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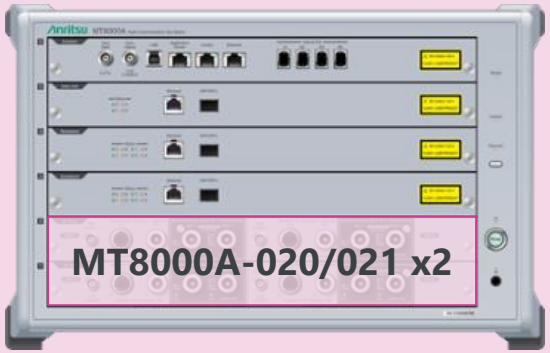
Multiple Box Solution For NR/LTE Protocol Test

Radio Communication Test Station

MT8000A

MT8000A Introduction

■ MT8000A supports various tests only by switching Firmware.



■ MT8000A-020/021: FR2 Configuration

- **NR Protocol test (MX800030A/51A)**
  - NR FR2 Protocol test (8CA 2Band 2x2MIMO)
  - NR FR1+ FR2 Interworking
    FR1(2CA 1Band 2x2MIMO) + FR2 (4CA 1Band 2x2MIMO)
- **NR Fading test (MX800031A/51A)**
  - NR FR2 with Fading (8CA 2Band 2x2MIMO)

■ MT8000A-031/032: LTE/FR1 Configuration

- **NR Protocol test (MX800030A/51A)**
  - NR FR1 Protocol test (4CA 2Band 4x4MIMO)
- **LTE Protocol test (MX800032A/52A)**
  - LTE 6CA 2Band 4x4MIMO
- **LTE Fading test (MX800033A/52A)**
  - LTE 6CA 2Band 4x4MIMO with Fading

Note: NR and LTE work exclusively.

MT8000A Multiple-Box Solution

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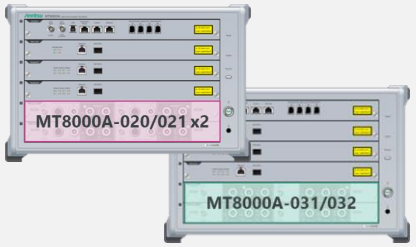
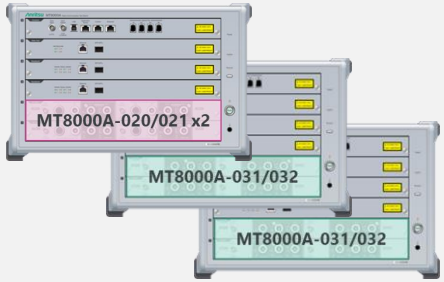
■ Capability extended by combining multiple MT8000A units.

Test Item	Capability		
	1x MT8000A -FR2 Configuration or LTE/FR1 Configuration 	**2x MT8000A** -1x FR2 Configuration -1x LTE/FR1 Configuration 	**3x MT8000A** -1x FR2 Configuration -2x LTE/FR1 Configuration 
EN-DC IP Throughput	・Not supported	・EN-DC supported -LTE: 2B 6CA 4x4MIMO+ -NR FR2: 2B 8CA 2x2MIMO	・EN-DC Supported -LTE: 4B 6CA 4x4MIMO+ -NR FR2: 2B 8CA 2x2MIMO
FR1+FR2 Inter-working	・Supported -FR1: 1Band 2CA 2x2MIMO -FR2: 1Band 4CA 2x2MIMO	・Supported -FR1: 2Band 4CA 4x4MIMO -FR2: 2Band 8CA 2x2MIMO	・Supported -FR1: 4Band 4CA 4x4MIMO -FR2: 2Band 8CA 2x2MIMO
Fading test	・Supported -FR2: 2Band 4CA 2x2MIMO	・Supported -FR2: 2Band 8CA 2x2MIMO	・EN-DC Fading on roadmap

This document describes four types of use case
that can be expanded / realized by using multiple MT8000A.

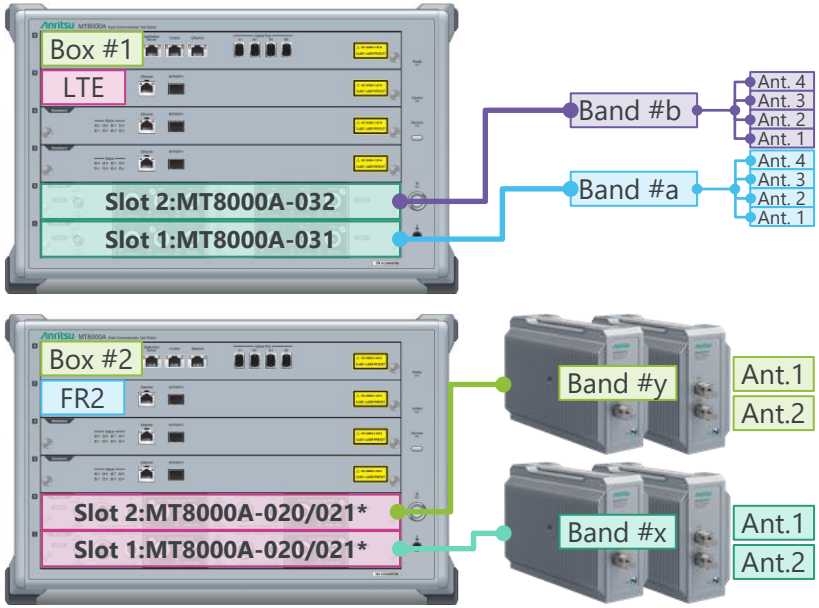
Index

EN-DC IP Throughput

The following measurement system supports EN-DC 8Gbps (LTE 2 Gbps + NR FR2 6 Gbps) IP Throughput test.

■ Configuration : **2x** MT8000A (1x MT8000A for NR/ 1x MT8000A for LTE)

- LTE: 2Band 6CA 4x4MIMO
- FR2: 2Band 8CA 2x2MIMO (100 MHz/CC, Total 800 MHz BW),



■ LTE

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

■ FR2

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

EN-DC IP Throughput

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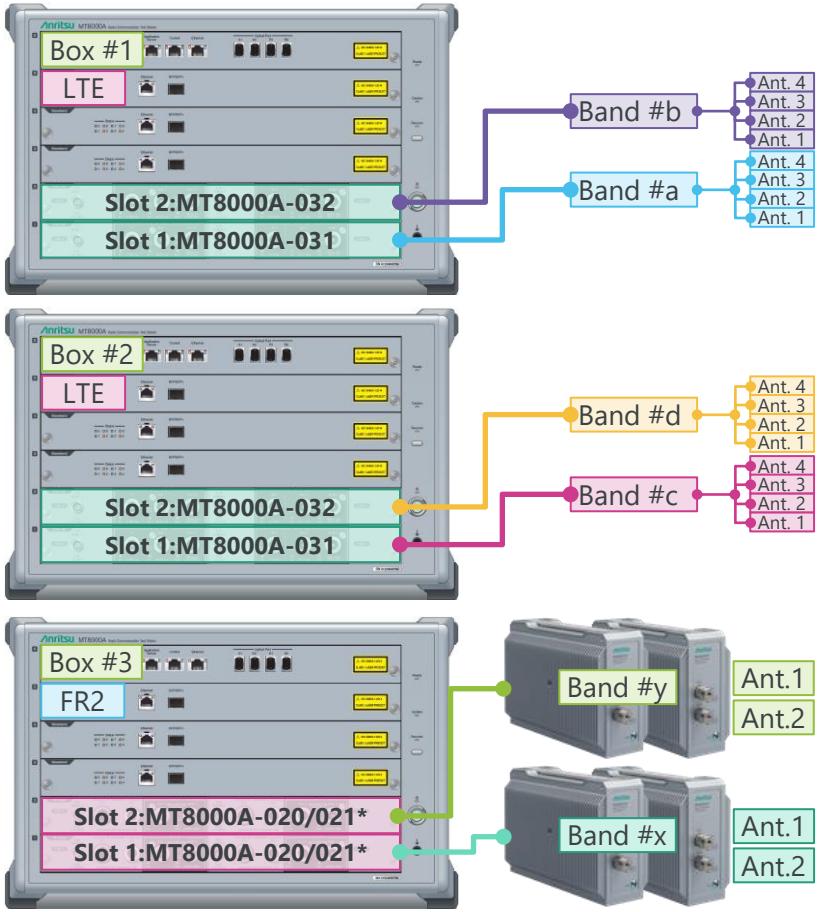
Extend the number of LTE bands by using two or more MT8000A.

■ Configuration : **3x** MT8000A (1x MT8000A for NR/ 2x MT8000A for LTE)

- LTE: 4Band 6CA 4x4MIMO
- FR2: 2Band 8CA 2x2MIMO (100 MHz/CC, Total 800 MHz BW),



■ LTE

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

■ FR2

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

Comparison of LTE on MT8000A and MD8430A

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Comparison of LTE on MT8000A and MD8430A.

MD8430A

✓ Existing MD8430A can be used as LTE Anchor

DL CA configuration, All 4x4MIMO, 256QAM

4 Bands	N/A	N/A	N/A	4x MD8430A	4x MD8430A	4x MD8430A
3 Bands	N/A	N/A	3x MD8430A	3x MD8430A	3x MD8430A	3x MD8430A
2 Bands	N/A	2x MD8430A	2x MD8430A	2x MD8430A	2x MD8430A	2x MD8430A
1 Band	1x MD8430A	1x MD8430A	1x MD8430A	2x MD8430A	2x MD8430A	2x MD8430A
CA	1	2	3	4	5	6
Max. IP TPUT	400 Mbps	800 Mbps	1.0 Gbps	1.0 Gbps	1.0 Gbps	1.0 Gbps

When the MD8430A is used as an LTE Anchor, the MT8000A and MD8430A can support up to 4 units due to RTD restrictions.

MT8000A

✓ Supports IP Throughput test more than 2.0 Gbps.

DL CA configuration, All 4x4MIMO, 256QAM

4 Bands	N/A	N/A	N/A	2x MT8000A	2x MT8000A	2x MT8000A
3 Bands	N/A	N/A	2x MT8000A	2x MT8000A	2x MT8000A	2x MT8000A
2 Bands	N/A	1x MT8000A	1x MT8000A	1x MT8000A	1x MT8000A	1x MT8000A
1 Band	1x MT8000A	1x MT8000A	1x MT8000A	1x MT8000A	1x MT8000A	1x MT8000A
CA	1	2	3	4	5	6
Max. IP TPUT	400 Mbps	800 Mbps	1.2 Gbps	1.6 Gbps	2.0 Gbps	2.4 Gbps

Comparison of LTE on MT8000A and MD8430A

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■ Comparison of MD8430A and MT8000A functions, Option based

MD8430A	MD8430A Option Name	MX800032A LTE Protocol Platform Software	MX800032A-001 LTE Anchor For Protocol	MX800032A-002 LTE Advance 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	Not supported	Not supported	Not supported
MD8430A-085	LTE Carrier Aggregation Option			✓
MD8430A-086	Ciphering Option	✓		
MD8430A-087	LTE CoMP Option	Only UL CoMP supported		DL CoMP (TM10)
MD8430A-072	LTE Licensed Assisted Access (LAA) Option			✓
MD8430A-073	LTE Dual Connectivity Option			✓
MD8430A-076	LTE DL 8×4 MIMO Option			✓
MD8430A-078	LTE UL 2×2 MIMO Option			✓*2
MD8430A-088	LTE DL 4 Carrier Aggregation Option			✓
MD8430A-045	LTE UL 3 Carrier Aggregation Option			✗*1
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	✓		

■ Legend:

- ✓ : Features equivalent to MD8430A are supported.
- ✗ : Function not supported

*1 : Features not required by the market as of March 2020

*2 : Support up to 1CC

Index

FR1+FR2 Inter-working

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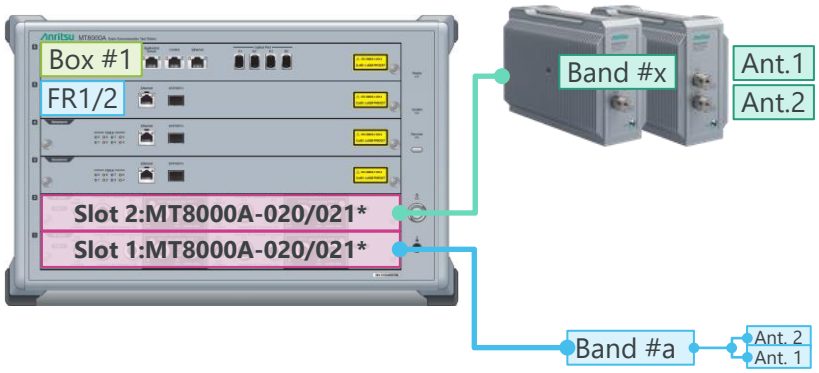
MT8000 supports dual connectivity of FR1 and FR2 by 1 box.

■ **1x MT8000A**, IP Throughput: 4.7Gbps/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 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*2

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 described in Slide 2, when the frequency is 3.3 GHz-6 GHz, the RF Module supports up to 400 MHz Bandwidth. However, Total BW will be 200 MHz for the following reasons
- The frequency per 1CC of FR1 is 100 MHz in 3GPP standard.
- The reason explained in * 1

2*: As shown below, Total Bandwidth differs depending on the frequency band.
- 20 MHz (0.4 GHz ≤ f<0.6 GHz)
- 200 MHz (0.6 GHz ≤ f <3.3 GHz)
- 400 MHz (3.3 GHz ≤ f ≤6 GHz)

FR1+FR2 Inter-working

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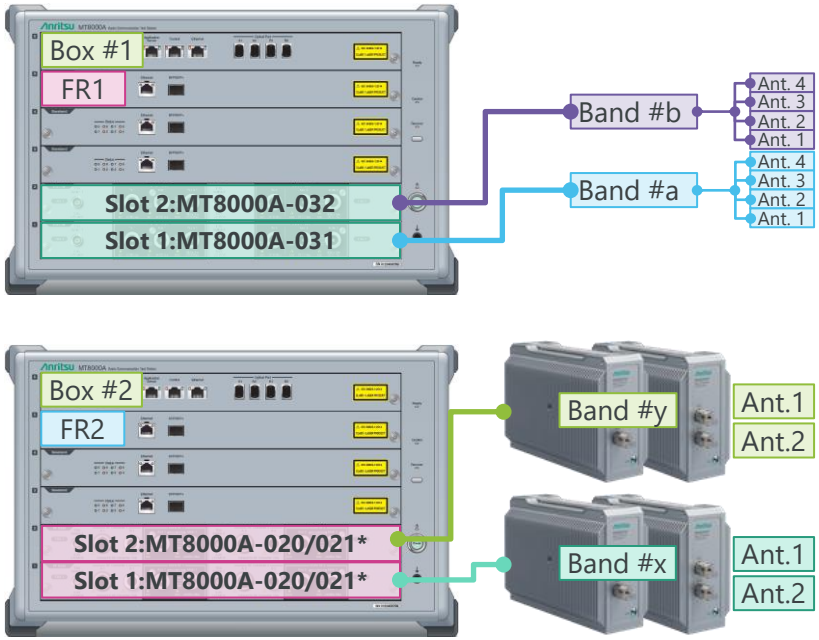
Extend the number of bands and CA/MIMO by using two or more MT8000A.

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



■ FR1*2

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

■ FR2

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

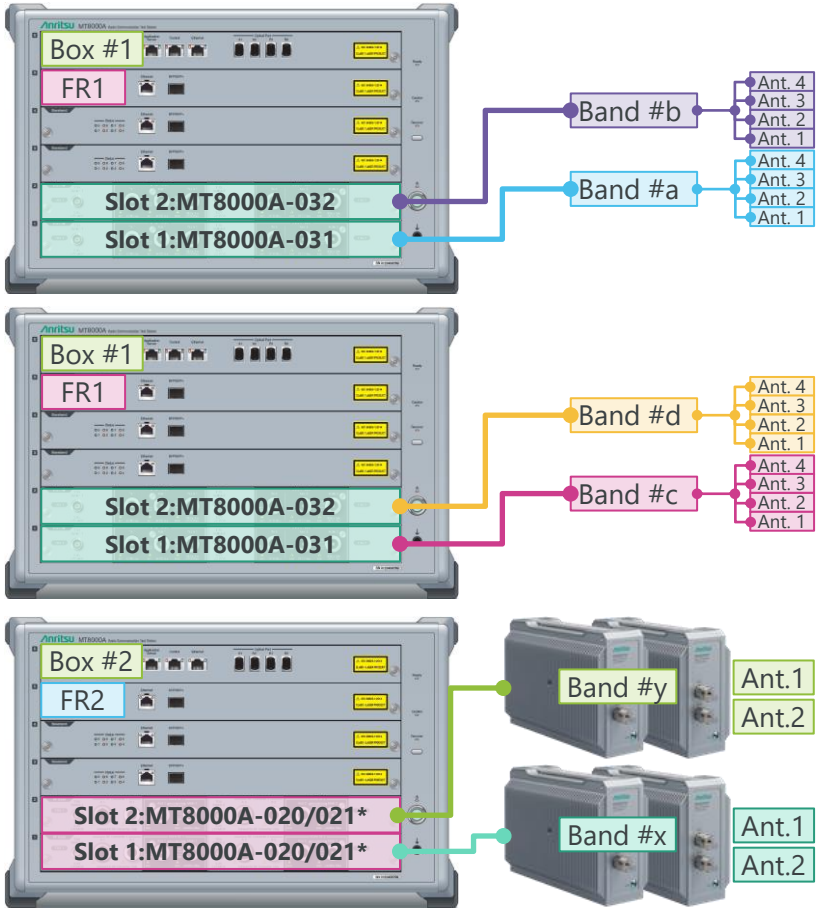
1*: The maximum value of Mac Padding Throughput is the **sum of FR1 and FR2**.
However, the upper limit of IP Throughput is **FR1+FR2 <8 Gbps** due to the limitation of PDCP Layer.

2*: As shown below, Total Bandwidth differs depending on the frequency band.
- 20 MHz (0.4 GHz ≤ f<0.6 GHz)
- 200 MHz (0.6 GHz ≤ f<3.3 GHz)
- 400 MHz (3.3 GHz ≤ f ≤6 GHz)

FR1+FR2 Inter-working

■ **3x MT8000A** : 3x MT8000A, IP Throughput: 8 Gbps, Mac Padding Throughput: 12.8 Gbps*1

- FR1: 4Band 4CA 4x4MIMO (100 MHz/CC, Total 400 MHz BW), 6.8 Gbps
- FR2: 2Band 8CA 2x2MIMO (100 MHz/CC, Total 800 MHz BW), 6.0 Gbps



■ FR1*2

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

■ FR2

Ant.2	Band #x, #y (8CA, Contiguous)							
Ant.1	Band #x, #y (8CA, Contiguous)							
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 <8 Gbps** due to the limitation of PDCP Layer.

2*: As shown below, Total Bandwidth differs depending on the frequency band.
- 20 MHz (0.4 GHz ≤ f<0.6 GHz)
- 200 MHz (0.6 GHz ≤ f<3.3 GHz)
- 400 MHz (3.3 GHz ≤ f ≤6 GHz)

Index

Fading test

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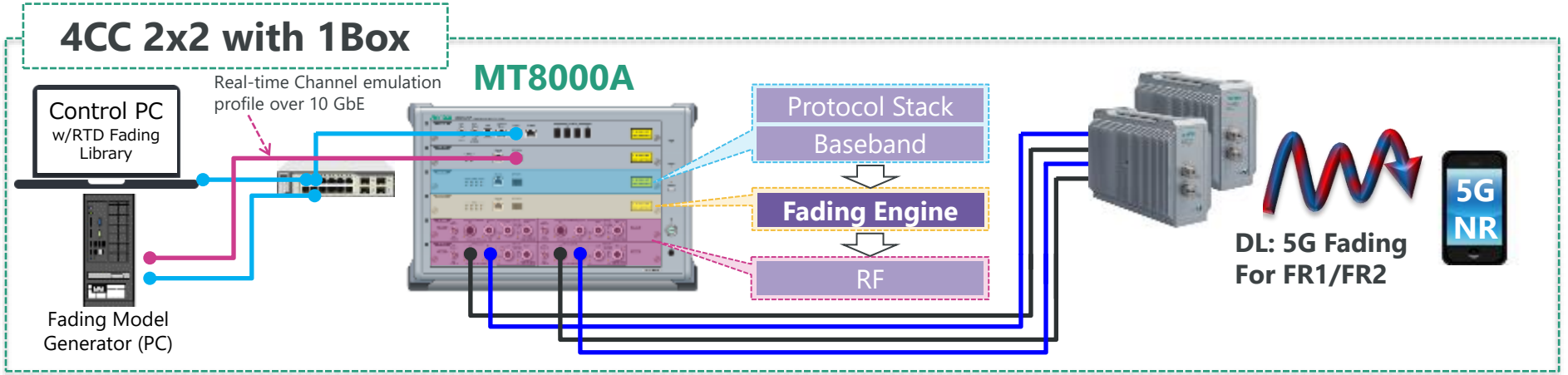
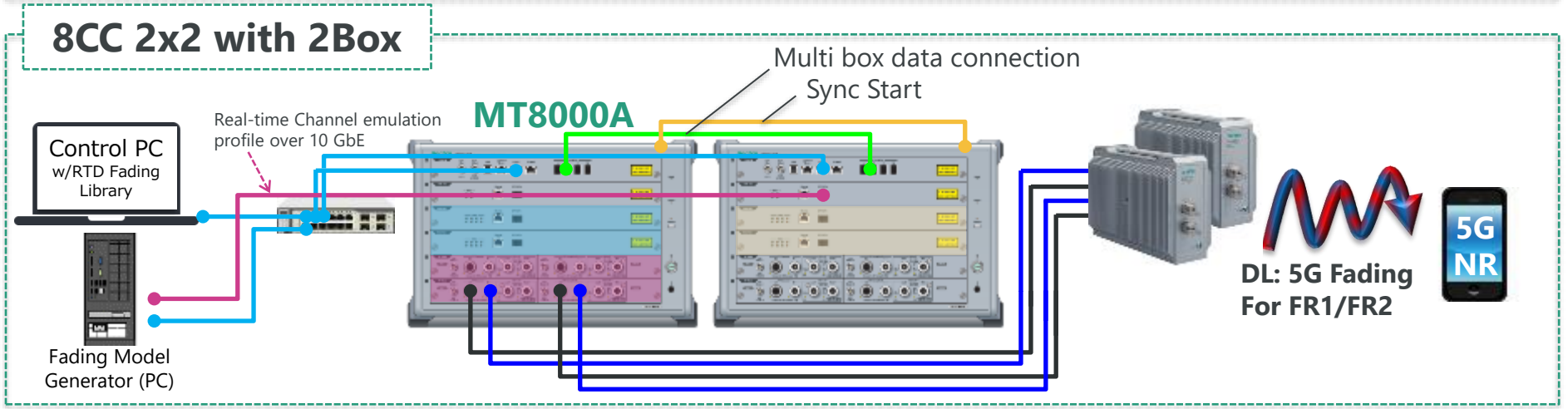
Fading Feature Concept

- Real-time Fading for FR1 and FR2
- All Features for requirements of 3GPP 5G NR Conformance Test
- NR + Fading on one MT8000A *Up to 4CC, need two boxes for up to 8CC





RTD control MT8000A and Fading PC

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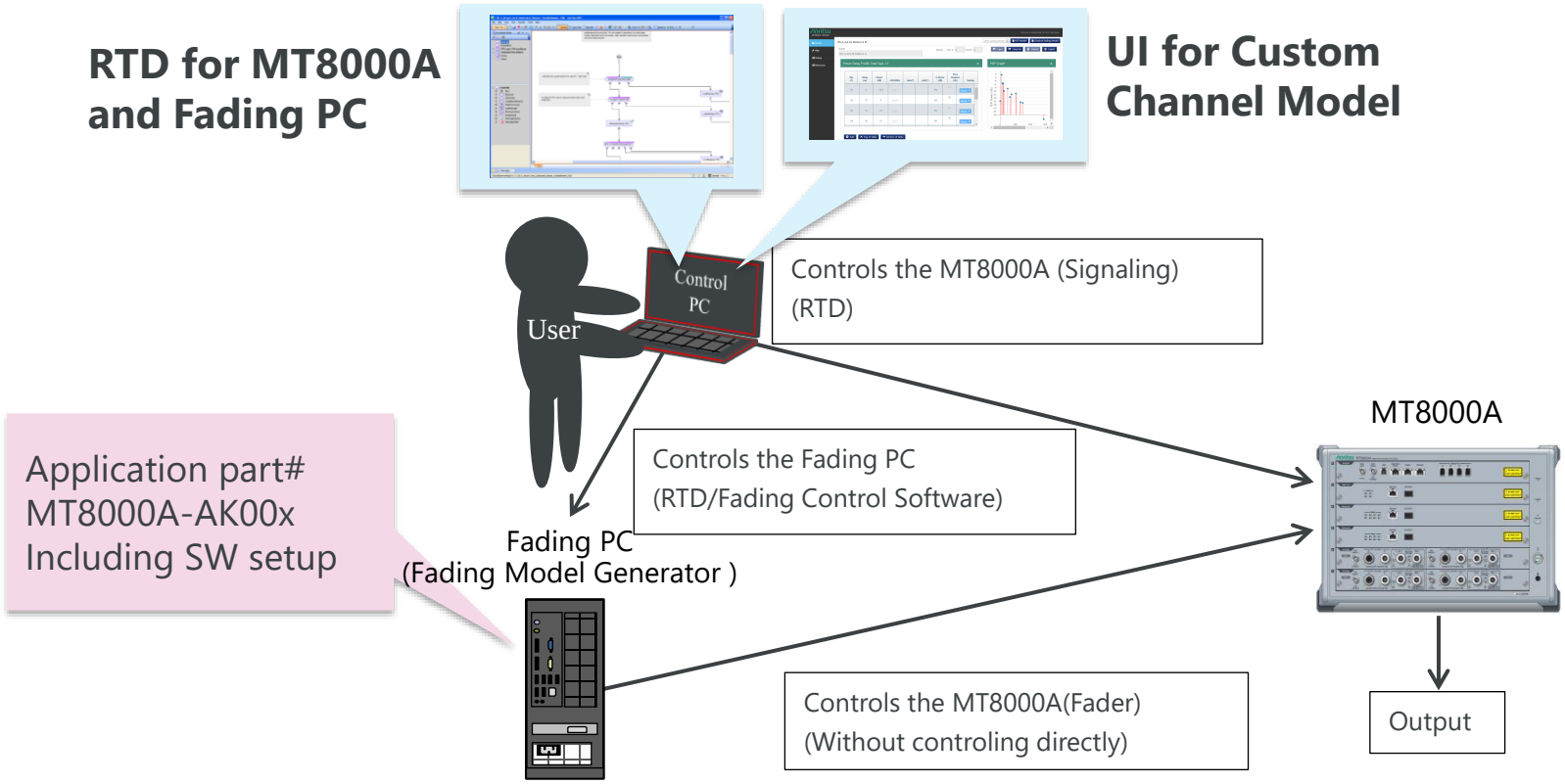
Every Control can be done from Control PC.



- 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

MT8000A NR Fading Option List

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Model	Description	Remark
NR Fading software		
MX800031A	NR Fading Basic	Including Fading Control Software for PC
MX800031A-001	NR Fading 2x2 MIMO	
MX800031A-002	NR Fading 4x2/4x4 MIMO	
MX800031A-003	NR Fading 2CA-4CA	
MX800031A-004	NR Fading 5CA-8CA	
LTE Fading software (for MT8000A)		
MX800033A	LTE Fading Basic	LTE Fading Function for EN-DC
MX800032A-010	LTE RF/Fading Driver for Multiple Box	Option for Secondary Box
RTD		
MX800050A-012	5G Fading Library for RTD	
MX800050A-SS112	5G Fading Support Service (Per Year)	
Application part		
MT8000A-AK001	Fading Control PC	Including SFP+ Network Adapter Card, SFP+ Transceiver, setting up Fading Control Software

MT8000A Fading Feature Specification

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Fading Feature Concept

- **Real-time Fading** on external PC with Fading Engine on Baseband Board
- Support all fading features required for **3GPP 5G NR Conformance Test**

Key Specification

- Faded channel : 64 channels
  - Sub 6G - 1 gNodeB with **four 100 MHz CC** (**400 MHz per gNodeB – 2x2, 4x2, 4x4 links**)
  - mmWave (IF)- 1 gNodeB with **eight 100 MHz CC** (**800 MHz per gNodeB – only 2x2 links**)

4CC 4x4, 8CC 2x2 by 2 units

- Channel Model
  - 3GPP 5G Channel Models (3GPP TS 38.521-4 B.1/B.2 V15.0.0, 2019-03)
  - Static Butler and Bypass models
  - High Speed Train when defined by 3GPP TS 38.521-4
- AWGN setting range is -99.99 to -15.0 [dBm/30 kHz]
- Maximum Doppler Frequency : 6 kHz

High Speed Train (Single Tap)

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Support High Speed Train (Single Tap) Channel Profile with HST Edit feature

Table B.3.1-1: High speed train scenario

Parameter	Value	
	HST-750	HST-1000
D_s	300 m	300 m
$D_{\min}$	2 m	2 m
v	300 km/h	300 km/h
f_d	750 Hz for 15 kHz SCS test	1000 Hz for 30 kHz SCS test

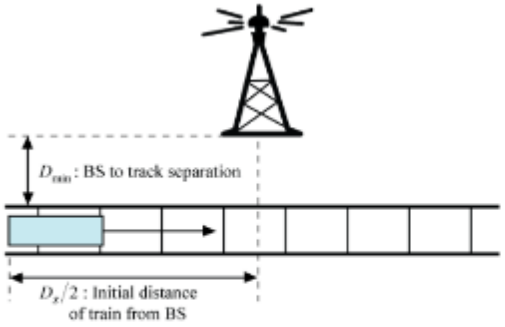
What is this?:
The High Speed Train Scenario is a test defined by the 3GPP designed to validate the performance of a device under extreme velocity conditions.The high speed train condition is a non fading propagation channel with one tap and Doppler shift variations.

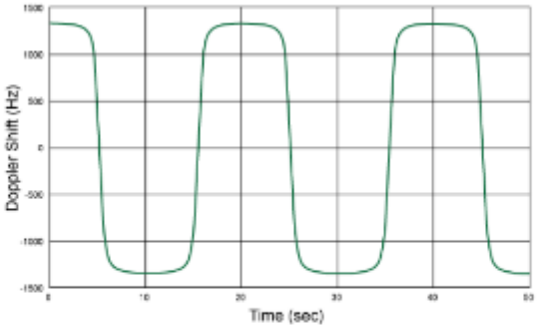
$$f_s(t) = \frac{f_d(D_s/2 - vt)}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}} \qquad 0 \le t \le D_s/v$$

The Doppler shift variation is typically characterized by:

$$f_s(t) = \frac{f_d(-1.5D_s + vt)}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}} \qquad D_s/v < t \le 2D_s/v$$

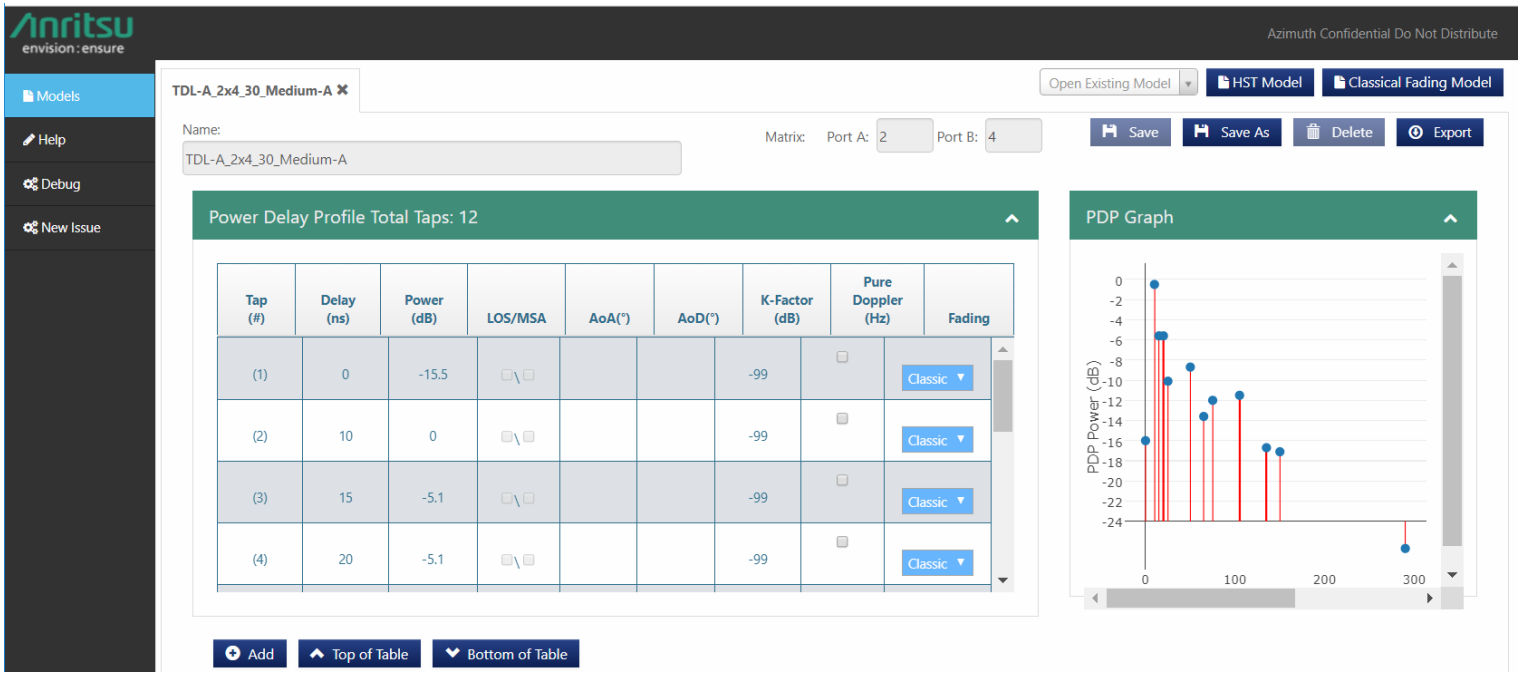
Standards Definition:
Various high speed train scenarios are defined in the 3GPP propagation conditions sections including T.S 25.xxx, T.S 34.xxx and T.S 36.xxx. Presets for these pre-defined configurations are provided.





Editing Custom Model parameters

- Custom Models can be built using the UI



Parameter	Range	Resolution	Description
Delay	0 to 32000 ns	5 ns up to 10000; 10 ns from 10001 to 32000 ns	Excess delay of the tap relative to tap 1
Power	0 to -99 dB	0.1 dB	Average power relative to tap 1
Line of Sight (LoS)	True / False	--	True if this tap is a "Line of Sight" component (direct path).
Angle of Arrival (AoA)	-90˚ to +90˚	1.0˚	Angle of Arrival of the Line of Sight component at the UE.
Angle of Departure (AoD)	-90˚ to +90˚	1.0˚	Angle of Departure of the Line of Sight component from the Base Station.
K-Factor	0 to -99 dB	0.1 dB	Ratio of the power between the Line of Sight component and the Fading component.
Pure Doppler	-6000 to 6000 Hz	0.0001 Hz	Doppler shift of the Line of Sight component.
Fading	Classic or Static	--	Classic for Rayleigh fading on this tap (such as TDL models). Static for fixed, unchanging power on this tap (such as Butler or Bypass models).

Index

MT8000A RF modules

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Item	MT8000A-020[*7]/021	MT8000A-031/032
Frequency range	0.4 to 6.0 GHz	0.4 to 6.0 GHz
Modulation BW	400 MHz[*4]	200 MHz[*6]
Connector	N – J	N – J
Simplex/Duplex	Full Duplex, TX Simplex	Full duplex
Downlink	2 TX	4 TX
Output level	-110 to -10 dBm	-110 to -10 dBm
Level Accuracy	±0.7 dB typ(0.4-3 GHz) [*1] ±1.0 dB(3-6 GHz) [*1]	±0.7 dB typ(0.4-3 GHz)[*1] ±1.0 dB(3-6 GHz)[*1]
Uplink	2 RX	2 RX
Max input power(Setting)	+26 dBm	+26 dBm
Max input power	+30 dBm	+35 dBm
Level Accuracy (100 MHz BW)	±0.5 dB typ(0.4-3 GHz) [*5] ±1.0 dB(3-6 GHz) [*5]	±0.5 dB typ(0.4-3 GHz) [*5] ±1.0 dB(3-6 GHz) [*5]
Appearance		

+18°C to +28°C
*1 : at Output Level ≥ –100 dBm
*2 : at Input Level Setting ≥–40 dBm
*3 : Level Accuracy is not specified because of for Protocol.

*4 : 20 MHz (0.4 GHz ≤ f <0.6 GHz), 200 MHz (0.6 GHz ≤ f <3.3 GHz), 400 MHz (3.3 GHz ≤ f ≤ 6GHz)
*5 : at Input Level Setting ≥–20 dBm（±0.7 dBtyp@-40 to-20 dBm）
*6 : 20 MHz (0.4 GHz ≤ f<0.6 GHz), 200 MHz (0.6 GHz ≤ f ≤ 6 GHz)
*7 : MT8000A-021 is always set with 020. The performance of MT8000A-020 depends on RF Converter.

RF Converter for FR2

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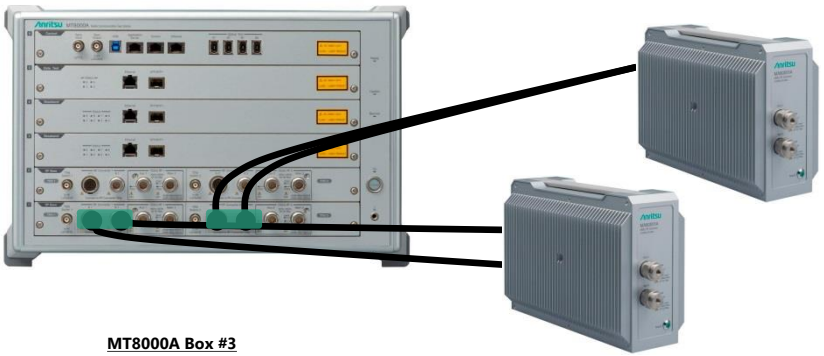
New RF Converter, MA80003A supports all of 3GPP FR2 operation bands

			MA80001A 28 GHz RF Converter	MA80002A 39 GHz RF Converter	MA80003A Multiband RF Converter
Frequency Range			24.25 to 29.5 GHz	37.0 to 40.0 GHz	24.25 to 29.5 GHz 37.00 to 43.5 GHz
Connector Type			K/P	K/P	V/P
Output level			-90 dBm to +5 dBm	-90 dBm to +5 dBm	-70 dBm to +15 dBm
Level Accuracy			±1.5 dB[*1]	±2.0 dB[*1]	±1.5 dB[*1] (24.25~29.5) ±2.0 dB[*1] (37.00~43.5)
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]	±1.5 dB[*1] (24.25~29.5) ±2.0 dB[*1] (37.00~43.5)
n257	26500 –29500	TDD	✓	---	✓
n258	24250 – 27500	TDD	✓	---	✓
n259	[40500 –43500]	TDD	---	---	✓
n260	37000–40000	TDD	---	✓	✓
n261	27500 – 28350	TDD	✓	---	✓

MT8000A



MT8000A Box #3

RF Converter

- 28 GHz Converter
- 39 GHz Converter
- Multi Band Converter

+18°C to +28°C
*1 : 37.0 GHz to 40 GHz
*2 : at Measurement band width 100 MHz, Input Level Setting ≥ –50 dBm

Pre-defined 3GPP 5G Channel Models for FR1

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3GPP 38.521-4 V15.0.0

FR1 TDL-A			**FR1 TDL-C**	Butler_4x4
TDL-A_1x2_30_High_5Hz	TDL-A_2x4_30_Medium_5Hz	TDL-A_4x4_30_Medium-A_5Hz	TDL-C_1x2_300_High_100Hz	**CQI**
TDL-A_1x2_30_High_10Hz	TDL-A_2x4_30_Medium_10Hz	TDL-A_4x4_30_Medium-A_10Hz	TDL-C_1x2_300_Low_100Hz	5G-CQI_2x2
TDL-A_1x2_30_High_300Hz	TDL-A_2x4_30_Medium_300Hz	TDL-A_4x4_30_Medium-A_300Hz	TDL-C_1x4_300_Low_100Hz	5G-CQI_4x4
TDL-A_1x2_30_Low_5Hz	TDL-A_2x4_30_Medium-A_5Hz	**FR1TDL-B**	TDL-C_2x1_300_High_100Hz	**HST (Tentative)**
TDL-A_1x2_30_Low_10Hz	TDL-A_2x4_30_Medium-A_10Hz	TDL-B_XPOL_4x2_100_High	TDL-C_2x1_300_Low_100Hz	HST Open Space 1x1
TDL-A_1x2_30_Low_300Hz	TDL-A_2x4_30_Medium-A_300Hz	TDL-B_XPOL_4x2_100_Low	TDL-C_2x2_300_High_100Hz	HST Open Space 1x2
TDL-A_1x4_30_Low_5Hz	TDL-A_4x1_30_Low_5Hz	TDL-B_1x2_100_High_400Hz	TDL-C_2x2_300_Low_100Hz	HST Open Space 2x1
TDL-A_1x4_30_Low_10Hz	TDL-A_4x1_30_Low_10Hz	TDL-B_1x2_100_Low_400Hz	TDL-C_2x2_300_Medium_100Hz	HST Open Space 2x2
TDL-A_1x4_30_Low_300Hz	TDL-A_4x1_30_Low_300Hz	TDL-B_1x4_100_Low_400Hz	TDL-C_2x4_300_Low_100Hz	HST Open Space 2x4
TDL-A_2x1_30_High_5Hz	TDL-A_4x2_30_High_5Hz	TDL-B_2x1_100_High_400Hz	TDL-C_2x4_300_Medium_100Hz	HST Open Space 4x2
TDL-A_2x1_30_High_10Hz	TDL-A_4x2_30_High_10Hz	TDL-B_2x1_100_Low_400Hz	TDL-C_2x4_300_Medium-A_100Hz	HST Open Space 4x4
TDL-A_2x1_30_High_300Hz	TDL-A_4x2_30_High_300Hz	TDL-B_2x2_100_High_400Hz	TDL-C_4x1_300_Low_100Hz	HST Tunnel 1x1
TDL-A_2x1_30_Low_5Hz	TDL-A_4x2_30_Low_5Hz	TDL-B_2x2_100_Low_400Hz	TDL-C_4x2_300_High_100Hz	HST Tunnel 1x2
TDL-A_2x1_30_Low_10Hz	TDL-A_4x2_30_Low_10Hz	TDL-B_2x2_100_Medium_400Hz	TDL-C_4x2_300_Low_100Hz	HST Tunnel 2x1
TDL-A_2x1_30_Low_300Hz	TDL-A_4x2_30_Low_300Hz	TDL-B_2x4_100_Low_400Hz	TDL-C_4x2_300_Medium_100Hz	HST Tunnel 2x2
TDL-A_2x2_30_High_5Hz	TDL-A_4x2_30_Medium_5Hz	TDL-B_2x4_100_Medium_400Hz	TDL-C_4x4_300_High_100Hz	HST Tunnel 2x4
TDL-A_2x2_30_High_10Hz	TDL-A_4x2_30_Medium_10Hz	TDL-B_2x4_100_Medium-A_400Hz	TDL-C_4x4_300_Low_100Hz	HST Tunnel 4x2
TDL-A_2x2_30_High_300Hz	TDL-A_4x2_30_Medium_300Hz	TDL-B_4x1_100_Low_400Hz	TDL-C_4x4_300_Medium_100Hz	HST Tunnel 4x4
TDL-A_2x2_30_Low_5Hz	TDL-A_4x4_30_High_5Hz	TDL-B_4x2_100_High_400Hz	TDL-C_4x4_300_Medium-A_100Hz	**XPOL**
TDL-A_2x2_30_Low_10Hz	TDL-A_4x4_30_High_10Hz	TDL-B_4x2_100_Low_400Hz	**Static**	TDL-A_XPOL_4x2_30_High_5Hz
TDL-A_2x2_30_Low_300Hz	TDL-A_4x4_30_High_300Hz	TDL-B_4x2_100_Medium_400Hz	5G-Static_1x2	TDL-A_XPOL_4x2_30_High_10Hz
TDL-A_2x2_30_Medium_5Hz	TDL-A_4x4_30_Low_5Hz	TDL-B_4x4_100_High_400Hz	5G-Static_1x4	TDL-A_XPOL_4x2_30_Low_5Hz
TDL-A_2x2_30_Medium_10Hz	TDL-A_4x4_30_Low_10Hz	TDL-B_4x4_100_Low_400Hz	5G-Static_2x2	TDL-A_XPOL_4x2_30_Low_10Hz
TDL-A_2x2_30_Medium_300Hz	TDL-A_4x4_30_Low_300Hz	TDL-B_4x4_100_Medium_400Hz	5G-Static_2x4	TDL-B_XPOL_4x2_100_High_400Hz
TDL-A_2x4_30_Low_5Hz	TDL-A_4x4_30_Medium_5Hz	TDL-B_4x4_100_Medium-A_400Hz	5G-Static_4x2	TDL-B_XPOL_4x2_100_Low_400Hz
TDL-A_2x4_30_Low_10Hz	TDL-A_4x4_30_Medium_10Hz		5G-Static_4x4	TDL-C_XPOL_4x2_300_High_100Hz
TDL-A_2x4_30_Low_300Hz	TDL-A_4x4_30_Medium_300Hz		Butler_2x2	TDL-C_XPOL_4x2_300_Low_100Hz

Combination name	Model	Maximum Doppler frequency
TDLA30-5	**TDLA30**	**5 Hz**
TDLA30-10	**TDLA30**	**10 Hz**
TDLB100-400	**TDLB100**	**400 Hz**
TDLC300-100	**TDLC300**	**100 Hz**

Pre-defined 3GPP 5G Channel Models for FR2

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3GPP 38.521-4 V15.0.0

FR2 TDL-A		FR2 TDL-C	Static
TDL-A_1x2_30_High_35Hz	TDL-A_2x4_30_Medium_75Hz	TDL-C_1x2_60_High_300Hz	5G-Static_1x2
TDL-A_1x2_30_High_75Hz	TDL-A_2x4_30_Medium-A_35Hz	TDL-C_1x2_60_Low_300Hz	5G-Static_1x4
TDL-A_1x2_30_Low_35Hz	TDL-A_2x4_30_Medium-A_75Hz	TDL-C_1x4_60_Low_300Hz	5G-Static_2x2
TDL-A_1x2_30_Low_75Hz	TDL-A_4x1_30_Low_35Hz	TDL-C_2x1_60_High_300Hz	5G-Static_2x4
TDL-A_1x4_30_Low_35Hz	TDL-A_4x1_30_Low_75Hz	TDL-C_2x1_60_Low_300Hz	5G-Static_4x2
TDL-A_1x4_30_Low_75Hz	TDL-A_4x2_30_High_35Hz	TDL-C_2x2_60_High_300Hz	5G-Static_4x4
TDL-A_2x1_30_High_35Hz	TDL-A_4x2_30_High_75Hz	TDL-C_2x2_60_Low_300Hz	Butler_2x2
TDL-A_2x1_30_High_75Hz	TDL-A_4x2_30_Low_35Hz	TDL-C_2x2_60_Medium_300Hz	Butler_4x4
TDL-A_2x1_30_Low_35Hz	TDL-A_4x2_30_Low_75Hz	TDL-C_2x4_60_Low_300Hz	**CQI**
TDL-A_2x1_30_Low_75Hz	TDL-A_4x2_30_Medium_35Hz	TDL-C_2x4_60_Medium_300Hz	5G-CQI_2x2
TDL-A_2x2_30_High_35Hz	TDL-A_4x2_30_Medium_75Hz	TDL-C_2x4_60_Medium-A_300Hz	5G-CQI_4x4
TDL-A_2x2_30_High_75Hz	TDL-A_4x4_30_High_35Hz	TDL-C_4x1_60_Low_300Hz	**FR2 XPOL**
TDL-A_2x2_30_Low_35Hz	TDL-A_4x4_30_High_75Hz	TDL-C_4x2_60_High_300Hz	TDL-A_XPOL_4x2_30_High_35Hz
TDL-A_2x2_30_Low_75Hz	TDL-A_4x4_30_Low_35Hz	TDL-C_4x2_60_Low_300Hz	TDL-A_XPOL_4x2_30_High_75Hz
TDL-A_2x2_30_Medium_35Hz	TDL-A_4x4_30_Low_75Hz	TDL-C_4x2_60_Medium_300Hz	TDL-A_XPOL_4x2_30_High_300Hz
TDL-A_2x2_30_Medium_75Hz	TDL-A_4x4_30_Medium_35Hz	TDL-C_4x4_60_High_300Hz	TDL-A_XPOL_4x2_30_Low_35Hz
TDL-A_2x4_30_Low_35Hz	TDL-A_4x4_30_Medium_75Hz	TDL-C_4x4_60_Low_300Hz	TDL-A_XPOL_4x2_30_Low_75Hz
TDL-A_2x4_30_Low_75Hz	TDL-A_4x4_30_Medium-A_35Hz	TDL-C_4x4_60_Medium_300Hz	TDL-A_XPOL_4x2_30_Low_300Hz
TDL-A_2x4_30_Medium_35Hz	TDL-A_4x4_30_Medium-A_75Hz	TDL-C_4x4_60_Medium-A_300Hz	TDL-C_XPOL_4x2_60_High_300Hz
			TDL-C_XPOL_4x2_60_Low_300Hz

Table B.2.2-2 Channel model parameters for FR2

Combination name	Model	Maximum Doppler frequency
TDLA30-35	TDLA30	35 Hz
TDLA30-75	TDLA30	75 Hz
TDLA30-300	TDLA30	300 Hz
TDLC60-300	TDLC60	300 Hz

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公知 2022-6 MJM No. MT8000A-E-L-3-(1.01)