Digital Terrestrial TV in Japan

October 14, 2004

MIYAZAWA Shigeki
Broadcasting Technology Division
Information and Communications Policy Bureau
Ministry of Internal Affairs and Communication
JAPAN
Topics

1. Overview of Broadcasting in Japan
2. Strategy for Digital Terrestrial Television Broadcasting
3. Promotion of Digital Broadcasting
4. ISDB-T as DTTB systems
5. Service Features of DTTB
6. World Trend of Digital TV Broadcasting
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></th>
<th>1950</th>
<th>1970</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Terrestrial</strong></td>
<td></td>
<td></td>
<td>▲ Analog</td>
</tr>
<tr>
<td><strong>Television</strong></td>
<td></td>
<td></td>
<td>▲ Start of broadcasting (December 2003)</td>
</tr>
<tr>
<td><strong>BS</strong> (High output satellite broadcasting)</td>
<td></td>
<td></td>
<td>▲ Analog</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▲ Start of broadcasting (1989)</td>
</tr>
<tr>
<td><strong>CS</strong> (Medium output satellite broadcasting)</td>
<td></td>
<td></td>
<td>▲ Analog</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▲ Start of broadcasting (1996)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▲ Digital</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End 2011</td>
</tr>
</tbody>
</table>

**End 2011**
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
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

1999-2003
Real Scale Experiment Broadcasting

Sep. 2002
MPHPT established license conditions and requirements

Feb. 2003
Start of Analog channel reallocation

Apr. 2003
Provisional licenses were awarded

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

Dec 1st 2003
Start of DTTB!
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. DTTB will be started in Ibaraki (Oct. 2004), Toyama (Oct. 2004), Gifu (Nov. 2004), Kanagawa (Dec. 2004) and Hyogo (Dec. 2004).
Population Coverage of DTTB in Japan

Approximately over 12 million households
(25% of total household in Japan)

Expansion of population coverage (households)

- 2004: 17 million (35%)
- 2005: 23 million (48%)
- 2006: available at all prefectures (80%)

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
Digital TV Products (1)

Plasma
PDP
HITACHI
SONY
Panasonic

Pioneer
Victor · JVC
SANYO
TOSHIBA
Digital TV Products (2)

LCD

Panasonic

SONY

SHARP

TOSHIBA

Victor・JVC

SANYO

MITSUBISHI

HITACHI
Digital TV Products (3)

CRT

Panasonic
SONY
MITSUBISHI
TOSHIBA

STB type

SONY
Panasonic

More manufactures are entering the market!
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**

### Systems

<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>
Promotion of Digital Broadcasting
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

**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
Strategy to promote DTTB

- 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
Gateway to the ICT Society

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>Make an application via the Internet</td>
</tr>
<tr>
<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>
<td>Make a reservation via the Internet</td>
</tr>
<tr>
<td>Travel information program</td>
<td></td>
</tr>
<tr>
<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>
<td></td>
</tr>
</tbody>
</table>
Digital Broadcasting
~Home gateway to the ICT society~
Digitalization of Broadcasting in e-Japan Strategy

**e-Japan Strategy II** (July, 2 2003 by IT Strategic Headquarters)

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.

**e-Japan Priority Policy Program - 2004** (June 15, 2004 by IT Strategic Headquarters)

**Digitalization of Broadcasting**

1. In order to promote digitization of broadcasting as the basis of the IT revolution at home, terrestrial digital broadcasting is set to start in the three major areas of Kanto, Kinki and Chukyo in December 2003 and in other areas by CY2006.

2. With this in mind, readjust frequencies for analog broadcasting along with digitization of broadcasting.

3. For the smooth transition to digital broadcasting, widely publicize merits, schedule and how digital broadcasting can be received, and the timing of analog broadcasting termination, etc.

**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.

(* unofficial translation)
Action Plan to Promote DTTB

Decision of the “DTTB promotion conference (Oct 31\textsuperscript{th} 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 10 million

Penetration into 24 million

Penetration into 48 million

World Cup held in Germany

Beijing Olympics

End of analog broadcasting

Number of households (10,000 households)

Year

2003 2004 2005 2006 2007 2008 2009 2010 2011
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
ISDB-T as DTTB standard
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
**ISDB-T system**

Band Segmented OFDM: Orthogonal Frequency Division Multiplexing

- **Features**
  - Modulation: DQPSK, QPSK, 16QAM, 64QAM
  - 1 HDTV or 3 SDTV/channel
  - Net data rate: 23.42 Mbps (6 MHz)
  - Single Frequency Network
  - Mobile reception (time interleaving)
<table>
<thead>
<tr>
<th>Standard Code</th>
<th>Description</th>
<th>Established Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIB STD-B32</td>
<td>Image encoding, sound encoding and multiplexing</td>
<td>2001.5</td>
</tr>
<tr>
<td></td>
<td>formats</td>
<td></td>
</tr>
<tr>
<td>ARIB STD-B24</td>
<td>Data broadcasting encoding formats and transmission formats</td>
<td>1999.10</td>
</tr>
<tr>
<td>ARIB STD-B25</td>
<td>Restricted reception formats</td>
<td>1999.10</td>
</tr>
<tr>
<td>ARIB STD-B10</td>
<td>Program lineup information</td>
<td>1997.6</td>
</tr>
<tr>
<td>ARIB STD-B31</td>
<td>Transmission formats</td>
<td>2001.5</td>
</tr>
<tr>
<td>ARIB STD-B21</td>
<td>Receiver device</td>
<td>1999.10</td>
</tr>
<tr>
<td>ARIB TR-B14</td>
<td>Terrestrial TV operation specification</td>
<td>2002.1</td>
</tr>
</tbody>
</table>

ARIB: Association of Radio Industries and Businesses (Private standardization body in Japan)
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_{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.
Service features of DTTB
Segmented Structure and Partial Reception

Example of Hierarchical Multiplexing

- Layer A: Sound/DATA
- Layer B: HDTV (or 3 SDTV)

13 segments (6MHz bandwidth)

Mobile reception

HDTV reception
HDTV service

Example: modulation 64QAM
       code ratio 3/4
       guard interval 1/8
       bit rate 16.9 Mbps

<table>
<thead>
<tr>
<th></th>
<th>SDTV</th>
<th>HDTV</th>
</tr>
</thead>
<tbody>
<tr>
<td>aspect ratio</td>
<td>4:3</td>
<td>16:9</td>
</tr>
<tr>
<td>scanning line</td>
<td>525</td>
<td>1125</td>
</tr>
</tbody>
</table>
HDTV and Multiple programs

● High-Definition programs

● Multiple programs
Situation of HDTV broadcasting by DTTB

All broadcasters providing pure HDTV programs* now
* Recorded and transmitted by 1080i HDTV format

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

- Private Network stations provide HDTV about 50% of all programs in Tokyo Area.

Prime time: more than 50%
Broadcasting to Portable Terminals

Example: modulation 16QAM
code ratio 1/2
guard interval 1/4
bit rate 630 kbps

13 segments (6MHz)

Display image
Visual data
Text data

Prototype Mobile Phone receiver
Mobile reception of Digital broadcasting

Service image

Link to Internet via Network
To purchase displayed items
To get more information, etc.

An example of KDDI

Mobile operator
• Streaming data
• Information data

Network

Streaming server
/ Communication server

Communications network

DTTB

Broadcaster
• TV program
• Information data

TV Program server
/ Data server

TV program

BML DATA
Example for mobile phone receiver

**Hardware Specification**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• DTTB receiver</td>
<td></td>
</tr>
<tr>
<td>• GPS chip</td>
<td></td>
</tr>
<tr>
<td>• Browser</td>
<td></td>
</tr>
</tbody>
</table>

**Developed by**

KDDI

**Feature**

- DTTB receiver
- GPS chip
- Browser

**Broadcasting Specification**

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIDEO</td>
<td>MPEG-4 Visual Simple Profile</td>
</tr>
<tr>
<td>AUDIO</td>
<td>MPEG-2 AAC LC</td>
</tr>
<tr>
<td>DATA</td>
<td>ARIB STD-B24+KDDI Profile</td>
</tr>
</tbody>
</table>

**Actual**

Actually MPEG-4 AVC/H.264 will be used for video codec system.

**Table**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEIGHT</td>
<td>140g</td>
</tr>
<tr>
<td>SIZE</td>
<td>50mm(W) × 100mm(H) × 38mm(D)</td>
</tr>
<tr>
<td>(Except for OFDM receiver)</td>
<td></td>
</tr>
<tr>
<td>BATTELY</td>
<td>2 Hours</td>
</tr>
<tr>
<td>CPU</td>
<td>SH-Mobile</td>
</tr>
<tr>
<td>MEMORY</td>
<td>64MB</td>
</tr>
<tr>
<td>LCD</td>
<td>QVGA</td>
</tr>
</tbody>
</table>

**Development**

Developed by KDDI
Implementation Schedule toward portable reception of DTTB

- Video compression system: MPEG4 AVC/H.264
- Patent agreed in March 2004
- Prototype receivers developed by manufactures
- Service will start in 2005
- TV viewing on Cellular phone while commuting
HDTV mobile reception (1)

Broadcasting station

Direct Wave

Reflection Wave

Mobile Receiver

Adaptive Array Antenna on the vehicle's window

Antenna Gain Control Technic

Gain Control

Decoder
HDTV mobile reception (2)

Demonstration will be provide at ITS World Conference in Oct. 2004 in Nagoya
Integrated Transport System (ITS) using DTTB

Demonstration will be provide at ITS World Conference in Oct. 2004 in Nagoya

Contents Provider

Web server

BML server

Broadcaster

ITS information

Mobile Communication Network

Cellular Phone

DSRC

DTTB
Data Broadcasting

All DTTB Broadcasters and BS Broadcasters providing Data broadcasting (datacast) now

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

Currently the description language is BML format

Based on

- XHTML

Features
- Easy creation of contents
- Facilitate convergence of internet

Functions for Broadcasting

Additional capability
Example for Data Broadcasting (1)

Top menu
Example for Data Broadcasting (2)

Weather news
Example for Data Broadcasting (3)

Program related data
Local governmental information service using datacast of DTTB (Gifu prefecture in 2004)

- Gifu Data Center
- Internet
- Broadcaster
- DTTB
- Local authority
- Monitor households (approximately 150 households)
Server-type Broadcasting System

- Broadcasting station
- Program by Air transmitting
- Pick up favorite Pictures
- Home server with large capacity storage
- External storage

Service coming soon
Interactive Broadcasting

Broadcasting station  Interactive  Contents server / Portal server

Program + data

Response

Request

Internet

Home

Send a request

Join the Quiz show by voting
Purchase on TV shopping
Interactive service

NHK Data Online service available from April 2004

Access to NHK Data server

Top menu of Data broadcasting

BML data via Broadcasting

DTTB receiver

NHK Data Online image

BML data via Internet
Fusion of communications and broadcasting

Service image

TV program

BML DATA

Broadcaster
- TV program
- Information data

DTTB

Communications network

User

Link to Internet via Network
To purchase displayed items
To get more information, etc.

Network

Mobile operator
- Streaming data
- Information data

TV Program server / Data server

Streaming server / Communication server
World Trend of Digital TV Broadcasting
Current Situation of Implementing Digital Terrestrial Television Broadcasting

- Spain (DVB-T) May 2000
- Germany (DVB-T) September 1998
- Holland (DVB-T) April 2003
- Switzerland (DVB-T) August 2000
- Italy (DVB-T) December 2003
- Sweden (ATSC) April 1999
- Korea (ATSC) October 2001
- Finland (DVB-T) August 2001
- Japan (ISDB-T) December 2003
- Taiwan (DVB-T) July 2003
- Singapore (DVB-T) February 2001
- Australia (DVB-T) January 2001
- Canada (DVB-T) March 2003
- USA (ATSC) November 1998

Updated: September 2004

- ISDB-T system
- DVB-T system
- ATSC system
## Comparison of ISDB-T, DVB-T, ATSC

<table>
<thead>
<tr>
<th>Systems</th>
<th>ISDB-T</th>
<th>DVB-T</th>
<th>ATSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission system</td>
<td>Multiple carrier (OFDM)</td>
<td>Single carrier (8VSB)</td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>6/7/8 MHz</td>
<td>6/7/8 MHz</td>
<td></td>
</tr>
<tr>
<td>Modulation Scheme</td>
<td>DQPSK/QPSK/16QAM/64QAM</td>
<td>QPSK/16QAM/64QAM</td>
<td>8VSB</td>
</tr>
<tr>
<td>Error control</td>
<td>Convolutional code/ RS</td>
<td></td>
<td>Trellis code + RS</td>
</tr>
<tr>
<td>Characteristic</td>
<td>SFN capability</td>
<td>SFN capability</td>
<td>Analog based format</td>
</tr>
<tr>
<td></td>
<td>Effective against ghost</td>
<td>Effective against ghost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Segmented OFDM</td>
<td>Time interleaving</td>
<td></td>
</tr>
<tr>
<td>Proposing country</td>
<td>Japan</td>
<td>Europe</td>
<td>U.S.A.</td>
</tr>
</tbody>
</table>

The DTTB systems are recommended in ITU-R Rec.BT.1306.
## Digital Terrestrial TV in the World

<table>
<thead>
<tr>
<th></th>
<th>EU</th>
<th>Asia Pacific</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK, Germany, Sweden, Finland, Spain etc.</td>
<td>USA, Canada, Australia, Korea, Japan</td>
</tr>
<tr>
<td>Regulatory framework</td>
<td>New license</td>
<td>Give 6(7)MHz to incumbent analog operators Simulcast requirement</td>
</tr>
<tr>
<td></td>
<td>-Multiplex</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Program (4-6 programs in 1 multiplex)</td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>Pay TV or Free to air</td>
<td>Free to air</td>
</tr>
<tr>
<td></td>
<td>More channels, no HDTV</td>
<td>HDTV</td>
</tr>
<tr>
<td></td>
<td>STB</td>
<td>Integrated digital TV set</td>
</tr>
<tr>
<td>System</td>
<td>DVB-T</td>
<td>ATSC (USA, Canada, Korea)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISDB (Japan)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DVB-T (Australia)</td>
</tr>
</tbody>
</table>
### HDTV as mainstream of digital TV

<table>
<thead>
<tr>
<th>country</th>
<th>HDTV requirement and service</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>No mandatory requirements. Major terrestrial TV network started HDTV in primetime. Satellite and cable operators started HDTV service.</td>
</tr>
<tr>
<td>Canada</td>
<td>Market driven but emphasis on HDTV in CRCT licensing policy in 2002. Satellite, Cable and terrestrial TV providing HDTV.</td>
</tr>
<tr>
<td>Australia</td>
<td>HDTV requirement: 20 hours per week, from July 2003 (including up-converted HDTV).</td>
</tr>
<tr>
<td>Korea</td>
<td>HDTV requirement: 14 hours per week for pure HDTV.</td>
</tr>
<tr>
<td>Japan</td>
<td>HDTV requirement: more than 50% (including up-converted HDTV). NHK-G providing 90% pure HDTV.</td>
</tr>
</tbody>
</table>
Summary

- DTT should have more values than multi-channels; i.e. pure HDTV, datacast, interactive service, mobile
- All-in one HDTV sets are available in the market as thrusters of digital market, and integrated home information terminal.
- Collaborative work among government, broadcasters, industry to promote DTT
- DTT is growing rapidly since 2003 due to HDTV
- Attractive application of DTT, datacast is necessary.
Reference

Thank you for your attention !!

MIC
http://www.soumu.go.jp/joho_tsusin/eng/

Contact point:
MIYAZAWA Shigeki
Assistant Director,
Broadcasting Technology Division, MIC
s-miyaza@soumu.go.jp