Digital TV Broadcasting in Japan

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Manila, Philippines

Digital Broadcasting Expert Group
(DiBEG)
Yasuo TAKAHASHI

This Presentation is prepared by Ministry of Internal Affairs and Communications (MIC) in Japan
Today’s Topics

Only Pick up key points

• Advanced Features of Japan’s Digital Terrestrial TV Broadcasting System (named ISDB-T).

• Comparison of 3 DTTB Systems

• Special Advantages of Japan’s System for Mobile Reception.

• Summaries.
Advanced Features of Japan’s Digital Terrestrial TV Broadcasting System (named ISDB-T)
Process of Digitization of Terrestrial Television Broadcasting

1997
• Technical Standards for DTTB were established in E.U (DVB-T) and U.S.(ATSC)

1998
• DTTB started in E.U (DVB-T) and U.S.(ATSC)

1999
• Technical Standards for DTTB were established in Japan (ISDB-T).
  • Support center for R&D of DTTB in Japan opened.
    (Shared use of facility, Organization of Communications and Broadcasting)

2000
• Technical standards for Digital Terrestrial Sound Broadcasting were established in Japan.
• Planning of DTTB station channels.

2001
• Development of institutions for digitization of Terrestrial Television Broadcasting.
  (Revised part of Basic Plan Popularization of Broadcasting and Use of Broadcasting Frequency)

2003
• DTTB started in Japan (in three metropolitan areas).
  • Start of trials for practical application of Digital Terrestrial Sound Broadcasting
    in part of Kanto and Kinki areas.

ISDB-T is the newest DTTB system and as such includes the latest technology
Diffusion of Digital Broadcasting Receivers

**Digital Terrestrial Broadcasting Receiver Shipments**

**24,150,000**

Source: Japan Electronics and Information Technology association (JEITA), Japan Cable Laboratory

<table>
<thead>
<tr>
<th>Model</th>
<th>Shipments (Unit: thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CRT</td>
<td>720</td>
</tr>
<tr>
<td>2 LCD</td>
<td>11,807</td>
</tr>
<tr>
<td>3 PDP</td>
<td>2,082</td>
</tr>
<tr>
<td>4 Tuner</td>
<td>349</td>
</tr>
<tr>
<td>5 Digital Recorder</td>
<td>4,176</td>
</tr>
<tr>
<td>6 Personal Computer</td>
<td>788</td>
</tr>
<tr>
<td>7 CATV STB</td>
<td>4,309</td>
</tr>
</tbody>
</table>

**Access to Digital Broadcasting Satellite**

**27,470,000**

Jun 2007 Source: NHK

<table>
<thead>
<tr>
<th>Model</th>
<th>Shipments (Unit: thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
<td>1,860</td>
</tr>
<tr>
<td>PDP &amp; LCD</td>
<td>14,420</td>
</tr>
<tr>
<td>Tuner (including Digital Recorder)</td>
<td>5,370</td>
</tr>
<tr>
<td>CATV STB</td>
<td>4,280</td>
</tr>
</tbody>
</table>

**Digital Broadcasting Satellite Receiver Shipments**

**25,930,000**

**Access to Digital Broadcasting Satellite using CATV**

**1,540,000 households**

**One-Seg Mobile Phone Shipments**

**11,780,000**

Jul 2007

**In-car DTTB Receiver Shipments**

**650,000**

Jun 2007

Source: Japan Electronics and Information Technology association (JEITA)
ISDB-T is a Suitable System for Next Generation Broadcasting

HDTV, Mobile Reception, and Data (Multimedia) Broadcasting are necessary for Next Generation Broadcasting.

For Large-screen Television
High-Definition Image
High-Quality Sound

For Portable Terminals
Anytime Anywhere

HDTV, Mobile Reception, and Data (Multimedia) Broadcasting are necessary for Next Generation Broadcasting.

1 Segment Compressed by H.264
12 Segments Compressed by MPEG2

At home
In the bus
In the train
While walking

10110...
ISDB-T Hierarchical service in Japan (HDTV + One-seg service)

(Example; 1seg + 12 seg)

Layer A (LDTV, Audio, Data)

Layer B (HDTV or Multi-SDTV with Data)

13 segments (6MHz bandwidth)

QPSK constellation

64QAM constellation

Difference of required C/N Between 64QAM and QPSK is about 12 dB

*13 segments are divided into layers, maximum number of layers is 3.
*Any number of segment for each layers can be selected (totally 13 segment)
*Transmission parameter sets of each layer can be set independently
(In above example, modulation index of each layer are different)
Technical Features of ISDB-T 1& 2

Robustness to Radio Interference by Multi Path. Because of OFDM system is adopted.

OFDM: Orthogonal Frequency Division Multiplex

Stability of reception for mobile HDTV reception!

Frequency and Time Interleaving

Ordinary system
Comparison of Interleaving and No-Interleaving

TV Station

No-Interleaving

Original date

Sort data in accordance with set rules

Interleaving

Transmission Path

Errors occur as a result of radio interference

Difficult to correct continuous errors.

Receivers

Errors occur as a result of radio interference

Reconstruction of data

Dispersed errors can be corrected.
Features of ISDB-T transmission system

1. Efficient frequency utilization
   (1) Adopt OFDM transmission system; SFN operation
   (2) Adopt hierarchical transmission; service for different type of reception in one frequency channel

2. Mobile/ handheld service in one transmission standard
   (1) Time interleaving; Improve mobile reception quality
   (2) Partial reception; handheld service in same channel

3. Robustness against interference
   (1) Adopt concatenated error correction with plural interleaving
   (2) Time interleaving; very effective for impulse noise (urban noise)

4. Flexibility for several type of service/ reception style
   (1) Any of HDTV/Multi-SDTV
   (2) Fixed/Mobile/Portable service in same channel

5. Commonality of TV/audio transmission standard

6. Data Casting/Interactive Service
Features of ISDB-T

- **HDTV**: High quality image and sound service
- **Multi-Channel Service**: Realization of multi-SDTV program service on 1ch bandwidth (6MHz)
- **Interactive TV**: Communication linked services with TV

- **High quality image**
- **Data Broadcasting**: Simple retrieval of program and information at any time
- **Mobile Reception**: TV service to In-car DTTB Receiver and cell-phone

- High Robustness to ghost image interference
Comparison of 3 DTTB Systems
## Comparison of Three DTTB Systems

### Results of fair evaluation by a third country (Federative Republic of Brazil)

<table>
<thead>
<tr>
<th>System Items</th>
<th>Japan (ISDB-T)</th>
<th>EU (DVB-T)</th>
<th>U.S (ATSC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Robustness to ghost image</strong></td>
<td>Effective against ghost image interference using advanced technique.</td>
<td>Effective against ghost image interference.</td>
<td>The same degree of analog TV broadcasting.</td>
</tr>
<tr>
<td><strong>Feasibility of Single Frequency Network (SFN)</strong></td>
<td>A channel plan including SFN has already been prepared.</td>
<td>Some countries such as Germany, Australia, and Singapore, are operating this.</td>
<td>Being tested in the U.S. and Canada. However, no prospect for commercialization has emerged.</td>
</tr>
<tr>
<td><strong>Feasibility of portable reception</strong></td>
<td>One channel can carry portable reception service simultaneously with HDTV service.</td>
<td>DVB-H, another channel is necessary for portable reception.</td>
<td>Portable reception is not available in the current system. Other systems are not being considered.</td>
</tr>
<tr>
<td><strong>Transmission system</strong></td>
<td><img src="image" alt="Diagram" /> It is possible to designate the modulation system of the segment group unit according to the service purpose.</td>
<td><img src="image" alt="Diagram" /> Bandwidths of 6, 7 or 8MHz,</td>
<td>Improved system based on analog TV broadcasting system.</td>
</tr>
</tbody>
</table>

- **BEST** indicates the highest performance.
- **IMPOSSIBLE** indicates a system that is not feasible.
- **POOR** indicates a poor performance.
- **BETTER** indicates a better performance compared to the other systems.
## Tests Results of Mobile Reception in Brazil

### Experiment of field mobile in Brazil

<table>
<thead>
<tr>
<th>Standard</th>
<th>Modulation</th>
<th>Convolution</th>
<th>Guard Length</th>
<th>Carrier</th>
<th>Transmission Rate (Mbps)</th>
<th>Errors (Times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISDB-T</td>
<td>16QAM</td>
<td>2/3</td>
<td>1/16</td>
<td>2k</td>
<td>11.45</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>64QAM</td>
<td>2/3</td>
<td>1/16</td>
<td>2k</td>
<td>17.18</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>16QAM</td>
<td>2/3</td>
<td>1/16</td>
<td>4k</td>
<td>11.45</td>
<td>0</td>
</tr>
<tr>
<td>DVB-T</td>
<td>QPSK</td>
<td>1/2</td>
<td>1/16</td>
<td>2k</td>
<td>4.39</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>QPSK</td>
<td>2/3</td>
<td>1/16</td>
<td>2k</td>
<td>5.85</td>
<td>Many</td>
</tr>
<tr>
<td></td>
<td>QPSK</td>
<td>1/2</td>
<td>1/32</td>
<td>8k</td>
<td>4.52</td>
<td>Many</td>
</tr>
<tr>
<td>ATSC</td>
<td>8VSB</td>
<td></td>
<td></td>
<td></td>
<td>19.39</td>
<td>Out of measurement</td>
</tr>
</tbody>
</table>
Reception performance under Impulse noise condition
(3 DTTB systems)
Reason for adopting ISDB-T in Brazil

- Brazil confirmed the advantage of ISDB-T by fair technical tests.
- ISDB-T has the highest robustness to interference and can provide a mobile reception service.
- Only ISDB-T can provide stationary and mobile reception services using the same TV channels and transmitters.
- The channel separation of Brazil is 6MHz.
Special Advantages of Japan’s System for Mobile Reception
Demand Expansion for One-Seg Mobile Phones

- One-Seg service started in April 2006.
- One-Seg Mobile Phone Shipments have been expanded and reached 10,000,000 for the first time in June 2007.

(Unit: thousand)

11.8 million One-Seg Mobile Phones were shipped (by the end of July, 2007).
GSM+3G Phones Correspond to One-Seg*

*Japan’s Mobile TV Reception Service is called “One-Seg”.

GSM+3G and One-Seg can be combined. One-Seg has no relation with mobile phone systems.

In fact, these GSM phones correspond to One-Seg will go on sale in this November. These phones can be used in over 140 countries.

One-Seg Service does not Conflict with PPV by Mobile TV

**One-Seg**

- Free Mobile TV Services
- **Transmission Scheme:** Terrestrial Broadcasting
- **Main Contents:**
  - News
  - Weather Information
  - Earthquake Information
  - Traffic Information etc..
- **Viewer:** Ordinary People

**Pay Per View**

- **Transmission Scheme:** 3G Mobile Phone, Media FLO etc.
- **Main Contents:**
  - Sports Program
  - Cinema
  - Animation etc..
- **Viewer:** Subscribers

**Contents are different**

**Targets are different**

---

One-Seg service leads to develop new Subscribers for PPV in Japan.
Mobile Phones

<table>
<thead>
<tr>
<th>Model</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>W33SA</td>
<td>Dec 2005</td>
</tr>
<tr>
<td>W41H</td>
<td>Feb 2006</td>
</tr>
<tr>
<td>W33SA II</td>
<td>Jun 2006</td>
</tr>
<tr>
<td>W43H</td>
<td>Sep 2006</td>
</tr>
<tr>
<td>W43SA</td>
<td>Oct 2006</td>
</tr>
<tr>
<td>W44S</td>
<td>Dec 2006</td>
</tr>
<tr>
<td>W43H II</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>MEDIA SKIN</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>W51CA</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>W51K</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>W51SA</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>W51SH</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>W51T</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>W52T</td>
<td>Jan 2007</td>
</tr>
<tr>
<td>P901iTV</td>
<td>Mar 2006</td>
</tr>
<tr>
<td>D903iTV</td>
<td>Jun 2007</td>
</tr>
<tr>
<td>D903iTV</td>
<td>(2007)</td>
</tr>
<tr>
<td>P903iTV</td>
<td>(2007)</td>
</tr>
<tr>
<td>SH903iTV</td>
<td>(2007)</td>
</tr>
<tr>
<td>905SH</td>
<td>May 2006</td>
</tr>
<tr>
<td>911SH</td>
<td>Nov 2006</td>
</tr>
</tbody>
</table>

Each company's press released merchandise in Japan

NTT DoCoMo

KDDI

SoftBank

Usable also as digital radio
### Personal Computers

<table>
<thead>
<tr>
<th>Company</th>
<th>Model/Description</th>
<th>Released Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sony</td>
<td>VGN-TX91PS, etc. (from Jan 2006)</td>
<td></td>
</tr>
<tr>
<td>Aro System</td>
<td>LesanceNB CL206GW-GT/TV etc (from Jul 2006)</td>
<td></td>
</tr>
<tr>
<td>Fujitsu</td>
<td>T70S/V, etc. (from Apr 2006)</td>
<td></td>
</tr>
<tr>
<td>NEC</td>
<td>LavieA (LA700/GD) (Sep 2006)</td>
<td></td>
</tr>
<tr>
<td>Logite</td>
<td>PC Card (Mar 2006 OEM Supply)</td>
<td></td>
</tr>
<tr>
<td>PIXER</td>
<td>USB connective Tuner (DH-ONE/U2) (Oct 2006)</td>
<td></td>
</tr>
<tr>
<td>SKnet</td>
<td>USB connective Tuner MonsterTV 1D (Nov 2006)</td>
<td></td>
</tr>
<tr>
<td>Sony</td>
<td>USB connective Tuner (DH-ONE/U2) (Oct 2006)</td>
<td></td>
</tr>
<tr>
<td>NEC</td>
<td>USB connective Tuner (LDT-1S100U) (Sep 2006)</td>
<td></td>
</tr>
<tr>
<td>Logite</td>
<td>SDIO Tuner (2007 OEM supplied)</td>
<td></td>
</tr>
<tr>
<td>ZENTE</td>
<td>USB connective Tuner (LDT-1S100U) (Sep 2006)</td>
<td></td>
</tr>
<tr>
<td>DELL</td>
<td>USB connective Tuner MonsterTV 1D for DELL (Nov 2006)</td>
<td></td>
</tr>
<tr>
<td>Fujitsu</td>
<td>USB connective Tuner (LDT-1S100U) (Sep 2006)</td>
<td></td>
</tr>
<tr>
<td>LOGFARM</td>
<td>USB connective Tuner PCTV-hiwasa (LOG-J100) (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>SanwaSupply</td>
<td>USB connective Tuner VGA-TV1S (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>I.O.Data</td>
<td>USB connective Tuner SEG CLIP (GV-1S/USB) (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>ZENTE</td>
<td>USB connective Tuner DigiTVe (LC-1SEGU) (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>DELL</td>
<td>USB connective Tuner QOT-W100 (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>TRYWIN</td>
<td>USB connective Tuner DT-007 (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>SanwaSupply</td>
<td>USB connective Tuner K-ONESEG/U2 (2007)</td>
<td></td>
</tr>
<tr>
<td>KEIAN</td>
<td>USB connective Tuner W-one (GH-1ST-U2K) (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>I.O.Data</td>
<td>USB connective Tuner ON TIME TV (IM-1ST0001U/S) (Dec 2006)</td>
<td></td>
</tr>
<tr>
<td>IMJ</td>
<td>USB connective Tuner ON TIME TV (IM-1ST0001U/S) (Dec 2006)</td>
<td></td>
</tr>
</tbody>
</table>

Each company's press released merchandise in Japan
One-Seg Broadcasting Receivers Introduced to the Market (3/3)

Portable DVD Players
- DVD-LX97 (Mar 2006) - Panasonic
- SD-P90DT (Dec 2006) - TOSHIBA
- SD-P50DT (Dec 2006) - TOSHIBA
- ROSSINI RPD7100SN-SV (Nov 2006) - Nagase
- axion AXN6709TD (Dec 2006) - NAGASE

Digital Audio Player
- gigabeat V30T (Jul 2006) - TOSHIBA
- gigabeat V30E & V60E (Nov 2006) - TOSHIBA

Exclusive Terminals, etc.
- BTV-400K (Feb 2007) - BLUEDOT
- One-segment unit Produced by Wilcom (Dec 2006) - PIXERA
- Prodia (Sep 2006) - TOSHIBA

Electronic Dictionary
- SD-PDT1 (Jul 2006) - TOSHIBA
- DVF-DTV100 (Aug 2006) - SANYO
- Papyrus PW-TC900 (Dec 2006) - SHARP

Game Terminal
- Nintendo DS (scheduled in 2007) - Nintendo

Others
- XDV-100 (Apr 2007) - SONY
- Super One-seg TV Watch (campaign prize) - Asahi Beer
- Original One-seg TV (G I Challenge campaign prize) - Georgia

※ One-Seg tuner only for portable DVD player
※ Usable also as digital radio

Each company's press released merchandise in Japan
1. Realization of non-congested communication even in times of disaster.
2. Ensure conveying information by automatic activation even in times of disaster and/or in emergency.
3. Able to convey information according to area and objectives.

<table>
<thead>
<tr>
<th>Text</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possibility of xxx river flooding has increased. Residents in the surrounding areas should evacuate. Areas affected are as follows.</td>
<td>![Image of a map indicating evacuation areas] (Evacuate from this area!)</td>
</tr>
</tbody>
</table>

**Activation Control by Broadcasting**

- Non-congested communication
- Power-saving feature is necessary

**Activation control signal & Text and Image**

**Master Room (on-air button)**

**TV Station**

**Server**

Translate to Broadcasting Markup Language

**Activate !**

(Cell Base Station)

Both in and outside the home.
There is no difference in price of the television receivers among DTTB systems. Because almost component of digital television receivers are same. As for the difference depend on DTTB systems is just modulation part which is negligible against price of TV set. As proof, price of the television receivers are same among PAL, NTSC and SECAM.

Price of the television receivers is depend on functions. e.g. High Definition TV, Multi SD, Date broadcasting, interactive function. etc

General Block Diagram of Digital Receivers

[note] the different component is only digital demodulator for different systems
This STB is now under developing!

[main spec]

<table>
<thead>
<tr>
<th>Item</th>
<th>Spec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal output</td>
<td>Video; Standard Definition</td>
</tr>
<tr>
<td></td>
<td>Audio; (L, R) two devices (close-captioned)</td>
</tr>
<tr>
<td>Frequency band</td>
<td>VHF and UHF</td>
</tr>
<tr>
<td>Electric power</td>
<td>21W</td>
</tr>
<tr>
<td>Size</td>
<td>H100 × W25 × D131 (mm)</td>
</tr>
</tbody>
</table>
Summaries
Digitizing broadcasting consists of not only upgrading existing analog TV systems but also achieving attractive broadcasting service is the key to expand digital terrestrial TV for viewers.

ISDB-T makes it possible to receive SDTV or HDTV while moving and provides the chance for enjoying new broadcasting service to users.

ISDB-T can provide a “free” mobile TV reception service like ordinary TV broadcasting.

→ ISDB-T can be the most suitable system for expanding digital terrestrial TV.
Thank you!

- Digital Broadcasting Experts Group (DiBEG) in ARIB

- Presenter:
  Yasuo TAKAHASHI
  Chairman of DiBEG

- Contact us:
  http://www.dibeg.org/
  mail; info@dibeg.org