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Australian Communications and Media Authority

3.4 GHz spectrum licence technical framework

Review of the unwanted emission boundary—outcomes paper

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Introduction

In February 2020, the ACMA released the consultation paper 3.4 GHz spectrum licence technical framework: Review of the unwanted emission boundary (the review paper). The review paper presented a case for seeking agreement from spectrum licensees to change the frequency ranges to which the unwanted emission limits on their licences apply in relation to registered devices in the 3425–3492.5 MHz and 3542.5–3700 MHz (3.4 GHz) bands (referred to as the proposed changes).

The purpose of the proposed changes was to align the 3.4 GHz band unwanted emission limits with international standards. Doing so would allow licensees to fully leverage the global 5G ecosystem and associated economies of scale. In addition to this—pending future planning decisions by the ACMA in the 3700-4200 MHz band—it would enable licensees to make use of existing equipment, rather than replacing it, to extend operation into the 3700–3800 MHz band.

The review paper also analysed the effect the proposed changes would have on apparatus-licensed fixed satellite service (FSS) earth stations and fixed service (FS) point-to-point links operating in adjacent bands. The analysis concluded that the proposed changes would:

> Have no impact on existing adjacent band apparatus-licensed FSS and point-to-point links.

> 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 reasons stated above, the preferred view of the Australian Communications and Media Authority (ACMA) expressed in the review paper was to adopt the proposed changes. Stakeholders were asked to comment on this proposal. Of particular interest was whether there were additional issues related to the effect on adjacent band services that should be considered.

This paper considers and responds to issues raised in submissions to the review paper.

After reviewing submissions, the ACMA has also updated its assessment of the benefits of the proposed changes as well as the effect on adjacent band services. This assessment reaffirms that the proposed changes would:

> Align more closely with the global n78 spectrum band (3300–3800 MHz) defined by the 3rd Generation Partnership Program (3GPP), allowing licensees to fully leverage the global 5G ecosystem and associated economies of scale. While the cost of meeting the existing Australian specific requirements were found not to be significant, adopting the proposed changes would remove the delays some operators face in deploying new technologies until appropriately modified equipment is available for the Australian market.

> Pending future planning decisions by the ACMA in the 3700–4200 MHz band, enable existing spectrum licensees to make use of existing equipment, rather than replacing it, to extend operation into the 3700–3800 MHz band. This would result in cost savings in the order of $30–$75 million.

> Have no impact on existing adjacent band apparatus licenses.

> Have no to low effect on new adjacent band apparatus-licensed services.

For the above reasons, the ACMA has decided to proceed with the proposed changes.

Current arrangements

Each spectrum licence issued by the ACMA must include a core condition setting out the maximum permitted levels of radio emissions outside of the band that is authorised by the spectrum licence. These are referred to as 'unwanted emission limits' and encompass both out-of-band and spurious emissions. The unwanted emission limits 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-Advanced Antenna System (AAS) devices within the 3360–3740 MHz band

Frequency offset from operating channel edge	Total radiated power (dBm) per cell/sector	Measurement bandwidth
0 kHz ≤ f_{offset} ≤ 5 MHz	-7 – (7/5).f_{offset} (MHz)	100 kHz
5 MHz≤ f_{offset} ≤ 10 MHz	-14	100 kHz
f_{offset} ≥ 10 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 kHz ≤ f ≤ 150 kHz	-36	1 kHz
150 kHz ≤ f ≤ 30 MHz	-36	10 kHz
30 MHz ≤ f ≤ 1 GHz	-36	100 kHz
1 GHz ≤ f ≤ 19 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 MHz ≤ f ≤ 1 GHz	-57	100 kHz
1 GHz ≤ f ≤ 19 GHz	-47	1 MHz

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

Proposed changes

The proposed changes that formed the basis of the consultation in the review paper were limited to the frequency range definitions to which the unwanted emission limits in Tables 1–3 apply. Specifically, it was proposed to change the frequency range from 3360–3740 MHz to 3360–3840 MHz. This would 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 were proposed to the unwanted emission limits set for devices exempt from registration (i.e. mobile phones and other low-power terminals).

It is noted that the proposed changes relate to a core condition currently included on 3.4 GHz spectrum licences as required by Subsection 66 (1) of the *Radiocommunications Act 1992* (the Act). Consequently, the only viable options considered in the review paper were:

> No changes to the existing unwanted emission limits; and

> Implement the changes after seeking agreement from spectrum licensees in accordance with section 72 of the Act.

Summary of and response to submissions

Consultation on the review paper was conducted from 13 February to 13 March 2020. Six submissions[1] were received. The paper invited comment on the following:

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?

Responses received to the review paper have been grouped into two categories to allow for easier comparison: responses from the wireless broadband and satellite industries.

No submissions were received from existing or prospective point-to-point apparatus licensees in the 3.4 GHz band.

Satellite industry

Responses were received from Intelsat and the Communications Alliance Satellite Services Working Group (SSWG)[2]. Key points raised in these submissions are summarised below:

> The satellite industry did not support the proposed changes and preferred that the status quo be maintained.

> Ongoing access to C band downlink spectrum[3] is important to the satellite industry. This is due to the coverage it provides and resistance to rain fade, making it suitable for national or global applications such as those related to the distribution of broadcasting content, banking networks, emergency services and mobile backhaul used to extend network coverage.

> Changing the unwanted emission limits now would prejudge and possibly prejudice the outcomes of the current review of planning arrangements in the 3700–4200 MHz band.

> Generous concessions have already been made to the mobile industry by making the extended C band available for 5G use. This came at considerable expense to the satellite industry. Prior to making any decision to implement the proposed changes, the ACMA should conduct a review and audit of the usage of the 3575–3700 MHz band. This will inform whether there is a need for additional spectrum for such applications, and if so, how much additional spectrum will be needed.

> To justify any changes, 3.4 GHz spectrum licensees should be required to provide data on the price difference between 5G equipment for the n77 (3300–4200 MHz) and n78 (3300–3800 MHz) profile bands.

[1] Submissions can be viewed on the ACMA website.

[2] It is noted that the submission from the SSWG does not represent the views of Optus or Telstra.

[3] C band downlink spectrum comprises the standard C band (3700–4200 MHz) and extended C band (3400–3700 MHz).

- The current protection requirements for FSS earth stations are contained in the Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters — 3.4 GHz Band) 2015 (RAG Tx). These are consistent with a protection boundary of 3740 MHz not 3840 MHz.
- The proposed changes may affect the ability of operators to deploy new FSS earth stations in the 3740–3840 MHz band, particularly at existing earth station sites. In the opinion of the respondents, the suggestion that this can be managed by appropriate planning, and siting of services is simplistic and could have destructive consequences for the satellite industry in C band. It is also incompatible with new licensing arrangements being developed. Operating earth stations from multiple sites is economically unsound and has operational and organisation implications on operators.
- The satellite industry is concerned by the first-in-time coordination requirements in place between devices deployed under a spectrum licence and FSS earth stations. This limits the flexibility of satellite operators to deploy new earth station in some areas of Australia. Respondents stated they believe there is no value in obtaining new apparatus licences under such arrangements. They further stated that, to some degree, it downgrades the status of FSS from a primary to a secondary service in the 3700–4200 MHz band. It is not believed that this is the intention of the ACMA. For the deployment of new services, respondents proposed that existing earth station sites be provided with ongoing protection with no accompanying time constraints.
- Mobile signals are considerably more powerful than satellite signals, which complicates coexistence between these services. Even adjacent channel interference into FSS will occur unless carefully managed. The ACMA should carefully study co-channel and adjacent channel interference caused by the potential deployment of terrestrial 5G systems into FSS earth stations. Intelsat also detailed measures mobile network operator could implement to mitigate co-channel and adjacent channel interference.
- In order to prevent 5G signals from saturating earth station low-noise block downconverters (LNBs), one respondent proposed that, in line with technical studies conducted by other administrations, a 100 MHz guard band should be put in place between 5G and FSS earth stations. This would provide additional suppression of unwanted signals from 5G services. However, additional restriction zones would be required to some sensitive services.
- The ACMA should investigate the use of treaty powers to establish and protect a multi-occupant satellite facility site in eastern Australia for ongoing use by FSS earth stations. This is in line with government-stated objectives to grow the domestic space sector. Such a treaty has been developed with the European Space Agency (ESA) in the past. As a result of this treaty, ESA agreed to relocate services to a location outside of Perth.

ACMA response

The ACMA acknowledges the concerns the satellite industry has raised regarding the proposed changes.

The ACMA reiterates (as stated in the review paper) that any decisions regarding the proposed changes will 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 ongoing needs of the satellite industry in C band will necessarily be a consideration in any decisions made as part of that review.

It is also important to note that the proposed changes to the 3.4 GHz emission limits will not result in spectrum in the 3700–4200 MHz band being made available for wireless broadband use. That possibility is being considered in the 3700–4200 MHz

band review. The major factor that needs to be considered under this consultation is the impact the proposed changes may have on existing and new point-to-point links and FSS earth stations in the 3740–3840 MHz band.

Price difference between 5G equipment for the n77 and n78 profile bands

As stated in the review paper, the existing unwanted emission limits applying to the 3.4 GHz spectrum licences do not align with standards defined for either the 3GPP, n77 (3300–4200 MHz) or n78 (3300–3800 MHz) profile bands. For this reason, the difference in price between equipment compliant with these bands is not relevant. To meet the existing unwanted emission limits, equipment consistent with both profile bands needs to be modified by operators with licence holdings close to the 3700 MHz frequency boundary.

Since this is currently an Australian-specific requirement, it requires equipment to be custom-modified for such use at a cost to operators. A key benefit of the proposed changes is that this would no longer be required. Adopting the changes would allow operators to fully leverage the global 5G ecosystem and the associated economies of scale. This is expected to reduce equipment costs compared with the current technical arrangements and support faster adoption of new technologies. This is discussed further in the Benefits to 3.4 GHz spectrum licensees section.

FSS earth station protection requirements

As indicated by one of the satellite industry submissions, the RAG Tx details protection criteria for FSS earth stations.

However, as stated in the review paper, these protection criteria are independent of the unwanted emission limits that are defined for spectrum licences. Specifically, the Rag Tx states that FSS earth stations are to be protected from unwanted emissions (both out-of-band and spurious) to a level of -128.6 dBm/MHz. Noting that coordination between FSS earth stations and devices registered under a 3.4 GHz spectrum licence (spectrum licensed devices) occurs on a first-in-time basis, newly registered spectrum-licensed devices are required to protect existing apparatus-licensed FSS earth stations to the stated levels—irrespective of the unwanted emission limits as defined. Consequently, on a case-by-case basis, this may require spectrum licensees to implement various mitigation techniques, including appropriate planning and siting of new services.

The ACMA acknowledges the satellite industry's concerns over the use of first-in-time coordination to manage interference. However, this is the usual practice for the management of interference (including adjacent-band interference) between coordinated co-primary services in C band and other bands. This approach maximises the utility of the spectrum by enabling the deployment of new services without speculatively reserving access for possible future use by some operators (whether they be spectrum or FSS earth station licensees). It also ensures that all licensees are paying for the spectrum denial they cause to other services. This is particularly important in areas of high demand for access to spectrum such as cities and other significant population centres.

Other approaches to first-in-time coordination can be considered on a case-by-case basis. For example, an alternative approach is identified for earth station protection zones (ESPZs) located in areas of low demand for access to spectrum by other services. These are discussed further below.

The ACMA does not intend to change the established first-in-time coordination requirements as part of this process. Both spectrum licensees and FSS earth station operators will need to continue to consider first-in-time coordination requirements when deploying new services. In many instances, it is expected that FSS earth

stations at existing teleports[4] will provide an inherent level of protection at these sites for the deployment of new services.

In addition, the ACMA has identified four earth station protection zones (ESPZs) located in regional areas outside of major population centres.[5] These areas preserve access to spectrum for the deployment of new earth stations—that is, ESPZs are provided with ongoing protection with no accompanying time constraints for individual coordination and licensing of earth stations within these areas. This has been done to provide long-term options for the deployment of new earth stations in C band and other bands used by the satellite industry.

Intelsat suggested implementing a 100 MHz guard band between FSS earth stations and spectrum licence devices to prevent saturation of LNBs. The ACMA notes that for this form of interference, emissions within the licensed bandwidth of an adjacent band service (i.e. in-band emissions) are usually dominant since unwanted emissions are much lower in strength. The proposed changes are not expected to alter this arrangement.

The ACMA does not support implementing a 100 MHz guard band between spectrum licence devices and FSS earth stations. Doing so would unnecessarily restrict the deployment of both spectrum licence devices and FSS earth stations. There are numerous mitigation techniques that could be implemented to allow much closer operation and increase utility of the spectrum. Of course, satellite operators are free to self-impose such a guard band by limiting the deployment of new services to above 3800 MHz.

Impact of proposed changes on existing and new earth stations

The ACMA acknowledges that the proposed changes may affect the ability of operators to deploy new FSS earth stations in the 3740–3840 MHz band. However, as discussed in the Effect on incumbent services section, this is not expected to be a major impediment at existing teleports. In addition, historical licence data indicates the deployment of FSS earth stations at new sites and the creation of new teleports does not occur often. When it does occur, the ACMA maintains that it can be mitigated via appropriate planning and siting of services. This is not a new requirement and generally applies to the deployment of any new service.

Where feasible, consideration could also be given to deploying new FSS earth stations at one of the defined ESPZs. As mentioned previously, the ACMA has identified several ESPZs in western and eastern Australia that it is preserving for use by the satellite industry. These areas are provided with ongoing protection to provide long-term certainty for operators that deploy new services in these areas.

Use of treaty powers

The ESA treaty mentioned[6] is a very specific treaty between the Australian Government and the European Space Agency for a co-operative space vehicle tracking program. It is not clear what treaty powers would be relevant to the location of earth stations in the current context.

The ACMA therefore does not consider the use of treaty powers are applicable, appropriate or necessary to establish sites in eastern Australia capable of supporting multiple satellite operators. In any case, equivalent arrangements are already in place at defined ESPZs. This includes one location near Mingenew (Western Australia) and

[4] A teleport is defined as a site where multiple earth stations are licensed to operate.

[5] Radiocommunications assignment and licensing instruction (RALI) MS44 provides a description of these areas.

[6] See: https://info.dfat.gov.au/Info/Treaties/Treaties.nsf/AllDocIDs/C3710A23C10AA344CA2579210001C39B.

three prospective sites in eastern Australia that have been preserved pending consideration for such use by the satellite industry.

Similar to the basis on which the treaty with ESA was developed, the ESPZs are located away from major population centres and consequently areas of high spectrum demand by other services. This minimises the potential for spectrum denial between earth stations and other services.

Wireless broadband industry

Responses were received from the NBN Co, Optus, Vodafone Hutchison Australia and Nokia. Key points arising in submissions were:

- The wireless broadband industry agreed with the case for action and supported the proposed changes. One respondent indicated that proposed changes promote the objects of the Act.
- The proposed changes align more closely with the global n78 spectrum band defined by 3GPP. This allows licensees to fully leverage the global 5G ecosystem. Considering economies of scale and ease of deployment in spectrum licensed bands will enable licensees to more cost-effectively use their spectrum.
- Pending future planning decisions by the ACMA in the 3700–4200 MHz band, the proposed changes would enable wireless broadband operators to make use of existing equipment, rather than replacing it, to extend operation into the 3700–3800 MHz band.
- A view that the likelihood of existing FSS and point-to-point services (PTP) being negatively impacted by the proposed changes is minimal.
- The impact on future FSS and PTP is low. This is because the prospect of future FSS and PTP being deployed in the 3700–3800 MHz band is low. This is evidenced by:
  - The decreasing trend of PTP licences over time.
  - The lack of new proposed FSS in the pipeline.
  - The ongoing review of planning arrangements in the 3700–4200 MHz band.
- Some submissions requested the changes be made as quickly as possible, noting it affects all 3.4 GHz band spectrum licensees that are in the process of rolling out 5G networks.

ACMA response

The ACMA acknowledges the benefits the proposed changes will have to the deployment of 5G services in Australia. Estimates of the associated savings are provided in the Outcomes section. We agree they will have no effect on existing adjacent-band apparatus-licensed services, and low to no impact on the deployment of new apparatus licensed services. This is discussed further in the Effect on incumbent services section.

Outcomes

When determining whether to adopt the proposed changes, the ACMA has considered the overall public benefit—specifically, the:

> benefits to 3.4 GHz spectrum licensees

> impact on existing and new apparatus licensed services in the 3740–3840 MHz band.

After considering submissions made to the review paper the ACMA has reassessed each of these issues. The results of this assessment are provided below.

Benefits to 3.4 GHz spectrum licensees

The benefits of the proposed changes to 3.4 GHz spectrum licensees identified in the review paper were:

> The proposed changes align more closely with the global n78 spectrum band defined by 3GPP. They would allow licensees to fully leverage the global 5G ecosystem and associated economies of scale.

> Pending future planning decisions by the ACMA in the 3700–4200 MHz band, the proposed changes would enable licensees to make use of existing equipment, rather than replacing it, to extend operation into the 3700–3800 MHz band.

After considering submissions, the ACMA still considers that these are relevant identified benefits. The ACMA has further analysed these benefits to quantify them in terms of cost savings.

Based on information provided by the mobile industry, the estimated monetary cost savings related to 3.4 GHz band spectrum licensees not having to modify equipment to adhere to Australian-specific requirements are not significant. The main impact is the delay in obtaining equipment that adheres to these requirements, as it can take time for manufacturers to modify equipment for the Australian market. It can take many months (approaching a year) for such equipment to become available. This is expected to have the greatest impact on operators that hold licences directly adjacent to, or near the 3700 MHz frequency boundary. For affected operators, it results in delays to the deployment of new technological advancements—the flow-on effect being consumers must wait longer than they otherwise would to gain access to the latest network capabilities. This could also result in delayed revenues associated with licensees offering associated services. Aligning unwanted emission limits with international standards would prevent this from occurring.

The estimated cost savings related to possible decisions in the 3700–4200 MHz band are provided in Table 2. This table shows the additional costs in delaying a decision on adopting the proposed changes until the review of the 3700-4200 MHz band is completed. The analysis only considers the costs for a single operator to replace equipment to enable the relocation of services above 3700 MHz. This would need to be done as the existing limits require filters to reduce emission above 3740 MHz, meaning existing equipment would not be able to be retuned close to or above this frequency. If more than one operator is required to do this, then associated cost will increase.

It is noted that these costs would only eventuate if a future decision is made to extend spectrum licence arrangements into the 3700-3800 MHz band.

Table 2: Potential cost savings for a single operator to replace equipment if adoption of the proposed changes is delayed until the end of 2020

Cost per site	$100,000	
Number of new sites	300	750
Total cost	$30,000,000	$75,000,000

An explanation of the parameters and assumptions made to determine costs in Table 2 follows:

> It would cost operators $100,000 per site to replace equipment. This is based on information provided to the ACMA during the review of the 3575–3700 MHz band and to the February 2020 consultation process. It assumes a typical deployment of three sectors per site.

> A decision to adopt the changes is delayed until after the outcomes of the 3700–4200 MHz review are known. The ACMA currently aims to announce decisions for the 3700–4200 MHz review by the end of 2020. For this reason, cost estimates for the proposed changes being adopted at the end of 2020 are provided. The estimated costs are expected to increase if there are any delays beyond this date.

> A lower estimate of the number of sites where 5G is deployed per quarter by one operator is 100. The upper estimate is 250. This results in services being deployed at 300–750 new sites between now and the end of the year. These numbers are based on information provided by industry, as well as current and historical data obtained from the ACMA's Register of Radiocommunications Licences (RRL). It is noted as of 6 April 2020 that Telstra had 5G services registered at 692 sites and Optus at 1012 sites.

Effect on incumbent services

Adjacent band FSS earth stations

There are numerous FSS earth stations licensed for operation in the 3700–4200 MHz band across Australia—including ESPZs as summarised in Table 4. Currently most FSS earth station licences are located in Perth and Sydney, with a majority of these at teleports in the following areas:

> Sydney: Belrose, Macquarie Park, Oxford Falls and Willoughby.

> Perth: Henderson, Landsdale and Lockridge.

FSS earth stations are provided protection-based on the criteria contained in the RAG Tx. Coordination between FSS earth stations and devices registered under a 3.4 GHz spectrum licence (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 how the applicable unwanted emission limits are defined in the spectrum licence. Consequently, the proposed changes will have no impact on existing FSS earth station licences.

Spectrum licensed devices are not required to protect FSS earth stations licensed after the time the spectrum licensed device is 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 spectrum licensed wireless broadband services are typically densely deployed and sites that have little to no terrain or other shielding.

Table 4: Number of apparatus licensed FSS earth stations in the 3700-4200 MHz band as of 2 March 2020

Region	3700–3800 MHz	3800–3900 MHz	3900–4000 MHz	4000–4100 MHz	4100–4200 MHz
Adelaide	0	0	1	0	1
Brisbane	0	0	0	0	0
Canberra	2	0	0	0	2
Melbourne	1	1	0		3
Perth	22	16	18	14	12
Sydney	26	43	32	16	9
Regional (ex. ESPZs)	2	0	0	2	10
Remote (ex. ESPZs)	2	8	1	6	13
ESPZs	2	0	15	1	11

Since the proposed changes would result in an increase in unwanted emissions within the 3740–3840 MHz band, the impact this would have on the deployment of new FSS earth stations needs to be considered. Analysis of this issue is divided into the impact in remote areas, regional areas and major cities:

> As spectrum licensing arrangements do not extend to remote areas, the proposed changes will have no impact on the deployment of new FSS earth stations there.

> In regional areas, the impact is considered low to negligible. This is due to the small number of FSS earth station licences (and expected new licences) coupled with the lower density of wireless broadband service deployments in regional areas. The ACMA considers that the effect of the proposed changes can be mitigated, where required, 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. There is also the option of deploying new services at one of the ESPZs located in regional areas.

> In major cities, the impact of the proposed changes on the deployment of new FSS earth stations needs more detailed consideration. This is due to the higher density of spectrum-licensed wireless broadband services and FSS earth station deployments. As mentioned in submissions, of particular interest to the satellite industry is the ability to deploy new services at existing sites.

Table 5 shows the number of locations that new FSS earth station licences were issued from March 2014 to March 2020 across the entire 3700–4200 MHz band in major cities. It also shows the number of licences issued in the 3740–3840 MHz segment. Of the licences issued in the 3740–3840 MHz segment:

> 91 per cent were issued at one of the major teleports in Sydney and Perth.

> 5 per cent were issued at teleports that previously contained multiple licences in Adelaide (most have since expired or been surrendered).

> 3 per cent appear to be due to previous licences being allowed to expire, triggering an application for a new licence.
> 1 per cent were at a new site.

This data indicates that from 2014–20 there were few new FSS earth station licences issued in the 3740–3840 MHz band located at new sites in major cities. Almost all were licensed at existing teleports.

Existing major teleports in Sydney and Perth accommodate a number of satellite services. All have existing licensed services in the 3740–3840 MHz band. It is expected that the protection afforded to these existing licensed services will limit the impact the proposed changes will have on deploying new services at these locations. The use of different mitigation measures such as site shielding (where practical) and taking advantage of existing clutter could assist in reducing the impact further.

For new FSS earth station locations, the ACMA considers that the effect of the proposed changes can be mitigated through appropriate planning and siting. 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. Such measures are considered good practice and part of the standard process operators would normally go through in assessing and choosing new sites.

Where feasible, consideration could also be given to deploying new FSS earth stations in one of the ESPZs defined in RALI MS44. These areas are reserved and protected for use by satellite services.

Table 5: Number of locations[7] new FSS earth station licences were issued in the 3700-4200 MHz band in cities from 2014–20[8].

Number of locations new licences were issued in 3700–4200 MHz (number of new licences issued in the 3740–3840 MHz segment)				
City	**March 2014**	**March 2016**	**March 2018**	**March 2020**
Adelaide	2 (3)	2 (2)	1 (0)	0
Brisbane	0	0	0	0
Canberra	0	1 (0)	2 (0)	2 (1)
Melbourne	2 (0)	0	2 (1)	2 (1)
Perth	2 (15)	5 (2)	4 (12)	2 (12)
Sydney	2 (2)	0	2 (21)	2 (25)

[7] A location here encompasses either a single site with one or more earth receive licences or a group of sites located close together with multiple earth receive licences.
[8] Licences issued in the two years prior to the date the RRL data extraction was taken are included in the count.

Adjacent band point-to-point links

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 that:

> 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 has been 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.

> Embargo 73 restricts the deployment of new point-to-point links in the 3700–3790 MHz band. This means new services are generally restricted to frequencies above 3790 MHz. As stated in RALI FX3, new point-to-point links above 3790 MHz are only afforded protection out to the second adjacent channel. Since 40 MHz channelling applies, in the worst case, coordination is only required with services operating in frequencies above 3710 MHz. Consequently, coordination with spectrum-licensed devices operating below 3700 MHz is not required.

> There are alternative bands defined in RALI FX3 which new point-to-point links could use.

When combined, the above factors show that the proposed changes would have no impact on existing point-to-point links and have a low to negligible effect on access to spectrum for new point-to-point links.

Table 6: Point-to-point licences in the 3700–4200 MHz band 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)
April 2020	95 (346)

Planning outcomes

After considering submissions to the review paper and the analysis presented in this paper, it appears the proposed changes would:

> Align more closely with the global n78 spectrum band defined by 3GPP. This would allow licensees to fully leverage the global 5G ecosystem and associated economies of scale. While the cost of meeting the existing Australian-specific requirements were found not to be significant, adopting the proposed changes would remove the delays some operators face in deploying new technologies until modified equipment is available for the Australian market.

- Pending future planning decisions by the ACMA in the 3700–4200 MHz band, would enable licensees to make use of existing equipment, rather than replacing it, to extend operation into the 3700–3800 MHz band. This would result in cost savings in the order of $30-75 million.
- Have no impact on existing adjacent band apparatus licences.
- Have a negligible impact on new point-to-point links in the 3740–3840 MHz band.
- Have no impact on the deployment of new FSS earth stations in the 3740–3840 MHz band in remote areas.
- Have a low to no impact on the deployment of new FSS earth stations in the 3740–3840 MHz band at existing major teleports and in regional areas.
- Not prevent the deployment of new FSS earth stations in the 3740–3840 MHz band in major cities, provided services are appropriately planned and sited.

Based on this analysis, there appears to be benefits to 3.4 GHz band spectrum licensees in adopting the proposed changes. However, delaying a decision until after the review of the 3700–4200 MHz band is completed has the potential to result in significant costs to 3.4 GHz band spectrum licensees (this, of course, depends on planning decisions made). Given there would be low to no impact on adjacent band FSS and point-to-point link services, the ACMA believes there is benefit in adopting the proposed changes now. We will therefore work to implement the proposed changes.

To give effect to this outcome, the ACMA will write to all 3.4 GHz band spectrum licensees seeking their agreement to implement the proposed changes to their licence conditions. As this relates to a change in core conditions, the changes will only be made on a licence-by-licence basis if there is agreement from licensees in accordance with section 72 of the Act.