

Review of the 700 MHz spectrum licence technical framework

Technical liaison group paper

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Version control

Version	Comments
Version 1.0	Initial release: 22 October 2024
Version 1.1	Correction of text describing the limits in Figure 3. 29 November 2024

Introduction

The Australian Communications and Media Authority (ACMA) develops a technical framework for every band subject to spectrum licensing. Each framework is a collection of technical and regulatory conditions applicable to the use of radiocommunications devices in the spectrum-licensed band. The purpose of the technical framework is to define the technical conditions and constraints under which a device may be deployed and operated within the specified geographic area and frequency band of the licence.

Although the technical framework is optimised for technologies, or services most likely to be deployed in the band, it is intended to be technology flexible. This means licensees can operate any type of radiocommunications device for any purpose, provided they comply with the technical framework relevant to the licence.

The paired frequency ranges 703–748 MHz and 758–803 MHz (the 700 MHz band) were designated for the issue of spectrum licences Australia-wide. In 2022 the legislative instruments associated with the 700 MHz band were reviewed and remade due to their upcoming sunset in 2023. The 700 MHz band spectrum licences were not reviewed at that time. Therefore, it was considered, in consultation with stakeholders, that a revision to the 700 MHz band technical framework, focusing on the spectrum licences was warranted.

We have stated our intention to progressively review the technical framework for all spectrum-licensed bands in the [Five-year spectrum outlook 2019–23](#).

To assist with this work, we formed the 700 MHz band technical liaison group (TLG). Members of the TLG included 700 MHz band spectrum licensees, in-band and adjacent-band licensees and equipment manufacturers.

In addition, a revision to the 814–845 and 859–890 MHz/890–915 and 935–960 MHz (850/900 MHz) bands exemption from registration condition was considered.

The TLG is the first step in the process of reviewing or establishing a technical framework. We will use the outcomes of the TLG to publicly consult on proposed changes to, or new, relevant, instruments that will form the 700 MHz band technical frameworks. TLG members are able to provide comments on the technical frameworks both as part of the informal TLG and the subsequent formal public consultation processes.

While we strive to achieve consensus with members, the final decision on the content of, or changes to, a spectrum or apparatus licence technical framework rests with the ACMA. This is particularly relevant in cases where consensus cannot be achieved on an issue, or advice from the TLG is not provided within a reasonable time frame.

The purpose of this paper is to summarise changes to the 700 MHz band spectrum licence technical framework proposed by the TLG.

Outline

This paper has been divided into discussion on the relevant instruments that form a spectrum licence technical framework as follows:

- The conditions on the spectrum licence:
 - In-band emission limits
 - Unwanted emission limits
 - Spurious emission limits
 - Exemption from registration requirement
 - Other conditions on the licence.
- The advisory guidelines made under s.262
- Radiocommunications assignment and licensing instruction (RALI) updates
- The exemption from registration requirement on 850/900 MHz band spectrum licences.

Scope

This paper is focused on modifications to the technical framework for the areas and frequencies subject to spectrum licensing in the 700 MHz band to cater for the use of 5G technologies including advanced antenna systems.

Timeline

The proposed timeline for updating the 700 MHz technical framework is:

Key steps	Proposed date
TLG process	April 2023 to October 2024
Public consultation on the draft updates to the following technical framework instruments: <ul style="list-style-type: none">• Draft spectrum licence• Draft update to Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters – 700 MHz Band) 2023.	December 2024 to February 2025
Finalisation of technical framework	Q2 2025

It is noted that:

- The TLG is the first step in the process of developing or updating a technical framework. The ACMA will use the outcomes of the TLG to publicly consult on the relevant instruments that will form the 700 MHz band technical framework. This means TLG members will be able to provide comments on the technical framework both as part of the informal TLG and subsequent formal public consultation processes.

- A TLG is a short-term advisory body convened by the ACMA. Its purpose is to provide advice on the development of, or possible changes to, a spectrum or apparatus licence technical framework. While we strive to achieve consensus with members, the final decision on the content of, or changes to, a spectrum or apparatus licence technical framework rests with the ACMA. This is particularly relevant in cases where consensus cannot be achieved on an issue or advice from the TLG is not provided within a reasonable time frame.

Discussion on proposed technical framework

A technical framework consists of 3 interlocking regulatory elements provided for under the *Radiocommunications Act 1992* (the Act):

The conditions specified on the spectrum licence – in particular, the core conditions that define the spectrum space (both frequency and geographical area) and the level of emissions permitted inside and across the frequency boundaries of the licence (section 66 of the Act).

A determination of unacceptable interference for the purpose of device registration in each band (section 145 of the Act). This defines permissible levels of emissions across geographical licence boundaries and can also define various deployment constraints.

Radiocommunications advisory guidelines (RAG) that provide assistance and advice for coordination with stations in other services when and where required (section 262 of the Act). This includes detailing interference management criteria with incumbent apparatus and other spectrum licences.

A more comprehensive explanation of spectrum licence technical frameworks is provided in the document [Spectrum licensees – know your obligations](#).

This section of the paper considers the development of each of these components. This would normally include the standard trading unit and minimum contiguous bandwidth, however, as these will not change, they are not discussed.

700 MHz band spectrum licence technical framework

The current 700 MHz band spectrum licence technical framework is optimised for the use of frequency division duplex (FDD) technologies. We believe the continued optimisation of arrangements for FDD are appropriate for future use of this band.

The relevant 700 MHz band technical framework instruments are the:

- Spectrum licence ([current licence holders and copies of licences](#))
- [Radiocommunications \(Unacceptable Levels of Interference – 700 MHz Band\) Determination 2023](#)
- [Radiocommunications Advisory Guidelines \(Managing Interference from Spectrum Licensed Transmitters – 700 MHz Band\) 2023](#)
- [Radiocommunications Advisory Guidelines \(Managing Interference to Spectrum Licensed Receivers – 700 MHz Band\) 2023](#).

Conditions on the spectrum licence

Each spectrum licence includes both core conditions and statutory conditions specified under relevant sections of the Act. The Act also provides that other specific conditions may be included by the ACMA.

Core conditions: required under section 66, these conditions define the spectrum space within which the licensee is authorised to operate radiocommunications devices under the licence, and the maximum permitted level of radio emissions inside and outside the band. They are included in all spectrum licences.

Statutory conditions: required under sections 67 to 69A, these conditions include information about payment of charges, use by third parties, residency, registration of transmitters and devices exempt from registration. They are included in all spectrum licences.

Other conditions: conditions placed on licences under section 71 generally provide for the efficient management of the spectrum and administration of the Act. They may vary from one band or licence to another.

The core conditions of a spectrum licence form the fundamental building blocks for operation of a spectrum-licensed device, and for managing interference with adjacent frequency bands and geographic areas. Section 66 of the Act states spectrum licences must specify the following core conditions:

The part or parts of the spectrum in which operation of radiocommunications devices is authorised under the licence (frequency range of operation).

The maximum permitted level of radio emission, in parts of the spectrum outside the frequency range specified on the licence, that may be caused by operation of radiocommunications devices under the licence (outside-the-band emission).

The area within which operation of radiocommunications devices is authorised under the licence (geographic area of operation).

The maximum permitted level of radio emission that may be caused by the operation of radiocommunications devices under the licence (outside-the-area emission).

In-band emission limits

The current in-band emission limit for 700 MHz band spectrum licences is 47 dBm/30 kHz equivalent isotopically radiated power (EIRP).

While traditionally emission limits in technical and regulatory frameworks have been defined in terms of EIRP, there is a general preference to define emission limits for services using active antenna systems (AAS) in the form of total radiated power (TRP). This is considered to more accurately reflect and limit the risk of interference presented by AAS (refer to section 6.3.2.1 of [ECC Report 281](#)).

Currently there is no AAS equipment commercially available for the 700 MHz band, however mobile network operators (MNOs) would like the option to deploy AAS equipment if available in the future. The use of TRP provides a

level of flexibility to the technical framework that will help it accommodate future technologies.

Section 6.3.2.1 of ECC Report 281 provides a comparison on the use of TRP vs EIRP metrics to specify AAS emissions. Based on 3GPP studies,¹ the impact of unwanted emissions on the adjacent mobile systems is best represented and limited by use of TRP. While these studies apply to mobile systems, similar logic is considered to apply for interference to other services.

Importantly, it is not intended that use of TRP replace the need for spectrum licensees to coordinate with other services, with known locations, using actual EIRP values. This requirement, along with the defined protection criteria for other services will not change.

Considering the current EIRP in-band limit of 47 dBm/30 kHz, the following in-band limit was proposed and accepted by the TLG:

- TRP of 53.2 dBm/5 MHz for all transmitters.²

Adopting these levels also ensures existing registered devices operating in the 700 MHz band are not affected by the change.

Unwanted emission limits

Existing unwanted emission limits that apply to 700 MHz band spectrum licences are reproduced at Appendix A. The term unwanted emission limits encompasses both out-of-band and spurious emission limits. 3GPP standards define different limits for both cases.

Proposed unwanted emission limits for devices operating in the upper 700 MHz band

The TLG considered changes to the unwanted emissions limits for devices operating in 758–803 MHz (upper 700 MHz band). For the upper 700 MHz band, out-of-band emissions are those that fall outside the lower and upper frequency limits of the licence and within the 748–813 MHz frequency range (that is, the operating band +/- 10 MHz either side). Spurious emissions are all emissions that fall outside the 748–813 MHz frequency range.

A summary of points raised in the TLG on this issue are:

- MNOs Optus, Telstra and TPG currently operate 4G and 5G services using the 700 MHz band spectrum licences.
- All unwanted emission limits are defined as EIRP levels. However, AAS networks are more effectively defined in terms of TRP.
- The current limits were defined to provide a degree of coexistence with services operating inside and adjacent to the 700 MHz band.
- Upper band emission limits above 803 MHz are derived to protect adjacent apparatus licensed services. They are more restrictive than Category B option 1 limits defined in 3GPP standards. Alignment to 3GPP standards is preferred by the MNOs.

¹ 3GPP R4-168430, 'On NRb BS ACLR requirement', Huawei, 3GPP TSG-RAN WG4 Meeting #80bis, October 2016.

² A gain of 23.7 dBi (8x8 array) was used as we are converting from EIRP to TRP of an AAS system.

Taking into account the above issues, the TLG agreed a revision of the current upper 700 MHz band unwanted emissions limits was required. The aim of the revision was to:

- ensure existing devices deployed under the current 700 MHz band framework can continue operating unaffected by any changes
- enable new technologies (for example, 5G and AAS) to be deployed
- avoid unnecessary costs and burdens on licensees to implement strict unwanted emission limits that are only required to enable compatibility in specific situations
- align the way unwanted emissions limits are defined with international standards except where appropriate to support coexistence with other services.

Additional comments/suggestions provided by the TLG include:

- having pre-transitioning PMP links planning to move above 700 MHz move instead to a different band
- clearing the apparatus licences out of 803–809 MHz by the time the 700 MHz spectrum licences expire
- migrating the apparatus licences to the reserved PSMB (Public Safety Mobile Broadband) spectrum
- developing areas with different limits based on licence density.

These planning decisions are out of scope of this spectrum licence technical framework review. However, these comments have been noted for future planning and it has been recommended to submit them to the next Five-Year Spectrum Outlook consultation.

758–803 MHz

The TLG agreed to adopt TRP limits and the 3GPP 38.104 Category B option 1 requirements for New Radio (NR) bands below 1 GHz limits for non-AAS devices with an additional allowance of 9 dB for AAS. Non-AAS limits are defined as conducted powers (mean power) per antenna port, see Table 1. AAS limits are defined in terms of TRP, which means they apply to the aggregate emissions from all transmitters and receivers contained in a piece of equipment. This is consistent with the approach adopted in the 2 GHz band review.

Table 1: Unwanted emission limits in 758 MHz to 803 MHz for transmitters operating in the upper 700 MHz band – non-AAS devices

Frequency offset of measurement filter -3dB point from upper/lower limit of licence (f_{offset})	Mean power (dBm) per transmitter	Measurement bandwidth
$0 \text{ MHz} \leq f_{offset} < 5 \text{ MHz}$	$-7 \text{ dBm} - \frac{7}{5} \left(\frac{f_{offset}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq f_{offset} < 10 \text{ MHz}$	-14	100 kHz
$10 \text{ MHz} \leq f_{offset}$	-16	100 kHz

Table 2: Unwanted emission limits in 758 MHz to 803 MHz for transmitters operating in the upper 700 MHz band – AAS devices

Frequency offset of measurement filter -3dB point from upper/lower limit of licence (f_{offset})	Total radiated power per sector (dBm)	Measurement bandwidth
$0 \text{ MHz} \leq f_{offset} < 5 \text{ MHz}$	$2 \text{ dBm} - \frac{7}{5} \left(\frac{f_{offset}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq f_{offset} < 10 \text{ MHz}$	-5	100 kHz
$10 \text{ MHz} \leq f_{offset}$	-7	100 kHz

803–813 MHz

The current unwanted emissions limits above 803 MHz are more stringent than 3GPP limits to enable coexistence with apparatus licensed services. Figure 1 below summarises the frequency arrangements around the 803 MHz boundary.

Figure 1: Frequency arrangements around the 803 MHz boundary (paired frequency segments not shown)

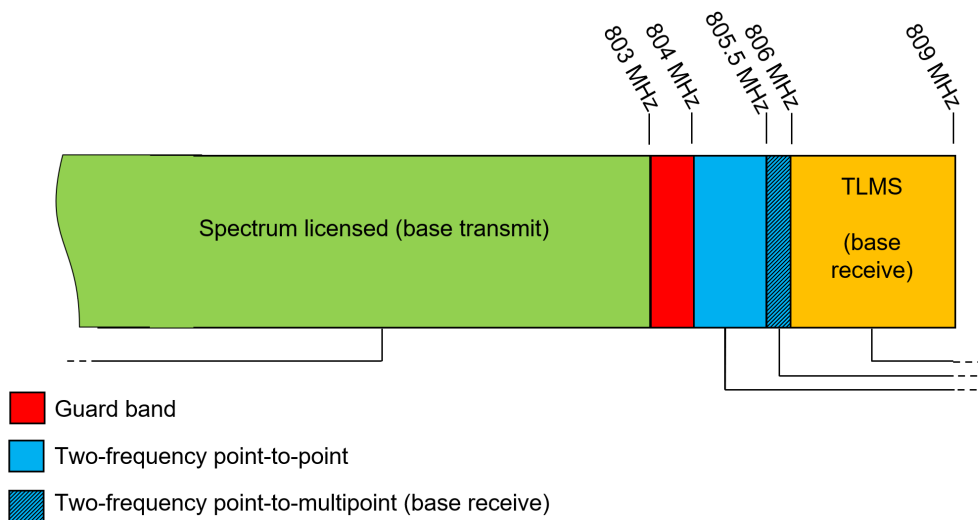
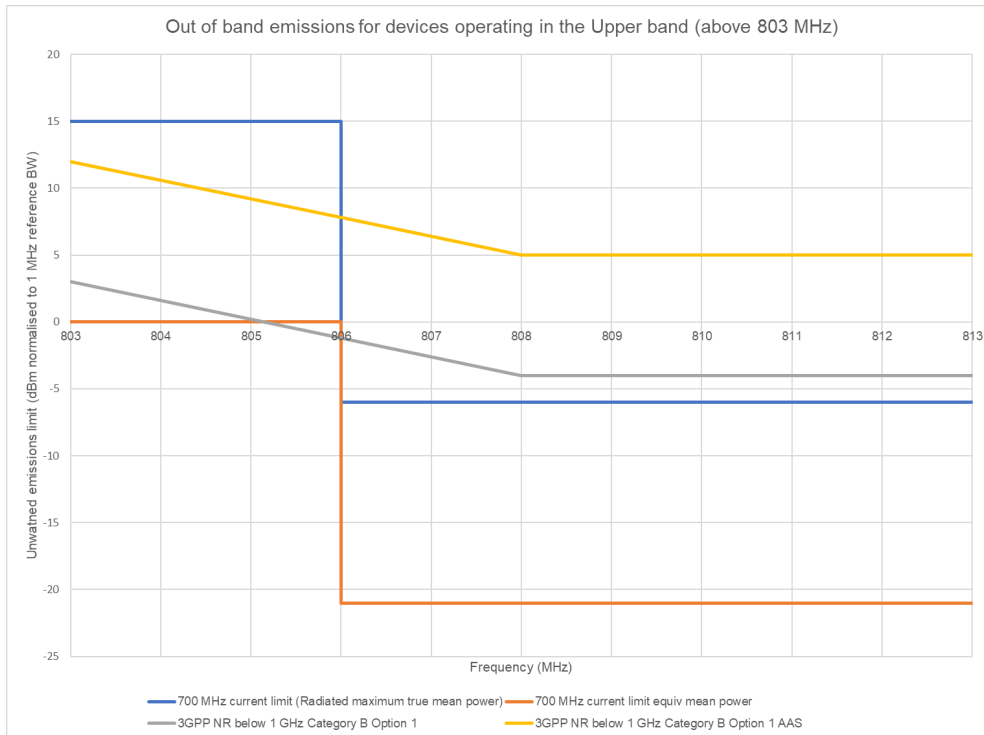


Figure 2 below compares the following limits:

- In blue, the current unwanted emissions limit (EIRP)
- In orange, the equivalent mean power of the current limit converted assuming an antenna gain of 15 dBi (conducted power)
- In grey, the 3GPP NR Category B Option 1 non-AAS limit (conducted power)
- In yellow, the 3GPP NR Category B Option 1 AAS limit (TRP).

Figure 2: Emissions mask above 803 MHz



Separation distance calculations using 3GPP Category B Option 1 limits showed a modest increase in separation distances for point-to-point services in 804–805.5 MHz and greater increases for point-to-multipoint (PMP) and trunked land mobile (TLMS) in 805.5 to 809 MHz.

The ACMA proposed a minor revision of the current upper 700 MHz band unwanted emission limits which for the first 2.5 MHz (803–805.5 MHz) the band adopts the 3GPP Category B Option 1 limit with the remainder of the band remaining unchanged for coexistence with the adjacent band apparatus licences.

Some TLG members proposed the adoption of 3GPP limits up to 806 MHz. Although the equivalent TRP limit (using the 3GPP limit with typical non-AAS gain) is stricter than the current EIRP limit on the 700 MHz spectrum licence, the non-AAS 3GPP limit is defined per antenna port which in low order MIMO configurations can have 2, 4 and potentially up to 8 different transmitters. Separation distance calculations show that this adoption may impact PMP services.

Another proposal was to relax the unwanted emissions limit between 806–808 MHz, using a sloping line from 806 MHz to 808 MHz. While this can help reduce the impact of the change in limits at the 806 MHz boundary, the narrower bandwidths (12.5 and 25 kHz) of TLMS services operating in this frequency range can increase the potential interference, especially to licences closer to 806 MHz.

The proposed revision will be to adopt 3GPP Category B Option 1 limits from 803 to 805.5 MHz and retaining existing EIRP limits above 805.5 MHz.

Table 3: Unwanted emission limits in 803 MHz to 805.5 MHz for transmitters operating in the upper 700 MHz band – non-AAS devices

Frequency offset of measurement filter -3dB point from upper/lower limit of licence (f_{offset})	Mean power (dBm) per transmitter	Measurement bandwidth
$0 \text{ MHz} \leq f_{\text{offset}} < 2.5 \text{ MHz}$	$-7\text{dBm} - \frac{7}{5} \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{dB}$	100 kHz

Table 4: Unwanted emission limits in 803 to 805.5 MHz for transmitters operating in the upper 700 MHz band – AAS devices

Frequency offset of measurement filter -3dB point from upper/lower limit of licence (f_{offset})	Total radiated power per sector (dBm)	Measurement bandwidth
$0 \text{ MHz} \leq f_{\text{offset}} < 2.5 \text{ MHz}$	$2\text{dBm} - \frac{7}{5} \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{dB}$	100 kHz

Table 5: Unwanted emission limits in 805.5 to 813 MHz for transmitters operating in the upper 700 MHz band – all transmitters

Frequency offset range (f_{offset})	Radiated maximum true mean power (dBm EIRP)	Measurement bandwidth
$805.5 \text{ MHz} \leq f_{\text{offset}} < 806 \text{ MHz}$	15	1 MHz
$806 \text{ MHz} \leq f_{\text{offset}} \leq 813 \text{ MHz}$	-6	1 MHz

748–758 MHz

The existing unwanted emissions limits in 748–758 MHz are defined as an EIRP limit. The unwanted emission limits below 758 MHz can be less stringent than the limits above 758 MHz, as they do not have to consider potential interference to apparatus licences. The TLG agreed to adopt 3GPP 38.104 Category B Option 1 requirements for NR bands below 1 GHz limits for non-AAS devices with an additional allowance of 9 dB for AAS.

Table 6: Unwanted emission limits in 748 MHz to 758 MHz for transmitters operating in the upper 700 MHz band – non-AAS devices

Frequency offset of measurement filter -3dB point from upper/lower limit of licence (f_{offset})	Mean power (dBm) per transmitter port	Measurement bandwidth
$0 \text{ MHz} \leq f_{\text{offset}} < 5 \text{ MHz}$	$-7\text{dBm} - \frac{7}{5} \left(\frac{f_{\text{offset}}}{\text{MHz}} - 0.05 \right) \text{dB}$	100 kHz
$5 \text{ MHz} \leq f_{\text{offset}} < 10 \text{ MHz}$	-14	100 kHz
$10 \text{ MHz} \leq f_{\text{offset}}$	-16	100 kHz

Table 7: Unwanted emission limits in 748 to 758 MHz for transmitters operating in the upper 700 MHz band – AAS devices

Frequency offset of measurement filter -3dB point from upper/lower limit of licence (f_{offset})	Total radiated power per sector (dBm)	Measurement bandwidth
$0 \text{ MHz} \leq f_{offset} < 5 \text{ MHz}$	$2 \text{ dBm} - \frac{7}{5} \left(\frac{f_{offset}}{\text{MHz}} - 0.05 \right) \text{ dB}$	100 kHz
$5 \text{ MHz} \leq f_{offset} < 10 \text{ MHz}$	-5	100 kHz
$10 \text{ MHz} \leq f_{offset}$	-7	100 kHz

Proposed unwanted emission limits for devices operating in the lower 700 MHz band

The TLG considered changes to the unwanted emissions limits for devices operating in 703–743 MHz (lower 700 MHz band).

Unwanted emission limits (above 694 MHz)

3GPP TS 38.101-1 defines spurious emission limits as applying +/- (channel bandwidth + 5 MHz) outside a device’s assigned channel. This means non-spurious emissions apply at offsets of +/- (channel bandwidth + 5 MHz).

The TLG agreed to adopt 3GPP TS 38.101-1 unwanted emission limits. Importantly this standard does not define separate limits for AAS transmitters. To future proof arrangements for possible AAS use, it is proposed to implement the 3GPP limits as TRP rather than conducted power.

The limits for the first 1 MHz in 3GPP TS 38.101-1 use a measurement bandwidth of 1% of channel BW. This limit can potentially be stricter than that on the current licence, therefore for the first 1 MHz it is proposed to use the current limit on the licence converted to TRP.

Table 8: Unwanted emission limits for transmitters operating in the lower 700 MHz band at frequency offsets of channel bandwidth + 5 MHz – all transmitters

Frequency offset (f_{offset})	Total radiated power per sector (dBm)	Measurement bandwidth
$0 \text{ MHz} \leq f_{offset} < 1 \text{ MHz}$	-15	30 kHz
$1 \text{ MHz} \leq f_{offset} < 5 \text{ MHz}$	-10	1 MHz
$5 \text{ MHz} \leq f_{offset} < \max(\text{Channel BW}, 6)$	-13	1 MHz
$\max(\text{Channel BW}, 6) \leq f_{offset} < \max(\text{Channel BW} + 5, 10)$	-25	1 MHz

Spurious emissions

For the upper 700 MHz band, the spurious domain commences at +/- 10 MHz either side of the operating band (758–803 MHz). The current 700 MHz spectrum licences define spurious emission limits as a radiated mean power (EIRP) for all devices.

The TLG proposed adopting the transmitter and receiver spurious emissions limits specified in the 3GPP TS 38.104.³ 3GPP TS 38.104 defines separate limits for non-AAS and AAS devices. Non-AAS limits are defined as conducted powers (mean power) per antenna port. AAS limits are defined in terms of TRP, which means they apply to the aggregate emissions from all transmitters/receivers that form a device.

As the definitions will be changed from EIRP to TRP, the new limit can potentially be greater than on the current licence. However, due to the large separation in frequency from the upper band to services below the 700 MHz band, the effects are unlikely to be significant. It is noted that the same limits below 700 MHz apply for upper band transmitters in the 800 MHz and 900 MHz. This is consistent with the approach adopted in the 850/900 MHz band review.

The proposed spurious emission limits for non-AAS and AAS transmitters operating in the upper 700 MHz band are detailed in Tables 9 and 10.

Table 9: Unwanted emission limits outside 748 MHz to 813 MHz for transmitters operating in the upper 700 MHz band – non-AAS transmitters

Frequency range (f)	Mean power (dBm) per transmitter	Measurement bandwidth
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36	1 kHz
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36	10 kHz
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-36	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-30	1 MHz

Table 10: Unwanted emission limits outside 748 MHz to 813 MHz for transmitters operating in the upper 700 MHz band – AAS transmitters

Frequency range (f)	Total radiated power per sector (dBm)	Measurement bandwidth
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-27	1 kHz
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-27	10 kHz
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-27	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-21	1 MHz

The spurious emission limits for receivers are defined in Table 11. To support possible future AAS, these limits are defined as TRP.

³ 3GPP TS 38.104, available at: <https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3202>.

Table 11: Unwanted emission limits for receivers operating in the upper 700 MHz band – all receivers

Frequency range (f)	Total radiated power (dBm)	Measurement bandwidth
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-57	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-47	1 MHz

3GPP TS 38.101-1 defines the spurious domain for lower 700 MHz band transmitters as commencing +/- (channel bandwidth + 5 MHz) of a device's assigned channel.

The TLG proposed adopting the transmitter and receiver spurious emissions limits specified in 3GPP TS 38.101-1 and TS 38.104 but (similarly for the non-spurious emissions limits) specifying them in terms of TRP rather than conducted power. This is consistent with the approach adopted in the 850/900 MHz band review.

The proposed spurious emission limits for non-AAS and AAS transmitters operating in the lower 700 MHz band are detailed in Table 12.

Table 12: Unwanted emission limits for transmitters operating in the lower 700 MHz band at frequency offsets greater than channel bandwidth + 5 MHz – all transmitters

Frequency range (f)	Total radiated power (dBm)	Measurement bandwidth
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36	1 kHz
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36	10 kHz
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-36	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-30	1 MHz

The associated receiver spurious emissions limits for receivers are defined in Tables 13 and 14. However, consistent with 3GPP TS 38.104, for a radiocommunications receiver where the antenna or transceiver array boundary connectors support both a radiocommunications receiver and a radiocommunications transmitter, the limits in Table 12 will apply instead.⁴

Table 13: Unwanted emission limits for receivers operating in the lower 700 MHz band – non-AAS receivers

Frequency range (f)	Mean power (dBm) per receiver port	Measurement bandwidth
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-57	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-47	1 MHz

⁴ 3GPP TS 38.104 section 7.6.1 and 10.7.2

Table 14: Unwanted emission limits for receivers operating in the lower 700 MHz band – AAS receivers

Frequency range (f)	Total radiated power (dBm)	Measurement bandwidth
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-27	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-21	1 MHz

Management of potential interference to broadcast and retransmission service exclusion zones

700 MHz spectrum licences issued before 2018 included conditions to protect broadcasting and retransmission services in the 700 MHz band that were in the process of transitioning out of the band. As all the services have transitioned out of the 700 MHz band these conditions are no longer needed on the licence.

Paying the spectrum access charge by instalments

700 MHz spectrum licences issued in 2018 include payment condition clauses for the winning price. As all instalments have been received these conditions are no longer needed on the licence.

Exemption from registration requirement (700 MHz)

Some TLG members proposed changes to the definition of devices that are exempt from registration.

Devices exempt from registration are defined on the 700 MHz spectrum licences as:

- Radiated maximum true mean power of less than or equal to 23 dBm EIRP per occupied bandwidth in the lower band.
- Radiated maximum true mean power of less than or equal to 30 dBm EIRP per occupied bandwidth in the upper band.

This condition exempts low power portable devices, User Equipment (UE), from registration on the Register of Radiocommunications Licences (RRL) as it would be impractical to do.

Broadcasters are concerned about the potential for interference to digital terrestrial television (DTT) receivers. DTT services operate in the frequency range 520–694 MHz which is below the lower 700 MHz band.

A summary of points raised in the initial discussion in the TLG on this issue are:

- MNOs suggest adopting TRP limits in the lower band to allow for the use of antennas with UE.
 - Members of the public can use aftermarket devices to operate UE at levels that exceed the current exemption from registration conditions.
 - The probability of the worst-case interference scenario where the UE antenna is pointing into the boresight of a DTT antenna is low.
- In addition to TRP limits, MNOs support having the limit relaxed to 33 dBm TRP to allow for the use of 3GPP Power Class 1 (PC-1) equipment.
 - PC-1 equipment has applications in safety of life and emergency services.

There are privacy concerns with members of the public using fixed wireless services because they must be registered on the RRL with site information and client names. If PC-1 equipment with antennas can be exempt, this would no longer be an issue.

- The current limit of 23 dBm EIRP does not align with 3GPP specifications for Power Class 3 (PC-3) equipment because it does not provide for +2 dB margin (23 dBm +2 / -2.5 dB)

Given the operation of broadcasting services adjacent to the lower band, careful consideration is required. While it may be preferable to have similar exemption requirements to other spectrum licensed bands, adjusting requirements requires consideration of the specific band environment and the effect on adjacent services. Adopting a TRP limit and/or increasing the limit allows for the use of antennas which could increase the interference environment for DTT receivers.

Telstra developed a study which tested the adjacent channel interference from high powered UE to broadcasting receivers. The study proposed two potential limits:

- 37 dBm EIRP per occupied bandwidth to support PC-3 UE (23 dBm +2 / -2.5 dB + 12 dBi antenna gain)
- 40.5 dBm EIRP per occupied bandwidth to support PC-1 UE (31 dBm +2 / -3 dB + 7.5 dBi antenna gain)

The study was reviewed by the TLG and feedback was provided. Members of the TLG are continuing to work on developing Telstra's study, at the current moment no consensus has been reached on a preferred option. The ACMA will present possible options in the public consultation to gather further information before making a decision.

Unwanted emission limits (below 694 MHz)

The existing unwanted emissions limits below 694 MHz are defined as an EIRP and were developed to provide some coexistence with broadcasting services. In addition, there are defined Block E areas, see Appendix B, where transmitters have a stricter limit.

Broadcasters are concerned about the potential for interference to DTT receivers and have stated that any change to the limit would need to be at least as strict as the current unwanted emission limit or there should be evidence that the current unwanted emission limit is higher than needed to protect television reception.

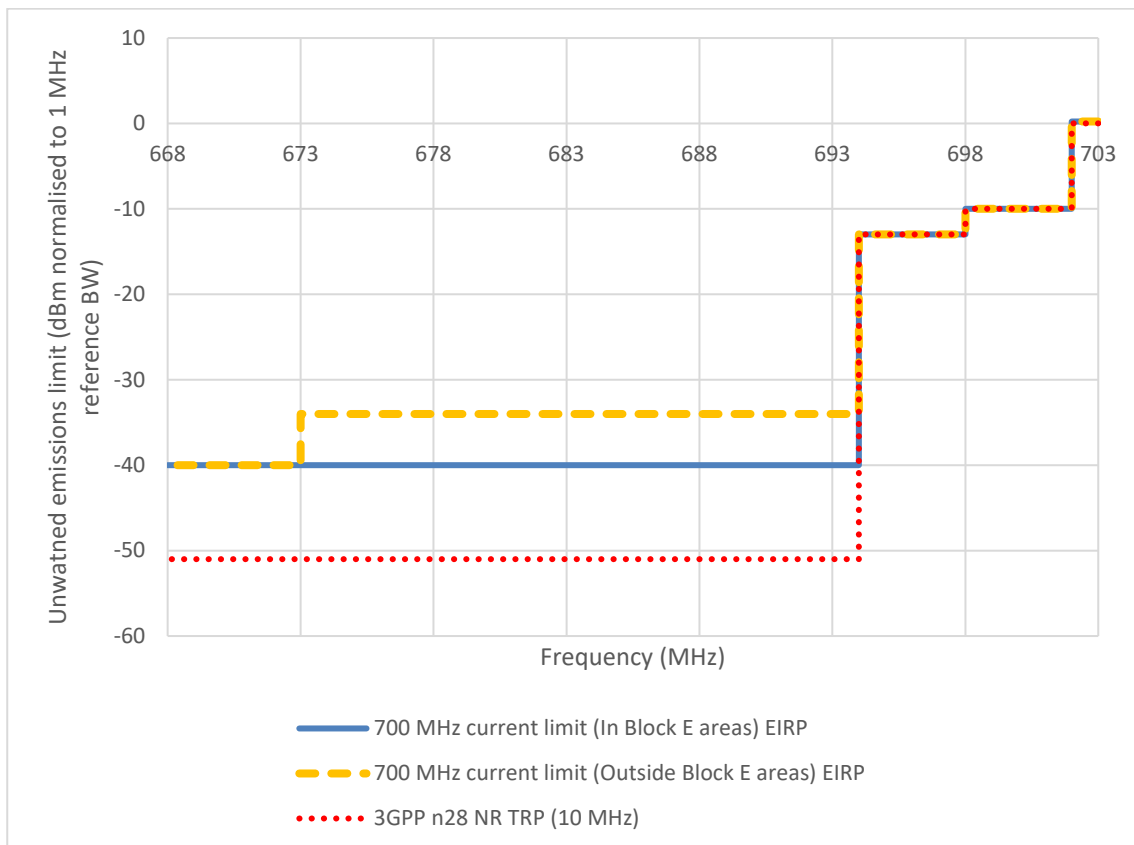
MNOs noted that under current standards equipment in Australia is required to comply with the ETSI standards for Band 28, which specifies a limit of -42 dBm/8 MHz TRP in 470–694 MHz. This limit is also stated in the 3GPP standards.⁵ The MNOs recommended that this limit be adopted as it is stricter than the current limits, outside of and in Block E areas, and will align with 3GPP standards.

⁵ 3GPP TS 38.101-1 V18.1.0 Table 6.5.3.2-1

Figure 3 below compares the following limits:

- In blue, the current unwanted emissions limit in defined Block E areas (EIRP)
- In dashed yellow, the current unwanted emissions limit outside of defined block E areas (EIRP)
- In dotted red, the ETSI/3GPP NR standard for Band 28 (TRP).

Figure 3: Unwanted emission limits comparison for transmitter operating in 703–748 MHz (Lower 700 MHz band)



The adoption of the ETSI limits for band 28 would remove the need for Block E areas, as it is equivalently stricter (when assuming 0 dBi gain out of band) than both inside and outside Block E area limits, reducing regulatory burden. It will also align with 3GPP standards which eases compliance requirements for suppliers. The change will not affect current operating devices as they already must meet this requirement.⁶

As this is an adoption of a TRP metric over EIRP consideration of the potential for EIRP exceeding the current limits is needed. This issue is dependent on the exemption from registration requirements.

⁶ [Australian standard AS/CA S042.4:2022 Requirements for connection to an air interface of a Telecommunications Network—Part 4: IMT Customer Equipment](#) which requires compliance with [ETSI EN 301 908-13](#).

If there is no change to the exemption from registration condition a typical UE gain of 0 dBi would be operating in the lower band and the EIRP is 11 dB lower than the current limit in Block E areas.

Under a proposed limit of 37 dBm EIRP, the allowance for a 12 dBi antenna used with PC-3 devices can result in an unwanted emissions power level 1 dB greater than the current limit in Block E areas.

The proposed limit of 40.5 dBm EIRP allows the use of PC-3 devices with up to 15.5 dBi gain or PC-1 devices with up to 7.5 dBi gain. The 15.5 dBi gain would be 4.5 dB higher than the current limit in Block E areas.

Due to the dependency of the unwanted emission limits to the exemption from registration condition in the lower 700 MHz band, the ACMA will consider this with the possible options in the public consultation to gather further information before making a decision.

Radiocommunications advisory guidelines

Further guidance on interference management with other licensed services is provided in Radiocommunications Advisory Guidelines (RAGs) made under section 262 of the Act. RAGs can refer to any aspect of radiocommunications or radio emissions.

Generally, RAGs include provisions to help assess the possible interference between spectrum-licensed devices and services operating under spectrum, apparatus or class licences. Potentially affected services are identified in the RAGs to enable licensees to assess and mitigate the risk of interference between these services.

It is important to note that where a case of interference arises between a spectrum-licensed device and another licensed device, the ACMA will refer to the provisions of the RAGs in resolving the matter. In general, affected licensees also have the ability to negotiate their own arrangements in order to manage interference. Such arrangements will also be taken into account when resolving any interference disputes.

Currently, there are three section 262 guidelines relevant to the deployment of services under 700 MHz band spectrum licences:

- [Radiocommunications Advisory Guidelines \(Managing Interference from Spectrum Licensed Transmitters – 700 MHz Band\) 2023](#) (RAG Tx)
- [Radiocommunications Advisory Guidelines \(Managing Interference to Spectrum Licensed Receivers – 700 MHz Band\) 2023](#) (RAG Rx)

The 700 MHz RAGs were remade as part of the sunseting of spectrum licensing instruments of other bands in 2023. No substantial updates were proposed by the TLG, however the RAG Tx will be updated to reflect changes to the unwanted emissions limit below 694 MHz on the spectrum licences.

Managing interference to television broadcast services

The [Radiocommunications Advisory Guidelines \(Managing Interference from Spectrum Licensed Transmitters – 700 MHz Band\) 2023](#) provides guidance on the management of interference to receivers operating under a 700 MHz band spectrum licence.

A key part of the management of interference are the core conditions in the 700 MHz band spectrum licence which require radiocommunications transmitters to comply with specific emission limits outside the band in areas where broadcast channels 49, 50 and 51 (Block E) are used (Unwanted emissions below 694 MHz). These conditions in the spectrum licence are reflected in the RAG Rx.

If there is an update to the unwanted emissions below 694 MHz on the spectrum licence the RAG Rx Part 3 Television broadcast services will be updated to be consistent.

Radiocommunications assignment and licensing instruction (RALI) updates

The TLG provided feedback for a concurrent update program to RALI LM08⁷, RALI FX16⁸ and RALI FX22⁹. These updates considered additional criteria and guidance for coordination between apparatus-licensed services in the 800 MHz band and 700 MHz band spectrum licences.

These proposed updates went to [public consultation](#) in October 2023 and were finalised in June 2024.

No other substantial updates were proposed to the RALIs as part of the spectrum licence technical framework review.

850/900 MHz band spectrum licence technical framework

In April 2021 the 850/900 MHz band TLG developed the technical framework for the 850/900 MHz band. The band was allocated in December 2021 with the spectrum licences coming into effect on the 1 July 2024.

Exemption from registration requirement (850/900 MHz)

For the 850/900 MHz band spectrum licences devices that are exempt from registration are identified by reference to their maximum EIRP. Spectrum licensees expressed a desire to have this reviewed. As it is a small change to the 850/900 MHz band technical framework and the same spectrum licensees in the 850/900 MHz band are present in the TLG it was proposed to consult on this together with the 700 MHz band technical framework review.

It is proposed to change this limit from an EIRP to a TRP. This aligns with changes made in other spectrum licensed bands and better supports possible AAS use. It recognises that:

- the previous exemption from registration requirements in the 800 MHz band and 900 MHz band did not have such a strict requirement (or had no limit specified) as currently on the licence
- devices (including user terminals) have been operating under less strict requirements for two decades or more.

⁷ [RALI LM08: Land mobile service | ACMA](#)

⁸ [RALI FX16: Frequency assignment requirements for the point to multipoint service in the VHF high, 400 MHz and 800 MHz bands | ACMA](#)

⁹ [RALI FX22: Frequency assignment requirements for the fixed service in the 800 MHz band | ACMA](#)

Current	Proposed Amendment
<p>Exemption from registration requirements</p> <p>4. The following kinds of radiocommunications transmitters are exempt from the registration requirement in Statutory Condition 3:</p> <p>(a) a radiocommunications transmitter that operates with a radiated maximum true mean power that is less than or equal to 25 dBm per occupied bandwidth in:</p> <p>(i) the frequency range 814 MHz to 845 MHz; or</p> <p>(ii) the frequency range 890 MHz to 915 MHz;</p> <p>(b) a radiocommunications transmitter that operates with a radiated maximum true mean power that is less than or equal to 30 dBm per occupied bandwidth in:</p> <p>(i) the frequency range 859 MHz to 890 MHz; or</p> <p>(ii) the frequency range 935 MHz to 960 MHz</p>	<p>Exemption from registration requirements</p> <p>4. The following kinds of radiocommunications transmitters are exempt from the registration requirement in Statutory Condition 3:</p> <p>(a) a radiocommunications transmitter that operates with a maximum total radiated power that is less than or equal to 25 dBm per occupied bandwidth in:</p> <p>(i) the frequency range 814 MHz to 845 MHz; or</p> <p>(ii) the frequency range 890 MHz to 915 MHz;</p> <p>(b) a radiocommunications transmitter that operates with a maximum total radiated power that is less than or equal to 30 dBm per occupied bandwidth in:</p> <p>(i) the frequency range 859 MHz to 890 MHz; or</p> <p>(ii) the frequency range 935 MHz to 960 MHz</p>

Appendix A – Current 700 MHz band unwanted emission limits

Frequency band and geographic areas

1. This licence authorises the operation of radiocommunications devices in the frequency bands and within the geographic areas set out at Part 2 of Licence Schedule 1.

Emission limits outside the band

2. Core conditions 3 to 13 apply in relation to those frequencies that are outside the frequency bands set out in Part 2 of Licence Schedule 1.
3. Where a written agreement specifying the maximum permitted level of radio emission for frequencies described in core condition 2 exists between:
 - (a) the licensee; and
 - (b) all the affected licensees of frequency-adjacent and area-adjacent spectrum licences;the licensee must comply with that specified maximum permitted level of radio emission.
4. Where there is no written agreement for the purposes of core condition 3 in force, the licensee must comply with core conditions 5 to 13.

Non spurious emission limits

5. The licensee must ensure that radiocommunications devices operated under the licence do not exceed the non spurious emission limits in core conditions 6 to 10.
6. The non spurious emission limits in Table 3 apply:
 - (a) to a radiocommunications transmitter operating in the band 703 to 748 MHz; and
 - (b) at frequencies outside the upper or lower frequency limits set out in Part 2 of Licence Schedule 1; and
 - (d) at frequencies above 694 MHz; and
 - (e) offset from the upper and lower limits set out in Part 2 of Licence Schedule 1.where:

f_{offset} : is the frequency offset from the upper or lower frequency limits set out in Part 2 of Licence Schedule 1.

Table 3: Non spurious emission limits at frequencies outside the band

Frequency offset range (f_{offset})	Radiated maximum true mean power (dBm EIRP)	Specified Bandwidth
$0 \text{ Hz} \leq f_{\text{offset}} < 1 \text{ MHz}$	-15	30 kHz
$1 \text{ MHz} \leq f_{\text{offset}} < 5 \text{ MHz}$	-10	1 MHz
$5 \text{ MHz} \leq f_{\text{offset}} < 20 \text{ MHz}$	-13	1 MHz
$f_{\text{offset}} \geq 20 \text{ MHz}$	-25	1 MHz

7. The non spurious emission limits in Table 4 apply:
- to a radiocommunications transmitter operating in the band 758 MHz to 803 MHz;
 - at frequencies outside the upper or lower frequency limits set out in Part 2 of Licence Schedule 1;
 - within the band 748 to 806 MHz; and
 - offset from the upper and lower limits set out in Part 2 of Licence Schedule 1.

where:

f_{offset} : is the frequency offset from the upper or lower frequency limits set out in Part 2 of Licence Schedule 1.

Table 4: Non spurious emission limits at frequencies outside the band

Frequency offset range (f_{offset})	Radiated maximum true mean power (dBm EIRP)	Specified Bandwidth
$0 \text{ Hz} \leq f_{\text{offset}} < 5 \text{ MHz}$	15	1 MHz
$5 \text{ MHz} \leq f_{\text{offset}} < 10 \text{ MHz}$	11	1 MHz
$f_{\text{offset}} \geq 10 \text{ MHz}$	9	1 MHz

8. The non spurious emission limits in Table 5 apply to a radiocommunications transmitter operating in the band 758 MHz to 803 MHz where:

f_{offset} : is the range of frequencies at which the limit applies.

Table 5: Non spurious emission limits at frequencies outside the band

Frequency offset range (f_{offset})	Radiated maximum true mean power (dBm EIRP)	Specified Bandwidth
$f_{\text{offset}} < 748 \text{ MHz}$	-15	1 MHz
$806 \text{ MHz} \leq f_{\text{offset}} < 813 \text{ MHz}$	-6	1 MHz
$813 \text{ MHz} \leq f_{\text{offset}}$	-15	1 MHz

9. The non spurious emission limits in Table 6 apply:
- to a radiocommunications transmitter operating in the band 703 MHz to 748 MHz;

- (b) within an area referred to in paragraph 3.2(1)(a) of the *Radiocommunications Advisory Guidelines (Managing Interference from Transmitters — 700 MHz Band) 2012 (affected areas)*;

where:

f_{offset} : is the range of frequencies at which the limit applies.

Table 6: Non spurious emission limits at frequencies outside the band

Frequency offset range (f_{offset})	Radiated maximum true mean power (averaged over a 7 MHz television channel bandwidth) (dBm EIRP)	Specified Bandwidth
$f_{\text{offset}} < 694 \text{ MHz}$	-40	1 MHz

10. The non spurious emission limits in Table 7 apply:
- (a) to a radiocommunications transmitter operating in the band 703 MHz to 748 MHz;
- (b) outside of the affected areas;

where:

f_{offset} : is the range of frequencies at which the limits applies.

Table 7: Non spurious emission limits at frequencies outside the band

Frequency offset range (f_{offset})	Radiated maximum true mean power (averaged over a 7 MHz television channel bandwidth) (dBm EIRP)	Specified Bandwidth
$f_{\text{offset}} < 673 \text{ MHz}$	-40	1 MHz
$673 \text{ MHz} \leq f_{\text{offset}} < 694 \text{ MHz}$	-34	1 MHz

Spurious emission limits

11. The licensee must ensure that radiocommunications devices operated under the licence do not exceed the spurious emission limits in core conditions 12 and 13.
12. For radiocommunications transmitters operated under the licence, the spurious emission limits in Table 8 apply at frequencies outside the 703-748 MHz and 758-803 MHz frequency bands.

Table 8: Radiocommunications transmitter spurious emission limits

Frequency range (f)	Radiated mean power (dBm EIRP)	Specified Bandwidth
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36	1 kHz
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36	10 kHz
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-36	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-30	1 MHz

13. For radiocommunications receivers operated under the licence, the spurious emission limits in Table 9 apply at frequencies outside the 703-748 MHz and 758-803 MHz frequency bands.

Table 9: Radiocommunications receiver spurious emission limits

Frequency range (f)	Radiated mean power (dBm EIRP)	Specified Bandwidth
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	-57	100 kHz
$1 \text{ GHz} \leq f < 12.75 \text{ GHz}$	-47	1 MHz

Emission limits outside the geographic area

14. Core conditions 15 to 17 apply in relation to those areas that are outside the geographic areas set out at Part 2 of Licence Schedule 1.
15. Where a written agreement specifying the maximum permitted level of radio emission for areas described in core condition 14 exists between:
 - (a) the licensee; and
 - (b) all the affected licensees of frequency-adjacent and area-adjacent spectrum licences;
 the licensee must comply with that specified maximum permitted level of radio emission.
16. Where there is no written agreement for the purposes of core condition 15 in force, core condition 17 applies.
17.
 - (1) The maximum permitted level of radio emission for an area described in core condition 14 caused by operation of radiocommunications devices under the licence must not exceed a horizontally radiated power of 47 dBm EIRP per 30 kHz.
 - (2) The licensee complies with sub-condition 17(1) by ensuring that no radiocommunications device is operated under the licence in excess of a horizontally radiated power of 47 dBm EIRP per 30 kHz.

Appendix B – Block E areas

DTT services operate in 520–694 MHz with channel planning Block E channels 49, 50 and 51 (673 – 694 MHz) adjacent to the 700 MHz lower band. The current spectrum licences stipulate stricter unwanted emission limits outside the band where these channels are used.

Figure 4: Block E predicted areas of digital coverage

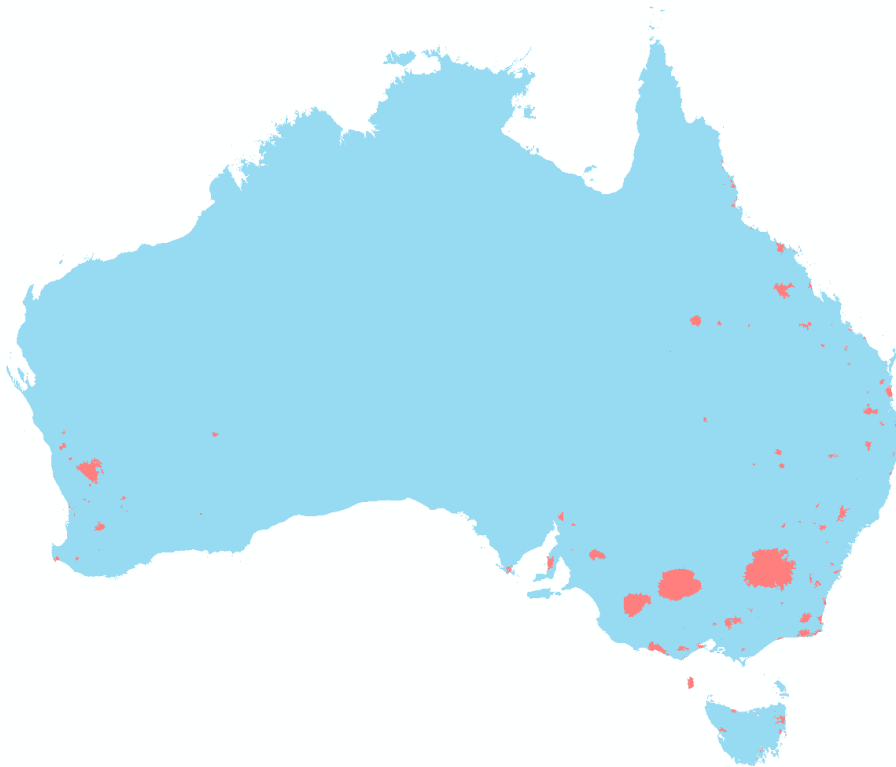


Figure 5: Block E predicted areas of digital coverage in south-western Australia

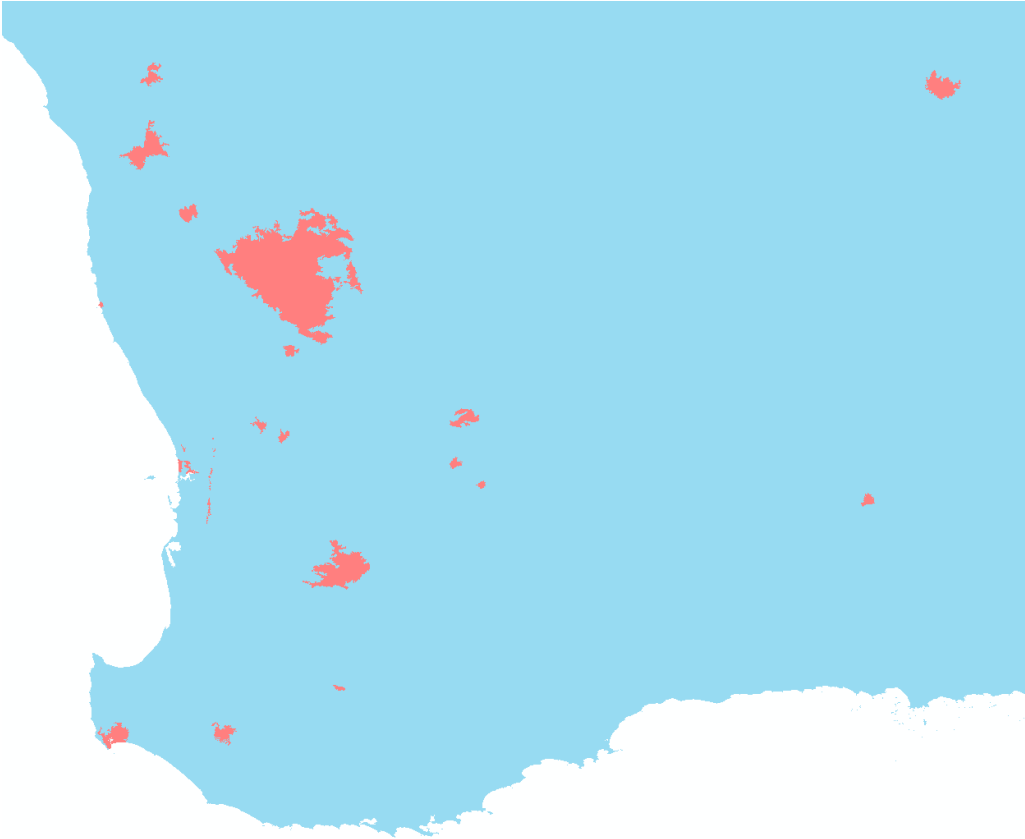


Figure 6: Block E predicted areas of digital coverage in eastern Australia

