Beyond 2020 - A spectrum management strategy to address the growth in mobile broadband capacity

A submission to the Australian Communications and Media Authority Discussion Paper

October 2015

Alcatel-Lucent welcomes the opportunity to respond to Australian Communications and Media Authority Discussion Paper, '*Beyond 2020- A spectrum management strategy to address the growth in mobile broadband capacity*'. As a leading player in the global communications sector, and contributor to the Australian market over many decades, Alcatel-Lucent is well placed to provide insight on market and technology trends, including industry structure and regulatory practice.

The next five years will be crucial in the development of connected society as the use of wireless technologies and mobile broadband increase their influence across the economy. ACMA's spectrum management strategy discussion is clear signal that all stakeholders should work together to meet the expected demand for spectrum for mobile broadband and ensuring the development of 5G. ACMA has identified several spectrum bands to address future capacity growth and some, such as 'above 6GHz', will be relevant. Alcatel-Lucent welcomes the effort of ACMA to further investigate spectrum sharing.

The shift towards a holistic approach in spectrum allocation delivers greater flexibility, however we recommend that ACMA maintain a pragmatic approach to the market. By principle, mobile network operators will always look for an optimal use of spectrum and infrastructure investment and ACMA should also take into account deployment challenges (topology wise) and the configuration and optimal possible use of certain allocated bands.

About Alcatel-Lucent

Alcatel-Lucent (Euronext Paris and NYSE: ALU) is the leading IP networking, ultra-broadband access and cloud technology specialist. We are dedicated to making global communications more innovative, sustainable and accessible for people, businesses and governments worldwide. Our mission is to invent and deliver trusted networks to help our customers unleash their value. Every success has its network.

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Table of contents

Moving towards a wireless connected world

The whole world is going mobile.

Driven by the proliferation of smartphones and tablets, the allure of anywhere, anytime access continues to attract users worldwide. Fourth generation LTE networks are now mainstream and the Global mobile Suppliers Association (GSA) predicts there will be 460 commercial LTE networks by the end of 2015 and 1.46 billion subscribers by the end of 2016.[i] Analysts predict that 84 percent of the world population will be using mobile technology by 2018.[ii] And, the number of mobile devices in use is expected to grow by over 57 percent to reach 12.1 billion by 2018.[iii]

As the number of mobile subscribers continues to climb, operators worldwide are witnessing a shift from voice-centric to data-centric communication. The number of people using mobile apps is expected to more than triple by 2017, increasing from 1.2 billion in 2012 to 4.4 billion, and the number of mobile apps being downloaded per year will increase over four times, growing from 46 billion to 200 billion.[iv]

Meanwhile, machine-to-machine (M2M) connections are increasing rapidly. Sensors, meters, smart thermostats, smart street lights, manufacturing sensors, repair sensors, health and fitness monitors, and more are creating an Internet of Things (IoT) installed base that is expected to reach 28.1 billion in 2020, a more than threefold increase since 2013.[v] The GSM Association (GSMA) forecasts that cellular M2M connections will reach one billion globally by 2020, from 243 million in 2014.[vi]

Obviously, this increase in users, usage, and machine connections will affect all wireless networks. Mobile data traffic is expected to grow by almost ten times by 2019, increasing from 2.5 exabytes in 2014 to 24.3 exabytes per month in 2019.[vii] Furthermore, the International Telecommunication Union (ITU) estimates that this rate of growth will continue into the future to reach 351 exabytes per day worldwide by 2025.[viii]

To successfully address escalating capacity demands, operators will apply new traffic management techniques. In addition to offloading data traffic to other network technologies, such as Wi-Fi and LTE-U, operators will increase spectral efficiency by adopting technical innovations, increase spatial efficiency through small cells densification, and obtain new spectrum for additional carriers. However, a variety of new demands will dictate the need for additional actions in the near future. New applications will require higher speed and capacity that LTE will not be able to

support economically. A new fifth generation network will be needed to respond to all these challenges.

A 5G network will provide a fully connected society where access to information and sharing of data, including cloud-based services, is provided anywhere and anytime for anyone and anything. End user devices will provide primary access for a number of applications and services. Therefore, mobile networks will have to have the ability to support and respond to a variety of demands and devices.

As the industry moves towards 5G everywhere, administrations should take a closer look at the policies and regulations that govern the telecom sector and wireless networks in particular. Engaging in early dialogue with the entire ecosystem will be beneficial for all stakeholders for understanding the challenges ahead of the 5G systems. By adjusting policies early, regulators can enable an efficient migration to 5G, and ensure their citizens reap the full societal and economic benefits that the next generation of mobile networks promises.

Creating the premises for the global digital society requires a closer dialogue among the parties involved for a correct assessment of the regulatory reforms and the timelines. As technology is evolving at a faster pace than the regulatory framework, the later should be reviewed and adjusted to reflect the digital realities.

Paving the way to 5G

- **Access to spectrum**

The development of 5G systems will rely on different connectivity technologies that can respond to specific user demands (capacity, latency, availability, etc.). Therefore, new spectrum bands will be of paramount importance. All stakeholders agree that both low and high frequency bands will be needed, and harmonised bands across the regions are preferred by the industry for techno-economic reasons. But, the identification and allocation of new spectrum for 5G requires a long lead time at the international level, within ITU processes.

At the time of writing, the mobile industry was preparing for the World Radiocommunication Conference 2015 (WRC-15), which is expected to address medium- and long-term requirements for additional spectrum for mobile broadband. One of the priorities is to recommend the inclusion of an agenda item for the next WRC that will focus on the identification and allocation of spectrum for 5G in new,

higher frequency ranges, above 6 GHz.

With that in mind, at WRC-15, international and regional spectrum administration groups could play a significant role in the rollout of 5G by agreeing on which spectrum bands would be suitable. Once identification and allocation are complete, at the WRC-19, assignment can take place at the local and national level. This is a very important regulatory consideration because it has a major influence on market dynamics, roll-out timeframes, and the performance of the wireless broadband sector in each region.

Regardless of the outcome of WRCs, accessing additional spectrum bands for mobile services will require more flexible forms of spectrum management. Traditional mobile bands will be at the foundation of new 5G networks and exclusively-licensed spectrum will be preferred by operators when deploying 5G systems. However, some new 5G services will need spectrum bands with different characteristics in terms of bandwidth and throughput for capacity, coverage, and latency. But in many cases, these frequency bands are already being used by other services.

For example, coverage spectrum bands are required for 5G to ensure wide area availability of low latency and optimised service for machine type communications. Traditionally, the bands below 6 GHz have been used by different services, including mobile. As a result, it is difficult to find new exclusive bands for mobile broadband in this range. Refarming existing mobile bands for 5G is an attractive option because it will enable a more efficient use of available resources.

The higher frequency bands above 6 GHz are expected to offer both an increased total amount of spectrum and wider contiguous channels that are required for efficient delivery of very high data rates. Increasing the available bandwidth can be achieved through carrier aggregation, but at the cost of increased complexity. The availability of contiguous spectrum of sufficient bandwidth to deliver 5G services will simplify implementation considerably.

The new 5G mobile technology will make use of low frequencies for wide area and indoor coverage, while frequencies above 6 GHz — typically in the 20-60 GHz range (high-band) — will be used for ultra-high bit rate, short-range transmission in very dense urban areas. This will require rapid deployment of small cell equipment in very crowded areas. But installation rules, administrative taxes, and local certifications can hamper a 5G rollout, and slow the realisation of economic and societal benefits. To eliminate delays and support the process, generic administrative rules and regulations should be considered that will foster the deployment of new technologies and future upgrades.

Accessing new frequency bands already in use by other services implies sharing spectrum and, therefore, an optimised coexistence with other radio technologies and possibly a dynamic use of radio resources. This use of complementary spectrum on a licensed-shared and/or on a license-exempt basis requires equitable access to it through coordination mechanisms. Managing access will be important to maintain high spectrum efficiency and ensure that interference is controlled and managed, as required. This will require revisions to existing regulations and spectrum management practices to encourage and favor the use of shared spectrum resources with other services.

Likewise, backhaul requirements must be considered. Backhaul is an important component of any wireless network. In many cases, wireless backhaul is a fast and economic alternative that can transport increasing volumes of mobile traffic. Having access to backhaul spectrum will be of paramount importance to any operator's ability to deliver the expected quality of experience (QoE) to end users. Therefore, the spectrum allocated and used by fixed services should be preserved to ensure efficient, end-to-end network operation and avoid bottlenecks in future 5G networks.

- **Affordable spectrum**

Spectrum is the lifeblood of mobile communications and spectrum-related policies, including spectrum management, are critical for the future development of 5G networks. To enable adoption, operators must be assured that sufficient and affordable spectrum is available in a timely manner. This is required to support the growing mix of data traffic that will be generated by the increasing number of humans and machines that will access 5G networks.

Exclusively licensed spectrum will continue to be a critical element for the developments of 5G because it provides a predictable and stable way to establish the capacity of a deployed network. As such, a forward-looking and investment-friendly policy framework for spectrum management is needed to ensure that the ecosystem develops at a fast pace. Harmonised spectrum, timely and (cross-country) coordinated releases, and longer duration of usage rights are some of the measures that can create certainty in the market and foster the necessary investments in technologies and networks.

Also, spectrum pricing should be balanced against network investments that will be required to ensure the ubiquitous availability of networks and services. An investment-friendly approach to spectrum pricing will ensure that the rising population density and its increasing use of wireless services will be supported by the necessary network

infrastructure. Excessive pricing of spectrum can have as effect limited future investments in networks and innovative services and may delay their adoption. As such, it can delay 5G deployments and increase the technology gap between regions. Therefore, spectrum pricing should take into account a number of factors, such as the available bandwidth per operator that will influence technical performance, the required network investments, and the continuous network evolutions that will be required over a licensing period.

A pricing framework that supports balanced ongoing investment in spectrum and networks is an essential step towards a truly mobile and connected society. Moreover, considering that legacy technologies will be switched off eventually to allow operators to re-farm spectrum using more efficient technologies, the existence of a simple secondary market for spectrum trading will allow operators to optimise their spectrum holdings. Likewise, a simplification of the regulatory requirements attached to spectrum licenses will benefit operators (e.g., a technology neutral approach to spectrum, coverage obligations per technology, etc.).

ACMA proposed strategies

Alcatel-Lucent fully shares the 10 assumptions developed by ACMA.

Strategy 1: Holistic approach to mobile broadband capacity growth

Alcatel-Lucent welcomes ACMA holistic approach to address the outcome of mobile broadband capacity growth that balances the available inputs of spectrum, technology and network infrastructure/topology.
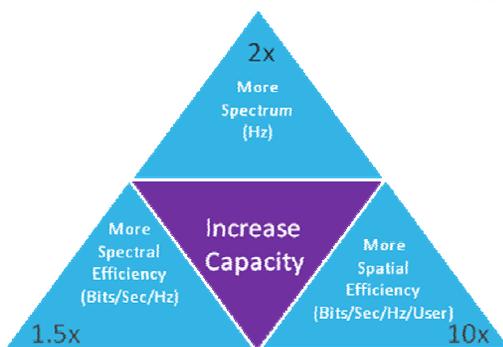
Operators have to consider a number of factors as they decide how best to model their networks for future needs. With 25x capacity growth in five years, 3G networks are saturating already, and 4G LTE networks will need increased capacity within 2-3 years of launch. Operators not only have to consider issues such as subscriber growth and capacity, but also how they can best optimise their existing spectrum assets. Essentially, there are only three ways to add network capacity: more spectrum (2x), more spectral efficiency (1.5x) or more spatial efficiency (10x).

Nevertheless, the ACMA check-list has to be carefully used and has also to take into account the reality of spectrum allocation and deployment. Even if ACMA is looking for an optimal allocation of spectrum, there are current cases, such as 900 MHz in Australia, where the present configuration/allocation is not usable for mobile broadband. This occurs as well for others bands such (1.9 GHz, 3.4 GHz, 3.5GHz).

In addition, while ACMA's questionnaire considers densification and topology issues, it should also take into account the deployment reality. Small cells and 'het net' are deployed in large numbers and face real-world deployment challenges such as scaling the planning and administrative processes and gaining general public acceptance. Small cells and 'het net' require multi-level approvals, including national and state regulatory approvals, local administrative approvals, and buy-in from the community and special interest groups. Streamlining the processes to assure fast access to sites and reduced deployment costs will assure an optimal deployment of more dense networks, to respond the coverage and capacity demands.

Strategy 2: Transparent spectrum management planning process

Alcatel-Lucent welcomes the ACMA approach for new planning process, however we note the different proposed stages, as described, appear unclear, in particular in relation to how a spectrum band may progress to another stage. As the discussion document focuses beyond 2020, we believe that spectrum bands 'above 6GHz' and 2.7GHz/2.9GHz have to be considered in stage one. Also, as part of a coverage-focused strategy, low frequencies bands should be considered, therefore exploiting ways to optimise the use of the sub-700MHz UHF band between incumbent services and mobile broadband in the future.

Strategy 3: Utilising the often long lead-times to reduce effect on incumbents

Even in the best possible world of spectrum management, the evolution of networks and technologies will result in additional future spectrum demand. Given this reality, ACMA should play an active role in understanding the evolution and needs of the industry and ensure the release of new spectrum in an adequate time to ensure that Australia may take full advantage in the networked society. We recommend that ACMA adopt a more proactive approach in the identification of new spectrum bands and actively engage with industry on this topic. In addition, access to spectrum in use by other incumbent services will require an update of the spectrum management framework and investigation into sharing schemes that bring certainty and

predictability for investors.

Strategy 4: Exploring opportunities for increased spectrum sharing

Exclusively licensed spectrum will continue to be a critical element for the development of mobile networks in general, and 5G in particular, because it provides a predictable and stable way to establish the capacity of a deployed network. Accessing new frequency bands already in use by other services implies sharing spectrum and, therefore, an optimised coexistence with other radio technologies and a dynamic use of radio resources. This use of complementary spectrum on a licensed-shared and/or on a license-exempt basis requires equitable access to it through coordination mechanisms. Managing access will be important to maintain high spectrum efficiency and ensure that interference is controlled and managed, as required. This will require revisions to existing regulations and spectrum management practices to encourage and favour the use of shared spectrum resources with other services. Alcatel-Lucent welcomes the effort of ACMA to further investigate spectrum sharing.

Strategy 5: Influencing international spectrum harmonisation

Australia is playing a key role internationally (ITU) and regionally (APT) and it must continue. Policy makers have to consider global standards that will enable development of new, interoperable communication networks, and allow economies of scale that can accelerate deployments and ensure affordable services are delivered to end users. Specifically, spectrum harmonisation will ensure the development of radio infrastructure and devices at reasonable costs to support end user roaming when deployments begin. Regional and global harmonisation of spectrum (especially for 5G) is also important because it can significantly reduce equipment design complexity, preserve device battery life, improve spectrum efficiency and reduce cross-border interference.

In light of the forthcoming WRC-15, we believe ACMA should further support the identification of the sub-700 MHz UHF band for mobile, recognising this band as a significant milestone as the mobile industry seeks greater access to the UHF band for mobile broadband. We also encourage ACMA to identify 2.7/2.9GHz.

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[i] *"The Evolution of LTE to 5G"*, Joe Barrett, Global mobile Suppliers Association, 2015.

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viii *"Mobile Traffic Forecasts"*, 2010-2020," UMTS Forum, January 2011.