



Trends in digital broadcasting

Radiocommunication Bureau

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Overview



- **Trends in the Digital Radio**
 - ITU Regulation
- **Trends in the Digital Television**
 - ITU Regulation



Frequency bands for Broadcasting services (≠ HF)



Band	Frequency (kHz/MHz)	BC/BT	Region Geo. zone	Plan
LF	148.5-283.5 kHz	BC	R1	GE75
MF	526.5-1 606.5 kHz	BC	R1 and R3	GE75
	525-1 605	BC	R2	RJ81
	1 605-1 705	BC	R2	RJ88
VHF /UHF	47-68 MHz	BC, BT	EBA	ST61
	47-68	BT	ABA	GE89
	87.5-100	BT	EBA	ST61
	87.5-108	BC	R1*	GE84
	162-170 MHz	BT	MRC	ST61
	(170 _{MRC})174-230	BC , BT	R1-MNG+IRN	GE06
	230-238, 246-254	BT	See RR 5.252	GE89
470-862	BT	R1-MNG+IRN	GE06	

* and part of R3



Why digital?



New possibilities to the viewers:

- Additional number of programs
- Additional reception modes
- Improved quality of image and sound
- Additional type of services: interactivity, Electronic Program Guides, etc.

Attractive

for Regulators :

- **Fair competition:** To develop a terrestrial platform competitive with the other platforms
- **Efficiency of spectrum** (1 frequency for multiple programs)
- **Possibility to free a part of the Band for other usage**

Efficient use of Spectrum

TV operators/content providers:

Significant decrease in transmission costs comparing to analogue.

- **Power costs:** DTT requires less energy to ensure the same coverage as for the analogue,
- **Investment and transmission cost:** One transmitter to broadcast multiple channels/programs.
- **Development of new services without spectrum constraints.**
- **Offering of new innovative services** (mobile TV , data, games, interactivity, VoD,...).

Good for the environment



Digital

Radio



ITU-R recommendations



Recommendation ITU-R BS.1514-2:

System for digital sound broadcasting in the broadcasting bands below 30 MHz.



Recommendation ITU-R BS.1114-7:

Systems for terrestrial digital sound broadcasting to vehicular, portable and fixed receivers in the frequency range 30-3 000 MHz.



Recommendation ITU-R BS.774-3:

Service requirements for digital sound broadcasting to vehicular, portable and fixed receivers using terrestrial transmitters in the VHF/UHF bands.



Digital Sound standards

(See ITU-R Recommendation BS. 1114-7)



DRM Digital Radio Mondiale	ISDB-TSB – Integrated Services Digital Broadcasting- Terrestrial Sound Broadcasting	T-DAB/T-DMB Terrestrial Digital Audio Broadcasting/ Multimedia Broadcasting	HD Radio™ <i>proprietary standard from iBiquity</i>	IBOC In-band on- channel
<ul style="list-style-type: none">• DRM30: Designed to operate on 150kHz to 30 MHz• DRM+: in VHF Bands I, II, and III• Allows to broadcast up to 4 different services in an ITU channel (9 or 10 kHz).	<ul style="list-style-type: none">• consists of one or three OFDM-segments;• The bandwidth of the system is approximately 500 kHz or 1.5 MHz	<ul style="list-style-type: none">• DAB/DAB+: operates at any frequency up to 3 000 MHz• DMB: Suitable for mobile radio and TV as it supports MPEG 4 AVC. (designed to be carried on a DAB subchannel).	<ul style="list-style-type: none">• The only standard approved by the FCC for AM/FM in the US.• 200 kHz-wide channels.• uses a codec based upon the MPEG-4 HE-AAC standard.	<ul style="list-style-type: none">• < 3MHz• Described in Annex 4;



DRM transmission modes



Mode	QAM	Bandwidth (kHz)	Typical uses	
A	16, 64	4.5, 5, 9, 10, 18, 20	LF & MF ground-wave, 26MHz band line-of-sight	DRM30
B	16, 64	4.5, 5, 9, 10, 18, 20	HF & MF transmission on sky-wave	
C	16, 64	10, 20	Difficult sky-wave channels on HF	
D	16, 64	10, 20	NVIS sky-wave (highest Doppler & delay spread)	
E	4, 16	100	VHF transmissions in the bands above 30 MHz	DRM+

Mode A is designed to deliver the highest bit rate possible within the context of ground-wave or line-of-site coverage.

- Mode B will generally be the first choice for sky-wave services.
- Where propagation conditions are more severe, such as for long paths with multiple hops, or near vertical incidence, where several very strong reflections may occur, Mode C or Mode D may need to be employed.
- Finally, Mode E is used for the VHF frequency bands from 30 MHz up to Band III (DRM+).



DAB+ transmission modes



	Mode 1 VHF	Mode 2 UHF	Mode 3 L- Band
bandwidth DAB+ frequency block	1.536 MHz	1.536 MHz	1.536 MHz
number of carriers in frequency block	1536	768	384
carrier spacing	1 kHz	2 kHz	4 kHz
data rate (incl. overhead)	2.4 Mbit/s	2.4 Mbit/s	2.4 Mbit/s
transmitter distance in SFN	75 km	48 km	18.8 km

Source: LSTelcom



Introduction of digital
sound broadcasting

according to Regional
Broadcasting Agreements
And HFBC



Introduction of Digital Sound in Regional Agreements (LF/MF)



RJ81

MF: 535 - 1605

R2



Does **not provide** the possibility of introducing digital modulation in the bands concerned.

Question ITU-R 120/6 (2006) "Digital sound broadcasting in Region 2" has been adopted by Study Group 6E.

RJ88

1 605 – 1 705 kHz

R2



CCRR/20(6 September 2002), the BR concluded that the formulations in the RJ88 Agreement would permit the introduction of digital modulation DRM A3 or B3 and also perhaps that of IBOC DSB

subject to completion of the studies related to co-channel, first and second adjacent channel protection ratios and subject to further limitations at the band edges in order to be consistent with RR 4.5.

GE75

LF:150 –285 kHz; MF – 525 –1 605 kHz;

R1 and R3



Rule of Procedure (RRB): Transmission systems DRM A2 and B2. Radiation reduced by at least 7 dB in all directions w.r.t analogue assignment

Temporary measure until the decision from a competent conference



Introduction of Digital Sound in Regional Agreements (VHF/UHF)



ST61

41-68 MHz

R1 & 3



under RoP Part A2/ST61 paragraph 5 – same coordination distances as analogue systems

No submission or notification to date

GE84

87.5 –108 MHz: FM

R 1&3



possible under 3.1 of Chapter 3 of Annex 2 to GE84: not cause greater interference, Nor require higher

Problematic to introduce new digital assignments in **congested bands**

GE06

174 –230 MHz (Band III)

1.536 kHz T-DAB
R1&Iran



Adopted T-DAB as planned standard for digital sound broadcasting

Implementation of alternative standards under envelope of Plan entries : DVB-T → 1–4 T-DAB blocks (Prov. 5.1.2 e + RoP A10)

- T-DAB → Other digital systems (Prov. 5.1.3)



Introduction of digital HFBC



12.7 § 6 of RR: Other modulation techniques recommended by ITU-R



shall be permitted in place of double-sideband or single-sideband emissions, provided that the level of interference caused to existing emissions is not increased.

Res. 517 (Rev.WRC-03)

Introduction of digital modulation schemes 5 900 – 26 100 kHz

Entry into force July 2003



Digital

Television



ITU-R Documents on DTT



Handbook

Guidelines for the transition from analogue to digital broadcasting

- DTTB IMPLEMENTATION- VOLUME 1: NETWORKING ASPECTS OF DIGITAL TV BROADCASTING- SG6 OF ITU-R

Reports

BT.2035: Guidelines for DTT implementation

- **BT.2049:** Mobile DTT
- **BT.2137:** Coverage prediction methods and planning software for digital terrestrial television broadcasting (DTTB) networks
- **BT.2140:** TRANSITION FROM ANALOGUE TO DIGITAL

Recommendations

BT.1125: Basic objectives for the planning and implementation of digital terrestrial television broadcasting systems

- **BT.1306:** Error correction, data framing, modulation and emission methods for digital terrestrial television broadcasting
- **BT.1368:** Planning criteria for digital terrestrial television services in the VHF/UHF bands



DTT System standards-FX



ASTC

- Advanced Television Systems Committee (System A)

DMB-T/H (ChinaDTV)

- Framing structure, channel coding and modulation for DTTB system: designed for fixed and mobile reception.

DVB

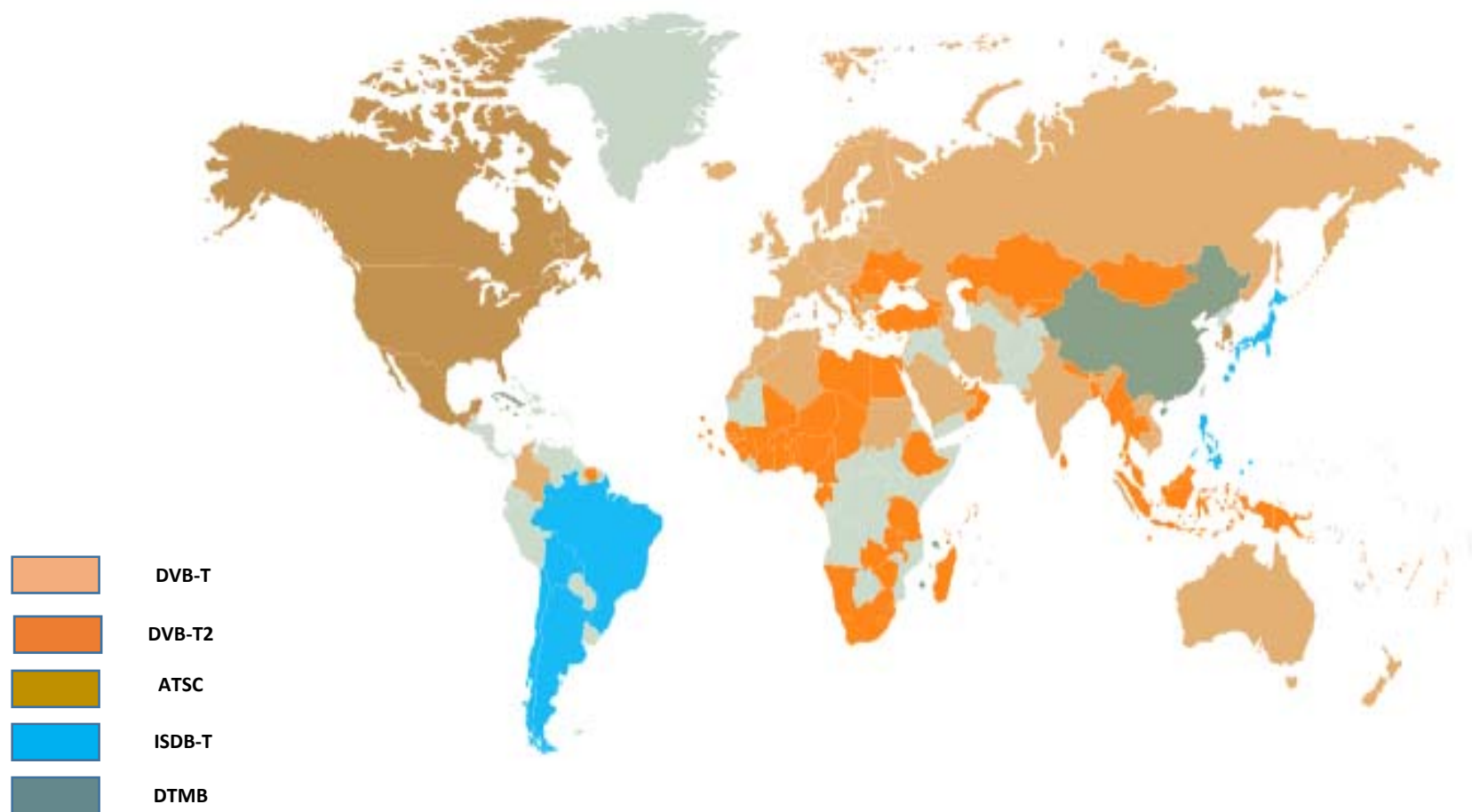
- DVB-T : Digital Video Broadcasting Terrestrial (System B)
- DVB-T2 : Second Generation of DVB-T (at least 30% higher transmission capacity and improved SFN performance)

ISDB-T

- Integrated Services Digital Broadcasting Terrestrial- (System C)
- SBTVD: Adapted by Brazil



Adopted DTT standards



Source: <http://www.itu.int/en/ITU-D/Spectrum-Broadcasting/Pages/DSO/dashboard.aspx>



Description of Digital Television Broadcasting systems



Standard	Channels	Band	Modulation
ATSC	6 MHz	UHF/VHF	8-VSB
DMB-T	8 MHz	UHF/VHF	OFDM
DVB-T	6, 7 and 8 MHz	UHF/VHF	OFDM
DVB-T2	6, 7 and 8 MHz	UHF/VHF	OFDM
ISDB-T	6, 7 and 8 MHz	UHF/VHF	Segmented OFDM



DTT System standards-MO & H



ATSC-M/H	DMB-T/H (ChinaDTV)	DVB-H	ISDB-Tmm	T-DMB
<ul style="list-style-type: none">• Advanced Television Systems Committee (System A)	<ul style="list-style-type: none">• Framing structure, channel coding and modulation for DTTB system: designed for fixed and mobile reception.	<ul style="list-style-type: none">• Digital Video Broadcasting Terrestrial – Handheld	<ul style="list-style-type: none">• Integrated Services Digital Broadcasting Terrestrial- (System C)	<ul style="list-style-type: none">• Terrestrial Digital Multimedia Broadcasting system: enables video services using T-DAB networks for handheld receivers in a mobile environment



Mobile digital broadcasting



Standard or Spec.	Modulation	Transport stream	RF channel (MUX) size (MHz)	Int. Broadcast bands	Regional national origin
DVB-H	QPSK or 16-QAM COFDM	IP/MPE-FEC/ MPEG2 TS	8	IV and V	Region 1 (Europe)
ISDB-Tmm	QPSK or 16-QAM COFDM	MPEG2 TS	0.433	IV and V	Region 3 (Japan)
T-DMB	DQPSK COFDM	MPEG2 TS	1.75	III and 1.5 GHz	Region 3 (Korea)
ATSC-M/H	8-VSB		1.834	UHF/VHF	Region 2
T2-lite	QPSK	H.264	8	IV and V	Region 1 (Europe)



Introduction of Digital TV in Regional Agreements (VHF/UHF)



ST61

41-68 MHz (Sound and TV)

87.5-100 MHz (TV)

162-174 MHz (TV)



Digital Modulation :
RoP Part A2

under Art 4 or Art 5, the relevant coordination distances of the Agreement **shall be equally applied to analogue and digital systems.**

An appropriate symbol shall be used to identify the television standard.

GE89

41-68 MHz

R1 & 3



Digital modulation systems can be used under provision 2.3

*RoP Part A6
for a modification
under Article 4 of the
agreement*

GE06

174-230/470-896 MHz

R1&Iran



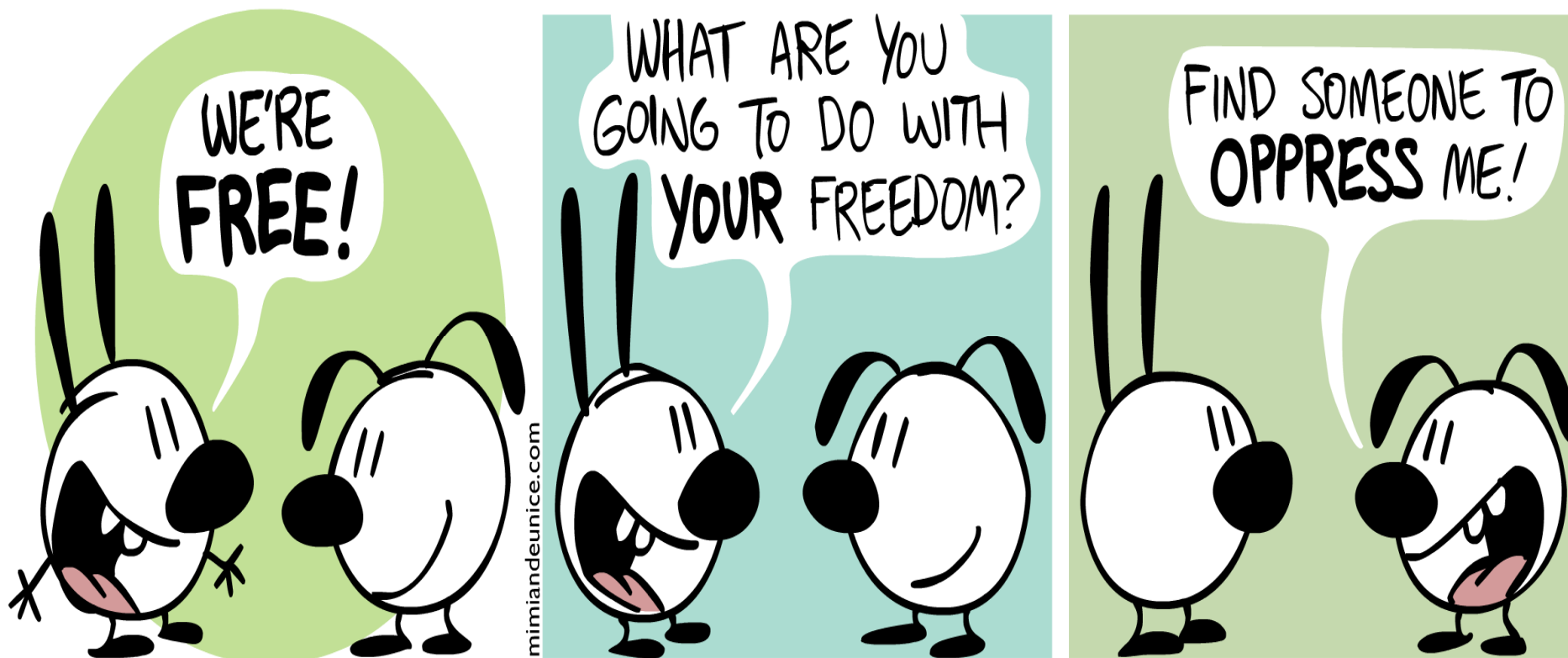
Adopted DVB-T as planned standard for DTT

Implementation of alternative standards under envelope of Plan entries :

- DVB-T → Other digital systems (Prov. 5.1.3)



Digital Broadcasting Not under Regional Agreements





Digital Broadcasting Not under Regional Agreements



Frequency to be in conformity with article 5 of the RR (11.31)



System: No standard imposed



Conditions: for ex.: 5.86 In Region 2, in the band 525-535 kHz the carrier power of broadcasting stations shall not exceed 1 kW during the day and 250 W at night.



Notification and recording in the MIFR Article 11 of the RR



Thank you

ITU – Radiocommunication Bureau
Questions/request of assistance: brmail@itu.int

