

# LSA - Technology architecture, standardization and regulatory update

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# Support up to 1000 times more capacity in wireless access

Radio spectrum is essential

10x  
Spectrum

10x  
Performance

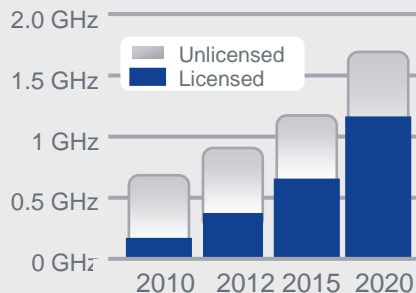
10x  
Base station

=

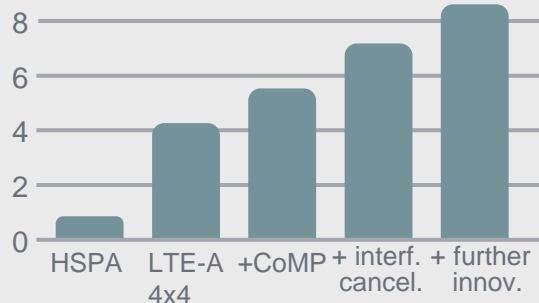
Up to  
1000x  
capacity



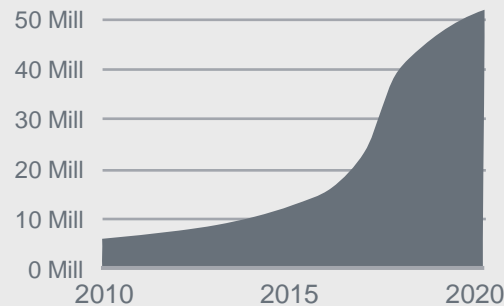
Available radio Spectrum



Spectral efficiency [bps/Hz/cell]



Global base station forecast



# Spectrum *the Real Estate* for Mobile Broadband

800/850, 900,  
700 UHF

- *FDD, 10MHz BW*
- *Macro*

**Coverage**

2600, 3500, 2300

- *TDD, >20MHz BW*
- *dense HetNet*

**Densification**

1800/1900,  
2100/AWS, 2600

- *FDD, 20MHz BW*
- *HetNet*

**Capacity**

2300, 3500, 5000+

- *ASA/LSA, Co-primary  
Unlicensed*

**Spectrum Sharing**

**We cannot  
generate new  
spectrum,  
but we can  
optimize its use!**

**Overall  
Efficiency**

## A new way of licensing spectrum

# Licensed Shared Access (LSA)

### Mainstream Approach

Auctions  
of Cleared Spectrum



#### Exclusive Use

Ensures Quality of Service

### Complementary License Model

Licensed Shared  
Access



#### Exclusive Shared Use

*Binary sharing* with Incumbent  
(government, defence, etc.)  
in Time, Location, and/or Frequency  
Maintains Quality of Service

### Unlicensed Approach

Dedicated to Wi-Fi

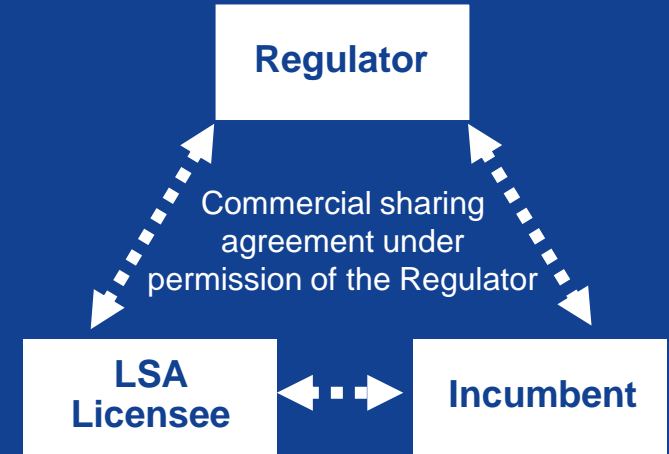
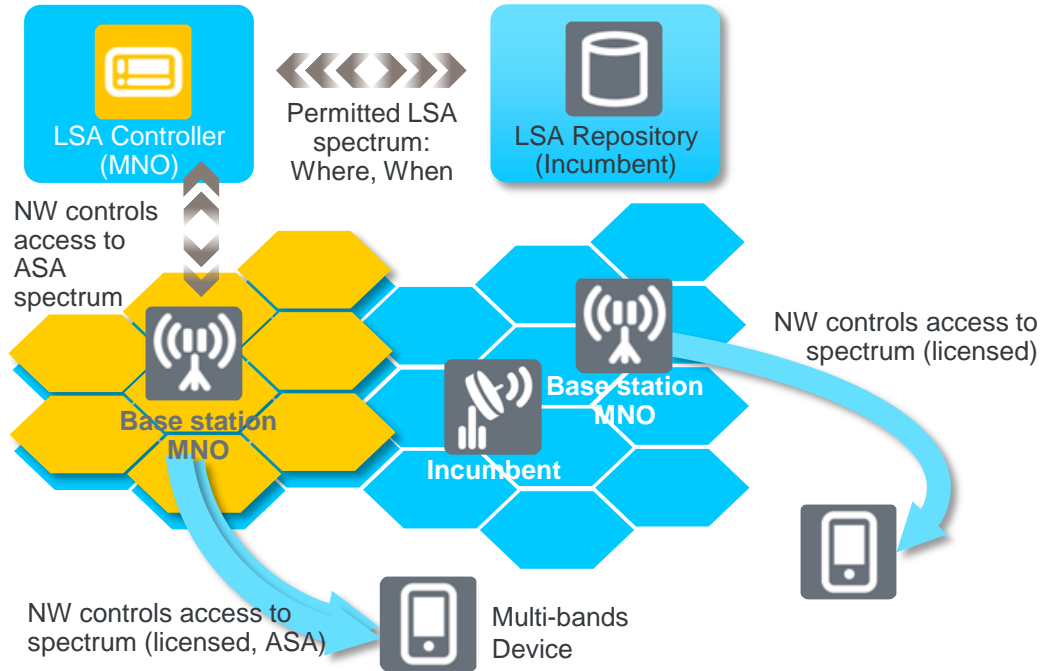


#### Shared Use

Unpredictable  
Quality of Service

## Harmonization and Global Standards Drive Economies of Scale

# Licensed Shared Access Concept



# LSA in Europe

## Research – Standardisation – Regulatory Bodies & Administration



### Standardisation



- ➡ **ETSI TR 103 113 (V1.1.1, 07/2013)-System Reference Document for LSA**  
“Mobile broadband services in the 2 300 MHz - 2 400 MHz frequency band under Licensed Shared Access regime”
- ➡ **ETSI TS 103 154 (V0.0.9, Draft 01/2014)-System Requirements for LSA**  
“System requirements for operation of Mobile Broadband Systems in the 2300 MHz - 2400 MHz band under Licensed Shared Access”
- ➡ **ETSI TS 103 235 (V0.0.1, Draft 01/2014) – System Architecture for LSA**  
“System Architecture and High Level Procedures for operation of Licensed Shared Access (LSA) in the 2300 MHz-2400 MHz band”

### Regulatory Bodies & Administration



#### European Conference of Postal and Telecommunications Administrations

- 48 European countries cooperating to regulate posts, radio spectrum and communications networks

- ➡ **ECC Report 205 (Approved 02/2014)**  
Licensed Shared Access (LSA)
- ➡ **ECC Decision (14)BB (Public consultation 02/2014)**  
Harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for MFCN
- ➡ **ECC Rec. (14)04 (Public consultation 02/2014)**  
Cross-border coordination for MFCN and between MFCN and other systems in the frequency band 2300-2400 MHz

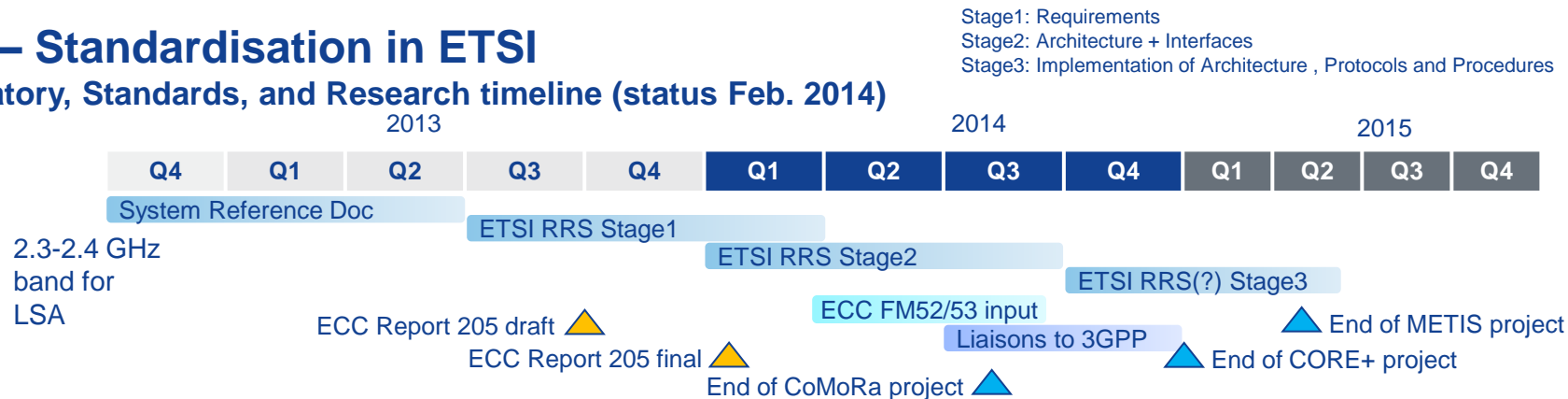


#### Radio Spectrum Policy Group (RSPG)

- ➡ **RSPG13-529 rev1 (Draft 05/2013)**  
RSPG Opinion on Licensed Shared Access
- ➡ **RSPG11-392**  
Report on CUS and other spectrum sharing approaches

# LSA – Standardisation in ETSI

## Regulatory, Standards, and Research timeline (status Feb. 2014)



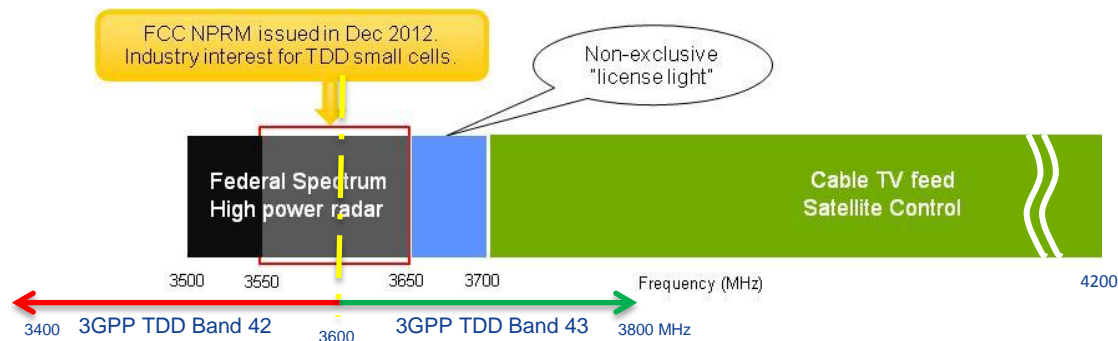
### Reasons for standardization:

- Using LSA in multi-vendor 3GPP networks
- Limit integration efforts by using standardized interfaces between LSA Repository and LSA Controller
- Allow flexibility in rule adaptations for different LSA spectrum bands
- Re-use of existing 3GPP functionalities to meet time to market requirements for new spectrum (e.g. OAM ltf-type2)
- Avoid complex spectrum broker mechanisms with uncertain behavior due to unclear LSA sharing rules

### How to adapt ETSI LSA for other spectrum:

- Re-use ETSI concept with LSA Repository and LSA Controller, including LSA spectrum sharing rules and interfaces
- Create working assumptions and basic LSA definitions (or reuse or adapt ETSI definitions)
- Define the LSA spectrum sharing rules for new spectrum, possibly considering European activities in ECC FM 52/53
- Start in-time to avoid delays:
  - open discussion with Regulator, Incumbents, MNOs and Network Vendors
  - liaisons to 3GPP and other standardization groups

## USA 3550-3650MHz (Small Cells focus)



- Sharing Spectrum with Radar and Fixed Satellite Systems
- Global band, available 2H 2015
- Interference trial with NTIA by unnamed OP using other vendor equipment
- 3.4 – 3.6 GHz equipment likely on Nokia roadmap driven by KDDI and Softbank
- Shared licensed and possibly unlicensed use (LTE-U)

## 3550-3650 MHz NTIA Exclusion Zones\*



NTIA Fast-Track Report, Figure 5-3. Composite Depiction of Exclusion Zone Distances, Shipborne Radar Systems

- Exclusion zones for Macro/Navy radar systems
- Exclusion zones for Small cells/Navy radar systems TBD
- Small cells along with LSA to enable access to spectrum

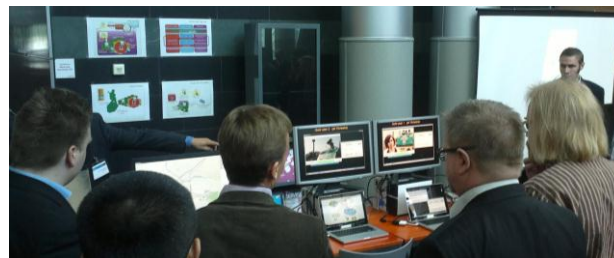
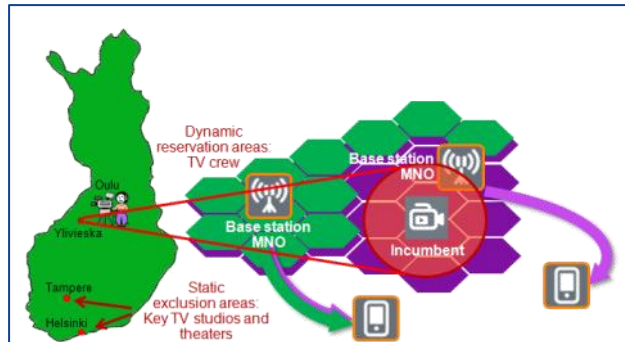


# Cognitive Radio to Business (CRB)

## LSA unlocks TD LTE 2300 band for operators in Europe

MNOs will not get enough spectrum in time to monetize 1000x traffic growth opportunities through traditional lengthy and costly 'command & control' auctioning & re-farming process

ASA enables faster and cost efficient access for existing operators towards licensed QoS spectrum for additional capacity/overlay and opens up new business opportunities with Tier3, challenger and local operators



World 1st on air LSA/ASA at 2.3 GHz trial

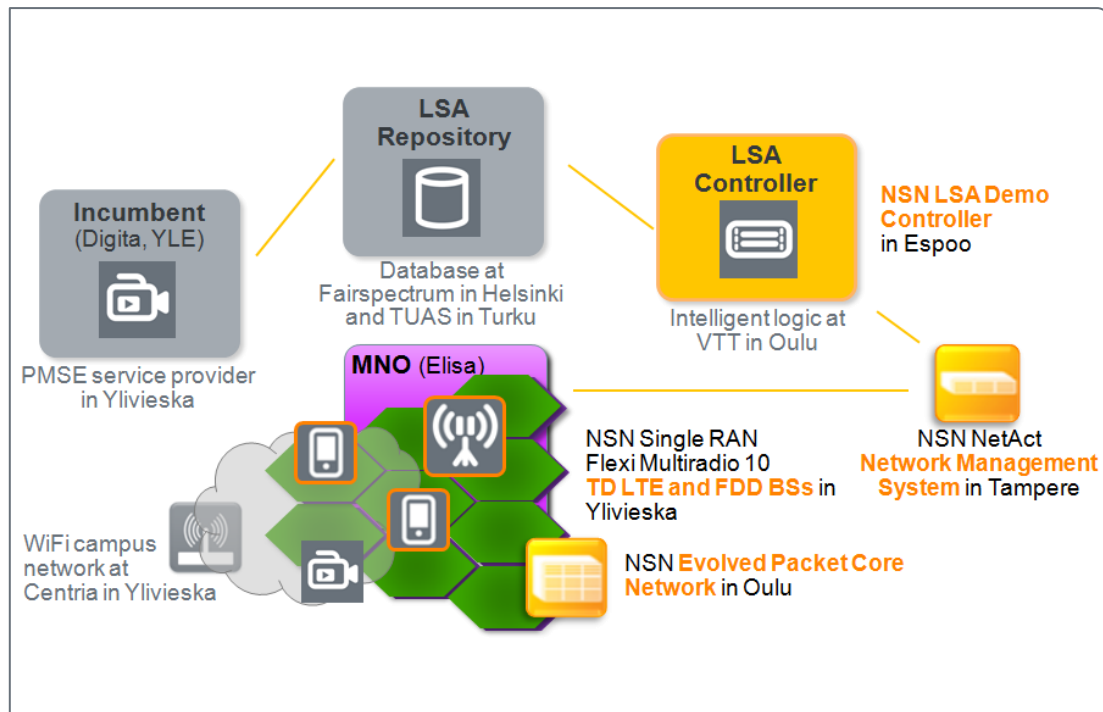


Support up to 1000 times more capacity



A2  
Next LSA  
Trial#3 at IEEE  
DySpan'14 in  
April and  
CrownCom'14  
in June

## Leverages global and available LTE technologies to ensure economies of scale and early use



**Trials built on NSN  
Flexi (TD-LTE 2.3 GHz)  
and NetAct core assets**

**Flexi & NetAct**

**Trial included full LSA  
ecosystem in Finland,  
joint work with TEKES  
Trial program**

**LSA Ecosystem**

## World 1st on air LSA/ASA TD-LTE 2.3 GHz trial

- MNOs will not get enough spectrum in time to monetize 1000x traffic growth opportunities through traditional lengthy and costly 'command & control' auctioning & re-farming process
- LSA unlocks TD LTE 2300 band for European MNOs
- Trials built on NSN Flexi (TD-LTE 2.3 GHz and FDD) and NetAct core assets
- Trial included full LSA ecosystem in Finland, joint work with TEKES Trial program
- €12bn economic benefits of LSA in Europe
- Next with Nokia Demo LSA Controller

- ✓ <https://inside.nsn.com/sites/news/insidenews/2013/july/pages/nsn-shows-world's-first-live-asa-trial.aspx>
- ✓ <http://nsn.com/news-events/press-room/press-releases/nsn-demonstrates-world-s-first-authorized-shared-access-field-trial-with-td-lte-spectrum>
- ✓ <http://nsn.com/portfolio/products/mobile-broadband/long-term-evolution-lte/td-lte>
- ✓ <http://core.willab.fi/?q=node/8>
- ✓ <http://www.tekes.fi/en/programmes-and-services/tekes-programmes/trial/>

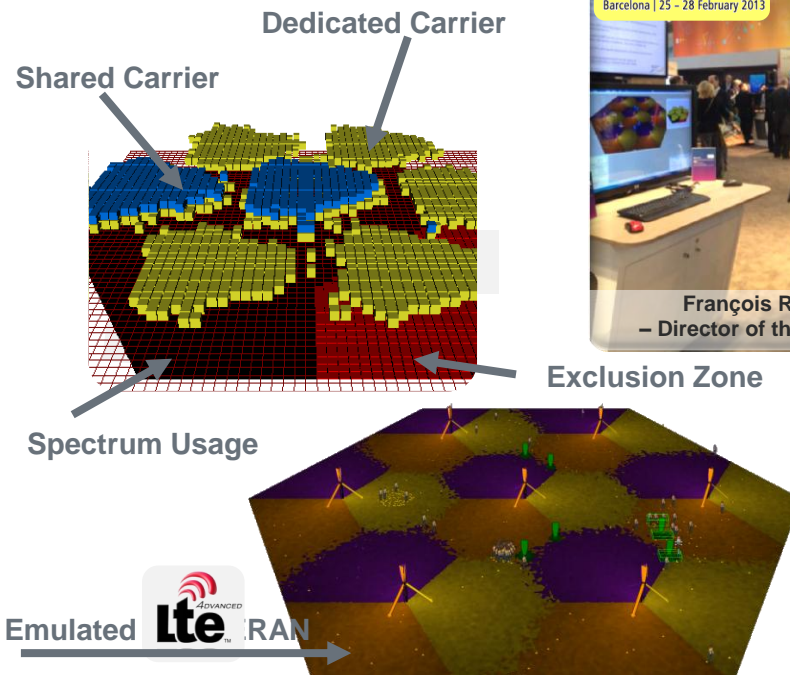
# Pioneering LSA Demo @MWC-2013 by Nokia & Qualcomm

- Huge attention from all stakeholders
- ~200 visitors over 3½ days

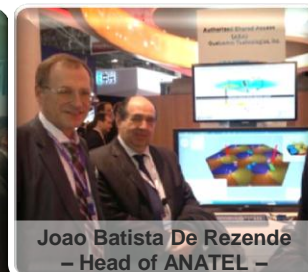
**Key players**

**Comprehensive demo tool for real time radio access network emulation**

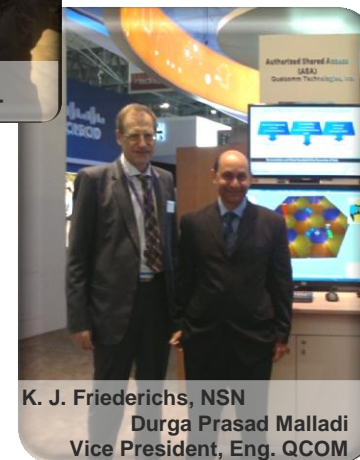
**SEASON**



**François Rancy**  
– Director of the ITU-R –



**Joao Batista De Rezende**  
– Head of ANATEL –

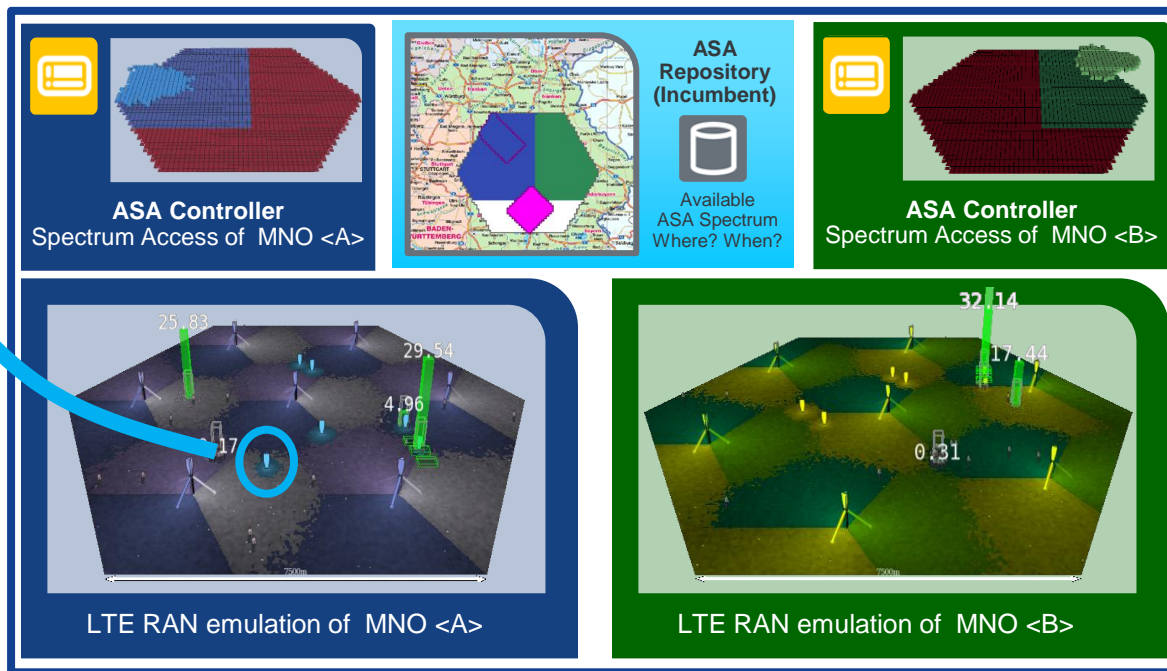


**K. J. Friederichs, NSN**  
**Durga Prasad Malladi**  
Vice President, Eng. QCOM

## Hardware Setup



## ASA Network and Traffic Simulation (NSN enabled)



# Nokia views on ways to more spectrum

- Exclusive Spectrum Access is preferred as MBB requires predictable conditions
- Min 100 MHz of additional spectrum below 1 GHz shall provide improved rural broadband
- Min 500 MHz of additional spectrum between 1 GHz and 5 GHz shall provide capacity for the data growth
- We see the need to maximize spectrum harmonization for global economies of scale and international roaming capabilities

## Exclusive Spectrum

- Where exclusive use not feasible, we see LSA as a valuable additional tool for spectrum optimization
- Co-primary sharing can become attractive particularly for small cell deployments operating in new higher frequency bands
- In the UHF bands new primary allocations and future joint integrated multimedia networks/solutions for Broadband and Broadcast convergence

## Shared Spectrum

# LSA – Standardisation in ETSI

## Participants ETSI RRS (Stage1+2)



**NOKIA**



**SONY**



National and Kapodistrian  
UNIVERSITY OF ATHENS



Bundesnetzagentur



**Drivers**

**Active**

**Passive**



# Authorized/Licensed Shared Access (ASA/LSA)

- > ASA enables LTE usage in non IMT incumbent bands
- > ETSI RRS Std. ongoing → harmonization in EU
- > 3GPP to specify needed interfaces starting 2H14
- > FCC 3-Tier sharing model in discussion, differences with ASA to be seen 1H14

## ASA spectrum for LTE

### 2300-2400 MHz band in EU

- > TD-LTE base stations and UEs available, ASA enables LTE usage in the countries where clearing not possible
- > Band availability depending on agreement with national regulator and current spectrum holder

### 3550-3650 MHz band in US

- > FCC making the band available, sharing with federal systems, suitable for small cells
- > Band available for 3GPP earliest 2H15

## What & When

- > ASA needs agreement & rules between regulator, operator and current spectrum holder
- > **“ASA Controller”** in OSS will execute ASA rules, external input from **“ASA Repository”**
- > Semi static case with simple ASA band switch on/off mechanism
- > Small cells operation may need more flexibility & dynamic control
- > First deployments with FDD-TDD HO and traffic steering, no UE changes (Rel'8 compatible)
- > Later, advanced deployments with Rel'12 FDD-TDD carrier aggregation

## How



# Exclusive *and* Shared spectrum for Mobile BroadBand

	Exclusive Use Auctions of cleared spectrum	Exclusive Shared Use Complementary licensing model, exclusive use on a shared and binary basis	Shared Use Unlicensed approach, anyone can use (Wi-Fi, BT...)
<b>Business</b>	MNOs key asset	Complementary low cost spectrum	Maximize benefit from free spectrum
<b>Feasibility</b>	Ensured QoS, fully controlled by the owner	High QoS but availability < 100% for secondary user	Unpredictable Quality of Service, low TX powers only
<b>Deployment</b>	3GPP technologies GSM, HSPA, LTE, HetNet for coverage and capacity	Exclusive IMT anchor layer (mainly LTE FDD) + additional ASA layer (mainly LTE TDD) for capacity	Exclusive IMT anchor layer + unlicensed layer for local access: a) Wi-Fi offload b) LTE-Unlicensed
<b>Bands</b>	IMT bands cleared for 3GPP use	IMT bands where clearing not possible, ASA bands (TDD: 2.3GHz and 3.5GHz)	a) Wi-Fi 2.4GHz, 5GHz, 60GHz b) LTE-U bands (5GHz, US 3.55GHz)
<b>Features</b>	Standalone Operation Carrier Aggregation (DL, later UL)	Inter-System Handover with LTE Rel-8 CA (TDD+FDD) with LTE Rel-12	a) 3GPP-Wi-Fi IW, ANDSF b) LTE-U in Rel-13 with Supplemental Downlink and Carrier Aggregation

# NOKIA