



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

- **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).

ISDB-TSB –

Integrated Services Digital Broadcasting-Terrestrial Sound Broadcasting

- consists of one or three OFDM-segments;
- The bandwidth of the system is approximately 500 kHz or 1.5 MHz

T-DAB/T-DMB

Terrestrial Digital Audio Broadcasting/Multimedia Broadcasting

- **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).

HD Radio™

proprietary standard from iBiquity

- 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.

IBOC

In-band on-channel

- < 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

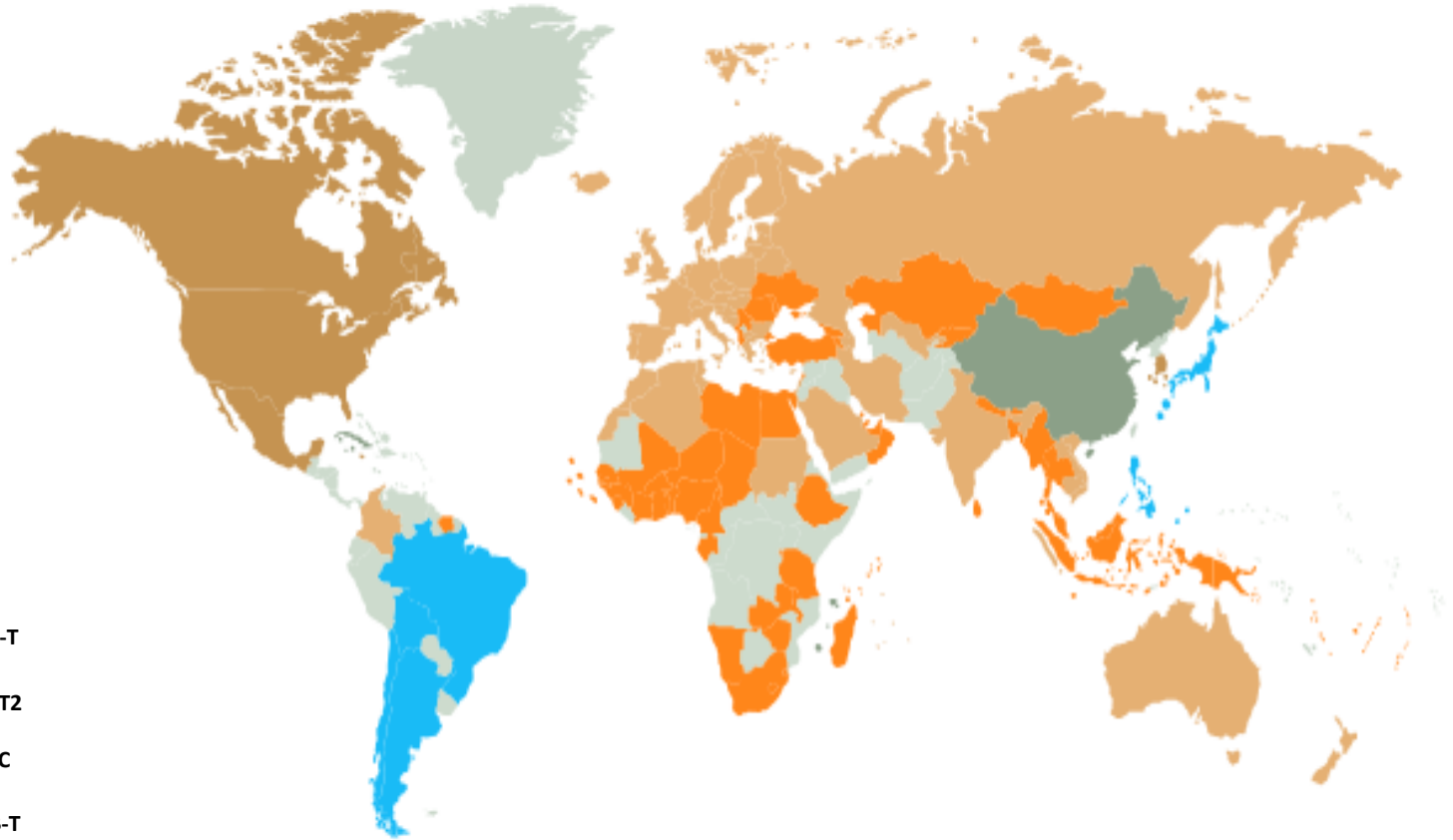
- DVB-T : Digital Video Broadcasting Terrestrial (System B)
- DVB-T2 : Second Generation of DVB-T (at least 30% higher transmission capacity and improved SFN performance)






ISDB-T

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



Adopted DTT standards



-  DVB-T
-  DVB-T2
-  ATSC
-  ISDB-T
-  DTMB



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

- 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-H

- Digital Video Broadcasting Terrestrial – Handheld

ISDB-Tmm

- Integrated Services Digital Broadcasting Terrestrial- (System C)

T-DMB

- 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

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