



Date: 22 October 2014.

To

Shri Arvind Kumar  
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New Delhi - 110002.

**Regarding: Consultation Paper on Delivering Broadband Quickly: What do we need to do? (12/2014).**

Ericsson welcomes the opportunity to offer comments on the TRAI consultation paper on *Delivering Broadband Quickly: What do we need to do? (12/2014)*, released on 20, September 2014.

The responses have been drafted keeping in view the current status of the networks and indicative trends in network evolution. The document contains only the questions responded by us.

Our endeavor has been to propose a roadmap for expansion of broadband ecosystem in India along with global best practices to expedite such transformation.

For Ericsson India Pvt. Limited

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**Ericsson India Ltd. response to:**

**TRAI Consultation Paper on Delivering Broadband Quickly:**

**What do we need to do?**

**(12/2014)**

**Issues for Consultation**

**Q2. What are the impediments to the deployment of wireless technologies in the access network? How can these deployments be made faster? Please reply separately for each technology.**

Response:

India is well suited for deployment of wireless technology for broadband access. We have seen this in the voice era and can confidently say that wireless was the main reason why teledensity of where we are now is achieved.

With the advent of next generation wireless broadband technologies, data will also be dominantly carried over wireless in our country.

While there exist clear advantages of wireless technologies, there are two key factors that deserve close attention, viz.:

- a) Unmitigated demand for wireless capacity is a reality and its growth is exponential. However, as we all know, there is no corresponding growth in the availability of spectrum suitable for delivering mobile services (Countries where broadband access is wireless have quite large bands of spectrum that are made available).
- b) The global adoption of mobile telephony and the rapid growth of broadband have promoted the flow of ideas and goods in a global environment. ICT has changed the way people obtain information, communicate, have fun, do business, work and study. A society's success and growth depends on its capacity to harness its technological transformations. For instance, there is a strong link between ICT maturity and the triple bottom line benefits of economic, societal and environmental sustainability, but the scope of those benefits is not automatic.

We believe, technology per se is not a constraint, is rather a positive enabler. Broadband enabling technologies are abundantly and readily available. Some of the impediments to broadband growth are summarized below –

End terminals	Availability of smart phones, desktops, laptops in rural areas due to cost concerns is an impediment
Spectrum	<ol style="list-style-type: none"> <li>1. High cost of spectrum</li> <li>2. Availability of non-contiguous spectrum</li> <li>3. Active sharing would drive costs down in Access</li> </ol>



	4. High coverage bands like APT 700 (698MHz – 806MHz) would support rural broadband
Access	1. The availability of copper last mile and its quality is very low in rural areas. 2. Challenges in site availability and high site acquisition costs 3. Infra / Power availability issues need resolution
Backhaul	1. Availability of fibre in rural areas 2. MW spectrum issues due to link by link coordination and site availability 3. Cost and hassles in ROW for fibre laying
Business models and market forces	1. Low subscriber density and low ARPU potential in rural segment 2. Lack of vernacular & relevant content for rural populace 3. Complex field operations due to scattered low density Access POPs
Infrastructure	Poor grid and supply availability and high diesel costs
Policy & Regulation	1. An incentive model may be devised to motivate local entrepreneurship to create local ASPs at rural level. 2. Lower spectrum bands like 700MHz would provide cost advantage for rural broadband 3. There is need to promote awareness about Internet benefits, and its positive impact to life and ease of usage and to create minimum digital literacy in rural segment 4. Governmental initiatives for networked society such as eGovernance/eHealth/eEducation/eAgriculture/Citizen-Services/ Mobile-Money etc. would prove a great catalyst for uptake of mobile in all demographics

**Q7. Are PSUs ideal choices for implementing the National Optical Fibre Network (NOFN) project?**

Response:

Private sector should be encouraged to complement the efforts of PSUs to achieve the national aim for broadband connectivity and inclusive growth. Competent companies with proven track record in respective domain would support expedite the project for broadband infrastructure roll out and operational management alike.

**Q8. Should awarding of EPC turnkey contracts to private sector parties through International Competitive Bidding (ICB) be considered for the NOFN project?**

Response:

In continuity to the response to Q7, leveraging the strengths of private sector would expedite completion of this ambitious project. ICB can be one of the effective ways of doing so.

**Q9. Are there any ways in which infrastructure development costs can be reduced? Is it possible to piggyback on the existing private sector access networks so as to minimize costs in reaching remote rural locations?**

Response:

An increasing number of countries are enshrining with clear agreement on shared objectives for delivery of public infrastructure and/ or public services in sectors which are effectively regulated or where there is extensive private sector initiative, such as in Telecoms.



PPP model or piggyback on the existing private sector access networks so as to minimize costs in reaching remote rural locations will be in the national interest to reuse the existing public and private infrastructure optimally to catalyze project completion speed as well as to avoid creating redundant infrastructure.

**Q12. Should the Government consider framing guidelines to mandate compulsory deployment of duct space for fibre/ telecommunications cables and space for telecommunication towers in all major physical infrastructure construction projects such as building or upgrading highways, inner-city metros, railways or sewer networks?**

Response:

A comprehensive, futuristic and integrated planning is indispensable to avoid costly rework and delays in implementation. In fact the government may plan that all utility requirements are catered to at one go. A single nodal agency may be mandated to ensure compliance before giving permissions to civic projects as per Master Plan. A town planning blueprint must be prepared for non-negotiable compliance in all states under which no road is planned without laying of fibre ducts underground for at least 20 years' requirements.

**Q16. What are other spectrum bands which can be unlicensed for usage of Wi-Fi technology or any other technology for provision of broadband?**

Response:

Mobile broadband is playing an increasingly important role in our daily lives. It is changing the way we are entertained, educated, working and sharing information. It has the power to improve the quality of our lives.

Mobile broadband presents greater opportunities for operators in both mature and new markets. To meet the ever-increasing user demands of the mobile broadband experience, networks need to be smart, simple, scalable and deliver superior performance. The opportunities for growth are exceptional.

Current indoor wireless solutions will not enable operators to address the broad range of buildings and venues that they are targeting as they seek to grow their current mobile business and expand in enterprise.

The new technology solutions (HetNet, Small Cells, Radio Dot, License Assisted Access using LTE , WiFi etc. ...) enables mobile operators to deliver consistently high performance voice and data coverage and capacity in the broadest range of enterprise buildings and public venues, including the underserved, high growth, medium-to-large building and venue category.

**Coverage in Cities:**

- Majority of mobile traffic originates in cities
- Urban users expect instant and reliable access to apps wherever they go
- Measurement in Stockholm shows that the most frequent users interact with their smartphone more than 150 times a day, or an average of every 7 minutes during daytime.

**The challenge:**

- It's a challenge to provide good Application coverage in cities, both outdoor and indoor (due to its environment, population density, structural conditions, etc.)
- Ericsson Consumerlab research shows that some areas have less satisfactory app coverage according to users perception and that citizens notice the difference between voice coverage and Internet (App) coverage
- Satisfaction with internet coverage is limited in locations that are frequently visited by city dwellers. Public transportation has the lowest satisfaction with both voice and internet coverage. And difference in satisfaction level between voice and internet coverage is largest at indoor locations like shopping malls and restaurants

**Downlink speeds in cities:**

- Using speedtest.net measurements and map the 90% probability to experience a certain minimum downlink throughput speed in seventeen different cities shows that app coverage is poor in many cities
- All cities are unique and provide different conditions for operators to be able to offer sufficient network performance. There is a large difference between peak (10%), median (50%) and 90% probability downlink speeds in all cities. If the end-users expectation is that the app should be possible to run anywhere in the city, with a 90% probability, the downlink speed is in range of 100's of Kbps, but only momentarily experience top speed (10%) or median (50%) speeds that could be in range of 10's of Mbps

**Key takeaways:**

- The network performance experienced by the user is also influenced by the number of other active users/people density, spectrum availability and the demands their apps place on the network at any given time. The wide variance in radio performance means that KPIs for managing user experience cannot be limited to peak or even median downlink throughput speeds. To allow a high probability (e.g. 90 percent) of receiving a targeted network performance level, radio networks need to be deployed with site-to-site distances that can enable an acceptable service out to the radio cell edge.

**Heterogeneous** network solutions will address capacity and coverage demands in the most challenging areas. In city centers, transport hubs and business parks these network solutions will provide subscribers with a truly mobile lifestyle.

**Efficient use of spectrum:** This challenge can be met with a heterogeneous network solution building on a strong interaction between every element in RAN and backhaul, thus providing both performance and cost efficiency. The key is to use available spectrum in the most efficient way.



A three step approach where the combination and timing must be determined for each operator:

### Improve:



Improve the existing macro layer using our lineup of new digital units, radio units and antenna configurations in existing sites. This is an attractive way to increase coverage, capacity and data rates as it doesn't require new sites.

### Densify:



Densify the macro layer by adding more small, lightweight macro cells that installs on walls or poles. This keeps the total number of sites relatively low resulting in low total cost of ownership.

### Add Small Cells



Add small cells in additional layers as a complement to the macro layer. The small cells may be based on 3GPP standard (micro cells, pico cells or low-power remote radio units, RRU's) and License Assisted LTE / Wi-Fi. The performance will depend on how strongly the small cells can be integrated with the macro network.

## Mobile backhaul for heterogeneous networks

To support a good end user experience, the backhaul needs to be planned and deployed according to the requirements of the mobile services it is intended to carry. To densify the macro layer, scalable optical and microwave nodes are needed. To add small cells, compact all outdoor microwave solutions are the fastest and most cost efficient way to provide backhaul. Existing fiber and copper infrastructure can and will be re-used.

## Meeting mobile broadband expectations with maximum efficiency

As the Networked Society takes shape, providing the right user experience is a top priority for operators. Bandwidth-hungry applications on smartphones, tablets and other connected devices are driving figures for data traffic sky high. Heterogeneous networks efforts to improve and densify existing mobile broadband infrastructure together with added small cells are important when meeting ever-increasing user expectations.

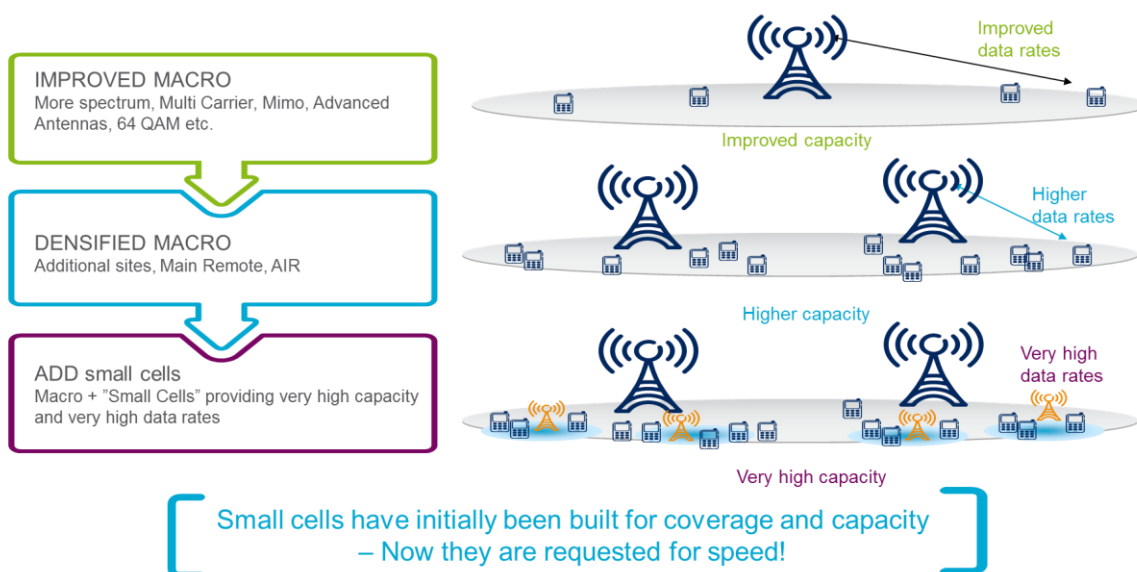


## Customer situation

Current indoor wireless solutions will not enable operators to address the broad range of buildings and venues that they are targeting as they seek to grow their current mobile business and expand in enterprise.

The Radio Dot System enables mobile operators to deliver consistently high performance voice and data coverage and capacity in the broadest range of enterprise buildings and public venues, including the underserved, high growth, medium-to-large building and venue category.

## HETNET FOR ENHANCED COVERAGE, CAPACITY & SPEED



### Q17. How much spectrum will be required in the immediate future and in the long term to meet the target of broadband penetration? What initiatives are required to make available the required spectrum?

Response:

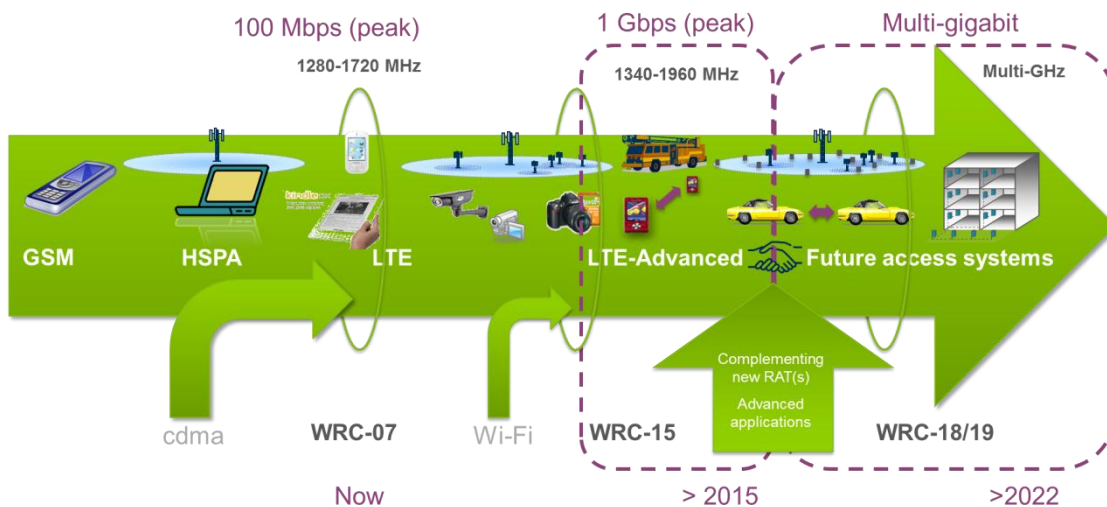
The technology evolution is taking place at fast pace to respond and meet the 10x capacity demands by 2020. Action is happening on two dimensions-

1. Improving spectrum efficiency of radio technologies
2. New spectrum identification for IMT

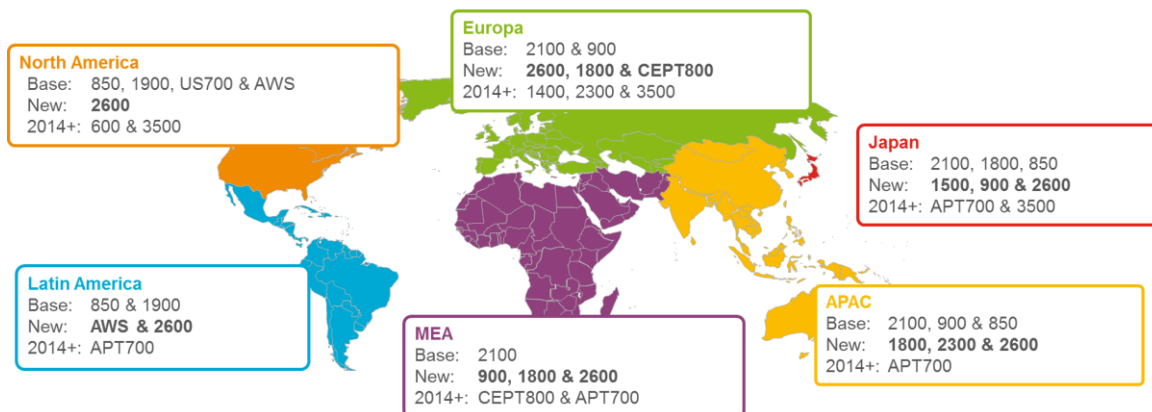
ITU WRC-15 agenda item 1.1 consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications



# THE TECHNOLOGY EVOLUTION



## SPECTRUM FOR MOBILE BROADBAND - REGIONAL MAINSTREAM HSPA & LTE DEPLOYMENTS



### Spectrum needs – IMT

#### Allocation of more spectrum to the Mobile Service, and Identification to IMT

- › Spectrum estimates delivered to the ITU-R JTG 4-5-6-7 by WP 5D, a need for a total amount of:
  - 1340 MHz (low user densities)
  - 1960 MHz (high user densities)
- › Now published in [Report ITU-R M.2090](#) “Future spectrum requirements estimate for terrestrial IMT”
- › Target spectrum range 470 – 6425 MHz; providing different properties
- › Preferred block size: 40+40 MHz (FDD), 40 MHz (TDD)
- › Spectrum to be found in contiguous blocks, to the extent possible





## High level view of WRC-15: Objectives

- to provide sufficient bandwidth for very high-speed, of the order of 1 Gbit/s, and for capacity-hungry applications e.g. streaming video
- to fulfil coverage needs, preferably in bands below 1 GHz, for the favourable radio wave propagation conditions
- for both urban and rural areas, particularly for cost efficient coverage in sizeable rural areas, and for good (deep) indoor coverage
- to bridge the digital divide between regions / countries, and also within countries

## Bands under discussion

- 470 – 694/698 MHz
- 1350 – 1518/1525 MHz
- 1 695-1 710 MHz:
- 2700 – 2900 MHz
- 3 300-3 400 MHz:
- 3400 – 3500 MHz
- 3500 – 3600 MHz
- 3600 – 4200 MHz
- 4 400-4 500 MHz
- 4 500-4 800 MHz
- 4 800-5 000 MHz
- 5 350-5 470 MHz (RLAN)
- 5850-5925 MHz (RLAN)
- 5 725-5 850 MHz (RLAN)
- 5 925-6 425 MHz

## RLAN (radio local area networks) Spectrum

- › An amount of 880-2020 MHz of RLAN spectrum based on traffic demand in the year 2018 has been estimated by WP 5A ([JTG4-5-6-7/137](#)), including the bands already in use according to Resolution 229 (Rev.WRC-12), i.e., 5150-5250 MHz, 5250-5350 MHz and 5470-5725 MHz.
- › Suitable frequency ranges ([JTG4-5-6-7/137](#)) or bands:
- › 5350 – 5470 MHz (120)
- › 5850 – 5925 MHz (75)
- › Parameters for RLAN to be used in the sharing studies ([JTG4-5-6-7/108](#))

We would like to provide an update on new Bands and their commercial readiness for deployment:

- › LTE enters new spectrum bands and grow into already established bands
- The 700 MHz & 800 MHz coverage bands (UHF bands),
- The 1800 MHz, AWS, 1900 MHz, 2.6 GHz (FDD/TDD) and 2.3 GHz (TDD) capacity bands.



## A. 3.5 GHz Radio Solutions

3.5 GHz is a standardized 3GPP band, trials ongoing now in 2014 with commercial availability in H2 2015, supporting both LTE TDD and FDD from RBS, macros to small cells

### Deployment scenarios

- Start 3.5 GHz deployment on macro grid
- Add small cells for traffic hot-spots
- Carrier Aggregation for inter-layer coordination for best end user experience

## 3.5 GHZ ON ALL LAYERS

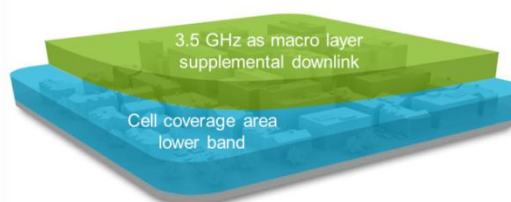
### Deploy 3.5 GHz as high band macro layer

More than 90% coverage for dense urban  
Use lower band for downlink and uplink  
3.5 GHz small cells added for hot spot relief and indoor

### Supplemental Downlink as option for some markets

3.5 GHz for extra capacity on downlink only  
Improves inter-operator co-existence  
Maximizes user-bitrate and spectral efficiency

Inter Site Distance	Users covered by 3.5 GHz
300 meters	100.0%
500 meters	96.5%
700 meters	92.5%



## B. SDL (Supplemental Downlink) - 1400 MHz<sup>1</sup>

A supplemental downlink uses unpaired spectrum to enhance the downlink capability of mobile broadband networks by enabling significantly faster downloads and supporting a much greater number of users with mobile or portable wireless devices. Supplemental downlink and carrier aggregation are now enabled in the HSPA+ and LTE-Advanced standards.

The technology allows the bonding of the usual downlink with a *supplemental* downlink channel(s), in a different band, into a single wider downlink channel. This provides an efficient way of using spectrum because consumption of rich content and other data heavy applications is asymmetric. There is much more traffic on the downlink than on the uplink over mobile broadband networks.

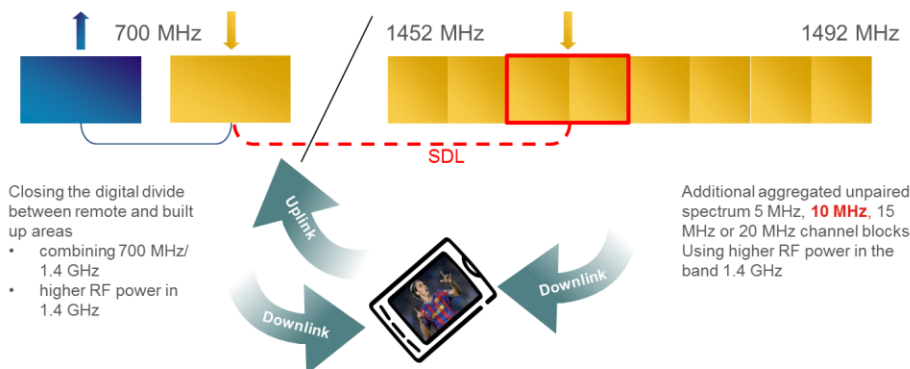
A network implementing a SDL uses a wider channel for the downlink than for the uplink, by aggregating the usual downlink with a *supplemental* downlink channel. Using an additional downlink channel enables faster download speeds for mobile or portable wireless devices and support for a greater number of users,

<sup>1</sup>([http://www.plumconsulting.co.uk/pdfs/Plum\\_Oct2012\\_The\\_economic\\_benefits\\_from\\_deploying\\_1.4\\_GHz\\_spectrum\\_in\\_the\\_MENA\\_region.pdf](http://www.plumconsulting.co.uk/pdfs/Plum_Oct2012_The_economic_benefits_from_deploying_1.4_GHz_spectrum_in_the_MENA_region.pdf))



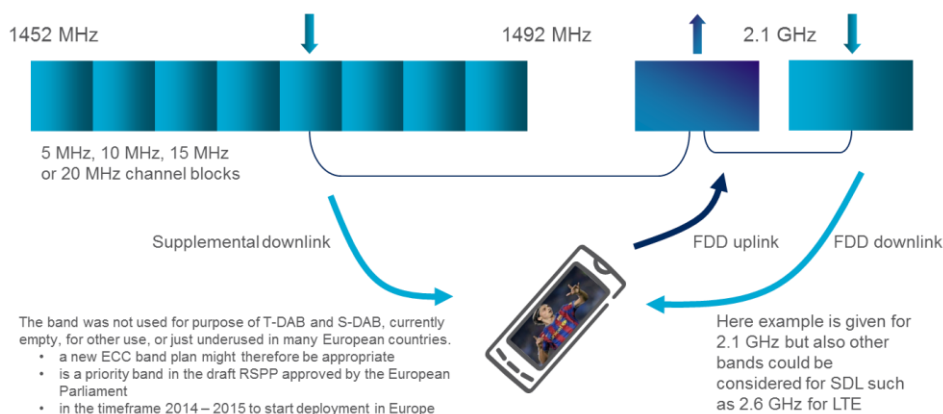
## SDL AND LTE CA 700 MHZ AND 1.4 GHZ

Aggregate unpaired carriers in the band 1452 – 1492 MHz with carriers in the band 700 MHz FDD to provide more downlink capacity and higher data throughput using SDL across the coverage area of the band 700 MHz



## 1.4 GHZ - SUPPLEMENTAL DOWNLINK

In Europe, the band 1.4 GHz (1452 – 1492 MHz) is allocated to digital audio broadcasting (DAB). Now suggested for supplemental downlink (SDL) uses carrier aggregation technology to bond the usual FDD downlink with a SDL, to provide a wider downlink channel



### C. Carrier Aggregation

- LTE Advanced offers considerably higher data rates. While the spectrum usage efficiency has been improved, this alone cannot provide the required data rates that are being headlined for LTE Advanced.
- To achieve these very high data rates it is necessary to increase the transmission bandwidths over those that can be supported by a single carrier or channel.
- The method being proposed is termed carrier aggregation, CA, or sometimes channel aggregation. Using LTE Advanced carrier aggregation, it is possible to utilise more than one carrier and in this way increase the overall transmission bandwidth.



- These channels or carriers may be in contiguous elements of the spectrum, or they may be in different bands.
- Spectrum availability is a key issue for LTE. In many areas only small bands are available, often as small as 10 MHz. As a result carrier aggregation over more than one band is contained within the specification, although it does present some technical challenges.
- More information can be found at <http://www.3gpp.org/technologies/keywords-acronyms/101-carrier-aggregation-explained>
- Carrier aggregation is supported by both formats of LTE, namely the FDD and TDD variants. This ensures that both FDD LTE and TDD LTE are able to meet the high data throughput requirements placed upon them.

#### **D. Licensed Shared Access: Fast-track capacity**

Spectrum sharing opens opportunities for mobile operators to quickly unlock additional, currently underutilized, spectrum, with the Authorized/Licensed Shared Access approach showing great promise. In particular, Licensed Shared Access is a viable way to share spectrum with existing non-mobile incumbent users that exhibit low or localized utilization in their bands, and where it is undesirable to change the conditions of use within a reasonable time period.

##### **D.1 Authorized and Licensed Shared Access**

ASA/LSA is a new approach to mobile spectrum that:

- is currently assigned to and used by an incumbent non-mobile user
- exhibits low or localized utilization
- is difficult to redistribute or repurpose to mobile/IMT within a reasonable time frame.

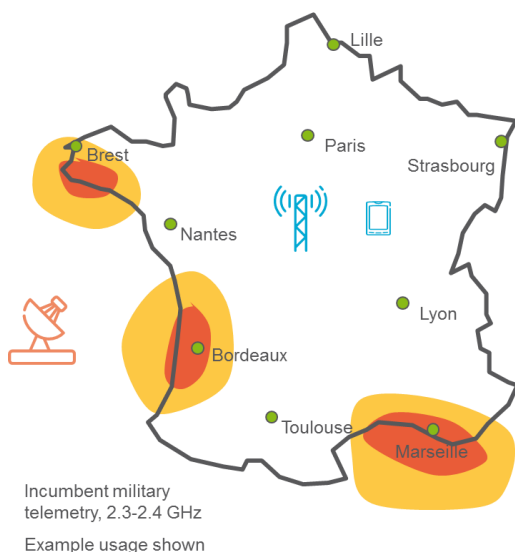
Typical examples are government and military spectrum subject to sparse use, either in terms of geographic coverage or temporal characteristics. Figure below shows an example situation in France for the 2.3-2.4GHz band (3GPP band 40) with very localized incumbent military telemetry use.

ASA/LSA assigns licenses that are similar in structure to dedicated, licensed spectrum with similar benefits to ASA/LSA licensees. An ASA/LSA spectrum usage right is binary: the spectrum is used by either the incumbent user or by the ASA/LSA licensee in any given place at any given time. The low or localized utilization by the incumbent makes it easier to characterize the rights of the incumbent, and provides scale and certainty to the ASA/LSA licensee.

A novel aspect of ASA/LSA licenses is that, in order to use the license, the licensee needs an agreement with the incumbent user, based on a sharing framework negotiated multilaterally between the parties, policy and the regulator.



## LICENSED SHARED ACCESS UNLOCKING MOBILE SPECTRUM



- › For harmonized mobile spectrum
  - low or localized utilization
  - not obtainable in reasonable time due to incumbent use (military, radar, satellite)
  - use existing mobile eco-system
- › Examples
  - 2.3-2.4 GHz in Europe, 3GPP band 40
  - 3.5 GHz in US
- › Incumbent protection
  - single sharing user, either/or usage
  - reliable enforcement of conditions
  - higher frequency facilitates sharing

Maximum availability of spectrum in the identified bands as given in Chapter 2 especially in sub-1GHz band would be beneficial in meeting broadband penetration targets. Moreover, additional spectrum in > 1GHz band would be beneficial to consumers in higher level of end user experience by densification of network through small cells/HetNets. Initiatives required are:

1. Coordination with Defense to free more spectrum in lower band.
2. Coordination with Broadcasting to free more spectrum in 470-698MHz band. The unused portions in TV Whitespace may be used with Cognitive radio techniques
3. Refarming of spectrum enabling contiguous allocation of spectrum crucial for enhancing end user experience i.e., for example 42 Mbps experience in UMTS is possible in the 2100 MHz band when the 2<sup>nd</sup> carrier allocation for a MSP is contiguous with the 1<sup>st</sup> carrier allocated to the MSP in a geographical area.

### **Q18. Are there any other spectrum bands apart from the ones mentioned in Chapter-2 to be identified for provision of wireless broadband services?**

Response: Response provided in Question 17. Kindly refer the same.

### **Q21. Do you agree with the demand side issues discussed in Chapter 5 and Chapter 6? How these issues can be addressed? Please also indicate any other demand side issues which are not covered in the CP.**

Response:

A detailed account of our recommendations based on global experience on catalyzing broadband expansion is attached below response to Q22.

**Q22. Please give your comments on any related matter, not covered above.**

Response:

We can't make deterministic assumptions about the Networked Society: the benefits it will deliver depend on what we do, or what we fail to do, today and in the future.

Technological progress comes also with public policy challenges, and since the adoption process of technology is a social process, policy makers must therefore identify where they can contribute to shape this adoption process in socio-economically desirable directions.

Some important ICT policy issues have significant impact on R&D investments (knowledge), value creation (innovation), roll out (diffusion), and use (adoption) of ICT. These policies determine the cumulative strength and sustainability of ICT in driving transformational change and in the distribution of socio-economic benefits. The topics, central to a transformative ICT policy agenda, impact the timing and willingness to invest in ICT, and the long-term supply of ICT-related capabilities. They also determine end users' (individuals, businesses, and public services) ability to benefit from ICT as they define the speed, scope and intensity of opportunities and benefits available from ICT-led services.

**Supply-side ICT policy issues**

National broadband (BB) policies aim to increase the roll out of Broadband infrastructure within a geography (region or a state) typically specifying an ambition in terms of expected Broadband service speeds, service roll out time plan, and sometimes adoption. They may also include Government funding and cooperation mechanisms.

- Network regulation should aim to address technical (standards), market (incumbent, new entrant), investment protection, infrastructure policies those are conducive to ease of doing business as well supporting the economy growth continuity of service and consumer (protection, pricing) specific conditions with the aim to improve market efficiency, public interest (universal access) and protection of consumer right.
- Spectrum management should aim to efficiently manage scarce resources and ensure adequate spectrum is available for commercial deployment of services including Broadband, allocate new spectrum as they come up with standardization, deployment and global ecosystem. Also includes global or regional coordination and harmonization of spectrum usage including sharing, and most importantly standardized technology specifications enable mass market deployment of devices at low cost.

**Promoting market innovation in the Broadband value-chain:**

- Promoting innovation in the Broadband value chain is a desirable policy goal to pursue.
- Regulation that stifles innovation in the Broadband value chain is hence to be avoided.
- New network services such as prioritized access to virtualized network resources, including computing and caching (e.g., cloud computing) should be permitted.



**Competitive wholesale markets are desirable:**

- Promote up-take of new high speed Broadband networks, that is socio-economically desirable
- Increased speed of innovation and introduction of innovations in network distribution markets

In summary, we need to take advantage of economic benefits of whole sale market mechanisms; increased choice, more competition, lower price, increased differentiation.

A detailed account of our recommendations based on global experience on catalyzing broadband expansion is attached below.



Ericsson Comments  
on Global Broadband

