

**STATE OF VERMONT
PUBLIC UTILITY COMMISSION**

Case No. 21-4060-PET

Petition of Consolidated Communications of Vermont Company, LLC and Consolidated Communications of Northland Company (both d/b/a “Consolidated Communications”) for approval of a Successor (2022-2024) Incentive Regulation Plan, pursuant to 30 V.S.A. § 226b	
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**PREFILED TESTIMONY OF
KENNETH MARTIN
ON BEHALF OF CONSOLIDATED COMMUNICATIONS**

October 22, 2021

SUMMARY OF TESTIMONY

Witness Kenneth Martin provides testimony regarding Altman Solon’s study of the current level of competition in broadband and voice markets in the State of Vermont.

**PREFILED TESTIMONY OF
KENNETH MARTIN
ON BEHALF OF CONSOLIDATED COMMUNICATIONS**

1 **Q1. Please state your name, position, and business address.**

2 **A1.** My name is Kenneth Martin. I am a Director at Altman Solon, a global strategic
3 management consulting firm focused on the telecommunications industry. My business address
4 is Altman Solon, 101 Federal Street, 28th Floor, Boston, MA 02110.

5 **Q2. Please describe your experience in the telecommunications industry and your**
6 **educational background.**

7 **A2.** I am an economic and strategy consultant and have managed over 300 projects in the
8 telecommunications and media industries over the last 20 years. I am an expert in developing
9 rigorous data analysis. For clients in regulatory and litigation projects, I have developed and filed
10 analyses with, and presented to, regulators including the U.S. Federal Communications
11 Commission (“FCC”), the U.S. Congressional Budget Office, the U.S. Department of Justice,
12 courts and arbitration boards, and international bodies.

13 Prior to joining Altman Solon, I was an economic consultant at The Brattle Group where
14 I led numerous regulatory and litigation projects. I have held positions with Cambridge Strategic
15 Management Group (CSMG) and Braxton Associates / Deloitte Consulting.

16 I received an MBA from MIT Sloan School of Management. I received a JD with Honors
17 from Boston University School of Law. I received a BA cum laude, from Brandeis University.

1 **Q3. Have you previously testified before the Vermont Public Utility Commission**
2 **(“Commission”)?**

3 **A3. No.**

4 **Q4. What is the purpose of your testimony?**

5 **A4.**Altman Solon has been retained by Consolidated Communications to provide background
6 on the competition level in the broadband and voice markets in Vermont. I led a team of Altman
7 Solon consultants to study the level and nature of broadband and voice competition in Vermont.
8 In this testimony, I address the following topics: 1) competition in the broadband market (fixed
9 broadband and mobile broadband), 2) competition in the voice market, 3) impact of mobile
10 service on the voice market, 4) impact of VoIP on the voice market, 5) the current state of
11 competition in broadband and voice markets in Vermont, and 6) trends for the level of
12 competition in broadband and voice markets in Vermont.

13 **Q5. Please summarize your testimony.**

14 **A5.**Based on analysis of available data, competition exists in both the broadband and voice
15 markets in Vermont. Nearly all Vermont consumers have choice of at least three fixed broadband
16 providers and two facilities-based mobile broadband providers with 4G or 5G technology.
17 Likewise, nearly all Vermont consumers have choice for voice services from dozens of operators
18 ranging from Mobile Network Operators, Mobile Virtual Network Operators, over-the-top Voice
19 over IP, in addition to cable companies, overbuilders, Incumbent Local Exchange Carriers, and
20 Competitive Local Exchange Carriers.

Given the likely continued expansion of mobile 5G networks and broadband fiber networks, and resulting increase in consumer choice, growth in consumer adoption of broadband and of non-switched landline voice, specifically, mobile and Voice over IP (both facilities-based and over-the-top) is likely to continue.

Q6. Please describe competition in the broadband market in Vermont.

A6. The broadband market in Vermont is comprised of seven key provider types, each with several technologies, with various numbers of providers in each type. The provider types and technologies include:

- Incumbent Local Exchange Carrier (ILEC): Digital Subscriber Line (DSL), Fiber-to-the-Premises (FTTP)
- Competitive Local Exchange Carrier (CLEC): DSL
- Cable Multiple System Operator (MSO): Cable Modem, FTTP
- Overbuilders: Cable Modem, FTTP
- Wireless Internet Service Provider (WISP): Wi-Fi, WiMax, Fixed Wireless
- Satellite: Low-Earth Orbit (LEO), Medium-Earth Orbit (MEO)
- Mobile: 3G, 4G, 5G

A. Fixed Broadband

The FCC collects and publishes data on the availability of broadband, often referred to as FCC Form 477 data. Form 477 data is collected from broadband providers who report coverage areas and speeds to the FCC. There are 33 self-reporting broadband providers in Vermont; 24 of them offer residential services.¹ The table below lists all self-reporting fixed broadband providers by type and technology in Vermont.

¹ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

Figure A: Vermont Fixed Broadband Providers²

Provider Name	Provider Type	Technology Types
Crown Castle Fiber LLC	Business Market Only	FTTP
FirstLight Fiber	Business Market Only	DSL, FTTP
GCI Communication Corp.	Business Market Only	Satellite
Lumen (formerly Level 3)	Business Market Only	Copper, FTTP
MCI Communications Corporation (Verizon)	Business Market Only	Copper, FTTP
New Horizon Communications Group Inc	Business Market Only	DSL
Stellar Private Cable Systems, Inc.	Business Market Only	Cable Modem
U.S. TelePacific Corp.	Business Market Only	Copper, FTTP , Fixed Wireless
Windstream Holdings, Inc.	Business Market Only	DSL, FTTP, Other Copper
Charter Communications, Inc.	Cable MSO	Cable Modem, FTTP
Comcast Cable Communications	Cable MSO	Cable Modem
Stowe Communications LLC	Cable MSO	Cable Modem, FTTP
Champlain Broadband, LLC (D/B/A Burlington Telecom)	Fiber	FTTP
Mansfield Community Fiber	Fiber	FTTP
Pear Networks LLC	Fiber	FTTP
Valleynet, Inc. (Includes EC Fiber)	Fiber	FTTP
Consolidated Communications	ILEC	DSL, FTTP
Franklin Telephone Co., Inc	ILEC	DSL, FTTP
Otelco	ILEC	DSL, FTTP
TDS Telecommunications Corporation	ILEC	DSL, FTTP, Fixed Wireless
Topsham Telephone	ILEC	DSL, FTTP, FTTP
Vermont Telephone Co., Inc	ILEC	DSL, FTTP
Waitsfield-Fayston Telephone Co., Inc.	ILEC	DSL, Copper, FTTP
Hughes Network Systems, LLC	Satellite	Satellite
ViaSat, Inc.	Satellite	Satellite
802Networks	WISP	Copper, Fixed Wireless
Cloud Alliance LLC	WISP	Fixed Wireless
Hudson Valley Wireless	WISP	Fixed Wireless
King Street Wireless, L.P.	WISP	Fixed Wireless
Kingdom Connection	WISP	Fixed Wireless
North Branch Networks, LLC	WISP	Fixed Wireless
Northern Community Investment Corporation	WISP	Fixed Wireless
TCC Networks Inc	WISP	Fixed Wireless

² FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

1 Collectively, the dozens of fixed providers in Vermont offer consumers choice of high-
2 speed internet in nearly all of the state.³ The Figure below shows the number of buildings in
3 Vermont, both residential and business, that had access to fixed broadband options as of June
4 2019. This analysis is based on the Vermont Department of Public Service 2019 survey of
5 building-level access to broadband by minimum available speed.⁴ The survey found that 77.3%
6 of building locations in Vermont had access to internet with speeds of at least 25 Mbps download
7 speed and 3 Mbps upload speed⁵, meeting the FCC's definition of "broadband."⁶ The survey also
8 found that 93.2% of building locations in Vermont had access to speeds of at least 4 Mbps down
9 and 1 Mbps up.⁷ Note that satellite providers were not included in this data and additional
10 building locations could be served via satellite broadband.⁸

³ <https://publicservice.vermont.gov/content/broadband-availability>

⁴ "building-level access" is defined by the VT Department of Public Service as having a service route within 500 feet of the physical location.

⁵ By convention, this report refers to broadband speeds with the formulation: X Mbps down and Y Mbps up or X/Y Mbps, meaning X megabits per second download speed and Y megabits per second upload speed.

⁶ <https://publicservice.vermont.gov/content/broadband-availability>

⁷ <https://publicservice.vermont.gov/content/broadband-availability>

⁸ Altman Solon team communication with Vermont Department of Public Service staff.

Figure B: Vermont Broadband Statistics Summary by County as of December 31, 2019⁹

County	Percent of Locations Served 100/100 or Better	Percent of Locations Served 25/3 or Better	Percent of Locations Served 4/1 or Better	Percent of Locations with less than 4/1
Addison	14.1%	75.8%	95.6%	4.4%
Bennington	1.0%	83.7%	93.8%	6.2%
Caledonia	0.5%	55.3%	80.2%	19.8%
Chittenden	25.7%	95.7%	98.9%	1.1%
Essex	2.2%	32.2%	67.7%	32.3%
Franklin	3.8%	71.2%	90.2%	9.8%
Grand isle	0.0%	70.3%	93.8%	6.2%
Lamoille	3.6%	55.0%	89.9%	10.1%
Orange	39.0%	64.3%	89.5%	10.5%
Orleans	2.3%	56.6%	86.2%	13.8%
Rutland	21.9%	90.2%	97.4%	2.6%
Washington	8.2%	75.0%	95.4%	4.6%
Windham	13.9%	74.8%	90.1%	9.9%
Windsor	48.8%	90.9%	97.4%	2.6%
Total	17.5%	77.3%	93.2%	6.8%

FCC Form 477 data is self-reported at the census block level, meaning that if an operator provides broadband to any location within the census block, the entirety of the locations within that census block are assumed to have access. While this is a less precise definition of broadband availability than the Vermont study, it is very granular since the average census block contains about 20 households, and is used throughout the US as the standard approach for determining the level of broadband availability, number of providers, speeds, and technologies.

The FCC reports the level of broadband coverage at the census block level of fixed providers by advertised speed, technology type, and whether the provider serves residential and/or business customers. Based on the FCC definition of “served” as a census block with advertised broadband speeds of at least 25 Mbps download and 3 Mbps upload, over 99.9% of

⁹ <https://publicservice.vermont.gov/content/broadband-availability>

1 households¹⁰ in Vermont as of 2020 are in census blocks having access to at least 25 down and 3
 2 Mbps up speeds from at least two broadband providers, with 93.4% having access to three or
 3 more.¹¹

Figure C: Vermont Households in CBs served by Broadband Providers with 25/3 Mbps¹²

Number of Broadband Provider Advertising >=25 Mbps Down and >=3 Mbps Up	Households (2019 US Census Estimates)	Percent of Households	Percent of Households (Cumulative)
0	0	0.0%	100.0%
1	20	0.0%	100.0%
2	17,788	6.6%	100.0%
3	103,071	38.1%	93.4%
4	125,204	46.3%	55.3%
5 or More	24,210	9.0%	9.0%
Total	270,293	100.0%	

4 Using a lower broadband speed threshold of advertised speeds of at least 4 Mbps
 5 download and 1 Mbps upload, over 99.9% of 2019 Vermont households are in census blocks
 6 having access to at least two providers and 98.7% of households are in census blocks having
 7 access to three or more providers.¹³

¹⁰ FCC estimated household counts by census block. <https://www.fcc.gov/staff-block-estimates>

¹¹ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

¹² FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>. “CB” is abbreviation for census block.

¹³ FCC estimated household counts by census block. <https://www.fcc.gov/staff-block-estimates>

Figure D: Vermont Households in CBs served by Broadband Providers with 4/1 Mbps¹⁴

Number of Broadband Provider Advertising >=4 Mbps Down and >=1 Mbps Up	Households (2019 US Census Estimates)	Percent of Households	Percent of Households (Cumulative)
0	0	0.0%	100.0%
1	19	0.0%	100.0%
2	3,491	1.3%	100.0%
3	37,264	13.8%	98.7%
4	163,674	60.6%	84.9%
5 or More	65,845	24.4%	24.4%
Total	270,293	100.0%	

Utilizing FCC data and 2021 business location data from data vendor InfoUSA, over 99.9% of Vermont businesses are in census blocks having access to two or more fixed providers with advertised speeds of at least 25 Mbps down and 3 Mbps up.¹⁵ Furthermore, 93.4% of businesses are in census blocks having three or more broadband providers operating in their area.¹⁶

Figure E: Vermont Businesses in CBs served by Broadband Providers with 25/3 Mbps¹⁷

Number of Broadband Provider Advertising >=25 Mbps Down and >=3 Mbps Up	Businesses (2021 InfoUSA Estimates)	Percent of Businesses	Percent of Businesses (Cumulative)
0	0	0.0%	100.0%
1	23	0.1%	100.0%
2	1,937	6.5%	99.9%
3	10,562	35.4%	93.4%
4	16,201	54.3%	58.0%
5 or More	1,122	3.8%	3.8%
Total	29,845	100.0%	

¹⁴ FCC 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

¹⁵ FCC 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>. InfoUSA Business Locations information is available with a service subscription.

¹⁶ FCC 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>

¹⁷ FCC 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>

Likewise, providers that advertise speeds of at least 4 Mbps down and 1 Mbps up cover census blocks containing nearly all Vermont business locations. The figure below shows that over 99.9% of businesses are in census blocks having access to two or more providers and over 97% are in census blocks having access to three or more providers.¹⁸

Figure F: Vermont Businesses in CBs served by Broadband Providers with 4/1 Mbps¹⁹

Number of Broadband Provider Advertising >=4 Mbps Down and >=1 Mbps Up	Businesses (2021 InfoUSA Estimates)	Percent of Businesses	Percent of Businesses (Cumulative)
0	0	0.0%	100.0%
1	23	0.1%	100.0%
2	714	2.4%	99.9%
3	4,035	13.5%	97.5%
4	20,976	70.3%	84.0%
5 or More	4,097	13.7%	13.7%
Total	29,845	100.0%	

A summary of the differences in building counts between the Vermont Department of Public Service data and FCC Form 477 is shown below. The Vermont Department of Public Service broadband access data is collected at an address level, based on Vermont's emergency 911 system.²⁰ The FCC Form 477 census block-level data may show a different number of overall locations with broadband coverage than the Vermont Department of Public Service data for at least four reasons. First, analysis of FCC data at the census block level requires an assumption of 100% coverage of the locations within it, however, an ISP's service may be to only a portion of those buildings, whereas the Vermont Department of Public Service data is

¹⁸ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>

¹⁹ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>

²⁰ State of Vermont Department of Public Service, <https://publicservice.vermont.gov/content/broadband-availability>

1 based on coverage of actual locations. A second reason is in the definition of locations versus
2 buildings: multiple housing units from Census and business locations from InfoUSA may be
3 contained within a single building (e.g., apartments, townhomes units, or business suites) and
4 treated as a single building location by Vermont's E911 system. A third reason is based on the
5 definition of service availability: Form 477 reports on presence of advertised service within a
6 specific census block, whereas Vermont's service coverage is defined as presence of a physical
7 wireline route within 500 feet of a physical address, thus a building located within 500 feet of a
8 fiber line but outside of a census block boundary would be counted by the Vermont data, but not
9 captured by the FCC data.²¹ Finally, Vermont Department of Public Service data does not
10 include coverage from satellite providers, which is included in FCC Form 477 data.²²

11 Chittenden County, home to Vermont's largest and most urban area, has the largest
12 difference between Census/InfoUSA location counts and the Vermont Department of Public
13 Service building counts, likely due to a higher concentration of multi-family and multi-business
14 buildings.

²¹ State of Vermont Department of Public Service, <https://publicservice.vermont.gov/content/broadband-availability>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>; <https://www.fcc.gov/staff-block-estimates>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>.

²² Altman Solon team communication with Department staff.

Figure G: Comparison of Form 477 and Department of Public Service Locations²³

County	HUs + Business Counts, aggregated by Census Block	Vermont Public Service Department Location Count	Percent of total FCC count	Percent of total Public Service Department count
Addison	19,362	17,876	5.2%	5.8%
Bennington	23,138	20,660	6.3%	6.7%
Caledonia	17,851	15,940	4.8%	5.2%
Chittenden	78,764	57,713	21.3%	18.7%
Essex	5,409	5,434	1.5%	1.8%
Franklin	24,454	22,667	6.6%	7.4%
Grand Isle	5,658	6,343	1.5%	2.1%
Lamoille	15,242	12,891	4.1%	4.2%
Orange	16,662	15,665	4.5%	5.1%
Orleans	19,107	16,569	5.2%	5.4%
Rutland	37,641	30,855	10.2%	10.0%
Washington	34,336	26,826	9.3%	8.7%
Windham	33,524	26,922	9.1%	8.7%
Windsor	38,135	31,721	10.3%	10.3%
Total	369,283	308,082	100.0%	100.0%

In the Vermont Department of Public Service survey, locations serviceable by fiber were designated as at least 100 Mbps; locations serviceable by cable were designated as at least 25/3 Mbps, and locations serviceable by DSL were designated as at least 4/1 Mbps by the Vermont Department of Public Service.²⁴ However, advertised speeds are likely higher than these minimums: for example, FTTP and cable technology now often reaches gig speeds (near or

²³ State of Vermont Department of Public Service, <https://publicservice.vermont.gov/content/broadband-availability>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>.

²⁴ State of Vermont Department of Public Service, <https://publicservice.vermont.gov/content/broadband-availability>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>.

above 1,000 Mbps) and DSL speeds are often available at 10, 25, and 50 Mbps or higher. The Vermont Department of Public Service data also does not include satellite technology, which is available, per the FCC Form 477 data,²⁵ to 100% of locations (housing units and business locations) at a minimum speed of 25 Mbps down and 3 Mbps up. These differences in methodology and resulting coverage calculations are summarized in the Figure below.

Figure H: Comparison of 477 and Public Service Department Coverage²⁶

Speed Tiers	% of HUs + Businesses aggregated by Census Block covered (Satellite Included)	% of HUs + Businesses aggregated by Census Block covered (Satellite Excluded)	% of HUs + Businesses aggregated by Census Block covered by only Satellite	% Vermont Public Service Department Buildings covered
25/3 Mbps or Better	100.0%	92.3%	100.0%	77.3%
4/1 Mbps or Better	100.0%	98.3%	100.0%	93.2%

While the Vermont Department of Public Service data does not provide detail on the number of broadband operators for each building, a minimum number can be inferred considering satellite broadband as reported by the FCC. Form 477 data shows that broadband operators using satellite technology cover census blocks containing 100% of housing units and business locations in Vermont.²⁷ However, the Vermont Department of Public Service broadband coverage data does not include satellite providers because they did not provide coverage data to the Department of Public Service. Therefore, there is at least one broadband

²⁵ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>.

²⁶ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; State of Vermont Department of Public Service, <https://publicservice.vermont.gov/content/broadband-availability>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>.

²⁷ See % of HUs + Businesses aggregated by Census Block covered by only Satellite in Figure H.

1 operator advertising at least 25 Mbps down and 3 Mbps up to census blocks containing 100% of
2 Vermont buildings and at least two operators covering 77.3% of Vermont buildings.²⁸ Using the
3 same inference, there is at least one broadband operator advertising at least 4 Mbps down and 1
4 Mbps up to census blocks containing 100% of Vermont buildings and at least two operators
5 covering 93.2% of Vermont buildings.²⁹

6 **B. Mobile Broadband**

7 There are five Mobile Network Operators (MNOs) reporting coverage to the FCC:
8 AT&T, Verizon, T-Mobile (recently merged with Sprint)³⁰, VTel Wireless, and US Cellular.³¹
9 These operators provide mobile broadband options to over 99% of Vermont customers.³² In
10 addition to MNOs, there are dozens of non-facilities based Mobile Virtual Network Operators
11 (MVNOs) that resell MNO service in Vermont, giving consumers additional choice on service
12 plans.³³ Some examples of these companies include: Boost Mobile, Consumer Cellular, Cricket,
13 Google Fi, Mint Mobile, Straight Talk, TracFone, Virgin Mobile, and Xfinity Mobile.

14 Both AT&T and Verizon cover over 95% of Vermont households with 4G mobile and
15 over 98% with 3G mobile, as shown in the table below.³⁴ After completing its merger with
16 Sprint, T-Mobile covers nearly 90% of Vermont households with 4G mobile and over 30% with

²⁸ Figure H.

²⁹ Figure H.

³⁰ Merger closed on April 1, 2020, <https://www.t-mobile.com/news/un-carrier/t-mobile-sprint-one-company>

³¹ FCC Mobile Form 477, <https://www.fcc.gov/mobile-deployment-form-477-data>

³² FCC Mobile Form 477, <https://www.fcc.gov/mobile-deployment-form-477-data>

³³ See for example: <https://www.wirefly.com/content/phone-plans/vermont/Burlington>

³⁴ FCC Mobile Form 477, <https://www.fcc.gov/mobile-deployment-form-477-data>

1 5G.³⁵ VTel Wireless and US Cellular cover 62% and 17% of Vermont households with 4G
 2 mobile, respectively.³⁶

Figure I: Mobile Broadband Household Coverage, Vermont, 2019³⁷

Mobile Provider	Mobile Technology Generation			
	3G	4G	5G	Any
AT&T	97.8%	99.5%	0.0%	99.6%
Verizon	89.6%	97.4%	0.0%	98.0%
T-Mobile & Sprint	68.9%	88.3%	30.3%	88.9%
Sprint	61.9%	65.6%	0.0%	67.9%
T-Mobile	49.6%	77.3%	30.3%	77.7%
VTel Wireless	0.0%	62.0%	0.0%	62.0%
US Cellular	20.5%	16.8%	0.0%	21.4%

3 With the prevalence of broadband options, 84% of Vermont households had adopted
 4 broadband internet as of 2019 according to the Annual US Census American Community
 5 Survey, see Exhibit J below. Most Vermont consumers with broadband subscriptions take
 6 service from fixed broadband options (71% of all Vermont households), with a smaller number
 7 taking service only from satellite (4.6% of all Vermont households). A majority of US
 8 households, 78%, had mobile data plans in addition to home internet in 2019 and 64.6% of
 9 Vermont households had a mobile data subscription in addition to home internet in 2019.³⁸

³⁵ FCC Mobile Form 477, <https://www.fcc.gov/mobile-deployment-form-477-data>

³⁶ FCC Mobile Form 477, <https://www.fcc.gov/mobile-deployment-form-477-data>

³⁷ FCC Mobile Form 477, <https://www.fcc.gov/mobile-deployment-form-477-data>

³⁸ US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>

Figure J: Broadband Internet Subscription Distribution by Type, US and VT, 2019³⁹

Type of Internet Subscription	US	VT
Landline Broadband (Cable Modem, FTTP, DSL, 5G Fixed Wireless)	70.8%	70.8%
Satellite Broadband Only	3.8%	4.6%
Mobile Broadband Only	11.8%	8.0%
Broadband Sub Total	86.4%	83.4%
Dial-up Internet Only	0.2%	0.7%
Internet Subscription Sub Total	86.6%	84.1%
No Internet Subscription	13.4%	15.9%
Total Households	100.0%	100.0%
Mobile Data Plan	78.0%	64.6%
Percent of Households with Mobile Data Plan with no Other Internet Subscription	15.2%	12.4%

Some consumers have begun to rely exclusively on their mobile data plans for internet, especially with the increase in mobile data speeds over the last five years from 3G technologies, which has download speeds typically in the 1-5 Mbps range, to 4G technologies, which has download speeds typically in the 20-30 Mbps range.⁴⁰ In 2019, 11.8% of US households subscribed to mobile broadband with no other fixed broadband subscription. In Vermont, 8.0% of households subscribed to mobile broadband with no other fixed broadband subscription, representing 12.4% of all Vermont internet subscriptions.⁴¹

³⁹ US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>

⁴⁰ Opensignal Mobile Network Experience Report, <https://www.opensignal.com/reports/2021/07/usa/mobile-network-experience>

⁴¹ US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>

1 **Q7. Please describe competition in the voice market in Vermont.**

2 **A7.** Voice providers in Vermont include Local Exchange Telephone Services, Interconnected
3 Voice over Internet Protocol (VoIP) services, Mobile services, and other services.⁴² Local
4 Exchange Telephone services are switched line services accessed over a copper line. These
5 services are provided by Incumbent Local Exchange Carriers (ILECs), as well as non-ILEC
6 voice-service affiliates, also known as Competitive Local Exchange Carriers (CLECs).

7 VoIP subscriptions can be provided on a dedicated basis via facilities-based, wired
8 internet connections, or over-the-top of an existing broadband connection. Facilities-based
9 providers typically include Cable MSOs and fiber overbuilders, which provide dedicated voice
10 service over a coaxial or fiber optic cable connected to the home. Over-the-top (“OTT”) services
11 are defined, for the purposes of this review, as services which allow the customer to receive calls
12 via a traditional phone number over an existing internet connection.⁴³ Such OTT VoIP service
13 providers include Vonage, Magic Jack, and Google Voice, and include many traditional landline
14 voice features, such as number portability, call forwarding, and voicemail.⁴⁴

15 Mobile voice services are provided via radio waves and offered by commercial mobile
16 radio service (CMRS) providers. Other services, not covered in this report, may include satellite
17 phones, long-range radios, and similar voice options.

18 As of June 2019, 121 providers reported to the FCC that they offered voice services in
19 Vermont.⁴⁵ Six of these were mobile providers; the merger of T-Mobile and Sprint has since

⁴² FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁴³ For the purposes of this review, services which allow users to have voice or video conversations without the use of a phone number, such as Skype or WhatsApp, are not considered to be providers of OTT VoIP connections.

⁴⁴ <https://www.pcmag.com/picks/finally-ditch-that-landline-the-best-voip-home-phone-services>

⁴⁵ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

reduced this number to five.⁴⁶ Fixed line voice services were reported to the FCC as available from LECs, MSOs, and OTT VoIP in the following numbers: 27 LECs offered switched line (copper) access; 27 MSOs and fiber companies provided voice services over coaxial or fiber cables; and 61 providers offered over-the-top voice service options.⁴⁷ Seven ILECs and 20 CLECs were present in Vermont; many offered VoIP services in addition to traditional switched line access.⁴⁸

Figure K: Providers Reporting Voice Subscriptions in Vermont, June 2019⁴⁹

Vermont Voice Service Type	Count of Providers
Mobile	6
Switched Line Access	27
ILEC	7
Other	20
VoIP	88
MSO or Overbuilder	27
Over-the-top	61
Total Fixed Line	115
Total	121

Mobile accounts for the greatest proportion of voice lines in Vermont: in 2019, mobile telephony accounted for 67% of voice lines. Among fixed lines, 53% were switched lines, while VoIP represented the balance of 47%. ILECs provided 91% of switched line access services. Cable MSOs and overbuilders provided 78% of VoIP services.⁵⁰ ILECs as a group had 16% of total business and residential voice lines in 2019.⁵¹

⁴⁶ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁴⁷ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>.

⁴⁸ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>.

⁴⁹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>.

⁵⁰ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>.

⁵¹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>.

Figure L: Residential and Business Voice Subscriptions (in Thousands)⁵²

Vermont Voice Service Type	Subscribers (000s)	Percent of Total	Percent of Fixed Lines
Mobile	591	66.7%	N/A
Switched Line Access	156	17.6%	52.9%
ILEC	142	16.0%	48.1%
Other	14	1.6%	4.7%
VoIP	139	15.7%	47.1%
MSO or Fiber Overbuilder	109	12.3%	36.9%
Over-the-top	30	3.4%	10.2%
Total Fixed Line	295	33.3%	100%
Total	886	100%	N/A

Across the state, there were an average of 0.70 wired landlines per household, and 0.36 wired business landlines per business employee in 2019.⁵³ Chittenden County had the greatest number of both residential and business voice connections.⁵⁴

Figure M: Fixed Voice Subscriptions by County⁵⁵

Vermont County	Residential Lines (000s)	Total Households (000s)	Lines per HH	Business Lines (000s)	Business Employees	Lines per Employee
Addison County	10	15	0.67	6	15	0.40
Bennington County	12	15	0.80	6	19	0.32
Caledonia County	8	12	0.67	4	11	0.35
Chittenden County	34	65	0.52	37	98	0.38
Essex County	2	3	0.67	0	1	0.00
Franklin County	12	19	0.63	5	16	0.32
Grand Isle County	2	3	0.67	1	2	0.64
Lamoille County	7	10	0.70	4	15	0.26
Orange County	9	12	0.75	3	10	0.31
Orleans County	9	11	0.82	4	12	0.33
Rutland County	19	25	0.76	10	32	0.31
Washington County	16	25	0.64	19	37	0.51
Windham County	17	19	0.89	7	26	0.27
Windsor County	24	24	1.00	9	28	0.33
Total	181	258	0.70	115	322	0.36

⁵² FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>.

⁵³ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>; InfoUSA Business Locations, 2021, <https://www.dataaxleusa.com/lp/partner/>

⁵⁴ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁵⁵ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

1 A number of providers offer broadband connections with sufficient speed to support OTT
2 VoIP voice applications. FCC data from June 2020, as shown in Figure N, shows that 100% of
3 Vermont households were in census blocks having access to broadband advertised with at least 4
4 Mbps upload and 1 Mbps download speed, technically sufficient for OTT VoIP.⁵⁶ Additionally,
5 98.7% of households have at least three provider options with at least these minimum speeds.⁵⁷

Figure N: Vermont Households served by Broadband Providers with 4/1 Mbps⁵⁸

Number of Broadband Provider Advertising >=4 Mbps Down and >=1 Mbps Up	Households (2019 US Census Estimates)	Percent of Total Households
1+	270,293	100.0%
3+	266,783	98.7%

6 Given the prevalence of mobile coverage from multiple providers (MNOs) to nearly all
7 Vermont households, dozens of MVNOs, the presence of sufficient broadband to support OTT
8 VoIP in 100% of Vermont households which enables dozens of OTT VoIP provider, in addition
9 to wired VoIP and switched voice providers, Vermont consumers have numerous options for
10 voice services.

⁵⁶ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>. Our review has assumed broadband connections of at least 4 Mbps up and 1 Mbps down sufficient for OTT VoIP out of convenience since the Vermont Department of Public Service broadband tiers are based on this minimum speed threshold. However, the FCC states that OTT VoIP can be supported with much lower internet speeds of less than 0.5 Mbps, see <https://www.fcc.gov/consumers/guides/broadband-speed-guide>.

⁵⁷ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁵⁸ FCC Form 477, June 2020, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

1 **Q8. Please describe the impact of mobile service on the voice market.**

2 **A8.** Vermont mobile adoption rates have increased from 81% to 95% of the population over
3 the last 10 years.⁵⁹ The number of mobile providers reporting to the FCC that they serve
4 Vermont increased from 4 in 2014, to 5 in 2015, and 6 in 2019, and has since decreased to 5 with
5 the merger of Sprint and T-Mobile.⁶⁰ While the number of operators has remained relatively
6 constant, Vermont mobile adoption rates have increased steadily from 81% to 95% of the
7 population over the last 10 years.⁶¹ Wireline usage in Vermont has fallen as a proportion of
8 population from 59% to 47% over the same time period.⁶²

9 With growing mobile adoption, many consumers have evaluated the need for both
10 landline and mobile voice lines. Over the last ten years, US households have increasingly “cut
11 the cord,” disconnecting landline voice service in favor of only using mobile phone service. The
12 US Centers for Disease Control and Prevention (CDC) has regularly surveyed American
13 households and reports that by the end of 2020, 62.5% of US households had adopted mobile as
14 their only voice service and dropped their landline voice service.⁶³ A majority of US households
15 have adopted mobile voice as their only voice service, indicating that mobile is more than a
16 substitute to landline voice, instead it is a competitive category with over half of the market.⁶⁴

⁵⁹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁶⁰ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

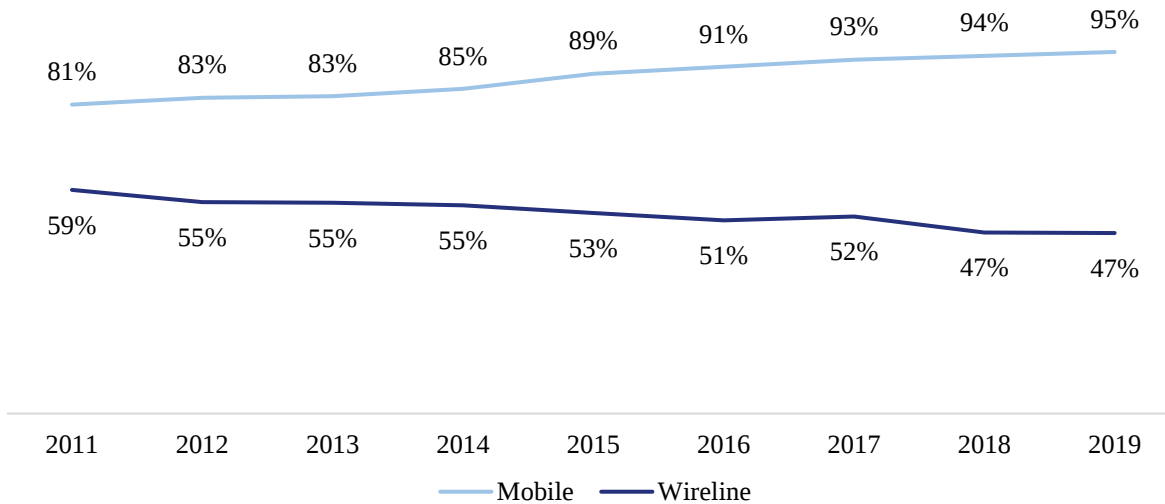
⁶¹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁶² FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁶³ <https://www.cdc.gov/nchs/nhis/erwirelessubs.htm>

⁶⁴ <https://www.cdc.gov/nchs/nhis/erwirelessubs.htm>

Figure O: Vermont Voice Lines as a Percent of Population, 2011-2019⁶⁵

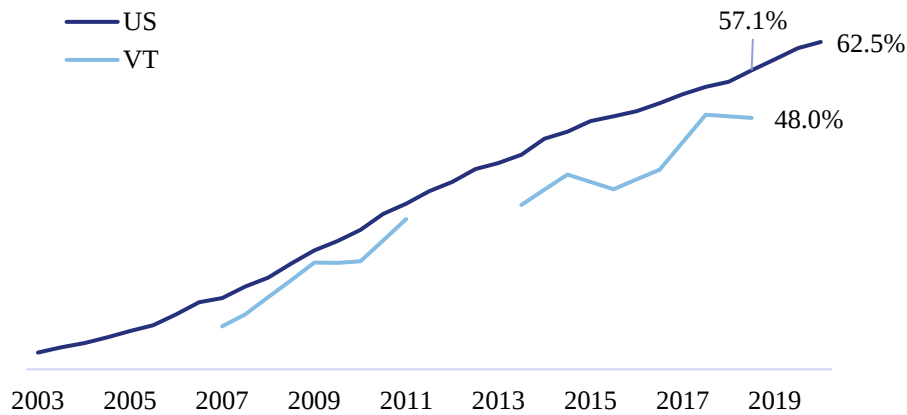


1 Vermont consumers have followed the overall US trend of increasingly cutting the cord.
2 Roughly half of Vermont households had moved to mobile-only voice communications as of the
3 second half of 2018, when the CDC last reported state level figures, compared to a nationwide
4 average of over 57% for the same period.⁶⁶ This indicates that for consumers in Vermont as well,
5 mobile is more than a substitute to landline voice; it is instead a competitive category to landline
6 voice.

⁶⁵ Lines refers to switched access lines and VoIP subscriptions. FCC Voice Telephone Services Report, June 2019; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁶⁶ <https://www.cdc.gov/nchs/nhis/erwirelessubs.htm>

Figure P: Mobile Substitution, US vs VT, 2003-2019⁶⁷



1 **Q9. Please describe the impact of VoIP on the voice market in Vermont.**

2 **A9.** The FCC has tracked the availability of VoIP services in Vermont since 2011.⁶⁸ These
 3 services have been provided over existing wired broadband connections, and typically offer
 4 features such as caller ID and voicemail. Vermont landline customers have increasingly
 5 transitioned from traditional landlines to VoIP services: between 2011 and 2019, the number of
 6 switched lines has declined by 46%, while VoIP subscriptions grew by 74%.⁶⁹

7 Corresponding to the growth in subscribers, the overall count of VoIP providers in
 8 Vermont grew by 87% between 2011 and 2019.⁷⁰ Since 2016, this growth has accelerated: the
 9 number of providers grew at 6.7% annually between 2011 and 2016, and 10.6% between 2016

⁶⁷ <https://www.cdc.gov/nchs/nhis/erwirelessubs.htm>

⁶⁸ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁶⁹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁷⁰ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

1 and 2019.⁷¹ The number of switched line providers has remained largely stable over the same
 2 time period.⁷²

Figure Q: Vermont VoIP Subscribers (000s of lines), 2011-2019⁷³

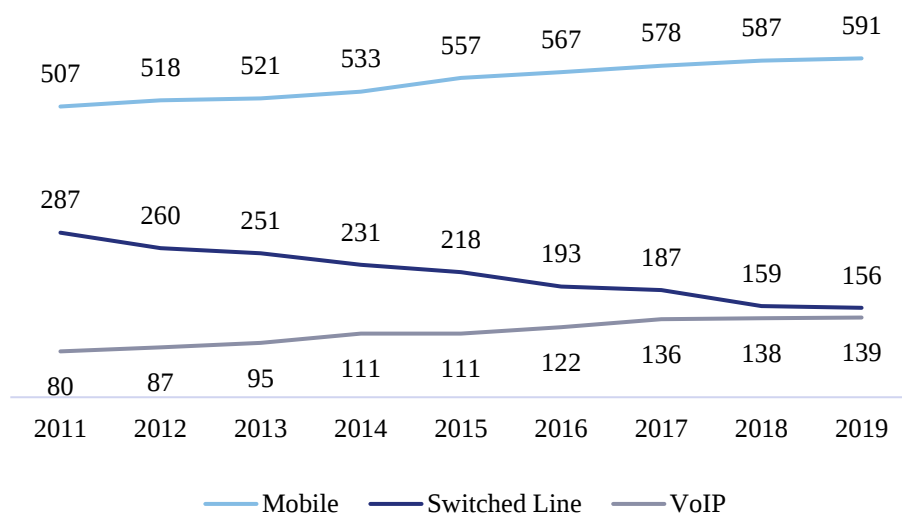


Figure R: Vermont Voice Service Providers, 2011-2019⁷⁴

Vermont Providers	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mobile	N/A	N/A	N/A	5	5	5	6	6	6
Switched Line Access	24	23	25	30	31	28	28	27	27
ILEC	8	7	7	7	7	6	7	7	7
Other	16	16	18	23	24	22	21	20	20
VoIP	47	52	57	60	60	65	70	84	88
MSO or Fiber Overbuilder	N/A	N/A	N/A	30	28	29	28	29	27
Over-the-top	N/A	N/A	N/A	30	32	36	42	55	61
Total Fixed Line	71	75	82	90	91	93	98	111	115
Total Voice	N/A	N/A	N/A	95	96	98	104	117	121

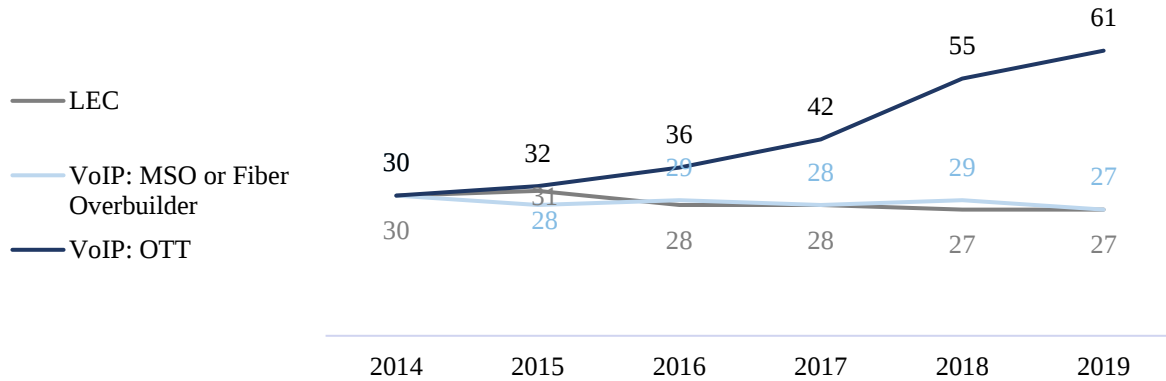
⁷¹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁷² FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁷³ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁷⁴ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

Figure S: Vermont Fixed Line Providers, 2014-2019⁷⁵



The FCC has only tracked the split of facilities-based versus OTT providers since 2014. During this time period, the number of OTT VoIP providers doubled from 30 to 61, increasing the number of provider options for customers seeking voice services.⁷⁶

Furthermore, between 2014 and 2019, nearly 100% of Vermont households were in census blocks having access to at least two providers with advertised speeds of at least 4 Mbps download and 1 Mbps upload based on FCC data.⁷⁷ Meanwhile, the coverage of providers with advertised speeds of at least 25 Mbps download and 3 Mbps upload has increased. In December 2014, only 16% of households were in census blocks having access to two or more providers, while by December 2017, approximately 100% of households were in census blocks having access to two or more providers. Since December 2017, the approximate broadband coverage

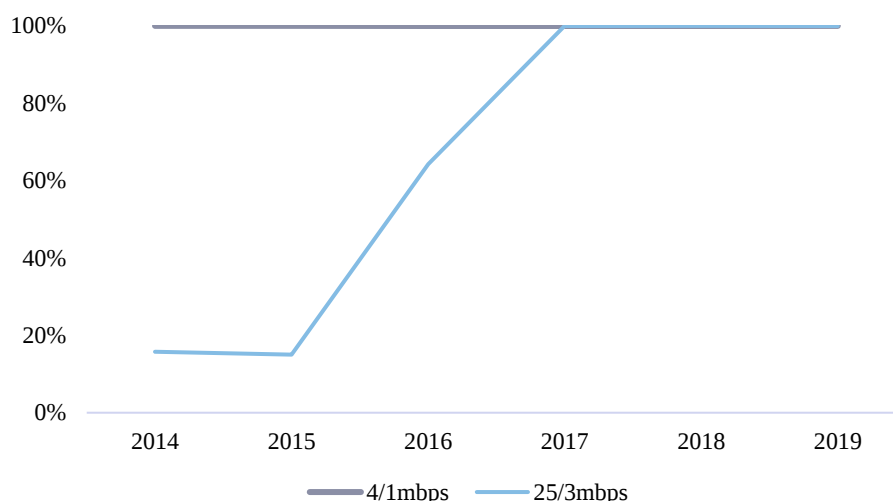
⁷⁵ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁷⁶ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁷⁷ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey, 2014-2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

1 rate at both the 25/3 and 4/1 speed tiers has remained constant at census blocks covering 100%
 2 of households.⁷⁸

Figure T: Percentage of Vermont HHs in CBs with 2+ Providers Year Over Year⁷⁹



3 **Q10. Please describe the current state of competition in the broadband and voice markets**
 4 **in Vermont.**

5 **A10.** Based on the above data and analysis, competition exists in both the broadband and voice
 6 markets in Vermont. Nearly all Vermont residential and business consumers have choice of at
 7 least three fixed broadband providers, including FTTP, Cable Modem, DSL, and Satellite, and
 8 two facilities-based mobile broadband providers with 4G or 5G technology. Likewise, nearly all
 9 Vermont residential and business consumers have choice for voice services from dozens of

⁷⁸ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

⁷⁹ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey, 2014-2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

1 operators ranging from MNOs, MVNOs, OTT VoIP, in addition to cable companies,
2 overbuilders, ILECs, and CLECs.

3 **A. Findings on the Broadband Market**

4 As of 2019, nearly 100% of Vermont households and businesses had access to two or
5 more 25 Mbps broadband providers.⁸⁰ Options for Vermont residential consumers include DSL,
6 Cable Modem, FTTP, fixed wireless, Satellite, and mobile broadband from 24 fixed broadband
7 providers and five mobile operators. Given the level of access and choice, Vermont consumers
8 have adopted broadband at similar rates to the rest of the US market at 83.4% (versus 86.4% for
9 the US).⁸¹

10 **B. Findings on the Voice Market**

11 As of 2019, there were 121 voice providers operating in Vermont across all technology
12 types.⁸² In 2019, 100% of Vermont households and business had access to at least one broadband
13 provider with speeds of at least 4 Mbps download and 1 Mbps upload and 98.6% had access to at
14 least three or more broadband providers with speeds of at least 4 Mbps download and 1 Mbps
15 upload, enabling OTT VoIP.⁸³ Mobile providers had the largest share of voice lines, making up
16 66.7% of total lines. Mobile-only households represented 48% of total households.⁸⁴ The number

⁸⁰ FCC Form 477, December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁸¹ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁸² FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁸³ FCC Form 477, December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

⁸⁴ <https://www.cdc.gov/nchs/nhis/erwirelessubs.htm>

1 of switched lines reached an 8-year low in 2019 with approximately 156,000 lines.⁸⁵ In 2019,
2 ILECs' share of total business and residential voice lines was 16%.⁸⁶

3 **Q11. Please describe the trends for the level of competition in the broadband and voice**
4 **markets in Vermont.**

5 **A11.** There are a number of trends in the broadband and voice markets which are driving
6 expansion of broadband availability, increased broadband speeds, and expansion of VoIP
7 options, resulting in increased consumer choice for broadband and voice.

8 **A. Trends in the Broadband Market**

9 In 2014, the FCC assumed responsibility for the collection of data on broadband
10 deployment, an effort previously overseen by the National Telecommunications & Information
11 Administration (NTIA). As part of this change, the FCC began collecting additional data not
12 previously available as part of its semi-annual Form 477 collection.⁸⁷

13 Since data has been available on broadband deployment speeds, nearly 100% of Vermont
14 households have been within census blocks having access to advertised broadband speeds of at
15 least 4 Mbps download and 1 Mbps upload.⁸⁸ Between 2014 and 2019, providers have increased
16 download speeds, resulting in wider high-speed coverage. For example, the figures below show
17 that in 2014 only 12% of households had access to at least 1 provider offering 900+ Mbps speeds

⁸⁵ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁸⁶ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

⁸⁷ www.fcc.gov/general/changes-form-477-data-collection-2014

⁸⁸ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

1 while in 2019 that number increased to 81%.⁸⁹ Likewise, there has been an increase in broadband
 2 speeds in areas where at least two providers are present. Looking at 2014 data, only 14% of
 3 households had at least two provider options of download speeds of 100 Mbps or higher; by
 4 2019 this number quadrupled to 63% (47% at 100 Mbps or higher plus 16% at 900 Mbps or
 5 higher).⁹⁰

Figure U: Vermont Broadband Coverage by Speed, % of CB HHs, Fastest Provider⁹¹

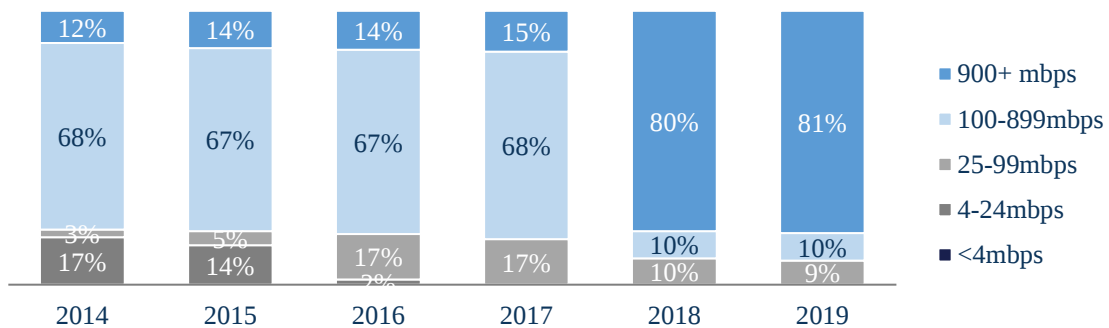
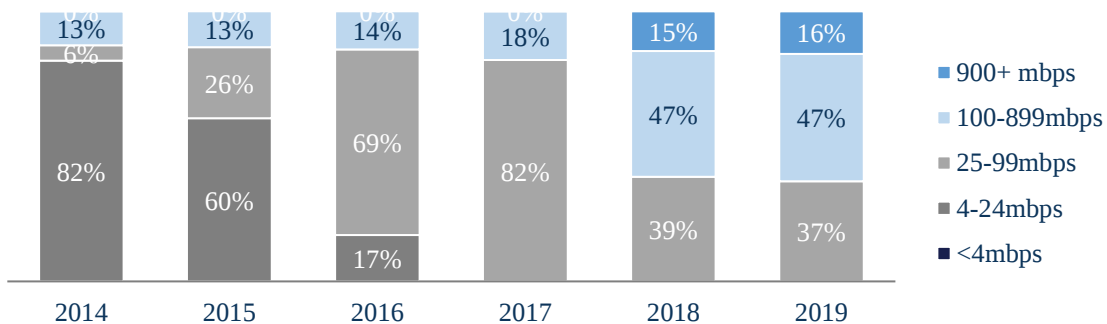


Figure V: Vermont Broadband Coverage by Speed, % of CB HHs, 2 or More Providers⁹²



⁸⁹ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

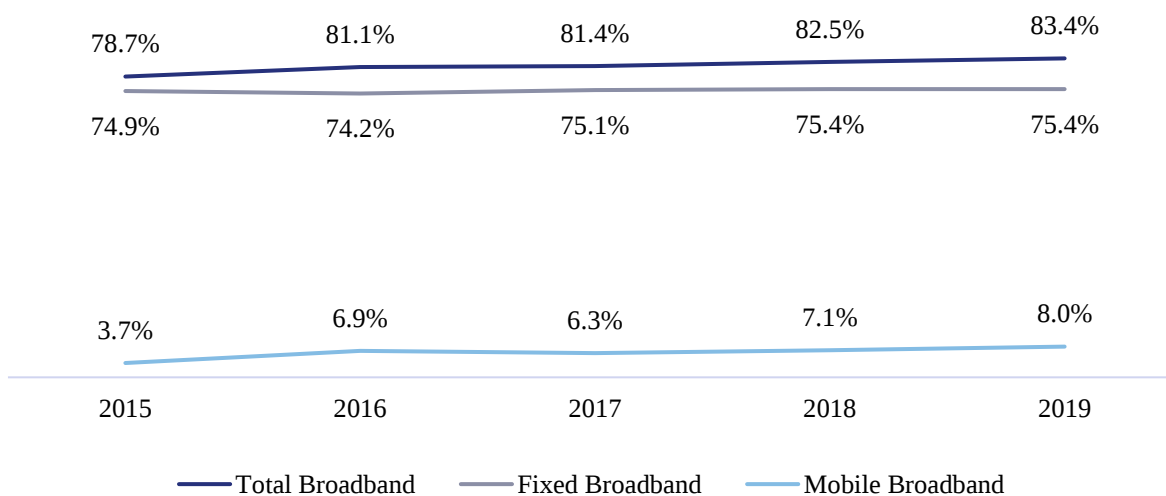
⁹⁰ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>

⁹¹ FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey, 2014-2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁹² FCC Form 477, December 2014 to December 2019, <https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477>; US Census American Community Survey 2014-2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

Broadband penetration levels had reached 83.4% in Vermont as of 2019, adding 4.7% since 2015 and 1.0% over 2018, see chart below.⁹³ Much of the growth in broadband penetration levels in Vermont has come from households adopting mobile data plans as their only broadband subscription, doubling between 2014 and 2019 to 8% of Vermont households, while fixed broadband penetration remained relatively flat at 75%.⁹⁴ The increase in bandwidth capabilities in mobile from 3G to 4G has enabled mobile to be more attractive to consumers as a primary broadband source. The expansion of 5G networks in Vermont will continue to provide consumers with higher bandwidth choice for mobile broadband.

Figure W: Vermont Broadband Subscriptions as Percent of Households, 2015-2019⁹⁵



⁹³ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁹⁴ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

⁹⁵ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>; US Census American Community Survey, 2019, <https://www.census.gov/acs/www/data/data-tables-and-tools/subject-tables/>, <https://www.fcc.gov/staff-block-estimates>

Recent Rural Development Opportunity Fund (RDOF) auctions will result in additional providers offering higher broadband speeds in rural areas in Vermont. In November 2020, four providers won the FCC’s Phase 1 Auction to provide these services: SpaceX’s Starlink will offer download speeds of at least 50 Mbps via its low orbit satellite technology to about 1,500 Vermont households, while Consolidated, NRTC, and Charter will offer gigabit speeds to an additional approximate 11,000 households.⁹⁶

Figure X: Vermont FCC RDOF Auction Results⁹⁷

Winning Bidder	HHs	HUs	Speed
Consolidated Communications	6,724	9,406	Gigabit
NRTC	4,299	6,707	Gigabit
Spectrum (previously Charter)	62	69	Gigabit
SpaceX / Starlink	1,468	2,049	50 Mbps DL
Total	12,553	18,231	

In addition to federal funding via RDOF, the State of Vermont has made funding available for the buildout of broadband networks through various programs, including through recently enacted Act 71. Additionally, Vermont Communications Union Districts (CUDs) are consortiums of towns collaborating to build communication infrastructure. One CUD, EC Fiber, currently has an operational fiber network, built and operated by Valleyenet; it has plans for additional expansion in Windsor and Orange counties.⁹⁸ Other CUDs have recently announced partnerships with GWI/Valleyenet (DV Fiber)⁹⁹ and Waitsfield Champlain Valley Telecom (Maple Broadband¹⁰⁰ and NEK Broadband¹⁰¹), while other CUDs are in the planning and RFP

⁹⁶ FCC RDOF auction results www.fcc.gov/auction/904/round-results

⁹⁷ FCC RDOF auction results www.fcc.gov/auction/904/round-results

⁹⁸ <https://www.ecfiber.net/about-us/>

⁹⁹ <https://dvfiber.net/dvfiber-to-partner-with-great-western-internet-to-secure-broadband-access/>

¹⁰⁰ <https://addisonindependent.com/news/county-internet-utility-finds-partner-seeks-funding>

¹⁰¹ <https://www.telecompetitor.com/vermont-telco-wins-partnership-broadband-deal-with-another-cud/>

1 processes. It is expected that all of Vermont's nearly a dozen CUDs will eventually provide high
2 speed broadband options to their towns' residents.

3 Based on the historical trajectory of broadband expansion, recent announcements for
4 network plans, and the availability of additional federal and state funding, growth in broadband
5 availability and speeds can be expected to continue.

6 **B. Trends in the Voice Market**

7 The key trends in the voice market have included three areas of growth: 1) mobile-only
8 households, 2) facilities-based VoIP with Cable MSOs and overbuilders, and 3) OTT VoIP.
9 While provider types in these categories have grown voice lines, switched lines have declined.
10 Each of these trends has continued monotonically during the 2014 to 2019 period, inclusive of
11 2019, with no significant change suggesting a trend reversal. Therefore, it is reasonable to
12 conclude that each of these trends will likely continue.

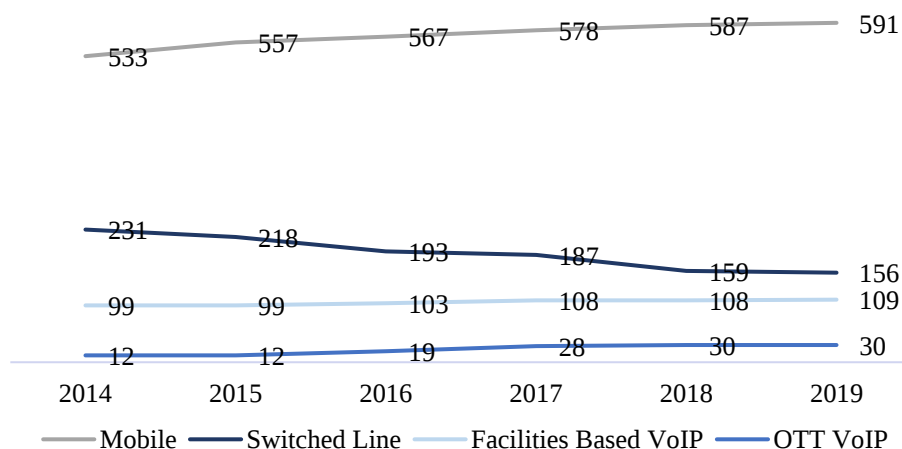
13 Between 2014 and 2019, mobile voice lines grew by 11%.¹⁰² Facilities-based VoIP grew
14 by 10% over the same period.¹⁰³ OTT VoIP subscriptions grew by 150% with a compound
15 annual growth rate of 20%.¹⁰⁴ Meanwhile, switched voice lines in Vermont declined by 32%
16 during this period.

¹⁰² FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

¹⁰³ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

¹⁰⁴ FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>

Figure Y: Vermont Voice Lines (000s), 2014-2019¹⁰⁵



1 Given the continued likely expansion in mobile 5G networks and broadband FTTP
 2 networks, and resulting increase in consumer choice, growth in consumer adoption of broadband
 3 and of non-switched landline voice, specifically, mobile and Voice over IP (both facilities-based
 4 and over-the-top) is likely to continue.

5 **Q12. Does this conclude your testimony?**

6 **A12. Yes.**

¹⁰⁵ Lines refers to switched access lines and VoIP subscriptions, FCC Voice Telephone Services Report, June 2019, <https://www.fcc.gov/voice-telephone-services-report>