Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 700 MHz Band) 2023

The Australian Communications and Media Authority makes the following guidelines under section 262 of the *Radiocommunications Act 1992*.

Dated: 16 March 2023

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Australian Communications and Media Authority

Part 1 Preliminary

1 Name

These are the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers –700 MHz Band) 2023*.

2 Commencement

This instrument commences at the start of the day after the day it is registered on the Federal Register of Legislation.

Note: The Federal Register of Legislation may be accessed free of charge at www.legislation.gov.au.

3 Authority

This instrument is made under section 262 of the Act.

4 Repeal of the *Radiocommunications Advisory Guidelines (Managing Interference to Receivers – 700 MHz Band) 2012*

The *Radiocommunications Advisory Guidelines (Managing Interference to Receivers – 700 MHz Band) 2012* [F2012L02544] are repealed.

5 Definitions

(1) In this instrument:

700 MHz band means the 700 MHz lower band and the 700 MHz upper band.

700 MHz lower band means the frequency band 703 MHz to 748 MHz.

700 MHz band receiver means a radiocommunications receiver operated under a 700 MHz band spectrum licence.

700 MHz band spectrum licence means a spectrum licence that authorises the operation of radiocommunications devices in the 700 MHz band.

700 MHz upper band means the frequency band 758 MHz to 803 MHz.

Act means the *Radiocommunications Act 1992*.

adjacent channel, in relation to a particular channel (***the occupied channel***), means a channel with a centre frequency offset on either side of the assigned channel frequency of the occupied channel by a specific frequency relation.

adjacent channel selectivity: see item 2 of Schedule 1.

adjacent spectrum licence, in relation to a spectrum licence, means another spectrum licence that has either a common frequency boundary or a common geographic boundary adjacent to that licence.

broadcasting service has the meaning given by section 6 of the *Broadcasting Services Act 1992*.

compatibility requirement: see Part 5 and Schedule 2.

emission buffer zone, in relation to a spectrum licence, means a zone along the frequency or geographic boundary specified in a spectrum licence where emission levels of radiocommunications transmitters are reduced to ensure that significant levels of emissions stay within the geographic area and frequencies of the licence.

fixed receiver means a radiocommunications receiver:

(a) located at a fixed point on land or sea; and

(b) not designed or intended for use while in motion.

fixed transmitter means a radiocommunications transmitter:

(a) located at a fixed point on land or sea; and

(b) not designed or intended for use while in motion.

in-band means:

(a) for a radiocommunications device operated under a spectrum licence – the part of the spectrum within which the operation of radiocommunications devices is authorised under the licence; or

(b) for a radiocommunications device operated under an apparatus licence that specifies a frequency band – the frequencies within the lower frequency limit and the upper frequency limit specified in the licence;

(c) for a radiocommunications device operated under an apparatus licence that specifies a specific frequency and bandwidth – the frequencies within that bandwidth, when centred on the specific frequency.

intermodulation response rejection: see item 3 of Schedule 1.

mobile device means a radiocommunications device that is used:

(a) while it is in motion on land, on water or in the air; or

(b) in a stationary position at unspecified points on land, on water or in the air.

notional receiver performance level: see section 13.

out-of-band, for a radiocommunications device, means the frequencies that are not in-band frequencies for the device.

receiver blocking, in relation to a radiocommunications receiver, means a measure of the ability of the receiver to receive a wanted signal in the presence of a high level unwanted interferer on frequencies other than those of an adjacent channel.

unwanted signal means a radio emission from a radiocommunications transmitter that is not a wanted signal.

wanted signal means a radio emission from a radiocommunications transmitter that is intended for reception by a radiocommunications receiver protected by this instrument.

Note: A number of other expressions used in this instrument are defined in the Act, including the following:

(a) ACMA;

(b) apparatus licence;

(c) class licence;

(d) core condition;

(e) frequency band;

(f) interference;

(g) radiocommunications device;

(h) radiocommunications receiver;

(i) radiocommunications transmitter;

(j) Register;

(k) spectrum licence.

(2) Unless the contrary intention appears, terms used in this instrument that are defined in the *Radiocommunications (Unacceptable Levels of Interference — 700 MHz Band) Determination 2023* have the same meaning as in that determination.

Note: The following terms that are used in this instrument are defined in the *Radiocommunications (Unacceptable Levels of Interference — 700 MHz Band) Determination 2023*:

(a) centre frequency;
(b) device boundary;
(c) device boundary criterion;
(d) fixed receiver;
(e) fixed transmitter;
(f) geographic area.

(3) Unless the contrary intention appears, terms used in this instrument that are defined in:

(a) the *Radiocommunications (Interpretation) Determination 2015*; or
(b) if another instrument replaces that determination – that other instrument;

have the same meaning as in that determination or instrument.

Note: The following terms that are used in this instrument are defined in Schedule 1 to the *Radiocommunications (Interpretation) Determination 2015:*

(a) spurious emission.

(4) In this instrument, unless otherwise specified, a reference to part of the spectrum or a frequency band includes all frequencies that are greater than but not including the lower frequency, up to and including the higher frequency.

Note: This subsection means the lower number in a part of the spectrum or a frequency band is not included in the part of the spectrum or the frequency band.

6 References to other instruments

In this instrument, unless the contrary intention appears:

(a) a reference to any other legislative instrument is a reference to that other legislative instrument as in force from time to time; and
(b) a reference to any other kind of instrument is a reference to that other instrument as in force or existing from time to time.

Note 1: For references to Commonwealth Acts, see section 10 of the *Acts Interpretation Act 1901*; and see also subsection 13(1) of the *Legislation Act 2003* for the application of the *Acts Interpretation Act 1901* to legislative instruments.

Note 2: All Commonwealth Acts and legislative instruments are registered on the Federal Register of Legislation.

Note 3: See section 314A of the Act.

Part 2 Overview

7 Background

(1) A spectrum licence authorises operation of radiocommunications devices within a part of the spectrum and in a geographic area. Interference occurring between adjacent spectrum licences consists of in-band interference, across the geographic area, and out-of-band interference, across the frequency bands.

(2) This interference is managed by creating emission buffer zones along the geographic and frequency boundaries of a spectrum licence, using a number of powers under the Act. Emission buffer zones may be created by, or as a result of, the following:

(a) specifying out-of-area and out-of-band emission limits in the core conditions of the licence, which must be included in all spectrum licences (see section 66 of the Act);

(b) a determination under section 145 of the Act, relating to unacceptable levels of interference and the registration of radiocommunications devices, and related licence conditions (see section 69 of the Act);

(c) advisory guidelines under section 262 of the Act, about managing interference in specific circumstances.

(3) This instrument:

(a) provides protection to 700 MHz band receivers from interference caused by radiocommunications transmitters operated under an apparatus licence, class licence, or spectrum licence; and

(b) assists in the management of in-band and out-of-band interference by providing compatibility requirements for registered fixed receivers operated under a 700 MHz band spectrum licence; and

(c) sets out minimum receiver performance requirements that the ACMA will assume are met by a radiocommunications receiver, when considering whether to provide protection to the receiver in accordance with this instrument, so that the onus of managing interference is not solely placed upon the operators of radiocommunications transmitters.

(4) This instrument is intended to provide guidance on the management and settlement of interference to 700 MHz band receivers, caused by radiocommunications transmitters operated under another class, apparatus or spectrum licence issued under the Act.

(5) This instrument should be used by spectrum licensees, apparatus licensees, and authorised third parties in the planning of services and in the resolution of interference.

(6) This instrument does not prevent a person negotiating and implementing other protection requirements with other persons.

Part 3 Managing interference from other services

8 In-band interference

(1) In-band interference to a 700 MHz band receiver caused by a radiocommunications transmitter operated under an adjacent spectrum licence, is managed by the core conditions imposed on spectrum licences under section 66 of the Act and the device boundary criterion.

(2) In-band interference to a 700 MHz band receiver, caused by a radiocommunications transmitter operated under an apparatus licence is managed as if the transmitter were operated under a spectrum licence. The device boundary criterion should be applied to such radiocommunications transmitters, affording 700 MHz band receivers the same level of in-band protection from new apparatus licensed radiocommunications transmitters as they are afforded from radiocommunications transmitters operated under adjacent spectrum licences.

(3) Application of the device boundary criterion manages in-band interference. The device boundary criterion incorporates emission limits that provide reasonable protection within the geographic area of a spectrum licence. Emission limits are also used to manage out-of-band interference, but these do not provide protection along the frequency boundaries of a spectrum licence. Because of the nature of out-of-band interference, emission limits cannot be used to provide protection from out-of-band interference for radiocommunications devices that are located near each other.

Example: Radiocommunications devices that are located near each other include devices located at multi-operator sites.

(4) The ACMA does not intend to act in relation to in-band interference to a 700 MHz band receiver caused by a radiocommunications transmitter operated under a class licence where the operation complies with all relevant conditions of the class licence.

9 Out-of-band interference

(1) Out-of-band interference is difficult to predict, because the levels and frequencies of unwanted emissions depend on both the nearness and the operating frequencies of radiocommunications transmitters and radiocommunications receivers that are spectrally or geographically close. In addition, out-of-band interference:

(a) can extend for many MHz either side of the frequency boundary of a spectrum licence; and

(b) is dependent on the quality of the radiocommunications receiver as well as the levels of the radiocommunications transmitter's emissions; and

(c) is difficult to model accurately.

(2) Emission limits are also used to manage out-of-band interference, but these do not provide protection along the frequency boundaries of a spectrum licence throughout the entire geographic area. Because of the nature of out-of-band interference, emission limits cannot be used to provide protection from out-of-band interference for radiocommunications devices that are located near each other.

Example: Radiocommunications devices that are located near each other include devices located at multi-operator sites.

(3) Emission limits are not the sole mechanism used to manage out-of-band interference for devices in close proximity, because the interference modelling inaccuracy would require large probability margins to be added to those limits. Large probability margins would place severe constraints on the use of the spectrum because the upper and lower frequency limits of a spectrum licence extend throughout the geographic area. Emission limits to manage out-of-band interference throughout the geographic area cannot be used, because they would lead to a severe loss of utility of the spectrum on both sides of the frequency limits.

(4) To avoid large probability margins, out-of-band interference is managed through interference management procedures based on a compatibility requirement for radiocommunications receivers. A minimum level of receiver performance is specified in Part 4 in conjunction with the compatibility requirement because the performance level of receivers:

(a) affects the level of interference; and

(b) can vary for receivers operating under spectrum licences.

Note: The minimum level of receiver performance is specified in Part 4. The compatibility requirement is set out in Part 5.

10 Recording radiocommunications receiver details in the Register

(1) In this instrument, for a 700 MHz band receiver to be afforded protection from interference caused by an apparatus licensed radiocommunications transmitter, the details of the receiver must have been included in the Register before the relevant apparatus licence was first issued under section 100 of the Act.

(2) In this instrument, for a 700 MHz band receiver to be afforded protection from interference caused by a spectrum licensed radiocommunications transmitter, the details of the receiver must have been included in the Register before the details of the relevant transmitter were included in the Register.

Note: See also Part 5.

11 Mobile devices

The compatibility requirement specified in Part 5 does not apply to radiocommunications receivers operated under a 700 MHz band spectrum licence that are mobile devices, because the transient nature of these devices prevents the use of this requirement as an interference management procedure.

12 Managing interference from frequency adjacent digital television transmitters

Digital television services will operate on UHF channels in the 520 MHz to 694 MHz frequency range. A minimum separation of 9 MHz exists between 700 MHz band receivers operating in the 700 MHz lower band and digital television transmitters. In these circumstances, appropriate mitigation techniques should be employed by spectrum licensees to manage any potential interference to a 700 MHz band receiver.

Note: Information on the location and characteristics of the digital television transmitters is provided in the Register; more information is available on the ACMA's website at www.acma.gov.au.

Part 4 Minimum level of receiver performance

13 Notional receiver performance

(1) The level of interference caused by unwanted emissions depends on the interference susceptibility of a radiocommunications receiver and the level of the unwanted signal. Emission levels from radiocommunications transmitters should not have to be reduced below a point where the performance of the radiocommunications receiver is the main cause of the problem.

(2) A notional receiver performance level is set out in Schedule 1 and is to be used when setting a compatibility requirement for a radiocommunications receiver. A receiver should meet the notional receiver performance level to gain protection from interference from a radiocommunications transmitter specified in this instrument.

Part 5 Compatibility requirement

14 Compatibility

(1) In relation to a fixed receiver specified in subsection (2), the licensee of a fixed transmitter operated under an apparatus licence or a spectrum licence must ensure that the transmitter meets the ***compatibility requirement*** in Schedule 2.

(2) For the purposes of subsection (1), a fixed receiver is specified if the receiver:
   (a) is operated under a spectrum licence; and
   (b) has at least the notional receiver performance level; and
   (c) was included in the Register, before:
      (i) if the fixed transmitter mentioned in subsection (1) is operated under a spectrum licence – the fixed transmitter was included in the Register; and
      (ii) if the fixed transmitter mentioned in subsection (1) is operated under an apparatus licence – the apparatus licence was issued.

(3) A radiocommunications transmitter operated under a class licence must comply with the conditions of the class licence.

Schedule 1 Notional receiver performance level

(subsections 5(1) and 13(2))

1 Notional receiver performance level

(1) The notional level of performance for a 700 MHz band receiver in relation to an unwanted signal from a radiocommunications transmitter operated under an apparatus licence, relates to:

(a) adjacent channel selectivity; and

(b) receiver intermodulation response rejection; and

(c) receiver blocking.

(2) This level of performance is taken to be a ***notional receiver performance level*** with reference to a radiocommunications receiver sensitivity level of:

(a) -96 dBm measured within a 5 MHz rectangular bandwidth that is within the frequency band of the spectrum licence, for a receiver with a bandwidth of less than 20 MHz; and

(b) -89 dBm measured within a 20 MHz rectangular bandwidth that is within the frequency band of the spectrum licence, for a receiver with a bandwidth equal to or greater than 20 MHz.

(3) A notional radiofrequency selectivity for the radiocommunications receiver (between the antenna and the antenna connector of the equipment) may be assumed to be at least equal to:

(a) $2 + 70 \cdot \log_{10}[1+(2 \cdot \text{FreqOffset}/5)^{1.5}]$ dB for $\text{FreqOffset} \leq 2.5$ MHz;

(b) $2 + 70 \cdot \log_{10}[1+(2 \cdot \text{FreqOffset}/5)^{2}]$ dB for $2.5 \text{ MHz} < \text{FreqOffset} \leq 9$ MHz;

(c) 82 dB for $\text{FreqOffset} > 9$ MHz;

where ***FreqOffset*** is the smallest frequency difference between either the upper or lower limits of the frequency band of the spectrum licence under which the receiver operates and any frequency outside that frequency band.

(4) For the purposes of verifying these performance parameters of the notional radiocommunications receiver, the comparison of the sensitivity level and the unwanted signal is defined at the antenna connector port of the receiver unit. In this way, the performance of the entire receiving system, including the receiver unit and external filters, is taken into account.

(5) All frequency offsets are specified with reference to the upper and lower limits of the frequency bands of the spectrum licence under which the receiver operates.

2 Adjacent channel selectivity

(1) In this instrument, ***adjacent channel selectivity*** means the measure of the ability of a radiocommunications receiver to receive a wanted signal without exceeding a specified degradation in output due to the presence of an unwanted signal from an adjacent channel.

(2) An adjacent channel selectivity of greater than or equal to the following relative figures for respective channel bandwidths is required:

Receiver Occupied Bandwidth	Frequency offsets from the upper and lower frequency limit of the spectrum licence receiver	Minimum relative adjacent channel selectivity (dB)
< 20 MHz	≤ 5 MHz	44 dB
≥ 20 MHz	≤ 20 MHz	37 dB

Source: 3GPP TS 38.104 V17.5.0 (2022-04) Tables 7.2.2-1, 7.4.1.2-1 & 7.4.1.2-2.

Note: The values in the table above are the ratio between the received unwanted signal power in the adjacent (interferer's) channel and the receiver's sensitivity level.

3 Intermodulation response rejection

(1) In this instrument, ***intermodulation response rejection*** means the measure of the ability of a radiocommunications receiver to receive a wanted signal in the presence of two or more unwanted signals with a specific amplitude and frequency relationship to the wanted signal frequency.

(2) An intermodulation response rejection greater than or equal to the following values for each out-of-band signal is required:

Receiver Occupied Bandwidth	Frequency offsets from the upper and lower frequency limit of the spectrum licence receiver	Intermodulation performance requirement (dB)
< 20 MHz	≥ 5 MHz	44 dB
≥ 20 MHz		37 dB

Source: 3GPP TS 38.104 V17.5.0 (2022-04) Tables 7.2.2.-1 & 7.7.2-2.

Note: The values in the table above are the ratio between the received unwanted signal power at the defined frequency offset and the receiver's sensitivity level.

4 Receiver blocking

(1) At frequencies in the following:

(a) for radiocommunications receivers operating in 703 MHz to 748 MHz – the frequency range 683 MHz to 768 MHz;

(b) for radiocommunications receivers operating in 758 MHz to 803 MHz – the frequency range 738 MHz to 823 MHz;

a receiver blocking level greater than or equal to the following figures above the sensitivity level for interfering signals in the frequency ranges set out below is required:

Receiver Occupied Bandwidth	Frequency offsets from the upper and lower frequency limit of the spectrum licence receiver	Minimum blocking requirement (dB)
< 20 MHz	> 5 MHz	53
≥ 20 MHz	> 20 MHz	46

Source: 3GPP TS 38.104 V17.5.0 (2022-04) Tables 7.2.2-2 & 7.4.2.2-1.

Note: The values in the table above are the ratio between the received unwanted signal power at the defined frequency offset and the receiver's sensitivity level.

(2) At frequencies in the frequency range 1 MHz to 12750 MHz, excluding frequencies ranges to which subclause 4(1) applies, the receiver blocking requirement is a total mean power of -15 dBm.

5 Receiver antenna and feeder losses

The antenna gain and feeder loss recorded for a radiocommunications receiver in the Register should be used for coordination.

Schedule 2 Compatibility requirement

(section 14)

(1) For the purpose of assessing compatibility with other radiocommunications services, the performance of a fixed radiocommunications receiver operated under a spectrum licence in the 700 MHz band is a maximum unwanted signal level of -108 dBm per 5 MHz, not exceeded for more than 5% of any 1 hour period.

(2) Logarithmic scaling should be used to find the appropriate level in alternative bandwidths.