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# The economic benefits of LSA in 2.3 GHz in Europe

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Executive summary  
of a report for  
Ericsson, NSN and  
Qualcomm

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## About Plum

Plum Consulting is a specialised consulting firm offering strategy, policy and regulatory advice on telecoms, online and spectrum issues. We draw on economics, our knowledge of the sector and our clients' perspectives to deliver soundly based solutions to problems. We are an international leader in advising on spectrum policy and regulation. We work in many countries in Asia, Africa, the Americas and Europe on issues affecting all uses of spectrum. Our clients include telecoms operators, regulators, equipment vendors, broadcasters and online service providers. Many of our reports are published and can be seen at <http://plumconsulting.co.uk/publications>.

## Preface

Mobile communications over the last few decades has contributed significantly to the economic and social developments in Europe and other parts of the world. As today's world is powered by information, the opportunities created by Information and Communication Technology (ICT) are one of the main impacting factors on how society is evolving. Given that the Internet has become an indispensable tool in everyday life, access to the Internet on the move with ever growing bandwidth requirements is also expected to become a key fundament of society. In many ways the mobile internet will be the 21st century equivalent of train tracks and roads in the 19th and 20th century: the prerequisite for but also a main trigger of economic growth.

Spectrum availability is the key enabler of mobile broadband. It is not just a question of spectrum being available, but it is critical for spectrum to be available in a timely and harmonized manner. Further, mobile broadband relies on exclusive spectrum to provide Quality of Service (QoS). Europe has precious assets in the race towards mobile digital innovation, including its large population and its technological expertise. But Europe also faces a unique challenge due to the widespread range of legacy spectrum use in various states. In particular, the important 2.3-2.4 GHz frequency band is not currently used in Europe to provide mobile broadband services; rather it is mainly used by a mix of amateur services, Programme Making and Special Events (PMSE) and government use.

Licensed Shared Access (LSA), or Authorised Shared Access (ASA), has been identified by the RSPG and the CEPT as one of the key tools to overcome the European spectrum challenge. LSA can provide the best of both worlds, by unlocking bands in a harmonized manner at European level while maintaining flexibility at national level. LSA is a national and voluntary decision and delivers predictable quality of service. LSA is a complementary solution for mobile network operators to access spectrum when critical incumbent uses cannot be vacated from a frequency band. It enables world-class mobile infrastructure on the 2.3-2.4 GHz frequency band that can unlock European innovation potential for connected products and services. Thus, LSA can contribute to achieving the targets of a Digital Single Market.

The 2.3-2.4 GHz band - a band harmonized for mobile broadband at international level - is used by many important services in some European countries, while being hardly used in other countries. This study demonstrates the significant benefits the 2.3-2.4 GHz band can deliver for mobile broadband Europe-wide if it is unlocked by LSA. Ericsson, NSN and Qualcomm encourage European regulators to consider the study and its findings as a direct call to make the 2.3-2.4 GHz band available for mobile broadband to benefit Europe through maximizing the economic contribution of this valuable spectrum. Though the report focuses on the direct economic benefits of the approach, there is little doubt that the indirect benefits would be much greater from Europe taking global lead in implementing innovative and sustainable spectrum access methods.



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## Executive Summary

The 2.3 GHz band was identified for IMT services at a global level at WRC-07. It has been standardised for LTE TDD by 3GPP. In Europe the band is not currently used to provide mobile broadband services; rather it is mainly used by a mix of amateur services (secondary), government use (e.g. military, including aeronautical telemetry, emergency services and wireless cameras) and PMSE applications (video links, wireless cameras)<sup>1</sup>. CEPT and ETSI have each initiated regulatory activities aimed at harmonising the band for mobile broadband services in Europe, including developing guidelines for the implementation of Licensed Shared Access (LSA) in the band. The Radio Spectrum Policy Group (RSPG) adopted an opinion on Wireless Broadband spectrum in June 2013, including 2.3GHz spectrum, and in November 2013 adopted an Opinion on Licensed Shared Access. This study commissioned by Ericsson, NSN and Qualcomm is intended to provide an input to these regulatory activities.

## What is Licensed Shared Access?

Licensed shared access is a regulatory framework for licensed sharing of bands that are already assigned to a user(s) where the additional user is granted access through an individual authorisation scheme following the terms set out in the Authorisation Directive<sup>2</sup>. This framework has the following key features<sup>3</sup>:

- **Voluntary:** The terms and conditions of any access to the band by a new user(s) would be agreed between the incumbent user, the new user(s) and the regulator on a voluntary basis.
- **Mutually beneficial:** Both the incumbent and the new user(s) need to have incentives to engage in a sharing arrangement.
- **Legal certainty and quality of service:** The new user in the band has exclusive licensed access to the spectrum on the terms and conditions specified in its licence. Incumbent and new user(s) systems will receive protection from harmful emissions. The new licensee(s) would be of equal status to the incumbent.
- **Harmonised bands:** To create and take advantage of scale economies, the bands in question are likely to be harmonised for uses requiring significant additional spectrum access, in particular for mobile broadband services.
- **Compatible with European regulation:** The involvement of the regulator is required to ensure the terms and conditions of access are compatible with the Authorisation Directive and any EU or ECC measures prescribing least restrictive technical conditions for use of the band.

It is important to be clear that LSA is not about opportunistic access to a band through cognitive radio or radio environment sensing, unlicensed access to a band, access to a band on a secondary basis or spectrum trading.

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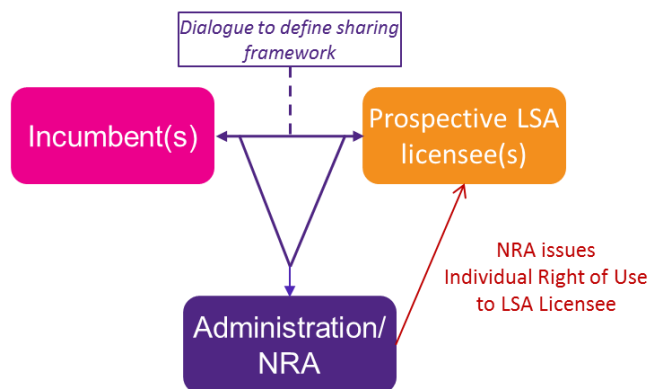
<sup>1</sup> The current and intended use in 40 CEPT countries is given in the ECC document FM (12)017rev1, 13 April 2012.

<sup>2</sup> Directive 2002/20/EC

<sup>3</sup> The definition given by ECC is given in draft ECC Report 205 (October 2013) which can be found at <http://www.cept.org/ecc/tools-and-services/ecc-public-consultation>; The definition given in the RSPG Opinion on LSA (November 2013) can be found at <https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp>

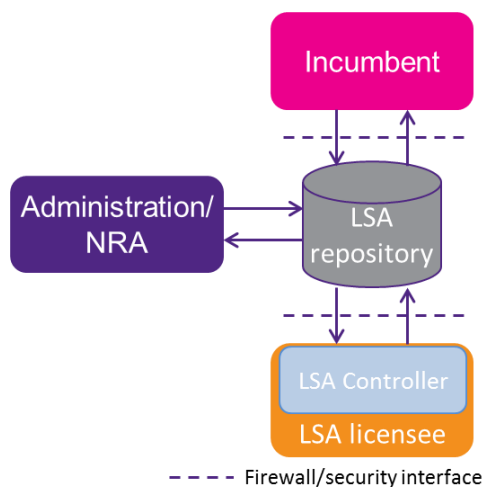
The administrative and functional implementation of LSA in the 2.3 GHz band is envisaged to be as shown in Figure 1 and Figure 2, respectively.

**Figure 1: Administrative implementation of LSA**



Source: Draft ECC Report 205

**Figure 2: Functional implementation of LSA**



Source: Draft ECC Report 205

## What is the extent of the sharing opportunity at 2.3 GHz?

The current and expected future use of the 2.3 GHz band was surveyed by CEPT in 2012. The survey showed that current use varies by country and includes one or more of government use (e.g. military, including aeronautical telemetry, emergency services, wireless video link) and PMSE applications (video links, ENG) and amateur services (secondary)<sup>4</sup>. In terms of future use of the band the CEPT survey showed that of the 40 countries surveyed 43% planned to use some or all of the band for BWA or mobile services while 30% had no plans to change the use of the band and 27% were uncertain about the future use of the band.

<sup>4</sup> The current and intended use in 40 CEPT countries is given in the ECC document FM(12)017rev1, 13 April 2012.

The extent of current use of the band by frequency, geography and time is not reported by the CEPT survey. To quantify the scale of current use and so the sharing opportunity, we contacted stakeholders in Finland, France, Germany, Ireland, Italy, Sweden and the UK. In the case of Germany, there is growing use of the band by the incumbent uses and no specific activity to address sharing through LSA<sup>5</sup> at this stage. The anticipated role of LSA in the other six countries is as shown in Table 1.

**Table 1: Access to the 2.3 GHz band under LSA in six case study countries**

| Country | Nature of sharing envisaged                  | Role of LSA                                | Availability for mobile services   |
|---------|--|--|--|
| Finland | Sharing by frequency, location and time      | To protect incumbent PMSE use              | 85 MHz available for 90% of the time; 15 MHz on a geographically limited basis |
| France  | Sharing by frequency and location            | To protect incumbent defence use           | 80% band in areas covering 80% population                                      |
| Ireland | None – incumbent uses not expected to remain | None                                       | 100MHz for all population  |
| Italy   | Sharing by frequency                         | To protect incumbent defence and fixed use | 85MHz on a national basis and 15Mhz on a geographically shared basis           |
| Sweden  | Sharing by frequency and location            | To protect incumbent defence use           | 100MHz in all inhabited areas – exclusion in uninhabited area                  |
| UK      | None   | None expected before 2022                  | 40 MHz exclusive, sharing for 20MHz only considered in the longer term         |

Source: Interviews with stakeholders, Plum analysis

Table 2 shows the estimated availability in terms of bandwidth and equivalent population coverage<sup>6</sup> of the spectrum that can be expected for CEPT (less Russia, Turkey and CIS states)<sup>7</sup> on average. The first year of availability of the 2.3 GHz spectrum is taken to be 2015. The equivalent population coverage increases over time as some applications (e.g. fixed and some defence uses) use spectrum more efficiently and/or are migrated to other bands.

<sup>5</sup> See FM52(13)23 - Germany - Frequency utilisation of the band 2300 - 2400 MHz.

[http://www.cept.org/Documents/fm-52/10612/FM52\(13\)23\\_Frequency-utilisation-in-Germany-of-the-band-2300-%E2%80%93-2400-MHz](http://www.cept.org/Documents/fm-52/10612/FM52(13)23_Frequency-utilisation-in-Germany-of-the-band-2300-%E2%80%93-2400-MHz)

<sup>6</sup> Equivalent coverage population is population coverage that takes into account the amount of time that the spectrum is available for use in the coverage area. For instance, if the spectrum is shared with PMSE incumbents, who need the spectrum 10% of the time on an exclusive basis across the country, and the population coverage of the spectrum is 100%, then the equivalent population coverage is 90% of the time x 100% of population = 90%.

<sup>7</sup> Only some Central and Eastern Europe countries are included in our CEPT region. These are Albania, Belarus, Bosnia & Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Slovak Republic, Slovenia and Ukraine. Western European countries that we include in our definition of the CEPT region are Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Andorra, Gibraltar, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Liechtenstein, Monaco, United Kingdom and Greenland.

**Table 2: Comparison of estimated population x time coverage of 80 MHz<sup>8</sup> of the 2.3 GHz band with and without LSA implementation**

| Parameter  | 2015 | 2020 | 2025 | 2030 |
|--|------|------|------|------|
| Equivalent population coverage <u>with</u> LSA                 | 71%  | 83%  | 84%  | 84%  |
| Equivalent population coverage <u>without</u> LSA <sup>9</sup> | 1%   | 17%  | 17%  | 17%  |

Source: Plum analysis

## The case for LSA at 2.3 GHz

Our analysis shows that there will be potential demand for spectrum at 2.3 GHz to support future mobile broadband traffic i.e. that demand will exceed current and planned future spectrum supply in many locations. Without LSA only a minority of countries in Europe would be able to offer access to the 2.3 GHz band. In particular, an ECC harmonisation measure could not be implemented without LSA<sup>10</sup>. The resulting market would not be sufficiently large for major operators to deploy the band and for vendors to manufacture European handsets supporting the band. This is because it will not include some core European markets e.g. Germany, France, Spain and the Netherlands.

The benefits offered to MNOs and possibly other operators by LSA and the 2.3 GHz band are reduced network costs or the opportunity to generate additional revenue from customers, who are interested in high capacity/low cost plans. In the latter case, the new product would also confer benefits in the form of increased consumer surplus – i.e. consumers' willingness to pay for the product over and above the price they pay for it.

Shared use of 2.3 GHz will therefore complement planned exclusive release of the band in parts of Europe. This will help to deliver the Europe-wide scale that European operators need to implement the 2.3 GHz band and to place orders for devices that support the band.

## Benefits and costs of LSA at 2.3 GHz

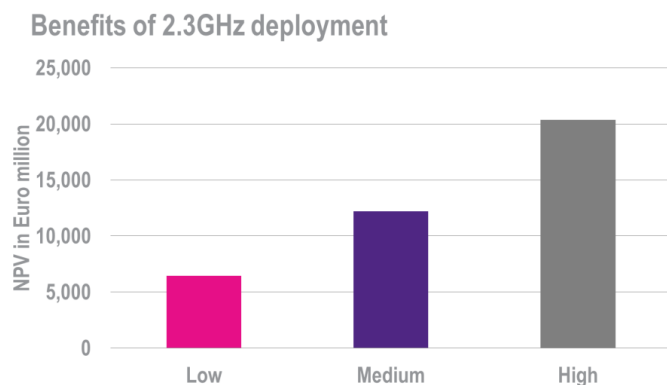
The availability of 2.3 GHz with LSA on a harmonised basis across Europe is estimated to yield significant net benefits - ranging from EUR 6.5-22 billion as shown in Figure 3. The costs of making the spectrum available are relatively small – around EUR 50 million plus administrative costs while our medium estimate of the benefits from savings in infrastructure costs is around EUR 12 billion. We find the need for the band to help support peak traffic demands varies considerably by country, largely because of differences in traffic levels.

<sup>8</sup> To allow for the same uplink and downlink capacities over TDD frequencies, we assume 2/3 of the bandwidth is used for downlink transmission. Therefore, given a total of 80 MHz of usable bandwidth in the 2.3 GHz band, 53 MHz is the downlink bandwidth.

<sup>9</sup> A few relatively small countries (e.g. Ireland and Sweden) have plans to release the entire band in the absence of LSA.

<sup>10</sup> Other countries have important incumbents that will remain in the band in the future, and therefore could not agree to an ECC Decision harmonising the band exclusively for mobile/fixed communications networks (MFCN).

Figure 3: Range of net benefits from availability of 2.3 GHz under LSA



Source: Plum Consulting

Qualcomm, NSN and Ericsson also asked Plum to consider an alternative scenario, where per-capita mobile data consumption in Europe catches up with the US by 2018. Under this scenario, the benefits could amount to EUR 30 billion.

In circumstances where operators are not capacity constrained the band might be used by an incumbent or possibly a new entrant to stimulate demand through a new low-cost, high-capacity service. A conservative estimate of the consumer benefits this service might offer if it were widely deployed is EUR 2.3 billion. However, it should be noted that this benefit cannot be directly added to the benefits from infrastructure cost savings, as operators can either use the spectrum to relieve capacity constraints or serve a new product market.