

Presentation 2

Technical Key features of ISDB-T and Efficient transition to Digital Broadcasting with ISDB-T

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- 1. Technical Key Features of ISDB-T
 - System requirements from broadcasters
 - System performance
 - Results of comparison tests in foreign countries
 - Applications in service
- 2. Efficient Transition to Digital Broadcasting with ISDB-T
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 - Schedule for DTTB
 - Digital transition in Japan with ISDB-T
 - Requirements for future applications





1. Technical Key Features of ISDB-T





System requirements from broadcasters

Key items for consideration of digital terrestrial television

Hi-Definition format in program production

 \rightarrow HD format has become a major format in TV program, movies, video gaming software, etc.

Frequency congestion

 \rightarrow For efficient use of frequency spectrum, capability of Single Frequency Network (SFN) is required.

Interference and fading in various environments

 \rightarrow Tolerance to interference, multi-path signals, fading, etc. is required in various environments.

Mobile reception with portable terminals such as cellular phones

 \rightarrow No extra cost for mobile reception is preferable.

Broadcasting service as a long term business

 \rightarrow No extra cost for future demand from subscribers is preferable.





System Performance

ISDB-T is ...

• One of the DTTB systems in the world

- There are 3 systems recommended in ITU-R BT1306.
 - ISDB-T, DVB-T and ATSC

The most flexible system

 HDTV, multi-SDTV, EPG, data-casting, internetaccess, mobile reception, cellular phone TV, etc.

The most robust system

- OFDM, time-interleaving, and segmentation.
- Brazilian and other countries' comparison test results proved it.





Schedule for Digitalization in Japan







Transmission flexibility in ISDB-T









Service lineup of ISDB-T in Japan

ISDB-T has powerful applications



screen and CD quality sound.

 Local news and weather forecast for viewers at any time.

Offers Interactive service



Transmission service to Mobile accesses 9



Examples of fixed reception service

High Definition Television Program

- ✓The high quality images on a 16x9 wide screen and CDquality sound make you feel as if you were at the theater.
- European broadcasters have opted for "multi-channel" strategy, but Japanese broadcasters have chosen to take advantages of "high definition" pictures.
- HDTV has become a killer application in both terrestrial broadcasting and satellite broadcasting.







Examples of fixed reception service

Multi-cannel SDTV program service

□ISDB-T can transmit multiple SD programs simultaneously on a single digital spectrum of 6 MHz.







Examples of interactive service (Electronic Program Guide)

An Electronic Program Guide (EPG) is an interactive schedule of current and upcoming programs that a viewer can display on-screen simply by pressing a button on his remote control unit.

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Examples of interactive service

(Data BroadcastingNo return link!)

- Data broadcasting is an interactive applications which provide various types of information.
- ISDB-T can provide various types of information without return links such as telephone lines, IP networks.

\rightarrow No additional cost for return link !



Traffic status



Weather forecast



Comparison Tests Results in Peru and Brazil



Comparison Tests on Impulse Noise in Peru



ISDB-T shows superiority in noise robustness.





Mobile Reception Route in Peru





Results of Mobile Reception in Peru

Test site (Total: Six routes)	Receiving antenna: Omni directional antenna TV signals: HDTV			
Route	ISDB-T	DVB-T	ATSC	
1 (A-B)	5 (5)	3	1	
2 (B-C)	1(5)	1	1	
3 (C-D)	<mark>3</mark> (5)	1	1	
4 (D-E)	4(5)	1+	1	
5 (E-F)	4(5)	1+	1	
6 (F-A)	5 (5)	3	1	

Note: 5: Excellent, 4: good, 3:fair, 2: poor, 1: bad (): Car TV (Strada, Panasonic)





- Transmission parameter : almost same bit rate
- ATSC
 - Fixed, 8VSB FEC=2/3

:19,39 Mbit/s

- DVB-T
 - DVB-2K : 64QAM FEC=3/4 GI=1/16 2K :19,75 Mbit/s
- ISDB-T
 - ISDB-4k : 64QAM FEC=3/4 GI=1/16 4K 0.1s :19,33 Mbit/s



Impulse noise Relation between the noise pulse width & interference to signal ratio 30 ISDB-T 25 20 15 (dB) ATSC 10 Better "I"/C 5 0 DVB-T -5 -10 -15 100 200 300 400 0 Pulse width (μ s)

Better performance of the ISDB-T system, by introducing time interleaving

(From the presentation of Brazilian SET/ABERT study group at NAB2000)





(From the presentation of Brazilian SET/ABERT study group at NAB2000)





(From the presentation of Brazilian SET/ABERT study group at NAB2000)



Applications in service - interactive service

(with telecommunication link such as the Internet)

With return links ISDB-T can provide various types of attractive online applications such as portal site, online games, online quizzes, and much more!

→ You can extend your business via return link.



NHK data online portal





Applications in service - Convergence of Broadcasting & Mobile telecommunications

BST-OFDM technology / Features of One-Seg -







Applications in service - Multi-channel service in One-Seg

One-Seg 1

One-Seg 2



例:2008年7月7日(月)

TOKYO MX homepage





2. Efficient transition to Digital Broadcasting with ISDB-T



Preparation for transition to digital broadcasting



Outline of DTTB system





Schedule for DTTB





Schedule for DTTB roll-out in Japan



- Expansion of DTTB coverage (number of households)
 - 2003 25% (12 million) Commencement of DTTB
 - 2004 38% (18 million)
 - 2005 60% (28.4 millión)
 - 2006 84% (39.5 million)

() Commencement in all prefectural capital cities

- 2007 92% (43.3 million)
- 2008 96% (47.8 million)



Challenges on DTTB until 2011 in Japan

 Broadcasters obliged to build DTTB main and relay stations until <u>2010</u>

(NHK: around 2200 stations)

(Commercial broadcasters: around 7000 stations)

- DTTB facilities are top priority for capital investment
- Simulcast
 - Must operate and maintain both analog and digital facilities
 - HD/SD simultaneous production system
 - VTR, Camera, ····
 - Aspect ratio (Conversion between SD and HD)





Digital transition in Japan with ISDB-T





Transmission Network

- Two types of transmission network
 - Broadcast wave relay is the best!
 - However, due to the frequency spectrum congestion in UHF band Microwave: STL, TTL (TS-TTL, IF-TTL) may be the last choice in order to avoid harmful interference





Investment cost reduction with ISDB-T

Key items for adoption ISDB-T

Reduce the number of relay-station

 \rightarrow Only one station is the best. However, some stations are required for coverage area. ISDB-T provides the network plan with long range. **More applications and less facilities**

 \rightarrow For additional mobile applications, no additional transmitter is required.

 \rightarrow For example, share the facilities with analog transmission stations such as buildings, antenna poles can reduce the investment cost.

Broadcasting is Long term business

 \rightarrow The transmitter capable of HD contents delivery and convergence with telecommunications is preferable for future business.

The flexibility is one of the most important points for future business.

Since the one ISDB-T transmitter is enough for both fixed reception and mobile reception, there must be big merit to adopt ISDB-T when there is less difference in the transmitter cost between ISDB-T and DVB-T.





Channel Planning Schedule for DTTB







To Achieve the Channel Plan with ISDB-T

- Effective use of frequency
 - The broadcasting network can be constructed with MFN and SFN.
 - SFN is useful where the available.
- Reduce the number of relay stations
 - Consider the improvement of interference protection ratio in receivers

for example;

- $28dB \rightarrow 26dB$ (Digital to Digital, co-channel)
- $30dB \rightarrow 20dB$ (Analog to Digital, co-channel)

Low required C/N ratio is preferable!



✓ Distorted OFDM carriers from analog fv or fa
✓ Treat as unreliable data in the error decoder



Example of the one transmission station - MMM Coverage of Tokyo Tx-station (NHK)





DTTB

Analog

Example of sharing the transmission antenna pole -



Relay-station in Japan





Software simulation result – in Manila



Indoor antenna: 1.5m height

Coverage: 70% Location probability

•Use ABS-CBN analogue tower: 600feet

- •ERP=70kW(power:10kW)
- •antenna pattern: omni

 topographic data: plane ground

channel: 19ch(500-506MHz)

•urban attenuation: nonconsideration

•Emed: 72.8dB *µ* V/m

One High power station and a few relay stations may cover the area.





Requirements for future digital applications - Trial in NHK with ISDB-T -





-Connected One-Seg Re-transmission System (R&D)

- •NHK developed a "connected One-Seg re-transmission system" that extracts One-Seg signals from the digital terrestrial broadcast-waves received from individual broadcasters and combines them into a single signal for re-transmission over a channel that is different from any of the receiving channels.
- A maximum of thirteen One-Seg signals can be re-transmitted. It will be possible to offer community broadcasting localized to a particular area for re-transmission, in addition to One-Seg services from every broadcaster.







- Automatic Activation of One-Seg Receivers by EWS -

- •The EWS (Emergency Warning broadcast System) automatically activates receivers when a disaster happens, such as an earthquake or Tsunami.
- •NHK developed EWS compatible adaptor that can be connected to a One-Seg receiver.
- •The low power consumption achieved by performing intermittent reception of the One-Seg activation flag, which is transmitted approximately every 0.2 seconds, showed the prospect of continuous standby operation for about two weeks without recharging.
- Among the 432 carriers used for One-Seg service, four carriers transmit the activation flag for emergency warning broadcasting. Increasing this to all four carriers, from the previously used two carriers that transmitted the activation flag signal, improved reception sensitivity without increasing power consumption.
- •NHK will work toward the actual implementation of One-Seg and radio receiver with the EWS reception function.



Prototype of EWS adaptor







Thank you for your attention ! Salamat po!

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