

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

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

To: The Commission

PETITION FOR RECONSIDERATION

**THE SOCIETY OF BROADCAST ENGINEERS,
INC.**

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SUMMARY

The stated objective of the *Second Report and Order* is to enable new entrants to use the broadcast television spectrum while ensuring that incumbent operations are protected.¹ The *Second Report and Order* does not, however, provide sufficient protections or detail in certain key areas in order to accomplish these goals.

Thus, SBE respectfully seeks reconsideration on the following points:

- First, the Commission should reconsider the 40 mW adjacent channel power limit for personal/portable white space devices (“WSDs”). The 40 mW power limit is too high, will not protect consumers, and is not justified technically.
- Second, the Commission should reject any efforts to use variable power levels for adjacent channel limits as suggested by some commenting parties. While the Commission’s 40 mW limit analysis was flawed and failed to properly take into account a number of factors, the Commission was correct in protecting all viewers within the DTV protected contour to the -84 dBm level and in recognizing that such levels can occur anywhere in the TV service area due to terrain, building losses, use of indoor antennas, and other factors.
- Third, the Commission should correct for its failure to test for interference to mobile video services, and it should protect mobile video services by basing its interference analysis on a reasonable separation distance (*e.g.*, 1-2 meters) and adopting a correspondingly reduced adjacent channel power level.
- Fourth, the Commission should address certain technical errors and ambiguities in the WSD rules that it adopted.
- Fifth, because the Commission recognized that “spectrum sensing” technology does not work and should not be relied upon to provide interference protection, it should not allow sensing-only technologies unless and until certain fundamental problems are resolved, should make the current sensing requirement more rigorous, and should enhance protection for wireless microphones.
- Sixth, while the geolocation concept holds promise, the Commission failed to address adequately a number of geo-location and database issues. It should reconsider its decision and ensure that there is only a single approved database manager, with all WSDs required to register. It should ensure that all

¹ *See id.* at para. 44 (stating that “our goal in this proceeding is to allow new uses of radio on unused television channels at locations where such operations will not result in harmful interference to, or disrupt, TV and other authorized services”).

communications between the unlicensed white space devices and the database manager are verified and secure and that devices relying on the database are protected against hacking or other means of circumventing requirements.

- Seventh, the Commission should reconsider its decisions with respect to protection of vital infrastructure systems, such as the wireless microphone and video assist devices used in electronic newsgathering services and relied upon by licensed entities.

Part 15 devices are subject to a requirement not to cause harmful interference, and there is no margin for error. Given the importance of over-the-air television broadcasting as well as other critical incumbent services (including wireless microphone operations and electronic newsgathering), and given the virtual impossibility of *ex post* interference remedies and enforcement mechanisms, the Commission must ensure that the technical and other requirements for white space devices are right from the very beginning.

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PETITION FOR RECONSIDERATION

The Society of Broadcast Engineers, Incorporated (“SBE”)² respectfully submits this Petition for Reconsideration of the Commission’s *Second Report and Order and Memorandum Opinion and Order* in the above-captioned proceeding.³ The Commission must protect consumers by ensuring that white space devices (“WSDs”) do not interfere with the public’s television broadcasting service. Specifically, the Commission erred in its decisions with respect to 40 mW adjacent channel operation by personal/portable WSDs and with respect to spectrum sensing. The rules permitting such operations will not protect consumers and must be reversed or, at a minimum, revised to minimize the interference to and disruption of the public’s access to licensed services.⁴

² SBE is the national association of broadcast engineers and technical communications professionals, with more than 5,000 members worldwide.

³ *Second Report and Order and Memorandum Opinion and Order*, ET Docket Nos. 04-186 and 02-380, 23 FCC Rcd 16807 (rel. Nov. 14, 2008) (“*Second Report and Order*”).

⁴ See *Second Report and Order* at para. 3 (recognizing “the importance of protecting licensed services from harmful interference”); *id.* at para. 33 (adding that “[i]t is, of course, most important that we ensure that new unlicensed devices do not interfere with the incumbent licensed services in the TV bands”).

SBE urges the Commission to reconsider the adjacent channel power limit and certain other technical conclusions in the *Second Report and Order*.

I. THE 40 MW POWER LIMIT FOR ADJACENT CHANNEL OPERATIONS BY PERSONAL/PORTABLE DEVICES IS TOO HIGH AND NOT JUSTIFIED TECHNICALLY.

In the *Second Report and Order*, the Commission established a transmit EIRP of 40 mW for personal/portable WSD operation on channels adjacent to those used by television stations.⁵ The 40 mW power level will not protect television viewers. Therefore, the Commission must reconsider the 40 mW power level and adopt a lower value that provides adequate protection to all television viewers and services.

As the Commission recognized, digital television signals can vary significantly throughout a DTV station's contour.⁶ This variation is due to several factors, including the use of indoor versus outdoor antennas, signal propagation, building losses, terrain, and multipath interference.⁷ The Commission correctly concluded that, therefore, protection for all of the public's critical over-the-air television service should be based on weak and benign DTV signal conditions. However, the Commission's analysis that 40 mW would adequately protect adjacent-channel television operations was seriously flawed and without substantiation.⁸

⁵ *See id.* at para. 176.

⁶ *See id.* at para. 77 (observing that “there will be cases where 1) a station's signal is below 41 dBu within its service area, and 2) the difference in received signal level between an outdoor and indoor antenna at the same structure/location will exceed 30 dB”); *id.* at para. 79 (citing empirical evidence that “there is considerable variability in the difference in signal levels received with an outdoor antenna at about 9 meters and with an indoor antenna at differing positions within a structure”).

⁷ *See id.* at para. 178 (noting that “actual TV signal strengths in an area can vary from the predicted signal strengths by as much as 20 to 30 dB due to shadowing, multipath fading and other propagation variables”).

⁸ SBE agrees with the Commission that a single adjacent-channel power limit, and not a variable limit, is appropriate and the simplest to administer and enforce.

A. The 40 mW Standard Is Inapt For A Part 15 Device And Fails To Achieve An Adequate Level Of Protection For Television Viewers.

First, the Commission used the wrong protection standard for protecting viewers from unlicensed Part 15 white space devices. Specifically, instead of using the no interference standard established for Part 15 devices, it used the equal protection standard that is provided for full power television. This is the wrong standard,⁹ because WSDs are unlicensed, secondary devices required to cause no interference, while television stations are primary, licensed services.

Second, the interference model that the Commission used to develop the adjacent channel power limit is flawed. It used desired-to-undesired (“D/U”) signal values that, as discussed below, provide inadequate protection to broadcasters and their viewers. Its analysis of other factors, such as antenna discrimination, was not justified technically. Moreover, the interference model completely failed to take into account protections needed for new mobile DTV services, even though this issue was fully discussed in the record of the proceeding.

B. TV Viewers Should Not Be Provided With Only “Marginal Protection” From Part 15 Unlicensed Operations.

Part 15 unlicensed devices have no allocation status and must fully protect all licensed operations. Section 15.5 of the Commission’s rules specifically states that persons operating an unlicensed device “shall not be deemed to have any vested or

⁹ *See id.* at para. 50 (finding that “unlicensed operation under Part 15 of our rules is a better fit for TV band devices because Part 15 devices must not cause harmful interference to licensed users, whether primary or secondary”); *id.* at para. 167 (“We will require TV band devices to protect full service and low power TV reception within their own contours using the proposed D/U ratios. . . . We do not expect that the susceptibility of TV receivers with respect to unlicensed TVBDs will vary much, if at all, from their susceptibility to interference from undesired TV signals”).

recognized right” and that the operation of any unlicensed device is permitted at sufferance – *i.e.*, “subject to the conditions that no harmful interference is caused.”¹⁰

Yet the *Second Report and Order* establishes a power level that, by the Commission’s own recognition, fails to meet the “no harmful interference” standard. A 40 mW adjacent channel power limit will not provide adequate protection to television reception. In its interference analysis, the Commission stated that “a 40 mW power limit would reduce the signal strength of a TVBD by 4 dB from the maximum allowed 100 mW and thereby provide adequate protection for indoor DTV reception from TVBD interference on both the first upper adjacent channels.”¹¹ By contrast, the Commission found that a 40 mW power limit for adjacent channel operations would provide only “marginal protection for outdoor DTV reception from such TVBD signals.”¹² Given that millions of households rely on outdoor DTV reception, a standard that by the Commission’s own recognition provides only “marginal” protection is not acceptable, especially with respect to unlicensed Part 15 operations.¹³ Further, as shown below, the Commission’s interference analysis was flawed and failed to properly take into account a number of factors such that even this “marginal protection” standard would not be met in most instances.

¹⁰ 47 C.F.R. § 15.5.

¹¹ See *Second Report and Order* at para. 176.

¹² *Id.*

¹³ The Commission and the public know that “marginal” interference does not differ from total interference in digital television reception. See Stephen R. Martin, Office of Engineering and Technology, *Interference Rejection Thresholds of Consumer Digital Television Receivers Available in 2005 and 2006* (“DTV Receiver Report”), FCC/OET 07-TR-1003, at x (March 30, 2007) (describing the “cliff effect”). In addition, the Commission must adopt rigorous requirements from the beginning, given that it will be virtually impossible to implement effective interference remedies and enforcement actions once these devices are released into the marketplace.

C. The Commission’s Interference Analysis Used Wrong D/U Ratios.

The 40 mW adjacent channel power limit is not based on the D/U ratios that the Commission stated it was adopting but rather on a D/U ratio that results in an adjacent channel power limit that is 5 to 7 dB less protective of TV viewers. In the *Second Report and Order*, the Commission required “TV band devices to protect full service and low power TV reception within their own contours using the proposed D/U ratios”¹⁴ or “the same protection criteria that are currently specified in the rules for digital television”¹⁵ – specifically, -26 dB and -28 dB for upper and lower adjacent channels, respectively. The Commission further stated that “it is reasonable and appropriate to continue to apply these same service and rights definitions with respect to unlicensed devices.”¹⁶ In fact, the Commission went on to state that “(n)one of the commenting parties argue that we should use less stringent standards for protection” and “(w)e will require TV band devices to protect full service and low power TV reception within their own contours using the proposed D/U ratios,”¹⁷ *i.e.*, the D/U ratios used for protection of broadcast services in Part 73 of the rules.

Yet the Commission’s interference analysis does not provide broadcasters with this level of protection. Nor does the analysis use the same D/U protection ratios that the Commission stated were required to provide adequate protection for broadcasters. Rather, the Commission’s analysis inappropriately used the D/U ratios for adjacent channel protection from ATSC Recommendation A/74: -33 dB.¹⁸ This results in a

¹⁴ *See id.* at para. 167.

¹⁵ *See id.* at para. 161.

¹⁶ *See id.* at para. 167.

¹⁷ *See id.*

¹⁸ *See id.* at para. 169-171.

higher adjacent channel power level that is 5 to 7 dB less protective and inadequate to protect TV viewers. While the adjacent channel performance of the DTV receivers tested by the FCC and those tested and submitted in the record had a median value of about -33 dB (similar to the ATSC recommendation), the use of this value for service protection and interference analysis is inappropriate and a misuse of the tested receiver performance values.¹⁹ As the Commission noted in its DTV receiver report, the ATSC value for receiver performance is measured in the laboratory for clean laboratory signals without transmitter splatter and other conditions that degrade performance in the field. As the Commission further stated in the DTV receiver report, the -33 dB value is recommended to ensure that the OET-69 adjacent channel interference criteria of -26 and -28 dB are met under “real world” conditions where transmitter splatter is present.²⁰ Therefore, the -33 dB DTV receiver performance is needed to ensure that the receiver can meet the D/U values of -26 and -28 dB used in the OET 69 DTV allocations and interference analysis.

D. Antennas Do Not Provide The Level of Discrimination Assumed By The Commission.

The Commission’s outdoor interference model assumed a level of discrimination by an outdoor antenna that generally is not achievable in consumer television antennas, including the vast number of outdoor television antennas that the Commission itself recommends to consumers on its website promoting the digital

¹⁹ The -33 dB is the median value of *all* tested DTV receivers including the eight “best” receivers tested by the FCC, the receivers tested by the University of Kansas and the receivers tested by the Canadian Research Centre. The FCC test data was limited to only the eight “best” performing receivers among a sample of 30 DTV receivers which were used in testing in support of the *Satellite Home Viewer Extension and Reauthorization Act of 2004*.

²⁰ See *DTV Receiver Report* at 4-2

television transition.²¹ The Commission assumed an antenna gain of 10 dB for TV signals and off-axis gain of -2 dB for emissions from the WSD for a total discrimination of -12 dB.²² For most consumer antennas, the antenna discrimination value for the scenario used in the FCC's interference analysis is far less than the -12 dB assumed. Consequently, the Commission's finding of "marginal protection" is inaccurate, and the protection shortfall to TV viewers is even greater.

The Commission's outdoor interference model assumes that the unlicensed device is located off the primary axis of the main beam of the television antenna by about 28 degrees, and that this would result in an antenna discrimination of 12 dB. For popular consumer television receive antennas, such as the Winegard Square Shooter, the actual change in gain for 28 degrees is closer to 3 dB rather than the 12 dB used by the Commission, based on manufacturers' data.²³ Even large directional antennas, such as the ChannelMaster 4121, have 3 dB beamwidths of 45 degrees, meaning that the unlicensed device emissions at 28 degrees would likely be in the main beam of the antenna. A review of outdoor antennas on the RadioShack website, a popular source of antennas, shows many available outdoor antennas that based on SBE's experience are likely to provide consumers with far less discrimination than the 12 dB

²¹ The Commission's website has links to www.antennaweb.org that provides recommendations on types of antennas based on consumers' addresses and locations.

²² See *Second Report and Order* at para. 174 ("We consider that a personal/portable TVBD near ground level would be outside of the main receive pattern of the TV antenna, so that instead of receiving 10 dBd gain, the device's signal might only receive -2 dBd gain").

²³ Data from the manufacturer states that the beamwidths at the half power points are 68 degrees for channel 14 and 67 degrees for channel 32. See http://www.winegarddirect.com/pdf/spec_SS1000-SS2000.pdf.

assumed in the Commission analysis.²⁴ In summary, this means that the Commission has dramatically underestimated the areas in which interference may occur.

The Commission's analysis overestimates by at least 5 to 10 dB the protection for television viewers using these or similar types of popular consumer television antennas. SBE would welcome a Commission study of the performance of various TV antennas to confirm where within this 5 to 10 dB range is the appropriate reduction of the 40 mW adjacent channel power limit.

E. Interference Distance And Modulation.

The Commission originally proposed an interference distance of 10 meters, stating that “[f]ield strengths within 10 meters of the unlicensed device may be ignored since it could be assumed that this region would be under the unlicensed operator’s control.”²⁵ The 10 meter standard was based originally on potential interference between a desktop computer and a TV set.²⁶ There is a serious question whether a 10 meter standard provides adequate protection when applied to portable transmitting devices.²⁷ In the *Second Report and Order*, however, the Commission’s analysis was based on an interference distance of 16 meters without providing any explanation for the change.²⁸ SBE is unaware of any explanation that would justify the 16 meter assumption. The 10 meter distance originally proposed by the Commission has

²⁴ See, e.g., Winegard Models SS-2000, MS-2000, MS-2002 and GS-2200; Terk HD-TVS, and Radio Shack Models 15-1634, 15-2187 and DA-5200 at www.radioshack.com.

²⁵ See *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Notice of Proposed Rulemaking, ET Docket Nos. 04-186 and 02-380, 19 FCC Rcd 10018, at n.50 (2004).

²⁶ Computers are not intentional transmitters and emissions in the TV bands from these devices are much less than the 100 mW or even 40 mW output power permitted under the WSD rules.

²⁷ See Section II, *infra*, with respect to mobile devices and the 2 meter interference distance assumed for AWS.

²⁸ See *Second Report and Order* at para. 174.

a better basis in the technical rules applicable to Part 15 unlicensed devices,²⁹ and the change to 16 meters represents a difference of 4 dB, which is the equivalent of permitting almost three times more power and, more importantly, providing three times less protection to TV viewers.

In addition, the Commission failed to consider the fact that WSD operations may be located close enough to TV receivers such that the TV receiver is in a “strong signal” condition. For example, a TV receiver operating within about 10 meters of a WSD operating at 100 mW or about 400 meters from a 4W fixed WSD would be in a strong signal situation that would reduce a DTV receiver’s ability to reject interference to about -20 dB on almost all channels, according to the ATSC recommendations and the FCC’s own DTV receiver tests.³⁰ This fact was also not taken into account in establishing an adjacent channel power limit.

Finally, the Commission also failed to take account of the difference resulting from the fact that WSDs are likely to use different modulations, such as OFDM, and that such signals can be much more aggressive interferers due to the very high peak-to-average ratios, adversely affecting the required D/U ratio.³¹ In effect the Commission avoided the conclusion that there is an interference problem by redefining what

²⁹ See *Amendment of Part 15 To Redefine and Clarify the Rules Governing Restricted Radiation Devices and Low Power Communication Devices*, Docket No. 20780, 79 F.C.C. 2d 28 at paras. 53, 55, Appendix C (rel. Oct. 11, 1979) (adopting the emission limits for personal computers assuming a distance of 10 meters from the receiver); see also 47 C.F.R. § 15.209.

³⁰ See *DTV Receiver Report* at 4-2.

³¹ The Commission’s receiver tests showed that the D/U ratio for DTV receivers was about one dB worse when the modulation of the undesired signal was 4.8 MHz OFDM signal rather than a 6 MHz VSB signal. This 1 dB difference may be even greater where for OFDM signals with wider bandwidths and high peak-to-average ratios. See *DTV Receiver Report* at x.

constitutes interference. Such redefinitions provide no comfort to consumers that are unable to receive DTV due to interference.

F. Conclusion

Given all of the errors described above, 40 mW is not an appropriate power level for WSDs that will be operating on channels adjacent to the public's critical over-the-air television service. In order to protect the public's DTV service, a much lower power level (such as 5 mW) is needed. Indeed, after the release of the *Second Report and Order*, the United Kingdom proposed a power limit of 20 mW for adjacent channel personal/portable WSDs.³² However, DTV service in the United Kingdom is based on a significantly higher signal level of -70 dBm rather than the -84 dBm used in the United States. Using the same analysis and protections contained in the Ofcom Report for the lower protected contour value used in the U.S. would mean that the adjacent channel power limit would have to be reduced to less than 2 mW to provide the same level of protection as afforded to broadcasting in the U.K. Given the near impossibility of enforcement once devices are in wide use,³³ the Commission must ensure that the power limits (and other rules for WSDs) are right from the very beginning.

³² See Ofcom, "Digital Dividend: Cognitive Access," *Consultation on License-Exempting Cognitive Devices Using Interleaved Spectrum* (rel. Feb. 16, 2009) ("Ofcom Consultation") at 5.25.

³³ Individuals that call the Commission to complain about interference to radio or television hear a message stating that "this type of interference is not routinely investigated by the Enforcement Bureau" and that fact sheets are available. See also *Second Report and Order* at para. 122 (conceding that "personal/portable devices pose a greater risk of interference to licensed TV band service because the locations where these non-fixed devices are used will change.... [T]he transitory nature of such devices makes it difficult for others to identify the devices if they cause interference.... [T]he interference from such operations would be very difficult to identify and control.").

II. THE COMMISSION SHOULD PROTECT MOBILE BROADCASTING OPERATIONS

The Commission correctly pointed out that “future broadcast uses of the television band will have the right to interference protection from TV band devices.”³⁴ Although it confirmed that “future primary use of the band by broadcasters [must] be protected,”³⁵ the Commission failed to account for new mobile television operations (which are in the process of being introduced and were cited in the comments to this proceeding).³⁶ The Open Mobile Video Coalition has stated that “broadcasters have declared their intention to launch mobile DTV across 63 stations in 22 markets, covering 35 percent of U.S. television households” in 2009.³⁷

Traditionally, for mobile operations, the interference distance is either 1 or 2 meters.³⁸ In light of the 16 meter interference distance assumed by the Commission, this future primary use of the band by broadcasters – which stands to benefit consumers enormously – will be immediately threatened by WSDs. Clearly Part 15 devices must protect licensed mobile DTV operations. To do so requires using a more realistic interference distance (such as the 2 meters assumed for AWS operations, and not the arbitrary 16 meters assumed by the Commission in the *Second Report and Order*).³⁹ This

³⁴ See *Second Report and Order* at para. 50.

³⁵ *Id.*

³⁶ See, e.g., Comments of MSTV and NAB to the OET Measurement Report on DTV Receiver Interference Rejection Capabilities, ET Docket Nos. 04-186, 02-380, at 8 (Apr. 30, 2007).

³⁷ See Press Release, “OMVC Demonstrates Future of Mobile DTV and Details Initial Broadcaster Roll-Out Plans,” Open Mobile Video Coalition (Jan. 8, 2009).

³⁸ See Advanced Wireless Service Interference Test Results and Analysis, Office of Engineering and Technology, ET Docket No. 07-195 (rel. Oct. 10, 2008), at 12-13 and n.15 (assuming a 2 meter interference distance).

³⁹ See MSTV and NAB, Reply To Opposition and Addition To Request for Relief, ET Docket Nos. 04-186, 02-380, at Appendix (Oct. 28, 2008).

analysis would show the need for a corresponding reduction in the adjacent channel power limit.

III. THE COMMISSION FAILED TO PROTECT LPTV AND TV TRANSLATOR OPERATIONS.

The Commission's interference analysis focused exclusively on digital television operations. As the Commission concluded, unlicensed devices must protect LPTV and TV translator stations. Yet, now and for some time to come, many of these stations will be broadcasting in analog. The protection of analog operations requires the use of different D/U ratios to prevent interference: the D/U ratios for protection of adjacent channel analog operations are -17 and -14 dB, rather than the -26 and -28 values for digital TV or the -33 dB ATSC value that the Commission used in its analysis. The Commission should either (1) require an effective date for WSDs that tracks the termination of all analog services or (2) prohibit both co- and adjacent-channel operation of personal/portable devices within the service contours of LPTV stations and TV translators.

IV. A NUMBER OF WSD RULES ARE UNCLEAR, CONTAIN TECHNICAL ERRORS, OR FAIL TO ADDRESS ADEQUATELY TECHNICAL MATTERS.

The Commission should reconsider and clarify or correct several technical rules that are either unclear, in error, or incomplete. These include the rules with respect to WSD emissions, the maximum antenna height for fixed WSDs, and cable headends, satellite receive sites, TV translator receive sites, and fixed BAS links.

A. Emissions From WSDs Must Be Wideband And Noise-like.

The *Second Report and Order* assumes that WSDs “are expected to operate with signals that have wide bandwidth, noise-like characteristics similar to those

of DTV signals”⁴⁰ and that the power from the WSD is measured across an entire 6 MHz television channel. This assumption, however, is not reliable because the Commission included no requirements with respect to this issue in the WSD rules that it adopted. Multiple narrowband emissions could occur within the same 6 MHz television channel, with the total power of the undesired WSD signals greater than a single wideband signal. The Commission should require that all WSD emissions have a minimum bandwidth of at least 4.5 MHz and that all power output requirements for WSDs be defined based on the power contained in the 6 MHz defined by each television channel. Such an approach is consistent with the Commission’s DTV receiver tests and the D/U protection ratios.

B. Antenna Height Should Be Based On HAAT.

The Commission should specify the maximum antenna height of fixed WSDs as height above average terrain (“HAAT”), not height above ground. The *Second Report and Order* specifies that the maximum permitted antenna height is 30 meters above ground level⁴¹ and provides a table of minimum separation distances to the protected contour based on this antenna height, to limit potential interference. A maximum that turns on height above ground level would permit fixed antennas to be placed on mountains and other high-elevation sites, undermining the effectiveness of the maximum antenna height requirements.⁴² Placing the burden on a licensed service to identify problem installations is not appropriate and would occur after the antenna has already been installed, causing hardship to both the broadcaster and the unlicensed device operator. HAAT requirements can be implemented easily as part of the professional

⁴⁰ See *Second Report and Order* at para. 167.

⁴¹ See *id.* at para. 181.

⁴² See *id.* at n.246 (which recognized this problem but claimed that such installations would be infrequent and resolvable with the registration requirement).

installation requirement, or can be calculated by the database manager from the geo-location information required to be supplied by the registrant.

C. The Commission Should Provide for Rural Broadband Operation.

One of the Commission's stated purposes in this proceeding was to provide spectrum for new broadband data services for rural America.⁴³ This goal is supported by broadcasters and the broadcast industry. However, the rules adopted by the Commission are so heavily biased towards personal/portable use that they could actually prohibit wireless internet service providers ("WISPs") and others from providing the fixed broadband services that were a chief goal of this proceeding. The Commission should eliminate the requirement in Section 15.711(f) that a fixed customer premise device may not operate as a client to a fixed WISP base station. Not only should this type of operation be permitted to promote rural broadband access, SBE believes that this service should be included in the database and receive interference protection from personal/portable devices.

D. The Commission Should Protect Other Critical Services.

The Commission has recognized the importance of protecting viewers who receive television service from TV translators and cable systems.⁴⁴ However, the protection provided for TV translator receive sites and cable headends is limited and will fail to provide adequate protection. The Commission's determination that such sites can only register for protection in the database "if they are outside the protected contour of the TV station being received"⁴⁵ is flawed. These sites warrant independent protection

⁴³ See *id.* at paras. 2, 6, and 32.

⁴⁴ See *id.* at para. 185.

⁴⁵ See *id.* at para. 187.

regardless of whether they are located inside or outside of the contour. Furthermore, the Commission failed to include satellite receive sites altogether.⁴⁶ Satellite pick-up/receive sites warrant protection for the same reason that cable system headends do. Moreover, many DBS subscribers rely on over-the-air (“OTA”) reception for local broadcast television service. They will suffer the same interference problems as OTA households if the Commission fails to reconsider the *Second Report and Order* as described herein.

V. THE COMMISSION SHOULD NOT ALLOW SENSING-ONLY TECHNOLOGIES UNTIL CERTAIN FUNDAMENTAL PROBLEMS ARE RESOLVED, SHOULD MAKE THE CURRENT SENSING REQUIREMENT MORE RIGOROUS, AND SHOULD ENHANCE PROTECTION FOR WIRELESS MICROPHONES.

A. Sensing Fails to Protect TV Viewers.

The Commission recognized that “spectrum sensing” technology does not work and cannot be relied upon to provide adequate interference protection. In short, “it does not appear that the devices were designed to cope with certain real-world conditions such as strong adjacent channel signals or the challenges of operating in noisy environments.”⁴⁷ The Commission conceded that “spectrum sensing, as currently presented in our measurement studies of prototype devices, is not sufficient by itself to enable unlicensed devices to reliably determine the TV channels that are available for use at a location.”⁴⁸ The Commission also noted that several of the devices “incorrectly reported channels as unoccupied (available) when the device was operated within a station’s service contour and the signal was viewable.”⁴⁹

⁴⁶ *See id.* at para. 186.

⁴⁷ *See id.* at para. 257.

⁴⁸ *See id.* at para. 71

⁴⁹ *See id.* at para. 29. Under “Condition I” (in which the WSD was operating within a station’s DTV contour and its signal was viewable on a simple DTV receiver), three of the WSDs (Adaptrum, I2R, and

B. Sensing Fails to Protect Wireless Microphone Operation.

The Commission's test data clearly show that sensing failed to properly detect wireless microphones and therefore protect such operation. The test report states that "[t]he I2R device indicated several channels as available even when the microphones were on."⁵⁰ The *OET Phase II Report* showed that "[i]n the presence of DTV signals in adjacent channels, the detection threshold of both devices was degraded such that it affected the ability of the devices to reliably detect the microphone signals."⁵¹ The Commission's "measurement studies found that while the prototype devices were generally able to detect 'clean' TV and wireless microphone signals on a channel with no other signals present, their ability to reliably detect unoccupied channels degraded to levels we consider unsatisfactory when the test signals included multipath and other fading effects and when signals were present on other channels."⁵² The Commission's decision provides false assurances of reliability, and indeed the Commission appears to have abandoned providing adequate protection to critical, incumbent wireless microphone operations and TV viewers so that WSD manufacturers can save money.⁵³

Motorola) failed to accurately detect DTV signals even when they were receivable by a simple \$40 NTIA coupon-eligible converter box; Motorola's WSD in sensing-mode failed to accurately detect occupied channels 10 percent of the time; and the Philips device had an oversensitivity failure on 85 percent of vacant channels. See *Evaluation of the Performance of Prototype TV-Band White Spaces Devices: Phase II*, FCC/OET 08-TR-1005, at 112-115 (rel. Oct. 15, 2008) ("*OET Phase II Report*").

⁵⁰ *Id.* at 141 (further noting that "(a)t both sites and all test locations, the Philips device reported all channels on which microphones were designated to transmit as occupied whether the microphone was transmitting or not").

⁵¹ See *Second Report and Order* at para. 30. "Both devices" refers to the Philips and I2R devices, the only devices tested with wireless microphone sensing capability.

⁵² See *id.* at para. 82. At the Majestic Theatre test site, the I2R device failed to accurately "detect" any microphone operation and erroneously reported every channel that was occupied by a microphone transmission as available for unlicensed WSD device use.

⁵³ See *id.* at para. 95 (stating that -114 dBm would be "consistent with manufacturing economics").

In contrast, the *Ofcom Consultation* released subsequent to the *Second Report and Order* adopted a sensing value of -126 dBm for wireless microphone protection.⁵⁴

The test results clearly show that spectrum sensing will not be able to protect wireless microphones. And protecting wireless microphone operations is particularly important given the significant loss of spectrum available to wireless microphones given the Commission's actions in the 700 MHz proceeding.⁵⁵

Consequently, the Commission should provide more than just two "safe harbor" channels between channels 21-51, and it should make these safe harbors available nationwide, not just in 13 markets.⁵⁶ For example, Shure has proposed a solution whereby the Commission would protect 6 UHF and 2 VHF channels for three years following the digital transition (and 4 UHF and 2 VHF channels thereafter).

C. There Is No Basis For A -114 dBm Sensing Level.

The Commission should reconsider the -114 dBm sensing level and recognize that sensing, and especially sensing at this inadequate level, will create a serious risk of interference to the public's free, over-the-air television service as well as to wireless microphones and other operations in the television spectrum.

There is no basis in the record to suggest that -114 dBm is an appropriate or adequate level. IEEE 802.22 recommended a level of -116 dBm, but this level assumed that the sensing antenna was located outdoors and at a height of 30 feet, an

⁵⁴ See *Ofcom Consultation* at 5.34.

⁵⁵ See Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band, WT Docket No. 08-166, Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition, WT Docket No. 08-167, Notice of Proposed Rulemaking and Order, FCC 08-188 (Aug. 15, 2008).

⁵⁶ See e.g., *Ex Parte* Letters of Shure, ET Docket No. 04-186 (Oct. 31, 2008 and Sept. 25, 2008) (suggesting centering the protected channels around channels 37 and 11 in the interests of spectrum efficiency).

assumption not valid for personal portable devices. For personal portable devices this value should be lowered to provide additional margin to account for potential indoor operation, low antenna, signal absorption by the body, and other “real world” factors. In fact, the Commission’s own test results do not support the -114 dBm value. Limited Commission field measurements showed that the signal level difference between a modest outdoor television antenna and WSD antennas can be up to 34 dB.⁵⁷ Adjusting these results for an antenna based on the DTV planning factors, these data yield a sensing value of -122 dBm, not -114 dBm. Furthermore since no attempt was made to maximize the signal differential, more testing would show even lower values are needed (as set forth in the record).

D. Any Sensing Level is Meaningless Without Defining How Such Level Must Be Measured, and Critical Measurement Definitions Should Be Subject to Notice and Comment Rule Making.

Further, the -114 dB sensing level adopted by the Commission is meaningless because there is no requirement with respect to how that sensing level is measured. The Commission tested sensing levels in many ways. By providing a “clean” DTV signal, some devices were able to sense at about the -120 sensing level. However, by providing more of a real-world testing environment, using RF captures (which have impairments found in actual over-the-air broadcasts), the sensing level decreased significantly.⁵⁸ In some cases, this decrease was 10 dB or more.⁵⁹

⁵⁷ *OET Phase II Report* at 115.

⁵⁸ *See OET Phase II Report* at 26. For example, the Adaptrum device went from a sensing level of -120 dBm to about -113 dBm for one of the captures. Similarly, the Motorola device went from about -117 dBm for a clean DTV to about -110 dBm for one of the captures.

⁵⁹ *See id.* (I2R device).

Laboratory tests using clean RF captures but with a strong adjacent channel signal reduced the sensing level of these devices even more dramatically. “For some of the devices, the degradation in the detection sensitivity was as much as 60-70 dB. In some cases, the degradation was such that the detection threshold could not be measured.” The *OET Phase II Report* went on to state that “(t)his could impact significantly the ability of the devices to reliably detect TV signals within stations’ areas.⁶⁰ Thus, a -114 sensing level requirement is meaningless unless the Commission specifies how it must be measured. Another factor that must be considered is the antenna used for sensing. While the Commission has specified that the sensing level is “referenced to an omnidirectional receive antenna with a gain of 0 dBi,”⁶¹ it has not specified whether the antenna is omnidirectional in 2 or 3 planes nor has it taken into account the effect of body attenuation and nearby objects.

Because these devices will be used in the real world, and not in laboratories where RF conditions can be controlled, the Commission should require the sensing level to be achieved (1) using real-world signal captures and (2) strong adjacent channel signals.

In addition, the Commission’s tests showed that sensing devices take an impractical amount of time to scan for available channels — over 3 minutes per channel in some cases.⁶² Devices with such long scan times will not be useful for the applications for which WSDs are envisioned and undermine the claim that there has been a “proof of performance.”

⁶⁰ *Id.* at vi.

⁶¹ See *Second Report and Order* at para. 238.

⁶² See *OET Phase II Report* at vii.

Furthermore, given the failure of spectrum sensing technologies in Commission testing, authorizing devices that rely only on sensing is slippery slope. Sensing-only devices have not demonstrated the ability to protect licensed services, as the Commission has recognized. Given this history and the importance of ensuring that the devices do not cause harmful interference to the public's free over-the-air television service (and other critical services), the test procedures should be subject to full notice and comment rule making and not merely placed in a Public Notice as suggested in the *Second Report and Order*.

VI. THE COMMISSION FAILED TO ADDRESS ADEQUATELY GEO-LOCATION AND DATABASE ISSUES.

If the geo-location technology and related database are to provide effective protection to the public's critical television (and other) services, they must be simple to administer, reliable, easy to update, and secure. The Commission should establish requirements that will reduce the burden on licensees that need to register their facilities, and it should ensure that the database and devices have stringent protections to ensure that users are unable to circumvent necessary database checks.

A. Single Database Manager

The Commission should establish a single database manager. Multiple database managers would complicate device design and the ability to prevent and control "rogue" database operators. In addition, it would impose a greater burden on television stations and others who are registering in order to ensure that all databases are accurate. A single database operator would facilitate device design and database security.

B. Master/Servant Operations

The Commission should clarify that every device, including Mode II personal/portable devices, is required to contact the database before being allowed to transmit, unless it is acting as a “servant” to a “master” device that has contacted the database. In other words, the Commission must prohibit “daisy chains” of devices in which a Mode II personal/portable device is able to transmit by receiving attenuated authorization to do so from another device that did not itself contact the database but – perhaps through several other devices – received authorization from a database-capable device. In addition, the Commission should clarify that a non-master personal/portable device that has not contacted the database cannot tell another personal/portable device that it is authorized to transmit.

C. Daily Updates

Unlicensed device should not be permitted to operate more than 24 hours without receiving an update from the database manager. The rules adopted in the *Second Report and Order* permit devices to operate until 11:59 PM of the following day (a maximum time of 48 hours). This timeframe should be reduced to 24 hours to protect wireless microphone and BAS operations more effectively.

D. Registration of Personal/Portable Devices

All unlicensed devices, including Mode II personal/portable devices, should be registered in the database. Personal/portable devices are required to contact the database in order to provide both device and geo-location information as a means of determining available channels. The uncontrolled nature of personal/portable devices means that these devices pose the greatest interference threat, and these devices should be required to register in the database. This will facilitate broadcasters’ and the

Commission's ability to detect devices that, intentionally or not, are transmitting in unauthorized manners. This would not place any additional burden on device manufacturers, because no additional information would be required beyond what is already transmitted in order to acquire the list of free channels (including the FCC ID and manufacturer's serial number).

E. Security

Communications between the device and the database manager and communications between devices must be secure, protected and validated to prevent illegal operation on occupied channels. Mechanisms must be in place to ensure that devices can not be "hacked" or "spoofed" by communications from rogue database sources or rogue devices.

F. Burden of Keeping Database Up-to-Date

The Commission did not consider the impact and cost on licensees of inputting data into the database/database manager. The Commission suggests that input is "voluntary,"⁶³ but only at the risk of interference from WSDs. The cost of database maintenance should be calculated, and the costs should be paid for by the new entrants benefitting from it – *i.e.*, unlicensed equipment manufacturers.⁶⁴ Licensees should not have to pay to receive protection from unlicensed devices. The Commission should carefully calculate the administrative burdens imposed on such services as temporary BAS fixed links (and consider providing a safe harbor for such operations, as opposed to forcing them to rely entirely on the failed "sensing" technology) and cable headend

⁶³ See *Second Report and Order* at Appendix C, p. 117.

⁶⁴ SBE intends to submit separate comments in April on the regulatory burdens imposed by this requirement. See 74 Fed. Reg. 7314, 7315 (Feb. 17, 2009).

receive locations that are located outside of a television station's coverage area.

Likewise, the Commission should assess the resources involved in registration of low power auxiliary devices (which registrations would be valid for only one year under the current rule) and wireless microphones and wireless assist video devices that are "used regularly and predictably" such as at sports venues. The Commission should permit cable headend receive locations that are located within a television station's contour to register, as well as nomadic Part 74 wireless microphones (which are often used for critical newsgathering services). Finally, the Commission must ensure that enforcement mechanisms are available if the database manager fails to keep the database up-to-date.

VII. THE COMMISSION FAILED TO PROVIDE ADEQUATE PROTECTION FOR ELECTRONIC NEWSGATHERING/WIRELESS MICROPHONES.

Wireless microphones are critical for broadcasters' operations, and are used to support coverage of breaking news, emergencies, other newsroom activities, and programming of high value to the public. As other commenters including sports leagues, Broadway interests, and churches have noted in the record in this proceeding, wireless microphones also are critical in providing the communications used to support a wide range of services that benefit consumers.

The Commission must ensure that wireless microphone operations are protected from interference by WSDs. However, Commission testing showed that sensing failed to detect wireless microphone operations.⁶⁵ Even if reliability of sensing could be improved, the framework adopted in the *Second Report and Order* would not be sufficient. Specifically, monitoring once every 60 seconds is not sufficient to prevent disruption of active newsgathering or live entertainment or sports. The Commission

⁶⁵ *OET Phase II Report* at 129.

should adopt a more stringent sensing and detecting requirements for wireless microphones, such as the two-second sensing requirement proposed by IEEE 802.22. The U.K. proposals for white space use require both a more stringent sensing or detection level of -126 dBm for wireless microphones (in contrast to the much more lenient -114 dBm specified by the Commission) as well as a requirement that white space devices check much more frequently for wireless microphones.⁶⁶ The U.K requires that devices check for wireless microphone operation every second rather than the once per minute. A stringent requirement such as the U.K.'s is important in order to ensure that WSDs do not cause interference to critical wireless microphone operations.

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⁶⁶ See *Ofcom Consultation* at 5.34 and 9.11.

For the reasons discussed herein, SBE respectfully requests that the Commission reconsider and clarify the *Second Report and Order*.

Respectfully submitted,

**THE SOCIETY OF BROADCAST ENGINEERS,
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