

§ 15.707

(4) Consult the manufacturer, dealer or an experienced radio/TV technician for help.

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

§ 15.707 Permissible channels of operation.

(a)(1) All white space devices are permitted to operate on available channels in the frequency bands 470–698 MHz (TV channels 14–51), subject to the interference protection requirements in §§ 15.711 and 15.712, except as provided in paragraph (a)(2) of this section.

(2) White space devices are not permitted to operate on the first channel above and below TV channel 37 (608–614 MHz) that are available (*i.e.*, not occupied by an authorized service) until June 23, 2017, but no later than release of the Channel Reassignment Public Notice upon completion of the broadcast television spectrum incentive auction, as defined in § 73.3700(a) of this chapter. 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 white space database(s).

(3) *600 MHz guard band.* In the 600 MHz guard band between television and 600 MHz service downlink bands, white space devices may only operate immediately adjacent to the television band with a maximum bandwidth of 6 megahertz. White space devices are prohibited from operating in the three megahertz segment adjacent to the 600 MHz service band.

(4) *600 MHz duplex gap.* In the 600 MHz duplex gap, white space devices shall only operate in the 6 megahertz segment immediately adjacent to the 600 MHz service uplink band.

(5) *600 MHz service band.* White space devices may operate on frequencies in the 600 MHz service band in areas where 600 MHz band licensees have not commenced operations, as defined in § 27.4 of this chapter.

47 CFR Ch. I (10–1–16 Edition)

(6) *Channel 37 guard band.* White space devices are not permitted to operate in either three megahertz segment above or below channel 37 if that spectrum is adjacent to the 600 MHz service band.

(b) Only fixed white space devices that communicate only with other fixed white space devices may operate on available channels in the bands 54–72 MHz (TV channels 2–4), 76–88 MHz (TV channels 5 and 6), and 174–216 MHz (TV channels 7–13), subject to the interference protection requirements in §§ 15.711 and 15.712.

[80 FR 73070, Nov. 23, 2015, as amended at 81 FR 4974, Jan. 29, 2016]

§ 15.709 General technical requirements.

(a) *Radiated power limits.* The maximum white space device EIRP per 6 MHz shall not exceed the limits of paragraphs (a)(2) through (4) of this section.

(1) *General requirements.* (i) White space devices may be required to operate with less power than the maximum permitted to meet the co-channel and adjacent channel separation requirements of § 15.712 of this part.

(ii) Mode I personal/portable devices are limited to 40 mW, if the white space device that controls it is limited to 40 mW.

(2) *TV bands and 600 MHz service band.*

(i) Fixed devices: Up to 4 W (36 dBm) EIRP, and up to 10 W (40 dBm) EIRP in less congested areas in the TV bands and 600 MHz service band at locations where they meet the co-channel and adjacent channel separation distances of §§ 15.712(a)(2) and 15.712(i) of this part, respectively. Operation in the 602–620 MHz band is limited to a maximum of 4 W (36 dBm) EIRP.

(ii) Personal/Portable devices: Up to 100 mW (20 dBm) EIRP.

(3) *608–614 MHz band (channel 37).* (i) Fixed devices: Up to 4 W (36 dBm) EIRP.

(ii) Personal/Portable devices: Up to 100 mW (20 dBm) EIRP.

(4) *600 MHz duplex gap and guard bands.* Up to 40 mW (16 dBm) EIRP.

(b) *Technical limits—(1) Fixed white space devices.* (i) Technical limits for fixed white space devices are shown in

the table and subject to the requirements of this section.

(ii) For operation at EIRP levels of 36 dBm (4000 mW) or less, fixed white space devices may operate at EIRP levels between the values shown in the table provided that the conducted power and the conducted power spec-

tral density (PSD) limits are linearly interpolated between the values shown and the adjacent channel emission limit of the higher value shown in the table is met. Operation at EIRP levels above 36 dBm (4000 mW) shall follow the requirements for 40 dBm (10,000 mW).

EIRP (6 MHz)	Conducted power limit ¹ (6 MHz)	Conducted PSD limit (100 kHz)	Conducted adjacent channel emission limit (100 kHz)
16 dBm (40 mW)	10 dBm (10 mW)	-7.4 dBm	-62.8 dBm
20 dBm (100 mW)	14 dBm (25 mW)	-3.4 dBm	-58.8 dBm
24 dBm (250 mW)	18 dBm (63 mW)	0.6 dBm	-54.8 dBm
28 dBm (625 mW)	22 dBm (158 mW)	4.6 dBm	-50.8 dBm
32 dBm (1600 mW)	26 dBm (400 mW)	8.6 dBm	-46.8 dBm
36 dBm (4000 mW)	30 dBm (1000 mW)	12.6 dBm	-42.8 dBm
40 dBm (10000 mW)	30 dBm (1000 mW)	12.6 dBm	-42.8 dBm

¹The conducted power spectral density from a fixed white space device shall not be greater than the values shown in the table when measured in any 100 kHz band during any time interval of continuous transmission, except that a 40 mW fixed white space device operating in a four megahertz channel within a seven megahertz guard band must comply with a conducted power spectral density limit of -5.4 dBm.

(2) *Personal/Portable white space devices.* Technical limits for personal/portable white space devices are shown

in the table and subject to the requirements of this section.

EIRP (6 MHz)	Radiated PSD limit EIRP ¹ (100 kHz)	Radiated adjacent channel emission limit EIRP (100 kHz)
16 dBm (40 mW)	-1.4 dBm	-56.8 dBm
20 dBm (100 mW)	2.6 dBm	-52.8 dBm

¹The radiated power spectral density from a personal/portable white space device shall not be greater than the values shown in the table when measured in any 100 kHz band during any time interval of continuous transmission, except that a 40 mW white space device operating in a four megahertz channel within a seven megahertz guard band must comply with a radiated power spectral density limit of 0.6 dBm.

(3) *Sensing-only devices.* Sensing-only white space devices are limited to 17 dBm (50 mW) EIRP and are subject to the requirements of this paragraph and of § 15.717 of this part.

(i) Radiated PSD limit: -0.4 dBm EIRP.

(ii) Adjacent channel emission limit: -55.8 dBm EIRP.

(c) *Conducted power limits.* (1) The conducted power, PSD and adjacent channel limits for fixed white space devices operating at up to 36 dBm (4000 milliwatts) EIRP shown in the table in paragraph (b)(1) of this section are based on a maximum transmitting antenna gain of 6 dBi. 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 direc-

tional gain of the antenna exceeds 6 dBi.

(2) The conducted power, PSD and adjacent channel limits for fixed white space devices operating at greater than 36 dBm (4000 milliwatts) EIRP shown in the table in paragraph (b)(1) of this section are based on a maximum transmitting antenna gain of 10 dBi. If transmitting antennas of directional gain greater than 10 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 10 dBi.

(3) 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 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.

(4) White space devices connected to the AC power line are required to comply with the conducted limits set forth in § 15.207.

(d) *Emission limits.* (1) The adjacent channel emission limits shown in the tables in paragraphs (b)(1) and (2) of this section apply in the six megahertz channel immediately adjacent to each white space channel or group of contiguous white space channels in which the white space device is operating.

(2) At frequencies beyond the six megahertz channel immediately adjacent to each white space channel or group of contiguous white space channels in which the white space device is operating the white space device shall meet the requirements of § 15.209.

(3) Emission measurements in the adjacent bands 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.

(e) *Transmit power control.* White space devices 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 the device's transmit power control feature mechanism.

(f) *Security.* White space devices shall incorporate adequate security measures to prevent the devices from accessing databases not approved by the FCC and to ensure that unauthorized parties cannot modify the device or configure its control features to operate in a manner inconsistent with the rules and protection criteria set forth in this subpart.

(g) *Antenna requirements—*(1) *Fixed white space devices—*(i) *Above ground level.* The transmit antenna height shall not exceed 30 meters above ground level, except that the antenna height may not exceed 10 meters above ground level for fixed white space devices operating in the TV bands or guard band at 40 mW EIRP or less or operating across multiple contiguous TV channels at 100 mW EIRP or less.

(ii) *Height above average terrain (HAAT).* The transmit antenna shall not be located where the height above average terrain is more than 250 meters. The HAAT is to be calculated by the white space database using the methodology in § 73.684(d) of this chapter.

(2) *Personal/portable white space devices.* Personal/portable devices shall have permanently attached transmit and receive antenna(s).

(3) *Sensing-only white space devices operating under the provisions of § 15.717 of this subpart.* (i) The provisions of § 15.204(c)(4) do not apply to an antenna used for transmission and reception/spectrum sensing.

(ii) Compliance testing for white space devices that incorporate a separate sensing antenna shall be performed using the lowest gain antenna for each type of antenna to be certified.

(h) *Compliance with radio frequency exposure requirements—*(1) *Fixed white space devices.* To ensure compliance with the Commission's radio frequency 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.

§ 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) *Geo-location required.* White space devices shall rely on a geo-location 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; off-shore 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); 600 MHz service band licensees where they have commenced operations, as defined in § 27.4 of this chapter; and unlicensed wireless microphones used by venues of large events and productions/shows as provided under § 15.713(j)(9). 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 and antenna height above ground level of a fixed white space device shall be

determined at the time of installation and first activation from a power-off condition by either an incorporated geo-location capability or a professional installer. This information may be stored internally in the white space device. In the case of professional installation, the party who registers the fixed white space device in the database will be responsible for assuring the accuracy of the entered coordinates and antenna height. If a fixed white space device is moved to another location or if its stored coordinates become altered, the operator shall re-establish the device's:

(i) Geographic location and antenna height above ground level and store this information in the white space device 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 and antenna height above ground level.

(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.