Digital Terrestrial Television

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Agenda

- Digital Terrestrial Television
- Digitalization of Broadcasting
- ISDB-T
- One-segment Broadcasting
- Digital Terrestrial Television in Japan
- Standard in Each Country
Digital Terrestrial Television

- Analog Television
  - Standard: NTSC
  - Frequency Band: VHF • UHF

- Digital Terrestrial Television
  - Standard: ISDB-T (Japan)  
    DVB (Europe) etc…
  - Frequency Band: UHF (470MHz ~ 770MHz)
Digitalization of Broadcasting

- Data is transmitted by digital information.
  - Good and stabilized reception
    - With no ghost image
  - High quality of image and sound
  - Efficient use of frequency
    - Broadcast by many channels
  - High functionality
    - Data broadcasting, Interactive functions
    - Service for mobile phone
  - Transmission delay
    - Result from compression and coding of a digital signal
# ISDB-T

- ISDB-T: a Japanese standard for digital terrestrial television

<table>
<thead>
<tr>
<th>Transmission Parameter of ISDB-T</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modulation</strong></td>
<td>13 Segments BST-OFDM</td>
</tr>
<tr>
<td>Carrier Modulation</td>
<td>64QAM, 16QAM, QPSK, DQPSK</td>
</tr>
<tr>
<td>Error correction coding</td>
<td>Outer: R-S (204, 488), Inner: Convolutional Coding (1/2, 2/3, 3/4, 5/6, 7/8)</td>
</tr>
<tr>
<td>Guard Interval</td>
<td>1/4, 1/8, 1/16, 1/32</td>
</tr>
<tr>
<td>Transmission band width</td>
<td>5.57MHz</td>
</tr>
<tr>
<td>Number of Symbols</td>
<td>204 Symbols/frame</td>
</tr>
<tr>
<td>Transmission Bit Rate</td>
<td>3.651～23.234Mbps</td>
</tr>
<tr>
<td>Video Coding</td>
<td>MPEG-2 Video</td>
</tr>
<tr>
<td>Audio Coding</td>
<td>MPEG-2 Audio AAC</td>
</tr>
</tbody>
</table>
Orthogonal Frequency Division Multiplexing (OFDM)

- Data is modulated by the orthogonal subcarriers.
- High carrier density ⇒ Improvement of the usability of the frequency band

Spectrum of OFDM signal

Time signal of OFDM signal
Segment

- In the ISDB-T, an OFDM symbol is divided into the 13 segments.
  - Assigning a different number of segments according to service
  - Using different transmission parameters for every segment
- Many channels and services are transmitted by a symbol.
There are the 3 mode according to the number of carriers.

- Mode 1: For mobile reception
- Mode 3: For fixed reception
- Presently, the mode 3 is used.

Parameter of each mode

<table>
<thead>
<tr>
<th></th>
<th>Mode 1</th>
<th>Mode 2</th>
<th>Mode 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of carriers</td>
<td>1405</td>
<td>2809</td>
<td>5617</td>
</tr>
<tr>
<td>Carrier Interval</td>
<td>3.968kHz</td>
<td>1.984kHz</td>
<td>0.992kHz</td>
</tr>
<tr>
<td>Symbol Length</td>
<td>252µs</td>
<td>504µs</td>
<td>1008µs</td>
</tr>
</tbody>
</table>
One-segment Broadcasting

- Service for a mobile phone and an in-car TV set
- Transmission system of One-segment broadcasting
  - Using a central segment of among 13 segments
  - Using a transmission parameter strong against an error
    - Low coding rate, a long guard interval
  - Restrictive image and sound quality

Segment composition of digital terrestrial television
Digital Terrestrial Television in Japan

In Japan

- The ISDB standard which NHK took the lead and developed is adopted.
- A broadcast was started in urban areas from December 1, 2003.  
  ⇒ A broadcast area is expanded.
- Analog television will stop broadcasting by July 24, 2011, and terrestrial television shifts thoroughly to digital terrestrial television.
Diffusion of Digital Terrestrial Television in Japan

- Household cover rate in Japan: 97% (March, 2009)

Viewing-and-listening propriety of digital terrestrial television in Japan

『地上デジタルテレビ放送に関する浸透度調査』平成21年5月総務省情報流通行政局
Standard in Each Country

The standard adoption situation of each country

Wikipedia『Digital Video Broadcasting』
Share Competition of Standards

- **DVB-T**
  - Adopted in Europe, Australia and India
  - Most diffused standard

- **ATSC**
  - Adopted in North America.
  - In the United States⇒ Already shifted thoroughly to digital terrestrial television on June 12, 2009.

- **ISDB-T**
  - Adopted in Japan and South America, such as Brazil.
  - Receiving performance is better than DVB-T.
  - Compared with other standards, diffusion is behind.

It is important to make it spread more and to expand the market of Japanese television allied products.
Reference

- 日本放送協会編
  NHKデジタルテレビ教科書（NHK出版、2007）

- 総務省 地上デジタルテレビ放送のご案内

- ボクにもわかる地上デジタル
  http://www.geocities.jp/bokunimowakaru/

- 地上デジタルテレビジョン放送の伝送方式 標準規格
Thank you for your attention.