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Australian Mobile Telecommunications Association

AMTA Submission

Australian Communications and Media Authority

26 GHz band spectrum licence draft legislative instruments

About AMTA

The Australian Mobile Telecommunications Association (AMTA) is the peak industry body representing Australia's mobile telecommunications industry. Its mission is to promote an environmentally, socially and economically responsible, successful and sustainable mobile telecommunications industry in Australia, with members including the mobile network operators and service providers, handset manufacturers, network equipment suppliers, retail outlets and other suppliers to the industry. For more details about AMTA, see http://www.amta.org.au.

Contents

Introduction

AMTA welcomes the opportunity to provide comments on the draft legislative instruments for the 26 GHz band spectrum licence(s). We have provided comments in relation to both the draft auction instruments as well as the draft spectrum licence technical framework (SLTF) below.

AMTA appreciates the ACMA's demonstration of fairness and good judgement in reflecting the common ground among stakeholders in relation to TRP limits and mitigation measures in the draft SLTF. We recognise the level of effort involved in the timely incorporation of the concept of an EIRP limit, intended to protect fixed-satellite service (FSS) space station receivers while providing wireless broadband network operators some flexibility to operate above baseline TRP levels.

We note that the 26 GHz apparatus licence draft instruments have now been released for consultation and that we do have concerns around the use of area wide licences (AWLs) in this band. The use of AWLs in 26 GHz will likely serve as a pilot for broader use of AWLs in the future. Our concerns around AWLs centre around how interference issues will be resolved and the need to adequately protect the property rights inherent in spectrum licences.

26 GHz Draft Auction Instruments

1.1. Change in auction starting price

26 GHz band auction—change in starting prices
We seek stakeholder views on providing the ACMA with the power to change the starting prices before the auction.

AMTA does not support providing the ACMA with the power to change the starting prices after applications open but before the eligibility deadline as per the draft allocation determination. While we understand that the ACMA only sees potential for this to occur in "unusual and necessary circumstances", we do not believe that this possibility is compatible with providing the requisite certainty to stakeholders or with sound governance. Potential bidders must have certainty of the prices to begin the application process. Any potential for prices to vary after the application process begins, effectively means that most potential bidders would need to revisit the requisite internal decision-making and governance processes to continue.

1.2 Managing interference between spectrum licensees and area-wide licensees

Clause 11 of Schedule 4 of the sample spectrum licence contains the Synchronisation Requirement. We note the increased flexibility afforded to prospective spectrum licensees by clause 11(e)(ii), which permits a frame pattern consistent with the uplink-downlink to be used, rather than mandating that it must be the frame pattern specified in clause 3.4 of RALI[NEW].

Nevertheless, we remain very concerned that where interference occurs between the devices of a spectrum licensee and an area-wide licensee, both parties are afforded the same resolution options. We are also very concerned about the first-in-time provisions in the note immediately below clause 11(f), which would require the spectrum licensee of a second-in-time device to "… accept any interference or cease causing interference …" during the time-period where interference is being resolved.

AMTA takes the view that the property rights included in spectrum licences must not be undermined by giving equal consideration or protection to apparatus-, or for that matter, class-licensed devices when resolving co-existence issues where equipment or services are operating in the same or adjacent bands. AMTA proposes the inadvertent elevation of the apparatus licensee status could readily be resolved in the design of interference management criteria[1] in a way that would protect the spectrum licensee's property rights.

We propose clause 3.4 of RALI[NEW] is amended such that:

- where an unresolvable interference issue occurs between two spectrum licensees, the ACMA can impose a pre-determined frame pattern and synchronisation timing offset (preferably from 3GPP TS 38.104 as the ACMA has done); and

- where an unresolvable interference issues occurs between a spectrum licensee and an apparatus licensee of any type (other than an FSS earth station), the spectrum licensee should be required to nominate the frame pattern and synchronisation timing offset.

[1] For example, requiring the synchronisation fallback frame pattern is specified by the spectrum licensee (rather than mandated ex ante by the ACMA) would maintain primacy of the spectrum licence.

26 GHz Draft SLTF

2.1 Positive reception of the draft SLTF

As highlighted in the consultation paper, following the close of the 26 GHz Technical Liaison Group (TLG), the ACMA allowed for review of the TRP limits if accompanied by mitigation measures, and it was expected that these mitigation measures would reflect an agreement between relevant stakeholders. Despite no formal agreement having been reached, the ACMA has demonstrated fairness and good judgement in taking the common aspects of both sides of the argument and reflecting them in the draft SLTF. We are appreciative of the level of effort and foresight involved in the timely incorporation of the concept of an EIRP limit, intended to protect fixed-satellite service (FSS) space station receivers while providing wireless broadband network operators some flexibility to operate above baseline TRP levels.

2.2 Different environment below and above 27.5 GHz

We note the ACMA's observation that, "the coexistence scenario in the 27-27.5 GHz segment of the 26 GHz band is almost identical to the 28 GHz band (the key difference being that mobile use is contemplated in the 26 GHz band but not the 28 GHz band)…". We agree that this is the case, but only with respect to protection of NBN Co FSS gateway uplinks, which have licences that span across the 27.5 GHz frequency boundary. Beyond the NBN Co FSS gateway uplinks, the spectrum sharing environment is different—above 27.5 GHz, there are other satellite users, a higher number of FSS deployments and NGSO systems serving Australia in the spectrum, which are not present below 27.5 GHz.

2.3 Background of the EIRP mask

The ACMA's EIRP mask for 27-27.5 GHz applicable inside the FSS coexistence zones exactly replicates that in the Russian Federation's Study E of TG 5/1 Chairman's Report Annex 3 Part 4 for protection of the inter-satellite service (ISS). The mask is simply based on generating an envelope around the EIRP pattern for TRP 25 dBm and an 8×8 AAS array pointing at or below the horizon.

It is therefore noteworthy that the ACMA's proposed EIRP mask is based on an input to the TG 5/1 studies, rather than an output or outcome from the studies.

The Russian authors then verified the mask by considering a vast area illuminated by a data relay satellite (DRS) at 10 degrees elevation angle, and found the protection criterion of that DRS to be satisfied. At 10 degrees elevation angle, the mask allows for 40 dBm/(200 MHz) EIRP in the direction of the satellite, which the Russian authors concluded was tolerable. Notwithstanding potential differences in the characteristics of the satellite receive system and antennas between the Australian and Russian satellites considered[2], and assuming the satellite receive beam is pointing towards the 'interfering' IMT network, at a conceptual level there is no reason[3] why a GSO satellite at 90 degree elevation needs more protection than a GSO satellite at 40 degree

2 It is not clear which of the two ISS receivers was considered in "Verification of the e.i.r.p. mask", but both had high gain antennas of 57.4 dBi and 49 dBi. A very low protection criterion of I/N = -17 dB was also assumed.
3 Except for some minor variations for path loss (greater distance and lower slant path angle) and beam footprint size.

elevation. It follows that there is also no reason why a GSO satellite at 40 degree elevation needs more protection than a GSO satellite at 10 degree elevation.

2.4 Refinements to the EIRP mask for 27-27.5 GHz inside coexistence zones

AMTA requests four refinements to the EIRP mask for use in the range 27.0-27.5 GHz inside coexistence zones, in order of priority:

1. Applicability limited to "in the direction of the geostationary arc";

2. Extension of the EIRP level corresponding to 40 degrees (i.e. 27.6 dBm/(200 MHz)) to the higher elevation angles;

3. Extension of 34 dBm/(200 MHz) EIRP level across the full range of elevation angles (15 degrees upwards); and

4. Introduction of a slope from 34 dBm/(200 MHz) up to 42 dBm/(200 MHz) for elevation angles from 34 degrees down to 15 degrees.

Below we explain how each instance of refinement of the EIRP mask maintains equivalent protection to FSS space station receivers in the band 27-27.5 GHz.

We note that adoption of refinement 3 supersedes refinement 2. Adoption of refinement 4 supersedes refinement 3 only for elevation angles between 15 and 34 degrees. Refinement 1 applies to all scenarios and is the highest priority change requested.

2.4.1 EIRP mask only applied in the direction of the geostationary arc

Considering that the FSS space station receivers that need protection in 27-27.5 GHz are all in geostationary orbit (GSO), this refinement to only apply the EIRP mask "in the direction of the geostationary arc" will result in no increase whatsoever in the EIRP radiated towards these satellites. On the other hand, it will provide significantly more flexibility for wireless network operators, in particular for BS sectors pointing southwards (as the most obvious example).

Note that our strong preference would be to only apply these limits in the direction of GSO orbital positions 140E and 145E, but we note the ACMA's comments surrounding providing some future flexibility for the FSS (including NBN Co itself), and seek to offer "in the direction of the geostationary arc" as a compromise solution.

2.4.2 EIRP mask 27.6 dBm/(200 MHz) for 40-90 degrees

As explained above in Section 2.3, satellites require a level of protection that is agnostic to their elevation. Provided the terrestrial interferer is within the satellite's beam footprint, the satellite does not require greater protection[4] if it subtends an elevation angle greater than 40 degrees from that interferer, compared to if it subtends an elevation angle of exactly 40 degrees from the same interferer. The ACMA's proposed mask (Table 3 in the consultation document) for transmitters operating in 27.0-27.5 GHz inside gateway footprints affords 27.6 dBm/200 MHz EIRP limit at 40 degrees elevation (protection = 34 – 0.43(el – 25), which for el = 40 degrees gives 27.6 dBm/200 MHz). As a minimum, AMTA proposes the EIRP level of 27.6 dBm/(200 MHz) should be used for all elevation angles above 40 degrees.

2.4.3 EIRP mask 34 dBm/(200 MHz) for 15-90 degrees

Of all the FSS coexistence zones, the Waroona WA zone is the most conservative case as it both:

- subtends the zone with the lowest elevation angle to the NBN Co satellite (40 degrees to the satellite at 145E); and
- also happens to contain the likely population within it (only metro area covered by an FSS coexistence zone), which is likely to result in the highest number of BS deployed within an FSS coexistence zone.

In the interim period between the finalisation of the TLG and the release of the Draft SLTF, AMTA and its members liaised with NBN Co to seek agreement for an increase in the TRP mitigated by an EIRP limit in the direction of their satellites. The value of the EIRP limit proposed was 35 dBm/(200 MHz), very close to the value of 34 dBm/(200 MHz) which both the Russian Federation and NBN Co endorsed as being tolerable[5] for a GSO satellite at an elevation angle of between 15 and 25 degrees.

Firstly and for background, it is important to reiterate that:

a) the ACMA's proposed EIRP mask is based on an *input* to the TG 5/1 studies, rather than an *output* or *outcome* from the studies, as explained in Section 1.3 above;

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4 Except for some minor variations for path loss (greater distance and lower slant path angle) and beam footprint size.

5 In its response to the 26/28 GHz Apparatus Licence Technical Liaison Group (TLG) Paper v2.1 nbn's submission to 26/28 GHz Apparatus Licence and 26 GHz spectrum licence TLG, NBN Co stated that "*compliance with this mask appears feasible from 15 degrees elevation and would create a flexible co-existence environment for Fixed Wireless deployments between 27.5 and 29.5 GHz, supported by sufficient protection for Satellite Systems*." For clarity, the mask referred to in this quote is the same as that proposed by the ACMA in the consultation paper for the Draft SLTF, in turn equivalent to the Russian mask as introduced in section 2.3 above.

b) studies that were carried out in the TG 5/1[6] found very large margins between the aggregate interference level and the protection criterion of an FSS space station receiver; and

c) the value of the EIRP limit to which terrestrial wireless networks will be restricted should be based on what measures are needed to satisfy the protection of space station receivers, and not what a hypothetical base station transmitter is capable of doing.

To address this, AMTA started with the FSS space station protection criterion and worked backwards from there. For the following parameters:

- FSS space station protection criterion of -97 dBm/(200 MHz)[7];
- receive antenna gain at the footprint edge (where most of the BS would be in Perth) of approx. 53 dBi; and
- 212.8 dB path loss;

an aggregate EIRP of 62.8 dBm/(200 MHz) from Perth would not exceed the FSS protection criterion. If the individual BS EIRP were set to 34 dBm/(200 MHz), the aggregate EIRP limit could be satisfied with the simultaneous transmission of approx. 800 high-power and line of sight (LOS) BS sectors.

In June, to support its proposal AMTA liaised with NBN Co and ran probabilistic studies for the EIRP limit of 35 dBm/(200 MHz) in the direction of the satellite modelled on an IMT network of 3600 BS sectors with an activity factor of 30%. While half of the BS were set up as low-power hotspots operating at 25 dBm/(200 MHz) TRP, the other half were high power macrocells operating at 45 dBm/(200 MHz) TRP, *well* above the max. 30 dBm/(200 MHz) TRP being offered by the ACMA. In a Monte Carlo study with 100 snapshots involving beamforming to randomised UE locations for all active BS, the aggregate interference calculated did not exceed the FSS protection criterion.

Finally, as explained in Section 2.3 and reiterated in Section 2.4.2 above; if a particular EIRP limit protects a satellite at 20 degrees elevation, it will also protect a satellite at 40 degrees elevation and above. In fairness, NBN Co potentially has not considered the impacts of the EIRP levels corresponding to the lower elevation angles as the lowest elevation angle towards their satellites and within their footprint beams is 40 degrees, as already mentioned above.

Noting the above, for 27-27.5 GHz and *inside* the FSS coexistence zones, we advocate for a single EIRP limit value be applied (a) from 15 to 90 degrees elevation and (b) in the direction of the

6 ITU-R TG 5/1, August 2018, Report on the sixth meeting of Task Group 5/1, Annex 03 Part 3 - Sharing and compatibility of the FSS and IMT operating in the 24.25-27.5 GHz frequency range. https://www.itu.int/md/R15-TG5.1-C-0478/en
7 Derived with T = 820 K and I/N = -10.5 dB

geostationary arc: 34 dBm/(200 MHz). If this proposal is adopted, it supersedes the proposal in section 2.4.2.

2.4.4 EIRP mask 42 to 34 dBm/(200 MHz) for 15-34 degrees

Lastly, we propose an increase in the EIRP elevation mask for the portion between 15 and 34 degrees elevation. We propose the mask should commence with 42 dBm/200 MHz EIRP at 15-degrees above the horizon with a downward gradient of -0.43 dBm/degree of elevation to 34 dBm/200 MHz at 34-degrees above the horizon (i.e., in the range 15 degrees ≤ el < 34 degrees, $EIRP_{MAX} = 42 - 0.43(el - 15)$) in the direction of the geostationary arc.

This is intended to provide greater flexibility for early antenna systems whose deployment would not affect any existing FSS systems serving Australia, as there are none that subtend elevation angles of less than 34 degrees from the gateway transmitter.

This increased portion still restricts radiation in the direction of the GSO, but allows early mmWave deployments with current antenna technologies in the interim period before any new satellite systems may be introduced that serve Australia. We stress that this increase will not affect SkyMuster satellites as they do not serve any gateways with elevation angles lower than 40 degrees. Furthermore, any future satellite systems will be able to plan their uplinks taking into consideration the increased EIRP mask and take appropriate measures e.g. select gateway locations in regional/remote areas likely to coincide with lower-density WBB deployments within the satellite beam footprint and/or with higher elevation angles to the satellite. If this proposal is adopted, it supersedes the proposal in section 2.4.3 for elevation angles in the range 15-34 degrees.

2.5 Refinements to the EIRP mask for 27-27.5 GHz *outside* coexistence zones

2.5.1 Extension of refinements in Section 2.4 to other masks

For any refinements accepted in response to section 2.4 above, it would make sense to reflect these in the other masks. Whatever EIRP mask is adopted in 27-27.5 GHz *inside* coexistence zones should simply be copied and increased by *X* dB to obtain the mask for 27-27.5 GHz *outside* coexistence zones, where *X* dB is to be:

- 12 dB in Perth and Margaret River; and
- 15 dB outside Perth/Margaret River.

Note that we suggest 15 dB rather than 12 dB outside Perth/Margaret River due to a proposed increase of the baseline level from 37 to 40 dBm/(200 MHz) as explained further below.

2.5.2 Removal of 3 dB reduction in TRP and EIRP mask outside Perth & Margaret River

The ACMA's rationale for a 3 dB reduction in the TRP limits in 27-27.5 GHz outside coexistence zones (relative to those in 25.1-27.5 GHz) is that *"the frequency range is shared with domestic satellite services and that high power transmitters located near (but just outside) the gateway footprint areas will contribute to the aggregate interference level at the satellite receiver"*. We recognise this and believe the only spectrum-licensed areas that are "just outside" a gateway footprint area are Perth and Margaret River.

As such, we propose that

a) the 3 dB reduction only apply to the reallocation areas of Perth and Margaret River.

b) the TRP limit in 27-27.5 GHz *outside* coexistence zones and *outside* of the Perth and Margaret River reallocation areas is increased to 40 dBm/(200 MHz) (baseline in Tx RAG) and 45 dBm/(200 MHz) (upper limit in core conditions), along with a corresponding increase in the EIRP mask as per section 2.5.1 above.

We acknowledge that this would result in four sets of TRP levels in the core conditions and four sets of EIRP masks in the Transmitter RAG, however, this small increase in complexity is designed to confine the tighter limits and restrictions to only those areas where the ACMA intends to preclude increasing the aggregate interference level at the satellite receiver due to high-power transmitters that are in close proximity to the gateway zones. This improvement to the framework does not need to be accompanied by any compensating measures as we are not in principle proposing an increase to the limits outside the Perth and Margaret River area, but rather circumscribing where they apply on the basis of what the ACMA is trying to achieve.

2.6 Refinements to the EIRP mask for 25.1-27 GHz

WRC-19 adopted *resolves* 2.2 of Resolution 242 (WRC-19) to address the protection of the ISS, and the ACMA has in turn proposed to add this as a statutory condition of the 26 GHz spectrum licences. In accordance with *resolves* 2.2, only beams exceeding 60 dBm/(200 MHz) need to ensure angular separation with the GSO. Beams radiating levels up to 60 dBm/(200 MHz) in the direction of the GSO do *not* need any adjustment by way of angular separation. By implication, the ISS on the GSO can tolerate levels up to 60 dBm/(200 MHz).

Noting that there are parts of the proposed EIRP mask for 25.1-27 GHz that are below and above 60 dBm/(200 MHz):

- for the parts of the EIRP mask below 60 dBm/(200 MHz), this is unnecessarily restrictive on IMT and should be set to 60 dBm/(200 MHz), which is sufficient to protect the ISS as per *resolves* 2.2; and

- for the part of the EIRP mask exceeding 60 dBm/(200 MHz)[8], and noting that the EIRP should only be applicable in the direction of the GSO (as per section 2.4 of this response), *resolves* 2.2 would not permit radiation exceeding 60 dBm/(200 MHz) in the direction of the GSO anyway

the EIRP mask for 25.1-27 GHz becomes redundant and should be removed altogether.

2.7 Clarification of conformance with *resolves* 2.2 of Res 242

resolves 2.2 of Resolution 242 (WRC-19) states that, for BS with EIRP <u>per beam</u> exceeding 60 dBm/(200 MHz), <u>sites</u> *"should be selected so that the direction of maximum radiation <u>of any antenna</u> will be separated from the GSO (within LOS of the IMT BS) by ±7.5 degrees"*.

Conceptually there are two approaches which could be enforced: angular separation with the GSO for the:

A. direction of maximum radiation of the antenna array; or
B. direction of maximum radiation of any beam?

Beamforming antennas will typically have the maximum radiation for beams which are at (or close to) the normal to the antenna array, as the beam gain reduces with the magnitude of scanning angle in the horizontal and vertical planes. Under approach A. above, the operator would have to

i. find the angle for which the antenna array produces the maximum gain (of all possible beams/scanning angles);
ii. adjust that pointing direction/vector for mechanical tilt (if applicable); and
iii. calculate the angular separation with the GSO for that pointing direction/vector.

Under approach B. above, the operator would have to perform steps i. through iii. for all possible electrically-steered beams. Approach B would also mean that *resolves* 2.2 would impact on a much wider range of base station sector orientations, noting that beams can be steered as far as (nominally) 60 degrees from the normal to the array along the horizontal axis.

AMTA's interpretation is that approach A should apply, since *resolves* 2.2 refers to "site selection" and explicitly refers to the "maximum radiation of any *antenna*" (not any *beam*). However, we seek the ACMA's official confirmation that conformance to *resolves* 2.2 will be enforced as such.

If, rather, conformance with *resolves* 2.2 applies to any steered beam as per approach B above, then this needs to be stated clearly by the ACMA. In such a case, we would have further comments on this being included as a statutory condition of spectrum licences.

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8 Between 62 dBm/(200 MHz) at 5 degrees and 60 dBm/(200 MHz) at approx. 6.5 degrees

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