Policy and Digitalization

Process in Japan

28th-29th August, 2006
In Caracas

DiBEG JAPAN

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(Toshiba)
Topics

1. Outline of Broadcasting in Japan
2. Schedule and Policy for Digitalization
3. Standardization Process and Structure of ISDB-T Standard
4. Experimental Broadcasting in Japan
5. Outline of Service Features of ISDB-T
6. Outline of Narrow Band ISDB-T(ISDB-Tsb)
Outline 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
Number of Channels Available for Private Terrestrial Broadcasting (analog broadcasting)

<table>
<thead>
<tr>
<th>Number of viewable channels</th>
<th>Number of prefectures</th>
<th>Household coverage rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Channels</td>
<td>6</td>
<td>31.6%</td>
</tr>
<tr>
<td>7 Channels</td>
<td>14</td>
<td>38.2%</td>
</tr>
<tr>
<td>6 Channels</td>
<td>13</td>
<td>19.3%</td>
</tr>
<tr>
<td>5 Channels</td>
<td>9</td>
<td>7.6%</td>
</tr>
<tr>
<td>4 Channels</td>
<td>3</td>
<td>2.1%</td>
</tr>
<tr>
<td>3 Channels</td>
<td>2</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

(Reference) Household coverage rate for terrestrial digital broadcasting services*

*Household coverage rate is calculated based on MCI “Residents basic ledger” (end of 2002)
## Schedule for Digital Broadcasting in Japan

<table>
<thead>
<tr>
<th></th>
<th>1950</th>
<th>1970</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Terrestrial Television</strong></td>
<td></td>
<td>Analog</td>
<td>End 2011</td>
</tr>
<tr>
<td><strong>BS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(High output satellite broadcasting)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲broadcasting start (1989)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Medium output satellite broadcasting)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲Start of broadcasting (1996)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▲Start of broadcasting (December 2000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>End 2011</td>
</tr>
<tr>
<td><strong>Digital</strong></td>
<td></td>
<td></td>
<td></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
Schedule and Policy for Digitalization
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

Summer in Hokkaido is ...

Detail

HDTV Hour respectively
10th ( Fri )
16:35 PM
Program
1 World music
3 Drama in Friday
5 Sports
7 Human documents
10 News
12 10th Friday Movie
14 New noted places in Tokyo
38 Pro-wrestling hour
42 Quiz show - bikkuri gyouten
46 Italian lesson

DiBEG
Digital Broadcasting Experts Group
Implementation Schedule of Digital Terrestrial Television Broadcasting in Japan

1994
MPT asked to Council for technical requirement

1999
Issue of Digital Broadcasting Study Group Report

1999-2003
Real Scale Experiment Broadcasting

2002
Sep. MPHPT established license conditions and requirements

2003
Apr. Provisional licenses were awarded

2003
Feb. Start of Analog channel relocation

2006
Apr. 1st Start of 1-Segment Broadcasting

2006
Oct. Start of DTTB (main city of the whole country)

2007
Dec 1st Start of DTTB ! (Tokyo, Nagoya, Osaka)

2007
Start of Server-type Broadcasting

2008
Start of DTTB (main city of the whole country)
Expansion Schedule for DTTB in Japan

In the seat of Prefectural Government, DTTB...

- **Already Begun**
- **Will begin by Oct. 2006**
- **Will begin by Dec. 2006**
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-70s</td>
<td>Started Black-and-white TV</td>
</tr>
<tr>
<td>1953</td>
<td>Started color TV broadcasting</td>
</tr>
<tr>
<td>1960</td>
<td>Started black-and-white TV broadcasting</td>
</tr>
<tr>
<td>1960</td>
<td>Started color TV broadcasting</td>
</tr>
<tr>
<td>1953</td>
<td>Started Black-and-white TV</td>
</tr>
<tr>
<td>1960</td>
<td>Started color TV broadcasting</td>
</tr>
<tr>
<td>1970</td>
<td>Started satellite broadcasting</td>
</tr>
<tr>
<td>1980</td>
<td>Started CATV broadcasting</td>
</tr>
<tr>
<td>1996</td>
<td>Started BS digital broadcasting</td>
</tr>
<tr>
<td>2000</td>
<td>Started digital broadcasting in some regions</td>
</tr>
<tr>
<td>2003</td>
<td>Started digital broadcasting in three major metropolitan areas (Key Stations)</td>
</tr>
<tr>
<td>2006</td>
<td>Start digital broadcasting nationwide.</td>
</tr>
<tr>
<td>2011</td>
<td>Completion of Digitalization by 2011</td>
</tr>
<tr>
<td>July 24, 2011</td>
<td>Termination of Analog Broadcasting</td>
</tr>
<tr>
<td>2011</td>
<td>Digital terrestrial broadcasting can be received in all subscribed households</td>
</tr>
<tr>
<td>Year</td>
<td>2003</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
</tr>
<tr>
<td>Analog broadcasting</td>
<td></td>
</tr>
<tr>
<td>Digital broadcasting</td>
<td>3 main areas</td>
</tr>
<tr>
<td>Other areas</td>
<td></td>
</tr>
</tbody>
</table>

**Number of potential households nationwide**

- **(End of 2003)**
  - Approx. 12 million
- **(End of 2004)**
  - Approx. 18 million
- **(End of 2005)**
  - Approx. 27 million
- **(End of 2006)**
  - Approx. 37 million
- **(End of 2007 - 2010)**
  - Approx. 23 million

**Number of potential households through CATV**

- Approx. 7 million
- Approx. 12 million
- Approx. 17.5 million
- Approx. 23 million
Image of Effective Use of Frequencies by Digitization of Terrestrial Broadcasting

【Before measures for changing analog frequencies are taken】

Bandwidth of 370 MHz

【While measures for changing analog frequencies are taken】

Changing the channel of an analog TV broadcasting station

【After analog broadcasting services are terminated】

1/4 or more of the frequency band which was used for broadcasting in the past can be used for new applications (bandwidth of 118 MHz).
Licensing Policy for Digital Terrestrial Television Broadcasting

- Over 2/3 simultaneous broadcasting of analog programs per day
- HDTV program time quota of more than 50% for all Digital terrestrial television broadcasters
- Broadcasting using subtitles and commentary
Strategy to Promote Digital Terrestrial Television Broadcasting

- End of Analog Broadcasting; July 2011 mandated by Radio Law
- Promote Digital terrestrial television broadcasting receivers
- DTV as integrated home information terminal
- Need of collaborative work among government, broadcasters and industry
Official support for broadcasters

Support by the “Extraordinary Law for Measures to Promote the Construction of Advanced TV Broadcasting Facilities” etc.

- Preference for the national tax (corporate tax)
- Preference for the local tax (fixed property tax, real-estate acquisition tax*)
- Supply of no- or low-interest funds by policy-based financial institutions
- Supply of low- or super-low*-interest funds by the Development Bank of Japan

*newly installed in FY2005
Standardization Process of DTTB in Japan

Note; Details of structure for ISDB-T standard are explained in 2nd session
Decision Making Process

Technical Standard

License, Regulation

Inform WTO

Ministry

Telecommunications Council

Radio Regulatory Council

ARIB

Parties interested

DTTB Implementation Council
Standardization Flow in Japan

(Note) MIC: Ministry of Internal Affairs and Communications
# Government Regulations and ARIB Standards for radio systems

<table>
<thead>
<tr>
<th>Government Regulations</th>
<th>ARIB Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature</strong></td>
<td>Mandatory</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td></td>
</tr>
<tr>
<td>♦ To promote efficient use of frequency</td>
<td>♦ To ensure common air interface</td>
</tr>
<tr>
<td>♦ To avoid interference</td>
<td>♦ To ensure suitable quality</td>
</tr>
<tr>
<td>♦ etc.</td>
<td>♦ For greater convenience to manufacturers and users</td>
</tr>
<tr>
<td>♦ etc.</td>
<td>♦ etc.</td>
</tr>
<tr>
<td><strong>Technical items</strong></td>
<td></td>
</tr>
<tr>
<td>♦ Frequency band</td>
<td>♦ Communication protocol</td>
</tr>
<tr>
<td>♦ Spurious emission</td>
<td>♦ Sencitivy</td>
</tr>
<tr>
<td>♦ Frequency tolerance</td>
<td>♦ Carrier to Noise ratio</td>
</tr>
<tr>
<td>♦ Occupied bandwidth</td>
<td>♦ Bit error rate</td>
</tr>
<tr>
<td>♦ etc.</td>
<td>♦ Measurement method</td>
</tr>
<tr>
<td>♦ etc.</td>
<td>♦ etc.</td>
</tr>
</tbody>
</table>
Comparison of ISDB-T, DVB-T and 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></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>Characteristics</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></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Time interleaving</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Proponent          | Japan                        | Europe            | U.S.A.             |

Note: Details are presented in session 2
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
What is Band Segmented OFDM with time interleave?

(Example; 1seg + 12 seg)

- **Segmented OFDM**; Possible to support fixed/mobile/handheld reception service

- **Time interleave**; reduce impulse noise and reduce the degradation caused by fading (tested in Brazil by Mackenzie and TV GLOBO)
Service Image of ISDB-T

Multiplexing to One

- HDTV
- Portable
- HDTV

12 Segment
Compressed by MPEG2

1 Segment
Compressed by H.264

Original Image

While walking

In the train

For Portable Terminal

10110...

Digital Broadcasting

For large Screen Television

High Definition Picture

High Quality Sound

Anytime

Anywhere

In the Bus

At home

Sports

News

Disaster

For Portable Terminal
Experimental Test for DTTB in Japan

During 1998 -2003, Experimental Test for DTTB was held in Japan.

The purpose of Experimental Test were,

• To Evaluate the ISDB-T System (mainly in Tokyo Pilot Test)
• Develop and Test DTTB Transmission Network and It’s technology
• Develop and Test Studio System
• Develop and Test New Service in Digital Broadcasting
Laboratory Test (1/2)

Purpose; (following documents are attached on DiBEG Home Page)

- Transmission Performance of ISDB-T (note 1)
- Protection ratio

Fundamental Data for Channel Planning

(note 1) Japan submitted to ITU-R SG-11 as an Input Document

Transmission Performance Test

- BER (Bit Error Rate) vs. C/N in a Gaussian Channel
- BER (Bit Error Rate) vs. C/N in a Multipath Channel
- BER (Bit Error Rate) vs. C/N in a Rayleigh Channel
- Others
Laboratory Test(2/2)

Protection Ratio

Measure the protection ratio for following Combinations

<table>
<thead>
<tr>
<th>Undesired</th>
<th>Lower Adjacent</th>
<th>Co-channel</th>
<th>Upper Adjacent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired</td>
<td>Digital</td>
<td>Digital</td>
<td>Digital</td>
</tr>
<tr>
<td>Analog</td>
<td>Digital</td>
<td>Digital</td>
<td>Digital</td>
</tr>
<tr>
<td>Digital</td>
<td>Analog</td>
<td>Analog</td>
<td>Analog</td>
</tr>
<tr>
<td>Digital</td>
<td>Digital</td>
<td>Digital</td>
<td>Digital</td>
</tr>
</tbody>
</table>
Experimental Broadcasting in Japan

for System finalization of ISDB-T

Transmitting started since Oct.'98

Sawara Stn.

Tokyo Tower
Height 210m
CH UHF-15
Power 500W

Existing Analog TV
Ch-14 50kW
Ch-16 10kW

Kanto Area

SFN
System configuration of experimental Broadcasting

for new business promoting

Digital broadcasting
Studio Master System

Microwave
(ISDB-T/OFDM)

Main Transmitting System (Fixed)

Broadcasting Wave (UHF)

Relay Transmitting System (Fixed)

Mobile Transmitting System (experimental use)

Studio

Data & Information Broadcasting System
Features of Digital broadcasting Facilities Experimental

(1) Digital Studio System

Multi-format Hybrid broadcasting

Storage System
VCRs Servers

MTX SW’er

MPEG-2 Encoding System
HD(1080i) SD(480P) SD(480i)

ISDB-T Multiplex

OFDM MOD

3 layered Transmission to Microwave

Data & Information Sending System

compressed uncompressed

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Features of Digital broadcasting Facilities Experimental

(2) Digital Broadcasting Network

SFN (Single Frequency Network) constructed by UHF & SHF
  Rx/Tx isolation and cancellation
  Feasibility study of usage of 3.5G & 7G for SHF link

Mobile reception under SFN constructed network

Station allocation plan in economy
  investigated by Mobile TX
Features of Digital broadcasting Facilities Experimental

(3) Multimedia Broadcasting Service

Bidirectional network of data and information services
Telephone line return

Handheld reception of 1 segment multimedia services

Broadcasting of Community services for limited area

Stored and rendered services of multimedia broadcasting
4. Current DTTB service in Japan

Note 1; Details of DTTB service are presented in session 3. For mobile/portable service, presented in session 5
Feature of Japanese DTTB system

- Fixed Reception
- Mobile/Handheld Reception
- Communication/Internet
- TV station
- HDTV
- Home Receiver
- Communication carrier
- Handheld terminal
- Receiver in Vehicle

Support 3 reception type by one channel

13 Segments
13 segment
13/1 segment
(diversity reception)
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 main service of digital TV

HDTV services

- Wide screen
- High quality image
- High quality audio program
- 5.1ch surround audio program
Multiple SDTV programs within one channel

- Digital TV makes transmission of three different programs possible within one channel independently.
Example for Data Broadcasting

Weather information

Anytime news

Statistics and Analysis of sports

Program related information
Broadcasting to Portable Terminals

Mobile reception

13 segments (6MHz)

1 segment

Example:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>16QAM</th>
<th>1/2</th>
<th>1 segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit rate</td>
<td>630 kbps</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Broadcasting to Portable Terminals (sample)

- SANYO
- NEC
- KDDI (developed with NHK)
- PANASONIC
5. Digital Terrestrial Sound Broadcasting (DTSB) in Japan

DTSB is based on ISDB-Tsb technology, which is the family of ISDB-T. Technical details are presented in session 2.
Digital Terrestrial Sound Broadcasting (DTSB)

Status

- Report of technical requirement for Digital Terrestrial Sound Broadcasting (DTSB) published in 1999
- ARIB STD-B29 "Transmitting system of DTSB and ARIB STD-B30 "Receiver for DTSB" established in 2001
- Enforcement of revised radio raw for DTSB in 2002
- Test licences for DTSB awarded to DRP in 2003
- Experimental DTSB services started at 10th Oct. 2003 in Tokyo and Osaka
## Digital Terrestrial Sound Broadcasting System

### Comparison of DTSB system

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>Europe</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
<td>ISDB-T_{SB}</td>
<td>DAB</td>
<td>IBOC</td>
</tr>
<tr>
<td><strong>Carrier modulation</strong></td>
<td>OFDM (DQPSK,QPSK, 16QAM,64QAM)</td>
<td>OFDM (DQPSK)</td>
<td>OFDM</td>
</tr>
<tr>
<td><strong>Error-correcting code</strong></td>
<td>Reed-solomon + convolutional error correcting</td>
<td>convolutional error correcting</td>
<td>convolutional error correcting</td>
</tr>
<tr>
<td><strong>Multiplex structure</strong></td>
<td>MPEG-2 System</td>
<td>Original System</td>
<td>Original System</td>
</tr>
<tr>
<td><strong>Audio coding</strong></td>
<td>MPEG-2 Audio AAC</td>
<td>MPEG-1(Layer2)</td>
<td>MPEG-2 Audio AAC</td>
</tr>
</tbody>
</table>

**Note:** ISDB-Tsb has a commonality with ISDB-T “One-Seg” service
Promotion of the Digital Terrestrial Sound Broadcasting (DTSB) in Japan

1 Purpose

The Digital Radio Promotion Association (DRP) was established in October 2001 to promote the Digital Terrestrial Sound Broadcasting (DTSB) in Japan.

2 Activities

- Carry out the experimental DTSB services (started at 10 October 2003 in Tokyo and Osaka)
- Develop new application for DTSB
- Research of the demand for DTSB
- Promote the DTSB receivers

3 Members

DRP has 76 members (Sound Broadcasters, manufacturers etc)
Trial Services of DRP

VHF television band assignments

- VHF 6ch
- VHF 7ch
- VHF 8ch

Segment structure

- 8 segments (Normally 13seg.)
- 3seg. broadcasting

Broadcast programs

- 91ch 92ch 93ch 94ch 95ch
- 95ch

Example of Tokyo station, Osaka's all programs are 1seg. broadcasting.
Development of receivers

DRP prepared digital receivers for test monitor.

Trial portable receiver

Near future

PC card type (test product)

PDA type (test product)
Thank You for Your Attention

Digital Broadcasting Expert Group

http://www.dibeg.org/
mail; info@dibeg.org