Outline of Digital Broadcasting in Japan/ Outline of ISDB-T System

28\textsuperscript{th} March, 2005

Digital Broadcasting Expert Group (DiBEG)

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2. Strategy for Terrestrial Television Broadcasting
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8. Current DTTB service in Japan

(note) Main part of Chapter 1. – 3. and 5. are presented by MIC (Ministry of Internal Affairs and Communication)

(note) main part of Chapter 4. is presented by DTV workshop held in Inter BEE last November at Makuhari

(note) main part of chapter 7. is presented by ARIB separately
1. Overview of Broadcasting in Japan
Japan's Profile

- Population: 127 million
- Number of households: 48 million
- Area of Japan: 378,000 km²
- TV receivers: 100 million

Terrestrial TV networks:
- 3-9 stations/region with many relay stations (including 2 channels by public broadcaster, NHK)
- NHK: reception license fee based, nation wide network
- Private broadcasters: regional based (30 regions in Japan)
- 5 major networks + independent stations
<table>
<thead>
<tr>
<th>Year</th>
<th>Terrestrial Television</th>
<th>BS (High output satellite broadcasting)</th>
<th>CS (Medium output satellite broadcasting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>Analog</td>
<td>Analog</td>
<td>Analog</td>
</tr>
<tr>
<td>2003</td>
<td>End 2011</td>
<td>Digital</td>
<td>Digital</td>
</tr>
</tbody>
</table>
Cable Televisions Broadcasting

- Cable and community reception penetration 47%
- Cable TV with own programming penetration 32%
- Cable TV operators are shifting full service; more channels, internet services

- Legislation
  - Cable TV law: must carry rule of terrestrial TVs.
  - Internet service subject to Telecommunication business law
Satellite Television Broadcasting

- Analog Satellite BS, SDTV 3ch  12 million subscribers  
  (25% penetration)

- Digital BS Satellite, HDTV 7ch  5.25 million subscribers  
  (10%) since 2000 including cable reception

- SkyPerfecTV, digital SDTV 200plus ch  
  3.5 million (7%) subscribers since 1996
1. Strategy for Digital Terrestrial Television Broadcasting
Policies and Bottleneck for DTTB

- Assign 6MHz channels for incumbent terrestrial broadcasters
- Simulcast of Analog, but something more values; i.e. HDTV, SDTV multichannels, datacast, etc
- Different and additional value more than satellite digital TV (SDTV more channel)
- Digital Television set as integrated home information terminal
- Massive reallocation of existing relay station channels
The Merits of Digital Broadcasting

- HDTV
- Multiple programs
- Data broadcasting
- Mobility
- Advanced caption etc.
- Interactive TV

Merits:
- Summer in Hokkaido is …
Actual schedule of implementing Digital Terrestrial Television Broadcasting in Japan

1994
MPT asked to Council for technical requirement

1998
Issue of Digital Broadcasting Study Group Report

1999
MPT established technical standard

Sep. 2002
MPHPT established license conditions and requirements

1999-2003
Real Scale Experiment Broadcasting

Apr. 2003
 Provisional licenses were awarded

Feb. 2003
Start of Analog channel reallocation

Dec 1st 2003
Start of DTTB! (Tokyo, Nagoya, Osaka)

Feb. 2003
Start of Analog channel reallocation

1999-2003
Real Scale Experiment Broadcasting

1999
MPT established technical requirements

1998
Issue of Digital Broadcasting Study Group

1994
MPT asked to Council for technical requirement
Conditions and Requirements for DTTB licensee in Japan

- Over 2/3 simultaneous per day
- HDTV is more than 50% of all programs
- Broadcasting using subtitles and commentary
- Covered same areas as analog
- Updating the receiver's by data broadcast
Digital Terrestrial Television Broadcasting (DTTB) started in **three main areas** (Tokyo, Nagoya and Osaka) on December 1\textsuperscript{st}, 2003.

Population Coverage of DTTB in Japan

Approximately over **12 million** households

*(25% of total household in Japan)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>17 million</td>
<td>(35%)</td>
</tr>
<tr>
<td>2005</td>
<td>23 million</td>
<td>(48%)</td>
</tr>
<tr>
<td>2006</td>
<td>available at all prefectures</td>
<td>(80%)</td>
</tr>
</tbody>
</table>

Number of potential households via CATV networks

**7 million** households in total
Rapid increase of DTTB Receiver Shipment

1.3 million receivers are in the market now
All-in one DTTB Receiver

1.3 million of DTTB receiver are All-in one DTTB receivers

- Equipped with Digital Terrestrial and Satellite Tuner
- Compatible with HDTV (1080i)
- Equipped with Data Broadcasting decoder
- Capability to connect Network

Some models have internet web browsing function

In addition, more than 3 million of HDTV ready TV (HDTV display without digital tuner) are in the market
**DTTB transmission by CATV**

Update Digital CATV for DTTB transmitting

<table>
<thead>
<tr>
<th>Systems</th>
<th>Modulation Schemes</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass-through System</td>
<td>DTTB format (ISDB-T, OFDM)</td>
<td>Direct connection to DTTB receiver</td>
</tr>
<tr>
<td>Transmodulation System</td>
<td>Digital Cable format (256 or 64 QAM)</td>
<td>Mix with Satellite Programming Digital Cable STB is available in the market</td>
</tr>
</tbody>
</table>
3. Promotion of Digital Broadcasting
### Status of Terrestrial Digital Television Broadcasting at its Initial Stage

1. Services provided during the initial stage of terrestrial digital broadcasting (October 2004)

   <Number of potential households by aerial>
   Approximately over 14 million

   【Reference】 Number of potential households via CATV networks:
   9.8 million households in total

2. Terrestrial digital broadcasting receivers

   <Number of shipped units>
   Total of approximately 1,346,000 units
   (as of end of August)
Approach to the DTTB in Tokyo

Tokyo Metropolitan Area

- Dec. 1st, 2003
  - NHK General
  - NHK Educational
  - Private Network (6)

- End of Dec, 2004
  - NHK General
  - NHK Educational
  - Private Network (6)

- End of Dec, 2005 (maximum output)
  - All Broadcasters
Stage by Stage Enlargement of DTTB Service Area (1/3)

Kanto wide Area

- **Dec. 1st, 2003**: Should be covered by translator by 2008-2009
- **End of 2004**: NHK General, NHK Educational, Private Network (6)
- **End of 2005 (maximum output)**: All Broadcasters
Stage by Stage Enlargement of DTTB Service Area (2/3)

Chukyo wide Area

Should be covered by translator by 2008-2009

Seto tower

Dec. 1st, 2003

NHK and Private Network

End of 2005 (maximum output)

NHK and Private Network
Stage by Stage Enlargement of DTTB Service Area (3/3)

Kinki wide Area

- Should be covered by translator by 2008-2009

Dec. 1st, 2003
- NHK and Private Network

End of 2004
- NHK and Private Network

End of 2005 (maximum output)
- NHK and Private Network

Ikoma Mt.
End of Analog Broadcasting; July 2011 mandated by Radio Law

Replace all analog receiver into digital by the time

Promote DTTB receivers

DTV as integrated home information terminal

Need of collaborative work among government, broadcasters and industry
1. Digitalization of terrestrial TV broadcasting promotes the formation of accessible and convenient ICT foundations in all households.

2. Digital broadcasting will be available for Interactive and two-way services in conjunction with the Internet.

[Examples for Digital broadcasting services]

<table>
<thead>
<tr>
<th>TV programs</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>• General information from municipalities</td>
<td>Select a desired event in the region using TV remote control. (Detailed information on the event such as contents, time and date, location, etc.)</td>
</tr>
<tr>
<td>• Travel information program</td>
<td>Select a hot-spring hotel of choice using TV remote control. (Detailed information on the hotel such as vacancies, types of rooms and rates)</td>
</tr>
</tbody>
</table>
Digital Broadcasting
~Home gateway to the ICT society~

- E-Government Service
- Captioning
- Home doctor
- On-Line Shopping
- Emergency Alert System
- Broadcasting
- Contents
- Metadata
- Home Gateway
- Broadband
- Home Network
- Internet Homepage
By 2011, the digitalization of terrestrial broadcasting will be completed and an environment to receive digital broadcasting programs throughout the country will be put in place.

Promotion of New Service Utilization by Terrestrial Digital Broadcasting

For the advanced utilization of terrestrial digital broadcasting as one of the measures to promote telemedicine and remote education etc., and for the promotion of the practical use of broadcasting services for portable devices by 2006 and of server type broadcasting and related new application services by 2008, consider how to promote utilization of terrestrial digital broadcasting in the public sector, such as education, medical services or disaster prevention.
Action Plan to Promote DTTB

Decision of the “DTTB promotion conference (Oct 31st 2003) composed by government, broadcasters and industries

- Set objectives for the penetration of DTTB receivers including cable reception
- Set objectives for expansion in the coverage rate of digital broadcasting in the three main areas (Tokyo, Osaka, Nagoya)
- Action items for government, broadcasters, manufactures, retailers
Objectives for the penetration of terrestrial digital broadcasting receivers (households)

Penetration into 48 million households
Penetration into 24 million households
Penetration into 10 million households

World Cup held in Germany
Beijing Olympics
End of analog broadcasting
Penetration of HDTV receivers

The number of shipment HDTV receivers now

- HDTV integrated receiver (with DTTB tuner)
  0.7 million sets since 2003

- HDTV ready receiver (without DTTB tuner)
  2 million sets since 2000
Subject for promotion of Terrestrial TV Broadcasting

Key of promotion of DTTB
"10C"

1. Contents
2. Customer cognition
3. Copyrights
4. Cable standard
5. Cable retransmission
6. Cost of receiver
7. Common service = ubiquity
8. Cinch to operate
9. Certain to buy everywhere
10. Connection to the network
4. Migration pass to digital

As mentioned in section 3., digital terrestrial TV broadcasting was standardized, and by 2011 analog TV will be changed.

In this section, the process of digitalization program has been done are explained mainly.

Because of copyright, the text for this section(note) should be prepared separately.

(note) the text of this section is a part of “The migration pass and the experiences to the digital terrestrial broadcasting”, which is presented by DTV workshop held in Inter BEE last November at Makuhari
5. ISDB-T as DTTB standard
At first, the requirement of digital broadcasting should be established. The requirements described above are for digitalization in Japan.
Multimedia-Service
High-Quality, Multi-Channels
- HDTV 1CH or SDTV 3CH within 6MHz band.
- Robustness against multi-path

Multimedia-Service
- Integrated Service (Video/Audio/Data)
- High quality Data Service
- Bi-directional Service

Flexible/Versatile
- Single Frequency Network (SFN)

Efficient Spectrum utilization
- Robustness against mobile/portable reception
- Both fixed/mobile service within same band
  → Layer Transmission Technology

Mobile and handheld service (ground wave)
- Commonality for BS/Cable/Terrestrial Broadcasting.

Commonality of receiver

Requirements for Digitization → Solutions
Features of ISDB-T

Technical Specification
- OFDM
- Segment Structure
- Time Interleaving
- TMCC

Japanese Requirements for DTTB
- Robustness, SFN
- Extensible, Partial Reception
- Mobile Reception, Indoor Reception
- Flexible, Versatile
Band Segmented OFDM: Orthogonal Frequency Division Multiplexing

**Features**
- Modulation: DQPSK, QPSK, 16QAM, 64QAM
- 1HDTV or 3 SDTV/channel
- Net data rate: 23.42Mbps
- Single Frequency Network
- Mobile reception (time interleaving)
Segmented Structure and Partial Reception

HDTV + mobile reception within one 6MHz channel

Mobile reception

Sound/DATA

Layer A

Layer B

HDTV (or 3 SDTV)

13 segments
(6MHz bandwidth)

HDTV reception
### Features of ISDB-T system (2)

#### Comparison with other system

<table>
<thead>
<tr>
<th>Feature</th>
<th>ISDB-T &gt; DVB-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robustness against Impulse Noise (time interleave)</td>
<td></td>
</tr>
<tr>
<td>Mobile Service (time interleave):</td>
<td>ISDB-T &gt; DVB-T</td>
</tr>
<tr>
<td>Mobile/Stationary Hybrid Reception (segment transmission):</td>
<td>ISDB-T &gt; DVB-T</td>
</tr>
<tr>
<td>Commonality between Digital TV/Radio (segment transmission):</td>
<td>ISDB-T OK   DVB-T: Impossible</td>
</tr>
</tbody>
</table>
6. Standardization Structure of Digital broadcasting

ARIB standards (ARIB STD)

private technical standards which are to supplement the MPHPT regulations for telecommunications and broadcasting radio systems and are set for the purpose of guaranteeing compatibility of radio facilities and transmission quality as well as offering greater convenience to radio equipment manufacturers and users.
Layered Structure for Digital Broadcasting

- **Video**
  - Encode
  - Multiplex
  - FEC/Interleaving
  - Modulation
  - MPEG-2

- **Audio**
  - Encode
  - Multiplex
  - FEC/Interleaving
  - Modulation
  - MPEG-2

- **Data**
  - Encode
  - Multiplex
  - FEC/Interleaving
  - Modulation
  - MPEG-2

**Application Layer**
- Commonality
- Interoperability
- MPEG-2 Standard

**Transmission Layer**
- Optimized for each transmission system
- Satellite/Terrestrial/Cable

**Satellite**
- Single Carrier-8 PSK/QPSK

**Terrestrial (TV/Audio)**
- OFDM-QAM/(DQPSK)

**Cable**
- Single Carrier-64QAM

**Satellite Audio**
- CDM
Digital Broadcasting Standard in Japan

- **Source coding**
  - Video/Audio Coding (STD-B32)
  - Data Broadcasting (STD-B24)

- **Transmission coding**
  - Satellite TV (STD-B20)
  - Terrestrial TV (STD-B31)
  - Terrestrial Audio (STD-B29)
  - Satellite Audio (STD-B41)
  - Cable TV (JCL SPC-001)

- **Receiver**
  - Satellite/ Terrestrial TV (STD-B21)
  - Terrestrial Audio (STD-B30)
  - Satellite Audio (STD-B42)
  - Cable TV (JCTEA STD-004)

Source coding and MUX systems are common for each system.

Transmission systems are different.

Note: Cable transmission system standards are defined at another consortium.
## DTTB Standards

<table>
<thead>
<tr>
<th>Technical Standards for DTTB</th>
<th>established</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIB STD-B32 image encoding, sound encoding and multiplexing formats</td>
<td>2001.5</td>
</tr>
<tr>
<td>ARIB STD-B24 Data broadcasting encoding formats and transmission formats</td>
<td>1999.10</td>
</tr>
<tr>
<td>ARIB STD-B25 Restricted reception formats</td>
<td>1999.10</td>
</tr>
<tr>
<td>ARIB STD-B10 Program lineup information</td>
<td>1997.6</td>
</tr>
<tr>
<td>ARIB STD-B31 transmission formats</td>
<td>2001.5</td>
</tr>
<tr>
<td>ARIB STD-B21 receiver device</td>
<td>1999.10</td>
</tr>
<tr>
<td>ARIB TR-B14 Terrestrial TV operation specification</td>
<td>2002.1</td>
</tr>
</tbody>
</table>

ARIB: Association of Radio Industries and Businesses
Private standardization body in Japan
# Outline of ARI B Standards

**Source coding & Multi-plex**

<table>
<thead>
<tr>
<th>Name</th>
<th>Outline</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video/Audio coding (STD-B32)</td>
<td>- Based on MPEG-2 video coding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Cover 1080i,720p,480p,480i</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Based on MPEG AAC audio coding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 5.1 Stereo audio</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Based on MPEG systems multi-plex</td>
<td></td>
</tr>
<tr>
<td>Data Broadcasting (STD-B24)</td>
<td>- Data broadcasting description</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Data transmission format</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Small size Video coding(MPEG-4,H.264)</td>
<td></td>
</tr>
<tr>
<td>Program line-up information (STD-B10)</td>
<td>- PSI/SI description</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- EPG description</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Necessary for program selection</td>
<td></td>
</tr>
</tbody>
</table>
## Outlines of Standards (continued)

### Transmission coding

<table>
<thead>
<tr>
<th>Name</th>
<th>Outline</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite TV (STD-B20)</td>
<td>-Slot structure</td>
<td>2 HDTV programs are multiplexed into 1 transponder</td>
</tr>
<tr>
<td></td>
<td>-Trellis+RS (Concatenated coding)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Single carrier 8 PSK modulation</td>
<td></td>
</tr>
<tr>
<td>Terrestrial TV (STD-B31)</td>
<td>-Segment structure</td>
<td>1 segment transmission is available</td>
</tr>
<tr>
<td></td>
<td>-Viterbi+RS (Concatenated coding)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Multi-carrier (OFDM) transmission</td>
<td></td>
</tr>
<tr>
<td>Terrestrial Audio (STD-B29)</td>
<td>-1 and 3 segment transmission</td>
<td>1 segment system is compatible to 1 segment of TV</td>
</tr>
<tr>
<td></td>
<td>-Others are almost same as STD-B31</td>
<td></td>
</tr>
<tr>
<td>Satellite Audio (STD-B42)</td>
<td>-Multiplex 64 CDM channel</td>
<td>Adopt “AAC+SBR” 2.6GHz Band</td>
</tr>
<tr>
<td></td>
<td>-Viterbi+RS (Concatenated coding)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-CDM-BPSK/QPSK transmission</td>
<td></td>
</tr>
</tbody>
</table>
Outlines of Standards (continued)

What is the operational guideline?
All the technical elements required are written in ARIB STD. But, the details for operation of broadcasting are defined separately, even though based on ARIB STD. These documents are called “Operational Guideline”

Examples
ARIB TR-B13; Terrestrial Audio broadcasting operational guideline
ARIB TR-B14; Terrestrial TV broadcasting operational guideline
ARIB TR-B15; BS/wideband CS broadcasting operational guideline
ARIB TR-B26; Satellite Audio broadcasting operational guideline
The Digital Broadcasting Experts Group (DiBEG) was founded in September 1997 for the key forces to promote the Japanese Digital Terrestrial Broadcasting System ISDB-T and ISDB-T\textsubscript{SB} into the world.

Today, DiBEG has 23 members, including broadcasters, broadcast equipment manufactures and consumer electronics manufactures etc.

DiBEG is one committee of ARIB.

**Activities**

- Research of the trend toward digital broadcasting in the world.
- Exchange of digital broadcasting technologies and facilitation of common understanding.
- Exchange of technologies and ways for interoperability toward smooth exchange of program.
In this section, as representative organization for digitalization we will introduce Association of Radio Industries and Business (ARIB) and its activities.

Text for this section is presented by ARIB separately (note)

(note) “ARIB Activities related to Digital Broadcasting - R&D, Standardization, etc. –”
9. Current DTTB Service in Japan

In this section, only introduce outline of current DTTB service. Details will be presented in seminar #9.

(1) Hivision TV service
(2) Multiple SDTV (Standard Definition TV) service
(3) Data Broadcasting service
(4) Interactive Broadcasting service
(7) Contents Protection
Applications of Digital Terrestrial Television Broadcasting

- **HDTV**
  - High quality image and sound services

- **Data broadcasting**
  - Simple program searching and retrieval of information at any time.

- **Mobile**
  - Stable reception services

- **Multiple SDTV programs**
  - Realization of multiple channels

- **Interactive TV**
  - Communication services and linked services
HDTV is the mainstream of digital TV(1)

HDTV services

- Wide screen
- High quality image
- High quality audio program
- 5.1ch surround audio program
HDTV is the mainstream of digital TV (2)

- High-Definition programs

**Pure HDTV: produced by HDTV 1080i format**

- NHK provides pure HDTV more than 90% of all programs in the three metropolitan Area.
  
  **Prime time**: more than 90%

- Commercial Network stations provide pure HDTV about 50% of all programs in Tokyo Area.
  
  **Prime time**: more than 50%
Multiple SDTV programs within one channel (1)

- Digital TV makes transmission of three different programs possible within one channel independently.
Multiple SDTV programs within one channel (2)

**Example of multiple programs**
The drama you can choose as you like

**The outline of story deployment of a drama**

HD channel (common story)

- A man meets three ladies.

**Selection point 1**
Choose a lady among three

- SD:A ch. Kyoko’s story
- SD:B ch. Yuka’s story
- SD:C ch. Emi’s story

HD channel (common story)

- A hero worries about marriage partner selection

**Selection point 2**
Choose a marriage partner

- Marry with Kyoko
- Marry with Yuka
- Marry with Emi
All DTTB Broadcasters are providing Data broadcasting (datacast) now.

Program related information
Weather information
Anytime news
Report of sports game etc.

Currently the description language is BML format.

Features
- Easy creation of contents
- Facilitate convergence of internet
- Additional capability

Based on
- XHTML
- Functions for Broadcasting
- BML
- XHTML
Example for Data Broadcasting (1)

Top menu
Interactive Broadcasting (1)

You can enjoy the Quiz show by voting, purchase any goods on TV shopping.
Content Protection

Satellite

Terrestrial

Mandatory equipped Digital interface

Digital Receive

CAS by B-CAS card

Insert B-CAS card

Cancel the scramble

Not insert B-CAS card

Not cancel the scramble

Digital Output

DVR

Copy control

In operation from April 2004
END of
Seminar 1

Thank you for your attention!