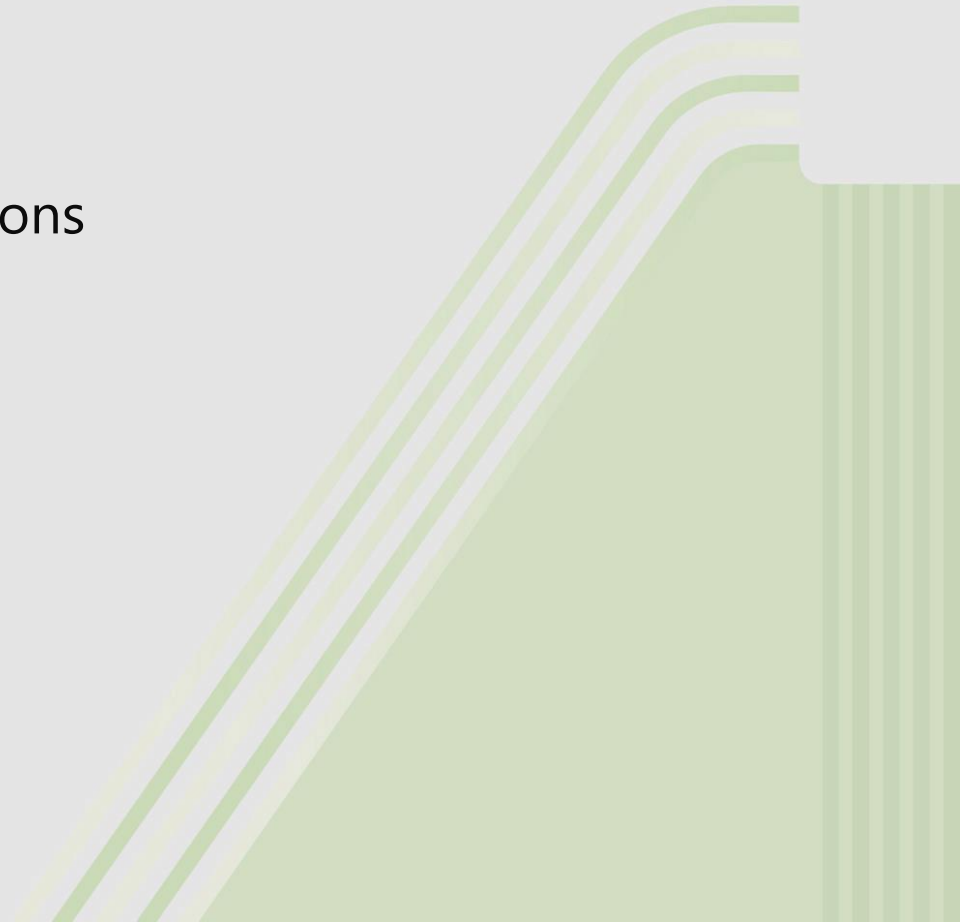




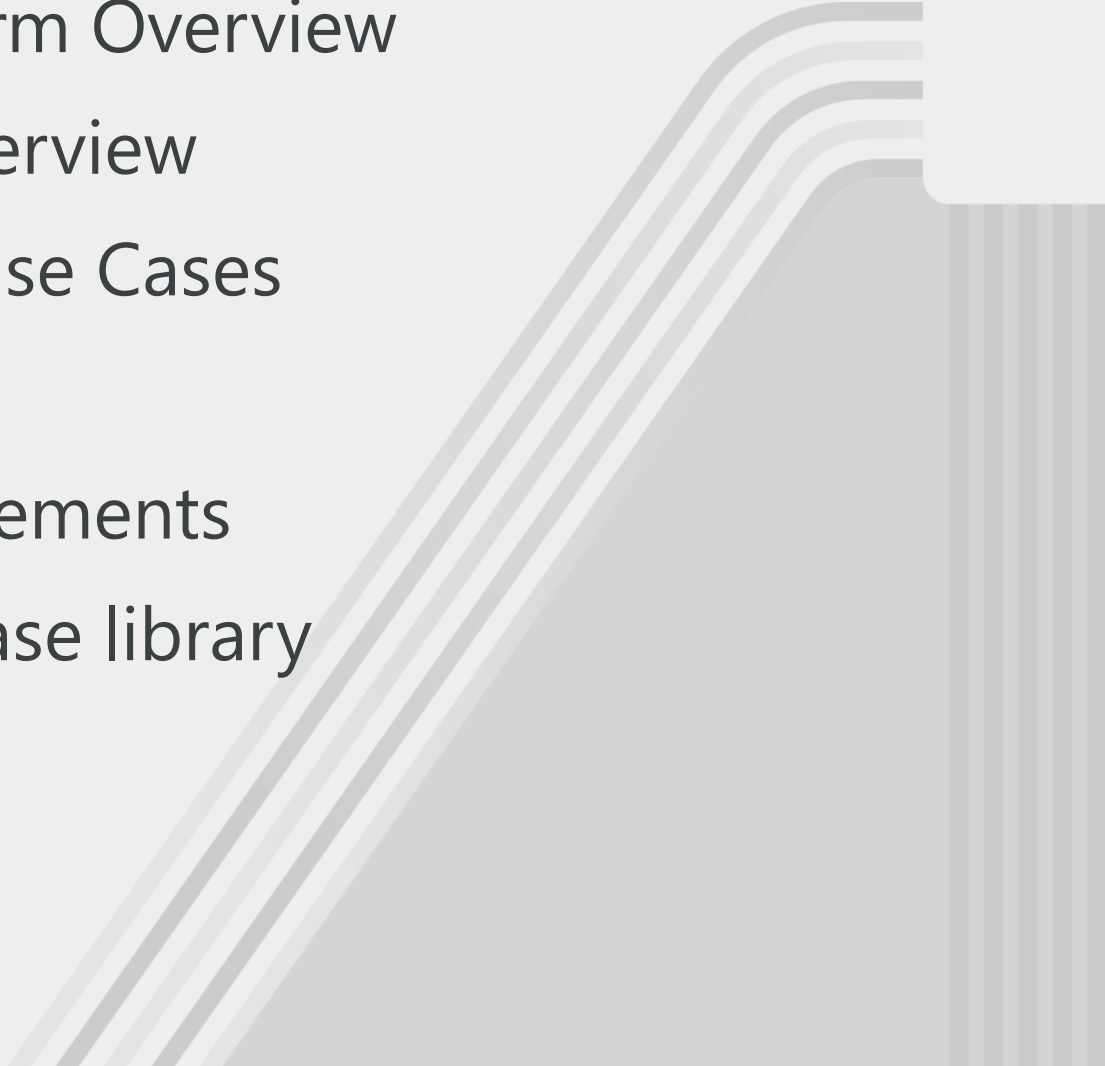
Anritsu 5G Protocol test Solution Introduction

Radio Communication Test Stations
MT8000A





Contents

- 1. 5G Portfolio Overview**
 2. MT8000A Platform Overview
 3. Protocol test Overview
 4. RTD/MT8000A Use Cases
 5. Latest Features
 6. RTD tool improvements
 7. Reference test case library
- 

Anritsu 5G Test Solution Portfolio

Components
Transmitter

Chipset
Device R&D

Certification
Acceptance

Production

Commercial

Vector Network Analyzer



5G NR Device
Protocol & RF Test



MT8000A

RF
Conformance



ME7873NR

Production Test
(Sub-6GHz)



MT8870A

Application Test
Maintenance



SmartStudio NR

Signal Analyzer

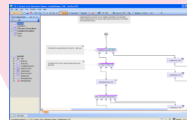


MS2850A

NSA-NR LTE Anchor



RTD



Protocol
Conformance
Carrier
Acceptance



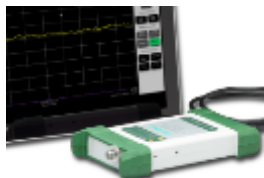
ME7834NR

Production Test
(mmWave)



MT8000A

Spectrum Master



MS2760A

OTA Chamber/Shield Box



5G Testing
Anritsu

5G Platform Portfolio Overview

1. Platform

-MT8000A



2. Hardware auxiliaries

-RF Converter, OTA Chamber, LTE Anchor



3. Application Software:

-Protocol (RTD), RF (TRx), Functional (SSNR)



4. System Solutions:

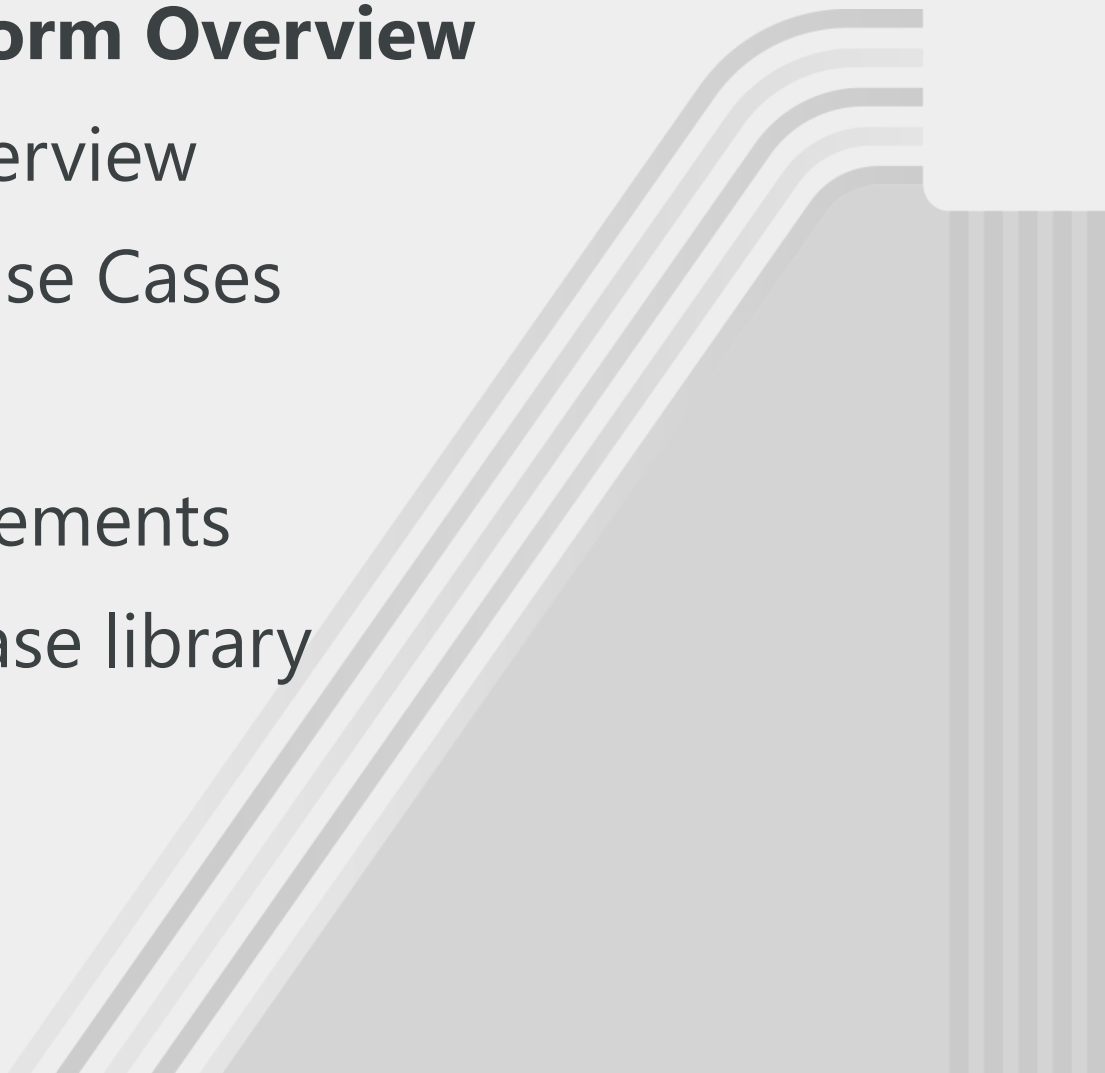
-Conformance (RFCT, PCT), Acceptance (CAT)



This article focuses on the Protocol Test Solution.



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1. 5G Portfolio Overview
 - 2. MT8000A Platform Overview**
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- 

Comprehensive Set of Hardware & Options

Flexible modular architecture for various test need

MT8000A-001 Control Module

Control for each MT8000A module

MT8000A-009 Multi-box Data Connection

For protocol test using multiple units

MT8000A-012 Data Test Module

Simulate U-plane stack with built-in IP generator

MT8000A-011 Baseband Module

Simulate full-stack 5G NR gNB signaling.

MT8000A-020 RF Base Module

Base module for RF TRx. Max.

MT8000A-021 0.4GHz-6GHz RF Sub Module*

MT8000A-022 3GHz-12GHz RF Sub Module**

MT8000A-023 Extend RF 2.4GHz-3GHz***

MT8000A-024 Extend RF 6GHz-7.125GHz***

RF TRx for Sub-6 GHz and IF signal.

*MT8000A-021 and 022 are exclusive options in the same slot.

**Installed on RF Base Module

***Extend the frequency range supported by MT8000A-022

MT8000A-031 0.4GHz-6GHz Multi RF Module

MT8000A-032 0.4GHz-6GHz Multi RF Extension

Sub-6 GHz specialized RF module.

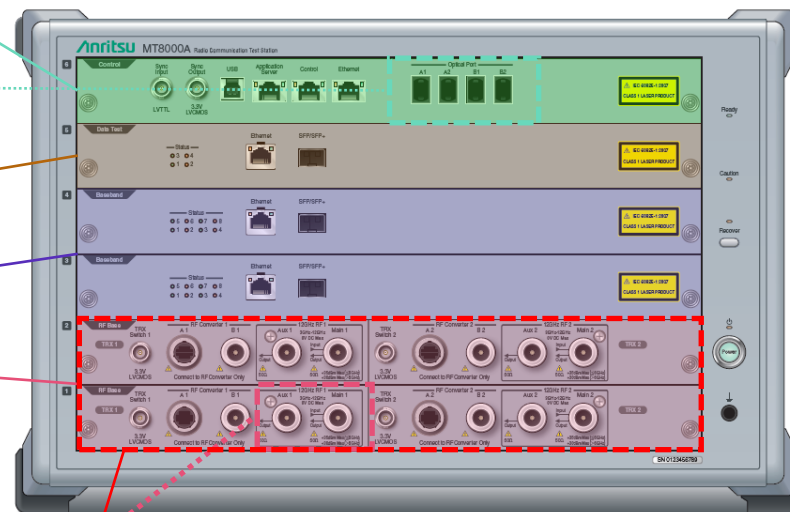
MA80001A 28GHz RF Converter

MA80002A 39GHz RF Converter

MA80003A Multiband RF Converter

for 2x2 MIMO, 2pcs converters required. for execute handover, x2 converters required.

MT8000A Mainframe



RF Module Product overview

◆ The RF module can be selected from the following 3 types.

Item	MT8000A-021	MT8000A-022/023/024			MT8000A-031/032
					
FR1 range	Sub-6 GHz 0.4 to 6 GHz	Sub-6 GHz 2.4 to 6 GHz	NR-U 6 to 7.125 GHz	UE High IF 7.125 to 12 GHz	Sub-6 GHz 0.4 to 6 GHz
FR2 mmW Conv	2				N/A
LTE on MT8000A range	0.4 to 6 GHz	N/A			0.4 to 6 GHz
Downlink (Tx)	4Tx (2slot)				8Tx (2slot)
Bandwidth (Tx)	FR1 400 MHz FR2 1 GHz	FR1 200 MHz FR2 1 GHz	FR1 200 MHz FR2 1 GHz	1 GHz	FR1 200 MHz
Output range	-110 to -10 dBm	-110 to -10 dBm	-110 to -18 dBm		-110 to -10 dBm
Accuracy	±0.7 dB typ (0.4-3 GHz) ±1.0 dB (3-6 GHz)	±1.0 dB	±1.3 dB	---	±0.7 dB typ (0.4-3 GHz) ±1.0 dB (3-6 GHz)
Uplink (Rx)	4Rx (2 slot)				4Rx (2 slot)
Bandwidth (Rx)	400 MHz	200 MHz	200 MHz	1 GHz	200 MHz
Input range	-50 to +26 dBm				-50 to +26 dBm
Accuracy (100 MHz BW)	±0.5 dB typ (0.4-3 GHz) ±1.0 dB (3-6 GHz)	±1.0 dB	±1.3 dB	---	±0.5 dB typ (0.4-3 GHz) ±1.0 dB(3-6 GHz)

RF Converter Product overview

Specification

Item		MA80001A 28 GHz RF Converter	MA80002A 39 GHz RF Converter		MA80003A Multiband RF Converter	
Test Ports		2 connectors (for Horizontal and Vertical Antenna)	2 connectors (for Horizontal and Vertical Antenna)		2 connectors (for Horizontal and Vertical Antenna)	
Connector Type		K/P (K/J - K/J standard accessory)	K/P (K/J - K/J standard accessory)		V/P (V/J - V/J standard accessory) (V/J-K/J application accessory)	
Simplex/Duplex		Simplex	Simplex		Simplex	
Down Link		1 TX	1 TX		1 TX	
Frequency range (GHz)		24.25 to 29.5	37.0 to 40.0	40.0 to 42.5	24.25 to 29.5 ^{*3}	37 to 43.5 ^{*3}
Modulation BW		1 GHz	1 GHz		1 GHz	
Output level		-90 dBm to +5 dBm	-90 dBm to +5 dBm		-70 dBm to +10 dBm	
Level Accuracy		±1.5 dB ^{*1}	±2.0 dB ^{*1}	--- ^{*2}	±1.5 dB ^{*1}	±2.0 dB ^{*1}
Up Link		1 RX	1 RX		1 RX	
Frequency range(GHz)		24.25 to 29.5	37.0 to 40.0	40.0 to 42.5	24.25 to 29.5 ^{*3}	37 to 43.5 ^{*3}
Analysis BW		1 GHz	1 GHz		1 GHz	
Maximum input Level		CW,+20 dBm 0VDC	CW,+17 dBm 0VDC		CW,+20 dBm 0VDC	
Measurement Accuracy		±1.5 dB ^{*1}	±2.0 dB ^{*1}	--- ^{*2}	±1.5 dB ^{*1}	±2.0 dB ^{*1}
3GPP Band	n257	✓	---		✓	
	n258	✓	---		✓	
	n259	---	---		✓	
	n260	---	✓		✓	
	n261	✓	---		✓	

*1 : +18°C to +28°C

*2 : Actual value ± 5.0 dB, check at shipment with 40.5 GHz, 41.5 GHz, 42.0 GHz, 42.5 GHz

*3 : 29.5 to 37 GHz is under consideration.

OTA Solution Matrix

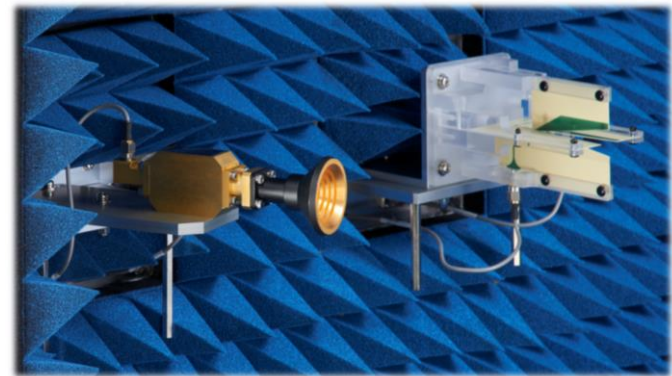
Model	MA8161A	MA8171A
Type	Shield Box	Anechoic Chamber
Figure		
Solution	- IP/PHY Throughput - Functional test	- IP/PHY Throughput - Link Adaptation - Beam management
Antenna Type	Spiral Antenna (Max. 2x2 MIMO x4 antennas)	Multi Antenna (Max. 2x2 MIMO x4 antennas)
Meas. Condition	White Box (Gray Box)	White Box (Gray Box)
	Radiative NFM	Radiative NFM for Protocol Test Direct FFM for Protocol & RF Test
Measurable DUT Size (mm)	300(W) x 50(H) x 200(D) or less/	(Diagonal) 300 mm or less
Outer Size W*D*H(mm)	434(W) x 271(H) x 328(D)	1460(W) x 1785(H) x 1000(D) (with B0746 Chamber rack)

MA8171A RF Chamber

- Compact & Cost effective
- Applicable to White Box testing with excellent performance
- Applicable to Black Box testing with additional MU

■ Specification

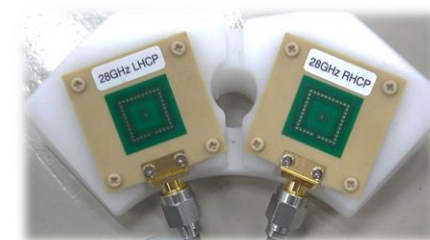
Maximum number of Antenna	4 antennas
Outer Size	1460(W) x 1785(H) x 1000(D) (with B0746 Chamber rack)
Mass	240 kg
Isolation	60 dB (20 GHz – 40 GHz)
Reflectivity	-30 dB (20 GHz – 40 GHz)
AUT to source horn distance	0.6 m (max.)
Path loss calibration	reference antenna method
Quiet zone size	MA8181A: 0.15 (m) diameter Z1996A: 0.30 (m) diameter Z2031A: 0.30 (m) diameter



MA8161A Shield box

◆ MA8161A Shield Box:

MA8161A is used to check the operation of functions such as Hand over, IMS, and Throughput during the DUT development process.



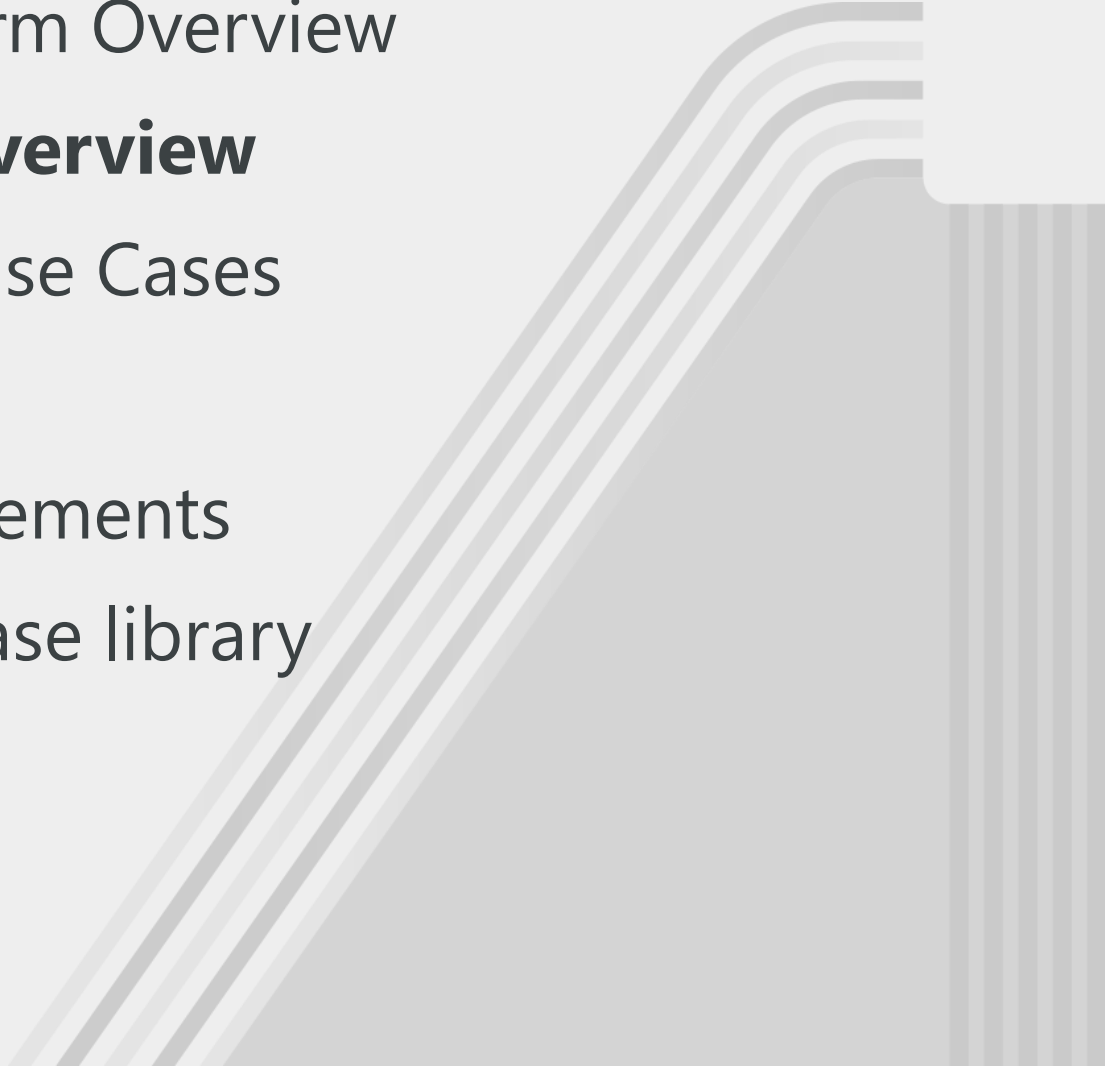
The installation area is same as MT8000A and installed on the desktop as shown in the photo is available.

MA8161A provides a simple OTA environment for FR2 28 GHz/39 GHz/43 GHz. band

Specification	MA8161A
Type	Shield Box
Solution	Protocol test for R&D
Compatible models	MT8000A
Antenna type	Spiral Antenna
Test environment	Shield Box, Radiative NFM
Shielding characteristics	≥ 50 dB (600 MHz $\leq$ frequency $\leq$ 43.5 GHz) (nom.)
Maximum Supported UE Size	300 *(W) x 50 (H) x 200 (D) mm, *: without any cable
Outer size	434 (W) x 271 (H) x 328 (D) mm (excluding projections), ≤ 16 kg(Max.)

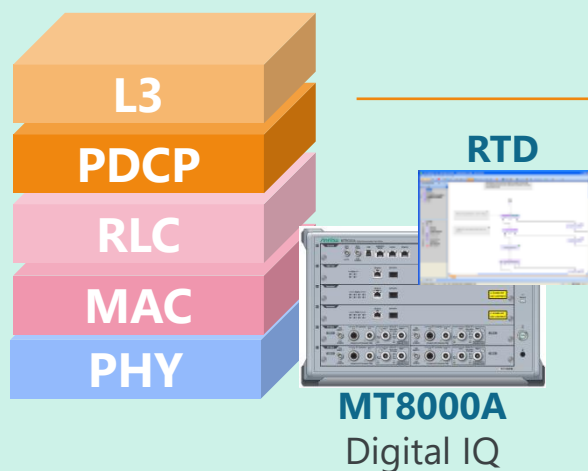


Contents

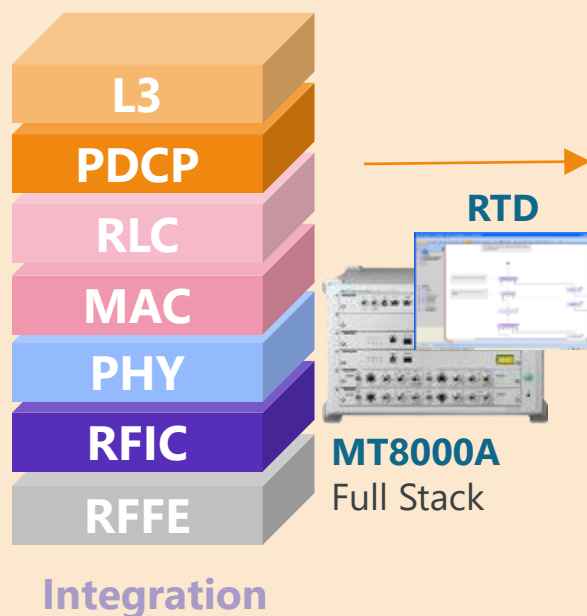
1. 5G Portfolio Overview
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- 

5G protocol test solutions across all R&D phases

Pre-Silicon



All Layers Verification



Total Testing



- Beneficial for cost saving by checking all layers with Digital IQ interface pre silicon.
- High repeatability test environment w/o RF interface.

- IF frequency and sub-6 RF interface for integration.
- Flexible parameter setting for normal and abnormal test cases.

- Utilize verified RTD test case by global chipset vendors for easily checking various features with our OTA solutions(Anechoic chamber, shield box).

Rapid Test Designer (RTD)

An Integrated Protocol Test Environment for 5G

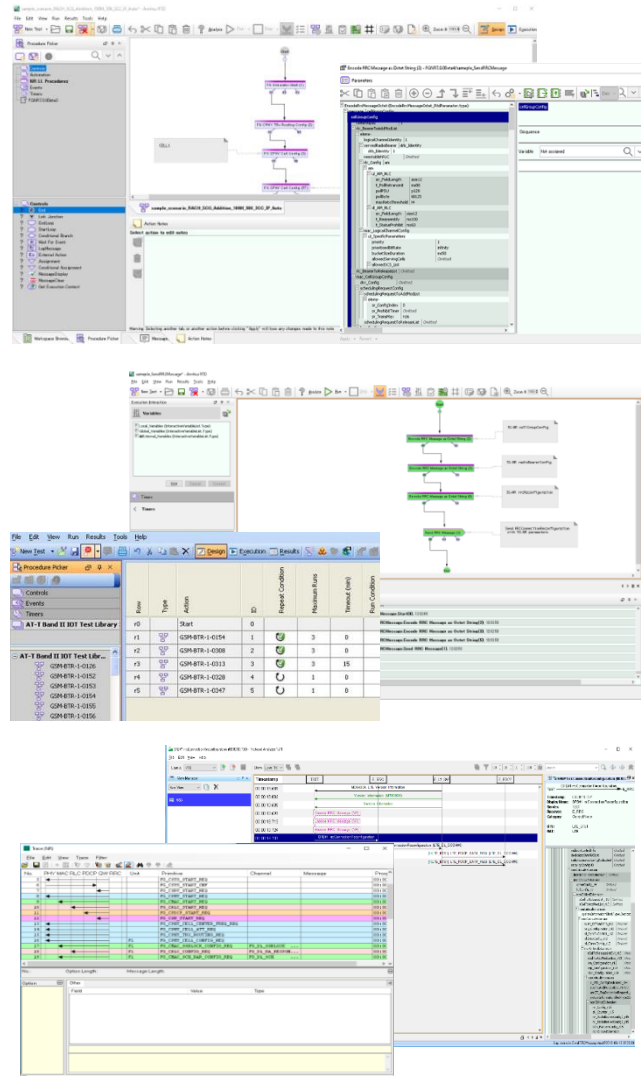
DESIGN TEST

L1/2
Library

L3
Library

EXECUTE & AUTOMATE

TRACE/LOG & ANALYZE



Graphical test development
Flexible API
Simple n/w configuration
Reference test library

Manual, interactive execution
Real-time displays
UE automation
Regression testing

Displays all protocol layers
(PHY/MAC/RLC/PDCP/RRC)
Advanced search & filtering

RTD/MT8000A : Speed and Leading Technology

Leading Edge 5G Protocol Technology

- Driven by the needs of leading chipset vendors
- Latest 3GPP features+ 4G/3G/2G
- First to market for every technology wave

Accelerates Development

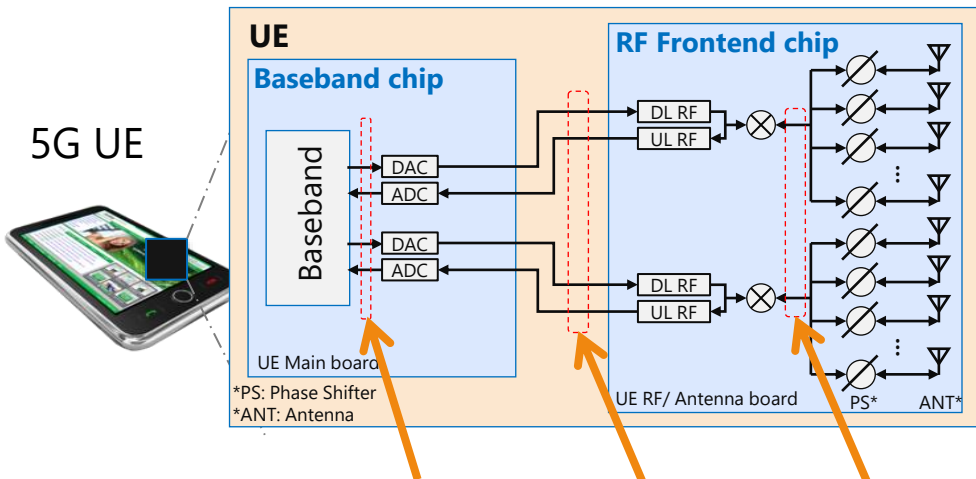
- Flexible Layer 1/2 and Layer 3 test environment
- Comprehensive suite of reference tests
- Quick to learn. Easy to use

Protocol test Set-Up for 5G NR Testing

- Protocol testing of 5G NR chipset and UEs, including comprehensive support for the following tests necessary for protocol development.
 - ✓ EN-DC, SA, FR1/FR2, CA, MIMO, FR1+FR2 Dual connectivity
 - ✓ IP Throughput
 - ✓ Beam-forming, beam management test
 - ✓ Fading test
 - ✓ 2G/3G/4G Handover test

2G,3G,LTE Anchor/Fading	For NR/NR Fading	Interface
 MD8430A Signaling Tester	 MT8000A Radio Communication Test Station	MT8000A/RF Converter ➤ IF connection for mmW ➤ Digital IQ interface ➤ FR2 RF Converter
LTE Anchor/High performance/ Fading		MA8161A Shield Box ➤ Protocol Functional test ➤ Throughput test ➤ Debug ➤ Regression test
 MT8000A Radio Communication Test Station		MA8171A RF Chamber ➤ AoA test ➤ Beam forming test

Multiple Test Interfaces for Maximum Flexibility



DIQ interface

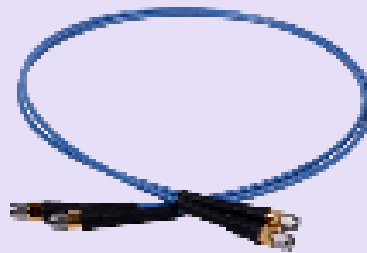
DIQ interface for Pre-silicon Test



SFP+ (optical cable)

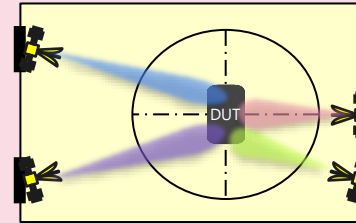
RF cable (conducted)

RF/IF interface for Basic Protocol test



OTA (Over The Air)

Compact Anechoic chamber MA8171A



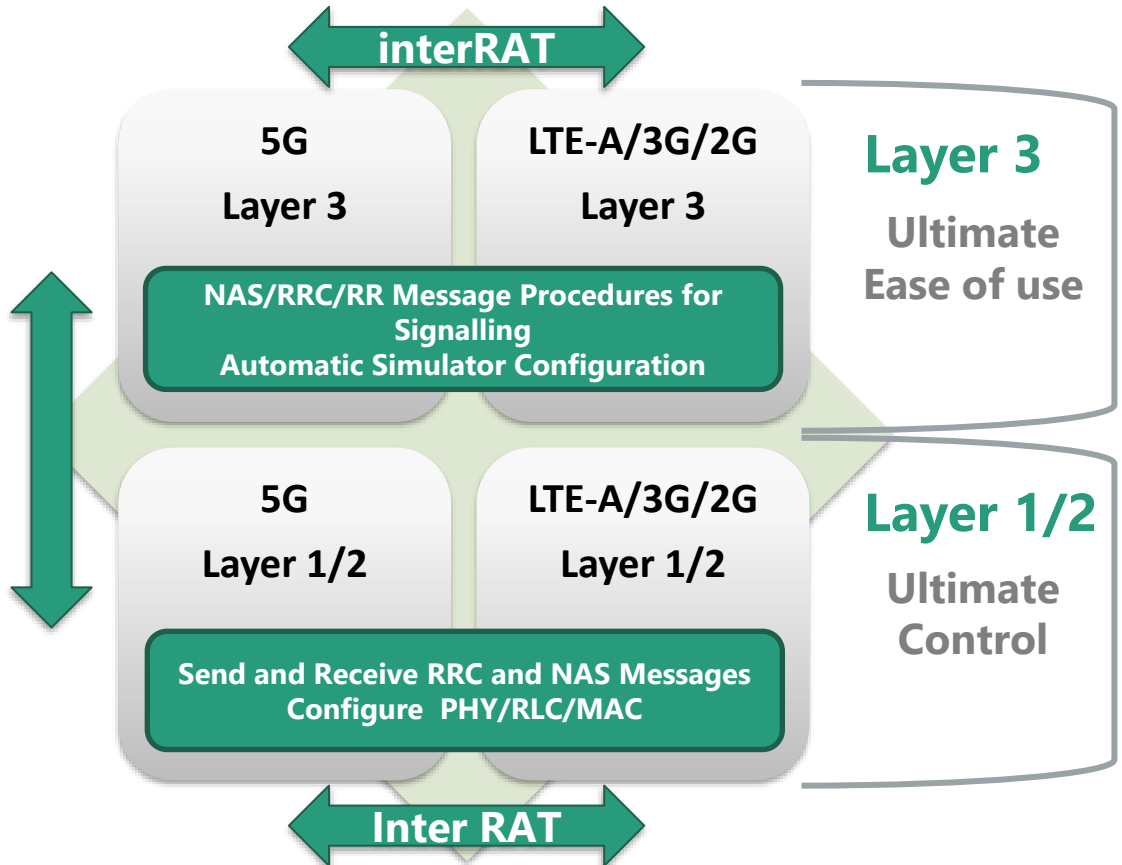
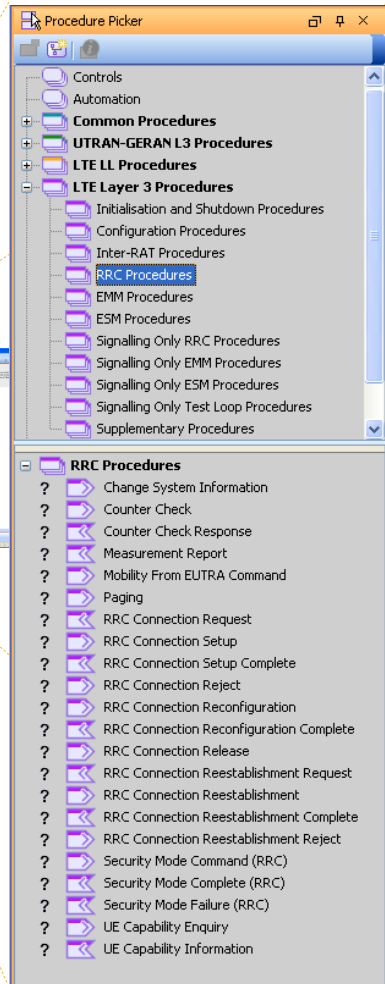
mmW Shield Box MA8161A

- ✓ 2x2MIMO test
- ✓ Hand over test **
- ✓ Throughput test **

** : Under Verification



RTD – Ultimate Flexibility in 5G Protocol Testing



Easy to use, with fine-grained control when you need it

100



Executing an RTD Test

The **Execute** ribbon displays automatically at the start of test execution

Click to edit variables during test execution

Progress displayed by changing colour

When run completes, click to view message sequence chart

Runtime Data, Message Details and Stack Trace

Displays messages requiring operator attention during test execution

myTest_simple - Running - Anritsu RTD

Design View | Analyze | Run | Stop | Abort | Pause | Resume | Run Comments | Run Tags | Message Sequence Chart | Timestamps | Node Headers | Message Detail | Runtime Data | Track Execution | Stack Trace | Select Failed | Go To Results

Execution Interaction

Variables

Local_Variables (InteractiveVariableList.Type)

Variable	Value	Description
myVar_idDigit1	07	Onlined

Timers

myDelay_5000ms 100ms

Events

myEvent_OK

myEvent_ulIDMisMatch

myTest_simple | Message Sequence Chart

Messages

Analysis report, 2016-02-20

Analysis completed with 0 errors and 0 warnings.

myTest_simple is not watermarked or licensed, 10:48:33

Action completed, reached @myArchive_LTEA/myTest_simple.Start(0), 10:48:33

Action completed, reached OK@myArchive_LTEA/myTest_simple.Configure CellGroup Profile(1), 10:48:33

myArchive_LTEA/myTest_simple

Zoom % 100 | myWorkspace 7.0.0 INT01 A

Analysing Results

The screenshot displays the Anritsu RTD (Radio Test Design) software interface, specifically the 'Execution (F11)' view. The main window shows a sequence of test steps and their results for the procedure 'LTE3_0001_Attach_And_Dedicated_Bearer_Establishment_FDD'. The steps include 'Start', 'Configure CellGroup Profile (86)', 'InitializeParameters (85)', and 'Configure System (8)'. The results are presented in a table format, showing the status of various parameters and the execution of different test cases.

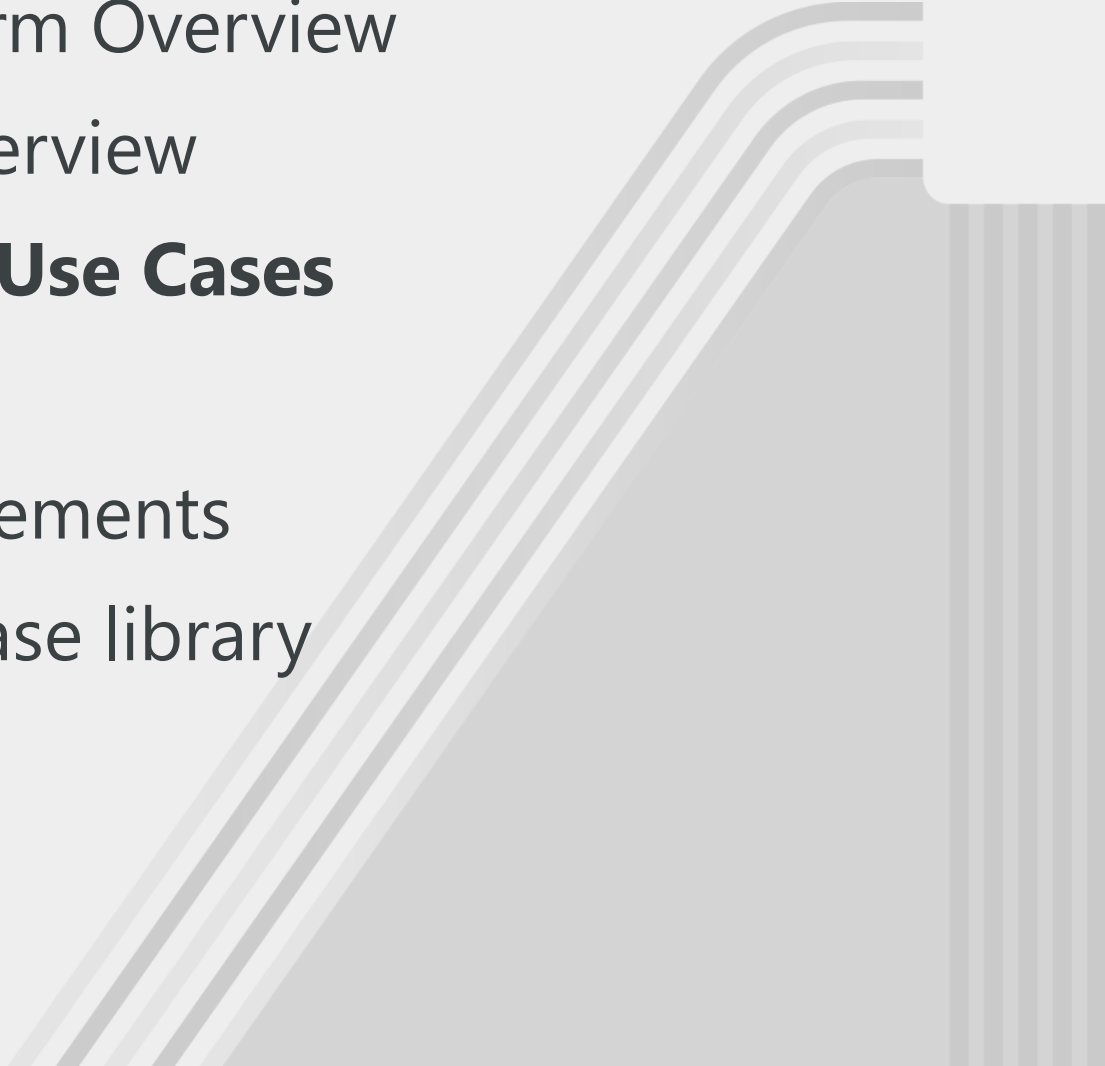
Execution (F11) Table:

Step	Parameters	Results
Start	After successful LTE attach, the network initiates dedicated bearer establishment procedure. On successful completion of the dedicated bearer establishment procedure, data transfer is performed via default and dedicated bearer.	
Configure CellGroup Profile (86)	parameters to be used for the RF configuration,	
InitializeParameters (85)		
Configure System (8)		

The bottom of the screen shows a detailed view of the 'Configure System (8)' step, which includes a flowchart and a list of parameters to be used. The parameters are categorized into 'RF configuration', 'RF configuration', and 'RF configuration'. The flowchart shows the sequence of steps: 'Start' -> 'Configure CellGroup Profile (86)' -> 'InitializeParameters (85)' -> 'Configure System (8)'.



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- 

MT8000A 5G NR Protocol test Use Cases

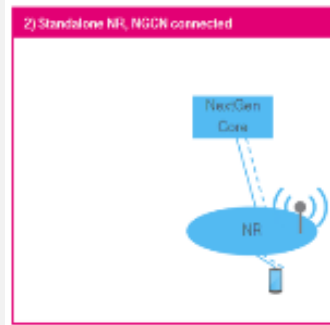
Use case	HW Configuration	Value for customer
1.NSA/SA feature bring-up	 MD8430A	Utilize MT8000A or existing MD8430A for LTE Anchor and Inter RAT testing.
2.Throughput	 MA8171A MA8161A	Giga-bit data throughput testing.
3.Beam Management AoA (Angle of Arrival)	 MA8171A	Max 4 antennas can be mounted on MA8171A for enabling several AoAs testing.
4. Fading		One box for Sub-6 NR Fading feature.

1. NSA/SA feature bring-up

NSA and NR-eLTE interworking testing can be done by leveraging existing LTE asset.

SA(Stand Alone Solution)

Only NR cell (Option2)

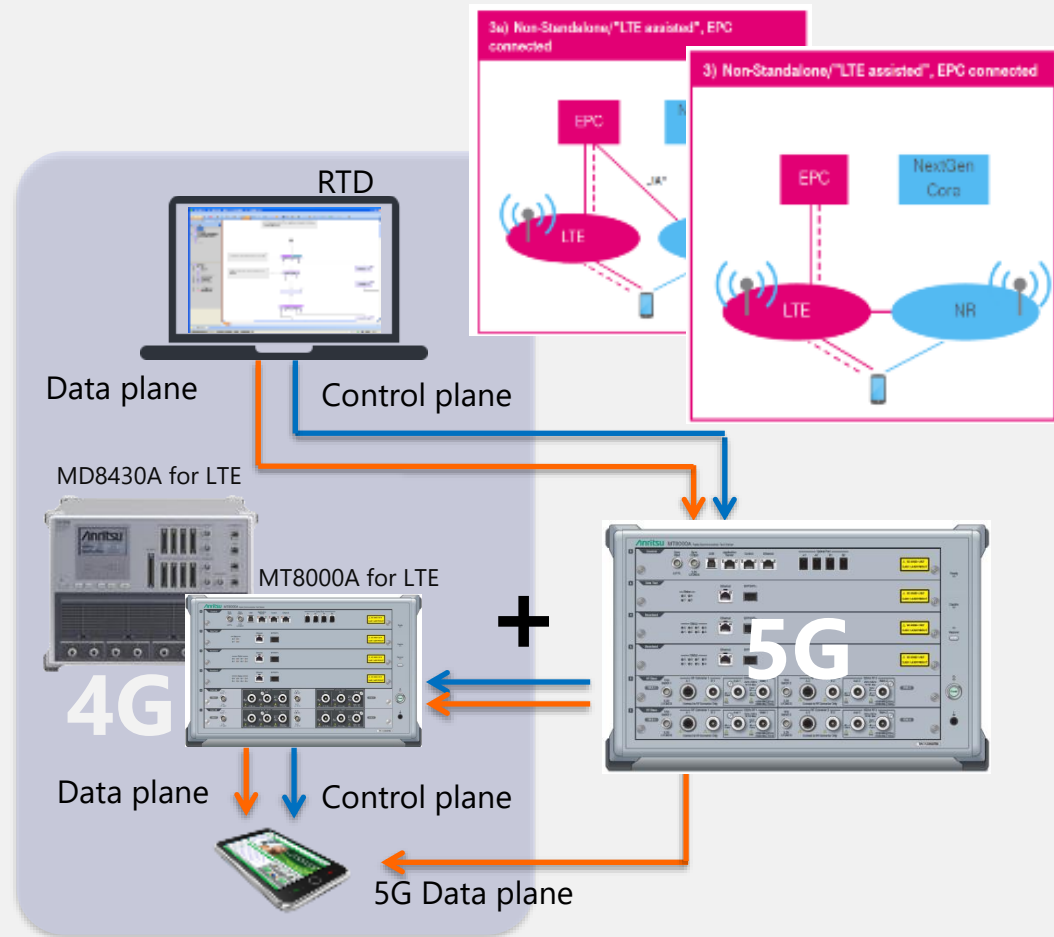


Data plane (orange arrow) and Control plane (blue arrow) connections from the RTD to the 5G equipment.

NSA (Non Stand Alone Solution)

Both NR cell and LTE cell (Option3/3a/3x)

Reference for RP-161266

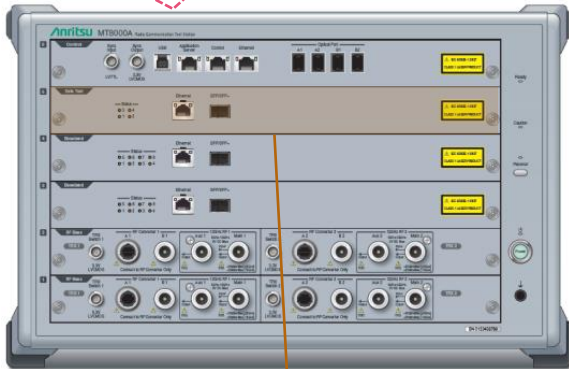


2. Throughput Test

IP Throughput testing is achieved using **Data Test Module MT8000A-012**

MX800030A-004 Internal Server

A complicated measurement system can be made simple



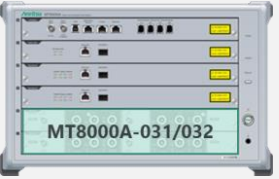
MT8000A-012 Data Test Module

Simulate U-plane stack with built-in IP generator

Layer	Function
General	- Throughput: 10 Gbps - External Server I/F: SFP+(10GEther) - EN-DC Option: 3/3a/3x - NR Option 2 (Stand Alone) - Internal Server (optional)
Gateway	- 2 Bearer - IPv4/IPv6 - MTU size (equal or less than 9000)
PDCCP	- DTCH (2Channel) - PDCCP SN Size 12/18bit - Ciphering (AES, Snow, ZUC) - Split Bearer - Duplicate
RLC	- DTCH (2Channel) - UM, AM - RLC SN Size 12/18bit

2. Throughput Test

MT8000A Multiple-Box Solution

MT8000A Configuration		Stand Alone (FR1/FR2)	LTE on MT8000A	Fading (FR1/FR2)
Box #1	Box #2			
		FR1 : 1Band 4CA 4x4MIMO FR2 : 2Band 8CA 2x2MIMO	8CA 1Band 4x4MIMO	FR1: 2Cell (E.g., 2CA 4x4MIMO) FR2: 4Cell (E.g., 4CA 2x2MIMO)
		FR1 : 2Band 4CA 4x4MIMO FR2 : Not support	8CA 2Band 4x4 MIMO	FR1: 2Cell (E.g., 2CA 4x4MIMO)
		FR1 : 2Band 4CA 4x4MIMO FR2 : 4Band 8CA 2x2MIMO	8CA 2Band 4x4MIMO	FR1: 4Cell (E.g., 4CA 4x4MIMO) FR2: 8Cell (E.g., 8CA 2x2MIMO)
		FR1 : 4Band 4CA 4x4MIMO FR2 : Not support	8CA 4Band 4x4 MIMO	FR1: 4Cell (E.g., 4CA 4x4MIMO)

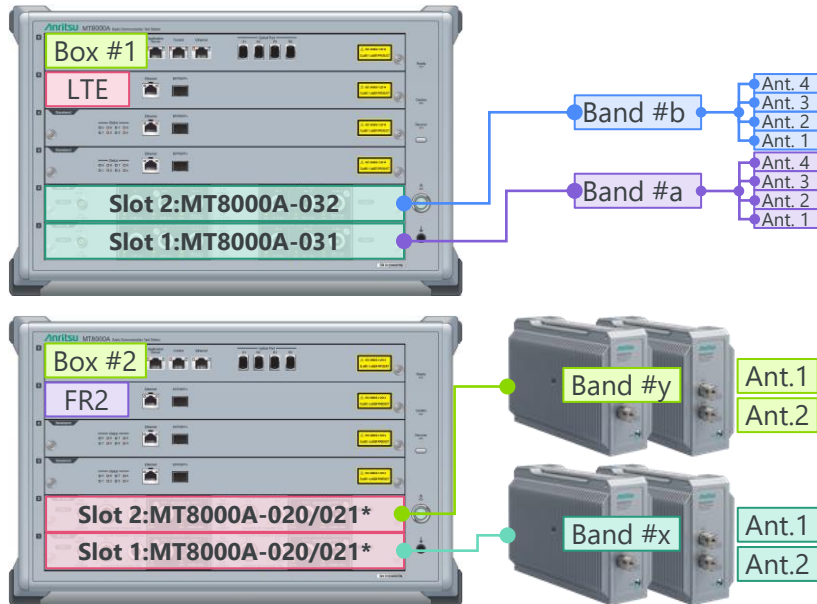
Multiple use cases are realized by combining the functions of FR1/FR2, LTE on MT8000A, and Fading.

2. Throughput Test

EN-DC IP Throughput

■ 2x MT8000A,

- IP/MAC Padding Throughput: 9.2 Gbps*1
- LTE: 2Band 8CA 4x4MIMO, 3.2 Gbps
- FR2: 2Band 8CA 2x2MIMO (100 MHz/CC, Total 800 MHz BW), 6.0 Gbps



■ LTE

Ant.4	Band #a + #b = 8CA							
Ant.3	Band #a + #b = 8CA							
Ant.2	Band #a + #b = 8CA							
Ant.1	Band #a + #b = 8CA							
CA	1	2	3	4	5	6	7	8

■ FR2

Ant.2	Band #x + #y = 8CA							
Ant.1	Band #x + #y = 8CA							
BW(MHz)	100	200	300	400	500	600	700	800

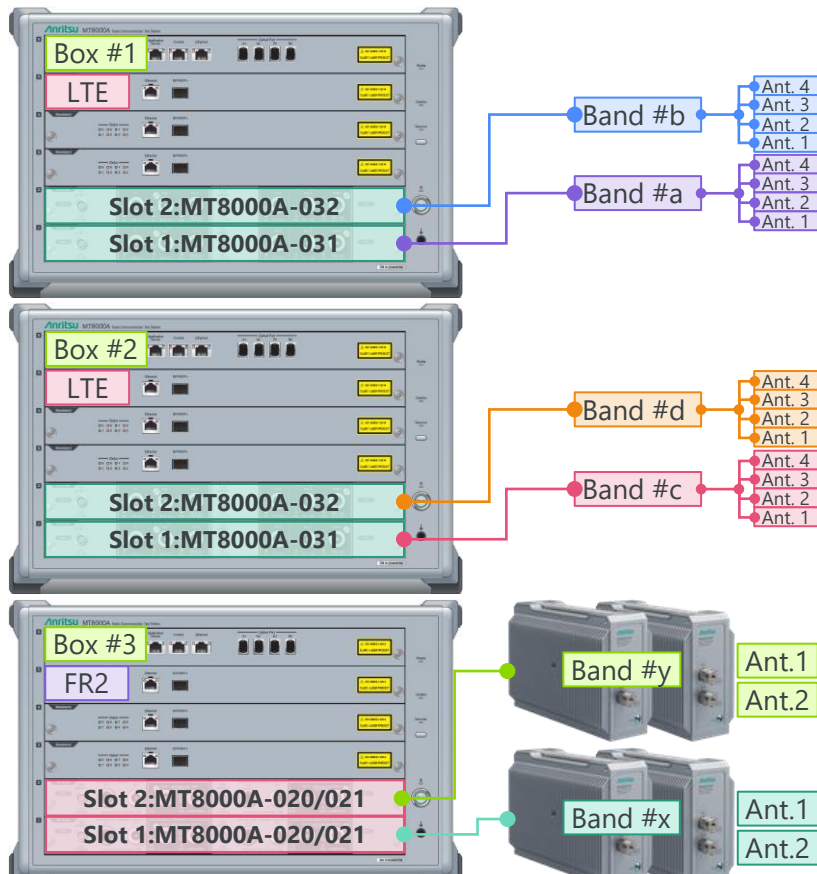
*1: The maximum value of Mac Padding Throughput is the **sum of FR1 and FR2**.
However, the upper limit of IP Throughput is **FR1+FR2 <10 Gbps** due to the limitation of PDCP Layer.

2. Throughput Test

EN-DC IP Throughput

Extend the number of LTE bands by using two or more MT8000A.

- 3x MT8000A (1x MT8000A for NR/ 2x MT8000A for LTE),
 - IP/MAC Padding Throughput: 9.2 Gbps*1
 - LTE: 4Band 8CA 4x4MIMO, 3.2 Gbps
 - FR2: 2Band 8CA 2x2MIMO (100 MHz/CC, Total 800 MHz), 6.0 Gbps



■ LTE

Ant.4	Band #a + #b + #c + #d = 8CA							
Ant.3	Band #a + #b + #c + #d = 8CA							
Ant.2	Band #a + #b + #c + #d = 8CA							
Ant.1	Band #a + #b + #c + #d = 8CA							
CA	1	2	3	4	5	6	7	8

■ FR2

Ant.2	Band #x + #y = 8CA							
Ant.1	Band #x + #y = 8CA							
BW(MHz)	100	200	300	400	500	600	700	800

*1: The maximum value of Mac Padding Throughput is the **sum of FR1 and FR2**.
However, the upper limit of IP Throughput is **FR1+FR2 < 10 Gbps** due to the limitation of PDCP Layer.

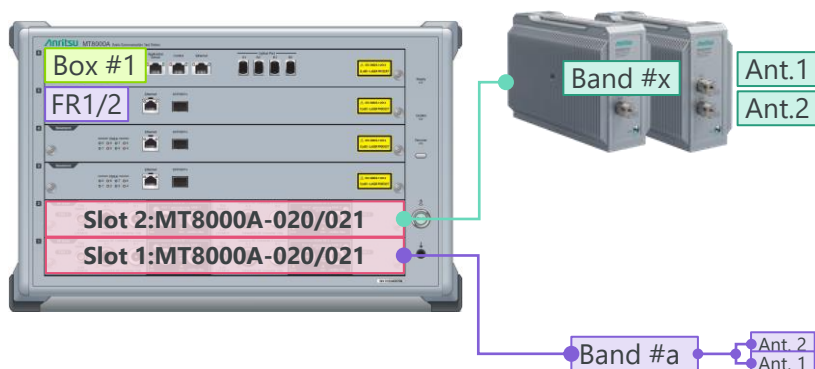
2. Throughput Test

FR1+FR2 DC/CA

MT8000 supports dual connectivity/carrier aggregation of FR1 and FR2 by 1 box.

■ 1x MT8000A, IP/MAC Padding Throughput : 4.7 Gbps

- FR1: 1Band 2CA 2x2MIMO (100 MHz/CC, Total 200 MHz^{*1} BW), 1.7 Gbps
- FR2: 1Band 4CA 2x2MIMO (100 MHz/CC, Total 400 MHz BW), 3.0 Gbps



■ FR2

Ant.2	Band #x (4CA, Contiguous)							
Ant.1	Band #x (4CA, Contiguous)							
BW(MHz)	100	200	300	400	500	600	700	800

■ FR1^{*}

Ant.4								
Ant.3								
Ant.2	Band #a (2CA Cont.)							
Ant.1	Band #a (2CA Cont.)							
BW(MHz)	100	200	300	400	500	600	700	800

*1: As shown below, Total Bandwidth differs depending on the frequency band.

- 20 MHz ($0.4 \text{ GHz} \leq f < 0.6 \text{ GHz}$)
- 200 MHz ($0.6 \text{ GHz} \leq f < 3.3 \text{ GHz}$)

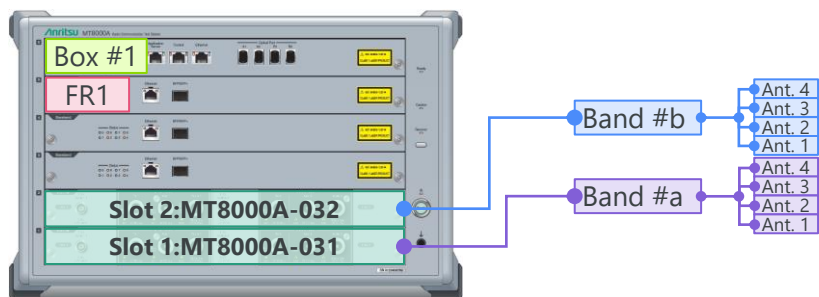
*2: MA80001A 28 GHz RF Converter supports DL 256 QAM.

2. Throughput Test

FR1+FR2 DC (FR1 2Band)

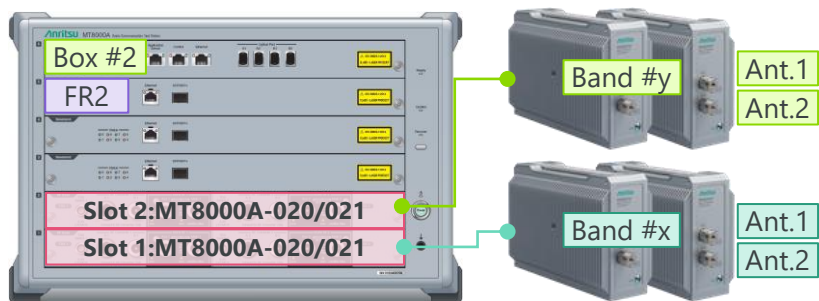
Extend the number of bands and CA/MIMO by using two or more MT8000As.

- 2x MT8000A, IP Throughput: 10 Gbps, MAC Padding Throughput: 12.8 Gbps^{*1}
 - FR1: 2Band 4CA 4x4MIMO (100 MHz/CC, Total 400 MHz^{*2} BW), 6.8 Gbps
 - FR2: 2Band 8CA 2x2MIMO (100 MHz/CC, Total 800 MHz BW), 6.0 Gbps



■ FR1

Ant.4	Band #a + #b = 8CA							
Ant.3	Band #a + #b = 8CA							
Ant.2	Band #a + #b = 8CA							
Ant.1	Band #a + #b = 8CA							
BW(MHz)	100	200	300	400	500	600	700	800



■ FR2

Ant.2	Band #x + #y = 8CA							
Ant.1	Band #x + #y = 8CA							
BW(MHz)	100	200	300	400	500	600	700	800

*1: The maximum value of Mac Padding Throughput is the **sum of FR1 and FR2**.

However, the upper limit of IP Throughput is **FR1+FR2 < 10 Gbps** due to the limitation of PDCP Layer.

*2: As shown below, Total Bandwidth differs depending on the frequency band.

- 20 MHz ($0.4 \text{ GHz} \leq f < 0.6 \text{ GHz}$)
- 200 MHz ($0.6 \text{ GHz} \leq f < 3.3 \text{ GHz}$)

2. Throughput Test

MT8000A Scalability for LTE high performance test

■ Concept

The MX800032A makes full use of the latest MT8000A HW's capability to easily realize LTE IP Throughput tests of 20 Layer or higher / 2Gbps or higher.

Features

- ✓ Expandable up to DL 8CA 4x4 MIMO
- ✓ Supports IP Throughput tests of 2 Gbps
→ Support total 8 Gbps IP TPUT test by ENDC
- ✓ Selectable test environment for LTE and NR by switching FW.

■ Capability

● DL CA/MIMO

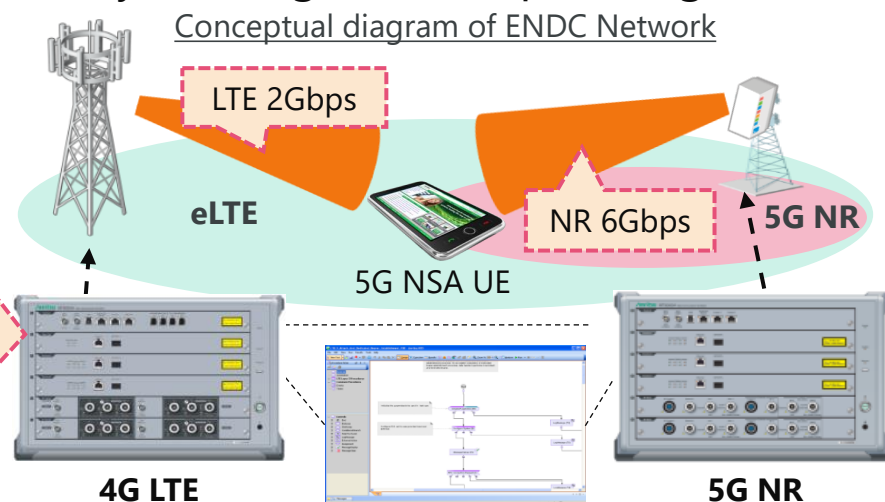
	DL 256QAM	DL 4x4 MIMO	UL CA SISO
DL 1-3CC	✓8430	✓8430	✓(UL3CC)8430
	✓8000	✓8000	✓(UL2CC)8000
DL 4-6CC	✓8430	✓8430	✓(UL3CC)8430
	✓8000	✓8000 ^(*1)	✓(UL2CC)8000
DL 7-8CC	✗8430	✗8430	✗8430
	✓8000	✓8000 ^(*2)	✓(UL2CC)8000

*1:It is necessary to stop SIB transmission when LTE_BTS1,2,3 and 4 is used.

To avoid SIB transmission restriction, use other BTS unit combination (e.g. LTE_BTS1,2,3,5,6,7 for 6CC)

*2:It is necessary to stop SIB transmission

MT8000A Advancing beyond



● UL CA/MIMO

	UL SISO			UL MIMO		
	UL 1CC	UL 2CC	UL 3CC	UL 1CC	UL 2CC	UL 3CC
UL 16QAM	✓8430	✓8430	✓8430	✓8430	✓8430	✗8430
	✓8000	✓8000	✗8000	✓8000 ^(*3) ^(*4)	✗8000 ^(*5)	✗8000
UL 64QAM	✓8430	✓8430	✓8430	✗8430	✗8430	✗8430
	✓8000	✓8000	✗8000	✓8000 ^(*3) ^(*4)	✗8000 ^(*5)	✗8000
UL 256QAM	✓8430	✓8430	✗8430	✗8430	✗8430	✗8430
	✓8000 ^(*4)	✓8000 ^(*4)	✗8000 ^(*4)	✓8000 ^(*3) ^(*4)	✗8000 ^(*5)	✗8000

*3:requires v08.60.00.00

*4:Implemented but there is no required by anyone (especially CAT) as of now

*5:FW development is suspended because there is no required by anyone (especially CAT) as of now

*6:Implemented, but not verified (there is a bug where 2nd SCell data is corrupted)

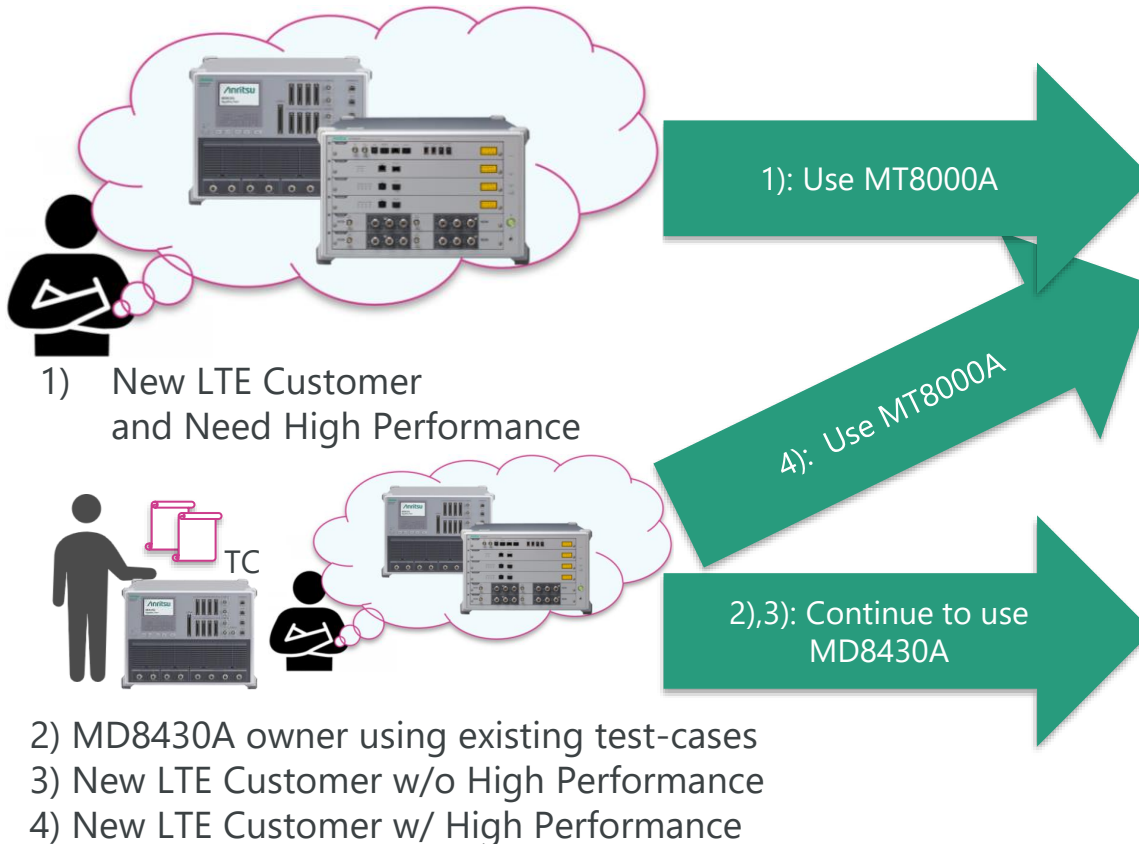
For other detailed specifications and restrictions, please contact our sales team.

2. Throughput Test

MT8000A Scalability for LTE high performance test

■ LTE on MT8000A/MD8430A Target Customer

Customer type (4-types)



Recommended Solution



LTE on MT8000A + new TCs



MD8430A + existing TCs

Note:

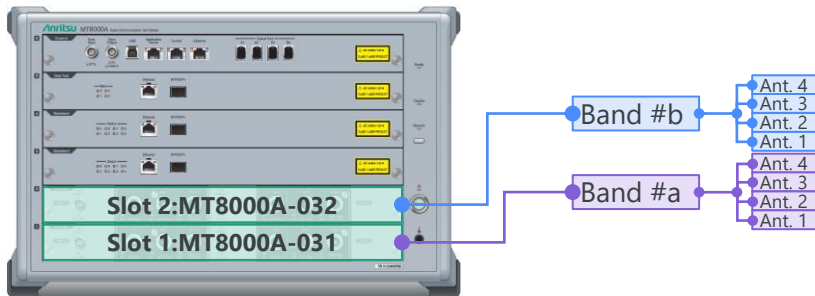
- When using an existing TC with LTE on MT8000A, it is necessary to convert the TC.
- There are some differences in functionality between the MD8430A and LTE on MT8000A. Please contact our sales team for more information.

2. Throughput Test

MT8000A Scalability for LTE high performance test

■ LTE on MT8000A configuration

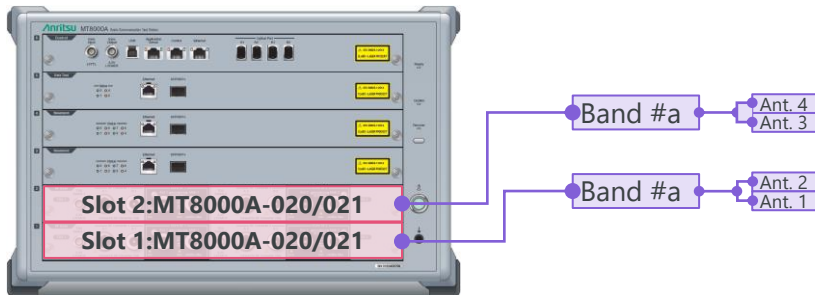
- MT8000A-031/032 Multi RF Module Installed MT8000A case:
 - CA/MIMO capability: 2Band 8CA 4x4MIMO, 32Layer



■ LTE

Ant.4	Band #a + #b = 8CA							
Ant.3	Band #a + #b = 8CA							
Ant.2	Band #a + #b = 8CA							
Ant.1	Band #a + #b = 8CA							
CA	1	2	3	4	5	6	7	8

- MT8000A-020/021 0.4GHz-6GHz RF Sub Module Installed MT8000A case:
 - CA/MIMO capability: 1Band 8CA 4x4MIMO, 32Layer



■ LTE

Ant.4	Band #a, 8CA contiguous							
Ant.3	Band #a, 8CA contiguous							
Ant.2	Band #a, 8CA contiguous							
Ant.1	Band #a, 8CA contiguous							
CA	1	2	3	4	5	6	7	8

*Please contact the sales team for Throughput measurement results and multiple unit configurations.

2. Throughput Test

MT8000A Scalability for LTE high performance test

■ Just for information if that the case of replace existing MD8430A

MD8430A Option Model	MD8430A Option Name	MX800032A LTE Protocol Platform Software	MX800032A-001 LTE Anchor For Protocol	MX800032A-002 LTE Advanced Features
MD8430A-060	LTE FDD Option	✓		
MD8430A-061	LTE TDD Option	✓		
MD8430A-075	LTE DL 4x4 MIMO Option			✓
MD8430A-080	LTE Ciphering Option	✓		
MD8430A-081	LTE ROHC Option	✓		
MD8430A-082	LTE MBMS Option			
MD8430A-085	LTE Carrier Aggregation Option			✓
MD8430A-086	Ciphering Option	✓		
MD8430A-087	LTE CoMP Option	Only UL CoMP		DL CoMP(TM10)
MD8430A-072	LTE Licensed Assisted Access (LAA) Option			✓
MD8430A-073	LTE Dual Connectivity Option			✓
MD8430A-076	LTE DL 8x4 MIMO Option			
MD8430A-078	LTE UL 2x2 MIMO Option			✓
MD8430A-088	LTE DL 4 Carrier Aggregation Option			✓
MD8430A-045	LTE UL 3 Carrier Aggregation Option			
MD8430A-089	LTE DL 5 Carrier Aggregation Option			✓
MD8430A-044	LTE DL 6 Carrier Aggregation Option			✓
MD8430A-079	LTE UL 256QAM Option			✓
MD8430A-064	LTE Anchor For 5G NSA Option		✓	
MD8430A-077	LTE Internal server Option	✓		

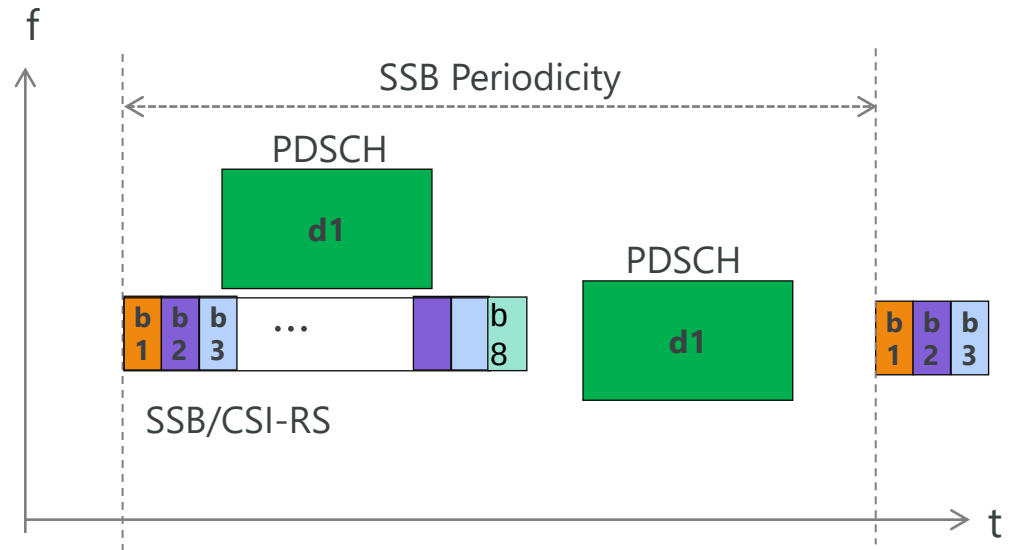
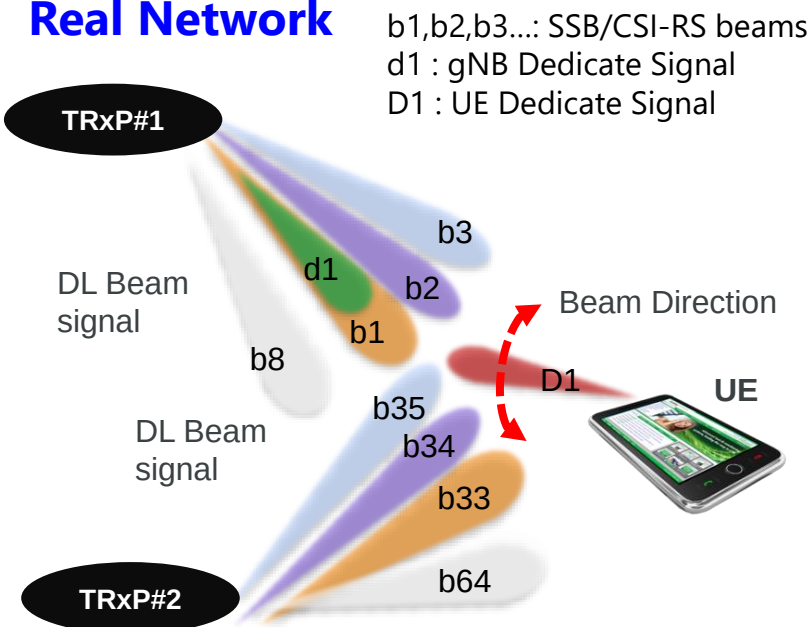
Note:

- When using an existing TC with LTE on MT8000A, it is necessary to convert the TC.
 - There are some differences in functionality between the MD8430A and LTE on MT8000A.
- Please contact our sales team for more information.

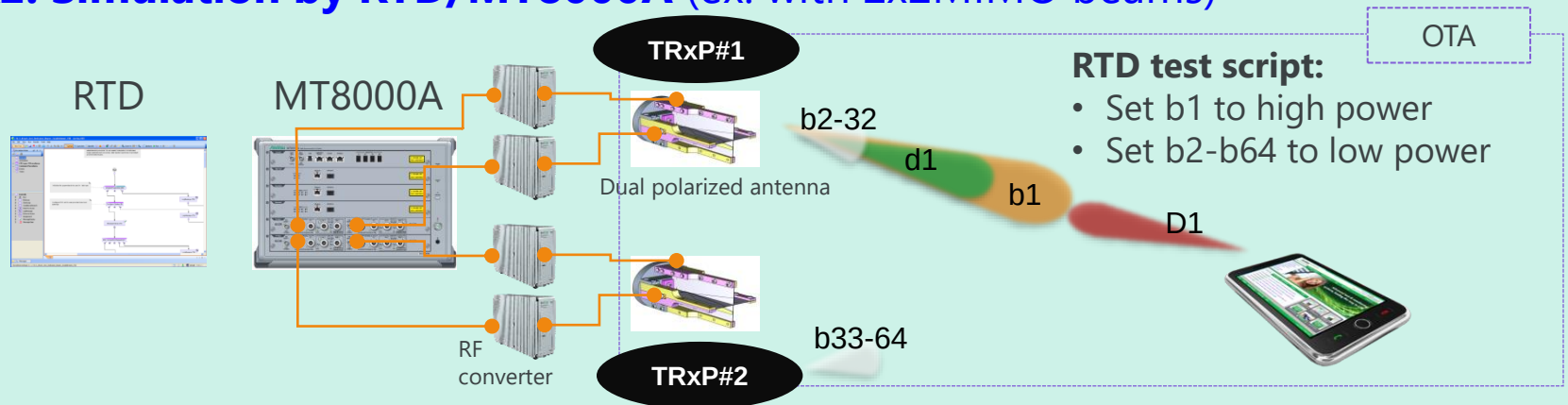
3. Beam Management - AoA (Angle of Arrival)

FR2 : 2 AoA Simulation

Real Network



FR2: Simulation by RTD/MT8000A (ex. with 2x2MIMO beams)

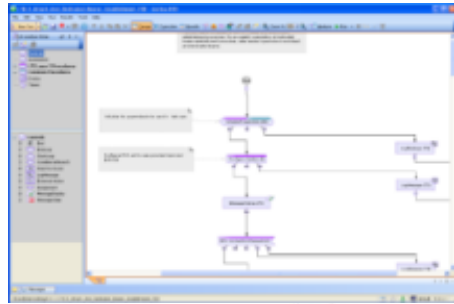
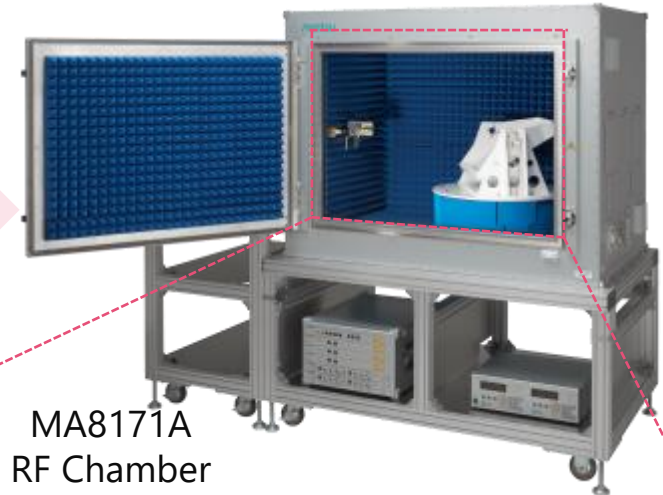
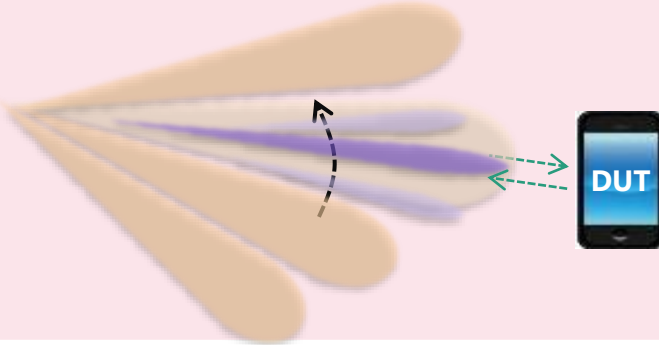
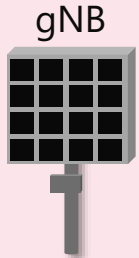


3. Beam Management - AoA (Angle of Arrival)

FR2 : 2 AoA Simulation

■ 2AoA testing image

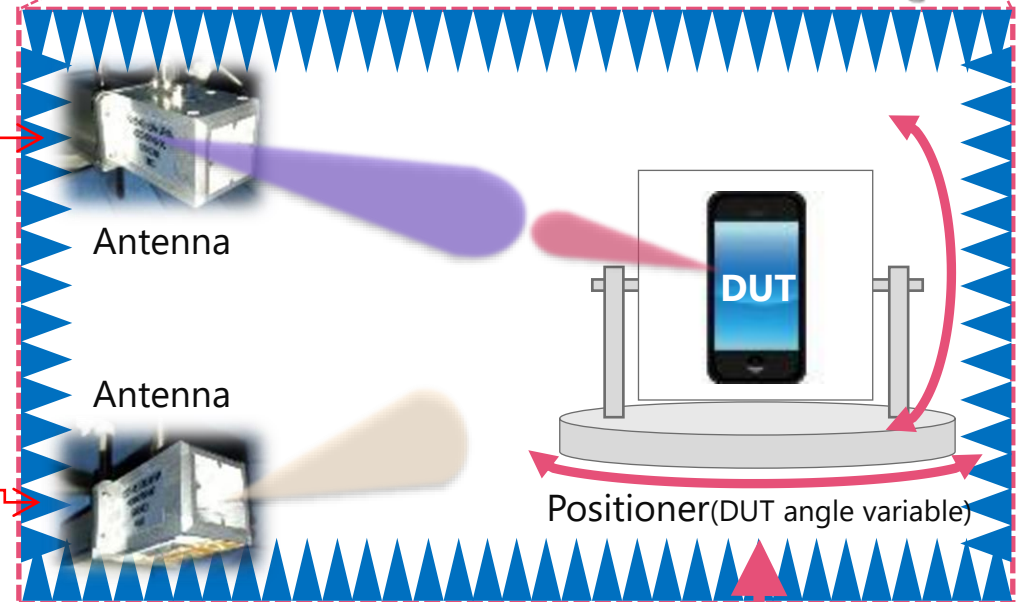
*Beamforming image diagram



RTD



5G NR BTS simulator



4. Fading

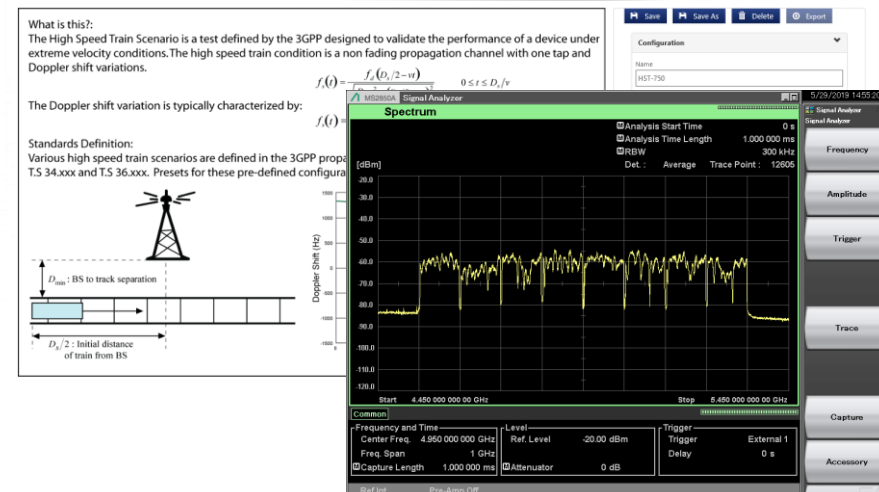
MT8000A Built-In Fading Solution Overview

■ What is MT8000A built-in fader?

- High performance NR/LTE fader with SW option
- High-stability/high-reliability & Calibration free by digital I/F
- Flexible combination for NR 4Cells + NR Fader, NR fader 8Cells + LTE fader 8Cells, etc.

■ Key Features

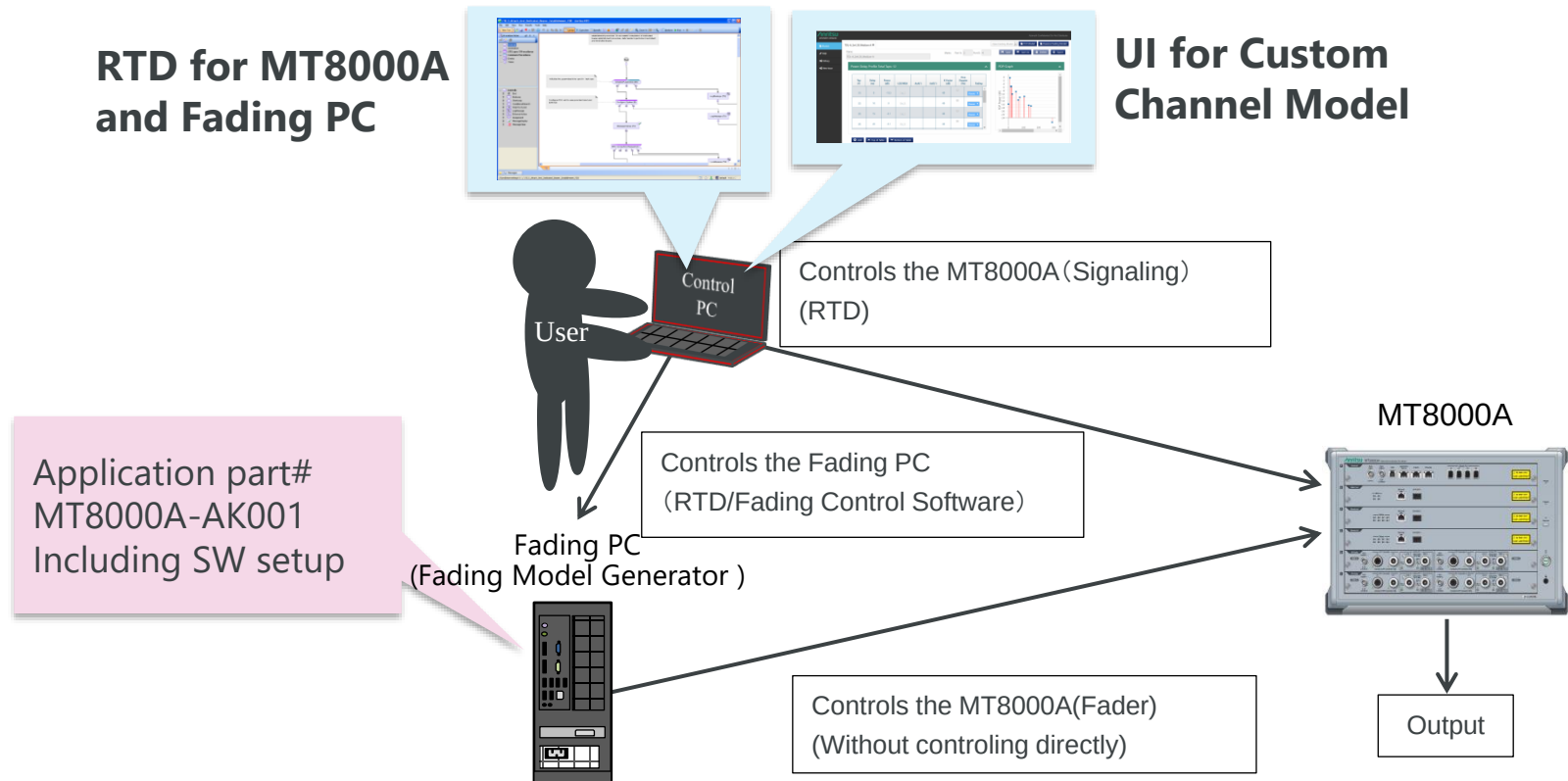
- High performance real-time processing
- High flexibility & wide scalability
 - MT8000A multi box for number of cells, number of bands
- Specialized & versatile
 - Channel models for both 3GPP 5G NR and LTE UE conformance
 - Customize channel model for user-defined



4. Fading

RTD : Highly Integrated Tool Controls NR & Fading

Only one PC is needed for controlling all MT8000A NR & fading features.



- Fading PC (Ubuntu OS) works only as Fading Model Generator that provides the MT8000A BB with the necessary IQ fading samples
- No user intervention needed to select or modify fading profiles on Fading PC, as everything is controlled over the Windows control PC

4. Fading

MT8000A NR Fading Key Function Specification

■ Multipath Fading

- 3GPP 5G TDL Channel Models defined by 3GPP TS 38.101-4 Annex B
- Number of Channels : 64
- Signal Processing Bandwidth : 100MHz per CC
- Doppler Frequency : 6kHz max.
- MIMO Configuration : up to 8x4 for FR1, up to 2x2 for FR2

■ High Speed Train

- 3GPP high speed train model defined by 3GPP TS 38.101-4 Annex B
- Number of Channels : 16
- Signal Processing Bandwidth : 100MHz per CC
- Doppler Frequency : 6kHz max.
- MIMO Configuration : up to 2x2 for both FR1 and FR2

■ Static Butler Model

- Original static model with no gain & static phase shift on each channel, guarantee full rank for all MIMO configuration
- MIMO Configuration : up to 8x4

■ Static Bypass Model

- Original static model, output MT800A Tx signal straight through to DUT.
- MIMO Configuration : up to 8x4

■ AWGN

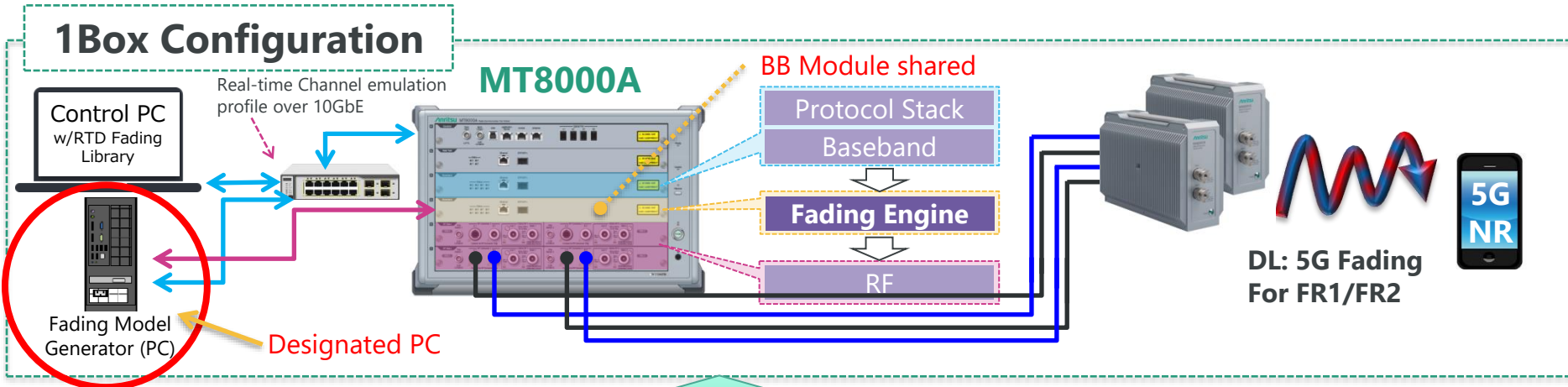
- Level range [dBm/SCS] : -99.99 to -15.0
- Level resolution [dBm/SCS] : 0.1
- Bandwidth [MHz] : 50, 100, 200, 400, 800

4. Fading NR Configuration

■ Configuration Overview

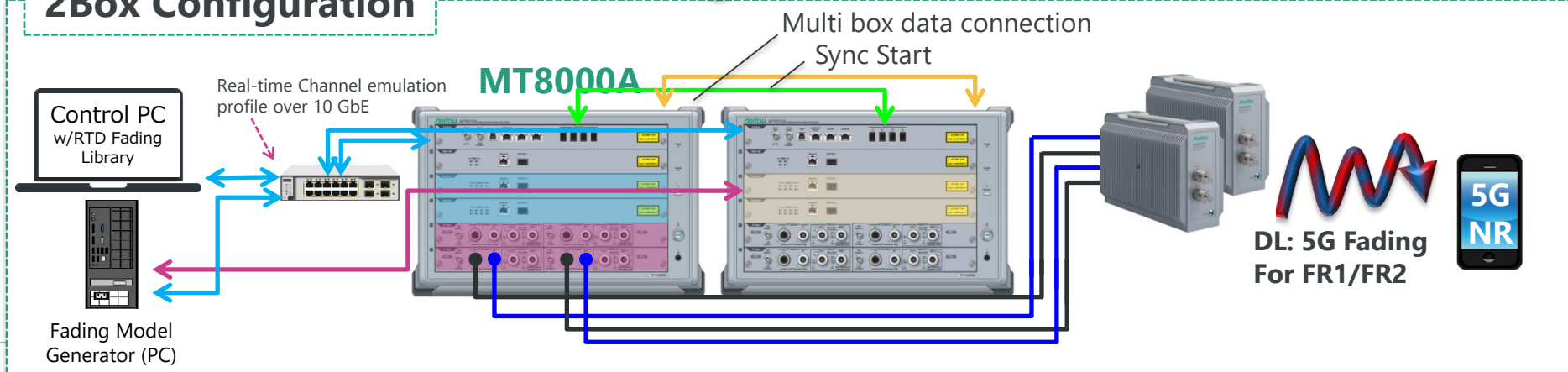
- 1 box configuration : up to FR1 2CC NR Cell + Fading or FR2 4CC NR Cell+Fading
- 2 box configuration : up to FR1 4CC NR Cell + Fading or FR2 8CC NR Cell+Fading

1Box Configuration



Can be changed flexibly

2Box Configuration



4. Fading

MT8000A LTE Fading Key Function Specification

■ **Multipath Fading**

- 3GPP LTE Channel Models defined by 3GPP TS 36.101 Annex B
- Number of Channels : 128
- Signal Processing Bandwidth : 20 MHz per CC
- Doppler Frequency : 2 kHz max.
- MIMO Configuration : up to 4x4

■ **High Speed Train**

- 3GPP high speed train model defined by 3GPP TS 36.101 Annex B
- Number of Channels : 4
- Signal Processing Bandwidth : 20 MHz per CC
- Doppler Frequency : 2 kHz max.
- MIMO Configuration : up to 2x2

■ **Static Butler Model**

- Original static model with no gain & static phase shift on each channel, guarantee full rank for all MIMO configuration
- MIMO Configuration : up to 4x4

■ **Static Bypass Model**

- Original static model, output MT800A Tx signal straight through to DUT.
- MIMO Configuration : up to 4x4

■ **AWGN**

- Level range [dBm/SCS] : -99.99 to -15.0
- Level resolution [dBm/SCS] : 0.1
- Bandwidth [MHz] : 1.5, 3, 5, 10, 15, 20

4. Fading

Comparison with MD8430A LTE Fading

■ Propagation Model

Propagation Model	MD8430A	MT8000A
Multipath Fading	Available (LTE, WCDMA)	Available(LTE)
CQI	Available	Available
High Speed Train	Available	Available
Moving	Available	N/A (for UMTS)
Birth-Death	Available	N/A (for UMTS)
SCME	Available	N/A (Not 3GPP standard)
AWGN	Available	Available

■ HST

Capability	MD8430A	MT8000A
Max Fading Channel	1x1, 1x2, 2x2	1x1, 1x2, 2x2
Profiles	High Speed Train Scenario	High Speed Train Scenario

■ Multipath Fading

Capability	MD8430A	MT8000A
Max Fading Channel	96, up to 3CC 8x4	128, up to 8CC 4x4
Num. of Path in channel	12 or 24(need 2channels)	24
Path Delay	0 – 600us, 0.1ns res.	0 – 32us, 0.1ns res.
Doppler Frequency	0 – 20kHz, 0.1Hz res.	0 – 2kHz, 1Hz res.
Antenna Configuration	8x4, 8x2, 4x4, 4x2, 4x1, 2x2, 2x1, 1x2, 1x1	4x4, 4x2, 4x1, 2x2, 2x1, 1x2, 1x1
Profiles	3GPP EPA, ETU, EVA	3GPP EPA, ETU, EVA
MIMO Correlation	Normal : High, Mid, Low, and User Define Xpol : Fixed Condition	Normal : High, Mid, Mid-A, Mid-B , Low Xpol : High, Mid-A 2D-Xpol : High, Mid

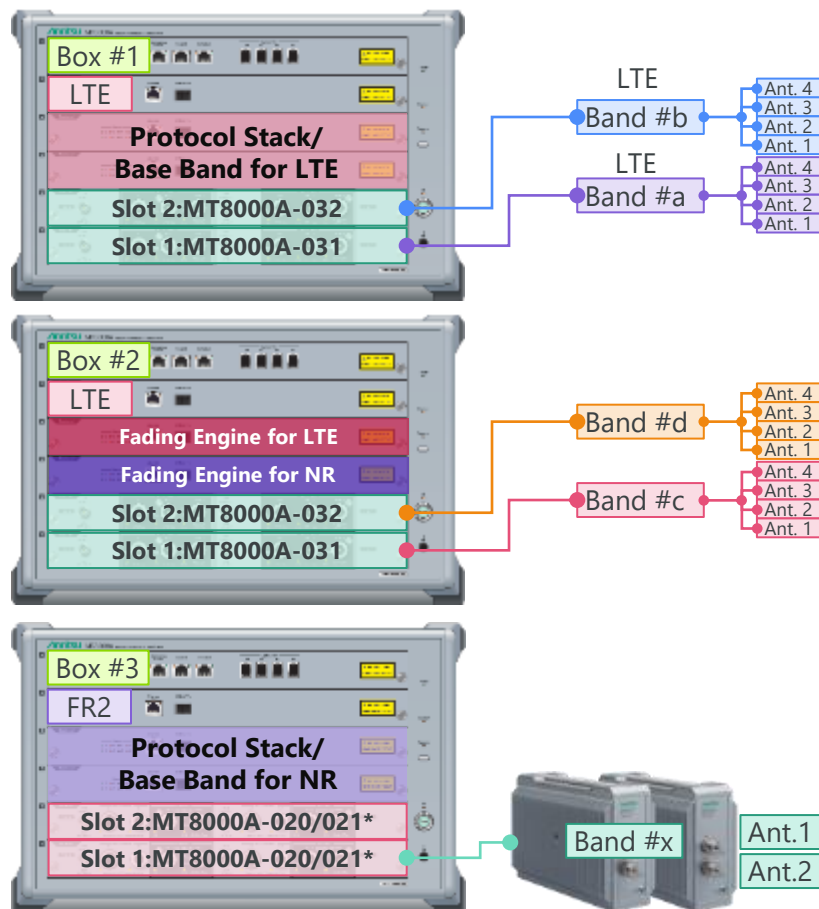
■ CQI

Capability	MD8430A	MT8000A
Max Fading Channel	1x1, 1x2, 2x2	1x1, 1x2, 2x2

4. Fading

EN-DC with Fading test configuration example

- 3x MT8000A supports LTE 6 cells + NR with Fading up to 8 cells



■ LTE with Fading

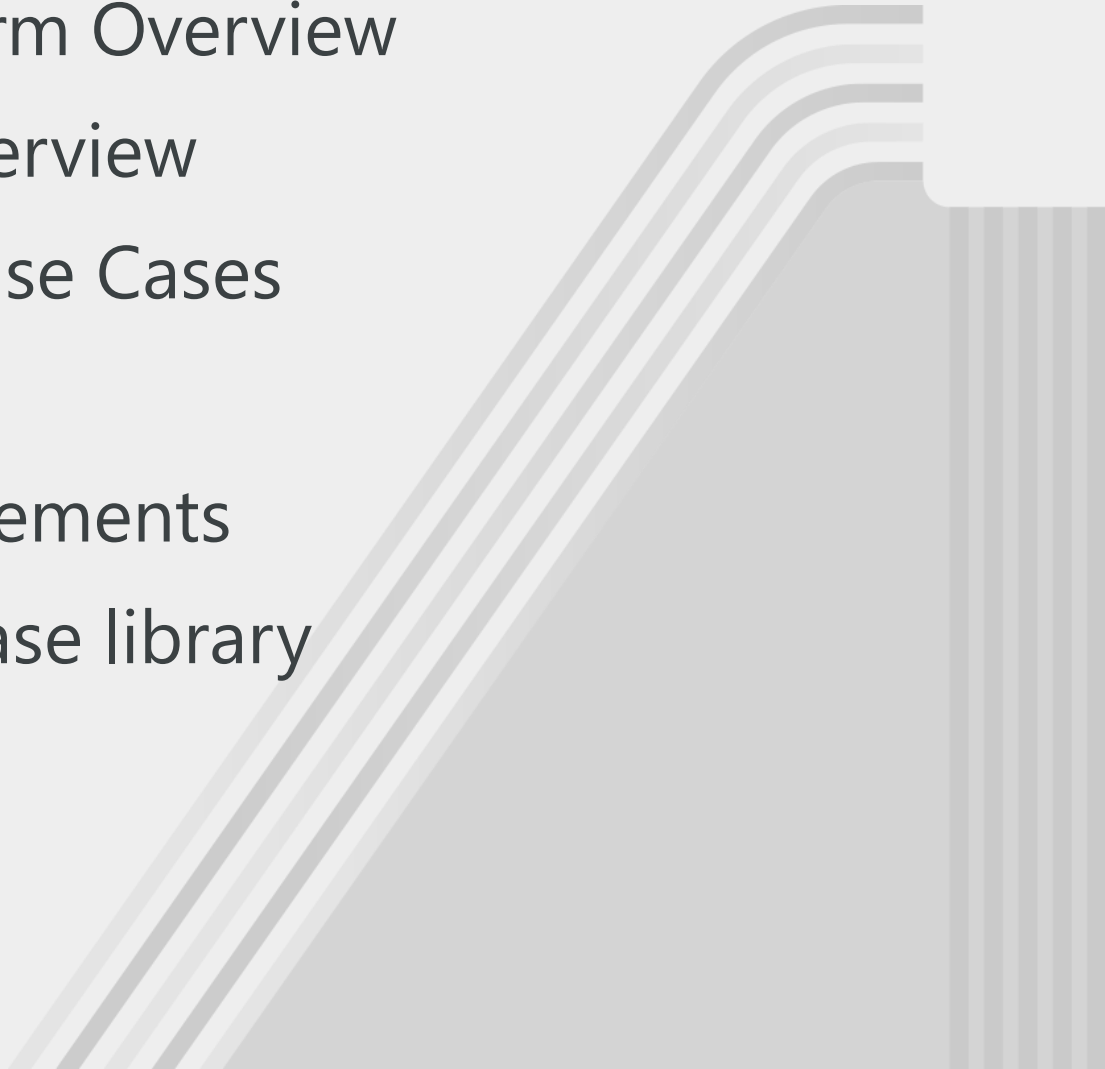
Ant.4	Band #a, #b, #c and #d, any combination for 8CA							
Ant.3	Band #a, #b, #c and #d, any combination for 8CA							
Ant.2	Band #a, #b, #c and #d, any combination for 8CA							
Ant.1	Band #a, #b, #c and #d, any combination for 8CA							
CA	1	2	3	4	5	6	7	8

■ FR2 with Fading

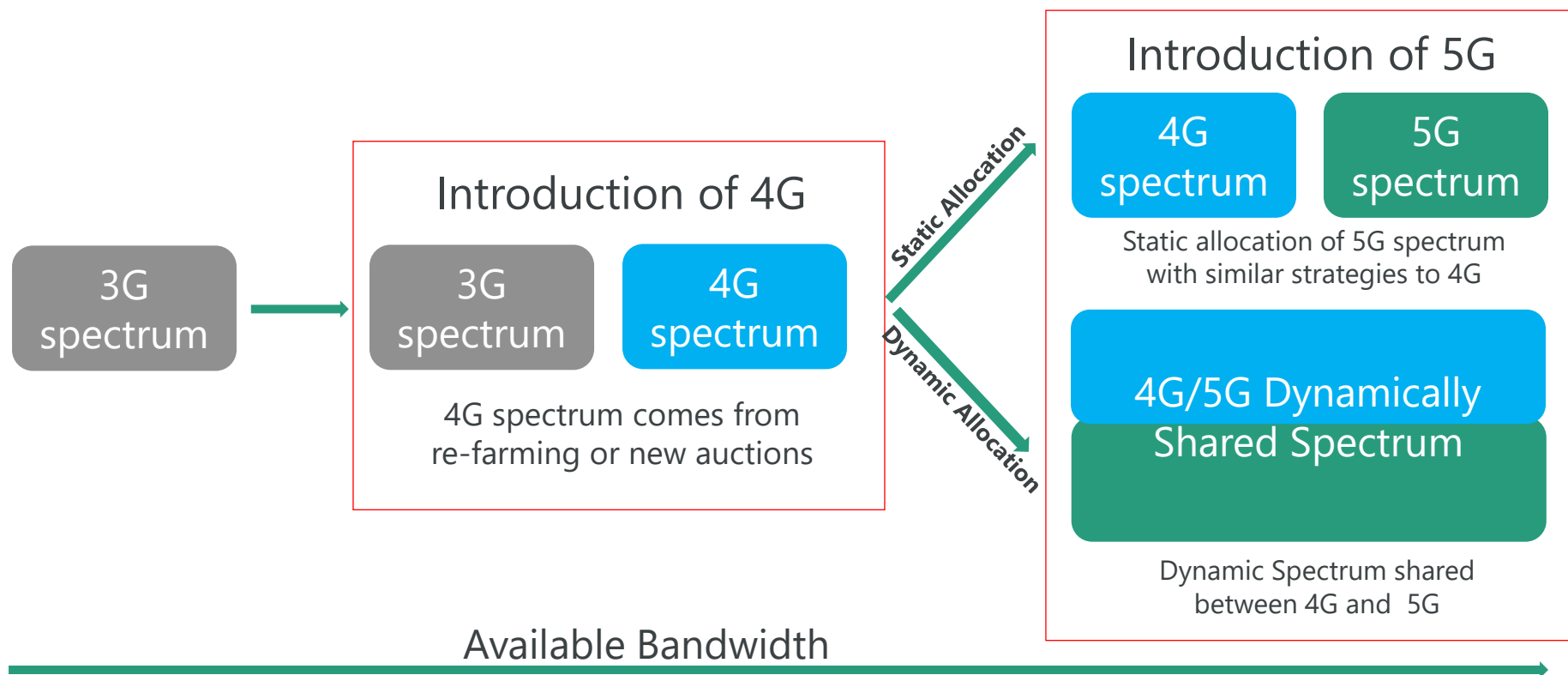
Ant.2	Band #x (8CA, Contiguous)							
Ant.1	Band #x (8CA, Contiguous)							
BW(MHz)	100	200	300	400	500	600	700	800



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1. 5G Portfolio Overview
 2. MT8000A Platform Overview
 3. Protocol test Overview
 4. RTD/MT8000A Use Cases
 - 5. Latest Features**
 6. RTD tool improvements
 7. Reference test case library
- 

Dynamic Spectrum Sharing (DSS)



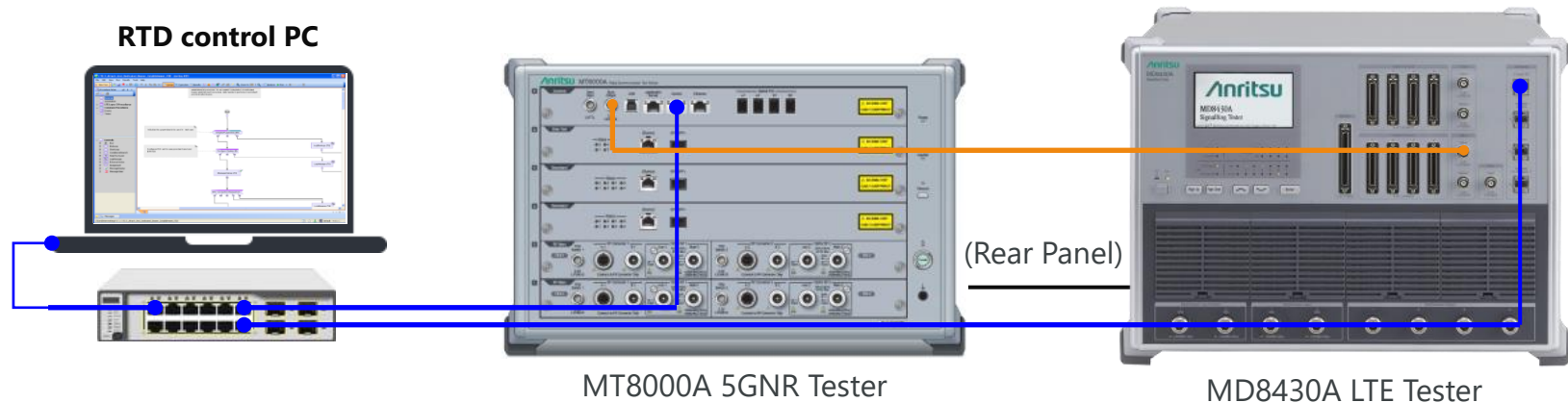
- A huge investment is required in new equipment and network infrastructure to deliver the highest 5G data rate and bandwidths in the mmWave spectrum
- Existing 3G/4G mobile spectrum is very crowded and some MNOs struggle with spectrum re-farming
- Dynamic Spectrum Sharing (DSS) enables existing 4G spectrum to be shared between 4G and 5G
- DSS deployment is relatively low cost & is a key enabler for many MNOs to roll-out 5G

RTD/MT8000A supports Dynamic Spectrum Sharing testing today!

Anritsu DSS test solution

■ Features

- Highly flexible configuration of both NR and LTE for DSS
- High accuracy synchronization and simple cabling between two boxes
- Scalable 2 box combination for various test cases, EN-DC, HO, split bearer, ...

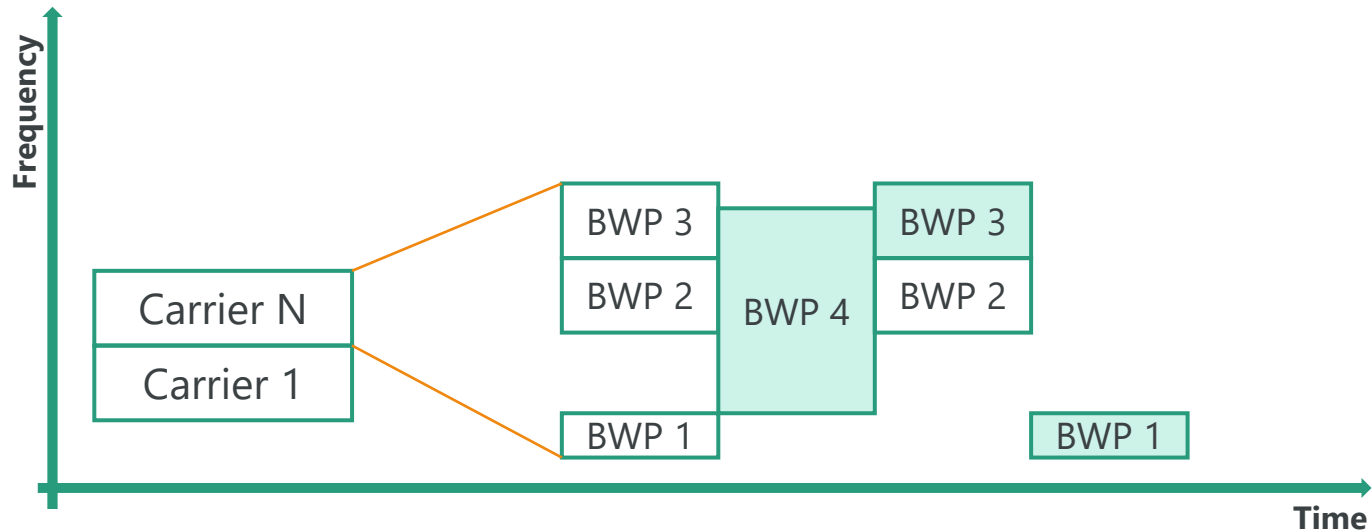


■ Supported DSS Functionalities

DSS functionalities
LTE-NR coexistence in LTE FDD band
PDSCH mapping type A
PDSCH mapping type B
General rate matching pattern to map around LTE sync and PBCH
Rate matching around LTE CRS
7.5 kHz UL raster shift
Alternative additional DMRS location
PDCCH mapping, start symbol #2 with CORESET duration 1 symbol
PDCCH resource enhancement (mapping on symbol #3, 4 and 5)
MIMO features for LTE-sub6 coexistence

5G NR Bandwidth Parts (BWP)

- BWP enables greater flexibility so that multiple different signal types can be sent in a given bandwidth
 - Supports UEs not capable of full carrier bandwidth
 - Supports bandwidth adaptation
 - Enables better utilisation & adaptation of spectrum and reduced UE power consumption
- Up to four BWPs can be configured in a UE for both DL and UL. Only one BWP is active at a time
- **BWP can support legacy 4G devices with new 5G devices on the same carrier**



RTD/MT8000A supports Bandwidth Parts testing today!

Dual and Multi-SIM Testing

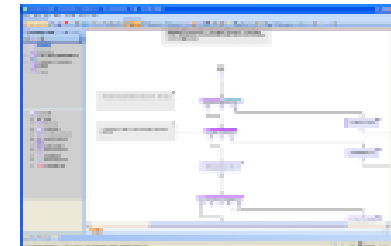
- Dual and Multi-SIM devices are increasingly popular in some markets :
 - For separation of personal and business calls
 - Where network coverage may be inadequate or unreliable
 - Where phones are not locked to a carrier contract
- What's DSDS? – Dual SIM Dual Standby
 - DSDS : One SIM active. Modem locks to active channel when making/receiving calls
- Anritsu RTD supports 5G, 4G, 3G & 2G RATs for DSDS



MT8000A



MD8430A

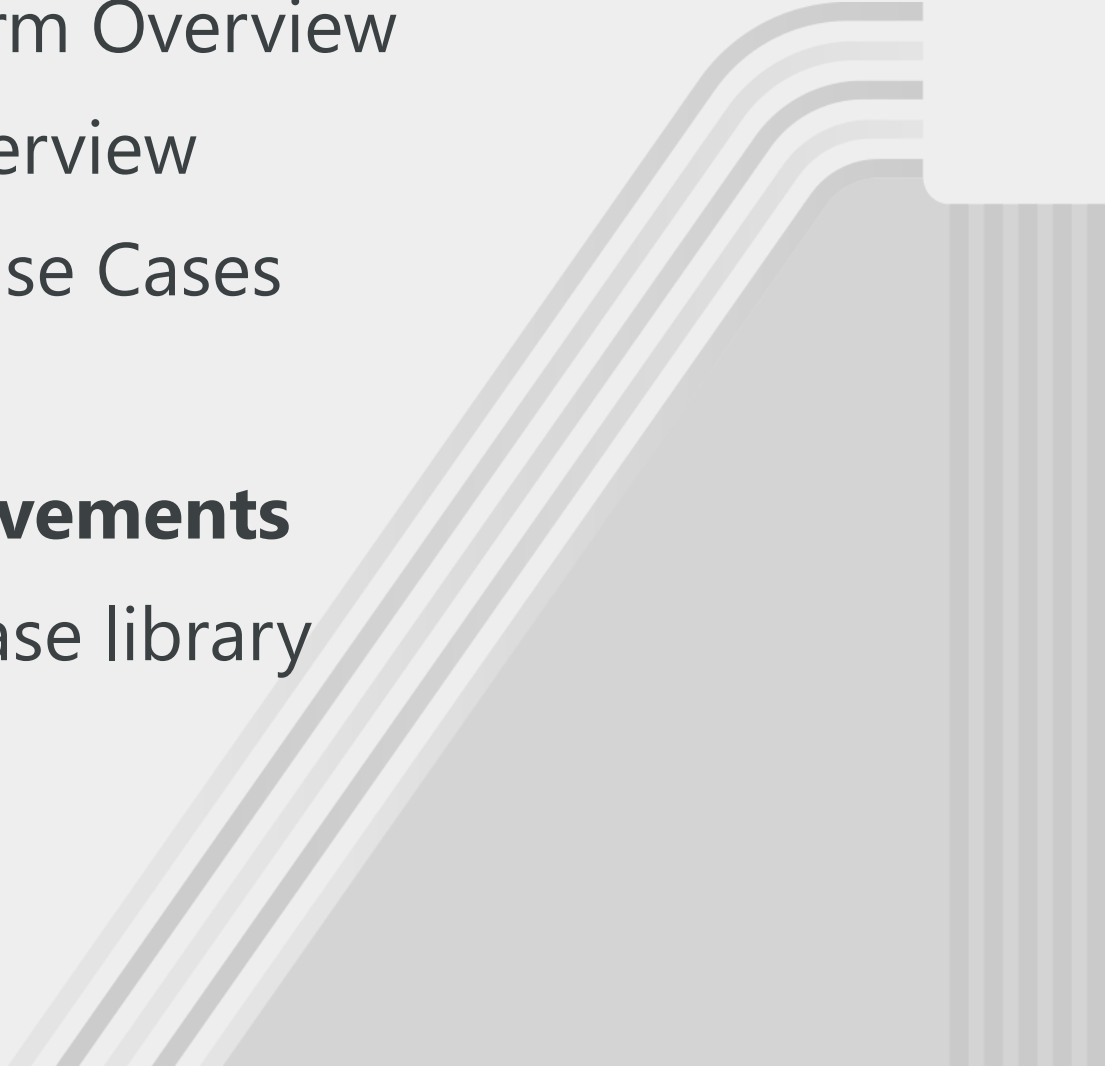


RTD

RTD supports Multi-SIM testing today!



Contents

1. 5G Portfolio Overview
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 5. Latest Features
 - 6. RTD tool improvements**
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- 

Tabular Development Environment (TDE)

The screenshot displays the Tabular Development Environment (TDE) interface. The main window is titled "Tab_Demo_0001_Control_Highlighting* - Anritsu RTD". The interface is divided into several panels:

- Procedure Picker:** Located on the left, it shows a tree view of procedures including Controls, Automation, Common Procedures, HAL Procedures, LTE Layer 3 Procedures, NR LL Procedures, Events, Timers, and Compound Procedures. A list of actions is also visible, such as Link Junction, StartLoop, If, Wait For Event, LogMessage, External Action, Assignment, Conditional Assignment, MessageDisplay, MessageClear, Get Execution Context, Goto, and Blank Row.
- Tabular Test Editor:** The central panel displays a table with columns: Line, Type, Action, and Notes. The table contains 11 rows of actions, including Start (0), AT Command (1), MMI Prompt (2), AT Response (3), MMI Response (4), External Action (5), MessageDisplay (7), RRC Connection Request (26), CP_0001_Simple_Assignment (12), CP_0002_Display_Message (13), StartLoop (14), If (17), GOTO Link_Junction (9), Link Junction (9), and End (11).
- Parameters:** Located on the right, it shows the "RRC Connection Request (26)" parameter editor. It includes a "Parameters" section with a table of values (e.g., Group: Ignored, BtsNo: Ignored, Message: Ignored, Configuration: Omitted, Timeout: Omitted) and a "Variable" section with a "Not assigned" status.

The bottom of the interface shows a workspace browser with tabs for "Tab_NRL3_0003_ENDC_FR1_PSCell_Addition", "Tab_Demo_0001_Control_Highlighting", and "Tab_Demo_0002_Loop_Co". The status bar at the bottom indicates the workspace is "Tabular_Demo_v2_Workspace" and the version is "7.3.1 TABULAR_TEST_DEV_v6".

Procedure
Picker

Tabular
Test Editor

Parameters

TDE - Compact Flow

1. Identical test, less than half the vertical height

NRL3_0001_ENDC_FR1_Measurement* - Anritsu RTD

Home Design Execute Results View

This test demonstrates EUTRA-NR Measurements, in particular the following operations:
 -> Basic LTE attach and UE capability enquiry
 -> Measurement configuration and reception for NR

Initialise the parameters to be used in the test case.
 To change the the RF configuration, security configuration or other test parameters please edit this compound procedure by double clicking on it and changing the relevant parameter.

Configure one LTE cell (LTE Anchor) and one NR cell
 NR cell is using 30kHz, 100mhz, FR1 band, EARFCN 633696 (n78)

Increase LTE Cell Power

Power ON UE

Basic LTE attach

Configure Measurement object for NR FR1 and Receive Measurement Report and check for NR cell reporting

Start

Configure CellGroup Profile (80)

A_NLWG_InitialiseParameters (598)

A_NL_ConfigureSystem (599)

A_L_NR_ModifyPower (600)

ATCmd_PowerOnUe (601)

A_L_InitialAttach (602)

A_NL_LTEFR1_Measurement_Procedure (603)

Link Junction (Error)

L (Error) L (Error)

L (Error) L (Error)

L (Error) L (Error)

Line Type Action Notes

0	Start (0)		
1	Configure CellGroup Profile (80)		
2	A_NLWG_InitialiseParameters (598)		Initialise the parameters to be used in the test case. To change the ...
3	A_NL_ConfigureSystem (599)		Configure one LTE cell (LTE Anchor) and one NR cell NR cell is usi...
8	A_L_NR_ModifyPower (600)		Increase LTE Cell Power
13	ATCmd_PowerOnUe (601)		Power ON UE
18	A_L_InitialAttach (602)		Basic LTE attach
23	A_NL_LTEFR1_Measurement_Procedure (603)		Configure Measurement object for NR FR1 and Receive Measuremen...
28	MessageDisplay (614) - Please start data and verify data transfer...		
29	Start vg_A_GenericTimer - 10000ms (609)		
30	Wait For Event (610)		
36	A_L_System_Cleanup (604)		Test objectives is complete and test is terminated with network-initia...
41	A_NL_DeconfigureSystem (605)		Deconfigure System
42	ATCmd_PowerOffUe (606)		Power OFF UE
43	MessageClear (486)		
44	End (79)		
45			
46	Link Junction (637) - Error		
47	A_NL_DeconfigureSystem (633)		
48	ATCmd_PowerOffUe (634)		
49	MessageClear (635)		
50	End (636)		

2. Expansion and collapse controls for conditional activities allow easy browsing of the test case flow

NRL3_0001_ENDC_FR1_Measurement

Tab_NRL3_0001_ENDC_FR1_Measurement

NR7.3.1/NRL3_0001_ENDC_FR1_Measurement

Zoom % 100

Tabular_Demo_v2_Workspace 7.3.1 TABULAR_TEST_DEV_v6

TDE - Inline Parameter View

Line	Type	Action	Notes
0		Start (0)	
1		AT Command (1) - at+CGATT=1	1. User/Automation interactions shown in green
2		MMI Prompt (2) - Please switch off the UE	
3		AT Response (3) - AT OK	
4		MMI Response (4) - true	
5		External Action (5) - java(com.anritsu.extensions.examples.spreadSheet. Rtd...	
6		MessageDisplay (7) - Controls Highlight Message	
7		RRC Connection Request (26)	Outcome rows demonstration
15		CP_0001_Simple_Assignment (12)	CP and it's outcome rows demonstration
22		CP_0002_Display_Message (13)	Simple CP with no custom added outcome, wi...
23		StartLoop (14) Count = 5	
26		IF (17) vg_G_Counter > 5 {	2. Conditional/Branching parameterisation shown in blue
27		MessageDisplay (23) - Condition IF action example	
28		}	
29		ELSE IF (19) vg_G_Counter > 6 && vg_G_Counter <= 20 {	
32		ELSE (21) {	
35		Link Junction (9) - LABEL_NAME	
36			3. Comments can be added to any action in the Notes column
37		End (11)	

Flexibility

1. Wait For Event

Line	Type	Action
0		
1		Wait For Event (1)
2		Start waitTimer - 10000ms (7)
3		Wait For Event (2)
4		CASE - waitTimer expiry
5		waitTimer expiry (5)
6		CASE - User Event
7		User Event (11)
8		Stop waitTimer (13)
9		MessageClear (8)
10		End (9)

3. Compound Procedures and alternative outcomes

Line	Type	Action
0		Start (0)
1		Configure CellGroup Profile (80)
2		A_NLWG_InitialiseParameters (598)
3		A_NL_ConfigureSystem (599)
8		A_L_NR_ModifyPower (600)
13		ATCmd_PowerOnUe (601)
18		A_L_InitialAttach (602)
19		Err
20		GOTO Link Junction (637)
21		SE

2. Loops, IF/ELSEIF/ELSE

Line	Type	Action
0		Start (0)
1		Assignment (1)
2		StartLoop (4) Count = 1
3		IF (6) vg_Counter >= 1 && vg_Counter <= 3 {
4		MessageDisplay (12) - IF block execution mes...
5		}
6		ELSE IF (8) vg_Counter >= 4 && vg_Counter...
9		ELSE (10) {
12		Assignment (15)
13		Start waitTimer - 2000ms (16)
14		waitTimer expiry (17)
15		EndLoop (5) Count += 1 Count < 10

Tabular Declaration Editing

TAB_NRL3_0001_ENDC_FR1_Measurement - Anritsu RTD

Home Design Execute Results View

Cut Delete Add Free-form Note Move up Move Down Copy Undo Align Centre Distribute Vertically Increase Indent Paste Select All

Properties Declarations Criteria Create Local Edit Terminators Automatically Restore Export Restore Compare with saved Find Close Current Tab Apply Analyze Run Execution View

Procedure Picker

Controls Automation NR LL Procedures LTE LL Procedures Common Procedures HAL Procedures LTE Layer 3 Procedures Events Timers

Line Type Action Notes

0 Start (0)

1 Configure CellGroup Profile (80)

2 A_NLWG_InitialiseParameters (598)

3 ATCmd_PowerOffUe (619)

4 A_NL_ConfigureSystem (599)

5 A_L_NR_ModifyPower (600)

6 ATCmd_PowerOnUe (601)

7 A_L_InitialAttach (602)

8 A_NL_LTEHR_Measurement_Procedure (603)

9 StartLoop (631) Count = 0

10 Start vg_A_GenericTimer - 10000ms (656)

TAB_NRL3_0001_ENDC_FR1_Measurement

Events

Event	Group	Description	Acronym	Scope
CA				
Add SCell	CA		Add SCell	External
Modify SCell	CA		Modify SCell	External
General				
Check Reported CSI	General		Check Reported CSI	External
Check OnDemand SIBs	General		Check OnDemand SIBs	External
Check if UE has receive...	General		Check if UE has received SMS	External
Check Reported SRS	General		Check Reported SRS	External
Configure Periodic CSI...	General		Configure Periodic CSI...	External

Apply Revert

Workspace Br... Procedure Picker Timer Events Parameters Variables

NSA/TAB_NRL3_0001_ENDC_FR1_Measurement

Zoom % 100 default 7.4.01 A

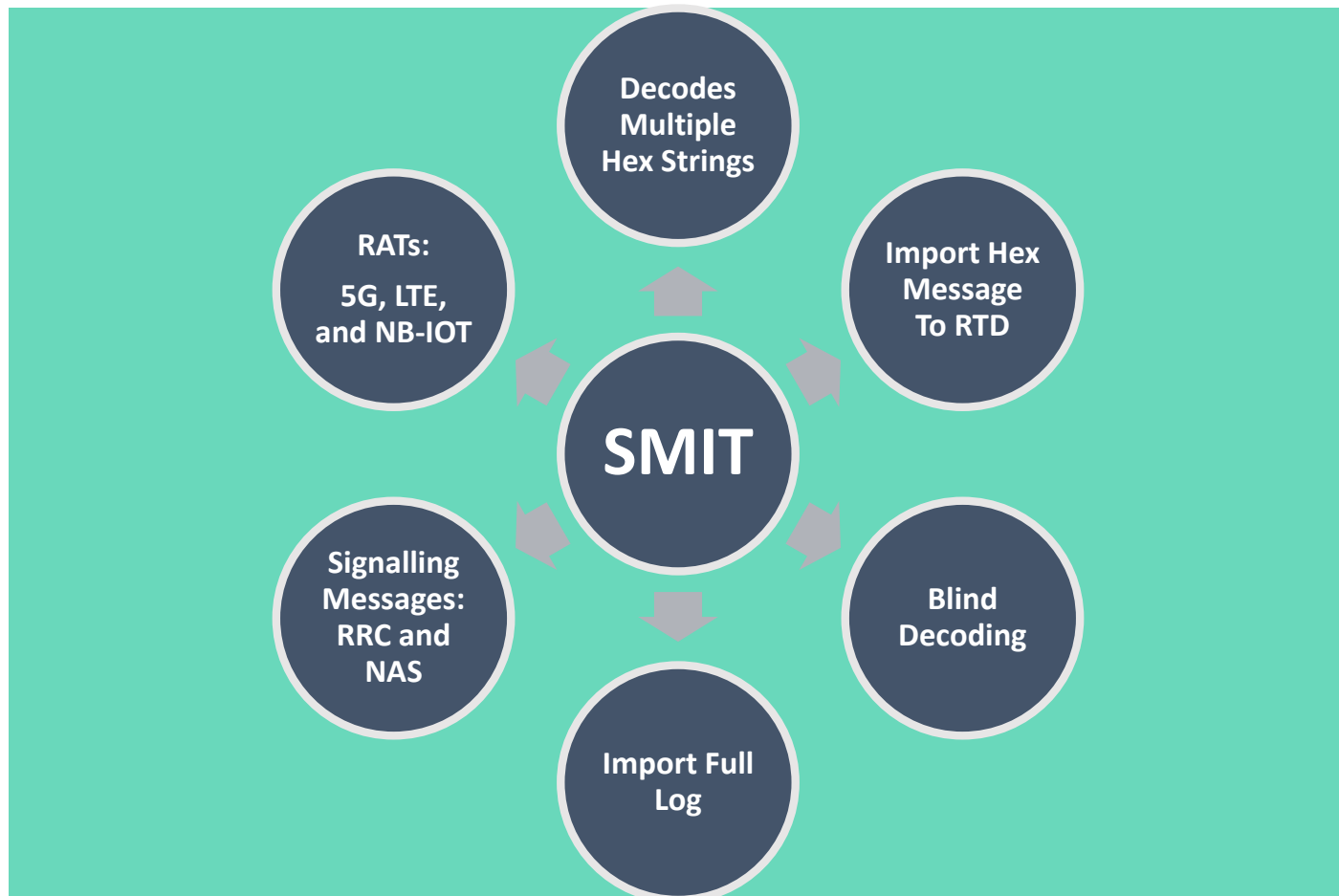
- Toggle displays 4 editable tabs for Events, Timers, Parameters and Variables
- Tabs are fully editable, searchable
- Targeted controls for each declaration type

New RTD Tabular View - Advantages

1. Simple design language.
 - Easier for new users to start writing test in RTD
2. Compact representation of test flow.
 - The user has to scroll less
3. More space on the screen to show parameters and variables.
 - Less work for the user to view pop-up screens.
4. Ability to see key action parameters and comments inline.
 - Less clicking for the user to understand the test flow.
5. Maintain all conditional and reuse capability (branching, compound procedures etc) that RTD has today.
 - No loss of RTD flexibility

Signalling Message Import Tool (SMIT)

- The Signalling Message Import Tool (SMIT) enables RTD users to convert multiple hex strings with L3 signalling messages at a time and import them into RTD.



SMIT - Import and Conversion

1. Import several hex messages from .csv file, or copy paste them into the table

Signalling Message Import Tool

Input Output Setting

Import CSV Export CSV Add Remove

	Hex	Type	Decoded Messages
1	223344556		
2	4040040300010000100C44CA8080042022011809004A02601380A005202...		(3/3) SystemInformationBlockType1__Configure_System, SystemInformati...
3	00000C60FD6C8160CA1270042004260012094D52AB4F686007	NR RRC UL DCCH	(1/1) MeasurementReport__Measurement_Report_(NR)

2. Select hypothesis (message type) for each message if known, otherwise leave blank

3. Press "analyse". Decoded messages will be shown in green, those that cannot be decoded (incorrect hex string) in red.

Analyse Generate

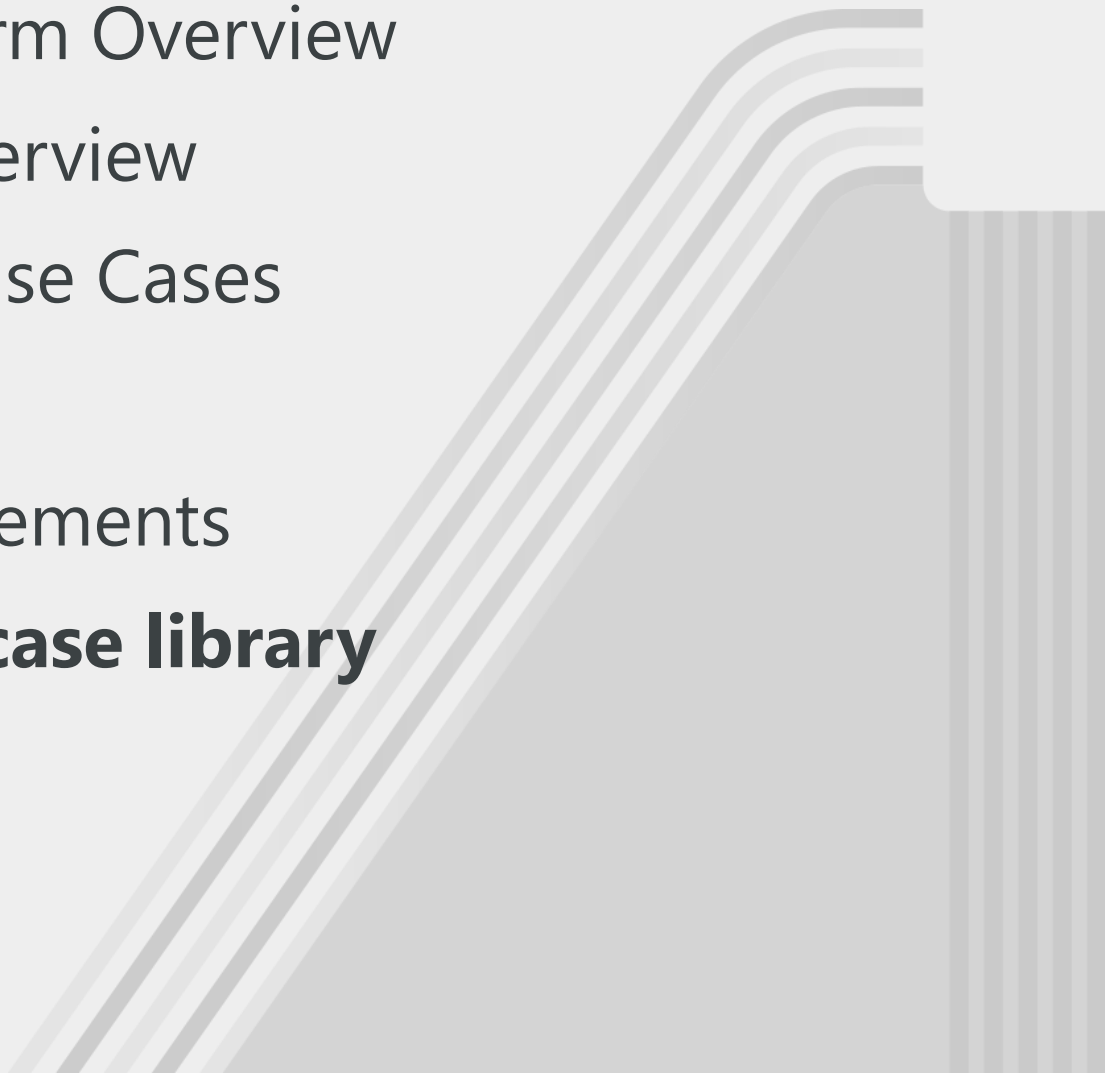
```
graph TD
    LTE --> RRC_LTE
    LTE --> NAS_LTE
    RRC_LTE --> UL_LTE
    RRC_LTE --> DL_LTE
    UL_LTE --> CCCH_LTE
    UL_LTE --> DCCH_LTE
    DL_LTE --> CCCH_LTE
    DL_LTE --> DCCH_LTE
    DL_LTE --> BCCH_LTE
    DL_LTE --> PCCH_LTE
    NAS_LTE --> UL_LTE
    NAS_LTE --> DL_LTE
    NB --> RRC_NB
    NB --> NAS_NB
    RRC_NB --> UL_NB
    RRC_NB --> DL_NB
    UL_NB --> CCCH_NB
    UL_NB --> DCCH_NB
    DL_NB --> CCCH_NB
    DL_NB --> DCCH_NB
    DL_NB --> BCCH_NB
    DL_NB --> PCCH_NB
    NAS_NB --> UL_NB
    NAS_NB --> DL_NB
    NR --> RRC_NR
    NR --> NAS_NR
    RRC_NR --> UL_NR
    RRC_NR --> DL_NR
    UL_NR --> CCCH_NR
    UL_NR --> DCCH_NR
    DL_NR --> CCCH_NR
    DL_NR --> DCCH_NR
    DL_NR --> BCCH_NR
    DL_NR --> PCCH_NR
```

SMIT Highlights

- Extracts information from messages taken from UE or field logs and import them into RTD.
- Imports information taken from hex strings created or copied by the user.
- Supports 5G, LTE and NB-IoT technologies.
- Supports RRC and NAS signalling messages.
- Can perform “blind decoding” of hex strings where the user does not know the type of the message.
- Speeds up log to test case conversion, saving the user several hours or possibly days in case of large logs.

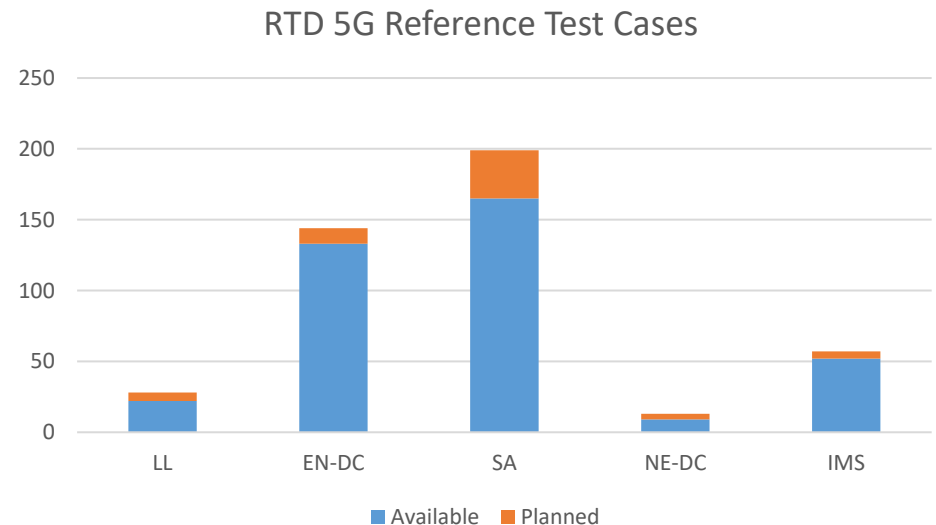


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1. 5G Portfolio Overview
 2. MT8000A Platform Overview
 3. Protocol test Overview
 4. RTD/MT8000A Use Cases
 5. Latest Features
 6. RTD tool improvements
 - 7. Reference test case library**
- 

RTD 5G Reference Test Cases

- RTD is supplied with >350 example/reference test cases as standard
- The RTD reference test library contains examples of how to test all major 5G features in both NSA and SA modes
- The purpose of these tests is to make it easier for customers to create their own tests by providing templates on which to build
- Tests are easily reconfigurable
 - FR1/FR2 selection, cell frequencies, bandwidth, cell power, number of antennas
- Test cases will be validated against commercial 5G chipsets & terminals
- We have a dedicated team of expert RTD engineers creating and validating new tests
- Full details of latest available test cases are available on request



RTD MT8000A Reference Test Cases

	Available Today		
LL	• Configure basic NR cell SCS 30/120KHz • Configure 2 NR cells • Carrier Aggregation - 2CC/ 4CC/ 8CC • Beamforming configuration • DL max throughput - 2CC/ 4CC • Initial registration – SA • NR to NR handover • Fading Configuration	• Split bearer • PScell addition • DL max throughput 8CC DL + 2CC UL • TDD PDSCH/PUSCH • Inactive Paging	
NSA	• FR1 Measurement • FR2 Measurement • FR1/FR2 PScell addition/ release • FR1/FR2 - 2CC / 4CC/ 8CC • FR1/FR2 Dedicated Split Bearer • 4CC DL + 4CC UL throughput • Handover – LTE<>ENDC, ENDC<>ENDC • Split bearer <> MCG/SCG • Secondary Node Change • UE Capability Check • Intra-frequency handover • IMS IPv6	• ENDC > WCDMA handover • LTE 5CC + ENDC NR • Simultaneous PScell addition/release • FDD Measurement • FDD Dedicated Split Bearer • FDD PScell addition	• FDD 2CC/ 4CC/ 8CC • 2CC Joint FDD/ TDD • FDD Master node handover • FDD HO LTE<>ENDC • FDD HO to WCDMA • FDD HO with split bearer • Beam-switching • Inter-frequency measurement • TDD/FDD handover • DSDS Multi-SIM LTE+EN-DC
SA	• FR1 / FR2 registration • UE registration with security context • PDU session establishment • Registration failure • RRC connection reject • LTE to NR idle mode mobility • NR HARQ test • NR Periodic/ Aperiodic • Inter/Intra-freq measurement	• Suspend/resume RRC • Cell reselection • RRC connection re- establishment • NR <> LTE handover • RRC paging • NR to LTE idle mode mobility • NR<>LTE redirection • FR1/FR2 - 2CC / 4CC/ 8CC • FR1 FR2 Dual Connectivity	• 4CC DL + 4CC UL throughput • DL 4x4 MIMO, UL 2x2 MIMO • NR Handover – 1CC/2CC/4CC • Remove/ modify SCell • VoNR • InterRAT measurement • NR Reselect LTE • FR1 measurement • Multiple PDU sessions

RTD MT8000A Reference Test Cases for Rel.16

Planned		
NSA	- NRL3_0068_ENDC_FR2_2CC_Beam_Failure - NRL3_0135_ENDC_FR1_SIB24_Smtc2_LP_Measurement - NRL3_0136_ENDC_FR1_EarlyMeasurement_RRCConnectionRelease - NRL3_0140_ENDC_FR1_LTE_RRCCoordinated_AutoGAP_RCGIMeasurement_NR - NRL3_0144_ENDC_FR2_LTE_RrcConnected_AutoGAP_RCGIMeasurement_NR	
SA	- NRL3_1156_SA_FR1_RRCCoordinated_NeedForGapNR_Measurement - NRL3_1157_SA_FR1_RRCInActive_NeedForGapNR_Measurement - NRL3_1158_SA_FR1_NR_RRCCoordinated_AutoGAP_RCGIMeasurement_LTE - NRL3_1159_SA_FR1_NR_RRC_Segmentation_UL - NRL3_1160_SA_FR1_EarlyMeasurement_RRCConnectionRelease - NRL3_1161_SA_FR1_EarlyMeasurement_RRCInActive - NRL3_1162_SA_FR1_RRMMeasurement_Relaxation_LowMobility - TBD- NRL3_1163_SA_FR1_NR_NR_Conditional_Handover - NRL3_1173_SA_FR1_NR_RRC_Segmentation_DL - NRL3_1175_SA_FR1_IntraFreq_Reselection_smtc2_LPMeas - NRL3_1176_SA_FR1_InterFreq_Reselection_smtc2_LPMeas - NRL3_1178_SA_FR1_RrcConnected_WithOutNeedForGapNR_Measurement - NRL3_1179_SA_FR1_NR_RrcConnected_AutoGAP_RCGIMeasurement - NRL3_1180_SA_FR2_NR_RrcConnected_AutoGAP_RCGIMeasurement - NRL3_1181_SA_FR1_EarlyMeasurement_SIB11 - NRL3_1182_SA_FR1_RRMMeasurement_Relaxation_NotAtCellEdge - NRL3_1183_SA_FR1_RRMMeasurement_Relaxation_LowMob_NotAtCellEdge - NRL3_1184_SA_FR1_RRMMeasurement_Relaxation_LowMob_NotAtCellEdge_HighPrioMeasRelax - TBD- NRL3_1185_SA_FR1_NR_NR_Conditional_Handover_Fail - NRL3_1186_SA_FR1_RACS_ID	- NRL3_1187_SA_FR1_URSP_PDUSessionType (Basically a Rel15 feature) - TBD- NRL3_1188_MCG failure report and fast recovery (TC name to be Add) - NRL3_1189_SA_FR1_UEAssistance_Overheat_IDC_DRX - TBD- NRL3_1190_On-demand SI in Connected (TC name to be Add) - TBD- NRL3_1191_Fast SCellActivation (TC name to be Add) - TBD- NRL3_1192_White list for reselection (TC name to be Add) - NRL3_1193_SA_FR1_MDT_Logged_Periodic - NRL3_1194_SA_FR1_NSSAA - TBD- NRL3_1195_NR FADER - HST(High Speed Train) (TC name to be Add) - NRL3_1211_SA_FR1_NR_InterRAT_PSHandover_to_ENDC_Rel16 - NRL3_1212_SA_FR1_NR_HST_No_Fader - NRL3_1214_SA_FR1_NR_Wake_Up_Signal - NRL3_1215_SA_FR1_UL_MIMO_2x2_Full_UL_Power - NRL3_1217_SA_FR1_NR_Wake_Up_Signal_False - NRL3_1218_SA_FR1_NR_Wake_Up_Signal_True - NRL3_1219_SA_FR1_NR_Wake_Up_Signal_Periodic_CSI

This is a non-binding document for the purpose of discussion with customers to align solutions with customers' requirement only. The schedule and functions described are subject to change without notice.

Qualcomm OEM Downstream Test Case Library

- New RTD reference TC library specifically for use with Qualcomm chipset
- Available free-of-charge on request to RTD customers integrating the Qualcomm chipset
- Suitable for companies developing 5G terminal devices based on the Qualcomm X55 and X60
- Test cases are configured & optimised specifically for Qualcomm X55/X60
- Minimises the amount of additional set-up and test case configuration required
- All test case verified against a defined Qualcomm commercial build
- Available with RTD version 7.4.2
- Test cases are upgradeable to latest RTD release in the normal way
- February 2021 library update (Rel 21.1) currently contains 109 test cases :

EN-DC	37
SA	61
IMS	11

