

3.4 GHz spectrum licence technical framework

Review of the unwanted emission boundary

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Introduction

The technical framework for the 3425–3492.5 MHz and 3542.5–3700 MHz (3.4 GHz) spectrum licence band was reviewed and updated in 2018. This was done to incorporate the 3575–3700 MHz (3.6 GHz) band and support the introduction of 5G services and new advanced antenna systems (AAS). Details of the changes are available on the [ACMA's website](#).

Since the 3.4 GHz band technical framework was developed, mobile network operators (MNOs) both domestically and internationally have started to deploy 5G services. As a result, industry knowledge and understanding of 5G and AAS has continued to evolve. While the technical framework was only recently reviewed, we believe the developments in the landscape warrant a review of the spurious emission frequency boundary associated with unwanted emission limits.

In order to reduce deployment costs for industry and improve future flexibility to defragment spectrum holdings, the ACMA has been approached by some spectrum licensees to consider changing the definition of the spurious emission frequency boundary at 3740 MHz for devices that are required to be registered (e.g. base stations). No changes are proposed or considered necessary to the limits defined for devices exempt from registration.

This paper provides the ACMA's analysis and considerations identifying the potential impact of the proposed changes. We are seeking comment on the analysis and impact assessment to inform future decision making. This includes ensuring the potential impact on incumbent and new fixed satellite service (FSS) earth stations and point-to-point links operating in adjacent bands has been appropriately assessed.

Issues for comment

The ACMA invites comments on the issues set out in this paper:

1. Are there any other developments that the ACMA should consider as part of the case for action?
2. Are there any other issues the ACMA should consider regarding the proposed changes?
3. Do stakeholders have any views or comments on the proposed changes and way forward?

Case for action

Recent developments

In the time since the 3.4 GHz band technical framework was reviewed the following has occurred:

- > MNOs are in the process of deploying 5G services.
- > Most of the currently available 5G equipment is designed to operate in the 3rd Generation Partnership Project (3GPP) N78 (3300–3800 MHz) profile band. Existing frequency boundaries for spurious emission limits do not align with 3GPP standards for the N78 band. Consequently, due to the integrated nature of radio units and antenna elements in AAS, operators are required to incorporate additional filtering during the manufacturing process to meet this requirement. These filters cannot simply be incorporated or removed post manufacture as they can with traditional antenna systems.
- > In August 2019 the ACMA commenced a [review of the adjacent 3700–4200 MHz band](#). This review is still ongoing, and planning decisions are not expected to be made until the second half of 2020. However, as part of the review, options for possible wireless broadband use in some or all the 3700–4200 MHz band are being considered.
- > In submissions to the 3700–4200 MHz consultation process, MNOs expressed interest in expanding existing 3.4 GHz spectrum licence arrangements to encompass the 3700–3800 MHz band. This is within the tuneable range of currently available and unmodified 5G equipment. It could also provide an opportunity for licensees to expand existing spectrum holdings up to 100 MHz—the optimal amount of spectrum for 5G in the N78 profile band.

As a result of these developments, the ACMA has been approached by 3.4 GHz spectrum licensees to consider changing the current 3740 MHz spurious emission boundary to 3840 MHz. This is for the following reasons:

- > The proposed changes better align with 3GPP standards for the N78 profile band.
- > In the event that more spectrum is made available for spectrum licensing in the 3700–4200 MHz band, it is expected there will be interest in defragmenting spectrum holdings with the adjacent 3.4 GHz band. Due to the existing spurious emission frequency boundary at 3740 MHz, it is expected that licensees will need to replace equipment where they move into spectrum close to, or above, 3740 MHz. Noting that 3.4 GHz spectrum licensees are at the early stage of procuring and deploying 5G equipment, changing the spurious emission frequency boundary now could allow deployment of systems that are tuneable up to 3800 MHz and minimise the financial implications of any future defrag process (if it occurs).

It is stressed that reviewing the spurious emission boundary does not predetermine the outcomes of the current 3700–4200 MHz band review. While spectrum licensing to support wide-area wireless broadband use is an option for the band, it is not the only use case and licensing option under consideration. The major factor that needs to be considered is the impact on the deployment of new FSS earth stations in the 3740–3840 MHz band—this is discussed further in the next section of this paper.

Question 1

Are there any other developments that the ACMA should consider as part of the case for action?

Current arrangements

The unwanted emission limits (which encompasses both out-of-band and spurious emissions) that currently apply to devices required to be registered under 3.4 GHz spectrum licences are reproduced in Tables 1, 2 and 3.

Table 1: Radiocommunications transmitter unwanted emission limits for registered non-AAS devices within the 3360–3740 MHz band

Frequency offset from operating channel edge	Total Radiated Power (dBm) per cell/sector	Measurement bandwidth
$0 \text{ kHz} \leq f_{\text{offset}} \leq 5 \text{ MHz}$	$-7 - (7/5) \cdot f_{\text{offset}} \text{ (MHz)}$	100 kHz
$5 \text{ MHz} \leq f_{\text{offset}} \leq 10 \text{ MHz}$	-14	100 kHz
$f_{\text{offset}} \geq 10 \text{ MHz}$	-15	1 MHz

For registered AAS devices an additional 9 dB is added to the TRP values.

Table 2: Radiocommunications transmitter unwanted emission limits for registered non-AAS devices outside the 3360–3740 MHz band

Frequency range	Total Radiated Power (dBm) per cell/sector	Measurement bandwidth
$9 \text{ kHz} \leq f \leq 150 \text{ kHz}$	-36	1 kHz
$150 \text{ kHz} \leq f \leq 30 \text{ MHz}$	-36	10 kHz
$30 \text{ MHz} \leq f \leq 1 \text{ GHz}$	-36	100 kHz
$1 \text{ GHz} \leq f \leq 19 \text{ GHz}$	-30	1 MHz

For registered AAS devices an additional 9 dB is added to the TRP values.

Table 3: Radiocommunications receiver unwanted emission limits for registered non-AAS devices outside the 3360–3740 MHz band

Frequency range	Total Radiated Power (dBm) per cell/sector	Measurement bandwidth
$30 \text{ MHz} \leq f \leq 1 \text{ GHz}$	-57	100 kHz
$1 \text{ GHz} \leq f \leq 19 \text{ GHz}$	-47	1 MHz

For registered AAS devices an additional 9 dB is added to the TRP values.

When defining the unwanted emission limits, we considered the most likely use of the band and relevant applicable international standards. Where possible the ACMA seeks to align limits with international standards. This avoids creating bespoke arrangements that only apply in Australia that could affect equipment costs. However, this needs to be balanced with the need to protect or coexist with other adjacent band services.

International standards

In the case of the 3.4 GHz band, we have considered the 4G and 5G standards published by the 3GPP. These standards define the following operating bands for 4G (E-UTRA¹) and 5G (New Radio) technologies²:

- > E42 (E-UTRA operating band 42): 3400–3600 MHz
- > E43: 3600–3800 MHz
- > E48: 3550–3700 MHz
- > N77 (New radio operating band 77): 3300–4200 MHz
- > N78: 3300–3800 MHz.

For base stations, 3GPP standards state that the spurious domain for 4G and 5G systems commence ± 10 MHz and ± 40 MHz outside the defined operating band respectively. For 4G systems this means the natural point for the spurious domain to commence at the upper end of the operating band is either 3810 MHz for E43 or 3710 MHz for E48. For 5G systems, the natural point for the spurious domain to commence is either 3840 MHz for N78 or 4240 MHz for N77.

Adjacent band FSS earth stations

In the Australian Radiofrequency Spectrum Plan 2017 (the ARSP), the FSS is a primary service in the 3700–4200 MHz band. The band is used for the reception of signals from satellites. There are numerous FSS earth stations licensed for operation in the 3700–4200 MHz band across Australia—including in earth station protection zones (ESPZs) as summarised in Table 4.

Table 4: Number of apparatus licensed FSS earth stations in the 3740–3840 MHz band as of 1 December 2019

Region	3700–3800 MHz	3800–3900 MHz	3900–4000 MHz	4000–4100 MHz	4100–4200 MHz	Total
Adelaide	0	0	1	0	1	2
Brisbane	0	0	0	0	0	0
Canberra	2	0	0	0	2	4
Melbourne	1	1	0	0	3	5
Perth	17	16	18	14	12	77
Sydney	26	43	32	15	8	124
Regional (ex. ESPZs)	4	0	0	2	20	26
Remote (ex. ESPZs)	3	11	2	4	16	36
ESPZ	1	0	41	1	24	67

FSS earth stations are provided protection based on the criteria contained in the [Radiocommunications Advisory Guidelines \(Managing Interference from Spectrum Licensed Transmitters — 3.4 GHz Band\) 2015](#) (RAG Tx). Coordination between FSS earth stations and devices registered under a 3.4 GHz spectrum licence

¹ Evolved Universal Terrestrial Radio Access (E-UTRA) is the air interface for Long Term Evolution (LTE) defined by 3GPP

² 3GPP specifications [TS 36.104](#) 'Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception' and [TS 38.104](#) 'NR; Base Station (BS) radio transmission and reception'.

(spectrum licensed devices) occurs on a first-in-time basis. This means spectrum-licensed devices are required to protect existing apparatus-licensed FSS earth stations to the levels stated in the RAG Tx—irrespective of what unwanted emission limits are defined.

However, such devices are not required to protect FSS earth stations licensed after they are registered. In this case, the onus is on FSS earth station operators to licence new services at locations that will not result in harmful interference from existing services. This can affect the ability of operators to licence new services in some areas. This includes populated areas where mobile services are typically densely deployed and sites that have little to no terrain or other shielding.

To limit the impact on the deployment of new FSS earth stations in the adjacent 3700–4200 MHz, we previously defined the spurious boundary—where stricter limits apply—at 3740 MHz; i.e. 40 MHz above the frequency range identified for spectrum licensing. This decision was informed by advice provided by mobile operators and manufacturers. Based on the available information, a balance was reached between supporting coexistence with adjacent band FSS and defining limits that did not deviate too much from 3GPP standards.

Adjacent band point-to-point links

[Radiocommunications and licensing instruction \(RALI\) FX3](#) defines frequency assignment criteria to and from point-to-point links operating in the 3700–4200 MHz band. When assessing the impact of unwanted emissions on existing and new point-to-point licences we considered:

- > There have been few new point-to-point links licensed over the last decade, and as shown in Table 5 the total number of licences is in decline.
- > The deployment of new services was limited to regional and remote areas.
- > As with FSS earth stations, coordination with point-to-point links occurs on a first-in-time basis. This means existing services are afforded a defined level of protection irrespective of what unwanted emission limits are defined.
- > The directional nature of point-to-point link antennas reduces their susceptibility to interference.

When combined, these factors point to a low to negligible effect of unwanted emission limits denying access to spectrum for existing and new point-to-point links.

Table 5: Point-to-point licences over time

Date	Point-to-point licences (devices)
June 2000	1090 (4008)
June 2005	714 (2588)
June 2010	302 (1032)
June 2015	190 (616)
January 2020	98 (350)

Assessment of proposed changes

Proposed changes

The proposed changes are limited to the frequency range definitions that the unwanted emission limits in tables 1–3 apply. Specifically, it is proposed to change the frequency range from 3360–3740 MHz to 3360–3840 MHz. This will only result in changes to the unwanted emission limits in the 3740–3840 MHz frequency range as follows:

- > For registered transmitters, the total radiated power (TRP) will increase from -30 dBm/MHz to -15 dBm/MHz.
- > For receivers, the unwanted emission limits will no longer apply in the 3740–3840 MHz band.

No changes are proposed to the unwanted emission limits defined for devices exempt from registration (i.e. mobile phones and other low power terminals).

Effect on incumbent services

Adjacent band FSS earth stations

As shown in Table 4, most earth stations are licensed in Perth and Sydney. Currently and historically these are limited to a handful of locations. There are even fewer services to consider in the 3740–3840 MHz range.

The proposed changes would have no effect on existing apparatus-licensed FSS earth stations. This is because spectrum licence devices are required to protect existing licensed services to the levels stated in the RAG Tx—irrespective of what unwanted emission limits are defined.

The impact of the changes to the unwanted emission limit frequency range for receivers is not considered significant. It is expected, however, that the increase in TRP for registered transmitters will result in significantly higher levels of unwanted emissions. Therefore, limiting the assessment on impact to FSS earth stations to those changes is sufficient.

The proposed changes may affect the ability of operators to licence new FSS earth stations in the 3740–3840 MHz band, particularly in areas with a high density of base station deployments (e.g. within cities). This is due to the higher TRP levels from registered transmitters. However, we consider that the effect of the proposed changes can be mitigated through appropriate planning and siting of new FSS earth stations. This could include employing site shielding (where practical) and choosing sites that take advantage of local terrain and clutter or are located away from significant population centres. It is expected that the protection afforded to existing services at major teleports would also make it easier to licence new services at these locations.

Where feasible, consideration could also be given to deploying new FSS earth stations in one of the earth station protection zones defined in [RALI MS44](#). These areas are reserved and protected for use by satellite services.

Adjacent band point-to-point links

For the same reasons discussed in the [Case for action](#) section of this paper, the effect the proposed changes would have on denying access to spectrum for new point-to-point links is considered low to negligible.

Proposed way forward

Based on the analysis presented in this paper, it appears the proposed changes would:

- > Have no impact on existing adjacent band apparatus licences.
- > Have low to negligible impact on new point-to-point links in the 3740–3840 MHz band.
- > Not prevent the deployment of new FSS earth stations in the 3740–3840 MHz band, provided services are appropriately planned and sited.

For these reasons, the ACMA's current view is to adopt the proposed changes. However, before making a final decision, we will consider all information provided in submissions to this consultation. Of particular interest is whether there are any other issues related to the impact on adjacent band services that should be considered.

Once a decision has been made, the ACMA will announce the outcomes on its website. In the event a decision is made to adopt the proposed changes, the ACMA would seek to apply them to all 3.4 GHz spectrum licences. As this relates to a change in a core condition of the licence, the changes would need to be made via agreement with licensees under section 72 of the Radiocommunications Act. Consequently, the ACMA would write to all spectrum licensees seeking their agreement to implement the changes.

Question 2

Are there any other issues the ACMA should consider regarding the proposed changes?

Question 3

Do stakeholders have any views or comments on the proposed changes and way forward?

Invitation to comment

Making a submission

The ACMA invites comments on the issues set out in this discussion paper.

- > [Online submissions](#) can be made by uploading a document. Submissions in PDF, Microsoft Word or Rich Text Format are preferred.
- > Submissions by post can be sent to:
 - The Manager
 - Wireless Broadband Section
 - Australian Communications and Media Authority
 - PO Box 78
 - Belconnen ACT 2616

The closing date for submissions is COB, Friday 13 March 2020.

Consultation enquiries can be emailed to fregplan@acma.gov.au.

Publication of submissions

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