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)

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

* 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.

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

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,...).

Efficient use of Spectrum

Good for the environment
Digital Radio
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)

<table>
<thead>
<tr>
<th>DRM</th>
<th>ISDB-TSB – Integrated Services Digital Broadcasting-Terrestrial Sound Broadcasting</th>
<th>T-DAB/T-DMB Terrestrial Digital Audio Broadcasting/Multimedia Broadcasting</th>
<th>HD Radio™ proprietary standard from iBiquity</th>
<th>IBOC In-band on-channel</th>
</tr>
</thead>
</table>
| DRM30: | • 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). | • 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. | • 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. | • < 3MHz  
• Described in Annex 4; |
| ISDB-TSB | • consists of one or three OFDM-segments;  
• The bandwidth of the system is approximately 500 kHz or 1.5 MHz | | | |
| T-DAB/T-DMB | | | | |
| HD Radio™ | | | | |
| IBOC | | | | |
DRM transmission modes

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

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+).

Source: www.drm.org
## DAB+ transmission modes

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

*Source: LSTelcom*
Introduction of digital sound broadcasting according to Regional Broadcasting Agreements And HFBC
### Introduction of Digital Sound in Regional Agreements (LF/MF)

<table>
<thead>
<tr>
<th><strong>RJ81</strong></th>
<th><strong>RJ88</strong></th>
<th><strong>GE75</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MF: 535 - 1605 kHz</strong>&lt;br&gt;R2</td>
<td><strong>1 605 – 1 705 kHz</strong>&lt;br&gt;R2</td>
<td><strong>LF: 150 – 285 kHz; MF – 525 – 1 605 kHz</strong>&lt;br&gt;R1 and R3</td>
</tr>
<tr>
<td>Does <strong>not provide</strong> the possibility of introducing digital modulation in the bands concerned.</td>
<td>CCRR/20(6 September 2002), the BR concluded that the formulations in the RJ88 Agreement <strong>would permit the introduction of digital modulation DRM A3 or B3</strong> and also <strong>perhaps</strong> that of <strong>IBOC DSB</strong>. 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.</td>
<td>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.</td>
</tr>
</tbody>
</table>

Question ITU-R 120/6 (2006) “Digital sound broadcasting in Region 2” has been adopted by Study Group 6E.
# 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)
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
<table>
<thead>
<tr>
<th><strong>ASTC</strong></th>
<th><strong>DMB-T/H</strong> (ChinaDTV)</th>
<th><strong>DVB</strong></th>
<th><strong>ISDB-T</strong></th>
</tr>
</thead>
</table>
| Advanced Television Systems Committee (System A) | Framing structure, channel coding and modulation for DTTB system: designed for fixed and mobile reception. | 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) | Integrated Services Digital Broadcasting Terrestrial- (System C)  
SBTVD: Adapted by Brazil |
Adopted DTT standards

# Description of Digital Television Broadcasting systems

<table>
<thead>
<tr>
<th>Standard</th>
<th>Channels</th>
<th>Band</th>
<th>Modulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATSC</td>
<td>6 MHz</td>
<td>UHF/VHF</td>
<td>8-VSB</td>
</tr>
<tr>
<td>DMB-T</td>
<td>8 MHz</td>
<td>UHF/VHF</td>
<td>OFDM</td>
</tr>
<tr>
<td>DVB-T</td>
<td>6, 7 and 8 MHz</td>
<td>UHF/VHF</td>
<td>OFDM</td>
</tr>
<tr>
<td>DVB-T2</td>
<td>6, 7 and 8 MHz</td>
<td>UHF/VHF</td>
<td>OFDM</td>
</tr>
<tr>
<td>ISDB-T</td>
<td>6, 7 and 8 MHz</td>
<td>UHF/VHF</td>
<td>Segmented OFDM</td>
</tr>
<tr>
<td>ATSC-M/H</td>
<td>DMB-T/H (ChinaDTV)</td>
<td>DVB-H</td>
<td>ISDB-Tmm</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>Advanced Television Systems Committee (System A)</td>
<td>Framing structure, channel coding and modulation for DTTB system: designed for fixed and mobile reception.</td>
<td>Digital Video Broadcasting Terrestrial – Handheld</td>
<td>Integrated Services Digital Broadcasting Terrestrial- (System C)</td>
</tr>
</tbody>
</table>
## Mobile digital broadcasting

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

WE'RE FREE!

WHAT ARE YOU GOING TO DO WITH YOUR FREEDOM?

FIND SOMEONE TO OPPRESS ME!
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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Questions/request of assistance: brmail@itu.int