

ISDB-T

(Integrated Services Digital Broadcast – Terrestrial)

THE BEST FIT DIGITAL TELEVISION STANDARD FOR THE PHILIPPINES

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<http://www.arib.co.jp>

<http://www.dibeg.org>

DIGITAL TELEVISION FOR THE PEOPLE, THE BROADCASTERS AND THE GOVERNMENT

State of broadcast and information in the country

The Philippines is a tropical country that encounters a lot of natural calamities yearly, it can range from any of the following :

Natural Calamities

Typhoon

Floods

Earthquake

Landslides

Customized info

Transportation

Special announcements

Sports

Other events

ISDB-T IS BEST FOR EVERYBODY

ISDB-T's technology

**GOVERNMENT
INFORMATION
SYSTEM**

NDCC, PHILVOCS,
PAGASA, DECS,
MMDA, ETC.

BROADCASTERS

EWBS
EMERGENCY
WARNING
BROADCAST
SYSTEM

PEOPLE

PEOPLE ARE
EMPOWERED!,
Information received
whenever, wherever
necessary

Why the need for immediate information?

12mn 1am 2am 3am 4am 5am 6am 7am 8am 9am 1:0am 11am
12Nn 1am 2am 3am 4am 5am 6am 7am 8am 9am 1:0am 11am

**TRANSPORTATION
INFORMATION**

SCHOOL INFORMATION

WEATHER INFORMATION

**SPECIAL ANNOUNCEMENTS/EMERGENCIES
(SEISMIC/TIDAL, VOLCANIC, TERRESTRIAL, FIRE, ETC.)**

**PROBLEM : CURRENT INFORMATION DELIVERY IS INEFFICIENT,
UNSYNCHRONIZED TO THE NEED OF THE PEOPLE**

**ISDB-T WILL ENABLE A UNIFIED INFORMATION SYSTEM
THAT CAN BE DELIVERED TO THE PEOPLE IMMEDIATELY!**

**TRAFFIC INFORMATION
MMDA**

**NATIONAL DISASTER
COORDINATING COUNCIL**

**DELIVER
INFORMATION
TO THE PEOPLE**

PAGASA

PHILVOCS

**DEPARTMENT OF EDUCATION
(DECS)**

DIGITAL TELEVISION FOR THE BROADCASTERS

Solution for Nationwide Terrestrial Network

**Single Frequency Network
(SFN)**

Network Configuration

SFN - a technique that enables transmission on the same frequency within the same coverage without interference. a key feature in DTV.

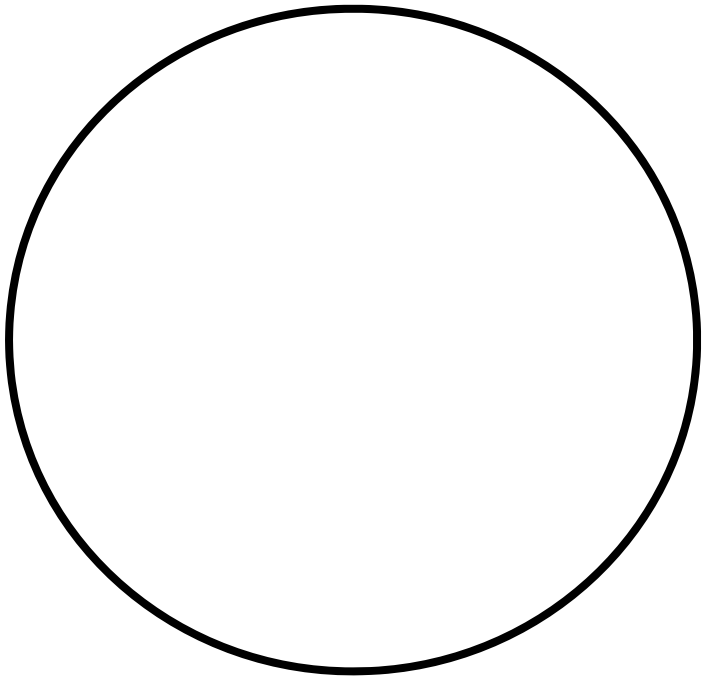
MFN – a technique of providing coverage in a service area utilizing multiple frequencies, this technique is used in analog. a.K.a. Translator.

In providing signal coverage in a particular service area, the following are the options in delivering content to various transmitter sites :

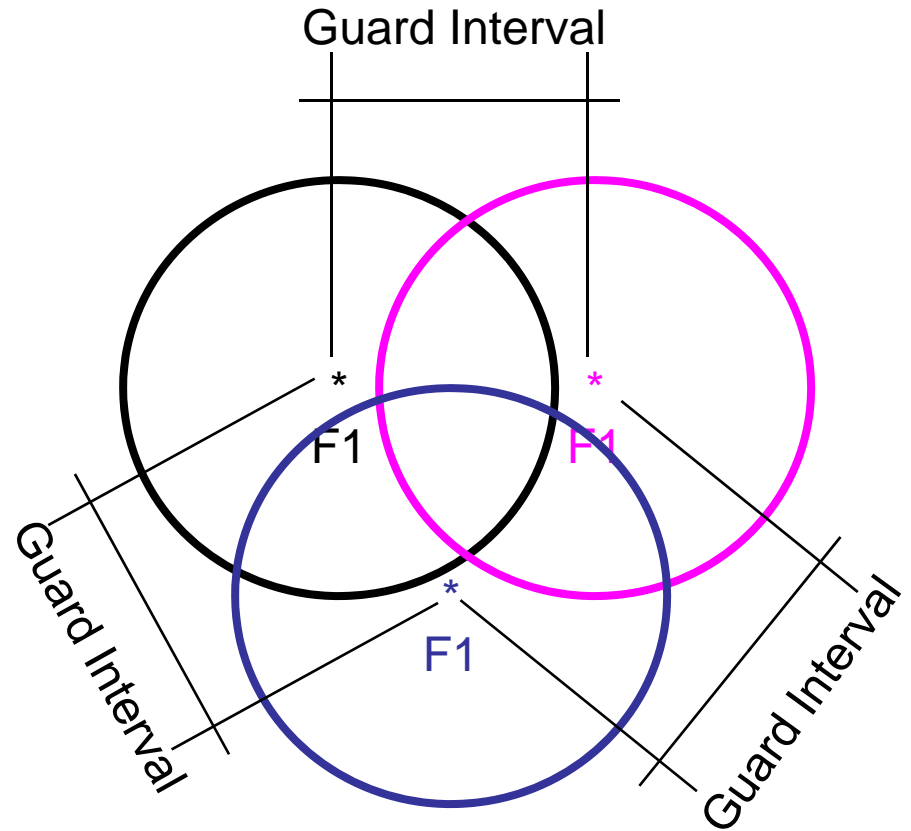
1. Microwave Distribution Network
2. Satellite
3. Broadcast Wave Relay
4. Dedicated Fiber link

Network Coverage using SFN

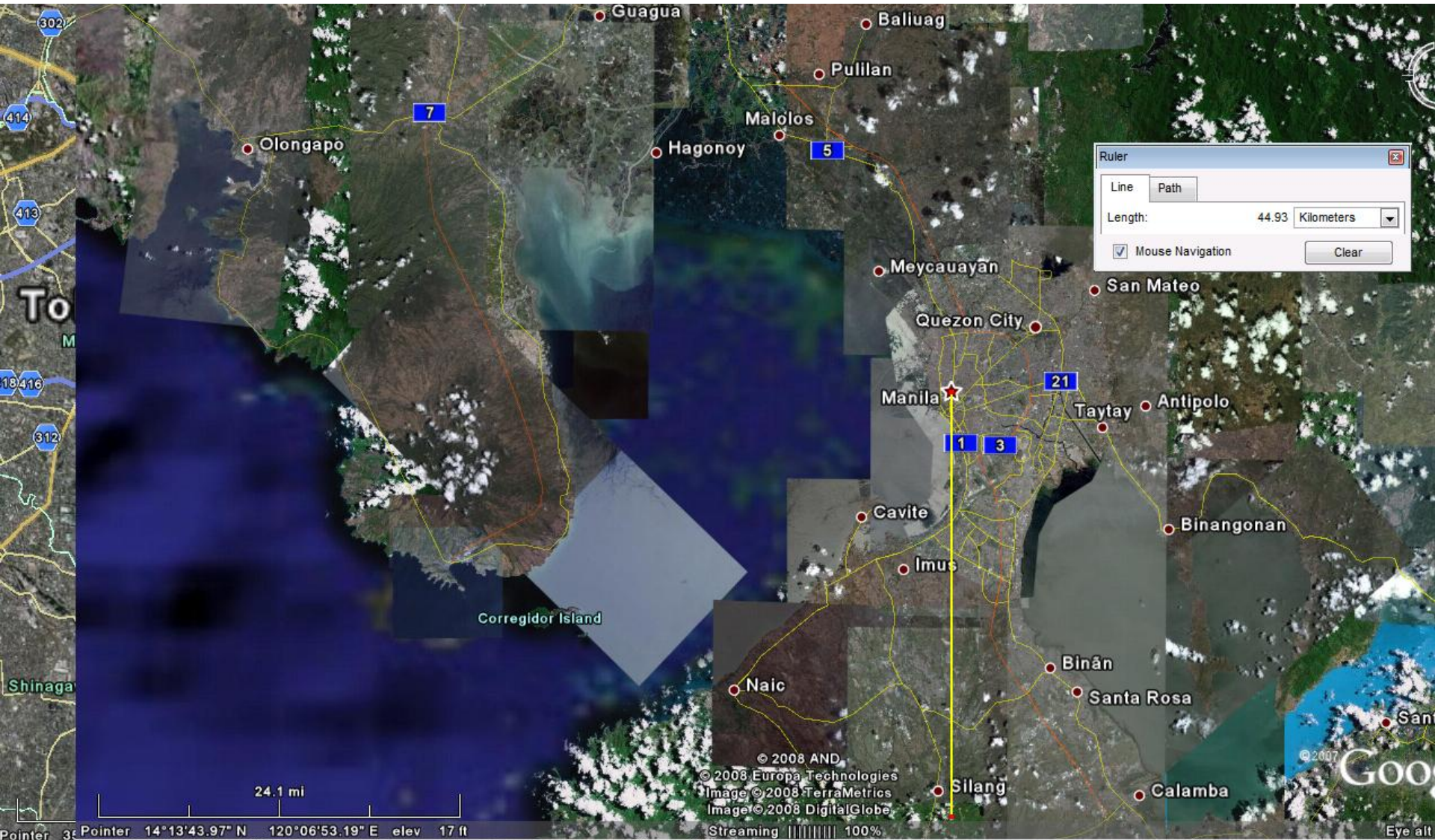
Single Large Power Tx



Multiple Low power TX



Mega-Manila



Guard Interval comparison

ISDB-T			
	Symbol Duration		
	Mode 1	Mode 2	Mode 3
GI Length	2.52E-04	5.04E-04	1.01E-03
1/4	18.90	37.80	75.60
1/8	9.45	18.90	37.80
1/16	4.73	9.45	18.90
1/32	2.36	4.73	9.45

Distance (Kms.)

DVB-T			
	Symbol Duration		
	2K	4K	8K
GI Length	2.99E-04	5.97E-04	1.19E-03
1/4	22.40	44.81	89.61
1/8	11.20	22.40	44.81
1/16	5.60	11.20	22.40
1/32	2.80	5.60	11.20

Distance (Kms.)

SFN Links

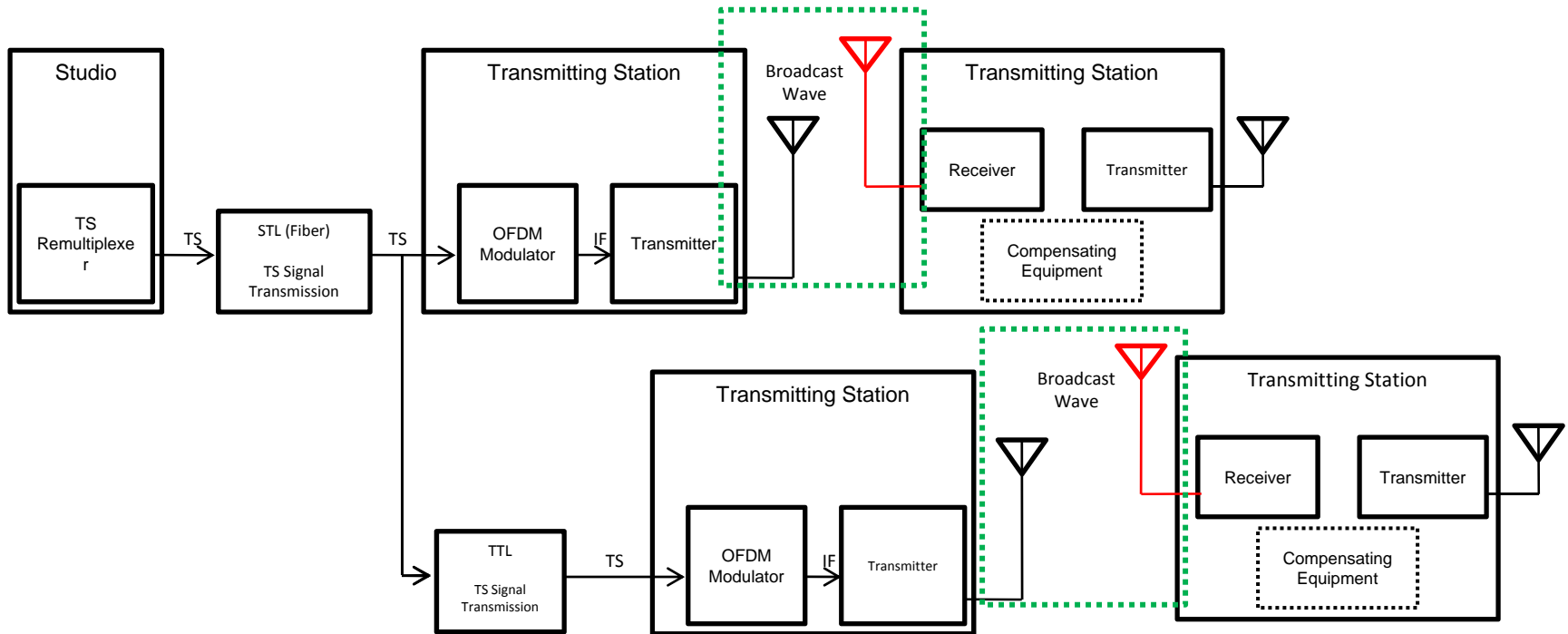
In this design, Studio to Transmitter Links, Transmitter to Transmitter links and Broadcast Wave Relay configurations are used for distributing signals from the Broadcast Center.

STL/TTL are simply microwave links used to connect two points.

Broadcast Wave Relay is the same as “Off the air pick-up and re-distribution of signal.

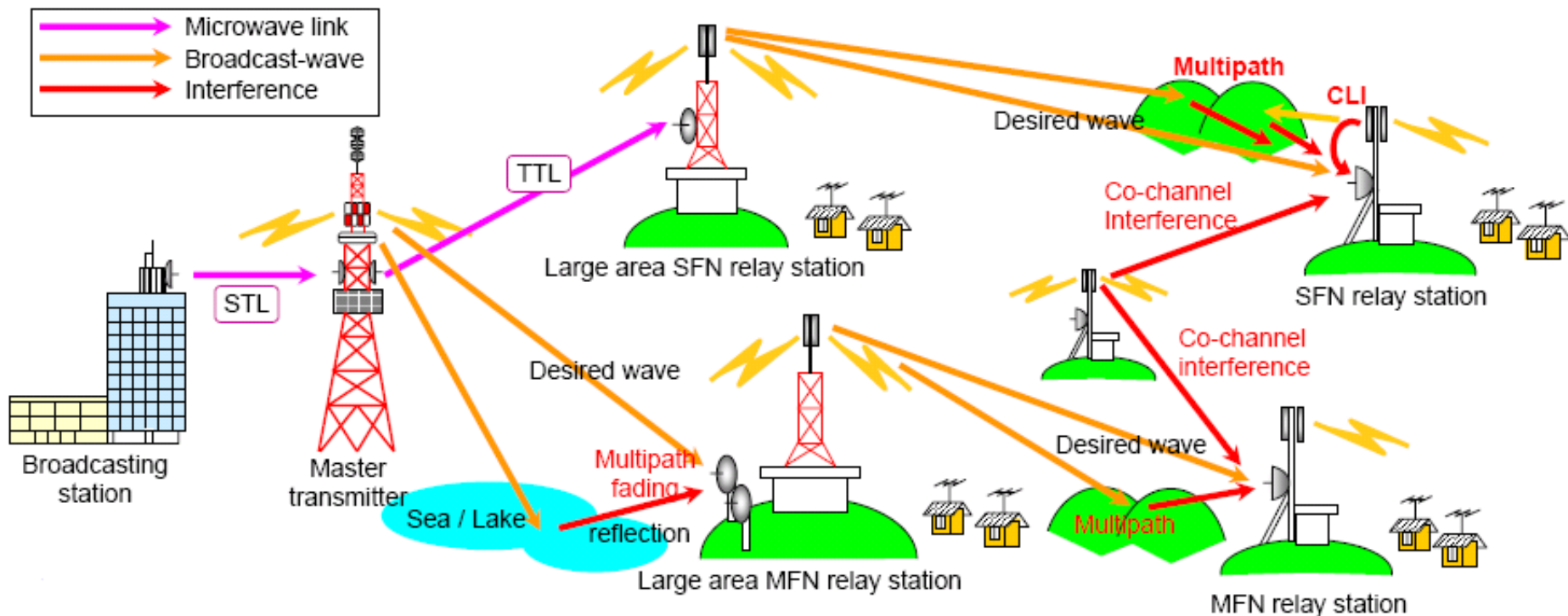
ISDB-T's OPTIMIZED SFN UTILIZATION

SFN STL/Broadcast Wave Relay Block Diagram



Broadcast Wave Relay

- Interferences mixed in reception at relay station:
 - Multipath
 - Fading
 - Co-channel interference (analog / digital) from other stations
 - CLI (coupling loop interference; feed back loop) in SFN relay



Compensation Technologies

Compensation technology	Interference at relay station			
	Multipath	Fading	Co-channel Interference	Coupling Loop Interference
Multipath Equalizer	○	×	×	×
Diversity Reception	⊙	⊙	×	×
CLI Canceller (On-channel Repeater)	○	×	×	⊙
Adaptive Array Antenna	⊙	⊙	⊙	×

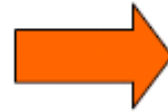
⊙: excellent, ○: good, ×: ineffective

Problem of co-channel repeater (SFN)

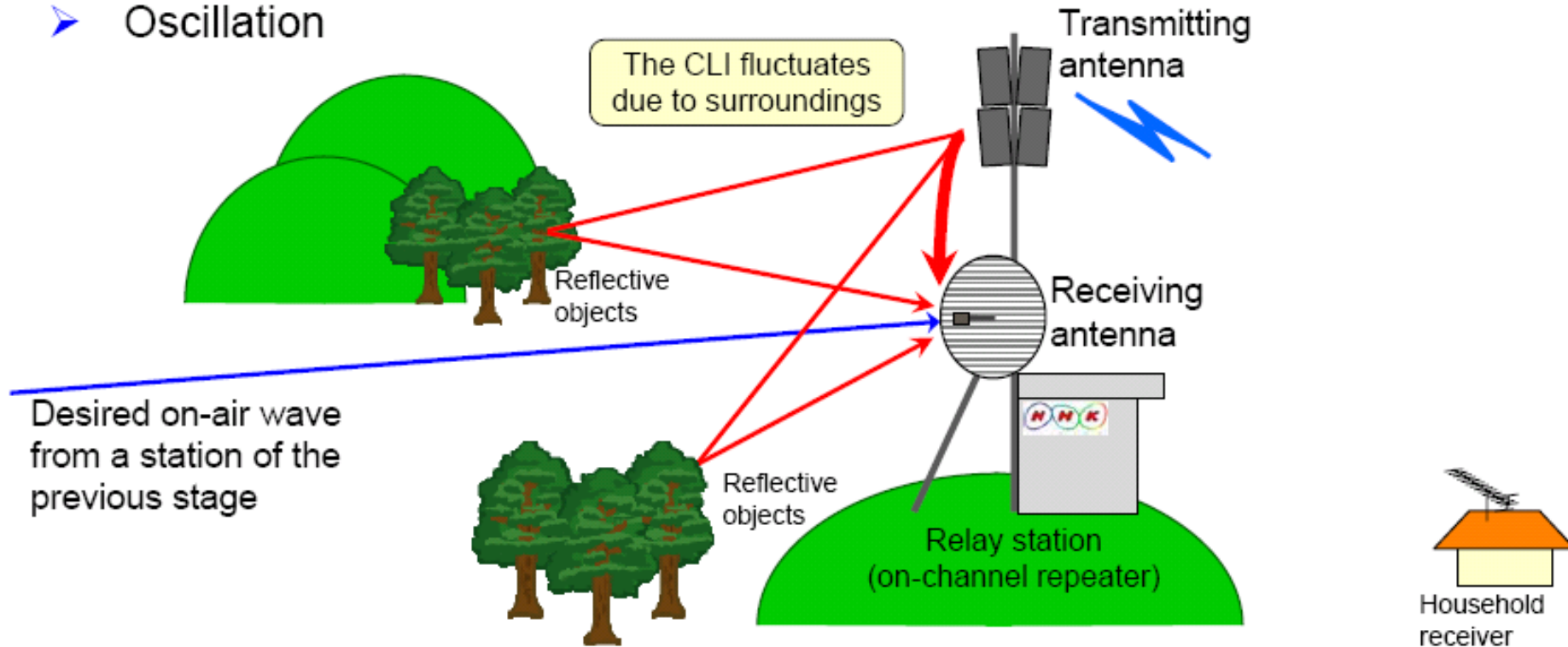
■ Problem of **coupling loop interference (CLI)**.

= **Howling of radio wave**

- Signal degradation
- Oscillation

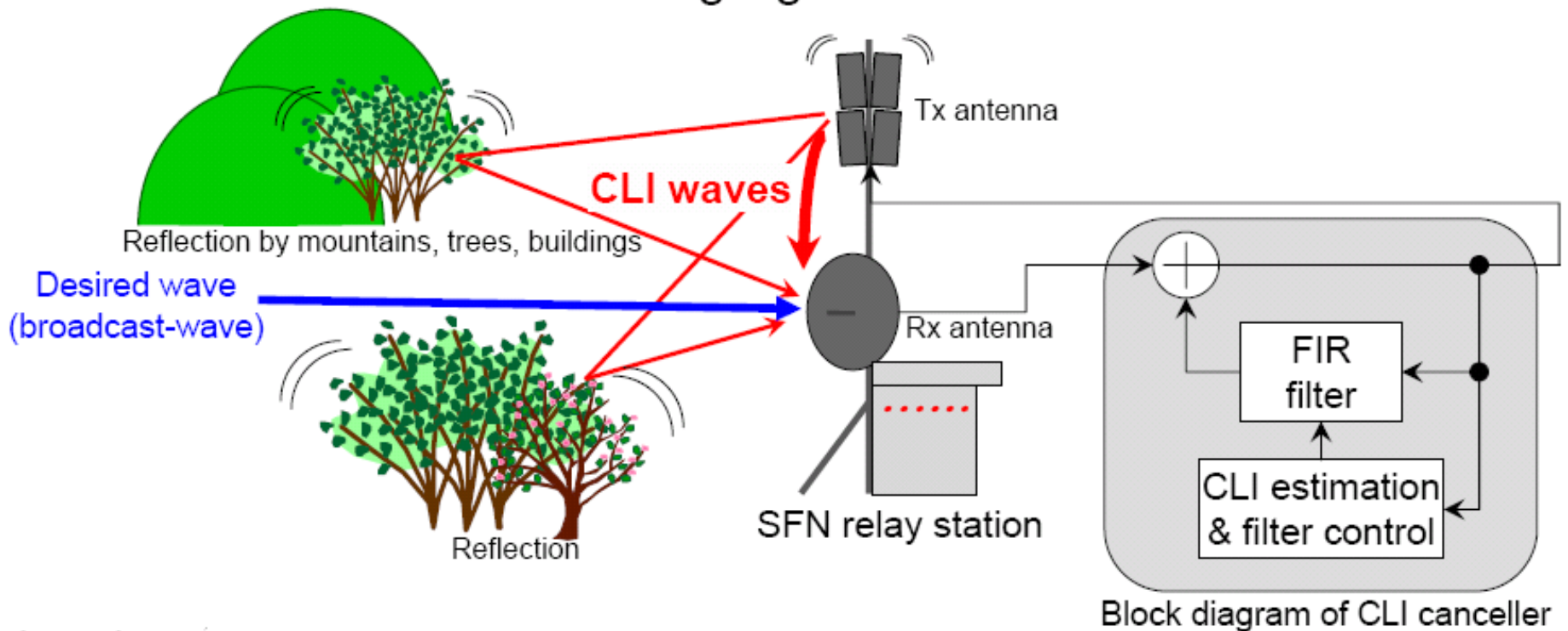


CLI Cancellor

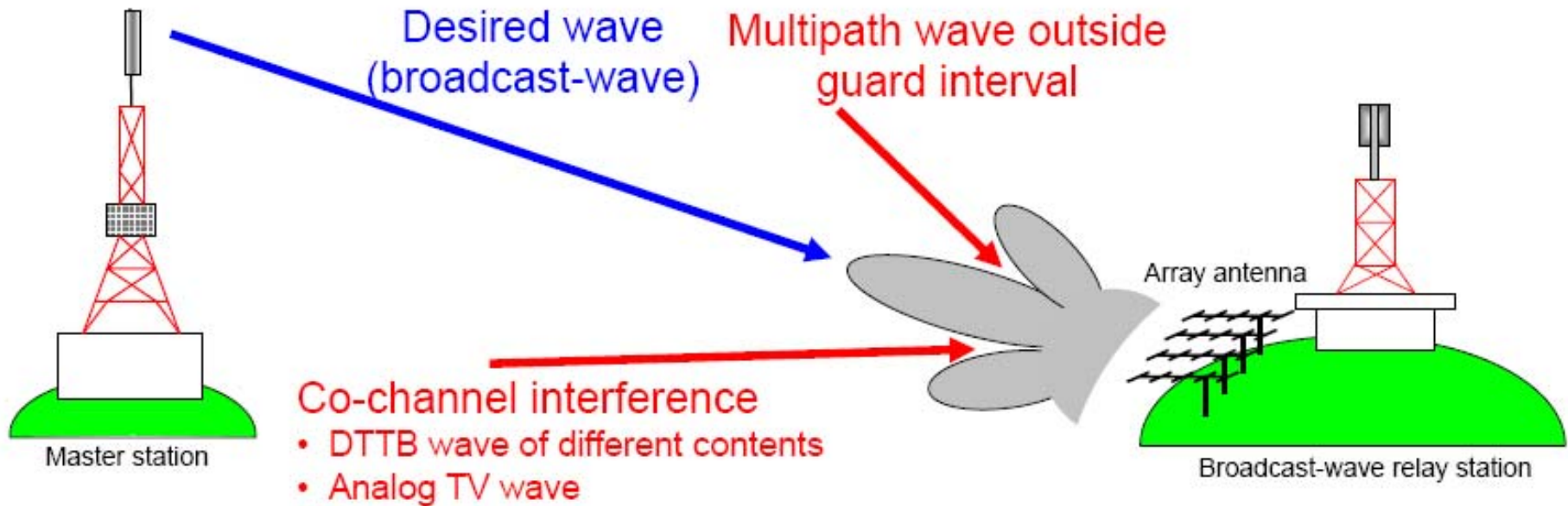


Coupling Loop Interference canceller

- Enables single frequency re-transmission (SFN relay)
- Adaptive cancelling algorithm with digital signal processing
- Estimates CLI characteristic, generates CLI replica and cancels CLI from receiving signal



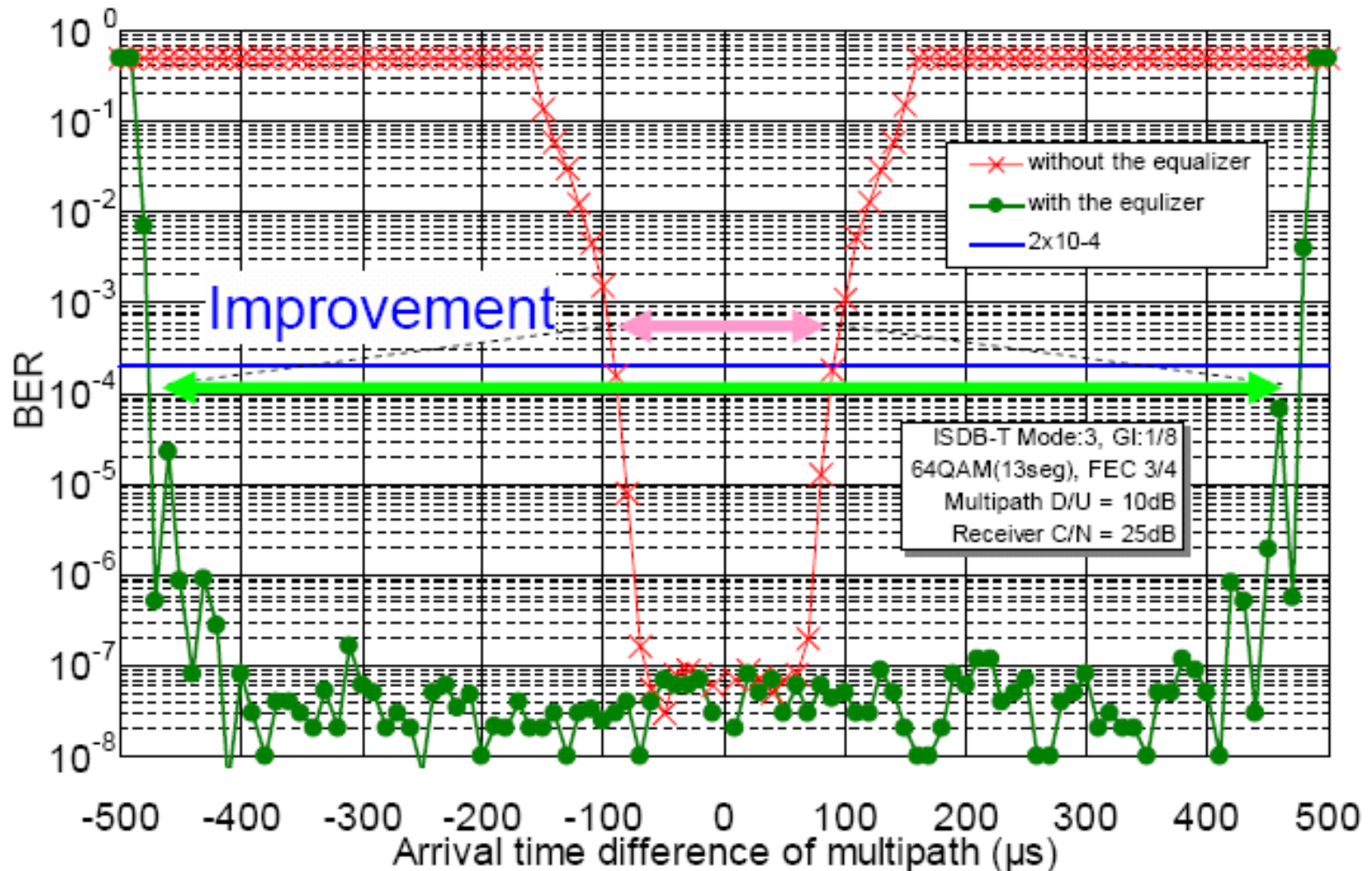
adaptive antenna array for CLI canceller



- **Adaptive array antenna system with digital signal processing**
- Eliminates the co-channel interference utilizing the difference in the arrival directions of desired wave and undesired interference

Outside the Guard Interval Equalizer

- This technology enables to equalize multipath outside the guard interval (GI) of OFDM.



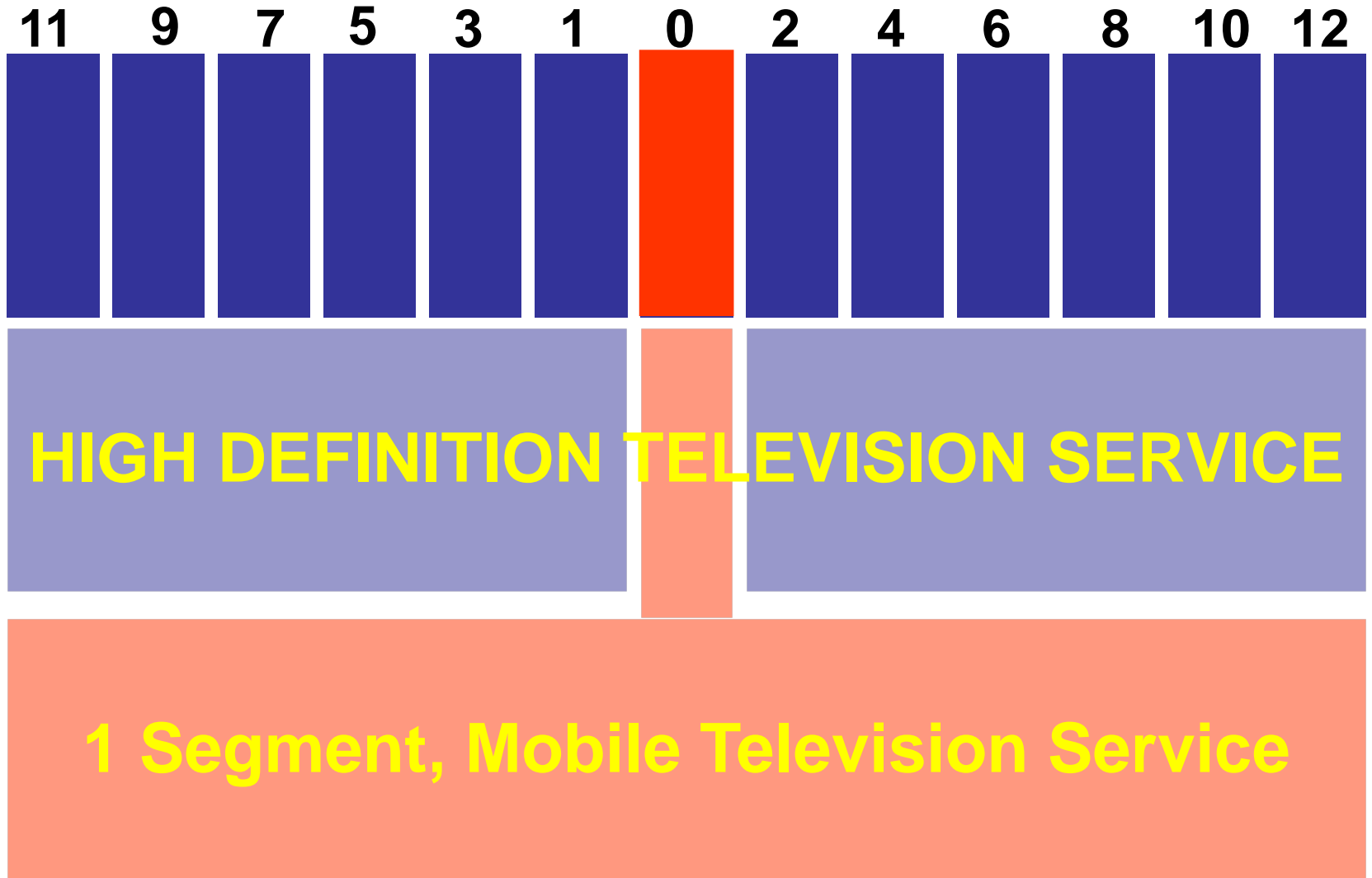
OFDM parameters

MODES

1
2
3

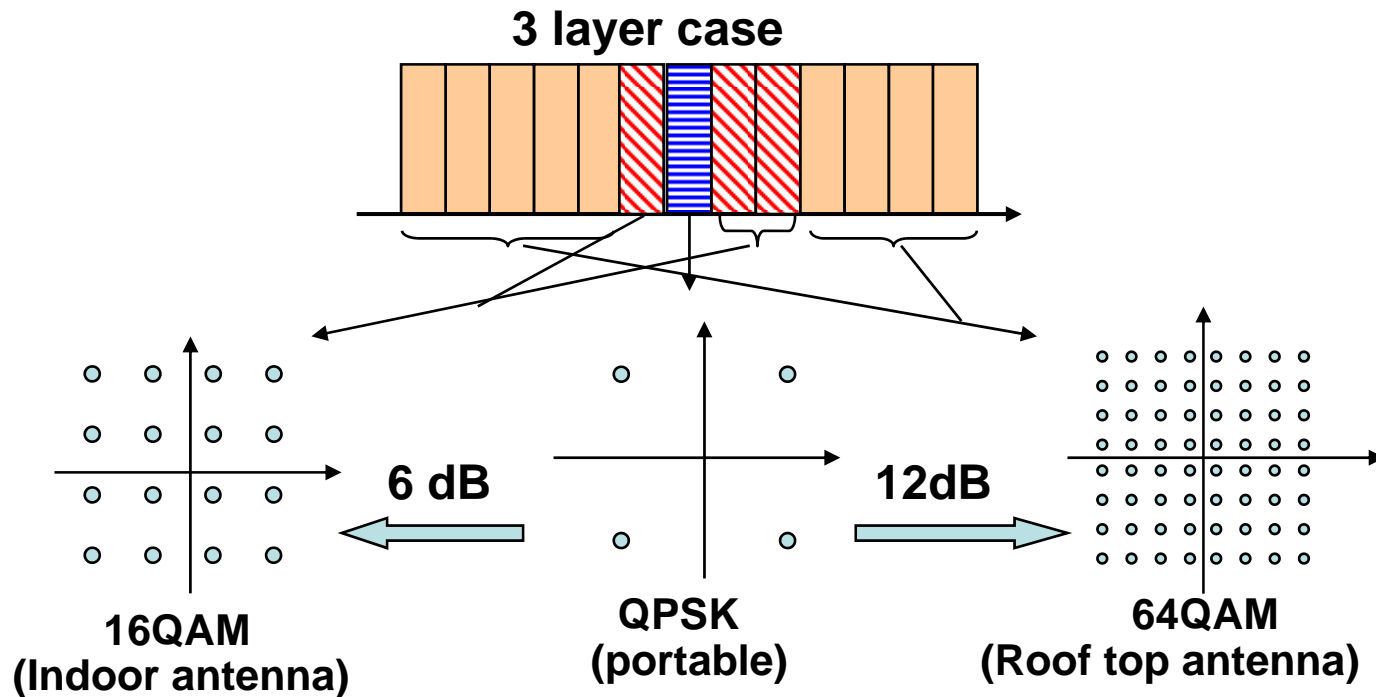
OFDM parameters		MODES					
		1		2		3	
Carrier Saacing		4Khz (250/63)		2Khz (125/63)		1Khz (125/126)	
Number of Carriers	Data	96	96	192	192	384	384
	Scattered ailots	9	0	18	0	36	0
	Continual ailots	0	1	0	1	0	1
	TMCC	1	5	2	10	4	20
	aC1	2	2	4	4	8	8
	aC2	0	4	0	9	0	19
	Total	108		216		432	
Carrier Modulation Scheme		QaSK	DQaSK	QaSK	DQaSK	QaSK	DQaSK
		16QaM		16QaM		16QaM	
		64QaM		64QaM		64QaM	
Symbols per frame		204					
Effective symbol length		252uS		504uS		1008uS	
Guard Interval		63uS (1/4)		126uS		252uS (1/4)	
		31.5uS (1/8)		63uS		126uS (1/8)	
		15.75uS (1/16)		31.5uS		63uS (1/16)	
		7.875uS (1/32)		15.75uS		31.5uS (1/32)	
Frame Length		34.26mS		128.52mS (1/4)		257.04mS (1/4)	
		57.834mS		115.668mS (1/8)		231.336mS (1/18)	
		54.621 mS		109.242mS (1/16)		218.484mS (1/16)	
		53.0145mS		106.029mS (1/32)		212.058mS (1/32)	
IFFT sampling frequency		8.12Mhz (512/63)					
Inner code		Convolutional Code (1/2, 2/3, 3/4, 4/5, & 7/8)					
Outer code		Reed Solomon (204,188)					

ISDB-T Segments



ISDB-T's Segmented OFDM

- Hierarchical transmission



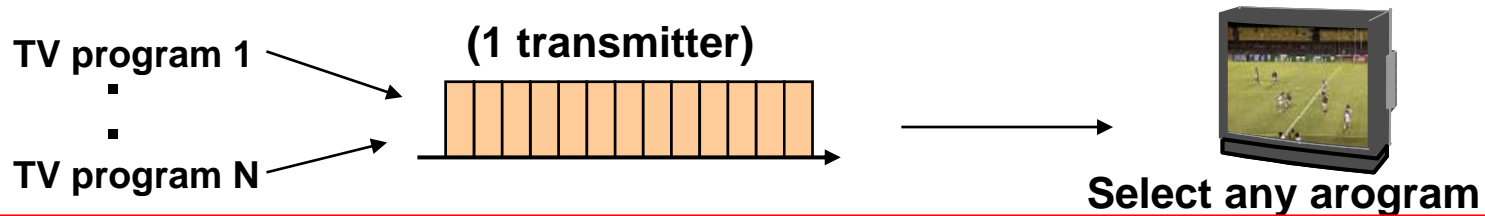
as shown above, ISDB-T transmission system supports a maximum 3 reception style.

Therefore, any of transmission system can be arranged according to the service concept in one frequency channel and one transmitter

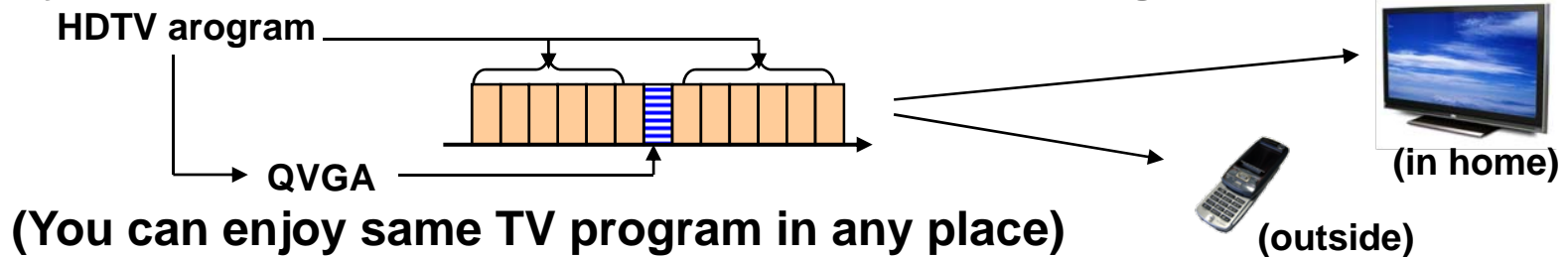
ISDB-T's Segmented OFDM

Examples of Broadcasting service by using Hierarchical transmission

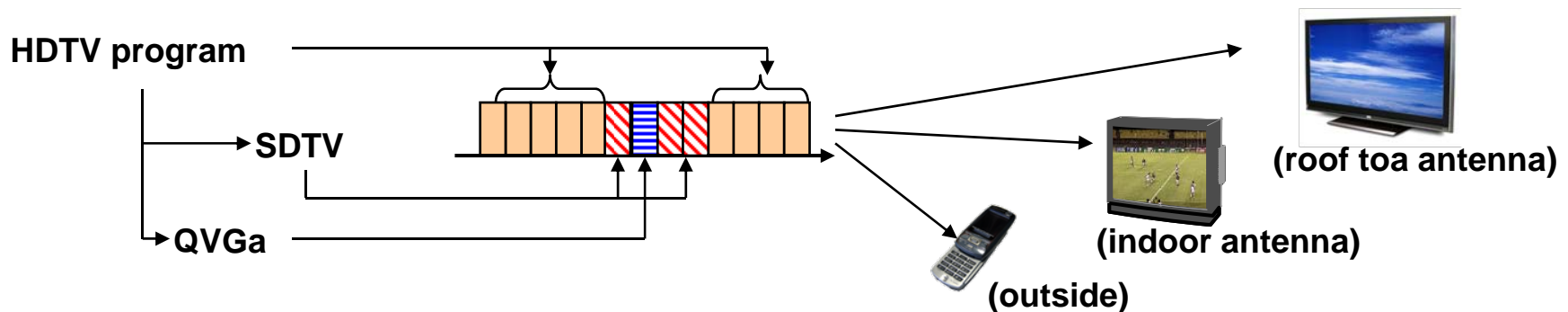
(1) Single layer multi-program for stationary reception



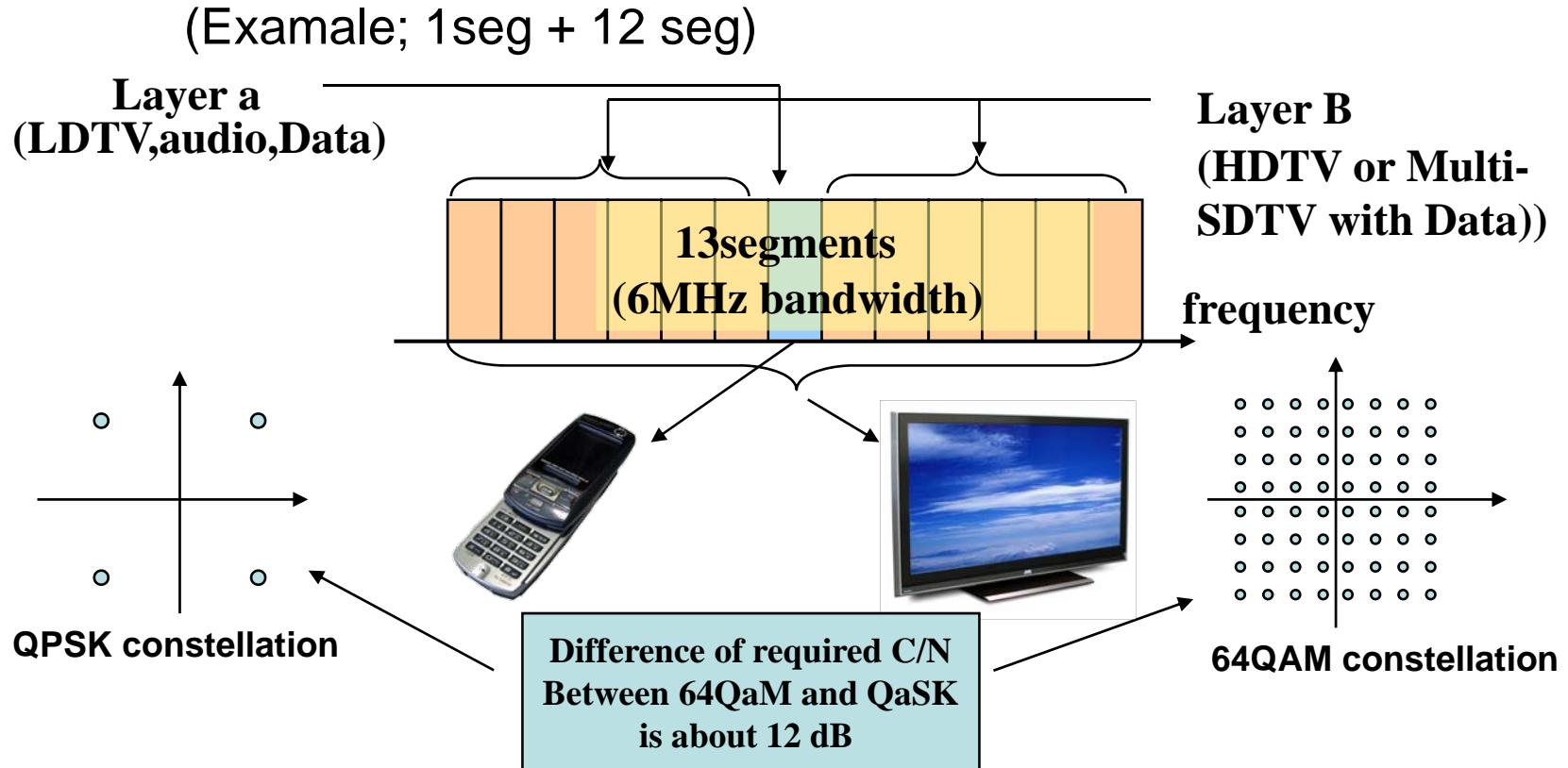
(2) 2 layers for HDTV and portable reception (same program)



(3) 3 layers for HDTV, SDTV and portable reception (same program)



ISDB-T's Hierarchical Operation



*13 segments are divided into layers, maximum number of layers is 3.

*any number of segment for each layers can be selected (totally 13 segment)

***Transmission parameter sets of each layer can be set independently**
(In above example, modulation index of each layer are different)

**ISDB-T is best for the Broadcaster, the
Government and the People!**