QUALCOMM International

Unit 2702-04, 27th Floor
9 Queen's Road Central
Central, Hong Kong
Telephone : (852) 3144 8300
Facsimile : (852) 2537 1188

www.qualcomm.com

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Ms Aileen Chia
Deputy Director General (Telecoms and Post)
Infocomm Development Authority of Singapore
10 Pasir Panjang Road
#10-01 Mapletree Business City
Singapore 117438

Fax: (65) 6211 2116

Qualcomm Incorporated appreciates the opportunity to provide comments to the IDA on its '*Proposed Framework for the Reallocation of Spectrum for Fourth Generation Telecommunication Systems and Services*.'

Qualcomm is the world leader in 3G and next-generation mobile technologies. Our ideas and inventions have driven the evolution of wireless communications, connecting people 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 the majority of all 3G devices commercially available today. We are a recognized world leader in advanced 3G technologies, and we continue to bring enhancements to market that increase network capacity and performance.

Our technologies are powering the convergence of mobile communications and consumer electronics, making wireless devices and services more personal, affordable and accessible to people everywhere. We are redefining the experience of wireless mobility by applying our unmatched legacy of wireless innovation to enable new generations of increasingly powerful cell phones, smartphones, computers and consumer electronics devices. As a result, 3G wireless connectivity can be found in an ever-wider range of products and services.

Qualcomm's robust patent portfolio includes thousands of U.S. and international patents on many of the most important inventions in wireless and related technologies. Since our founding, our philosophy has been to enable many other companies in the value chain to succeed. Today, we license nearly our entire patent portfolio to more than 200 manufacturers worldwide - from new market entrants to large multinational companies. Our business model has created a pro-competitive, pro-innovation value chain of global scale – of which the ultimate beneficiaries are consumers.

Mobile Industry Transformation

The mobile phone is the largest technology platform in history. Mobile phone shipments far exceed that of any other consumer electronic device. According to Wireless Intelligence, as of the end of 2011 there were more than 6 billion mobile connections worldwide, with approximately 1.5 billion of these connecting to 3G technology and services.[1] Among the OECD countries at the end of 2010, 62 percent of all broadband subscriptions were mobile.[2]

We have seen the wireless market undergo a major transformation in recent years as the result of innovations in technology that have led to significant increases in data throughput and mobile device functionality. Just over five years ago, most mobile phones were limited to providing voice and text messaging capabilities. Rapid technology advances, however, have accelerated the convergence of wireless connectivity, computing and consumer electronics functionality into handsets. Since Q1 2011, 3G/4G handset shipments have continuously surpassed that of 2G and are growing at a cumulative annual growth rate of 16 percent (2G handset shipments, by contrast, have been steadily declining).[3]

Convergence has resulted in an astounding array of wirelessly connected devices available in the market today. In addition to feature phones and laptops embedded with WiFi and 3G connectivity, there are smartphones, tablet computers, e-readers, as well as position location, gaming and other devices – all with wireless connectivity. Smartphone shipments are forecast to grow more than 30 percent annually from 2010-2015, with overall sales surpassing one billion units by 2015, and growth within Asia Pacific has been particularly strong.[4] Similarly, tablets have stormed the marketplace since the introduction of the iPad, and remain a significant growth opportunity with analysts predicting approximately 56 percent annual growth from 2010 to 2015.[5] Technology innovation is helping to drive these new types of connected devices and experiences. Mobile broadband will be one of the major drivers of economic growth, universal broadband connectivity and improving societal welfare.

Mobile Data Growth

We believe that the mobile Internet will have an even greater impact than the fixed Internet, and that every consumer electronics device is better when it is connected to the Internet's vast resources. Mobile broadband is growing explosively across the world, thanks in large part to the rapid spread of smartphones, tablets, e-readers, gaming devices and a wide range of other wirelessly connected mobile devices. Subscribers enjoy personalized access to Internet applications through an increased diversity of connected, intelligent and contextually aware devices.

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[1] http://www.wirelessintelligence.com/analysis/2012/03/infographic-6-billion-connections/

[2] http://www.oecd.org/document/17/0,3746,en_21571361_44315115_48240913_1_1_1_1,00.html

[3] Average of Strategy Analytics (Sep-11), IDC (Sep-11). Note: 3G/4G includes CDMA2000, WCDMA , TD-SCDMA and LTE.

[4] Gartner Inc. Market Share: PC Shipment Estimates, 4Q2010 and Mobile communication Devices, 2010).

[5] Average of ABI, Strategy Analytics, Infinite Research, IMS Research, Gartner (Q1 2011).

Wireless Intelligence estimates that here are now more than 1.5 billion 3G subscribers globally and the GSM Association expects this figure reach 3.2 billion by 2015.[6] In fact, the number of *mobile* broadband subscribers surpassed the number of *fixed* broadband subscribers globally in 2010.[7] Studies predict that the number of devices connected to IP networks will be twice as high as the global population in 2015.[8]

Data traffic has already surpassed voice traffic on 3G networks and is predicted to double every year through 2013, increasing 39 times between 2009 and 2013.[9] Cisco recently concluded that mobile data traffic will grow at a compound annual growth rate (CAGR) of 92 percent from 2010 to 2015.[10] A United States Federal Communications Commission (FCC) staff technical paper on mobile broadband analyzed three separate studies and noted that the average projection for wireless data growth by 2014 was 3,506 percent.[11] As of 2011, the Web and Internet traffic category is the largest source of all communications traffic, contributing 4,810 petabytes or 60.5 percent of the total. However, video and TV streaming is the fastest growing traffic category with a CAGR of 75 percent, and is expected to surpass Web and Internet (with a CAGR of 36 percent) in 2015.

The industry has responded to this rapid rise in mobile data demand in various ways: by escalating the migration from 2G to more efficient 3G; deploying 3G enhancements that increase the capacity and performance of existing networks, deploying next-generation Long Term Evolution (LTE) to boost data capacity, leveraging advanced topology solutions and bringing the network closer to the user (e.g., femtocells).

At Qualcomm, we are continuously innovating and looking for ways to provide more processing power and radio capability using a smaller footprint inside the user device. The radio link, however, is rapidly approaching its theoretical limits – all while data consumption is growing. Leveraging topology, bringing the network closer to the user, and mitigating interference will provide the next significant performance gains. We remain concerned, however, that the rising demand for mobile data and mobile broadband will soon outpace the networks' ability to provide them.

PCMTS bands (900 MHz and 1800 MHz)

Qualcomm urges the IDA to implement regulatory changes that would encourage refarming of the 900 MHz and 1800 MHz bands and enable the evolution to advanced wireless technologies, on a technology neutral basis. Technology neutral policies allow licensees to evolve and upgrade

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[6] Wireless Intelligence estimates as of Oct 31st for the quarter ending Sep 30th , 2011; GSMA Press Release, http://www.mobileworldcongress.com/articles/mobile-world-congress-press-releases/connected-economy.html.

[7] Infonetics Research, "Mobile broadband subscribers overtake fixed broadband," (June 7, 2011), available at http://www.infonetics.com/pr/2011/Fixed-and-Mobile-Subscribers-Market-Highlights.asp.

[8] Cisco Visual Networking Index: Forecast and Methodology, 2010-2015.

[9] Cisco Systems, "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2009-2014," (February 2010).

[10] Ibid.

[11] Mobile Broadband: The Benefits of Additional Spectrum, OBI Technical Paper Series, FCC (Oct. 2010) at 18.

networks in time with market and technological advances, and based on consumer demands. Moreover, frequency spectrum is a scarce and valuable national resource and technology neutral policies encourage licensees to utilize their licensed spectrum in the most effective and efficient manner.

Many countries around the world have already completed or initiated their 2G to 3G migration in both 900 MHz and 1800 MHz. We firmly believe in the improvements and efficiencies afforded by HSPA+ and LTE mobile broadband technologies.

900 MHz

HSPA/HSPA+ in 900 MHz is becoming mainstream and is supported by a large device ecosystem. HSPA/HSPA+ allows for even higher data rates and throughput on both the uplink (for video distribution) as well as downlink, providing for greater mobile broadband capability. Thus, HSPA technology advances help to ensure existing licensed spectrum resources are utilized most efficiently.

Operators are continuously evolving their 3G network capabilities, in many cases by deploying HSPA/HSPA+ in 900 MHz to complement HSPA+ in 2.1 GHz band; enhancing the mobile broadband experience with extended coverage and better indoor penetration. The 900 MHz frequency range provides superior rural and indoor coverage at 50-70 percent less cost than 2.1 GHz for the same coverage area. The multi-carrier feature further enhances the performance of HSPA+ 900. HSPA+ Release-8 introduces the first step of the multicarrier feature (a.k.a dual-carrier), aggregating two 5 MHz carriers in the downlink (DL), which doubles the data rates for all users in the cell. Release-9 expands the multicarrier feature to support aggregation across spectrum bands (e.g., 2.1 GHz and 900 MHz) as well as dual-carrier in the uplink (UL). These features significantly increase capacity, improve the user experience and allow operators to best leverage their spectrum assets.

As a result, momentum is rapidly building for HSPA/HSPA+900, with commercial networks already deployed by more than 35 operators worldwide, and the launch of more than 663 devices to the marketplace.[12] Importantly, users can benefit from HSPA900 immediately following deployment, as the vast majority of 3G handsets sold today already support HSPA900. Data shows penetration of HSPA/HSPA+900 in the EU5 markets (France, U.K., Germany, Italy, Spain) is just under 90 percent.[13]

HSPA/HSPA+900 can co-exist with GSM900; various 3GPP and CEPT studies offer co-existence guidelines[14] to mitigate inter-system interference and minimize any service disruption to consumers (e.g., introduction of a single 3G HSPA carrier in 900 MHz while gradually migrating users from GSM to HSPA). Potential interference can also be managed through intelligent network planning

[12] www.gsacom.com, October 2011.
[13] GfK, January 2011.
[14] ECC Report 82: Compatibility Study For UMTS Operating Within The GSM 900 And GSM 1800 Frequency Bands, Roskilde, May 2006.

and spectrum assignment techniques. Multi-mode devices have also made the re-farming process easier and less costly for operators and consumers.

1800 MHz

Almost half of the world's mobile operators already have 1800 MHz spectrum and the total amount of spectrum available in 1800 MHz is greater than that available in 900 MHz. 351 mobile operators in 148 countries have licenses to use 1800 MHz.[15] Considering this current availability of spectrum, refarming 1800 MHz band is very appealing from cost-coverage and time to market viewpoints.

Deployments of both HSPA/HSPA+ and LTE technologies are increasing in the 1800 MHz band. In the Asia Pacific region, due in part to the limited access thus far to new mobile broadband spectrum, there has been a rapid rise in the number of LTE1800 deployments. Global interest in LTE1800 is backed by at least 23 firm deployment commitments,[16] with operators in Europe, the Middle East, and the Asia Pacific region having now launched services.

Need for Additional Mobile Broadband Spectrum

One of the biggest challenges facing the industry is access to spectrum that can meet the increased demand for mobile broadband services, and that will allow evolution to more advanced technologies such as LTE.

Qualcomm concurs with the sentiments expressed by FCC Chairman Genachowski at a November 2011 conference in Hong Kong, where he stated that "the problem of spectrum demand outstripping supply is the most immediate threat to a successful mobile future. We need to tackle the looming spectrum crunch by dramatically increasing the amount of spectrum available for mobile broadband. The FCC has made recovering spectrum one of our highest priorities."

Importantly, any new spectrum made available for mobile broadband should be harmonized, at least on a regional basis, to the greatest extent possible. Irrespective of what technologies or services may be deployed, a common and harmonized band plan reduces the risks of interference and facilitates economies of scale and international roaming, which in turn brings benefits to consumers. Economies of scale reduce the cost of user devices and ensure the devices are widely available and affordable.

We are encouraged by the increasing efforts taking place at the regional level within the Asia Pacific Telecommunity (APT) to harmonize spectrum usage, similar to the activity at the pan-European level within CEPT, and we anticipate these regional harmonization efforts will increase. Even Asia Pacific countries that have in the past adopted unique frequency band plans are showing a greater willingness to harmonize their spectrum usage with other Asia Pacific countries. For Example, Japan has adjusted frequencies in one of its core 3G bands to align with other countries in the region and is in the process of harmonizing its 700 MHz usage with the APT 700 MHz

[15] GSMA "Mobile Broadband in the 1800 MHz band, July 2011.
[16] www.gsacom.com.

Frequency Division Duplex (FDD) band plan. The economies of scale that the Asia Pacific region offers, with 38 countries including China and India, represents a significant opportunity to benefit Asian consumers and their economies. We, therefore, urge governments to harmonize frequency bands at least on a regional basis, and to the greatest extent possible.

Spectrum planning is a long term process. It is imperative for governments to develop spectrum policies well in advance of intended licensing and deployment, so that operators have time to plan and invest in network and service rollout. If governments are intending to introduce 4G, such as LTE, within the next few years, policy decisions need to be made now.

LTE

LTE is an optimized mobile OFDM-based solution that offers high data rates, reduced latency, and an enhanced user experience by taking advantage of new spectrum and wider bandwidth channels. LTE interoperates seamlessly and complements 3G's ubiquitous data and voice coverage, boosting data capacity in high demand areas. LTE is a natural migration choice for existing operators as they are able to leverage existing infrastructure as LTE is rolled out. LTE offers a smooth evolutionary path to higher speeds and lower latency and an even richer, more compelling mobile service environment.

LTE standardization is complete and approved by 3GPP. The standard supports both FDD and Time Division Duplex (TDD) modes, with the same specification and hardware components. Release 8 is the basis for initial LTE deployments worldwide.

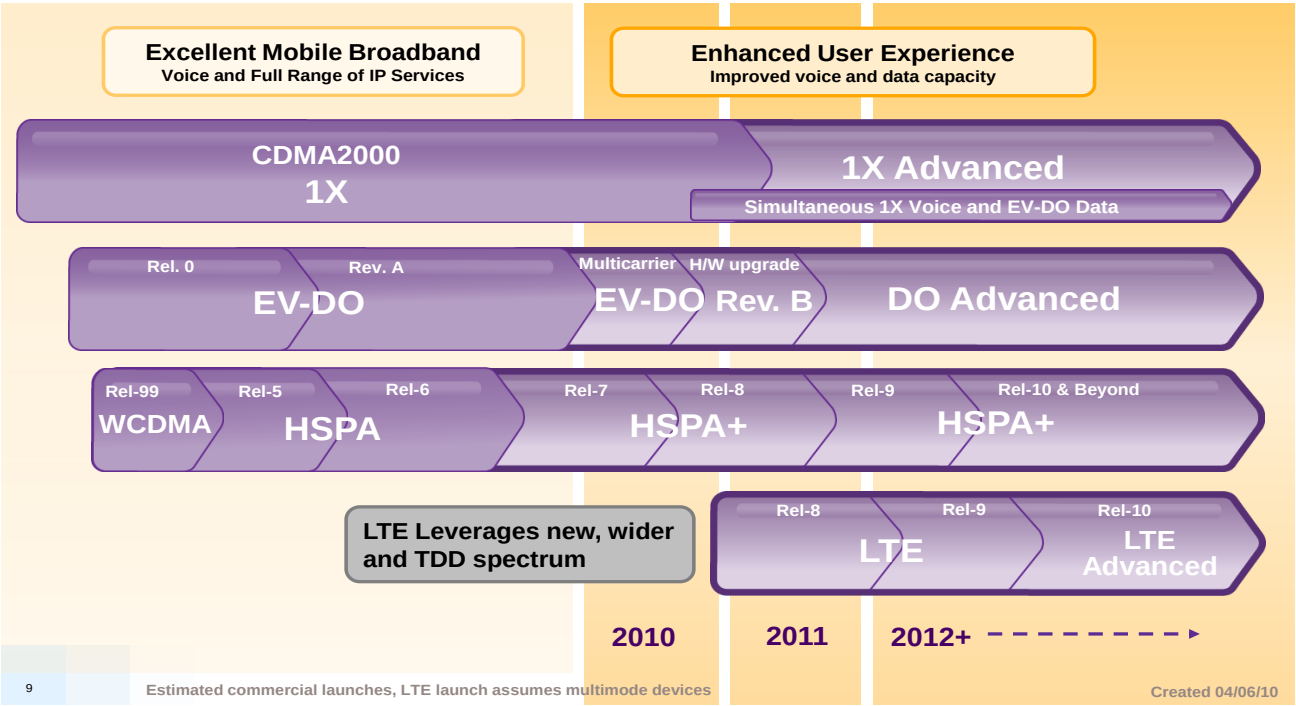

Figure 2 - LTE Technology Roadmap

The LTE standard, from Release 8 onwards, supports a wide range of carrier bandwidths from 1.4 MHz to 20 MHz. However, LTE is best suited for new wider FDD spectrum (2 x 10 MHz), as well as TDD spectrum, with channel bandwidths of 10 MHz or greater. The LTE standard, from Release 10, allows for the ability to aggregate both contiguous carriers within the same band as well as non-contiguous carriers across disparate bands.

To date, 80 LTE networks have launched commercial services in 38 countries, which is almost double the number of commercial networks in operation just six months ago: Armenia, Australia, Austria, Bahrain, Belarus, Brazil, Canada, Denmark, Estonia, Finland, Germany, Hong Kong, Hungary, Japan, Kuwait, Latvia, Lithuania, Norway, Philippines, Poland, Puerto Rico, Saudi Arabia, Singapore, South Korea, Sweden, UAE, Uruguay, USA, and Uzbekistan.[17] An additional 327 operators in 99 countries have committed to commercial LTE network deployments or are engaged in trials, technology testing or studies.

The frequency bands industry is targeting for LTE in the Asia Pacific region include:

- 698-806 MHz (“700 MHz”)
- 1800 MHz
- 2300-2400 MHz

[17] “GSA: Evolution to LTE report” ”,4 June 2012.

- 2500-2690 MHz (“ 2.6 GHz”)

700 MHz

There is considerable interest and momentum in the 700 MHz band for mobile broadband use. This interest has been driven primarily by the transition from analog to digital terrestrial broadcasting, which has freed up spectrum (referred to as the “Digital Dividend”) in many countries for new services such as mobile broadband. The Digital Dividend represents a once in a generation opportunity to recover scarce spectrum resources and reallocate them to their highest value use. Momentum has also been generated by other developments, including the decisions taken by the International Telecommunication Union’s (ITU) 2007 World Radiocommunication Conference (WRC-07) to identify additional spectrum in the 700 MHz band for International Mobile Telecommunications (IMT) and by the $19 billion that was paid for 700 MHz spectrum in the United States’ 2008 auction.

While the timing is uncertain, it is clear that the future for 700 MHz is mobile broadband. The opportunities presented by the Digital Dividend transition are enormous and the benefits of utilizing lower 700 MHz frequencies for mobile services are well understood. Lower frequency bands such as 700 MHz are particularly well suited for covering large geographic areas and for indoor penetration. Furthermore, the cost of deploying a network in 700 MHz is roughly one third of the cost of deploying in higher bands (e.g., above 2 GHz) due to the reduced number of base stations required to provide similar levels of coverage. Thus, cost savings can be transferred to the consumer.

In late 2010, the APT Wireless Group (AWG) published two new 700 MHz band plans for the Asia Pacific region, one for FDD and one for TDD. These band plans were developed over a three year period with significant input and cooperation between governments and industry. The FDD band plan consists of 2 x 45 MHz of spectrum from 703 -748 / 758 – 803 MHz operating in conventional duplex mode. Guardbands were agreed to ensure co-existence with other services. Most all of the interest indicated is in the FDD variant. The design of the new FDD frequency arrangement maximizes the amount of usable spectrum for mobile (2x45 MHz) and is a highly efficient use of valuable spectrum resources.

The APT band plans have been included in the latest version of ITU-R Recommendation M. 1036 which provides guidance on the frequency bands that can be used by IMT. As a result, the work within both the APT and the ITU on FDD 700 MHz frequency arrangements is complete.

Response to the new APT FDD band plan has been overwhelmingly positive and steps have been taken toward adoption at the national level in many Asia Pacific countries. Australia was the first country to adopt this band plan at the national level and will auction its 700 MHz spectrum in November 2012. Other countries in the Asia Pacific region are expected to follow shortly thereafter. The APT harmonized FDD band plan is also under consideration by other regions of the world and has recently been included in a CITEL (Americas region) recommendation as one of two options for harmonization across the Americas region.

3GPP standardization of the APT 700 MHz bands plans, referred to within 3GPP as “Band 28”, is expected to be finalized this month. Qualcomm firmly believes the APT FDD 700 MHz band plan represents the best opportunity for Asia Pacific regional spectrum harmonization in the medium to long term and, therefore, the largest potential LTE 700 MHz device ecosystem. Adopting any other frequency band plan would significantly reduce the economies of scale that could be realized, thus affecting handset affordability and availability.

For these reasons, Qualcomm strongly urges the IDA to also include the 700 MHz band in its 4G spectrum planning. We believe momentum is steadily building for the use of this band for mobile broadband, and the benefits of using the band are so strong that demand for spectrum access and availability will occur sooner than may be evident right now.

2.5 GHz

The 2500-2690 MHz frequency band was identified by WRC-2000 for IMT and, therefore, has been targeted by administrations, operators and vendors around the world for over ten years for IMT use. This band is identified for IMT by all three ITU Regions of the world and thus represents an opportunity to serve as a global roaming band. It has also been deployed to provide capacity relief for 3G networks. This band also enables deployment of wider channel bandwidths due to the amount of spectrum identified.

LTE will be the most widely deployed technology in the 2.6 GHz band. While HSPA+ provides for optimal usage of 5 MHz and 10 MHz FDD channel bandwidths, LTE is optimized for FDD and TDD frequencies with channel bandwidths of more than 2x10 MHz and 10 MHz, respectively.

Qualcomm strongly supports the 2.6 GHz channel arrangement contained in ITU Recommendation M.1036-3 Option C1 for this frequency range. This option designates 2500-2570 MHz for FDD uplink, 2570-2620 MHz for TDD, and 2620-2690 MHz for FDD downlink. The advantages to this band plan are that it provides separate band segments for FDD and TDD operations, maintains the 120 MHz duplex separation required by 3GPP specifications and ITU-R Rec. M.1036-3 and would be consistent with the 2.6 GHz channel arrangement expected to be used by the vast majority of countries around the world.

Qualcomm strongly believes it is in Singapore’s best interests to harmonize its 2.6 GHz usage to the greatest extent possible and recommends adoption of ITU Option C1. Any other option would significantly reduce the economies of scale that could be realized, thus affecting handset affordability and availability, as well as minimizing international roaming capability for Singapore consumers and roamers to Singapore. We believe the ecosystem will be greatest in support of LTE-FDD in the outer 2x70 MHz and in support of LTE-TDD in the mid-band gap of 2.6 GHz (i.e., 2570-2620 MHz).

Many countries around the world have already allocated and/or assigned 2.6 GHz in accordance with ITU-R M.1036-4 Option C1. In the Asia Pacific region, these countries include Hong Kong,

Australia[18], New Zealand, Singapore, Vietnam and Malaysia. In Europe, the European Electronic Communications Committee (ECC) adopted this channel arrangement which has been included in ECC Decision (05)05 of 18 March 2005, "On harmonized utilisation of spectrum for IMT-2000/UMTS systems operating within the band 2500-2690 MHz." To date, over 20 European countries have implemented or have committed to implementing ECC(05)05. This Decision provided clarity to the stakeholders and a clear path forward allowing industry to proceed with product development for this band plan. ECC Decision (05)05 and the list of countries which have adopted it can be obtained at the following url, http://www.erodocdb.dk/doks/implement_doc_adm.aspx?docid=2056.

We anticipate that many other countriesthat have not yet made decisions at the national level will also allocate and assign 2.6 GHz in accordance with Option C1. Activites are also on-going within the APT Wireless Group (AWG) to harmonize a regional band plan for 2.6 GHz.

2.3 GHz

Due to the widespread availability of this band across the Asia Pacific region, and the relative lack of incumbent users, this band provides a near term opportunity in many countries for the introduction of LTE TDD. Qualcomm is encouraged by recent decisions/announcements and ongoing trials in China, Indonesia, Australia, Malaysia, and Hong Kong, among others, that will facilitate the introduction of LTE TDD in this band. Certain WiMAX licensees in this band are also conducting LTE TDD trials and have announced plans to migrate to LTE TDD. In Europe, this band has been used by the military for some time, but there have been recent positive developments with respect to using 2.3 GHz for mobile broadband, which will further strengthen the LTE ecosystem for this band.

Timing and Sequencing for Release of Spectrum

Operators will ultimately need a combination of both high and low frequency bands to meet capacity and coverage obligations. The rapidly rising demand for additional spectrum to meet mobile broadband demand is noted above. A number of countries are releasing, in most cases via auction, a combination of both the high and low frequency bands simultaneously. For example, Australia will auction both 700 MHz and 2.6 GHz together in November 2012. In Europe, many countries have auctioned or are auctioning the 800 MHz European Digital Dividend and 2600 MHz spectrum simultaneously. There are benefits to simultaneous release in that prospective licensees would have the ability to better develop medium and long term network planning, based on consumer needs and business objectives.

Economic and Social Benefits of Mobile Broadband

[18] Australia decision has allowed incumbent broadcast ENG operations to remain in the 50 MHz center gap and preserved the option for migration to other services in future.

Beyond the looming spectrum crunch, the economic and social benefits of mobile services in general, and mobile broadband, more specifically, have been proven. A 2009 World Bank study found that an increase of ten mobile subscriptions in low- and middle-income economies is correlated to a 0.81 percent increase in economic growth.[19] In addition, mobile broadband has been shown to stimulate investment, increase productivity, drive innovation, enable economic growth, introduce new business models, create jobs, and enhance competitiveness. Every 10 percentage point increase in broadband penetration in low- and middle-income countries has been found to increase economic growth by 1.38 percentage points.[20] And mobile broadband has been found to have an even higher impact on GDP growth than fixed broadband, particularly in low income countries.[21] The Boston Consulting Group (BCG) studied the 700 MHz band specifically and estimated that by 2020 $729 billion would be added to the GDP of Asia Pacific nations by allocating the 700 MHz band to mobile broadband and harmonizing it with the APT FDD band plan.[22] BCG also estimated that the Asia Pacific region could expect to see 1.1 million new business activities, both additional units in existing operations and entirely new enterprises, between 2014 and 2020. They are projected to generate 2.3 million new jobs. BCG is expected to soon release a follow-up to this study.

Direct Response to IDA Questions

Question 1
IDA seeks views on the proposed allocation of the 1800 MHz, 2.3 GHz and 2.5 GHz spectrum bands.

For the reasons stated above, Qualcomm strongly supports the IDA's proposal to allocate each of these bands. Qualcomm recommends that the IDA also consider allocation of the 700 MHz band within similar timeframes.

Question 2
IDA seeks views on the amount of spectrum to be made available for allocation in the 1800 MHz, 2.3 GHz and 2.5 GHz bands.

Qualcomm supports the IDA's proposal on the amount of spectrum to be made available in these three bands. As discussed, spectrum is a scarce and highly valuable resource and we encourage the IDA to continue to develop policies that allocate these resources to its highest value use which would maximize benefits to Singapore consumers.

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[19] See Qiang C, and Rossotto C. (2009). *Economic Impacts of Broadband*, Chapter 3 in World Bank, p. 45 (2009 Information and Communication for Development Report: Extending Reach and Increasing Impact., The World Bank. www.worldbank.org/ic4d.
[20] See Qiang C, and Rossotto C. (2009). *Economic Impacts of Broadband*, Chapter 3 in World Bank, p. 45 (2009 Information and Communication for Development Report: Extending Reach and Increasing Impact., The World Bank. www.worldbank.org/ic4d.
[21] Thomson, H. et al. (2011). *Economic impacts of mobile versus fixed broadband*, in Telecommunications Policy. http://www.sciencedirect.com/science/article/pii/S0308596111001339.

Question 3
IDA seeks views on the benefits of an earlier start date for the full-band sharing arrangement, and what an appropriate start date might be.

Qualcomm strongly supports the IDA's view for the 2.5 GHz band "that an earlier implementation of the full-band sharing arrangement would be beneficial for Singapore operators and the market…." and urges the IDA to implement as expeditiously as possible.

Question 4
IDA seeks views on the proposed block size per spectrum lot, the number of spectrum lots, and the arrangement of the spectrum lots to be made available for reallocation.

No comment.

Question 5
IDA seeks views on its proposal for operators to co-ordinate the use of different services and not to set aside guard bands at the frequency boundaries between FDD and TDD technologies in the 2.5 GHz band.

Qualcomm encourages the designation of the 2570-2575 MHz and 2615-2620 MHz blocks as guard bands between FDD and TDD operations. Numerous studies have shown that a guard band is needed between FDD and TDD operations. In Europe, the European Commission has studied the interference and implementation constraints linked to terminals for the FDD/TDD scenario. ECC Report 131 contains the results of these studies and identifies technical conditions of access to the band for terminals.[23] In particular, ECC Report 131 identifies some mobile-to-mobile interference issues at the border between FDD and TDD blocks, and also between unsynchronized TDD blocks. The coexistence of terminals without harmful interference in the 2.6 GHz band imposes severe emission restrictions at the 2570 and 2620 MHz borders between FDD and TDD. If precautions are not taken in the band plan design, the necessary interference constraints will go well beyond the filtering capabilities defined by 3GPP standards for terminals. This could result in the need for additional specific RF components (RF filters) for terminals.

In particular, Qualcomm urges the IDA to not adopt any technical conditions, particularly on mobile terminals, that are more constraining than those required by the European Commission Decision of 13 June 2008.[24] Most European countries will conform to the EC Decision technical conditions and not impose more stringent requirements. In particular, Qualcomm would have concerns with requiring more stringent out-of-block power limits on mobile terminals due to the constraints this would place on mobile terminal design.

According to the conclusions of the CEPT Report 19 and ECC Report 131, the 2570-2575 MHz and 2615-2620 MHz frequency blocks can only be used for communications purposes under very stringent technical restrictions. Furthermore, the emission limits defined to protect adjacent frequency blocks indicate that these two frequency blocks will correspond to the RF-filter transition bands of the equipment and, therefore, will be subject to severe interference. Such constraints raise major questions regarding the value of these blocks for commercial use, as well as the availability of equipment capable of operating in them.

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[23] http://www.erodocdb.dk/Docs/doc98/Official/Pdf/ECCRep131.pdf.

[24] European Commission Decision "on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community"; 13 June 2008, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:163:0037:0041:EN:PDF.

Most countries have carved the guard band out of the TDDspectrum, and corresponding terminals are designed accordingly. Applying the guard band at any other place than the TDD spectrum would result in terminals having to be specifically designed and manufactured for this case, which would entail a corresponding price premium. Qualcomm, therefore, recommends identifying the blocks 2570-2575 MHz and 2615-2620 MHz as guard bands between the FDD and TDD blocks in order to reduce the interference risks between FDD and TDD networks and to ensure Singapore consumers have access to a wide variety of affordable user devices.

Question 6
IDA seeks views on its proposed definition of 4G technologies and the proposal to assess on a case-by-case basis alternative technologies to be deployed in the 4G spectrum bands.

The ITU has requirements that define the capabilities of International Mobile Telecommunication-Advanced (IMT-Advanced—also known as "4G"). Qualcomm urges the IDA to rely on the ITU definitions and recommendations related to IMT.

Question 7
IDA seeks views on its proposal that successful bidders of 4G spectrum should meet nationwide 4G systems and service coverage requirements by the dates specified.

Qualcomm generally supports the imposition of service coverage requirements and other milestones as a means to ensure efficient use of scarce and valuable spectrum resources. However, with respect to the 2.3 GHz band, Qualcomm notes that the development and introduction of LTE TDD networks in the 2.3 GHz band are lagging behind the development of LTE FDD in the other three bands, e.g., 700 MHz, 1800 MHz, 2.5 GHz. We encourge IDA to [provide more flexibility for operators licensed in the 2.3 GHz band]take these timeframes into account.

Question 8
IDA would like to seek the industry's views on the proposed auction parameters for the 4G spectrum rights.

No comment

Question 9
IDA would like to solicit interest from potential new entrants in the market. In addition, IDA seeks views on the proposed spectrum set-aside and nationwide 4G systems and service coverage obligations for the new entrant.
Interested parties may submit their comments on the "new entrant" rules in a confidential annex if required.
IDA would also like to seek the industry's views on whether the reserve price for the spectrum set aside for a new entrant should differ from the spectrum to be auctioned to non-new entrants.

No comment

Question 10
IDA invites views and comments on the adoption of the ECC/REC/(11)05 Recommendation for cross border coordination in the 2.5 GHz band in Singapore.

No comment.

Question 11
IDA invites views and comments on the practical measures for the deployment of 4G base stations at the border areas for the harmonised co-existence with the BSS in Indonesia.

Qualcomm is extremely pleased to see that practical measures are being considered that would allow co-existence of 4G base stations with the broadcast-satellite service (BSS) in the border areas with Indonesia. We encourage IDA to continue discussions with neighboring countries on possibilities for greater mobile service access to this spectrum. BSS usage of the 2.6 GHz band is somewhat unique and efforts to harmonize usage of this band for mobile services on a regional or multi-regional basis should be maximized.

Question 12
IDA invites views and comments on the possible practical measures that the operators would implement to allow coexistence of mobile services and radar services in the adjacent band.
IDA also invites views and comments on the required mitigation parameters indicated in the ECC Report 174 and the regulatory limit proposed by IDA for the co-existence between mobile services in 2.5 GHz with S-band radars.

No comment

Question 13
IDA would like to seek the industry's views on whether IDA should: (1) allow the 2G service providers to individually decide on when to shut down their 2G networks; or (2) intervene or assist to facilitate in any aspect of a possible winding down of 2G services in Singapore in order to manage the efficient use of spectrum. Such intervention could include the possibility of IDA centrally managing the 2G spectrum made available, e.g., by specifying spectrum, to be used by the 2G service providers on a shared basis for a shared 2G network.

As stated above, Qualcomm urges the IDA to implement regulatory changes that would incentivize the evolution to advanced wireless technologies such as 3G and 4G, which are able to utilize the scarce spectrum resources in the most effective and efficient manner.

Conclusion

In conclusion, Qualcomm is very grateful to the IDA for this opportunity to express our views on the Proposed Framework for the Allocation of Spectrum for 4G. Qualcomm applauds IDA's efforts in developing a holistic approach that looks at mobile spectrum demand requirements over the medium and long terms and provides a "roadmap" for making additional spectrumavailable. These very important policy decisions provide certainty to stakeholders and lay the foundation for business planning and investment decisions.

Should you have any questions or comments on this submission, please do not hesitate to contact me at +852 6348 6687 (mobile) or juliewelch@qualcomm.com.

Sincerely,

Julie Garcia Welch
Senior Director, Government Affairs
Southeast Asia & Pacific
Qualcomm Incorporated

cc: Mantosh Malhotra, Regional Head for Singapore, Malaysia, & Philippines, Qualcomm International