ITU-R Forum: Digital Dividend

Veena Rawat
Asuncion, Paraguay
July 12, 2013

BlackBerry

Contents

- Importance of Harmonization
- Digital Dividend
- WRC-15 Agenda Item 1.1

BlackBerry® Z10 smartphone

Harmonization: Benefits and Need

Benefits of spectrum harmonization include:

- achieving economies of scale
- enabling global roaming
- possibly increasing competition
- reducing equipment design complexity
- preserving battery life
- improving spectrum efficiency
- reducing cost for consumers
- potentially reducing cross border interference

Resolution 233 (WRC-12) for WRC-15 AI 1.1

resolves to invite ITU-R

2 to study potential candidate frequency bands, taking into account the results of the studies under *resolves to invite ITU-R* 1, protection of existing services and the need for harmonization;

Resolution 232 (WRC-12) for WRC-15 AI 1.2

invites ITU-R

2 to study the channelling arrangements for the mobile service, adapted to the frequency band below 790 MHz, taking into account:

– the desire for harmonization with arrangements across all Regions,

3 to study coexistence between the different channelling arrangements which have been implemented in Region 1 above 790 MHz, as well as the possibility of further harmonization;

Harmonization: Four levels

1. Radio frequencies to be allocated to the mobile service in the ITU frequency allocation table as primary or co-primary service and identification of frequency bands for IMT.
2. To establish global or regional frequency arrangements, including channel blocks and specific duplexing modes. The second level is guided by the ITU frequency allocation table and coordinated bilaterally, multilaterally or regionally.
3. Detailed technical specification standardization for the common harmonized allocations and frequency arrangements. At this technical specification level, system performance, RF performance and co-existence with other systems in the neighbouring bands are specified.
4. The administrations assign the frequency blocks with the same technical conditions and specifications to appropriate operators and service providers.

These four levels may interact with each other and happen in an iterative manner.

Current IMT Frequency Bands

Band (MHz)	Footnotes identifying the band for IMT
450 – 470	5.286AA
698 – 960	5.313A, 5.317A
1710 – 2025	5.384A, 5.388
2110 – 2200	5.388
2300 – 2400	5.384A
2500 – 2690	5.384A
3400 – 3600	5.430A, 5.432A, 5.432B, 5.433A

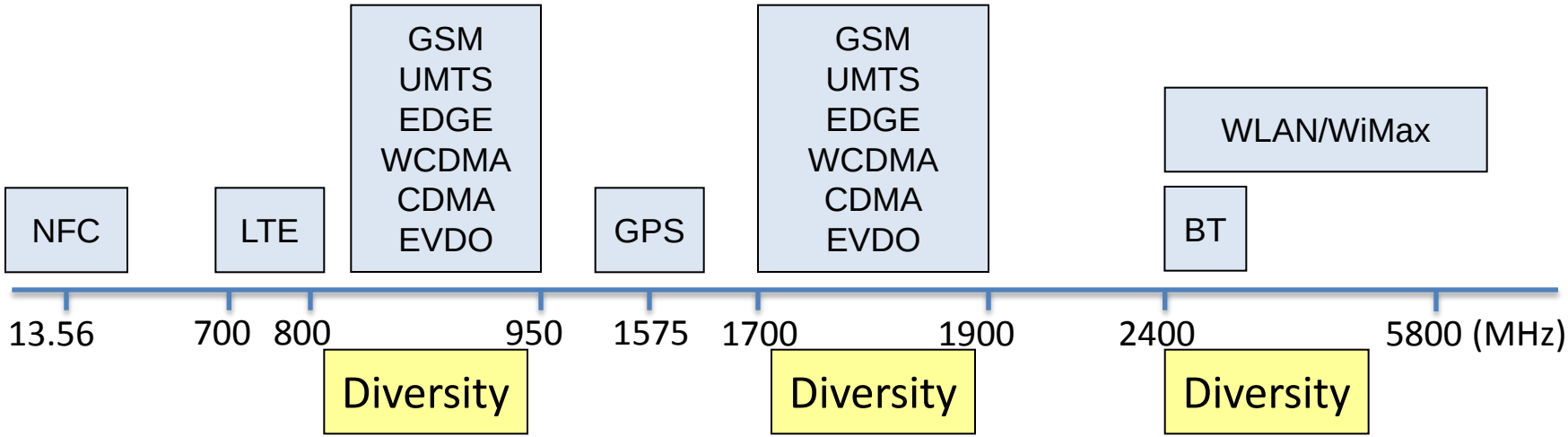
LTE Band Plans

LTE Band Number	Uplink (MHz)	Downlink (MHz)	Main Regions of Use
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	

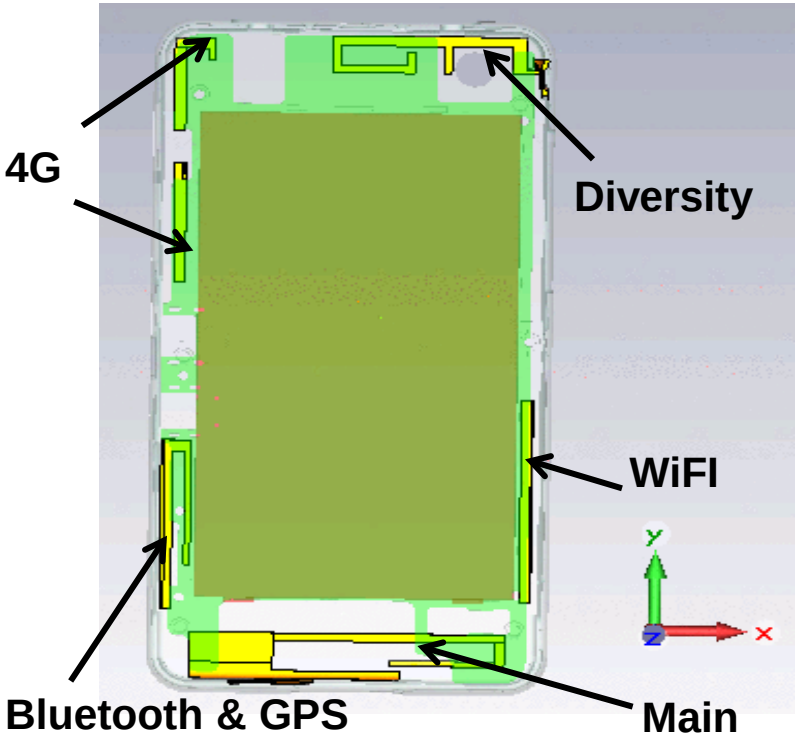
Note:
Band numbers 12, 13, 14, 17, 18, 19, 20 in the 700 MHz band for LTE

Technologies and Bands

- 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

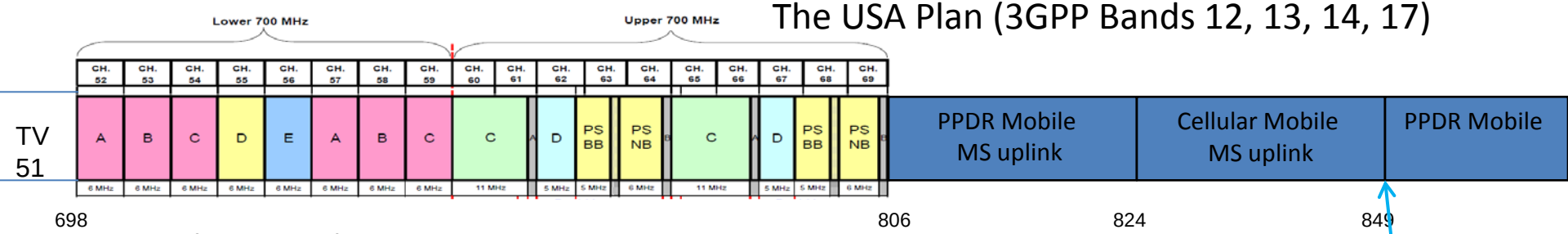
- Components (shield cans, speaker, camera) are directly behind the antenna
- Larger batteries limit space allocated for antennas
- Distance between PCB/bracket and antenna should be >3mm (BT, GPS, WiFi and WiMax); for low bands it should be even higher
- Space under antenna element should be clear of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

International Background: 700 MHz

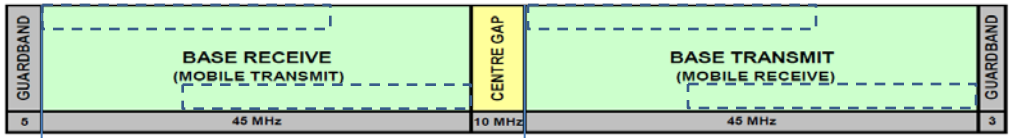
- Use of band depends on the timing for transition to DTV (2009 -2025)
- Europe, Africa and Iran are part of ITU GE-06 plan for transition by June 17, 2015, i.e. analogue TV will not be protected after this date
- Broadcasting use in many countries is scattered, will not provide much spectrum for Digital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

Various “700 MHz” plans

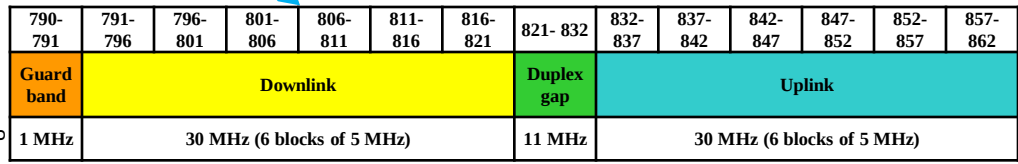
The USA Plan (3GPP Bands 12, 13, 14, 17)



The APT Plan (3GPP Band 28 for FDD and 44 for TDD)



One proposed EU plan compatible with lower duplex of APT plan



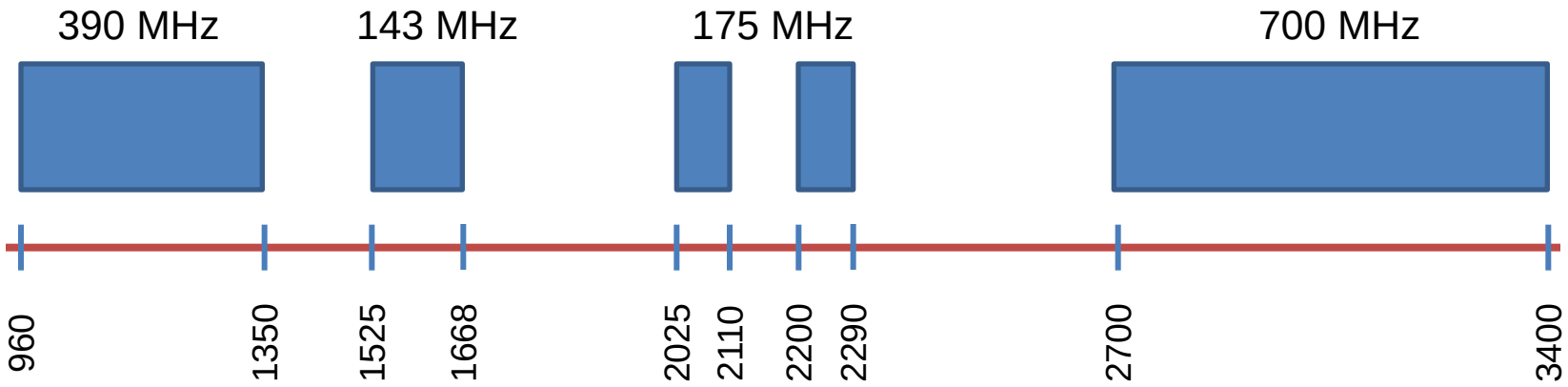
The EU-CEPT Plan (GSM 3GPP Band 20)

Current 600MHz allocations in R2

- There is no table allocation, to mobile service on co-primary basis in R2, unlike in R3.
- Footnotes provide the following, noting provisions of 5.33 and 9.21 of RR's:
- 470-512 MHz: Canada, Chile, Colombia, Cuba, Guyana, Honduras, Jamaica, Mexico, Panama, Peru, USA (FN's 5.292, 5.293)
- 512-608 MHz: Canada, Costa Rica, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, USA (FN 5.297)
- 614-698 MHz: Canada, Chile, Colombia, Cuba, Guyana, Honduras, Jamaica, Mexico, Panama, Peru, USA (FN 5.293)
- 614-806 MHz: Costa Rica, El Salvador, Honduras (FN 5.309)

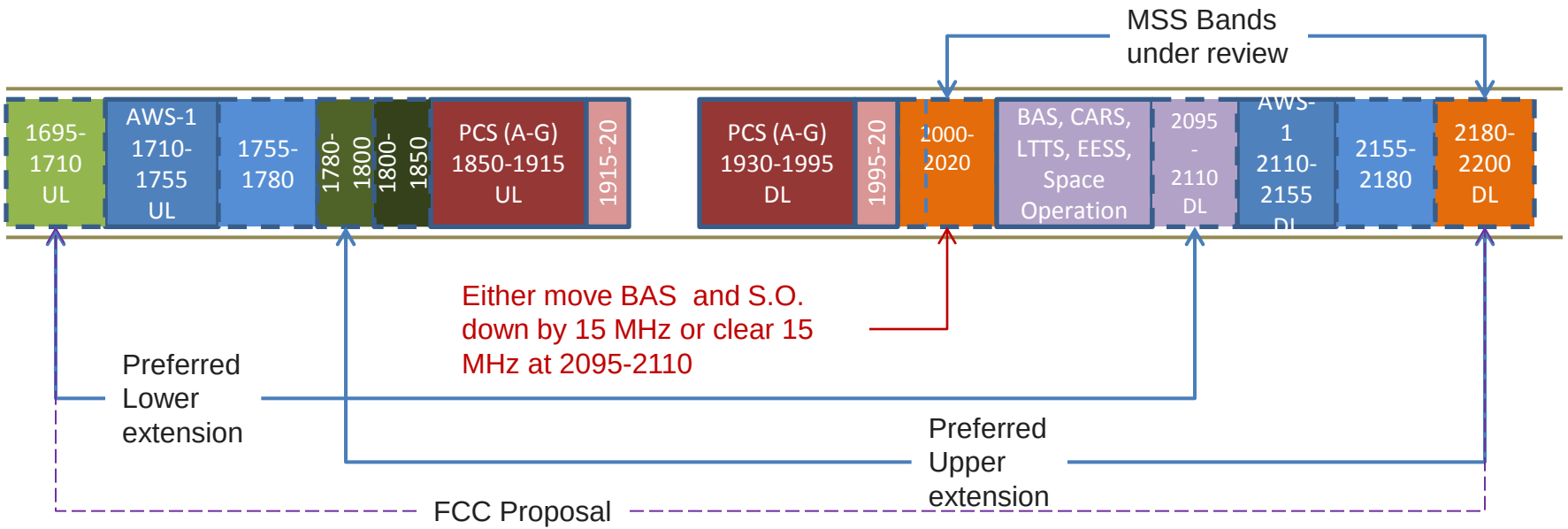
Region 1	Region 2	Region 3
470-790 BROADCASTING **No Mobile??** 5.149, 5.291A, 5.294, 5.296, 5.300, 5.302, 5.306, 5.311A, 5.312	**470-512** BROADCASTING Fixed Mobile 5.292, 5.293	**470-585** FIXED **MOBILE** BROADCASTING 5.291, 5.298
	512-608 BROADCASTING 5.297	
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-Space)	
	614-698 BROADCASTING Fixed Mobile 5.293, 5.309, 5.311A	**585-610** FIXED **MOBILE** BROADCASTING RADIONAVIGATION 5.149, 5.305, 5.306, 5.307
	698-806 BROADCASTING Fixed **MOBILE** 5.313B, 5.317A 5.293, 5.309, 5.311A	
790-862 FIXED BROADCASTING **MOBILE** except aeronautical mobile 5.316B, 5.317A 5.312, 5.314, 5.315, 5.316, 5.316A, 5.319	**806 – 890** FIXED **MOBILE** 5.317A BROADCASTING	**610-890** FIXED **MOBILE** 5.313A, 5.317A BROADCASTING

Non-Terrestrial Spectrum Use: 1 - 3.4 GHz



Almost 58% of the spectrum between 960 MHz and 3400 MHz is currently not available for terrestrial mobile use!

AWS Extension Bands



Frequency Bands for JTG 4-5-6-7 Discussions

- 1300-1400 MHz
- 1427-1525 MHz
- 2700-2900 MHz
- 3400-3800 MHz
- 4200-4900 MHz
- 5350-5470 MHz

Summary

- Important to develop approaches to achieve harmonization at all levels (e.g. strengthening regional coordination/consultations)
- In R2, allocations on co-primary basis in 470-698 MHz important
- Spectrum 5 GHz and below requires longer term look for the benefit of mobile broadband use as well as for the current incumbents.
- Takes 7-10 years to bring product to market after a WRC decision, hence critical to approve new allocations at international level at WRC-15 to meet demand in beyond 2020 period with full flexibility for the timing of national decisions

WRC-15 1.1 (470-698 MHz, R2)

- An important first step is to harmonize Region 2 with the international allocations to the mobile service in the range 470-806 MHz. In addition to the current allocations, only some countries have a primary allocation in the range 470-698 MHz to the mobile service. The following Footnotes in the ITU Table of Frequency Allocations are provided for reference.

- **5.292** *Different category of service:* in Mexico, the allocation of the band 470-512 MHz to the fixed and mobile services, and in Argentina, Uruguay and Venezuela to mobile service, is on a primary basis (see No. **5.33**), subject to agreement obtained under No. **9.21** (WRC-07)

- **5.293** *Different category of service:* in Canada, Chile, Colombia, Cuba, the United States, Guyana, Honduras, Jamaica, Mexico, Panama and Peru, the allocation of the bands 470-512 MHz and 614-806 MHz to the fixed service is on a primary basis (see No. **5.33**), subject to agreement obtained under No. **9.21**. In Argentina and Ecuador, the allocation of the band 470-512 MHz to the fixed and mobile services is on a primary basis (see No. **5.33**), subject to agreement obtained under No. **9.21** (WRC-07)

WRC-15 1.1 (470-698 MHz, R2)

- **5.297** *Additional allocation:* in Canada, Costa Rica, Cuba, El Salvador, the United States, Guatemala, Guyana, Honduras, Jamaica and Mexico, the band 512-608 MHz is also allocated to the fixed and mobile services on a primary basis, subject to agreement obtained under No. **9.21**. (WRC-07)

- **5.309** *Different category of service*: in Costa Rica, El Salvador and Honduras, the allocation of the band 614-806 MHz to the fixed service is on a primary basis (see No. **5.33**), subject to agreement obtained under No. **9.21**.

- **5.313B** *Different category of service:* in Brazil, the allocation of the band 698-806 MHz to the mobile service is on a secondary basis (see No. **5.32**). (WRC-07)