DIGITAL TERRESTRIAL TELEVISION

SESSION 16
DIGITAL DIVIDEND FOR MOBILE INDUSTRY

Policy and Regulation Initiative for Digital Africa (PRIDA)

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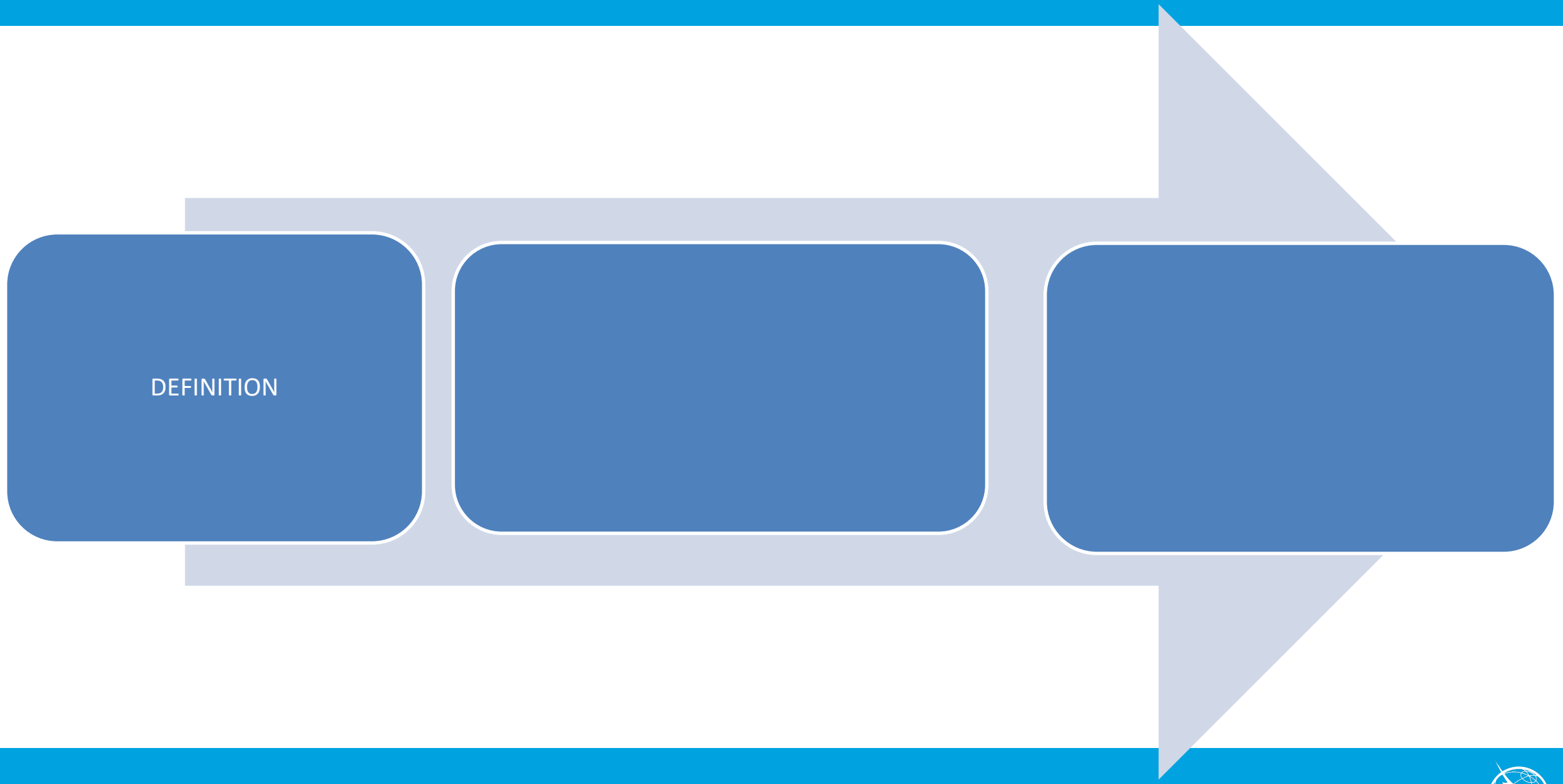


DEFINITION

"THE DIGITAL DIVIDEND IS UNDERSTOOD AS THE SPECTRUM MADE AVAILABLE OVER AND ABOVE THAT REQUIRED TO ACCOMMODATE EXISTING (ANALOGUE TELEVISION) SERVICES IN A DIGITAL FORM, IN VHF (BAND III: 174-230 MHZ) AND UHF BANDS (BANDS IV AND V: 470-862 MHz)".

WRC-07 ENABLED THE **FIRST DIGITAL DIVIDEND** FOR MOBILE BROADBAND IN THE **BAND 790-862 MHz (800 MHz)** IN REGION 1 AND 698-790 MHz (700 MHz) IN REGIONS 2 AND 3.

WRC-12 AND WRC-15 ENABLED THE SECOND DIGITAL DIVIDEND FOR MOBILE BROADBAND IN THE BAND **694-790 MHz (700 MHz)** IN REGION 1 AND IN THE BAND 610/614-698 MHz (600 MHz) IN A FEW COUNTRIES IN REGIONS 2 AND 3.

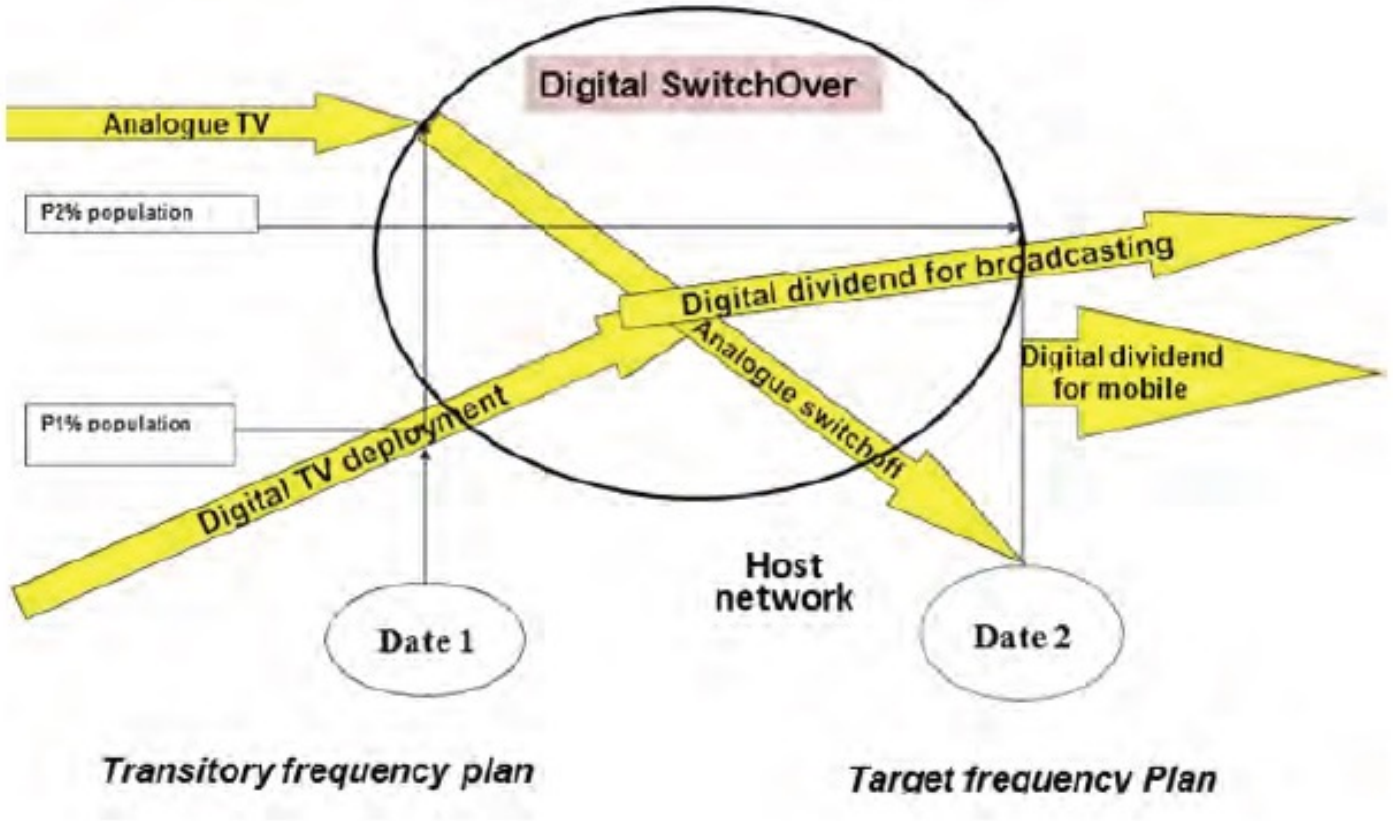
DIGITAL DIVIDEND – 3 INTER-RELATED OBJECTIVES

DIGITAL DIVIDEND IS A RESULT OF THE ANALOGUE SWITCH-OFF AND DIGITAL SWITCH-OVER. ALL THREE PROCESSES HAVE TO BE SEEN IN CONJUNCTION

1) ANALOGUE SWITCH-OFF

1) SWITCH OFF

2) DIGITAL DIVIDEND



CONTENT

FREQUENCY ARRANGEMENTS
HARMONISATION

FREQUENCY ARRANGEMENTS – 700 MHz

This is the digital-dividend two as a result of successful migration from analogue to digital TV. Many countries still use it for broadcasting. The band could be used for IMT-2020 deployments to achieve coverage objectives. The recommended channeling plan for implementation of IMT in the 700 MHz band is based on paired frequency arrangement A7 coupled with the unpaired frequency arrangement A10 as follows[5,6]:

1. 2x30 MHz band plan that consists of 703–733 MHz (uplink) paired with 758–788 MHz (downlink);
2. For the centre gap, an unpaired frequency arrangement for Supplemental Downlink (SDL) on optional basis. Zero to four frequency blocks of 5 MHz in 738–758 MHz could be used to complement the downlink capacity of a frequency arrangement in this or other bands;
3. For the guard bands, the spectrum band 2x5MHz that consists of 698–703MHz (uplink) paired with 753–758MHz (downlink), and the 2x3MHz band that consisting of 733–736MHz (uplink) paired with 788–791MHz (downlink) is proposed to be considered to develop harmonized use for Public Protection and Disaster Relief (PPDR) and Machine to Machine (M2M) applications; and
4. There are inherent benefits of deploying IMT technologies for PPDR applications in this band, including advantages of large coverage area and possible interoperability across the 700 and 800 MHz bands, noting the differences in operational requirements and implementations.

FREQUENCY ARRANGEMENTS – 700 MHz

Frequency arrangements	Paired arrangements (FDD)				Un-paired arrangements (TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
A7	703–733	25	758–788	55	None
A10	External		738–758		None
	698–703		753–758		None
	733–736		788–791		None

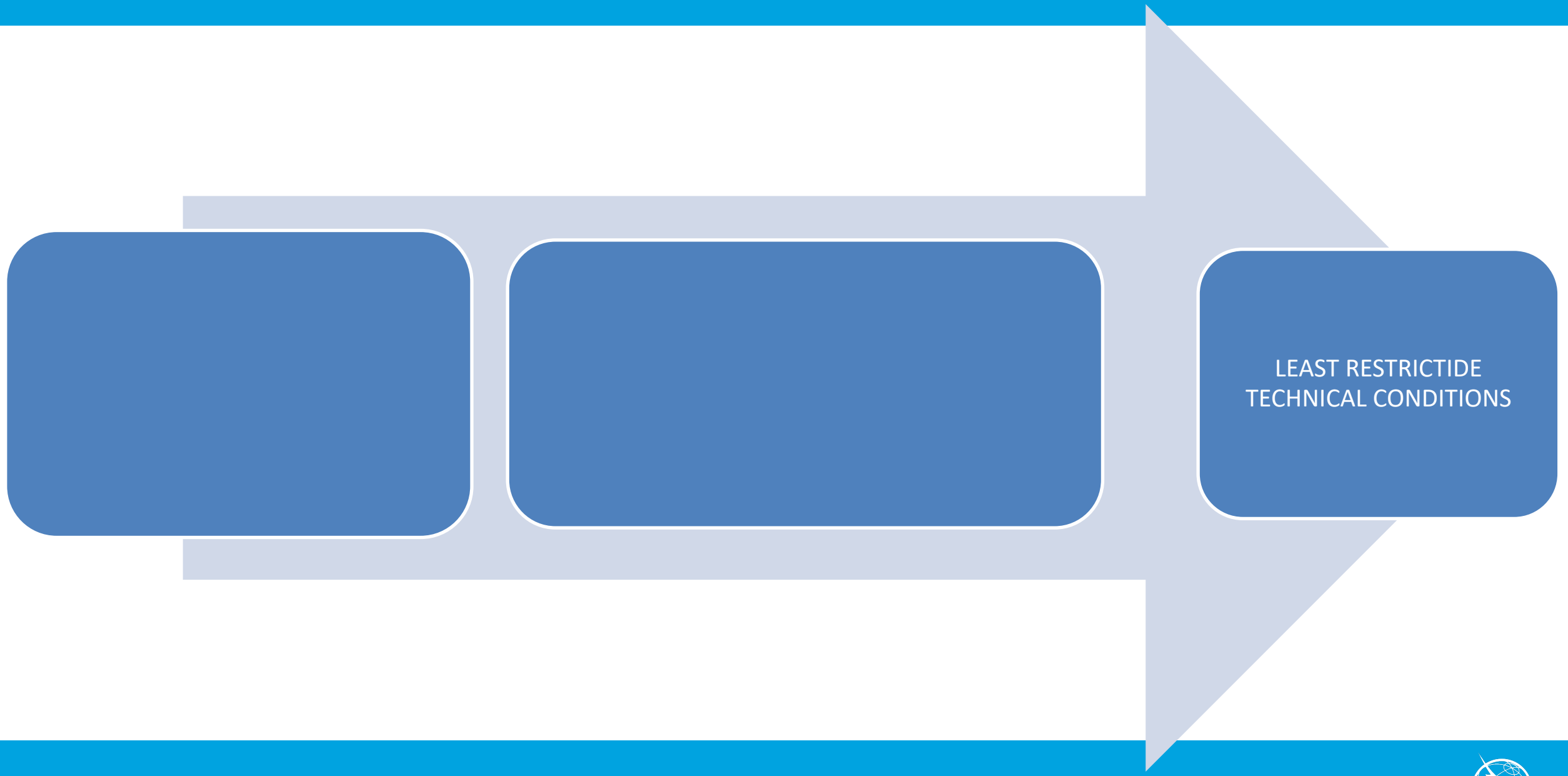
FREQUENCY ARRANGEMENTS – 800 MHz

This band is the digital-dividend one as a result of successful migration from analogue to digital TV. The channeling plan for implementation of IMT in the band is based on paired frequency arrangement A3 as follows[7,8,9]:

1. 2x30 MHz band plan consists of 832–862 MHz (uplink) paired with 791–821 MHz (downlink); and
2. IMT systems are operating in FDD mode and use a reversed duplex direction, with mobile terminal transmit within the upper band and base station transmit within the lower band. Such an arrangement provides better conditions for coexistence with the lower adjacent broadcasting service.

Frequency arrangements	Paired arrangements (FDD)				Un-paired arrangements (TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
A3	832-862	11	791–821	41	None

CONTENT



LEATS RESTRICTIVE TECHNICAL CONDITION – GENERAL

CONDITIONS TO ENSURE THE PROTECTION OF RADIOCOMMUNICATION SERVICES IN-BAND AND IN ADJACENT BANDS.

1) FREQUENCY ARRANGEMENTS SHOULD BE BASED ON A 5 MHZ BLOCK APPROACH. CHANNEL BANDWIDTH SHOULD BE MULTIPLE OF 5 MHZ.

2) IF FDD AND TDD SYSTEMS ARE USED IN A BAND, A COMMON FDD-TDD FREQUENCY BOUNDARY SHOULD BE USED INTERNATIONALLY TO REDUCE THE POTENTIAL OF INTERFERENCE;

3) INTERFERENCE BETWEEN TDD AND FDD SYSTEMS SHOULD BE ANALYSED WITH THE PARTICULAR CHARACTERISTICS OF THE INTENDED SYSTEMS. A FREQUENCY SEPARATION (TYPICALLY 5 MHZ) BETWEEN FDD AND TDD SYSTEMS OPERATING IN THE SAME GEOGRAPHICAL AREA IS ALWAYS REQUIRED F

4) WHEN THERE ARE DEPLOYMENTS FOLLOWING DIFFERENT BAND PLANS FOR FDD AND TDD OPERATION, THE INTERFERENCE SITUATION SHOULD BE ANALYSED.

5) TO AVOID INTERFERENCE BETWEEN TWO TDD NETWORKS, MITIGATIONS MEASURES COULD BE USED LIKE NETWORK SYNCHRONIZATION, RESTRICTED BLOCK EDGE MASK BETWEEN TWO OPERATORS, GUARD BAND;

6) IN CASE OF TDD NETWORKS IN THE SAME GEOGRAPHICAL AREA, IT MAY BE BENEFICIAL TO SYNCHRONISE

7) WHERE APPROPRIATE, IMT SUBSCRIBER TERMINAL STATION SHOULD COMPLY WITH THE TECHNICAL SPECIFICATION OUTLINED UNDER 3GPP TS 36.521-112 LATEST VERSION.

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LEATS RESTRICTIVE TECHNICAL CONDITION – CONT'D

3.7.3 Specific technical conditions applicable in the 700 MHz and 800 MHz bands

1) Maximum radiated power; see EM section 2.5.4.2.10.

a) Base Station in-block transmissions:

	Maximum EIRP
Radio Equipment	61 dBm / 5 MHz EIRP per antenna

b) Mobile station transmissions:

	Maximum mean power
Radio Equipment	23 dBm

2) Maximum power outside the Permitted Frequency Block (see ECC Decisions (09)03 and (15)01[15].

Baseline requirements for the out-of-block emission mask for base stations in the frequency band 790 – 862 MHz:

Frequency range	Max. mean EIRP	Measurement bandwidth
790 to 791 MHz	–17.4 dBm	1 MHz
791 to 821 MHz	11 dBm	5 MHz
821 to 832 MHz	15 dBm	1 MHz
832 to 862 MHz	–49.5 dBm	5 MHz

Baseline requirements for the out-of-block emission mask for base stations in the frequency band 694 – 790 MHz:

Frequency range	Max. mean EIRP	Measurement bandwidth
470 to 694 MHz	–23 dBm/cell	8 MHz
694 to 698 MHz	–32 dBm/cell	1 MHz
698 to703 MHz	–50 dBm/cell	5 MHz
703 to 733 MHz	–50 dBm/cell	5 MHz
733 to 736 MHz	–52 dBm/cell	3 MHz
736 to 738 MHz	–4 dBm/antenae	5 MHz
738 to 758 MHz	16 dBm/antenae	5 MHz
758 to 788 MHz	16 dBm/antenae	5 MHz
788 to 791 MHz	14 dBm/antenae	5 MHz
791 to 821 MHz	16 dBm/antenae	5 MHz
832 to 862 MHz	–49 dBm/cell	5 MHz

Administrations may adopt less stringent technical parameters provided that they continue to comply with the technical conditions applicable for the protection of other services, applications or networks and with their cross-border obligations; see ECC Decision (09)03.

3) To protect TV channel 48 (686–694 MHz), 9 MHz offset should be used; see ECC Report 283.

4) In order to facilitate protection of broadcasting services in the frequency band 470-694 MHz, unwanted emission levels of IMT mobile stations operating in the frequency band 703 -733 MHz into the frequency band 470-694 MHz should be as specified below derived from Recommendation ITU-R M.2090 :

IMT channel bandwidth	Value not to exceed
greater than 10 MHz	–25 dBm/8 MHz
10 MHz or less	–42 dBm/8 MHz

5) Administrations may wish to consider also block edge mask (BEM) concept developed by CEPT to facilitate implementation of spectrum rights of use which are as technology neutral as possible. It is described in:
   - Annex 2 of ECC Decision (15)01 for base stations and user equipment in the band 694–790 MHz;
   - Annex 3 of ECC Decision (09)03 for base stations and user equipment in the band 790–862 MHz.

6) Report ITU-R BT.2339-0 provides the requirement for ensuring electromagnetic compatibility between digital terrestrial television broadcasting and IMT in the frequency band 694-790 MHz in the GE-06 planning area. Report ITU-R M.2242-0 provides guidance to ensure compatibility between IMT systems operating in the frequency bands 790-862 MHz or 698-806 MHz and systems of other services operating in the same or adjacent band, and also between systems of the mobile service with different technical characteristics, including different IMT systems.

LEATS RESTRICTIVE TECHNICAL CONDITION – X-BORDER FREQUENCY COORDINATION

Cross-border coordination requirements for the 700 MHz and 800 MHz bands are stipulated below

1. For coexistence with broadcasting, the coordination procedure will take into account the framework of the GE-06 agreement.
2. Use of these frequency bands shall require coordination with the neighbouring countries within the coordination zone of 6 kilometers in case of LTE-to-LTE or 9 kilometers in case of LTE-to-other technologies from the borderline of the neighbouring country;
3. The following field strength thresholds have to be assured in the frequency bands 703-790 MHz and 790-862 MHz:

   In general, stations of FDD systems may be used without coordination with a neighboring country if the mean field strength produced by the cell (all transmitters within the sector) does not exceed the value of 55 dBµV/m/5MHz at a height of 3 m above ground at the borderline between countries and does not exceed a value of 29 dBµV/m/5MHz at a height of 3m above ground at a distance of 9 km inside the neighboring country;

   In the case that LTE is deployed both sides of the border the field strength levels can be increased to 59 dBµV/m/5MHz and 41 dBµV/m/5MHz at 6 km.

   In cases of other frequency block sizes 10 x log (frequency block size/5MHz) should be added to the field strength values.
4. For field strength predictions the calculations should be made according to the following:
   a. the propagation model for interference field strength prediction is the latest version of ITU-R Rec. P.452; and
   b. the basic model to be used to trigger coordination between administrations and to decide, if co-ordination is necessary, is ITU-R Rec. P.1546, "Method for point to area predictions for terrestrial services in the frequency range 30 to 3000 MHz".
5. Coordination between neighbouring systems using LTE technology in border areas should use a Physical Cell Identifier (PCI) sharing agreed within neighbouring administrations when channel centre frequencies are aligned. PCIs coordination is necessary for LTE systems to avoid unnecessary signalling load and handover failures.
6. For LTE, it may be beneficial to coordinate other radio parameters besides PCI (demodulation reference signal (DM RS) coordination, physical random-access channel (PRACH) coordination) in order to minimise deteriorating effects of uplink interference.
7. Operator-to-operator coordination may be necessary to avoid interference

MERCI !!!