ISDB-T: Japanese Digital Terrestrial Television Broadcasting (DTTB)

มาตรฐานการแพร่ภาพโทรทัศน์ระบบดิจิตอลภาคพื้นดินของญี่ปุ่น

18 มิถุนายน 2543

คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

รศ.ดร.ธีรภัทร สงวนกชกร
สำนักวิชาวิศวกรรมและเทคโนโลยี
สถาบันเทคโนโลยีแห่งเอเชีย

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- ISDB-T System Performance in 6,7 and 8 MHz Bandwidth
- ISDB-T Current Situation
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Features of ISDB-T

- **High quality TV (HDTV) and sound or Multi-broadcasting program**
- **Robustness for interferences**
  - OFDM
  - Time and frequency interleaving technology (for Vehicular receivers)
- **Hierarchical transmission up to 3 layers**
  - Modulation, coding rates, length of time interleaving
  - Parameters are sent in TMCC (transmission and multiplexing configuration control) signal
- **Multimedia Services**
  - Data broadcasting: Regional information service
  - Interaction: Quizzes, questionnaires, requests, voting
  - Combined with communication services
- **Inter-operability with Other Broadcasting Media**
  - ISDB-S (for satellite) and ISDB-C (for cable)
- **Partial reception with handheld receivers**
  - Simultaneous with HDTV service
- **Mobile reception with vehicular receivers**
- **SFN (Single Frequency Network) Operation**

Outline of ISDB-T transmission scheme

Item		Contents	ARIB Standards	ITU-R Recommendations
Video coding		MPEG-2 Video (ISO/IEC 13818-2)	STD-B32	BT.1208
Audio coding		MPEG-2 AAC (ISO/IEC 13818-7)	STD-B33	BS.1115
Data broadcasting		BML(XHTML), ECMA Script	STD-B24	BT.1699
Multiplex		MPEG-2 Systems (ISO/IEC 13818-1)	STD-B10, STD-B32	BT.1300, BT.1209
Conditional access		Multi 2	STD-B25	---
Transmission		ISDB-T transmission	STD-B31	BT.1306 System C
Channel Bandwidth		6MHz, 7MHz, 8MHz		
Modulation		Segmented OFDM (13 segment/ch)		
Mode, Guard		Mode: 1, 2, 3 Guard Interval Ratio: 1/4, 1/8, 1/16, 1/32		
Carrier Modulation		QPSK, 16QAM, 64QAM, DQPSK		
Error correction	Inner	Convolutional code (Coding rate: 1/2, 2/3, 3/4, 5/6, 7/8)		
	Outer	(204, 188) Reed-Solomon code		
Interleave		Frequency and Time Interleave Time Interleave : 0 - 0.5 sec		
Information bit rate (depend on parameters)		6MHz : 3.7 - 23.2 Mbit/s 7MHz : 4.3 - 27.1 Mbit/s 8MHz : 4.9 - 31.0 Mbit/s		
Receiver		ISDB-T receiver	STD-B21	---
Operational guideline		ISDB-T broadcasting operation	TR-B14	---

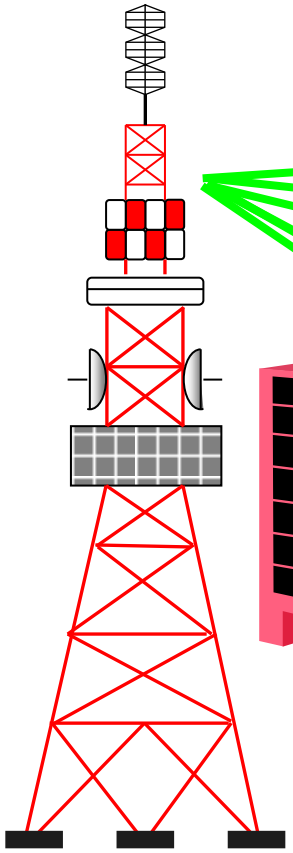
ISDB-T Main Specifications

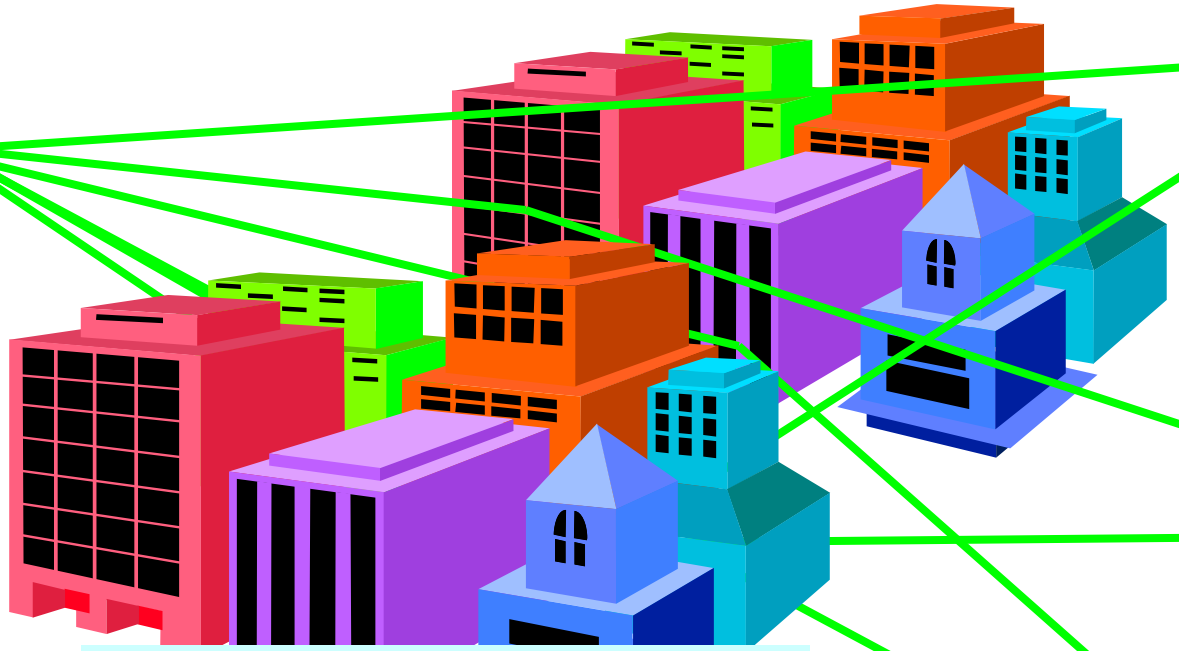
- Hierarchical transmission
  - Transmission segment groups with different transmission parameters
  - Maximum of three layers can be transmitted simultaneously in a channel
  - Possible to select parameters to adjust services such as HDTV, vehicular and so on

ISDB-T in Japanese 6MHz system

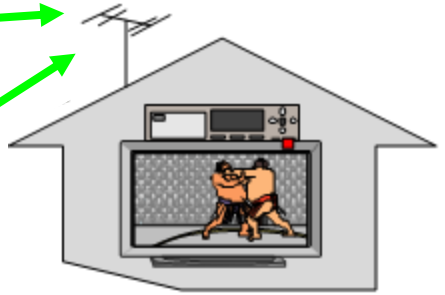
Transmission Parameter	Mode 1	Mode 2	Mode 3
No. of OFDM segments	13		
Bandwidth	5.575 MHz	5.573 MHz	5.572 MHz
Carrier interval	3.968 kHz	1.984 kHz	0.992 kHz
No. of carriers	1405	2809	5617
Carrier modulation	QPSK, 16QAM, 64QAM, DQPSK		
Effective symbol length	252 μs	504 μs	1.008 ms
Guard-interval length	1/4, 1/8, 1/16, 1/32 of effective symbol length		
No. of symbols per frame	204		
Time interleave	Maximum 4 values : 0, 0.1, 0.2, 0.4 sec		
Frequency interleave	Intra-segment and inter-segment interleaving		
Inner code	Convolutional coding (1/2, 2/3, 3/4, 5/6, 7/8)		
Outer code	RS (204, 188)		
Information bit rate	3.65 Mbps - 23.23 Mbps		
Hierarchical transmission	Maximum 3 levels (Layer A, B, and C)		

Receiving environment for terrestrial TV broadcasting

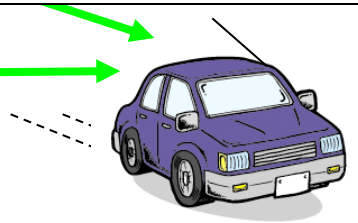




Fixed reception



Vehicular reception



Handheld reception

- Multipath interference
- Fading interference
- Impulse, man-made noise
- Shadowing

Receiving environment is very severe.

Signal degradation due to Multipath

- OFDM Modulated signal

$$s(t) = Ae^{-j2\pi ft}$$

- Multipath signal

$$u(t) = \rho Ae^{-j2\pi f(t-\tau)}$$

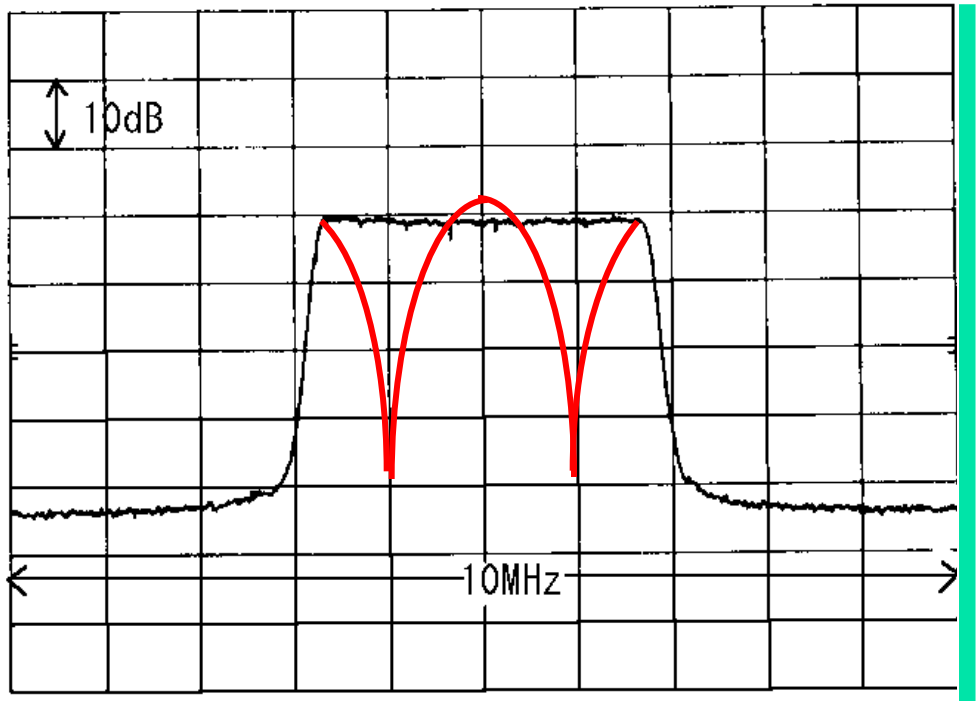
- Received signal

$$s(t)+u(t) = Ae^{-j2\pi ft} + \rho Ae^{-j2\pi f(t-\tau)}$$

$$= Ae^{-j2\pi ft}\left\{1+\rho e^{j2\pi f\tau}\right\}$$

- $2\pi f\tau = 2k\pi \quad (f = k/\tau)$

  amplitude of received signal decreases



Power of specific sub-carrier decreases

Degradation of C/N of specific sub-carrier

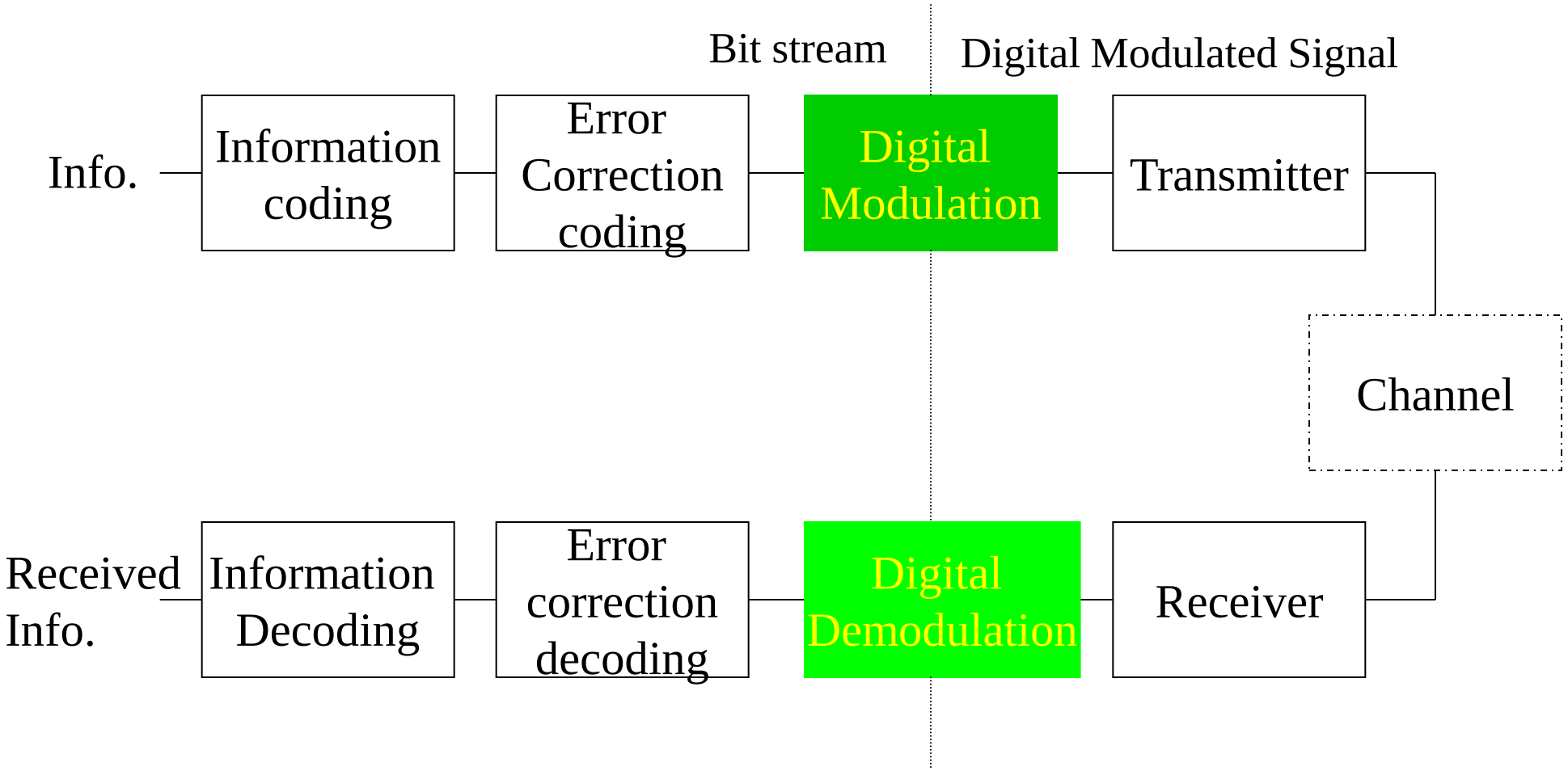
*Official Information: NHK Science and Technology Research labs, Japan

Key technologies for ISDB-T

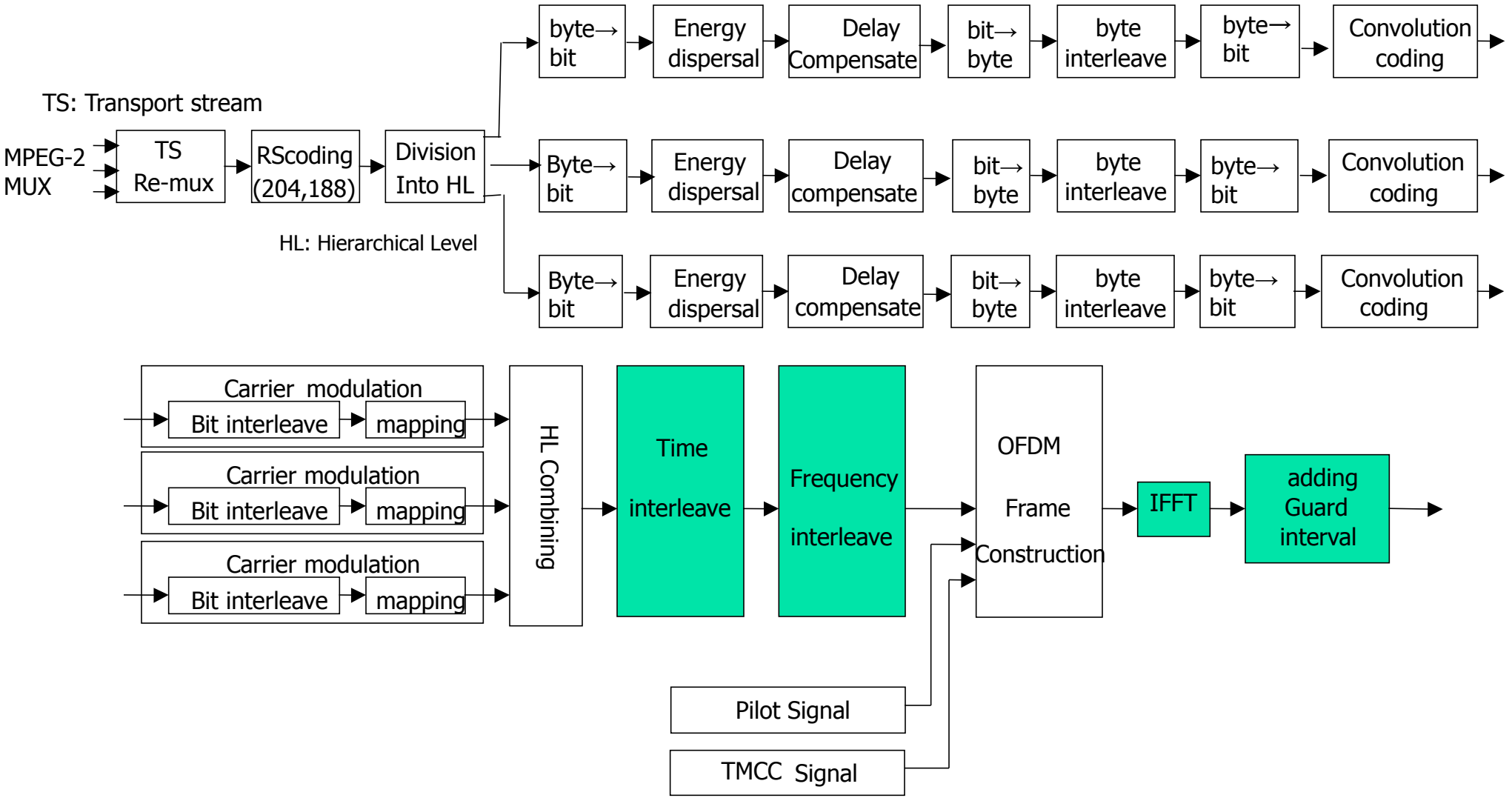
- To overcome the terrestrial severe receiving environment
  - **OFDM**
  - **Frequency & Time-interleaving**

- To realize the effective and smart transmission
  - **Hierarchical transmission** by Band Segmented Transmission OFDM
    - Realization of One-Segment service for handheld reception

Digital Transmission Diagram

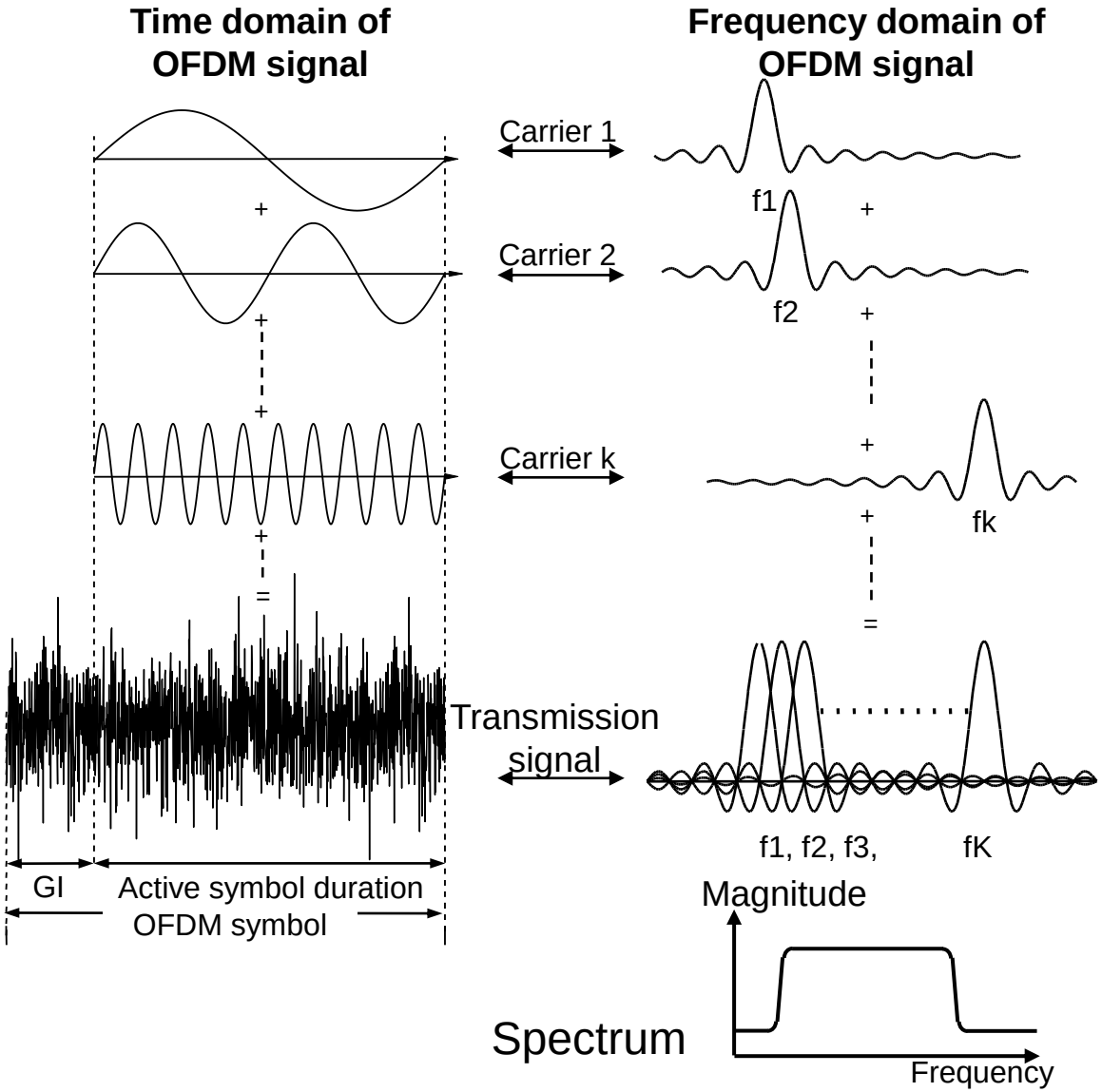


ISDB-T Configuration



*Official Information: ARIB STD-B31 version 1.6

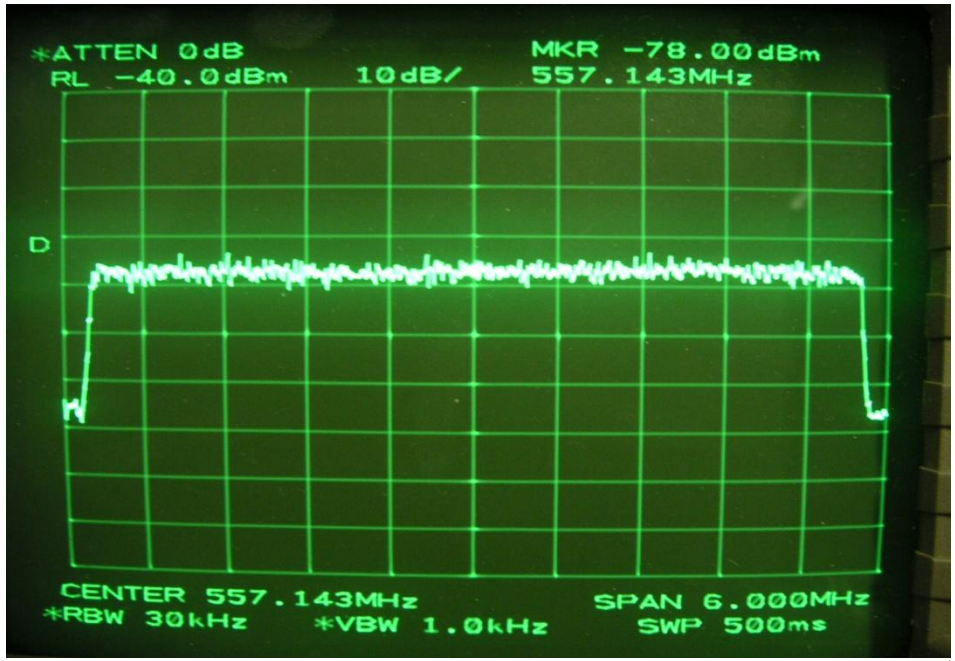
OFDM signal



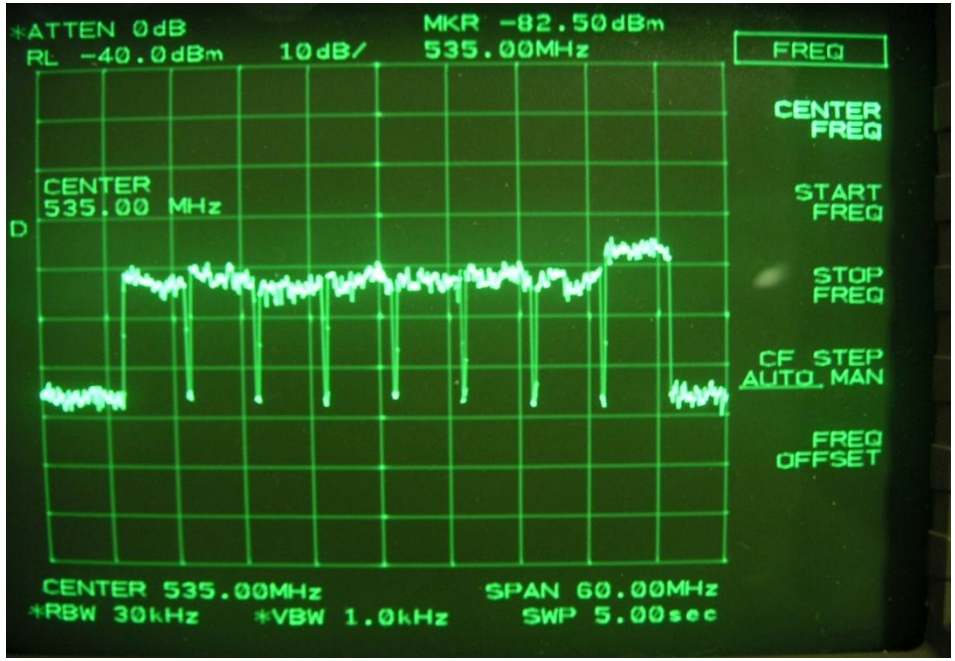
OFDM is

- 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 **IFFT/FFT.**

Example of OFDM Spectrum



UHF 27ch

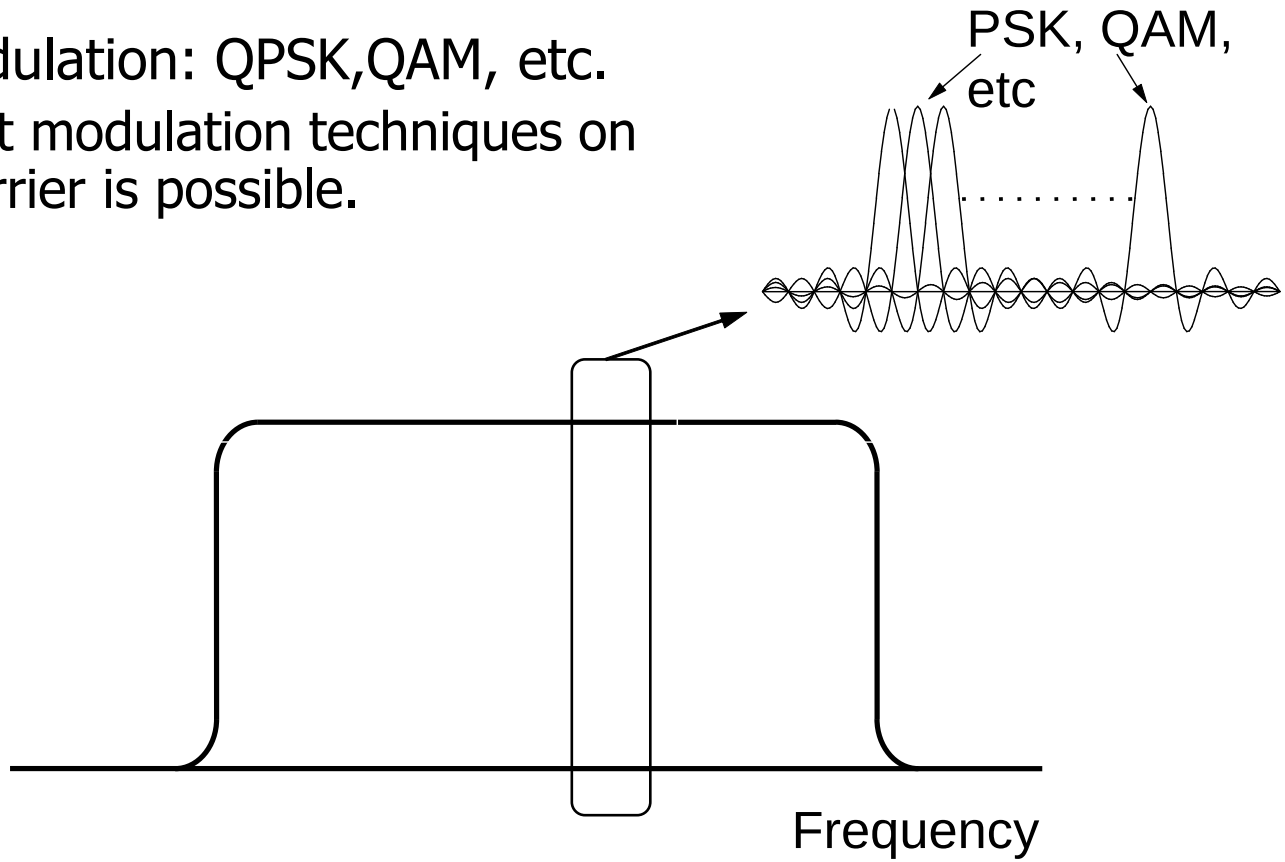


UHF 20~27ch

*Official Information: NHK Science and Technology Research labs, Japan

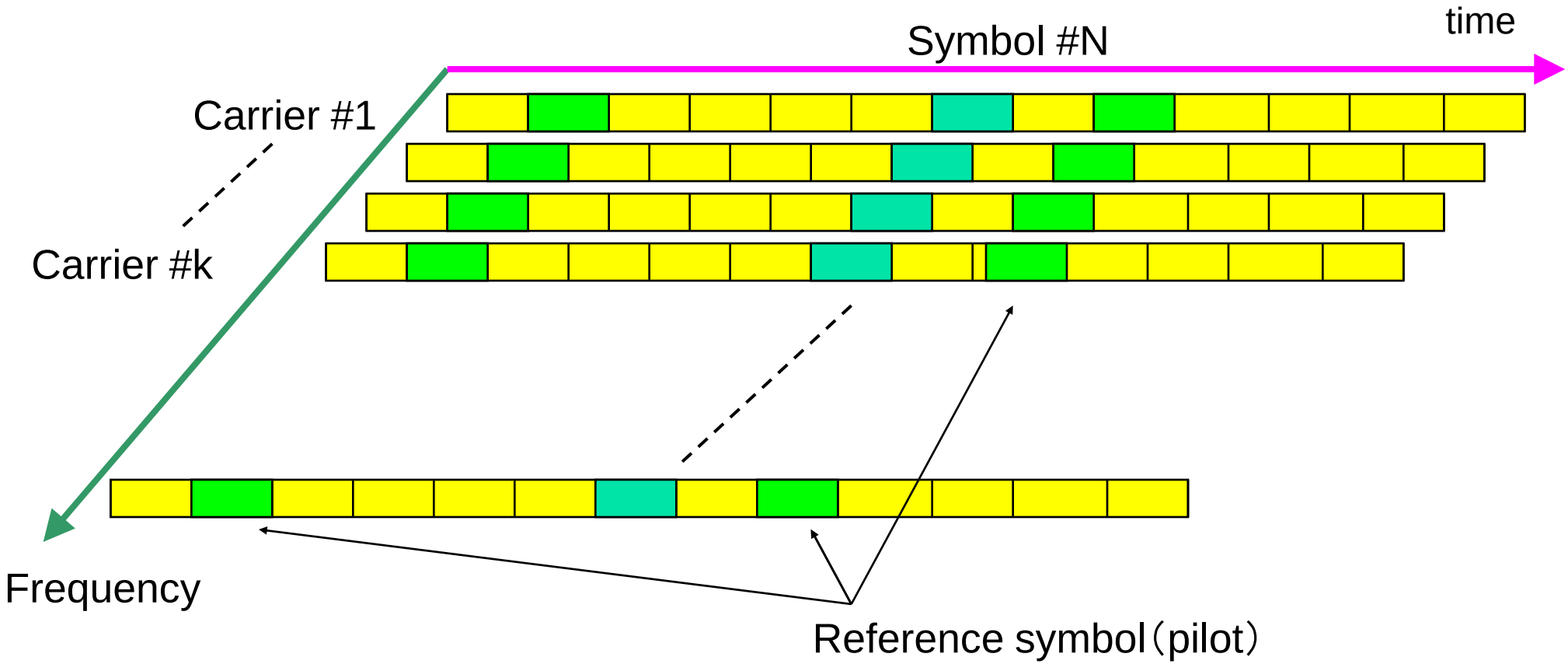
OFDM Signal（Frequency domain）

- Carrier Modulation: QPSK,QAM, etc.
  - Different modulation techniques on each carrier is possible.



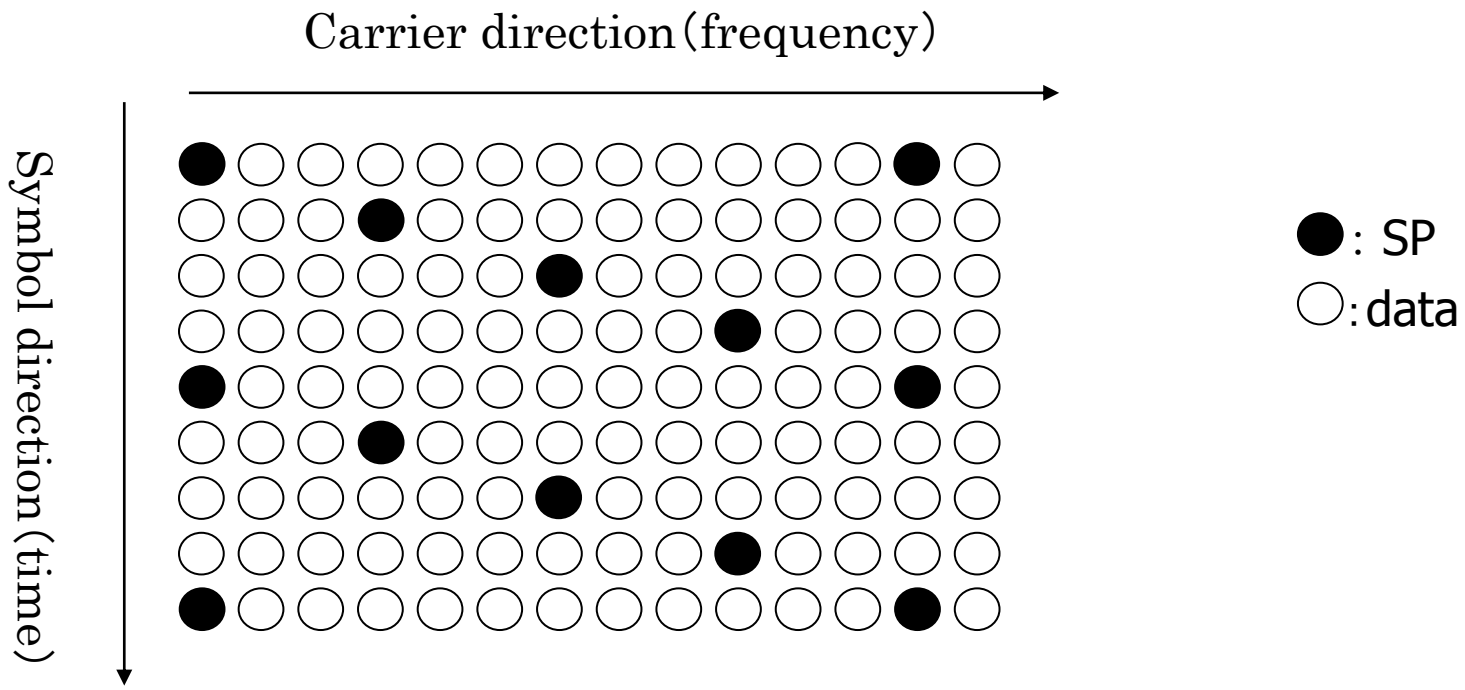
Conceptual Model of OFDM Signal

Relationship between OFDM Carriers and Symbols

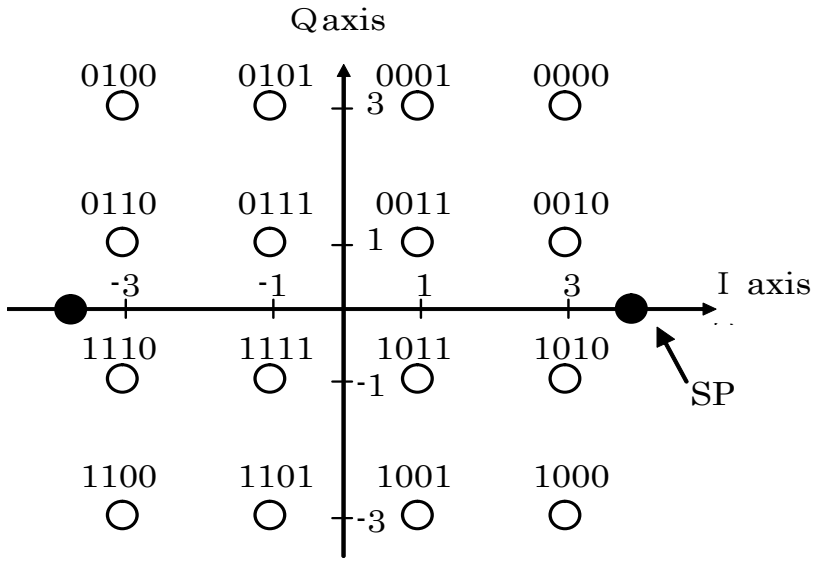


*Official Information: NHK Science and Technology Research labs, Japan

Scattered Pilot(SP)signal

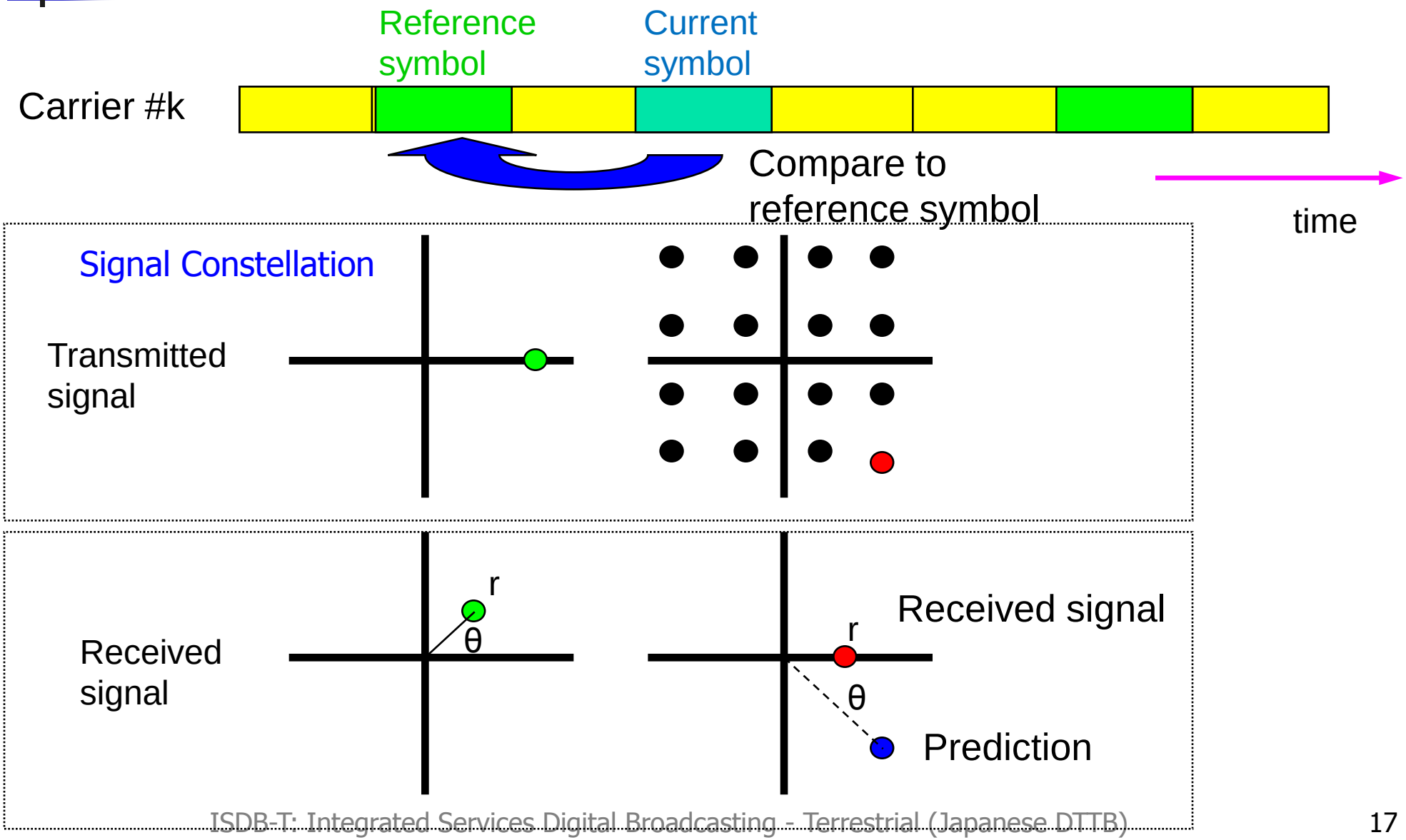


Mapping of Scattered Pilot (SP) signal

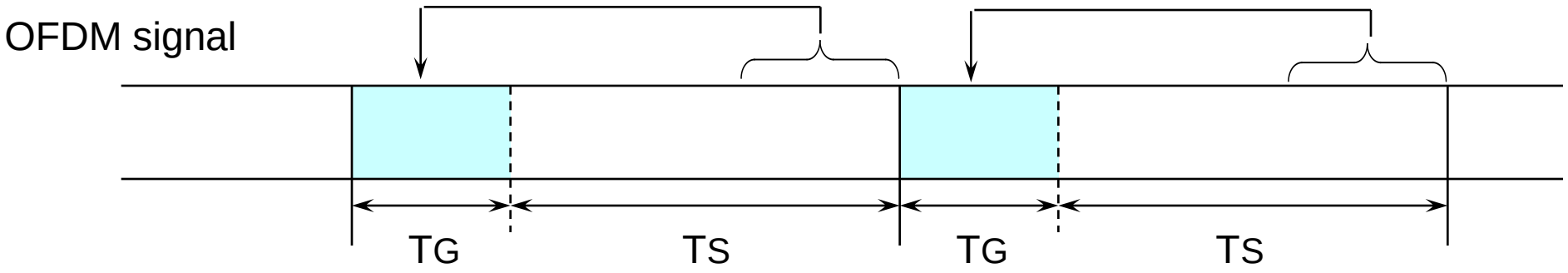


（RMS value16QAM　is√10、while the value of SP　is（+4/3√10、0）or（-4/3√10、0）

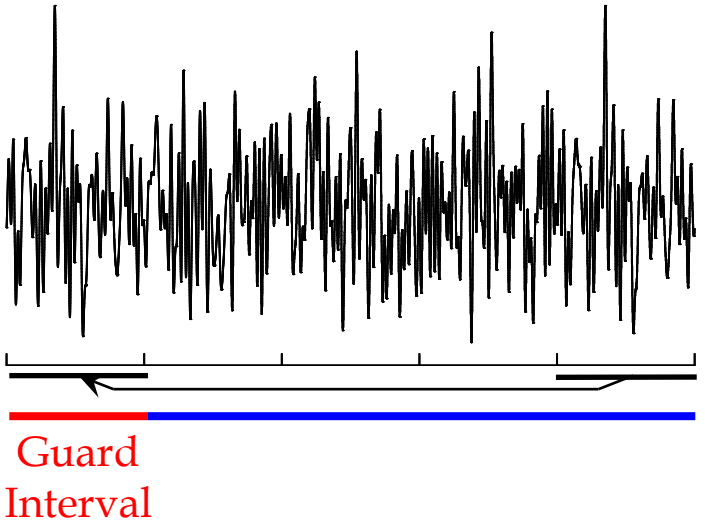
Demodulation of OFDM Signal



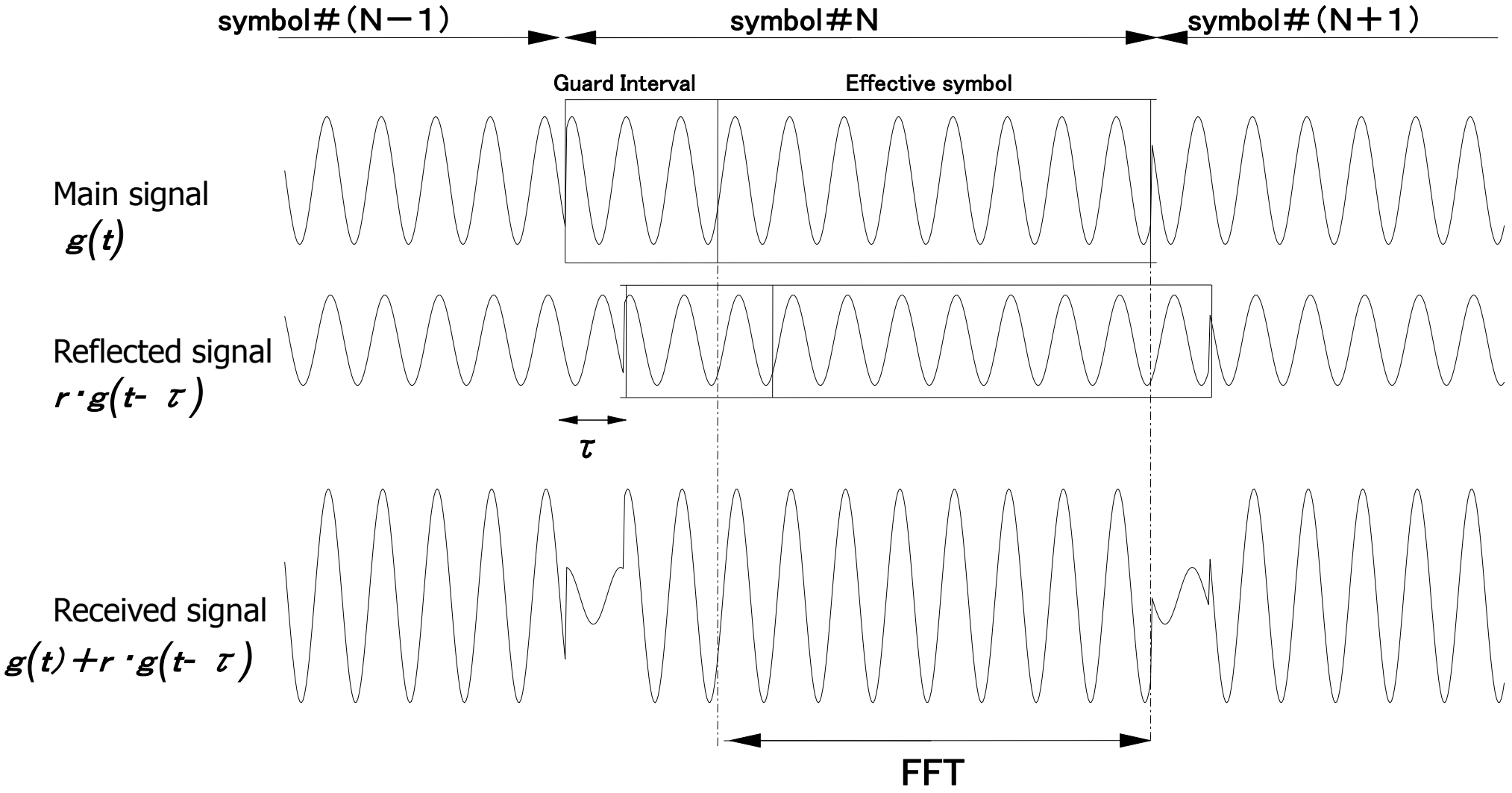
Guard Interval



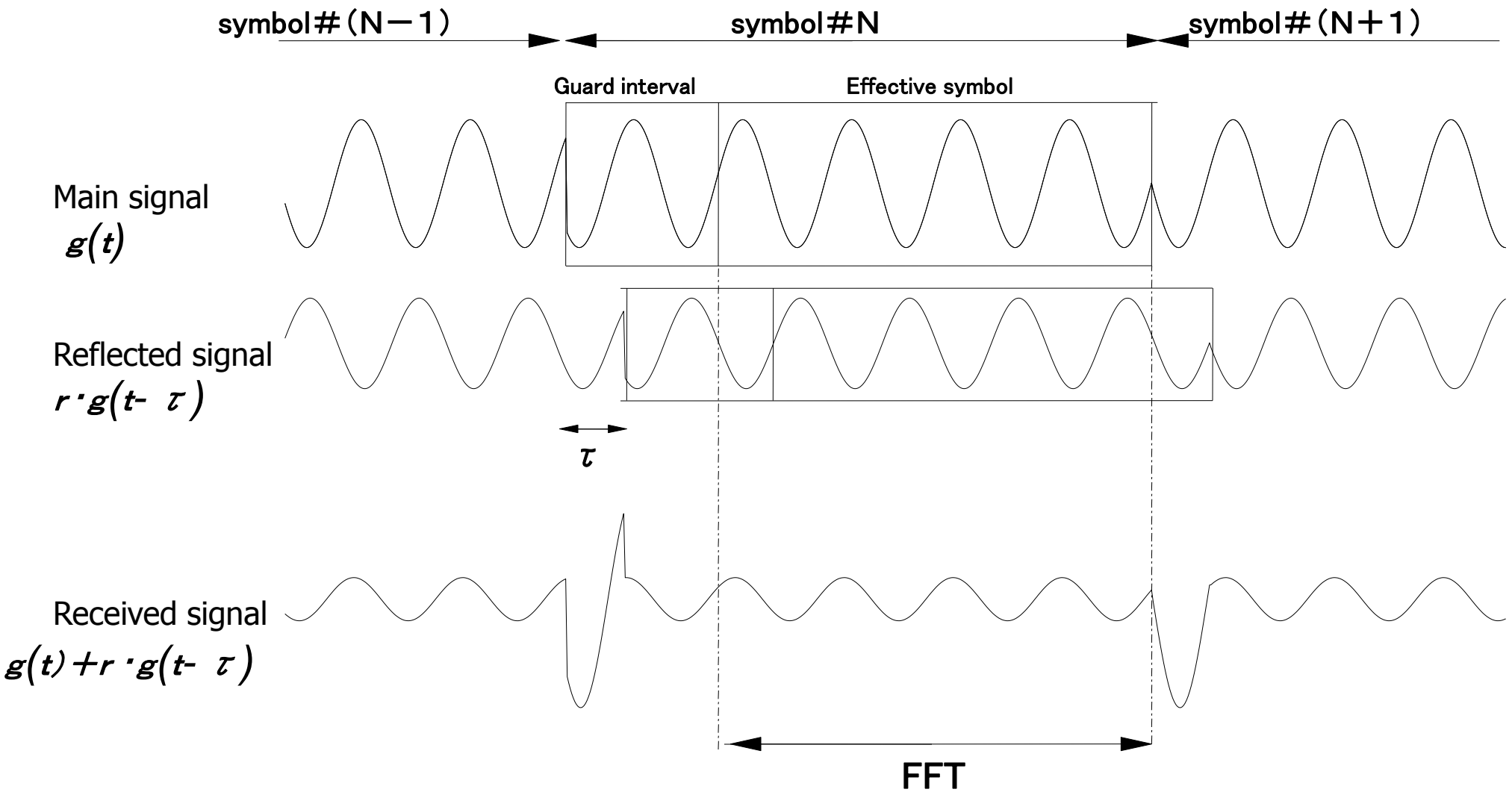
- Copy the last part and add to the front of symbol
- Reduce the effect of multipath delay signal if delay is smaller than TG



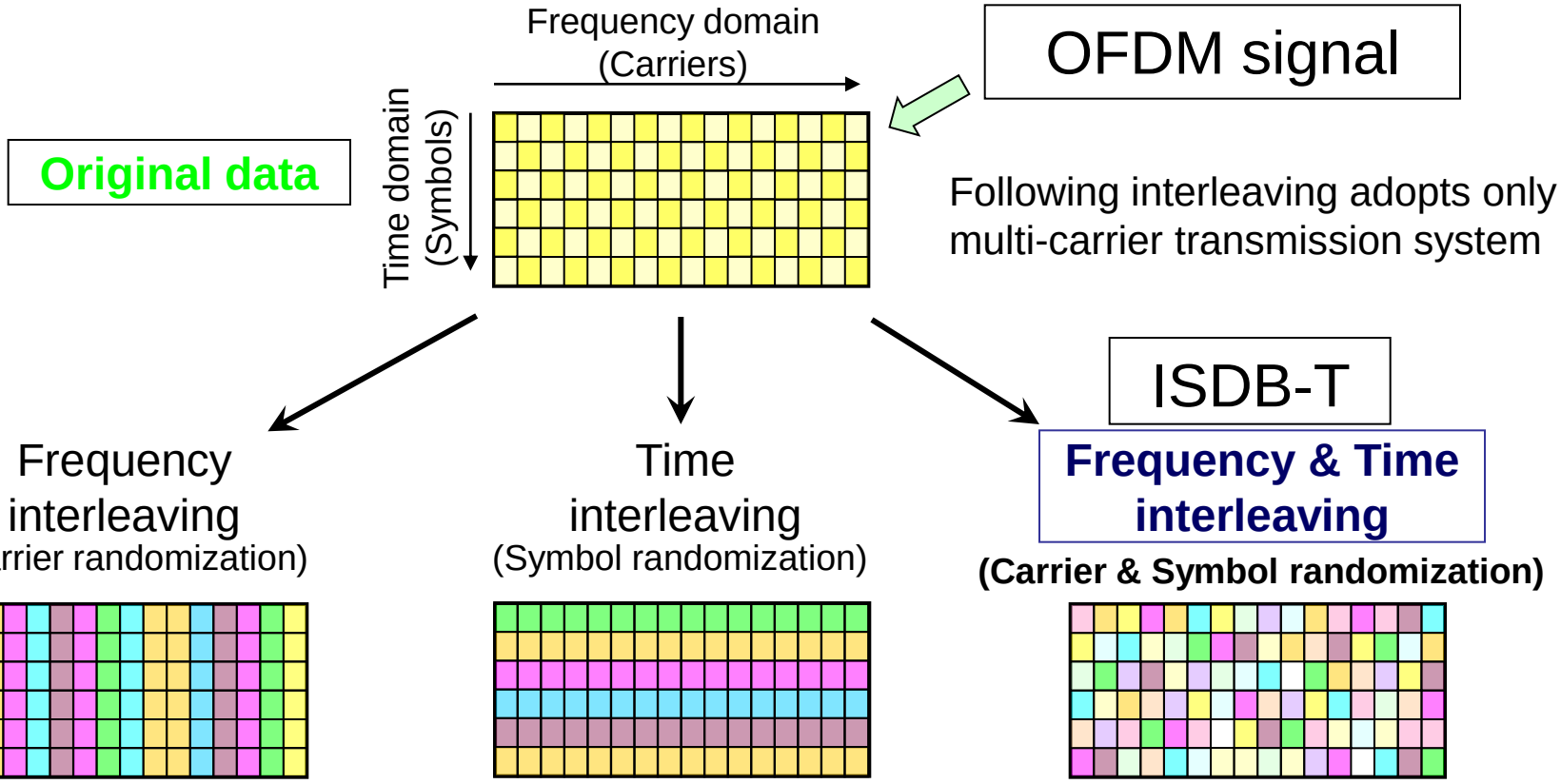
Guard Interval and Multipath (the same phase)



Guard Interval and Multipath (opposite phase)



Frequency and time interleaving (I)



Suitable for multipath interference.
But, ineffective to flat-fading and impulse noise.

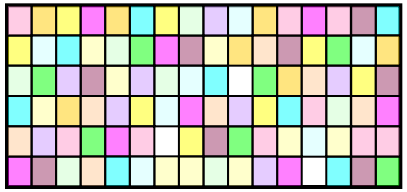
Suitable for fading and impulse interference.
But, ineffective to multipath interference.

Suitable for all kinds of interference.

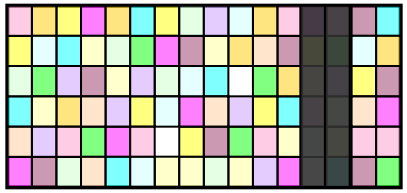
*Official Information: NHK Science and Technology Research labs, Japan

Frequency and time interleaving (II)

Frequency & Time interleaving
(Carrier & Symbol randomization)



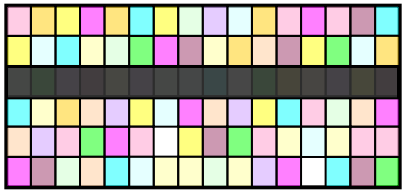
Multipath interference
(Frequency selective interference)



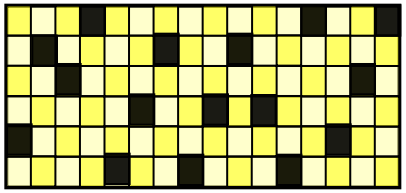
Transmission

Burst errors

Flat fading or impulse noise
, Transmission errors



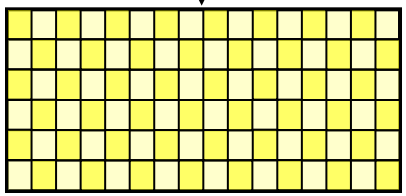
De-interleave



Random errors

2-dimentional Random errors
Suitable for Viterbi and
Reed-Solomon error correction

*Official Information:
NHK Science and Technology Research labs, Japan



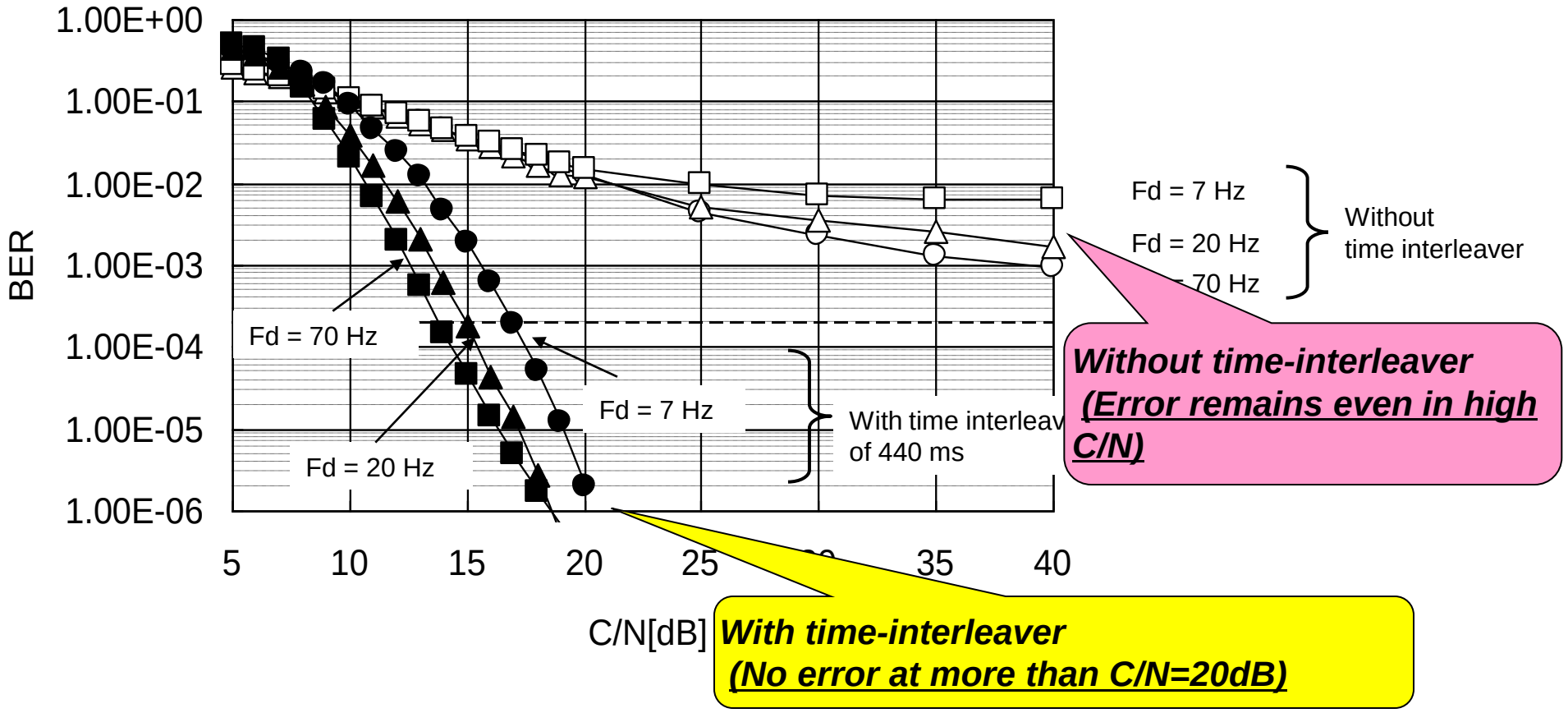
Original data

Error correct

Effect of Frequency and Time Interleaving

Laboratory test results

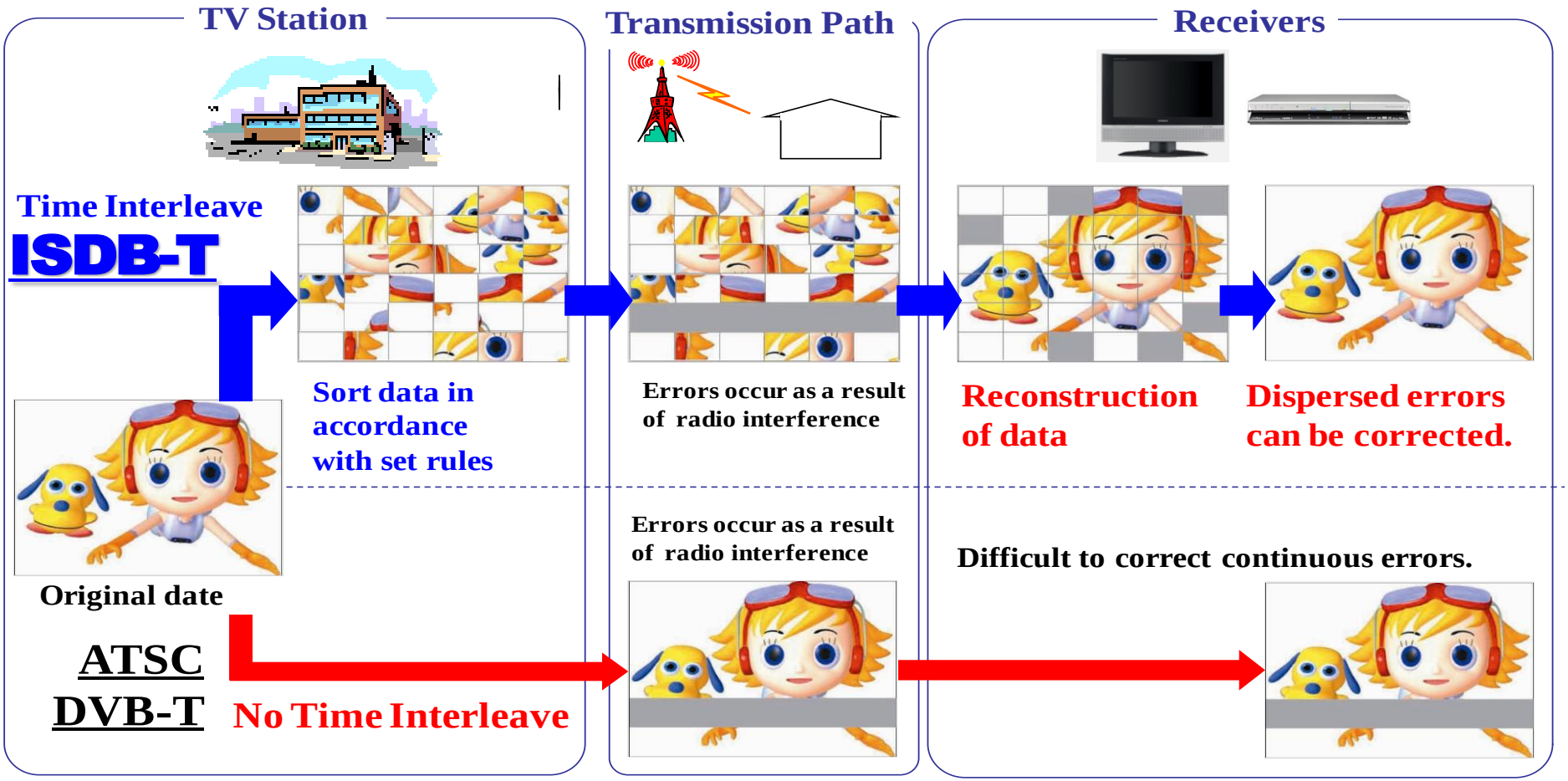
flat fading,DQPSK,Mode=1,GI=1/8,FEC=1/2,RS=OFF



*Official Information: NHK Science and Technology Research labs, Japan

Effect of Frequency and Time Interleaving

Time Interleave Technology



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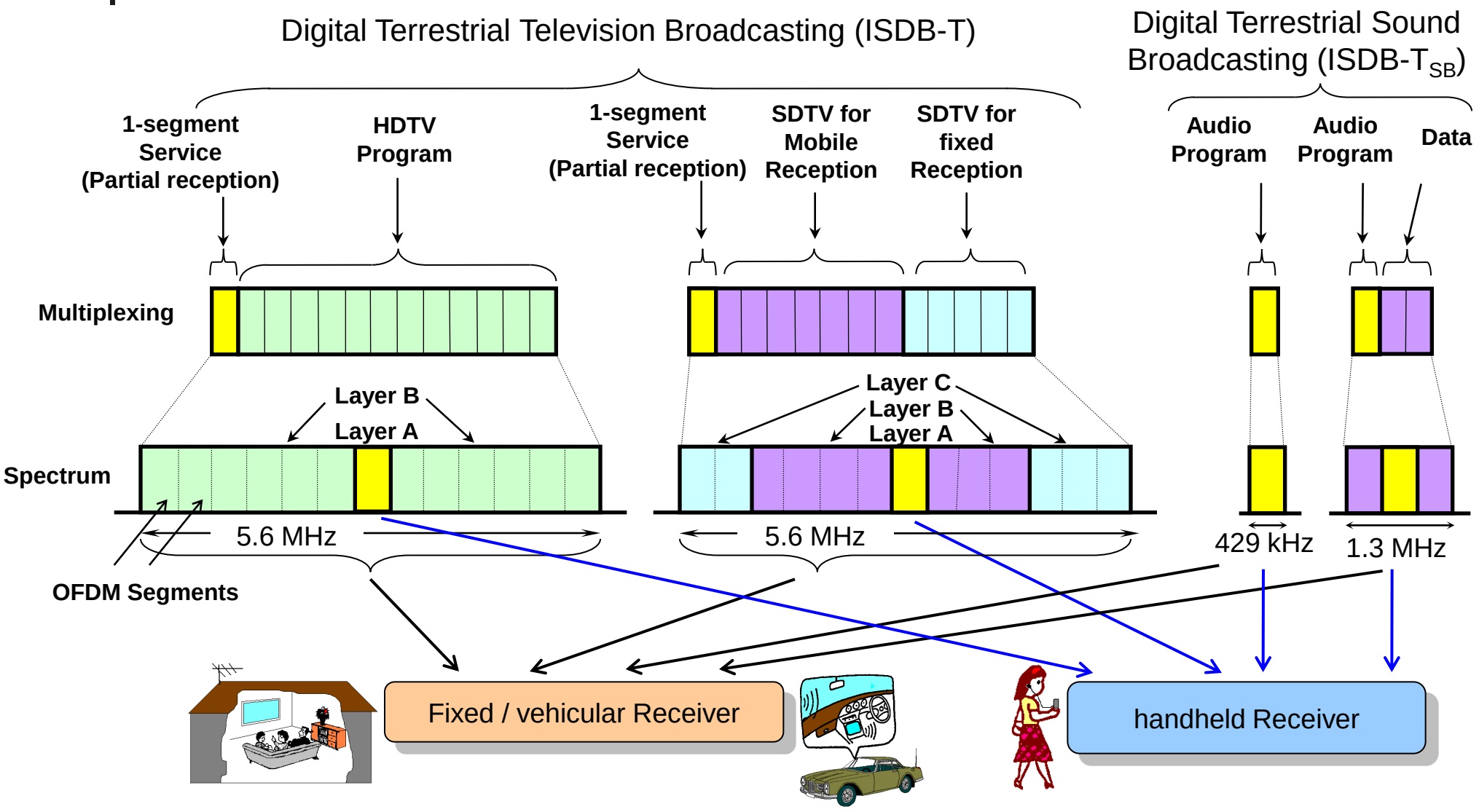
Hierarchical Transmission Examples



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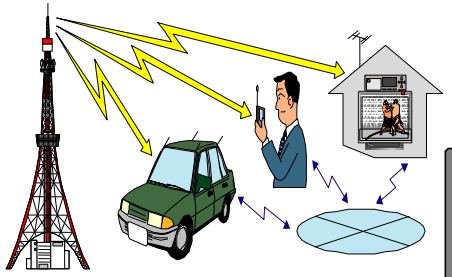
Broadcasting Services By ISDB-T

Digital Terrestrial Broadcasting



Advanced Features of ISDB-T

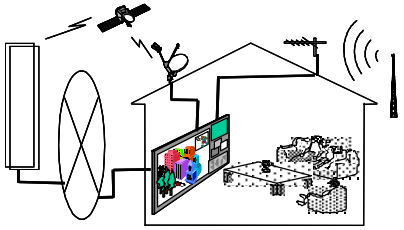
HDTV

High quality image and sound service

Multi-Channel Service

Realization of multi-SDTV program service on 1ch bandwidth (6MHz)

Interactive TV

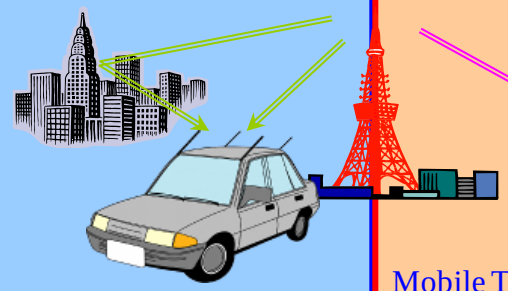


Communication linked services with TV

Data Broadcasting

Simple retrieval of program and information at any time

Mobile Reception



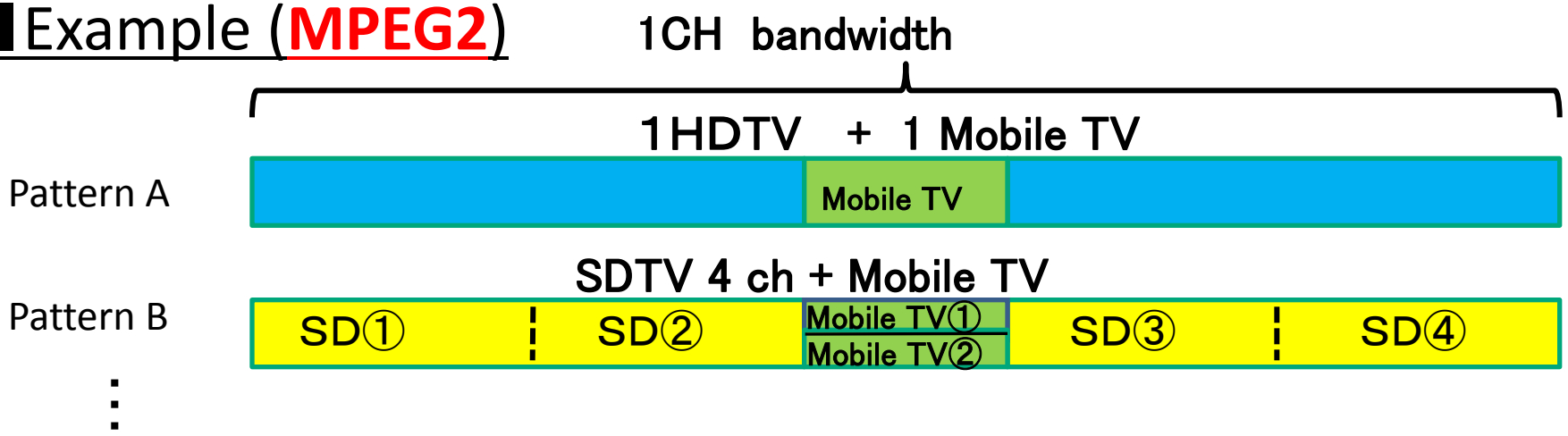
HD TV and Mobile TV in vehicle

Mobile TV on Handheld Reception like Cell phones , Portable Game machine and so on.

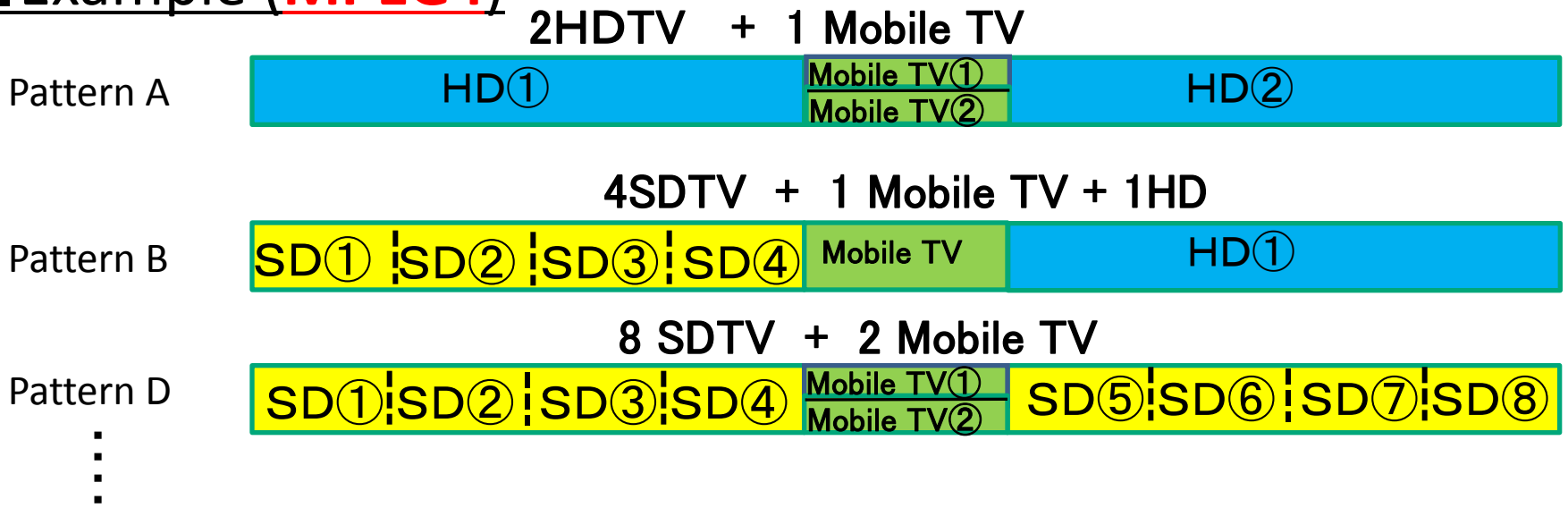
*Official Information: Ministry of Internal Affairs and Communications, Japan

Multi-broadcasting and Multi-view Services

Example (MPEG2)

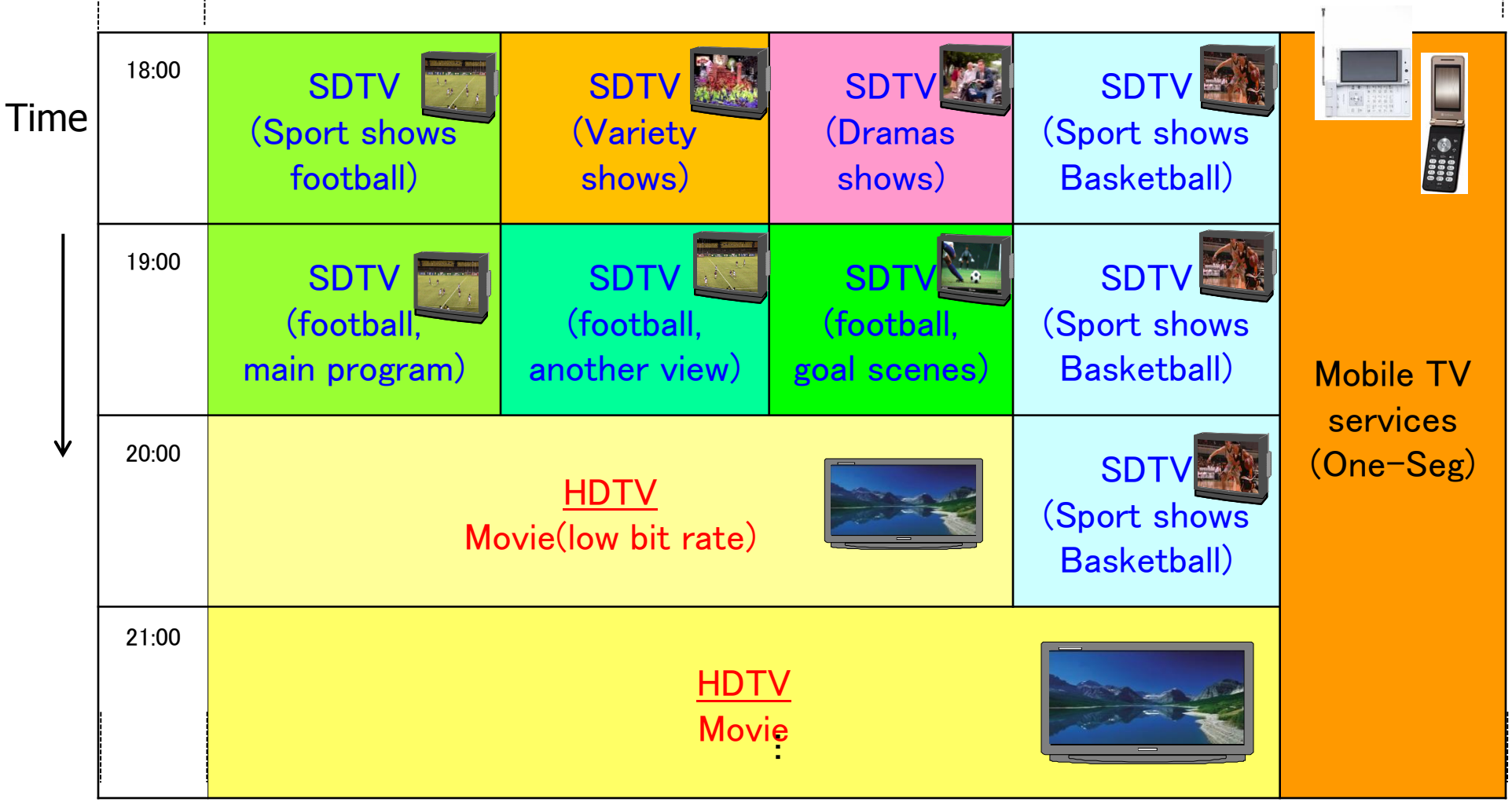


Example (MPEG4)



Flexibility of TV Program Planning with ISDB-T

ISDB-T's Flexibility can provide various combination of programs.



ISDB-T One-Seg Handheld Receivers

Service commenced in April 2006

Lineup of ISDB-T mobile TV receivers

GSM+3G mobile Phones in Brazil

Mobile Phones

Car Navigators

Portable Dictionary

PCs with One-Seg

Portable Games

Portable Players

USB type One-Seg tuners

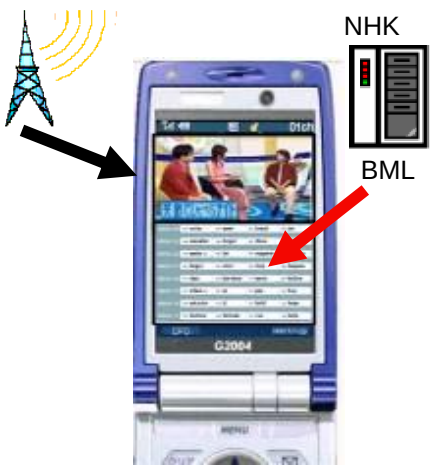
A large variety of mobile TV receivers attract new viewers.

*Official Information: NHK Science and Technology Research labs, Japan

Service Model of One-Segment Service for Mobile Communication Terminals

- Various types of services can be realized using functionalities combining One-segment service reception and mobile communication

Linkage from broadcasting to communication

Broadcasting program view	Data broadcasting view	Mobile data online	Link to web sites
			
Receive and watch TV program via Broadcasting	Receive and browse data broadcasting via Broadcasting	TV program is received via Broadcasting (top), data is received via mobile Internet (bottom)	Mobile Internet services of various provider

*Official Information: NHK Science and Technology Research labs, Japan

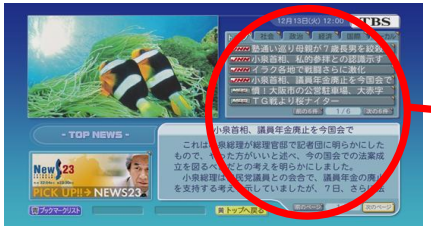
Interactive TV Service

ISDB-T can provide Interactive TV service

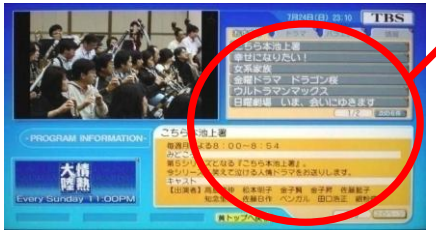
High functionality

Data Broadcasting

Weather forecast



News



Information linked to on-air program

Interactive TV over 51 million receivers, e.g. interactive shopping

You can see the items and you can buy them directly.

Only ISDB-T succeeds those New businesses

DVB-T hasn't provided attractive services of Data-broadcast and interactivity

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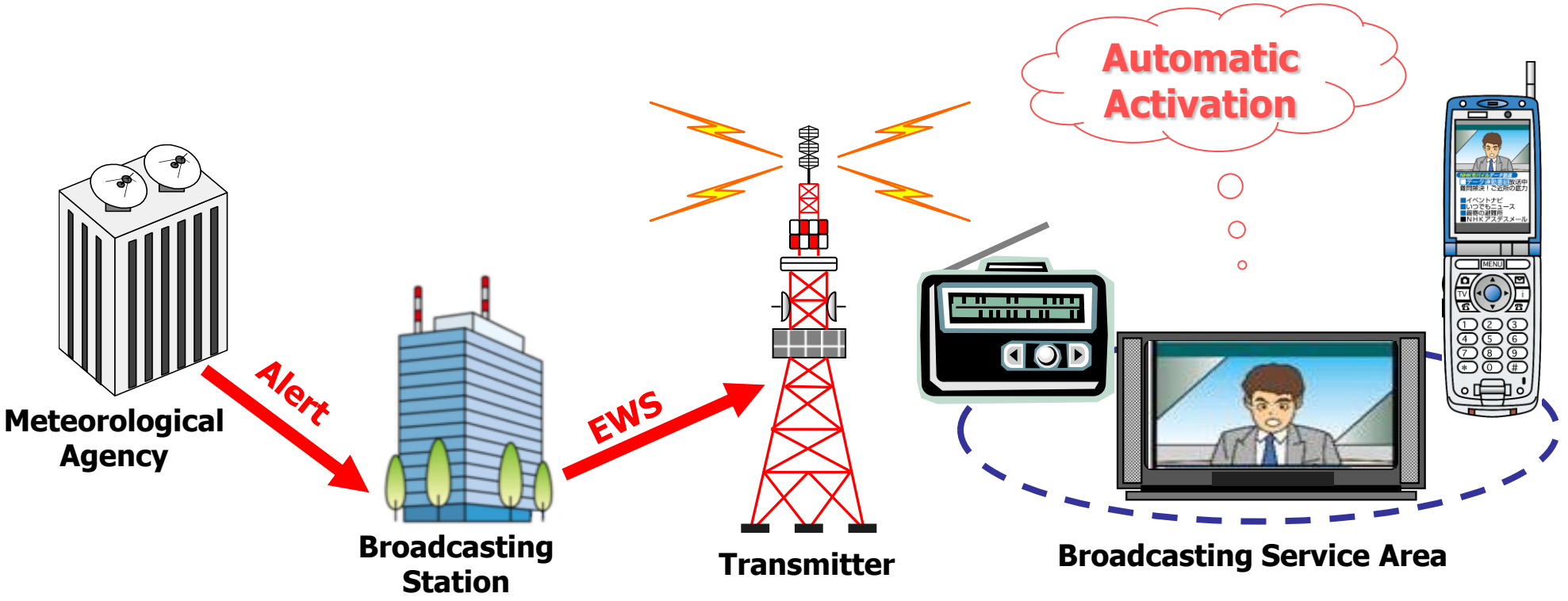
*Official Information: Ministry of Internal Affairs and Communications, Japan

Emergency Warning System (for Human life)

People can get Emergency Warning under such inclement conditions as typhoons and tsunamis. Many lives would be saved with ISDB-T.

EWS test signals are monthly broadcasted in Japan.



*Official Information: NHK Science and Technology Research labs, Japan

Mobile TV is the Best in case of Disaster

Mobile TV is the Best tool to inform people of emergency information in case of Disaster

In case of Disaster, traffic congestion in mobile telephone network disable its services. In contrast, mobile TV by ISDB-T tolerates disaster damage and enables service continuation.

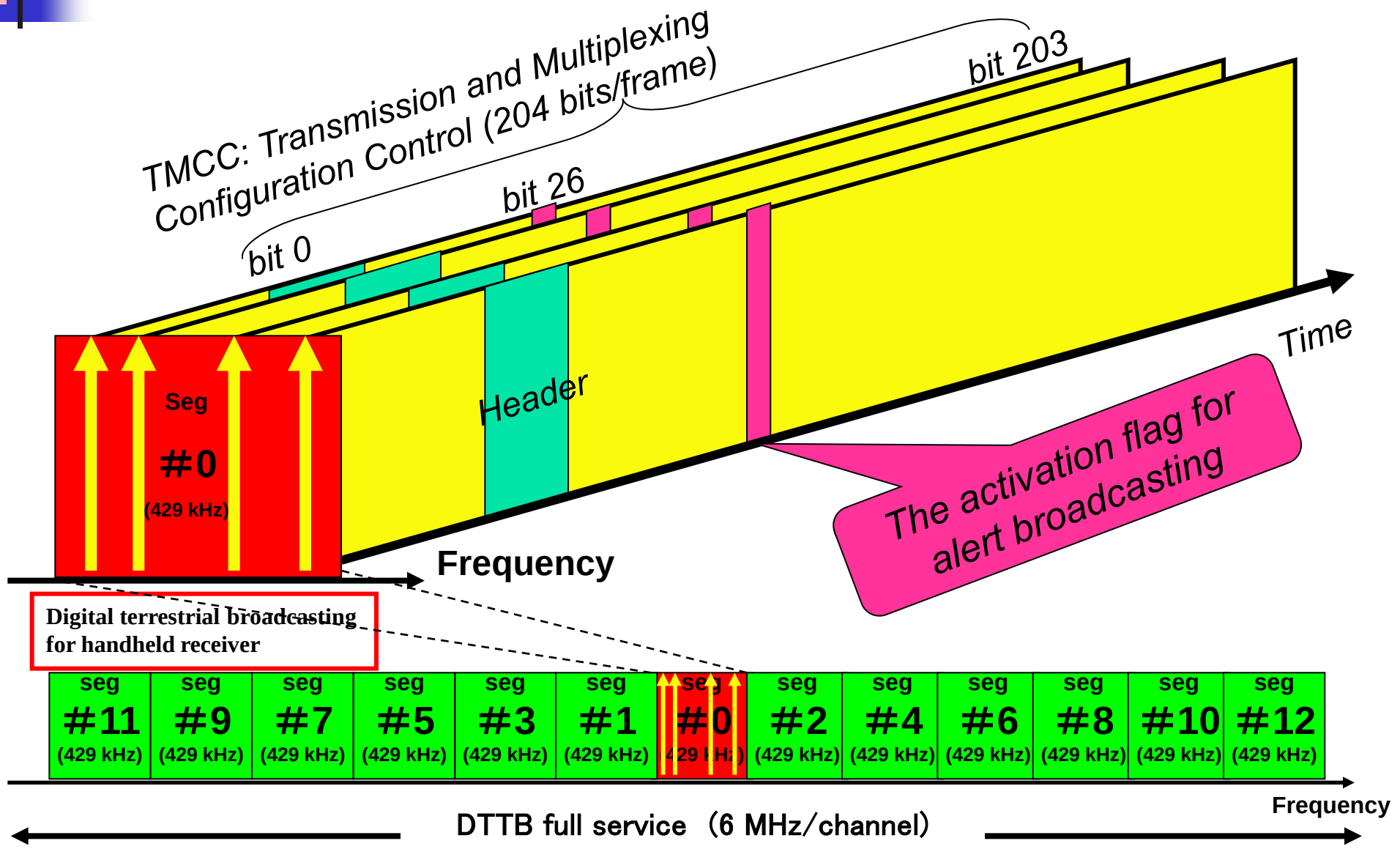
People can receive important information Anytime Anywhere.

Information of Disaster

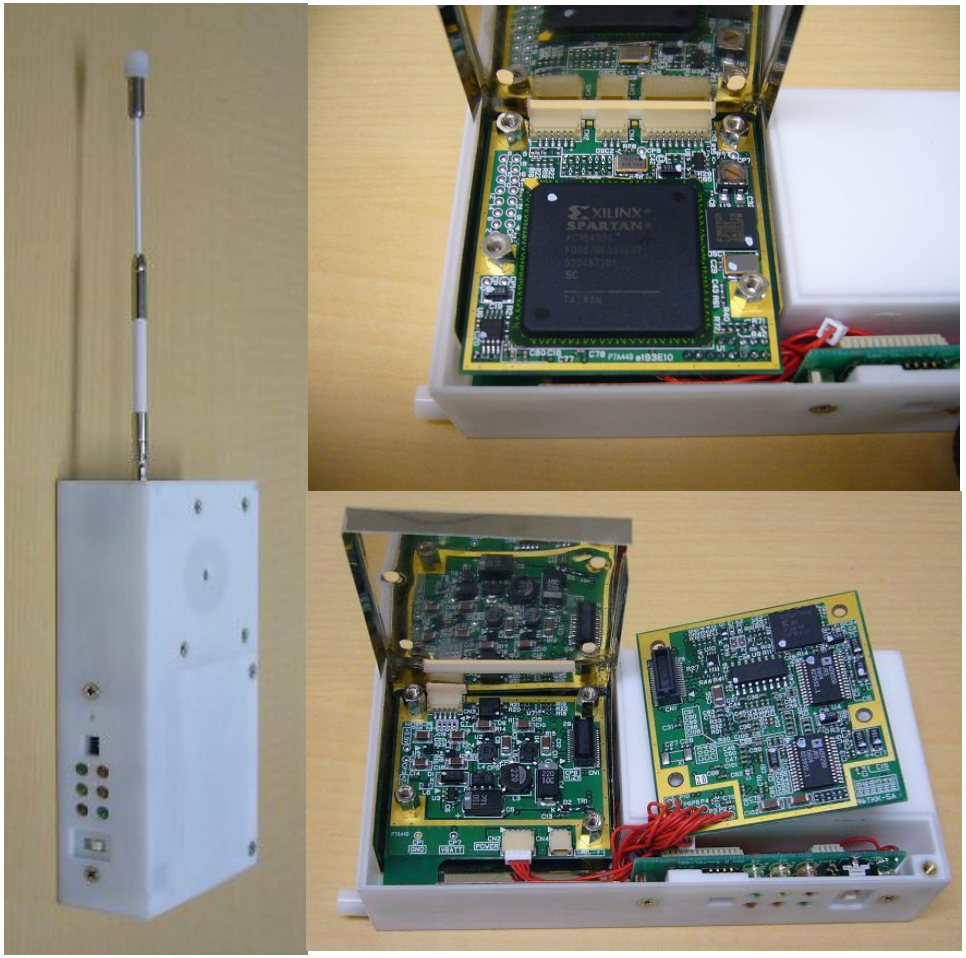
Evacuate from this area !

Mobile telephone line is not available, but <u>I can get necessary information via Mobile TV!!</u>

Activation Flag for Handheld Receivers in ISDB-T



EWS low power consumption technology for Handheld Receivers



Small prototype receiver that detects the activation flag for alert broadcasting

Cell phone being connected to small prototype receiver

*Official Information: NHK Science and Technology Research labs, Japan

HDTV vehicular reception technology for ISDB-T

- Conventional reception
  - Robust modulation (16QAM ½ or QPSK)
  - 1 receiving antenna
  - **SDTV**

- Diversity reception
  - 64QAM (transmission same as in fixed reception)
  - 2-4 branches (number of receiving antennas)
  - **HDTV**

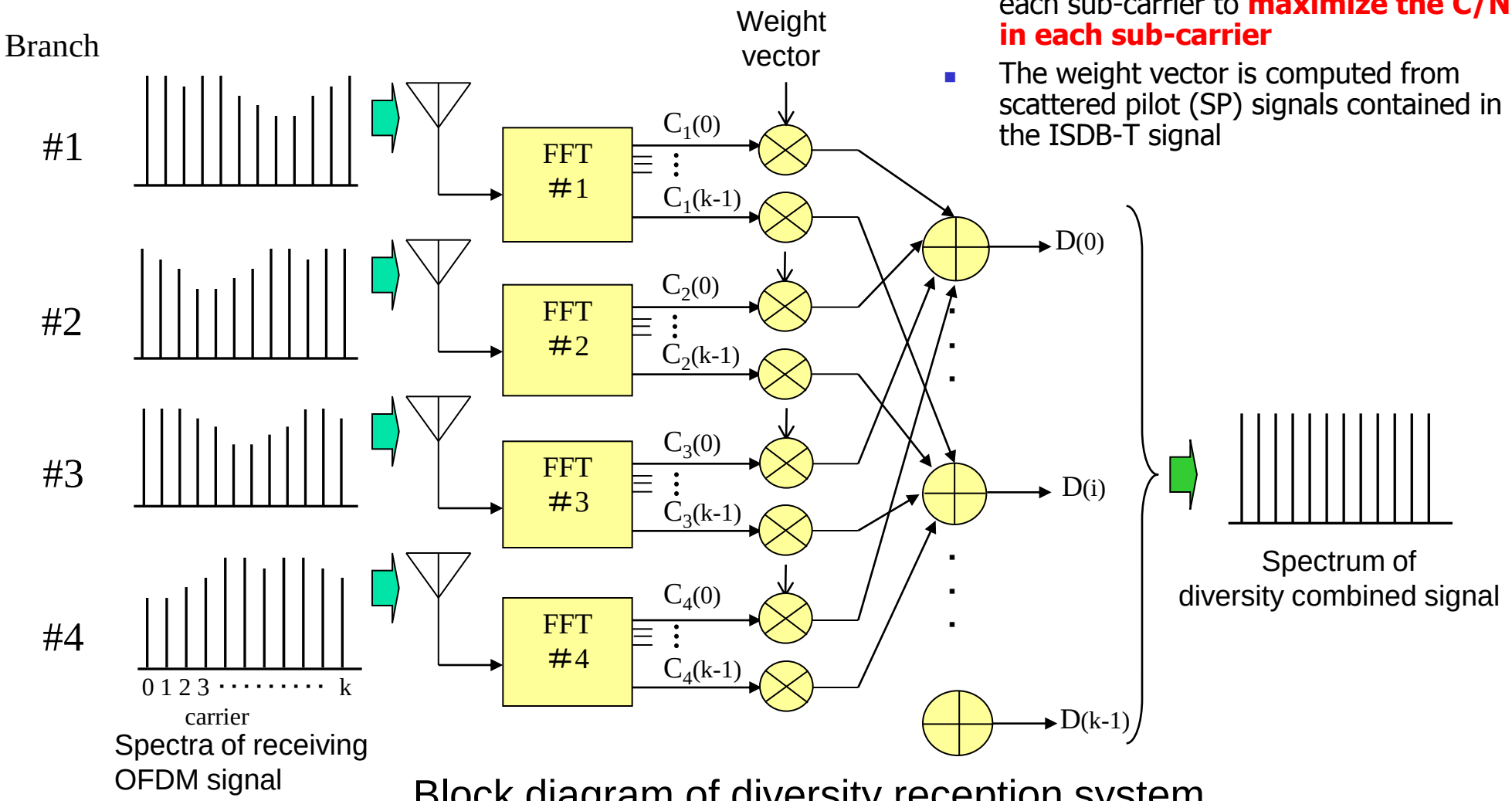
- Diversity reception technology for motor vehicles
  - Space diversity
  - HDTV programs are available in a vehicle with high quality, clear and noiseless image
  - A HDTV vehicular system based on the diversity reception technology is already on sale in Japan

Already on sale in Japan

*Official Information: NHK Science and Technology Research labs, Japan

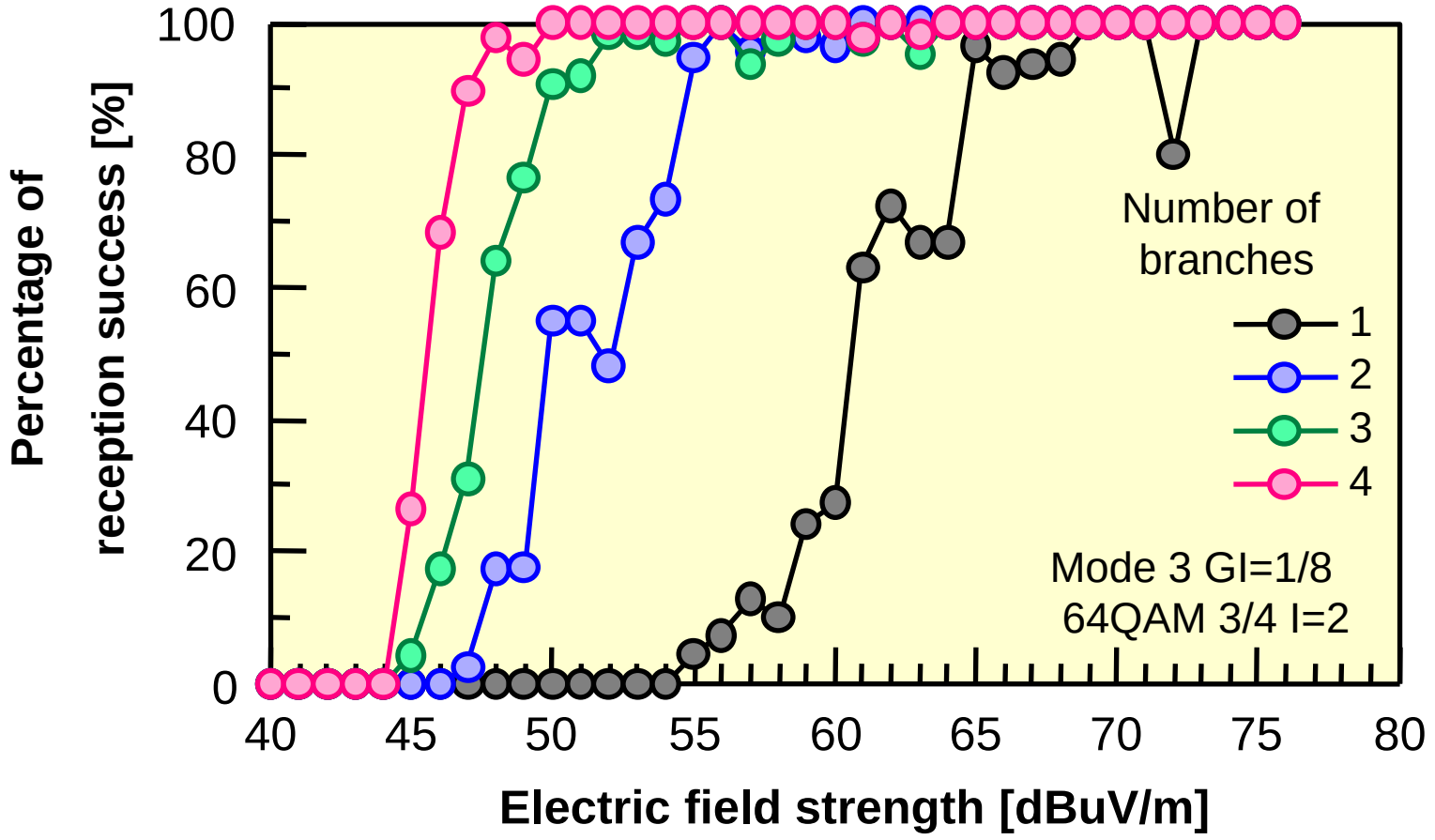
Diversity reception system for vehicular reception

- After multiplying weight vector, the signals at each branch are diversity combined for each sub-carrier to **maximize the C/N in each sub-carrier**
- The weight vector is computed from scattered pilot (SP) signals contained in the ISDB-T signal



Block diagram of diversity reception system

Result of vehicular reception field experiment



*Official Information: NHK Science and Technology Research labs, Japan

Example: ISDB-T Vehicular Receivers

Panasonic

CN-HDS960TD

CN-HDS635TD

SANYO

NV-HD870DT

NVA-HD1500DT

Pioneer

AVIC-VH009MDG

Fujitsu ten

AVN7406HD

ALPINE

VIE-XO7B1/S1

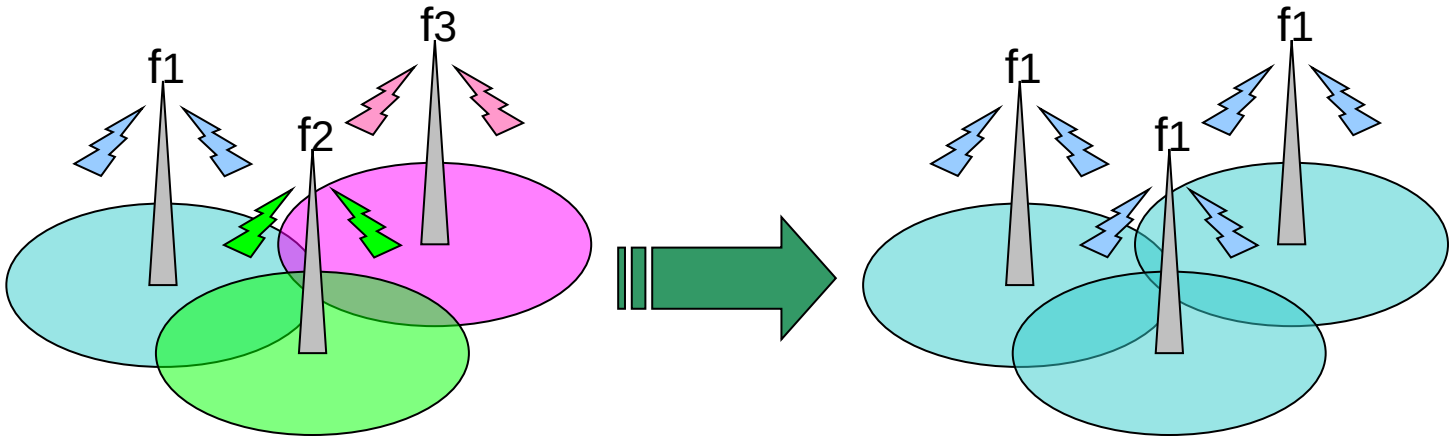
Toyota

TDT-H56

*Official Information: NHK Science and Technology Research labs, Japan

SFN: Single Frequency Network

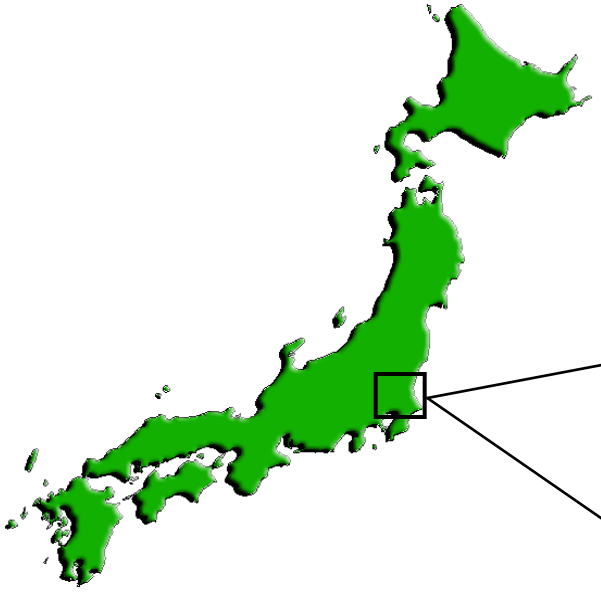
- ISDB-T enables SFN
  - Addition of guard interval of OFDM
    - Robustness to multipath interference
  - Effective utilization of frequency channel

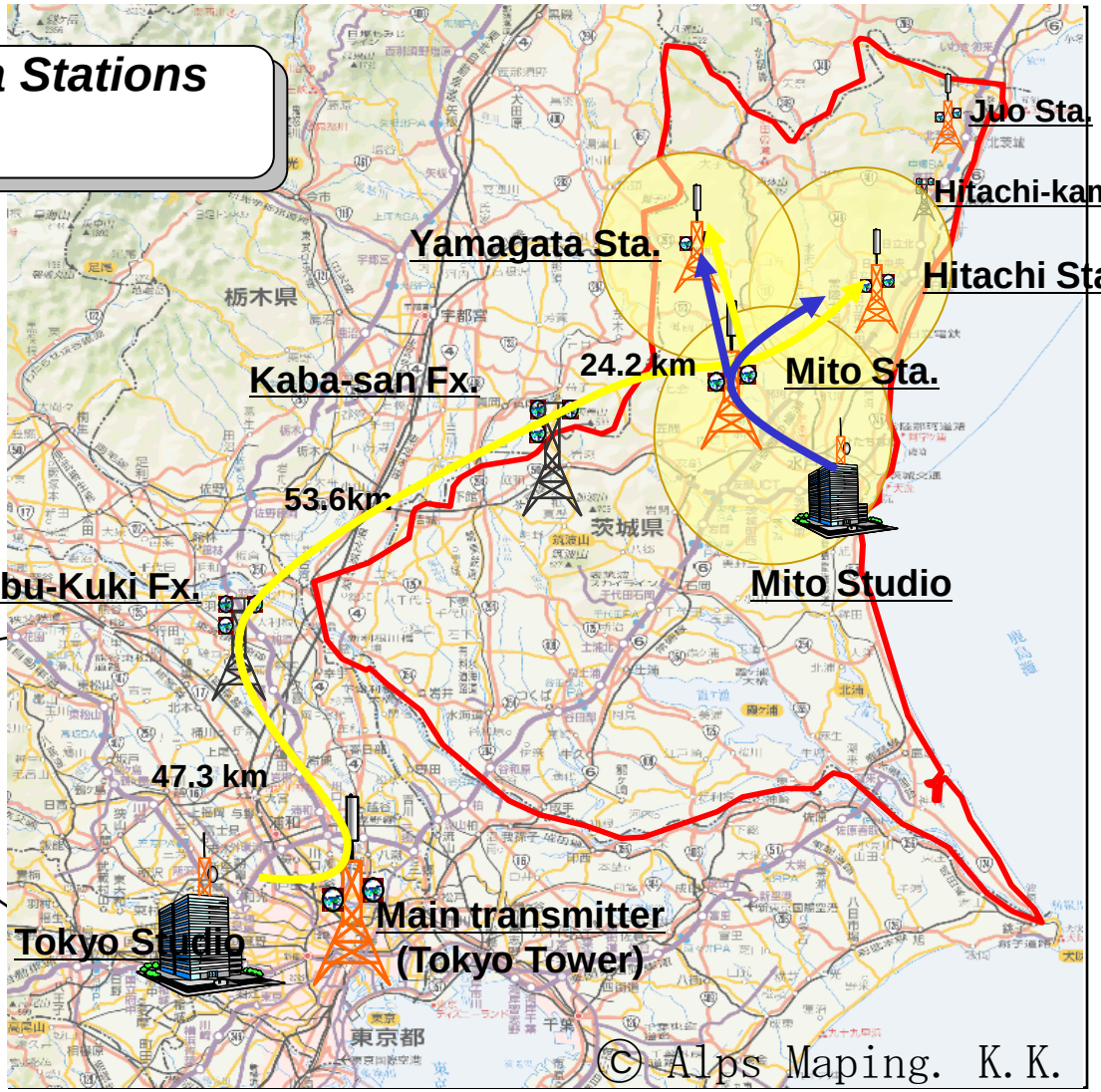


- NHK has recently developed and put into service SFN On-air (broadcast-wave) relays technology for more effective frequency utilization and equipment cost reduction

The first practical SFN in Ibaraki prefecture

Mito, Hitachi* and *Yamagata Stations comprise the SFN.





*Official Information: NHK Science and Technology Research labs, Japan

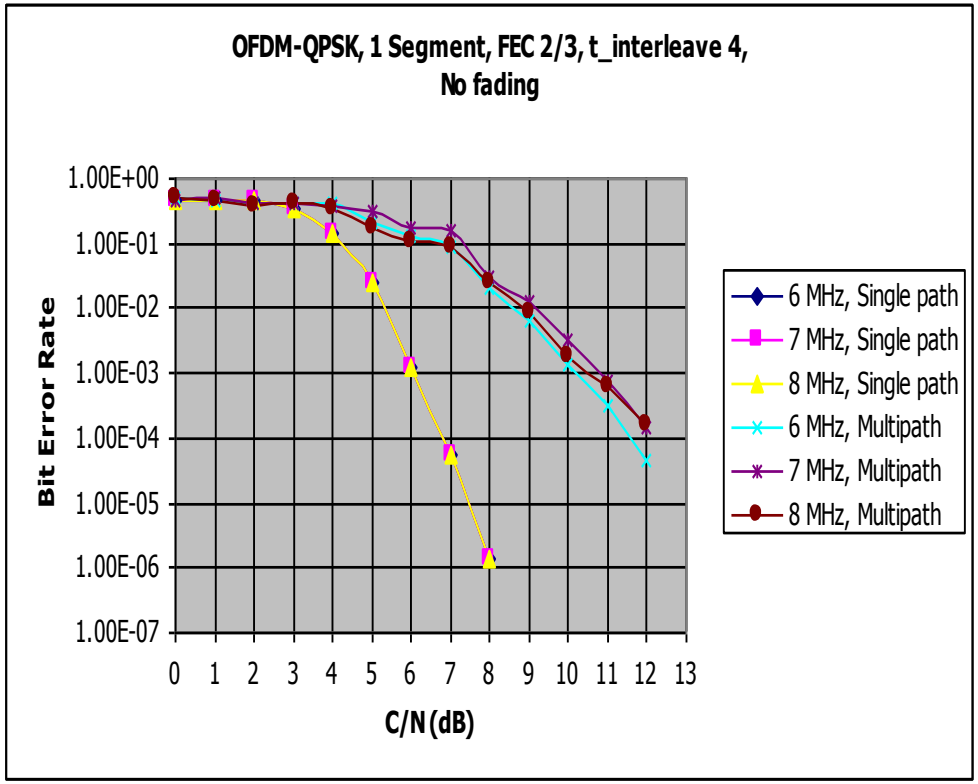
ISDB-T System Performance in 6, 7 and 8 MHz Bandwidth

*The simulation results produced by the author at NHK Science and Technology Research labs, Japan during 1st July-31st August 2009

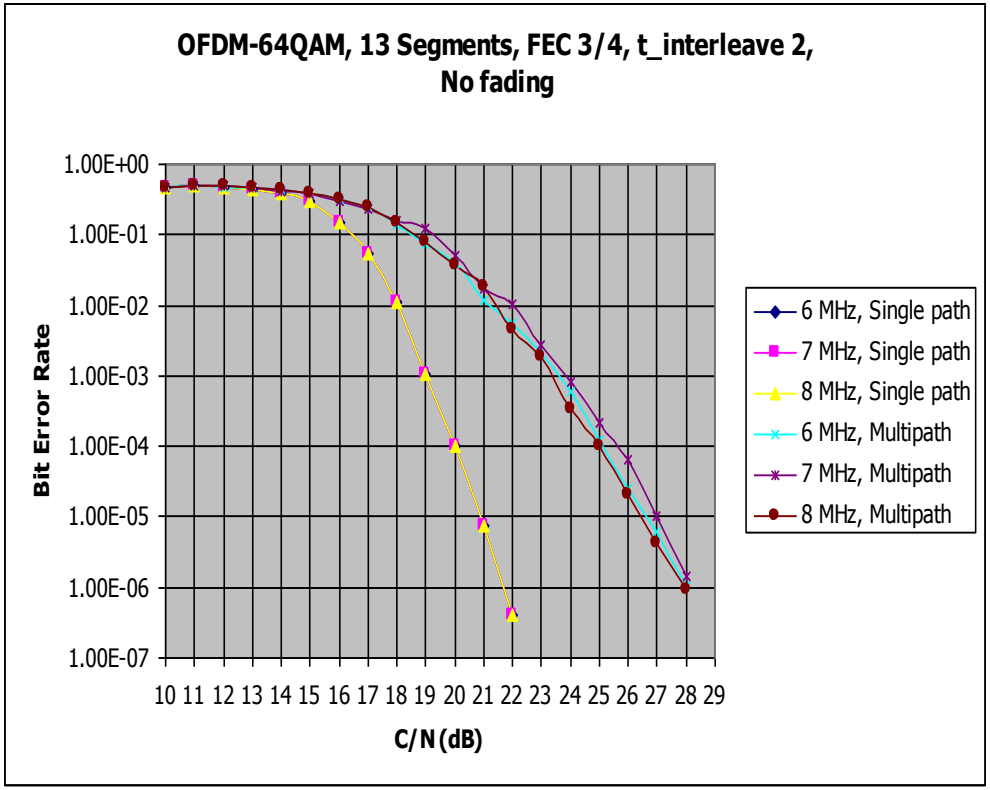
Simulation Parameters

Bandwidth (MHz)	6	7	8	6	7	8
No. of Segment	1			13		
Mode	3			3		
No of carriers	432			5617		
Used Bandwidth	428.571 KHz	500 KHz	571.428 KHz	5.572 MHz	6.501 MHz	7.430 MHz
Effective Symbol Length (μs)	1008	864	756	1008	864	756
Carrier Spacing (KHz)	0.992	1.157	1.322	0.992	1.157	1.322
Guard Interval (1/8) (μs)	126	108	94.5	126	108	94.5
Modulation	QPSK			64QAM		
FEC	2/3			3/4		
Time interleave	4 (~0.4 sec)			2 (~0.2 sec)		
Bit rate (Mbps)	0.416	0.485	0.555	18.252	21.298	24.341

Gaussian Noise and Multipath Characteristics of 6,7,8 MHz BW: (1 and 13 Segments)



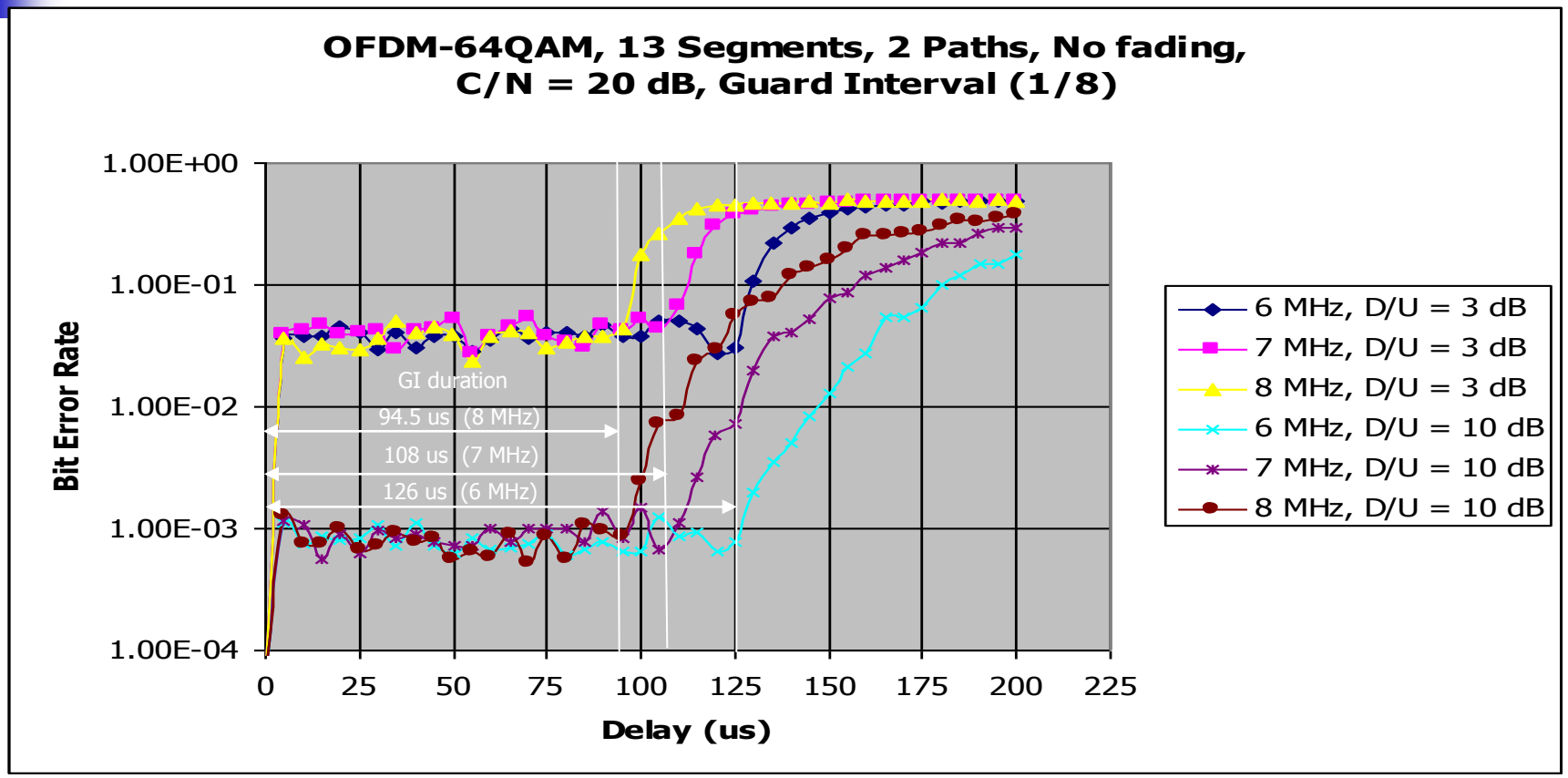
1-Segment, QPSK, Delay = 50 us, D/U = 3 dB



13-Segment, 64QAM, Delay = 50 us, D/U = 3 dB

- ISDB-T has the same Gaussian and Multipath Characteristics in all bandwidth (6, 7 and 8 MHz) for both 1 and 13 segments. Since both carrier and noise power are directly proportional to bandwidth size.

Multipath Characteristics of 6,7,8 MHz BW : (13 Segments)

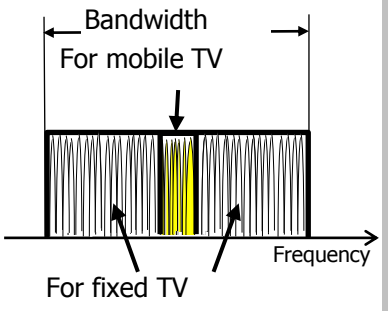
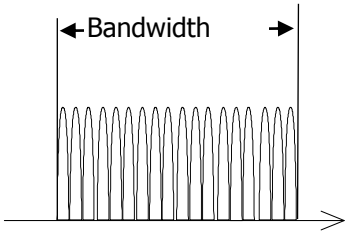
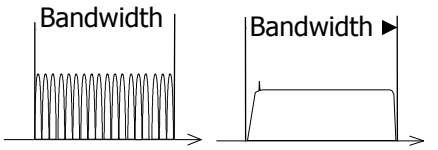
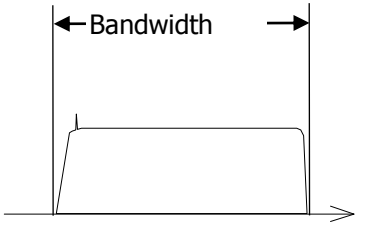


Multipath Characteristics of 13-Segment with various D/U

- When delay time of the scattered signal exceeds the guard interval length, the performance become worse in every bandwidth regardless of the value of D/U.
- For the same D/U, system with 6 MHz bandwidth has the best performance among all, due to the longest guard interval.

Comparison of DTTB Systems

Comparison of Digital TV systems in the World

System / Characteristics	Japan - Brazil (ISDB-T)	EU (DVB-T)	China (DTMB)	USA (ATSC)
Transmission System	 Multi-Carrier	 Multi-Carrier	Not standardized in ITU  Multi-Carrier Single-Carrier Chinese has 2 standard Standard is Not unified.	 Single-Carrier
High Robustness against noise	Excellent Well experienced	Medium	Excellent	Poor
HDTV + Mobile TV with one transmitter by one Bandwidth	In service	Not available (Need additional Transmitter for Mobile TV) →Double investment	Not available (Need additional Transmitter for Mobile TV) →Double investment	Not available (Need additional Transmitter for Mobile TV) →Double investment
Emergency Warning System	In service	Not In service	Not In service	Not In service
openness	No limit to use	Need to pay royalty of Middle-ware	▪Not international standard ▪A few Chinese companies monopolize chip market	No info

3 DTTB Systems Main Specifications Comparison

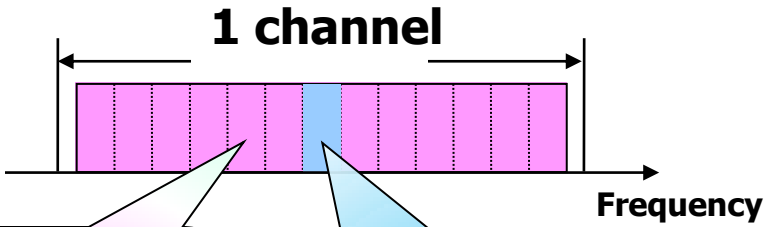
Rec. ITU-R 1306-3		System A	System B	System C
System		ATSC	DVB-T	ISDB-T
Format		Single carrier System	No-segment, multi-carrier OFDM	13 segments, multi-carrier OFDM
No. of radiated carriers		-	1705 (2k mode), 3409 (4k mode), 6817 (8k mode)	1405 (mode 1), 2809 (mode 2), 5617 (mode 3)
Modulation method		8VSB	QPSK, 16QAM, 64QAM, MR-16QAM, MR-64QAM	DQPSK, QPSK, 16QAM, 64QAM
	Bit/ Symbol	Yes	Yes	Yes
Interleaving	Freq.	No	Yes	Yes
	Time	No	No	Yes (0, 0.1, 0.2, 0.4 s)
Transmission Frame Duration		48.4 ms (6 MHz), 43.4 ms (7 MHz), 37.2 ms (8 MHz)	272 OFDM symbols	204 OFDM symbols
Net Data Rate (Mbps)		19.39 (6 MHz)	3.69-23.5 (6 MHz), 4.35-27.71 (7 MHz), 4.98-31.67 (8 MHz)	3.65-23.2 (6 MHz), 4.26-27.1 (7 MHz), 4.87-31.0 (8 MHz)
Configuration Signal		-	TPS	TMCC
C/N in AWGN channel		15.19. 9.2, 6.2 dB depending on channel code	3.1-20.1 (dB)	5.0-23.0 (dB)

*Official Information: ARIB STD B1 version 1.6

Comparison between ISDB-T and DVB-T

ISDB-T(Terrestrial)

have ***Band segmentation***



Fixed reception

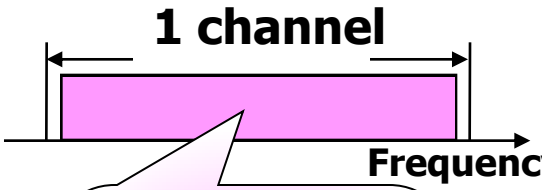
Mobile TV

One Transmitter is enough

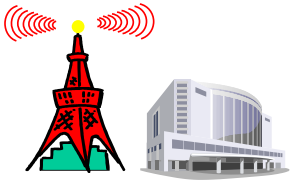
Very Economical

DVB-T (Terrestrial) — DVB — DVB-H (Handheld)

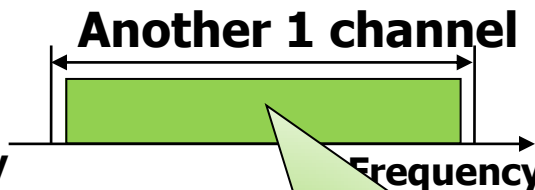
Different standard



Fixed reception



Transmitter for Fixed TVs



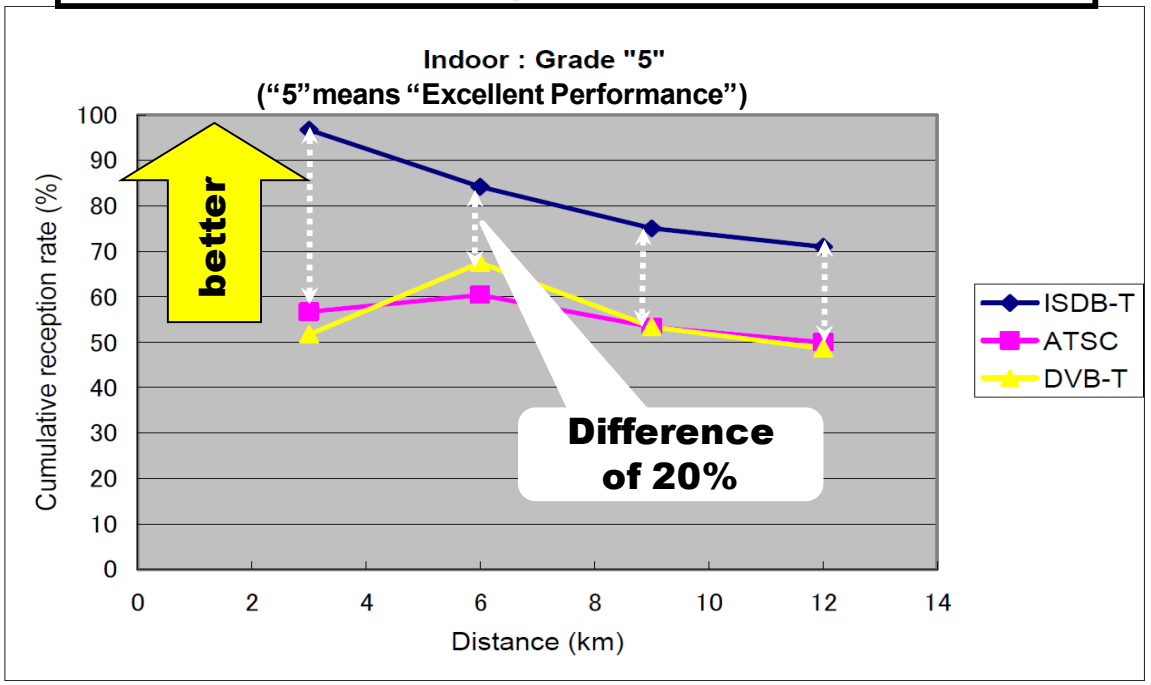
Mobile TV

Another Transmitter For Mobile TV

Double- Investments!!

Comparison between ISDB-T and DVB-T

Result of Comparison Test in Chile



→ISDB-T is more cost effective than DVB-T because ISDB-T can cover wider service area than DVB-T at the same transmitting power.

Cost for anttena of the digital TV

In case an antenna is required for TV receiver, cost is as follows;

	Indoor antenna	Outdoor antenna
Antenna	USD 6	USD 46

If 10 million households can watch digital TV with indoor antenna with ISDB-T, then only 8 million households can watch digital TV with indoor antenna with DVB-T.

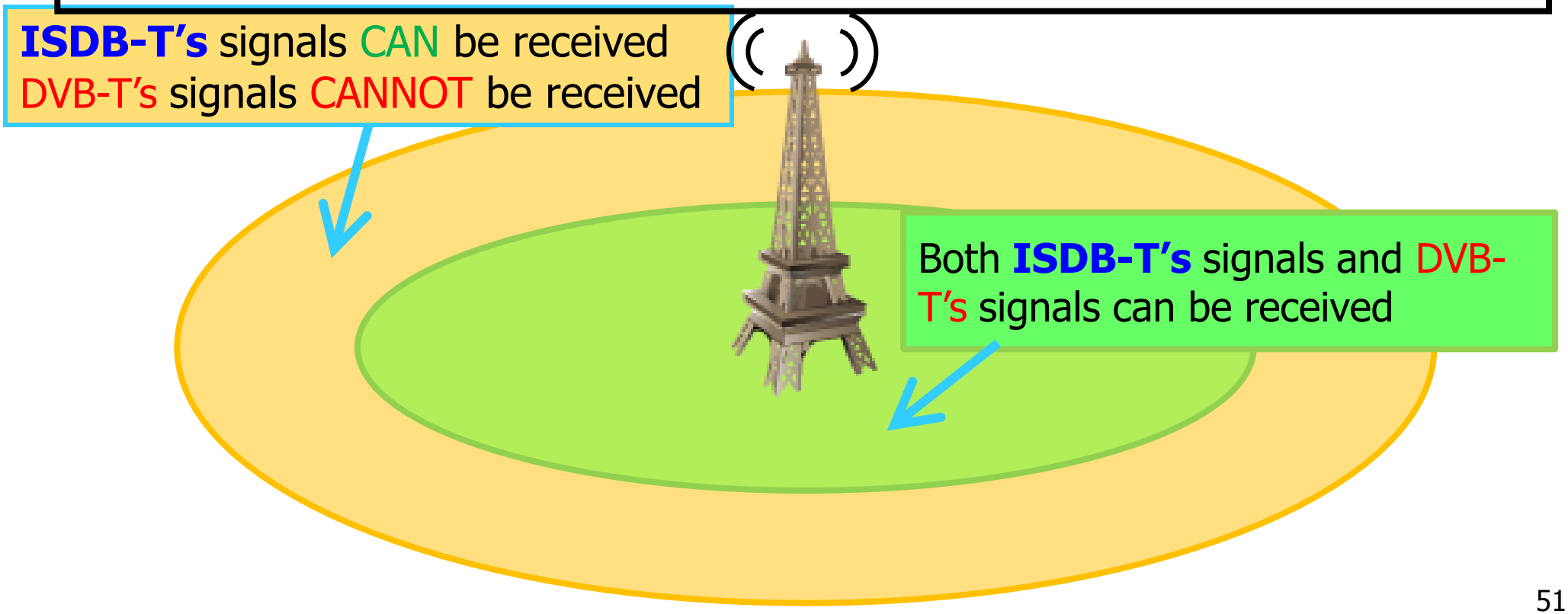
2million people have to prepare outdoor antenna.)

*Official Information: Ministry of Internal Affairs and Communications, Japan

Coverage area of ISDB-T and DVB-T

Coverage of **ISDB-T** is larger than that of DVB-T under same transmitter condition.

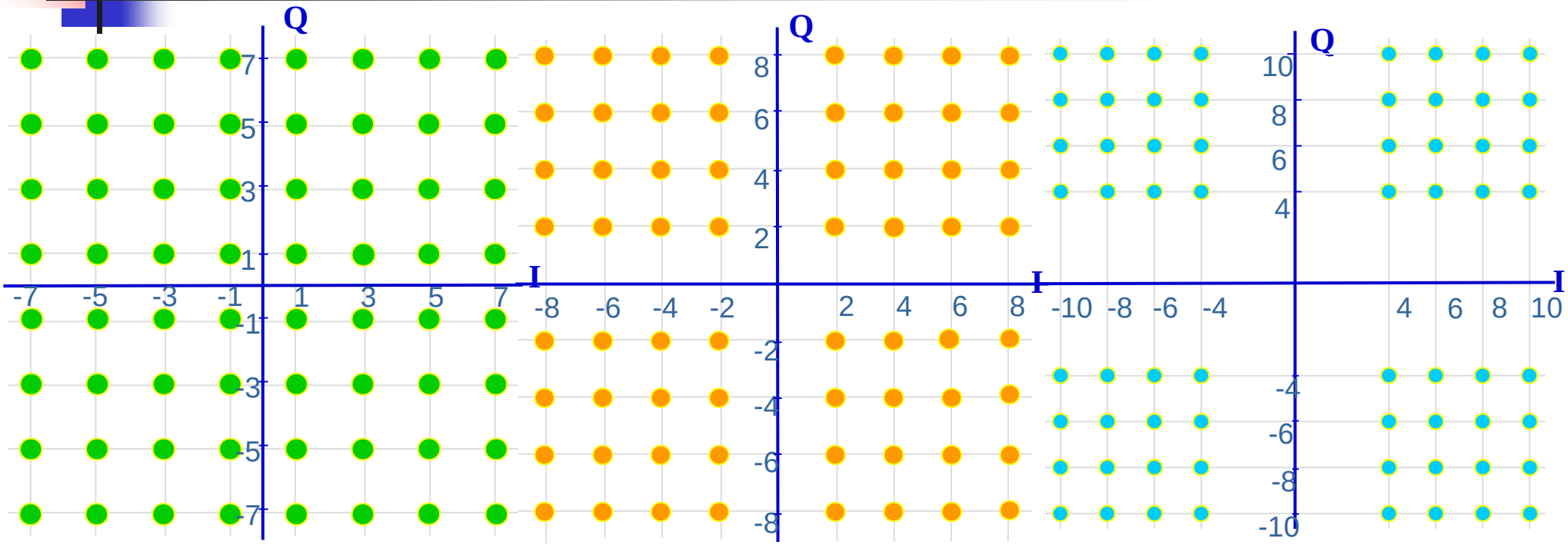
→ **ISDB-T** can cover their national land by smaller number of transmitters than DVB-T



Comparison of MR-64QAM and 64QAM

*The simulation results produced by the author at NHK Science and Technology Research labs, Japan during 1st July-31st August 2009

MR-64QAM Signal Constellations

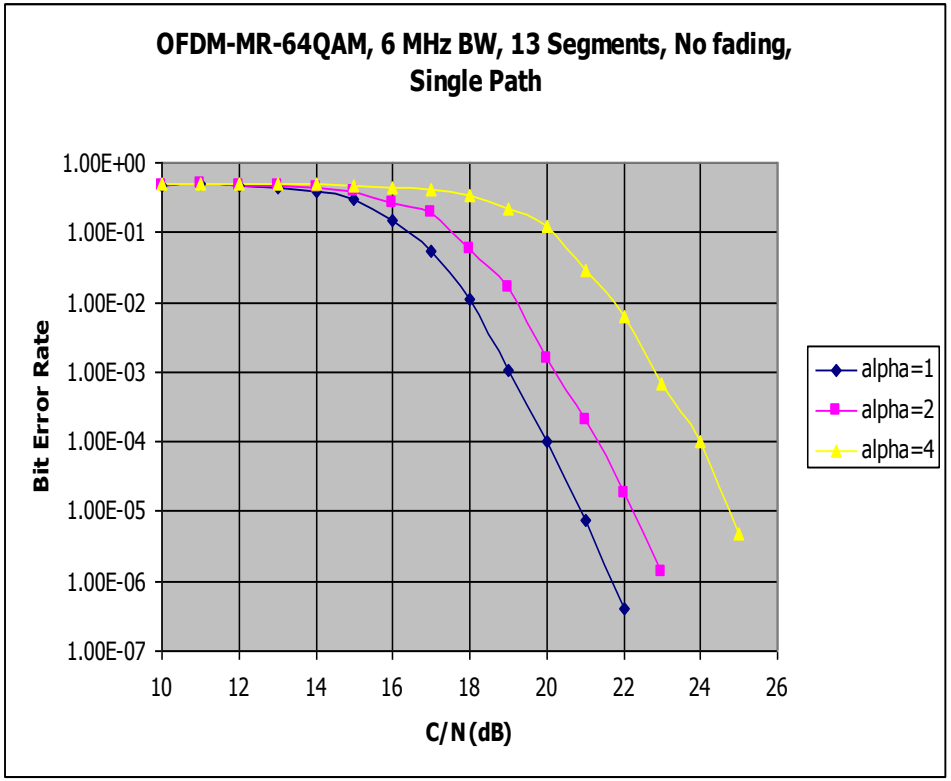


$\alpha = 1$ $\alpha = 2$ $\alpha = 4$

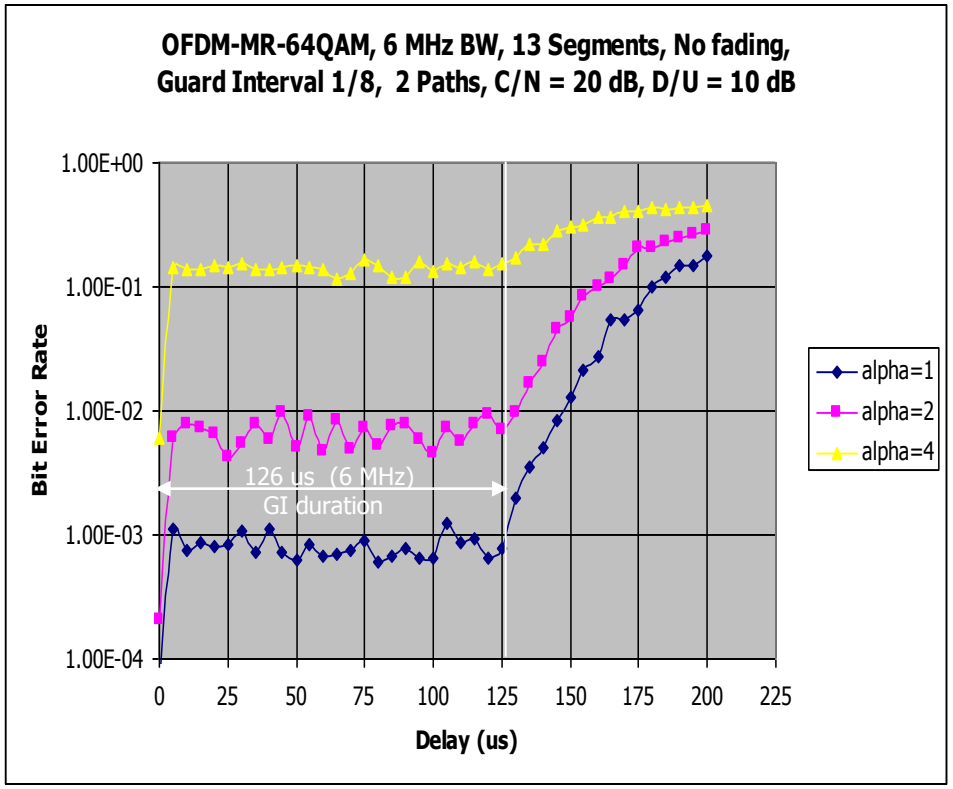
$$\alpha = \frac{\text{minimum distance separating two constellation points carrying different HP-bit values}}{\text{minimum distance separating any two constellation points}}$$

Fig. 4: Signal Constellations of various α values (power normalization)

Gaussian Noise and Multipath Characteristics of MR-64QAM



Gaussian Characteristics



Multipath Characteristics

- 64QAM modulation technique provides superior performance in terms of BER than MR-64QAM in both Gaussian and Multipath Characteristics.

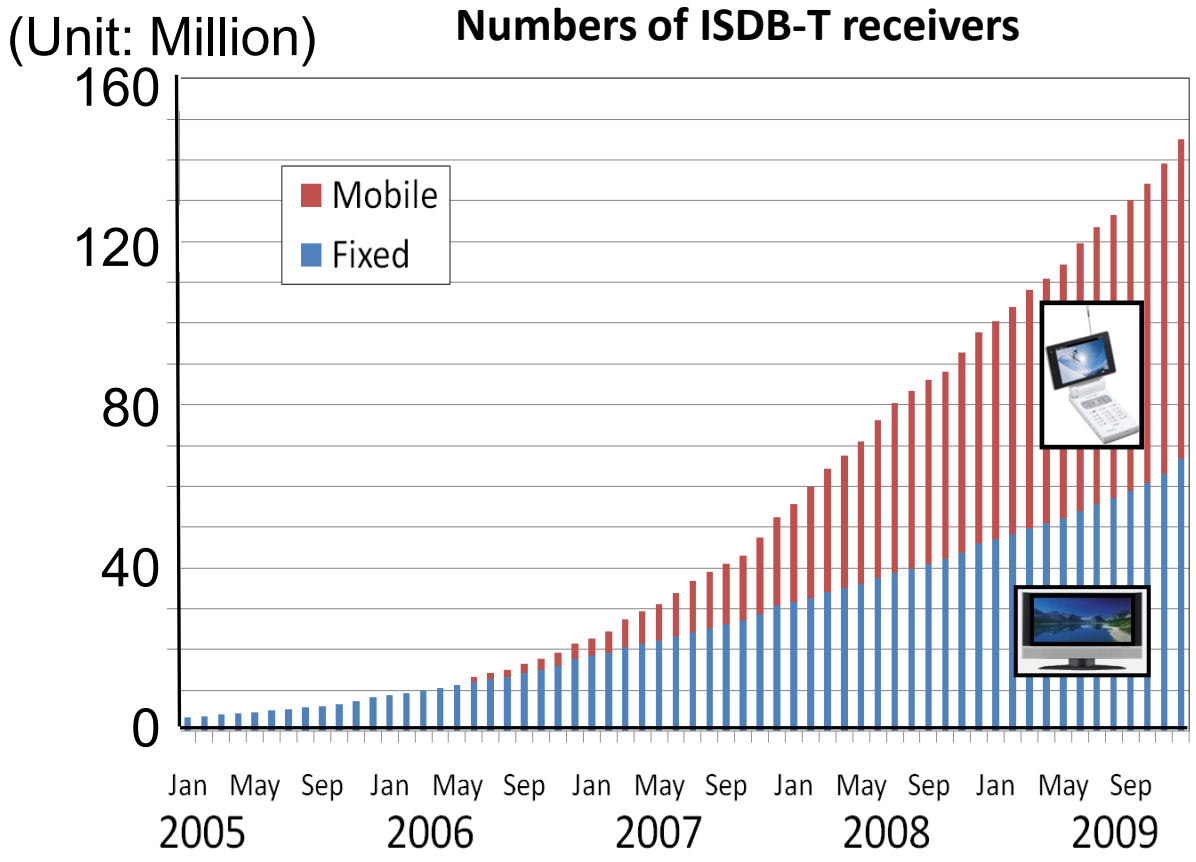
ISDB-T
Current Situation

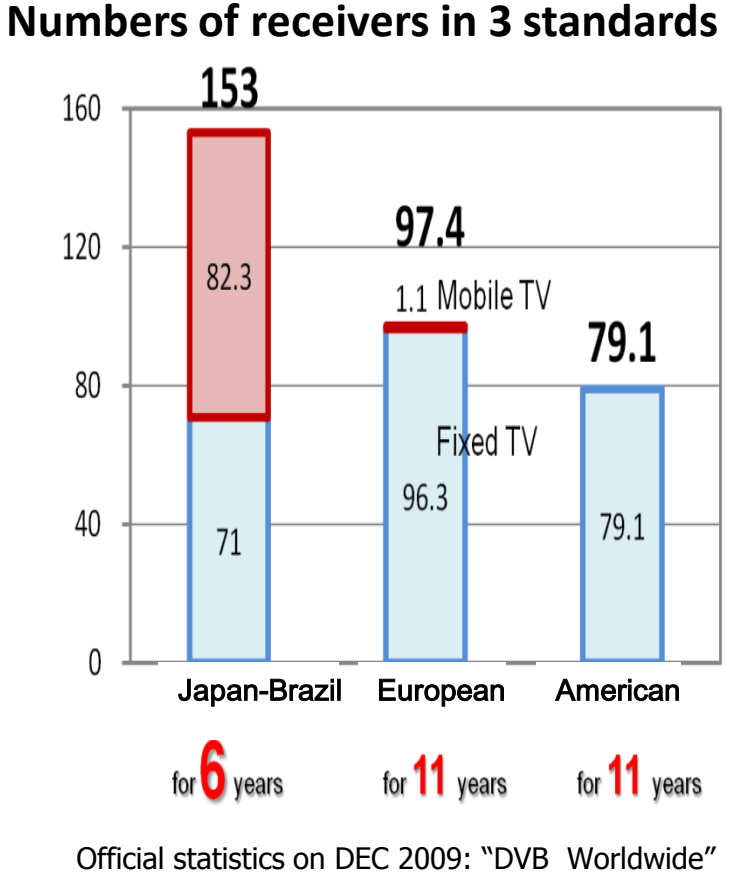
Official Information: DiBEG, Ministry of Internal Affairs and Communications, NHK Science and Technology Research labs, Japan

Penetration of ISDB-T Receivers

More than 153millions ISDB-T receivers have been shipped .

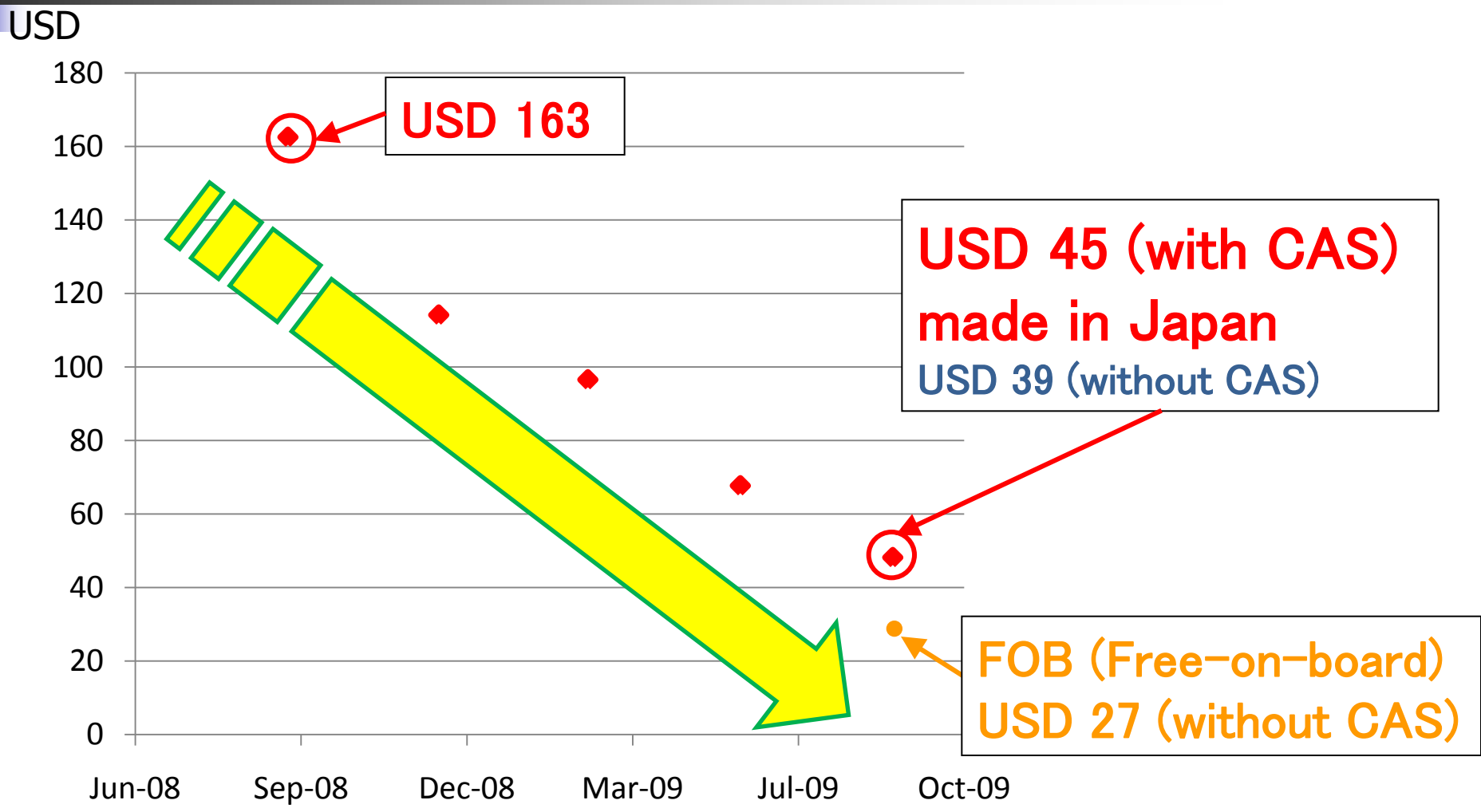
ISDB-T receiver has largest number of shipment in the world.





Official statistics on DEC 2009: "DVB Worldwide"

Tendency of STB price in Japan



1 USD = 103.37JPY

*Official Information: DiBEG, Japan

Global Manufacturers of ISDB-T Receivers

- Gradiente
- Philips
- Positivo
- Tec Toy
- Semp Toshiba
- Ebcom
- Samsung
- LG
- Envisio
- Aiko
- Amplimatic
- Thevear
- Visiontec
- Zinwell
- Panasonic
- Sony
- Olévia
- Telesystem
- Plasmatic
- Coship
- EWD

GSM / 3G+TV Digital

LCD & PLASMA

STB

USB One-Seg receiver

In Japan: Sony, Panasonic, Hitachi, Toshiba, NEC, Sanyo, Sharp Philips, Samsung, EWD, Dynaconnective, Maspro, Pixela, etc…..

Portable TV receivers in the Japanese market

Affordable portable TV receiver

$23.5

Web site

Affordable portable TV receiver with Video recording function

$56.8

Web site

* Average rate of last 3years: *1USD=105.29JPY

Global Manufacturers of ISDB-T Transmitters

- **TOSHIBA**

  Company headquarters are in Tokyo, Japan.

  http://www3.toshiba.co.jp/snis/ovs/broadcast_top.htm

- **NEC**

  Company headquarters are in Tokyo, Japan.

  http://www.nec.com/global/prod/nw/broadcast/index.html

- **ROHDE&SCHWARZ**

  Company headquarters are in Munich, Germany.

  http://www2.rohde-schwarz.com/en/products/broadcasting/tv_transmitters/tv_transmitter_power/

- **HARRIS**

  Company headquarters are in Melbourne, Florida, USA

  http://www.broadcast.harris.com/productsandsolutions/TelevisionTransmission/MobileTelevisionSolutions/default.asp

- **LINEAR**

  Company headquarters are in Santa Rita do Sapucai', Brazil.

  http://www.linear.com.br/ing/index2.php?abrir=digital#vhf

ISDB-T Receivers in Japan

	Television			STB	Portable TV receiver
Image and Information of receivers	 DY-32SDK200 Dynaconnective Co,.Ltd	 PRD-LA103-16 PIXELA CORPORATION	 WS-TV1310SK Don Quijote Co., Ltd	 EAGLE WORLD DEVELOPMENT CO LTD	 DY-1S25 Dynaconnective
Size	32inches	16inches	13.3inches	MPEG4 STB*	2.5inches
Price	385USD	193USD	180USD	19.99USD	25USD

(*demonstrated at International ISDB-T Forum at Lima, Peru, 21st September 2009)

*Official Information: Ministry of Internal Affairs and Communications, Japan

*1USD=103.37 JPY

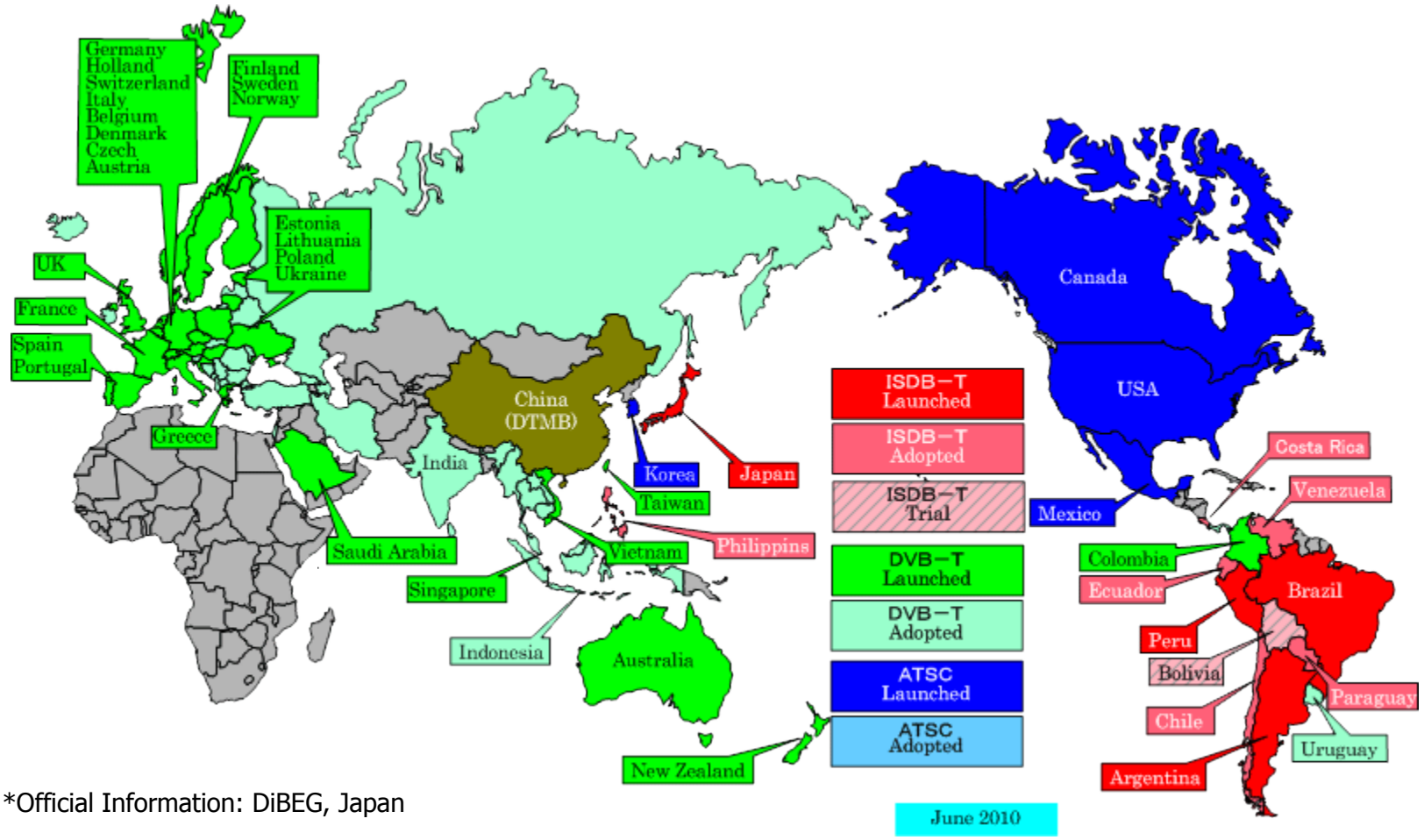
Comparison of price of STB (Set Top Box)

		ISDB-T	DVB-T
MPEG4	6MHz (South America)	19.99 US$	*32 US$
MPEG2		10.98 US$	*32 US$

*Presentation by DVB-T in Costa Rica on 21st January, 2010. (No Estimation)

*Official Information: DiBEG, Japan

Current DTTB Situation in the World



*Official Information: DiBEG, Japan

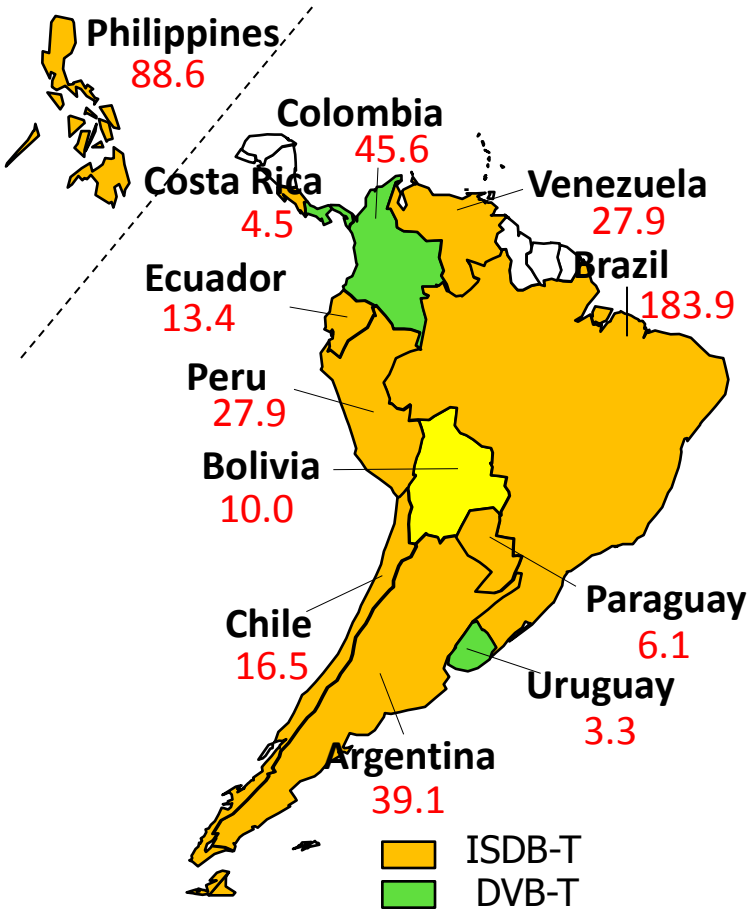
ISDB-T Countries are Expanding !!

Since 2009, all countries, that conducted deliberate comparison in technical / economical aspects between ISDB-T and DVB-T, have been adopting ISDB-T!!!

ISDB-T family countries

○Brazil:	June 2006	Adopt ISDB-T
	December 2007	Start DTTB service
○Peru:	April 2009	Adopt ISDB-T
	March 2010	Start DTTB service
○Argentina:	August 2009	Adopt ISDB-T
	April 2010	Start DTTB service
○Chile:	September 2009	Adopt ISDB-T
○ Venezuela:	October 2009	Adopt ISDB-T
○ Ecuador:	March 2010	Adopt ISDB-T
○ Costa Rica:	May 2010	Adopt ISDB-T
○ Paraguay:	June 2010	Adopt ISDB-T
○ Philippines:	June 2010	Adopt ISDB-T

ISDB-T market has a population of over 550 million (including Japan).



※The red value shows "population", (million)

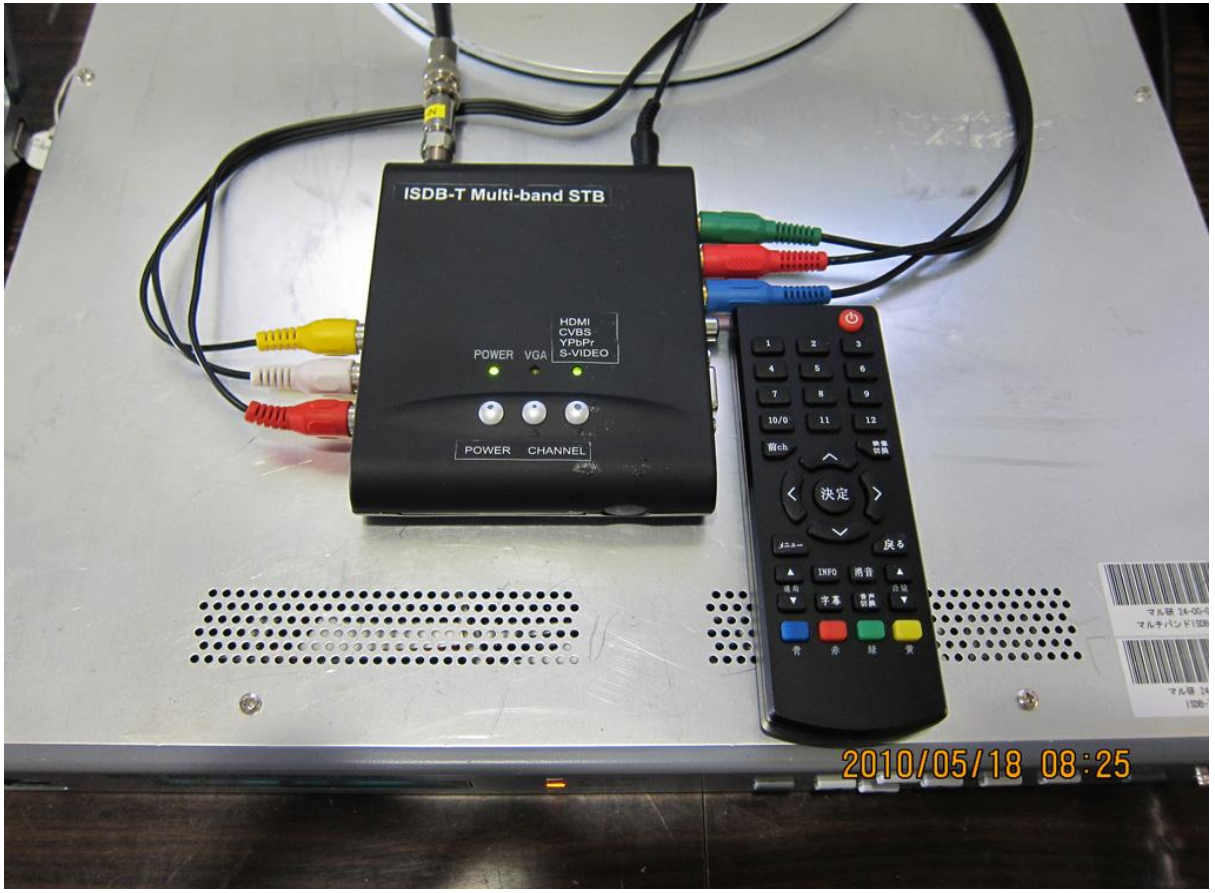
*Official Information: Ministry of Internal Affairs and Communications, Japan

Development of ISDB-T Multi-Band STB

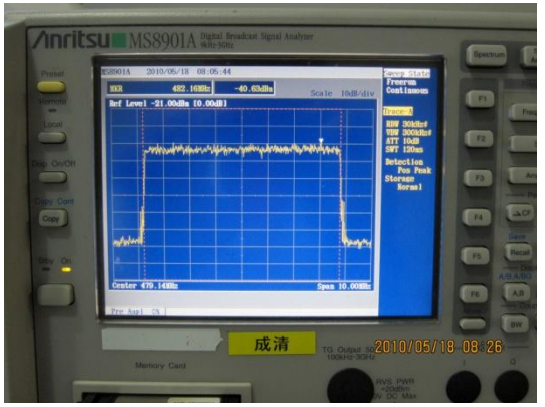
Demonstration of 8MHz ISDB-T System

*Official Information: NHK Science and Technology Research labs, Japan

Development of ISDB-T Multi-band STB



ISDB-T Multi-band Set top box



8 MHz Channel Spectrum

*Official Information: NHK Science and Technology Research labs, Japan

Summary of ISDB-T Transmission system

- ISDB-T promises **flexible** broadcasting services through hierarchical transmission
- ISDB-T is **robust** for interferences because of OFDM, time and frequency interleaving technology
- ISDB-T has technological **advantages in mobile reception**
- **HDTV** and **mobile service** can be transmitted **simultaneously**
  - **one-segment service** for handheld receivers
- **HDTV vehicular system** using diversity reception technology
  - The same HDTV broadcasted for fixed receiver can be viewed in motor vehicle
- **EWS** (Emergency Warning System)
  - Handheld receivers woken up by EWS signal alerts the user quickly of disaster (earthquake and tsunami, etc) warnings.
- **SFN** for effective frequency utilization
- Currently, **Brazil, Peru, Chile, Argentina, Venezuela, Paraguay, Ecuador Costa Rica** and **Philippines** decided to adopt ISDB-T as their DTTB system.

Thank you

for your kind attention !

teerapat@ait.ac.th

http://www.tc.ait.ac.th

Unsuccessful DVB-H

News

Nokia admits DVB-H is not succeeding

14 April 2008 20:07 by James "Dela" Delahunty | 2 comments

The world's largest mobile phone handset manufacturer **Nokia** has admitted that mobile television broadcasting is not catching on as previously expected. Despite the support for the DVB-H standard which is backed heavily by Nokia, only a few operators in Europe have opened any TV broadcasting services. The European Union backed the DVB-H standard last year.

NOKIA
CONNECTING PEOPLE

"It's a bit in a turmoil," **Niklas Savander**, head of Nokia's Internet services, told a conference in Helsinki. Mobile phones on the market that can retrieve and playback TV programming use third-generation (3G) mobile networks, which allows the carriers to charge for data rates which ultimately can affect the overall quality of content, and the number of users.

"We have seen that there are multiple segments who are not interested in the broadcasting, but rather in downloads. Roll out is slower than also we anticipated a couple of years ago," Savander said.

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http://www.afterdawn.com/news/archive/13656.cfm

DVB-H seems to have problems

Broadband TV News
The Business of Multiscreen Television

Spain abandons terrestrial mobile TV

By **Robert Briel**
May 19, 2010 08.17 UK

For the moment, Spain will not introduce terrestrial mobile TV, according to Bernardo Lorenzo, DG of telecommunications at the Ministry of Industry, quoted in local press reports. If there is not an increase in demand, the government will allocate the frequencies destined for mobile DTT to other services.

Industry players in the country "have not proposed an appropriate business model," he said. The country does not want to become "one of the failures that have occurred in Europe", according to Lorenzo. Also, the technological impact for the country of not introducing broadcast mobile TV "is minimal."

The announcement looks like another nail in the coffin of terrestrial mobile TV broadcasting and the DVB-H standard in particular. So far, just a few countries have commercially rolled out DVB-H services and not one has been a success. As a result, most countries now take a cautious approach.

According to the DG, terrestrial pay TV in Spain is now in the process of being accepted by the general public, "despite the apocalyptic messages that were circulating before the approval."

With regards to the introduction of terrestrial HD broadcasts, the government plans to introduce legislation requiring manufacturers to include a MPEG4/HD tuner into every TV set of 21 inches and larger.

URL:http://www.broadbandtvnews.com/2010/05/19/spain-abandons-terrestrial-mobile-tv/

DVB-H seems to have problems (2)

swisscom

Press release

Berne, 23 March 2010, 10:30

Swisscom TV air to replace Swisscom TV mobile

Swisscom TV air will replace Swisscom TV mobile with immediate effect. The benefits for existing customers will be two-fold. They can now watch TV on their computers, and only have to pay CHF 9 instead of CHF 16. Following the launch of the new TV offering, Swisscom will also be discontinuing its **DVB-H** service for residential customers. At the moment there are not enough DVB-H compatible devices to make the service a success. The DVB-H network will remain in place for the time being.

Source: http://www.swisscom.com/GHQ/content/Media/Medienmitteilungen/2010/20100323_MM_Swisscom_TV_air.htm?lang=en