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Worldwide Commercial Deployments, Pilots, and Trials

Global Map of Worldwide Commercial Deployments, Pilots, and Trials

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The Dynamic Spectrum Alliance is a global organization advocating for laws and regulations that will lead to more efficient and effective spectrum utilization. The DSA's membership spans multinationals, small- and medium-sized enterprises, and academic, research, and other organizations from around the world, all working to create innovative solutions that will increase the amount of available spectrum to the benefit of consumers and businesses alike. Visit http://www.dynamicspectrumalliance.org/.

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Asia-Pacific

Tang Valley, Bumthang, Bhutan   **February 2014 – Present**

Bhutan TVWS trial connects remote health unit

Microsoft partnered with Terabit, Bhutan Telecom and the Asian Development Bank (ADB) to connect a remote health unit in the Bhutanese village of Tang to Bumthang Hospital. The TV White Space link, established in February 2014, connects the villagers to quality healthcare and ensures treatment is received quickly and cost effectively.

Tang was previously underserved by the internet due to its remote and mountainous terrain, but one of the TV White Space Technology capabilities (thanks to the physics of TV spectrum) is the ability to provide point-to-multipoint broadband connectivity over long distances. The TV White Space link enables villagers to book appointments and receive medical advice without the long journey into the city.

The pilot is being used by ADB for designing an ICT Development loan instrument to leverage the cost effectiveness of TV White Space technology.

The Island of Bohol, Philippines   **July 2013 – Present**

Philippines TVWS Pilot improves fisher folk registrations

Microsoft, the Philippines Department of Science and Technology's Information and Communication Technology Office (DOST-ICT Office), Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR), and the U.S. Embassy Manila's United States Agency for International Development (USAID) have a partnership to explore delivering broadband connectivity and facilitate mobile fisher folk registration to remote areas in the municipalities of Talibon, Trinidad, Bien Unido, Ubay and Carlos P Garcia.

A TVWS base station was set up at a transmission tower at DOTC Compound at Tubigon, Bohol to bring internet access to sparsely located pockets of population all around the island who currently have slow or non-existent network connectivity. This is a simplified base station setup whereby the main communication path is to the surrounding areas within 3 – 7km radius of the base station. For this implementation, the TVWS clients are set at local schools or community areas within the villages.

The trial also enables local government agencies to distribute IDs, certificates and licenses to fishermen whilst out in remote locations and collate an online database. Police will be able to access the central database to monitor compliance and cross reference individuals. The project strengthens the Government's economic assistance to the fishing sector, with a focus on sustainable practices that produce more fish, feed more people, and generate more jobs.

The pilot will also connect local institutions such clinics and public schools, with the network considered for further expansion.

Long-distance broadband networking using TV white space for disaster scenarios

This project confirmed long-range broadband wireless communications using IEEE 802.22 and IEEE 802.11af systems in Tono City, Iwate, Japan. The key assumption of the pilot is that white space communication systems would be utilized in order to provide Internet access where commercial network services were damaged by an earthquake disaster. Key achievements of the project include:

The IEEE 802.22 system established a link over 12.7 km. Throughput was 5.2 Mbps downstream and 4.5 Mbps upstream.
The original specifications of IEEE 802.22 were modified to operate using non-contiguous multiple channels, i.e. channel aggregation. With two channels, throughput was 15.5 Mbps downstream and 9.0 Mbps upstream over 6.3 km.

 A multi-hop network was constructed using IEEE 802.22 and IEEE 802.11af systems. The IEEE 802.22 and IEEE 802.11af systems provided for backbone links and for expansion of service area, respectively. Conventional wireless LAN (IEEE 802.11b/g/n in 2.4 GHz) provided for the last hundred metres to the IEEE 802.11af system so that off-the-shelf end user WiFi devices can connect to the Internet via the TV white space-based wireless links.

This project was carried out by NICT and Hitachi Kokusai Electric under R&D contracts with the Ministry of Internal Affairs and Communications, Japan.

TVWS in disaster response

On November 8, 2013, Typhoon Haiyan, one of the strongest typhoons ever recorded, struck the Philippines killing at least 6,268 people and affecting approximately 11 million more. Standard communication systems failed and extreme damage to infrastructure throughout the region posed greater hazard to both the residents and relief efforts. The Department of Science & Technology's (DOST) ICT Office built a TV White Spaces (TVWS)-based network to provide an immediate on-the-ground communications network for disaster relief respondents and victims of the disaster. The network was able to be set up, backhauled via VSAT, and switched on in a matter of hours. It provided a network immediately for two-way voice and data wireless communications for anyone with a functioning end user devices (handsets, laptops, tablets, etc.). The network was setup at less than 1/10th the cost of other alternative viable solutions. It was also rapidly set up and deployed, requiring minimal technical expertise, system integration or support, and provided ongoing communication throughout the later disaster relief efforts.

TVWS field trial for rural aboriginal Fu-Hsing Township

Fu-Hsing Township is an aboriginal rural township located in eastern Taoyuan County, Taiwan. Famous for scenic spots including the Sanmin Bat Cave, Jiaobanshan Park and more, this is an eco-system tourism spot where the local aboriginal population co-exists in the highlands. Based on the little existence of network connectivity within the highlands, Power Automation (PA) is working closely with the Institute for Infocomm Research (I2R) and local research partners to provide a greater and wider network infrastructure to the aboriginal township using TV White Space (TVWS). TVWS creates a wireless network whose signal can cover greater distances than traditional networks and travel through the forested terrain. For a start, a TVWS base station was set up at the roof top of the Fu-Hsing Township Office building. This is a simplified base station setup whereby the main communication path will be to surrounding areas within 3 – 10km radius of the base station.

Singapore Island Country Club, National University of   **September 2012 – Present**
Singapore, Gardens by the Bay, and Other Sites

Singapore commercial TVWS pilots using dynamic spectrum management

The first wave of the Singapore White Spaces Pilot Group's (SWSPG) TV White Space (TVWS) pilot projects were announced in September of 2012 to establish TVWS projects that demonstrates the variety of commercial services that could be deployed using White Spaces technology in an environment where other traditional wireless deployment would be difficult to achieve. The sites include the National University of Singapore, Singapore Island Country Club and the Changi district, around the airport. SWSPG was established in April 2012 with four founding members (I2R, Microsoft, StarHub, and Neul) and with support from Infocomm Development Authority (IDA), Singapore. The organization's objective is to deploy White Spaces technology pilots in Singapore, thereby accelerating the adoption of White Spaces technologies in Singapore, the Asia Pacific region, and globally.

Additionally, StarHub and InterDigital performed an evaluation and trial of Wi-Fi® over *dynamically* managed unlicensed spectrum. The DSM Wi-Fi® platforms were used to evaluate the suitability of Wi-Fi® and UHF (TV White Space) spectrum for both indoor and outdoor applications. Video surveillance and small cell backhaul were some of the key applications tested along with general throughput, latency and coverage. Testing showed good overall performance with minimal latency and TCP/IP speeds up to 20 Mbps over a 40 meter indoor NLOS distance.

Africa

Boane Municipality, Maputo, Mozambique   **August 8, 2015 – Present**

TV white spaces Mozambique

The Institute of National Communications of Mozambique (INCM) in partnership with the Universal Access Fund (FSAU), the Network Startup Resource Center (NSRC), the Abdus Salam International Centre for Theoretical Physics (ICTP), Internet Solutions (IS) and the University Eduardo Mondlane Center of Informatics (CIUEM), are conducting a TV white spaces pilot project. The pilot project aims at providing clear understanding regarding the potentialities of cognitive radios to deliver free access to the Internet to the rural schools and the library at the University Unitiva located in the municipality of Boane.

The trial project was launched on the 8th of August 2015; the established network uses 6Harmonics TV white spaces base stations to deliver broadband access and create new opportunities for the education sector, whose access is hindered by the distance between the urban fiber optic and the municipality of Boane. The trial is expected to last for one year, and will be financed by the Universal Access Fund of Mozambique. The resulting internet availability will allow Mozambican young scientists to continue with a wide variety of research, as well as help the Institute of National Communications decide the best ways to expand the project and wireless access throughout the country

Gaborone, Botswana   **March 2015 – Present**

Project Kgolagano

The Botswana Innovation Hub, in collaboration with Microsoft, the Botswana-UPenn Partnership (BUP), Global Broadband Solutions, Vista Life Sciences, BoFiNet, Adaptrum and USAID-NetHope, launched a TV White Space (TVWS) pilot project to provide internet connectivity and telemedicine services to local hospitals and clinics. The project, known as Project Kgolagano, will enable access to specialised medicine in Gaborone and other locations around the world.

Project Kgolagano, which means 'to be connected or networked', has a specific focus on providing access to specialised maternal medicine, which will improve the livelihoods of women located in small towns and rural areas. Telemedicine experts and doctors providing medical expertise for referred patients are being provided by BUP.

Project Kgolagano is made possible under an authorisation from the Botswana Communications Regulatory Authority (BOCRA) to transmit using TV white spaces. It is also operating with the support of the Botswana Ministry of Health and the Ministry of Infrastructure, Science and Technology.

Oshana, Ohangwena, and Omusati, Namibia   **August 2014 – Present**

World's "largest" TV white space pilot

MyDigitalBridge Foundation in partnership with Microsoft and Adaptrum, with support from the Millennium Challenge Corporation (MCC) and Millennium Challenge Account (MCA)-Namibia, has successfully trialled the Namibian TV White Spaces (TVWS) pilot project. The intention is to provide a blueprint of broadband internet connectivity countrywide. Called 'Citizen Connect', the pilot consists of a network deployed over a 62km x 152km (9,424 km²) area covering three regional councils: Oshana, Ohangwena, and Omusati, and connecting 28 schools in northern Namibia. This makes it the biggest TVWS project of its kind in terms of area coverage.

"This pilot project came at the right time for us to answer to the challenges of internet access, or the lack thereof, to all our citizens. This pilot project is ambitious by any standard and can only be realised with the support and contributions from a large stakeholder community. I call on all stakeholders to continue to collaborate in an effort to ensure that we afford all Namibians the right of internet access for purposes of education, health and government services," says Hon. Dr. Moses Amweelo, the Chairman of the Parliamentary Standing Committee on ICT.

Accra, Ghana   **March 2014 – Present**

Accra TVWS pilot network is the first of its kind in West Africa

In March 2014, SpectraLink Wireless, under authorization from the Government of Ghana's National Communications Authority (NCA), and in collaboration with the Meltwater Entrepreneurial School of Technology (MEST) deployed a pilot network to offer free wireless broadband access for its community of Entrepreneurs in Training.

The successful network deployment of the company's leading edge TV white space technology is the first of its kind in West Africa and has proven the viability of SpectraLink's platform in delivering high speed Internet connectivity through this medium. The purpose of the pilot with MEST has been to test the efficiency of using TV white spaces for Internet radio networks, in an urban environment that presents multiple sources of interference. The network has been successfully tested on channels adjacent to active television channels, over a 10 km link, with no interference observed.

Koforidua, Ghana   **2013 – Present**

Koforidua Polytechnic TVWS trial

SpectraLink Wireless, in collaboration with Microsoft and Facebook, are connecting Koforidua Polytechnic and other universities in Ghana to wireless broadband and cloud-based services through TV white space technology. The pilot is supported by Microsoft's 4Afrika Initiative which aims to improve the region's competitive positioning by facilitating technology access, while ensuring students have reliable Internet access.

The networks use TV white space-enabled radios from 6Harmonics to connect campus buildings, as well as hostels where students live, to ensure pupils have access to fast wireless broadband and cloud-based services, such as Office 365. The project is operating under the first TV white space pilot license issued by the Ghana National Communications Authority.

The TV White Space networks enable greater internet penetration, providing more bandwidth for less money, and this allows students to take university courses online and use bandwidth intensive applications such as video conferencing.

Polokwane, South Africa   **July 2013 – Present**

University of Limpopo TVWS trial

In 2013 Microsoft, 6Harmonics and The Meraka Institute, who research and develop geo-location spectrum databases, partnered with the University of Limpopo in South Africa to provide the institution and five schools in an 8km radius with internet access.

Hundreds of students benefit from TV White Space network which allowed ICT to be included in the syllabus for the very first time. The project enables access to vast online resources and allows quality education through technology which improves employment opportunities for students.

The cost of broadband remains an obstacle to internet access in rural South Africa, but by reducing the cost of broadband access millions of South Africans could get online. This creates new opportunities for education, health care, commerce and the delivery of government services across the country.

It is hoped the TV White Space pilot will extend to encompass disadvantaged schools throughout South Africa and deliver interactive based learning to progressively more students. The focus of the pilot will be to prove that TV white spaces can be used to meet the South African Government's goals of providing low-cost access for a majority of South Africans by 2020.

Zomba, Malawi **July 2013 – Present**

Malawi TV white spaces pilot

The University of Malawi, in partnership with the regulator, Malawi Communications Regulatory Authority (MACRA), and the International Centre for Theoretical Physics in Trieste, launched a white-spaces pilot project in the city of Zomba, in southern Malawi. The pilot, which got underway in September 2013, has connected a number of different institutions including a school, a hospital, an airport and a research facility.

Dar es Salaam, Tanzania **May 2013 – Present**

Dar es Salaam TVWS trial

UhuruOne and Microsoft are partnering with the Tanzania Commission for Science and Technology (COSTECH) to supply 74,000 students with affordable wireless broadband access, devices, and cloud-based services.

The Broadband4Wote project is designed to assess the commercial feasibility of wireless broadband using TV White Space technology. The Open University of Tanzania, Institute of Finance Management, College of Business Education and Dar Es Salaam School of Journalism and Mass Communication are all connected to the network which focuses on TV White Space capabilities in urban settings.

The Tanzanian deployment will also hire a team of students to support the network infrastructure, devices, and software, giving students the opportunity to learn valuable technical skills and gain IT qualifications.

The ongoing pilot hopes to improve student's education through access to vast online resources and boost employment opportunities through the development of technical expertise.

Cape Town, South Africa   **March 2013 – September 2013**

Cape Town TV white spaces trial

In 2011, several partners hosted a workshop in Johannesburg on TV White Spaces, where the regulator, the Independent Communications Authority of South Africa (ICASA), lent support for a white space trial in South Africa. This led to Google partnering with the CSIR Meraka Institute, Tertiary Education and Research Network of South Africa, e-Schools Network (TENET), the Wireless Access Providers' Association (WAPA), Comsol Wireless Solutions, Carlson Wireless, and Neul to take up the challenge. The six-month trial launched in Cape Town March 2013. The TVWS network consisted of multiple base stations located at Stellenbosch University's Faculty of Medicine and Health Sciences in Tygerburg, Cape Town, which delivered broadband Internet service to ten schools within a 10 kilometer radius. Each school received dedicated 2.5 Mbps service with failover to ADSL in order to prevent downtime during school hours. To prevent interference with other channels, the network used Google's spectrum database to determine white space availability. At the end of the six-month period, the trial had successfully showed that broadband can be offered over white spaces without interfering with licensed spectrum holders.

Nanyuki, Kenya   **February 2013 – Present**

Kenya Mawingu TVWS pilot

Microsoft Corp., in collaboration with the Government of Kenya (Ministry of Information and Communications), Mawingu Networks (previously Indigo Telecom), and Jamii Telecom Limited, and with support from the Communications Authority of Kenya (CAK), are conducting a pilot project delivering low-cost wireless broadband access to previously unserved schools, healthcare clinics, government offices, and some small businesses near Nanyuki, Kenya. Launched in 2013, the network utilizes Adaptrum and 6Harmonics TV white spaces and solar-powered base stations to deliver broadband access and create new opportunities for commerce, education, healthcare and delivery of government services. To maximize coverage and bandwidth, while keeping costs to a minimum, the project is using several complementary spectrum bands available to license-exempt devices, including 13 GHz, 5 GHz, 2.4 GHz, and TV white spaces band spectrum. The Mawingu project has successfully demonstrated the technical viability of this model of delivery, with interference free point to multi-point coverage of up to 14 kilometers from TV white spaces base stations operating at only 2.5 Watts power (EIRP measurement). The TV white space base stations have achieved speeds of up to 16 Mbps on a single 8 MHz TV channel at distances of up to 14 kilometers.

Europe

Turku, Finland   **2011 - 2015**

WISE – White space test environment for broadcast frequencies

The Finnish WISE project was one of the first TV White Space pilot projects in Europe. Its testbed for studying the use of White Space Devices on the UHF terrestrial broadcasting band (470-790 MHz) consisted also a commercial level Digital Terrestrial Television network. The project contributed the results of several interference measurement campaigns to European Commission CEPT SE43 working group. The applicability of TV White Space communication was trialed in various use cases: rural broadband, wireless surveillance systems, smart grid, intelligent transport systems, and machine-to-machine communications. Finnish regulator Ficora issued the Europe's first geolocation database controlled radio license for the project. The unique test cases and results were achieved by participants representing various types of TVWS stakeholders: Aalto University, City of Jyväskylä, Fairspectrum, Finnish Communications Regulatory Authority, Digita, Helsinki Region Transport, Nokia, Nokia Solutions and Networks, Teleste, Turku University of Applied Sciences, University of Turku, Viola Systems. The project was funded by Finnish Funding Agency for Innovation (Tekes).

London, United Kingdom   **October 2014 – Present**

London Zoo TVWS trial to save the animals

Ofcom, the UK's communication regulator, teamed up with Alliance members 6Harmonics, Mediatek and Google to launch a TV White Space trial at ZSL London Zoo, using the technology to stream daily live footage of zoo animals to YouTube.

6Harmonics and Mediatek provided the equipment to transmit images of meerkats, otters and tortoises from their enclosures to YouTube via spectrum temporarily licensed by Ofcom. The trial, dubbed "Whitespace for Wildlife", uses Google's spectrum database and will help ZSL London Zoo test the technology for efforts to protect endangered animals in the wild.

Following completion of the trials, testing and policy development, Ofcom expects the UK to be the first European country to deploy widespread TV White Space networks in 2015.

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NICT tests combined LTE and 802.11af device communicating with TVWS database at Ofcom white space pilot

NICT, supported by King's College London, has conducted trials within the Ofcom TV White Spaces Pilots. In this pilot, the system for White Space Devices (WSDs) communicating with White Space Databases (WSDBs) to obtain allowed channel/power information was tested using the evolving IETF PAWS standard, also referred to as ETSI 301598. PAWS (Protocol to Access White Space) is the protocol to access spectrum databases. Other aspects investigated included the performance of the WSDs, and coexistence issues.

The WSDs tested in these trials are developed by NICT. These are an LTE system (3GPP Release 8) extended to operate in TVWS, and an IEEE 802.11af system. These WSDs satisfy the requirements of the ETSI 301598 specification, including spectrum mask characteristics. The WSDB, developed by NICT, has since been qualified by Ofcom as meeting requirements for operation with WSDs in the UK.

The LTE system realized mobile broadband communications using TVWS frequencies, achieving a downlink throughput of 45 Mbps in FDD mode (20MHz each for uplink and downlink, from aggregating 3 TV channels) and 19 Mbps in TDD mode (20MHz, aggregating 3 TV channels). The IEEE 802.11af system established a 3.7km point-to-point link using one TV channel, achieving a downlink throughput of over 2Mbps.

As part of an extensive trial led by King's College London starting in June 2014, and including the Joint Research Centre of the European Commission, Eurecom, Queen Mary University of London and numerous others, a range of white space equipment is being tested or operated on a continuous basis primarily across London but also sporadically at other locations in the UK. The equipment includes Carlson Wireless, InterDigital, Eurecom (jointly developed with King's College London), Sinecom/KTS, Runcom, NICT, and others. London locations include the King's College London Strand, Waterloo, Denmark Hill, and Guys (London Bridge) campuses, and the Queen Mary University of London Mile End campus, among others. This trial is testing, among other scenarios, long-distance point-to-point links, indoor broadband provisioning, and outdoor wide-area broadband provisioning, and performing numerous research investigations. It is using geolocation databases including Fairspectrum, Spectrum Bridge, and Nominet.

The equipment was deployed at campuses of King's College London, located in the Center of London. Feasibility of TVWS utilization in a metropolitan area was demonstrated.

Glasgow white spaces

Microsoft, Mediatek, 6Harmonics and Aviacomm successfully developed and trialled the world's first triple band WiFi transceivers as part of a wider TV White Space project at the University of Strathclyde, Glasgow. The Glasgow White Spaces Pilot builds on the unrivalled experience of the Centre for White Space Communications (CWSC) (University of Strathclyde), in both Scotland and Africa. The Pilot used TVWS to fill urban broadband gaps and enable smart city applications. The tri-band Wi-Fi transceivers are designed to locate vacant parts of the spectrum and then to refer to a constantly updated database to find which frequencies are available and at what power.

The first phase of the project deployed radios at defined locations around the University's City Centre Campus, helped by seed funding from the Scottish Government under its Demonstrating Digital Programme and with support from Microsoft.

The CWSC is now considering how to harvest and aggregate data from distributed environmental sensors, to feed a novel City Observatory and an Open Glasgow portal. The network was also designed to support sensor innovation – a particular strength of businesses in this part of the UK. A number of the countries represented in the Glasgow 2014 Commonwealth Games, at the end of July 2014, are embarking on their own white space journeys. The City and CWSC looks forward to welcoming visitors and briefing them on the Pilot.

Rural Scotland TVWS ferry services

Currently, rural Scotland has far slower speeds than the rest of the UK. However Scotland is beginning to use TV white space to provide internet connectivity and communications to the Orkney Ferries serving the Orkney Islands and in the Pentland Firth. Until now, there has been no wireless broadband available on board these ships.

Accessing the Internet from home or during the daily commute via ferry has been a challenge for residents of the Orkney Islands. Directors Greg Whitton and Nikki Linklater of CloudNet IT Solutions are deploying TVWS gear from Carlson Wireless to provide Internet access at ferry terminals and on the ferries themselves to passengers while travelling. There are further plans that call for expansion network coverage throughout these remote islands.

Isle of Bute, Scotland, United Kingdom   **June 2012 – December 2013**

White space rural broadband trial on the Isle of Bute

In April 2011, a six-partner consortium, with support from the UK government's Technology Strategy Board, started work on a rural broadband trial network that would use white space radio spectrum to provide broadband connectivity to a small rural community on the south part of the Isle of Bute, Scotland. A key aim was to investigate and demonstrate the potential of white space spectrum for providing broadband access to remote, difficult-to-reach rural areas in challenging terrain. The 18-month project involved the planning and installation of white space radio links from the local telephone exchange to eight premises in the surrounding area, as well as backhaul connectivity from the telephone exchange to the mainland and then on to BT's IP backbone for access to the Internet.

Cambridge, United Kingdom   **June 2011 – April 2012**

Cambridge white spaces trial

Launched in June of 2011, the Cambridge White Spaces Trial was designed to evaluate both the technical capabilities of the technology as well as potential end user applications and scenarios. The consortium explored and measured a range of applications, including rural wireless broadband, urban pop-up coverage and the emerging "machine-to-machine" communication, and found TV White Spaces can be successfully utilized to help satisfy the rapidly accelerating demand for wireless connectivity. The Cambridge trial partners were: Adaptrum, Alcatel-Lucent, Arqiva, BBC, BSkyB, BT, Cambridge Consultants, CSR, Digital TV Group, Neul, Nokia, Samsung, Spectrum Bridge, TTP, Virgin Media, and Microsoft.

North America

March 2015 – Present

Seattle Center TV White Space

The Seattle Center TV White Space (TVWS) network is a partnership between Microsoft and the City of Seattle, and is part of the Mayor's 3-point plan to improve broadband Internet. Located at Seattle Center, the network is designed to serve an estimated 25,000 users at the 74-acre location.

The new system lets users browse at speeds more than 5,000 times faster than they could before. "The most obvious advantages of this technology are speed and performance," said Dayne Sampson, Microsoft Corporate Vice President of Engineering, in a statement. "That's a distinct difference from the free Wi-Fi often found in public places."

Washington County, Maine, USA **June 2014 – Present**

Washington County Maine TVWS Deployment

Working with local Wireless Internet Service Provider Axiom Technologies, Adaptrum has embarked on a project to provide a TV White Space-based broadband service to the rural areas in Washington County, Maine. Deploying Adaptrum's ACRS 2.0 technology in June 2014, which is certified by the FCC, the current phase comprises of 5 base sites and 40 customers across the county.

ACRS 2.0's NLOS OFDMA technology combined with superior propagation characteristics in the UHF TV band allows reliable connectivity in the most challenging radio propagation environments in rural, suburban and urban areas. In Washington County, the NLOS distance from the tower to the customer premise was between 2 to 5 miles with a link speed 10 Mbps. The next phase of the project includes 600 customer sites in densely wooded and hard-to-reach areas.

Louisa Water Tower TVWS deployment demonstrates resilience of TVWS-based WiFi

CVALINK Broadband of Louisa County, is the first Internet Service Provider in the U.S. to partner with Adaptrum Inc., a California-based wireless manufacturer and leading developer of TV White Space technology, to launch Adaptrum's ACRS 2.0 technology in rural areas, bringing fast and reliable Internet services to the county.

Adaptrum installed a base station on Louisa's water tower and tested the link back to the company's offices on Davis Highway. The equipment demonstrated an increase in range and reliability of TV White Space when compared side-by-side with 900 MHz and 2.4GHz Wi-Fi-based products.

The deployment, which went live in April 2014, will enable CVALINK Broadband to serve customers in dense wooded areas which are unreachable using traditional unlicensed services and technologies. With the ability to penetrate through trees, TV White Space has the ability to connect more citizens than before, bridging the digital divide in the county. Since CVALINK Broadband partnered with Adaptrum, the county of Louisa has also committed to testing the technology at the county office building as it looks to provide broadband Internet availability to all its residents.

Dover, Delaware, USA **Spring 2014**

Delaware State Library Pilot

State Librarian and the University of Delaware are leading an ambitious state-wide initiative to determine the feasibility of deploying TVWS hubs at every library facility in the state.

Humboldt County, California, USA **October 2013 – Present**

Humboldt County pilot

Humboldt County, CA library is pleased to announce that it has been selected as a test site for the TV Whitespace "Super Wifi" project. This project will test the efficacy of using vacant broadcast spectrum (the TV "whitespace") as a means of providing reliable wireless Internet access to public spaces.

Delta County, Colorado, USA **October 2013 – Present**

Delta County, CO pilot

The Delta County Library District has applied for and been approved to participate in a trial of Super WiFi technology under a program sponsored by the Gigabit Libraries Network.

Skokie, Illinois, USA **October 2013 – Present**

Skokie, IL pilot

Skokie Public Library is pleased to announce that it has been selected as a test site for the TV Whitespace "Super Wifi" project. This project will test the efficacy of using vacant broadcast spectrum (the TV "whitespace") as a means of providing reliable wireless Internet access to public spaces in the Village of Skokie.

Topeka, Kansas, USA **October 2013 – Present**

Kansas State pilot

The State Library of Kansas announces the establishment of the Kansas K20-Librarians Whitespace Pilot, initiated by the Kansas City K-20 Librarians Initiative and coordinated by the State Library, under the national Gigabit Libraries Network's Libraries Super-Wi-FI Pilot.

Pascagoula, Mississippi, USA   **October 2013 – Present**

Pascagoula, MS pilot

Libraries WhiteSpace Pilot project will examine how integrating unlicensed open wireless communication technologies can benefit library users by combining the near universal compatibility of WiFi with the range and penetrating capabilities of WhiteSpace devices.

Concord, New Hampshire, USA   **October 2013**

New Hampshire State pilot

Partnership between UNH Broadband Center of Excellence, NH State Librarian & New Hampshire FastRoads. Endeavor aimed at providing affordable broadband connectivity to unserved and underserved public libraries in New Hampshire.

Pittsburgh, Pennsylvania, USA   **October 2013 – Present**

Using TVWS to connect vessels in Pittsburgh waterway

In Pittsburgh, the Port of Pittsburgh Commission engaged with Adaptrum as part of its ongoing Interoperability Test Bed (ITB) Program which demonstrates and evaluates new technologies and services aimed at enhancing inland waterway safety, transportation efficiency and environmental systems management. This trial involves the U.S. inland waterway system, where broadband wireless services promise marked improvements in lock and vessel safety, crew liability and overall regional economic competitiveness.

Two Adaptrum base stations were deployed on the rooftop of the Carnegie Science Center to connect boats on the Monongahela, Allegheny and Ohio rivers in Pittsburgh. Using Adaptrum's ACRS2.0 technology, the project demonstrated how TV White Space can effectively connect vessels travelling at different speeds to enable VoIP services and video calls. The project displayed successful TV White Space handovers when the client boats went from one TV White Space cell to another TV White Space cell, coupled with excellent NLOS coverage, which spanned several miles on all three rivers, further highlighting that the technology is a critical element in creating wireless waterways.

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West Virginia University deployment

West Virginia University is ambitious and innovative, highlighted by the fact that it is the first University in the U.S. to use vacant broadcast TV channels to provide wireless broadband Internet services for its staff and students. Using FCC-certified white space radios from Adaptrum, a San Jose startup that has developed a software-defined radio that can dynamically shift channels, channel sizes, and power levels. The TV White Space deployment went live in February 2014 and is the first of its kind in a U.S. University.

At the heart of White Spaces network is the Adaptrum base station radio, which has been placed in the rooftop of the Engineering Sciences Building near the center of Morgantown. With it, are the accompanying directional antennas, cabling, power supply, performance and availability monitoring equipment, switching facility, and interconnections for back-haul through the University's backbone to the Internet. There are five Adaptrum client radios, one for each PRT station, along with their own antennas, an Ethernet connection with one or more off-the-shelf Cisco Wi-Fi access points. Despite challenging terrains and harsh weather conditions, the entire network is transparent to end users: they simply use Wi-Fi to create a connection for laptops, Smartphones, tablets and the like. The Adaptrum client radio makes the necessary conversions at its end, and sends the packets over the TV band to the base station, which then does its own conversion magic, and connects with a router into the WVU network and through there to the Internet.

Phase 1 provided Wi-Fi backhaul to the 5 platforms of an on-campus TRAM system over a 4 mile loop around the campus and Phase 2 connected additional sites on campus including an off-campus building, nursery and parking lots. Both Phase 1 and Phase 2 have been completed with average NLOS link distances between 1 to 3 miles and link speeds of 10 Mbps. Work has started on Phase 3, which will connect further municipal areas.

The great outdoors trial

In October 2012, 6Harmonics worked alongside the Gatineau Valley Societe d'aide au développement des collective to establish Canada's first TV White Space network.

The trial site of Pointe a David was chosen because of the significant demand for internet: the region incorporates over 100 campsites, and the difficulties of accessing the internet due to dense vegetation. The non-line-of sight performance capability of TV White Space technology overcomes this obstacle with the ability to penetrate trees, buildings and rugged terrain.

The Gatineau Valley Societe d'aide au développement invested $20,000 into the project in the hope the network will be emulated across other rural regions.

Wilmington "Smart City" deployment

The City of Wilmington and New Hanover County were presented the 'Community Broadband Wireless Network of the Year' Award by the National Association of Telecommunications Officers and Advisors Community Broadband Awards.

Working with 6Harmonics the TV White Space network was the first of its kind in 2012 and successfully delivered internet to remote previously hard to access areas. As well as providing broadband access to the New Hanover County Juvenile Centre, police stations and the Youth Enrichment Zone. Public security remains the main function of the network, which will be expanded to carry video surveillance and manage traffic congestion.

The network is part of Wilmington's wider, ongoing "Smart City" initiative to improve the standard of living and drive the economy by creating a better communications infrastructure.

The TV White Space network has proved particularly valuable to manufacturers, and serves as a test-bed for new radio devices.

South America

Kingston, Jamaica   **January 2015 – Present**

Jamaica Connected Nation Project

Microsoft, in partnership with the U.S. Agency for International Development (USAID), and the Jamaica Universal Services Fund, the Global Broadband and Innovations Alliance (GBI), Lime, and Adaptrum are bringing the benefits of broadband (high-speed Internet and data transmission) to rural communities by leveraging TV White Space (TVWS) technology.

By September 2015 more than 30 schools, libraries, and other community locations around the island will receive Internet access via TVWS connections, and the pilot is working to leverage other education and community-focused technology projects.

Montevideo, Uruguay   **May 2014 – Present**

Plan Ceibal remote schools pilot in Uruguay

Microsoft and 6Harmonics partnered with Plan Ceibal to connect five remote rural schools to the internet using TV White Space Technology.

The project, part of Plan Ceibal's wider initiative to support the integration of ICT into public schools, was the first of its kind in Uruguay and is expected to expand further to include five more schools. Microsoft provided technical support to Plan Ceibal whilst 6Harmonics provided the base-station technology to transmit and receive Wi-Fi signals.

For more information and press regarding these Commercial Deployments, Pilots, and Trials please visit the DSA website here: http://www.dynamicspectrumalliance.org/pilots/.

If you have any questions or comments, please contact us at admin@dynamicspectrumalliance.org.