

exposure requirements in §§1.1307(b), 2.1091 and 2.1093 of this chapter, fixed white space devices shall be accompanied by instructions on measures to take to ensure that persons maintain a distance of at least 40 cm from the device, as well as any necessary hardware that may be needed to implement that protection. These instructions shall be submitted with the application for certification.

(2) *Personal/portable white space devices.* Personal/portable white space devices that meet the definition of portable devices under §2.1093 of this chapter and that operate with a source-based time-averaged output of less than 20 mW will not be subject to routine evaluation for compliance with the radio frequency exposure guidelines in §§1.1307(b), 2.1091, and 2.1093 of this chapter, while devices that operate with a source-based time-average output power greater than 20 mW will be subject to the routine evaluation requirements.

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#### § 15.711 Interference avoidance methods.

Except as provided in §15.717 of this part, channel availability for a white space device is determined based on the geo-location and database access method described in paragraphs (a) through (e) of this section.

(a) *Geolocation required.* White space devices shall rely on a geolocation capability and database access mechanism to protect the following authorized service in accordance with the interference protection requirements of §15.712: 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 licensed wireless microphones; MVPD receive sites; wireless medical telemetry service (WMTS); radio astronomy service (RAS); and 600 MHz service band licenses where they have commenced oper-

ations, as defined in §27.4 of this chapter. In addition, protection shall be provided in border areas near Canada and Mexico in accordance with §15.712(g).

(b) *Geo-location requirement—(1) Accuracy.* Fixed white space devices that incorporate a geo-location capability and Mode II devices shall determine their location and their geo-location uncertainty (in meters), with a confidence level of 95%.

(2) *Reference datum.* All geographic coordinates shall be referenced to the North American Datum of 1983 (NAD 83).

(c) *Requirements for fixed white space devices.* (1) The geographic coordinates of a fixed white space device shall be determined at the time of installation and first activation from a power off condition by an incorporated geo-location capability. The antenna height above ground shall be determined by the installer or operator of the device, or by an automatic means. This information shall be stored internally in the white space device and transmitted automatically by the device to the white space database. The operator of a fixed white space device shall be responsible for assuring the accuracy of the information registered in the white space database. If a fixed white space device is moved to another location or if its stored coordinates become altered, the operator shall reestablish the device's:

(i) Geographic location through the incorporated geo-location capability and the antenna height above ground level and store this information in the white space device; and

(ii) Registration with the database based on the device's new coordinates and antenna height above ground level.

(iii) A fixed white space device may obtain its geographic coordinates through an external geo-location source when it is used at a location where its internal geo-location capability does not function. An external geo-location source may be connected to a fixed device through either a wired or a wireless connection, and a single geo-location source may provide location information to multiple fixed devices. An external geo-location source must be connected to a fixed device

using a secure connection that ensures that only an external geo-location source that has been approved with a particular fixed device can provide geographic coordinates to that device. The geographic coordinates must be provided automatically by the external geo-location source to the fixed device; users may not manually enter them. Alternatively, an extender cable may be used to connect a remote receive antenna to a geo-location receiver within a fixed device.

(iv) The applicant for certification of a fixed device must demonstrate the accuracy of the geo-location method used and the location uncertainty as defined in paragraph (b) of this section. For fixed devices that are not using an internal geo-location capability, this uncertainty must account for the accuracy of the geo-location source and the separation distance between such source and the white space device.

(2)(i) Each fixed white space device must access a white space database over the Internet to determine the available channels and the corresponding maximum permitted power for each available channel that is available at its geographic coordinates, taking into consideration the fixed device's antenna height above ground level and geo-location uncertainty, prior to its initial service transmission at a given location.

(ii) Operation is permitted only on channels and at power levels that are indicated in the database as being available for each white space device. Operation on a channel must cease immediately or power must be reduced to a permissible level if the database indicates that the channel is no longer available at the current operating level.

(iii) Each fixed white space device shall access the database at least once a day to verify that the operating channels continue to remain available. Each fixed white space device must adjust its use of channels in accordance with channel availability schedule information provided by its database for the 48-hour period beginning at the time the device last accessed the database for a list of available channels. The fixed device's registration information shall be updated if the geo-

graphic coordinates reported to the database differ by more than  $\pm 50$  meters from the previously registered coordinates.

(iv) Fixed devices without a direct connection to the Internet: A fixed white space device may not operate on channels provided by a white space database for another fixed device. A fixed white space device that has not yet been initialized and registered with a white space database consistent with § 15.713 of this part, but can receive the transmissions of another fixed white space device, may transmit to that other fixed white space device on either a channel that the other white space device has transmitted on or on a channel which the other white space device 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 fixed white space device must only use the channels that the database indicates are available for it to use.

(d) *Requirements for Mode II personal/portable white space devices.* (1) The geographic coordinates of a Mode II personal/portable white space device shall be determined by an incorporated geo-location capability prior to its initial service transmission at a given location and each time the device is activated from a power-off condition to determine the available channels and the corresponding maximum permitted power for each available channel at its geographic coordinates, taking into consideration the device's geo-location uncertainty. The location must be checked 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.

(2) Each Mode II personal/portable white space device must access a white space database over the Internet to obtain a list of available channels for its location. The device must access the database for an updated available channel list if its location changes by more than 100 meters from the location at which it last established its available channel list.

(3) Operation is permitted only on channels and at power levels that are

indicated in the database as being available for the Mode II personal/portable white space device. Operation on a channel must cease immediately or power must be reduced to a permissible level if the database indicates that the channel is no longer available at the current operating level.

(4) A Mode II personal/portable white space 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) and corresponding power levels continue to be available. Mode II personal/portable devices must adjust their use of channels and power levels 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.

(5) A Mode II personal/portable device may load channel availability information for multiple locations, (*i.e.*, in the vicinity of its current location) and use that information to define a geographic area within which it can operate on the same available channels at all locations. For example a Mode II personal/portable white space device 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 white space device 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.

(e) *Requirements for Mode I personal/portable white space devices.* (1) A Mode I personal/portable white space device may only transmit upon receiving a list of available channels from a fixed or Mode II white space device. A fixed or Mode II white space 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.

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

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

(4) 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 white space device or on a channel the fixed or Mode II white space device indicates is available for use by a Mode I device. 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 white space device that provided its current list of available channels or contact a Mode II or fixed white space 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. If a fixed or Mode II white space device loses power and obtains a new channel list, it must signal all Mode I devices it is serving to acquire and use a new channel list.

(f) *Display of available channels.* A white space device must incorporate the capability to display a list of identified available channels and its operating channels.

(g) *Identifying information.* Fixed white space devices 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.

(h) *Continuing operation.* If a fixed or Mode II personal/portable white space device fails to successfully contact the white space 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 white space database and re-verifies its list of available channels.

(i) *Push notifications.* White space device manufacturers and database administrators must implement the push notification requirements of paragraphs (i)(1) and (2) of this section, and may also implement a system that pushes additional updated channel availability information from the database to white space devices.

(1) In response to a request for immediate access to a channel by a licensed wireless microphone user, white space database administrators are required to share the licensed microphone channel registration information to all other white space database administrators within 10 minutes of receiving each wireless microphone registration.

(2) White space database administrators shall push updated available channel lists to fixed and Mode II personal/portable white space devices within 20 minutes of receiving the notification required by paragraph (i)(1) of this section. The information need only be pushed to white space devices that are located within the separation distances, specified in §15.712(f) of this part, for each licensed wireless microphone registration received.

(3) White space database administrators must update their systems to comply with these requirements no later than December 23, 2016.

(j) *Security.* (1) White space 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 white space devices and databases 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. This requirement applies to communications of channel availability and other spectrum access information between the databases and fixed and Mode II devices (it is not necessary for white space devices 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).

(2) 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 white space 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.

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

(4) Applications for certification of white space devices shall 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 white space devices shall identify at least one of the white space databases operated

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by a designated white space 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.

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**§ 15.712 Interference protection requirements.**

The separation distances in this section apply to fixed and personal/portable white space devices with a location accuracy of ±50 meters. These dis-

tances must be increased by the amount that the location uncertainty of a white space device exceeds ±50 meters.

(a) *Digital television stations, and digital and analog Class A TV, low power TV, TV translator and TV booster stations*—(1) *Protected contour*. White space devices 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)
	Low VHF (2–6) .....	28	F(50,90)
Digital: Full service TV, Class A TV, LPTV, translator and booster.	High VHF (7–13) .....	36	F(50,90)
	UHF (14–51) .....	41	F(50,90)

(2) *Required separation distance*. White space devices 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 tables.

(i) If a device operates between two defined power levels, it must comply with the separation distances for the higher power level.

(ii) White space devices operating at 40 mW EIRP or less are not required to

meet the adjacent channel separation distances.

(iii) Fixed white space devices operating at 100 mW EIRP or less per 6 megahertz across multiple contiguous TV channels with at least 3 megahertz separation between the frequency band occupied by the white space device and adjacent TV channels are not required to meet the adjacent channel separation distances.

(iv) Fixed white space devices may only operate above 4 W EIRP in less congested areas as defined in § 15.703(h).

**MODE II PERSONAL/PORTABLE WHITE SPACE DEVICES**

	Required separation in kilometers from co-channel digital or analog TV (full service or low power) protected contour	
	16 dBm (40 mW)	20 dBm (100 mW)
Communicating with Mode II or Fixed device .....	1.3	1.7
Communicating with Mode I device .....	2.6	3.4

**FIXED WHITE SPACE DEVICES**

Antenna height above average terrain of unlicensed devices (meters)	Required separation in kilometers from co-channel digital or analog TV (full service or low power) protected contour*						
	16 dBm (40 mW)	20 dBm (100 mW)	24 dBm (250 mW)	28 dBm (625 mW)	32 dBm (1600 mW)	36 dBm (4 W)	40 dBm (10 W)
Less than 3 .....	1.3	1.7	2.1	2.7	3.3	4.0	4.5