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Qualcomm Incorporated (Qualcomm) welcomes the opportunity to provide input to the Australian Communications and Media Authority (ACMA) *Exploring RLAN use in the 5 GHz and 6 GHz discussion and options paper* ("the Discussion Paper").

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. From our homes, to airports, campuses, and the enterprise, Qualcomm's Wi-Fi solutions build on our world-class engineering capabilities to connect users and devices.

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 advanced wireless technologies, including 5G and Wi-Fi based technologies.

In this response, Qualcomm updates the information related to new unlicensed and shared spectrum use that it provided in response to the ACMA's *draft Five-year spectrum outlook 2020–24 - consultation 09/2020* and provides specific answers to the ACMA's preliminary proposal and issues for comment. We are appreciative that the ACMA has initiated stakeholder consultation as suggested to "initiate at the first opportunity re-planning the 5925 – 7125 MHz band via a review of the Low Interference Potential Devices (LIPD) class license".

1 Introduction

The 6 GHz band (5925-7125 MHz) is the only expansion band currently under study by the ACMA for class licensed technology usage that can alleviate the increasing congestion in existing spectrum used for those technologies (including Wi-Fi), those bands being 2.4 GHz and 5 GHz. Class licensed technologies are widely used in everyday life to connect innumerous devices from smart phones and personal computers to baby monitors, security cameras, and IoT devices in residential, educational and commercial settings. While class licensed technologies like Wi-Fi and 5G NR-U are uniquely suited to share with other applications operating in the same frequency band, the pressure on these technologies to deliver reasonable last mile throughput across a range of devices will only increase. Opening additional spectrum in the 6 GHz band for class licensed technology like Wi-Fi and NR-U enables higher performance and seamless end-to-end connectivity within the wireless device ecosystem.

2 Updates on 6GHz standardization and ecosystem development

Wi-Fi standards for the 6 GHz band are in place and ready for use when the spectrum is made available. Wi-Fi 6E is a term that will be used to distinguish devices that will offer the features and capabilities of Wi-Fi 6 – including higher performance, lower latency, and faster data rates – extended into the 6 GHz band as it becomes available.1 Wi-Fi CERTIFIED 6™, or Wi-Fi 6 is the industry certification program based on the IEEE 802.11ax standard, which provides higher data rates, increased capacity, and greatly enhanced performance in environments with many connected devices, and improved power efficiency.2

To expand 5G's reach beyond traditional public mobile networks, 3GPP completed two projects in Release 16 that are essential for new vertical deployments. The first is 5G NR-U, allowing 5G to operate in unlicensed spectrum. It defines two operation modes, anchored NR-U requiring an anchor in licensed or shared spectrum and standalone NR-U that – like Wi-Fi – utilizes only unlicensed spectrum, i.e., does not require any licensed spectrum. It is the first time that 3GPP has defined a cellular technology for "standalone" usage in unlicensed spectrum. Release 16 not only supports the existing global 5 GHz unlicensed band widely used by Wi-Fi and LTE LAA today, but also opens the door to the 6 GHz band that brings a massive 1200 MHz of unlicensed bandwidth. Release 16 was completed in 3Q20.

3 Updates on International arrangements (The Discussion Paper Appendix B)

In addition to the US, Canada, South Korea and Brazil (as noted in the Discussion Paper Appendix B); Guatemala, Chile, Peru and Saudi Arabia have also opened the whole 1,200 MHz for license-exempt use

[1] https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-brings-wi-fi-6-into-6-ghz
[2] IEEE 802.11 ax (https://standards.ieee.org/project/802_11ax.html) And Wi-Fi 6 (https://www.wi-fi.org/discover-wi-fi/wi-fi-certified-6)

and Canada, Mexico, Colombia, Costa Rica, Taiwan, Jordan and Qatar are considering doing the same[3,4,5,6,7,8,9,10,11].

4 Updates on Qualcomm products and Ecosystem Development

Qualcomm Technologies, Inc. launched the Qualcomm® FastConnect™ mobile connectivity subsystem and the Qualcomm® Networking Pro Series Wi-Fi Access Point platforms with Wi-Fi 6E operation using 6GHz spectrum in May 2020. There have been multiple OEM product announcements using these technologies and numerous Mobile Handset and Access Points Wi-Fi 6E product designs are currently under development.

Since 2000, the Wi-Fi Alliance® has developed certification programs and technologies that deliver quality Wi-Fi® experiences. Members have completed more than 65,000 certifications. Through industry-developed comprehensive testing, Wi-Fi Alliance certification programs ensure that Wi-Fi products from multiple manufacturers work well together. These certification programs are foundational to the rapid adoption and proliferation of Wi-Fi products in home, office, and public access locations around the world and underpin the success of Wi-Fi technology proliferation.

Qualcomm has a number of Wi-Fi 6E certified reference designs[12] and certified products incorporating these designs include the Linksys MX8500[13] and MR7500[14].

[3] Canada ISED Consultation on the Technical and Policy Framework for Licence-Exempt Use in the 6 GHz Band, available at https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11643.html.

[4] Mexico IFT "Questionnaire on the Frequency Band 5.925 – 7.125 MHz" available at http://www.ift.org.mx/industria/consultas-publicas/consulta-publica-de-integracion-del-cuestionario-sobre-la-banda-de -frequencies-5925-7125-mhz.

[5] Colombian regulators ANE and MINTIC announce a public consultation on the use of the 6 GHz band. See https://www.mintic.gov.co/portal/inicio/Sala-de-Prensa/Noticias/161376:Se-amplia-plazo-para-comentarios-al-documento-de-consulta-publica-sobre-el-uso-libre-en-la-banda-de-6-GHz

[6] Costa Rica's MICITT, https://www.micit.go.cr/transparencia/consultas-publicas.

[7] Taiwanese Ministry of Transport and Communications, *Consultation Paper on the Plan to Use 5925-7125MHz, June 2020*

[8] Chile Subtel issues Resolution 1807 to support Wi-Fi 6, available at https://www.bcn.cl/leychile/navegar?idNorma=1109333&idParte=9841504&idVersion=&r_c=6

[9] Kingdom of Saudi Arabia CITC Spectrum Outlook for Commercial and Innovative Use 2021- 2023. Available at https://www.citc.gov.sa/en/mediacenter/pressreleases/PublishingImages/Pages/2021033001/Spectrum%20Outlook%20for%20Commercial%20and%20Innovative%20Use%202021-2023.pdf

[10] Government of Jordan, Questionnaire regarding the availability of the 6G band for using Wi-Fi Technology, Dec. 6, 2020, available at https://trc.gov.jo/DetailsPage/NewsDetails?ID=3013

[11] Qatar CRA Public Consultation on Class License For use of RLAN devices Over 5925-7125 MHz band Wi-Fi 6 Available at https://www.cra.gov.qa/en/document/public-consultation-on-class-license-for-use-of-rlan-devices-over-5925-7125-mhz-band-wi-fi-6.

[12] https://www.wi-fi.org/content/search-page?keys=WFA101084 and https://www.wi-fi.org/content/search-page?keys=WFA109957

[13] https://www.linksys.com/us/wifi-6e/#products

[14] https://www.linksys.com/us/wireless-routers/mesh-routers/linksys-hydra-pro-6e-tri-band-mesh-wifi-6e-router/p/p-mr7500/

5 ACMA Issues for comment

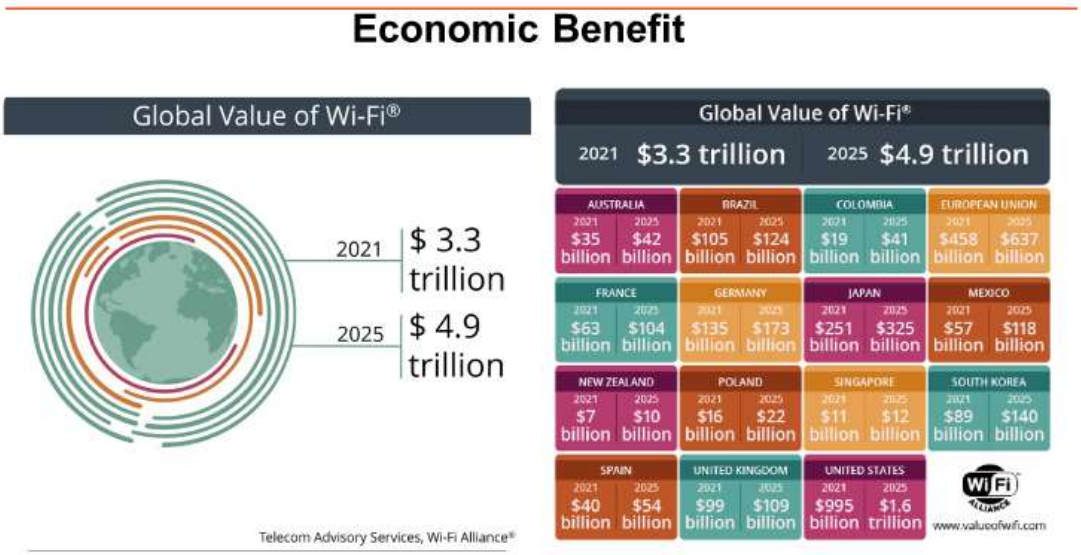
5.1 What is the demand for spectrum for RLAN use in the 6 GHz band (5925–7125 MHz)?

As we move into a world that is increasingly connected, home and enterprise networks must be able to support dense access point (AP) deployments serving an increasing number of client devices. Such dense deployments are seen in transportation hubs, schools, stadiums, and a broad range of enterprises that are increasingly relying on class licensed devices for their business operations, well beyond the traditional use of class licensed technology to facilitate communications.

A 2016 study performed by Qualcomm concluded that "to enable future WLAN-type application and usage scenarios, regulators should plan for around 1280 MHz of unlicensed spectrum centered around the 5 GHz band for use by unlicensed technologies"[15]. The proposed 1200 MHz new spectrum in 6 GHz band can fulfill this requirement.

A wide range of third-party research has been published in support of growing demand for class licensed spectrum in support of RLAN and associated uses, a selection of this research is provided below:

In 2021, the global economic value provided by Wi-Fi will reach $3.3 trillion USD and is expected to grow to almost $5 trillion USD by 2025, taking into consideration factors such as consumer and business communication needs, technology developments, access to additional spectrum, and the economic impact of a global pandemic.[16] In Australia this translates to $35 Billion in 2021 and $42 Billion in 2025 – see below.



[15] A Quantification of 5GHz Unlicensed Band Spectrum Needs, available at https://www.qualcomm.com/media/documents/files/a-quantification-of-5-ghz-unlicensed-band-spectrum-needs.pdf

[16] https://www.wi-fi.org/downloads-registered-guest/Global_Economic_Value_of_Wi-Fi_2021-2025.pdf/37347

Wi-Fi has proven to be a key driver of digital resilience and innovation during the COVID-19 pandemic. The study results reveal that industry-wide support for Wi-Fi growth and development is essential to continue realizing the benefits Wi-Fi technology provides. By the end of 2021 there will be 16.4 billion Wi-Fi devices in use.[17] Market adoption of Wi-Fi 6 will grow to 2.2 billion shipments in 2021, including nearly 340 million Wi-Fi 6E products which are capable of operating in the 6 GHz band.[18] Wi-Fi 6 and access to the 6 GHz band enables a suite of advanced applications—such as multigigabit video streaming, unified communications, cloud computing, and immersive telepresence—the combined effects of which could exponentially increase Wi-Fi value in years to come.[19]

Global Fixed/Wi-Fi will increase to 52.6% of total Internet traffic in 2021. The majority of this traffic is IP video traffic and will be supported on 27.1 billion networked devices. Furthermore globally, the average Wi-Fi speeds from mobile devices will double from 2016 to 2021, from 18.2 Mbps to 37 Mbps and globally.[20]

According to ABI Research, COVID-19's impact on Wi-Fi infrastructure indicates that existing infrastructure is inadequate. Wireless networks are now facing higher demand with more traffic, and users are finding their existing home Wi-Fi networks, inadequate or incapable of supporting the recent 80% increase in upload traffic. Many users are still using older Wi-Fi equipment with legacy Wi-Fi standards, such as 802.11n, rather than the latest Wi-Fi 6, which has been specifically designed to deal with better provision in more crowded networks.[21]

Globally, the gigabit Wi-Fi hotspot market is expected to grow with a CAGR of 14.2% during the forecast period from 2020 to 2028. The market is driven by the increasing adoption of smart devices across the globe.[22]

At Qualcomm, we view mobile 4G and 5G and Wi-Fi networks as complementary, for example, class licensed technologies may provide local area and offload services and licensed 5G NR provides mobile, fixed wireless access, wide area networking services and backhaul. As the capability of mobile 4G and 5G networks increases additional capacity on complementary networks and services is also required and there is a net increase in demand for class licensed spectrum.

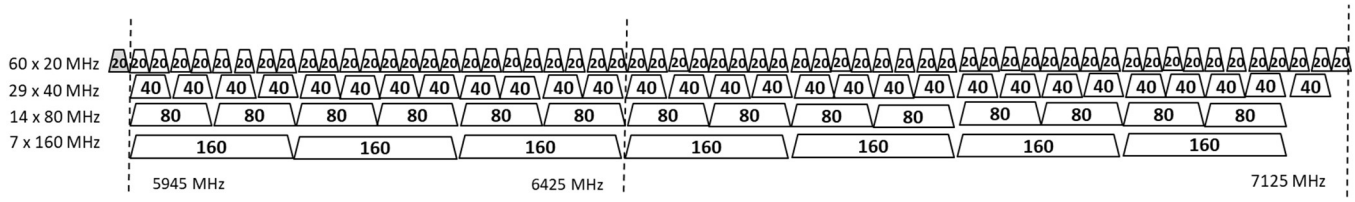
5.2 Is it appropriate to consider inclusion of the upper 6 GHz band (6425–7125 MHz) in the LIPD class licence or should this be deferred to monitor future developments (for example, in the wide-area International Mobile Telecommunications (IMT) space) as outlined in the ACMA's preliminary view?

[17] IDC, 2020
[18] Ibid note 18
[19] Ibid note 17
[20] https://www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecast-highlights/pdf/Global_2021_Forecast_Highlights.pdf
[21] https://www.broadbandtechreport.com/wireless/article/14174610/abi-demand-spikes-suggest-need-for-faster-wifi
[22] https://www.globenewswire.com/en/news-release/2020/10/09/2106204/28124/en/Global-Gigabit-WiFi-Hotspot-Markets-2020-2028-Increasing-Demand-for-Reliable-and-Fast-Internet-Connectivity-for-Employees-and-Students-Operating-from-Home-is-Driving-the-Growth.html#:~:text=Globally%2C%20the%20gigabit%20WiFi%20hotspot,smart%20devices%20across%20the%20globe.

The full 1200 MHz (5125 – 7125 MHz) should be included in the LIPD class license.

Wi-Fi topologies in the 5 GHz band typically are limited to a density of 1 AP every 12m (111m2). To ensure that each AP does not degrade the experience of a neighbouring AP, non-overlapping channels are required. Reducing AP spacing by as little as 1m, e.g., 1 AP every 11m (93m2), results in channel reuse that adversely impacts the bandwidth benefit of 40 MHz vs signal quality, leading to a decrease in throughput and increased latency, impacting the quality of voice and video applications. This means 40 MHz channels are the maximum bandwidth that can be supported in these dense networks.

However, 40 MHz channel sizes are insufficient to address the steep growth in the number of devices per user and higher bandwidth requirements per user. This means that to retain the expected quality of service for users, 80 MHz and 160 MHz channels are needed. Without wider channels (e.g., 80 and 160 MHz), there will be a detrimental impact on real time high-quality voice and video services, and immersive services such as augmented and virtual reality (AR/VR) will be starved of sufficient capacity.



To solve the bandwidth crunch, the full availability of 5925-7125 MHz is necessary. The possible channelisation options are shown in the Figure above. The additional 1.2 GHz of channels provided by Wi-Fi 6E provides a roughly equivalent number of 80 MHz channels in 6 GHz as there are 40 MHz channels in 5 GHz.

The spatial frequency reuse scheme, in which access points automatically sense available channels and serve their users in different channels from those used by nearby access points, minimizes interference between the service sets, or cells, composed by the access points and their client devices. If only 500 MHz (5925-6425 MHz) are made available, only 3 x 160 MHz channels, in the bottom row of the Figure, can be used. The additional 700 MHz (6425-7125 MHz) allows an additional 4 x 160 MHz channels. This limits the frequency reuse factor to 3 instead of 7, whereas the same channel frequency in a cell will be allocated in other cells with a closer proximity (2 cells separation). If the full 1200 MHz is available, the same channel frequency in a cell will be allocated in other cells beyond a 2-cell separation. The possibility of co-frequency interference is thereby minimized.

Allowing just 500 MHz, users would not be able to take full advantage of the benefits of Wi-Fi 6 in the 6 GHz band, and the brunt of that burden in terms of lesser quality and congestion will fall on users of Wi-Fi in enterprises, schools, transportation hubs and other public venues.

5.3 Comments on the utility of the band for IMT use

Should additional mid-band spectrum be required for 5G (IMT) the ACMA should look at methods to release more spectrum in the 3.8 – 4.2 GHz, and 4.5 – 5 GHz range as these bands have already been standardized for 5G NR by 3GPP (bands n77 and n79). Whereas 5150 – 5925 MHz (3GPP band 46) and 5925 – 7125 MHz (3GPP band 96) have been standardized for unlicensed use (5G NR-U and LAA).

Examining the 5925 – 7125 MHz band from the perspective of WRC-23 Agenda Item 1.2 for possible identification of IMT in accordance with Resolution 245 (WRC-19) "Studies on frequency-related matters for the terrestrial component of International Mobile Telecommunications identification in the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz" we note that consideration of the band 6425-7025 MHz is limited to Region 1 only (Europe, Middle East, and Africa). The study of this band is NOT a Region 3 issue except for 100 MHz (7025-7125 MHz). We also note that ITU-R studies do not always result in identification of the band to IMT. In any case, such an identification would not preclude the use of the frequency band by Wi-Fi as an application of the Mobile Service to which the band is allocated on a primary basis. Furthermore, the study of the 6425-7025MHz for IMT was not supported by the APT Preparatory Group for WRC-19 (APG19) and in Region 1 was only supported by Africa. Neither Europe nor the Middle East advocated for IMT in that portion of the band.

Global IMT harmonization via WRC-23 Agenda Item 1.2 is only under consideration in the upper 100 MHz of the band (7025-7125 MHz), and Qualcomm believes that this 100 MHz is better provisioned from other mid-band spectrum 3GPP band classes.

5.4 Should the ACMA proceed, as proposed, to consult on a formal variation to the LIPD class licence that adds the frequency range 5925–6425 MHz for RLAN use, bounded by the parameters described in the ACMA's preliminary view section of this paper?

Qualcomm is of the view that the ACMA should proceed to consult on a formal variation to the LIPD class licence for the entire 5925 – 7125 MHz range (i.e., 1200 MHz) – see answers above and below.

5.5 If class licensing arrangements are to be made in the lower 6 GHz band (by variation to the LIPD class licence), should alternative/additional power limits and/or other conditions be considered?

Power limits may be required to reduce the impact of class licensed devices on the incumbent services such as terrestrial Fixed Service Links, and the Fixed Satellite Service operating in the 6 GHz band. Extensive coexistence studies have been undertaken with modelling based on these power limits (a list of these studies is annexed to this submission) and other operational factors such as whether the devices are to be used indoors or outdoors.

As the ACMA notes in the Discussion Paper there are three classes of devices; Low Power Indoor (LPI), Very Low Power (VLP), and Standard Power (SP) enabled via Automatic Frequency Coordination (AFC). To enable the full utility of class licensed devices in the 6 GHz band, Qualcomm recommends the following power levels (expressed as power spectral density in a 1 MHz bandwidth): for LPI 17 dBm/MHz indoors only, for VLP 1 dBm/MHz in all locations, and for SP 23 dBm/MHz in all location with AFC. Similarly, we recommend the following total EIRP power limits: for LPI 30 dBm, for VLP 17 dBm, and for SP 36 dBm.

There is a need to protect the C-V2X operations in the 5.9 GHz band immediately below the 6 GHz band. As such, Broadcom, Cisco, Facebook, Intel and Qualcomm[23] have jointly developed a proposal to ensure

[23] These companies have had different views on the necessary level of protection for C-V2X (ITS) applications in the adjacent 5.9 GHz band, and recently proposed this compromise OOBE rule for VLP in the U.S., Canada, and Brazil. ACMA should adopt a -27 dBm/MHz level for LPI and SP device classes.

that VLP devices, particularly those operating in vehicles, can co-exist with CV2X operating below 5925 MHz. Thus, we strongly encourage the ACMA to implement the following rule:

(1) VLP devices shall comply with an out-of-band emissions level of -37 dBm/MHz measured by root mean square (RMS) at and below 5925 MHz.
(2) VLP devices shall prioritize class licensed operations in channels above 6000 MHz before beginning operation below 6000 MHz. Manufacturers shall submit with their application for equipment authorization a declaration that the equipment complies with this prioritization rule.

The requirement for VLP devices to prioritize class licensed operations in channels above 6000 MHz will reduce the likelihood of VLP traffic in the channel adjacent to the 5.9 GHz ITS band when VLP devices operate within vehicles. In the incidences when VLP traffic occurs in the channel adjacent to ITS, the out-of-band emissions limit of -37 dBm/MHz RMS should further help to ensure coexistence.

5.6 Should standard power (that is, higher power devices, including for outdoor use) operating under a dynamic spectrum access system such as the automatic frequency coordination (AFC) system adopted in the USA, be adopted in Australia for some or all of the 6 GHz band? Is there an appetite and capability for industry to provide the necessary systems to enable such use? We welcome views and evidence on the commercial and technical feasibility of introducing AFC systems in the band.

Qualcomm encourages the ACMA to prioritize LPI and VLP in the short term and consider SP with AFC in the medium term.

Both the Wi-Fi Alliance (for IEEE 802.11) and the technology-agnostic Wireless Innovation Forum (WinnForum) have committees focusing on development of 6 GHz AFC standards. More specifically, the Wi-Fi Alliance AFC Task Group is engaged in projects to develop an AFC to AFC device interface specification, and the development of certification tests for AFC systems and AFC devices. Standardization of the AFC interface helps to accelerate the availability of AFC devices and AFC systems. As a result, there is a built-in incentive for AFCs to utilize the standards. The interface standard also helps device manufacturers and users because Standard Power APs can be manufactured and used with the confidence that the equipment will interface with any AFC using the standard.24 The compliance test specifications are addressing compliance of AFC devices, including Standard Power Access Points and Fixed Client Devices, under control of AFC as well as compliance of the AFC Systems to the target regulatory domains. The Wi-Fi Alliance specifications are flexible to comply with various National Regulatory Authorities requirements and databases for protection of incumbent services against harmful interference.

The ACMA can monitor these AFC-related activities and decide if the FCC certification rules for AFCs and Standard Power APs are also suitable for Australia.

5.7 Should the higher power regulatory arrangements and associated interference mitigation measures added to the International Telecommunication Union (ITU) Radio Regulations at WRC-19 (see Resolution 229 (Rev WRC-19)) in the 5 GHz band be included in any amendment to the LIPD class licence?

[24] In contrast, standardization of AFCs themselves should not be attempted. Outcome-oriented rules frameworks for AFCs are critical, but AFCs themselves should be able to innovate and differentiate offerings above the regulatory minimums.

In order to ensure that the full benefits of class licensed outdoor use in the 5 GHz band are enabled in Australia the LIPD class licence should be aligned with the latest international regulatory developments vis-à-vis Resolution 229 (Rev WRC-19).

6 Conclusion

In order to ensure the greatest utility and socio-economic value of this important spectrum band for Australian businesses and consumers, Qualcomm strongly encourages the ACMA to open the entire band 5925 – 7125 MHz (1200 MHz) for class licensed use on a technology neutral basis.

We encourage the ACMA to complete consultation and finalize policy decisions on 6 GHz bands to enable an update to the LIPD class license at the earliest opportunity.

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

Sincerely,

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

Cc: Alex Fernandez, Sr Dir, Business Development, Qualcomm Australia

Annex: Co-existence/Sharing studies between class licensed services and incumbent services in the 6 GHz band

- Fixed Service:
  - RKF report (commissioned by 6USC, detailed report from 2018): https://s3.amazonaws.com/rkfengineering-web/6USC+Report+Release+-+24Jan2018.pdf
  - RKF report (commissioned by 6USC, studies VLP): https://rkfengineering-web.s3.amazonaws.com/RKF+VLP+Report+(final).pdf
  - ECC report 302 (CEPT report with multiple studies developed by European administrations and industry): https://www.ecodocdb.dk/download/cc03c766-35f8/ECC%20Report%20302.pdf
  - ECC report 316 (CEPT report with multiple studies developed by European administrations and industry, focuses on VLP and short term criteria): https://www.ecodocdb.dk/download/8951af9e-1932/ECC%20Report%20316.pdf
  - 6USC Group Fixed Link Interference Testing: https://ecfsapi.fcc.gov/file/108230735019254/6GHz%20FS%20coexistence%20study%20ex%20parte%20(final).pdf
  - 6USC Lidar Analysis: https://ecfsapi.fcc.gov/file/10731443209780/6%20GHz%20LIDAR%20ex%20parte%20(AS%20FILED).pdf
  - 6USC Study of interference to Los Angeles Department of Water & Power links: https://ecfsapi.fcc.gov/file/10705662603550/LADWP%20Ex%20Parte%202%20July%202019.pdf
  - 6USC VLP Sharing Study: https://ecfsapi.fcc.gov/file/10702302769261/VLP%20Ex%20Parte_28June2019.pdf
  - 6USC Comments to NPRM (outdated but good information): https://ecfsapi.fcc.gov/file/10216633127609/6%20GHz%20RLAN%20Group%20Comments%20(Feb%2015%202019).pdf
  - Summary of 6USC position (before R&O): https://ecfsapi.fcc.gov/file/1031999525288/AFC%20Ex%20Parte%20(Mar%2019%202020).pdf
- Sharing with Fixed Satellite Systems:
  - RKF report (commissioned by 6USC, detailed report from 2018): https://s3.amazonaws.com/rkfengineering-web/6USC+Report+Release+-+24Jan2018.pdf
  - ECC report 302 (CEPT report with multiple studies developed by European administrations and industry): https://www.ecodocdb.dk/download/cc03c766-35f8/ECC%20Report%20302.pdf
  - Note: Studies clearly show that there is no issues sharing with satellites. Hence, there was not much work on this topic at later stages of process in EU/US.
- Sharing with Broadcast systems:
  - 6USC Study (3 parts): https://ecfsapi.fcc.gov/file/1022876707131/NAB%20Response%20(Feb%2028%2C%202020).pdf
  - RKF Report that studies VLP sharing with mobile service (ENG truck to central receive sites): https://rkfengineering-web.s3.amazonaws.com/RKF+VLP+Report+(final).pdf

- VLP Body Loss measurements
    - https://ecfsapi.fcc.gov/file/109231800718613/2020-09-23%20Body%20Loss%20Ex%20Parte%20Response%20FINAL.pdf
    - https://ecfsapi.fcc.gov/file/1082063676421/8.18.20%20OET%206%20GHz%20Body%20Loss%20Meeting%20ex%20parte%20(final).pdf
- FCC docket on 6 GHz has reference studies both from Wi-Fi industry and incumbents: https://www.fcc.gov/ecfs/search/filings?limit=100&proceedings_name=18-295&sort=date_disseminated,DESC