Evaluation of the Performance of Prototype TV- Band White Space Devices Phase II

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Prepared by:
Steven K. Jones
Thomas W. Phillips
Hugh L. Van Tuyl
Robert D. Weller

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Executive Summary

Introduction. The Federal Communications Commission's Laboratory Division has completed a second phase of its measurement studies of the spectrum sensing and transmitting capabilities of prototype "TV white space" devices. These devices have been developed to demonstrate capabilities that might be used in unlicensed low power radio transmitting devices that would operate on frequencies in the broadcast television bands that are unused in each local area. At this juncture, we believe that the burden of "proof of concept" has been met. We are satisfied that spectrum sensing in combination with geo-location and database access techniques can be used to authorize equipment today under appropriate technical standards and that issues regarding future development and approval of any additional devices, including devices relying on sensing alone, can be addressed.

The Commission is conducting a rulemaking proceeding to consider authorization of new, low power transmitting devices in the television broadcast spectrum at locations where channels are not being used for TV or other authorized services (ET Docket No. 04-186). This locally unused spectrum is often referred to as "TV white space." As established thus far by the Commission, white space devices (WSDs) that operate from a fixed location will be allowed into the TV spectrum simultaneous with the completion of the transition from analog to digital television broadcasting on February 17, 2009. This action will open for use a significant amount of spectrum with very desirable propagation characteristics that has heretofore lain fallow. It will also allow the development of new and innovative types of unlicensed devices that provide broadband data and other services for businesses and consumers without disrupting the incumbent television and other authorized services that operate in the TV bands. The Commission is considering whether to also allow "personal/portable" WSDs to operate in the TV spectrum.

One of the principal considerations in the white space proceeding is how to reliably determine the availability of unused frequencies in local areas. A number of parties participating in the proceeding have suggested an approach for identifying unused frequencies whereby a WSD would employ a "listen before talk" or "detect and avoid" strategy. This approach would use "spectrum sensing" techniques that listen for the signals of TV stations, wireless microphones, and other incumbent services. The Commission has requested comment on whether to require that the sensing capability of devices using this approach be able to detect signals as low as -116 dBm, or some alternative value. A second technical consideration in this matter is the potential for WSDs to interfere with TV reception and wireless microphone operations. To address these issues, the Commission announced that it would perform testing of the spectrum sensing and transmitting capabilities of the prototype WSDs.

The purpose of the testing program is to provide additional information for the record that will be considered along with other information in developing the Commission's final decision on white space devices. The tests are not intended for equipment authorization or to determine whether the devices would comply with any possible standards that the Commission might adopt. Rather, they will provide information in support of the Commission's action in this matter. Initial tests (Phase I) under this program were completed in July of 2007.[1] This report describes the tests performed during the second (Phase II) series of tests and provides a compilation of the results of measurements of the spectrum sensing and transmitting functions of various prototype WSDs.

In October 2007, the Commission's Office of Engineering and Technology (OET) issued a Public Notice announcing that it would perform additional laboratory and field tests of white space devices and invited interested parties to submit such devices for testing at the FCC Laboratory in Columbia, Maryland.[2] Subsequently, OET issued a second Public Notice announcing that the second phase testing would begin on January 24, 2008.[3]

WSD Prototype Devices Submitted for Evaluation. Five devices were submitted for examination in the Phase II tests. These devices were provided by Adaptrum, the Institute for Infocomm Research (I2R), Microsoft Corporation, Motorola Inc., and Philips Electronics North America (Philips). These devices are not intended as actual consumer products but rather are development tools for evaluating the viability of spectrum sensing and potential interference. They do not communicate with other devices. Not all tests were performed on all devices. For example, the Microsoft device was available only for limited tests in the laboratory and the I2R device was submitted after the initial tests were completed.

Spectrum Sensing for TV Broadcast Signals. This portion of the study examined the ability of the WSDs to detect whether channels are occupied by ATSC (digital) TV signals. All of the prototype devices had capabilities for detecting TV broadcast signals on UHF channels 21-51, the operating range of the prototype devices. The tests were initially performed in the laboratory under various controlled conditions. Spectrum sensing sensitivity to clean digital TV signals in isolation and also in the presence of other TV signals on adjacent channels was measured. In addition, sensitivity tests were performed using recorded TV signals to simulate "real world" conditions. Spurious emissions generated by the prototype WSDs were also measured. The laboratory tests were followed by field tests at nine sites in Maryland and the District of Columbia to evaluate the DTV sensing performance.

Spectrum Sensing for Wireless Microphones. The wireless microphone portion of the testing looked at the ability of the WSDs to detect wireless microphones authorized

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[1] S. Jones and T. Philips , "Initial Evaluation of the Performance of Prototype TV-Band White Space Devices,", OET Report FCC/OET 07-TR-1006, July 31, 2007.

[2] FCC Public Notice DA 07-4179, "Office of Engineering and Technology Announces Additional Testing of TV White Space Devices, ET Docket No. 04-186," October 5, 2007.

[3] FCC Public Notice DA 08-118, "Office of Engineering and Technology Announces Plans for Conducting Measurements of Additional Prototype TV White Space Devices, ET Docket No. 04-186," January 17, 2008.

under Part 74 of FCC rules. Microsoft, Philips and I2R indicated that their devices were capable of sensing wireless microphones. Tests of this capability were initially performed in a controlled environment in the laboratory. Those tests were followed by field tests at two sites, one in Maryland and one in New York City, to evaluate the capability of the devices to detect wireless microphones under field conditions.

Transmitter Characterization and Interference Testing. The Adaptrum device included transmitting capability.[4] Laboratory tests were performed to characterize the transmitter's signal, which is an important element for assessing the interference potential of WSD devices. Field tests were also performed to evaluate potential interference from the Adaptrum transmitter; however, these tests were limited.

<u>Observations:</u>

- All of the devices were able to reliably detect the presence a clean DTV signal on a single channel at low levels in the range of -116 dBm to -126 dBm; the detection ability of each device varied little relative to the channel on which the clean signal was applied. These measurements did not take into account the antenna that would be used with personal/portable devices.

- The detection threshold sensitivity of the devices varied from -106 dBm to -128 dBm when recorded off-air DTV signals, which included multi-path fading and other "real-world" distortion, were used. The impact on detection ability varied considerably among the WSDs and with the characteristics of the different recorded signals.

- Several tests were performed with DTV signals present in adjacent channels. These tests showed that in the presence of moderate-to-strong signals in a first adjacent channel, the detection threshold sensitivity of all of the devices was severely impacted. For some of the devices, the degradation in the detection sensitivity was as much as 60-70 dB. In some cases, the degradation was such that the detection threshold could not be measured. This could impact significantly the ability of the devices to reliably detect TV signals within stations' service areas.

- The Microsoft, Philips and I2R devices were tested for their ability to sense for the presence of wireless microphones (both FM/analog and digital) operating within UHF TV channels. With no other signals present, the devices were able to detect wireless microphones at levels ranging from -103 dBm to -129 dBm depending on the type of microphone, and the device. In the presence of DTV signals in adjacent channels, the detection threshold was degraded such that it affected the ability of the devices to reliably detect the microphone signals.

[4] The Microsoft device also had a transmitting capability but that device was withdrawn from the test program before the transmitter tests were conducted.

- Scan time for the devices varied from 0.1 second per channel (Motorola) to 185 seconds per channel (Adaptrum). The Adaptrum device was modified during the tests and its scan time changed from 37 seconds per channel to 185 seconds per channel.

- Channel Occupancy (TV sensing) field tests were performed at nine locations for the Adaptrum, I2R, Motorola, and Philips devices.
    - In most cases, the devices correctly reported channels as occupied when the device was operated within the service contour of the stations broadcasting on those channels and viewable signals were observed on the channels.
    - In some instances, the Adaptrum, I2R, and Motorola (in sensing only mode) devices incorrectly reported channels as unoccupied (available) when the WSD was operated within a station's service contour and the signal was viewable.
    - All of the devices reported some channels as occupied when the WSD was operated outside of the service contours of stations broadcasting on those channels whether the signal was viewable or not.
    - The Philips device generally reported most channels occupied, whether the WSD was operating inside or outside any service contours whether the signal was viewable or not.
    - During the field tests, the Motorola device's geolocation/database feature was used in combination with its sensing capabilities. In those tests, the Motorola device correctly reported all occupied channels used by stations within whose contours the WSD was operated.

- Wireless microphone sensing tests were performed using the I2R and Philips devices at two field locations. The tests were conducted first with microphones off, and then turned on, in pre-determined channels to determine if the devices could sense the presence of wireless microphones. At both sites and all the test locations, the Philips device reported all the channels on which the microphones were designated to transmit as occupied whether the microphone was transmitting or not. The I2R device indicated several channels as available even when the microphones were on.

- The Adaptrum device's transmitter was characterized in the laboratory and was used to investigate interference potential to DTV signal reception. Anecdotal tests demonstrated that co-channel interference would occur at line-of-sight distances of up to 360 meters at an EIRP of approximately +7 dBm when the DTV was receiving a weak signal using a receive antenna at a height of 9.3 meters. No interference was observed when the Adaptrum device transmitted on an immediate adjacent channel even with the transmitter in close proximity to the receiver with a roof-top antenna. No other configurations were tested for interference.

- Anecdotal tests were performed at two field sites to assess the interference potential from WSD transmitters to cable television reception via direct pick-up of signals by cable system components. These tests showed that under certain circumstances, when the transmit antenna was placed in close proximity to a cable connected TV, direct pick-up interference was observed. The direct pick-up interference potential appears to be highly dependent on the interconnection among various system components (*e.g.,* cable amplifiers, splitters and set-top boxes) being used.

1 Introduction

The Federal Communications Commission's (FCC) Laboratory Division has completed the second phase of its program to measure the spectrum sensing and transmitting capabilities of devices intended to operate on frequencies in the broadcast television bands that are unused in each local area. These so-called "white space devices" (WSDs) have been developed to demonstrate features that might be used in unlicensed low power radio transmitting devices.

This measurement project was undertaken in support of the Commission's pending consideration in ET Docket No. 04-186 on whether to permit low power radio transmitting devices to operate on an unlicensed basis in the frequency bands that are currently allocated to the television broadcast and certain other licensed services.[1] Such low power operations would only be allowed on frequencies that are not used by TV stations or other licensed services in each local area. These unused, *i.e.*, vacant or "available," frequencies in local areas are often termed spectrum "white spaces." As established thus far by the Commission, fixed white space devices (WSDs) will be allowed into the TV spectrum simultaneous with the completion of the transition from analog to digital television broadcasting on February 17, 2009. This action will open for use a significant amount of spectrum with very desirable propagation characteristics that has heretofore lain fallow and will allow the development of new and innovative types of unlicensed devices that provide broadband data and other services for businesses and consumers without disrupting the incumbent television and other authorized services that operate in the TV bands. The Commission is considering whether to also allow "personal/portable" WSDs to operate in the TV spectrum.

The Commission is considering two categories of devices for unlicensed operation in the TV white spaces.[2] The first category consists of low-power "personal/portable" WSDs that will function similar to WiFi transceivers in laptop computers, and wireless in-home local area networks (LANs). The second category consists of higher-powered "fixed/access" WSDs that would typically be operated from a fixed location and might be used to provide a commercial service such as wireless broadband access. As established previously by the Commission, fixed white space devices will be allowed into the TV spectrum upon completion of the transition from analog to digital television broadcasts on February 17, 2009.[3] The Commission is now

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[1] *First Report and Order and Further Notice of Proposed Rule Making* in the Matter of Unlicensed Operation in the TV Broadcast Bands, ET Docket No. 04-186 and 02-380, October 18, 2006 (hereinafter *FNPRM*). While the focus of this proceeding is on unlicensed operation, the Commission has also requested comment on issues relevant to whether TV band low power devices should be allowed on a licensed or hybrid licensed/unlicensed basis. It also requested comment as to whether, if unused TV spectrum were made available on a licensed basis, licensed devices should be required to incorporate the same type of interference avoidance mechanisms and be subject to the same low power limits that it proposed for unlicensed devices.

[2] *Notice of Proposed Rulemaking in ET Docket Nos. 02-380 and 04-186, 19 FCC Rcd 10018 (2004).*

[3] *Id*.

considering whether to allow non-fixed “personal/portable” WSDs to also operate in the TV spectrum.

An important consideration in the proceeding is how to ensure that unlicensed devices operate only on vacant frequencies. One approach under consideration is for the WSD to employ “smart radio” features that would use a “detect and avoid” or “spectrum sensing” strategy. An alternative approach would rely on accessing a database of licensed services to identify active services near the device’s location. The device location would be determined by an integral geo-location technology, such as GPS. This technique is commonly known as a “geolocation” detection approach. A second issue is the potential for signals transmitted by a WSD to cause radio frequency interference (RFI) to incumbent users of these bands (*i.e.*, TV reception and wireless microphone operations). The Commission indicated that it would test prototype devices to collect technical information regarding both of these issues.

Consistent with the Commission’s plan for white space testing, the Office of Engineering and Technology (OET), through its Laboratory Division, performed initial tests of two prototype devices and issued a report on the results of those tests in July of 2007.[4] Subsequently, on October 5, 2007, OET issued a Public Notice inviting submittal of additional prototype devices for further tests (Phase II).[5] On January 17, 2008, OET issued a test plan for the Phase II tests to help ensure that the testing would be open to outside observers, and announced that the testing would commence on January 24, 2008.[6]

Five parties responded to the announcement of the Phase II testing and provided prototype WSDs to the Laboratory for testing: Adaptrum, the Institute for Infocomm Research (I2R), Microsoft Corporation (Microsoft), Motorola Inc., and Philips Electronics North America Corp (Philips).[7] The Microsoft devices malfunctioned during the test process and were not replaced. The I2R device was submitted after the initial laboratory tests were completed. As a result, not all the tests were performed on these two devices. All of these prototypes have a sensing capability, but only two (Microsoft and Adaptrum) have a transmitter. Since the Microsoft device malfunctioned before the transmitter tests were performed, its transmitter was not used in any of these tests.

This report describes the tests and measurements performed on the prototype WSDs and the results obtained, with focus on impacts to broadcast television and wireless microphone operations. In particular, this report provides the results of tests of the spectrum sensing capabilities of the prototype devices as a means for identifying TV

[4] OET Report FCC/OET 07-TR-1006, *Initial Evaluation of the Performance of Prototype TV-Band White Space Devices*, S. Jones and T. Philips July 31, 2007 (Phase I measurement report).

[5] FCC Public Notice, DA 07-4179, “The Office of Engineering and Technology Announces Additional Testing of TV White Space Devices, DA 07-4179, October 5, 2007.

[6] FCC Public Notice DA 08-118, “Office of Engineering and Technology Announces Plans for Conducting Measurements of Additional Prototype TV White Space Devices, ET Docket No. 04-186,” January 17, 2008.

[7] Microsoft submitted two units of the same device.

channels unused by TV broadcast or wireless microphone operations and, where the devices included transmission capability, their emission characteristics and potential for causing interference to those services. While other incumbent services operate in the TV bands, those services are not specifically being examined in this test program as the Commission has proposed other methods for protecting them from WSD operations.

1.1 Test Scope and Approach

The Phase II tests first examined the devices in the laboratory under various controlled test conditions. The WSDs' ability to sense DTV signals was evaluated in several ways: using a single DTV signal, with two DTV signals (one placed on an adjacent channel), and with recorded RF captures that exhibit various signal fading conditions. Similarly, for those devices capable of sensing wireless microphones, tests were performed with wireless microphones alone and with DTV signals present on adjacent channels. The wireless microphones were operated on various frequencies within a TV channel (both near the center of the channel and near the edges).

In preparation for the field tests, the performance of the devices in sensing off-the-air signals was recorded at various locations in the laboratory. Also, controlled tests of the Adaptrum transmitter were performed at the laboratory to estimate the distances at which it might cause interference to TV reception. Finally with input from various interested parties, nine sites were selected for field tests of the device's ability to sense TV signals, and two sites were chosen for field tests of their ability to sense wireless microphones. The field sites were selected to represent a variety of environments including urban, suburban, rural, residential and business locations. At two of the field test sites, anecdotal direct pick-up interference tests were performed to assess the impact of a WSD transmitter on cable TV reception. The following sections and the appendices provide a tabulation of the data collected during the tests.

2 White Space Prototype Devices

2.1 Adaptrum Prototype White Space Device

Adaptrum indicates that its “Cognitive Radio (CR) Platform” is an integrated hardware and software development system that has been specifically designed for TV white space operation on UHF television channels 21-51. The system is capable of various forms of TV signal sensing including waveform/signature sensing, spectral identification, signal power estimation, and network-level cooperative sensing. It detects both analog and digital TV signals, but performs those functions in two separate scans. It is not designed to detect wireless microphone signals. The system is also capable of signal transmission in the TV bands with flexible waveform, modulation, and signal bandwidth construction. It incorporates transmit power control and chain linearization to reduce adjacent channel interference. The maximum transmitter output power specification is 100 mW (+20 dBm) over the selected bandwidth. Figure 2-1 provides a photograph of the prototype device/platform.

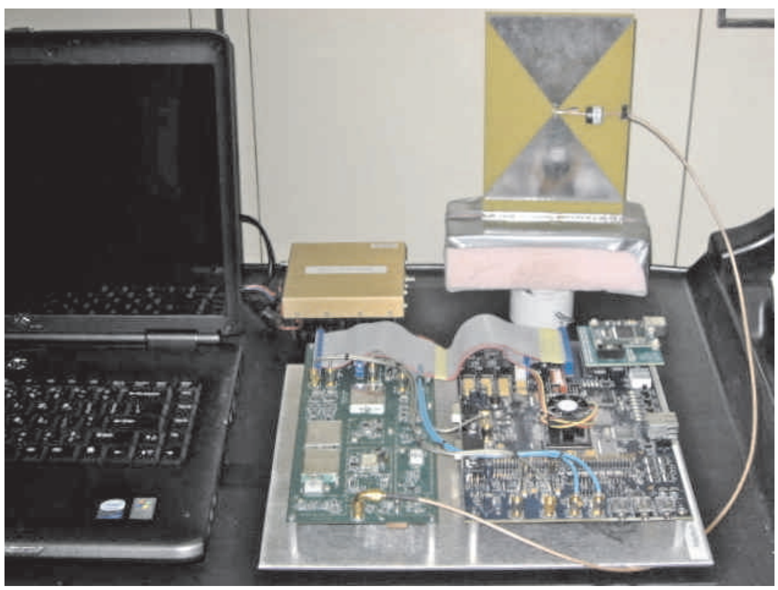

Figure 2-1. Adaptrum Prototype WSD.

The key components of the platform are: 1) a wide-band high dynamic-range radio frequency (RF) transceiver operating over the frequency range 400 MHz to 1000 MHz, 2) a field-programmable gate array (FPGA)-based hardware development board with integrated high-speed analog-to-digital converters (ADCs) and a high-density FPGA where CR baseband and protocol-layer functions are implemented, and 3) a Matlab-based integrated development environment (IDE) where the CR hardware functions are controlled using a Matlab graphical user interface (GUI) and Matlab scripts.

The scan time associated with this prototype device was initially 37 seconds per channel (sec/ch). However, a software modification installed to improve the detection sensitivity with respect to DTV signals with offset pilot carriers slowed the scan time by a factor of five to 185 sec/ch. Additional information can be obtained from the Adaptrum *ex-parte* filing in the subject rulemaking proceeding.[8]

2.2 Institute for Infocomm Research (I2R) Prototype White Space Device

The I2R prototype WSD operates on channels 21-51 and is capable of sensing analog and digital TV signals and wireless microphone signals. The device consists of: 1) a commercial TV tuner to receive television signals and translate them to their associated intermediate frequency (IF), 2) mixed-signal digital processing boards for performing ADC, downconversion and filtering, 3) a laptop computer used to configure the hardware, provide a GUI and generate reports, and 4) a fixed-length whip receive antenna.

The (I2R) device was also able to detect wireless microphones. It provided two scan modes – “DTV” and “All” and two test modes – “Lab” and “Field”. In the DTV scan mode it searched only for DTV signals and in the “All” mode it searched only for microphones. The “Lab” test mode was intended only for conducted bench testing and the “Field” mode was intended only for reception of radiated signals with an antenna. Figure 2-2 presents a photograph of the I2R prototype device/platform. Additional information can be obtained from the I2R *ex-parte* filing in the subject rulemaking proceeding.[9]

Figure 2-2. I2R Prototype WSD

[8] Adaptrum, Inc *ex-parte* filing of December 5, 2007.

[9] I2R *ex-parte* filing of June 23, 2008.

2.3 Microsoft Prototype White Space Device

The Microsoft WSD platform operates on channels 21-51 and is capable of sensing analog and digital TV signals and wireless microphone signals. The system consists of two core system subassemblies: 1) a wide-band spectrum scanner, a network processor and a tunable UHF half-duplex transceiver controlled by the network processor and 2) a Windows-based laptop computer that utilizes the Internet Explorer browser to establish a command and control user interface via an Ethernet connection. This device is also capable of transmitting on its operating channels.

The scanner/sensor function consists of a broadband (521-698 MHz) computer-controlled frequency scanner and high-speed digitizer used to incrementally scan over UHF TV channels 21-51 in 6-MHz segments. The accumulated digitized time-domain information is then passed to the network analyzer where a 2048-point Fast Fourier Transform (FFT) is performed. Signal feature templates for DTV, analog TV, and wireless microphone waveforms are sequentially compared to the resulting FFT output to determine those channels occupied by DTV or analog TV signals. Channels determined not to be occupied by DTV or analog TV signals are subsequently analyzed for potential narrowband incumbent signals such as wireless microphones. Those channels determined not to be occupied by either DTV, analog TV, or wireless microphone signals are declared to be available "white space" channels. User control and scanner results are provided via the laptop computer connection.

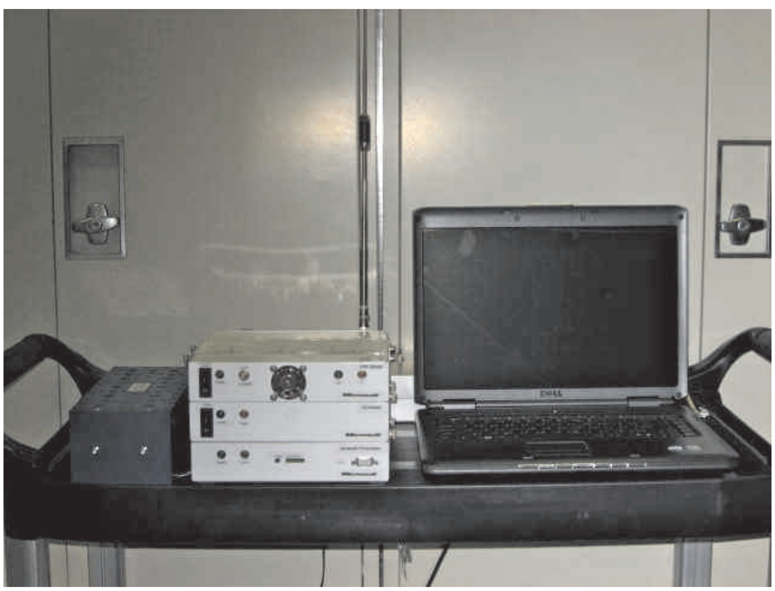

Figure 2-3. Microsoft Prototype WSD.

The UHF transmitter assembly consists of three sub-components: 1) an S-Band (2.4 GHz) 802.11g OFDM modem; 2) a Half-duplex S-Band to UHF block converter; and 3) and a network processor browser to exercise control over frequency and power. Two external fixed-frequency bandpass filters were provided for use in transmitter testing. A photograph of the Microsoft WSD platform is provided in Figure 2-3.

Additional information can be obtained from the Microsoft *ex parte* filings in the subject rulemaking proceeding.[10]

2.4 Motorola Prototype White Space Device

The Motorola WSD platform operates on channels 21-51 and includes capabilities for geo-location and sensing of digital TV signals. It does not sense analog television signals or wireless microphone signals. The system consists of a Cognitive Radio Rack and a laptop computer host connected via Ethernet. The rack consists of a UHF radio and two PRO-3500 carrier boards co-located in a compact Peripheral Component Interconnect (PCI) chassis. The cognitive engine runs on the lower board.

This WSD implements a geo-location-based approach as its primary method for the determination of occupied TV channels with a spectrum-sensing capability used to refine the results of the geo-location solution and to prioritize those channels found to be available. The geo-location capability as tested requires the user to manually input the geographic coordinates and relies on a downloaded version of the FCC's TV database for a particular geographic area.

This WSD exhibited the fastest scan execution time of 0.1 sec/ch. A photograph of the Motorola WSD is provided in Figure 2-4. More information can be obtained from Motorola *ex parte* filings in the subject rulemaking proceeding.[11]

Figure 2-4. Motorola Prototype WSD.

[10] Microsoft *ex-parte* filings of December 11, 2007 and January 15, 2008.

[11] Motorola *ex-parte* filings of November 16 and December 6, 2007.

2.5 Philips Prototype White Space Device

The Philips WSD platform operates on channels 21-51 and is capable of sensing analog and digital TV signals and wireless microphone signals consists of: 1) a commercial TV tuner for tuning to a specified television channel and translating to IF, 2) a digital signal processing board for ADC and processing and 3) a desktop computer used to configure the hardware, provide a GUI and store detection results.

Philips claims that the prototype WSD will scan UHF channels 21-51 and detect ATSC (DTV), NTSC (analog TV) or wireless microphones to a level of at least -114 dBm over a 6-MHz television channel. The channel scan time for this device varies between 8 and 50 sec/ch due to the sequential application of separate ATSC, NTSC and wireless microphone detection algorithms.

Figure 2-5 presents a photograph of the Philips WSD platform. Additional information can be obtained from Philips *ex-parte* filing in the subject rulemaking proceeding.[12]

Figure 2-5. Philips Prototype WSD.

[12] Philips ex-parte filing of December 10, 2007.

3 DTV Scanning/Spectrum Sensing Capability Tests

This section describes the laboratory measurements performed on each of the prototype WSDs submitted for testing. For the sensing measurements performed in the laboratory, a simulated or recorded signal was applied to the antenna input of the WSD prototype utilizing a coaxial cable connection (*i.e.*, conducted measurements). As such, the effects of the WSD receive antenna were ignored.

Ignoring the WSD receive antenna contribution is analogous to assuming an isotropic receive antenna (*i.e.,* a theoretical antenna having uniform gain and directivity). An isotropic receive antenna for ultra-high frequency (UHF) operation represents an ideal that cannot be physically realized. Rather, the receive antenna of WSDs will likely have low and variable (or negative gain) and thus the results reported herein would have to be adjusted accordingly to describe practical devices. These measurements also make no effort to quantify other potential contributors to television signal loss such as might be experienced from shielding/absorption effects introduced by proximate human bodies.

The general approach to these tests was to provide a DTV input signal at progressively lower amplitude levels until the prototype could no longer detect it with complete (100%) reliability.

It is recognized that some of the WSD detection algorithms interpret detection reliability as low as 50% as indicative of an occupied channel, but the design intentions of the algorithms in other devices were not readily apparent.

3.1 Clean DTV Signal Measurements

The objective of the clean DTV signal measurements was to determine the detection sensitivity of the scanning/sensing capability of the WSD prototype devices submitted for evaluation with respect to a "clean" (undistorted) DTV signal.

For these measurements the input was a single, simulated DTV signal produced by a Rhode and Schwarz DTV Test Broadcast System (SFU). The generated DTV signal was provided to the antenna input of the WSD prototype under test via a coaxial cable. An external variable attenuator bank was used to adjust the signal power. Block diagrams showing the measurement equipment and related interconnections in addition to detailed equipment information are provided in Appendix A. The detailed procedure used to perform these measurements follows:

- The SFU was used to produce a single, clean DTV signal that was provided via coaxial cable through a variable attenuator and into the RF input of a spectrum analyzer.

- With the variable attenuator set to zero, the SFU power control was adjusted to produce an average power level of -60 dBm/6 MHz, referenced to the input connection of the spectrum analyzer. This level provides a displayed signal-tonoise ratio (S/N) of at least 20 dB. The signal power was measured using a root-mean-square (rms) detector and averaged over 100 sweeps.

- The cable from the SFU was then removed from the analyzer input and connected to the antenna input of the WSD prototype.

- The SFU-generated DTV signal was further attenuated using the external variable attenuator bank from the -60 dBm level to a level slightly higher than the expected detection threshold (*e.g.*, the variable attenuator was typically set to provide an additional 54 dB attenuation so as to produce an initial input signal level of -114 dBm)

- Thirty (30) independent detection trials were performed with the WSD tuned to channel 21 (lowest channel in tuning range). The number of successful detections of an occupied channel was recorded.

- If the successful detection rate over the thirty trials was 100%, the input signal power was reduced by increasing the variable attenuator by 1 dB and the procedure repeated.

- If the successful detection rate over the thirty trials was less than 100%, then the input signal power was increased by decreasing the variable attenuator by 1 dB and the procedure repeated.

- This iterative process was repeated until the DTV power level was found where the WSD prototype could no longer detect the occupying signal in the channel with 100% reliability.

- Additional data points were then collected above and below this breakpoint.

- The process was repeated in its entirety on two additional test channels, 36 and 51, representing the middle and upper channels within the tuning range, respectively.[13]

The figures that follow represent the results obtained from the clean signal DTV sensing measurements for each of the WSD prototype devices. Two separate plots are provided for the I2R device, representing results obtained in the two available modes of operation ("laboratory" test mode and the "field" test mode). The field test mode utilizes separate circuitry to suppress spurious reception.

[13] The Adaptrum device was found to be particularly prone to false detections on channel 36, likely because of the presence of an OTA signal on the channel. Thus, channel 37 was used as the middle test channel for this device.

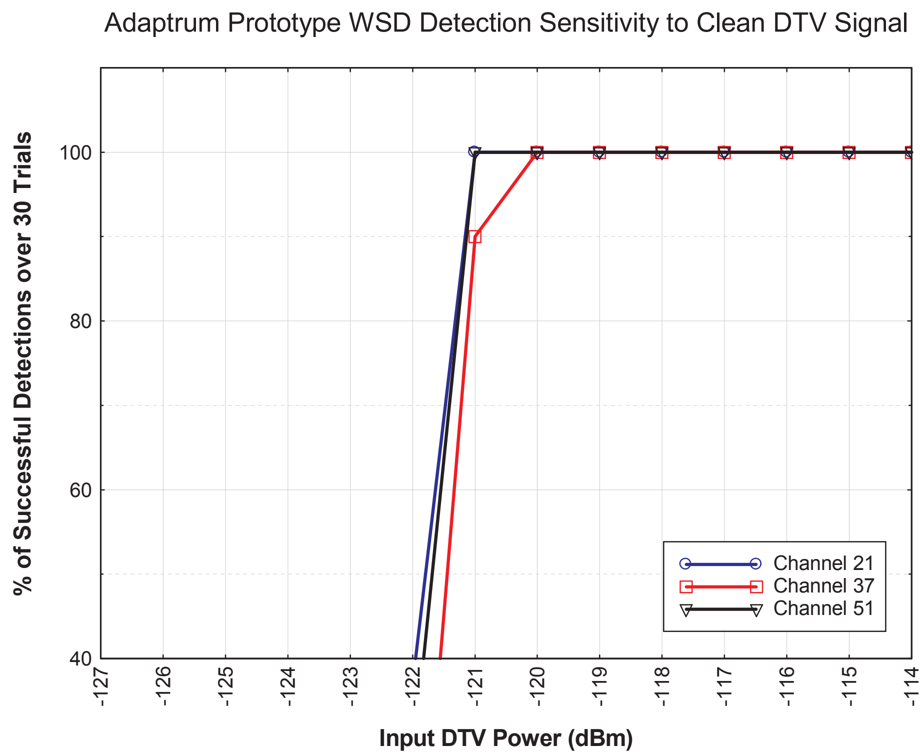

Figure 3-6. Clean Signal Sensitivity Results for Adaptrum WSD Prototype.

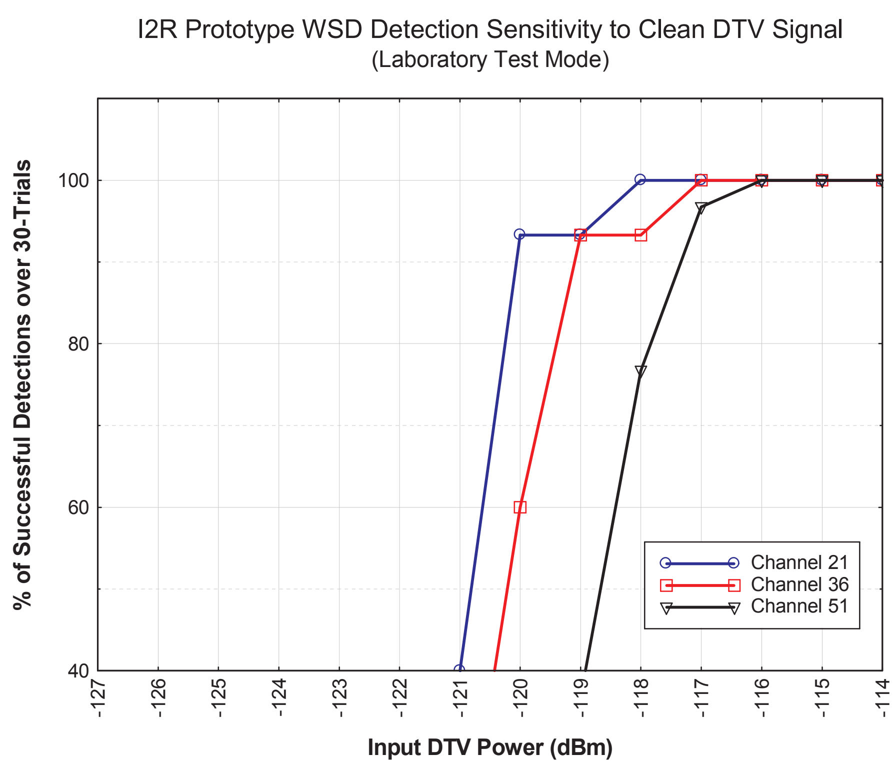

Figure 3-7. Clean Signal Sensitivity Results for I2R WSD Prototype in Laboratory Test Mode.

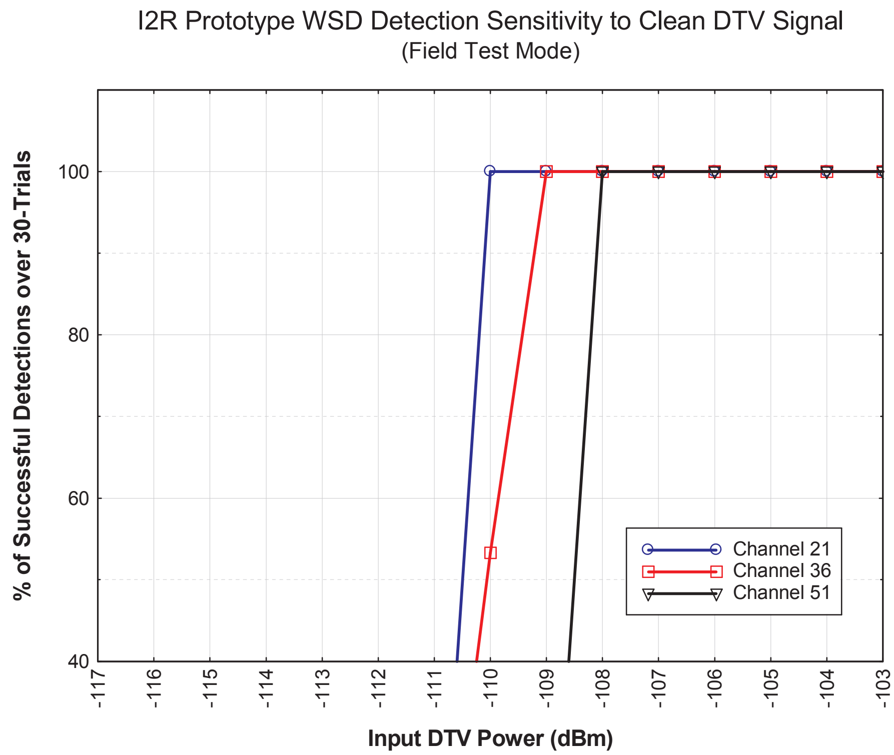

Figure 3-8. Clean Signal Sensitivity Results for I2R WSD Prototype in Field Test Mode.

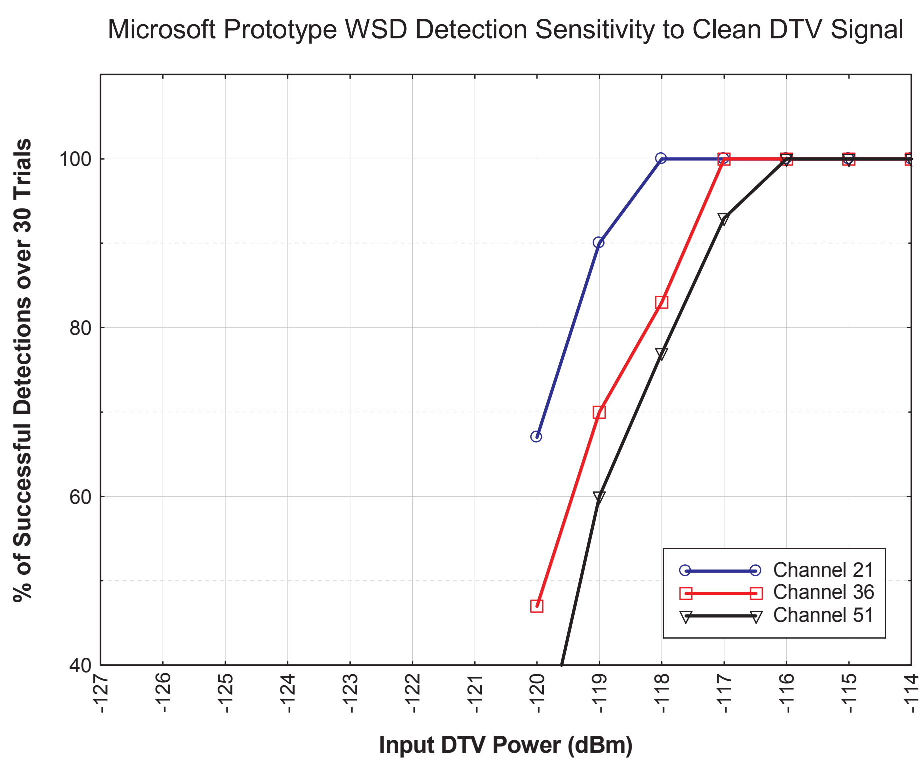

Figure 3-9. Clean Signal Sensitivity Results for Microsoft WSD Prototype.

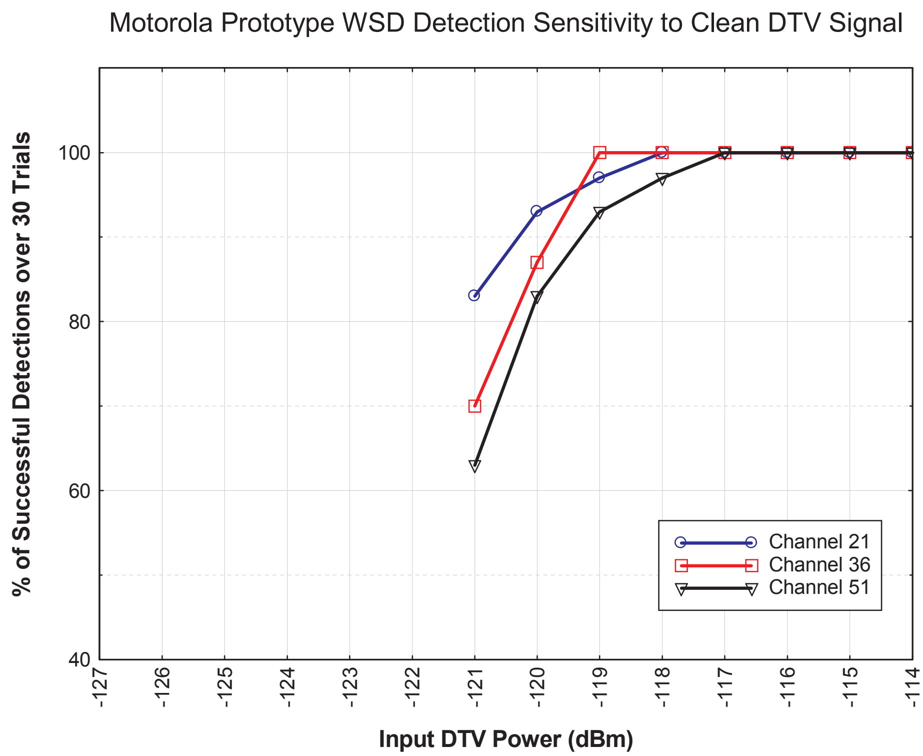

Figure 3-10. Clean Signal Sensitivity Results for Motorola WSD Prototype in Test Mode.

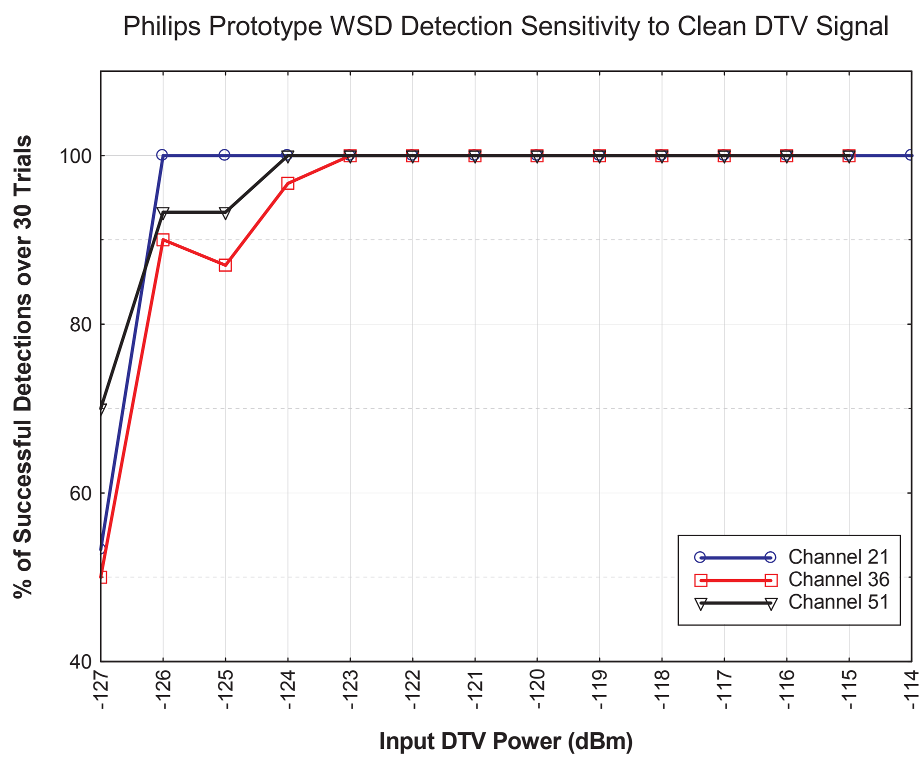

Figure 3-11. Clean Signal Sensitivity Results for Philips WSD Prototype.

3.2 Recorded (Captured) DTV Signal Measurements

The objective of the recorded DTV signal measurements was to determine the detection sensitivity of the scanning/sensing capability of the WSD prototype devices with respect to recorded over-the-air DTV signals that incorporate "real world" signal distortions resulting from reflections, multi-path fading, and other factors.

The signal input for these measurements consisted of a set of twelve recorded DTV waveforms ("captures") selected by the IEEE 802.22 subcommittee.[14] Detailed information, including frequency domain and temporal representations of each of these twelve waveforms, is provided in Appendix B of this report.

A Wavetech Services WS-2100 RF player® was used to play back the captures on the desired RF channel and to provide them to the antenna input of each of the WSD prototypes via coaxial cable. Two external variable attenuator banks were utilized to adjust the power level of the input signal. A 75-50 Ω transformer was utilized at the Wavetech player output to match system impedance.

Although different algorithms are utilized among the prototype devices to detect the presence of a DTV signal, they all appear to share a similarity in that they all sample the spectrum in proximity of an anticipated DTV pilot signal. However, the amount of time dedicated to sampling and signal processing differs significantly among the prototype devices. Since there are significant instantaneous temporal variations in many of the RF captures over their 25-second playback period (see Appendix B), the resulting detection decisions can also vary depending on when the sampling actually occurs. Efforts were made to minimize this variable (*e.g.*, the waveform playback was restarted for each independent trial); however its effect is evident in the results obtained from some of the prototype devices. Another method for reducing this variability is to increase the number of trials beyond the stated number of thirty. For some of the devices, the additional time required to execute more than thirty trials was excessive and was thus deemed impractical. However, for others (*e.g.*, the Motorola WSD), it was practical to perform additional trials. Therefore, for this device, in addition to performing the measurement over thirty independent trials, a second measurement was also performed utilizing one thousand independent trials. The results of both measurements are provided herein.

After the laboratory measurements were completed but before the field trials commenced, the prototype manufacturers were offered an opportunity to make minor adjustments to their devices based on the laboratory results. For example, one issue observed by the manufacturer of the Adaptrum prototype was difficulty in detecting a DTV signal having a frequency offset pilot tone. As a result, Adaptrum utilized this opportunity to improve this with a software modification.[15] A second set of data is presented for the Adaptrum device showing the effect of this modification.

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[14] See *ex parte* submission from Qualcomm, dated August 24, 2007.

[15] See *ex parte* filing from Adaptrum, dated June 2, 2008.

Block diagrams showing the measurement equipment and related interconnections in addition to detailed equipment information are provided in Appendix A. The measurement procedure was as follows:

- A Wavetech Services WS-2100 RF player® was used to play back each of twelve recorded DTV signals and provide the RF output via coaxial cable through an external variable attenuator bank and into the RF input of a spectrum analyzer.

- With the external variable attenuators set to zero, the average output signal power in the channel bandwidth was measured using the spectrum analyzer (over 100-sweeps utilizing an rms detector).

- The coaxial cable was then removed from the RF input of the analyzer and connected to the receive antenna input of the prototype device.

- The signal was further attenuated using the variable attenuator bank to achieve a power level near the threshold level recorded in Section 3.1.

- Thirty (30) independent trials were performed and the number of successful detections recorded.[16] Since the data from the Section 3.1 indicated relative consistency over the three channels examined, these tests were performed only on a single channel (typically channel 36, mid-channel in the WSD tuning range).[17]

- If the successful detection rate over the thirty scans was 100%, then the input signal power was reduced by increasing the attenuation by 1 dB and the procedure repeated.

- If the successful detection rate over the thirty scans was less than 100%, then the input signal power was increased by reducing the attenuation by 1 dB and the procedure repeated.

- The process was repeated until the DTV power level was found where the WSD prototype could no longer detect the signal in the channel with 100% reliability.

- Additional data points were then collected above and below this breakpoint.

The results of these measurements are provided in the figures that follow.

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[16] For some devices, an additional measurement was performed utilizing more than 30 trials (see discussion in previous text).

[17] The Adaptrum device was found to be particularly prone to false detections on channel 36, likely because of the presence of an OTA signal on the channel. Thus, channel 37 was used as the middle test channel for this device.

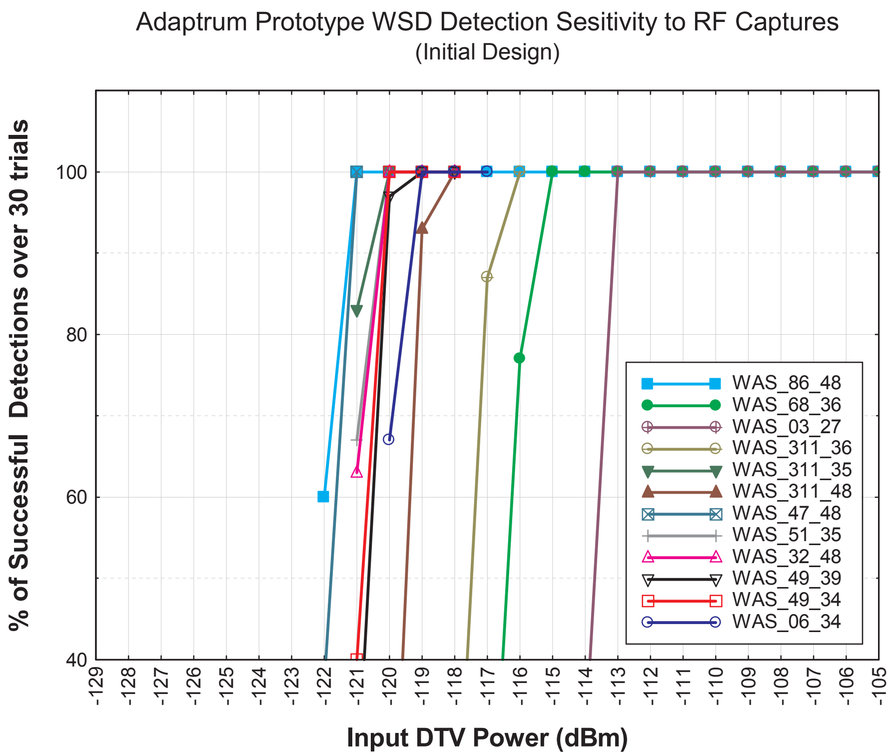

Figure 3-12. DTV Capture Results for Adaptrum WSD Prototype (initial configuration with limited freqency offset pilot capability).

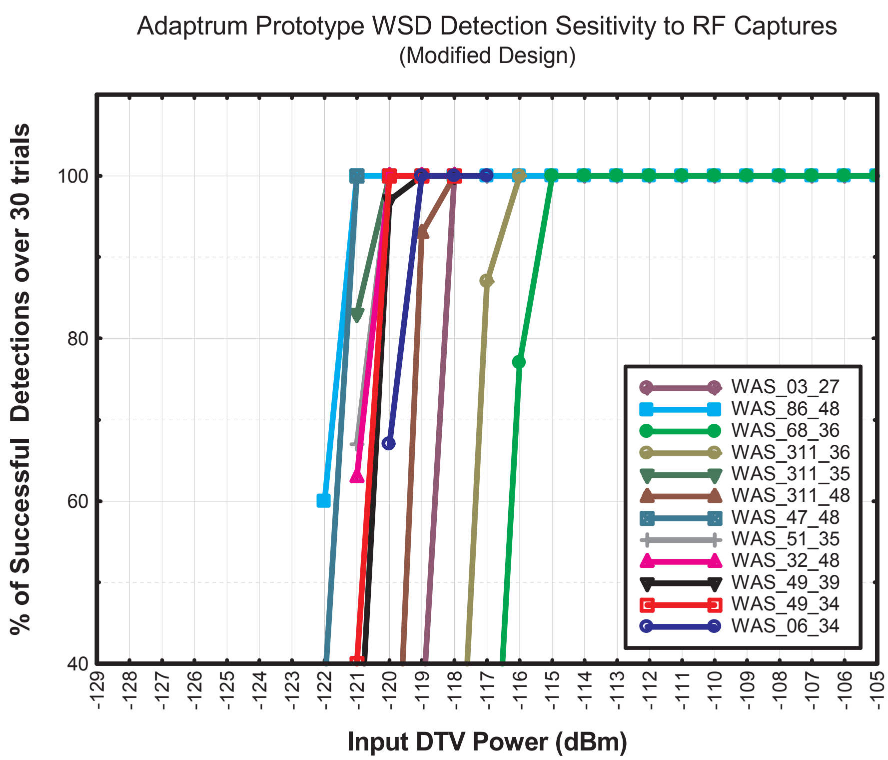

Figure 3-13. DTV Capture Results for Adaptrum WSD Prototype (modified configuration with improved frequency offset pilot capability).

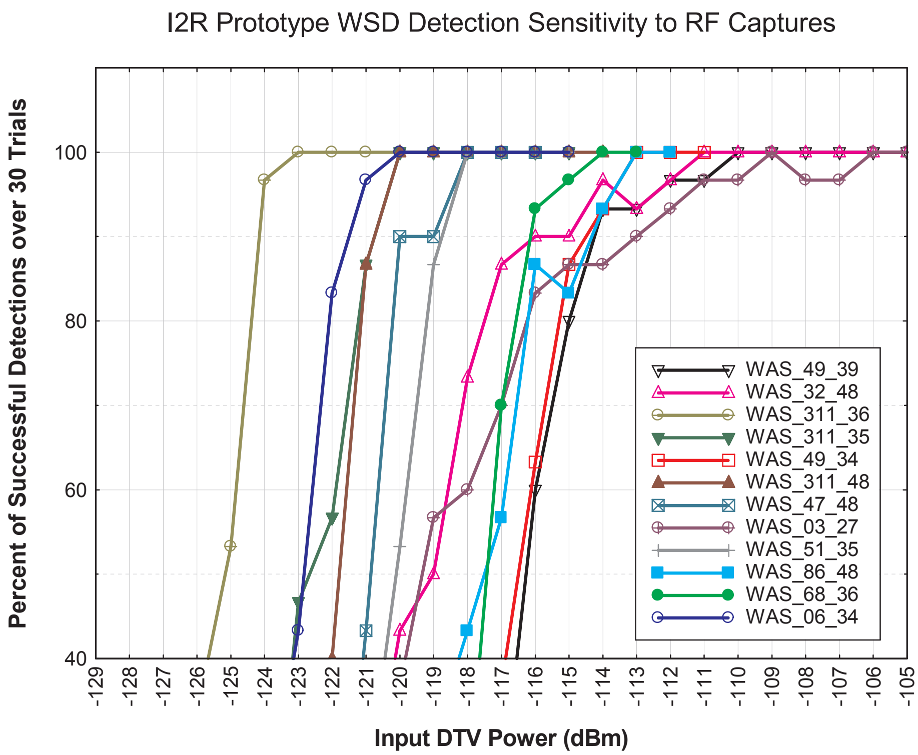

Figure 3-14. DTV Capture Results for I2R WSD Prototype (Laboratory Mode).

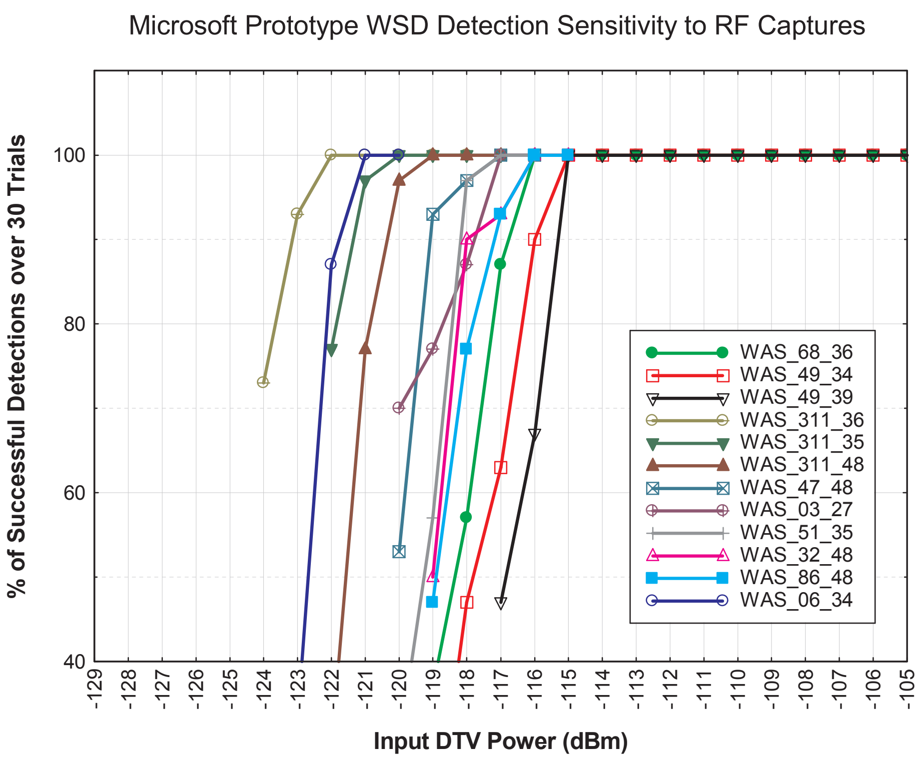

Figure 3-15. DTV Capture Results for Microsoft WSD Prototype.

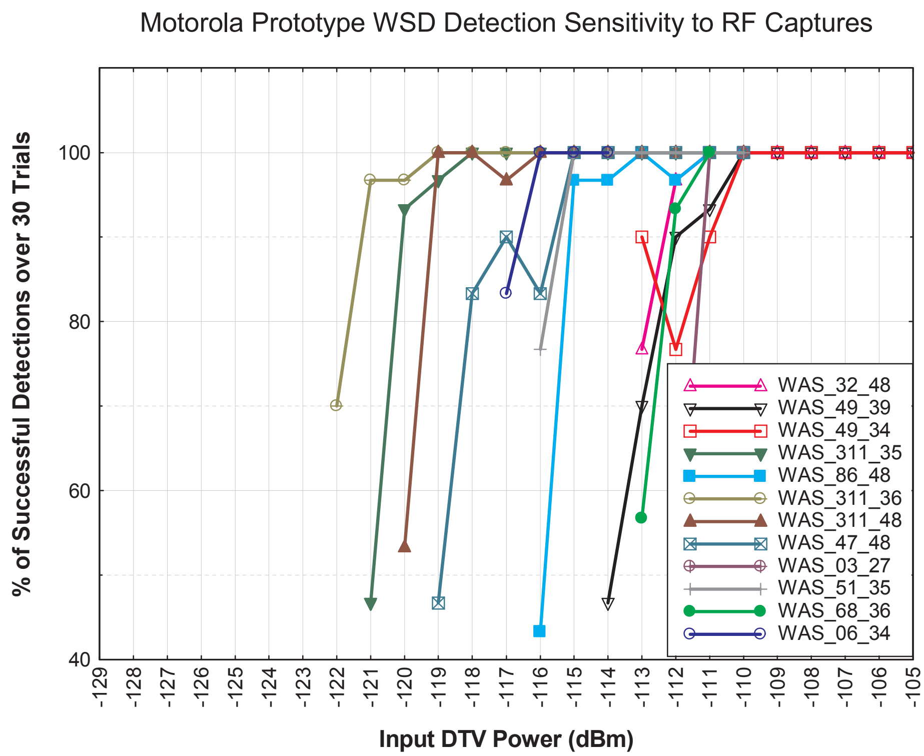

Figure 3-16. DTV Capture Results for Motorola WSD Prototype (30-trials).

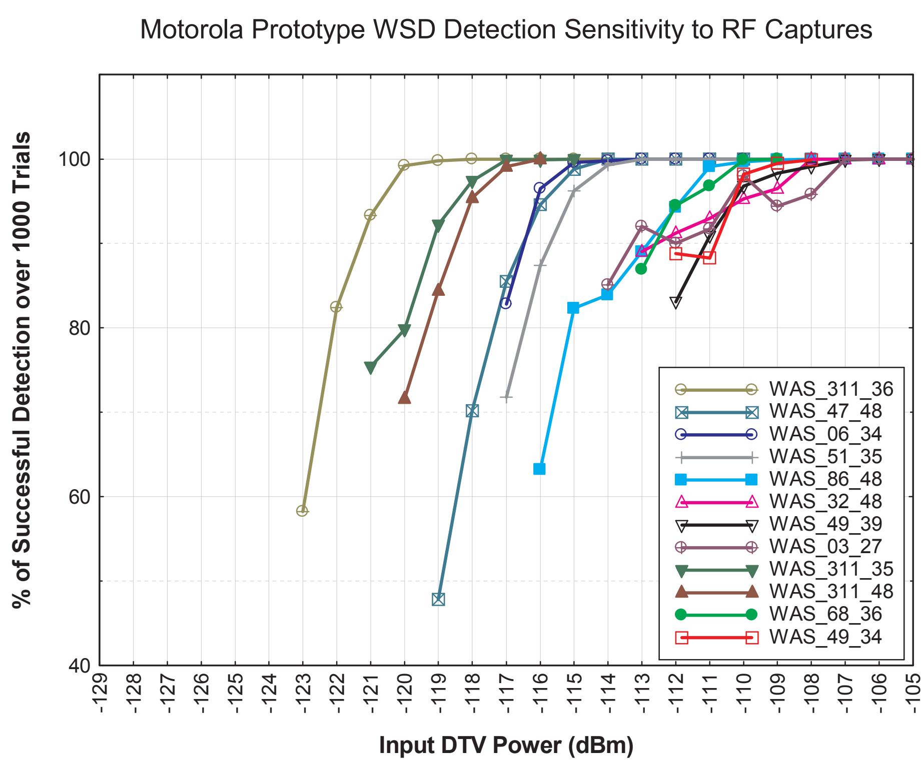

Figure 3-17. DTV Capture Results for Motorola WSD Prototype (1000 Trials).

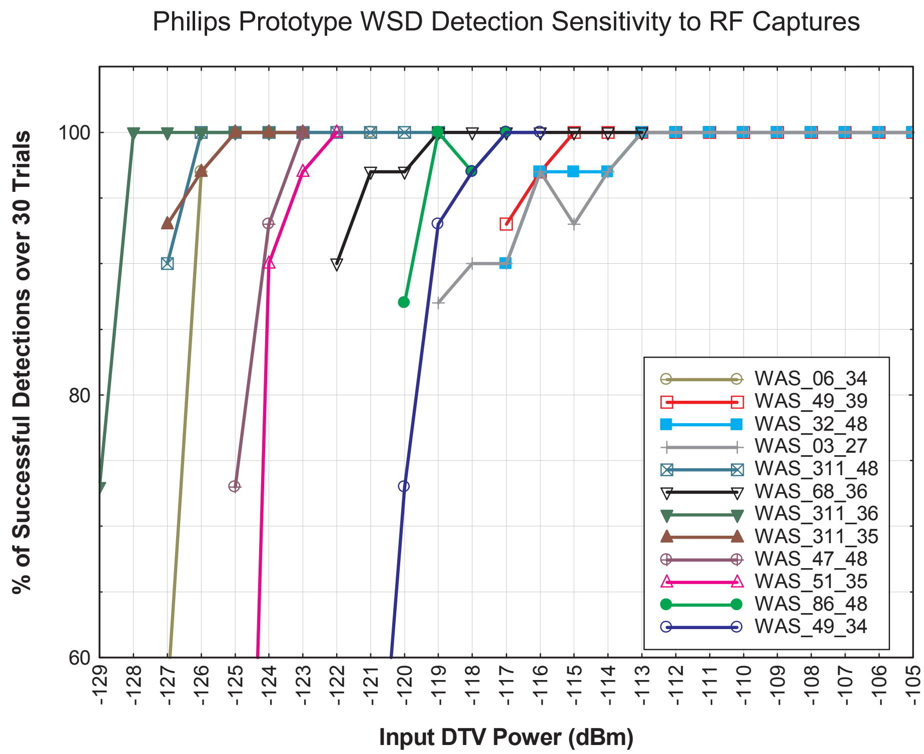

Figure 3-18. DTV Capture Results for Philips WSD Prototype.

3.3 Two-Signal (Adjacent Channel Interference) Measurements

The objective of the two-signal adjacent-channel interference measurements was to assess the potential for degradation to the DTV signal detection capability when another DTV signal is present on an adjacent channel. Because of equipment limitations, these measurements were limited to assessing the effect of one adjacent channel at a time (*i.e.*, two-signals, one on the detection channel and one on an adjacent channel). The effects of DTV signals on both first- and second-adjacent channels were tested.

Detection threshold measurements were made in a manner similar to that described in Section 3.1, but included one additional DTV signal placed sequentially on the first (N±1) and then second (N±2) adjacent channels relative to the detection channel. Detection threshold measurements were performed with the adjacent-channel signal power set to the -28 dBm (high), -53 dBm (moderate) and -68 dBm (low) levels. It should be noted that DTV signal levels in "real world" environments can exceed -28 dBm and actual examples of this were observed in the field test component of this effort (see Section 5.2).

For these measurements, the R&S SFU was used to generate the adjacent-channel DTV signal. The Wavetech player was used to play back a "clean" DTV signal (Zone Plate test signal) in the detection channel. The power level of the adjacent channel DTV signal was set using the SFU's internal power controls and verified with a spectrum analyzer. The power level of the detection-channel signal was set utilizing a bank of external variable attenuators and verified with a spectrum analyzer.

The SFU provides a good representation of a DTV signal within the 6 MHz TV channel passband but it does not precisely match the out-of-band characteristics of operating DTV stations (*i.e.,* the "DTV Mask" for full service stations). Therefore, in order to preclude the possibility of excessive signal leakage ("splatter") from the adjacent channel into the detection channel, the DTV signal was filtered through a 7-pole RF bandpass filter in order to more accurately simulate the out-of-band characteristics of a "real world" DTV broadcast signal.

The filter employed was a Micro Communications, Inc. fixed-tuned Interdigital Bandpass (IDBP) filter.[18] Passing the SFU-generated DTV waveform through this filter provides out-of-band characteristics that adhere to the DTV emissions mask (see Appendix A).[19] However, since the filter is fixed-tuned to channel 29, the adjacent-channel signal had to be maintained on channel 29 while the detection channel was varied to represent the N±1 and N±2 relationships with respect to the detection channel. For example, in order to examine the effect of an N+1 adjacent channel interaction, the SFU DTV signal (representing the adjacent-channel signal) was generated on channel 29 and the Wavetech DTV signal (representing the detection-channel signal) was generated on channel 28. Likewise, the N-1 adjacent channel scenario was simulated by transmitting the detection signal on channel 30 and the N+2 and N-2 scenarios were simulated by transmitting the detection signals on channels 27 and 31, respectively, while the adjacent-channel DTV signal remained on channel 29.

During the course of these measurements, the Microsoft prototype sample device began to malfunction and eventually ceased to operate, necessitating the abandonment of further measurements utilizing this device.

As mentioned above, before the field trials were initiated, the prototype manufacturers were offered an opportunity to make minor adjustments to modify their devices based on the bench-test results. One issue observed by the manufacturer of the Motorola prototype was degradation to the detection capability in the presence of an adjacent-channel DTV signal (particularly one at moderate and higher power levels). Motorola utilized this opportunity to add an automatic gain control (AGC) circuit to the device.[20] This necessitated that a second set of laboratory data be collected from this prototype to demonstrate and verify the effect of the modification.

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[18] Filter specifications available at: http://www.mcibroadcast.com/files/42100%20Interdigital%20Band%20Pass%20Filters.pdf.

[19] IEEE P1631™/D2, *Draft Recommended Practice for Measurement of 8-VSB Digital Television Mask Compliance for the USA*, RF Standards Committee G-2.2 of the IEEE Broadcast Technology Society, 2007.

[20] See *ex parte* filing of Motorola, dated May 15, 2008.

Block diagrams showing the measurement equipment and related interconnections in addition to detailed equipment information are provided in Appendix A.

The measurement procedure was as follows:

- The SFU was used to generate a DTV waveform on channel 29 that was delivered via coaxial cable through a fixed-tuned bandpass filter to provide the adjacent-channel signal. The Wavetech player was used to playback another DTV waveform on the pertinent detection channel. The detection-channel signal was provided via coaxial cable through a bank of external variable attenuators and combined with the adjacent channel signal. The combined signals were split with one output connected with coaxial cable to the antenna input of the WSD prototype device and the other output connected with identical coaxial to a spectrum analyzer. A block diagram of this set-up is provided in Appendix A.

- The SFU-generated adjacent-channel signal was set to produce a signal with amplitude of -28 dBm at the spectrum analyzer input. For subsequent measurements, this same procedure was used to set the adjacent-channel signal power to -53 dBm (representing a moderate level) and -68 dBm (representing a low level), respectively.

- The Wavetech RF player was set-up to provide the detection signal on channel 28, simulating an N+1 adjacent-channel scenario (*i.e.,* channel 28 detection channel with a second DTV signal in the upper adjacent channel 29). In subsequent measurements, the output channel of the Wavetech player was set to channel 30 (N-1), channel 27 (N+2), and channel 31 (N-2) to represent the remaining three adjacent-channel scenarios under examination.

- With the external variable attenuator set to zero, the power in the detection channel was measured with the spectrum analyzer. Using this measurement as a baseline, the variable attenuator banks were adjusted to reduce the signal power in the detection channel to a level near the previously observed detection threshold.

- Thirty (30) independent trials of the WSD detector were performed in the detection channel and the number of successful detections was recorded.

- If the successful detection rate over the thirty independent trials was 100%, then the input signal power was reduced (by increasing the signal attenuation) and the procedure repeated.

- If the successful detection rate over the thirty trials was less than 100%, then the input signal power was increased (by decreasing the signal attenuation) and the procedure repeated.

- The process was repeated until the DTV power level was found where the WSD prototype could no longer detect the signal with 100% reliability.

- Additional data points were collected at levels above and below this breakpoint.

The data resulting from these measurements are presented below in Table 3-1. Only the final signal level where 100% correct detection was observed is reported in this table.

Table 3-1. Adjacent Channel Test Results

Prototype WSD	Detection Thresholds in the Presence of DTV-Occupied Adjacent Channels (dBm)											
	N+1			N-1			N+2			N-2		
	H	M	L	H	M	L	H	M	L	H	M	L
Adaptrum	**A**	-108	-120	-100	**A**	**A**	-108	-120	-120	-105	-119	-120
I2R	-97	-117	-119	**A**	**A**	-117	-118	-118	-118	-118	-118	-117
Microsoft	-67	-110	**A**	**B**	**B**	**B**	-76	-118	-120	**B**	**B**	**B**
Motorola	-52	-97	-114	-47	-68	-109	-79	-115	-114	-76	-115	-114
Motorola (w/modification)	-102	-111	-110	-73	-98	-110	-96	-112	-112	-96	-112	-112
Philips	**A**	**A**	-122	**A**	**A**	-122	**A**	-122	-124	**A**	**A**	-123

Notes:
H = High adjacent signal level (-28 dBm);
M = Moderate adjacent signal level (-53 dBm);
L = Low adjacent signal level (-68 dBm).
A = Insufficient receiver selectivity and/or receiver desensitization prevented collection of meaningful data.
B = Device malfunction prevented collection of data.

3.4 Transmitter Measurements

3.4.1 Conducted Measurement

The objective of the conducted transmitter measurements was to examine the emitted spectral characteristics of those WSD prototype devices having a transmit function. Two of the originally-provided WSD prototypes include active transmitters, the Adaptrum and Microsoft devices. Prior to these measurements, the Microsoft device malfunctioned. However, the spectral characteristics associated with the Microsoft WSD transmitter are expected to be unchanged from those measured and reported in the Phase I measurements.[21]

The Adaptrum WSD was used with an external wide-band amplifier to boost the power applied to the transmit antenna. The emission spectrum was measured by connecting the transmitter/amplifier output through a 30 dB attenuator to a spectrum analyzer. Figure 3-13 presents the resulting spectral plot.

[21] Phase I measurement report.

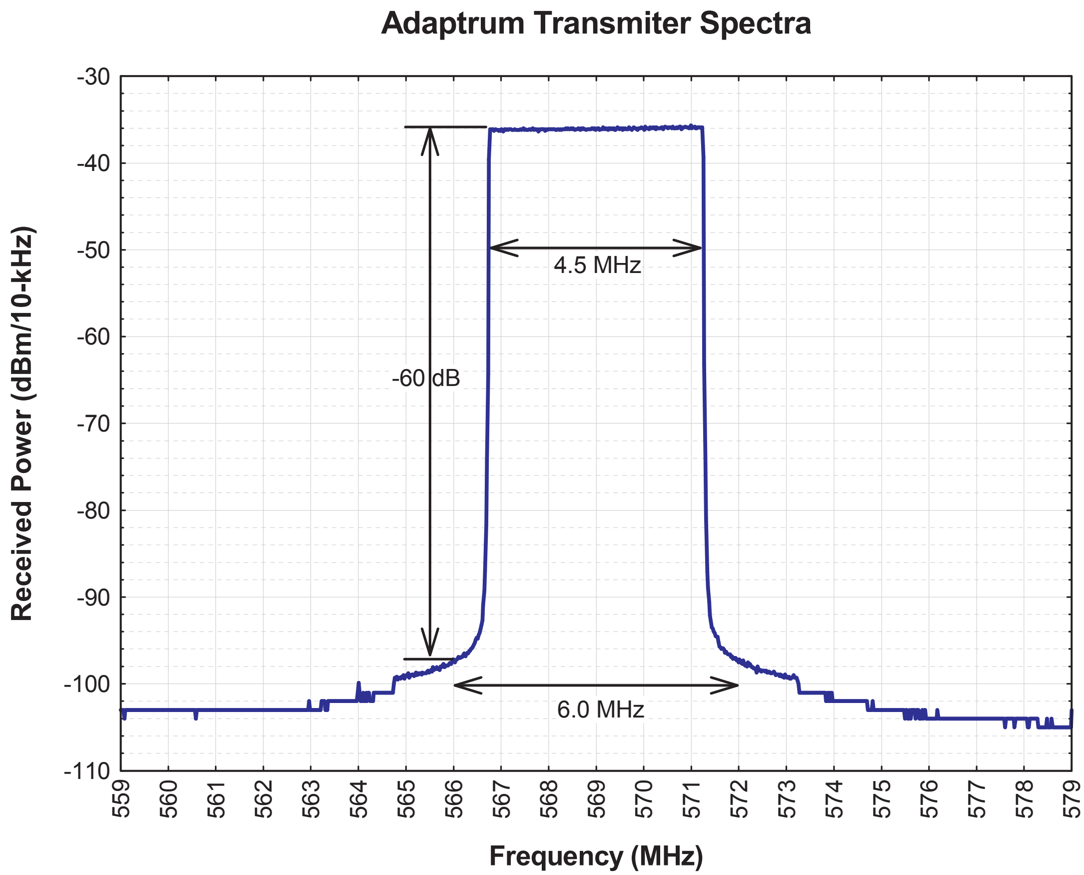

Figure 3-19. Adaptrum Transmitter Emission Spectrum.

The following information can be determined from this data:

- The bandwidth of the transmitted signal is approximately 4.5 MHz.

- The out-of-band (channel) emission (OOBE) suppression is slightly more than 86.5 dB (60 dB + 10 log(4.5 MHz/10 kHz)) relative to the total power in the carrier.

- The output power is shown as -36 dBm as measured in a 10-kHz resolution bandwidth. This converts to a level of -9.5 dBm (-36 + 10log (4.5 MHz/10 kHz)) in the 4.5 MHz emission bandwidth. A 30-dB external attenuator was utilized to protect the spectrum analyzer from overload and the coaxial cable loss was measured at 1.2 dB. Therefore, the final conducted output power from the WSD is (-9.5 + 30 + 1.2) = 21.7 dBm or approximately 150 milliwatts.

3.4.2 Radiated Measurement

Measurements were made to derive the equivalent isotropically radiated power (EIRP) based on measurements of the radiated power of the transmitter in the Adaptrum WSD prototype. In order to determine the EIRP of this device's transmitter, a set of radiated measurements were performed utilizing the laboratory's semi-anechoic chamber. For these measurements, the WSD was placed atop a wooden test bench that is mounted on a turntable and activated in the transmit mode of operation. A calibrated laboratory-grade receive antenna was affixed to a variable-height mast at a separation distance of 3-meters relative to the transmit antenna. The WSD transmit antenna and the calibrated receive antenna were varied in relative orientation (*e.g.*, with respect to polarization, height and angular position) until a maximum signal level was obtained on a spectrum analyzer. This measurement process was repeated on three distinct frequencies representing the lower, middle and upper tuning range of the transmitter. The maximum received signal level was recorded at each frequency.

The maximum EIRP of the transmitter can be determined from the measured maximum received power by applying the following equation:

$$EIRP = P_R - G_R + L_C + L_P \qquad (1)$$

where;

P_R = received power measured with the spectrum analyzer, in dBm,
G_R = receive antenna gain, in dBi,
L_C = signal attenuation in coaxial connecting cable, in dB,
L_P = free space propagation path loss, in dB.

The receive antenna gain was determined from manufacturer-provided calibration data, the signal attenuation in the connecting coaxial cable was measured and the free-space propagation path loss[22] was calculated for each measurement frequency. The parameters used in Equation (1) along with the results are provided in Table 3-2 below.

[22] RF absorbing material was placed over the conductive floor of the chamber so that contributions from reflected waves could be ignored.

Table 3-2. EIRP Measurement Results.

Frequency (MHz)	P_R (dBm)	G_R (dBi)	L_C (dB)	L_P (dB)	EIRP (dBm)
515	-10.9	5.8	2.9	36.2	22.4
605	-12.6	6.3	3.1	37.7	21.9
695	-16.2	4.8	3.3	38.9	21.2

3.5 Miscellaneous Laboratory Measurements

This section describes some miscellaneous measurements performed on the WSDs that were not a part of the original test plan. These measurements were typically undertaken to help explain unusual and/or unexpected observations.

In preparation for the field trials, the detection capabilities of the prototype devices were first exercised in the over-the-air environment at the laboratory facility (sensing the real world environment, not laboratory test signals). Several of the devices indicated that all (or most) channels were occupied even though it was known that unoccupied (available) channels existed at the laboratory.

These miscellaneous measurements represent an attempt to investigate working hypotheses regarding these unanticipated observations. Since these measurements were solely exploratory, they were not necessarily performed consistently over the set of all prototype devices. In fact, because of the late submission of the I2R device, none of these measurements were performed with it. In other cases, only a partial suite was performed, particularly if preliminary results did not raise concerns.

The first of these measurements consisted of exercising the detection capability of the WSD device using its associated antenna at locations within the laboratory (indoors), in the laboratory's parking lot (outdoors), and inside of the laboratory's semi-anechoic chamber. When some of the devices indicated significant channel occupancy inside the anechoic chamber (where all environmental UHF signals are significantly attenuated), a set of measurements were performed to examine possible explanations. Radiated measurements were performed to determine the spurious energy emitted by the prototypes under the assumption that at sufficient intensity they may trigger false detections. No effort was made to isolate the source of the spurious emissions among the individual system components.

The results of these measurements are presented in Appendix H. The tables provided in Section H.1 provide the results obtained from exercising the WSD sensing/detection capability within the laboratory. Section H.2 presents spectral plots representing the data collected from the radiated spurious emissions measurements. These tables and plots show that many of the prototype platforms generate emissions internally at levels that create a potential for degrading a device's detection capability (in the form of high missed detection and/or false alarm rates).

3.6 Summary of Laboratory Measurement Results

The following table summarizes the results obtained from the laboratory measurements performed with each of the WSD prototype devices.

Table 3-3. Summary of Bench Test Results.

WSD Prototype	Clean Signal Threshold Range (dBm/6-MHz)	Capture Signal Threshold Range (dBm-6-MHz)	Clean Signal Threshold Range with Adjacent Channel Signal Present (dBm/6-MHz)
Adaptrum	-120 to -121	-113 to -121	-100 to -120
I2R	-116 to -118 (lab mode) -108 to -100 (field mode)	-106 to -123	-97 to -119
Microsoft	-116 to -118	-115 to -122	-67 to -120
Motorola	-120 to -121	-107 to -119	-47 to -115 -73 to -112 (w/mod)
Philips	-123 to -126	-113 to -128	Unknown to -123
Note: Thresholds are referenced to device antenna input (receive antenna characteristics ignored).			

The clean signal results indicate that the measured detection threshold ranges between -116 and -126 dBm (ignoring the I2R results in field test mode) over the complete set of prototype devices. The results also indicate that the detection threshold is relatively consistent over the tuning range of the device.

The measured detection thresholds with respect to the twelve DTV waveform captures range between -106 and -128 dBm over the total set of prototype devices. Variability observed in the results of the waveform capture tests when compared with the results of the clean waveform tests is explained partly by temporal amplitude variations in the recorded waveform.

The adjacent-channel sensitivity measurements indicate that moderate-to-strong DTV signals occupying channels adjacent to the detection channel can significantly degrade detection capability, thereby affecting the ability of a device to reliably detect DTV signals.

Transmitter measurements on the one WSD with transmit capability demonstrated a clean output spectra with good out-of-band emission (OOBE) suppression. The maximum EIRP of the device was determined to nominally be +22 dBm (~150 mW) over the tuning range and the OOBE suppression was found to be at least -86.5 dB.

The miscellaneous measurements showed that many of the prototype platforms generate emissions internally, at levels that create a potential for degrading the devices' detection capabilities (in the form of high missed detection and/or false alarm rates).

4 WSD Transmitter Interference Tests and Demonstrations

This section describes transmitter interference tests performed as a part of the Phase II measurement effort. These tests are considered anecdotal for a number of reasons. For example, the use of over-the-air signals implies that little control could be exercised upon significant test variables. In addition, since the tests were performed at a limited number of locations and at particular times of day, variations in signal level occurred which could not be characterized. Also, since the Adaptrum WSD prototype was the only available working device with a transmitter, the interference effects to DTV reception were examined for only the waveform of this particular device, which may or may not be representative of a final TV white space product.

These tests all utilized the Adaptrum WSD transmitter to radiate an undesired signal while the potential victim receive system was monitored visually for interference. Attempts were made to operate the victim receiver in a minimum desired signal condition to represent a worst-case interference scenario.

Section 4.1 describes a test performed to assess potential adjacent-channel and co-channel interference interactions when a proximate DTV receive system is tuned to a station near the recognized threshold of visibility (TOV) of -84 dBm. This test was performed within the FCC laboratory facility.

Section 4.2 describes tests performed at two of the residential field trial sites to assess the potential for interference to the reception of cable television programming via the direct pick-up of an undesired WSD-transmitted signal either by the coaxial cable/connections, the television tuner and/or a set-top converter box. In these tests, the precise interference entry point was not identified.

4.1 Channel Interference Potential to DTV

The objective of this test was to examine interference distances between the prototype WSD transmitter and a typical consumer-installed DTV receiving system, with WSD transmissions either on the same or on an adjacent channel relative to a weak-signal DTV signal. The co-channel scenario is one that should be avoided by the WSD channel detection scheme, but is investigated as a part of this effort in order to provide an estimate of the interference distance in the case where the detection scheme fails to identify a weak-signal occupied channel.

4.1.1 Undesired Signal (U) Transmission System

The undesired signal was produced by the Adaptrum transmitter coupled with an external 21 dB gain wideband amplifier. The WSD is capable of transmitting an OFDM signal with a signal bandwidth adjustable from 0.5 to 18 MHz. A vertically-polarized planar bi-conical transmit antenna at a height of 2 meters (6.6 feet) above ground level (AGL) was used to radiate the signal generated by the transmitter. The EIRP of the WSD prototype transmitter was measured in the semi-anechoic chamber and determined to nominally be +22 dBm (~150 mW). See Section 3.4 for details. Figure 4-1 presents a photograph of the WSD signal transmission system on the laboratory grounds.

Figure 4-1. Adaptrum WSD Prototype Transmit System.

4.1.2 Desired Signal (D) Receive System

The receive system used in these tests consisted of a consumer-grade horizontally-polarized television antenna (Radio Shack VU-90XR) mounted at a height of 9.3 meters (30.5 feet) on the rotor-driven extendable mast of an FCC measurement truck and connected via coaxial cable sequentially to 1) an Agilent E7405A spectrum analyzer with internal pre-amplifier and 2) a commercial set-top box with a late-generation DTV tuner (Magnavox) feeding a consumer DTV receiver (JVC). See Figures 4-2 and 4-3 for photographs of the desired signal receive and measurement system.

Figure 4-2. FCC Measurement Truck.

Figure 4-3. DTV Receive System.

4.1.3 Test Methodology

The following test procedure was used for the transmitter field tests:

- The DTV receive antenna was mounted on the extendable mast of the FCC measurement truck and elevated to 9.3 meters (30.5 feet) above ground level (AGL) to simulate a consumer-installed roof-top mounted antenna. The truck was parked on one end of the FCC laboratory property.

- A 75-50 Ω transformer was used to connect the antenna through the antenna feed (coaxial cable) to a spectrum analyzer.

- The antenna was rotated and the spectrum analyzer used to examine the received power levels associated with all available DTV channels.

- Power measurements were compared to determine the weakest receivable signal. This signal was used as the desired signal in these tests. By this method, channel 30 (WNVT-DT in Goldvein, VA, approximately 50-miles distant) was selected as the desired channel for this test. The measured channel power of WNVT-DT was found to vary between -75 and -77 dBm at the test location.

- The antenna feed was then switched from the spectrum analyzer to the set-top box and the signal content displayed on the DTV receiver.

- The signal was observed to produce a stable picture without obvious artifacts.

- A step attenuator was inserted into the signal path and the desired signal was attenuated in 1 dB steps until the picture was lost. By this method it was determined that a 5-6 dB margin existed between the received and threshold signal levels. This confirmed the TOV of the receiver to be within the range -80 to -83 dBm.

- The Adaptrum WSD transmit system (transmitter and supplied antenna) was initially placed at a distance of 12.2 meters (40 feet) from the base of the receive antenna mast along the same radial as the receive antenna boresight and oriented to maximize mainbeam-to-mainbeam coupling (not considering cross-polarization losses). The transmitter was tuned to each of the immediately adjacent channels (29 and 31) and the OFDM signal was transmitted at full power in a 4.5 MHz bandwidth. No interference was observed to the set-top box/DTV receiver while receiving WNVT programming on channel 30.

- The distance was decremented in 3.1 meters (10 feet) steps and the adjacent-channel tests repeated. No adjacent-channel interference was observed on the DTV at any distance; however, alternative test configurations were not explored.

- This test was repeated with a transmit bandwidth of 6 MHz. Again, no interference could be produced with the WSD transmitter tuned to either of the immediately adjacent channels.

- The WSD transmitter was then tuned to channel 30 (co-channel) with an emission bandwidth of 4.5 MHz.

- The transmit antenna was initially placed at a distance of 45.7 meters (150 feet) from the base of the receive antenna along the same radial as before.

- The transmitter was activated at full power. Interference was immediately observed in the form of complete loss of the television picture.

- The transmit channel was changed to 31 in order to isolate from the desired signal and the power through the receiver chain measured. It was determined that at this distance, the undesired power level was 28 dB above the desired power (D/U = -28 dB) which suggested that considerable additional distance would likely have to be realized to mitigate the interference (*i.e.*, to achieve a D/U of 15 dB requires 43 dB additional attenuation of the undesired signal).

- In order to achieve as much attenuation as possible from distance separation (while still maintaining a line-of-sight propagation path), the transmitter and receiver systems were separated as far as practical within in the confines of the laboratory property.

- The maximum distance that could be practically obtained between the transmitter system and the receiver system while staying within the receive antenna mainbeam was 360 meters (1180 feet). The transmitter was again activated at full power within a 4.5-MHz bandwidth and co-tuned with the desired signal (on channel 30). Interference was once again observed as a complete loss of picture. The desired signal level was measured on channel 30 and determined to be -76.9 dBm and the undesired signal level was measured on channel 31 and determined to be -77.4 dBm (D/U = 0.5 dB)

- Since no greater distance separation could be practically realized, a step attenuator was placed between the transmitter amplifier and antenna and used to further attenuate the undesired signal until the interference was eliminated. It was found that an additional 15 dB of attenuation was required to resolve the interference (D/U = 15.5 dB). The results of this test are summarized in Table 4-1.

- The test was repeated with the WSD transmitter located to the side and behind the DTV receive antenna, in order to observe the variation in interference level as the WSD was moved off boresight of the receive antenna (away from the axis of symmetry of the mainbeam). The resulting data are summarized in Table 4-2. The approximate locations associated with the side- and back-lobe tests are shown in the aerial image provided as Figure 4-4.

TABLE 4-1. Co-Channel Interference Test Results in Rx Antenna Mainbeam.

Tx Location (WGS-84)	Rx Location (WGS-84)	Path Length (m)	Bearing w.r.t. Rx MB axis (degrees)	Ix ?	Required Attenuation (dB)
39°10.098'N 076°49.445'W	39° 10.098'N 076° 49.445'W	360	0	Y	15
Receive antenna oriented at a bearing of 239° relative to North.					

FIGURE 4-4. Site Orientation for Co-Channel Interference Tests in Rx Back- and Side-Lobes.

TABLE 4-2. Co-Channel Interference Test Results in Rx Back-Lobe and Side-Lobes.

Tx Site	Coordinates (WGS-84)	Path Length (m)	Bearing w.r.t. Rx MB axis (degrees)	IX	Required Attenuation (dB)
1	39° 10.100'N 076° 49.441'W	370	180.0	Y	3
2	39° 10.161'N 076° 49.554'W	340	147.8	Y	14
3	39° 10.096'N 076° 49.801'W	270	72.7	Y	27
4	39° 10.024'N 076° 49.808'W	220	43.7	Y	24
Receive system located at 39°10.098'N; 076°49.445'W with antenna oriented at a bearing of 239° relative to North.					

4.2 Direct Pick-Up Interference to Cable Service

Anecdotal checks for direct pick-up interference to cable service were performed at the two residential test sites with cable television subscriptions (the third residential site did not subscribe to cable service). The intent was to observe the susceptibility of cable TV reception to interference caused by the direct pick-up of emissions from a WSD prototype transmitter. This interference mechanism has been previously examined and documented by the FCC laboratory.[23]

Consumer cable service networks in the United States typically utilize quadrature-amplitude-modulated (QAM) signals to provide digital television programming. This requires a dedicated QAM demodulator, distinct from that used to demodulate ATSC 8-VSB broadcast signals. Many DTV receivers include both QAM and ATSC 8-VSB demodulators to permit reception of digital cable signals without the need for a separate set-top box. A DTV equipped with a QAM tuner can thus receive unencrypted digital cable TV programming (and also encrypted cable programming if equipped with an active CableCard).

The frequency plan of cable channels differ from the frequency plan of broadcast television channels. Cable channels are offset in frequency relative to over-the-air (broadcast) channel allocations.[24] Cable channels also use different numeric designations and include channels on frequencies not used by broadcast television. At each test site, it was necessary to find an analog and an unencrypted (clear QAM) digital cable channel whose frequencies overlapped the spectrum of a broadcast channel within the tuning range of the Adaptrum prototype WSD transmitter.

4.2.1 Field Test Site 3 (Residential)

Cable channel 73, (519.0 ± 3.0 MHz) was identified as an analog cable channel available at this test site. The Adaptrum WSD prototype can tune its transmitter to channel 21 (515.0 ± 3.0 MHz), which overlaps cable channel 73. Therefore, this channel combination was used to observe the interference potential to analog CATV reception at test site 3.

First, a spectrum analyzer was used to measure the channel power at the cable service outlet, utilizing a 75-50Ω transformer. The measured channel power from the cable TV outlet at site 3 was -7 dBmV. The applicable standard states that the carrier level at the "input terminals of the first device located on the subscriber premises" should be -12 to +15 dBmV.[25] A step attenuator was inserted into the cable signal path and

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[23] Martin, Stephen R., Direct-Pickup Interference Tests of Three Consumer Digital Cable Television Receivers Available in 2005, OET Report FCC/OET 07-TR-1005, July 31, 2007.

[24] Consumer Electronics Association, "CEA Standard: Cable Television Channel Identification Plan", CEA-542-B, July, 2003.

[25] Society of Cable Telecommunications Engineers, "*Digital Cable Network Interface Standard*", ANSI/SCTE 40-2004, p.1, 17.

used to reduce the power on channel 73 at the DTV "cable" input to -11 dBmV (1 dB above the minimum specified level).

The cable service was then attached to the "cable" input of a digital widescreen television, bypassing the existing cable routing (including a distribution amplifier, splitters, various cables, and a set-top converter box). Figure 4-5 presents a line-diagram of the cable receive system at test site 3. The DTV receiver was tuned to cable channel 73 and a good quality analog picture was observed.

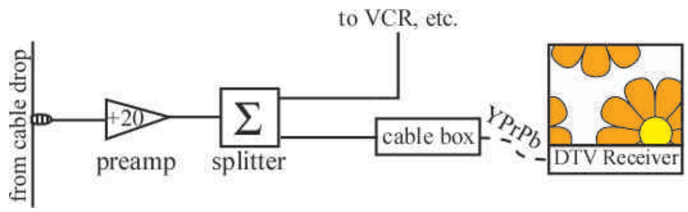

Figure 4-5. Line Diagram of Cable TV Receive System at Test Site #3.

Interference to Analog Cable Service. The Adaptrum antenna was placed on a tripod at a height of approximately 1.5 meters and approximately 1 meter horizontally distant from the TV. The antenna was connected to the WSD transmitter output port via coaxial cable through a step attenuator and mounted in its normal polarization (vertical). The prototype transmitter was tuned to channel 21 and activated at full power (no external attenuation). The picture quality on the cable channel was observed to be significantly degraded. The Adaptrum prototype provides for a variable transmit bandwidth. Using that feature, the transmit bandwidth was reset from 4.5 MHz to 6.0 MHz and the demonstration repeated. Interference to the TV became noticeably worse.

The cable service signal path was changed to include the existing cable routing (including the distribution amplifier, etc., but without the converter box) and the test was repeated. Again, interference was observed on the TV receiver and was also noted on an analog TV in an adjacent room, which was tuned to channel 73, in the form of a complete loss of picture.

The step attenuator in the transmitter signal path was used to decrease the transmitted signal level from the maximum power (+22 dBm EIRP based on data presented in Section 3.4) in 1 dB steps while observing the DTV for interference. With 15 dB of signal attenuation (7 dBm EIRP), the interference was barely perceptible (on either TV).

Interference to Digital Cable Service. Next, an attempt was made to observe the interference potential from the WSD transmitter to a digital cable (QAM) channel. Cable channel 77 (543.0 ± 3.0 MHz) was identified as a clear QAM Cable TV channel available at this test site. The Adaptrum WSD prototype transmitter can tune to broadcast TV channel 26 (545.0 ± 3.0 MHz), which overlaps CATV channel 77. Therefore, this channel combination was used in the demonstration.

The digital widescreen TV was tuned to channel 77 but could not demodulate the signal. Thus, a demonstration of the interference potential to the TV's QAM tuner could not be performed at this site.

The cable converter (set-top) box was inserted into the signal path and connected to the DTV's tuner input. The set-top box was tuned to virtual channel 220 (cable channel 77) and a good quality digital picture was observed. The Adaptrum transmitter was tuned to channel 26 and activated at full power (no external attenuation). Interference was immediately observed in the form of a complete loss of picture.

The variable attenuator was incrementally increased to reduce the radiated power in 1 dB steps. At a reduction of 18 dB (4 dBm EIRP) the picture reappeared. The attenuation in the cable signal path was removed and the test repeated. Picture loss was again observed at a transmit attenuation setting of 12 dB (10 dBm EIRP).

Finally, all of the existing routing from the cable service wall outlet to the converter box (including amplifier, splitters and cables) was removed and replaced with a laboratory-grade patch connecting the wall outlet and the converter box input. The Adaptrum transmitter was reset to its maximum power (all external attenuation removed) and turned on. No interference was observed until the transmit antenna was moved very close to the converter box (within 0.3 meters).

<u>Tentative Conclusions at Test Site #3</u>

- The residence's wiring, preamps, and television receivers were susceptible to direct pick-up (DPU) interference in analog mode.

- The cable converter set-top box operating in QAM mode was almost immune to interference from the WSD transmitter (this set-top box was not tested in the analog mode).

4.2.2 Field Test Site 6 (Residential)

A line diagram of the cable service receive system at test site #6 is presented as Figure 4-6. Digital cable signals were processed by the digital set top box; analog cable signals passed through the digital set top box and were processed by the tuner/demodulator set top box.

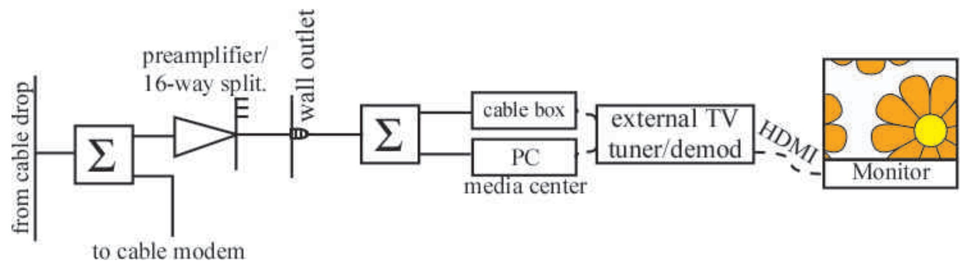

Figure 4-6. Line Diagram of Cable TV Receive System at Test Site #6.

The peak visual carrier level on cable channel 72 (511.25 MHz)[26] from the connector at the wall was measured at +1 dBmV.[27] No additional attenuation was used for the tests at this site.

Interference to Analog Cable Service. The Adaptrum transmitter was set to operate with a 6 MHz transmit bandwidth on TV channel 21 (512–518) MHz, and its antenna was located about two meters from the analog cable converter box (which fed via HDMI a video monitor). The picture showed perceptible interference (TASO Grade 3) when the transmitter was energized. The antenna was then relocated about one foot from the set top box and the picture degraded further and showed definitely objectionable interference (TASO Grade 5).

With the WSD antenna located about two meters from the analog cable converter box the transmit power output from the WSD was reduced in one decibel steps until the interference became barely visible on the video monitor. This threshold of visibility was found at +13 dBm (9 dB below full transmitter output power).

Interference to Digital Cable Service. The Adaptrum transmitter was set to operate on TV Channel 30 (566–572 MHz). The cable signal path ran from the wall outlet through a splitter to a digital cable converter set top box.[28] Cable channel 81 (564–570 MHz) was used for the tests; the measured channel power in 6 MHz was -7 dBmV.[29] The 256 QAM cable channel provided six program streams, corresponding to virtual channels 2, 4, 5, 6, 9, and 12. The set-top box was tuned to (virtual) channel 2 for the tests.

The WSD transmitter's antenna was located about four meters from the set-top box. When the transmitter was energized at +22 dBm, the picture experienced occasional blocking, indicating "weak" interference. When the transmitter antenna was relocated to a position two meters from the set-top box, the blocking became frequent, and at a distance of one meter, the picture froze and then disappeared. The same severity of

[26] EIA Standard 542B, Channel 72 is 510–516 MHz.

[27] –48 dBm + 48.75 = +0.75 dBmV for a 75Ω system.

[28] The set top box fed HDMI the converter box and then the monitor.

[29] -56 + 48.75 = -7.25 dBmV for a 75Ω system.

interference was observed at each distance with the transmitter set to either 4.5 or 6 MHz transmit bandwidth.

With the WSD transmitter's antenna at a distance of two meters from the set-top box, 3 dB of attenuation was introduced between the WSD transmitter and its antenna, and the interference ceased. This represents a transmitter power output of +19 dBm.

The additional 3 dB of signal attenuation was removed and the WSD transmit antenna was maintained at a distance of 2 meters from the set-top box, and rotated from vertical to horizontal. The severity of the interference increased when the antenna was rotated. Additional attenuation of 11 dB was required to eliminate the interference, representing a power output of +11 dBm.

Tentative Conclusions from Location #6 Tests

- The residence's cable receiving system was susceptible to direct pick-up (DPU) interference in analog mode when the WSD transmit antenna was within two meters of the RF components.

- The residence's digital cable set-top box was susceptible to interference from the WSD in QAM mode (analog mode not tested) at a distance of about two meters.

- The digital set-top box was more susceptible to interference from the WSD transmitter when the transmit antenna was horizontally polarized.

4.3 Summary of Results

The results of the tests described in Section 4.1 demonstrate that a DTV receive system tuned to a weak DTV channel can experience interference at significant separation distances (data extrapolation indicates to up to 1.2 km) from the WSD transmitter when it is radiating a signal at ~150 mW EIRP.

With the transmitter operating at full power on a channel adjacent to a weak channel being received by the DTV receiver system, interference was not observed in a simulated rooftop-mounted receive antenna scenario.

These tests served to informally validate currently accepted D/U thresholds for co-channel interference (15 dB).

Direct pick-up interference to cable television reception was demonstrated at transmit power levels consistent with those reported in previous FCC measurement efforts. The interference appears to be dependent on the configuration of the cable installation and whether or not a set-top box was used and if so, the susceptibility of the box to signal ingress.

5 TV-Sensing (Channel Occupancy) Field Tests

This section describes the field measurement component of the Phase II measurement effort and provides a summary of the data collected. This component involved field trials performed with each of the WSD prototypes in an effort to assess their ability to detect incumbent television stations in "real world" environments. Measurements of over-the-air TV signals were also performed at each site to determine the occupancy of each television channel over the range 21-51.

Four of the originally submitted WSD prototypes were used for these tests. As previously discussed, prior to the commencement of the field tests, Adaptrum modified its device to improve the detection of DTV signals with frequency offset pilot carriers.[30] Unfortunately, this software patch resulted in the device taking considerably longer to perform a full 31-channel scan.[31] This limited the number of trials that could be practically performed with this device at each test location. Motorola also modified its device prior to the field tests to mitigate overload problems resulting from strong adjacent channel signals.[32]

Nine field sites were selected for these tests, representing a mix of urban, suburban and rural locales. The sites included three private residences, an office building and five outdoor locations. Table 5-1 lists these nine test sites. More information is provided on a site-by-site basis in the following subsections.

Trials of the detection capabilities of each of the WSD prototypes were performed from two distinct locations at each test site (the Adaptrum device was often limited to one full-scan trial due to time limitations). The rationale for performing trials from two separate locations at each site was to attempt to avoid the possibility of testing in a signal null zone. This practice also provided an opportunity to examine the consistency in the results between proximate locations. Except for the Adaptrum WSD, two trials were performed at each of two locations, for a total of four separate trials at each site.

The WSDs were generally operated separately and sequentially in order to prevent spurious energy generated by one prototype from affecting the results of another (exceptions were at test sites 5 and 8, where an adequate distance between the WSDs could be achieved). Although only four WSDs were tested, the Motorola prototype was tested in two configurations at each site ("normal or geolocation" and "test or sensing" modes), and at several sites the Philips prototype was also tested in a second configuration (with external attenuation added between the antenna and the receiver input).

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[30] See *ex parte* filing from Adaptrum, dated June 2, 2008.

[31] The modified Adaptrum WSD required approximately 2-hours to complete a full scan of channels 21-51 for both digital and analog TV signals.

[32] See *ex parte* filing from Motorola, dated May 15, 2008.

Table 5-1. Test Site Information.

Site Number	Site Location	GPS Coordinates (NAD 27)	Site Description
1	Patapsco State Park Avalon Area Rear Parking Lot Elkridge, MD	39° 14’ 33” N 076° 45’ 06” W	Public state park aside Patapsco riverbed in Baltimore suburbs
2	Thomas A. Dixon, Jr Aircraft Observation Area Dorsey Road, Glen Burnie, MD	39° 09’ 44” N 076° 39’ 51” W	Public park in Baltimore suburbs; Under approach path to BWI/Thurgood Marshall Airport runway 15R/33L
3	Private Residence Ellicott City, MD	39° 14’ N 076° 46’ W	Single family home on hilltop in Baltimore suburbs
4	Private Residence College Park, MD	38° 59’ N 076° 54’ W	Single family home in Washington DC suburbs
5	FCC Headquarters (Portals) 445 12th St., SW Washington, DC	38° 52’ 59” N 077° 01’ 43” W	High rise office building in downtown Washington DC (urban)
6	Private Residence Galesville, MD	38° 50’ N 076° 32’ W	Single family home on waterfront in rural southern Maryland
7	Doub’s Park Wolfsville Rd (Rt 17) @ Rt 40 Myersville, MD	39° 30’ 33” N 077° 33’ 37” W	Public baseball park in rural western Maryland
8	Horse Farm Rt 17 @ Middle Point Road North of Myersville, MD	39° 33’ 48” N 077° 31’ 30” W	Driveway entrance to horse farm in rural western Maryland
9	Grossnickle Church of the Brethren Rt 17 @ Meeting House Road North of Myersville, MD	39° 32’ 36” N 077° 31’ 46” W	Parish Hall parking lot in rural western Maryland

At each test site, measurements were performed to determine the occupancy of each of the channels in the 21-51 range. These measurements involved using the FCC truck, equipped with a pneumatic mast that was used to extend a consumer television receive antenna to a height (relative to ground level) of approximately 9.1 meters (30 feet) in an effort to simulate a typical rooftop antenna installation. The antenna was connected first to a spectrum analyzer via coaxial cable and rotated to optimize reception on each channel. A spectrum analyzer was used to identify the signal type and to measure the associated signal power level. For digital TV (ATSC) signals, the power level was measured as the integrated power over the 6-MHz channel. For analog TV (NTSC) signals, the power level was measured in terms of the peak-of-sync power of the visual carrier. After completing these measurements, the antenna lead was connected to an appropriate receiver to determine whether a “viewable” picture could be displayed. For those channels occupied by DTV signals, a digital-to-analog set-top box was used as the tuner, paired with the display portion of a digital television receiver. For channels with analog signals, the antenna lead was connected directly to the TV receiver. Additional details regarding these on-site measurements are presented in Appendix C.

Several anecdotal interference tests were also performed as a part of these field measurements. As discussed above, at sites 3 and 6, tests were performed to aid in assessing the potential for direct pick-up interference to cable television reception (see Section 4.2). Additionally, anecdotal tests of the wireless microphone detection capability implemented in two of the prototype devices (Philips and I2R) were performed at test sites 3 and 5. This data is described elsewhere in this report (see Section 6).

The following subsections describe the test sites in greater detail and present the information and data collected at each. For each test site, a table is presented that summarizes information associated with each channel in the 21-51 range (excluding channel 37). This table provides six columns of data obtained from the FCC database, augmented with a column of data obtained from on-site observations. The data under each column header are as follows:

- **CH** – lists each channel from 21-51, excluding channel 37 (which is reserved for Radio Astronomy and in-hospital wireless medical telemetry operations).

- **Station Call Sign** – lists the station identifier (call sign) for each TV station (transmitter location) within a 100-km radius of the test site. The 100-km radius was chosen because it is larger than the service areas of most analog and digital TV broadcast stations.

- **Station Location** – lists the community associated with each licensed station.

- **Signal Type** – identifies whether the channel is anticipated to be occupied with an analog or digital television broadcast signal based on information extracted from the FCC consolidated database system (CDBS).

- **Separation Distance** – provides the distance (in kilometers) between the station's broadcast antenna site and the test site location.

- **Within Service Contour** – identifies whether or not the test site is located within the calculated service contour of the associated station.

- **Viewable** – identifies whether or not a television signal could be demodulated and viewed with the test receiver set-up utilized in this effort.[33] In declaring an NTSC channel as viewable, no consideration was given to received picture quality.

Subsequent tables are presented for each test site that provides the raw data from the field trials for each WSD prototype. The unique column headings used in tables are described as follows:

[33] It is noted that the test receiving system used herein varies from both the analog and digital TV planning factors by approximately 4.3 dB (the receive antenna used in the field tests provides 7 dBd of gain rather than the 10 dBd used in the planning factors and the line loss of the field test receive system was about 5.3 dB rather than 4 dB used in the planning factors). Therefore, the test system provided 4.3 dB less signal to the receiver than would a system adhering to the planning factors.

- **Measured Signal Type** – identifies whether the actual measured signal on each channel was digital or analog. In general, this data was consistent with the anticipated signal type; however exceptions were observed. These exceptions can be explained. Often, the anticipated signal was associated with a low-power station located some distance from the test site. In such cases, it is plausible that a full-power station located beyond 100-km will overpower the low-power station. Additionally, because of differences in the methodology for measuring and expressing analog and digital signal levels, it's possible to measure NTSC signals at a lower receive carrier level than ATSC signals. Thus, it's often possible to measure an analog signal originating beyond the 100-km radius, whereas a digital signal originating inside, but near the edge of the radius, could not be measured. In most cases where a discrepancy exists between the anticipated signal type versus the measured signal type, it involves the detection of an analog signal when a digital signal was anticipated.

- **Measured Power Level** – This column presents the measured power level on each channel for each test site. Information regarding how these measurements were performed is provided in Appendix C.

- **Occupied (O) & Available (A) Channels Reported by Each WSD** – This column indicates whether the WSD prototype reported the channel as occupied (indicated by an "O"). The status of those channels not reported as "occupied" were determined based on the rationale discussed below and indicated in the table by either an "A" to represent available or a "-" to represent indeterminate. This column may be further subdivided to indicate the results observed at each particular location where the device was tested. For example, L1/S1 denotes those results obtained from the first scan performed at location 1 and similarly, L2/S2 denotes those results obtained from the second scan performed at location 2.

All of the prototype devices, except for the Motorola device when operated in "Normal" (geo-location) mode, explicitly report only those channels determined to be occupied. When operated in this mode, the Motorola device reports those channels determined to be occupied and also provides a list of the channels that it determines to be "available".

When a prototype WSD scans for both ATSC and NTSC signals (even when it requires separate scans to accomplish this) upon completion of a scan, those channels not reported as occupied can reasonably be presumed to be vacant or "available". However, if the scan is performed to detect only channels occupied with one signal type (NTSC or ATSC), then the status of the channels not reported as occupied is not readily apparent. Examples of such scans performed in the field trials were: 1) those scans performed with the Adaptrum prototype device for NTSC-occupied channels only, 2) those scans performed with the Motorola prototype device in "test" (sensing only) mode for ATSC-occupied channels only, and 3) those scans performed with the I2R prototype device at test sites 1 and 2, where the device was operated in the incorrect mode for detecting ATSC-occupied channels (in effect, resulting in NTSC-only scans).

In populating the data tables reported for each test site, the following approach was applied to determine the status of each channel based on the scan results:

- For all devices, those detection results indicated in the table by an "O" represent exactly what was reported by the device at the conclusion of each scan.

- For those devices used to perform scans for both signal types (ATSC and NTSC) at the same location, the detection results indicated in the table by an "A" represent the channels that were not reported by the device as occupied under scans for both signals and thus were presumed to be vacant or "available". This condition is applicable to the following devices under the described conditions:

    - The Adaptrum device in those locations where both ATSC and NTSC scans were performed,
    - The I2R device at all sites except 1 and 2,
    - The Motorola device when operated in the "Normal" mode (effectively),
    - The Philips device in all configurations.

- For those scans performed for only one signal type (ATSC or NTSC), determining whether a channel not reported as occupied would have been considered vacant (available) was often ambiguous and in some cases required that some judgment be applied. The following criteria was applied in making such channel status decisions:

    - If the measured over-the-air signal type anticipated via the TV contours matched the signal type and was of the same type as that being detected by the device, then a channel not reported by the device as occupied was presumed to be available (indicated by "A" in the tables).
    - If the measured signal type was of the same type as that being detected by the device (i.e., the measured signal was NTSC and the device was scanning for an NTSC signal), then regardless of the expected signal type, a channel not reported by the device as occupied was presumed to be available (indicated by "A" in the tables).
    - If the expected signal type matched the measured signal type but was of the opposite type from that being detected by the device (i.e., the expected and measured signal were ATSC but the device was scanning for NTSC), then no presumption was made for those channels not reported by the device as occupied (indicated by "-" in the tables).
    - If there was no expected signal type reported for the channel (no station assigned to the channel) and a signal type was not measured at the site,

then no presumption was made regarding those channels not reported by the device as occupied (indicated in the tables by "-").[34]

- For any other conditions for which ambiguity existed, no presumption was made regarding the channel status for those channels not reported by the device as occupied (indicated in the tables by "-").

Finally, there are some entries to the table where more than one station within the 100-km search radius is assigned to a single channel. In these cases, the signal type measured at the site took precedence when assessing channel status.

5.1 Test Site #1 – Patapsco Valley State Park, Elkridge, MD

This site offered public access (Maryland State Park) and is representative of a setting with difficult television reception characteristics. The actual test site was a parking lot in the rear of the park, adjacent to the Patapsco river bed, in a valley with rapidly rising, wooded terrain to the Northeast (towards Baltimore) and Southwest (towards Washington). The two test locations at this site were in the same parking lot, separated by approximately 45.7 meters (150 feet).

[34] In these cases it could not be determined with certainty that a signal of the opposite type was not present at levels below the measurement threshold but still within the detection range of the device.

TABLE 5-2. Licensed TV Station Assignments within 100-km radius of Test Site 1.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	-	-	-	-	N	N
22	WMPT	Annapolis, MD	NTSC	28.47	Y	Y
23	WDDN-LP	Washington, DC	NTSC	37.68	N	N
24	WUTB	Baltimore, MD	NTSC	5.18	Y	Y
25	WZDC-LP	Washington, DC	NTSC	44.04	N	N
26	WETA	Washington, DC	NTSC	43.41	Y	Y
27	WETA	Washington, DC	ATSC	43.05	Y	N
28	WFPT	Frederick, MD	ATSC	48.49	Y	N
29	WMPB	Baltimore, MD	ATSC	22.98	Y	N
30	WGCB	Red Lion, PA	ATSC	75.07	N	N
	WNVT	Goldvein, VA	ATSC	90.49	N	
31	WRZB-LP	Annapolis, MD	NTSC	33.02	N	N
32	WHUT	Washington, DC	NTSC	43.46	Y	N
33	WHUT	Washington, DC	ATSC	43.05	Y	N
34	WUSA	Washington, DC	ATSC	43.05	Y	N
35	WDCA	Washington, DC	ATSC	42.76	Y	N
36	WTTG	Washington, DC	ATSC	42.76	Y	N
38	WJZ	Baltimore, MD	ATSC	13.49	Y	Y
39	WJLA	Washington, DC	ATSC	43.05	Y	N
40	WNUV	Baltimore, MD	ATSC	13.67	Y	Y
41	WUTB	Baltimore, MD	ATSC	5.18	Y	Y
42	WMPT	Annapolis, MD	ATSC	28.47	Y	N
43	WPMT	York, PA	NTSC	88.29	N	N
	WPXW	Manassas, VA	ATSC	71.06	N	
44	-	-	-	-	N	N
45	WBFF	Baltimore, MD	NTSC	13.67	Y	Y
46	WBFF	Baltimore, MD	ATSC	13.67	Y	Y
47	WPMT	York, PA	ATSC	88.29	N	N
48	WRC	Washington, DC	ATSC	44.03	Y	N
49	WGCB	Red Lion, PA	NTSC	75.07	N	N
50	WDCW	Washington, DC	NTSC	39.11	Y	Y
51	WDCW	Washington, DC	ATSC	39.11	Y	N

TABLE 5-3. Adaptrum WSD Prototype Results at Test Site 1.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2 [1]	L2/ S1	L2/ S2 [2]
21	-	N	N	-	-	A	-	A	-
22	NTSC	Y	Y	NTSC	-74.0	O	O	O	-
23	NTSC	N	N	-	-	O	-	A	-
24	NTSC	Y	Y	NTSC	-55.0	O	O	O	-
25	NTSC	N	N	-	-	A	-	A	-
26	NTSC	Y	Y	NTSC	-96.6	O	O	A	-
27	ATSC	Y	N	-	-	A	-	A	-
28	ATSC	Y	N	ATSC	-96.3	A	-	A	-
29	ATSC	Y	N	ATSC	-90.9	O	-	O	-
30	ATSC	N	N	-	-	O	-	A	-
	ATSC	N							
31	NTSC	N	N	-	-	O	-	A	-
32	NTSC	Y	N	NTSC	-99.3	A	A	A	-
33	ATSC	Y	N	ATSC	-86.0	A	-	A	-
34	ATSC	Y	N	-	-	O	-	O	-
35	ATSC	Y	N	ATSC	-85.5	A	-	A	-
36	ATSC	Y	N	ATSC	-85.0	O	-	O	-
38	ATSC	Y	Y	ATSC	-72.5	O	-	O	-
39	ATSC	Y	N	-	-	O	-	A	-
40	ATSC	Y	Y	ATSC	-77.0	O	-	O	-
41	ATSC	Y	Y	ATSC	-69.6	O	-	O	-
42	ATSC	Y	N	ATSC	-87.0	O	-	O	
43	NTSC	N	N	NTSC	-97.9	A	A	A	-
	ATSC	N							
44	-	N	N	-	-	A	-	A	-
45	NTSC	Y	Y	NTSC	-77.3	O	O	O	-
46	ATSC	Y	Y	ATSC	-74.0	O	-	O	-
47	ATSC	N	N	NTSC	-88.3	A	A	A	-
48	ATSC	Y	N	ATSC	-87.8	A	-	A	-
49	NTSC	N	N	NTSC	-103.2	A	A	A	-
50	NTSC	Y	Y	NTSC	-95.3	O	A	A	-
51	ATSC	Y	N	NTSC	-93.9	O	A	O	-

[1] Second scan at location 1 for NTSC signals only.
[2] No second scan performed at location 2.

TABLE 5-4. I2R WSD Prototype Results at Test Site 1.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	-	-	-	-	-
22	NTSC	Y	Y	NTSC	-74.0	O	A	A	A
23	NTSC	N	N	-	-	-	-	-	-
24	NTSC	Y	Y	NTSC	-55.0	A	A	A	A
25	NTSC	N	N	-	-	-	-	-	-
26	NTSC	Y	Y	NTSC	-96.6	A	A	A	A
27	ATSC	Y	N	-	-	-	-	-	-
28	ATSC	Y	N	ATSC	-96.3	-	-	-	-
29	ATSC	Y	N	ATSC	-90.9	O	O	O	O
30	ATSC	N	N	-	-	O	O	O	O
	ATSC	N							
31	NTSC	N	N	-	-	-	-	-	-
32	NTSC	Y	N	NTSC	-99.3	A	A	A	A
33	ATSC	Y	N	ATSC	-86.0	-	-	-	-
34	ATSC	Y	N	-	-	-	-	-	-
35	ATSC	Y	N	ATSC	-85.5	-	-	O	O
36	ATSC	Y	N	ATSC	-85.0	O	O	-	-
38	ATSC	Y	Y	ATSC	-72.5	O	O	O	O
39	ATSC	Y	N	-	-	-	-	-	-
40	ATSC	Y	Y	ATSC	-77.0	O	O	O	O
41	ATSC	Y	Y	ATSC	-69.6	O	O	-	O
42	ATSC	Y	N	ATSC	-87.0	-	-	O	O
43	NTSC	N	N	NTSC	-97.9	A	A	A	A
	ATSC	N							
44	-	N	N	-	-	-	-	-	-
45	NTSC	Y	Y	NTSC	-77.3	O	A	A	A
46	ATSC	Y	Y	ATSC	-74.0	O	O	O	O
47	ATSC	N	N	NTSC	-88.3	A	A	A	A
48	ATSC	Y	N	ATSC	-87.8	-	-	-	-
49	NTSC	N	N	NTSC	-103.2	A	A	A	A
50	NTSC	Y	Y	NTSC	-95.3	A	A	A	A
51	ATSC	Y	N	NTSC	-93.9	A	A	O	A

NOTE: Device was operated in “all signal” mode which was later discovered to be incorrect mode for detecting ATSC signals.

TABLE 5-5. Motorola WSD Prototype (Test Mode) Results at Test Site 1.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	-	O	O	O	-
22	NTSC	Y	Y	NTSC	-74.0	-	-	-	-
23	NTSC	N	N	-	-	-	-	-	-
24	NTSC	Y	Y	NTSC	-55.0	-	-	-	-
25	NTSC	N	N	-	-	-	-	-	-
26	NTSC	Y	Y	NTSC	-96.6	-	-	-	-
27	ATSC	Y	N	-	-	O	-	-	-
28	ATSC	Y	N	ATSC	-96.3	A	A	A	A
29	ATSC	Y	N	ATSC	-90.9	O	O	O	O
30	ATSC	N	N	-	-	-	-	-	-
	ATSC	N							
31	NTSC	N	N	-	-	-	-	-	-
32	NTSC	Y	N	NTSC	-99.3	-	-	-	-
33	ATSC	Y	N	ATSC	-86.0	A	A	A	A
34	ATSC	Y	N	-	-	O	O	O	O
35	ATSC	Y	N	ATSC	-85.5	O	O	O	O
36	ATSC	Y	N	ATSC	-85.0	O	O	A	A
38	ATSC	Y	Y	ATSC	-72.5	O	O	O	O
39	ATSC	Y	N	-	-	O	O	O	O
40	ATSC	Y	Y	ATSC	-77.0	O	O	O	O
41	ATSC	Y	Y	ATSC	-69.6	O	O	O	O
42	ATSC	Y	N	ATSC	-87.0	O	O	O	O
43	NTSC	N	N	NTSC	-97.9	O	O	O	O
	ATSC	N							
44	-	N	N	-	-	-	-	-	-
45	NTSC	Y	Y	NTSC	-77.3	-	-	-	-
46	ATSC	Y	Y	ATSC	-74.0	O	O	O	O
47	ATSC	N	N	NTSC	-88.3	-	-	-	-
48	ATSC	Y	N	ATSC	-87.8	O	A	O	O
49	NTSC	N	N	NTSC	-103.2	-	-	-	-
50	NTSC	Y	Y	NTSC	-95.3	-	-	-	-
51	ATSC	Y	N	NTSC	-93.9	-	-	O	O

NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).

TABLE 5-6. Motorola WSD Prototype (Normal Mode) Results at Test Site 1.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	-	N	N	-	-	A	A
22	NTSC	Y	Y	NTSC	-74.0	O	O
23	NTSC	N	N	-	-	A	A
24	NTSC	Y	Y	NTSC	-55.0	O	O
25	NTSC	N	N	-	-	A	A
26	NTSC	Y	Y	NTSC	-96.6	O	O
27	ATSC	Y	N	-	-	O	O
28	ATSC	Y	N	ATSC	-96.3	O	O
29	ATSC	Y	N	ATSC	-90.9	O	O
30	ATSC	N	N	-	-	O	O
	ATSC	N					
31	NTSC	N	N	-	-	A	A
32	NTSC	Y	N	NTSC	-99.3	O	O
33	ATSC	Y	N	ATSC	-86.0	O	O
34	ATSC	Y	N	-	-	O	O
35	ATSC	Y	N	ATSC	-85.5	O	O
36	ATSC	Y	N	ATSC	-85.0	O	O
38	ATSC	Y	Y	ATSC	-72.5	O	O
39	ATSC	Y	N	-	-	O	O
40	ATSC	Y	Y	ATSC	-77.0	O	O
41	ATSC	Y	Y	ATSC	-69.6	O	O
42	ATSC	Y	N	ATSC	-87.0	O	O
43	NTSC	N	N	NTSC	-97.9	A	A
	ATSC	N					
44	-	N	N	-	-	A	A
45	NTSC	Y	Y	NTSC	-77.3	O	O
46	ATSC	Y	Y	ATSC	-74.0	O	O
47	ATSC	N	N	NTSC	-88.3	O	O
48	ATSC	Y	N	ATSC	-87.8	O	O
49	NTSC	N	N	NTSC	-103.2	A	A
50	NTSC	Y	Y	NTSC	-95.3	O	O
51	ATSC	Y	N	NTSC	-93.9	O	O

TABLE 5-7. Philips WSD Prototype Results at Test Site 1.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	-	O	O	O	O
22	NTSC	Y	Y	NTSC	-74.0	O	O	O	O
23	NTSC	N	N	-	-	O	O	O	A
24	NTSC	Y	Y	NTSC	-55.0	O	O	O	O
25	NTSC	N	N	-	-	O	O	O	O
26	NTSC	Y	Y	NTSC	-96.6	O	O	O	O
27	ATSC	Y	N	-	-	O	O	O	O
28	ATSC	Y	N	ATSC	-96.3	O	O	A	O
29	ATSC	Y	N	ATSC	-90.9	O	O	O	O
30	ATSC	N	N	-	-	O	A	O	O
	ATSC	N							
31	NTSC	N	N	-	-	A	A	O	A
32	NTSC	Y	N	NTSC	-99.3	O	O	O	O
33	ATSC	Y	N	ATSC	-86.0	O	A	O	O
34	ATSC	Y	N	-	-	O	O	O	O
35	ATSC	Y	N	ATSC	-85.5	O	O	O	O
36	ATSC	Y	N	ATSC	-85.0	O	O	O	O
38	ATSC	Y	Y	ATSC	-72.5	O	O	O	O
39	ATSC	Y	N	-	-	O	A	O	O
40	ATSC	Y	Y	ATSC	-77.0	O	O	O	O
41	ATSC	Y	Y	ATSC	-69.6	O	O	O	O
42	ATSC	Y	N	ATSC	-87.0	O	O	O	O
43	NTSC	N	N	NTSC	-97.9	O	O	O	O
	ATSC	N							
44	-	N	N	-	-	A	A	A	A
45	NTSC	Y	Y	NTSC	-77.3	O	O	O	O
46	ATSC	Y	Y	ATSC	-74.0	O	O	O	O
47	ATSC	N	N	NTSC	-88.3	O	O	O	O
48	ATSC	Y	N	ATSC	-87.8	O	O	O	O
49	NTSC	N	N	NTSC	-103.2	A	O	A	O
50	NTSC	Y	Y	NTSC	-95.3	O	O	O	O
51	ATSC	Y	N	NTSC	-93.9	O	A	O	O

5.2 Test Site #2 - Aircraft Observation Area, Glen Burnie, MD

This is a public accessible site in the Baltimore suburbs, just south of BWI/Thurgood Marshall Airport, under the approach path to runway 15R/33L. The channel occupancy measurements were performed from the west side of the parking lot and the prototype field trials were performed adjacent to the parking lot (location 1) and approximately 45.7 meters (150 feet) southwest of the first location (location 2). Several high-power TV signals were observed at this site.

TABLE 5-8. Licensed TV Station Assignments within 100-km radius of Test Site 2.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	-	-	-	-	N	N
22	WMPT	Annapolis, MD	NTSC	17.53	Y	Y
23	WDDN-LP	Washington, DC	NTSC	38.57	N	N
24	WUTB	Baltimore, MD	NTSC	16.26	Y	Y
25	WZDC-LP	Washington, DC	NTSC	43.85	N	N
26	WETA	Washington, DC	NTSC	44.09	Y	N
27	WETA	Washington, DC	ATSC	43.06	Y	Y
28	WFPT	Frederick, MD	ATSC	57.12	N	N
29	WMPB	Baltimore, MD	ATSC	33.21	Y	Y
30	WGCB	Red Lion, PA	ATSC	82.75	N	N
	WNVT	Goldvein, VA	ATSC	89.68	N	N
31	WRZB-LP	Annapolis, MD	NTSC	21.65	N	N
32	WHUT	Washington, DC	NTSC	44.15	Y	Y
33	WHUT	Washington, DC	ATSC	43.06	Y	Y
34	WUSA	Washington, DC	ATSC	43.06	Y	Y
35	WDCA	Washington, DC	ATSC	42.96	Y	Y
36	WTTG	Washington, DC	ATSC	42.96	Y	Y
38	WJZ	Baltimore, MD	ATSC	19.18	Y	Y
39	WJLA	Washington, DC	ATSC	43.06	Y	N
40	WNUV	Baltimore, MD	ATSC	19.34	Y	Y
41	WUTB	Baltimore, MD	ATSC	16.26	Y	Y
42	WMPT	Annapolis, MD	ATSC	17.53	Y	Y
43	WPMT	York, PA	NTSC	96.28	N	Y
	WPXW	Manassas, VA	ATSC	71.17	N	N
44	-	-	-	-	N	N
45	WBFF	Baltimore, MD	NTSC	19.34	Y	Y
46	WBFF	Baltimore, MD	ATSC	19.34	Y	Y
47	WPMT	York, PA	ATSC	96.28	N	N
48	WRC	Washington, DC	ATSC	43.84	Y	N
49	WGCB	Red Lion, PA	NTSC	82.75	N	N
50	WDCW	Washington, DC	NTSC	38.52	Y	Y
51	WDCW	Washington, DC	ATSC	38.52	Y	N

TABLE 5-9. Adaptrum WSD Prototype Results at Test Site 2.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L1/ S2
21	-	N	N	-	< -71.0	O	O
22	NTSC	Y	Y	NTSC	-39.4	O	O
23	NTSC	N	N	ATSC	< -67.3	A	A
24	NTSC	Y	Y	NTSC	-28.0	O	O
25	NTSC	N	N	NTSC	-88.6	A	A
26	NTSC	Y	N	NTSC	-79.5	O	O
27	ATSC	Y	Y	ATSC	-65.4	O	O
28	ATSC	N	N	NTSC	-90.0	A	A
29	ATSC	Y	Y	ATSC	-47.9	O	O
30	ATSC	N	N	ATSC	< -69.8	O	O
	ATSC	N	N				
31	NTSC	N	N	-	-	O	A
32	NTSC	Y	Y	NTSC	-73.4	O	O
33	ATSC	Y	Y	ATSC	-81.6	O	O
34	ATSC	Y	Y	ATSC	-59.1	O	O
35	ATSC	Y	Y	ATSC	-62.6	A	A
36	ATSC	Y	Y	ATSC	-62.2	O	O
38	ATSC	Y	Y	ATSC	-16.0	O	O
39	ATSC	Y	N	ATSC	-65.3	O	O
40	ATSC	Y	Y	ATSC	-20.4	O	O
41	ATSC	Y	Y	ATSC	-44.7	O	O
42	ATSC	Y	Y	ATSC	-43.9	O	O
43	NTSC	N	Y	NTSC	-72.7	A	A
	ATSC	N	N				
44	-	N	N	-	-	A	A
45	NTSC	Y	Y	NTSC	-23.0	O	O
46	ATSC	Y	Y	ATSC	-20.7	O	O
47	ATSC	N	N	NTSC	-78.7	A	A
48	ATSC	Y	N	ATSC	< -69.2	O	O
49	NTSC	N	N	NTSC	-93.1	A	A
50	NTSC	Y	Y	NTSC	-66.1	O	A
51	ATSC	Y	N	NTSC	-69.1	O	O

TABLE 5-10. I2R WSD Prototype Results at Test Site 2.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	< -71.0	-	-	-	-
22	NTSC	Y	Y	NTSC	-39.4	A	A	A	A
23	NTSC	N	N	ATSC	< -67.3	-	-	-	-
24	NTSC	Y	Y	NTSC	-28.0	A	O	O	A
25	NTSC	N	N	NTSC	-88.6	A	A	A	A
26	NTSC	Y	N	NTSC	-79.5	O	A	A	A
27	ATSC	Y	Y	ATSC	-65.4	-	-	-	O
28	ATSC	N	N	NTSC	-90.0	A	A	A	A
29	ATSC	Y	Y	ATSC	-47.9	O	O	O	O
30	ATSC	N	N	ATSC	< -69.8	O	O	O	O
	ATSC	N	N						
31	NTSC	N	N	-	-	-	O	-	-
32	NTSC	Y	Y	NTSC	-73.4	A	O	A	A
33	ATSC	Y	Y	ATSC	-81.6	-	-	-	-
34	ATSC	Y	Y	ATSC	-59.1	O	-	O	O
35	ATSC	Y	Y	ATSC	-62.6	-	-	O	-
36	ATSC	Y	Y	ATSC	-62.2	-	-	-	O
38	ATSC	Y	Y	ATSC	-16.0	O	O	-	-
39	ATSC	Y	N	ATSC	-65.3	-	-	O	O
40	ATSC	Y	Y	ATSC	-20.4	O	-	-	A
41	ATSC	Y	Y	ATSC	-44.7	O	O	O	O
42	ATSC	Y	Y	ATSC	-43.9	-	O	-	-
43	NTSC	N	Y	NTSC	-72.7	A	A	A	A
	ATSC	N	N						
44	-	N	N	-	-	-	-	-	-
45	NTSC	Y	Y	NTSC	-23.0	A	A	O	O
46	ATSC	Y	Y	ATSC	-20.7	O	O	O	O
47	ATSC	N	N	NTSC	-78.7	A	A	O	O
48	ATSC	Y	N	ATSC	< -69.2	-	-	-	-
49	NTSC	N	N	NTSC	-93.1	A	A	A	A
50	NTSC	Y	Y	NTSC	-66.1	A	A	A	A
51	ATSC	Y	N	NTSC	-69.1	A	A	O	A

NOTE: Device was operated in “all signal” mode which was later discovered to be incorrect mode for detecting ATSC signals.

TABLE 5-11. Motorola WSD Prototype (Test Mode) Results at Test Site 2.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	< -71.0	-	-	-	O
22	NTSC	Y	Y	NTSC	-39.4	-	-	-	-
23	NTSC	N	N	ATSC	< -67.3	A	A	A	A
24	NTSC	Y	Y	NTSC	-28.0	-	-	-	-
25	NTSC	N	N	NTSC	-88.6	-	-	-	-
26	NTSC	Y	N	NTSC	-79.5	-	-	-	-
27	ATSC	Y	Y	ATSC	-65.4	O	O	O	O
28	ATSC	N	N	NTSC	-90.0	-	-	-	-
29	ATSC	Y	Y	ATSC	-47.9	O	O	O	O
30	ATSC	N	N	ATSC	< -69.8	A	A	A	A
	ATSC	N	N						
31	NTSC	N	N	-	-	-	-	-	-
32	NTSC	Y	Y	NTSC	-73.4	-	-	-	-
33	ATSC	Y	Y	ATSC	-81.6	A	A	A	A
34	ATSC	Y	Y	ATSC	-59.1	O	O	O	O
35	ATSC	Y	Y	ATSC	-62.6	O	O	O	O
36	ATSC	Y	Y	ATSC	-62.2	O	O	O	O
38	ATSC	Y	Y	ATSC	-16.0	O	O	O	O
39	ATSC	Y	N	ATSC	-65.3	O	O	A	A
40	ATSC	Y	Y	ATSC	-20.4	O	O	O	O
41	ATSC	Y	Y	ATSC	-44.7	O	O	O	O
42	ATSC	Y	Y	ATSC	-43.9	O	O	O	O
43	NTSC	N	Y	NTSC	-72.7	O	O	O	O
	ATSC	N	N						
44	-	N	N	-	-	O	O	-	-
45	NTSC	Y	Y	NTSC	-23.0	-	-	-	-
46	ATSC	Y	Y	ATSC	-20.7	O	O	O	O
47	ATSC	N	N	NTSC	-78.7	-	-	-	-
48	ATSC	Y	N	ATSC	< -69.2	O	O	O	-
49	NTSC	N	N	NTSC	-93.1	O	O	-	O
50	NTSC	Y	Y	NTSC	-66.1	-	-	-	-
51	ATSC	Y	N	NTSC	-69.1	O	O	O	O

NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).

TABLE 5-12. Motorola WSD Prototype (Normal Mode) Results at Test Site 2.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	-	N	N	-	< -71.0	A	A
22	NTSC	Y	Y	NTSC	-39.4	O	O
23	NTSC	N	N	ATSC	< -67.3	A	A
24	NTSC	Y	Y	NTSC	-28.0	O	O
25	NTSC	N	N	NTSC	-88.6	O	O
26	NTSC	Y	N	NTSC	-79.5	O	O
27	ATSC	Y	Y	ATSC	-65.4	O	O
28	ATSC	N	N	NTSC	-90.0	O	O
29	ATSC	Y	Y	ATSC	-47.9	O	O
30	ATSC	N	N	ATSC	< -69.8	A	A
	ATSC	N	N				
31	NTSC	N	N	-	-	A	A
32	NTSC	Y	Y	NTSC	-73.4	O	O
33	ATSC	Y	Y	ATSC	-81.6	O	O
34	ATSC	Y	Y	ATSC	-59.1	O	O
35	ATSC	Y	Y	ATSC	-62.6	O	O
36	ATSC	Y	Y	ATSC	-62.2	O	O
38	ATSC	Y	Y	ATSC	-16.0	O	O
39	ATSC	Y	N	ATSC	-65.3	O	O
40	ATSC	Y	Y	ATSC	-20.4	O	O
41	ATSC	Y	Y	ATSC	-44.7	O	O
42	ATSC	Y	Y	ATSC	-43.9	O	O
43	NTSC	N	Y	NTSC	-72.7	O	O
	ATSC	N	N				
44	-	N	N	-	-	A	A
45	NTSC	Y	Y	NTSC	-23.0	O	O
46	ATSC	Y	Y	ATSC	-20.7	O	O
47	ATSC	N	N	NTSC	-78.7	O	O
48	ATSC	Y	N	ATSC	< -69.2	O	O
49	NTSC	N	N	NTSC	-93.1	A	A
50	NTSC	Y	Y	NTSC	-66.1	O	O
51	ATSC	Y	N	NTSC	-69.1	O	O

TABLE 5-13. Philips WSD Prototype Results at Test Site 2.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	< -71.0	O	O	O	O
22	NTSC	Y	Y	NTSC	-39.4	O	O	O	O
23	NTSC	N	N	ATSC	< -67.3	O	O	O	O
24	NTSC	Y	Y	NTSC	-28.0	O	O	O	O
25	NTSC	N	N	NTSC	-88.6	O	O	O	O
26	NTSC	Y	N	NTSC	-79.5	O	O	O	O
27	ATSC	Y	Y	ATSC	-65.4	O	O	O	O
28	ATSC	N	N	NTSC	-90.0	O	O	O	O
29	ATSC	Y	Y	ATSC	-47.9	O	O	O	O
30	ATSC	N	N	ATSC	< -69.8	O	O	O	O
	ATSC	N	N						
31	NTSC	N	N	-	-	O	O	O	O
32	NTSC	Y	Y	NTSC	-73.4	O	O	O	O
33	ATSC	Y	Y	ATSC	-81.6	O	O	O	O
34	ATSC	Y	Y	ATSC	-59.1	O	O	O	O
35	ATSC	Y	Y	ATSC	-62.6	O	O	O	O
36	ATSC	Y	Y	ATSC	-62.2	O	O	O	O
37				ATSC	-16.0	O	O	O	O
38	ATSC	Y	Y	ATSC	-65.3	O	O	O	O
39	ATSC	Y	N	ATSC	-20.4	O	O	O	O
40	ATSC	Y	Y	ATSC	-44.7	O	O	O	O
41	ATSC	Y	Y	ATSC	-43.9	O	O	O	O
42	ATSC	Y	Y	ATSC	-72.7	O	O	O	O
43	NTSC	N	Y	NTSC	-	O	O	O	O
	ATSC	N	N						
44	-	-	-	-	-23.0	O	A	O	A
45	NTSC	Y	Y	NTSC	-20.7	O	O	O	O
46	ATSC	Y	Y	ATSC	-78.7	O	O	O	O
47	ATSC	N	N	NTSC	< -69.2	O	O	O	O
48	ATSC	Y	N	ATSC	-93.1	O	O	O	O
49	NTSC	N	N	NTSC	-66.1	O	O	O	O
50	NTSC	Y	Y	NTSC	-69.1	O	O	O	O
51	ATSC	Y	N	NTSC	< -71.0	O	O	O	O

5.3 Test Site #3 – Private Residence in Ellicott City, MD

This site is a two-story single-family home on a hilltop in the suburbs of Baltimore, MD. The channel occupancy measurements were performed in the driveway. The prototype trials were performed in the first floor living area (location 1) and a second floor bedroom (location 2). Because of the hilltop location, excellent television reception was observed, including some stations for which the site was beyond their service contour.

TABLE 5-14. Licensed TV Station Assignments within 100-km radius of Test Site 3.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	-	-	-	-	N	N
22	WMPT	Annapolis, MD	NTSC	28.85	Y	Y
23	WDDN-LP	Washington, DC	NTSC	36.03	N	N
24	WUTB	Baltimore, MD	NTSC	5.73	Y	Y
25	WZDC-LP	Washington, DC	NTSC	42.46	N	N
26	WETA	Washington, DC	NTSC	41.75	Y	Y
27	WETA	Washington, DC	ATSC	41.46	Y	Y
28	WFPT	Frederick, MD	ATSC	46.69	Y	Y
29	WMPB	Baltimore, MD	ATSC	23.39	Y	Y
30	WGCB	Red Lion, PA	ATSC	75.96	N	Y
	WNVT	Goldvein, VA	ATSC	88.89	N	N
31	WRZB-LP	Annapolis, MD	NTSC	33.57	N	Y
32	WHUT	Washington, DC	NTSC	41.80	Y	Y
33	WHUT	Washington, DC	ATSC	41.46	Y	Y
34	WUSA	Washington, DC	ATSC	41.46	Y	Y
35	WDCA	Washington, DC	ATSC	41.15	Y	Y
36	WTTG	Washington, DC	ATSC	41.15	Y	Y
38	WJZ	Baltimore, MD	ATSC	15.11	Y	Y
39	WJLA	Washington, DC	ATSC	41.46	Y	Y
40	WNUV	Baltimore, MD	ATSC	15.28	Y	Y
41	WUTB	Baltimore, MD	ATSC	5.73	Y	Y
42	WMPT	Annapolis, MD	ATSC	28.85	Y	Y
43	WPMT	York, PA	NTSC	89.10	N	Y
	WPXW	Manassas, VA	ATSC	69.39	N	Y
44	-	-	-	-	N	N
45	WBFF	Baltimore, MD	NTSC	15.28	Y	Y
46	WBFF	Baltimore, MD	ATSC	15.28	Y	Y
47	WPMT	York, PA	ATSC	89.10	N	Y
48	WRC	Washington, DC	ATSC	42.44	Y	Y
49	WGCB	Red Lion, PA	NTSC	75.96	N	Y
50	WDCW	Washington, DC	NTSC	37.59	Y	Y
51	WDCW	Washington, DC	ATSC	37.59	Y	Y

TABLE 5-15. Adaptrum WSD Prototype Results at Test Site 3.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L1/ S2 [1]
21	-	N	N	NTSC	-95.7	O	A
22	NTSC	Y	Y	NTSC	-29.8	O	O
23	NTSC	N	N	NTSC	-72.0	O	O
24	NTSC	Y	Y	NTSC	-39.2	O	O
25	NTSC	N	N	NTSC	-72.8	O	O
26	NTSC	Y	Y	NTSC	-37.2	O	O
27	ATSC	Y	Y	ATSC	-50.9	O	-
28	ATSC	Y	Y	ATSC	-50.9	O	-
29	ATSC	Y	Y	ATSC	-64.4	O	-
30	ATSC	N	Y	ATSC	-68.3	O	-
	ATSC	N	N				
31	NTSC	N	Y	NTSC	-90.6	O	A
32	NTSC	Y	Y	NTSC	-40.1	O	O
33	ATSC	Y	Y	ATSC	-51.7	O	-
34	ATSC	Y	Y	ATSC	-43.0	O	-
35	ATSC	Y	Y	ATSC	-41.8	A	-
36	ATSC	Y	Y	ATSC	-38.6	O	-
38	ATSC	Y	Y	ATSC	-27.4	O	-
39	ATSC	Y	Y	ATSC	-44.2	O	-
40	ATSC	Y	Y	ATSC	-30.9	O	-
41	ATSC	Y	Y	ATSC	-42.7	O	-
42	ATSC	Y	Y	ATSC	-51.1	O	-
43	NTSC	N	Y	NTSC	-66.0	A	A
	ATSC	N	Y				
44	-	N	N	-	-	A	-
45	NTSC	Y	Y	NTSC	-28.8	O	O
46	ATSC	Y	Y	ATSC	-30.0	O	-
47	ATSC	N	Y	NTSC	-82.0	O	O
48	ATSC	Y	Y	ATSC	-43.8	O	-
49	NTSC	N	Y	NTSC	-77.8	O	O
50	NTSC	Y	Y	NTSC	-40.5	O	O
51	ATSC	Y	Y	ATSC	-49.7	O	-

[1] Second scan for NTSC signals only.

TABLE 5-16. I2R WSD Prototype Results at Test Site 3.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	NTSC	-95.7	A	O	O	O
22	NTSC	Y	Y	NTSC	-29.8	A	O	A	O
23	NTSC	N	N	NTSC	-72.0	A	A	A	O
24	NTSC	Y	Y	NTSC	-39.2	O	O	O	O
25	NTSC	N	N	NTSC	-72.8	O	O	O	A
26	NTSC	Y	Y	NTSC	-37.2	O	O	O	O
27	ATSC	Y	Y	ATSC	-50.9	O	O	O	O
28	ATSC	Y	Y	ATSC	-50.9	O	O	O	O
29	ATSC	Y	Y	ATSC	-64.4	O	O	O	O
30	ATSC	N	Y	ATSC	-68.3	O	O	O	O
	ATSC	N	N						
31	NTSC	N	Y	NTSC	-90.6	O	O	A	A
32	NTSC	Y	Y	NTSC	-40.1	O	A	O	O
33	ATSC	Y	Y	ATSC	-51.7	O	O	O	O
34	ATSC	Y	Y	ATSC	-43.0	O	O	O	O
35	ATSC	Y	Y	ATSC	-41.8	O	O	O	O
36	ATSC	Y	Y	ATSC	-38.6	O	O	O	O
38	ATSC	Y	Y	ATSC	-27.4	O	O	O	O
39	ATSC	Y	Y	ATSC	-44.2	O	O	O	O
40	ATSC	Y	Y	ATSC	-30.9	O	O	O	O
41	ATSC	Y	Y	ATSC	-42.7	O	O	O	O
42	ATSC	Y	Y	ATSC	-51.1	O	O	O	O
43	NTSC	N	Y	NTSC	-66.0	O	O	O	O
	ATSC	N	Y						
44	-	N	N	-	-	A	A	A	A
45	NTSC	Y	Y	NTSC	-28.8	A	A	O	A
46	ATSC	Y	Y	ATSC	-30.0	O	O	O	O
47	ATSC	N	Y	NTSC	-82.0	A	A	O	O
48	ATSC	Y	Y	ATSC	-43.8	O	O	O	O
49	NTSC	N	Y	NTSC	-77.8	A	A	A	A
50	NTSC	Y	Y	NTSC	-40.5	O	A	O	O
51	ATSC	Y	Y	ATSC	-49.7	O	O	O	O

TABLE 5-17. Motorola WSD Prototype (Test Mode) Results at Test Site 3.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	NTSC	-95.7	-	-	-	-
22	NTSC	Y	Y	NTSC	-29.8	-	-	-	-
23	NTSC	N	N	NTSC	-72.0	-	-	-	-
24	NTSC	Y	Y	NTSC	-39.2	-	-	-	-
25	NTSC	N	N	NTSC	-72.8	-	-	-	-
26	NTSC	Y	Y	NTSC	-37.2	-	-	-	-
27	ATSC	Y	Y	ATSC	-50.9	O	O	O	O
28	ATSC	Y	Y	ATSC	-50.9	O	O	O	O
29	ATSC	Y	Y	ATSC	-64.4	O	O	O	O
30	ATSC	N	Y	ATSC	-68.3	O	O	O	O
	ATSC	N	N						
31	NTSC	N	Y	NTSC	-90.6	-	-	-	-
32	NTSC	Y	Y	NTSC	-40.1	-	-	-	-
33	ATSC	Y	Y	ATSC	-51.7	A	A	A	A
34	ATSC	Y	Y	ATSC	-43.0	O	O	O	O
35	ATSC	Y	Y	ATSC	-41.8	O	O	O	O
36	ATSC	Y	Y	ATSC	-38.6	O	O	O	O
38	ATSC	Y	Y	ATSC	-27.4	O	O	O	O
39	ATSC	Y	Y	ATSC	-44.2	O	O	O	O
40	ATSC	Y	Y	ATSC	-30.9	O	O	O	O
41	ATSC	Y	Y	ATSC	-42.7	O	O	O	O
42	ATSC	Y	Y	ATSC	-51.1	O	O	O	O
43	NTSC	N	Y	NTSC	-66.0	O	O	O	O
	ATSC	N	Y						
44	-	N	N	-	-	-	-	O	-
45	NTSC	Y	Y	NTSC	-28.8	-	-	-	-
46	ATSC	Y	Y	ATSC	-30.0	O	O	O	O
47	ATSC	N	Y	NTSC	-82.0	-	-	-	-
48	ATSC	Y	Y	ATSC	-43.8	O	O	O	O
49	NTSC	N	Y	NTSC	-77.8	-	-	-	-
50	NTSC	Y	Y	NTSC	-40.5	O	-	-	-
51	ATSC	Y	Y	ATSC	-49.7	O	O	O	O

NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).

TABLE 5-18. Motorola WSD Prototype (Normal Mode) Results at Test Site 3.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	-	N	N	NTSC	-95.7	A	A
22	NTSC	Y	Y	NTSC	-29.8	O	O
23	NTSC	N	N	NTSC	-72.0	A	A
24	NTSC	Y	Y	NTSC	-39.2	O	O
25	NTSC	N	N	NTSC	-72.8	A	A
26	NTSC	Y	Y	NTSC	-37.2	O	O
27	ATSC	Y	Y	ATSC	-50.9	O	O
28	ATSC	Y	Y	ATSC	-50.9	O	O
29	ATSC	Y	Y	ATSC	-64.4	O	O
30	ATSC	N	Y	ATSC	-68.3	O	O
	ATSC	N	N				
31	NTSC	N	Y	NTSC	-90.6	A	A
32	NTSC	Y	Y	NTSC	-40.1	O	O
33	ATSC	Y	Y	ATSC	-51.7	O	O
34	ATSC	Y	Y	ATSC	-43.0	O	O
35	ATSC	Y	Y	ATSC	-41.8	O	O
36	ATSC	Y	Y	ATSC	-38.6	O	O
38	ATSC	Y	Y	ATSC	-27.4	O	O
39	ATSC	Y	Y	ATSC	-44.2	O	O
40	ATSC	Y	Y	ATSC	-30.9	O	O
41	ATSC	Y	Y	ATSC	-42.7	O	O
42	ATSC	Y	Y	ATSC	-51.1	O	O
43	NTSC	N	Y	NTSC	-66.0	O	O
	ATSC	N	Y				
44	-	N	N	-	-	A	A
45	NTSC	Y	Y	NTSC	-28.8	O	O
46	ATSC	Y	Y	ATSC	-30.0	O	O
47	ATSC	N	Y	NTSC	-82.0	O	O
48	ATSC	Y	Y	ATSC	-43.8	O	O
49	NTSC	N	Y	NTSC	-77.8	A	A
50	NTSC	Y	Y	NTSC	-40.5	O	O
51	ATSC	Y	Y	ATSC	-49.7	O	O

TABLE 5-19. Philips WSD Prototype Results at Test Site 3.

<table>
<tr><th rowspan="2">CH</th><th rowspan="2">Signal Type (Database)</th><th rowspan="2">Within Service Contour? (Y/N)</th><th rowspan="2">Viewable? (Y/N)</th><th rowspan="2">Signal Type (Measured)</th><th rowspan="2">Measured Power Level (dBm)</th><th colspan="4">Occupied (O) & Available (A) Channels Reported by WSD</th></tr>
<tr><th>L1/ S1</th><th>L1/ S2</th><th>L2/ S1</th><th>L2/ S2</th></tr>
<tr><td>21</td><td>-</td><td>N</td><td>N</td><td>NTSC</td><td>-95.7</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>22</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-29.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>23</td><td>NTSC</td><td>N</td><td>N</td><td>NTSC</td><td>-72.0</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>24</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-39.2</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>25</td><td>NTSC</td><td>N</td><td>N</td><td>NTSC</td><td>-72.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>26</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-37.2</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>27</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-50.9</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>28</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-50.9</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>29</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-64.4</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td rowspan="2">30</td><td>ATSC</td><td>N</td><td>Y</td><td rowspan="2">ATSC</td><td rowspan="2">-68.3</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td></tr>
<tr><td>ATSC</td><td>N</td><td>N</td></tr>
<tr><td>31</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-90.6</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>32</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-40.1</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>33</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-51.7</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>34</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-43.0</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>35</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-41.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>36</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-38.6</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>38</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-27.4</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>39</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-44.2</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>40</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-30.9</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>41</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-42.7</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>42</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-51.1</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td rowspan="2">43</td><td>NTSC</td><td>N</td><td>Y</td><td rowspan="2">NTSC</td><td rowspan="2">-66.0</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td></tr>
<tr><td>ATSC</td><td>N</td><td>Y</td></tr>
<tr><td>44</td><td>-</td><td>N</td><td>N</td><td>-</td><td>-</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>45</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-28.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>46</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-30.0</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>47</td><td>ATSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-82.0</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>48</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-43.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>49</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-77.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>50</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-40.5</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>51</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-49.7</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td colspan="10">NOTE: An additional scan was run from location 1 with a 6-dB attenuator inserted between the receive antenna and the WSD but no change in the results was observed (i.e., all channels still reported as occupied).</td></tr>
</table>

5.4 Test Site #4 – Private Residence in College Park, MD

This site is a single-family one-story home located in the suburbs of Washington, DC. The channel occupancy measurements were performed in the driveway. The prototype trials were performed from the first floor living room (location 1) and from an entertainment room in the finished basement (location 2).

TABLE 5-20. Licensed TV Station Assignments within 100-km radius of Test Site 4.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	-	-	-	-	N	N
22	WMPT	Annapolis, MD	NTSC	26.72	Y	Y
23	WDDN-LP	Washington, DC	NTSC	12.43	Y	Y
24	WUTB	Baltimore, MD	NTSC	36.42	Y	Y
25	WZDC-LP	Washington, DC	NTSC	15.16	Y	Y
26	WETA	Washington, DC	NTSC	16.50	Y	Y
27	WETA	Washington, DC	ATSC	14.67	Y	Y
28	WFPT	Frederick, MD	ATSC	46.13	Y	N
29	WMPB	Baltimore, MD	ATSC	52.90	Y	Y
30	WNVT	Goldvein, VA	ATSC	60.10	Y	Y[1]
31	WRZB-LP	Annapolis, MD	NTSC	31.39	N	N
32	WHUT	Washington, DC	NTSC	16.55	Y	Y
33	WHUT	Washington, DC	ATSC	14.67	Y	Y
34	WUSA	Washington, DC	ATSC	14.67	Y	Y
35	WDCA	Washington, DC	ATSC	14.81	Y	Y
36	WTTG	Washington, DC	ATSC	14.81	Y	Y
38	WJZ	Baltimore, MD	ATSC	45.31	Y	Y
39	WJLA	Washington, DC	ATSC	14.67	Y	Y
40	WNUV	Baltimore, MD	ATSC	45.49	Y	Y
41	WUTB	Baltimore, MD	ATSC	36.42	Y	N
42	WMPT	Annapolis, MD	ATSC	26.72	Y	Y
43	WPXW	Manassas, VA	ATSC	41.94	Y	Y
44	-	-	-	-	N	N
45	WBFF	Baltimore, MD	NTSC	45.49	Y	Y
46	WBFF	Baltimore, MD	ATSC	45.49	Y	Y
47	WMDO-CA	Washington, DC	NTSC	15.15	Y	Y
48	WRC	Washington, DC	ATSC	15.15	Y	Y
49	WWTD-LP	Washington, DC	NTSC	15.15	Y	Y
50	WDCW	Washington, DC	NTSC	9.89	Y	Y
51	WDCW	Washington, DC	ATSC	9.89	Y	Y

TABLE 5-21. Adaptrum WSD Prototype Results at Test Site 4.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L1/ S2 [1]
21	-	N	N	-	-	A	-
22	NTSC	Y	Y	NTSC	-63.1	O	O
23	NTSC	Y	Y	NTSC	-48.2	O	O
24	NTSC	Y	Y	NTSC	-67.5	O	O
25	NTSC	Y	Y	NTSC	-66.6	O	O
26	NTSC	Y	Y	NTSC	-47.5	O	O
27	ATSC	Y	Y	ATSC	-47.3	O	-
28	ATSC	Y	N	-	-	A	-
29	ATSC	Y	Y	ATSC	-77.0	O	O
30	ATSC	Y	Y	ATSC	-78.1	A	-
31	NTSC	N	N	-	-	A	-
32	NTSC	Y	Y	NTSC	-42.2	O	O
33	ATSC	Y	Y	ATSC	-46.7	O	-
34	ATSC	Y	Y	ATSC	-37.2	O	-
35	ATSC	Y	Y	ATSC	-49.7	O	-
36	ATSC	Y	Y	ATSC	-45.5	O	-
38	ATSC	Y	Y	ATSC	-70.8	O	-
39	ATSC	Y	Y	ATSC	-45.7	O	-
40	ATSC	Y	Y	ATSC	-68.7	O	-
41	ATSC	Y	N	-	-	O	-
42	ATSC	Y	Y	ATSC	-74.0	O	-
43	ATSC	Y	Y	ATSC	-75.6	A	-
44	-	N	N	ATSC	-	A	-
45	NTSC	Y	Y	NTSC	-69.4	O	O
46	ATSC	Y	Y	ATSC	-68.9	O	-
47	NTSC	Y	Y	NTSC	-84.3	O	O
48	ATSC	Y	Y	ATSC	-52.1	O	-
49	NTSC	Y	Y	NTSC	-66.7	O	O
50	NTSC	Y	Y	NTSC	-40.0	O	O
51	ATSC	Y	Y	ATSC	-53.1	O	-

[1] Second scan for NTSC signals only.

TABLE 5-22. I2R WSD Prototype Results at Test Site 4.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	-	A	A	A	A
22	NTSC	Y	Y	NTSC	-63.1	A	O	A	O
23	NTSC	Y	Y	NTSC	-48.2	A	A	A	A
24	NTSC	Y	Y	NTSC	-67.5	A	O	A	A
25	NTSC	Y	Y	NTSC	-66.6	A	A	A	A
26	NTSC	Y	Y	NTSC	-47.5	O	O	A	O
27	ATSC	Y	Y	ATSC	-47.3	O	O	O	O
28	ATSC	Y	N	-	-	A	A	A	A
29	ATSC	Y	Y	ATSC	-77.0	O	O	A	A
30	ATSC	Y	Y	ATSC	-78.1	O	O	O	A
31	NTSC	N	N	-	-	A	A	A	A
32	NTSC	Y	Y	NTSC	-42.2	O	O	A	O
33	ATSC	Y	Y	ATSC	-46.7	O	O	O	O
34	ATSC	Y	Y	ATSC	-37.2	O	O	O	O
35	ATSC	Y	Y	ATSC	-49.7	O	O	O	O
36	ATSC	Y	Y	ATSC	-45.5	O	O	O	O
38	ATSC	Y	Y	ATSC	-70.8	O	O	O	O
39	ATSC	Y	Y	ATSC	-45.7	O	O	O	O
40	ATSC	Y	Y	ATSC	-68.7	O	O	O	O
41	ATSC	Y	N	-	-	A	O	A	A
42	ATSC	Y	Y	ATSC	-74.0	O	O	O	O
43	ATSC	Y	Y	ATSC	-75.6	O	O	A	A
44	-	N	N	ATSC	-	A	A	A	A
45	NTSC	Y	Y	NTSC	-69.4	A	A	A	A
46	ATSC	Y	Y	ATSC	-68.9	O	O	O	O
47	NTSC	Y	Y	NTSC	-84.3	A	A	A	A
48	ATSC	Y	Y	ATSC	-52.1	O	O	O	O
49	NTSC	Y	Y	NTSC	-66.7	A	A	A	A
50	NTSC	Y	Y	NTSC	-40.0	O	O	A	A
51	ATSC	Y	Y	ATSC	-53.1	O	O	O	O

TABLE 5-23. Motorola WSD Prototype (Test Mode) Results at Test Site 4.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	-	-	-	-	-
22	NTSC	Y	Y	NTSC	-63.1	-	-	-	-
23	NTSC	Y	Y	NTSC	-48.2	-	-	-	-
24	NTSC	Y	Y	NTSC	-67.5	-	-	-	-
25	NTSC	Y	Y	NTSC	-66.6	-	-	-	-
26	NTSC	Y	Y	NTSC	-47.5	-	-	-	-
27	ATSC	Y	Y	ATSC	-47.3	O	O	O	O
28	ATSC	Y	N	-	-	-	-	-	-
29	ATSC	Y	Y	ATSC	-77.0	O	O	O	O
30	ATSC	Y	Y	ATSC	-78.1	O	O	A	O
31	NTSC	N	N	-	-	-	-	-	-
32	NTSC	Y	Y	NTSC	-42.2	-	-	-	-
33	ATSC	Y	Y	ATSC	-46.7	A	A	A	A
34	ATSC	Y	Y	ATSC	-37.2	O	O	O	O
35	ATSC	Y	Y	ATSC	-49.7	O	O	O	O
36	ATSC	Y	Y	ATSC	-45.5	O	O	O	O
38	ATSC	Y	Y	ATSC	-70.8	O	O	O	O
39	ATSC	Y	Y	ATSC	-45.7	O	O	O	O
40	ATSC	Y	Y	ATSC	-68.7	O	O	O	O
41	ATSC	Y	N	-	-	O	O	-	O
42	ATSC	Y	Y	ATSC	-74.0	O	O	O	O
43	ATSC	Y	Y	ATSC	-75.6	O	O	O	O
44	-	N	N	ATSC	-	A	A	A	A
45	NTSC	Y	Y	NTSC	-69.4	-	-	-	-
46	ATSC	Y	Y	ATSC	-68.9	O	O	O	O
47	NTSC	Y	Y	NTSC	-84.3	-	-	-	-
48	ATSC	Y	Y	ATSC	-52.1	O	O	O	O
49	NTSC	Y	Y	NTSC	-66.7	-	-	-	-
50	NTSC	Y	Y	NTSC	-40.0	-	-	-	-
51	ATSC	Y	Y	ATSC	-53.1	O	O	O	O
NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).									

TABLE 5-24. Motorola WSD Prototype (Normal Mode) Results at Test Site 4.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	-	N	N	-	-	A	A
22	NTSC	Y	Y	NTSC	-63.1	O	O
23	NTSC	Y	Y	NTSC	-48.2	O	O
24	NTSC	Y	Y	NTSC	-67.5	O	O
25	NTSC	Y	Y	NTSC	-66.6	O	O
26	NTSC	Y	Y	NTSC	-47.5	O	O
27	ATSC	Y	Y	ATSC	-47.3	O	O
28	ATSC	Y	N	-	-	O	O
29	ATSC	Y	Y	ATSC	-77.0	O	O
30	ATSC	Y	Y	ATSC	-78.1	O	O
31	NTSC	N	N	-	-	A	A
32	NTSC	Y	Y	NTSC	-42.2	O	O
33	ATSC	Y	Y	ATSC	-46.7	O	O
34	ATSC	Y	Y	ATSC	-37.2	O	O
35	ATSC	Y	Y	ATSC	-49.7	O	O
36	ATSC	Y	Y	ATSC	-45.5	O	O
38	ATSC	Y	Y	ATSC	-70.8	O	O
39	ATSC	Y	Y	ATSC	-45.7	O	O
40	ATSC	Y	Y	ATSC	-68.7	O	O
41	ATSC	Y	N	-	-	O	O
42	ATSC	Y	Y	ATSC	-74.0	O	O
43	ATSC	Y	Y	ATSC	-75.6	O	O
44	-	N	N	ATSC	-	A	A
45	NTSC	Y	Y	NTSC	-69.4	O	O
46	ATSC	Y	Y	ATSC	-68.9	O	O
47	NTSC	Y	Y	NTSC	-84.3	O	O
48	ATSC	Y	Y	ATSC	-52.1	O	O
49	NTSC	Y	Y	NTSC	-66.7	O	O
50	NTSC	Y	Y	NTSC	-40.0	O	O
51	ATSC	Y	Y	ATSC	-53.1	O	O

TABLE 5-25. Philips WSD Prototype Results at Test Site 4.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	-	-	O	O	O	O
22	NTSC	Y	Y	NTSC	-63.1	O	O	O	O
23	NTSC	Y	Y	NTSC	-48.2	O	O	O	O
24	NTSC	Y	Y	NTSC	-67.5	O	O	O	O
25	NTSC	Y	Y	NTSC	-66.6	O	O	O	O
26	NTSC	Y	Y	NTSC	-47.5	O	O	O	O
27	ATSC	Y	Y	ATSC	-47.3	O	O	O	O
28	ATSC	Y	N	-	-	O	O	O	O
29	ATSC	Y	Y	ATSC	-77.0	O	O	O	O
30	ATSC	Y	Y	ATSC	-78.1	O	O	O	O
31	NTSC	N	N	-	-	O	O	O	A
32	NTSC	Y	Y	NTSC	-42.2	O	O	O	O
33	ATSC	Y	Y	ATSC	-46.7	O	O	O	O
34	ATSC	Y	Y	ATSC	-37.2	O	O	O	O
35	ATSC	Y	Y	ATSC	-49.7	O	O	O	O
36	ATSC	Y	Y	ATSC	-45.5	O	O	O	O
38	ATSC	Y	Y	ATSC	-70.8	O	O	O	O
39	ATSC	Y	Y	ATSC	-45.7	O	O	O	O
40	ATSC	Y	Y	ATSC	-68.7	O	O	O	O
41	ATSC	Y	N	-	-	O	O	O	O
42	ATSC	Y	Y	ATSC	-74.0	O	O	O	O
43	ATSC	Y	Y	ATSC	-75.6	O	O	O	O
44	-	N	N	ATSC	-	A	A	A	A
45	NTSC	Y	Y	NTSC	-69.4	O	O	O	O
46	ATSC	Y	Y	ATSC	-68.9	O	O	O	O
47	NTSC	Y	Y	NTSC	-84.3	O	O	O	O
48	ATSC	Y	Y	ATSC	-52.1	O	O	O	O
49	NTSC	Y	Y	NTSC	-66.7	O	O	O	O
50	NTSC	Y	Y	NTSC	-40.0	O	O	O	O
51	ATSC	Y	Y	ATSC	-53.1	O	O	O	O

TABLE 5-26. Philips WSD Prototype Results at Test Site 4 (w/ 10-dB attenuator).

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	-	N	N	-	-	O	A
22	NTSC	Y	Y	NTSC	-63.1	O	O
23	NTSC	Y	Y	NTSC	-48.2	O	O
24	NTSC	Y	Y	NTSC	-67.5	O	O
25	NTSC	Y	Y	NTSC	-66.6	O	O
26	NTSC	Y	Y	NTSC	-47.5	O	O
27	ATSC	Y	Y	ATSC	-47.3	O	O
28	ATSC	Y	N	-	-	O	A
29	ATSC	Y	Y	ATSC	-77.0	O	O
30	ATSC	Y	Y	ATSC	-78.1	O	O
31	NTSC	N	N	-	-	A	A
32	NTSC	Y	Y	NTSC	-42.2	O	O
33	ATSC	Y	Y	ATSC	-46.7	O	O
34	ATSC	Y	Y	ATSC	-37.2	O	O
35	ATSC	Y	Y	ATSC	-49.7	O	O
36	ATSC	Y	Y	ATSC	-45.5	O	O
38	ATSC	Y	Y	ATSC	-70.8	O	O
39	ATSC	Y	Y	ATSC	-45.7	O	O
40	ATSC	Y	Y	ATSC	-68.7	O	O
41	ATSC	Y	N	-	-	O	O
42	ATSC	Y	Y	ATSC	-74.0	O	O
43	ATSC	Y	Y	ATSC	-75.6	O	O
44	-	N	N	ATSC	-	A	A
45	NTSC	Y	Y	NTSC	-69.4	O	O
46	ATSC	Y	Y	ATSC	-68.9	O	O
47	NTSC	Y	Y	NTSC	-84.3	O	O
48	ATSC	Y	Y	ATSC	-52.1	O	O
49	NTSC	Y	Y	NTSC	-66.7	O	O
50	NTSC	Y	Y	NTSC	-40.0	O	O
51	ATSC	Y	Y	ATSC	-53.1	O	O

5.5 Test Site #5 – FCC Headquarters in Washington, DC

This site is a high-rise office building in downtown southwest Washington, DC. Field trials of the WSD prototypes were performed in a training room on the 12^{th} street level (ground floor) and in an area on the 7^{th} floor near a window. Channel occupancy measurements were performed at the same locations, using a bi-conical receive antenna mounted on a tripod.

TABLE 5-27. Licensed TV Station Assignments within 100-km radius of Test Site 5.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)	
						L1	L2
21	-	-	-	-	N	N	N
22	WMPT	Annapolis, MD	NTSC	39.00	Y	N	Y
23	WDDN-LP	Washington, DC	NTSC	13.22	Y	N	Y
24	WUTB	Baltimore, MD	NTSC	50.54	Y	N	Y
25	WZDC-LP	Washington, DC	NTSC	7.81	Y	N	Y
26	WETA	Washington, DC	NTSC	11.13	Y	Y	Y
27	WETA	Washington, DC	ATSC	8.68	Y	N	Y
28	WFPT	Frederick, MD	ATSC	48.54	Y	N	N
29	WMPB	Baltimore, MD	ATSC	66.21	Y	N	N
30	WNVT	Goldvein, VA	ATSC	45.51	Y	N	N
31	WRZB-LP	Annapolis, MD	NTSC	42.79	N	N	N
32	WHUT	Washington, DC	NTSC	11.13	Y	Y	Y
33	WHUT	Washington, DC	ATSC	8.68	Y	N	Y
34	WUSA	Washington, DC	ATSC	8.68	Y	N	Y
35	WDCA	Washington, DC	ATSC	9.38	Y	N	Y
36	WTTG	Washington, DC	ATSC	9.38	Y	Y	Y
38	WJZ	Baltimore, MD	ATSC	59.85	Y	N	Y
39	WJLA	Washington, DC	ATSC	8.68	Y	N	Y
40	WNUV	Baltimore, MD	ATSC	60.03	Y	N	Y
41	WUTB	Baltimore, MD	ATSC	50.54	Y	N	N
42	WMPT	Annapolis, MD	ATSC	39.00	Y	N	N
43	WPXW	Manassas, VA	ATSC	28.2	Y	N	N
44	-	-	-	-	N	N	N
45	WBFF	Baltimore, MD	NTSC	60.03	Y	Y	Y
46	WBFF	Baltimore, MD	ATSC	60.03	Y	N	Y
47	WMDO-CA	Washington, DC	NTSC	7.82	Y	N	N
48	WRC	Washington, DC	ATSC	7.82	Y	Y	Y
49	WWTD-LP	Washington, DC	NTSC	7.82	Y	N	Y
50	WDCW	Washington, DC	NTSC	8.79	Y	Y	Y
51	WDCW	Washington, DC	ATSC	8.79	Y	N	Y

TABLE 5-28. Adaptrum WSD Prototype Results at Test Site 5.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)		Measured Signal Type1		Measured Power Level (dBm)		Occupied (O) & Available (A) Channels Reported by WSD			
									L1/ S1	L1/ S2 [2]	L2/ S1	L2/ S2[2]
			L1	L2	L1	L2	L1	L2				
21	-	N	N	N	-	NT	-	-	A	-	A	A
22	NTSC	Y	N	Y	NT	NT	-96.5	-91.7	A	A	O	O
23	NTSC	Y	N	Y	-	NT	-	-74.8	A	-	O	O
24	NTSC	Y	N	Y	-	NT	-	-87.5	A	-	O	O
25	NTSC	Y	N	Y	NT	NT	-92.4	-74.9	O	A	O	O
26	NTSC	Y	Y	Y	NT	NT	-77.0	-61.4	O	O	O	O
27	ATSC	Y	N	Y	AT	AT	-92.3	-72.2	O	-	O	-
28	ATSC	Y	N	N	-	-	-	-	A	-	A	-
29	ATSC	Y	N	N	-	-	-	-	O	-	O	O
30	ATSC	Y	N	N	-	AT	-	-92.1	A	-	O	-
31	NTSC	N	N	N	-	-	-	-	A	-	O	-
32	NTSC	Y	Y	Y	NT	NT	-80.9	-56.9	O	O	O	O
33	ATSC	Y	N	Y	AT	AT	-87.1	-75.3	O	-	O	-
34	ATSC	Y	N	Y	AT	AT	-84.1	-63.9	O	-	O	-
35	ATSC	Y	N	Y	AT	AT	-83.3	-62.6	O	-	O	-
36	ATSC	Y	Y	Y	AT	AT	-86.2	-62.4	O	-	O	-
38	ATSC	Y	N	Y	AT	AT	-93.5	-72.4	O	-	O	-
39	ATSC	Y	N	Y	AT	AT	-87.1	-70.8	O	-	O	-
40	ATSC	Y	N	Y	AT	AT	-92.7	-72.4	A	-	O	-
41	ATSC	Y	N	N	-	-	-	-	A	-	O	-
42	ATSC	Y	N	N	-	AT	-	-88.4	A	-	A	-
43	ATSC	Y	N	N	-	AT	-	-92.9	A	-	A	-
44	-	N	N	N	-	-	-	-	A	-	A	-
45	NTSC	Y	Y	Y	NT	NT	-105	-75.4	A	A	A	A
46	ATSC	Y	N	Y	AT	AT	-88.5	-73.3	O	-	O	-
47	NTSC	Y	N	N	-	-	-	-	A	-	A	-
48	ATSC	Y	Y	Y	AT	AT	-79.2	-52.2	O	-	O	-
49	NTSC	Y	N	Y	NT	NT	-101	-81.7	A	A	O	O
50	NTSC	Y	Y	Y	NT	NT	-80.0	-71.7	O	O	O	O
51	ATSC	Y	N	Y	AT	AT	-86.5	-67.4	O	-	O	-

[1] **NT = NTSC; AT = ATSC.**
[2] Second scan for NTSC signals only.

TABLE 5-29. I2R WSD Prototype Results at Test Site 5.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)		Measured Signal Type[1]		Measured Power Level (dBm)		Occupied (O) & Available (A) Channels Reported by WSD			
			L1	L2	L1	L2	L1	L2	L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	N	-	NT	-	-	A	A	A	A
22	NTSC	Y	N	Y	NT	NT	-96.5	-91.7	A	A	A	A
23	NTSC	Y	N	Y	-	NT	-	-74.8	A	A	A	A
24	NTSC	Y	N	Y	-	NT	-	-87.5	A	A	A	A
25	NTSC	Y	N	Y	NT	NT	-92.4	-74.9	A	A	A	A
26	NTSC	Y	Y	Y	NT	NT	-77.0	-61.4	O	A	O	O
27	ATSC	Y	N	Y	AT	AT	-92.3	-72.2	O	O	O	O
28	ATSC	Y	N	N	-	-	-	-	A	A	A	A
29	ATSC	Y	N	N	-	-	-	-	A	A	O	O
30	ATSC	Y	N	N	-	AT	-	-92.1	A	A	O	O
31	NTSC	N	N	N	-	-	-	-	A	A	A	A
32	NTSC	Y	Y	Y	NT	NT	-80.9	-56.9	A	A	A	A
33	ATSC	Y	N	Y	AT	AT	-87.1	-75.3	O	O	O	O
34	ATSC	Y	N	Y	AT	AT	-84.1	-63.9	O	O	O	O
35	ATSC	Y	N	Y	AT	AT	-83.3	-62.6	O	O	O	O
36	ATSC	Y	Y	Y	AT	AT	-86.2	-62.4	O	O	O	O
38	ATSC	Y	N	Y	AT	AT	-93.5	-72.4	A	A	O	O
39	ATSC	Y	N	Y	AT	AT	-87.1	-70.8	O	O	O	O
40	ATSC	Y	N	Y	AT	AT	-92.7	-72.4	A	A	O	O
41	ATSC	Y	N	N	-	-	-	-	A	A	A	A
42	ATSC	Y	N	N	-	AT	-	-88.4	A	A	O	O
43	ATSC	Y	N	N	-	AT	-	-92.9	A	A	O	O
44	-	N	N	N	-	-	-	-	A	A	A	A
45	NTSC	Y	Y	Y	NT	NT	-105	-75.4	A	A	A	A
46	ATSC	Y	N	Y	AT	AT	-88.5	-73.3	A	A	O	O
47	NTSC	Y	N	N	-	-	-	-	A	A	A	A
48	ATSC	Y	Y	Y	AT	AT	-79.2	-52.2	O	O	O	O
49	NTSC	Y	N	Y	NT	NT	-101	-81.7	A	A	O	A
50	NTSC	Y	Y	Y	NT	NT	-80.0	-71.7	A	A	A	A
51	ATSC	Y	N	Y	AT	AT	-86.5	-67.4	O	O	O	O

[1] NT = NTSC; AT = ATSC.

TABLE 5-30. Motorola WSD Prototype (Test Mode) Results at Test Site 5.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)		Measured Signal Type[1]		Measured Power Level (dBm)		Occupied (O) & Available (A) Channels Reported by WSD			
			L1	L2	L1	L2	L1	L2	L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	N	-	NT	-	-	-	-	-	-
22	NTSC	Y	N	Y	NT	NT	-96.5	-91.7	-	-	-	-
23	NTSC	Y	N	Y	-	NT	-	-74.8	-	-	-	-
24	NTSC	Y	N	Y	-	NT	-	-87.5	-	-	-	-
25	NTSC	Y	N	Y	NT	NT	-92.4	-74.9	-	-	-	-
26	NTSC	Y	Y	Y	NT	NT	-77.0	-61.4	-	-	-	-
27	ATSC	Y	N	Y	AT	AT	-92.3	-72.2	O	O	O	O
28	ATSC	Y	N	N	-	-	-	-	-	-	-	-
29	ATSC	Y	N	N	-	-	-	-	-	-	-	-
30	ATSC	Y	N	N	-	AT	-	-92.1	-	-	A	A
31	NTSC	N	N	N	-	-	-	-	-	-	-	-
32	NTSC	Y	Y	Y	NT	NT	-80.9	-56.9	-	-	-	-
33	ATSC	Y	N	Y	AT	AT	-87.1	-75.3	A	A	A	A
34	ATSC	Y	N	Y	AT	AT	-84.1	-63.9	O	O	O	O
35	ATSC	Y	N	Y	AT	AT	-83.3	-62.6	O	O	O	O
36	ATSC	Y	Y	Y	AT	AT	-86.2	-62.4	O	O	O	O
38	ATSC	Y	N	Y	AT	AT	-93.5	-72.4	O	A	O	O
39	ATSC	Y	N	Y	AT	AT	-87.1	-70.8	O	O	O	A
40	ATSC	Y	N	Y	AT	AT	-92.7	-72.4	O	A	O	O
41	ATSC	Y	N	N	-	-	-	-	-	-	O	O
42	ATSC	Y	N	N	-	AT	-	-88.4	O	O	O	O
43	ATSC	Y	N	N	-	AT	-	-92.9	-	O	O	O
44	-	N	N	N	-	-	-	-	-	-	-	-
45	NTSC	Y	Y	Y	NT	NT	-105	-75.4	-	-	-	-
46	ATSC	Y	N	Y	AT	AT	-88.5	-73.3	A	A	O	O
47	NTSC	Y	N	N	-	-	-	-	-	-	-	-
48	ATSC	Y	Y	Y	AT	AT	-79.2	-52.2	O	O	O	O
49	NTSC	Y	N	Y	NT	NT	-101	-81.7	-	-	-	-
50	NTSC	Y	Y	Y	NT	NT	-80.0	-71.7	-	-	-	-
51	ATSC	Y	N	Y	AT	AT	-86.5	-67.4	O	O	O	O

[1] **NT = NTSC; AT = ATSC.**
NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).

TABLE 5-31. Motorola WSD Prototype (Normal Mode) Results at Test Site 5.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)		Measured Signal Type[1]		Measured Power Level (dBm)		Occupied (O) & Available (A) Channels Reported by WSD	
			L1	L2	L1	L2	L1	L2	L1/ S1	L2/ S1
21	-	N	N	N	-	NT	-	-	A	A
22	NTSC	Y	N	Y	NT	NT	-96.5	-91.7	O	O
23	NTSC	Y	N	Y	-	NT	-	-74.8	O	O
24	NTSC	Y	N	Y	-	NT	-	-87.5	O	O
25	NTSC	Y	N	Y	NT	NT	-92.4	-74.9	O	O
26	NTSC	Y	Y	Y	NT	NT	-77.0	-61.4	O	O
27	ATSC	Y	N	Y	AT	AT	-92.3	-72.2	O	O
28	ATSC	Y	N	N	-	-	-	-	O	O
29	ATSC	Y	N	N	-	-	-	-	O	O
30	ATSC	Y	N	N	-	AT	-	-92.1	O	O
31	NTSC	N	N	N	-	-	-	-	A	A
32	NTSC	Y	Y	Y	NT	NT	-80.9	-56.9	O	O
33	ATSC	Y	N	Y	AT	AT	-87.1	-75.3	O	O
34	ATSC	Y	N	Y	AT	AT	-84.1	-63.9	O	O
35	ATSC	Y	N	Y	AT	AT	-83.3	-62.6	O	O
36	ATSC	Y	Y	Y	AT	AT	-86.2	-62.4	O	O
38	ATSC	Y	N	Y	AT	AT	-93.5	-72.4	O	O
39	ATSC	Y	N	Y	AT	AT	-87.1	-70.8	O	O
40	ATSC	Y	N	Y	AT	AT	-92.7	-72.4	O	O
41	ATSC	Y	N	N	-	-	-	-	O	O
42	ATSC	Y	N	N	-	AT	-	-88.4	O	O
43	ATSC	Y	N	N	-	AT	-	-92.9	O	O
44	-	N	N	N	-	-	-	-	A	A
45	NTSC	Y	Y	Y	NT	NT	-105	-75.4	O	O
46	ATSC	Y	N	Y	AT	AT	-88.5	-73.3	O	O
47	NTSC	Y	N	N	-	-	-	-	O	O
48	ATSC	Y	Y	Y	AT	AT	-79.2	-52.2	O	O
49	NTSC	Y	N	Y	NT	NT	-101	-81.7	O	O
50	NTSC	Y	Y	Y	NT	NT	-80.0	-71.7	O	O
51	ATSC	Y	N	Y	AT	AT	-86.5	-67.4	O	O

[1] NT = NTSC; AT = ATSC.

TABLE 5-32. Philips WSD Prototype Results at Test Site 5.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)		Measured Signal Type[1]		Measured Power Level (dBm)		Occupied (O) & Available (A) Channels Reported by WSD			
			L1	L2	L1	L2	L1	L2	L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	-	N	N	N	-	NT	-	-	O	O	O	O
22	NTSC	Y	N	Y	NT	NT	-96.5	-91.7	O	O	O	O
23	NTSC	Y	N	Y	-	NT	-	-74.8	O	O	O	O
24	NTSC	Y	N	Y	-	NT	-	-87.5	O	O	O	O
25	NTSC	Y	N	Y	NT	NT	-92.4	-74.9	O	O	O	O
26	NTSC	Y	Y	Y	NT	NT	-77.0	-61.4	O	O	O	O
27	ATSC	Y	N	Y	AT	AT	-92.3	-72.2	O	O	O	O
28	ATSC	Y	N	N	-	-	-	-	A	O	A	A
29	ATSC	Y	N	N	-	-	-	-	O	O	O	O
30	ATSC	Y	N	N	-	AT	-	-92.1	O	O	O	O
31	NTSC	N	N	N	-	-	-	-	O	O	O	O
32	NTSC	Y	Y	Y	NT	NT	-80.9	-56.9	O	O	O	O
33	ATSC	Y	N	Y	AT	AT	-87.1	-75.3	O	O	O	O
34	ATSC	Y	N	Y	AT	AT	-84.1	-63.9	O	O	O	O
35	ATSC	Y	N	Y	AT	AT	-83.3	-62.6	O	O	O	O
36	ATSC	Y	Y	Y	AT	AT	-86.2	-62.4	O	O	O	O
38	ATSC	Y	N	Y	AT	AT	-93.5	-72.4	O	O	O	O
39	ATSC	Y	N	Y	AT	AT	-87.1	-70.8	O	O	O	O
40	ATSC	Y	N	Y	AT	AT	-92.7	-72.4	O	O	O	O
41	ATSC	Y	N	N	-	-	-	-	O	O	O	O
42	ATSC	Y	N	N	-	AT	-	-88.4	O	A	O	O
43	ATSC	Y	N	N	-	AT	-	-92.9	O	O	O	O
44	-	N	N	N	-	-	-	-	A	A	O	A
45	NTSC	Y	Y	Y	NT	NT	-105	-75.4	O	O	O	O
46	ATSC	Y	N	Y	AT	AT	-88.5	-73.3	O	O	O	O
47	NTSC	Y	N	N	-	-	-	-	O	O	O	O
48	ATSC	Y	Y	Y	AT	AT	-79.2	-52.2	O	O	O	O
49	NTSC	Y	N	Y	NT	NT	-101	-81.7	O	O	O	O
50	NTSC	Y	Y	Y	NT	NT	-80.0	-71.7	O	O	O	O
51	ATSC	Y	N	Y	AT	AT	-86.5	-67.4	O	O	O	O

[1] **NT = NTSC; AT = ATSC.**

TABLE 5-33. Philips WSD Prototype Results at Test Site 5 (Loc1) w/ 10-dB attenuator.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD
21	-	N	N	-	-	A
22	NTSC	Y	N	NTSC	-96.5	O
23	NTSC	Y	N	-	-	O
24	NTSC	Y	N	-	-	O
25	NTSC	Y	N	NTSC	-92.4	O
26	NTSC	Y	Y	NTSC	-77.0	O
27	ATSC	Y	N	ATSC	-92.3	O
28	ATSC	Y	N	-	-	A
29	ATSC	Y	N	-	-	O
30	ATSC	Y	N	-	-	O
31	NTSC	N	N	-	-	A
32	NTSC	Y	Y	NTSC	-80.9	O
33	ATSC	Y	N	ATSC	-87.1	O
34	ATSC	Y	N	ATSC	-84.1	O
35	ATSC	Y	N	ATSC	-83.3	O
36	ATSC	Y	Y	ATSC	-86.2	O
38	ATSC	Y	N	ATSC	-93.5	O
39	ATSC	Y	N	ATSC	-87.1	O
40	ATSC	Y	N	ATSC	-92.7	O
41	ATSC	Y	N	-	-	O
42	ATSC	Y	N	-	-	A
43	ATSC	Y	N	-	-	A
44	-	N	N	-	-	A
45	NTSC	Y	Y	NTSC	-105	O
46	ATSC	Y	N	ATSC	-88.5	A
47	NTSC	Y	N	-	-	A
48	ATSC	Y	Y	ATSC	-79.2	O
49	NTSC	Y	N	NTSC	-101	O
50	NTSC	Y	Y	NTSC	-80.0	O
51	ATSC	Y	N	ATSC	-86.5	O

5.6 Test Site #6 – Private Residence in Galesville, MD

This site is a two-story single-family waterfront home with a detached garage. The channel occupancy measurements were performed from the driveway. The WSD prototype field trials were performed from the first floor great room (location 1) and from a guest room over the detached garage (location 2).

TABLE 5-34. Licensed TV Station Assignments within 100-km radius of Test Site 6.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	WBOC	Salisbury, MD	ATSC	86.95	N	Y
22	WMPT	Annapolis, MD	NTSC	19.16	Y	Y
23	WDDN-LP	Washington, DC	NTSC	47.76	N	Y
24	WUTB	Baltimore, MD	NTSC	52.57	Y	Y
25	WZDC-LP	Washington, DC	NTSC	47.87	N	Y
26	WETA	Washington, DC	NTSC	50.42	Y	Y
27	WETA	Washington, DC	ATSC	47.97	Y	Y
28	WFPT	Frederick, MD	ATSC	80.95	N	N
	WCPB	Salisbury, MD	NTSC	97.26	N	N
29	WMPB	Baltimore, MD	ATSC	69.89	Y	Y
30	WNVT	Goldvein, VA	ATSC	81.52	N	N
31	WRZB-LP	Annapolis, MD	NTSC	15.75	N	N
32	WHUT	Washington, DC	NTSC	50.46	Y	Y
33	WHUT	Washington, DC	ATSC	47.97	Y	Y
34	WUSA	Washington, DC	ATSC	47.97	Y	Y
35	WDCA	Washington, DC	ATSC	48.41	Y	Y
36	WTTG	Washington, DC	ATSC	48.41	Y	Y
38	WJZ	Baltimore, MD	ATSC	55.13	Y	Y
39	WJLA	Washington, DC	ATSC	47.97	Y	Y
40	WNUV	Baltimore, MD	ATSC	55.26	Y	Y
41	WUTB	Baltimore, MD	ATSC	52.57	Y	Y
42	WMPT	Annapolis, MD	ATSC	19.16	Y	Y
43	WPXW	Manassas, VA	ATSC	68.60	Y	N
44	WDPB	Seaford, DE	ATSC	83.72	N	N
45	WBFF	Baltimore, MD	NTSC	55.26	Y	Y
46	WBFF	Baltimore, MD	ATSC	55.26	Y	Y
47	WMDT	Salisbury, MD	NTSC	80.11	N	N
48	WRC	Washington, DC	ATSC	47.87	Y	Y
49	WWTD-LP	Washington, DC	NTSC	47.87	N	Y
50	WDCW	Washington, DC	NTSC	43.89	Y	Y
51	WDCW	Washington, DC	ATSC	43.89	Y	Y

TABLE 5-35. Adaptrum WSD Prototype Results at Test Site 6.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L1/ S2 [1]
21	ATSC	N	Y	ATSC	-79.1	O	-
22	NTSC	Y	Y	NTSC	-42.4	O	O
23	NTSC	N	Y	NTSC	-72.2	A	A
24	NTSC	Y	Y	NTSC	-59.0	O	O
25	NTSC	N	Y	NTSC	-90.2	A	A
26	NTSC	Y	Y	NTSC	-68.6	O	O
27	ATSC	Y	Y	ATSC	-72.3	O	-
28	ATSC	N	N	NTSC	-99.6	A	A
	NTSC	N	N				
29	ATSC	Y	Y	ATSC	-76.9	O	O
30	ATSC	N	N	ATSC	-90.0	A	-
31	NTSC	N	N	-	-	A	-
32	NTSC	Y	Y	NTSC	-67.5	O	A
33	ATSC	Y	Y	ATSC	-70.8	O	-
34	ATSC	Y	Y	ATSC	-63.5	O	-
35	ATSC	Y	Y	ATSC	-71.4	A	-
36	ATSC	Y	Y	ATSC	-73.1	O	-
38	ATSC	Y	Y	ATSC	-56.9	O	-
39	ATSC	Y	Y	ATSC	-64.0	O	-
40	ATSC	Y	Y	ATSC	-53.7	O	-
41	ATSC	Y	Y	ATSC	-75.5	O	-
42	ATSC	Y	Y	ATSC	-44.8	O	-
43	ATSC	Y	N	NTSC	-98.0	A	A
44	ATSC	N	N	-	-	A	-
45	NTSC	Y	Y	NTSC	-61.7	O	O
46	ATSC	Y	Y	ATSC	-54.3	O	-
47	NTSC	N	N	NTSC	-96.3	A	A
48	ATSC	Y	Y	ATSC	-68.5	O	-
49	NTSC	N	Y	NTSC	-89.1	A	A
50	NTSC	Y	Y	NTSC	-70.0	A	A
51	ATSC	Y	Y	ATSC	-76.7	O	-

[1] Second scan for NTSC signals only.

TABLE 5-36. I2R WSD Prototype Results at Test Site 6.

CH	NTSC/ ATSC	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	Y	ATSC	-79.1	O	O	A	A
22	NTSC	Y	Y	NTSC	-42.4	A	A	O	A
23	NTSC	N	Y	NTSC	-72.2	A	A	A	A
24	NTSC	Y	Y	NTSC	-59.0	O	O	A	A
25	NTSC	N	Y	NTSC	-90.2	A	A	A	A
26	NTSC	Y	Y	NTSC	-68.6	A	A	O	O
27	ATSC	Y	Y	ATSC	-72.3	A	O	O	O
28	ATSC	N	N	NTSC	-99.6	A	A	A	A
	NTSC	N	N						
29	ATSC	Y	Y	ATSC	-76.9	O	O	O	O
30	ATSC	N	N	ATSC	-90.0	A	A	O	O
31	NTSC	N	N	-	-	O	O	A	A
32	NTSC	Y	Y	NTSC	-67.5	A	A	A	A
33	ATSC	Y	Y	ATSC	-70.8	O	O	O	O
34	ATSC	Y	Y	ATSC	-63.5	O	O	O	O
35	ATSC	Y	Y	ATSC	-71.4	O	O	O	O
36	ATSC	Y	Y	ATSC	-73.1	O	O	O	O
38	ATSC	Y	Y	ATSC	-56.9	O	O	O	O
39	ATSC	Y	Y	ATSC	-64.0	O	O	O	O
40	ATSC	Y	Y	ATSC	-53.7	O	O	O	O
41	ATSC	Y	Y	ATSC	-75.5	A	A	O	O
42	ATSC	Y	Y	ATSC	-44.8	O	O	O	O
43	ATSC	Y	N	NTSC	-98.0	A	A	O	O
44	ATSC	N	N	-	-	A	A	A	A
45	NTSC	Y	Y	NTSC	-61.7	A	A	O	A
46	ATSC	Y	Y	ATSC	-54.3	O	O	O	O
47	NTSC	N	N	NTSC	-96.3	A	A	O	O
48	ATSC	Y	Y	ATSC	-68.5	O	O	O	O
49	NTSC	N	Y	NTSC	-89.1	A	A	A	A
50	NTSC	Y	Y	NTSC	-70.0	A	A	A	O
51	ATSC	Y	Y	ATSC	-76.7	O	O	O	O

TABLE 5-37. Motorola WSD Prototype (Test Mode) Results at Test Site 6.

CH	NTSC/ ATSC	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	Y	ATSC	-79.1	O	O	O	O
22	NTSC	Y	Y	NTSC	-42.4	-	-	-	-
23	NTSC	N	Y	NTSC	-72.2	-	-	-	-
24	NTSC	Y	Y	NTSC	-59.0	-	-	-	-
25	NTSC	N	Y	NTSC	-90.2	-	-	-	-
26	NTSC	Y	Y	NTSC	-68.6	-	-	-	-
27	ATSC	Y	Y	ATSC	-72.3	O	O	O	O
28	ATSC	N	N	NTSC	-99.6	-	-	-	-
	NTSC	N	N						
29	ATSC	Y	Y	ATSC	-76.9	O	O	O	A
30	ATSC	N	N	ATSC	-90.0	A	A	A	A
31	NTSC	N	N	-	-	-	-	-	-
32	NTSC	Y	Y	NTSC	-67.5	-	-	-	-
33	ATSC	Y	Y	ATSC	-70.8	A	A	A	A
34	ATSC	Y	Y	ATSC	-63.5	O	O	O	O
35	ATSC	Y	Y	ATSC	-71.4	O	O	O	O
36	ATSC	Y	Y	ATSC	-73.1	A	A	O	O
38	ATSC	Y	Y	ATSC	-56.9	O	O	O	O
39	ATSC	Y	Y	ATSC	-64.0	O	O	O	O
40	ATSC	Y	Y	ATSC	-53.7	O	O	O	O
41	ATSC	Y	Y	ATSC	-75.5	O	O	O	O
42	ATSC	Y	Y	ATSC	-44.8	O	O	O	O
43	ATSC	Y	N	NTSC	-98.0	O	O	O	O
44	ATSC	N	N	-	-	-	-	-	-
45	NTSC	Y	Y	NTSC	-61.7	-	-	-	-
46	ATSC	Y	Y	ATSC	-54.3	O	O	O	O
47	NTSC	N	N	NTSC	-96.3	-	-	-	-
48	ATSC	Y	Y	ATSC	-68.5	O	O	O	O
49	NTSC	N	Y	NTSC	-89.1	-	-	-	-
50	NTSC	Y	Y	NTSC	-70.0	-	-	-	-
51	ATSC	Y	Y	ATSC	-76.7	O	O	O	O
NOTE: In the test mode this device detects ATSC signals only (*i.e.*, no NTSC detection capability).									

TABLE 5-38. Motorola WSD Prototype (Normal Mode) Results at Test Site 6.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L1/ S2
21	ATSC	N	Y	ATSC	-79.1	A	A
22	NTSC	Y	Y	NTSC	-42.4	O	O
23	NTSC	N	Y	NTSC	-72.2	A	A
24	NTSC	Y	Y	NTSC	-59.0	O	O
25	NTSC	N	Y	NTSC	-90.2	A	A
26	NTSC	Y	Y	NTSC	-68.6	O	O
27	ATSC	Y	Y	ATSC	-72.3	O	O
28	ATSC	N	N	NTSC	-99.6	A	A
	NTSC	N	N				
29	ATSC	Y	Y	ATSC	-76.9	O	O
30	ATSC	N	N	ATSC	-90.0	A	A
31	NTSC	N	N	-	-	A	A
32	NTSC	Y	Y	NTSC	-67.5	O	O
33	ATSC	Y	Y	ATSC	-70.8	O	O
34	ATSC	Y	Y	ATSC	-63.5	O	O
35	ATSC	Y	Y	ATSC	-71.4	O	O
36	ATSC	Y	Y	ATSC	-73.1	O	O
38	ATSC	Y	Y	ATSC	-56.9	O	O
39	ATSC	Y	Y	ATSC	-64.0	O	O
40	ATSC	Y	Y	ATSC	-53.7	O	O
41	ATSC	Y	Y	ATSC	-75.5	O	O
42	ATSC	Y	Y	ATSC	-44.8	O	O
43	ATSC	Y	N	NTSC	-98.0	O	O
44	ATSC	N	N	-	-	A	A
45	NTSC	Y	Y	NTSC	-61.7	O	O
46	ATSC	Y	Y	ATSC	-54.3	O	O
47	NTSC	N	N	NTSC	-96.3	A	A
48	ATSC	Y	Y	ATSC	-68.5	O	O
49	NTSC	N	Y	NTSC	-89.1	A	A
50	NTSC	Y	Y	NTSC	-70.0	O	O
51	ATSC	Y	Y	ATSC	-76.7	O	O

TABLE 5-39. Philips WSD Prototype Results at Test Site 6.

CH	NTSC/ ATSC	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	Y	ATSC	-79.1	O	O	O	O
22	NTSC	Y	Y	NTSC	-42.4	O	O	O	O
23	NTSC	N	Y	NTSC	-72.2	O	O	O	O
24	NTSC	Y	Y	NTSC	-59.0	O	O	O	O
25	NTSC	N	Y	NTSC	-90.2	O	O	O	O
26	NTSC	Y	Y	NTSC	-68.6	O	O	O	O
27	ATSC	Y	Y	ATSC	-72.3	O	O	O	O
28	ATSC	N	N	NTSC	-99.6	O	O	O	O
	NTSC	N	N						
29	ATSC	Y	Y	ATSC	-76.9	O	O	O	O
30	ATSC	N	N	ATSC	-90.0	O	O	O	O
31	NTSC	N	N	-	-	O	O	O	O
32	NTSC	Y	Y	NTSC	-67.5	O	O	O	O
33	ATSC	Y	Y	ATSC	-70.8	O	O	O	O
34	ATSC	Y	Y	ATSC	-63.5	O	O	O	O
35	ATSC	Y	Y	ATSC	-71.4	O	O	O	O
36	ATSC	Y	Y	ATSC	-73.1	O	O	O	O
38	ATSC	Y	Y	ATSC	-56.9	O	O	O	O
39	ATSC	Y	Y	ATSC	-64.0	O	O	O	O
40	ATSC	Y	Y	ATSC	-53.7	O	O	O	O
41	ATSC	Y	Y	ATSC	-75.5	O	O	O	O
42	ATSC	Y	Y	ATSC	-44.8	O	O	O	O
43	ATSC	Y	N	NTSC	-98.0	O	O	O	O
44	ATSC	N	N	-	-	A	A	A	O
45	NTSC	Y	Y	NTSC	-61.7	O	O	O	O
46	ATSC	Y	Y	ATSC	-54.3	O	O	O	O
47	NTSC	N	N	NTSC	-96.3	O	O	O	O
48	ATSC	Y	Y	ATSC	-68.5	O	O	O	O
49	NTSC	N	Y	NTSC	-89.1	O	O	O	O
50	NTSC	Y	Y	NTSC	-70.0	O	O	O	O
51	ATSC	Y	Y	ATSC	-76.7	O	O	O	O

5.7 Test Site #7 – Daub's Park in Myersville, MD

This site is a public baseball park located just outside of Myersville, in rural western Maryland. This was one of four sites recommended for measurement by MSTV.[35] Channel occupancy measurements were performed at the northwest end of the parking lot and the WSD prototype field trials were performed at the northwest and southwest end of the parking lot.

[35] See *ex parte* filing by MSTV filed on July 2, 2008.

TABLE 5-40. Licensed TV Station Assignments within 100-km radius of Test Site 7.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	WVPY	Front Royal, VA	ATSC	90.16	N	N
22	WMPT	Annapolis, MD	NTSC	99.07	N	Y
23	WDDN-LP	Washington, DC	NTSC	71.27	N	Y
24	WUTB	Baltimore, MD	NTSC	73.20	N	Y
25	WHAG	Hagerstown, MD	NTSC	38.61	Y	Y
26	WETA	Washington, DC	NTSC	72.19	N	Y
27	WETA	Washington, DC	ATSC	74.63	N	Y
28	WFPT	Frederick, MD	ATSC	34.92	Y	N
29	WMPB	Baltimore, MD	ATSC	67.55	Y	N
30	WNVT	Goldvein, VA	ATSC	98.26	N	Y
	WGCB	Red Lion, PA	ATSC	94.70	N	
31	WWPB	Hagerstown, MD	NTSC	38.60	Y	Y
32	WHUT	Washington, DC	NTSC	72.19	N	N
33	WHUT	Washington, DC	ATSC	74.63	N	Y
34	WUSA	Washington, DC	ATSC	74.63	Y	Y
35	WDCA	Washington, DC	ATSC	73.93	Y	Y
36	WTTG	Washington, DC	ATSC	73.93	Y	Y
38	WJZ	Baltimore, MD	ATSC	80.73	Y	Y
39	WJLA	Washington, DC	ATSC	74.63	Y	Y
40	WNUV	Baltimore, MD	ATSC	80.78	Y	N
41	WUTB	Baltimore, MD	ATSC	73.20	Y	N
42	WMPT	Annapolis, MD	ATSC	99.07	N	N
	WVPY	Front Royal, VA	NTSC	90.16	N	
43	WPXW	Manassas, VA	ATSC	82.48	N	Y
44	WWPB	Hagerstown, MD	ATSC	38.60	Y	N
45	WBFF	Baltimore, MD	NTSC	80.78	N	Y
46	WBFF	Baltimore, MD	ATSC	80.78	Y	N
47	WMDO-CA	Washington, DC	NTSC	75.49	N	Y
48	WRC	Washington, DC	ATSC	75.49	Y	Y
49	WGCB	Red Lion, PA	NTSC	94.70	N	Y
50	WDCW	Washington, DC	NTSC	76.21	N	Y
51	WDCW	Washington, DC	ATSC	76.21	N	N

TABLE 5-41. Adaptrum WSD Prototype Results at Test Site 7.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L1/ S2 [1]
21	ATSC	N	N	ATSC	-92.9	A	-
22	NTSC	N	Y	NTSC	-69.0	O	A
23	NTSC	N	Y	NTSC	-89.2	A	A
24	NTSC	N	Y	NTSC	-88.5	A	A
25	NTSC	Y	Y	NTSC	-80.1	O	O
26	NTSC	N	Y	NTSC	-81.1	O	O
27	ATSC	N	Y	ATSC	-81.5	O	-
28	ATSC	Y	N	ATSC	-88.2	A	-
29	ATSC	Y	N	ATSC	-92.9	O	-
30	ATSC	N	Y	ATSC	-75.7	O	-
	ATSC	N					
31	NTSC	Y	Y	NTSC	-81.3	O	O
32	NTSC	N	N	NTSC	-96.5	A	A
33	ATSC	N	Y	ATSC	-79.6	O	-
34	ATSC	Y	Y	ATSC	-72.0	O	-
35	ATSC	Y	Y	ATSC	-73.1	A	-
36	ATSC	Y	Y	ATSC	-74.3	O	-
38	ATSC	Y	Y	ATSC	-84.3	A	-
39	ATSC	Y	Y	ATSC	-76.3	O	-
40	ATSC	Y	N	ATSC	-87.3	A	-
41	ATSC	Y	N	ATSC	-93.8	O	-
42	ATSC	N	N	ATSC	-89.0	A	-
	NTSC	N					
43	ATSC	N	Y	NTSC	-89.9	O	A
44	ATSC	Y	N	ATSC	-93.3	O	-
45	NTSC	N	Y	NTSC	-87.7	A	A
46	ATSC	Y	N	ATSC	-87.4	A	-
47	NTSC	N	Y	ATSC	-78.4	A	-
48	ATSC	Y	Y	ATSC	-85.5	O	-
49	NTSC	N	Y	NTSC	-84.5	A	A
50	NTSC	N	Y	NTSC	-82.6	A	A
51	ATSC	N	N	ATSC	-87.6	O	-

[1] Second scan for NTSC channels only.

TABLE 5-42. I2R WSD Prototype Results at Test Site 7.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-92.9	A	A	A	A
22	NTSC	N	Y	NTSC	-69.0	A	A	A	A
23	NTSC	N	Y	NTSC	-89.2	A	A	O	O
24	NTSC	N	Y	NTSC	-88.5	A	A	A	A
25	NTSC	Y	Y	NTSC	-80.1	A	A	A	A
26	NTSC	N	Y	NTSC	-81.1	A	A	A	A
27	ATSC	N	Y	ATSC	-81.5	O	O	O	A
28	ATSC	Y	N	ATSC	-88.2	A	A	A	A
29	ATSC	Y	N	ATSC	-92.9	A	A	A	A
30	ATSC ATSC	N N	Y	ATSC	-75.7	O	O	O	O
31	NTSC	Y	Y	NTSC	-81.3	A	A	A	A
32	NTSC	N	N	NTSC	-96.5	A	A	A	A
33	ATSC	N	Y	ATSC	-79.6	O	O	O	A
34	ATSC	Y	Y	ATSC	-72.0	O	O	O	O
35	ATSC	Y	Y	ATSC	-73.1	O	O	O	O
36	ATSC	Y	Y	ATSC	-74.3	A	O	O	O
38	ATSC	Y	Y	ATSC	-84.3	A	A	O	O
39	ATSC	Y	Y	ATSC	-76.3	O	O	O	O
40	ATSC	Y	N	ATSC	-87.3	O	O	O	O
41	ATSC	Y	N	ATSC	-93.8	A	A	O	O
42	ATSC NTSC	N N	N	ATSC	-89.0	A	A	A	A
43	ATSC	N	Y	NTSC	-89.9	A	O	A	O
44	ATSC	Y	N	ATSC	-93.3	A	O	O	O
45	NTSC	N	Y	NTSC	-87.7	A	A	A	A
46	ATSC	Y	N	ATSC	-87.4	A	A	A	A
47	NTSC	N	Y	ATSC	-78.4	A	O	O	O
48	ATSC	Y	Y	ATSC	-85.5	O	A	A	A
49	NTSC	N	Y	NTSC	-84.5	A	A	A	A
50	NTSC	N	Y	NTSC	-82.6	A	A	A	A
51	ATSC	N	N	ATSC	-87.6	A	A	A	A

TABLE 5-43. Motorola WSD Prototype (Test Mode) Results at Test Site 7.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-92.9	A	A	A	A
22	NTSC	N	Y	NTSC	-69.0	-	-	-	-
23	NTSC	N	Y	NTSC	-89.2	-	-	-	-
24	NTSC	N	Y	NTSC	-88.5	-	-	-	-
25	NTSC	Y	Y	NTSC	-80.1	-	-	-	-
26	NTSC	N	Y	NTSC	-81.1	-	-	-	-
27	ATSC	N	Y	ATSC	-81.5	A	A	A	O
28	ATSC	Y	N	ATSC	-88.2	A	A	A	O
29	ATSC	Y	N	ATSC	-92.9	A	A	A	A
30	ATSC	N	Y	ATSC	-75.7	O	O	O	O
	ATSC	N							
31	NTSC	Y	Y	NTSC	-81.3	-	-	-	-
32	NTSC	N	N	NTSC	-96.5	-	-	-	-
33	ATSC	N	Y	ATSC	-79.6	A	A	A	A
34	ATSC	Y	Y	ATSC	-72.0	O	O	O	O
35	ATSC	Y	Y	ATSC	-73.1	O	O	O	O
36	ATSC	Y	Y	ATSC	-74.3	A	A	A	A
38	ATSC	Y	Y	ATSC	-84.3	O	O	O	O
39	ATSC	Y	Y	ATSC	-76.3	O	O	O	O
40	ATSC	Y	N	ATSC	-87.3	O	O	O	O
41	ATSC	Y	N	ATSC	-93.8	O	O	O	O
42	ATSC	N	N	ATSC	-89.0	A	A	O	O
	NTSC	N							
43	ATSC	N	Y	NTSC	-89.9	O	O	O	O
44	ATSC	Y	N	ATSC	-93.3	A	A	O	O
45	NTSC	N	Y	NTSC	-87.7	-	-	-	-
46	ATSC	Y	N	ATSC	-87.4	A	A	O	A
47	NTSC	N	Y	ATSC	-78.4	A	A	A	A
48	ATSC	Y	Y	ATSC	-85.5	O	O	O	A
49	NTSC	N	Y	NTSC	-84.5	-	-	-	-
50	NTSC	N	Y	NTSC	-82.6	-	-	-	-
51	ATSC	N	N	ATSC	-87.6	A	A	O	O

NOTE: In the test mode this device detects ATSC signals only (*i.e.*, no NTSC detection capability).

TABLE 5-44. Motorola WSD Prototype (Normal Mode) Results at Test Site 7.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	ATSC	N	N	ATSC	-92.9	A	A
22	NTSC	N	Y	NTSC	-69.0	O	O
23	NTSC	N	Y	NTSC	-89.2	A	A
24	NTSC	N	Y	NTSC	-88.5	A	A
25	NTSC	Y	Y	NTSC	-80.1	O	O
26	NTSC	N	Y	NTSC	-81.1	A	A
27	ATSC	N	Y	ATSC	-81.5	O	O
28	ATSC	Y	N	ATSC	-88.2	O	O
29	ATSC	Y	N	ATSC	-92.9	O	O
30	ATSC	N	Y	ATSC	-75.7	A	A
	ATSC	N					
31	NTSC	Y	Y	NTSC	-81.3	O	O
32	NTSC	N	N	NTSC	-96.5	A	A
33	ATSC	N	Y	ATSC	-79.6	O	O
34	ATSC	Y	Y	ATSC	-72.0	O	O
35	ATSC	Y	Y	ATSC	-73.1	O	O
36	ATSC	Y	Y	ATSC	-74.3	O	O
38	ATSC	Y	Y	ATSC	-84.3	O	O
39	ATSC	Y	Y	ATSC	-76.3	O	O
40	ATSC	Y	N	ATSC	-87.3	O	O
41	ATSC	Y	N	ATSC	-93.8	O	O
42	ATSC	N	N	ATSC	-89.0	A	A
	NTSC	N					
43	ATSC	N	Y	NTSC	-89.9	A	A
44	ATSC	Y	N	ATSC	-93.3	O	O
45	NTSC	N	Y	NTSC	-87.7	O	O
46	ATSC	Y	N	ATSC	-87.4	O	O
47	NTSC	N	Y	ATSC	-78.4	A	A
48	ATSC	Y	Y	ATSC	-85.5	O	O
49	NTSC	N	Y	NTSC	-84.5	A	A
50	NTSC	N	Y	NTSC	-82.6	O	O
51	ATSC	N	N	ATSC	-87.6	O	O

TABLE 5-45. Philips WSD Prototype Results at Test Site 7.

<table>
<tr><th rowspan="2">CH</th><th rowspan="2">Signal Type (Database)</th><th rowspan="2">Within Service Contour? (Y/N)</th><th rowspan="2">Viewable? (Y/N)</th><th rowspan="2">Signal Type (Measured)</th><th rowspan="2">Measured Power Level (dBm)</th><th colspan="4">Occupied (O) & Available (A) Channels Reported by WSD</th></tr>
<tr><th>L1/ S1</th><th>L1/ S2</th><th>L2/ S1</th><th>L2/ S2</th></tr>
<tr><td>21</td><td>ATSC</td><td>N</td><td>N</td><td>ATSC</td><td>-92.9</td><td>O</td><td>O</td><td>O</td><td>A</td></tr>
<tr><td>22</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-69.0</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>23</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-89.2</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>24</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-88.5</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>25</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-80.1</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>26</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-81.1</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>27</td><td>ATSC</td><td>N</td><td>Y</td><td>ATSC</td><td>-81.5</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>28</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-88.2</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>29</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-92.9</td><td>O</td><td>O</td><td>O</td><td>A</td></tr>
<tr><td rowspan="2">30</td><td>ATSC</td><td>N</td><td rowspan="2">Y</td><td rowspan="2">ATSC</td><td rowspan="2">-75.7</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td></tr>
<tr><td>ATSC</td><td>N</td></tr>
<tr><td>31</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-81.3</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>32</td><td>NTSC</td><td>N</td><td>N</td><td>NTSC</td><td>-96.5</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>33</td><td>ATSC</td><td>N</td><td>Y</td><td>ATSC</td><td>-79.6</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>34</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-72.0</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>35</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-73.1</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>36</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-74.3</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>38</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-84.3</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>39</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-76.3</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>40</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-87.3</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>41</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-93.8</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td rowspan="2">42</td><td>ATSC</td><td>N</td><td rowspan="2">N</td><td rowspan="2">ATSC</td><td rowspan="2">-89.0</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td><td rowspan="2">O</td></tr>
<tr><td>NTSC</td><td>N</td></tr>
<tr><td>43</td><td>ATSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-89.9</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>44</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-93.3</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>45</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-87.7</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>46</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-87.4</td><td>O</td><td>O</td><td>A</td><td>O</td></tr>
<tr><td>47</td><td>NTSC</td><td>N</td><td>Y</td><td>ATSC</td><td>-78.4</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>48</td><td>ATSC</td><td>Y</td><td>Y</td><td>ATSC</td><td>-85.5</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>49</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-84.5</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>50</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-82.6</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
<tr><td>51</td><td>ATSC</td><td>N</td><td>N</td><td>ATSC</td><td>-87.6</td><td>O</td><td>O</td><td>O</td><td>O</td></tr>
</table>

TABLE 5-46. Philips WSD Prototype Results at Test Site 7 (w/ 10-dB attenuator).

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD (Loc 2)
21	ATSC	N	N	ATSC	-92.9	A
22	NTSC	N	Y	NTSC	-69.0	O
23	NTSC	N	Y	NTSC	-89.2	O
24	NTSC	N	Y	NTSC	-88.5	O
25	NTSC	Y	Y	NTSC	-80.1	O
26	NTSC	N	Y	NTSC	-81.1	O
27	ATSC	N	Y	ATSC	-81.5	O
28	ATSC	Y	N	ATSC	-88.2	O
29	ATSC	Y	N	ATSC	-92.9	A
30	ATSC	N	Y	ATSC	-75.7	O
	ATSC	N				
31	NTSC	Y	Y	NTSC	-81.3	O
32	NTSC	N	N	NTSC	-96.5	O
33	ATSC	N	Y	ATSC	-79.6	A
34	ATSC	Y	Y	ATSC	-72.0	O
35	ATSC	Y	Y	ATSC	-73.1	O
36	ATSC	Y	Y	ATSC	-74.3	O
38	ATSC	Y	Y	ATSC	-84.3	O
39	ATSC	Y	Y	ATSC	-76.3	O
40	ATSC	Y	N	ATSC	-87.3	A
41	ATSC	Y	N	ATSC	-93.8	A
42	ATSC	N	N	ATSC	-89.0	O
	NTSC	N				
43	ATSC	N	Y	NTSC	-89.9	O
44	ATSC	Y	N	ATSC	-93.3	O
45	NTSC	N	Y	NTSC	-87.7	O
46	ATSC	Y	N	ATSC	-87.4	A
47	NTSC	N	Y	ATSC	-78.4	A
48	ATSC	Y	Y	ATSC	-85.5	O
49	NTSC	N	Y	NTSC	-84.5	O
50	NTSC	N	Y	NTSC	-82.6	O
51	ATSC	N	N	ATSC	-87.6	O

5.8 Test Site #8 – Intersection of Rt. 17 and Middle Point Rd., NE of Myersville

This site is northeast of Myersville, in rural western Maryland. This was one of four sites recommended for measurement by MSTV.[36] Channel occupancy measurements were performed at the entrance of a long paved driveway leading to a horse barn and the WSD prototype field trials were performed at two locations in a field adjacent to the driveway, separated by approximately 91.4 meters (300 feet).

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[36] *Ibid*.

TABLE 5-47. Licensed TV Station Assignments within 100-km radius of Test Site 8.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	WVPY	Front Royal, VA	ATSC	96.57	N	N
22	-	-	-	-	N	N
23	WDDN-LP	Washington, DC	NTSC	74.42	N	N
24	WUTB	Baltimore, MD	NTSC	72.59	N	Y
25	WHAG	Hagerstown, MD	NTSC	39.35	Y	Y
26	WETA	Washington, DC	NTSC	75.79	N	Y
27	WETA	Washington, DC	ATSC	78.15	N	N
	WHTM	Harrisburg, PA	NTSC	96.92	N	
28	WFPT	Frederick, MD	ATSC	38.30	Y	N
29	WMPB	Baltimore, MD	ATSC	65.35	Y	N
30	WGCB	Red Lion, PA	ATSC	89.20	N	Y
31	WWPB	Hagerstown, MD	NTSC	39.52	Y	N
32	WHUT	Washington, DC	NTSC	75.80	N	N
33	WHUT	Washington, DC	ATSC	78.15	N	N
34	WUSA	Washington, DC	ATSC	78.15	Y	N
35	WDCA	Washington, DC	ATSC	77.44	Y	N
36	WTTG	Washington, DC	ATSC	77.44	Y	N
38	WJZ	Baltimore, MD	ATSC	79.40	Y	N
39	WJLA	Washington, DC	ATSC	78.15	Y	N
40	WNUV	Baltimore, MD	ATSC	79.44	Y	N
41	WUTB	Baltimore, MD	ATSC	72.59	Y	N
42	WVPY	Front Royal, VA	NTSC	96.57	N	Y
43	WPXW	Manassas, VA	ATSC	87.72	N	Y
	WPMT	York, PA	NTSC	94.55	N	
44	WWPB	Hagerstown, MD	ATSC	39.52	Y	N
45	WBFF	Baltimore, MD	NTSC	79.44	N	N
46	WBFF	Baltimore, MD	ATSC	79.44	Y	N
47	WPMT	York, PA	ATSC	94.55	N	N
48	WRC	Washington, DC	ATSC	79.06	Y	N
49	WGCB	Red Lion, PA	NTSC	89.20	N	N
50	WDCW	Washington, DC	NTSC	79.38	N	Y
51	WDCW	Washington, DC	ATSC	79.38	N	N

TABLE 5-48. Adaptrum WSD Prototype Results at Test Site 8.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2 [1]	L2/ S1	L2/ S2 [1]
21	ATSC	N	N	ATSC	-93.4	O	-	O	-
22	-	N	N	NTSC	-90.4	O	A	A	A
23	NTSC	N	N	ATSC	-92.8	A	-	A	-
24	NTSC	N	Y	NTSC	-94.4	A	A	A	A
25	NTSC	Y	Y	NTSC	-77.7	O	O	O	O
26	NTSC	N	Y	NTSC	-93.4	A	A	A	A
27	ATSC	N	N	ATSC	-95.8	A	-	A	-
	NTSC	N							
28	ATSC	Y	N	ATSC	-96.2	A	-	A	-
29	ATSC	Y	N	NTSC	-90.8	A	A	A	A
30	ATSC	N	Y	ATSC	-72.7	O	-	O	-
31	NTSC	Y	N	NTSC	-75.6	O	O	O	O
32	NTSC	N	N	ATSC	-88.7	O	O	A	O
33	ATSC	N	N	ATSC	-93.1	A	-	A	-
34	ATSC	Y	N	ATSC	-91.2	O	-	O	-
35	ATSC	Y	N	ATSC	-91.7	A	-	A	-
36	ATSC	Y	N	ATSC	-93.2	O	-	O	-
38	ATSC	Y	N	ATSC	-93.8	O	-	A	-
39	ATSC	Y	N	ATSC	-92.3	O	-	A	-
40	ATSC	Y	N	ATSC	-93.2	A	-	A	-
41	ATSC	Y	N	ATSC	-95.0	O	-	A	-
42	NTSC	N	Y	NTSC	-96.1	A	A	O	O
43	ATSC	N	Y	NTSC	-102.3	A	A	A	A
	NTSC	N							
44	ATSC	Y	N	ATSC	-90.1	O	-	O	-
45	NTSC	N	N	NTSC	-100.5	A	A	A	A
46	ATSC	Y	N	ATSC	-94.6	O	-	A	-
47	ATSC	N	N	-	-	A	-	A	-
48	ATSC	Y	N	ATSC	-93.2	O	O	A	-
49	NTSC	N	N	ATSC	-94.6	O	-	A	-
50	NTSC	N	Y	NTSC	-95.7	O	A	A	A
51	ATSC	N	N	ATSC	-96.7	O	-	O	-

[1] Second scan for NTSC signals only.

TABLE 5-49. I2R WSD Prototype Results at Test Site 8.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2 [1]	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-93.4	A	O	O	O
22	-	N	N	NTSC	-90.4	A	A	A	A
23	NTSC	N	N	ATSC	-92.8	A	A	O	O
24	NTSC	N	Y	NTSC	-94.4	A	A	A	A
25	NTSC	Y	Y	NTSC	-77.7	A	A	A	A
26	NTSC	N	Y	NTSC	-93.4	A	A	A	A
27	ATSC	N	N	ATSC	-95.8	O	O	A	A
	NTSC	N							
28	ATSC	Y	N	ATSC	-96.2	A	A	A	A
29	ATSC	Y	N	NTSC	-90.8	A	A	A	O
30	ATSC	N	Y	ATSC	-72.7	O	O	O	O
31	NTSC	Y	N	NTSC	-75.6	A	A	A	A
32	NTSC	N	N	ATSC	-88.7	A	A	A	A
33	ATSC	N	N	ATSC	-93.1	A	A	A	A
34	ATSC	Y	N	ATSC	-91.2	A	A	O	A
35	ATSC	Y	N	ATSC	-91.7	A	A	O	O
36	ATSC	Y	N	ATSC	-93.2	A	A	O	O
38	ATSC	Y	N	ATSC	-93.8	A	A	A	O
39	ATSC	Y	N	ATSC	-92.3	O	O	A	A
40	ATSC	Y	N	ATSC	-93.2	O	O	A	A
41	ATSC	Y	N	ATSC	-95.0	O	O	A	A
42	NTSC	N	Y	NTSC	-96.1	O	O	A	A
43	ATSC	N	Y	NTSC	-102.3	A	A	A	O
	NTSC	N							
44	ATSC	Y	N	ATSC	-90.1	A	A	O	O
45	NTSC	N	N	NTSC	-100.5	A	A	A	A
46	ATSC	Y	N	ATSC	-94.6	O	O	A	A
47	ATSC	N	N	-	-	A	A	A	A
48	ATSC	Y	N	ATSC	-93.2	A	A	O	O
49	NTSC	N	N	ATSC	-94.6	A	A	A	A
50	NTSC	N	Y	NTSC	-95.7	A	A	A	A
51	ATSC	N	N	ATSC	-96.7	A	A	A	A

TABLE 5-50. Motorola WSD Prototype (Test Mode) Results at Test Site 8.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2 [1]	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-93.4	O	O	O	O
22	-	N	N	NTSC	-90.4	-	O	-	-
23	NTSC	N	N	ATSC	-92.8	A	A	A	A
24	NTSC	N	Y	NTSC	-94.4	-	-	-	-
25	NTSC	Y	Y	NTSC	-77.7	-	-	-	-
26	NTSC	N	Y	NTSC	-93.4	O	-	-	-
27	ATSC	N	N	ATSC	-95.8	A	A	A	A
	NTSC	N							
28	ATSC	Y	N	ATSC	-96.2	O	A	A	A
29	ATSC	Y	N	NTSC	-90.8	-	-	-	-
30	ATSC	N	Y	ATSC	-72.7	O	O	A	O
31	NTSC	Y	N	NTSC	-75.6	-	-	-	-
32	NTSC	N	N	ATSC	-88.7	A	A	A	A
33	ATSC	N	N	ATSC	-93.1	A	A	A	A
34	ATSC	Y	N	ATSC	-91.2	O	A	O	O
35	ATSC	Y	N	ATSC	-91.7	O	O	A	O
36	ATSC	Y	N	ATSC	-93.2	A	A	A	A
38	ATSC	Y	N	ATSC	-93.8	O	O	O	A
39	ATSC	Y	N	ATSC	-92.3	O	O	A	A
40	ATSC	Y	N	ATSC	-93.2	O	O	A	A
41	ATSC	Y	N	ATSC	-95.0	O	A	A	A
42	NTSC	N	Y	NTSC	-96.1	O	O	-	-
43	ATSC	N	Y	NTSC	-102.3	O	O	O	O
	NTSC	N							
44	ATSC	Y	N	ATSC	-90.1	A	O	O	A
45	NTSC	N	N	NTSC	-100.5	-	-	-	-
46	ATSC	Y	N	ATSC	-94.6	O	O	O	A
47	ATSC	N	N	-	-	-	-	-	-
48	ATSC	Y	N	ATSC	-93.2	A	O	O	O
49	NTSC	N	N	ATSC	-94.6	A	O	O	A
50	NTSC	N	Y	NTSC	-95.7	-	-	-	-
51	ATSC	N	N	ATSC	-96.7	A	A	O	A

NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).

TABLE 5-51. Motorola WSD Prototype (Normal Mode) Results at Test Site 8.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	ATSC	N	N	ATSC	-93.4	A	A
22	-	N	N	NTSC	-90.4	A	A
23	NTSC	N	N	ATSC	-92.8	A	A
24	NTSC	N	Y	NTSC	-94.4	A	A
25	NTSC	Y	Y	NTSC	-77.7	O	O
26	NTSC	N	Y	NTSC	-93.4	A	A
27	ATSC	N	N	ATSC	-95.8	A	A
	NTSC	N					
28	ATSC	Y	N	ATSC	-96.2	O	O
29	ATSC	Y	N	NTSC	-90.8	O	O
30	ATSC	N	Y	ATSC	-72.7	A	A
31	NTSC	Y	N	NTSC	-75.6	O	O
32	NTSC	N	N	ATSC	-88.7	A	A
33	ATSC	N	N	ATSC	-93.1	A	A
34	ATSC	Y	N	ATSC	-91.2	O	O
35	ATSC	Y	N	ATSC	-91.7	O	O
36	ATSC	Y	N	ATSC	-93.2	O	O
38	ATSC	Y	N	ATSC	-93.8	O	O
39	ATSC	Y	N	ATSC	-92.3	O	O
40	ATSC	Y	N	ATSC	-93.2	O	O
41	ATSC	Y	N	ATSC	-95.0	O	O
42	NTSC	N	Y	NTSC	-96.1	A	A
43	ATSC	N	Y	NTSC	-102.3	A	A
	NTSC	N					
44	ATSC	Y	N	ATSC	-90.1	O	O
45	NTSC	N	N	NTSC	-100.5	O	O
46	ATSC	Y	N	ATSC	-94.6	O	O
47	ATSC	N	N	-	-	O	O
48	ATSC	Y	N	ATSC	-93.2	O	O
49	NTSC	N	N	ATSC	-94.6	A	A
50	NTSC	N	Y	NTSC	-95.7	A	A
51	ATSC	N	N	ATSC	-96.7	O	O

TABLE 5-52. Philips WSD Prototype Results at Test Site 8.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Signal Type (Measured)	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2 [1]	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-93.4	O	O	O	O
22	-	N	N	NTSC	-90.4	O	O	O	O
23	NTSC	N	N	ATSC	-92.8	O	O	O	O
24	NTSC	N	Y	NTSC	-94.4	O	O	O	O
25	NTSC	Y	Y	NTSC	-77.7	O	O	O	O
26	NTSC	N	Y	NTSC	-93.4	O	O	O	O
27	ATSC	N	N	ATSC	-95.8	O	O	O	O
	NTSC	N							
28	ATSC	Y	N	ATSC	-96.2	O	O	O	O
29	ATSC	Y	N	NTSC	-90.8	O	O	O	O
30	ATSC	N	Y	ATSC	-72.7	O	O	O	O
31	NTSC	Y	N	NTSC	-75.6	O	O	O	O
32	NTSC	N	N	ATSC	-88.7	O	O	O	O
33	ATSC	N	N	ATSC	-93.1	O	O	O	O
34	ATSC	Y	N	ATSC	-91.2	O	O	O	O
35	ATSC	Y	N	ATSC	-91.7	O	O	O	O
36	ATSC	Y	N	ATSC	-93.2	O	O	O	O
38	ATSC	Y	N	ATSC	-93.8	O	O	O	O
39	ATSC	Y	N	ATSC	-92.3	O	O	O	O
40	ATSC	Y	N	ATSC	-93.2	O	O	O	O
41	ATSC	Y	N	ATSC	-95.0	O	O	O	O
42	NTSC	N	Y	NTSC	-96.1	O	O	O	O
43	ATSC	N	Y	NTSC	-102.3	O	O	O	O
	NTSC	N							
44	ATSC	Y	N	ATSC	-90.1	O	O	O	O
45	NTSC	N	N	NTSC	-100.5	O	O	O	O
46	ATSC	Y	N	ATSC	-94.6	O	O	A	O
47	ATSC	N	N	-	-	A	O	A	A
48	ATSC	Y	N	ATSC	-93.2	O	O	O	O
49	NTSC	N	N	ATSC	-94.6	O	O	O	O
50	NTSC	N	Y	NTSC	-95.7	O	O	O	O
51	ATSC	N	N	ATSC	-96.7	O	O	O	O

TABLE 5-53. Philips WSD Prototype Results at Test Site 8 (w/ 10-dB attenuator).

<table>
<tr><th>CH</th><th>Signal Type (Database)</th><th>Within Service Contour? (Y/N)</th><th>Viewable? (Y/N)</th><th>Signal Type (Measured)</th><th>Measured Power Level (dBm)</th><th>Occupied (O) & Available (A) Channels Reported by WSD (Loc 1)</th></tr>
<tr><td>21</td><td>ATSC</td><td>N</td><td>N</td><td>ATSC</td><td>-93.4</td><td>O</td></tr>
<tr><td>22</td><td>-</td><td>N</td><td>N</td><td>NTSC</td><td>-90.4</td><td>O</td></tr>
<tr><td>23</td><td>NTSC</td><td>N</td><td>N</td><td>ATSC</td><td>-92.8</td><td>A</td></tr>
<tr><td>24</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-94.4</td><td>O</td></tr>
<tr><td>25</td><td>NTSC</td><td>Y</td><td>Y</td><td>NTSC</td><td>-77.7</td><td>O</td></tr>
<tr><td>26</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-93.4</td><td>O</td></tr>
<tr><td rowspan="2">27</td><td>ATSC</td><td>N</td><td rowspan="2">N</td><td rowspan="2">ATSC</td><td rowspan="2">-95.8</td><td rowspan="2">A</td></tr>
<tr><td>NTSC</td><td>N</td></tr>
<tr><td>28</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-96.2</td><td>O</td></tr>
<tr><td>29</td><td>ATSC</td><td>Y</td><td>N</td><td>NTSC</td><td>-90.8</td><td>O</td></tr>
<tr><td>30</td><td>ATSC</td><td>N</td><td>Y</td><td>ATSC</td><td>-72.7</td><td>A</td></tr>
<tr><td>31</td><td>NTSC</td><td>Y</td><td>N</td><td>NTSC</td><td>-75.6</td><td>O</td></tr>
<tr><td>32</td><td>NTSC</td><td>N</td><td>N</td><td>ATSC</td><td>-88.7</td><td>O</td></tr>
<tr><td>33</td><td>ATSC</td><td>N</td><td>N</td><td>ATSC</td><td>-93.1</td><td>O</td></tr>
<tr><td>34</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-91.2</td><td>O</td></tr>
<tr><td>35</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-91.7</td><td>O</td></tr>
<tr><td>36</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-93.2</td><td>O</td></tr>
<tr><td>38</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-93.8</td><td>O</td></tr>
<tr><td>39</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-92.3</td><td>O</td></tr>
<tr><td>40</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-93.2</td><td>O</td></tr>
<tr><td>41</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-95.0</td><td>A</td></tr>
<tr><td>42</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-96.1</td><td>O</td></tr>
<tr><td rowspan="2">43</td><td>ATSC</td><td>N</td><td rowspan="2">Y</td><td rowspan="2">NTSC</td><td rowspan="2">-102.3</td><td rowspan="2">O</td></tr>
<tr><td>NTSC</td><td>N</td></tr>
<tr><td>44</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-90.1</td><td>O</td></tr>
<tr><td>45</td><td>NTSC</td><td>N</td><td>N</td><td>NTSC</td><td>-100.5</td><td>O</td></tr>
<tr><td>46</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-94.6</td><td>O</td></tr>
<tr><td>47</td><td>ATSC</td><td>N</td><td>N</td><td>-</td><td>-</td><td>A</td></tr>
<tr><td>48</td><td>ATSC</td><td>Y</td><td>N</td><td>ATSC</td><td>-93.2</td><td>O</td></tr>
<tr><td>49</td><td>NTSC</td><td>N</td><td>N</td><td>ATSC</td><td>-94.6</td><td>O</td></tr>
<tr><td>50</td><td>NTSC</td><td>N</td><td>Y</td><td>NTSC</td><td>-95.7</td><td>O</td></tr>
<tr><td>51</td><td>ATSC</td><td>N</td><td>N</td><td>ATSC</td><td>-96.7</td><td>A</td></tr>
</table>

5.9 Test Site #9 – Grossnickle Church at Rt 17 and Meeting House Road

This site is northeast of Myersville, in rural western Maryland. This was one of four sites recommended for measurement by MSTV.[37] Channel occupancy measurements were performed in the parking lot of the Church Parish Hall and the WSD prototype field trials were performed at two locations in the parking lot, separated by approximately 30.5 meters (100 feet).

[37] *Ibid*.

TABLE 5-54. Licensed TV Station Assignments within 100-km radius of Test Site 9.

CH	Station Call Sign	Station Location	Signal Type	Separation Distance (km)	Within Service Contour? (Y/N)	Viewable? (Y/N)
21	WVPY	Front Royal, VA	ATSC	94.78	N	N
22	WMPT	Annapolis, MD	NTSC	99.05	N	Y
23	WDDN-LP	Washington, DC	NTSC	72.80	N	N
24	WUTB	Baltimore, MD	NTSC	72.05	N	N
25	WHAG	Hagerstown, MD	NTSC	39.65	Y	Y
26	WETA	Washington, DC	NTSC	74.06	N	Y
27	WETA	Washington, DC	ATSC	76.44	N	N
27	WHTM	Harrisburg, PA	NTSC	99.02	N	N
28	WFPT	Frederick, MD	ATSC	36.58	Y	N
29	WMPB	Baltimore, MD	ATSC	65.34	Y	N
30	WGCB	Red Lion, PA	ATSC	90.51	N	N
31	WWPB	Hagerstown, MD	NTSC	39.76	Y	Y
32	WHUT	Washington, DC	NTSC	74.06	N	Y
33	WHUT	Washington, DC	ATSC	76.44	N	N
34	WUSA	Washington, DC	ATSC	76.44	Y	N
35	WDCA	Washington, DC	ATSC	75.73	Y	N
36	WTTG	Washington, DC	ATSC	75.73	Y	N
38	WJZ	Baltimore, MD	ATSC	79.10	Y	N
39	WJLA	Washington, DC	ATSC	76.44	Y	N
40	WNUV	Baltimore, MD	ATSC	79.15	Y	N
41	WUTB	Baltimore, MD	ATSC	72.05	Y	N
42	WVPY	Front Royal, VA	NTSC	94.78	N	Y
42	WMPT	Annapolis, MD	ATSC	99.05	N	N
43	WPXW	Manassas, VA	ATSC	85.64	N	N
43	WPMT	York, PA	NTSC	96.09	N	Y
44	WWPB	Hagerstown, MD	ATSC	39.76	Y	N
45	WBFF	Baltimore, MD	NTSC	79.15	N	Y
46	WBFF	Baltimore, MD	ATSC	79.15	Y	N
47	WPMT	York, PA	ATSC	96.09	N	N
48	WRC	Washington, DC	ATSC	77.34	Y	N
49	WGCB	Red Lion, PA	NTSC	90.51	N	N
50	WDCW	Washington, DC	NTSC	77.76	N	Y
51	WDCW	Washington, DC	ATSC	77.76	N	N

TABLE 5-55. Adaptrum WSD Prototype Results at Test Site 9.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L2/ S1	L2/ S2 [1]
21	ATSC	N	N	ATSC	-90.6	O	-
22	NTSC	N	Y	NTSC	-92.9	O	A
23	NTSC	N	N	ATSC	-95.2	A	-
24	NTSC	N	N	NTSC	-108.0	A	A
25	NTSC	Y	Y	NTSC	-94.5	O	A
26	NTSC	N	Y	NTSC	-96.8	A	O
27	ATSC	N	N	NTSC	-105.6	A	A
	NTSC	N	N				
28	ATSC	Y	N	NTSC	-114.9	A	A
29	ATSC	Y	N	-	-	A	-
30	ATSC	N	N	ATSC	-88.8	A	-
31	NTSC	Y	Y	NTSC	-91.7	O	A
32	NTSC	N	Y	NTSC	-97.0	A	A
33	ATSC	N	N	NTSC	-100.5	A	A
34	ATSC	Y	N	ATSC	-92.5	O	-
35	ATSC	Y	N	ATSC	-93.7	A	-
36	ATSC	Y	N	ATSC	-91.4	O	-
38	ATSC	Y	N	ATSC	-93.5	O	-
39	ATSC	Y	N	ATSC	-92.7	A	-
40	ATSC	Y	N	ATSC	-94.7	A	-
41	ATSC	Y	N	-	-	O	-
42	NTSC	N	Y	NTSC	-100.5	O	O
	ATSC	N	N				
43	ATSC	N	N	NTSC	-85.6	A	A
	NTSC	N	Y				
44	ATSC	Y	N	ATSC	-96.3	A	-
45	NTSC	N	Y	NTSC	-93.4	A	A
46	ATSC	Y	N	ATSC	-96.5	O	-
47	ATSC	N	N	ATSC	-93.1	A	-
48	ATSC	Y	N	NTSC	-105.4	A	A
49	NTSC	N	N	ATSC	-	A	-
50	NTSC	N	Y	NTSC	-95.0	A	A
51	ATSC	N	N	ATSC	-95.9	O	-

[1] Second scan for NTSC channels only.

TABLE 5-56. I2R WSD Prototype Results at Test Site 9.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-90.6	O	O	A	O
22	NTSC	N	Y	NTSC	-92.9	A	A	A	A
23	NTSC	N	N	ATSC	-95.2	A	A	A	A
24	NTSC	N	N	NTSC	-108.0	A	A	A	A
25	NTSC	Y	Y	NTSC	-94.5	A	A	A	A
26	NTSC	N	Y	NTSC	-96.8	A	A	A	A
27	ATSC	N	N	NTSC	-105.6	A	A	A	A
	NTSC	N	N						
28	ATSC	Y	N	NTSC	-114.9	A	A	A	A
29	ATSC	Y	N	-	-	A	A	A	A
30	ATSC	N	N	ATSC	-88.8	O	O	A	A
31	NTSC	Y	Y	NTSC	-91.7	A	A	A	A
32	NTSC	N	Y	NTSC	-97.0	A	A	A	A
33	ATSC	N	N	NTSC	-100.5	A	A	A	A
34	ATSC	Y	N	ATSC	-92.5	A	A	A	A
35	ATSC	Y	N	ATSC	-93.7	A	A	A	A
36	ATSC	Y	N	ATSC	-91.4	A	A	A	A
38	ATSC	Y	N	ATSC	-93.5	O	A	O	O
39	ATSC	Y	N	ATSC	-92.7	A	A	A	A
40	ATSC	Y	N	ATSC	-94.7	A	A	A	A
41	ATSC	Y	N	-	-	A	A	A	A
42	NTSC	N	Y	NTSC	-100.5	A	A	A	A
	ATSC	N	N						
43	ATSC	N	N	NTSC	-85.6	A	A	A	A
	NTSC	N	Y						
44	ATSC	Y	N	ATSC	-96.3	A	A	A	A
45	NTSC	N	Y	NTSC	-93.4	A	A	A	A
46	ATSC	Y	N	ATSC	-96.5	A	A	A	A
47	ATSC	N	N	ATSC	-93.1	A	A	A	A
48	ATSC	Y	N	NTSC	-105.4	A	A	A	A
49	NTSC	N	N	ATSC	-	A	A	A	A
50	NTSC	N	Y	NTSC	-95.0	A	A	A	A
51	ATSC	N	N	ATSC	-95.9	A	A	A	A

TABLE 5-57. Motorola WSD Prototype (Test Mode) Results at Test Site 9.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-90.6	O	O	O	O
22	NTSC	N	Y	NTSC	-92.9	-	-	-	-
23	NTSC	N	N	ATSC	-95.2	A	A	A	A
24	NTSC	N	N	NTSC	-108.0	-	-	-	-
25	NTSC	Y	Y	NTSC	-94.5	-	-	-	-
26	NTSC	N	Y	NTSC	-96.8	-	-	-	-
27	ATSC	N	N	NTSC	-105.6	-	-	-	-
	NTSC	N	N						
28	ATSC	Y	N	NTSC	-114.9	-	-	-	-
29	ATSC	Y	N	-	-	-	-	-	-
30	ATSC	N	N	ATSC	-88.8	O	O	O	O
31	NTSC	Y	Y	NTSC	-91.7	-	-	-	-
32	NTSC	N	Y	NTSC	-97.0	-	-	-	-
33	ATSC	N	N	NTSC	-100.5	-	-	-	-
34	ATSC	Y	N	ATSC	-92.5	A	A	A	A
35	ATSC	Y	N	ATSC	-93.7	A	A	A	A
36	ATSC	Y	N	ATSC	-91.4	A	A	A	A
38	ATSC	Y	N	ATSC	-93.5	A-	A	O	O
39	ATSC	Y	N	ATSC	-92.7	A	A	O	A
40	ATSC	Y	N	ATSC	-94.7	O	O	O	O
41	ATSC	Y	N	-	-	O	O	O	O
42	NTSC	N	Y	NTSC	-100.5	-	-	-	-
	ATSC	N	N						
43	ATSC	N	N	NTSC	-85.6	O	O	O	O
	NTSC	N	Y						
44	ATSC	Y	N	ATSC	-96.3	A	A	A	A
45	NTSC	N	Y	NTSC	-93.4	-	-	-	-
46	ATSC	Y	N	ATSC	-96.5	O	A	O	A
47	ATSC	N	N	ATSC	-93.1	A	A	A	A
48	ATSC	Y	N	NTSC	-105.4	-	-	-	-
49	NTSC	N	N	ATSC	-	A	A	A	A
50	NTSC	N	Y	NTSC	-95.0	-	-	-	-
51	ATSC	N	N	ATSC	-95.9	A	A	O	A

NOTE: In the test mode this device detects only ATSC signals (*i.e.*, no NTSC detection capability).

TABLE 5-58. Motorola WSD Prototype (Normal Mode) Results at Test Site 9.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD	
						L1/ S1	L2/ S1
21	ATSC	N	N	ATSC	-90.6	A	A
22	NTSC	N	Y	NTSC	-92.9	A	A
23	NTSC	N	N	ATSC	-95.2	A	A
24	NTSC	N	N	NTSC	-108.0	A	A
25	NTSC	Y	Y	NTSC	-94.5	O	O
26	NTSC	N	Y	NTSC	-96.8	A	A
27	ATSC	N	N	NTSC	-105.6	A	A
	NTSC	N	N				
28	ATSC	Y	N	NTSC	-114.9	O	O
29	ATSC	Y	N	-	-	O	O
30	ATSC	N	N	ATSC	-88.8	A	A
31	NTSC	Y	Y	NTSC	-91.7	O	O
32	NTSC	N	Y	NTSC	-97.0	A	A
33	ATSC	N	N	NTSC	-100.5	O	O
34	ATSC	Y	N	ATSC	-92.5	O	O
35	ATSC	Y	N	ATSC	-93.7	O	O
36	ATSC	Y	N	ATSC	-91.4	O	O
38	ATSC	Y	N	ATSC	-93.5	O	O
39	ATSC	Y	N	ATSC	-92.7	O	O
40	ATSC	Y	N	ATSC	-94.7	O	O
41	ATSC	Y	N	-	-	O	O
42	NTSC	N	Y	NTSC	-100.5	A	A
	ATSC	N	N				
43	ATSC	N	N	NTSC	-85.6	A	A
	NTSC	N	Y				
44	ATSC	Y	N	ATSC	-96.3	O	O
45	NTSC	N	Y	NTSC	-93.4	O	O
46	ATSC	Y	N	ATSC	-96.5	O	O
47	ATSC	N	N	ATSC	-93.1	O	O
48	ATSC	Y	N	NTSC	-105.4	O	O
49	NTSC	N	N	ATSC	-	A	A
50	NTSC	N	Y	NTSC	-95.0	O	A
51	ATSC	N	N	ATSC	-95.9	O	O

TABLE 5-59. Philips WSD Prototype Results at Test Site 9.

CH	Signal Type (Database)	Within Service Contour? (Y/N)	Viewable? (Y/N)	Measured Signal Type	Measured Power Level (dBm)	Occupied (O) & Available (A) Channels Reported by WSD			
						L1/ S1	L1/ S2	L2/ S1	L2/ S2
21	ATSC	N	N	ATSC	-90.6	O	O	O	O
22	NTSC	N	Y	NTSC	-92.9	O	O	O	O
23	NTSC	N	N	ATSC	-95.2	O	A	O	O
24	NTSC	N	N	NTSC	-108.0	O	O	O	O
25	NTSC	Y	Y	NTSC	-94.5	O	O	O	O
26	NTSC	N	Y	NTSC	-96.8	O	O	O	O
27	ATSC	N	N	NTSC	-105.6	O	O	O	O
	NTSC	N	N						
28	ATSC	Y	N	NTSC	-114.9	O	A	A	O
29	ATSC	Y	N	-	-	O	A	O	O
30	ATSC	N	N	ATSC	-88.8	O	O	O	O
31	NTSC	Y	Y	NTSC	-91.7	O	O	O	O
32	NTSC	N	Y	NTSC	-97.0	O	O	O	O
33	ATSC	N	N	NTSC	-100.5	O	O	O	O
34	ATSC	Y	N	ATSC	-92.5	O	O	O	O
35	ATSC	Y	N	ATSC	-93.7	O	O	O	O
36	ATSC	Y	N	ATSC	-91.4	O	O	O	O
38	ATSC	Y	N	ATSC	-93.5	O	O	O	O
39	ATSC	Y	N	ATSC	-92.7	O	A	O	O
40	ATSC	Y	N	ATSC	-94.7	O	O	O	O
41	ATSC	Y	N	-	-	O	O	O	O
42	NTSC	N	Y	NTSC	-100.5	O	O	O	O
	ATSC	N	N						
43	ATSC	N	N	NTSC	-85.6	O	O	O	O
	NTSC	N	Y						
44	ATSC	Y	N	ATSC	-96.3	O	O	O	O
45	NTSC	N	Y	NTSC	-93.4	O	O	O	O
46	ATSC	Y	N	ATSC	-96.5	O	A	O	O
47	ATSC	N	N	ATSC	-93.1	O	O	O	O
48	ATSC	Y	N	NTSC	-105.4	A	O	O	O
49	NTSC	N	N	ATSC	-	O	O	O	O
50	NTSC	N	Y	NTSC	-95.0	O	O	O	O
51	ATSC	N	N	ATSC	-95.9	A	A	O	O

5.10 TV-Sensing (Channel Occupancy) Field Test Summary

This section provides a summary of the prototype TV WSD field trial results obtained at the nine test sites.

In reducing the data from the TV sensing field tests it became obvious that two available parameters can be used to define a set of conditions which apply uniquely to each channel under consideration for "white" space use. These two parameters have been labeled "Within Contour" and "Viewable" in this report and each has a value of either yes (1) or no (0). This binary combination yields four possible conditions that will uniquely describe each TV channel at a particular location. These four conditions are:

- Condition I: the WSD is operating <u>within</u> the service contour of a station assigned to the channel and the broadcast signal <u>can</u> be displayed on a representative consumer TV receiver system (viewable).

- Condition II: the WSD is operating <u>within</u> the service contour of a station assigned to the channel but the broadcast signal <u>cannot</u> be displayed on a representative consumer TV receiver system (not viewable).

- Condition III: the WSD is operating <u>outside</u> of the service contour of a station assigned to the channel but the broadcast signal <u>can</u> be displayed on a representative consumer TV receiver system (viewable).

- Condition IV: the WSD is operating <u>outside</u> of the service contour of a station assigned to the channel and the broadcast signal <u>cannot</u> be displayed on a representative consumer TV receiver system (not viewable).

Table 5-60, presented below, defines how each channel between 21 and 51 was categorized at each of the field trial sites. In this table, each channel is assigned to one of the four conditions described above and then further segmented according to the signal type utilizing the channel (ATSC or NTSC).

Table 5-60. Categorization of Channels at Each Field Test Site.

Test Site	ATSC Channels			NTSC Channels			Condition IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
1	38,40,41,46	27,28,29,33, 34,35,36,39, 42,48,51	None	22,24,26,45, 50	32	None	21,23,25,30, 31,43,44,47, 49
2	27,29,33,34, 35,36,38,40, 41,42,46	39,48,51	None	22,24,32,45, 50	26	43	21,23,25,28, 30,31,44,47, 49
3	27,28,29,33, 34,35,36,38, 39,40,41,42, 46,48,51	None	30,47	22,24,26,32, 45,50	None	31,43,49	21,23,25,44
4	27,29,30,33, 34,35,36,38, 39,40,42,43, 46,48,51	28,41	None	22,23,24,25, 26,32,45,47, 49,50	None	None	21,31,44
5a	36,48	27,28,29,30, 33,34,35,38, 39,40,41,42, 43,46,51	None	26,32,45,50	22,23,24,25, 47,49	None	21,31,44
5b	27,33,34,35, 36,38,39,40, 46,48,51	28,29,30,41, 42,43	None	22,23,24,25, 26,32,45,49, 50	47	None	21,31,44
6	27,29,33,34, 35,36,38,39, 40,41,42,46, 48,51	None	21	22,24,26,32, 45,50	43	23,25,49	28,30,31,44, 47
7	34,35,36,38, 39,48	28,29,40,41, 44,46	27,30,33,43	25,31	None	22,23,24,26, 45,47,49,50	21,32,42,51
8	None	28,29,34,35, 36,38,39,40, 41,44,46,48	30	25	31	24,26,42,43, 50	21,22,23,27, 32,33,45,47, 49,51
9	None	28,29,34,35, 36,38,39,40, 41,44,46,48	None	25,31	None	22,26,32,42, 43,45,50	21,23,24,27, 30,33,47,49, 51

Tables 5-61 through 5-66 provide the results from the field trials in terms of the ability of each WSD prototype to correctly identify Condition I, II, III or IV channels. For each condition, the number of correct detections is shown as a function of the number of scans performed. While this approach presumes that Condition II and III channels represent occupied, rather than available channels, the arithmetic complement of each reported result defines the performance under the opposite presumption (*i.e.*, that they represent available channels).

Table 5-61. Adaptrum WSD Prototype Field Trial Results.

Test Site	ATSC			NTSC			Condition IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
1	8/8	11/22	-	12/15	0/3	-	18/21
2	20/22	6/6	-	9/10	2/2	0/2	13/18
3	14/15	-	3/3	12/12	-	3/6	2/7
4	13/15	1/2	-	20/20	-	-	3/3
5a	2/2	9/15	-	6/8	1/12	-	3/3
5b	11/11	1/6	-	16/18	0/2	-	2/3
6	13/14	-	1/1	9/12	0/2	0/6	7/7
7	4/6	3/6	4/4	4/4	-	1/16	4/5
8	-	11/24	2/2	4/4	4/4	3/20	17/26
9	-	5/12	-	2/4	-	4/14	10/12
Totals[1]	91%	51%	100%	89%	30%	17%	75%

Notes: A significant spurious emission was observed at 600 MHz (see Appendix H) that may have prevented accurate detection on channel 35.
[1] Percentage of successful identifications of the channel occupancy under assumed conditions.

Table 5-62. I2R WSD Prototype Field Trial Results.

Test Site	ATSC Channels			NTSC Channels			Condition IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
1	-	-	-	2/20	0/4	-	12/16
2	-	-	-	5/20	1/4	0/4	14/21
3	60/60	-	6/8	17/24	-	6/12	9/16
4	55/60	1/8	-	11/40	-	-	12/12
5a	4/4	12/30	-	1/8	0/12	-	6/6
5b	22/22	8/12	-	3/18	0/2	-	6/6
6	53/56	-	2/4	7/24	2/4	0/12	14/20
7	18/24	9/24	12/16	0/8	-	5/32	16/16
8	-	18/48	4/4	0/4	0/4	3/20	33/40
9	-	3/48	-	0/8	-	0/28	31/36
Totals[1]	94%	30%	75%	25%	10%	13%	81%

Notes: This device was inadvertently operated in “all signal” mode at test sites 1 and 2, which was the wrong mode for DTV detection. Therefore, no ATSC results are presented for these two test sites.
[1] Percentage of successful identifications of the channel occupancy under assumed conditions.

Table 5-63. Motorola WSD Prototype (Sensing Mode) Field Trial Results.

Test Site	ATSC Channels			NTSC Channels			Condition[1] IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
1	16/16	28/44	-	-	-	-	0/7
2	40/44	9/12	-	-	-	-	8/13
3	56/60	-	4/8	-	-	-	0/1
4	55/60	3/8	-	-	-	-	4/4
5a	4/4	15/30	-	-	-	-	-
5b	19/22	6/12	-	-	-	-	-
6	49/56	-	-	-	-	-	4/4
7	19/24	12/24	9/16	-	-	-	8/12
8	-	23/48	3/4	-	-	-	21/29
9	-	13/48	-	-	-	-	15/24
Totals[2]	90%	48%	57%	-	-	-	64%

Notes:
[1] **Since i**n the test mode the prototype device detects only ATSC signals, those channels not identified as occupied could .not be determined with certainty to be available or to be occupied by NTSC signals.
[2] Percentage of successful identifications of the channel occupancy under assumed conditions.

Table 5-64. Motorola WSD Prototype (Geolocation Mode) Field Trial Results.

Test Site	ATSC Channels			NTSC Channels			Condition IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
1	8/8	22/22	-	10/10	2/2	-	14/18
2	22/22	6/6	-	10/10	2/2	2/2	12/18
3	30/30	-	4/4	12/12	-	2/6	8/8
4	30/30	4/4	-	20/20	-	-	6/6
5a	2/2	15/15	-	4/4	6/6	-	3/3
5b	11/11	6/6	-	9/9	1/1	-	3/3
6	28/28	-	0/2	12/12	2/2	0/6	10/10
7	12/12	12/12	4/8	4/4	-	6/16	6/8
8	-	24/24	0/2	2/2	2/2	0/10	14/20
9	-	24/24	-	4/4	-	3/14	12/18
Totals[1]	100%	100%	50%	100%	100%	24%	71%

Notes:
[1] Percentage of successful identifications of the channel occupancy under assumed conditions.

Table 5-65. Philips WSD Prototype Field Trial Results.

Test Site	ATSC Channels			NTSC Channels			Condition IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
1	16/16	40/44	-	20/20	4/4	-	11/36
2	44/44	12/12	-	20/20	4/4	4/4	2/36
3	60/60	-	8/8	24/24	-	12/12	0/16
4	60/60	8/8	-	40/40	-	-	5/12
5a	4/4	28/30	-	8/8	12/12	-	2/6
5b	22/22	10/12	-	18/18	2/2	-	1/6
6	56/56	-	4/4	24/24	4/4	12/12	3/20
7	24/24	22/24	16/16	8/8	-	32/32	3/16
8	-	47/48	4/4	4/4	4/4	20/20	3/40
9	-	42/48	-	8/8	-	28/28	3/36
Totals[1]	100%	92%	100%	100%	100%	100%	15%

Notes:
[1] Percentage of successful identifications of the channel occupancy under assumed conditions.

Table 5-66. Philips WSD Prototype (w/external attenuator) Field Trial Results.

Test Site	ATSC			NTSC			Condition IV
	Condition I	Condition II	Condition III	Condition I	Condition II	Condition III	
3 (6dB)	15/15	-	2/2	6/6	-	3/3	0/4
4 (10dB)	30/30	3/4	-	20/20	-	-	5/6
5a (10dB)	2/2	11/15	-	4/4	5/6	-	3/3
7 (10dB)	6/6	2/6	3/4	2/2	-	7/8	1/4
8 (10dB)	-	11/12	0/1	1/1	1/1	5/5	4/10
Totals[1]	100%	73%	71%	100%	86%	92%	48%

Notes:
[1] Percentage of successful identifications of the channel occupancy under assumed conditions.

Table 5-67 shows the overall percentage of accurate signal detections confined to those channels whose occupancy status is easily established (Condition I and IV channels) over all nine of the test sites. The results are presented for Condition I (occupied) ATSC (digital) and NTSC (analog) channels and for Condition IV (available) channels.

Table 5-67. WSD Signal Detection Performance

Prototype WSD	Condition I		Condition IV
	ATSC Occupied Channels	NTSC-Occupied Channels	Unoccupied (Available) Channels
Adaptrum	91 %	89%	75%
I2R	94%	25%	81%
Motorola (geo-loc)	100%	100%	71%
Motorola (sensing)	90%	-	64%
Philips	100%	100%	15%

It should be noted that the reported NTSC-detection performance may be somewhat misleading since no consideration was given to the quality of the analog picture when identifying "viewable" channels.

5.10.1 Observations Based on Results

The TV-sensing field trial results indicate that the Motorola WSD, which employs a geo-location/database look-up approach to identify occupied and unoccupied TV channels, was the best overall performer with respect to correctly determining occupied and unoccupied (available) TV channels within TV station service contours. This prototype also employs a spectrum sensing capability that was found to perform with less accuracy than that of other devices. The combination of geo-location/database look up and spectrum sensing techniques provide an acceptable mechanism to allow for authorization of equipment today.

The results obtained from those WSD prototypes that rely solely on spectrum sensing to identify occupied and unoccupied (available) channels demonstrate the importance of correctly specifying a detection sensitivity requirement. The Philips device, which demonstrated the most sensitivity in the laboratory tests, also performed best with respect to detecting occupied channels; however, it reported a very high percentage of channels occupied that were potentially available. The Adaptrum and I2R devices, which demonstrated less sensitivity in the laboratory measurements, did much better at correctly determining available channels but did not detect occupied channels with complete reliability. Spectrum sensing worked to some degree and it may be possible to authorize products that rely on spectrum sensing, in the future, if it can be demonstrated that they will not interfere.

The comparative received power measurements performed at each test site indicate that the difference in signal level between TV signals received by a roof-top television antenna and those received by ground-proximate antenna can vary between 0 and 34 dB, depending on the specific site conditions and whether the WSD antenna is located indoors or outdoors relative to the TV antenna.

6 Wireless Microphone Measurements

6.1 Wireless Microphone Laboratory Tests

6.1.1 Introduction

The purpose of this part of the test project was to observe the capabilities of the current white space device (WSD) prototypes to sense Part 74 wireless microphones (WM) operating on broadcast television channels at known signal levels with and without digital television (DTV) signals on adjacent channels. Tests were performed with two different types of microphones – FM modulated and digitally modulated.[38] All of the tested microphones operate in a maximum 200 kHz authorized bandwidth segment within a TV channel. Each microphone was limited to operation in a different subset of television channels 21 to 51; individual microphones were tested on frequencies within their subset as shown in the test results. The test modulation was a 1000 Hz tone at 24 kHz deviation. The two FM microphones had a 32 kHz pilot tone and the digital microphone was encrypted. The measured modulated signal for the FM microphones is shown in Figure 6-1 and the measured signal of the digital microphone, which appears the same with or without modulation, is shown in Figure 6-2.

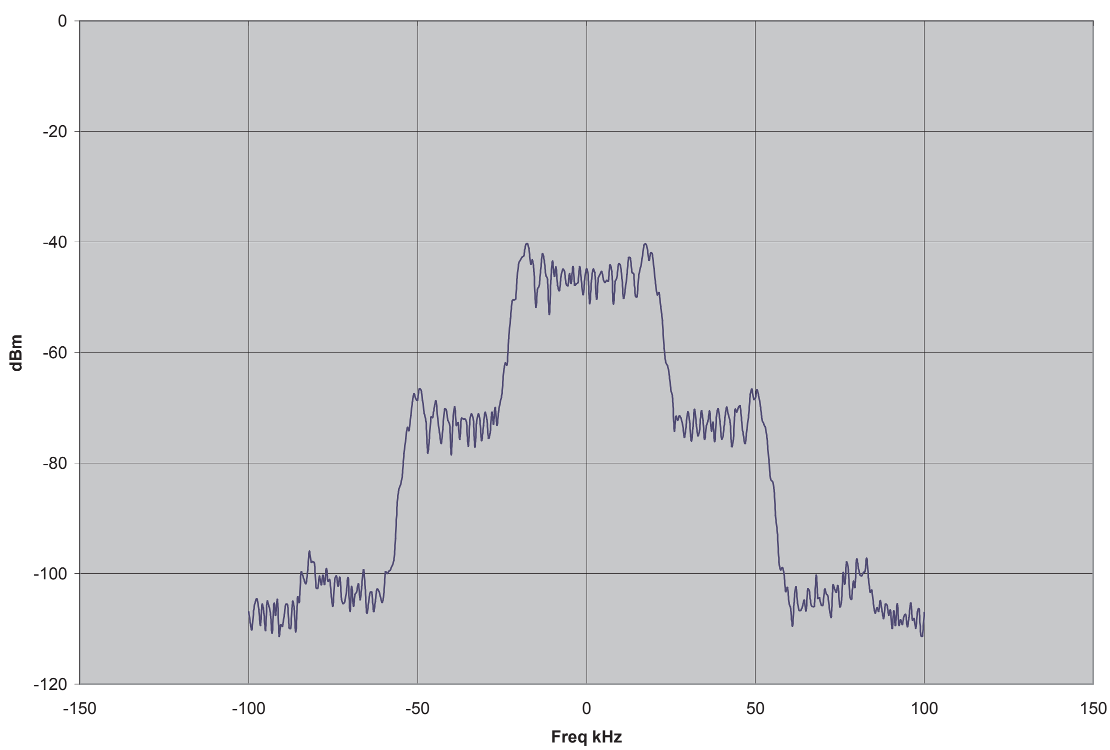

Figure 6-1. FM Microphone Signal

[38] Two FM microphones manufactured by Shure Incorporated and one digital microphone manufactured by Lectrosonics were loaned to the Commission for testing.

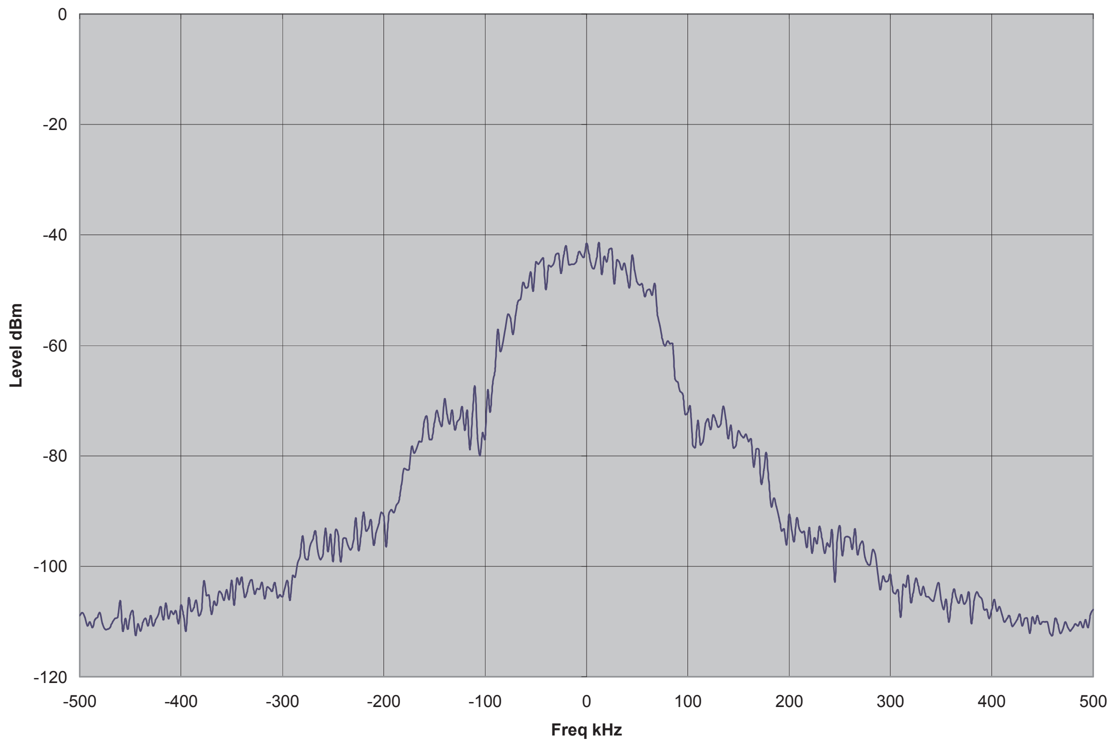

Figure 6-2. Digital Microphone Signal

The WSDs submitted by Microsoft and Philips were similar to those submitted in the previous round of testing (Phase I) with respect to their ability to detect wireless microphones with some modifications. The changes eliminate the ability to select the type of signal (ATSC, NTSC or wireless microphone) to search for and the identification of the type of signal sensed. The versions of both of these WSDs examined in the Phase II tests searched for all three types of signals on each scan of a channel and indicated only whether the channel was occupied or available on each scan or the probability of detection for the number of scans selected. The Institute for Infocomm Research (I2R) device had the capability to search for either DTV or wireless microphone signals. It provided two scan modes – "DTV" and "All" and two test modes – "Lab" and "Field". In the DTV scan mode it searched only for DTV signals and in the "All" mode it searched only for microphones. The "Lab" test mode was intended only for conducted bench testing and the "Field" mode was intended only for reception of radiated signals with an antenna. The test results were displayed as the probability of detection for the number of scans selected.

6.1.2 Test Procedure

Because of ambient emissions, direct pick-up and spurious radiated emissions from the WSD systems, it was not possible to derive a clean test signal on the bench by sampling the radiated signal from a wireless microphone with a receive antenna and applying it to the antenna input connector of the WSD. It was thus determined that the testing needed to be performed with the wireless microphone in an anechoic chamber. This approach avoided interference to the test from undesired signals, and allowed a sample of the radiated signal from the microphone to be received with an antenna in the chamber. This received signal was then conducted by coaxial cable to the control room for connection to the antenna terminal of the WSD, as shown in Figure 6-3.

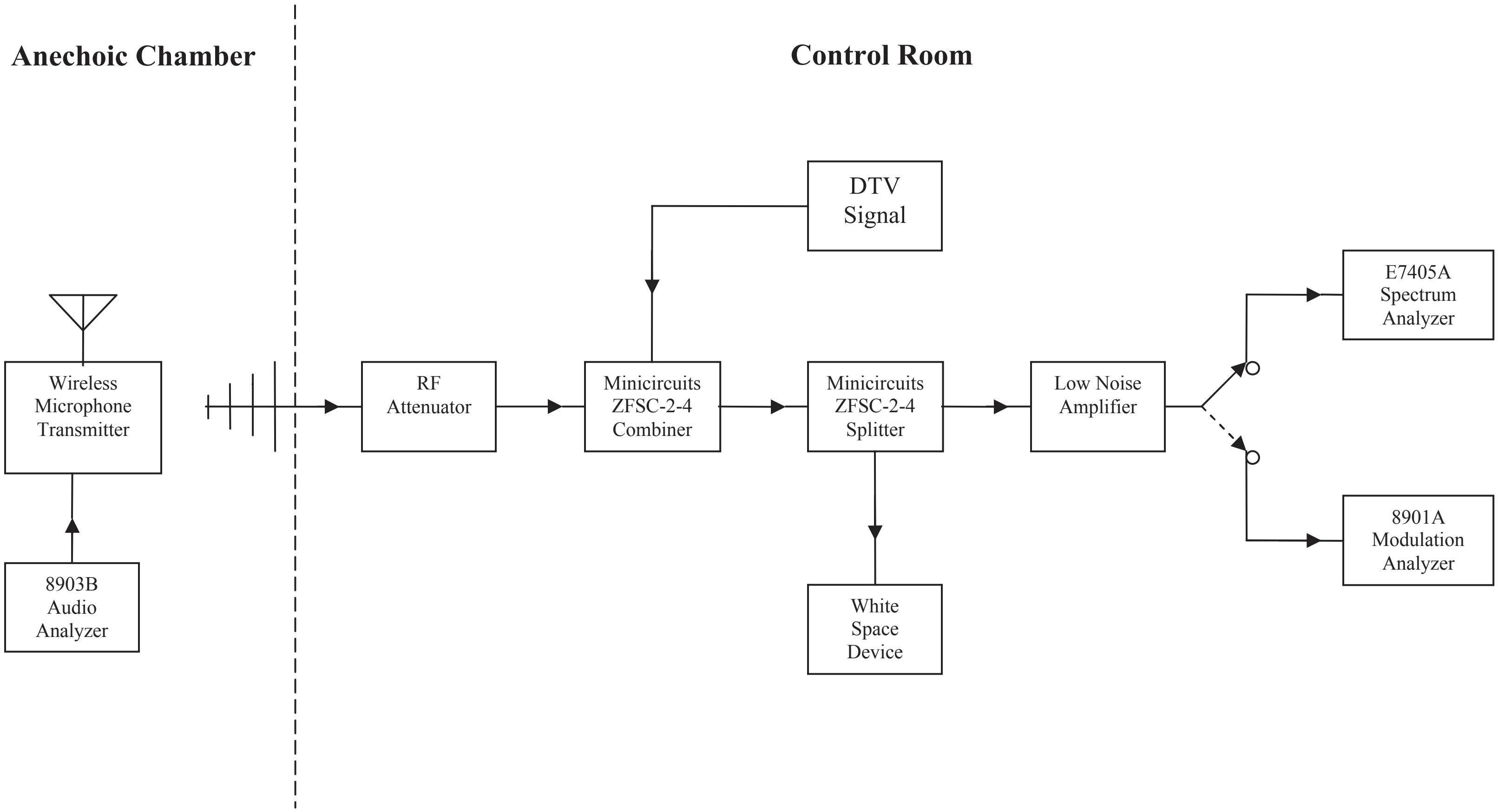

Figure 6-3. Wireless Microphone Sensing Test Setup

The WSDs were first tested for sensitivity to a wireless microphone signal at a low, middle and high frequency within a TV channel with no other signals present. The sensitivity threshold of a WSD was defined as the lowest bandpower at which the microphone is detected on 10 of 10 successive scans. Each WSD was tested with the FM microphone modulated and, in some cases, unmodulated. The digital microphone was tested with or without modulation since there was no discernible difference between the modulated and unmodulated signal or in the response of the WSDs to the different signals. Testing was then performed with simulated DTV signals located in various combinations of first and second adjacent channels over a range of power levels. The simulated DTV signal was obtained from a Rohde& Schwarz SFU signal generator. The spectral characteristics of the simulated DTV signal with the emissions mask specified in Section 73.622(h) of the Commission's rules are shown in Figure 6.4.

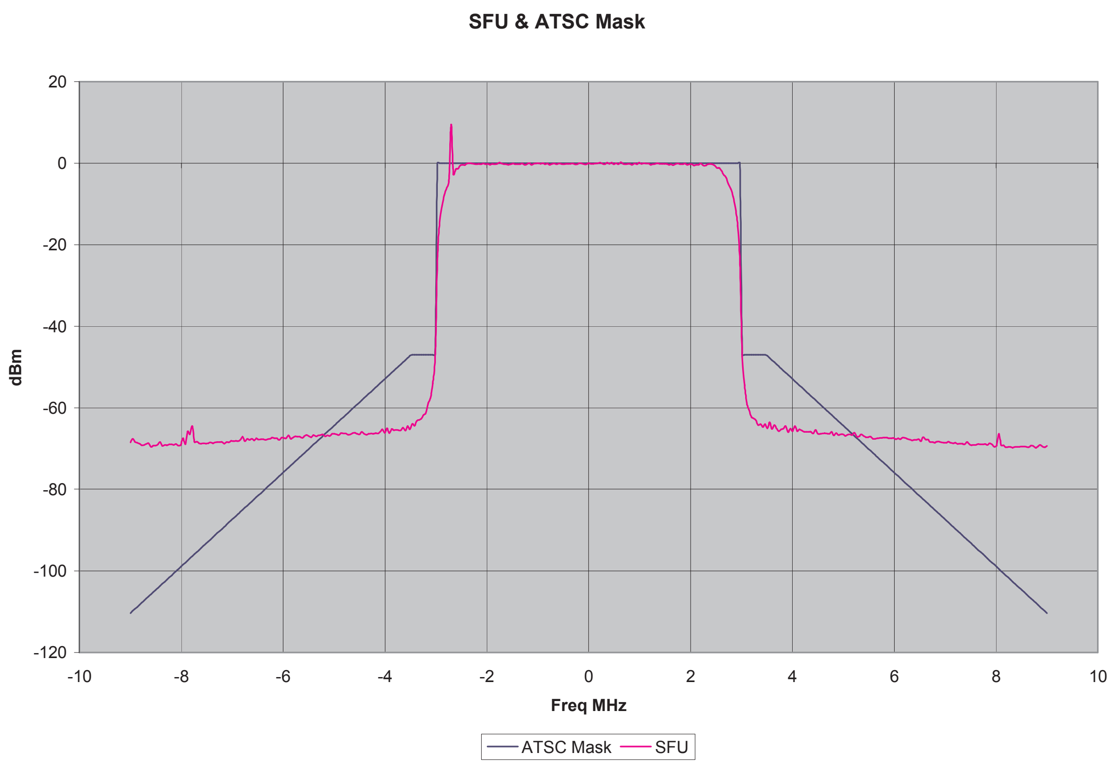

Figure 6-4. Simulated DTV Signal & ATSC Mask

6.1.3 Test Results with Microphones and No DTV Signals

The sensitivity of the WSDs with no other signals present is shown in tables 6-1 through 6-9. In most cases the FM wireless microphones were tested at 50 kHz above the low frequency edge of the channel, in the middle of the channel and 50 kHz below the high edge of the channel and, because of its wider occupied bandwidth, the digital microphone was tested 100 kHz above the low edge of the channel, in the middle of the channel and 100 kHz below the high edge of the channel. It was not always possible or considered necessary to test at all three frequencies within a channel. The Shure UR1 H4 is the same basic model as the UR1 L3 tuned to a different frequency range.

The Microsoft 205 WSD

Table 6-1. Shure UR1 L3 on Channel 44

Mic. Freq MHz	Sensitivity dBm	
	Modulated	Unmodulated
650.05	-119	-125
653	-125	-122
655.95	-124	-129

Table 6-2. Shure UR1 H4 on Channel 23

Mic. Freq MHz	Sensitivity dBm	
	Modulated	Unmodulated
524.05	-116	-123
527	-123	-120
529.95	-123	-128

Table 6-3. Lectrosonics UM 700 on Channel 44

Mic. Freq MHz	Sensitivity dBm	
	Modulated	Unmodulated
650.1	-117	---
653	-122	---
655.9	-122	---

The Philips #1 WSD

Table 6-4. Shure UR1 L3 on Channel 44

Mic. Freq MHz	**Sensitivity dBm**	
	Modulated	Unmodulated
650.05	-117	-115
653	-116	-103
655.95	-117	-116

Table 6-5. Shure UR1 H4 on Channel 23

Mic. Freq MHz	**Sensitivity dBm**	
	Modulated	Unmodulated
524.05	-117	-114
527	-116	-108
529.95	-118	-106

Table 6-6. Lectrosonics UM 700 on Channel 44

Mic. Freq MHz	**Sensitivity dBm**	
	Modulated	Unmodulated
650.1	-112	---
653	-115	---
655.9	-113	---

The I2R (Test Mode: Lab; Scan Mode: All) WSD

Table 6-7. Shure UR1 L3 on Channel 44

Mic. Freq MHz	**Sensitivity dBm**	
	Modulated	Unmodulated
650.05	-105	---
653	-127	-126
655.95	-94	---

Table 6-8. Lectrosonics UM 700 on Channel 29

Mic. Freq MHz	**Sensitivity dBm**	
	Modulated	Unmodulated
---	---	---
563.2	---	-121
565.9	---	-110

Table 6-9. Shure UR1 H4 on Channel 30

Mic. Freq MHz	**Sensitivity dBm**	
	Modulated	Unmodulated
---	---	---
569	-123	---
---	---	---

6.1.4 Test Results with Microphones and DTV Signals

The WSDs were tested to determine their ability to sense a wireless microphone on a channel and with simulated DTV signals on various combinations of first and second adjacent channels. The DTV signals were provided at power levels -28, -53, -68 and -84 dBm, which represent a high, medium, low and very low signal level. In most cases, it was found that at DTV power levels of -68 dBm or higher, the WSDs would indicate that the wireless microphone channel was occupied when no microphone signal was present (false positive) and the Microsoft WSD would not sense a wireless microphone signal at -80 dBm when the DTV signal power was -28 dBm. In a few cases when the DTV signal was on the lower adjacent channel, the WSDs would only indicate a false positive if the DTV power was increased to a power level of -53 dBm or higher. Because of test scheduling problems, the availability of test equipment or the malfunctioning of a device, formal measurements for some test conditions were not performed in all cases. Sensitivity was measured with DTV signal levels below the power level that produced false positive indications. The results are given in the tables below. For comparison, the sensitivity without DTV signals is given in parentheses.

The Microsoft 205 WSD

Table 6-10. Shure UR1 L3 (modulated) on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
43	650.05	-106 (-119)
	653	-125 (-125)
	655.95	-124 (-124)

Table 6-11. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
43	650.1	-116 (-117)
	653	-122 (-122)
	655.9	-120 (-122)

Table 6-12. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
45	650.1	-117 (-117)
	653	-123 (-122)
	655.9	-121 (-122)

Table 6-13. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
43,45	650.1	-115 (-117)
	653	-122 (-122)
	655.9	-121 (-122)

Table 6-14. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
42,43	650.1	-117 (-117)
	653	-120 (-122)
	655.9	-120 (-122)

Table 6-15. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
45,46	650.1	-117 (-117)
	653	-121 (-122)
	655.9	-121 (-122)

The Philips #1 WSD

Table 6-16. Shure UR1 L3 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm	
		Modulated	Unmodulated
43	650.05	-114 (-117)	-112 (-115)
	653	-116 (-116)	-93 (-103)
	655.95	-116 (-117)	-116 (-116)

Table 6-17. Shure UR1 L3 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm	
		Modulated	Unmodulated
45	650.05	-116 (-117)	-110 (-115)
	653	-115 (-116)	-115 (-103)
	655.95	-117 (-117)	-114 (-116)

Table 6-18. Shure UR1 L3 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm	
		Modulated	Unmodulated
43,45	650.05	-116 (-117)	-114 (-115)
	653	-116 (-116)	-101 (-103)
	655.95	-117 (-117)	-116 (-116)

Table 6-19. Shure UR1 L3 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm	
		Modulated	Unmodulated
42,43	650.05	-115 (-117)	---
	653	-116 (-116)	---
	655.95	-118 (-117)	---

Table 6-20. Shure UR1 L3 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm	
		Modulated	Unmodulated
45,46	650.05	-116 (-117)	---
	653	-116 (-116)	---
	655.95	-117 (-117)	---

Table 6-21. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
43	650.1	-111 (-112)
	653	-116 (-115)
	655.9	-113 (-113)

Table 6-22. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
45	650.1	-111 (-112)
	653	-115 (-115)
	655.9	-113 (-113)

Table 6-23. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
43,45	650.1	-112 (-112)
	653	-115 (-115)
	655.9	-113 (-113)

Table 6-24. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
42,43	650.1	-111 (-112)
	653	-115 (-115)
	655.9	-112 (-113)

Table 6-25. Lectrosonics UM 700 on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
45,46	650.1	-112 (-112)
	653	-114 (-114)
	655.9	-112 (-113)

I2R (Test Mode: Lab; Scan Mode: All)

Table 6-26. Shure UR1 L3 (modulated) on Channel 44

DTV Channels	Microphone Freq MHz	Sensitivity dBm
43	650.05	* (-105)
45	653	-124 (-127)
	655.95	-94 (-94)

* False positive at all DTV power levels

Table 6-27. Shure UR1 H4 (Modulated)

DTV Channels	Microphone Freq MHz	Sensitivity dBm
30	565.95 (Ch 29)	-99
	572.05 (Ch 31)	-98

Table 6-28. Lectrosonics UM 700

DTV Channels	Microphone Freq MHz	Sensitivity dBm
30	565.9 (Ch 29)	-110 (-110)
	572.1 (Ch 31)	-108

6.1.5 Summary

All of the WSDs gave false positive indications of microphone detection with DTV signal levels as low as -68 dBm in adjacent channels. The Microsoft device also gave false negative indications with a DTV signal level of -28 dBm in adjacent channels and a microphone power of -80 dBm. The presence of DTV signals had little effect on the sensitivity of the devices to the Lectrosonics microphone but there was insufficient data to determine the effect of DTV signals on the sensitivity of the Microsoft device to the Shure microphone. The sensitivity of the Philips device to a modulated Shure microphone signal was not significantly affected by the presence of DTV signals. However, when the Shure microphone signal was unmodulated, the Philips device was significantly less sensitive to a microphone in the middle of the TV channel with or without DTV signals in adjacent channels.

6.2 Wireless Microphone Field Tests

6.2.1 Introduction

Field tests were conducted to evaluate the performance of the WSDs in detecting wireless microphones under real-world conditions. Arrangements were made with the National Football League (NFL) and the ESPN Network (ESPN) to perform tests before and during a pre-season football game at FedEx Field in Landover, MD and with the Majestic Theatre in New York City to perform tests before and during a performance of a Broadway play.

ESPN offered to simulate a game day broadcast at FedEx Field from 10:30 AM in the morning until 5:00 PM in the afternoon before the start of the game. During this time they would turn all their wireless microphones on or off upon request. The WSDs were operated and spectrum measurements were taken at four different locations at the venue: on the east (home field) side of the playing field from 10:30 AM to 12:00 PM, at the "tailgate" area outside the stadium from 12:40 PM to 2:00 PM, on the upper deck from 2:20 PM to 3:30 PM, and in the Press Box from 4:00 PM on. At 5:00 PM, ESPN was required to cease transmissions so the NFL could set up and test their wireless microphones for use during the game, which began at 7:00 PM. From 6:20 PM to 7:00 PM during pre-game activities and from 7:20 PM to 7:45 PM during the first quarter of the game, the WSDs were operated and spectrum measurements taken.

At the Majestic Theatre, WSD tests and spectrum measurements were taken at three different locations before the performance: on the sidewalk at the entrance to the theater, in the middle of the mezzanine and in the orchestra seating area. Measurements were also taken at one location during the performance (entrance ramp to the orchestra seating area). Before the performance, measurements were performed with the wireless microphones to be used during the show turned on and off upon request.

6.2.2 Test Procedure

At each location the Philips and I2R WSDs were set up with their receive antennas located approximately 2 meters from the wireless microphone base unit. The frequency spectrum was scanned by the WSDs from TV channels 21 to 51 with the wireless microphones turned on and off. The channels indicated as occupied by the WSD were recorded in each case. The frequency spectrum was also observed and recorded with a spectrum analyzer using a ground plane vertical antenna with a gain of approximately 0 dBi from channels 21 to 51.

6.2.3 Test Results

Tables 6-29 through 6-48 show the results of the WSD scans. "X" indicates the channels on which ESPN, the NFL or the Majestic Theatre were operating wireless microphones and the channels which the WSDs reported as occupied with the microphones off and on. The channels indicated as NFL channels are those on which it appears that there were NFL microphones based on the spectrum scans. The spectrum plots obtained with the spectrum analyzer under the same conditions are given in Appendix A for FedEx Field and Appendix B for the Majestic Theatre.

Additionally, during two of the field tests of the of the white space devices' ability to detect TV signals, brief tests were conducted to check the ability of the Philips and the I2R devices to detect wireless microphones. At the Portals location, it was found that the Philips device could detect the Shure UR1 and the Lectrosonics UM 700 microphones at distances up to 30.5 meters (100 feet) within the building with intervening walls. The I2R device reported detection of the Shure UR1 with less than 100% probability at 4.6 meters (15 feet) or less but could not detect the microphone at 30.5 meters (100 feet). The I2R device reported detection of the Lectrosonics unit with 100 % probability at distances up to 6.1 meters (20 feet) but with only 60% probability at distances of 30.5 meters (100 feet) and 61 meters (200 feet). At the #3 test site, a residential location, the Philips device could not be tested because it indicated that all channels were occupied. At this location, the I2R device could not detect the Shure UR2 even as close as 1.5 meters (5 feet) but it could detect the Lectrosonics UM 700 at distances up to 15.2 meters (50 feet) where the reported probability of detection decreased to 50%.

FedEx Field

X indicates occupied channel

Location: East (home team) side of field at the 50 yard line.

Time: 10:30 AM to 12:00 PM

Table 6-29. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-30. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off							X	X	X	X		X	X	X		X
Mic on		X				X	X	X	X	X			X	X		X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X	X	X		X	X	X		X			X		X	X
Mic on	X	X	X		X	X				X		X			X

Location: Tailgate area

Time: 12:40 PM to 2:00 PM

Table 6-31. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on		X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-32. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off		X						X	X	X		X	X			
Mic on							X	X	X	X			X			

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X				X	X	X								X
Mic on	X		X			X	X			X			X		X

Location: Upper deck, Section 401

Time: 2:20 PM to 3:30 PM

Table 6-33. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on		X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-34. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off			X						X	X					X	X
Mic on	X	X	X	X	X	X			X	X	X	X			X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X	X				X	X		X	X			X		X
Mic on	X	X			X	X		X	X	X	X		X		

Location: Press box

Time: 4:00 PM to 5:00 PM

Table 6-35. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-36. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
ESPN	X		X				X				X		X	X		
Mic off	X	X	X		X				X		X	X	X	X	X	X
Mic on	X	X	X		X				X		X			X		X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
ESPN							X	X	X		X		X		
Mic off		X	X		X	X	X	X	X		X	X	X	X	
Mic on		X	X		X	X		X	X		X	X	X	X	X

Location: Press box—Pre-game

Time: 6:20 PM to 7:00 PM

Table 6-37. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
NFL	X		X		X						X					
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
NFL					X			X	X		X		X		
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-38. I2R

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
NFL	X		X		X						X					
Mic on	X	X	X		X				X	X	X		X			X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
NFL					X			X	X		X		X		
Mic on		X	X	X	X	X	X	X	X		X	X	X		X

Location: Press box—First Quarter

Time: 7:20 PM to 7:45 PM

Table 6-39. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
NFL	X		X		X						X					
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
NFL					X			X	X		X		X		
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-40. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
NFL	X		X		X						X					
Mic on	X	X	X	X	X	X	X		X	X	X		X	X		X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
NFL					X			X	X		X		X		
Mic on		X	X	X	X		X	X	X		X	X	X		

Majestic Theatre

X indicates occupied channel

Location: Sidewalk at entrance to theater

Time: 10:00 AM to 12:00 PM

Table 6-41. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-42. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic off		X	X			X	X	X	X	X		X	X			X
Mic on	X	X		X				X	X	X			X			X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic off	X	X		X				X	X			X			X
Mic on		X		X	X			X	X		X			X	X

Location: Middle of Mezzanine

Time: 12:00 PM to 2:00 PM

Table 6-43. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic off	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic off		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-44. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic off				X				X	X	X			X			X
Mic on				X				X	X	X						X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic off		X		X				X	X		X				X
Mic on		X		X				X	X						X

Location: Orchestra, stage right, row I

Time: 2:30 PM to 4:00 PM

Table 6-45. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic off	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic off		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-46. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic off				X				X	X	X	X		X			X
Mic on				X				X	X	X			X			X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic off		X		X				X	X		X				X
Mic on		X		X				X	X		X			X	X

Location: Ramp from lobby to orchestra, stage left

Time: 7:00 PM to 9:00 PM

Table 6-47. The Philips No. 2 WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic on	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 6-48. The I2R WSD

Channel	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Theater			X			X									X	
Mic on				X				X	X	X			X			X

Channel	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Theater			X							X		X			
Mic on		X		X				X	X						X

6.2.4 Summary

Wireless microphone sensing tests were performed with the I2R and Philips devices at 2 locations. The tests were conducted first with microphones off, and then turned on, in pre-determined channels to determine if the devices could sense the presence of wireless microphones. At both sites and all the test locations, the Philips device reported all the channels on which the microphones were designated to transmit as occupied whether the microphone was transmitting or not. The I2R device indicated several channels as available even when the microphones were on.