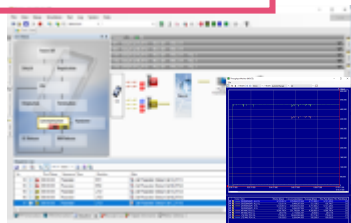**Anritsu** Advancing beyond

# SmartStudio NR IP Performance
# MX800071A

Radio Communication Test Station

MT8000A

# MT8000A Common Platform for Entire Cellular Device R&D/Mfg. Cycle

**Anritsu**
Advancing beyond

**MX800070A SSNR**
**MX800071A SSIP**

**ME7873NR**
RF Conformance Test System

**Smart Device Integration / Higher IP Throughput**

**RF Conformance Test**

**MX800010A RF Measurement**

**MT8000A**
**Radio Communication Test Station**

**ME7834NR**
5G NR Mobile Device Test Platform

**RF Performance Verification**

**Protocol Conformance Test**
**Carrier Acceptance Test**

**MX800050A RTD**

**MX800040A**
NR mmW Production Test

**MT8870A**
Universal Wireless Test Set

5G
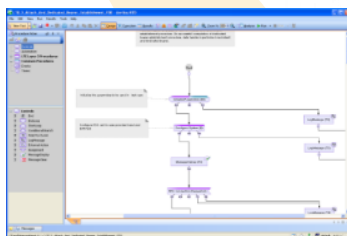
**Chipset/Protocol Development**

**Volume Production**

# Challenges for Evaluating Higher IP Throughput

FWA (Fixed Wireless Access) services are evolving rapidly due to increased demand for Digital Transformation (DX), remote work, and home entertainment. To improve the User Experience (UX), the CPE (Customer Premises Equipment) used for FWA, and the built-in module must have sufficient transmission speed.

**Module**

**CPE**

Outdoor receivers

Indoor gateways
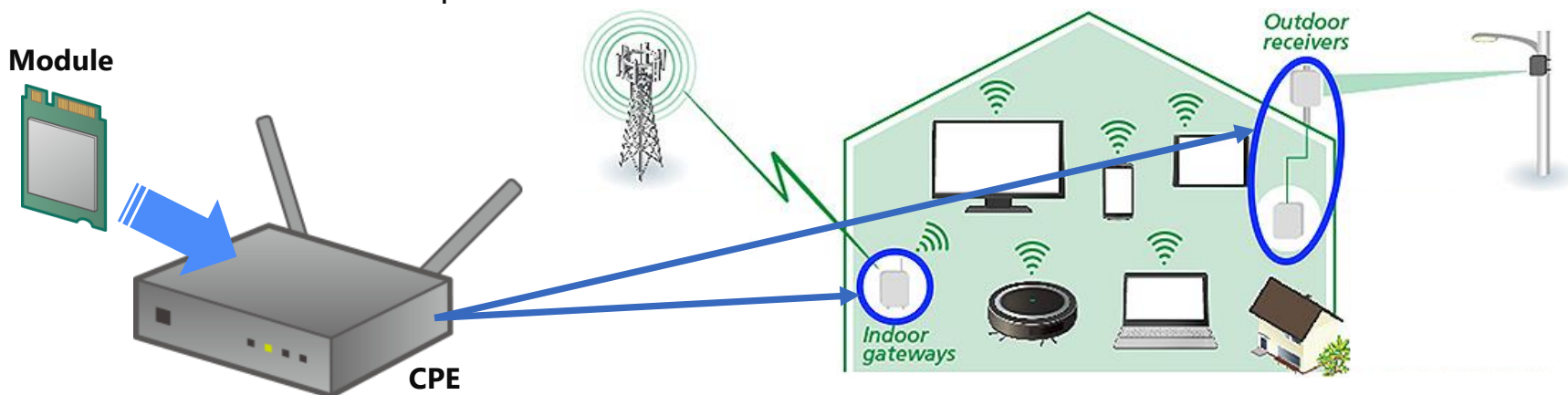
To support these use cases, chipset vendors are implementing various frequency bands and higher-layer CCs/MIMO. The CPE/module development scene tests IP throughput with various combinations of frequency bands/CCs/MIMO. Since there are more than 1000 pattern combinations, an efficient IP throughput test is required.

**System** ✕ **Frequency** ✕ **# of CCs** ✕ **# of MIMO** ═

· LTE
· 5G NSA
· 5G SA

· 4G
· 5G FR1
· 5G FR2

**Very Complex & Wide Variety**

# Product Outline

# Efficient 5G Device IP Throughput Test
## - SmartStudio NR IP Performance MX800071A -

**Anritsu**
*Advancing beyond*

**Best test solution to evaluate IP throughput performance** with higher-layer CCs/MIMO at any band combination

✓ **Single platform s**upports FR1 SA/NSA and LTE systems**, contributing to **easy-to-use, small-footprint** test systems

✓ Supports **wide variety of CCs/MIMO combinations**

✓ **Easy testing start** by verifying connection with advanced chipsets

✓ **Cost effective** with scalable HW/SW platform

✓ **Intuitive state machine GUI**

Cell Parameter
(CA, MIMO, TDD configuration, etc.)

Throughput Monitor

Simulation Parameter
(Frequency, Channel, BW, etc.)

UE Status

Sequence Log
between UE and MT8000A

**MT8000A**

**MX800071A GUI**
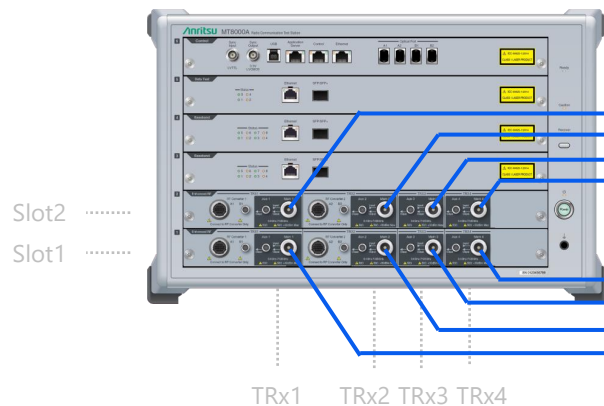
# Scalable HW/SW Platform
## - MT8000A-033 and "RF Sharing" Function -

The MX800071A uses the MT8000A-033 as a standard platform and supports an **RF sharing function** that bundles/outputs signals with similar frequencies, covering a wide frequency/CCs/MIMO combination.

➤ **Small footprint and cost-effective platform**
➤ **Scalability for future advanced chipset performance**

Example: NR DL 2CC 4x4 MIMO + LTE DL4CC 4x4 MIMO

✓ NR: band n40A (2.3 to 2.4 GHz) + n78A (3.3 to 3.8 GHz)
✓ LTE: band1A (2.1 GHz) + 3A (1.8 GHz) + 7A (2.6 GHz) + 28A (700 MHz)

| Slot | Signal Generator | # | RAT | Band | |
|------|------------------|---|-----|------|---|
| 2 | Tx-C (in TRx1~TRx4) | #1 | LTE | B1 | RF sharing |
| | | #2 | LTE | B7 | |
| | Tx-D (in TRx1~TRx4) | #1 | LTE | B3 | RF sharing |
| | | #2 | LTE | B28 | |
| 1 | Tx-A (in TRx1~TRx4) | #1 | NR | n40 | |
| | | #2 | N/A | | |
| | Tx-B (in TRx1~TRx4) | #1 | NR | n78 | |
| | | #2 | N/A | | |



SG slot2 Tx-C    SG slot2 Tx-D

Ant#1 band 1/7  + Ant#1 band 3/28
Ant#2 band 1/7  + Ant#2 band 3/28
Ant#3 band 1/7  + Ant#3 band 3/28
Ant#4 band 1/7  + Ant#4 band 3/28

Ant#1 band n40  + Ant#1 band n78
Ant#2 band n40  + Ant#2 band n78
Ant#3 band n40  + Ant#3 band n78
Ant#4 band n40  + Ant#4 band n78

SG slot1 Tx-A    SG slot1 Tx-B

Slot2
Slot1

TRx1   TRx2 TRx3 TRx4

1200 MHz BW    1200 MHz BW

#1  #2    #1  #2
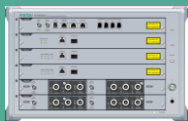B1  B7    B3  B28
Tx-C      Tx-D
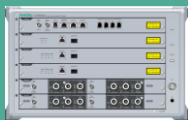
#1          #1
n40         n78
Tx-A        Tx-B
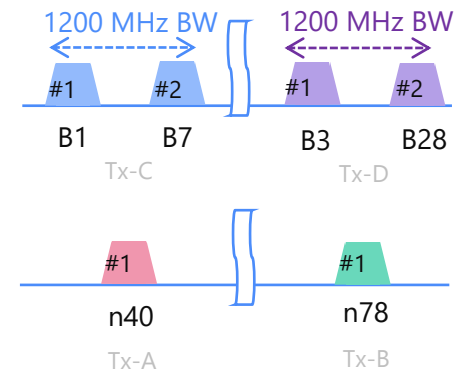
# Supports Expanding CCs/MIMO Variations

SSIP can test CCs/MIMO conditions supported by advanced chipsets.

## ◆ DL Coverage

| System | 033 model MT8000A x 1 | 033 model / 031 model MT8000A x 2 |
|---|---|---|
| FR1 SA | DL4CC (4B) 4x4 | - |
| FR1 NSA | FR1 DL2CC (2B) 4x4 + LTE DL4CC (4B) 4x4 | FR1 DL2CC (2B) 4x4 + LTE DL6CC (6B) 4x4 |
| FR2 NSA | Under consideration | Under consideration |
| FR1+2 | Under consideration | Under consideration |
| LTE | DL7CC (6B) 4x4 | - |

## ◆ UL Coverage

| System | 033 model MT8000A x 1 | 033 model / 031 model MT8000A x 2 |
|---|---|---|
| FR1 SA | UL 2CC (2B) 2x2 | - |
| FR1 NSA | FR1 UL 2CC (2B) 2x2 + LTE UL 2CC (2B) 1x1 | FR1 UL 2CC (2B) 2x2 + LTE UL 2CC (2B) 1x1 |
| FR2 NSA | Under consideration | Under consideration |
| FR1+2 | Under consideration | Under consideration |
| LTE | UL2CC (2B) 1x1 | - |

# Proposal for Automated Test System using ACC-380

The increasing number of CC/MIMO and Band combinations for 5G NR SA/NSA, LTE, requires frequent **changes of the physical RF cable connections** between the tester and DUT when test conditions are changed, which is a **difficult to automate**. Using the ACC-380 **eliminates the need to reconnect physical RF cables**, so engineers can build a test system to **automate IP throughput tests under different combinations of conditions**.



DUT

MT8000A

Server PC

Control PC

Spatial Combiner ACC-380
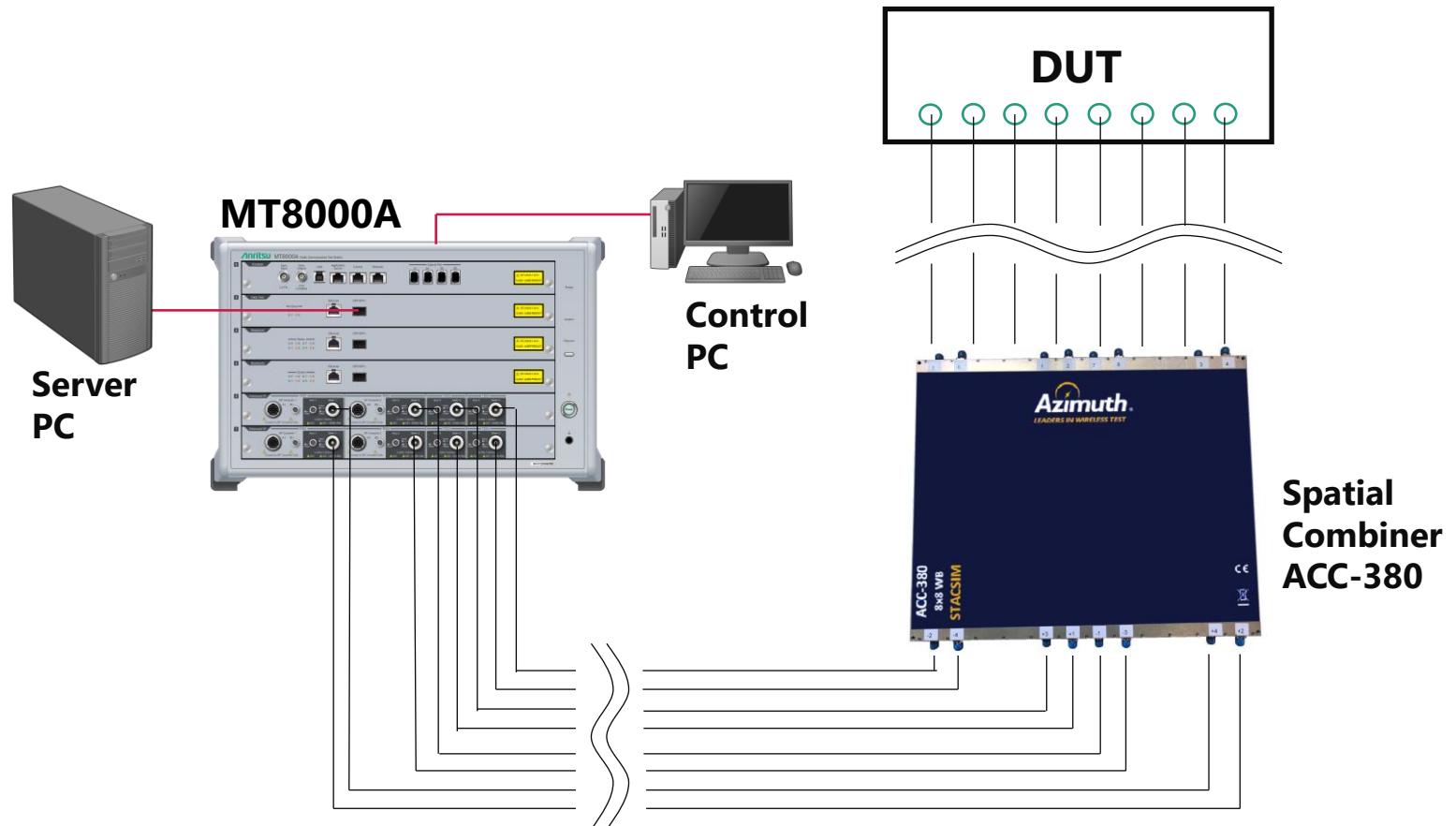
# Example Throughput Measurement Results

# Throughput Meas. Result (1) FR1 SA

- **Test result**

| RAT | LTE | NR | PHY-TPUT DL/UL | IP-TPUT DL/UL | DUT |
|---|---|---|---|---|---|
| **FR1 SA** | -- | DL3CC 4x4 MIMO UL1CC SISO | 1123/112 Mbps | 1116/111 Mbps | Chipset vendor A device |

- **iPerf command**: iPerf3 -c 192.168.1.1 -w 8M -p 5201 -t 600 -P 10

- **Parameter settings and Throughput Monitor graph**



Band n1+n7+n28

NR2, 3 : SIB = Not send

NR 3CC

All 20 MHz BW

TDD configuration 7D1S2U

4x4+4x4+2x2 MIMO

All DL256QAM

Note: DUT supports up to FR1 DL3CC (all FDD), but MX800071A supports up to FR1 DL4CC.

# Throughput Meas. Result (2) FR1 SA

- **Test result**

| RAT | LTE | NR | PHY-TPUT DL/UL | IP-TPUT DL/UL | DUT |
|---|---|---|---|---|---|
| **FR1 SA** | -- | DL2CC 4x4 MIMO UL1CC SISO | 4367/29 Mbps | 4340/26 Mbps | Chipset vendor A device |

- **iPerf command**: iPerf3 -c 192.168.1.1 -w 8M -p 5201 -t 600 -P 20
- **Parameter settings and Throughput Monitor graph**



NR 2CC

Band n78 n77

All 100 MHz BW

NR2 : SIB = Not send

TDD configuration: 19D1U

All 4x4 MIMO

All DL256QAM

033

## Test result

| RAT | LTE | NR | PHY-TPUT DL/UL | IP-TPUT DL/UL | DUT |
|---|---|---|---|---|---|
| **FR1 NSA** | DL4CC 2x2 MIMO UL1CC SISO | DL2CC 4x4 MIMO UL1CC SISO | 5148/134 Mbps | 5120/132 Mbps | Chipset vendor A device |

- **iPerf command**: iPerf3 -c 192.168.1.1 -w 8M -p 5201 -t 600 -P 20
- **Parameter settings**

NR 2CC+ LTE 4CC

RF sharing = ON

NR Band n78 +n78

NR SIB = Not send

TDD configuration: 19D1U

100+100 MHz BW

LTE Band 1+3+7+7

All 20 MHz BW

All 4x4MIMO

All 2x2MIMO

All DL256QAM

All DL256QAM

Note: DUT supports up to LTE DL4CC (3B) in NSA mode, but MX800071A supports up to LTE DL4CC (4B) in NSA mode.

# Throughput Meas. Result (3) FR1 NSA

■ **Throughput Monitor graph**
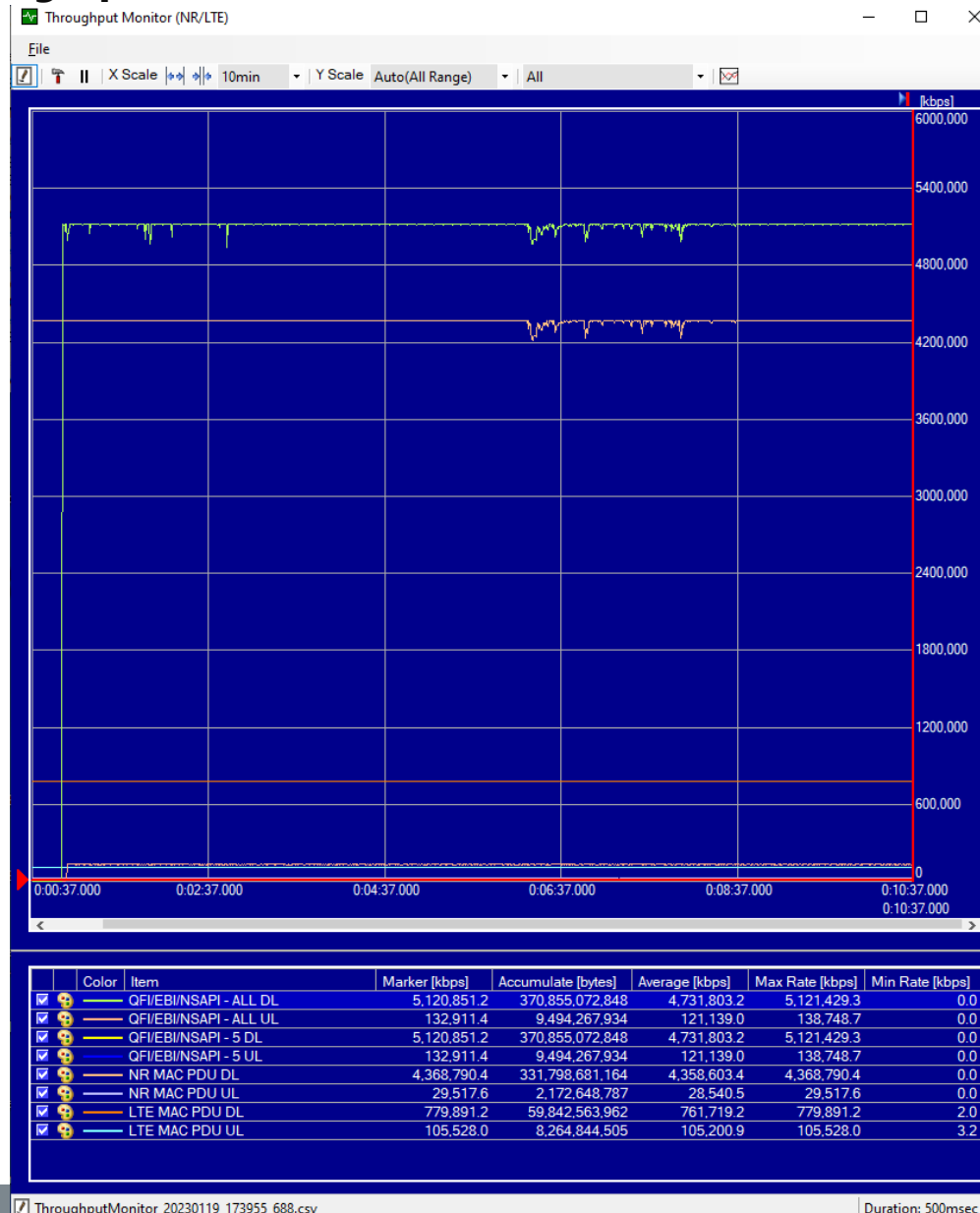
# Throughput Meas. Result (4) FR1 NSA

- **Test result**

| RAT | LTE | NR | PHY-TPUT DL/UL | IP-TPUT DL/UL | DUT |
|---|---|---|---|---|---|
| **FR1 NSA** | DL6CC 4x4 MIMO UL1CC SISO | DL1CC 4x4 MIMO UL1CC SISO | 4134/134 Mbps | 3992/132 Mbps | Chipset vendor A device |

- **iPerf command**: iPerf3 -c 192.168.1.1 -w 8M -p 5201 -t 600 -P 10

- **Parameter settings and Throughput Monitor graph**



2 x MT8000A

NR 1CC+ LTE 6CC

RF sharing = ON

NR Band n78

100 MHz BW

4x4 MIMO

DL256QAM

TDD configuration: 19D1U

LTE Band 1+3+3+28+7+7
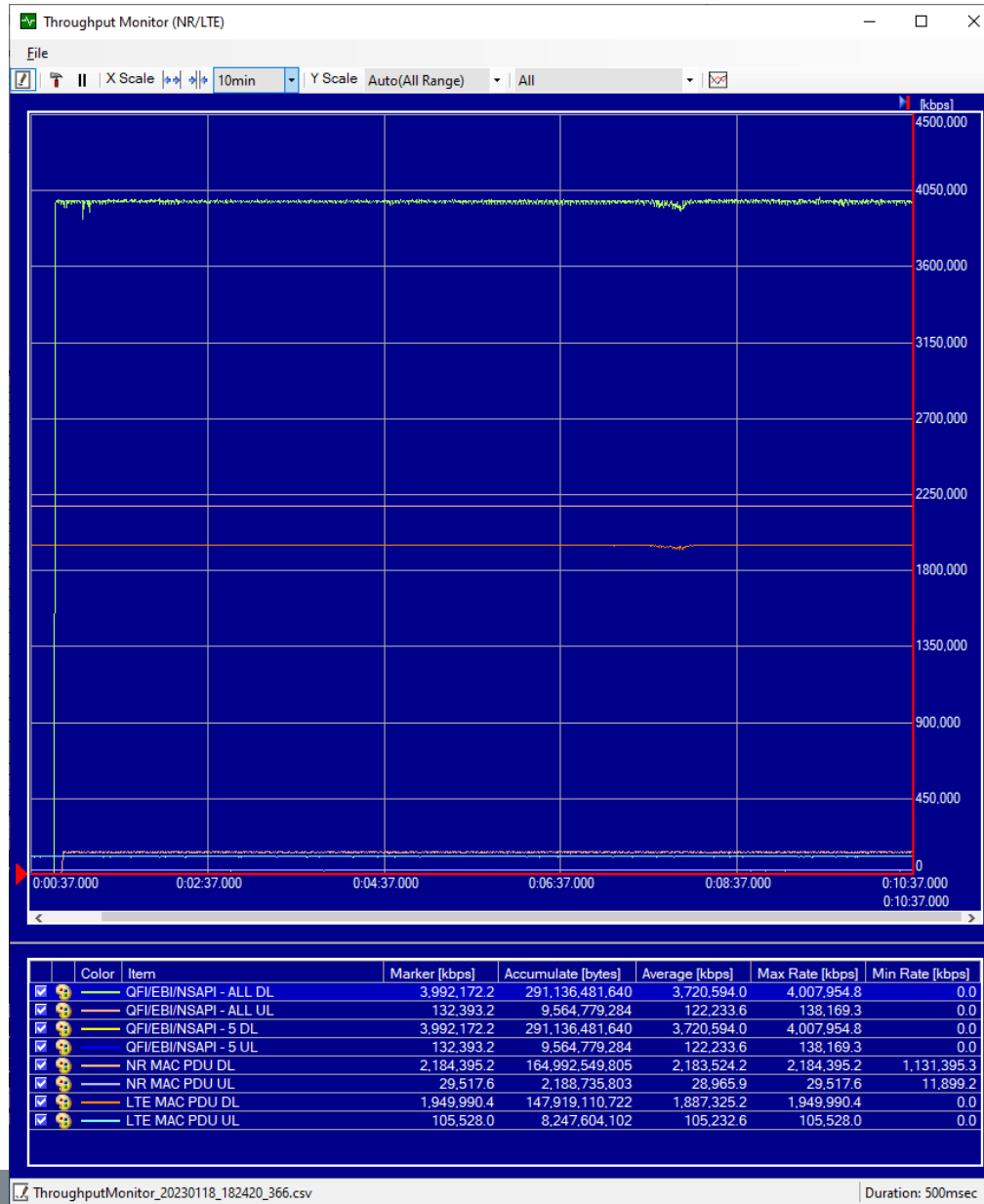
All 20 MHz BW

2x2+4x4+4x4+2x2+4x4+4x4 MIMO

All DL256QAM

NR SIB = Not send

Note: DUT supports up to NR1CC (1B) + LTE DL6CC (4B/All FDD) in NSA mode, but MX800071A supports up to NR 2CC (2B) + LTE DL6CC (6B) in NSA mode.

■ **Throughput Monitor graph**

# Throughput Meas. Result (5) LTE

- **Test result**

| RAT | LTE | NR | PHY-TPUT DL/UL | IP-TPUT DL/UL | DUT |
|---|---|---|---|---|---|
| **LTE** | DL7CC 4x4 MIMO UL1CC SISO | -- | 1950/105 Mbps | 1944/105 Mbps | Chipset vendor A device |

- **iPerf command**: iPerf3 –c 192.168.1.1 -w 8M -p 5201 -t 600 -P 10
- **Parameter settings and Throughput Monitor graph**

Simulation Parameter Setup

LTE 7CC

RF sharing = ON

Band 1+28+1+3+3+7+7

All 20 MHz BW

All DL256QAM

| | LTE1 | LTE2 | LTE3 | LTE4 |
|---|---|---|---|---|
| Duplex Mode | FDD | FDD | FDD | FDD |
| E-UTRA Band | Band1 | Band28 | Band1 | Band3 |
| Channel (DL) | 300 | 9360 | 500 | 1575 |
| Frequency (DL) | 2140.0 | 773.0 | 2160.0 | 1842.5 |
| Channel (UL) | Synchronizes with DL | Synchronizes with DL | - | - |
| Frequency (UL) | 1950.0 | 718.0 | - | - |
| DL Bandwidth | 20MHz | 20MHz | 20MHz | 20MHz |
| UL Bandwidth | SameAsDL | SameAsDL | - | - |
| Number of DL Antennas | 4 | 2 | 2 | 4 |
| Transmission Mode | TM3 | TM3 | TM3 | TM3 |
| DL Modulation Order | 256QAM | 256QAM | 256QAM | 256QAM |
| UL Modulation Order | 256QAM | | | 256QAM |

| | LTE5 | LTE6 | LTE7 |
|---|---|---|---|
| Duplex Mode | FDD | FDD | FDD |
| E-UTRA Band | Band3 | Band7 | Band7 |
| Channel (DL) | 1773 | 3100 | 3298 |
| Frequency (DL) | 1862.3 | 2655.0 | 2674.8 |
| Channel (UL) | - | - | - |
| Frequency (UL) | - | - | - |
| DL Bandwidth | 20MHz | 20MHz | 20MHz |
| UL Bandwidth | - | - | - |
| Number of DL Antennas | 4 | 2 | 2 |
| Transmission Mode | TM3 | TM3 | TM3 |
| DL Modulation Order | 256QAM | 256QAM | 256QAM |
| UL Modulation Order | 256QAM | 256QAM | 256QAM |

4x4+2x2+2x2+4x4+4x4+2x2+2x2 MIMO

Note: DUT supports up to LTE DL7CC (4B), but MX800071A supports up to LTE DL7CC (6B).

# Appendix

# 5G Chipset and UE Test Platform

**MT8000A**
Radio Communication Test Station

## 5GNR ALL-in-ONE Test Platform

Install each application in all-in-one platform
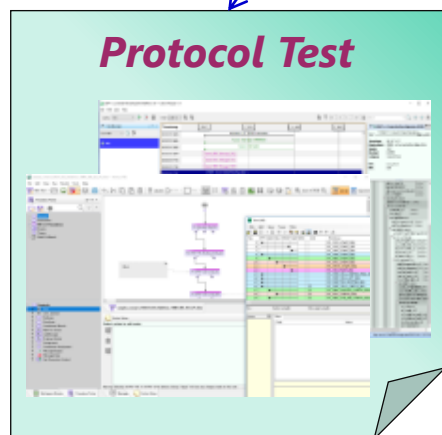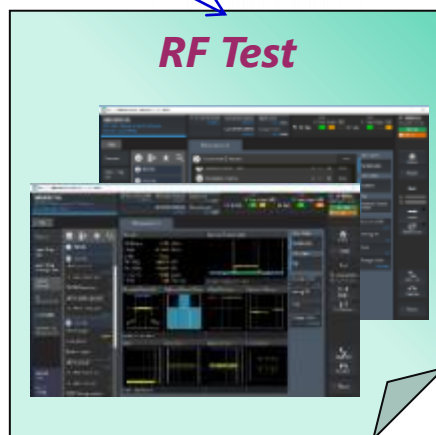and switch by system number

**Platform GUI**

## Test Applications

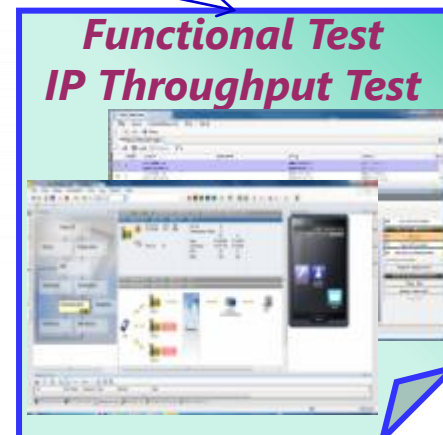| Protocol Test | RF Test | Functional Test IP Throughput Test |

MX800050A
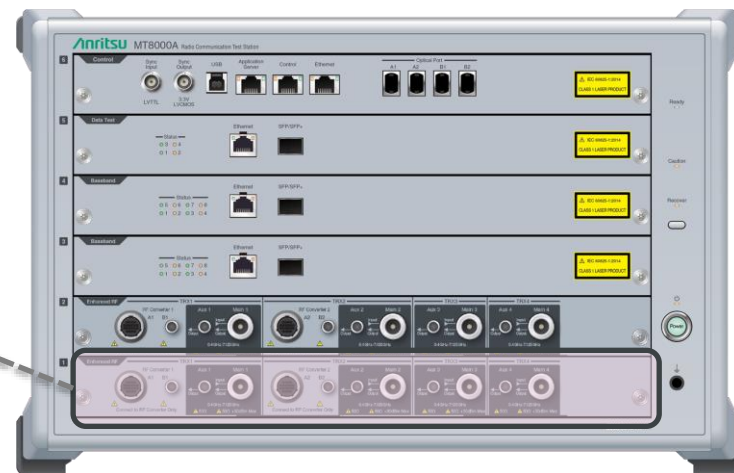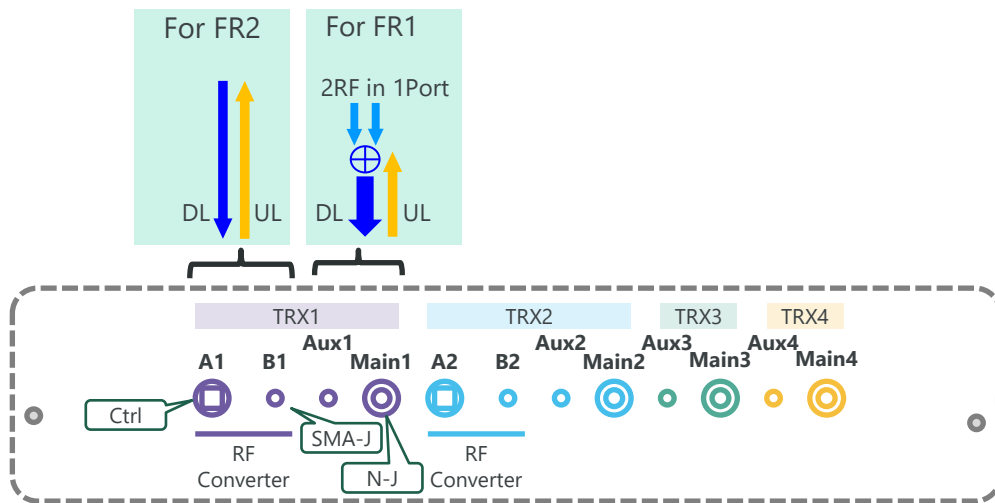*Rapid Test Designer Platform (RTD)*

MX800010A
*TRx Measurement.*

MX800070A SSNR
**MX800071A SSIP**

# MT8000A-033 0.4 to 7.125 GHz Enhanced RF Module

- Features
  - **Four sets of RF input/output connectors per slot** (N-type Main In/Out and SMA-type Aux Out)
  - **Eight RF transmitters per slot** (total of 16 Tx and four 4x4 MIMO bands)
  - **Four RF receivers per slot** (total of 8 Rx for UL 2x2 MIMO and UL antenna switch)
  - Frequency range: **FR1: 400 to 7125 MHz, FR2: external RF converter interface**
- Input/Output (4 Ports/slot)
  - Main 1/2/3/4 – RF In/Out
  - Aux 1/2/3/4 – RF Out (exclusive with Main output)
  - RF Converter 1/2 – for MX8000 1/2/3A external RF converter connection
- Transmitter
  - FR1 Bandwidth: **OBW 800 MHz (IBW 1200 MHz)**
  - FR2 Bandwidth: **1000 MHz**
  - FR1 Upper freq:  Four Tx up to 7125 MHz and remaining four Tx up to 5000 MHz
- Receiver
  - Receive waveform bandwidth: FR1 800 MHz / FR2 1000 MHz
  - Signal analysis bandwidth: FR1 **1200 MHz (max.)/**FR2 1000 MHz



**Output/Input for FR1 or FR2**

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