

**Comments on the Radio Spectrum Policy Group's Public Consultation
on the draft Opinion on Licensed Shared Access**

23 August 2013

6 Harmonics

Adaptrum

ARM

BskyB

Carlson Wireless

CSR Technology

CTVR, Trinity College Dublin

Google

InterDigital

Microsoft

Neul

Ruckus Wireless

Tanzania Commission For Science and Technology

Texas Instruments

Selcom Broadband Limited Brand UhuruOne

Draft RSPG Opinion on Licensed Shared Access: Response to Consultation

The signatory companies welcome this opportunity to respond to the Radio Spectrum Policy Group (RSPG) draft Opinion on Licensed Shared Access (LSA) and support the RSPG's efforts to enable an enhanced shared use of spectrum in Europe.

The need for a dramatic increase in public wireless access has been well established in many reports and forums. More specifically, the need to provide low cost, local and wide area internet access for diverse populations around the world is essential to global economic development. This challenge is largely constrained by the availability of wireless spectrum which is today greatly underutilized. New spectrum use policies must take into account this urgent need, the economic realities and the spectrum utilization challenges. In reviewing these policies, we feel that the fundamental questions to consider are:

- Will the policy increase the available spectrum for license-exempt use or open up underutilized licensed spectrum for shared license-exempt use?
- Will the policy offer minimal regulation to promote rapid and low-cost implementation of new infrastructure?
- Is the policy adaptable to a wide range of spectrum use and malleable to the advances in technology while requiring minimal regulatory intervention?
- Lastly, are the key goals and requirements of the policy aligned with the need for urgent and low cost access to the internet?

In this context we reviewed the LSA proposal and would like to share with you our concerns.

Overview

On the continuum of spectrum sharing regimes, LSA appears to sit somewhere between license-exempt collective use and secondary trading, both of which the RSPG notes are already permitted under European and some Member States' legislation. As we discuss in more detail below, with the right safeguards, LSA – much like license-exempt collective use – could potentially lead to more efficient and effective use of limited spectrum resources. The RSPG's draft Opinion represents a major mind-set shift from a static to a more dynamic way of thinking about spectrum and we welcome that new focus.

Nonetheless, the draft Opinion does leave some critical questions unresolved, both about the eligibility criteria for LSA and how LSA would be implemented in practice. Questions that need answering include: Under what circumstances does LSA become a more appropriate option than license-exempt collective use or reallocation and exclusive use licensing? What level of quality of service for both the primary and secondary users can be obtained through the use of LSA in comparison with license-exempt collective use? What kind of input should primary licensees have in deciding the economic and technical conditions under which secondary LSA access is permitted? Should European regulators also consider a framework such as the one recommended by the United States President's Council on Advisors for Science and Technology, which allows for three tiers of access to spectrum currently allocated to government incumbents – an incumbent tier, a secondary exclusive tier, and an unlicensed tier?¹ We believe that resolving these questions and addressing concerns arising from them is important as a next step in drafting regulations for LSA.

While these questions are being resolved, it is important that Member State regulatory authorities move forward with implementing greater license-exempt collective use. A spectrum policy that balances licensed

¹ PCAST report: [Realizing the full potential of government held spectrum](#), July 2012

and unlicensed approaches will maximise innovation and investment. Evidence shows that spectrum regimes that are over-reliant on licensing alone can induce uncertainty about spectrum availability and limit new investments in the sector, preventing the countries from capturing the rewards of broadband connectivity. This is significant because, as Richard Thanki notes in a recently released economic paper, "*the success of the license-exempt bands has been the most surprising and consequential change in the previous 15 years in spectrum management. The attendant economic benefits from license-exempt technologies are substantial, widely dispersed, and likely to exceed \$270 billion per annum globally.*"² Thanki further observes that the narrow bands authorised for license-exempt access have proven to be a remarkable success, now accounting for the majority of innovation in wireless communications, the majority of wireless devices manufactured, and the majority of Internet data traffic delivered to consumers. Thanki concludes that this success "*is bound to continue with more license-exempt access across a variety of frequencies, above and below 1 GHz.*"³

EU Member State regulatory authorities can build upon these successes by creating more opportunities for license-exempt access, across complementary bands such as UHF TV white spaces, 2.4 GHz, and 5 GHz. The characteristics of these bands offer different benefits, allowing devices and applications to trade off range, power consumption, and throughput. Dynamic spectrum access technologies and techniques, which are being implemented on a license-exempt basis in unused TV band spectrum (the "TV white spaces") and could also be used in other bands, will unlock spectrum's economic potential by reducing barriers to market entry, introducing new business models and allowing for the development of new technologies. The ecosystem created by the license-exempt collective use model, already demonstrated by vibrant growth of products and services facilitating access to unlicensed spectrum, will drive sustainable economic benefit for the EU on an on-going basis. With this track record and potential, we recommend that license-exempt collective use be expanded as a means of spectrum sharing in Europe, in addition to LSA.

License-Exempt Collective Use as a Motor for Innovation

Spectrum creates value in a number of direct and indirect ways. Broadband facilitates connectivity, which creates value through the provision of digital services, products, information, and business over the Internet. It generates revenues for government through tax receipts spurred by economic growth. It also provides enormous social benefits through the provision of public goods like education, healthcare and government services. Moreover, at a rapid rate, sensors and actuators, intelligence and connectivity are being incorporated in devices and objects around us including smart electricity meters, precision agriculture systems, healthcare and environmental monitoring and industrial process control networks. The economic potential of this Internet of Things lies in making existing processes more efficient as well as enabling entirely new applications. This value can only be enhanced if we ensure we make full use of the opportunities of spectrum, both in terms of economics and innovation. For example, today the economic value generated by mobile wireless and broadcast TV in the EU derives from the occupation of only a small portion of the total usable spectrum (2% of usable bands) yet mobile wireless alone contributes to GDP growth at an approximate rate of 0.6% per annum⁴.

In specific relation to LSA and license-exempt collective use, the signatory companies believe that the RSPG should take note of the volume of innovation and investment taking place in license-exempt bands as an

² Thanki, R., "Making the case for permissive dynamic access to the radio spectrum", August 2013

³ Thanki, R., "Making the case for permissive dynamic access to the radio spectrum", August 2013

⁴ Noam, E.M. "The Economists' Contribution to Radio Spectrum Access: The Past, the Present, and the Future." Proceedings of the IEEE 100, no. Special Centennial Issue (2012): 1692–1697. doi:10.1109/JPROC.2012.2187133.

indicator of the current and future economic growth trends in spectrum usage and technologies. To demonstrate the potential of this exciting technology, it has recently been estimated that “even using the highly conservative assumption that each license-exempt node generates only a tenth of the value of each licensed node, over 65% of the value of the Internet of Things would come from license-exempt devices – a figure equivalent to \$6.5 – 9.8 trillion of global GDP by 2030⁵.” We would advocate that the RSPG position Europe’s regulatory framework to take advantage of the clear momentum and future potential success of technologies based upon license-exempt collective use.

Historically, wideband license-exempt usage was first authorised in 1985, by the US Federal Communications Commission, at 900 MHz and 2.4 GHz, which were considered unsuitable for communications usage due to inundation by radiation from microwave ovens. These narrow license-exempt bands today account for the majority of innovation in wireless communications, the majority of wireless devices manufactured and the majority of Internet data traffic delivered to consumers. As a comparison between innovation in license-exempt and licensed technologies, the license-exempt collective use models have a clear lead. Digital signal encoding was introduced on license-exempt wireless LAN in 1985 and on licensed cellular networks in 1991; for spread spectrum it was 1991 vs. 1995; OFDM, 1999 vs. 2006; and, MIMO/Adaptive beamforming, 2004 vs. 2013. By way of further example, the license-exempt consumer technologies of Bluetooth and Wi-Fi are now ubiquitous in smartphones, tablets, notebook PCs and games consoles. Wi-Fi is on the verge of ubiquity in cameras, set-top boxes and televisions. Bluetooth has achieved near ubiquity in cars. The technology is also making rapid strides in the connected home, in areas such as lighting, locks and climate control.

These technologies have led to fundamental improvements to the range, capacity, reliability and cost-effectiveness of wireless communications, factors that have tremendously benefited consumers and businesses through higher quality products and services. The license-exempt collective use approach was crucial in generating these successes, and we would argue that for Europe the realisation of the full economic and technological potential of spectrum sharing remains dependent upon license-exempt collective use and its extension. This is a trend that is likely to continue due to the open nature of the license-exempt bands, which permits experimentation by large and small firms and allows these firms to sell their products directly to a large number of end users.

Looking forward, the most recent research suggests that in 2013 <2.5 billion devices will be sold that incorporate licensed connectivity (and the large majority of these will also feature a complementary license-exempt technologies) whilst >2.5 billion devices will be sold that use only license-exempt communication technologies. This disparity is set to increase over time⁶. If Europe intends to play a role in the services, devices and Internet of Things markets of the coming decade, it should have a regulatory framework that recognises the importance of these license-exempt communication technologies.

Therefore, whilst the implementation of LSA could spur development of new spectrum sharing technologies, we believe that there are strong arguments that license-exempt collective use should be fully explored as a mode of dynamic spectrum access. As shown by the past performance and current trends, non-discriminatory, license-exempt collective use drives tremendous innovation in fundamental technologies,

⁵ Thanki, R., “Making the case for permissive dynamic access to the radio spectrum”, August 2013

⁶ See “Report”; “Gartner: “For licensed devices we use Gartner’s estimate of 1.9 billion mobile phones shipped and that 20% of the 240 million tablets shipped will be mobile enabled. We further assume that the sales of every other device that uses licensed spectrum to communicate, from mobile base station cards and to televisions and radio receiver sets, ship less than 552 million devices – a safe assumption. For license-exempt devices we directly use ABI Research’s estimate that 5 billion chipsets incorporating at least one license-exempt technology will ship in 2013.

applications and business models. It also dramatically reduces the barriers to using spectrum and increases the positive competitive intensity across a number of industries.

Governmental Bands Appear the Best Candidates Use for LSA's Immediate Applicability

We agree with the RSPG's conclusion that initially major opportunities for application of the LSA concept would be in accommodating secondary use where the primary incumbent is a governmental user. While the LSA concept needs to apply to both commercial and governmental incumbents to be successful, we expect that the first steps towards implementing the approach in practice are likely to happen at the governmental level. Over the past two years, we have seen similar approaches start in other spectrum sharing initiatives internationally, for instance in license-exempt sharing of TV White Spaces. Likewise, the US Federal Communications Commission is proposing a form of licence-exempt and licence-shared access to be used in the 3.5-3.65 GHz spectrum, which currently is used primarily by government users. In the US, a similar LSA proposal has been put forth for the 1.755-1.85 bands. Indeed, we would recommend the European regulators look at these approaches in order to see immediate results.

License Shared Access and Quality of Service

The opinion asserts that LSA will provide a controlled environment enabling enhanced shared use of spectrum otherwise not available and that LSA should be used to grant spectrum rights of use in specific bands on a shared and licensed basis, ensuring predictable quality of service for all rights holders and consumers. It therefore seems the key distinction implicitly being made between LSA and license-exempt collective use is the need to ensure that both the primary and secondary users can deliver quality of service to end users. We are of the opinion that license-exempt collective use can provide a similar quality of service experience when in a controlled environment as explained below.

As a specific example of how license-exempt collective use-related dynamic access technologies can manage coexistence between different services, geolocation databases have emerged as a critical and reliable interference protection mechanism to underpin dynamic spectrum sharing. Moreover, network planning and management techniques designed to deliver a high quality of service can be used in deploying networks relying upon license-exempt spectrum. Other techniques used by radios in licence-exempt bands to improve quality of service include power control, listen-before-talk, and autonomous sensing. Many of these technologies and techniques have been demonstrated in trials and pilots around the world, including in Finland, the US, the UK, Singapore, and South Africa, where their use has been proven to minimise interference from license-exempt shared access systems to primary incumbent services and deliver a controlled environment.

Furthermore, the quality of service provided by license-exempt technologies is likely to satisfy many if not most users. It is the license-exempt Wi-Fi that delivers the majority of the world's Internet data traffic. In the case of smartphones and tablets, Wi-Fi carries 69% of total traffic generated. For traditional PCs and laptops, Wi-Fi is responsible for carrying 57% of total traffic, greater than the share of Ethernet connections and 3G data combined⁷. Such license-exempt connectivity, offering both high throughput and low latency, is not just limited to latency-tolerant data applications. Latency-sensitive applications, such as online gaming and video conferencing, increasingly occur over license-exempt connections. Given the increasing demands on spectrum, consumers' increased use of and preference for license-exempt connectivity indicates that adequate quality of service can be and is being delivered.

⁷ Thanki, R., "Making the case for permissive dynamic access to the radio spectrum", August 2013

Ease of market entry

We fully support RSPG's objective of preserving fair competition and upholding consumer interests and we welcome this initiative as an important first step towards increased spectrum sharing. We particularly support the assumption that spectrum assigned through shared access can generally be made available on the market more rapidly, compared to spectrum being made available through licensing, be it for exclusive use or otherwise.

Furthermore, we believe that spectrum sharing can in fact play a critical role in clearing various spectrum bands, a process that has so far typically proven both slow and costly, often requiring payments to incumbents to move to other bands, and taking years and sometimes even decades to accomplish. Spectrum sharing approaches, in particular license-exempt collective use, could play a critical role in ensuring spectrum becomes available on the market more rapidly, through a constant recycling of the bands. License-exempt collective use could also help the market match demand with available capacity, reducing the need for traditional exclusive use spectrum assignments while easily accommodating changes to license assignments. Rather than the introduction of each new technology requiring the retirement of an older technology and clearing of the corresponding frequency band, a system driven by license-exempt collective use would allow for the ebb and flow of technological advancement, with new iterations seamlessly replacing older wireless devices.

Harmonisation across EU28

Finally, the development of pan-European services in an objective, transparent and non-discriminatory manner almost takes for granted a key predicate: that spectrum frequency allocation should be harmonised across the continent. This is of critical importance in license-exempt collective use of spectrum and LSA and we would like to see it further considered in RSPG proposals. This approach, underpinned by reliance on internationally accepted voluntary standards, including those developed by ETSI, as well as principles of technology neutrality and interoperability, will ensure that spectrum sharing delivers seamless roaming across Member State borders and allows businesses to build economies of scale, both of which are central to maximising the economic potential of spectrum.

Although harmonisation is necessary, it is important, as per Section 4.B, that regulators do not attempt to dictate the specifics of the technology. Instead they should allow industry to continue creating new and improved solutions over time. In other words, it is critical that any harmonised regulatory framework is technology-neutral in order to be future-proof. Given the stage of development of both spectrum access technology and regulation, the RSPG has a unique opportunity to build the necessary flexibility into the foundations of the EU regulatory system.

Conclusion

In the right circumstances and with the right level of regulatory oversight, LSA could lead to more efficient and effective use of limited spectrum resources. We however believe that the RSPG should also encourage the robust use of license-exempt collective use technologies, across complementary bands. By almost any measure, technologies stemming from license-exempt collective use have represented a remarkable success, accounting for the majority of innovation in wireless communications, the majority of wireless devices manufactured and the majority of internet data traffic delivered to consumers today and hold

enormous promise for the Internet of Things. With this track record, we recommend that license-exempt collective use be fully employed as a means of sharing spectrum in Europe, and LSA being adopted under well-defined circumstances.

We would welcome greater discussions around the possibilities for license-exempt collective use at the EU, as well as Member State levels. All of us are willing to work with the regulators and share our knowledge and expertise in this space to ensure we arrive to workable long-term solutions. We would also encourage administrations and regulators to share their expertise and experience amongst each other to encourage a faster uptake of efficiency-producing solutions and a speedier development of this nascent industry.