IMT issues for WRC-15: Looking for Spectrum

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Forum: Digital Dividend in Americas

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IMT on ITU-R

Since 25 years ago, ITU has been coordinating efforts of government and industry and private sector in the development of a Global Broadband Multimedia International Mobile Telecommunication System, known as IMT.

Since 2000, the world has seen the introduction of the first family of standards derived from the IMT concept.

Nowadays there are more than 2 billion IMT subscribers in the world!

http://www.itu.int/ITU-R/go/imt-advanced

ITU-R WP5D: IMT Systems

Overall radio system aspects of (IMT) systems

- issues related to the terrestrial component of IMT, including technical, operational and spectrum-related issues to meet the objectives of future IMT systems
- works closely with WP4C on issues related to the satellite component of IMT.
- overall maintenance of existing, and the development of new, Rec. on the terrestrial component of IMT
- liaison with ITU-T on the standardization activities of IMT and with ITU-D in relation to IMT in developing countries.
- Strong cooperative efforts with external organizations and well-known standards development organizations

http://www.itu.int/ITU-R/go/rwp5d

IMT-x and xG Families

IMT-2000, in use for over a decade since 2.000, has been widely deployed; it is also referred commercially as 3G.

The term 4G remains undefined:

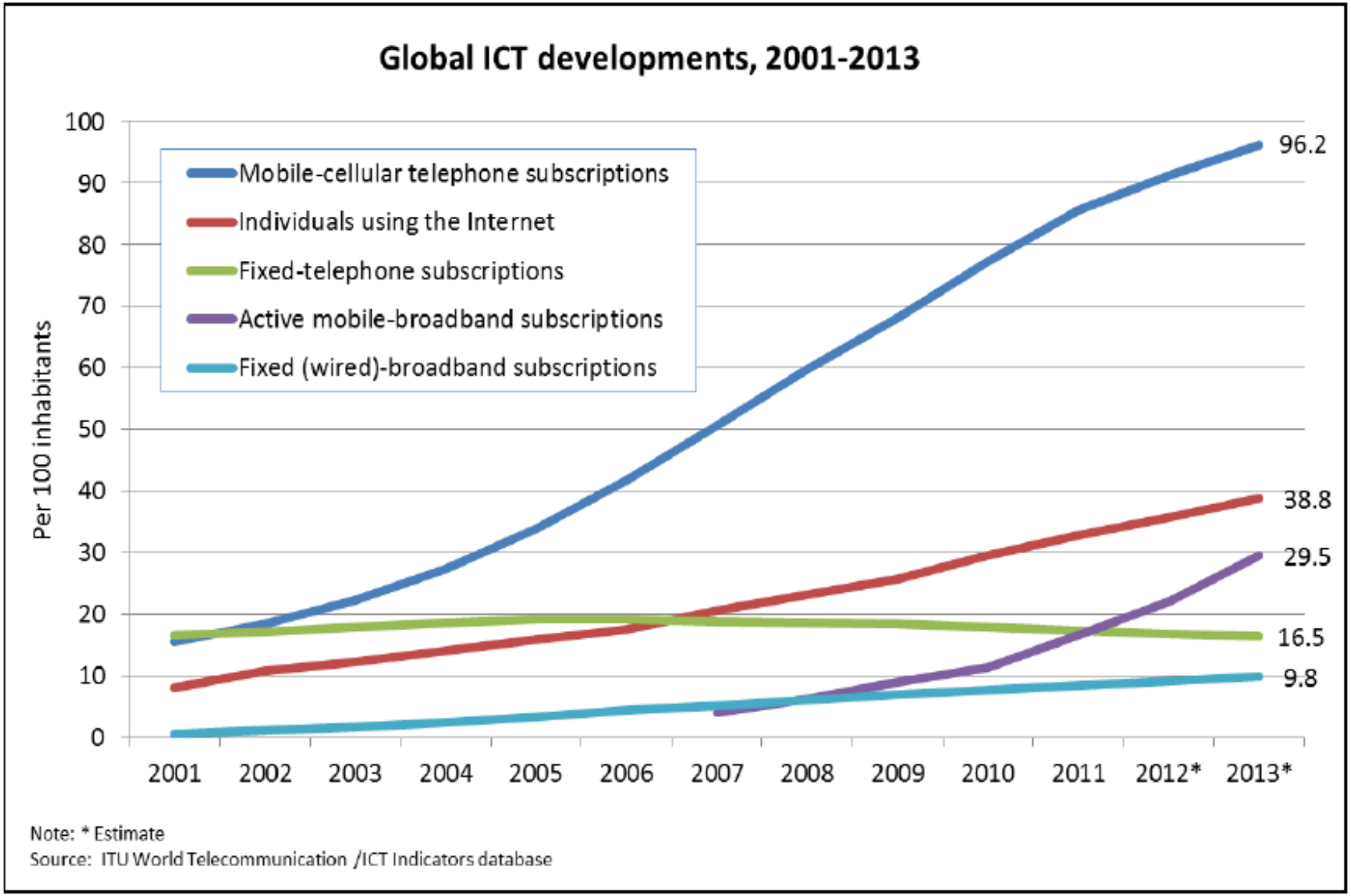
- Some operators (countries) apply to technologies complying IMT-Advanced, and make difference from so-called 3.5G
- Other operators (countries) apply to any technology beyond 3G (i.e. IMT-2000)

RA-12 agreed that IMT encompass both IMT-2000 and IMT-Advanced

IMT Standards

	IMT-2000	IMT-Advanced
ITU-R Recommendation	ITU-R M.1457-10 (06/2011): Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)	ITU-R M.2012 (01/2012): Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)
Main Technical Criteria	1- high degree of commonality of design worldwide;	1- high degree of commonality of functionality worldwide while retaining the flexibility to support a wide range of services and applications in a cost-efficient manner;
	2- compatibility of services within IMT-2000 and with the fixed networks;	2- compatibility of services within IMT and with fixed networks;
	3- high quality;	3- high-quality mobile services;
	4- worldwide roaming capability;	4- worldwide roaming capability;
	5- small terminal for worldwide use;	5- user equipment suitable for worldwide use;
	6- capability for multimedia applications, and a wide range of services and terminals.	6- user-friendly applications, services and equipment;
		7- capability of interworking with other radio access systems;
		8- enhanced peak data rates to support advanced services and applications (100 Mbit/s for high and 1 Gbit/s for low mobility were established as targets for research; (rates surced from ITU-R M.1645)
Recognized Radio Interfaces	1- IMT-2000 CDMA Direct Spread	1- LTE-Advanced
	2– IMT-2000 CDMA Multi-Carrier	2- WirelessMAN-Advanced
	3– IMT-2000 CDMA TDD	
	4– IMT-2000 TDMA Single-Carrier	
	5– IMT-2000 FDMA/TDMA	
	6– IMT-2000 OFDMA TDD WMAN	

Why more spectrum for BB?



Why more spectrum for BB?

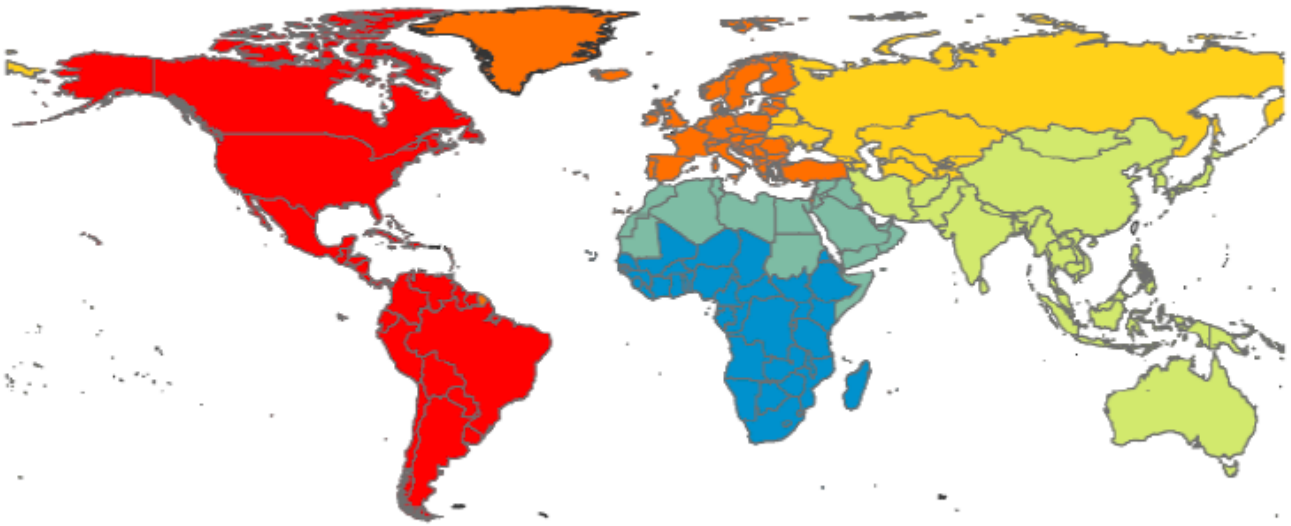
CONTINUOUS HIGH GROWTH OF MOBILE BROADBAND

More than 2 billion subscriptions worldwide by end 2013*

Americas
460 million subscriptions
48% penetration
28% CAGR (2010-2013)

Europe
422 million subscriptions
68% penetration
33% CAGR (2010-2013)

CIS
129 million subscriptions
46% penetration
27% CAGR (2010-2013)



Arab States
71 million subscriptions
19% penetration
55% CAGR (2010-2013)

Africa
93 million subscriptions
11% penetration
82% CAGR (2010-2013)

Asia-Pacific
895 million subscriptions
22% penetration
45% CAGR (2010-2013)

Source: ITU World Telecommunication /ICT Indicators database
Note: * Estimate

SPECTRUM ALLOCATIONS

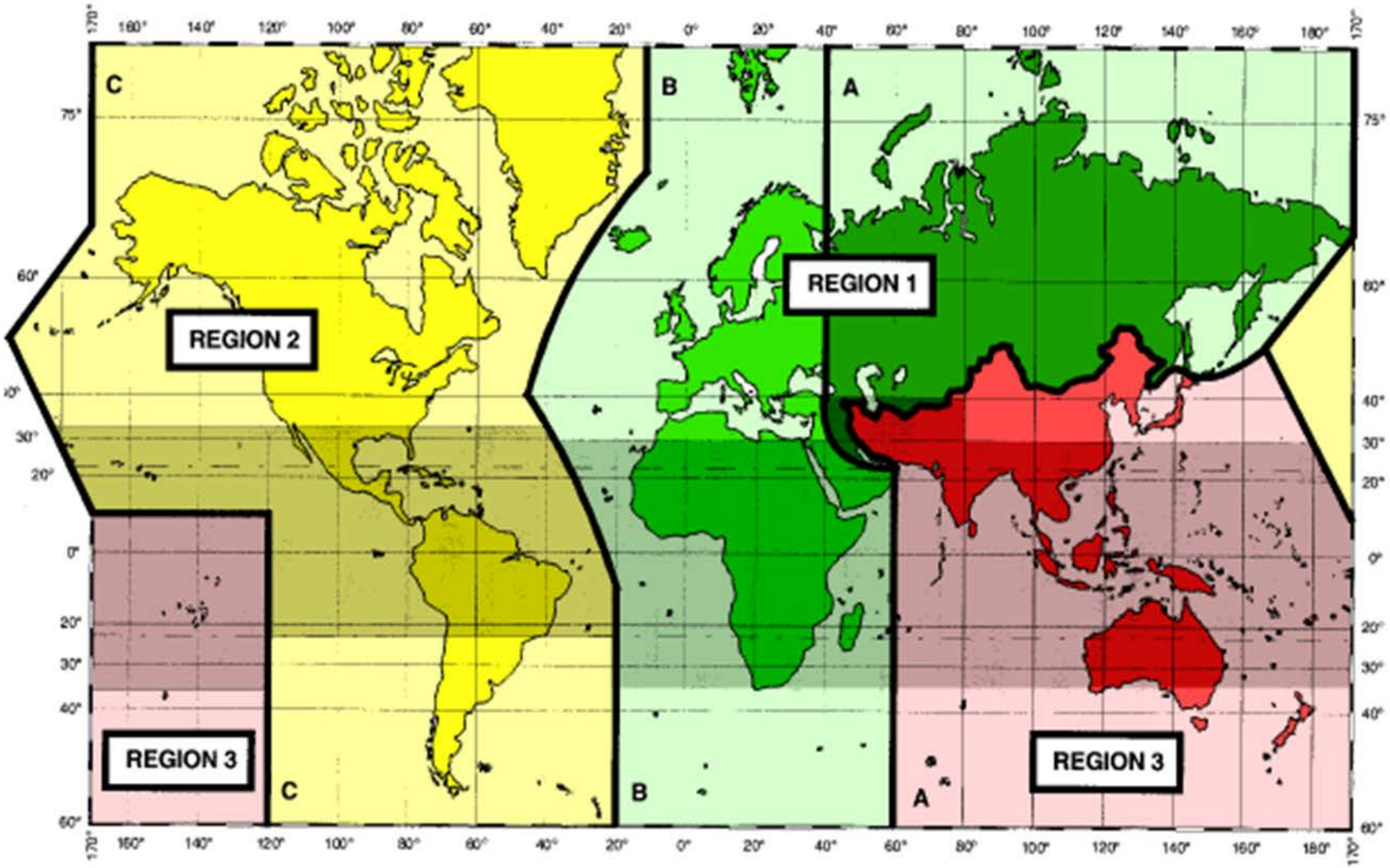
- All Spectrum Bands are already allocated (Innal: RR, IFT; nal.: NAFT)
- Effective Assignments, and intensive exploitation of frequencies below 3 GHz (Administrations)
- Attending the needs for more Spectrum from some services, is only possible by modifying the current allocation of other ones
- A "refarming" is necessary: where to migrate an incumbent service to let the room to a new comer?
- How to avoid a "domino" effect?

SPECTRUM ALLOCATIONS

Responding to growing Capacity Demand (Mbps) can be improved by:

- New technologies: better spectrum efficiency (Mbps/MHz); e.g. TDT
- Increasing Radio Stations (lower coverage (traffic)/Station); e.g. Femtocells
- Allocating more Spectrum
- Prevent Domino's Effect:
- Compare and prioritize growing demands (and social impact)
- Foster network updating (spectrum efficiency)

IMT in Americas (As in RR)



WRC-15 Agenda Items

1.1 to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution COM6/8 (WRC-12);

1.2 to examine the results of ITU-R studies, in accordance with Resolution 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;

IMT during WRC-12

IMT Services (Mobile Broadband): identification

Band (MHz)	Radio Rules Footnotes
450-470	5.286AA
698-960	5.313A, 5.317A
1 710-2 025	5.384A, 5.388
2 110-2 200	5.388
2 300-2 400	5.384A
2 500-2 690	5.384A
3 400-3 600	5.430A, 5.432A, 5.432B, 5.433A

698-960: Includes the Digital Dividend

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
450-455	FIXED MOBILE 5.286AA 5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E	
455-456 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**455-456** FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.209 5.286A 5.286B 5.286C	**455-456** FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E
456-459	FIXED MOBILE 5.286AA 5.271 5.287 5.288	
459-460 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**459-460** FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.209 5.286A 5.286B 5.286C	**459-460** FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E
460-470	FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 5.289 5.290	

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	
1 930-1 970 FIXED MOBILE 5.388A 5.388B 5.388	**1 930-1 970** FIXED MOBILE 5.388A 5.388B Mobile-satellite (Earth-to-space) 5.388	**1 930-1 970** FIXED MOBILE 5.388A 5.388B 5.388
1 970-1 980	FIXED MOBILE 5.388A 5.388B 5.388	
1 980-2 010	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.388 5.389A 5.389B 5.389F	
2 010-2 025 FIXED MOBILE 5.388A 5.388B 5.388	**2 010-2 025** FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.388 5.389C 5.389E	**2 010-2 025** FIXED MOBILE 5.388A 5.388B 5.388

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 110-2 120	FIXED MOBILE 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space) 5.388	
2 120-2 160 FIXED MOBILE 5.388A 5.388B 5.388	**2 120-2 160** FIXED MOBILE 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	**2 120-2 160** FIXED MOBILE 5.388A 5.388B 5.388
2 160-2 170 FIXED MOBILE 5.388A 5.388B 5.388	**2 160-2 170** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.388 5.389C 5.389E	**2 160-2 170** FIXED MOBILE 5.388A 5.388B 5.388
2 170-2 200	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F	

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	Region 2	Region 3
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	

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
2 500-2 520 FIXED 5.410 MOBILE except aeronautical mobile 5.384A 5.405 5.412	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A	**2 500-2 520** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A 5.404 5.415A
2 520-2 655 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 5.339 5.405 5.412 5.417C 5.417D 5.418B 5.418C	**2 520-2 655** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 5.339 5.417C 5.417D 5.418B 5.418C	**2 520-2 535** FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 5.403 5.414A 5.415A **2 535-2 655** FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 5.339 5.417A 5.417B 5.417C 5.417D 5.418 5.418A 5.418B 5.418C
2 655-2 670 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.208B	**2 655-2 670** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.420
2 670-2 690 FIXED 5.410 MOBILE except aeronautical mobile 5.384A Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149 5.412	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.208B 5.415 MOBILE except aeronautical mobile 5.384A Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149	**2 670-2 690** FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (Earth-to-space) 5.351A 5.419 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 5.149

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
3 400-3 600 FIXED FIXED-SATELLITE (space-to-Earth) Mobile 5.430A Radiolocation	**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
5.431		

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
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 5.312 5.314 5.315 5.316 5.316A 5.319	**806-890** FIXED MOBILE 5.317A BROADCASTING	
862-890 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.319 5.323	5.317 5.318	5.149 5.305 5.306 5.307 5.311A 5.320

IMT in Americas (As in RR)

Band (MHz)
450-470
698-960
1 710-2 025
2 110-2 200
2 300-2 400
2 500-2 690
3 400-3 600

Allocation to services		
Region 1	**Region 2**	**Region 3**
890-942 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 Radiolocation	**890-902** FIXED MOBILE except aeronautical mobile 5.317A Radiolocation 5.318 5.325	**890-942** FIXED MOBILE 5.317A BROADCASTING Radiolocation
	902-928 FIXED Amateur Mobile except aeronautical mobile 5.325A Radiolocation 5.150 5.325 5.326	
	928-942 FIXED MOBILE except aeronautical mobile 5.317A Radiolocation 5.325	
5.323		5.327
942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.323	**942-960** FIXED MOBILE 5.317A	**942-960** FIXED MOBILE 5.317A BROADCASTING 5.320

Importance of spectrum harmonization of mobile broadband in reducing the digital divide

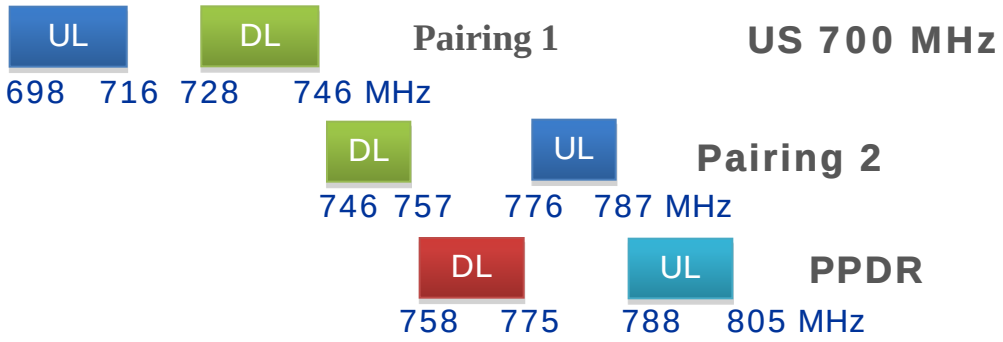
- Spectrum harmonization **reduces the cost of mobile hardware** (i.e. cheaper smartphones)
- Enables global **roaming**.
- **Reduces the complexity** of the radio design.
- **Reduces interference** with adjacent services and helps managing cross-border interference.
- **Cost of infrastructure is reduced**, benefit passed on to users through a reduced cost of service.
- Increased access to mobile broadband will **increase ICT literacy**.
- Development of relevant mobile **applications will add value to users** over time.

2007-2012
…a difficult start for global harmonisation of mobile

- WRC-07: mobile spectrum allocations were not harmonized throughout the world.
- Historical problems due to the legacy allocations of 2G spectrum bands (CDMA in 850 and GSM in 900 MHz).
- Non-harmonized mobile bands below 1 GHz as a result.

Digital Dividend bands: bands adopted in USA

- Allocated in 2007, it resulted in a complex and fragmented market, requiring two different types of incompatible handsets.
- Auction considered allocating bands for public safety communications. LTE networks have been deployed.
- Also adopted by Canada (with some mod.)
- Market size: 350 million

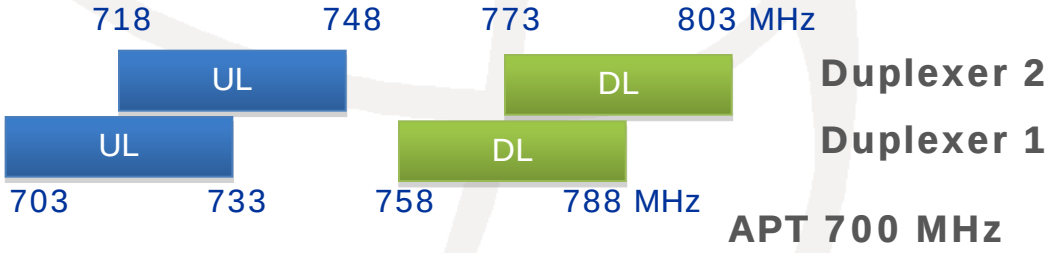


Digital Dividend bands: bands adopted in Europe

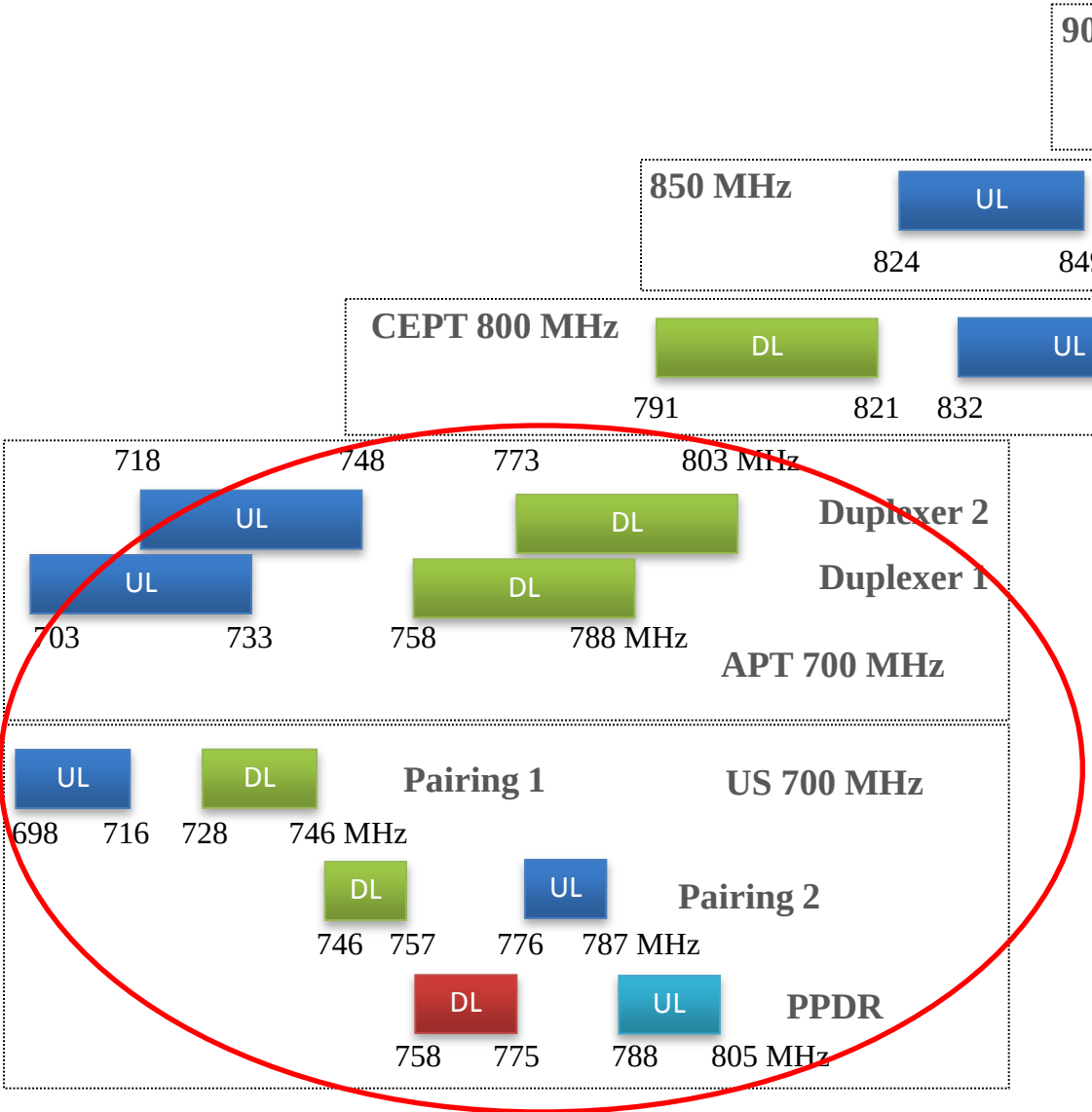
- In 2009, Europe (CEPT, 48 countries) adopted a regionally harmonised band for mobile in 800 MHz, (two blocks of 30 MHz).
- Germany, Sweden, Spain, Switzerland, Italy and France have already auctioned these bands and deployment of LTE networks started.
- Market size: 800 million

Digital Dividend bands: bands for Asia Pacific (also being adopted by several countries in Latin America)

- In 2010, the Asia Pacific Telecommunity (APT) adopted two paired blocks (2 x 45 MHz) in 700 MHz plus one block for TDD, covering the entire 703-803 MHz band.
- Countries in Asia, the Pacific and Latin America have already announced its adoption.
- Market size: over 4 billion



The overall picture: Sub-1GHz mobile spectrum: 700, 800, 850, 900 MHz: Present use and bands adopted before 2012



Bands specified by CITEL as options for the Americas region

Current uptake of digital dividend bands for mobile broadband

- Asia Pacific (APT) harmonized band plan:

  - Region 3 (Asia Pacific): Japan, Australia, Taiwan, Papua New Guinea, Tonga, India.

  - Region 2 (Americas): Mexico, Chile, Colombia, Costa Rica.

- European (CEPT) harmonized band plan:

  - Region 1 (Europe): France, Germany, Sweden, Italy, Spain, Denmark, UK, Netherlands, Switzerland.

- US band plan:

  - Region 2 (Americas): US, Canada

WRC-12 decisions

- At WRC-12 it was decided to allocate the 700 MHz band for the mobile service globally, as well as its identification for IMT services, in addition to 800 MHz, with commencement date end of 2015.

- **This decision illustrates the global consensus for harmonization of mobile spectrum bands**.

Conclusions

Reduction of the digital divide through better, more efficient and cost effective broadband

The spectrum challenges:

- Sub -1 GHz spectrum: best bands for wide coverage of mobile broadband in rural areas.
- Availability and allocation: digital dividend and migration to digital television.
- Efficient utilization: through coordinated use.

- Harmonization: makes it cost effective and interoperable.

Conclusions

- **The steps for success…**

  - Regional **harmonization** is necessary
  - Implement the most efficient **band allocations**
  - Negotiation frameworks for **frequency coordination**
  - Existing services to be **re-deployed and protected**
  - Implement an appropriate **licensing process**

Thank you…

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