Virginia TVWS “Homework Gap” Project FCC Experimental License Application Overview

Adaptrum, Inc.

Experimental License Request
File Number:

Exhibit 1: Explanation of Experiment

Introduction

Adaptrum, Mid-Atlantic Broadband Communications Corporation (MBC), and Microsoft together are launching a TV White Space project to connect student homes in two counties in southern Virginia, Halifax County and Charlotte County. The partnering companies intend to use TV white space technology to extend broadband access to low-income K-12 public school students in these counties. The goal of the project is to demonstrate how TV white space connectivity solution, along with Microsoft's cloud services, relevant content, and devices, can enable school districts to inexpensively close the "homework gap" by getting millions more students online at school, at home, and in between (e.g., on school buses). According to an FCC report, about 20% of school age children lack broadband Internet access at home. Although most schools in America already have fiber connectivity, 3 out of 5 schools in America lack Wi-Fi connectivity which means that Internet access is available only where there are cabled connections.

When fully deployed, the proposed TV white space network will have almost 20 tower sites with 3-sector TV white space base stations per site. The network will be capable of serving up to 5000 student homes in the two counties.

In this proof-of-concept project, MBC would leverage the fiber optic connectivity already provided to schools and install TV white spaces base stations at the schools to extend the reach of broadband access into the surrounding communities. The TV white space base stations will enable students to connect to school district education networks from home, thereby accessing content and applications needed to complete their homework assignments. Students will connect to the TV white space network through a Wi-Fi access point or a USB dongle provided to them.

The Halifax County and Charlotte County areas have about 15 schools and approximately 7,500 students total. Halifax and Charlotte Counties were chosen as the first deployment locations based on the availability of MBC fiber-optic connectivity to the schools, the presence of existing towers at the schools, and a significant opportunity for impact in these communities, which currently lack a variety of affordable broadband options.

The TVWS connectivity service will be made available free-of-charge to approximately 3,500 students who currently lack broadband Internet access at home in these two counties. According to various studies, low-income students are less likely to have broadband access at home and therefore face challenges in completing homework assignments requiring access to online content. This project is designed to show how such "homework gap" can be closed, using the TVWS technology.

The current application is being filed to seek experimental authorization to build and test the network in advance of the start of the school year. The goal is to launch the homework gap service as soon as possible after the school year starts.

Technical synopsis

Power level: 630 mW conducted, with 7.94 W ERIP

Spectrum Needed:

473-599 MHz and 623-695 MHz
Not all frequencies will be used at all sites, but they are requested to allow flexibility in the system design. In order to avoid interference to primary licensees, frequencies will be selected for each site based on consultation to TVWS database providers and local measurements.

Modulation & Use:

The system uses channels, that are multiples of 6 MHz wide up to 24 MHz with OFDM modulation

Experimentation with the radio technology

TVWS is an emerging new broadband technology championed by US FCC and has since been adopted by leading countries around world including UK, Singapore and Canada. The technology holds huge potential to connect the world's 4.5 billion unserved and underserved population as well as tens of billions Internet devices in the coming years. This test will focus on how to implement the technology to harness its potential to address education needs in areas underserved by broadband technologies.

Adaptrum is a leading TVWS technology and solution vendor. Adaptrum's current generation ACRS 2.0 TVWS product has been certified by FCC in 2014 ACRS 2.0 radios have been deployed in more than 25 countries across 4 continents. Adaptrum's product is well known for its quality and performance. With many ACRS 2.0 radios deployed to date, Adaptrum has not received a single complaint about white space device interference to TV broadcast signal.

Figure 1: Adaptrum ACRS 2.0 worldwide deployments.

In this project, while certain number of certified ACRS 2.0 radios will be deployed, Adaptrum and partners intend to experiment new TVWS products, technology or operation conditions, which will

significantly enhance TVWS technology performance, e.g. 100+ Mbps throughput, but which are not currently type approved by FCC or beyond the current FCC TVWS rules. Specifically, Adaptrum and partners intend to test the following in this project:

- **4 Channel Aggregation**. Current ACRS 2.0 radios only operate a single TV channel. Part of the testing proposed here will experiment with channel aggregation over 4 non-contiguous TV channels. For example, the radios may be used to operate on TV Channels 14, 16, 23, 28 simultaneously. On each individual TV channel, operations will still observe the 55 dBc adjacent channel limit and FCC 15.209 limits beyond adjacent channels. Adaptrum will work with TVWS database providers to ensure proper separation distances are provided on all the used channels to protect any TV broadcast service on these channels according to the FCC TVWS Rules.
- **Channel Expansion**. Current ACRS 2.0 radios occupy one 6 MHz TV channel. Adaptrum and partners wish to experiment with channel expansion up to 24 MHz and occupying up to 4 contiguous TV channels. Operations will still observe the 55 dBc adjacent channel limit and FCC 15.209 limits beyond adjacent channels. Adaptrum will also work with the TVWS database providers to ensure proper separation distances are provided on all the used channels to protect any TV broadcast service on these channels according to the FCC TVWS Rules.
- **High Output Power**. Current ACRS 2.0 radios are certified to operate around 20 dBm conducted output power level. Because of the characteristics of the area of operation, this testing will also experiment by using a higher output power level at 28 dBm conducted. At this output power level, the radio will continue observing the 55 dBc adjacent channel limit and FCC 15.209 limits beyond adjacent channels. Adaptrum will work with TVWS database providers to ensure we only use the valid channels returned by the database which take into account the higher device output power when computing channel separation distances.
- **New product configurations**:
    - A wall mount white space device with integrated antenna, GPS and Wi-Fi and operate as a Fixed TVBD or Personal-Portable Mode II TVBD
        - Antenna gain around 7 dBi and antenna pattern file will be provided as part of the experimental license application
    - An indoor white space device with integrated antenna, GPS and Wi-Fi and operate as a Personal-Portable Mode I or Personal-Portable Mode II TVBD.
        - Antenna gain around 0 – 2 dBi and antenna pattern file will be provided as part of the experimental license application
    - For interference protection, Adaptrum will make sure all TVWS emission rules (adjacent channel and 15.209) and all TVWS database rules related to these different product configurations are observed during the operation.
- **Increased AGL**. Antenna height above ground level (AGL) will be tested up to 199 feet (comparing to 30-m limit in the current TVWS rules) to improve signal coverage. This higher antenna height will help provide better coverage in the deployment area where tall and dense trees (70-feet height typical) are common, and customer geographic density is low. Note that even though this application proposes experimenting with higher elevation of the antenna, Adaptrum will work with TVWS database providers to ensure that the 250-meter HAAT rules are observed in all cases and only use the valid channels returned by the database which take into account of the increased AGL when computing channel separation distances.

Nature of the Proposed Operations

Adaptrum and partners are proposing to install TV White space technology at sixteen tower sites. Each site will have sectorized transmitters covering 360 degrees, with reasonable antenna gain, allowing for improved signal coverage in the sectors. The conducted power levels of the transmissions are 630 mW. The 11 dBi of gain added to the transmitters brings the ERIP up to a level of 7.94 W. The radio technology proposed above including higher power and increased AGL are essential in the experimentation phase of the project to ensure good signal coverage and the data rates made available to the students are sufficient for Internet access The goal is to design and build the network with the lowest power levels possible while delivering performance that gives students high quality Internet access everywhere they go. Users of this network will not be charged for the service provided.

The spectrum requested will be tested during the design/build phase of the project, and if any spectrum is not available for use according to the TVWS databases, the services will be shifted to other frequencies that are available. The experimental license allows the engineers to test the radio technology components proposed and work with the TVWS database providers to ensure that there are no interference issues during the operations.

Area of Operations

Adaptrum and partners are proposing to test a radio network with 15 tower sites covering Halifax and Charlotte counties in southern Virginia. The area is rural, with some small towns, but no nearby large metropolitan areas. The area is in the foothills of the Blue Ridge Mountains. It is heavily forested, causing signal propagation and coverage issues. Each tower site is intended to cover a surrounding area that the school serves – ensuring that all students of the school have access to the Internet, whether they are at home, in the classroom, or even in town. Using sector antennas with good gain and AGL at each tower site, the signal in each sector are maintained at a level in order to deliver higher performance Internet access for the students living in that area. The sector radios at the tower sites will communicate with devices provided to the students that can be used outdoors and indoors at various locations.

Protection from Interference

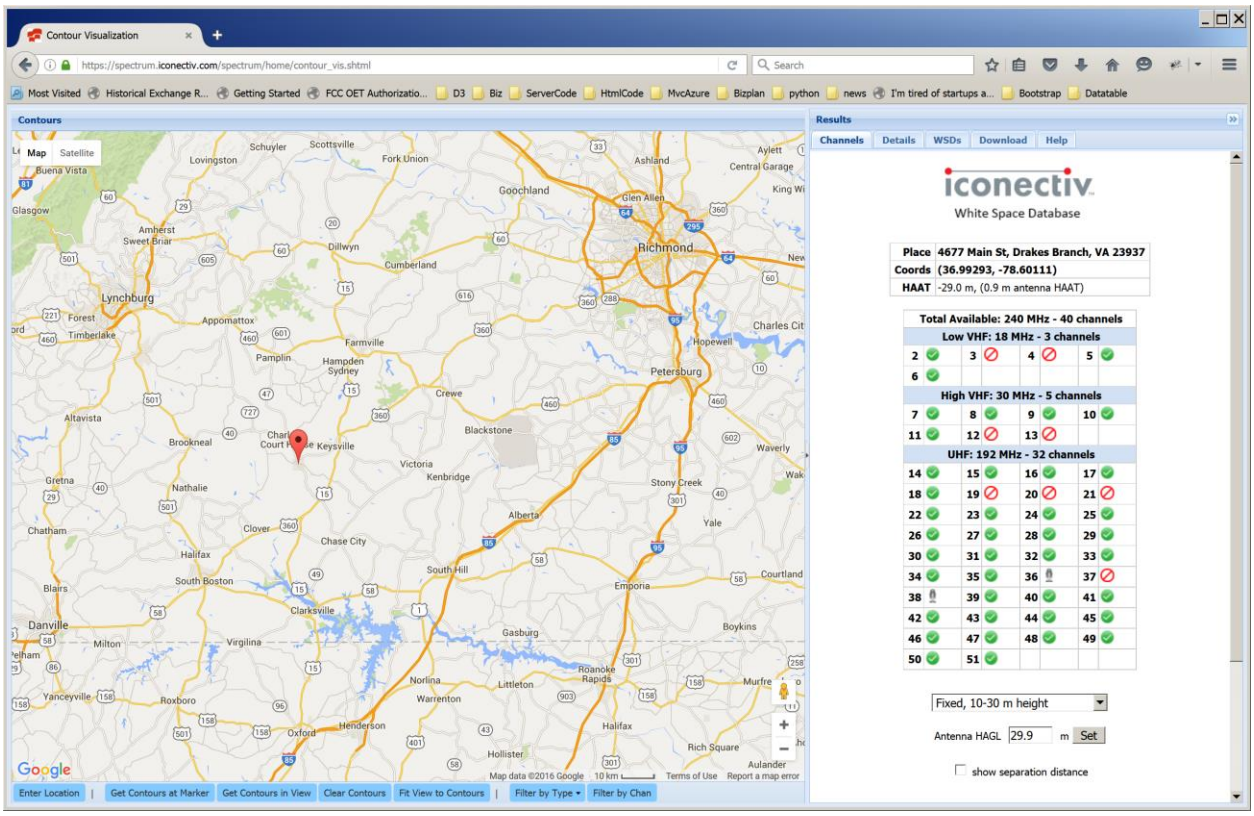

Figure 2: Typical TV white space spectrum availability in the area (at one of the base site locations) according to Iconectiv TVWS database.

Adaptrum and partners are confident that conducting the experiments listed above will not cause harmful interference to TV broadcast service in the area. The partners will exercise extra precaution to ensure such is the case. In support of this application, we have studied the area and the existing TV broadcast licensees:

- The target area has very limited number of TV channels on air and plenty of TV white space channels available as shown in Figure 2.
- The features being tested follow the FCC TVWS rules as closely as possible, even though they have not received FCC certification.
- When manually selecting operating channels, Adaptrum will only select the channels from the list of channels approved by a certified TVWS database like Iconectiv or Google, computed based on the device location and operating parameters.
- Adaptrum will work with TVWS database providers to ensure that all experimental features listed before are taken into account during the channel separation distance computation using the FCC TVWS propagation model and adequate protection will be provided to existing TV band services in all cases.
- Adaptrum will keep track of all experimental stations in real time and keep a data log of the usage.
- Adaptrum are ready to coordinate with the society of broadcast engineers regarding to the proposed operations to ensure there is no interference to TV reception in all conditions.

Stop Buzzer Point of Contact

In the event that anyone needs to contact Adaptrum regarding its proposed operations, the stop buzzer point of contact is:

Jeff Lee
Adaptrum, Inc.
2740 Zanker Road, Suite 100
San Jose, CA 95134
jeff@adaptrum.com
408-850-9996 x703
510-589-6773 (cell)

Conclusion

Adaptrum, Mid-Atlantic Broadband and Microsoft are proposing to build and test a broadband network to deliver high speed Internet connectivity to low-income students in two counties in southern Virginia. The purpose of the network is to close the "homework gap" between students who do have high quality broadband Internet at home and those who do not. The proposed operations covered by the experimental license will allow the partners the opportunity to design and test the network properly to ensure that it functions as intended and delivers the quality of service necessary. As part of the experimental license, Adaptrum and partners will be testing a number of additional technical parameters to optimize the functions of the network, while ensuring that there is no harmful interference to licensed broadcast services.

If there are any questions about this application, please contact Anne E. Cortez, Esq. 520-360-0925 or alc@conspecinternational.com.