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FUB Fondazione Ugo Bordoni Research and Innovation

The potential of Licensed Shared Access for the wireless broadband growth

-

Regulatory aspects of LSA

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Content

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LSA is not about cognitive radio but…

Software-defined radio and cognitive radio systems at WRC-12 (agenda item 1.19)

Definitions:

•Definitions for software-defined radio (**SDR**) and cognitive radio systems (**CRS**) have been developed by ITU-R Working Party 1B and published in **Report ITU-R SM.2152**

Deployment scenarios:

•Use of CRS technology to guide ***reconfiguration of connections between terminals*** and multiple radio systems

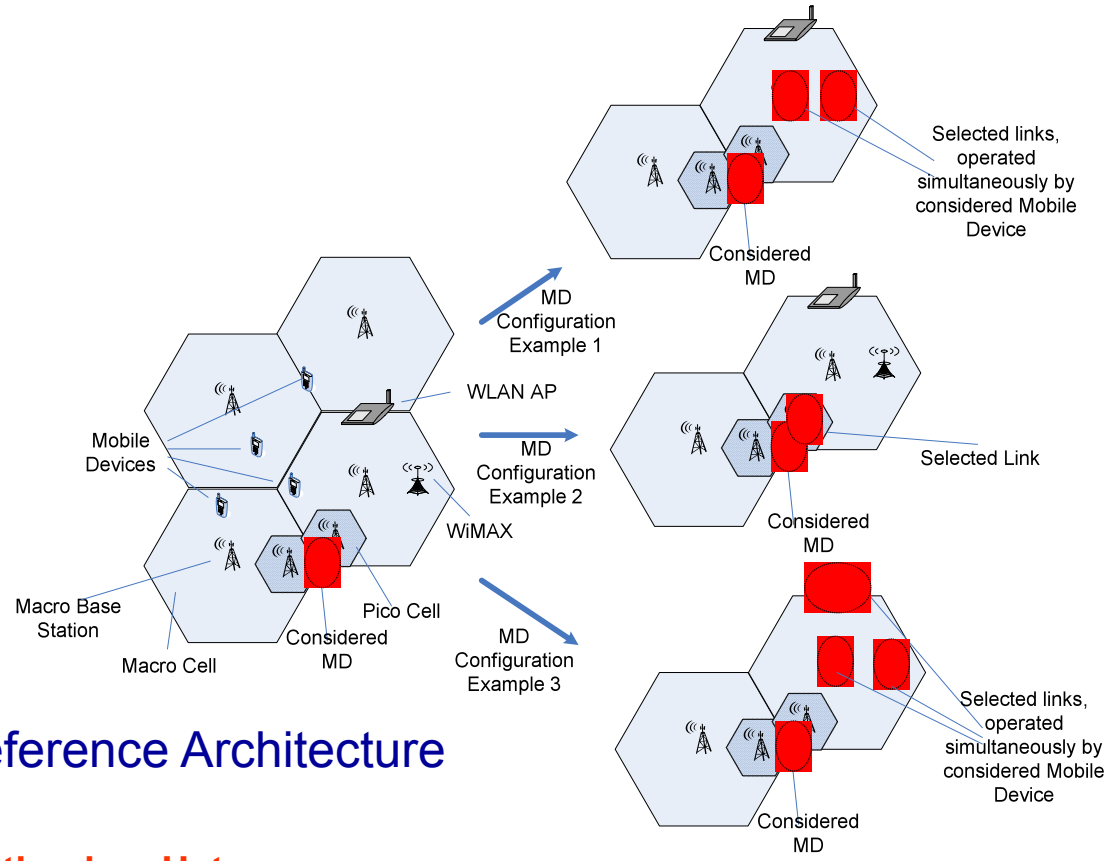
•Use of CRS technology by ***an operator*** of radiocommunication systems to improve the management of ***its assigned spectrum resources***

•Use of CRS technology as an enabler of ***cooperative spectrum access***

•Use of CRS technology as an enabler of ***opportunistic*** spectrum access

(Source: Conference Preparatory Meeting (CPM-11) Report

Use of CRS technology to guide ***reconfiguration of connections between terminals*** and multiple radio systems



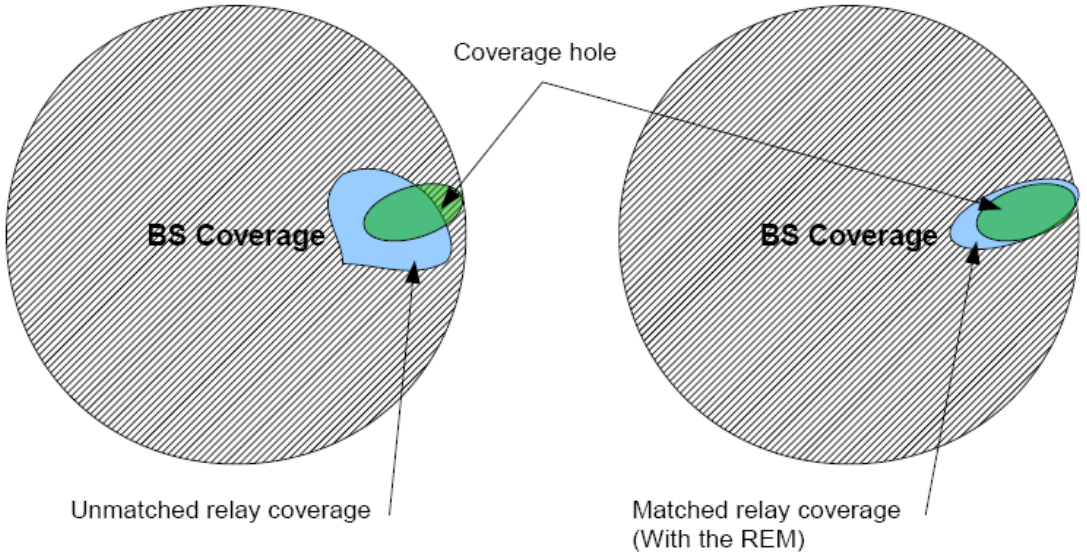
Use Cases related to SDR Reference Architecture for Mobile Device

- **Terminal-Centric Configuration in a Heterogeneous Radio Context**

(Source: ETSI TC RRS)

Use of CRS technology by ***an operator*** of radiocommunication systems to improve the management of ***its assigned spectrum resources*** (1)

Hand-made solution



Solution tailored with REM

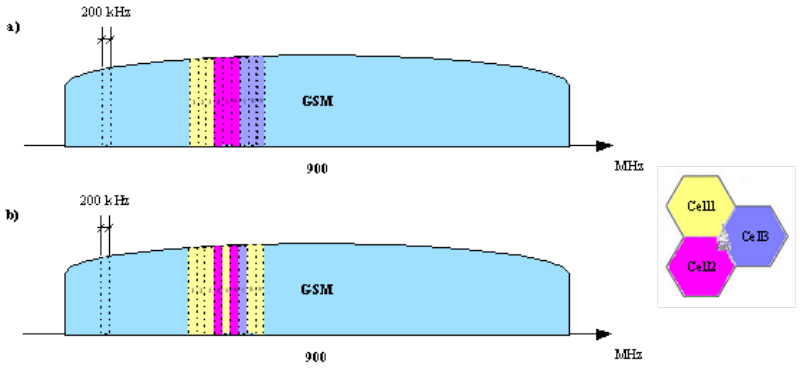
- green area: requirement for better coverage due to propagation issues or more capacity due to traffic issues.
- blue area: relay coverage

  - REM (Radio Environment Map) helps detecting and locating coverage and capacity problems by supplying geo-localized information on the coverage/capacity indicators. As a remedy, it provides a means to dynamically adjust the transmit power of the relay transmitters (i.e. relay auto-configuration). Indeed, relays should be agile enough in configuration of modifications (power adjustment, beamforming capability, etc.).

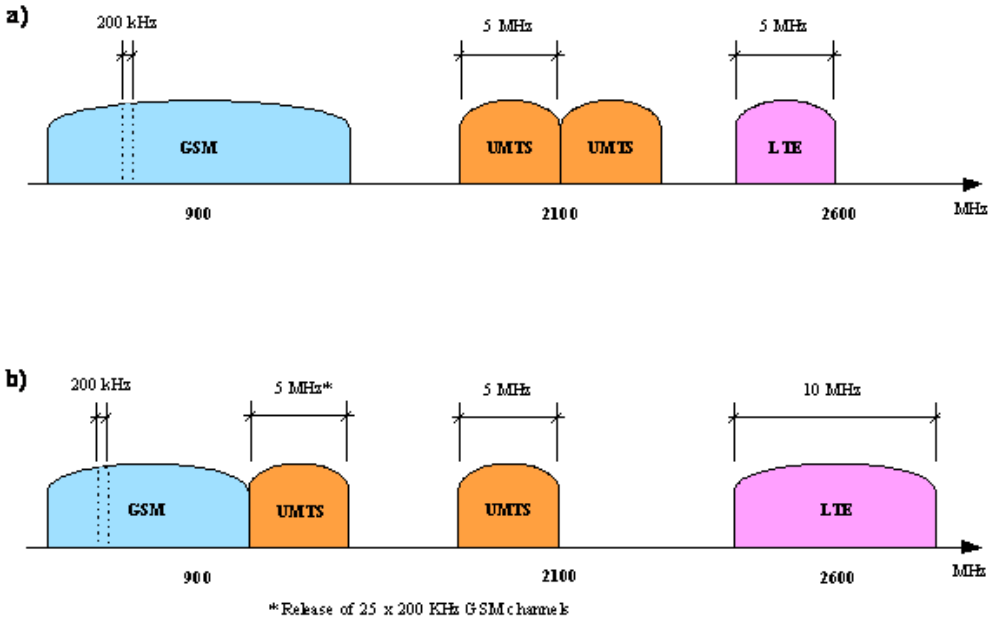
(Source: ITU-R Working Party 5D)

Use of CRS technology by ***an operator*** of radiocommunication systems to improve the management of ***its assigned spectrum resources*** (2)

- Use Cases related to Reconfigurable Radio Systems operating in IMT bands and GSM bands
  - **Radio Resource optimization**



Intra-RAT reconfiguration



Inter-RAT reconfiguration

(Source: ETSI TC RRS)

Use of CRS technology as an enabler of ***cooperative spectrum access***

- Collaborative mechanisms between network operators within an horizontal market to share spectrum dynamically (“spectrum pooling”, interference resolution…)

Use of CRS technology as an enabler of ***opportunistic*** spectrum access

e.g. “TV white space”

•Definition for white space in CEPT Report 24 (June 2008) :

– *White space is a part of the spectrum, which is available for a radiocommunication application (service, system) at a given time in a given geographical area on a **non-interfering / non-protected basis** with regard to primary services and other services with a higher priority on a national basis.*

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New focus on “spectrum sharing”

- **Reduced regulatory focus on cognitive radio after WRC-12**
  - No change to the Radio Regulations at WRC-12
    - ITU-R Resolution 58 (RA-12), Recommendation 76 (WRC-12)

- **A shift from “cognitive radio” / “white space” towards “spectrum sharing”…**
  - RSPG Opinion on Cognitive Technologies (February 2011)
  - RSPG Opinion on review of spectrum use (February 2012)
  - Commission communication COM(2012) 478 “Promoting the shared use of radio spectrum resources in the internal market” (September 2012)
  - Request for Opinion on Licensed Shared Access (LSA) (November 2012)
    - RSPG Opinion on Licensed Shared Access (November 2013)

- **CEPT/ECC WG FM established FM53 in September 2012**
  - White space devices, in particular, in the UHF band (TVWSD)
  - Licensed Shared Access (LSA)
  - General objective on reconfigurable radio systems (RRS)

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Part II

About spectrum regulatory framework…
(*ECC Report 205)*

1) Regulatory framework for the use of the radio spectrum

… Overview of the key regulatory and legal instruments that govern the use of spectrum

2) Spectrum management / Management of frequency authorisations

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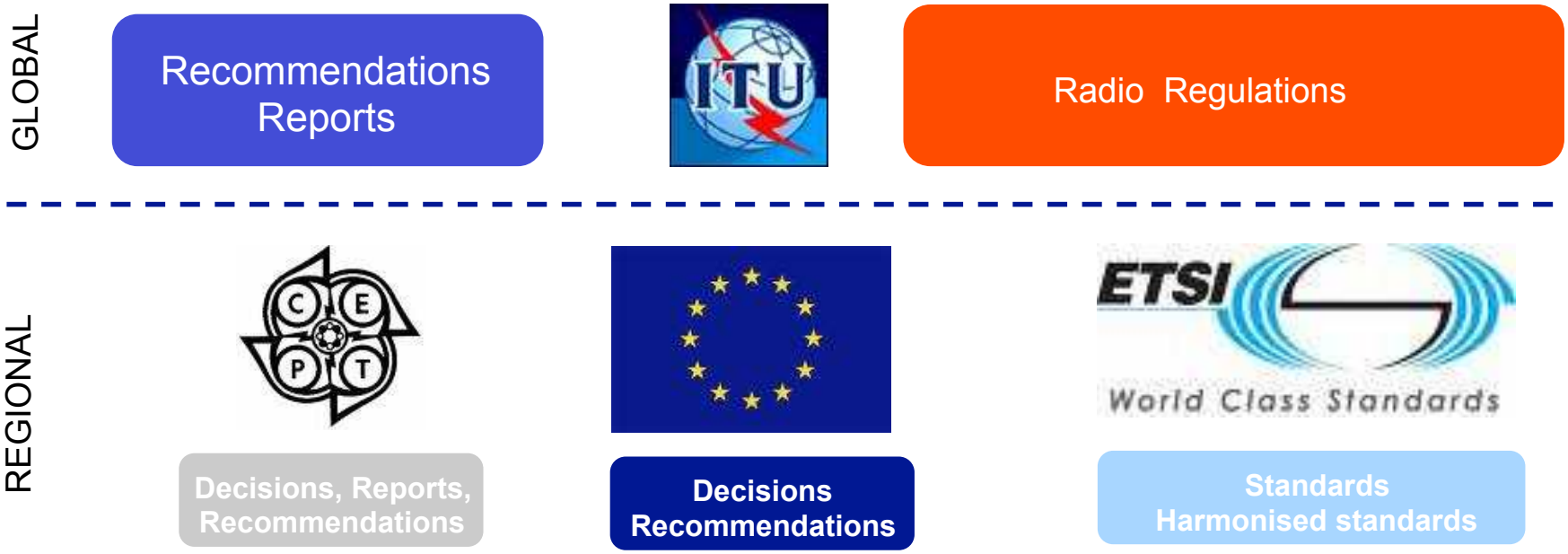
Regulatory framework for the use of the radio spectrum

3 levels



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International regulatory framework

1.19 *radiocommunication service:* A service as defined in this Section involving the transmission, *emission* and/or reception of *radio waves* for specific *telecommunication* purposes.

- **Radio Regulations (RR)**
  - The RR allocates in the first place frequency bands to Radiocommunication Services, while accounting for:
    - Need for **global harmonisation** in specific domains (satellite communication, maritime, civil aviation, scientific research…)
    - **Coexistence capability** between different types of radio communication networks
    - **Physical properties** of frequency bands
    - **Economies of scale**

- **ITU legal instruments binding to the states**
  - Not directly applicable to individuals, operators or others, concerned by spectrum utilisation; compliance with those instruments require suitable national implementation measures
  - Do not affect ability of national administrations to implement specific technical harmonisation measure (e.g. EU legislation) and to make available the spectrum for stations of any type, except for cases where there is a potential for interference with another country

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 170-2 200	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F	
2 200-2 290	SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space) 5.392	
2 290-2 300	FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	
2 300-2 450 FIXED MOBILE 5.384A Amateur Radiolocation 5.150 5.282 5.395	**2 300-2 450** FIXED MOBILE 5.384A RADIOLOCATION Amateur 5.150 5.282 5.393 5.394 5.396	
2 450-2 483.5 FIXED MOBILE Radiolocation 5.150 5.397	**2 450-2 483.5** FIXED MOBILE RADIOLOCATION 5.150	
2 483.5-2 500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 Radiolocation 5.398A 5.150 5.399 5.401 5.402	**2 483.5-2 500** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 5.150 5.402	**2 483.5-2 500** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398 5.150 5.401 5.402

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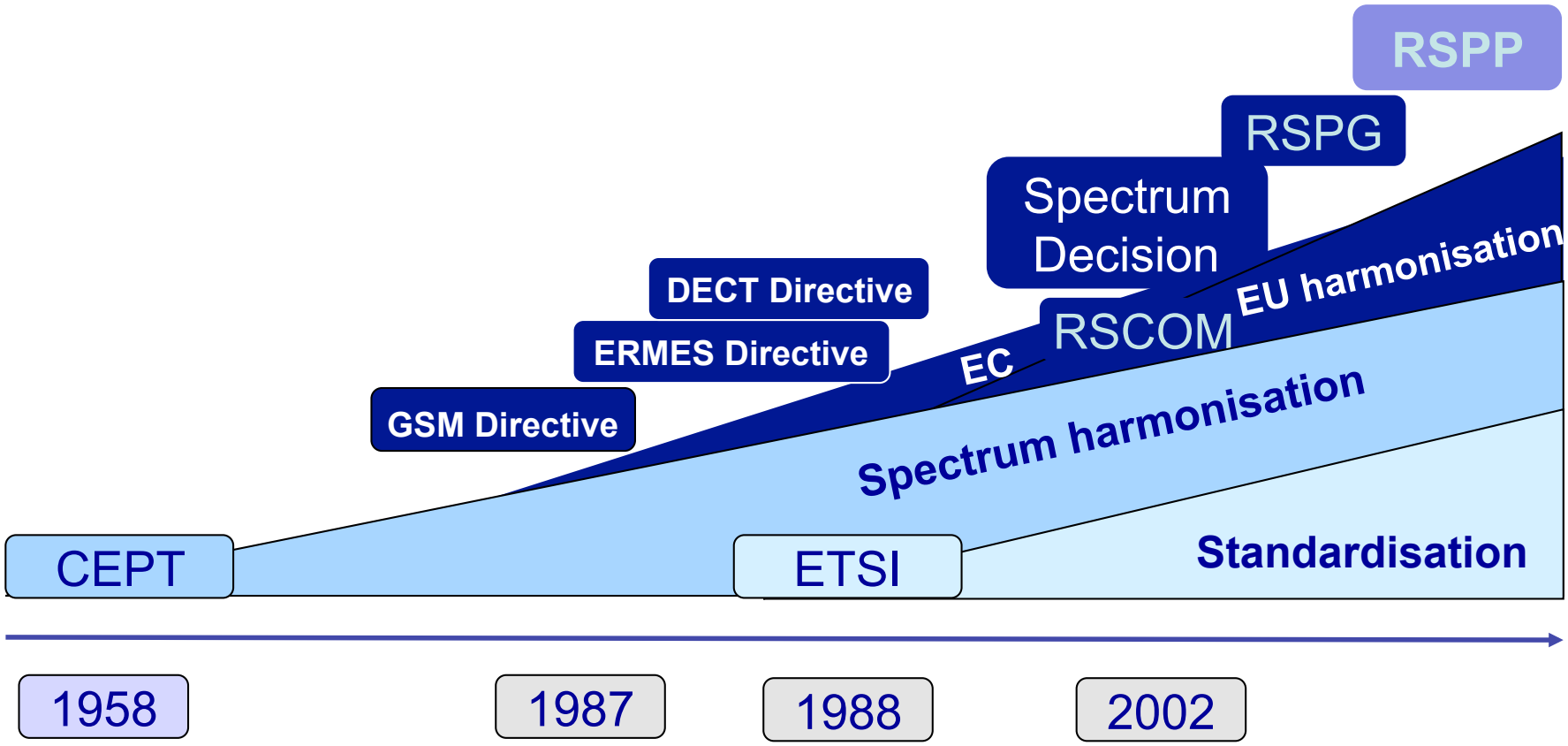
European context (1)

Spectrum policy



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European context (2)

Harmonisation measures

- **ECC aim to deliver effective harmonisation measures based on consensus between the member countries**
  - Industry consistently asks for harmonised spectrum to ensure development of innovative applications
  - Permanent negotiation on conditions of use of spectrum is critical over Europe as it enables adapting spectrum use conditions to industry requirements and national situations

CEPT ECC
Electronic Communications Committee

- **EC harmonisation measures provide legal certainty** to industry stakeholders on the availability of identified spectrum for a given usage and under specified conditions

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National legislation (1)

- **Authorising the use of the spectrum is a national prerogative**, subject to international obligations and community law in the case of EU member states
  - *No transmitting station may be established or operated by a private person or by any enterprise without a licence issued in an appropriate form and in conformity with the provisions of these Regulations by or on behalf of the government of the country to which the station in question is subject (RR Article 18.1).*

2 step process

- **Frequency allocation**
  - **National Tables of Frequency Allocations (NTFAs)** primarily specify the radio services authorised by an individual administration in frequency bands and the entities which have access to them
- **Frequency assignment / authorisation**
  - Spectrum usage rights for Governmental / non-governmental use of different nature
    - The term “authorisation” shall be understood as the public legal act issued by National Regulatory Authorities (NRAs) for the purpose of delivering spectrum usage rights to private entities or citizens (i.e. “non-governmental” use of the spectrum)

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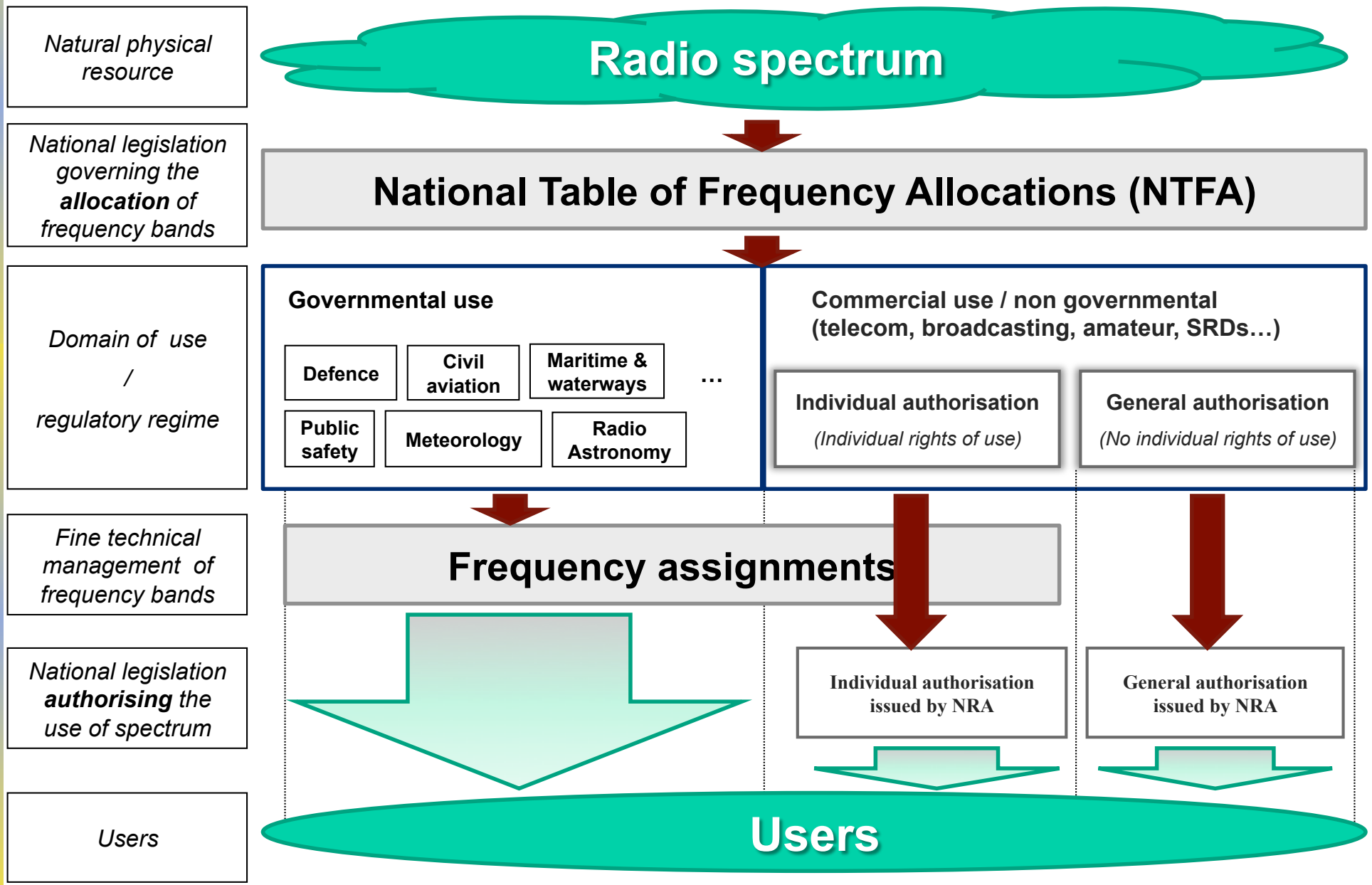
National legislation

From the radio spectrum to users



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Spectrum management

- **Spectrum management**: combination of regulatory procedures and tools for managing the spectrum resource at radio service or application level in view of delivering regulatory solutions to accommodate different types of use, address new spectrum demand while accounting for existing uses
  - Regulatory solutions dependent upon the type of "regulatory regime" (General vs individual licence/authorisation)

- **National level**
  - ITU-R Radio Regulations and European harmonisation measures provide key references to administrations
  - National Tables of Frequency Allocations (NTFAs)
  - Spectrum sharing as the baseline solution to accommodate new demand
    - Spectrum refarming as an option where sharing is not feasible or desirable

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Management of frequency authorisations

- **Managing frequency authorisations** takes place at national level and focus on adequate procedures for assigning spectrum to individual users and market regulation
  - **How to acquire an individual right of use?**
    1) Apply to the NRA
       - Procedures must be transparent and non-discriminatory
    2) Seek under the principles of "spectrum trading" a commercial agreement with a licensee that detains a "tradable right"
       - enable access to spectrum without going to the regulator (NRA)
       - allows transfer of spectrum rights for operators to optimize their capacity/coverage
       - for services operated within the regulatory conditions set by the "rights of use" issued by the NRA

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Part III

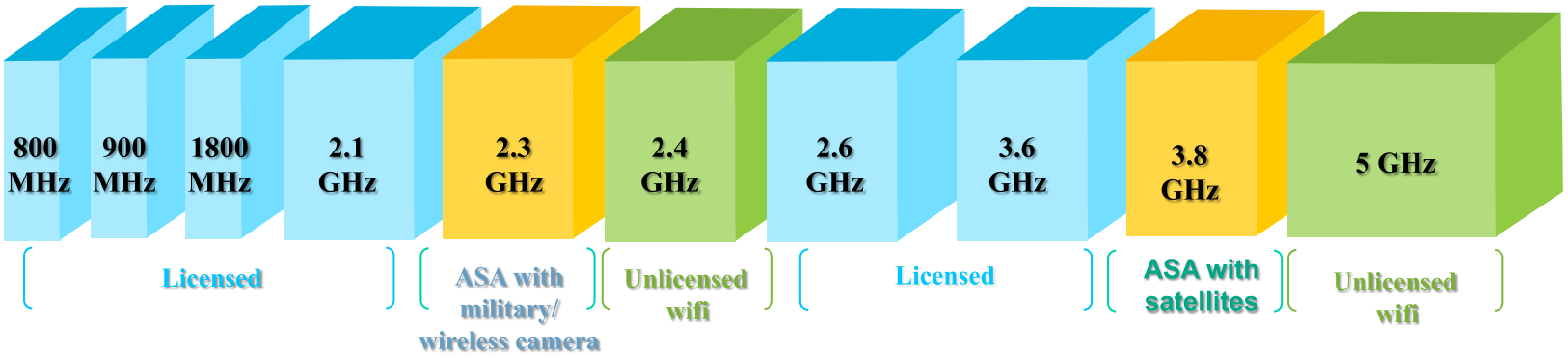
Licensed Shared Access (LSA)
(*ECC Report 205*)

LSA as a complementary tool for spectrum management

- Background and justification
- ASA/LSA concept & mobile broadband
- Definition
- Conclusions

Background and justification

- **Principles initially based on industry proposal for *Authorised Shared Access* (ASA)**
  - ASA introduced as an enabler to **unlock access to additional frequency bands** for **mobile broadband** under individual licensed regime
  - Alternative to spectrum clearing/refarming



Source: presentation at WG FM May 2011, doc. FM(11)116

- Concept extended as ***Licensed Shared Access*** (LSA)
  - Potential for other applications in addition to mobile broadband applications (MFCN) (WG FM April 2012)
  - General analysis to be carried out by Project Team FM53 in parallel with RSPG

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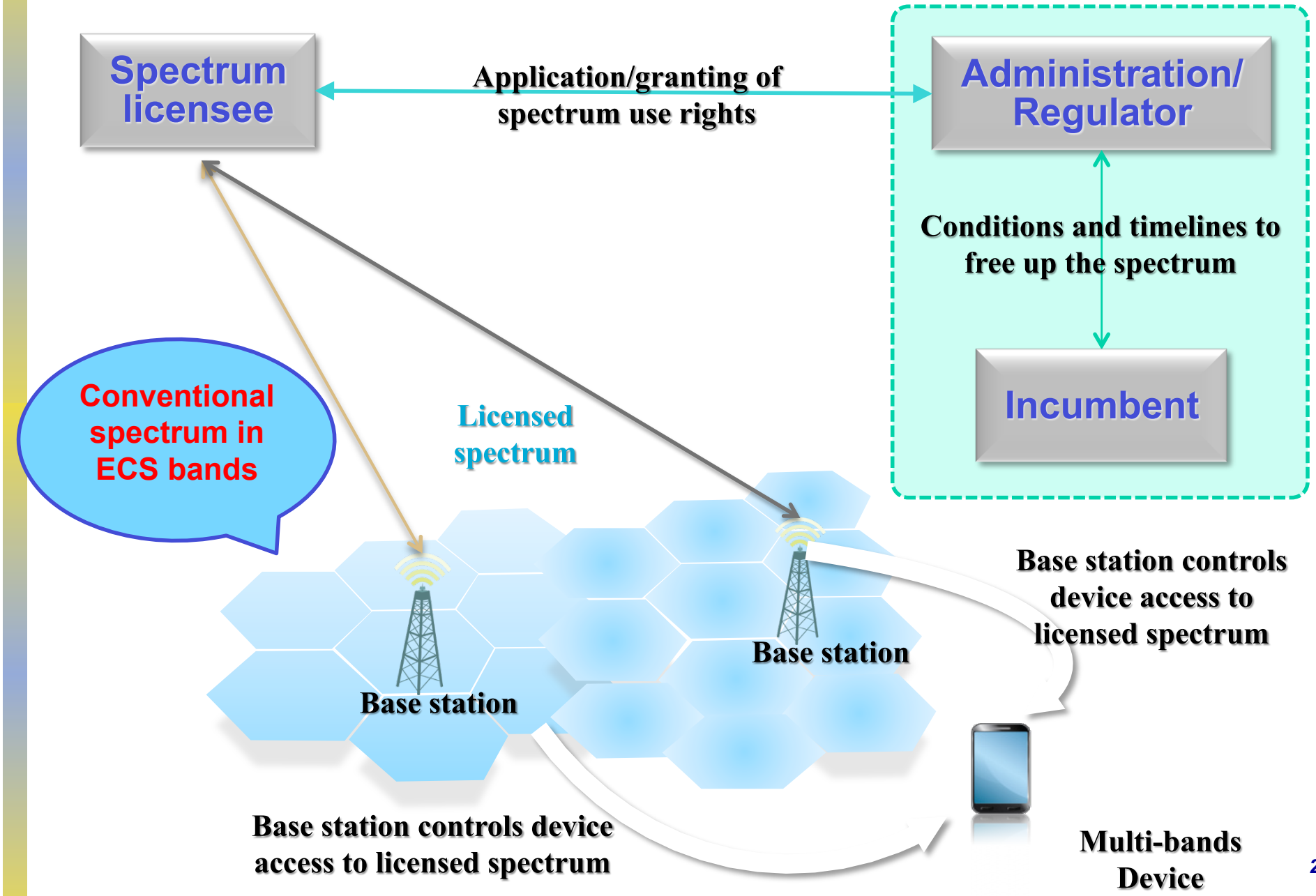
ASA/LSA concept & mobile broadband (1)



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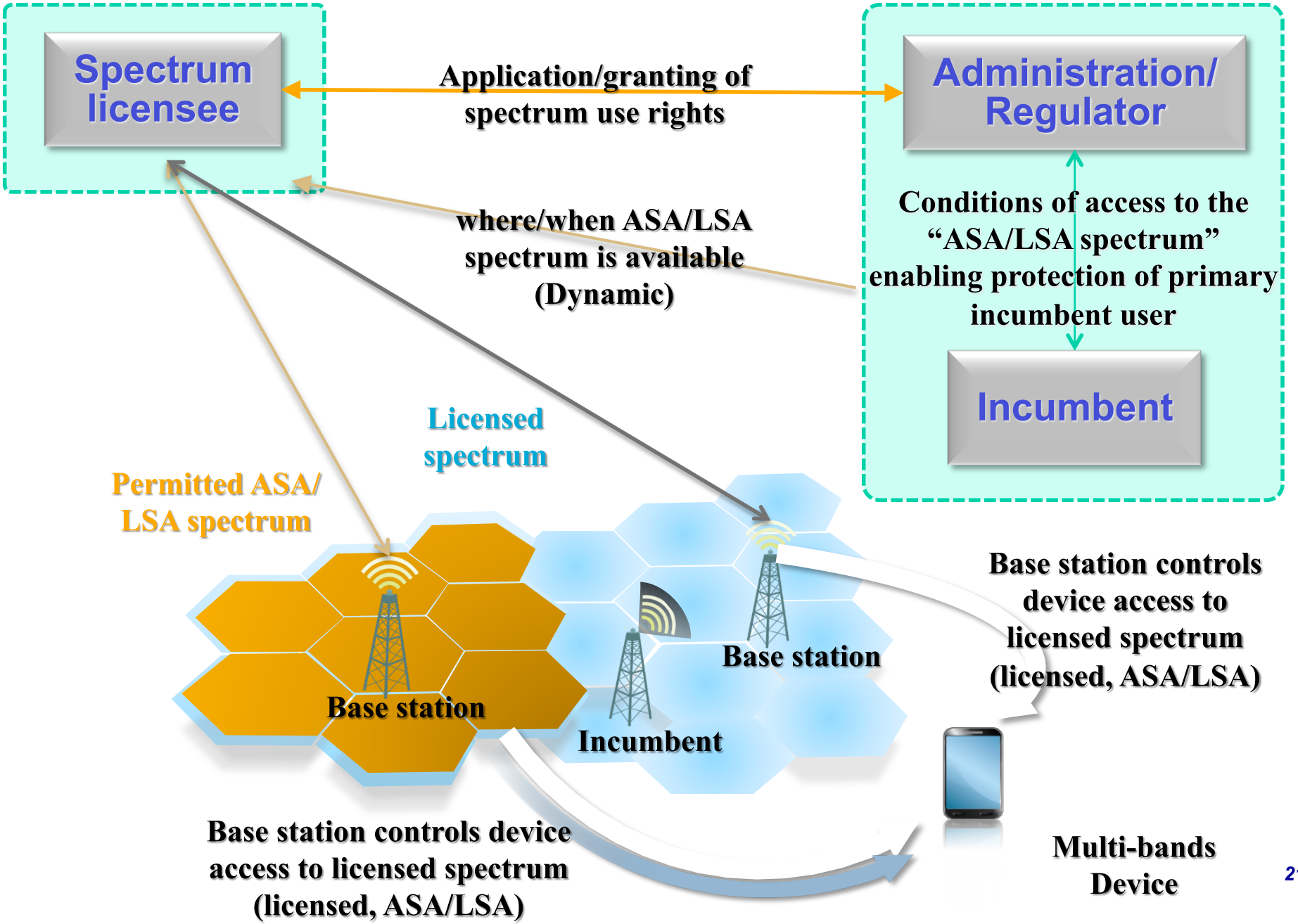
ASA/LSA concept & mobile broadband (2)



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LSA definition

- **RSPG definition**
  - *"A **regulatory approach** aiming to facilitate the introduction of radiocommunication systems operated by a limited number of licensees under an **individual licensing regime** in a frequency band already assigned or expected to be assigned to one or more incumbent users. Under the Licensed Shared Access (LSA) approach, the additional users are authorised to use the spectrum (or part of the spectrum) in accordance with **sharing rules included in their rights of use of spectrum**, thereby allowing all the authorised users, including incumbents, to provide a certain Quality of Service (QoS)"*

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Conclusions of ECC Report 205

Scope of LSA

- LSA is a **complementary spectrum management tool** that fits under an "**individual licensing regime**".
- LSA facilitates the introduction in a frequency band of **new users** while **maintaining incumbent services** in the band. LSA aims to **ensure a certain level of guarantee in terms of spectrum access** and **protection against harmful interference** for both the incumbent(s) and LSA licensees, thus allowing them to provide a predictable quality of service.
  - LSA excludes concepts such as "opportunistic spectrum access", "secondary use" or "secondary service" where the applicant has no protection from primary user(s).
- **LSA licensees and incumbents operate different applications** and are subject to different regulatory constraints.
  - They would each have exclusive individual access to spectrum at a given location and time.

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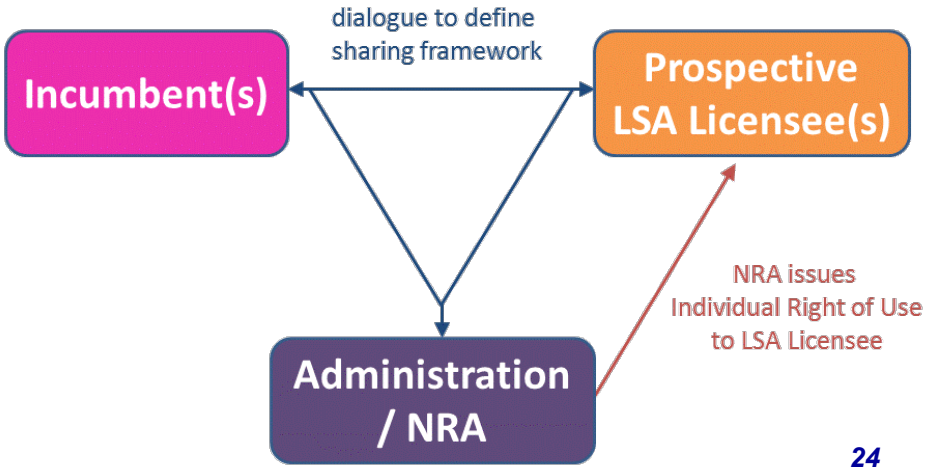
Sharing framework (1)

- The implementation of LSA relies on the concept of a “sharing framework” that is **under the responsibility of Administration/NRA**. Its development requires the involvement of all relevant stakeholders.
- The “sharing framework” can be understood as a set of sharing rules or sharing conditions that will materialise the **change**, if any, in the spectrum rights of the incumbent(s) and define the spectrum, with corresponding technical and operational conditions, that can be made **available for alternative usage under LSA**.



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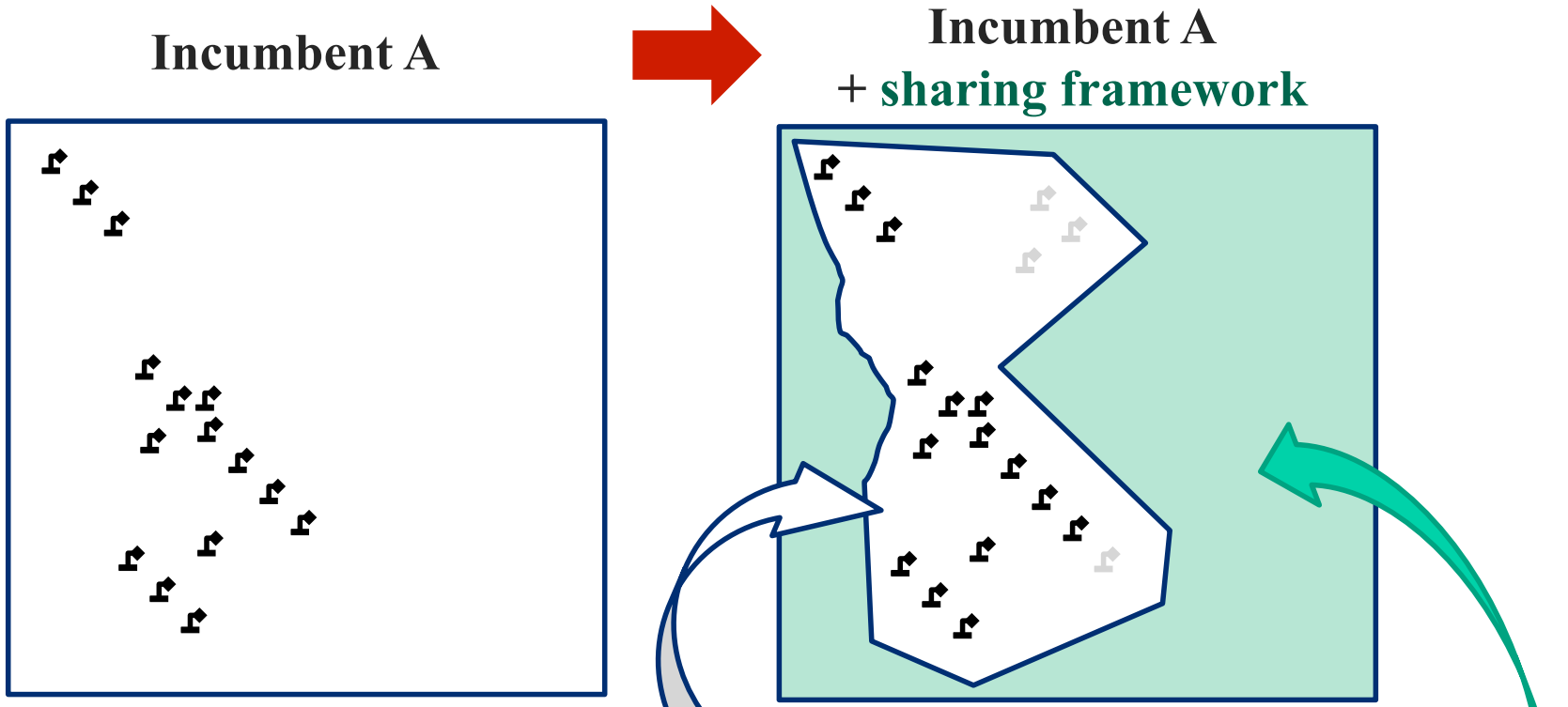
Sharing framework (2)



Station / frequency assignment

Spectrum rights of incumbent A under NTFA with LSA : service allocation(s) limited in accordance with the terms of the "sharing framework".

The "sharing framework" also defines the spectrum that can be made available for alternative usage under LSA.

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Frequency allocation

- **LSA impacts the national allocation of a frequency band**, which is a sovereign decision on the destination of this public resource.
- **National administrations decide which existing applications need to be considered as incumbent uses within the sharing framework and maintained in the long term** according to national policy objectives, and taking into account international obligations and community law in the case of EU Member States.

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Authorisation process

- **The Administration/NRA would set the authorisation process** with a view to delivering, in a **fair, transparent and non-discriminatory manner**, individual rights of use of spectrum to LSA licensees, in accordance with the sharing framework defined beforehand.
- **LSA does not prejudge the modalities of the authorisation process** to be set by Administration/NRAs taking into account national circumstances and market demand.
- **LSA is not a tool to regulate the ECS market and is based on different principles than "Spectrum trading"**
  - It could nevertheless be necessary to check that competition is not adversely affected.
  - The possibility for a governmental entity to engage in trading its spectrum holdings is a national institutional issue.

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European harmonisation

- From a European perspective, LSA assists addressing the market demand for harmonised introduction of new applications in specific bands characterised by fragmented incumbent uses which have to be maintained in different countries. **National administrations therefore require some flexibility in the national implementation to enable the protection of incumbent services**.
- A **CEPT harmonisation measure** would designate a frequency band and define harmonised conditions of use (e.g. BEM, radio interface).
  - **The first practical use cases of LSA will be to provide access to additional spectrum for mobile broadband services (MFCN)**
  - See draft ECC Decision developed by CEPT/WGFM Project Team FM52 for the frequency band 2.3-2.4 GHz

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Part IV

Implementation of LSA in France in the 2.3-2.4 GHz frequency band

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Scope of work

- Working group established in January 2013 and coordinated by ANFR
  - Objective of defining suitable “sharing framework”
  - Involvement of relevant parties: ARCEP, Ministry of defence, DGA, mobile operators, industry stakeholders
  - Initial investigations have aimed to deliver exhaustive inventory of spectrum usage and planned evolution in France in the 2.3-2.4 GHz frequency band
    - Identification of critical military applications to be maintained

- Compatibility studies
  - First phase : impact of the mobile service on aeronautical telemetry
  - Second phase : impact of aeronautical telemetry on the mobile service

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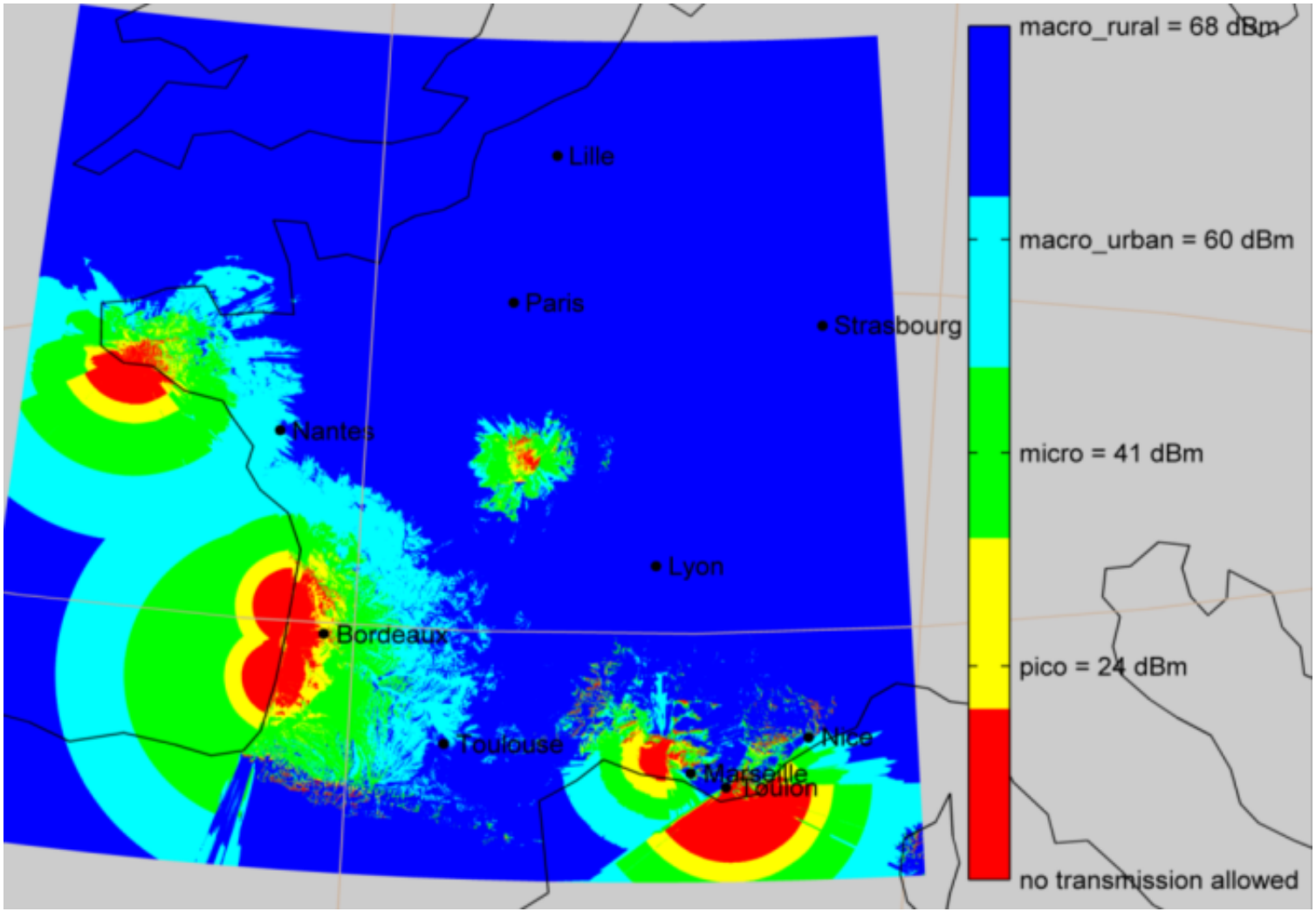
1st phase : impact of the mobile service on aeronautical telemetry

- Static geographical sharing : one example of simulation to show where BS could be deployed (this is not the final deployment map)

macro-rural 45m
macro-urban 30m
micro 6m
pico 1.5m

1 BS in simulation

Protection level:
N - 6 dB
(ECC Report 172)



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Conclusion

- LSA builds upon the benefits of harmonised regulatory framework at international (ITU-R) and European level while recognizing the need for flexibility in national implementation

- Practical benefits by facilitating timely access in Europe for mobile broadband to the 2,3-2,4 GHz frequency band

- Can provide confidence to the stakeholders to support gradual implementation of enhanced sharing mechanisms pending spectrum demand and availability

Thank you!