ALCATEL-LUCENT

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Submission to the Public Consultation of the Radio Spectrum Policy Group

Draft RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband

1. Introduction

Alcatel-Lucent is pleased to respond to the Radio Spectrum Policy Group consultation on the draft Opinion "Strategic challenges facing Europe in addressing the growing spectrum demand for wireless broadband".

Alcatel-Lucent appreciates the work conducted by the RSPG and considers that the Opinion provides an exhaustive overview of the situation in Europe. We also support the overall recommendations made in the Opinion.

In addition, we take this opportunity to provide views on some specific issues that we feel could be usefully incorporated into the final version of the Opinion, especially on Heterogeneous Networks and on Shared Spectrum Access.

2. About Alcatel-Lucent

Alcatel-Lucent (Euronext Paris and NYSE: ALU) is the long-trusted partner of service providers, enterprises and governments around the world. Alcatel-Lucent is a leading innovator in the field of networking and communications technology, products and services. The company is home to Bell Labs, one of the world's foremost research centres, responsible for breakthroughs that have shaped the networking and communications industry.

Alcatel-Lucent innovations are regularly recognized by international institutions for their positive impact on society. In 2012 and for the second year running, Alcatel-Lucent was named one of the Thomson Reuters Top 100 Global Innovators, recognition for the company's continued addition to its world-class patent portfolio, one of the largest in the telecom industry. Alcatel-Lucent has also been recognized for its sustainability performance. In 2012 the company was ranked Technology Supersector Leader by the Dow Jones Sustainability Index. Through its innovations, Alcatel-Lucent is making communications more sustainable, more affordable and more accessible as we pursue our mission of Realizing the Potential of a Connected World.

With operations throughout the world, Alcatel-Lucent is a local partner with global reach. The Company achieved revenues of Euro 14.4 billion in 2012 and is incorporated in France and headquartered in Paris.

For more information, visit Alcatel-Lucent on: http://www.alcatel-lucent.com, read the latest posts on the Alcatel-Lucent blog: http://www.alcatel-lucent.com/blog and follow the Company on Twitter: http://twitter.com/Alcatel_Lucent.

3. Comments on Specific Parts of the Opinion

3.1. " IV. Definition and Trends for Wireless Broadband" – page 8

It is stated in the last paragraph of this section that bands of a maximum width of 20 MHz allocated to TDD spectrum are not attractive enough for the industry to develop equipment.

We agree with this statement, but we want to point out that it is valid mainly in the context of a multi-operator deployment of TDD. In this context the small piece of spectrum allocated to a specific operator (typically 5 MHz in the case of 1900-1920 MHz band) is not sufficient to take into account the potential guard band required between operators and to satisfy the demand for mobile data.

In the case of operators having major spectrum holdings in TDD arrangement the baseline for TDD is 20-40MHz per operator[1].

On the other hand, small pieces of spectrum could be considered adequate in a different context. For instance, 20 MHz of spectrum could be used for the provision of Supplemental Down Link (SDL), which means it would be used in combination with conventional FDD Down Link spectrum. Another alternative would be to use the spectrum in one of the various carrier aggregation modes being developed in 3GPP.

3.2. "Trends in wireless technology" – page 9

This section rightly points out the increasing importance of Femtocells and Wi-Fi offloading in addressing the need to handle the exponential increase in traffic on networks. It is our view that this section could be enhanced with a broader focus on the range of changes in network infrastructure that are being employed to address the 'data tsunami'. These innovations in network infrastructure have led to the emergence of Heterogeneous Networks (HetNet), which will allow mobile networks to be tailored to the specific capacity needs encountered in specific locations. In this context, we would recommend that the text address Small Cells in general, including the so-called Microcells and Picocells and not just Femtocells.

Heterogeneous Networks, and especially Microcells and Picocells, will contribute to the overall spectral efficiency of an operator's network by providing additional capacity resource where required. In contrast to Femtocells, which can be deployed by end users, Microcells and Picocells are deployed by the operator itself under its full control, thus ensuring that the impact on the network is minimized.

The HetNet approach (combining Micro/Picocells solutions) provide the operator with a mechanism to adapt the network to the capacity demands in specific areas, beyond what could be ensured by Femtocells or Wi-Fi deployments, while ensuring that the network operator's Quality of Service (QoS) requirements are fully met.

The figure below illustrates the benefits of increased spatial efficiency, such as that attained through HetNet, can be significant. Although network densification itself is not the only option to take into account for addressing the growing demand of increased capacity, it is the most effective of the options in conjunction with new spectrum and technologies that maximize spectrum efficiency.

[1] A recent study of Informa Telecoms & Media "LTE TDD Year Book" indicates that more than 90% of the TDD operators are holding more than 20MHz of TDD spectrum, and some up to 100MHz.

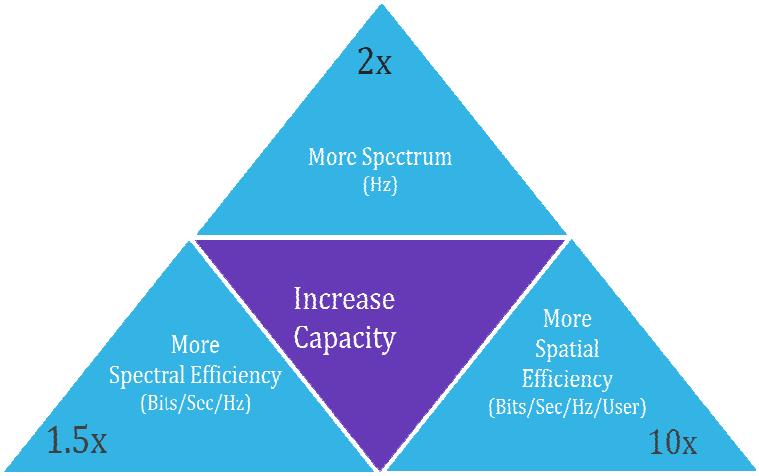

Figure 1 - Factors that Influence the Increase of Capacity

In the following years technological progress will enable an increasing number of users to be satisfied by the same amount of spectrum as today, however, the anticipated growth in data traffic will still require additional spectrum to be made available to meet those needs.

3.3. "V. Spectrum Policy and Regulatory Issues Regarding Wireless Broadband" - pages 10-11

As we read Paragraphs 2 and 3 of Section V, it appears to be making the case that wireless broadband connectivity in urban areas requires high frequencies, while the rural areas have a need for low frequencies.

In our opinion, it would be beneficial to present a slightly more nuanced perspective, based on the experience of our operator customers:

- The lower frequency spectrum (typically below 1 GHz), due to its propagation characteristics, provides a superior coverage, making it suitable to cover wider areas. At the same time, these propagation characteristics also offer excellent indoor penetration. Therefore, this same spectrum could also provide valuable coverage solutions in urban areas.

- As operators must consider both coverage and capacity requirements in all areas, it is not possible to simply say that a particular band is for only for coverage in rural areas only.

- The higher frequencies, due to their smaller coverage area and the possible availability of larger bandwidths, are most appropriately employed in congested areas to respond to high data traffic demand. As the traffic distribution and peaks depend of the population density in the dense urban areas, effective solutions that assure that QoS is maintained include the HetNet architecture with Metrocells (smaller cells Micro/Picocells) that can be powered to satisfy the demand of additional capacity when required.

We would also like to point out that our experience has been that even in urban areas sometimes substitutes may not be able to offer an alternative to the Mobile Broadband. For example:

- Fixed Broadband may not be available everywhere, and in any case would not be able to manage nomadic or mobile usages

- Wi-Fi connections would not offer QoS guarantees to the user. Additional considerations should be attached to Wi-Fi usage, namely that the costs associated with accessing Wi-Fi hotspots may be unattractive to the users, and that Wi-Fi accessibility is conditional on device capability and the user decision to switch on this connectivity. It is our view that Wi-Fi networks are complementary and supplementary to the cellular networks, not a replacement.

For these same reasons there may also be a need to implement HetNets in dedicated zones in rural areas, and not just in urban areas.

3.4. "V. The Role of Shared Spectrum Access and Licence Exempt Spectrum" - pages 14-15

We support the inclusion of the section on Shared Spectrum Access and Licence Exempt Spectrum in the draft Opinion.

Alcatel-Lucent is convinced that spectrum sharing is an appropriate means to use the spectrum more efficiently in order to deal with the explosion of mobile data traffic.

Nevertheless we want to point out that, besides the licence exempt spectrum and LSA mentioned in the draft Opinion, there may also be a need for some advanced sharing techniques associated with some kind of licensing – for instance 'dynamic licensing', which in some cases may provide better performance to networks than licence exempt spectrum.

While LSA targets on a quasi-static approach for sharing a specific band among an incumbent user (governmental body e.g. military) with a single secondary licensee, for a given region and a given time, a 'dynamic licensing' approach would support controlled sharing of such a band among an incumbent and more than one secondary licensee.

In this case spectrum management would be required to guarantee agreed QoS levels also for the secondary users. This could be handled e.g. by a 'Spectrum Broker' (SB). The SB must not only protect incumbent operations, but should also protect secondary users from each other, and should provide sufficient information to allow secondary users to protect themselves from incumbent operations. Otherwise, secondary users' spectral efficiency will be reduced and the directive to use the spectrum to maximum benefit will not be met. Such a mechanism is amenable to several alternative arrangements with different granularity in time, space and QoS levels for ensuring the spectrum is put to the most valuable use. For example, secondary rights might be auctioned for maximum economic utility. An auction of the secondary licenses provides the license holders with maximum certainty with respect to longer-term spectrum rights and quality of service.

3.5. "IX. Key Frequency Bands with Potential for Wireless Broadband" page 16-21

Alcatel-Lucent supports the detailed consideration of all the bands listed in Section IX and Annex 1 and 2 for mobile broadband. To support the RSPG's deliberations on these bands Alcatel-Lucent offers the following considerations on some of the bands:

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Frequency band (MHz)	Pros of WBB in the band	Cons of WBB in the band
470-694 MHz	• These frequencies have favourable propagation characteristics that allow broadband wireless coverage to be provided over large areas with fewer cells compared to higher frequency band which reduces network infrastructure costs. • When used for the macro network, these frequencies allow for reliable outdoor and indoor coverage as these frequency ranges also offer favourable building penetration of radio signals. • The lower and upper edges of the 470-694 MHz frequency range are adjacent to bands in which IMT systems are currently deployed (i.e. 450-470 MHz and 698-960 MHz). The use of bands currently used by IMT terminals, or in close proximity to bands currently implemented in IMT terminals, could result in greater availability of RF components and reduce equipment complexity	Sharing with existing services could be problematic. Therefore, relocation of existing services may be required, delaying access to this spectrum. Many physical layer devices including filters and antennas are limited by their fractional bandwidth, and as the centre frequency becomes smaller, their size and performance degrades. For example, a 10% fractional bandwidth rule of thumb for antennas suggests that only a 65 MHz duplex spacing between uplink and downlink frequencies can be implemented at 650 MHz.
1375-1400 MHz	• These frequencies have favourable propagation characteristics that are suitable for mobile broadband systems that provide reliable wide area coverage over urban and rural areas. • These frequencies can be used for Macrocell and microcell network to provide capacity. • Parts of the spectrum around 1.5 GHz are currently used, or planned for use, for IMT systems in some countries. Equipment based on international standards, is already available in relatively close proximity to this band.	Sharing with other existing services, such as radars and limits set to protect adjacent passive services make sharing particularly problematic.
1427-1452 MHz	• These frequencies combine the attractive propagation characteristics of the lower frequencies with the ability to offer larger bandwidths. • These frequencies are already allocated to the Mobile Service on a primary basis in all three Regions.	In Region 2, the use of the band 1 435-1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service; so, it may be difficult to get a global identification.

1452-1492 MHz	• These frequencies combine the attractive propagation characteristics of the lower frequencies with the ability to offer larger bandwidths. • These frequencies are already allocated to the Mobile Service on a primary basis in all three Regions.	In Region 2, the use of the band 1 435-1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service; so, it may be difficult to get a global identification.
3800-4200 MHz	• These frequencies have propagation characteristics that are suitable for use in dense urban areas where the deployment of mobile networks is typically capacity limited since it provides an opportunity for increased frequency reuse. • These frequencies have potential to provide large contiguous bandwidths that can be used for microcell and Picocells network to provide increased capacity and performance. • 3.5-4.2 GHz is allocated to the Mobile Service on a primary basis in Regions 2 and 3.	The propagation characteristics in 3.8-4.2 GHz make it relatively unattractive for Macrocell deployment. Small cells might be a more appropriate use of the spectrum. Sharing with existing services could be problematic. Additionally portions of these frequencies are used in some countries to backhaul mobile broadband traffic.
5350-5470 MHz	• These frequencies have propagation characteristics that are suitable for use in small coverage areas, both indoors and outdoors, within dense urban areas since it provides an opportunity for increased frequency reuse. • These frequencies are particularly suitable for massive multiple antenna techniques, e.g., higher order multiple antenna techniques, which increases system capacity and coverage because a large number of antenna elements can be implemented in smaller size in higher frequencies.	While there may be some specialized applications (e.g. RLANs and Wi-Fi) for these higher frequencies, Alcatel-Lucent does not believe the propagation characteristics lend themselves to IMT use; however, these frequencies would be appropriate for handling mobile broadband wireless backhaul traffic.
5875-5925 MHz	• These frequencies have propagation characteristics that are suitable for use in small coverage areas, both indoors and outdoors, within dense urban areas since it provides an opportunity for increased frequency reuse. • These frequencies are particularly suitable for massive multiple antenna techniques, e.g., higher order multiple antenna techniques, which increases system capacity and coverage because a large number of antenna elements can be implemented in smaller size in higher frequencies.	While there may be some specialized applications (e.g. RLAN and Wi-Fi) for these higher frequencies, Alcatel-Lucent does not believe the propagation characteristics lend themselves to IMT use; however, these frequencies would be appropriate for handling mobile broadband wireless backhaul traffic.

4. Contact Details

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