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AMTA Submission

Australian Communications & Media Authority

Draft Instruments for the
850/900 MHz band auction



About AMTA

The Australian Mobile Telecommunications Association (AMTA) is the peak industry body representing Australia's mobile telecommunications industry. Its mission is to promote an environmentally, socially and economically responsible, successful and sustainable mobile telecommunications industry in Australia, with members including the mobile network operators and service providers, handset manufacturers, network equipment suppliers, retail outlets and other suppliers to the industry. For more details about AMTA, see <http://www.amta.org.au>.



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Draft technical instruments

890 MHz boundary interference management

AMTA members (including the three incumbent 800 MHz and 900 MHz licensees) are in agreement in relation to the following comments on the draft technical instruments, and specifically, the proposed interference management process at the 890 MHz boundary that is presented in this submission, including **Appendices A and B** where we have marked-up proposed changes to the relevant draft instruments. In particular, the detail of the 890 MHz boundary interference management process is detailed in Appendix B which contains AMTA's proposed edits to the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 850/900 MHz Band) 2021* (Rx RAG), specifically in Section 16 of Part 3.

The objective of the interference management process is to avoid the situation where one side of the 890 MHz boundary is not useable and disadvantaged by being “second-in-time”, by facilitating more equitable utility of the spectrum on both sides of the boundary. Due to the challenging nature of the technical problem, it is accepted that part of the lower 5 MHz channel of the 900 MHz Band will be compromised, which has been quantified as a “guard band” above which criteria to protect 900 MHz Band receivers will apply. When coordinating a new (second-in-time) station, existing (first-in-time) registrations in close proximity to, or for which the protection criterion is not satisfied, will require the second-in-time licensee to notify the first-in-time licensee. This triggers a “notification period” during which both parties are required to ensure that certain requirements are satisfied: a minimum out-of-band attenuation expressed as an Adjacent Channel Leakage Ratio (ACLR) for the transmitting system and a minimum out-of-band overall system attenuation for the receiving system. The specification of pre-determined out-of-band attenuation values is intended to provide certainty to licensees on both sides of the boundary in terms of what may be expected of them moving forward.

AMTA members have agreed on an initial guard band of 2.5 MHz above the top of the existing 800 MHz band for OOB emissions requirements to be met. Evidence from filter suppliers indicates that suitable filters are available that can achieve improved OOB performance, facilitating a narrower guard band above the top of the 800 MHz band, thereby improving the utility of the lowest channel in the 900 MHz band.

AMTA proposes that the conditions determining the guard band are revisited in a subsequent, issue-specific TLG on the boundary between the 850 MHz and 900 MHz bands once the outcome of the auction is known in early 2022. By revisiting this issue at that time, it will ensure that all licensees resulting from the auction are appropriately engaged and the 20-year licences will not be unduly constrained for their entire duration.

AMTA proposes the TLG should work to the ACMA's principles for spectrum management, which strive to maximise the utility of all spectrum. Possible solutions include, but are not limited to grandfathering and eventual sunseting of existing guard band requirements and a commitment from licensees and the ACMA to impose a reduced guard band above the top of the 800MHz band beyond an agreed date.

Sample Spectrum licence

Clarification of “per transmitter” in Out of band emission limits for Non-AAS

We understand that the status quo is that the out of band emission limits are applied per port in a multi-port sector (Non-AAS). However, we believe that it would be worthwhile adding a footnote to Tables 1 & 3 in Schedule 4 of the Sample Spectrum Licence clarifying this.

Definition of Total Radiated Power (TRP)

In the sample spectrum licence in schedule 5 of the Draft Radiocommunications Spectrum Marketing Plan, the ACMA uses the following definition for *total radiated power*:

total radiated power per sector means the total power radiated by an antenna over its horizontal beamwidth.

AMTA members consider the reference to horizontal beam width is inappropriate because it disregards certain parts of the total power emitted from the antenna (e.g. the vertical plane, outside the main beam). AMTA recommends the definition of total radiated power could be better expressed as follows:

total radiated power per sector means the total power radiated by a sector antenna ~~over its horizontal beamwidth~~ or antenna array oriented towards a particular azimuth and elevation angle.

Note: TRP is the integral of the power transmitted in different directions over the entire radiation sphere. It is measured considering the combination of all radiating elements on an antenna panel or individual device. In ITU-R studies, TRP is typically modelled as the conducted power (summed over all ports) minus Ohmic losses.

Emission limits for Receivers

We’ve noted that the out-of-band emission limits for Receivers are defined in an inconsistent manner. In Table 8 for Non-AAS receivers, they are based on receiver requirements (3GPP TS 38.104 Table 7.6.2-1 and 3GPP TS 38.101 Table 7.9-1). In Table 9 they are based on transmitter requirements (3GPP TS 38.104 Table 6.6.5.2.1-2). While we understand that for FDD systems, the receiver emission limits are to be based on the transmitter emission limits, we believe this should be defined consistently. Specifically, both Tables 8 and 9 are based on receiver levels with a footnote under each explaining that for FDD bands, the emissions can be increased up to a level in line with unwanted emission limits for transmitters (i.e. Tables 3 and 4 respectively).

Furthermore, Table 8 specifies the limit in TRP for Non-AAS. We believe this should be defined in terms of “Mean power per receiver”, as for Non-AAS transmitters (with a clarification that this is per-port).

Prompt implementation of new spectrum licence conditions

AMTA requests that, upon finalisation of the spectrum licence technical framework, the ACMA promptly progresses to consultation with incumbent licensees to adopt the changes to their licence conditions.

Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 850/900 MHz Band) 2021 **(Rx RAG)**

Definition of 850 MHz Band

If the entire band (814-845 MHz and 859-890 MHz) is intended to be referred to by the term “850 MHz Band”, then the definition needs to be expanded to include the current 800 MHz Band (825-845 and 870-890 MHz), and not just the 850 MHz expansion band (814-825 MHz and 859-870 MHz).

Protection from Trunked Land Mobile Service (TLMS)

Section 13 of Part 3 of the Rx RAG refers to RALI LM8 for “*coordination requirements with 850 MHz base station receivers*”. We wish to point to that there are no coordination requirements in RALI LM8 with respect to 850 MHz spectrum licensed receivers, so as a minimum, this part of the sentence should be deleted. In our submission to the first TLG paper, we expressed the view that coordination requirements on mobile transmitters (both apparatus- and spectrum-licensed) are impractical and should be removed. As such, we recommend that:

- a) the provisions on TLMS be limited to 851 to 854 MHz; and
- b) these be required to satisfy the compatibility requirement specified in the Rx RAG.

Protection of 850 MHz spectrum-licensed UE receivers

Section 14 of Part 3 of the Rx RAG—which focuses on the compatibility between 900 MHz UE transmitters and adjacent-band 850 MHz UE receivers—states that “*the coordinated nature of base station transmitters and receivers operating in both the 850 MHz band and the 900 MHz band does provide some natural, although only partial, mitigation of interference potential*”. Given that the cell radii—and therefore the size of the areas over which 850 & 900 MHz UEs can potentially be co-located—are larger than the distance down to which the corresponding base stations would be coordinated, we believe there is little basis to this statement, and it should be removed. Mobile receivers operate on a no protection basis.

890 MHz boundary interference management

Section 16 of Part 3 of the Rx RAG on “Spectrum licensed transmitters near the 900 MHz band” is updated as per the 890 MHz boundary interference management procedure introduced earlier and detailed in Appendix A to this document.

Compatibility requirement

Section 19 of Part 5 “Compatibility requirement—Compatibility” has provisions for fixed receivers in the nominal base transmit / mobile receive sub-bands (i.e. 859-890 MHz and 935-960 MHz). In our submission to the first TLG paper, we expressed the view that former provisions supporting opposite site-sense stations (i.e. fixed transmitters in the base receive sub-bands and fixed receivers in the base transmit sub-bands) unnecessarily complicated the technical framework, noting that they were barely used with only a handful of registrations in the 800 and 900 MHz

Bands. For the most part, such provisions have been omitted in the draft revised framework, including but not limited to, the emission limits in the core conditions. The provisions in Section 19 clause (1)(c)(ii)—along with the accompanying Notes 2 and 3—are a remnant of this, and should be removed for consistency.

There are also conditions on the heights of the fixed receivers in the base receive sub-bands (i.e. 814-845 MHz and 890-915 MHz), i.e. in clause (1)(c)(i) “with an effective antenna height... greater than 20 metres”. We don’t see why a base station receiver would need to be higher than 20 metres to be afforded protection, and suggest the deletion of that part of the sentence.

Notional receiver performance level—Performance parameters

Section 1 of Schedule 1 of the Rx RAG refers to a receiver sensitivity level of -101 dBm/(5 MHz). We recommend that this be modified to -95.7 dBm/(5 MHz) to align with $P_{\text{REFSENS}}+6\text{dB}$ as defined in 3GPP TS 38.104.

Adjacent channel selectivity and Blocking

We request the inclusion of clear guidance on what the dB values in the tables for Adjacent channel selectivity (ACS) and Receiver blocking are. Please include footnotes under each table clarifying that “*The values in the table above are simply the ratio between the received unwanted signal power in the adjacent (interferer’s) channel and the received wanted signal power in the receiver’s channel.*” The values should not be confused with the attenuation/rejection provided by a receiver’s frequency response e.g. as for use in an ACIR calculation.

We note that the second row of the Receiver blocking table has a frequency offset of ± 30 MHz, which appears to be the middle of the “In-Band” region of up to 60 MHz for wider frequency bands that are more than 200 MHz wide. Such bands are not applicable in these sub-1 GHz bands. As such, we recommend that the second row be deleted and therefore the first column can also be deleted. However, we would support a replacement second row for bandwidths > 20 MHz. Might need to have a separate value for $\text{BW} \geq 20$ MHz, to account for the difference in P_{REFSENS} (as was done in the table for ACS).

Receiver intermodulation response rejection

The reproduction of the table with ratios but not all the parameters is cumbersome in the body of the instrument. We recommend replacing with a reference to Section 7.7.2 of 3GPP TS 38.104 v17.0.0, along with a reference to a new Annex A in which the relevant parameter values can be reproduced.

Compatibility requirement

We believe that the minimum wanted signal level of base station receivers can be lower than -83 dBm/(5 MHz) and therefore the specification of a minimum wanted signal level can be misleading. As such, we request the replacement of this two-part compatibility requirement with a single maximum unwanted signal level of -108 dBm/(5 MHz), in turn based on I/N ratio of -6 dB.

Other editorial revisions

Other editorial changes are proposed and tracked in Appendix A—Rx RAG.

Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters — 850/900 MHz Band) 2021 (Tx RAG)

Definition of 850 MHz Band

If the entire band (814-845 MHz and 859-890 MHz) is intended to be referred to by the term “850 MHz Band”, then the definition needs to be expanded to include the current 800 MHz Band (825-845 and 870-890 MHz), and not just the 850 MHz expansion band (814-825 MHz and 859-870 MHz).

890 MHz boundary interference management

Section 16 of Part 3 of the Rx RAG on “Spectrum licensed transmitters near the 900 MHz band” is updated as per the 890 MHz boundary interference management procedure introduced earlier and detailed in Appendix A to this document. In the Tx RAG, the protection requirements for 900 MHz BS receivers are replaced with a reference to this section of the Rx RAG.

Other editorial revisions

Other editorial changes are proposed and tracked in Appendix B—Tx RAG.

Radiocommunications (Unacceptable Levels of Interference — 850/900 MHz Band) Determination 2012 (Section 145 Determination)

AMTA is of the view that device boundary criterion (DBC) violations across St Vincent’s Gulf and Bass Strait should not be exempted. We observe that other recently amended section 145 determinations such as those for the 2.3 GHz and 3.4 GHz bands¹ also include a third condition on the radial, such that DBC violations across St Vincent’s Gulf and Bass Strait are not unintentionally exempted:

(iii) does not cross into any of the following HCIS: IW3E, IW3I, IW3M, IW6A, IW6E, KX9, LX7, LX8, LX9.

AMTA requests the AMCA include the third condition (at Roman numeral iii) for the 850/900 MHz Section 145 determination.

¹For example, the 2.3 GHz section 145 determination <https://www.legislation.gov.au/Details/F2021C00360> and the 3.4 GHz section 145 determination <https://www.legislation.gov.au/Details/F2018C00557>

Draft marketing plan

In relation to the draft marketing plan, AMTA members will have varying views which they will outline in separate submissions, however, we note that the following points are agreed by AMTA members:

- Incumbent AMTA members² currently holding 850/900 MHz spectrum are strongly of the view that, at minimum, the geographic borders between metro and regional lots in the 850 MHz band must be aligned with the existing 850 MHz boundaries. Not aligning the geographic borders will reduce the utility of the spectrum by unnecessarily increasing the size of the 'dead-zone' beyond that already experienced in the 5 MHz of the existing 850 MHz band where different operators exist on either side of the boundary. It would also hinder the ACMA objective of increasing the tradability of spectrum licences.
- As outlined elsewhere in this submission, AMTA's proposal for managing interference at the 890 MHz boundary (between the 850 MHz and the 900 MHz bands) includes the creation of a guard band 2.5 MHz in width into the lowest channel of the 900 MHz base station received band. 2.5 MHz equates to 50% of this channel being compromised, and AMTA members consider this makes the lot sufficiently technically different to the other four lots in the **900 national product** (900NAT). As such, AMTA recommends the ACMA should make the lowest 2 x 5 MHz channel (Lot 3) in the auction a separate product, not of the same type as the other four lots (Lots 4, 5, 6 & 7) in the product type 900NAT.

Draft allocation determination

In relation to the draft allocation determination:

- Information Policy: AMTA members strongly suggest that excess demand information should be provided to bidders at the end of each clock round. We note that in the 3.6 GHz band 2018 auction, information for exact excess demand was provided only where it was greater than supply by more than 4 lots (a limited information policy) and in the recently concluded 26 GHz band auction, a full information policy was provided including where aggregate demand is equal to or less than supply. AMTA members request that a full information policy, including excess demand and excess supply information, should be adopted for the 850/900 MHz auction to support overall transparency and efficient

² Other non-incumbent AMTA members have a different view on the proposed boundaries.

outcomes being realised. The competitive results of previous auctions clearly demonstrate that concerns over strategic demand reductions should be minimal.

- Starting prices should not be allowed to change after the date when applications open. Creating the potential to amend starting prices after applications open undermines certainty for stakeholders creating great difficulty for valuation and internal governance, even if prices are not amended. Potential bidders must have certainty of the prices to begin the application process. Any potential for prices to vary after the application process begins, effectively means that most potential bidders would need to revisit the requisite internal decision-making and governance processes to continue.

Early access arrangements

We support the ACMA's view in relation to early access arrangements and encourage the ACMA to facilitate such arrangements as spectrum becomes unencumbered.

We note that some interference mechanisms that have not previously been considered will have to be addressed including co-channel single-channel fixed links (SCFL) and cordless telephone services (CTS) in 857-861 MHz, along with co-channel TLMS.

Contact:

For any questions in relation to this submission please contact Lisa Brown, Public Policy Manager, AMTA at lisa.brown@amta.org.au or (02) 8920 3555 or Juan Pablo Casetta (Open Spectrum), AMTA Spectrum Consultant at juanpablo@openspec.com.au.



Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 850/900 MHz Band) 2021

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

Dated:

Member

Member/General Manager

Australian Communications and Media Authority

Part 1 Preliminary

1 Name

These are the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 850/900 MHz Band) 2021*.

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 Revocation

The *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licence Receivers – 800 MHz Band) 2012* (F2012L01774) are revoked.

4 Authority

This instrument is made under section 262 of the *Radiocommunications Act 1992*.

5 Definitions

(1) In this instrument:

850 MHz band means the following frequency bands:

- (a) 814 MHz to 825 MHz;
- (b) 859 MHz to 870 MHz.

900 MHz band means the following frequency bands:

- (a) 890 MHz to 915 MHz; and
- (b) 935 MHz to 960 MHz.

Act means the *Radiocommunications Act 1992*.

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

adjacent channel selectivity, in relation to a radiocommunications receiver, means a measure of the receiver's ability to receive a wanted signal without exceeding a specified degradation in output quality due to the presence of an unwanted signal from an adjacent channel.

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.

blocking, in relation to a radiocommunications receiver operating on a particular channel, means a measure of the ability of the receiver to receive a wanted signal in the presence of a high power unwanted signal on frequencies other than those of the adjacent channels to the particular channel.

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.

in-band means, for a radiocommunications device operated under a spectrum licence or apparatus licence, frequencies within which the device is authorised to operate.

intermodulation response rejection, in relation to a radiocommunications receiver, means a measure of the ability of the 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.

mobile transmitter means a radiocommunications transmitter that is only designed or intended for use while in motion or during halts at unspecified points on land or sea.

out-of-band means, for a radiocommunications device operated under a spectrum licence or apparatus licence, a frequency on which the device is not authorised to operate.

RALI FX 22 means the Radiocommunications Assignment and Licensing Instruction FX 22 *Frequency assignment requirements for the fixed service in the 800 MHz band*, published by the ACMA.

Note RALI FX 22 is available, free of charge, on the ACMA website: www.acma.gov.au.

RALI LM 8 means the Radiocommunications Assignment and Licensing Instruction LM 8 *Frequency Assignment Requirements for the Land Mobile Service*, published by the ACMA.

Note RALI LM 8 can be accessed, free of charge, on the ACMA website: www.acma.gov.au.

spectrum space means a three-dimensional space consisting of a frequency band and geographic area.

unwanted emissions, in relation to a spectrum licence, means any radio emission (whether ~~or not~~ an out-of-band emission or a spurious emission) outside the lower frequency limit and upper frequency limit specified in a spectrum licence.

unwanted signal means any radio emission from any radiocommunications transmitter that is not communicating with the radiocommunications receiver used for a service protected by this instrument.

wanted signal means a radio emission from a radiocommunications transmitter designed for communication between the transmitter and radiocommunications receiver used for a service 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; and
- (k) spectrum licence.

- (2) Unless the contrary intention appears, terms used in this instrument that are defined in the *Radiocommunications (Unacceptable Levels of Interference — 850/900 MHz Band) Determination 2021* 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 — 850/900 MHz Band) Determination 2021*:

- (a) 850/900 MHz band;
- (b) centre frequency;
- (c) device boundary;
- (d) device boundary criterion;
- (e) fixed receiver; and
- (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) land mobile service; and
- (b) 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.

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 existence 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 in a frequency band and in a geographic area, as specified in the relevant licence. Interference may occur between adjacent spectrum licences, and may include:
 - (a) in-band interference, across the geographic area; and
 - (b) out-of-band interference, across the frequency bands.
- (2) The interference is managed by creating emission buffer zones along the boundaries of the geographic area and frequency bands specified in the spectrum licence. This is achieved through the application of:
 - (a) core licence conditions that all spectrum licences are subject to under section 66 of the Act, including both:
 - (i) emission limits outside the geographic area;
 - (ii) emission limits outside the frequency band; and
 - (b) the *Radiocommunications (Unacceptable Levels of Interference — 850/900-GHz Band) Determination 2021* about what are unacceptable levels of interference for the registration of radiocommunications devices under a spectrum licence; and
 - (c) advisory guidelines made under section 262 of the Act, which guide decisions about managing interference in specified circumstances.

8 Purpose

- (1) The purpose of this instrument is to:
 - (a) manage in-band and out-of-band interference by providing compatibility requirements for registered fixed receivers operated under a spectrum licence issued for the 850/900 MHz band; and
 - (b) provide protection to radiocommunications receivers operated under spectrum licences issued for the 850/900 MHz band from interference caused by radiocommunications transmitters operated under an apparatus licence, class licence, or spectrum licence;
 - (c) [require that radiocommunications receivers comply with certain minimum performance requirements in order to receive protection in accordance with this instrument, so that the onus of managing interference is not unduly laid upon the operator of the radiocommunications transmitters in question.](#)
- (2) This instrument should be used by operators of spectrum licensed services, class licensed services and apparatus licensed services in the planning of services or in the resolution of interference with radiocommunications under spectrum licences in the 850/900 MHz band.
- (3) The ACMA will consider this instrument to determine whether a radiocommunications receiver operated under a spectrum licence in the 850/900 MHz band is affected by interference from a radiocommunications transmitter operated under an apparatus licence, class licence or spectrum licence, where there are no other interference protection arrangements between the relevant parties.
- (4) This instrument does not prevent a spectrum licensee negotiating other interference protection arrangements with another [person/ licensee](#).

Part 3 Managing interference from other services

9 In-band interference

- (1) In-band interference caused to a radiocommunications receiver operated under a spectrum licence in the 850/900 MHz band by a radiocommunications transmitter operated under an adjacent spectrum licence, is managed by:
 - (a) imposing the core conditions in section 66 of the Act on each spectrum licence; and
 - (b) the device boundary criteria and deployment constraints specified in the *Radiocommunications (Unacceptable Levels of Interference — 850/900 GHz Band) Determination 2021*.

- (2) In-band interference caused to a radiocommunications receiver operated under a spectrum licence in the 850/900 MHz band by:
 - (a) a radiocommunications transmitter operated under an apparatus licence issued on or after 18 June 2013, in the 825 MHz to 845 MHz and 870 MHz to 890 MHz frequency bands; or
 - (b) a radiocommunications transmitter operated under an apparatus licence, issued after the commencement of the *Radiocommunications Spectrum Marketing Plan (850/900 MHz Band) 2021*, in the 814 MHz to 825 MHz, 859 MHz to 915 MHz and 935 MHz to 960 MHz frequency bands;

is managed as if the transmitter were operated under a spectrum licence. The device boundary criteria mentioned in paragraph 9(1)(b), are taken to be applicable to an apparatus-licensed radiocommunications transmitter mentioned in paragraph (a) or (b). Spectrum licensed receivers should be afforded the same level of in-band protection from new apparatus-licensed radiocommunications transmitters as they would be afforded from radiocommunications transmitters operated under an adjacent spectrum licence.

- (3) The device boundary criteria mentioned in paragraph 9(1)(b) incorporate emission limits that provide protection from in-band interference in the geographic area of a spectrum licence.

10 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 of, and the operating frequencies of, the~~ proximity of radiocommunications transmitters and radiocommunications receivers in both the geographical/spatial and frequency domains. Out-of-band interference:
 - (a) can extend for many megahertz outside the upper and lower frequency limits of a spectrum licence;
 - (b) is dependent on the quality performance of the radiocommunications receiver, as well as the levels of the radiocommunications transmitter emissions; and
 - (c) can be 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 devices that are located near each other.

Example: 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.

11 Recording radiocommunications receiver details in the Register

A radiocommunications receiver operated under a spectrum licence must be recorded in the Register to be afforded protection under this instrument.

12 Mobile devices

The compatibility requirement specified in Part 5 does not apply to mobile radiocommunications receivers operated under a spectrum licence in the 850/900 MHz band because the transient nature of these devices prevents the use of this requirement as an interference management procedure.

13 Apparatus licensed services near the 850 MHz band

A spectrum licensed radiocommunications base station and mobile receivers operated in the 850 MHz band generally use near-or-adjacent frequencies to those that may be used by apparatus licensed:

- (a) ~~fixed transmitters of~~ trunked land mobile ~~services (TLMS) transmitters~~ in the following frequency range~~s~~:
 - (b) ~~806 MHz to 809 MHz;~~
 - (c)(a) 851 MHz to 854 MHz; and
 - (d)(b) fixed service transmitters in the 845 MHz to 851 MHz band.

Note 1: For ~~trunked land mobile transmitters~~ TLMS mentioned in paragraph 1(a) see RALI LM 8 for details about these services ~~and coordination requirements with~~. With respect to 850 MHz base station receivers, [the TLMS transmitters should satisfy the compatibility requirement specified in this instrument.](#)

Note 2: For fixed service transmitters mentioned in paragraph 1(b), see RALI FX 22 for details about these services and coordination requirements with 850 MHz base station receivers.

14 Spectrum licensed services near the 850 MHz band

- (1) Spectrum licensed radiocommunications mobile receivers operated in the 850 MHz band generally use near-or-adjacent frequencies to other spectrum licensed mobile transmitters operated under 900 MHz band spectrum licences.

- (2) As mentioned in section 10, the transient nature of mobile devices makes it difficult to codify practical interference mitigation measures in these guidelines, and since mobile devices are not registered they are not afforded protection from other services. ~~However, the first-in-time coordinated nature of base station transmitters and receivers operating in both the 850 MHz band and the 900 MHz band does provide some natural, although only partial, mitigation of interference potential.~~

15 Apparatus licensed ~~services~~ transmitters near the 900 MHz band

Apparatus licensed aeronautical navigation services are operated in the 960 MHz to 1215 MHz frequency range, above the 900 MHz spectrum licensed band upper boundary at 960 MHz. Immediately adjacent to or near-adjacent to the 960 MHz boundary, these services are limited to the operation of distance measuring equipment (DME) and tactical air navigation (TACAN) systems. As mobile receivers operating in the upper segment of the 900 MHz band are not registered, they are not afforded any protection from aeronautical services, but this is not expected to cause any issues because both mobile and aeronautical services have operated on either side of the 960 MHz boundary for many years.

16 Spectrum licensed ~~services~~ transmitters near the 900 MHz band

- (1) Spectrum licensed base station radiocommunications receivers that are operated in the 900 MHz band use near-or-adjacent frequencies to base station radiocommunications transmitters operated under spectrum licences in the 850 MHz band. ~~New~~ Base station radiocommunications receivers operated under a spectrum licence in the 900 MHz band will generally not only be given protection from ~~existing~~ registered base station radiocommunications transmitters operated under a spectrum licence in the 850 MHz band for operation above the Guard band defined in Point (3) below, for unwanted signal levels exceeding the Protection criterion defined in Point (4) below, and if they satisfy the Selectivity Requirement in Point (5) below.

A first-in-time receiver will also be afforded protection in the following cases:

- a. if not duly notified of the intention to register the interfering transmitter; or
- b. following notification of the intention to register the interfering transmitter, within the notification window as defined in Point (6) below.

A second-in-time receiver will not be afforded protection in (but not limited to) the following cases:

- c. if the transmitter's licensee was not duly notified of the intention to register the victim receiver; or
- d. following notification of the intention to register the interfered-with receiver, within the notification window as defined in Point (6) below.

(1)

- (2) Coordination of a new (second-in-time) base station radiocommunications receiver, under a spectrum licence in the 900 MHz band, with a registered (first-in-time) base station radiocommunications transmitter, under a spectrum licence in the 850 MHz band, may occur ~~through bilateral negotiation between licensees, or~~ by applying: the receiver compatibility requirements and notional receiver performance specified in Schedule 2 and Schedule 1 respectively,

- a. the Protection criterion defined in Point (4) below, above the Guard band defined in Point (3) below; and
- b. in the absence of more detailed information about the out-of-band emissions of the existing first-in-time transmitter, an adjacent-channel leakage ratio (ACLR) of at least 100 dB below its in-channel power,

and taking into account details of the transmitter as entered in the Register and core conditions on the spectrum licence in the 850 MHz band.

(3) **Guard band.** 2.5 MHz above the upper edge of the 850 MHz Band.

Note The ACMA is allocating spectrum licences in the 850/900 MHz band in a way that will allow the 850 MHz band to be downshifted by 1 MHz, making its upper boundary 889 MHz, by no later than 17 June 2028. This is expected to partially alleviate coexistence problems between 850 MHz and 900 MHz services operating either side of 890 MHz. This instrument assumes the downshift has not occurred. More information about the ACMA's policy for the downshift can be found, free of charge, on the ACMA's website: www.acma.gov.au in the paper *The ACMA's long-term strategy for the 803-960 MHz band decision paper*.

- (4) **Protection criterion.** -102 dBm/(5 MHz) in any 5 MHz (above the guard band) of the 900 MHz receiver's channel.
- (5) **Selectivity requirement.** To ensure a 900 MHz base station receiver is not a victim of blocking interference, the 900 MHz receiver will need to employ receiver blocking pre-select filters to reject signals outside the wanted receive band. The requirement is that the receive system's (including the radio unit and external filters) frequency response must provide at least 102 dB of attenuation for frequencies below 890 MHz.
- (6) **Notification requirement.** A licensee intending to register a second-in-time station (transmitter or receiver) must notify the licensee of a first-in-time station (receiver or transmitter) in either of the following cases:
 - a. where the registration of the second-in-time station (transmitter or receiver) would result in the Protection criterion above the Guard band being exceeded; or
 - b. within the notification radius specified below.

Unless agreement is reached between both licensees on another method to manage the adjacent-band interference:

- c. the 850 MHz licensee must ensure that it either satisfies the Protection criterion above the Guard band or meet the minimum ACLR requirement of 100 dB; and
- d. the 900 MHz licensee will not receive protection from the relevant 850 MHz transmitter unless it satisfies the Selectivity requirement

by the end of the notification window. The notification window lasts for 3 months from the date of notification and the cost of reaching the Protection criterion and/or the Selectivity requirement is borne by the second-in-time licensee (transmitter or receiver).

- (7) **Notification radius.** 0.8 kilometres around a second-in-time 850 MHz transmitter or 900 MHz receiver being registered.
- (8) **Notwithstanding Points (1) through (6) above, where possible, negotiation between parties is the preferred method to optimise spectrum utility and access either side of 890 MHz.**

(2)

17 Class licensed services near the 900 MHz band

The *Radiocommunications (Low Interference Potential Devices) Class Licence 2015* authorises ubiquitous, uncoordinated operation by a range of radiocommunications transmitters in the frequency range 915 MHz to 935 MHz. This class licence prescribes operating conditions, including transmission limits and references to applicable equipment standards, that enable coexistence with other services.

DRAFT

Part 4 Minimum level of receiver performance

18 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.

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Part 5 Compatibility requirement

19 Compatibility

- (1) If a fixed radiocommunications transmitter is operated under an apparatus licence or is registered ~~in relation to~~ a spectrum licence, the licensee of that licence should ensure that the transmitter meets the compatibility requirements set out in Schedule 2, in relation to a fixed radiocommunications receiver protected by this instrument, if the receiver:
- (a) has the notional level of performance set out in Schedule 1;
 - (b) is registered in the Register, before:
 - (i) if the fixed radiocommunications transmitter is operated under an apparatus licence – the date of issue of the apparatus licence the transmitter is operated under; or
 - (ii) if the fixed radiocommunications transmitter is registered in relation to a spectrum licence – before the date of registration of the transmitter in relation to the spectrum licence; and
 - (c) operates under a spectrum licence in ~~either:~~
 - ~~(i) the 814 MHz to 845 MHz or 890 MHz to 915 MHz frequency ranges, with an effective antenna height (for any increment 1, $he_1(\phi_n)$) greater than 20 metres; or~~
 - ~~(ii) the 859 MHz to 890 MHz or 935 MHz to 960 MHz frequency ranges, with an effective antenna height (for any increment 1, $he_1(\phi_n)$) less than 10 metres.~~

Note 1: An example of a fixed radiocommunications transmitter operated under an apparatus licence or registered ~~in relation to~~ a spectrum licence is a base station transmitter in the 850 MHz band. Such a fixed transmitter may cause interference to a base station receiver in the 900 MHz band.

~~Note 2: The effective antenna height (in each increment 1, $he_1(\phi_n)$) for a receiver is calculated in accordance with the formula specified in the *Radiocommunications (Unacceptable Levels of Interference — 850/900 MHz Band) Determination 2021*, as if the receiver were a transmitter.~~

~~Note 3: The 20 metre and 10 metre effective antenna height limits are chosen to be consistent with common deployment practice.~~

- (2) Subsection (1) does not apply to trunked land mobile receivers that are operated in either the 806 MHz to 809 MHz frequency range or the 851 MHz to 854 MHz frequency range, under an apparatus licence:
- (a) issued before 30 June 2024, and
 - (b) that replaced an apparatus licence issued in either the 820 MHz to 825 MHz frequency range or the 865 MHz to 870 MHz frequency range.

Note: For trunked land mobile receivers mentioned in subsection (2) see RALI LM 8 for details about these receivers and coordination requirements. See also Part 3 of the *Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters — 850/900 MHz Band) 2021*.

Schedule 1 Notional receiver performance level

(subsections 16(2) and 18(2), and paragraph 19(1)(a))

1 Performance parameters

- (1) The notional level of performance for a radiocommunications receiver operated under a spectrum licence in the 850/900 MHz band in relation to an unwanted signal from a radiocommunications transmitter operated under an apparatus licence, relates to:
 - (a) adjacent channel selectivity;
 - (b) receiver intermodulation response rejection; and
 - (c) receiver blocking.
- (2) This level of performance is taken to be a notional level of performance with reference to a radiocommunications receiver sensitivity level of ~~-101~~**-95.7** dBm measured within a 5 MHz rectangular bandwidth that is within the frequency band of the spectrum licence.
- (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) $2 + 60 \cdot \log_{10}[1 + (2 \cdot \text{FreqOffset}/5)^{1.5}]$ dB for $\text{FreqOffset} \leq 2.5$ MHz;
 - (b) $2 + 60 \cdot \log_{10}[1 + (2 \cdot \text{FreqOffset}/5)^2]$ dB for $2.5 < \text{FreqOffset} \leq 9$ MHz; and
 - (c) 70dB 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) ~~These~~ [For the purposes of verifying these](#) performance parameters of the notional radiocommunications receiver, [the comparison of wanted and unwanted signals](#) are defined at the antenna connector port of the receiver unit or, in the case where additional devices such as filters or amplifiers are installed in the signal path ahead of the receiver, then the values are defined at the outer antenna connector port. [In this way, the performance of the entire receiving system—including the receiver unit and external filters—is taken into account.](#)

2 Adjacent channel selectivity

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

Channel Bandwidth	Relative adjacent channel selectivity
< 20 MHz	44 dB
≥ 20 MHz	37 dB

Source: 3GPP TS 38.104 V17.0.0 (2020-12) Tables [7.2.2-1-1](#) and [7.4.1.2-1](#)

[The values in the table above are simply the ratio between the received unwanted signal power in the adjacent \(interferer's\) channel and the received wanted signal power in the receiver's channel.](#)

3 ~~Receiver intermodulation response rejection~~

~~A receiver intermodulation response rejection greater than or equal to the following figures for frequency offsets between the edge of the wanted channel and the centre of the interfering intermodulation product bandwidth is required:~~

~~Source: 3GPP TS 38.104 V17.0.0 (2020-12) Table 7.7.2-1 & 7.2.2-2~~

~~4 Source: 3GPP TS 38.104 V17.0.0 (2020-12) Table 7.7.2-1 & 7.2.2-2~~

3 Receiver blocking

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

Base station channel bandwidth of the lowest/highest carrier received (MHz)	Interfering signal centre frequency minimum offset from the lower/upper base station radiofrequency bandwidth edge or sub-block edge inside a sub-block gap (MHz)	Relative Blocking Requirements (dB)
5, 10, 15, 20 MHz	± 7.5	52.7 dB
25, 30, 40, 50, 60, 70, 80, 90 & 100 MHz	± 30	52.7 dB

~~Source: 3GPP TS 38.104 V17.0.0 (2020-12) Tables ~~7.4.2.2-1~~ & ~~7.2.2-1~~~~

The values in the table above are simply the ratio between the received unwanted signal power in the adjacent (interferer’s) channel and the received wanted signal power in the receiver’s channel.

34 Receiver intermodulation response rejection

The receiver intermodulation response rejection should be at least as good as that specified in Section 7.7.2 of 3GPP TS 38.104 v17.0.0. The relevant parameter values are reproduced in Annex A. A receiver intermodulation response rejection greater than or equal to the following figures for frequency offsets between the edge of the wanted channel and the centre of the interfering intermodulation product bandwidth is required:

<u>Base station channel bandwidth of the lowest/highest carrier received (MHz)</u>	<u>Interfering signal centre frequency offset from the lower/upper base Station radiofrequency bandwidth edge (MHz)</u>	<u>Intermodulation Performance Requirement (dB)</u>
<u>5 MHz</u>	<u>± 7.5 MHz</u>	<u>43.7 dB</u>

<u>10 MHz</u>	<u>± 7.465 MHz</u>	<u>43.7 dB</u>
<u>15 MHz</u>	<u>± 7.43 MHz</u>	<u>43.7 dB</u>
<u>20 MHz</u>	<u>± 7.395 MHz</u>	<u>37.3 dB</u>
<u>25 MHz</u>	<u>± 7.465 MHz</u>	<u>37.3 dB</u>
<u>30 MHz</u>	<u>± 7.43 MHz</u>	<u>37.3 dB</u>

Source: 3GPP TS 38.104 V17.0.0 (2020-12) Table 7.2.2-1 & 7.2.2-2

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. If an antenna gain or feeder loss is not available in the Register, then an antenna gain (including losses) of 13 dBi in all directions applies.

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Schedule 2 Compatibility requirement

(subsections 16(2) and 19(1))

- (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 850/900 MHz band is:
 - (a) a ~~minimum-maximum un~~wanted signal level of ~~-83-108~~ dBm per 5 MHz ~~corresponding to a bit error rate of 0.001; and~~
 - (b) ~~a wanted to unwanted ratio of 24 dB for an annual availability of 99.99%.~~
~~(2) The minimum wanted signal level is inclusive of a 1dB increase in the receiver noise floor. .~~

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

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Appendix B—Proposed edits to Tx RAG



Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters — 850/900 MHz Band) 2021

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

Dated:

Member

Member/General Manager

Australian Communications and Media Authority

Part 1 Preliminary

1 Name

These are the *Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters – 850/900 MHz Band) 2021*.

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 *Radiocommunications Act 1992*.

4 Revocation

The *Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters – 800 MHz band) 2012* (F2012L01775) are revoked.

5 Definitions

(1) In this instrument, unless the contrary intention appears:

800 MHz band means the following frequency bands:

- (a) 825 MHz to 845 MHz;
- (b) 870 MHz to 890 MHz.

850 MHz band means the following frequency bands:

- (a) 814 MHz to ~~825–845~~ MHz;
- (b) 859 MHz to ~~870–890~~ MHz.

850 MHz Upper Band means the frequency band 859 MHz to 890 MHz.

900 MHz band means the following frequency bands:

- (a) 890 MHz to 915 MHz; and
- (b) 935 MHz to 960 MHz.

900 MHz base station radiocommunications receiver: see subsection 14(1).

900 MHz Lower Band means the frequency band 890 MHz to 915 MHz.

Act means the *Radiocommunications Act 1992*.

RALI FX 22 means the Radiocommunications Assignment and Licensing Instruction FX 22 *Frequency assignment requirements for the fixed service in the 800 MHz band*, published by the ACMA.

Note: RALI FX 22 is available, free of charge, on the ACMA website: www.acma.gov.au.

RALI LM 8 means the Radiocommunications Assignment and Licensing Instruction LM 8 *Frequency Assignment Requirements for the Land Mobile Service*, published by the ACMA.

Note: RALI LM 8 is available, free of charge, on the ACMA website: www.acma.gov.au.

SOB link means a Sound Outside Broadcast link.

unwanted signal means any radio emission from any radiocommunications transmitter that is not communicating with the radiocommunications receiver used for a service protected by this instrument.

wanted signal means a radio emission from a radiocommunications transmitter designed for communication between the transmitter and radiocommunications receiver used for a service 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) frequency band;
- (e) interference;
- (f) radiocommunications receiver;
- (g) radiocommunications transmitter;
- (h) Register;
- (i) spectrum licence; and
- (j) spectrum plan.

- (2) Unless the contrary intention appears, terms used in this instrument that are defined in the *Radiocommunications (Unacceptable Levels of Interference — 850/900 MHz Band) Determination 2021* have the same meaning as in that determination.

Note: The following term that is used in this instrument is defined in the *Radiocommunications (Unacceptable Levels of Interference — 850/900 MHz Band) Determination 2021*:

- (a) 850/900 MHz band.

- (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) land mobile service;
- (b) radionavigation; and
- (c) spurious emission.

- (4) In this instrument, unless otherwise specified, a reference to a 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.

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 or writing is a reference to that other instrument or writing 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.

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Part 2 Overview

7 Background

- (1) In parts of the 850/900 MHz band, spectrum licensed radiocommunications transmitters operate in frequency bands directly adjacent to frequency bands for apparatus licensed radiocommunications receivers of different services. Apparatus licensed receivers may suffer interference from a spurious emission, and from blocking and intermodulation caused by a spectrum licensed radiocommunications transmitter.
- (2) A spurious emission, is a by-product of a radiocommunications transmitter's radio emissions and includes broadband noise, harmonics, intermodulation products, transient signals and other emissions. Blocking occurs when a high level off-tune signal overloads a radiocommunications receiver's front-end and causes a degradation in the quality of the wanted output signal. Intermodulation products can be generated in-band in the input stages of receivers in the presence of two or more high level signals at the receiver input.

8 Purpose

- (1) The purpose of this instrument is to manage interference by providing for the protection of radiocommunications receivers that:
 - (a) are operated under a receiver licence; or
 - (b) receive, or are intended to receive, radiocommunications from radiocommunications transmitters operated under transmitter licences; in or adjacent to the 850/900 MHz band:
 - (c) outside the parts of the spectrum specified in the *Radiocommunications (Spectrum Re-allocation – 850/900 MHz Band) Declaration 2020*; or
 - (d) outside the named area specified in the *Radiocommunications (Spectrum Re-allocation – 850/900 MHz Band) Declaration 2020*.
- (2) This instrument has been made to guide the management of these types of interference to licensed radiocommunications receivers operating in the following circumstances:
 - (a) apparatus licensed trunked land-mobile radiocommunications receivers operating in the following frequency bands (Part 3):
 - (i) 806 MHz to 809 MHz;
 - (ii) 820 MHz to 825 MHz¹;
 - (iii) 851 MHz to 854 MHz; and
 - (iv) 865 MHz to 870 MHz²;
 - (b) apparatus licensed fixed link radiocommunications receivers operating in the frequency band 845 MHz to 851 MHz (Part 4);
 - (c) spectrum licensed base station receivers operating in the 900 MHz band (Part 5); and
 - (d) apparatus licensed aeronautical navigation services operating above 960 MHz (Part 6).
- (3) Protection criteria and coordination arrangements recommended by these guidelines are specified in RALI FX 22 and RALI LM 8.

¹ At the time of making of this instrument, ACMA policy is that Trunked land-mobile services are required to cease operation in the segments 820-825 MHz and 865-870 MHz by 1 July 2024, as set out in the ACMA's Decision Paper [The ACMA's long-term strategy for the 803–960 MHz band](#).

Note 1: RALI FX 22 and RALI LM 8 are available, free of charge, on the ACMA website:
www.acma.gov.au.

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- (4) As radio waves propagate in different ways because of factors such as frequency, terrain, atmospheric conditions and topography, there are several ways to predict path loss. The ITU-R Recommendation P.1144 *Guide to the application of the propagation methods of Radiocommunications Study Group 3* provides a guide on the application of various propagation methods developed internationally by the International Telecommunication Union – Radiocommunications Sector (*ITU-R*). It advises users on the most appropriate methods for particular applications, as well as the limits, required input information, and output for each of these methods. It is recommended that the most recent version of propagation models defined by the ITU-R should be considered when modelling propagation in the 850/900 MHz band.

Note 1: The ITU-R Recommendation P.1144 *Guide to the application of the propagation methods of Radiocommunications Study Group 3* is available, free of charge, on the International Telecommunication Union’s website: www.itu.int.

Note 2: The use of other published propagation methods applicable to the 850/900 MHz band may also be suitable.

- (5) The ACMA will take this instrument into account in determining whether interference has occurred from a radiocommunications transmitter operating under a spectrum licence in the 850/900 MHz band to a radiocommunications device operating under another licence, in the absence of separate criteria agreed between affected licensees.
- (6) This instrument does not prevent a licensee negotiating other protection arrangements with another licensee.

Part 3 Trunked land-mobile receivers

9 Background

(1) At the time of making this instrument, trunked land-mobile services operate in a paired band where base station radiocommunications receivers use the 820 MHz to 825 MHz frequency band, and mobile station radiocommunications receivers use the 865 MHz to 870 MHz frequency band. This places land-mobile receivers in these two bands in spectrum near-adjacent to the existing 800 MHz band.

~~(1)(2)~~ The 850/900 MHz long-term arrangements in this band are that trunked land-mobile services operate in a paired band where base station radiocommunications receivers use the 806 MHz to 809 MHz frequency band, and mobile station radiocommunications receivers use the 851 MHz to 854 MHz frequency band. This places land-mobile receivers in these two bands in spectrum adjacent to the extended 850/900 MHz band after commencement of spectrum licences in this extended 850 MHz band.

~~(2)(3)~~ Protection of trunked land-mobile radiocommunications receivers from spectrum licensed radiocommunications transmitters is on a first-in-time basis. The ACMA intends that any existing apparatus licensed receiver, licensed prior to the registration of a spectrum licensed transmitter in the Register, will receive protection in accordance with this instrument.

Note: The Register is established under section 143 of the Act and is available, free of charge, on the ACMA's website: www.acma.gov.au.

10 Trunked Land-Mobile Base Station Receivers

- (1) The protection requirements for base station radiocommunications receivers operating in the 820 MHz to 825 MHz frequency band—no later than 1 July 2024—and in the 806 MHz to 809 MHz ~~and 820 MHz to 825 MHz~~ frequency bands, for the percentage of time specified in RALI LM 8, are:
- a wanted signal to unwanted signal level ratio at the receiver input not less than the wanted to unwanted ratio specified in RALI LM 8; and
 - a blocking level at the receiver input not exceeding the blocking level specified in RALI LM 8.
- (2) The radiofrequency selectivity performance of the base station radiocommunications receiver may be assumed to be at least equal to the performance of a cavity filter with a response as specified in RALI LM 8 tuned to the operating frequency of that receiver. The base station receiver intermediate frequency bandwidth may be assumed to be that specified in RALI LM 8. The base station receiver antenna may be assumed to have a response equivalent to the notional antenna specified in RALI LM 8.

11 Trunked Land-Mobile Mobile Receivers

- (1) The protection requirements for mobile radiocommunications receivers operating in the 865 MHz to 870 MHz frequency band—no later than 1 July 2024—and in the 851 MHz to 854 MHz ~~and 865 MHz to 870 MHz~~ frequency bands, for the percentage of time and percentage of locations specified in RALI LM 8, are:
- a wanted signal to unwanted signal level ratio at the receiver input not less than the wanted to unwanted ratio specified in RALI LM 8; and
 - a blocking level at the receiver input not exceeding the blocking level specified in RALI LM 8.

- (2) The mobile radiocommunications receiver intermediate frequency bandwidth may be assumed to be that specified in RALI LM 8.

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Part 4 Fixed link receivers

12 Background

- (1) Fixed link receivers operate in the [frequency bands 804-806 MHz and 845 MHz to 851 MHz](#) ~~frequency band~~, adjacent to the 850/900 MHz band. SOB links also operate in this band, predominately in the 845 MHz to 846.5 MHz segment.
- (2) RALI FX 22 specifies the arrangements for all ~~800 MHz band~~ fixed links [in the frequency range 804-851 MHz](#). Protection of fixed link radiocommunications receivers from spectrum licensed radiocommunications transmitters is on a first-in-time basis. The ACMA intends that any existing apparatus licensed fixed link receiver, licensed prior to the registration of a spectrum licensed transmitter in the Register, will receive protection in accordance with this instrument. A SOB link is typically operated on a temporary, transportable basis. Given the ad hoc nature of their operation, a SOB link is operated on a “no interference/no protection” basis in the 845 MHz to 851 MHz frequency band with regard to fixed links of the primary service planned in the spectrum plan, other SOB links and spectrum licensed services that operate in the 850/900 MHz band.

Note The phrase “no interference/no protection” refers to a service operating on the basis that it does not cause interference to a primary service and will not receive protection from that service. SOB apparatus licences that authorise operation in the 845 MHz to 851 MHz frequency band are subject to a special licence condition. The condition requires that no interference may be caused to any radiocommunications station, or any service operating on a primary basis.

13 Protection requirements

Spectrum licensees are to ensure that authorised radiocommunications transmitters protect fixed link receivers to the level detailed in section 4.22 and section 6.22 of RALI FX 22.

Part 5 900 MHz base station receivers

14 Background

- (1) Spectrum licensed base station receivers in the 900 MHz Lower Band (*900 MHz base station radiocommunications receivers*) are in parts of the spectrum immediately adjacent to spectrum licensed base station transmitters in the 850 MHz Upper Band (*850 MHz spectrum licensed radiocommunications transmitters*).
- (2) Protection of 900 MHz base station radiocommunications receivers from 850 MHz spectrum licensed radiocommunications transmitters presents a technical challenge which to date has been managed successfully, but that in practice requires cooperation between the licensees both below and above the 890 MHz boundary, and requires both to participate in the implementation of mitigation measures. In practice, it has also resulted in the lower part of the 900 MHz being compromised prior to the 1 MHz downshifts on a first in time basis. The ACMA intends that any existing 900 MHz base station radiocommunications receiver, registered prior to the registration of an 850 MHz spectrum licensed radiocommunications transmitter in the Register, will receive protection in accordance with this instrument.
- ~~(3) Where possible, negotiation between parties is the preferred method to optimise spectrum utility and access either side of 890 MHz.~~

Note The ACMA is allocating spectrum licences in the 850/900 MHz band in a way that will allow the 850 MHz band to be downshifted by 1 MHz, making its upper boundary 889 MHz, before 17 June 2028. This is expected to partially alleviate coexistence problems between 850 MHz and 900 MHz services operating either side of 890 MHz. This instrument assumes the downshift has not occurred. More information about the ACMA's policy for the downshift can be found, free of charge, on the ACMA's website: www.acma.gov.au in the paper *The ACMA's long-term strategy for the 803-960 MHz band decision paper*.

15 Protection requirements

- (1) The protection requirements for 900 MHz base station radiocommunications receivers consist of:
 - (a) ~~a wanted signal to unwanted signal level ratio not greater than that set out in Schedule 2 to the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 850/900 MHz Band) 2021* for the percentage of time specified;~~
 - (b) ~~a signal level not exceeding the blocking levels specified in clause 4 of Schedule 1 to the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 850/900 MHz Band) 2021*; and~~
 - (c) ~~the protection requirement set out in subsection (3).~~

~~(2) The reference point for all signal levels is the base station system radiocommunications receiver antenna connector. Where multiple signals appear at the receiver antenna connector, an allowance for the summation of the power of multiple signals may be required to ensure that these requirements are met.~~

- ~~(3) If:~~
- ~~(a) two signals are transmitted by 850 MHz spectrum licensed radiocommunications transmitters; and~~
 - ~~(b) those two signals have a frequency relationship such that a third order intermodulation product falls within the frequency bandwidth of the receive frequency of a 900 MHz base station radiocommunications receiver;~~

~~the signal level of those two signals must not exceed the receiver intermodulation level~~ specified in ~~clause 3 of Schedule 1 to~~ Part 3, section 16 of the *Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 850/900 MHz Band) 2021*.

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Part 6 Systems operating under the Aeronautical Radionavigation Service

16 Background

- (1) Many aeronautical services operate in the 960 MHz to 1215 MHz frequency band, above the 900 MHz spectrum licensed band upper boundary at 960 MHz. Many of these are transponder-based, using discrete frequency pairs (namely 1030 and 1090 MHz). The scope of this instrument is limited to compatibility with services operating within 20 MHz above the 960 MHz boundary, which in Australia is exclusively used by distance measuring equipment and tactical air navigation systems.
- (2) The radiocommunications transmitters below 960 MHz, which ~~may behave been~~ used as base stations for 2G, 3G and 4G public mobile telecommunications services, have operated under apparatus licences for many years, without causing interference to aeronautical services above 960 MHz. The section 17 protection requirement is intended to ensure ongoing protection of aeronautical services from interference from radiocommunications transmitters below 960 MHz, used as base stations for 4G~~and~~, 5G (and further generation) public mobile telecommunications services, operated under spectrum licences.

17 Protection requirements

A spectrum licensed radiocommunications transmitter that is a base station, and that operates in the 900 MHz band, must protect existing stations appearing in the Register in the 960 MHz to 980 MHz frequency band under the licence type “aeronautical system” to a level of -129 dBW/MHz at the antenna connector, assuming an antenna gain of 9 dBi in any direction if gain and azimuth is not otherwise specified in the Register.

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