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**Unlicensed Operation in the TV Broadcast
Bands; Final Rule**

FEDERAL COMMUNICATIONS COMMISSION**47 CFR Parts 0 and 15**

[ET Docket No. 04–186 and 02–380; FCC 10–174]

Unlicensed Operation in the TV Broadcast Bands**AGENCY:** Federal Communications Commission.**ACTION:** Final rule.

SUMMARY: This document finalizes rules to make the unused spectrum in the TV bands available for unlicensed broadband wireless devices. This particular spectrum has excellent propagation characteristics that allow signals to reach farther and penetrate walls and other structures. Access to this spectrum could enable more powerful public Internet connections—super Wi-Fi hot spots—with extended range, fewer dead spots, and improved individual speeds as a result of reduced congestion on existing networks. This type of “opportunistic use” of spectrum has great potential for enabling access to other spectrum bands and improving spectrum efficiency. The Commission’s actions here are expected to spur investment and innovation in applications and devices that will be used not only in the TV band but eventually in other frequency bands as well.

DATES: Effective January 5, 2011 except for amendments to §§ 15.713, 15.714, 15.715 and 15.717, which contain information collection requirements that are not effective until approved by the Office of Management and Budget. The Commission will publish a document in the **Federal Register** announcing the effective dates for those amendments.

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SUPPLEMENTARY INFORMATION: This is a summary of the Commission’s Second Memorandum Opinion and Order, ET Docket No. 04–186 and 02–380, adopted September 23, 2010 and released September 23, 2010. The full text of this document is available on the Commission’s Internet site at <http://www.fcc.gov>. It is also available for inspection and copying during regular business hours in the FCC Reference Center (Room CY–A257), 445 12th Street, SW., Washington, DC 20554. The full text of this document also may be purchased from the Commission’s duplication contractor, Best Copy and

Printing Inc., Portals II, 445 12th St., SW., Room CY–B402, Washington, DC 20554; telephone (202) 488–5300; fax (202) 488–5563; e-mail FCC@BCPIWEB.COM.

Paperwork Reduction Act of 1995 Analysis

This document adopts new or revised information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104–13 (44 U.S.C. 3501–3520). The requirements will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA. The Commission will publish a separate notice in the **Federal Register** inviting comment on the new or revised information collection requirements adopted herein. The requirements will not go into effect until OMB has approved them and the FCC has published a notice announcing the effective date of the information collection requirements. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107–198, *see* 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might “further reduce the information collection burden for small business concerns with fewer than 25 employees.”

Summary of the Second Memorandum Opinion and Order

1. In this Second Memorandum Opinion and Order, the Commission addresses on reconsideration a wide variety of issues relating to unlicensed use of the TV bands. These issues include protection criteria for incumbent authorized services, technical rules for TV bands devices, TV bands database requirements, the channels that can be used by TV bands devices, and several miscellaneous issues. The Commission is generally upholding the decisions it made in the *Second Report and Order* and *Memorandum Opinion and Order* (Second Report and Order) in this proceeding, 74 FR 7314, February 17, 2009, with some specific revisions and clarifications. In this regard the actions taken here are consistent with and continue the approach towards authorization of unlicensed devices in the TV bands that the Commission enunciated in the *Second Report and Order*—its actions in this proceeding are to be a conservative first step that includes many safeguards to prevent harmful interference to incumbent communications services. The Commission does, however, agree with petitioners with regard to a number of the requested changes to the rules and

are modifying and clarify our rules as appropriate in granting those requests. The Commission believes these changes and clarifications will provide for improved protection of licensed services in the TV bands, resolve certain uncertainties in the rules and provide manufacturers with greater flexibility in designing products to meet market demands. The Commission decisions granting and denying the various requests for changes to our rules for TV bands devices are discussed.

2. With the issuance of this decision and the forthcoming decision by the Commission’s Office of Engineering and Technology on selection of one or more database managers, manufacturers will be able to begin to make unlicensed TV bands devices and systems available to consumers, business and government users for general use. The Commission intends to closely oversee the introduction of these devices to the market and will take whatever actions may be necessary to avoid, and if necessary correct, any harmful interference that may occur. Further, the Commission will consider in the future any changes to the rules that may be appropriate to provide greater flexibility for development of this technology and protect against harmful interference to incumbent communications services.

3. Specifically, the Commission is resolving on reconsideration certain legal and technical issues in order to provide certainty concerning the rules for operation of unlicensed transmitting devices in the television broadcast frequency bands (unlicensed TV bands devices, or TVBDs). Resolution of these issues will allow manufacturers to begin marketing unlicensed communications devices and systems that operate on frequencies in the TV bands in areas where they are not used by licensed services (“TV white spaces”). The opening of these bands for unlicensed use, which represents the first significant increase in unlicensed spectrum below 5 GHz in over 20 years, will have significant benefits for both businesses and consumers and will promote more efficient spectrum use.

4. The Commission responds to seventeen petitions for reconsideration that were filed in response to the *Second Report and Order* in this proceeding. These petitions collectively request numerous changes in the rules for TV bands devices. The Commission is upholding the majority of its prior decisions on the issues raised therein. In this regard, the Commission continues to believe that the approach it followed in the *Second Report and Order* is desirable and appropriate for this first step in allowing unlicensed operations

in the TV bands. The Commission does, however, find merit in a number of the requests for changes to the rules for TVBDs and is granting those requests by modifying and clarifying the rules in four areas. Specifically, the Commission is taking the following actions:

- **Protection Criteria for Incumbent Services**
 - Modifying the protection criteria for low power auxiliary stations such as wireless microphones to reduce the required separation between such devices and unlicensed personal/portable devices operating in Mode II.
 - Modifying the definition of the receive sites entitled to protection outside of a television station's service area to include all multi-channel video programming distributors as defined by our rules.
 - Reserving two vacant UHF channels for wireless microphones and other low power auxiliary service devices in all areas of the country.
 - Allowing operators of event and production/show venues that use large numbers of wireless microphones on an unlicensed basis that cannot be accommodated in the two reserved channels and any others available at that location to register the sites of those venues on TV bands databases to receive the same geographic spacing protections afforded licensed wireless microphones.
 - Restricting fixed TV bands devices from operating on locations where the ground level is more than 76 meters above the average terrain level in the area.
- **TV Bands Devices**
 - Eliminating the requirement that TV bands devices that incorporate geo-location and database access must also listen (sense) to detect the signals of TV stations and low power auxiliary service stations (wireless microphones). As part of that change the Commission is also revising and amending the rules in several aspects to reflect use of that method as the only means for determining channel availability. While the Commission is eliminating the sensing requirement for TVBDs, it is encouraging continued development of this capability because it believes that it holds promise to further improvements in spectrum efficiency in the TV spectrum in the future and will be a vital tool for providing opportunistic access to other spectrum bands.
 - Adopting power spectral density limits for unlicensed TV bands devices.
 - Modifying the rules governing measurement of adjacent channel emissions.
 - Restricting fixed TV bands devices from operating at locations

where the height above average terrain of the ground level is greater than 76 meters.

- **TV Bands Database**
 - Requiring that communications between TV bands devices and TV bands databases, and between multiple databases, are secure.
 - Requiring that all information that is required by the Commission's rules to be in the TV bands databases be publicly available.
 - **Use of TV Channels**
 - Amending the rules to protect Canadian and Mexican stations in the border areas by including those stations in the TV bands database as protected services.
 - Changing the protection zone for the radio astronomy facility near Socorro, New Mexico to a rectangular area.
 - Declining to grant a request by FiberTower to set aside TV channels for fixed licensed backhaul use.
5. The Commission also makes other minor changes and refinements to its rules for TV bands devices. With these changes and clarifications, the rules will better ensure that licensed services are protected from interference while retaining flexibility for unlicensed devices to share the TV bands with them.

Protection Criteria for Incumbent Services

TV Stations

6. In the *Second Report and Order*, the Commission adopted technical criteria for determining when a TV channel is considered vacant for the purpose of allowing operation of an unlicensed device on that channel. It protected full service TV stations and Class A TV, low power TV, TV translator and TV booster stations from interference within defined signal contours. The signal level defining a television station's protected contour varies depending on the type of station, e.g., analog or digital TV, and the band in which a TV station operates, e.g., VHF or UHF. The protected contours for analog TV stations are calculated in accordance with the F(50,50) curves specified in the Commission's rules, and the protected contours for digital TV stations are calculated in accordance with the F(50,90) curves. While part 74 of the rules protects low power stations to a higher signal strength contour, and therefore to a shorter distance, than full service TV stations, the Commission decided to require TV bands devices to protect low power stations to the same contour as full service TV stations.

7. *Decision.* The Commission affirms its decisions regarding the protection

contours for TV stations. First, the Commission declines to change the method that must be used to calculate TV station protected contours. No party has described an alternative model that will provide more accurate calculations of TV station contours than the Commission's current method. The current method of calculating TV station contours in § 73.684 of the rules using the FCC curves in § 73.699 of the rules is straightforward, well understood and has proven sufficiently accurate over time. Given the lack of compelling information to the contrary, the Commission believes that calculations of channel availability relying on that methodology will provide satisfactory protection of TV services. Further, with respect to Adaptrum's request that TV signal information be incorporated into the TV bands databases, the Commission is removing the requirement that TV bands devices that include a geo-location capability and access to a database must sense television and low power auxiliary stations. Thus, sensing information on the location of TV signals would not be available to incorporate into the database. The Commission agrees with Rudman/Ericksen that the TV bands device database should include information on transmit antenna beam tilt to permit TV contour calculations to be made consistent with part 73 of the rules and is modifying § 15.713(h) of the rules accordingly.

8. The Commission also affirms its decision to protect low power television stations to the same signal contour as full service TV stations. Low power stations may provide the only over-the-air broadcast services in rural areas, and the Commission disagrees that viewers of those stations should receive less protection than viewers of full service stations. Further, low power stations by their nature cover only a relatively small area, so a modest increase in the protected area beyond the defined part 74 contour for these stations will not significantly impact the deployment of TV bands devices.

9. The Commission disagrees with SBE and Community Broadcasters that the rules fail to protect analog TV stations. While the D/U protection ratios for analog TV stations are higher than for digital stations, the protected service contours for analog stations are also higher than for digital stations. The net result is that the level of an undesired signal from a TVBD that will cause interference to an analog station is higher than the level that will cause interference to a digital station. Thus, the Commission's standards for protection of digital TV stations from

interference caused by TVBDs when applied for protection of analog TV stations provide somewhat greater protection of analog TV stations than would standards produced from a similar analysis that specifically considered protection of analog TV stations. The Commission also finds that an analysis focusing on digital operation is appropriate for low power television stations because these stations will eventually convert to digital operation.

10. The Commission declines to adopt any new requirements related to the use of TV bands devices in close proximity to amplified indoor antennas. A TV bands device and a TV receiver in close proximity would be under the control of the same party who could take steps to eliminate interference. The Commission previously adopted a requirement in the *Second Report and Order* requiring manufacturers to provide information to consumers on possible methods to resolve interference to television in the event it occurs, so the Commission finds no need to adopt any additional requirements.

Wireless Microphones and Other Low Power Auxiliary Stations

11. In the *Second Report and Order*, the Commission decided that the locations where licensed part 74 low power auxiliary stations, including wireless microphones, are used can be registered in the TV bands device database and will be protected from interference from TV bands devices. TV bands devices may not operate co-channel to a registered low power auxiliary station within a distance of 1 kilometer of the registered coordinates.

12. *Decision.* The Commission continues to recognize that wireless microphones are currently used in many different venues where people gather for events large and small and many consumers and businesses have come to rely on these devices. The Commission has previously limited use of channels 2 and 5–20 to communications between fixed TVBDs and reserved two channels in the range 14–51 in the 13 markets where PLMRS and CMRS systems operate to make sure that frequencies are available for wireless microphones. The Commission herein expands the reservation of two channels in the range 14–51 to all markets nationwide as suggested by several petitioners. This will provide frequencies where a limited but substantial number of wireless microphones can be operated on any basis without the potential for interference from TV bands devices. It will also ensure that frequencies are available everywhere for licensed wireless microphones used on a roving

basis to operate without risk of receiving harmful interference from TVBDs. The Commission has also provided for a nominal separation distance between TVBDs and sites of venues and events where large numbers of unlicensed wireless microphones used by permitting such sites to be registered in the TV bands databases. Further, it notes that at any particular location a number of TV channels will not be available for use by TVBDs due to the application of the various interference protection requirements under our rules. Thus, a significant amount of spectrum will be available on which wireless microphones can be operated as they have in the past without concern for interference from TVBDs. The Commission believes that this spectrum will provide sufficient frequencies to support wireless microphone operations at the great majority of events. The Commission disagrees with those who argue that more spectrum should be reserved for wireless microphones. It observes that wireless microphones generally have operated very inefficiently, perhaps in part due to the luxury of having access to a wealth of spectrum. While there may be users that believe they need access to more spectrum to accommodate more wireless microphones, the Commission finds that any such needs must be accommodated through improvements in spectrum efficiency. The Commission underscored this point in the currently pending wireless microphone proceeding and sought comment on solutions that could enable wireless microphones to operate more efficiently and/or improve their immunity to harmful interference. *See Report and Order and Further Notice of Proposed Rule Making* in WT Docket Nos. 08–166 and 08–167 and ET Docket No. 10–24, 25 FCC Rcd 643, 702 (2010), FCC 10–16, 75 FR 9113, March 1, 2010. The Commission will continue to pursue this issue as it considers possible repurposing of the TV spectrum.

13. The Commission disagrees with the petitioners that argue unlicensed wireless microphones should be subject to the same requirements as TVBDs under the rules. There are many important differences that make it impractical to apply the same rules to both types of devices. For example, TVBDs are expected to be data devices that will have access to the Internet. Wireless microphones do not typically include geo-location technology nor do they connect to the Internet, so requiring these devices to check for channel availability through a database would be impractical. Also, TVBDs

generally should be able to tolerate some latency, whereas wireless microphones operate in real time and generally cannot tolerate significant latency. Most importantly, unlicensed wireless microphones have been operating for quite some time without causing harmful interference. Accordingly, the Commission concludes that unlicensed wireless microphones should not be subject to the more confined approach it has applied to TVBDs.

14. With regard to registration of unlicensed devices in the TV bands databases, the Commission first observes that unlicensed wireless microphones operate under the same general conditions of operation in § 15.5 of the rules as TV bands devices, meaning they may not cause interference to authorized services and must accept any interference received, including interference from other non-licensed devices. As a general matter, the Commission therefore finds that it would be inappropriate to protect unlicensed wireless microphones against harmful interference from other unlicensed devices, and in particular TV bands devices. The Commission observes that there are a wide variety of applications for wireless microphones ranging from a single wireless microphone used by a performer or presenter, to small theatrical productions using perhaps 10–20 microphones, to large scale productions and events such as professional sports events and Broadway style productions that may use well over 100 wireless microphones. The overwhelming majority of such use does not merit registration in the TV bands database. In cases where the number of wireless microphones needed for an event is relatively low, the operator of unlicensed microphones can avoid receiving harmful interference from TVBDs by simply using the reserved channels or other channels in each market where TVBDs are not allowed to operate. The two reserved TV channels will accommodate a minimum of at least 16 wireless microphones, and the additional channels that are not available for TVBDs at most locations will accommodate many additional wireless microphones. On the other hand, the Commission recognizes that certain events, such as major sporting contests or live theatrical productions/shows, may use scores of wireless microphones and therefore may not be able to be accommodated in the two reserved channels and other channels that may be available for wireless microphones at that location.

15. Accordingly, the Commission is addressing unlicensed wireless microphones and low power auxiliary devices in our rules for TV band devices as follows. As the general rule, it is not allowing unlicensed wireless microphones and other low power auxiliary devices operating without a license to be registered in the database; these devices will not be afforded protection from interference from TV bands devices on channels where TV bands devices are allowed to operate. Entities desiring to operate wireless microphones on an unlicensed basis without potential for interference from TVBDs may use the two channels in each market area where TVBDs are not allowed to operate, as well as other TV channels that will be available in the vast majority of locations. Such entities may consult with a TV bands database to identify the reserved channels at their location, as well as the TV channels that may not be available for TV band devices. Entities operating or otherwise responsible for the audio systems at major events where large numbers of wireless microphones will be used and cannot be accommodated in the available channels at that location may request registration of the site in the TV bands databases. The registration requests must be filed with the Commission. Entities filing registration requests will be required to certify that they are using the reserved channels and all other available channels from 7–51 (except channel 37) that are not available for use by TV band devices and are practicable for use by wireless microphones. The request to be registered must be filed with the Commission at least 30 days in advance and include the hours, dates or days of the week and specific weeks on which those microphones will be in actual use (on dates where events are not taking place, those sites will not be protected) and other identifying information also required of low power auxiliary licensees. Unlicensed microphones at event sites qualifying for registration in TV bands databases will be afforded the same geographic spacing from TVBDs as licensed microphones. The Commission also advises entities responsible for event sites qualifying for registration in TV bands databases that registration does not create or establish any form or right or assurance of continued use of the spectrum in the future.

16. To allow it to better identify registered wireless microphone licensed operations and unlicensed sites, the Commission adopted the following registration procedures. Operators of licensed wireless microphones may

register sites directly with one of the designated database administrators and provide the information required by the rules, which the Commission is amending to include the wireless microphone call sign. As indicated, operators of venues using unlicensed wireless microphones will be required to register their sites with the Commission, which will transmit the information to the TV bands device database administrators. For the purpose of this registration, the Commission will develop a form that will allow the information to be filed through one of the Commission's electronic filing systems, such as the Universal Licensing System (ULS). The applicant will be required to certify that it complies with the requirements for registration of unlicensed wireless microphones, including that it will first make use of all TV channels not available for TV bands devices that are practicable for wireless microphone use, including channels 7–51 (except channel 37), and submit the information specified by the rules, which we are amending to include the name of the venue where the equipment is operated. As a benchmark, at least 6–8 wireless microphones must be operating in each channel that is being used for the event. Registration requests that do not meet these criteria will not be registered in the TV bands databases. The Commission will take actions against parties that file inaccurate or incomplete information, such as denial of registration in the database, removal of information from the database pursuant to § 15.713(i), or other sanctions as appropriate to ensure compliance with the rules. The Commission will make requests for registration of sites that use unlicensed wireless microphones public and will provide an opportunity for public comment or objections. The Commission has delegated authority for administering this registration process jointly to its Office of Engineering and Technology and Wireless Telecommunications Bureaus.

17. The Commission is maintaining the requirement that fixed TV bands devices may not operate co-channel with low power auxiliary stations within 1 km of their coordinates registered in the TV bands databases. The Commission recognizes the arguments of Shure and CWMU about the difference in power levels between fixed TV bands devices and wireless microphones. However, whether harmful interference occurs in a particular situation depends on many factors, including the undesired signal power, antenna directivity and

separation distance, as well as the level of the desired signal at the receiver, the receive antenna and receiver characteristics, and any intervening structures or terrain that could attenuate the undesired signal. Neither Shure nor CWMU provided an analysis with their petitions demonstrating that the 1 km separation distance adopted in the *Second Report and Order* is inadequate for fixed devices when taking all relevant factors into account. In cases where licensed low power auxiliary stations are being used at large outdoor venues, such as racetracks or golf courses, the Commission will permit the party registering the devices to specify the coordinates of multiple locations within the site to ensure that protection is provided over the entire facility where microphones are being used.

18. However, the Commission agrees with petitioners that argue that it is not necessary to provide low power auxiliary stations the same protection from personal/portable TV bands devices because the latter operate with power levels at least forty times lower than the maximum power permitted for fixed TV bands devices. Therefore, it is modifying the rules to require that Mode II (independent) personal/portable devices not operate co-channel with low power auxiliary stations within 400 meters (0.4 km) of their coordinates registered in the TV bands device database. A 100 mW transmitter will produce a lower signal at 400 meters than a 4 watt transmitter at 1 km using a free space calculation, so this shorter distance will provide greater protection for low power auxiliary devices from 100 mW TV bands devices than a 1 km separation from 4 watt devices. The Commission will use this same 400 meters distance for personal/portable devices that operate with less than 100 mW of power.

19. The Commission finds that it is not practical to protect wireless microphones using information obtained from the ULS and declines to require that that information be used in defining such protection as suggested by Rudman/Ericksen. Some wireless microphones are licensed using specific coordinates, while others are licensed to a wide area such as the entire service area of a TV station, and a license may specify multiple operating channels. The Commission also observes that wireless microphones can be operated intermittently at discrete locations, rather than continuously over a wide area. Thus, the use of ULS licensing data could preclude TV bands devices from operating on multiple channels and at locations where no wireless microphones are in operation.

Translators, Cable Headends and Multichannel Video Program Distributors

20. In the *Second Report and Order*, the Commission adopted rules to protect TV translator receive sites and cable TV headends that are located outside the protected contours of the TV stations being received. TV translator receive sites are often located on high towers or at high elevations and use high gain antennas to receive a full service station's signal well beyond the station's service area. Cable headends are facilities that acquire and distribute video service signals over a cable television system. Broadcast TV signals are often received off-the-air at a cable headend for retransmission over the cable system. In many cases, the cable headend will use an antenna with high gain antenna mounted high on a tower to receive a TV station's signals well beyond the station's service area in a manner similar to that used by TV translators. The Commission found that it is important to avoid disruption of TV service to viewers who are located beyond TV station service areas and able to receive those signals through retransmission on TV translators and cable systems. While those viewers are in fact located beyond the areas where the Commission normally protects TV services, in these cases TV services have *de facto* been extended and valuable service is being provided to a significant number of households. If a TV bands device were to be located between the TV translator/cable headend and TV station and then operate on one or more of the channels being received by those facilities in a manner that results in harmful interference, TV reception to the households and the cable system services could be disrupted.

21. To protect cable headends and TV translator receive sites which are not listed in Commission databases, the Commission allowed operators of TV translator receive sites and cable headends that are located within 80 km of the service contour of the received TV station to register their location and the channel(s) they receive in the TV bands device database. To prevent unnecessary entries into the database, the Commission permitted translator receive sites and cable headends to be registered only if they are outside the protected contour of the TV station being received. The rules limit operation of TV bands devices co-channel and adjacent to the channel(s) being received over an arc of ± 30 degrees from a line between the receive site and the TV station(s) being received. Within this arc, TV bands

devices operating co-channel to the received station may not operate within 80 km of the receive site, and TV bands devices on channels adjacent to the received station may not operate within 20 km of the receive site. The protection radius extends only as far as the protected contour of the station being received, so the co-channel protection distance would be less than 80 km for receive sites closer than this distance from a protected contour, and both the co-channel and adjacent channel protection distances would be less than 20 km for receive sites closer than this distance from a protected contour. In addition, to prevent interference to TV translators and cable headends from TV bands devices outside the main beam of the receive antenna, the Commission prohibited TV bands devices from operating co-channel to the channel(s) being received by these facilities within 8 kilometers and from operating on adjacent channels within 2 kilometers in all directions off the ± 30 degree arc.

22. *Decision.* The Commission modified the rules to expand and more clearly define the types of receive facilities that may be registered in the TV bands database and are making certain changes to the protection criteria for these receive facilities. The purpose of permitting the registration of receive sites is to protect the reception of over-the-air TV signals that are redistributed through another means. Consistent with this intent, the Commission will permit the registration of TV receive sites for other types of video service providers besides cable systems and is modifying the rules in this regard to more clearly and completely define the types of facilities that may be registered. The Commission therefore specifies that receive sites of all multi-channel video programming distributors (MVPDs) as defined by section 602(13) of the Communications Act may be voluntarily registered in the database, in addition to TV translator receive sites.

23. The Commission recognizes that there are cable headends that receive TV station signals located at distances beyond 80 km from the edge of a television station's protected service contour and understand NCTA's concern for possible disruption service to cable subscribers. These same considerations would apply to other MVPDs and to TV translator, low power TV and Class A TV stations that retransmit programming from another TV station. The Commission does not believe that the requested change would have significant impact on the availability of TV white space because these facilities are generally in remote areas where many channels will be

available for white space devices. However, the Commission also recognizes that parties may wish to have an opportunity to review such requests to confirm the assessment. We are therefore providing that current MVPD operators, TV translator, low power TV and Class A TV stations with receive sites located beyond the 80 km co-channel protection distance in the rules may apply for a waiver of that distance during a period that will end 90 days after the effective date of the rules adopted herein. Such waiver requests would also involve shifting the 20 km adjacent channel protection distance so that it is measured from the actual receive site. The Commission will then issue a public notice requesting comment on requests it receives and issue decisions. MVPD operators and TV translator, low power TV and class A TV stations that commence operation in the future with receive sites located beyond the co-channel and adjacent protection distances may apply for a waiver of those distances within 90 days of commencing operation. Following receipt of such request(s), the Commission will then issue a public notice asking for comment on the request(s) and issue decision(s).

24. The Commission declines to increase the width of the ± 30 degree protected arc as requested by NCTA. A receive site located outside the protected contour of a TV station would need to incorporate a high gain receive antenna, which has a narrow beamwidth. While it recognizes NCTA's argument that an antenna has side lobes that will allow it to receive signals outside its main beam, this does not in itself demonstrate that the current protection requirement is inadequate or that a wider protected arc is necessary. Adaptrum provides no information to support its argument that the protection distance outside of the main lobe of the receive antenna should be significantly reduced and we therefore deny that request. The Commission further declines to require operators of fixed TV bands devices to coordinate with operators of receive sites. The requirements it has adopted are extremely conservative and will adequately protect receive sites, so a coordination requirement is unnecessary and would be cumbersome to implement.

25. The Commission finds it unnecessary to provide for registration of receive sites within the protected contour of a TV station being received and thus declines to allow such registrations. Within a station's protected service contour, receive sites are protected from interference by the

same provisions that protect reception by consumers. The rules require that TV bands devices be located outside the contour of a co-channel TV station, so a TV bands device located near a contour that is communicating with another TV bands device would not be directing its signal into the contour where the receive site is located. Further, a receive site inside, but near the edge of a protected contour, would have it receive antenna directed toward the TV station and not at the TV bands device outside the contour. Therefore, the orientation of the antennas in this situation makes interference highly unlikely. Additionally, a TV bands device operating on a channel adjacent to an occupied TV channel is permitted to operate within the service contour, but at a lower power level not to exceed 40 mW. This lower power level combined with the fact that a receive site within a contour will receive a higher signal level than a receive site outside the contour makes adjacent channel interference from that source again unlikely. Furthermore, in the event that interference does occur, the operator of the TV bands device is required to cease operation.

26. Finally, the Commission is modifying the text of the rules to clarify that registration for receive sites is limited to channels that are received over-the-air and are used as part of service of the MVPD, TV translator, low power TV station or Class A TV station. The Commission is not limiting registration to local channels so as not to preclude the possibility that an MVPD or TV translator/low power television station may retransmit out-of-market channels if it is authorized to do so.

TV Bands Devices

Spectrum Sensing

27. In addition to requiring that TV bands devices access a database to determine available channels, the Commission decided in the *Second Report and Order* to require that TV bands devices be capable of sensing analog TV signals, digital TV signals and wireless microphone signals at a level of -114 dBm within defined receiver bandwidths. This level is referenced to an omni-directional 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 must be reduced by the amount in dB that the minimum directional gain of the antenna is less than 0 dBi. Alternative approaches for the sensing antenna are permitted that provide at least the same

performance as an omni-directional antenna with 0 dBi gain. The Commission also required that the receive antenna used by fixed devices be located at least 10 meters above the ground to maximize the likelihood that its reception is not blocked from receiving signals originating from any direction. It found that receive antenna height requirements are impractical for personal/portable devices and declined to impose such requirements on those devices.

28. Under the rules adopted in the *Second Report and Order*, a TV bands device is permitted to begin 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. A TV bands device must also perform in-service monitoring of channels on which it operates a minimum of once every 60 seconds. There is no minimum channel availability check time for in-service monitoring. If a device detects a wireless microphone or other low power auxiliary device signal on a channel it is using, the device must cease all transmissions on that channel within two seconds. If a TV signal is detected on a channel indicated as available for use by the database, the TV bands device must provide a notice of that detection to the operator of the device and provide a means for the operator to remove the channel from the device's list of available channels. However, with respect to TV signals, the database is the controlling factor in determining whether a channel is available, and there is no requirement for a TV bands device to avoid operating on a channel where it detects a TV signal, since it is possible to detect a signal outside a station's protected service contour.

29. A personal/portable device operating in Mode I must identify (report) those TV channels on which it senses a wireless microphone or television signal above the detection threshold to the fixed or Mode II personal/portable device that provides it with a list of available channels. The fixed or Mode II device must respond as if it had detected the signal itself, *i.e.*, it must not use the occupied channel if the Mode I device detects a wireless microphone and must report the TV signal detection to the operator of the device. In addition, TV bands devices 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 and notifies other devices

with which it is linked, all the other linked devices will be required to respond as if they had detected the signal themselves.

30. *Decision.* The Commission eliminated the requirement for TV bands devices that rely on geo-location and database access to sense analog and digital TV signals and also wireless microphones and other low power auxiliary stations. Much of this proceeding has focused on the central question of whether spectrum sensing is a viable tool for providing access to spectrum. The Commission has noted the benefits and limitations of spectrum sensing through testing conducted by its engineers and extensive discussion in the *Second Report and Order*. The Commission continues to believe that spectrum sensing will continue to develop and improve. It anticipates that some form of spectrum sensing may very well be included in TVBDs on a voluntary basis for purposes such as determining the quality of each channel relative to real and potential interference sources and enhancing spectrum sharing among TVBDs. However, at this juncture, the Commission does not believe that a mandatory spectrum sensing requirement best serves the public interest. As petitioners and responding parties indicate, the geo-location and database access method and other provisions of the rules will provide adequate and reliable protection for television and low power broadcast auxiliary services, so that spectrum sensing is not necessary. With respect to protection of television services, the Commission observes that the geo-location and database method is already the primary means for preventing interference to TV stations. The sensing requirement adopted in the *Second Report and Order* only requires that a TV bands device inform the user when a TV signal above a threshold is detected and provide an opportunity for the user to change channel, but it does not preclude operation on a channel where a TV signal is detected. That is, the *Second Report and Order* essentially relied on geo-location and the TV bands databases to protect over-the-air TV broadcasting, not spectrum sensing.

31. The Commission also now concludes that inclusion of a spectrum sensing capability is not necessary to protect wireless microphone operations. Parties operating part 74 licensed low power auxiliary stations at fixed locations are eligible to register those operations in the TV bands device database to obtain interference protection from TV bands devices. As indicated, for parties ineligible for part

74 licensing, the Commission, in its *Wireless Microphone R&O/FNPRM* permitted the operation of low power auxiliary service stations on an unlicensed basis under part 15 of the rules pending a final decision on its proposals to expand eligibility for part 74 licensing and to allow a new category of wireless audio devices to operate in the core TV bands under part 15. Based on the Commission's informal observations of the marketing and uses of wireless microphones, it appears that the number of wireless microphones operating under the part 15 waiver significantly outnumbers those operating as part 74 licensed devices. Unlicensed devices operate on a non-interference basis, meaning they may not cause interference to authorized services, and must accept any interference received, including interference from other unlicensed devices such as TV bands devices. Requiring TV bands devices to sense low power auxiliary stations such as wireless microphones would inappropriately give interference protection to a large number of other unlicensed, unprotected devices because there is no way for the sensing feature of a TV bands device to distinguish licensed from unlicensed devices. The Commission recognizes that there will be some licensed low power auxiliary stations that can be used in roving applications for which the location cannot be known in advance and therefore cannot be registered in the TV bands device database. The Commission has reserved two channels at all locations on which unlicensed TV bands devices will not be allowed to operate in order to ensure that there are frequencies on which licensed microphones used in roving applications such as electronic news gathering can operate. The availability of the frequencies in these channels will make it unnecessary to provide special protection from interference for such applications.

32. With the elimination of the spectrum sensing requirement for TV bands devices that use geo-location and database access, there is collaterally no longer a need for a minimum receive antenna height for fixed devices, and the Commission consequently is removing that requirement from the rules. The Commission also revised and amended certain elements of the rules so that they continue to provide comparable assurance of protection against interference in the absence of sensing capabilities and to clarify and simplify the rules as they pertain to interference protection. In addition to

revisions of the geo-location and database access rules, the changes include revision of certain terms used in the rules and elimination of the terms "client device," "client mode," "master device," and "master mode."

33. As part of these changes, the Commission eliminated the requirements for devices operating in Mode I to use distributed sensing. It also observes that some of the comments on this issue appear to reflect an understanding that the rules permit extensive networks of devices that would all be linked together using a commonly identified list of available channels. The Commission wishes to correct any misconceptions that, at least at this stage, the rules contemplate or permit such networks and sharing of channel availability information. Rather, as stated in the *Second Report and Order*, the Commission will permit personal/portable TVBDs to be used in the operation of networks only where a means is provided to ensure that each device is operating consistent with the channels available at its particular location. The rules do not permit personal/portable devices operating in Mode I to relay channel availability information from one Mode I device to another Mode I device unless some means is used to ensure that each device is operating within the parameters for its particular location.

34. The Commission's elimination of the general requirement that all TV bands devices perform spectrum sensing at least once per minute and report channel availability information to other devices in a network removes the only existing requirement in the rules for a Mode I device to maintain contact with a fixed or Mode II device. In reviewing this provision, the Commission also observed that the rules currently do not require that a Mode I device periodically re-establish its list of available channels through either device that uses geo-location and database access; however, such re-checks for channel availability are necessary to ensure that a Mode I device does not continue to operate on a channel that becomes unavailable. To address these concerns, the Commission is adding a requirement that a device operating in Mode I must either receive a special signal from the Mode II or fixed device that provided its current list of available channels to verify that it is still in reception range of that device or contact a Mode II or fixed device at least once per minute to re-verify/re-establish channel availability. This new requirement, including the special signal for verifying contact with the Mode II or fixed device that provided

the Mode I device's list of available channels, is described in more detail in the section below on Re-check Procedures. This requirement is necessary because a Mode I device is not generally expected to be able to determine when it has moved, and it could possibly be moved to a location where the operating channel is occupied. Maintaining regular contact with a Mode II or fixed device will ensure that Mode I devices operate only on channels available at their location and that they cease operation when they move out of range of the device from which they obtained their list of available channels, in which case their list of available channels would no longer be valid. This requirement will also address situations where a Mode I device is no longer able to maintain contact with an operating fixed or Mode II device (for example, if the fixed or Mode II device with which the Mode I device has been communicating ceases operation and the Mode I device is not able to contact a replacement).

35. In reviewing the rules in this context, the Commission also observes that § 15.711(b)(3)(ii) of the rules requires that a Mode II personal/portable device 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. It is the Commission's intent that a Mode II device monitor its location regularly to determine if its location has changed under this requirement. The Commission therefore amended this section of the rules to clarify that a Mode II device must use its geo-location capability to check its location at least once every 60 seconds, except when in "sleep mode," *i.e.*, in a mode in which the device is inactive but is not powered-down. This clarification will ensure that Mode II devices re-check their list of available channels within a short interval if their location changes. It will also provide clarity with respect to the re-check requirements for devices that operate on a mobile basis within a bounded geographic area in which the same channels are available at all locations.

36. While the Commission eliminated spectrum sensing for TVBDs that use geo-location and database access, it continues to believe that this technology offers significant promise for improving spectrum access and efficiency both in the TV bands and in providing access to other spectrum. Spectrum sensing has come a long way and some have expressed the view that even today it is sufficiently developed that it can be

relied upon for determining access to the TV bands and other spectrum. The Commission is therefore leaving open the opportunity to submit applications for certification of sensing-only devices. It acknowledges that the process for approval of such devices is rigorous. However, the Commission continues to believe that an open and transparent review as provided by that process is appropriate for sensing-only devices. Accordingly, the Commission retained the provisions in the rules that permit the authorization and operation of personal/portable TV bands devices that rely on sensing alone under a “proof-of-performance” standard. The Commission invites parties that submit such applications when they are ready to do so. The Commission takes this opportunity to clarify that devices that use sensing alone may initiate and participate in a network of TVBDs and may communicate with fixed, Mode I, Mode II and other sensing-only TVBDs but may not provide a Mode I device with a list of available channels. The Commission is also re-locating the existing spectrum sensing technical provisions that previously applied to all TVBDs into the rule section on sensing-only devices.

37. The Commission is also increasing the minimum required detection threshold for wireless microphones and other LPAS stations of sensing-only devices from -114 dBm to -107 dBm. It is making this change for two reasons. First, sensing-only devices must operate with lower power than fixed or other personal/portable devices (except for personal/portable devices operating on channels adjacent to television stations), so a higher detection threshold would provide a level of protection that is approximately comparable to a lower threshold in a higher power device. Second, the rules for such devices specify that although compliance with the detection threshold for spectrum sensing is required, it is not necessarily sufficient for demonstrating reliable interference avoidance. Thus, the required detection threshold we are adopting serves as a minimum performance criteria for a device.

38. Authorization of a sensing only TVBD under the proof-of-performance standard also requires that a manufacturer submit a prototype device that will be tested by the Commission to ensure that the device is capable of operating without interference prior to certification. The decision on whether to certify a sensing-only device will be based on its performance, and in particular its ability to reliably detect the presence of authorized transmissions. If the Commission

determines through testing that a lower detection threshold is necessary to prevent interference then it will require the device to meet the lower threshold before it could be certified. The Commission believes that these requirements for sensing-only devices are sufficiently conservative to prevent interference to TV reception and low power auxiliary stations. The Commission sees no basis for increasing the threshold for sensing of television signals.

Technical Requirements

Antenna Height

39. Because the range at which a TV bands device can cause interference increases as the height of the device’s antenna increases, the Commission adopted a maximum antenna height limit of 30 meters above ground for fixed devices. This height limit was intended to balance unlicensed fixed TV bands device transmission range with the distance at which those operations could impact licensed services. The Commission did not impose height restrictions on personal/portable devices because it found that it is not practical to administer an antenna height limit for those devices and the lower power and limited antenna gain of personal/portable devices would generally result in propagation over a shorter range than fixed devices. Further, the Commission observed that personal/portable devices, unlike fixed devices which have gain antennas mounted outdoors to maximize the propagation range of their signals, will likely typically be used indoors where their signals will be attenuated by exterior walls. These factors will significantly reduce the range at which signals from a personal/portable device will be of sufficient field strength to cause interference.

40. *Decision.* The Commission declines to increase the maximum permitted transmit antenna height above ground for fixed TV bands devices. As the Commission stated in the *Second Report and Order*, the 30 meters above ground limit was established as a balance between the benefits of increasing TV bands device transmission range and the need to minimize the impact on licensed services. Consistent with the Commission’s stated approach in the *Second Report and Order* of taking a conservative approach in protecting authorized services, it finds the prudent course of action is to maintain the previously adopted height limit. If, in the future, experience with TV bands devices indicates that these devices

could operate at higher transmit heights without causing interference, the Commission could revisit the height limit.

41. While the Commission expects that specifying a limit on antenna height above ground rather than above average terrain is satisfactory for controlling interference to authorized services in the majority of cases, it also recognizes petitioners’ concerns about the increased potential for interference in instances where a fixed TV bands device antenna is located on a local geographic high point such as a hill or mountain. In such cases, the distance at which a TV bands device signal could propagate would be significantly increased, thus increasing the potential for interference to authorized operations in the TV bands. The Commission therefore concludes that it is necessary to modify our rules to limit the antenna HAAT of a fixed device as well as its antenna height above ground. In considering a limit for antenna HAAT, the Commission needs to balance the concerns for long range propagation from high points against the typical variability of ground height that occurs in areas where there are significant local high points—the Commission does not want to preclude fixed devices from a large number of sites in areas where there are rolling hills or a large number of relatively high points that do not generally provide open, line-of-sight paths for propagation over long distances. The Commission finds that limiting the fixed device antenna HAAT to 106 meters (350 feet), as calculated by the TV bands database, provides an appropriate balance of these concerns. It will therefore restrict fixed TV bands devices from operating at locations where the HAAT of the ground is greater than 76 meters; this will allow use of an antenna at a height of up to 30 meters above ground level to provide an antenna HAAT of 106 meters. Accordingly, the Commission specifies that a fixed TV bands device antenna may not be located at a site where the ground HAAT is greater than 75 meters (246 feet). The ground HAAT is to be calculated by the TV bands database using computational software employing the methodology in § 73.684(d) of the rules to ensure that fixed devices comply with this requirement.

42. In reexamining this issue, the Commission also notes that the rules currently do not indicate that fixed device antenna heights must be provided to the database for use in determining available channels. It was clearly the Commission’s intent that fixed devices include their height when

querying the database because the available channels for fixed devices cannot be determined without this information. The Commission is therefore modifying §§ 15.711(b)(3) and 15.713(f)(3) to indicate that fixed devices must submit their antenna height above ground to the database.

43. The Commission continues to decline to establish height limits for personal/portable devices. As the Commission stated in the *Second Report and Order*, there is no practical way to enforce such limits, and such limits are not necessary due to the different technical and operational characteristics of personal/portable devices.

Power and Power Spectral Density Limits

44. In the *Second Report and Order*, the Commission allowed fixed TV bands devices to operate with a peak transmitter output power of one watt with a maximum antenna gain of 6 dBi, and required that the transmitter power be reduced by the same amount in dB that the maximum antenna gain exceeds 6 dBi. This allows unlicensed TV bands fixed devices to operate with the equivalent of 4 watts EIRP. The Commission found that 4 watts EIRP is sufficient to allow fixed devices to communicate at ranges that will serve community and rural users while minimizing the potential for interference to broadcast television and other authorized services in the TV bands. Fixed TV bands devices were not permitted to operate adjacent to occupied TV channels, although the Commission decided to defer a final decision on this issue and to keep the record open pending the development of additional information demonstrating that a reliable method can be developed to allow adjacent channel operation while protecting authorized services.

45. The Commission allowed personal/portable TV bands devices to operate with a peak transmitter output power of 100 mW with a maximum antenna gain of 0 dBi, and required that the transmitter power of such devices be reduced by the same amount in dB that the maximum antenna gain exceeds 0 dBi. This allows personal/portable TV bands devices to operate with an equivalent of 100 mW EIRP. In cases where a personal/portable device is operating adjacent to an occupied TV channel, the maximum permitted EIRP is 40 mW. Personal/portable devices that rely on spectrum sensing without the use of geo-location and a TV bands device database may be authorized at a power level up to 50 mW EIRP. The Commission did not specify minimum bandwidth limits for transmissions by

TV bands devices or power spectral density (PSD) limits in the *Second Report and Order*.

46. *Decision.* The Commission is not convinced by the petitions for reconsideration that the power limits for unlicensed TV bands can be increased without also increasing the potential for interference to authorized services and is therefore affirming the power limits for fixed and personal/portable devices that it adopted in the *Second Report and Order*. In addition, the Commission does not find that the power level of TV bands devices should be restricted to protect against direct pick-up interference to cable and satellite TV services. The Commission does, however, recognize the need to address power considerations in TV bands device signals that occupy less than the full bandwidth of a TV channel and is therefore amending the rules to include power spectral density limits.

47. The Commission declines to increase the 4 watt EIRP power limit for fixed devices and notes that it also considered and rejected a higher power limit for fixed devices in the *Second Report and Order*. While the Commission previously observed that there are advantages to higher power levels for fixed devices, such as reduced infrastructure costs and increased service range, it did not adopt a higher power limit due to concerns about increased risk of interference in congested areas and a lack of experience with unlicensed wireless broadband operations in the TV bands. The Commission also recognizes the increased range provided by operation at higher power levels would be particularly desirable for some applications, including rural service and mobile operations as suggested by Motorola. The Commission also understands that there may be situations where radio communications facilities could operate at higher power in TV white spaces without causing interference. However, the Commission continues to conclude that because the extended range of such devices would significantly increase the potential for interference and also make it more difficult to identify sources of interference, it would not be appropriate to allow higher power for unlicensed TV bands devices at this time. Indeed, such operation would be more appropriate under a licensed regime of regulation. The Commission therefore affirms its previous decision on fixed device power levels, but could re-visit the issue of higher power levels for TV bands devices on a licensed or unlicensed basis at some point in the future as may be appropriate.

48. The Commission retained the current 100 mW maximum transmitter power limit for Mode I and Mode II personal/portable devices and decline to establish a new class of higher power vehicle mounted portable devices. As the Commission noted in the *Second Report and Order*, personal/portable devices generally pose a greater risk of harmful interference to authorized operations than fixed devices because these devices will change locations, making identification of both unused TV frequencies and the devices themselves, if interference occurs, more complex and difficult. The Commission also noted the significant distances at which interference could occur from a personal/portable device operating at greater than 100 mW would make it very difficult to identify a device that is the source of interference. The Commission therefore declines to increase the power limit for personal/portable devices at this time.

49. Additionally, the Commission is retaining the 50 mW power limit for sensing-only devices. The Commission stated in the *Second Report and Order* that the prototype TV bands devices it tested were able to sense the presence of signals from incumbent services under some conditions, but were unable to do so in others, such as in noisy environments or in the presence of strong adjacent channel signals. It further stated that these factors made it difficult to fully validate the performance of sensing technology and develop standards to ensure that devices relying on sensing alone would not cause interference. While the Commission believed that these problems could be solved and decided to permit sensing-only devices, it decided to limit these devices to 50 mW rather than 100 mW as permitted for other personal/portable devices out of an abundance of caution with regard to their interference potential. The Commission finds that it provided an adequate rationale for the 50 mW power limit for sensing-only devices and declines to change the power limit for these devices at this time.

50. The Commission also declines to reduce the maximum permitted power for personal/portable devices that operate adjacent to occupied TV channels. In the *Second Report and Order*, the Commission recognized that there is a potential for TV bands devices to interfere with TV reception on adjacent channels, but found that such interference is unlikely to occur in the majority of situations if the power level is kept low. As with any interference analysis, certain assumptions were made concerning factors such as the

separation distance from the potential source of interference to the receive antenna, the characteristics of the receiver, the type of transmit and receive antennas and any intervening terrain or obstacles. The petitioners are essentially challenging the assumptions the Commission used in its analysis in the *Second Report and Order*. We find that the Commission made reasonable assumptions and are upholding the 40 mW adjacent channel power limit. Specifically, the Commission observes that interference to TV reception from a transmitter on adjacent channel would occur only when an adjacent channel signal level is substantially greater than the received TV signal level. Thus, adjacent channel interference would be most likely to occur in weak signal areas where an outdoor rooftop antenna is needed. In such situations, we find the Commission's assumed separation distance of 16 meters from a TV bands device to a rooftop TV antenna to be reasonable, as well as its assumption that the receive antenna will have horizontal polarization while the TV bands device has vertical polarization and that such a configuration will have a 3 dB polarization mismatch.

51. The Commission agrees that a PSD limit would help protect authorized services in the TV bands and is therefore requiring that the conducted output power of fixed and personal/portable TV bands devices comply with PSD limits. In the absence of a PSD limit, multiple devices with transmit bandwidths of significantly less than 6 megahertz could share a single channel, resulting in a total transmitted power within a channel significantly greater than the power limits for fixed or personal/portable devices. A PSD limit will prohibit high power concentrations in a single channel, which will reduce the interference potential to TV stations and other services in the TV bands. The Commission bases the PSD limit on the maximum permissible conducted output power spread across a transmit bandwidth of 6.0 megahertz, the full bandwidth of a TV channel. The resulting conducted PSD limits in a 100 kilohertz bandwidth are 16.7 mW (12.2 dBm) for fixed devices, 1.67 mW (2.2 dBm) for personal/portable devices, 0.83 mW (−0.8 dBm) for sensing-only personal/portable devices and 0.7 mW (−1.8 dBm) for personal/portable devices operating adjacent to occupied channels. The Commission adopted these PSD limits. The Commission declines, however, to adopt minimum bandwidth requirements as requested by IEEE 802 and SBE. It finds that a

minimum bandwidth requirement could unnecessarily constrain the types of modulation that could be used with TV bands devices and is not necessary because the PSD limit has the same effect of preventing high power levels in a TV channel. The Commission also clarified that a device that operates across more than one 6 MHz TV channel is still subject to the maximum power limits in § 15.709(a)(1) and (a)(2) of the rules per channel—the allowable power per channel does not increase with use of additional bandwidth beyond 6 megahertz.

Out of Band Emission (OOBE) Limits

52. In the *Second Report and Order*, the Commission required that TV bands device emissions in channels adjacent to the occupied channel be attenuated at least 55 dB below the highest average power in the occupied channel. Emission measurements in both the occupied channel and the adjacent channels are to be made with a minimum resolution bandwidth of 100 kHz and an average detector.

53. *Decision.* The Commission modified the rule for adjacent channel emissions to require that emissions be measured relative to the total in-band power in a 6 megahertz bandwidth, rather than in a 100 kHz bandwidth. This change will address the concerns raised by petitioners that the measured in-band power in a narrow bandwidth will vary depending upon the bandwidth of the transmitted signal. The Commission will continue to require that the adjacent channel emissions be measured with a 100 kHz bandwidth, because a wider bandwidth would not be able to resolve emissions located just outside the channel of operation without being affected by the in-band power. The use of a 6 megahertz bandwidth for measuring the in-band power means that a higher reading will be obtained as compared to using a 100 kHz bandwidth, because the wider bandwidth will capture all the energy in a channel rather than only a portion of that energy. The 55 dB attenuation that the Commission adopted for adjacent channel emissions was based on the assumption that identical bandwidths would be used to measure both in-band and adjacent channel power, so we agree with IEEE that the currently required 55 dB attenuation should be increased to reflect the increased in-band measuring bandwidth while providing the same level of adjacent channel protection. As noted, the Commission will assume the maximum transmit bandwidth used to be the full 6 MHz channel. We will therefore base the increase in adjacent channel

attenuation on a bandwidth ratio of 6.0 megahertz/100 kHz or 17.8 dB. Thus, the Commission revised the required adjacent channel attenuation to be 72.8 dB.

54. The Commission declines to reduce the required adjacent channel attenuation as requested by Motorola and the Wi-Fi Alliance. Adjacent channel emissions from a TV bands device appear as co-channel emissions in an adjacent channel used by a TV station or other authorized service. Personal/portable TV bands devices are permitted to operate within the protected contours of adjacent channel TV stations, and fixed TV bands devices can operate as close as 0.1 kilometers outside the contours of adjacent channel stations and at significantly higher power than personal/portable TV bands devices. For these reasons, the Commission finds it necessary to limit adjacent channel emissions to the extent practicable to prevent interference to adjacent channel TV stations and other authorized services. The Commission declines to modify the adjacent channel emissions limits for the VHF band as requested by Rudman/Erickson because they failed to describe or provide a justification for any specific changes to the rules.

Direct Pickup Interference

55. In the *Second Report and Order*, the Commission recognized the concerns of cable interests regarding the potential for direct pickup interference and their position that power levels should be limited to a lesser value. It noted that FCC staff tests of three digital cable ready receivers, and anecdotal tests performed by the FCC staff in the laboratory and field, indicated that there is some potential for direct pickup interference to cable service from TV bands devices. The Commission observed that this direct pickup interference occurred at relatively close distances within the user's premises and could be corrected by removing consumer-installed splitters and wiring that effectively reduce the shielding of interfering signals as well as reduce the desired signal levels available at the user's TV receiver. It also observed that in the FCC staff tests when just a cable converter box was used to connect directly to the TV receiver, interference declined dramatically and was virtually non-existent on the digital tier of channels. The Commission further observed in tests by the staff with a 10 meter separation between devices on separate sides of a wall, such as in a townhouse, interference did not occur at undesired signal levels below 100 mW for two receivers and slightly under 50

mW for a third. Based upon these observations and the fact the TV bands devices must incorporate transmit power control to limit their operating power to the minimum necessary for successful communications, the Commission decided that the risk of direct pickup interference is not sufficiently great to warrant a reduction in power that could impede the viability of certain TV bands device applications.

56. *Decision.* The Commission declines to reduce the maximum permissible power for personal/portable devices or to impose power and separation limits for fixed devices as requested by NCTA and DIRECTV. It notes that direct pickup interference is different from interference that can be received at the antenna of licensed over-the-air radio services such as broadcast television, low power auxiliary services or the PLRMS/CMRS. Interference can be caused to off-air reception of these services when an undesired signal on the same frequency as the transmitted signal exceeds some threshold at a receiver. By contrast, a cable system or satellite in-home wiring is a closed system in which the operator is not licensed to transmit on the frequencies used. No signal is transmitted over-the-air in those applications; rather direct pickup interference occurs when an undesired signal leaks into some part of the otherwise closed system, such as the cable, connectors, set top box or TV set. Thus, direct pickup interference results from a lack of immunity to undesired signals at some point(s) in the closed system of wiring and equipment. As noted, the Commission has standards for regarding the ability of analog cable ready TV receivers to reject direct pickup interference. However, there are no rules regarding the ability of other components in a system to reject direct pickup interference, and selection of appropriate system components is the owner or cable/satellite TV operator's responsibility. In this regard, the Commission generally does not believe it is appropriate to protect the operations of closed systems that use radiofrequency (RF) signaling from interference from radio services and operations that use the airways. In this regard, the Commission observes that the operators/users of such systems have full discretion to design their equipment to be immune to ambient RF energy transmitted by radio systems that use the airways.

57. The Commission is not persuaded that direct pickup interference is a significant problem as NCTA states. Its testing revealed many of the same characteristics of direct pickup interference that the Commission's staff

discovered during its testing. Specifically, NCTA determined that the cables in a system are a significant source of direct pickup and that low quality (inadequately shielded) cables and connectors can result in substantially increased signal ingress. It also determined that analog systems are significantly more sensitive to direct pickup interference than digital systems. The Commission previously considered these factors when it established the power limits for TV bands devices in the *Second Report and Order*. It notes that the NCTA tests assumed a worst case scenario in which the cable signal level to a home is at the minimum level required by the rules, the TV bands device operates at the maximum power permitted by the rules and the maximum signal level is directed towards a TV receiver. In real world situations, the cable signal level may be greater than the minimum required, the TV bands device may operate at less than the maximum power due to the requirement to incorporate transmit power control, and the maximum TV bands device signal may not be directed toward a TV receiver, depending on the antenna directivity and orientation. These factors can have a greater impact on the potential for direct pickup interference than the power reductions requested by NCTA. The Commission also notes that NCTA's testing showed that some TV receivers can withstand signals levels greater than 100 mW without interference on digital channels, even assuming minimum cable signal input levels. The Commission further notes that NCTA did not perform any tests using a cable converter box, which the Commission's testing showed, and which NCTA agrees, could further reduce the potential for direct pickup interference. In any event, notwithstanding NCTA's concerns for direct pickup interference and the possible mitigation of those concerns by elements in rules for TV bands devices, the Commission finds it inappropriate to limit the utility of TV bands devices by limiting their power to protect cable installations with inadequately shielded wiring or TV receivers that do not comply with the Part 15 shielding requirements.

TV Bands Database

58. In the *Second Report and Order*, the Commission required all fixed and Mode II TV bands devices to access a database to obtain information on the available channels at their location and required all unlicensed fixed TV bands devices to register their operations in this database. The Commission stated that it will designate one or more

entities to create and operate the TV bands database(s) and, has invited interested parties to apply for selection as database administrators. The database(s) will be a privately owned and operated service that unlicensed TV bands devices must contact to obtain information on channel availability at the locations where they are operated and, in the case of fixed devices, to register their operation at those locations. In the case that multiple database administrators are selected, each device must contact a database service that the user or the manufacturer of the device selects. Database administrators are permitted to charge fees for registering fixed devices and providing lists of available channels to fixed devices and personal/portable devices. A TV bands database will be required to contain information on: (1) All of the authorized services that operate in the TV bands using fixed transmitters with designated service areas, including full service and low power TV stations, (2) the service paths of broadcast auxiliary point-to-point facilities, (3) the geographic regions served by PLRMS/CMRS operations on channels 14–20, (4) regions served by the Offshore Radiotelephone Service, and (5) the locations of cable headends and low power TV receive sites that are outside the protected contours of the TV stations whose signals they receive. In addition, a TV bands database will be required to contain the locations of registered sites where wireless microphones and other low power auxiliary devices are used on a regular or scheduled basis. The Commission did not establish any specific security requirements or protocols for communications between TV bands devices and the TV bands database.

59. The Commission required fixed and Mode II TV bands devices to re-check the database, at a minimum, on a daily basis to provide for timely protection of wireless microphones and other new or modified licensed facilities. If a device fails to make contact with its database on any given day, it will be required to cease operating at 11:59 p.m. on the following day. Mode II devices are also required to re-establish their location coordinates and to access a TV bands database for a list of available channels each time they are activated or moved. The Commission further required that, if multiple database administrators are authorized, the database administrators are to cooperate to develop a standardized process for sharing data on a daily basis or more often, as appropriate, to ensure consistency in

the records of protected facilities. Finally, the Commission required that a database administrator make its services available to all unlicensed TV bands device users on a non-discriminatory basis.

Security

60. *Decision.* On reconsideration, the Commission found that it is important and necessary for TV bands devices and TV bands databases to incorporate reasonable and reliable security measures to minimize the possibility that TV bands devices will operate on occupied channels and cause interference to licensed services, and to protect the operation of the databases and the devices they serve from outside manipulation. While the Commission did not explicitly require the incorporation of security measures in the *Second Report and Order*, it noted that virtually all online transactions involving financial or other confidential information currently use security measures to protect against unauthorized viewing and/or alteration of information being sent and to ensure that only authorized users have access to information. The Commission therefore expects that device manufacturers and database administrators will have access to and be able to incorporate the reliability and security measures needed to protect the contents of databases and communications between databases and TV bands devices or other databases. The Commission is concerned that if a device uses channels provided through other than legitimate contact with a TV bands database or if a database administrator does not include appropriate security to avoid serving unauthorized devices or to prevent outside parties from altering its processing system and data records, there could be interference consequences ranging from mild to severe.

61. To achieve the necessary protection of databases and connections between devices and databases regarding channel availability, the Commission will require that TV bands devices and database systems employ security measures follows. First, it will require that, for purposes of obtaining a list of available channels and related matters, fixed and Mode II TVBDs only be capable of contacting databases operated by administrators designated by the Commission. This will prevent TV bands devices from obtaining channel lists from unauthorized databases which may be invalid or inaccurate—the Commission is particularly concerned about potential

cases where a database would indicate as available channels that are used by authorized services. The Commission will also specify that TV bands databases must not provide lists of available channels to uncertified TV bands devices for purposes of operation (is acceptable for a TV bands database to distribute lists of available channels by means other than contact with TVBDs) in order to avoid facilitating the operation of unapproved and non-compliant devices. To facilitate these restrictions, the Commission will require that database(s) verify that the FCC identification number (FCC ID) supplied by a fixed or personal/portable TV bands device is for a certified device. To implement this provision, the Commission will also require that database administrators obtain a list of certified TVBDs from its Equipment Authorization System.

62. The Commission will further require that communications between TV bands devices and databases be transmitted using secure methods to prevent corruption or unauthorized modification of data. This requirement includes 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 that they simply pass through as such information will already be protected by the sending device). The Commission will require that when Mode I devices communicate with fixed or Mode II devices for purposes of obtaining a list of available channels, they are to use a secure method that ensures against corruption or unauthorized modification of the data. In addition, a fixed or Mode II device must check with its database that the Mode I device has a valid FCC Identifier before providing a list of available channels. The Commission will also require that contact verification signals transmitted for Mode I devices be encoded with encryption to secure the identity of the transmitting device and that Mode I devices using such signals accept as valid for authorization only the signals of the device from which they obtained their list of available channels. Finally, the Commission will require that databases be protected from unauthorized data input or alteration of stored data. In order to accomplish this goal, the database administrator is to 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.

63. The Commission will not require the use of specific technologies to meet these requirements, as it believes that database administrators and device manufacturers are in the best position to determine the appropriate methods to ensure compliance. Rather, the Commission will require that applications for certification of TV bands device include a high level operational description of the technologies and measures that are incorporated in the device to comply with the security requirements. In addition, the Commission will require that applications for certification of fixed and Mode II devices identify at least one of the designated TV bands databases that the device will have the ability to access for channel availability information and affirm that the device will conform to the communications security methods used by that database. With regard to MSTV/NAB's concerns about the possible problems with protocols developed after a database administrator is selected, there is no practical way the Commission could review a communication protocol in advance to provide absolute assurance that there are no security flaws with it. The Commission will, however, take all reasonable steps in its examination of applications for certification to ensure that communications protocols are secure. In the event that flaws are discovered in a TVBD's security measures, the Commission will take steps to ensure that those measures are quickly corrected by device manufacturers and database administrators or to withhold or withdraw the authorization for operation of any affected devices.

Database Administrators

64. *Decision.* The Commission will uphold its decision to allow the designation of multiple database administrators and will rely on market forces to shape the structure of the database administration functions and service offerings, subject to the various requirements set forth in the rules. Under this approach, some providers may choose to provide a full panoply of services and others may choose to provide only a repository function or "look-up" service. As the Commission stated in the *Second Report and Order*, multiple database administrators could offer services on a competitive basis. This would prevent a single party from obtaining monopoly control over the database, could provide an incentive for database operators to provide additional services beyond those required by the

rules and could result in lower costs to consumers. The Commission will permit the database functions, such as a data repository, registration and query services, to be split among multiple entities. This approach will allow for competition between providers of specific elements of the database function and encourage the provision of enhanced services not specifically required by the rules. The Commission recognizes Key Bridge's concerns about creating a situation in which some parties engaged in the process do not have full competency in all aspects of database administration, but no parties would be provide all the necessary database functions. Therefore, the Commission will require that entities selected as database administrators will be held accountable for all aspects of database administration, including any functions performed by third parties. The nine proposals received in response to the Commission's November 25, 2009 public notice indicate that there are multiple parties seeking to be designated as TV bands device database managers, some as full-service operations and others as partial service providers. The Commission is confident that market forces will result in the necessary and appropriate mix of database providers and third party entities that perform some aspect of the database function.

65. The Commission disagrees with SBE that designating multiple database administrators would complicate equipment design or limit the Commission's ability to control unauthorized database operators. Manufacturers would only have to design equipment to communicate with a single database, although they could design equipment to communicate with multiple databases if they choose. Further, designating only a single database administrator would not prevent unscrupulous parties from attempting to establish an unauthorized and inaccurate database, as parties could attempt this whether the Commission designates a single or multiple database administrators. Rather, the requirement to incorporate security in communications between TV bands devices and the databases will thwart unauthorized database operators.

66. The Commission recognizes that a complication of designating multiple database administrators is the need to synchronize licensing and registration information between databases. However, the rules already require this, and no party has shown that it is impractical to share information between TV bands device databases. The Commission declines to establish

an advisory panel to oversee the database as requested by CWMU. It finds that this approach is unnecessary given that the Commission has already started the process for selecting the database administrators, and it is concerned that disagreements between panel members could potentially slow the development of the database. Rather, the Commission will expect entities selected as a database administrator to cooperate in complying with the requirements for database coordination. The Commission also declines to state a preference for a non-profit organization to run the database, as there is no evidence that a non-profit organization would administer a database better than a for-profit company.

67. In the *Second Report and Order*, the Commission stated that the database manager or managers would be selected by its Office of Engineering and Technology. Once the selection of a database manager or managers is completed there will need to be Commission oversight and management of the database administrator(s) and their functions. The Commission is delegating authority for this oversight to the Chief, Office of Engineering and Technology under part 0 of the rules.

Re-Check Procedures

68. *Decision.* The Commission affirms the current requirement that fixed and Mode II personal/portable TV bands device check the database at least once per day. The majority of entries in the database will be fixed services, such as TV stations, TV translator receive sites, cable and satellite headends, fixed BAS links, and the PLMRS/CMRS facilities. These fixed services change channels or service areas infrequently, so we find that requiring a daily database check by TV bands devices is quite adequate to protect these services. The concerns expressed in the record about the need to increase the frequency of database contact relate primarily to protecting LPAS stations and wireless microphones in particular. Even in the case of wireless microphones, most events for which users can register wireless microphones in the database occur at fixed locations where the required registration information will be known more than a day in advance. Thus, the main concern appears to be how to protect licensed wireless microphones that are used in applications where the location and/or channel are not known at least a day in advance, such as electronic news gathering. As discussed, the Commission is taking steps to ensure that some channels remain available for wireless microphones by prohibiting

personal/portable devices from operating below channel 21, designating two channels in each market from among channels 14–51 where TV bands devices cannot operate, and prohibiting fixed devices from operating adjacent to occupied TV bands channels. The Commission finds that these measures will ensure that adequate spectrum is available for licensed itinerant wireless microphone users in the vast majority of situations. In this context, the Commission also must consider that in most locations many channels will be available for wireless microphone use that are not available for TVBD use. Those channels can be used by wireless microphones for unscheduled events. The Commission also observes that in the case of a major unplanned news event, broadcasters already coordinate their use of frequencies for wireless microphones and that at a site can share frequencies by avoiding operation of wireless microphones at the same time. The Commission therefore declines to require more frequent database checks by TV bands devices which would substantially increase the amount of database traffic without significant benefit.

69. In re-affirming the daily re-check requirement, the Commission also observes that the rules currently do not specify that a database provide the TVBD with information on changes in channel availability that occur over the course of the 24 hours before the next re-check. For example, if a database were to provide a TVBD with only a list of the channels that are available at 9 a.m. and there is a scheduled use of wireless microphones on one or more of those channels during the period 3 p.m. to midnight, the TVBD would not cease operating on the channels that became unavailable later in the day. It is the Commission's intention that a database provide TVBDs with information on the full schedule of channel availability over the course of the 24 hour re-check period plus the additional period of up to 24 hours that a device may continue to operate if it is not able to contact its database at the end of the re-check period. This is necessary to ensure that TVBDs do not cause interference to protected operations that use channels during part of a 24 hour period. Accordingly, the Commission is amending its rules to provide that (1) a database must provide fixed and Mode II TVBDs with channel availability information that includes scheduled changes in channel availability over the course of the 48 hour period beginning at the time the TVBDs make a re-check contact and (2) fixed and Mode II

TVBDs must adjust their use of channels in accordance with channel availability schedule information provided by their database.

70. As indicated, because they have no geo-location capability to identify their location, the Commission is requiring Mode I personal/portable devices to either receive a signal to verify contact from the Mode II or fixed device that provided its current list of available channels or contact a Mode II or fixed device at least once per minute to re-verify/re-establish channel availability. Under the new contact verification option, a "contact verification signal" will be an encoded identification signal that may be broadcast by a fixed or Mode II device for reception by Mode I devices to which the fixed or Mode II device has provided a list of available channels for operation. Such signal will be for the purpose of establishing that a Mode I device is still within the reception range of the fixed or Mode II device from which it received a list of available channels; reception of a contact verification signal will be presumed to verify that the list of available channels used by the Mode I device remains valid for purposes of the once per minute re-check requirement. The Commission expects that this feature will be especially useful for improving efficiency in cases where several Mode I devices receive lists of available channels from the same fixed or Mode II device. The Commission is not requiring that Mode II and fixed devices transmit contact verification signals in support of Mode I devices they serve; however, use of this option is strongly suggested. The Commission requires that contact verification signals be encoded to ensure that they originate from the TV bands device that provided the list of available channels; the fixed or Mode II device transmitting a contact verification signal would need to provide a Mode I device it serves with decoding information at the time it makes an exchange contact with the Mode I device to provide a list of available channels. Mode I devices that receive contact verification signals will still be required to re-check with a fixed or Mode II device at least once a day. In addition, Mode II devices will be required to re-check/reestablish contact to obtain a list of available channels if they lose 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 new channel list. The Commission also clarifies the requirement that Mode II devices re-check with their database

when they move to specify that such devices must re-check only when they are moved more than 100 meters from the location at which they performed their last re-check. This will avoid the need for re-checking when a device is moved very short distances that would have a de minimis impact on potential interference and reduce the burden of the re-check function on the database and the Mode II TVBD.

71. The Commission will permit database administrators and device manufacturers to develop a system to "push" channel availability changes and other information to TV bands devices if they choose. This capability could, for example, be used in the development of standards that allow more efficient sharing of TV spectrum by networks of TV bands devices. The Commission will not require that databases or devices incorporate this capability. To guard against the possibility that a device may miss updates pushed by the database and continue transmitting on a channel that becomes unavailable, devices that incorporate this capability must still function in the same manner as other TV bands devices and validate their channel at least once per day and cease operation no later than 11:59 p.m. the following day if they cannot validate the operating channel. The operation of such an information "push" system must be described in the application for certification. Any other clearing of channels, such as marking particular channels as unavailable in the database, may only be done under authorization by the Commission.

72. The Commission also will permit Mode II personal/portable devices to load available channel information for locations beyond their current position and use that information in their operation. Mode II devices will be allowed to use such additional available channel information to define a geographic area within which they could operate on the same available channels at all locations. Allowing channel lists to be stored for more than a single location will allow for more efficient operation of portable devices by reducing the number of queries to the database and to support mobile operation. 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. Mode II TVBDs that use such an approach must contact the database when they have moved beyond the boundary of the area where their channel availability data is valid, and must re-check the database at least once each day like other Mode II devices even if they have not moved

beyond the range where the data is valid. Parties that incorporate the ability to load channel lists for multiple locations and operate within an area bounded into a device must describe in the application for certification how they will ensure the device operates only on available channels within the bounded area.

Additional Service Features

73. *Decision.* Database administrators may perform additional functions besides those required by the rules, such as tracking active channel use if reported by the TV bands device, or sending additional information to a TV bands device to enable it to determine the "best" available channel to use. Such functions are not prohibited by the rules, and the ability to add additional functionality could allow multiple database operators to distinguish their services and could be useful in the development of industry standards to enable more efficient spectrum sharing. However, in the interest of keeping the rules simple and avoiding the imposition of unnecessary requirements that could hamper innovation, the Commission declines to require TV bands devices to report additional information to the database beyond what the rules currently require. It also declined to require the incorporation of different (and currently unspecified) TV service area prediction models into the database as requested by Motorola. The rules currently prohibit adjacent channel operations by fixed devices, and there is insufficient record to change that requirement at this time.

Database Information

74. *Decision.* The Commission will require that all information that is required by the Commission's rules to be in a TV bands device database be publicly available, including fixed TV bands device registration and voluntarily submitted protected entity (e.g., cable head ends) information. The Commission will not require the public disclosure of information that a database manager may collect to support additional services, provided that this information also is not required to be provided by our rules. The Commission notes that the registration of a protected entity in the database will preclude operation of TV bands devices on one or more channels over specific areas, and that there is the possibility of errors in the registration information. Although much of the data will come from Commission databases that already are public sources, errors could result from the inadvertent entry of incorrect data, or as a result of a party deliberately

entering false data. The Commission finds that it is appropriate to permit public examination of protected entity registration information to allow the detection and correction of errors. It also finds that making fixed TV bands device registration information publicly available could assist parties in locating the source of any interference that occurs and contacting the device operator to correct it. With regard to Key Bridge's request concerning the Commission's requirement to provide or delete information from the database, the Commission clarifies that this requirement applies only to the information that the Commission requires to be placed in the database and not any other information that a database administrator collects beyond what the rules require.

75. The Commission declined to require fixed TV bands device operators to access and review the database prior to network deployment and to select a channel that is not in use, because one of the general conditions of operation for part 15 is that a party's use of a particular frequency does not give it rights over other parties to continued use of that frequency. In addition, a TV bands device may need to operate on more than one available channel and may do so. However, the Commission will permit database administrators to allow prospective operators of TV bands devices to query the database to verify whether there are vacant channels at a site where they wish to operate, and operators of TV bands devices may use information from the database to voluntarily coordinate their channel usage to avoid conflicts.

76. In reviewing the rules for the information to be included in a TV bands database, the Commission observes that in the case of full power TV, Class A TV, low power TV and TV translator stations the Commission's Consolidated Broadcast Data Base System (CDBS) from which the TV station database records will be extracted in many cases includes multiple types of records for each station. For example, the database may include license, license application, special temporary authorization and construction permit applications for the same station and may also include more than one of each of these types of records for the same station. These multiple records can pose confusion in administering a TV bands database with respect to which records to extract for the database. It is our intention that the records in a TV bands database only reflect stations that are serving viewers. In the CDBS, only records for licenses and license applications imply that a

station is providing service to viewers. The Commission therefore clarifies that a TV bands database is to include only TV station information from license or license application records. Given that a license application implies a change that is to the station's ongoing operations, the Commission finds that in cases where a station has records for both a license application and a license, a TV bands database should include the information from the license application rather than the license. The Commission amended its rules to add these clarifications.

Database Fees

77. *Decision.* The Commission declines to establish a particular fee structure for database administrators. It finds that database administrators are in the best position to manage their costs and fees. The Commission disagrees with SBE that registering protected entities with the database will have a significant impact on licensees or others. Many of the registrations will be for services at fixed locations such as fixed BAS links or satellite, MVPD or TV translator receive sites, and these only need to be registered once, and in the case of receive sites, only if they are located outside the protected contour of the TV station being received. Information for licensed services will come from Commission databases. Further, all such registrations are voluntary, so a party may choose not to register sites where it believes that interference from TV bands devices is unlikely to occur. The Commission modified § 15.714(a) to remove the provision that database administrators may charge to register temporary BAS links. The Commission did not state in the *Second Report and Order* that database administrators could charge for registering temporary BAS links, and a provision stating that they could was inadvertently added to the rules.

Other Database Issues

78. *Decision.* Fixed and Mode II TV bands devices are allowed to contact a database for a list of available channels through other TV bands devices, provided they follow the rules and connect to an authorized database using the appropriate protocol, send their geographic coordinates and other required information and operate only on channels that the database indicates are available. The rules already permit this practice but do not allow the formation of "chains" of devices that did not access the database but merely pass on a list of available channels. Therefore, no rule changes are necessary in this regard. The Commission will not

require Mode II personal/portable devices to register in the database, because this would substantially increase the number of registrations in the database, and each of these registrations would have to be updated as device changes locations, thus substantially increasing the database traffic. The Commission also sees no need for registration of these devices as a means to help identify a source of interference, as the interference range of personal/portable devices is in general relatively short. In this regard, the Commission is correcting an error in § 15.713(e)(4) of the rules which incorrectly states that Mode II devices must register on initialization. The Commission will not require devices to provide coordinates accurate to ± 5 meters because that is a higher degree of precision than necessary, and such accuracy may not be readily achievable by most devices.

Use of TV Channels

TV Bands Devices, Wireless Microphones and Low Power Auxiliary Stations

79. In the *Second Report and Order*, the Commission prohibited fixed TV bands devices from operating adjacent to occupied TV channels at this time, although it deferred a final decision on this issue and kept the record open pending the development of additional information demonstrating that a reliable method can be developed to allow adjacent channel operation. The Commission decided to allow both fixed and personal/portable unlicensed TV bands devices to operate on channels 21–36 and 38–51. In addition, the Commission allowed only fixed TV bands devices to operate on channels 2 and 5–13 and on channels 14–20 outside of areas where PLMRS/CMRS services operate. The Commission stated that allowing only fixed TV bands devices to operate below channel 20 would ensure that some channels remain available for use by wireless microphones and eliminate the possibility of interference from TV bands devices to public safety and other important communications operations in the PLMRS. While it believed that the geo-location/database and Mode I operation provisions of the rules would provide a high degree of assurance that PLMRS/CMRS, Offshore Radiotelephone Service and other authorized services on channels 14–20 are protected, the Commission chose a more conservative approach to protect the PLMRS/CMRS services from expected high numbers of nomadic personal/portable devices and affirmed

its decision from the *First Report and Order and Further Notice of Proposed Rule Making*, 71 FR 66897, November 17, 2006, in this proceeding to prohibit personal/portable devices from operating on channels 14–20. In addition, in 13 major markets where certain channels between 14 and 20 are allocated for land mobile operations, the Commission designated two channels between 21 and 51—*i.e.*, the first vacant channels above and below channel 37—where personal/portable TV bands devices could not operate, leaving those two channels available for low power auxiliary stations.

80. *Decision.* The Commission affirms its initial decision to prohibit fixed devices from operating on channels adjacent to occupied TV channels. While Adaptrum and Motorola provided general information on possible ways that fixed devices could operate adjacent to occupied TV channels, neither party provided sufficiently detailed information on the technical requirements that would be necessary to allow adjacent channel operation without interference and still permit operation of TVBDs. The Commission also declines to change the designated channels where TV bands devices are prohibited from operating and, in this regard, it also affirms its decision to prohibit personal/portable devices from operating below channel 21. As the Commission noted in both the *First Report and Order*, 71 FR 66897, November 17, 2006, and *Second Report and Order*, 74 FR 7314, February 17, 2009, there is some potential for interference to PLMRS/CMRS services on channels 14–20 due to the nomadic nature of personal/portable devices, and it took a conservative approach to protect these services from interference and prohibit operation of personal/portable devices on these channels. In addition, the Commission affirms the prohibition on personal/portable devices on channels below 14 as well to help ensure that unused channels remain available for wireless microphones and other LPAS devices.

81. The Commission is revising its rules to reserve two channels nationwide where TV devices are not permitted to operate to ensure that some spectrum remains available for wireless microphones and other LPAS stations. Reserving two channels nationwide will ensure that at least two channels remain available for wireless microphones in all markets. These channels will be the first channels on either side of channel 37 that are unoccupied by broadcast television stations or, if no channels are available on one side of channel 37, the first two channels nearest to channel 37.

These reservations will provide channels to accommodate LPAS operations that are not at fixed locations that would have been protected under the spectrum sensing provisions we are eliminating. Such LPAS operations include electronic news gathering and other temporary on-site applications, where the operating channels and locations are not known sufficiently far in advance to register them in the database. The Commission believes that the reservation of two channels nationwide, along with the additional channels that will be available at the vast majority of locations that cannot be used by TVBDs, will provide more than sufficient spectrum to accommodate the vast majority of wireless microphone usage. This will allow protected operation of a minimum of 12–16 wireless microphones and other LPAS stations in a small geographic area. Further, the relatively low power of these stations limits their operating range to about 100 meters, allowing each vacant TV channel to be used at many locations in a TV market. The Commission notes that in many areas more than two channels will likely remain available for LPAS stations because fixed TV bands devices are not permitted to operate adjacent to occupied TV channels and personal/portable devices are not permitted to operate below channel 21.

82. Recently the Broadband Action Agenda announced an intention for the Commission to initiate rule making proceedings to increase spectrum efficiency and innovation in various frequency bands, including broadcast TV spectrum. In addition, the Commission has initiated a proceeding to consider changes to the rules for wireless microphones that operate in the TV bands. If the Commission makes changes to the rules concerning the channels available for operation for TV and other authorized services, the channels available for use by unlicensed TV bands devices and wireless microphones could change, and any TV bands device or wireless microphone that operates on a channel that is later designated for another use would have to cease operation on that channel. Depending on the tuning range of the TV bands device, particularly personal/portable devices, or wireless microphone, these radios could have a reduced operating range. The Commission recognizes that the anticipated proceedings introduce some uncertainty for manufacturers of TV bands devices and could delay their deployment. To avoid this problem, manufacturers can design devices that

have the capability to tune over a wider range of frequencies than the rules currently permit, but that incorporate measures to limit operation to the frequency range over which the device is certified. Manufacturers would therefore not have to redesign their equipment if the Commission modifies the permitted operating frequency range and could modify their equipment certification through a streamlined procedure. The Commission also observes that manufacturers are contemplating that devices that connect to CMRS services, mobile and personal/portable devices, whole-home wireless networks and other wireless data systems that will use TV white space spectrum will also include Wi-Fi and Bluetooth communications technologies.

Fixed Licensed Point-to-Point Backhaul Use

83. In the *Second Report and Order*, the Commission decided that it would not be practicable to authorize the use of TV white spaces on a licensed basis. It concluded that the attributes supporting successful use of licensing—spectrum rights that are clearly defined, exclusive, flexible and transferable—would be difficult to accomplish in the TV bands if the Commission were to maintain its goal of not affecting the interference protection status of existing services. The frequencies and amount of unused TV bands spectrum will vary at each location and could change as other primary users enter the band. Instead, the Commission decided to allow low power unlicensed devices to operate on the TV white spaces at power levels no greater than 4 watts EIRP. First, it was concerned that operation at higher power levels would increase the risk of interference in congested areas and thus could make sharing spectrum between TV bands device users more difficult. Second, because the Commission did not have experience with unlicensed wireless broadband operations in the TV bands, it decided to take a cautious approach in setting power limits to minimize the risk of interference to authorized users of the TV bands.

84. *Decision.* The Commission has declined to set aside TV channels for fixed licensed backhaul use as requested by FiberTower at this time. The Broadband Action Agenda recently indicated an intention that the Commission initiate rule making proceedings to increase spectrum efficiency and innovation in various frequency bands including the broadcast TV spectrum. The Commission intends to consider FiberTower's requests for spectrum for fixed licensed backhaul to

support broadband services in the broader context of these future proceedings in order to better ensure a comprehensive approach to wireless rural backhaul in these bands. The Commission disagrees with FiberTower's contention that it should not delay in addressing its request for access to the TV bands because it would be impossible for the Commission to authorize licensed uses after unlicensed devices occupy the TV bands. Both fixed and personal/portable devices are to rely on a TV bands device database as their primary method for determining available channels. If the Commission makes changes to the rules concerning permissible channels of operation, imposes geographic area restrictions or makes other changes to the technical parameters for TV bands devices, these will be taken into account by the database administrator in determining available channels for TV bands devices. Therefore, any TV bands device that operates on a channel that is later designated for another use would cease operation on that channel after it performs its daily database check and the database indicates that the channel is no longer available for use. As the Commission moves forward, it is interested in pursuing the question of whether it can accommodate licensed rural backhaul in the white spaces within the UHF bands. Therefore, Commission staff will evaluate this possibility over the coming months, and will formulate and submit a recommendation on next steps to the Commissioners by the end of 2010.

Other Issues

Canada/Mexico Border Areas

85. The allotment and assignment of TV channels in the border areas with Canada and Mexico are subject to agreements with each of those countries. Low power TV assignments within 32 kilometers (20 miles) of the Canadian border must be referred to the Canadian authorities for approval. In addition, low power UHF TV stations that are located less than 40 kilometers (25 miles) from the Mexican border, and low power VHF TV stations that are less than 60 kilometers (37 miles) from the Mexican border, must be referred to the Mexican government for approval.

86. In the *Second Report and Order*, the Commission decided that fixed TV bands devices should not be permitted to operate within the border areas specified in the Canadian and Mexican agreements until it has an opportunity "to negotiate any necessary changes to those agreements with Canada and Mexico." The Commission stated that

fixed TV bands devices that operate with outdoor antennas at an EIRP of up to 4 watts "will be somewhat similar in operation to low power TV stations," and thus decided "in keeping with the low power broadcasting agreements with Canada and Mexico" that TV bands devices must comply with the distance separations from the border specified in the agreements. The Commission also applied the same distance restrictions on the use of lower powered unlicensed personal/portable TV bands devices within the border areas "to avoid any uncertainty in administering the agreements with Canada and Mexico." These border distance restrictions will be enforced for fixed devices and Mode II personal/portable devices through the use of their geo-location and database access capabilities. Devices operating in Mode I without a geo-location/database access capability will be prevented from operating in the border areas in that they will operate relatively close to an associated base station (fixed or personal/portable) that uses a geo-location/database access capability that will keep it from operating in the border areas.

87. *Decision.* The Commission modified the requirements for the operation of TV bands devices in border areas with Canada and Mexico. The Commission clarified that unlicensed devices are not covered by the TV broadcast agreements with Canada and Mexico, and thus it does not need to negotiate changes to those agreements as stated in the *Second Report and Order*. The Commission historically applied these agreements to licensed operations which are well-defined and readily identified under its rules and in its databases, characteristics which do not apply to unlicensed devices. Nonetheless, because TV bands devices will operate in the same frequency bands and on the same channels as TV stations in those countries as well as in the U.S., albeit at lower power than licensed stations, the Commission is sensitive to the need to avoid causing interference to TV broadcast operations in Canada and Mexico. The Commission finds merit in Tribal Digital Village's suggested option to protect Canadian and Mexican stations in the border areas by including information on the Canadian and Mexican stations in the TV bands database as protected services within those countries. The Commission will do so, thereby ensuring that stations in those countries will be protected to the same level as stations in the U.S. The Commission will discuss its decision with Canada and Mexico to ensure that information on

their operations in the database will be timely and accurate.

Transmitter IDs

88. In the *Second Report and Order*, the Commission required fixed TV bands devices to transmit identifying information to ensure that they can be identified if interference occurs. It required the identification signal to conform to a standard established by a recognized industry standards setting organization and stated that it expects the identification signal to carry sufficient information to identify the device and its location.

89. *Decision.* The Commission affirms its decision to require fixed TV bands devices to transmit an identification signal to identify the specific device and its location. The Commission concluded previously that an identification signal will provide a useful means to help locate a specific device in the event that it causes interference. Although it has not specified the type of information that should be transmitted, it anticipates that, because fixed devices also have to register in the TV bands database, the transmitted identification information will be correlated, perhaps identical, with the database information to facilitate the location of a specific device.

90. The Commission recognizes the concerns of Motorola and Adaptrum about possible delays in development of a standard for the identification signal. Although the rules require that the signal conform to a standard established by a "recognized industry standards setting organization," the Commission does not specify beyond this general criterion the type of organization that could develop such a standard, nor limit the number of organizations that might participate in the development of the standard. If necessary, the Commission will work with industry groups to ensure development of a standard in a timely fashion. Accordingly, the Commission anticipates that the development of a standard, at worst, will result in relatively little delay in the entry into the market of new TV bands devices. This slight potential downside is more than outweighed by the benefits of standardizing the delivery of the identification information.

91. Adaptrum is mistaken in asserting that the Commission's reliance on a non-governmental group for developing a standard for the identification signal constitutes an improper delegation of authority. The Commission established minimum requirements for the identification information in the *Second Report and Order*, and it retained

authority to determine whether fixed TV bands device operators comply with this requirement. The referral to an industry standards-setting organization in the *Second Report and Order* of the task to develop a standard for the identification signal only involves issues related to the details of the identifying information to be transmitted, such as format. To the extent the standard fails to facilitate the intended use of the identification information that the device operators are required to provide, the Commission can easily address this failing by revisiting the sufficiency of the device operators' compliance with the underlying identification requirements and the framework for ensuring such compliance. Under these circumstances, the Commission's instruction that the device operators conform their identification signals to an industry standard established by a non-governmental standards-setting group does not come close to crossing the line drawn by the courts against improper delegations of agency authority.

92. The Commission declines to require that personal/portable devices operating in Mode I transmit an identification signal. Personal/portable devices operate at lower power than fixed devices and have a lower interference potential so there is less need for them to transmit identification information. Also, a personal/portable device operating in Mode I will not "know," and therefore cannot transmit, its geographic coordinates, making an identification signal from such a device significantly less useful.

Professional Installation

93. The geographic coordinates of a fixed TV bands device are to be determined by either an incorporated geo-location capability or a professional installer. In the case of professional installation, the party who registers the device in the database will be responsible for assuring the accuracy of the entered coordinates.

94. *Decision.* The Commission sees no need to modify the rules concerning the requirements for professional installation. The rules provide professional installation as an alternative to including a geo-location capability in the devices, and the intended purpose is to ensure that the geographic coordinates are correctly ascertained. The Commission generally intended that a "professional installer" mean an entity consisting of an individual or team of individuals with experience in installing radio communications equipment and that provides service on a fee basis—such an individual or team can generally be

expected to be capable of ascertaining the geographic coordinates of a site and entering them into the device for communication to a database. The task of ascertaining geographic coordinates and entering them into a device is not particularly difficult or complex and the Commission therefore does not believe it is necessary to define the qualifications of a professional installer in the rules. In this context, the Commission finds it adequate to simply provide that a professional installer may be responsible for assuring the accuracy of the entered coordinates. Further, the rules already recognize professional installation for certain categories of part 15 transmitters, and if professional installation is deemed appropriate for a device, the grant of certification is conditioned accordingly.

Section 301 Licensing

95. *Decision.* The Commission considered and rejected SBE's contention that the rules adopted in the *Second Report and Order* do not provide adequate protection against interference. Accordingly, the Commission need not address SBE's assertion that section 301 of the Act requires licensing in this case. In addition, it declines to modify the rules to provide a private right of action if interference occurs. The Commission's statutory authority and its rules provide for a range of enforcement actions that could be relied upon to eliminate and prevent interference.

Radio Astronomy

96. In the *Second Report and Order*, the Commission prohibited both fixed and personal/portable TV bands devices from operating on any channel within 2.4 kilometers (1.5 miles) of certain radio astronomy receive sites, including the Very Large Array (VLA) observatory located approximately 50 miles west of Socorro, New Mexico. This observatory consists of 27 moveable antennas laid out in a Y-shaped configuration. The Commission's rules list the coordinates of the center of the array, but each segment of the array is 13 miles long, so the protection zone of 2.4 kilometers around the center point does not encompass large portions of the array. The National Telecommunications and Information Administration (NTIA) requested that the Commission change the protected coordinates from a single point to a rectangular area that encompasses the entire VLA. To ensure that this facility is protected from interference from TV bands devices, the Commission is adopting the change requested by NTIA. The rectangular area recommended by NTIA is

approximately 19 miles by 22.5 miles, but because the observatory is in a generally unpopulated area, this change will affect few potential users of TV bands devices.

Other Rule Clarifications

97. Upon review of the rules adopted in the *Second Report and Order*, the Commission discovered a number of minor inconsistencies between the text of the *Second Report and Order* and the rules. In addition, it noted a number of cases where it believes it is appropriate to clarify the rules, consistent with the *Second Report and Order*. Because these changes are not substantive, the Commission may make them on its own motion without prior notice and comment. A summary of the changes is provided as follows.

- Changes to definitions:

- The Commission is correcting an erroneous cross-reference in the definition of available channel and removing text that is not necessary as part of this definition; it is also clarifying the definition of a television channel.

- The Commission is removing the specific definitions of client mode, client device, master mode and master device and revising the text of other portions of the TV white space rules to reflect these changes.

- The Commission is incorporating the concepts of master and client in the definitions of fixed, Mode I and Mode II personal/portable devices.

- The Commission is indicating that a TV receive site may be used to provide signals to a Multiple Video Program Distributor (MVPD) and making minor wording edits to the definition of receive site.

- The Commission is indicating in the definition of TV bands devices that they operate on an unlicensed basis.

- The Commission is indicating that TV bands device databases used by TV bands devices to obtain lists of available channels must be authorized by the Commission.

- Clarifications of the requirements for Mode I TV bands devices.

- The Commission is specifying that the list of channels provided to a Mode I device must be the same as the list of channels that are available to the fixed or Mode II device that provides the list.

- The Commission is clarifying that a Mode I device may operate only on channels that are permissible for its use, even if there are available channels outside the permitted range for Mode I devices, e.g., channels below 21, where only fixed devices may operate.

○ The Commission is clarifying that a fixed device or a Mode II device has the option to provide a supplemental list of available channels to Mode I devices (*i.e.*, a list of available channels in addition to the list of channels available to the fixed or Mode II device) that includes channels that are adjacent occupied TV channels and therefore not available to the fixed or Mode II device.

Final Paperwork Reduction Act of 1995 Analysis

98. The *Second Memorandum Opinion and Order* contains new or modified information collections subject to the Paperwork Reduction Act of 1995 (PRA) and will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA, Public Law 104–13. A modification is required to the Form 731 (OMB 3060–0057). OMB, the general public, and other Federal agencies are invited to comment on the new or modified information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107–198, see 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

Final Regulatory Flexibility Analysis

99. As required by the Regulatory Flexibility Act (RFA),¹ an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rule Making* (NPRM) in ET Docket No. 04–186,² 69 FR 34103, June 18, 2004, and an additional IRFA was incorporated in the *First Report and Order and Further Notice of Proposed Rule Making* (Further NPRM) in ET Docket No. 04–186,³ 71 FR 66897, November 17, 2006. The Commission sought written public comment on the proposals in the NPRM and in the Further NPRM, including comment on the IRFAs. No comments were received in response to either IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.⁴

¹ See 5 U.S.C. 603. The RFA, see 5 U.S.C. 601–612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Public Law 104–121, Title II, 110 Stat. 857 (1996).

² NPRM, 19 FCC Rcd at 10018.

³ Further NPRM, 21 FCC Rcd at 12299.

⁴ See 5 U.S.C. 604.

A. Need for, and Objectives of, the Second Memorandum Opinion and Order

100. This *Second Memorandum Opinion and Order* responds to seventeen petitions for reconsideration that were filed in response to the *Second Report and Order and Memorandum Opinion and Order* (Second Report and Order) in this proceeding.⁵ It upholds the majority of the Commission's prior decisions permitting unlicensed broadband operations in the TV bands and also makes other minor changes and refinements to the rules for TV bands devices. The Commission believes that these changes and clarifications to the rules will better ensure that licensed services are protected from interference while retaining flexibility for unlicensed devices to share spectrum with new services or to change frequencies if TV spectrum is reallocated for other purposes.

101. In the *Second Memorandum Opinion and Order*, the Commission is taking steps to provide access to unused TV spectrum that will fuel innovation and investment in new unlicensed wireless technologies, such as Wi-Fi and Bluetooth have changed the landscape of communications in recent years. It is resolving on reconsideration certain legal and technical issues in order to provide certainty concerning the rules for operation of unlicensed transmitting devices in the television broadcast frequency bands (unlicensed TV bands devices, or TVBDs). The steps being taken will make a significant amount of currently unused spectrum with very desirable propagation characteristics available for new and innovative products and services, particularly broadband data and other services for businesses and consumers. Resolution of these issues will allow manufacturers to begin marketing unlicensed communications devices and systems that operate on frequencies in the TV bands in areas where they are not used by licensed services (TV white spaces). The opening of these bands for unlicensed use, which represents the first significant increase in unlicensed spectrum below 5 GHz in over 20 years, will spur manufacturers to develop new radio technologies that will have wide ranging applicability for spectrum sharing in many frequency bands, will have significant benefits for both

⁵ We are addressing seventeen petitions for reconsideration that were filed in response to the *Second Report and Order and Memorandum Opinion and Order* (Second Report and Order) in this proceeding. See *Second Report and Order and Memorandum Opinion and Order* in ET Docket Nos. 02–380 and 04–186, 23 FCC Rcd 16807 (2008).

businesses and consumers and will promote more efficient spectrum use. The technology that enables access to TV white spaces will also serve as a foundation for a model that can be extended to provide opportunistic access to other spectrum bands.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

102. Richard A. Rudman and Dane E. Ericksen (Rudman/Ericksen) argue that the Final Regulatory Flexibility Analysis (FRFA) in the *Second Report and Order* is deficient because it did not address certain burdens on industry.⁶ Specifically, they argue that the FRFA failed to consider the burden of every one of the 6,635 cable television systems in the United States having to register with the TV bands device database to protect the multiple TV receivers typically installed at a cable headend. Rudman/Ericksen state that because the rules permit the registration of receive sites only if they are outside the protected contour of the station being received, and only at distances up to 80 km from the protected contour, a cable system operator will have to calculate the contour for each station being received to determine if the receive site is eligible for registration. They state that there are 8,126 cable headends in the United States, and that if each headend receives ten stations, then over 80,000 contour calculations must be performed. Similarly, Rudman/Ericksen argue that thousands of TV translator licensees will have to perform contour calculations to determine whether their receive sites are at locations that are eligible for registration in the TV bands device database.

103. The Commission disagrees with Rudman/Ericksen that voluntary registration of receive sites for cable headends and TV translators poses a significant burden. As the Commission noted in the *Second Report and Order*, the receive sites that may be registered in the TV bands device database are located in areas where TV services are normally not protected, but the Commission decided to provide parties the option of registering sites if they choose to minimize the potential for interference from TV bands devices. However, there is no requirement to register a site. Further, operators of cable systems or other multi-channel video programming distributors (MVPDs) typically already have information on the location of the protected contours of TV stations in their service areas, so they can quickly

⁶ See Rudman/Ericksen petition at 7.

determine whether a particular receive site is eligible for registration. Even if the operator of a receive site does not know its location with respect to the protected contour of the station being received, such information can be readily obtained. The Commission notes that it received petitions for reconsideration from the cable and TV translator industries and two MVPDs, and none of these parties claimed that registration of receive sites is unduly burdensome as Rudman/Ericksen allege.⁷

C. Description and Estimate of the Number of Small Entities To Which Rules Will Apply

104. The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the rules adopted herein.⁸ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁹ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.¹⁰ A “small business concern” is one which: (1) Is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).¹¹

105. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* The Census Bureau defines this category as follows: “This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio

and television studio and broadcasting equipment.”¹² The SBA has developed a small business size standard for Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees.¹³ According to Census Bureau data for 2002, there were a total of 1,041 establishments in this category that operated for the entire year.¹⁴ Of this total, 1,010 had employment of under 500, and an additional 13 had employment of 500 to 999.¹⁵ Thus, under this size standard, the majority of firms can be considered small.

106. *Wireless Telecommunications Carriers (except Satellite).* Since 2007, the Census Bureau has placed wireless firms within this new, broad, economic census category.¹⁶ Prior to that time, such firms were within the now-superseded categories of “Paging” and “Cellular and Other Wireless Telecommunications.”¹⁷ Under the present and prior categories, the SBA has deemed a wireless business to be small if it has 1,500 or fewer employees.¹⁸ Because Census Bureau data are not yet available for the new category, we will estimate small business prevalence using the prior categories and associated data. For the category of Paging, data for 2002 show that there were 807 firms that operated

for the entire year.¹⁹ Of this total, 804 firms had employment of 999 or fewer employees, and three firms had employment of 1,000 employees or more.²⁰ For the category of Cellular and Other Wireless Telecommunications, data for 2002 show that there were 1,397 firms that operated for the entire year.²¹ Of this total, 1,378 firms had employment of 999 or fewer employees, and 19 firms had employment of 1,000 employees or more.²² Thus, we estimate that the majority of wireless firms are small.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

107. TV bands devices are required to be authorized under the Commission’s certification procedure as a prerequisite to marketing and importation, and the Second Memorandum Opinion and Order makes no change to that requirement. However, it makes certain changes to the technical requirements for TV bands devices, which are discussed below. In addition, the Second Memorandum Opinion and Order makes certain changes to the requirements for TV bands device databases, which are also discussed.

E. Steps Taken To Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

108. The RFA requires an agency to describe any significant alternatives that it has considered in developing its approach, which may include the following four alternatives (among others): “(1) The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption

¹² U.S. Census Bureau, 2002 NAICS Definitions, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing”; <http://www.census.gov/epcd/naics02/def/NDEF334.HTM#N3342>.

¹³ 13 CFR 121.201, NAICS code 334220.

¹⁴ U.S. Census Bureau, American FactFinder, 2002 Economic Census, Industry Series, Industry Statistics by Employment Size, NAICS code 334220 (released May 26, 2005); <http://factfinder.census.gov>. The number of “establishments” is a less helpful indicator of small business prevalence in this context than would be the number of “firms” or “companies,” because the latter take into account the concept of common ownership or control. Any single physical location for an entity is an establishment, even though that location may be owned by a different establishment. Thus, the numbers given may reflect inflated numbers of businesses in this category, including the numbers of small businesses. In this category, the Census breaks-out data for firms or companies only to give the total number of such entities for 2002, which was 929.

¹⁵ *Id.* An additional 18 establishments had employment of 1,000 or more.

¹⁶ U.S. Census Bureau, 2007 NAICS Definitions, “517210 Wireless Telecommunications Categories (Except Satellite)”; <http://www.census.gov/naics/2007/def/ND517210.HTM#N517210>.

¹⁷ U.S. Census Bureau, 2002 NAICS Definitions, “517211 Paging”; <http://www.census.gov/epcd/naics02/def/NDEF517.HTM>; U.S. Census Bureau, 2002 NAICS Definitions, “517212 Cellular and Other Wireless Telecommunications”; <http://www.census.gov/epcd/naics02/def/NDEF517.HTM>.

¹⁸ 13 CFR 121.201, NAICS code 517210 (2007 NAICS). The now-superseded, pre-2007 CFR citations were 13 CFR 121.201, NAICS codes 517211 and 517212 (referring to the 2002 NAICS).

⁷ See petitions of the National Cable and Telecommunications Association (March 19, 2009), Community Broadcasters Association (March 19, 2009) and DirecTV and Dish Network (March 19, 2009).

⁸ 5 U.S.C. 604(a)(3).

⁹ 5 U.S.C. 601(6).

¹⁰ 5 U.S.C. 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. 632). Pursuant to 5 U.S.C. 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

¹¹ 15 U.S.C. 632.

¹⁹ U.S. Census Bureau, 2002 Economic Census, Subject Series: Information, “Establishment and Firm Size (Including Legal Form of Organization,” Table 5, NAICS code 517211 (issued Nov. 2005).

²⁰ *Id.* The census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “1000 employees or more.”

²¹ U.S. Census Bureau, 2002 Economic Census, Subject Series: Information, “Establishment and Firm Size (Including Legal Form of Organization,” Table 5, NAICS code 517212 (issued Nov. 2005).

²² *Id.* The census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “1000 employees or more.”

from coverage of the rule, or any part thereof, for such small entities.”²³

109. The Second Memorandum Opinion and Order generally upholds the rules adopted in the *Second Report and Order*. However, the Commission agreed with petitioners with regard to a number of the requested changes to the rules and modified and clarified the rules as appropriate in granting those requests. It believed those changes and clarifications will provide for improved protection of licensed services in the TV bands, resolve certain uncertainties in the rules and provide manufacturers with greater flexibility in designing products to meet market demands.

110. The Commission eliminated the requirement for TV bands devices that rely on geo-location and database access to sense analog and digital TV signals and also wireless microphones and other low power auxiliary stations. In reaching this decision, it considered the competing views from various parties on whether spectrum sensing is a viable tool for providing access to spectrum. The Commission believes that spectrum sensing will continue to develop and improve and anticipates that some form of spectrum sensing may very well be included in TVBDs on a voluntary basis for purposes such as determining the quality of each channel and enhancing spectrum sharing among TVBDs. However, the Commission did not believe that a mandatory spectrum sensing requirement best serves the public interest. It found that the geo-location and database access method and other provisions of the rules will provide adequate and reliable protection for television and low power broadcast auxiliary services, so that spectrum sensing is not necessary. These other rule provisions include: (1) Reserving two vacant UHF channels for wireless microphones and other low power auxiliary service devices in all areas of the country, and (2) allowing operators of the venues of large events and productions/shows that use large numbers of wireless microphones on an unlicensed basis to register the sites of those venues with the Commission to receive the same geographic spacing protections afforded licensed wireless microphones.

111. The Commission also adopted changes to the requirements for the databases that TV bands devices must contact to contain lists of available channels. Specifically, it required that communications between TV bands devices and TV bands databases, and between multiple databases, are secure. The Commission found that it is

important and necessary for TV bands devices and TV bands databases to incorporate reasonable and reliable security measures to minimize the possibility that TV bands devices will operate on occupied channels and cause interference to licensed services and to protect the operation of the databases and the devices they serve from outside manipulation. The Commission noted that virtually all online transactions involving financial or other confidential information currently use security measures to protect against unauthorized viewing and/or alteration of information being sent and to ensure that only authorized users have access to information. It therefore expects that device manufacturers and database administrators will have access to and be able to incorporate the reliability and security measures needed to protect the contents of databases and communications between databases and TV bands devices or other databases. In addition, the Commission required that all information that is required by the Commission's rules to be in a TV bands device database be publicly available, including fixed TV bands device registration and voluntarily submitted protected entity (e.g., cable head ends) information. Although much of the data will come from Commission databases that already are public sources, errors could result from the inadvertent entry of incorrect data, or as a result of a party deliberately entering false data. The Commission found it is appropriate to permit public examination of protected entity registration information to allow the detection and correction of errors.

112. The Commission made certain changes to the technical requirements for TV bands devices. It adopted a power spectral density (PSD) limit, which is a measure of transmitter power per unit of bandwidth. In the absence of a PSD limit, multiple devices with transmit bandwidths of significantly less than the width of a TV channel (6 megahertz) could share a single channel, resulting in a total transmitted power within a channel significantly greater than the power limits for fixed or personal/portable devices. A PSD limit will prohibit high power concentrations in a single channel, which will reduce the interference potential to TV stations and other services in the TV bands. The Commission also adopted changes to the measurement procedure for TV bands device emissions that fall into a TV channel adjacent to the operating channel to ensure that consistent measurement results are obtained regardless of the bandwidth of the transmitted signal.

113. The Commission also removed the prohibition on TV bands devices operating within the border areas near Canada and Mexico. It found that TV stations in Canada and Mexico could be protected by including them in the TV bands device database rather than by a blanket exclusion on TV bands device operation within the border areas.

F. Report to Congress

114. The Commission will send a copy of the Second Memorandum Opinion and Order, including this FRFA, in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act.²⁴ A copy of the Second Memorandum Opinion and Order and FRFA (or summaries thereof) will also be published in the **Federal Register**.²⁵

Ordering Clauses

115. Pursuant to the authority contained in sections 4(i), 302, 303(e), 303(f), and 307 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 302, 303(c), 303(f), and 307 this Second Memorandum Opinion and Order *is hereby adopted*.

116. Pursuant to sections 4(i), 302, 303(e), 303(f), 303(g), 303(r) and 405 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 302, 303(e), 303(f), 303(g), 303(r) and 405, the petitions for reconsideration addressed *are granted* to the extent discussed and the remainder of requests in the petitions for reconsideration *are denied* as discussed.

117. Part 15 of the Commission's rules *is amended* as specified in Appendix B, and such rule amendments shall be effective January 5, 2011 except for §§ 15.713, 15.714, 15.715 and 15.717, which contains information collection requirements that require approval by the Office of Management and Budget (OMB) under the PRA. The Federal Communications Commission will publish a document in the **Federal Register** announcing such approval and the relevant effective date.

118. Pursuant to sections 4(i), 302, 303(e), 303(f), 303(g), 303(r) and 405 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 302, 303(e), 303(f), 303(g), 303(r) and 405, the remainder of requests in the petitions for reconsideration addressed herein *are denied*.

119. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, *shall send* a copy of the Second Memorandum Opinion and Order, including the Final Regulatory

²³ 5 U.S.C. 603(c)(1) through (c)(4).

²⁴ See 5 U.S.C. 801(a)(1)(A).

²⁵ See 5 U.S.C. 604(b).

Flexibility Analysis, to the Chief Counsel for Advocacy of the U.S. Small Business Administration.

List of Subjects

47 CFR Part 0

Organization and functions (government agencies), Reporting and recordkeeping requirements.

47 CFR Part 15

Communications equipment.
Federal Communications Commission.
Marlene H. Dortch,
Secretary.

Final Rules

■ For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR parts 0 and 15 to read as follows:

PART 0—COMMISSION ORGANIZATION

■ 1. The authority citation for part 0 continues to read as follows:

Authority: Sec. 5, 48 Stat. 1068, as amended; 47 U.S.C. 155, 225, unless otherwise noted.

■ 2. Section 0.241 is amended by redesignating paragraph (h) as paragraph (i) and adding new paragraph (h) to read as follows:

§ 0.241 Authority delegated.

* * * * *

(h) The Chief of the Office of Engineering and Technology is delegated authority to administer the database functions for unlicensed devices operating in the television broadcast bands (TV bands) as set forth in subpart H of part 15 of this chapter. The Chief is delegated authority to develop specific methods that will be used to designate TV bands database managers, to designate these database managers; to develop procedures that these database managers will use to ensure compliance with the requirements for database operations; to make determinations regarding the continued acceptability of individual database managers; and to perform other functions as needed for the administration of the TV bands databases. The Chief is also delegated authority jointly with the Chief of the Wireless Telecommunications Bureau to administer provisions of § 15.713(h)(8) of this chapter pertaining to the registration of event sites where large numbers of wireless microphones that operate on frequencies specified in § 74.802 of this chapter are used.

* * * * *

■ 3. Section 0.331 is amended by revising the introductory text and adding new paragraph (e) to read as follows:

§ 0.331 Authority delegated.

The Chief, Wireless Telecommunications Bureau, is hereby delegated authority to perform all functions of the Bureau, described in § 0.131, subject to the exceptions and limitations in paragraphs (a) through (d) of this section, and also the functions described in paragraph (e) of this section.

* * * * *

(e) The Chief of the Wireless Telecommunications Bureau is delegated authority jointly with the Chief of the Office of Engineering and Technology to administer provisions of § 15.713(h)(8) of this chapter pertaining to the registration of event sites where large numbers of wireless microphones that operate on frequencies specified in § 74.802 of this chapter are used.

PART 15—RADIO FREQUENCY DEVICES

■ 4. The authority citation for part 15 continues to read as follows:

Authority: 47 U.S.C. 154, 302a, 303, 304, 307, 336, and 544a.

■ 5. Section 15.701 is revised to read as follows:

§ 15.701 Scope.

This subpart sets forth the regulations for unlicensed Television Band Devices (TVBDs). These devices are unlicensed intentional radiators that operate on available TV channels in the broadcast television frequency bands at 54–60 MHz (TV channel 2), 76–88 MHz (TV channels 5 and 6), 174–216 MHz (TV channels 7–13), 470–608 MHz (TV channels 14–36) and 614–698 MHz (TV channels 38–51).

■ 6. Section 15.703 is revised to read as follows:

§ 15.703 Definitions.

(a) *Available channel*. A six-megahertz television channel, as specified in § 73.603 of this chapter, which is not being used by an authorized service at or near the same geographic location as the TVBD and is acceptable for use by an unlicensed device under the provisions of this subpart.

(b) *Contact verification signal*. An encoded signal broadcast by a fixed or Mode II device for reception by Mode I devices to which the fixed or Mode II device has provided a list of available channels for operation. Such signal is for the purpose of establishing that the

Mode I device is still within the reception range of the fixed or Mode II device for purposes of validating the list of available channels used by the Mode I device and shall be encoded to ensure that the signal originates from the device that provided the list of available channels. A Mode I device may respond only to a contact verification signal from the fixed or Mode II device that provided the list of available channels on which it operates. A fixed or Mode II device shall provide the information needed by a Mode I device to decode the contact verification signal at the same time it provides the list of available channels.

(c) *Fixed device*. A TVBD that transmits and/or receives radiocommunication signals at a specified fixed location. A fixed TVBD may select channels for operation itself from a list of available channels provided by a TV bands database, initiate and operate a network by sending enabling signals to one or more fixed TVBDs and/or personal/portable TVBDs. Fixed devices may provide to a Mode I personal/portable device a list of available channels on which the Mode I device may operate under the rules, including available channels above 512 MHz (above TV channel 20) on which the fixed TVBD also may operate and a supplemental list of available channels above 512 MHz (above TV channel 20) that are adjacent to occupied TV channels on which the Mode I device, but not the fixed device, may operate.

(d) *Geo-location capability*. The capability of a TVBD to determine its geographic coordinates within the level of accuracy specified in § 15.711(b)(1), i.e. 50 meters. This capability is used with a TV bands database approved by the FCC to determine the availability of TV channels at a TVBD's location.

(e) *Mode I personal/portable device*. A personal/portable TVBD that does not use an internal geo-location capability and access to a TV bands database to obtain a list of available channels. A Mode I device must obtain a list of available channels on which it may operate from either a fixed TVBD or Mode II personal/portable TVBD. A Mode I device may not initiate a network of fixed and/or personal/portable TVBDs nor may it provide a list of available channels to another Mode I device for operation by such device.

(f) *Mode II personal/portable device*. A personal/portable TVBD that uses an internal geo-location capability and access to a TV bands database, either through a direct connection to the Internet or through an indirect connection to the Internet by way of fixed TVBD or another Mode II TVBD,

to obtain a list of available channels. A Mode II device may select a channel itself and initiate and operate as part of a network of TVBDs, transmitting to and receiving from one or more fixed TVBDs or personal/portable TVBDs. A Mode II personal/portable device may provide its list of available channels to a Mode I personal/portable device for operation on by the Mode I device.

(g) *Network initiation.* The process by which a fixed or Mode II TVBD sends control signals to one or more fixed TVBDs or personal/portable TVBDs and allows them to begin communications.

(h) *Operating channel.* An available channel used by a TVBD for transmission and/or reception.

(i) *Personal/portable device.* A TVBD that transmits and/or receives radiocommunication signals at unspecified locations that may change. Personal/portable devices may only transmit on available channels in the frequency bands 512–608 MHz (TV channels 21–36) and 614–698 MHz (TV channels 38–51).

(j) *Receive site.* The location where the signal of a full service television station is received for rebroadcast by a television translator or low power TV station, including a Class A TV station, or for distribution by a Multiple Video Program Distributor (MVPD) as defined in 47 U.S.C. 602(13).

(k) *Sensing only device.* A personal/portable TVBD that uses spectrum sensing to determine a list of available channels. Sensing only devices may transmit on any available channels in the frequency bands 512–608 MHz (TV channels 21–36) and 614–698 MHz (TV channels 38–51).

(l) *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.

(m) *Television band device (TVBD).* Intentional radiators that operate on an unlicensed basis on available channels in the broadcast television frequency bands at 54–60 MHz (TV channel 2), 76–88 MHz (TV channels 5 and 6), 174–216 MHz (TV channels 7–13), 470–608 MHz (TV channels 14–36) and 614–698 MHz (TV channels 38–51).

(n) *TV bands database.* A database system that maintains records of all authorized services in the TV frequency bands, is capable of determining the available channels as a specific geographic location and provides lists of available channels to TVBDs that have been certified under the Commission's equipment authorization procedures. TV bands databases that provide lists of available channels to TVBDs must receive approval by the Commission.

■ 7. Section 15.706 is amended by revising paragraph (a) to read as follows:

§ 15.706 Information to the user.

(a) In addition to the labeling requirements contained in § 15.19, the instructions furnished to the user of a TVBD shall include the following 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 bands 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. 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.

* * * * *

■ 8. Section 15.707 is revised to read as follows:

§ 15.707 Permissible channels of operation.

(a) All TVBDs are permitted to operate available channels in the frequency bands 512–608 MHz (TV channels 21–36) and 614–698 MHz (TV channels 38–51), subject to the interference protection requirements in §§ 15.711 and 15.712, except that operation of TVBDs is prohibited on the first channel above and the first channel below TV channel 37 (608–614 MHz) that are available, *i.e.*, not occupied by an authorized service. If a channel is not available both above and below channel 37, operation is prohibited on the first two channels nearest to channel 37. These channels will be identified and protected in the TV bands database(s).

(b) Operation on available channels in the bands 54–60 MHz (TV channel 2), 76–88 MHz (TV channels 5 and 6), 174–216 MHz (TV channels 7–13) and 470–512 MHz (TV channels 14–20), 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.

(c) Fixed and Mode II TVBDs shall operate only on available channels as identified in paragraphs (a) and (b) of

this section and as determined by a TV bands database in accordance with the interference avoidance mechanisms of §§ 15.711 and 15.712.

(d) Mode I TVBDs shall operate only on available channels as identified in paragraphs (a) and (b) of this section and provided from a fixed or Mode II TVBD in accordance with § 15.711(b)(3)(iv).

■ 9. Section 15.709 is amended by revising paragraphs (a) and (b); removing paragraph (c) introductory text and adding a heading to paragraph (c) in its place; and revising paragraphs (c) (1) through (c)(3) to read as follows:

§ 15.709 General technical requirements.

(a) *Power limits for TVBDs.* (1) For fixed TVBDs, the maximum power delivered to the transmitting antenna shall not exceed one watt per 6 megahertz of bandwidth on which the device operates. The power delivered to the transmitting antenna is the maximum conducted output power reduced by the signal loss experienced in the cable used to connect the transmitter to the transmit 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 EIRP shall not exceed 100 milliwatts (20 dBm) per 6 megahertz of bandwidth on which the device operates with the following exceptions; Mode II personal/portable TVBDs that do not meet the adjacent channel separation requirements in § 15.712(a) and Mode I personal/portable TVBDs that operate on available channels (provided by a Mode II TVBD) that do not meet the adjacent channel separation requirements of § 15.712(a) are limited to a maximum EIRP of 40 milliwatts (16 dBm) per 6 megahertz of bandwidth on which the device operates.

(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.

(4) Maximum conducted output power is the total transmit power over the occupied 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.

(5) The power spectral density conducted from the TVBD to the antenna shall not be greater than the following values when measured in any 100 kHz band during any time interval of continuous transmission:

(i) Fixed devices: 12.2 dBm.

(ii) Personal/portable devices operating adjacent to occupied TV channels: -1.8 dBm.

(iii) Sensing-only devices: -0.8 dBm.

(iii) All other personal/portable devices: 2.2 dBm.

(6) TVBDs shall incorporate adequate security measures to prevent the 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 height above average terrain (HAAT) at ground level is more than 76 meters. The ground level 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 a TVBD is operating, emissions from the TVBD shall be at least 72.8 dB below the highest average power in the TV channel in which the device is operating.

(2) Emission measurements in the channel of operation shall be performed over a reference bandwidth of 6 megahertz with an average detector.

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.

(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.

* * * * *

■ 10. Section 15.711 is amended by revising the section heading, adding introductory text, and revising paragraphs (a) through (f) to read as follows:

§ 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; offshore 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 Mode I personal/portable TVBD may only transmit upon receiving a list of available channels from a fixed or Mode II TVBD that has contacted a database and verified that the FCC identifier (FCC ID) of the Mode I device is valid. The list of channels provided to the Mode I device must be the same as the list of channels that are available to the fixed or Mode II device, except that a Mode I device may operate only on 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. 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. 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/reestablish contact with a fixed or Mode II device to obtain a list of available channels if they lose 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 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.

(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.

* * * * *

■ 11. Section 15.712 is amended by revising paragraphs (a)(1), (a)(2), (b), (d), (f), (g), paragraph (h) introductory text and (h)(3) to read as follows:

§ 15.712 Interference protection requirements.

(a) * * *

(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, 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 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	6.0	0.1
3—Less than 10 meters	8.0	0.1
10–30 meters	14.4	0.74

(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 TV bands database if they are no farther than 80 km outside the nearest edge of the relevant contour(s). Only channels received over the air and used by the MVPD, TV translator station or low power/Class A TV station may be registered. TVBDs

may not operate within an arc of ± 30 degrees from a line between a registered receive site and the contour of the TV station being received in the direction of the station's transmitter at a distance of up to 80 km from the edge of the protected contour of the received TV station for co-channel operation and up to 20 km from the registered receive site for adjacent channel operation, except that the protection distance shall not exceed the distance from the receive site to the protected contour. 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. For purposes of this section, a TV station being received may include a full power TV station, TV translator station or low power TV/Class A TV station.

* * * * *

(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 authorized by waiver 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.

* * * * *

(f) *Low power auxiliary services, including wireless microphones:* (1) Fixed TVBDs are not permitted to operate within 1 km, and personal/portable TVBDs will not be permitted to operate within 400 meters, of the

coordinates of registered low power auxiliary station sites on the registered channels during the designated times they are used by low power auxiliary stations.

(2) TVBDs are not permitted to operate on the first channel on each side of TV channel 37 (608–614 MHz) that is not occupied by a licensed service.

(g) *Border areas near Canada and Mexico:* Fixed and personal/portable TVBDs shall comply with the required separation distances in § 15.712(a)(2) from the protected contours of TV

stations in Canada and Mexico. TVBDs are not required to comply with these separation distances from portions of the protected contours of Canadian or Mexican TV stations that fall within the United States.

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

* * * * *

(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)	Rectangle between latitudes 33 58 22 N and 34 14 56 N, and longitudes 107 24 40 W and 107 48 22 W	
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

■ 11. Section 15.713 is amended by revising paragraphs (a)(1), (b)(2)(i), (c)(2), (d), (e), (f)(3), (h) introductory text, (h)(1), and (h)(6) through (h)(9), and adding new paragraph (j) to read as follows:

§ 15.713 TV bands database.

(a) * * *

(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. A database must provide fixed and Mode II personal portable TVBDs with channel availability information that includes scheduled changes in channel availability over the course of the 48 hour period beginning at the time the TVBDs make a re-check contact. In making lists of available channels available to a TVBD, the TV bands database shall ensure that all communications and interactions between the TV bands database and the 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 affect the

database system or TVBDs in performing their intended functions or in providing adequate interference protections to authorized services operating in the TV bands. In addition, a TV bands database must also verify that the FCC identifier (FCC ID) of a device seeking access to its services is valid; under this requirement the TV bands database must also verify that the FCC ID of a Mode I device provided by a fixed or Mode II device is valid. A list of devices with valid FCC IDs and the FCC IDs of those devices is to be obtained from the Commission's Equipment Authorization System.

* * * * *

(b) * * *

(2) * * *

(i) MVPD receive sites.

* * * * *

(c) * * *

(2) MVPD receive sites within the protected contour or more than 80 kilometers from the nearest edge of the protected contour of a television station being received are not eligible to register that station's 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.

(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 this subpart.

(2) Fixed and Mode II TVBDs shall not transmit unless they receive, from the TV bands database, a list of available channels and may only transmit on the available channels on the list provided by the database.

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

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

(5) A fixed or Mode II TVBD that provides a list of available channels to a Mode I device shall notify the database of the FCC identifier of such

Mode I device and receive verification that that FCC identifier is valid before providing the list of available channels to the Mode I device.

(6) A fixed device located at a site where the ground level height above average terrain (HAAT) is greater than 76 meters shall not be provided a list of available channels. The ground level HAAT of sites occupied by fixed TVBDs is to be calculated using computational software employing the methodology in § 73.684(d) of this chapter.

(f) * * *

(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) Device's antenna height above ground level (meters);
- (v) Name of the individual or business that owns the device;
- (vi) Name of a contact person responsible for the device's operation;
- (vii) Address for the contact person;
- (viii) E-mail address for the contact person;
- (ix) Phone number for the contact person.

* * * * *

(h) *TV bands database information.* 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, including stations in Canada and Mexico that are within the border coordination areas as specified in § 73.1650 of this chapter (a TV bands database is to include only TV station information from station license or license application records. In cases where a station has records for both a license application and a license, a TV bands database should include the information from the license application rather than the license. In cases where there are multiple license application records or license records for the same station, the database is to include the most recent records, and again with license applications taking precedence over licenses.):

- (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) Amount of electrical and mechanical beam tilt (degrees depression below horizontal) and orientation of mechanical beam tilt (degrees azimuth clockwise from true north);

- (vi) Channel number; and
- (vii) Station call sign.

* * * * *

(6) MVPD receive sites. Registration for receive sites is limited to channels that are received over-the-air and are used as part of the MVPD service.

- (i) Name and address of MVPD company;
- (ii) Location of the MVPD receive site (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 MVPD receive site 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. Registration for television translator, low power TV and Class A receive sites is limited to channels that are received over-the-air and are used as part of the station's service.

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

(8) Licensed low power auxiliary stations, including wireless microphones and wireless assist video devices. Use of licensed low power auxiliary stations 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. Registrations must include the following information:

(i) Name of the individual or business responsible for the low power auxiliary device(s);

- (ii) An address for the contact person;
- (iii) An email 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, weeks, days of the week and times when the device(s) are used (on dates when microphones are not used the site will not be protected); and

(viii) The stations call sign.

(9) Unlicensed wireless microphones at venues of events and productions/shows that use large numbers of wireless microphones that cannot be accommodated in the two reserved channels and other channels that are not available for use by TVBDs at that location. Such sites of large events and productions/shows with significant wireless microphone use at well defined times and locations may be registered in the database. Entities responsible for eligible event venues registering their site with a TV bands data base are required to first make use of the two reserved channels and other channels that are not available for use by TVBDs at that location. As a benchmark, at least 6–8 wireless microphones should be operating in each channel used at such venues (both licensed and unlicensed wireless microphones used at the event may be counted to comply with this benchmark). Multiple registrations that specify more than one point in the facility may be entered for very large sites. Sites of eligible event venues using unlicensed wireless microphones must be registered with the Commission at least 30 days in advance and the Commission will provide this information to the data base managers. Parties responsible for eligible event venues filing registration requests must certify that they are making use of all TV channels not available to TV bands devices and on which wireless microphones can practicably be used, including channels 7–51 (except channel 37). The Commission will make requests for registration of sites that use unlicensed wireless microphones public and will provide an opportunity for public comment or objections. Registrations will be valid for one year, after which they may be renewed. The Commission will take actions against parties that file inaccurate or incomplete information, such as denial of registration in the database, removal of

information from the database pursuant to paragraph (i) of this section, or other sanctions as appropriate to ensure compliance with the rules. Registrations must include the following information:

(i) Name of the individual or business that owns the unlicensed wireless microphones;

(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 wireless microphones operated at the site and the number of wireless microphones used in each channel. As a benchmark, least 6–8 wireless microphones must be used in each channel. Registration requests that do not meet this criteria will not be registered in the TV bands data bases;

(vii) Specific months, weeks, days of the week and times when the device(s) are used (on dates when microphones are not used the site will not be protected); and

(viii) The name of the venue.

* * * * *

(j) *Security.* The TV bands database shall employ protocols and procedures to ensure that all communications and interactions between the TV bands 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 a TVBD.

(1) Communications between TV bands devices and TV bands databases, and between different TV bands databases, shall be secure to prevent corruption or unauthorized interception of data. A TV bands database shall be protected from unauthorized data input or alteration of stored data.

(2) A TV bands database shall verify that the FCC identification number supplied by a fixed or personal/portable TV bands device is for a certified device and may not provide service to an uncertified device.

(3) A TV bands database must not provide lists of available channels to uncertified TV bands devices for purposes of operation (it is acceptable for a TV bands database to distribute lists of available channels by means other than contact with TVBDs to provide list of channels for operation). To implement this provision, a TV bands database administrator shall obtain a list of certified TVBDs from the FCC Equipment Authorization System.

■ 12. Section 15.714 is amended by revising paragraph (a) to read as follows:

§ 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.

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■ 13. Section 15.715 is amended by revising the introductory text, revising paragraphs (c), (d), and (e), redesignating paragraphs (f) through (k) as paragraphs (g) through (l), revising newly designated paragraphs (h) through (l), and adding new paragraph (f) to read as follows:

§ 15.715 TV bands database administrator.

The Commission will designate one or more entities to administer the TV bands database(s). The Commission may, at its discretion, permit the functions of a TV bands database, such as a data repository, registration, and query services, to be divided among multiple entities; however, it will designate specific entities to be a database administrator responsible for coordination of the overall functioning of a database and providing services to TVBDs. Each database administrator designated by the Commission shall:

* * * * *

(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 MVPD and TV translator receive sites.

(d) Establish a process for registering facilities where part 74 low power auxiliary stations 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 and provide accurate lists of available channels to fixed and Mode II devices requesting lists of available channels for Mode I devices. Database administrators may allow prospective operators of TV bands devices to query the database and determine whether there are vacant channels at a particular location.

(f) Establish protocols and procedures to ensure that all communications and interactions between the TV bands 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 a TVBD consistent with the provisions of § 15.713(i).

* * * * *

(h) Provide service for a five-year term. This term can be renewed at the Commission's discretion.

(i) 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. This requirement applies only to information that the Commission requires to be stored in the database.

(j) 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.

(k) 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.

(l) 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.

■ 14. Section 15.717 is revised to read as follows:

§ 15.717 TVBDs that rely on spectrum sensing.

(a) *Applications for certification.* 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) *Power limit for devices that rely on sensing.* The TVBD shall meet the requirements for personal/portable devices in this subpart except that it will be limited to a maximum EIRP of 50 mW per 6 megahertz of bandwidth on which the device operates and 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

§ 15.717(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.

(c) *Sensing requirements.*

(1) *Detection threshold.*

(i) The required detection thresholds are:

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

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

(C) Low power auxiliary, including wireless microphone, signals: -107 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 rotatable 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) *Channel availability check time.* A TVBD may start operating on a TV channel if no TV, wireless microphone or other low power auxiliary device signals above the detection threshold are detected within a minimum time interval of 30 seconds.

(3) *In-service monitoring.* A TVBD must perform in-service monitoring of an operating channel at least once every 60 seconds. There is no minimum channel availability check time for in-service monitoring.

(4) *Channel move time.* After a TV, 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.

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