November 10, 2010

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW, Room TW-B204
Washington, DC 20554

Re: Response to N.E. Colorado Cellular, Inc.,
d/b/a Viaero Wireless Ex Parte
September 16 and 19, and October 1, 2010
GN Docket No. 09-51
WC Docket No. 05-337

Dear Ms. Dortch:

This letter is submitted to the Commission on behalf of the Nebraska Rural Independent Companies identified below (the "Nebraska Companies")[1] in response to the ex parte communication transmitted to the Commission on September 19, 2010 by David A. LaFuria as counsel for N.E. Colorado Cellular, Inc. d/b/a Viaero Wireless (the "Viaero ex parte").

Vantage Point Solutions (Vantage Point), the Nebraska Companies' engineering consultant, has reviewed the assumptions presented in the Viaero ex parte. Although much of the technical material presented in the Viaero ex parte is general in nature, Viaero represents that its wireless network will be able to meet the fixed broadband needs of customers in Nebraska and Colorado today and into the future. Based on Vantage Point's analysis of the current and future broadband needs of customers, described in *An Engineering Analysis of the Broadband Assessment Model Using Actual Network Data*, Attachment A to the Nebraska Rural Independent Companies Comments in response to the FCC's USF NOI/NPRM ("Comments-Attachment A")[2], Viaero's premise is flawed for the following reasons:

A. The Viaero wireless network is a shared and oversubscribed resource. Wireless network are ill-suited for most customers' fixed broadband demands, let alone future demands.

[1] The Nebraska Companies are: Arlington Telephone Company, Blair Telephone Company, Cambridge Telephone Co., Clarks Telecommunications Co., Consolidated Telephone Company, Consolidated Telco, Inc., Consolidated Telecom, Inc., The Curtis Telephone Company, Eastern Nebraska Telephone Company, Great Plains Communications, Inc., Hamilton Telephone Company, Hartington Telecommunications Co., Inc., Hershey Cooperative Telephone Company, Inc., K & M Telephone Company, Inc., The Nebraska Central Telephone Company, Northeast Nebraska Telephone Company, Rock County Telephone Company, Stanton Telephone Co., Inc., and Three River Telco.

[2] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020522082

B. The wireless broadband data rates presented by Viaero are peak theoretical gross data rates and actual throughput will be much lower.
C. The Viaero ex parte suggests that a purely wireless backhaul strategy will provide sufficient capacity to handle customers' fixed broadband demand, which would be nearly impossible to accomplish with any practical wireless network and would be inconsistent with the backhaul strategy of nearly every other major wireless provider.

The following sections further discuss these issues, and support the conclusion that a purely wireless network is inappropriate for providing fixed rural broadband access.

1 Wireless Alone Cannot Meet Future Customer Broadband Demands

Analysis of the Viaero ex parte begins with an exploration of current and future customer broadband demands and the appropriate juxtaposing of wired and wireless broadband access networks' capabilities to serve those demands. Comments-Attachment A demonstrates that broadband consumers' demands for broadband speeds are constantly increasing as a result of the introduction of ever-expanding applications.[3] Currently, consumers are demanding broadband speeds in excess of 10 Mbps. Experts predict that customers will require 100 Mbps broadband speeds within the next five to ten years and 1 Gbps within the next ten to fifteen years.[4] Many of the broadband applications most suited to rural areas, such as diagnostic telemedicine and high-quality distance learning and telecommuting, require at least a speed of 5 Mbps to function well, and some distance learning sites currently consume 45 Mbps of broadband speeds. As illustrated in Figure 1-1, Vantage Point anticipates that broadband demand for telemedicine and distance learning in both upstream and downstream directions will rise from 10 Mbps to 100 Mbps over the next 5 to 10 years. As broadband speed requirements continue to grow, the broadband of today will become the narrowband of tomorrow.

Even though wireless networks will provide a part of customers' broadband needs, a wireline network is still necessary. Comments-Attachment A discusses and supports this complementary nature of wireless and wireline broadband services. A wireline connection is required to provide adequate broadband capacity to serve consumers' homes or businesses and a wireless connection is required to meet their mobile needs.[5] Rysavy Research points out that "Given the inherent capacity of one fiber optical link exceeds the entire available radio frequency (RF) spectrum, data flow over wireless links will never represent more than a small percentage of the total global communications traffic."[6] For example, NebraskaLink LLC, a consortium which was awarded a grant from the National Telecommunications and Information Administration to build three fiber rings in Nebraska, is nearing completion of its transport network with an initial capacity of 9.6 Gbps. This fiber optic capacity will provide over 30 times the bandwidth anticipated in Viaero's wireless-only backhaul network.

[3] Comments-Attachment A, p. 7.
[4] Comments-Attachment A, p. 11.
[5] Comments-Attachment A, Section 2.2 – Broadband Applications and Drivers, pp. 14-17.
[6] Rysavy Research, EDGE, HSPA, and LTE Broadband Innovation, 3G Americas, p. 5, September 2008.

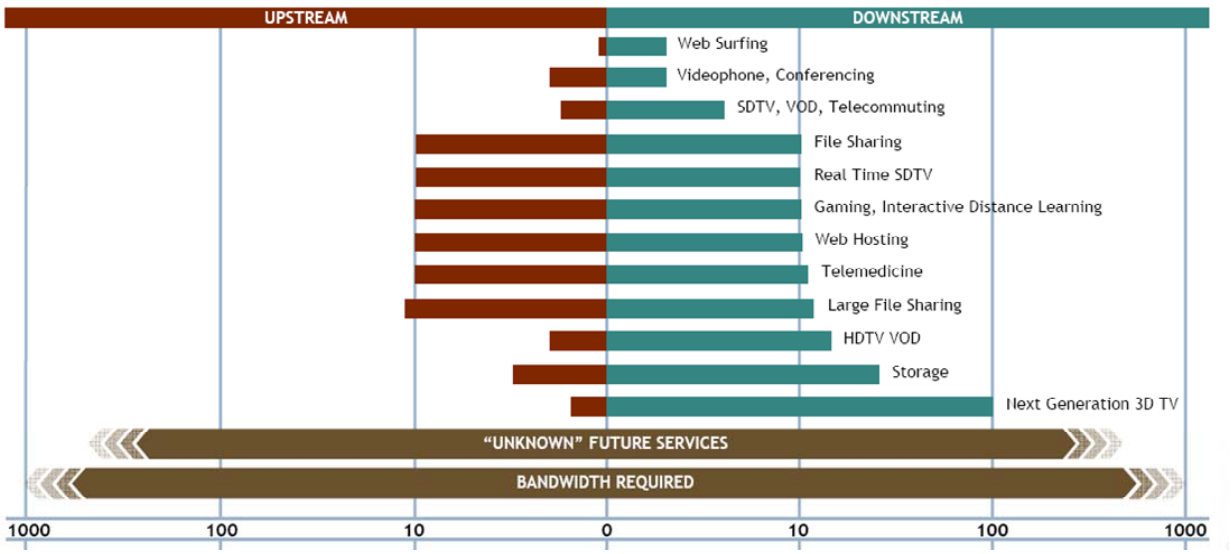


Figure 1-1: Estimated Broadband Application Upstream and Downstream Rates (Mbps)

In addition, a wireline network is necessary to provide adequate backhaul to wireless networks. In order to meet even just the mobile broadband needs of its customers, Viaero agrees that wireless carriers will need to transition their networks to 4th Generation wireless technologies (4G).[7] For this to occur, wireless towers will require high capacity connections, typically utilizing Ethernet delivered via a landline carrier's fiber network. Viaero suggests that such backhaul can be provided over wireless links, but wireless backhaul will be inadequate.

2 Viaero Overstates Achievable Wireless Broadband Access Throughput Rates

With the anticipated 4G services, unsupportable claims regarding deliverable data speeds have become commonplace, and can be misleading. Peak theoretical data rates have little to do with a single user's useful throughput experience. Viaero's analysis appears to be based upon 2 x 5 MHz channels, and a concatenation of two contiguous channels for dual carrier operations. Viaero misleadingly suggests that a user could soon experience a 42 Mbps wireless downlink throughput. Worse yet, Viaero claims that a user could have a phenomenal throughput of 325 Mbps, assuming the base station sector and the user each have four antennas. Viaero does not mention that this throughput assumes that 2 x 20 MHz of contiguous spectrum is available. The spectrum map provided in the Viaero ex parte shows that there are only a few locations in which Viaero has 2 x 20 MHz of spectrum available.

[7] Comments-Attachment A, p. 18.

Peak theoretical data rates should not be confused with throughput rates. Peak theoretical data rates are only obtainable for a single user in a perfect, undistorted, unobstructed, unfaded environment with a nearly limitless signal to noise ratio. Even if this environment could exist in the real world, in addition to physical layer overheads, forward error correction can consume 45% or more of the connection data rate, and TCP/IP overheads another 10-15%. Thus, equipment overheads consume much of the available bandwidth. In a more realistic depiction of an HSPA+[8] deployment, a single user's theoretical peak 42 Mbps data rate is reduced to less than 20 Mbps of throughput.

This rate must be reduced significantly further, as it is generally accepted in the industry that a cell's throughput capacity must be considered as the cell's average throughput spectral efficiency – that is, the quotient of the cell's actual total usable throughput divided by the number of users that created it, spread out across the cell from tower to cell edge. This typically will be less than one half to one third of its peak throughput capacity.

Further, a wireless network, such as Viaero's, is a shared resource. As such, its performance is sensitive to the number of users. HSPA+ (or any other wireless access technology) rapidly becomes inadequate with only a few users competing for the available bandwidth. And as applications become more bandwidth intensive, the network's performance will diminish further. LTE (Long Term Evolution) with 4x4 MIMO (Multiple-Input and Multiple-Output) is a new technology developed to increase the capacity and speed of mobile telephone networks. It combines enhanced modulation techniques and multiple antennas at both the transmitter and receiver to improve the communication performance. Even LTE-Advanced (Release 10) with 4x4 MIMO, while requiring 2 x 20 MHz of spectrum to provide Viaero's peak theoretical data rate of "325 Mbps," delivers an actual average downlink throughput spectral efficiency of little more than 2.5 bps/Hz, or 50 Mbps. This 50 Mbps must be shared among all users served by the sector. When one considers that 100 Mbps per household is anticipated to be required in the next five to ten years, even an LTE-Advanced network will not have nearly enough capacity to serve even a few customers' fixed broadband needs. In contrast, Fiber to the Premises (FTTP) is not shared in the access network. In fact, each customer's ability to receive bandwidth is limited only by the capacity of the electronics, not the medium. Serving rural customers with only wireless broadband networks would relegate rural customers to second-class citizens even in today's digital world, let alone tomorrow's.

While a wireless network may initially be less expensive than a FTTP network, the cost advantage diminishes over time as additional broadband capacity is required. Plus, fiber optic network's costs per Mbps of access are a fraction of a wireless network's costs per Mbps.[9] Once the fiber media is installed, the incremental cost to add bandwidth is small, only requiring upgrades to the attached electronics. Wireless networks, on the other hand, must obtain large amounts of scarce, expensive spectrum, and must add additional cell towers, electronics and antenna systems to increase bandwidth. Fiber optic technology has vast potential for future bandwidth capacity increases, while wireless technology's

[8] HSPA+ is defined as the evolution of High Speed Packet Access (HSPA) initially defined in Release 7 of the Third Generation Partnership Project (3GPP) Technical Specifications.

[9] Comments-Attachment A, Section 1.2.3 – LTE is Not a Cost Effective Fixed Broadband Solution, pp. 8-10.

potential for bandwidth capacity growth is nearly depleted.[10] Any apparent initial cost savings from building a fixed wireless access network will be quickly overcome by the cost to upgrade the network to meet future bandwidth demand. Thus, while 4G or any future wireless broadband technology may appear to compete with low-end wireline broadband technologies for a short time, such technologies will quickly become non-cost-effective for this purpose, and will become wasted investment that could be made in fiber networks better suited for the inevitable broadband demands of the future. Wireless networks should instead work in tandem with wireline networks to meet the comprehensive broadband needs of the subscriber.[11]

3 Wireless-Only Backhaul is Inadequate for Most Broadband Applications

A wireless network that relies exclusively on microwave backhaul may have been adequate for mobile voice, and perhaps even for 2G or early 3G mobile broadband data, but wireless is inadequate in most instances to transport the Committed Information Rates (CIRs) required by the cells of an advanced 3G or 4G network. Illustrative of this need is a recent news item concerning backhaul associated with a high-speed wireless network:

> When a wireless firm is hyping high-speed Internet connectivity, it is best not to forget about backhaul. Clearwire Communications chose FiberLight to provide fiber network backhaul for its wireless deployment in Washington, D.C., Maryland, Texas and Florida.[12]

In Viaero's network, as with any sizable rural network, the data from many cell sites is accumulated onto a "backbone." Using microwave, paths must cover long distances to the core network without prohibitively expensive numbers of microwave repeaters and add/drop sites. To achieve carrier-class reliability (>99.999% availability), the amount of spectrum and number of towers required to support the near-future bandwidth needs for backhaul would be overwhelmingly cost prohibitive.

Today's 300Mbps microwave backhaul limitation will be quickly exhausted by a small number of cell sites having only the 37.5 Mbps CIR requirement of a three sector, "42 Mbps" HSPA+ cell site, (three sectors per cell x 12.5 Mbps average throughput spectral efficiency), and will be exhausted even more quickly with 4G technologies. Again, wireless technology's potential for bandwidth capacity growth is nearly depleted. There is no wireless technology on the horizon that will significantly increase this wireless long-haul limitation at carrier-class reliability. This bandwidth limitation is especially problematic in those paths close to the core network, which must carry a great portion of the entire network's sites. A fixed wireless access network relying solely on microwave will not be able to support more than approximately eight cell sites on any backbone path and frequency, and even fewer with 4G

[10] Comments-Attachment A, p. 22.
[11] Comments-Attachment A, Section 2.3 – The Role of Wireless and Wireline Broadband, pp. 17-18.
[12] *See*, http://www.agl-mag.com/newsletter/AB_101810_FiberLight.htm.

access technologies. Additional spectrum is necessary for every 300 Mbps increment of wireless backhaul. As with the access network, while the initial cost of a wireless backhaul network may appear competitive compared to fiber optic backhaul, the incremental cost of expanding capacity will quickly exceed the cost of fiber optics. For example, consider the typical cost of $400,000 per microwave path including tower cost, and $150,000 cost per additional parallel path between existing towers, and an average backbone path length of 25 miles (Viaero's appears to be around 17 miles, which would only worsen the situation). Compare this with an average $20,000 per mile cost for rural fiber optic construction including electronics. For each 300 Mbps increase in backhaul bandwidth requirement, the incremental cost for wireless backhaul expansion skyrockets compared to that of fiber optics, as illustrated below:

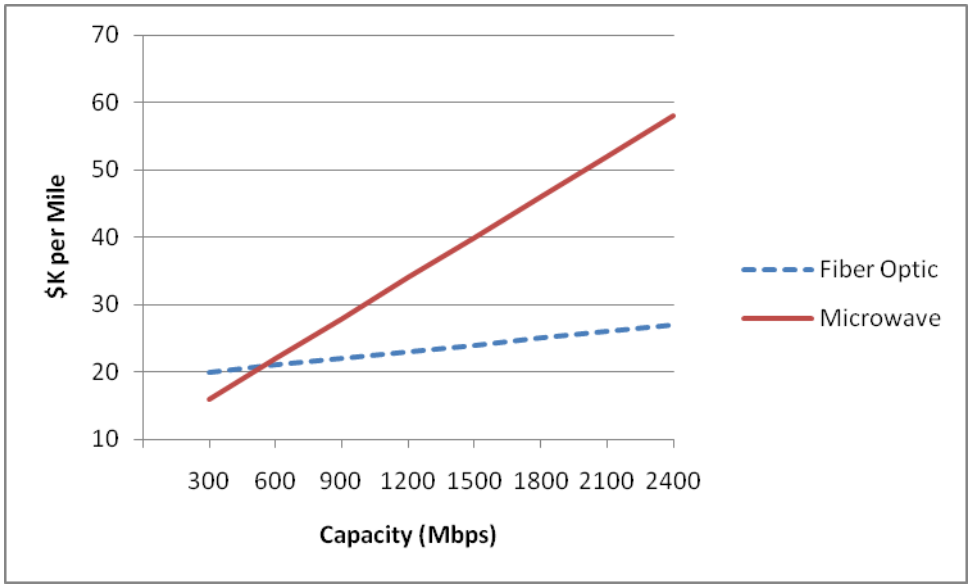


Figure 3-1: Fiber Optic vs. Microwave Backhaul Cost

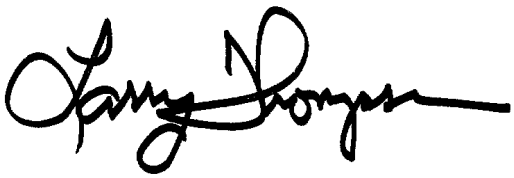
Unfortunately, wireless proponents only focus on the initial network costs. While cost estimates can be argued a few percentage points either way, the pattern is unmistakable and unavoidable—fiber optics are more cost effective as capacity increases. A more granular study will not change this outcome significantly. And when the network cost is considered over a longer period, the fiber optic network quickly becomes less expensive due to the long life expectancy of the fiber cable compared to the relatively short life expectancy of the microwave electronics. Fiber optic backhaul also offers a strategic advantage over microwave backhaul networks, as presented in "The Broadband Availability Gap, OBI Technical White Paper No. 1", which states, "As broadband needs continue to grow, fiber emerges as the only last-mile technology capable of meeting ultra high-speed needs. So any solution that brings

fiber closer to the home by pushing it deeper into the network puts into place an infrastructure that has long-term strategic benefits."[13]

4 Conclusion

Viaero's wireless broadband speeds suggested in the Viaero ex parte are purely theoretical, while real throughputs are much lower. Further, a purely wireless backhaul solution cannot meet customers' demands for fixed broadband services. Unless the inevitable bandwidth demand growth is completely ignored, wireless fixed broadband access networks will be ill-positioned to deliver cost-effective fixed broadband. The primary goal of 4G wireless access networks is to provide mobile broadband, working in tandem with wired access networks to provide higher capacity fixed broadband to meet the customer's broadband needs. Once demand exceeds the capacity of these networks, investments in fixed wireless broadband will be stranded. Capital should be invested in a fiber-optic network that will support increasing bandwidth demands at a lower incremental cost.

Sincerely,



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[13] The Broadband Availability Gap, OBI Technical Paper No. 1, Federal Communications Commission, April 2010, p. 76.