Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 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
	)	

REPLY COMMENTS OF MSTV AND NAB TO THE OET REPORT ON THE PERFORMANCE OF PROTOTYPE TV-BAND WHITE SPACE DEVICES

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INTRODUCTION & SUMMARY

The comments submitted in response to the Commission's Office of Engineering and Technology ("OET") and its Laboratory Division's most recent testing confirm that personal/portable devices reliant on so-called "spectrum sensing" technology will fail to protect digital television ("DTV") receivers, digital cable services, and wireless microphones. A diverse range of parties – including broadcasters, the cable industry, consumer electronics manufacturers, entertainment producers, microphone manufacturers, and wireless service providers – have submitted studies and data showing the harmful interference effects of personal/portable devices.[1] These interference concerns have now been confirmed by the recent OET testing.[2]

[1] Comments of Community Broadcasters Association, ET Docket No. 04-186 (filed Aug. 15, 2007) (CBA Comments); Comments of the DTV Manufacturers, ET Docket No. 04-186 (filed Aug. 15, 2007) (DTV Manufacturers Comments); Comments of the Microphone Interests Coalition, ET Docket No. 04-186 (filed Aug. 15, 2007) (MIC Comments); Comments of Motorola, Inc., ET Docket No. 04-186 (filed Aug. 15, 2007) (Motorola Comments); Comments of Sony Electronics, Inc., ET Docket No. 04-186 (filed Aug. 15, 2007) (Sony Comments); Comments of Sprint Nextel Corporation, ET Docket No. 04-186 (filed Aug. 15, 2007) (Sprint

In light of the record confirming the inadequacy of spectrum sensing as a primary means of preventing interference, the Association for Maximum Service Television, Inc. ("MSTV")[3] and the National Association of Broadcasters ("NAB")[4] again urge the Commission to prohibit personal/portable devices from operating in the television spectrum. There is no legal basis for allowing such devices to operate. MSTV and NAB agree with other commenters that the data before the Commission compels it to stay on course to allow fixed but not personal/portable devices in the TV band.[5]

The unlicensed device proponents would have the Commission change its entire regulatory approach to the television band on the basis of failed and inadequate testing. First, **there is no scientific data in the record to demonstrate that the sensing thresholds considered in the *Further Notice* (-116 dBm) or by the device proponents (-114 dBm) are sufficient to protect digital receivers from interference.** Even if the devices had worked as advertised, there would still be interference to DTV television reception. At its most recent meeting on testing at the laboratory, OET acknowledged that it did not know whether these thresholds (-114 or -116 dBm) would be sufficient to protect DTV sets from interference. As

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Nextel Comments); Comments of Shure Incorporated, ET Docket No. 04-186 (filed Aug. 15, 2007) (Shure Comments); Comments of National Cable and Telecommunications Association, ET Docket No. 04-186 (filed Aug. 15, 2007) (NCTA Comments).

[2] *See Initial Evaluation of the Performance of Prototype TV-Band White Space Devices*, OET Report, FCC/OET 07-TR-1006 (July 31, 2007) ("FCC Report"); *Direct-Pickup Interference Tests of Three Consumer Digital Cable Television Receivers Available in 2005*, OET Report, FCC/OET 07-TR-1005 (July 31, 2007) ("FCC Direct-Pickup Report").

[3] MSTV is a non-profit trade association of local broadcast television stations committed to achieving and maintaining the highest technical quality for the local broadcast system.

[4] NAB is a nonprofit trade association that advocates on behalf of more than 8,300 free, local radio and television stations and also broadcast networks before Congress, the Federal Communications Commission and other federal agencies, and the Courts.

[5] *See, e.g.*, Shure Comments at 5.

MSTV's August 2007 Field Report documents, – **these thresholds will not protect TV sets from interference.** Absent any scientific knowledge about the sensing threshold necessary to protect DTV receivers, it is unclear how the Commission could craft rules to ensure these devices worked properly and avoided interference. Personal/portable proponents are asking the Commission to put the proverbial cart before the horse. Second, even if the Commission were able to scientifically determine the appropriate threshold, OET's tests demonstrate that spectrum sensing, which is a precondition to unlicensed mobile operations, does not work in the real world.

This country will soon have an all-digital television service. The Commission's rules must ensure that consumers are able to benefit from all that new DTV services will have to offer, not only at the time of the DTV transition but in the many years following it. They also must protect the millions of consumers who will rely on digital-to-analog converter boxes to continue to receive free, over-the-air television. The government, private industry, and the American public are making a huge investment in the future of digital television and as a result are expecting a lot in return. Interference to new digital services, whether viewed on new digital television sets or via digital-to-analog converter boxes, *cannot* be tolerated. Interference must not inhibit or prevent the ability of the American public to enjoy the full potential of digital television, including new services such as mobile television.

Finally, these interference concerns apply equally to digital cable ready sets. As was noted during the OET laboratory meeting, "There are no white spaces on cable." Accordingly, such interference will undermine a key Commission policy of fostering cable ready DTV sets in the marketplace. As the National Cable & Telecommunications Association ("NCTA") noted, the FCC Report and the report on the Direct-Pickup Interference of Consumer

Digital Cable Television Receivers ("FCC Direct-Pickup Report") "validate the concerns expressed by cable industry and other parties regarding the substantial risks of wide-scale interference from unlicensed devices." Sprint-Nextel also expressed concerns about cable interference, commenting that the FCC Direct-Pickup Report shows that "television receivers are also susceptible to direct pickup interference," and "this means that, even if it could properly determine that a watchable television signal is not present (something that does not appear possible today), an unlicensed device is still likely to cause interference to cable television viewers nearby."[6]

The Commission must move forward with this proceeding without legally authorizing personal/portable devices to operate in the television band. The future of the Nation's television service is too important to risk on devices that are *proven* to cause harmful interference to over-the-air, cable television, and other incumbent services. As the DTV Manufacturers warned, "now is not the time to endanger the nascent market with the introduction of personal/portable unlicensed devices."[7] By instead returning its focus to rules for fixed devices, the Commission can promote broadband access in rural and other underserved areas while protecting new digital services from harmful interference.

I. THE PROPOSED SENSING THRESHOLDS WILL NOT PROTECT DIGITAL TELEVISION RECEIVERS FROM INTERFERENCE.

A. Sensing at the -114 or -116 dBm level Will Fail to Protect DTV Viewers and Other Incumbent Services in the Television Spectrum.

Even assuming arguendo that unlicensed personal/portable devices were able to sense effectively at the -114 level proposed by the device manufacturers, this level is clearly not sufficient to protect viewers. Indeed, earlier in the proceeding IEEE 802 found that a device able

[6] Sprint Nextel Comments at 3.

[7] DTV Manufacturers Comments at 7-8.

to sense television signals at a level of -116 dBm would fail to protect TV receivers from interference.[8] IEEE 802's finding echoes that of MSTV and NAB, which have consistently demonstrated both analytically and empirically that the -116 dBm sensing level considered in the *Further Notice* will often allow unlicensed devices to operate on-channel *within* the protected contour of a TV station.[9] While the exact sensing level needed to protect television services cannot be known without further extensive testing, what is clear at this point is that the -114 dBm and -116 dBm levels will fail to prevent harmful interference.[10] NCTA confirms the inadequacy of the -116 dBm level to protect television viewers, including cable subscribers, arguing that "there can be no assurance that -116 dBm is a sufficiently low threshold to avoid harmful interference."[11]

In the initial comments in response to the OET testing, MSTV and NAB submitted a Field Report documenting the ineffectiveness of the -116 dBm sensing level.[12] This Field Report contains both outdoor and indoor measurements that demonstrated many instances where sensing at -116 *and below* would not have properly detected that the device was located within the protected contour. For example, the Field Report showed many situations where DTV signal levels were below -114 dBm in certain rooms of a house, but there was reliable DTV reception in other rooms of the house.[13] The clear implication of this Field Report: an

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[8] *See* Comments of IEEE 802, ET Docket No. 04-186 (filed Jan. 31, 2007).

[9] *See Unlicensed Operation in the TV Broadcast Bands*, First Report and Order and Further Notice of Proposed Rulemaking, ET Docket No. 04-186, FCC 06-156, at App. B § 15.707(f) (rel. Oct. 18, 2006).

[10] *See* MSTV Field Report attached to Comments of MSTV & NAB, ET Docket No. 04-186 (filed Aug. 15, 2007) (MSTV Field Report).

[11] NCTA Comments at 7.

[12] *See* MSTV Field Report.

[13] *See Id.*

unlicensed, personal/portable TV band devices operating in the home would have failed to sense a reliable television signal, thereby operating and disrupting television services within the home and surrounding neighborhood.

There will be numerous areas throughout a television station's service area that will have signal levels well below the signal thresholds proposed by the White Space Coalition. Unlicensed devices relying on spectrum sensing will, believing the channel to be vacant, turn on to these channels. The resulting co-channel interference will spread for miles. In light of these results, it is imperative that the Commission not let any device into the TV band if it relies upon the inadequate sensing method to prevent interference.

B. The OET Report Confirms that Personal/Portable Devices Are Ineffective at Preventing Harmful Interference to Television Services.

The FCC Report, and the comments submitted in response thereto, confirm that personal/portable devices reliant on spectrum sensing will harm incumbent services. The Commission's laboratory and field tests of the Microsoft devices demonstrate that the devices are incapable of sensing television channels at even the manufacturer's suggested -114 dBm detection level, let alone the -116 dBm threshold considered in the *Further Notice*.[14] Further, the Philips device's "sensing performance declines rapidly as the signal levels are reduced" below -114 or -115 dBm.[15] NCTA, summarizing these results, stated that the measurements "confirm that signal sensing alone is insufficient to avoid interference."[16] The DTV Manufacturers too noted that the results show that "personal/portable devices reliant upon the spectrum-sensing

[14] *See* FCC Device Report at vii. Although IEEE 802 uses a -116 dBm level, that standard includes a geo-location requirement that ensures that any fixed station is located well outside the protected contour of a TV station. IEEE and others have said this sensing level alone is not appropriate. *See* Comments of IEEE 802, ET Docket No. 04-186 (filed Jan. 31, 2007).

[15] *See* FCC Report at viii.

[16] NCTA Comments at 3.

technique *will* interfere more often than not."[17] Finally, the Microphone Interests Coalition warned that testing makes clear that "spectrum sensing technology is not a ripe technology ready for implementation in a radically new environment."[18]

While Microsoft claims that a "damaged scanner accounted for the entire discrepancy between" its figures and the Commission's data,[19] this is not a sufficient explanation to quell concerns about the ineffectiveness of spectrum sensing. First, Microsoft's custom-built device was designed specifically to prove that sensing is effective; the fact that it broke so easily and this malfunction was not discovered by engineers in the Commission's laboratory does not instill great confidence that personal/portable devices released into the market would work effectively in the hands of untrained consumers.[20] Furthermore, Microsoft's own data disproves their contention that their device would protect television viewers, as their testing indicates that the device's performance in the Commission's bench test would only have improved 13 dB, to

[17] DTV Manufacturers Comments at 4.

[18] Microphone Interests Coalition Comments at 4.

[19] Letter from Edmund J. Thomas, Harris Wiltshire & Grannis LLP to Marlene H. Dortch, Secretary, FCC (filed Aug. 13, 2007) (Microsoft Ex Parte Letter).

[20] In fact, this device failure also points out a key interference fact with regard to personal/portable devices: the sensing and transmitting functions of the device are completely independent of one another. Thus, if the sensing feature fails or completely breaks, the device's transmitter continues to function and, in fact, can now transmit on many more channels. One can also easily envision "software downloads" to disable or change the sensing function and enable a personal/portable device to operate on any channel desired. Since a personal/portable device can be operated anywhere and anytime, such interference is almost impossible to find and resolve. The fixed approach, in which a base station is equipped with geo-location that controls the channel choices, is the only way to avoid such interference in the first instance and resolve interference in the unlikely case that it occurs.

-108 dBm if the scanner had been working properly.[21] This is well below their suggested -114 dBm level.[22]

In light of these results, the majority of commenting parties agree that personal/portable devices should not be allowed to operate in the television spectrum.[23] As the Microphone Interest Coalition stated, because of "the serious interference threat these devices represent, and their apparent immature state of development, the Commission should stand firmly behind its initial decision and restrict the unlicensed operations in the "white spaces" to fixed applications."[24] The Community Broadcasters Association ("CBA") confirms that "the OET report validates its position that any White Space operations must be limited to operations at fixed locations."[25] Sprint Nextel urges that "unlicensed devices, particularly personal/portable unlicensed devices, should not be permitted to operate in TV white spaces." The record is clear: personal/portable devices will cause harmful interference to broadcast television services on co- and adjacent channels and will also jeopardize cable television services. The Commission must not allow personal/portable devices to operate in the band and disrupt the Nation's new digital television services for years to come.

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[21] Microsoft Ex Parte Letter at Figure 2.

[22] Apparently, Microsoft did eventually make alterations to its Prototype A device. However, it is not clear whether these changes were limited to fixing the broken scanner or whether other changes were made as well. To the extent any additional modifications were made, then it is incumbent on the Commission and the relevant parties to reveal and place all changes in the public record of this proceeding.

[23] *See* CBA Comments; DTV Manufacturers Comments; MIC Comments; Shure Comments; Sprint Nextel Comments; NCTA Comments.

[24] Microphone Interests Coalition Comments at 4.

[25] CBA Comments at 2.

II. INTERFERENCE FROM PERSONAL/PORTABLE DEVICES WOULD BE SIGNIFICANT.

Earlier in this proceeding, Intel observed that the interference zone for a 100 miliwatt "low power" device could be in the range of 5 miles.[26] MSTV and NAB believe this is more likely to be 10 miles.[27] Nonetheless, a five mile interference zone for co-channel interference would be devastating to over-the-air digital television.

In its most recent filing the White Space Coalition references a co-channel interference zone of "only" 87 meters.[28] This misapprehends basic interference analysis. First, OET did not attempt to conduct a thorough examination of the interference zones caused by the proposed devices.[29] The DTV signal strength measured at the FCC laboratory was not indicative of the signal strength that occurs throughout a majority (84%) of a televisions stations service area. As the Commission stated in its March Report, with weaker signals, the zone of interference from these devices will be much greater.[30]

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[26] *See* Comments of Intel Corp, ET Docket No. 04-186 (filed Nov. 30, 2004) ("Intel Comments") at App. A.

[27] Comments of MSTV and NAB, ET Docket no. 04-186 (filed Jan. 31, 2007)at 9-10.

[28] *See* Comments of the White Space Coalition, ET Docket No. 04-186 (filed on Aug. 15, 2007) at 5 (White Space Coalition Comments).

[29] The Commission expressly states that it intended its results to demonstrate interference "even under favorable DTV reception conditions (*e.g.,* with a received DTV signal level well above TOV)." *See* FCC Report at 54. Notwithstanding the fact that the Commission found an interference distance of 87 meters (285 feet), which is completely unprecedented for any previously authorized Part 15 device, the Commission clearly stated that the interference distance would have been *much greater* had the test been performed at TOV, rather than 20 dB above TOV. Assuming that the distance would double for each 6 dB, this 20 dB difference alone would yield an interference distance of about 1 kilometer at TOV.

[30] *See Office of Engineering and Technology Report: Interference Rejection Thresholds of Consumer Digital Television Receivers Available in 2005 and 2006*, OET Report, FCC/OET 07-TR-1003 (March 30, 2007) ("FCC Rejection Report").

In addition, contrary to the White Space Coalition's assertion, the Commission did not assume a "free space" scenario.[31] Had it assumed such a scenario it would have predicted much larger interference distances. The test was premised on placing both an unlicensed device and a receiving TV antenna only 4-5 feet from the ground. Because of ground clutter, the interference zone in this situation is artificially reduced dramatically from a "free space" condition. [32] In other words, most people have their TV antennas well above 4-5 feet. Indeed, the Commission's television service rules are based on an outdoor antenna at 10 meters (33 ft); this reflects the fact that many antennas are on a viewer's roof. Moreover, one must also assume that an unlicensed device will be used at heights above 4 feet, as consumers will use these devices on outdoor decks, rooftops, and in apartment buildings on the second floor and above.

In summary, the FCC Report was correct in observing that its interference range analysis was "anecdotal," "specific to the interaction scenario examined," and that other factors, such as reduced DTV signal level "will likely result in much greater interference distances" if unlicensed personal/portable devices are allowed to operate in the real world. [33] MSTV and NAB tend to agree with Intel's earlier finding, as well as more thorough interference analysis

[31] *See* White Spaces Coalition Comments at 5 (the Commission assumed the "worst possible theoretical deployment for a white space device: placed at the same height as a rooftop antenna…with nothing but free space in between the two"). One can easily calculate the fact that the propagation loss in this case was about 40 dB greater than that would occur under an actual free space conditions. This 40 dB difference along with the 20 dB difference noted above would clearly result in interference ranges of kilometers.

[32] The TV receive antenna used in the FCC test was also not representative of the performance of an actual outdoor TV antenna. The gain of the test antenna was only about 4 dB where a typical outdoor antenna for TV reception can have a gain of 10 dB and more. The lower height and gain of the antenna used in the test reduced the actual interference distance that would be experienced by consumers with typical outdoor television antennas.

[33] See FCC Rejection Report at 49 and 55.

presented in this proceeding, which demonstrate that such co-channel interference would extend for miles. [34]

A. Personal/Portable Devices Will Also Cause Harmful Interference if Allowed to Operate on Adjacent Channels.

The FCC Report also confirms MSTV and NAB's long held assertion that operation of personal/portable devices on adjacent channels will cause significant interference to television services. While the White Space Coalition asserts that the FCC Report indicates that unlicensed devices with accompanying filters can successfully mitigate out-of-band emissions and operate on adjacent channels, this is once again a mischaracterization of the Commission's findings. Further, as Shure notes, "out-of-band emissions of the prototype transmitters were unacceptably high absent any filtering" and the filtering submitted to address this issue "would likely be impractical for inclusion in consumer devices."[35]

The White Space Coalition states that the FCC Report confirms that the potential for interference on first adjacent channels was a maximum of only two meters when the white space device transmissions conform to the Coalition's proposed mask.[36] Although it is true that

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[34] Although the 87m interference distance was measured under strong DTV signal conditions, there is some question whether this interference distance is representative of the full potential for interference even under these strong signal conditions. The OET test results appear somewhat inconsistent with the previous DTV receiver report and other technical information reported. For example, the first adjacent channel interference distances without the band pass filter were 47 and 52 meters, as compared to the co-channel reported distance of 87 meters. However, the "channel powers" reported in Table 4-3 show that the powers in the adjacent channels were more than 27 dB less than the power in the co-channel. The difference in the D/U ratios between co- and first adjacent channels is more than 50 dB. In other words, an interfering signal on the adjacent channel has to be more than 50 dB greater than a co-channel interfering signal but in this case the "channel power" on the adjacent was 27 dB less. This 50 dB difference in D/U and the difference in actual channel power of more than 27 dB raises some question with regard to the results.

[35] Shure Comments at 7.

[36] *See* White Space Comments at 5.

the Commission measured a first adjacent interference distance of two meters, what the Coalition fails mention is this interference distance is for a device that operates at *6 milliwatts* or 8 dBm *and* under strong DTV signal conditions.[37] This is not true for the 100 mW unlicensed personal/portable devices that would actually operate in the band.[38] An unlicensed TV band device operating at 100 mW would have caused interference at 10 meters for a DTV signal that was only 1 dB weaker (-64.5 dBm) than the DTV signal (-63.5 dBm) under which the test was conducted. As the Commission has previously found a signal strength of -64.5 dBm or less is received in approximately 80% of the service area of a DTV station, this interference will affect a significant portion of television viewers.[39] Furthermore, under weak DTV signal conditions that can occur at the edge of a station's service area or under indoor reception conditions, this two meter interference distance would be about 90 meters for a 100 mW unlicensed device.[40]

B. Personal/Portable Devices Will Also Interfere with Digital Cable-Ready Television Sets.

The FCC Direct Pickup Report found that unlicensed TV band devices will not only cause harmful interference to over-the-air television services but also have the potential to interfere with cable television services, including digital cable ready sets.[41] As NCTA noted, the FCC Direct Pickup Report "establishes without a doubt that a 100 mW" personal/portable device

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[37] There is an effective insertion loss of 14 dB with the use of the external filter. *See* FCC Report at p.54.

[38] Further, this measurement was also taken where the DTV signal was more than 20 dB above TOV.

[39] *See* FCC Rejection Report.

[40] For a device of 100 mW and the case where the DTV signal was at TOV (e.g., at the edge of the TV station's contour) the interference distance would have not been the 2 meters claimed by the Coalition but about 90 meters, based on free space path loss. The distance cited above is based on the D/U ratio for an unlicensed device operating at 6 mW of power and 2 meter interference distance in the presence of a desired DTV signal level of -63.5 dBm.

[41] FCC Direct-Pickup Report.

"will cause harmful interference to television viewing on cable systems," and therefore should not be allowed to operate in the band.[42]

The Commission must not allow personal/portable devices to jeopardize cable services and the millions of digital cable-ready sets that will be sold to consumers over the next few years. MSTV agrees with the DTV Manufacturers that "digital cable-ready sets are critical to a successful digital transition."[43] Consumers will be purchasing millions of digital-cable ready sets in the time leading up to the DTV transition and long after February 2009. The country cannot afford to risk cable television services and the investments in new technology on personal/portable devices.

[42] NCTA Comments at 4.

[43] DTV Manufacturers Comments at 7.

CONCLUSION

At stake in this proceeding is the public's ability to benefit from the Nation's multibillion dollar investment in DTV technology and services. The results of those tests, and the comments submitted in response, confirm that the Commission must not allow personal/portable devices into the broadcast spectrum. It should instead move forward with rules to authorize fixed devices with appropriate protections.

Respectfully submitted,

/s/ Marsha J. MacBride

Marsha J. MacBride
Jane E. Mago
Ann West Bobeck
Lynn Claudy
David Layer
Art Allison
NATIONAL ASSOCIATION OF BROADCASTERS
1771 N Street, NW
Washington, DC 20036
(202) 429-5430

/s/ David L. Donovan

David L. Donovan
Victor Tawil
Bruce Franca
ASSOCIATION FOR MAXIMUM SERVICE TELEVISION, INC.
4100 Wisconsin Avenue, NW
Washington, D.C. 20016
(202) 966-1956

Jonathan D. Blake
Matthew S. DelNero
Jodi M. Steiger
COVINGTON & BURLING LLP
1201 Pennsylvania Avenue, N.W.
Washington, DC 20004-2401
(202) 662-6000

Its Attorneys

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