Wireless Broadband in the 26GHz band - Options Paper

Ericsson Australia Response

Rev A

Summary

Ericsson thanks the ACMA for the opportunity to input to the **Wireless Broadband in the 26GHz Band – Options Paper**. This is an important time as the industry is moving towards 5G and having clear direction on spectrum is essential.

Ericsson supports the ACMA's approach of accelerating the spectrum planning process, i.e. through to the *preliminary replanning* stage, and considers it important to progress the 26GHz band beyond to the *refarming* stage. The ACMA has indicated in the recent **Five Year Spectrum Outlook** the *Potential timing of allocations* for 26GHz spectrum auction to be Q1–2 2020–21 in the ACMA time plan. With the momentum for 5G services globally and the intended use of 26GHz as a key band, it is recommended to bring the availability of spectrum forwards to allow timely access to spectrum. With the interest Ericsson sees in Australia from the operators, industry and society in 5G, an introduction of 5G in the 2022 timeframe would be felt as late not only nationally but also in an international comparison. Australia should target a commercial 5G introduction no later than 2020.

To enable the benefits and potential of 5G operators will require up to around 1GHz of high band spectrum, and a minimum of 100-200 MHz of mid-band spectrum. In an initial phase of 5G deployment operators will require around 300-400MHz of high band spectrum and having a mechanism for operators to access this earlier than the current timeframes will benefit the industry. Equipment and device ecosystems are developing to enable 5G services in the 2019 time frame.

Australia has been a leading market for mobile broadband, and this will continue with the introduction of 5G. In Australia Telstra have already started the deployment of 5G services with 200 5G-capable sites planned to be live around the country by the end of 2018[1] and recently announced a 5G supply agreement with Ericsson to 'deliver the next generation of mobile technology for Australia'[2]. This has followed a number of significant activities developing 5G capabilities in Australia, including in late 2017, a 'world first 5G trial data call over mmWave spectrum using Telstra's production core network'.

Having the right amount of spectrum available and in a timely manner is required to enable the benefits of 5G in Australia. Those deploying 5G should not be impeded and the co-existence of Spectrum and apparatus licenses is not ideal. A further consideration is the EESS protection requirements. The 26GHz band is a key band for Europe and there are concerns about EESS protection. The passive EESS services do require protection, however the conditions proposed by CEPT are considered too restrictive and is overprotecting the passive EESS services as this leads to excessive guard bands and potentially less performing 5G equipment and systems as well.

[1] Telstra turns on 5G on the Gold Coast
[2] Telstra confirms 5G partnership with Ericsson as it launches sites in Canberra, Adelaide and Perth

Introduction

5G will be a major technology for growing industry digitalization, creating and enhancing industry digitalization use cases such as autonomous driving, remote robotic surgery and augmented reality (AR) support for field maintenance and repair. Globally, the largest opportunity will be seen in the energy and utilities industry, closely followed by the manufacturing and public safety sectors. The *Ericsson Mobility Report*[3] provides an insight into the drivers for 5G.

The standardization of 5G accelerated during 2017, with 3GPP Release 15 for Non-Standalone 5G New Radio (NR) finalized at the end of 2018. This acceleration of the standardization work has enabled early 5G deployments in several markets.

Operators in the United States will be among the first to launch 5G commercial services. The country's four major operators have publicly announced that they will begin providing 5G services between late 2018 and mid-2019. Other markets where significant 5G subscription volumes are expected early include South Korea, Japan and China. Globally, major 5G network deployments are expected from 2020. We forecast over 1 billion 5G subscriptions for enhanced mobile broadband by the end of 2023, accounting for 12 percent of all mobile subscriptions.

- 2018 sees the first commercial launches of 5G.
- By the end of 2023, over 1 billion 5G subscriptions and 5.5 billion LTE subscriptions are forecast.

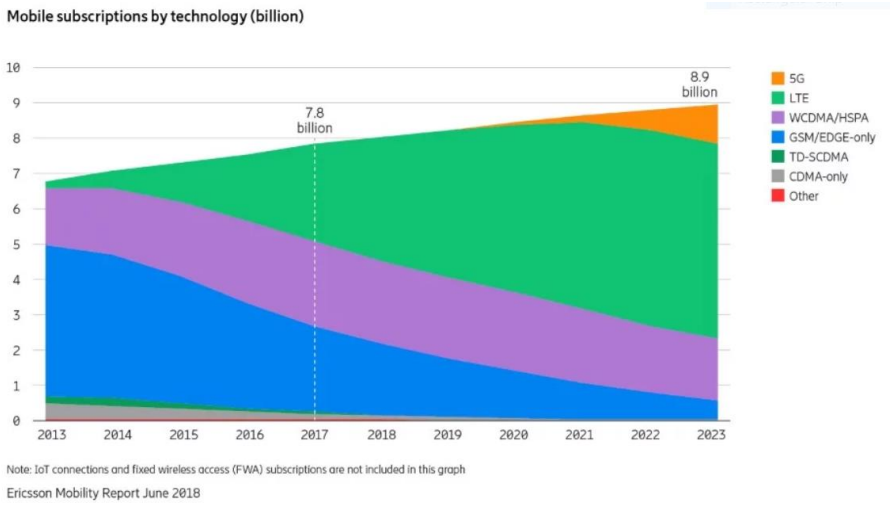

Figure 1. Mobile Subscriptions per technology.

[3] https://www.ericsson.com/en/mobility-report

5G Device Outlook

A key success factor for 5G will be development of a strong device ecosystem. The figure below summarizes 5G device availability, based on first-generation chipsets following 3GPP standards. From 2020, when third-generation chipsets will be introduced, large numbers of 5G devices are expected.

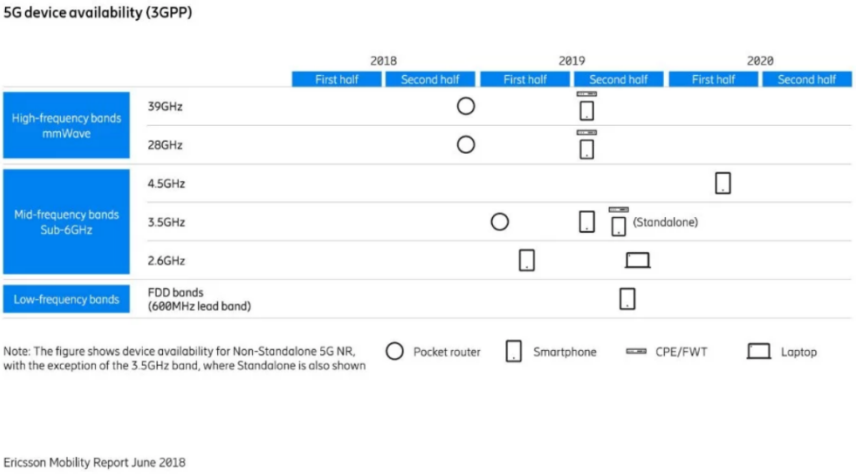

Figure 2. 5G Device availability.

- First 5G data-only devices are expected from the second half of 2018.
- The first 3GPP smartphones supporting 5G are expected in early 2019. Smartphones will evolve to support 5G in already-available LTE bands, as well as in higher spectrum bands that will be allocated for 5G.
- From 2020, when third-generation chipsets will be introduced, large numbers of 5G devices are forecast.
- By 2023, 1 billion 5G devices for enhanced mobile broadband are expected to be connected worldwide.
- 5G is also expected to empower use cases across industries. The first module-based 5G devices, supporting ultra-low latency communications for industrial process monitoring and control, are expected during 2020

Mobile data traffic growth outlook

In 2023, 20 percent of mobile data traffic will be carried by 5G networks.

- Total mobile data traffic is expected to increase by nearly eight times by the end of 2023.
- In 2023, 95 percent of total mobile data traffic is expected to be generated by smartphones, increasing from 85 percent today.

Globally, factors that drive higher usage include improved device capabilities and more affordable data plans, as well as an increase in data-intensive content. As virtual reality (VR) and augmented reality (AR) technologies are more widely adopted, content will be even more data intensive.

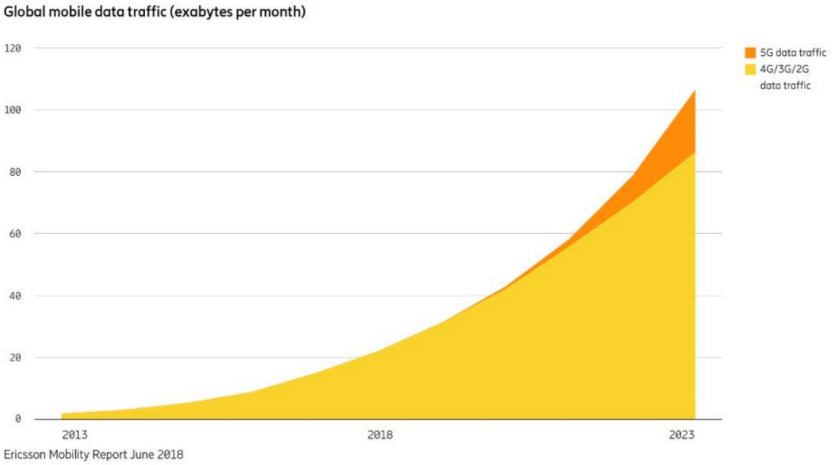

Figure 3. Global mobile data traffic.

Currently, the 5G traffic forecast does not include traffic generated by fixed wireless access (FWA) services. However, as FWA is one of the early use cases planned for 5G in some regions, it could have a significant impact on the forecast figures, depending on market uptake of the service.

Mobile video traffic is forecast to grow by around 45 percent annually through 2023 to account for 73 percent of all mobile data traffic. Traffic from social networking is also expected to rise – increasing by 31 percent annually over the next 6 years. However, its relative share of traffic will decline from 12 percent in 2017 to around 8 percent in 2023, because of the stronger growth of video.

An emerging trend with increased streaming of immersive video formats, such as 360-degree video, would also impact data traffic consumption. For example, a YouTube 360-degree video consumes four to five times as much bandwidth as a normal YouTube video at the same resolution.

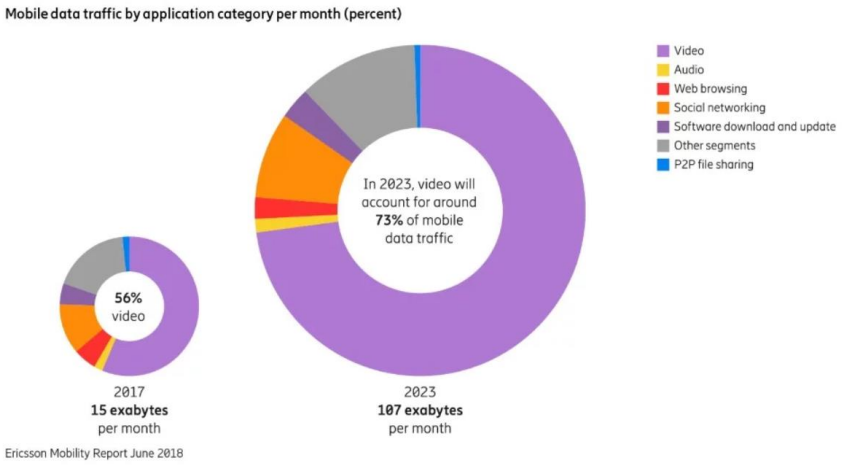

Figure 4. Mobile traffic by application category.

5G Spectrum

The figure below highlights the spectrum being considered for 5G. The 26/28GHz along with the mid-band spectrum, is seen as the most important for early 5G deployments.

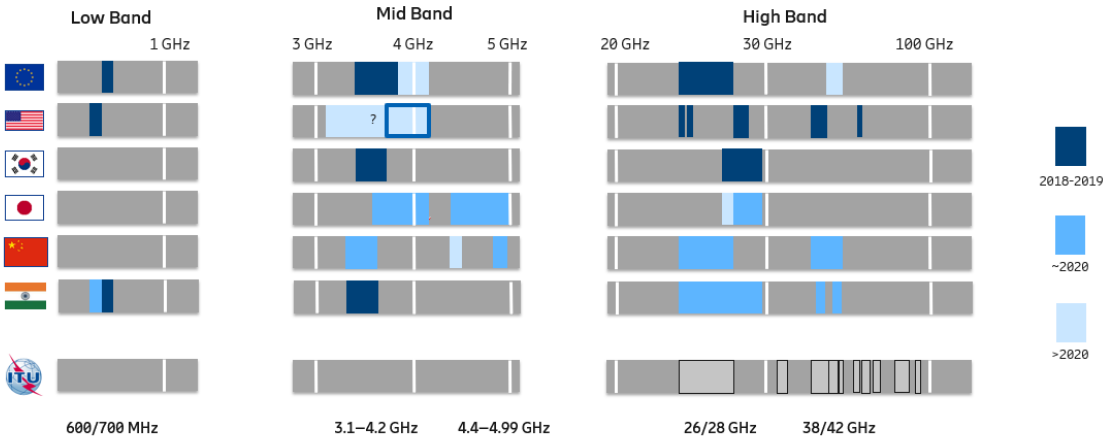

Figure 5. 5G early frequency bands and timing

This is further illustrated from the GSA[4] publication, **Global Progress to 5G - Trials, Deployments and Launches**, where the 28 GHz band (spectrum between 24 GHz and 29.5 GHz) has been most used for trials and demonstrations of 5G (followed by the 3.5 GHz band).

[4] https://gsacom.com/paper/global-progress-to-5g-trials-deployments-and-launches/

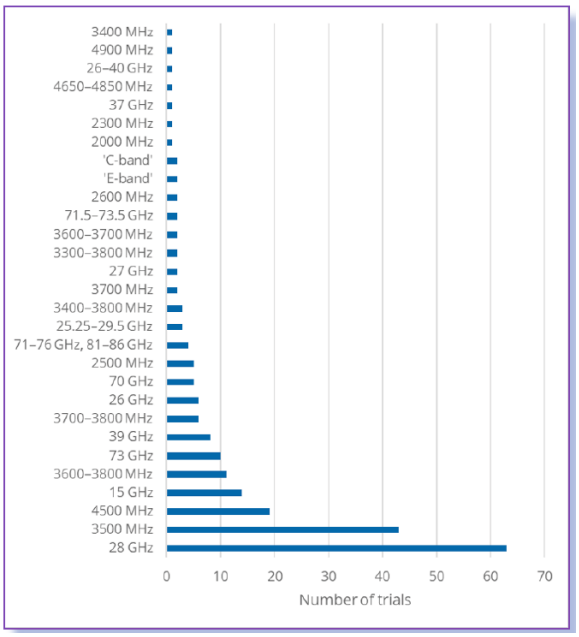

Figure 6. Count of 5G demonstrations and trials according to spectrum bands used (base: 261 demos/trials where the spectrum used has been stated; often multiple trials per operator). '28GHz' is using spectrum from 24GHz to 29.5GHz. Ref. GSA.

5G Business Potential

5G brings new revenue opportunities for telecom operators. *The 5G business potential - Industry digitalization and the untapped opportunities for operators*[5], is a report that analyzes the 5G business opportunity that comes from industrial digitalization.

This highlights the opportunities for operators across 10 key industries: manufacturing, automotive, energy and utilities, public safety, healthcare, media and entertainment, public transport, financial services, retail and agriculture. It also incorporates detailed use cases on these industries.

- Industry digitalization investments will generate an estimated USD 619 billion revenue opportunity for telecom operators by 2026
- Telecom operators can profit from an additional 36 percent revenue potential by 2026 from 5G-enabled market opportunities

[5] https://www.ericsson.com/en/networks/trending/insights-and-reports/5g-challenges-the-guide-to-capturing-5g-iot-business-potential

Operators can benefit from an additional 36 percent revenue from 5G-enabled industry digitalization market opportunities by 2026. In today's world, telecom operators are facing multiple challenges; increasing demands from consumers and tough pricing competition are only a few of the factors causing market stagnation for the industry. Despite high growth in both mobile subscriptions and mobile data traffic, overall mobile service revenue growth has flattened out, compared to the 10 to 15 percent annual growth a decade ago.

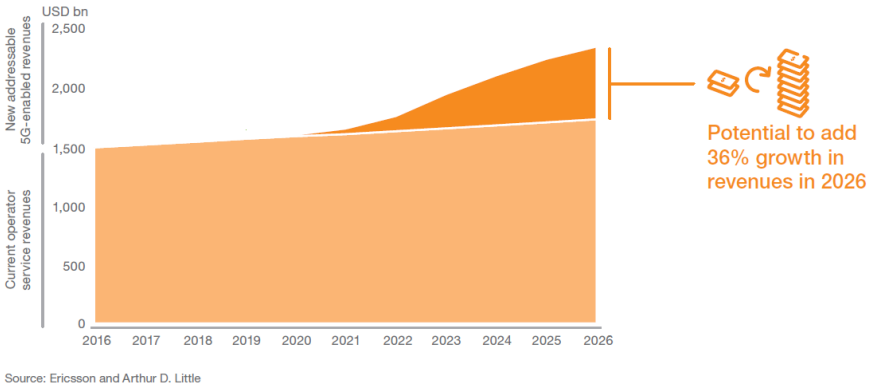

Figure 7. Current and 5G-addressable revenues (global).

Issues for comment

Potential wireless broadband deployment models

1 Does the three-type model constitute an appropriate high-level representation of potential usage of the 26 GHz band? If not, are there any use cases that should be included, excluded or omitted?

Ericsson Comments:

The ‘three-type model’ provides a good representation of the potential usage of the 26GHz band.

5G will enable a broad range of use cases and it will be expected that operators may provide 5G services and offerings across one or all of these types.

Technical issues

2 What are the implications for 26 GHz wireless broadband in Australia of the Electronic Communication Committee of CEPT (ECC) decision on emission limits to protect passive EESS?

Ericsson Comments[6]:

The implications of the CEPT decision on emission limits to protect passive EESS are that it will demand significant spectrum for a guard band, limiting the available spectrum. The passive EESS services do require protection, however the conditions proposed by CEPT are considered too restrictive and is overprotecting the passive EESS services.

Studies into the application of radio hardware for MBB and FWA applications using Massive MIMO technology are a relatively new activity. Research into the development of new and innovative antenna, filter and radio hardware solutions for mm-wave AAS (Active Antenna Systems) applications continues to advance at a rapid pace. Considering the industry focus and investment in this area, it is highly probable that performance of current best in class solutions available today for controlling emissions and interference will be exceeded in the medium to longer term.

Ericsson, therefore, believes it would be advantageous to formulate regulatory requirements which are flexible and can make use of the superior hardware characteristics which will become available in the coming years.

[6] Ericsson is contributing to the domestic study group and has provided a response to the ACMA document **26 GHz IMT/EESS (passive) coexistence work, Informal Working Document**

Unwanted emissions and the EESS (passive) protection/compatibility - Band 23.6-24.0 GHz[7]

A number of studies have been carried out to determine the technical conditions for protection/compatibility of passive services in 23.6-24.0 GHz, based on different parameters and assumptions. Whereas it is clear that the passive services should be provided protection, it should also be noted that stringent requirements will result in large guard bands. It is Ericsson's view that the requirements should be based on the following assumptions:

- Antenna performance in 23.6-24.0 GHz is better modelled by beamforming than by the single element method.
- Base-station density should be based directly on Ra and Rb, i.e. not the alternative "population-based" approach.
- Margins necessary to manage variation in the production of equipment and to meet stipulated requirements at all times should be incorporated.
- Aggregate interference level should be based on the 95th percentile.
- Interference apportionment: 2 dB.
- Multi-channel/multi-operator factor (in regions where several operators are assumed): 2 dB.

Taking into account studies that have applied beam-forming, that have line-of-sight probability between 70 and 95%, and further applying the assumptions as listed above, the resulting protection intervals are -32 to -36 dB(W/200 MHz) for base stations and -30 to -32 dB(W/200 MHz) for terminals. Ericsson proposes to use the middle of these intervals, -34 dB(W/200 MHz) and -31 dB(W/200 MHz) respectively. In case the multi-channel/multi-operator factor does not apply, these values should be relaxed by 2 dB.

26GHz Band Options

3 Are the proposed defined geographic areas for wide-area licensing appropriate?

Ericsson Comments:

The proposed defined geographic areas in general appear to be appropriate, being aligned to the proposed 3.4GHz geographic areas defined and represent the most populated and industrialised areas. Beyond this, the service providers are better positioned to comment on the specific demand in different areas.

[7] MODIFICATIONS TO the Working document on draft CPM text
for WRC-19 agenda item 1.13, Telefon AB – LM Ericsson (ITU, Radiocommunication Study Groups, Document 5-1/471-E, 16 August 2018)

5G on 26GHz will be a TDD based system. It is important to consider in the planning of geographic spectrum areas the boundary conditions and interference that may be present. Synchronization between allocated spectrum blocks within the 26GHz band must be considered to ensure efficient use of the spectrum. This does not suggest that synchronization will be required in all scenarios, such as where isolated systems are deployed.

Licensing and Deployment models

4 What is the expected proliferation of—or demand for—services deployed under type 2 (apparatus-licensed) and/or 3 (class-licensed) models?

Ericsson Comments:

Ericsson agrees that the demand for ‘type 1’ services will be prolific. Other types will exist.

The demand and opportunity of 5G services is discussed in the introduction section of this document. References to *Ericsson Mobility report*[8] *& 5G Business Potential*[9]*.*

[8] https://www.ericsson.com/en/mobility-report
[9] https://www.ericsson.com/en/networks/trending/insights-and-reports/5g-challenges-the-guide-to-capturing-5g-iot-business-potential

License Options

Summary of options (*Option 1—No change* is not included)

	Spectrum licensing			
		+ apparatus licensing in part of the band	**+ co-frequency class licence (underlay across entire band)**	**+ apparatus licensing in part of the band + co-frequency class licence (entire band)**
24.25*–27 GHz in metro	Option 2a	Option 3a	Option 4a	Option 5a
24.25*–27 GHz in metro + major regional centres	Option 2b	Option 3b	Option 4b	Option 5b
24.25*–27.5 GHz in metro	Option 2c	Option 3c	Option 4c	Option 5c
24.25*–27.5 GHz in metro + major regional centres	Option 2d	Option 3d	Option 4d	Option 5d

5 Comment is sought on preferred option(s) for configuring and licensing the 26 GHz band.

Ericsson Comments:

In the defined geographic areas, Ericsson's view is that **Option 2d** (24.25*–27.5 GHz in metro + major regional centres) with Spectrum Licenses only, is the best approach. Considering the demand expected for 5G services, the operators will require optimal use of spectrum.

5G, using mmWave, is expected to address many use cases and the sites will be deployed with varying architectures. Small cells and sites closer to the users and/or devices will be required and the likelihood of interference from other spectrum users (i.e. Class license users) in the same areas or locations may be more prevalent.

One of the key benefits of 5G is the ability to deliver ultra-reliable, low latency services (URLLC, Ultra Reliable Low Latency Communication). The requirements for URLLC are in early study stages, with ongoing standardization work in 3GPP R16 and beyond. Ultra-reliable services will be a key enabler for new 5G use cases. To provide these services, operators and service providers must be able to deploy services without risk of interference.

Ideally the use of Class licenses in the same areas as spectrum licenses is not recommended. If it was decided these options were to be used, it would be expected that for Class licenses voluntary registration would be required up to a certain lower level, and mandatory registration beyond this. The technical requirements will need to be established to ensure there is adequate protection for the spectrum license users.

In the case Apparatus licenses are used in the 26GHz band, they should be at the lower part of the band. Co-existence of Spectrum and apparatus licenses is not ideal, and what would need to be considered is the interference management and synchronization requirements.

6 If options 3 or 5 (all variants) are preferred, how much of the band should be available for spectrum licensing and apparatus licensing?

No Comment

7 If options 4 or 5 (all variants) are preferred, how much of the band should be available for class licensing?

No Comment

8 If options 4 or 5 (all variants) are preferred, what conditions should be applied to a class licence to protect co-frequency spectrum-licensed operations (in defined areas)? Would it be appropriate to define a means of making class-licensed use visible (for example, through a form of voluntary device registration)?

No Comment

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

No Comment

10 Is there likely to be sufficient demand for type 1 services in regional centres outside metropolitan areas, and if so, what centres (either explicitly listed or by population threshold) should be included in the expanded licence areas?

Ericsson Comments:

Ericsson sees many uses cases and applications for type 1 also in regional centres outside metro areas. With appropriate backhaul (fiber or wireless) this could serve the regional centres, including industrial areas, with 5G high capability systems equally well as in metropolitan areas. However, it is expected the operators will have better insight into the demand expected.