

Measuring O-RAN Fronthaul 5G Base Station Multi-Antenna

ORAN Test Platform MX772000PC

O-DU Emulator Platform Software MX773000PC

Base Station Test Suite for NR sub-6GHz MX800046A

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1. Introduction

Data transmission capacity and speeds continue increasing to meet the needs of smartphone contents and applications. MIMO (Multi-Input Multi-Output) technology using multiple antennas between smartphones and base stations is one method for increasing data transmission speeds.

Smartphone and base-station development and manufacturing require implementing 3GPP TS38.141-1 and O-RAN ALLIANCE WG4 defined tests for each 5G base-station multi-antenna.

When used with the MX800046A Base Station Test Suite for NR sub-6GHz, the MX773000PC ODU emulator platform software measures up to four antennas simultaneously. This cuts setting and cable connection times for more efficient development and manufacturing with shorter test times.

The MX772000C O-RAN Test Platform software controls the MX773000PC and MX800046A to measure the downlink and uplink automatically. The test time is shorter because the multi-antenna measurement results can be displayed and evaluated at once.

This application note explains how to measure the multi-antenna of 5G base stations using the MX772000PC and MX773000PC simultaneously.

2. Preparations

2.1 Required Software

The following software are required to measure a multi-antenna.

Model	Name
MX772000PC	ORAN Test Platform
MX772000PC-TL001	MX773000PC Control Plugin (1 year)
MX772000PC-TL002	MT8000A Control Plugin (1 year)
MX773000PC	O-DU Emulator Platform Software
MX773000PC-TL001	ORU Test Suite (1 year)
MX773000PC-TL030	DL UC-Plane Player (1 year)
MX773000PC-TL040	UL U-Plane Analyzer (1 year)
MX800046A	MX800046A Base Station Test Suite for NR sub-6GHz

This multi-antenna measurement function is supported by the July 2024 beta test version. The later official release will require separate software purchase.

2.2 Required Hardware

The following hardware are required to measure multi-antenna.

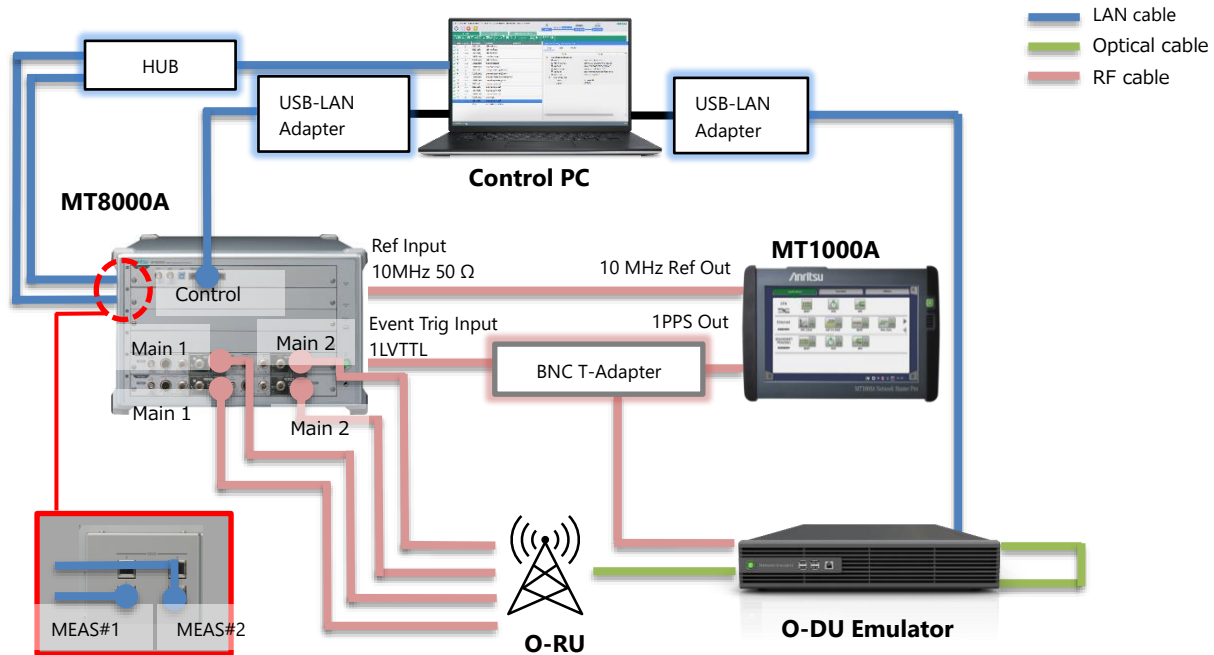
Model	Name
MT8000A	Radio Communication Test Station
MT8000A-001	Control Module
MT8000A-020*	RF Base Module
MT8000A-021*	0.4GHz-6GHz RF Sub Module
MT1000A	Network Master Pro
MT1000A-005	AUX I/O
MU100010A1	10G Multirate module
MU100010A-001	Up to 2.7G dual channel
MU100090B	High Performance GNSS Disciplined Oscillator

G0437A	Server for O-DU Emulator
G0438A	Accelerator card for O-RAN Fronthaul

*Install one of each to measure two antennas and two of each to measure four antennas.

2.3 Equipment Connections

Connect the test equipment as shown below to measure multiple antennas.



2.4 Required Conditions and Supported Range

- Use an attenuator as necessary between the O-RU and MT8000A.
- Before implementing the procedure in this application note, the M-Plane and S-Plane must be connected between the O-RU and O-DU Emulator.
- The sub-carrier spacing and channel bandwidth are as follows.

Sub-carrier Spacing	15 kHz, 30 kHz Only 15 kHz or 20 MHz channel bandwidth
Channel Bandwidth	20, 40, 60, 80, 100 MHz

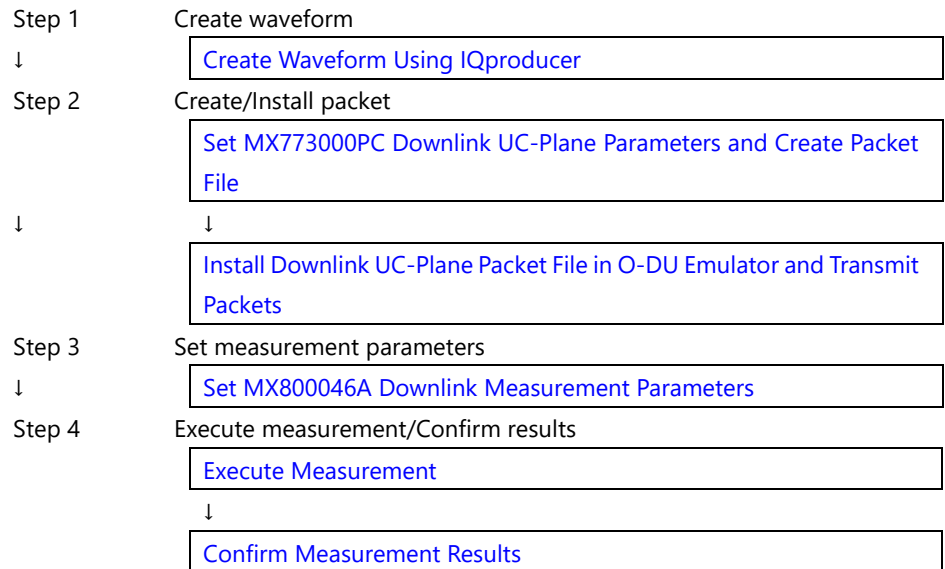
- The Test Model and Fixed Reference Channel are as follows.

Downlink	NR-FR1-TM1.1 NR-FR1-TM1.2 NR-FR1-TM2 / 2a NR-FR1-TM3.1 / 3.1a NR-FR1-TM3.2 NR-FR1-TM3.3
Uplink	G-FR1-A1-1 G-FR1-A1-2 G-FR1-A1-5

	G-FR1-A1-7
	G-FR1-A1-8
	G-FR1-A2-4
	G-FR1-A2-5

3. Multi-Antenna Measurement (Downlink) using MX773000PC

The following procedure is required to perform Downlink measurement of the multi-antenna using the MX773000PC Refer to sections 3.1 to 3.6 for concrete examples of the procedure.

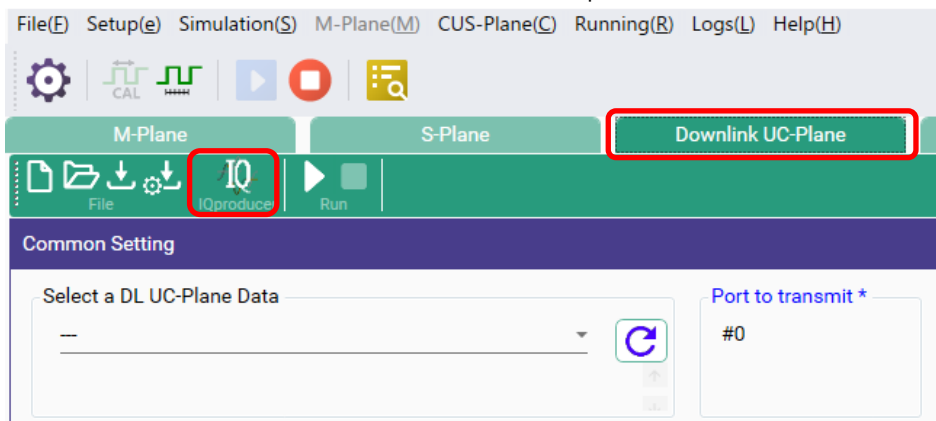


3.1 Create Waveform Using IQproducer

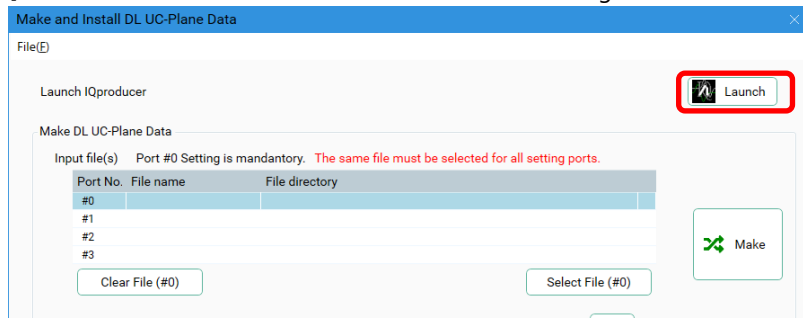
Use IQproducer to create the Downlink waveform (oraDllq) used by the MX773000PC.

[Setting Procedure]

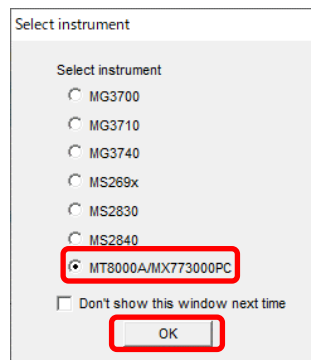
1. Select the MX773000PC Downlink UC-Plane tab and click the [IQproducer] button.



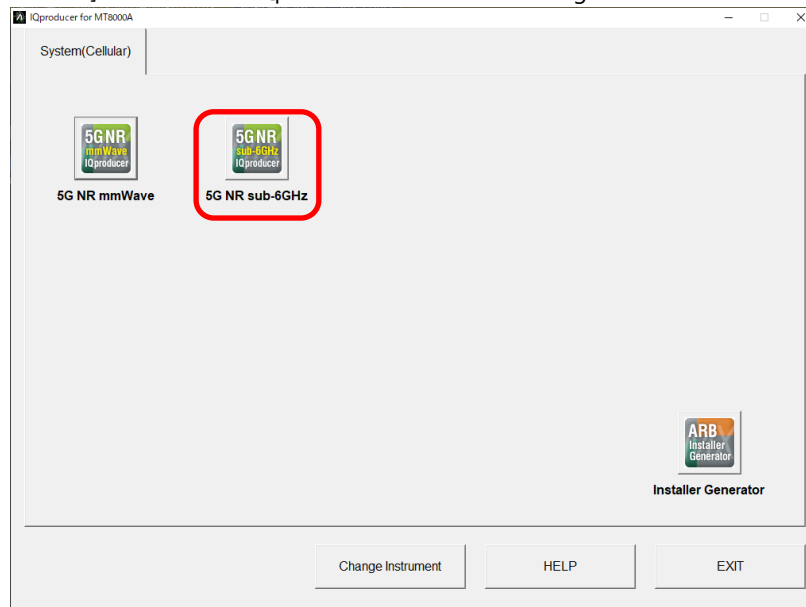
- Click the [Launch] button at the Make and Install DL UC-Plane Data dialog.



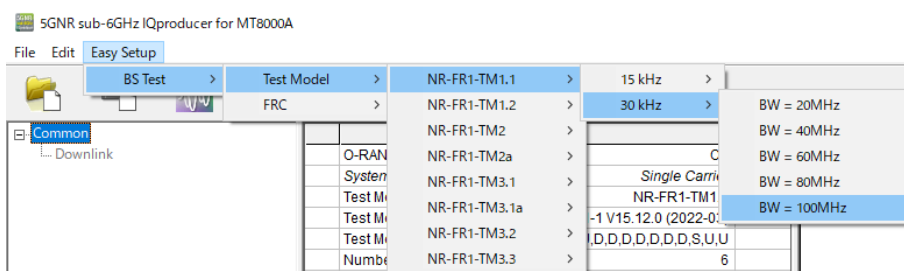
- Select MT8000A/MX773000PC at the Select instrument dialog and click the [OK] button.



- Click the [5G NR sub-6GHz] button at the IQproducer for MT8000A dialog.

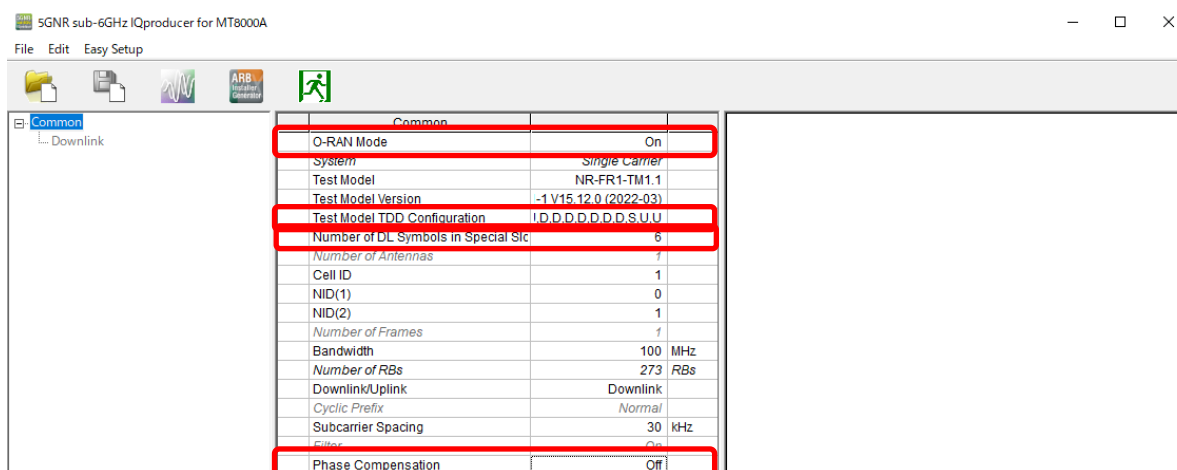


- Select [Easy Setup] → [BS Test] → [FRC] in sequence at the 5GNR sub-6GHz IQproducer for MT8000A dialog and select the target DL waveform.

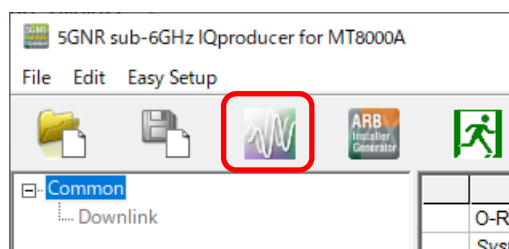


- Set the following parameters at the 5GNR sub-6GHz IQproducer for MT8000A dialog.

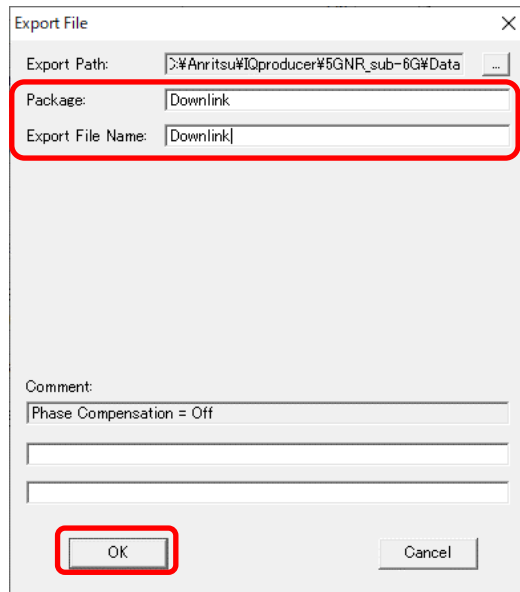
O-RAN Mode	On
TestModel TDD Configuration	Value matching O-RU settings Example: D,D,D,D,D,D,S,U,U,D,D,D,D,D,D,S,U,U
Number of DL Symbols in Special Slot	Value matching O-RU settings Example: 6
Phase Compensation	Off



- Click the [Calculation] button at the 5GNR sub-6GHz IQproducer for MT8000A dialog.

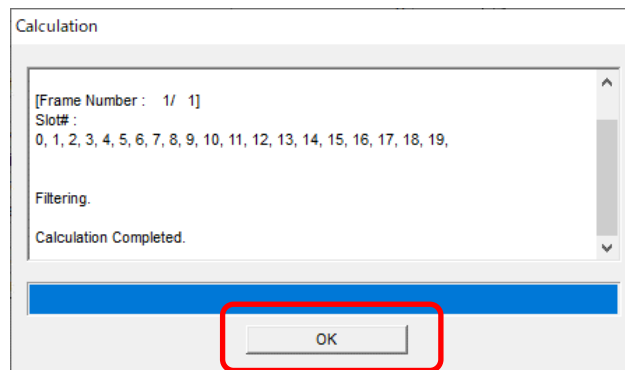


8. Input the Package and Export File Name at the Export File dialog and click the [OK] button to create the Downlink waveform file (oraDllq).



The 'Export File' dialog box is shown. It has a title bar with a close button. The 'Export Path' field contains '>#Anritsu#IQproducer#5G NR_sub-6G#Data'. The 'Package' field contains 'Downlink'. The 'Export File Name' field contains 'Downlink'. A red rectangle highlights the 'Package' and 'Export File Name' fields. Below these fields is a 'Comment' section with a text area containing 'Phase Compensation = Off'. At the bottom, there are 'OK' and 'Cancel' buttons. A red rectangle highlights the 'OK' button.

9. At the opened Calculation dialog, wait until the displayed [OK] button is enabled and click it.



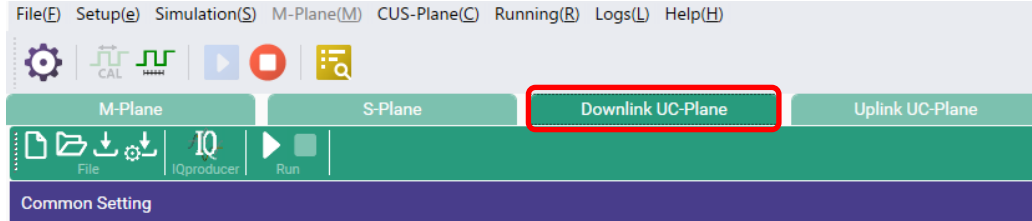
The 'Calculation' dialog box is shown. It has a title bar. The main area contains a text box with the following text: '[Frame Number : 1/ 1]', 'Slot# :', '0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19,', 'Filtering.', and 'Calculation Completed.'. Below the text box is a blue progress bar. At the bottom, there is an 'OK' button. A red rectangle highlights the 'OK' button.

3.2 Set MX773000PC Downlink UC-Plane Parameters and Create Packet File

Use the MX773000PC to set the Downlink parameters and create the multi-antenna Downlink UC-Plane packet file (oraDIPacket).

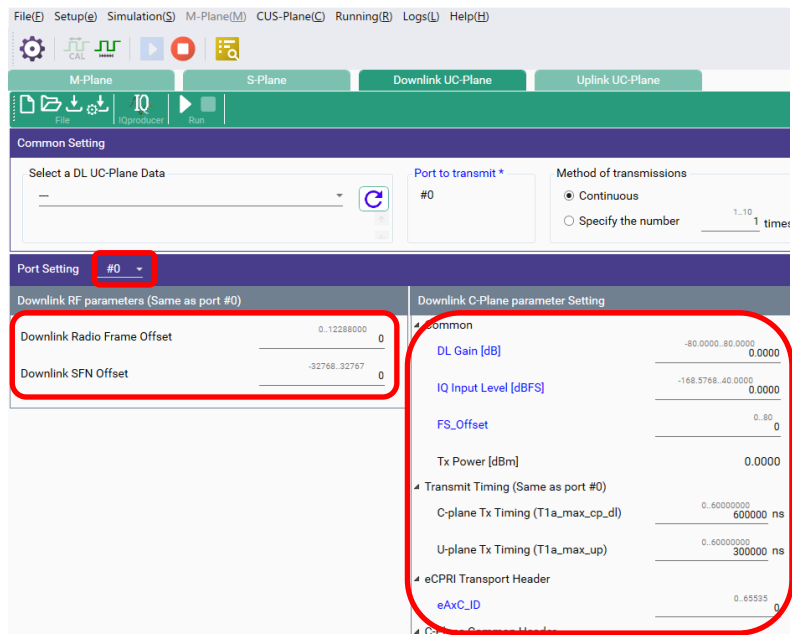
[Setting Procedure]

1. Select the MX773000PC Downlink UC-Plane tab.

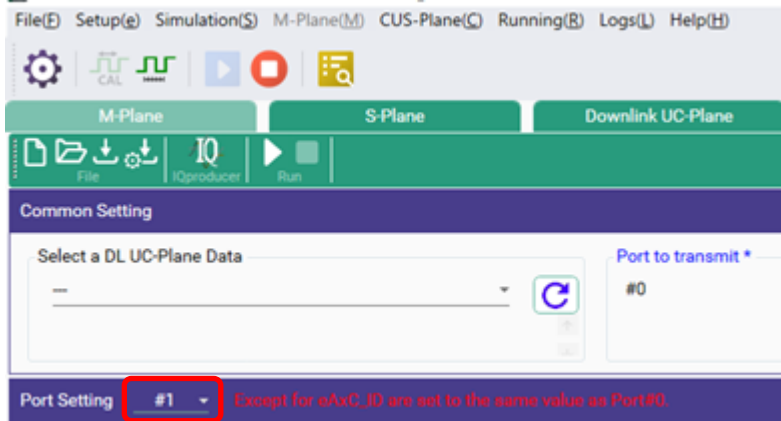


2. Make the settings for the first antenna (Port #0). Confirm that the Port Setting is #0 and set the Downlink RF parameters and Downlink C-Plane parameter Setting fields as follows.

Downlink RF parameters	
Downlink Radio Frame Offset	Value matching O-RU settings Ex: 0
Downlink SFN Offset	Value matching O-RU settings Ex: 0
Downlink C-Plane parameter Setting	
Common	
DL Gain[dB]	Value matching O-RU settings Ex: 0.0000
IQ Input Level[dBFS]	Value matching O-RU settings Ex: 0.0000
FS_Offset	Value matching O-RU settings Ex: 0
Transmit Timing	
C-plane Tx Timing	Value matching O-RU settings Ex: 600000
U-plane Tx Timing	Value matching O-RU settings Ex: 300000
eCPRI Transport Header	
eAxC_ID	Value matching O-RU settings Ex: 0
C-Plane Common Header	
startSymbolId	0
sectionType	1
CompressionType	Value matching O-RU settings Ex: Static
udCompHdr_IqWidth	Value matching O-RU settings Ex: 9
udCompHdr_CompMeth	Value matching O-RU settings Ex: 0001b_block_floating point
Split into Multi-Sections per nRNTI	OFF
Highest Subcarrier Spacing supported by O-RU[kHz]	Value matching O-RU settings Ex: 30
C-Plane Section Parameter	
rb	Value matching O-RU settings Ex: 0
symInc	Value matching O-RU settings Ex: 0
numPrbc Flag	Value matching O-RU settings Ex: 0:all PRBs
reMask	0xFFF
beamId	Value matching O-RU settings Ex: 0

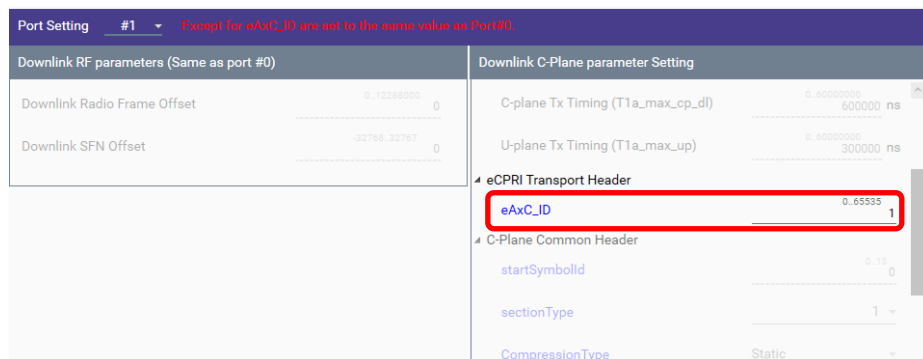


3. Select #1 (second antenna setting) at the Port Setting dialog.

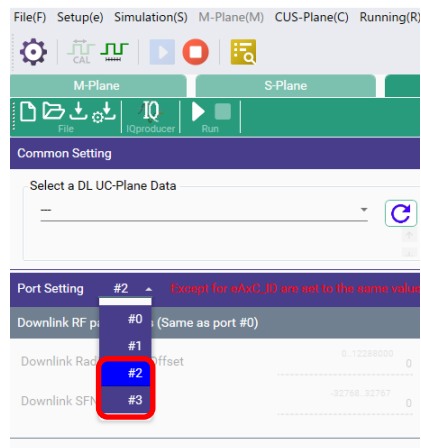


4. Set the following parameters.

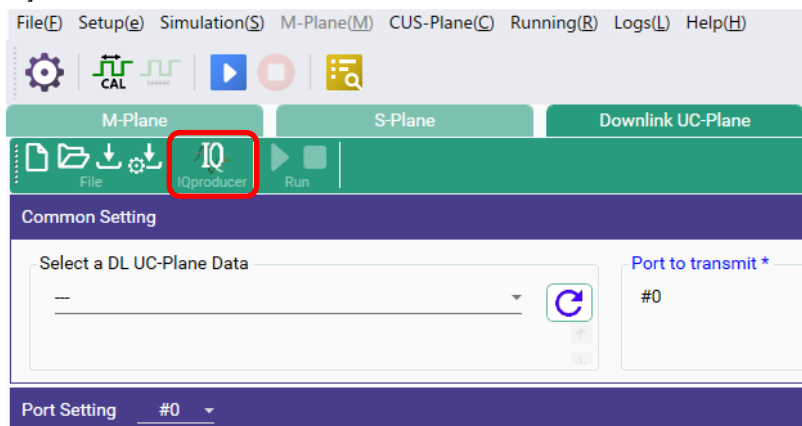
Downlink C-Plane parameter Setting	
eCPRI Transport Header	
eAxC_ID	Value matching O-RU settings Ex: 1



- Change the Port Setting to #2 and #3 (third and fourth antenna settings) in succession and make each settings as described in step 4.

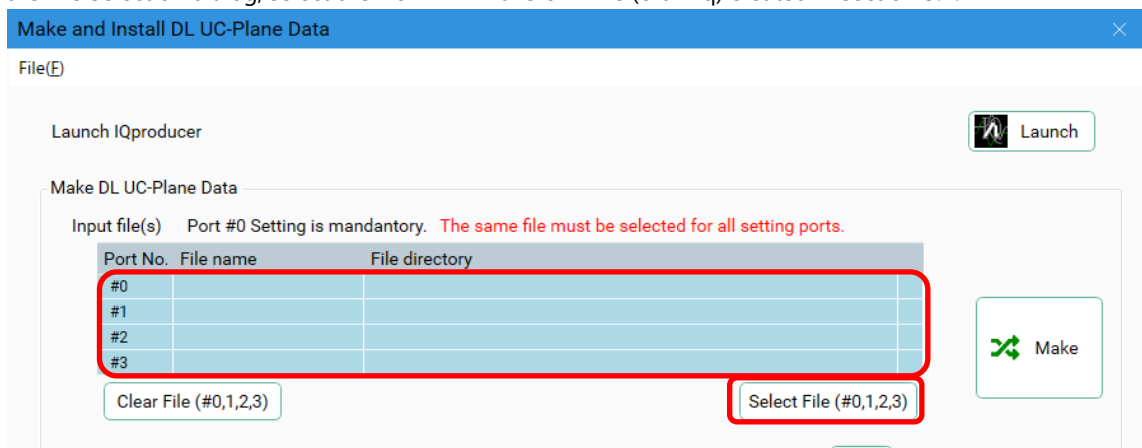


- Click the [IQproducer] button.

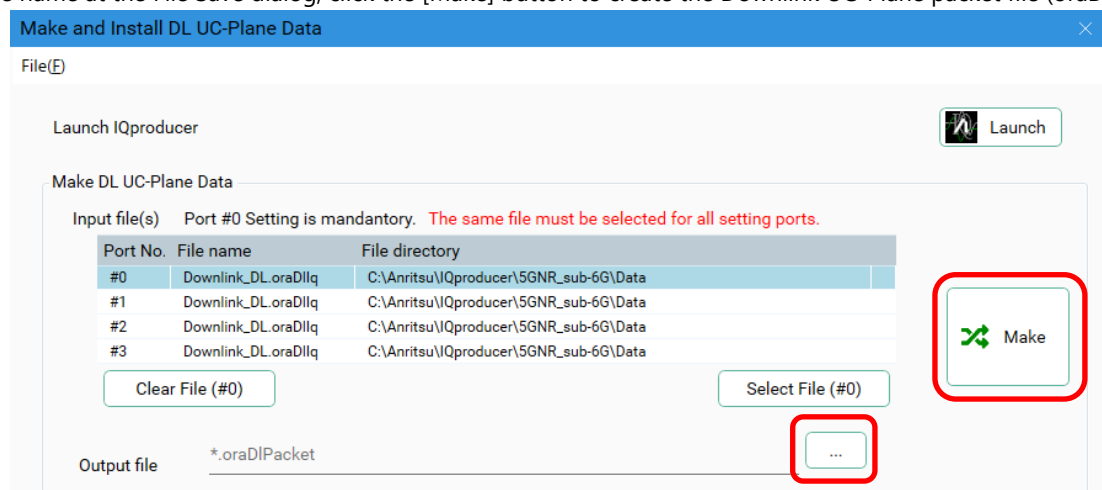


- While pressing Ctrl key at the Make and Install DL UC-Plane Data dialog, select Port No.#0 to #3 and click the [Select File(#0,1,2,3)] button.

At the File Selection dialog, select the Downlink waveform file (oraDllq) created in section 3.1.



- Click the [...] button in the Make DL UC-Plane Data field at the Make and Install DL UC-Plane Data dialog. After setting the file name at the File Save dialog, click the [Make] button to create the Downlink UC-Plane packet file (oraDIPacket).

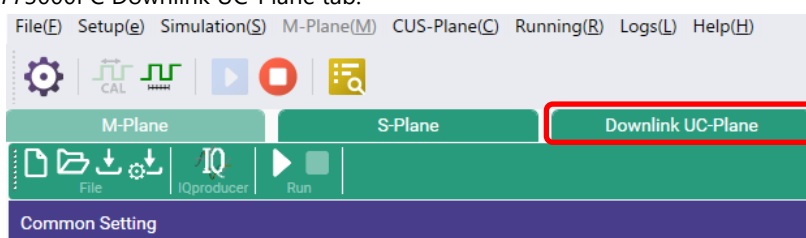


3.3 Install Downlink UC-Plane Packet File in O-DU Emulator and Transmit Packets

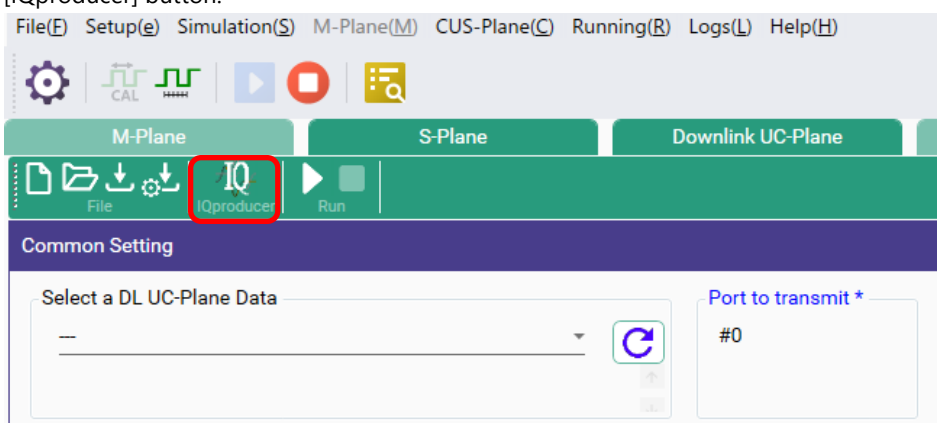
Use the MX773000PC to install the Downlink UC-Plane packet file (oraDIPacket) in the O-DU Emulator and transmit the multi-antenna packet to the O-RU.

[Setting Procedure]

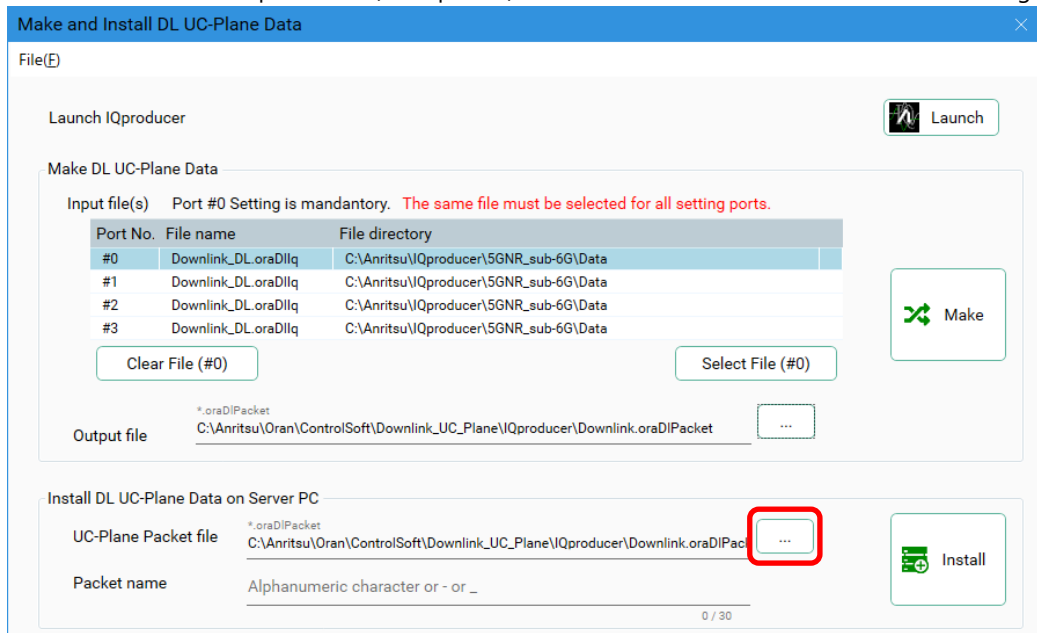
- Select the MX773000PC Downlink UC-Plane tab.



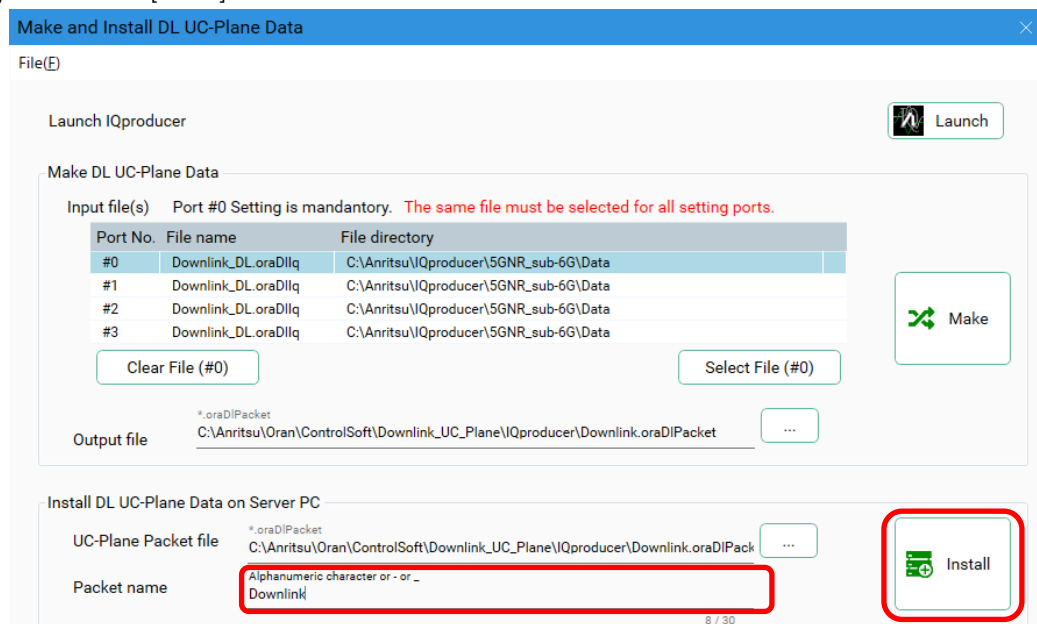
- Click the [IQproducer] button.



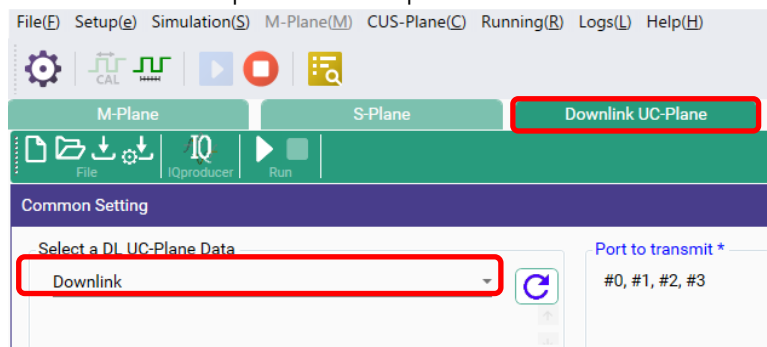
- Click the [...] button in the Install DL UC-Plane Data on Server PC field at the Make and Install DL UC-Plane Data dialog. Select the Downlink UC-Plane packet file (oraDlpacket) created in section 3.2 at the File Selection dialog.



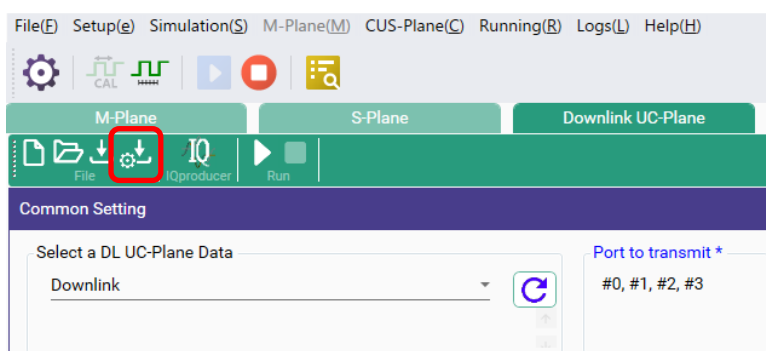
- Input the packet name at the Install DL UC-Plane Data on Server PC field of the Make and Install DL UC-Plane Data dialog and click the [Install] button.



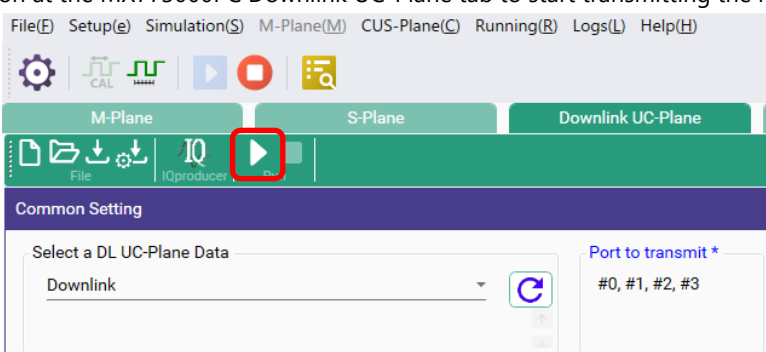
- Select the MX773000PC Downlink UC-Plane tab and click the [▼] button directly under Select a DL UC-Plane Data. Select the installed Packet name installed at step 4 from the dropdown menu.



- Click the MX773000PC [Save As] button. Set the file name at the File Save dialog to save the Downlink UC-Plane Setting file (orasg).



- Click the [Run] button at the MX773000PC Downlink UC-Plane tab to start transmitting the multi-antenna packet.



3.4 Set MX800046A Downlink Measurement Parameters

Use the MX800046A to set the multi-antenna Downlink analysis parameters.

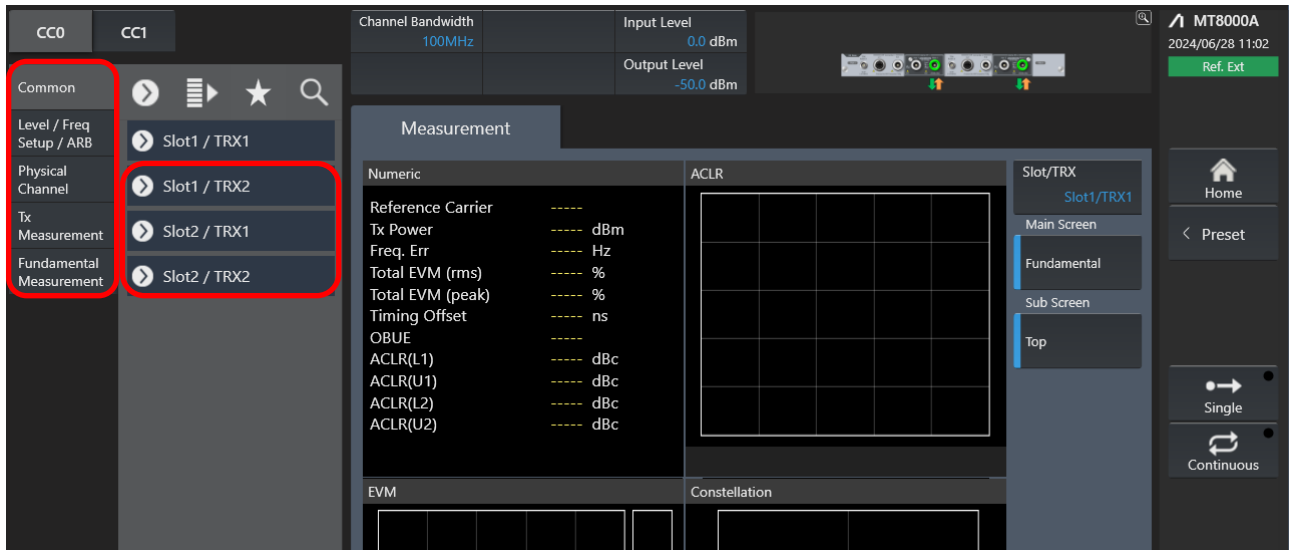
[Setting Procedure]

- Execute the first antenna settings. Set the MX800046A menu Slot1/TRX1 as follows.

Common	
Cell	
Subcarrier Spacing	Value matching waveform created in section 3.1 Ex. 30kHz
Channel Bandwidth	Value matching waveform created in section 3.1 Ex. 100MHz
Phy Cell ID	1
Event Trigger	
Input Setting	Input1
Level/Frequency Setup/ARB	
Frequency	
SA Frequency	Value matching O-RU settings Ex. 3351.000000MHz
SA Level	
Input Level	Value matching O-RU settings Ex. -30.0
Input Level Offset	Value matching measurement system Ex.10.0
Physical Channel	
General	
Test Model	Value matching waveform created in section 3.1 Ex.

	FR1_TM1_1
Tx Measurement	
General	
SA Trigger	On

- Using the same procedure as in step 1, set the same parameters for Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 (second to fourth antennas).

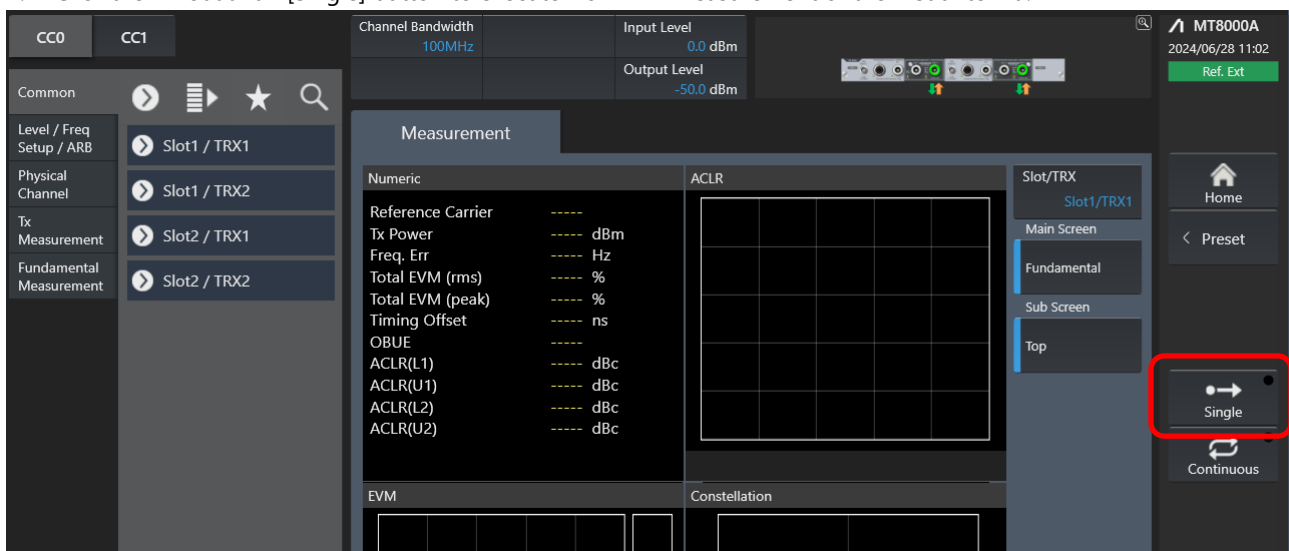


3.5 Execute Measurement

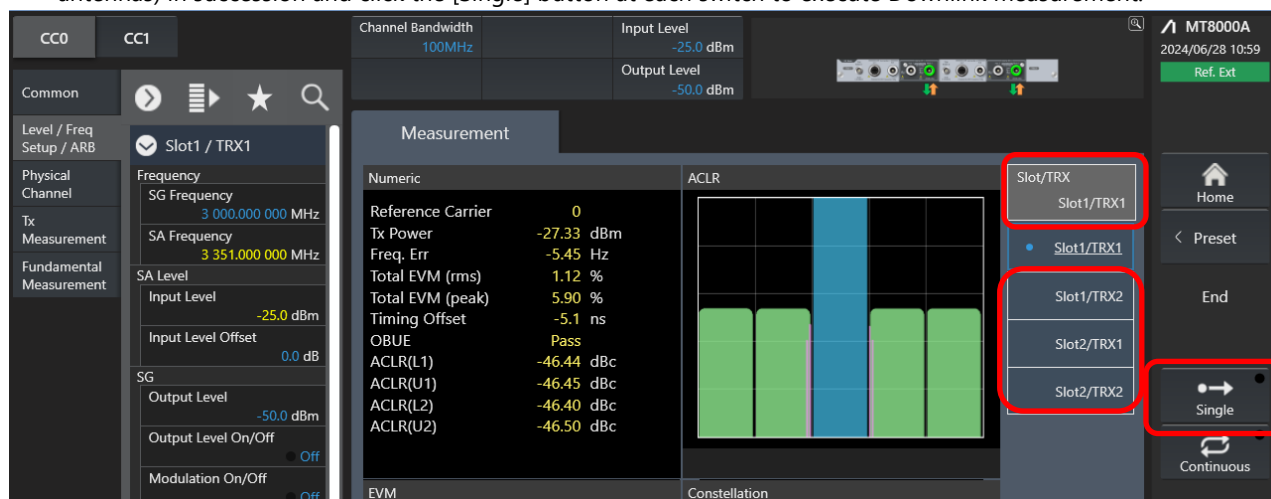
Use the MX800046A to execute multi-antenna Downlink measurement.

[Setting Procedure]

- Click the MX800046A [Single] button to execute Downlink measurement of the first antenna.



- Click the MX800046A Slot/TRX settings to switch between Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 (second to fourth antennas) in succession and click the [Single] button at each switch to execute Downlink measurement.

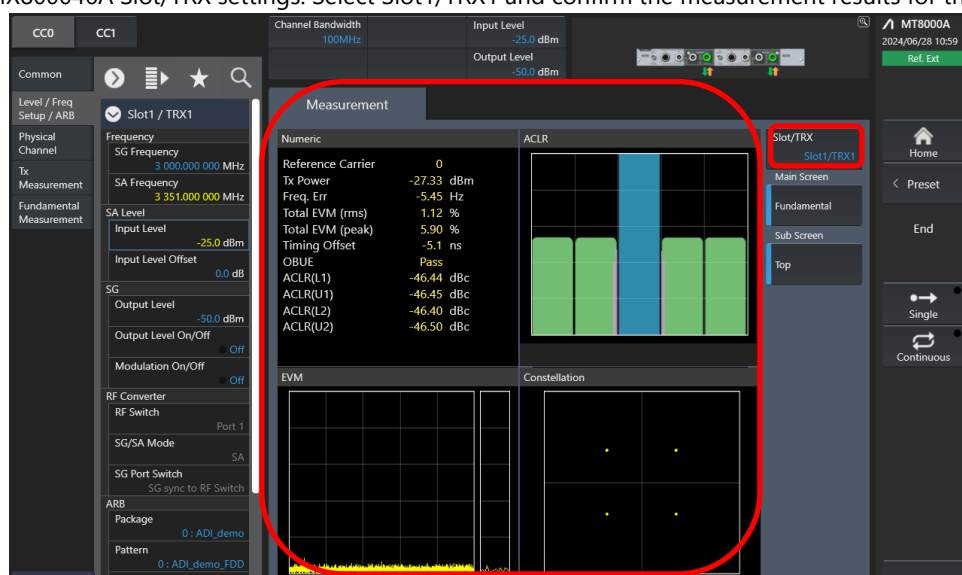


3.6 Confirm Measurement Results

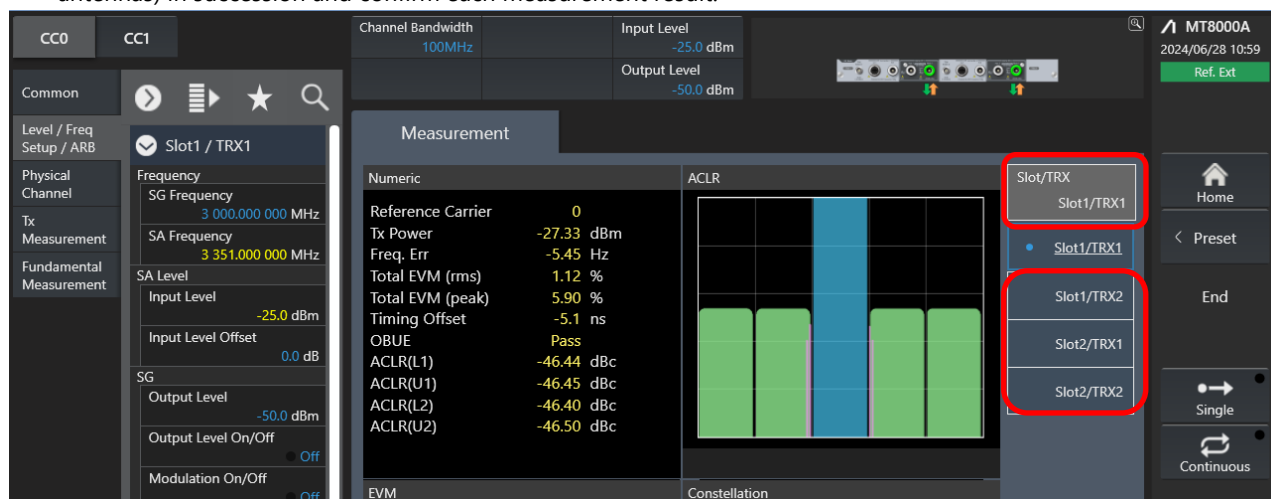
Use the MX800046A to confirm the multi-antenna measurement results.

[Setting Procedure]

- Click the MX800046A Slot/TRX settings. Select Slot1/TRX1 and confirm the measurement results for the first antenna.



- Click the MX800046A Slot/TRX settings to switch between Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 (second to fourth antennas) in succession and confirm each measurement result.



4. Multi-Antenna Measurement (Uplink) using MX773000PC

The following procedure is required to perform Uplink measurement of the multi-antenna using the MX773000PC Refer to sections 4.1 to 4.7 for concrete examples of the procedure.

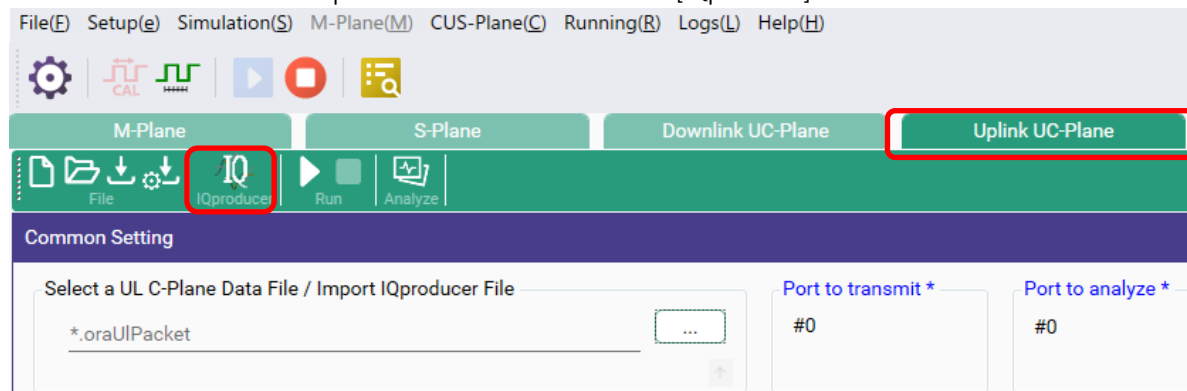
Step 1	Create waveform
↓	Create Waveform Using IQproducer
Step 2	Create and install waveform installer
↓	Create MT8000A Waveform Installer using IQproducer
↓	Install Waveform File in MT8000A
Step 3	Set measurement parameters
↓	Set MX800046A Uplink Parameters
↓	Set MX773000PC Uplink UC-Plane Parameters and Create Uplink C-Plane Data File
Step 4	Execute measurement/Confirm results
↓	Execute Measurement
↓	Confirm Measurement Results

4.1 Create Waveform Using IQproducer

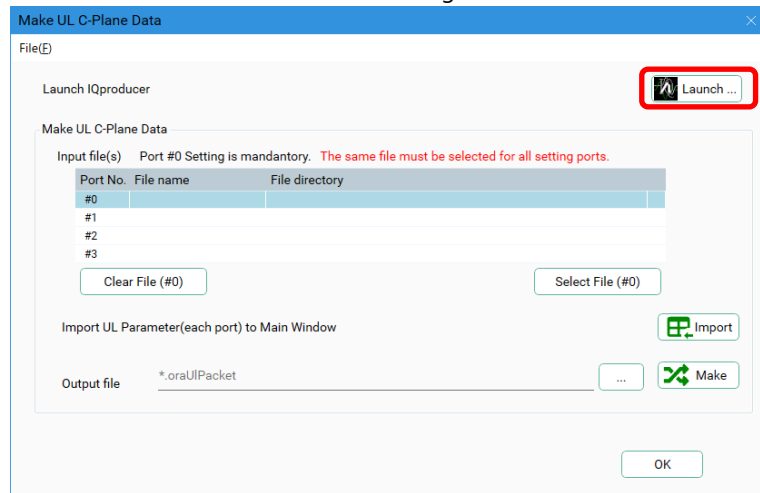
Use IQproducer to create the Uplink waveform files (oraUlIq and wvd) used by the MX773000PC and MX800046A.

[Setting Procedure]

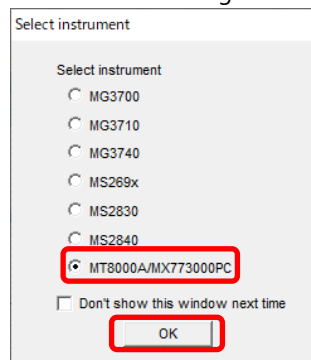
1. Select the MX773000PC Uplink UC-Plane tab and click the [IQproducer] button.



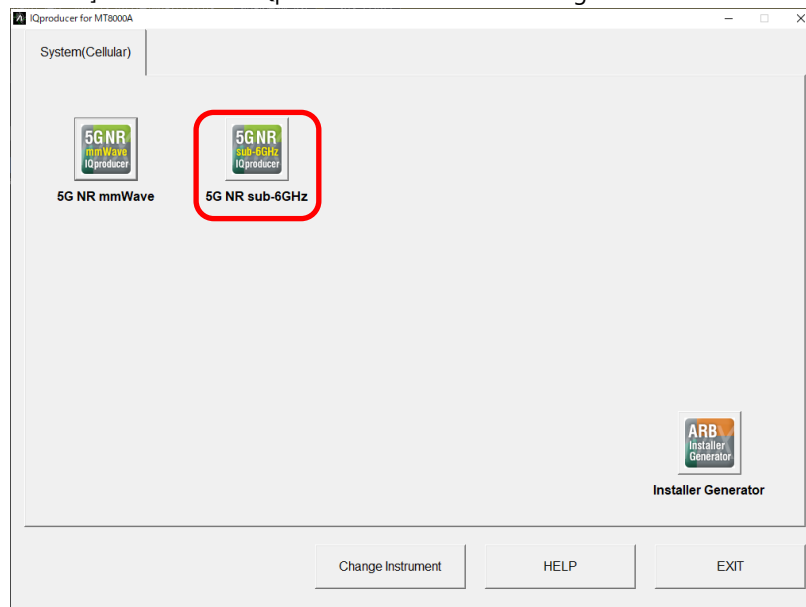
- Click the [Launch] button at the Make UL C-Plane Data dialog.



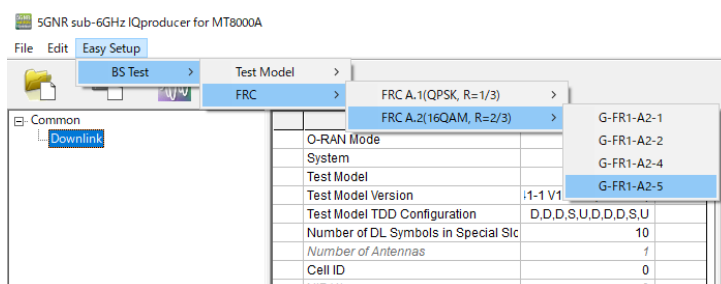
- Select MT8000A/MX773000PC at the Select instrument dialog and click the [OK] button.



- Click the [5G NR sub-6GHz] button at the IQproducer for MT8000A dialog.

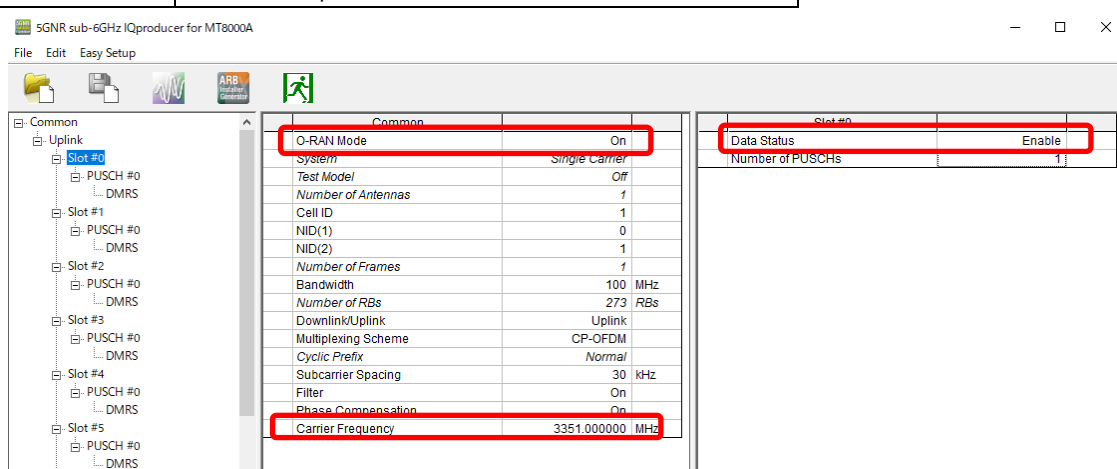


- Select [Easy Setup] → [BS Test] → [FRC] in sequence at the 5G NR sub-6GHz IQproducer for MT8000A dialog and select the measurement target FRC.

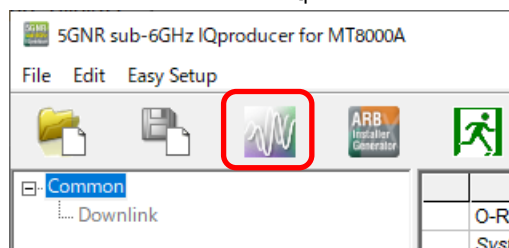


- Set the following parameters at the 5G NR sub-6GHz IQproducer for MT8000A dialog.

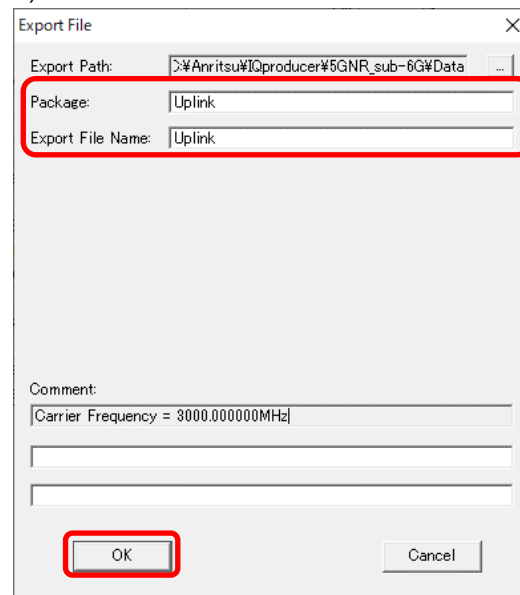
O-RAN Mode	On
Carrier Frequency	O-RU Frequency [MHz] Ex. 3351.000000[MHz]
Data Status	Enable for Uplink slot and Disable for Downlink Slot



- Click the [Calculation] button at the 5G NR sub-6GHz IQproducer for MT8000A dialog.

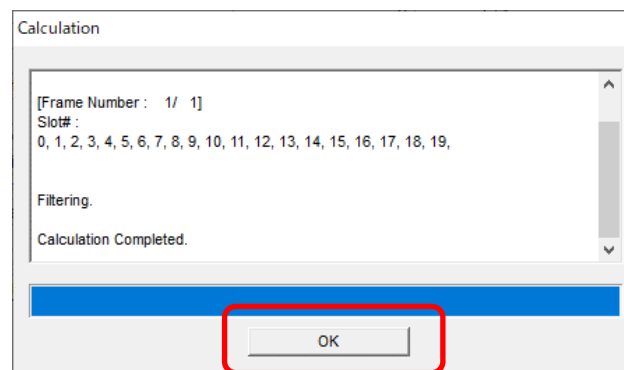


8. After inputting the Package and Export File name at the Export File dialog, click the [OK] button to create the Uplink waveform files (oraUllq and wvd).



The 'Export File' dialog box is shown. It has a title bar with a close button. The 'Export Path' field contains a file path. The 'Package' field contains 'Uplink'. The 'Export File Name' field contains 'Uplink'. A red rectangle highlights the 'Package' and 'Export File Name' fields. Below these fields is a 'Comment' section with a text area containing 'Carrier Frequency = 3000.000000MHz'. At the bottom, there are 'OK' and 'Cancel' buttons. A red rectangle highlights the 'OK' button.

9. When the Calculation dialog opens, wait until the [OK] button is enabled and then click it.



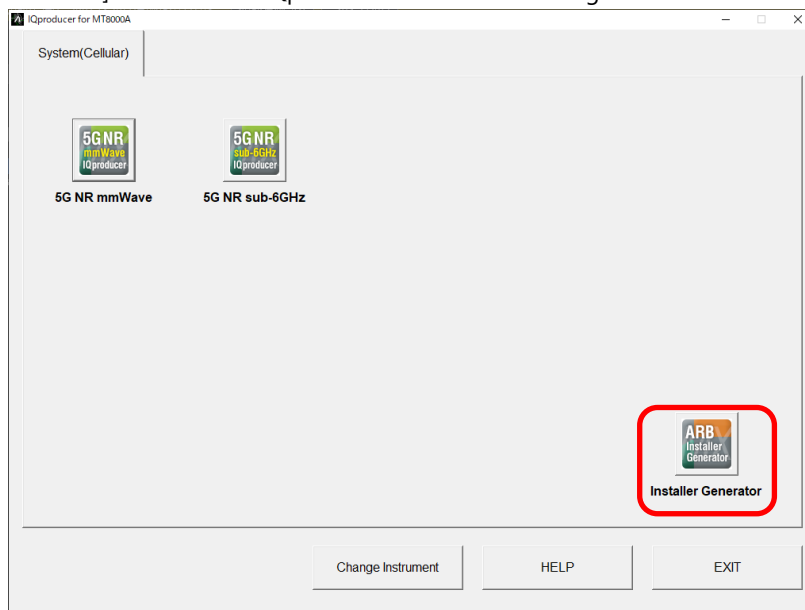
The 'Calculation' dialog box is shown. It has a title bar. The main area contains a text box with the following text: '[Frame Number : 1/ 1]', 'Slot# :', '0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19,', 'Filtering.', and 'Calculation Completed.'. Below the text box is a blue progress bar. At the bottom, there is an 'OK' button. A red rectangle highlights the 'OK' button.

4.2 Create MT8000A Waveform Installer using IQproducer

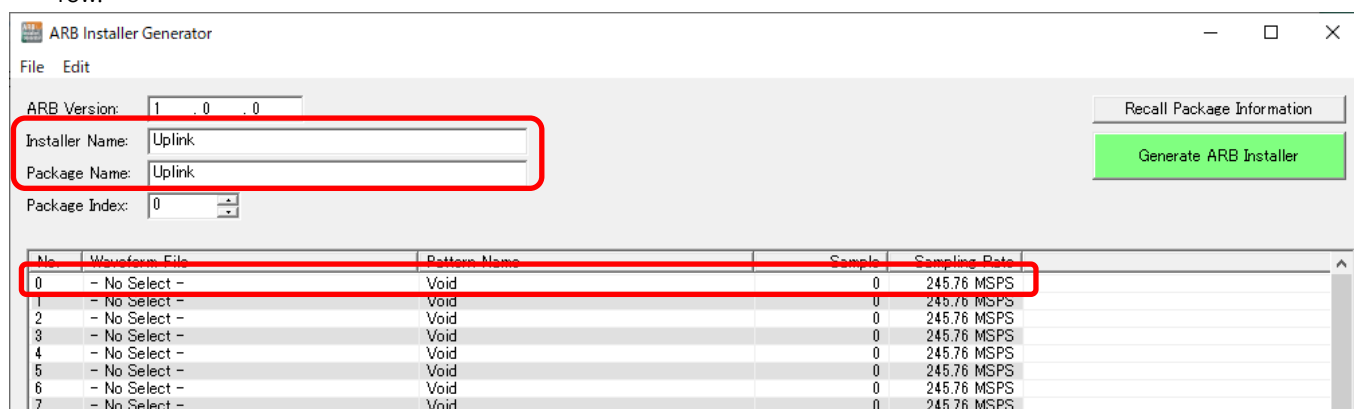
Use IQproducer to create the waveform installer for outputting the Uplink signal from the MT8000A.

[Setting Procedure]

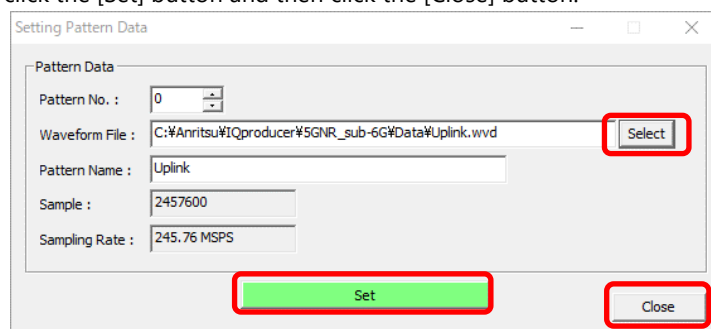
1. Click the [Installer Generator] button at the IQproducer for MT8000A dialog.



2. Input the Installer Name and Package Name in the rows at the ARB Installer Generator dialog and double-click the No.0 row.



3. Click the [Select] button at the Setting Pattern Data dialog. Select the Uplink waveform file (wvd) created in section 4.1 at the File Selection dialog.
After selecting the file, click the [Set] button and then click the [Close] button.



4. Confirm that No.0 is set at the ARB Installer Generator dialog, and click the [Generate ARB Installer] button. Set the name of the saved file at the File Save dialog to save the file.

ARB Installer Generator

File Edit

ARB Version: 1.0.0

Installer Name: Uplink

Package Name: Uplink

Package Index: 0

Recall Package Information

Generate ARB Installer

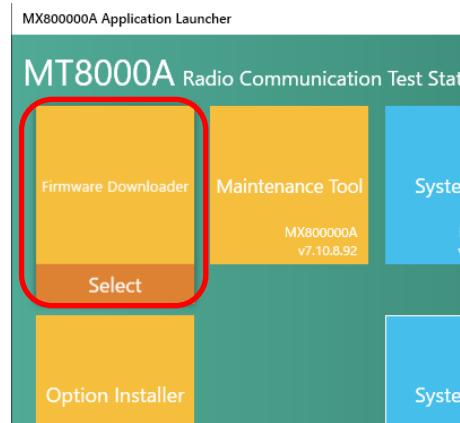
No.	Waveform File	Pattern Name	Sample	Sampling Rate
0	C:\Anritsu\IQproducer\5G NR_sub-6G\Data\...	Uplink	2457600	245.76 MSPS
1	- No Select -	Void	0	245.76 MSPS
2	- No Select -	Void	0	245.76 MSPS
3	- No Select -	Void	0	245.76 MSPS

4.3 Install Waveform File in MT8000A

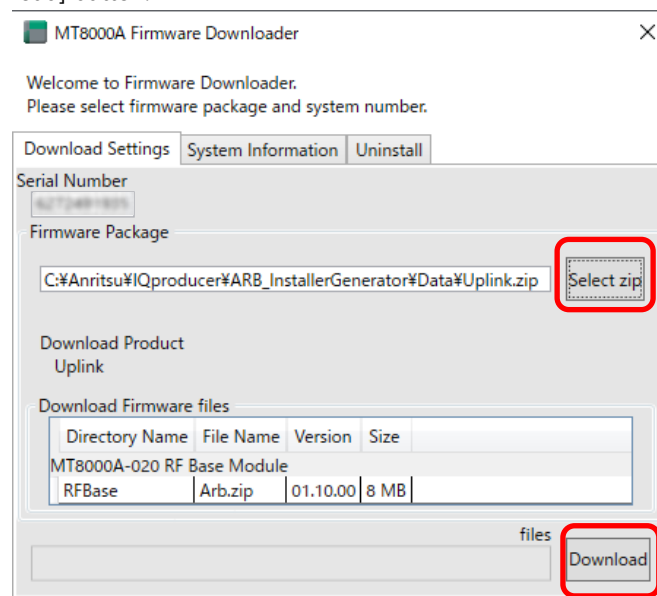
Install the Uplink waveform created as described in section 4.2 in the MT8000A.

[Setting Procedure]

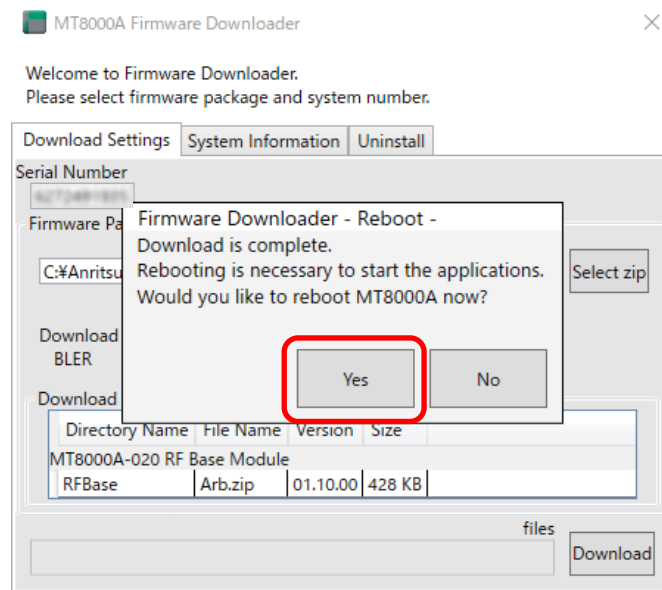
1. Click the [Firmware Downloader] button at the MX800000A Application Launcher.



2. Click the [Select zip] button at the MT8000A Firmware Downloader dialog and select the ARB Installer created in section 4.2. Next, click the [Download] button.



- After downloading completes, the Firmware Downloader - Reboot dialog is displayed. Click [Yes] to reboot the MT8000A.



4.4 Set MX800046A Uplink Parameters

Use the MX800046A to set the Uplink parameters and output the multi-antenna Uplink signal from the MT8000A.

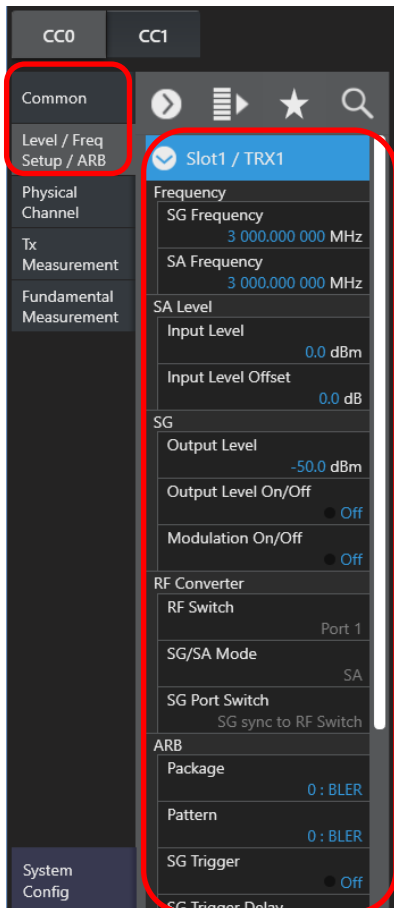
[Setting Procedure]

1. Execute the first antenna settings. Set the MX800046A menu Slot1/TRX1 as follows.

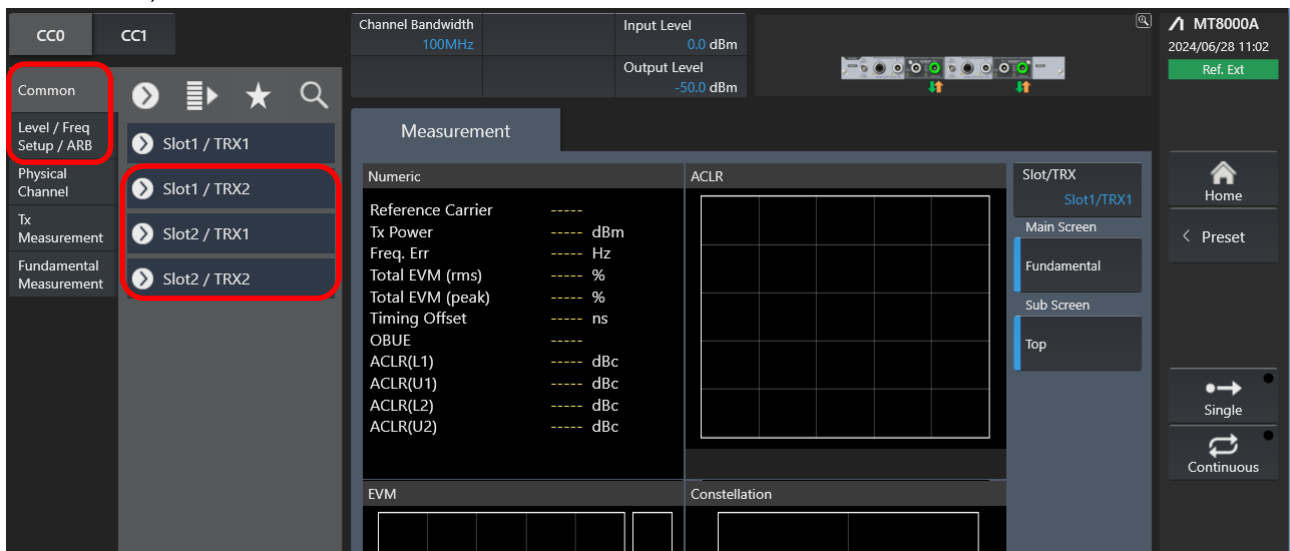
Common		
Event Trigger		
	Input Setting	Input1
Level/Frequency Setup/ARB		
Frequency		
	SG Frequency	Value matching O-RU settings Ex. 3351.000000MHz
SG		
	Output Level	O-RU Level Ex. -10.0[dBm]
	Output Level On/Off	On
	Modulation On/Off	On
ARB		
	Package	Package Number of waveform to output Ex. 0
	Pattern	Pattern Number of waveform to output Ex. 0
	SG Trigger	On
	SG Trigger Delay	Value calculated from O-RU n-ta-offset Ex. -2604

Example: SG Trigger Delay setting when n-ta-offset = 25600

n-ta-offset	25600	
Timing Advance [ns]	13021	n-ta-offset/1.96608
SG Trigger Delay [Sample@200MSPS]	-2604	-200 x Timing Advance x 10 ⁻³



- Using the same procedure as step 1, set the parameters for Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 (second to fourth antennas) in succession.

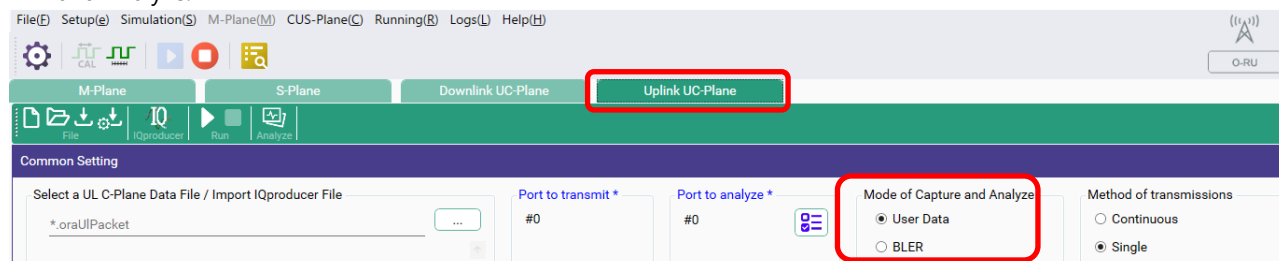


4.5 Set MX773000PC Uplink UC-Plane Parameters and Create Uplink C-Plane Data File

Use the MX773000PC to set and save the multi-antenna Uplink parameters.

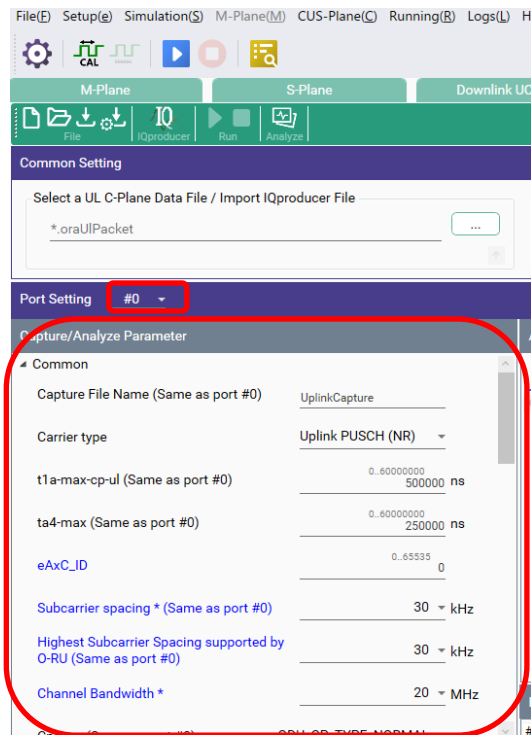
[Setting Procedure]

1. Select the MX773000PC Uplink UC-Plane tab and select the measurement mode (User Data or BLER) at Mode of Capture and Analyze.

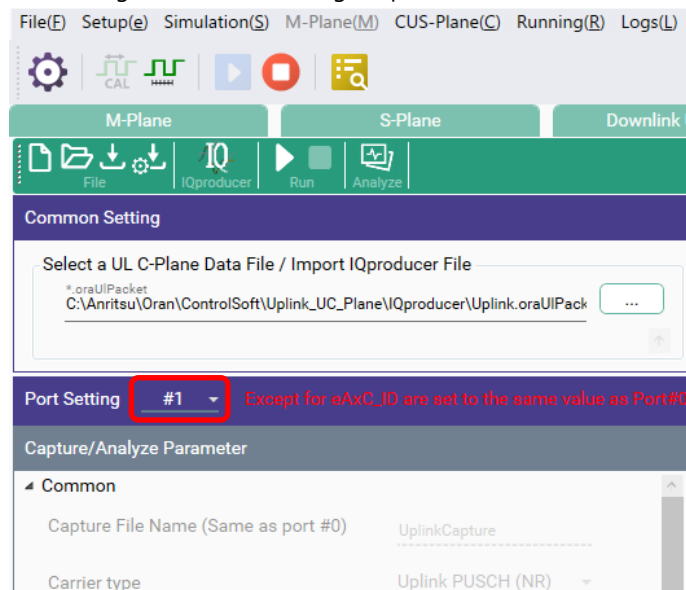


2. Execute the first antenna (Port #0) settings. Confirm that Port Setting is #0 and set the Capture/Analyze Parameter as follows.

Common	
t1a-max-cp-ul	Value matching O-RU settings Ex. 500000[ns]
ta4-max	Value matching O-RU settings Ex. 250000[ns]
eAxC_ID	Value matching O-RU settings Ex. 0
Highest Subcarrier Spacing supported by O-RU	Value matching O-RU settings Ex. 30[kHz]
Downlink Radio Frame Offset	Value matching O-RU settings Ex. 0
Downlink SFN Offset	Value matching O-RU settings Ex. 0
Compression Parameter	
Compression Type	Value matching O-RU settings Ex. Static
IQ bitwidth	Value matching O-RU settings Ex. 9
Compression Method	Value matching O-RU settings Ex. 0001b_block floating point
C-Plane Common Header	
startSymbolId	Value matching O-RU settings Ex. 0
C-Plane Section Parameter	
rb	Value matching O-RU settings Ex. 0
symInc	Value matching O-RU settings Ex. 0
numPrbc Flag	Value matching O-RU settings Ex. 0:all PRBs
reMask	0xFFFF
beamId	Value matching O-RU settings Ex. 0
Uplink Analysis Parameter	
gain-correction	Value matching O-RU settings Ex. 0
FS_Offset	Value matching O-RU settings Ex. 0
Number of TBs	Ex. 100 *Uplink Slot count per Number of TBs/Frame = Measures Frame count Only settable when BLER selected at step 1

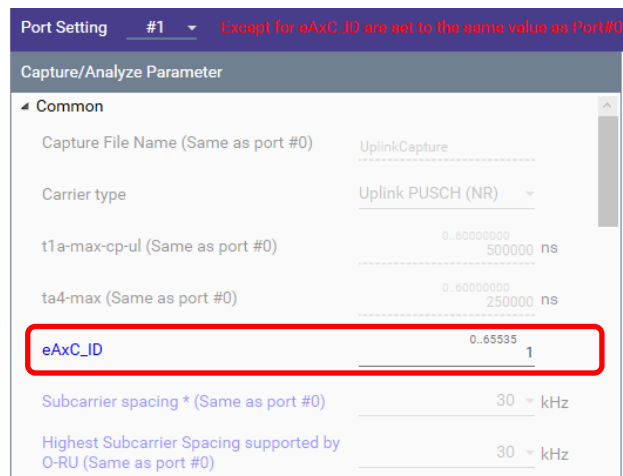


3. Select #1 (second antenna settings) at the Port Setting dropdown menu.

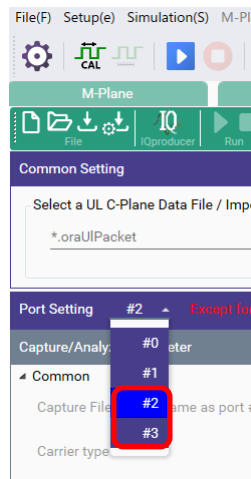


4. Set the following parameters.

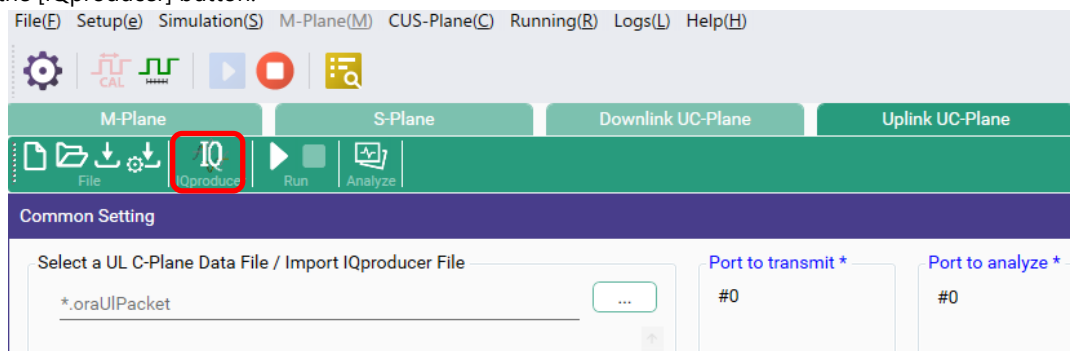
Capture/Analyze Parameter	
Common	
eAxC_ID	Value matching O-RU settings Ex. 1



- Change the Port Setting to #2, and #3 (third and fourth antenna settings) in succession and repeat the procedure in step 4.

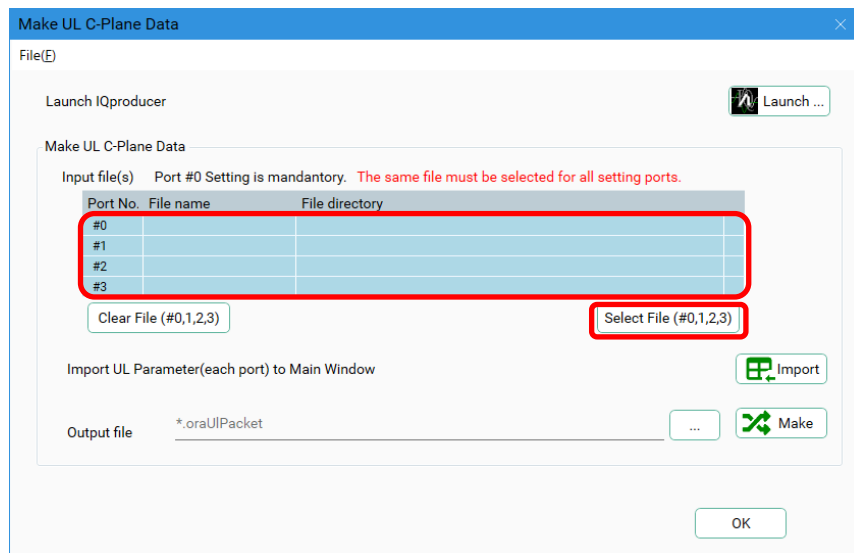


- Click the [IQproducer] button.

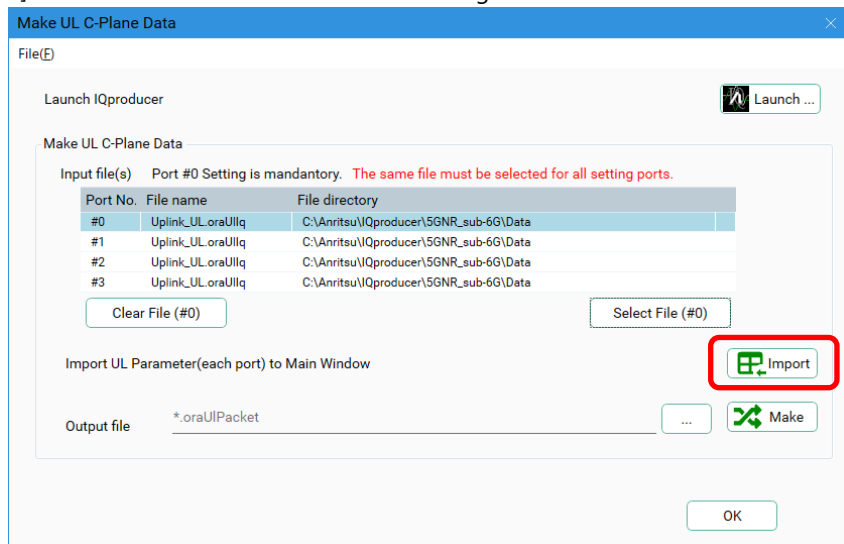


- While pressing Ctrl key at the Make UL C-Plane Data dialog, select Port No.#0 to #3 and click the [Select File(#0,1,2,3)] button.

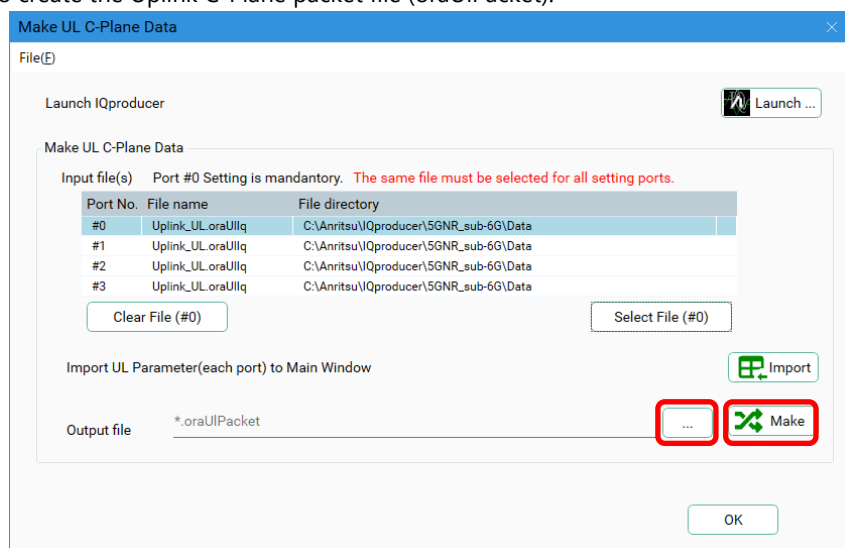
At the File Selection dialog, select the Uplink waveform file (oraUllq) created in section 4.1.



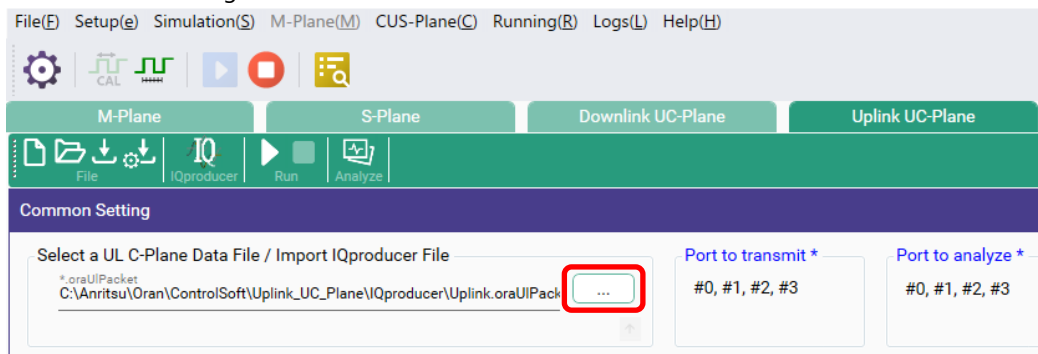
- Click the [Import] button at the Make UL C-Plane Data dialog.



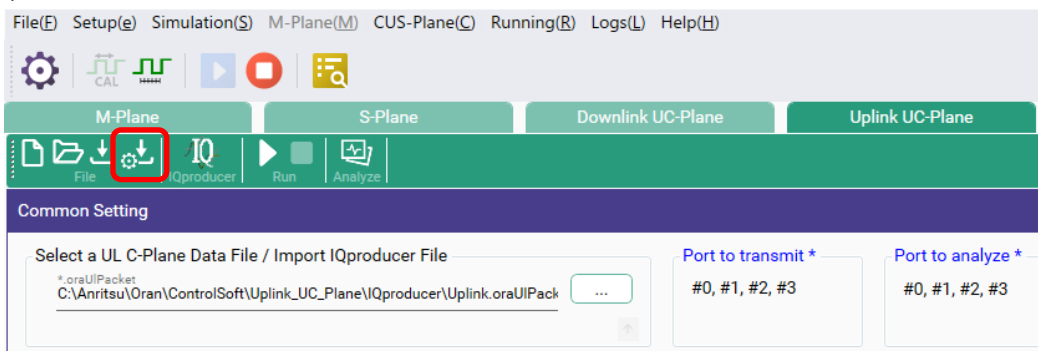
- Click the [...] button at the Make UL C-Plane Data dialog. Set the file name at the File Save dialog and then click the [Make] button to create the Uplink C-Plane packet file (oraUIPacket).



10. Click the [...] button at the MX773000PC Uplink UC-Plane tab. Select the Uplink C-Plane packet file (oraUIPacket) created in step 9 at the File Save dialog.



11. Click the MX773000PC [Save As] button. Set the file name at the File Save dialog to save the Uplink UC-Plane Setting file (orasa).

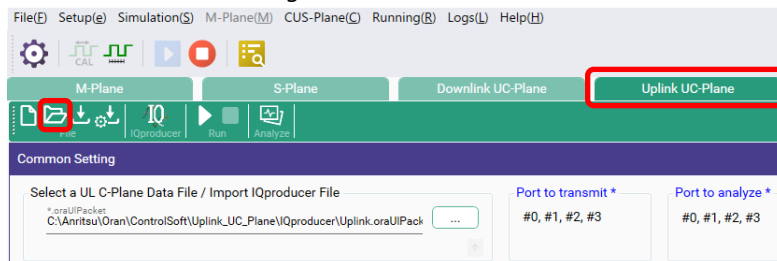


4.6 Execute Measurement

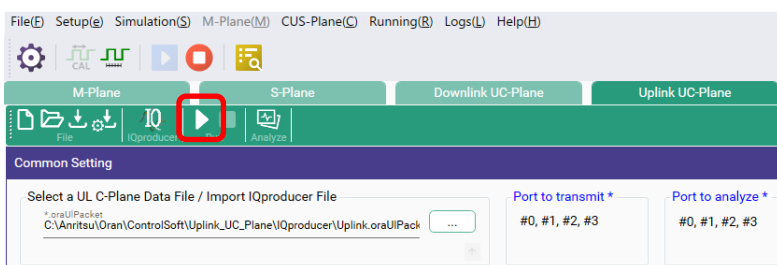
Transmit the Uplink C-Plane packet from the MX773000PC and execute multi-antenna Uplink measurement.

[Setting Procedure]

1. Select the MX773000PC Uplink UC-Plane tab and click the [Open] button. Select the Uplink UC-Plane Setting file (orasa) created in section 4.5 at the File Selection dialog.



2. Click the [Run] button.



4.7 Confirm Measurement Results

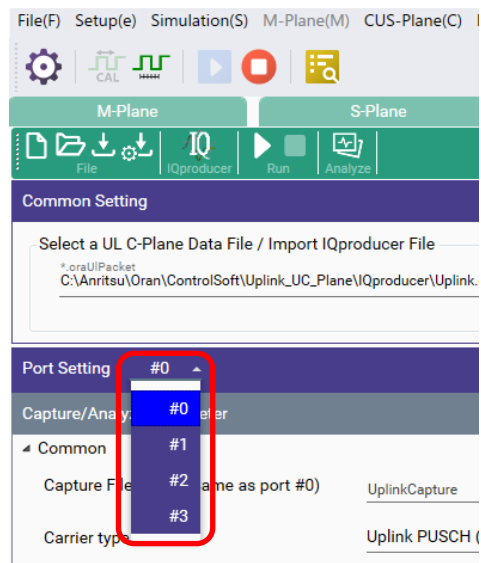
[Confirmation Procedure]

1. Select #0 at the Port Setting dropdown menu and confirm the first antenna measurement results in the MX773000PC Analyze Data field.

The screenshot shows the 'Analyze Data' window with the 'RF Measurement' tab selected. The results are displayed in a table. A red rounded rectangle highlights the table content.

Radio Frame Structure	All eAxC_ID	RF Measurement	Power vs RB	EVM vs Slot	EVM vs Subcarrier	Constellation	User Data
Frequency Error		15.3 Hz					
Interface resolution		-138.47 dBFS					
Configured UL gain		13.5 dB					
RF input level (On the calculation)		-47.31 dBm					
IQ Output Level		-33.81 dBFS					
Total EVM		1.1 %					
Origin Offset		-56.8 dB					
Timing Offset		48 ns					

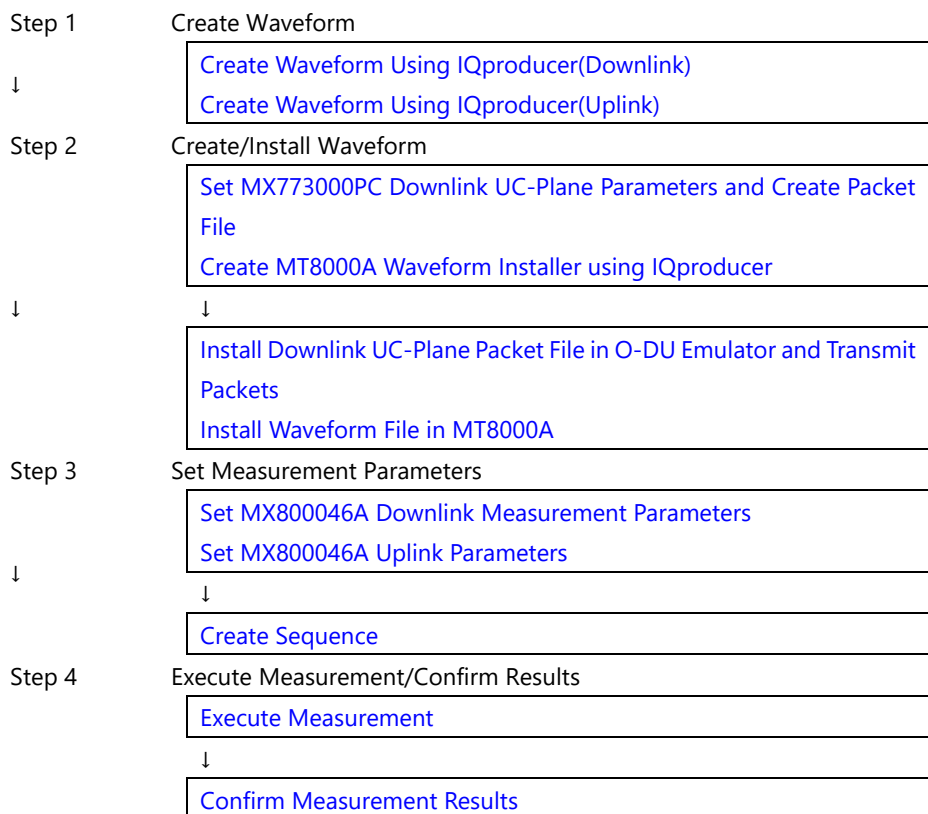
2. Select #1 to #3 successively at the Port Setting dropdown menu and confirm the second to fourth antenna measurement results in the Analyze Data field.



5. Multi-Antenna Automatic Measurement

Automatic multi-antenna Uplink and Downlink measurement can be performed by controlling the MX773000PC and MX800046A using the MX772000PC.

Automatic multi-antenna measurement using the MX772000PC requires the following procedure. If the procedures described in section 3.1 to 3.4, and 4.1 to 4.5 have been performed already, start the following procedure from step 3.



5.1 Create Sequence

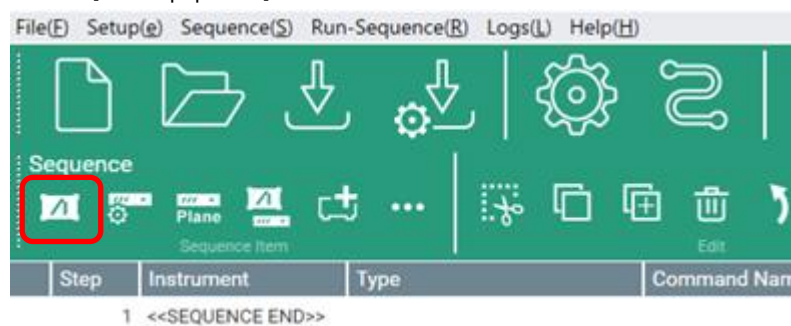
Create a sequence to control the MX773000PC and MX800046A using the MX772000PC and automatically execute Downlink and Uplink measurements.

This application note describes sequence creation including the following six steps.

Step	Contents	Control Target
1	Set Downlink measurement parameters	MX800046A
2	Transmit Downlink UC-Plane packet	MX773000PC
3	Execute Downlink measurement and evaluate	MX800046A
4	Stop transmitting Downlink UC-Plane packet	MX773000PC
5	Set Uplink waveform parameters and transmit waveform	MX800046A
6	Transmit Uplink C-Plane packet and execute Uplink measurement and evaluate	MX773000PC

[Creation Procedure]

1. Click the MX772000PC [Test Equipment] button.



2. Set the first antenna measurement parameters. Set as follows at the Test Equipment(New) dialog.

Controlled Ports	
Port	Slot1/TRX1
Execution target	Checkmark: On
Parameters	
Common	
Cell	
Subcarrier Spacing	Value matching used waveform Ex. 30kHz
Channel Bandwidth	Value matching used waveform Ex. 100MHz
Level/Frequency Setup/ARB	
Frequency	
SA Frequency	Value matching O-RU settings Ex. 3351.000000MHz
SA Level	
Input Level	Value matching O-RU settings Ex. 30.0
Input Level Offset	Value matching measurement system Ex. 10.0
Physical Channel	
General	
Test Model	Value matching used waveform Ex. FR1_TM1_1
Tx Measurement	
General	

SA Trigger	On
------------	----

Test Equipment(New)

Instrument: MT8000A

Type: Setting

Command Name: <Setting Parameters>

Controlled Ports

Port: Slot1/TRX1

☒ Execution target

Parameters

Common

- Level / Frequency Setup / ARB
- Physical Channel
- TX Measurement

- Switch the Controlled Port at the Test Equipment(New) dialog in succession between Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 to set the second to fourth Downlink measurement parameters. Set the same parameters as described in step 2 and click the [OK] button.

Test Equipment(New)

Instrument: MT8000A

Type: Setting

Command Name: <Setting Parameters>

Controlled Ports

Port: Slot1/TRX2

☒ Execution target

Parameters

Common

- Level / Frequency Setup / ARB
- Physical Channel
- TX Measurement

- Click the MX772000PC [O-DU Plane] button.

File(F) Setup(e) Sequence(S) Run-Sequence(R) Logs(L) Help(H)

Sequence

Sequence Item

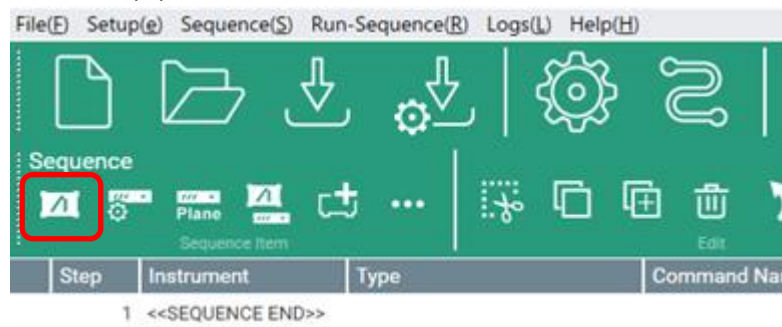
Step	Instrument	Type	Command
1	MT8000A	Setting	<Setting Parameters>
2	<<SEQUENCE END>>		

- Set the following Downlink UC-Plane packet transmit settings at the O-DU Plane(New) dialog and click the [OK] button.

Plane	UC-Plane:Downlink
Downlink UC-Plane Setting File (Checkboxes)	Checkmark: On
Downlink UC-Plane Setting File (File settings)	Downlink UC-Plane Setting file (orasg) saved in section 3.3

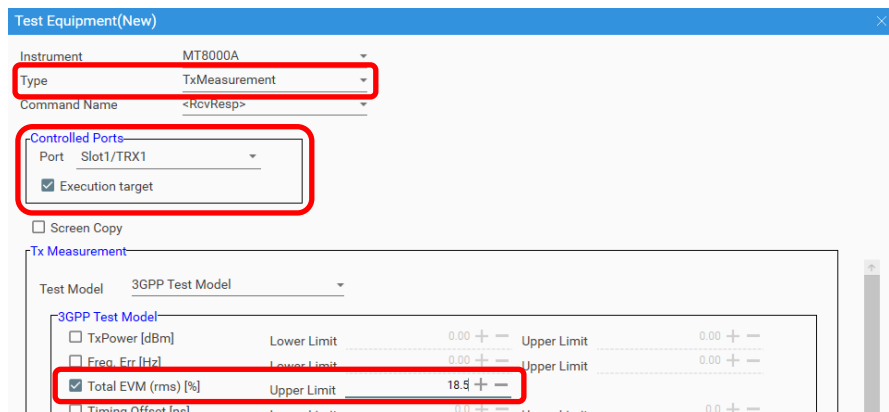
Transmit	Checkmark: On Start
----------	------------------------

6. Click the MX772000PC [Test Equipment] button.

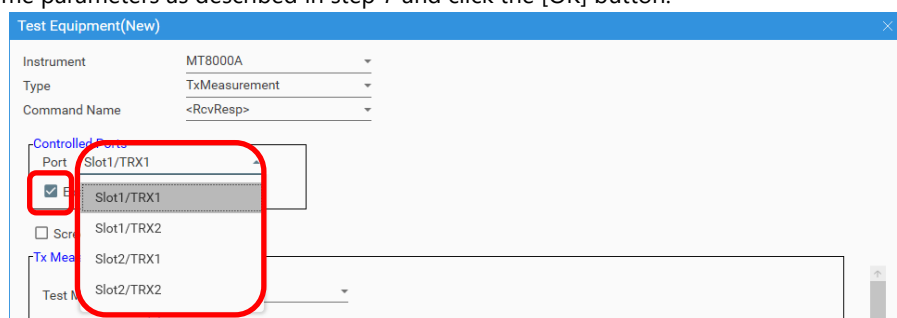


7. Set the following measurement and evaluation settings for the first antenna at the Test Equipment(New) dialog. Set checkmarks for Tx Measurement items to On and set the measurement and evaluation conditions. This application note only demonstrates the Total EVM measurement procedure.

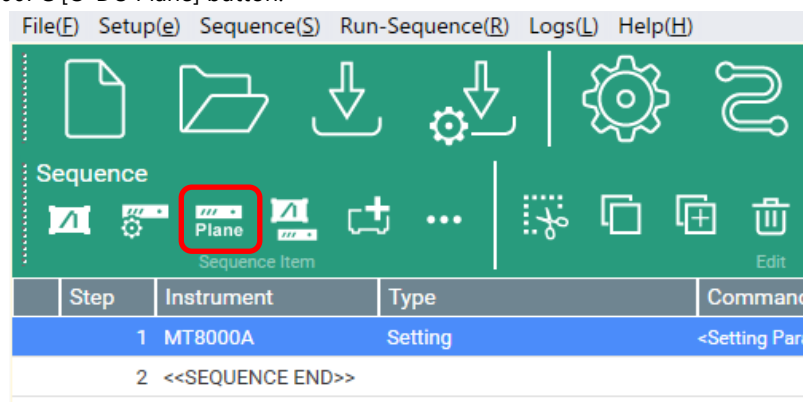
Type	Tx Measurement
Controlled Ports	
Port	Slot1/TRX1
Execution target	Checkmark: On
Tx Measurement	
3GPP Test Model	
Total EVM(rms) [%]	Checkmark: On Upper Limit 18.5



8. Switch the Controlled Port in succession between Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 to set the second to fourth measurement and evaluation conditions.
Set the same parameters as described in step 7 and click the [OK] button.



9. Click the MX772000PC [O-DU Plane] button.



10. Execute the following setting at the O-DU Plane(New) dialog to stop transmitting the Downlink UC-Plane packet, and click the [OK] button.

Plane	UC-Plane:Downlink
Transmit	Checkmark: On Stop

O-DU Plane(New)

Instrument: Anritsu O-DU

Plane: UC-Plane:Downlink

Type: Setting

Command Name: 0 / 32

☐ Downlink UC-Plane Setting File

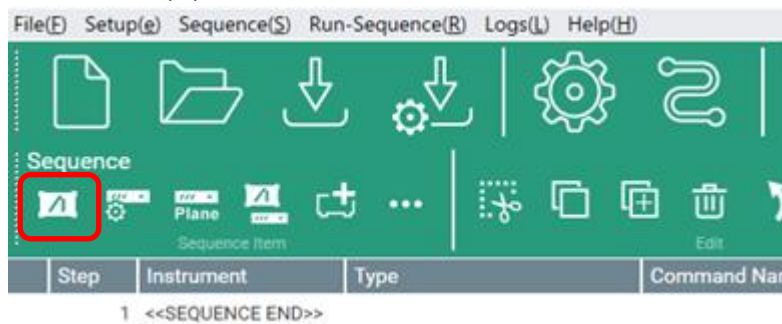
Launch Software

☒ Transmit Stop 0 / 256

Note: 0 / 200

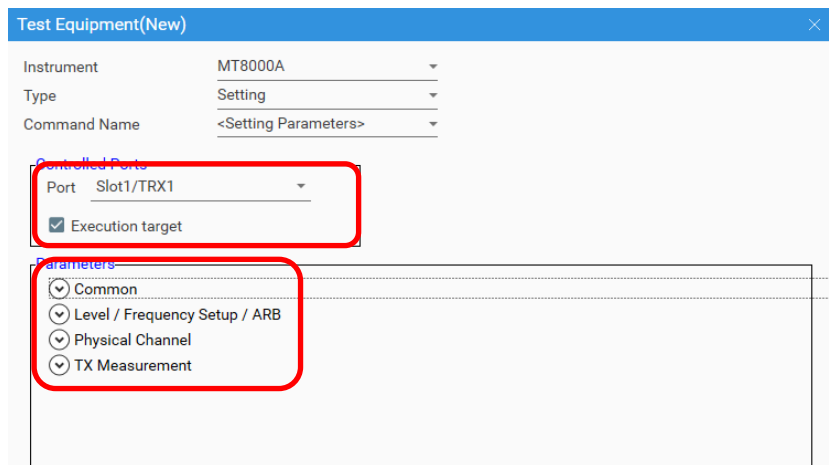
OK Cancel

11. Click the MX772000PC [Test Equipment] button.

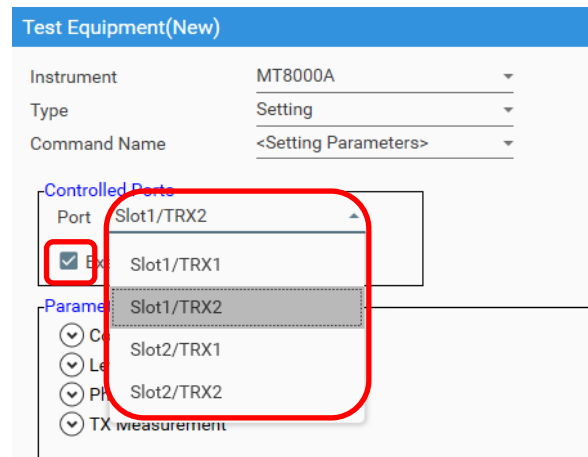


12. Set the first antenna Uplink waveform output from the MT8000A as follows at the Test Equipment(New) dialog.

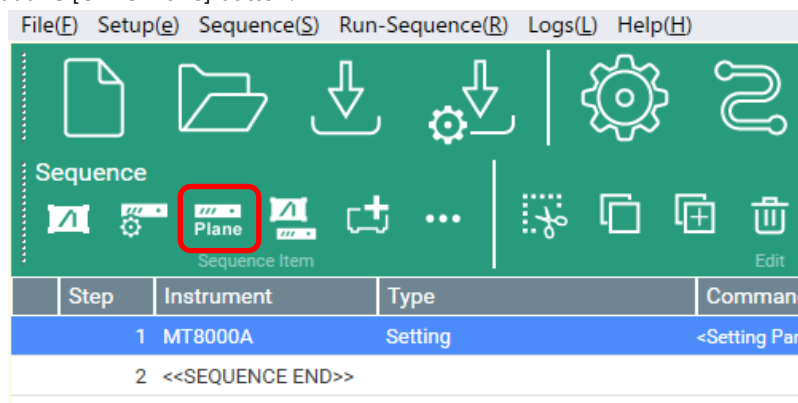
Controlled Ports	
Port	Slot1/TRX1
Execution target	Checkmark: On
Parameters	
Level/Frequency Setup/ARB	
Level/Frequency	
SG Frequency	O-RU Frequency Ex. 3351.000000[MHz]
SG	
Output Level	O-RU Level Ex. -10.0[dBm]
Output Level On/Off	On
Modulation On/Off	On
ARB	
Package Index	Package Number of output waveform Ex. 0
Pattern Index	Pattern Number of output waveform Ex. 0
SG Trigger	On
SG Trigger Delay	Value calculated from O-RU n-ta-offset Ex. -2604



13. Switch the Controlled Ports to Slot1/TRX2, Slot2/TRX1, and Slot2/TRX2 in succession and set the second to fourth antenna output Uplink waveform at the Test Equipment(New) dialog. Set the same parameters as in step 12 and click the [OK] button.



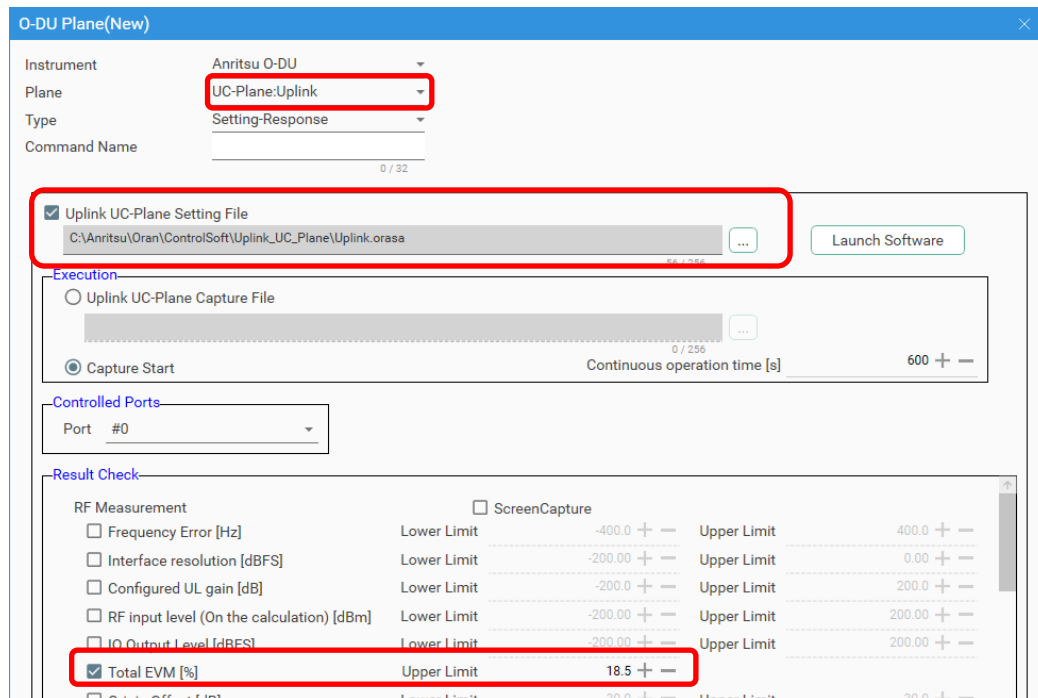
14. Click the MX772000PC [O-DU Plane] button.



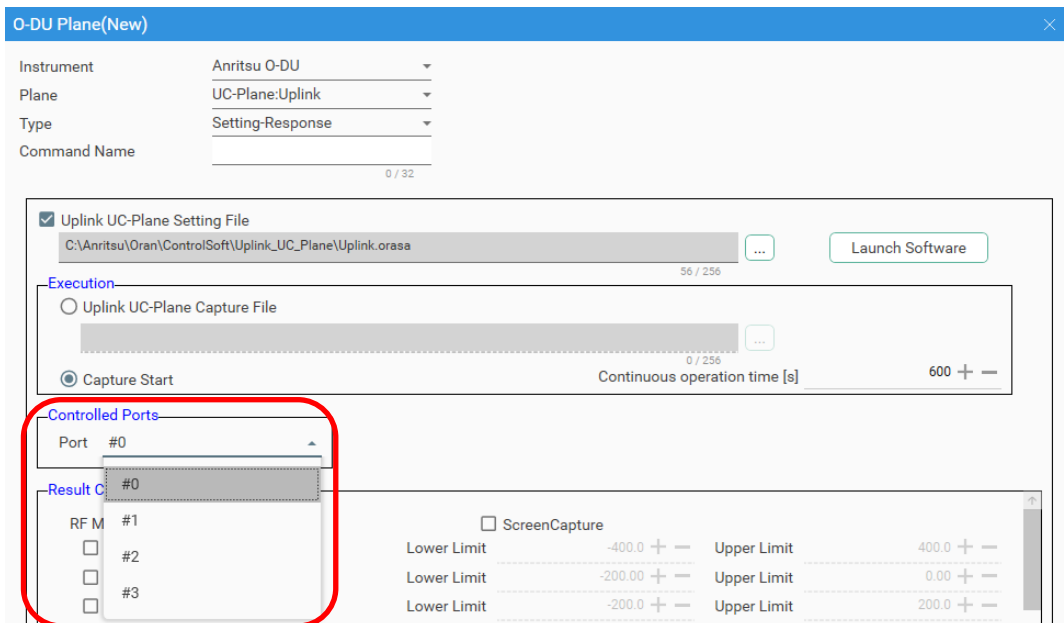
15. Set the following first antenna Uplink C-Plane transmit setting and the Uplink measurement conditions at the O-DU Plane(New) dialog.

Plane	UC-Plane:Uplink *UC-Plane:Uplink(BLER) when measuring BLER
Uplink UC-Plane Setting File (Checkboxes)	Checkmark: On
Uplink UC-Plane Setting File (File settings)	Uplink UC-Plane Setting filed (orasa) saved in section 4.5
Result Check	

RF Measurement	
Total EVM[%]	Checkmark: On Upper Limit 18.5

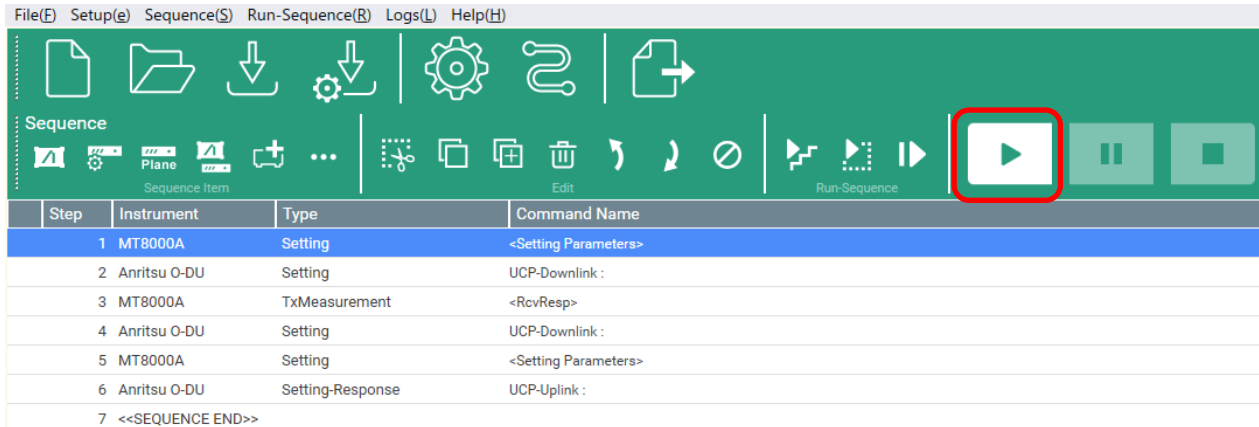


16. Switch Controlled Ports to #1, #2, and #3 in succession and set the Uplink C-Plane packet transmit settings and Uplink measurement conditions at the O-DU Plane(New) dialog. Set the same parameters as in step 15 and click the [OK] button.



5.2 Execute Measurement

1. Click the MX772000PC [Run(all)] button to execute measurement.



5.3 Confirm Measurement Results

1. Confirm the Downlink measurement results for step 3 at the MX772000PC Execution Log. The Upper Limit set at step 7 described in section 5.1, Total EVM, and evaluation results are displayed for each antenna.

11:28:56.427	3	OK	MT8000A	TxMeasurement	<RcvResp>	Port [Slot1/TRX1], Test Model [3GPP Test Model]
	3	Pass				Port [Slot1/TRX1] Total EVM (rms) [%]=1.21 : spec <= 18.50
11:28:56.427	3	OK	MT8000A	TxMeasurement	<RcvResp>	Port [Slot1/TRX2], Test Model [3GPP Test Model]
	3	Pass				Port [Slot1/TRX2] Total EVM (rms) [%]=1.26 : spec <= 18.50
11:28:56.427	3	OK	MT8000A	TxMeasurement	<RcvResp>	Port [Slot2/TRX1], Test Model [3GPP Test Model]
	3	Pass				Port [Slot2/TRX1] Total EVM (rms) [%]=1.27 : spec <= 18.50
11:28:56.427	3	OK	MT8000A	TxMeasurement	<RcvResp>	Port [Slot2/TRX2], Test Model [3GPP Test Model]
	3	Pass				Port [Slot2/TRX2] Total EVM (rms) [%]=1.31 : spec <= 18.50

2. Confirm the Uplink measurement results for step 6 at the MX772000PC Execution Log.

The Upper Limit set at step 15 described in section 5.1, Total EVM, and evaluation results are displayed for each antenna.

11:31:29.155	6	OK	Anritsu O-DU	Setting-Response	UCP-Uplink :	Uplink UC-Plane Setting File "Uplink.orasa" : "C:\Anritsu\Oran\ControlSoft\Uplink_UC_Plane", Execution [Capture Start]
	6	Pass				Port [#0] Rx Measurement-Total EVM [%]=1.3 : spec <= 18.5
	6	Pass				Port [#1] Rx Measurement-Total EVM [%]=1.4 : spec <= 18.5
	6	Pass				Port [#2] Rx Measurement-Total EVM [%]=1.4 : spec <= 18.5
	6	Pass				Port [#3] Rx Measurement-Total EVM [%]=4.7 : spec <= 18.5

6. Conclusion

This application note explains the 5G base station multi-antenna test method using the O-DU Emulator. The MX72000PC and MX773000PC help shorten multi-antenna test times to facilitate 5G base station development and manufacturing.



Specifications are subject to change without notice.

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