



Submission in response to
ACMA Consultation Paper

3.4 GHz and 3.6 GHz band spectrum licence technical framework

Public Version

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Section 1. EXECUTIVE SUMMARY

- 1.1 Optus welcomes the opportunity to respond to the Australian Communications and Media Authority's (ACMA) Consultation Paper on the draft allocation instruments for the 3.6 GHz spectrum (Consultation Paper).
- 1.2 In summary, the ACMA has presented four options for the 3400 MHz to 3700 MHz technical framework (1a, 1b, 2 and 3). Within Option 2 there are also possible sub-options that could be taken. The auction lots and auction rules will depend on the outcome of the concurrent consultation on the draft technical instruments
- 1.3 Both ACMA consultations also currently present a different stated preference: the draft technical instruments consultation paper suggests a preference for TLG Option 1, while the draft allocation instruments have been drafted assuming TLG Option 2. This approach has a high risk of a sub-optimal auction design.
- 1.4 The current approach further highlights that there should be additional consultation on ACMA's preferred approach once its technical rules are finalised.
- 1.5 Optus therefore recommends that the ACMA reopen consultation on the revised draft allocation instruments before it is finalised. This is important to ensure that all potential applicants are given opportunity to comment on a common set of documents for the award of spectrum in the 3.6 GHz band.
- 1.6 In summary, Optus recommends:
 - (a) Licences in 3.4GHz and 3.6GHz should have a harmonised technical framework to support the use of 3400 MHz to 3700 MHz as a 5G band.
 - (b) The changes need to be made to existing 3.4GHz licences as soon as practical to make them substitutable with 3.6Ghz licences and suitable for 5G deployment.
 - (c) Option 1a provides the best outcome for the success of 5G, the best use of scarce spectrum availability for 5G and the most flexibility for achieving defragmentation of C-band for 5G services.
 - (d) Option 2 should not be used as it creates significant barriers for early deployment such as lack of suitable equipment that meet Australian specific conditions. The creation of additional guard bands also restrict availability of 5G spectrum. Frequency specific filter requirements will also hamper the defragmentation of C-Band.

Section 2. ISSUES FOR COMMENT

Conditions on spectrum Licence

2.1	The ACMA seeks comment from interested stakeholders on the draft spectrum licences for the 3.4 GHz band at Attachment A (for Option 1) and Attachment B (for Option 2).
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Optus agrees that in-band and unwanted emission limits should be specified using TRP (Total Radiated Power).

Optus agrees that the increased in-band emission limit is appropriate for AAS devices. For non-AAS devices Optus agrees with the ACMA assumption that antennas will not be more than 20dBi gain. Existing non-AAS antennas deployed so far in this 3.4GHz band have no more than 20dBi gain even when further sectorising sites with 30deg HBW antennas.

Optus agrees that the frequency offsets for unwanted emissions should align with 3GPP standards for 5G devices.

Optus agrees that there should be separate unwanted emission limits for AAS and non-AAS devices and that AAS devices have unwanted emission limits 9dB higher than non-AAS because this is consistent with the approach in 3GPP specifications.

Optus do not agree that such tight OOB limits are needed when 5G basestation antennas are mounted within the clutter i.e. on buildings or lower than building height. Optus also proposes that if CEPT adopt stricter limits for Radiolocation services that this should be managed by coordination with Department of Defence at the specific locations where this is warranted.

Option 1

Optus agree that mandating synchronisation between interfering devices is the best approach when it is used as the last resort for management of interference between TDD licences ie when no agreements can be reached. This requirement should only be applied to devices with an interference issue and must not mandate whole-of-network synchronisation.

This approach should also support the concept of Semi-Synchronisation (as described in CEPT) along with per cell mitigations such as semi-synchronisation with power control, slot blanking, beam control in AAS and other suitable mitigation such as site planning. Full synchronisation should be invoked when no agreements can be reached and interference has not been resolved.

Optus supports the current wording of the Synchronisation Requirement (Schedule 4 clause 11) with the inclusion of the Note regarding use of other frame structures.

Option 2

Optus does not agree that very tight emission limits and large guard band requirements for co-existence is a viable solution because of the impact on device and equipment availability and in addition it will be very inefficient use of limited 5G spectrum.

Emission reduction is a last resort solution for interference when no agreements can be reached however the emission reduction required will generally be less than this limit due to geographic separation.

The tighter block emission specifications in Schedule 3 are described in CEPT Report 67 as only applying in cases where there is no geographic separation. This CEPT clarification should be included in the proposed Option 2 licence conditions Schedule 4 11(g) if following CEPT specifications.

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| 2.2 | The ACMA seeks comment on the proposed sub-options 1a and 1b, including wording for the temporary synchronisation configuration. If sub-option 1b is adopted, what would be an appropriate time frame for the temporary synchronisation configuration to apply? What would be an appropriate time frame for the transition period (when both the temporary and Attachment A configuration would apply)? |
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Option 1a

Optus is of the view that option 1a is the only viable option. During the reallocation period deployments at the top of 3.4GHz band will be limited so coordination between 3.4GHz licences and 3.6GHz licences by early access licence is viable. Coordination between 3.6GHz licences is facilitated by synchronisation clauses in the 3.6GHz licence conditions.

Option 1b

Optus do not agree that 1:1 synchronisation is a viable short-term option. This configuration would not be supported by early 5G equipment because international developments in 5G are based on 3:1, 4:1 and 8:2 ratios and 5G use cases have not driven a requirement for a 1:1 configuration. This has view has been confirmed in vendor discussions and from available vendor roadmap information.

Device availability will also prevent the use of option 1b as a short-term solution. The frame structure for Option 1b is not a priority for the manufacturers of chipsets to be used in end user devices. This development is currently weighted to support the most likely use scenarios for 5G, with 3:1 as a key configuration. 1:1 support is not a priority, potentially limiting the usefulness of any early 5G infrastructure deployment should this frame structure be imposed by ACMA. Without device support a network is unable to function as intended, so it is preferred that synchronisation in line with a 3:1 frame structure become the fall-back scenario, as per Option 1a.

In both options, the synchronisation clause should only apply to the devices that have an interference issue and should not imply network synchronisation as this would potentially escalate a site issue into a network issue.

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| 2.3 | The ACMA seeks comment on the proposed stricter unwanted emission limit in the 3100–3380 MHz frequency range, including whether it is appropriate to follow the Electronic Communications Committee and adopt an even stricter limit should they decide to adopt one. |
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Based on table 1 in ITU-R M.1465-3 the horizontal beamwidth for the radar is typically 1.5deg so the likelihood of line-of-sight to more than one basestation is very low and alignment with a beamforming antenna even lower.

Previous studies (eg NTIA Report TR-06-444) on interference to radar from telecommunications equipment have shown that radar is more susceptible to continuous interference than from bursty interference. 5G TDD systems are not continuous transmitters and hence studies based on continuous transmission would be too pessimistic.

Study #4 in ECC report 281 which simulated out of band emissions into military radar below 3400 MHz from 5G systems with beamforming antennas concluded there was scope to raise existing TRP levels to the range -36dBm to -26dBm/MHz.

Optus do not agree that further tightening of OOB limits by CEPT for protection of Defence Radar receivers is needed, especially when 5G basestation antennas are mounted within the clutter e.g. on low structures or below rooftop height.

Optus agree that the additional 9dB for AAS devices applies at all frequencies outside 3380-3740 MHz as per the core condition 9 in the current draft licence.

Optus strongly recommends that ACMA adopt the 3GPP standard unwanted emission levels in the 3100-3400 MHz band (i.e. OOB emission levels above 3360 MHz and a TRP of -30 dBm/MHz adding 9 dB for AAS in 3100-3360 MHz band).

Optus does not agree that the proposed limit is changed if CEPT does adopt more strict limits than currently proposed by ACMA. Optus propose that in this case within Australia the implementation should be managed by coordination with Department of Defence at the specific locations where this is warranted.

Unacceptable levels of interference

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| 2.4 | The ACMA seeks comment from interested stakeholders on the proposed changes to the arrangements for unacceptable levels of interference in the 3.4 GHz band set out in the draft Radiocommunications (Unacceptable Levels of Interference – 3.4 GHz Band) Determination 2015 at attachments C, H and I. |
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Optus agrees with the use of Total Radiated Power (TRP) as a measurement metric to describe the radiated power and spurious emission levels of a device rather than Effective Isotropic Radiated Power (EIRP).

Optus agrees with the change in the Level of Protection for Device boundary criterion from -111dBm per MHz to -98dBm per MHz.

Optus agrees with the increase in resolution of the device boundary calculation from 500 metres to 250 metres.

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| 2.5 | The ACMA seeks comment on potential methods to improve the device boundary criteria for paths over water. Is the text proposed by the ACMA suitable? |
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Currently there are unintended consequences (i.e. registration fails) with the current s145 Determination methodology because spectrum licence boundaries extend out into the ocean. The current s145 device boundary can often fail for sites on or near the coast due to radials extending into or crossing parts of unpopulated ocean covered by another spectrum licence. For example, s145 registration fails for a small cell at Bondi Beach due to a radial that crosses the corner of a regional licence in the ocean.

In Australia many people live near or visit coastal areas so this unintended consequence can have a significant impact to customers.

To address these unintended registration issues in areas of high importance, Optus propose that the Device Boundary Criterion is amended to remove the parts of s145 radials that clearly do not cause co-existence issues.

In a few exceptional cases, such as Adelaide York Peninsula, there is a possibility of interference to land based services across an internal water path which must also be considered.

To address all the above issues Optus proposes that following wording is used in the unacceptable interference determination with one additional radial condition [c.]:

A level of interference is not unacceptable in relation to a part of the device boundary that:

- a) lies outside the geographical area of the licence
- b) is connected to a radial that:
 - a. is mentioned in Part 1 of Schedule 2 (of the unacceptable interference determination)
 - b. does not cross over land, outside the geographical area of the licence, that is permanently above the Australian territorial sea baseline as defined by GeoScience Australia.
 - c. does not enter any of the following HCIS areas:
IW3E, IW3I, IW3M, IW6A, IW6E,
KX9, LX7, LX8, LX9

Any remaining un-intended consequences can be managed by the licensees.

Radiocommunications Advisory Guidelines

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| 2.6 | The ACMA seeks comment from interested stakeholders on the draft Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters – 3.4 GHz Band) 2015 at attachments D and H (for Option 1) and attachments E and I (for Option 2) |
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Optus agrees with the changes proposed in Option 1 RAG TX with additional clarification regarding use of AAS antennas to be included in line with the guidance given in the s145 Determination. Optus agrees that the Synchronisation clause only applies to devices and does not mandate whole of network synchronisation.

Optus requests that for clarity NBN protection requirements are clearly separated from other PTS licences as the NBN spectrum allocation is more like a wide area licence and NBN spectrum is also more likely to change in future band defragmentation.

Optus does not agree with the additional Protection requirements in 5.2 of Option 2 RAG TX as this is a very large amount of filtering for protection within the existing 3.4GHz licence which will significantly impact deployment of 5G networks in this band.

Optus do not support the use of a 5Mhz offset in Option 2 RAG TX 5.2 as this further tightens the spec from RAG RX Schedule 3 which means the 3GPP spec is now -14dBm/100KHz or +20dBm/5MHz EIRP (17dBi antenna) so the additional filtering required would be 54dB for non-AAS antenna and 46dB for AAS antenna. This would require products that are specific only to Australia causing availability delays and cost penalties for Australian 5G launch networks.

Option 2 would also require existing 3.4GHz licensees to agree to add new guard bands to the existing licence. The current guardbands in the 3.4GHz licences are 5MHz based on 20MHz LTE carrier, for 5G carriers this requirement could increase to 15MHz or more. Introducing new guardbands at the top of 3.4GHz licences can render upper parts of the 3.4GHz band unusable for 5G due to the current fragmentation in the band.

Emission reduction is a last resort solution for interference when no agreements can be reached however the emission reduction required will generally be less than this limit due to geographic separation.

The tighter block emission specifications in schedule 3 are described in CEPT Report 67 as only applying in cases where there is no geographic separation. This CEPT clarification should be included in the proposed licence conditions 11(g) if following CEPT specifications.

Optus also do not support tightening CEPT spec further by reducing the offset to 5Mhz.

Part 8: Optus comments in this document on the s145 determination should be noted for this section.

Optus note Sect 4.4 (3) Incumbent earth stations in 3.4GHz within 300km of transmitter max interference level of -119.9dBm/MHz no more than 0.005% of time and seeks clarification on the derivation of 0.005% which is not in ITU-R SF.1006.

2.7 The ACMA seeks comment on the suitability of the updated coexistence arrangements for earth stations?

Optus believes the proposed FSS protection criteria in Part 4 are adequate.

Optus agrees with the step to adopt the FCC earth station filter—in particular to address the 0 dB rejection over the first 15 MHz - Optus does not see a need for the filter to become less stringent than what was in the existing RAG TX. Optus recommends Table 1 be modified as follows:

- 45.5 dB rejection between 50 and 110 MHz; and
- correction to the rejection for frequency offset < 150 MHz

Frequency offset (MHz) from the lower or upper frequency on the earth receive station licence	Rejection (dB)
< 50	$0.5 + 0.6 \cdot f_{\text{offset}} \text{ (MHz)}$
<u>≤ 110</u>	<u>45.5</u>
< 150	$30.5 + 0.25 \cdot (f_{\text{offset}} \text{ (MHz)} - 50)$
< 200	55.5
≥ 200	70

Table 1: Minimum frequency response of earth receive station's RF filter

With regard to the proposed new notification requirement in Part 4.3(45), Optus proposes a minor change for clarity:

This is to ensure FSS licensee have installed an RF filter with the relevant characteristics from Table 1 to their front end of their earth station receiver.

2.8	The ACMA seeks comment on the suitability of the proposed amendments regarding coexistence with apparatus-licensed BWA services?
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Optus supports Option 1a. The additional Guardband requirements listed for BWA services in Option 2 are not supported. Part 5 of the RAG TX references all BWA apparatus services – this applies to both NBN and smaller ISPs. Optus believes the proposed Out-of-Band emission limits are too strict. With respect to the NBN National licences, these are also one-sided with all the protection given to the NBN service. To encourage greater coordination, mitigations need to be shared across the operators as well as the associated costs.

Incumbent ISPs in the 3.6GHz band have specific protections defined in the RALIs. Since there is a plan to migrate these licensees out of the band, Optus agrees with the current wording of the RALIs.

2.9	The ACMA seeks comment from interested stakeholders on the draft Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 3.4 GHz Band) 2015 at attachments F and H (for Option 1) and attachments G and I (for Option 2).
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Optus agrees with the changes proposed in Option 1 RAG RX with additional clarification regarding use of AAS antennas should be included in line with the guidance given in the s145 Determination. Optus comments in this document on the s145 Determination should be noted for this section.

Optus requests that for clarity NBN protection requirements are clearly separated from other PTS licences as the NBN spectrum allocation is more like a wide area licence and NBN spectrum is also more likely to change in future band defragmentation.

Part 3.1 (5) (a) The spectrum license was in effect prior to December 2015. This date was the renewal date. The original issue date of the spectrum license should be referenced as this licence was in existence before many of the existing deployments.

Optus does not agree with the additional Protection requirements in 5.2 of Option 2 RAG RX as this is a very large amount of filtering which will significantly impact deployment of networks in this band.

RAG RX Schedule 3 with 10MHz offset which means the 3GPP spec is -15dBm/MHz or +9 dBm EIRP/5MHz (with 17dBi antenna). This implies that additional filtering required for the additional emission limits is 35dB for AAS and 43dB for non-AAS antennas around the 3.4 to 3.6 Spectrum boundary. This would require products that are specific only to Australia causing availability delays and cost penalties for Australian 5G launch networks.

Emission reduction is a last resort solution for interference when no agreements can be reached however the emission reduction required will generally be less than this limit due to geographic separation.

The tighter block emission specifications in schedule 3 are described in CEPT Report 67 as only applying in cases where there is no geographic separation. This CEPT clarification should be included in the proposed option 2 licence conditions Schedule 4 11(g) if following CEPT specifications.

Schedule 1 (3) Adjacent Channel Selectivity should align with 3GPP TS38.104

Schedule 1 (5) Receiver Blocking should align with 3GPP TS38.104

Schedule 3 should be removed.

2.10	The ACMA seeks comment on the proposed additional out-of-band emission limit in cases where a synchronisation requirement does not apply. Is it appropriate to share the 20 MHz guard band equally between adjacent band licensees? If agreement cannot be achieved with all 3.4 GHz band licensees to share the 20 MHz guard band, are the proposed alternative limits suitable?
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Optus do not agree that very tight emission limits and large guard band requirements for co-existence is a viable solution because of the impact on device and equipment availability and because it will be a very inefficient use of limited 5G spectrum.

This option would also require existing 3.4GHz licensees to agree to add new guard bands to the existing licence. The current guardbands in the 3.4GHz licences are 5MHz based on 20MHz LTE carrier, for 5G carriers the tighter emissions approach would increase this requirement to 15MHz or more. Optus do not agree with this option.

These block emission specifications are described in CEPT Report 67 as only applying in cases where there is no geographic separation. This CEPT clarification should be included in the proposed licence conditions if following CEPT specifications.

Standard trading units and minimum contiguous bandwidth

2.11	The ACMA seeks comment from interested stakeholders on the proposed amendment to the Radiocommunications (Trading Rules for Spectrum Licences) Determination 2012 to define a minimum contiguous bandwidth of 10 MHz for the 3.6 GHz band, as detailed in attachments H and I.
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Optus support 10 MHz for the Minimum Contiguous Bandwidth.

2.12	The ACMA seeks comment from interested stakeholders on the proposed amendment to the Radiocommunications (Trading Rules for Spectrum Licences) Determination 2012 to remove the minimum contiguous bandwidth for the 27 GHz band, as detailed in attachments H and I.
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Optus have no objection to removing the 50MHz MCB from Schedule 1 item 14 (26500 to 27500 MHz). Note this is not related to the 3.6GHz technical framework.

Section 3. SUPPLEMENTARY INFORMATION

- 3.1 This section provides additional Optus' comments on elements of the *3.4 GHz and 3.6 GHz band spectrum licence technical framework*.
- 3.2 In Part 2 of Licence schedule 1 Core condition 11 should refer to Core conditions 12 to 14 and Core condition 12 should refer to core condition 11.
- 3.3 In the draft licence the in-band emission limit is in the section 'Emission Limits outside the geographic area' which states that core conditions 12 to 14 apply to areas outside the geographic areas listed in Part 2 of Licence schedule 1. Clause 14 with max in-band limits seems to only apply outside the licence area which does not seem to be the intent for maximum in-band power. Optus suggest that this is confusing and should made clearer in new licences.
- 3.4 RAG RX Options 1 the value given for 20MHz bandwidth is -43dbm per 5MHz. Optus believe this should be -43dBm per 20 MHz as shown in 3GPP.
- 3.5 The RAG RX documents for Option1 and Option 2 are different for Schedule 1 'Notional Receiver Performance'. Option 1 has -43 dBm and Option 2 has -80.5dB. Optus believes that Option 1 5(a) and 5(b) is preferred as it aligns with 3GPP. Optus acknowledges that this requirement is not mandatory.
- 3.6 Optus request that NBN apparatus licences separated from the rest of the apparatus licences as it is currently confusing.
- 3.7 The RALI documents are currently under separate consultation and hence the final RALI documents are not available for this consultation. The final RALI documents should be aligned to the RAG documents in this consultation.