Ericsson Australia Response to ACMA Consultation on "Future Use of the 3.6GHz Band" – Options Paper

Rev A

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Re: Future Use of the 3.6GHz Band, Options Paper – ACMA consultation – August 2017

Ericsson Australia welcomes the opportunity to respond to the ACMA consultation on the publication *Future Use of the 3.5GHz Band – Options Paper.*

About Ericsson

Over the past 140 years, Ericsson has been at the forefront of communications technology. Today, we are committed to maximizing customer value by continuously evolving our business portfolio and leading the ICT industry.

We are a global leader in delivering ICT solutions. In fact, 40% of the world's mobile traffic is carried over Ericsson networks. We have customers in over 180 countries and comprehensive industry solutions ranging from Cloud services and Mobile Broadband to Network Design and Optimization.

Our services, software and infrastructure - especially in mobility, broadband and the cloud - are enabling the communications industry and other sectors to do better business, increase efficiency, improve user experience and capture new opportunities.

Ericsson has one of the industry's strongest patent portfolios with a total count of over 42,000 granted patents. R&D is at the heart of our business and approximately 23,700 employees are dedicated to our R&D activities. This commitment to R&D allows us to drive forward our vision for a Networked Society - one where everyone and everything is connected in real time - enabling new ways to collaborate, share and get informed.

Ericsson has been an active industry participant in Australia since the 1950s, delivering high-value professional services capability across Australia, New Zealand and the Asia Pacific region.

1 Introduction

The demand for Mobile broadband services continues to grow rapidly and with this it will continue for the foreseeable future. Further advancements of LTE and the emergence of 5G capabilities will provide new opportunities for growth in mobile broadband and other industries. This will drive demand for additional spectrum, to enhance existing networks and introduce 5G. As highlighted in Ericsson's Mobility Report[1] between 2016 & 2022 the total global mobile data traffic is expected to rise at a CAGR of 42% from the end of 2016 to the end of 2022.

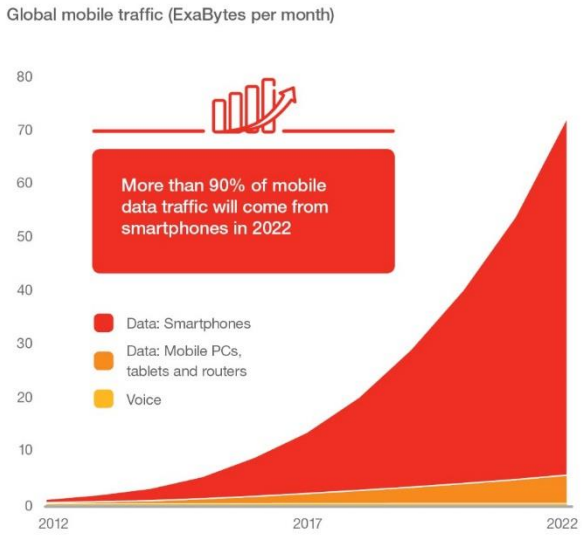

Fig.1 Global Mobile Traffic.

To meet this demand, cellular networks are evolving to deliver enhanced mobile broadband and communication services with high data throughput, quality of service, and low latency requirements. In addition, networks will also support new Internet of Things ("IoT") services with robust requirements on characteristics such as scalability, reliability, availability, and latency. These services are designed to support new use cases coming from industries such as automotive, manufacturing, energy and utilities.

With the possibility to address new industries, the 5G enabled revenue growth opportunities globally are estimated to be USD 582 billion[2]. This is an additional 34% revenue from 5G-enabled industry digitization market opportunities by 2026.

[1] Ericsson Mobility Report – July 2017
[2] The 5G Business Potential – Industry Digitization and the Untapped Opportunities for Operators

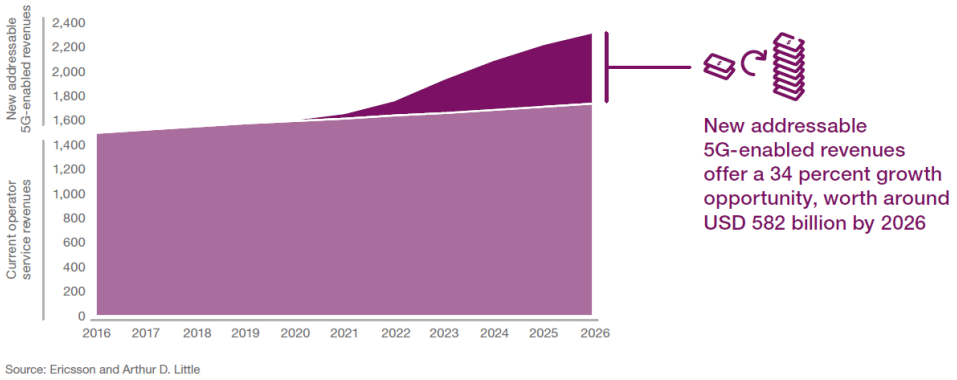

Fig. 2 5G Business Potential.

Acceleration of the 5G New Radio (NR) standardization schedule will enable large-scale trials and deployments of 5G in 2019. In March 2017, 3GPP approved acceleration of the 5G NR standardization schedule by introducing an intermediate milestone for an early variant called Non-Standalone 5G NR. This will enable early 5G deployments and support the requirements for enhanced mobile broadband services.

The forecasted number of 5G subscriptions[3] globally will exceed half a billion by the end of 2022. There will be continued growth in other mobile technologies, with 5 billion LTE subscriptions by the end of 2022, and 9 billion mobile subscriptions.

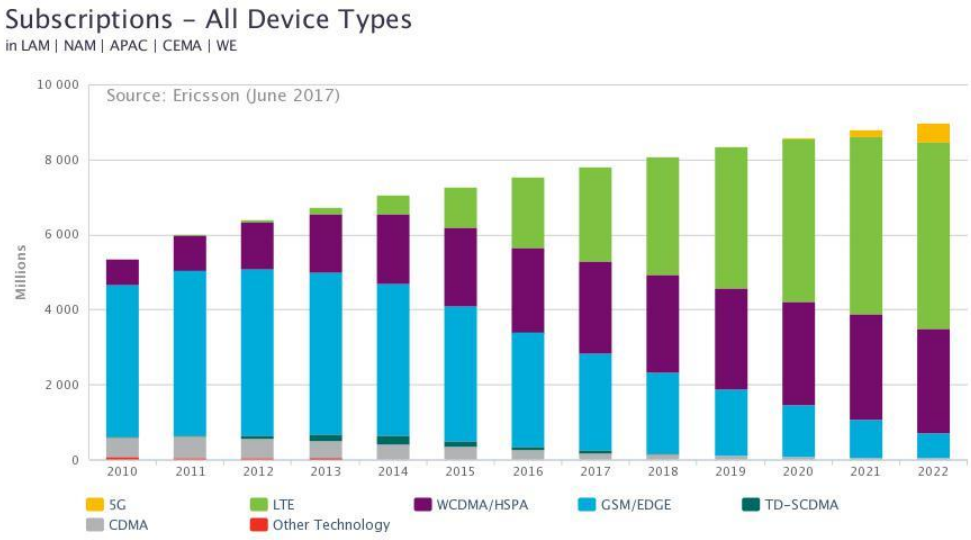

Fig. 3 Mobile Smartphone subscription by Technology.

Significant R&D investments are being made to enable the industrial use cases mentioned above. However, to realize the full potential of such technologies, additional spectrum in both mid- and high-bands is needed. Mid-band spectrum, the 3.6 GHz band offers great promise for small cell deployment, wide area networks, and next-generation services.

[3] Ericsson Mobility Report – July 2017

Mid Band Spectrum is increasingly being targeted for 5G around the world

Mid-band spectrum is increasingly important in the mix of spectrum that should be available for 5G[4], and many nations around the globe have opened proceedings to make 3 GHz band spectrum available for 5G services. For example, China, the European Union, Ireland, Japan, Russia, South Korea, the United Kingdom and USA[5] have all recently taken steps to make 3 GHz spectrum available for 5G.

At the WRC-15, the 3.6GHz band was highlighted in addition to what was already decided in WRC-07, and is now identified to IMT in all three ITU Regions, among others, as bands for 4G mobile broadband and potentially also 5G. There is considerable momentum for the use of bands in the 3.3-3.8GHz range for early or initial deployment of 5G.

Globally harmonized spectrum remains integral to the continued growth of the mobile industry and should be the touchstone for selecting spectrum for 5G, because globally harmonized spectrum allocations result in a broader ecosystem for technology, equipment, and engineering expertise, leading to economies of scale, lower costs for deployment, more rapid roll-out of new services, and enhanced competition among suppliers to global markets. The broader ecosystem spurs innovation at the application level and creates a platform for transformation.

[4] FierceWireless (June 7, 2017), China issues plan to use 3300-3600 MHz, 4800-5000 MHz for 5G; European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions, 5G for Europe: An Action Plan, at 5 (Sept. 14, 2016);
Commission for Communications Regulation, Results of the 3.6 GHz Band Spectrum Award, ComReg 17/38 (May 22, 2017);
Forward Thinking for Spectrum: Getting Ready for 5G, GSMA-GSA Seminar, ITU World Telecom (Nov. 16, 2016);
5G in China: Outlook and Regional Comparisons (July 2017);
Cho Jin-young, South Korean Government to Secure 40 GHz Frequency Width for 10 Years, BusinessKorea (Dec. 23, 2016) .

[5] FCC Commissioner Michael O'Rielly, A Mid-Band Spectrum Win in the Making, FCC Blog (July 10, 2017); FCC Opens Inquiry Into New Opportunities In Mid-Band Spectrum

Early Deployments by 2020

There is considerable activity globally towards deploying 5G services by 2020. Leading markets are UK, USA, Korea, Japan. For the mid-band specifically, EU and notably UK, Korea and China will have 5G deployments in 2020 timeframe. This clearly highlights the 5G momentum currently. With the initial expected deployment for 5G in the 2020 timeframe, this indicates there will be early deployments from 2018 with commercially 'stable' 5G equipment. The following operators and markets have indicated their intent for early 5G:

Verizon[6], AT&T[7], T-Mobile USA[8], Telia[9], MTS Russia[10], Korea Telecom[11], China[12], Vodafone UK[13].

Implementation of 5G by 2020 means that deployments will start prior to WRC-19, and spectrum decisions are required now.

In general harmonization for 5G can be seen in three main frequency ranges:

- 3GHz & 4 GHz
- 26+28 GHz; The 28GHz is one of the first high frequency bands for 5G. 26 GHz (a 'pioneer' 5G band in Europe) will be implemented prior to WRC-19 decision
- 37 - 43.5 GHz
- Existing and new mobile spectrum addresses IoT needs

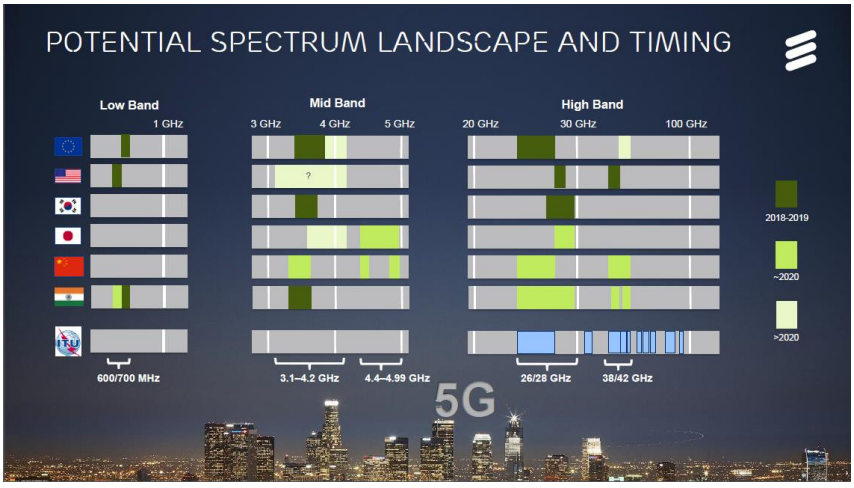

Fig. 4 Potential Spectrum Landscape and Timing

[6] Verizon to deliver 5G service to pilot customers in 11 markets across U.S. by Mid 2017
[7] AT&T Plans to Bring 5G Evolution to Over 20 Metros by End of Year
[8] T-Mobile Announces Plans for Real Nationwide Mobile 5G
[9] Telia Plots 5G Launch in Stockholm and Tallinn by 2018
[10] MTS and Ericsson to Trial 5G in Russia
[11] South Korea to launch first commercial 5G network in 2019; KT gets ready to show off 5G for PyeongChang 2018 Olympics; 5G Services KT will provide world's first 5G Experience
[12] Report: China will spend $411 billion on 5G from 2020 to 2030;
[13] Vodafone 5G in the UK

Spectrum for 5G in Australia

The establishment of a strong mid-band spectrum platform for 5G is essential to maintain leadership in wireless and spur a new wave of innovation. However, to *realize the maximum potential of 5G:*

1. It is important to have low-band, mid-band and high-band (mmWave) spectrum available for 5G – this enables coverage, outdoor-2-indoor, and capacity scenarios.

2. The C-band (3400-4200MHz) will be widely used globally for 5G as a mid-band.

3. An early auction will give clear and sound signal to the industry, and as an initial step, the 3.6GHz should be progressed from the preliminary replanning stage to the re-farming stage.

4. Make available the 125 MHz as per ACMA suggestion (3575–3700MHz). We agree that Option 3c is the preferred option for the 3.6GHz band.

5. Additional C-band spectrum in Australia should be made available in a timely manner with 26 GHz.

6. 5G ideally needs approximately 100MHz/operator at the mid-band, and of the order of 500 MHz/operator or more at high bands (mmW)

    a. This implies that additional spectrum at the mid-band needs to be considered, in the range 3.4GHz – 3.7GHz, and 3.7GHz – 4.2GHz range

    b. Ideally contiguous blocks of spectrum should be considered, and if possible rearrange the band 3400-3700 MHz to contiguous nationwide blocks

7. Consider extending the current 3.6 GHz for 5G band to also include the range 3700-4200 MHz, as being considered in other countries such as EU, Japan, USA.

1.1 Summary

Ericsson considers the 3.6GHz band to be of high value for mobile broadband and fixed wireless deployment, due to ongoing technical standardization efforts plus regional and global interest, leading to the development of healthy device and equipment ecosystems for 4G/5G. The increasing demand for these services with further developments in LTE and considering the introduction of 5G, provides the incentive to progress the 3.6GHz band from the *preliminary re-planning* stage to the *re-farming* stage in the ACMA's process for consideration of additional spectrum.

- The 3.6GHz band is of high interest, globally, for the initial deployment of 5G. This band spans parts of 3GPP Band 42 (B42) & Band 43 (B43), and used predominantly in TDD deployments today.

- Regional and global harmonization are key considerations to achieving economies of scale in end-user devices such as smartphones and connected devices, resulting in improved affordability and increased uptake by consumers. 3.4-3.8 GHz the first primary band for 5G (capacity for new services in urban areas), hence it is valuable for metro and rural areas.

- An early auction will give clear and sound signal to the industry, and it is essential to auction the 125 MHz as per ACMA suggestion (3575–3700MHz).

2 Issues for Comment

The following section provides a response to the specific questions requested by the ACMA.

1 Should the 3.6 GHz band be progressed from the *preliminary replanning* stage to the *re-farming* stage in the ACMA's process for considering additional spectrum for MBB services? Why/Why not?

It is essential to progress the planning of 3.6GHz as soon as possible to ensure certainty in planning – for operators, suppliers and the eco-systems, and to ensure the potential of 5G can be realized. The 3.6GHz band should be progressed from the preliminary replanning stage to the re-farming stage.

There is considerable momentum towards early 5G deployments, as highlighted in the Introduction section of this document. 5G activities are occurring globally, most notably: USA, Europe, China, Korea and Japan, i.e. all leading markets are driving 5G. Standards are still being completed, however there is very strong momentum for 5G being deployed in the 3.6GHz band, i.e. 3GPP B42 & B43 (and mm Wave) bands.

2 Do the areas identified in this analysis cover the likely areas of high demand for access to the 3.6 GHz band? Would smaller or larger areas be more appropriate? Why?

The areas identified by the ACMA are appropriate regarding areas that would be considered high demand access to the 3.6GHz, this is similar to the 2GHz spectrum license boundaries. Operators or other service providers will have better insight into the specific demands experienced in these areas.

In terms of the areas defined it is important to consider the interference issues that can arise, especially with TDD systems. Due to the TDD structure where uplink and downlink are transmitted in the same band, i.e. they are not separated as with FDD systems. In the TDD case interference is of key concern across license boundaries.

Base station to Base station interference can be a key issue due to different synchronization triggers used by operators, variations in TDD frame structure and Transmit/Receive timing. These issues not only impact co-channel systems but can also occur between adjacent channel systems operating in the same geographic areas. In addition, interference can be an issue due to propagation delays which exceed the guard time between the TDD DL and UL transmission periods, leading to interference from distant sites. Experience has shown that this anomalous propagation interference can be a significant issue in TDD networks in many parts of Australia from time to time. These issues can be managed more effectively within a single operator environment of course, however as there will be multiple users, it is important to consider the potential interference issues that may arise at license boundaries to ensure the spectrum is optimally allocated.

These issues also need to be considered with the existing adjacent users, i.e. users outside the 125MHz 3.6GHz band being considered.

A more detailed analysis that is required through the re-farming stage to clearly understand the possible interference issues.

3 If any part of the 3.6 GHz band is re-allocated for the issue of spectrum licences is seven years a suitable re-allocation period? If not, what period of time would be appropriate?

A seven-year re-allocation period for incumbents is a significant period of time. The interests of incumbents have to be considered, however of consideration must be the potential for very tight restrictions on the deployment of new services. As mid-band spectrum (including 3.6GHz) is a key band for early deployment of 5G (refer Question 1) and the amount of spectrum being considered in the mid-band initially for Australia is limited, minimizing the incumbent re-allocation time frame as much as possible is preferable. This is to ensure initial deployments do not limit the potential of 5G in Australia. However, a spectrum auction should not be delayed as certainty in the market is required for operators & service providers, and to secure ecosystem development.

Further, more detailed investigation will be required for this, i.e. what restriction the seven-year period will impose in the defined areas, due to satellite earth stations, point-to-point and point-to-multi-point existing services.

4 Should different re-allocation periods be considered for different areas? For example, should a longer period be considered for services outside Area 1?

It is considered ideal to minimize the re-allocation periods as much as possible. Area1 (Metro) would be expected to be a priority for initial deployment of services, however interaction with surrounding areas needs to be considered.

5 Are these guidelines appropriate? Why?

‘The ACMA has taken into account the following three guidelines when assessing potential areas for replanning in the 3.6 GHz band:

- *To the extent possible, define geographical borders in areas of low demand.*
- *To the extent possible, define geographical areas that are large enough to minimise potential co-channel interference issues when deploying services in areas of high demand.*
- *Consider allocating spectrum licences simultaneously across the entire area in which spectrum licensing is considered the most appropriate longer term outcome, even if the rollout of services is likely to commence in some areas first.'*

In principle, we agree with these guidelines. Some of the considerations:

- *The potential of 'long range' interference must be considered*
- *even in areas of low demand, it is important to consider surrounding areas (e.g. of higher demand) where interference may be an issue.*
- *Areas need to be sufficiently large to limit interference at boundaries*

The comments in Question 2 are also relevant, and a more detailed analysis that is required through the re-farming stage to clearly understand the possible interference issues.

6 Are there any other issues that affect the usability of an area-wide license that should be taken into account when defining the license area?

No further comments.

7 If point-to-point licences are affected by replanning activities in the 3.6 GHz band, are the options identified for point-to-point licences suitable? Are there any alternative options that should be considered?

No Comment.

8 Is the 5.6 GHz band a viable option for wireless broadband systems?

The 5.6GHz band is defined as the LAA (License Assisted Access), defined in 3GPP as B46 (5150-5350MHz and 5470-5925MHz). The proposed use of 5.6GHz bands is only for 40MHz of the band (5610 – 5650MHz).

The proposed use of the 5.6GHz band for wireless broadband services is limited and is currently used for BOM radar. This appears to be a viable option.

9 Under what circumstances should apparatus- and class-licensed arrangements be considered for the 5.6 GHz band?

- *No comment*

10 If apparatus licensing arrangements are developed for wireless broadband systems in the 5.6 GHz band, are the notional arrangements proposed in Appendix 3 suitable?

- *No comment*

11 If point-to-multipoint licences are affected by replanning activities in the 3.6 GHz band, are the alternative options identified suitable? Are there any alternative options that should be considered?

- Comments/ alternatives??
- *No comment*

12 The ACMA seeks comment on the suitability of the current west coast earth station protection zone located near Mingenew, WA, for long-term satellite service use. Are the current regulatory arrangements effective?

- *No comment*

13 In the event FSS earth stations are affected by replanning activities in the 3.6 GHz band, the ACMA seeks comment on:
   a) Any issues surrounding the development and establishment of an east coast earth station protection zone; particularly on what factors would be necessary to make it an attractive option for earth station operations.
   b) Whether there are any views on potential candidate locations to consider.
   c) Whether there should there be more than one earth station protection zone on the east and west coasts of Australia.
   d) If the identification of a central Australia earth station zone should be considered.

- *No comment*

14 Are the approaches for amateurs, radiolocation services, class licensed devices and TVRO systems suitable?

- *No comment*

15 Are there any other options for incumbent services, not identified in this paper, which should be considered?

- *No comment*

16 Should any of the sharing arrangements discussed in this section be considered for implementation in the 3.6 GHz band? Why or why not?

We do not see the need to implement the sharing arrangements discussed. Mitigation options are proposed in the consultation paper that should be considered.

3.6GHz spectrum should be licensed and allocated to ensure best possible use for 5G services, else the potential of 5G cannot be achieved. As highlighted in previous responses, being aligned to developments in other markets is key to harmonize the band globally with licensing and technical rules will unlock the full potential for the band. Sharing will create restrictions, due to the need to manage interference between the various users. The nature of interference in TDD systems, as discussed in previous sections, will make the make planning very challenging.

To gain the most potential from 5G services, certainty is required. In-particular this implies the duration of licenses, the interference protection, and technical implementation.

17 Are there any other sharing arrangements that should be considered?

- *No further comments.*

18 Are there any other replanning options that should be considered?

There are no further replanning options Ericsson would recommend be considered. The options proposed provide sufficient scope to be considered, and the preferred option (3C) appears to be the most appropriate. As discussed in the relevant responses it is of course necessary to analyse further levels of detail to ensure the interference is managed effectively across the Areas defined and at license boundaries.

Ericsson looks forward to the interference and management & mitigation options that will a accompany the preferred option, the proposed option looks adequate, however the technical implementation must be considered.

19 Which replanning option should be implemented in the band? Why?

Refer to Question 18 response.

20 In the event an area-wide licensing option is implemented, in which of the defined areas (that is, Area 1, 2, 3 and Australia-wide as defined in Appendix 6) should these arrangements be implemented? Are the current area definitions appropriate? If not, what area should be defined?

No Comments.

21 If Option 4a is implemented, what frequencies and areas should be re-allocated for the issue of spectrum licences? How much spectrum should remain subject to site-based apparatus licensing arrangements? Should different amounts be considered in different areas?

Option 4a limits the amount of spectrum available for 5G services. As there is limited spectrum available it should be allocated to mobile services use to ensure the potential of 5G.

22 If Option 4b is implemented, what frequencies and areas (that is, incumbent apparatus licence services) should remain subject to site-based apparatus licensing arrangements?

Option 4b limits the amount of spectrum available for 5G services. As there is limited spectrum available it should be allocated to mobile services use to ensure the potential of 5G. The 'swiss cheese' approach considered will create technical challenges, i.e. managing interference, and is not an optimal approach.

23 Comment is sought on the ACMA's preferred option (Option 3c) for the 3.6 GHz band.

Comment as above, Refer to Question 18. We agree that Option 3c is the preferred option for the 3.6GHz band.