

**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

Second Report and Order and Memorandum
Opinion and Order FCC 08-260

Via the ECFS

IEEE 802 PETITION FOR RECONSIDERATION

IEEE 802¹ hereby respectfully submits this petition for reconsideration in response to FCC 08-260, *Second Report and Order and Memorandum Opinion and Order*, regarding operation of unlicensed white spaces devices (WSD) in the TV Band.²

The members of the IEEE 802 that participate in the IEEE 802 standards process are interested parties in this proceeding. IEEE 802, as a leading consensus-based industry standards body, produces standards for wireless networking devices, including wireless local area networks (“WLANs”), wireless personal area networks (“WPANs”), wireless metropolitan area networks (“Wireless MANs”), and wireless regional area networks (“WRANs”).

IEEE 802 is an interested party in this Proceeding and we appreciate the opportunity to provide these comments to the Commission.

¹ The IEEE Local and Metropolitan Area Networks Standards Committee (“IEEE 802” or the “LMSC”)

² This document represents the views of the IEEE 802. It does not necessarily represent the views of the IEEE as a whole or the IEEE Standards Association as a whole.

INTRODUCTION

1. On November 4, 2008, the Commission adopted a *Second Report and Order and Memorandum Opinion and Order* to "...adopt rules to allow unlicensed radio transmitters to operate in the broadcast television spectrum at locations where that spectrum is not being used by licensed services (this unused TV spectrum is often termed "white spaces")."³
2. Within IEEE 802 are a number of Working Groups ("WG"), including 802.11, 802.15, 802.16 and 802.22, which are, or are planning to, create standards for operation in the TV Bands under the rules created by the subject Report and Order ("R&O").
3. In our previous comments⁴, we noted that IEEE 802.22 is presently in the process of creating a standard for fixed operation in the TV Band. In that submission, we outlined some of the operational characteristics under consideration for devices operating under the preliminary draft of the 802.22 standard.
4. In addition, other IEEE 802 WGs are also in the process of considering how to address operation in the TV Band under the rules proposed in the R&O.
5. In our review of the R&O we found several issues with the rules proposed and are recommending the changes outlined below.

FIXED MASTER DEVICES SHOULD BE ALLOWED TO HAVE MULTIPLE FIXED CLIENT DEVICES

6. In Appendix B of the R&O, Section 15.711(f) states that: "A fixed device may not operate as a client to another fixed device." This rule would prohibit fixed devices from using a "master/slave" protocol as proposed for 802.22 systems. The IEEE 802.22 architecture is designed around a protocol where a client/slave fixed device is required to operate under the control of and communicate with a master fixed device (a base station in IEEE 802.22 nomenclature). As mentioned in our previous filing, IEEE 802.22 established a class of fixed client/slave devices known as Customer Premise Equipment ("CPEs") with a power output of up to 4 W EIRP which can determine their geolocation parameters and send them to the master/base station as a condition for association. The master/base station is responsible for querying the database on behalf a CPE requesting association to get a list of available channels which may be used by the CPE at its location. In order to associate with

³ FCC 08-260, Second Report and Order and Memorandum Opinion and Order, Para 2.

a master/base station and begin normal operation, a CPE must receive a list of available channels and permission to operate from the master/base station.

7. Our recommendation is that the rules be changed to allow the master/slave relationship as described above, permitting fixed master devices operating at 4 W EIRP to have multiple fixed client devices operating at 4 W EIRP.
8. We further recommend that fixed client devices, whose operation is controlled by the master, be relieved of the requirement to directly query the database.

**WHERE RELIABLE DATABASE ACCESS EXISTS, SENSING TO DETECT
BROADCAST TV SIGNALS SHOULD BE OPTIONAL**

9. In Section 15.711(a)(1) and 15.711(a)(2), the Commission mandated the use of a geolocation and database access mechanism as well as sensing for both fixed and personal/portable operation.
10. If the database is used, sensing to detect broadcast TV signals should be optional and, in such cases, there is no longer a need for a 10 meter minimum receive antenna height requirement and the fixed CPE antenna heights indicated in the proposed new Table below would be feasible for both transmit and receive antennas as long as the receive antenna is at the same height or above the transmit antenna for proper wireless microphone sensing.⁵ This change would significantly reduce the cost and complexity of CPE equipments and installation, benefiting consumers and making rural broadband access more affordable and ubiquitous.

**FIXED BASE STATION HEIGHT SHOULD BE BASED ON HAAT RATHER THAN
AGL AND NOT LIMITED TO 30 METERS AGL**

11. In paragraph 181 of the R&O the Commission limited the antenna height for fixed unlicensed TVBDs to 30 meters above ground level (AGL) and used that limit for its calculation of the separation distance to the TV protected contour. In the case of a fixed base station located on a mountain, using 30 meters AGL would considerably underestimate the required separation distance and compromise the protection of the TV service in some situations and would unnecessarily limit fixed base station coverage area in other situations,

⁴ 18-06-0073-r1-0000_FCC_Cmt_TV_band_FNPRM.doc

⁵ The 10m antenna height was driven by TV sensing and is not required for wireless microphone sensing since in the case of wireless microphones the RF path is reciprocal.

requiring the deployment of more base stations than necessary, thereby increasing cost to consumers.

12. We recommend that the antenna height for such fixed base stations should be expressed in terms of HAAT (Height Above Average Terrain) rather than height above ground level (AGL) to allow the determination of the appropriate separation distances necessary to protect the incumbents while allowing to achieve extended coverage.
13. We recommend that HAAT be used to determine the required separation distance from TV protected contours as described in the Table below.⁶ The method for calculating HAAT should be the same as was employed in Part 90 to protect the TV service from PLMRS. In addition, we recommend no limits on the antenna height above ground for fixed base stations.⁷ We further recommend that no changes in the assumption of antenna heights of 10m AGL for fixed user terminals (CPEs) be made for the purpose of calculating the separation distance to the TV protected contour.

Antenna height of Unlicensed Device (AGL* for personal/portable and fixed CPE, HAAT for fixed base station)	Required Separation (km) From Digital or Analog TV (Full Service or Low Power) Protected Contour	
	Co-channel	Adjacent Channel
Less than 3 meters*	6 km	0.1 km
3 – Less than 10 meters*	6.9 km	0.256 km
10 – Less than 30 meters	10.8 km	0.285 km
30 – Less than 50 meters	13.6 km	0.309 km
50 – Less than 75 meters	16.1 km	0.330 km
75 – Less than 150 meters	22.6 km	0.372 km
150 – Less than 300 meters	32 km	0.405 km
300 – Less than 600 meters	45.7 km	0.419 km
600 meters or higher	68 km	0.426 km

PSD LIMITS AND MINIMUM OCCUPIED BANDWIDTH SHOULD BE SPECIFIED

14. In the January 2007 comments to the TV Band NPRM, 802.18 recommended that the minimum channel bandwidth to be used in the TV white space should be 6 MHz. In the

⁶ An explanation of the assumptions, propagation models, and calculations used to derive the table is found in Annex A.

⁷ Note that for Part 74 device protection, higher antenna heights for fixed base station TVBDs will improve both coverage and sensing in a similar way since the RF parts are reciprocal.

second R&O, the Commission conducted all its tests based on a wideband noise-like signal. However, in specifying the maximum power, the Commission did not specify a minimum bandwidth.

15. IEEE 802 believes there is a need to allow narrower bandwidths than proposed earlier while maintaining the same protection for incumbents. We therefore believe that the Commission should specify a minimum bandwidth and a maximum spectrum power density.
16. Specifically, we propose that, in addition to a maximum of 1 W conducted power in 6 MHz, we recommend that the maximum PSD limit be set as defined in Part 15.247(e), where the maximum PSD is specified as +8 dBm (conducted) in a 3 kHz bandwidth.
17. We also propose that a minimum occupied bandwidth of 500 kHz be required in order to differentiate between a Part 74 wireless microphone and a TVBD.

THE UNDESIRABLE EMISSION LIMITS SHOULD BE DEFINED RELATIVE TO THE MAXIMUM ALLOWABLE POWER IN A 6 MHZ BANDWIDTH

18. The undesirable emission limits should, in our view, be defined relative to the maximum allowable power in 6 MHz, as stated in 15.709(a)(4), rather than relative to the PSD in the reference bandwidth, i.e., 100 kHz, as stated in 15.709(c)(2). This clarification would appropriately limit the out-of-band emission levels when the transmitted signal is concentrated in a narrower bandwidth
19. The undesirable emissions limit is defined as -55 dB level relative to the maximum PSD in 100 kHz in the current rules. Without the above clarification, a transmitted signal narrower than the channel bandwidth (6 MHz) would be allowed to increase its PSD in the adjacent TV channel by the same amount as its in-band PSD increases.
20. In addition, we recommend that the undesirable emissions be measured in a 100 kHz bandwidth relative to the transmitted signal power measured in a 6 MHz bandwidth. The level of power allowed in the adjacent channel should therefore be defined as $-55 \text{ dB} - 10 \cdot \log(6 \text{ MHz}/0.1 \text{ MHz}) = -72.8 \text{ dBc}$.

WE RECOMMEND CHANGING THE SENSING THRESHOLD FOR WIRELESS MICROPHONES TO -107 DBM

21. IEEE 802 believes that the proposed -114 dBm sensing threshold is too low and results in the sensing device very often wrongly detecting the presence of wireless microphones.

IEEE 802 originally proposed a threshold level of -107 dBm. We still believe that this threshold would adequately protect the incumbents.

22. This higher threshold would help to reduce the problem of false detection of non-existent wireless microphones due to the presence of spurious and noise in the channel, as well as the possibility of a denial of service attack resulting from the presence of very simple RF oscillators in the channel.
23. It is difficult, if not impossible, for a sensing approach to differentiate between a legal Part 74 device and any other narrowband signals sources such as spurious signals as allowed by Part 15.209(a) since the specified sensing threshold proposed by the FCC is 33.5 dB below the permitted level from such a source at a 10 m distance.

**THE DATABASE SYSTEM PLAN AND OPERATION SHOULD BE AUGMENTED
TO ALLOW ONLINE, NEAR REAL TIME OPERATION**

24. The database system plan and operation (R&O paragraphs 204-207) is specified for day-to-day contact and operation, but many Internet transaction systems operate continuously, with redundant elements and very high reliability. One consequence of the day-to-day contact rule is that constant sensing by all devices is imperative to protect others during the interval between updates from the TV bands database. Constant sensing costs energy.
25. Our recommendation is to have each master mode device provide an Internet contact address, and the TV bands database push changes in channel availability to affected master devices. We believe that the 48 hour grace period for continued operation in the event that a device loses contact with the database, as stated in 15.711(b)(3)(iii), can lead to an extended duration of uncontrollable interference. We believe that this grace period defeats the proposed ability to resolve interference issues by having a database administrator issue a “no channels available” message. In our recommendation, the requirement for daily contact with the TV bands database is replaced by the requirement for master mode devices to verify their Internet connectivity hourly or cease operation. There are a broad range of standards-based paging and messaging technologies available that the TV bands database could use to push messages that reflect changes in channel availability to master mode devices for near real time updates.

CONCLUSION

16 March 2009

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26. We appreciate the considerable work the Commission has accomplished in devising the newly published rules for Part 15 Subpart H. Given the range of concerns expressed in comments to the TV Band NPRM, the Commission's actions have been fair and balanced.
27. In our review of the Part 15 Subpart H rules, we have identified some modest changes and clarifications to the rules proposed which we believe should be incorporated in the final rulemaking.

Respectfully submitted,

/s/

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Annex A

Propagation model applied to the calculation of separation distances to TV protected contour

We note in paragraph 181 that the FCC curves from Section 73.699 of the Rules are used for a transmit antenna height of 30 m and the Okumura propagation model is applied for lower antenna heights. It was found in our discussions that the Okumura propagation model is not well suited for non-urban areas and for antenna heights below 30 m.

The ITU-R P.1546 propagation model which contains the original FCC propagation curves (Section 73.699 of the Rules) and which has been updated successively to, among other things, extend the model for lower antenna heights has been used to obtain the new separation distances shown in the new proposed Table below.

Calculation of separation distances to the protected TV contours

Analysis of the separation distances shown in Table 3 allowed the IEEE 802 to conclude that the predictions were made based on the following assumptions:

- Interference probability: F(50,10)
- TVBD EIRP: 4 Watts
- DTV field strength to be protected: 41 dB μ V/m at mid-band UHF (Ch. 38, 617 MHz)
- Co-channel D/U: 15 dB , adjacent channel D/U: -33 dB
- DTV receiving antenna discrimination: 0 dB

It is recognized that the co-channel interference from fixed TVBDs will specifically affect DTV reception at the edge of the coverage areas and that the two following aspects need to be considered in the calculation of the required separation distances to the TV protected contours:

- OET Bulletin 69 recommends an increase of the co-channel D/U for low DTV SNR conditions at edge of coverage from 15 dB to 23 dB. This results in a reduction of the DTV receiver desensitization from 3 dB to 0.7 dB.
- It is understood that the DTV receiving antenna will be pointing inward towards the DTV transmit station while the interfering TVBD will be, by definition, outside the protected contour in the opposite direction, thus allowing the consideration of a DTV receiving antenna discrimination corresponding to the front-to-back ratio indicated in the OET Bulletin 69, that is 14 dB.

This would result in a tightening of the interference requirement of 8 dB from the co-channel D/U at the same time as a relaxation of 14 dB from the DTV receiving antenna, with a net 6 dB relaxation in the separation distance calculations.

It is proposed to replace the existing Table 3 in paragraph 181 and in section 15.712(a)(2) with the new Table 3 below based on the following assumptions:

- Interference probability: F(50,10)
- TVBD EIRP: 4 Watts
- DTV field strength to be protected: 41 dB μ V/m and mid-band UHF (Ch. 38, 617 MHz)
- Co-channel D/U = 23 dB, adjacent channel D/U= -33 dB
- DTV receiving antenna discrimination toward TVBD's= 14 dB
- Propagation model: ITU-R P.1546-2 extrapolated up to free-space for distances less than about 1 km to be representative of rural environment.

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