

Spectrum Issues for Mobile Broadband

CTU Meeting, Barbados
December 7-8, 2012



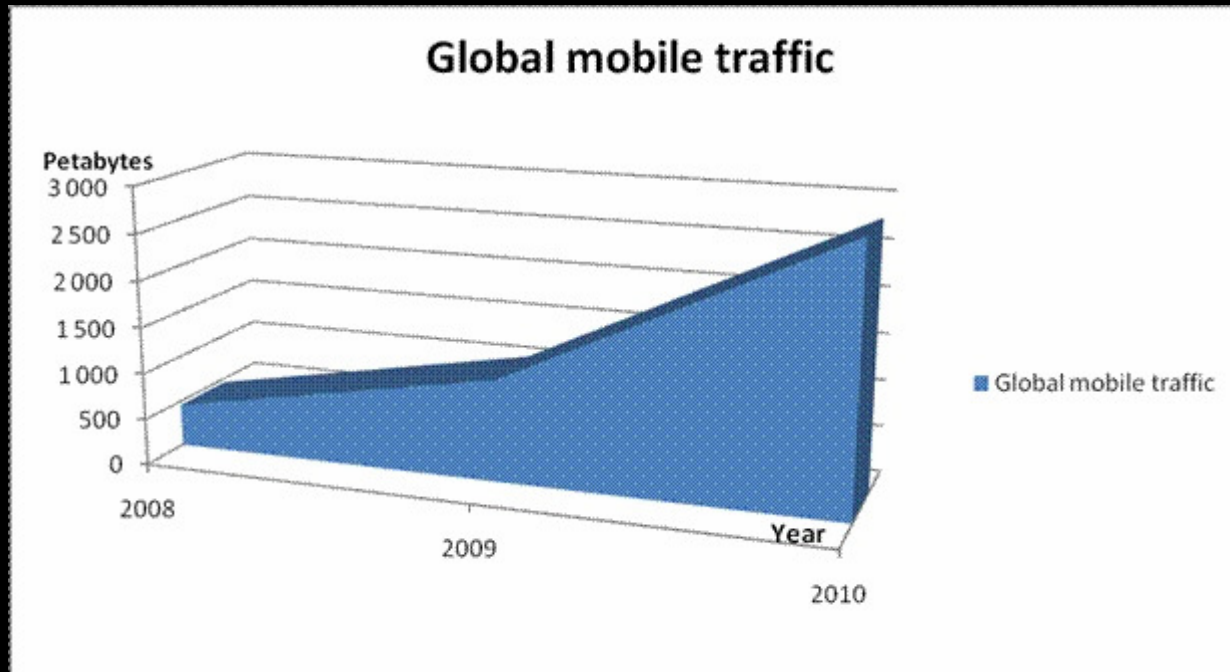
Introduction

- Trends in mobile broadband
- Importance of spectrum efficiency and harmonization for handset design
- 700 MHz issues for harmonization
- WRC-12 agenda items related to mobile broadband
- Summary

Trends and increased demand for mobile broadband: ITU-R M

- Growth of devices: smartphones, dongles, tablets
- Mobile access to internet replacing home/office
- Huge increase in mobile applications
- Video traffic growing dramatically
- Media rich social networks going mobile
- Machine-to-Machine traffic growing and expanding to new applications
- More capable network – user experience improvement
- Cost reduction and price decrease
- Several policy initiatives to promote mobile broadband
- Broader user-age demographics impacting traffic growth

Global mobile traffic: 2008-2010



- Traffic increased 2.6-fold in 2010, nearly tripling for third year in a row
- 740M users in 2000 > 3.9B in 2008 > 5.3B in 2010 (1.8B mobile broadband users)

Trends

- Mobile broadband consumers are demanding access to the same services and applications in the mobile environment as they have in wired office or home environments, with a similar, if not identical, user experience. Therefore, it is imperative to provide high data rate services, as well as high quality, to mobile broadband consumers.
- In 2002, there were just two economies in the world with mobile cellular penetration over 100%. Eight years later, almost 100 economies had mobile cellular penetration over 100% – and 17 economies had penetration rates above 150%.
- The 17 economies are: **Anguilla**, Finland, Maldives, Kuwait, **St Kitts & Nevis**; Oman, Russia, **Suriname**, Libya, Vietnam, Cayman Islands, **Antigua & Barbuda**, Panama, Montenegro, Saudi Arabia, Hong Kong (China) and Macao (China).

Some data on mobile and Desktop Use

- U.S.:
 - Desktop – 94% of internet users visited a social networking site, and 83% of internet users visited Facebook in Sep 2011
 - Mobile – 70% of smartphone users used a social networking site, 61% of smartphone users visited Facebook
- Mexico:
 - Desktop – 91% of internet users visited a social networking site, and 81% of internet users visited Facebook in Sep 2011
 - Mobile – 84% of smartphone users used a social networking site
- Brazil:
 - Desktop – 91% of internet users visited a social networking site, and 62% of internet users visited Facebook in Sep 2011
 - Mobile – 82% of smartphone users used a social networking site

Spectrum Issues

Efficient Use:

- The amount of data consumed by mobile devices is a critical factor in the overall efficiency of networks and spectrum demand
- Increasing efficiency provides significant benefits to:
 - Users: lower data charges; faster downloads; longer battery life
 - Network Operators: lower capital expenditures; less backhaul traffic (reducing costs and spectrum requirements for backhaul); lower spectrum requirements for the mobile network or increased capacity; smaller carbon footprint
 - Regulators: additional flexibility in assigning spectrum

Spectrum Issues

- Harmonization is critical
 - Spectrum harmonization achieves economies of scale; allows roaming; increases competition; reduces equipment design complexity; increases battery life; improves spectrum efficiency; reduces cost for consumers
- Need additional spectrum to address future growth in traffic and users
- Enabling regulatory framework

Current Smart Phone Landscape



- Meeting technical specs isn't the only challenge
- The device has to provide an attractive appearance, a smart user interface, great applications, and a reliable connection over many RF interfaces and technologies.

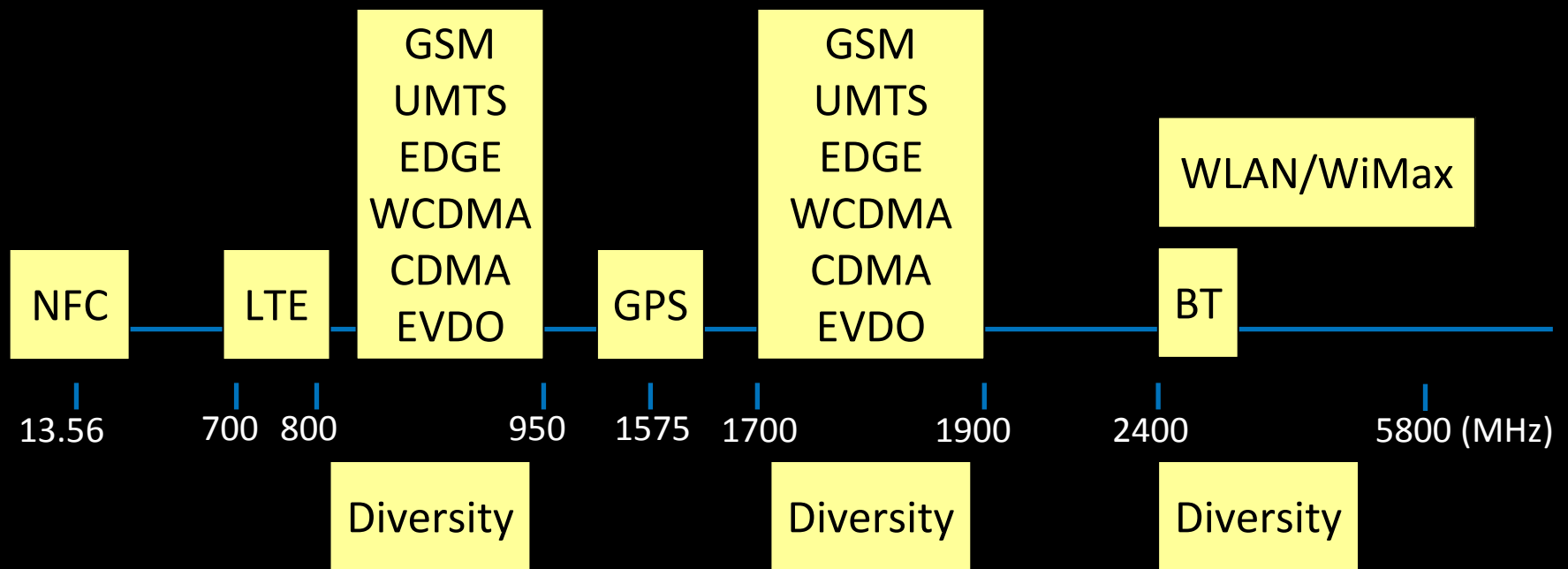
Challenges for handset manufacturers

- Aggressive Industrial Design
- Mechanical and structural limitations (dimensions, curvature, metal frame, etc.)
- Tighter customer/carrier requirements
- EMC/EMI issues

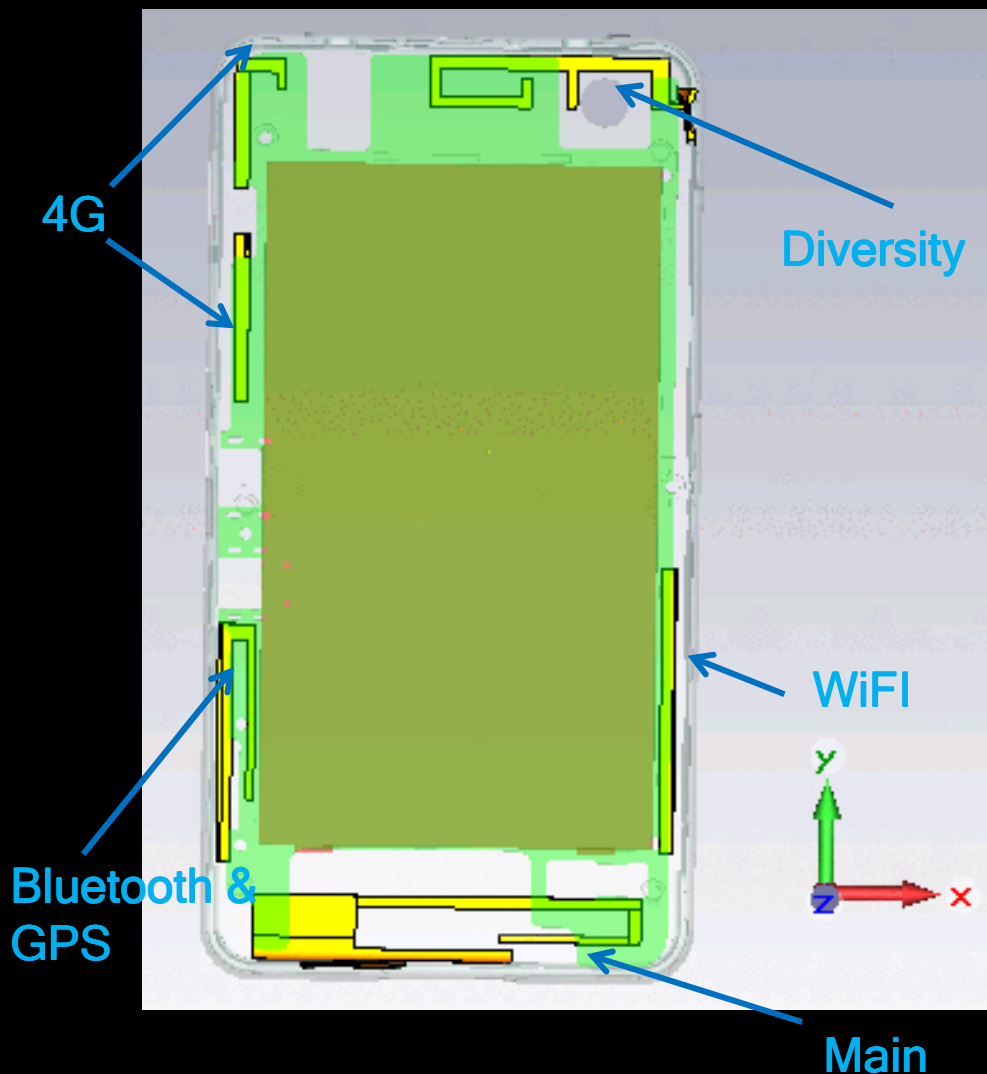


Technologies and band challenges

- Mobile phones are required to support a wide range of wireless technologies
- In most devices, two antennas are a minimum; five or more antennas are generally needed in a smartphone.



Antenna placement in the handset



Challenges

- Components (shield cans, speaker, camera) are directly behind the antenna.
- Larger batteries limit space allocated for antennas.
- Distance between PCB/bracket and antenna should be $>3\text{mm}$ (BT, GPS, WiFi and WiMax); for low bands it should be even higher.
- Space under antenna element should be clear of any shields, flexes, or components.
- Modern small phone should include NFC solution of 0.3mm .

Issues: 700 MHz for mobile broadband

- ITU allocations to mobile service co-primary with broadcasting is not yet harmonized at regional and global levels.
- Use of the band depends on timing for transition to DTV (2009 -2025).
- Europe, Africa and Iran are part of ITU GE-06 plan for transition by 17June 2015, i.e. analogue TV will not be protected after this date.
- Broadcasting use in many countries is scattered; will not provide much spectrum for Digital Dividend without significant harmonization efforts.

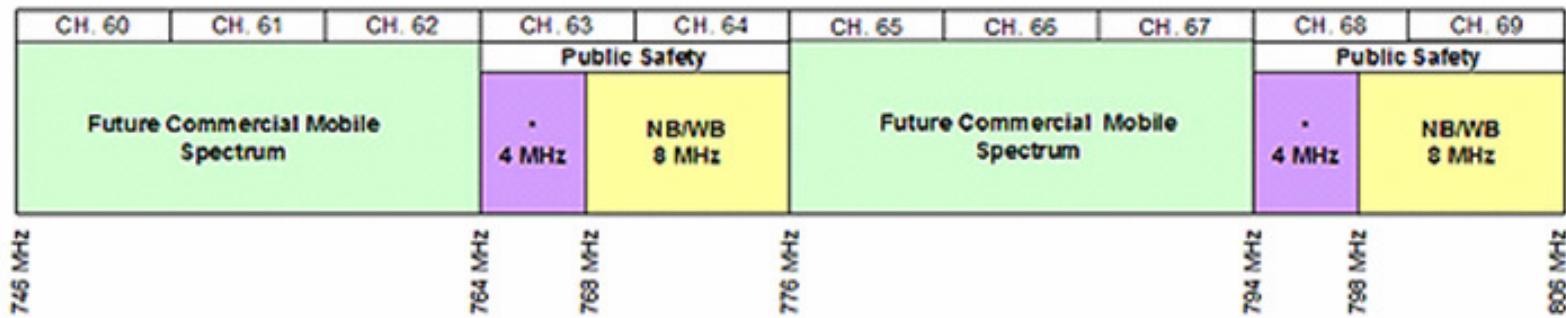
LTE band plans including 700 MHz

LTE Band	Uplink	Downlink	Main Regions of Use
Number	(MHz)	(MHz)	
1	1920 - 1980	2110 - 2170	Asia, Europe
2	1850 - 1910	1930 - 1990	Americas, Asia
3	1710 - 1785	1805 - 1880	Americas, Asia, Europe
4	1710 - 1755	2110 - 2155	Americas
5	824 - 849	869 - 894	Americas
6	830 - 840	875 - 885	Japan
7	2500 - 2570	2620 - 2690	Asia, Europe
8	880 - 915	925 - 960	Asia, Europe
9	1749.9 - 1784.9	1844.9 - 1879.9	Japan
10	1710 - 1770	2110 - 2170	Americas
11	1427.9 - 1452.9	1475.9 - 1500.9	Japan
12	698 - 716	728 - 746	USA
13	777 - 787	746 - 756	USA
14	788 - 798	758 - 768	USA
17	704 - 716	734 - 746	USA
18	815 - 830	860 - 875	Japan
19	830 - 845	875 - 890	Japan
20	832 - 862	791 - 821	Europe
21	1447.9 - 1462.9	1495.5 - 1510.9	Japan
22	3410 - 3500	3510 - 3600	

Note: Band numbers 12,13,14,17,18,19,20 in the 700 MHz band for LTE

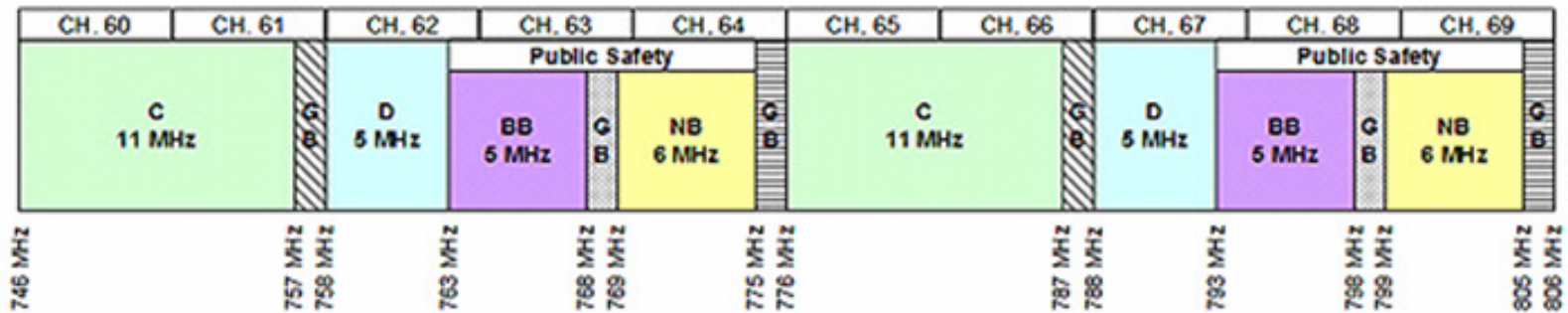
Canada proposed-US plan for 700 MHz

- Canadian and U.S. Band Plan for Public Safety



* In the band plan adopted in 2009, it was indicated that "This block will be subject to a future consultation"

a) Existing Canadian Band Plan



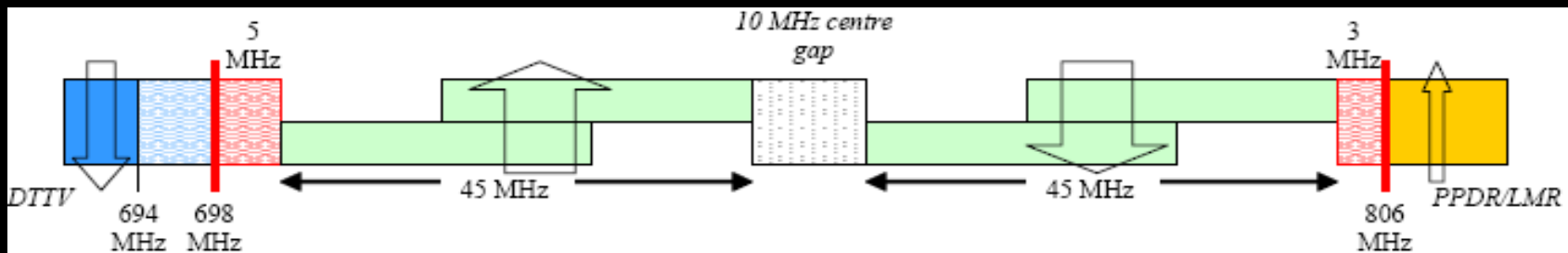
b) U.S. Band Plan

CEPT and APT plans for 700 MHz

791-796	796-801	801-806	806-811	811-816	816-821	821 - 832	832-837	837-842	842-847	847-852	852-857	857-862
Downlink						Duplex gap	Uplink					
30 MHz (6 blocks of 5 MHz)						11 MHz	30 MHz (6 blocks of 5 MHz)					

CEPT preferred harmonized frequency arrangement for the 790-862 MHz band

The CEPT preferred harmonized frequency arrangement is 2 x 30 MHz with a duplex gap of 11 MHz, based on a block size of 5 MHz, paired and with reverse duplex direction. The FDD downlink starts at 791 MHz and the FDD uplink starts at 832 MHz.



AWF harmonized FDD arrangement of 698-806 MHz band

Taking into consideration the capabilities of state-of-the-art filter technology, and to maximize the amount of FDD spectrum, a 2 x 45 MHz FDD structure with a 10 MHz centre-band gap was decided.

RIM's comments to Industry Canada re: 700 MHz consultation

- RIM supports Industry Canada's stated objective to make the 700 MHz band available for commercial mobile systems. In RIM's view, Industry Canada must do so in a manner that harmonizes the Canadian 700 MHz band plan with other neighboring jurisdictions while ensuring the widest possible contiguous spectrum blocks to enable the operation of next generation broadband services.
- RIM also recommends that Industry Canada develop a long-term plan that will take advantage of the efficiencies of channel bandwidths of 20+20MHz and larger and for redeployed spectrum contiguous with the 700 MHz band.

WRC-12 issues related to mobile broadband

- AI 1.2: Convergence of Fixed and Mobile Services
- AI 1.17: Re: R1 and R3 Broadcasting Plan (GE-06)
- AI 1.19: Regulatory treatment for new technologies Cognitive Radio (CRS) and SDR
- AI 1.22: Spectrum Harmonization for Short Range devices (SRDs)
- AI 8.2: Item for WRC-15 for Mobile Broadband

Draft IAP of CITEL for mobile broadband for WRC-15

“ to consider spectrum requirements and possible regulatory actions, including additional spectrum allocations to the mobile service on a primary basis to accommodate the development of IMT and other mobile broadband applications and technologies, taking into account the results of ITU-R studies, in accordance with Resolution [XXX] (WRC-12) ”

Under this Agenda Item, harmonization of current and future bands will need to be addressed.

Status of support for CITELE IAP

- Argentine Republic, Brazil (Federative Republic of), Canada, Costa Rica, Dominican Republic, Guatemala (Republic of), Mexico, Uruguay (Eastern Republic of), Venezuela (Bolivarian Republic of)

Pending support from :

- [Antigua and Barbuda], [Bahamas (Commonwealth of the)], [Barbados], [Belize], [Bolivia (Plurinational State of)], [Chile], [Colombia (Republic of)], [Dominica (Commonwealth of)], [Ecuador], [El Salvador (Republic of)], [United States of America], [Grenada], [Guyana], [Haiti (Republic of)], [Honduras (Republic of)], [Jamaica], [Nicaragua], [Panama (Republic of)], [Paraguay (Republic of)], [Peru], [Saint Lucia], [Saint Vincent and the Grenadines], [Saint Kitts and Nevis (Federation of)], [Suriname (Republic of)], [Trinidad and Tobago]

Other IAP's and DIAP of interest

- **Agenda item 1.10:** *to examine the frequency allocation requirements with regard to operation of safety systems for ships and ports and associated regulatory provisions, in accordance with Resolution 357 (WRC-07);*
- **Agenda item 1.9:** *to revise frequencies and channelling arrangements of Appendix 17 to the Radio Regulations, in accordance with Resolution 351 (Rev.WRC-07), in order to implement new digital technologies for the maritime mobile service*
- At citel.oas.org follow WRC-12 documents (2684 r 4, 2683 r4 and 2682 r4) for IAP's, DIAP's and preliminary proposals
- Puerto Rico Meeting of Nov 28-Dec 3 :
<http://www.oas.org/es/citel/P2!R.htm>

Summary

- Spectrum harmonization is important to:
 - improve spectrum efficiency through use of new technologies
 - reduce equipment design complexity, and
 - reduce service cost to consumers (and improve user experience)
- 700 MHz spectrum provides opportunity for harmonization and improved coverage for mobile broadband
- WRC-12 decisions critical to accommodate anticipated growth in mobile traffic and users