



TELSTRA CORPORATION LIMITED

Submission to the Australian Communications and Media Authority

Draft 3.4 GHz and 3.6 GHz band spectrum licence technical framework

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Executive Summary

We welcome the opportunity to respond to the ACMA's **3.6 GHz band legislative instruments consultation**. This document contains our response to the Technical Framework component of the consultation. As we have noted in our submissions to previous consultations on this band, the 3.6 GHz band is essential to the timely introduction of 5G Mobile Networks in Australia, and we appreciate the work the ACMA has done to expedite the re-allocation of this band.

We strongly recommend that the ACMA proceed with Licensing Technical Framework sub-option 1a, as this option provides the framework that gives the best opportunity to realise the band's highest-value use and provide prospective licensees the certainty they require to invest.

We submit that the draft instruments associated with sub-option 1a are essentially ready with only a few minor amendments required, which we outline in this submission. Of the amendments we propose, the most important is to remove the overly-prescriptive values for synchronisation parameters (referenced to 3GPP standard TS 36.211) from the ACMA's proposed **Synchronisation Requirement**. We suggest that prescribing the values for these synchronisation parameters is unnecessary to achieve the ACMA's objective of specifying a Synchronisation Requirement, and that simply specifying the alignment of timing of uplink and downlink emissions and a downlink to uplink ratio is sufficient to achieve the objective. The consequence of taking the extra step to prescribe very specific values for the synchronisation parameters and refer to a specific 3GPP technical standard for LTE synchronisation would be to lock Australia into a synchronisation framework that will potentially be obsolete within the term of the licences as the standards evolve. This will prohibit future opportunities to adopt more innovative and flexible arrangements such as semi-synchronisation, which is currently being explored by industry.

We observe that sub-option 1a requires existing spectrum licensees to voluntarily agree to the amendment of core conditions on their licences in order for sub-option 1a to be implemented across the entire 3.4 GHz band. Telstra is supportive of the proposed changes to the 3.4 GHz framework (with some corrections and clarifications as proposed in our submission), but in the event that agreement cannot be achieved, we strongly recommend that the ACMA adopt Option 2 as the next best option, rather than adopting sub-option 1b. We strongly believe that sub-option 1b is not a workable solution for the introduction of fifth generation mobile technology and it will frustrate 5G technical innovation for an extended period of time.

Option 3 is not supported as the 3.4 GHz licence framework needs to change to properly support 5G network designs and services, (for example, support 5G active antenna systems, and more efficient spectrum utilisation through network synchronisation rather than using substantial guard bands to prevent adjacent channel interference).

We look forward to supporting the ACMA's efforts to remain on track to conduct the proposed auction of this spectrum in October 2018.

1 Introduction

We firstly outline our views about the overall technical framework in section 2, and then provide detailed answers to the ACMA's specific questions in section 3.

2 Response to the draft technical framework

We appreciate the work invested by the Technical Liaison Group (TLG) in developing the draft technical framework, including the effort to design a 'fall-back' mechanism to resolve interference in the event that parties cannot reach mutual agreement to resolve interference of their own accord. The options presented in the consultation paper reflect the effort of multiple rounds of refinement by the TLG.

2.1. General comments on the technical framework

We make the following general comments on the technical framework:

- We strongly support and recommend that the ACMA proceed with sub-option 1a. Sub-option 1a permits the greatest possible compliance with 3GPP specification for fifth generation (5G) mobile network standards, and the greatest opportunity to realise key new features of IMT-2020 standards such as ultra-reliable, low-latency communication (URLLC), by mandating a 3:1 DL:UL ratio from licence commencement no later than 30 March 2020 (in the event that interference between licensees cannot be self-addressed). This provides prospective licensees the certainty they require to invest.
- We are, however, concerned that the ACMA has elected to prescribe specific values for the synchronisation parameters in TS 36.211 (i.e., prescribing frame structure type 2, configuration 2 and employing configuration 6 for the special sub-frame) in the draft spectrum licence for both Option 1 and Option 2 (under Schedule 4, "*Other Conditions*"). First, this is an LTE (4G) Technical Specification and not a New Radio (NR or 5G) Technical Specification. We also observe that there is work underway to look at more flexible synchronisation mechanisms for 5G New Radio, including semi-synchronisation options. Defining the values for these parameters in a spectrum licence is unnecessary to achieve the ACMA's objective of specifying a synchronisation requirement. We believe that specifying, in broad terms, the alignment of timing of uplink and downlink emissions, and a downlink to uplink ratio, is sufficient to achieve the objective. It also gives licensees greater flexibility to achieve coexistence with other spectrum users. Further, locking a reference to a specific 3GPP TS in a spectrum licence will result in technical inflexibility for the duration of the licence term, which may be up to twelve years. During the licence term it is likely that the capability of 5G will evolve, along with the relevant technology standards to provide new frame and sub frame structures. This means that locking in a detailed fall-back position into the instruments now is unlikely to be future-proof, potentially leading to a sub-optimal outcome in the future.
- If the ACMA is of the mind to proceed with prescribing specific values for these synchronisation parameters (i.e., frame structure type, configuration and sub-frame configuration), we recommend that the corresponding set of parameters from the 5G New Radio technical standard (for example, TS 38.211 and any other relevant 3GPP standards) be included, rather than only listing 4G-LTE parameter values in the other conditions on the licence. We acknowledge that clause 11(e) of the other conditions in the draft licences allows parties to reach their own agreement(s) for managing interference, however, as synchronisation will need to be applied with a high degree of uniformity across all licensees in the band, we recommend it would be appropriate to provide guidance that directs licensees toward the new 5G standards rather than LTE (4G) standards.

- We support that the ACMA's proposed amendment to s145 "*Radiocommunications (Unacceptable Levels of Interference — 3.4 GHz Band) Determination 2015*" such that device boundaries that cross another licensee's licence area but that occur only over oceanic waters are defined as not causing an unacceptable level of interference. The ACMA's comment that the same outcome could be achieved via an agreement with that licensee, while prima facie is correct, overlooks the fact that an area-adjacent licensee may refuse to come to any such agreement even if any such Device Boundary Condition (DBC) violation poses no risk to them. In short there may be no incentive for a geographically adjacent licensee to negotiate such an agreement and may simply ignore the request, and under the current rules there is nothing the first licensee can do about it.
- The ACMA's comment that this change could result in unintended consequences mentions tropospheric ducting across water as an example. We note that tropospheric ducting is not prevented by the current licence conditions hence this change will not change that risk. Tropospheric ducting is a challenging issue that is impractical to accommodate in a technical framework without negatively impacting spectrum utility.
- We do not support sub-option 1b, as the 1:1 DL:UL ratio will prevent the introduction of new features of IMT-2020 such as URLLC, and will prevent Australia from fully exploiting the benefits of 5G and capabilities of 5G technology for as long as five years (and even this timeframe is not guaranteed) from the date of licence commencement. There is a further problem with this option that is potentially unworkable. [C-i-C]
- In the event the ACMA cannot proceed with sub-option 1a, we strongly recommend that the ACMA proceed with option 2 rather than proceeding with sub-option 1b. While Option 2 introduces new challenges with regards to lot valuation and the design and the conduct of the auction, it at least keeps the door open for licensees to solve any interference issues bilaterally or multilaterally, and hence allows flexibility in 5G deployment, and only imposes punitive emission limits if no agreement can be reached.

2.2. A structured approach to resolving interference

We want to restate our preference for a structured (staged) approach for resolving issues of interference between different parties.

Currently, in Schedule 4, Section 11 of the draft licence, "*Synchronisation Requirement*", the proposed synchronisation scheme is imposed upon licensees if "*no agreement can be reached on how to manage this interference*". All it takes to trigger this clause is a single instance of interference that does not comply with the compatibility requirement defined in "*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers — 3.4 GHz Band) 2015*". In other words, there is no materiality test beyond a single instance of interference in any dimension:

- a) Duration or intermittency in the nature of the interference (is the interference periodic, random, or continuous?);
- b) The significance of the interference (in other words, does the interference only marginally fail to comply with the relevant RAG or is the breach by a significant margin?); and
- c) The extent of the interference (is a single receiver being interfered with, or an entire network?).

We believe that before the invocation of the potentially drastic step of mandating network-wide synchronisation, there needs to be demonstration of a material level of harm to a licensee as opposed to an isolated or immaterial breach which can be easily remedied.

We suggest that a staged process based on the demonstration of material harm would be a suitable approach for parties involved in an interference dispute to engage with prior to the enforcement of either



mandated synchronisation or mandated restricted-block parameters. This approach will prevent enforcement being triggered by a single instance of interference, and would result in a superior outcome that achieves greater utilisation of the band. The process could be based on different states of operation, as per the following description:

- State A: No interference is evident
 - No regulatory imposed conditions; no enforcement;
 - State A continues as long as no licence holder does harm to another licence holder according to a defined 'harm metric'.
- State B: Remedy required
 - Invoked because the 'harm metric' is violated (duration, magnitude and extent of the violation);
 - No regulatory imposed conditions; enforcement that parties must work together to find an appropriate remedy;
 - Return to State A once 'harm metric' is no longer violated;
 - Can only stay in state B for a limited period before State C is triggered, for example, 4 weeks.
- State C: Dispute
 - Invoked because parties were unable to resolve State B within prescribed time;
 - The licence specified Synchronisation Requirement may be imposed;
 - Return to state A once 'harm metric' is no longer violated.

For example, noting the proposed minimum wanted signal level and W/I ratio, the 'harm metric' could be defined as I/N (as proxy for throughput degradation) not exceeding 0 dB for more than 2 per cent of sites for more than 15 per cent of time.

We suggest that this approach has many benefits over a predefined set of synchronisation or restricted block parameters triggered by a single interference event, as it is more future-proof, allows for future innovative solutions that are not available today, and provides the ACMA with an enforcement mechanism that would strongly incentivise the parties to resolve the interference issue.

We recommend that the staged process and harm metric outlined above are an approach that the ACMA could have regard to in the event of an interference dispute, which the parties involved in the dispute could engage with. For clarity, we are not recommending that this approach necessarily be introduced into the technical framework instruments at this phase of consultation. There are other pathways for this approach to be fully considered and adopted in due course by the ACMA and stakeholders.

3 Responses to Issues for comment

This section contains our responses to the twelve specific issues for comment raised by the ACMA in the consultation document.

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).

We make the following observation on the draft licence for both Attachment A (Option 1) and Attachment B (Option 2):

- **Core condition 13.** We think that core condition 13 (in Schedule 2, page 17) should reference core condition 14 rather than referencing itself.

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)?

We fully support, and recommend that the ACMA proceed with sub-option 1a. Sub-option 1a facilitates the greatest opportunity to realise key new features of IMT-2020 standards such as ultra-reliable, low-latency communication (URLLC). Also mandating a 3:1 DL:UL ratio from licence commencement (no later than 30 March 2020) in combination with having an early access regime for successful bidders prior to licence commencement, provides prospective licensees with the certainty they require to invest.

The early access regime for successful bidders is important in this context since it will be provided via apparatus licences, hence providing both more time to define the right coexistence framework (at least another 3-4 months) and more flexibility, since the technical rules associated with apparatus licences can be amended relatively easily should they need to be. In contrast, a spectrum licence is by its intended nature, inflexible and difficult to amend.

We have very strong concerns with the proposal outlined in sub-option 1b, which prescribes a 1:1 DL:UL ratio for an extended period of time – as long as five years and potentially even longer as there is currently no certainty on the five-year period. Our concerns stem from the impact this would have on licensees who may wish to deploy networks with a heavy downlink requirement.

The 1:1 DL:UL ratio may also negatively impact latency, which will render the ultra-reliable low latency communication (URLLC) capability in 5G unworkable, and would downgrade other 5G system benefits to the same performance as 4G, thereby removing some of the key benefits of fifth generation mobile networks. IMT-2020 requirements set out the minimum requirements for IMT-2020 as a user-plane latency of 1 ms for URLLC and 4 ms for eMBB¹. LTE will typically have a 20 ms latency for a DL:UL ratio which is downlink heavy².

Additionally, we assume that the detail of the transition mechanism between 1:1 DL:UL and some other ratio (presumably 3:1 DL:UL) would have to be defined in the spectrum licence itself. This removes licensee flexibility, since inevitably the “lowest common denominator” will prevail, hence the entire industry can move no faster than the slowest licensee. It also means that the ACMA will need to design and codify this mechanism within the next four weeks, as the final auction instruments including a sample licence are due to be released by the end of July. We cannot see how the ACMA could

¹ <https://www.itu.int/en/mediacentre/Pages/2017-PR04.aspx>

² https://www.ericsson.com/res/thecompany/docs/journal_conference_papers/wireless_access/VTC10S_LTEinternetperf.pdf

reasonably consult with industry, draft suitable text, and have this locked in a licence for the next 12 years without rushing the process and risking a highly sub-optimal or compromised outcome.

Finally, it is common practice in the industry for network and user equipment vendors to not implement every combination of frame format, especially in early releases. [C-i-C]

We strongly recommend that the ACMA adopts sub-option 1a, and does not adopt sub-option 1b.

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.

No comment.

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.

We support:

- the addition of devices with active antenna systems at Part 2 of Schedule 2;
- lifting the level of protection (LoP) from -111 dBm/MHz to -98 dBm/MHz (including the associated changes to the calculation granularity);
- the use of Total Radiated Power (TRP); and
- the inclusion of Schedule 4, “Earth Station Protection Zones”.

See also, our answer to question 5 in relation to device boundary conditions over water.

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?

We consider that the proposed drafting of Clause 9 of the Radiocommunications (*Unacceptable Levels of Interference – 3.4 GHz Band*) Determination as shown in Attachment C does not currently address device boundary criteria for paths over oceanic waters. We recommend that the ACMA make the changes it proposes³ to Section 9 “*Unacceptable level of interference*” of the section 145 determination.

In support of this change, we believe that if a device boundary calculation shows a ‘violation’ only over oceanic waters that it should be deemed to not cause unacceptable interference. This is similar to the current clause (9)(2)(a) which excludes DBC violations beyond the Australian Spectrum Map Grid (ASMG), and extends the concept to the oceanic parts of geographically adjacent spectrum licenses.

The reason for this is that offshore licence boundaries within the ASMG are often somewhat arbitrary, with no specific reason as to whether a particular HCIS block is or is not included in a given lot area. There are also geometric anomalies, such as slivers of oceanic lot areas protruding offshore, depending on how the lots are carved up. Such anomalies could restrict on-shore deployment of base stations

³ See 3.4 GHz and 3.6 GHz band spectrum licence technical framework consultation paper, page 17.

which do not cause any interference to any other land-based service, merely because a DBC crosses the ocean boundary of an adjacent licensee potentially tens of kilometres offshore.

Note that a licensee would still not be able to deploy a device in an adjacent licensee's lot area, even if that device was offshore.

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)

We make the following observations on the Transmitter RAG for both Option 1 and Option 2.

- **Part 4, Table 1.** We suggest there is a small error in the second row of the table, where 50 MHz should be subtracted from the offset value for the range $50 < f_{\text{offset}} \leq 150$ MHz (see green highlight). Without this amendment, if taken literally, the rejection required in the range of 50 MHz to 150 MHz at points exceeds the 55.5 dB rejection required in the range of 150 MHz to 200 MHz.

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

For consistency, Table 5 in RALI MS-39 should be updated to match the (FCC-based) filter mask in the Transmitter RAG.

- We support the additional protection requirements for FSS Earth Receive Stations operating in the 3600-3700 MHz band specified in section 4.4 of the RAG ahead of the expiry of the relevant reallocation period; namely that any transmitter operated under a 3.4 GHz band spectrum licence within a 300km radius of a FSS Earth Station must ensure short-term co-channel interference does not exceed -119.9 dBm for more than 0.005 per cent of the time in accordance with ITU-R SF.1006.
- We support the coordination procedures for adjacent area spectrum licensed receivers in Part 8, section 8.2 of the Transmitter RAG.
- We support the protection requirements for Earth Station Protection Zones in Part 9, and the protection requirements specific to the Earth Station facility near Uralla described in Part 10.

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

We support the updated coexistence arrangements for earth stations.

8. The ACMA seeks comment on the suitability of the proposed amendments regarding coexistence with apparatus-licensed BWA services?

No comment. We will comment separately in the ACMA's consultation regarding RALI FX19.



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).

No comment.

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?

We restate our strong support for sub-option 1a as the preferred approach for the 3.4 GHz band.

However, in the event that Option 2 prevails, we support the additional out-of-band emission limits (-34 dBm EIRP for non-AAS and -43 dBm TRP for AAS) specified in Schedule 3 of the Option 2 variant of the Receiver RAG, and support the 20 MHz guard band being applied equally between adjacent licensees (i.e., 10 MHz each), noting that these should be imposed only in the event that it impacts a frequency adjacent spectrum licensee or that no agreement can be reached with a frequency adjacent spectrum licensee. If there is no frequency adjacent spectrum licensee, either because the adjacent spectrum that is subject of this reallocation remains unsold, or the adjacent spectrum is apparatus licenced, then these stricter limits should not apply. Hence we propose this alternate wording for Schedule 3 Clauses (1) and (2):

Schedule 3 Additional out-of-band emission limit

(subsection 5.1 (3))

(1) The out-of-band emission limits in Table 1 apply to radiocommunications transmitters with non-AAS:

- (a) at frequencies outside the upper or lower frequency limits of the spectrum licence; and
- (b) offset from the upper or lower frequency limits of the spectrum licence;

but only if there is a frequency adjacent spectrum licence at the upper or lower frequency limits of the spectrum licence in the same geographic area of the spectrum licence. If there are no frequency adjacent spectrum licences, these limits do not apply, and if there is only one frequency adjacent spectrum licence, these limits only apply at the frequency limit of the licence at which there is a frequency adjacent spectrum licence. Further, if an agreement is reached with any frequency adjacent spectrum licensee, these limits do not apply and instead the technical parameters in the agreement apply.

Table 1: Additional out-of-band emission limit for non-AAS devices

Frequency offset range	Radiated maximum true mean power (dBm EIRP)	Specified Bandwidth
$f_{\text{offset}} \geq 10 \text{ MHz}$	-34	5 MHz

(2) The out-of-band emission limits in Table 2 apply to radiocommunications transmitters with AAS:

- (a) at frequencies outside the upper or lower frequency limits of the spectrum licence; and
- (b) offset from the upper or lower frequency limits of the spectrum licence;

but only if there is a frequency adjacent spectrum licence at the upper or lower frequency limits of the spectrum licence in the same geographic area of the spectrum licence. If there are no



frequency adjacent spectrum licences, these limits do not apply, and if there is only one frequency adjacent spectrum licence, these limits only apply at the frequency limit of the licence at which there is a frequency adjacent spectrum licence. Further, if an agreement is reached with any frequency adjacent spectrum licensee, these limits do not apply and instead the technical parameters in the agreement apply.

Table 2: Additional out-of-band emission limit for AAS devices

Frequency offset range	A total radiated mean power (dBm)	Specified Bandwidth
$f_{\text{offset}} \geq 10 \text{ MHz}$	-43	5 MHz

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.

We support the proposed amendment to the Radiocommunications (Trading Rules for Spectrum Licences) Determination 2012 to define a minimum contiguous bandwidth of 10 MHz for the entirety of the 3.6 GHz band, by increasing the upper limit of item 13 in Schedule 1 from 3575 MHz to 3700 MHz.

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.

We have no objection to the proposed amendment to the Radiocommunications (Trading Rules for Spectrum Licences) Determination 2012 to omit item 14 in from Schedule 1, relating to the minimum contiguous bandwidth for the 27 GHz band. We assume this matter will be dealt with afresh in a new instrument if and when the 27 GHz band moves into the “Replanning” phase.