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BY HAND DELIVERY AND ELECTRONIC FILING

Julius Genachowski
Chairman
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: White Spaces/Sensing/Geolocation Database
ET Docket Nos. 04-186 and 02-380

Dear Chairman Genachowski:

In response to requests from various Commission officials, the Association for Maximum Service Television, Inc. (MSTV) and the National Association of Broadcasters (NAB) respectfully submit suggestions with respect to the Commission's rules for unlicensed devices in the TV Band. To assist the Commission, we here attach proposed revisions to these rules to safeguard against harmful interference to incumbents by retaining the requirements for both spectrum sensing and a robust geolocation/database.¹

The proposed revisions set forth in the attachment are chiefly designed to address ambiguities and omissions that appear in the Commission's rules for TV Band Devices (TVBDs).² MSTV and NAB representatives would be pleased to meet with Commission

¹ See *Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, ET Docket Nos. 04-186 and 02-380, 23 FCC Rcd 16807, at para. 1 ("The actions we take here are a conservative first step that includes many safeguards to prevent harmful interference to incumbent communications services") ("White Spaces Order").

² For example, many of the changes clarify the definitions contained in § 15.703. A small number of "substantive" refinements are proposed in order to help achieve the goal of avoiding interference to protected operations, including specification of a minimum bandwidth for TVBD transmissions, more rigorous database checking requirements, and clarification that the database cannot override a TVBD that has detected an incumbent signal sensed at the -90 dBm level (a (continued...))

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officials to explain the purpose and effect of the proposed revisions. To be clear, these proposed changes do not reflect the fundamental concerns already raised by the broadcast industry.³ Moreover, these changes are based on the assumption that the FCC will retain both spectrum sensing and geolocation/database protections.

We are aware that certain device manufacturers want the Commission to eliminate spectrum sensing protections. We urge the Commission to adhere to its decision that spectrum sensing is a necessary companion to the geolocation/database requirement.⁴ The two together are essential to achieving the Commission's stated goal of avoiding harmful interference to the public's television service.⁵ This is so because (1) sensing serves as an important backstop to compensate for the inevitable database errors and security breaches in the geolocation/database process; (2) sensing at least limits interfering TVBD operations to a short period of time; and (3), in the case of licensed microphones used for newsgathering and other valued mobile uses, geolocation protection is not even possible. The Commission's recent experience with 5 GHz unlicensed devices illustrates the need to avoid eliminating necessary protections.⁶

Further, elimination of the Commission's sensing requirement would require substantially more complex and robust requirements concerning both geolocation/database and

level high enough to avoid "false positives" while offering some protection from device/database mistakes or security breaches).

³ See, e.g., Society of Broadcast Engineers Petition for Reconsideration (March 19, 2009); Opposition and Comments of MSTV and NAB to Petitions for Reconsideration and Clarification (May 8, 2009); Reply of MSTV and NAB to Oppositions (May 18, 2009). In particular, MSTV and NAB continue to believe that the Commission should make two important changes in its white spaces rules: It should (1) reduce the 40 mW power limit for adjacent-channel operations by personal/portable TVBDs and (2) it should make the sensing levels more sensitive.

⁴ MSTV, NAB, Shure, Shared Spectrum, Philips, and others have supported retaining the sensing requirement. See, e.g., Ex Parte Comments of MSTV, ET Docket Nos. 04-186 and 02-380 (July 16, 2010).

⁵ Eliminating the sensing requirement, and simply allowing existing equipment and technologies to "retune" to the TV band, runs counter to this objective. Supporters of eliminating sensing have offered no evidence or support for their position except to state that such devices would be cheaper to produce.

⁶ For example, a number of 5 GHz base station operations have caused widespread harmful interference to aeronautical radar systems, and the FCC required these stations to shut down or be modified and temporarily suspended processing all new 5 GHz equipment authorizations. If this problem had occurred with hundreds of thousands of consumer devices (as is a possibility in the case of TVBDs), it would have been impossible to enforce interference protection rules to solve the problem.

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TVBD operations in order to mitigate risks of interference to the public's television service. The Commission has not previously solicited comments on or established a record regarding the changes in its geolocation/database rules that would be needed as a pre-requisite to eliminating the sensing requirement. At this juncture, it is difficult to pinpoint the exact rule changes that would be necessary. Nonetheless, an illustrative, but incomplete, list of the kinds of changes that would be necessary should include: (1) elimination of Mode I devices; (2) a requirement that all TVBDs check the database more frequently, on a near real-time basis (*e.g.*, every 60 seconds); (3) a requirement that the database have more direct control over TVBDs (including the ability to cause forced shut-downs if a protected television operation commences or moves into the area, such as could occur with licensed wireless newsgathering microphones, and also including a requirement to comply with other proposed enhancements suggested by Spectrum Bridge);⁷ (4) additional requirements regarding the security of TVBDs and the database; (5) enhancement of FCC oversight and control over the database administrator; and (6) designation of a single administrator in order to improve accountability.

We also point out that additional, more complex geolocation/database requirements would be necessary if the Commission were to eliminate its current sensing requirement. Now is not the time to water down the Commission's white spaces rules and procedures and abandon the prudent approach previously adopted by the Commission. Accordingly, we urge the Commission to adopt these proposed revisions to the white spaces rules.

⁷ See Ex Parte filing of Spectrum Bridge, ET Docket No. 04-186 (June 24, 2010).

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Respectfully submitted,

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Subpart H—Television Band Devices

§ 15.701 Scope.

This subpart sets out the regulations for Television Band Devices (TVBDs) which are unlicensed intentional radiators operating on available TV channels in the broadcast television frequency bands at 54–60 MHz, 76–88 MHz, 174–216 MHz, 470–608 MHz and 614–698 MHz bands.

§ 15.703 Definitions.

(a) Available TV channel. A television channel which is not being used by an authorized user at or near the same geographic location as the TVBD and is acceptable for use by an unlicensed device under the provisions of ~~§15.709. A TVBD determines television channel availability either from the TV bands database or spectrum sensing.~~

~~(b) Client device. A TVBD operating in client mode. (c) Client mode. An operating mode in which the transmissions of the TVBD, including frequencies of operation, are under control of the master device. A device in client mode is not able to initiate a network. this Subpart. The numerical designation and frequency bands of all television channels are contained in §73.603 of the rules.~~

~~(d)~~ Fixed device. A TVBD that transmits and/or receives radiocommunication signals at a specified fixed location. Fixed TVBDs may operate as part of a system, transmitting to one or more fixed TVBDs or to personal/portable TVBDs.

~~(e)~~ Geo-location capability. The capability of a TVBD to determine its geographic coordinates within a specified level of accuracy. This capability is used with a TV bands database designated and approved by the FCC to determine available TV channels at a TVBD's location.

Comment [A1]: Changes clarify that definition refers to a television channel including the frequencies of each channel.

Comment [A2]: Client device definition not used and client mode definition only applies to Mode I devices. Language moved to Mode I device definition. Simplifies and makes rules more consistent.

Comment [A3]: Adds missing word “capability” and defines how capability is used.

~~(f) Master device. A TVBD operating in master mode.~~

~~(g) Master mode. An operating mode in which the TVBD has the capability to transmit without receiving an enabling signal. The TVBD is able to select a channel itself based on a list provided by the database and initiate a network by sending enabling signals to other devices. A network always has at least one device operating in master mode. d) Master device. A TVBD that controls the operations of a Mode I device and notifies the Mode I device to the database. Only fixed and Mode II devices may act as master devices.~~

~~(e) Mode I device. A personal/portable TVBD that has spectrum sensing but does not have geo-location capability and may operate only under the direct control of a master device that controls its operation. Mode I device transmissions must cease if communications with the master device is terminated or lost. A Mode I device may not initiate a network or control another TVBD.~~

~~(h)~~ Mode ~~I operation. Operation of a~~ II device. A personal/portable TVBD ~~operating only on the available channel identified by either the fixed TVBD or Mode II TVBD that enables its operation. Mode I operation does not require use of a geo-location capability or access to the TV bands database and requires operation in client mode.~~ ~~(i) Mode II operation. Operation of a personal/portable TVBD whereby the device determines the available channels at its location using its own geo-location and TV bands database access capabilities. Devices operating in~~ that has spectrum sensing and geo-location capabilities. Mode II devices may function as master devices to Mode I devices.

~~(j) Network initiation . The process by which a fixed or Mode II TVBD sends control signals to another similar device or to a client device(s) and allows them to begin transmissions.~~

~~(k)~~ Operating channel . An available TV channel used by a TVBD for transmission and/or reception.

~~(h)~~ Personal/portable device . A TVBD that transmits and/or receives radiocommunication signals ~~while in motion or~~ at unspecified locations that may change. Personal/portable devices may only transmit on available TV channels above 512 MHz.

~~(m)~~ Receive site . The location where the signal of a full service station is received for rebroadcast by a cable television system, direct broadcast satellite system, television translator or low power TV, including Class A TV, station.

~~(n)~~ Spectrum sensing . A process whereby a TVBD monitors a television channel to detect whether the channel is occupied by a radio signal or signals from authorized services.

~~(k)~~ Television band device (TVBD) . Intentional radiators operating on available TV channels in the broadcast television frequency bands at 54–60 MHz, 76–88 MHz, 174–216 MHz, 470–608 MHz and 614–698 MHz.

~~(p)~~ TV bands database . A database of authorized services in the TV frequency bands that has been approved by the FCC and is used to determine the available TV channels at a given location for use by TVBDs.

§ 15.705 Cross reference.

(a) The provisions of subparts A, B, and C of this part apply to TVBDs, except where specific provisions are contained in subpart H.

(b) The requirements of subpart H apply only to the radio transmitter contained in the TVBD. Other aspects of the operation of a TVBD may be subject to requirements contained elsewhere in this chapter. In particular, a TVBD that includes a receiver that tunes within the frequency range specified in §15.101(b) contains digital circuitry not directly associated with the radio transmitter is also subject to the requirements for unintentional radiators in subpart B.

§ 15.706 Information to the user.

(a) ~~For TV band device, In addition to the labeling requirements contained in §15.19,~~ the instructions furnished to the user of a TV band device shall include the following or similar statement, placed in a prominent location in the text of the manual:

This equipment has been tested and found to comply with the rules for TV band devices, pursuant to part 15 of the FCC rules. These rules are designed to provide reasonable protection against harmful interference. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. ~~However, there is no guarantee that interference will not occur in a particular installation.~~ If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the manufacturer, dealer or an experienced radio/TV technician for help.

(b) In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

§ 15.707 Permissible channels of operation.

(a) All TVBDs are permitted to operate on available TV channels in the frequency bands 512–608 MHz and 614–698 MHz, subject to the interference protection requirements in §§15.711 and 15.712, except that in the 13 metropolitan areas listed §90.303(a) of this chapter and nearby areas where private land mobile services and commercial land mobile services are authorized by waiver, operation of TVBDs is prohibited on the first channel on each side of TV channel 37 (608–614 MHz) that is available at ~~all~~ locations within the protection range of the coordinates of each such area as set forth in §15.712(d). These channels will be ~~listed in identified and~~ protected for licensed wireless microphone use by the TV bands database.

Comment [A4]: Not practical to “list” channels for every location.

(b) Operation on available TV channels in the bands 54–60 MHz, 76–88 MHz, 174–216 MHz, and 470–512 MHz, subject to the interference protection requirements in §§15.711 and 15.712, is permitted only for fixed TVBDs that communicate ~~only with other fixed TVBDs.~~ with other fixed TVBDs, except that co-channel and adjacent channel operation in the 470-512 MHz band is prohibited on the channels listed for the 13 metropolitan areas in §90.303(a) of this chapter and nearby areas where private land mobile services and commercial land mobile services are authorized by waiver.

(c) Fixed and Mode II TVBDs shall only operate on available TV channels as identified in paragraphs (a) and (b) of this section and as determined by sensing and the TV bands database ~~and~~ in accordance with the interference avoidance mechanisms of ~~§15.711, 15.711 and~~ §15.712.

(d) Mode I TVBDs shall only operate on available TV channels ~~provided to it from a described in paragraph (a) that are also available to the~~ Fixed or Mode II TVBD that controls its operation and operation shall cease if communications with the Fixed or Mode II TVBD is terminated or lost.

§ 15.709 General technical requirements.

(a) Power limits for TVBDs are as follows: (1) For fixed TVBDs, the maximum conducted output power over the TV channel of operation shall not exceed one watt. Transmitter power will be measured at the antenna input to account for any cable losses between the transmitter and the antenna. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For personal/portable TVBDs, the maximum conducted output power over the TV channel of operation shall not exceed 100 milliwatts; except that for personal/portable TVBDs that do not meet the adjacent channel separation requirements in §15.712(a), the maximum conducted output power shall not exceed 40 milliwatts. If transmitting antennas of directional gain greater than 0 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 0 dBi.

(3) TVBDs shall incorporate transmit power control to limit their operating power to the minimum necessary for successful communication. Applicants for equipment certification shall include a description of a device's transmit power control feature mechanism. The power control feature shall at a minimum ensure that the output power of the device is reduced in approximately six equal steps from maximum permitted power to no transmissions.

(4) Maximum conducted output power is the total transmit power in the entire emission bandwidth delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g. , alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

~~(b)~~ 5) TVBDs shall incorporate adequate security measures to prevent the TVBD from accessing databases not designated or approved by the FCC and to ensure that unauthorized parties can not corrupt or otherwise prevent the TVBD from operating properly and consistent with the rules and protection criteria established in this Subpart.

(b) Minimum bandwidth. All transmissions from a TVBD shall have a minimum necessary bandwidth of 4.5 MHz and shall be contained within a single available TV channel as defined in §73.603(a). Transmissions from a TVBD must also meet the spurious emissions and other requirements of paragraph (d) of this section.

(c) Antenna requirements . (1) For personal/portable TVBDs, ~~the~~ all transmit and receive antenna(s) shall be permanently attached.

(2) The transmit and receive antenna used with fixed devices shall be located outdoors at least 10 meters ~~above the ground. The~~ and not more than 30 meters in height above average terrain (HAAT); provided, however, that antenna heights above 30 meters (HAAT) may be used with a reduction in power such that the radiated power is equivalent to an unlicensed fixed device at 30 meters (HAAT). The TV bands database shall include the height (HAAT) and computed maximum power of such fixed devices with antenna heights more than 30 meters along with all other required information.

Comment [A5]: Interference calculations based on HAAT as opposed to height above ground. Additional language provides flexibility for higher antenna height with reduced power (equivalent interference).

(3) ~~The receive~~ antenna system used with a TVBD shall be capable of receiving signals of protected services equally in all directions. ~~The transmit antenna used with fixed devices may not be more than 30 meters above the ground.~~

Comment [A6]: This requirement applies to both fixed and personal/portable devices but follows requirements that only apply to fixed devices. More clear if this requirement is set forth in separately numbered rule.

(34) For both fixed and personal/portable TVBDs, the provisions of §15.204(c)(4) do not apply to an antenna used for transmission and reception/spectrum sensing.

(45) For both fixed and personal/portable TVBDs with a separate sensing antenna, compliance testing shall be performed using the lowest gain antenna for each type of antenna to be certified.

(e) ~~Undesirable emission~~ d) Emission limits for TVBDs are as follows:

(1) In the ~~6 MHz~~ television channels immediately adjacent to the channel in which the TVBD is operating ~~channel~~, emissions from TVBD devices shall be at least 55 dB below the highest average power in the ~~band~~ TV channel in which the device is operating.

(2) The above emission measurements shall be performed using a minimum resolution bandwidth of 100 kHz with an average detector. A narrower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 100 kHz.

(3) At frequencies beyond ~~6 MHz from the edge of the~~ the television channels immediately adjacent to the channel in which the TVBD is operating ~~channel~~, the radiated emissions from TVBD devices shall meet the requirements of §15.209.

(4) Emissions in the band 602–620 MHz must also comply with the following field strength limits at a distance of one meter.

Frequency (MHz)	Field strength dBμV/meter/120 kHz
602–607	120–5[F(MHz)–602]

607-608	95
608-614	30
614-615	95
615-620	120-5[620-F(MHz)]

(5) TVBDs connected to the AC power line are required to comply with the conducted limits set forth in §15.207.

~~(d)~~ Compliance with radio frequency exposure requirements. To ensure compliance with the Commission's radio frequency exposure requirements in §§1.1307(b), 2.1091 and 2.1093 of this chapter, fixed TVBDs shall be accompanied by instructions on measures to take to ensure that persons maintain a distance of at least 40 cm from the device, as well as any necessary hardware that may be needed to implement that protection. These instructions shall be submitted with the application for certification. Personal/portable TVBDs that meet the definition of portable devices under §2.1093 of this chapter and that operate with a source-based time-averaged output of less than 20 mW will not be subject to routine evaluation for compliance with the radio frequency exposure guidelines, while devices that operate with a source-based time-average output power greater than 20 mW will be subject to the routine evaluation requirements.

§ 15.711 Interference avoidance mechanisms.

~~(a)~~ Except as provided in §15.717, television channel availability for a TVBD is determined based on ~~either~~ the geo-location and database access mechanism described in ~~paragraph~~ paragraphs (a) and (b) of this section ~~or~~ and spectrum sensing described in paragraph (c) of this section.

(a) Geo-location and database access. (1) A TVBD shall rely on the geo-location and database access mechanism to identify available television channels consistent with the interference protection requirements of §15.712. Such protection will be provided for the following authorized services: digital television stations, digital and analog Class A, low power, translator and booster stations; translator receive operations; fixed broadcast auxiliary service links; private land mobile service/commercial radio service (PLMRS/CMRS) operations; offshore radiotelephone service; and cable system head-ends. In addition, protection shall be provided in border areas near Canada and Mexico in accordance with §15.712(g).

(2) For low power auxiliary services authorized pursuant to §§74.801 through 74.882 of this chapter, including wireless microphones, a TVBD shall rely on the geo-location and database access mechanism to identify available television channels to provide interference protection to registered locations of such operations, consistent with the requirements of §15.712, and shall rely on spectrum sensing to identify available television channels to provide interference protection to all other operations.

(b) Geo-location and database access requirements. (1) The geographic coordinates of a fixed TVBD shall be determined to an accuracy of ± 50 meters by either an incorporated geo-location capability or a professional installer. In the case of professional installation, the party who registers the fixed TVBD in the database will be responsible for assuring the accuracy of the entered coordinates. The geographic coordinates of a fixed TVBD shall be determined at the

time of installation and first activation from a power-off condition, and this information may be stored internally in the TVBD. If the fixed TVBD is moved to another location or if the stored coordinates become altered, the operator shall re-establish the device's:

(i) Geographic location and store this information in the TVBD either by means of the device's incorporated geo-location capability or through the services of a professional installer; and

(ii) Registration with the database based on the device's new coordinates.

(2) A Mode II personal/portable device shall incorporate a geo-location capability to determine its geographic coordinates to an accuracy of ± 50 meters. The device must re-establish its position each time it is activated from a power-off condition.

(3)(i) Fixed devices must access a TV bands database over the Internet to determine the TV channels that are available at their geographic coordinates prior to their initial service transmission at a given location. Operation is permitted only on channels that are indicated in the database as being available for TVBDs. Fixed ~~TVBDs~~ TVBDs shall access the database at least once ~~a day~~ an hour to verify that the operating channels continue to remain available. Operation must cease immediately if the database or spectrum sensing indicates that the channel is no longer available.

Comment [A7]: Requires the database to have the capability to turn off a device or change its channel.

(ii) Mode II personal/portable devices must access a TV bands database over the Internet to determine the TV channels that are available at their geographic coordinates prior to their initial service transmission at a given location. Operation is permitted only on channels that are indicated in the database as being available for personal/portable TVBDs. A Mode II personal/portable device must access the database for a list of available channels each time it is activated from a power-off condition and re-check its location and the database for available channels if it changes location during operation. A Mode II personal/portable device that has been in a powered state shall re-check its location and access the database daily at least hourly to verify that the operating channel(s) continue to be available. Operation must cease immediately if the database or spectrum sensing indicates that the channel is no longer available.

(iii) If a fixed or mode II TVBD fails to successfully contact the TV bands database ~~during any given day, it may continue to operate until 11:59 PM of the following day at which time to reconfirm its operating channels in three attempts or three hours.~~ it must cease operations ~~unless it has contacted~~ until contact with the TV bands database ~~during the intervening period.~~ has been re-established and its operating channels re-affirmed.

~~(iv) Personal/portable devices operating in Mode I shall obtain a list of channels on which they may operate from a master device.~~

(iv) A Mode I device may only operate under the control of a fixed or Mode II device. The fixed or Mode II device shall provide the TV bands database with the FCC Identifier (FCC ID) of the Mode I device under its control and either request a list of channels on which the Mode I device may operate or permit the Mode I device to operate on the same channel

that its operating on provided that that channel is available for personal/portable devices. The Mode I device must maintain contact with the master device and re-confirm that its operating channels remain valid at least once an hour. If communications with the master device is terminated or lost, all transmissions from the Mode I device must cease.

(4) All geographic coordinates shall be referenced to the North American Datum of 1983 (NAD 83).

(5) All communications between TVBDs and the TV bands database, and between a fixed or Mode II device and Mode I device under its control, shall include adequate security measures to ensure that unauthorized parties can not access or alter the database or otherwise corrupt the database system in performing its intended functions or the TVBDs from operating properly and consistent with the rules and protection criteria established in this Subpart.

Comment [A8]: Language taken from 11/25/2009 database public notice.

(c) Spectrum sensing—(1) Detection threshold. (i) All fixed and personal/portable TVBDs must be capable of detecting ATSC digital TV, NTSC analog TV and wireless microphone signals using analog or digital modulation methods. The required detection thresholds are.

(A) ATSC signals: -114 dBm, averaged over a 6 MHz bandwidth;

(B) NTSC signals: -114 dBm, averaged over a 100 kHz bandwidth;

(C) Wireless microphone signals: -114 dBm, averaged over a 200 kHz bandwidth. (ii) The detection thresholds are referenced to an omnidirectional receive antenna with a gain of 0 dBi. If a receive antenna with a minimum directional gain of less than 0 dBi is used, the detection threshold shall be reduced by the amount in dB that the minimum directional gain of the antenna is less than 0 dBi. Minimum directional gain shall be defined as the antenna gain in the direction and at the frequency that exhibits the least gain. Alternative approaches for the sensing antenna are permitted, e.g. , electronically rotateable antennas, provided the applicant for equipment authorization can demonstrate that its sensing antenna provides at least the same performance as an omnidirectional antenna with 0 dBi gain.

(2) Low power auxiliary device channel availability check time. A TVBD may start operating on a TV channel if no wireless microphone or other low power auxiliary device signals above the detection threshold are detected within a minimum time interval of 30 seconds.

(3) TV channel availability check time. A TVBD is required to check for TV signals for a minimum time interval of 30 seconds. If a TV signal is detected on a channel indicated as available for use by the database system, the device will provide a notice of that detection to the operator of the device and a means for the operator to optionally remove the channel from the device's list of available channels. If a TV or authorized service signal is detected at the -90 dBm signal level or higher, the TVBD shall immediately cease operating on that channel and re-contact the database and notify the database of that detection and request another available TV channel.

Comment [A9]: This level would eliminate the risk of "false" positives while offering some protection to TV viewers from device and database mistakes or security breaches.

(4) In-service monitoring. A TVBD must perform in-service monitoring of an operating channel a minimum of once every 60 seconds. There is no minimum channel availability check time for in-service monitoring. If a TV or authorized service signal is detected at the -90 dBm signal level or higher, the TVBD shall immediately cease operating on that channel and re-contact the database and notify the database of that detection and request another available TV channel.

Comment [A10]: See above.

(5) Channel move time. After a wireless microphone or other low power auxiliary device signal is detected on a TVBD operating channel, all transmissions by the TVBD must cease within two seconds.

(6) ~~Personal/portable devices operating in the client mode~~ A Mode I device shall identify to ~~the~~ its fixed or Mode II personal/portable master device those television channels on which it senses any signals above the detection threshold. The fixed or Mode II device shall respond in accordance with the provisions of this paragraph as if it had detected the signal itself.

(7) TVBDs communicating either directly with one another or linked through a base station must share information on channel occupancy determined by sensing. If any device in a local area group or network determines that a channel is occupied, all other linked devices will also be required to respond in accordance with the provisions of this paragraph as if it had detected the signal itself.

(d) A TVBD must incorporate the capability to display a list of identified available channels and its operating channels.

(e) Fixed TVBDs shall transmit identifying information. The identification signal must conform to a standard established by a recognized industry standards setting organization. The identification signal shall carry sufficient information to identify the device and its geographic coordinates.

(f) If a fixed TVBD device does not have a direct connection to the Internet and has not yet been initialized and registered with the TV bands database, consistent with §15.713, but can receive the transmissions of another fixed TVBD, the device needing initialization may transmit to that other device on either a channel that the other TVBD has transmitted on or on a channel which the other TVBD indicates is available for use to access the database to register its location and receive a list of channels that are available for it to use. Subsequently, the newly registered TVBD must only use the television channels that the database indicates are available for it to use. Such fixed devices must re-contact the database through another fixed device to review their list of available channels at least once every 60 seconds. ~~A fixed device may not operate as a client to another fixed device.~~

(g) A ~~personal/portable TVBD operating in~~ Mode I device may only transmit ~~upon receiving under the transmissions control of a~~ fixed or Mode II TVBD. ~~A personal/portable device operating in Mode I that has contacted and notified the database of the Mode I device. The Mode I device~~ may transmit on ~~either an operating channel of the fixed or Mode II TVBD or on a channel~~ an available TV channels above 512 MHz that the fixed or Mode II

TVBD indicates is available for use. [The Mode I device must cease all transmissions if communications with the master device is terminated or lost.](#)

§ 15.712 Interference protection requirements.

(a) Digital television stations, and digital and analog Class A TV, low power TV, TV translator and TV booster stations:

(1) Protected contour . TVBDs must protect digital and analog TV services within the contours shown in the following table. The contours are based on the R-6602 curves contained in §73.699 of this [chapter](#).

Comment [A11]: Does not take into account correct calculation of TV station contours which includes dipole factor. See Advanced Television Systems and Their Impact upon the Existing Television Broadcast Service, M&O on Reconsideration of 6th R&O, MM Docket No. 87-268, 13 FCC Rcd 7418, at para. 167 (1998).

Type of station	Protected contour		
	Channel	Contour (dBu)	Propagation curve
Analog: Class A TV, LPTV, translator and booster	Low VHF (2-6)	47	F(50,50)
	High VHF (7-13)	56	F(50,50)
	UHF (14-69)	64	F(50,50)
Digital: Full service TV, Class A TV, LPTV, translator and booster	Low VHF (2-6)	28	F(50,90)
	High VHF (7-13)	36	F(50,90)
	UHF (14-51)	41	F(50,90)

(2) Required separation distance . **Fixed TVBDs and personal/portable TVBDs operating in Mode-H TVBDs** must be located outside the contours indicated in paragraph (a)(1) of this section of co-channel and adjacent channel stations by at least the minimum distances specified in the following table. Personal/portable TVBDs **operating in Mode-H** must comply with the separation distances specified for an unlicensed device with an antenna height of less than 3 meters. Alternatively, **Mode-H** personal/portable TVBDs may operate at closer separation distances, including inside the contour of adjacent channel stations, provided the power level is reduced [to 40 mW or less](#), as specified in §15.709(a)(2).

Comment [A12]: Interference distances should apply to all TVBDs. Rules already do that for all other cases in this rule section, e.g., (b), (c), (d), etc. Database can make Mode I device adjustments. All other sections apply to all TVBDs.

Antenna height of unlicensed device (Height Above Average Terrain (HAAT))	Required separation (km) from digital or analog TV (full service or low power) protected contour	
	Co-channel (km)	Adjacent channel (km)
Less than 3 meters	6.0	0.1 <u>0.15</u>
3-Less than 10 meters	8.0	0.1 <u>0.15</u>
10-30 meters	14.4	0.74 <u>0.80</u>
More than 30 meters (fixed device only)	Permitted power and separation distance to be calculated by TV bands database to provide equivalent interference protection as device at 30 meters (HAAT) at the permitted	

Comment [A13]: All distances were calculated based on HAAT. HAAT can be determined easily from geolocation data by the database. Separation distances are incorrect and meaningless if TVBD is located on top of hill or mountain.

Comment [A14]: Distance need s to take into account accuracy of location data. 100 meters is minimum required distance but location is only known to 50 meter accuracy.

Comment [A15]: This new row provides additional flexibility for unlicensed devices to operate at higher antenna heights while ensuring same level of interference protection.

power levels in §15.709(a).

(b) Translator receive sites and cable headends . For translator receive sites and cable headends registered in the TV bands database, TVBDs may not operate within an arc of ± 30 degrees from a line between the registered translator or cable headend receive site and the TV station being received within a distance of 80 km from the protected contour for co-channel operation and 20 km from the protected contour for adjacent channel operation. Outside of this ± 30 degree arc, TVBDs may not operate within 8 km from the receive site for co-channel operation and 2 km from the receive site for adjacent channel operation.

(c) Fixed Broadcast Auxiliary Service (BAS) Links . For permanent BAS receive sites appearing in the Commission's Universal Licensing System or temporary BAS receive sites registered in the TV bands database, TVBDs may not operate within an arc of ± 30 degrees from a line between the BAS receive site and its associated permanent transmitter within a distance of 80 km from the receive site for co-channel operation and 20 km for adjacent channel operation. Outside this ± 30 degree arc, TVBDs may not operate within 8 km from the receive site for co-channel operation and 2 km from the receive site for adjacent channel operation.

(d) PLMRS/CMRS operations . TVBDs may not operate at distances less than 134 km for co-channel operations and 131 km for adjacent channel operations from the coordinates of the metropolitan areas and on the channels listed in §90.303(a) of this chapter. For PLMRS/CMRS operations outside of the metropolitan areas listed in §90.303(a) of this chapter, co-channel and adjacent channel TVBDs may not operate closer than 54 km and 51 km, respectively from a base station.

(e) Offshore Radiotelephone Service. TVBDs may not operate on channels used by the Offshore Radio Service within the geographic areas specified in §74.709(e) of this chapter.

(f) Low power auxiliary services, including wireless microphones. (1) TVBDs will not be permitted to operate within 1 km of the coordinates of registered wireless microphone sites during designated times on the channels used by wireless microphones.

(2) In the 13 metropolitan areas listed in §90.303(a) of this chapter and nearby areas where private land mobile services and commercial land mobile services are authorized by waiver, operation of TVBDs will not be permitted to operate on the first channel on each side of TV channel 37 (608–614 MHz) that is available, i.e., not occupied by a licensed service, at all locations within the protection range of the coordinates of each such area as set forth in §15.712(d).

(g) Border areas near Canada and Mexico. (1) Fixed and personal/portable TVBDs shall not operate within 32 kilometers of the Canadian Border.

(2) Fixed and personal/portable TVBDs shall not operate within 40 kilometers of the Mexican border on UHF channels, or within 60 kilometers of that border on VHF channels.

(h) Radio astronomy services. Operation of fixed and personal/portable TVBDs is prohibited on all channels within 2.4 kilometers at the following locations.

(1) The Naval Radio Research Observatory in Sugar Grove, West Virginia.

(2) The Table Mountain Radio Receiving Zone (TMRZ) at 40°07'50" N and 105°15'40" W.

(3) The following facilities.

Observatory	Longitude (deg/min/sec)	Latitude (deg/min/sec)
Allen Telescope Array	121°28'24" W	40°49'04" N.
Arecibo Observatory	066°45'11" W	18°20'46" N.
Green Bank Telescope (GBT)	079°50'24" W	38°25'59" N.
Very Large Array (VLA)	107°37'04" W	34°04'44" N.
Very Long Baseline Array (VLBA) Stations:		
Pie Town, AZ	108°07'07" W	34°18'04" N.
Kitt Peak, AZ	111°36'42" W	31°57'22" N.
Los Alamos, NM	106°14'42" W	35°46'30" N.
Ft. Davis, TX	103°56'39" W	30°38'06" N.
N. Liberty, IA	091°34'26" W	41°46'17" N.
Brewster, WA	119°40'55" W	48°07'53" N.
Owens Valley, CA	118°16'34" W	37°13'54" N.
St. Croix, VI	064°35'03" W	17°45'31" N.
Hancock, NH	071°59'12" W	42°56'01" N.
Mauna Kea, HI	155°27'29" W	19°48'16" N.

§ 15.713 TV bands database.

(a) Purpose. The TV bands database serves the following functions:

(1) To determine and provide to a TVBD, upon request, the available TV channels at the TVBD's location. Available channels are determined based on the interference protection requirements in §15.712. In making such channels available to a TVBD, the TV band database shall ensure that all communications and interactions between the TV band database and a TVBD include adequate security measures such that unauthorized parties cannot access or alter the TV bands database or the list of available channels sent to TVBDs or otherwise corrupt the database system or TVBDs in performing their intended functions or in providing adequate interference protections to authorized operations in the TV band.

(2) To register the identification information and location of fixed TVBDs.

(3) To register protected locations and channels as specified in paragraph (b)(2) of this section, that are not otherwise recorded in Commission licensing databases.

(b) Information in the TV bands database. (1) Facilities already recorded in Commission databases. Identifying and location information will come from the official Commission database. These services include:

(i) Digital television stations.

(ii) Class A television stations.

(iii) Low power television stations.

(iv) Television translator and booster stations.

(v) Broadcast Auxiliary Service stations (including receive only sites), except low power auxiliary stations.

(vi) Private land mobile radio service stations.

(vii) Commercial mobile radio service stations.

(viii) Offshore radiotelephone service stations.

(2) Facilities that are not recorded in Commission databases. Identifying and location information will be entered into the TV bands database in accordance with the procedures established by the TV bands database administrator(s). These include:

(i) Cable television headends.

(ii) Class A television station receive sites.

(iii) Low power television station receive sites.

(iv) Television translator station receive sites.

(v) Sites where low power auxiliary stations, including wireless microphones and wireless assist video devices, are used and their schedule for operation.

(vi) Fixed TVBD registrations.

(c) Restrictions on registration. (1) Television translator, low power TV and Class A station receive sites within the protected contour of the station being received are not eligible for registration in the database.

(2) Cable television headends within the protected contour of a television channel are not eligible to register that channel in the database.

(d) Determination of available channels. The TV bands database will determine the available channels at a location using the interference protection requirements of §15.712, the location information supplied by a TVBD, and the data for protected stations/locations in the database. The TV bands database will also check for proximity of a TVBD to the Canadian and Mexican borders where operation may be prohibited pursuant to §15.712(g).

(1) The TV bands database will determine the HAAT and permitted power levels for TVBDs based on the geolocation location information supplied to ensure that the separation distances specified in §15.712(a)(2) are met.

(e) TVBD initialization. (1) Fixed and Mode II TVBDs must provide their location and required identifying information to the TV bands database in accordance with the provisions of paragraph (b) of this section.

Comment [A16]: Appears to be an incorrect citation.

(2) Fixed and Mode II TVBDs shall not transmit unless they receive, from the TV bands database, a list of available ~~channels.~~ TV channels and may only transmit on available TV channels permitted by the TV database and available for its type of TVBD. For example, personal/portable Mode II TVBDs may only operate on TV channels above 512 MHz.

(3) Fixed TVBDs register and receive a list of available channels from the database by connecting to the Internet, either directly or through another fixed TVBD that has a direct connection to the Internet.

Comment [A17]: Need to prevent "chains" of fixed devices that are not connected to the Internet and are not in the same geographic area.

(4) Mode II TVBDs register and receive a list of available channels from the database by connecting to the Internet, either directly or through a fixed TVBD that has a direct connection to the Internet.

(5) A fixed and Mode II TVBD acting as a master device shall notify the database of the FCC identifier (FCCID) of any Mode I TVBDs it is controlling and request a list of available channels from the database that may be used by the Mode I device under its control. The database shall take into account the location, height and power of the master device to ensure that list of available channels for the Mode I device will meet the separation distances and protections set forth in section 15.712. Alternatively, the fixed and Mode II TVBD acting as a master device, after notifying the database of any TVBDs it is controlling, may permit the Mode I device to operate on a TV channel above 512 MHz that the database has indicated is available for its use. The Mode I device must maintain communications with the master device and transmissions from the Mode I device must cease if communications with the master device is terminated or lost.

(f) Fixed TVBD registration. (1) Prior to operating for the first time or after changing location, a fixed TVBD must register with the TV bands database by providing the information listed in paragraph (f)(3) of this section.

(2) The party responsible for a fixed TVBD must ensure that the TVBD registration database has the most current, up-to-date information for that device.

(3) The TVBD registration database shall contain the following information for fixed TVBDs:

(i) FCC identifier (FCC ID) of the device.

(ii) Manufacturer's serial number of the device.

(iii) Device's geographic coordinates (latitude and longitude (NAD 83) accurate to ± 50 m).

(iv) Name of the individual or business that is responsible for the device.

(v) Name of a contact person responsible for the device's operation.

(vi) Address for the contact person.

(vii) E-mail address for the contact person.

(viii) Phone number for the contact person.

(g) A personal/portable device operating in Mode II shall provide the database its FCC Identifier (as required by §2.926 of this chapter), serial number as assigned by the manufacturer, and the device's geographic coordinates (latitude and longitude (NAD 83) accurate to ± 50 m)

(h) The TV bands database shall contain the listed information for each of the following:

(1) Digital television stations, digital and analog Class A, low power, translator and booster stations:

(i) Transmitter coordinates (latitude and longitude in NAD 83).

(ii) Effective radiated power (ERP).

(iii) Height above average terrain of the transmitting antenna (HAAT).

(iv) Horizontal transmit antenna pattern (if the antenna is directional).

(v) Channel number.

(vi) Station call sign.

(2) Broadcast Auxiliary Service.

(i) Transmitter coordinates (latitude and longitude in NAD 83).

(ii) Receiver coordinates (latitude and longitude in NAD 83).

(iii) Channel number.

(iv) Call sign.

(3) Metropolitan areas listed in §90.303(a) of this chapter.

(i) Region name.

(ii) Channel(s) reserved for use in the region.

(iii) Geographic center of the region (latitude and longitude in NAD 83).

(iv) Call sign.

(4) PLMRS/CMRS base station operations located more than 80 km from the geographic centers of the 13 metropolitan areas defined in §90.303(a) of this chapter (e.g. , in accordance with a waiver).

(i) Transmitter location (latitude and longitude in NAD 83) or geographic area of operations.

(ii) Effective radiated power.

(iii) Transmitter height above average terrain (if specified).

(iv) Antenna height above ground level (if specified).

(v) Call sign.

(5) Offshore Radiotelephone Service. For each of the four regions where the Offshore Radiotelephone Service operates.

(i) Geographic boundaries of the region (latitude and longitude in NAD 83 for each point defining the boundary of the region).

(ii) Channel(s) used by the service in that region.

(6) Cable Television headends.

(i) Name and address of cable company.

(ii) Location of the headend receiver (latitude and longitude in NAD 83, accurate to ± 50 m).

(iii) Channel number of each television channel received, subject to the following condition: channels for which the cable headend is located within the protected contour of that channel's transmitting station are not eligible for registration in the database.

(iv) Call sign of each television channel received and eligible for registration.

(v) Location (latitude and longitude) of the transmitter of each television channel received.

(7) Television translator, low power TV and Class A TV station receive sites.

(i) Call sign of the TV translator station.

(ii) Location of the TV translator receive site (latitude and longitude in NAD 83, accurate to ± 50 m).

(iii) Channel number of the re-transmitted television station, subject to the following condition: a channel for which the television translator receive site is located within the protected contour of that channel's transmitting station is not eligible for registration in the database.

(iv) Call sign of the retransmitted television station.

(v) Location (latitude and longitude) of the transmitter of the retransmitted television station.

(8) Low power auxiliary stations, including wireless microphones and wireless assist video devices. Sites with significant wireless microphone use at well defined times and locations may be registered in the database. Multiple registrations that specify more than one point in the facility may be entered for very large sites. Registrations will be valid for no more than one year, after which they may be renewed.

(i) Name of the individual or business that owns the low power auxiliary device(s).

(ii) An address for the contact person.

(iii) An e-mail address for the contact person (optional).

(iv) A phone number for the contact person.

(v) Coordinates where the device(s) are used (latitude and longitude in NAD 83, accurate to ± 50 m).

(vi) Channels used by the low power auxiliary devices operated at the site.

(vii) Specific months, days and times when the device(s) are used.

(i) Commission requests for data. (1) A TV bands database administrator must provide to the Commission, upon request, any information contained in the database.

(2) A TV bands database administrator must remove information from the database, upon direction, in writing, by the Commission.

§ 15.714 TV bands database administration fees.

(a) A TV bands database administrator may charge a fee for provision of lists of available channels to fixed and personal/portable TVBDs and for registering fixed TVBDs and temporary BAS links.

(b) The Commission, upon request, will review the fees and can require changes in those fees if they are found to be excessive.

§ 15.715 TV bands database administrator.

The Commission will designate one or more entities to administer a TV bands database. Each database administrator shall:

(a) Maintain a database that contains the information described in §15.713.

(b) Establish a process for acquiring and storing in the database necessary and appropriate information from the Commission's databases and synchronizing the database with the current Commission databases at least once a week to include newly licensed facilities or any changes to licensed facilities.

(c) Establish a process for registering fixed TVBDs and registering and including in the database facilities entitled to protection but not contained in a Commission database, including cable headends and TV translator receiver sites.

(d) Establish a process for registering facilities where part 74 low power auxiliary devices are used on a regular basis.

(e) Provide accurate lists of available channels to fixed and personal/portable TVBDs that submit to it the information required under §15.713(~~(e)~~, (f) and (g)) based on their geographic location.

Comment [A18]: Original cite incorrect. (f) applies only to fixed TVBDs.

~~(f)~~ Provide accurate lists of available channels to fixed and Mode II devices requesting channels for a Mode I device under its control.

(f) Establish protocols and procedures to ensure that all communications and interactions between the TV band database and TVBDs are accurate and secure and that unauthorized parties cannot access or alter the database or the list of available channels sent to the TVBD.

(g) Establish protocols and procedures with TVBD manufacturers to ensure that TVBDs are built with adequate security and respond correctly to the list of available channels sent by the TV bands database and that unauthorized parties cannot corrupt the database system or devices from performing their intended functions or in providing adequate protection to authorized services in the TV bands.

(h) Make its services available to all unlicensed TV band device users on a non-discriminatory basis.

(~~g~~i) Provide service for a five-year term. This term can be renewed at the Commission's discretion. In addition, the term is subject to change or cancellation by the Commission at any time without hearing if in its discretion the need for such action arises. A petition for reconsideration or application of review may be filed with respect to such Commission action.

Comment [A19]: Language similar to cancellation provisions in Section 5. 83 for experimental services.

(~~h~~j) Respond in a timely manner to verify, correct and/or remove, as appropriate, data in the event that the Commission or a party brings claim of inaccuracies in the database to its attention.

(~~i~~k) Transfer its database along with the IP addresses and URLs used to access the database and list of registered Fixed TVBDs, to another designated entity in the event it does not continue as the database administrator at the end of its term. It may charge a reasonable price for such conveyance.

(~~j~~l) The database must have functionality such that upon request from the Commission it can indicate that no channels are available when queried by a specific TVBD or model of TVBDs.

(~~k~~m) If more than one database is developed, the database administrators shall cooperate to develop a standardized process for providing on a daily basis or more often, as appropriate, the data collected for the facilities listed in §15.713(b)(2) to all other TV bands databases to ensure consistency in the records of protected facilities.

§ 15.717 TVBDs that rely on spectrum sensing.

(a) Parties may submit applications for certification of TVBDs that rely solely on spectrum sensing to identify available channels. Devices authorized under this section must demonstrate with an extremely high degree of confidence that they will not cause harmful interference to incumbent radio services.

(1) In addition to the procedures in subpart J of part 2 of this chapter, applicants shall comply with the following.

(i) The application must include a full explanation of how the device will protect incumbent authorized services against interference.

(ii) Applicants must submit a pre-production device, identical to the device expected to be marketed.

(2) The Commission will follow the procedures below for processing applications pursuant to this section.

(i) Applications will be placed on public notice for a minimum of 30 days for comments and 15 days for reply comments. Applicants may request that portions of their application remain confidential in accordance with §0.459 of this chapter. This public notice will include proposed test procedures and methodologies.

(ii) The Commission will conduct laboratory and field tests of the pre-production device. This testing will be conducted to evaluate proof of performance of the device, including characterization of its sensing capability and its interference potential. The testing will be open to the public.

(iii) Subsequent to the completion of testing, the Commission will issue by public notice, a test report including recommendations. The public notice will specify a minimum of 30 days for comments and, if any objections are received, an additional 15 days for reply comments.

(b) The device shall meet the requirements for personal/portable devices in this subpart except that (i) it will be limited to a maximum EIRP of 50 mW **and 40 mW if the device does not meet the adjacent channel separation requirements in § 15.712(a)** and (ii) it does not have to comply with the requirements for geo-location and database access in §15.711(b). Compliance with the detection threshold for spectrum sensing in §15.711(c), although required, is not necessarily sufficient for demonstrating reliable interference avoidance. Once a device is certified, additional devices that are identical in electrical characteristics and antenna systems may be certified under the procedures of part 2, subpart J of this chapter.

Comment [A20]: Clarifies that the limitation for adjacent channel operations is 40 mW, while the 50 mW limitation is in place of the 100 mW maximum permitted for other personal/portable devices.