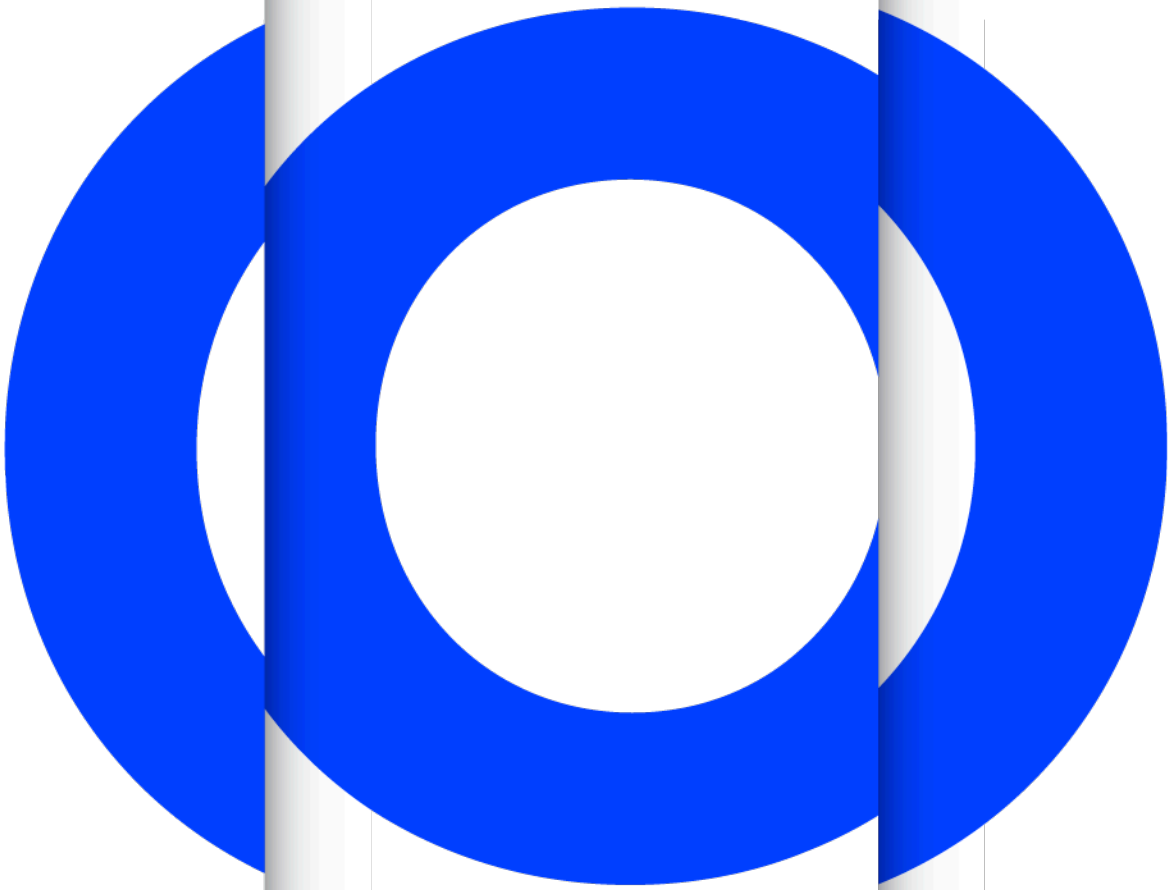
EBU

OPERATING EUROVISION AND EURORADIO



WEBINAR ON WRC '15 PREPARATIONS

ELENA PUIGREFAGUT & WALID SAMI
(EBU TECHNOLOGY & INNOVATION)

WEBINAR, 27TH SEPTEMBER 2013

EBU
OPERATING EUROVISION AND EURORADIO

PLAN

1. **Introduction to WRC**
2. **AI 1.1: Additional allocation to the MS and identification for IMT**
3. **AI 1.2: Use of the frequency band 694-790 MHz by the mobile service**
4. **AI 1.3: Spectrum for PPDR**

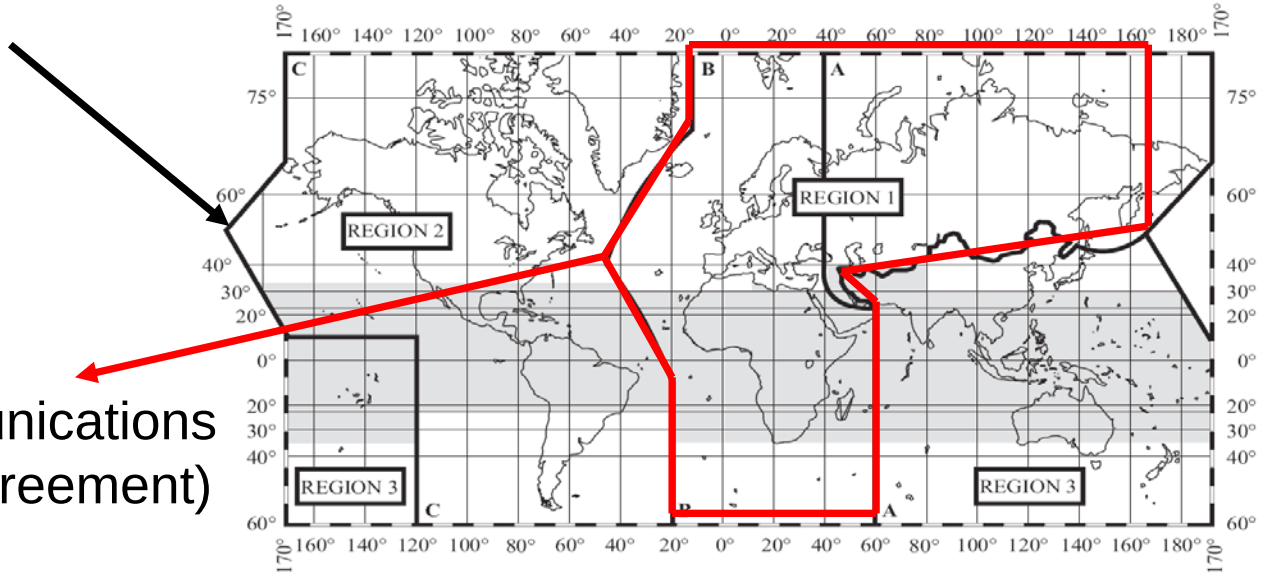
- **Questions and Answers after each module and a general Q/A session at the end**
- **Please send your questions during the presentation of each module by typing it in the chat window**
- **To ask for the floor during the Q/A sessions please raise your hand (click on the hand next to your name)**

INTRODUCTION TO WRC

OBJECTIVE: To modify the ITU-R Radio Regulations (RR)

- The RR is ‘the international treaty governing the use of the radio-frequency spectrum and the satellite orbits’

191 Member states are involved



Regional Radiocommunications Conference (GE06 agreement)

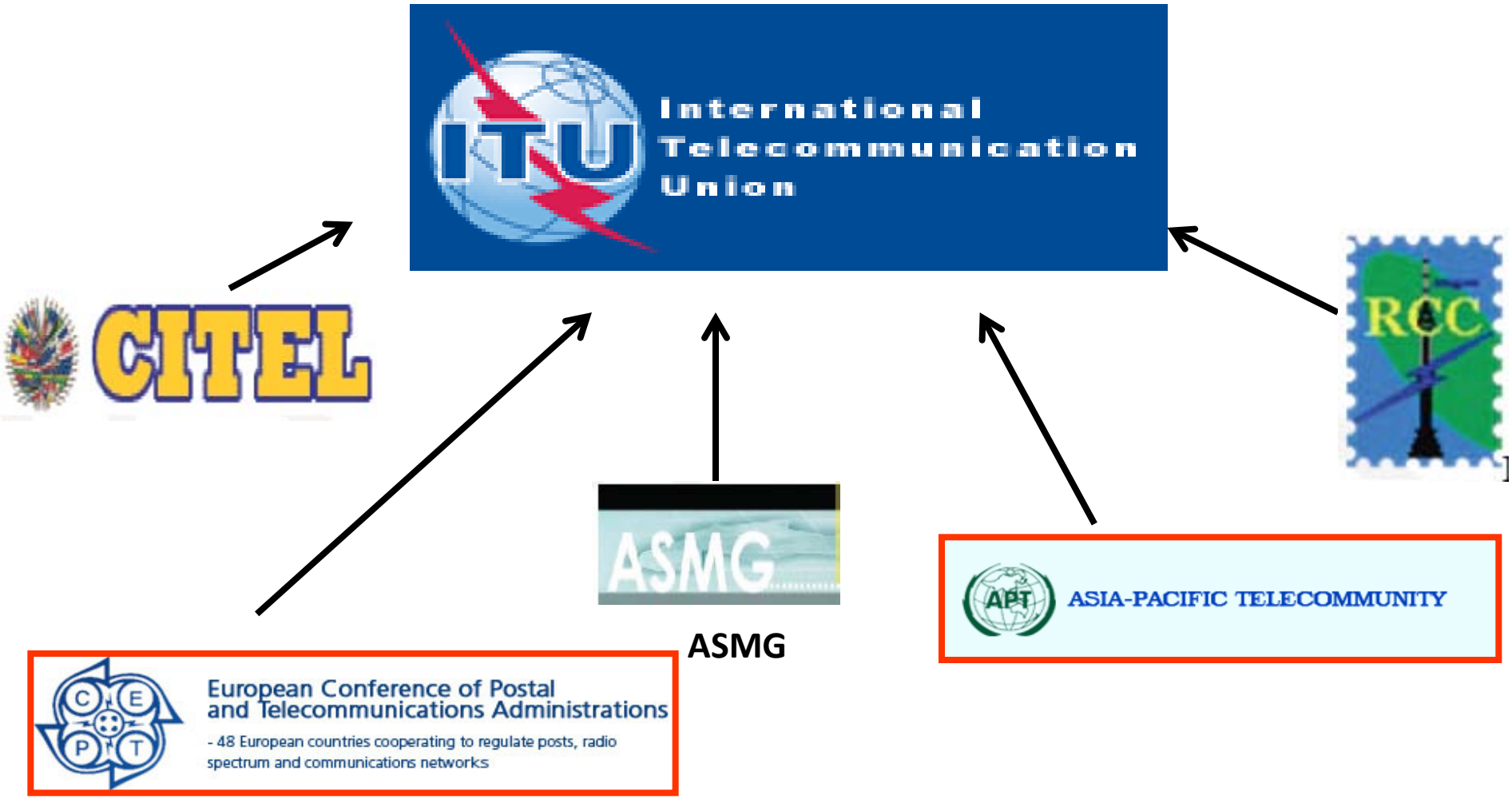
All frequency bands and all services might be involved, all defined in the WRC Agenda

WRC OUTPUT

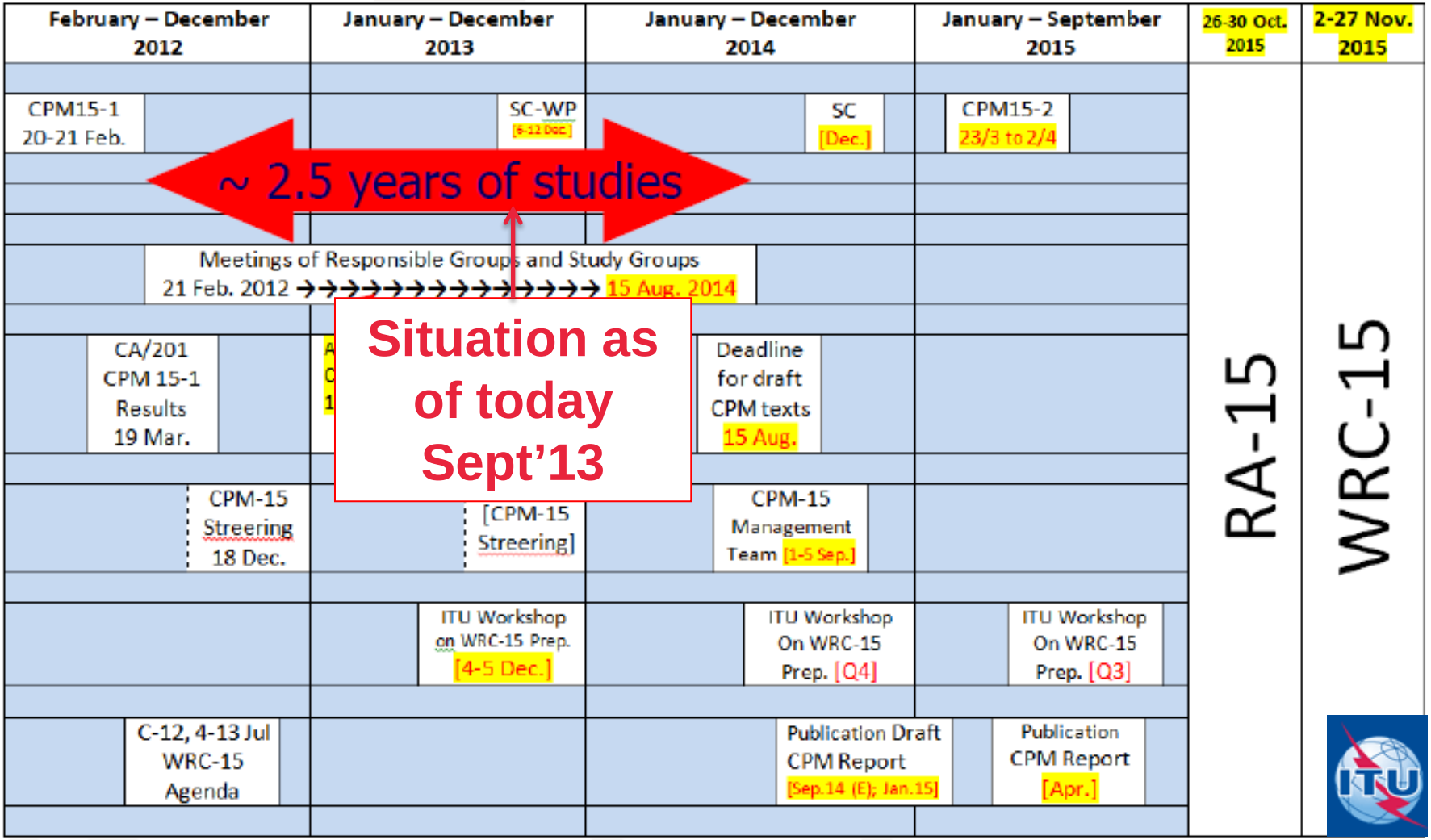
Allocation to services		
Region 1	**Region 2**	**Region 3**
460-470	FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 5.289 5.290	
470-790 BROADCASTING 5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.311A 5.312 5.312A	**470-512** BROADCASTING Fixed Mobile 5.292 5.293	**470-585** FIXED MOBILE BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.297	**585-610** FIXED MOBILE BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	
	614-698 BROADCASTING Fixed Mobile 5.293 5.309 5.311A	**610-890** FIXED MOBILE 5.313A 5.317A BROADCASTING
	698-806 MOBILE 5.313B 5.317A BROADCASTING Fixed 5.293 5.309 5.311A	
790-862 FIXED MOBILE except aeronautical mobile 5.316B 5.317A BROADCASTING 5.312 5.314 5.315 5.316 5.316A 5.319	**806-890** FIXED MOBILE 5.317A BROADCASTING	
862-890		

EBU
OPERATING EUROVISION AND EURORADIO

INFLUENTIAL REGIONAL ORGANISATIONS



CHALLENGING TIME SCHEDULE



HIGH PRIORITY WRC-15 AGENDA ITEMS RELATED TO BROADCASTING

WRC-15 Agenda Item		ITU group	CEPT groups
1.1	to consider additional spectrum allocations to the mobile service (MS) on a primary basis and identification of additional frequency bands for IMT	Joint Task Group 4-5-6-7 (JTG 4-5-6-7)	**CPG** **CPG PTD** ECC TG6
1.2	to examine the results of ITU-R studies, in accordance with Resolution **232 [COM5/10] (WRC-12)**, on the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service in Region 1 and take the appropriate measures	Joint Task Group 4-5-6-7 (JTG 4-5-6-7)	**CPG** **CPG PTD** ECC TG6
1.3	to review and revise Resolution 646 (Rev.WRC-12) for broadband public protection and disaster relief (PPDR), in accordance with Resolution 648 (COM6/11) (WRC-12)	WP5A	**CPG** **CPG PTA** FM49 ECC PT1 CPG PTD

Information on WRC-15 preparations and other WRC-15 agenda items related to broadcasting but with lower priority is available in the confluence at http://workspace.ebu.ch/display/smr/WRC-15+Preparations

EBU
OPERATING EUROVISION AND EURORADIO

WRC-15 AI 1.1

List of specific tasks:

1) To list the frequency bands to be considered for IMT applications
2) Define spectrum requirements for the MS
3) To perform sharing and compatibility studies between MS and existing services in the above frequency bands
4) Develop CPM text (Conference Preparatory Meeting) with a list of methods to satisfy the agenda item
5) WRC-15 will have to decide about the frequency bands for MS allocation

WRC-15 AI 1.1

1) Current list of frequency bands to be considered includes:

Frequency band	Supporting as a candidate band	Supporting to perform sharing studies	No support
470-694 MHz	GSMA USA	CAN Sweden, UK	ECOWAS + CME (14 African countries), AUS, IRN, Brazil, EBU
1452-1492 MHz	KOR	F	IRN, (EBU)
3400-4200 MHz	GSMA KOR	J Sweden, UK, FIN	Immarsat, SES, Intersal, Eutelsat, Lux, ECOWAS + CME (14 African countries), Rus, INS, AFS, ZWE, NABA

- Objective: harmonise allocations worldwide
- Difficulties expected to avoid performing sharing studies in the 470-694 MHz
- CEPT position: to be developed. ECC TG6 to perform studies on the long term vision for the UHF broadcasting band

WRC-15 AI 1.1

2) Define spectrum requirements for the MS

- ITU-R WP5D reported a range for IMT spectrum requirements of 1 340 MHz to 1 960 MHz for year 2020, for lower user density settings and higher user density settings, respectively
- This is currently included in the draft CPM text
- ITU-R WP5D meeting in October 2013: potential EBU input questioning some parameters and assumptions used in the methods for calculating the spectrum requirements for MS resulting in an a never-ending exponential growth:
  - Super high data rates assumed: 30 Mbit/s to 100 Mbit/s/1 Gbit/s
  - Excessive user density values assumed and not aligned with realistic demographic data
  - Incorrect assumptions about mobility in home and office environments
  - Unclear relation between data traffic levels and spectrum requirements
  - Misuse of polynomial extrapolation in data traffic forecast
  - Unclear consideration of Wifi offload in spectrum requirements calculations
  - No consideration of economic aspects

WRC-15 AI 1.1

3) To perform sharing and compatibility studies between MS and existing services in the above frequency bands

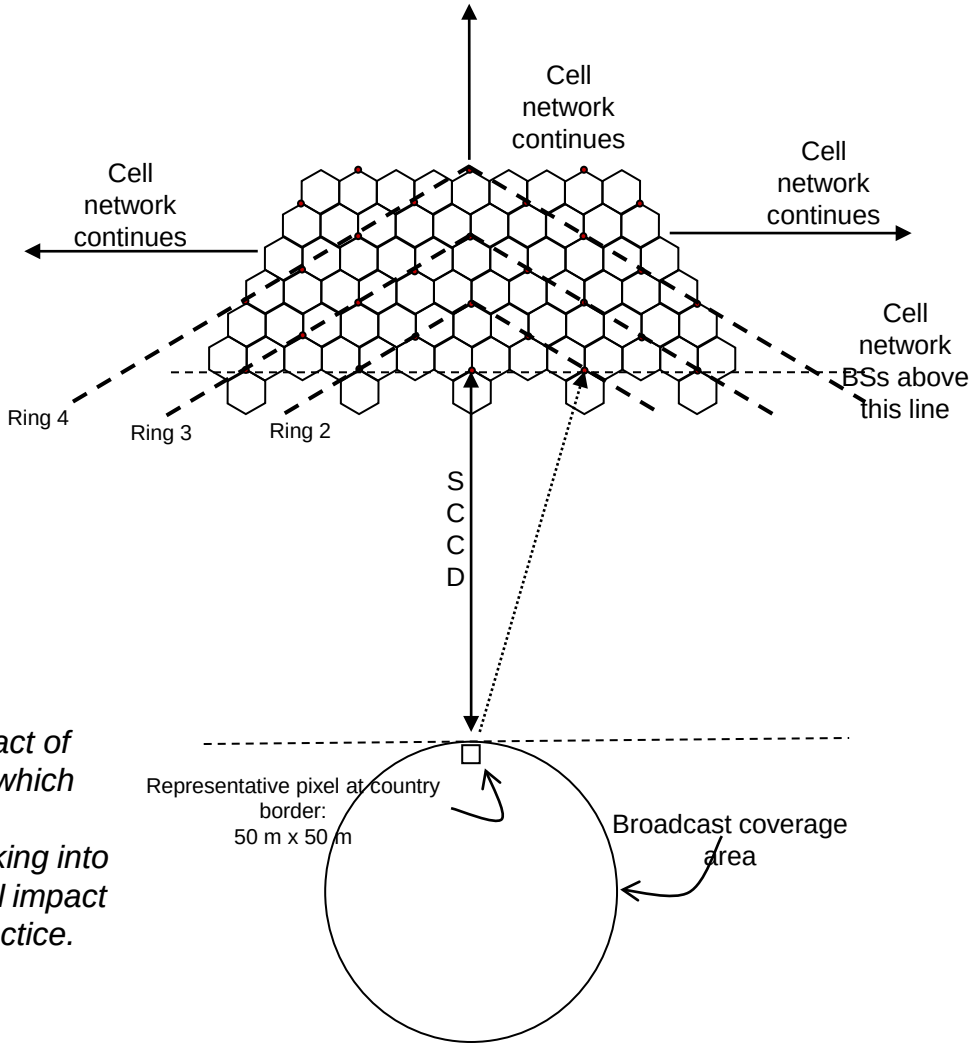
Is sharing possible between MS (IMT) and BS in the same frequency band ?

- Co-channel sharing:
  - Theoretically possible through geographical separation, but..
    - The cumulative effect of interference from multiple base stations (IMT downlink) into DTT reception increases the separation distances. Studies made before the WRC12 have shown an increase of up to 20 dB of the multiple interference compared to a single interference.
    - The protection of the IMT uplink from the DTT emissions in the same or in overlapping channels might be a serious issue that could prevent from sharing the band by different services in two neighbouring countries.

WRC-15 AI 1.1

3) Illustration of the cumulative effect of interference

1% time for the interfering signals	Large DTT areas	Small DTT areas
Decrease in location coverage probability	5.2% (in the entire area) 18.2% (at the edge)	20.2% (in the entire area) 40.8% (at the edge)
Decrease in SINR	5.7 dB (in the entire area) 5.3 dB (at the edge)	12.7 dB (in the entire area) 11.4 dB (at the edge)

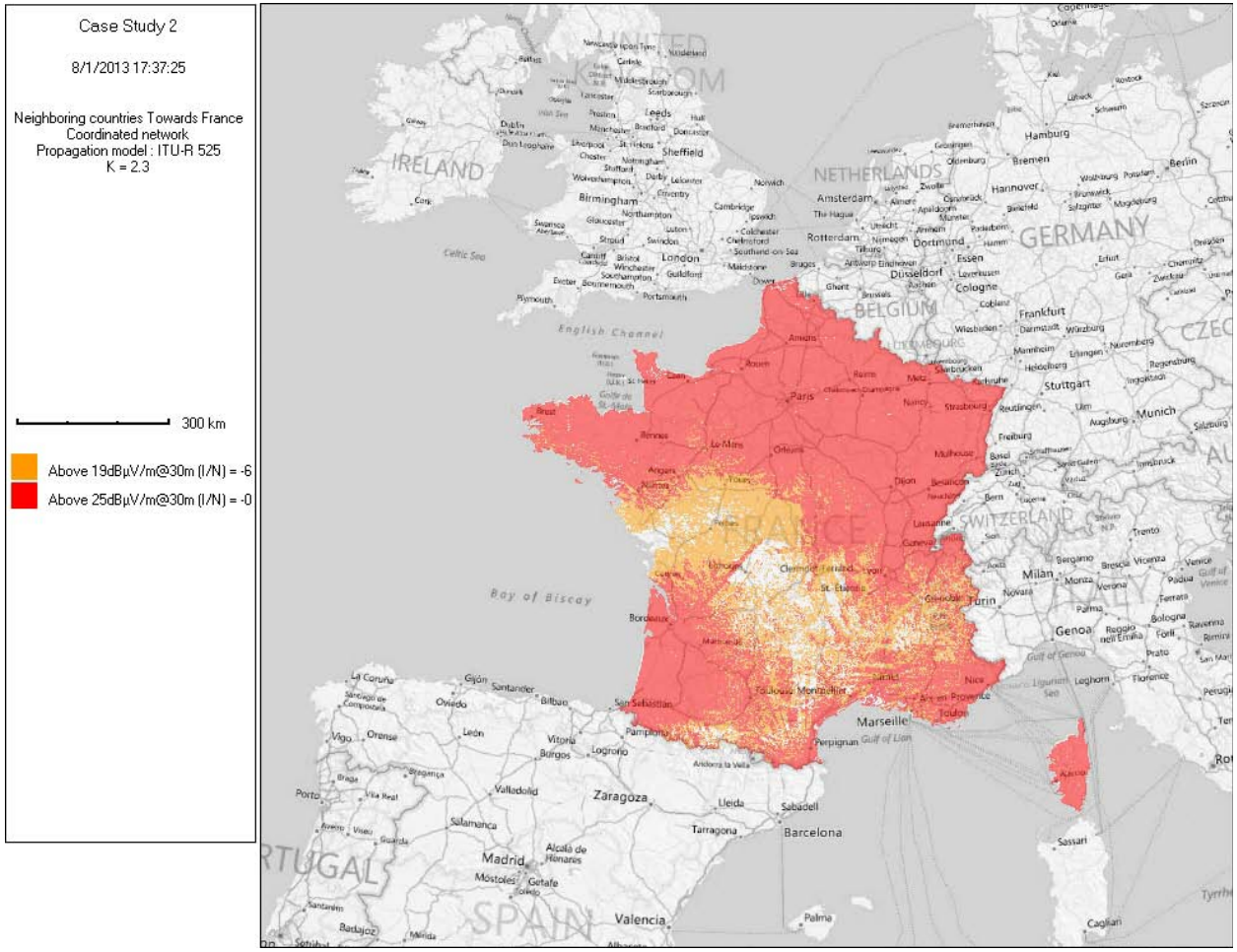


"In conclusion, the studies showed that the potential impact of the cumulative effect of interference from base stations, which individually did not trigger the need for coordination with broadcasting, could be significant. On the other hand, taking into account the elements previously mentioned, the potential impact of cumulative interference might be less significant in practice. Therefore it is suggested to draw the attention of the administrations to this subject"

WRC-15 AI 1.1

3) Illustration of the impact from DTT into IMT uplink (Study made by France in the CEPT)

The example of the 800 MHz band has shown that IMT requires an exclusive use of a given frequency band, therefore decisions have been taken in Europe to release the band from broadcasting. A similar decision has been taken for the 700 MHz band in Africa and might be also taken in Europe.



Interference from neighbouring countries towards France. Broadcasting service as an interferer, mobile service base stations as victims.

3) To perform sharing and compatibility studies between MS and existing services in the above frequency bands (continues)

Is sharing possible between MS (IMT) and BS in the same frequency band ?

- Adjacent channel compatibility:

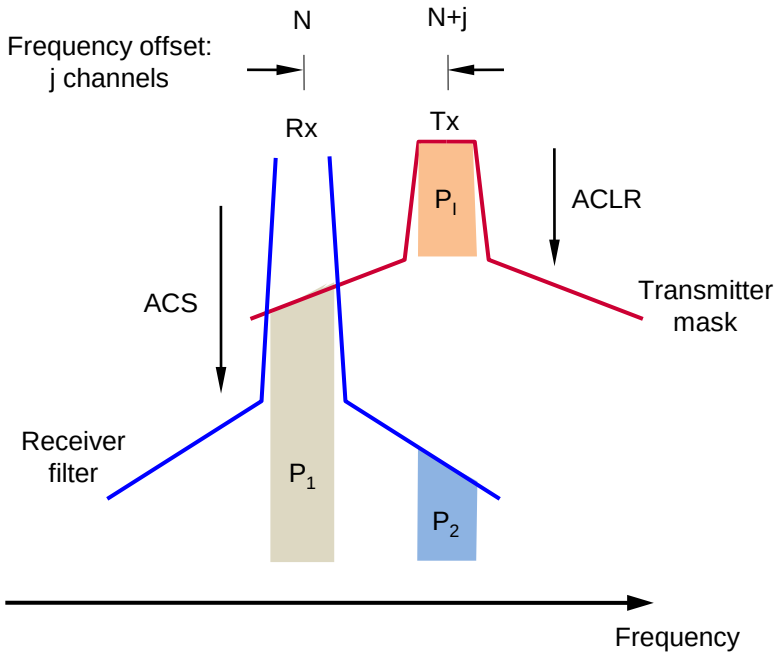
  The out of band emission levels of the IMT base stations and user terminals should be reduced to a sufficiently low level to limit the interference into DTT in the adjacent band. The required level depends on the MS technology and its band plan (FDD conventional or reverse duplex, TDD, size of the guard band). These technical details are not yet defined for the MS in the band 470-694 MHz.

WRC-15 AI 1.1

3) Illustration of the adjacent band compatibility (example of the situation at the lower edge of the 800 MHz band)

-Limitations on the transmission characteristics of the mobile network are needed in order to reduce the interference probability on broadcasting. In Europe, these limitations have been harmonised and have been made mandatory by a Decision of the European Commission. However, a certain degree of freedom was left to the individual Administrations to chose between several levels of restrictions, depending on their targeted protection level.

- It was shown that the risk of interference cannot in any case be reduced to zero and therefore there is a need for additional *mitigation techniques to solve the possible interference cases that* could occur during the implementation. In Europe, the obligations of the license holders, in terms of choosing and bearing the cost of implementing the mitigation techniques, were left to the decision of the individual Administrations.



4) To develop CPM text

- Method 1 (case where an allocation to MS on a primary basis already exists in the given frequency band):

  To identify the frequency band for IMT in a footnote

  Example: **ADD**

  5.XYZ The frequency bands, or portions of the frequency bands [aa-bb, and cc-dd MHz], [in Regions/Country Names] are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. See [WRC Resolution and/or WRC Recommendation]

4) To develop CPM text (continues)

- Method 2 (case where an allocation to MS on a primary basis does not exist in the given frequency band)

  Method 2A: make allocation to MS on a primary basis in the RR table of frequency allocations or in a footnote

  Example: **ADD**

  5.XYZ The frequency bands [aa-bb, and cc-dd MHz] are allocated to the mobile service on a primary basis.

  Method 2B: make allocation to MS on a primary basis and identify the band for IMT in the RR table of frequency allocations or in a footnote

  Example: similar as in Method 1 but adding the allocation to the MS

- Method 3: No change to the RR

WRC-15 AI 1.1

UHF band

Allocation to services		
Region 1	**Region 2**	**Region 3**
460-470	FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 5.289 5.290	
470-790 BROADCASTING 5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.311A 5.312 5.312A	**470-512** BROADCASTING Fixed Mobile 5.292 5.293	**470-585** FIXED MOBILE BROADCASTING 5.291 5.298
	512-608 BROADCASTING 5.297	**585-610** FIXED MOBILE BROADCASTING RADIONAVIGATION 5.149 5.305 5.306 5.307
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	**610-890** FIXED MOBILE 5.313A 5.317A BROADCASTING
	614-698 BROADCASTING Fixed Mobile 5.293 5.309 5.311A	
	698-806 MOBILE 5.313B 5.317A BROADCASTING Fixed 5.293 5.309 5.311A	
790-862 FIXED MOBILE except aeronautical mobile 5.316B 5.317A BROADCASTING	**806-890** FIXED MOBILE 5.317A BROADCASTING	

EBU
OPERATING EUROVISION AND EURORADIO

WRC-15 AI 1.1

L band

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 300-1 350	RADIOLOCATION AERONAUTICAL RADIONAVIGATION 5.337 RADIONAVIGATION-SATELLITE (Earth-to-space) 5.149 5.337A	
1 350-1 400 FIXED MOBILE RADIOLOCATION 5.149 5.338 5.338A 5.339	**1 350-1 400** RADIOLOCATION 5.338A 5.149 5.334 5.339	
1 400-1 427	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.341	
1 427-1 429	SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 5.338A 5.341	
1 429-1 452 FIXED MOBILE except aeronautical mobile 5.338A 5.341 5.342	**1 429-1 452** FIXED MOBILE 5.343 5.338A 5.341	
1 452-1 492 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	**1 452-1 492** FIXED MOBILE 5.343 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.344 5.345	
1 492-1 518 FIXED MOBILE except aeronautical mobile	**1 492-1 518** FIXED MOBILE 5.343	**1 492-1 518** FIXED MOBILE

EBU
OPERATING EUROVISION AND EURORADIO

WRC-15 AI 1.1

C band

Region 1	Region 2	Region 3
2 700-2 900	AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation 5.423 5.424	
2 900-3 100	RADIOLOCATION 5.424A RADIONAVIGATION 5.426 5.425 5.427	
3 100-3 300	RADIOLOCATION Earth exploration-satellite (active) Space research (active) 5.149 5.428	
3 300-3 400 RADIOLOCATION 5.149 5.429 5.430	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429
3 400-3 600 FIXED FIXED-SATELLITE (space-to-Earth) Mobile 5.430A Radiolocation 5.431	**3 400-3 500** FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.431A Radiolocation 5.433 5.282	**3 400-3 500** FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.432B Radiolocation 5.433 5.282 5.432 5.432A
	3 500-3 700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.433	**3 500-3 600** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.433A Radiolocation 5.433
3 600-4 200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile		**3 600-3 700** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.435
	3 700-4 200 FIXED FIXED-SATELLITE (space to-Earth) MOBILE except aeronautical mobile	

EBU
OPERATING EUROVISION AND EURORADIO

WRC-15 AI 1.2

List of specific tasks

1) To define spectrum requirements for DTT and define the lower limit of the 700 MHz band
2) To perform sharing and compatibility studies between MS and DTT
3) To perform sharing and compatibility studies between MS and other services
4) To develop solutions for accommodating applications ancillary to broadcasting (PMSE)
5) Define CPM text with a list of methods to satisfy the agenda item

WRC-15 AI 1.2

1) To define spectrum requirements for DTT and to define the lower limit of the 700 MHz

- WP6A questionnaire started in July 2012. Latest update in July 2013.

	Responses
Total administration responses received	85
Sector Members	11
Total responses received	96

Proportion of users who receive television by terrestrial broadcasting

	<25%	≥25 and <50%	≥50 and <75%	≥75%	No reply
Total administrations considered	15	10	14	25	21

EBU
OPERATING EUROVISION AND EURORADIO

WRC-15 AI 1.2

1) To define spectrum requirements for DTT and to define the lower limit of the 700 MHz (continues)

Number of operational or planned DTT transmitters and/or allotments

	694-790 MHz	470-694 MHz and 790-862 MHz
Total administrations considered	21 223	59 800

Other usages of the band 470-862 MHz

	Primary services	Secondary services	Primary and secondary services	No other services	No reply
Total administrations considered	5	26	12	28	14

[1] Primary services: aeronautical radionavigation service, military and radiolocation services, fixed and mobile services, PMR (Private Mobile Radio), RAS (Radio astronomy).

[2] Secondary services: PMSE (Programme Making and Special Events), SRD (Short Range Devices), RAS (Radio astronomy), UWB (Ultra Wide Band), PMR(Private Mobile Radio), wind profile radars.

WRC-15 AI 1.2

1) To define spectrum requirements for DTT and to define the lower limit of the 700 MHz (continues)

Required number of multiplexes in the band 470-862 MHz in the future

	0-3	4-6	7-8	>8	No or unclear reply
Total administrations considered	4	57	9	4	11

Required amount of spectrum in the band 470-862 MHz for DTT in the future

	<224 MHz	= 224 MHz	> 224 MHz and < 320 MHz	= 320 MHz	>320 MHz	No or unclear reply
Total administrations considered	4	39	6	14	3	19

DTT spectrum requirements: 62 Administrations out of the 66 who responded clearly to this question from Region 1 have indicated a requirement for at least 224 MHz of UHF spectrum for DTT.

The lower limit was defined at 694 MHz at the JTG4-5-6-7 meeting in July 2013

WRC-15 AI 1.2

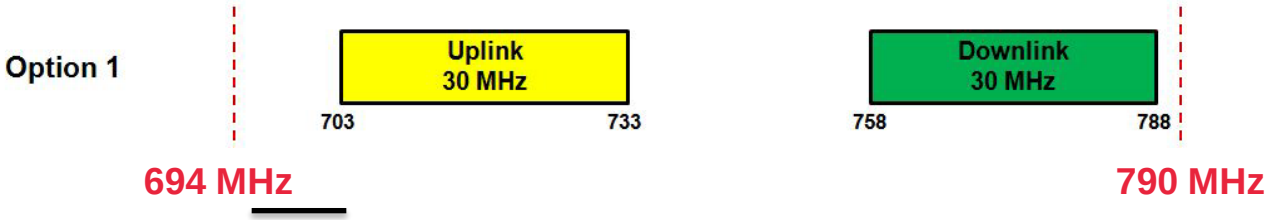
2) To perform sharing and compatibility studies between MS and DTT

- Report with elements for sharing and compatibility studies between the broadcasting and the mobile service. Key issue: propagation model agreed
- For generic studies:
  - For the assessment of interference from the broadcasting service into the mobile service Recommendation ITU-R P.1546 will be used.
  - For the assessment of co-channel interference from base stations into broadcasting, the prediction method in Recommendation ITU-R P.1546 will be used.
  - For the assessment of interference from user equipment into the broadcasting service the wanted median field strength of the broadcasting service can be fixed to any appropriate value ín a given pixel, without using a specific prediction method for the wanted DTT signal. Furthermore, the wanted median field strength of the broadcasting service will be varied over a range of values. For the uplink of the mobile service the modified Hata model as contained in ITU-R Report SM.2028 will be used together with all other parameters provided by WP5D.

WRC-15 AI 1.2

2) To perform sharing and compatibility studies between MS and DTT (continues)

- Technical studies on channeling arrangements, UE OOB levels and required guard band. No final decisions:
  - Most likely band plan: APT plan (option 1 below)



9 MHz of theoretical guard band; final guard band is related to AI 1.3

WRC-15 AI 1.2

2) To perform sharing and compatibility studies between MS and DTT (continues)

- Work on UE OOB levels is ongoing; Two divergent views:

-The Mobile community and many APT Administrations: APT levels are sufficient to ensure protection of DTT below 694 MHz: -25 dBm/8MHz for an IMT user terminal transmitting in 20 MHz block.

- The Broadcasting community and some European Administrations: APT levels not sufficient to ensure protection of DTT below 694 MHz: Request for -56 dBm/8 MHz for an IMT user terminal in 10 MHz block to protect DTT fixed reception and lower levels for the protection of DTT portable reception (with 9 MHz Guard Band)

- Outcome of CEPT studies in the 800 MHz band as shown in Report 30: -50 dBm/8MHz for an IMT user terminal in 10 MHz block to protect DTT fixed reception and -65 dBm/8MHz for the protection of DTT portable reception (with 7 MHz Guard Band).

WRC-15 AI 1.2

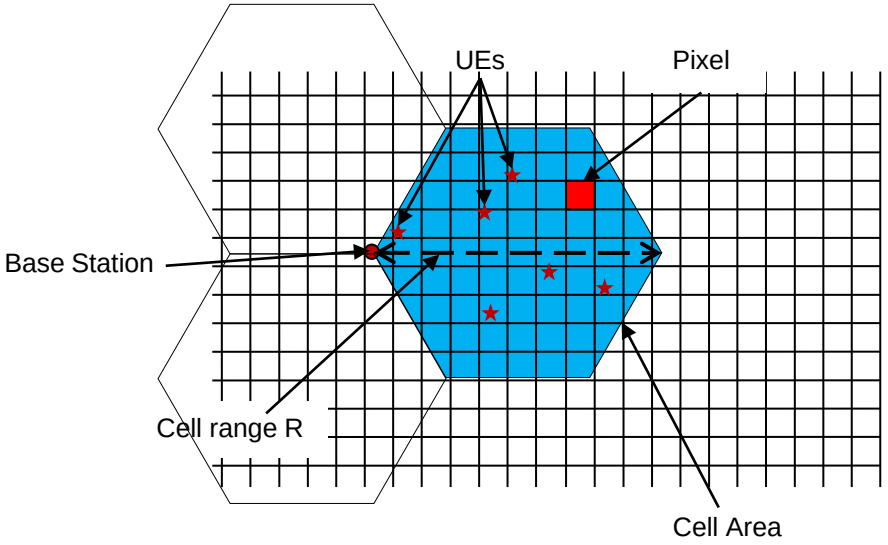
2) To perform sharing and compatibility studies between MS and DTT (continues)

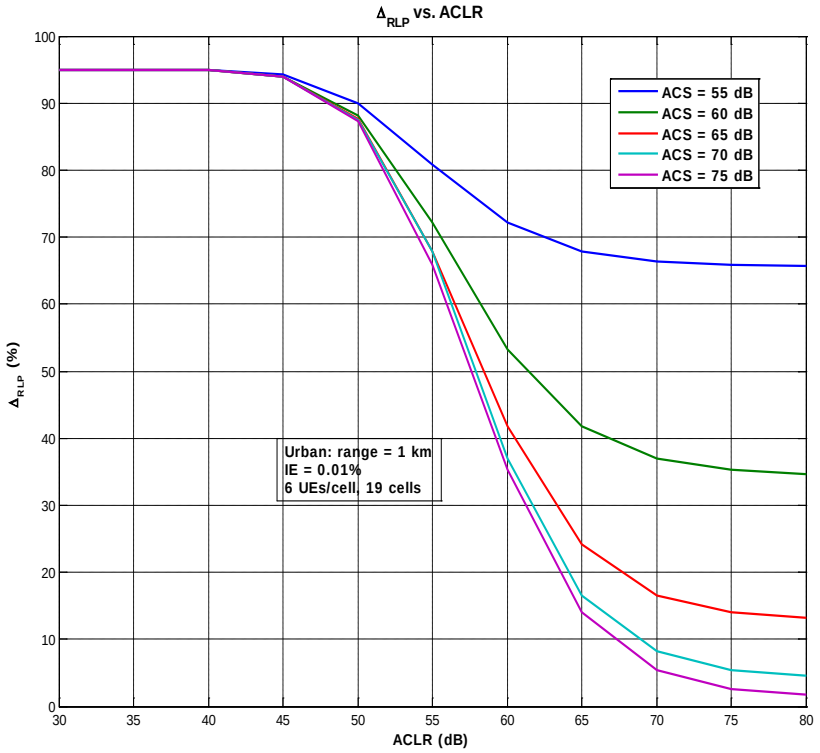
Main reasons for the divergence in technical results:

- The studies made in the APT are based on methodologies initially used for the compatibility studies between Mobile networks. The broadcasters are trying to show the difference when protection of broadcasting is concerned.
- This is particularly significant when dealing with interference from mobile user terminals into broadcasting.
- The intermittent and non stationary nature of interference from user terminals requires appropriate way of assessing its impact on the DTT reception.
- This can be done in studies based on statistical Monte Carlo techniques provided that a Time element is introduced in addition to the Location element. This point is a major point of disagreement.
- Considerable effort is being made in CEPT to conclude on this issue, but no firm conclusions are made so far.

2) To perform sharing and compatibility studies between MS and DTT (continues)

Indications about the detailed technical studies: Example of Monte Carlo simulations done by the EBU





WRC-15 AI 1.2

4) To develop solutions for accommodating applications ancillary to broadcasting (PMSE)

- Certain PMSE applications such as wireless microphones use the white spaces of the broadcasting service in the UHF band
- PMSE applications are secondary services in many countries through footnote 5.296 for the land mobile service
- Draft solutions for discussion:
  - Solution a: In the VHF range: 174-230 MHz
  - Solution b: increased use in the UHF range: 470-694 MHz (white spaces)
  - Solution c: Potential use of the centre part of the 700 MHz duplex gap
  - Solution d: Potential use of the centre part of the 800 MHz duplex gap
  - Solution e: Potential ranges between 1 200-1 650 MHz
    (specific band ranges should be identified in advance to the next JTG)
  - Solution f: Potential use of the centre part of the 1 800 MHz duplex gap
  - Solution g: In other bands still to be identified
- Technical sharing studies are also to be done

5) Define CPM text with a list of methods to satisfy the agenda item

- **Refinement of the lower edge of the 700 MHz band**:
  - Method 1:
    - Insert primary allocation to MS in the RR in the frequency band 694-790 MHz
    - Modify footnote 5.317A to extend the identification to IMT
- **Protection of broadcasting from MS**:
  - Method 1: No regulatory provisions for broadcasting protection because GE06 Agreement applies. OOB and other parameters to be included in an ITU-R Recommendation

    - Concerns: GE06 does not consider accumulative interference from a cellular network and a recommendation is not binding

    - Advantage: Technical parameters in the recommendation can be changed during regular ITU-R study periods without the need to wait for a WRC

5) Define CPM text with a list of methods to satisfy the agenda item (continues)

- **Protection of broadcasting from MS**:
  - Method 2: Regulatory and technical provisions in RR (i.e. OOB, guard band, etc) to protect broadcasting in neighbouring countries taking into account GE06 Agreement

    - Concerns: it only applies to neighbouring countries and changing the regulatory provisions can only be done at a WRC

    - Advantage: Technical provisions to protect broadcasting are binding
  - Method 3: activation of the allocation subject to application of RR No. 9.21 (i.e. all mobile stations need to be coordinated)

    - Concern: high administrative burden for Administrations

    - Advantage: Detailed interference calculations can be done including cumulative effect of interference

WRC-15 AI 1.3

List of tasks:

1) Define spectrum requirements for PPDR
2) Identify potential frequency bands to satisfy them
3) Draft CPM text and methods to satisfy the agenda item

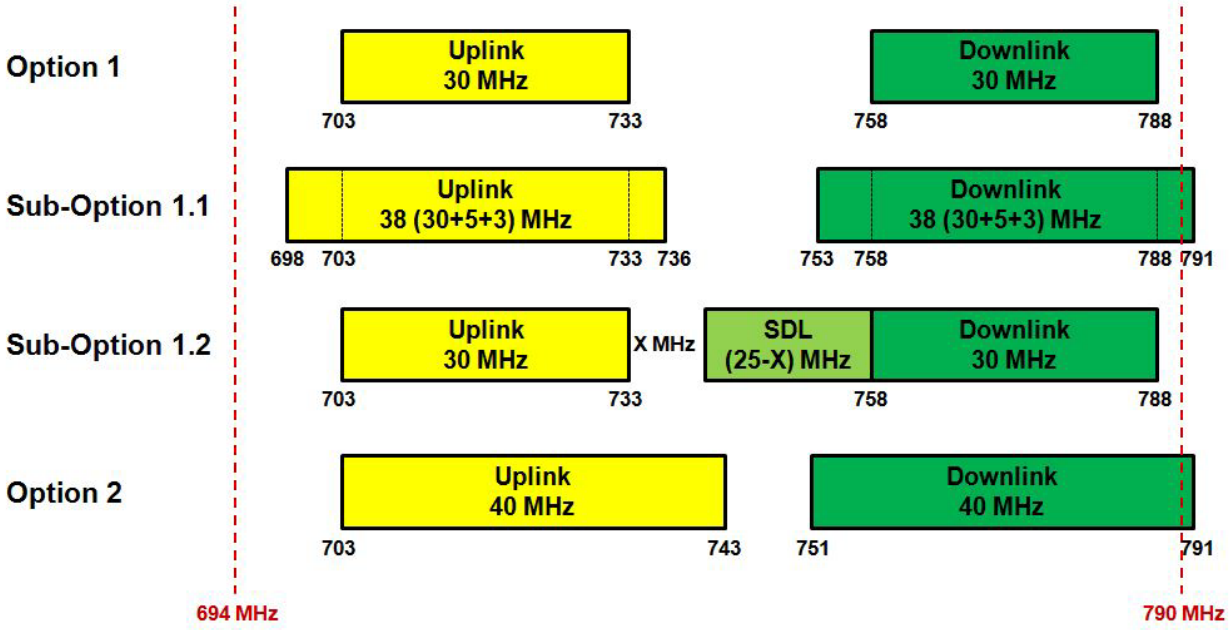
1) Define spectrum requirements for PPDR

- At WP5A, discussions on amendments to Report ITU-R M.2033 with spectrum requirements for PPDR
- CEPT may propose the development of a new ITU report with spectrum requirements for advanced PPDR applications (i.e. using LTE technologies to include broadband video links)
- CEPT proposed spectrum requirements: 2x10 MHz.

WRC-15 AI 1.3

2) Identify potential frequency bands for PPDR

- CEPT has identified as potential frequency bands the 400 MHz and 700 MHz bands
- Different options under discussion in CEPT for the 700 MHz:



- Concern: Option 1.1 reduces the guard band and may imply the lose of channel 48 for DTT and additional constraints to protect PPDR

WRC-15 AI 1.3

3) Draft CPM text and methods to satisfy the agenda item

- Preliminary draft CPM text started:
  - Method 1: Only Editorial updating to Resolution 646 (Rev.WRC-12)] and the broadband PPDR requirements will be addressed through ITU-R studies

    Advantages: not binding, flexible and easy to update requirements through regular ITU-R study periods

  - Method 2: Modify Resolution 646 (Rev.WRC-12) to address requirements of broadband PPDR

    Concern: binding through the resolution, more difficult to make changes (only at WRC)

- Preliminary CEPT views: PPDR is a national issue (CEPT might not be in favour of a strongly binding solution and might prefer a flexible regulatory approach)

FINAL THOUGHTS

1. **WRC-15 is particularly important with regard to the future of terrestrial television broadcasting**
2. **Terrestrial television is the single most important TV platform in Europe. It provides significant benefits which cannot be easily replicated on any other TV platform**
3. **The UHF band is ideally suited for digital terrestrial TV (DTT) and is the only spectrum that allows for a long term evolution of digital terrestrial TV services**
4. **Furthermore, this frequency band is the only sub-1GHz spectrum allocated worldwide to the television broadcasting service. Maintaining a worldwide harmonized band for digital television broadcasting is essential for economies of scale to allow for affordable consumer equipment to be put on market**
5. **Any adverse change to the DTT platform would therefore generate significant costs for viewers and broadcasters, and a significant adverse social and economic impact on European citizens**
6. **Taking into account the steady market demand for DTT capacity in most countries, the wide public acceptance and the ongoing industry support to DTT it is recommended that the UHF band remains to be used for terrestrial TV service**

WALID SAMI AND ELENA PUIGREFAGUT

EBU T&I

SAMI@EBU.CH

PUIGREFAGUT@EBU.CH

EBU
OPERATING EUROVISION AND EURORADIO