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ACMA Consultation: IFC 25/2020 - Proposed Apparatus Licensing Arrangements in the 26 GHz and 28 GHz Bands – CSIRO Comments

Dear Manager,

CSIRO welcomes the opportunity to comment on the ACMA consultation IFC 25/2020 **"Proposed licensing arrangements in the 26 GHz and 28 GHz bands - consultation 25/2020".**

CSIRO is responsible for the management and operation of the Canberra Deep Space Communication Complex (CDSCC) and other NASA facilities in Australia under a government to government treaty between Australia and the USA as well as a Cooperating Agency Agreement between CSIRO and NASA. CSIRO is also responsible to manage the operations of the European Space Agency (ESA) space research activities in Australia, including the operation of the Space Research Services (SRS) earth station at New Norcia in W.A. under the provisions of a long-standing Treaty between the Australian government and ESA. CDSCC and New Norcia are both integral and vital parts of the respective global networks represented as NASA's Deep Space Network (DSN) and ESA's tracking network (ESTRACK), respectively. Each provide ongoing and invaluable contributions to international space exploration. They both comprise substantial earth station assets developed over 50 years of cooperation including very large antennas at the NASA CDSCC facility and ESA New Norcia facility, enabling tracking of dozens of international Near-Earth and Deep-Space missions representing spacecraft assets in excess of $35 Billion dollars. Additionally, both NASA and ESA continue to invest substantial sums of money in expansion and upgrade projects to maintain a world leading space research and exploration capability in Australia. The capability for these stations to continue their space research work, under local management by CSIRO, is critically dependent on the ongoing interference-free access to the requisite radiocommunications frequency spectrum, as has been the case for over 50 years.

Concerning the ACMA's invitation to comment, CSIRO is pleased to hereby submit the following comments, against the specific questions presented in the two consultation documents. CSIRO's inputs, presented in red text, are as follows:

Issues for Comment

The ACMA invited comment from interested stakeholders on any aspect of the consultation package. The "Issues for Comment" are presented as follows:

1. The ACMA is proposing to use a two-stage administrative allocation for apparatus licences in certain segments of the 26 GHz band and in all of the 28 GHz band. Do stakeholders agree with this approach? If not, please explain why. No comment.

2. Do stakeholders have any concerns with the licence duration and renewal policy for AWLs in the 26 GHz and 28 GHz bands? No comment.

3. The ACMA is proposing that AWLs be available for issue for the operation of FSS earth stations in the 27–29.5 GHz range. Do stakeholders support this proposal? If not, please explain why. No comment.

4. The draft technical framework is optimised for both wireless broadband and FSS earth stations. Fixed earth stations in the range 29.5–30 GHz are still authorised under a fixed-earth apparatus licence. We are seeking views on a proposal to authorise FSS in the 29.5–30 GHz range with AWLs. Do stakeholders have any comments about this proposal? No comment.

5. Do stakeholders have any specific comments about the draft AWL LCD or RALI [new] or updated RALI MS 38? Please refer to the detailed comments and concerns presented below in this CSIRO submission.

6. Do stakeholders agree with the proposed apparatus licence tax? As explained in Appendix A, at this time in Australia there is limited information about the value of the spectrum on offer for administrative allocation. The ACMA is open to reviewing the apparatus licence tax for AWLs in light of developments in domestic markets that have occurred or will occur over time. What considerations should the ACMA take into account? No comment.

CSIRO comments and Concerns

CSIRO, as manager of both the ESA New Norcia and the NASA Canberra Deep Space Communication Complex (CDSCC) at Tidbinbilla, has concerns due to some technical criteria and co-existence issues stemming from the details presented in the consultation documents released for public consultation under IFC 25/2020.

These concerns are fundamentally related to a number of proposals in the documents which are regarded as presenting potential co-existence issues related to sharing of the proposed new Apparatus licensed IMT-2020 transmitters, including Base Stations (BS) and their client User Equipment (UE) and the existing, long established Space Research Service Earth stations at NASA's CDSCC and ESA New Norcia. These concerns relate primarily to last minute increased TRP's (and resultant EIRP implications), UE registration and coordination zones.

The major concern relates to the proposal of ACMA to now allow a variance of the initially defined TRP provided to the TLG participants for sharing consideration of 30dBm/200MHz to increased levels as high as 45dBm/200MHz. This change, (as proposed in the draft Marketing Plan) if incorporated by ACMA, effectively invalidates the extensive sharing studies conducted on CSIRO's behalf by its space tracking Treaty partners, ESA and NASA and is cause for serious concern. These concerns are further exacerbated by the ACMA proposal to now exempt high power UE's (with TRP above 23 dBm (PSD above 46 dBm/200MHz)) from licensing, thereby relieving them of their obligation to comply with PSD limits that would assure (through license conditions) interference protection levels at the New Norcia and Tidbinbilla SRS tracking stations were preserved through regulatory means. This provision of regulatory protection is consistent with the terms of the international Treaties between the Australian government and ESA and the USA. Both ESA and NASA plan to support human space exploration missions in this band, demanding that the integrity of communication at CDSCC and New Norcia in this 26GHz band is fully protected and assured through regulation from the risk of interference as a safety of life matter. CSIRO presents below the issues that are identified, in turn, for both the ESA New Norcia Space Research Service Earth station and the NASA CDSCC Earth station.

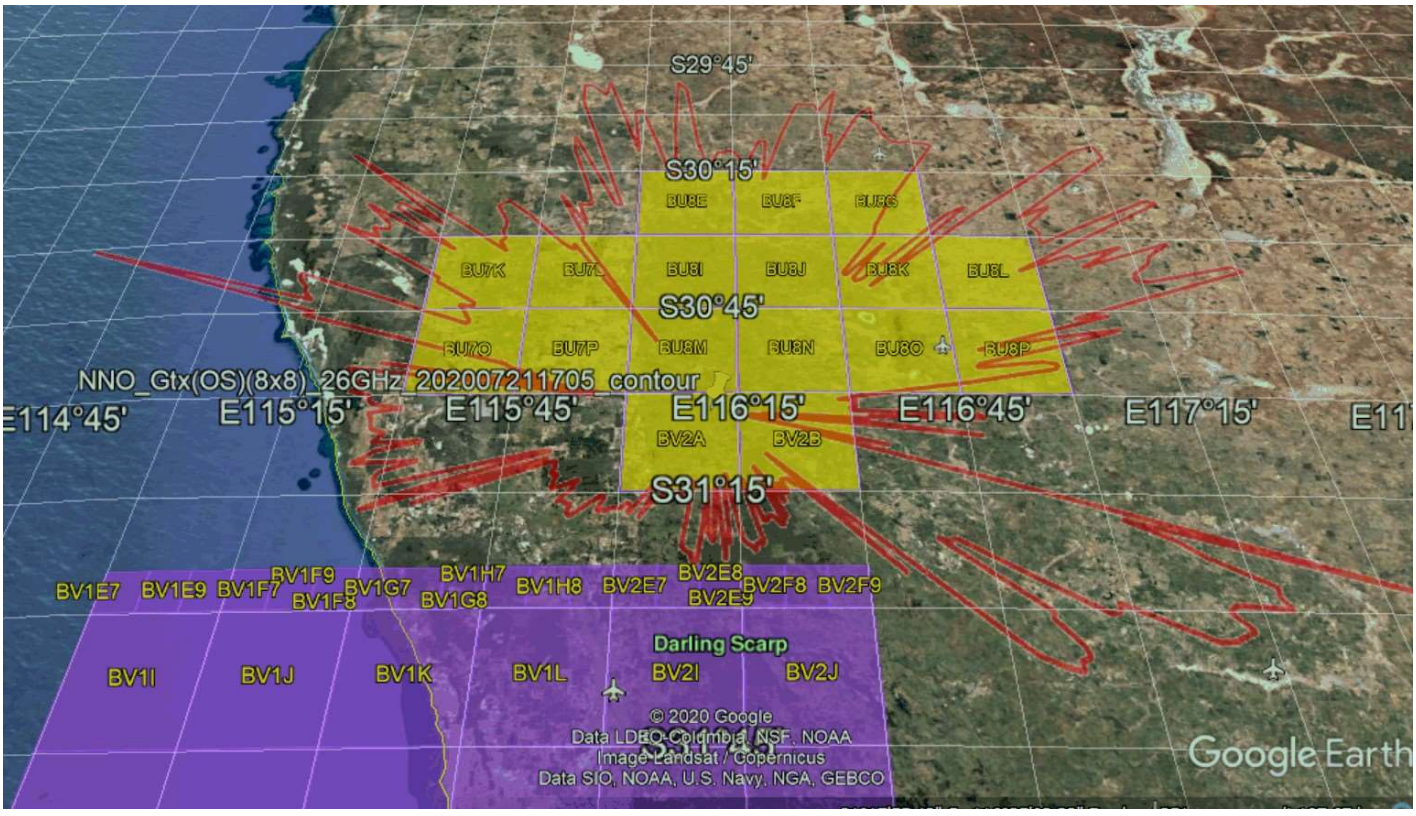
1. ESA New Norcia

Compatible TRP Limits for Co-Existence with New Norcia

For the ESA New Norcia SRS station, the sharing analysis in the band 25.5 – 27.0 GHz conducted by ESA during the TLG was based on 25dBm/200MHz TRP in line with the TG 5/1 defined sharing study criteria. It was on this basis that the exclusion zone around New Norcia was determined and consequently, sharing with the spectrum and apparatus licensees within the Greater Perth and surrounding areas and New Norcia was shown to be feasible. The ACMA's initial TLG assumptions already exceeded by 5 dB the studies done in ITU TG 5/1 leading to WRC-19 decisions.

CSIRO is concerned that these sharing arrangements will now be invalidated if the changes being suggested of a maximum TRP of 45dBm/200MHz Australia-wide are implemented in the vicinity of the ESA New Norcia Earth station. Concerning the higher TRP, there is no obvious point at which the TRP of 45dBm/200MHz in the 26 GHz band was accepted and agreed by consensus within the TLG. Rather, there is a suggestion in the final TLG document that if this higher TRP were to be implemented, then the spectrum and apparatus licensees would be required to propose/implement appropriate emission mitigation measures, through "modern beam-steering antennas". However, no mitigation measures below 5 degrees elevation have been proposed, but would be needed to protect the Space Research Service Earth stations at New Norcia.

In response to this stated higher TRP, ESA conducted a recent sharing study which demonstrated an interference problem at New Norcia if the 45dBm/200MHz TRP (68dBm/200MHz EIRP spectral density) is implemented. The figure below extracted from that study illustrates the large area that could result in interference above the -156 dB(W/MHz) protection level at this proposed higher TRP (without mitigation measures).



As the bidders for the apparatus licenses will (if approved by ACMA) be assuming a baseline nation-wide approval of 45dBm/200MHz TRP within the apparatus license conditions, CSIRO believes that it is incumbent on ACMA to recognise and acknowledge the protection level exceedance demonstrated by the most recent ESA studies and to include in the license conditions the requisite mitigation measures that will be required to be applied by the IMT-2020/5G operators (including UE) to avoid this exceedance and assure (as a consequential outcome) the preservation (through legislation) of the current (ITU-R specified) protection criteria of -156dB(W/MHz) necessary for the protection of the operating environment at New Norcia.

It is noted that the justification presented by the prospective apparatus licensees to the TLG for this high TRP was that the apparatus licensees would implement mitigation techniques through modern beam-forming technologies to avoid potential interference to other apparatus licensed services. Therefore, if ACMA accept this higher TRP above those upon which the initial sharing studies with the Space Research stations were based, CSIRO believes that ACMA now need to formally impose as a license condition the strict use of limited TRPs and/or touted mitigation measures to ensure a reduced EIRP directed towards the New Norcia Earth station to that level initially stated by the ACMA upon which the TLG (and TG 5/1) sharing studies were based. This is a similar activity to those measures adopted within these technical and regulatory documents by ACMA for the protection of the FSS services.

The imposition of such regulatory (mitigation) protection measures are consistent with the obligations articulated in the current ESA/Australian government Agreement (dated 5 October 2011) which extends to ESA the protection of New Norcia from harmful interference within the 26 GHz band (and other bands).

Accordingly, consistent with these Treaty commitments, CSIRO believes pre-emptive measures are required by ACMA prior to the issuance of the apparatus licenses rather than the seemingly proposed blanket approval of the 45dBm/200MHz TRP Australia-wide and leaving the onus to ESA/CSIRO to coordinate with the AWL licensees in a rear-guard defensive activity. This latter option is unacceptable and would also impose an unnecessary and onerous obligation on ESA/CSIRO to assign assets and effort to ongoing coordination, environmental RFI monitoring and interference source detection/identification.

In the spirit of proposing a cooperative resolution and to restore the acceptable sharing arrangements established within the TLG (studied by ESA on the basis of a TRP of 25dBm/200MHz), CSIRO therefore proposes that ACMA include in the associated apparatus (AWL) license conditions statements that would encapsulate the following protection measures:

The deployment and/or apparatus licensing under the AWL concept of base stations and UE in the vicinity of the New Norcia Earth station, outside the exclusion zone, but within a radius of 100km of New Norcia, must stipulate that the EIRP (PSD) be limited to the initially agreed maximum 48 dBm/200MHz in the band 25.5 – 27.0 GHz.

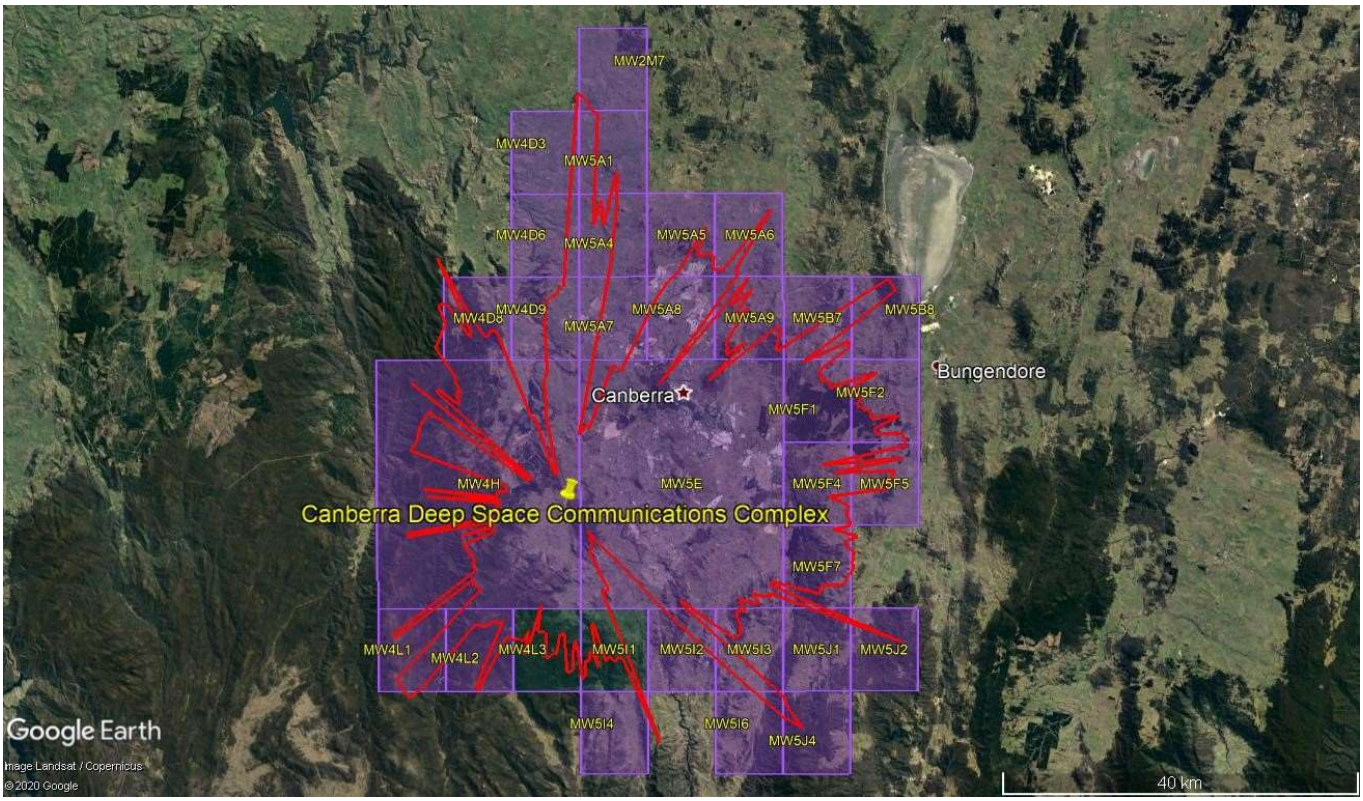
A possible alternative to this could be the extension of the current exclusion zone to cover all the HCIS cells around the New Norcia tracking station in the above diagram that are shown to exceed the SRS protection level (all those HCIS zones into which the red exceedance contours intrude) should a TRP of 45 dBm/200MHz (PSD/EIRP of 68 dBm/200MHz) be legislated.

2. NASA CDSCC

Compatible TRP Limits for Co-Existence with CDSCC

CSIRO has very similar concerns (to those described above for ESA/New Norcia) regarding the protection of the NASA CDSCC Earth Stations from interference in this 25.5 – 27.0 GHz band.

In response to the proposed higher base station TRP of 45dBm/200MHz, NASA conducted a recent sharing study which demonstrated an interference problem at CDSCC if the 45dBm/200MHz TRP (68dBm/200MHz EIRP power spectral density) is implemented. The figure below extracted from that study illustrates the large area that would result in interference above the -156 dB(W/MHz) protection level at this proposed higher TRP (without mitigation measures).



As the prospective AWL licensees will (if approved by ACMA) be assuming a baseline nation-wide approval of 45dBm/200MHz within the AWL license conditions, CSIRO believes that it is incumbent on ACMA to recognise and acknowledge the level of exceedance demonstrated by the most recent NASA studies and to include in the license conditions the requisite mitigation measures that will be required to be applied by the IMT-2020/5G operators (including UE) to avoid this exceedance and preserve (through legislation) the current (ITU-R specified) protection criteria of -156dB(W/MHz) necessary for the protection of the operating environment at CDSCC.

It is noted, that the justification presented by the prospective apparatus (AWL) licensees to the TLG for this high TRP was that the AWL licensees would implement mitigation techniques through modern beam-forming technologies to avoid potential interference to other apparatus licensed services. Therefore, if ACMA accept this higher TRP above those upon which the sharing studies with the Space Research stations were based, then it is incumbent on ACMA to, as a minimum, formally impose as a license condition the strict use of limited TRP's and/or touted mitigation measures to ensure a reduced EIRP directed towards the Tidbinbilla Earth stations to that level initially stated by the ACMA upon which the TLG (and TG 5/1) sharing studies were based. This is a similar activity to those measures adopted within these technical and regulatory documents by ACMA for the protection of the FSS services.

The imposition of such regulatory (mitigation) measures are consistent with the obligations articulated in the current government-to-government Treaty between the United States of America and Australia (dated 17 October 2017) which requires the Government of Australia to take all reasonable necessary steps to protect the NASA facilities (including CDSCC) from harmful radiofrequency interference. Consistent with these Treaty commitments, CSIRO believes pre-emptive measures are required by ACMA prior to the issuance of the apparatus licenses rather than the seemingly proposed blanket approval of the 45dBm/200MHz TRP Australia-wide and leaving the onus to NASA/CSIRO to coordinate with the apparatus licensees in a rear-guard defensive activity. Due to the potentially large number of base stations deployed around CDSCC, this would also impose an unacceptable, unnecessary and onerous obligation on NASA/CSIRO to assign assets and effort to ongoing coordination, environmental monitoring and interference source identification.

In the spirit of proposing a cooperative resolution and to restore the acceptable sharing arrangements established within the TLG (studied by NASA on the basis of a TRP of 25dBm/200MHz), CSIRO therefore proposes that ACMA include in the associated apparatus (AWL) license conditions statements that would encapsulate the following protection measures:

The deployment and/or apparatus licensing under the AWL concept of base stations and UE in the vicinity of the CDSCC Earth station, outside the exclusion zone, but within a radius of 50km of CDSCC, must stipulate that the EIRP (PSD) be limited to the initially agreed maximum 48 dBm/200MHz in the band 25.5 – 27.0 GHz.

A possible alternative to this could be the extension of the current exclusion zone to cover all the HCIS cells around the CDSCC tracking station in the above diagram that are shown to exceed the SRS protection level (all those HCIS zones into which the red exceedance contours intrude) should a TRP of 45 dBm/200MHz (PSD/EIRP of 68 dBm/200MHz) be legislated.

3. High Powered UEs for both New Norcia and CDSCC

It is not clear at this stage the restrictions that will apply to the IMT-2020/5G high power UEs outside the current New Norcia and CDSCC exclusion zones. For instance, on page 20 of the "Draft Technical Framework for Consultation" section, it is stated that "It is proposed that the TRP limits in Table 3 will apply to all transmitters (e.g. base stations and user equipment)". This appears to allow high powered UEs to transmit at up to 45dBm/200MHz TRP, rather than the previously specified TRP limit of 35dBm/200 MHz. CSIRO seeks assurance that ACMA studies indicate that under the proposed regulations, that constraints will be imposed on the UEs (mobile and fixed) to prevent (through geographic and EIRP limitations) exceedance of the requisite protection criteria at New Norcia and CDSCC.

The matter of CSIRO concern over the change by ACMA at the TLG to not require registration of high powered UE's (TRP >23dBm) has been raised several times, with the concerns still unresolved. For instance on 22 April 2020 the following comments were lodged with ACMA – "*Thank you for your email response (below), clarifying some of the points raised. While you have kindly elaborated on a number of matters raised, the one significant point of concern (raised in both the CSIRO submission and my email of 15 April 2020) relates to the proposal that appeared in the version 3 consultation documents which effectively presents as a fate accompli that high power UE's not be registered. CSIRO and their partner clients ESA and NASA firmly believe that if these high powered UE's (fixed and mobile) are not registered, this will present a heightened risk/uncertainty to control, monitoring and oversight of the deployment of the high-powered UE's. Unregistered devices prima facie increases potential for surreptitious, loosely constrained deployments (particularly for mobile high-powered UE's) in the vicinity of the SRS earth stations, which could well manifest as periodic, unaccountable bursts of interference (or worse) which will be difficult (and time consuming) for the SRS station to attribute to a particular device, locate it and engage ACMA in correcting the problem. It also appears that the decision of the high-power UE operators to coordinate is the unilateral prerogative of the new UE operator, with no identifiable trigger other than the operator's decision to initiate coordination. The current exclusion zones were of course established based on the characteristics of UE's with a TRP <23dBm.*

Registration would assure (through a formal, legislated process) that the requisite technical and operations coordination is properly undertaken between the high powered UE operators and respective SRS Earth station in all instances (say, for all high powered UE's within a TBD coordination radius of the respective SRS earth station). Accordingly, CSIRO, ESA and NASA requests a mandatory registration of high-powered UE's that facilitates coordination with SRS earth stations (to ensure that the coordination is not forgotten) and the associated geographic boundaries and operations parameters are clearly documented as approved outcomes in each case.

[Finally, the summary points at the end of your email of 17 April 2020 provided a succinct clarification of two of the critical elements in the AWL operations criteria when operating in the vicinity of the SRS Earth stations at New Norcia and CDSCC. There may be great value in adding the following two dot points to the Apparatus License and Spectrum License consultation documents at the very end of the Section related to "Coexistence with SRS earth stations in 25.5 - 27 GHz" and in the related Appendices (such as Appendix A - Draft RALI [NEW] Section 3.4 titled "Coordination Requirements with SRS earth stations"). The dot points for inclusions are:

In summary:
- *all outdoor transmitters in 25.5-27 GHz with a TRP > 23 dBm will be required to directly coordinate with SRS earth stations*
- *no transmitters in 25.5-27 GHz (of any type) will be permitted to operate in an exclusion zone]*

As the work of the 26GHz TLG has been terminated, it appears that (unless ACMA agree to amend the consultation documents to revert to include registration) this will need to be pursued by CSIRO, ESA and NASA during the public consultation phase."

CSIRO therefore requests ACMA reconsider and reinstate the registration of high-powered UE's, their deployment and TRP restrictions in the vicinity of the ESA New Norcia and CDSCC SRS space tracking stations (within a radius of 100km of New Norcia or 50km of CDSCC), if higher TRPs of 45dBm/200MHz are implemented Australia-wide.

4. General Comments Related to User Equipment.

Notwithstanding the documents provided under IFC 25/2020, there remains a number of areas of uncertainty, which present cause for concern for the SRS tracking stations. These are summarised as follows:

a. It is not clearly defined what technical criteria constitutes low powered User Equipment (UE). A clear definition of the criteria of low powered UE is required. It is implied through Attachment C, Draft RALI [NEW] (page 11) footnote 7, that "High-powered outdoor UEs (operate with a TRP of > 23 dBm and ≤ 35 dBm per occupied bandwidth). Therefore, by exception it is assumed that low powered UE have a TRP ≤ 23dBm/occupied bandwidth (assuming occupied bandwidth is 200MHz).
b. Under the somewhat apparent laissez-faire AWL concept, it is understood that the nature of UE's could cover a wide range of fixed and mobile devices. For instance, it is not clearly defined if the low powered UE's may be mobile devices with EIRP's up to 48 dBm/200MHz (TRP of 25 dBm/200MHz) or possibly even higher. By a process of deduction, it seems that if an AWL device is required to be registered, then by definition, it must be fixed (as a fixed location has to be specified). Therefore, it seems that any AWL device with a TRP below 35 dBm/200MHz could be either fixed or mobile. This further emphasised the critical importance that the AWL devices in the vicinity of New Norcia or Tidbinbilla SRS Earth stations be registered, if their TRP exceeds 23 dBm/200MHz. By definition, then the AWL mobile devices deployed immediately outside the exclusion zone will be limited to a TRP of <23 dBm/200MHz, which was the basis for the sharing studies that established the exclusion zones. It is to be noted that TG 5/1 studies assumed for UEs a maximum TRP of 19 dBm/200 MHz yielding an EIRP of 36 dBm/200 MHz.
c. There appears to be a potential problem to the stations related to the aggregate effect of multiple mobile UE's in the vicinity of the tracking stations at New Norcia or Tidbinbilla. Hypothetically, it appears possible that multiple "low powered" UE's operating adjacent to the HCIS exclusion zone within which the SRS stations are located, may result in an aggregated PSD exceeding the SRS protection criteria due to the increase of EIRP and TRP of UE compared to TG 5/1 studies.
d. Given that it is possible that the maximum TRP can be fed into an "active antenna system" wherein this TRP is concentrated in a non-omni-directional manner (a small, concentrated sector) there is a possibility that the currently assumed maximum EIRP/PSD of 68 dBm/200MHz will be exceeded, with the potential for interference to the SRS tracking stations, within scenarios that have not been studied. Accordingly, as the many scenarios studied, assumed an antenna gain of 23 dBi for all AWL fixed and mobile devices, this should be specified as a maximum to avoid the possibility of invalidating the sharing studies that have been conducted as a basis for the feasibility of coexistence with other services, such as the SRS.

5. Coordination

Finally, concerning coordination, the current proposed apparatus (AWL) license documentation and associated draft legislation states that all apparatus licensed operators (Australia-wide) coordinate with CSIRO concerning sharing with the ESA New Norcia and NASA CDSCC Space Research Service Earth stations. As this will impose an avoidable and large coordination overhead, CSIRO proposes that instead, ACMA include in the apparatus license documentation the conditions currently articulated in RALI MS 43, concerning coordination with the current CSIRO apparatus-licensed 26 GHz band. In this regard, the RALI MS43 states:

"3.1.2 Earth station receiver bands

Co-Channel

Services that wish to operate in the earth station receive bands within:

- 400 km of New Norcia Earth station below 10 GHz (8400-8500 MHz); and
- 200 km of New Norcia Earth station for bands above 10 GHz (25.5-27.0 GHz and 31.8-32.3 GHz)

must coordinate their use by using the procedure set out in section 3.1.3 of this RALI. All services wishing to operate in these bands must assume co-channel operation. Additional guidance on coordinating with earth stations can be found in Appendix 7 of the Radio Regulations of the ITU."

Note: an update to RALI MS43 is currently in draft format with the ACMA that proposes the same coordination distance (200 km) for CDSCC as New Norcia. Therefore the same coordination distance is requested for CDSCC (Tidbinbilla).

6. Summary

Accordingly, in summary, CSIRO proposes that ACMA implement the following protective regulatory measures for ESA New Norcia and NASA CDSCC:

ESA New Norcia:

a. In the 26GHz Apparatus license (AWL) legislative package and associated documentation, the deployment and/or licensing of base stations and UE in the vicinity of the New Norcia Earth station, outside the exclusion zone, but within a radius of 100km of New Norcia must stipulate that the EIRP (PSD) be limited to the initially agreed 48 dBm/200MHz in the band 25.5 – 27.0 GHz for BS and to 36 dBm/200 MHz for UE.
   Alternatively, the exclusion zone be extended to include all those HCIS zones into which the red exceedance contours intrude, as shown in the illustration above for New Norcia.
b. A coordination zone centred on New Norcia and extending out with a radius of 200km be specified as a licensing condition on the successful 5G broadband AWL licensees in accordance with RALI MS43.
c. High-powered UE's (TRP>23dBm/200MHz), within a 200km radius of New Norcia be licensed/registered with ACMA and coordinated with the SRS Earth stations (noting also that no AWL base stations or UE's are allowed to emit within the exclusion zone around New Norcia).

NASA CDSCC:

d. In the 26GHz Apparatus license (AWL) legislative package and associated documentation, the deployment and/or licensing of base stations and UE in the vicinity of the CDSCC Earth station, outside the exclusion zone, but within a radius of 50km of CDSCC must stipulate that the EIRP (PSD) be limited to the initially agreed 48 dBm/200MHz in the band 25.5 – 27.0 GHz for BS and to 36 dBm/200 MHz for UE.
   Alternatively, the exclusion zone be extended to include all those HCIS zones into which the red exceedance contours intrude, as shown in the illustration above for CDSCC.
e. A coordination zone centred on CDSCC and extending out with a radius of 200km be specified as a licensing condition on the successful 5G broadband AWL Licensees.
f. High-powered UE's (TRP>23dBm/200MHz), within a 200km radius of CDSCC be licensed/registered with ACMA and coordinated with the SRS Earth stations (noting also that no AWL base stations or UE's are allowed to emit within the exclusion zone around CDSCC).

Thank you for the opportunity to consider and comment on the ACMA IFC 25/2020.

Yours Sincerely,

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