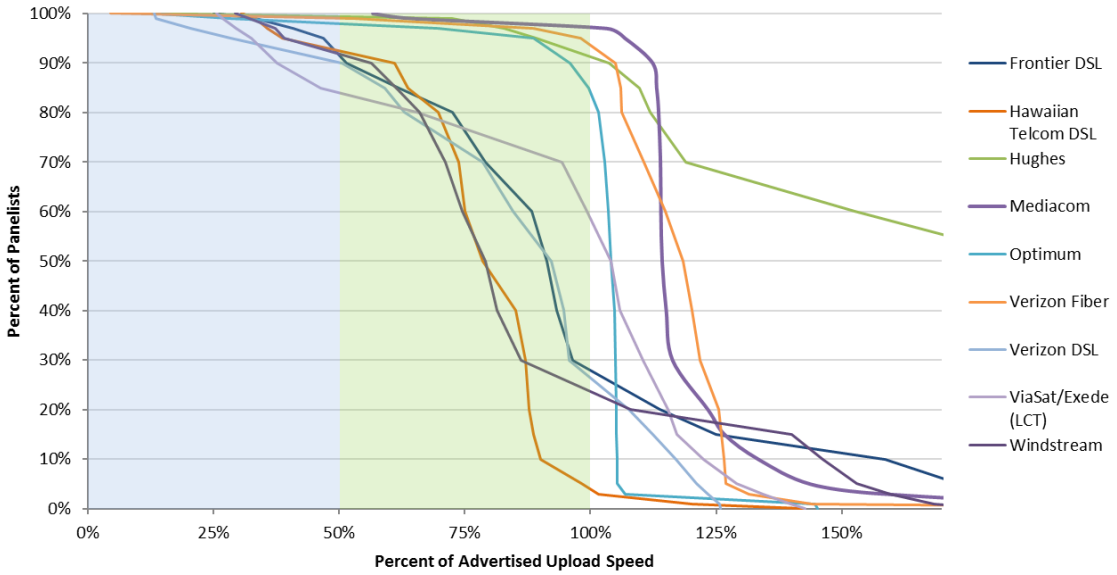
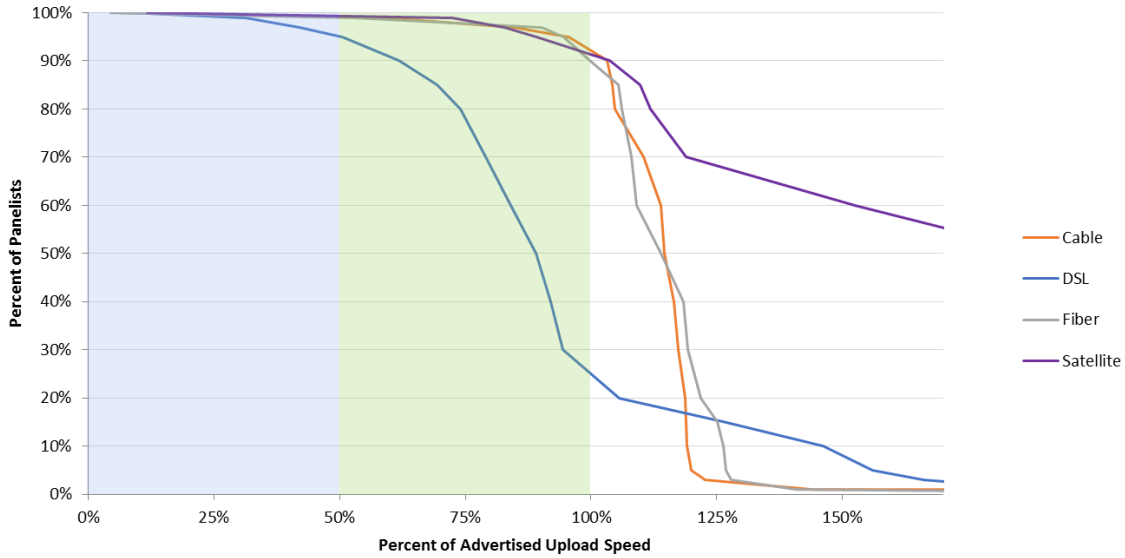


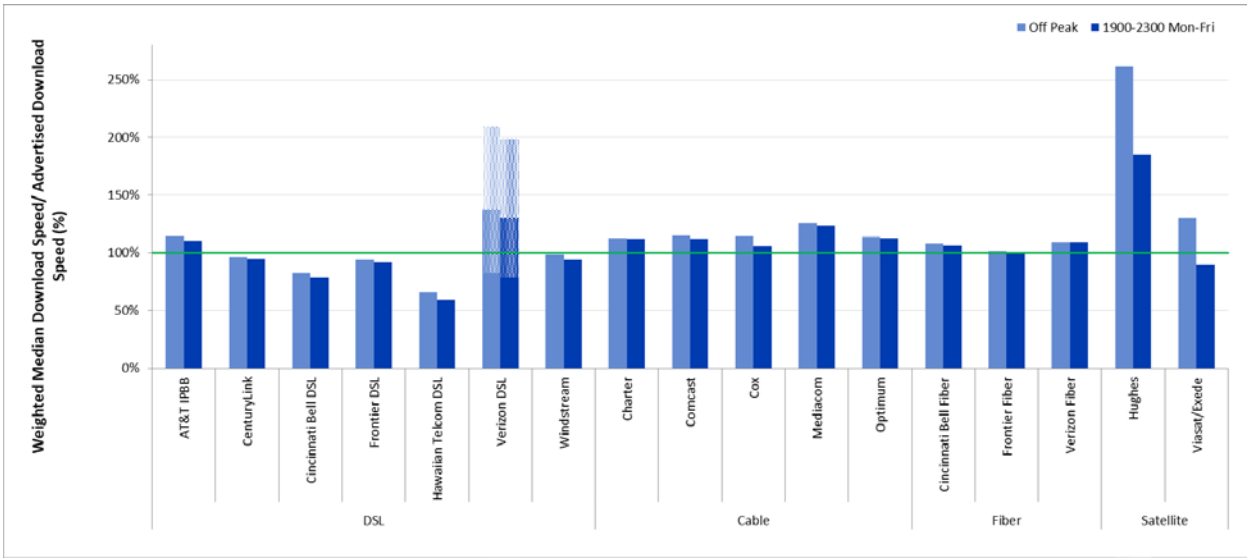
Chart 15.6: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed, by technology.



All actual speeds discussed above were measured during peak usage periods. In contrast, Charts 16.1 and

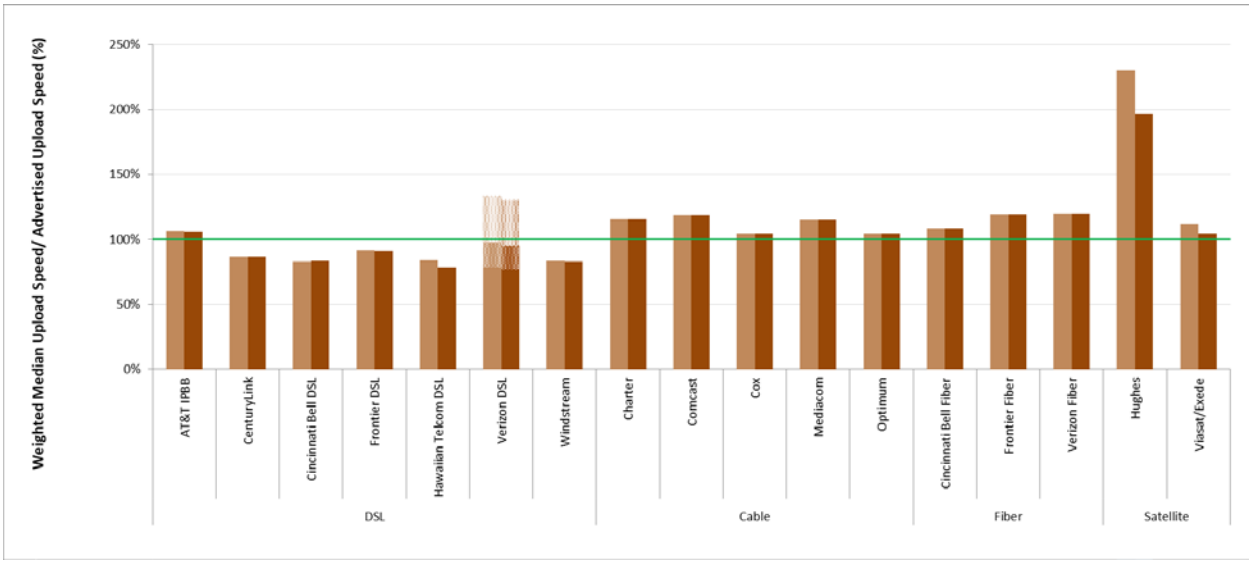
16.2 below compare the ratio of actual speed to advertised speed during peak and off-peak times.[28] Charts 16.1 and 16.2 show that while most ISPs show only a slight degradation from off-peak to peak hour performance, satellite ISPs show a markedly larger degradation. Hughes customers experience a drop from 261% to 185% in the ratio of median download speed to advertised speed from off-peak hours to peak hours. Similarly, ViaSat customers experience a corresponding drop from 131% to 90%.

Chart 16.1: The ratio of weighted median download speed to advertised download speed, peak hours versus off-peak hours.



[28] As described earlier, Verizon DSL download and upload results are shown as a range since Verizon advertises its DSL speed as a range rather than as a specific speed.

Chart 16.2: The ratio of weighted median upload speed to advertised upload speed, peak versus off-peak.



Charts 17.1[29] and 17.2 below show the actual download speed to advertised speed ratio in each two-hour time block during weekdays for each ISP. The ratio is lowest during the busiest four-hour time block (7:00 p.m. to 11:00 p.m.).

[29] In this chart, we have shown the median download speed of Verizon-DSL as a percentage of the midpoint of the advertised speed range for its tier.

Chart 17.1: The ratio of median download speed to advertised download speed, Monday-to-Friday, two-hour time blocks, terrestrial ISPs.

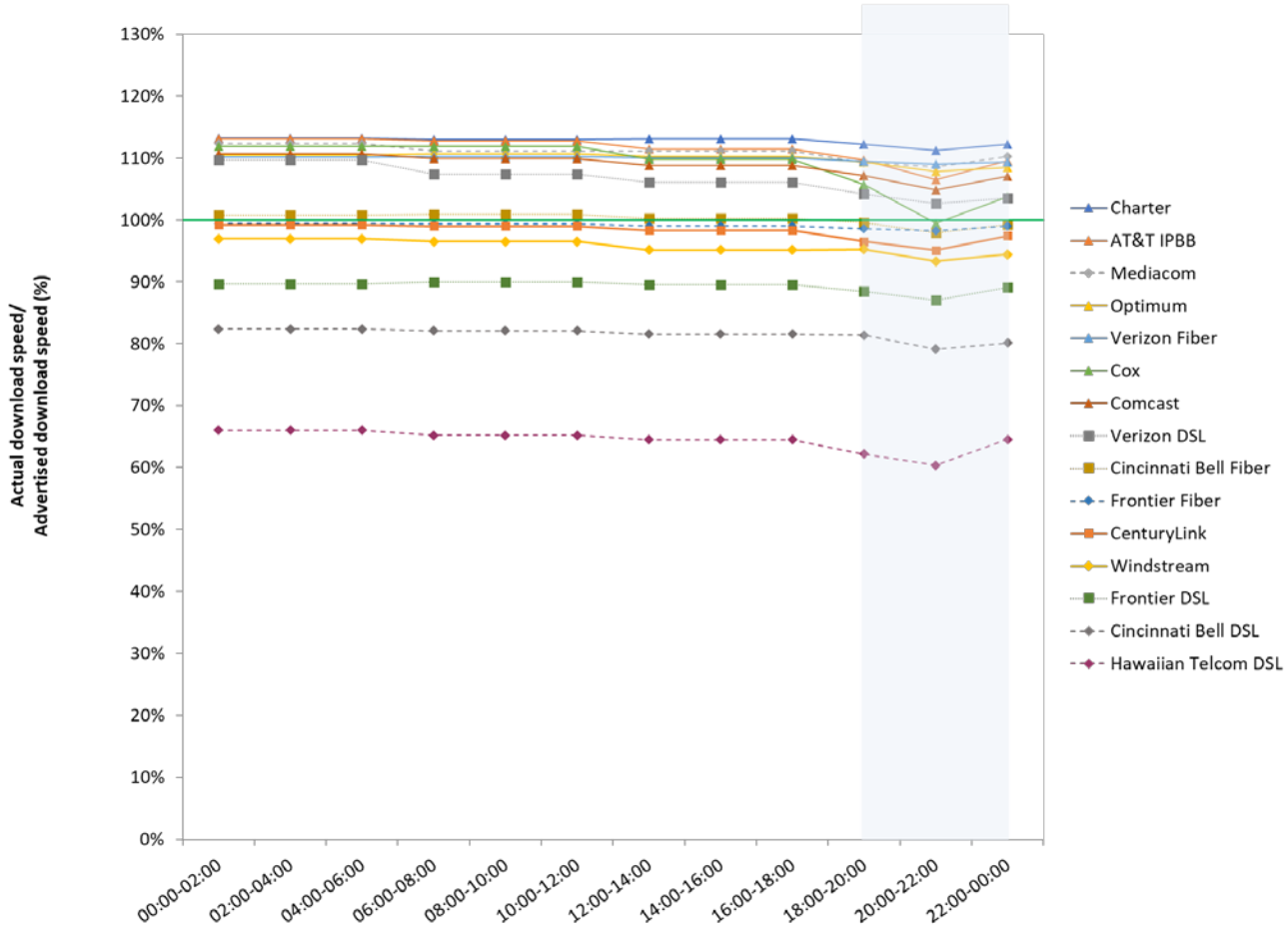
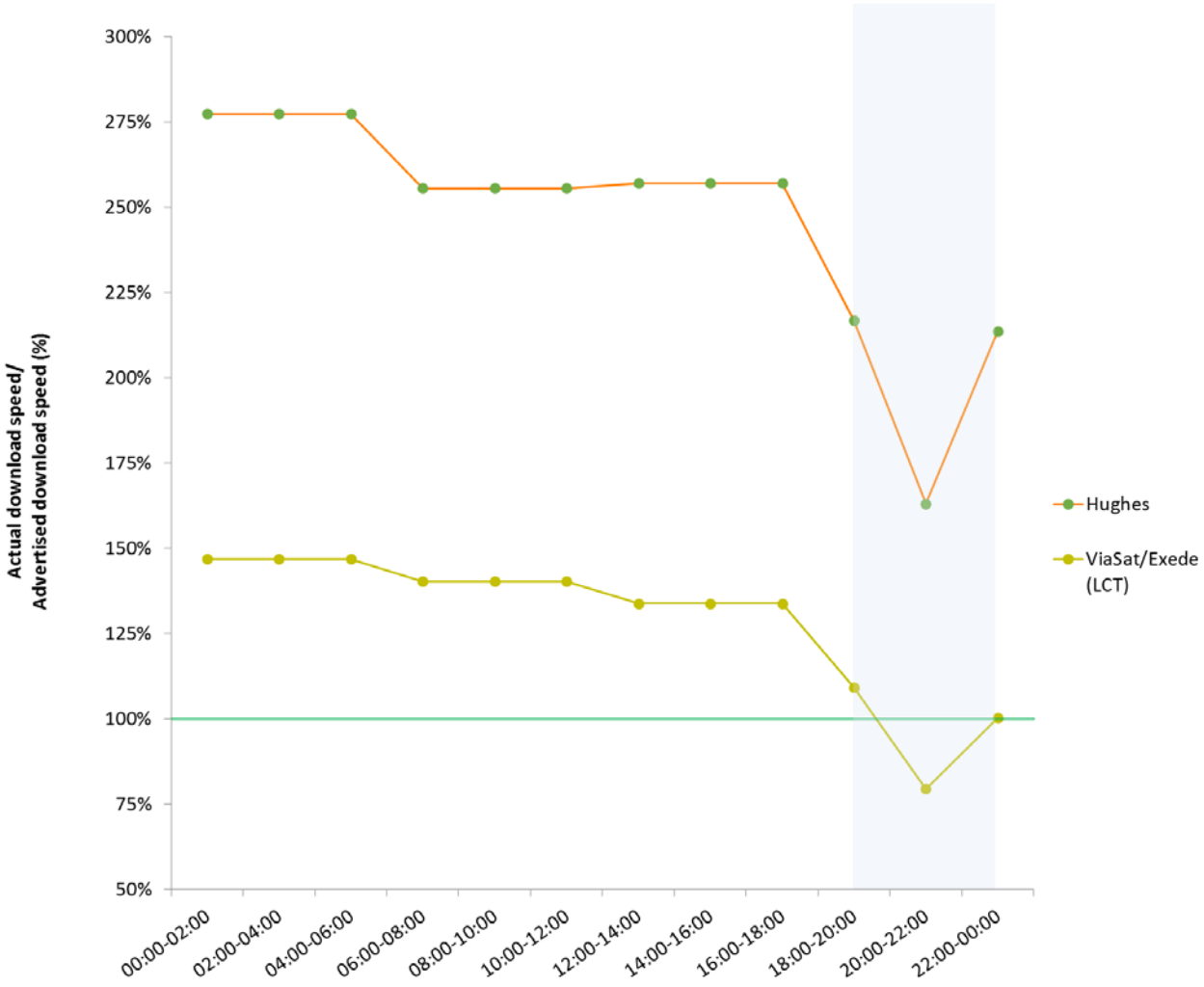


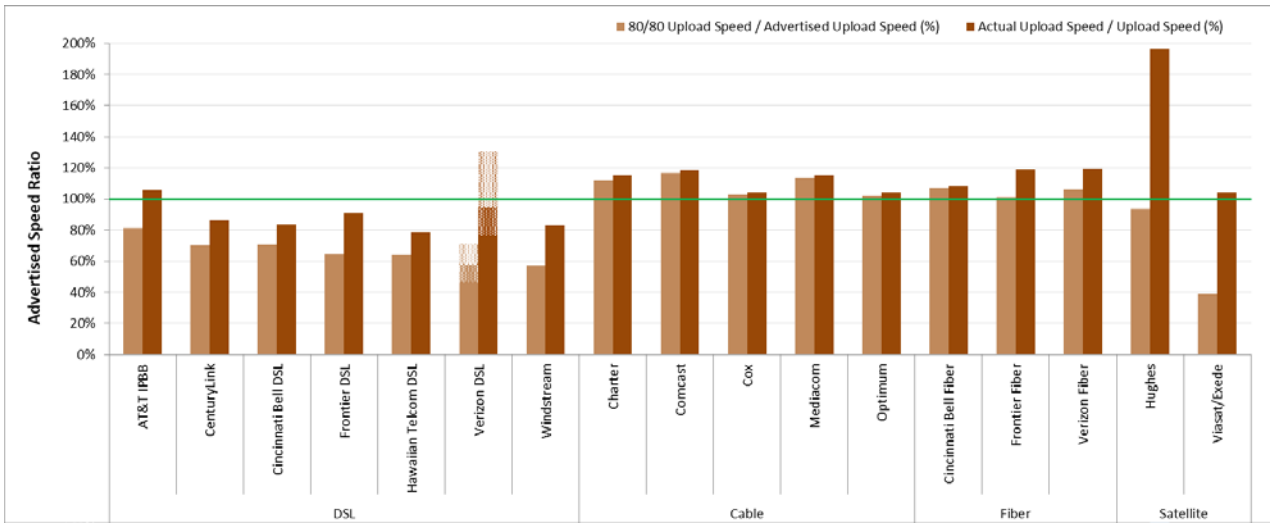
Chart 17.2: The ratio of median download speed to advertised download speed, Monday-to-Friday two-hour time blocks, satellite ISPs.



For each ISP, Chart 6 (in section 2.C) showed the ratio of the 80/80 consistent median download speed to advertised download speed, and for comparison, Chart 4 showed the ratio of median download speed to advertised download speed.

Chart 18.1 illustrates information concerning 80/80 consistent upload speeds. For all ISPs, the upload 80/80 speed is lower than the upload median speed. For most ISPs, the upload 80/80 speed is slightly lower than the upload median speed. However, in the case of Hughe, ViaSatand Verizon DSL, the 80/80 speed was considerably lower than the upload median speed.

Chart 18.1: The ratio of 80/80 consistent upload speed to advertised upload speed.



Charts 18.2 and 18.3 below illustrate similar consistency metrics for 70/70 consistent speeds, i.e., the minimum speed (as a percentage of the advertised speed) experienced by at least 70% of panelists during at least 70% of the peak usage period. [30] The ratios for 70/70 consistent speeds as a percentage of the advertised speed are higher than the corresponding ratios for 80/80 consistent speeds. In fact, for many ISPs, the 70/70 consistent download speed is close to the median download speed. ViaSat and Hawaiian Telecom showed a considerably smaller value for the 70/70 download speed as compared to the download median speed.

[30] Chart 18.2 excludes Cox due to the sampling issue discussed in note 15 above.

Chart 18.2: The ratio of 70/70 consistent download speed to advertised download speed.

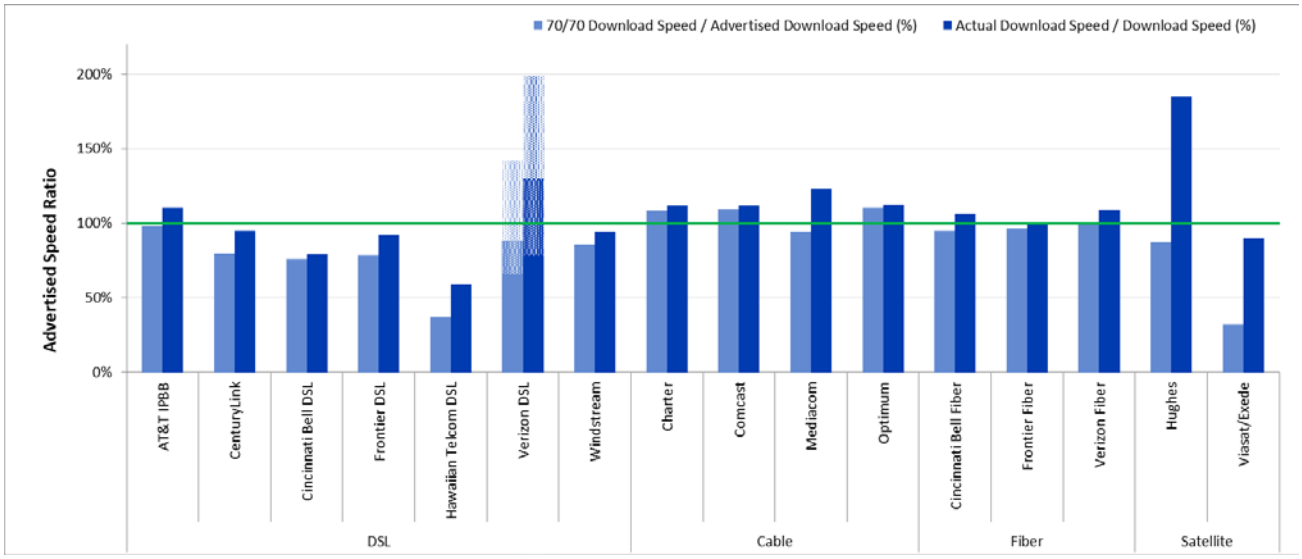
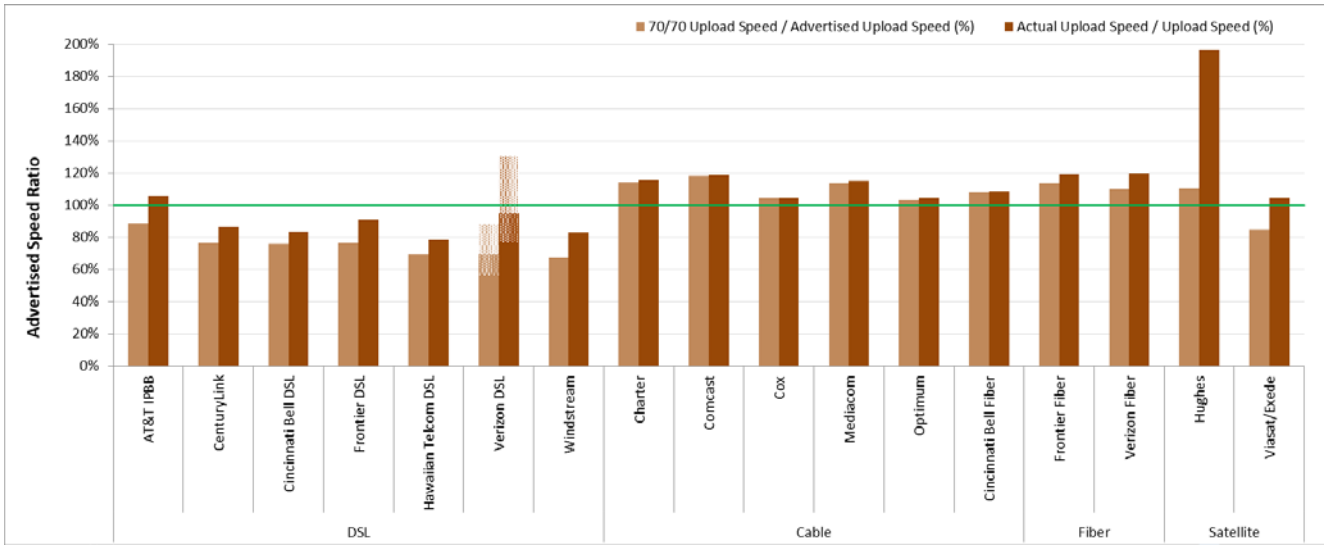


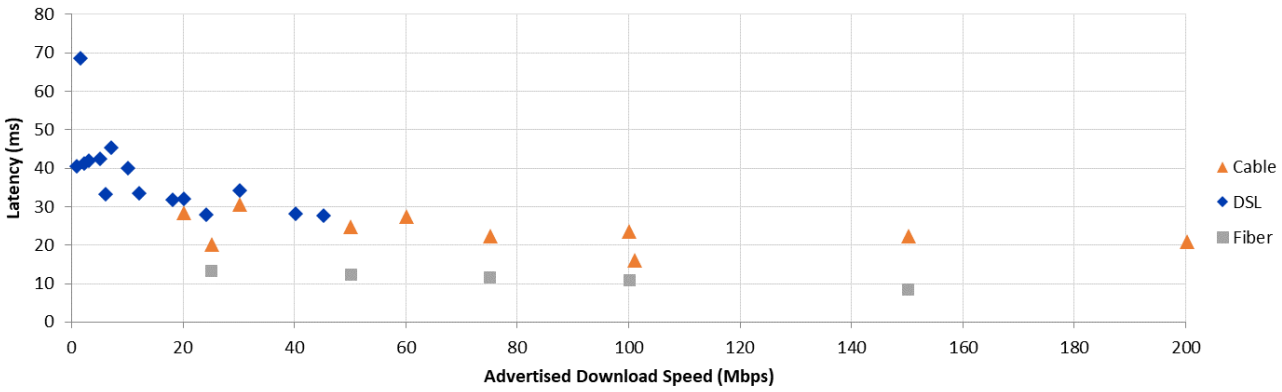
Chart 18.3: The ratio of 70/70 consistent upload speed to advertised upload speed.



T. Latency

Chart 19 below shows the weighted median latencies, by technology and by advertised download speed for terrestrial technologies. For all terrestrial technologies, latency varied little with advertised download speed. DSL service typically had higher latencies than either cable or fiber.

Chart 19: Latency for Terrestrial ISPs, by technology, and by advertised download speed.


Latency (ms)
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
Advertised Download Speed (Mbps)
Cable
DSL
Fiber

5. ADDITIONAL TEST RESULTS

U. Actual Speed, By Service Tier

As shown in Charts 20.1-20.7, peak usage period performance varied by service tier among participating ISPs during the September 2017 period. On average, during peak periods, the ratio of median download speed to advertised download speed for all ISPs was 59% or better, and 90% or better for most ISPs. However, the ratio of median download speed to advertised download speed varies among service tiers. It should be noted that for Verizon-DSL, which advertises a range of speeds, we have calculated a range of values corresponding to its advertised range.

Chart 20.7: The ratio of median download speed to advertised download speed, by ISP (0-5 Mbps).

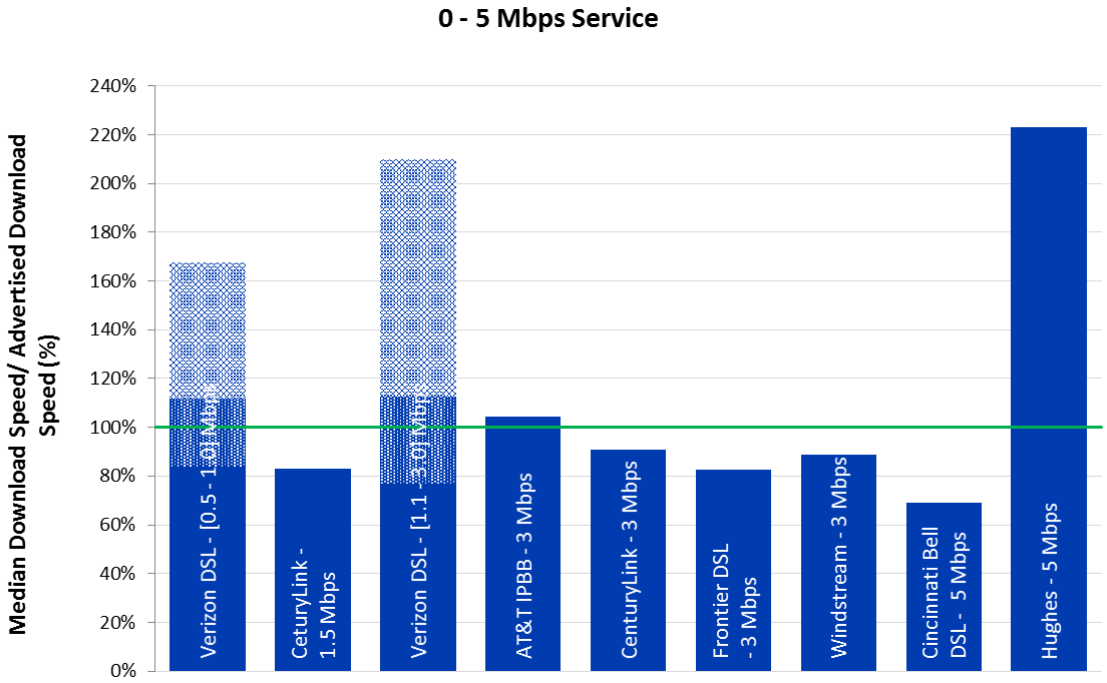


Chart 20.8: The ratio of median download speed to advertised download speed, by ISP (6-10 Mbps).

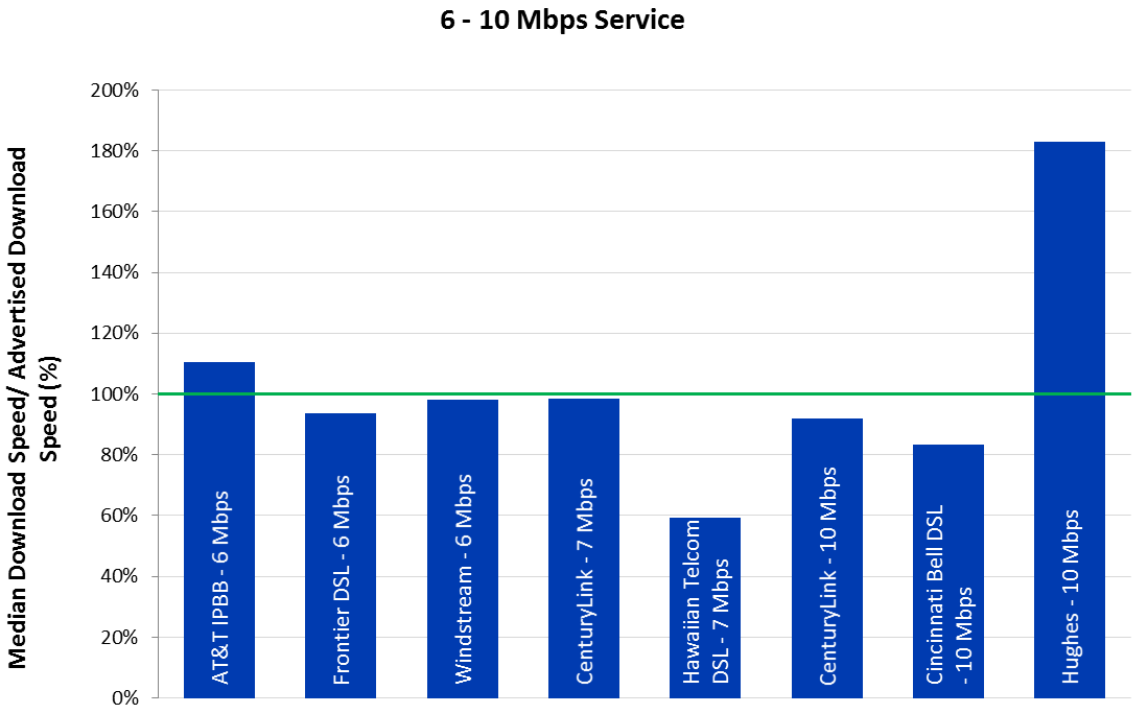


Chart 20.9: The ratio of median download speed to advertised download speed, by ISP (12-18 Mbps).

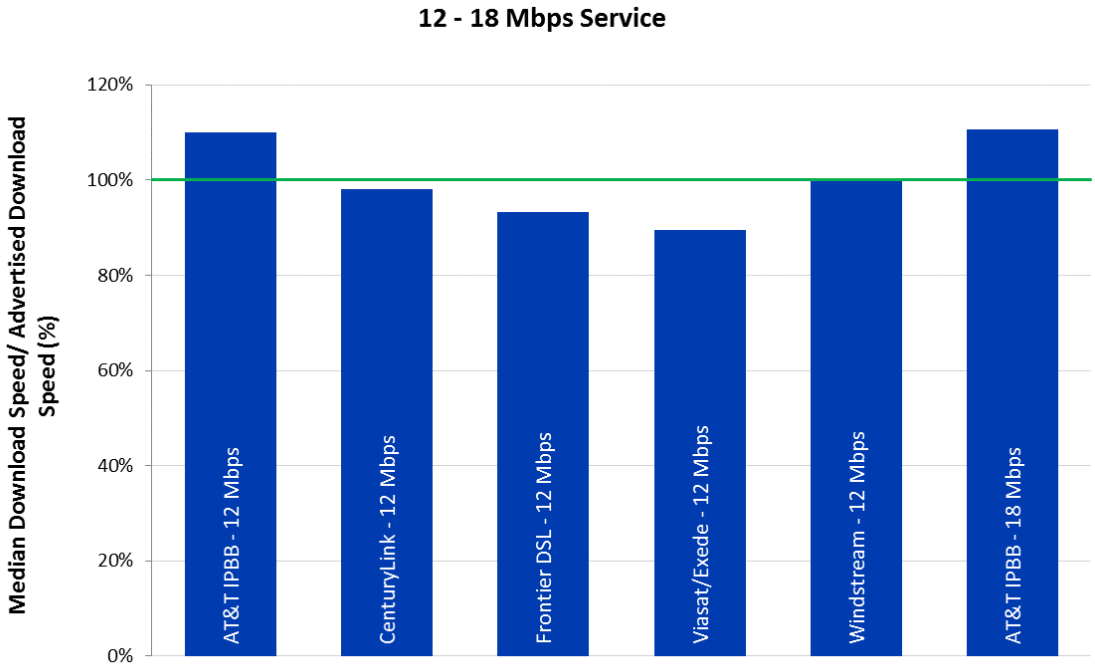


Chart 20.10: The ratio of median download speed to advertised download speed, by ISP (20-25 Mbps).

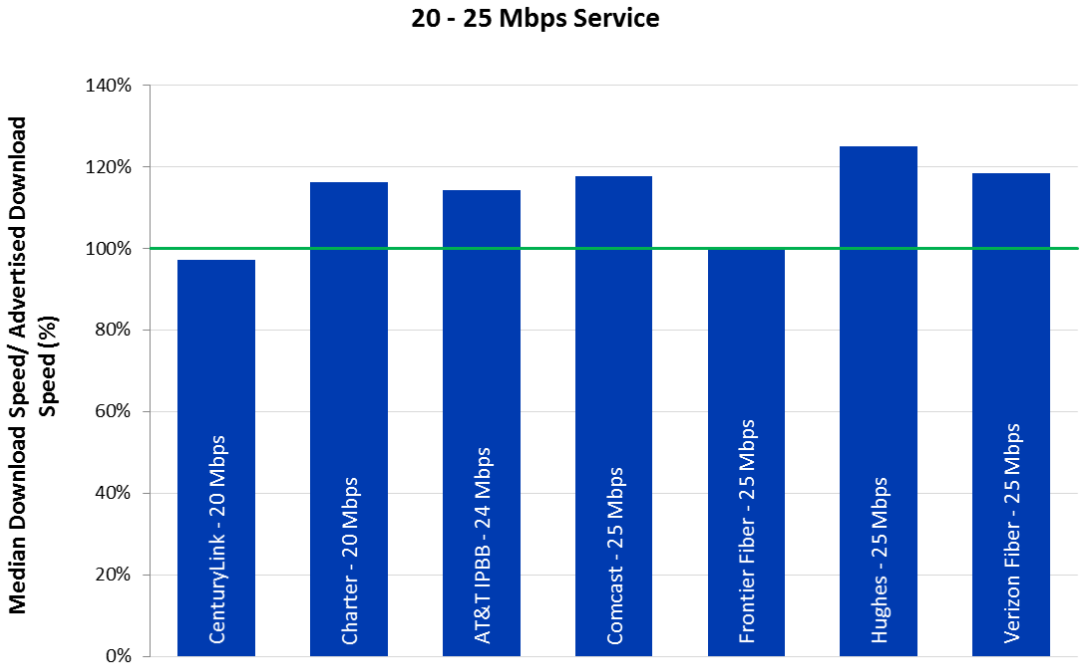


Chart 20.11: The ratio of median download speed to advertised download speed, by ISP (30-50 Mbps).

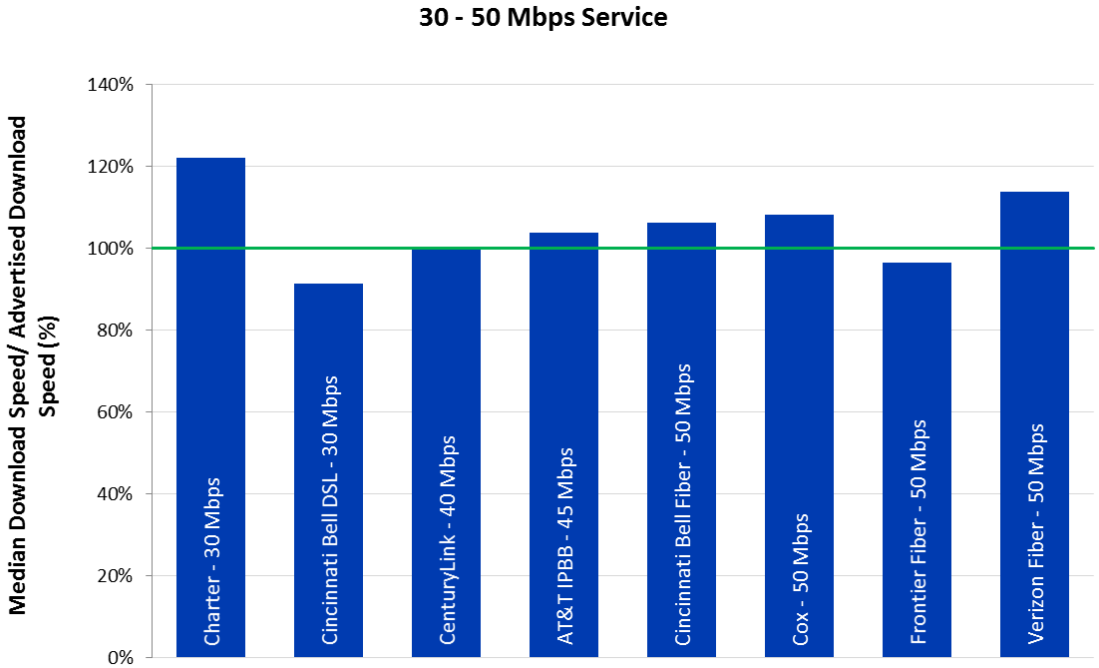


Chart 20.12: The ratio of median download speed to advertised download speed, by ISP (60-75 Mbps).

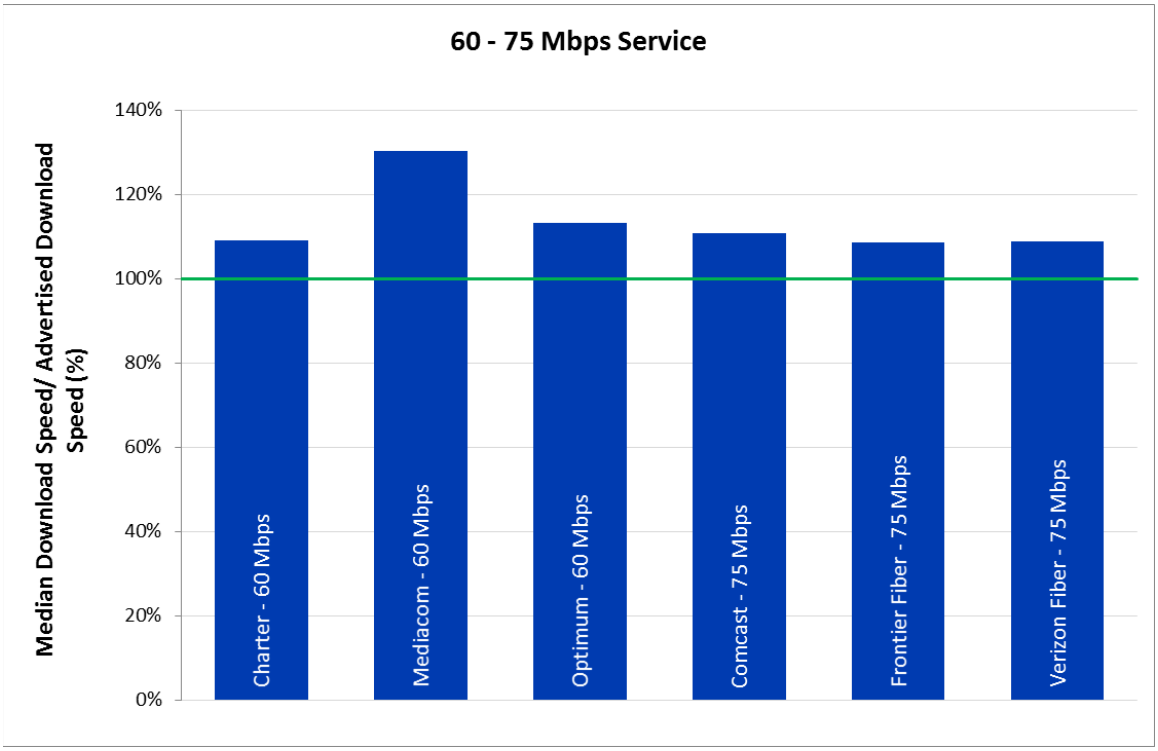
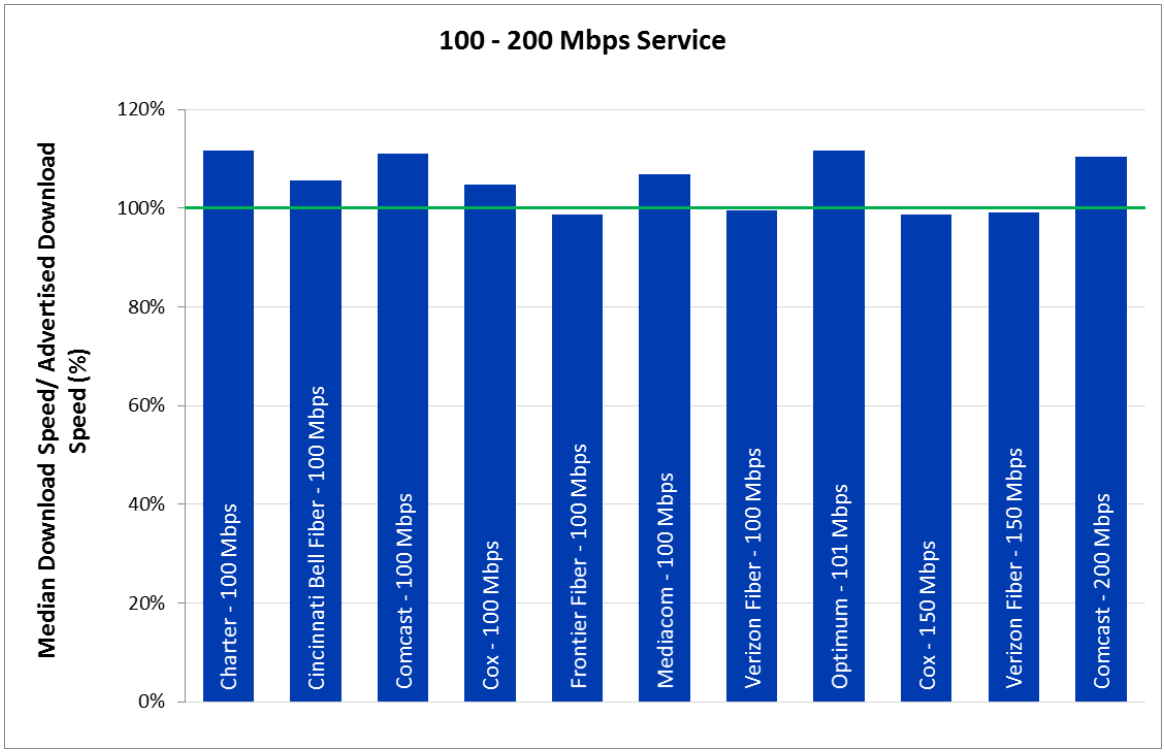


Chart 20.7: The ratio of median download speed to advertised download speed, by ISP (100-200 Mbps).



Charts 21.1 –21.7 depict the ratio of median upload speeds to advertised upload speeds for each ISP by service tier.

Chart 21.1: The ratio of median upload speed to advertised upload speed, by ISP (0-0.64 Mbps).

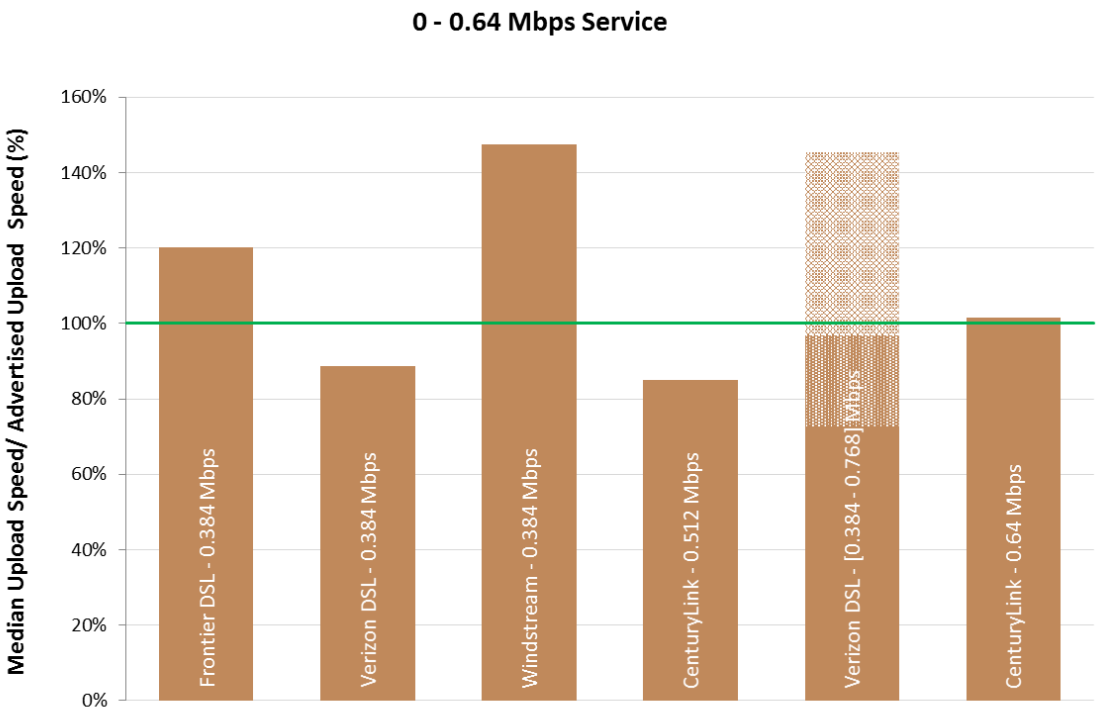


Chart 21.2: The ratio of median upload speed to advertised upload speed, by ISP (0.768-0.896 Mbps).

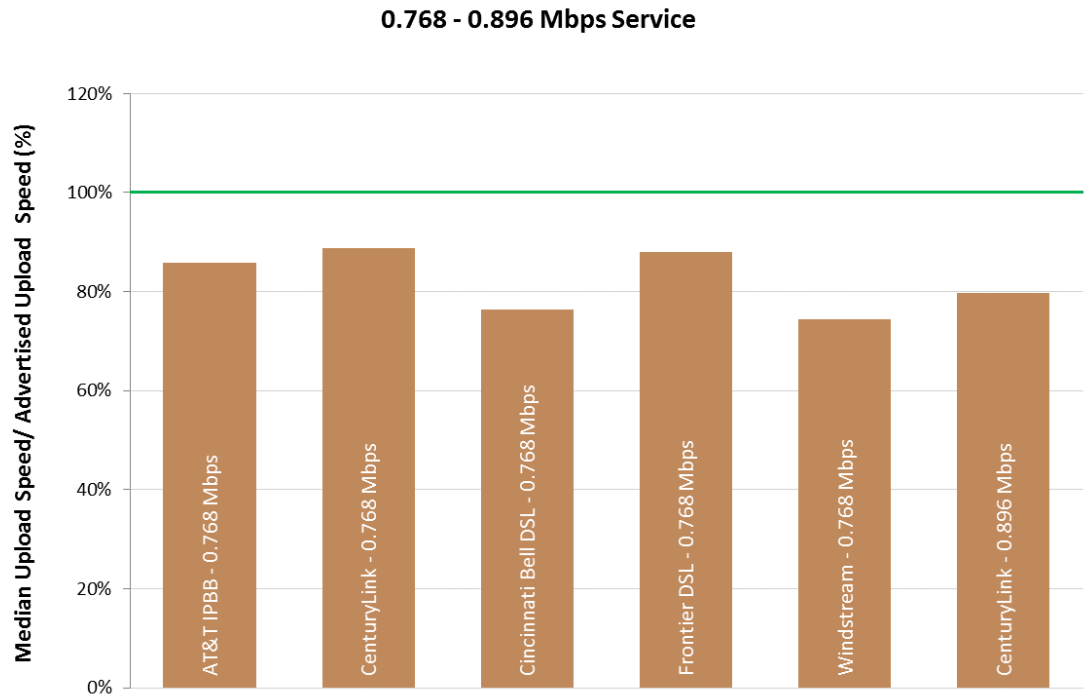


Chart 21.3: The ratio of median upload speed to advertised upload speed, by ISP (1-2 Mbps).

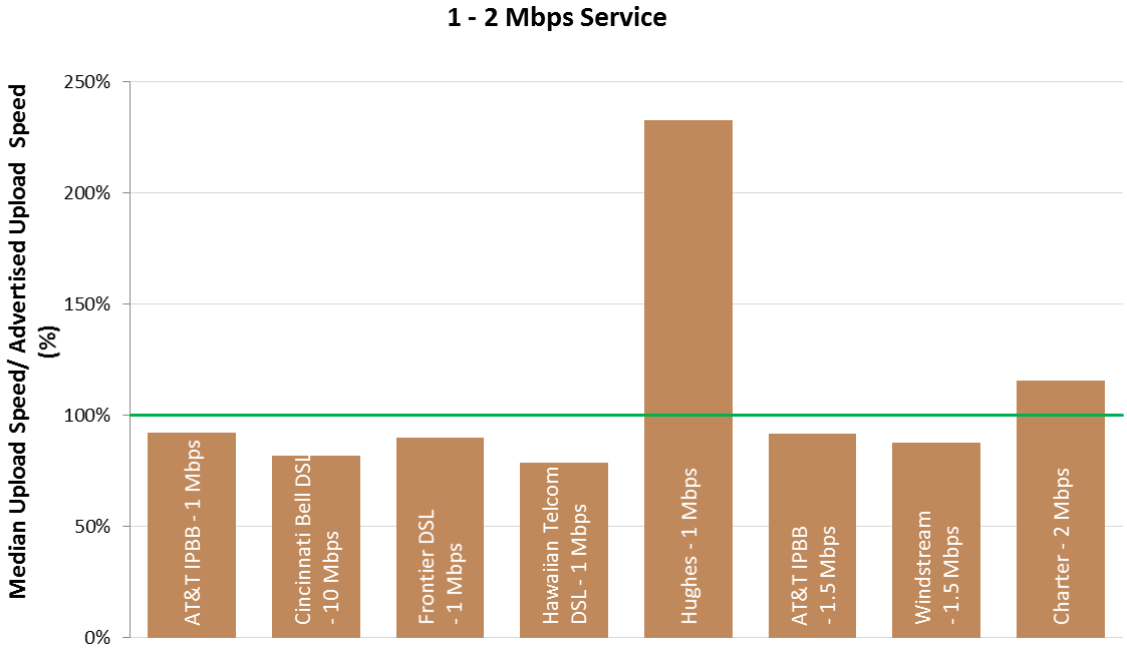


Chart 21.4: The ratio of median upload speed to advertised upload speed, by ISP (3-5 Mbps).

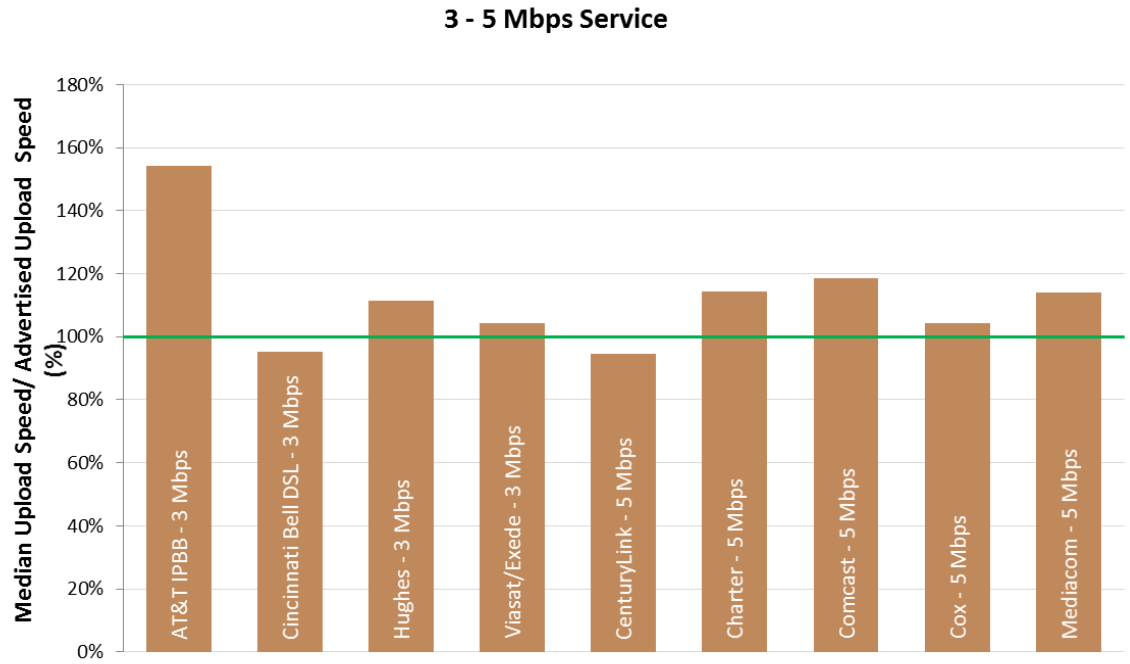


Chart 21.5: The ratio of median upload speed to advertised upload speed, by ISP (6-10 Mbps).

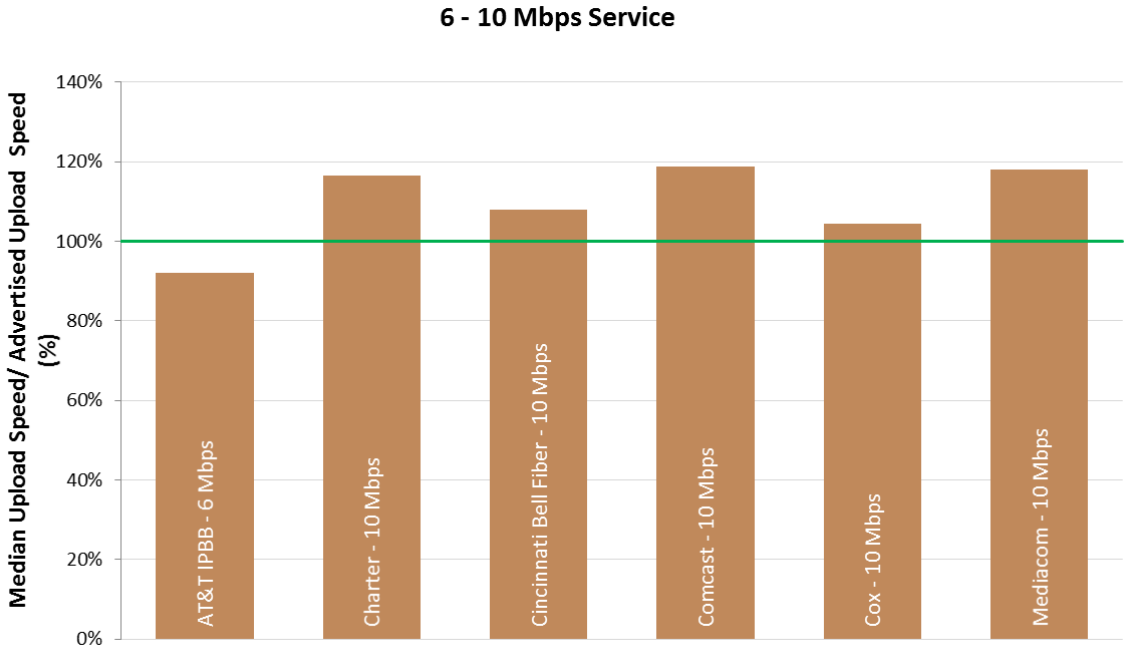


Chart 21.6: The ratio of median upload speed to advertised upload speed, by ISP (20-50 Mbps).

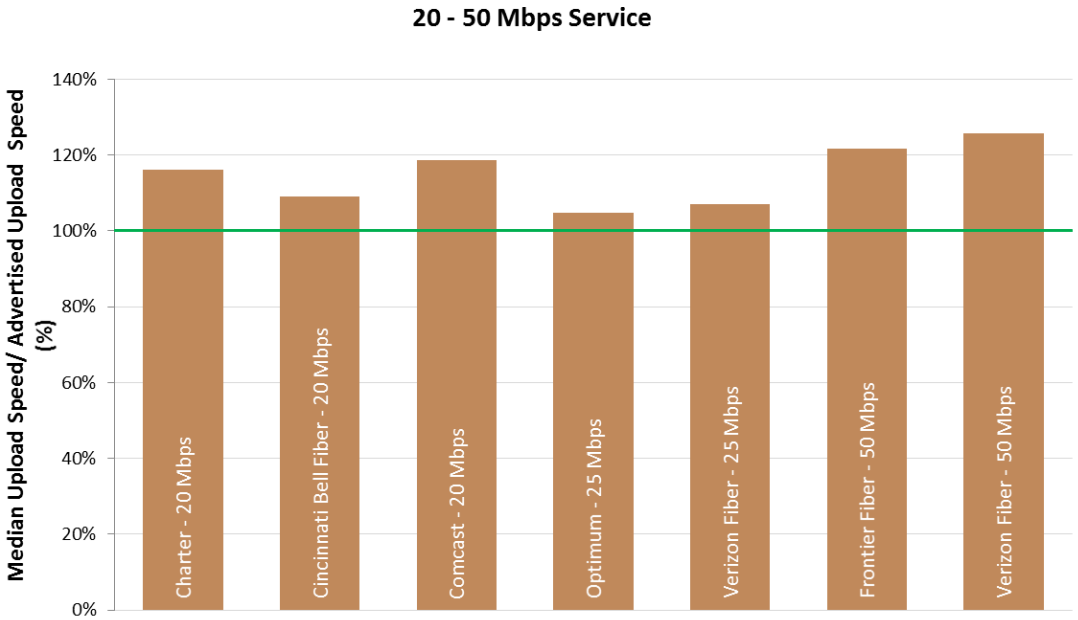


Chart 21.7: The ratio of median upload speed to advertised upload speed, by ISP (75-150 Mbps).

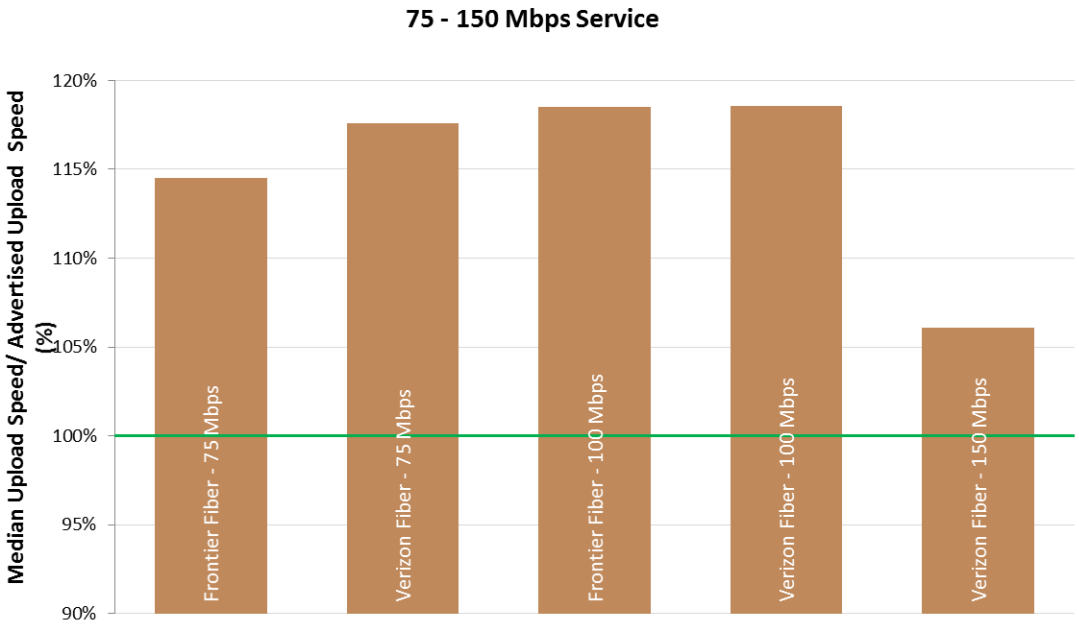


Table 2 lists the advertised download service tiers included in this study. For each tier, an ISP's advertised download speed is compared with the median of the measured download speed results. As in past reports, we note that the download speeds listed here are based on national averages and may not

represent the performance experienced by any particular consumer at any given time or place.

Table 2: Peak period median download speed, sorted by actual download speed

Download Median Speed (Mbps)	Advertised Download Speed (Mbps)	ISP	Actual Speed / Advertised Speed (%)
0.84	0.5 - 1	Verizon DSL	83.7 - 167.4
2.31	1.1 - 3	Verizon DSL	76.9 - 209.8
1.24	1.5	CenturyLink	82.9
3.13	3	AT&T IPBB	104.2
2.72	3	CenturyLink	90.7
2.48	3	Frontier DSL	82.7
2.66	3	Windstream	88.7
3.45	5	Cincinnati Bell DSL	69.0
11.15	5	Hughes	223.0
6.63	6	AT&T IPBB	110.6
5.61	6	Frontier DSL	93.5
5.88	6	Windstream	98.0
6.90	7	CenturyLink	98.6
9.18	10	CenturyLink	91.8
8.35	10	Cincinnati Bell DSL	83.5
18.29	10	Hughes	182.9
13.19	12	AT&T IPBB	109.9
11.77	12	CenturyLink	98.1
11.19	12	Frontier DSL	93.3
10.75	12	ViaSat	89.6
12.00	12	Windstream	100.0
19.89	18	AT&T IPBB	110.5
19.45	20	CenturyLink	97.3
23.22	20	Charter	116.1
27.42	24	AT&T IPBB	114.3
29.41	25	Comcast	117.6
24.90	25	Frontier Fiber	99.6

31.27	25	Hughes	125.1
29.60	25	Verizon Fiber	118.4
36.66	30	Charter	122.2
27.42	30	Cincinnati Bell DSL	91.4
39.87	40	CenturyLink	99.7
46.74	45	AT&T IPBB	103.9
53.17	50	Cincinnati Bell Fiber	106.4
54.13	50	Cox	108.3
48.20	50	Frontier Fiber	96.4
56.84	50	Verizon Fiber	113.7
65.37	60	Charter	109.0
78.19	60	Mediacom	130.3
67.95	60	Optimum	113.2
83.11	75	Comcast	110.8
81.45	75	Frontier Fiber	108.6
81.64	75	Verizon Fiber	108.9
111.77	100	Charter	111.8
105.58	100	Cincinnati Bell Fiber	105.6
111.07	100	Comcast	111.1
104.82	100	Cox	104.8
98.69	100	Frontier Fiber	98.7
106.98	100	Mediacom	107.0
99.48	100	Verizon Fiber	99.5
112.74	101	Optimum	111.6
147.98	150	Cox	98.7
148.59	150	Verizon Fiber	99.1
221.07	200	Comcast	110.5

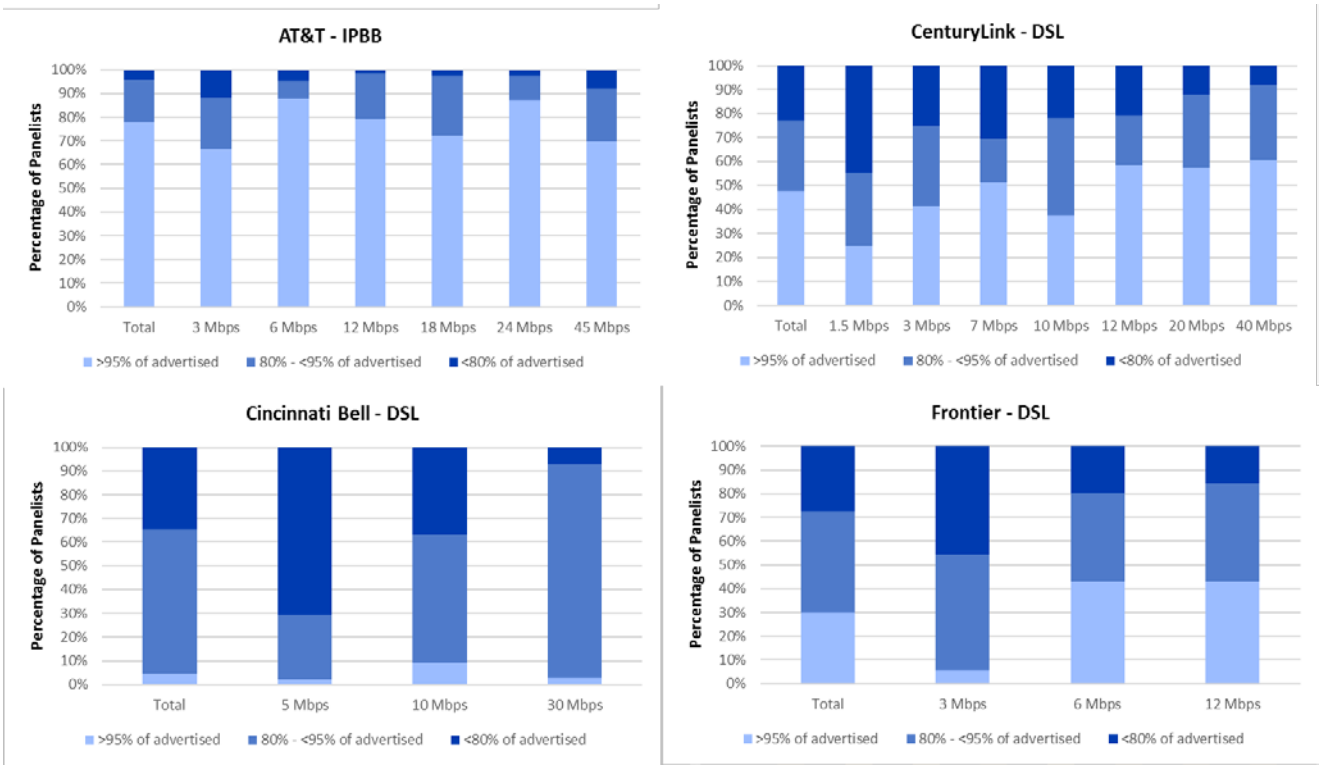
V. Variations In Speed

In Section 3.C above, we presented speed consistency metrics for each ISP based on test results averaged across all service tiers. In this section, we provide detailed speed consistency results for each ISP's individual service tiers. Consistency of speed is important for services such as video streaming. A significant reduction in speed for more than a few seconds can force a reduction in video resolution or an

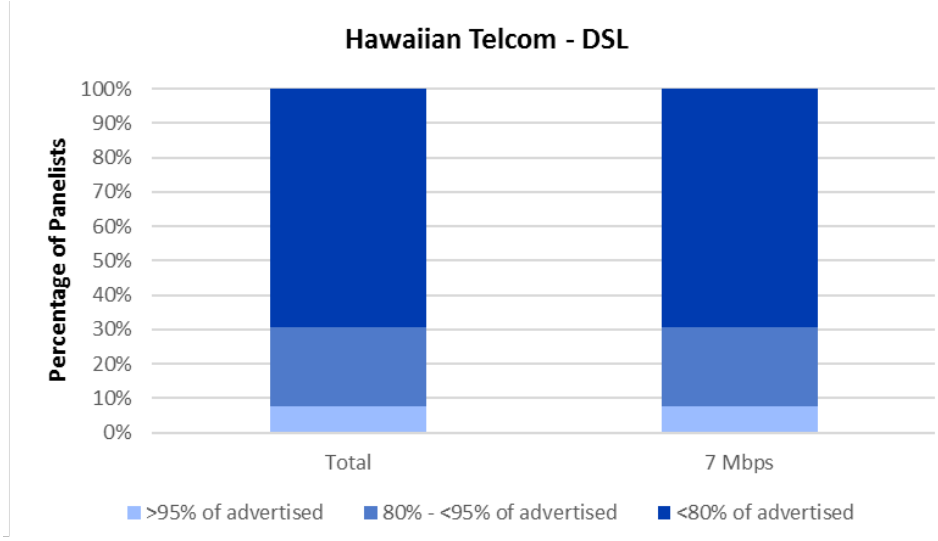
intermittent loss of service.

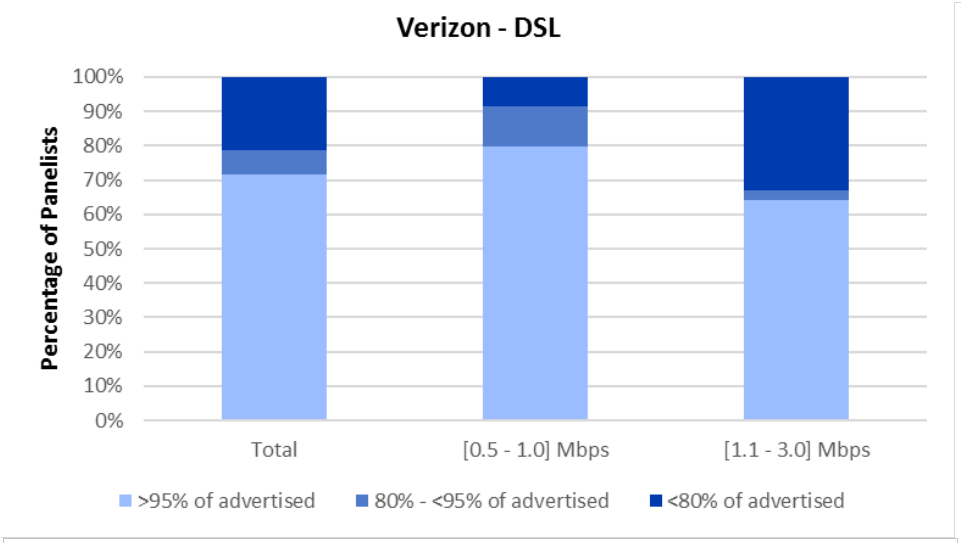
Charts 22.1 – 22.3 below show the percentage of consumers that achieved greater than 95%, between 85% and 95%, or less than 80% of the advertised download speed for each ISP speed tier. [31] Consistent with past performance, ViaSat/Exede showed low consistency of speed with 52% of consumers experiencing an average service speed of 80% or less of the advertised speed. ISPs using DSL technology also frequently failed to deliver advertised service rates. ISPs quote a single 'up-to' speed, but the actual speed of DSL depends on the distance between the subscriber and the serving central office. Cable companies and fiber-based systems, in general, showed a high consistency of speed.

Chart 22.1: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed, by service tier (DSL).



[31] Chart 22.2 excludes Cox due to the sampling issue discussed in note 15 above.


Hawaiian Telcom - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
7 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised


Verizon - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
[0.5 - 1.0] Mbps
[1.1 - 3.0] Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised

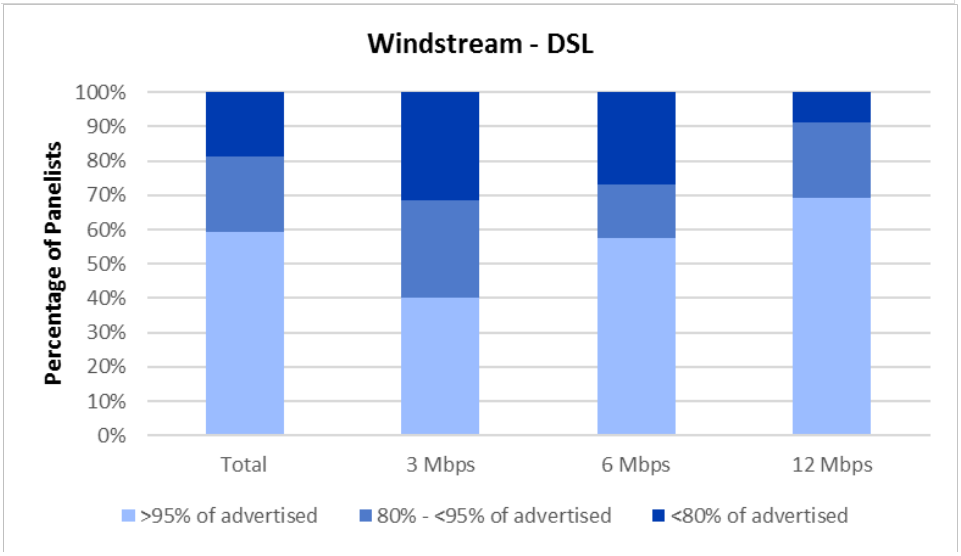

Windstream - DSL
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
3 Mbps
6 Mbps
12 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised

Chart 22.2: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed (cable).

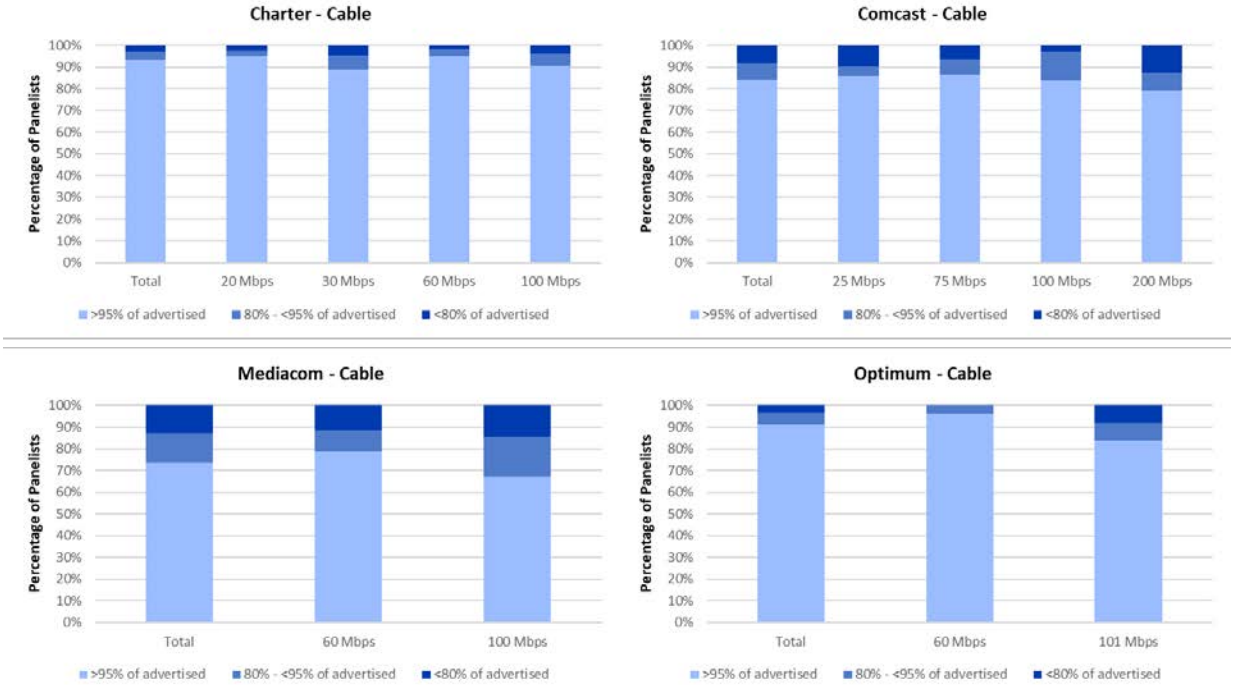
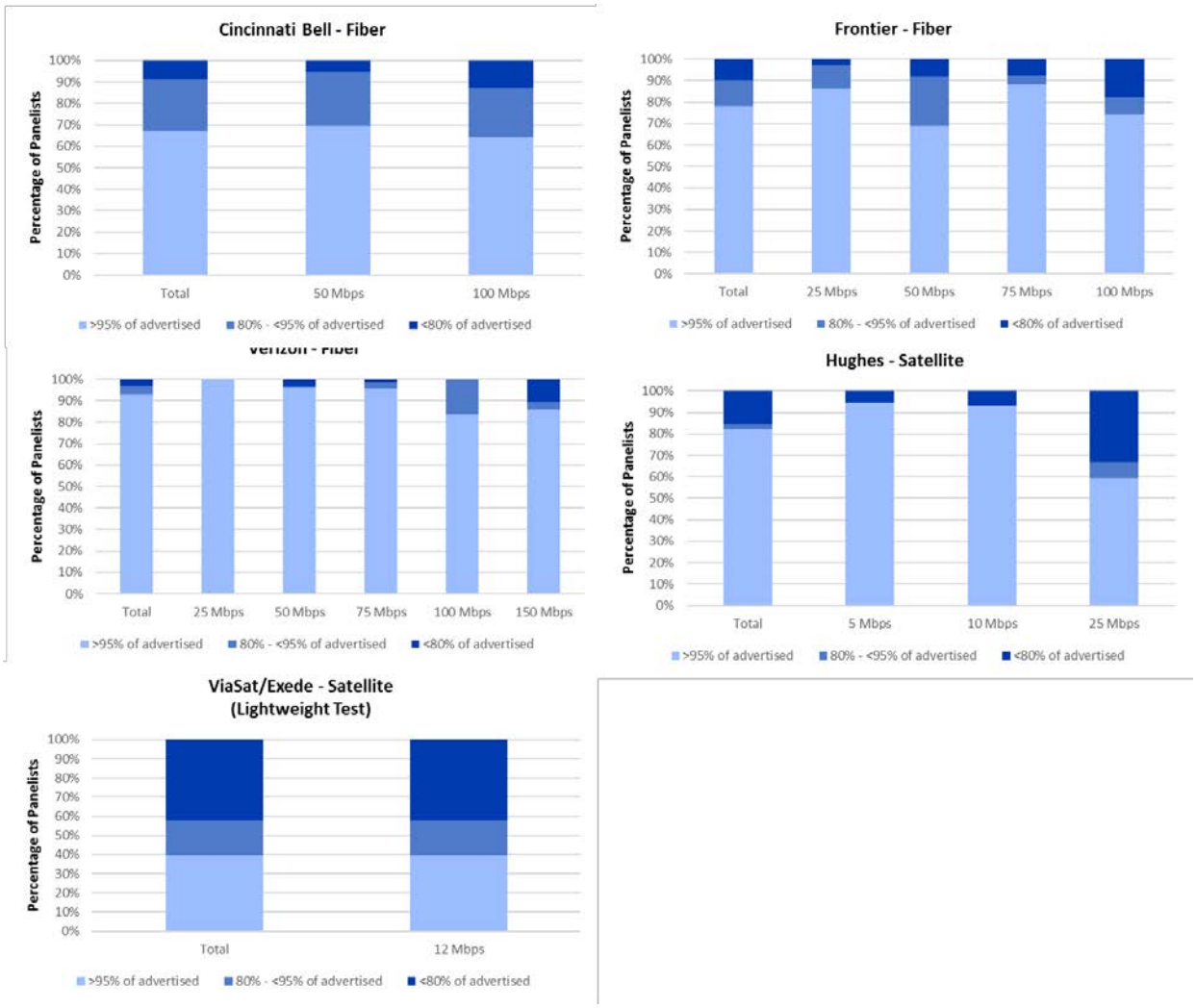
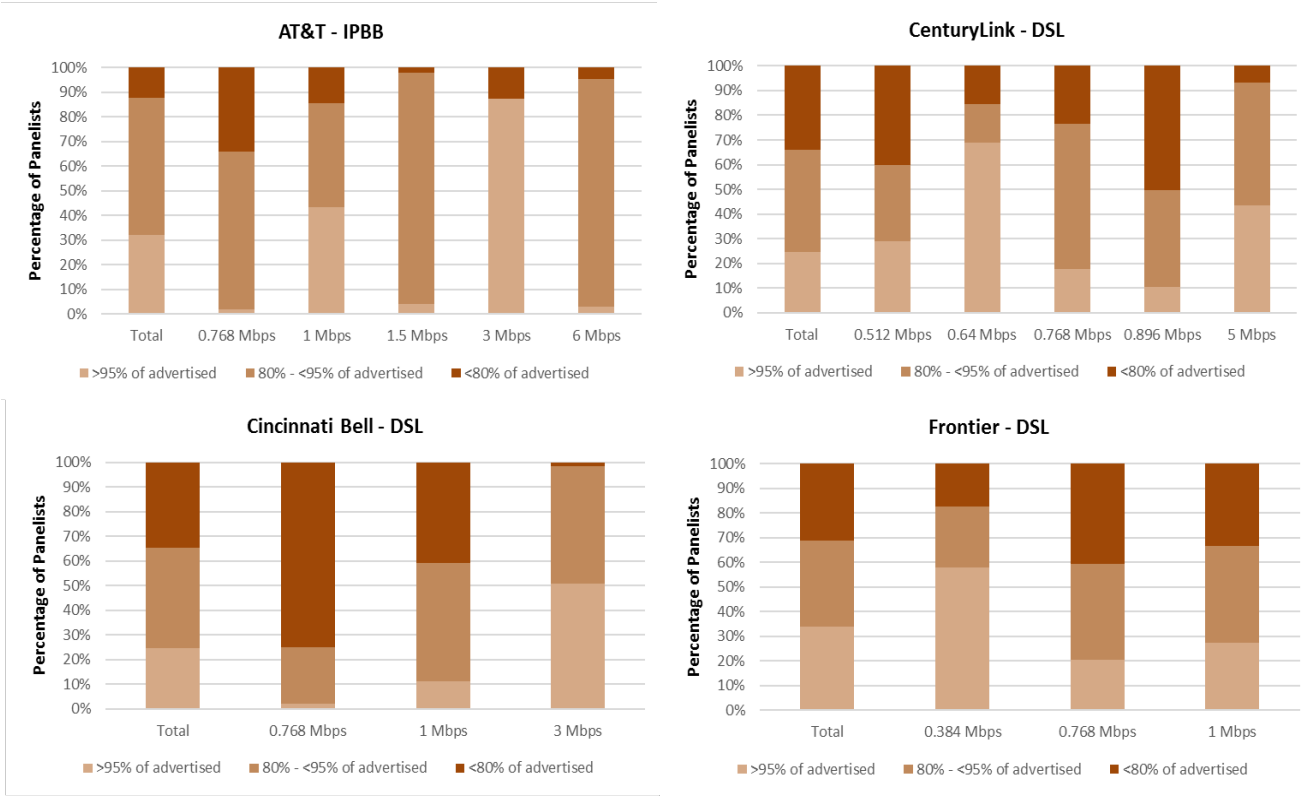


Chart 22.3: The percentage of consumers whose median download speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised download speed (fiber and satellite).



Similarly, Charts 23.1 to 23.3 show the percentage of consumers that achieved greater than 95%, between 85% and 95%, or less than 80% of the advertised upload speed for each ISP speed tier.

Chart 23.1: The percentage of consumers whose median upload speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised upload speed (DSL).



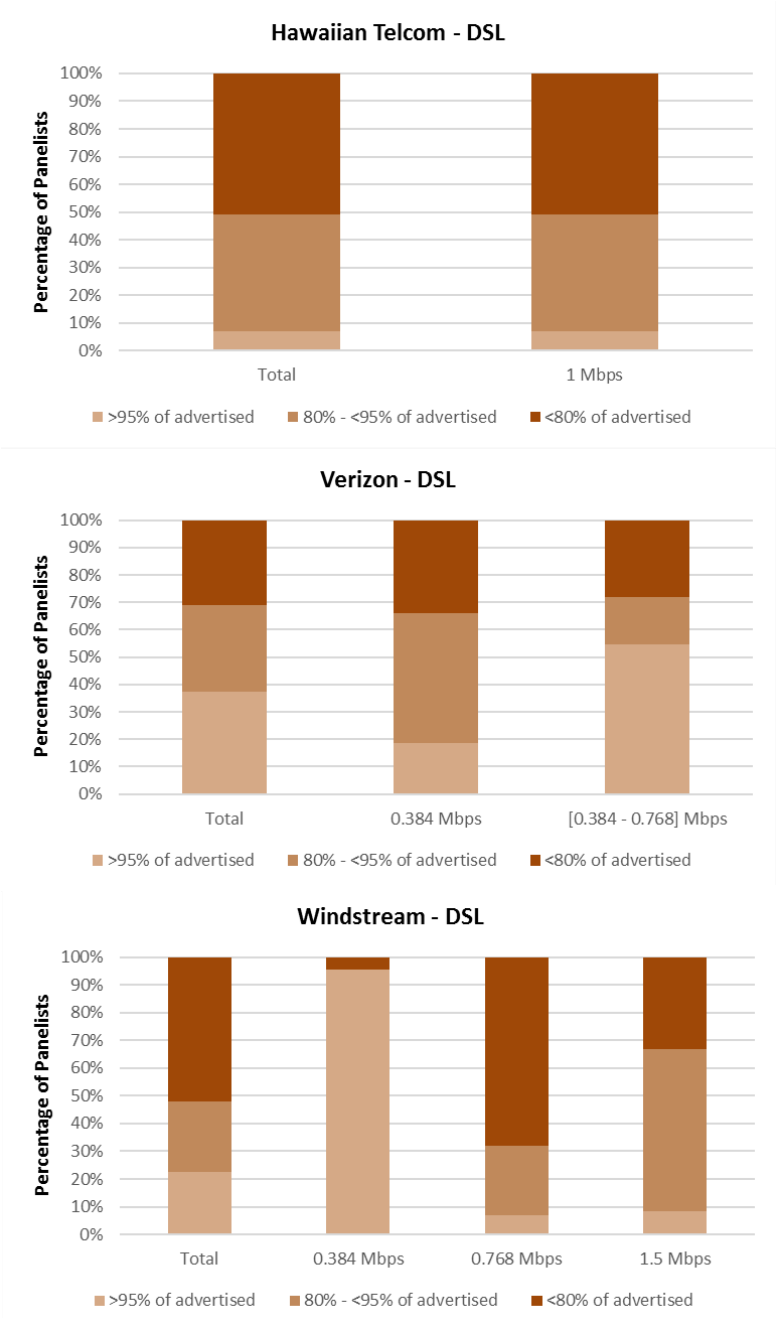
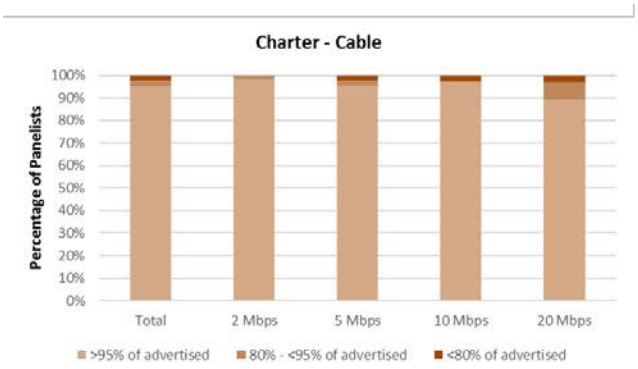
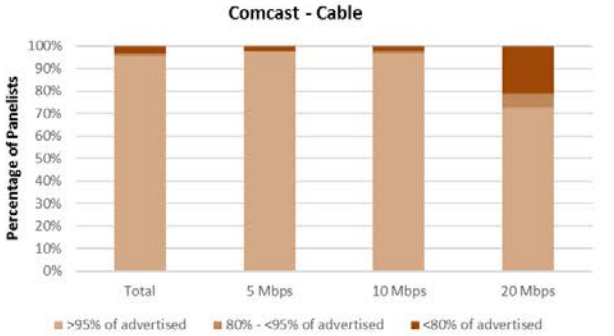
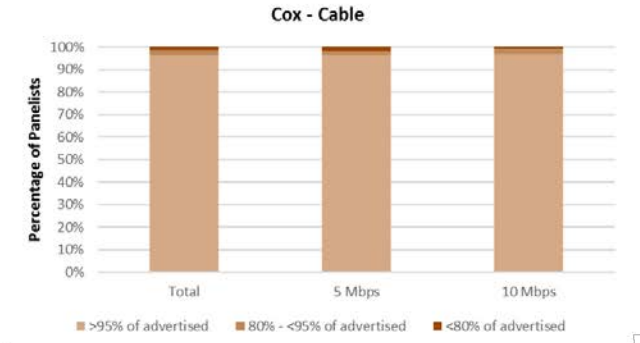
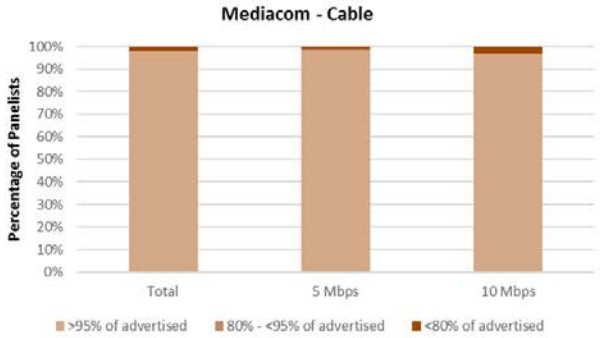


Chart 23.2: The percentage of consumers whose median upload speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised upload speed (cable).


Charter - Cable
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
2 Mbps
5 Mbps
10 Mbps
20 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised


Comcast - Cable
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
5 Mbps
10 Mbps
20 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised


Cox - Cable
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
5 Mbps
10 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised


Mediacom - Cable
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
5 Mbps
10 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised

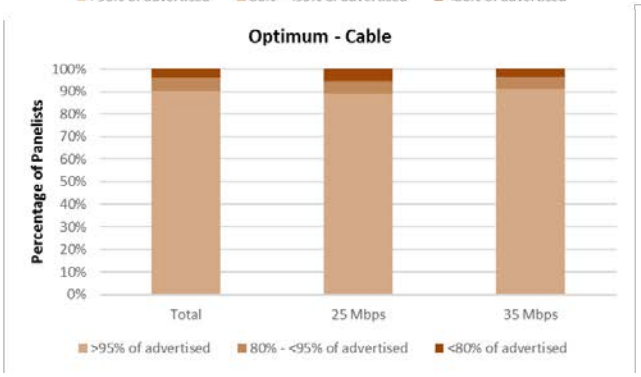
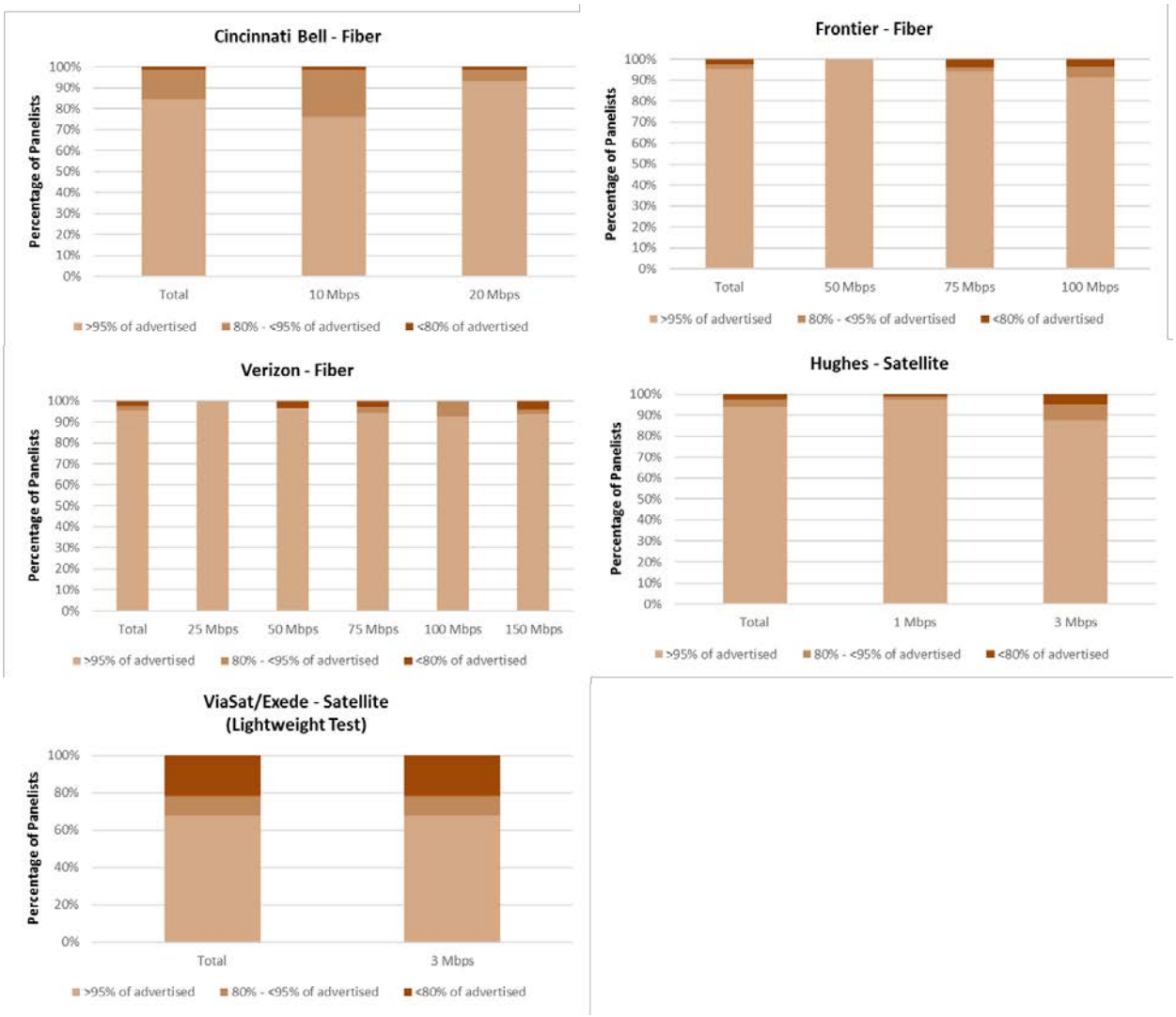

Optimum - Cable
Percentage of Panelists
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Total
25 Mbps
35 Mbps
>95% of advertised
80% - <95% of advertised
<80% of advertised

Chart 23.3: The percentage of consumers whose median upload speed was greater than 95%, between 80% and 95%, or less than 80% of the advertised upload speed (fiber and satellite).



In Section 3.C above, we presented complementary cumulative distributions for each ISP based on test results across all service tiers. Below, we provide tables showing selected points on these distributions by each individual ISP. Overall, performance depended less on a specific technology and more on the engineering and marketing choices made by each provider. For example, Optimum and Charter, which are cable-based companies, provided average download speeds over 92% and 93%, respectively, of advertised rates to 95% of their panelists. Mediacom, also a cable-based company, provided median speeds of at least 59% of advertised speed to 95% of its panelists. Verizon's fiber-based service provided speeds of 93% or better to 95% of its panelists whereas Frontier Fiber provided speeds of 72% or better to 95% of its panelists.

Table 3: Complementary cumulative distribution of the ratio of median download speed to advertised download speed by ISP

ISP	20%	50%	70%	80%	90%	95%
AT&T IPBB	120.9%	108.6%	99.3%	94.2%	86.8%	80.9%
CenturyLink	106.2%	93.0%	84.5%	77.9%	68.0%	57.6%
Cincinnati Bell Fiber	108.3%	106.0%	94.7%	91.9%	82.6%	70.0%
Cincinnati Bell DSL	92.4%	84.8%	77.7%	69.3%	33.4%	28.0%
Charter	116.8%	109.6%	107.8%	105.4%	99.3%	92.5%
Comcast	118.0%	112.0%	106.8%	98.5%	86.5%	67.7%
Cox	118.3%	103.9%	92.0%	82.5%	67.5%	54.5%
Frontier Fiber	109.5%	99.4%	96.4%	94.6%	81.1%	71.7%
Frontier DSL	96.8%	87.8%	81.6%	75.0%	49.9%	32.8%
Hawaiian Telcom DSL	89.9%	59.2%	38.4%	36.1%	27.4%	24.9%
Hughes	236.1%	177.4%	132.9%	110.0%	64.5%	50.3%
Mediacom	132.4%	116.2%	103.3%	89.5%	72.2%	59.3%
Optimum	114.2%	112.9%	110.9%	106.3%	96.4%	92.1%
Verizon Fiber	114.1%	108.9%	99.8%	99.1%	97.3%	93.0%
Verizon DSL	122.9%	111.6%	100.1%	78.7%	55.9%	49.2%
ViaSat/Exede	106.3%	89.6%	77.2%	68.8%	62.8%	54.2%
Windstream	102.9%	97.8%	89.3%	80.8%	66.3%	50.9%

Table 4: Complementary cumulative distribution of the ratio of median upload speed to advertised upload speed by ISP

ISP	20%	50%	70%	80%	90%	95%
AT&T IPBB	140.0%	92.1%	89.2%	86.0%	76.4%	59.9%
CenturyLink	97.1%	86.5%	77.8%	74.9%	66.2%	56.3%
Cincinnati Bell Fiber	109.1%	108.5%	107.8%	107.5%	94.8%	94.4%
Cincinnati Bell DSL	95.3%	85.0%	78.6%	76.1%	70.8%	58.0%
Charter	116.9%	114.5%	113.8%	112.7%	108.4%	97.2%
Comcast	119.1%	118.7%	118.2%	117.3%	113.8%	100.7%
Cox	105.3%	104.5%	104.0%	103.4%	101.3%	98.0%
Frontier Fiber	121.7%	118.3%	113.2%	102.6%	97.7%	96.9%
Frontier DSL	113.8%	91.4%	79.1%	72.5%	51.4%	46.8%
Hawaiian Telcom DSL	87.8%	78.6%	73.7%	69.7%	60.9%	38.8%
Hughes	258.1%	190.1%	118.9%	111.8%	103.7%	89.2%
Mediacom	123.4%	114.3%	113.9%	113.6%	112.4%	106.9%
Optimum	105.1%	104.2%	102.9%	101.6%	95.9%	88.7%
Verizon Fiber	125.4%	118.4%	110.7%	106.2%	104.9%	98.1%
Verizon DSL	107.6%	92.2%	78.6%	63.0%	50.5%	28.4%
ViaSat/Exede	115.4%	104.2%	94.3%	65.4%	37.7%	32.5%
Windstream	108.0%	79.1%	71.2%	65.9%	56.3%	39.1%

W. Web Browsing Performance, By Service Tier

Below, we provide the detailed results of the webpage download time for each individual service tier of each ISP. Generally, website loading time decreased steadily with increasing tier speed until a tier speed of 15 Mbp,s and does not change markedly above that speed.

Chart 24.1: Average webpage download time, by ISP (0-5 Mbps).

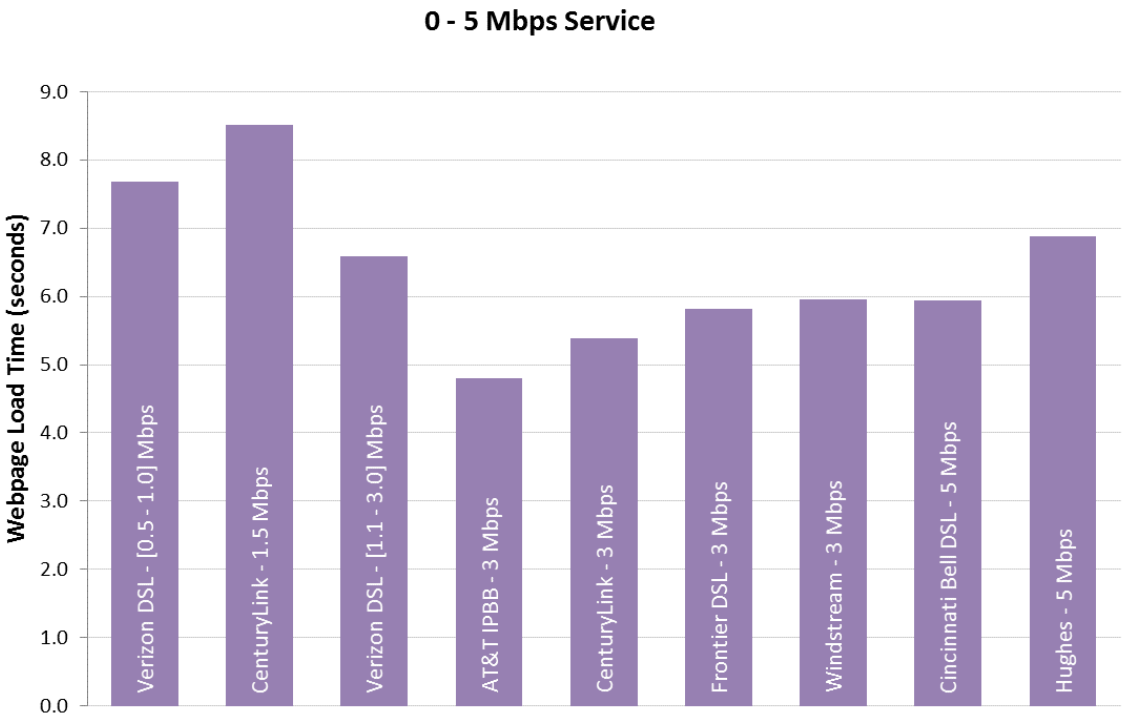

0 - 5 Mbps Service
Webpage Load Time (seconds)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Verizon DSL - [0.5 - 1.0] Mbps
CenturyLink - 1.5 Mbps
Verizon DSL - [1.1 - 3.0] Mbps
AT&T IPBB - 3 Mbps
CenturyLink - 3 Mbps
Frontier DSL - 3 Mbps
Windstream - 3 Mbps
Cincinnati Bell DSL - 5 Mbps
Hughes - 5 Mbps

Chart 24.2: Average webpage download time, by ISP (6-10 Mbps),

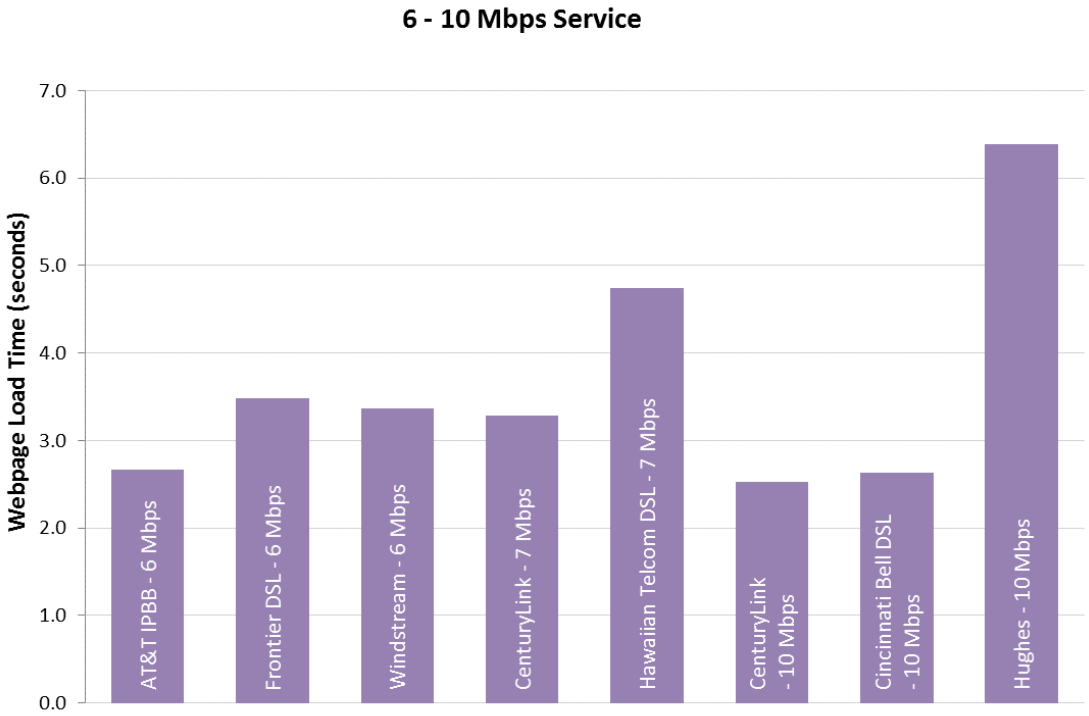


Chart 24.3: Average webpage download time, by ISP (12-18 Mbps).

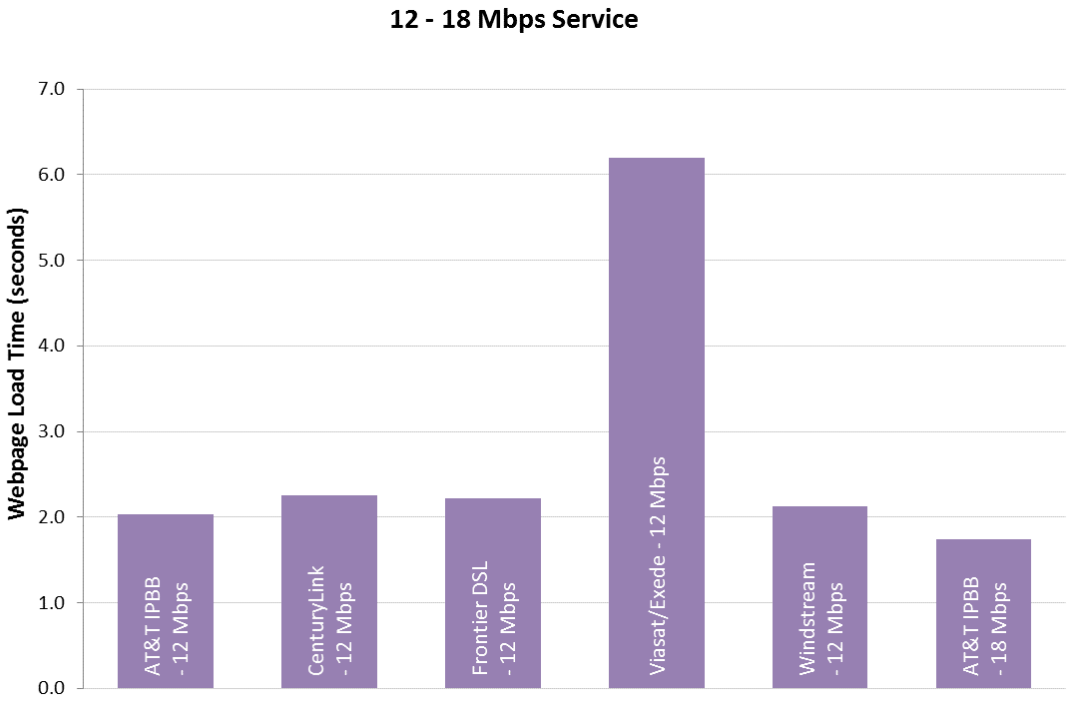


Chart 24.4: Average webpage download time, by ISP (20-25 Mbps).

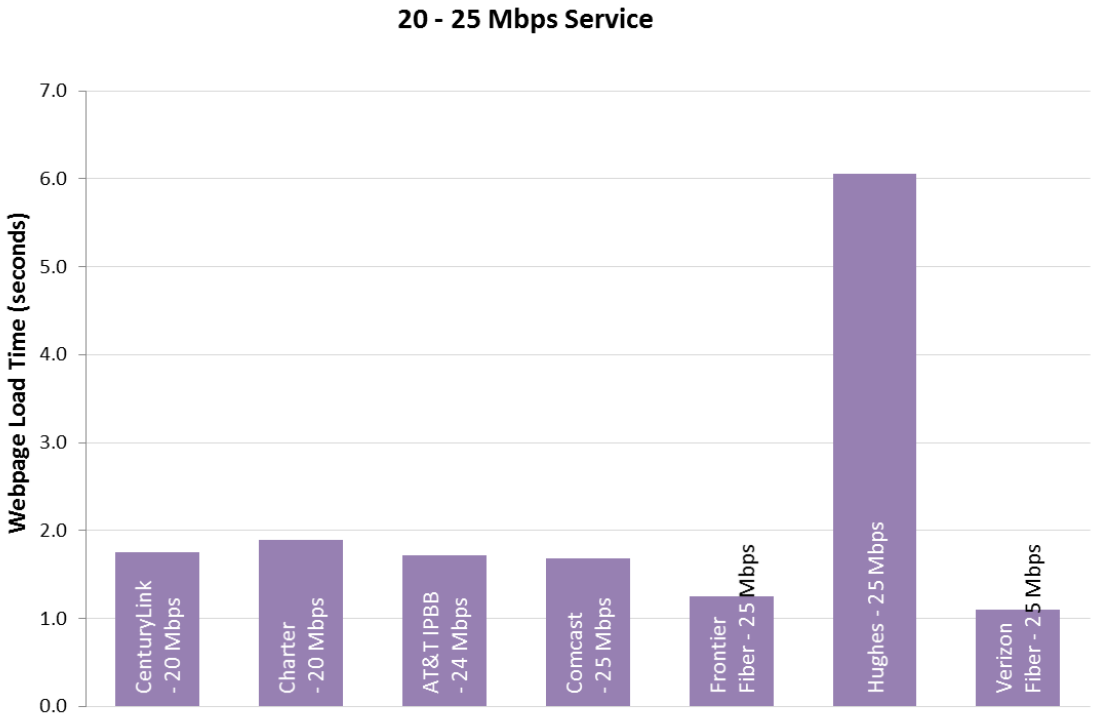


Chart 24.5: Average webpage download time, by ISP (30-50 Mbps).

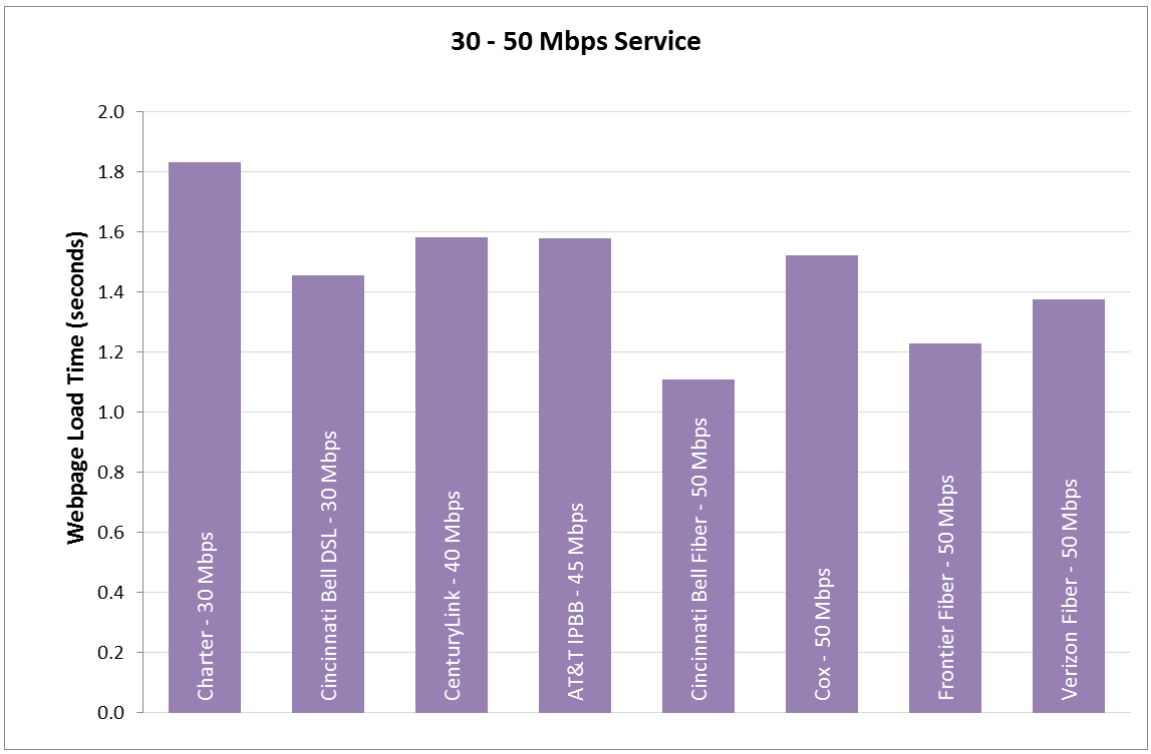


Chart 24.6: Average webpage download time, by ISP (60-75 Mbps).

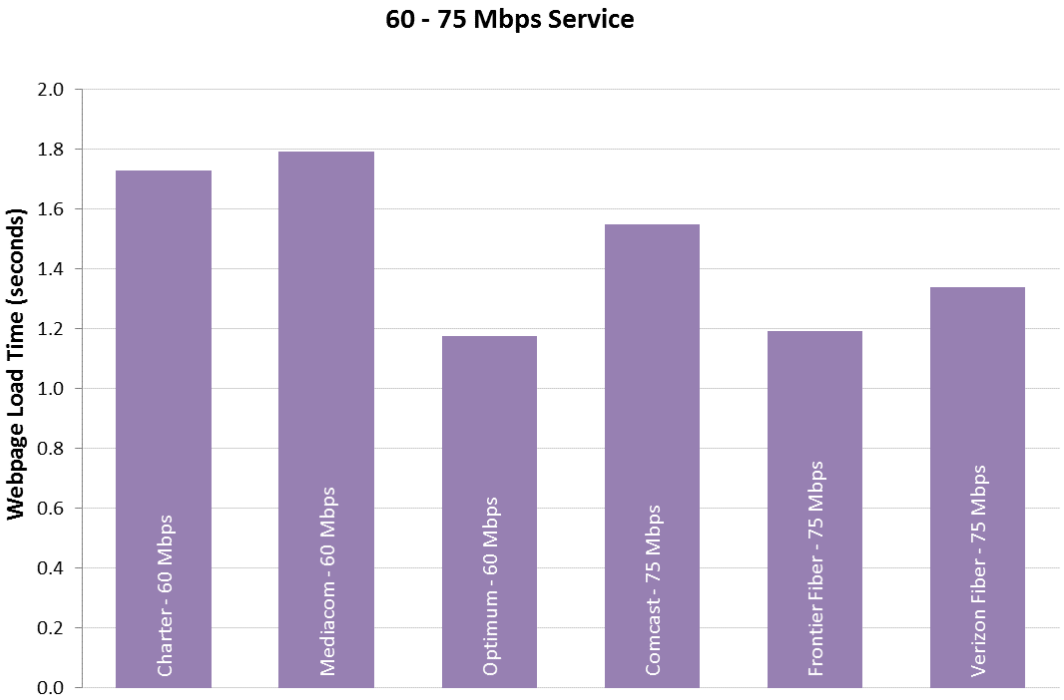
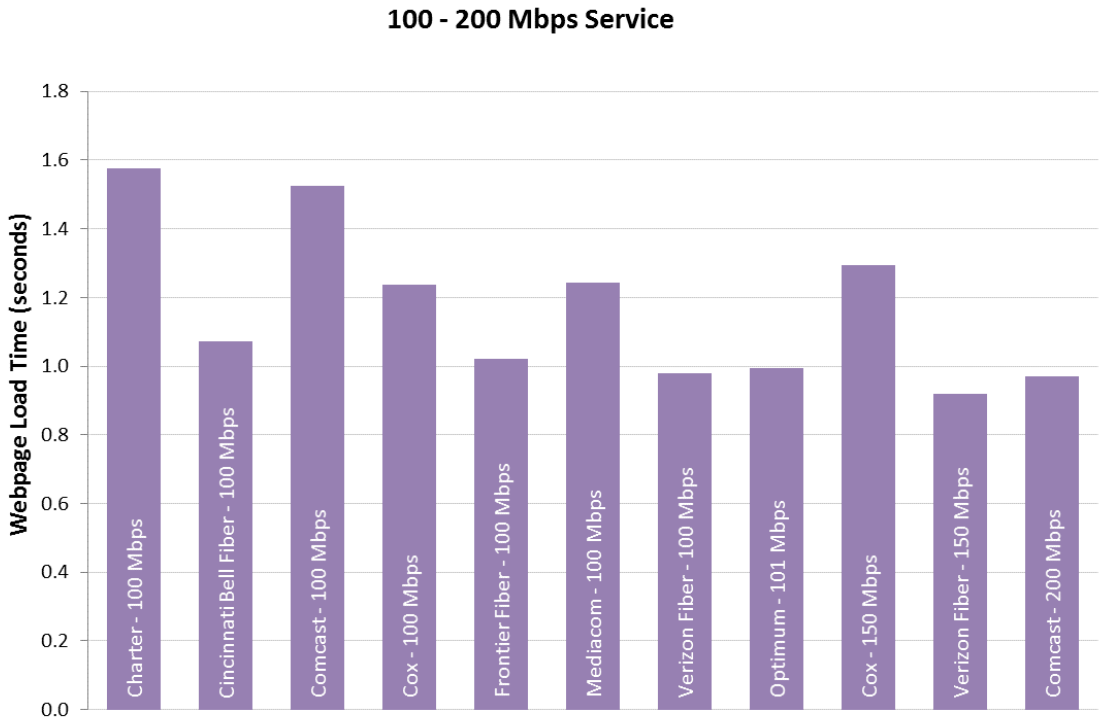


Chart 24.7: Average webpage download time, by ISP (100-200 Mbps).

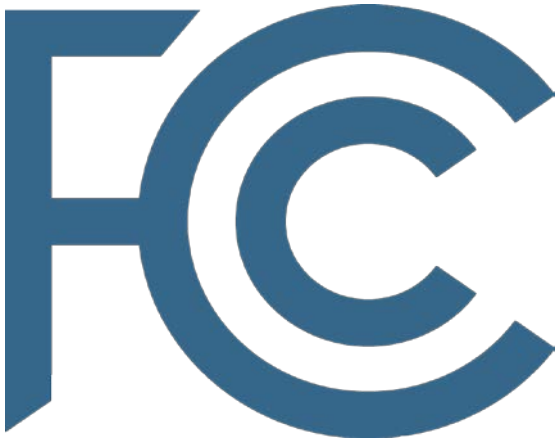


APPENDIX F-2.1

Technical Appendix to the Eighth MBA Report

Measuring Broadband America Fixed Broadband

A Report on Consumer Fixed Broadband Performance in the U.S.



FCC's Office of Engineering and Technology

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X. 1 – INTRODUCTION AND SUMMARY

This Appendix to the Eighth Measuring Broadband America Report,[32] a Report on Consumer Wireline Broadband Performance in the United States, provides detailed technical background information on the methodology that produced the Report. It covers the process by which the panel of consumer participants was originally recruited and selected for the August 2011 MBA Report, and then maintained over the last eight years. This Appendix also discusses the testing methodology used for the Report and describes how the test data was analyzed.

XI. 2 - PANEL CONSTRUCTION

This section describes the background of the study, as well as the methods employed to design the target panel, select volunteers for participation, and manage the panel to maintain the operational goals of the program.

The study aims to measure fixed broadband service performance in the United States as delivered by an Internet Service Provider (ISP) to the consumer's broadband modem. Many factors contribute to end-to-end broadband performance, only some of which are under the control of the consumer's ISP. The methodology outlined here is focused on the measurement of broadband performance within the scope of an ISP's network, and specifically focuses on measuring performance from the consumer Internet access point, or consumer gateway, to a close major Internet gateway point. The actual quality of experience seen by consumers depends on many other factors beyond the consumer's ISP, including the performance of the consumer's in-home network, the Internet backbone, interconnection points, content distribution networks (CDN) and the infrastructure deployed by the providers of content and services. The design of the study methodology allows it to be integrated with other technical measurement approaches that, in the future, could focus on other aspects of broadband performance.

A. 2.1 - USE OF AN ALL VOLUNTEER PANEL

During a 2008 residential broadband speed and performance test in the United Kingdom[33], SamKnows[34] determined that attrition rates of an all-volunteer panel was lower than a panel maintained with an incentive scheme of monthly payments. Consequently, in designing the methodology for this broadband performance study, the Commission relied entirely on volunteer consumer broadband subscribers. The volunteers were selected from a large pool of prospective participants according to a plan designed to generate a representative sample of desired consumer demographics, including geographical location, ISP, and speed tier. As an incentive for participation, volunteers were given access to a personal reporting suite which allowed them to monitor the performance of their broadband service. They were also provided with a measurement device referred to in the study as a "Whitebox," configured to run custom SamKnows software.[35]

[32] The First Report (2011) was based on measurements taken in March 2011, the Second Report (2012) on measurements taken in April 2012, and the Third (2013) through Seventh (2017) Reports on measurements taken in September of the year prior to the reports' release dates.

[33] *See* **http://www.samknows.com/broadband/pm/PM_Summer_08.pdf,** (last accessed June 21, 2016).

[34] SamKnows is a company that specializes in broadband availability measurement and was retained under contract by the FCC to assist in this study. *See* **http://www.samknows.com/**

[35] The Whiteboxes are named after the appearance of the first hardware implementation. The Whiteboxes remain in consumer homes and continue to run the tests described in this report. Participants may remain in the measurement project as long as it continues, and may retain their Whitebox when they end their participation.

B. 2.2 - SAMPLE SIZE AND VOLUNTEER SELECTION

The Eighth MBA Report relied on data gathered from 4,378 volunteer panelists across the United States The methodological factors and considerations that influenced the selection of the sample size and makeup included:

- The panel of U.S. broadband subscribers was initially drawn from a pool of over 175,000 volunteers during a recruitment campaign that ran in May 2010. Since then additional panelists have been recruited through email solicitations by the ISPs.
- The volunteer sample was originally organized with a goal of covering major ISPs in the 48 contiguous states across five broadband technologies: DSL, cable, fiber-to-the-home, fixed terrestrial wireless, and satellite.[36]
- Target numbers for volunteers were also set across the four Census Regions—Northeast, Midwest, South, and West—to help ensure geographic diversity in the volunteer panel and compensate for differences in networks across the United States.[37]
- A target plan for allocation of Whiteboxes was developed based on the market share of participating ISPs. Initial market share information was based principally on FCC Form 477[38] data filed by participating ISPs for June 2011. This data is further enhanced by the ISPs who brief SamKnows on new products and changes in subscribership numbers which may have occurred after the submission of the 477 data. A speed tier may be included if it has at least 30,000 subscribers and constitutes at least 5% of the subscriber base of the participating ISP. This threshold ensures that we are measuring the ISP's most popular speed tiers and that it is possible to recruit sufficient panelists.
- An initial set of prospective participants was selected from volunteers who had responded directly to SamKnows as a result of media solicitations, as described in detail in Section 2.3. Where gaps existed in the sample plan, SamKnows worked with participating ISPs via email solicitations targeted at underrepresented cells. A miscellaneous cell was created across fiber-to-the-home, DSL, cable and satellite technologies, and across all regions and service tiers, to allow additional units to be allocated to accommodate volunteers who did not fit into other cells or who changed ISPs or service tiers during the trial.
- Since the initial panel was created in 2011, participating ISPs have contacted random subsets of their subscribers by email to replenish cells that were falling short of their desired panel size.

The sample plan is designed prior to the reporting period and is sent to each ISP by SamKnows. ISPs review this and respond directly to SamKnows with feedback on speed tiers that ought to be included based on the threshold criteria stated above. SamKnows will include all relevant tiers in the final report, assuming a target sample size is available. As this may not be known until after the reporting period is over, a final sample description containing all included tiers is produced and shared with the FCC and ISPs once the reporting period has finished and the data has been processed. Test results from a total of 4,378 panelists were used in the Eighth MBA Report. This figure includes only panelists that are subscribed to the tiers that were tested as part of the sample plan.

The recruitment campaign resulted in the coverage needed to ensure balanced representation of users

[36] At the request of, and with the cooperation of the Department of Commerce and Consumer Affairs, Hawaii, we have begun to collect data from the state of Hawaii. Data from Hawaii has been included in this year's report.

[37] Although the Commission's volunteer recruitment was guided by Census Region to ensure the widest possible distribution of panelists throughout the United States, as discussed below, a sufficient number of testing devices were not deployed to enable, in every case, the evaluation of regional differences in broadband performance. The States associated with each Census Region are described in Table 4.

[38] The FCC Form 477 data collects information about broadband connections to end user locations, wired and wireless local telephone services, and interconnected Voice over Internet Protocol (VoIP) services. *See https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477* for further information.

across the United States. Table 1 shows the number of volunteers for the months of September/October 2017 listed by ISP, as well as the percentage of total volunteers subscribed to each ISP.

Table 13: ISPs, Sample Sizes and Percentages of Total Volunteers

ISP	Sample Size	% of total volunteers
AT&T	467	10.67%
CenturyLink	460	10.51%
Charter	774	17.68%
Cincinnati Bell	318	7.26%
Comcast	472	10.78%
Cox	230	5.25%
Frontier DSL	181	4.13%
Frontier Fiber	208	4.75%
Hawaiian Telcom	57	1.30%
Hughes	128	2.92%
Mediacom	130	2.97%
Optimum	184	4.20%
Verizon DSL	123	7.74%
Verizon Fiber	339	0.87%
Wildblue/ViaSat	38	6.14%
Windstream	269	10.67%
Total	**4378**	100%

Table 14: Distribution of Whiteboxes by State

State	Total boxes	% of total boxes	% of total US broadband
Alabama	46	1.05%	1.6%
Arkansas	34	0.78%	1.0%
Arizona	113	2.58%	2.0%
California	375	8.57%	10.8%

Colorado	89	2.03%	1.7%
Connecticut	55	1.26%	1.1%
District of Columbia	11	0.25%	0.2%
Delaware	16	0.37%	0.3%
Florida	157	3.59%	6.2%
Georgia	117	2.67%	3.0%
Hawaii	91	2.08%	0.5%
Iowa	144	3.29%	1.0%
Idaho	23	0.53%	0.5%
Illinois	123	2.81%	4.0%
Indiana	69	1.58%	2.1%
Kansas	25	0.57%	0.9%
Kentucky	134	3.06%	1.4%
Louisiana	34	0.78%	1.5%
Massachusetts	86	1.96%	2.2%
Maryland	88	2.01%	1.8%
Maine	7	0.16%	0.5%
Michigan	121	2.76%	3.2%
Minnesota	102	2.33%	1.8%
Missouri	111	2.54%	2.0%
Mississippi	13	0.30%	0.9%
Montana	9	0.21%	0.3%
North Carolina	139	3.17%	3.2%
North Dakota	0	0.00%	0.3%
Nebraska	26	0.59%	0.6%
New Hampshire	13	0.30%	0.4%
New Jersey	151	3.45%	2.7%
New Mexico	39	0.89%	0.6%
Nevada	33	0.75%	0.9%
New York	271	6.19%	6.1%
Ohio	407	9.30%	3.9%
Oklahoma	47	1.07%	1.2%

Oregon	91	2.08%	1.3%
Pennsylvania	175	4.00%	4.2%
Rhode Island	12	0.27%	0.3%
South Carolina	46	1.05%	1.5%
South Dakota	2	0.05%	0.3%
Tennessee	50	1.14%	2.1%
Texas	206	4.71%	7.7%
Utah	27	0.62%	0.8%
Virginia	171	3.91%	2.6%
Vermont	2	0.05%	0.2%
Washington	154	3.52%	2.3%
Wisconsin	109	2.49%	1.9%
West Virginia	12	0.27%	0.6%
Wyoming	2	0.05%	0.2%
	4378		

The distribution of Whiteboxes by Census Region is found in the table on the next page.

Table 15: Distribution of Whiteboxes by Census Region

Census region	total boxes	% total boxes	% total U.S. broadband subscribers
Midwest	1239	28.30%	22.17%
Northeast	772	17.63%	17.80%
South	1321	30.17%	36.93%
West	1046	23.89%	21.96%

The distribution of states associated with the four Census Regions used to define the panel strata are included in the table below.

Table 16: Panelists States Associated with Census Regions

Census region	States
Northeast	CT MA ME NH NJ NY PA RI VT
Midwest	IA IL IN KS MI MN MO ND M NE OH SD WI

South	AL AR DC DE FL GA KY LA MD MS NC OK SC TN TX VA WV
West	AK AZ CA CO HI ID MT NM NV OR UT WA WY

C. 2.3 - PANELIST RECRUITMENT PROTOCOL

Panelists were recruited in the 2011- 2017 panels using the following method:

- Several thousand volunteers were recruited through an initial public relations and social media campaign led by the FCC. This campaign included discussion on the FCC website and on technology blogs, as well as articles in the press. The composition of this initial panel were reviewed to identify any deficiencies with regard to the sample plan described above. These goals were set to targets for sets of volunteers for demographics based on ISP, speed tier, technology type, and region. Where the pool of volunteers fell short of the desired goal, ISPs sent out email messages to their customers asking them to participate in the MBA program. The messages directed interested volunteers to contact SamKnows to request participation in the trial. The ISPs did not know which of the email recipients would volunteer. In almost all cases, this ISP outreach allowed us to meet desired demographic targets.

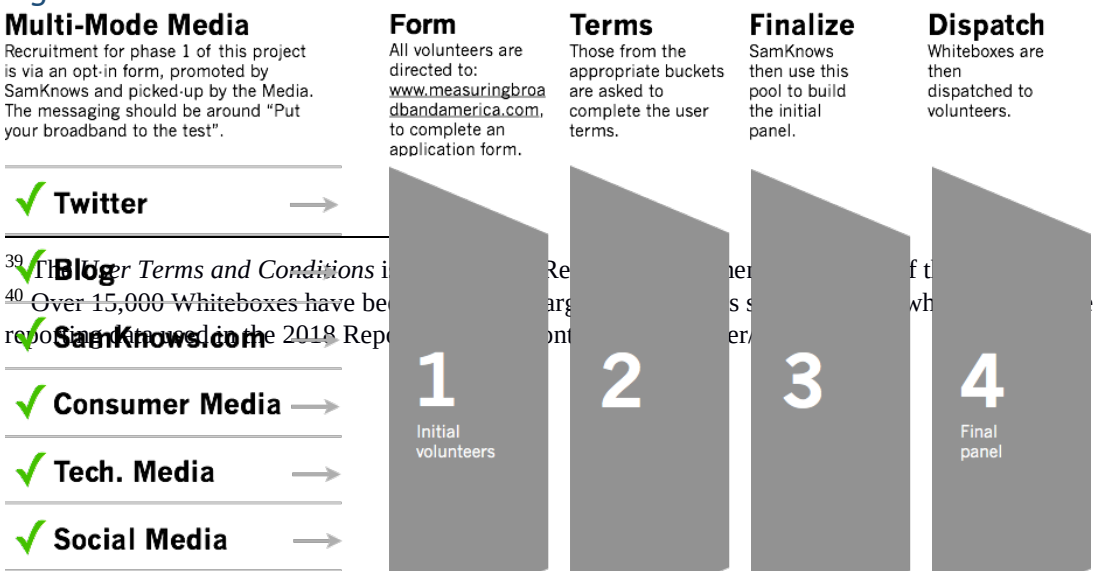
The mix of panelists recruited using the above methodologies varied by ISP.

A multi-mode strategy was used to qualify volunteers for this trial. The key stages of this process were as follows:

4. Volunteers were directed to complete an online form which provided information on the study and required volunteers to submit a small amount of information.
5. Volunteers were selected from respondents to this follow-up email based on the target requirements of the panel. Selected volunteers were then asked to agree to the *User Terms and Conditions* that outlined the permissions to be granted by the volunteer in key areas such as privacy.[39]
6. From among the volunteers who agreed to the User Terms and Conditions, SamKnows selected the first panel of 13,000 participants,[40] each of whom received a Whitebox for self-installation. SamKnows provided full support during the Whitebox installation phase.

The graphic in Figure 1 illustrates the study recruitment methodology.

Figure 3: Panelist Recruitment Protocol



[39] The *User Terms and Conditions* i... Re... ner... f t...

[40] Over 15,000 Whiteboxes have be... arg... s s... wh... online and reporting tools used in the 2018 Repo... ont... er/...

D. 2.4 - VALIDATION OF VOLUNTEERS' SERVICE TIER

The methodology employed in this study included verifying each panelist's service tier and ISP against the customer records of participating ISPs.[41] Initial throughput tests were used to confirm reported speeds.

The broadband service tier reported by each panelist was validated as follows:

- When the panelist installed the Whitebox, the device automatically ran an IP address test to check that the ISP identified by the volunteer was correct.
- The Whitebox also ran an initial test which flooded each panelist's connection in order to accurately detect the throughput speed when their deployed Whitebox connected to a test node.
- Each ISP was asked to confirm the broadband service tier reported by each selected panelist.
- SamKnows then took the validated speed tier information that was provided by the ISPs and compared this to both the panelist-provided information, and the actual test results obtained, in order to ensure accurate tier validation.

SamKnows manually completed the following four steps for each panelist:

- Verified that the IP address was in a valid range for those served by the ISP.
- Reviewed data for each panelist and removed data where speed changes such as tier upgrade or downgrade appeared to have occurred, either due to a service change on the part of the consumer or a network change on the part of the ISP.
- Identified panelists whose throughput appeared inconsistent with the provisioned service tier. Such anomalies were re-certified with the consumer's ISP.[42]
- Verified that the resulting downstream-upstream test results corresponded to the ISP-provided speed tiers, and updated accordingly if required.

[41] Past FCC studies found that a high rate of consumers could not reliably report information about their broadband service, and the validation of subscriber information ensured the accuracy of expected speed and other subscription details against which observed performance was measured. *See* John Horrigan and Ellen Satterwhite, *Americans' Perspectives on Online Connection Speeds for Home and Mobile Devices*, 1 (FCC 2010), available at **http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-298516A1.doc** (finding that 80 percent of broadband consumers did not know what speed they had purchased).

[42] For example, when a panelist's upload or download speed was observed to be significantly higher than that of the rest of the tier, it could be inferred that a mischaracterization of the panelist's service tier had occurred. Such anomalies, when not resolved in cooperation with the service provider, were excluded from the 2017 Report, but will be included in the raw bulk data set.

Of the more than 15,000 Whiteboxes that were shipped to panelists since 2011, 6,034[43] units were reporting data in September/October 2017. The participating ISPs validated 5,944 units of these panelists, of which 3.7 percent were reallocated to a different tier following the steps listed above. Of these 5,944 units, 1,566 boxes were excluded for the following reasons:

- 134 units had insufficient data or changed ISP or service plan during reporting period.
- 289 units were part of legacy hardware and unable to support the subscriber's download or upload speed tier.
- 17 units were on commercial accounts and were test units issued to ISP employees.
- 1,116 units were validated, but subscribed to plans that are not part of this study.
- 10 units were excluded due to the impact of adverse weather conditions.

With those units removed, the Eighth Report relies on data provided by 4,378 volunteers.

E. 2.5 - PROTECTION OF VOLUNTEERS' PRIVACY

Protecting the panelists' privacy is a major concern for this program. The panel was comprised entirely of volunteers who knowingly and explicitly opted in to the testing program. For audit purposes, we retain the correspondence with panelists documenting their opt-in.

All personal data was processed in conformity with relevant U.S. law and in accordance with policies developed to govern the conduct of the parties handling the data. The data were processed solely for the purposes of this study and are presented here and in all online data sets with all personally identifiable information (PII) removed.

A set of materials was created both to inform each panelist regarding the details of the trial, and to gain the explicit consent of each panelist to obtain subscription data from the participating ISPs. These documents were reviewed by the Office of General Counsel of the FCC and the participating ISPs and other stakeholders involved in the study.

[43] This figure represents the total number of boxes reporting during September/October 2017, the month chosen for the Eighth Report. Shipment of boxes continued in succeeding months and these results will be included in the raw bulk data set.

XII. 3 - BROADBAND PERFORMANCE TESTING METHODOLOGY

This section describes the system architecture and network programming features of the tests, and other technical aspects of the methods employed to measure broadband performance during this study.

A. 3.1 – RATIONALE FOR HARDWARE-BASED MEASUREMENT APPROACH

Either a hardware or software approach can be used to measure broadband performance. Software approaches are by far the most common and allow for measurements to easily and cost-effectively include a very large sample size. Web-based speed tests fall into this category and typically use Flash applets, Java applets or JavaScript that execute within the user's web browser. These clients download content from remote web servers and measure the throughput. Some web-based performance tests also measure upload speed or round-trip latency.

Other, less common, software-based approaches to performance measurement install applications on the user's computer. These applications run tests periodically while the computer is on.

All software solutions implemented on a consumer's computer, smart phone, or other device connected to the Internet suffer from the following disadvantages:

- The software and computing platform running the software may not be capable of reliably recording the higher service tiers currently available.
- The software typically cannot know if other devices on the home network are accessing the Internet when the measurements are being taken. The lack of awareness as to other, non-measurement related network activity can produce inconsistent and misleading measurement data.
- Software measurements may be affected by the performance, quality and configuration of the device.
- Potential bottlenecks, such as Wi-Fi networks and other in-home networks, are generally not accounted for and may result in unreliable data.
- If the device hosting the software uses in-home WIFI access to fixed broadband service, differing locations in the home may impact measurements.
- The tests can only run when the computer is turned on, limiting the ability to provide a 24-hour profile.
- If software tests are performed manually, panelists might only run tests when they experience problems and thus bias the results.

In contrast, the hardware approach used in the MBA program requires the placement of the previously described Whitebox inside the user's home, directly connected to the consumer's service interconnection device (router), via Ethernet cable. The measurement device therefore directly accesses fixed Internet service to the home over this dedicated interface and periodically runs tests to remote targets over the Internet. The use of hardware devices avoids the disadvantages listed earlier with the software approach. However, hardware approaches are much more expensive than the software alternative, are thus more constrained in the achievable panel size, and require correct installation of the device by the consumer or a third party. This is still subject to unintentional errors due to misconfigurations i.e. connecting the Whitebox incorrectly but these can often be detected in the validation process that follows installation. The FCC chose the hardware approach since its advantages far outweigh these disadvantages.

B. 3.2 - DESIGN OBJECTIVES AND TECHNICAL APPROACH

For this test of broadband performance, as in previous Reports, the FCC used design principles that were previously developed by SamKnows in conjunction with their study of broadband performance in the U.K. The design principles comprise 17 technical objectives:

Table 17: Design Objectives and Methods

#	Technical objectives	Methodological accommodations
1	Must not change during the monitoring period.	The Whitebox measurement process is designed to provide automatic and consistent monitoring throughout the measurement period.
2	Must be accurate and reliable.	The hardware solution provides a uniform and consistent measurement of data across a broad range of participants.
3	Must not interrupt or unduly degrade the consumer's use of the broadband connection.	The volume of data produced by tests is controlled to avoid interfering with panelists' overall broadband experience, and tests only execute when consumer is not making heavy use of the connection.
4	Must not allow collected data to be distorted by any use of the broadband connection by other applications on the host PC and other devices in the home.	The hardware solution is designed not to interfere with the host PC and is not dependent on that PC.
5	Must not rely on the knowledge, skills and participation of the consumer for its ongoing operation once installed.	The Whitebox is "plug-and-play." Instructions are graphics-based and the installation process has been substantially field tested.
6	Must not collect data that might be deemed to be personal to the consumer without consent.	The data collection process is explained in plain language and consumers are asked for their consent regarding the use of their personal data as defined by any relevant data protection legislation.
7	Must be easy for a consumer to completely remove any hardware and/or software components if they do not wish to continue with the research program.	Whiteboxes can be disconnected at any time from the home network. As soon as the route is reconnected the reporting is resumed as before.
8	Must be compatible with a wide range of DSL, cable, satellite and fiber-to-the-home modems.	Whiteboxes can be connected to all modem types commonly used to support broadband services in the U.S. either in an in-line or bridging mode.
9	Where applicable, must be compatible with a range of computer operating systems, including, without limitation, Windows XP, Windows Vista, Windows 7, Mac OS and Linux.	Whiteboxes are independent of the PC operating system and therefore able to provide testing with all devices regardless of operating system.
10	Must not expose the volunteer's home network to increased security risk, i.e., it should not be susceptible to viruses, and should not degrade the effectiveness of the user's existing firewalls, antivirus and spyware software.	Most user firewalls, antivirus and spyware systems are PC-based. The Whitebox is plugged in to the broadband connection "before" the PC. Its activity is transparent and does not interfere with those protections.
11	Must be upgradeable from the remote control center if it contains any software or firmware components.	The Whitebox can be completely controlled remotely for updates without involvement of the consumer PC, providing the Whitebox is switched on and connected.

12	Must identify when a user changes broadband provider or package (e.g., by a reverse look up of the consumer's IP address to check provider, and by capturing changes in modem connection speed to identify changes in package).	Ensures regular data pool monitoring for changes in speed, ISP, IP address or performance, and flags when a panelist should notify and confirm any change to their broadband service since the last test execution.
13	Must permit, in the event of a merger between ISPs, separate analysis of the customers of each of the merged ISP's predecessors.	Data are stored based on the ISP of the panelist, and therefore can be analyzed by individual ISP or as an aggregated dataset.
14	Must identify if the consumer's computer is being used on a number of different fixed networks (e.g., if it is a laptop).	The Whiteboxes are broadband dependent, not PC or laptop dependent.
15	Must identify when a specific household stops providing data.	The Whitebox needs to be connected and switched on to push data. If it is switched off or disconnected its absence is detected at the next data push process.
16	Must not require an amount of data to be downloaded which may materially impact any data limits, usage policy, or traffic shaping applicable to the broadband service.	The data volume generated by the information collected does not exceed any policies set by ISPs. Panelists with bandwidth restrictions can have their tests set accordingly.
17	Must limit the possibility for ISPs to identify the broadband connections which form their panel and therefore potentially "game" the data by providing different quality of service to the panel members and to the wider customer base.	ISPs signed a Code of Conduct[44] to protect against gaming test results. While the identity of each panelist was made known to the ISP as part of the speed tier validation process, the actual Unit ID for the associated Whitebox was not released to the ISP and specific test results were not directly assignable against a specific panelist. Moreover, most ISPs had hundreds, and some had more than 1,000, participating subscribers spread throughout their service territory, making it difficult to improve service for participating subscribers without improving service for all subscribers.

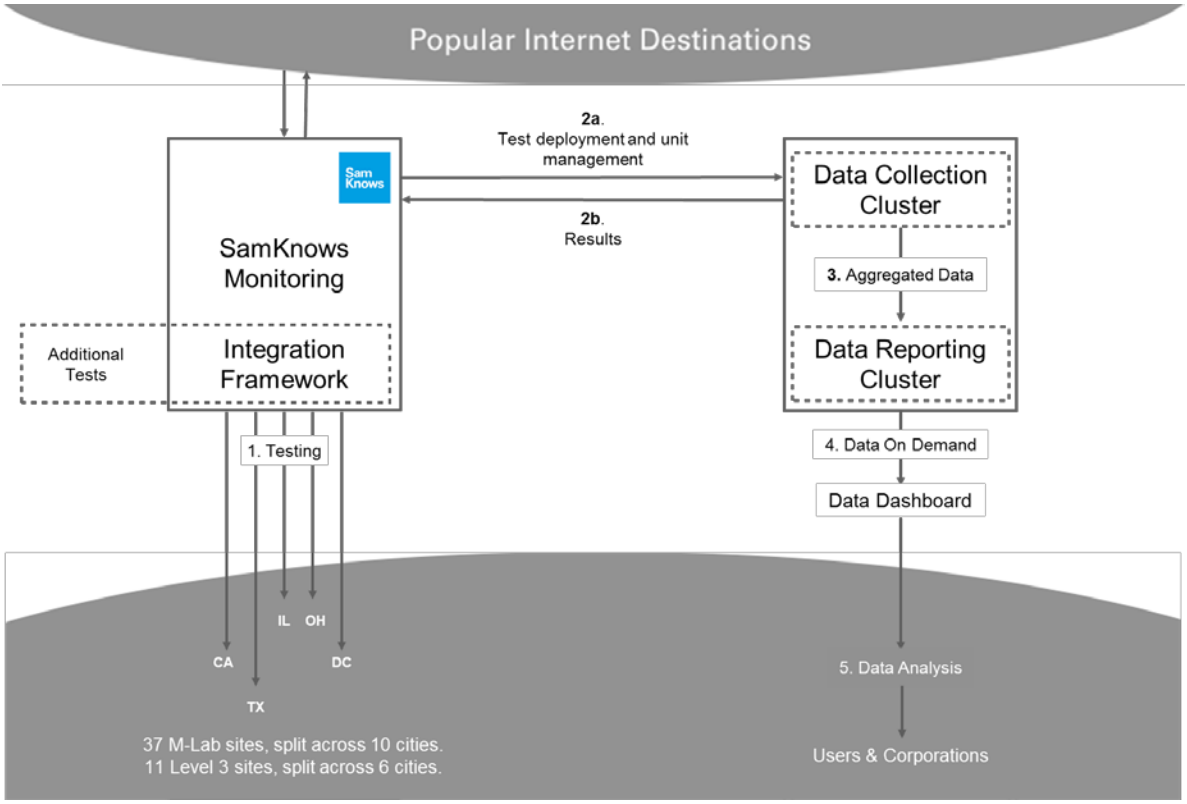
[44] Signatories to the Code of Conduct are: AT&T, CenturyLink, Charter, Cincinnati Bell, Comcast, Cox, Frontier, Hughes, Level3, Measurement Lab, Mediacom, NCTA, Optimum, Time Warner Cable, Verizon, ViaSat, and Windstream. A copy of the Code of Conduct is included as a Reference Document attached to this Appendix.

C. 3.3 - TESTING ARCHITECTURE

1. Overview of Testing Architecture

As illustrated in Figure 2, the performance monitoring system comprises a distributed network of Whiteboxes in the homes of members of the volunteer consumer panel. The Whiteboxes are controlled by a cluster of servers, which hosts the test scheduler and the reporting database. The data was collated on the reporting platform and accessed via a reporting interface[45] and secure FTP site. The system also included a series of speed-test servers, which the Whiteboxes called upon according to the test schedule.

Figure 4: Testing Architecture



2. Approach to Testing and Measurement

Any network monitoring system needs to be capable of monitoring and executing tests 24 hours a day, seven days a week. Similar to the method used by the television audience measurement industry, each panelist is equipped with a Whitebox, which is self-installed by each panelist and conducts the performance measurements. Since 2011, the project has used three different hardware platforms, described below. The software on each of the Whiteboxes was programmed to execute a series of tests designed to measure key performance indicators (KPIs) of a broadband connection. The tests comprise a suite of applications, written by SamKnows in the programming language C, which were rigorously

[45] Each reporting interface included a data dashboard for the consumer volunteers, which provided performance metrics associated with their Whitebox.

tested by the ISPs and other stakeholders. The Eighth Report incorporates data from all three types of Whiteboxes and we use the term Whitebox generically. Testing has found that they produce results that are indistinguishable.

During the initial testing period in 2011, the Whitebox provided used hardware manufactured by NETGEAR, Inc. (NETGEAR) and operated as a broadband router. It was intended to replace the panelist's existing router and be directly connected to the cable or DSL modem, ensuring that tests could be run at any time the network was connected and powered, even if all home computers were switched off. Firmware for the Whitebox routers was developed by SamKnows with the cooperation of NETGEAR. In addition to running the latest versions of the SamKnows testing software, the routers retained all of the native functionality of the NETGEAR consumer router.

A second Whitebox model was introduced starting with the 2012 testing period. This version is based upon hardware produced by TP-Link (and later manufactured by SamKnows) and operates as a bridge rather than as a router. It connects to the customer's existing router, rather than replacing it, and all home devices connect to LAN ports on the TP-Link Whitebox. The TP-Link Whitebox passively monitors wireless network activity in order to determine when the network is active and defer measurements. It runs a modified version of OpenWrt, an open source router platform based on Linux. All Whiteboxes deployed since 2012 use the TP-Link or SamKnows hardware.

SamKnows Whiteboxes have been shown to provide accurate information about broadband connections with throughput rates of up to 1 Gbps.

3. Home Deployment of the NETGEAR Based Whitebox

This study was initiated by using existing NETGEAR firmware, and all of its features were intended to allow panelists to replace their existing routers with the Whitebox. If the panelist did not have an existing router and used only a modem, they were asked to install the Whitebox according to the usual NETGEAR instructions.

However, this architecture could not easily accommodate scenarios where the panelist had a combined modem/router supplied by their ISP that had specific features that the Whitebox could not provide. For example, some Verizon FiOS gateways connect via a MoCA (Multimedia over Cable) interface and AT&T IPBB gateways provide U-Verse specific features, such as IPTV.

In these cases, the Whitebox was connected to the existing router/gateway and all home devices plugged into the Whitebox. In order to prevent a double-NAT configuration, in which multiple routers on the same network perform network address translation (NAT) and make access to the SamKnows router difficult, the Whitebox was set to dynamically switch to operate as a transparent Ethernet bridge when deployed in these scenarios. All consumer configurations were evaluated and tested by participating ISPs to confirm their suitability.[46]

4. Home Deployment of the TP-Link Based Whitebox

The TP-Link-based Whitebox, which operates as a bridge, was introduced in response to the increased deployment of integrated modem/gateway devices. To use the TP-Link-based Whitebox, panelists are required to have an existing router. Custom instructions guided these panelists to connect the Whitebox to their existing router and then connect all of their home devices to the Whitebox. This allows the Whitebox to measure traffic volumes from wired devices in the home and defer tests accordingly. As an Ethernet bridge, the Whitebox does not provide services such as network address translation (NAT) or DHCP.

5. Home Deployment of the SamKnows Whitebox 8.0

The Whitebox 8.0 was manufactured by SamKnows and deployed starting in August 2016. Like the TP-Link device, this Whitebox works as a bridge, rather than a router, and operates in a similar manner. Unlike the NETGEAR and TP-Link hardware, it can handle bandwidths of up to 1 Gbps.

6. Internet Activity Detection

No tests are performed if the Whiteboxes detect wired or wireless traffic beyond a defined bandwidth threshold. This ensures both that testing does not interfere with consumer use of their Internet service and that any such use does not interfere with testing or invalidate test results.

Panelists were not asked to change their wireless network configurations. Since the TP-Link Whiteboxes and Whitebox 8.0 attach to the panelist's router that may contain a built-in wireless (Wi-Fi) access point, these devices measure the strongest wireless signal. Since they only count packets, they do not need access to the Wi-Fi encryption keys and do not inspect packet content.

7. Test Nodes (Off-Net and On-Net)

For the tests in this study, SamKnows employed fifty-two core measurement servers as test nodes that were distributed geographically across eleven locations, outside the network boundaries of the participating ISPs. These so-called off-net measurement points were supplemented by additional measurement points located within the networks of some of the ISPs participating in this study, called on-net servers. The core measurement servers were used to measure consumers' broadband performance between the Whitebox and an available reference point that was closest in roundtrip time to the

[46] The use of legacy equipment has the potential to impede some panelists from receiving the provisioned speed from their ISP, and this impact is captured by the survey.

consumer's network address. The distribution of off-net primary reference points operated by M-Lab and Level 3 and on-net secondary reference points operated by broadband providers provided additional validity checks and insight into broadband service performance within an ISP's network. In total, the following 133 measurement servers were deployed for the 2017 Report:

Table 18: Overall Number of Testing Servers

Operated by	Number of servers
AT&T	11
CenturyLink	13
Charter	5
Cincinnati Bell	1
Comcast	33
Cox	2
Frontier	5
Level 3 (off-net)	10
M-Lab (off-net)	35
Mediacom	1
Optimum	2
Qwest	4
Time Warner Cable (now part of Charter)	6
Verizon	5
Windstream	4

8. Test Node Locations

Off-Net Test Nodes

The M-Lab test nodes were located in the following major U.S. Internet peering locations:

- New York City, New York (two locations)
- Chicago, Illinois
- Atlanta, Georgia (five locations)
- Miami, Florida (four locations)
- Washington, DC (five locations)
- Mountain View, California (five locations)
- Seattle, Washington (six locations)
- Los Angeles, California (five locations)
- Dallas, Texas (five locations)

- Denver, Colorado (four locations)

The Level 3 nodes were located in the following major U.S. Internet peering locations:

- Chicago, Illinois (two locations)
- Dallas, Texas
- New York City, New York
- San Jose, California (two locations)
- Washington D.C. (two locations)
- Los Angeles, California (two locations)

On-Net Test Nodes

In addition to off-net nodes, some ISPs deployed their own on-net servers to cross-check the results provided by off-net nodes. Whiteboxes were instructed to test against the off-net M-Lab and Level 3 nodes and the on-net ISP nodes, when available.

The following ISPs provided on-net test nodes:

- AT&T
- CenturyLink[47]
- Charter
- Cincinnati Bell
- Comcast
- Cox
- Frontier
- Mediacom
- Optimum
- Qwest (now part of CenturyLink)
- Time Warner Cable (now part of Charter)
- Verizon
- Windstream

The same suite of tests was scheduled for these on-net nodes as for the off-net nodes and the same server software developed by SamKnows was used regardless of whether the Whitebox was interacting with on-net or off-net nodes. Off-net test nodes are continually monitored for load and congestion.

While these on-net test nodes were included in the testing, the results from these tests were used as a control set; the results presented in the Report are based only on tests performed using off-net nodes. Results from both on-net and off-net nodes are included in the raw bulk data set that will be released to the public.

9. Test Node Selection

Each Whitebox fetches a complete list of off-net test nodes and on-net test nodes hosted by the serving ISP from a SamKnows server and measures the round trip time to each. This list of test servers is loaded

[47] QWest was reported separately from Centurylink in reports prior to 2016. The entities completed merging their test infrastructure in 2016.

at startup and refreshed weekly. It then selects the on-net and off-net test nodes with lowest round trip time to test against. The selected nodes may not be the geographically closest node.
Technical details for the minimum requirements for hardware and software, connectivity, and systems and network management are available in the **5.3 - Test Node Briefing** provided in the Reference Document section of this Technical Appendix.

D. 3.4 – TESTS METHODOLOGY

Each deployed Whitebox performs the following tests.[48] All tests are conducted with both the on-net and off-net servers except as noted, and are described in more detail in the next section.

Table 19: List of tests performed by SamKnows

Metric	Primary metric(s)
Download speed	Throughput in Megabits per second (Mbps) utilizing three concurrent TCP connections
Upload speed	Throughput in Mbps utilizing three concurrent TCP connections
Web browsing	Total page fetch time and all its embedded resources from a popular website
UDP latency	Average round trip time of a series of randomly transmitted UDP packets distributed over a long timeframe
UDP packet loss	Fraction of UDP packets lost from UDP latency test
Voice over IP	Upstream packet loss, downstream packet loss, upstream jitter, downstream jitter, round trip latency
DNS resolution	Time taken for the ISP's recursive DNS resolver to return an A record[49] for a popular website domain name
DNS failures	Percentage of DNS requests performed in the DNS resolution test that failed
ICMP latency	Round trip time of five evenly spaced ICMP packets
ICMP packet loss	Percentage of packets lost in the ICMP latency test
UDP Latency under load	Average round trip time for a series of evenly spaced UDP packets sent during downstream/upstream sustained tests
Consumption[50]	A count of the total bytes downloaded and uploaded by the router, this is no longer collected from all Whiteboxes
Lightweight download speed	Downstream throughput in Megabits per second (Mbps) utilizing a burst of UDP datagrams
Lightweight upload speed	Upstream throughput in Megabits per second (Mbps) utilizing a burst of UDP datagrams

E.

F. 3.5 - TEST DESCRIPTIONS

The following sub-sections detail the methodology used for the individual tests. As noted earlier, all tests only measure the performance of the part of the network between the Whitebox and the target (which may be a test node). In particular, the VoIP tests can only approximate the behavior of real applications and do not reflect the impact of specific consumer hardware, software, media codecs, bandwidth adjustment

[48] Specific questions on test procedures may be addressed to **team@samknows.com**

[49] An "A record" is the numeric IP address associated with a domain address such as **www.fcc.gov**

[50] While all other tests are active, the consumption metric is passive.

algorithms, Internet backbones and in-home networks.

1. Download speed and upload speed

These tests measure the download and upload throughput by performing multiple simultaneous HTTP GET and HTTP POST requests to a target test node.
Binary, non-zero content—herein referred to as the payload—is hosted on a web server on the target test node. The test operates for a fixed duration of 10 seconds. It records the average throughput achieved during this 10 second period. The client attempts to download as much of the payload as possible for the duration of the test.
The test uses three concurrent TCP connections (and therefore three concurrent HTTP requests) to ensure that the line is saturated. Each connection used in the test counts the numbers of bytes transferred and is sampled periodically by a controlling thread. The sum of these counters (a value in bytes) divided by the time elapsed (in microseconds) and converted to Mbps is taken as the total throughput of the user's broadband service.
Factors such as TCP slow start and congestion are taken into account by repeatedly transferring small chunks (256 kilobytes, or kB) of the target payload before the real testing begins. This "warm-up" period is completed when three consecutive chunks are transferred at within 10 percent of the speed of one another. All three connections are required to have completed the warm-up period before the timed testing begins. The warm-up period is excluded from the measurement results.
Downloaded content is discarded as soon as it is received, and is not written to the file system. Uploaded content is generated and streamed on the fly from a random source.
The test is performed for both IPv4 and IPv6, where available, but only IPv4 results are reported.

2. Web Browsing

The test records the averaged time taken to sequentially download the HTML and referenced resources for the home page of each of the target websites, the number of bytes transferred, and the calculated rate per second. The primary measure for this test is the total time taken to download the HTML front page for each web site and all associated images, JavaScript, and stylesheet resources. This test does not test against the centralized testing nodes; instead it tests against actual websites, ensuring that the effects of content distribution networks and other performance enhancing factors can be taken into account.
Each Whitebox tests against the following nine websites:[51]

- http://www.cnn.com
- http://www.youtube.com
- http://www.msn.com
- http://www.amazon.com
- http://www.yahoo.com
- http://www.ebay.com
- http://www.wikipedia.org
- http://www.facebook.com
- http://www.google.com

The results include the time needed for DNS resolution. The test uses up to eight concurrent TCP connections to fetch resources from targets. The test pools TCP connections and utilizes persistent connections where the remote HTTP server supports them.
The client advertises the user agent as Microsoft Internet Explorer 10. Each website is tested in sequence and the results summed and reported across all sites.

3. UDP Latency and Packet Loss

These tests measure the round-trip time of small UDP packets between the Whitebox and a target test

[51] These websites were chosen based on a list by Alexa, http://www.alexa.com/, of the top twenty websites in October 2010.

node.
Each packet consists of an 8-byte sequence number and an 8-byte timestamp. If a response packet is not received within three seconds of sending, it is treated as being lost. The test records the number of packets sent each hour, the average round trip time and the total number of packets lost. The test computes the summarized minimum, maximum, standard deviation and mean from the lowest 99 percent of results, effectively trimming the top (i.e., slowest) 1 percent of outliers.
The test operates continuously in the background. It is configured to randomly distribute the sending of the requests over a fixed interval of one hour (using a Poisson distribution), reporting the summarized results once the interval has elapsed. Approximately two thousand packets are sent within a one hour period, with fewer packets sent if the line is not idle.
This test is started when the Whitebox boots and runs permanently as a background test. The test is performed for both IPv4 and IPv6, where available, but only IPv4 results are reported.

4. Voice over IP

The Voice over IP (VoIP) test operates over UDP and utilizes bidirectional traffic, as is typical for voice calls.
The Whitebox handshakes with the server, and each initiates a UDP stream with the other. The test uses a 64 kbps stream with the same characteristics and properties (i.e., packet sizes, delays, bitrate) as the G.711 codec. 160 byte packets are used. The test measures jitter, delay, and loss.
Jitter is calculated using the Packet Delay Variation (PDV) approach described in section 4.2 of RFC 5481. The 99th percentile is recorded and used in all calculations when deriving the PDV.

5. DNS Resolutions and DNS Failures

These tests measure the DNS resolution time of an A record query for the domains of the websites used in the web browsing test, and the percentage of DNS requests performed in the DNS resolution test that failed.
The DNS resolution test is targeted directly at the ISP's recursive resolvers. This circumvents any caching introduced by the panelist's home equipment (such as another gateway running in front of the Whitebox) and also accounts for panelists that might have configured the Whitebox (or upstream devices) to use non-ISP provided DNS servers. ISPs provide lists of their recursive DNS servers for the purposes of this study.

6. ICMP Latency and Packet Loss

These tests measure the round trip time (RTT) of ICMP echo requests in microseconds from the Whitebox to a target test node. The client sends five ICMP echo requests of 56 bytes to the target test node, waiting up to three seconds for a response to each. Packets that are not received in response are treated as lost. The mean, minimum, maximum, and standard deviation of the successful results are recorded. The number of packets sent and received are recorded too.

7. Latency Under Load

The latency under load test operates for the duration of the 10-second downstream and upstream speed tests, with results for upstream and downstream recorded separately. While the speed tests are running, the latency under load test sends UDP datagrams to the target server and measures the round trip time and number of packets lost. Packets are spaced five hundred milliseconds (ms) apart, and a three second timeout is used. The test records the mean, minimum, and maximum round trip times in microseconds. The number of lost UDP packets is also recorded.
This test represents an updated version of the methodology used in the initial August 2011 Report and aligns it with the methodology for the regular latency and packet loss metrics.

8. Traceroute

A traceroute client is used to send UDP probes to each hop in the path between client and destination. Three probes are sent to each hop. The round-trip times, the standard deviation of the round-trip times of

the responses from each hop and the packet loss are recorded. The open source traceroute client "mtr" (https://github.com/traviscross/mtr) is used for carrying out the traceroute measurements.

9. Lightweight capacity test

This test measures the instantaneous capacity of the link using a small number of UDP packets. The test supports both downstream and upstream measurements, conducted independently.
In the downstream mode, the test client handshakes with the test server over TCP, requesting a fixed number of packets to be transmitted back to the client. The client specifies the transmission rate, number of packets and packet size in this handshake. The client records the arrival times of each of the resulting packets returns to it.
In the upstream mode, the client again handshakes with the test server, this time informing it of the characteristics of the stream it is about to transmit. The client then transmits the stream to the server, and the server locally records the arrival times of each packet. At the conclusion of this stream, the client asks the server for its summary of the arrival time of each packet.
With this resulting set of arrival times, the test client calculates the throughput achieved. This throughput may be divided into multiple windows, and an average taken across those, in order to smooth out buffering behavior.
This test uses approximately 99% less data than the TCP speed test and completes in a fraction of the time (100 milliseconds versus 10 seconds). The lightweight capacity test achieves results are within 1% deviation from the existing speed test results on fixed-line connections tested on average.

Table 20: Estimated Total Traffic Volume Generated by Test

The standard test schedule, below, was used across all ISPs, with the exception of Viasat. In 2017, Viasat opted to no longer provide panelists with an increased data allowance to offset the amount of data used by the measurements. This meant that the standard test schedule could no longer be used on Viasat, so a lighter weight test schedule was developed for them.

Standard test schedule

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
Web browsing	9 popular US websites	Every 2 hours, 24x7	Est. 30 seconds	80 MB
Voice over IP	1 off-net test node	Hourly, 24x7	Fixed 10 seconds at 64k	1.8 MB
	1 on-net test node	Hourly, 24x7	Fixed 10 seconds at 64k	1.8 MB
Download speed (Capacity – 8x parallel TCP connections)	1 off-net test node	Once 12 am - 6 am Once 6 am - 12 pm Once 12 pm - 6 pm Hourly thereafter	Fixed 10 seconds	107 MB at 10 Mbps
	1 on-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Once 6pm-8pm, Once 8pm-10pm, Once 10pm-12am	Fixed 10 seconds	70 MB at 10 Mbps

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
Download speed (Single TCP connection)	1 off-net test node 1 on-net test node	Once in peak hours, once in off-peak hours	Fixed 10 seconds	46 MB at 10 Mbps
Upload speed (Capacity – 8x parallel TCP connections on terrestrial, 3x on satellite)	1 off-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Hourly thereafter	Fixed 10 seconds	11 MB at 1 Mbps
	1 on-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Once 6pm-8pm, Once 8pm-10pm, Once 10pm-12am	Fixed 10 seconds	7 MB at 1 Mbps
Upload speed (Single TCP connection)	1 off-net test node 1 on-net test node	Once in peak hours, once in off-peak hours	Fixed 10 seconds	6 MB at 1 Mbps
UDP latency	2 off-net test nodes (Level3/MLab)	Hourly, 24x7	Permanent	5.8 MB
	1 on-net test node	Hourly, 24x7	Permanent	2.9 MB
UDP packet loss	2 off-net test node	Hourly, 24x7	Permanent	N/A (uses above)
	1 on-net test nodes	Hourly, 24x7	Permanent	N/A (uses above)
Consumption	N/A	24x7	N/A	N/A
DNS resolution	10 popular US websites	Hourly, 24x7	Est. 3 seconds	0.3 MB
ICMP latency	1 off-net test node 1 on-net test node	Hourly, 24x7	Est. 5 seconds	0.3 MB
ICMP Packet loss	1 off-net test node 1 on-net test node	Hourly, 24x7	N/A (As IMCP latency)	N/A (uses above)
Traceroute	1 off-net test node 1 on-net test node	Three times a day, 24x7	N/A	N/A
Download speed IPv6^^	1 off-net test node	Three times a day	Fixed 10 seconds	180 MB at 50 Mbps 72 MB at 20 Mbps 11 MB at 3 Mbps 5.4 MB at

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
				1.5 Mbps
Upload speed IPv6^^	1 off-net test node	Three times a day	Fixed 10 seconds	172 MB at 2 Mbps 3.6MB at 1 Mbps 1.8MB at 0.5 Mbps
UDP Latency / Loss IPv6^^	2 off-net test nodes (Level3/MLab)	Hourly, 24x7	Permanent	5.8 MB
Lightweight capacity test – Download (UDP)	1 off-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Hourly thereafter	Fixed 1000 packets	9MB
Lightweight capacity test – Upload (UDP)	1 off-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Hourly thereafter	Fixed 1000 packets	9MB

Lightweight test schedule (currently Viasat only)

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
Web browsing	9 popular US websites	Once 8pm-10-pm	Est. 30 seconds	7MB
Download speed (Capacity – 8x parallel TCP connections)	1 off-net test node	Once 8pm-10-pm	Fixed 10 seconds	30MB at 10Mbps
Upload speed (Capacity – 8x parallel TCP connections on terrestrial, 3x on satellite)	1 off-net test node	Once 8pm-10-pm	Fixed 10 seconds	3MB at 1Mbps
UDP latency	1 off-net test node	Hourly, 24x7	Permanent	1MB
UDP latency	1 on-net test node	Hourly, 24x7	Permanent	1MB
UDP packet loss	1 off-net test node	Hourly, 24x7	Permanent	N/A (uses above)
UDP packet loss	1 on-net test node	Hourly, 24x7	Permanent	N/A (uses above)
Consumption	N/A	24x7	N/A	N/A
DNS resolution	10 popular US websites	Hourly, 24x7	Est. 3 seconds	0.3MB
ICMP latency	1 off-net test node	Hourly, 24x7	Est. 5 seconds	0.3MB

Test Name	Test Target(s)	Test Frequency	Test Duration	Est. Daily Volume
	1 on-net test node			
ICMP Packet loss	1 off-net test node 1 on-net test node	Hourly, 24x7	N/A (As IMCP latency)	N/A (uses above)
Traceroute	1 off-net test node 1 on-net test node	Three times a day, 24x7	N/A	N/A
CDN performance	Amazon, Apple, Microsoft, Google, Cloudflare, Akamai	Every 2 hours, 24x7	5 seconds	3MB
UDP Latency / Loss IPv6^	1 off-net test node	Hourly, 24x7	Permanent	1MB
Lightweight capacity test – Download (UDP)	1 off-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Hourly thereafter	Fixed 1000 packets	9MB
Lightweight capacity test – Upload (UDP)	1 off-net test node	Once 12am-6am, Once 6am-12pm, Once 12pm-6pm, Hourly thereafter	Fixed 1000 packets	9MB

**Download/upload daily volumes are estimates based upon likely line speeds. All tests will operate at maximum line rate so actual consumption may vary.

^Currently in beta testing.

^^Only carried out on broadband connections that support IPv6.

Tests to the off-net destinations alternate randomly between Level3 and M-Lab, except that latency and loss tests operate continuously to both Level3 and M-Lab off-net servers. All tests are also performed to the closest on-net server, where available.

10. Consumption

For Whiteboxes other than the NETGEAR version, the consumption measurement does not include any Wi-Fi data directly delivered from an access point integrated into the router to home devices as these bypass the Whitebox.

11. Cross-Talk Testing and Threshold Manager Service

In addition to the tests described above, for 60 seconds prior to and during testing, a ”threshold manager” service on the Whitebox monitors the inbound and outbound traffic across the WAN interface to calculate if a panelist is actively using the Internet connection. The threshold for traffic is set to 64 kbps downstream and 32 kbps upstream. Metrics are sampled and computed every 10 seconds. If either of these thresholds is exceeded, the test is delayed for a minute and the process repeated. If the connection is being actively used for an extended period of time, this pause and retry process continues for up to five times before the test is abandoned.

XIII. 4 - DATA PROCESSING AND ANALYSIS OF TEST RESULTS

This section describes the background for the categorization of data gathered for the 2017 Report, and the

methods employed to collect and analyze the test results.

A. 4.1 -BACKGROUND

1. Time of Day

Most of the metrics reported in the 2017 Report draw on data gathered during the so-called peak usage period of 7:00 p.m. to 11:00 p.m. local time[52]. This time period is generally considered to experience the highest amount of Internet usage.

2. ISP and Service Tier

A sufficient sample size is necessary for analysis and the ability to robustly compare the performance of specific ISP speed tiers. In order for a speed tier to be considered for the fixed line MBA Report, it must meet the following criteria:

(d) The speed tier must have a subscribership of at least 5% of the ISP's total number of subscribers,
(e) There must be a minimum of 35 panelists that are recruited for that tier who have provided valid data for the tier within the validation period and
(f) Each panelist must have a minimum of five days of valid data within the validation period.

The study achieved target sample sizes for the following download and upload speeds[53] (listed in alphabetical order by ISP):

Download Speeds:

AT&T IP-BB: 3, 6, 12, 18, 24 and 45 Mbps tiers;
CenturyLink: 1.5, 3, 7, 10, 12, 20 and 40 Mbps tiers;
Charter: 20, 30, 60 Mbps and 100 Mbps tiers;
Cincinnati Bell DSL: 5, 10, and 30 Mbps tiers;
Cincinnati Bell Fiber: 60 and 100 Mbps tier;
Comcast: 25, 75, 100 and 200 Mbps tiers;
Cox: 50, 100 and 150 Mbps tiers;
Frontier DSL: 3, 6 and 12 Mbps tiers;
Frontier Fiber: 25, 50, 75 and 100 Mbps tiers;
Hawaiian Telcom DSL: 7 Mbps tier;
Hughes: 5, 10 and 25 Mbps tier;
Mediacom: 60 and 100 Mbps tiers;
Optimum: 60 and 101 Mbps tiers;
Verizon DSL: [0.5 - 1.0] Mbps and [1.1 - 3.0] Mbps tiers;
Verizon Fiber: 25, 50, 75, 100 and 150 Mbps tiers;
Viasat/Excede: 12 Mbps tier;
Windstream: 3, 6, and 12 Mbps tiers.

Upload Speeds:

AT&T IP-BB: 0.768, 1, 1.5, 3 and 6 Mbps tiers;
CenturyLink: 512, 640, 768, and 896 kbps and 5 Mbps tiers;
Cincinnatti Bell DSL: 768 kbps, 1 Mbps and 3 Mbps tiers;

[52] This period of time was agreed to by ISP participants in open meetings conducted at the beginning of the program.

[53] Due to the large number of different combinations of upload/download speed tiers supported by ISPs where, for example, a single download speed might be offered paired with multiple upload speeds or vice versa, upload and download test results were analyzed separately.

Cincinnati Bell Fiber: 10 and 20 Mbps tiers;
Charter: 2, 5, 10, and 20 Mbps tiers;
Comcast: 5, 10 and 20 Mbps tiers;
Cox: 5, and 10 Mbps tiers;
Frontier DSL: 384 kbps, 768 kbps and 1 Mbps tiers;
Frontier Fiber: 50, 75 and 100 Mbps tiers;
Hawaiian Telcom DSL: 1 Mbps tier;
Hughes: 1 and 3 Mbps tiers;
Mediacom: 5, and 10 Mbps tiers;
Optimum: 25 and 35 Mbps tiers;
Verizon DSL: 384 kbps and [384 – 768] kbps tiers;
Verizon Fiber: 25, 50, 75. 100 and 150 Mbps tiers;
Viasat/Excede: 3 Mbps tier;
Windstream: 384 and 768 kbps tier, and 1.5 Mbps tier.

A file containing averages for each metric from the validated September/October 2017 data can be found on FCC's Measuring Broadband America website.[54] Some charts and tables are divided into speed bands, to group together products with similar levels of advertised performance. The results within these bands are further broken out by ISP and service tier. Where an ISP does not offer a service tier within a specific band or a representative sample could not be formed for tier(s) in that band, the ISP will not appear in that speed band.

[54] See: http://data.fcc.gov/download/measuring-broadband-america/2016/statistical-averages-Sept-2015.xlsx

B. 4.2 - DATA COLLECTION AND ANALYSIS METHODOLOGY

1. Data Integrity

To ensure the integrity of the data collected, the following validity checks were developed:

5. *Change of ISP intra-month*: By checking the WHOIS results once a day for the user's IP address, we found units that changed ISP during the month. We only kept data for the ISP where the panelist was active the most.
6. *Change of service tier intra-month*: This validity check found units that changed service tier intra-month by comparing the average sustained throughput observed for the first three days in the reporting period against that for the final three days in the reporting period. If a unit was not online at the start or end of that period, we used the first or final three days when they were actually online. If this difference was over 50 percent, the downstream and upstream charts for this unit were individually reviewed. Where an obvious step change was observed (e.g., from 1 Mbps to 3 Mbps), the data for the shorter period was flagged for removal.
7. *Removal of any failed or irrelevant tests*: This validity check removed any failed or irrelevant tests by removing measurements against any nodes other than the US-based off-net nodes. We also removed measurements using any off-net server that showed a failure rate of 10 percent or greater during a specific one hour period, to avoid using any out-of-service test nodes.
8. *Removal of any problem Whiteboxes*: We removed measurements for any Whitebox that exhibited greater than or equal to 10 percent failures in a particular one hour period. This removed periods when the Whitebox was unable to reach the Internet.

2. Legacy Equipment

In previous reports, we discussed the challenges ISPs face in improving network performance where equipment under the control of the subscriber limits the end-to-end performance achievable by the subscriber.[55] Simply, some consumer controlled equipment may not be capable of operating fully at new, higher service tiers. Working in open collaboration with all service providers we developed a policy permitting changes in ISP panelists when their installed modems were not capable of meeting the delivered service speed that included several conditions on participating ISPs. First, proposed changes in consumer panelists would only be considered where an ISP was offering free upgrades for modems they owned and leased to the consumer. Second, each ISP needed to disclose its policy regarding the treatment of legacy modems and its efforts to inform consumers regarding the impact such modems may have on their service.

While the issue of DOCSIS 3 modems and network upgrades affect the cable industry today, we may see other cases in the future where customer premises equipment affects the achievable network performance. In accordance with the above stated policy, 105 Whiteboxes connected to legacy modems were identified and removed from the final data set in order to ensure that the study would only include equipment that would be able to meet its advertised speed. The 105 excluded Whiteboxes were connected to Charter, Comcast, Cox, and Hughes accounts.

[55] See pgs. 8-9, 2014 Report, pg. 8 of the 2013 Report, as well as endnote 14. http://www.fcc.gov/measuring-broadband-america/2012/july

3. Collation of Results and Outlier Control

All measurement data were collated and stored for analysis purposes as monthly trimmed averages during three time intervals (24 hours, 7:00 p.m. to 11:00 p.m. local time Monday through Friday, 12:00 a.m. to 12:00 a.m. local time Saturday and Sunday). Only participants who provided a minimum of five days of valid measurements and had valid data in each of the three time intervals were included in the September / October 2016 test results. In addition, the top and bottom 1 percent of measurements were trimmed to control for outliers that may have been anomalous or otherwise not representative of actual broadband performance. All results were computed on the trimmed data.[56]

Data was only charted when results from at least 35 separate Whiteboxes was available for individual ISP download speed tiers. Service tiers of 50 or fewer Whiteboxes were noted for possible future panel augmentation.

The resulting final validated sample of data for September/October 2017 was collected from 4,378 participants.

4. Peak Hours Adjusted to Local Time

Peak hours were defined as weekdays (Mondays through Fridays) between 7:00 p.m. to 11:00 p.m. (inclusive) for the purposes of the study. All times were adjusted to the panelist's local time zone. Since some tests are performed only once every two hours on each Whitebox, the duration of the peak period had to be a multiple of two hours.

5. Congestion in the Home Not Measured

Download, upload, latency, and packet loss measurements were taken between the panelist's home gateway and the dedicated test nodes provided by M-Lab and Level 3. Web browsing measurements were taken between the panelist's home gateway and nine popular United States-hosted websites. Any congestion within the user's home network is, therefore, not measured by this study. The web browsing measurements are subject to possible congestion at the content provider's side, although the choice of nine popular websites configured to serve high traffic loads reduced that risk.

6. Traffic Shaping Not Studied

The effect of traffic shaping is not studied in the Eigth Report, although test results were subject to any bandwidth management policies put in place by ISPs. The effects of bandwidth management policies, which may be used by ISPs to maintain consumer traffic rates within advertised service tiers, may be most readily seen in those charts in the 2016 Report that show performance over 24-hour periods, where tested rates for some ISPs and service tiers flatten for periods at a time.

7. Analysis of PowerBoost and Other "Enhancing" Services

The use of transient speed enhancing services marketed under names such as "PowerBoost" on cable connections presented a technical challenge when measuring throughput. These services will deliver a far higher throughput for the earlier portion of a connection, with the duration varying by ISP, service tier, and potentially other factors. For example, a user with a contracted 6 Mbps service tier may receive 18 Mbps for the first 10 MB of a data transfer. Once the "burst window" is exceeded, throughput will return to the contracted rate, with the result that the burst speed will have no effect on very long sustained transfers.

Existing speed tests transfer a quantity of data and divide this quantity by the duration of the transfer to compute the transfer rate, typically expressed in Mbps. Without accounting for burst speed techniques, speed tests employing the mechanism described here will produce highly variable results depending on how much data they transfer or how long they are run. Burst speed techniques will have a dominant

[56] These methods were reviewed with statistical experts by the participating ISPs.

effect on short speed tests: a speed test running for two seconds on a connection employing burst speed techniques would likely record the burst speed rate, whereas a speed test running for two hours will reduce the effect of burst speed techniques to a negligible level.
The earlier speed test configuration employed in this study isolated the effects of transient performance enhancing burst speed techniques from the long-term sustained speed by running for a fixed 30 seconds and recording the average throughput at 5 second intervals. The throughput at the 0-5 second interval is referred to as the burst speed and the throughput at the 25-30 second interval is referred to as the actual speed. Testing was conducted prior to the start of trial to estimate the length of time during which the effects of burst speed techniques might be seen. Even though the precise parameters used for burst speed techniques are not known, their effects were no longer observable in testing after 20 seconds of data transfer.
In the Sixth report we noted that the use of this technology by providers was on the decline. For the Seventh and Eighth reports, we no longer provide the results of burst-speed since these techniques are now rarely used. The speed test configuration has been altered to shorten the test duration to 10 seconds, as there is no need to run it for 30 seconds any more.

8. Consistency of Speed Measurements

In addition to reporting on the median speed of panelists, the MBA Report also provides a measure of the consistency of speed that panelists experience in each tier. For purposes of discussion we use the term "80/80 consistent speed" to refer to the minimum speed that was experienced by at least 80% of panelists for at least 80% of the time during the peak periods. The process used in defining this metric for a specific ISP tier is to take each panelist's set of download or upload speed data during the peak period across all the days of the validated measurement period and arrange it in increasing order. The speed that corresponds to the 20th percentile represents the minimum speed that the panelist experienced at least 80% of the time. The 20 percentile values of all the panelists on a specific tier are then arranged in an increasing order. The speed that corresponds to the 20th percentile now represents the minimum speed that at least 80% of panelists experienced 80% of the time. This is the value reported as the 80/80 consistent speed for that ISP's tier. We also report on the 70/70 consistent speed for an ISP's tier, which is the minimum speed that at least 70% of the panelists experience at least 70% of the time. We typically report the 70/70 and the 80/80 consistent speeds as a percentage of the advertised speed.
When reporting on these values for an ISP, we weigh the 80/80 or 70/70 consistent speed results (as a percentage of the advertised speed) of each of the ISP's tier based on the number of subscribers to that tier; so as to get a weighted average across all the tiers for that ISP.

9. Latencies Attributable to Propagation Delay

The speeds at which signals can traverse networks are limited at a fundamental level by the speed of light. While the speed of light is not believed to be a significant limitation in the context of the other technical factors addressed by the testing methodology, a delay of approximately 5 ms per 1000 km of distance traveled can be attributed solely to the speed of light (depending on the transmission medium). The geographic distribution and the testing methodology's selection of the nearest test servers are believed to minimize any significant effect. However, propagation delay is not explicitly accounted for in the results.

10. Limiting Factors

A total of 10,614,694,862 measurements were taken across 180,933,887unique tests.
All scheduled tests were run, aside from when monitoring units detected concurrent use of bandwidth. Schedules were adjusted when required for specific tests to avoid triggering data usage limits applied by some ISPs.

C. 4.3 DATA PROCESSING OF RAW AND VALIDATED DATA

The data collected in this program are made available as open data for review and use by the public. Raw and processed data sets, testing software, and the methodologies used to process and analyze data are freely and publicly available. Researchers and developers interested in working with measurement data in raw form will need skills in database management, SQL programming, and statistics, depending on the

analysis. A developer FAQ for database configuration and data importing instructions for MySQL and PostgreSQL are available at http://www.fcc.gov/measuring-broadband-america/database-setup-and-importing-measuring-broadband-america-data
The process flow below describes how the raw collected data was processed for the production of the *Measuring Broadband America Report*. Researchers and developers interested in replicating or extending the results of the Report are encouraged to review the process below and supporting files that provide details.

Raw Data:	Raw data for the chosen period is collected from the measurement database. The ISPs and products that panelists were on are exported to a "unit profile" file, and those that changed during the period are flagged. 2018 Raw Data Links
Validated Data Cleansing:	Data is cleaned. This includes removing measurements when a user changed ISP or tier during the period. Anomalies and significant outliers are also removed at this point. A data cleansing document describes the process in detail. 2018 Data Cleansing Document Link
SQL Processing:	Per-unit results are generated for each metric. Time-of-day averages are computed and a trimmed median is calculated for each metric. The SQL scripts used here are contained in SQL processing scripts available with the release of each report. 2018 SQL Processing Links
SPSS Processing:	The per-unit CSV data is processed by SPSS scripts coupled with the unit profile data. This process removes ISPs and tiers with low sample sizes and computes averages for the remainder that can be used in the report. 2018 SPSS Scripts Links
Unit Profile:	This document identifies the various details of each test unit, including ISP, technology, service tier, and general location. Each unit represents one volunteer panelists. The unit ID's were randomly generated, which served to protect the anonymity of the volunteer panelists. 2018 Unit Profile link
Excluded Units:	A listing of units excluded from the analysis due to insufficient sample size for that particular ISP's speed tier. 2018 Excluded Units Link
Unit Census Block:	This step identifies the census block (for blocks containing more than 1,000 people) in which each unit running tests is located. Census block is from 2010 census and is in the FIPS code format. We have used block FIPS codes for blocks that contains more than 1,000 people. For blocks with fewer than 1,000 people we have aggregated to the next highest level, i.e., tract, and used the Tract FIPS code, provided there are more than 1,000 people in the tract. In cases where there are less than 1,000 people in a tract we have aggregated to Regional level. 2018 Unit Census Block Link.
Excel Tables & Charts:	Summary data tables and charts in Excel are produced from the averages. These are used directly in the report2018 Statistical Averages Links

The raw data collected for each active metric is made available by month in tarred gzipped files. The files in the archive containing active metrics are described in table 9.

Table 21: Test to Data File Cross-Reference List

Test	Validated Data File Name

Download speed	curr_httpgetmt.csv — IPv4 Tests curr_httpgetmt6.csv — IPv6 Tests
Upload speed	curr_httppostmt.csv — IPv4 Tests curr_httppostmt6.csv — IPv6 Tests
Web browsing	curr_webget.csv
UDP latency	curr_udplatency.csv — IPv4 Tests curr_udplatency6.csv — IPv6 Tests
UDP packet loss	curr_udplatency.csv — IPv4 Tests curr_udplatency6.csv — IPv6 Tests
Voice over IP	curr_udpjitter.csv
DNS resolution	curr_dns.csv
DNS failures	curr_dns.csv
ICMP latency	curr_ping.csv
ICMP packet loss	curr_ping.csv
Latency under load	curr_dlping.csv – Downstream latency under load results curr_ulping.csv – Upstream latency under load results
Consumption[57]	curr_netusage.csv
Traceroute	curr_traceroute.csv
Lightweight Capacity Test	

Table 22: Validated Data Files - Dictionary

The following Data Dictionary file describes the schema for each active metric test for row level results stored in the files described in table 9.[58] All `dtime` entries are in the UTC timezone. All durations are in microseconds unless otherwise noted. The `location_id` field should be ignored.

curr_dlping.csv	
`unit_id`	Unique identifier for an individual unit
`dtime`	Time test finished
`target`	Target hostname or IP address
`rtt_avg`	Average RTT
`rtt_min`	Minimum RTT
`rtt_max`	Maximum RTT
`rtt_std`	Standard deviation in measured RTT

[57] While this metric is not an active test it is included in this description as a passive test.

[58] This data dictionary is also available on the FCC Measuring Broadband America website, located with the other validated data files available for download.

successes	Number of successes
failiures	Number of failures
location_id	Internal key mapping to unit profile data
curr_dns.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
nameserver	Name server used to handle the DNS request
lookup_host	Hostname to be resolved
response_ip	Field currently unused
rtt	DNS resolution time
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_httpgetmt.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
address	The IP address of the server (resolved by the client's DNS)
fetch_time	Time the test ran for
bytes_total	Total bytes downloaded across all connections
bytes_sec	Running total of throughput, which is sum of speeds measured for each stream (in bytes/sec), from the start of the test to the current interval
bytes_sec_interval	Throughput at this specific interval (e.g., Throughput between 25-30 seconds)
warmup_time	Time consumed for all the TCP streams to arrive at optimal window size
warmup_bytes	Bytes transferred for all the TCP streams during the warm-up phase
sequence	The interval that this row refers to (e.g., in the US, sequence=0 implies result is for 0-5 seconds of the test)
threads	The number of concurrent TCP connections used in the test
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_httppostmt.csv	

unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
address	The IP address of the server (resolved by the client's DNS)
fetch_time	Time the test ran for
bytes_total	Total bytes downloaded across all connections
bytes_sec	Running total of throughput, which is sum of speeds measured for each stream (in bytes/sec), from the start of the test to the current interval
bytes_sec_interval	Throughput at this specific interval (e.g., throughput between 25-30 seconds)
warmup_time	Time consumed for all the TCP streams to arrive at optimal window size
warmup_bytes	Bytes transferred for all the TCP streams during the warm-up phase.
sequence	The interval that this row refers to (e.g., in the US, sequence=0 implies result is for 0-5 seconds of the test)
threads	The number of concurrent TCP connections used in the test
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_ping.csv	ICMP based
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
rtt_avg	Average RTT
rtt_min	Minimum RTT
rtt_max	Maximum RTT
rtt_std	Standard deviation in measured RTT
successes	Number of successes
failiures	Number of failures
location_id	Internal key mapping to unit profile data
curr_udpjitter.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address

packet_size	Size of each UDP Datagram (bytes)
stream_rate	Rate at which the UDP stream is generated (bits/sec)
duration	Total duration of test
packets_up_sent	Number of packets sent in upstream (measured by client)
packets_down_sent	Number of packets sent in downstream (measured by server)
packets_up_recv	Number of packets received in upstream (measured by server)
packets_down_recv	Number of packets received in downstream (measured by client)
jitter_up	Upstream Jitter measured
jitter_down	Downstream Jitter measured
latency	99th percentile of round trip times for all packets
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Internal key mapping to unit profile data
curr_udplatency.csv	UDP based
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
rtt_avg	Average RTT
rtt_min	Minimum RTT
rtt_max	Maximum RTT
rtt_std	Standard deviation in measured RTT
successes	Number of successes (note: use failures/(successes + failures)) for packet loss)
failiures	Number of failures (packets lost)
location_id	Internal key mapping to unit profile data
curr_ulping.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	Target hostname or IP address
rtt_avg	Average RTT
rtt_min	Minimum RTT
rtt_max	Maximum RTT
rtt_std	Standard deviation in measured RTT

successes	Number of successes
failures	Number of failures
location_id	Internal key mapping to unit profile data
curr_webget.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
target	URL to fetch
address	IP address used to fetch content from initial URL
fetch_time	Sum of time consumed to download HTML content and then concurrently download all resources
bytes_total	Sum of HTML content size and all resources size (bytes)
bytes_sec	Average speed of downloading HTML content and then concurrently downloading all resources (bytes/sec)
objects	Number of resources (images, CSS, …) downloaded
threads	Maximum number of concurrent threads allowed
requests	Total number of HTTP requests made
connections	Total number of TCP connections established
reused_connections	Number of TCP connections re-used
lookups	Number of DNS lookups performed
request_total_time	Total duration of all requests summed together, if made sequentially
request_min_time	Shortest request duration
request_avg_time	Average request duration
request_max_time	Longest request duration
ttfb_total_time	Total duration of the time-to-first-byte summed together, if made sequentially
ttfb_min_time	Shortest time-to-first-byte duration
ttfb_avg_time	Average time-to-first-byte duration
ttfb_max_time	Longest time-to-first-byte duration
lookup_total_time	Total duration of all DNS lookups summed together, if made sequentially
lookup_min_time	Shortest DNS lookup duration
lookup_avg_time	Average DNS lookup duration
lookup_max_time	Longest DNS lookup duration
successes	Number of successes

failures	Number of failures
location_id	Internal key mapping to unit profile data
curr_netusage.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished
wan_rx_bytes	Total bytes received via the WAN interface on the unit (incl. Ethernet and IP headers)
wan_tx_bytes	Total bytes transmitted via the WAN interface on the unit (incl. Ethernet and IP headers)
sk_rx_bytes	Bytes received as a result of active performance measurements
sk_tx_bytes	Bytes transmitted as a result of active performance measurements
location_id	Internal key mapping to unit profile data

curr_lct_dl.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished in UTC
target	Target hostname
address	Target IP address
packets_received	Total number of packets received
packets_sent	Total number of packets sent
packet_size	Packet size
bytes_total	Total number of bytes
duration	Duration of the test in microseconds
bytes_sec	Throughput in bytes/sec
error_code	An internal error code from the test.
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Please ignore (this is an internal key mapping to unit profile data)

curr_lct_ul.csv	
unit_id	Unique identifier for an individual unit
dtime	Time test finished in UTC
target	Target hostname

address	Target IP address
packets_received	Total number of packets received
packets_sent	Total number of packets sent
packet_size	Packet size
bytes_total	Total number of bytes
duration	Duration of the test in microseconds
bytes_sec	Throughput in bytes/sec
error_code	An internal error code from the test.
successes	Number of successes (always 1 or 0 for this test)
failures	Number of failures (always 1 or 0 for this test)
location_id	Please ignore (this is an internal key mapping to unit profile data)

XIV. 5 - Reference Documents

A. 5.1 - USER TERMS AND CONDITIONS

The following document was agreed to by each volunteer panelist who agreed to participate in the broadband measurement study:

End User License Agreement

PLEASE READ THESE TERMS AND CONDITIONS CAREFULLY. BY APPLYING TO BECOME A PARTICIPANT IN THE BROADBAND COMMUNITY PANEL AND/OR INSTALLING THE WHITEBOX, YOU ARE AGREEING TO THESE TERMS AND CONDITIONS.

YOUR ATTENTION IS DRAWN PARTICULARLY TO CONDITIONS 3.5 (PERTAINING TO YOUR CONSENT TO YOUR ISPS PROVIDING CERTAIN INFORMATION AND YOUR WAIVER OF CLAIMS), 6 (LIMITATIONS OF LIABILITY) AND 7 (DATA PROTECTION).

1. Interpretation

1.1. The following definitions and rules of interpretation apply to these terms & conditions.

Connection: the Participant's own broadband internet connection, provided by an Internet Service Provider ("ISP").

Connection Equipment: the Participant's broadband router or cable modem, used to provide the Participant's Connection.

Intellectual Property Rights: all patents, rights to inventions, utility models, copyright and related rights, trademarks, service marks, trade, business and domain names, rights in trade dress or get-up, rights in goodwill or to sue for passing off, unfair competition rights, rights in designs, rights in computer software, database right, moral rights, rights in confidential information (including know-how and trade secrets) and any other intellectual property rights, in each case whether registered or unregistered and including all applications for and renewals or extensions of such rights, and all similar or equivalent rights or forms of protection in any part of the world.

ISP: the company providing broadband internet connection to the Participant during the term of this Program.

Participant/You/Your: the person who volunteers to participate in the Program, under these terms and conditions. The Participant must be the named account holder on the Internet service account with the ISP.

Open Source Software: the software in the Whitebox device that is licensed under an open source license (including the GPL).

Participant's Equipment: any equipment, systems, cabling or facilities provided by the Participant and used directly or indirectly in support of the Services, excluding the Connection Equipment.

Parties: both the Participant and SamKnows.

Party: one of either the Participant or SamKnows.

Requirements: the requirements specified by SamKnows as part of the sign-up process that the Participant must fulfil in order to be selected to receive the Services.

SamKnows/We/Our: the organization providing the Services and conducting the Program, namely:

SamKnows Limited (Co. No. 6510477) of 25 Harley Street, London W1G 9BR

Services / Program: the performance and measurement of certain broadband and Internet services and research program (Broadband Community Panel), as sponsored by the Federal Communications Committee (FCC), in respect of measuring broadband Internet Connections.

Software: the software that has been installed and/or remotely uploaded onto the Whitebox, by SamKnows as updated by SamKnows, from time to time, but not including any Open Source Software.

Test Results: Information concerning the Participant's ISP service results.

Whitebox: the hardware supplied to the Participant by SamKnows with the Software.

1.2. Headings in these terms and conditions shall not affect their interpretation.

1.3. A person includes a natural person, corporate or unincorporated body (whether or not having separate legal personality).

1.4. The schedules form part of these terms and conditions.

1.5. A reference to writing or written includes faxes and e-mails.

1.6.Any obligation in these terms and conditions on a person not to do something includes, without limitation, an obligation not to agree, allow, permit or acquiesce in that thing being done.

2. SamKnows' Commitment to You

2.1 Subject to the Participant complying fully with these terms and conditions, SamKnows shall use reasonable care to:

(a) provide the Participant with the Measurement Services under these terms and conditions;

(b) supply the Participant with the Whitebox and instructions detailing how it should be connected to the Participant's Connection Equipment; and

(c) if requested, SamKnows will provide a pre-paid postage label for the Whitebox to be returned.

(d) comply with all applicable United States, European Union, and United Kingdom privacy laws and directives, and will access, collect, process and distribute the information according to the following principles:

Fairness: We will process data fairly and lawfully;

Specific purpose: We will access, collect, process, store and distribute data for the purposes and reasons

specified in this agreement and not in ways incompatible with those purposes;

Restricted: We will restrict our data collection and use practices to those adequate and relevant, and not excessive in relation to the purposes for which we collect the information;

Accurate: We will work to ensure that the data we collect is accurate and up-to-date, working with Participant and his/her ISP;

Destroyed when obsolete: We will not maintain personal data longer than is necessary for the purposes for which we collect and process the information;

Security: We will collect and process the information associated with this trial with adequate security through technical and organizational measures to protect personal data against destruction or loss, alteration, unauthorized disclosure or access, in particular where the processing involves the transmission of data over a network.

2.2 In addition, SamKnows shall:

(a) provide Participant with access to a Program-specific customer services email address, which the Participant may use for questions and to give feedback and comments;

(b) provide Participant with a unique login and password in order to access to an online reporting system for access to Participant's broadband performance statistics.

(c) provide Participant with a monthly email with their specific data from the Program or notifying Participant that their individual data is ready for viewing;

(d) provide Participant with support and troubleshooting services in case of problems or issues with their Whitebox;

(e) notify Participant of the end of the FCC-sponsored Program and provide a mechanism for Participant to opt out of any further performance/measuring services and research before collecting any data after termination of the Program;

(f) use only data generated by SamKnows through the Whitebox, and not use any Participant data for measuring performance without Participant's prior written consent; and

(g) not monitor/track Participant's Internet activity without Participant's prior written consent.

2.3 While SamKnows will make all reasonable efforts to ensure that the Services cause no disruption to the performance of the Participant's broadband Connection, including only running tests when there is no concurrent network activity generated by users at the Participant's location. The Participant acknowledges that the Services may occasionally impact the performance of the Connection and agrees to hold SamKnows and their ISP harmless for any impact the Services may have on the performance of their Connection.

3. Participant's Obligations

3.1 The Participant is not required to pay any fee for the provision of the Services by SamKnows or to participate in the Program.

3.2 The Participant agrees to use reasonable endeavors to:

(a) connect the Whitebox to their Connection Equipment within 14 days of receiving it;

(b) not to unplug or disconnect the Whitebox unless (i) they will be absent from the property in which it is connected for more than 3 days and/or (ii) it is reasonably necessary for maintenance of the Participant's Equipment and the Participant agrees that they shall use reasonable endeavors to minimize the length of time the Whitebox is unplugged or disconnected;

(c) in no way reverse engineer, tamper with, dispose of or damage the Whitebox, or attempt to do so;

(d) notify SamKnows within 7 days in the event that they change their ISP or their Connection tier or package (for example, downgrading/upgrading to a different broadband package), to the email address provided by SamKnows;

(e) inform SamKnows of a change of postal or email address by email; within 7 days of the change, to the email address provided by SamKnows;

(f) agrees that the Whitebox may be upgraded to incorporate changes to the Software and/or additional tests at the discretion of SamKnows, whether by remote uploads or otherwise;

(g) on completion or termination of the Services, return the Whitebox to SamKnows by mail, if requested by SamKnows. SamKnows will provide a pre-paid postage label for the Whitebox to be returned;

(h) be an active part of the Program and as such will use all reasonable endeavors to complete the market research surveys received within a reasonable period of time;

(i) not publish data, give press or other interviews regarding the Program without the prior written permission of SamKnows; and

(k) contact SamKnows directly, and not your ISP, in the event of any issues or problems with the Whitebox, by using the email address provided by SamKnows.

3.3 You will not give the Whitebox or the Software to any third party, including (without limitation) to any ISP. You may give the Open Source Software to any person in accordance with the terms of the relevant open source licence.

3.4 The Participant acknowledges that he/she is not an employee or agent of, or relative of, an employee or agent of an ISP or any affiliate of any ISP. In the event that they become one, they will inform SamKnows, who at its complete discretion may ask for the immediate return of the Whitebox.

3.5 THE PARTICIPANT'S ATTENTION IS PARTICULARLY DRAWN TO THIS CONDITION. The Participant expressly consents to having their ISP provide to SamKnows and the Federal Communications (FCC) information about the Participant's broadband service, for example: service address, speed tier, local loop length (for DSL customers), equipment identifiers and other similar information, and hereby waives any claim that its ISPs disclosure of such information to SamKnows or the FCC constitutes a violation of any right or any other right or privilege that the Participant may have under any federal, state or local statute, law, ordinance, court order, administrative rule, order or regulation, or other applicable law, including, without limitation, under 47 U.S.C**.** §§ 222 and 631 (each a "Privacy Law"). If notwithstanding Participant's consent under this Section 3.5, Participant, the FCC or any other party brings any claim or action against any ISP under a Privacy Law, upon the applicable ISPs request SamKnows promptly shall cease collecting data from such Participant and remove from its records all data collected with respect to such Participant prior to the date of such request, and shall not provide such data in any form to the FCC. The Participant further consents to transmission of information from this

Program Internationally, including the information provided by the Participant's ISP, specifically the transfer of this information to SamKnows in the United Kingdom, SamKnows' processing of it there and return to the United States.

4. Intellectual Property Rights

4.1 All Intellectual Property Rights relating to the Whitebox are the property of its manufacturer. The Participant shall use the Whitebox only to allow SamKnows to provide the Services.

4.2 As between SamKnows and the Participant, SamKnows owns all Intellectual Property Rights in the Software. The Participant shall not translate, copy, adapt, vary or alter the Software. The Participant shall use the Software only for the purposes of SamKnows providing the Services and shall not disclose or otherwise use the Software.

4.3 Participation in the Broadband Community Panel gives the participant no Intellectual Property Rights in the Test Results. Ownership of all such rights is governed by Federal Acquisition Regulation Section 52.227-17, which has been incorporated by reference in the relevant contract between SamKnows and the FCC. The Participant hereby acknowledges and agrees that SamKnows may make such use of the Test Results as is required for the Program.

4.4 Certain core testing technology and aspects of the architectures, products and services are developed and maintained directly by SamKnows. SamKnows also implements various technical features of the measurement services using particular technical components from a variety of vendor partners including: NetGear, Measurement Lab, TP-Link.

5. SamKnows' Property

The Whitebox and Software will remain the property of SamKnows. SamKnows may at any time ask the Participant to return the Whitebox, which they must do within 28 days of such a request being sent. Once SamKnows has safely received the Whitebox, SamKnows will reimburse the Participant's reasonable postage costs for doing so.

6. Limitations of Liability - THE PARTICIPANT'S ATTENTION IS PARTICULARLY DRAWN TO THIS CONDITION

6.1 This condition 6 sets out the entire financial liability of SamKnows (including any liability for the acts or omissions of its employees, agents, consultants, and subcontractors) to the Participant, including and without limitation, in respect of:

(a) any use made by the Participant of the Services, the Whitebox and the Software or any part of them; and

(b) any representation, statement or tortious act or omission (including negligence) arising under or in connection with these terms and conditions.

6.2 All implied warranties, conditions and other terms implied by statute or other law are, to the fullest extent permitted by law, waived and excluded from these terms and conditions.

6.3 Notwithstanding the foregoing, nothing in these terms and conditions limits or excludes the liability of SamKnows:

(a) for death or personal injury resulting from its negligence or willful misconduct;

(b) for any damage or liability incurred by the Participant as a result of fraud or fraudulent misrepresentation by SamKnows;

(c) for any violations of U.S. consumer protection laws;

(d) in relation to any other liabilities which may not be excluded or limited by applicable law.

6.4 Subject to condition 6.2 and condition 6.3, SamKnows' total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation, restitution or otherwise arising in connection with the performance, or contemplated performance, of these terms and conditions shall be limited to $100.

6.5 In the event of any defect or modification in the Whitebox, the Participant's sole remedy shall be the repair or replacement of the Whitebox at SamKnows' reasonable cost, provided that the defective Whitebox is safely returned to SamKnows, in which case SamKnows shall pay the Participant's reasonable postage costs.

6.6 The Participant acknowledges and agrees that these limitations of liability are reasonable in all the circumstances, particularly given that no fee is being charged by SamKnows for the Services or participation in the Program.

6.7 It is the Participant's responsibility to pay all service and other charges owed to its ISP in a timely manner and to comply with all other ISP applicable terms. The Participant shall ensure that their broadband traffic, including the data pushed by SamKnows during the Program, does not exceed the data allowance included in the Participant's broadband package. If usage allowances are accidentally exceeded and the Participant is billed additional charges from the ISP as a result, SamKnows is not under any obligation to cover these charges although it may choose to do so at its discretion.

7. Data protection - the participation's attention is particularly drawn to this condition.

7.1 The Participant acknowledges and agrees that his/her personal data, such as service tier, address and line performance, will be processed by SamKnows in connection with the program.

7.2 Except as required by law or regulation, SamKnows will not provide the Participant's personal data to any third party without obtaining Participant's prior consent. However, for the avoidance of doubt, the Participant acknowledges and agrees that subject to the privacy polices discussed below, the specific technical characteristics of tests and other technical features associated with the Internet Protocol environment of architecture, including the client's IP address, may be shared with third parties as necessary to conduct the Program and all aggregate statistical data produced as a result of the Services (including the Test Results) may be provided to third parties.

7.3 You acknowledge and agree that SamKnows may share some of Your information with Your ISP, and request information about You from Your ISP so that they may confirm Your service tiers and other information relevant to the Program. Accordingly You hereby expressly waive claim that any disclosure by Your ISP to SamKnows constitutes a violation of any right or privilege that you may have under any law, wherever it might apply.

8. Term and Termination

8.1 This Agreement shall continue until terminated in accordance with this clause.

8.2 Each party may terminate the Services immediately by written notice to the other party at any time.

Notice of termination may be given by email. Notices sent by email shall be deemed to be served on the day of transmission if transmitted before 5.00 pm Eastern Time on a working day, but otherwise on the next following working day.

8.3 On termination of the Services for any reason:

(a) SamKnows shall have no further obligation to provide the Services; and

(b) the Participant shall safely return the Whitebox to SamKnows, if requested by SamKnows, in which case SamKnows shall pay the Participant's reasonable postage costs.

8.4 Notwithstanding termination of the Services and/or these terms and conditions, clauses 1, 3.3 and 4 to 14 (inclusive) shall continue to apply.

9. Severance

If any provision of these terms and conditions, or part of any provision, is found by any court or other authority of competent jurisdiction to be invalid, illegal or unenforceable, that provision or part-provision shall, to the extent required, be deemed not to form part of these terms and conditions, and the validity and enforceability of the other provisions these terms and conditions shall not be affected.

10. Entire agreement

10.1 These terms and conditions constitute the whole agreement between the parties and replace and supersede any previous agreements or undertakings between the parties.

10.2 Each party acknowledges that, in entering into these terms and conditions, it has not relied on, and shall have no right or remedy in respect of, any statement, representation, assurance or warranty.

11. Assignment

11.1 The Participant shall not, without the prior written consent of SamKnows, assign, transfer, charge, mortgage, subcontract all or any of its rights or obligations under these terms and conditions.

11.2 Each party that has rights under these terms and conditions acknowledges that they are acting on their own behalf and not for the benefit of another person.

12. No Partnership or Agency

Nothing in these terms and conditions is intended to, or shall be deemed to, constitute a partnership or joint venture of any kind between any of the parties, nor make any party the agent of another party for any purpose. No party shall have authority to act as agent for, or to bind, the other party in any way.

13. Rights of third parties

Except for the rights and protections conferred on ISPs under these Terms and Conditions which they may defend, a person who is not a party to these terms and conditions shall not have any rights under or in connection with these Terms and Conditions.

14. Privacy and Paperwork Reduction Acts

14.1 For the avoidance of doubt, the release of IP protocol addresses of client's Whiteboxes are not PII for the purposes of this program and the client expressly consents to the release of IP address and other

technical IP protocol characteristics that may be gathered within the context of the testing architecture. SamKnows, on behalf of the FCC, is collecting and storing broadband performance information, including various personally identifiable information (PII) such as the street addresses, email addresses, sum of data transferred, and broadband performance information, from those individuals who are participating voluntarily in this test. PII not necessary to conduct this study will not be collected. Certain information provided by or collected from you will be confirmed with a third party, including your ISP, to ensure a representative study and otherwise shared with third parties as necessary to conduct the program. SamKnows will not release, disclose to the public, or share any PII with any outside entities, including the FCC, except as is consistent with the SamKnows privacy policy or these Terms and Conditions. See https://www.measuringbroadbandamerica.com/privacy/. The broadband performance information that is made available to the public and the FCC, will be in an aggregated form and with all PII removed. For more information, see the Privacy Act of 1974, as amended (5 U.S.C. § 552a), and the SamKnows privacy policy.

14.2 The FCC is soliciting and collecting this information authorized by OMB Control No. 3060-1139 in accordance with the requirements and authority of the Paperwork Reduction Act, Pub. L. No. 96-511, 94 Stat. 2812 (Dec. 11, 1980); the Broadband Data Improvement Act of 2008, Pub. L. No. 110-385, Stat 4096 § 103(c)(1); American Reinvestment and Recovery Act of 2009 (ARRA), Pub. L. No. 111-5, 123 Stat 115 (2009); and Section 154(i) of the Communications Act of 1934, as amended.

14.3 *Paperwork Reduction Act of 1995 Notice*. We have estimated that each Participant of this study will assume a one hour time burden over the course of the Program. Our estimate includes the time to sign-up online, connect the Whitebox in the home, and periodic validation of the hardware. If you have any comments on this estimate, or on how we can improve the collection and reduce the burden it causes you, please write the Federal Communications Commission, Office of Managing Director, AMD-PERM, Washington, DC 20554, Paperwork Reduction Act Project (3060-1139). We will also accept your comments via the Internet if you send an e-mail to PRA@fcc.gov. Please DO NOT SEND COMPLETED APPLICATION FORMS TO THIS ADDRESS. You are not required to respond to a collection of information sponsored by the Federal government, and the government may not conduct or sponsor this collection, unless it displays a currently valid OMB control number and provides you with this notice. This collection has been assigned an OMB control number of 3060-1139. THIS NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104-13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507. This notice may also be found at https://www.measuringbroadbandamerica.com/paperwork-reduction-act/.

15. Jurisdiction

These terms and conditions shall be governed by the laws of the state of New York.

SCHEDULE

THE SERVICES

Subject to the Participant complying with its obligations under these terms and conditions, SamKnows shall use reasonable endeavors to test the Connection so that the following information is recorded:

13. Web browsing
14. Video streaming
15. Voice over IP
16. Download speed

17. Upload speed
18. UDP latency
19. UDP packet loss
20. Consumption
21. Availability
22. DNS resolution
23. ICMP latency
24. ICMP packet loss

In performing these tests, the Whitebox will require a variable download capacity and upload capacity per month, which will be available to the Participant in motion 2.3. The Participant acknowledges that this may impact on the performance of the Connection.

2. SamKnows will perform tests on the Participant's Connection by using SamKnows' own data and will not monitor the Participant's content or internet activity. The purpose of this study is to measure the Connection and compare this data with other consumers to create a representative index of US broadband performance.

B. 5.2 – CODE OF CONDUCT

The following Code of Conduct, available at http://data.fcc.gov/download/measuring-broadband-america/2017/Code-of-Conduct-fixed.pdf*, was signed by ISPs and other entities participating in the study:*

FCC MEASURING BROADBAND AMERICA PROGRAM

FIXED TESTING AND MEASUREMENT
STAKEHOLDERS CODE OF CONDUCT

WHEREAS the Federal Communications Commission of the United States of America (FCC) is conducting a Broadband Testing and Measurement Program, with support from its contractor SamKnows, the purpose of which is to establish a technical platform for the Measuring Broadband America Program Fixed Broadband Testing and Measurement and further to use that platform to collect data;

WHEREAS volunteer panelists have been recruited, and in so doing have agreed to provide broadband performance information measured on their Whiteboxes to support the collection of broadband performance data; and steps have been taken to protect the privacy of panelists to the program's effort to measure broadband performance. WE, THE UNDERSIGNED, as participants and stakeholders in that Fixed Broadband Testing and Measurement, do hereby agree to be bound by and conduct ourselves in accordance with the following principles and shall:

7. At all times act in good faith;
8. Not act, nor fail to act, if the intended consequence of such act or omission is inconsistent with the privacy policies of the program;
9. Not act, nor fail to act, if the intended consequence of such act or omission is to enhance, degrade, or tamper with the results of any test for any individual panelist or broadband provider, except that:
    9.1. It shall not be a violation of this principle for broadband providers to:
        9.1.1. Operate and manage their business, including modifying or improving services delivered to any class of subscribers that may or may not include panelists among them, provided that such actions are consistent with normal business practices, and

9.1.2. Address service issues for individual panelists at the request of the panelist or based on information not derived from the trial;

9.2. It shall not be a violation of this principle for academic and research purposes to simulate or observe tests and components of the testing architecture, provided that no impact to MBA data or the Internet Service of the subscriber volunteer panelist occurs; and

10. Not publish any data generated by the tests, nor make any public statement based on such data, until such time as the FCC releases data, or except where expressly permitted by the FCC; and

11. Not publish or make use of any test data or testing infrastructure in a manner that would significantly reduce the anonymity of collected data, compromise panelists privacy, or compromise the MBA privacy policy governing collection and analysis of data except that:

11.1. It shall not be a violation of this principle for stakeholder signatories under the direction of the FCC to:

11.1.1. Make use of test data or testing infrastructure to support the writing of FCC fixed Measuring Broadband America Reports;

11.1.2. Make use of test data or testing infrastructure to support various aspects of the testing and architecture for the program including to facilitate data processing or analysis;

11.1.3. Make use of test data or testing infrastructure to support the analysis of collected data or testing infrastructure for privacy risks or concerns, and plan for future measurement efforts;

12. Ensure that their employees, agents, and representatives, as appropriate, act in accordance with this Code of Conduct.

Signatories:

_____

Printed: _____

Date: _____

C. 5.3 - TEST NODE BRIEFING

Test Node Briefing
DOCUMENT REFERENCE:
SQ302-002-EN

TEST NODE BRIEFING
Technical information relating to the SamKnows test nodes

August 2013

Important Notice

1 - SamKnows Test Nodes

In order to gauge an Internet Service Provider's broadband performance at a User's access point, the SamKnows Whiteboxes need to measure the service performance (e.g. upload/download speeds, latency, etc.) from the Whitebox to a specific test node. SamKnows supports a number of "test nodes" for this purpose.

The test nodes run special software designed specifically for measuring the network performance when communicating with the Whiteboxes.

It is critical that these test nodes be deployed near to the customer (and their Whitebox). The further the test node is from the customer, the higher the latency and the greater the possibility that third party networks may need to be traversed, making it difficult to isolate the individual ISP's performance. This is why SamKnows operates so many test nodes all around the world—locality to the customer is critical.

1.1 Test node definition

When referring to "test nodes," we are specifically referring to either the dedicated servers that are under SamKnows' control, or the virtual machines that may be provided to us. In the case of virtual machines provided by Measurement-Lab, Level3, and others, the host operating system is under the control of and maintained by these entities and not by SamKnows.

1.2 Test node selection

The SamKnows Whiteboxes select the nearest node by running round-trip latency checks to all test nodes

before measurement begins. Note that when we use the term "nearest" we are referring to the test node nearest to the Whitebox from the point of view of network delay, which may not necessarily always be the one nearest geographically.
Alternatively, it is possible to override test node selection based on latency and implement a static configuration so that the Whitebox will only test against the test node chosen by the Administrator. This is so that the Administrator can choose to test any particular test node that is of interest to the specific project and also to maintain configuration consistency. Similarly, test node selection may be done on a scheduled basis, alternating between servers, to collect test data from multiple test nodes for comparison purposes.

1.3 Test node positioning—on-net versus off-net

It is important that measurements collected by the test architecture support the comparison of ISP performance in an unbiased manner. Measurements taken from using the standardized set of "off-net" measurement test nodes (off-net here refers to a test node located outside a specific ISP's network) ensure that the performance of all ISPs can be measured under the same conditions and would avoid artificially biasing results for any one ISP over another. Test nodes located on a particular ISP's network ("on-net" test nodes), might introduce bias with respect to the ISP's own network performance. Thus data to be used to compare ISP performance are collected using "off-net" test nodes, because they reside outside the ISP network.
However, it is also very useful to have test nodes inside the ISP network ("on-net" test nodes). This allows us to:

- Determine what degradation in performance occurs when traffic leaves the ISP network; and
- Check that the off-net test nodes are performing properly (and vice versa).
- By having both on-net and off-net measurement data for each Whitebox, we can have a great deal of confidence in the quality of the data.

2.3 Data that is stored on test nodes

No measurement data collected by SamKnows is stored on test nodes.[59] The test nodes provide a "dumb" endpoint for the Whiteboxes to test against. All measurement performance results are recorded by the Whiteboxes, which are then transmitted from the Whitebox to data collection servers managed by SamKnows.

Note that Measurement-Lab run sidestream measurements for all TCP connections against their test nodes, and publish this data in accordance with their data embargo policy.

2 - Test Node Hosting and Locations

SamKnows test nodes reside in major peering locations around the world. Test nodes are carefully sited to ensure optimal connectivity on a market-by-market basis. SamKnows' test infrastructure utilizes nodes made available by Level3, Measurement-Lab and various network operators, as well as under contract with select hosting providers.

2.1 Global test nodes

Level3 has provided SamKnows with 11 test nodes to use for the FCC's Measuring Broadband America Program. These test nodes are virtual servers meeting SamKnows specifications. Similarly, Measurement-

[59] Note that Measurement-Lab runs sidestream measurements for all TCP connections against their test nodes and publishes these data in accordance with their data embargo policy.

Lab has also provided SamKnows with test nodes in various cities and countries for use with the Program's fixed measurement efforts. Measurement-Lab provides location hosting for at least three test nodes per site. Furthermore, SamKnows maintains its own test nodes, which are separate from the test nodes provided by Measurement-Lab and Level3.

Table 1 below shows the locations of the SamKnows test node architecture supporting the Measuring Broadband America Program.[60] All of these listed test nodes reside outside individual ISP networks and therefore are designated as off-net test nodes. Note, that in many locations there are multiple test nodes installed which may be connected to different providers.

Location	SamKnows	Level3	Measurement-Lab
Atlanta, Georgia			✓
Chicago, Illinois		✓	✓
Dallas, Texas		✓	✓
Los Angeles, California	✓	✓	✓
Miami, Florida			✓
Mountain View, California			✓
New York City, New York	✓	✓	✓
San Jose, California		✓	
Seattle, Washington			✓
Washington D.C	✓	✓	
Washington, Virginia			✓
Denver, Colorado			✓

Table 1: Test Node Locations

SamKnows also has access to many test nodes donated by ISPs around the world. These particular test nodes reside within individual ISP networks and are therefore considered on-net test nodes.

ISPs have the advantage of measuring to both on-net and off-net test nodes, which allows them to segment end-to-end network performance and determine the performance of their own network versus third party networks. For example, an ISP can see what impact third party networks have on their end-users Quality of Experience ('QoE') by placing test nodes within their own network and at major National and International peering locations.

[60] In addition to the test nodes used to support the Measuring Broadband America Program, SamKnows utilizes a diverse fleet of nodes in locations around the globe for other international programs.

Diagram 1 below shows this set-up.

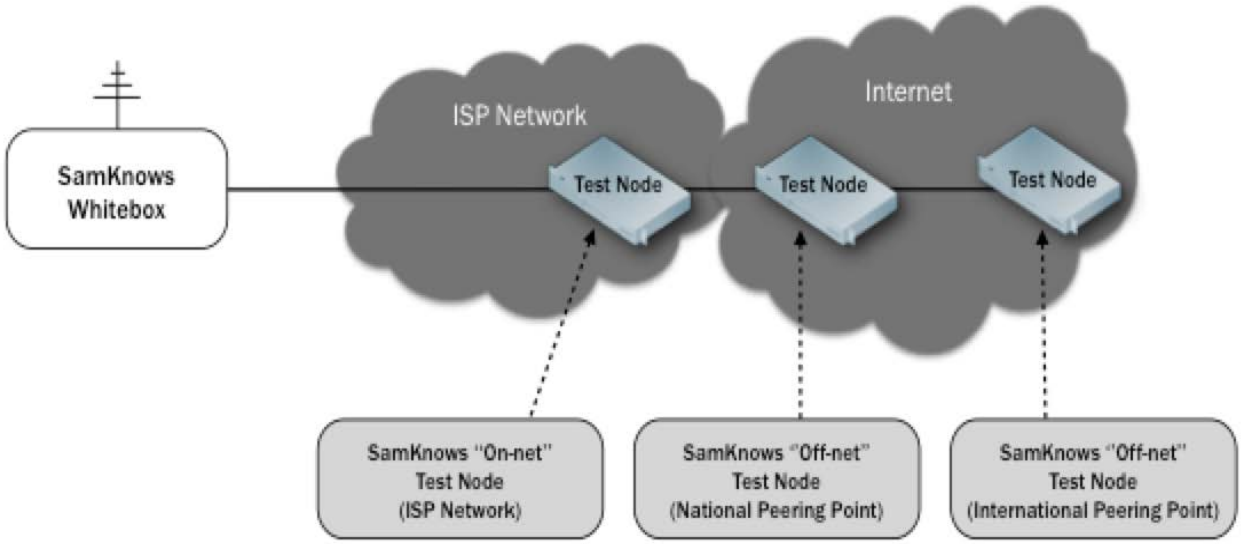


Diagram 1: On-net and Off-net Testing

Both the on-net and off-net test nodes are monitored by SamKnows as part of the global test node fleet. Test node management is explained in more detail within the next section of this document.

3 - Test Node Management

SamKnows test node infrastructure is a critical element of the SamKnows global measurement platform and includes extensive monitoring in place. SamKnows uses a management tool to control and configure the test nodes, while the platform is closely scrutinized using the Nagios monitoring application. System alerts are also in place to ensure the test node infrastructure is always available and operating well within expected threshold bounds.

The SamKnows Operations team continuously checks all test nodes to monitor capacity and overall health. Also included is data analysis to safeguard data accuracy and integrity. This level of oversight not only helps to maintain a healthy, robust platform but also allows us to spot and flag actual network issues and events as they happen. Diagnostic information also supports the Program managers' decision-making process for managing the impact of data accuracy and integrity incidents. This monitoring and administration is fully separate from any monitoring and administration of operating systems and platforms that may be necessary by hosting entities with which SamKnows may be engaged.

3.1 Seamless test node management

SamKnows controls its network of test nodes via a popular open-source management tool called Puppet (**https://puppetlabs.com**). Puppet allows the SamKnows Operations team to easily manage hundreds of test nodes and ensure that each group of test nodes is configured properly as per each project requirement. Coded in Python, Puppet uses a low-overhead agent installed on each test node that regularly communicates with the controlling SamKnows server to check for updates and ensure the integrity of the configuration.

This method of managing our test nodes allows us to deal with the large number of test nodes without affecting the user's performance in any way. We are also able to quickly and safely make changes to large parts of our test node fleet while ensuring that only the relevant test nodes are updated. This also allows

us to keep a record of changes and rapidly troubleshoot any potential problems.

3.2 Proactive test node monitoring

While Puppet handles the configuration and management of the test nodes, Nagios (the most popular online monitoring application) is used by SamKnows to monitor the test nodes. Each test node is configured to send Nagios regular status updates on core metrics such as CPU usage, disk space, free memory, and SamKnows-specific applications. Nagios will also perform active checks of each test nodes where possible, providing us with connectivity information—both via "ping" and connections to any webserver that may be running on the target host.

4 - Test Node Specification and Connectivity

SamKnows maintains a standard specification for all test nodes to ensure consistency and accuracy across the fleet.

4.1 SamKnows test node specifications

All dedicated test nodes must meet the following minimum specifications:

- CPU: Dual core Xeon (2 GHz+)
- RAM: 4 GB
- Disk: 80 GB
- Operating System: CentOS/RHEL 6.x
- Connectivity: Gigabit Ethernet connectivity, with gigabit upstream link.

4.2 Level3 test node specifications

All test nodes provided by level3 meet the following minimum specifications:

- CPU: 2.2 GHz Dual Core
- RAM: 4GB
- Disk: 10 GB
- Operating System: CentOS 6 (64bit)
- Connectivity: 4x1 Gigabit Ethernet (LAG protocol)

4.3 Measurement-Lab test node specifications

All test nodes provided by Measurement-Lab meet the following minimum specifications:

- CPU: 2 GHz 8-core CPU
- RAM: 8 GB
- Disk: 2x100 GB
- OS: CentOS 6.4
- Connectivity: minimum 1 Gbps dedicated upstream

4.4 Test node connectivity

Measurement test nodes must be connected to a Tier-1 or equivalently neutral peering point. Each test node must be able to sustain 1 Gbps throughput.
At minimum, one publicly routable IPv4 address must be provisioned per-test node. The test node must not be presented with a NAT'd address. It is highly preferable for any new test nodes to also be provisioned with an IPv6 address at installation time.
It is preferred that the test nodes do not sit behind a firewall. If a firewall is used, then care must be taken to ensure that it can sustain the throughput required above.

4.5 Test node security

Each of the SamKnows test nodes is firewalled using the IPTables linux firewall. We close any ports that are not required, restrict remote administration to SSH only, and ensure access is only granted from a limited number of specified IP addresses. Only ports that require access from the outside world—for example TCP Port 80 on a webserver—would have that port fully open. SamKnows regularly checks its rulesets to ensure that there are no outdated rules and that the access restriction is up to date.
SamKnows accounts on each test node are restricted to the systems administration team by default. When required for further work, an authorized SamKnows employee will have an account added.

5 - Test Node Provisioning

SamKnows also has a policy of accepting test nodes provided by network operators providing that

- The test node meets the specifications outlined earlier
- Minimum of 1 Gbps upstream is provided and downstream connectivity to national peering locations

Please note that donated test nodes may also be subject to additional local requirements.

5.1 Installation and qualification

ISPs are requested to complete an information form for each test node they wish to provision. This will be used by SamKnows to configure the test node on the management system.
SamKnows will then provide an installation script and an associated installation guide. This will require minimal effort from the ISPs involved and will take a very similar form to the package used on existing test nodes.
Once the ISP has completed installation, SamKnows will verify the test node meets performance requirements by running server-to-server tests from known-good servers. These server-to-server measurements will be periodically repeated to verify performance levels.

5.2 Test node access and maintenance

ISPs donating test nodes are free to maintain and monitor the test nodes using their existing toolsets, providing that these do not interfere with the SamKnows measurement applications or system monitoring tools. ISPs must not run resource intensive processes on the test nodes (e.g. packet captures), as this may affect measurements.
ISPs donating test nodes must ensure that these test nodes are only accessed by maintenance staff when absolutely necessary.
SamKnows requests SSH access to the test nodes, with sudo abilities. sudo is a system administration tool that allows elevated privileges in a controlled granular manner. This has greatly helped diagnosis of performance issues with ISP-provided test nodes historically and would enable SamKnows to be far more responsive in investigating issues.

[DOCUMENT ENDS]