Presentation 2

Current state of digital broadcasting of Japan

Oct. 14th 2004

Digital Broadcasting Expert Group (DiBEG)

Yoshiki MARUYAMA (TV Asahi)
Yasuo TAKAHASHI (Toshiba)
Contents

1. Outline of Digital Broadcasting
   (1) Background of Digitalization & Comparison of Analog and Digital
   (2) Structure of Digital Broadcasting & Examples of Service

2. Standardization Structure

3. Current DTTB Service of Japan

4. Cover Area of DTTB in Japan

1. Outline of Digital Broadcasting

(1) Background of Digitalization & Comparison of Analog and Digital

   Explain the requirement of digital broadcasting, technical solutions and comparison table between analog broadcasting and digital broadcasting

(2) Structure of Digital Broadcasting & Examples of Service

   Explain the structure of digital broadcasting, especially for the backbone of technical standard, and the feature of ISDB-T system. Also show the outline of digital broadcasting service (details are described at following item 3.)
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

- Efficient Spectrum utilization
  - Single Frequency Network (SFN)

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

- Mobile and handheld service (ground wave)
  - Robustness against mobile/portable reception
  - Both fixed/mobile service within same band
    → Layer Transmission Technology

- Commonality of receiver
  - Commonality for BS/Cable/Terrestrial Broadcasting.

Requirements for Digitization → Solutions
## Analog/Digital Comparison (1/2)

### Limits of Analog Broadcasting

<table>
<thead>
<tr>
<th>Items</th>
<th>Yes/No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-channel service</td>
<td>No</td>
<td>-Limit of bandwidth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Limit of Modulation system</td>
</tr>
<tr>
<td>HDTV service</td>
<td>No</td>
<td>Same as above</td>
</tr>
<tr>
<td>5.1 CH Stereo</td>
<td>No</td>
<td>Same as above</td>
</tr>
<tr>
<td>Data Broadcasting service</td>
<td>Limited (Tele-text)</td>
<td>-Same as above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Limit of Receiver system</td>
</tr>
<tr>
<td>Multi-Media Service</td>
<td>Limited</td>
<td>Same as above</td>
</tr>
<tr>
<td>Mobile Reception</td>
<td>Limited</td>
<td>-AMFM available, But TV difficult</td>
</tr>
</tbody>
</table>
### Analog/Digital Comparison (1/2)

#### Technical Possibility of Digital Broadcasting

<table>
<thead>
<tr>
<th>Items</th>
<th>Technical Possibility</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Quality TV</td>
<td>480i - 1080i</td>
<td>Fixed Reception</td>
</tr>
<tr>
<td>Multi-Channel TV</td>
<td>3 SDTV CH/6MHz</td>
<td>Fixed Reception</td>
</tr>
<tr>
<td>5.1 CH Stereo</td>
<td>Possible</td>
<td></td>
</tr>
<tr>
<td>Data Broadcasting</td>
<td>Various services are available within Standard</td>
<td></td>
</tr>
<tr>
<td>Mobile/Portable Reception</td>
<td>Possible</td>
<td>Terrestrial Broadcasting</td>
</tr>
<tr>
<td>Multi-Media Service</td>
<td>Various services are available within Standard</td>
<td></td>
</tr>
<tr>
<td>Inter-Operability</td>
<td>Standard Possible</td>
<td></td>
</tr>
</tbody>
</table>
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
Features of ISDB-T system (1)

Band Segmented OFDM: Orthogonal Frequency Division Multiplexing

- 13 Segments
- 6MHz
- 1 segment 429kHz

Features
- Modulation: DQPSK, QPSK, 16QAM, 64QAM
- 1HDTV or 3 SDTV
- Net data rate: 23.42Mbps (6MHz)
- Single Frequency Network
- Mobile reception
  - Time interleaving improve mobile environment
**Features of ISDB-T system (2)**

Comparison with other system

- Robustness against Impulse Noise (time interleaving): ISDB-T > DVB-T
- Mobile Service (time interleaving): ISDB-T > DVB-T
- Mobile/Stationary Hybrid Reception (segment transmission): ISDB-T > DVB-T
- Commonality between Digital TV/Radio (segment transmission): ISDB-T OK, DVB-T: Impossible
Segmented Structure and Partial Reception

HDTV + mobile reception within one 6MHz channel

HDTV reception

13 segments (6MHz bandwidth)

Mobile reception

Layer A

Layer B

HDTV (or 3 SDTV)

Sound/DATA
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.
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.
### Outline of ARIB Standards

#### Source coding & Multi-plex

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

In this section, explain current DTTB service started from Dec. 2003, at 3 mega-police wide service area.(note)
(note) Tokyo, Nagoya and Osaka wide service area

Following services are introduced as the examples of DTTB.
(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

Multiple SDTV programs

- Realization of multiple channels

Data broadcasting

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

Interactive TV

- Communication services and linked services

Mobile

- Stable reception 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
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
Multiple SDTV programs within one channel (1)

- Digital TV makes transmission of three different programs possible within one channel independently.

SD-1  SD-2  SD-3
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.

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

- **SD:B ch.**
  - Marry with Kyoko
  - Marry with Yuka

- **SD:C ch.**
  - Marry with Emi

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

**Selection point 2**
Choose a marriage partner
Data Broadcasting

All DTTB Broadcasters are providing Data broadcasting (datacast) now

<table>
<thead>
<tr>
<th>Program related information</th>
<th>Anytime news</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather information</td>
<td>Report of sports game</td>
</tr>
</tbody>
</table>

Currently the description language is BML format.

Based on XHTML

Features
- Easy creation of contents
- Facilitate convergence of internet

Additional capability

Functions for Broadcasting

BML

XHTML
Example for Data Broadcasting (1)
Example for Data Broadcasting (2)

Weather news
Example for Data Broadcasting (3)

Program related data
Example for Data Broadcasting (4)

EPG (Electronic Program Guide)
Interactive Broadcasting (1)

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

Interactive

Broadcasting station ➔ Program + data ➔ Contents server / Portal server ➔ Home

Response ➔ Request ➔ Internet ➔ Send a request

Home

Interactive Broadcasting (1)
Interactive data service (1)

NHK Data Online service available from April 2004

Top menu of Data broadcasting

Data Online image

Access to Data server

BML data via Broadcasting

DDTB receiver

BML data via Internet
TV Asahi com.Plete! is the official portal site access from mobile phone.

From this site, contents/information of TV Asahi’s TV programs can be downloaded and participate in some variety program as the guest.
Content Protection

- **Satellite**
- **Terrestrial**

**Digital Receiver**
- Insert B-CAS card
- CAS by B-CAS card

**Digital Output**
- DVR
  - Copy control

**Mandatory equipped Digital interface**

- **In operation from April 2004**

- Insert B-CAS card
  - Cancel the scramble
  - Not insert B-CAS card
  - Not cancel the scramble
Outline of content protection receivers

ECM: Entitlement Control Message
EMM: Entitlement Management Message

Content

ECM (program control information)
EMM (personal information)

Scrambling

Decoding

Local encryption

User access path

Decoded content to be protected

Protection by HDCP

Protection by DTCP

Example: Protection by CPRM

Decoding possible only by the applicable receiver

Recording to removable media

Display

External recording device

B-CAS card

Key

Analog output: Copy Generation Management System (CGMS-A) or Macrovision

ECM: Entitlement Control Message
EMM: Entitlement Management Message
The new system is under consideration in a preparatory work group of the RMP Council.
4. Cover Area of DTTB in Japan

Digital Terrestrial Broadcasting has started in 3 areas (Tokyo(Kanto), Nagoya(Tyukyo), Osaka(Kansai)) on Dec. 1, 2003.

At early stage, transmitter power is suppressed to avoid interference to analog TV channel, but step by step increase the transmitter power and finally reach to full power operation. In other area, Digital terrestrial broadcasting will start during 2004-2006.
Digital Terrestrial Television Broadcasting (DTTB) started in three main areas (Tokyo, Nagoya and Osaka) on December 1st, 2003. DTTB will be started in Ibaraki (Oct. 2004), Toyama (Oct. 2004), Gifu (Nov. 2004), Kanagawa (Dec. 2004) and Hyogo (Dec. 2004).
Stage by Stage Enlargement of DTTB Service Area (1/3)

Kanto wide Area

Should be covered by translator by 2008-2009

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

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

End of 2005 (maximum output)
- All Broadcasters

Tokyo Tower
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

End of 2005

(maximum output)

NHK and Private Network

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

Kinki wide Area

- Dec. 1st, 2003
  - NHK and Private Network
- End of 2004
  - NHK and Private Network
- End of 2005 (maximum output)
  - NHK and Private Network

Should be covered by translator by 2008-2009

Ikoma Mt.
5. Current state of Digital Receiver in Japan & Forecast of Market

- **Background**: Digital terrestrial broadcasting has started Dec.2003. BS and 110 CS digital broadcasting has already started.

- **Main current of digital receiver in Japan**

  (1) **All in one type**: Analog, 110 CS digital, BS digital and DTTB tuners are mounted)

  (2) **Wide Screen**: wider than 30” up to 50” screen type are popular to enjoy HDTV.

  (3) **Ratio of flat panel increased**: in digital receiver market, flat panel get over than 50% this year

  (4) **Digital receiver market extremely grow**: JEITA forecasts the shipment of digital receiver (note) increase over than 50% of total TV set shipment within a couple of year

    (note) analog receiving function is also equipped
Volume of Shipments of Digital TV Sets and Set-Top-boxes
--Sales Achievements and Projections--

Source: JEITA Electronics and Statistics Committee AV Forecast Working Group
Ratios between Flat Panel Displays TV and CRT TV

Source: JEITA Electronics and Statistics Committee AV Forecast Working Group
New Material for Display

• OLED (Organic Light Emitting Diode)
  – Expected as next generation display
  – Self-luminous
  – Low power consumption
  – Wide-angle vision
  – High switching-speed
  – Possibility of low-price panel
  – Eastman Kodak and Sanyo developed 15” full-color OLED panel last year.

• FED (Field Emission Display)
  – Basic principle is same with CRT
  – Economical advantages for display over 30”
  – Development of cold-cathode is one of key factors
Key Technology for DTV Systems

- BS-Tuner QF20 (June’00)
- MN88415 (June’99)
- MN2WS0002B H (June’00)
- MN6775 (June’00)
- NS864602 (Jun’01)
- IEEE1394 I/F

Digital Tuner → Front-end LSI → Transport Dec LSI → Video Dec. 2D-Graphic Format Conv.

SDRAM → RDRAM

News Release (May’00)
Core Software PiE-OS Operating System for DTV

News Release (April’00)
Toshiba Launched the Sale of New TV Sets

- Four tuners (ISDB-T, ISDB-S for BS, ISDB-S for CS110, Analog terrestrial) are installed.
- Equips LAN terminal for interactive TV
- Upgraded software can be installed by a customer.

Sep. 2003

Feb. 2004

PDP type

LCD Type
Panasonic Launched the Sale of New TV Sets on Sep. 1

- Three types: TH-36D50 (36”), and TH-32D50 (32”) and TH-28D50 (28”)
- Four tuners (ISDB-T, ISDB-S for BS, ISDB-S for CS110, Analog terrestrial ) are installed.
- Equips LAN terminal (10BASE-T) for Tnavi.
- Browser for Tnavi is installed.
- EPG for all tuners is installed.

Sharp Launched the Sales of New LCD TV Sets on July 9

- **LC-37AD1 and LC-37AD2**
  - 37” LCD display
  - For HDTV (1366 X 768 pix)
  - Separated tuner (NTSC analog, ISDB-S and ISDB-T)

- **LC-30AD1 and LC-30AD2**
  - 30” LCD display
  - For HDTV (1280 X 768 pix)
  - Display is provided with tuner

- **LC-22AA1**
  - 22” LCD display
  - For wide TV (854 X 480 pix)

Installed Video processing Board
Sanyo Announced the sales of New TV Sets

- PDP (42”, 37”) and LCD (30”)
- Four tuners (ISDB-T, ISDB-S for BS, ISDB-S for CS110, Analog terrestrial) are installed.
- Pixel
  - PDP 1024 X 1024
  - LCD 1280 X 768
- Sanyo will launch the sales on Oct. 2003

Panasonic Launched the Sale of ISDB-T STB by Subscription

- Customers who have or will buy Panasonic TV set can buy it.
- This STB is able to be connected to only Panasonic TV set.
- For ISDB-T and ISDB-S(BS and 110 CS)
- The list price is open.

Sony announced ISDB-T STB

- For ISDB-T and ISDB-S (BS + CS110)
- Though open-priced, the STB is likely to be sold for about 600$.
- Sony will launch the delivery on October 21.
SONY announced all in one type LCD TV

- Analog, Digital Satellite (BS/110 CS) & Digital Terrestrial
- LCD Display
- High Quality Sound

VEGA series
NEC announced new Desk Top PC

- DTTB receiver function is equipped
- Large HDD for Video recording is also equipped
- Support Internet, and bi-directional entertainment
- Wide screen (23”)

Jan. 2004
Thank you!
For your attention

Digital Broadcasting Expert Group
http://www.dibeg.org