Ericsson's submission to the Australian Communications and Media Authority's 26 GHz (25.1–27.5 GHz) band spectrum licence technical framework - Consultation Paper

August 2020

Ericsson appreciates the opportunity to respond to the Australian Communications and Media Authority's (ACMA) *26 GHz (25.1–27.5 GHz) band spectrum licence technical framework - Consultation Paper*. (**Consultation Paper**)

Ericsson also supports the submission made in response to the **Consultation Paper** by the Australian Mobile Telecommunications Association (**AMTA**).

Ericsson strongly supports the proposed March 2021 auction of 2.4GHz of mmWave spectrum in the 26GHz band to support 5G deployments.

For 5G to do what is it designed to do it requires access to a mix of low, mid and high-band spectrum. Operator access to mmWave spectrum will complement existing and planned low and mid band spectrum allocations to deliver super-fast speeds and greater capacity, especially over short distances.

Globally harmonised spectrum and technical requirements that are aligned to relevant standards are of critical importance for Australia to leverage economies of scale and deployable equipment.

5G continues to be deployed globally at a rapid pace.

The Ericsson Mobility Report June 2020[1] provides insight on mobile subscription and data traffic outlooks.

Mobile subscriptions outlook

- 5G subscriptions are forecast to reach 2.8 billion globally by the end of 2025, accounting for about 30 percent of total mobile subscriptions.
- The uptake rate of 5G subscriptions is expected to be *significantly* higher than it was for 4G.

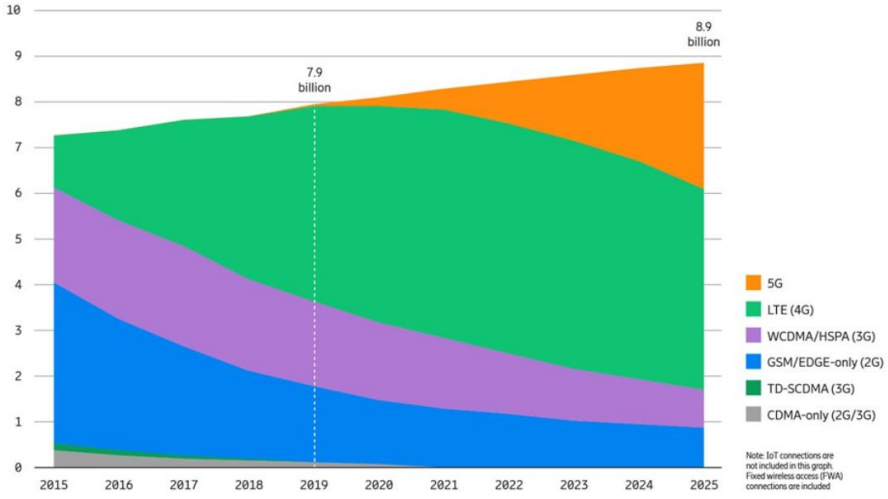

Figure 1: Mobile subscriptions by technology (billion)

[1] https://www.ericsson.com/en/mobility-report/reports/june-2020

Mobile data traffic outlook

- 5G is forecast to account for 45 percent of global mobile data traffic by 2025.
- By the end of 2019, global mobile data traffic reached around 33EB per month. This is forecast to grow by almost a factor of 5 to reach 164EB per month in 2025.
- In North America, strong near-term traffic growth is expected to give way to even higher long-term growth due to the adoption of immersive services using AR/VR.

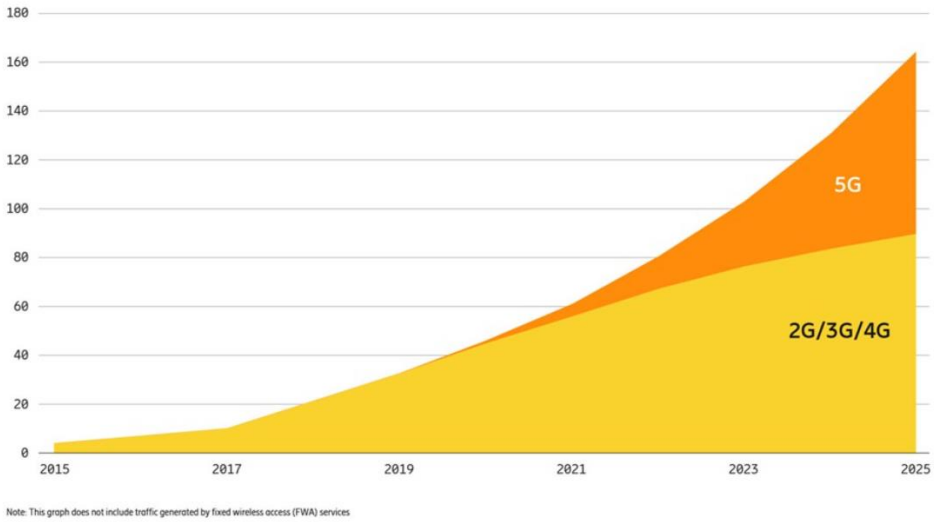

Figure 2: Global mobile data traffic (EB per month)

26GHz Technical Conditions

Ericsson acknowledges there has been significant progress made in moving towards a consensus of the technical conditions for the 26GHz band.

Ericsson welcomes the ACMA's decision to align fully with the outcome of WRC-19 with regard to additional unwanted emission limits to protect passive earth exploration passive services (**EESS**) in the adjacent 23.6 - 24 GHz band.

Total Radiated Power (**TRP**)

Ericsson recognises the challenges in accommodating the concerns raised by various stakeholders in establishing the requirements to ensure there is sufficient protection to co-exist with other services, notably proposed **out-of-area core condition** total radiated power (**TRP**) limits.

Ericsson maintains its position that that a maximum TRP in the range of at least 40 – 45dBm/200MHz is required. This is based on WRC-19 TG-5/1 studies of IMT vs. FSS in 26 GHz range evaluating the maximum TRP values (Refer to **Appendix: WRC Studies**).

These compatibility studies show that maximum TRP values in the range 40 – 45dBm/200MHz are acceptable.

If TRP limits are too conservative and restrictive, it will unnecessarily restrict the deployment of 5G. Setting such a limit will also require more sites to be deployed adding cost and complexity to deployment. Ericsson understands that no administration has put any TRP limit to prevent upper limits.

5G mmWave deployments are in early stages with the two leading 5G mmWave markets - the United States of America (USA) and Korea. Regulations in these market support higher TRPs.

The South Korean regulation defines the maximum power limits for the band 26.5-28.9 GHz as follows:

"*Transmission bandwidth (MHz) X 0.2 / MHz) W for TRP. This corresponds to a TRP of* ***46dBm/200MHz****."*

In the USA, the recent 26 GHz band auction required mmWave frequencies to be regulated by the same rules – Part 30[2].

§ 30.202 Power limits.

(a) For fixed and mobile base stations operating in connection with mobile systems, the average power of the sum of all antenna elements is limited to an equivalent isotopically radiated power (EIRP) density of +75dBm/100 MHz. For channel bandwidths less than 100 megahertz the EIRP must be reduced proportionally and linearly based on the bandwidth relative to 100 megahertz.

An EIRP density of +75dBm/100 MHz is +78dBm/200 MHz. Considering the typical array gain in a mmWave active antenna system (massive MIMO) the TRP will be in excess of **50dBm/200MHz**.

EIRP mask

Ericsson understands the proposed EIRP mask 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 based on *input* to the TG 5/1 studies, rather than an *output* or *outcome* from the studies.

The elevation EIRP mask is proposed to be valid for all Base stations (BS) (and we understand for all elevations angles) when the TRP exceeds a certain level.

The protection directions are only required toward the satellites, and in a limited number of other directions.

If the EIRP mask is to apply for all base stations and all elevations angles, it will significantly reduce the number of possible mitigation methods (and thus create restrictions in equipment design and deployments).

The elevation EIRP mask is based on a specific assumed base station antenna and not on the required protection for satellites. The assumed antenna is strictly based on a theoretical antenna model excluding antenna impairments and

[2] https://www.law.cornell.edu/cfr/text/47/part-30

required design margins. This approach will potentially create restrictions in equipment design and deployment or impact the deployability of AAS radios.

There are outstanding questions regarding the application of 21.5 for AAS that have been raised at ITU[3] via the WRC-19 (Doc WRC-19/550), and later confirmed by the CPM23-1, the ITU-R WP5D is the responsible group and the WPs 4A, 4C, 5A, 5C, 7B and 7C are interested groups, to study the applicability of Article 2.15 in the ITU Radio Regulations with the following text:

> *"ITU-R is invited to study, as a matter of urgency, the applicability of the limit specified in No. 21.5 of the Radio Regulations to IMT stations, that use an antenna that consists of an array of active elements, with a view to recommend ways for its possible replacement or revision for such stations, as well as any necessary updates to Table 21-2 related to terrestrial and space services sharing frequency bands. Furthermore, the ITU-R is invited to study, as a matter of urgency, verification of No. 21.5 regarding the notification of IMT stations that use an antenna that consists of an array of active elements, as appropriate*."

This task has been considered in the two WP5D meetings that have been held after the conclusion of WRC-19. There is currently a total of seven input contributions with extensive discussions but there is no agreement yet on the workplan for these studies. From the WP5D meeting that finished early July 2020 there are currently four different approaches suggested that are significantly different from each other.

Therefore, it is the view of Ericsson that any type of interpretation or use of No. 21.5 related to implementation of 5G/IMT-2020 is immature at this stage and should not be considered for a regulatory framework in any way until this work has been agreed and approved in ITU-R WP5D.

Core Conditions

Ericsson has reviewed the core conditions that will apply to Spectrum Licences issued as an outcome of the auction process detailed in the *Draft Radiocommunications Spectrum Marketing Plan (26 GHz Band) 2020* **(Draft Marketing Plan).**

Ericsson notes that the out-of-band core conditions are proposed to be aligned with the unwanted emission limits of international equipment standards, referring to the limits contained in 3GPP Release 15 specifications.

3GPP standards have progressed to Release 16 and there have been some developments in the standards. The Draft Marketing Plan is based on 3GPP 38.104 version 15.3 and the current 3GPP 38.104 is version 16.2.

The changes identified are:

1. **Introduction of OTA receiver spurious emissions – minimum requirements for BS type 2-O**. This was not defined in Release 15 version and introduced in Rel 16.2. The Draft Marketing Plan OTA receiver spurious emissions are currently referring to BS Type 1-C and 1-

[3] World Radiocommunication Conference (WRC-19) Document 550-E

H. This is defined in the tables 3GPP 38.104 Revision 16.2 10.7.3-1 and 10.7.3-2. If these updates are not adopted, there is the possibility that future **3GPP complaint** products will not be able to be deployed in Australia. This will in turn create an unnecessary need for bespoke products for the Australian market.

2. **Δf OBUE** - The Draft Marketing Plan notes 40MHz which is the specification for BS type 1-O configured with configured BW between 100 and 900MHz. The 26GHz band is operating in FR2, which is BS type 2-O and has a single Δf OBUE of 1500MHz specified.

Ericsson strongly recommends the ACMA adopts changes to ensure aligned with the most recent version of specifications relating to FR2.

Co-ordination procedures

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). This should not be mandated as flexibility is required to accommodate changes as the 5G mmWave technology as it is deployed and as it evolves.

In regard to **fallback synchronisation uplink-downlink configuration**, it is Ericsson's view that there is more alignment towards the second option suggested by the ACMA, i.e.: *An uplink-downlink configuration which is consistent with the FR2.120-1 UL-DL pattern described in Table A.1.3-2 of 3GPP TS 38.101-4 V15.4.0, where:*

1. *The period of the slot configuration pattern is 0.625 ms;*
2. *The period of a slot is 0.125 ms; and*
3. *There are 14 symbols within a slot.*

Appendix: WRC Studies

The following analysis is based on the TG-5/1 studies IMT vs. FSS in 26 GHz range evaluating the maximum TRP values. These compatibility studies show that maximum TRP values in the range 40 – 45dBm/200MHz are acceptable.

Seven of the performed co-existence studies between IMT-2020 and FSS uplink included results for elevation angles up to 20 degrees. Five of these studies assumed worst case conditions, e.g. IMT deployed in whole satellite footprint (assumes no non-land parts of footprint), and the remaining two studies (one using IMT deployment based on actual land area within footprint and the other used IMT deployment based on population density) looked at the earths most populated area (total number within satellite footprint).

When results are adjusted with respect to IMT antenna normalization, the possible maximum allowed TRP value is calculated from TRP values used in simulation + margins beyond the required I/N = -10.5 dB from simulation results.

The possible TRP value resulting from the five worst case studies is in the range 37 to 42 dBm/200 MHz and from the two more realistic studies in the range 42-45 dBm/200MHz.

In summary:

- Considering results up to 20 deg. Elevation angle.
- The maximum TRP is calculated as used Base Station power (25 dBm/200MHz) + margin beyond the required I/N= -10.5 dB in study results.
- **Five studies used worst case assumption** (either IMT deployment in full area or finding a combination of satellite position and land area without any non-land parts (e.g. sea/lake/ocean)).
    - Performed study results found:37.5/38.9/39.3/41.5/44.3 dBm/200 MHz.
    - If adjusting number due to antenna normalization (subtract 2 dB), the number becomes: 37.5/38.9/37.3/39.5/42.3 dBm/200 MHz (range ~37-42 dBm/200MHz).
- Two studies **did not use worst case assumption** (IMT deployment only on land area or population based deployment) but studied the worlds most populated area (within satellite footprint).
    - The difference in number of base stations for the population based and Ra,Rb deployment correspond to ~2 dB less interference for the population based method.
    - Performed study result shows: 44/45(pop based, 43 adjusted) dBm/200 MHz.
    - If adjusting number due to antenna normalization (subtract 2 dB), the number becomes: 42/45 (pop based, 43 adjusted) dBm/200 MHz (range ~42-43(45) dBm/200MHz).

Results are summarised below in *Figure 3: Maximum TRP based on TG5/1 study results*.

Study IMT/FSS UL	Study A	Study B	Study C	Study F	Study H	Study I	Study K
I/N (dB, mean value)	-29.5	-30.5	-27	-24.8	-23	-24.4	-29.8
For Elevation angle (Degrees)	15	17.3	15	5	7.7	20	15.3
Ra,Rb deployed area	Real area	Popul. based	Full area	Full area	Real area	Full area	Full area
Worst area	China	China	NA	NA	Russia	NA	NA
Include open area BS deployment	No	No	No	No	Yes	No	No
Used Antenna Normalization	No	Yes	No	No	Yes	Yes	No
Corresponding max permissible TRP value (consider -10.5dB I/N)	44	45	41.5	39.3	37.5	38.9	44.3
Antenna normalization added and selected based on angles between 0-20 degree	42	45 (~43 adjust.)	39.5	37.3	37.5	38.9	42.3

Figure 3: Maximum TRP based on TG5/1 study results[4].

Based on this Ericsson recommends a maximum TRP value in the range 40-45 dBm/200MHz, noting that a 37dBm TRP limit is:

1) not required as the compatibility studies show a large margin relative interference to satellite systems when using such a power level.
2) damaging for 5G deployments, because it limits coverage and will lead to additional, unnecessary site deployment.

[4] Attachment 3 to Annex 3 to Task Group 5/1 Chairman's Report – Sharing and Compatibility of the FSS and IMT Operating in the 24.24 – 27.5GHz Frequency Band