



Welcome to the World of Standards



ETSI RECONFIGURABLE RADIO SYSTEMS – STATUS ON SPECTRUM SHARING ACTIVITIES

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Overview



Overview LSA/CBRS

ETSI LSA Deliverables

Regulation and Standardization Landscape

Further ETSI RRS Activities – SW Reconfiguration

Next Steps & Conclusions



I. Overview LSA/CBRS

Spectrum Sharing is an Enabling Technology for 5G



→ 5G CAPACITY

Effects of complementary vectors are
multiplicative

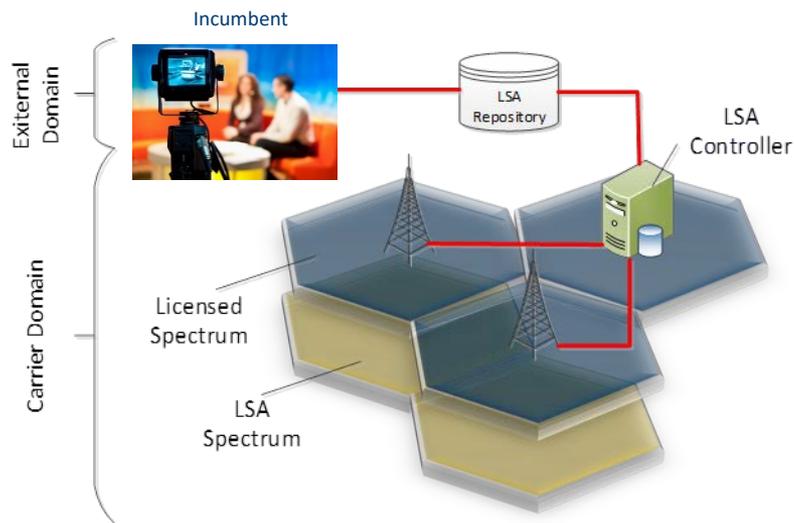
Different Sharing Business Models in Europe and US

Provide capacity to e.g. carriers on co-primary basis

LSA	CBRS
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Enable new business cases, e.g., owning spectrum in a census tract

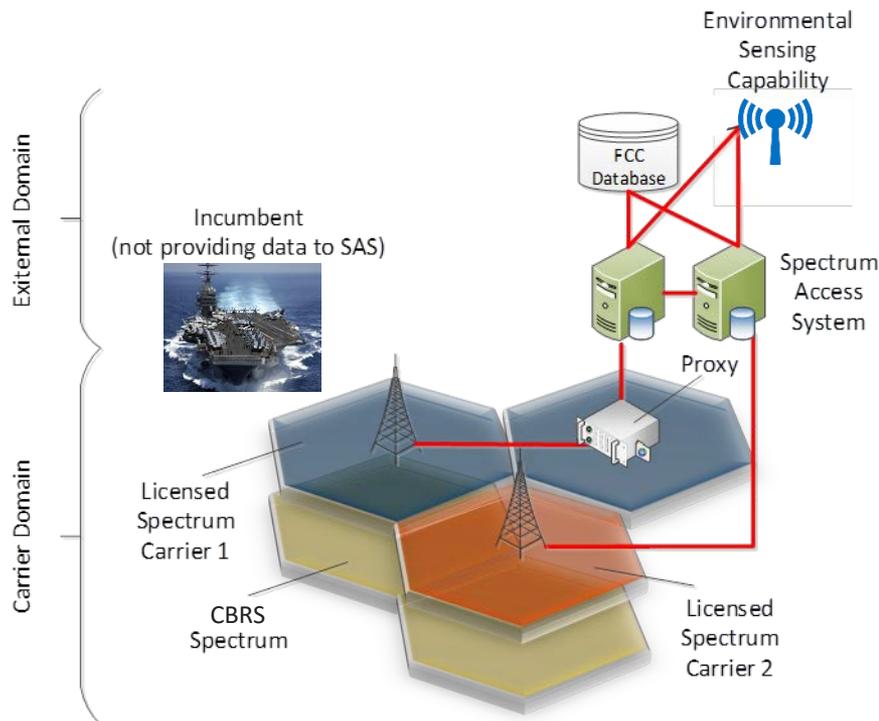
Enable 3rd layer of spectrum usage, e.g., for cellular off-loading



- LSA supports:
 - 1st tier: Incumbent User
 - 2nd tier: (Co-primary) Licensee
- Operates in 2.3-2.4 GHz (LTE Band 40)
- Incumbent protection through database

- A clear business model
- Investment certainty
- Protection of assets

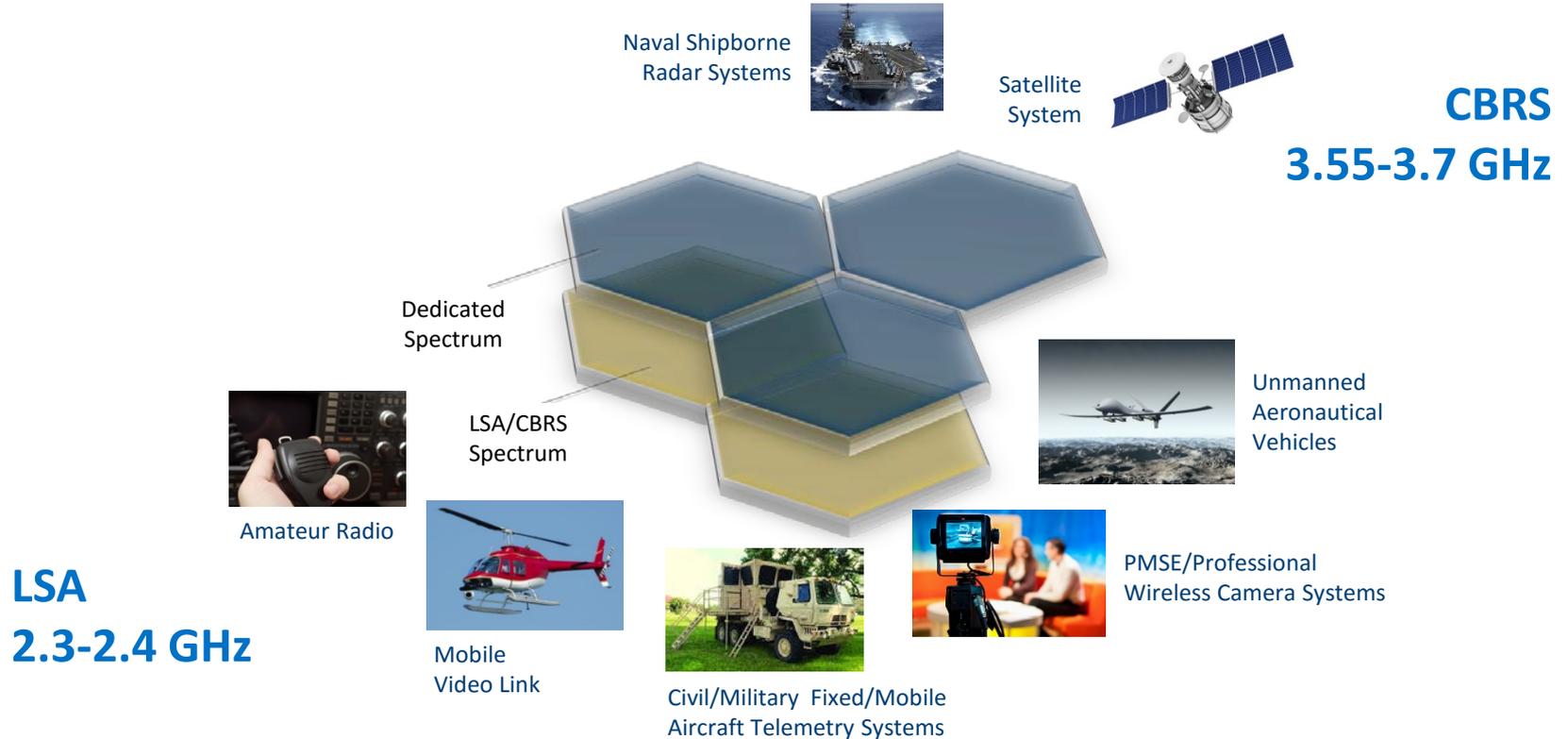
U.S. Citizens Broadband Radio Service (CBRS) Provides Additional Spectrum to Carriers and Enables New Business Cases



- CBRS supports:
 - 1st tier: Incumbent User
 - 2nd tier: Primary Access License
 - 3rd tier: General Authorized Access
- Operates in 3.55-3.7 GHz (LTE Bands 48)
- Incumbent protection through sensing

- ✓ A clear business model (tbd for Tier-3)
- ✓ Investment certainty
- ✓ Protection of assets (under definition)

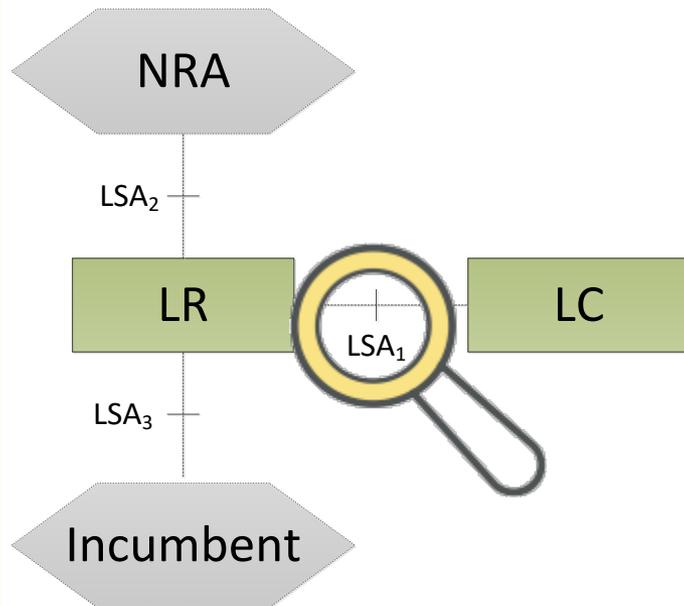
CBRS and LSA Incumbents Differ Substantially



II. ETSI Deliverables on LSA

Sharing Architecture – A Key to a new world!

Licensed Shared Access for 2.3-2.4 GHz



- ETSI and 3GPP are closely collaborating on the definition of LSA
- Following Requirements definitions in TS 103 154, the ETSI LSA Architecture and Procedures have been defined in ETSI TS 103 235
- A key Interface: LSA1 is bridging both worlds!
- ETSI TC RRS (Technical Committee Reconfigurable Radio Systems) has finalized TS 103 379 to define the protocols on LSA1

Summary on ETSI References

- ETSI TS 103 154 V1.1.1 (2014-10)
 - Reconfigurable Radio Systems (RRS); System requirements for operation of Mobile Broadband Systems in the 2 300 MHz - 2 400 MHz band under Licensed Shared Access (LSA)
- ETSI TS 103 235 V1.1.1 (2015-10)
 - Reconfigurable Radio Systems (RRS); System architecture and high level procedures for operation of Licensed Shared Access (LSA) in the 2 300 MHz - 2 400 MHz band
- ETSI TS 103 379 V1.1.1 (2017-01)
 - Reconfigurable Radio Systems (RRS); Information elements and protocols for the interface between LSA Controller (LC) and LSA Repository (LR) for operation of Licensed Shared Access (LSA) in the 2 300 MHz - 2 400 MHz band

III. Regulation & Standardization Landscape

Standards Groups Paving the Way to Mass Adoption



Licensed Shared Access (LSA)
2.3-2.4 GHz



Citizens Broadband Radio Service (CBRS)
3.55-3.7 GHz



3GPP

- 3GPP TR 32.855 V1.0.0 (2016-02), Technical Report 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Study on OAM support for Licensed Shared Access (LSA); (Release 14)
- 3GPP TS 28.302 V0.4.0 (2017-04), Technical Specification 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Licensed Shared Access (LSA) Controller (LC) Integration Reference Point (IRP); Information Service (IS) (Release 14)

CEPT

- ECC Report 172: Broadband Wireless Systems Usage in 2300-2400 MHz
- ECC Report 205: "Licensed Shared Access (LSA)"
- ECC Report 219: Characteristics of PMSE digital video links to be used in compatibility and sharing studies
- ECC Report 254: Operational guidelines for spectrum sharing to support the implementation of the current ECC framework in the 3600-3800 MHz range. Nov. 2016.
- CEPT Report 055: "Harmonized technical conditions for the 2300-2400 MHz in the EU for the provision of wireless broadband electronic communications services"
- CEPT Report 056: "Technological and regulatory options facilitating sharing between Wireless broadband applications (WBB) and the relevant incumbent service/application in the 2.3 GHz band"
- CEPT Report 058: "Technical sharing solutions for the shared use of the 2300-2400 MHz band for WBB (Wireless Broadband) and PMSE"

FCC

- REPORT AND ORDER AND SECOND FURTHER NOTICE OF PROPOSED RULEMAKING, Adopted: April 17, 2015 Released: April 21, 2015, FCC 15-47
- ORDER ON RECONSIDERATION AND SECOND REPORT AND ORDER, Adopted: April 28, 2016 Released: May 2, 2016, FCC 16-55

WINNF (WInnForum's Spectrum Sharing Committee)

- <http://www.wirelessinnovation.org/ssc-public-files>

CBRS Alliance

- <https://www.cbrsalliance.org/>

IV. Further ETSI RRS Activities – SW Reconfiguration

ETSI RRS has developed a series of Standards (European Norms & Technical Specifications) in order to support **Software Reconfiguration for Commercial Applications**.

In Particular, the following challenges have been addressed:

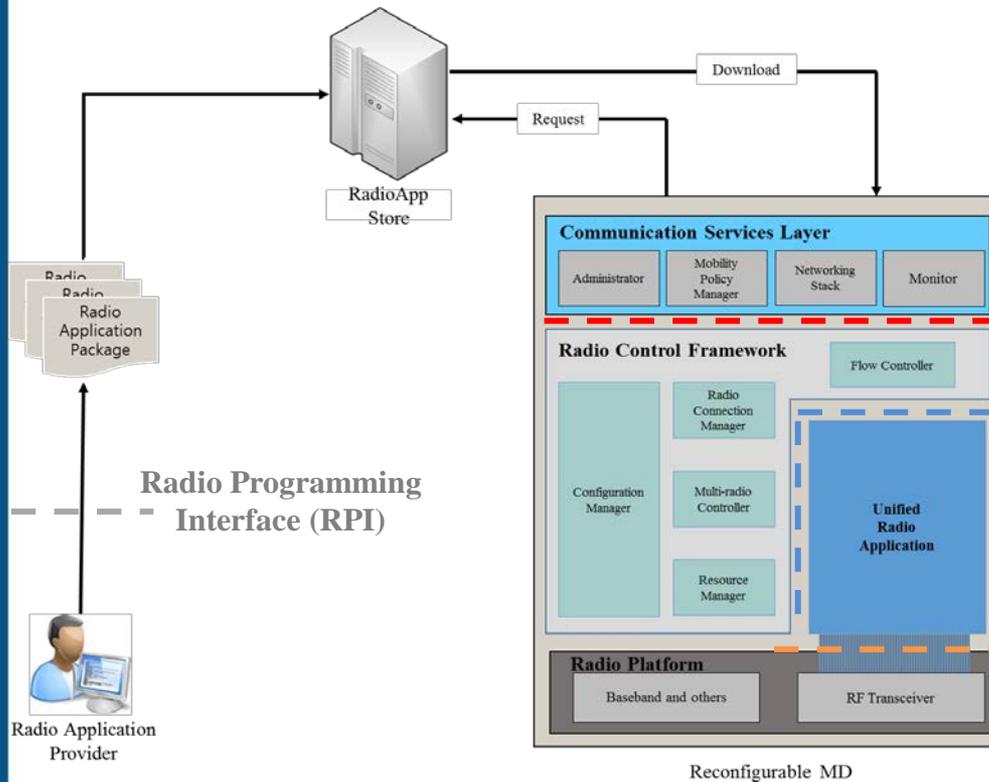
- Safe Delivery of SW Components to target platforms
- Software Portability
- Code Efficiency (in terms of power consumption, etc.)

The ETSI RRS solution is considered to be in alignment to the new **Radio Equipment Directive (RED), articles 3(3)(i) and 4** introducing Software Reconfiguration mechanisms.

Further ETSI RRS Activities – SW Reconfiguration



ETSI defines four sets of interfaces for Reconfigurable MD



Multiradio Interface (MURI)

- ✓ Administrative Services
- ✓ Access Control Services
- ✓ Data Flow Services

Unified Radio Application Interface (URAI)

- ✓ Radio Application Management Services
- ✓ User Data Flow Services
- ✓ Multiradio Control Services

Reconfigurable RF Interface (RRFI)

- ✓ Spectrum Control Services
- ✓ Power Control Services
- ✓ Antenna Management Services
- ✓ Tx/Rx Chain Control Services
- ✓ RVM Protection Services

ETSI Deliverables

- ETSI EN 302 969 V1.2.1 (2014-11), Reconfigurable Radio Systems (RRS); Radio Reconfiguration related Requirements for Mobile Devices
- ETSI EN 303 095 V1.2.1 (2015-06), Reconfigurable Radio Systems (RRS); Radio Reconfiguration related Architecture for Mobile Devices
- ETSI EN 303 146-1 V1.2.1 (2015-11), Reconfigurable Radio Systems (RRS); Mobile Device Information Models and Protocols; Part 1: Multiradio Interface (MURI)
- ETSI EN 303 146-2 V1.2.1 (2016-06), Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 2: Reconfigurable Radio Frequency Interface (RRFI)
- ETSI EN 303 146-3 V1.2.1 (2016-08), Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 3: Unified Radio Application Interface (URAI)
- ETSI EN 303 146-4 V1.1.2 (2017-04), Reconfigurable Radio Systems (RRS); Mobile Device (MD) information models and protocols; Part 4: Radio Programming Interface (RPI)

V. Next Steps & Conclusions

Next Steps

ETSI has completed the specification of Licensed Shared Access for 2.3-2.4 GHz.

ETSI currently considers an extension of Spectrum Sharing principles to address needs of Vertical Applications.