Digital Multimedia Broadcasting

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I Introduction of DMB
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1. Definition

- Provides video and data services as well as CD-quality audio service
- AV and data standard extension of Digital Audio Broadcasting (DAB)
- Fully backward compatible with Eureka-147

Diagram:
- DMB Transmitter
- Distribution Network
- Radio Studio
- TV Studio
- Additional info provider
- Mobile Terminal
- Fixed receiver
- GPS
### 2. Characteristics of T-DMB

**Personal**
- Personal services using individual receiver
  - Mobile phone, PDA, Notebook PC, DMB receiver

**Mobile**
- Seamless reception of broadcasting contents
  - Any time, anywhere
  - Good reception at the speed of 150 km/h

**Interactive**
- Bidirectional services linked with mobile communication network
  - PPV, on-line shopping, internet services

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**Personal Mobile Interactive Multimedia Broadcasting Service**

### 3. Available Multimedia Service

**Audio only service**
- Stereo(CD-like)

**Video service**
- Video : VCD quality(7” LCD)
- Audio : Stereo(FM-like)
- Program related Data

**Data service**
- Electronic Program Guide
- Headline news, Weather, Stocks
- Traffic, Navigation
- Slide show, Broadcasting Web Service, etc.
4. System Structure

DAB system + Multimedia Processor = DMB

5. Transmission Parameters

<table>
<thead>
<tr>
<th>Signal</th>
<th>COFDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>DQPSK</td>
</tr>
<tr>
<td>Channel Coding</td>
<td>Convolution: variable rate, constraint length = 7</td>
</tr>
<tr>
<td>Time Interleaving</td>
<td>Ms</td>
</tr>
<tr>
<td>Frequency Interleaving</td>
<td>MHz</td>
</tr>
<tr>
<td>System Bandwidth</td>
<td>MHz</td>
</tr>
<tr>
<td>Effective Data Rate</td>
<td>Mbps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Band</td>
<td>GHz</td>
<td>&lt; 0.375</td>
<td>&lt; 1.5</td>
<td>&lt; 3</td>
</tr>
<tr>
<td>Sub carriers</td>
<td>MHz</td>
<td>1,536</td>
<td>384</td>
<td>192</td>
</tr>
<tr>
<td>Sub carrier interval</td>
<td>kHz</td>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Guard interval</td>
<td>us</td>
<td>246</td>
<td>62</td>
<td>31</td>
</tr>
<tr>
<td>Symbol length</td>
<td>us</td>
<td>1,000</td>
<td>250</td>
<td>125</td>
</tr>
<tr>
<td>Frame length</td>
<td>ms</td>
<td>96</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

※ COFDM : Coded Orthogonal Frequency Division Multiplexing
※ DQPSK : Differential QPSK
6. Spectrum Utilization

Usable Spectrum for T-DMB
- VHF Band-III (TV ch-7~ch13, 174~216MHz)
- L-band (1452~1492MHz)

Example: Ch.12 in Korea

MBC  KBS  SBS
204MHz  210MHz

1 TV Channel (6MHz)

Effective Data Rate 1.152Mbps

7. Technologies for T-DMB

A/V Encoding
- MPEG-4 Part 10 AVC(H.264) and BSAC/AAC
  - Increase Frequency Usage Efficiency

Interactive Data
- MPEG-4 System core2D Profile(BIFS)
  - Video Program associated Data Service

Error Correction
- RS-Coding, Convolutional Interleaving
  - High Quality in Audio/Video

Transmission
- OFDM (Orthogonal Frequency Division Multiplexing)
  - Good service quality in high speed moving vehicle

MPEG-4 Video
- MPEG-4 BSAC/AAC Audio
- MPEG-4 BIFS Interactive Contents

MPEG-4 SL Encapsulation

MPEG-2 TS Multiplexing

Forward Error Correction

EU-147 DAB Stream Mode
8. T-DMB Service Category and Standard

<table>
<thead>
<tr>
<th>Type</th>
<th>Quality</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>Near CD quality stereo (BER $10^{-4}$)</td>
<td>MUSICAM (MPEG-1,2, layer 2)</td>
</tr>
<tr>
<td>Video</td>
<td>7” display</td>
<td>MPEG-4 AVC (H.264)</td>
</tr>
<tr>
<td>Data</td>
<td>Many applications</td>
<td>MPEG-4 BIFS</td>
</tr>
<tr>
<td>Multiplex</td>
<td>A/V/D</td>
<td>MPEG-4 SL, TS</td>
</tr>
<tr>
<td>Channel</td>
<td>Mobile, Urban (BER $10^{-8}$)</td>
<td>RS(204, 188), Convolutional Byte interleaver</td>
</tr>
<tr>
<td>Data</td>
<td>EPG, news, weather, stock, traffic information, etc.</td>
<td>PAD, NPAD, TDC, MOT, BWS, IP-tunneling, Slideshow, etc.</td>
</tr>
</tbody>
</table>

※ AVC : Advanced Video Coding, PAD : Program Associated Data, TDC : Transparent Data Channel, ※ BWS : Broadcasting Web Site, BSAC : Bit-sliced Arithmetic Coding, EPG : Electronic Program


<table>
<thead>
<tr>
<th>MCI &amp; SI</th>
<th>TMC EWS</th>
<th>2 Ch</th>
<th>Multi Ch. 5.1</th>
<th>DLS</th>
<th>TDC</th>
<th>MOT</th>
<th>IP Tunneling</th>
<th>TDC</th>
<th>MPEG4 A/V</th>
<th>MPEG4 Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Audio</td>
<td>PAD</td>
<td>NPAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Audio Service</td>
<td>Data Service</td>
<td>Video Service</td>
<td>Packet Mode</td>
<td>Stream Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EWS</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

※ DLS : Dynamic Label Segment, EWS : Emergency Warning System, FIC : Fast Information Channel
※ FIDC : Fast Information Data Channel, IP : Internet Protocol, MCI : Multiplex Configuration Information
※ MOT : Multimedia Object Transfer, MSC : Main Service Channel, NPAD : Non PAD
※ PAD : Program Associated Data, SI : Service Information, TDC : Transparent Data Channel
※ TMC : Traffic Message Channel
1. Commercial Service in Korea

- Launched in Dec. 2005 covering Seoul metropolitan area
- Total Channel: Video 7 Audio 13 Data 8
- Spectrum: VHF Band III (TV channels 8 & 12)
- Spectrum: VHF Band III (TV channels 8 & 12)
2. Nationwide DMB Network

- 13 DMB broadcasters for non-Metropolitan area
- 6 regional broadcasting areas
- Nationwide commercial T-DMB service: mid of 2007

3. Terminal Types

Totally 6.3 million Receivers sold in Korea until the last July

- Cellphone: 39.8%
- Navigation: 43.6%
- PDA, PMP: 8.9%
- Notebook: 6.5%
- Others: 1.2%

Unit: 10,000

<table>
<thead>
<tr>
<th>Terminal Type</th>
<th>Feb. 2007</th>
<th>July 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellphone</td>
<td>134,000</td>
<td>147,000</td>
</tr>
<tr>
<td>Navigation</td>
<td>147,000</td>
<td>128,000</td>
</tr>
<tr>
<td>PDA, PMP</td>
<td>37,000</td>
<td>41,000</td>
</tr>
<tr>
<td>Notebook</td>
<td>7,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Others</td>
<td>25,000</td>
<td>41,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>357,000</strong></td>
<td><strong>357,000</strong></td>
</tr>
</tbody>
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4. Available Terminals

<table>
<thead>
<tr>
<th>Price Range</th>
<th>Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Price</td>
<td>Erantech iufi BLUE, DigitalCube i-STATION, DigitalCube i-STATION V35, Zen Networks LEO V10, New Media Life TAVI, Samsung yepp, Samsung DMB-T750</td>
</tr>
<tr>
<td>Mid Price</td>
<td>Samsung SPH-B2300, P&amp;C PT-K1800, P&amp;C PT-L1800, LG KD-1200, LG SB-100, LG LT-1000</td>
</tr>
<tr>
<td>Low Price</td>
<td>Cobalt Technology DMB STICK-K1, Ceringis CTD-100, UVBro Technology ARTEMIS, MNBT UD-100, Caros KSD-7070S, Perstel DR 402 VK</td>
</tr>
</tbody>
</table>

5. Responses from Users

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch any where</td>
<td>49.0</td>
</tr>
<tr>
<td>Same contents to home TV channel</td>
<td>27.7</td>
</tr>
<tr>
<td>Mobile reception</td>
<td>16.1</td>
</tr>
<tr>
<td>Audio &amp; Video reception with a single device</td>
<td>5.8</td>
</tr>
<tr>
<td>Contents only for DMB</td>
<td>1.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>73.3</td>
</tr>
<tr>
<td>Same contents to home TV channel</td>
<td>11.1</td>
</tr>
<tr>
<td>Contents</td>
<td>6.7</td>
</tr>
<tr>
<td>AV quality</td>
<td>6.7</td>
</tr>
</tbody>
</table>
1. Business Model

- **TV Radio**
  - Free to air
  - Revenue from the Advertisement
  - Fast Creation of Customer Base

- **Data Services (Interactive)**
  - Pay service
  - Flat Rate/Usage Based ( + Comm. Expenses )

- **Revenue**
  - Free Service
  - Market Creation
  - Develop Pay Services

- **Data Service, TTI Cooperate with telco**
2. Business Model

- **Condition**
  - 5 million users

- **Total revenue**
  - 1 Video Channel: US$ 80 million/year
  - 1 Audio Channel: US$ 18 million/year

- **Pay Services**
  - EPG
  - TPEG
  - Location Based Services
    - Shopping
    - Restaurant
  - Weather
  - Stock

- **Added Services**
  - TV-Portal
  - Video/Audio related data services
  - VOD, MOD, Capture
  - Detailed program guide
  - Program community
  - SMS Reply
  - Chatting between audiences
  - Network game/quiz
  - M-Commerce

IV DMB Overseas Launching Status
1. DMB Overseas Launching Status

- **Commercial services:** 3 countries
- **Preparing:** 3 countries
- **Trial Test:** 9 countries

Future Service
1. Future Service : Personalized T-DMB

- Dynamic program guide and contents browsing according to program genre and user preferences
  - ToC (Table of Contents) based browsing in terms of segment units
  - Event/index-based summary and access for news programs
  - Keyword-based segment search

※ Services: Personalized News, Personalized T-Learning, etc.

2. Future Service : Advanced T-DMB

Doubled Data Rate

- 1.062 Mbps → 2 Mbps

1. Multichannel Services
double the number of programs

2. High quality AV service (7” → 15” SD-quality video and 5.1 ch audio)
3. Future Service : 3D T-DMB

- 3D DMB Verification System
  - 3D AV media processors on T-DMB Transmitter/Receiver
  - Features
    - Compatible with the standard T-DMB
    - 2D/3D display selectable

3D DMB verification system

Applications

- 3D Cellular phone
- 3D Portable media player
- 3D Receiver over T-DMB

THANK YOU

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