

BROADBAND IS FUNDAMENTAL TO EMERGENCY RESPONSE

COVID-19 Response 2020

Interim Fixed Wireless Proposal

Executive Summary

The following proposal integrates the best commercially available technology in response to the connectivity needs of telehealth, distance education, community broadband, public safety radio, electric grid resilience and mobile wireless.

The proposal has great potential to rapidly achieve a real return on prior wireless infrastructure investments of public funds in a timeframe to address the response to urgent needs while also implementing integrated planning so as to provide a foundation to meet future requirements. This is intended to be accomplished in a manner to remain adaptive to emerging strategies as are likely to be detailed in the next Vermont Ten Year Telecommunications Plan.

It is proposed here that the Vermont Legislature make a prompt decision that will set in motion a plan to provide predictable, functional, interim broadband connectivity to all crisis workers, emergency personnel and nearly all Vermont students, teachers, remote workers, telemedicine patients, clinicians and counselors by the end of calendar year 2020. The prospect of achieving success, in June, 2020, with only six months available before the onset of winter, depends on near immediate legislative action.

I. Background

Broadband expansion is now urgent as never before. The COVID pandemic has driven emergency workers, schools, universities, hospitals, medical professionals, legislators and other businesses offering jobs in Vermont to rapidly scale up their use of broadband-based communications and learning technologies. Yet the chronic gaps in broadband coverage across the state have unfairly excluded many students, teachers, administrators, clinicians, patients and businesses from effectively utilizing these services even as the needs are more urgent.

Experts anticipate that the COVID-19 public health emergency will continue for the next 12-18 months, with recurring virus outbreaks and a continuing need to impose social distance requirements until a vaccine is developed, distributed and administered. Schools are closed now, but it is not clear whether they can be opened in the fall with

anything like normal operations. Even if they do open, they may not stay open. Vermonters are therefore developing contingency plans for their schools and businesses that rely heavily on broadband communications. The level of Vermont's emergency preparedness response to COVID-19 and broadband needs simply cannot be overstated.

The Legislature is correctly looking for the best strategy to provide more support for this emergency response, distance learning, remote work and telehealth by expanding broadband coverage as widely and as soon as possible.

Federal law has now added to the urgency by making substantial response funds available on a time limited basis. Vermont legislators are considering the use of up to \$100M of the \$1.25B in COVID/ CRF CARES funds for broadband improvements to reach currently unserved Vermonters' addresses. The most recent guidance from the United States Treasury requires that the broadband benefits accruing from the use of the funds be realized before the public health emergency passes.¹ While the pandemic may continue for years, it is understood that the available CARES funds must be expended before December 30, 2020. Given the complexity of developing equipment supply chains, the limited availability of skilled tradespersons and installers and Vermont's early winter weather, prompt decision making by both the legislature and Governor will be critical to the success of this effort by the end of the year.

A. Wired or Wireless

One approach to this problem would be to fund new fiber builds. Fiber provides by far the best, upgradable world class broadband service, but it cannot be quickly designed, installed and made operational. To the extent that fiber projects are not already engineered and under construction, completion by this fall is unlikely. The normal 180 day delays in creating pole attachment access already would, if left unchanged, bring us to year end. Therefore, construction of any new fiber routes by any of the current players cannot be a solution to our broadband requirements this year, even if projects already under way will reach some number of locations this year.

¹ The most recent May 28, 2020 guidance from the US Treasury on eligible use of the COVID/ CRF CARES funds addresses broadband as a "Frequently Asked Question" and responds as follows:

Q: May recipients use Fund payments to expand rural broadband capacity to assist with distance learning and telework?"

A: "Such expenditures would only be permissible if they are necessary for the public health emergency. The cost of projects that would not be expected to increase capacity to a significant extent until the need for distance learning and telework have passed due to this public health emergency would not be necessary due to the public health emergency and thus would not be eligible uses of Fund payments."

Another proposed approach is to fund incremental line extensions of existing wireline services, such as coaxial cable TV lines or to upgrade telephone company DSL equipment. This option does not offer a comprehensive approach statewide and will still require pole attachments and construction and their concomitant lead times. The multi-year approach currently proposed for such support relies on reverse auctions, which have highly unpredictable results. An auction might possibly expend any funds appropriated, but it would be unlikely to produce ubiquitous broadband and will certainly not do so within the CARES funding window.

Conversely, wireless broadband strategies are rapidly deployable, even during the remainder of 2020 (assuming the most favorable conditions). A statewide project to provide fixed wireless broadband in currently unserved areas is still possible at this point, but has a severe time constraint. First, the necessary decisions and funding commitments must be in place to allow sufficient lead times for manufacturers and distributors to deliver necessary equipment. Second, we must quickly organize a group of very competent people with the skills to plan and safely deploy a large number of wireless radios and antennas both on towers/poles and in customers' homes and businesses, and arrange for required fiber or microwave backhaul. Thirdly, the necessary staff and subcontractors will need time to convene and schedule the installation teams and tradespersons. Fourth, regulatory obstacles to building vertical assets, even new roadside utility poles, as wireless support structures will need to be overcome. Finally, if early onset winter weather precludes antenna installation on towers, delays will be unavoidable and may risk CARES funding for parts of the planned capital expenditures.

B. Fixed or Mobile

Wireless broadband service comes in two flavors, fixed wireless and mobile wireless. While mobile wireless service is important, even essential for emergency calling along highways and for other reasons, fixed wireless is the fastest and best available method of delivering residential and business broadband as an interim strategy until fiber can be built to most or all E911 locations over the next several years.

Cellular mobile carriers do provide data services. But the data speeds are generally much slower and the costs can be much higher, particularly for customers who rely heavily on data and require streaming video services. If only mobile cell service is present at a location, the situation would require the provider to waive data caps and overage charges or the government to provide subsidies, neither of which seem to be viable. The speed may still be inadequate. For example, AT&T only promises a speed of 10/1 on the parts of its mobile network that are also used for fixed broadband delivery under its federal Connect America Fund obligation.

Fixed wireless service on the other hand is provided today by a small number of Wireless Internet Service Providers (WISPs) such as Cloud Alliance in central Vermont and VTel. The largest fixed wireless provider in Vermont is VTel Wireless. Much of the current fixed wireless service does not meet the current FCC broadband definition of 25/3 Mbps. and may not simultaneously support remote work, distance learning and videoconferencing.

C. Existing VTel Infrastructure

Nearly a decade ago, Vermont, as part of the American Recovery and Reinvestment Act, invested some millions of dollars in the VTel Wireless project. The state's expectations were not met, and some bad feelings persist to this day. Nevertheless, VTel has constructed a modern telecommunications infrastructure able to support both fixed and mobile wireless, and did so in part at state expense. That equipment offers a stable and useful foundation from which to quickly expand broadband coverage and speeds in Vermont using wireless technology.

- VTel today has approximately 155 cell towers, with a few major wireless customers. The very successful GMP SmartGrid, which operates the state's largest electric distribution network, including GMP's smart meters, sends data reliably across the VTel Wireless network.²
- VTel also has a large, 1700 mile fiber optic transport network, which provides "backhaul" for many of its cell towers as well as high capacity, redundant "Internet pipes" to Montreal, Boston and New York.
- VTEL has acquired a large amount of radio spectrum in Vermont, also extending into New York and New Hampshire, a limited and expensive resource. This spectrum could be very useful to support efforts to extend fixed wireless broadband. Some of the spectrum is at relatively low frequencies and is particularly useful for rural fixed and mobile wireless services where higher frequencies are frequently blocked by rugged topography and leaf-on foliage.³

² Similarly, the subscribers to the VTel fiber network (built with other public and private funds) benefit today from symmetric gigabit speed broadband over fiber (for \$35/mo.) and a world class television channel package.

³ VTel long ago secured Band 12, 700 MHz spectrum, an advantage that is held by AT&T across much of the rest of the country. This spectrum works extremely well to reach further up into Vermont's many valleys and hollows and not be blocked by foliage. Low band spectrum is also more effective at penetrating buildings and as such is valued by public safety professionals.

VTel's CEO has recently presented conceptual offers to allow the State of Vermont or the CUDs to utilize the company's unused "BRS" spectrum.⁴ This offer creates the opportunity of rapidly expanding broadband by deploying BRS radios and antennas on existing towers and utility poles, as well as on hundreds of new utility poles that can support small cells, but only where fiber backhaul is available, even without electric grid power present.

VTel has also recently applied to the federal Rural Utilities Service (RUS) for funding to upgrade 102 of its existing wireless radios on towers to use the BRS spectrum with the latest generation of transmitter/receivers. Should the RUS funding be awarded quickly, that step alone could allow VTel to offer fixed broadband by year-end to many of the unserved addresses identified by the Public Service Department. The BRS technology when deployed can reportedly serve many of these addresses at speeds equal to or better than traditional 25/3 cable broadband.⁵ BRS radios and spectrum therefore can be today considered the best commercially available technology and one that is unlikely to become obsolete or outmoded in the near future.

Band 12 (700 MHz low band) provides a complementary service. BRS has very high capacity but is moderately sensitive to blockage by foliage and walls. Low band has less capacity but is uniquely suited to reach the smaller numbers of homes otherwise not reachable by fixed or mobile networks. Low band small cells do not need to be mounted on actual towers; because of their greater penetrating ability, lower mounting points, such as poles, will often suffice.

D. State Planning

In the continued absence of a completed Ten Year Telecommunications Plan, the best response to the emergency is to inventory all existing telecom assets, fund the most efficient, cost effective strategy to accomplish interim wireless broadband connectivity at functional speeds, and to do so in a manner that also lays a solid foundation to support all of the policy goals of 30 VSA 202c. Those goals include competitive choice, open access, sharing existing infrastructure, enhancing mobile wireless coverage, and not investing in technology which will soon be outmoded.

⁴ "BRS" stands for "Broadband Radio Service," a term defined by the FCC for part of the 2500-2690 MHz band. It is currently used to provide high-speed, high-capacity broadband service, including two-way Internet service via cellularized communication systems.

⁵ The BRS "massive MIMO" radios installed recently in Rutland are capable of delivering hundreds of megabits per second download and 50 Mbps upload exceeding cable modem capabilities. These new BRS radios can also be configured to deliver 100/100 Mbps. symmetric service within a limited range if necessary.

II. Proposal

This proposal recommends that the Legislature appropriate up to \$100M of the CRF/CARES funds to be spent this year as described below, and closely monitored by the State Auditor. The purpose is to deploy fixed wireless broadband throughout the unserved and underserved parts of Vermont in 2020 to provide high quality broadband to as many unserved areas in Vermont as possible, to enhance mobile wireless coverage while also laying a solid planning foundation for future FTTP investments.

A. The Equipment

The new broadband service would be delivered using the following wireless equipment:

- The grantee would lease space on existing VTel towers and other locations as necessary, lease VTel spectrum⁶, and if necessary lease backhaul and network maintenance to install massive MIMO transmitters/receivers operating at BRS frequencies, thereby offering wholesale or retail fixed and mobile wireless service.
- The grantee would also aim to install between 50-100 new wooden utility poles,⁷ provide them with electric power and fiber backhaul (leased from any available provider), and install small cells to BRS standards. The poles will be installed in areas where (acknowledging the lack of current coverage data) they appear most likely to extend broadband service to the greatest number of students, teachers, remote workers and patients' locations.

The new publicly funded BRS transmitters/receivers may be required to operate as a neutral host network for both fixed and mobile wireless service. Network transport would be operated on an Open Access basis. This could mean that the equipment installed with these funds would have to provide service to all customers, retail or wholesale and including CUDs, without discrimination, and at published prices and terms.

⁶ Spectrum leasing of both BRS and 700 MHz licenses is permissible under Part 1 Subpart X of FCC Rules.

⁷ The new poles could be 70' to 90' wooden utility poles or new steel or fiberglass monopole towers. Although quickly setting these new poles will be expensive, because they will operate using a neutral host model they will be more economical in rural areas where separate poles for each provider have been deemed prohibitively costly.

B. The Grantee

Although use of the existing VTel network and equipment will be involved, VTel cannot be the grantee under current circumstances. Experience with the project ten years ago has left a residue of mutual distrust between the Department, key legislative leaders and VTel. These trust issues cannot be resolved in the time available for the COVID response. Therefore, although VTel will be intimately involved and relied upon in the project, its role will be primarily contractual and at arms-length from the state's grantee.

The emerging Communications Union Districts might choose to have an integral role in owning the newly installed small cells or even a few new macro tower sites, providing retail broadband and voice services, and installing and supporting the equipment that customers need at their home or office. It appears, however, that no CUD is presently capable and willing to step into a role with a statewide responsibility. If a CUD wishes to take responsibility for the project within a limited geographic area of the state, the state's grantee could negotiate a sub-grant to a CUD.

Developing an entirely new team, a kind of "skunk works," is a third possibility. Properly staffed, a new organization could achieve wireless broadband results far better than those achieved a decade ago. The legislature routinely grants funds to similar nonprofit agencies for a variety of purposes. Once again, however, no existing entity is presently capable and willing to take on statewide responsibility. Forming a new special purpose corporation would take too much time and could easily encounter delays because of regulatory uncertainties such as a CPG.

The fourth and final option is to revive the Vermont Telecommunications Authority. This entity already exists with broad powers as detailed in Vermont statute. Reviving this authority seems to be the simplest and most expeditious course to pursue this strategy of integrated planning and coordination, deploying fixed and mobile wireless broadband in 2020. The VTA could be quickly revived by legislation, necessarily amending or repealing the dormancy and requiring immediate board and director appointments. Board appointments should be made subject to advice and consent of the Senate.

C. Critical Elements for Success

The success of the plan depends on several critical factors.

- The project grantee will need to get to work promptly. Being fully staffed and organized by July 15 will be essential.

- The grantee must obtain access to use VTel's existing towers, spectrum and network management services at reasonable rates in order to install BRS and 700 MHz equipment by professionals selected in cooperation with VTel.
- The grantee must obtain VTel's agreement that the new equipment will be used subject to neutral host rules, with agreed upon enforcement mechanisms.⁸
- The grantee must obtain necessary backhaul for new radio locations and reasonable leasing rates from VTel, Consolidated Communications and other fiber owners, or be able to rapidly construct microwave paths to towers on fiber backhaul networks.
- The grantee must analyze existing and available GIS data and wireless propagation studies in order to identify the best sites for new utility poles and any new towers.
- The grantee must identify, in cooperation with VTel, installers and line workers capable of installing the BRS equipment and the new poles.
- The grantee must find ways, in cooperation with school districts and medical providers to effectively market the new wireless broadband service, including providing customer service and support. BRS or 700 MHz customer-premise radios will need to be professionally installed on homes; customers will need help to install WiFi access points and computers so that they can benefit from the fixed wireless service.
- The Legislature will need to finally resolve the issue of who pays geolocation costs for the E911 system, and whether to pay for these costs from the Universal Service Fund as part of the 911 system costs. The small cell densification elements of this proposal providing coverage for mobile wireless cannot be expected to carry the E911 costs, nor be economical to operate without mobile roaming revenue.

⁸ Were VTel infrastructure be used to support the a neutral host operation its market position providing its towers, fiber and spectrum as a neutral host infrastructure provider in Vermont, it may result in VTel being in a far superior position to support shared tower space, wholesale fixed and mobile wireless service, core switching, roaming agreement management, and carrier settlements in partnership with the numerous emergent CUDs, supporting both high-speed broadband, in-fill mobile wireless using both public and privately owned small cells, hardening and resiliency and LMR public safety radio repeater connectivity needs.

III. Conclusion

What is here proposed is a very well integrated short-term strategy to get high quality broadband to all or most people currently unserved in Vermont by the end of this calendar year. The proposal utilizes the best available technologies. It offers to place new utility poles in a thoughtful way that allows for future fine-tuning of the locations of the small cells to in-fill the mobile wireless network. It offers opportunities in the future to convert fiber runs that are now used only for wireless backhaul into multi-use resilient rings that support more demanding services including public safety radio and other uses. In this way the state can solve its immediate problem and also position itself well for even larger anticipated broadband infrastructure stimulus funds which might become available in the coming years.

By utilizing shared infrastructure with a neutral host operator model, and by building on earlier investments made by the State, VTel and other providers, this proposal can better integrate and realize the benefits of a broadband infrastructure, better support competition, enhance resiliency and improve contingency planning in preparation for future emergencies.

Appendix: VTel Radio Frequency Spectrum holdings:

A. 700 MHz Lo-Band spectrum

VTel owns Band 12 licenses for 12 MHz of 700 MHz spectrum across all of Vermont and portions of neighboring states East and West. These consist of a pair of 5 MHz channels at 710-716 MHz and 740-746 MHz statewide, in Blocks C & D; as well as a second pair of 5 MHz channels at 704-710 MHz and 734-740 MHz in Chittenden County, including the Lake Champlain Islands, in Blocks A, B & E. Together these spectrum holdings represent a total of 24 MHz of extremely robust, building and foliage penetrating, voice and lower speed data spectrum in the most populated part of Vermont.

B. AWS Mid-Band spectrum

VTel owns Band 4 licenses for 90 MHz of spectrum located at 1710-1755 MHz and 2110-2155 MHz. VTel is currently using only 20 MHz of this AWS spectrum with the installed radios on 165 towers covering much of Vermont. The installed radios offer fixed wireless Internet service, and also provide limited 4G/LTE mobile voice and data services by roaming with other carriers whose tower density complements VTel's.

C. BRS Mid-Band spectrum

VTel owns Band 41 licenses for 72 MHz of spectrum in the 2500 MHz (2.5GHz) range and has applied for \$28M in RUS funding support for accelerated deployment of this 72 MHz of rural BRS spectrum using new Ericsson 5G massive MIMO radios as upgrades to 102 of it's 153 towers across Vermont. The new BRS massive MIMO technology is reportedly capable of delivering 300-500 Mbps aggregate download speeds and 50Mbps upload speeds, with the ratio of upload and download speeds tunable.

Channel Plan:	Channel Number:	Frequency:	
New	BRS1	002496.00000000 - 002502.00000000 MHz	6MHz
New	BRS2	002618.00000000 - 002624.00000000 MHz	6MHz
New	E1	002624.00000000 - 002629.50000000 MHz	5.5MHz
New	E2	002629.50000000 - 002635.00000000 MHz	6MHz
New	E3	002635.00000000 - 002640.50000000 MHz	5.5MHz
New	E4	002608.00000000 - 002614.00000000 MHz	6MHz

New	F1	002640.50000000 - 002646.00000000 MHz	6MHz
New	F2	002646.00000000 - 002651.50000000 MHz	5.5MHz
New	F3	002651.50000000 - 002657.00000000 MHz	5.5MHz
New	F4	002602.00000000 - 002608.00000000 MHz	6MHz
New	H1	002657.00000000 - 002662.50000000 MHz	5.5MHz
New	H2	002662.50000000 - 002668.00000000 MHz	5.5MHz
New	H3	002668.00000000 - 002673.50000000 MHz	5.5MHz

D. High-Band Spectrum

In 2019-20 VTel bid in FCC Auction 103, known as the Spectrum Frontier Auction, and may have acquired an additional 300 MHz of high-band spectrum for 5G. (Upper 37 GHz/39 GHz and 47 GHz)

E. CBRS Mid-Band Spectrum

Last year, the FCC opened 150 MHz of CBRS frequencies (Band 48), and in fall 2020 will auction 70 MHz of Priority Access Licenses on a county by county basis. This band is thus usable on both an auctioned priority basis and on a free “licensed by rule” General Authorized Access basis.

F. Mobile Wireless Roaming Agreements

VTel has completed negotiation of roaming agreements with AT&T and Sprint / T-Mobile for commercial roaming of voice and data traffic, not including Band 14 spectrum used for FirstNet. A separate roaming agreement would need to be negotiated with AT&T to assure interoperability with the FirstNet QoS, Priority and Preemption features required for public safety first responders available from both Verizon Wireless and FirstNet.