SUBSTANTIAL SERVICE SHOWING SUPPLEMENT

I. INTRODUCTION AND SUMMARY

RS Access, LLC, MDS Operations, Inc., and affiliates (hereinafter referred to as "RSA/MDS")[1] have fully satisfied the construction requirements[2] for the 60 active Multichannel Video Distribution and Data Service ("MVDDS") licenses listed in Exhibit 1.[3] RSA/MDS provides innovative, point-to-multipoint services to a wide array of customers throughout its geographic license areas and continues to invest in new means of deploying services over its MVDDS spectrum.

RSA/MDS has developed a point-to-multipoint offering that not only can provide connectivity among the dispersed sites of customers in niche and underserved markets, but also can support two-way connectivity to the Internet using an unlicensed, return-link path. Customer interest has proven strong, and RSA/MDS's attractive service offerings have generated demand for additional receive sites from existing customers and for new receive sites from nearby businesses and institutions.

RSA/MDS has met and exceeded the Commission's substantial service obligation, including by: (1) deploying and providing service to customers over at least four separate transmitting locations for every million people in each geographic license area; or (2) deploying

[1] Unless otherwise noted, "RSA/MDS" refers to all entities acting on behalf of or in cooperation with MDS Operations, including its lessee and prospective assignee, RS Access, LLC ("RS Access"). When specific context so indicates, it also includes MDS Operations' affiliate, MDS America, Inc. ("MDS America"), and the Albuquerque-based broadband service provider Cibola LLC, d/b/a Cibola Wireless ("Cibola Wireless").

[2] 47 C.F.R. § 101.1413.

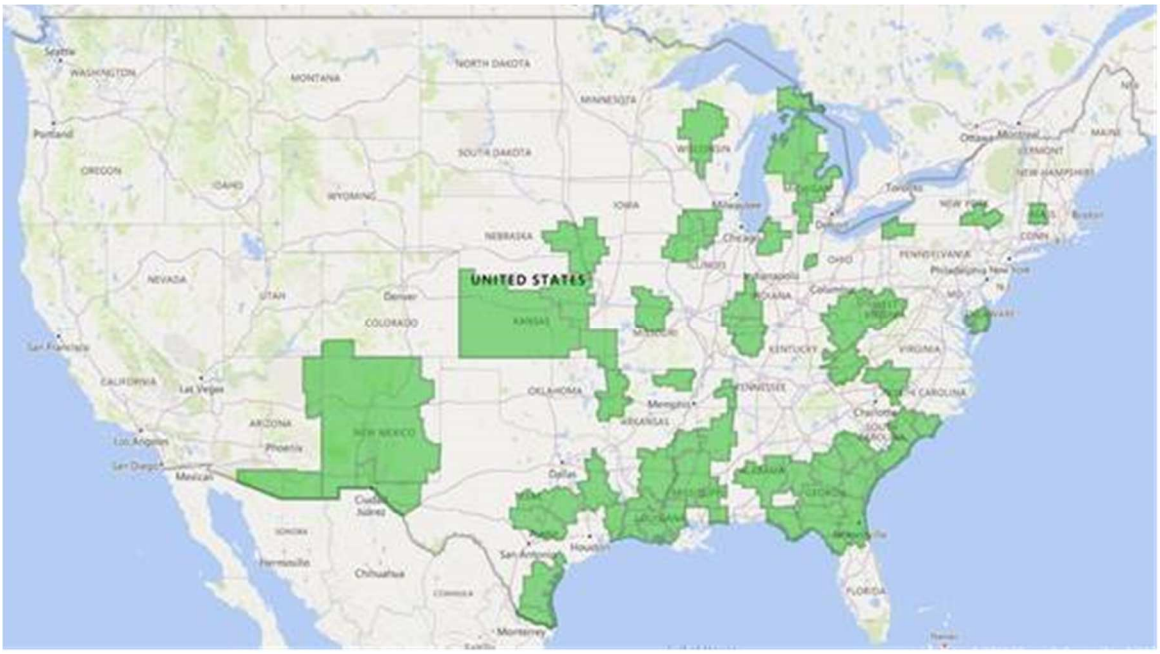
[3] RS Access sought and received authority to purchase and lease sixty MVDDS licenses in the 12.2-12.7 GHz band ("12 GHz band") from MDS Operations. *See* ULS File Nos. 0008485654, 0008583545. MDS Operations requested an extension of time to consummate the assignment July 19, 2019. *See* ULS File No. 0008733979.

a large-scale broadband Internet service offering that reaches more than 900,000 people (or approximately 50 percent of the population) in the Albuquerque geographic license area.[4] RSA/MDS has also served the public interest by investing in and deploying innovative, point-to-multipoint connectivity solutions for numerous niche and underserved market segments, including rural small businesses, community anchor institutions, veterans organizations, first responder training facilities, health care providers, and public safety organizations.

RSA/MDS has deployed hundreds of facilities to bring wireless terrestrial point-to-multipoint services to customers. In line with the Commission's goal to deploy MVDDS service, RSA/MDS has drawn on significant capital resources, strategic infrastructure provider partnerships, and its technical expertise to deploy a wide range of services throughout the license areas of its 60 active MVDDS authorizations.[5]

[4] The Commission has created a safe harbor under which MVDDS licensees may satisfy the substantial service requirement by providing "actual delivery of service to customers via four separate transmitting locations per million population." *Amendment of Parts 2 and 25 of the Commission's Rules to Permit Operation of NGSO FSS Systems Co-Frequency with GSO and Terrestrial Systems in the Ku-Band Frequency Range, et al.*, Memorandum Opinion and Order and Second Report and Order, 17 FCC Rcd 9614, ¶ 177 (2002) ("*MVDDS Order*"). In a point-to-multipoint MVDDS system, the path of communication between the transmitting location and a receiving location is referred to as a "link."

[5] *See* Exhibit 1 ("RSA/MDS MVDDS Deployment by License").



MDS Operations' Active Licenses

The diversity of RSA/MDS's MVDDS licenses, which span a wide swath of disparate geographies, topographies, and demographics, underscores RSA/MDS's extraordinary efforts to deploy service in underserved and niche markets throughout the United States in the face of restrictive, Commission-imposed operating constraints that have historically impeded MVDDS deployment. As the map above indicates, the licensed footprint of RSA/MDS starts as far north as Massachusetts, winds south through the mountains of Appalachia, including parts of West Virginia and Tennessee, then cuts eastward through North Carolina toward the Atlantic coast of South Carolina and into northern Florida. RSA/MDS is licensed to operate over large areas of the entire south, from Northeast Florida and southern Georgia westward through Alabama, Mississippi, and large parts of Louisiana. In Texas, RSA/MDS holds licenses for areas "behind the pine curtain" in East Texas, the hill country north of Austin, and along the Gulf coast of the state's southern tip. Further west, RSA/MDS may operate in most of New Mexico, southern and Northeastern Arizona, and Southwest Colorado. RSA/MDS also holds licenses located in the

Great Plains, including parts of Kansas and Nebraska, and the Midwest, including portions of Indiana, Illinois, Wisconsin, and Michigan.

RSA/MDS had to overcome significant challenges in developing a business model and service architecture, given the geographic diversity of the authorizations in its license portfolio. The discontiguous geographic license areas that RSA/MDS must support span thousands of miles and feature enormous topographical variation, including mountains, plains, deserts, forests, and swamps. The licenses cover territory that exhibits socioeconomic heterogeneity, with meaningful variations in median household income, unemployment, and population density. For example, while many of these geographic areas are rural and underserved, RSA/MDS's licenses also include major metropolitan cities, including Jacksonville, Florida; Albuquerque, New Mexico; and Austin, Texas.

Across all of its diverse geographic license areas listed in Exhibit 1, RSA/MDS is required to make a substantial service showing by July 26, 2019.[6] "Substantial service" is defined as a "service that is sound, favorable, and substantially above a level of mediocre service which might minimally warrant renewal."[7] When the Commission adopted its MVDDS rules, the agency attempted to reduce uncertainty that arose from this amorphous standard's case-by-case approach by creating a "safe harbor" that provides licensees with greater certainty about the types of service deployments sufficient to warrant renewal and stimulate investment in the band.[8] An MVDDS licensee that "chooses to offer a point-to-multipoint service" may demonstrate substantial service through a showing of "actual delivery of service to customers via four

[6] *See, e.g.*, Call Sign WQAR560 (listing the buildout deadline as July 26, 2019).

[7] 47 C.F.R. § 101.1413(b); *see also MVDDS Order* ¶ 177.

[8] *See, e.g.*, *MVDDS Order* ¶ 177 ("Due to the significant flexibility that this [substantial service] standard affords, we will provide a safe harbor example to serve as a guide to licensees in satisfying the substantial service requirement.").

separate transmitting locations per million population."[9] For substantial service showings, the Commission has said it will consider additional factors, such as whether the licensee is serving rural areas or "niche markets," in making an assessment of a licensee's substantial service showing.[10]

RSA/MDS has exceeded the Commission's safe harbor of demonstrating the "actual delivery of service to customers via four separate transmitting locations per million population."[11] Aside from Albuquerque, where RSA/MDS deployed a large-scale broadband Internet service offering that covers 50 percent of the market, RSA/MDS has deployed more than the minimum number of links in every geographic license area. Moreover, every transmitter is configured with point-to-multipoint capability, which allows for the cost effective deployment of additional receive terminals in the future.[12] In addition, RSA/MDS's network serves a variety of niche markets, including veterans service and support organizations, public safety and educational institutions, communications infrastructure providers, and rural small businesses. For example, RSA/MDS has deployed services that provide:

- Real-time video support for first responders in training at the largest public safety training facility in the United States;
- Broadband connectivity at a horse farm that offers therapeutic riding for veterans;
- Wireless connectivity to support high-resolution LED billboards that allow businesses to remotely change advertising and more effectively target consumers;
- Wireless Internet connectivity services to public service organizations and rural small businesses; and

[9] *Id.* (requiring "actual delivery of service to customers via four separate transmitting locations per million population").

[10] *Id.*

[11] *Id.*

[12] RSA/MDS does not offer or support "multipoint-to-point" connections in which multiple transmitters link to a single receive terminal.

- Wireless Internet connectivity for tower climbers in areas where service is unavailable or has been disabled.

These deployments fill an unmet demand for broadband connectivity. For a variety of reasons, RSA/MDS's customers struggle to receive adequate services tailored to their needs. Some customers attribute the lack of service to the degree of customization their operations require. Others attribute the lack of service to limited revenue opportunities owing to low population density. Still others cite a simple lack of customer engagement by providers more focused on the mass market than various niche offerings.

For RSA/MDS, deploying innovative new forms of connectivity to underserved businesses, educators, and community anchor institutions represents part of the company's core mission. RSA/MDS configured its network design to accommodate point-to-multipoint deployments, which is a key component to the scalability of its business model. Its deployment in the MVDDS band has served the public interest, convenience, and necessity and exceeds the level of service minimally sufficient to warrant renewal.

II. RSA/MDS BACKGROUND

MDS Operations acquired MVDDS licenses in Auctions 53 in 2004 and 63 in 2005. In 2018, MDS Operations entered into a spectrum lease and related asset purchase agreement with RS Access, a company formed by V. Noah Campbell[13] and MSD Capital, L.P. ("MSD Capital").[14]

[13] V. Noah Campbell is a wireless industry entrepreneur and founder of Radio Spectrum Group, LLC.

[14] The spectrum lease and assignment applications are publicly available and provide additional information. *See* ULS File Nos. 0008583545, 0008485654. As noted above, MDS Operations requested an extension of time to consummate the assignment on July 19, 2019. *See* ULS File No. 0008733979.

MSD Capital is a private investment firm established in 1998 to exclusively manage capital for Michael Dell, his family, and affiliated charitable foundation assets. The principals of MSD Capital founded MSD Partners, L.P. ("MSD Partners"), an SEC-registered investment adviser, in 2009. MSD Capital and MSD Partners make investments across the globe in public equities, debt securities, private equity, real estate, and telecommunications. For example, in 2011, MSD Capital and MSD Partners formed OTA Broadcasting, which owned and operated more than 20 television stations and participated in Auction 1001 in 2017. MSD Capital, MSD Partners, and their affiliates manage approximately $15 billion and employ more than 115 people.

III. RSA/MDS HAS DEVELOPED A BUSINESS PLAN AND NETWORK DESIGN THAT TARGETS A DIVERSE USER BASE, SERVES THE PUBLIC INTEREST, AND COMPLIES WITH THE COMMISSION'S MVDDS RULES

RSA/MDS has invested significant capital and resources to deploy meaningful MVDDS-based network services that: (1) serve a diverse base of users; (2) possess a strong public interest focus; and (3) are designed to succeed within the current regulatory and operational constraints that apply to MVDDS.[15] RSA/MDS's business plan is designed to ensure that customers can affordably acquire MVDDS point-to-multipoint connections to augment existing network architectures. Thanks to its point-to-multipoint design, RSA/MDS can easily scale its initial deployments with additional access points as demand grows and customer use increases.

Consistent with the operational limitations that currently apply to MVDDS spectrum,[16] RSA/MDS provides one-way, point-to-multipoint offerings. Where two-way services are offered, RSA/MDS relies on unlicensed, 5.9 GHz spectrum for the forward or return link, as

[15] *See infra* Sections IV and V.

[16] *See, e.g.*, 47 C.F.R. § 101.1407 (restricting MVDDS to one-way service and prohibiting mobile services).

needed. This configuration has several advantages over a two-way link that uses unlicensed spectrum in both directions, including greater throughput, a much lower contention ratio on the licensed portion of the connection, managed connectivity, and better security.

RSA/MDS holds 60 active licenses, each having a substantial service deadline of July 26, 2019. Exhibit 1 shows the list of each active license by call sign and, for each call sign, identifies the following information: (1) the market identifier; (2) the market name; (3) the 2010 U.S. Census Bureau block-level population data; (4) the 2018 population data based on county-level population data estimates provided by the U.S. Census Bureau; (5) the minimum number of transmitting locations required under the MVDDS safe harbor of four links per million; and (6) the number of transmitting locations RSA/MDS has installed and put into service in that market area as of July 23, 2019.[17]

The FCC has typically required substantial service showings to be based on the latest decennial census, which in this case would imply 2010 U.S. Census Bureau data. In most of RSA/MDS's geographic area license areas, however, population increased between 2010 and 2018, sometimes substantially. To ensure that its deployments could satisfy growing customer demand, RSA/MDS based its calculation of the minimum number of links per geographic license area on the Census Bureau's interim 2018 population estimates rather than on the eight-year-old data from the last decennial census. Use of the 2018 U.S. Census Bureau population estimates

[17] The FCC's MVDDS market areas for which population data is presented here reflect Nielsen designated market areas ("DMAs") as they existed in 2002. Nielsen market area definitions are proprietary to Nielsen, and Nielsen has advised that any use and or reproduction of these materials without the express written consent of Nielsen is strictly prohibited. Nielsen DMAs also can be adjusted annually; therefore, Nielsen's 2019 DMAs do not correspond to the Nielsen DMAs as they existed in 2002. Nielsen's DMAs follow county boundaries for all of RSA/MDS's active geographic market area licenses, except for Albuquerque, where partial county population calculations are provided, again based on 2018 U.S. Census Bureau data.

rather than the 2010 U.S. Census Bureau population data uniformly required RSA/MDS to install either the same or a larger number of links to satisfy the safe harbor than would have been required if 2010 U.S. Census Bureau population data had been used. In no case did RSA/MDS's reliance on the 2018 data reduce its burden to meet the substantial service safe harbor. To meet customer demand, RSA/MDS has constructed a number of transmitting locations to deliver service to customers that surpasses the minimum in every market.[18]

A. Development of Business Plan

RSA/MDS has focused on providing high-bandwidth wireless services to underserved organizations, including public safety groups, veterans service organizations, and small or rural businesses. RSA/MDS recognized that these potential customers could use Internet connections but often lacked affordable options that provide robust and reliable service. In many of the license areas, wireline facilities do not reach the customer's needed locations, and barriers to wireline buildout, such as limitations on access to government lands, make access to the site challenging for wireline providers. Customers have struggled to procure wireless services like those that RSA/MDS offers. By offering attractive introductory service to community anchor institutions and key business stakeholders, RSA/MDS has helped increase customer awareness and engagement and, in so doing, stimulated demand for additional point-to-multipoint link subscriptions. Having configured its network to accommodate point-to-multipoint networks, RSA/MDS can scale economically to meet this growing demand by adding additional receive terminals in the vicinity of existing deployments. A number of markets have already

[18] In Albuquerque, RSA/MDS met the substantial service showing independently of the safe harbor by deploying a large-scale broadband Internet service offering that reaches more than 900,000 people, or approximately 50 percent of the total population of the Albuquerque geographic license area. *See infra* Section V.

demonstrated this growing demand, with existing customers requesting additional receivers or new, nearby customers requesting installations.

RSA/MDS initially identified more than 2,000 potential locations for building its network by focusing on a handful of hard-to-reach businesses with distinct needs. Even in geographic areas deemed served by traditional wireless operators, RSA/MDS identified shortfalls in current service offerings that a well-designed MVDDS system could overcome. Veterans service organizations, for example, often have dispersed facilities used for training or recreation that are not connected to the Internet. The lack of connectivity limits the opportunities of each post to attract and retain new members who would benefit from workforce training and other forms of post-service support. Similarly, vocational and technical facilities require Internet access across remote areas for large-scale simulated environments designed to replicate real-world conditions. A lack of connectivity among remotely located vocational training facilities impedes understanding of ways to improve the ability of both student and educators to learn from the field experience.

Not all of the potentially addressable service locations would prove suitable for deployment, however, because the MVDDS rules impose a variety of operational limitations that constrain a licensee's ability to select deployment locations. MVDDS operations, for example, are prohibited from causing interference to certain legacy DBS receivers.[19] And serious operational constraints apply along all international boundaries of the United States.[20] Therefore,

[19] 47 C.F.R. § 101.1440.

[20] In Mission, Texas, for example, RSA/MDS identified the Center for Education and Economic Development ("CEED") as an eager customer where a desk top Equivalent Power Flux Density ("EPFD") analysis and site walks of the area demonstrated no potential for interference; however, RSA/MDS could not provide service at that location because the proposed site was some three miles from the United States border with Mexico, where the Commission's decades-

RSA/MDS had to orient its business model to: (1) serve customers not already well-served by existing wireline and wireless providers; (2) do so only in those areas that would not conflict with co-primary DBS receivers operating in the same spectrum; and (3) comply with other operational constraints that apply to the band.

B. Identification of Deployment Sites

When assessing the feasibility of each potential customer location, RSA/MDS relied on satellite imagery to conduct a more detailed site analysis to assess location topography, analyze potential DBS coordination issues, and ensure the proposed service to new customers satisfied all other Commission rules and restrictions. Having pared down the list of addressable sites, RSA/MDS then conducted physical site walks of each potential location to assess potential interference issues, to speak with potential customers to gauge interest, and to identify the opportunity to support additional receive terminals from any given access point.

At the end of this process, RSA/MDS prioritized 300 transmitter sites that would receive service in the near-term. The customers at these locations included: (1) the Texas A&M Engineering Extension Service's training sites for first responders, including "Disaster City;" (2) several municipalities, including Salem, West Virginia; (3) a veterans therapeutic riding center; (4) several dozen veterans service organizations, such as Veterans of Foreign Wars and

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old rules impose special coordination obligations and prohibit all MVDDS deployments, pending adoption of an as-yet unrealized final international agreement with Mexico governing MVDDS and notwithstanding the very low power levels at which MVDDS systems must currently operate. 47 C.F.R. § 101.1423 (providing that "[n]o stations are allowed within 5 miles of the borders" and requiring the use of coordination procedures within 35 miles of the border "until final international agreements concerning MVDDS are signed"). CEED houses the regional headquarters of Teach for America, a community magazine (*RGVision*), a veteran-owned craft brewery that sells its products to more than 100 restaurants and bars in the Rio Grande Valley, and classrooms for continuing education. CEED has identified alternative sites for development and has engaged with RSA/MDS to deploy them in the coming weeks.

American Legion posts; and (5) various small businesses, franchises, and commercial partners, such as InSite Wireless Group, OUTFRONT Media Inc., Food City, Inc., franchisees of Kampgrounds of America ("KOA") and True Value Hardware, and Fanelli Boys, Inc.

C. Development of Network Technical Design

Under current MVDDS rules, MVDDS spectrum may only be used for any digital, fixed, non-broadcast service;[21] two-way service is permitted only "by using other spectrum or media for the return or upstream path."[22] MVDDS transmit power has an Equivalent Isotropically Radiated Power ("EIRP") limitation of 14 dBm per 24 MHz.[23] MVDDS licensees must meet Equivalent Power Flux Density ("EPFD") levels, which vary by region of the United States at each DBS subscriber location. The regions and corresponding EPFD limits are: (1) East: -168.4 dBW/m^2 /4kHz; (2) Midwest: -169.8 dBW/m^2 /4kHz; (3) Southwest: -171.0 dBW/m^2 /4kHz; and (4) Northwest: -172.1 dBW/m^2 /4kHz.[24]

Given the Commission's established operating constraints for MVDDS,[25] technical design of the network was labor intensive. When evaluating site locations, RSA/MDS performed an initial radiofrequency engineering analysis, which required: (1) analyzing each site using satellite imagery to determine initial feasibility; (2) conducting physical site walks to

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[21] In the *MVDDS Order*, the Commission clarified that permissible "non-broadcast" services included "fixed one-way service direct-to-home/business video and data services." *MVDDS Order* ¶ 137. The Communications Act defines "broadcasting" as "the dissemination of radio communications intended to be received *by the public*, directly or by the intermediary of relay stations." 47 U.S.C. § 153(7) (emphasis added). Because RSA/MDS's fixed, one-way service deployments are directed to private customers and not the public at large, they qualify as "non-broadcast" services under the Communications Act and the *MVDDS Order*.

[22] 47 C.F.R. § 101.1407.

[23] 47 C.F.R. §§ 101.113(a) fn.11, 101.147(p).

[24] *See* 47 C.F.R. § 101.105(a)(4)(ii)(B).

[25] 47 C.F.R. § 101.1401 *et seq.*

assess potential coordination issues with DBS dishes and the location's topography, which includes determining whether trees, buildings, or elevation changes would affect the ability to close network links; and (3) evaluating opportunities to turn a point-to-point link into a point-to-multipoint link by looking for sites where multiple receivers could be placed within an antenna's 90-degree "look angle" and more efficiently provide wireless services to a larger area. Wherever feasible, RSA/MDS selected site locations that offered the greatest potential for deploying multitenant connections. Building a point-to-multipoint network with future growth in mind promised to fortify RSA/MDS's business model and long-term business prospects while better serving customers.

RSA/MDS then finalized its network equipment design. Through its relationship with Cambridge Broadband Networks Limited ("Cambridge Broadband"),[26] RSA/MDS acquired small, easy-to-maintain access points and remote terminals for downlink use in RSA/MDS's point-to-multipoint network that supported channel bandwidths of 25 megahertz and were capable of delivering up to 25 Mbps gross throughput per sector.[27] Working with installation partners, RSA/MDS secured and confirmed transmitter locations for its target customers, ordered radios and ancillary network equipment, and secured backhaul from third-party providers.

Meanwhile, RSA/MDS organized a comprehensive supply chain and logistics operation to support field deployments of the point-to-multipoint MVDDS equipment. Working together with Novation Networks ("Novation") – a veteran owned-and-operated business founded in 2012

[26] Cambridge Broadband was established in 2000 by ten engineers based at Cambridge University in the United Kingdom and creates equipment that complies with the FCC's MVDDS rules. *See* Cambridge Broadband, *About CBNL*, https://cbnl.com/about-cbnl (last visited July 25, 2019).

[27] RSA/MDS's network in Albuquerque offers higher speeds to customers (and covers approximately 50 percent of the population in the geographic license area) due to a waiver of the Commission's MVDDS EIRP limits for the Albuquerque market only. *See infra* Section V.

that deploys wireless broadband networks, services, and programs – RSA/MDS identified the long list of radiofrequency and non-radiofrequency components necessary to support each installation, from network transmitters and receivers to fasteners, supply lines, ties, power cables, sealants, and related gear. RSA/MDS worked to ensure every field unit had all the equipment needed to install the MVDDS point-to-multipoint system correctly the first time because second installation visits increase costs considerably. In support of this goal, RSA/MDS made a point of requiring pre-installation inspection, assembly, integration, and testing of each customer deployment prior to conducting a truck roll to the planned service site. Moreover, to prepare each kit for delivery, RSA/MDS acquired access to secure storage facilities large enough to accommodate multiple concurrent kit assemblies for eventual delivery and installation throughout its far-flung license footprint. Developing this type of comprehensive, forward-looking supply chain management system required considerable time and investment; however, RSA/MDS understood that achieving sustainable operations and ensuring a high level of customer satisfaction depended on the type of upfront investment that would allow for the installing of equipment as efficiently as possible.

RSA/MDS also designed and built a Network Operations Center ("NOC") in Stuart, Florida. The NOC has proven critical to managing RSA/MDS's broadly distributed MVDDS network infrastructure. The NOC allows the operations team to review network operations for faults and errors 24 hours per day, seven days per week as well as to take preventative measures to ensure network disruptions do not occur. Continuous monitoring through the NOC also accelerates event detection, reduces downtime, and improves the ability of RSA/MDS to deliver on its high service-level objectives for customer support. The NOC is also able to support post-event, root-cause analysis to improve the RSA/MDS network over time.

The NOC includes the following equipment:

- Mikrotik Gigabit routers (RB1100AHx4);
- Mikrotik 24x Gigabit Ethernet layer 3 Smart Switches (CRS125-24G-1S-IN);
- Dell Precision 3930 Rack Workstations;
- CyberPower PR1000LCDRM1U rackmount Uninterruptible Power Supply; and
- EnEdge 1U Rack Mount Aluminum Power Distribution Unit ("PDU").

Other than the PDU, RSA/MDS has installed and supported redundant equipment for each element of the NOC infrastructure to increase network reliability and resilience. If one piece of equipment experiences a fault, the parallel, duplicate equipment ensures continuous operation.

The NOC supports RSA/MDS's mission critical, line-of-business activities. The NOC connects to endpoints on the RSA/MDS network via a separate data connection, allowing the NOC to communicate with network endpoints. The NOC uses pre-installed battery back-up power in the event of a prolonged power outage and features autonomous power support for field units, which allows the company to reboot an endpoint's router remotely without the time and expense of a truck roll to remote locations.

To monitor endpoints, the NOC maps the network and displays real-time connections, disconnections, and performance levels for individual links. The NOC alerts operators whenever specified events occur or when support is necessary. The NOC can be programmed to send out "first-level" technical issues, which can be handled either at the NOC or by personnel contracted to work with customers over the phone and to troubleshoot the customer's router. Included among the NOC's five displays is a "board" monitor, which enables non-technical personnel to observe the quality of network performance and operations at all levels without disrupting the

network configuration or impeding the ability of the operations staff to provide back-end maintenance, problem resolution, and support.

While deploying an advanced NOC represents a substantial upfront investment for RSA/MDS, the NOC promises long-term benefits by allowing company personnel to more rapidly identify and resolve potential customer-service interruptions through careful, continuous monitoring of the distributed MVDDS network infrastructure. The NOC will also more easily allow RSA/MDS to scale up the number of its deployments in the future.

D. Typical Site Location Installation Process

Of the initial 2,000 potential locations it identified when formulating its business plan, RSA/MDS concentrated on installing and providing service to 300 in the near-term, with a special focus on locations where multipoint architecture provided a pathway for growth. RSA/MDS's partner Novation installed MVDDS antennas and other infrastructure on customers' premises. At the end of each successful installation, Novation's contractors – veterans receiving on-the-job training through Warriors4Wireless, a non-profit entity that trains veterans to work in the wireless industry – prepared a "Close-Out Document" memorializing key parameters and specifications of each location's buildout.[28] These Close-Out Documents included photographs of the deployment; antenna geo-coordinates; the serial numbers for antennas, modems, and other equipment; and confirmation that the location connected to the NOC. A copy of one such Close-Out package is attached as Exhibit 3.[29]

As an example, the infrastructure deployed on the property of Hanover Stables in Castle Hayne, North Carolina illustrates a typical MVDDS installation that occurs on the customer's

[28] *See, e.g.*, Exhibit 3 ("Installation Close-Out Document for Fanelli Boys (Parkersburg, WV)").

[29] A full set of Close-Out packages for all sites documented in this submission is on file with RSA/MDS and can be made available to the Commission on request.

premises. At Hanover Stables, Novation contractors installed Ligo Wave transmit and receive MVDDS antennas at multiple stables and the covered arena, as shown below.[30]

RSA/MDS installed A Site and B Site Antennas in Castle Hayne, NC.

Following installation of the transmit and receive antennas, Novation then checked and recorded the azimuth for each – that is, Novation measured the angle at which the antennas were directed in order to ensure a functional link and to avoid the possibility, if any, of harmful co-channel interference.

[30] While discussion of the installation process focuses on one link at Hanover Stables, Novation installed another MVDDS transmitter and receiver between the stable's covered arena and garage.

RSA/MDS verified the A Site and B Site Azimuths in Castle Hayne, NC.

The antennas and modems were then wired with approximately 55 feet of Ethernet CAT 5 routing from the MVDDS antenna to the building's interior. Novation also used remote terminals and access points from Cambridge Broadband to connect the deployment to the NOC. Cambridge Broadband developed its terminals and access points for use in point-to-multipoint systems and to comply with the Commission's MVDDS rules by operating a downlink, one-way mode in the 12 GHz band. The equipment supports a channel bandwidth of 25 megahertz, can deliver speeds of up to 25 Mbps, and weighs only 11 pounds, which makes it easy to install and maintain. Cambridge Broadband's terminals and access points are compatible with a range of antennas, including 1ft/30cm or 2ft/60cm parabolic dish antennas (for remote terminals) and vertically or horizontally polarized sector horn antennas (for access points).

RSA/MDS installed this CBNL Radio Transmitter in Castle Hayne, NC.

Finally, Novation undertook numerous resiliency and hardening measures, installing lightning protection using a CITEL surge protector, open suppression systems to prevent fires, and wall penetrations to weather proof equipment.

Successful operation of an MVDDS installation requires power. Unfortunately, not all locations had a preexisting power source. Where the use-case was strong but for an absent power source, Novation contracted with local electricians to secure permitting; install a dedicated, weather-proof circuit; trench conduit to the desired installation location; and, if necessary, install a separate meter. The process of installing electricity at a site can easily take up two weeks or longer, especially if the permitting process does not run smoothly. RSA/MDS's buildout required the installation of electricity at approximately 70 locations, adding an additional layer of complexity to its buildout.

RSA/MDS, in partnership with Novation, has performed a similar set of processes that it undertook in Castle Hayne, North Carolina in each of the 285 transmitter sites where RSA/MDS has installed MVDDS point-to-multipoint equipment.[31]

E. Coordination with Co-Channel DBS Operations

RSA/MDS complied with the Commission's requirements that MVDDS licensees coordinate their network buildout with co-channel DBS operators.[32] The Commission requires MVDDS licensees to "cooperate fully and in good faith to resolve whatever potential interference and transmission security problems may be present in adjacent areas and co-channel operations."[33] To this end, RSA/MDS only deployed at locations for which DBS operators received EPFD notices, took into account all DBS operator feedback in response to those notice and waited until the 90-day evaluation period had passed before commencing service.

Before initiating coordination procedures with other operators in the 12 GHz band, RSA/MDS conducted a Desk Top survey of each potential location. Each Desk Top survey began with a visual inspection from the roof of each location to make note of any DBS dishes installed on rooftops and therefore "determine the location of all DBS customers who may

[31] In addition to these transmitter sites, RSA/MDS deployed a large-scale broadband Internet service offering that covers more than 900,000 people, or approximately 50 percent of the market, in the Albuquerque geographic license area.

[32] *See* 47 C.F.R. §§ 101.1440(a) ("An MVDDS licensee shall not begin operation unless it can ensure that the EPFD from its transmitting antenna at all DBS customers of record locations is below the values listed for the appropriate region in § 101.105(a)(4)(ii)."), 101.1440(b) ("MVDDS licensees are required to conduct a survey of the area around its proposed transmitting antenna site to determine the location of all DBS customers of record that may potentially be affected by the introduction of its MVDDS service."), 101.1440(d)(1) (requiring MVDDS licensees to provide certain information to DBS licensees "at least 90 days prior to the planned date of MVDDS commencement of operations"), 101.1440(d)(3) ("Prior to commencement of operation, the MVDDS licensee must take into account any new DBS customers or other relevant information provided by DBS licensees in response to the notification in paragraph (d)(1) of this section.").

[33] *MVDDS Order* ¶ 188.

potentially be affected by the introduction of MVDDS service."[34] RSA/MDS also developed detailed data on each proposed site, creating site-specific deployment information that included: (1) a review of visual geospatial imagery of the transmitter site location and its surroundings; (2) an analysis of various technical parameters, including the main beam azimuth, description of the antenna radiation pattern, altitude orientation/tilt, height above ground level, maximum EIRP of each transmitting antenna system, power levels, and antenna type; and (3) an analysis of local conditions using the EPFD contour model developed by the Commission.[35] If no DBS equipment was visible within the radiation pattern of the MVDDS antenna, including the transmitter's main beam, side lobes, and back lobe, the analysis demonstrated that the proposed site had no potential for the proposed MVDDS operations to create harmful interference to DBS receivers.

Using geospatial imagery, RSA/MDS created models that showed where it would locate the A Site and B Site equipment to create a link, shown here as a red line.

RSA/MDS then notified the two DBS operators, AT&T, Inc. ("AT&T") and DISH Broadcasting Corporation ("DISH"), of all potential sites for deployment and complied with all

[34] *Id.* ¶ 91.

[35] *See id.*

notification and coordination obligations.[36] RSA/MDS emailed the notifications in batches to each DBS provider. In separate emails to both AT&T and DISH, RSA/MDS submitted 850 notifications on March 7, 2019; 20 notifications on March 11, 2019; 280 notifications on April 6, 2019; 4 notifications on April 15, 2019; 729 notifications on April 22, 2019; 151 notifications on April 26, 2019; and 1 notification on April 27, 2019. The DBS operators confirmed receipt of these notifications. Consistent with the coordination obligations that apply to MVDDS licensees,[37] RSA/MDS provided the DBS licensees extensive information regarding the planned service deployments, including information about site location and the proposed operating parameters, such as the latitude/longitude coordinates, height above average terrain, power, and other operating parameters as well as a narrative description of the service area.

If a DBS operator is concerned that a proposed MVDDS deployment may cause interference to its customers, it is required by FCC rules to provide a notifying MVDDS licensee with a list of the potentially impacted DBS customer locations.[38] However, in response to the deployment notices that RSA/MDS duly sent to each DBS provider, neither AT&T nor DISH provided RSA/MDS with information about specific subscribers that might experience interference.

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[36] *Id.* ¶ 92.

[37] *See* 47 C.F.R. § 101.1440.

[38] *See* 47 C.F.R. § 101.1440(d)(2) (providing that "[n]o later than forty-five days after receipt of the MVDDS system information in paragraph (d)(1) of this section" the DBS licensee identify newly installed sites that the MVDDS operator could not have identified, "indicate agreement with the MVDDS licensee's technical assessment [that no interference is likely], or identify DBS customer locations that the MVDDS licensee failed to consider or DBS customer locations where they believe the MVDDS licensee erred in its analysis and could exceed the prescribed EPFD limit.").

Instead, AT&T "strongly recommended" that alternate sites or transmission parameters be considered with respect to 83 of the 2,035 potential sites, and AT&T "recommended" that alternate sites or transmission parameters be considered at hundreds of other proposed MVDDS site locations, in both cases without identifying specific DBS subscribers that might be affected or providing other supporting technical information. DISH replied that its "preliminary analysis" indicated that 900 of RSA/MDS's proposed sites may cause interference to unspecified DISH customers. DISH did not indicate which 900 of RSA/MDS's 2,035 prospective deployment sites it believed might cause this interference and offered no response to any of the subsequent coordination notices that RSA/MDS submitted.

RSA/MDS sent personnel back into the field to conduct additional site inspections for potential DBS receivers prior to MVDDS deployment, taking into account the recommendation of AT&T and DISH.[39] This fresh examination of site conditions provided RSA/MDS further assurances that no DBS receivers were in a location proximate to the transmission path of a planned low-power MVDDS link. RSA/MDS undertook these additional site examinations notwithstanding the lack of meaningful detail about customer locations or operating conditions received from AT&T or DISH, as they are required to provide under Commission rules. Nevertheless, in an abundance of caution and in the spirit of mutual cooperation, RSA/MDS refrained from deploying MVDDS service at sites for which AT&T "strongly recommended" an alternate site or transmission parameter, except for seven sites where further specific on-site diligence confirmed a lack of potential interference to DBS.

[39] *See* 47 C.F.R. § 101.1440(d)(3) ("Prior to commencement of operation, the MVDDS licensee must take into account any new DBS customers or other relevant information provided by DBS licensees in response to the notification in paragraph (d)(1) of this section.").

RSA/MDS exercised thorough due diligence, including multiple site visits, transmission parameter planning, and related operational design modifications to ensure that harmful interference for DBS subscribers does not occur. It took into account, consistent with Commission rules, the concerns expressed by DBS providers. RSA/MDS is highly confident that its MVDDS deployments are not causing and will not cause harmful interference to DBS subscribers. To be clear, RSA/MDS understands that under FCC regulations it remains ultimately responsible for remediating interference DBS receivers experience as a result of its MVDDS deployments for one year following notification and intends to fulfill its mitigation obligations in the unlikely event the need should arise.[40]

F. Coordination with Co-Channel NGSO FSS Operators

MVDDS licensees must notify non-geostationary fixed satellite service ("NGSO FSS") operators of sites that MVDDS licensees intend to build prior to MVDDS construction and provide certain technical information about the proposed MVDDS site operations to the NGSO FSS licensees.[41] MVDDS licensees may construct any proposed MVDDS sites that are located

[40] *See* 47 C.F.R. §101.1440(g) ("The MVDDS licensee must satisfy all complaints of interference to DBS customers of record which are received during a one year period after commencement of operation of the transmitting facility. Specifically, the MVDDS licensee must correct interference caused to a DBS customer of record or cease operation if it is demonstrated that the DBS customer is receiving harmful interference from the MVDDS system or that the MVDDS signal exceeds the permitted EPFD level at the DBS customer location.").

[41] 47 C.F.R. § 101.103(f)(1) ("Prior to the construction or addition of an MVDDS transmitting antenna in this frequency band, the MVDDS licensee shall provide notice of intent to construct the proposed antenna site to NGSO FSS licensees operating in the 12.2-12.7 GHz frequency band and maintain an Internet web site of all existing transmitting sites and transmitting antennas that are scheduled for operation within one year including the 'in service' dates."). MVDDS licensees must coordinate with pre-existing NGSO FSS receivers. If an NGSO FSS licensee is not yet operational, there are no receivers to be coordinated and, thus, no apparent reason for MVDDS licensees to provide NGSO FSS licensees with notice. In the interest of fully apprising all market actors of RSA/MDS's deployment intentions, however, RSA/MDS provided notice to

more than 10 kilometers away from an NGSO FSS site within one year.[42] If the MVDDS licensee does not construct the notified MVDDS site location within one year, the MVDDS licensee's protection right notification date sunsets for that MVDDS site.[43]

RSA/MDS has satisfied the Commission's notification and coordination requirements. On May 7, 2019, RSA/MDS notified six NGSO FSS operators with authorizations to use the 12 GHz band of its intent to construct MVDDS transmitting antennas at up to 2,035 site locations. The notified NGSO FSS operators included WorldVu Satellites Limited d/b/a OneWeb; Space Exploration Holdings, LLC; Space Norway AS; Theia Holdings A, Inc.; Karousel LLC; and Kepler Communications Inc. RSA/MDS served notices of MVDDS construction out of an abundance of caution, even though no authorized NGSO FSS operator has deployed qualifying receivers in the 12 GHz band.[44]

IV. RSA/MDS'S DEPLOYMENT SERVES THE PUBLIC INTEREST BY PROVIDING SERVICE TO A NUMBER OF NICHE MARKETS TRADITIONALLY UNSERVED OR UNDERSERVED

In addition to the large-scale deployment in Albuquerque discussed in Section V, which provides commercial broadband Internet access to residences and businesses, RSA/MDS has generally targeted certain niche and underserved markets.[45] For example, even with the power and service limitations that the Commission's rules impose on MVDDS licensees, RSA/MDS has deployed wireless service to public safety training facilities and educational institutions,

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all NGSO licensees and applicants despite the absence of any NGSO FSS commercial deployments.

[42] 47 C.F.R. § 101.129(b).

[43] 47 C.F.R. § 101.129(b)(3).

[44] *See* 47 C.F.R. § 101.129(b)(1).

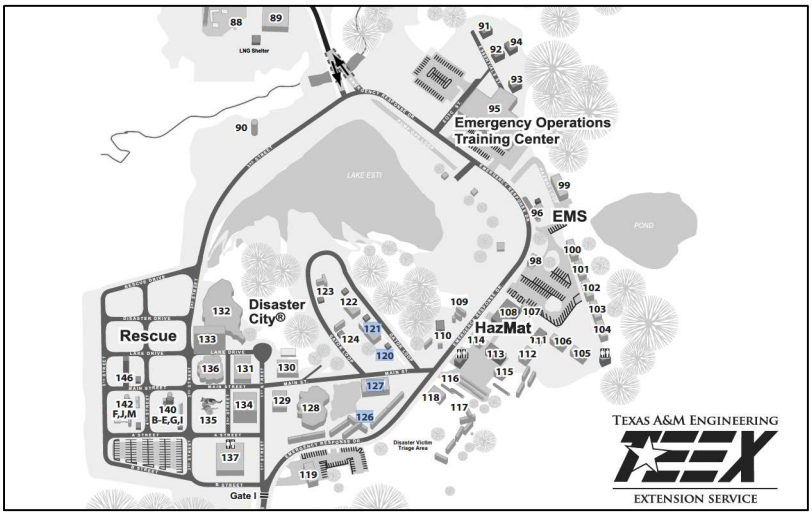
[45] In Albuquerque, RSA/MDS has entered into a service agreement with Cibola Wireless to provide commercial broadband Internet access via MVDDS and unlicensed spectrum to approximately 50 percent of the market in the geographic license area. *See infra* Section V.

creating new opportunities for these entities to live-stream training classes and exercises. RSA/MDS also has deployed wireless service at tower site locations, which will provide tower climbers with mission-critical Internet access when tower radios are either disabled for safety or out of commission and in need of repair, and at electronic billboards, which can use MVDDS' one-way wireless signal to safely change advertisements without requiring climbers, paper, and glue. For veterans service and support organizations, RSA/MDS has deployed wireless service at horse stables that offer veterans therapeutic riding lessons and Veterans of Foreign Wars ("VFW") halls so that these organizations can enhance programs for veterans' physical and mental health care and career development. In rural areas, RSA/MDS has deployed Internet connectivity services to a variety of small businesses, including True Value hardware stores, Food City supermarkets, and KOA campgrounds, which will allow these businesses to operate more efficiently and to better serve their customers.

A. Public Safety and Educational Institutions

Wireless Internet connectivity can improve operations by enabling real-time video streaming and other services for remote instruction. Recognizing this opportunity, RSA/MDS has sought out public safety organizations training first responders and community anchor institutions that provide educational and economic opportunities for residents, including at Texas A&M University's Engineering Extension Service ("TEEX") (discussed below). RSA/MDS has also partnered with educational institutions, such as St. Mary-of-the-Woods, a Catholic liberal arts college in Terre Haute, Indiana, to deploy and operate a wireless system that allows the school to live-stream online video and monitor its property at multiple vantage points where wires may be impractical or difficult to install.

TEEX (Disaster City, Brayton Fire Training Field). At its campus in College Station, Texas, TEEX annually trains more than 85,000 first responders from all U.S. states and territories and more than 81 countries.[46] Along with related training facilities, the TEEX campus includes "Disaster City," a 52-acre mock community that offers first responders customized, hands-on training in a wide variety of emergencies, including chemical fires, earthquakes, and attacks on critical infrastructure, such as the electric grid, roads, and telecommunications. In addition to Disaster City, the TEEX campus also includes a 300-acre fire training field and Emergency Operations Training Center.



The TEEX Campus includes the Disaster City, Brayton Fire Training Field, and the Emergency Operations Training Center, among other emergency training sites.[47]

The TEEX campus features full-scale structures designed to simulate a variety of disasters as realistically as possible. For example, the transportation disaster training area has two rail-car assemblies. The first scenario simulates a chemical and freight train derailment

[46] *See* Texas A&M Engineering Extension Service ("TEEX"), *About Us*, https://teex.org/Pages/about-us/about-us.aspx (last visited July 25, 2019). TEEX trains a total of 196,000 first responders annually, though not all travel through its College Station campus.

[47] *Id.*

involving both derailed cars and cars sitting on tracks. TEEX has outfitted the rail cars with a plumbing system to simulate leaks of liquid fuel and toxic chemicals. The second scenario features an actual passenger train in a derailment configuration that allows TEEX to offer first responders a hyper-realistic tangle of rail cars, catenary poles, and high-voltage transmission lines from which to learn how to extract people playing wounded and dead passengers as quickly, safely, and efficiently as possible.

Disaster City is one of the nation's top canine evaluation and training centers.[48]

For all of the sophistication of TEEX's rescue scenarios, however, the educational mission of the institution is limited by a lack of reliable, high-throughput connectivity from the emergency operations command centers to the different Disaster City environmental stations. Service on the remote, 52-acre campus is spotty and fiber connections are virtually non-existent. But the demand for connectivity is substantial because of the need to connect the sprawling campus to the classroom training centers and leadership environments.

[48] TEEX, *Rubble Pile and Canine Training*, https://teex.org/Pages/about-us/rubble-pile.aspx (last visited July 25, 2019).

As just one example of the need for connectivity, TEEX conducts tabletop exercises that allow public safety managers to discuss emergencies being simulated elsewhere on the campus. Participants in the tabletop exercise review the emergency, test their plans against the scenario, and identify shortcomings in the chain of command or response plan to improve their preparedness for an actual disaster. While these exercises allow leadership personnel to identify strengths and areas for improvement through supportive group discussion, the tabletop exercises are largely, if not entirely, disconnected from the elaborately simulated operational response scenarios unfolding in real-time elsewhere on the campus. The lack of interaction creates an artificial barrier between classroom learning and the field experience.

The Transportation Disaster Training Area uses genuine passenger and freight train cars, which are positioned in realistic derailment configurations and outfitted with plumbing to train emergency responders how best to handle chemical leaks.[49]

TEEX and RSA/MDS have partnered to help bridge this gap. The five MVDDS transmitter locations and multiple receive-site equipment that RSA/MDS has deployed connect the Emergency Operations Training Center and other leadership areas with field stations spread across the TEEX campus. These dedicated connections will allow TEEX to integrate the

[49] TEEX, *Transportation Disaster Training Area*, https://teex.org/Pages/about-us/transportation-disaster-training-area.aspx (last visited July 25, 2019).

tabletop exercises with the field environments and, in so doing, offer new pedagogical opportunities to help public safety leaders and front-line personnel better understand the challenges they face as a unit. With access to live, high-quality video streams from the field, for example, the first responder leadership teams not physically present at the exercise site can better validate their plans and readiness against real-time information drawn from the simulated operational environment taking place elsewhere on the campus. And by varying the amount and source of information received from the field operations, TEEX educators can test and validate the leadership team's ability to operate in a variety of lifelike scenarios where they may receive either too much or too little information, which taxes their ability to make intelligent decisions in real time.

The Brayton Fire Training Field includes full-size aircraft models as part of its Aircraft Rescue and Firefighting program.[50]

TEEX anticipates that offering more realistic tabletop exercise programs will improve first responders' operational response times and, ultimately, improve the ability of first responders in the United States and around the world to save lives and property. As its wireless

[50] TEEX, *Aircraft Rescue and Firefighting (ARFF)*, https://teex.org/Pages/Program.aspx?catID=319&courseTitle=Aircraft%20Rescue%20and%20Firefighting%20(ARFF)&division=ESTI (last visited July 25, 2019).

service demonstrates its value and improves emergency responders' and city officials' learning experience, RSA/MDS is excited by the opportunity to increase the number of links installed at TEEX's facilities. This opportunity includes installing more links at TEEX's College Station campus as well as its RELLIS campus in Bryan, Texas. RELLIS is specifically designed for public utility workers and includes "overhead and underground electric power training fields, a firing range for law enforcement officers, a heavy equipment training field, an emergency vehicle-driving track, unexploded ordnance ranges and search grids, and simulation prop houses for tactical training."[51]

B. Municipal Organizations

City of Salem, West Virginia. A town of roughly 1,500 people, Salem is nestled in the heart of Appalachia. For the city of Salem, RSA/MDS has installed four separate point-to-multipoint systems:

- One system has commenced service by connecting the fire station and library;
- A second system has begun service by connecting a municipal building to a pavilion on the North Bend Rail-Trail, a 72-mile pathway used for biking, hiking, and horseback riding that is part of the 5,500 mile American Discovery Trail;[52]
- A third system has established service by connecting a municipal building to a church and nearby tennis courts used by Salem College's tennis team; and
- A fourth system has begun point-to-multipoint service by connecting a municipal building to the baseball fields.

As a small town located in the mountains, Salem lacks robust wireline facilities to deliver residents and businesses high speeds that more urban residents take for granted. Salem's Town

[51] TEEX, *Texas A&M University RELLIS Campus*, https://teex.org/Pages/about-us/rellis-campus.aspx (last visited July 25, 2019).

[52] West Virginia State Parks, *North Bend Rail Trail*, https://wvstateparks.com/park/north-bend-rail-trail/ (last visited July 25, 2019).

Manager, Ronnie Davis, told RSA/MDS that Salem residents regularly complain about Internet speeds and reliability. When asked to describe RSA/MDS's wireless service, Mr. Davis said that the service would be a "big boost" for Salem's educational and recreational centers. For example, the library's Internet connection experiences limited speeds. By extending connectivity from the fire station, which is located across the street and has a robust Internet connection, the library can offer better Internet access service to students who study at the facility at night. According to Mr. Davis, a faster, more reliable connection than what students may have at home will help narrow the digital divide in rural areas, like those in Salem.

The other backbone point-to-multipoint deployments that RSA/MDS has installed in Salem promises to strengthen community involvement. For example, the service connecting a municipal building to points on the North Bend Rail-Trail will serve multiple purposes. There is a pavilion on the North Bend Rail-Trail that hosts concerts and events that attract anywhere from 1,800 to 2,200 people. Where cellular connections may be spotty, RSA/MDS's service can help concertgoers check email, send text messages, and post photos or videos of the event on social media. Additionally, cyclists, hikers, and horseback riders frequently travel along the Rail-Trail. More than 72 miles long, the Rail-Trail offers numerous opportunities for travelers to stop, take a break, hop online, and grab something to eat or drink. By expanding Internet connectivity from Town Hall to the pavilion, which sits by the Rail-Trail, Salem hopes to be known as an "Internet hub" where travelers stop for a break. As part of their rest stop, they may venture half a block onto Main Street, where they can support local businesses. Meanwhile, the link from Town Hall across Main Street to the church will connect the church's youth center, which serves nearly 60 children of all ages, as well as an addiction recovery group. The church's pastor has said that a

reliable connection will help maintain attendance at community events, such as cookouts and support events.

Other deployments in Salem suggest the growth opportunities for RSA/MDS's point-to-multipoint technology. For example, deployment from a municipal building to Salem's baseball fields will expand Internet connectivity to the concession stand, which sits between: (1) a baseball field for Kindergartners to second graders; (2) a baseball field for Little League; and (3) a softball field. Beyond expanding wireless capabilities at the baseball fields, Salem has expressed interest in having RSA/MDS install wireless service at a converted armory, which once housed the West Virginia National Guard and is currently being converted into a shelter and community center, and at Salem University.

C. Electronic Billboards and Base Stations

Electronic Billboards. Among the more promising commercial opportunities RSA/MDS has identified is the delivery of high-resolution advertising to LED billboards. Maximizing the utility of large-format, high-resolution display advertising platforms requires new data-delivery systems. While many billboards are located along major thoroughfares, few have fiber connectivity, and traditional cellular wireless connectivity is frequently either unavailable or impractical due to comparatively high costs, limited coverage, or poor reliability. The barriers associated with connecting many billboard locations to the Internet increase the upfront cost and operating expense for next-generation display ads and have helped slow the adoption of digital advertising platforms. But unilateral information-delivery networks, such as one-way, point-to-multipoint MVDDS systems, allow for a cost-effective means of delivering high-resolution imagery to remote locations. And once the site owner has solved the challenge of the last leg of connectivity, businesses are more willing to consider running display advertising at the facility.

They grow more confident that the site warrants the kind of investment needed to convert from static displays that can fade, crack, and peel to vibrant digital ads supported by thousands of LED bulbs flawlessly rendering color for ten years or more.

To help address the growing demand for next-generation outdoor display advertising, RSA/MDS partnered with Diamond Communications, LLC ("Diamond Communications"), which acts as an agent for wireless equipment deployment on OUTFRONT Media's billboards. Formerly known as CBS Outdoor, OUTFRONT Media is a national leader in outdoor advertising with more 29,000 billboard structures located in 37 states and is one of the largest out-of-home media companies in North America. Having seen that OUTFRONT Media locations prove more attractive to potential advertisers when they can support synchronous delivery of high-quality imagery, Diamond Communications entered a strategic agreement with RSA/MDS to install links at sites that it manages. The testbed deployment that RSA/MDS has implemented in partnership with Diamond Communications has converted a static billboard into a "digital ready" platform capable of offering consumers relevant, compelling, next-generation advertising at an attractive price. With numerous opportunities for expansion, RSA/MDS intends to focus its deployment initiative on those outdoor advertising platforms that are in close proximity to other as-yet unconnected assets. Careful site selection will leave RSA/MDS well positioned to capitalize on its existing facilities-based investment by incorporating additional receive-site locations at other nearby billboards, signs and related infrastructure.

Towers and Wireless Infrastructure. As part of its continuing effort to maximize the opportunities within the nearly twenty-year-old service-rule constraints that the FCC imposes on MVDDS licensees, RSA/MDS investigated other short-hop, point-to-multipoint opportunities in

need of connectivity. The area in the immediate vicinity of towers and related wireless infrastructure proved to be an important market segment in need of additional connectivity.

RSA/MDS partnered with: (1) InSite Wireless Group, one of the largest privately owned tower and wireless infrastructure companies in the United States;[53] and (2) Diamond Communications, which (in addition to managing the wireless equipment deployments for OUTFRONT Media's billboards) has more than 200,000 wireless infrastructure sites under management across the United States, with well over 1,000 tenanted sites.[54] Both companies have hundreds of towers located in RSA/MDS's leased license areas, often in rural or remote areas where wireline connections are economically infeasible or otherwise lacking.

In RSA/MDS's discussions with InSite about potential partnership opportunities, RSA/MDS learned that while these businesses provide infrastructure for wireless service providers, the tower locations themselves sometimes lack critical wireless Internet connectivity. When tower climbers come to install collocations or replace faulty equipment, they often find themselves unable to connect to the Internet. The lack of connectivity can occur because the workers are at the site to restore wireless connections or because antennas placed on the tower are disabled to mitigate RF hazards to tower climbers working on the tower. Additionally, some radio and television broadcast towers and other infrastructure do not host wireless broadband antennas and may lack sufficient coverage to provide coverage for tower climbers to communicate in emergencies or process paperwork while on-site.

[53] InSite Wireless Group, LLC, *About Us*, https://insitewireless.com/about-us/ (last visited July 25, 2019).

[54] Diamond Communications LLC, *About Us*, https://www.diamondcomm.com/us/ (last visited July 25, 2019).

To promote connectivity and facilitate compliance with worker-safety rules requiring the termination of radiofrequency transmission units at tower locations, RSA/MDS installed MVDDS solutions at 58 InSite and two Diamond Communications towers. The installation extends wireless connectivity to areas underneath the tower and nearby areas, which provides tower climbers and other personnel with the necessary connectivity to work on location. Without wasting time searching for signals, climbers can work more efficiently and, by extension, visit more locations in a given time period.

RSA/MDS also installed wireless video security solutions at numerous InSite tower locations. Trespassers often enter these locations to climb the tower or vandalize tower company or carrier property. By installing video security at these locations, RSA/MDS can eliminate potential blind spots for infrastructure owners and their employees. Increased surveillance not only protects existing infrastructure and tenants' property, but also enhances public safety by deterring intruders and preventing injuries and deaths from potentially hazardous site conditions.

D. Veterans Support and Service Organizations

Veterans support and service organizations often have additional facilities, such as disconnected secondary buildings, recreational grounds, pavilions, fields, and parking lots that are used for training or other purposes but are not connected to the Internet. The lack of connectivity limits these organizations' opportunities to attract and retain new members. With access to better-connected facilities, members can benefit from workforce training and are more likely to participate in other forms of post-service support, such as community barbeques, flea markets, and community gatherings. RSA/MDS has constructed more than 100 of these connections at veterans service organizations, most of which involve establishing broadband connections between primary buildings and disconnected secondary facilities.

Therapeutic Riding Center. RSA/MDS deployed wireless and video services to Hanover Stables in rural Castle Hayne,[55] North Carolina. In addition to boarding horses and offering lessons, Hanover Stables offers therapeutic riding programs for veterans suffering from Post-Traumatic Stress Disorder. Hanover Stables was limited by its DSL line and needed greater connectivity throughout the property. That connection, which had topline speeds of 6 Mbps, could only allow Hanover Stables to do little more than process credit card payments at the main office. Although Hanover Stables maintained a website, it did not have sufficient network speeds to update the website from the premises. The company's broadband capabilities were virtually nonexistent.

These capabilities have been significantly improved thanks to the wireless services installed by RSA/MDS. RSA/MDS has established two links on the property, which extend from the horse barn to the common arena (where the stable hosts events) to the garage. Now, the stable's wireless signal extends to multiple locations on the 52-acre horse farm. Veterans, who come from all over the country and are often working with horses for the first time in their lives, can upload photographs and video of their lessons to social media and communicate with friends and family about their experience. Instructors, working with anywhere between 4 and 12 veterans at a time, can email notes to students in real-time without drawing from their personal cellular data plans.

Looking ahead, as wireless and wireline networks improve throughout rural America, Hanover plans to leverage the network constructed by RSA/MDS to develop live video feeds to live-stream shows, monitor boarded horses on behalf of their owners, and to install security

[55] *See supra* Section III.D for photographs and additional discussion of the installation at Hanover Stables.

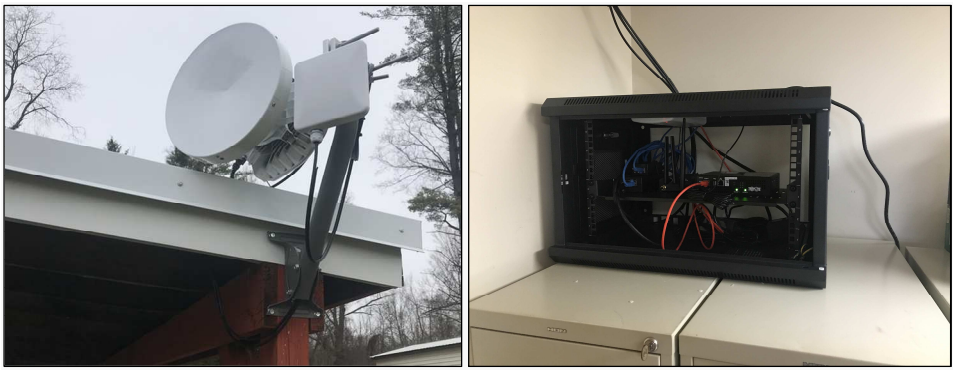
cameras to protect against the theft of horse hair and other valuable assets. An enhanced network will also promise greater flexibility for Hanover Stables' employees to develop marketing materials and promote therapeutic horseback riding to visiting veterans at Camp Lejeune, which is the second largest Marine base in the United States and is located approximately an hour north of the stable.

Veterans Service Organizations. The VFW is an American war veterans organization that includes veterans who, as soldiers, sailors, Marines, airmen, and Coast Guardsmen, served the United States in wars, campaigns, and expeditions on foreign soil or in hostile waters. The VFW's purpose is to rehabilitate the nation's disabled and needy veterans; assist veterans' widows, orphans, and the dependents of needy or disabled veterans; and promote education and constructive service to local communities.

Many of RSA/MDS's MVDDS sites are used to provide extended wireless connectivity, video streaming, and fixed wireless service to veteran community centers. For example, RSA/MDS's deployment provides the Veterans of Foreign Wars' Austin, Texas location wireless access between its main building and event pavilion, a fixed wireless membership tracking service, and streaming video of its baseball and rodeo events.

At the Linesville, Pennsylvania VFW lodge, meanwhile, the outpost intends to rely on RSA/MDS's MVDDS deployments to help augment the Advancing Telehealth through Local Access Stations ("ATLAS") solution for local veterans. Through ATLAS, the Department of Veterans Affairs collaborates with community, private, and alternate agency partners to establish telehealth access points in communities where there is a veteran population without Internet

access.[56] Project ATLAS enhances the accessibility of VA health care and promotes digital literacy among veterans by partnering with private companies and veterans service organizations to establish comfortable, private locations in rural communities where veterans can connect with their VA health care providers using a broadband connection. The Linesville, Pennsylvania VA has identified Project ATLAS as a long-term objective and plans to leverage the RSA/MDS deployment as part of any solution.



RSA/MDS installed a B Site antenna and cabinet housing the modem, router, and necessary wiring to extend Wi-Fi service at a VFW Hall in Linesville, PA.

Meanwhile, the MVDDS deployment provides dedicated, secure connectivity for the transmission of one-way video feeds from the building to the pavilion over MVDDS, with an unlicensed link supporting the transmission the other way. The Linesville VFW now has the ability to extend its MVDDS deployments to new use cases and additional locations because the transmitter is capable of supporting multiple receive points. These technologies are expected to help with fundraising, revenues, and community engagement at the Linesville VFW, and they help enhance capacity in a rural area where existing LTE coverage is often lacking.

[56] *See* Nicole Ogrysko, *VA's Telehealth Program is already the Largest in the Nation. It's About to get Bigger*, Federal News Network (Dec. 6, 2018, 5:45 PM), https://federalnewsnetwork.com/veterans-affairs/2018/12/vas-telehealth-program-is-already-the-largest-in-the-nation-its-about-to-get-bigger/ (VA Telehealth Program).

E. Rural Small Businesses

RSA/MDS also serves numerous rural small businesses through MVDDS, point-to-multipoint connections. Some illustrative installations of service offerings to business customers include KOA campground sites, True Value hardware stores, and Fanelli Boys.

Kampgrounds of America.[57] KOA campground sites are owned by franchisees that have the autonomy to provide wireless Internet access to customers. In its conversations with KOA franchisees, RSA/MDS discovered that customers expected to remain connected, even while camping or otherwise "getting away."[58]

By installing MVDDS at participating KOA sites, RSA/MDS has established Internet access throughout the entire campgrounds for KOA and its customers. For example, RSA/MDS provided wireless service to a KOA site in Blountville, Tennessee. This KOA franchise has 12 cabins, an area for pitching tents, a pool, pavilion, dog park, horseshoe pit, basketball court, volleyball court, and cornhole. Located off of I-81, the KOA site is roughly 14 miles from the Bristol Motor Speedway, which hosts two annual NASCAR races, concerts, and smaller racing events.[59] Additionally, the area hosts the Bristol Rhythm & Roots Reunion, an annual music festival that hosts over 130 bands on 20 stages in downtown Bristol and attracts approximately 45,000 attendees.[60] National baseball and softball tournaments as well as northern snowbirds migrating down I-81 to Florida or Texas keep the Blountville KOA occupied year-round. To

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[57] *See* Kampgrounds of America, https://koa.com/ (last visited July 25, 2019).

[58] When asked about consumer demand for Internet service on the campgrounds, a KOA franchise owner in Blountville, Tennessee said, "Trust me. When the Internet's down, you'll hear about it."

[59] *See* Bristol Motor Speedway, https://www.bristolmotorspeedway.com/ (last visited July 25, 2019).

[60] The Birthplace of Country Music, *About*, https://www.birthplaceofcountrymusic.org/about/ (last visited July 25, 2019).

meet the demands of his customers, the KOA franchisee in Blountsville, Tennessee maintains an Internet connection but with a very limited range of service. Using MVDDS for the downlink and an unlicensed link for the return connection, RSA/MDS wirelessly extended the reach of the Internet connection throughout the campground, allowing visitors to send and receive email, shop online, and post on social media regardless of where they were located.

RSA/MDS mounted an A Site Antenna and CAT5 Routing Cable to the roof of a building at a KOA campsite in Blountville, TN.

TrueValue Hardware Stores. RSA/MDS installed wireless services at separate locations for All Seasons Hardware, which is part of the True Value network of hardware stores and has two locations near Charleston, South Carolina. The main location – which houses the business' primary server – is on James Island, and the second location is roughly six miles away, on Johns Island. The store's main concern was network speed. With higher speeds, the business can use its Internet service more efficiently to make contact with customers, create purchase orders, and send invoices. Before installation and operation, the second location on Johns Island forwarded

roughly 95 percent of its paperwork to James Island for processing. With a faster network connection, the Johns Island location can operate more independently and efficiently.

Fanelli Boys, Inc. Fanelli Boys, Inc. ("Fanelli Boys") was established twenty-eight years ago and offers networking and on-site IT support for businesses and schools. Now with ten locations in the mountains of West Virginia and eastern Ohio, Fanelli Boys also repairs smartphones, tablets, computers, and consumer electronics. At two of Fanelli Boys' locations in rural Parkersburg, West Virginia, RSA/MDS installed four wireless links. The service will help Fanelli Boys' repair business, which requires a robust connection to download and, for security purposes, to store digital files off-site before initiating repairs.

Installations often require wall penetration, weather-proofing, and lightning protection/grounding, including this installation at a Fanelli Boys location in Parkersburg, WV.

In anticipation of 5G and the proliferation of point-to-multipoint systems, Fanelli Boys has partnered with Novation to train and certify Fanelli Boys' technicians on point-to-multipoint systems using links installed by RSA/MDS. Once trained, Fanelli Boys technicians will be able

to install or provide much-needed technology support for point-to-multipoint systems, like those installed by RSA/MDS, throughout the region.

V. RSA/MDS'S DEPLOYMENT IN ALBUQUERQUE SATISFIES THE SUBSTANTIAL SERVICE REQUIREMENT BY PROVIDING COMMERCIAL BROADBAND INTERNET ACCESS

RSA/MDS provides broadband Internet access services to customers in New Mexico through Cibola LLC ("Cibola Wireless"), which acts as a contract service provider. Cibola Wireless is a large-scale service offering that reaches approximately 900,000 consumers, or roughly 50 percent of all households in the Albuquerque geographic license area. Cibola Wireless delivers speeds up to 50 Mbps download and up to 10 Mbps upload to residences and businesses throughout the Albuquerque metro area.[61] RSA/MDS has satisfied the substantial service requirement by offering services that provide "service that is sound, favorable, and substantially above a level of mediocre service which might minimally warrant renewal."[62]

Obtaining Waiver of the EIRP Levels. To build a high-speed, high-power broadband network, RSA/MDS required a waiver from the FCC of certain MVDDS operating constraints – namely, the EIRP levels.[63] The waiver allows Cibola Wireless' single transmitter in Albuquerque to replicate the service quality of multiple MVDDS transmitters operating elsewhere without a waiver.

In May 2007, MDS Operations filed a waiver request seeking authority to operate at EIRP levels up to 40 dBm per 24 megahertz of spectrum, relying on a test report that demonstrated no harmful interference from an experimental MVDDS operation at a site located

[61] *See* Cibola Wireless, *Our Products*, http://www.cibolawireless.net/our-products.html (last visited July 25, 2019).

[62] 47 C.F.R. § 101.1413(b); *see also MVDDS Order* ¶ 177.

[63] *See* 47 C.F.R. §§ 101.113(a), n.11; 101.147(p).

at Sandia Park,[64] which is located on the edge of the Cibola National Forest Northeast of Albuquerque. As part of its waiver request, MDS Operations completed testing to measure possible interference from its terrestrially-broadcasted signals with DBS satellite reception (DIRECTV and DISH). DIRECTV, now owned by AT&T, alerted its DBS customers to the high-power tests. MDS Operations did not receive any concerns from DIRECTV's customers. As explained in the 2007 waiver request, MDS Operations' tests yielded a "lack of complaints at any power level," and "[t]he [MVDDS] system performed as . . . described" despite advanced notification to DBS operators and DBS customers.[65]

Nonetheless, DBS operators commented on MDS Operations' waiver request, expressing concerns about harmful interference. To accommodate these concerns, MDS Operations later amended the scope of its waiver request, limiting the waiver request to the Albuquerque area and at an operating EIRP up to 36 dBm per 24 megahertz of spectrum.[66] When it granted MDS Operations' waiver request, the FCC pre-approved transmission at Sandia Park and allowed up to 22 dBm EIRP, among other conditions.[67] Cibola Wireless has been in operation for more than eight years and has never received any complaint from the Commission or DBS operators or subscribers about its operations creating harmful interference to DBS subscribers.

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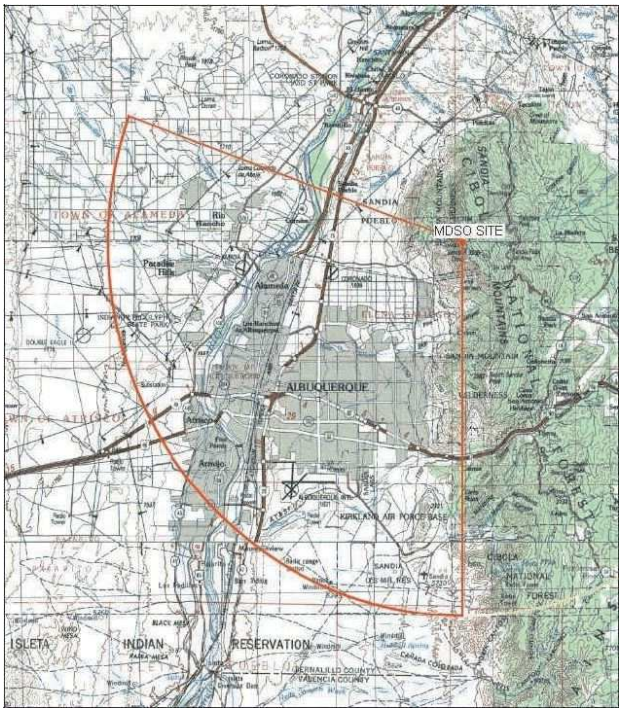
[64] *See MDS Operations, Inc. Request for Waiver of Certain Multichannel Video Distribution and Data Service Technical Rules for One Station in Sandia Park, New Mexico*, Order, 25 FCC Rcd 7963, ¶ 5 (WTB 2010) ("*MDS Waiver Order*").

[65] *See* MDS Operations, Inc., Petition for Rule Waiver, WT Docket No. 07-255, Exhibit One: Albuquerque MVDDS Test Report, at 34-35 (May 7, 2007).

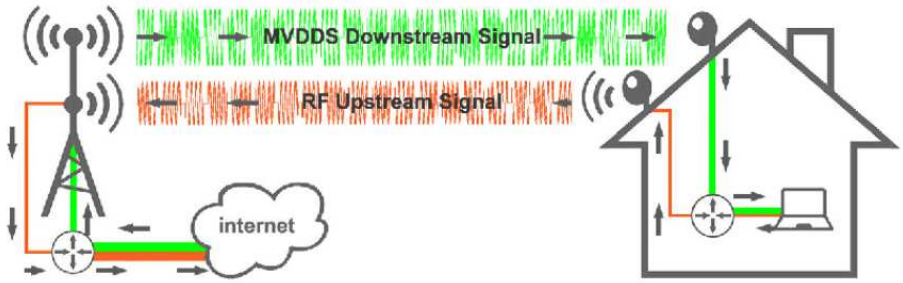
[66] *MDS Waiver Order* ¶ 6.

[67] *See MDS Waiver Order* ¶ 24.



The FCC preapproved the MVDDS transmission site at Sandia Park, NM.

Network Installation. Given MVDDS' operating constraints, even with the waiver, the MVDDS setup at a customer's location involves a complex equipment assembly. Since MVDDS is a one-way service, two small unobtrusive antennas must be mounted on the roof or eve of a customer's location. As the illustration below demonstrates, one antenna receives a signal while the other transmits a signal back to the base station. The MVDDS downstream signal delivers encapsulated IP data to customer equipment. The RF upstream signal brings back to the main tower the encapsulated IP data from the customer equipment. A single Ethernet cable provides upstream Internet connectivity from the roof-mounted customer premises equipment built into one of the antennas. The downstream service is delivered via RG6 coaxial cable. Both cables connect to MDS America's proprietary customer premises equipment, which has an Ethernet handoff to the customer's network.



This high-level MVDDS network design demonstrates how MVDDS offers high-speed broadband Internet access despite the cumbersome one-way restriction imposed by FCC rules.

The DVB-S2 Internet Radio Server is at the main transmitting site and NOC. The server consists of a number of components that carry out various functions ranging from IP encryption to authentication. It is a turnkey system, and no extra equipment is needed to provide high-speed Internet access. At the subscriber end, an MVDDS modem is used with the Ethernet router, which plays an important role separating downstream and upstream traffic between MVDDS and uplink spectrum. End-user equipment will typically have multiple interfaces: a MVDDS antenna interface, an Ethernet interface, and an interface for the upstream transmission. The equipment receives an IP address (dynamic or static) from the NOC. This upstream connection can be achieved using many different methods to include WiMAX, Wi-Fi, WLL, and PSTN, among others.

Employees deploying MVDDS high-speed broadband service in Albuquerque, NM.

Providing Service. From the Sandia Park transmission site, Cibola Wireless can deliver MVDDS service to a home or business up to 20 miles away at 50/10 Mbps speeds. This coverage reaches 900,000 people in the Albuquerque metropolitan area, or roughly half of the geographic license area's total population.

Cibola Wireless mails advertisements to Albuquerque-area residents and businesses to demonstrate that MVDDS speeds will surpass consumer expectations.

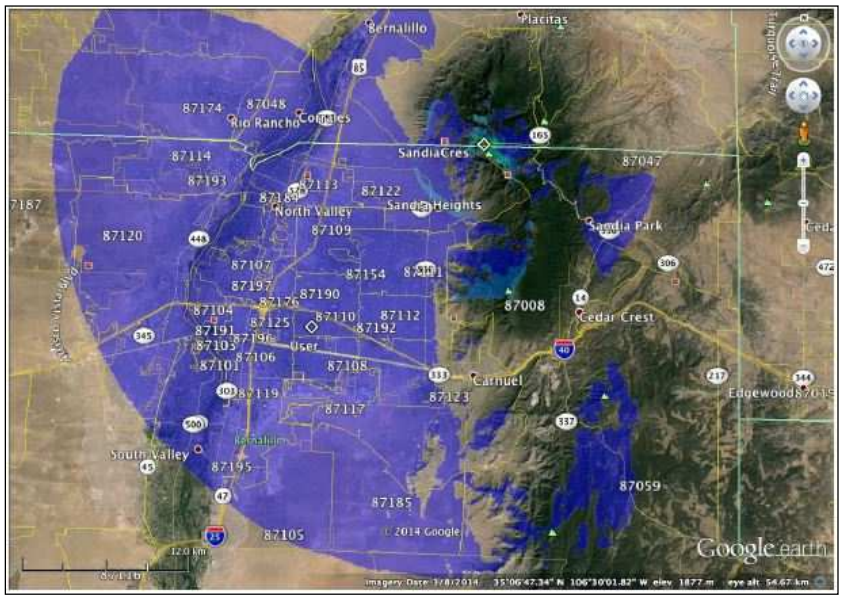
To compete against incumbent broadband Internet service providers, Cibola Wireless advertises its MVDDS broadband Internet service (branded "MegaBand")[68] through flyers and billboards. As the flyer above indicates, Cibola Wireless relies on promotions such as free installation to entice potential customers to leave their current Internet service provider for MVDDS-provided broadband. Since it provides broadband Internet service wirelessly throughout much of the Albuquerque area, Cibola Wireless can easily deploy to new customer locations in ways that traditional wireline providers cannot. Cibola Wireless therefore serves as a valuable competitor in Albuquerque's broadband market by increasing competition and, by extension, lowering costs for consumers.

Cibola Wireless advertises its broadband Internet service via billboards throughout the Albuquerque area.

Among Cibola Wireless' many residential and commercial customers is J&D Foods, which is the third largest wholesale manufacturer of beef jerky in the state of New Mexico. J&D Foods relies exclusively on Cibola for broadband connectivity to support two computer

[68] *See* Cibola Wireless, *MegaBand Technology*, http://www.cibolawireless.net/technology.html (last visited July 25, 2019).

terminals, two credit card processing machines, and 14 employees that use Wi-Fi across a 1,500 square foot warehouse. The wireless connection runs from the antenna at the top of the J&D Foods warehouse building to the Sandia Mountains, with the return connection running over an unlicensed link. J&D Foods particularly appreciates Cibola Wireless' responsive customer service and their reliable installation crew. And J&D Foods has said it finds Cibola Wireless' service to be a cost-effective substitute for larger fixed wireline services in the area without any tradeoffs in network quality.



Cibola Wireless' actual MVDDS service area extends 20 miles from the transmitting site at Sandia Park, NM, covering most of the Albuquerque area.

Having provided service for over eight years in a geographic area that covers 50 percent of homes in the Albuquerque geographic license area, RSA/MDS has more than satisfied the substantial service requirements. RSA/MDS, however, continues to explore additional opportunities to expand its presence in this market as part of its growth strategy.

VI. CONCLUSION

RSA/MDS satisfied the Commission's substantial service requirement for the MVDDS licenses listed in Exhibit 1. RSA/MDS not only has deployed operations that exceed the safe

harbor expressed in the *MVDDS Order*,[69] but also has done so by targeting traditionally unserved or underserved niche markets, including veterans service organizations, public safety training organizations, and rural small businesses.[70] In the Albuquerque market, RSA/MDS has deployed a large-scale broadband Internet service offering that reaches approximately 50 percent of the population in the geographic license area. RSA/MDS also has helped generate the demand for MVDDS point-to-multipoint subscriptions and drive adoption among equipment manufacturers.

As a result of RSA/MDS's point-to-multipoint architecture, additional opportunities for deployment exist at every site where initial deployment has occurred. Looking ahead, RSA/MDS has identified many other opportunities to expand MVDDS service throughout its license area and the United States using its point-to-multipoint network architecture. For example, RSA/MDS plans to capitalize on the Commission's LAUNCH Initiative and have many other openings for service, including the following:

- *Software updates and software delivery to smart devices and systems.* Over-the-air ("OTA") downloads of new features or security information to smart products or systems;
- *Video delivery to caching devices.* OTA downloads of video content to storage devices;
- *Audio delivery to caching devices.* OTA downloads of audio content to storage devices; and
- *Alarm systems.* A secure link from a central location to multiple remote destinations to provide area-wide alerts.

Relaxing the operating constraints and regulatory burdens facing MVDDS licensees would help RSA/MDS roll out these proposed deployments faster than otherwise possible without creating additional harmful interference. To that end, RSA/MDS and other MVDDS

[69] *See* Exhibit 1.

[70] *See supra* Section IV.

licensees have been calling on the Commission to reform its MVDDS rules to relax its limitations on MVDDS licensees for more than three years.[71] In the meantime, RSA/MDS continues to pursue its ambitious program of innovative one-way, point-to-multipoint deployments.

RSA/MDS has demonstrated that it has deployed services that exceed the Commission's substantial service safe harbor while also deploying a large-scale service offering in Albuquerque. These deployments are "sound, favorable, and substantially above a level of mediocre service which might minimally warrant renewal."[72]

[71] *See* Petition of MVDDS 5G Coalition for Rulemaking, RM-11768 (filed Apr. 26, 2016).

[72] 47 C.F.R. § 101.1413(b); *see also MVDDS Order* ¶ 177.

Exhibit 1:
RSA/MDS MVDDS Deployment by License

RSA/MDS submits this demonstration of substantial service for the following 60 call signs.

Call Sign	FCC MVD ID	Market Name	U.S. Census Bureau 2010 Population	U.S. Census Bureau 2018 Estimated Population	Transmitting Points Required[1]	Transmitting Points Installed & Operational
WQAR560	046	Greensboro-High Point-Winston Salem, NC	1,739,702	1,824,911	8	10
WQAR561	049	Albuquerque-Santa Fe, NM	1,893,532	1,928,171	N/A	N/A[2]
WQAR562	051	Jacksonville, FL	1,747,337	1,947,869	8	10
WQAR563	054	Austin, TX	1,858,852	2,322,783	10	12
WQAR564	061	Charleston-Huntington, WV	1,246,144	1,185,209	5	8
WQAR565	064	Flint-Saginaw-Bay City, MI	1,178,818	1,134,270	5	6
WQAR566	066	Wichita-Hutchinson, KS Plus	1,204,862	1,199,097	5	6
WQAR567	074	Tucson (Sierra Vista), AZ	1,159,029	1,212,354	5	6
WQAR568	078	Omaha, NE	1,092,799	1,165,460	5	7
WQAR569	087	South Bend-Elkhart, IN	892,734	902,543	4	7
WQAR570	089	Jackson, MS	912,791	910,333	4	5
WQAR571	090	Tri-Cities, TN-VA	803,267	786,727	4	7
WQAR572	092	Davenport, IA-Rock Island-Moline, IL	772,754	758,854	4	5
WQAR573	093	Waco-Temple-Bryan, TX	976,405	1,077,369	5	7
WQAR574	095	Baton Rouge, LA	903,564	924,502	4	6
WQAR575	097	Harlingen-Weslaco-Brownsville-McAllen, TX	1,264,091	1,375,887	6	9
WQAR576	098	Savannah, GA	891,134	970,157	4	5
WQAR577	099	Evansville, IN	735,813	737,125	3	4

[1] RSA/MDS calculated the minimum number of transmitting points required in the license area based on the Census Bureau's interim 2018 population estimates, not the 2010 U.S. Census Bureau population. Relative to 2010 census data, the number of required transmitting points to satisfy the safe harbor in every license area based on 2018 census estimates either: (1) remained the same, or (2) increased. RSA/MDS's methodology did not lower its burden to satisfy the substantial service safe harbor.

[2] RSA/MDS's large-scale broadband Internet service offering far exceeds the level necessary to satisfy the substantial service requirement. In the Albuquerque area, RSA/MDS's broadband Internet service covers more than 900,000 people, which is roughly half of the total population of the Albuquerque geographic license area. Operating pursuant to the *MDS Waiver Order*, RSA/MDS's large-scale broadband service in Albuquerque is unique and therefore does not fit squarely within the metrics provided in this table. *See supra* Section V (discussing service and buildout in Albuquerque).

WQAR578	101	El Paso, TX	1,015,754	1,065,279	5	6
WQAR579	105	Charleston, SC	798,080	918,158	4	5
WQAR580	106	Springfield-Holyoke, MA	692,942	702,724	3	5
WQAR581	107	Tallahassee, FL-Thomasville, GA	724,511	746,809	3	4
WQAR582	108	Ft. Smith-Fayetteville-Springdale-Rogers, AR	772,299	858,234	4	5
WQAR583	109	Tyler-Longview(Lufkin & Nacogdoches), TX	796,833	828,159	4	6
WQAR584	110	Myrtle Beach-Florence, SC	739,239	803,785	4	5
WQAR585	111	Lansing, MI	670,972	686,465	3	4
WQAR586	113	Traverse City-Cadillac	612,292	617,291	3	4
WQAR587	115	Augusta, GA	693,227	724,322	3	4
WQAR588	116	Montgomery-Selma, AL	652,682	633,985	3	5
WQAR589	122	Macon, GA	660,789	662,966	3	6
WQAR590	125	Lafayette, LA	615,712	637,153	3	4
WQAR591	126	Columbus, GA	572,656	597,977	3	4
WQAR592	128	Corpus Christi, TX	576,580	600,702	3	4
WQAR593	131	Columbus-Tupelo-West Point, MS	493,408	492,038	2	3
WQAR594	133	Monroe, LA-El Dorado, AR	480,685	466,654	2	3
WQAR595	134	Wausau-Rhinelander, WI	450,006	446,938	2	4
WQAR596	135	Rockford, IL	486,670	467,557	2	3
WQAR597	137	Beaumont-Port Arthur, TX	460,666	467,094	2	3
WQAR598	138	Topeka, KS	463,311	461,949	2	4
WQAR599	139	Columbia-Jefferson City, MO	465,693	482,949	2	3
WQAR600	143	Erie, PA	411,146	396,622	2	4
WQAR601	144	Wilmington, NC	455,603	520,025	3	5
WQAR602	145	Joplin, MO-Pittsburg, KS	404,128	399,375	2	3
WQAR603	146	Terre Haute, IN	396,082	387,712	2	5
WQAR604	148	Albany, GA	419,886	412,218	2	3
WQAR605	151	Salisbury, MD	406,420	441,977	2	4
WQAR606	154	Binghamton, NY	350,182	332,282	2	3
WQAR607	157	Biloxi-Gulfport, MS	367,137	392,894	2	3
WQAR608	159	Panama City, FL	368,866	400,268	2	4
WQAR609	162	Gainesville, FL	321,498	345,682	2	5
WQAR610	166	Clarksburg-Weston, WV	272,671	267,703	2	4
WQAR611	168	Hattiesburg-Laurel, MS	295,068	298,169	2	4
WQAR612	174	Lake Charles, LA	261,025	272,938	2	3
WQAR613	179	Alexandria, LA	248,329	242,366	1	4
WQAR614	181	Jonesboro, AR	220,960	234,071	1	3
WQAR615	182	Greenwood-Greenville, MS	206,730	186,441	1	2

WQAR616	183	Jackson, TN	192,368	190,954	1	3
WQAR617	188	Parkersburg, WV	156,339	151,865	1	4
WQAR618	194	Lima, OH	152,280	148,467	1	2
WQAR619	204	Victoria, TX	86,793	92,035	1	3
Total	---	----------	----------	----------	**188**	**285**[3]

[3] The total number of transmitting points listed in Exhibit 1 excludes the Albuquerque geographic license area where RSA/MDS has deployed a large-scale broadband Internet service offering that covers 900,000 people, or approximately 50 percent of the geographic license area's population.

Exhibit 2:
Cambridge Broadband Tearsheet for Downlink Access Points and Remote Terminals

CBNL
Cambridge Broadband Networks

ODU-S

Preliminary System datasheet
12GHz MVDDS Broadcast Downlink*

The ODU-S is a range of Access Points (APs) and Remote Terminals (RTs), for use in a point-to-multi-point topology and which operates in a downlink broadcast only mode in the FCC MVDDS 12GHz Band. ODU-S MVDDS 12GHz supports a channel bandwidth of 25MHz and delivers up to 25Mbps (TBC) gross throughput per sector. ODU-S is a compelling alternative to point to point links.

ODU-S has a small form factor and weighs only 10.6lb, making it easy to install and maintain while providing logistics benefits for the operator. A range of compatible antennas includes vertically and horizontally polarized 90° sector horn antennas for APs and 2ft/60cm parabolic dish antennas for RTs. Vertical and horizontal RT polarizations are supported by simply rotating the ODU-S to suit the required polarization. No mechanical changes are required.

ODU-S MVDDS deployments consist of single sector all outdoor Zero Footprint Sector (ZFS) units providing aggregation and a single logical interface to the core network. MVDDS traffic from the core is broadcast by the ZFS to connected RTs. ODU-S MVDDS systems support QPSK modulation to meet FCC regulations and deliver high availability in all weather conditions.

ZFS (AP-S)

The ODU-S ZFS (AP-S) is an integrated radio, modem and network interface unit, connecting directly to a sector antenna. An AP-S operates as a single sector without any additional indoor equipment (Zero-footprint mode), backhauling traffic from up to 16 RTs and terminating it on a single GigE interface. Power and data are provided to the AP-S over a single CAT-5E cable or by 2-core cable for power and a single mode fibre for data.

ODU-S AP-S & Sector Antenna

REMOTE TERMINAL (RT-S)

The ODU-S MVDDS RT (RT-S) and connected parabolic antenna provides a means to receive the MVDDS traffic broadcast by the AP-S with a downlink capacity of up to 25Mbps net Ethernet (TBC) at QPSK in a 25MHz channel. Power and data are provided over a single CAT-5E cable. Alignment of the RT-S to the sector AP-S can be performed using the dedicated alignment interface and a standard voltmeter.

ODU-S RT-S & 60cm Antenna

SERVICES

ODU-S MVDDS supports the following Ethernet services: 802.1Q (VLAN tagging).

UPGRADE

ODU-S MVDDS is capable of being upgraded via software to become VSG ODU-S 12GHz with Single Carrier FDD Full Duplex, TDMA uplink and downlink. Antenna re-use in such an upgrade is TBD.

ODU-S 12 GHZ TECHNICAL SPECIFICATIONS

General	12GHz Downlink with Broadcast only
Product conformance	FCC part 101 Sub Part P
Duplexer Tx/Rx bands	Downlink in the high band
Frequency Tolerance	15 ppm[2]
Duplex spacing	n/a
Radio access method	Single Carrier Fixed Half Duplex
EIRP	14dBm[1] / 24MHz
Channel sizes	6 x 25MHz channels
Modulation	QPSK
Sector throughput	Up to 25Mbps (TBC) Ethernet Downlink only (25MHz, QPSK).
Range	TBC

Access Point (AP-S)

AP Antenna** gain, min dBi	90° Horn: V 15, H 17 (nominal sector angle: 90° x 8°)
Network interfaces	1 x 100/1000BaseT Ethernet or 1 x 1000BaseLX (LC connector, single mode short haul 1310nm laser). Both VLAN capable.
Power Consumption per AP	40W typical
Power Input Requirement	–48V DC, (Optional 100-240V AC converter)
AP weight and dimensions (excluding antenna)	309x289x110mm (HxWxD), 10.6lb / 4.8kg

Remote Terminal (RT-S)

Antenna** gain, min dBi	0.6m dish: 34.5dBi
Network interfaces	1 x 100/1000BaseT (VLAN capable)
Alignment Interface	Single connector for use with a standard Voltmeter
Power Consumption per RT	40W typical
Power Input Requirement	–48V DC, (Optional 100-240V AC converter)
RT Throughput	Up to 25Mbps (TBC) Ethernet Downlink only (25MHz, QPSK)
RT weight and dimensions (excluding antenna)	309x289x110mm (HxWxD), 10.6lb / 4.8kg

Services

Ethernet	Ethernet (Unicast, Multicast and Broadcast frames), 802.1Q (VLAN tagging), carries transparently all L2CP frames.
Scalability	AP in Zero-footprint ZFS mode: Up to 16 RTs in a sector.

Standards Compliance

Radio		FCC part 101 Sub Part P
Antenna	AP	n/a
	RT	n/a
EMC		ETSI EN 301 489
Environmental		Class of indoor equipment is 3.1 (temperature range: +5°C to +40°C), as defined in ETSI EN 300 019-1-3. Class of outdoor equipment is 4.1E and 4.2H (temperature range: –45°C to +55°C), as defined in ETSI EN 300 019-1-4.
Safety		EN 60950-1 and 60950-22
Storage		Class of storage of equipment is 1.2, as defined in ETSI EN 300 019-1-1
Transportation		Class of transportation of equipment is 2.2, as defined in ETSI EN 300 019-1-2
DC power supply		ETSI EN 300 132-2
RoHS and WEEE		VectaStar is compliant with RoHS and WEEE directives (see http://www.cbnl.com/support/recycling.html)

1 The EIRP for MVDDS stations is limited to 14.0 dBm per 24 MHz.

2 The FCC 101.107 Frequency Tolerance for 12,200 to 13,250 MHz is 50ppm and is applicable to stations providing MVDDS.

* This product is subject to detailed commercial agreement. ** Typical antennas shown.

To confirm the latest product information and to find your nearest CBNL representative, please contact our head office sales@cbnl.com

Version 1 **About CBNL**: Pioneering the development and deployment of next generation microwave transmission equipment since 2000, CBNL is the global market leader in multipoint microwave backhaul and access solutions. Our carrier-class VectaStar platform serves more than 100 communication providers in over 50 countries, including 7 of the top 10 world's largest mobile operators. +44 1223 703000 www.cbnl.com

CB-006257-DS

Exhibit 3:
Installation Close-Out Document for Fanelli Boys (Parkersburg, WV)

Novation Enterprises

Installation Close-Out Document

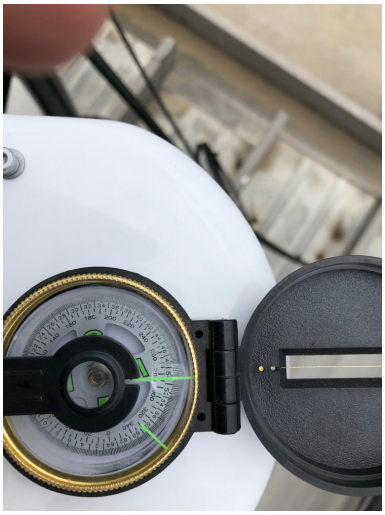
CLIENT: RSA

Owner/Field Tech	Snyder Jean
Date of Installation	05/13/2019
Location POC	John finelli
Location Phone Number	3044282886
Address, City State Zip	656 7th Street, Parkersburg, WV, USA
DMA	PARKERSBURG
Site ID	ALT_656_Parkersburg_Wv
KIT #	kit006
A Site Antenna Geo Coordinates	39.263415, -81.552269
B Site Antenna Geo Coordinates	39.263312, -81.552818
Record Azimuth - Side A	281
Record value on Digital Level - Side A	0.1
Estimate of overall ethernet lengths used - Side A	16
Side A - Insert AP Serial Number	1E144641
Side A - Insert RT Serial Number	1E144906
A Side Mikro Tik Serial Number	67D60865B5D8/817
B Side Mikro Tik Serial Number	8A730863AD9B/807/r2
Ligo Wave 90 degree Sector Antenna Serial Number	08161745000002F0C
Ligo Wave 15 degree B Side Antenna	08161839000003DB
PepWave Modem Serial Number	2935-FBE2-F1D8
A Side PDU Serial Number	2844DV0PD892500095
Record Azimuth - Side B	80
Record value on Digital Level - Side B	0.1
Estimate of overall ethernet lengths used - Side B	26
Connected to NOC	Tested

Take a picture of roof

A Site MVDDS Antenna (Photo)

Behind antenna verifying Azimuth - Side A (Photo)



Connection points on radio - Side A (Photo)

Record Azimuth - Side A

281

Record value on Digital Level - Side A

0.1

Level on the antenna for COP - Side A (Photo)

CAT 5 routing - Side A (Photo)

Estimate of overall ethernet lengths used - Side A

Lightning protection - Side A (Photo)

Open suppression system - Side A (Photo)

Suppression system ground source - Side A (Photo)

Close up of wall penetrations to verify weather proofing - Side A (Photo)

Interior Cable Installation - Site A (Photo)

Take picture of the rooftop after the installation of Site A

A Site Antenna Geo Coordinates

39.263415, -81.552269

AP Serial Number (Photo)

Insert AP Serial Number

1E144641

RT Serial Number (Photo)

Insert RT Serial Number

1E144906

A Side Mikro Tik Serial Number (Photo)

A Side Mikro Tik Serial Number

67D60865B5D8/817

B Side Mikro Tik Serial Number (Photo)

B Side Mikro Tik Serial Number

8A730863AD9B/807/r2

Ligo Wave 90 degree Sector Antenna Serial Number (Photo)

Ligo Wave 90 degree Sector Antenna Serial Number

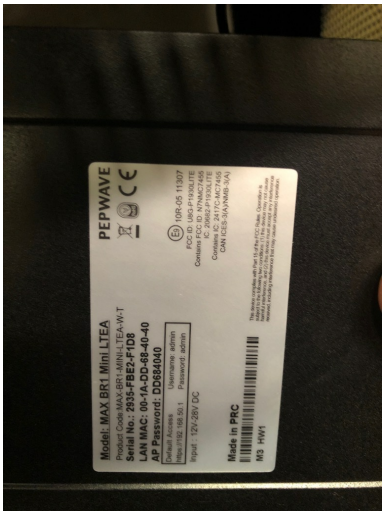
08161745000002F0C

Ligo Wave 15 degree B Side Antenna (Photo)

Ligo Wave 15 degree B Side Antenna

08161839000003DB

Pepwave Modem Serial Number (Photo)



PepWave Modem Serial Number

2935-FBE2-F1D8

A Side PDU Serial Number (Photo)

A Side PDU Serial Number

2844DV0PD892500095

B Side PDU Serial Number (Photo)

B Side PDU Serial Number

N/A

A Side Install

Yes

B Side Install

Yes

Cabinet Install

Yes

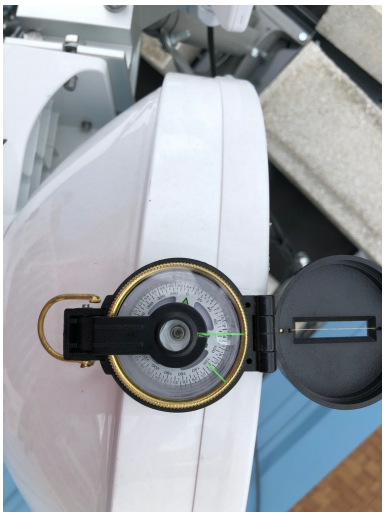
Address of B Site

656 7th Street, Parkersburg, WV, USA

Take picture of the rooftop before the installation of Site B

B Site MVDDS Antenna (Photo)

Behind antenna verifying Azimuth - Side B (Photo)



Connection points on radio - Side B (Photo)

Record Azimuth - Side B

Record value on Digital Level - Side B

0.1

Level on the antenna for COP - Side B (Photo)

CAT 5 routing - Side B (Photo)

Estimate of overall ethernet lengths used - Side B

26

Lightning protection - Side B

Open suppression system - Side B (Photo)

Suppression system ground source - Side B (Photo)

Close up of wall penetrations to verify weather proofing - Side B (Photo)

POE Connection (Photo)

Interior Cable Installation - Site B (Photo)

Take picture of the rooftop after the installation of Site B

B Site Antenna Geo Coordinates

39.263312, -81.552818

Is the installation of cabinet floor or wall mount?

Floor Mount

Description of Cabinet Location

Under the table in the Last office on the right side

Cabinet Location (Photo)

Equipment mounted in the cabinet (Photo)

Click here if an external antenna was used

N/A

Is the PDU outlet source non-switched and non-shared?

Yes

Does PDU outlet source have grounding?

Yes

Open cabinet (Photo)

Click Here if Link was tested

Was Pressed

Notes

Installed Solution

Extended wifi

Exhibit 4:
Declaration of P. Kelley Dunne, Chairman and CEO of Novation Networks

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)
	)
Construction Notification for	)
MDS Operations, Inc., and RS Access, LLC	)

DECLARATION OF P. KELLEY DUNNE

1. My name is P. Kelley Dunne. I serve as Chairman and CEO of Novation Networks ("Novation"), a privately held, veteran-owned and veteran-operated company founded in 2012 that serves clients' 4G and 5G infrastructure efforts by deploying wireless broadband networks and services across the country. I also serve as Executive Chairman and Co-founder of Warriors4Wireless ("W4W"), a nonprofit career development program designed to train veterans for employment as wireless technicians in the telecommunications industry.
2. Novation assisted RS Access, LLC ("RS Access") with all facets of RS Access's network deployment. RS Access's network operates in the 12.2-12.7 GHz band ("12 GHz band") pursuant to its fifty-nine (59) spectrum manager lease agreements with MDS Operations, Inc., a Multichannel Video and Data Distribution Service ("MVDDS") licensee.
3. To deploy RS Access's network, Novation engaged W4W-trained veterans as part of an on-the-job training program.
4. For each site location identified in the attachment, Novation performed or oversaw the following activities:
    a. Identification of site locations suitable for MVDDS deployment;
    b. Geospatial analysis of each proposed MVDDS link in the point-to-multipoint ("P2MP") network, consistent with MVDDS coordination obligations;

c. Acquisition of site access rights for each link to the P2MP network;

d. Pre-installation assembly and testing of 12 GHz band network equipment;

e. Distribution of equipment to customer premises locations nationwide;

f. Professional installation of 12 GHz band network equipment at customer premises locations;

g. On-site testing of 12 GHz band network equipment;

h. Network interconnection of the 12 GHz band network equipment to the MVDDS system, in accordance with service specifications; and

i. End-user setup, activation, and education.

5. I declare under penalty of perjury that the above information is complete, true, and correct and accurately represents the circumstances of each deployed system.

P. Kelley Dunne
Chairman & Chief Executive Officer
Novation Networks

July 21, 2019