

## **A. Mobile Wireless Market Appendices**

## APPENDIX A-1: TOTAL MOBILE WIRELESS CONNECTIONS

## Appendix Figure II.A.1

*Estimated Total Mobile Wireless Connections: 2003–2017*

Year	NRUF			CTIA
	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-Lowell-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%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
24	161	San Diego, CA	3,337,685	128%	126%	121%	111%
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%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
50	127	Dallas-Fort Worth, TX-AR-OK	10,169,082	122%	119%	116%	112%
51	107	Minneapolis-St. Paul, MN-WI-IA	5,162,587	122%	119%	114%	109%
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%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
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%
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%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
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	357,859	113%	109%	106%	99%
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%

2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
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%
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%



2017 Rank	EA	Market Name	2017 Population (est.)	2017	2016	2015	2014
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	813,442	104%	103%	100%	98%
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		<b>52.1%</b>		<b>-51.2%</b>		<b>-8.2%</b>		<b>13.9%</b>

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.<sup>1</sup>

<sup>1</sup> 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 Service Revenue (thousands)	Percentage Change	Average Reported Subscribers	Average Monthly Revenue per Active Subscriber Unit
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.<sup>2</sup>

**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
<b>Total</b>	<b>13.50</b>	<b>13.70</b>	<b>5,404</b>	<b>13.44</b>	<b>13.31</b>	<b>5,822</b>	<b>14.49</b>	<b>15.38</b>	<b>5,981</b>

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

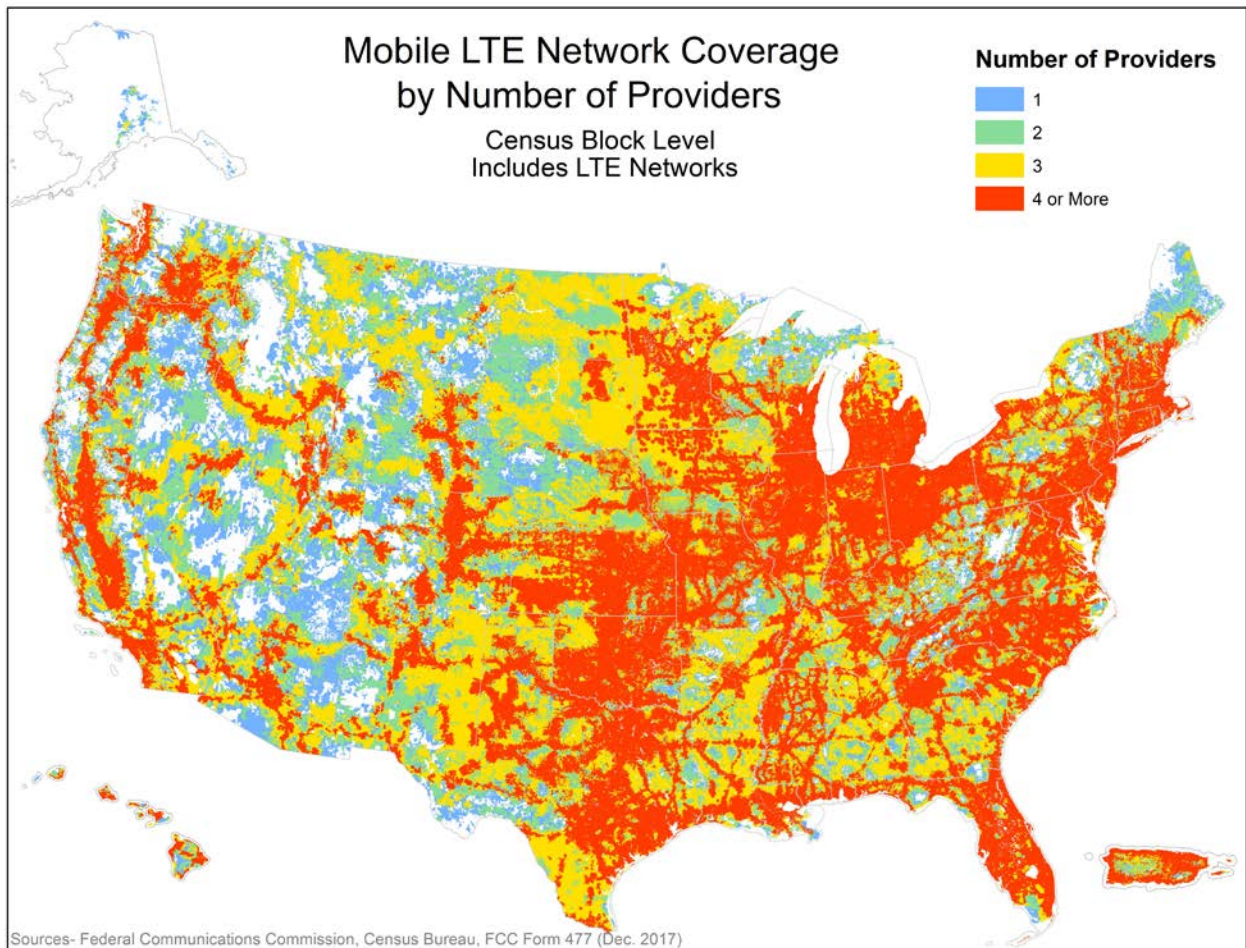
Source: The estimated speeds are based on the CalSPEED data. Fall 2016 tests were taken between the dates of Sept. 29, 2016 and Nov. 4, 2016. Spring 2017 tests were taken between the dates of May 25, 2017 to June 30, 2017. Fall 2017 tests were taken between the dates of Oct. 5, 2017 to Nov. 15, 2017.

<sup>2</sup> 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 Red 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.<sup>3</sup> These maps will be published in interactive form on the *Communications Marketplace Report’s* website after release of the *Communications Marketplace Report*.

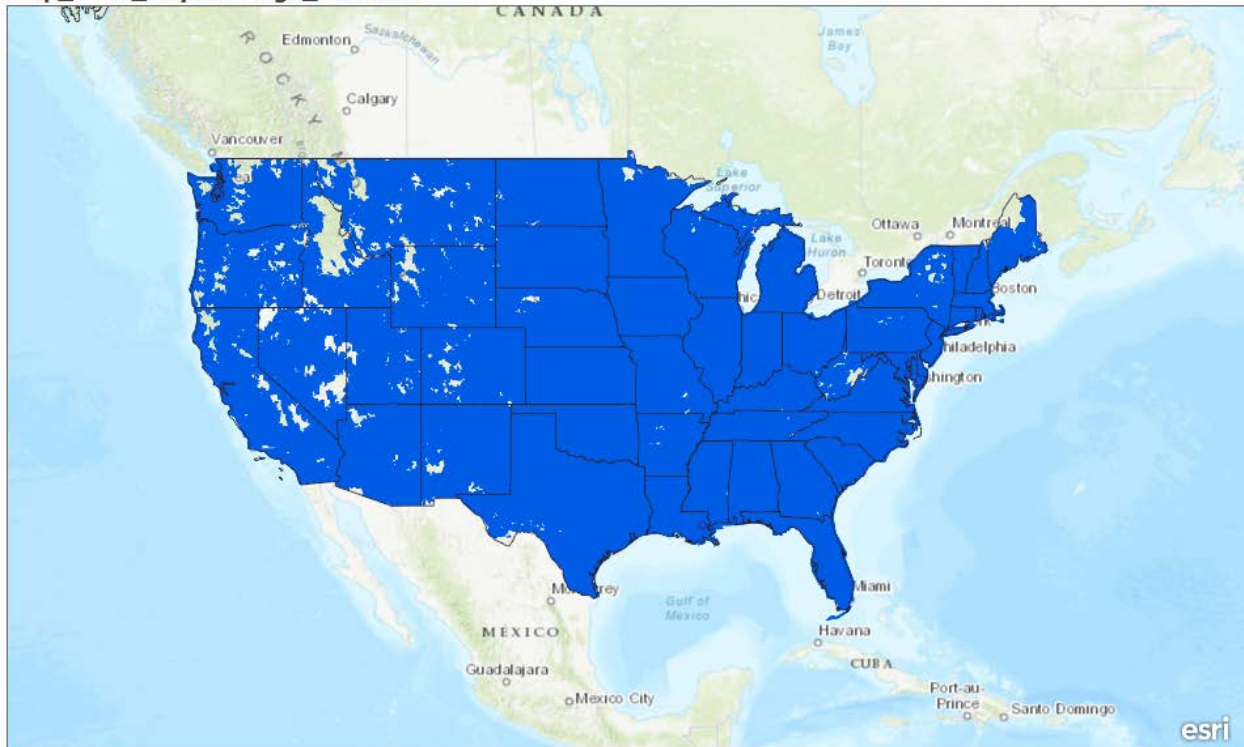
**LTE Coverage Nationwide by Number of Service Providers  
Form 477, Centroid Method, December 2017**



<sup>3</sup> 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.

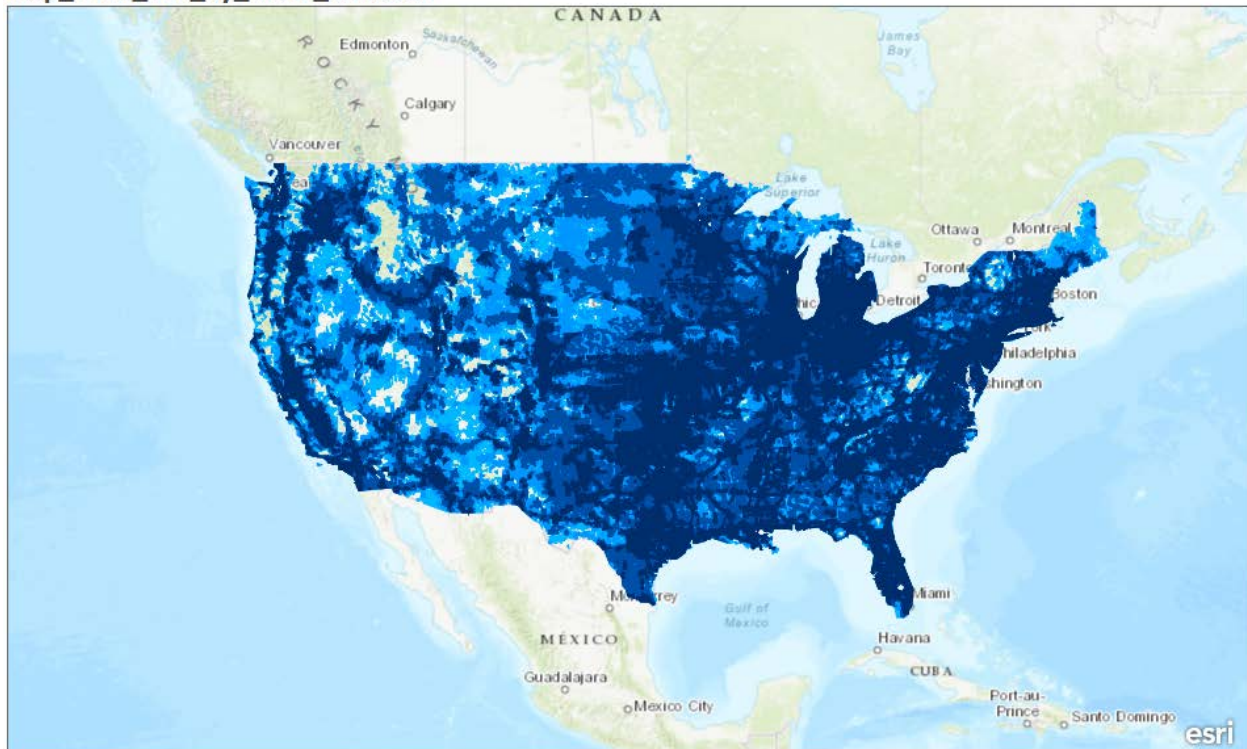
Nationwide Mobile Wireless Coverage, Year-End 2017 (Form 477)

map\_F477\_AnyCoverage\_Dec2017



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

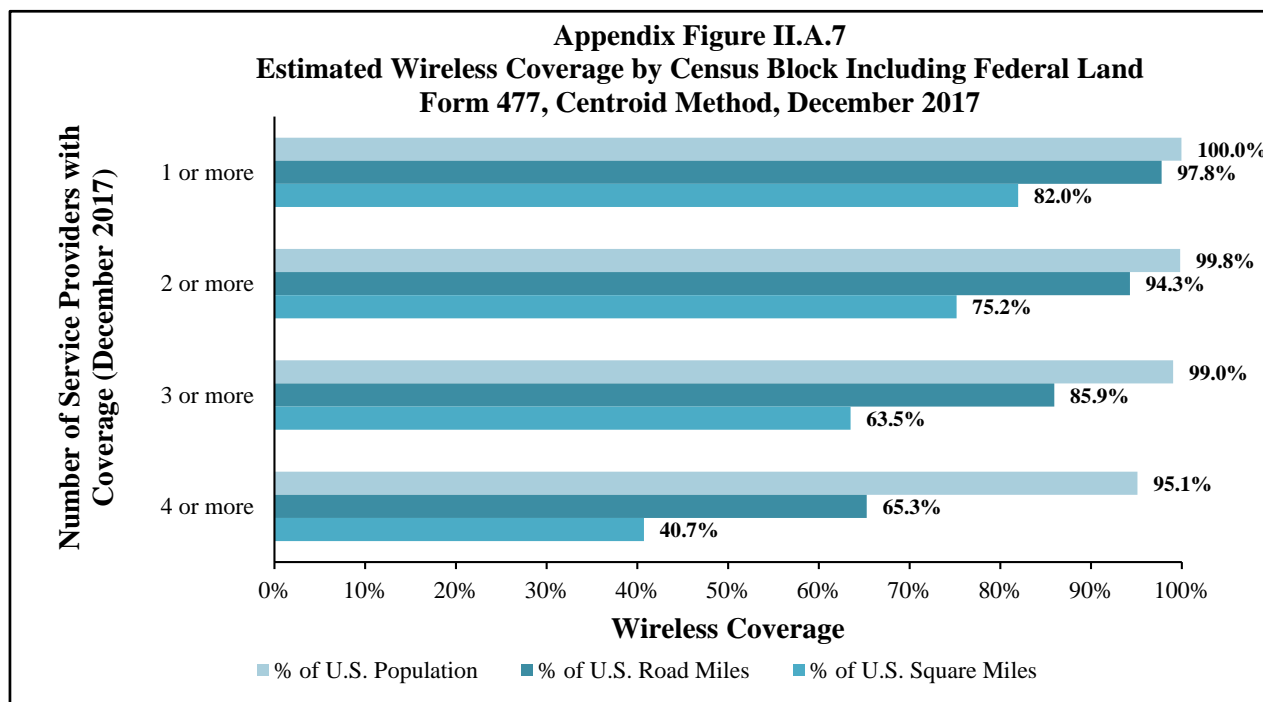
map\_F477\_LTE\_by\_Block\_Dec2017



### 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.<sup>4</sup> 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.<sup>5</sup>



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.

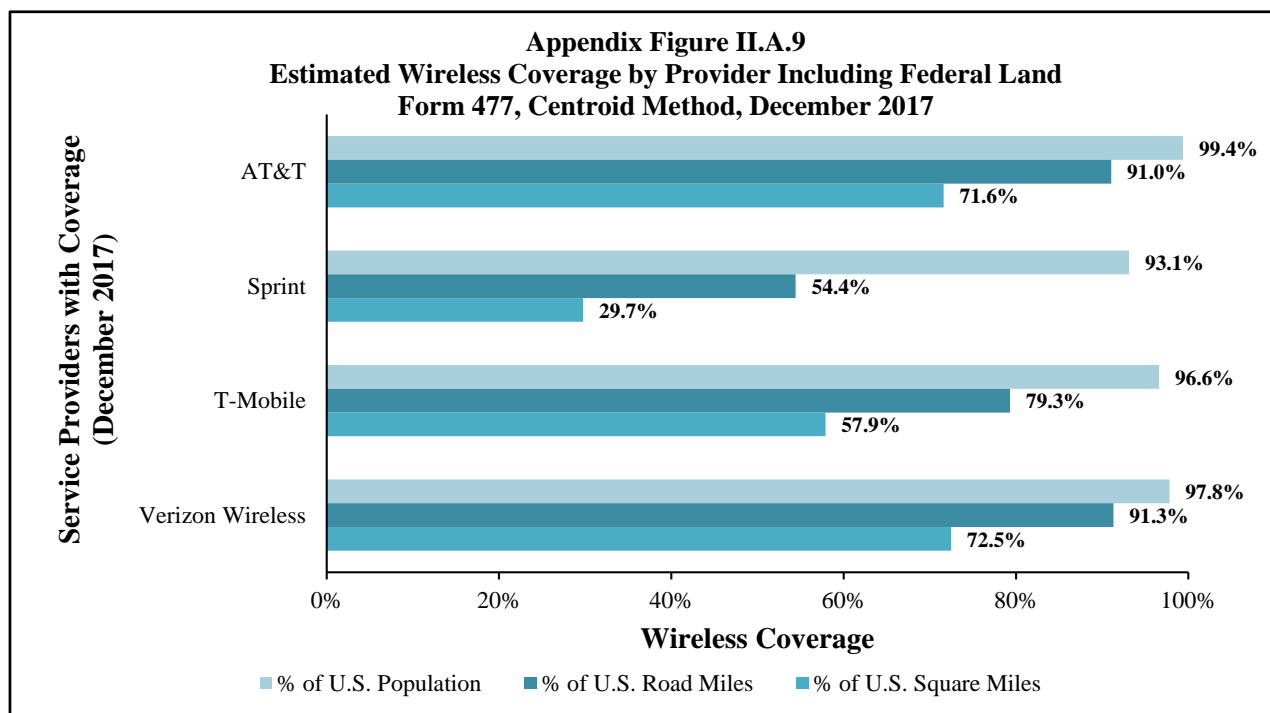
<sup>4</sup> For the actual area methodology, since we do not know the distribution of either the population or road miles at the sub-census block level, as noted above, we must approximate the percentage that is covered by each technology. To do this, we assume that both population and road miles are 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.

<sup>5</sup> 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
<i>US Total</i>	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.



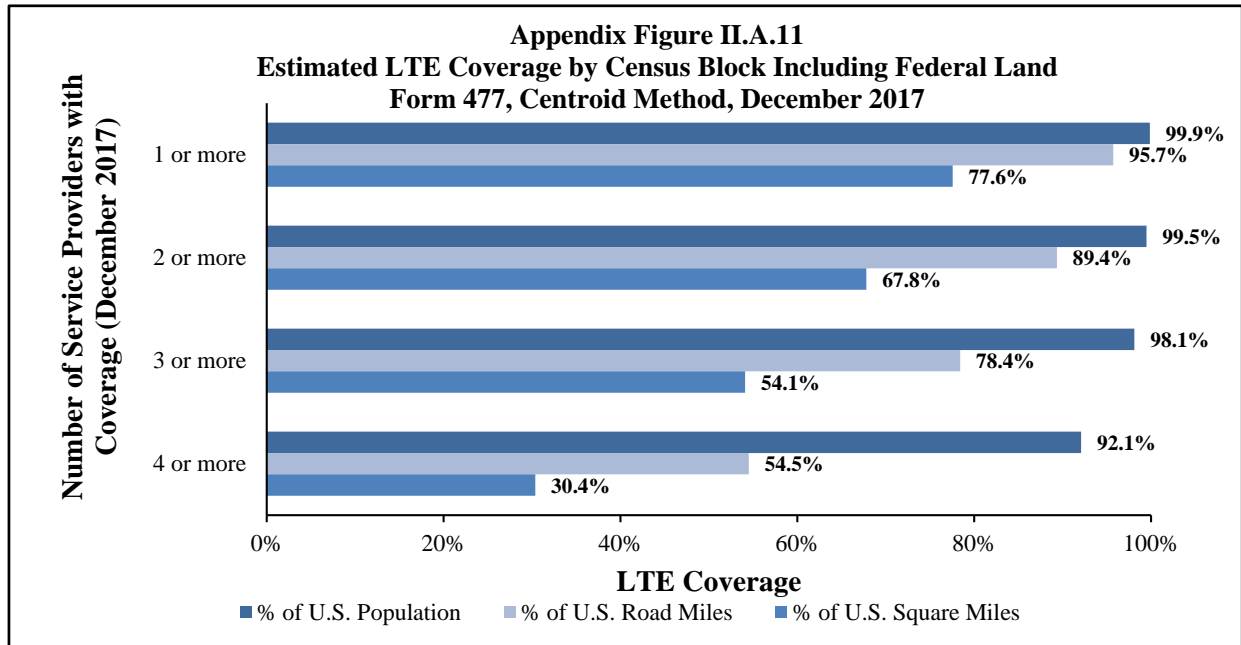
Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located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

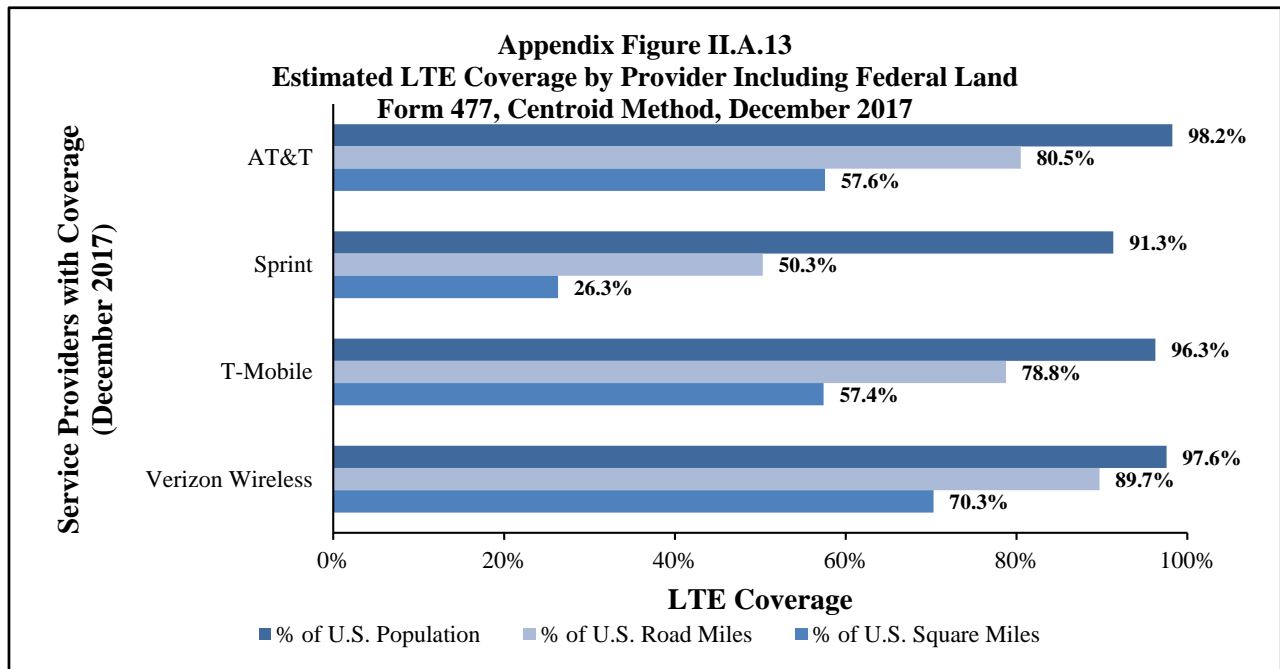


Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located 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
<i>US Total</i>	10,609,302	312,471,327	100.0%	3,550,852	100.0%	6,817,734	100.0%
<b>1 or more</b>	10,433,138	312,044,388	99.9%	2,754,031	77.6%	6,525,357	95.7%
<b>2 or more</b>	10,147,846	310,840,536	99.5%	2,407,597	67.8%	6,091,677	89.4%
<b>3 or more</b>	9,540,945	306,564,207	98.1%	1,920,661	54.1%	5,345,812	78.4%
<b>4 or more</b>	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.

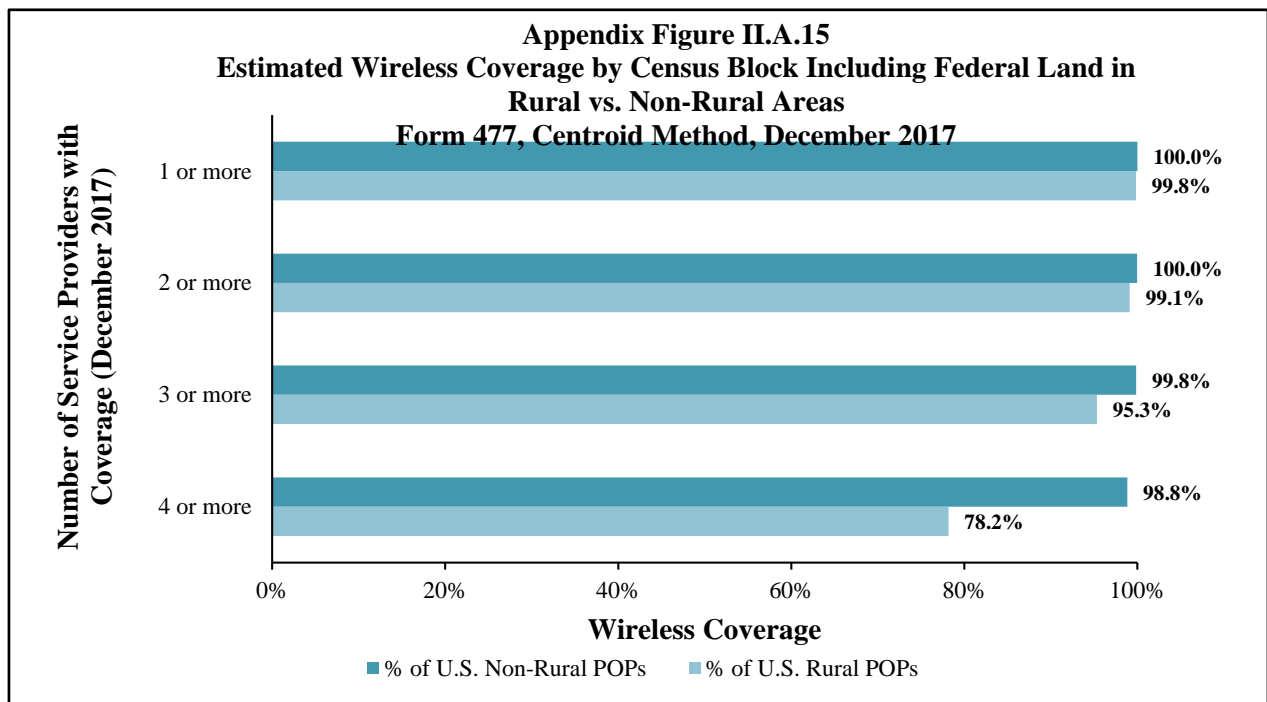


Source: Based on centroid analysis of December 2017 Form 477 and 2010 Census data. Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located 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
<i>US Total</i>	10,609,302	312,471,327	100.0%	3,550,852	100.0%	6,817,734	100.0%
<b>AT&amp;T</b>	9,614,934	307,000,222	98.2%	2,044,185	57.6%	5,487,898	80.5%
<b>Sprint</b>	7,535,705	285,385,219	91.3%	934,117	26.3%	3,428,669	50.3%
<b>T-Mobile</b>	9,292,861	300,756,476	96.3%	2,038,678	57.4%	5,370,112	78.8%
<b>Verizon</b>	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**

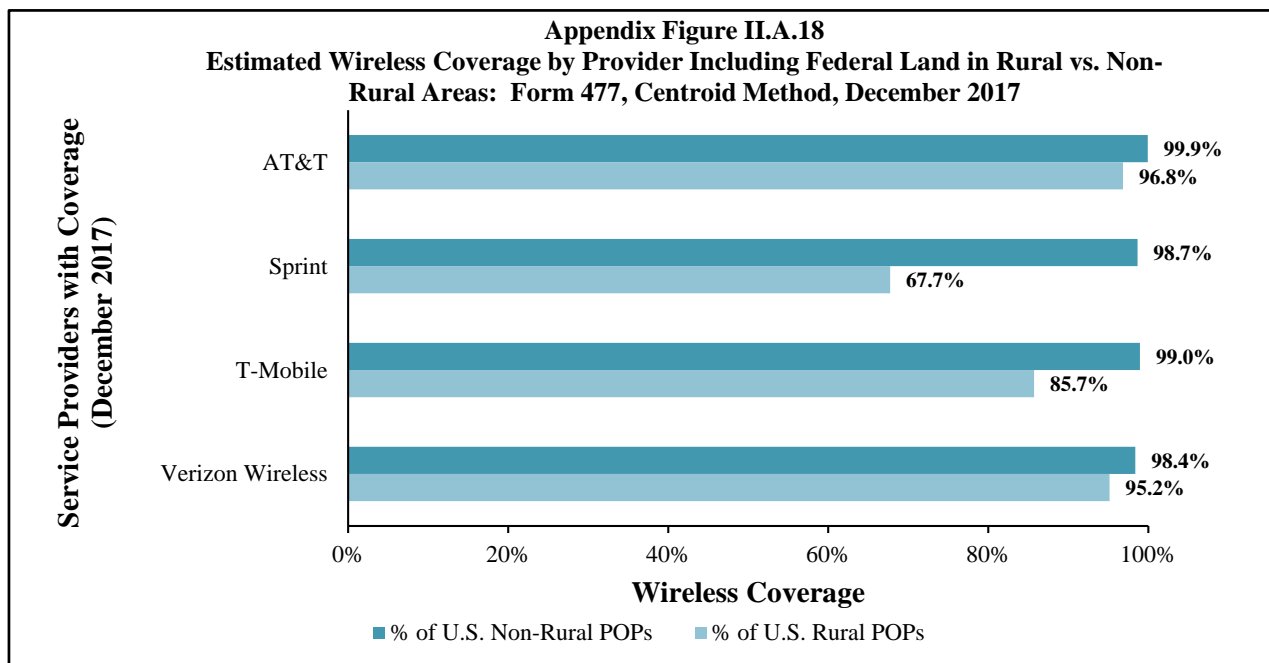
Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Rural US POPs	Square Miles Contained in Those Blocks	% of Total Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Rural US Rural Road Miles
<i>US Total</i>	4,937,330	56,094,552	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
<i>US Total</i>	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.



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**

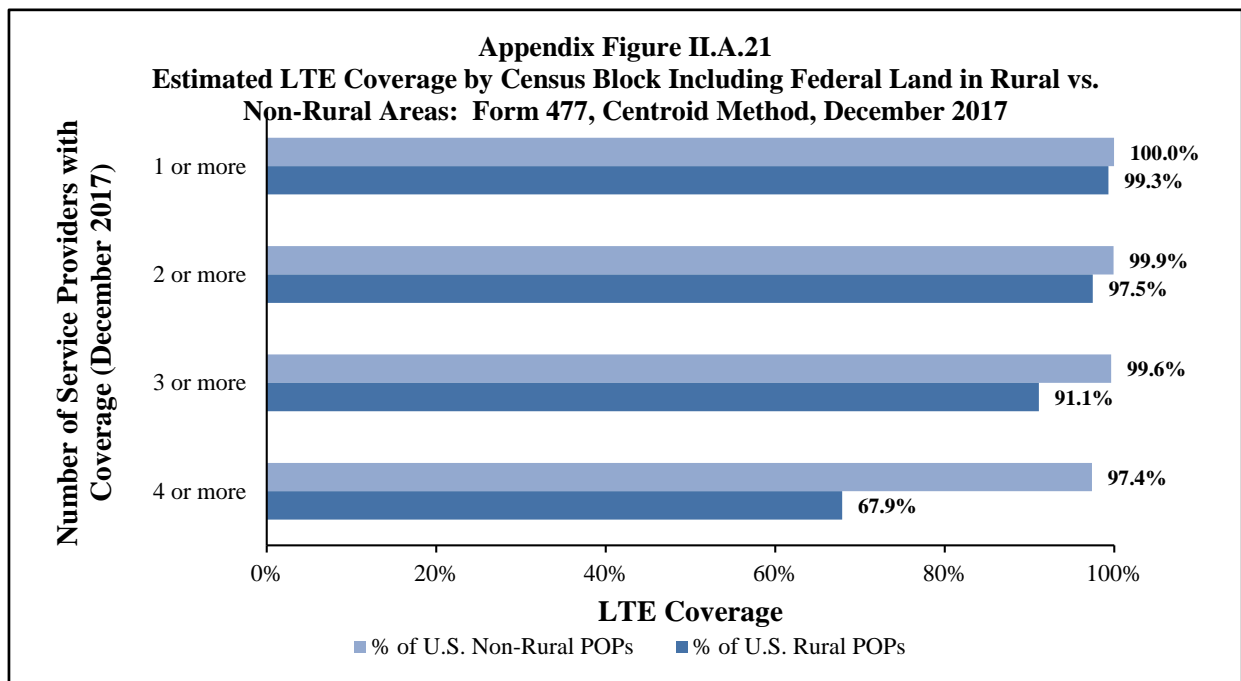
Provider	Number of Blocks	POPs Contained in Those Blocks	% of Total Rural US POPs	Road Miles Contained in Those Blocks	% of Total US Rural Road Miles
<i>US Total</i>	4,937,330	56,094,554	100.0%	4,518,876	100.0%
AT&T	4,517,284	54,318,840	96.8%	3,932,114	87.0%
Sprint	2,433,438	37,993,681	67.7%	1,615,636	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
<i>US Total</i>	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.



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**

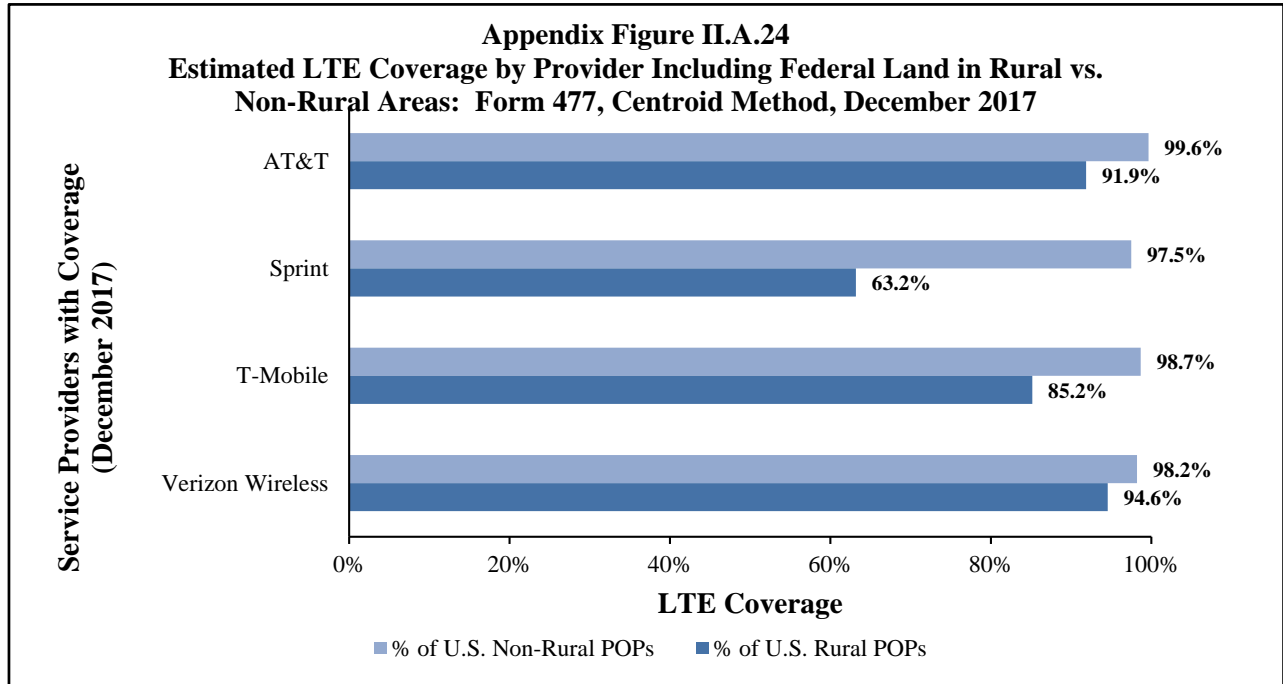
Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Non-Rural US POPs	Square Miles Contained in Those Blocks	% of Total Non-Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
<i>US Total</i>	5,671,972	256,376,773	100.0%	563,570	100.0%	2,298,858	100.0%
<b>1 or more</b>	5,662,241	256,336,800	100.0%	550,122	97.6%	2,286,095	99.4%
<b>2 or more</b>	5,637,995	256,163,024	99.9%	527,851	93.7%	2,256,943	98.2%
<b>3 or more</b>	5,578,692	255,463,328	99.6%	494,473	87.7%	2,199,456	95.7%
<b>4 or more</b>	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
<i>US Total</i>	10,609,302	312,471,327	100.0%	3,550,852	100.0%	6,817,734	100.0%
<b>1 or more</b>	10,433,138	312,044,380	99.9%	2,754,031	77.6%	6,525,357	95.7%
<b>2 or more</b>	10,147,846	310,840,536	99.5%	2,407,597	67.8%	6,091,677	89.4%
<b>3 or more</b>	9,540,945	306,564,200	98.1%	1,920,662	54.1%	5,345,812	78.4%
<b>4 or more</b>	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.



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
<i>US Total</i>	4,937,330	56,094,554	100.0%	4,518,876	100.0%
<b>AT&amp;T</b>	4,029,157	51,536,845	91.9%	3,280,816	72.6%
<b>Sprint</b>	2,209,889	35,438,910	63.2%	1,418,951	31.4%
<b>T-Mobile</b>	3,781,024	47,768,704	85.2%	3,187,527	70.5%
<b>Verizon</b>	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
<i>US Total</i>	5,671,972	256,376,773	100.0%	2,298,858	100.0%
<b>AT&amp;T</b>	5,585,777	255,463,377	99.6%	2,207,082	96.0%
<b>Sprint</b>	5,325,816	249,946,309	97.5%	2,009,718	87.4%
<b>T-Mobile</b>	5,511,837	252,987,772	98.7%	2,182,585	94.9%
<b>Verizon</b>	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
<i>US Total</i>	312,471,327	100.0%	3,550,852	100.0%	6,817,734	100.0%
<b>AT&amp;T</b>	310,408,683	99.3%	2,533,825	71.4%	6,188,828	90.8%
<b>Sprint</b>	290,734,898	93.0%	1,054,528	29.7%	3,699,433	54.3%
<b>T-Mobile</b>	301,714,599	96.6%	2,055,223	57.9%	5,400,147	79.2%
<b>Verizon</b>	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
<i>US Total</i>	312,471,327	100.0%	3,550,852	100.0%	6,817,734	100.0%
<b>1 or more</b>	312,008,352	99.9%	2,746,233	77.3%	6,510,130	95.5%
<b>2 or more</b>	310,709,888	99.4%	2,396,544	67.5%	6,071,729	89.1%
<b>3 or more</b>	306,358,944	98.0%	1,912,953	53.9%	5,327,027	78.1%
<b>4 or more</b>	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
<i>US Total</i>	312,471,327	100.0%	3,550,852	100.0%	6,817,734	100.0%
<b>AT&amp;T</b>	306,808,300	98.2%	2,033,640	57.3%	5,466,237	80.2%
<b>Sprint</b>	285,162,942	91.3%	933,056	26.3%	3,418,661	50.1%
<b>T-Mobile</b>	300,661,495	96.2%	2,039,867	57.4%	5,364,722	78.7%
<b>Verizon</b>	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
<i>US Total</i>	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
<i>US Total</i>	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
<i>US Total</i>	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
<i>US Total</i>	256,376,773	100.0%	2,298,858	100.0%
<b>1 or more</b>	256,332,080	100.0%	2,285,103	99.4%
<b>2 or more</b>	256,106,224	99.9%	2,255,598	98.1%
<b>3 or more</b>	255,366,768	99.6%	2,196,483	95.5%
<b>4 or more</b>	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
<i>US Total</i>	56,094,554	100.0%	4,518,876	100.0%
<b>AT&amp;T</b>	54,267,818	91.7%	3,262,217	72.2%
<b>Sprint</b>	37,892,940	63.0%	1,412,671	31.3%
<b>T-Mobile</b>	48,043,725	85.1%	3,182,022	70.4%
<b>Verizon</b>	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
<i>US Total</i>	256,376,773	100.0%	2,298,858	100.0%
<b>AT&amp;T</b>	255,377,712	99.6%	2,204,019	95.9%
<b>Sprint</b>	249,811,940	97.4%	2,005,989	87.3%
<b>T-Mobile</b>	252,933,205	98.7%	2,182,700	94.9%
<b>Verizon</b>	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.