Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Unlicensed Operation in the TV Broadcast Bands	)	ET Docket No. 04-186
	)	
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380

COMMENTS OF THE NATIONAL CABLE & TELECOMMUNICATIONS ASSOCIATION ON PETITIONS FOR RECONSIDERATION

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The National Cable & Telecommunications Association ("NCTA") hereby submits its comments on the petitions for reconsideration filed in this proceeding by Adaptrum, Inc.; Dell, Inc. & Microsoft Corp.; Motorola, Inc.; the Wireless Internet Service Providers Association (WISPA); the Public Interest Spectrum Coalition (PISC); and the IEEE Local and Metropolitan Area Networks Standards Committee ("IEEE").

NCTA is the principal trade association of the cable television industry. Its members provide video programming, broadband Internet, wireline phone, and other services throughout the United States. NCTA also represents programmers and suppliers of equipment to the cable television industry.

INTRODUCTION AND SUMMARY

NCTA's members support the Commission's interest in encouraging private investment and innovation in the TV band "white spaces" to benefit consumers. However, the above-referenced Petitions would undermine key Commission objectives. They would increase the transmitting antenna height and co- or adjacent channel power limits of fixed white spaces

devices and remove protections from any cable system that carries a broadcast station from an adjacent or distant market, thereby blocking access by entire communities to broadcast signals long received and enjoyed on cable. They would also raise the power of portable devices and open up VHF bands, resulting in acre-sized zones of interference to the cable television reception of white space device users and their neighbors. And they would eliminate or effectively undermine any obligation of fixed devices to identify themselves so that cable customers and their cable operators can isolate and try to remedy interference.

The Commission has been urged to "let the engineering analysis drive our decision making" regarding white space interference.[1] None of these proposals for reconsideration described above are data driven by or based on any engineering analysis. By contrast, the NCTA engineering analysis shows that these proposals would expose millions more consumers to significant risk of confusing and confounding service outages and degradation that could arise at any time without notice, and be difficult or even impossible to diagnose and resolve. The Commission has long sought to protect consumers' ability to access services and programming that they depend upon and enjoy today, yet these Petitions invite a level of consumer disruption to video, broadband and phone services and a degree of confusion that in some ways would be even worse than would have resulted from an unmanaged DTV transition.

As re-designed, the DTV transition involves potential disruption on specific, well-publicized dates, affecting all members of a community at the same time, to be addressed by a specific, readily-available solution (a converter box). By contrast, white space interference would occur out of the blue at different times in different places, with no warning and no immediately-preceding consumer education campaign, coupons, trained representatives at call

[1] Unlicensed Operation in the TV Broadcast Bands, ET Docket Nos. 04-186 and 02-380, Second Report and Order and Memorandum Opinion and Order, FCC 08-260 (rel. Nov. 14, 2008) ("*Second R&O*"), Statement of Commissioner Michael J. Copps at 1.

and walk-in centers, "boots on the ground" offering in-home support, online mapping tools, store displays, or an analog nightlight telling consumers what is wrong, who to call, and how to fix it. If these petitions are granted, consumers who experience white space interference will not know what is causing it. They might think it is a problem with their television or their cable service. If they activated a white space device (WSD) themselves, they might suspect the culprit; but they almost certainly won't connect the problem to a WSD activated by a neighbor, or know what to do if an entire cable system is affected.

The Commission has undertaken extraordinary efforts in the DTV transition to "ensure that viewers relying on over-the-air television do not lose access to local news, public affairs and emergency information."[2] The Commission, NTIA, states, local governments, the private sector and public interest groups have joined together to wage one of the largest consumer education and preparation campaigns in American history, and the Commission believes that even more should have been done. When Acting Chairman Copps assumed the leadership of the Commission, he announced that "our three most important priorities in the coming weeks would be DTV, DTV and DTV," that the Commission should do "whatever we could … to minimize …

[2] Public Notice, FCC 09-7 (Feb. 11, 2009). The Commission has likewise devoted enormous attention for decades to assure the availability of broadcast stations and public, educational and government channels to cable customers. Most recently, the Commission held that there was an "important governmental interest" in requiring cable operators to carry both the analog and digital channel of must-carry broadcasters without any material degradation or interruption if even a single cable customer did not have the necessary equipment to view the digital channel "to minimize the impact of the DTV transition on cable subscribers." *Carriage of Digital Television Broadcast Signals: Amendment to Part 76 of the Commission's Rules*, CS Docket No. 98-120, Third Report and Order and Third Further Notice of Proposed Rulemaking, FCC 07-170, ¶¶ 54, 56 (rel. Nov. 30, 2007). In that order, then-Commissioner Copps explained that "the role of cable" is "an important part of the transition" in "making sure that consumers … continue to receive signals when the transition occurs." *Id.*, Statement of Commissioner Michael J. Copps.

consumer disruption," and that "consumers deserve the truth" about the precise impact of the transition on their service.[3]

It would make no sense to turn all of these DTV transition efforts upside down by allowing new white space devices stripped of their precautionary limits, as the Petitions propose, that could interfere with television reception for as many as 100 million households that subscribe to MVPD services. In the *Second Report and Order*, the Commission emphasized the need for an appropriate balance between the development of white space devices and the protection of "incumbent television and other authorized services that operate in the TV bands."[4] These Petitions completely fail to serve that balance and are at odds with the Commission's effort to be "cautious and conservative" prior to gaining real-world experience with the unlicensed devices.[5] Therefore, these proposals to eliminate or relax safeguards even before they are implemented should be rejected.

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[3] Acting Chairman Michael J. Copps, Testimony Before the U.S. House Committee on Energy and Commerce Subcommittee on Communications, Technology and the Internet "Oversight of the Digital Television Transition," Mar. 26, 2009.

[4] *Second R&O*, ¶ 2 ("These new rules will allow the development of new and innovative types of unlicensed devices to provide broadband data and other services . . . without disrupting the incumbent television and other authorized services that operate in the TV bands.").

[5] *Second R&O*, ¶ 3, *see also id.*, ¶ 106 ("we do not have experience with unlicensed wireless broadband operations in the TV bands, we find it prudent to take a more cautious approach … to minimize the risk of interference" to existing authorized uses). As NCTA demonstrated in its Petition for Reconsideration, however, the rules, as adopted, fail in several major respects to protect cable consumers from proven harmful interference from white spaces devices.

DISCUSSION

I. PROPOSED POWER INCREASES WOULD CREATE WIDE SWATHS OF INTERFERENCE TO CONSUMER TVs ACROSS NEIGHBORHOODS AND MDUs

Consumers are particularly susceptible to "direct pick-up" interference (DPU) to their television receivers (due to limited shielding in the TV or VCR) and also to their in-home wiring (even with the highest level of professional shielding). In-home DPU interference should be of special concern because it can affect nearly all households. Whereas only 14% of homes rely on over-the-air broadcast, nearly all households are vulnerable to in-home interference.[6] The Commission sought to mitigate this interference, among other measures, by limiting the power output of white space devices; restricting the use of VHF and other low-band frequencies that are particularly susceptible to DPU interference; and requiring portable devices to employ a power reduction technology that is yet to be defined. Although spectrum sensing is required of white space devices, that technique does not mitigate DPU interference, because cable services employ the entire TV broadcast band in delivering services.[7]

VHF Channels: PISC proposes to overturn the Commission's decision not to allow portable devices to utilize VHF channels 5-13. PISC would permit the use of these VHF channels by portable devices to communicate with fixed devices.[8] PISC's proposal focuses entirely on interference in the TV bands outside of consumers' homes. However, neither PISC nor any other party has presented any solution that would mitigate the increased in-home DPU

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[6] DBS and the telephone companies often rely on connections to their customers' televisions that are similarly vulnerable to interference from the types of higher-powered white space devices that would be permitted under the *Second R&O*. The use of set-top boxes can reduce, but does not fully resolve, interference, as shown by the tests performed by OET and Carl T. Jones. *See* NCTA Petition for Reconsideration at 10.

[7] "The Potential Adverse Effects of Unlicensed Operation of New Devices in TV Broadcast Bands on Cable Customer's Reception of Cable Service," David Large, appended to the Comments of the National Cable & Telecommunications Association, filed in this docket on January 31, 2007 at 2.

[8] PISC Petition at 26.

problems that would be caused by operation on VHF channels. Whereas a 100 mW output in UHF channels causes interference of up to 80 feet, in VHF the interference would increase to nearly double that distance.[9] Even the White Spaces Coalition previously informed the Commission that it "does not oppose restricting personal/portable devices from all VHF channels" because of concerns regarding direct pickup interference.[10]

Although the outside plant that cable operators use to deliver service to a home are protected by the operator, the operator cannot control the exposure to DPU interference where cable services are connected to TVs, VCRs and other devices, or in-home wiring that lack sufficient shielding to protect against nearby white space devices that emit power greater than 10 mW.[11] These consumer electronics devices are vulnerable on all channels, but particularly on VHF channels where their shielding is least effective. Interference can also adversely affect cable operators' broadband and telephone services.[12] The Commission should therefore reject PISC's proposal to overturn the Commission's decision not to allow portable devices to utilize VHF channels 5-13.

Power Outputs: Adaptrum proposes to increase the maximum allowable power for portable devices from 100 mW to 250 mW.[13] PISC proposes to eliminate the 100 mW cap, as well as the 4 W cap for fixed devices, and allow greater power levels for devices using channels not proximate to a broadcast channel. Their proposals are entirely focused on interference in the TV bands. No party has presented any solution that would mitigate the increased DPU problems

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[9] "Technical Analysis of Selected Petitions for Reconsideration in 'White Spaces' Proceeding," David Large, May 7, 2009, attached to these comments ("Large Report") at 9.

[10] Reply Comments of the White Spaces Coalition, March 2, 2007, at 31.

[11] Large Report at 9.

[12] *Id*. at 13.

[13] Adaptrum Petition at 6.

in consumers' homes or the increased potential for interference to headend off-air signal reception that would be caused by any increase in portable device power levels. The existing record based upon actual testing shows that a 100 mW output in UHF channels will cause interference to television receivers 80 feet away in adjacent apartments or housing units where the customer has no control over signals emanating from another unit.[14] The practical effect is that one consumer's installation would create interference in neighboring apartments and even single family homes, leaving the neighbor with no clue on the source; and if the source is detected, leaving a choice of unrealistic remedies – such as moving a TV screen face to the wall, trying to forbid a neighbor from using a laptop in her living room, or opening walls and ripping out a landlord's wiring.

Indeed, in the very same 1979 order that Adaptrum cites in support of its request, the Commission drew as its perimeter of acceptable interference caused by personal computers to television reception at 10 meters (33 feet), a much smaller radius than the 80-foot zone of interference that would be caused by 100 mW white space devices. In that order, the Commission explained, "[w]e are most interested in protecting an individual who is receiving interference from his neighbor's computer," noting that a consumer can at least attempt corrective measures for their own devices, but that "these remedies may not work when a second party is receiving the interference."[15]

To limit interference to 33 feet, the Commission would need to *reduce* the power level for portable devices to 17 mW.[16] By contrast, Adaptrum's proposal to allow 250 mW would

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[14] Large Report at 5.

[15] *Amendment of Part 15 to Redefine and Clarify the Rules Governing Restricted Radiation Devices and Low Power Communication Devices*, Docket No. 20780, First Report and Order, FCC 79-555, 79 FCC 2d. 28, ¶ 54 (1979).

[16] Large Report at 5. The record evidence shows that consumers will experience interference well below this level.

increase the interference radius to more than 125 feet, *affecting a total area of more than an acre in size*.[17] The public's interest in using their televisions in their homes would be fundamentally threatened if the Commission allowed the introduction of unpredictable, undetectable, and mobile acre-sized zones of interference. Adaptrum and PISC present no hard evidence in support of their proposed increases. NCTA's data is supported by actual testing evidence included in the engineering study submitted by NCTA[18] and the results of OET's testing, which found that consumer televisions could be disrupted by as little as 5mW of power.[19]

Motorola proposes to permit the sale of portable devices "designated" for vehicular use to have outputs of 4 Watts, the same as fixed devices. A 4 Watt output in UHF channels creates interference up to 550 feet away, or 22 acres.[20] Obviously, many consumer televisions would be within range of such devices. With such a large roving radius of interference, the Commission should treat car-installed WSDs the same as it would treat any other portable white spaces device. In addition, nothing would practically restrict a consumer from using "vehicular" devices in their homes or elsewhere. This would undermine the Commission's reason for placing stricter limits on portable devices. The Commission should therefore reject Motorola's proposed change.

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[17] *Id*. The Commission should also reject Adaptrum's proposal that the Commission eliminate the 40 mW cap on devices using adjacent channels and permit such devices to emit as much power as other portable devices.

[18] *See* NCTA Petition for Reconsideration at 7-8 (describing the filed tests performed by Carl T. Jones Corp).

[19] *See* "Direct Pickup Interference Tests on Three Consumer Digital Cable Television Receivers Available in 2005, "FCC Office of Engineering and Technology Laboratory, released July 31, 2007 at iii.

[20] Large Report at 6. If the Commission permitted these portable devices to use VHF channels, the radius of interference would double to 1000 feet. *Id.*

II. WEAKENING PROTECTIONS FOR HEADENDS WOULD JEOPARDIZE RECEPTION FOR ENTIRE COMMUNITIES, PARTICULARLY IN RURAL AREAS

The impact of white space interference on consumers will be dramatic when fixed or personal/portable WSDs interfere with reception at a cable headend. There, even a single white space transmitter can block access to a television station for an entire community.[21] The Commission helped to mitigate this interference by creating protective zones around headends; limiting the antenna height, power and spacing of fixed transmitters; and creating registration databases to facilitate coordination, but the Petitions would undermine these safeguards.

Protective Zone for Headends: Adaptrum proposes to virtually eliminate the Commission's protective zone around headends for operation on adjacent channels outside of the 30 degree arc, from 2km to 100 meters. Adaptrum suggests that a wider zone is unnecessary because it believes that headends utilize taller towers less susceptible to interference than consumer antennas, but it offers no support for this assertion or any other field measurements to justify its suggested reduced protection. In fact, NCTA's actual expert testing demonstrates that the directivity of headend antennas is not dramatically better than consumer-grade antennas, and that the protective zone therefore cannot safely be reduced.[22] If the Commission were to afford such latitude to WSD manufacturers, it would need to adopt new mitigating measures such as requiring all fixed WSD device operators to coordinate in advance with the operators of all potentially-affected headends or requiring the WSD proponent to provide an alternate means for affected cable operators to receive the specific off-air DTV signals.

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[21] *Id*. at 10.

[22] *Id*. The need for a 2km zone is demonstrated in the record. *See* ET Docket No. 04-186, Comments of the National Cable & Telecommunications Association, appendix "The Potential Adverse Effects of Unlicensed Operation of New Devices in TV Broadcast Bands on Cable Customers' Reception of Cable Service," (Jan. 31, 2007).

Antenna Height: Motorola and WISPA propose to more than triple the Commission's limit on WSD transmitting antennas from 30 meters to 100. As their Petitions recognize, increasing antenna height causes a proportional increase in the susceptibility to interference that requires compensatory increases in the required separation distance from protected contours.[23] However, these Petitions would fail to extend the same increased protection for headends. Thus, the proposal would jeopardize reception at headends unless the Commission expanded the protective zone around headends and also extended protection to headends located inside the protected contour of broadcast stations, as proposed in NCTA's Petition.

IEEE proposes to eliminate antenna height restrictions altogether, and replace them with increases in the buffer zone surrounding stations' protected contours as height above average terrain (HAAT) is increased.[24] This change would expose all cable headends located outside of the protected contour of broadcast stations to increased interference. Even for headends located within protected contours, the added buffer distance would not be adequate when tall headend towers are utilized, as the line-of-sight distance to WSDs would be much greater than for typical residential roof-top antenna heights.

Power Output for Fixed Devices: WISPA proposes that the power output for fixed devices be increased by up to five-fold, to 20 watts EIRP, with the maximum allowed power increasing as a function of distance from protected station contours.[25] This proposal would fail to protect headends located beyond the contour boundaries. If the Commission wishes to permit such increases, it should either increase the protected area around each headend, require each

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[23] Motorola Petition at 5-6; WISPA Petition at 13-14.

[24] IEEE Petition at 3-4. NCTA supports IEEE's proposal that antenna mounting height should be measured as height above average terrain rather than height above ground level, since the elevation of the mounting point, such as on a hill, is a more accurate measure.

[25] WISP Petition at 15-16.

new fixed WSD to be coordinated with each potentially-affected headend, or require the operator of the WSD-based service to pay the cost of providing an alternative, equivalent-quality means for affected headends to receive the affected signals.

Exclusion of Certain Broadcast Channels from Protection: Dell and Microsoft propose to increase interference far more directly: by having the Commission declare that any broadcast signal carried from an adjacent or distant market would not be protected from interference.[26] The proposal bears no relationship to the reality of cable service, particularly service in rural areas or at the edge of DMAs. It is commonplace for cable systems to straddle markets, and there can be considerable consumer demand for continued reception of broadcast signals, whatever market to which they may be technically assigned. The Dell and Microsoft proposal would discard five decades of cable service and displace existing services enjoyed by consumers using their existing investments. Also, the Commission should note that under the existing rules, nothing precludes a WSD manufacturer from securing access to an otherwise available channel through a market agreement to compensate the cable operator for securing an alternate means to receive the broadcast signal at the headend.

Elimination or Degradation of Spectrum Sensing: WISPA and IEEE's proposals would also jeopardize headends by eliminating the Commission's requirement that fixed devices employ spectrum sensing, arguing that a geolocation/database access system is sufficient to protect wireless microphones.[27] In addition to the proposal to eliminate spectrum sensing outright, Motorola and WISPA also propose changes that would eliminate its effectiveness, such as to decrease the minimum receive antenna height from 10 meters to 3 meters, a height which

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[26] NCTA would not object to the request for clarification that protection is only provided with respect to television channels that are received via off-air antennas. As noted above, in some circumstances it would be appropriate for WSD providers to arrange for such alternative transport in order to mitigate interference to off-air channels.

[27] IEEE Petition at 3; WISPA Petition at 1-2.

they concede is likely to be shadowed.[28] The Commission should reject these proposals, since, independent of microphones, spectrum sensing is also an important back-up safeguard for headends. The proponents of these changes failed to provide any analysis of the impact of their proposals on headends. For example, without sensing, a database error could result in a single WSD interfering with an entire community's ability to access a broadcast channel through a headend.

III. OTHER PROPOSED CHANGES WOULD CREATE GREATER RISKS OF INTERFERENCE TO CABLE CUSTOMERS

Transmission of Identifying Information: Motorola and others propose to make it even more difficult to diagnose white space problems by removing the requirement that fixed devices emit standardized identifying information.[29] The ready availability of such identifying information is important to enabling *timely* resolution of interference problems, without knowing in advance what make and model of equipment is involved. It is not realistic to require every party seeking to identify interference to own and run multiple sets of special reception and decoding equipment one after another until the offending transmitter is discovered.[30]

Further Review of Devices Using Only Spectrum Sensing: The *Second R&O* correctly determined that the Commission could not at this time rely on devices to avoid harmful

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[28] *See* Motorola Petition at 7-8; WISPA Petition at 7 ("the Commission is justifiably concerned that [short] sensing antennas could be shadowed"). Motorola and WISPA also propose to eliminate the Commission's requirement that when a WSD detect incumbent usage with which it may be interfering, all WSDs with which it is in direct communication must initiate the required remedial measures, and not only the device that detected. Motorola also complains that the Commission's requirement for a -114 dBm sensing level will cause "false positives." Motorola Petition at 12. However, Motorola does not propose any alternative backed up by an engineering analysis. With each of these arguments, at least until a party provides compelling engineering analysis that these requirements are unnecessary, the Commission should err if at all on the side of caution rather than permit widespread interference to consumers if spectrum sensing were effectively eliminated.

[29] Motorola Petition at 21-22. Motorola proposes to eliminate the requirement that fixed WSDs transmit identifying information, or in the alternative to allow WSD device manufacturers to transmit such information in the format of its choosing, rather than in accordance with a standard to be established by a recognized standards organization, and make available equipment to enable such formats to be received and decoded.

[30] Large Report at 16-17.

interference only through the use of spectrum sensing, which then Commissioner Copps described as "not ready for prime time" based upon the results of Commission testing. Rather than close the door on such devices, though, the Commission created a process that would allow proponents of such devices to obtain approval for devices that would emit up to 50 mW and use only spectrum sensing. Rather than utilize this process, PISC proposes to water it down to avoid making the required showing of interference avoidance. PISC's proposal would defeat the very compromise adopted by the Commission to permit the development of these devices despite serious concerns. Proponents of these devices should focus their attention to innovative solutions that would assure the reliability of spectrum sensing in preventing interference, rather than urging the Commission to wish the problems away.

Re-defining Protected Contours: Adaptrum and Motorola propose to re-define the protected contours of broadcast stations to take into account more precisely the effects of local terrain features. NCTA does not oppose this suggestion in theory, but like spectrum sensing, NCTA's expert report demonstrates that these measures are not yet ready to be deemed reliable across the board.[31] Indeed, Adaptrum's proposal is essentially a form of spectrum sensing. For example, a low elevation area within the originally-defined service area may have undetectably-low signal levels and, thus be excluded by the proposed new techniques, yet homes on higher ground beyond that area may have acceptable signal levels.[32] If devices were allowed to transmit from within the low area, they would interfere with the reception at homes or at a headend located farther out from the station.

Access to White Space Database: PISC suggests that information in the WSD database should be available to anyone via an open Internet site. Completely unrestricted access to

[31] *Id*. at 13-14.

[32] *Id*. at 13.

information such as the location of secure technical facilities, such as cable headends, would pose an unnecessary risk of misuse. However, we agree that, in conjunction with the identifying signal standard discussed above, access by *registered entities* would permit cable operators to much more quickly and independently resolve cases of interference by WSDs than forcing such issues to pass through an undefined FCC process. NCTA supports the Commission's grant of PISC's request to that extent.

Power Outputs When Using Fractions of a Channel: IEEE points out that Commission's regulations do not specify a minimum occupied bandwidth for WSD transmissions and proposes a minimum occupied bandwidth of 500 kHz. They also propose that the Commission specify a maximum power density within the occupied channel.[33] NCTA does not oppose this concept in principle, but the power density suggested by IEEE would allow for much greater total EIRP per channel that what is currently allowed.[34] IEEE's proposal must be modified so that, for WSD transmissions that occupy less than a full television channel, the maximum EIRP be reduced in proportion to the bandwidth occupied. Without that provision, interference to reception would be increase when multiple white space devices, each operating at the full allowable power, simultaneously use portions of the same channel.

[33] IEEE Petition at 4-5.

[34] Large Report at 6.

CONCLUSION

NCTA continues to support the introduction of new wireless communications devices, provided the rules fairly balance the benefits of such devices with protecting cable customers from harmful interference to their video programming and broadband services. NCTA urges the Commission to reject requests to increase white space device power outputs or tower heights, reduce the protective zone around headends, exclude certain broadcast channels from headend protections, permit use of VHF channels by portable devices, or eliminate or undermine the use of spectrum sensing as a backup to geolocation/database interference protection. The Commission should also grant NCTA's Petition for Reconsideration, and grant in part PISC's request to allow access to the white space database by registered entities.

Respectfully submitted,

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TECHNICAL ANALYSIS OF SELECTED PETITIONS FOR RECONSIDERATION IN "WHITE SPACES" PROCEEDING

David Large

May 7, 2009

Various parties have filed Petitions for Reconsideration ("Petitions") urging the Federal Communications Commission to modify its Second Report and Order[1] and rules in the White Spaces proceeding. At the request of the National Cable & Telecommunications Association, I am providing this technical assessment of those portions of selected Petitions that touch upon issues of importance to the cable industry and its customers. Since the specific proposals contained in the Petitions tend to overlap, I have organized this report by subject, rather than by petitioner, with comments from various petitioners interleaved in each section.

SUMMARY

While a few Petitions address minor technical matters, the main Petitions raise issues in the following categories:

- Adaptrum, WISPA, Motorola, and PISC propose to increase permitted power levels.

These petitioners cite the reduced costs of serving a given population with fewer, higher-powered transmitters. In most of these petitions, additional protection is proposed for those living within broadcast stations' protected contours and using typical homeowner broadcast antennas, but no provisions are made for headends within the contours using tall towers, or for headends located outside the protected contours, for whom the risk of interference increases sharply with increased WSD power. Some of these proposals would also result in increased direct pickup (DPU) interference to the television reception of both the users of white spaces devices and their neighbors, with the potentially affected area extending to nearly an acre, or even much more if the FCC allowed portable devices to operate on VHF channels.

- WISPA and Motorola propose to increase white space transmitting antenna heights.

As with proposals to permit increased power, these petitions fail to protect cable headend reception. As shown in NCTA's Petition, it is the limitations of the line-of-sight signal propagation that primarily determine how far a co-channel WSD must be from a headend to avoid interference. Increasing WSD antenna height would cause a proportional increase in this susceptibility distance that is not considered in any of these Petitions.

[1] *Unlicensed Operations in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807 (2008) ("Second Report and Order").

- Dell and Microsoft, Motorola, and PISC propose to permit portable device operations below channel 21.

These petitioners seek to increase the number of eligible channels by allowing portable devices to operate on lower channels where currently only fixed devices are authorized to transmit. PISC, in particular, proposes that the FCC permit portable devices to operate on VHF channels. Unfortunately, it fails to take into account the increased probability of VHF DPU interference to cable television customers' reception of cable services carried in the VHF band. As demonstrated by recent tests which are included with NCTA's Petition, effective receiver shielding is considerably less effective at VHF than at UHF, thus increasing the distance within which a portable WSD would cause interference to neighboring apartments, and even single family homes. VHF operation of portable devices should be forbidden unless WSD EIRP levels are considerably reduced from those currently permitted.

- Adaptrum, Dell and Microsoft would reduce protection for headend reception, either by reducing the protected area or reducing the number of received channels which are protected.

Adaptrum would reduce the protection areas around headends, but without providing field measurements or calculations to justify its proposal. By contrast, previous filings by NCTA, as well as its Petition, have included calculations and measurements of required protection areas.

Dell and Microsoft would deny protection to any signal which is received at a headend that is physically outside the market area of that station. In effect, they would deny access to that television programming for an entire community, so that new, untested, WSD-based services will have more channels on which to operate. This proposal is inconsistent with the FCC's objective to avoid harmful interference to existing users of the TV broadcast band and should be rejected.

- Adaptrum and Motorola would re-define the protected contours of broadcast stations.

These petitioners wish to use techniques for measuring the service area of broadcast stations that take into account more precisely the effects of local terrain features. While there may be some benefit to petitioners, it must be approached very carefully, so that locally-shadowed areas or irregular boundaries do not create situations in which WSD operation would be permitted, but that result in greater interference than would be the case with the existing smooth-bordered, contiguous protected areas. At their worst, these proposals amount essentially to using spectrum sensing, with all its flaws, to define service areas.

- WISPA, Motorola and IEEE would degrade or eliminate spectrum sensing by decreasing receiver sensitivity, lowering sense antenna height, or decreasing the actions required if channel occupancy is detected.

In general, these petitioners feel that the geolocation+database access method provides adequate protection for over-air reception. These petitions fail, however, to consider the protective needs of headends, where one white space transmitter can block access to a television station for an entire community. Spectrum sensing is a necessary back-up safeguard in the event of a database error regarding the location of a nearby headend.

- PISC asks the Commission to essentially discard its requirement that those wishing to market devices that use spectrum sensing, but not geolocation/database access, must demonstrate an effective method for avoiding interference to existing users of the spectrum.

After considering all of the available technologies, the FCC decided (correctly) that the combination of geolocation, plus required access to a database of available channels, was the best primary means for protecting over-air television reception, with spectrum sensing as a backup should errors occur in the database. To provide for as-yet-undiscovered means of avoiding interference to reception while relying exclusively on spectrum sensing to detect channel usage, the FCC also defined a new class of device operating at reduced power, but only upon a showing by its developer of how interference with existing users of the spectrum was to be avoided. PISC would permit WSD operators to avoid making the required showing of interference avoidance and to persuade the Commission to, in effect, approve such devices anyway.

- Adaptrum and Motorola would eliminate or modify the requirement for fixed WSDs to transmit identifying information.

These petitioners point to the requirement that WSDs transmit identifying signals using an undefined, future standard as inconsistent with a quick rollout of WSD services and potentially limiting with respect to technology. In general, they propose either dropping the requirement, or allowing each device to transmit the information using its own proprietary modulation and protocol.

Unfortunately, neither solution works for those affected by harmful interference. In the case of a cable headend, interference by a WSD will cause reception to be lost for an entire community until eliminated. Both the cost and speed of resolution are important. If WSDs are allowed to transmit without a standard unique identifier, cable operators will not be able to quickly and effectively track the source of interference. Likewise, it is unreasonable to expect cable operators to acquire many sets of equipment and try each one until one manages to decode the proprietary identifier of the offending transmitter. Rather than agreeing to these proposals, the

FCC should move promptly to encourage the development of a single, universal identifying signal standard.

- PISC wants improved access to data contained in the white spaces database.

PISC suggests that information in the WSD database should be made available to anyone via an open Internet site. While we are cautious about allowing unrestricted access to such information (which poses significant security risks and could be used, for instance, to sabotage remotely located cable television equipment and facilities), we agree to the extent that, in conjunction with the identifying signal standard discussed above, access by registered entities would permit cable operators to much more quickly and independently resolve cases of interference by WSDs than forcing such issues to pass through an undefined FCC process.

* * * * *

In general, issues related to headend protection occasioned by the above Petitions could be resolved in any of three ways:

- By increasing headend protection areas where higher WSD power or antennas are used;
- By WSD proponents purchasing the equipment or services required to provide an alternate, equivalent, means for affected cable operators to acquire specific off-air DTV signals; or
- By requiring all operators of fixed WSD devices to coordinate with any potentially-affected headend before commencing operations and either determine that no interference exists or solve the interference.

There is no similar solution to the increased DPU problems that would accompany any increase in portable or fixed device power levels or operation on VHF channels. This problem is a function of the shielding effectiveness of television receivers and of the interconnecting cables and components used in residential television setups. Lacking any solution that would not entail massive expenditures by cable operators and their customers, the FCC should not consider any increase in the EIRP of portable devices (and, in fact, should reduce them). Given the greatly increased distance over which the more powerful fixed white space devices can cause DPU, a defined minimum spacing should be required between them and any buildings served by cable operators. Any power increase allowed fixed devices should be permitted only if the defined minimum spacing is increased in accordance with the expanded zone of potential interference.

DETAILED DISCUSSION OF SELECTED PETITIONS

Co-Channel Power Transmission Limits

§15.709(a)(1) limits fixed device effective isotropic radiated power (EIRP) to 4 watts over the TV channel of operation.
§15.709(a)(2) limits portable device EIRP to 100 mW over the TV channel of operation.

Adaptrum proposes that the FCC increase the maximum allowable power for portable devices from 100 mW to 250 mW.[2] Adaptrum agrees that the FCC should protect TVs used by cable customers by limiting DPU interference to a range of 10 meters (33 feet), but then it fails to provide any test results or other hard evidence that a 250 mW output would not interfere with consumer TVs outside of that range.

The effect of their proposed power increase, in fact, is simple to calculate using the base results from the Carl T. Jones testing: the field strength from a transmitted signal (expressed in logarithmic units) increases as 10 times the logarithm of the transmitted power and decreases as 20 times the logarithm of the distance to the receiver. Thus, for a constant field strength representing the threshold of interference, we can readily see that the distance within which interference can occur is equal to the original distance times the square root of the ratio of transmitted powers. Thus an increase from 100 mW to 250 mW will increase the radius of potential interference by 58% while the affected area will be 2.5 times larger.

The direct pickup (DPU) tests conducted by Carl T. Jones and filed with NCTA's Petition offer the primary field evidence of the extent of potential interference to television reception in adjacent households. The data from these tests strongly supports NCTA's contention that the potential interference radius from a 100 mW UHF WSD extends at least 80 feet into adjacent apartments. The interference radius would increase to 145 feet if the FCC granted PISC's request to allow the use of channels 5-13. These test results are consistent with the FCC's own tests and with the limited tests conducted by Motorola on coaxial cable and wiring components. Under Adaptrum's own standard of a 33-foot protective zone around consumer TVs, the maximum power output for portable devices should be decreased to 17 mW, not increased to 250 mW. A 250 mW output WSD would potentially create DPU interference to 126 feet, affecting a total area of almost 50,000 square feet (well over an acre), based upon the Jones testing. This is 14.6 times larger than the area Adaptrum asserts should be considered permissible for interference. Although Adaptrum's Petition includes some data and a chart, they are not based upon any testing evidence that has been submitted in the record, and even if accurate do not in any case actually support increasing power outputs as proposed by Adaptrum.

Motorola proposes a new class of mobile/portable device which would be allowed to transmit at the same power levels as fixed devices.[3] They justify this by proposing that such devices be

[2] Adaptrum Petition at 6.

[3] Motorola Petition at 15-16.

marketed only for vehicle installation, where they would pose no greater danger to reception than fixed devices. While it is not clear from their Petition, such devices should at the least follow the same rules regarding eligible channels and locations as fixed devices, given their similar potential for causing interference.

There is no way, however, to assure that such devices are restricted to vehicle installation. Absent any practical means of enforcement, portable devices would be available at the higher power level and labeled as "vehicle" models. This has very serious implications for direct pickup interference. While the interference radius from a 100 mW portable device is approximately 80 feet into an adjacent apartment, that danger extends to about 1,000 feet at VHF and 550 feet at UHF if the power is raised to 4 watts. A 550 foot interference radius would affect a zone of nearly 100,000 square feet, or 22 acres. Even if the devices were only installed in vehicles, such a transmitter installed in a car parked on a residential street would have sufficient power to cause DPU interference to several nearby homes. Based on the implications for DPU, therefore, the FCC should not authorize higher powered portable/mobile devices.

No petitioner has offered hard evidence in this rulemaking that contradicts NCTA's filings with regard to the potential for widespread DPU interference from 100 mW devices. Increasing the power from 100 mW to 250 mW, as suggested by Adaptrum, would increase the distance within which interference is likely by 58% and thus the area within which interference could occur would be two and a half times as large. Increasing it to 4 watts, as suggested by Motorola, would increase the interference radius by a factor of over 6 and the affected area by a factor of 40.

The Institute of Electrical and Electronics Engineers (IEEE) points out that the FCC regulations do not specify a minimum occupied bandwidth for WSD transmissions and proposes a minimum occupied bandwidth of 500 kHz. They also propose that the FCC specify a maximum power density within the occupied channel.[4] We agree with their proposals in principle. Unfortunately, the power density suggested would allow for much greater than 4 watts total EIRP per channel, if multiple WSDs each occupied a portion of the channel. To avoid that, we suggest that, for WSD transmissions that occupy less than a full television channel, the maximum EIRP be reduced in proportion to the bandwidth occupied. Without that provision, interference to reception would be worsened when multiple WSDs, each operating at the full allowable power, simultaneously use portions of the same channel.

The Wireless Internet Service Providers (WISPA) proposes that the FCC allow fixed WSDs to transmit at levels as high as 20 watts EIRP, with the maximum allowed power increasing as a function of distance from protected station contours.[5] They support this proposal, along with their proposal for increased antenna height discussed below, on the basis of the reduced cost to serve a given area and population group. No specific parameters are included in their proposal.

This proposal and the companion proposal to allow greater antenna heights suffer from the same deficiency – while the allowable increased power would be a function of distance beyond protected contours, that provision would only protect viewers (and to some degree headends)

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4 IEEE Petition at 4-5.

5 WISP Petition at 15-16.

located within the protected contour. It results in decreased protection for cable headends located beyond the protected contour boundaries by increasing the distance over which line-of-sight transmission conditions govern. Similarly, it would increase the distance over which DPU interference could occur by a factor of 2.24.

The potential for increased DPU interference could only be remedied by enforcing a minimum distance between fixed transmitters and buildings served by cable systems.

The increased potential for headend interference can be remedied in any of three ways: by increasing the protected area around each headend as a function of WSD antenna height and EIRP, by requiring each new fixed WSD to be coordinated with each potentially-affected headend, or by the operator of the WSD-based service offering to pay the cost of providing an alternative, equivalent-quality, means for affected headends to receive the off-air DTV signal.

Non-Co-Channel Power Limits and Allowed Operational Areas

§15.709(a)(2) limits portable device EIRP to 40 mW when operated within protected areas or buffer areas of television stations.
§15.712(a)(1) forbids adjacent-channel transmission by fixed WSDs within the protected contour of a television station.
§15.712(a)(2) forbids adjacent-channel transmission by fixed WSD within a buffer zone of 6 to 14.4 km extending outward from the boundary of the protected contour of a television station.

Adaptrum proposes that the FCC allow both portable (increased to 250 mW) and fixed adjacent-channel WSD operation at full power in all locations.[6] This would increase maximum radiated power within protected areas by a factor of 100, from 40 mW to 4 watts.

They point out that only a small fraction of the power in a potentially-interfering signal will fall within the susceptibility bandwidth of a receiver. However, Adaptrum ignores the fact that the relationship between desired and undesired signals is not new information, but is already factored into the adjacent channel rejection specifications of such documents as ATSC A-74. *ATSC Recommended Practice: Receiver Performance Guidelines*. Their stated justification for relaxing reception protection is that the degree of interference could be reduced by lower operating power, narrower occupied bandwidth, and/or reduced out-of-band emissions. Adaptrum also cites the existing requirement for WSDs to use adaptive power control, and states that adaptive bandwidth control is possible.

This ignores the simple fact that the parameters for adaptive power control are not specified in the rules (and only speculation is in the record as to what average power levels will be employed) and, further, there is no requirement that it be employed as a tool to eliminate interference when it occurs – in fact, the user of the WSD is unlikely to even be aware of interference to reception outside his own household. Finally, there is no provision in the rules for adaptive bandwidth utilization, nor does Adaptrum propose such a provision.

[6] Adaptrum Petition at 6.

Adaptrum has presented no field or laboratory evidence to support this change. It should be rejected as it offers no new, practical or enforceable method for avoiding interference to reception or DPU interference.

Motorola also proposes to allow adjacent channel operation by fixed devices within protected contours, combined with a proposal to more accurately define service areas and signal strengths within those areas.[7]

Unfortunately their proposal provides no parameters regarding when a fixed WSD should be able to use those channels, except vague references to predicted broadcast station field strength. Lacking a more specific proposal, this element of their Petition appears to be nothing more than another request for the FCC to lower the protection provisions of the Second Report and Order, without any science showing of how equivalent protection against reception interference is to be achieved.

High powered adjacent channel operation is a concern with regard to both DPU interference and headend reception.

- Fixed WSDs are allowed to operate on VHF channels, where their higher power, combined with lower shielding effectiveness can result in interference at distances of up to 1,000 feet. In general, population densities will be greater within protected contours, as will the percentage of multi-story housing. These factors will combine to increase, on average, the number of households who would be subject to DPU interference from a fixed WSD. Absent some requirement to maintain a specified minimum spacing between fixed WSDs and homes and businesses served by cable television, allowing fixed WSD operators more accessible channels within protected contours will increase the incidence of DPU interference. Although Motorola talks about some sort of control based on predicted off-air signal strength, those predictions are not relevant to DPU, since the signals delivered by cable systems are independent of off-air signal levels.

- Under the current rules, headends located within the protected contours of broadcast stations are not allowed to register with the database. Thus, they will be denied the protection radii currently provided for headends outside those contours, and thus subject to severe interference from nearby WSDs. Allowing fixed devices to operate within the contour boundaries will thus exacerbate the probability of interference with headend reception.

Public Interest Spectrum Coalition (PISC) proposes to allow higher transmitted power levels from both fixed and portable devices when operating on channels that are neither co-channel with, nor adjacent to, existing broadcast television stations.[8] They cite the increased efficiency that may be possible in constructing a network using fewer, but higher-powered, fixed WSDs by

[7] Motorola Petition at 20-21.

[8] PISC Petition at 10-12.

taking advantage of the decreased sensitivity of television receivers to non-adjacent-channel signals. PISC does not specify any specific new power limits in their Petition.

PISC does not take into account the increased potential for direct pickup interference from high-powered television band transmitters. Even at 4 watts EIRP, the probable interference radius from a fixed transmitter is about 1,000 feet into an adjacent building at VHF and about 550 feet at UHF, while the radius of potential interference from a portable 100 mW WSP is 80 feet into an adjacent apartment. Increasing either limit would greatly increase the probability of interference to cable customers' television reception, high-speed data service, and/or telephone service. The potential for such interference was recently verified by Carl T. Jones' tests included with NCTA's Petition.

Eligible Channel Ranges for Portable WSDs

§15.707 allows fixed devices to operate on VHF channels 2 and 4-13, and UHF channels 14-36, and 38-51 (with additional restrictions in certain cities). Portable devices, however, are not allowed to operate on any VHF channels or on channels 14-20.

PISC proposes that the FCC allow portable devices to operate on channels 5-20 when operated in a "slave" mode and controlled by a "master" fixed WSD.[9] However the FCC rules with respect to portable devices using the lower UHF channels, it should continue to forbid portable device operation on any VHF channels. The average television receiver shielding effectiveness is much worse on VHF channels than on UHF channels, as measured by Carl T. Jones in 1992 and confirmed in tests conducted in 2008, as reported in NCTA's Petition in this proceeding. Specifically, the radius of potential interference to reception in adjacent apartments is almost twice as large at channel 12 as it is at channel 21 or 45. Furthermore, most of the receivers tested showed a decreasing trend of shielding as the frequency is lowered. While lower VHF channels were not tested in 2008, Carl T. Jones found in 1992 that the medium shielding effectiveness was 13 dB worse at channel 6 than at channel 12.[10] Shielding effectiveness is the primary determiner of DPU interference threshold. Should portable devices be allowed to operate on VHF channels, the number of incidents of DPU will certainly be much greater than under the current rules.

Protection Areas Adjacent to Cable System Headends

§15.713 defines the contents of the database that must be consulted by WSDs to determine eligible channels for operation, including data on cable television headends. §15.713(c)(2) limits cable headends eligible for registration to those located outside television stations' protected contours. §15.712(b) defines the protected contour at each headend:

- For co-channel operation, both portable and fixed devices are forbidden to operate within a circular segment whose radius is 80 km towards the received station and whose angular

[9] PISC Petition at 25-26

[10] "Analysis of C.T. Jones Testing Results," at 2 and Figure 3, attached to NCTA's Petition.

width is 60 degrees, centered on a line between the headend and received broadcast television station. Outside that segment, operation is forbidden within 8 km of the headend.

- For adjacent-channel operation, both portable and fixed devices are forbidden to operate within a circular segment whose radius is 20 km towards the received station and whose angular width is 60 degrees, centered on a line between the headend and received broadcast television station. Outside that segment, operation is forbidden within 2 km of the headend.

Adaptrum has proposed reducing the adjacent-channel protection distance from headends from 2 km to 100 meters. (Although Adaptrum also suggests that the 20 km main-beam protection radius "is questionable," it does not appear that they propose a reduction in that requirement). They have not proposed changing any co-channel protection distances.

The justifications they give for this change include:

- That the FCC did not explain its logic for defining the headend protection area.
- The results of the OET testing of co-channel susceptibility.
- That cable system antennas are typically located on tall towers and have excellent directivity.

Although the FCC did not detail its rationale for selecting the headend protection areas, there is evidence in the record to support its findings. In particular, my original technical report in this matter[11] contained detailed calculations of both co-channel and adjacent-channel protection distances required to protect headend reception under various conditions.

Adaptrum also speculates that "typically" cable systems utilize tall towers and better antennas than consumers, but offer no evidence to support the assertion, nor data showing why this justifies looser regulations. In fact, the co-channel tests conducted by Carl T. Jones and myself show that the directivity of headend antennas is not dramatically better than consumer-grade antennas (though their construction is certainly superior), and that the beamwidth that must be protected is, in fact, wider than in the newly adopted white spaces rules. Our test results are detailed in NCTA's Petition.

Given the lack of field data in this area, however, it would be prudent to defer deployment of WSD in a wider area around all headends until more experience is gained or until meaningful field tests can be conducted, given that the consequences of interference to headend reception from WSD transmissions is the loss of a broadcast channel to an entire community.

Dell and Microsoft have proposed that protection only be provided with respect to signals classified as "local" with respect to the area served by the cable system. First, this proposal is

[11] "The Potential Adverse Effects of Unlicensed Operation of New Devices in TV Broadcast Bands on Cable Customers' Reception of Cable Service," David Large, appended to the *Comments of the National Cable & Telecommunications Association* in this matter and submitted to the FCC on January 31, 2007.

contrary to the FCC's objective to introduce white spaces devices in such a way that existing, authorized users of television channels are protected from interference. Second, Dell and Microsoft greatly overstate the supposed benefit of their proposal. It is likely that the majority of headends are located within the protected contours of all but one or two distant signals carried. Furthermore, unless a given headend is close to 80 km beyond the protected station contour, the additional protected area is smaller than described in Dell's Petition (the additional protected area increases approximately as the square of the distance beyond the contour boundary). And absent data on which broadcast signals are received via television signals at which headends, it is unclear whether any channel shortage, in fact, exists. By contrast, the cost for a small, rural cable system to provide an alternate means of obtaining a signal from an out-of-market station, such as a microwave link or fiber optic transmission line, could be prohibitive. If a provider of WSD-based services wants access to an additional channel within the protected zone of a headend, it should pay the cable operator's costs to obtain the programming via an alternate means.

In summary, petitioners have not presented any fact-based evidence to support reducing protection for cable headend signal reception. In contrast, NCTA's Petition, based on actual field testing, shows a need to increase co-channel protection of headend areas.

White Space Transmitting Antenna Regulations

§15.709(b)(2) specifies that fixed WSD transmitting antennas be not more than 30 meters above ground level.

Motorola and WISPA independently propose to increase the maximum transmit antenna height to 100 meters.[12]

Their justification for his change is that a greater transmit antenna height will lead to larger service areas from each fixed transmitter, and thus reduced cost to rollout a large-area service. To protect receivers with stations' protected contours, Motorola and others propose that the buffer distances beyond the contour boundaries, as specified in §15.712(a)(2) be increased when higher antennas are used.

Neither petitioner takes into account the effect of higher towers on reception at headends. For instance, the line of sight between a headend receiving antenna mounted 150 meters above ground and a fixed WSD antenna mounted 30 meters above ground is about 56 miles (90 km). If the WSD antenna height is increased to 100 meters, that distance increases to 70 miles (113 km). In order to adequately protect headend reception from fixed WSD antennas mounted at the increased height, headend protection distances must be increased accordingly. Alternately, new fixed WSD installations can be coordinated with headends or WSD proponents can pay the cost of providing an alternate means for the cable system to receive the programming.

IEEE makes two proposals with respect to transmitting antennas:

[12] Motorola Petition at 4; WISP Petition at 13-15.

- Antenna mounting height should be measured as height above average terrain (HAAT) rather than height above ground level (AGL).
- Antenna height restrictions be deleted in their entirety, but the buffer zone surrounding stations' protected contours be increased as HAAT is increased.[13]

IEEE justifies the first proposal by pointing out that the service area from an antenna is a function of both AGL and the local elevation of its mounting point (such as a small hill). We agree and recommend that the FCC accept that proposal.

The second proposal is presented without any justification. As with Motorola's more modest proposal, however, the proposed remedy only addresses the interference problem for receivers located within the protected contour of broadcast stations. It does not address the problem of interference with reception at cable system headends where those are outside the protected contour and, for which, the WSD device may be in the primary beam of the receiving antenna and for which the signals may be directed towards the headend (as opposed to the case with receivers within the contour whose antennas, if directional, will be pointed away from the WSD). Even for headends located within protected contours, the added buffer distance would not be adequate when tall headend towers are utilized, as the line-of-sight distance to WSDs would be much greater than for typical residential roof-top antenna heights.

NCTA's Petition includes the scaled results of actual field measurements that demonstrate the need for greater co-channel protection areas than now defined in the rules. Increasing allowed fixed device transmitting antenna heights should be allowed only if those protection distances are increased in proportion to fixed WSD antenna height. As an alternative, which recognizes that the details of particular WSD installations and other geographic features may reduce headend interference, the FCC should require each new fixed WSD to be coordinated with all headends within a radius where a potential line-of-sight transmission path exists (considering the HAAT of both WSD and headend antennas).

White Spaces Devices Relying Only on Spectrum Sensing

§15.717 defines a new class of WSD which is limited to 50 mW EIRP and which relies only on spectrum sensing to determine channel availability. Importantly, however, the FCC places the onus on proponents of such devices to "demonstrate with an extremely high degree of confidence that they will not cause harmful interference to incumbent radio services." Vendors must submit prototype devices for testing and be subject to public comment and FCC review before being accepted for deployment.

Adaptrum urges the FCC to eliminate its limitation on the power of such devices to 50 mW.[14] Given the FCC's conclusion that geolocation, combined with database access, is the best technology for minimizing interference to reception, Adaptrum has not provided any basis for

[13] IEEE Petition at 3-4.

[14] Adaptrum Petition at 9.

authorizing any particular devices relying on spectrum sensing alone, even at 50mW. There is ample evidence in the record in this proceeding to show that "shadowing," combined with rural headend antenna configurations in weak signal areas, will frequently set up conditions for headend reception interference (as well as interference to individual households using their own antennas). As the headend tests conducted on behalf of NCTA, and discussed above, demonstrated, even a 50 mW device operated within the main beam of a receiving antenna would generate co-channel interference from any location from which line-of-sight transmission conditions to the headend exist.

PISC proposes several changes to the regulations regarding signal-sensing-only WSDs:

- That the FCC should specify the criteria for interference avoidance
- That the FCC should simplify the certification procedure for such devices
- That the FCC should allow higher transmitted power levels – at least 100 mW – for such devices.

The FCC has evaluated all the available filings and determined that the combination of database access and geolocation is the minimum necessary means of avoiding interference. Spectrum sensing alone, as has been extensively discussed by several parties in this rulemaking, suffers from many deficiencies as the primary means of avoiding interference with reception. What the FCC has done, by defining this new class of device, is to leave the door open to new approaches, should a developer have an innovative new approach to solving the problem of coexisting with existing spectrum users.

What PISC is asking, in effect, is for the FCC to approve 100 mW devices using spectrum sensing as the sole means of avoiding interference – the very approach that was previously rejected as insufficient. It should be rejected.

In summary, for the very reasons that the FCC chose geolocation/database access as the best insurance for accurate determination of eligible channels for operation, I am pessimistic of any manufacturer developing a 50 mW device that can avoid reception interference, but at the very least, would strongly recommend against any increase in power for such a device until new innovative approaches are proven.

Definition of Protected Contours for Broadcast Stations

§15.712(a)(1) defines the protected contours for broadcast television stations.

Adaptrum proposes that the FCC allow the use of more modern techniques for determining coverage areas for stations. They also propose using WSDs which have both geolocation and signal sensing technology to develop improved signal availability determination, by transmitting that information back to the database operator who can then develop more accurate coverage maps.

Motorola, similarly, proposes that the FCC allow use of more modern techniques for determining both coverage areas of stations and signal strengths within those coverage areas.

While there are valid arguments for more precisely determining coverage areas for broadcast stations, given terrain variations, caution must be applied when using that information to determine eligible channels for WSD operation. As an example, a low elevation area within the originally-defined service area may have undetectably-low signal levels and, thus be excluded from an accurately-determined service area map, yet homes on higher ground beyond that area may have acceptable signal levels. If WSD were allowed to transmit from within the low area, they would interfere with the reception at a headend (or homes) located farther out from the station.

Additional problems arise when trying to define threshold levels. Areas that are shadowed, as measured using antennas placed 10 meters or 30 meters above the ground, may well still have usable signals at a cable headend which utilizes a 150 meter tower. If WSD were allowed to operate in the area based on signal measurements made at a lower antenna position, they would interfere with headend reception.

Adaptrum seems to be proposing that spectrum sensing be used to define coverage areas. If adopted, this would turn the entire protection scheme on its head – rather than geographically-defined areas, the database would then consist of areas where signals were detected by WSD devices. In essence, it would be a return to spectrum sensing, with all the dangers of shadowing and the difference between signal levels at different elevations above ground that are discussed above.

Should the FCC opt to redefine how coverage areas from stations are determined, the new procedures should be subject to a full rulemaking process that would allow affected parties to ensure that the new result is a lower, rather than higher, probability of reception interference.

Spectrum Sensing Requirements

§15.709(b)(2) specifies that fixed WSD antennas used for spectrum sensing be located at least 10 meters above ground level and be omnidirectional.

§15.711(c)(1)(i) requires that the sensitivity to television signals be -114 dBm.

IEEE proposes that the requirement for spectrum sensing of television broadcast signals be eliminated in its entirety.[15] WISPA make the same proposal.[16] In their view it is unnecessary if a reliable geolocation/database access system is in place.

If only individual reception of broadcast television were at stake, the lack of a redundant protection scheme might be arguable, but when reception for entire communities depends on a

[15] IEEE Petition at 3.

[16] WISP Petition at 1-2.

single signal reception point, as is the case with most cable systems, the backup provided by spectrum sensing is essential. If there is an error in the database of available channels, spectrum sensing is the only method by which a WSD can protect cable headends from destructive interference. On that basis, this proposal should be rejected.

Motorola proposes to decrease the minimum receive antenna height to three meters.[17] WISPA makes the same proposal, if spectrum sensing is retained as a requirement.[18]

The principal justification given for this proposal is simple cost reduction. In Motorola's view, the reduced effectiveness and greater probability of shadowing is justified because of the robustness of the adopted rules with respect to geolocation and database access.

Unfortunately, reducing the sense-antenna height to less than a third of that now required will increase the probability of shadowing, and almost certainly reduce effective sensitivity, thus decreasing spectrum sensing as an interference avoidance tool.

Motorola also questions the viability of the mandated -114 dBm sensing level, because of perceived problems with "false positives."[19] They do not, however, propose an alternative standard.

Motorola and WISPA independently suggest abandoning the sensing redundancy provided by distributed sensing by all WSDs in each communications group.[20] They cite what they feel is an imbalance between protecting existing spectrum users and efficient operation of networks based on WSD. WISPA suggests that only the specific WSD detecting an occupied channel be required to take action. Group sensing, however, is an important enhancement to signal sensing, as one or more devices in a communication group may be shadowed, yet transmissions from any of the devices might cause headend reception interference.

PISC proposes to eliminate the requirement that WSDs notify users if television broadcast signals above threshold level are detected if the database for that location identifies those channels as available for use.[21] Their primary justification for this change appears to be the potential for confusing the user. PISC thus ignores the purpose of spectrum sensing serves as a backup method of preventing interference when a database is not available or database errors occur.

WISPA proposes to eliminate the requirement that spectrum sense antennas be omnidirectional.[22] Their stated reason is that interference will be reduced when directional transmit antennas are used because "the transmitted signal power [will be directed] toward the base station and away

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17 Motorola Petition at 7.

18 WISP Petition at 2.

19 Motorola Petition at 12.

20 Motorola Petition at 14; WISP Petition at 12-13.

21 PISC Petition at 9.

22 WISP Petition at 9.

from the protected contour of co-channel and first adjacent channel TV stations." Thus, in their view, the sense antenna need only detect the presence of signals coming from the direction of transmission.

WISPA's logic doesn't hold up, when applied to protection of headends located beyond the protected contour boundary, however. For example, if the WSD doing the sensing is transmitting towards another WSD located farther out from the boundary, and a headend happens to be located even farther from the boundary, along roughly the same radial line from the broadcaster, then if the sensing WSD uses a directional sense antenna, that antenna will be pointed directly *away* from the broadcast station, while its transmissions will be pointed directly *towards* the headend. WISPA's proposal fails to account for the fact that, when using a directional transmit antenna, it is signals arriving from the opposite azimuth that need to be sensed, not those in the direction of transmission.

From the standpoint of avoiding interference with broadcast signal reception at cable headends, the primary question is the effectiveness of spectrum sensing as a backup to database access and the degree to which various WSD proponents' proposals would degrade that important protection layer. When database errors occur, it is incumbent on the FCC to ensure a high probability that the backup system act to prevent reception interference. Adopting the suggestions in various proposals summarized above would result in either no sensing at all or, at best, a single sense antenna, mounted at a lower elevation and thus more subject to blockage, combined with a receiver with some unspecified lower sensitivity. Given the impact on cable headends of blocking access to key broadcast programming for entire communities, these changes are ill-advised.

Transmission of Identifying Signals by Fixed WSDs

§15.711(e) requires fixed WSDs to transmit identifying information including, at least, sufficient data to uniquely identify the device and its location. The regulation specifies that the identification signal and format must correspond to an as-yet-undefined standard administered by a recognized standards organization.

§15.713(f) requires each fixed WSD to register with the database the above information, in addition to information that would enable someone to contact the person or entity responsible for its operation.

Taken together, these provisions would enable the source of interference by a fixed WSD to be located and identified and, using that information, to be contacted so that it can be rectified. Use of a single standard for transmission of the identifying signal assures that any fixed WSD can be identified without knowing in advance what make and model of equipment is involved.

Motorola proposes to delete the requirement that fixed WSDs transmit identifying information, citing the lack of a developed standard and also possible restrictions on device technology caused by such a standard (such as mandating or forbidding certain modulation types). As an alternative, it proposes that the Commission allow each manufacturer to specify the format of its

proprietary identification signals and to supply equipment to the FCC to allow it to receive and decode the identifying information.[23]

Adaptrum proposes to allow each manufacturer to specify the format of its identifying signal, together with the equipment required to decode such signal. It is not opposed to a future standard, but is concerned with the deployment delay while it is developed.[24] Unfortunately, neither of these proposals is practical as a tool for quickly resolving cases of interference which, in the case of a headend, would result in the total loss of a broadcast station's programming for an entire served community. It is not reasonable to expect a cable operator to purchase an additional set of special reception and decoding equipment every time a new model of fixed WSD is developed, nor is it reasonable to expect that FCC field crews to carry multiple sets of detection equipment.

Aside from the question of equipment, it is not reasonable to expect a technician to use multiple sets of equipment, one at a time, to first determine what type of WSD signal is interfering, before the source of the signal can be determined. It is for that reason that standards are required.

Notwithstanding petitioners' assertions to the contrary, it is not sufficient to just have the registration data in the database. Without transmitted ID signals, and with a possible headend interference distances of the order of 80 km, it would be very difficult to determine the source of interference without a readily accessible ID signal. Thus, the FCC should not eliminate the requirement, but should move as quickly as reasonably possible to resolve the standards issue.

Access to Database Information

§15.713(h) contains the only reference to access to information in the database (other than providing lists of available channels to WSDs). Specifically, it requires the database operator provide to the Commission any data on request and to correct data on orders from the Commission.

PISC proposes that the information in the database should be available to any member of the public through an Internet access portal and to be declared a matter of public record.[25]

I agree that improved access would be beneficial for the purposes of quickly resolving cases of reception interference originating with fixed WSDs. Under current rules, a cable operator experiencing headend reception interference would be forced to first detect the interfering station's identifying information, then send that to the FCC and request enforcement action. The FCC could then, following its internal procedures, request the database administrator to provide the contact information for the WSD operator and begin the process of resolving the interference. This is an unreasonably awkward procedure and would undoubtedly take an extended time, while an entire community is denied access to a broadcast station's programming. It would be

[23] Motorola Petition at 21-22.

[24] Adaptrum Petition at 8-9.

[25] PISC Petition at 14-15.

much more efficient if the cable operator, having determined the offending WSD's ID could directly access the contact information and resolve the interference, perhaps with as little as a telephone call. This would not only be more efficient, but would relieve the FCC staff from involvement in interference cases except when a dispute arises between the parties involved.

On the other hand, unfettered access to the database would pose an unnecessary risk that information could be used maliciously by a third party who has no legitimate need for access to such information. Thus, we support PISC's proposal, at least to the extent of allowing registered entities free access to data, as that would make the process of resolving headend reception interference cases more efficient.