Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Petition of General Communication, Inc. for Waiver of Certain Channelization and Other Restrictions on Common Carrier Fixed Point-to-Point Operations between 6425 and 7125 MHz

AMENDED PETITION OF GENERAL COMMUNICATION, INC. FOR WAIVER OF CERTAIN CHANNELIZATION AND OTHER RESTRICTIONS ON COMMON CARRIER FIXED POINT-TO-POINT OPERATIONS BETWEEN 6425 AND 7125 MHZ

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AMENDED PETITION FOR WAIVER

General Communication, Inc. ("GCI") hereby petitions the Federal Communications Commission ("FCC" or "Commission") to waive certain channelization and other limitations in the Upper 6 GHz bands (i.e., 6425–6525 MHz, 6525–6875 MHz, and 6875–7125 MHz), consistent with ITU-R Rec. F-384, to substantially increase the capacity of TERRA, GCI's rural broadband system, through more efficient spectrum utilization. GCI seeks authorization to deploy common carrier fixed point-to-point microwave service using wider, 60 MHz channels across the three Upper 6 GHz sub-bands in a narrowly defined area of rural Alaska. GCI limits this waiver request to current TERRA microwave sites identified at Appendix A, and microwave paths directly connected to those sites. The current TERRA backbone radio system capacity is approximately 3 Gbps. Under the current rules restraining use of the Upper 6 GHz bands, GCI could add about 3.5 Gbps. If the FCC grants GCI's request for a waiver herein, GCI would be able to use the Upper 6 GHz band in the most spectrally efficient manner to create a TERRA backbone capacity of almost 14 Gbps without requiring extensive new construction, which Alaska's unique conditions would render infeasible.

I. INTRODUCTION AND SUMMARY

The Commission concluded in its 2015 Broadband Progress Report that "Americans living in rural areas and on Tribal lands disproportionately lack access to broadband."[1] General Communication, Inc. ("GCI") has worked hard to address this disparity through its TERRA network, the first terrestrial (i.e., non-satellite) middle-mile network in western Alaska. TERRA is a hybrid fiber-microwave network that provides broadband to more than 70 isolated, mostly Alaska Native communities. GCI continues to upgrade and expand TERRA, but the backbone paths of the microwave system are nearing capacity.

The requested waiver of certain channelization and other limitations in the Upper 6 GHz bands will advance the public interest by allowing GCI to efficiently use otherwise idle spectrum, increasing middle-mile broadband capacity in rural Alaska by almost 40% (7.045 Gbps[2]) over what is achievable pursuant to the current rules. That increase is greater than the current capacity of the entire TERRA network. Because GCI limits its request to current TERRA microwave sites identified at Appendix A, and microwave paths directly connected to those sites, the waiver will not disrupt any service providers in the market, thereby benefitting the public interest with no cost.

Due to the unique challenges of serving Alaska's rural communities, this waiver is the only technically and economically feasible option to satisfy growing demand on GCI's TERRA

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[1] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, 2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment, 30 FCC Rcd. 1375, ¶ 6 (2015) ("2015 Broadband Progress Report").

[2] As explained in further detail in Section II.3, capacity doubles once the TERRA network is "ringed."

network in the foreseeable future. GCI urges the FCC to approve this waiver expeditiously, because GCI needs to work with third parties to develop and manufacture new radios, deploy the equipment, and incorporate the new equipment into the network before demand exceeds capacity.[3]

II. BACKGROUND

GCI's TERRA network is an innovative effort to bring modern broadband services to some of the most rural communities in the United States. Inaugurated in 2012, the TERRA network now connects more than 70 communities in western Alaska, with new communities coming online every year. TERRA is often the *only* terrestrial, low latency, broadband service available in these remote communities.

Given the low population density, high infrastructure deployment costs, and low revenue opportunity, it is necessary to deploy communications infrastructure as efficiently as possible. Without the ability to increase bandwidth efficiently, GCI will be unable to keep up with the exponential growth in demand for bandwidth from our existing customers while expanding the TERRA network to new communities that currently lack any terrestrial broadband options. Providing communications services in rural Alaska is always difficult. The inability to use spectrum as efficiently as possible can make that objective unattainable.

1. The TERRA Network is Critical to Rural Alaska

GCI serves Alaskans with the fastest and largest wireless network in the State of Alaska, so GCI agrees with Chairman Wheeler's assessment that "[b]roadband connectivity can overcome geographic isolation and put a world of information and economic opportunity at the

[3] *See* Declaration of Gene Strid, ¶ 7, appended as Appendix B hereto ("Strid Decl.").

fingertips of citizens in even the most remote communities."[4] And GCI also understands the "hard truth [that] there is a digital divide that particularly impacts rural America."[5] While microwave cannot match fiber in terms of the capacity and costs per unit of capacity, TERRA has substantially improved broadband connectivity in rural Alaska by providing terrestrial service that supports not only consumer Internet service in rural communities, but also supports bandwidth-hungry, latency-sensitive services like interactive distance learning and telemedicine.[6]

GCI knows full well that "[i]f you live hours from the nearest hospital, a broadband connection allows you to be treated remotely by a world-class specialist."[7] But the importance of TERRA to telemedicine in Alaska is even more profound: due to the remote geography, the lack of roads connecting Alaska Native villages, and the dearth of local medical professionals, medicine *is* telemedicine in many of the communities TERRA serves.[8] Without telemedicine, residents seeking care in many remote villages can either wait for a sporadic visit from a traveling doctor or travel vast distances—usually an expensive plane trip—to seek necessary

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[4] Tom Wheeler, Chairman, FCC, Closing the Digital Divide in Rural America (Nov. 20, 2014), https://www.fcc.gov/news-events/blog/2014/11/20/closing-digital-divide-rural-america?page=3.

[5] *Id.*

[6] *See* 2015 Broadband Progress Report ¶¶ 30-32, 50.

[7] Tom Wheeler, Chairman, FCC, NTCA Fall Conference, Boston, Massachusetts, at 2 (Sept. 21, 2015), https://apps.fcc.gov/edocs_public/attachmatch/DOC-335375A1.pdf ("Chairman Wheeler's Remarks at NTCA").

[8] *See* GCI, ConnectMD, http://www.connectmd.com/ (last visited Aug. 13, 2015) (The TERRA network supports, for example, teleradiology, telepsychiatry, remote patient monitoring, medical network solutions, and live video-conferencing between healthcare providers and patients in rural Alaska. Such services improve healthcare in areas that traditionally have few physicians and even fewer medical specialists.).

medical treatment.[9] Often for our customers, neither option is accessible at a time of need due to cost and/or weather during the long, harsh Alaskan winter.

Access to broadband is also crucial to teachers and students in these rural areas. Broadband access "provides customized teaching opportunities as teachers can access online interactive content and offer real-time student performance assessments" and connects rural students to educational opportunities that might otherwise have been impossible.[10] Unfortunately, market dynamics often dictate that rural schools, which would most benefit from distance learning, are also the least able to access broadband.[11] TERRA, however, extends these benefits beyond students in wealthy or urban areas.

2. Construction and Maintenance of the TERRA Network is a Monumental Task

Alaska is home to some of the most difficult geography in North America and regularly experiences unforgiving weather that hinders construction and threatens network availability. The communities the TERRA network serves are separated by vast distances and cannot be reached by road. The TERRA backbone consists of more than 2,000 miles of microwave links

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[9] For example, "the transportation costs, and then all of the other unintended costs that go along with that, traveling through Alaska [are a problem] . . . you're out of your village. You have costs if someone travels with you. You have food and lodging." Joaqlin Estus, *Study Shows Telepsychiatry Effective for Alaska Elders*, NEW AMERICA MEDIA (Feb. 13, 2014), http://newamericamedia.org/2014/02/study-shows-telepsychiatry-effective-for-alaska-elders.php (internal quotations omitted).

[10] 2015 Broadband Progress Report ¶ 56.

[11] *Id.* ¶ 138. *See also* Chairman Wheeler's Remarks at NTCA at 2. ("If you are a student and your rural high school doesn't offer advanced calculus or physics, the Internet allows you to take a class online at a neighboring school or even MIT.").

and 400 miles of fiber. Overall, the backbone would span roughly the distance from Washington, DC to Las Vegas, NV.[12]

GCI relies on fiber where possible, but it is not feasible to bury fiber throughout much of vast, inhospitable, and federally protected areas of western Alaska. While high-capacity fiber is often the technology of choice for core networks or dense urban environments, building fiber to all, or even most, Alaskan locations currently is logistically, technologically, operationally, and economically infeasible.[13]

As an initial matter, much of the land in rural Alaska is protected by numerous federal and state laws that limit human activity, including the Alaska National Interest Lands Conservation Act, the National Wildlife Refuge System Administration Act, the National Wildlife Refuge System Improvement Act of 1997, the Wilderness Act, the Wild and Scenic Rivers Act, the Marine Mammal Protection Act, and the Arctic Refuge Comprehensive Conservation Plan. Even absent federal land regulations, long fiber runs over Arctic tundra would need to be safeguarded against damage caused by the complex and changing structure of permafrost, which can range in thickness from a single meter to many hundreds of meters. Uneven freezing and thawing at or near the surface can result in dramatic changes to landforms, such as ice wedges (i.e., growing cracks in the ground) and pingos (i.e., small hills that arise quickly due to subsurface pressures), which could damage communications equipment.[14]

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[12] *See* TERRA network map at Appendix A.

[13] *See, e.g.*, Comments of General Communication, Inc., *Telecommunications Assessment of the Arctic Region*, NTIA Docket No. 140925800-4800-01 (filed Dec. 4, 2014).

[14] U.S. FISH & WILDLIFE SERV., *Ice Wedges, Polygons, and Pingos* (last visited Nov. 26, 2014), http://www.fws.gov/refuge/arctic/permcycle.html (describing the process by which the permafrost cycles through these changes); NAT'L SNOW & ICE DATA CTR., *All About Frozen Ground – How Does Frozen Ground Affect Land?* (last visited Nov. 26, 2014),

Even subsea fiber optic cable in the Arctic Ocean would not obviate the need for increased TERRA capacity. Such facilities would reach only coastal communities and thus would not solve the challenge of expanding broadband to rural Alaska's many isolated inland communities. Moreover, all submarine cables are at risk for occasional faults, i.e., manmade or natural events requiring maintenance or repair to ensure continuing functioning of those cables. GCI believes that the ice in the Arctic Ocean in the winter months could delay the ability to remedy such faults. Accordingly, GCI is unlikely to rely solely on such facilities without the availability of potentially expensive redundant backup capacity.

Because of the impediments to an extensive, reliable fiber optic solution, most of the TERRA network relies on microwave technology. Constructing a microwave middle-mile network in the face of all of Alaska's challenges, including an annual construction season that is only a few months long, was and continues to be a monumental achievement.

Overcoming those challenges is not only difficult, but also expensive. Most of the communities that TERRA serves are not accessible by road, and the construction of additional mountaintop repeater sites presents even greater challenges. This requires highly trained teams of engineers, construction managers, laborers, tower erectors, electricians, plumbers, diesel mechanics, and technicians operating out of remote temporary shelters for weeks at a time to build and install the towers and equipment. Parts, equipment, and supplies must be delivered by helicopter.

In addition, because rural Alaska is not connected to an intertied power grid, most communities in rural Alaska generate their own power, primarily through the use of diesel

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https://nsidc.org/cryosphere/frozenground/how_fg_affects_land.html (describing how freezing and thawing in the Arctic can change the shape of the land).

generators, often costing up to $10 per gallon for fuel.[15] Many of these rural communities pay more than 50 cents per kWh,[16] more than five times the national average for commercial retail electricity, with some paying between 60 and 90 cents per kWh for residential service.[17] GCI faces many of the same difficulties with its repeater sites—GCI must generate its own primary power with redundant diesel engine-generator sets at its mountaintop microwave repeaters, which require 18 annual helicopter trips to each site for refueling alone. These realities have a significant impact on the cost of communications infrastructure and operation.

GCI undertakes all of this effort and expense to serve a relatively small number of people. Alaska's overall population density is the lowest in the nation—1.2 persons per square mile,[18] compared to 103.8 in the Lower 48.[19] Densities in the Arctic are substantially lower still. For example, the Northwest Arctic Borough comprises a total land area of 35,573 square miles

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[15] *See* Will Swagel*, Lowering the Cost of Rural Energy, Investments in Sustainability Save Millions*, ALASKA BUSINESS MONTHLY (Sept. 3, 2014), http://www.akbizmag.com/Alaska-Business-Monthly/September-2014/Lowering-the-Cost-of-Rural-Energy/. Recently, utilities have begun adding wind turbines to the diesel systems, but these have generally slowed price increases rather than providing price reductions. There also are a small number of communities in rural Alaska that use hydroelectric or other renewable resources, but they are atypical.

[16] *See* Alaska Village Elec. Coop., *Table of Small Commercial Rates* (effective as of Jan. 1, 2015), http://avec.org/wp-content/uploads/2014/11/RatesforWebsite2015SC.pdf.

[17] *See* U.S. ENERGY INFO. ADMIN., *Table 5.3. Average Price of Electricity to Ultimate Customers: Total by End-Use Sector, 2005 – December 2015*, Electric Power Monthly (last visited Sept. 18, 2014), http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm ?t=epmt_5_3 (displaying year-to-date through September 2014 and 2013 data).

[18] *See* U.S. CENSUS BUREAU, *Statistical Abstract of the United States: 2012*, at 19 (last visited Dec. 2, 2014), http://www2.census.gov/library/publications/2011/compendia/statab/ 131ed/2012-statab.pdf (Table 14. State Population—Rank, Percent Change, and Population Density: 1980 to 2010).

[19] *See* U.S. CENSUS BUREAU, *Population Density for States and Puerto Rico: July 1, 2009* (last visited Jan. 17, 2012), https://www.census.gov/popest/data/maps/2009/pop_density2009.pdf.

(larger than Maryland) and is home to only 7,523 residents—just 0.2 persons per square mile, or one-five-hundredth of the overall density of the Lower 48.[20] Many Arctic communities are extremely tiny, with residents numbering in the tens to hundreds. Though small, they cannot be forgotten. Indeed, because these communities are so small and isolated, the FCC should make every effort to facilitate increased access to broadband wherever feasible, such as with the requested waiver herein.

3. Expanding Capacity on the TERRA Network

Despite these obstacles, GCI is working to expand the TERRA network to new communities and to satisfy growing demand in the communities it already serves. By 2018 GCI will "ring" TERRA, constructing two additional mountaintop repeater microwave sites between Galena and Dime to create a continuous, unbroken network. Ringing the system will improve reliability and effectively double backbone capacity, providing all traffic with two physical routes back to GCI's interconnection point in Anchorage and to the closest Tier 1 Internet POPs in Seattle or Portland.

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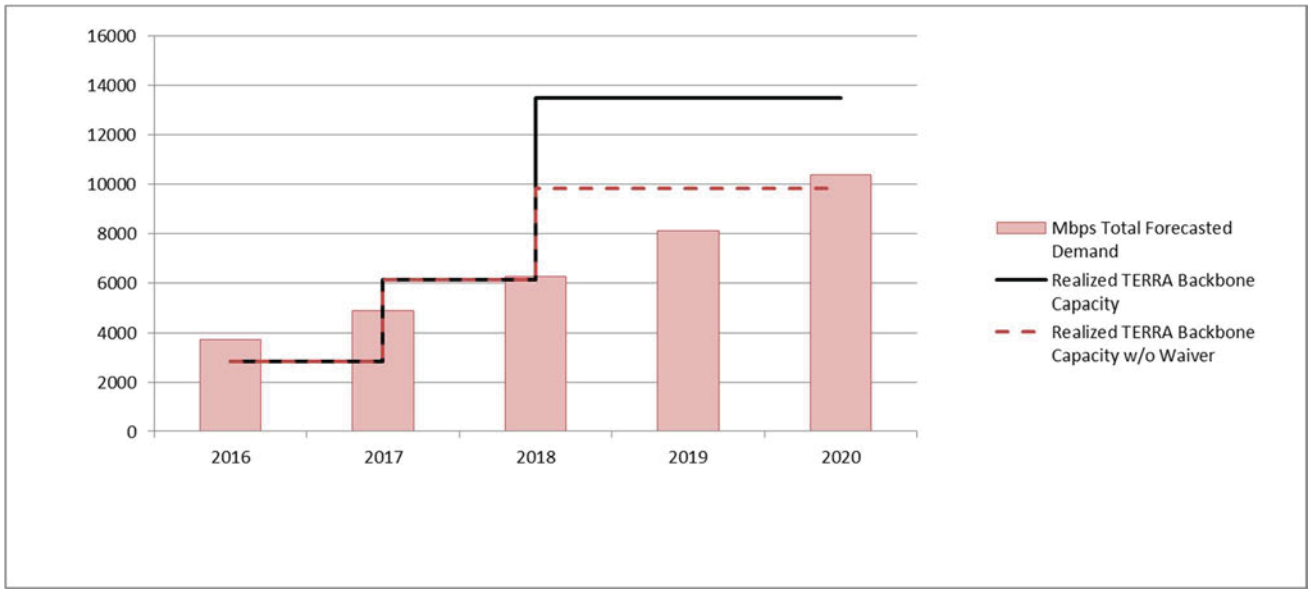
[20] *See* U.S. CENSUS BUREAU, State & County QuickFacts, *Northwest Arctic Borough, Alaska* (last visited Mar. 22, 2014), http://quickfacts.census.gov/qfd/states/02/02188.html.

FIGURE 1: TERRA Backbone Demand / Capacity (Mbps)



Due to the continually increasing demand illustrated in Figure 1 above, GCI must pursue other strategies to further increase TERRA capacity to meet consumer demand. Unfortunately, GCI cannot simply add additional microwave channels. The TERRA backbone currently uses the Lower 6 GHz band, but even operating on every Lower and Upper 6 GHz channel available under the Commission's rules without a waiver likely could only increase per-path capacity by approximately 1.761 Gbps (62% more than current capacity), and increase ringed capacity by about 3.523 Gbps. Current traffic projections will exhaust that capacity before 2020. As described below, and in the attached Declaration of Gene Strid, Appendix B, the unique constraints facing GCI in western Alaska leave GCI with no other feasible alternatives under the Commission's rules.

GCI cannot increase microwave capacity by adding additional channels outside of the 6 GHz bands, including, for example, 11 GHz spectrum. Some towers in the TERRA backbone are already near their structural limits, and could not accommodate the weight of additional antennas, waveguides, ice shielding, ice accumulation, and wind loading. Thus, supplementing

existing capacity with channels in entirely new bands would require GCI to rebuild from the ground up many of the towers of the TERRA backbone. Such a massive undertaking would make expanding TERRA capacity economically impossible given the small populations served.

And, transitioning the *entire* microwave backbone to a new band—instead of merely adding additional channels from a new frequency band—would be costly and would reduce the achievable system capacity. This approach would also require the construction of many new towers to compensate for the different propagation characteristics of those higher-frequency bands (such as 10.7 to 11.7 GHz) and minimize rain fade outages. It would also require GCI to change the equipment on every tower in the network, replacing all antennas and waveguides, again driving up costs in a network that serves a small population.

Implementing a uniform channelization scheme with 60 MHz channels pursuant to ITU-R Rec. F-384 in the 6425–7125 MHz bands will allow GCI to provide more middle-mile capacity with less equipment, allowing it to serve more Alaskans or increase the broadband capacity available to them. A key attribute and design feature of the existing TERRA microwave system is that its antennas and waveguides will operate over the entire 6 GHz spectrum, from 5.925 to 7.125 GHz. Leveraging this capability and the full use of the spectrum from 6425 to 7125 MHz will increase backbone system capacity by approximately 3.523 Gbps (7.045 Gbps after the network is ringed), an increase of 125% (as compared to the Lower 6 GHz spectrum system capacity). This would better enable GCI to meet the needs of consumers, clinics, and schools in rural Alaska well into the future. Given the costs of providing service in western Alaska, GCI urges the FCC to recognize the need to be extraordinarily efficient with spectrum channelization and bandwidth limits in this remote geographic area in order to allow GCI to keep up with demand.

III. WAIVER REQUEST

To resolve the capacity constraints described above, GCI respectfully requests that the FCC waive the following rules with respect to the current TERRA microwave sites or planned sites directly connected to the TERRA network identified at Appendix A: (1) 47 C.F.R. § 101.101 to permit GCI to use the 6425–6525 MHz band for common carrier fixed point-to-point service (Part 101, Subparts C & I) to the frequency availability for 6425–6525 MHz; (2) 47 C.F.R. § 101.109(c) to allow GCI to use 60-MHz-wide channels in frequency bands 6425 to 6525 MHz, 6525 to 6875 MHz, and 6875 to 7125 MHz; and (3) 47 C.F.R. §§ 101.147(j)-(l) to allow GCI to use an efficient, uniform 60 MHz channelization scheme, including channels that span band boundaries between the 6425–6525 MHz, 6525–6875 MHz, and 6875–7125 MHz bands.

The Commission's Lower 6 GHz rules currently allow eight 60 MHz channels of common carrier fixed point-to-point microwave service across a single 500 MHz spectrum band (5925–6425 MHz), consistent with ITU-R Rec. F-384.[21] Instead of a single continuous band that mirrors Lower 6 GHz, the Commission's Upper 6 GHz plan creates three separate bands (6425–6525 MHz; 6525–6825 MHz; and 6825–7125 MHz), the first of which is not available for common carrier microwave service under 47 C.F.R. Part 101, subpart I[22] and none of which allows 60 MHz channels. [23] A geographically limited waiver allowing GCI to use contiguous 60 MHz channels across the three Upper 6 GHz sub-bands would enable GCI to expand capacity on the TERRA network by adding more capacity with fewer radios, avoiding the need for extensive

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[21] 47 C.F.R. § 101.147(i)(9).

[22] *See* 47 C.F.R. §§ 101.101, 109(c), 147(k), (l). *See also, City of Ketchikan*, Memorandum Opinion and Order, DA 14-872, 29 FCC Rcd. 7551, 7551 (2014).

[23] *Id.*

new construction that, because of Alaska's unique conditions, would be infeasible. GCI's proposed band plan is illustrated below:

FIGURE 2: Current FCC Frequency Plan (6425–7125 MHz)

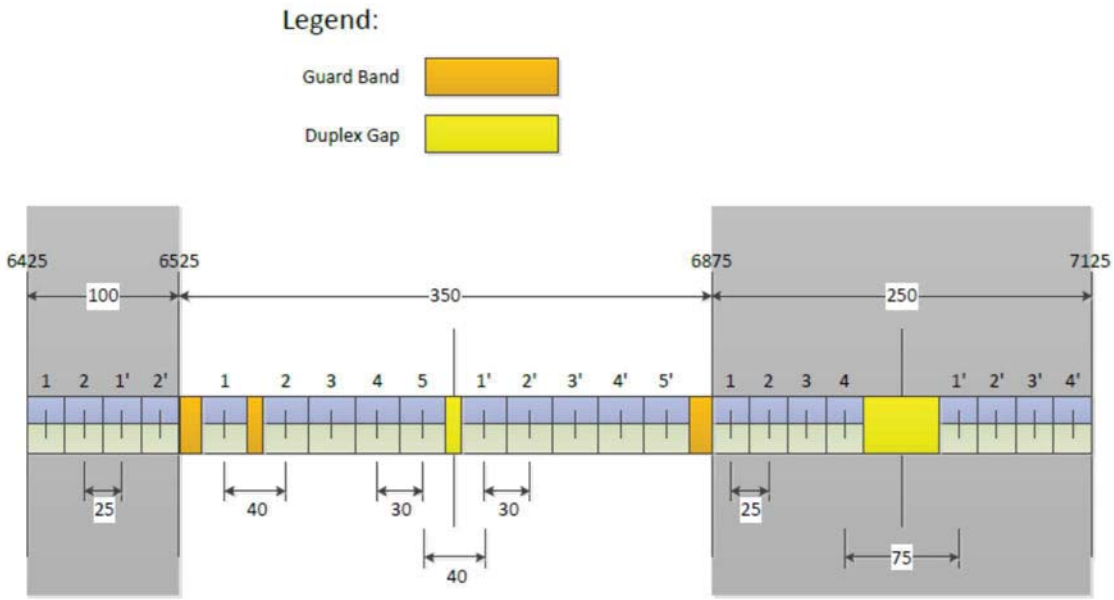
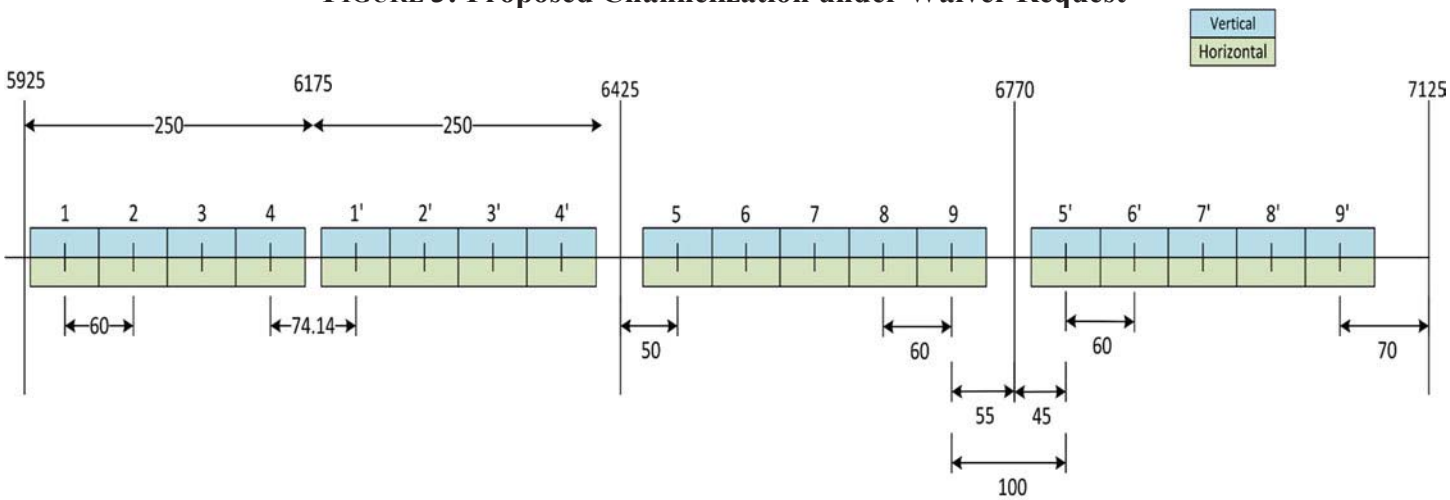


FIGURE 3: Proposed Channelization under Waiver Request



1. Waiver Standard

Waiver is appropriate under the Commission's rules if "[i]n view of unique or unusual factual circumstances of the instant case, application of the rule(s) would be inequitable, unduly burdensome or contrary to the public interest, or the applicant has no reasonable alternative."[24] The Commission's rules governing common carrier fixed point-to-point operations in the Upper 6 GHz bands impose a disproportionate burden on GCI as it seeks to serve extremely rural and uniquely challenging markets in western Alaska. The dramatic expense and permitting requirements associated with building new towers and other infrastructure in this region presents a unique situation in which the balance of these interests is very different from the rest of the United States, making this sort of unique problem ripe for a waiver.

Waiver of the Commission's rules in this case would also greatly advance the public interest with no adverse effect on other licensees. To increase capacity on the TERRA backbone, there is no other cost effective option than the use of the Upper 6 GHz band consistent with the single uniform band plan described in ITU-R Rec. F-384.[25] The current band plan will significantly and unnecessarily limit GCI's ability to bring broadband to currently unserved or underserved communities and to deliver the low-latency, high-speed connections demanded by consumers, schools, and clinics, as usage grows. Such an avoidable restriction on broadband access for rural Alaskans would clearly be contrary to the public interest.

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[24] 47 C.F.R. § 1.925(b)(3)(ii).

[25] *See* Strid Decl. ¶ 8. *See supra* at 10-11. Or, if GCI were to switch the TERRA backbone to use frequencies in the 11 GHz band, it would be required to construct numerous additional towers to compensate for the inferior propagation characteristics—and, in particular, rain fade—of these frequencies.

GCI's waiver request is geographically limited[26] to the rural portions of Alaska served by TERRA, while still providing GCI with the ability to make investments to accommodate future demand for TERRA service in additional rural villages. This geographic scope addresses potential congestion, interference, or other concerns that the Commission has voiced in other proceedings about wider channel bandwidths.[27] GCI has identified no other operators in the Upper 6 GHz bands near the TERRA backbone sites that would be affected by the proposed waiver. This waiver request therefore provides the Commission with an opportunity to greatly advance its goal of expanding access to broadband in rural areas with no harm to other users.

2. Waiver of 47 C.F.R. §101.101

GCI requests that the Commission waive 47 C.F.R. § 101.101, authorizing GCI to provide common carrier fixed point-to-point microwave service in the 6425–6525 MHz band, consistent with the rest of the 6 GHz frequencies. A waiver of these rules in the 6425–6525 MHz sub-band would enable two additional 60 MHz channels (one per polarization) in the 6425–7125 MHz spectrum, increasing potential capacity for the upper 6 GHz spectrum by 25% (705 Mbps).

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[26] GCI limited this request to the current microwave paths used at the TERRA network sites listed at Appendix A, as well as new sites that connect directly to the TERRA network. GCI proposes to operate these new sites only after notice to the Commission pursuant to its minor modification rules, 47 C.F.R. § 1.947(b), and subject to existing coordination requirements. 47 C.F.R. § 101.103. To the extent that request is inconsistent with the Commission's major and minor classification rules, 47 C.F.R. § 1.929, GCI respectfully requests a waiver of these rules as well to permit the necessary operational flexibility while simultaneously easing Commission oversight and coordination procedures.

[27] *See infra* at 16-17.

3. Waiver of 47 C.F.R. § 101.109(c)

GCI requests a waiver of 47 C.F.R. § 101.109(c), allowing GCI to use 60-MHz-wide channels throughout the Upper 6 GHz band because "[a]llowing wider channels can also result in more efficient spectrum utilization."[28] This limited waiver request is consistent with previous Commission assessments of larger Upper 6 GHz channelization in which the Commission stated that "we believe it is important to provide operators with the capability to offer faster services *wherever possible*."[29] Together with the requested waivers of 47 C.F.R. §§ 101.101 and 101.147, this request will allow GCI to create ten 60 GHz channels across all three Upper 6 GHz spectrum bands, reducing the necessary equipment, power, and overall cost to achieve higher middle-mile capacity.

The smaller channelization of the existing band plans for 6525–6875 MHz and 6875–7125 MHz would require nine radios per bay, for the Upper 6 GHz band alone. The proposed plan would require nine radios for the Lower and Upper 6 GHz bands *combined*. The additional radios required under the current channelization scheme greatly increases prime power requirements (and battery backup power needs) at each site. For GCI, this translates to fuel tank increases or replacements, new larger buildings to house the batteries, additional radios, as well as construction, installation, and labor costs. And, fitting that many radios in one bay is not likely to be feasible for current or future versions of the needed radios. Installing additional, new radio bays at each tower site and providing additional power for such radios creates the sort of construction project that the unique conditions of rural Alaska make economically infeasible.

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[28] *Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul & Other Uses & to Provide Additional Flexibility to Broad. Auxiliary Serv. & Operational Fixed Microwave Licensees*, 27 FCC Rcd. 9735, ¶ 52 (2012).

[29] *Id.* (emphasis added).

Wider channels will cause no coordination and interference challenges along the existing or planned TERRA network, where Upper 6 GHz bands currently lie fallow. GCI will work closely with a frequency coordinator, under the existing coordination procedures, to prevent interference with other licensees who seek to operate in the Upper 6 GHz bands in close proximity to the TERRA backbone in the future. This will resolve any interference concerns in a predictable and reliable manner no different than if GCI operated without a waiver.

In its 2011 decision adopting new technical rules for the 6575–6875 MHz band, the Commission mentioned the possibility of spectrum congestion as a potential concern associated with wider channels.[30] But spectrum congestion is simply not an issue in the extremely rural areas at issue in GCI's waiver request. The Commission has not identified any other substantive concerns associated with 60 MHz channels. Rather, the Commission limited bandwidths to 30 MHz channels in the 6575–6875 MHz band largely because "we have not received any requests for waivers authorizing such bandwidths in the Upper 6 GHz Band," further noting that "no commenter proposed a band plan that would accommodate 40 megahertz or wider channels."[31] Technological advances and increased consumer demand have now created the need for wider 60 MHz channels and, thus, GCI's waiver.

4. Waiver of 47 C.F.R. §§ 101.147(j)-(l)

GCI requests that the Commission waive 47 C.F.R. §§ 101.147(j)-(l) to authorize a contiguous band from 6425 to 7125 that allows 60 MHz channels to span across the current sub-bands of 6425 to 6525 MHz, 6525 to 6875 MHz, and 6875 to 7125 MHz. This will allow GCI to

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[30] *Amendment of Part 101 of the Commission's Rules to Accommodate 30 Megahertz Channels in the 6525-6875 MHz Band*, Report and Order, 25 FCC Rcd. 7760, ¶¶ 16-18 (2010).

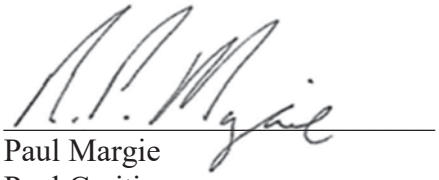
[31] *Id*. ¶ 19.

use the ten 60 MHz channels across all three Upper 6 GHz spectrum bands. Without a waiver allowing band unification, a significant amount of valuable spectrum would be stranded, or would be needed to provide duplex gaps between transmitters and receivers across three separate bands, as depicted in Figure 2. This would unnecessarily reduce the amount of Upper 6 GHz spectrum available to GCI for it to meet the needs of its customers. The incorporation of this spectrum band (6425–6525 MHz) into a uniform band plan that transcends the sub-bands of the Upper 6 GHz band would avoid stranding 100 MHz of spectrum that would otherwise go unused in rural Alaska and allow GCI to add approximately 1.4 Gbps of ringed capacity.

IV. CONCLUSION

GCI has proven time and again that it is willing and able to innovate and expand modern communications services in rural Alaska. GCI's TERRA network is another example of this commitment, and plays a critical role in providing broadband access to many of the most remote communities in the United States. Given the extreme expense of new tower construction in rural Alaska, GCI must maximize the investments made in the TERRA network to ensure its capability to provide broadband access to rural Alaskans extends as far into the future as possible. The future of the TERRA network depends on the grant of this waiver request for that reason. The proposed waiver of the Commission's channelization and other rules in the Upper 6 GHz bands is the only economically, technologically, and logistically rational means of increasing TERRA backbone capacity to meet growing demand over the next several years. Given the significant benefits of GCI's request, its narrow geographic limitations, and the absence of any adverse impacts, granting this waiver request will significantly advance the public interest.

Respectfully submitted,



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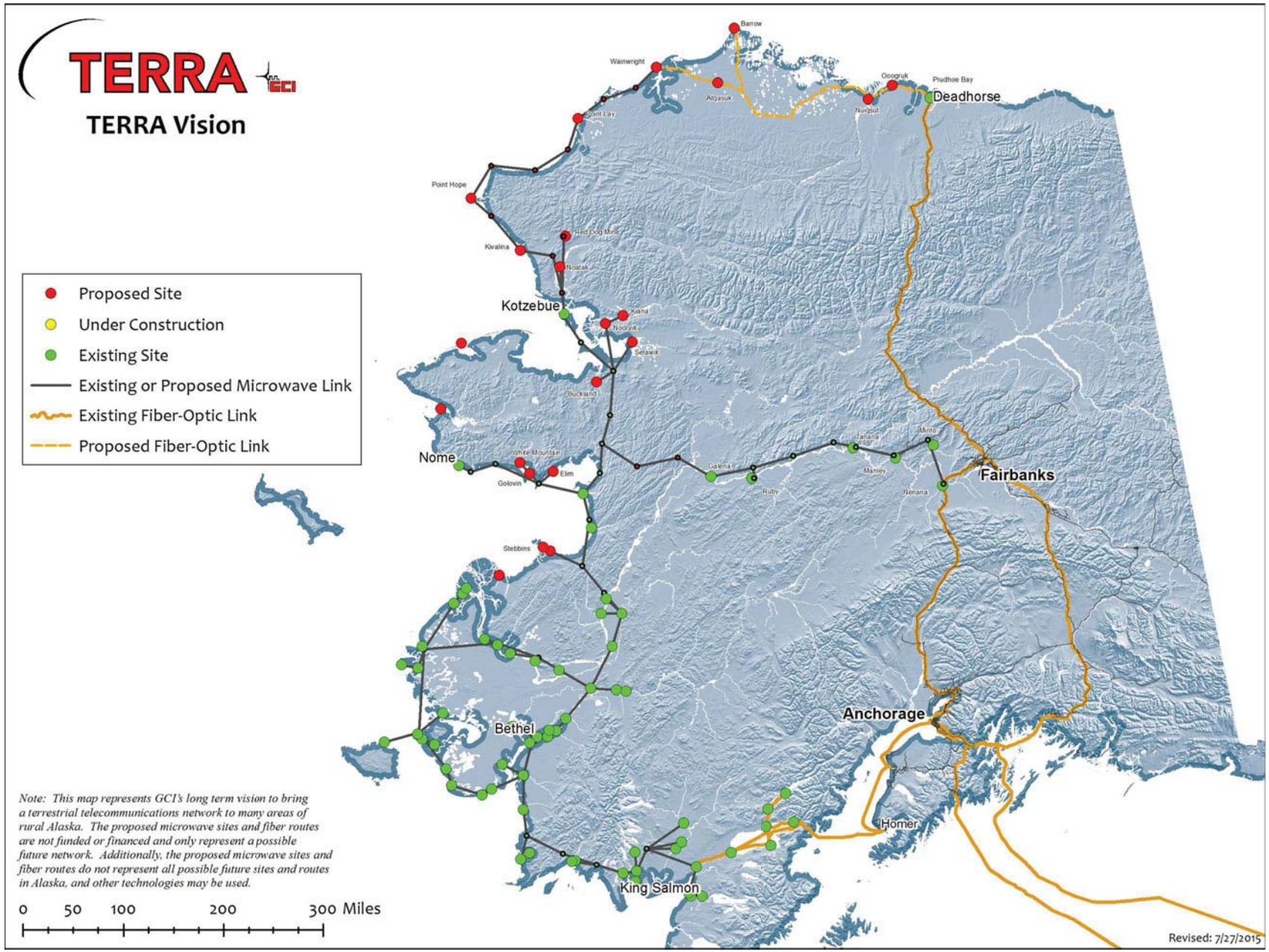
May 3, 2016

Appendix A

Existing TERRA Backbone Location Coordinates and Network Map

Site Name	Latitude	Longitude
Akiak	60 54 41.00 N	161 13 38.50 W
Bean Ridge	65 02 17.35 N	150 42 09.85 W
Bethel	60 46 53.80 N	161 53 01.60 W
Caribou	59 10 11.95 N	160 39 05.41 W
Cone	59 21 36.98 N	161 43 52.70 W
Dime Rptr	65 05 49.03 N	160 42 54.75 W
Eek	60 12 57.40 N	162 00 43.40 W
Elliott Rptr	65 13 50.93 N	149 30 24.94 W
FAA HILL	64 34 38.25 N	149 04 47.34 W
Final	64 59 27.97 N	158 04 57.63 W
Galena	64 44 20.01 N	156 53 18.30 W
Gold Mountain Alt.	65 05 11.21 N	154 07 06.48 W
Grant Creek Rptr #2	65 15 15.40 N	152 44 27.07 W
Holy Cross	62 12 04.69 N	159 46 54.30 W
Holy Cross Hills Rptr	62 57 29.05 N	160 10 24.51 W
Kalskag Hill	61 33 47.45 N	160 18 59.97 W
Kanakanak	58 59 58.42 N	158 32 41.77 W
Kulukak	59 02 41.35 N	159 40 18.87 W
Levelock	59 06 25.37 N	156 52 16.10 W
Manokotak	58 57 21.57 N	158 55 23.09 W
Melozitna	64 53 20.56 N	155 31 15.73 W
Mission Hill	65 10 48.97 N	151 59 06.52 W
Muklung Hills	59 17 51.43 N	158 07 22.34 W
Otter Creek Rptr	63 18 48.63 N	160 57 27.69 W
Pilcher Mt	61 55 40.11 N	161 59 45.26 W
Quinhagak	59 43 43.30 N	161 54 26.70 W
Shageluk	62 38 47.12 N	159 31 41.55 W
Shaktoolik	64 20 56.36 N	161 11 03.38 W
Summit	64 49 19.14 N	159 27 28.42 W
Talik	65 31 13.77 N	160 32 23.32 W
Tuluksak	61 05 55.30 N	160 57 32.00 W
Unalakleet Rptr	63 59 19.32 N	160 53 00.22 W
Ungalik Rptr	64 41 12.07 N	160 40 47.90 W


TERRA
GCI
TERRA Vision
Proposed Site
Under Construction
Existing Site
Existing or Proposed Microwave Link
Existing Fiber-Optic Link
Proposed Fiber-Optic Link
Barrow
Wainwright
Atqasuk
Point Lay
Point Hope
Kivalina
Red Dog Mine
Noatak
Kotzebue
Kiana
Noorvik
Selawik
Buckland
Nome
White Mountain
Golovin
Elim
Stebbins
Bethel
King Salmon
Homer
Anchorage
Fairbanks
Deadhorse
Prudhoe Bay
Ooogruk
Nuiqsut
Galena
Ruby
Tanana
Manley
Minto
Nenana
Note: This map represents GCI's long term vision to bring a terrestrial telecommunications network to many areas of rural Alaska. The proposed microwave sites and fiber routes are not funded or financed and only represent a possible future network. Additionally, the proposed microwave sites and fiber routes do not represent all possible future sites and routes in Alaska, and other technologies may be used.
0 50 100 200 300 Miles
Revised: 7/27/2015

Appendix B

Declaration of Gene Strid

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Petition of General Communication, Inc. for Waiver of Certain Channelization and Other Restrictions on Common Carrier Fixed Point-to-Point Operations between 6425 and 7125 MHz

DECLARATION OF GENE STRID

1. My name is Gene Strid, and I am the Vice President and Chief Technology Officer of the Alaska Wireless Network ("AWN"). I have served GCI in this capacity for 3 years. AWN is owned by GCI Communication Corp. ("GCI"), a subsidiary of General Communication, Inc. Prior to this assignment, I held various positions of progressive responsibility with GCI, including its Director of Engineering, its Network Services Vice President and Chief Engineer, and its Vice President and Wireless Chief Technology Officer. I have been with GCI and AWN for a total of 26 years. I have over 40 years' experience in building telecommunications systems and networks throughout Alaska. I hold an Alaska registered Professional Engineer license, number AELE-4502.
2. I have personal knowledge of the facts and information set forth in this Declaration and the associated Petition. I am competent to testify to these facts if called as a witness.
3. TERRA is GCI's next-generation communications network for the remote and rural areas of Alaska. Started in 2011, this historic project today provides more than 70 villages with access to terrestrial broadband. GCI's TERRA network has experienced huge success in bringing terrestrial broadband service to unserved and underserved western and northwestern rural Alaskan communities, previously served only by high latency satellite networks.
4. TERRA is a hybrid terrestrial fiber-optic and microwave network that removes the limitations of satellite and provides symmetrical broadband service to Alaska's remote and rural regions. With direct land-based connection to Anchorage and the Internet, the TERRA network delivers critical bandwidth to numerous public, nonprofit, and private entities such as regional health corporations, school districts, native organizations, and residents.
5. The build-out of the TERRA network was no small feat. Alaska is home to some of the most challenging geography in North America and regularly experiences unpredictable and unforgiving weather which can affect construction. A majority of

the communities that most need fast, reliable Internet are separated by vast distances and often can't be reached by road. GCI's TERRA project team, in partnership with other organizations, continues to answer these challenges as they expand the network to new communities throughout the Arctic.

6. TERRA's capacity is limited. As GCI takes a range of services to the communities the network serves, including distance education, telemedicine, and the internet, GCI forecasts the exhaustion of our TERRA backbone capacity within just a few years. GCI currently plans to double the TERRA system capacity by "ringing" the system (i.e., building out the system to form a ring) in early 2018, if not sooner. Even this increased capacity, however, is expected to be exhausted by 2020.
7. In order to address this future capacity constraint, we must plan for the next technology upgrade and implementation at least 4 years in advance of future traffic demands of our customers. This is necessary to allow adequate time for radios to be designed and manufactured and for them to be installed throughout the TERRA network, taking into account the vast scale of this network and the very short construction season in Alaska. Optimistically, we hope that it will take approximately 18 months from waiver grant to realize in-service radios, if the radios are constructed on time and all preparations are made in time for a successful 2017 construction season. We expect our vendor to take about 6 months to build radios for use with the full Upper 6 GHz spectrum, in time for our 2017 construction season, but it could take longer depending on whether these radios need to be tested for compliance with the FCC's certification lab. In 2017, we plan to add two new complete sites to enable us to close the TERRA ring. Additionally, new power and communication equipment buildings will be added to several other existing TERRA backbone sites along the Yukon River. The buildings, towers, fuel tanks and other ancillary equipment (including large battery plants and the initial site fueling) need to get staged in early July 2017 at various staging areas near each site so that this equipment can be lifted in place by a specially mobilized (from the Pacific Northwest) heavy lift helicopter in the last half of July. In order to make this schedule, these radios would need to be received by GCI in early 2017 (absolutely not later than March, desirably earlier) so that they may be pre-installed and pre-tested in pre-fabricated buildings at an integration facility somewhere in central Alaska and then trucked to Nenana, so that they may be barged to the various staging areas along the Yukon River in June (or earlier if demanded by our primary site construction contractor). We believe we can meet this schedule if the waiver is granted timely. If all radios are ready, and all are able to be installed, by next summer, the systems would be turned up prior to the end of 2017. If the waiver is not granted by the end of August 2016, it would push the estimated time period out by an additional 12 months to the end of 2018 (just a year prior to the anticipated exhaustion of TERRA's capacity in 2020) due to missing the 2017 construction season and the need to then add them to sites during the 2018 construction season. Doing so would also cause us to incur additional expenses to integrate these new Upper 6 GHz radios and associated radio hardware on the mountaintops, with a separate crew mobilization and additional helicopter transport support costs, rather than more cost effectively integrating these radios in an integration facility along with all the other equipment going into the communication equipment building.

8. To increase capacity on the TERRA network, GCI's options are limited. Option 1 is to leverage the current infrastructure that will fully support the expanded Upper 6 GHz spectrum. Option 2 is to upgrade each facility in the remote and arctic terrain of the 2,096 miles covered by the TERRA network. As explained below, however, only Option 1 is likely to be economically feasible. Option 1 leverages the fact that, the existing, installed antennas and waveguides already support operations in the 6.425–7.125 GHz band. Therefore, the most cost efficient and technically feasible method to expand the system would use these existing capabilities by adopting the channelization scheme recommended in ITU-R Recommendation F.384-11, specifically the recommendations as listed in Section 4, 4.2 and 7, and as diagrammed in the attached Appendix C. No additional outside tower work would be needed to more than double the system capacity, taking it from eight 60 MHz channels utilizing the lower 6 GHz band to a total of eighteen 60 MHz channels that would efficiently use all of the 6 GHz spectrum from 5.925 to 7.125 GHz. However, this much more efficient utilization of the 6 GHz spectrum would only work if the FCC would allow GCI to operate in the 6.425–6.525 GHz band and use a different channelization of the Upper 6 GHz spectrum than is currently allowed under Part 101.147 (j), (k), and (l) of its rules. This option is the most cost-effective and most technically feasible approach to upgrading the system. It will also allow GCI to bring greater capacity and speed to our customers in a fraction of the time because it will not require the same permitting and construction efforts and, specifically, will not require us to obtain new permits in the Togiak National Wildlife Refuge.
9. Leveraging the existing infrastructure with Option 1 is the most cost efficient and technically feasible method to augment the capacity of the TERRA network, but it requires a waiver of the current channelization rules in the Upper 6 GHz bands. Without a new channel plan that efficiently uses all of the 6425–7125 MHz spectrum, the current rules would allow us the possibility of ten 30 MHz channels in the 6525–6875 MHz band and eight 25 MHz channels in the 6875–7125 MHz band, both bands assuming polarization reuse. However, such a frequency plan, in addition to the current lower 6 GHz, 60 MHz channel plan, again with polarization reuse, would require that we install 26 microwave radios for each direction of transmission at a mountaintop repeater. We physically do not have enough space and power in our mountaintop shelters and prime power system to house and power this many radios. What could be accommodated, however, would be implementing just the ten 30 MHz channels in the 6525–6875 MHz band, which would add about 1.761 Gbps of increased capacity per path or about 3.523 Gbps of ringed capacity. This additional capacity would be exhausted shortly after 2019. If, however, the FCC were to adopt the band plan for the 6425–7125 MHz spectrum specified in ITU-R Recommendation F.384-11, GCI could add instead a total of ten 60 MHz channels in the Upper 6 GHz spectrum using only 18 radios in each direction. This would then augment the ringed system capacity from about 6.1 Gbps to approximately 13.5 Gbps.
10. The only alternative approach to expanding the network capacity, what I'll call Option 2, would be if GCI chose to increase capacity by adding another frequency band on which the network operates. This option is cost-prohibitive and time-intensive, if not also technically infeasible. The most feasible alternative spectrum band is 11 GHz (10.7–11.7 GHz). However, 11 GHz is susceptible to rain rate fading

outages, so this band would not provide equal propagation availability (operations at 6 GHz would be essentially unaffected by high rain fall rates). High rain rate outages are not frequency selective, so when they occur, they affect all channels on a given path at the same time. To avoid this problem, we would need to construct intermediate repeater sites to shorten the path lengths.

11. Furthermore, for Option 2 to work, we would need to install additional antennas on each of the backbone system towers to accommodate 11 GHz traffic. On all TERRA backbone paths, for high propagation availability, we operate with receive space diversity, and with waveguide switches that allow us to switch the transmitters to the space diversity antenna for additional system redundancy and system availability, in case the primary antenna should fail or be blown off path. To add the 11 GHz band, we would need to add four antennas of similar size to the tower, in addition to waveguides to feed these antennas (a total of eight new waveguide runs per tower for a two-way repeater) and the waveguide switches. This additional antenna and waveguide load will, with very high probability, exceed the wind and ice loading structural capacity for these towers.
12. Even if these loads did not render the tower over structural capacity, we would incur the steep cost of mobilizing tower-qualified and microwave and antenna test and alignment-qualified contractors to these remote mountaintops and villages, not only to install, align and test these new antennas, but to construct additional ice shields to protect these waveguides from falling ice that the tower collects and sheds during winter months. While the cost of the radio equipment is likely similar for the two alternatives, the cost of adding antennas, waveguides, and ice shields to the towers, if even technically feasible, would add millions to the cost of the system.
13. To do this work we'd need to start now with the massive permitting effort that this would require. Each tower is built on government land and each tower has required extensive coordination with permitting agencies, often taking a year or more to complete. Even then it may not be feasible to accomplish, since three of the paths transit the Togiak National Wildlife Refuge. While we were successful in getting the system originally permitted through this refuge, it is highly unlikely that we can get this additional tower work permitted. Furthermore, before we could pursue this option, we'd need 2 years to know for sure that we could get the permits, so we would have 2 years (two summer construction seasons) to complete the tower work. It would be very risky to assume we can get all permits within 2 years.
14. The associated Petition is the only feasible means of increasing TERRA backbone capacity to meet growing demand over the next several years.

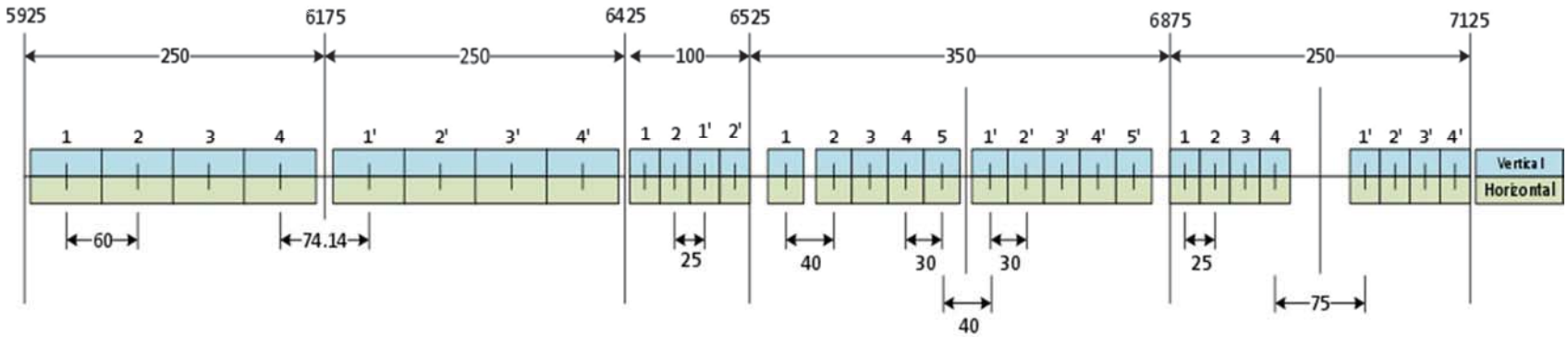
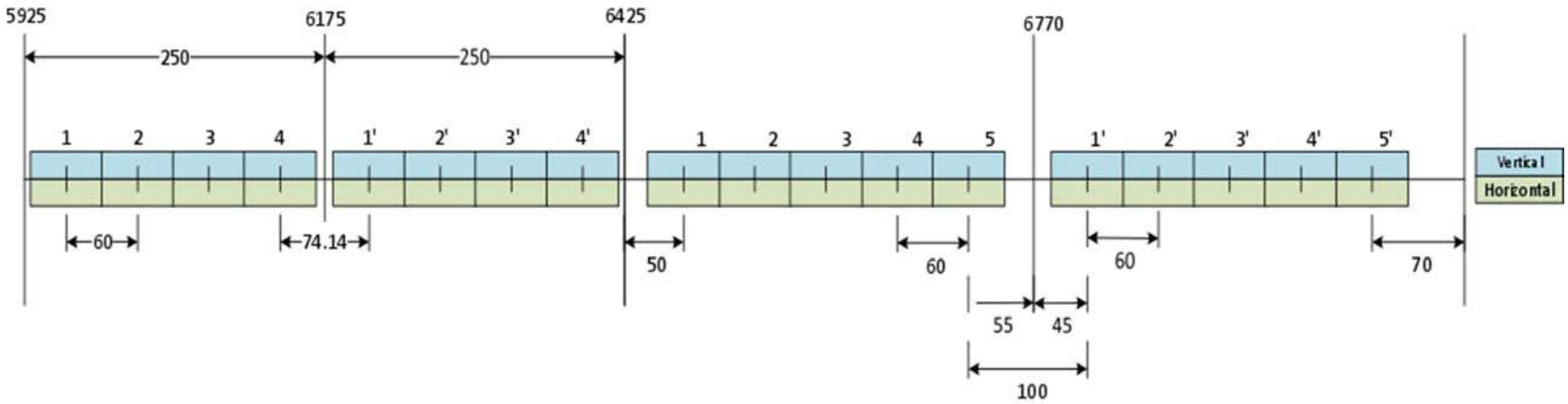
I, Gene Strid, under penalty of perjury, hereby swear and affirm the following, based on personal knowledge on behalf of the Alaska Wireless Network. Executed April 15, 2016.

Gene Strid

Appendix C

Current and Proposed 6 GHz Channelizations

Existing Channelization under FCC Rules



Proposed ITU Channelization under Waiver Request