Introduction of ISDB-T

~The latest information and technology~

29, October, 2008 CAPER Buenos Aires, Argentina

Osamu Yamada, Masayuki Takada Pioneer NHK Science & T

Masayuki Takada NHK Science & Technical Research Laboratories

1. Situation of ISDB-T in Japan

Implementation Schedule of ISDB-T in Japan



Estimation of the Number of Digital Broadcasting Receivers in Japan



Penetration of Fixed receivers and Mobile TV Phones

*More than 70Millions have been sold so far.



Cellular Phones with One-Seg



In-car TV Receivers



PCs with ISDB-T tuner (One-Seg)



USB Type ISDB-T Tuners for One-Seg



Portable DVD Player with ISDB-T tuner (One-Seg)



Other Portable One-Seg Receivers



Portable Audio Player



Portable Electronic Dictionary



Portable Navigator



Portable TV

Manufactures of Portable One-Seg Receivers

Mobile Phone	Car Navigation	PC Tuner	Audio/DVD Player	TV/Radio	Video Game
Toshiba	Panasonic	Logitech	Sony	Sanyo	Nintendo
Sharp	Fujitsu	Buffalo	Toshiba	Evergreen	Sony
Hitachi	Sanyo	Greenhouse	Panasonic	Sony	
Panasonic	Pioneer	Sanwa	Toshiba	Logitech	
Sony	Kenwood	IO-Data	Sanyo		
Kyocera	Clarion	Korega			
NEC	Mitsubishi	Pixela			
Fujitsu		RockridgeSound			
Sanyo					
Casio					

2. System Requirements and Technologies of ISDB-T

Features of ISDB-T ~Requirements and Key Technologies ~

The system requirement was formally approved at the meeting of Technical Communication Council in 1994.

- (1) System flexibility : Segmentation, Hierarchical transmission
- (2) Robustness against impulse noise and multi-path interference : BST-OFDM, Time interleaving
- (3) Mobile reception : BST-OFDM, Time interleaving,
- (4) Portable reception : BST-OFDM, Time interleaving, One seg(partial reception)
- (5) Effective frequency usage : **SFN**
- (6) Compatibility with digital radio services : Segmentation



OFDM Signals



OFDM was presented by Mr. Hirosaki(NEC) for the first in the world. OFDM is

- Multi-carrier modulation
 - More than 2,000 carriers in a 6MHz TV channel
 - Long symbol duration compare to single-carrier transmission system
- Multipath proof modulation -by adding guard interval
- Modulation/demodulation
 can be processed by

Superiority of OFDM



22 Segmentation

System for Mobile and Portable Reception ~Segmentation~



Services of ISDB-T





Transmission Parameters

Mode		Mode 1 (Mobile)	Mode 2 (Mobile, Fixed)	Mode 3 (Fixed)		
Number of carrier		1405	2809	4992		
Carrier distance		3.968kHz	1.984kHz	0.992kHz		
Valid symbol length		0.252ms	0.504ms	1.008ms		
Guard interval length		1/4, 1/8, 1/16, 1/32 of valid symbol length				
Error correction	inner coding	Convolution coding (1/2, 2/3, 3/4, 5/6, 7/8)				
	outer coding	Reed-Solomon (208, 188)				
Time domain interleave		Convolution 0, 0.1, 0.2, 0.4 second				
BST-OFDM Segment		13				
Hierarchical transmission		3				
Bit rate		3.65 – 23.23 Mbps				

2.3 Hierarchical Transmission

Information Bit-rate v.s. C/N



2.4 Time Interleaving and Mobile Reception

Impulse Noise to Analog TV



Comparative Test in Peru Test against Impulse Noises from Hair Dryer



Effect of Time Interleaving (1)



Why Mobile and Portable Reception

- (1) All kind of TV programs including data services can be received at home in the future, via satellite, cable, internet, etc..
- (2) People's outside life times are increasing in the present-day life.
- (3) Broadcasters have to serve anytime for such people including video, audio, and data.
- (4) Especially, the emergency information services are very important for people.
- (5) VHF and UHF band frequencies used by broadcasters, are the best for mobile and portable reception.
- (6) In the age of the convergence of broadcasting and communication, Broadcasters can't survive without mobile and portable services.

Field Trials of Mobile Reception TV for the First Time in the World (1993)



Comparison between Digital(OFDM) and Analog Broadcasting



OFDM

Analog

Effect of Time Interleaving (2)

Result of field trials



2.5 SFN(Single Frequency Network)

Reception in SFN



Extended Equalization Range





Conclusion

- (1) The Japanese terrestrial digital broadcasting (ISDB-T) had been developed based on a series of experiences in developing TELETEXT and FM multiplex broadcasting systems.
- (2) ISDB-T has a lot of merits, system flexibility, mobile and portable reception, SFN, robustness against any interferences etc. which other systems don't have.
- (3) In Japan, ISDB-T receivers have been penetrating fastest in the world, and the price is going down rapidly.
- (4) Brazil decided to adopt ISDB-T as their national system in 2006 on the results of comparison of three systems, and started it in 2007.
- (5) Only ISDB-T can satisfy the need of all people, and contribute to the improvement of the life of all people.

ISDB-T is the best.

Once Again

Since the radio frequencies are the common resources for people, we have to use them usefully.

The most effective usage for VHF and UHF is for not fixed but mobile and portable broadcasting.

Once we have decided the DTTB system as a national broadcasting standard, we can't change them anymore. Other two groups have been continuing to improve their performances.

We should select the best system for descendants not to regret and not to accused of it later.

Broadcasters are facing on the important time if the services can be extended.

We want you in Argentina to use ISDB-T not for us but for you. If you select ISDB-T, we, the Japanese side will do our best for Argentina.

Let's work together towards the future !