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TVBD from accessing databases not approved by the FCC and to ensure that unauthorized parties can not modify the TVBD or configure its control features to operate inconsistent with the rules and protection criteria set forth in this subpart.

(b) *Antenna requirements.* (1) All transmit and receive antenna(s) of personal/portable devices shall be permanently attached.

(2) The transmit antenna used with fixed devices may not be more than 30 meters above the ground. In addition, fixed devices may not be located at sites where the antenna height above average terrain is more than 250 meters. The HAAT is to be calculated by the TV bands database that the device contacts for available channels using computational software employing the methodology in §73.684(d) of this chapter.

(3) For personal/portable TVBDs operating under §15.717, the provisions of §15.204(c)(4) do not apply to an antenna used for transmission and reception/spectrum sensing.

(4) For personal/portable TVBDs operating under §15.717 that incorporate a separate sensing antenna, compliance testing shall be performed using the lowest gain antenna for each type of antenna to be certified.

(c) *Emission limits for TVBDs.* (1) In the television channels immediately adjacent to the channel in which the TVBD is operating, emissions from the TVBD shall not exceed the following levels.

(i) Fixed devices: -42.8 dBm conducted power.

(ii) Personal/portable device operating adjacent to occupied TV channels: -56.8 dBm EIRP.

(iii) Sensing-only devices: -55.8 dBm EIRP.

(iv) All other personal/portable devices: -52.8 dBm EIRP.

(2) Emission measurements in the adjacent channels 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.

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(3) At frequencies beyond the television channels immediately adjacent to the channel in which the TVBD is operating, the radiated emissions from TVBDs 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.

[74 FR 7326, Feb. 17, 2009, as amended at 75 FR 75836, Dec. 6, 2010; 77 FR 29245, May 17, 2012]

§ 15.711 Interference avoidance methods.

Except as provided in §15.717, television channel availability for a TVBD is determined based on the geo-location and database access method described in paragraphs (a) and (b) of this section.

(a) *Geo-location and database access.* 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 and unlicensed 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; off-shore radiotelephone service; low power auxiliary services authorized pursuant to §§ 74.801 through 74.882 of this chapter, including wireless microphones and MVPD receive sites; and unlicensed wireless microphones used by venues of large events and productions/shows as provided under § 15.713(h)(8). In addition, protection shall be provided in border areas near Canada and Mexico in accordance with § 15.712(g).

(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 its 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. A Mode II device must also re-establish

its position each time it is activated from a power-off condition and use its geo-location capability to check its location at least once every 60 seconds while in operation, except while in sleep mode, *i.e.*, in a mode in which the device is inactive but is not powered-down.

(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, taking into consideration the fixed device's antenna height, 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 such TVBDs. Fixed TVBDs shall access the database at least once a day to verify that the operating channels continue to remain available. Operation on a channel must cease immediately if the database indicates that the channel is no longer available. Fixed TVBD must adjust their use of channels in accordance with channel availability schedule information provided by their database for the 48-hour period beginning at the time of the device last accessed the database for a list of available channels.

(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 by more than 100 meters from the location at which it last accessed the database. A Mode II personal/portable device that has been in a powered state shall re-check its location and access the database daily to verify that the operating channel(s) continue to be available. Mode II personal/portable devices must adjust their use of channels in accordance

with channel availability schedule information provided by their database for the 48-hour period beginning at the time of the device last accessed the database for a list of available channels. A Mode II personal/portable device may load channel availability information for multiple locations around, *i.e.*, in the vicinity of, its current location and use that information in its operation. A Mode II TVBD may use such available channel information to define a geographic area within which it can operate on the same available channels at all locations, for example a Mode II TVBD could calculate a bounded area in which a channel or channels are available at all locations within the area and operate on a mobile basis within that area. A Mode II TVBD using such channel availability information for multiple locations must contact the database again if/when it moves beyond the boundary of the area where the channel availability data is valid, and must access the database daily even if it has not moved beyond that range to verify that the operating channel(s) continue to be available. Operation must cease immediately if the database indicates that the channel is no longer available.

(iii) If a fixed or Mode II personal/portable TVBD fails to successfully contact the TV bands database during any given day, it may continue to operate until 11:59 p.m. of the following day at which time it must cease operations until it re-establishes contact with the TV bands database and re-verifies its list of available channels.

(iv)(A) A Mode I personal/portable TVBD may only transmit upon receiving a list of available channels from a fixed or Mode II TVBD. A fixed or Mode II device may provide a Mode I device with a list of available channels only after it contacts its database, provides the database the FCC Identifier (FCC ID) of the Mode I device requesting available channels, and receives verification that the FCC ID is valid for operation.

(B) A Mode II device must provide a list of channels to the Mode I device that is the same as the list of channels available to the Mode II device.

(C) A fixed device may provide a list of available channels to a Mode I de-

vice only if the fixed device HAAT as verified by the TV bands database does not exceed 106 meters. The fixed device must provide a list of available channels to the Mode I device that is the same as the list of channels available to the fixed device, except that a Mode I device may operate only on those channels that are permissible for its use under §15.707. A fixed device may also obtain from a database a separate list of available channels that includes adjacent channels that would be available to a Mode I personal/portable device and provide that list to the Mode I device.

(D) To initiate contact with a fixed or Mode II device, a Mode I device may transmit on an available channel used by the fixed or Mode II TVBD or on a channel the fixed or Mode II TVBD indicates is available for use by a Mode I device on a signal seeking such contacts. At least once every 60 seconds, except when in sleep mode, *i.e.*, a mode in which the device is inactive but is not powered-down, a Mode I device must either receive a contact verification signal from the Mode II or fixed device that provided its current list of available channels or contact a Mode II or fixed device to re-verify/re-establish channel availability. A Mode I device must cease operation immediately if it does not receive a contact verification signal or is not able to re-establish a list of available channels through contact with a fixed or Mode II device on this schedule. In addition, a Mode II device must re-check/re-establish contact with a fixed or Mode II device to obtain a list of available channels if it loses power. Collaterally, if a Mode II device loses power and obtains a new channel list, it must signal all Mode I devices it is serving to acquire and use a new channel list.

(v) Device manufacturers and database administrators may implement a system that pushes updated channel availability information from the database to TVBDs. However, the use of such systems is not mandatory, and the requirements for TVBDs to validate the operating channel at least daily and to cease operation in accordance with paragraph (b)(3)(iii) of this section continue to apply if such a system is used.

(vi) TV bands devices shall incorporate adequate security measures to ensure that they are capable of communicating for purposes of obtaining lists of available channels only with databases operated by administrators authorized by the Commission, and to ensure that communications between TV bands devices and databases between TV bands devices are secure to prevent corruption or unauthorized interception of data. This requirement includes implementing security for communications between Mode I personal portable devices and fixed or Mode II devices for purposes of providing lists of available channels.

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

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

(d) *Identifying information.* 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.

(e) *Fixed devices without a direct connection to the Internet.* If a fixed TVBD 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 fixed TVBD needing initialization may transmit to that other fixed TVBD 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. A fixed device may not obtain lists of available channels from another fixed device as provided by a TV bands database for such other device, *i.e.*, a fixed device may not simply operate on the list of available channels provided by a TV

bands database for another fixed device with which it communicates but must contact a database to obtain a list of available channels on which it may operate.

(f) *Security.* (1) For purposes of obtaining a list of available channels and related matters, fixed and Mode II TVBDs shall only be capable of contacting databases operated by FCC designated administrators.

(2) Communications between TV bands devices and TV bands databases are to be transmitted using secure methods that ensure against corruption or unauthorized modification of the data; this requirement applies to communications of channel availability and other spectrum access information between fixed and Mode II devices (it is not necessary for TVBDs to apply security coding to channel availability and channel access information where they are not the originating or terminating device and that they simply pass through).

(3) Communications between a Mode I device and a fixed or Mode II device for purposes of obtaining a list of available channels shall employ secure methods that ensure against corruption or unauthorized modification of the data. When a Mode I device makes a request to a fixed or Mode II device for a list of available channels the receiving device shall check with the TV bands database that the Mode I device has a valid FCC Identifier before providing a list of available channels. Contact verification signals transmitted for Mode I devices are to be encoded with encryption to secure the identity of the transmitting device. Mode I devices using contact verification signals shall accept as valid for authorization only the signals of the device from which they obtained their list of available channels.

(4) A TV bands database shall be protected from unauthorized data input or alteration of stored data. To provide this protection, the administrator of the TV bands database administrator shall establish communications authentication procedures that allow the fixed or Mode II devices to be assured that the data they receive is from an authorized source.

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(5) Applications for certification of TV bands devices are to include a high level operational description of the technologies and measures that are incorporated in the device to comply with the security requirements of this section. In addition, applications for certification of fixed and Mode II devices are to identify at least one of the TV bands databases operated by a designated TV bands database administrator that the device will access for channel availability and affirm that the device will conform to the communications security methods used by that database.

(g) A personal/portable TVBD operating in Mode I may only transmit upon receiving the transmissions of fixed or Mode II TVBD. A personal/portable device operating in Mode I may transmit on either an operating

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channel of the fixed or Mode II TVBD or on a channel the fixed or Mode II TVBD indicates is available for use.

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§ 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. These contours are calculated using the methodology in §73.684 of this chapter and the R-6602 curves contained in §73.699 of this chapter.

| 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.* 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 II must comply with the separation distances specified for an unlicensed device with an antenna height of less than 3 meters. Alternatively, Mode II personal/portable TVBDs may operate at closer separation distances from the contour of adjacent channel stations than this table permits, 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).

| Antenna height above average terrain of unlicensed device | 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 | 4.0 | 0.4 |
| 3–Less than 10 meters | 7.3 | 0.7 |
| 10–Less than 30 meters ... | 11.1 | 1.2 |
| 30–Less than 50 meters ... | 14.3 | 1.8 |
| 50–Less than 75 meters ... | 18.0 | 2.0 |
| 75–Less than 100 meters | 21.1 | 2.1 |
| 100–Less than 150 meters | 25.3 | 2.2 |
| 150–Less than 200 meters | 28.5 | 2.3 |
| 200–250 meters | 31.2 | 2.4 |

(3) The antenna height above ground for a fixed TVBD may not exceed 30 meters.

(b) *TV translator, Low Power TV (including Class A) and Multi-channel Video Programming Distributor (MVPD) receive sites.* MVPD, TV translator station and low power TV (including Class A) station receive sites located outside the protected contour of the TV station(s) being received may be registered in the