

**ITU-R SG 1/WP 1B WORKSHOP:
SPECTRUM MANAGEMENT ISSUES ON
THE USE OF WHITE SPACES BY
COGNITIVE RADIO SYSTEMS
(Geneva, 20 January 2014)**

**Introduction of new
spectrum sharing
concepts:
LSA and WSD**

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Content

- I. From “cognitive radio” to “spectrum sharing”**
- II. About spectrum regulatory framework...**
(Draft ECC Report 205)
- III. Licensed Shared Access (LSA)**
(Draft ECC Report 205)
- IV. White Space Device (WSD)**

Background : ITU context

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

Definitions:

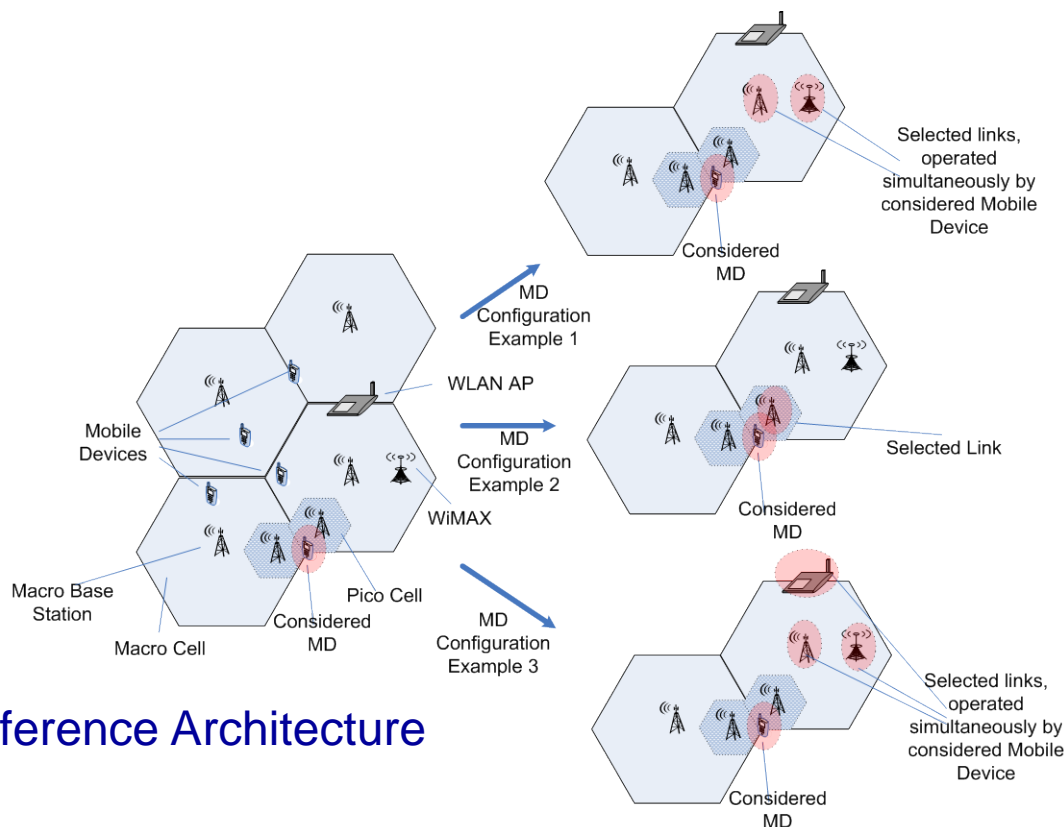
- Definitions for software-defined radio (**SDR**) and cognitive radio systems (**CRS**) have been developed by ITU-R Working Party 1B and published in **Report ITU-R SM.2152**

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

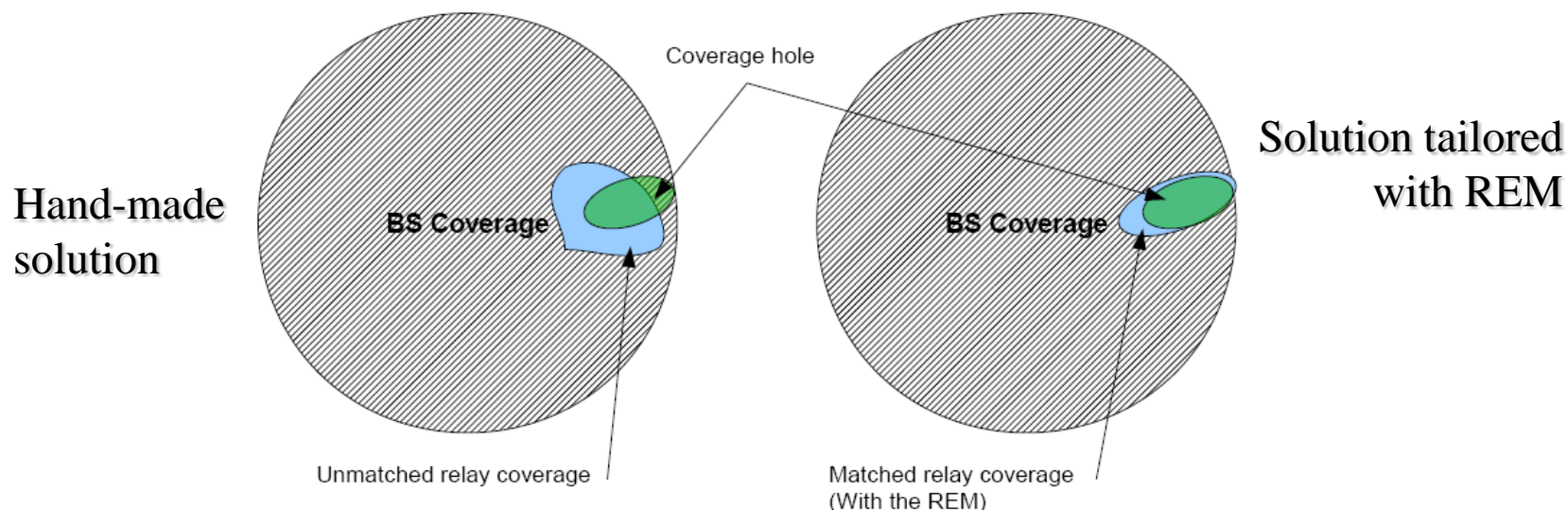


Use Cases related to SDR Reference Architecture for Mobile Device

- **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)*

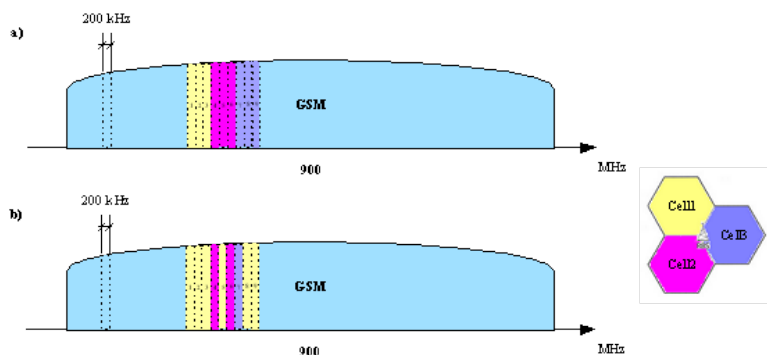


- green area: requirement for better coverage due to propagation issues or more capacity due to traffic issues.
- blue area: relay coverage
- REM (Radio Environment Map) helps detecting and locating coverage and capacity problems by supplying geo-localized information on the coverage/capacity indicators. 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.).

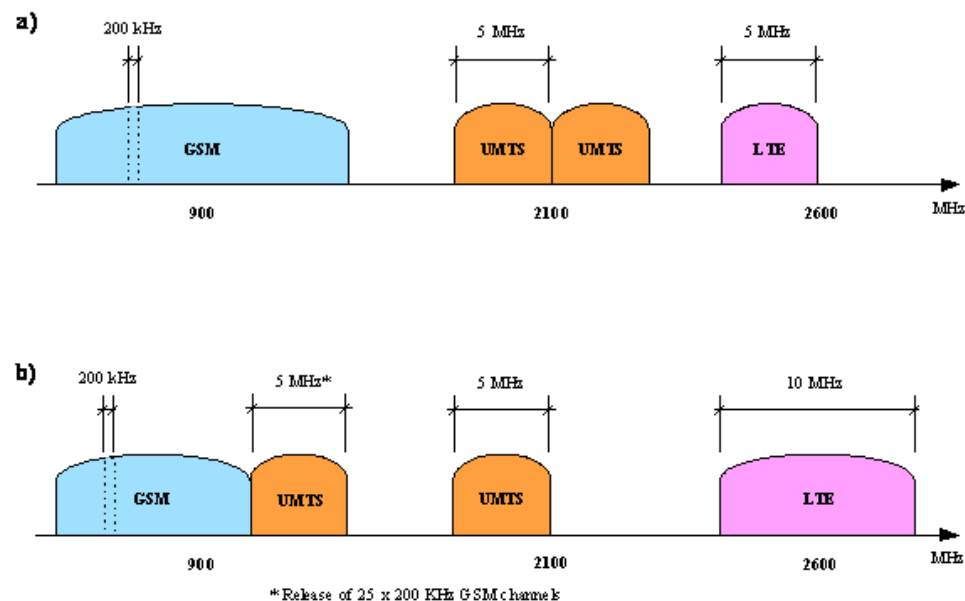
(Source: ITU-R Working Party 5D)

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...)

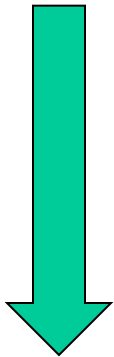
Use of CRS technology as an enabler of **opportunistic** spectrum access

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.*

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)



Part II

About spectrum regulatory framework... (*Draft ECC Report 205*)

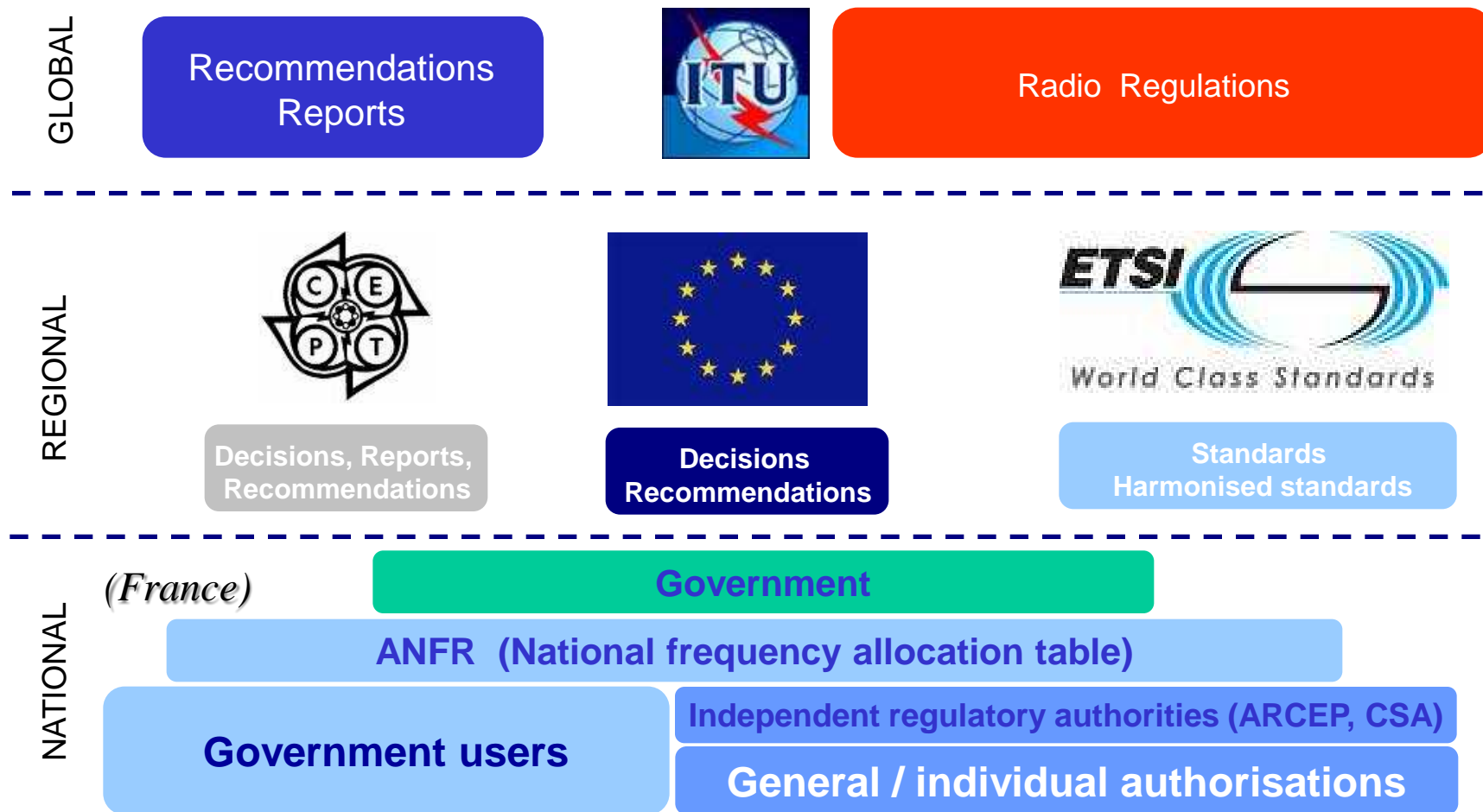
1) Regulatory framework for the use of the radio spectrum

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

2) Spectrum management / Management of frequency authorisations

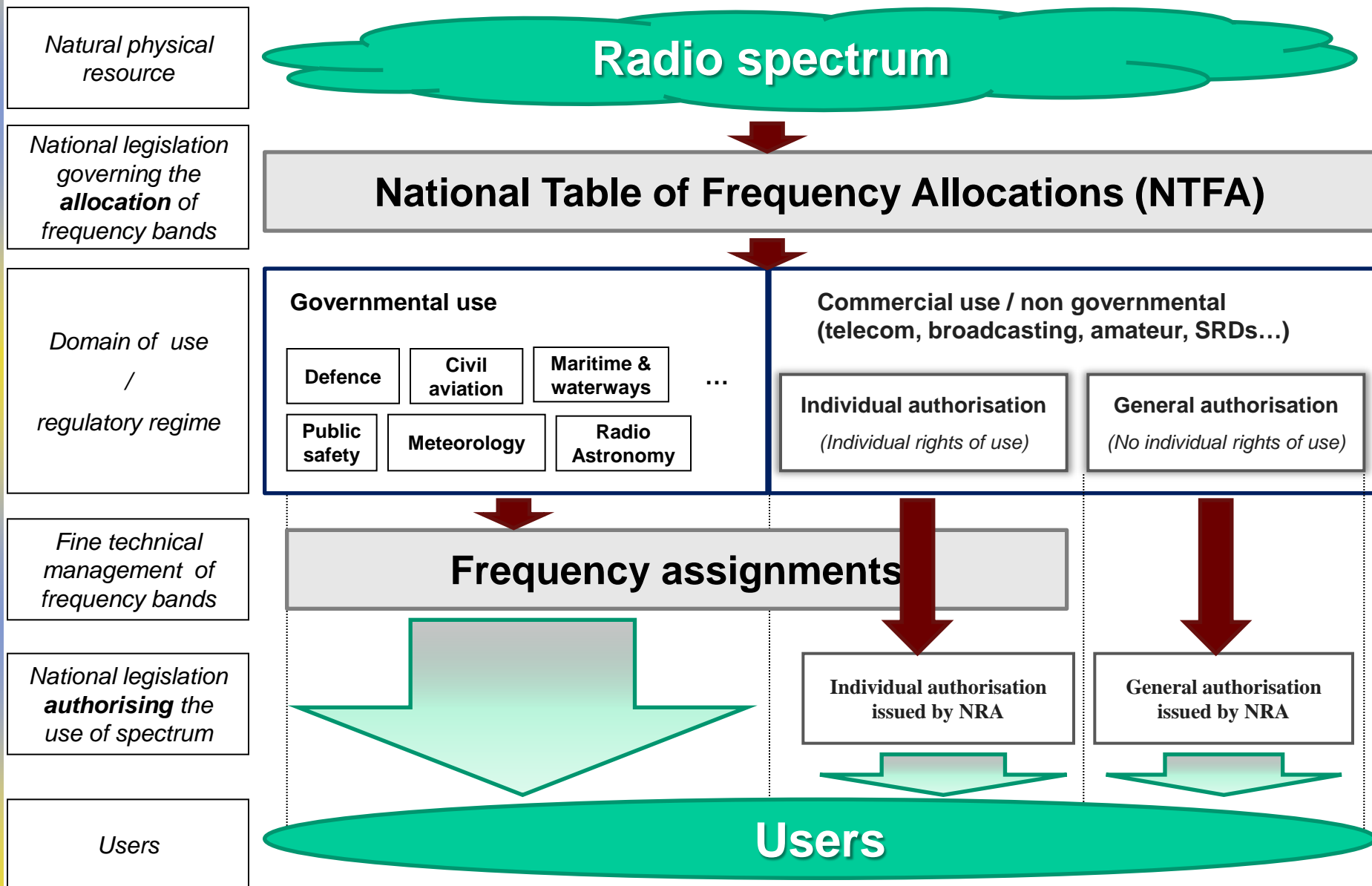
Regulatory framework for the use of the radio spectrum

3 levels



National legislation

From the radio spectrum to users



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

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

Part III

Licensed Shared Access (LSA) (*Draft 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

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)”

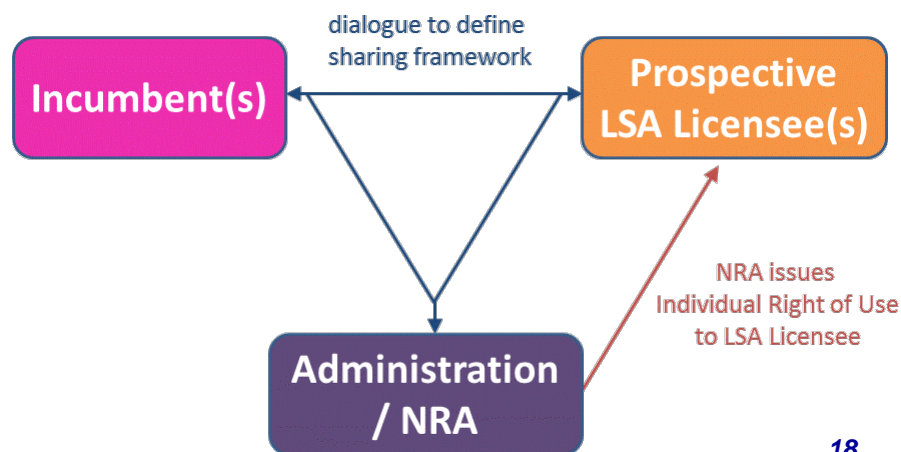
Conclusions of draft ECC Report 205

Scope of LSA

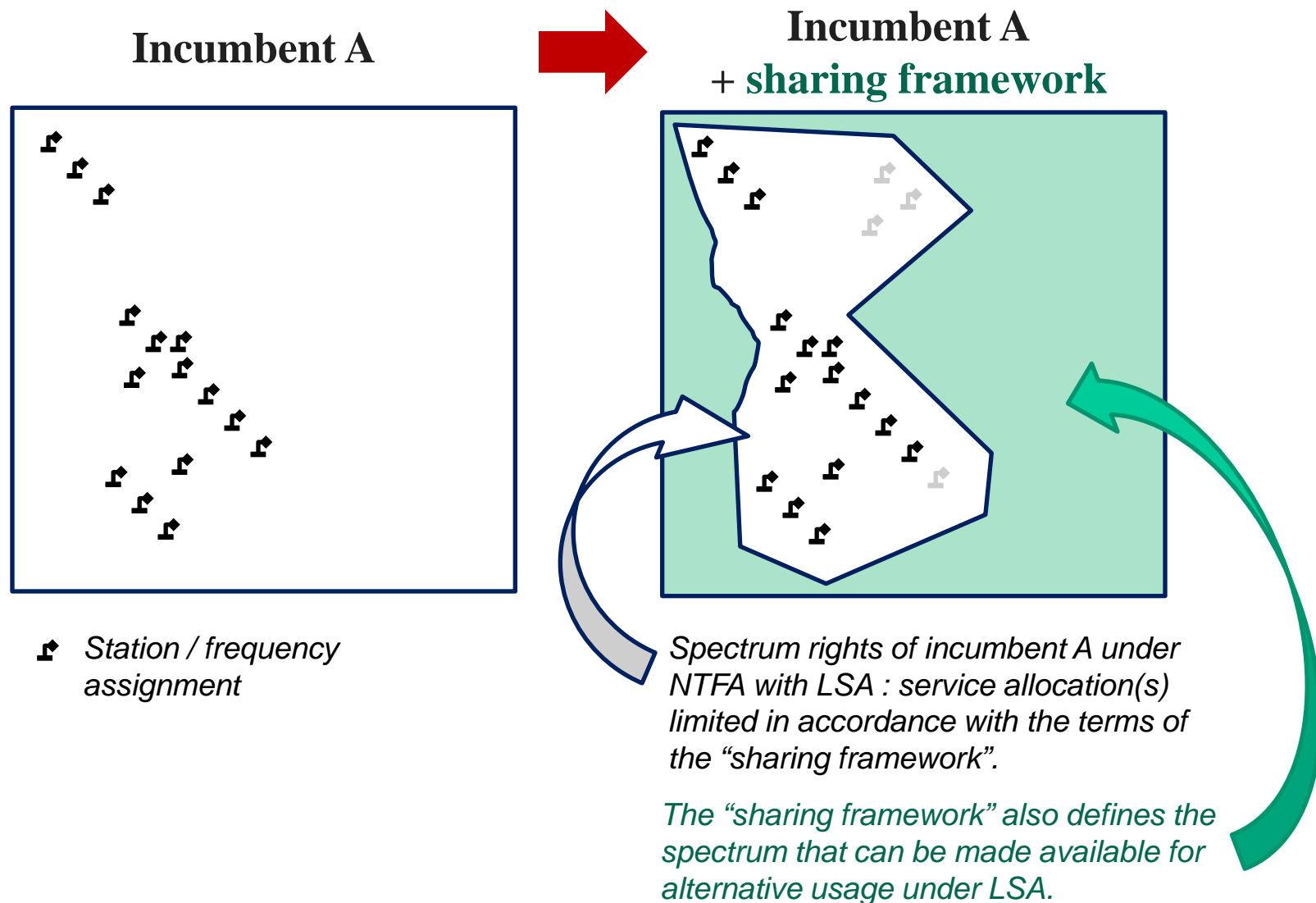
- LSA is a **complementary spectrum management tool** that fits under an “**individual licensing regime**”.
- LSA facilitates the introduction in a frequency band of **new users** while **maintaining incumbent services** in the band. LSA aims to **ensure a certain level of guarantee in terms of spectrum 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.

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**.



Sharing framework (2)



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.**

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 prejudice 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.

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

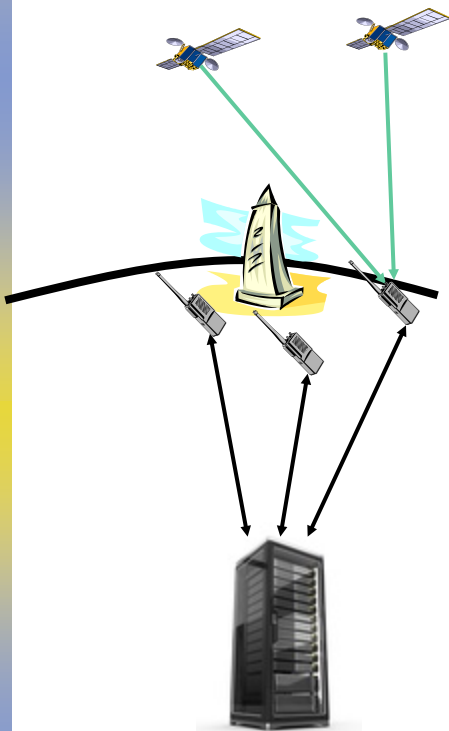
Part IV

White Space Device (WSD)

Technical studies

- **Technical studies** performed by CEPT/ECC **SE43**
 - ECC Report 159 “Technical and operational requirements for the possible operation of cognitive radio systems in the ‘white spaces’ of the frequency band 470-790 MHz”
 - ECC Report 185 “Complementary Report to ECC Report 159 - Further definition of technical and operational requirements for the operation of white space devices in the band 470-790 MHz”
 - ECC Report 186 “Technical and operational requirements for the operation of white space devices under geo-location approach”
 - Download from <http://www.erodocdb.dk/>

Geo-location database



CEPT view: the geo-location is the most feasible approach to ensure the protection of incumbent services in the band 470-790 MHz

- WSD determines its location and makes use of a database to get information on available frequencies at its current location
- Can be combined with spectrum sensing to improve the protection of services

→ Essential (no-go requirement):
WSD may only transmit in the territory of a country if it has successfully discovered a geo-location database approved by the NRA

Harmonisation measure

- Possible **harmonisation measures** for white space devices in the band 470-790 MHz -> CEPT/ECC **FM53**
- Regulatory approach / status:
 - Opportunistic spectrum access
 - General authorisation / Licence-exempt
 - Non-interference / non protected basis
- Progress
 - draft Harmonised Standard EN 301 598 -> ETSI TC BRAN
 - No significant development in FM53 until now
 - Meaning and implications of white space concept to be further investigated
 - Practical experience gained in the UK to be analysed
 - Uncertainties on future spectrum availability for TV WSD
 - WRC-15 a.i. 1.2, use by PMSE (wireless microphones)

Merci !