Qualcomm

www.qualcomm.com

May 7, 2018

Preparing for 5G in NZ
Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
WELLINGTON 6140

Email: Radio.Spectrum@mbie.govt.nz

Qualcomm Incorporated (Qualcomm) welcomes the opportunity to provide input to the Ministry of Business, Innovation, and Employment (the Ministry) discussion document, "Preparing for 5G in New Zealand" (the Discussion Document).

Qualcomm is a world leader in 3G, 4G, and the development of 5G and other advanced wireless technologies. For more than 30 years, Qualcomm's ideas and inventions have driven the evolution of digital communications, linking people everywhere more closely to information, entertainment, and each other. Qualcomm is the world's largest fabless semiconductor producer and the largest provider of wireless chipset and software technology which powers many wireless devices commercially available today in New Zealand and around the world. We are a recognized world leader in the research and development of advanced wireless technologies and continue to bring technology enhancements to market. Since our founding, Qualcomm's philosophy has been to enable many other companies in the wireless value chain to succeed. Qualcomm's business model has created a pro-competitive, pro-innovation value chain of global scale whose ultimate beneficiaries are consumers.

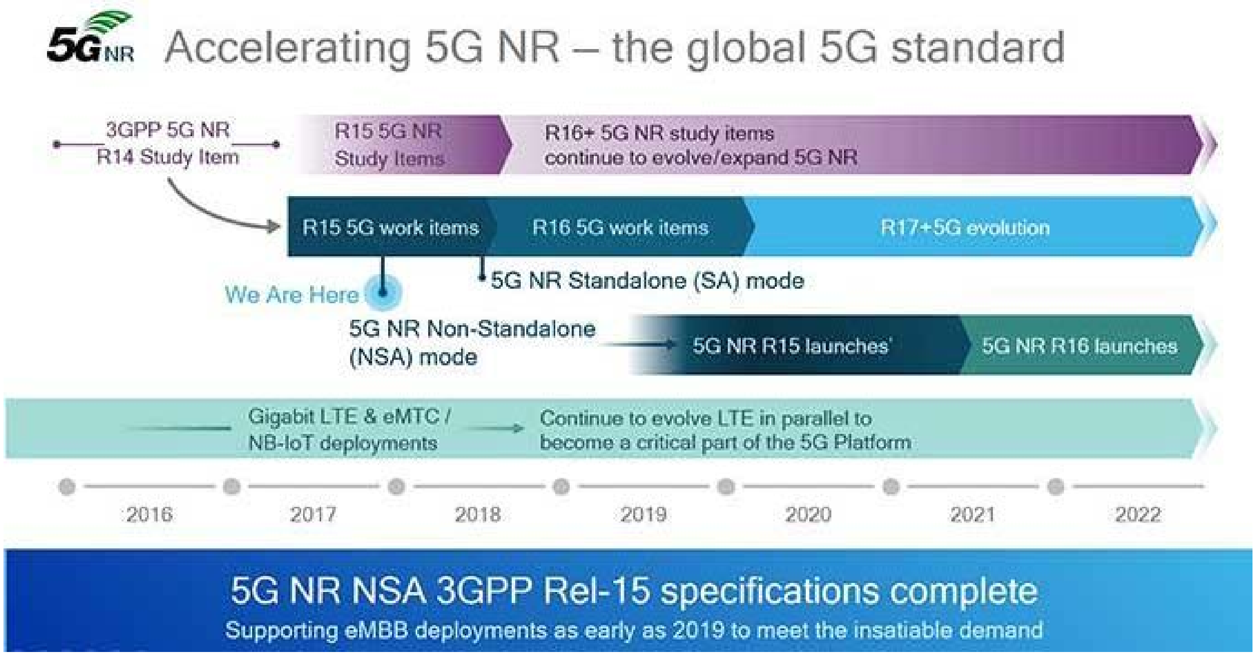
In this response, Qualcomm provides feedback on preparations for the deployment of 5G services in New Zealand.

Q1. What are the likely uses for 5G in New Zealand initially and in the longer term?

5G networks will be used to provide and enhance a range of services, including enhanced mobile broadband (eMBB), mission-critical services, and massive machine-type communications (mMTC).
The entire mobile industry continues to work toward the development and deployment of 5G technology. In particular, the Third Generation Partnership Project (3GPP), the standards organization developing the relevant radio interface standards, has been working towards the first specification for a new wireless air interface (5G New Radio or 5G NR).[1] The specification will be finalized in 2018, creating a global standard that will enable commercial 5G deployments starting in 2019 and more widespread deployment by 2020. In December 2017, 3GPP completed the first implementable 5G NR specifications that define the first phase of the global 5G standard. This milestone sets the stage for full-scale development of standard-

[1] This specification is known as Release 15.

compliant 5G NR networks and commercial devices for large-scale trials and commercial deployments starting in 2019. This work builds on the efforts of more than 500 companies and thousands of meeting hours. Implementation of 5G NR technologies will be critical to meeting the increasing connectivity requirements of emerging mobile broadband experiences such as streaming high-definition video and immersive virtual/augmented reality in the future, as well as enabling new high-reliability, low-latency services for autonomous vehicles, drones, and industrial control.



In particular, this achievement follows from a coalition of companies – led by Qualcomm – which committed to accelerate the 5G NR schedule. The companies were motivated by the ever-increasing global demand for mobile broadband that will drive a 30x growth in mobile data traffic from 2014 to 2020.[2] Further, this coalition understood that emerging, video-intensive use cases and the proliferation of mobile broadband in vehicles, among others, created an urgent need for 5G NR's increased performance and efficiency.

The acceleration of the 5G NR schedule introduced an intermediate milestone to complete technical specifications related to a configuration called Non-Standalone (NSA) 5G NR in such a way to enable large-scale trials and deployments starting in 2019, and these were the specifications completed last December. NSA 5G NR will utilize the existing LTE radio and core network as an anchor for mobility management and coverage while adding a new 5G carrier. This is the configuration that will be the target of early 2019 deployments.

This first 5G NR specification introduces many advanced wireless technologies to meet 5G requirements for eMBB – technologies for which Qualcomm invested in early R&D and which drove this first 5G NR specification. These essential 5G NR technology components include the 5G NR scalable orthogonal frequency duplex modulation (OFDM) numerology, 5G NR advanced channel coding, the low-latency 5G NR self-contained slot structure, and support for 5G NR Massive Multiple Input Multiple Output (MIMO)

[2] Nokia Bell Labs Consulting Report, 2016.

and mobile millimetre wave (mmWave).[3] 5G networks will deliver fiber-like data speeds, low latency, more consistent performance, and massive capacity. These capabilities will underpin use cases including mobilization of media and entertainment, rich user-generated content, improved performance in congested environments, high-speed mobility, connected cloud computing, immersive experiences (such as augmented reality and virtual reality), and connected vehicles. Delivery of eMBB will provide carriers and their customers with increased ability to connect and innovate, developing additional use cases.

A recent study jointly published by Qualcomm subsidiary Qualcomm Technologies and Nokia found that more than 86 percent of respondents across five countries need or would like to see faster connectivity on their next smartphone.[4] The study cites 10x faster speeds and 10x quicker response times among the top reasons for deploying 5G networks, and these goals will be met in large part through deployment of networks leveraging the 26 GHz and 28 GHz bands.

In comparison to NSA 5G NR, Standalone (SA) 5G NR implies full user and control plane capability for 5G NR, utilizing the 5G next-generation core network architecture (5G NGC) also being developed in 3GPP. SA 5G NR technical specifications are expected to be completed in June 2018. However, the work recently completed will benefit both NSA and SA 5G NR variants. 3GPP defined a framework to ensure commonality between the NSA and SA variants, and because NSA and SA 5G NR will share common physical layer specifications for the air interface, these aspects of SA 5G NR were also completed as part of this December 2017 intermediate milestone.

In addition to eMBB, 5G NR will help support new categories of services including mMTC and Ultra Reliable, Low-Latency Communications (URLLC). As 5G standards are finalized and networks are further deployed, 5G networks will offer new capabilities across multiple sectors of the global economy. 5G networks will enable mission-critical services, including cellular vehicle-to-everything (C-V2X) communications, drone communications, private networks, and other use cases built on URLLC. Due to enhanced power save modes, deeper coverage, narrow bandwidth, and efficient signaling; mMTC communications will see huge numbers of connected devices (at least 1 million devices per km^2) concentrated in small geographic areas and requiring efficient networks to support devices that communicate infrequently, but have long (10+ year) battery lives. In addition, the URLLC enabled by 5G will enable communications that are heavily time-sensitive, such as autonomous vehicle communications, through drastically reduced latency. mMTC and URLLC will enable a broad range of devices and applications such as industrial sensors, health monitors, security systems, and wearables to communicate wirelessly on a massive scale and at high densities.

Q2. Do you consider competition should be encouraged at the infrastructure level or purely at the retail level for 5G? Why?

No comment.

[3] For more information, please see https://www.qualcomm.com/news/onq/2017/12/18/five-wireless-inventions-define-5g-nr-global-5g-standard.

[4] Qualcomm Technologies, Inc. and Nokia, "Making 5G a reality: Addressing the strong mobile broadband demand in 2019 and beyond," (September 2017), available at https://www.qualcomm.com/documents/making-5g-reality-addressing-strong-mobile-broadband-demand-2019-beyond.

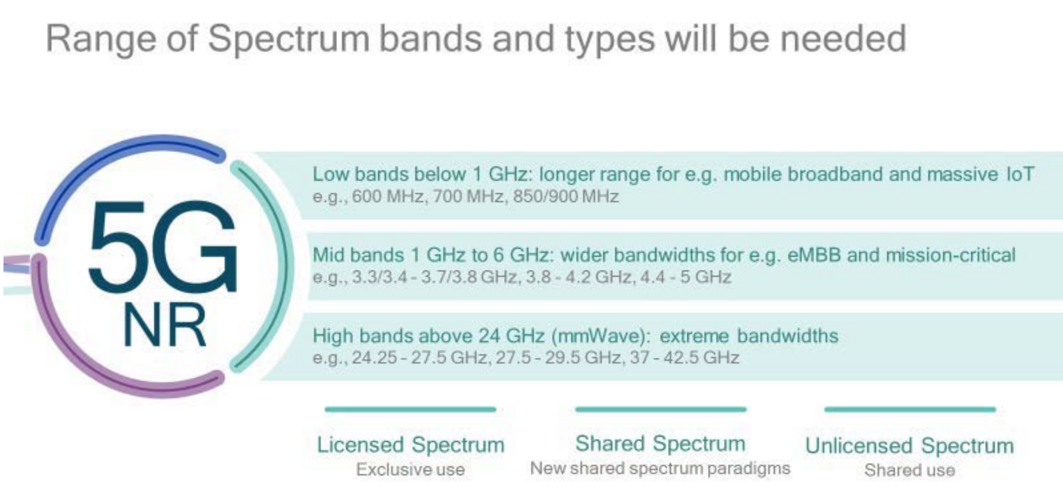
Q3. What regulatory issues need to be considered from a 5G perspective in New Zealand?

Q4. What aspects of these regulatory issues are most significant for 5G?

All spectrum bands — low-band spectrum below 1 GHz, mid-band spectrum from 1 to 6 GHz, and high-band spectrum above 24 GHz also known as mmWave — are needed for the successful deployment of 5G, IoT, enhanced mobile broadband, and mission-critical applications and services, like connected autonomous vehicles, critical infrastructure management, remote medical procedures, as well as command and control communications for drones and robotics. 5G will make the best use of a wide array of spectrum available across regulatory paradigms and spectrum bands. Previous generation networks primarily operated in licensed spectrum bands below 3 GHz. 5G will also bring the next level of convergence with support for licensed, shared, and unlicensed spectrum.

5G will be driven by heterogeneous services with vastly different requirements – from very low energy sensors, wearables and new form factors, to new mission critical applications with high reliability and low latency (e.g., smart city and critical infrastructure, medical and emergency response, sensing and remote control), to very high data rate backhaul and access transmissions across wide bandwidths for ultra-high capacity broadband. The goal is for 5G to be a new platform with the scalability and adaptability to cost efficiently support new wireless applications, services, and deployment models for 2019-2030 and beyond. Spectrum resources across all spectrum bands and regulatory paradigms are needed to support such 5G applications, services, and deployment models.

Qualcomm is pioneering spectrum sharing technologies today with various efforts including LTE Unlicensed (LTE-U), Licensed-Assisted Access (LAA), LTE Wi-Fi Link Aggregation (LWA), MulteFire, and Licensed Shared Access, among others. 5G will be built to natively support and advance these technologies as spectrum sharing becomes increasingly important to meeting tomorrow's connectivity needs for faster data rates and increased network capacity. Qualcomm encourages the Ministry to advance its 5G spectrum policy taking into account the developments listed above.



The Ministry should avoid policies that would constrain the ability for available spectrum to be employed in its highest-value use. For example, offering larger, contiguous blocks of spectrum will be an important enabler of 5G technologies, especially in the bands above 1 GHz. Providing the maximum amount of flexibility in spectrum use is a key enabler of evolution and innovation in wireless services, including 5G, leading to new business models and use cases. Flexible arrangements also increase service providers' ability to nimbly respond to changes in technology, services or usage patterns.

Beyond ensuring the availability of sufficient and suitable radiofrequency spectrum for 5G, key enabling approaches that maximize regulatory certainty and allow for flexibility and innovation include:

- pursuit of harmonized spectrum allocations, both regionally and globally when possible;
- continued objective and transparent treatment of mobile operators and potential market entrants, increasing regulatory certainty;
- ensuring that regulatory actions maximize operator and user flexibility to employ the technology or mix of technologies that best suit needs.

Q5. Do you agree that the 3.5 GHz band is the top priority for allocation for 5G?

Due to the proximity to other mobile bands and the relatively larger bandwidths available, there is increasing interest and support for accessing the 3.5 GHz band for mobile, either 5G or LTE, in many countries around the world. 3GPP has developed band plans conducive to deployment of TDD LTE in the 3400-3600 MHz and 3600-3800 MHz bands (bands 42 and 43, respectively), as well as a new band covering the 3550-3700 MHz band for use primarily in the United States (Band 48). These bands offer a large amount of contiguous spectrum thereby providing the opportunity to support wider carriers. Consequently, harmonization of the 3400-3800 MHz bands, or portions thereof, is increasing across the globe and these bands will be instrumental to 5G early deployments in the coming years.

- Australia: The ACMA has decided to prioritize the assignment of the 3.6 GHz band (3575-3700 MHz) following a consultation held in 2017.[5] The ACMA is currently preparing a recommendation to be sent to the Minister for Communications as the first step towards issuing spectrum licenses in regional and metropolitan Australia.
- China: In November 2017, China issued a frequency plan that included the use of 3300-3400 MHz and 3400-3600 MHz for 5G.[6] This followed a June 2017 consultation seeking comment on plans to deploy 5G in the 3.3 to 3.6 GHz and 4.8 to 5 GHz bands.[7]
- Japan: In July 2017, Japan's Ministry of Internal Affairs and Communications (MIC) issued a public consultation relating to 5G spectrum, identifying up to 500 MHz across the 3.6-4.2 GHz and 4.4-4.9 GHz ranges. MIC plans to issue the final technical rules, including the precise frequencies, by mid-2018. Japan has had an identification for International Mobile Telecommunications (IMT) services in the 3400-3600 MHz band for nearly 10 years, and in 2015 assigned spectrum in this

[5] ACMA, "Future approach to the 3.6 GHz band," available at https://www.acma.gov.au/theACMA/future-approach-to-the-3_6-ghz-band

[6] GSA, "Spectrum for 5G: Plans, Licences and Trials," (January 2018), available at https://gsacom.com/paper/spectrum-for-5g/

[7] http://zmhd.miit.gov.cn:8080/opinion/noticedetail.do?method=notice_detail_show&noticeid=1778.

band to mobile operators for MBB services. Trials in the 3.6-4.2 GHz band are already underway in Japan.[8]

- Korea: Korea's Ministry of Science and ICT (MSIT) announced that a 5G spectrum auction will be held in June 2018 comprising 280 MHz from 3.42-3.7GHz will be allocated.
- Singapore: In May 2017, the Infocomm Media Development Authority (IMDA) issued a public consultation on spectrum for 5G.[9] The consultation sought comment on a number of spectrum bands between 1 and 6 GHz, as well as mmWave and low-band spectrum, noting that 5G will require spectrum in a range of frequency bands.
- Hong Kong: In March 2018, the Office of the Communications Authority (OFCA) issued a decision to allocate the 3400 - 3700 MHz band to mobile services, with provisions to protect direct-to-home satellite reception above 3700 MHz, and with planned assignment by 2020.[10]
- United States: In 2015, a major FCC proceeding led to the development of arrangements for MBB services in the 3550-3700 MHz band based on a three-tiered spectrum sharing regime.[11] In early August 2017, the FCC released a Notice of Inquiry also targeting the 3700-4200 MHz band longer term.[12]
- Arab States: The Arab Spectrum Management Group in 2017 issued a questionnaire seeking input on the current use of the 3.4-3.8 GHz band, potentially to support consideration of the band for 5G.[13] Some Arab states, such as the United Arab Emirates, are moving forward with plans to deploy 5G in this band by 2020.[14]
- Americas: Countries in the Americas are targeting 3. 3-3.7 GHz and, at the June 2017 meeting of Permanent Consultative Committee II of the Inter-American Telecommunications Commission (CITEL PCC.II), a regional recommendation of frequency arrangements for the 3.3-3.7 GHz range was approved.[15]
- Brazil: The telecommunications regulator, Anatel, is currently analyzing possibilities for assigning the 3.5 GHz band for 5G services after identifying it as the first band that will be deployed for 5G in its 2017 regulatory agenda.[16]
- Europe: The Radio Spectrum Policy Group (RSPG) considers the frequency band 3400-3800 MHz to be the primary band suitable for the introduction of 5G-based services in Europe even before 2020, given that it is already harmonized for mobile networks and offers wide channel bandwidth.

---

[8] GSA, "The Future of IMT in the 3300-4200 MHz Frequency Range," (June 2017), p. 11, available at https://gsacom.com/paper/future-imt-3300-4200-mhz-frequency-range/.

[9] IMDA, "5G mobile services and networks," (May 23, 2017), available at https://www.imda.gov.sg/~/media/imda/files/inner/pcdg/consultations/consultation%20paper/public%20consultation%20on%205g%20mobile%20services%20and%20networks/5g-public-consultation.pdf.

[10] OFCA, "Change in the Allocation of the 3.4 – 3.7 GHz Band from Fixed Satellite Service to Mobile Service," (March 28, 2018) available at https://www.coms-auth.hk/filemanager/statement/en/upload/441/ca_statements20180328_en.pdf

[11] Federal Communications Commission, "Report and Order and Second Further Notice of Proposed Rulemaking, GN Docket No. 12-354," (April 17, 2015), available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-47A1.pdf.

[12] FCC, "FCC opens inquiry into new opportunities in mid-band spectrum," (August 3, 2017) available at https://www.fcc.gov/document/fcc-opens-inquiry-new-opportunities-mid-band-spectrum-0

[13] GSA, "The Future of IMT in the 3300-4200 MHz Frequency Range," (June 2017), p. 11, available at https://gsacom.com/paper/future-imt-3300-4200-mhz-frequency-range/.

[14] TRA, "TRA launches 5G in the UAE" (December 23, 2017) available here

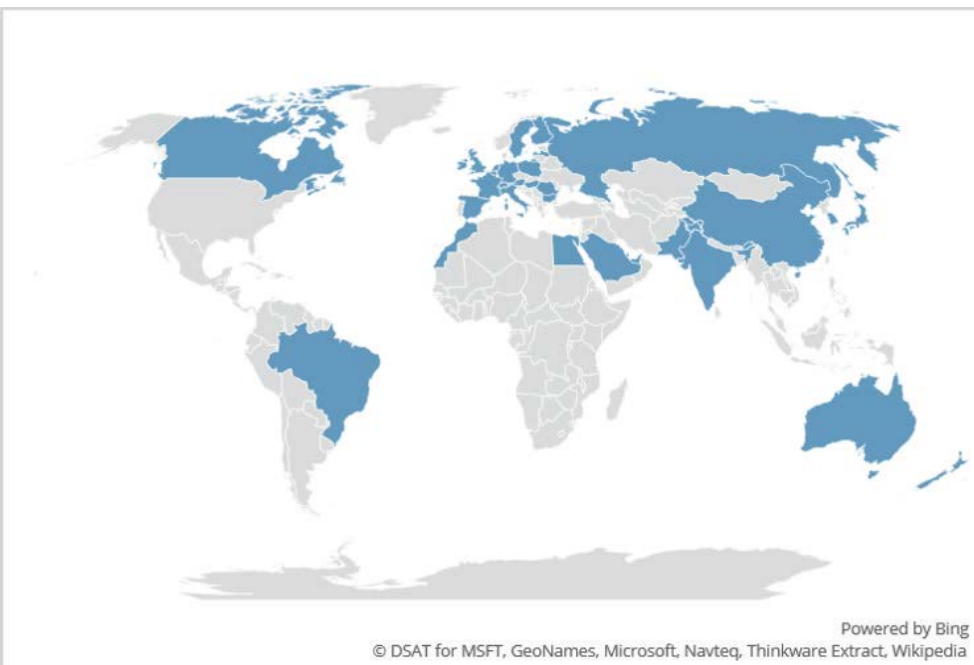
[15] Recommendation PCC.II/REC. XXX (XXIX-17) Frequency arrangements for the terrestrial component of IMT in the Bands 3300-3400 MHz, 3400-3600 MHz and 3600-3700 MHz, or combinations thereof.

[16] Anatel, "Regulatory Agenda 2017-2018" (January 5 2017) available at http://www.anatel.gov.br/institucional/ultimas-noticiass/1488-conselho-diretor-aprova-nova-agenda-regulatoria

In 2016, the European Commission (EC) published its action plan, targeting a Gigabit Society with the start of 5G trials from 2017, the launch of early 5G networks by 2018, followed by commercial 5G services in at least one major city in each Member State by 2020 and full 5G deployment across the European Union (EU) by 2025.[17] In December 2016, the EC RSCOM (Radio Spectrum Committee) issued a mandate to CEPT to develop harmonized technical conditions for spectrum use in support of the introduction of next-generation (5G) terrestrial wireless systems in the Union and in particular to review by June 2018 the harmonized technical conditions applicable to the 3.4-3.8 GHz frequency band, as a 5G pioneer band. A consultation was held on a draft decision in March 2018. In parallel, Germany and France have signaled in public consultations their willingness to auction this spectrum for 5G, with France awarding spectrum in the 3.5 GHz band for 5G trials and Germany seeking to award spectrum by 2019; in Italy an auction for the 3.6-3.8 GHz band is expected by the end of 2018, in Spain the regulator has provided information on their refarming activity regarding the 3.6-3.8 GHz band and their intention to tender it for MFCN. 5G spectrum awards are being planned in Sweden with licenses to be granted by 2019.[18]

According to the Global mobile Suppliers Association (GSA), other countries considering 3.5 GHz trials or deployments include several European Union members, as well as Bahrain, Egypt, Finland, Morocco, Pakistan, Qatar, and Saudi Arabia. Figure 1 illustrates countries considering, auctioning, or awarding 3400-3600 MHz spectrum for 5G, while Figure 2 provides a similar overview of 3600-3800 MHz.

Figure 1: Countries where 3400-3600 MHz is being considered, auctioned or awarded



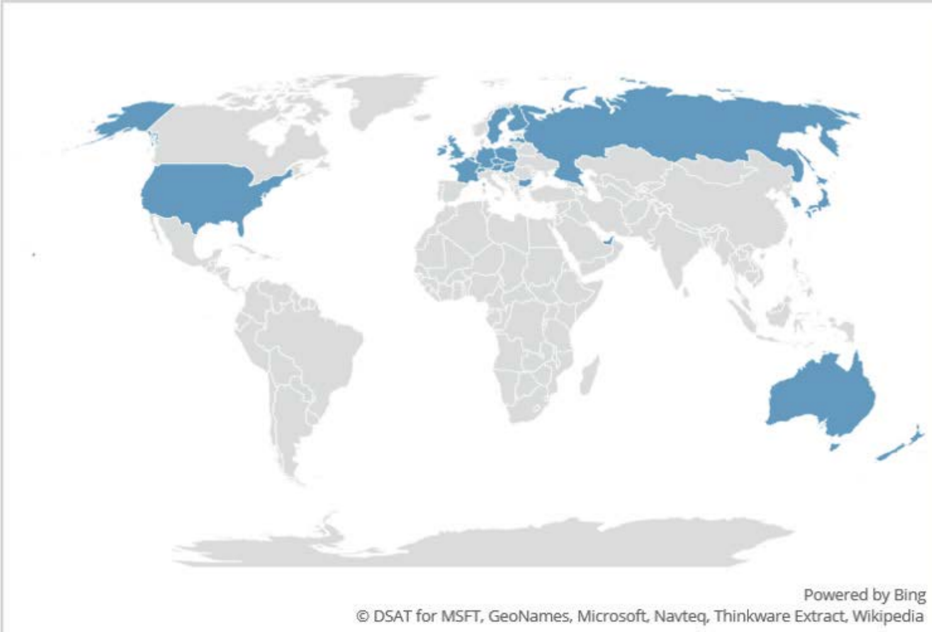
Source: GSA

---

17 European Commission, "5G for Europe: An Action Plan," (September 14, 2016), available at https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document.

18 PTS, "Preliminary study of future assignment of frequencies for 5G deployment," (February 19, 2018) available at http://www.pts.se/en/news/radio/2018/preliminary-study-of-future-assignment-of-frequencies-for-5g-deployment2/

Figure 2: Countries where 3600-3800 MHz is being considered, auctioned or awarded



Source: GSA

At the International Telecommunication Union (ITU), there has been considerable discussion of the 3300-3700 MHz band with respect to International Mobile Telecommunication (IMT), with the 3300 – 3400 MHz identified in 33 countries in Region 1, 6 countries in Region 2 and 6 countries in Region3; 3400-3600 MHz band identified for IMT in Regions 1 and 2, as well as in 12 countries in Region 3 (entirely or in part) including New Zealand. Further, four Region 2 countries identified the 3600-3700 MHz band for IMT.

We also note the continuing development of a global ecosystem for 3400-3800 MHz LTE equipment. According to the GSA, the LTE ecosystem continues to grow, with 118 devices available for use in the 3400-3600 MHz band and 93 devices available in the 3600-3800 MHz band as of mid-2017.[19] If interference is managed (see response to Q.30 and Q31), the 3400-3800 MHz frequency range (or portions thereof) can benefit from commonality of equipment, which is critical due to the number of bands that can be supported in mobile handsets at cost effective levels.

Q6. Do you have any comments on reallocating 3587 to 3690 MHz for 5G?

See answer to Q5.

Q7. Do you agree that the 26 GHz band is a high priority for allocation to 5G in New Zealand?

Yes. The 24.25-27.5 GHz band is already under study for 5G at the ITU and is expected to be a key band for 5G deployments in the mmWave bands globally. Key developments include:

- The European Union has identified 24.25-27.5 GHz band as a "5G Pioneer band" and is targeting commercialization in major cities from 2020.
  - In February 2018, the European Commission Radio Spectrum Policy Group issued a second opinion on 5G networks, maintaining the identification of the 26 GHz band as a pioneer band for 5G and recommending that member states make a sufficiently large portion of the band, e.g. 1 GHz, available for 5G by 2020.
  - In November 2016, the Radio Spectrum Policy Group (RSPG) recommended 24.25-27.5 GHz as a pioneer band for 5G above 24 GHz.
  - In December 2016, the EC RSCOM issued a mandate to European Conference of Postal and Telecommunications Administrations (CEPT) to study and assess the 24.25-27.5 GHz frequency band as a 5G pioneer band for use under relevant 5G usage scenarios and to develop channeling arrangements and common and minimal (least restrictive) technical conditions for spectrum use in the 26 GHz frequency band, which are suitable for 5G terrestrial wireless systems, in conjunction with relevant usage and sharing scenarios.
  - In CEPT, a group within the Electronic Communications Committee has been tasked with developing an ECC Decision on harmonized technical conditions for mobile/fixed communication networks in 24.25-27.5 GHz taking into account 5G requirements by June 2018.
  - EU Member States including Finland, France, Germany, Italy, Sweden and the United Kingdom have consulted on the use of the 26 GHz band for 5G or are currently holding or considering significant 5G tests in the band.
- China's Ministry of Industry and Information Technology (MIIT) has conducted a public consultation on the use of 24.75-27.5 GHz and plans to use the band for 5G trials.
- Australia: The ACMA continues to analyze preliminary options for mmWave 5G bands and has solicited public comment on whether consideration of the 26 GHz band should be accelerated given its status as a frontrunner for early mmWave 5G implementation.[20]

The 26 GHz (and 28 GHz) bands will predominantly be used to deploy eMBB services, helping to meet ongoing demand that is expected to see mobile data traffic increase by a factor of 30 between 2014 and 2020. 5G networks will deliver fiber-like data speeds, low latency, more consistent performance, and massive capacity. As noted in the response to Question 1, these capabilities will underpin a variety of use cases, and will provide carriers and their customers with increased ability to connect and innovate, developing additional use cases. These goals will be met in large part through deployment of networks leveraging mmWave bands, such as the 26 GHz band. As such, Qualcomm considers the 26 GHz band a high priority for allocation for 5G services in New Zealand and around the world.

Q8. Would this band be of interest to your organization for trials for 5G services in New Zealand?

Qualcomm supports the Ministry's decision to allow trials of 5G related technologies in frequencies currently in the radio licensing regime. However, it is also important that the Ministry continue to take actions to assign spectrum in mmWave bands for 5G as soon as is practical. Qualcomm, along with several other wireless industry stakeholders, is diligently working to bring 5G technologies to market, including in the mmWave bands, and has already carried out trials and technology demonstrations, with 5G trials continuing into 2018. Qualcomm's upcoming, ongoing, and recent trials include trials in several mmWave bands, including the 26 GHz band. The trials listed below include trials held in the 28 GHz band, given that

[20] ACMA, "Consultation: Five Year Spectrum Outlook 2017-2021," (comment period closed January 2018) available at https://www.acma.gov.au/theACMA/five-year-spectrum-outlook-2017-21

the Ministry's definition of the 26 GHz band from 24.25 GHz to 28.35 GHz overlaps with the 28 GHz band (27.5-29.5 GHz)

- **Multi-stakeholder interoperability testing –** In line with the approval of the NSA 5G NR specifications, a group of leading mobile communications companies including Qualcomm showcased 3GPP-compliant 5G NR multi-vendor interoperability during live demonstrations in late 2017.[21] The demonstrations, conducted with Ericsson, AT&T, NTT DOCOMO, Orange, SK Telecom, Sprint, Telstra, T-Mobile US, Verizon, and Vodafone, were held in an Ericsson laboratory in Sweden and a Qualcomm Research laboratory in the United States. The over-the-air Interoperability Data Testing (IoDT) was conducted for lower layer data connections operating in the 28 GHz band, as well as the 3.5 GHz band, both of which comprise fundamental building blocks of 5G NR. The trials leveraged Qualcomm's 5G NR mmWave prototype.[22]
- **Interoperability testing and over-the-air field trials** – In each of the trials below, Qualcomm and our partners are conducting interoperability testing and over-the-air field trials based on 5G NR standards. These trials take advantage of the wide bandwidths available in mmWave bands to increase network capacity and provide up to multi-gigabit per second data rates, and employ Multiple-Input Multiple-Output (MIMO) antenna technology with adaptive beamforming and beam tracking techniques to deliver robust and sustained mobile broadband communications at higher frequency bands, including non-line-of-sight (NLOS) environments and device mobility. The technologies being trialed will be critical to meeting the increasing connectivity requirements for emerging consumer mobile broadband experiences.
    - Qualcomm Technologies, Ericsson, and SK Telecom are conducting trials in South Korea in mmWave bands.[23]
    - Qualcomm Technologies, Verizon, and Novatel Wireless announced plans to collaborate in 2018 on trials in the United States using the 28 GHz and 39 GHz bands.[24]
    - Qualcomm Technologies, Telstra, and Ericsson began conducting trials in Australia during the second half of 2017 in mmWave and mid-band spectrum.[25]
    - Qualcomm Technologies, Ericsson, and AT&T began conducting trials in the United States during the second half of 2017 focused on the 28 GHz and 39 GHz bands.[26]

---

[21] Ericsson, "Global mobile industry leaders achieve multi-band 5G NR interoperability," (December 21, 2017), available at https://www.ericsson.com/en/press-releases/2017/12/global-mobile-industry-leaders-achieve-multi-band-5g-nr-interoperability?2055587666.

[22] Qualcomm, "Qualcomm Announces 5G NR mmWave Prototype to Accelerate Mobile Deployments for Smartphones," (September 11, 2017), available at https://www.qualcomm.com/news/releases/2017/09/11/qualcomm-announces-5g-nr-mmwave-prototype-accelerate-mobile-deployments.

[23] Qualcomm, "Qualcomm, Ericsson and SK Telecom announce collaboration on 5G NR trials to accelerate wide-scale 5G deployments," (December 19, 2016), available at https://www.qualcomm.com/news/releases/2016/12/19/qualcomm-ericsson-and-sk-telecom-announce-collaboration-5g-nr-trials.

[24] Qualcomm, "Verizon, Qualcomm and Novatel Wireless Announce Collaboration to Expedite Trials and Wide-scale Commercial Deployment of 5G NR mmWave Technology," (October 17, 2017), available at https://www.qualcomm.com/news/releases/2017/10/17/verizon-qualcomm-and-novatel-wireless-announce-collaboration-expedite.

[25] Qualcomm, "Telstra, Ericsson and Qualcomm Collaborate to Accelerate 5G NR Deployment in Australia," (February 26, 2017), available at https://www.qualcomm.com/news/releases/2017/02/26/telstra-ericsson-and-qualcomm-collaborate-accelerate-5g-nr-deployment.

[26] Qualcomm, "Qualcomm, Ericsson and AT&T announce collaboration on 5G New Radio trials intended to accelerate wide-scale 5G deployments," (January 3, 2017), available at

- Qualcomm Technologies, Ericsson, and NTT DOCOMO announced in 2017 that they would conduct trials during the first half of 2018 with Ericsson and NTT DOCOMO in both the 28 GHz and 4.5 GHz bands.[27]
- In the 3.5 GHz band, Qualcomm Technologies, ZTE, and China Mobile announced in November 2017 that they had successfully achieved the world's first end-to-end 5G NR IoDT system demonstrating a data connection based on the 3GPP Release 15 standard.[28]

The results of these tests continue to reinforce our confidence in the potential for the 26 GHz and 28 GHz to be used across a range of geographies and coverage areas, including outdoor, indoor, and small cells.

Qualcomm simulation studies conducted across ten global cities show that significant outdoor downlink coverage (up to 81%) is possible when co-siting 5G NR-based equipment in bands above 24 GHz with existing 4G LTE macro and small cell sites.[29] The positive results show that mobile deployments in urban areas based on existing LTE cell cities is feasible, especially when considering the tight-interworking of 5G NR with 4G LTE. We also note that outdoor mmWave coverage will significantly free up resources in the spectrum bands below 6 GHz for outdoor-to-indoor capacity, utilizing either 4G LTE or 5G NR technology.

In addition, outdoor mmWave coverage can be complemented with targeted indoor mmWave deployments, such as in large public buildings and venues, and can be leveraged for multiple scenarios. At the 2017 Mobile World Congress, Qualcomm demonstrated at 28 GHz 5G prototype in real-world environments including device mobility inside a moving vehicle, indoor mobility in an office environment including wall penetration, dynamic body- and hand-blocking, and fast beam-switching between multiple base stations.[30]

Qualcomm continues to work with partners to conduct trials of 26 GHz and 28 GHz 5G equipment and technologies around the world.

Q9. Do you agree that the 31.8 to 33.4 GHz, 40.5 to 42.5 GHz and 42.5 to 43.5 GHz bands are a low priority for allocation to 5G in New Zealand?

While commercialization of mmWave bands is expected to occur in the 26 and 28 GHz bands in 2019, 5G networks will require significant amounts of mmWave spectrum beyond what is available in these bands. Further standardization and commercialization of additional mmWave bands is expected to follow

---

https://www.qualcomm.com/news/releases/2017/01/03/qualcomm-ericsson-and-att-announce-collaboration-5g-new-radio-trials.

[27] Qualcomm, "Qualcomm, Ericsson and NTT DOCOMO Announce Collaboration on 5G NR Trials to Accelerate Wide-scale 5G Deployments in Japan," (February 26, 2017), available at https://www.qualcomm.com/news/releases/2017/02/26/qualcomm-ericsson-and-ntt-docomo-announce-collaboration-5g-nr-trials.

[28] Qualcomm, "Qualcomm, ZTE and China Mobile Showcase 5G Leadership with Completion of the World's First End-to-End 5G NR Interoperable System Based on 3GPP Standard," (November 16, 2017), available at https://www.qualcomm.com/news/releases/2017/11/16/qualcomm-zte-and-china-mobile-showcase-5g-leadership-completion-worlds.

[29] Qualcomm Technologies, Inc., "Mobilizing 5G NR Millimeter Wave: Network Coverage Simulation Studies for Global Cities," (October 2017), available at https://www.qualcomm.com/media/documents/files/white-paper-5g-nr-millimeter-wave-network-coverage-simulation.pdf.

[30] Qualcomm, "Making 5G NR mmWave a reality for 2019 smartphones," (October 5, 2017), available at https://www.qualcomm.com/news/onq/2017/10/05/making-5g-nr-mmwave-reality-2019-smartphones.

developments in the 26 GHz and 28 GHz bands. As one measure of mmWave spectrum requirements, ITU-R WP 5D sent a liaison statement to Task Group 5/1 in February 2017 regarding spectrum needs for terrestrial IMT between 24.25 GHz and 86 GHz, which estimated that between 14.8 and 19.7 GHz of spectrum would be needed for IMT-2020 between 24.25 GHz and 86 GHz.[31] Furthermore, studies undertaken by the Asia-Pacific Telecommunity (APT) – specifically the APT Wireless group (AWG) and the APT Preparatory Group (APG) – for WRC-19 have focused on multiple bands below 43 GHz, with multiple administrations expressing interest in all of these candidate bands. As such, the Ministry should continue to prioritize additional spectrum beyond the 26 and 28 GHz bands in order to ensure that New Zealand is well positioned to take full advantage of the benefits of 5G.

Q10. When do you think equipment is likely to become available in the bands identified in Q9?

In February 2018, Qualcomm announced that its Snapdragon™ X50 5G NR modem family has been selected by a number of global original equipment manufacturers (OEMs) for standard-compliant 5G NR mobile device product launches starting in 2019. Those working with Qualcomm Technologies include OEMs such as Asus, Fujitsu Limited, Fujitsu Connected Technologies Limited, HMD Global – the home of Nokia phones, HTC, Inseego/Novatel Wireless, LG, NetComm Wireless, NETGEAR, OnePlus, OPPO, Sharp Corporation, Sierra Wireless, Sony Mobile, Telit, vivo, Wingtech, WNC, Xiaomi and ZTE. These OEMs are working to commercialize 5G mobile devices for the sub-6 GHz and millimeter wave (mmWave) spectrum bands starting in 2019 based on the first commercially announced 5G modem solution, the Snapdragon X50 5G NR modem family. The Snapdragon X50 5G modem platform will initially support operation in the 28 GHz and 39 GHz millimeter wave bands with advanced features such as adaptive beamforming and antenna switch diversity. Qualcomm expects to support other mmWave bands in the family as the demand for product operation becomes clearer, and this is expected as 3GPP standardizes the bands, and leading regulators firm up on their plans to release additional spectrum.

Q11. Do you have any comment on the possible allocation of 27.5 to 29.5 GHz to IMT?

This band is expected to enable early 5G deployments as countries including Japan, Korea, and the United States are taking actions to commercialize as early as 2019. For example, the United States has adopted a decision allowing for the development and deployment of 5G services, focusing on high mmWave spectrum bands including the 27.5-28.35 GHz band. Korea has assigned spectrum in the 26.5-29.5 GHz band for trials and is planning to auction this spectrum in June 2018. Japan has identified the 27.5-29.5 GHz band for 5G allocation and, by summer 2018, will determine the actual frequency range and technical conditions for use. In May 2017, Singapore's Infocomm Media Development Authority (IMDA) issued a public consultation on spectrum for 5G. The consultation sought comment on various spectrum bands between 1 and 6 GHz, as well as mmWave and low-band spectrum, noting that 5G will require spectrum in a range of bands.

Qualcomm expects that both the 26 GHz and 28 GHz bands will play important roles in the development of 5G around the world. It is worth noting that equipment for use in the upper part of the 26 GHz band (specifically, above 26.5 GHz) is expected to reach the market sooner than equipment that can take advantage of frequencies as low as 24.25 GHz. As noted in the response to Question 8, Qualcomm

[31] ITU-R Working Party 5D, Document 5D/TEMP/249(Rev.1), "Spectrum needs for the terrestrial component of IMT in the frequency range between 24.25 GHz and 86 GHz," (February 28, 2017).

continues to plan 5G trials in the 28 GHz band. The first version of Qualcomm's X50 modem solution will be able to support 26.5-29.5 GHz (n257) in single mode; or 27.5-28.35 GHz and 37.0-40.0 GHz in dual band mode. Given that New Zealand is not constrained by national satellite use in the 28 GHz band, the assignment of this band at the earliest time possible would allow New Zealand to take full advantage of the earliest equipment available for 5G services.

Q12. Is there demand for alternative uses other than IMT of the 1400 MHz band? If so, what uses?

Qualcomm believes that the highest value use of the 1400 MHz band (1427 – 1518 MHz) is for IMT.

Q13. When is the demand likely to require consideration of reallocation of the 1400 MHz band for IMT, if at all?

The 1400 MHz band (the L band) should be considered for reallocation for IMT services at the earliest possible date. Qualcomm believes that the L band will be an important resource to meet future MBB demand. As MBB demand continues to grow, administrations are seeking additional spectrum bands that can be used to increase capacity and enhance the user experience. Qualcomm considers the L band to be an ideal candidate for MBB. This position is supported internationally, as this band was identified on a worldwide basis during the ITU World Radiocommunication Conference in 2015 (WRC-15).

Notably, developments have already taken place in other regions to designate a portion of the L-band, specifically 1452-1492 MHz, for supplemental downlink (SDL). For example, in November 2013, a CEPT Electronic Communications Committee (ECC) decision was approved on the "harmonized use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Network Supplemental Downlink (MFCN SDL)" resolving that the CEPT administrations should designate the frequency band 1452-1492 MHz for SDL. This decision was approved with significant support, with 25 administrations indicating that they will implement the ECC Decision. With that, 3GPP has standardized the 1452-1492 MHz for SDL as band 32, ensuring that there will be commercial devices available when the networks are deployed.

Other regional groups are looking at developing common Recommendations to use SDL for the full L-band i.e., 1427-1518 MHz. In September 2016, the AWG agreed to invite further views on the use of the L band, and develop a report "To provide technical and regulatory considerations on development of the frequency arrangement(s) in the band 1 427 – 1 518 MHz and possible harmonized frequency arrangement(s) for IMT systems in the band." Work on this matter has progressed at AWG-23 in April 2018 and is scheduled for earliest possible completion at AWG-25. Similarly, CITEL PCC.II held discussions on a common Recommendation during its meeting in November 2016. ITU-R Working Party 5D (WP 5D), responsible for IMT systems, is developing harmonized frequency arrangements for the full 90 MHz i.e., 1427-1517 MHz, for SDL, as a draft revision to Recommendation ITU-R M.1036.

The band has seen increasing interest from regulators following its identification for IMT in 2015. In the European Union, 1452-1492 MHz was opened for downlink use in 2015, followed by a decision in the United Kingdom to vary a license in the same range to allow mobile/fixed communication supplemental downlink. Spectrum was subsequently awarded to operators in Germany and Italy for supplemental downlink usage. Japan has also seen deployment of mobile broadband services in the L band, and Australia consulted on the future use of the band for mobile broadband in 2016.

Q14. Is there a need for more sub 1 GHz spectrum for IMT/5G?

Yes, sub-1 GHz spectrum is particularly valuable for coverage and in-building penetration, as well as support to IoT. One of the sub-1 GHz bands which presents opportunities for enhancing mobile service capacity and coverage is the 600 MHz band and there have been some recent developments in the United States worth highlighting. In April 2017, the U.S. Federal Communications Commission (FCC) announced the closing of the broadcast incentive auction, making available broadcast spectrum in the 600 MHz band for nationwide wireless mobile use.[32] A total of 50 winning bidders won 70 MHz of licensed spectrum nationwide. T-Mobile USA has already announced plans to deploy a combination of LTE and 5G in the 600 MHz spectrum it acquired in the auction. An additional 14 MHz of spectrum was made available for unlicensed use and wireless microphones. The 600 MHz band in the United States is expected to be available in 2020, in line with 5G deployment timelines. In the Asia Pacific region, the AWG has completed harmonized frequency arrangements for the 600 MHz band and published them as APT Report 79 "APT Report on Frequency Arrangements for IMT in the band 470 -698 MHz", for those administrations that wish to use this band for mobile.

Q15. If so, how should we deal with radio microphones in the 600 MHz band?

No comment.

Q16. When is the demand likely to require reallocation of the 600 MHz band to IMT, if at all?

Qualcomm encourages the Ministry to consider reallocation of the 600 MHz band for IMT services at the earliest possible date. Please see the response to Question 14 for additional information.

Q17. Which allocation methodology should be used for allocating spectrum bands identified for use with 5G? Why?
Q18. Should different allocation mechanisms be used for rights for regional providers and national providers? Why?

No comment.

Q19. Should deployment of 5G technology be specified for some or all bands? If not, why not?

Q20. What implementation requirements should be specified and how should these be expressed? – time, extent, etc.

Q21. What should be the consequence of non-implementation – lose spectrum, additional payment, other

[32] CITEL PCC.II Document 4262/17, "Updates on the United States' broadcast incentive auction," (June 7, 2017).

Q22. Should the implementation requirements be different for regional and national providers? What should these be and why?

No comment.

Q23. Should acquisition limits be imposed on 5G bands? If so, what should these be and why?

Q24. Should acquisition limits be imposed for regional providers? If so, what should these be and why?

No comment.

Q25. What term should be used for management rights suitable for 5G? Why?

No comment.

Q26. Should the 5G bands be re-planned as TDD bands or some bands or parts of bands be retained as FDD? Why?

The work being done by ITU-R Task Group 5/1 for WRC-19 Agenda Item 1.13 has included studies on the spectrum needs, technical and operational characteristics including protection criteria, and deployment scenarios for the terrestrial component of IMT. These studies are all assuming TDD configuration of the relevant frequency bands, indicating that the global trend for configuring frequency bands for 5G will be as TDD spectrum. Furthermore, the standardized 3GPP band plans for bands n77 and n78, corresponding to the 3300 – 4200 MHz and 3300 – 3800 MHz respectively, and the mmWave bands (shown below) are all TDD:

Table 5.2-2: NR *operating bands* in FR2[33]

NR *operating band*	**Uplink (UL) and Downlink (DL) *operating band* BS transmit/receive UE transmit/receive** F_{UL_low} – F_{UL_high} F_{DL_low} – F_{DL_high}	**Duplex Mode**
n257	26500 MHz – 29500 MHz	TDD
n258	24250 MHz – 27500 MHz	TDD
n260	37000 MHz – 40000 MHz	TDD

Qualcomm encourages the Ministry to continue to monitor international developments for band plan configuration for 5G and seek to adopt band plans that are harmonized, or as harmonized as is possible, with international standards.

[33]3GPP TS 38.104 V15.1.0 (2018-03)

Q27. What bandwidth should be used as the basis for allocation? Why?

3GPP Release 15 gives guidance on carrier bandwidth options for the 5G NR bands in section *5.3.5 BS channel bandwidth per operating band*. To take advantage of 5G capabilities in n77 or n78 carrier bandwidths of 20 MHz or greater, with the possibility of up to 100 MHz per operator, are desirable.

In order to maximize the benefits of spectrum for 5G, it is important that spectrum is assigned in large, contiguous blocks that will provide the flexibility and spectrum resources needed to deploy 5G services and ensure a high quality of service. We note, for example, that the United States has already developed a band plan for the 28 GHz band (defined as 27.5-28.35 GHz) in which two equal blocks of 425 MHz will be made available for potential licensees.[34] The United States does not explicitly prohibit a single entity from obtaining licenses for both blocks, provided they are in compliance with overall spectrum aggregation limits. In addition, work is underway within CEPT to develop a recommendation on a harmonized approach to the 26 GHz band. In March and April 2018, the ECC held a public consultation on a draft decision setting harmonized conditions for the introduction of 5G in the 26 GHz band, with final adoption expected in July 2018.[35] The draft recommends a standard block size of 200 MHz in the 26 GHz band. 3GPP Release 15 specifies carrier bandwidths of 50, 100, 200 and 400 MHz.

Q28. What out of band emission limits should apply to management rights when first created for allocation? Why?

Q29. Should out of band emission limits be different if the band is technology neutral? If so, what out of band emission limits should be applied?

We assume the out of band emission in the questions means unwanted emission. And it covers both out of band emission and spurious emission. 3GPP Release 15 gives guidance on out of band emission limits in TS38.104 section *6.6 Unwanted emissions* and TS38.101 section 6.4. Furthermore, the results of studies being undertaken by ITU-R TG5/1 in relation to WRC-19 should be taken into account. 3GPP is also studying the additional protection requirement for some incumbent service, such as EESS. And the results of these studies should only be applied in the least restrictive sense i.e. to meet the needs of the actual adjacent band usage situation in New Zealand.

LTE unwanted emission are specified in TS.36.101 (for user equipment) and TS36.104 (for base stations). 5G NR unwanted emission are specified in TS.38.101 (for user equipment) and TS38.104 (for base stations).

Q30. How should interference between adjacent frequency 5G TDD networks be managed? Should this be the same for all frequency bands?

Q31. How should interference between different technologies within the same band be managed, if bands are technology neutral?

---

[34] Federal Communications Commission (United States), Report and Order and Further Notice of Proposed Rulemaking: Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al (July 14, 2016), FCC 16-89, available at https://www.fcc.gov/document/spectrum-frontiers-ro-and-fnprm.

[35] CEPT, "ECC Consultation (March 2, 2018), available at https://cept.org/ecc/tools-and-services/ecc-consultation

Interference between Time Division Duplex (TDD) networks operating in adjacent channels can be mitigated either through filtering of the out-of-band emissions (OOBE) or through synchronization of the two networks, i.e., selection of a common frame UL/DL structure and time synchronization of the beginning of the frame. These two options were identified by the European Conference of Postal and Telecommunications Administrations (CEPT) in the ECC Decision (11)06 in the context of the deployment of LTE networks in 3400-3800 MHz.

An LTE network operator in 3400-3800 MHz can decide either to:

- Maintain frame flexibility (at the cost of extra filtering requirements at base station), or
- Reduce the base station OOBE filtering requirement (at the expense of frame flexibility)

However, with the expected introduction of 5G in 3400-3800 MHz, CEPT identified in the *ECC Report 281* that some assumptions enabling such solutions are no longer valid:

- Mobile network operator (MNO)-specific additional base station OOBE filtering is no longer feasible when deploying adaptive antenna systems (AAS), as such antenna panel cannot be augmented with external filters.
- Synchronization of LTE systems with typical 5G frame structure is not possible.

Some countries auctioning the band based on the ECC Decision (11)06 have attempted to solve the challenge by imposing synchronization of all networks on a specific LTE frame. This regulatory solution, however, has severe consequences on the performance of 5G networks.

A typical 5G frame structure has a much lower UL-DL turnaround time to improve the performance of AAS antennas and to reduce the latency of the air interface. Forcing a 5G network to adopt an LTE frame structure reduces the capacity throughput of the network by 33% and increases the latency from 2 ms to 9 ms. Such a network would only be a 5G network by name, as it would no longer fulfill the IMT-2020 requirements and would not be able to support ultra-reliable low latency communication (URLLC) services such as critical communication or advanced Industrial IOT (robot control for Industry 4.0).

Regulators can leverage some tools to prevent such unfortunate consequences. To enable deployment of true 5G networks, regulators may:

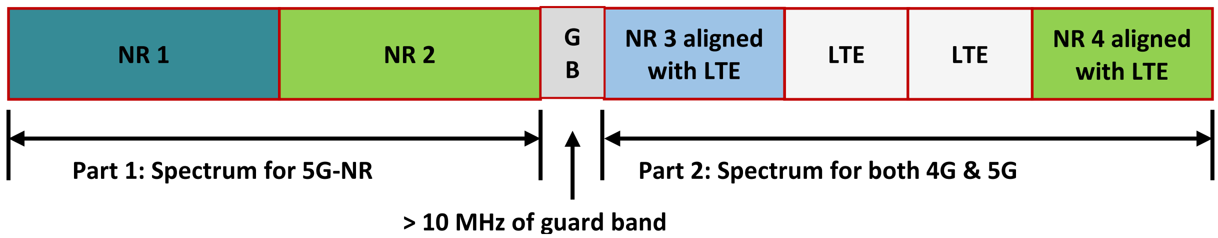
- Adopt the 5G ready regulatory framework developed in ECC Report 281.
- Limit synchronization requirement to necessary cases.
- Encourage and facilitate MNO discussion to identify an overall synchronization framework enabling 5G and innovation.

A synchronization framework can provide maximum freedom to operators by requiring synchronization between networks only when required. Synchronization would not be required when:

- Sufficient filtering is achievable (**Synchronization sub-bands**)
- Networks are geographically separated (**Geographical separation**)
- Network topology would result in low interference (**Network topology allowance**)

Synchronization sub-bands

One possibility to address LTE-NR adjacent coexistence issues for bands which include both LTE and NR deployments is to define two sub-bands such that NR-LTE adjacent channel operation would only be allowed in one of the sub-bands, whereas the other sub-band enables full NR operation. The two sub-bands would be separated by a guard band of sufficient size. The guard band required between networks in the same geographic area is directly linked to the filtering capability of AAS base stations. Detailed assessment of both the guard band required to prevent interference and the market scale required to justify products achieving such filtering for a specific frequency partition are required.



Geographical separation
Another way to ensure separation is to introduce geographical buffer zones. Here isolation is achieved by sufficient distance between interferer and victim in the unsynchronized case. Networks separated by more than 40 km do not need to be synchronized, and this may be reduced to 11km if an additional 10 MHz guard band is used.

Network Topology
Different synchronization requirements for different network layers, macro/small cell, and indoor/outdoor can be justified. For example, femto-cells (emitting less than 28 dBm total radio power (TRP)) do not need to be synchronized.

If all mobile network operators have a clear plan for 5G-NR in the 3.5 GHz band, and the spectrum is not encumbered, then there is no requirement for band partitioning or a guard-band and the economic value and utility of the band for 5G may be maximised.

Q32. Should regional uses be provided for in the 3.5 GHz band plan? Why?

Q33. If allowed in the 3.5 GHz band, how could this be managed or facilitated?

Q34. Which alternative bands may be suitable for regional allocation? Why?

To maximize the economic value of the 3.5 GHz band the maximum possible bandwidth should be made available for the deployment of 5G NR technologies on a [national/nationwide] basis. If there is insufficient time to migrate incumbent regional uses from the band then, with the participation of the likely 5G mobile network operators, a phased approach to eventual nationwide 5G network deployment may be explored. A useful component to such a phased approach may be sub-banding as illustrated above.

Q35. Is early access to the 3.5 GHz band required for roll out of 5G networks prior to the expiry of existing rights in 2022? If so, why?

New Zealand should make every effort to make 3.5 GHz spectrum available at the earliest possible date. As discussed in the response to Question 5, access to mid-band spectrum, including spectrum in the 3.5 GHz band, will be instrumental to 5G early deployments in the coming years. Furthermore, harmonization of the 3.4-3.8 GHz band, or portions thereof, for mobile LTE/5G is increasing across the globe. Europe has taken decisions to pioneer the use of the 3.4-3.8 GHz band for 5G; China and a number of other countries in Asia have designated 3.4-3.6 GHz for 5G; Korea, Australia, Hong Kong and some of the Americas are targeting 3.4-3.7 GHz for 5G; and the United States has authorized use of the 3.55-3.7 GHz band, among others.

As such, it will be important for New Zealand to make access to these bands a high priority in order to move towards international harmonization and facilitate the rapid deployment of 5G in the country as equipment comes to market. With respect to current management rights expiring in 2022 and the options provided in the Discussion Document, Option 1 would artificially delay deployment of 3.5 GHz 5G networks, while Options 2 through 4 consider mechanisms to enable earlier access to the spectrum. Qualcomm encourages the Ministry to favor, to the greatest extent possible, market-based mechanisms for allowing 5G deployments in the 3.5 GHz band before 2022.

Q36. How could early access to the 3.5 GHz band be achieved?

Please see response to Question 35.

Q37. Should the government be involved in early access arrangements for the 3.5 GHz band?

Please see response to Question 35.

Q38. Is early access to the 26 GHz band required for roll out of 5G networks prior to the expiry of existing rights in 2022? If so, why?

As mentioned in the response to Question 7, the 26 GHz band, and mmWave spectrum more generally, will facilitate the large amounts of data expected to be trafficked on 5G networks. The Ministry should prioritize the assignment of these bands for 5G as soon as possible in order to facilitate the deployment of 5G networks in the country. Delays in the assignment of spectrum in both the 3.5 GHz band and 26 GHz band until the expiry of existing licenses in 2022 would likely mean that New Zealand would see the implementation of 5G at a later date than other countries around the world. As mentioned in the response to Question 7, European Union member states are aiming for the assignment of these bands by 2020.

As in the case of the 3.5 GHz band discussed in Question 35, Qualcomm encourages the Ministry to consider the potential of market-based mechanisms for allowing early access to the 26 GHz band for 5G services. To the extent that incumbent right holders are amenable to commercial arrangements to allow access to their spectrum, there may be opportunities to enable early 5G deployments in the band without government intervention.

Q39. How could early access to the 26 GHz band be achieved?

Please see response to Question 38.

Q40. When is demand for the bands above 30 GHz likely to eventuate?

Please see response to question 10.

Q41. When is demand for the 600 and 1400 MHz band likely to eventuate, if at all?

Please see responses to Question 13 and Question 14.

Qualcomm is encouraged by the Ministry's timely, open and transparent efforts to prepare New Zealand for the deployment of 5G networks through an evaluation of relevant spectrum issues. We appreciate the opportunity to provide feedback to the Ministry and would be happy to provide further information that could help inform these and future decisions related to spectrum for mobile services.

Should you have any questions or comments on this submission, please do not hesitate to contact me at Email: aorange@qti.qualcomm.com or Tel.: +852 69010087.

Sincerely,

Alex Orange
Director, Government Affairs, Southeast Asia, Taiwan & Pacific
Qualcomm Incorporated