Presentation 4

System of ISDB-T
Part 2: Transmission system

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KBP ISDB-T Seminar
Manila, Philippines
DiBEG JAPAN
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Contents

1. What is ISDB-T
2. Requirement/Solution
3. Structure of ISDB-T Standard
4. ISDB-T transmission system
   4.1 Advantages of ISDB-T transmission system
   4.2 What is Segmented OFDM?
   4.3 Structure of ISDB-T transmission system
   4.4 Time Interleave
   4.5 Service Example
5. Differences of 3 DTTB systems
6. Examples of comparison test
   6.1 Example of laboratory test
   6.2 Examples of field test
7. ISDB-T receivers in Japanese market
8. Examples of ISDB-T transmitters
9. Others
   9.1 IPR policy
   9.2 About DVB-T2
10. Conclusion
1. What is ISDB-T?

ISDB-T is • • •

• ISDB-T system was developed by the Association of Radio Industries and Businesses (ARIB) in Japan.
• ISDB (Integrated Digital Services Digital Broadcasting) is a new type of digital broadcasting intended to provide audio, video, and multimedia services. T is Terrestrial.
• ISDB-T is one of ISDB family.
• ISDB-T uses a modulation method referred to as Band Segmented OFDM Transmission with Time Interleave.
2. Requirement/Solution

2.1 Requirement for ISDB-T

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Requirement</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>High quality</strong></td>
<td>HDTV should be possible in 6MHz bandwidth</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Robustness</strong></td>
<td>Robustness against multi-path, urban noise, fading and any other interference</td>
<td></td>
</tr>
<tr>
<td>2(1)</td>
<td><strong>Flexibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Service Flexibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2(2)</td>
<td><strong>Reception flexibility</strong></td>
<td>Any kinds of service are possible in 6MHz bandwidth</td>
<td>HD/SD possible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any kinds of reception system are possible, fixed/mobile/portable in same bandwidth</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>Effective utilization</strong></td>
<td>SFN(Single Frequency Network) is possible to reduce frequency.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of frequency resource</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>Interactivity</strong></td>
<td>Harmonization with network</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>Data casting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>Commonality</strong></td>
<td>Maximum commonality is need to reduce receiver cost. Especially, to digital radio, common standard is desirable.</td>
<td></td>
</tr>
</tbody>
</table>

See DiBEG homepage for details
What are Features?

Technical Features

- Segmented COFDM
- Time Interleaving
- Commonality
- MPEG-2 System
- Interactivity

Merits

- SFN
- Robustness against Multi-path & fading
- One-seg service
- Commonality of Digital TV/Audio receiver
- HDTV/Multi-channel SDTV
- Data-casting & Interactive service
(Details of Merit)

- **SFN**

- Robustness against Multi-path & fading

- One-seg service

- Commonality of Digital TV/Audio receiver

- HDTV/Multi-channel SDTV

- Data-casting & Interactive service

- **Save frequency resource**

- **Clear picture (free from ghost)**

- **Mobile/portable reception**

- **Indoor reception**

- **One transmitter for fixed/portable reception service**

- **Common receiver is available**

- **High quality TV service**

- **Service flexibility**
  - Independent data service
  - Data associated TV
  - Harmonization with Internet
Service Image of ISDB-T in Japan

One transmitter supports any kind of service

Digital Broadcasting

10110...

Broadcasting

Multiplexing to One Channel

HDTV   Portable   HDTV

12 Segment Compressed by MPEG2

1 Segment Compressed by H.264

Original Image

For large Screen Television

High Definition Picture

High Quality Sound

For Portable Terminal

Anytime Anywhere

While walking

In the train

At home

In the Bus

Anytime

Anywhere
3. Structure of ISDB-T Standard

- Structure of Japan’s Digital Broadcasting system

General View of Structure

- Source Coding
  - Common for all Broadcast media to keep commonality
  - Any services are available

- Multiplexing
  - Multiplex all data from Source coding
  - Interface to transmission media by TS format

- Transmission Coding
  - Modulation system is optimized for each media
Continued (details of structure)

- **Source coding**
  (any of service are available)

- **Multiplex**
  Common interface (Transport Stream interface)

- **Transmission coding**
  Common interface (Framed Transport Stream interface)

Fixed/mobile service

- One segment handheld service

- **Multiplex (Based on MPEG-2 systems)**

  - **MPEG-2 Video coding**
  - **MPEG-AAC Audio coding**
  - **Data coding (note)**
  - **H.264 video coding**

- **Data codings**
  - Single carrier 8-PSK/PSK (satellite)
  - Single carrier 64QAM (cable)
  - Segmented OFDM QAM/DQPSK With time interleave (terrestrial)

- **(note) both BML and MHP are available, But in Japan now BML is only service in.**
Multiplexed format in ISDB-T system

<table>
<thead>
<tr>
<th>Audio ES</th>
<th>Video ES</th>
<th>Data (stream)</th>
<th>Data (file)</th>
<th>Data (carousel)</th>
<th>SI</th>
<th>PSI</th>
<th>Information for scramble</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Section</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(note) signal format of PES, TS and Section area is defined in ARIB STD-B32, based on MPEG-2 systems

(note) PSI is defined in both STD-B32 and STD B10. In STD-B32, only outline related to MPEG-2 systems is defined
Source coding

Video/Audio Coding (STD-B32)

Data Broadcasting (STD-B24)

Multi-plex (STD-B32, B10)

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
4. ISDB-T Transmission System

The most important features of ISDB-T is its transmission system, these are “Segmented OFDM transmission” and “Time interleave”. In this section, both outline of ISDB-T transmission system and its features are introduced

4.1 Advantages of ISDB-T transmission system

4.2 What is Segmented OFDM transmission and its merits?

4.3 Structure of ISDB-T transmission system

4.4 Time Interleave

4.5 Service Example

(refernce) Transmission Parameter of ISDB-T
4.1 Advantages of ISDB-T Transmission System

(1) Robustness/reception flexibility
To give the robustness against such degradation factor, ISDB-T adopts OFDM transmission system with “Time Interleave” technology. As a result, ISDB-T gives following features compare to other DTTB systems;
(a) lower transmitter power,
(b) possibility of indoor antenna reception,
(c) mobile/portable reception service, etc.

(2) Effective utilization of frequency resource
By adopting OFDM transmission system, it is possible to construct Single Frequency Network(SFN). As a result, possible to reduce frequency resource for relay transmitter(repeater). Further more, using same frequency for plural transmitters of same network, mobile/portable receiver is not required to change receiving channel.
(3) Mobility/ Portability
To enable fixed/ mobile/portable reception service in same channel, ISDB-T developed new transmission technology, named “Segmented OFDM transmission system”.
As a result, fixed/mobile & portable service in same channel is possible. “One-seg” service, its unique portable service of ISDB-T, uses 1 segment of 6MHz.
One seg receiver is easily mounted into mobile-phone, portable PDA, USB tuner, etc, so it enable the broadcast service of “Any time, Any place”

(4) One-seg service
One-seg service, uses 1 segment of 6MHz, dose not need another channel, so not need more transmitter.. it leads save of frequency resource and broadcaster’s infrastructure cost.
And more, One-seg receiver operates as narrow band reception, this operation saves consumption power. As a result, long time reception is possible by battery.
4.2 What is Segmented OFDM?(1/4)

• Purpose
To enable multi reception service within same band.
4.2 What is Segmented OFDM? (2/4)

- Hierarchical transmission

6MHz (13 segment)

Examples

1 Layer; Fixed only (multi-TV program)

2 Layer; Fixed + Portable (HDTV + One-seg)

3 Layer; roof top + indoor + portable (HDTV + SDTV; One-seg)

Rule

- No. of layer; up to 3
- No. of segment in each layer; flexible
- Transmission parameters of each layer; independently setting
4.2 What is Segmented OFDM? (3/4)

- Hierarchical transmission

As shown above, ISDB-T transmission system supports maximally 3 reception style. Therefore, any of transmission system can be arranged according to the service concept in one frequency channel and one transmitter.
4.2 What is Segmented OFDM? (4/4)

Examples of Broadcasting service by using Hierarchical transmission

(1) Single layer multi-program for stationary reception

TV program 1

TV program N

(1 transmitter)

Select any program

(2) 2 layers for HDTV and portable reception (same program)

HDTV program

QVGA

(You can enjoy same TV program in any place)

(in home)

(outside)

(3) 3 layers for HDTV, SDTV and portable reception (same program)

HDTV program

SDTV

QVGA

(roof top Antenna)

(indoor antenna)

(outside)
4.3 Structure of ISDB-T transmission System

Features of ISDB-T system are indicated by red color
(1) Hierarchical Transmission
(2) Time Interleave
4 kinds of interleave are adopted in ISDB-T system

**4.4 Time Interleave**

- **Byte interleave**: Effective for burst error correction after Viterbi decoding. Byte interleave is located between outer coder and inner coder. Randomize the burst error of Viterbi decoder output.

- **Bit interleave**: Effective for symbol error correction. Bit interleave is located between convolutional coding and mapping. Randomize the symbol error before Viterbi decoding.

- **Time interleave**: Effective for fading and impulse noise degradation. Time interleave is located at the output of mapping (modulation). And randomize the burst error of time domain which is mainly caused by impulse noise, fading of mobile reception, etc.

- **Frequency interleave**: Effective for multi-path distortion degradation. Frequency interleave is located at the output of time interleave. Randomize the burst error of frequency domain which is mainly caused by multi-path, carrier interference, etc.
Effect of Time Interleave

Time Interleave is effective not only for signal level fluctuation but also for impulse interference.
What is the merit of Time-Interleave?

• How much improved by using Time-Interleave

Following graph shows degradation by impulse noise, which is dedicated by Mackenzie Presbyterian University measured in Autumn, 2005

![Graph showing C/Neq vs Pulse Width for different transmission standards]

7dB improved Transmitter power reduced to 1/5!!
4.5 Service example: 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)

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)
## Transmission Parameters of ISDB-T (6MHz Bandwidth)

<table>
<thead>
<tr>
<th>ISDB-T mode</th>
<th>Mode 1 (2k)</th>
<th>Mode 2 (4k)</th>
<th>Mode 3 (8k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of OFDM segment</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Useful bandwidth</td>
<td>5.575MHz</td>
<td>5.573MHz</td>
<td>5.572MHz</td>
</tr>
<tr>
<td>Carrier spacing</td>
<td>3.968kHz</td>
<td>1.984kHz</td>
<td>0.992kHz</td>
</tr>
<tr>
<td>Total carriers</td>
<td>1405</td>
<td>2809</td>
<td>4992</td>
</tr>
<tr>
<td>Modulation</td>
<td>QPSK, 16QAM, 64QAM, DQPSK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of symbols / frame</td>
<td>204</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active symbol duration</td>
<td>252 μs</td>
<td>504 μs</td>
<td>1.008ms</td>
</tr>
<tr>
<td>Guard interval duration</td>
<td>1/4, 1/8, 1/16, 1/32 of active symbol duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner code</td>
<td>Convolutional code (1/2, 2/3, 3/4, 5/6, 7/8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer code</td>
<td>RS (204,188)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time interleave</td>
<td>0 ~ 0.5s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Useful bit rate</td>
<td>3.651Mbps ~ 23.234Mbps</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 5. Differences of 3 DTTB systems

#### 5.1 What are the difference?

The difference of 3 DTTB systems should mainly depends on the difference of Transmission system

<table>
<thead>
<tr>
<th></th>
<th>ATSC</th>
<th>DVB-T</th>
<th>ISDB-T</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Modulation</strong></td>
<td>8VSB</td>
<td>COFDM (QPSK, 16QAM, 64QAM)</td>
<td>SegmentedCOFDM (DQPSK,QPSK, 16QAM, 64QAM)</td>
</tr>
<tr>
<td><strong>Interleaving</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bit/Symbol</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Frequency</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time</td>
<td>-</td>
<td>-</td>
<td>0.1s, 0.2s, 0.4s, 0.8s</td>
</tr>
<tr>
<td><strong>Excess Bandwidth/ Guard Interval</strong></td>
<td>11.5%</td>
<td>1/4, 1/8, 1/16, 1/32</td>
<td>1/2, 1/4, 1/8, 1/16, 1/32</td>
</tr>
<tr>
<td><strong>TMCC</strong></td>
<td>-</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Information bit rate</strong></td>
<td>19.39 Mbps</td>
<td>3.69 -23.5Mbps</td>
<td>3.65 -23.2 Mbps</td>
</tr>
<tr>
<td><strong>Channel bandwidth</strong></td>
<td>6/7/8 MHz</td>
<td>6/7/8 MHz</td>
<td>6/7/8 MHz</td>
</tr>
</tbody>
</table>
## 5.2 Summary of Comparison from Technical Aspect

Based on the differences of transmission system, show the difference of system performances in Comparison table below.

**Table 5-2 Comparison of system performances**

Any improvement of digital receiver was not considered to make the table below.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>System conform to requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum bit rate under Gaussian noise environment</td>
<td>ATSC</td>
</tr>
<tr>
<td>Robustness against multi-path distortion</td>
<td>ISDB-T &gt;&gt; DVB-T (note1)</td>
</tr>
<tr>
<td>Robustness against impulse noise</td>
<td>ISDB-T</td>
</tr>
<tr>
<td>Wide area single frequency network (SFN) operation</td>
<td>DVB-T, ISDB-T</td>
</tr>
<tr>
<td>Mobility and Portability</td>
<td>ISDB-T &gt;&gt; DVB-T</td>
</tr>
</tbody>
</table>

(note1) Indoor reception can be available, its reduce reception cost
### 5.2 Summary of Comparison from Technical Aspect-2/2

Table 5-2 Comparison of system performances

Any improvement of digital receiver was not considered to make the table below.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>System conform to requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical transmission (Multiple modulation systems simultaneously in the same channel is possible)</td>
<td>ISDB-T &gt;&gt; DVB-T</td>
</tr>
<tr>
<td>Both portable/fixed reception service by one channel and one transmitter</td>
<td>ISDB-T (note1)</td>
</tr>
<tr>
<td>System commonality with digital terrestrial sound broadcasting (One segment receiver is available)</td>
<td>ISDB-T (note2)</td>
</tr>
</tbody>
</table>

(note1) Save both frequency resource and Infrastructure cost  
(note2) Multi purpose portable receiver is available
5.3 Receiver structure

Figure 5-1. shows the Simplified Block diagram of Digital Terrestrial Receiver.

(1) Tuner block: mainly specified not by system, but by regulation of each countries

(2) Demodulator block: mainly specified by each transmission system

(3) Backend block: mainly specified not by transmission system, but by Service Quality/Performances

Conclusion: As shown above, the most important parameters for receiver cost is not the difference of system, but service Quality/Performances.
5.4 Transmitter structure

Figure 5-2, below, shows the Block diagram of 3 DTTB comparison test system in Chile, 2007.

As shown in figure 5-2, Main difference of each systems is only modulator portion. Therefore, the difference of system does not so affect for equipment cost. The dominant parameters for equipment cost are Output power, performances, composition, etc.

![Block diagram of 3 DTTB system comparison test in Chile](image)

Figure 5-2. Block diagram of 3 DTTB system comparison test in Chile
5.5 Difference of system cost

As described before, both receiver and transmitter hardware cost are not so different for each system. But, system cost for each system are quite different for following cases:

**Case 1: Both fixed/portable reception service**

ISDB-T is the only one system to **enable both service by one transmitter and one frequency**. In addition, only **one transmission network** is necessary for ISDB-T system. On the other hand, DVB system requires different network for fixed and handheld reception service.

**Case 2: Indoor reception service**

As described before, ISDB-T shows the best performances in impulse noise condition (7dB lower), it means that **ISDB-T saves transmitter power** to 1/5 compared to other system in same indoor reception condition.

**ISDB-T is the most economical system**
Comparison test was/has been/is done in some countries for getting the technical base and system design of DTTB system.

We will introduce some examples as a reference.

6.1 Example of Laboratory Test

This test was done in October, 2005 by Mackenzie University in Brazil, the purpose of this test was to compare/evaluate each system under critical condition. As an example, show the reception performance under impulse noise condition in next page.

(note) This test was finished before Brazilian decision
Laboratory test results

Impulse Noise pulse rate=100Hz

![Graph showing C/Neq [dB] vs Pulse Width [μs] for different standards and generations.](image-url)
6.2 Example of Field Test

(1) 3 DTTB Systems Comparison Test in Brazil in 2000

  This test was done by Broadcast engineers and members of Academia. The purpose of this test was to investigate the best system for Brazil on fair position.

(2) Field Test in Chile in 2007

  This test was done in 2007 for evaluating the performances of each systems.
  
  This test was mainly done for fixed reception performances, both outdoor antenna and indoor antenna.

(3) Field Test in Peru in 2007 -2008

  Peru is now on testing of 3 DTTB systems for various point of view.
  Such as, (a)Place( Capital city, Amazon, Andes), Reception style (outdoor, indoor, mobile).

As explained in previous presentation 2, all these test results indicate the priority of ISDB-T, especially indoor, mobile/portable reception.
7. ISDB-T receivers in Japanese market

Fixed Receivers

**PDP TV**
- **VIERA TH-42PZ700SK** - Panasonic
- **Wooo P42-HR01** - HITACHI
- **PDP-A427HX** - Pioneer

**LCD TV**
- **REGZA 42H3000** - TOSHIBA
- **AQUOS LC-42RX1W** - SHARP
- **VIERA TH-20LX70** - Panasonic
- **BRAVIA KDL-40V2500** - SONY
- **LCD-32HR100** - SANYO
- **AQUOS LC-16E1** - SHARP

**SDTV**
- **VIERA TH-15LD70** - Panasonic
- **AQUOS LC-13SX7** - SHARP
## Fixed Receivers (Cont.)

<table>
<thead>
<tr>
<th>HDD/DVD Recorder</th>
<th>Blu-ray</th>
<th>Cable STB</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDZ-D800 SONY</td>
<td>BDZ-V9 SONY</td>
<td>TZ-DCH1800 Panasonic</td>
</tr>
<tr>
<td>VARDIA RD-S600 TOSHIBA</td>
<td>DIGA DMR-BW200 Panasonic</td>
<td></td>
</tr>
<tr>
<td>DIGA DMR-XW51 Panasonic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVR-DV635 MITSUBISHI</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIGA DMR-BW200 Panasonic</td>
<td></td>
</tr>
</tbody>
</table>

For low cost STB, Please listen and watch next presentation!
### Fixed Receivers (Cont.)

#### Desktop PC
- **VALUESTAR S VS770/JG**
  - NEC
  - 20 inch
  - (1680x1050)

- **FMV-DESKPOWER LX70W/D**
  - FUJITSU
  - 20.1 inch
  - (1680x1050)

- **Prius One type W AW37W5U**
  - HITACHI
  - 20.1 inch
  - (1680x1050)

#### Notebook PC (medium-large size)
- **LaVie L LL970/HG**
  - NEC
  - 15.4 inch
  - (1280x800)

- **FMV-BIBLO NX95W/D**
  - FUJITSU
  - 17 inch
  - (1440x900)

- **Qosmio G40/95C**
  - TOSHIBA
  - 17 inch
  - (1920x1200)
In-car Receivers

Navigation System
Full-Seg/One-Seg

- Strada CN-HDS965TD
  Panasonic
  All-in-one model

- AVIC-VH099G
  Pioneer
  Tuner separated model

Portable Navigation Device
One-Seg Only

- Mini GORILLA NV-SD10DT
  SANYO

One-Seg Only
※Full-Seg is Optional

- HS706D-A
  NISSAN/SANYO

- GORILLA NV-HD830DT
  SANYO

In-Car TV
One-Seg Only

- CAV-TD85D1
  SANYO
Portable Receivers

Cell Phone One-Seg Only

W51SA

P903iTV

911SH

W52T

D903iTV

911T

au

NTT DoCoMo

Softbank

14 models are available at the end of May, 2007

4 models are available at the end of May, 2007

3 models are available at the end of May, 2007
■ Portable Receivers (Cont.)
One-Seg Only

**DVD Player**
- DVD-LX87
  - Panasonic
- DVD-HP700ND
  - SANYO

**Laptop**
- VAIO type T
  - SONY

**Adapters (USB, etc.)**
- Many products are on sale.
  - BUFFALO, I・O DATA, etc.

**Audio Player**
- gigabeat V30E
  - TOSHIBA

**Dictionary**
- Papyrus PW-TC900
  - SHARP

**Portable TV**
- XDV-100
  - SONY
8. Examples of ISDB-T Transmitter

(1) High power digital transmitter (Toshiba)

(a) Frequency band: UHF

(b) Output power: 15 kW
    \( (7.5 \text{ kW} \times 2) \)

(c) Cooling system: water
(2) Middle power digital transmitter (Toshiba)

(a) Frequency band: UHF

(b) Output power range: see table below

<table>
<thead>
<tr>
<th>Model</th>
<th>Number of PA</th>
<th>Output power (Max)</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(kg)</td>
<td>Width (mm)</td>
</tr>
<tr>
<td>TDU8024F#X</td>
<td>2</td>
<td>0.5kW</td>
<td>325</td>
</tr>
<tr>
<td>TDU8034F#X</td>
<td>3</td>
<td>0.8kW</td>
<td>350</td>
</tr>
<tr>
<td>TDU8044F#X</td>
<td>4</td>
<td>1.0kW</td>
<td>380</td>
</tr>
</tbody>
</table>

(c) Cooling system: air
9. Others

9.1 IPR Policy for ISDB-T system

ARIB announced to other countries which are considering to adopt ISDB-T system.

**COMMITMENT ON THE INDUSTRIAL PROPERTY RIGHTS**

Attached to this letter is the list of patents which are reported to ARIB and the reporter considers that the listed patents are essential to ARIB Standards B10, B21, B24 and/or B31. The attached list also contains countries of application for each patent. There are no patents that are applied or granted with regard to Argentina in the list. Therefore, as far as ARIB knows, ARIB thinks that no payments will be due by the essential patents in Argentina.

For Philippines, same policy will be adopted
November 10, 2008

Sr. Carlos Lisandro SALAS
Secretary of Communications
Government of Argentine Republic

Dear Sr. Carlos Lisandro SALAS,

I am pleased to advise you of the following commitment on the industrial property rights offered by the Japanese side, which will be valid in case the Government of Argentina selects ISDB-T as the Argentine standard for digital television.

COMMITMENT ON THE INDUSTRIAL PROPERTY RIGHTS
Attached to this letter is the list of patents which are reported to ARIB and the reporter considers that the listed patents are essential to ARIB Standards B10, B21, B24 and/or B31. The attached list also contains countries of application for each patent. There are no patents that are applied or granted with regard to Argentina in the list. Therefore, as far as ARIB knows, ARIB thinks that no payments will be due by the essential patents in Argentina.

Sincerely yours,

[Signature]

Yasuo Takeda
Chairperson
Digital Broadcasting Experts Group
9.2 About DVB-T2

(a) What is DVB-T2? How about the compatibility with DVB-T?

(1) Purpose: extend payload, improve required C/N

(2) Relation between DVB-T: **DVB-T2 is not designed to replace DVB-T; rather the two standards will coexist in many markets for many years.** (quoted from DVB fact sheet)

<table>
<thead>
<tr>
<th></th>
<th>DVB-T</th>
<th>DVB-T2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEC</strong></td>
<td>Convolutional Coding + Reed Solomon 1/2, 2/3, 3/4, 5/6, 7/8</td>
<td>LPDC + BCH 1/2, 3/5, 2/3, 3/4, 4/5, 5/6</td>
</tr>
<tr>
<td><strong>Modes</strong></td>
<td>QPSK, 16QAM, 64QAM</td>
<td>QPSK, 16QAM, 64QAM, 256QAM</td>
</tr>
<tr>
<td><strong>Guard Interval</strong></td>
<td>1/4, 1/8, 1/16, 1/32</td>
<td>1/4, 19/256, 1/8, 19/128, 1/16, 1/32, 1/128</td>
</tr>
<tr>
<td><strong>FFT size</strong></td>
<td>2k, 8k</td>
<td>1k, 2k, 4k, 8k, 16k, 32k</td>
</tr>
<tr>
<td><strong>Scattered Pilots</strong></td>
<td>8% of total</td>
<td>1%, 2%, 4%, 8% of total</td>
</tr>
<tr>
<td><strong>Continual Pilots</strong></td>
<td>2.6% of total</td>
<td>0.35% of total</td>
</tr>
</tbody>
</table>

Described in above table, DVB-T2 adopts quite different transmission system from DVB-T.

**DVB-T2 has no compatibility with DVB-T system**
(b) How about the schedule?

(1) Standardization: The DVB-T2 specification was approved by the DVB Steering Board at the end of June 2008.

(2) First prototype: ?

(3) Commercial model: ? (which countries? The first country to deploy DVB-T2 is likely to be the UK)

When commercial type DVB-T2 receiver will be provided? And How much?

(c) How co-exist (or co-work) with other DVB-T system?

(1) Australia has already started HDTV service in 7 MHz DVB-T.

(2) France is now considering to shift to HDTV by MPEG-4

How co-exist or harmonize the service/hardware?
10. Conclusion

• ISDB-T was born from high level requirement
  -High quality/service flexibility, Robustness, Resource saving, etc

• ISDB-T Transmission system
  -Segmented OFDM Transmission System, It enable hierarchical transmission service, stable mobile/portable reception and indoor reception

• One-seg is the unique and attractive service of ISDB-T

• Receiver and transmitter structure is not so different
  -the difference of hardware cost is affected from Quality/Performances, not affected from system difference

• But, ISDB-T is the most economical system
  -Save both frequency and transmitter for fixed/portable reception service, and show best performances under urban noise condition.
Thank you for your attention!

Salamat po!

Yasuo TAKAHASHI
ARIB-DiBEG

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mail: info@dibeg.org