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Qualcomm Incorporated (Qualcomm) welcomes the opportunity to provide input to the Australian Communications and Media Authority (ACMA) *Draft allocation instruments for the 26 GHz (25.1–27.5 GHz) metropolitan and regional lots auction Consultation paper* ("26 GHz Allocation instruments Consultation") and the *26 GHz (25.1–27.5 GHz) band spectrum licence technical framework consultation document* ("26 GHz Technical Framework Consultation").

Qualcomm is the world's leading wireless technology innovator and the driving force behind the development, launch, and expansion of 5G. When we connected the phone to the internet, the mobile revolution was born. Today, our foundational technologies enable the mobile ecosystem and are found in every 3G, 4G and 5G smartphone. We bring the benefits of mobile to new industries, including automotive, the internet of things, and computing, and are leading the way to a world where everything and everyone can communicate and interact seamlessly.

Qualcomm Incorporated includes our licensing business, Qualcomm Technology Licensing (QTL), and the vast majority of our patent portfolio. Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all of our engineering, research and development functions, and substantially all of our products and services businesses, including our Qualcomm CDMA Technologies (QCT) semiconductor business.

One of our major areas of focus is the development of 5G technologies, including those that leverage low-band, mid-band, and high-band spectrum. In 2019 5G became a reality and in 2020 5G is going mainstream.

In this response, Qualcomm updates the 26 GHz and 28 GHz 5G product readiness and ecosystem information that it provided in response to the ACMA's *draft Five-year spectrum outlook 2020–24 - consultation 09/2020* and information related to the practical implications of placing overly restrictive conditions on the operation of 5G transmitters in the 26 GHz and 28 GHz bands.

As we noted in our response to the draft Five Year Spectrum Outlook consultation, Australia is part of the first wave of global 5G deployments because of the ACMA's forward-looking radio frequency planning vis-à-vis the release of mid band 3.5 GHz spectrum (portions of 3GPP band n77 or n78) (mid-band) several years ago, and now the complementary release of mmWave spectrum (3GPP band n257 and n258). This

will allow Australian Mobile Network Operators to realize the full potential of 5G and support the new and varied eMBB and URLLC use cases.

The ACMA deserves credit for facilitating the technical licensing group process to seek a consensus for the technical conditions for licensing the 25.1 – 27.5 GHz spectrum and utilizing this as the basis for further public consultation on the detailed licensing framework.

1 Ecosystem updates

According to the GSA¹ by the end of July this year 364 5G devices had been announced and 162 of these are commercially available on a variety of form factors including; 162 phones, head-mounted displays, hotspots, 94 indoor and outdoor CPE and enterprise grade CPE/routers/gateways, laptops, modules, dongles, and drones amongst others. Importantly 23.3% of these devices support mmWave spectrum. As 5G momentum continues to increase we can expect these numbers to increase.

On August 5th, Qualcomm announced that its latest premium tier Qualcomm® Snapdragon™ 865 Plus 5G Mobile Platform is powering Samsung Electronics Co., Ltd.'s latest and most cutting-edge lineup of flagship devices, including the Samsung Galaxy Note20 Ultra and Note20 in select regions, and the Samsung Galaxy Z Fold2 and Samsung Galaxy Tab S7/S7+ globally. Snapdragon 865 Plus is designed to deliver increased performance compared to the previous generation across the board for superior gameplay, truly global 5G, and ultra-intuitive AI. The new Galaxy lineup was designed to take advantage of the performance and efficiency improvements achieved by Snapdragon 865 Plus. The upgraded Qualcomm® Kryo™ 585 CPU delivers up to 3.09GHz and the Qualcomm® Adreno™ 650 GPU offers up to 10% overall performance boost compared to the Snapdragon 865, enabling superior processing power for the new Galaxy lineup. Featured alongside the Snapdragon 865 Plus, the Snapdragon X55 5G Modem-RF System is the world's first multimode modem-to-antenna 5G solution for consistent, lightning-fast speeds across the board – delivering peak speeds of up to 7.5 Gbps. **This truly global 5G solution supports all key regions and bands including mmWave and sub-6 in both TDD and FDD frequencies.** Plus, it is compatible with both NSA and SA modes along with Dynamic Spectrum Sharing (DSS), global 5G roaming and support for multi-SIM.

On the network side 392 operators in 126 countries had announced investments in 5G, and of those 92 operators had launched full commercial 5G services, where large-scale US deployment of mmWave has set the stage for upcoming adoption in Japan & Korea.

2 Comments on the Draft allocation instruments for the 26 GHz (25.1–27.5 GHz) metropolitan and regional lots auction Consultation paper

Considering the growing 5G momentum, and the increasing number of mmWave networks being commissioned and devices entering the market **Qualcomm fully supports the ACMA's plans to allocate the 26 GHz band in late March 2021.**

For FR2 spectrum, encompassing the frequency range 24 250 - 52 600 MHz, 3GPP specifies carrier bandwidths options of 50, 100, 200 and 400 MHz. These carriers may be aggregated to accommodate

¹ 5G Device Ecosystem Report Executive Summary August 2020

faster upload and download capacities to enable the full capabilities of 5G enhanced mobile broadband services (eMBB). Commonly 100 MHz carrier bandwidths are aggregated up to 800 MHz. So the ACMA adopting an auction lot raster of 12 x 200 MHz allows bidders to choose a range of bandwidth options to suit their business and service desires whilst also balancing the risk of band fragmentation. This raster coupled with the recently announced 1 GHz allocation limit² maintains bidder flexibility whilst also ensuring competition for mmWave 5G services. **Qualcomm supports the proposed 12 x 200 MHz lot arrangement.** Use of an auction format that allows bidders to acquire contiguous lots, such as ESMRA, is preferred because contiguous spectrum will allow easier implementation of higher-order carrier aggregation in an optimized manner.

Page 5 of the 26 GHz Allocation instruments Consultation indicates the ACMA's decision to consult on adding the frequency range 24.25–25.1 GHz to the Radiocommunications (Low Interference Potential Devices) Class Licence 2015 (LIPD class licence) to enable uncoordinated time-division duplex (TDD) wireless broadband deployments. Even though a number of conditions were outlined in the paper, including limiting operation in the range 24.25–24.7 GHz to indoor use only while allowing operation both indoors and outdoors in 24.7–25.1 GHz it is not clear how these conditions will be enforced when the locations, antenna types and other deployment parameters are not recorded when operating under the LIPD class licence. Moreover, the question of determining whether an installation is in breach of compliance if further exacerbated because interference into adjacent bands may be caused by the aggregate emissions of many devices being operated by different parties in an uncoordinated manner. Looking at these issues from an international regulatory perspective Qualcomm believes that uncoordinated under the LIPD class licence will not meet the criteria specified in ITU Resolution 242 (WRC-19) resolves 4, as follows:

4 that the operation of IMT within the frequency band 24.25-27.5 GHz shall protect existing and future EESS (passive) systems in the frequency band 23.6-24 GHz

Furthermore, if uncoordinated devices are operating in close proximity to one another there is a risk of these devices interfering with one another if the TDD frame structure is not synchronized. At this point, it is not clear to Qualcomm how this issue can be solved in mmWave bands without coordinating to some extent the operation of devices operating in close proximity. [Alex Note: Do we need to mention that base stations need to be connected to a core network and the cost of connecting to a core network runs counter to the advantages of class licensing (i.e. unlicensed) that is to support; low cost, off the shelf, consumer grade equipment and self-deployment].

For the reasons outlined in the paragraphs above **Qualcomm recommends the ACMA consider licensing options other than the LIPD class license for authorizing IMT services in the 24.25 – 25.1 GHz.**

3 Comments on the 26 GHz (25.1–27.5 GHz) band spectrum licence technical framework consultation document

In the 26 GHz technical consultation paper it is noted that one outstanding issue from the Technical Licensing Group process was related to total radiated power (TRP) limits and associated additional mitigation measures to maintain coexistence with satellite services. **In this submission we examine the**

²<https://minister.infrastructure.gov.au/fletcher/media-release/bidding-limits-set-australias-next-5g-spectrum-auction#:~:text=Minister%20for%20Communications%2C%20Cyber%20Safety%20and%20the%20Arts%2C%20the%20Hon,heavy%20vehicles%20and%20equipment%20in>

international regulatory status of the 26 GHz band, the impact on coverage of restricting the radiated power from an IMT base station to provide recommendations on [the practicality/practicability] of implementing the ACMA's proposals for TRP and EIRP conditions.

Looking first at the international regulatory status of the 26 GHz band (24250 – 27500 MHz), the identification for IMT (i.e. 5G) and technical conditions pertaining to this band were agreed, after difficult discussion and debates under agenda item 1.13, in the full competence of the World Radio Conference 2019, these discussions and eventual decisions were predicated on, and subsequent to, the work carried out within ITU-R TG 5/1, as expressed in the chairman's report and CPM report to WRC-19. The outcome of the WRC-19 is the UN treaty level text the ITU Radio Regulations. The outcome of WRC-19 in relation to the 26 GHz band comprises several parts, including those that we consider relevant to our submission being; changes to Article 5 of the Radio Regulations, and ITU Resolution 242 (WRC-19). The identification for IMT in the band is contained in Article 5, and primary reference for technical conditions applicable to this band can be found in Resolution 242.

Our first observation is that the resolves section of Resolution 242 does not mention TRP limits as a necessary technical condition applicable to the implementation of IMT in the 26 GHz band. Relative to co-frequency IMT and satellite services within the same jurisdiction the relevant resolves are.

- take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency band 24.25-27.5 GHz; the mechanical pointing needs to be at or below the horizon;
- as far as practicable, sites for IMT base stations within the frequency band 24.45-27.5 GHz employing values of e.i.r.p. per beam exceeding 30 dB(W/200 MHz) should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary satellite orbit, within line-of-sight of the IMT base station, by ± 7.5 degrees.

Indeed, in Europe Administrations have or are moving ahead with licensing the 26 GHz band for IMT without implementing TRP conditions for coexistence of IMT and FSS. Instead they are relying the conditions outlined in ECC harmonization decision (18)06³ and EC Implementing Decision (EU) 2019/784⁴ Administrations that have already licensed IMT in 26 GHz are Italy and Finland, and those who plan to license in 2020 are Germany, Greece, Slovenia, Poland and UK.

Countries that adopt technical conditions that are not aligned with international and regional harmonization efforts with respect to base station operations, such as TRP, risk imposing unnecessary network design and deployment costs and delays that will be passed on to consumers.

Qualcomm's second observation is that the ACMA's proposals are based on study annexed to the Chairman's report of ITU-R TG5/1⁵ and this study was one of many and does not represent the consensus of the ITU-R membership. Our third observation is that this study and others annexed to the Chairman's report show that there is a large margin between the aggregate radiation from terrestrial IMT deployments and the point at which this becomes interference at the satellite receivers. This was one of the factors leading to the WRC-19 deciding the current form of the resolves of Resolution 242.

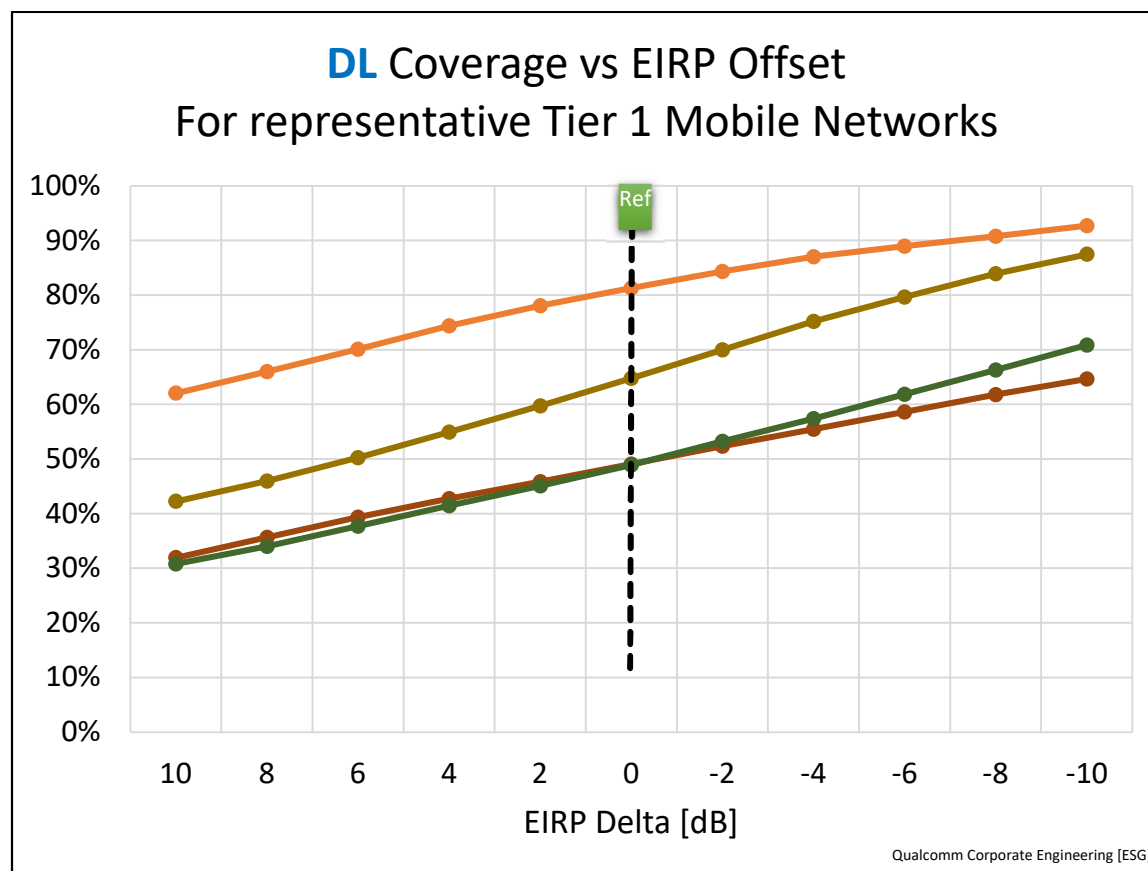
³ <https://www.ecodocdb.dk/download/5e74d0b8-fbab/ECCDec1806.pdf>

⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0784&from=EN>

⁵ <https://www.itu.int/md/R15-TG5.1-C-0478/en>

Based on the above **Qualcomm strongly recommends that the ACMA does not adopt in-band TRP restrictions for 5G mmWave deployments.** Instead the ACMA should adopt the least most restrictive conditions aligned with Resolution 242.

Turning now to the e.i.r.p. specifications, using propagation models specified in 3GPP 38.900, Qualcomm has simulated mmWave 5G coverage for a selection of representative tier-1 MNOs in large cities around the world (each plot line corresponds to a different city) and conducted a sensitivity of Coverage area in relation to EIRP Loss. Whilst the absolute coverage for a given EIRP Loss across the cities varies, the change in coverage relative to the change in EIRP Loss is roughly the same; 5% coverage decrease for every 2dB of loss (see graph below).



So, a 10dB increase in e.i.r.p. can lead to an up to a 25% increase in network coverage. As mmWave 5G is coverage limited and network cost is directly related to coverage this shows the importance of **having the least restrictive power specifications on 5G mmWave licenses.** Furthermore, with the current state of technology today an e.i.r.p. of 30dBW/200MHz is possible, as technology develops this is anticipated to increase to 39dBW/200Mhz], so it is recommended that **the ACMA ensure that its licensing framework accommodates today's technology and its anticipated enhancements..**

4 Conclusion

In order to ensure the most utility of the 26 GHz band for 5G Qualcomm recommends the ACMA adopts the least restrictive power specification for 5G licenses, and not adopt TRP based constraints on the deployment of IMT networks.

We encourage the ACMA to complete consultation and finalize policy decisions on the 26 and 28 GHz bands, and in accordance with the AMCA's published plan we look forward to mobile network operators acquiring licenses for mmWave spectrum in March 2021.

Should you have any questions or comments on this submission, please do not hesitate to contact me at +852 6901 0087 (mobile) or aorange@gti.qualcomm.com.

Sincerely,

A handwritten signature in black ink, appearing to read 'Alex Orange', with a stylized flourish at the end.

Alex Orange
Senior Director, Government Affairs, Southeast Asia, Taiwan & the Pacific
Qualcomm Inc.