

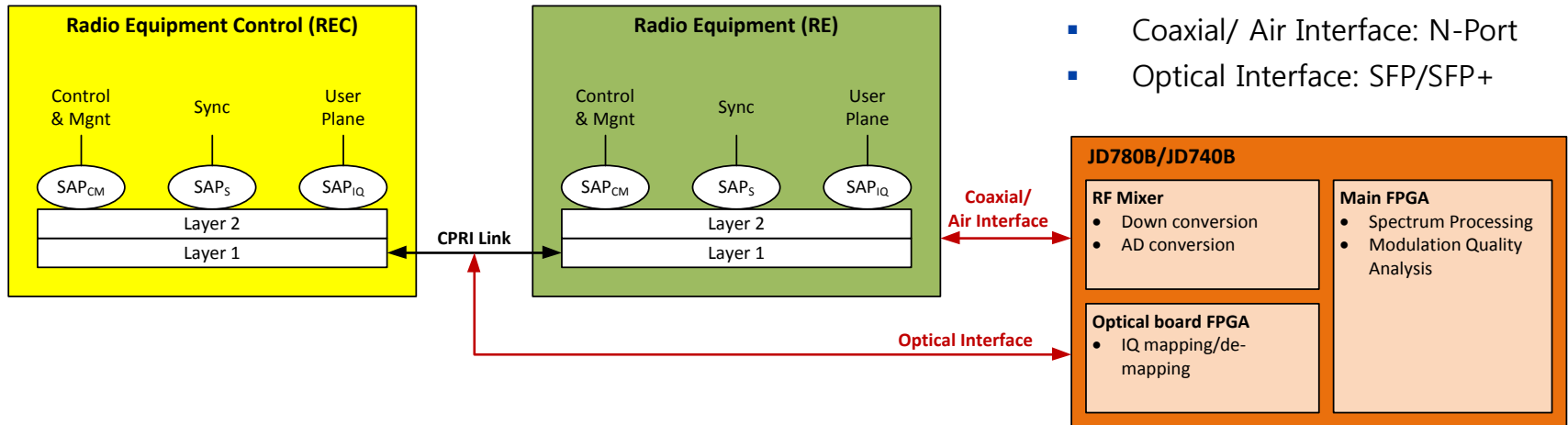
**VI.VI**

**CellAdvisor  
RFoCPRI™**



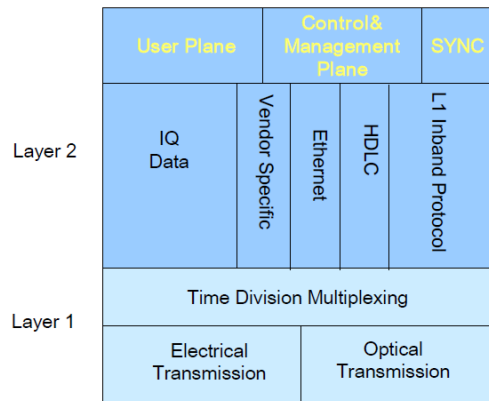
# RFoCPRI™ Technology Interface

JD745B은 RRH 테스트를 위한 인터페이스의 두 가지 유형을 지원합니다



- Coaxial/ Air Interface: N-Port
- Optical Interface: SFP/SFP+

## CPRI 프로토콜 개요



**User Plane:** 하나의 안테나 및 하나의 캐리어(AC)의 IQ 데이터 흐름.

**Control Plane:** 정보는 운영, 관리 및 CPRI 링크의 유지 보수 관련. 제어 데이터 바이트의 실제 내용은 CPRI 정의되지만 제조사에 특정되지 않는다

**Synchronization Plane:** 노드들 사이의 프레임 시간 동기 정보를 전송하는 데이터 흐름.

**IQ Data:** 동 위상 및 직교 변조 된 데이터의 형태로 사용자 정보 (디지털베이스 밴드 신호).

**L1 Inband Protocol:** 링크 관련되어 직접적으로 물리 계층에 의해 반송되는 정보 신호.

# CPRI Technology Overview

## CPRI Frame 구조

### Length of control word

Line Rate [Mbps]	Length of word [bit]
614.4	T=8
1228.8	T=16
2457.6	T=32
3072.0	T=40
4915.2	T=64
6144.0	T=80
9830.4	T=128

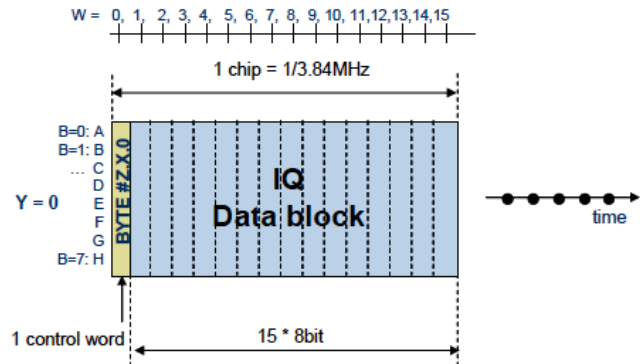
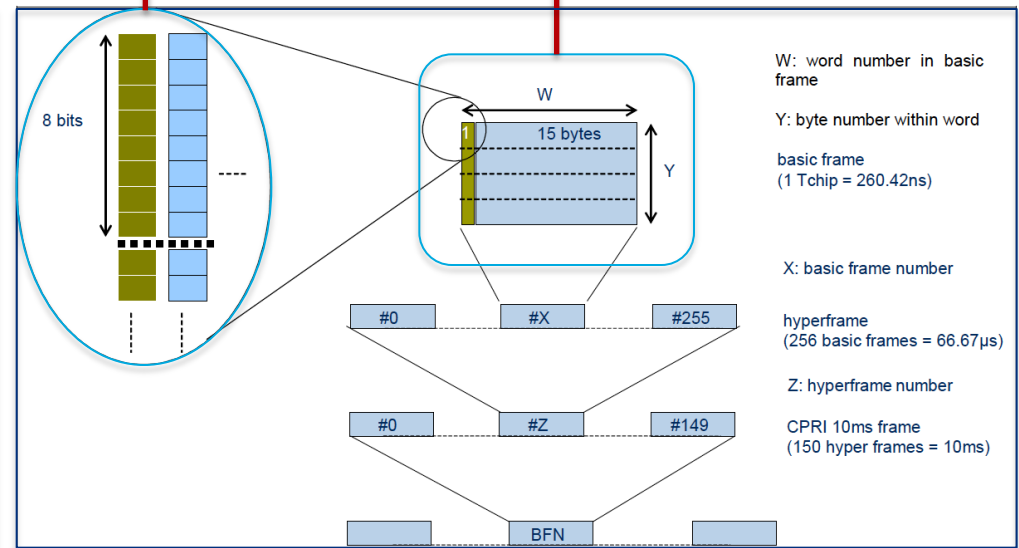


Figure 7: Basic frame structure for 614.4 Mbit/s CPRI line bit rate

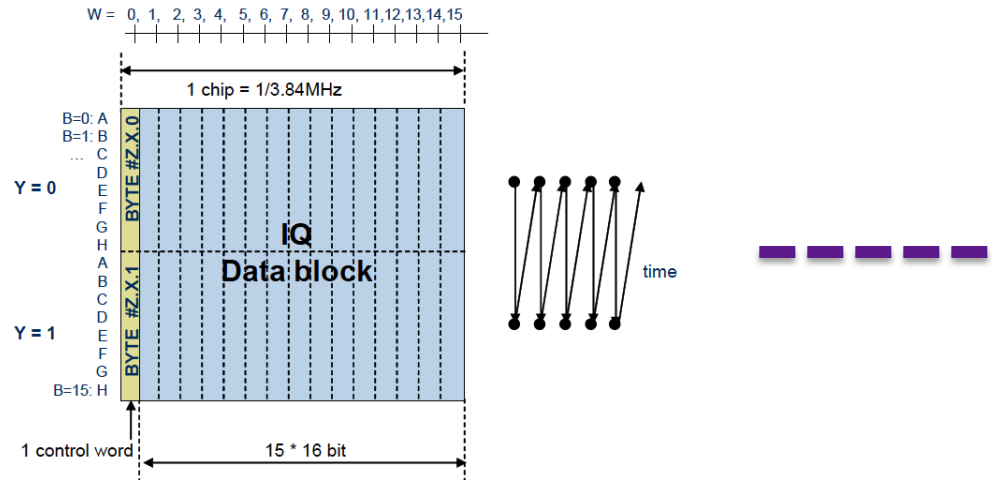


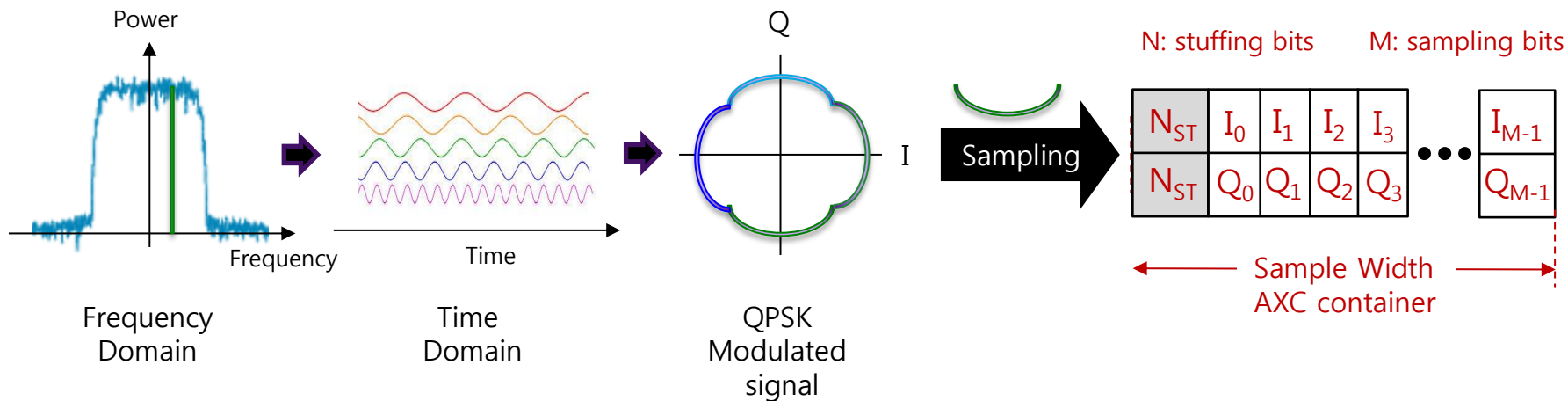
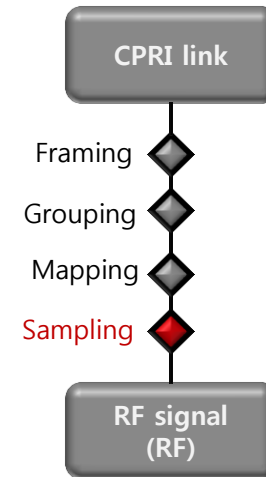
Figure 8: Basic frame structure for 1228.8 Mbit/s CPRI line bit rate

# CPRI Technology Overview

## User Plane Sampling

- Sampling:**

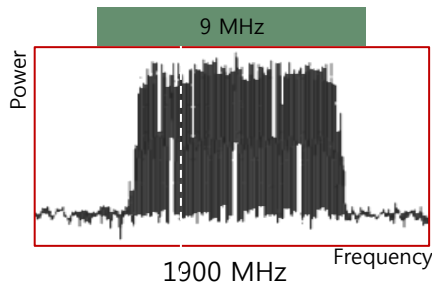
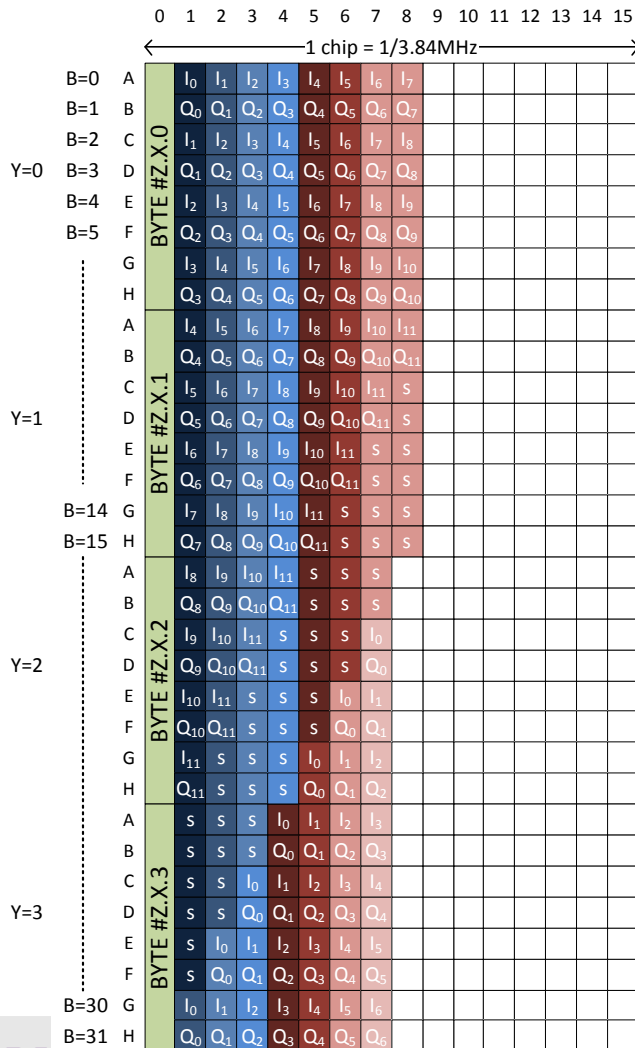
- 사용자 데이터는 하나의 캐리어, 다시 말해서, 안테나 캐리어 (AxC) 컨테이너에 대해 하나의 안테나의 데이터를 반영하고 IQ 데이터 흐름의 형태로 이송된다.
- AxC 당 샘플링 레이트는 스테핑 샘플 첨가 정수배에 동등하지 않은 신호 인 경우 (3.84MHz)의 정수배로 맞추어 집니다.



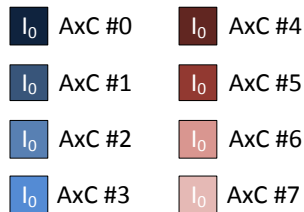
# RFoCPRI™ 측정

## LTE Spectrum 측정

### ■ LTE CPRI Mapping – 2457.8 Mbps



AxC Group #1 AxC Group #2



Total bits / Basic Frame  
 = 8 x 4 x 16  
 = 512

512 - 32  
 = 480

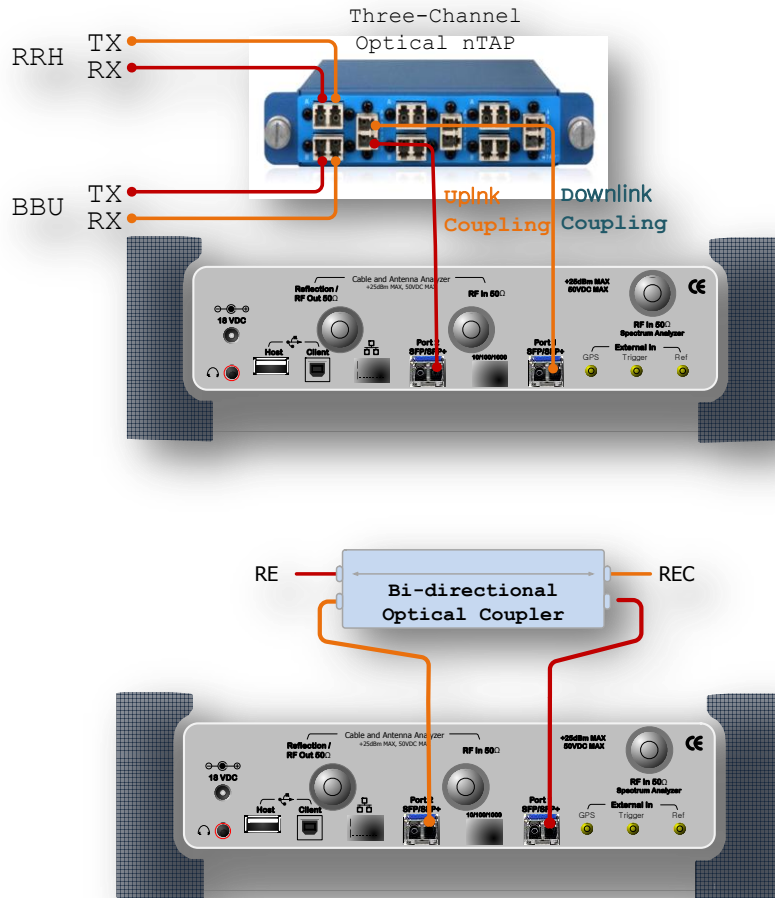
DUT	
CPRI line rate (Mbps)	2457.6
LTE Bandwidth	9 MHz
Carriers	MIMO
AxC positioning	Packed
IQ Sampling	15
Over sampling	1
Stuffing Bits	3

Test Configuration		
Link Rate (Mbps)	2457.6	
Bandwidth (MHz)	10	
NEM	None	
AxC Group	1 - 2	
IQ Sample Width	12	
Map Position (AxC Spacing)	AxC 0	0 (0)
	AxC 1	15 (30)
	AxC 2	30 (60)
	AxC 3	45 (90)
	AxC 4	60 (120)
	AxC 5	75 (150)
	AxC 6	90 (180)
	AxC 7	105 (210)

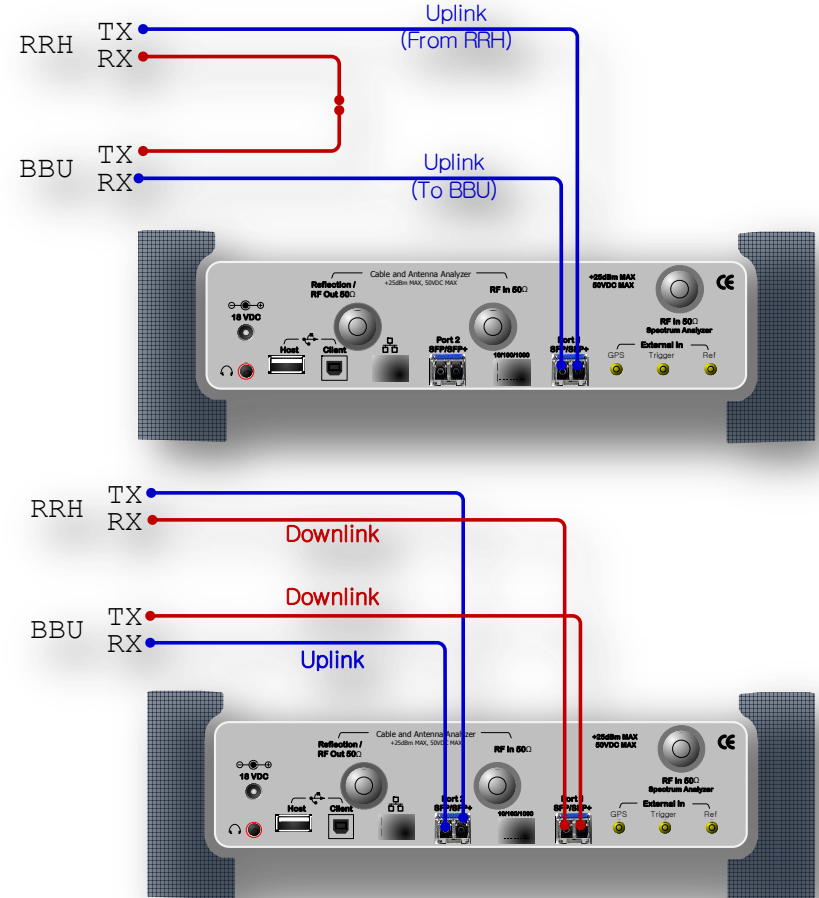
# RFoCPRITM Measurement

## Cable 연결방법

- Tab/Coupler 를 이용하는 경우



- Thru Mode를 이용하는 경우



# CellAdvisor RFoCPRI

Link 유지 보수

# CellAdvisor RFoCPRI

Layer 2 Monitoring



# CellAdvisor RFoCPRI™

## Layer 2 Monitoring

### ■ 링크 유지 보수

- **Loss of signal (LOS):** 코드 위반 또는 낮은 광 파워.
- **Loss of frame (LOF):** 프레임 동기화 또는 정렬.
- **Remote alarm indication (RAI):** LOS, LOF를 포함한 모든 오류.
- **SAP defect indication (SDI):** 서비스 액세스 포인트에 연결 상태
- **Optical Power Level**

### ■ SFP 사양 및 정보

- **Wavelength (파장)**
- **Nominal Rate**
- **Max RX Level**

The screenshot displays the 'Layer 2 Monitoring' interface for RFoCPRI. It shows the current status of two SFP ports (SFP/SFP+ PORT 2 and SFP/SFP+ PORT 1) with a table of indicators (LOS, LOF, RAI, SDI, Optic Rx Level) and their corresponding colors (green for OK, red for error). Below the status table, there are two sections for SFP information, including Wavelength, Vendor, Vendor PN, Vendor Rev, Power Level Type, Diagnostic Byte, Norminal Rate, Min Rate, Max Rate, Max Rx Level, and Max Tx Level.

SFP/SFP+ PORT 2	Current	History	SFP/SFP+ PORT 1	Current	History
LOS	●	●	LOS	●	●
LOF	●	●	LOF	●	●
RAI	●	●	RAI	●	●
SDI	●	●	SDI	●	●
Optic Rx Level	-1.3 dBm		Optic Rx Level	-2.4 dBm	

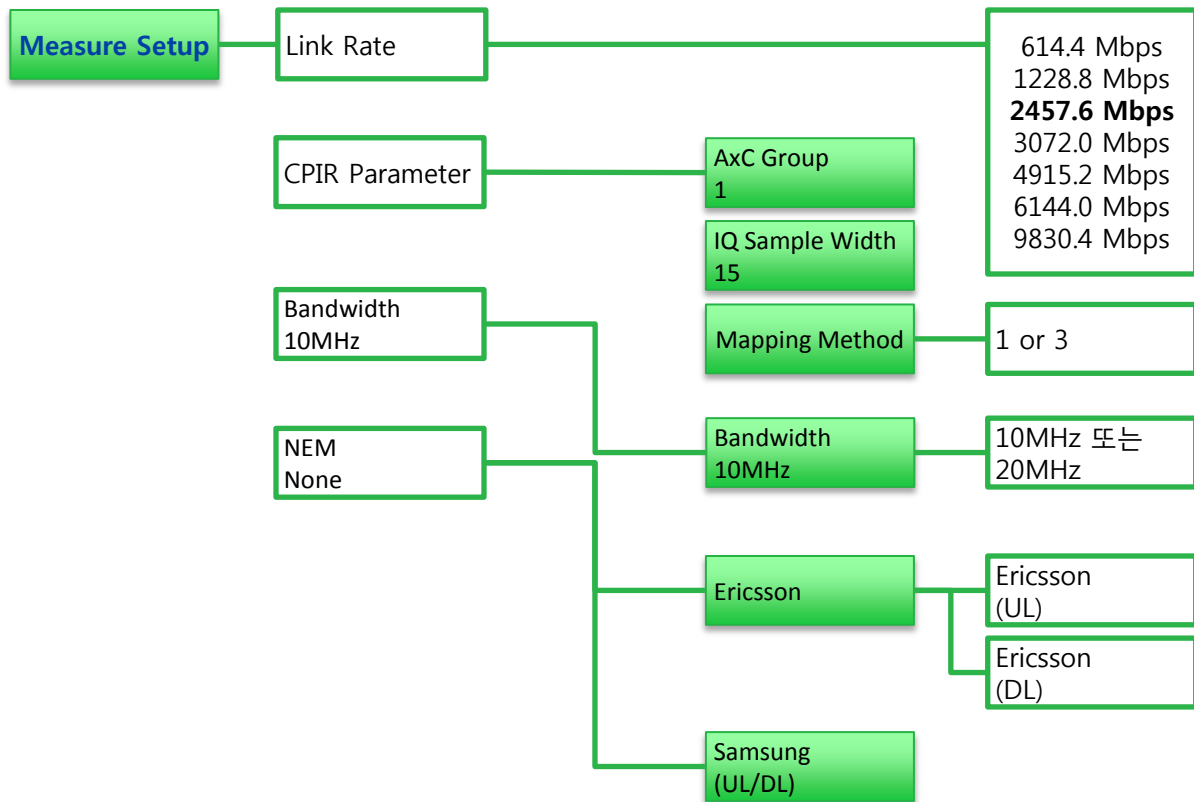
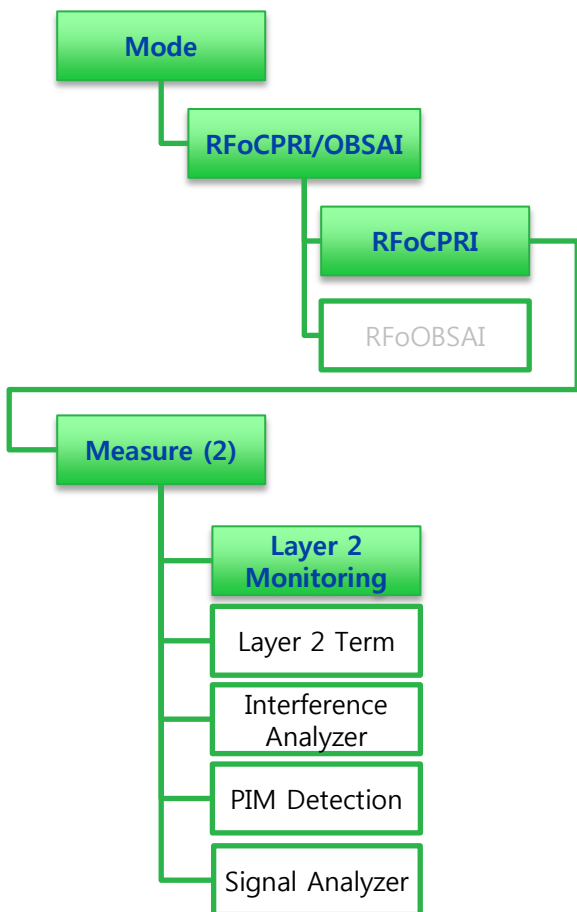
SFP/SFP+ PORT 2 Information		SFP/SFP+ PORT 1 Information	
Wavelength:	1310 nm	Wavelength:	1310 nm
Vendor:	Eoptolink	Vendor:	Eoptolink
Vendor PN:	EOLP-1360-10	Vendor PN:	EOLP-1360-10
Vendor Rev:	1.0	Vendor Rev:	1.0
Power Level Type:	Average Power	Power Level Type:	Average Power
Diagnostic Byte:	104	Diagnostic Byte:	104
Norminal Rate:	6300 Mbits/sec	Norminal Rate:	6300 Mbits/sec
Min Rate:	--- Mbits/sec	Min Rate:	--- Mbits/sec
Max Rate:	--- Mbits/sec	Max Rate:	--- Mbits/sec
Max Rx Level:	-1.00015 dBm	Max Rx Level:	-1.00015 dBm
Max Tx Level:	1.49988 dBm	Max Tx Level:	1.49988 dBm

#### 팁!

- SFP는 DU-RU라인에 맞는 사양을 사용 하시기 바랍니다.
- SFP는 DU-RU링크 속도 보다 높은 것을 사용 해야 합니다.

# RFoCPRITM Measurement

## 메뉴 구조 - Layer 2 Monitoring



### 팁!

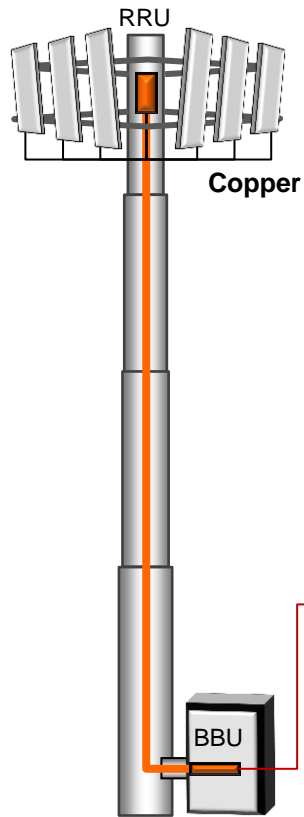
- 광 수신 레벨을 확인 :이 수준이 너무 낮으면 (<-18dBm)의 CPRI 링크가 제대로 작동하지 않을 수 있습니다.
- 라인 속도가 정확하지 않으면, LOS과 LOF 알람의 양쪽 또는 어느 한쪽은 빨간색 될 것입니다.

# CellAdvisor RFoCPRI

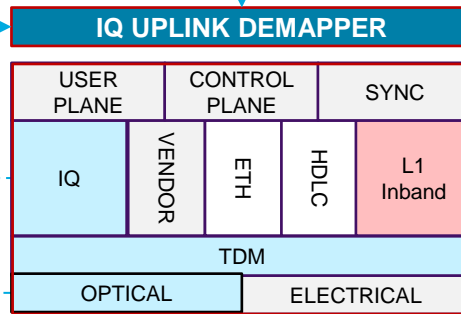
## Interference Analysis

# CellAdvisor RFoCPRI™

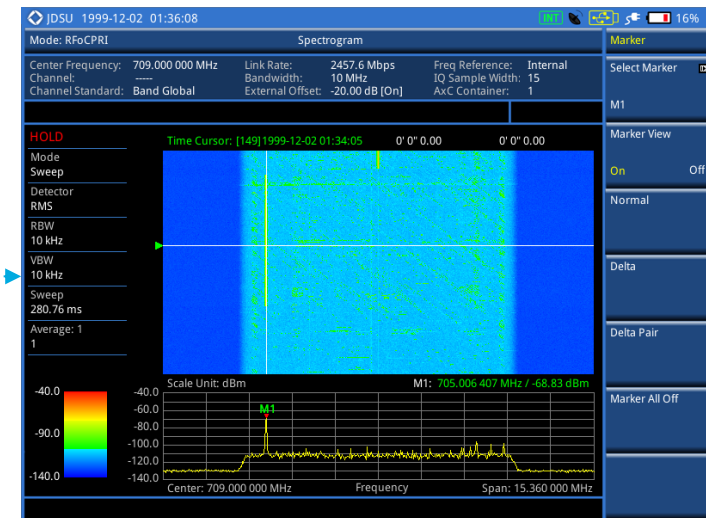
## Uplink / Downlink Spectrum Analysis



Line Rate Mbps	Word Size bits	CPRI Frames
1228.8	16	2
2457.6	32	4
3072.0	40	5
4915.2	64	8
6144.0	80	10
9830.4	128	16

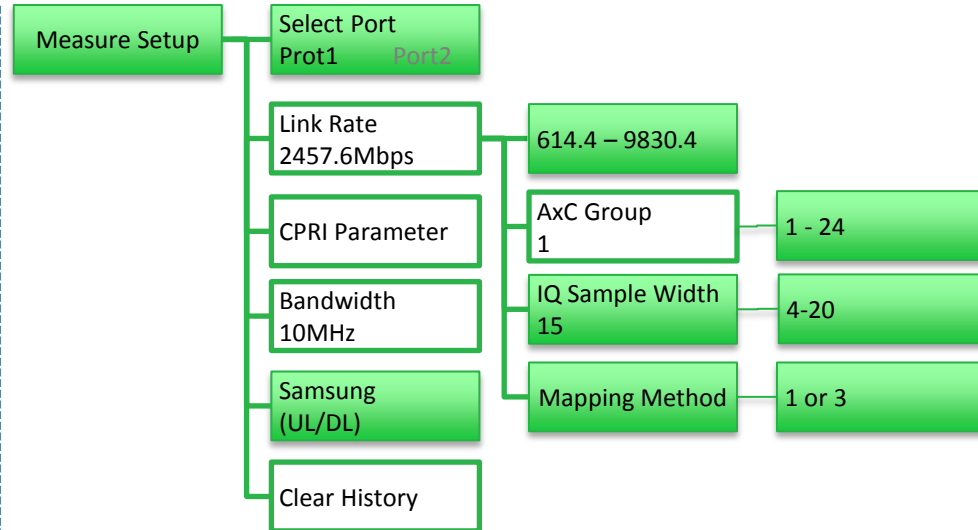
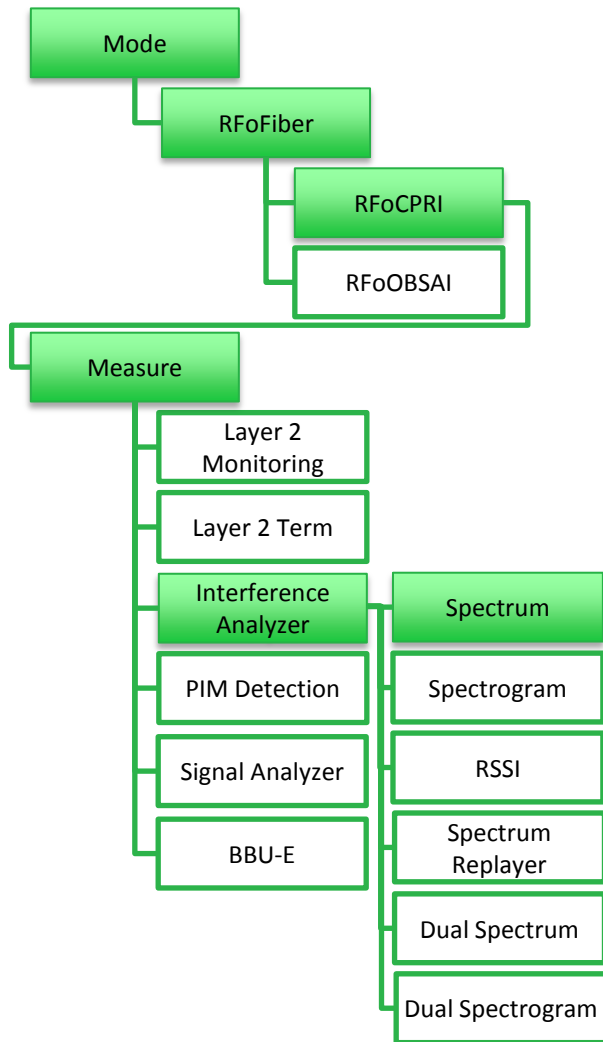


CellAdvisor JD785B  
RFoCPRI



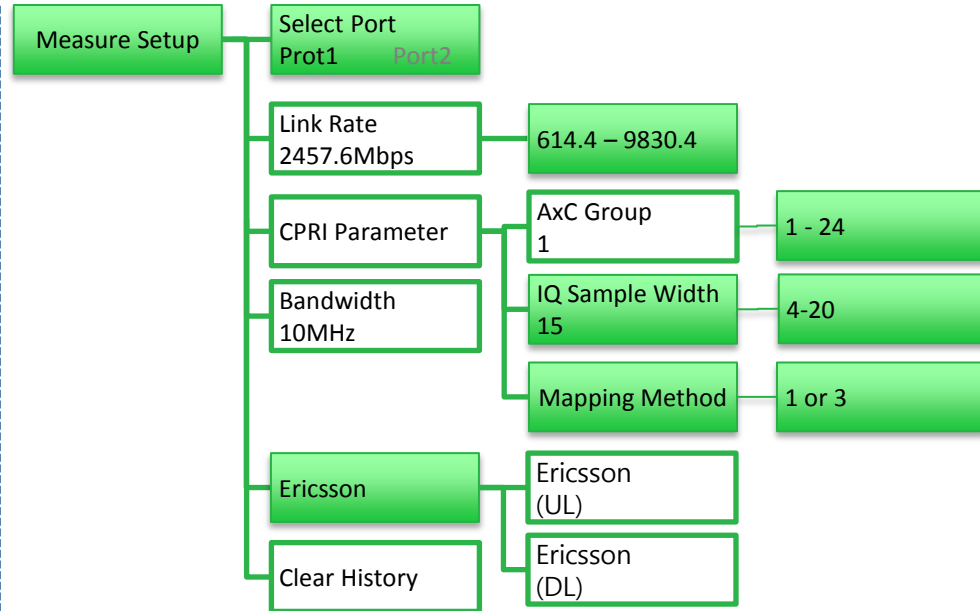
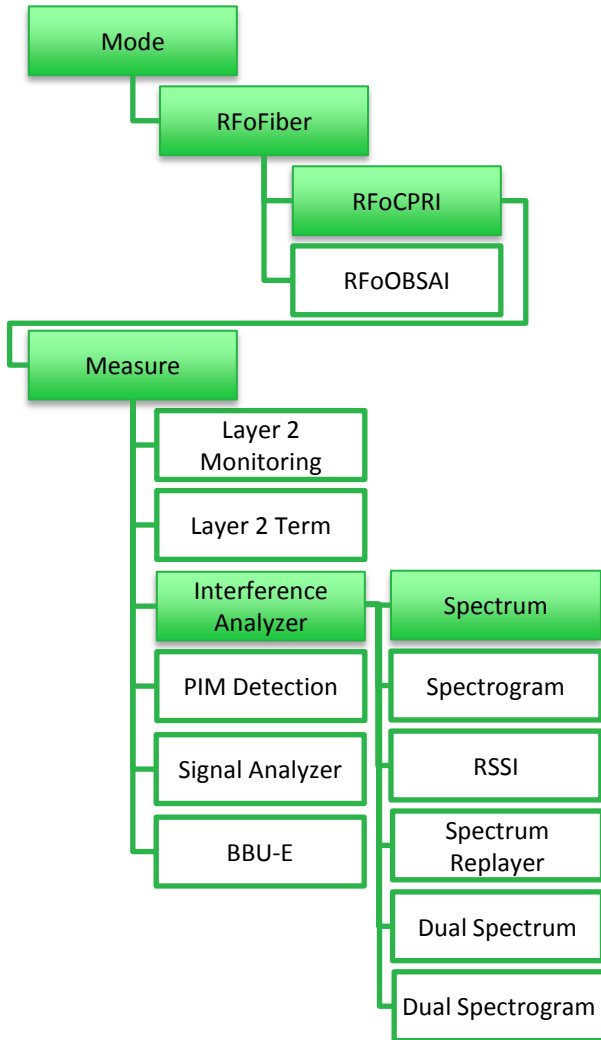
# RFoCPRI™ Measurement

## Menu 구조: Interference Analyzer - 삼성



# RFoCPRI™ Measurement

## Menu 구조: Interference Analyzer - 에릭슨

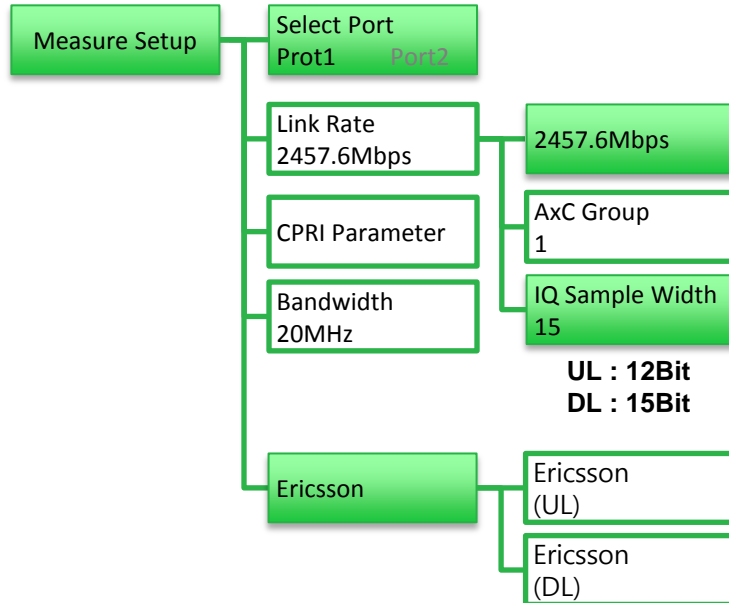


**팁!**  
 • 에릭슨은 CPRI 파라미터 설정이 현재 3가지가 있습니다.

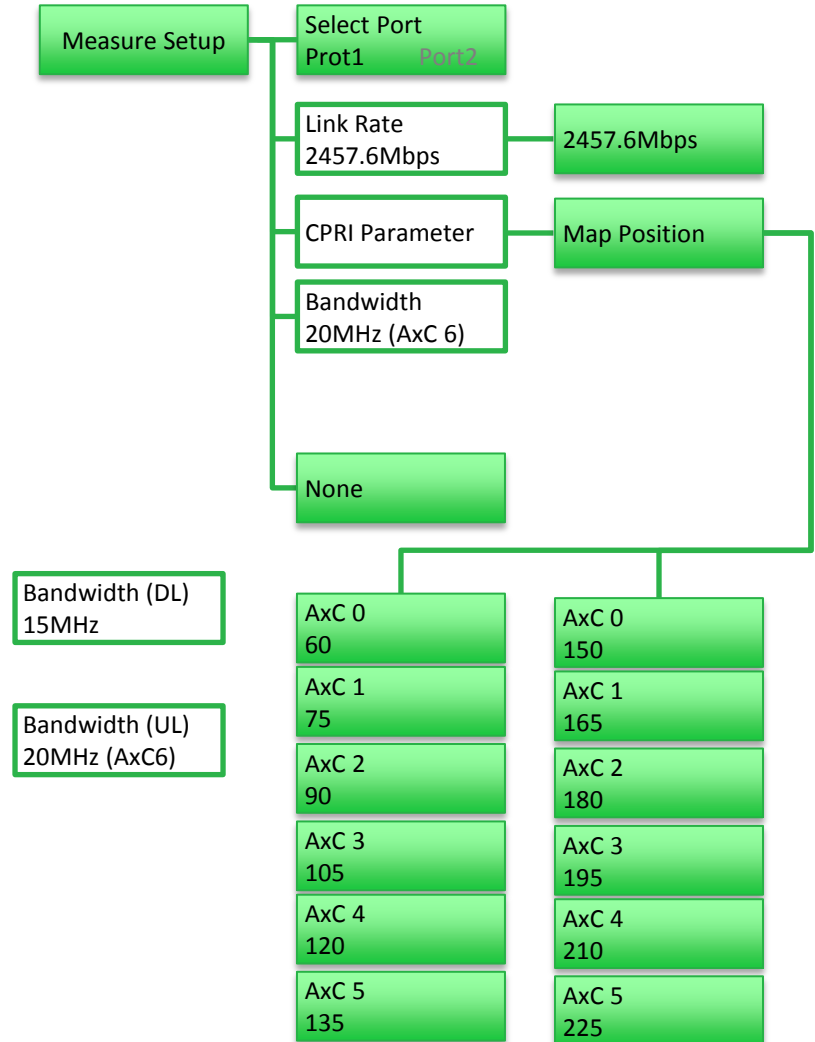
# RFoCPRI™ Measurement

## Menu 구조: Interference Analyzer – 에릭슨 Measure Setup

### Ericsson 기본 인 경우



### Ericsson 압축 모드 인 경우



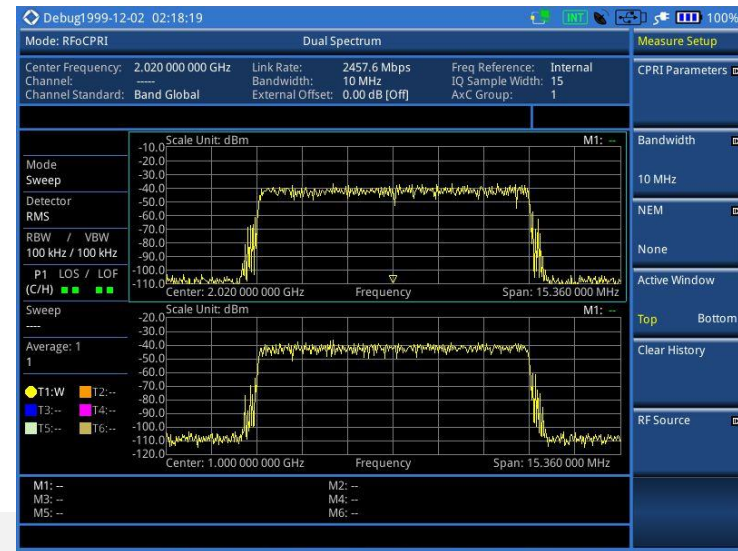
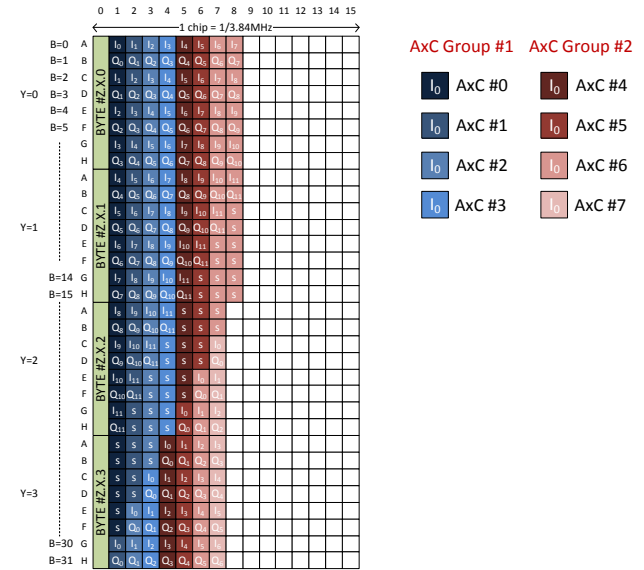
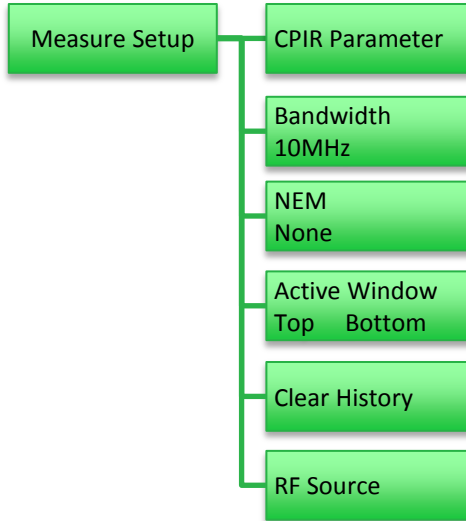
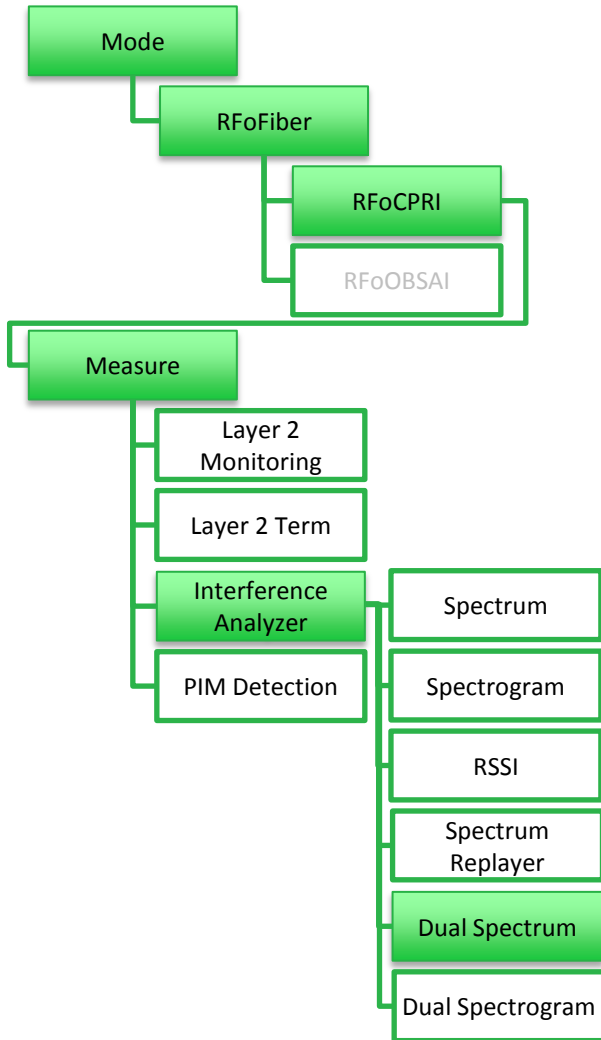
# CellAdvisor RFoCPRI

기타 다른 기능



# RFoCPRI™ Measurement

## Menu Structure: Interference Analyzer – Dual Spectrum



# RFoCPRI™ Measurement

## Dual Spectrum 측정 화면

The interface displays a grid of antenna groups (AxC #0 to #7) and two spectrum plots. The grid is organized into two groups: AxC Group #1 (AxC #0-3) and AxC Group #2 (AxC #4-7). The spectrum plots show the signal characteristics for these groups.

**AxC Group #1**

- AxC #0
- AxC #1
- AxC #2
- AxC #3

**AxC Group #2**

- AxC #4
- AxC #5
- AxC #6
- AxC #7

The top plot shows the spectrum for AxC #0-3, and the bottom plot shows the spectrum for AxC #4-7. Both plots show a signal centered at 751.000 000 MHz with a span of 15.360 000 MHz.

- 안테나 0과 동시에 안테나 1을 모니터링 합니다.

The screenshot shows the RFoCPRI measurement software interface. The top panel displays the mode as RFoCPRI and the measurement type as Dual Spectrum. The center frequency is 2.020 000 000 GHz, and the bandwidth is 10 MHz. The channel standard is Band Global, and the external offset is 0.00 dB [Off]. The frequency reference is internal, and the IQ sample width is 15. The AxC group is 1.

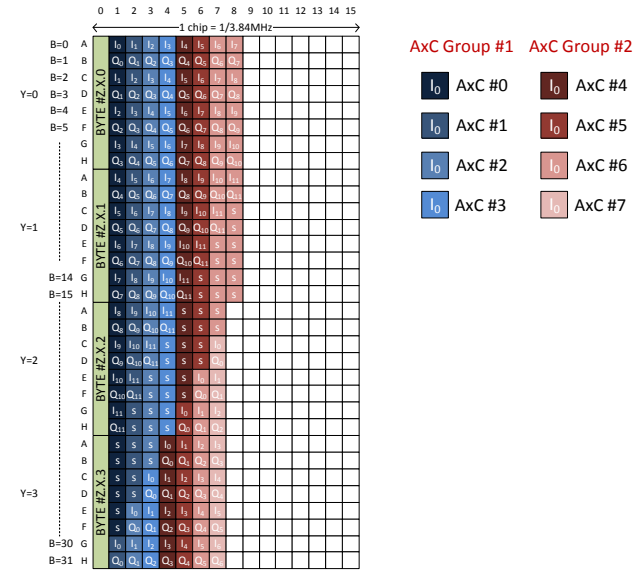
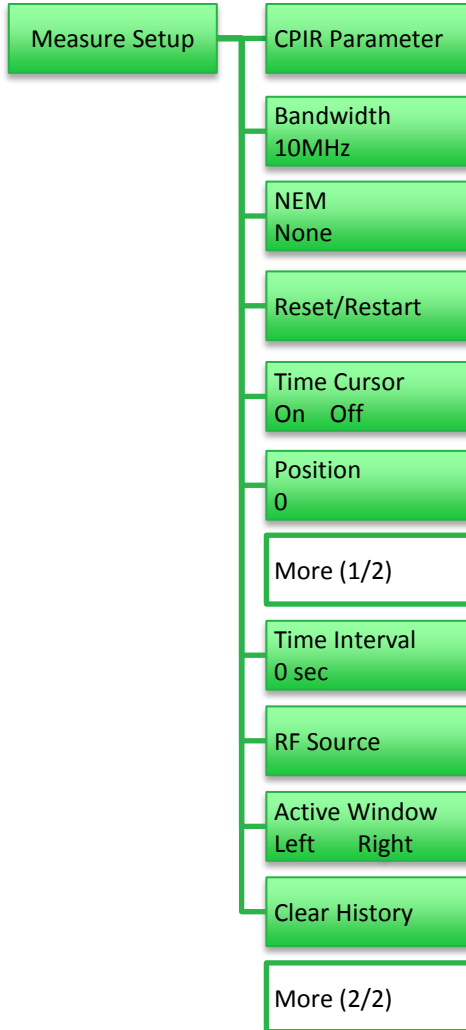
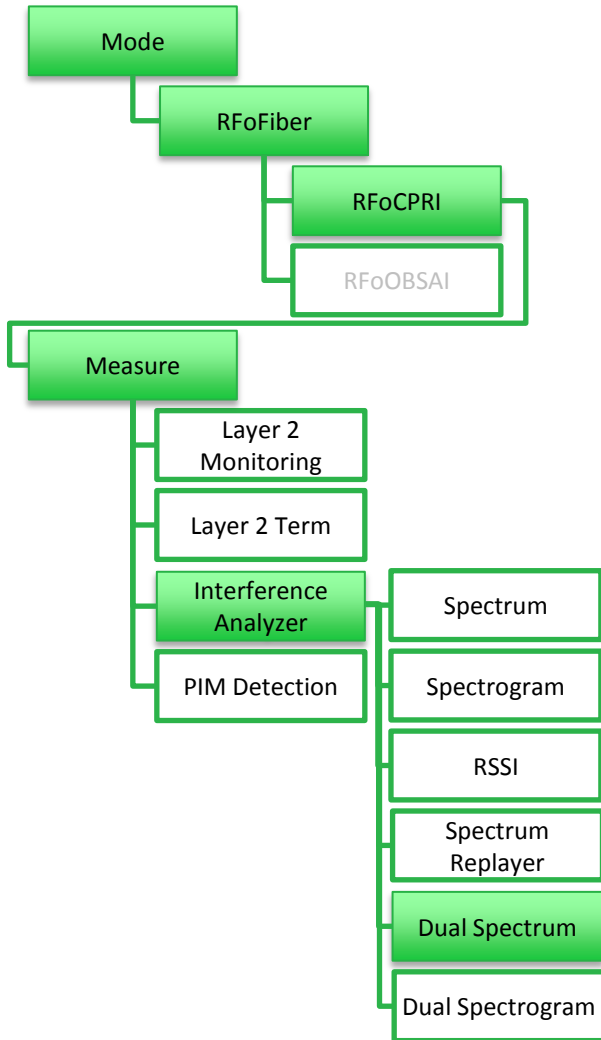
The main display area shows two spectrum plots. The top plot is centered at 2.020 000 000 GHz with a span of 15.360 000 MHz. The bottom plot is centered at 1.000 000 000 GHz with a span of 15.360 000 MHz. Both plots show a signal with a scale unit of dBm.

The right-hand side of the interface contains a sidebar with various measurement parameters and controls, including Measure Setup, CPRI Parameters, Bandwidth, NEM, Active Window, Top/Bottom, Clear History, and RF Source.

\* CPRI link에 두 신호가 동시에 있어야 합니다.

# RFoCPRI™ Measurement

## Menu Structure: Interference Analyzer – Dual Spectrogram



# CellAdvisor RFoCPRI

Downlink Signal Analysis for  
LTE-FDD/TDD

# RFoCPRI Downlink Signal Analyzer

## Introduction



### Introduction

RFoC PRI 다운 링크 신호 분석기는 셀 관리자는 CPRI 링크로드 기저 대역 신호에 대해 디 맵핑 IQ 데이터로 변조 정확도 테스트를 수행 할 수 있다.



### Value proposition

Modulation quality test over RFoCPRI enables user to verify the signal quality being injected to the RRH.

By comparing the signal quality degradation after passing RRH allows fast isolation of root cause.



### Specification

#### RF Analyzer

- Channel Power
- Occupied Bandwidth

#### Modulation Analyzer

- Constellation
- Data Channel
- Control Channel
- Subframe
- Frame
- Time Alignment Error
- Data Allocation Map

#### P vs. T

#### CCDF

#### Compatibility

- NEM: Ericsson/ ALU/ Huawei/ Samsung/ ZTE
- Link Rate: 614.4Mbps – 9.8Gbps
- Technology: LTE-FDD

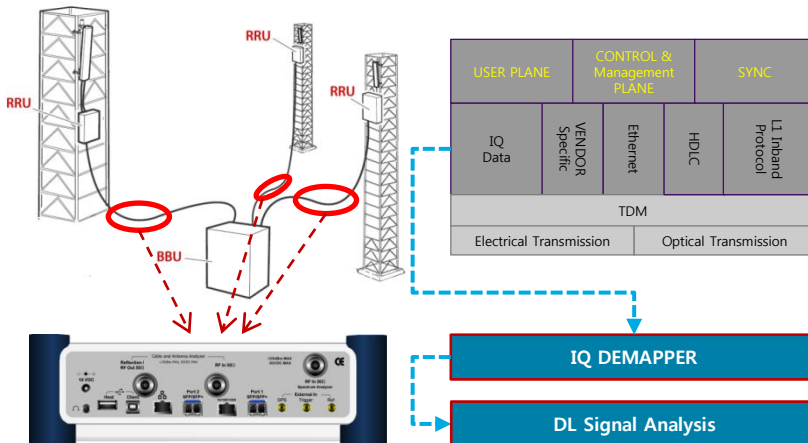


### Ordering Information

Opt.091 – RFoCPRI LTE-FDD Signal Analyzer

\*Available for JD740B and JD780B

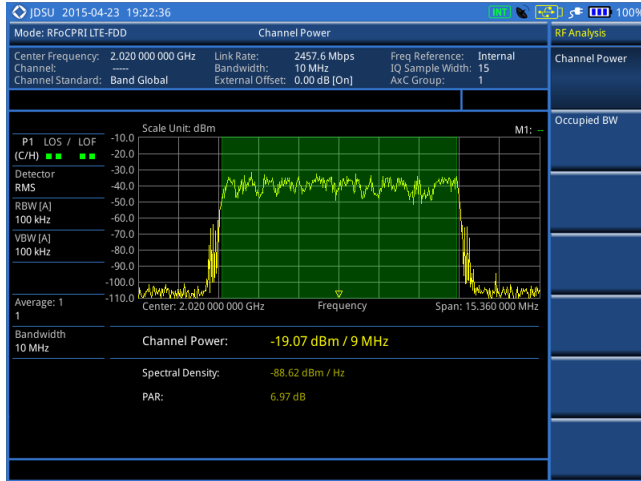
\*Requires Opt.008 and at least one option out of Opt.060, 061, 062, 063, 064, and 065



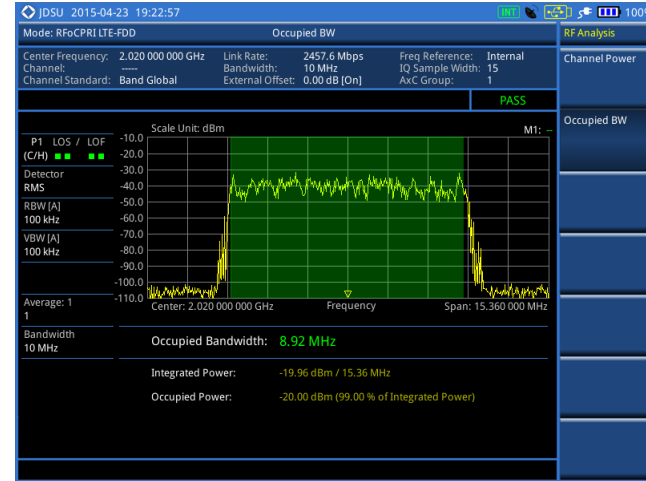
# RFoCPRI Downlink Signal Analyzer

## RF Conformance Tests: LTE-FDD

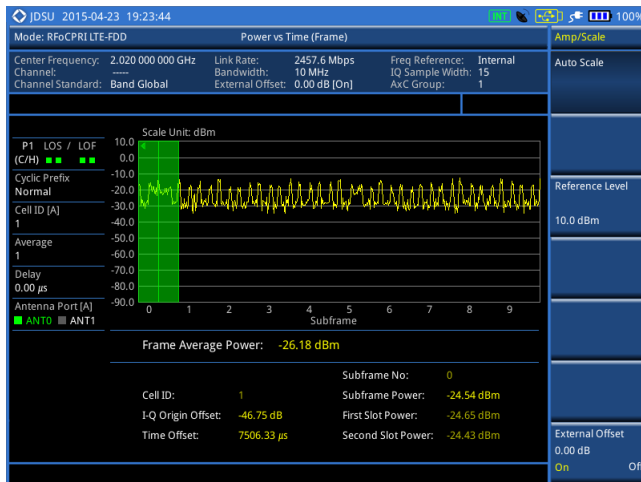
### ❖ RF Conformance – Channel Power



### ❖ RF Conformance – Occupied Bandwidth



### ❖ RF Conformance – P vs. T



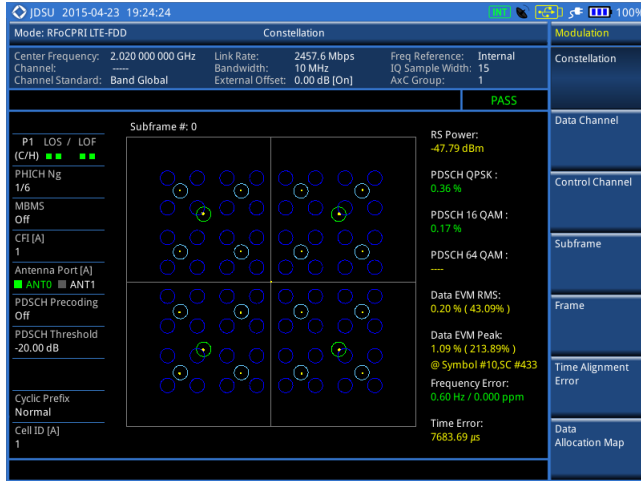
### ❖ RF Conformance – CCDF



# RFoCPRI Downlink Signal Analyzer

## Modulation Quality Tests: LTE-FDD

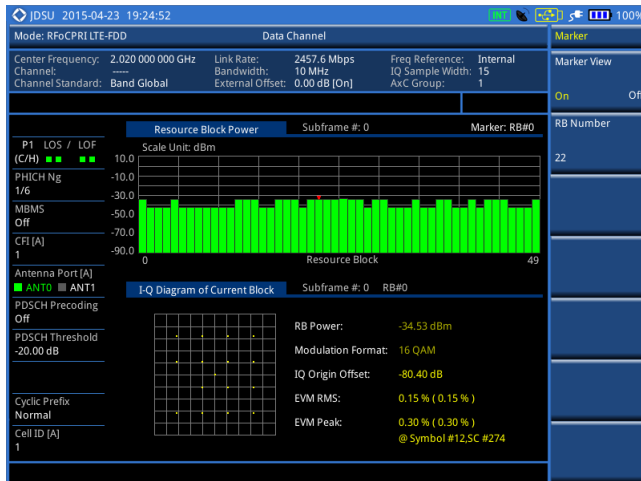
### ❖ Modulation Quality – Constellation



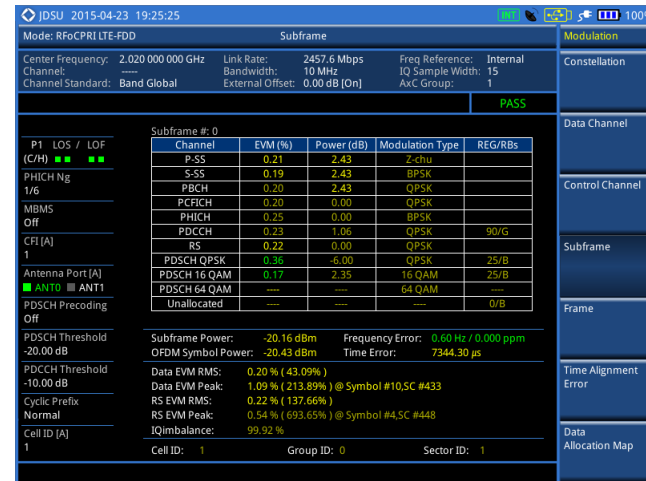
### ❖ Modulation Quality– Control Channel



### ❖ Modulation Quality – Data Channel



### ❖ Modulation Quality – Subframe



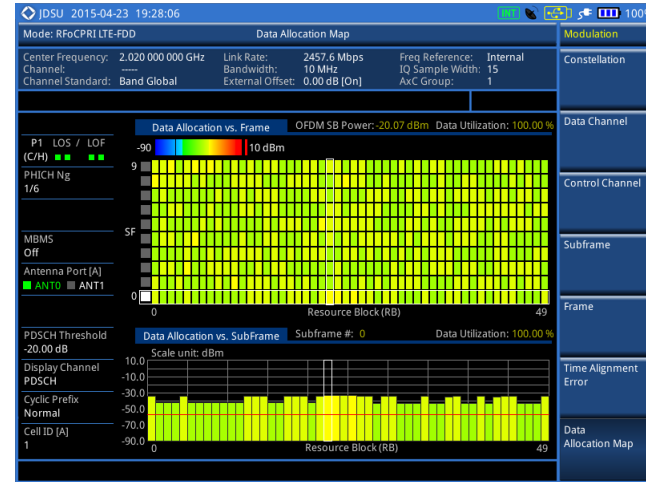
# RFoCPRI Downlink Signal Analyzer

## Modulation Quality Tests: LTE-FDD

### ❖ Modulation Quality – Frame



### ❖ Modulation Quality – Data Allocation Map



### ❖ Modulation Quality – Time Alignment Error







**VI.VI**

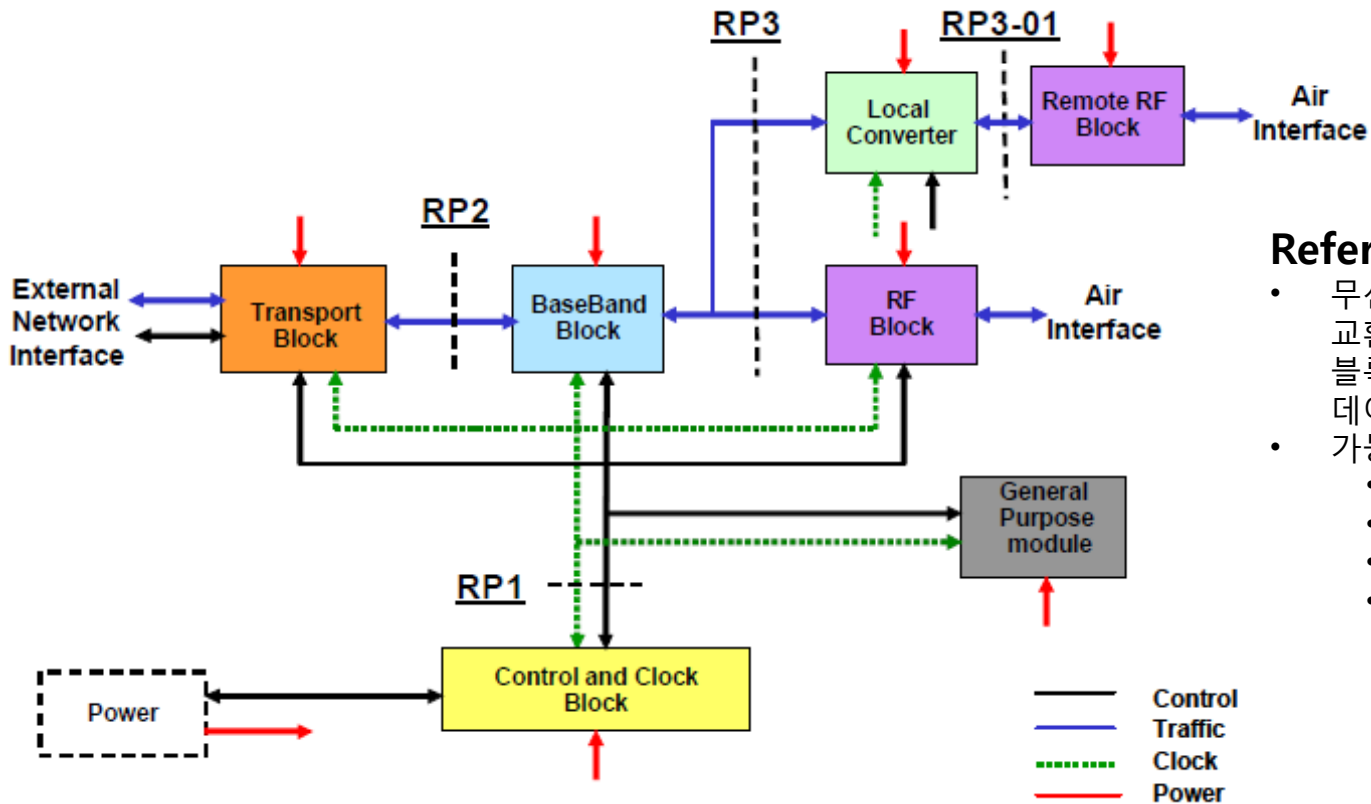
The logo consists of the letters 'VI.VI' in a bold, purple, sans-serif font. The 'V's are stylized with a small gap between the two vertical strokes. The background of the slide features a night cityscape with light trails from traffic and a large purple geometric shape on the left side.

**VI.VI**

# **CellAdvisor RFoOBSAI™**

# OBSAI 기본

## BTS 구조 (참고)



### Reference Point 3 (RP3)

- 무선 인터페이스 유저의 상호 교환 포맷, 베이스 밴드 블록과 블록 사이의 RF 신호 사용자 데이터
- 가능한 4개의 회선 속도:
  - 768Mbps (1x)
  - 1536Mbps (2x)
  - 3072Mbps (4x)
  - 6144Mbps (8x)

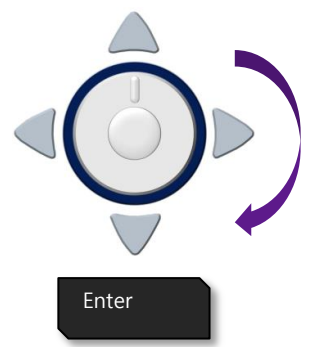
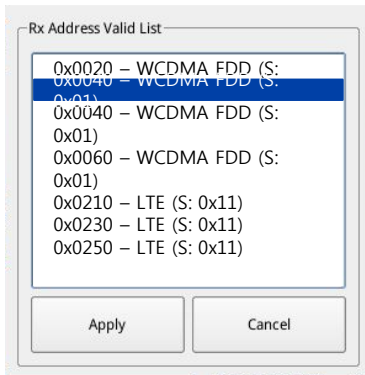
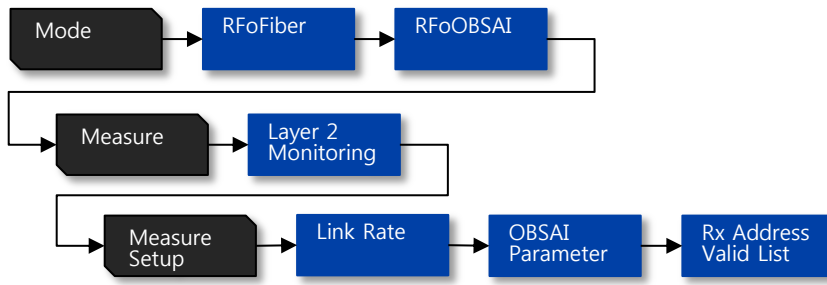
### OBSAI Base Station 구조

- Transport Block (TB)
- Control and Clock Block (CCB)
- Baseband block (BB)
- RF Block (RFB)
- Optional General Purpose Block

# RFoCPRI/RFoOBSAI

## RFoOBSAI LTE-FDD

### • 측정 순서



- Auto Configurable parameters**
- RP3 Address
  - RP3 Type
  - Scrambler Code (6.1Gbps only)

Verify signal bandwidth using Message count on Layer2 Monitoring

LTE-FDD 5MHz	LTE-FDD 10MHz	LTE-FDD 20MHz																																																																								
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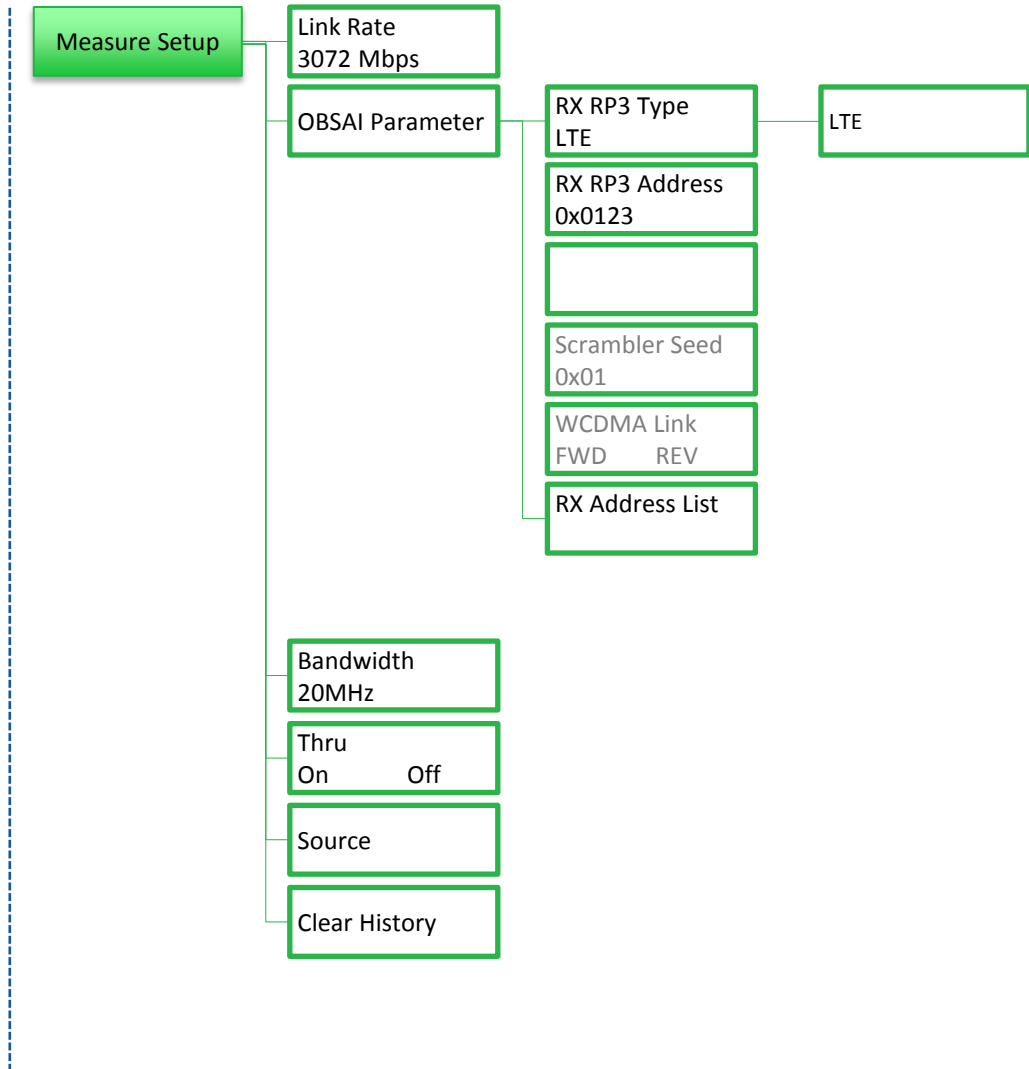
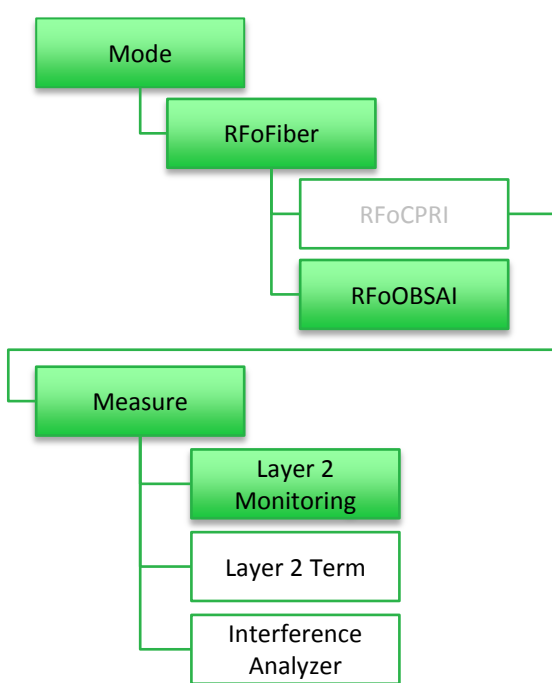
- Manual Configurable parameters**
- Bandwidth
  - External Offset
- Non configurable parameters**
- RBW
  - Span

# CellAdvisor RFoOBSAI

Layer 2 Monitoring

# RFoCPRI™ Measurement

## Menu 구조 – Layer 2 Monitoring



# RFoBSAI Measurement

## Layer-2 Monitoring

Mode: RFoBSAI Layer 2 Monitoring

Event Logging: Off Start Time: 05/06 23:51:29 Elapsed Time: 00:06:13

Link Rate 3072 Mbps

SFP/SFP+ PORT 2	Current	History	SFP/SFP+ PORT 1	Current	History
LOS	●	●	LOS	●	●
LOF	●	●	LOF	●	●
Optic Rx Level	-12.0 dBm		Optic Rx Level	-4.4 dBm	
Optic Tx Level	---		Optic Tx Level	---	
Code Violation:	0		Code Violation:	0	
Rx K30.7 Words:	0		Rx K30.7 Words:	0	
Messages Address:	0x0123/76800		Messages Address:	0x0123/76800	

SFP/SFP+ PORT 2 Information	SFP/SFP+ PORT 1 Information
Wavelength:	Wavelength:
Vendor: JDSU	Vendor: JDSU
Vendor PN: PLRXPL-VE-SG4-62	Vendor PN: JSH-85L3DA1-10
Vendor Rev: 1	Vendor Rev: 3
Power Level Type: Average Power	Power Level Type: Average Power
Diagnostic Byte: 104	Diagnostic Byte: 104
Nominal Rate: 4300 Mbps	Nominal Rate: 8500 Mbps
Min Rate: --- Mbps	Min Rate: --- Mbps
Max Rate: --- Mbps	Max Rate: --- Mbps
Max Rx Level: 0.00000 dBm	Max Rx Level: 0.49993 dBm
Max Tx Level: -2.50032 dBm	Max Tx Level: 0.49993 dBm

Message Address: 0x0040/307200  
RP3 Address/ Message counter

적용 장비: NSN  
Link Rate: 3.1Gbps  
Technology: LTE-FDD  
Signal Bandwidth: 20MHz

**LOS/LOF** 알람 상태와 히스토리를 보여 줍니다.

**Code Violation and K30.7** 표시 오류 수

**Optic RX level and TX level** 표시

**RP3 Address**는 OBSAI 링크에 사용 가능한 주소를 보여 줍니다.

RP3 주소를 할당하면 IQ 위치를 구성하고 스펙트럼을 볼 수 있습니다

Number of message 는 대역폭과 관련이 있으며 우리는 이 값으로 대역폭을 가정 할 수 있습니다.

# RFoOBSAI Measurement

## Layer-2 Monitoring: RP3 Address 설정

Measure Setup

The Measure Setup panel is divided into three columns:

- Measure Setup:** Select Port, Port1, Port2, Link Rate (6144.0 Mbps), OBSAI Parameter, Bandwidth (20 MHz), Thru (On), Source, Clear History.
- OBSAI Parameters:** Rx RP3 Type (LTE), Rx RP3 Address (0x0123), Scrambler Seed (0x01), Rx Address List, Rx Address Valid List.
- Rx RP3 Type:** LTE, WCDMA/FDD.

Red boxes highlight: Link Rate, OBSAI Parameter, Bandwidth, Rx RP3 Type, Rx RP3 Address, and Rx RP3 Type in the second column. A yellow box highlights Rx Address List and Rx Address Valid List in the second column. Arrows indicate the flow of configuration from the Measure Setup panel to the main interface.

The main interface shows the RFoOBSAI Spectrum measurement results:

- Mode:** RFoOBSAI
- Center Frequency:** 1.745 000 000 GHz
- Channel:** ---
- Channel Standard:** Band 3 (1800)
- Link Rate:** 6144.0 Mbps
- Bandwidth:** 20 MHz
- External Offset:** 0.00 dB [On]
- Freq Reference:** Internal
- Rx RP3 Type:** LTE
- Rx RP3 Address:** 0x01A0

The spectrum plot shows a signal at 1.745 GHz with a scale unit of dBm. A dialog box titled "Rx Address Valid List" is overlaid on the plot, listing the following addresses:

- 0x0040 - LTE (S: 0x09)
- 0x01C0 - LTE (S: 0x09)
- 0x01A0 - LTE (S: 0x09)
- 0x0080 - LTE (S: 0x09)

The dialog box has "Apply" and "Cancel" buttons. An orange arrow points from the "Rx Address Valid List" field in the Measure Setup panel to this dialog box.



# RFoOBSAI Measurement

## Layer-2 Monitoring

### ■ LTE-FDD 5 MHz

SFP/SFP+ PORT 1	Current	History
LOS	●	●
LOF	●	●
Optic Rx Level	-4.5 dBm	
Optic Tx Level	---	
Code Violation:	0	
Rx K30.7 Words:	0	
Messages Address:	0x0123/76800	

### ■ LTE-FDD 10 MHz

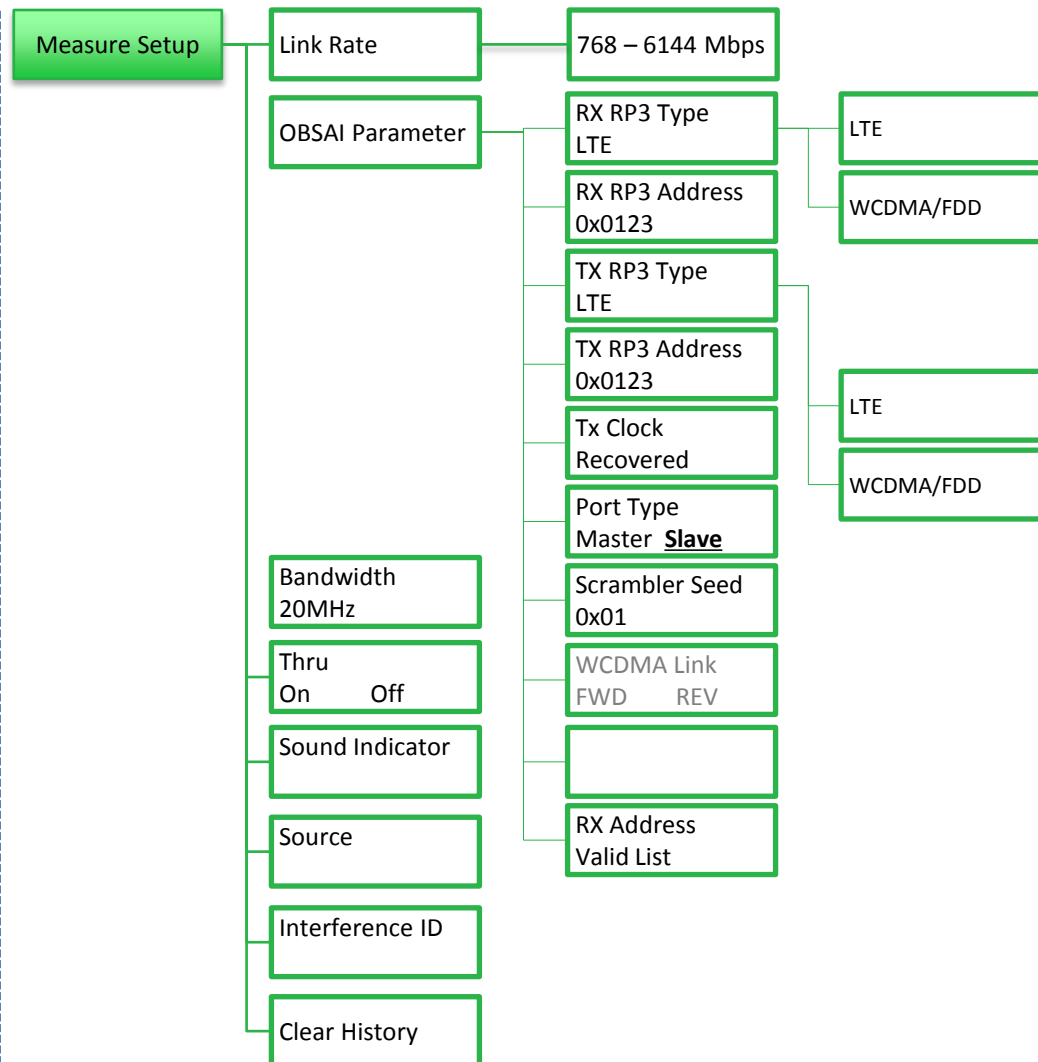
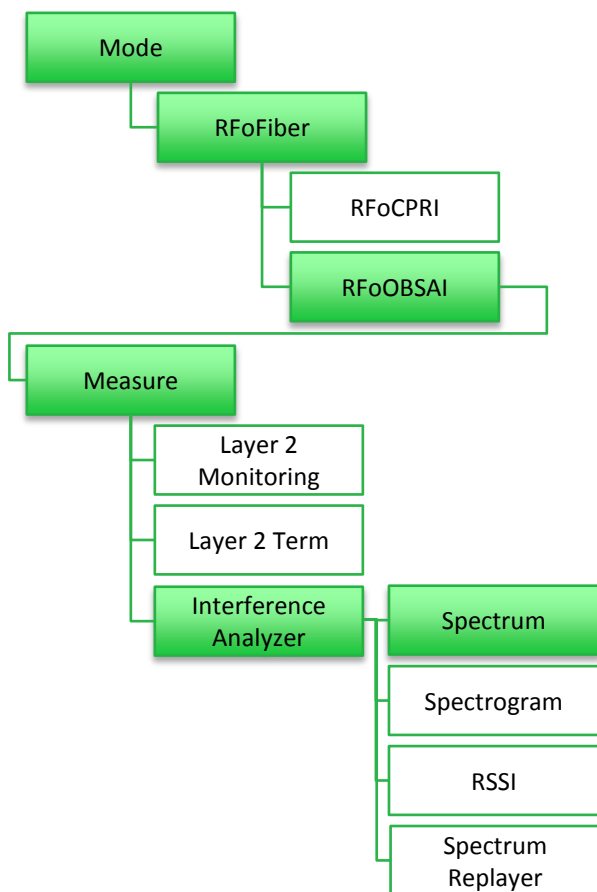
SFP/SFP+ PORT 1	Current	History
LOS	●	●
LOF	●	●
Optic Rx Level	-4.5 dBm	
Optic Tx Level	---	
Code Violation:	0	
Rx K30.7 Words:	0	
Messages Address:	0x0123/153600	

### ■ LTE-FDD 20 MHz

SFP/SFP+ PORT 1	Current	History
LOS	●	●
LOF	●	●
Optic Rx Level	-4.5 dBm	
Optic Tx Level	---	
Code Violation:	0	
Rx K30.7 Words:	0	
Messages Address:	0x0123/307200	

# RFoOBSAI™ Measurement

## Menu: Interference Analyzer



# RFoOBSAI Measurement

## Layer-2 Monitoring: RP3 Address 설정

Measure Setup

Measure Setup

- Select Port
- Port1 Port2
- Link Rate: 6144.0 Mbps
- OBSAI Parameter
- Bandwidth: 20 MHz
- Thru
- On Off
- Source
- Clear History

OBSAI Parameters

- Rx RP3 Type: LTE
- Rx RP3 Address: 0x0123
- Scrambler Seed: 0x01
- WCDMA Link
- FWD REV
- Rx Address List
- Rx Address Valid List

Rx RP3 Type

- LTE
- WCDMA/FDD

Available options to pick a carrier/spectrum

Opt 1: 수동RP3 Address 설정

Opt 2: RX Address Valid List

JDSU 2015-04-18 18:22:08

Mode: RFoOBSAI Spectrum

Center Frequency: 2.020 000 000 GHz Link Rate: 3072 Mbps Freq Reference: Internal

Channel: ----- Bandwidth: 10 MHz

Channel Standard: Band Global External Offset: 0.00 dB [On]

Scale Unit: dB

Mode Sweep

Detector RMS

RBW / VBW 100 kHz / 100 kHz

P2 LOS / LOF (C/H) [Red indicators]

Sweep 10.00 ms

Average: 1

Center: 2.020

Hex Editor

RP3 Address: 0x123

Backspace Clear

0 1 2 3 4 5

6 7 8 9 A B

C D E F

OK Cancel

OBSAI Parameters

- Rx RP3 Type: LTE
- Rx RP3 Address: 0x0123
- Tx RP3 Type: LTE
- Tx RP3 Address: 0x0123
- Tx Clock: Recovered
- Port Type: Master Slave
- Scrambler Seed: 0x01

# RFoOBSAI Measurement

## Layer-2 Monitoring: RP3 Address 설정

Measure Setup

The Measure Setup menu is shown with several items highlighted in red boxes:

- Link Rate:** 3072 Mbps
- Bandwidth:** 10 MHz
- Rx RP3 Type:** WCDMA/FDD
- Rx RP3 Address:** 0x0E01
- Rx Address Valid List:** (highlighted at the bottom)

Available options to pick a carrier/spectrum

Opt 1: 수동RP3 Address 설정

Opt 2: RX Address Valid List

The main interface shows the following parameters:

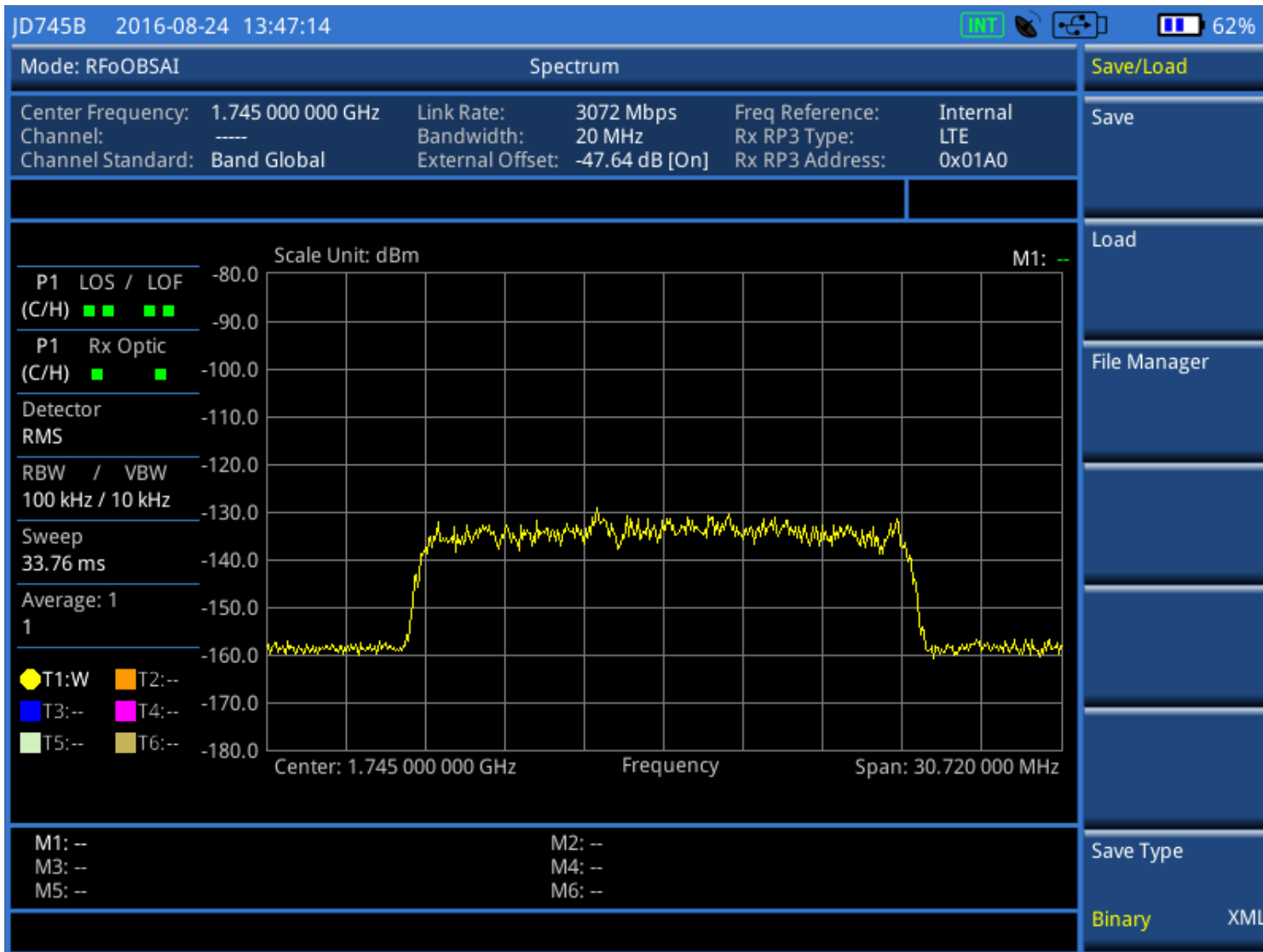
- Mode:** RFoOBSAI
- Center Frequency:** 1.745 000 000 GHz
- Channel:** ---
- Channel Standard:** Band 3 (1800)
- Link Rate:** 6144.0 Mbps
- Bandwidth:** 20 MHz
- External Offset:** 0.00 dB [On]
- Freq Reference:** Internal
- Rx RP3 Type:** LTE
- Rx RP3 Address:** 0x01A0

The Spectrum plot shows a signal at 1.745 GHz with a power of -27.36 dBm. An 'Rx Address Valid List' dialog box is overlaid, listing the following addresses:

- 0x0040 - LTE (S: 0x09)
- 0x01C0 - LTE (S: 0x09)
- 0x01A0 - LTE (S: 0x09)
- 0x0080 - LTE (S: 0x09)

# Field Test Data

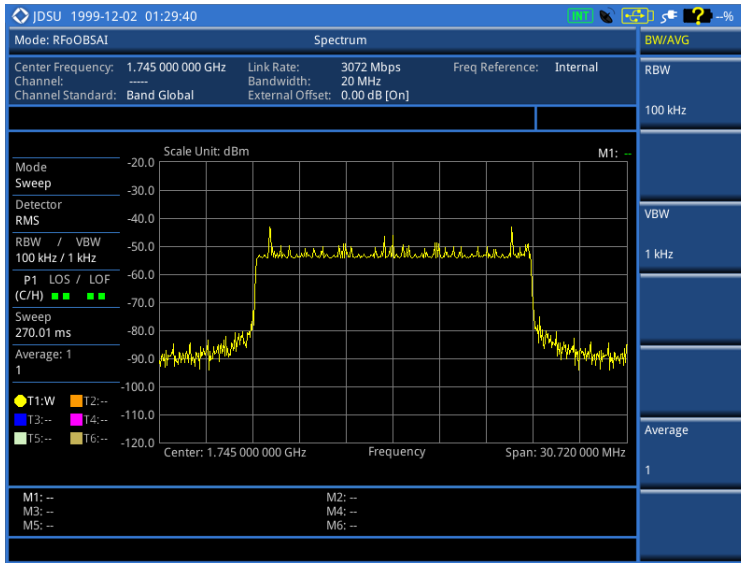
## RFoCPRI Interference Analyzer – Uplink Spectrum



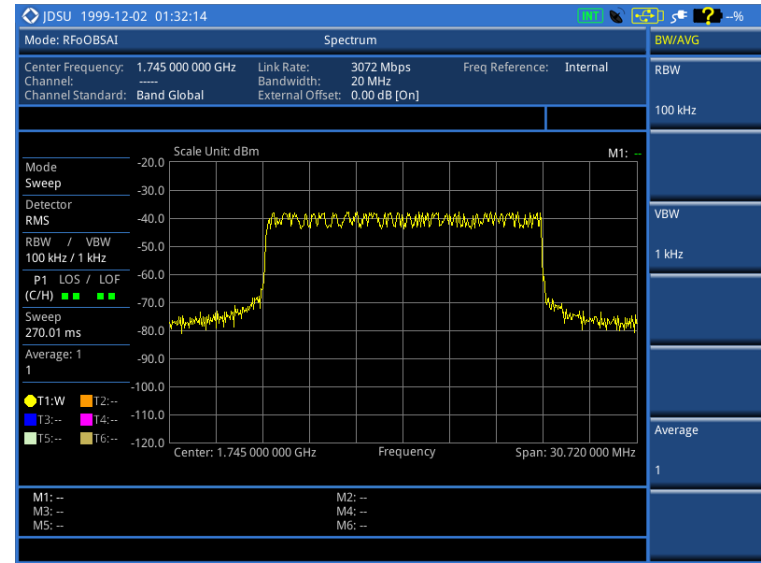
# Field Test Data

## RFoCPRI Interference Analyzer – DL Spectrum

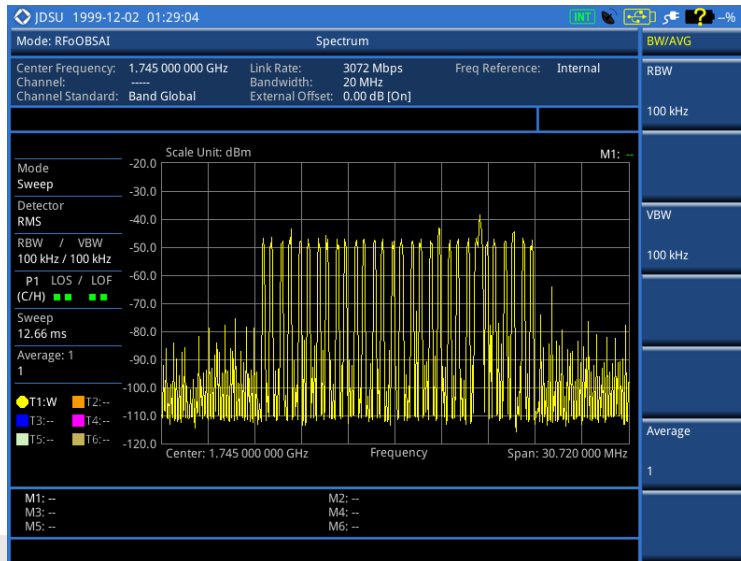
E-TM1.2



E-TM3.2



E-TM2

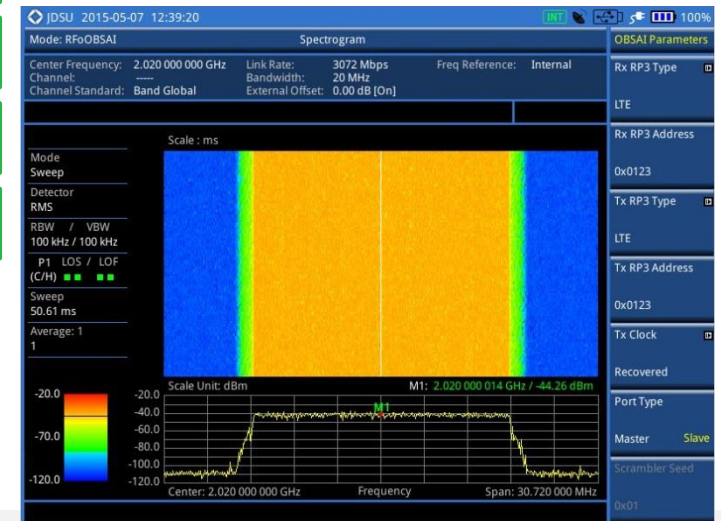
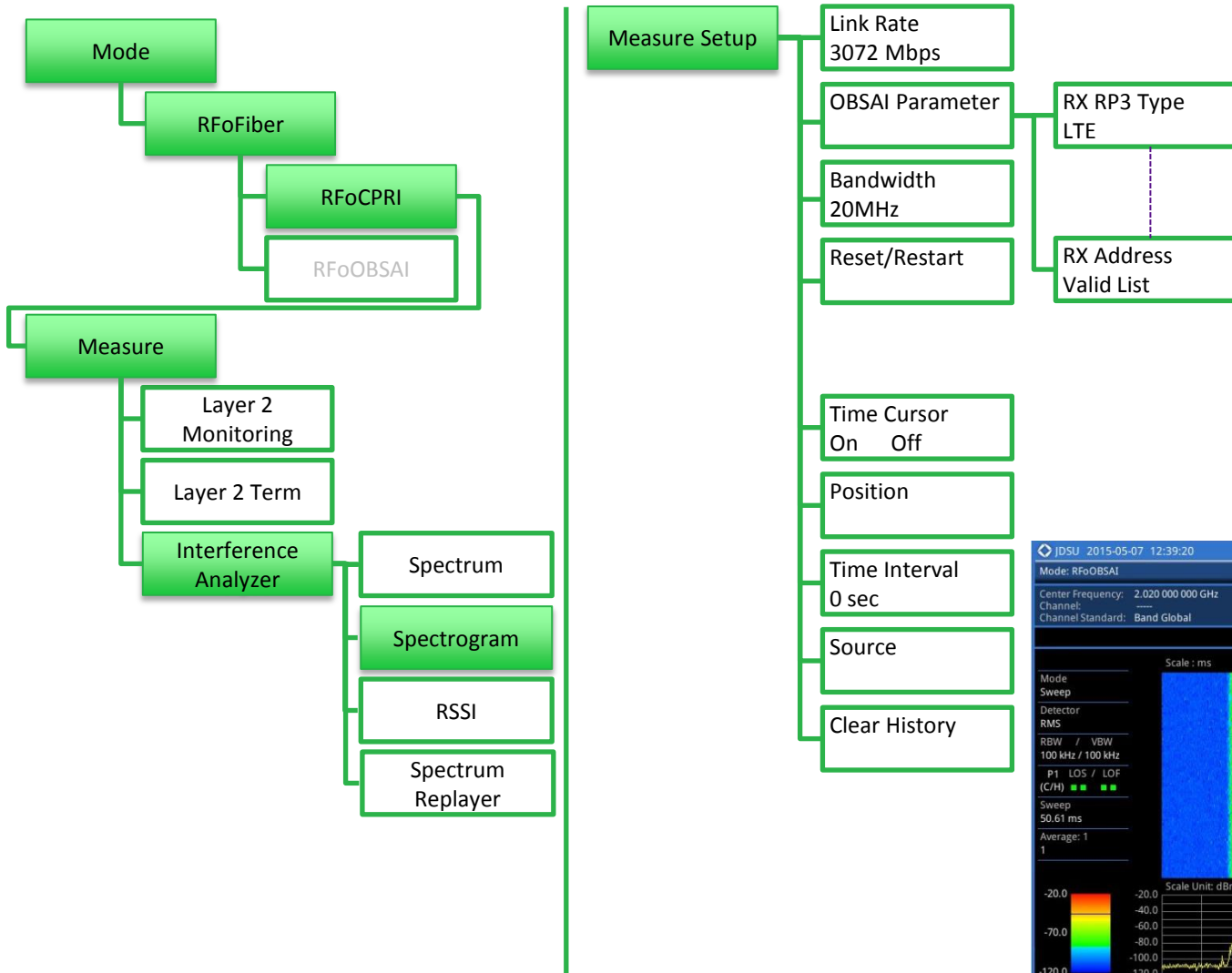


E-TM3.3



# RFoCPRI™ Measurement

## Menu Structure: Interference Analyzer - Spectrogram



# CellAdvisor RFoOBSAI

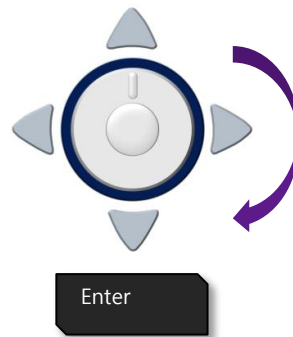
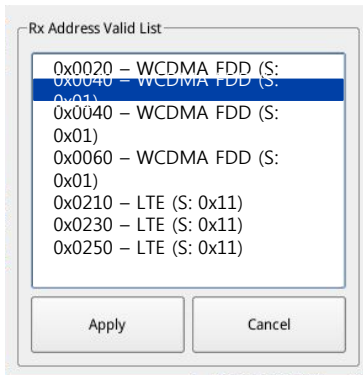
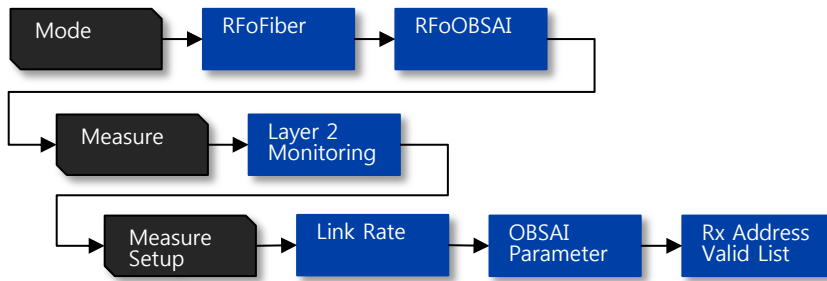
Layer 2 Signal Analyzer



# RFoOBSAI

## RFoOBSAI LTE-FDD Signal Analyzer

### • 측정 순서



#### Auto Configurable parameters

- RP3 Address
- RP3 Type
- Scrambler Code (6.1Gbps only)

Verify signal bandwidth using Message count on Layer2 Monitoring

LTE-FDD 5MHz	LTE-FDD 10MHz	LTE-FDD 20MHz																																																																								
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#### Manual Configurable parameters

- Bandwidth
- External Offset

#### Non configurable parameters

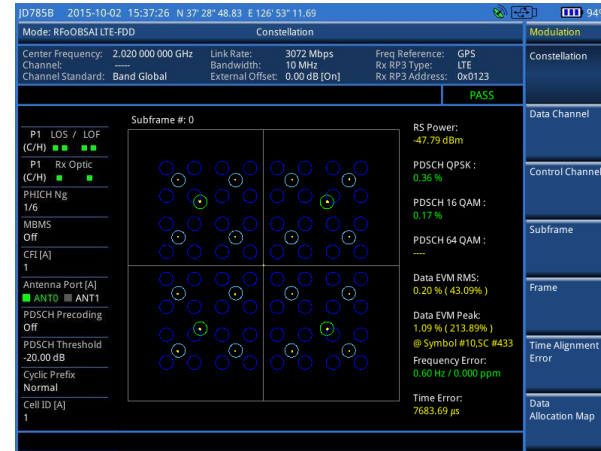
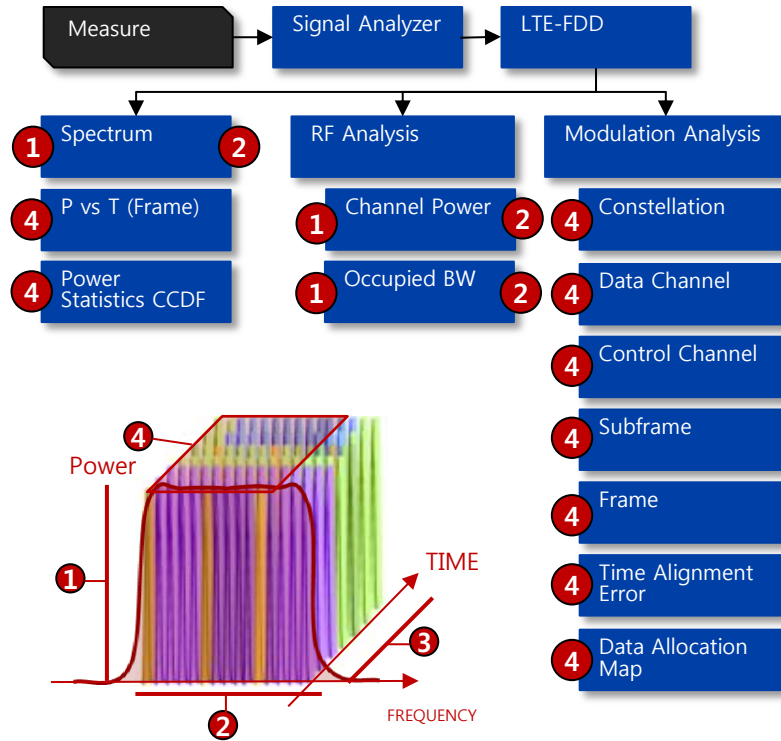
- RBW
- Span

# RFoOBSAI

## RFoOBSAI LTE-FDD Signal Analyzer

### 측정 순서

#### Step 3: Signal Analysis



#### IQ Invert

- I 및 Q 비트가 CPRI 페이로드로 반전하면, 변조 품질 측정에 오류가 발생.
- 기본 설정은 "IQ Invert: On" 입니다.
- Antenna Port의 **그린 LED**가 점등되지 않으면 설정을 바꿔 보세요



VI.VI

감사 합니다.