Spectrum management challenges and policies

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- The levels of spectrum management:
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  - introduction of WAPECS at 2.6 and 3.4 GHz
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Spectrum uses

- Commercial
  - Mobile
  - Radio, télévision
  - Wifi, radio tags,...
- Government
  - Defence, interior, safety, emergency
  - Transportation (air, maritime, roads)
  - Meteorology, space, research
- Increasing demand for spectrum, increasing dependence of society on spectrum
- Different needs in different countries: balance between all needs is best achieved at national level
- But harmonisation necessary for economies of scale and interference management.

Stakes in spectrum management

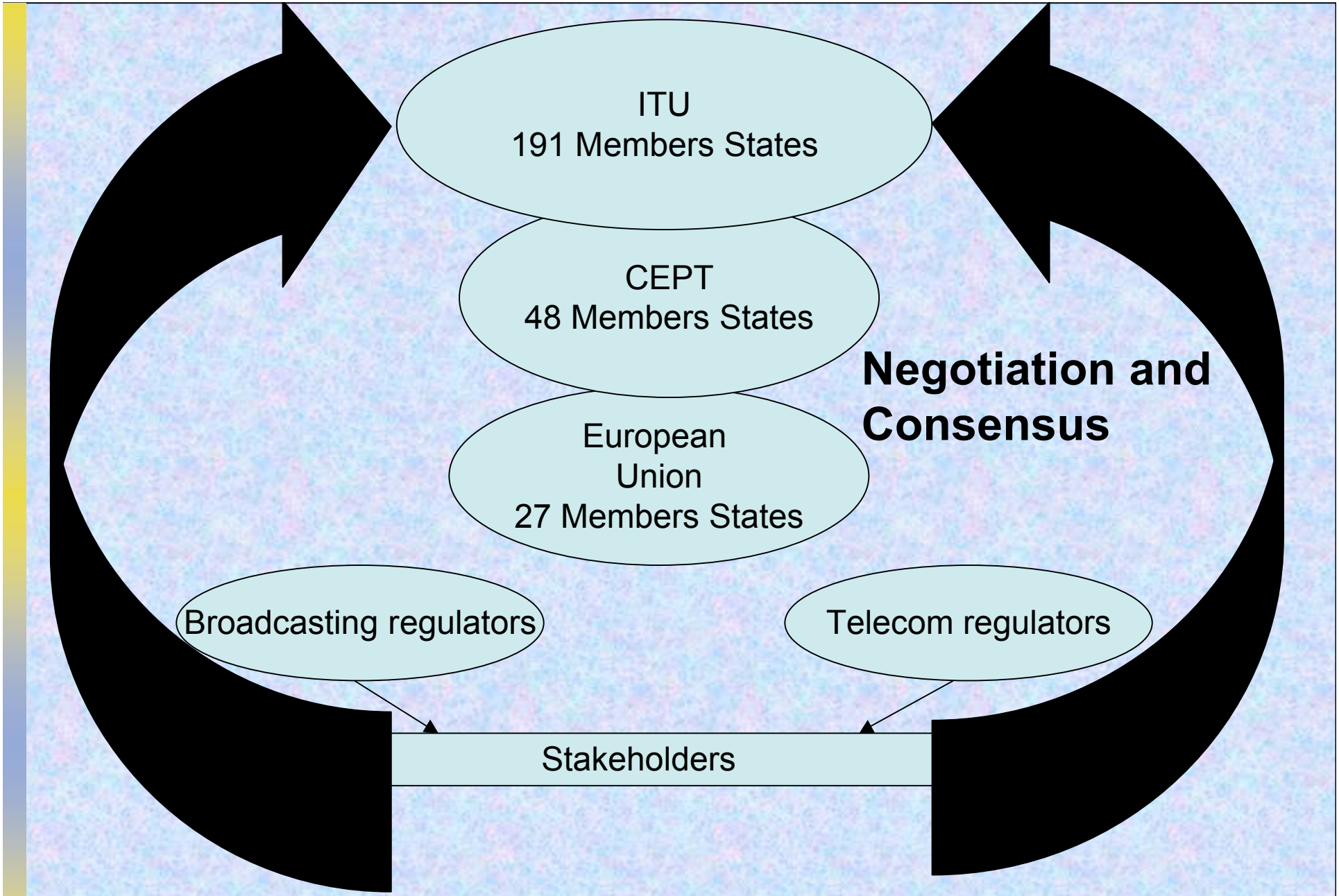
- Scarce resource, public State property
- Need to be managed rationally and efficiently
- Stakes:
  - Societal (cultural diversity, media pluralism, defence, security, transportation, geographic development)
  - Economic (industrial, commercial)
  - Strategic

Objectives of spectrum Management

- Encourage :
  - Efficient use
  - Innovation
- Facilitate access to spectrum by:
  - Services and applications
  - Users
  - Technologies
- Avoid interference (guarantee a clean spectrum)
  - Nationally
  - Internationally

Objectives of spectrum management (2)

- **Provide legal certainty to investment in spectrum**
  - Necessary to establish confidence of investors to build plants, terminals, networks, services
- **Stay in phase with international harmonisation**
  - Key to development of markets
- **Any change is best achieved by consensus**
  - Nationally,
  - Internationally : « Being right alone is being wrong »


ITU
191 Members States
CEPT
48 Members States
European
Union
27 Members States
Negotiation and
Consensus
Broadcasting regulators
Telecom regulators
Stakeholders

The levels of spectrum Management

- Global (ITU)
  - Frequency allocations at global level and define rights of countries in interference management
  - Influenced by international organisations of strong stakeholders: ICAO, IMO, WMO, EBU, NATO,...
  - Need to leave maximum flexibility to each country
- Regional (CEPT and EU)
  - Exercise flexibility by regional harmonisation
- National
  - States are ultimately responsible to ensure proper balance of all spectrum needs in their country

- Each level has its own purpose and merits.

National level of spectrum management

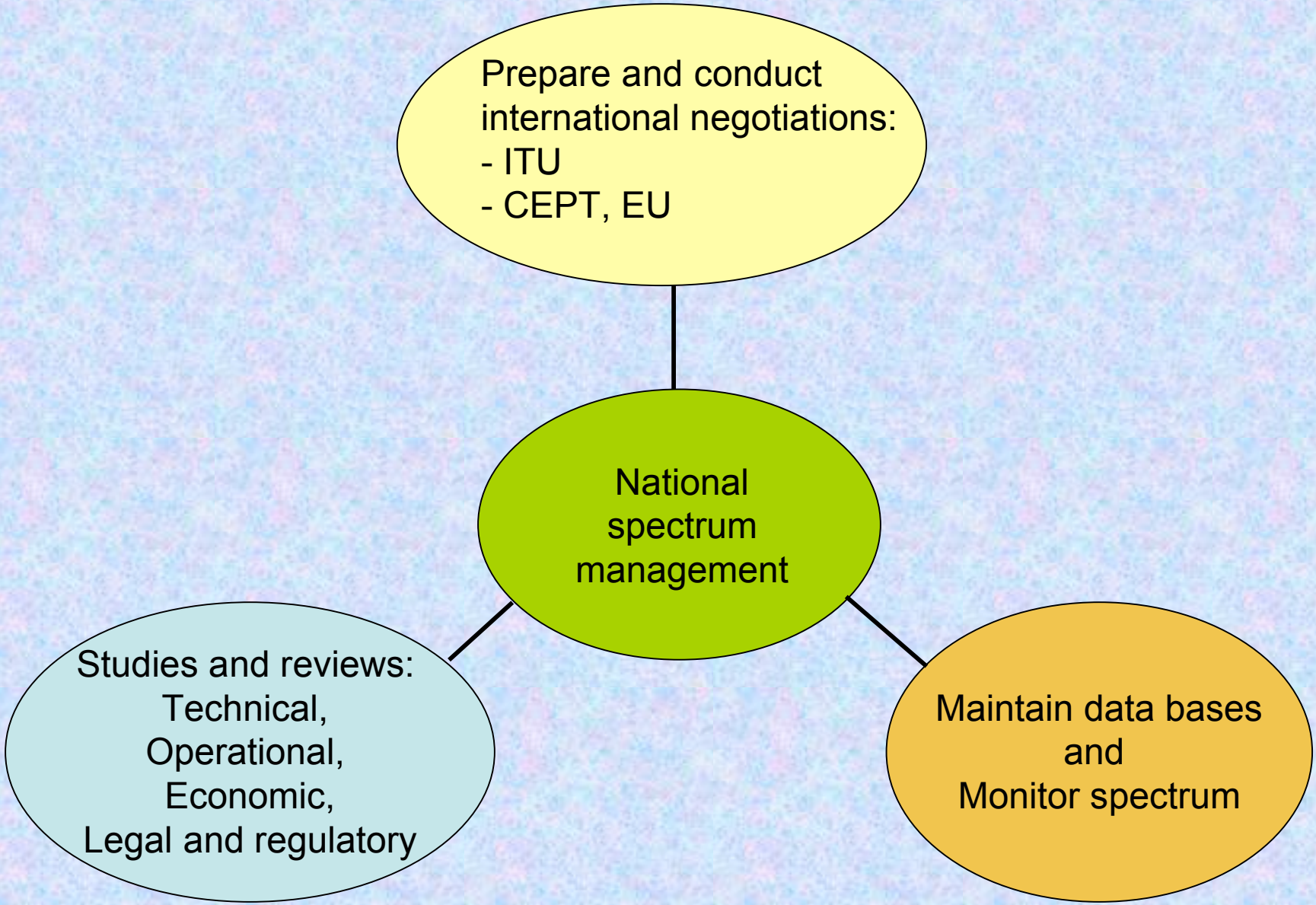
- National Table of Frequency Allocations : wholesale allocation to big users (government or independent regulators)
- Manage spectrum
  - For their own use (Governement)
  - For commercial operators or broadcasters (regulators)
- Changes in National Table of allocations is a political decision and as such, has to be taken at government level.

Role of spectrum management at national level

- Prepare and apply decisions for the political level on:
  - International negotiations
  - Changes to national Table of allocations
- Ensure availability of clean spectrum (free of interference)/protect the rights of users through:
  - Keeping the records of rights of use (assignments/allotments)
  - Controlling spectrum use (spectrum monitoring)
- Requires permanent investments, consultations and studies.

Challenges

- Avoid non explicit decisions between opposing forces:
  - International pressure, linked to existing treaties and undertakings (security, transportation, defence, meteorology, research)
  - National security
  - Industrial interests
  - Commercial interests
  - Cultural and societal objectives
- Requires studies/discussions/negotiations with all stakeholders to clarify issues before decisions are taken.


Prepare and conduct international negotiations:
- ITU
- CEPT, EU
National spectrum management
Studies and reviews:
Technical,
Operational,
Economic,
Legal and regulatory
Maintain data bases and
Monitor spectrum

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Main evolutions in spectrum in France 1992-2010

System	Spectrum amount	Transfered from/shared with
GSM 900	70 MHz	Defence
GSM 1800	150 MHz	Defence
UMTS 2 GHz	140 MHz	Defence (partly)
Wifi 2.4 GHz	83,5 MHz	Defence
Wifi 5 GHz	455 MHz	Defence Meteo, space
UMTS 2,5 GHz (2010)	190 MHz	Defence
Total	**1088,5 MHz**	**560 MHz**

European level of spectrum management

- Europe consists in small countries with densely populated areas and borders
- Harmonisation is key to:
  - Establish confidence for market players that the interference environment will remain under control
  - Enable economies of scale
- Two level:
  - CEPT : harmonisation through non binding decisions
  - EU : harmonisation policies and binding decisions if required.

CEPT level

- 48 Member States
- ECC harmonisation decisions : non binding
- Preparation and coordination of European positions and proposals in ITU World radio conferences : European Common Proposals : at least 10 supporting, no more than 6 opposing

EU level

- Structure established in 2002
- Strategic aspects are discussed in the Radio Spectrum Policy Group (RSPG)
- Harmonisation measures by
  - European Commission decisions, based on Radio Spectrum Committee decisions, rely on CEPT technical competence
  - CEPT (ECC) decisions (non binding)

The role of RSPG

- RSPG is a group composed of high-level government representatives to advise the European Commission on policy issues relating to spectrum
- RSPG has addressed most upcoming strategic issues in spectrum management :
  - Spectrum Trading
  - Digital switchover
  - WAPECS
  - Mobile multimedia
  - Digital Dividend
- RSPG opinions have defined clear directions while remaining pragmatic

Harmonisation of spectrum

- Industry consistently asks for harmonised spectrum to ensure development of innovative systems (GSM, 3G, WiMax, WiFi...).
- Particularly critical over Europe to ensure economies of scale in single market and interoperability.
- CEPT and EC have made significant steps for European harmonisation.
- They will continue to do so.

Spectrum Trading

- RSPG opinion on spectrum trading : new tool for spectrum management and efficient spectrum allocation, but the transfer of the rights to use spectrum does not modify the obligations attached to these rights
- Most EU Member States have implemented spectrum trading in many bands, in line with the guidance given by RSPG

A new approach to harmonisation: the WAPECS concept

- RSPG opinion on WAPECS (November 2005)
- To respond to the trend for convergence of services and need to rapid access to spectrum by new technologies
- Increasing flexibility and enhancing harmonisation,
- Maintain a stable and predictable regulatory framework
- Ensure a coherent authorisation scheme
- Technology neutrality where possible
- Service neutrality, without prejudice to any obligation to provide specific services in specific bands (broadcasting, emergency)

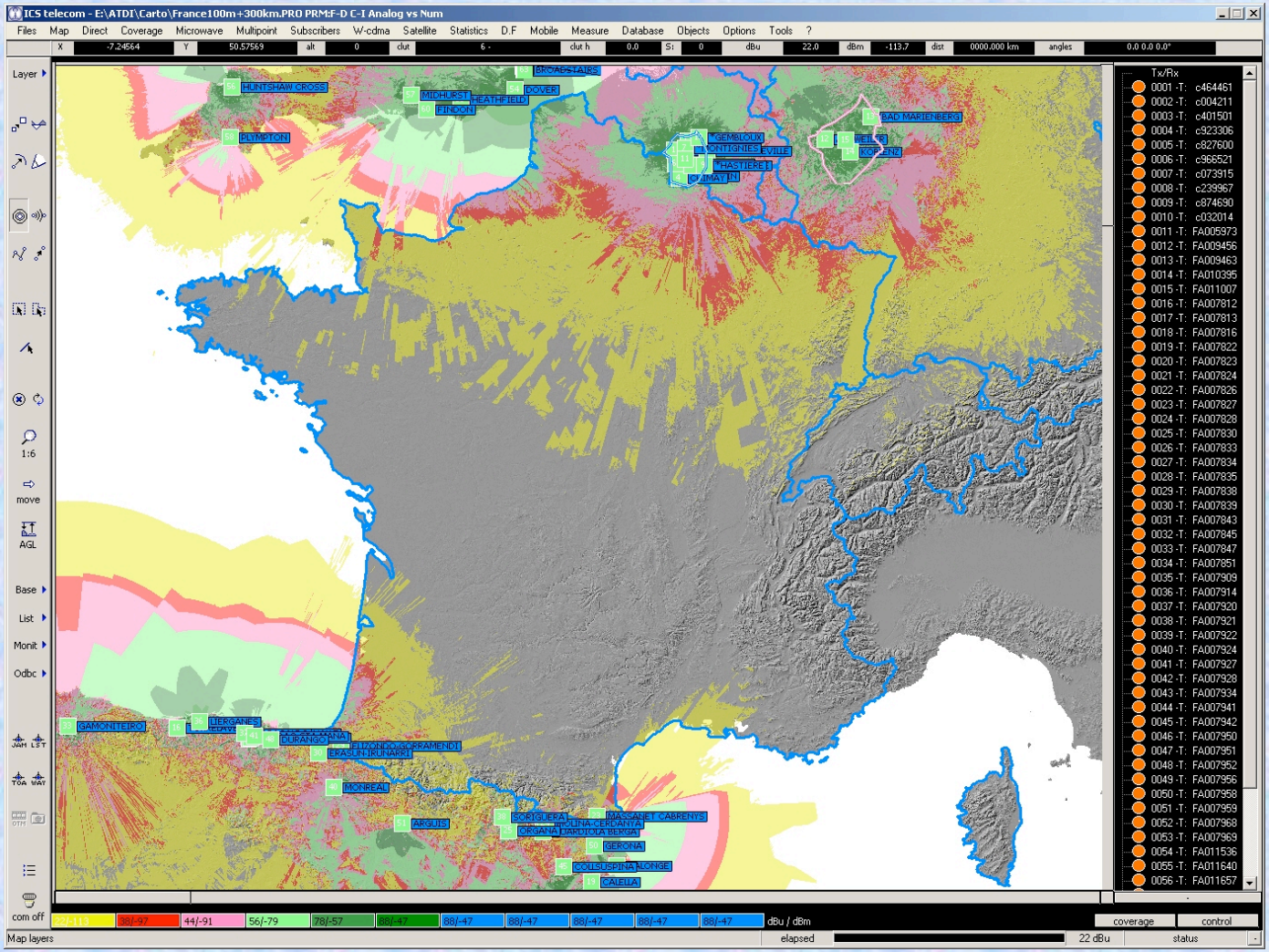
Application of the WAPECS concept

- Long term objective, implemented through official EU committes (RSCOM and COCOM)
- Bands where WAPECS concept may start to be implemented :
  - 470-862 MHz
  - 880-915 MHz, 925-960 MHz
  - 1710-1785 MHz, 1805-1880 MHz
  - 1900-1980 MHz, 2010-2025 MHz, 2110-2170 MHz
  - 2500-2690 MHz
  - 3.4-3.8 GHz
- In all bands, the goal is to identify current constraints and to identify measures for improving coherence of autorisation conditions and removing undue contraints

Digital Dividend

- RSPG opinion (February 2007) : EU-wide benefits to the use of the digital dividend by mobile applications (including uplinks) in a harmonised UHF sub-band
- ECC/TG4 (June 2007)
  - Harmonisation is feasible from a regulatory and technical viewpoint
  - Not mandatory at the EU level
  - Preferred sub-band should include at minimum channels 62-69
  - Requirements for bilateral and multilateral negociations between neighbouring countries

GE-06 plan entries from neighbouring countries interfering into mobile uplinks



RSPG expected opinions for 2008

- New opinions developed on:
  - Collective use of spectrum
  - Government use of spectrum
  - Relationship between standardization and spectrum harmonisation
  - Spectrum issues at borders of the European Union.

ITU Level of spectrum management

- 191 Member States
- Allocates frequency bands to radiocommunication services and define the rights of administrations to use spectrum
- World Radiocommunication conferences (WRC), every 4 years, update the Radio regulations. Decisions by consensus (no vote)
- Regional radiocommunication conferences when necessary (ST-61, GE-06)
- New allocations made by WRCs:
  - Mainly worldwide or regional allocations
  - if sharing is possible through technical limits or coordination with interested parties.
  - **Open possibilities, not obligations :** ITU allocations enable the creation of rights to protection/transmission through the application of the relevant procedures by administrations.
- « Identification » of bands (as for IMT), is signal to industry, not mandatory.

Example of WRC decisions: Mobile allocations and identifications for IMT at WRC-07

- 4 main candidate bands
  - 450-470 MHz
  - 470-862 MHz
  - 2.3-2.4 GHz
  - 3.4-4.2 GHz
- Initial proposals: No Change by a large majority in all proposed bands: IMT identification seen as pressure to vaccate spectrum from current uses, hence threat to national assets (Defence, broadcasting, satellite links).
- Compromise : all four bands or part thereof identified, together with emphasis on the need to obtain agreement from neighbours before implementation.

Examples of the challenges in spectrum management

- Digital dividend
- UMTS in GSM bands
- WAPECS at 2.6 GHz
- WAPECS at 3.4 GHz
- WAPECS conditions

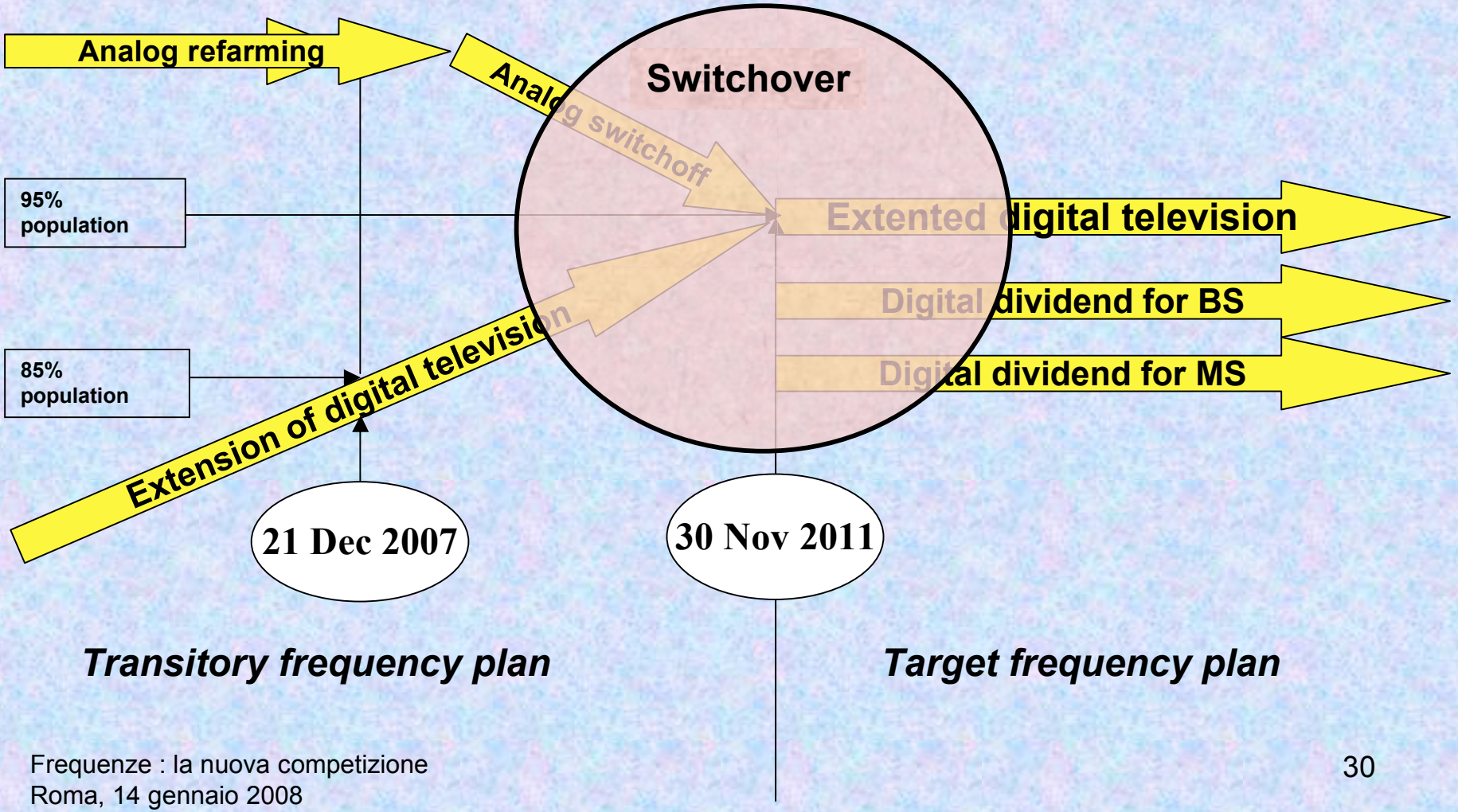
Digital dividend

- The spectrum released by analog switchoff
- 2015 : ITU deadline
- 2012 : EU objective
- GE06 Plan has already distributed the digital dividend between countries under one possible scenario : « broadcasting only »
- Any change is to be negociated bilaterally under the provisions of the GE06 Agreement : no implicit agreement to use remaining resources.

Three inter-related programs

1. **Extending digital television coverage on a transitory frequency plan, compatible with existing analog**
   - Geographic extension
   - Addition of new multiplexes
2. **Analog switchoff and digital swichover**
   - Define the conditions under which switchoff and switchover will take place: where, when ?
   - Requires a detailed plan (area by area, multiplex by multiplex, site by site
3. **Digital dividend**
   - Take a national decision on the digital dividend : what sub-band for what usage ?
   - Linked to progress in international negotiations

Three inter-related programs



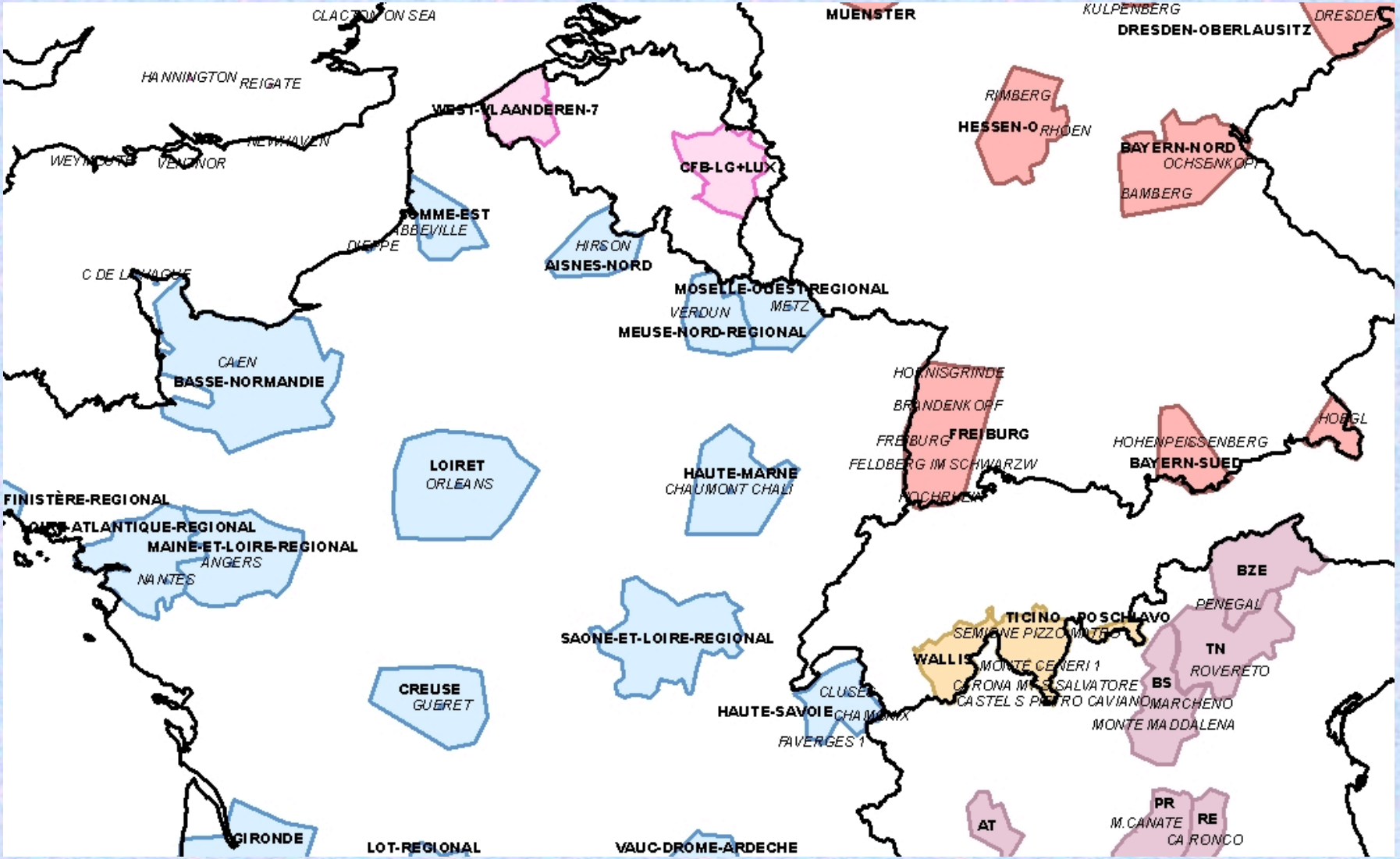
1. Adjust the transitory frequency plan

- Needs to be constantly updated and negociated with neighbours as planning progresses
- The specific situation before switchover is not yet known in detail.

2. Adjust the target frequency plan

- GE06 Plan foresees detailed frequencies by geographic areas for 7 multiplexes in UHF
- Insufficient to satisfy all requirements expressed
- GE06 plan may be modified by bilateral agreements to obtain additional frequency resources.

GE06 Plan allotment areas for channel 39

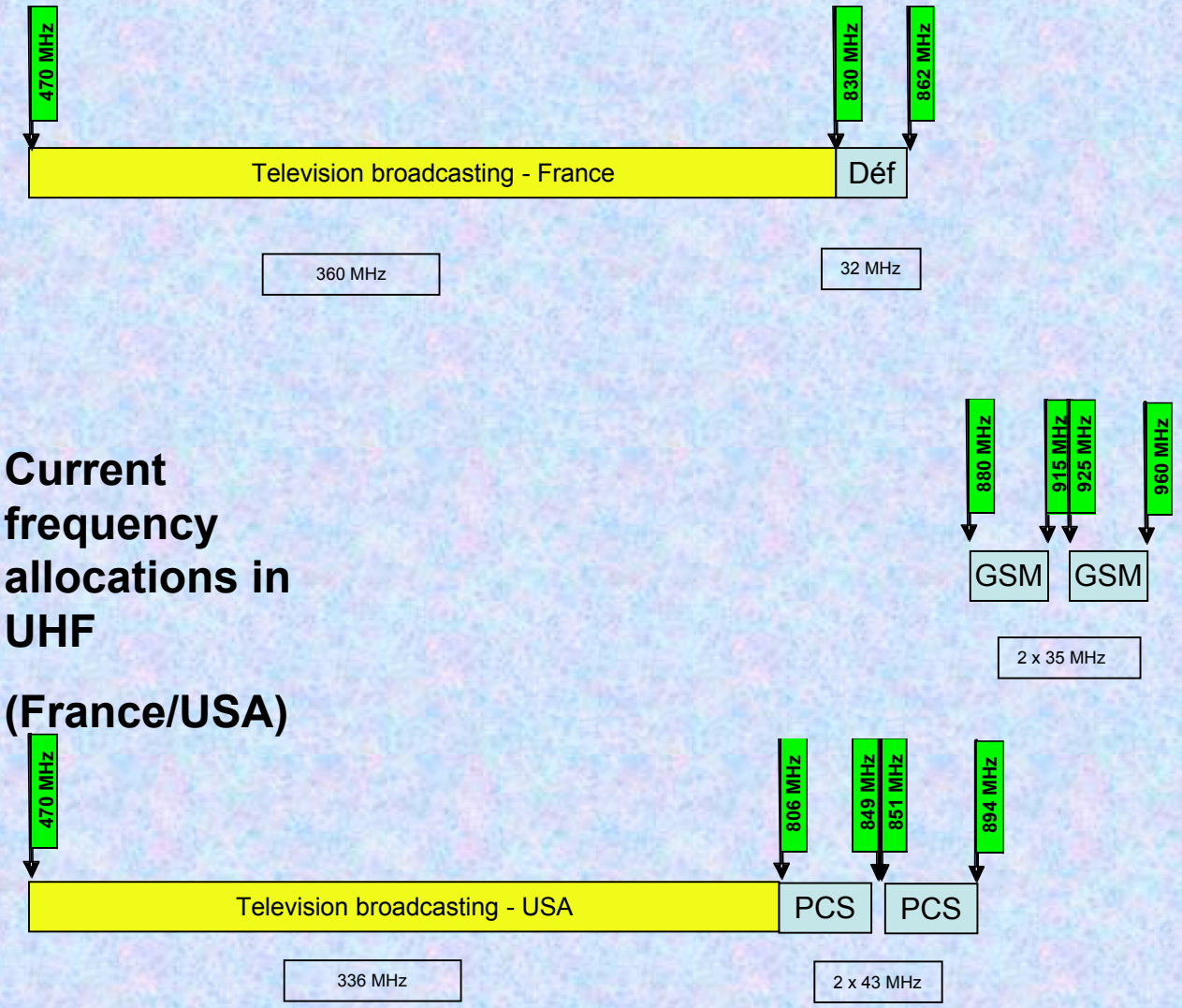


Broadcasting and mobile requiements

- Broadcasting requirements
  - HDTV
  - Mobile television
  - Up to 14 layers requirement now brought forward in France
- Mobile requirements
  - 72 to 150 MHz for large coverage and indoor penetration
  - Internationally harmonised
- Constraint
  - Band in also used by military
  - Base stations are sensitive to interference by broadcasting transmitters

Current frequency allocations in UHF

(France/USA)



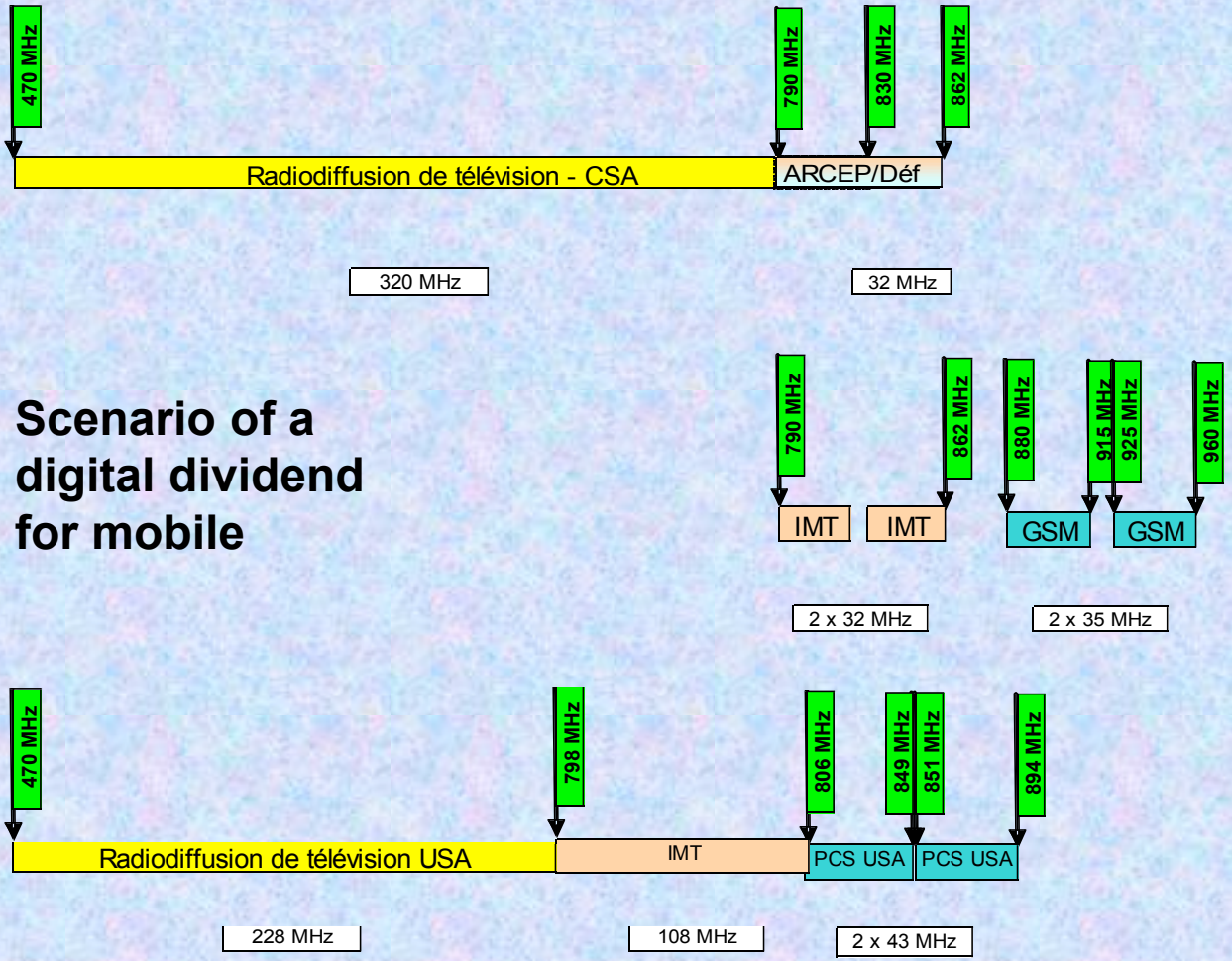
Consequences of WRC-07 decisions

Television broadcasting

or

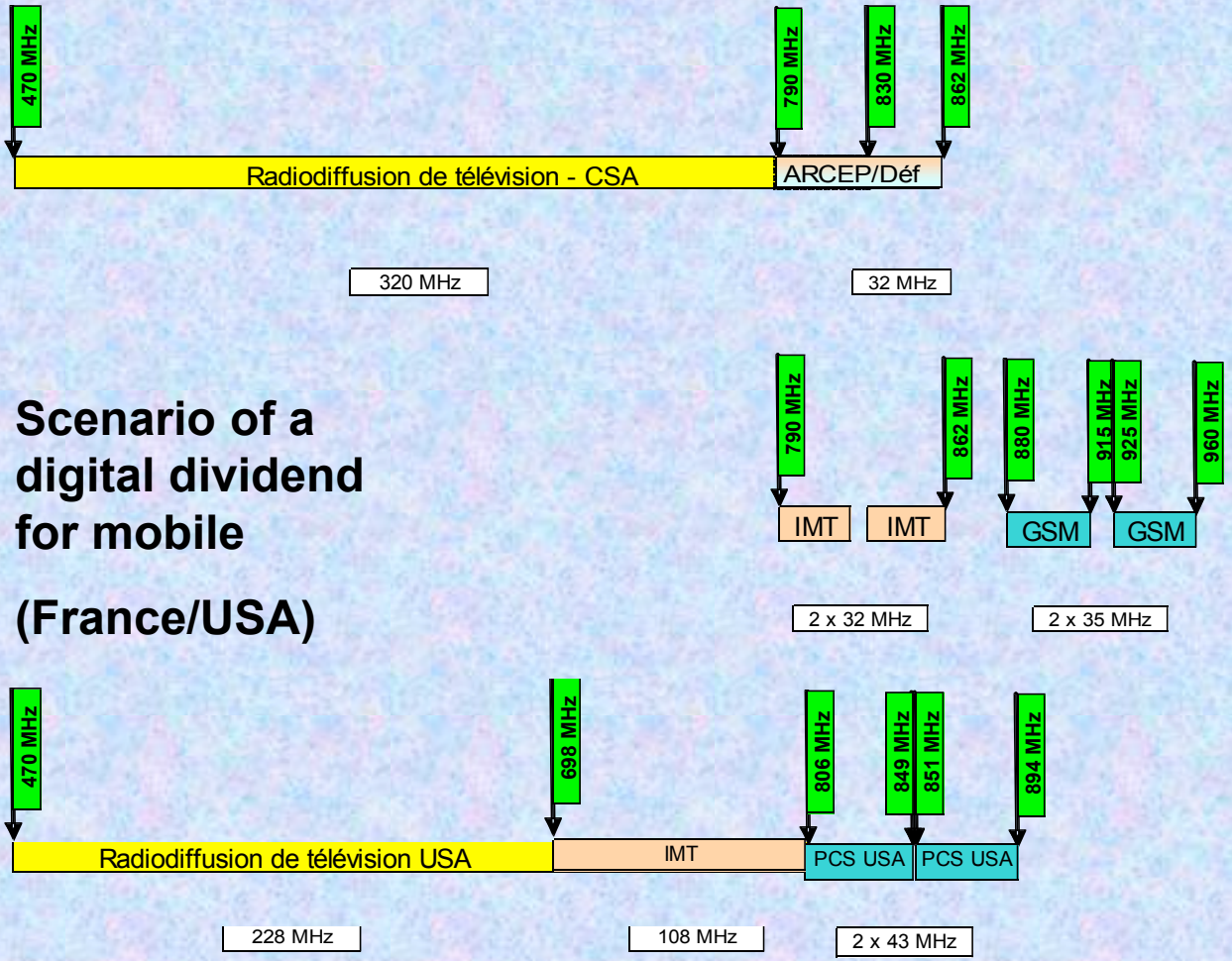
Mobile
After analog switchoff
Subject to agreement by neighbouring countries

Scenario of a digital dividend for mobile



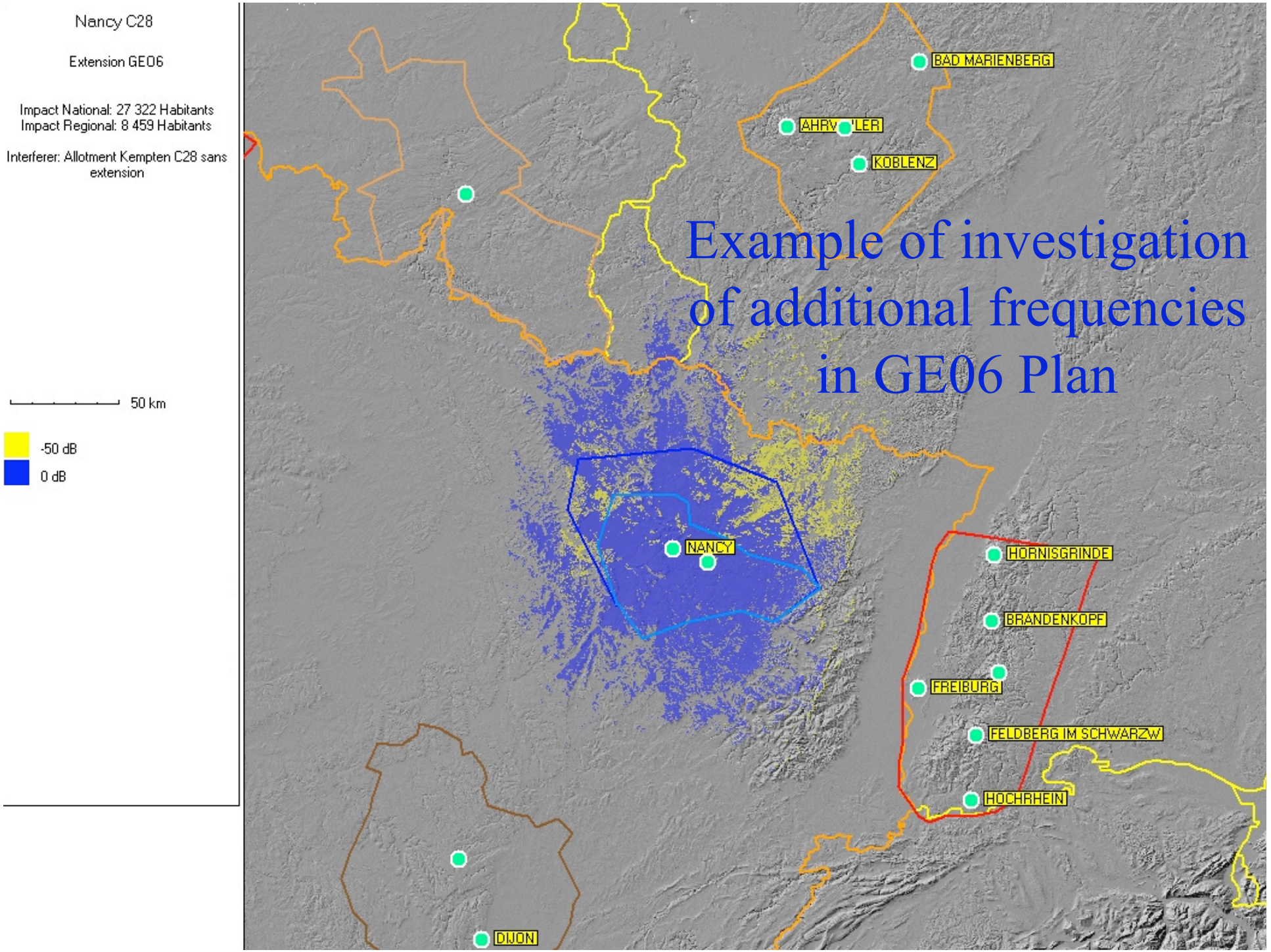
Scenario of a digital dividend for mobile

(France/USA)



Perspectives

- WRC-07 : open the possibility of a choice for the digital dividend in 11% (France) to 18% of the band currently allocated to broadcasting:
  - 320 MHz are kept for exclusive use by broadcasting
  - 40 MHz to 72 MHz are opened to a choice between broadcasing and mobile
- Uncertainty is detrimental to all stakeholders
- But pre-requisite to a decision is bilateral discussions and international harmonisation.



Example of investigation of additional frequencies in GE06 Plan

Impact of identification of channels 61-69 for mobile services on the current distribution of channels by allotment area and layer in current GE06 Plan

n° couche GE-06	total	**n°1**	**n°2**	**n°3**	**n°4**	**n°5**	**n°6**	**n°7**
découpage National/Régional		Nat	Nat	Nat	Nat	Nat	Reg	Nat
nombre d'allotissements utilisés ayant des canaux compris entre 62 et 69	**51**	5	2	4	4	11	16	9
nombre total d'allotissements utilisés	**543**	75	75	75	75	75	92	76
	9%	*7%*	*3%*	*5%*	*5%*	*15%*	*17%*	*12%*

Conclusion : revoir 9% des fréquences attribuées

Conclusion on digital dividend

- WRC-07 decisions are only a first step, which enable a choice, but does not forces it.
- Future steps:
  - Negotiations with neighbouring countries.
  - European harmonisation decisions (CEPT, UE) : technical limitations on interference power levels authorised in GE06 Plan in order to facilitate sharing and leave flexibility on use.
  - National decisions
- Impact on the development of national plans for extension of digital TV, for analog switchoff and for digital switchover.

UMTS in « GSM bands »

- 880-960 MHz and 1710-1880 MHz
- These bands are currently the most intensively used in spectrum
- WAPECS concept carefully introduced by opening these bands to UMTS, for which compatibility studies have been completed, and by defining a process for introducing other technologies
- Main compatibility issue related to the coexistence between technologies with different bandwidth and impact systems in adjacent bands

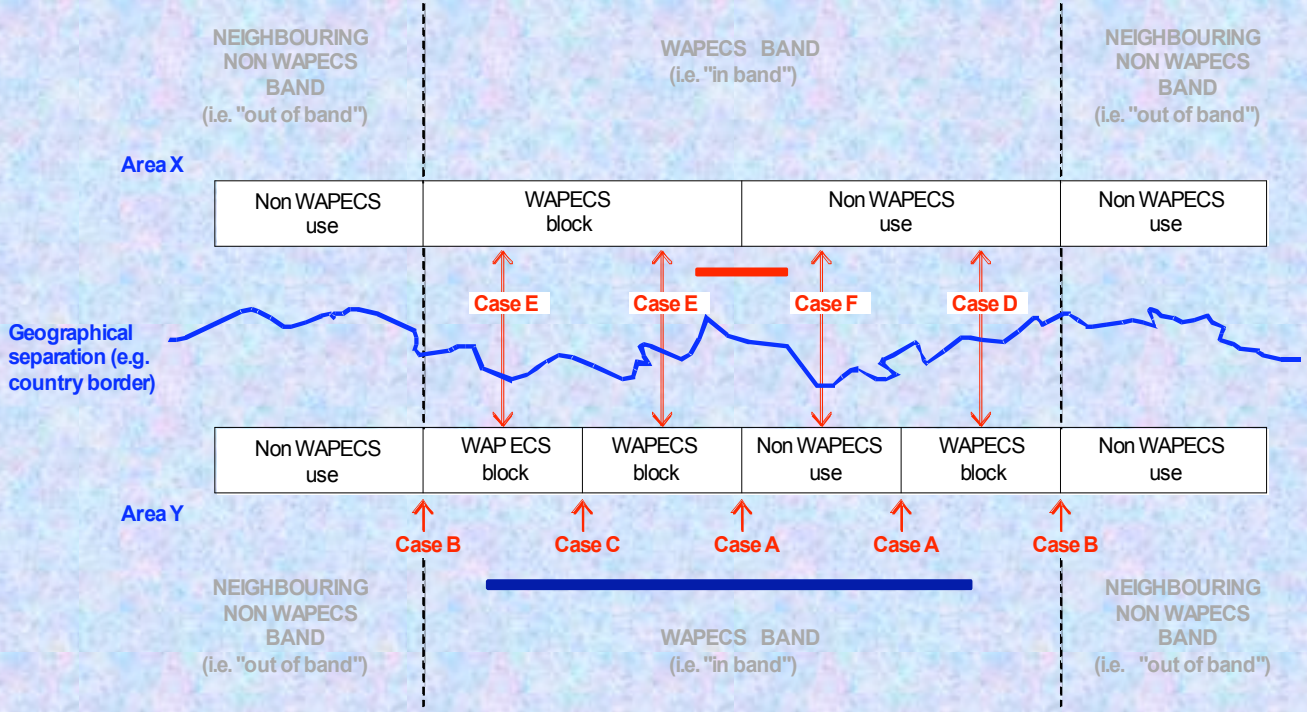
WAPECS at 2.6 GHz

- Frequency band under spotlight since 2004 :
  - Band identified for IMT at WRC-2000
  - conflict WiMax/IMT
  - resolved at RA-07 by including WiMax within IMT
- CEPT has studied « generic » conditions (« Block Edge Mask », BEM) on the basis of the technologies envisaged in this band.
- Main compatibility issue related to the FDD/TDD coexistence
- These generic conditions will be discussed in 2008 in the framework of RSC with the aim to develop an EC decision for this band

WAPECS at 3.4 GHz

- CEPT had already defined generic conditions for BWA in this band. They will be applied as WAPECS conditions
- In this band, flexibility has been increased to the maximum extent possible, maybe with a risk of creating interference issues and conflicts between operators
- Experience needs to be gained on this frequency band

Methodology for the development of WAPECS conditions



WAPECS reference system:

- network (fixed, nomadic, mobile)

Transmit power

Coverage (indoor, outdoor),

Transmitters density,

receive parameters (sensitivity, adjacent channel selectivilty)

WAPECS conditions

- Main interference issues related to significant differences in characteristics rather than technology itself :
  - TDD/FDD (2.6 GHz)
  - Power/antenna height/coverage (TV band)
  - Bandwidth (GSM/UMTS bands)
- All WAPECS conditions have been based on studies assuming specific systems:
  - Not really « technology neutral »
  - Underlying advantages given to some technologies
  - Interference situations may be different if systems implemented are different from those assumed
- Conservative assumptions in the definition of WAPECS conditions :
  - Operator may coordinate to find more relaxed conditions (ie, in GSM/UMTS bands)
  - However, win-win solution means that the situation is not asymetric : both operators should be able to win in the coordination. Not generally the case if systems are different.

Conclusion

- There is no « blank sheet situation » to which new concepts in spectrum management may be applied to improve
  - Flexibility
  - Service and technology neutrality
  - so-called « non intrusive » technologies
- Flexibility is illusive, it has a cost, may lead to uncertainty
- Interference is not service neutral
- Future technologies cannot be factored into todays decisions
- Most attractive frequency bands are already used by « incumbants » which have made plans based on past decisions.
- Spectrum decisions often relate to sensitive political issues

- There is not magic « one size does fit all » solution in spectrum management, only tools, each with limited application.
- Case by case remains the baseline

Thank you for your attention