MX887067A
NB-IoT Uplink
TX Measurement
Operation Manual

First Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided in the MT8870A Universal Wireless Test Set Operation Manual. Please also refer to this document before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W3937AE-1.0

Safety Symbols

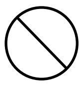
To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

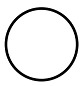
⚠ DANGER	This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
⚠ WARNING	This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
⚠ CAUTION	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

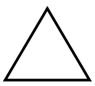
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.



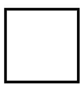
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



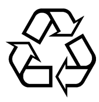
This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

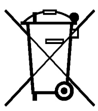


This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.





These indicate that the marked part should be recycled.

MX887067A
NB-IoT Uplink TX Measurement
Operation Manual

17 November 2017(First Edition)

Equipment Certificate

Anritsu Corporation guarantees that this equipment was inspected at shipment and meets the published specifications.

Anritsu Warranty

- During the warranty period, Anritsu Corporation will repair or exchange this software free-of-charge if it proves defective when used as described in the operation manual.
- The warranty period is 6 months from the purchase date.
- The warranty period after repair or exchange will remain 6 months from the original purchase date, or 30 days from the date of repair or exchange, depending on whichever is longer.
- This warranty does not cover damage to this software caused by Acts of God, natural disasters, and misuse or mishandling by the customer.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Anritsu Corporation Contact

In the event of this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the PDF version.

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Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

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a. If a fault (bug) is discovered in this Software, preventing operation as described in the operation manual or specifications whether or not the customer uses this software as described in the manual, Anritsu shall at its own discretion, fix the bug, or exchange the software, or suggest a workaround, free-of-charge. However, notwithstanding the above, the following items shall be excluded from repair and warranty.
   - i) If this Software is deemed to be used for purposes not described in the operation manual or specifications.
   - ii) If this Software is used in conjunction with other non-Anritsu-approved software.
   - iii) Recovery of lost or damaged data.
   - iv) If this Software or the Equipment has been modified, repaired, or otherwise altered without Anritsu's prior approval.
   - v) For any other reasons out of Anritsu's direct control and responsibility, such as but not limited to, natural disasters, software virus infections, etc.

b. Expenses incurred for transport, hotel, daily allowance, etc., for on-site repairs by Anritsu engineers necessitated by the above faults shall be borne by you.

c. The warranty period for faults listed in article 3a above covered by this EULA shall be either 6 months from the date of purchase of this Software or 30 days after the date of repair, whichever is longer.

4. **Export Restrictions**
You may not use or otherwise export or re-export directly or indirectly this Software except as authorized by Japanese and United States law. In particular, this software may not be exported or re-exported (a) into any Japanese or US embargoed countries or (b) to anyone on the Japanese or US Treasury Department's list of Specially Designated Nationals or the US Department of Commerce Denied Persons List or Entity List. By using this Software, you warrant that you are not located in any such country or on any such list. You also agree that you will not use this Software for any purposes prohibited by Japanese and US law, including, without limitation, the development, design and manufacture or production of missiles or nuclear, chemical or biological weapons of mass destruction.

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Anritsu shall deem this EULA terminated if you violate any conditions described herein. This EULA shall also be terminated if the conditions herein cannot be continued for any good reason, such as violation of copyrights, patents, or other laws and ordinances.

6. **Reparations**
If Anritsu suffers any loss, financial or otherwise, due to your violation of the terms of this EULA, Anritsu shall have the right to seek proportional damages from you.

7. **Responsibility after Termination**
Upon termination of this EULA in Upon termination of this EULA in accordance with item 5, you shall cease all use of this Software immediately and shall as directed by Anritsu either destroy or return this Software and any backup copies, full or partial, to Anritsu.

8. **Dispute Resolution**
If matters of dispute or items not covered by this EULA arise, they shall be resolved by negotiations in good faith between you and Anritsu.

9. **Court of Jurisdiction**
This EULA shall be interpreted in accordance with Japanese law and any disputes that cannot be resolved by negotiation described in Article 8 shall be settled by the Japanese courts.

Cautions against computer virus infection

- Copying files and data

  Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.

  All other required files should be transferred by means of USB or CompactFlash media after undergoing a thorough virus check.
- Adding software

  Do not download or install software that has not been specifically recommended or licensed by Anritsu.
- Network connections

  Ensure that the network has sufficient anti-virus security protection in place.

CE Conformity Marking

Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Decision 768/2008/EC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Software: MX887067A NB-IoT Uplink TX Measurement

2. Applied Directive and Standards

When MX887067A NB-IoT Uplink TX Measurement is installed in the MT8870A, the applied directive and standards of this software conform to those of the MT8870A main frame.

PS: About main frame

Please contact Anritsu for the latest information on the main frame types that MX887067A can be used with.

RCM Conformity Marking

Anritsu affixes the RCM mark on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

RCM marking

1. Product Model

Software: MX887067A NB-IoT Uplink TX Measurement

2. Applied Directive and Standards

When MX887067A NB-IoT Uplink TX Measurement is installed in the MT8870A, the applied directive and standards of this software conform to those of the MT8870A main frame.

PS: About main frame

Please contact Anritsu for the latest information on the main frame types that MX887067A can be used with.

About This Manual

This manual mainly describes the use, panels, and specifications of the MX887067A NB-IoT Uplink TX Measurement.

Products related to the MT8870A Universal Wireless Test Set include:

- MT8870A Universal Wireless Test Set (main unit)
- Modules installed in the MT8870A
- Application software installed in the modules
- Control software installed in a PC controller

These products are referred to as the "Universal Wireless Test Set Series". The operation manuals for the Universal Wireless Test Set Series consist of separate documents for the main unit, module(s), application software, and control software, as shown below. represents this manual.

Main Unit Operation Manual

Describes precautions for safe use, how to connect power and interfaces, and operation and maintenance of the unit.

Module Operation Manual

Describes specifications and operation of the modules.
Each module has its own operation manual.

Application Software Operation Manual

Describes how to use the application software installed in the modules and remote commands. Each application software has its own operation manual.

MX887067A NB-IoT Uplink TX Measurement Operation Manual

Describes the functions and remote commands of the MX887067A NB-IoT Uplink TX Measurement.

Control Software Operation Manual

Describes how to install and operate the software for controlling the MT8870A system via a PC. Each control software has its own operation manual.

Table of Contents

Chapter 1 Outline

This chapter outlines the MX887067A NB-IoT Uplink TX Measurement. Refer to Appendix A Specifications for the software functions and performance.

1.1 Outline

The MX887067A NB-IoT Uplink TX Measurement (hereafter MX887067A) adds the NB-IoT (Narrow Band Internet of Things) wireless measurement function to the MU887000A TRX Test Module.

The MX887067A supports setting of an arbitrary waveform pattern for sending as the NB-IoT downlink signal. Regardless of the uplink signal information, the modulated waveform pattern loaded from memory is sent as the downlink signal (Non-signalling method).

The Signalling method, which detects the Uplink signal information, such as call processing with the mobile station, and changes the Downlink signal modulation, is not supported.

The signal sent from the MU887000A to the mobile station is the downlink signal and the signal sent from the mobile station to the MU887000A is the uplink signal.

When conducting the RX measurement by the MX887067A, execute throughput measurement by the mobile station.

1.2 Composition

The composition of the MX887067A is shown in Table 1.2-1.

Table 1.2-1 MX887067A Composition

Item	Model/Code	Name	Qty	Remarks
Software		Storage media (DVD, etc.)	1	
	MX887067A	NB-IoT Uplink TX Measurement		License file included on storage media (DVD, etc.)
	W3937AE	MX887067A NB-IoT Uplink TX Measurement Operation Manual		English, on storage media (DVD, etc.)

1.3 License Registration

Before the MX887067A can be used, the software license must be registered in the MT8870A.

Refer to Chapter 8 “Utility Tool” in *the MU887000A TRX Test Module Operation Manual* for the license registration procedure.

1.4 Abbreviations

The abbreviations used in this manual are listed in Table 1.4-1.

Table 1.4-1 Abbreviations

Abbreviation	Name
ACLR	Adjacent Channel Leakage Ratio
CQI	Channel Quality Indicator
DL	Downlink
E-UMTS	Evolved UMTS Terrestrial Radio Access
EVM	Error Vector Magnitude
FDD	Frequency Division Duplex
LTE	Long Term Evolution
NB-IoT	Narrowband Internet of Things
NS	Network Signalling value
OBW	Occupied Bandwidth
NPDCCH	Narrowband Physical Downlink Control Channel
NPDSCH	Narrowband Physical Downlink Shared Channel
NPUSCH	Narrowband Physical Uplink Shared Channel
RB	Resource Block
RMC	Reference Measurement Channel
NRS	Narrowband Reference Signal
SEM	Spectrum Emission Mask
SIB	System Information Block
TPC	Total Power Control
TS	Technical Specification
UL	Uplink
UMTS	Universal Mobile Telecommunication System

Chapter 2 Fundamental Measurement

This chapter describes the fundamental functions and commands of the MX887067A. For details of the commands, refer to Chapter 4 "SCPI Command Reference" and Chapter 5 "Native Command Reference".

2.1 Common Operations

This section describes operations that are common to the measurements. Both Native and SCPI commands are described in the introduction to commands.

2.1.1 Selecting application

Switch the MU887000A application software to cellular by setting the parameter to CELLULAR using the following command.

```
SYSSEL
:INSTrument[:SELect]
```

Switch the MX887067A measurement standard using the following command. Set the parameter to NBIOT when a function described in Section 2.2, "Transmit Power" to Section 2.6, "Modulation Analysis" is to be used.

- Setting Measurement Mode

```
STDSEL
:CONFigure:CELLular:MEASurement:STANdard
```

2.1.2 Setting ports

Set the MU887000A ports to be used. The following command sets both the port for outputting the downlink signal and the port for receiving the uplink signals.
Set Port1 to Port4 at the parameter

```
PORT
:ROUTe:PORT:CONNect:DIRection
```

2.1.3 Frequency and level

Frequency

Set the frequency and channel of the measured signal using the following commands.

The signal sent from the MU887000A to the mobile station is the downlink signal and the signal sent from the mobile station to the MU887000A is the uplink signal.

- Uplink Channel
  `ULCHAN`
  `:CONFigure:CELLular:MEASurement:RFSettings:ULCHannel`
- Uplink Frequency (mobile station Tx)
  `ULFREQ`
  `TXFREQ`
  `:CONFigure:CELLular:MEASurement:RFSettings:FREQuency`
- Downlink Channel
  `DLCHAN`
  `:CONFigure:CELLular:MEASurement:RFSettings:DLCHannel`
- Downlink Frequency (mobile station Rx)
  `DLFREQ`
  `RXFREQ`
  `:CONFigure:CELLular:GENerator:RFSettings:FREQuency`

Level

Set the level of the signal sent (Tx) from and received (Rx) by the MU887000A using the following commands.

- Output Level
  `OLVL`
  `:CONFigure:CELLular:GENerator:RFSettings:LEVel`
- Input Level
  `ILVL`
  `:CONFigure:CELLular:MEASurement:RFSettings:LEVel`

Cable loss correction

The loss of coaxial cables can be corrected for the output, input, and measured levels.

Refer to Chapter 3 Basic Operation in the *MU887000A TRX Test Module Operation Manual* for an explanation of the commands and loss correction data.

2.1.4 Setting transmission signal

To transmit the waveform pattern from MU887000A by using the Cellular application software, load the waveform file into the waveform memory, and then follow the procedure below:

1. Select the waveform file in the waveform memory.
2. Select the waveform pattern in the waveform file selected in step 1.
3. Set the Modulation On/Off and Output On/Off.

Use the following commands to select waveform file and waveform pattern and to set modulation and output On and Off.

- Output On/Off
  `LVL`
  `:CONFigure:CELLular:GENerator:RFSettings:STATe`
- Modulation On/Off
  `MOD`
  `:CONFigure:CELLular:GENerator:BBMode`
- Waveform File Select
  `PACKAGE`
  `:CONFigure:CELLular:GENerator:ARB:PACKage:SELect`
- Waveform Pattern Select
  `DLPAT`
  `:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect`
  `DLPAT_SYNC`
  `:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC`

Use the following commands to load the waveform file into the waveform memory.

Refer to Chapter 5 SCPI Command Reference in the *MU887000A TRX Test Module Operation Manual*.

- To load waveform file into the waveform memory
  `:SOURce:GPRF:GENerator:ARB:FILE:LOAD`
- To query the file name in the waveform memory
  `:SOURce:GPRF:GENerator:ARB:WAVeform:NAME`
- To optimize the waveform memory capacity

:SOURce:GPRF:GENerator:ARB:WAVeform:DEFRag

- To delete waveform file in the waveform memory
  :SOURce:GPRF:GENerator:ARB:WAVeform:DELete
- To query the waveform memory free space
  :SOURce:GPRF:GENerator:ARB:WAVeform:FREE

2.1.5 Waveform patterns

To send an NB-IoT waveform pattern, specify a file in the MV887067A NB-IoT Downlink Waveform files as the waveform file.

Refer to Chapter 3, "Waveform File Details" in the *Waveform File for Cellular Application Operation Manual* for an explanation of the MV887067A NB-IoT Downlink Waveform files.

2.1.6 Setting NB-IoT signals

Set the following items to configure the NB-IoT signal.

NB Operation Mode

Three operation modes are defined for the NB IoT signal: stand-alone, guard band, and in-band. The operation mode is set by the measurement signal.

Frame Structure

The frame structure of the NB-IoT signal was defined only for FDD. Only FDD is available for MX887067A.

Duplex Mode

Only Half Duplex is defined for the NB IoT signal. Only Half Duplex is available for MX887067A.

Coexisting Bandwidth

Selects bandwidth of LTE signal when NB Operation Mode is Guard-band. The following value is defined.
1.4, 3, 5, 10, 15, 20 MHz

Uplink and Downlink Channels

If the Uplink Channel Number or NB Operation Mode setting is changed, the Downlink Channel Number, Operation Band, Downlink Frequency, and Uplink Frequency are changed as well.

Changing Downlink Channel Number or NB Operation Mode setting changes the Uplink Channel Number, Operation Band, Downlink Frequency, and Uplink Frequency settings.

However, the Uplink Frequency and channel number are not changed interlocking with the Downlink Frequency change and vice versa.

The following table below shows the relationship between the Downlink Channel Number and Uplink Channel Number settings.

Table 2.1.6-1 Relationship between Uplink Channel Number and Downlink Channel Number

Downlink Channel Number (N_{DL})	Uplink Channel Number (N_{UL})
dl_ch	ul_ch
0 to 4949	ul_ch = dl_ch + 18000
5010 to 5379	ul_ch = dl_ch + 18000
5730 to 7399	ul_ch = dl_ch + 18000
7500 to 9659	ul_ch = dl_ch + 18000
9770 to 9919	ul_ch = dl_ch + 17890
36000 to 46789	ul_ch = dl_ch
65536 to 67135	ul_ch = dl_ch + 65536

The Operating Bandwidth (Band) and the following values are determined referring to Table 2.1.6-2, based on the Uplink Channel Number (N_{UL}) and the Downlink Channel Number (N_{DL}).

Downlink lower limit frequency (F_{DL_low}), Downlink offset number ($N_{Offs\text{-}DL}$), Uplink lower limit frequency (F_{UL_low}), Uplink offset number ($N_{Offs\text{-}UL}$)

When Downlink Channel Number or NB Operation Mode is changed, the MX887067A executes the following processes:

1. Determines values of following parameters based on Downlink Channel Number (N_{DL}) and Table 2.1.6-2

   Downlink lower limit frequency (F_{DL_low}),
   Downlink offset number ($N_{Offs\text{-}DL}$)

2. Calculates Downlink frequency (F_{DL}) from following equation using the above values:

   $F_{DL} = F_{DL\_low} + 0.1(N_{DL} - N_{Offs\text{-}DL}) + 0.0025 \times (2M_{DL}+1)$

   Note that M_{DL} is –0.5.

3. Sets Downlink frequency at MU887000A
4. Determines Uplink Channel Number (N_{UL}) based on Downlink Channel Number (N_{DL}) and Table 2.1.6-1
5. Determines values of following parameters based Uplink Channel Number (N_{UL}) and Table 2.1.6-2

   Uplink lower limit frequency (F_{UL_low}),
   Uplink offset number ($N_{Offs\text{-}UL}$)

6. Calculates Uplink Frequency (F_{UL}) from following equation using the above values:

   $F_{UL} = F_{UL\_low} + 0.1(N_{UL} - N_{Offs\text{-}UL}) + 0.0025 \times (2M_{UL})$

   Note that M_{UL} is 0.

7. Sets Uplink frequency (F_{UL}) at MU887000A

When Uplink Channel, Uplink Offset Channel Number, or NB Operation Mode is changed, the MX887067A executes the following processing:

1. Determines values of following parameters based on Uplink Channel Number (N_{UL}) and Table 2.1.6-2.

   Uplink lower limit frequency (F_{UL_low}), Uplink offset number ($N_{Offs\text{-}UL}$), Operating Bandwidth (Band)

2. Calculates Uplink frequency (F_{UL}) from following equation using the above values:

   $F_{UL} = F_{UL\_low} + 0.1(N_{UL} - N_{Offs\text{-}UL}) + 0.0025 \times (2M_{UL})$

   Note that $M_{UL} = 0$.

3. Sets Uplink frequency at MU887000A

4. Determines Downlink Channel Number (N_{DL}) based on Uplink Channel Number (N_{UL}) and Table 2.1.6-1

5. Determines values of following parameters based on Downlink Channel Number (N_{DL}) and Table 2.1.6-2:

   Downlink lower limit frequency (F_{DL_low}),
   Downlink offset number ($N_{Offs\text{-}DL}$)

6. Calculates Downlink frequency (F_{DL}) from following equation using the above values:

   $F_{DL} = F_{DL\_low} + 0.1(N_{DL} - N_{Offs\text{-}DL}) + 0.0025 \times (2M_{DL}+1)$

   Note that M_{DL} is –0.5.

7. Sets Downlink frequency at MU887000A

Table 2.1.6-2 E-UTRA Channel Numbers and Default Mobile Station TX-RX Frequency Separation (Reprinted from Table 5.7.3-1 and Table 5.7.4-1 of 3GPP TS36.101)

Band	Freq Separation (MHz)	Downlink			Uplink		
		F_{DL_low} (MHz)	$N_{Offs-DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs-UL}$	Range of N_{UL}
1	190	2110	0	0 to 599	1920	18000	18000 to 18599
2	80	1930	600	600 to 1199	1850	18600	18600 to 19199
3	95	1805	1200	1200 to 1949	1710	19200	19200 to 19949
4	400	2110	1950	1950 to 2399	1710	19950	19950 to 20399
5	45	869	2400	2400 to 2649	824	20400	20400 to 20649
6	45	875	2650	2650 to 2749	830	20650	20650 to 20749
7	120	2620	2750	2750 to 3449	2500	20750	20750 to 21449
8	45	925	3450	3450 to 3799	880	21450	21450 to 21799
9	95	1844.9	3800	3800 to 4149	1749.9	21800	21800 to 22149
10	400	2110	4150	4150 to 4749	1710	22150	22150 to 22749
11	48	1475.9	4750	4750 to 4949	1427.9	22750	22750 to 22949
12	30	729	5010	5010 to 5179	699	23010	23010 to 23179
13	–31	746	5180	5180 to 5279	777	23180	23180 to 23279
14	–30	758	5280	5280 to 5379	788	23280	23280 to 23379
…	-----	-----	-----	-----	-----	-----	-----
17	30	734	5730	5730 to 5849	704	23730	23730 to 23849
18	45	860	5850	5850 to 5999	815	23850	23850 to 23999
19	45	875	6000	6000 to 6149	830	24000	24000 to 24149
20	–41	791	6150	6150 to 6449	832	24150	24150 to 24449
21	48	1495.9	6450	6450 to 6599	1447.9	24450	24450 to 24599
22	48	3510	6600	6600 to 7399	3410	24600	24600 to 25399
23	100	2180	7500	7500 to 7699	2000	25500	25500 to 25699
24	180	1525	7700	7700 to 8039	1626.5	25700	25700 to 26039
25	–101.5	1930	8040	8040 to 8689	1850	26040	26040 to 26689
26	45	859	8690	8690 to 9039	814	26690	26690 to 27039
27	45	852	9040	9040 to 9209	807	27040	27040 to 27209
28	55	758	9210	9210 to 9659	703	27210	27210 to 27659
29	N/A	717	9660	9660 to 9769	N/A	N/A	N/A
30	45	2350	9770	9770 to 9869	2305	27660	27660 to 27759
31	10	462.5	9870	9870 to 9919	452.5	27760	27760 to 27809
32	N/A	1452	9920	9920 to 10359	N/A	N/A	N/A

Table 2.1.6-2 E-UTRA Channel Numbers and Default UE TX-RX Frequency Separation (Reprinted from Table 5.7.3-1 and Table 5.7.4-1 of 3GPP TS36.101) (Cont'd)

Band	Freq Separation (MHz)	Downlink			Uplink		
		F_{DL_low} (MHz)	$N_{Offs\text{-}DL}$	Range of N_{DL}	F_{UL_low} (MHz)	$N_{Offs\text{-}UL}$	Range of N_{UL}
33	0	1900	36000	36000 to 36199	1900	36000	36000 to 36199
34	0	2010	36200	36200 to 36349	2010	36200	36200 to 36349
35	0	1850	36350	36350 to 36949	1850	36350	36350 to 36949
36	0	1930	36950	36950 to 37549	1930	36950	36950 to 37549
37	0	1910	37550	37550 to 37749	1910	37550	37550 to 37749
38	0	2570	37750	37750 to 38249	2570	37750	37750 to 38249
39	0	1880	38250	38250 to 38649	1880	38250	38250 to 38649
40	0	2300	38650	38650 to 39649	2300	38650	38650 to 39649
41	0	2496	39650	39650 to 41589	2496	39650	39650 to 41589
42	0	3400	41590	41590 to 43589	3400	41590	41590 to 43589
43	0	3600	43590	43590 to 45589	3600	43590	43590 to 45589
44	0	703	45590	45590 to 46589	703	45590	45590 to 46589
45	0	1447	46590	46590 to 46789	1447	46590	46590 to 46789
…	-----	-----	-----	-----	-----	-----	-----
65	190	2110	65536	65536 to 66435	1920	131072	131072 to 131971
66	400	2110	66436	66436 to 67335	1710	131972	131972 to 132671

Channel Coding

Sets the channel configuration. To perform TX test based on the measurement standards, set to RMC (Reference Measurement Channel based on TS36.521-1). Only RMC can be set on the MX887067A.

NPUSCH Format

Sets NPUSCH Format. NPUSCH supports two formats below.
NPUSCH format 1, used to carry the UL-SCH
NPUSCH format 2, used to carry uplink control information

UL RMC Subcarrier Spacing

Sets subcarrier spacing (Δf) of NPUSCH.

UL RMC Number of Subcarrier

Sets the subcarrier number (N_{SC}^{RU}) to assign to NPUSCH.
The options vary depending on the settings of NPUSCH Format and Subcarrier Spacing.

Table 2.1.6-3 UL RMC Number of Subcarrier Options

NPUSCH format	Δf (kHz)	N_{SC}^{RU} Options
1	3.75	1
	15	1,3,6,12
2	3.75	1
	15	1

UL RMC Starting Subcarrier
Sets the starting position of the subcarrier to be assigned to NPUSCH.

UL RMC Number of Resource Units
Sets the number of the resource units to be assigned to NPUSCH.

UL_RMC MCS Index
Sets MCS of Uplink. When MCS Index is set, modulation scheme is changed automatically.
The setting range of MCS Index varies according to UL RMC number of subcarriers.

Table 2.1.6-4 Relation Between MCS Index of UL RMC and Modulation Scheme

MCS Index I_{MCS}	Modulation Scheme N_{SC}^{RU} = 1	Modulation Scheme N_{SC}^{RU} > 1
1	BPSK	QPSK
2		
3	QPSK	
4		
5		
6		
7		
8		
9		
10		
11	–	
12	–	

UL RMC Cyclic Shift Index
Sets Cyclic Shift Index of NPUSCH. The setting is required only when UL RMC Number of Subcarrier is 3 or 6.

Group Hopping
Turns On or Off Group Hopping.

NCell ID

Sets the NCell ID.

Use the following commands to set the NB-IoT signals

- NB Operation Mode
  `NBOPEMODE`
  `:CONFigure:CELLular:NBIot:OPEMode`
- Frame Structure
  `FRAMETYPE`
  `:CONFigure:CELLular:NBIot:FSTRucture`
- Duplex Mode
  `DUPLEXMODE`
  `:CONFigure:CELLular:NBIot:DUPLex`
- Coexisting Bandwidth
  `COEXBANDWIDTH`
  `:CONFigure:CELLular:NBIot:CBANdwidth`
- Channel Coding
  `CHCODING`
  `:CONFigure:CELLular:NBIot:CHCoding`
- NPUSCH Format
  `NPUSCH`
  `:CONFigure:CELLular:NBIot:NPUSch`
- UL RMC Subcarrier Spacing
  `ULSC_SPACE`
  `:CONFigure:CELLular:NBIot:SCSPacing`
- UL RMC Number of Subcarrier
  `ULRMC_SC`
  `:CONFigure:CELLular:NBIot:SCALlocation:NSC`
- UL RMC Starting Subcarrier
  `ULSC_START`
  `:CONFigure:CELLular:NBIot:SCALlocation:OSC`
- UL RMC Number of Resource Units
  `ULRMC_RU`
  `:CONFigure:CELLular:NBIot:NPUSch:NRUNit`
- UL_RMC MCS Index
  `ULIMCS`
  `:CONFigure:CELLular:NBIot:MCS`
- UL_RMC Modulation
  `ULRMC_MOD`
  `:CONFigure:CELLular:NBIot:MODulation:MSCHeme`
- UL RMC Cyclic Shift Index
  `ULICSHIFT`
  `:CONFigure:CELLular:NBIot:CSHift:INDex`

- Group Hopping

  `GROUPHOP`

  `:CONFigure:CELLular:NBIot:GHOPping`

- NCell ID

  `NCELLID`

  `:CONFigure:CELLular:NBIot:NCID`

2.1.7 Setting measurement

Set the following measurement items.

- Trigger Source
  `TRGSRC`
  `:TRIGger:CELLular:NBIot:FUNDamental:SOURce`
- Trigger Level
  `TRGLVL`
  `:TRIGger:CELLular:NBIot:FUNDamental:LEVel`
- Trigger Delay
  `TRGDLY`
  `:TRIGger:CELLular:NBIot:FUNDamental:DELay`
- Trigger Timeout
  `TRGTOUT`
  `:TRIGger:CELLular:NBIot:FUNDamental:TOUT`

Use the following command when not measuring.

- Setting all measurement items to off
  `ALLMEASITEMS_OFF`
  `:CONFigure:CELLular:NBIot:FUNDamental:AMITems:OFF`

2.1.8 Starting/stopping measurement

Starting measurement

To start measurement, send the following command.

The status indication lamp 3 of MU887000A is on during the execution of measurement or analysis. For the explanation of the status lamp, refer to Appendix D "Status Indication of lamps" in *the MU887000A TRX Test Module Operation Manual*.

```
SNGLS
:INITiate:CELLular:MEASurement:SINGle
```

```
SWP
```

Stopping measurement

To stop measurement, send the following command.

```
MEASSTOP
:ABORt:CELLular:MEASurement
```

Checking measurement status

Query the measurement status and errors using the following commands.

```
TXMSTAT
MSTAT
:FETCh:CELLular:MEASurement:STATe
```

Table 2.1.8-1 Query Response

Response	Description
0	Measurement completed normally
2	Level exceeded The MU887000A receive level is higher than the set input level.
5	Synchronization word not detected No reference signal was detected for Uplink frame synchronization.
9	Measurement in progress or not executed
12	Tx measurement timeout No trigger occurred before measurement timed out.

2

Fundamental Measurement

The measurement status and errors can be queried using the status registers.
Refer to Chapter 3 "Fundamental Operation" in the *MU887000A TRX Test Module Operation Manual* for an explanation of the status registers.
The allocations of MX887067A status registers are described in the following tables.

Native command mode

Table 2.1.8-2 Bit Definition of End Event Status Register (Signal Generator)

Bit	Description
7 to 1	Not used and always set to 0.
0	Changed to 1 at end of reading waveform file

Table 2.1.8-3 Bit Definition of End Event Status Register (Measurement)

Bit	Description
7 to 2	Not used and always set to 0.
1	Changed to 1 after trigger prepared
0	Changed to 1 when measurement preparation completed

Table 2.1.8-4 Bit Definition of Error Event Status Register (Signal Generator)

Bit	Description
7 to 1	Not used and always set to 0.
0	Changed to 1 at error in read waveform file

Table 2.1.8-5 Bit Definition of Error Event Status Register (Measurement)

Bit	Description
7 to 3	Not used and always set to 0.
2	Changed to 1 at measurement timeout
1	Changed to 1 when measurement result under level
0	Changed to 1 when measurement result over level

SCPI Command mode

Table 2.1.8-6 Bit Definition of Signal Generator Status Register

Bit	Description
16 to 1	Not used and always set to 0.
0	Changed to 1 while reading file

Table 2.1.8-7 Bit Definition of Measurement Status Register

Bit	Description
16 to 2	Not used and always set to 0.
1	Changed to 1 while preparing trigger
0	Changed to 1 during measurement

Table 2.1.8-8 Bit Definition of Signal Generator Questionable Register

Bit	Description
16 to 1	Not used and always set to 0.
0	Changed to 1 at error in read file

Table 2.1.8-9 Bit Definition of Measurement Questionable Register

Bit	Description
16 to 3	Not used and always set to 0.
2	Changed to 1 at measurement timeout
1	Changed to 1 when measurement result under level
0	Changed to 1 when measurement result over level

2.2 Transmit Power

The Tx Power measurement measures the power in the bandwidth specified in Table 5.4.2F-1 of 3GPP TS36.521-1.

Table 2.2-1 Transmit Power Measurement Bandwidth (MHz)

Item	Measurement Bandwidth (kHz)
Tx Power	200
Channel Power	180

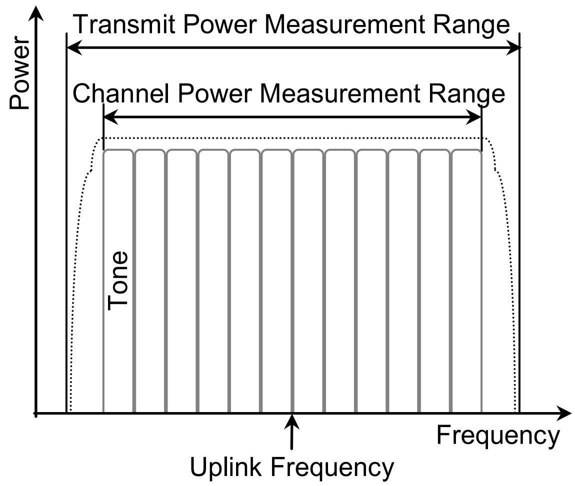

Figure 2.2-1 Tx Power Measurement Range

Set the following parameter to measure the Tx Power.

Measurement enable and measurement count

```
PWR_SET
:CONFigure:CELLular:NBIot:FUNDamental:POWer:SET
```

The Transmit Power for the following time length is measured at each measurement count.

Table 2.2-2 Transmit Power Measurement Time Length

UL RMC Subcarrier Spacing	Measurement Time Length
15 kHz	1 subframe (1 ms)
3.75 kHz	1 slot (2 ms, Excluding 75 µs gap)

Use the following commands to query the Tx power measurement results.

- Tx Power
  `POWER`
  `:FETCh:CELLular:NBIot:FUNDamental:POWer:TXPower`
- Channel Power
  `CHPWR`
  `:FETCh:CELLular:NBIot:FUNDamental:POWer:CHPower`

2.3 Occupied Bandwidth

Occupied Bandwidth is the bandwidth with a specific proportion of the total measured power.

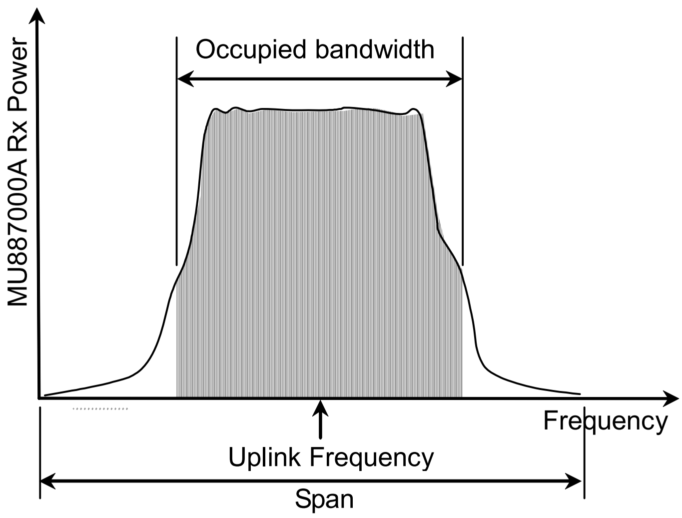

Figure 2.3-1 Occupied Bandwidth

The Occupied Bandwidth measurement settings are:

Span

The span is 510 kHz.

Occupied Bandwidth power ratio

The power ratio (occupied ratio) for determining the Occupied Bandwidth is 99.9%.

Measurement enable and measurement count

```
OBW_SET
:CONFigure:CELLular:NBIot:FUNDamental:OBW:SET
```

The Occupied Bandwidth for the following time length is measured at each measurement count.

Table 2.3-3 Occupied Bandwidth Measurement Time Length

UL RMC Subcarrier Spacing	Measurement Time Length
15 kHz	1 subframe (1 ms)
3.75 kHz	1 slot (2 ms, Excluding 75 μs gap)

Use the following command to query the results of Occupied Bandwidth measurement.

- OBW Result
  `OBW`
  `:FETCh:CELLular:NBIot:FUNDamental:OBW`
- OBW Frequency Result
  `OBWFREQ`
  `:FETCh:CELLular:NBIot:FUNDamental:OBW:FREQuency`

2.4 Spectrum Emission Mask

Spectrum Emission Mask measurement measures the peak level and margin at the conditions specified in TS 36.521-1 6.6.2.1 Spectrum Emission Mask for category NB1.

When using the MX887067A, the spectrum emission mask frequency ranges are called Range 1, Range 2, Range 3, Range 4, and Range 5, starting sequentially from the end of the channel bandwidth.

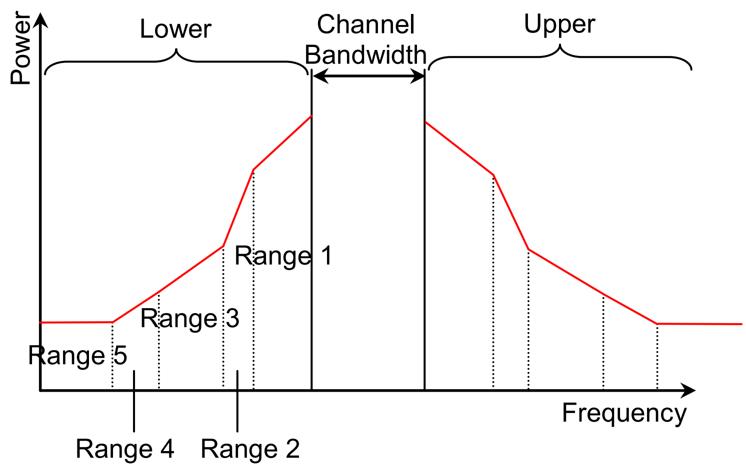

Figure 2.4.8-1 Mask Range of Spectrum Emission Mask

Table 2.4-1 Frequency Ranges of Range 1 to 5 (General)

Range	Frequency range (kHz)	Measurement bandwidth
1	±0 to ±100	30 kHz
2	±100 to ±150	30 kHz
3	±150 to ±300	30 kHz
4	±300 to ±500	30 kHz
5	±500 to ±1700	30 kHz

Additionally, when Operation Mode is Guard-band, Spectrum Emission Mask also measures E-UTRA spectrum emission requirement.

Table 2.4-2 Frequency Ranges of Range 1 to 4 (Guard-band)

Range	Frequency range (MHz) for different coexisting bandwidths						Measurement bandwidth
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
1	±0 to ±1	±0 to ±1	±0 to ±1	±0 to ±1	±0 to ±1	±0 to ±1	30 kHz
2	±1 to ±2.5	±1 to ±5	±1 to ±5	±1 to ±5	±1 to ±5	±1 to ±5	1 MHz
3	±2.5 to ±2.8	±5 to ±6	±5 to ±6	±5 to ±10	±5 to ±15	±5 to ±20	1 MHz
4	---	---	±6 to ±10	±10 to ±15	±15 to ±20	±20 to ±25	1 MHz

2

Table 2.4-3 Frequency Ranges for Measurement Results (Guard-band)

	Frequency Difference from Channel Bandwidth Δf_{OOB} (MHz)								
Coexisting Bandwidth (MHz)	0-1	1-2.5	2.5-2.8	2.8-5	5-6	6-10	10-15	15-20	20-25
1.4	✓	✓	✓						
3.0	✓	✓	✓	✓	✓				
5	✓	✓	✓	✓	✓	✓			
10	✓	✓	✓	✓	✓	✓	✓		
15	✓	✓	✓	✓	✓	✓	✓	✓	
20	✓	✓	✓	✓	✓	✓	✓	✓	✓
Measurement Bandwidth	30 kHz	1 MHz	1 MHz	1 MHz	1 MHz	1 MHz	1 MHz	1 MHz	1 MHz
Frequency Range	1, –1	2, –2	3, –3	4, –4	5, –5	6, –6	7, –7	8, –8	9, –9

Foffset is added to the measurement range according to the coexisting bandwidth as the table below.

Table 2.4-4 Foffset for category NB1 UE Spectrum Emission Mask

Coexisting bandwidth (MHz)	Foffset [kHz]
1.4	165
3	190
5	200
10	225
15	240
20	245

The Spectrum Emission Mask settings are:

Measurement enable and measurement count

Enable spectrum emission mask measurement and specify the measurement count. The Spectrum Emission Mask for the following time length is measured at each measurement count.

Table 2.4-5 Spectrum Emission Mask Measurement Time Length

UL RMC Subcarrier Spacing	Measurement Time Length
15 kHz	1 subframe (1 ms)
3.75 kHz	1 slot (2 ms, Excluding 75 μs gap)

Spectrum emission limits to use for judgement

Table 2.4-6 Spectrum Emission Limit of Range 1 to 5 (General)

Range	Frequency range (kHz)	Spectrum emission limit (dBm)
1	0 to 100	$(27.5 + (F - 0) \times \frac{-3.5 - 27.5}{100 - 0})$
2	100 to 150	$(-3.5 + (F - 100) \times \frac{-6.5 - (-3.5)}{150 - 100})$
3	150 to 300	$(-6.5 + (F - 150) \times \frac{-27.5 - (-6.5)}{300 - 150})$
4	300 to 500	$(-27.5 + (F - 300) \times \frac{-33.5 - (-27.5)}{500 - 300})$
5	500 to 1700	–33.5

Table 2.4-7 Spectrum Emission Limit of Range 1 to 4 (Guard-band)

Range	Spectrum emission limit (dBm)/ Channel bandwidth					
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
1	–8.5	–11.5	–13.5	–16.5	–18.5	–19.5
2	–8.5	–8.5	–8.5	–8.5	–8.5	–8.5
3	–23.5	–23.5	–11.5	–11.5	–11.5	–11.5
4	---	---	–23.5	–23.5	–23.5	–23.5

The results of the spectrum emission mask measurement are:

- Pass/fail result
  If the spectrum is at the mask level or below, the result is PASS. If it exceeds the mask level, the result is FAIL.
- Peak level and frequency at each level
- Margin
  This is the minimum level difference from the threshold. The applicable threshold depends on the signal level.

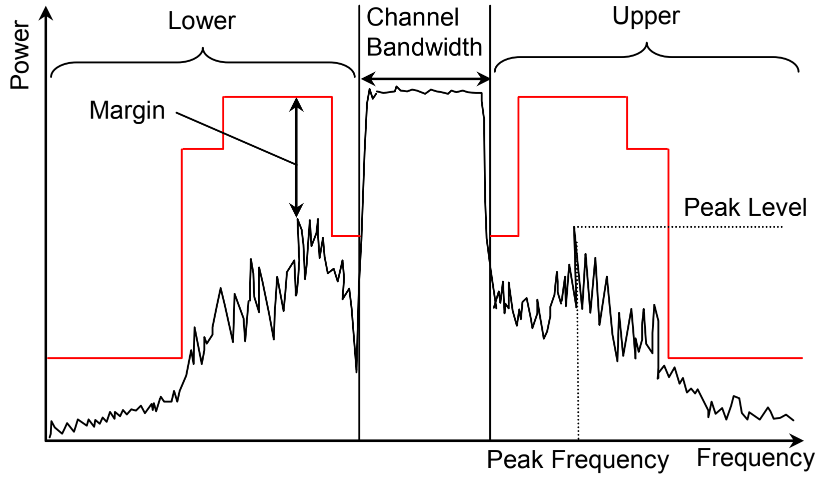

Figure 2.4.8-2 Spectrum Emission Mask Measurement Result

Use the following commands to set the spectrum emission mask measurement.

- Measurement ON/OFF and Measurement Count
  `SEM_SET`
  `:CONFigure:CELLular:NBIot:FUNDamental:SEMask:SET`

The commands for querying the spectrum emission mask measurement results are:

- Evaluation Result
  `SEMPASS`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:JUDGement`
- Peak Level and Frequency (General)
  `WORST_SEM_LV`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel`
  `TTL_WORST_SEM_LV`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:TTL`
- Peak Level and Frequency (Guard-band)
  `WORST_SEM_GB_LV`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd`
  `TTL_WORST_SEM_GB_LV`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd:TTL`
- Margin and Frequency (General)
  `WORST_SEM`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin`
  `TTL_WORST_SEM`
  `:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:TTL`
- Margin and Frequency (Guard-band)

WORST_SEM_GB
:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd
TTL_WORST_SEM_GB
:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:TTL

2.5 Adjacent Channel Leakage Power Ratio

Adjacent Channel Leakage Power Ratio (ACLR) is the ratio of in-band power to the power leaking to adjacent channels.

To protect GSM and UTRA/E-UTRA systems, two types of measurement are defined in TS 36.521-1 6.6.2.3F Adjacent Channel Leakage power Ratio for UE category NB1.

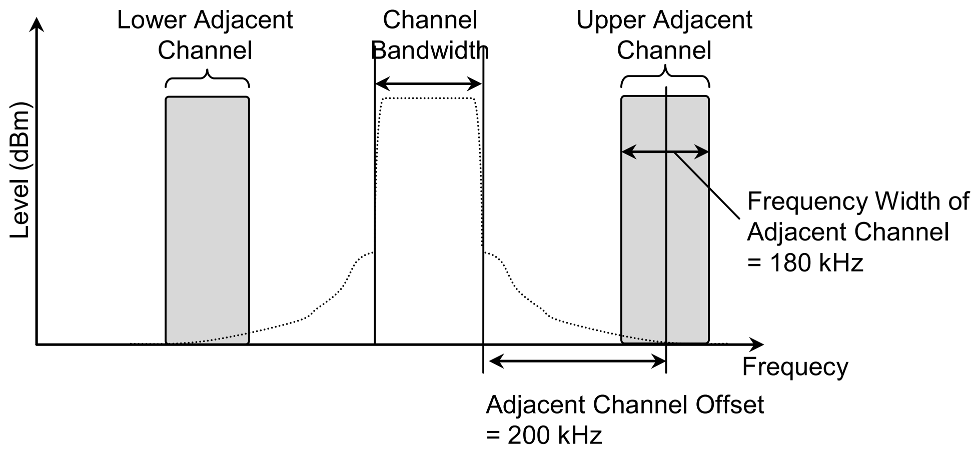

Figure 2.5-1 Adjacent Channels for ACLR Measurement (GSM_{ACLR})

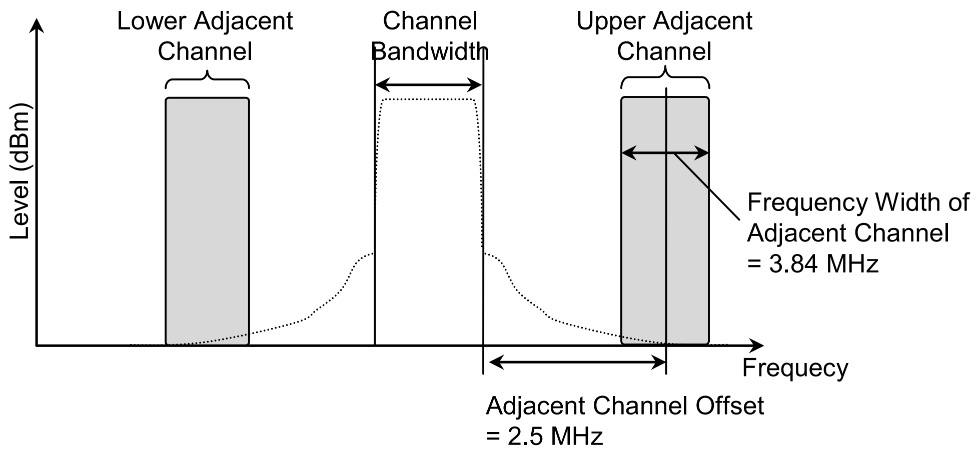

Figure 2.5-2 Adjacent Channels for ACLR Measurement ($UTRA_{ACLR}$)

The ACLR measurement parameters are:

Measurement enable and measurement count

Enable ACLR measurement and specify the measurement count.

```
ACLR_SET
:CONFigure:CELLular:NBIot:FUNDamental:ACLR:SET
```

The ACLR for the following time length is measured at each measurement count.

Table 2.5-1 ACLR Measurement Time Length

UL RMC Subcarrier Spacing	Measurement Time Length
15 kHz	1 subframe (1 ms)
3.75 kHz	1 slot (2 ms, Excluding 75 μs gap)

Use the following command to query the results of the ACLR measurement.

```
ACLR
:FETCh:CELLular:NBIot:FUNDamental:ACLR
```

2.6 Modulation Analysis

Modulation analysis measures:

- Frequency Error
- EVM
- Carrier Leakage
- Waveform Quality (Rho)
- In-band Emissions for Non-Allocated RB
- IQ Imbalance

Use the following command to enable modulation analysis measurement and specify the measurement count.

```
MOD_SET
:CONFigure:CELLular:NBIot:FUNDamental:MODulation:SET
```

The Modulation Analysis for the following time length is measured at each measurement count.

Table 2.6-1 Modulation Analysis Measurement Time Length

UL RMC Subcarrier Spacing	Measurement Time Length
15 kHz	1 slot (0.5 ms)
3.75 kHz	1 slot (2 ms, Excluding 75 μs gap)

2.6.1 Frequency Error

Frequency error measurement measures the carrier frequency and frequency error at Uplink.

Set the uplink frequency as the reference frequency for error measurement by referring to Section 2.1.3 “Frequency and level”.

Use the following commands to query the frequency error measurement results:

- Carrier Frequency
  `CARRF`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:CFRequency`
- Frequency Error
  `CFERR`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor`
- Worst Value of Frequency Error
  `CFERR_WORST`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor:WORSt`

The worst value is either the maximum or minimum frequency error, whichever is the larger absolute value.

2.6.2 EVM

Error Vector Magnitude (EVM) is the magnitude ratio of the error vector to the reference vector. The error vector is the difference between the vector of the measured signal and the reference vector.
The difference in phase between the vector of the measured signal and the reference vector is called the phase error while the difference in magnitude is called the magnitude error.

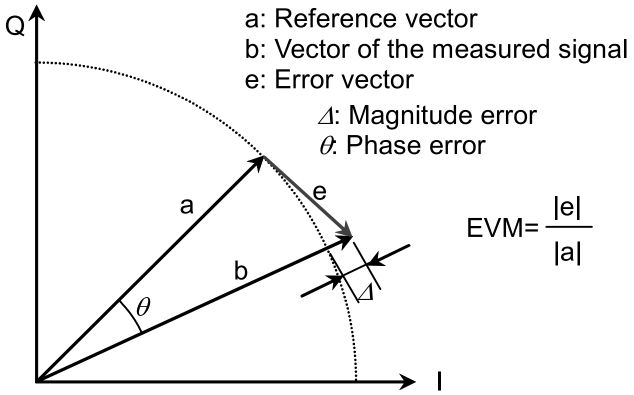

Figure 2.6.2-1 Definition of EVM

Query the EVM measurement result using the following commands:

- EVM
  `EVM`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVM`
- Peak EVM
  `PVECTERR`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:PEVM`
- EVM of the Reference Signal
  `RSEVM`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:RSEVm`
- Phase Error
  `PHASEERR`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:PHERror`
- Magnitude Error
  `MAGTDERR`
  `:FETCh:CELLular:NBIot:FUNDamental:MODulation:MERRor`

The reference signal is defined in TS 36.211 10.1.4 “Demodulation Reference Signal”.
The target symbol for EVM measurement differs with NPUSCH Format as described in Section 2.1.6 “Setting NB-IoT signals”.
(NPUSCH measurements are available, but NPRACH measurement is not.)

NPUSCH: Measures reference signal of EVM. Symbols other than the reference signal are the target for EVM and peak EVM measurement.

2.6.3 Carrier leakage

Query the mobile station carrier leakage measurement result using the following command:

- Carrier Leakage Result

```
CARRLEAK
:FETCh:CELLular:NBIot:FUNDamental:MODulation:CARLeakage
```

2.6.4 Rho

Waveform quality (ρ: Rho) shows the correlation between an ideal noiseless waveform and the measured signal. It is 1 when both signals match each other.
The approximate relationship between Rho and EVM is:

$$\rho \approx \frac{1}{1+EVM^2}$$

Query the Rho measurement results using the following command:

```
RHO
:FETCh:CELLular:NBIot:FUNDamental:MODulation:RHO
```

2.6.5 In-band emissions for non-allocated RB

The In-band Emission for Non-Allocated RB is the ratio between the signal power of the allocated RBs and the signal power in the non-allocated RBs.

TS 36.521-1 6.5.2.3F "In-band Emission for non-allocated RB for category NB1" specifies three measurement ranges: Carrier Leakage, General, and IQ Image.

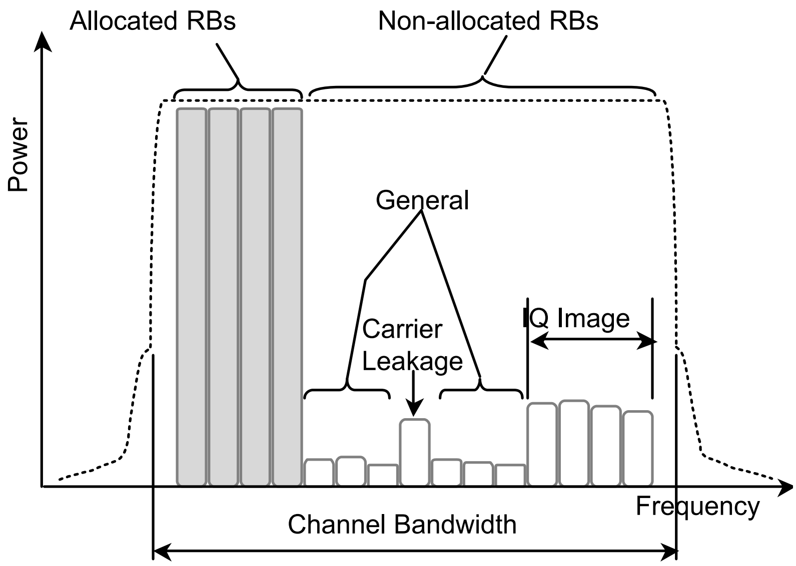

Figure 2.6.5-1 In-band Emission Measurement Range

Set the allocated tone signal using UL RMC Number of Subcarrier and UL RMC Starting Subcarrier as described in Section 2.1.6 "Setting NB-IoT signals".

Query the In-band Emissions for Non-Allocated RB measurement results using the following commands:

- Carrier Leakage
  INBANDE_LEAK
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:CARLeakage
- General
  INBANDE_GEN
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:GENeral
- IQ Image
  INBANDE_IMG
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:IQIMage

- In-Band Emissions limit - General
  INBANDE_GENUL
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:GENeral
- In-Band Emissions limit - IQ Image
  INBANDE_IMG
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:IQIMage
- In-Band Emissions limit - Carrier Leakage
  INBANDE_LEAKUL
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:CARLeakage
- In-Band Emissions margin
  INBANDE_MARG
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:MARGin
- In-Band Emissions Measured Item
  INBANDEITEM
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:ITEM
- In-Band Emissions Judgement
  INBANDEPASS
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:JUDGement

2.6.6 IQ Imbalance

Query the IQ Imbalance measurement result using the following command:

- IQ Imblance (%) Result
  IQIMB_PER
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:PERCent

- IQ Imblance (dB) Result
  IQIMB_DB
  :FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:DB

IQ Imbalance measures only when Subcarrier Spacing is 15 kHz and Number of Subcarrier is 12.

2.7 Capturing Waveform Data

The following command is used to capture the waveform data after measurement has been completed.

- Waveform

  ```
  WAVEFMEAS
  :FETCh:CELLular:NBIot:FUNDamental:TRACe
  ```

The query parameter, data interval and number of data for capturing the waveform data for each measurement item are listed in the following table.

Table 2.7-1 Waveform Data Type and Data Interval (1/2)

Measurement Item	Query Parameter	Data Interval	The number of data
Occupied Bandwidth	1	1.875 kHz	279
Constellation (I)	3	Subcarrier (3.75 kHz, 15 kHz)	The number of data varies depending on the subcarrier interval setting. 3.75 kHz: 48 15 kHz: 12
Constellation (Q)	4		
EVM (Average)	5	Subcarrier (3.75 kHz, 15 kHz)	The number of data varies depending on the subcarrier interval setting. 3.75 kHz: 48 15 kHz: 12
EVM (Maximum)	6		
Phase Error (Average)	7	Subcarrier (3.75 kHz, 15 kHz)	The number of data varies depending on the subcarrier interval setting. 3.75 kHz: 48 15 kHz: 12
Phase Error (Maximum)	8		
Magnitude Error (Average)	9	Subcarrier (3.75 kHz, 15 kHz)	The number of data varies depending on the subcarrier interval setting. 3.75 kHz: 48 15 kHz: 12
Magnitude Error (Maximum)	10		
In-band Emissions dB (Average)	11	Subcarrier (3.75 kHz, 15 kHz)	The number of data varies depending on the subcarrier interval setting. 3.75 kHz: 48 15 kHz: 12
dB (Maximum)	12		
dBc (Average)	13		
dBc (Maximum)	14		

Table 2.7-1 Waveform Data Type and Data Interval (2/2)

Measurement Item	Query Parameter	Data Interval	The number of data
Spectrum Emission Mask (General)	19	1.875 kHz	1935
Spectrum Emission Mask (Guard-band)	20	5.625 kHz	The number of data varies depending on the channel bandwidth setting. 20 MHz: 9039 15 MHz: 7247 10 MHz: 5487 5 MHz: 3695 3 MHz: 2255 1.4 MHz: 1135

2.8 Sample Programs

This section describes sample programs using the free Tera Term software.
For the Tera Term communication settings of, refer to Section 2.3.1 "Ethernet" in the *MU887000A TRX Test Module Operation Manual*.

2.8.1 Spectrum Emission Mask

An example of Spectrum Emission Mask measurement using the Native command mode is described here.
The sample program on the following pages can be executed as a Tera Term macro. Refer to the Tera Term Help file for how to execute the macro.

Processing Flow

1. Set the application software type to the MX887067A.
2. Set the following measurement conditions.

Test Port	Port 1
Input Level	–10 dBm
Uplink Frequency	1940 MHz
Operation Mode	Stand Alone
Frame Configuration	FDD
Duplex Mode	Half Duplex
RMC Modulation scheme	QPSK
Subcarrier Interval	3.75 kHz
Number of Subcarriers	1
Start Subcarrier Number	0
Tx Power Measurement	OFF
Occupied Bandwidth Measurement	OFF
Spectrum Emission Mask Measurement	ON, 100 times
Adjacent Channel Leakage Power Ratio Measurement	OFF
Modulation Analysis	OFF

3. Start measurement.
4. Read the measurement status.
5. Query measurement results after measurement is completed.

```
; Sample program for Spectrum Emission Mask
; Anritsu Corporation March,2012
; Macro for Tera Term Version 4.69
;
; set local echo to on
setecho 1
flushrecv
; time out 3 second
timeout=3

; Set language to "Native".
sendln 'SYST:LANG NAT'
call check_error_code

; Set application type to "Cellular".
sendln 'SYSSEL CELLULAR'
call check_error_code

; Set standard to "NBIOT".
sendln 'STDSEL NBIOT'
call check_error_code

; Set test port to "Port1".
sendln 'PORT PORT1,PORT1'
call check_error_code

; Set Operation Mode to "Stand Alone".
sendln 'NBOPEMODE STANDALONE'
call check_error_code

; Set Input Range to "-10 dBm".
sendln 'ILVL -10'
call check_error_code

; Set center frequency to "1940 MHz".
sendln 'ULFREQ 1940MHZ'
call check_error_code

; Set Frame Structure to "FDD".
sendln 'FRAMETYPE FDD'
call check_error_code

; Set Duplex Mode to "Half Duplex".
sendln 'DUPLEXMODE HALF'
```

```
call check_error_code

; Set RMC Modulation to "QPSK".
sendln 'ULRMC_MOD QPSK'
call check_error_code

; Set Subcarrier Spacing to "3.75kHz".
sendln 'ULSC_SPACE 3.75KHZ'
call check_error_code

; Set Count of Subcarrier to "1".
sendln 'ULRMC_SC 1'
call check_error_code

; Set Starting Subcarrier Number to "0".
sendln 'ULSC_START 0'
call check_error_code

; Set Measurement of Tx Power to "OFF".
sendln 'PWR_SET OFF'
call check_error_code

; Set Measurement of Occupied Bandwidth to "OFF".
sendln 'OBW_SET OFF'
call check_error_code

; Set Measurement of Spectrum Emission Mask to "ON","100 times".
sendln 'SEM_SET ON,100'
call check_error_code

; Set Measurement of Adjacent Channel Leakage power Ratio to "OFF".
sendln 'ACLR_SET OFF'
call check_error_code

; Set Measurement of Modulation Analysis to "OFF".
sendln 'MOD_SET OFF'
call check_error_code

; Start measurement
sendln 'SNGLS'
call check_error_code

; waiting measurement up to 10 second
for i 1 10
```

```
  sendln 'MSTAT?'
  pause 1; wait 1 second
  recvln
  recvln
  ;call check_response ; debug
  if result=0 goto _timeout
  if result=1 then
         break
  endif
  call check_error_code
next

; Query Judgement
sendln 'SEMPASS?'
call check_error_code

; Query Peak level and frequency in each range
sendln 'TTL_WORST_SEM_LV?'
call check_error_code

; Query Margin in each range
sendln 'TTL_WORST_SEM?'
call check_error_code

; Query Spectrum data
sendln 'WAVEFMEAS? 19,0,1935'
call check_error_code

messagebox  'Macro end successfully' 'Finish'

End

;       ------------ subroutines -----------

:check_error_code
  ; query error
  sendln 'SYSERR?'
  waitln 'No error'

  ; in case of timeout
  if result=0 goto _timeout
  ; in case of error occurring
  if result=2 then
```

```
            e_message='Error code = '
            strconcat e_message inputstr
            messagebox  e_message 'Command Error occurred'
            end
     endif

     ; in case of no error

   return

   :check_response

     ;for debug
     messagebox inputstr 'debug1'
     int2str result_str result
     messagebox result_str 'debug2'

     return

   :_timeout
     messagebox  'No response from MT8870A.' 'Time out!'
     call check_error_code
     End
```

2.8.2 Modulation Analysis

An example of modulation analysis using the SCPI command mode is described here.

The sample program on the following pages can be executed as a Tera Term macro. Refer to the Tera Term Help file for how to execute the macro.

Processing Flow

1. Set the application software type to the MX887067A.
2. Set the following measurement conditions.

Test Port	Port 2
Input Level	–20 dBm
Uplink Frequency	1940 MHz
Operation Mode	Stand Alone
Frame Structure	FDD
Duplex Mode	Half Duplex
RMC Modulation scheme	QPSK
Subcarrier Interval	3.75 kHz
Number of Subcarriers	1
Start Subcarrier Number	0
Tx Power	OFF
Occupied Bandwidth Measurement	OFF
Spectrum Emission Mask Measurement	OFF
Adjacent Channel Leakage Power Ratio Measurement	OFF
Modulation Analysis	ON, 200 times

3. Start measurement.
4. Read the measurement status.
5. Query the following measurement results when measurement is completed.

Frequency	
Frequency Error	
EVM	
Peak EVM	
Reference Signal EVM	
Phase Error	
Magnitude Error	
Carrier Leakage	
IQ Imbalance	
Waveform Quality	
In-band Emissions	General, IQ Image, Carrier Leakage

```
; Sample program for Modulation Analysis
; Anritsu Corporation March,2012
; Macro for Tera Term Version 4.69
;
; set local echo to on
setecho 1
flushrecv
; time out 3 second
timeout=3

; Set language to "SCPI".
sendln 'SYST:LANG SCPI'
call check_error_code

; Set application type to "Cellular".
sendln ':INST CELLULAR'
call check_error_code

; Set standard to "NBIot".
sendln ':CONF:CELL:MEAS:STAN NBIot'
call check_error_code

; Set test port to "Port2".
sendln ':ROUT:PORT:CONN:DIR PORT2,PORT2'
call check_error_code

; Set Operation Mode to "Stand Alone".
sendln ':CONF:CELL:NBI:OPEM STANDALONE'
call check_error_code

; Set channel to "9750".
sendln ':CONF:CELL:MEAS:RFS:ULCH 9750'
call check_error_code

; Set Input Level to "-20 dBm".
sendln ':CONF:CELL:MEAS:RFS:LEV -20'

; Set Frame Structure to "FDD".
sendln ':CONF:CELL:NBI:FSTR FDD'
call check_error_code

; Set Duplex Mode to "Half Duplex".
sendln ':CONF:CELL:NBI:DUPL HALF'
call check_error_code
```

```
; Set RMC Modulation to "QPSK".
sendln ':CONF:CELL:NBI:MOD:MSCH QPSK'
call check_error_code

; Set Subcarrier Spacing to "3.75kHz".
sendln ':CONF:CELL:NBI:SCSP 3.75KHZ'
call check_error_code

; Set Count of Subcarrier to "1".
sendln ':CONF:CELL:NBI:SCAL:NSC 1'
call check_error_code

; Set Starting Subcarrier Number to "0".
sendln ':CONF:CELL:NBI:SCAL:OSC 0'
call check_error_code

; Set Measurement of Tx Power to "OFF".
sendln ':CONF:CELL:NBI:FUND:POW:SET OFF'
call check_error_code

; Set Measurement of Occupied Bandwidth to "OFF".
sendln ':CONF:CELL:NBI:FUND:OBW:SET OFF'
call check_error_code

; Set Measurement of Spectrum Emission Mask to "OFF".
sendln ':CONF:CELL:NBI:FUND:SEM:SET OFF'
call check_error_code

; Set Measurement of Adjacent Channel Leakage power Ratio to "OFF".
sendln ':CONF:CELL:NBI:FUND:ACLR:SET OFF'
call check_error_code

; Set Measurement of Modulation Analysis to "ON","200 times".
sendln ':CONF:CELL:NBI:FUND:MOD:SET ON,200'
call check_error_code

; ! Note !
; Output the RF power of Device under test.

; Start measurement
sendln ':INIT:CELL:MEAS:SING'
call check_error_code

; waiting measurement up to 10 second
```

```
for i 1 10

  sendln ':FETC:CELL:MEAS:STAT?'
  pause 1; wait 1 second
  recvln
  recvln
  ;call check_response ; debug
  if result=0 goto _timeout
  if result=1 then
         break
  endif
  call check_error_code
next

; Query Frequency
sendln ':FETC:CELL:NBI:FUND:MOD:CFR? AVG'
call check_error_code

; Query Frequency Error
sendln ':FETC:CELL:NBI:FUND:MOD:FERR? TTL'
call check_error_code

; Query EVM
sendln ':FETC:CELL:NBI:FUND:MOD:EVM? TTL'
call check_error_code

; Query Peak EVM
sendln ':FETC:CELL:NBI:FUND:MOD:PEVM? TTL'
call check_error_code

; Query Demodulation Reference Signal EVM
sendln ':FETC:CELL:NBI:FUND:MOD:RSEV? TTL'
call check_error_code

; Query Phase Error
sendln ':FETC:CELL:NBI:FUND:MOD:PHER? TTL'
call check_error_code

; Query Magnitude Error
sendln ':FETC:CELL:NBI:FUND:MOD:MERR? TTL'
call check_error_code

; Query Carrier Leakage
sendln ':FETC:CELL:NBI:FUND:MOD:CARL? TTL'
```

```
call check_error_code

; Query IQ Imbalance
sendln ':FETC:CELL:NBI:FUND:MOD:IQIM:DB? TTL'
call check_error_code

; Query Waveform Quality
sendln ':FETC:CELL:NBI:FUND:MOD:RHO? TTL'
call check_error_code

; Query Inband Emission - General
sendln ':FETC:CELL:NBI:FUND:MOD:IEM:GEN? TTL'
call check_error_code

; Query Inband Emission – IQ Image
sendln ':FETC:CELL:NBI:FUND:MOD:IEM:IQIM? TTL'
call check_error_code

; Query Inband Emission – Carrier Leakage
sendln ':FETC:CELL:NBI:FUND:MOD:IEM:CARL? TTL'
call check_error_code

messagebox  'Macro end successfully' 'Finish'

End

;       ------------ subroutines -----------

:check_error_code
  ; query error
  sendln ':SYSTem:ERRor?'
  waitln 'No error'

  ; in case of timeout
  if result=0 goto _timeout
  ; in case of error occurring
  if result=2 then
          e_message='Error code = '
          strconcat e_message inputstr
          messagebox  e_message 'Command Error occurred'
          end
  endif

  ; in case of no error
```

```
return

:check_response

  ;for debug
  messagebox inputstr 'debug1'
  int2str result_str result
  messagebox result_str 'debug2'

  return

:_timeout
  messagebox  'No response from MT8870A.' 'Time out!'
  call check_error_code
  End


  messagebox result_str 'debug2'

  return

:_timeout
  messagebox  'No response from MT8870A.' 'Time out!'
  call check_error_code
  End
```

Chapter 4 SCPI Command Reference

This chapter describes the details of SCPI commands.
To switch to the SCPI command mode, send the command SYST:LANG SCPI.

4.1 List of Commands

The following table shows the rules for describing messages.

[ ]	Messages or parameters in square brackets can be omitted.
|	Choose one of several choices. A|B|C|D indicates a choice of A, B, C, and D.
{}	Choose one of the groups in braces. A|B({C|D}) indicates a choice of A, B(C), or B(D).

4.1.1 Common commands

Operation Status Register

Function	Command	Query	Response
Measurement Operation Status Register Query	-----	:STATus:OPERation:MEASure[:EVENt]?	<mosr>

Questionable Register

Function	Command	Query	Response
Measurement Questionable Status Register Query	-----	:STATus:QUEStionable:MEASure[:EVENt]?	<mqsr>

Common

Function	Command	Query	Response
Standard Select	:CONFigure:CELLular:MEASurement:STANdard <std>	:CONFigure:CELLular:MEASurement:STANdard?	<std>
Set Connect Port Direction	:ROUTe:PORT:CONNect:DIRection <input>,<output>	:ROUTe:PORT:CONNect:DIRection?	<input>,<output>

Measurement

Function	Command	Query	Response
Measurement Stop	:ABORt:CELLular:MEASurement	-----	-----
Measurement Status	-----	:FETCh:CELLular:MEASurement:STATe?	<m_status>
Measurement Start	:INITiate:CELLular:MEASurement:SINGle	-----	-----

Common Parameters

Function	Command	Query	Response
Output Level On/Off	:CONFigure:CELLular:GENerator:RFSettings:STATe <on_off>	:CONFigure:CELLular:GENerator:RFSettings:STATe?	<on_off>
Output Signal Modulation	:CONFigure:CELLular:GENerator:BBMode <on_off>	:CONFigure:CELLular:GENerator:BBMode?	<on_off>
Waveform File Select	:CONFigure:CELLular:GENerator:ARB:PACKage:SELect <pac>	:CONFigure:CELLular:GENerator:ARB:PACKage:SELect?	<pac>
Waveform Pattern Select	:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect <pat>	:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect?	<pat>
Waveform Pattern Select (SYNC)	:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC <pat>	:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC?	<pat>

System

Function	Command	Query	Response
Application Select	:INSTrument[:SELect] <app>	:INSTrument[:SELect]?	<app>
Language Selection of Remote Command	:SYSTem:LANGuage <mode>	:SYSTem:LANGuage?	<mode>

4.1.2 Fundamental measurement commands

Common Parameters

Function	Command	Query	Response
NB Operation Mode	:CONFigure:CELLular:NBIot:OPEMode <mode>	:CONFigure:CELLular:NBIot:OPEMode?	<mode>
Frame Structure	:CONFigure:CELLular:NBIot:FSTRucture <mode>	:CONFigure:CELLular:NBIot:FSTRucture?	<mode>
Duplex Mode	:CONFigure:CELLular:NBIot:DUPLex <mode>	:CONFigure:CELLular:NBIot:DUPLex?	<mode>
Coexisting Bandwidth	:CONFigure:CELLular:NBIot:CBANdwidth <bandwidth>	:CONFigure:CELLular:NBIot:CBANdwidth?	<bandwidth>
Uplink Channel	:CONFigure:CELLular:MEASurement:RFSettings:ULCHannel <ul_ch>	:CONFigure:CELLular:MEASurement:RFSettings:ULCHannel?	<ul_ch>
Uplink Frequency	:CONFigure:CELLular:MEASurement:RFSettings:FREQuency <ul_freq>	:CONFigure:CELLular:MEASurement:RFSettings:FREQuency?	<ul_freq>
Downlink Channel	:CONFigure:CELLular:MEASurement:RFSettings:DLCHannel <dl_ch>	:CONFigure:CELLular:MEASurement:RFSettings:DLCHannel?	<dl_ch>
Downlink Frequency	:CONFigure:CELLular:GENerator:RFSettings:FREQuency <dl_freq>	:CONFigure:CELLular:GENerator:RFSettings:FREQuency?	<dl_freq>
Operation Band	----	:CONFigure:CELLular:NBIot:FUNDamental:BAND?	<band>
Input Level	:CONFigure:CELLular:MEASurement:RFSettings:LEVel <level>	:CONFigure:CELLular:MEASurement:RFSettings:LEVel?	<level>
Output Level	:CONFigure:CELLular:GENerator:RFSettings:LEVel <level>	:CONFigure:CELLular:GENerator:RFSettings:LEVel?	<level>

NB-IoT Setting

Function	Command	Query	Response
Channel Coding	:CONFigure:CELLular:NBIot :CHCoding <object>	:CONFigure:CELLular:NBIot :CHCoding?	<object>
NPUSCH Format	:CONFigure:CELLular:NBIot :NPUSch <format>	:CONFigure:CELLular:NBIot :NPUSch?	<format>
UL RMC Subcarrier Spacing	:CONFigure:CELLular:NBIot :SCSPacing <sc_spacing>	:CONFigure:CELLular:NBIot :SCSPacing?	<sc_spacing>
UL RMC Number of Subcarrier	:CONFigure:CELLular:NBIot :SCALlocation:NSC <ul_rmc_sc>	:CONFigure:CELLular:NBIot :SCALlocation:NSC?	<ul_rmc_sc>
UL RMC Starting Subcarrier	:CONFigure:CELLular:NBIot :SCALlocation:OSC <ulsc>	:CONFigure:CELLular:NBIot :SCALlocation:OSC?	<ulsc>
UL RMC Number of Resource Units	:CONFigure:CELLular:NBIot :NPUSch:NRUNit <ul_rmc_ru>	:CONFigure:CELLular:NBIot :NPUSch:NRUNit?	<ul_rmc_ru>
UL RMC MCS Index	:CONFigure:CELLular:NBIot :MCS	----	----
UL RMC Modulation	:CONFigure:CELLular:NBIot :MODulation:MSCHeme <ul_rmc_mod>	:CONFigure:CELLular:NBIot :MODulation:MSCHeme?	<ul_rmc_mod>
UL RMC Cyclic Shift Index	:CONFigure:CELLular:NBIot :CSHift:INDex <index>	:CONFigure:CELLular:NBIot :CSHift:INDex?	<index>
Group Hopping	:CONFigure:CELLular:NBIot :GHOPping <on_off>	:CONFigure:CELLular:NBIot :GHOPping?	<on_off>
NCell ID	:CONFigure:CELLular:NBIot :NCID <id>	:CONFigure:CELLular:NBIot :NCID?	<id>
Delta SS	:CONFigure:CELLular:NBIot :DSS <val>	:CONFigure:CELLular:NBIot :DSS?	<val>

NB-IoT Setting

Function	Command	Query	Response
Trigger Source	:TRIGger:CELLular:NBIot:FUNDamental:SOURce <source>	:TRIGger:CELLular:NBIot:FUNDamental:SOURce?	<source>
Trigger Level	:TRIGger:CELLular:NBIot:FUNDamental:LEVel <level>	:TRIGger:CELLular:NBIot:FUNDamental:LEVel?	<level>
Trigger Delay	:TRIGger:CELLular:NBIot:FUNDamental:DELay <delay>	:TRIGger:CELLular:NBIot:FUNDamental:DELay?	<delay>
Trigger Timeout	:TRIGger:CELLular:NBIot:FUNDamental:TOUT <time>	:TRIGger:CELLular:NBIot:FUNDamental:TOUT?	<time>

Fundamental Measurement Parameters

Function	Command	Query	Response
Measurement Item	:CONFigure:CELLular:NBIot :FUNDamental:MITem <item>	:CONFigure:CELLular:NBIot :FUNDamental:MITem?	<item>
Power Measurement On/Off and Meas. Count	:CONFigure:CELLular:NBIot :FUNDamental:POWer:SET <on_off>[,<avg_count>]	:CONFigure:CELLular:NBIot :FUNDamental:POWer:SET?	<on_off>[,<avg_count>]
OBW On/Off and Meas. Count	:CONFigure:CELLular:NBIot :FUNDamental:OBW:SET <on_off>[,<avg_count>]	:CONFigure:CELLular:NBIot :FUNDamental:OBW:SET?	<on_off>[,<avg_count>]
SEM On/Off and Meas. Count	:CONFigure:CELLular:NBIot :FUNDamental:SEMask:SET <on_off>[,<avg_count>]	:CONFigure:CELLular:NBIot :FUNDamental:SEMask:SET?	<on_off>[,<avg_count>]
ACLR On/Off and Meas. Count	:CONFigure:CELLular:NBIot :FUNDamental:ACLR:SET <on_off>[,<avg_count>]	:CONFigure:CELLular:NBIot :FUNDamental:ACLR:SET?	<on_off>[,<avg_count>]
Modulation Analysis On/Off and Meas. Count	:CONFigure:CELLular:NBIot :FUNDamental:MODulation:SET <on_off>[,<avg_count>]	:CONFigure:CELLular:NBIot :FUNDamental:MODulation:SET?	<on_off>[,<avg_count>]
All Measurement Items Off	:CONFigure:CELLular:NBIot :FUNDamental:AMITems:OFF	----	----

Result (Power Measurement, Occupied Bandwidth, Adjacent Channel Power)

Function	Command	Query	Response
Tx Power Result	----	:FETCh:CELLular:NBIot:FUNDamental:POWer:TXPower? [<mode>]	<pwr> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL <s>,<pwr(1)>,<pwr(2)>,...,<pwr(s)> <mode>=IND AVG when <mode> is omitted.
Channel Power Result	----	:FETCh:CELLular:NBIot:FUNDamental:POWer:CHPower? [<mode>]	<pwr> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL <s>,<pwr(1)>,<pwr(2)>,...,<pwr(s)> <mode>=IND AVG when <mode> is omitted.
OBW Result	----	:FETCh:CELLular:NBIot:FUNDamental:OBW?	<bw>
OBW Frequency Result	----	:FETCh:CELLular:NBIot:FUNDamental:OBW:FREQuency? <pos>	<freq>
ACLR Result	----	:FETCh:CELLular:NBIot:FUNDamental:ACLR?	<aclr(G_LOW1)>,<aclr(G_UP1)>,<aclr(LOW1)>, <aclr(UP1)> <mode>=AVG,MAX,MIN <avg(G_LOW1)>,<avg(G_UP1)>,<avg(LOW1)>,<avg(UP1)>,<max(G_LOW1)>,<max(G_UP1)>,<max(LOW1)>,<max(UP1)>,<min(G_LOW1)>,<min(G_UP1)>,<min(LOW1)>,<min(UP1)> <mode>=TTL

Result (Spectrum Emission Mask)

Function	Command	Query	Response
SEM Judgement	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:JUDGement? [<target>]	<judgement>
SEM Worst Value	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel? <range>	<level>,<freq>
SEM Worst Value (All range)	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:TTL?	<level(-1)>,<freq(-1)>,…,<level(-5)>,<freq(-5)>, <level(1)>,<freq(1)>,…,<level(5)>,<freq(5)>
SEM Template Margin	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin? <range>	<margin>,<freq>
SEM Template Margin (All range)	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:TTL?	<margin(-1)>,<freq(-1)>,…,<margin(-5)>,<freq(-5)>,<margin(1)>,<freq(1)>,…,<margin(5)>,<freq(5)>
SEM Worst Value (Guard-band)	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd? <range>	<level>,<freq>
SEM Worst Value (Guard-band) (All range)	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd:TTL?	<level(-1)>,<freq(-1)>,…,<level(-4)>,<freq(-4)>, <level(1)>,<freq(1)>,…,<level(4)>,<freq(4)>
SEM Template Margin (Guard-band)	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd? <range>	<margin>,<freq>
SEM Template Margin (Guard-band) (All range)	----	:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd:TTL?	<margin(-1)>,<freq(-1)>,…,<margin(-4)>,<freq(-4)>,<margin(1)>,<freq(1)>,…,<margin(4)>,<freq(4)>

Result (Modulation Analysis)

Function	Command	Query	Response
Carrier Frequency Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:CFRequency? <mode>	<freq>
Carrier Frequency Error Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor? <mode>	<freq_ppm>,<freq_Hz> <mode>=AVG,MAX,MIN,DVT <avg_ppm>,<avg_Hz>,<max_ppm>,<max_Hz>,<min_ppm>,<min_Hz> <mode>=TTL
Worst Carrier Frequency Error Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor:WORSt?	<freq_ppm>,<freq_Hz>
EVM Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVM? [<mode>]	<evm> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL <s>,<evm(1)>,…,<evm[s]> <mode>=IND AVG when <mode> is omitted.
EVM low Result		:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVML? [<mode>]	<evm> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL <s>,<evm(1)>,…,<evm[s]> <mode>=IND AVG when <mode> is omitted.
EVM high Result		:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVMH? [<mode>]	<evm> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL <s>,<evm(1)>,…,<evm[s]> <mode>=IND AVG when <mode> is omitted.

Result (Modulation Analysis) (Cont'd)

Function	Command	Query	Response
Reference Signal EVM Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:RSEVm? [<mode>]	<rsevm> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL <s>,<rsevm(1)>,…,<rsevm[s]> <mode>=IND AVG when <mode> is omitted.
Peak EVM Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:PEVM? [<mode>]	<pevm> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.
Phase Error Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:PHERror? [<mode>]	<phase> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.
Magnitude Error Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:MERRor? [<mode>]	<magnitude> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.
Rho Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:RHO? [<mode>]	<rho> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.
Carrier Leakage Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:CARLeakage? [<mode>]	<cleakage> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.

Result (Modulation Analysis) (Cont'd)

Function	Command	Query	Response
In-Band Emissions Measured Item	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:ITEM?	<flag>
In-Band Emissions Judgement	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:JUDGement?	<judgement>
In-Band Emissions (General) Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:GENeral? [<mode>]	<ibe> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL MAX when <mode> is omitted.
In-Band Emissions limit (General)	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:GENeral?	<level>
In-Band Emissions (IQ Image) Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:IQIMage? [<mode>]	<ibe> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL MAX when <mode> is omitted.
In-Band Emissions limit (IQ Image)	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:IQIMage?	<level>

Result (Modulation Analysis) (Cont'd)

Function	Command	Query	Response
In-Band Emissions (Carrier Leakage) Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:CARLeakage? [<mode>]	<ibe> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.
In-Band Emissions limit (Carrier Leakage)	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:CARLeakage?	<level>
In-Band Emissions Margin	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:MARGin?	<margin>
IQ Imblance (%) Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:PERCent? [<mode>]	<percent> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.
IQ Imblance (dB) Result	----	:FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:DB? [<mode>]	<level> <mode>=AVG,MAX,MIN,DVT <avg>,<max>,<min> <mode>=TTL AVG when <mode> is omitted.

Result (Waveform)

Function	Command	Query	Response
Waveform	----	:FETCh:CELLular:NBIot:FUNDamental:TRACe? <format>,<position>,<length>[,<symbol>]	<data(1)>,…,<data(length)>

4.2 Details of Commands

This section describes the commands in alphabetical order.

■ Terms in this command list

EX .... Command name (header)

Example .... Command function name

Function .... Command function

Command.................................. Programming command syntax

Query .... Query syntax

Response .... Response syntax

Parameter... Parameter definition

Details .... Command restrictions and others

Example of Use .... Command usage example

Related Commands .... Introduction of related commands

■ Suffix Code list

Suffix Code	Unit	Suffix Code	Unit
DB	dB	MHZ	MHz
DBM	dBm	MS	ms
GHZ	GHz	MZ	MHz
GZ	GHz	NS	ns
HZ	Hz	S	s
KHZ	kHz	US	µs
KZ	kHz		

4.2.1 Common commands

:ABORt:CELLular:MEASurement

Measurement Stop

Function

Stops the current measurement.

Command

```
:ABORt:CELLular:MEASurement
```

Example of Use

To stop the current measurement:

```
:ABOR:CELL:MEAS
```

:CONFigure:CELLular:GENerator:ARB:PACKage:SELect

Waveform File Select

Function

Selects and queries the waveform file for arbitrary waveform signal used at Downlink signal.

Command

```
:CONFigure:CELLular:GENerator:ARB:PACKage:SELect <pac>
```

Query

```
:CONFigure:CELLular:GENerator:ARB:PACKage:SELect?
```

Response

```
<pac>
```

Parameter

<pac>	Waveform file

Details

The name of the file used from the waveform files loaded into waveform memory is set by this command.

Example of Use

To set the waveform file 1 from waveform files loaded in waveform memory:

```
:CONF:CELL:GEN:ARB:PACK:SEL “PAC1”
:CONF:CELL:GEN:ARB:PACK:SEL?
> PAC1
```

Related command

Use the following command to load the waveform file into waveform memory.
:SOURce:GPRF:GENerator:ARB:FILE:LOAD
For details of the command, refer to Chapter 5 "SCPI Command Reference" in the *MU887000A TRX Test Module Operation Manual*.

The following command can be used to query the names of waveform files that have been loaded into waveform memory.
:SOURce:GPRF:GENerator:ARB:WAVeform:NAME?
For details of the command, refer to Chapter 5 "SCPI Command Reference" in the *MU887000A TRX Test Module Operation Manual*.

Use the following commands to select a waveform pattern to use from the waveform patterns included in the waveform file configured using the command described in this section.
:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect
:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC
:CONFigure:CELLular:SEQuence:RFSettings:TRX

:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect

Waveform Pattern Select

Function

Selects a waveform pattern to use from patterns included in waveform file.
When the command received, the signal is immediately switched regardless of the frame cycle of signal, so the frame cycle is not continued.
This command is also used to query the currently selected waveform pattern.

Command

```
:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect <pat>
```

Query

```
:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect?
```

Response

```
<pat>
```

Parameter

<pat>	Waveform pattern
PAT1 to PATn	Waveform pattern number (n: waveform information file group range)
Default	PAT1

Details

Select the waveform pattern for RF output signal in waveform file.
The pattern number is the same as the group number. Refer to Chapter 3, "Waveform File Details" in the *Waveform Files for Cellular Application Operation Manual*.

Example of Use

To output the waveform pattern to 1:

```
:CONF:CELL:GEN:ARB:WAV:PATT:SEL PAT1
:CONF:CELL:GEN:ARB:WAV:PATT:SEL?
> PAT1
```

Related command

Waveform file for arbitrary waveform signal selection or query
:CONFigure:CELLular:GENerator:ARB:PACKage:SELect

Remarks

The group number depends on the selected waveform file.
For details of the waveform pattern, refer to Chapter 3, "Waveform File Details" in the *Waveform Files for Cellular Application Operation Manual*.

:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC

Waveform Pattern Select (SYNC)

Function

Selects a waveform pattern to use from patterns included in waveform file.
When the command received, the signal is switched according to the frame cycle of signal so that the frame cycle is continued.
This command is also used to query the currently selected waveform pattern.

Command

```
:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC <pat>
```

Query

```
:CONFigure:CELLular:GENerator:ARB:WAVeform:PATTern:SELect:SYNC?
```

Response

```
<pat>
```

Parameter

<pat>	Waveform pattern
PAT1 to PATn	Waveform pattern number (n: waveform information file group range)
Default	PAT1

Details

Select the waveform pattern for RF output signal in waveform file.
The pattern number is the same as the group number. Refer to Chapter 3, "Waveform File Details" in the *Waveform Files for Cellular Application Operation Manual*.

Example of Use

To output the waveform pattern to 1:

```
:CONF:CELL:GEN:ARB:WAV:PATT:SEL:SYNC PAT1
:CONF:CELL:GEN:ARB:WAV:PATT:SEL:SYNC?
> PAT1
```

Related command

Waveform file for arbitrary waveform signal selection or query
:CONFigure:CELLular:GENerator:ARB:PACKage:SELect

Remarks

The group number depends on the selected waveform file.
For details of the waveform pattern, refer to Chapter 3, "Waveform File Details" in the *Waveform Files for Cellular Application Operation Manual*.

:CONFigure:CELLular:GENerator:BBMode

Output Signal Modulation

Function

Sets or queries MU887000A RF signal output modulation.

Command

```
:CONFigure:CELLular:GENerator:BBMode <on_off>
```

Query

```
:CONFigure:CELLular:GENerator:BBMode?
```

Response

```
<on_off>
```

Parameter

<on_off>	Enables/disables modulation.
ON	Enables RF output signal modulation.
OFF	Disables RF output signal modulation.
Default	ON

Example of Use

To turn on the modulation.

```
:CONF:CELL:GEN:BBM ON
:CONF:CELL:GEN:BBM?
> ON
```

:CONFigure:CELLular:GENerator:RFSettings:STATe

Output Level On/Off

Function

Sets or queries RF signal output at MU887000A connector.

Command

```
:CONFigure:CELLular:GENerator:RFSettings:STATe <on_off>
```

Query

```
:CONFigure:CELLular:GENerator:RFSettings:STATe?
```

Response

```
<on_off>
```

Parameter

<on_off>	Enables/disables RF signal output.
ON	Enables RF signal output.
OFF	Disables RF signal output.
Default	ON

Example of Use

To turn on the RF signal transmitted from the MU887000A connector:

```
:CONF:CELL:GEN:RFS:STAT ON
:CONF:CELL:GEN:RFS:STAT?
> ON
```

:CONFigure:CELLular:MEASurement:STANdard

Standard Select

Function

Sets or queries the measurement standard.

Command

```
:CONFigure:CELLular:MEASurement:STANdard <std>
```

Query

```
:CONFigure:CELLular:MEASurement:STANdard?
```

Response

```
<std>
```

Parameter

<std>	Measurement standard	
COMMON	Common measurement	(requires MX887010A)
WCDMA	W-CDMA	(requires MX887011A)
GSM	GSM	(requires MX887012A)
LTE	LTE	(requires MX887013A or MX887014A)
CDMA2000	CDMA2000 1x	(requires MX887015A)
EVDO	CDMA2000 1xEVDO	(requires MX887016A)
TDSCDMA	TD-SCDMA	(requires MX887017A)
NBIOT	NB-IoT	(requires MX887067A)
SEQUENCE	Sequence	(requires MX887010A)
SEQ	Sequence	(requires MX887010A)
Default	COMMON	

Example of Use

To switch the measurement standard to SEQUENCE:

```
:CONF:CELL:MEAS:STAN SEQUENCE
:CONF:CELL:MEAS:STAN?
> SEQUENCE
```

Remarks

This parameter must be set to NBIOT to execute the commands described in Section 4.2.2 “Fundamental measurement commands”.

:FETCh:CELLular:MEASurement:STATe?

Measurement Status

Function

Queries the measurement status.

Query

```
:FETCh:CELLular:MEASurement:STATe?
```

Response

```
<m_status>
```

Parameter

<m_status>	Measurement status
0	Completed measurement
2	Over level
5	Synchronization word not detected
9	Measurement in progress or not measured
12	Tx measurement timeout

Details

This command can be used while measurement is in progress or suspended.

Example of Use

To query current measurement status:

```
:FETC:CELL:MEAS:STAT?
> 0
```

:INITiate:CELLular:MEASurement:SINGle

Measurement Start

Function

Sets the parameters for both specified measurement and signal transmission and executes measurement.

Command

```
:INITiate:CELLular:MEASurement:SINGle
```

Details

Sending this command executes one measurement execution.
Sending this command during measurement, aborts measurement once and restarts it.
ESR2 must be polled or sync processing via *WAI is required to determine the timing of measurement completion.

Example of Use

To start measurement:

```
INIT:CELL:MEAS:SING
```

Related command

:STATus:QUEStionable:MEASure[:EVENt]
For the details of the event status register, refer to Chapter 3 “Fundamental Operation” in the *MU887000A TRX Test Module Operation Manual*.

:INSTrument[:SELect]

Application Select

Function

Sets or queries the type of application software executing on MU887000A.

Command

```
:INSTrument[:SELect] <app>
```

Query

```
:INSTrument[:SELect]?
```

Response

```
<app>
```

Parameter

<app>	Type of application software
CELLULAR	Cellular Application
SRW	SRW Application

Details

Set the parameter to CELLULAR and send the command before using the MX887067A.

Example of Use

To set the application software to CELLULAR:

```
INST CELLULAR
INST?
> CELLULAR
```

Remarks

When using the MX887067A, set the application to CELLULAR using the :INSTrument[:SELect] command, and then set the standard to NBIOT using the :CONFigure:CELLular:MEASurement:STANdard command.

:ROUTe:PORT:CONNect:DIRection

Set Connect Port Direction

Function

Sets or queries connectors for inputting and outputting RF signals.

Command

```
:ROUTe:PORT:CONNect:DIRection <input>,<output>
```

Query

```
:ROUTe:PORT:CONNect:DIRection?
```

Response

```
<input>,<output>
```

Parameters

<input>	Test Port No.
PORT1	Test Port1
PORT2	Test Port2
PORT3	Test Port3
PORT4	Test Port4
Default	PORT1
<output>	Test Port No.
PORT1	Test Port1
PORT2	Test Port2
PORT3	Test Port3
PORT4	Test Port4
Default	PORT1

Details

Both Test Port1 and Test Port2 can be set to input and output simultaneously.
Test Port3 and Test Port4 can be set to either input or output at one time.
Only Port1 and Port2 are used by the MX887067A.

Example of Use

To set the RF signal input and output connectors to Test Port1 and Test Port2, respectively:

```
:ROUT:PORT:CONN:DIR PORT1,PORT2
:ROUT:PORT:CONN:DIR?
> PORT1,PORT2
```

:SYSTem:LANGuage

Language Selection of Remote Command

Function

Switches the language mode of remote control commands.

Command

```
:SYSTem:LANGuage <mode>
```

Query

```
:SYSTem:LANGuage?
```

Response

```
<mode>
```

Parameter

<mode>	Language mode
NAT	Native
SCPI	SCPI
Default	NAT

Example of Use

To switch the language mode of remote control commands to Native.

```
:SYST:LANG NAT
:SYST:LANG?
>NAT
```

:STATus:OPERation:MEASure[:EVENt]?

Measurement Operation Status Register Query

Function

Queries content of measurement operation status register

The event occurrence can be identified using the retrieved value.

Query

```
:STATus:OPERation:MEASure[:EVENt]?
```

Response

```
<mosr>
```

Parameter

`<mosr>`	Measurement operation status register	
Range	0 to 65535	
Value = bit0 + bit1 + ... + bit15		
bit0 = 2^0 = 1		Measurement in progress
bit1 = 2^1 = 2		Preparing trigger
bit2 = 2^2 = 4		Unused
bit3 = 2^3 = 8		Unused
bit4 = 2^4 = 16		Unused
bit5 = 2^5 = 32		Unused
bit6 = 2^6 = 64		Unused
bit7 = 2^7 = 128		Unused
bit8 = 2^8 = 256		Unused
bit9 = 2^9 = 512		Unused
bit10 = 2^{10} = 1024		Unused
bit11 = 2^{11} = 2048		Unused
bit12 = 2^{12} = 4096		Unused
bit13 = 2^{13} = 8192		Unused
bit14 = 2^{14} = 16384		Unused
bit15 = 2^{15} = 32768		Unused

Details

The sum of the values for bits of the occurring event from the values $2^0 = 1$, $2^1 = 2$ to 2^{15} = 32768, that correspond to the measurement operation status register bits 0, 1 to 15 becomes the response.

Example of Use

To query content of measurement operation status register:

```
:STAT:OPER:MEAS?
> 1
```

:STATus:QUEStionable:MEASure[:EVENt]?

Measurement Questionable Status Register Query

Function

Queries content of measurement questionable status register
The event occurrence can be identified using the retrieved value.

Query

```
:STATus:QUEStionable:MEASure[:EVENt]?
```

Response

<mqsr>

Parameter

<mqsr> Measurement questionable status register

Range 0 to 65535

Value = bit0 + bit1 + ... + bit15

bit0 = 2^0 = 1	Over level
bit1 = 2^1 = 2	Under level
bit2 = 2^2 = 4	Timeout
bit3 = 2^3 = 8	Unused
bit4 = 2^4 = 16	Unused
bit5 = 2^5 = 32	Unused
bit6 = 2^6 = 64	Unused
bit7 = 2^7 = 128	Unused
bit8 = 2^8 = 256	Unused
bit9 = 2^9 = 512	Unused
bit10 = 2^{10} = 1024	Unused
bit11 = 2^{11} = 2048	Unused
bit12 = 2^{12} = 4096	Unused
bit13 = 2^{13} = 8192	Unused
bit14 = 2^{14} = 16384	Unused
bit15 = 2^{15} = 32768	Unused

Details

The sum of the values for bits of the occurring event from the values $2^0 = 1$, $2^1 = 2$ to $2^{15} = 32768$, that correspond to the measurement questionable status register bits 0, 1 to 15 becomes the response.

Example of Use

To query content of measurement questionable status register:

```
:STAT:QUES:MEAS?
> 0
```

4.2.2 Fundamental measurement commands

:CONFigure:CELLular:GENerator:RFSettings:FREQuency

Downlink Frequency

Function

Sets or queries the downlink frequency.

Command

```
:CONFigure:CELLular:GENerator:RFSettings:FREQuency <dl_freq>
```

Query

```
:CONFigure:CELLular:GENerator:RFSettings:FREQuency?
```

Response

```
<dl_fleq>
```

Parameter

<dl_freq>	Downlink frequency
Range	400 000 000 to 3800.000 000 Hz
	400 000 000 to 6000.000000 Hz (with MU887000A-001/101)
Resolution	1 Hz
Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
Default	2140 000 000 Hz
Unit	Hz

Details

The Rx frequency for the mobile station is set.
Updating the Downlink Frequency setting does not affect the Downlink Channel setting.

Example of Use

To set the downlink frequency to 2140 MHz:

```
:CONF:CELL:GEN:RFS:FREQ 2140MHZ
:CONF:CELL:GEN:RFS:FREQ?
>2140000000
```

:CONFigure:CELLular:GENerator:RFSettings:LEVel

Output Level

Function

Sets or queries the total output level of all channels.

Command

```
:CONFigure:CELLular:GENerator:RFSettings:LEVel <level>
```

Query

```
:CONFigure:CELLular:GENerator:RFSettings:LEVel?
```

Response

```
<level>
```

Parameter

<level>	Output level
Range	–130.0 to –10.0 dBm (Port 1/Port 2) –120.0 to 0.0 dBm (Port 3/Port 4)
Resolution	0.1 dB
Suffix Code	DBM (uses dBm when omitted)
Default	–60.2 dBm
Unit	dBm

Details

The setting range varies with the output port setting.
When the Cable Loss Calibration is ON, the cable loss is subtracted from the output level setting range.
When the cable loss is 5 dB, the Port1/Port2 setting range is –135.0 to –15.0 dBm.

Range	–130.0 – Cable loss to –10.0 – Cable loss [dBm] (Port 1/Port 2) –120.0 – Cable loss to 0.0 – Cable loss [dBm] (Port 3/Port 4)

Example of Use

To set the output level to –50.0 dBm:

```
:CONF:CELL:GEN:RFS:LEV -50.0
:CONF:CELL:GEN:RFS:LEV?
> -50.0
```

Related Commands

[:ROUTe]:EXTLoss:TABLe:SWITch
:CALCulate:EXTLoss:TABLe:SETTing
:CALCulate:EXTLoss:TABLe:VALue
For details of the commands, refer to Chapter 5 “SCPI Command Reference” in the *MU887000A TRX Test Module Operation Manual*.

:CONFigure:CELLular:MEASurement:RFSettings:DLCHannel

Downlink Channel

Function

Sets or queries the Downlink Channel.

Command

```
:CONFigure:CELLular:MEASurement:RFSettings:DLCHannel <dl_ch>
```

Query

```
:CONFigure:CELLular:MEASurement:RFSettings:DLCHannel?
```

Response

```
<dl_ch>
```

Parameter

<dl_ch>	Downlink Channel
Range	0 to 262143
Resolution	1
Default	300
Suffix code	None

Details

When the Downlink Channel is updated, Operation Band, Uplink Channel, Downlink Frequency and Uplink Frequency are changed accordingly.
For the relationship between the channel and frequency settings refer to Table 2.1.6-1 “Relationship between Uplink Channel Number and Downlink Channel Number” and Table 2.1.6-2 “E-UTRA Channel Numbers and Default UE TX-RX Frequency Separation”.

Example of Use

To set the Downlink Channel to 300:

```
:CONF:CELL:MEAS:RFS:DLCH 300
:CONF:CELL:MEAS:RFS:DLCH?
> 300
```

:CONFigure:CELLular:MEASurement:RFSettings:FREQuency?

Uplink Frequency

Function

Sets or queries the Uplink frequency.

Command

```
:CONFigure:CELLular:MEASurement:RFSettings:FREQuency <ul_freq>
```

Query

```
:CONFigure:CELLular:MEASurement:RFSettings:FREQuency?
```

Response

```
<ul_fleq>
```

Parameter

<ul_freq>	Uplink frequency
Range	400 000 000 to 3800 000 000 Hz
	400 000 000 to 6000 000 000 Hz (with MU887000A-001/101)
Resolution	1 Hz
Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
Default	1950 000 000 Hz
Unit	Hz

Details

This setting corresponds to the mobile station Tx frequency setting.
Updating this Uplink frequency does not affect the Uplink Channel parameters.

Example of Use

To set the Uplink frequency to 1950 MHz:

```
:CONF:CELL:MEAS:RFS:FREQ 1950MHZ
:CONF:CELL:MEAS:RFS:FREQ?
>1950000000
```

:CONFigure:CELLular:MEASurement:RFSettings:LEVel

Input Level

Function

Sets or queries the input level of the MU887000A connector.

Command

```
:CONFigure:CELLular:MEASurement:RFSettings:LEVel <level>
```

Query

```
:CONFigure:CELLular:MEASurement:RFSettings:LEVel?
```

Response

```
<level>
```

Parameter

<level>	Input level of PCC	
Range	–65.0 to +35.0 dBm	(Port 1/Port 2)
	–65.0 to +25.0 dBm	(Port 3/Port 4)
Resolution	0.1 dB	
Suffix Code	DBM, (uses dBm when omitted)	
Default	–1.0 dBm	
Unit	dBm	

Details

The setting range varies according to the External Loss setting.
When Cable Loss Correction is ON, the cable loss is added to the input level setting range.
When the cable loss is 5 dB, the Port1/Port2 setting range is –60.0 to +40.0 dBm.

Range	–65.0＋Cable loss to +35.0＋Cable loss [dBm]	(Port 1/Port 2)
	–65.0＋Cable loss to +25.0＋Cable loss [dBm]	(Port 3/Port 4)

Example of Use

To set the input level to –10.0 dBm:

```
:CONF:CELL:MEAS:RFS:LEV -10.0
:CONF:CELL:MEAS:RFS:LEV?
>-10.0
```

Related Commands

[:ROUTe]:EXTLoss:TABLe:SWITch
:CALCulate:EXTLoss:TABLe:SETTing
:CALCulate:EXTLoss:TABLe:VALue
For details of the commands, refer to Chapter 5 “SCPI Command Reference” in the *MU887000A TRX Test Module Operation Manual*.

:CONFigure:CELLular:MEASurement:RFSettings:ULCHannel

Uplink Channel

Function

Sets or queries the Uplink Channel.

Command

```
:CONFigure:CELLular:MEASurement:RFSettings:ULCHannel <ul_ch>
```

Query

```
:CONFigure:CELLular:MEASurement:RFSettings:ULCHannel?
```

Response

```
<ul_ch>
```

Parameter

<ul_ch>	Uplink Channel
Range	0 to 262143
Resolution	1
Suffix code	None
Default	18300

Details

When the Uplink Channel is updated, the related Operation Band, Downlink Channel, Uplink Frequency, Downlink Frequency are changed accordingly.
For the relationship between the parameter and frequency settings of channels refer to Table 2.1.6-1 “Relationship between Uplink Channel Number and Downlink Channel Number” and to Table 2.1.6-2 “E-UTRA Channel Numbers and Default UE TX-RX Frequency Separation”.

Example of Use

To set the Uplink Channel to 18300:

```
:CONF:CELL:MEAS:RFS:ULCH 18300
:CONF:CELL:MEAS:RFS:ULCH?
> 18300
```

:CONFigure:CELLular:NBIot:CBANdwidth

Coexisting Bandwidth

Function

Sets or queries the LTE Bandwidth when Operation Mode is Guard-band.

Command

```
:CONFigure:CELLular:NBIot:CBANdwidth <bandwidth>
```

Query

```
:CONFigure:CELLular:NBIot:CBANdwidth?
```

Response

<bandwidth>

Parameter

<bandwidth>	Bandwidth
1.4MHZ	1.4 MHz
3MHZ	3 MHz
5MHZ	5 MHz
10MHZ	10 MHz
15MHZ	15 MHz
20MHZ	20 MHz
Default	5 MHZ

Example of Use

To set the Coexisting Bandwidth to 1.4 MHz:

```
:CONF:CELL:NBI:CBAN 1.4MHZ
:CONF:CELL:NBI:CBAN?
> 1.4MHZ
```

:CONFigure:CELLular:NBIot:CHCoding

Channel Coding

Function

Sets or queries the channel coding.

Command

```
:CONFigure:CELLular:NBIot:CHCoding <object>
```

Query

```
:CONFigure:CELLular:NBIot:CHCoding?
```

Response

```
<object>
```

Parameter

<object>	Target for channel coding
RMC	Reference Measurement Channel
Default	RMC

Examples of Use

To set the channel coding to RMC:

```
:CONF:CELL:NBI:CHC RMC
:CONF:CELL:NBI:CHC?
> RMC
```

:CONFigure:CELLular:NBIot:CSHift:INDex

UL RMC Cyclic Shift Index

Function

Sets or queries the Cyclic Shift Index of NPUSCH.

Command

```
:CONFigure:CELLular:NBIot:CSHift:INDex <index>
```

Query

```
:CONFigure:CELLular:NBIot:CSHift:INDex?
```

Response

```
<index>
```

Parameter

<index>	Cyclic Shift Index
Range	0 to 2 (Number of Subcarrier = 3)
	0 to 3 (Number of Subcarrier = 6)
	0 (Number of Subcarrier = 1 or 12)
Resolution	1
Default	0
Suffix code	None

Details

When the UL RMC Number of Subcarrier is 3 or 6, Cyclic Shift Index is required.
When the UL RMC Number of Subcarrier is updated, the Cyclic Shift Index is set to 0.

Example of Use

To set the Cyclic Shift Index to 0:

```
:CONF:CELL:NBI:CSH:IND 0
:CONF:CELL:NBI:CSH:IND?
> 0
```

:CONFigure:CELLular:NBIot:DSS

Delta SS

Function

Sets or queries the Delta SS.

Command

```
:CONFigure:CELLular:NBIot:DSS <val>
```

Query

```
:CONFigure:CELLular:NBIot:DSS?
```

Response

```
<val>
```

Parameter

<val>	Delta SS
Range	0 to 29
Resolution	1
Default	0
Suffix code	None

Example of Use

To set the Delta SS to 0:

```
:CONF:CELL:NBI:DSS 0
:CONF:CELL:NBI:DSS?
> 0
```

:CONFigure:CELLular:NBIot:DUPLex

Duplex Mode

Function

Sets or queries the Duplex Mode.

Command

```
:CONFigure:CELLular:NBIot:DUPLex <mode>
```

Query

```
:CONFigure:CELLular:NBIot:DUPLex?
```

Response

```
<mode>
```

Parameter

<mode>	Duplex Mode
HALF	Half Duplex
Default	HALF

Example of Use

To set the Duplex Mode to HALF:

```
:CONF:CELL:NBI:DUPL HALF
:CONF:CELL:NBI:DUPL?
> HALF
```

:CONFigure:CELLular:NBIot:FSTRucture

Frame Structure

Function

Sets or queries the frame structure.
This setting determines the duplex mode.

Command

```
:CONFigure:CELLular:NBIot:FSTRucture <mode>
```

Query

```
:CONFigure:CELLular:NBIot:FSTRucture?
```

Response

```
<mode>
```

Parameter

<mode>	Frame Structure
FDD	Frequency Division Multiplexing
Default	FDD

Example of Use

To set the frame structure to FDD:

```
:CONF:CELL:NBI:FSTR FDD
:CONF:CELL:NBI:FSTR?
> FDD
```

:CONFigure:CELLular:NBIot:FUNDamental:ACLR:SET

ACLR On/Off and Meas. Count

Function

Sets or queries the ACLR measurement On/Off state and measurement count.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:ACLR:SET <on_off>[,<avg_count>]
```

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:ACLR:SET?
```

Response

```
<on_off>,<avg_count>
```

Parameters

<on_off>	Enables/disables measurement.
ON	Enables measurement
OFF	Disables measurement
Default	ON
<avg_count >	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Examples of Use

To set the ACLR measurement to OFF:

```
:CONF:CELL:NBI:FUND:ACLR:SET OFF
:CONF:CELL:NBI:FUND:ACLR:SET?
> OFF
```

:CONFigure:CELLular:NBIot:FUNDamental:AMITems:OFF

All Measurement Items Off

Function

Sets all fundamental measurement items to off at one time.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:AMITems:OFF
```

Example of Use

To set all fundamental measurement items to off at one time:

```
:CONF:CELL:NBI:FUND:AMIT:OFF
```

:CONFigure:CELLular:NBIot:FUNDamental:BAND?

Operation band

Function

Sets or queries the operation band.

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:BAND?
```

Response

```
<band>
```

Parameter

<band>	Operation band
Range	0 to 256
Resolution	1

Example of Use

To query the operation band:

```
:CONF:CELL:NBI:FUND:BAND?
> 10
```

Remarks

"0" is returned when the uplink or downlink channel number is set, but the set band is not found in Table 2.1.6-2.

:CONFigure:CELLular:NBIot:FUNDamental:MITem

Measurement Item

Function

Sets or queries the Measurement Item in Fundamental Measurement.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:MITem <item>
```

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:MITem?
```

Response

```
<item>
```

Parameters

<item>	Measurement Item in Fundamental Measurement
NORMAL	Normal
Default	NORMAL

Example of Use

To set the Measurement Item in Fundamental Measurement to Normal:.

```
:CONF:CELL:NBI:FUND:MIT NORMAL
:CONF:CELL:NBI:FUND:MIT ?
> NORMAL
```

:CONFigure:CELLular:NBIot:FUNDamental:MODulation:SET

Modulation Analysis On/Off and Meas. Count

Function

Sets or queries the Modulation Analysis On/Off state and measurement count.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:MODulation:SET <on_off>[,<avg_count>]
```

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:MODulation:SET?
```

Response

```
<on_off>,<avg_count>
```

Parameters

<on_off>	Enables/disables measurement.
ON	Enables measurement.
OFF	Disables measurement.
Default	ON
<avg_count>	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set the Modulation Analysis to On and measurement count to 200:

```
:CONF:CELL:NBI:FUND:MOD:SET ON,200
:CONF:CELL:NBI:FUND:MOD:SET?
> ON,200
```

:CONFigure:CELLular:NBIot:FUNDamental:OBW:SET

OBW On/Off and Meas. Count

Function

Sets or queries the OBW (Occupied Bandwidth) measurement On/Off state and measurement count.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:OBW:SET <on_off>[,<avg_count>]
```

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:OBW:SET?
```

Response

```
<on_off>,<avg_count>
```

Parameters

<on_off>	Enables/disables measurement.
ON	Enables measurement.
OFF	Disables measurement.
Default	ON
<avg_count>	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set OBW measurement on and set the measurement count to 50:

```
:CONF:CELL:NBI:FUND:OBW:SET ON,50
:CONF:CELL:NBI:FUND:OBW:SET?
> ON,50
```

:CONFigure:CELLular:NBIot:FUNDamental:POWer:SET

Power Measurement On/Off and Meas. Count

Function

Sets or queries the Tx Power Measurement On/Off state and measurement count.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:POWer:SET <on_off>[,<avg_count>]
```

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:POWer:SET?
```

Response

```
<on_off>,<avg_count>
```

Parameters

<on_off>	Enables/disables measurement.
ON	Enables measurement.
OFF	Disables measurement.
Default	ON
<avg_count>	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set Tx Power measurement ON and set the measurement count to 200:

```
:CONF:CELL:NBI:FUND:POW:SET ON,200
:CONF:CELL:NBI:FUND:POW:SET?
> ON,200
```

:CONFigure:CELLular:NBIot:FUNDamental:SEMask:SET

SEM On/Off and Meas. Count

Function

Sets or queries the SEM (Spectrum Emission Mask) Measurement On/Off state and measurement count.

Command

```
:CONFigure:CELLular:NBIot:FUNDamental:SEMask:SET <on_off>[,<avg_count>]
```

Query

```
:CONFigure:CELLular:NBIot:FUNDamental:SEMask:SET?
```

Response

```
<on_off>,<avg_count>
```

Parameters

<on_off>	Enables/disables the measurement.
ON	Enables the measurement.
OFF	Disables the measurement.
Default	ON
<avg_count>	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set the SEM measurement to On and set the measurement count to 100:

```
:CONF:CELL:NBI:FUND:SEM:SET ON,100
:CONF:CELL:NBI:FUND:SEM:SET?
> ON,100
```

:CONFigure:CELLular:NBIot:GHOPping

Group Hopping

Function

Sets or queries the Group Hopping On/Off state.

Command

```
:CONFigure:CELLular:NBIot:GHOPping <on_off>
```

Query

```
:CONFigure:CELLular:NBIot:GHOPping?
```

Response

```
<on_off>
```

Parameter

<on_off>	Enables/disables Group hopping.
ON	Enables Group hopping.
OFF	Disables Group hopping.
Default	ON

Example of Use

To enable Group hopping:

```
:CONF:CELL:NBI:GHOP ON
:CONF:CELL:NBI:GHOP?
> ON
```

:CONFigure:CELLular:NBIot:MCS

UL RMC MCS Index

Function

Sets or queries the MCS Index of Uplink signal.

Command

```
:CONFigure:CELLular:NBIot:MCS <ulimcs>
```

Parameter

<ulimcs>	UL MCS Index
Range	0 to 10 (UL RMC Number of Subcarrier = 1.)
	0 to 12 (UL RMC Number of Subcarrier > 1.)
Resolution	1
Default	6
Suffix code	None

Details

When the UL RMC Number of Subcarrier is 1, Modulation scheme is set according to “Table 2.1.6-4”.

When the UL RMC Number of Subcarrier is more than 1, Modulation scheme is set according to “Table 2.1.6-4”.

Example of Use

To set the UL RMC MCS Index to 1:

```
:CONF:CELL:NBI:MCS 1
```

:CONFigure:CELLular:NBIot:MODulation:MSCHeme

Modulation

Function

Sets or queries the Modulation scheme of uplink signal.
When the MCS Index is updated, the this parameter is changed accordingly.

Command

```
:CONFigure:CELLular:NBIot:MODulation:MSCHeme <ul_rmc_mod>
```

Query

```
:CONFigure:CELLular:NBIot:MODulation:MSCHeme?
```

Response

```
<ul_rmc_mod>
```

Parameter

<ul_rmc_mod>	Modulation scheme
BPSK	BPSK
QPSK	QPSK
Default	QPSK

Example of Use

To set the Modulation scheme to BPSK:

```
:CONF:CELL:NBI:MOD:MSCH BPSK
:CONF:CELL:NBI:MOD:MSCH?
> BPSK
```

Remarks

When the NPUCH is 1 and the Number of Subcarrier is more than 1, Modulation scheme is fixed to QPSK.
When the NPUCH is format 2, Modulation scheme is fixed to BPSK.

:CONFigure:CELLular:NBIot:NCID

NCell ID

Function

Sets or queries the NCell ID.

Command

```
:CONFigure:CELLular:NBIot:NCID <id>
```

Query

```
:CONFigure:CELLular:NBIot:NCID?
```

Response

```
<id>
```

Parameters

<id>	NCell ID
Range	0 to 503
Resolution	1
Default	0
Suffix code	None

Examples of Use

To set the NCell ID to 0:

```
:CONF:CELL:NBI:NCID 0
:CONF:CELL:NBI:NCID?
> 0
```

:CONFigure:CELLular:NBIot:NPUSch

NPUSCH Format

Function

Sets or queries the NPUSCH Format.

Command

```
:CONFigure:CELLular:NBIot:NPUSch <format>
```

Query

```
:CONFigure:CELLular:NBIot:NPUSch?
```

Response

```
<format>
```

Parameters

<format>	Format
1	format 1
2	format 2
Default	1

Details

When the NPUSCH Format is updated, Subcarrier spacing, Number of subcarrier, Starting subcarrier, Modulation, Cyclic Shift Index, and Number of Resource Units are changed accordingly.

NPUSCH format	Subcarrier spacing	Number of subcarrier	Starting subcarrier	Modulation	Cyclic Shift Index	Number of Resource Units
1	3.75 kHz	1	0	QPSK	0	1
2	3.75 kHz	1	0	BPSK	0	1

Example of Use

To set the NPUSCH Format to format 1:

```
:CONF:CELL:NBI:NPUS 1
:CONF:CELL:NBI:NPUS?
> 1
```

:CONFigure:CELLular:NBIot:NPUSch:NRUNit

UL RMC Number of Resource Units

Function

Sets or queries the Number of Resource Units for NPUSCH.

Command

```
:CONFigure:CELLular:NBIot:NPUSch:NRUNit <ul_rmc_ru>
```

Query

```
:CONFigure:CELLular:NBIot:NPUSch:NRUNit?
```

Response

```
<ul_rmc_ru>
```

Parameter

<ul_rmc_ru>	Number of Resource Unit
1	1
2	2
3	3
4	4
5	5
6	6
8	8
Default	1

Example of Use

To set the Number of Resource Units to 1:

```
:CONF:CELL:NBI:NPUS:NRUN 1
:CONF:CELL:NBI:NPUS:NRUN?
> 1
```

:CONFigure:CELLular:NBIot:OPEMode

NB Operation Mode

Function

Sets or queries the Operation Mode of NB-IoT.

Command

```
:CONFigure:CELLular:NBIot:OPEMode <mode>
```

Query

```
:CONFigure:CELLular:NBIot:OPEMode?
```

Response

```
<mode>
```

Parameters

<mode>	Operation Mode
STANDALONE	Stand-alone
GUARDBAND	Guard-band
INBAND	In-band
Default	STANDALONE

Example of Use

To set the Operation Mode of NB-IoT to Stand-alone:

```
:CONF:CELL:NBI:OPEM STANDALONE
:CONF:CELL:NBI:OPEM?
> STANDALONE
```

:CONFigure:CELLular:NBIot:SCALlocation:NSC

UL RMC Number of Subcarrier

Function

Sets or queries the Number of Subcarrier for NPUSCH.

Command

```
:CONFigure:CELLular:NBIot:SCALlocation:NSC <ul_rmc_sc>
```

Query

```
:CONFigure:CELLular:NBIot:SCALlocation:NSC?
```

Response

```
<ul_rmc_sc>
```

Parameter

<ul_rmc_sc>	Number of Subcarrier
1	1
3	3
6	6
12	12
Default	1

Details

Number of Subcarrier is set to 1 when UL RMC Subcarrier Spacing is 3.75 kHz.
When the UL RMC start subcarrier number falls outside the setting range, it will be changed to a value within the range.

Example of Use

To set the Number of Subcarrier to 1:

```
:CONF:CELL:NBI:SCAL:NSC 1
:CONF:CELL:NBI:SCAL:NSC?
> 1
```

:CONFigure:CELLular:NBIot:SCALlocation:OSC

UL RMC Starting Subcarrier

Function

Sets or queries the Starting Subcarrier number for NPUSCH.

Command

```
:CONFigure:CELLular:NBIot:SCALlocation:OSC <ulsc>
```

Query

```
:CONFigure:CELLular:NBIot:SCALlocation:OSC?
```

Response

```
<ulsc>
```

Parameter

<ulsc>	Starting Subcarrier number	
Range	0 to (SCmax – SCn)	
	SCmax=12	(Subcarrier Spacing = 15 kHz)
	SCmax=48	(Subcarrier Spacing = 3.75 kHz)
	SCn is set by using ULRMC_SC.	
Resolution	1	
Default	0	
Suffix code	None	

Example of Use

To set the Starting Subcarrier number to 0:

```
:CONF:CELL:NBI:SCAL:OSC 0
:CONF:CELL:NBI:SCAL:OSC?
> 0
```

:CONFigure:CELLular:NBIot:SCSPacing

UL RMC Subcarrier Spacing

Function

Sets or queries the Subcarrier Spacing for NPUSCH.

Command

```
:CONFigure:CELLular:NBIot:SCSPacing <sc_spacing>
```

Query

```
:CONFigure:CELLular:NBIot:SCSPacing?
```

Response

```
<sc_spacing>
```

Parameter

<sc_spacing>	Subcarrier Spacing
3.75KHZ	3.75 kHz
15KHZ	15 kHz
Default	3.75KHZ

Details

When editing the Subcarrier Spacing, the UL RMC start subcarrier number is changed to a value within the range if it falls outside the range. Also, the subcarrier number is changed to “1”.

Example of Use

To set the Subcarrier Spacing for NPUSCH to 3.75 kHz:

```
:CONF:CELL:NBI:SCSP 3.75KHZ
:CONF:CELL:NBI:SCSP?
> 3.75KHZ
```

:FETCh:CELLular:NBIot:FUNDamental:ACLR?

ACLR Result

Function

Queries the result of ACLR (Adjacent Channel Leakage Power Ratio) measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:ACLR? <mode>
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<aclr(G_LOW1)>,<aclr(G_UP1)>,<aclr(LOW1)>,<aclr(UP1)>
```

When <mode> = TTL,

```
<avg(G_LOW1)>,<avg(G_UP1)>,<avg(LOW1)>,<avg(UP1)>,
<max(G_LOW1)>,<max(G_UP1)>,<max(LOW1)>,<max(UP1)>,
<min(G_LOW1)>,<min(G_UP1)>,<min(LOW1)>,<min(UP1)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
<aclr(offset)>	Result of Adjacent Channel Leakage Power Ratio measurement in specified Storage mode
<avg(offset)>	ACLR measurement result (Average)
<max(offset)>	ACLR measurement result (Maximum)
<min(offset)>	ACLR measurement result (Minimum)
Resolution	0.01 dB
Response unit	dB
<offset>	Offset frequency
G_LOW1	GSM$_{\mathrm{ACLR}}$ LOW
G_UP1	GSM$_{\mathrm{ACLR}}$ UP
LOW1	UTRA$_{\mathrm{ACLR}}$ LOW
UP1	UTRA$_{\mathrm{ACLR}}$ UP

Details

The measurement bandwidth of the target adjacent channel varies with the channel bandwidth setting.

Example of Use

To query the average of ACLR measurement result:

```
:FETC:CELL:NBI:FUND:ACLR? AVG
> -61.23,-30.06,-65.68,-62.44
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:CARLeakage?

Carrier Leakage Result

Function

Queries the Carrier Leakage (Origin offset) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:CARLeakage? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<cleakage>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average･Maximum･Minimum
DVT	Standard deviation
Omitted	Average
<cleakage>	Carrier Leakage measurement result in specified Storage mode
<avg>	Carrier Leakage measurement result (Average)
<max>	Carrier Leakage measurement result (Maximum)
<min>	Carrier Leakage measurement result (Minimum)
Resolution	0.01 dB
Unit	dBc

Example of Use

To query the average of Carrier Leakage measurement result:

```
:FETC:CELL:NBI:FUND:MOD:CARL? AVG
> 20.00
```

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SCPI Command Reference

:FETCh:CELLular:NBIot:FUNDamental:MODulation:CFRequency?

Carrier Frequency Result

Function

Queries the Carrier Frequency measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:CFRequency? <mode>
```

Response

```
<freq>
```

Parameter

<mode>	Storage mode
AVG	Average
<freq>	Carrier frequency
Resolution	1 Hz
Unit	Hz

Example of Use

To query the result of Carrier Frequency measurement:

```
:FETC:CELL:NBI:FUND:MOD:CFR? AVG
> 1951000000
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVM?

EVM Result

Function

Queries the EVM (Error Vector Magnitude) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVM? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<evm>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

When <mode> = IND,

```
<s>,<evm(1)>,<evm(2)>,...,<evm(s)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
<evm>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
<evm(n)>	n-th EVM measurement result (n=1 to s)
Resolution	0.01%
Unit	%
<s>	Number of valid measurement results

Example of Use

To query the average of EVM measurement result:

```
:FETC:CELL:NBI:FUND:MOD:EVM? AVG
> 1.50
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

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SCPI Command Reference

:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVMH?

EVM Result (High)

Function

Queries the EVM (Error Vector Magnitude) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVMH? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<evm>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

When <mode> = IND,

```
<s>,<evm(1)>,<evm(2)>,...,<evm(s)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
<evm>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
<evm(n)>	n-th EVM measurement result (n=1 to s)
Resolution	0.01%
Unit	%
<s>	Number of valid measurement results

Example of Use

To query the average of EVM measurement result:

```
:FETC:CELL:NBI:FUND:MOD:EVMH? AVG
> 1.50
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVML?

EVM Result (Low)

Function

Queries the EVM (Error Vector Magnitude) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:EVML? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<evm>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

When <mode> = IND,

```
<s>,<evm(1)>,<evm(2)>,...,<evm(s)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
<evm>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
<evm(n)>	n-th EVM measurement result (n=1 to s)
Resolution	0.01%
Unit	%
<s>	Number of valid measurement results

Example of Use

To query the average of EVM measurement result:

```
:FETC:CELL:NBI:FUND:MOD:EVML? AVG
> 1.50
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor?

Carrier Frequency Error Result

Function

Queries the Frequency Error measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor? <mode>
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<freq_ppm>,<freq_Hz>
```

When <mode = TTL,

```
<avg_ppm>,<avg_Hz>,<max_ppm>,<max_Hz>,<min_ppm>,<min_Hz>
```

Parameters

<mode>	Storage mode	
AVG	Average	
MAX	Maximum	
MIN	Minimum	
TTL	Average・Maximum・Minimum	
DVT	Standard deviation	
<avg_ppm>	Measurement result in ppm (Average)	
<avg_Hz>	Measurement result in Hz (Average)	
<max_ppm>	Measurement result in ppm (Maximum)	
<max_Hz>	Measurement result in Hz (Maximum)	
<min_ppm>	Measurement result in ppm (Minimum)	
<min_Hz>	Measurement result in Hz (Minimum)	
<freq_ppm>	Measurement result in ppm in specified Storage mode	
<freq_Hz>	Measurement results in Hz in specified Storage mode	
Resolution	0.01 ppm	(Measurement result in ppm)
	0.1 Hz	(Measurement result in Hz)
Unit	ppm	(Measurement result in ppm)
	Hz	(Measurement result in Hz)

Example of Use

To query the average of Frequency Error measurement result:

```
:FETC:CELL:NBI:FUND:MOD:FERR? AVG
> 0.03,60.0
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor:WORSt?

Worst Carrier Frequency Error Result

Function

Queries the worst value in Frequency Error measurement results.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:FERRor:WORSt?
```

Response

```
<freq_ppm>,<freq_Hz>
```

Parameters

<freq_ppm>	Worst value in Frequency Error measurement results in ppm
Resolution	0.01 ppm
Unit	ppm
<freq_Hz>	Worst value in Frequency Error measurement results in Hz
Resolution	0.1 Hz
Unit	Hz

Example of Use

To query the worst value in Frequency Error measurement results:

```
:FETC:CELL:NBI:FUND:MOD:FERR:WORS?
> 0.03,60.0
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:CARLeakage?

In-Band Emissions (Carrier Leakage) Result

Function

Queries the In-band emissions (Carrier Leakage) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:CARLeakage? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<ibe>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Maximum
<ibe>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the maximum of in-band emissions (Carrier Leakage) measurement result:

```
:FETC:CELL:NBI:FUND:MOD:IEM:CARL? MAX
> 0.04
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:GENeral?

In-Band Emissions (General) Result

Function

Queries in-band emissions (General) for non-allocated RB measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:GENeral? [<mode>]
```

Response

When <mode> =AVG, MAX, MIN, DVT,

```
<ibe>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Maximum
<ibe>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Unit	dB
Resolution	0.01 dB

Example of Use

To query the maximum of in-band emissions (General) measurement result:

```
:FETC:CELL:NBI:FUND:MOD:IEM:GEN? MAX
> 0.04
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:ITEM?

In-Band Emissions Measured Item

Function

Queries whether each in-band emission measurement item is measured or not.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:ITEM?
```

Response

```
<flag>
```

Parameter

<flag>	Measured/Not measured flag (0 to 7)
	Returns the sum of the following measurement items.
0	Not measured
1	Measure General
2	Measure IQ Image
4	Measure Carrier Leakage
Unit	None

Example of Use

To query whether each in-band emission measurement item is measured or not.

```
:FETC:CELL:NBI:FUND:MOD:IEM:ITEM?
> 4
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:IQIMage?

In-Band Emissions (IQ Image) Result

Function

Queries in-band emissions (IQ Image) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:IQIMage? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<ibe>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Maximum
<ibe>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the maximum of in-band emissions (IQ Image) measurement result:

```
:FETC:CELL:NBI:FUND:MOD:IEM:IQIM? MAX
> 0.04
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:JUDGement?

In-Band Emissions Judgement

Function

Queries the judgement on the in-band emission measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:JUDGement?
```

Response

```
<judgement>
```

Parameter

<judgement>	Judgement
PASS	Pass
FAIL	Fail
–	Not measured

Example of Use

To query the judgement on the in-band emission measurement result:

```
:FETC:CELL:NBI:FUND:MOD:IEM:JUDG?
> PASS
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:CARLeakage?

In-Band Emissions limit (Carrier Leakage)

Function

Queries the limit of in-band emission (Carrier Leakage).

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:CARLeakage?
```

Response

```
<level>
```

Parameter

<level>	Limit
Resolution	0.1 dB
Unit	dBc

Example of Use

To query the limit of in-band emission (Carrier Leakage).

```
:FETC:CELL:NBI:FUND:MOD:IEM:LIM:CARL?
> 1.4
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:GENeral?

In-Band Emissions limit (General)

Function

Queries the limit of the in-band emission (General).

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:GENeral?
```

Response

```
<level>
```

Parameter

<level>	Limit
Resolution	0.1 dB
Unit	dB

Example of Use

To query the limit of in-band emission (General):

```
:FETC:CELL:NBI:FUND:MOD:IEM:LIM:GEN?
> 2.4
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:IQIMage?

In-Band Emissions limit (IQ Image)

Function

Queries the limit of in-band emission (IQ Image).

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:LIMit:IQIMage?
```

Response

```
<level>
```

Parameter

<level>	Limit
Resolution	0.1 dB
Unit	dB

Example of Use

To query the limit of in-band emission (IQ Image).

```
:FETC:CELL:NBIot:FUND:MOD:IEM:LIM:IQIM?
> 1.4
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:MARGin?

In-Band Emissions Margin

Function

Queries the worst margin in the entire bandwidth for in-band emission measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IEMissions:MARGin?
```

Response

```
<margin>
```

Parameter

<margin>	Worst margin
Resolution	0.01 dB
Unit	dB

Example of Use

Queries the worst margin in the entire bandwidth of in-band emission measurement:

```
:FETC:CELL:NBI:FUND:MOD:IEM:MARG?
> 1.40
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:DB?

IQ Imbalance (dB) Result

Function

Queries the IQ Imbalance measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:DB? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<magnitude>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
<magnitude>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the average of IQ Imbalance measurement result:

```
:FETC:CELL:NBI:FUND:MOD:IQIM:DB? AVG
> 0.05
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:PERCent?

IQ Imbalance (%) Result

Function

Queries the IQ Imbalance measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:IQIMbalance:PERCent? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<percent>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average･Maximum･Minimum
DVT	Standard deviation
Omitted	Average
<percent>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01%
Unit	%

Example of Use

To query the average of IQ Imbalance measurement result:

```
:FETC:CELL:NBI:FUND:MOD:IQIM:PERC? AVG
> 0.05
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:MERRor?

Magnitude Error Result

Function

Queries the Magnitude Error measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:MERRor? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<magnitude>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
<magnitude>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01%
Unit	%

Example of Use

To query the average of Magnitude Error measurement result:

```
:FETC:CELL:NBI:FUND:MOD:MERR? AVG
> 1.05
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:PEVM?

Peak EVM Result

Function

Queries the peak EVM (Error Vector Magnitude) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:PEVM? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<pevm>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
<pevm>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01%
Unit	%

Example of Use

To query the average of Peak EVM measurement result:

```
:FETC:CELL:NBI:FUND:MOD:PEVM? AVG
> 1.75
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:PHERror?

Phase Error Result

Function

Queries the Phase Error measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:PHERror? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<phase>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
<phase>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.01 deg.
Unit	deg.

Example of Use

To query the average of Phase Error measurement result:

```
:FETC:CELL:NBI:FUND:MOD:PHER? AVG
> 1.55
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:RHO?

Rho Result

Function

Queries the Rho (waveform quality) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:RHO? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<rho>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
<rho>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
Resolution	0.00001

Example of Use

To query the average of Signal Quality measurement (Rho) result:

```
:FETC:CELL:NBI:FUND:MOD:RHO? AVG
> 0.00004
```

:FETCh:CELLular:NBIot:FUNDamental:MODulation:RSEVm?

Reference Signal EVM Result

Function

Queries the measurement result of Reference Signal EVM.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:MODulation:RSEVm? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<rsevm>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

When <mode> = IND,

```
<s>,<rsevm(1)>,<rsevm(2)>,...,<rsevm(s)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
<rsevm>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
<rsevm(n)>	The n-th Measurement result (n=1 to s)
Resolution	0.01%
Unit	%
<s>	Number of valid measurement results

Example of Use

To query the average of Reference Signal EVM measurement result:

```
:FETC:CELL:NBI:FUND:MOD:RSEV? AVG
> 1.51
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

:FETCh:CELLular:NBIot:FUNDamental:OBW?

OBW Result

Function

Queries the OBW (Occupied Bandwidth) measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:OBW?
```

Response

```
<bw>
```

Parameter

<bw>	Occupied Bandwidth
Resolution	1 Hz
Unit	Hz

Example of Use

To query the OBW measurement result:

```
:FETC:CELL:NBI:FUND:OBW?
> 3840000
```

:FETCh:CELLular:NBIot:FUNDamental:OBW:FREQuency?

OBW Frequency Result

Function

Queries the upper, lower and center frequency of OBW (Occupied Bandwidth) measurement results.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:OBW:FREQuency? <pos>
```

Response

```
<freq>
```

Parameters

<pos>	Offset type
UPPER	Upper frequency
LOWER	Lower frequency
CENTER	Center frequency
<freq>	Offset frequency
Resolution	0.1 Hz
Unit	Hz

Example of Use

To query the upper frequency of OBW measurement result:

```
:FETC:CELL:NBI:FUND:OBW:FREQ? UPPER
> 1951920000.0
```

:FETCh:CELLular:NBIot:FUNDamental:POWer:CHPower?

Channel Power Result

Function

Queries the Channel Power measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:POWer:CHPower? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN or DVT,

```
<pwr>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

When <mode> = IND,

```
<s>,<pwr(1)>,<pwr(2)>,<pwr(3)>,…,<pwr(s)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average･Maximum･Minimum
DVT	Standard deviation
IND	Individual measurement result
Omitted	Average
<pwr>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
<pwr(n)>	The n-th measurement result (n=1 to s)
Resolution	0.01 dB
Unit	dBm
<s>	Number of valid measurement results

Example of Use

To query the average of Channel Power measurement result:

```
:FETC:CELL:NBI:FUND:POW:CHP? AVG
> -20.00
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

:FETCh:CELLular:NBIot:FUNDamental:POWer:TXPower?

Tx Power Result

Function

Queries the Tx Power measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:POWer:TXPower? [<mode>]
```

Response

When <mode> = AVG, MAX, MIN, DVT,

```
<pwr>
```

When <mode> = TTL,

```
<avg>,<max>,<min>
```

When <mode> = IND

```
<s>,<pwr(1)>,<pwr(2)>,...,<pwr(s)>
```

Parameters

<mode>	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
<pwr>	Measurement result in specified Storage mode
<avg>	Measurement result (Average)
<max>	Measurement result (Maximum)
<min>	Measurement result (Minimum)
<pwr(n)>	The n-th Measurement result (n=1 to s)
Resolution	0.01 dB
Unit	dBm
<s>	Number of valid measurement results

Example of Use

To query the Tx Power measurement result:

```
:FETC:CELL:NBI:FUND:POW:TXP? AVG
> -20.00
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

:FETCh:CELLular:NBIot:FUNDamental:SEMask:JUDGement?

SEM Judgement

Function

Queries the judgement result of SEM (Spectrum Emission Mask) measurement.
Fail when any part of spectrum exceeds limit, otherwise Pass.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:JUDGement? [<target>]
```

Response

```
<judgement>
```

Parameter

<target>	Judgement target
GEN	General
GB	Guard-band
Omitted	General and Guard-band
<judgement>	Judgement result
PASS	Pass
FAIL	Fail
–	Not measured

Example of Use

To query the judgement result of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:JUDG?
> PASS
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel?

SEM Worst Value

Function

Queries the worst spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel? <range>
```

Response

```
<level>,<freq>
```

Parameter

<range>	Frequency Range
Range	–5 to –1, 1 to 5
Resolution	1
Suffix code	None
<level>	Worst spectrum level in the specified frequency range
Resolution	0.01 dB
Unit	dB
<freq>	Offset frequency of the worst spectrum level in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

Refer to Table 2.4-1 "Frequency ranges of Range 1 to Range 5 (General)" for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:LEV? 1
> -20.01,705
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd?

SEM Worst Value (Guard-band)

Function

Queries the worst spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd? <range>
```

Response

```
<level>,<freq>
```

Parameter

<range>	Frequency Range
Range	–4 to –1, 1 to 4
Resolution	1
Suffix code	None
<level>	Worst spectrum level in the specified frequency range
Resolution	0.01 dB
Unit	dB
<freq>	Offset frequency of the worst spectrum level in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

The frequency range varies according to the channel bandwidth.
Refer to Table 2.4-2 "Frequency ranges of Range 1 to Range 4 (Guard-band)" for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:LEV:GBAN? 1
> -20.01,705
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd:TTL?

SEM Worst Value (Guard-band) (All range)

Function

Queries the worst spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:GBANd:TTL?
```

Response

```
<level(-1)>,<freq(-1)>,…,<level(-4)>,<freq(-4)>,<level(1)>,<freq(1)>,…,
<level(4)>,<freq(4)>
```

Parameters

<level(n)>		Worst spectrum level in each frequency range (Frequency range: n = –4 to –1, 1 to 4)
	Resolution	0.01 dB
	Unit	dBm
<freq(n)>		Offset frequency of the worst spectrum level in each frequency range (Frequency range: n = –4 to –1, 1 to 4)
	Resolution	1 Hz
	Unit	Hz

Details

The frequency range varies according to the channel bandwidth.

Refer to Table 2.4-2 "Frequency ranges of Range 1 to Range 4 (Guard-band)" for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in each frequency range of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:LEV:GBAN:TTL?
>
-20.01,30,-20.02,30,-20.03,30,-20.04,30,-20.05,30,-20.06,30,-20.07,30,-20
.08,30
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:TTL?

SEM Worst Value (All range)

Function

Queries the worst spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:LEVel:TTL?
```

Response

```
<level(-1)>,<freq(-1)>,…,<level(-5)>,<freq(-5)>,<level(1)>,<freq(1)>,…,
<level(5)>,<freq(5)>
```

Parameters

<level(n)>		Worst spectrum level in each frequency range (Frequency range: n = –5 to –1, 1 to 5)
	Resolution	0.01 dB
	Unit	dBm
<freq(n)>		Offset frequency of the worst spectrum level in each frequency range (Frequency range: n = –5 to –1, 1 to 5)
	Resolution	1 Hz
	Unit	Hz

Details

Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in each frequency range of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:LEV:TTL?
>
-20.01,30,-20.02,30,-20.03,30,-20.04,30,-20.05,30,-20.06,30,-20.07,30,-20
.08,30,-20.09,30,-20.00,30
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin?

SEM Template Margin

Function

Queries the worst margin from the template of the spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin? <range>
```

Response

```
<margin>,<freq>
```

Parameter

<range>	Frequency Range
Range	–5 to –1, 1 to 5
Resolution	1
Suffix code	None
<margin>	Worst margin in the specified frequency range
Resolution	0.01 dB
Unit	dB
<freq>	Offset frequency of the worst margin in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:MARG? 1
> -20.01,705
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd?

SEM Template Margin (Guard-band)

Function

Queries the worst margin from the template of the spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd? <range>
```

Response

```
<margin>,<freq>
```

Parameter

<range>	Frequency Range
Range	–4 to –1, 1 to 4
Resolution	1
Suffix code	None
<margin>	Worst margin in the specified frequency range
Resolution	0.01 dB
Unit	dB
<freq>	Offset frequency of the worst margin in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
Refer to Table 2.4-2“Frequency ranges of Range 1 to Range 4 (Guard-band)” for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:MARG:GBAN? 1
> -20.01,705
```

:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd:TTL?

SEM Template Margin (Guard-band) (All range)

Function

Queries the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:GBANd:TTL?
```

Response

```
<margin(-1)>,<freq(-1)>,…,<margin(-4)>,<freq(-4)>,<margin(1)>,<freq(1)>,…,
<margin(4)>,<freq(4)>
```

Parameters

<margin(n)>	Worst margin in each frequency range (Frequency range: n= –4 to –1, 1 to 4)
Resolution	0.01 dB
Unit	dB
<freq(n)>	Offset frequency of the worst margin in each frequency range (Frequency range: n= –4 to –1, 1 to 4)
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
The frequency range varies according to the channel bandwidth.
Refer to Table 2.4-2 "Frequency ranges of Range 1 to Range 4 (Guard-band)" for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:MARG:GBAN:TTL?
>
-20.01,30,-20.02,30,-20.03,30,-20.04,30,-20.05,30,-20.06,30,-20.07,30,-20
.08,30
```

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SCPI Command Reference

:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:TTL?

SEM Template Margin (All range)

Function

Queries the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:SEMask:MARGin:TTL?
```

Response

```
<margin(-1)>,<freq(-1)>,…,<margin(-5)>,<freq(-5)>,<margin(1)>,<freq(1)>,…,
<margin(5)>,<freq(5)>
```

Parameters

<margin(n)>	Worst margin in each frequency range (Frequency range: n= –5 to –1, 1 to 5)
Resolution	0.01 dB
Unit	dB
<freq(n)>	Offset frequency of the worst margin in each frequency range (Frequency range: n= –5 to –1, 1 to 5)
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement:

```
:FETC:CELL:NBI:FUND:SEM:MARG:TTL?
>
-20.01,20,-20.02,20,-20.03,20,-20.04,20,-20.05,20,-20.06,20,-20.07,20,-20
.08,20,-20.09,20,-20.00,20
```

:FETCh:CELLular:NBIot:FUNDamental:TRACe?

Waveform

Function

Queries the spectrum waveform data of each measurement result.

Query

```
:FETCh:CELLular:NBIot:FUNDamental:TRACe?
<format>,<position>,<length>[,<symbol>]
```

Response

```
<data(1)>,…,<data(length)>
```

Parameter

<format>	Format
1	Occupied Bandwidth
3	Constellation (I)
4	Constellation (Q)
5	EVM (Average)
6	EVM (Maximum)
7	Phase Error (Average)
8	Phase Error (Maximum)
9	Magnitude Error (Average)
10	Magnitude Error (Maximum)
11	In-band Emissions (dB) (Average)
12	In-band Emissions (dB) (Maximum)
13	In-band Emissions (dBc) (Average)
14	In-band Emissions (dBc) (Maximum)
19	Spectrum Emission Mask General
20	Spectrum Emission Mask Guard-band
<position>	Start point of waveform data
Range	0 to 278 (Occupied Bandwidth)
	0 to 1934 (Spectrum Emission Mask General)
	0 to 1134 (Spectrum Emission Mask Guard-band 1.4 MHz)
	0 to 2254 (Spectrum Emission Mask Guard-band 3 MHz)
	0 to 3694 (Spectrum Emission Mask Guard-band 5 MHz)
	0 to 5486 (Spectrum Emission Mask Guard-band 10 MHz)
	0 to 7246 (Spectrum Emission Mask Guard-band 15 MHz)
	0 to 9038 (Spectrum Emission Mask Guard-band 20 MHz)
	0 to 47 (EVM, Phase Error, Magnitude Error, Subcarrier Spacing = 3.75 kHz)
	0 to 11 (EVM, Phase Error,Magnitude Error, Subcarrier Spacing = 15 kHz)
Resolution	1
Suffix code	None

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SCPI Command Reference

<length>	Number of read data	
Range	1 to 279	(Occupied Bandwidth)
	1 to 1935	(Spectrum Emission Mask General)
	1 to 1135	(Spectrum Emission Mask Guard-band 1.4 MHz)
	1 to 2255	(Spectrum Emission Mask Guard-band 3 MHz)
	1 to 3695	(Spectrum Emission Mask Guard-band 5 MHz)
	1 to 5487	(Spectrum Emission Mask Guard-band 10 MHz)
	1 to 7247	(Spectrum Emission Mask Guard-band 15 MHz)
	1 to 9039	(Spectrum Emission Mask Guard-band 20 MHz)
	1 to 48	(Constellation, EVM, Phase Error, Magnitude Error, In-band Emissions, Subcarrier Spacing = 3.75 kHz)
	1 to 12	(Constellation, EVM, Phase Error, Magnitude Error, In-band Emissions, Subcarrier Spacing = 15 kHz)
Resolution	1	
Suffix code	None	
<symbol>	Position of SC-FDMA symbol	
Range	0 to 6 (Constellation, EVM, Phase Error, Magnitude Error)	
<data(n)>	Waveform data	
Resolution	0.01 dB	(Occupied Bandwidth, Spectrum Emission Mask, In-band Emissions)
	0.01 deg.	(Phase Error)
	0.01 %	(EVM, Magnitude Error)
	0.0001	(Constellation)
Unit	dBm	(Spectrum Emission Mask)
	dB	(Occupied Bandwidth, In-band Emissions (dB))
	dBc	(In-band Emissions (dBc))
	degree	(Phase Error)
	%	(EVM, Magnitude Error)
	None	(Constellation)

Details

Refer to Table 2.7-1 “Waveform Data Type and Data Interval” for Data Interval.

Example of Use

To query the Occupied Bandwidth of 20 data from 25 of each measurement:

```
:FETC:CELL:NBI:FUND:TRAC? 1,25,20
> -42.12,-40.14,…,-41.22
```

:TRIGger:CELLular:NBIot:FUNDamental:DELay

Trigger Delay

Function

Sets or queries the Trigger Delay.

Command

```
:TRIGger:CELLular:NBIot:FUNDamental:DELay <delay>
```

Query

```
:TRIGger:CELLular:NBIot:FUNDamental:DELay?
```

Response

<delay>

Parameters

<delay>	Trigger Delay
Range	0.000 to 10.000 ms
Resolution	0.001 ms
Suffix code	S MS US NS (uses ms when omitted)
Default	0.000 ms
Unit	ms

Details

This command is available when trigger source is set to other than Freerun.

Example of Use

To set the Trigger Delay to 0.001 ms:

```
:TRIG:CELL:NBI:FUND:DEL 0.001
:TRIG:CELL:NBI:FUND:DEL?
> 0.001
```

:TRIGger:CELLular:NBIot:FUNDamental:LEVel

Trigger Level

Function

Sets or queries the Trigger Level.

Command

```
:TRIGger:CELLular:NBIot:FUNDamental:LEVel <level>
```

Query

```
:TRIGger:CELLular:NBIot:FUNDamental:LEVel?
```

Response

```
<level>
```

Parameters

<level>	Trigger Level
Range	–40 to 0 dB
Resolution	1 dB
Suffix code	DB
Default	–30 dB
Unit	dB

Details

This command is available when trigger source is set to Rise Config.

Example of Use

To set the Trigger Level to –30 dB:

```
:TRIG:CELL:NBI:FUND:LEV -30
:TRIG:CELL:NBI:FUND:LEV?
> -30
```

:TRIGger:CELLular:NBIot:FUNDamental:SOURce

Trigger Source

Function

Sets or queries the Trigger Source.

Command

```
:TRIGger:CELLular:NBIot:FUNDamental:SOURce <source>
```

Query

```
:TRIGger:CELLular:NBIot:FUNDamental:SOURce?
```

Response

<source>

Parameters

<source>	Trigger Source
FREE	Freerun
RISE_CONFIG	Rise Config
Default	FREE

Example of Use

To set the Trigger Source to Freerun:

```
:TRIG:CELL:NBI:FUND:SOUR FREE
:TRIG:CELL:NBI:FUND:SOUR?
> FREE
```

:TRIGger:CELLular:NBIot:FUNDamental:TOUT

Trigger Timeout

Function

Sets or queries the Trigger Timeout.

Command

```
:TRIGger:CELLular:NBIot:FUNDamental:TOUT <time>
```

Query

```
:TRIGger:CELLular:NBIot:FUNDamental:TOUT?
```

Response

```
<time>
```

Parameters

<time>	Trigger Timeout
Range	1 to 60 s
Unit	s
Resolution	1 s
Suffix code	NS, US, MS, S (uses s when omitted)
Default	10 s

Example of Use

To set the Trigger Timeout to 10 s:

```
:TRIG:CELL:NBI:FUND:TOUT 10
:TRIG:CELL:NBI:FUND:TOUT?
> 10
```

Chapter 5 Native Command Reference

This chapter describes the details of Native commands.
To switch to the Native command mode, send the command SYST:LANG NAT.

5.1 List of Commands

The following table shows the rules for describing messages.

[ ]	Messages or parameters in square brackets can be omitted.
|	Choose one of several choices. A|B|C|D indicates a choice of A, B, C, and D.
{}	Choose one of the groups in braces. A|B({C|D}) indicates a choice of A, B(C), or B(D).

5.1.1 Common commands

Common

Function	Command	Query	Response
Standard Select	STDSEL std	STDSEL?	std
Set Connect Port Direction	PORT input,output	PORT?	input,output

Measurement

Function	Command	Query	Response
Measurement Stop	MEASSTOP	-----	-----
Measurement Status	-----	MSTAT	m_status
Tx Measurement Status	-----	TXMSTAT?	m_status
Measurement Start	SNGLS	-----	-----
Measurement Start (Synchronization)	SWP	SWP?	status
End Event Status (Measurement) Register Query	-----	ESR2?	register
Error Event Status (Measurement) Register Query	-----	ESR3?	register

Common Parameters

Function	Command	Query	Response
Output Level On/Off	LVL on_off	LVL?	on_off
Output Signal Modulation	MOD on_off	MOD?	on_off
Waveform File Select	PACKAGE pac	PACKAGE?	pac
Waveform Pattern Select	DLPAT pat	DLPAT?	pat
Waveform Pattern Select (SYNC)	DLPAT_SYNC pat	DLPAT_SYNC?	pat

System

Function	Command	Query	Response
Application Select	SYSSEL app	SYSSEL?	app
Language Selection of Remote Command	SYST:LANG mode	SYST:LANG?	mode

5.1.2 Fundamental measurement commands

Common Parameters

Function	Command	Query	Response
NB Operation Mode	NBOPEMODE mode	NBOPEMODE?	mode
Frame Structure	FRAMETYPE mode	FRAMETYPE?	mode
Duplex Mode	DUPLEXMODE mode	DUPLEXMODE?	mode
Coexisting Bandwidth	COEXBANDWIDTH bandwidth	COEXBANDWIDTH?	bandwidth
Uplink Channel	ULCHAN ul_ch	ULCHAN?	ul_ch
Uplink Frequency	ULFREQ ul_freq TXFREQ ul_freq	ULFREQ? TXFREQ?	ul_freq
Downlink Channel	DLCHAN dl_ch	DLCHAN?	dl_ch
Downlink Frequency	DLFREQ dl_freq RXFREQ dl_freq	DLFREQ? RXFREQ?	dl_freq
Operation Band	----	BAND?	band
Input Level	ILVL level	ILVL?	level
Output Level	OLVL level	OLVL?	level

NB-IoT Setting

Function	Command	Query	Response
Channel Coding	CHCODING object	CHCODING?	object
NPUSCH Format	NPUSCH format	NPUSCH?	format
UL RMC Subcarrier Spacing	ULSC_SPACE sc_spacing	ULSC_SPACE?	sc_spacing
UL RMC Number of Subcarrier	ULRMC_SC ul_rmc_sc	ULRMC_SC?	ul_rmc_sc
UL RMC Starting Subcarrier	ULSC_START ulsc	ULSC_START?	ulsc
UL RMC Number of Resource Units	ULRMC_RU ul_rmc_ru	ULRMC_RU?	ul_rmc_ru
UL RMC MCS Index	ULIMCS ulimcs	----	----
UL RMC Modulation	ULRMC_MOD ul_rmc_mod	ULRMC_MOD?	ul_rmc_mod
UL RMC Cyclic Shift Index	ULICSHIFT index	ULICSHIFT?	index
Group Hopping	GROUPHOP on_off	GROUPHOP?	on_off
NCell ID	NCELLID id	NCELLID?	id
Delta SS	DELTASS val	DELTASS?	val
Trigger Source	TRGSRC source	TRGSRC?	source
Trigger Level	TRGLVL level	TRGLVL?	level
Trigger Delay	TRGDLY delay	TRGDLY?	delay
Trigger Timeout	TRGTOUT time	TRGTOUT?	time

Fundamental Measurement Parameters

Function	Command	Query	Response
Measurement Item	MEASITEM item	MEASITEM?	item
Power Measurement On/Off and Meas. Count	PWR_SET on_off[,avg_count]	PWR_SET?	on_off,avg_count
OBW On/Off and Meas. Count	OBW_SET on_off[,avg_count]	OBW_SET?	on_off,avg_count
SEM On/Off and Meas. Count	SEM_SET on_off[,avg_count]	SEM_SET?	on_off,avg_count
ACLR On/Off and Meas. Count	ACLR_SET on_off[,avg_count]	ACLR_SET?	on_off,avg_count
Modulation Analysis On/Off and Meas. Count	MOD_SET on_off[,avg_count]	MOD_SET?	on_off,avg_count
All Measurement Items Off	ALLMEASITEMS_OFF	----	----

Result (Power Measurement, Occupied Bandwidth, Adjacent Channel Power)

Function	Command	Query	Response
Tx Power Result	----	POWER? [mode]	pwr mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL s,pwr(1),pwr(2),...,pwr(s) mode=IND AVG when mode is omitted
Channel Power Result	----	CHPWR? [mode]	pwr mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL s,pwr(1),pwr(2),...,pwr(s) mode=IND AVG when mode is omitted
OBW Result	----	OBW?	bw
OBW Frequency Result	----	OBWFREQ? pos	freq
ACLR Result	----	ACLR? mode	aclr(G_LOW1),aclr(G_UP1),aclr(LOW1),aclr(UP1) mode=AVG,MAX,MIN avg(G_LOW1),avg(G_UP1),avg(LOW1),avg(UP1),max(G_LOW1),max(G_UP1),max(LOW1),max(UP1),min(G_LOW1),min(G_UP1),min(LOW1),min(UP1) mode=TTL

Result (Spectrum Emission Mask)

Function	Command	Query	Response
SEM Judgement	----	SEMPASS? [target]	judgement
SEM Worst Value	----	WORST_SEM_LV? range	level,freq
SEM Worst Value (All range)	----	TTL_WORST_SEM_LV?	level(-1),freq(-1),…,level(-5),freq(-5), level(1),freq(1),…,level(5),freq(5)
SEM Template Margin	----	WORST_SEM? range	margin,freq
SEM Template Margin (All range)	----	TTL_WORST_SEM?	margin(-1),freq(-1),…,margin(-5),freq(-5),margin(1),freq(1),…,margin(5),freq(5)
SEM Worst Value (Guard-band)	----	WORST_SEM_GB_LV? range	level,freq
SEM Worst Value (Guard-band) (All range)	----	TTL_WORST_SEM_GB_LV?	level(-1),freq(-1),…,level(-4),freq(-4), level(1),freq(1),…,level(4),freq(4)
SEM Template Margin (Guard-band)	----	WORST_SEM_GB? Range	margin,freq
SEM Template Margin (Guard-band) (All range)	----	TTL_WORST_SEM_GB?	margin(-1),freq(-1),…,margin(-4),freq(-4),margin(1),freq(1),…,margin(4),freq(4)

Result (Modulation Analysis)

Function	Command	Query	Response
Carrier Frequency Result	----	CARRF? AVG	freq
Carrier Frequency Error Result	----	CFERR? mode	freq_ppm,freq_Hz mode=AVG,MAX,MIN,DVT avg_ppm,avg_Hz,max_ppm,max_Hz,min_ppm,min_Hz mode=TTL
Worst Carrier Frequency Error Result	----	CFERR_WORST?	freq_ppm,freq_Hz
EVM Result	----	EVM? [mode]	evm mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL s,evm(1),…,evm[s] mode=IND AVG when mode is omitted
EVM low Result		EVM_L? [mode]	evm mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL s,evm(1),…,evm[s] mode=IND AVG when mode is omitted
EVM high Result		EVM_H? [mode]	evm mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL s,evm(1),…,evm[s] mode=IND AVG when mode is omitted
Reference Signal EVM Result	----	RSEVM? [mode]	rsevm mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL s,rsevm(1),…,rsevm[s] mode=IND AVG when mode is omitted
Peak EVM Result	----	PVECTERR? [mode]	pevm mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
Phase Error Result	----	PHASEERR? [mode]	phase mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted

Result (Modulation Analysis) (Cont'd)

Function	Command	Query	Response
Magnitude Error Result	----	MAGTDERR? [mode]	magnitude mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
Rho Result	----	RHO? [mode]	rho mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
Carrier Leakage Result	----	CARRLEAK? [mode]	cleakage mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
In-Band Emissions Measured Item	----	INBANDEITEM?	flag
In-Band Emissions Judgement	----	INBANDEPASS?	judgement
In-Band Emissions (General) Result	----	INBANDE_GEN? [mode]	ibe mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
In-Band Emissions limit (General)	----	INBANDE_GENUL?	level
In-Band Emissions (IQ Image) Result	----	INBANDE_IMG? [mode]	ibe mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
In-Band Emissions limit (IQ Image)	----	INBANDE_IMGUL?	level
In-Band Emissions (Carrier Leakage) Result	----	INBANDE_LEAK? [mode]	ibe mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
In-Band Emissions limit (Carrier Leakage)	----	INBANDE_LEAKUL?	level
In-Band Emissions Margin	----	INBANDE_MARG?	margin

Result (Modulation Analysis) (Cont'd)

Function	Command	Query	Response
IQ Imblance (%) Result	----	IQIMB_PER? [mode]	percent mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted
IQ Imblance (dB) Result	----	IQIMB_DB? [mode]	level mode=AVG,MAX,MIN,DVT avg,max,min mode=TTL AVG when mode is omitted

Result (Waveform)

Function	Command	Query	Response
Waveform	----	WAVEFMEAS? format,position,length[,symbol]	data(1),…,data(length)

5.2 Details of Commands

This section describes the commands in alphabetical order.

■ Terms in this command list

EX .... Command name (header)

Example .... Command function name

Function .... Command function

Command.................................. Programming command syntax

Query .... Query syntax

Response .... Response syntax

Parameter .... Parameter definition

Details .... Command restrictions and others

Example of Use................................ Command usage example

Related Commands ....Introduction of related commands

■ Suffix Code list

Suffix Code	Unit	Suffix Code	Unit
DB	dB	MHZ	MHz
DBM	dBm	MS	ms
GHZ	GHz	MZ	MHz
GZ	GHz	NS	ns
HZ	Hz	S	s
KHZ	kHz	US	μs
KZ	kHz		

5.2.1 Common commands

DLPAT

Waveform Pattern Select

Function

Selects a waveform pattern to use from patterns included in waveform file.
When the command received, the signal is immediately switched regardless of the frame cycle of signal, so the frame cycle is not continued.
This command is also used to query the currently selected waveform pattern.

Command

```
DLPAT pat
```

Query

```
DLPAT?
```

Response

```
pat
```

Parameter

pat	Waveform pattern
PAT1 to PATn	Waveform pattern number (n: waveform information file group range)
Default	PAT1

Details

Select the waveform pattern for RF output signal in waveform file.
The pattern number is the same as the group number. Refer to Chapter 3, "Waveform File Details" in the *Waveform Files for Cellular Application Operation Manual*.

Example of Use

To output the waveform pattern to 1:

```
DLPAT PAT1
DLPAT?
> PAT1
```

Related command

Waveform file for arbitrary waveform signal selection or query
PACKAGE

Remarks

The group number depends on the selected waveform file.
For details of the waveform pattern, refer to Chapter 3, "Waveform File Details" in the *Waveform Files for Cellular Application Operation Manual*.

DLPAT_SYNC

Waveform Pattern Select (SYNC)

Function

Selects a waveform pattern to use from patterns included in waveform file.
When the command received, the signal is switched according to the frame cycle of signal so that the frame cycle is continued.
This command is also used to query the currently selected waveform pattern.

Command

```
DLPAT_SYNC pat
```

Query

```
DLPAT_SYNC?
```

Response

```
pat
```

Parameter

pat	Waveform pattern
PAT1 to PATn	Waveform pattern number (n: waveform information file group range)
Default	PAT1

Details

Select the waveform pattern for RF output signal in waveform file.
The pattern number is the same as the group number. Refer to Chapter 3, “Waveform File Details” in the *Waveform Files for Cellular Application Operation Manual*.

Example of Use

To output the waveform pattern to 1:

```
DLPAT_SYNC PAT1
DLPAT_SYNC?
> PAT1
```

Related command

Waveform file for arbitrary waveform signal selection or query
PACKAGE

Remarks

The group number depends on the selected waveform file.
For details of the waveform pattern, refer to Chapter 3, “Waveform File Details” in the *Waveform Files for Cellular Application Operation Manual*.

ESR2?

End Event Status (Measurement) Register Query

Function

Queries the end event status register (measurement).
The event occurrence can be identified using the retrieved value.

Query

```
ESR2?
```

Response

```
register
```

register	End event status register (measurement)
Range	0 to 255

register	Value = bit0 + bit1 + ... + bit7
bit0 = 2^0 = 1	End of measurement
bit1 = 2^1 = 2	Trigger preparation completed
bit2 = 2^2 = 4	Unused (reserved for application use)
bit3 = 2^3 = 8	Unused (reserved for application use)
bit4 = 2^4 = 16	Unused (reserved for application use)
bit5 = 2^5 = 32	Unused (reserved for application use)
bit6 = 2^6 = 64	Unused (reserved for application use)
bit7 = 2^7 = 128	Unused (reserved for application use)

Details

The sum of the values for bits of the occurring event from the values $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^6 = 64$, and $2^7 = 128$, that correspond to the end event status register (measurement) bits 0, 1, 2, 3, 4, 5, 6, and 7 becomes the response.

Example of Use

To query the end event status register (measurement) value:

```
ESR2?
> 0
```

ESR3?

Error Event Status (Measurement) Register Query

Function

Queries the error event status register (measurement).
The event occurrence can be identified using the retrieved value.

Query

```
ESR3?
```

Response

```
register
```

register	Error event status register (measurement)
Range	0 to 255
register	Value = bit0 + bit1 + ... + bit7
bit0 = 2^0 = 1	Over level
bit1 = 2^1 = 2	Under level
bit2 = 2^2 = 4	Timeout
bit3 = 2^3 = 8	Unused (reserved for application use)
bit4 = 2^4 = 16	Unused (reserved for application use)
bit5 = 2^5 = 32	Unused (reserved for application use)
bit6 = 2^6 = 64	Unused (reserved for application use)
bit7 = 2^7 = 128	Unused (reserved for application use)

Details

The sum of the values for bits of the occurring event from the values $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$, $2^4 = 16$, $2^5 = 32$, $2^6 = 64$, and $2^7 = 128$, that correspond to the error event status register (measurement) bits 0, 1, 2, 3, 4, 5, 6, and 7 becomes the response.

Example of Use

To query the error event status register (measurement) value:

```
ESR3?
> 4
```

LVL

Output Level On/Off

Function

Sets or queries RF signal output at MU887000A connector.

Command

```
LVL on_off
```

Query

```
LVL?
```

Response

```
on_off
```

Parameter

on_off	Enables/disables RF signal output.
ON	Enables RF signal output.
OFF	Disables RF signal output.
Default	ON

Example of Use

To turn on the RF signal transmitted from the MU887000A connector:

```
LVL ON
LVL?
> ON
```

MEASSTOP

Measurement Stop

Function

Stops the current measurement.

Command

```
MEASSTOP
```

Example of Use

To stop the current measurement:

```
MEASSTOP
```

MOD

Output Signal Modulation

Function

Sets or queries MU887000A RF signal output modulation.

Command

```
MOD on_off
```

Query

```
MOD?
```

Response

```
on_off
```

Parameter

on_off	Enables/disables modulation.
ON	Enables RF output signal modulation.
OFF	Disables RF output signal modulation.
Default	ON

Example of Use

To turn on the modulation.

```
MOD ON
MOD?
> ON
```

MSTAT?

Measurement Status

Function

Queries the measurement status.

Query

```
MSTAT?
```

Response

```
m_status
```

Parameter

m_status	Measurement status
0	Completed measurement
2	Over level
5	Synchronization word not detected
9	Measurement in progress or not measured
12	Tx measurement timeout

Details

This command can be used while measurement is in progress or suspended.

Example of Use

To query current measurement status:

```
MSTAT?
> 0
```

PACKAGE

Waveform File Select

Function

Selects and queries the waveform file for arbitrary waveform signal used at Downlink signal.

Command

```
PACKAGE pac
```

Query

```
PACKAGE?
```

Response

```
pac
```

Parameter

pac	Waveform file

Details

The name of the file used from the waveform files loaded into waveform memory is set by this command.

Example of Use

To set the waveform file 1 from waveform files loaded in waveform memory:

```
PACKAGE "PAC1"
PACKAGE?
> PAC1
```

Related command

Use the following command to load the waveform file into waveform memory.
SOUR:GPRF:GEN:ARB:FILE:LOAD
For details of the command, refer to Chapter 5 "SCPI Command Reference" in the *MU887000A TRX Test Module Operation Manual*.
:SOURce:GPRF:GENerator:ARB:FILE:LOAD
The following command can be used to query the names of waveform files that have been loaded into waveform memory.
SOUR:GPRF:GEN:ARB:WAV:NAME?
For details of the command, refer to Chapter 5 "SCPI Command Reference" in the *MU887000A TRX Test Module Operation Manual*.
:SOURce:GPRF:GENerator:ARB:WAVeform:NAME?

Use the following commands to select a waveform pattern to use from the waveform patterns included in the waveform file configured using the command described in this section.
DLPAT, DLPAT_SYNC, SEQTRX

PORT

Set Connect Port Direction

Function

Sets or queries connectors for inputting and outputting RF signals.

Command

```
PORT input,output
```

Query

```
PORT?
```

Response

```
input,output
```

Parameters

input	Test Port No.
PORT1	Test Port1
PORT2	Test Port2
PORT3	Test Port3
PORT4	Test Port4
Default	PORT1
output	Test Port No.
PORT1	Test Port1
PORT2	Test Port2
PORT3	Test Port3
PORT4	Test Port4
Default	PORT1

Details

Both Test Port1 and Test Port2 can be set to input and output simultaneously.
Test Port3 and Test Port4 can be set to either input or output at one time.
Only Port1 and Port2 are used by the MX887067A.

Example of Use

To set the RF signal input and output connectors to Test Port1 and Test Port2, respectively:

```
PORT PORT1,PORT2
PORT?
> PORT1,PORT2
```

SNGLS

Measurement Start

Function

Sets the parameters for both specified measurement and signal transmission and executes measurement.

Command

```
SNGLS
```

Details

Sending this command executes one measurement execution.
Sending this command during measurement, aborts measurement once and restarts it.
ESR2 must be polled or sync processing via *WAI is required to determine the timing of measurement completion.

Example of Use

To start measurement:

```
SNGLS
```

Related command

ESR2
For the details of the event status register, refer to Chapter 3 “Fundamental Operation” in the *MU887000A TRX Test Module Operation Manual.*

STDSEL

Standard Select

Function

Sets or queries the measurement standard.

Command

```
STDSEL std
```

Query

```
STDSEL?
```

Response

```
std
```

Parameter

std	Measurement standard	
COMMON	Common measurement	(requires MX887010A)
WCDMA	W-CDMA	(requires MX887011A)
GSM	GSM	(requires MX887012A)
LTE	LTE	(requires MX887013A or MX887014A)
CDMA2000	CDMA2000 1x	(requires MX887015A)
EVDO	CDMA2000 1xEVDO	(requires MX887016A)
TDSCDMA	TD-SCDMA	(requires MX887017A)
NBIOT	NB-IoT	(requires MX887067A)
SEQUENCE	Sequence measurement	(requires MX887010A)
SEQ	Sequence measurement	(requires MX887010A)
Default	COMMON	

Example of Use

To switch the measurement standard to SEQUENCE:

```
STDSEL SEQUENCE
STDSEL?
> SEQUENCE
```

Remarks

This parameter must be set to NBIOT to execute the commands described in Section 5.2.2 “Fundamental measurement commands”.

SYSSEL

Application Select

Function

Sets or queries the type of application software executing on MU887000A.

Command

```
SYSSEL app
```

Query

```
SYSSEL?
```

Response

```
app
```

Parameter

app	Type of application software
CELLULAR	Cellular Application
SRW	SRW Application

Details

Set the parameter to CELLULAR and send the command before using the MX887067A.

Example of Use

To set the application software to CELLULAR:

```
SYSSEL CELLULAR
SYSSEL?
> CELLULAR
```

Remarks

When using the MX887067A, set the application to CELLULAR using the SYSSEL command, and then set the standard to NBIOT using the STDSEL command.

SYST:LANG

Language Selection of Remote Command

Function

Switches the language mode of remote control commands.

Command

```
SYST:LANG mode
```

Query

```
SYST:LANG?
```

Response

```
mode
```

Parameter

mode	Language mode
NAT	Native
SCPI	SCPI
Default	NAT

Example of Use

To switch the language mode of remote control commands to Native.

```
SYST:LANG NAT
SYST:LANG?
>NAT
```

SWP

Measurement Start (Synchronization)

Function

Sets the parameters of the measurement and signal transmission, and executes the measurement.
The following command is not processed until the measurement ends, so the MX887067A and the controller can synchronize.
Queries the measurement end.

Command

```
SWP
```

Query

```
SWP?
```

Response

```
status
```

Parameter

status	Measurement status
0	Measurement finished
1	Measurement in progress

Details

When this command is sent, the measurement is performed only once.
To average, the measurements are performed for the specified average count (number of measurements to average).

Example of Use

To start the measurement.

```
SWP
```

TXMSTAT?

Tx Measurement Status

Function

Queries the Tx measurement status.

Query

`TXMSTAT?`

Response

`m_status`

Parameter

m_status	Measurement status
0	Measurement completed
2	Over level
5	Synchronization word not detected
9	Measurement in progress or not measured
12	Tx measurement timeout

Details

This command can be used while measurement is in progress or suspended.

Example of Use

To query current Tx measurement status:

```
TXMSTAT?
> 0
```

5.2.2 Fundamental measurement commands

ACLR?

ACLR Result

Function

Queries the result of ACLR (Adjacent Channel Leakage Power Ratio) measurement.

Query

```
ACLR? mode
```

Response

When mode = AVG, MAX, MIN, DVT,

```
aclr(G_LOW1),aclr(G_UP1),aclr(LOW1),aclr(UP1)
```

When mode = TTL,

```
avg(G_LOW1),avg(G_UP1),avg(LOW1),avg(UP1),
max(G_LOW1),max(G_UP1),max(LOW1),max(UP1),
min(G_LOW1),min(G_UP1),min(LOW1),min(UP1)
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
aclr(offset)	Result of Adjacent Channel Leakage Power Ratio measurement in specified Storage mode
avg(offset)	ACLR measurement result (Average)
max(offset)	ACLR measurement result (Maximum)
min(offset)	ACLR measurement result (Minimum)
Resolution	0.01 dB
Response unit	dB
offset	Offset frequency
G_LOW1	GSM_{ACLR} LOW
G_UP1	GSM_{ACLR} UP
LOW1	$UTRA_{ACLR}$ LOW
UP1	$UTRA_{ACLR}$ UP

Details

The measurement bandwidth of the target adjacent channel varies with the channel bandwidth setting.

Example of Use

To query the average of ACLR measurement result:

```
ACLR? AVG
> -61.23,-30.06,-65.68,-62.44
```

ACLR_SET

ACLR On/Off and Meas. Count

Function

Sets or queries the ACLR measurement On/Off state and measurement count.

Command

```
ACLR_SET on_off[,avg_count]
```

Query

```
ACLR_SET?
```

Response

```
on_off,avg_count
```

Parameters

on_off	Enables/disables measurement.
ON	Enables measurement
OFF	Disables measurement
Default	ON
avg_count	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Examples of Use

To set the ACLR measurement to OFF:

```
ACLR_SET OFF
ACLR_SET?
> OFF
```

ALLMEASITEMS_OFF

All Measurement Items Off

Function

Sets all fundamental measurement items to off at one time.

Command

```
ALLMEASITEMS_OFF
```

Example of Use

To set all fundamental measurement items to off at one time:

```
ALLMEASITEMS_OFF
```

BAND?

Operation band

Function

Sets or queries the operation band.

Query

`BAND?`

Response

`band`

Parameter

band	Operation band
Range	0 to 256
Resolution	1

Example of Use

To query the operation band:

```
BAND?
> 10
```

Remarks

"0" is returned when the uplink or downlink channel number is set, but the set band is not found in Table 2.1.6-2.

CARRF?

Carrier Frequency Result

Function

Queries the Carrier Frequency measurement result.

Query

```
CARRF? mode
```

Response

```
freq
```

Parameter

mode	Storage mode
AVG	Average
freq	Carrier frequency
Resolution	1 Hz
Unit	Hz

Example of Use

To query the result of Carrier Frequency measurement:

```
CARRF? AVG
> 1951000000
```

CARRLEAK?

Carrier Leakage Result

Function

Queries the Carrier Leakage (Origin offset) measurement result.

Query

```
CARRLEAK? mode
```

Response

When mode = AVG, MAX, MIN, DVT,

```
cleakage
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
cleakage	Carrier Leakage measurement result in specified Storage mode
avg	Carrier Leakage measurement result (Average)
max	Carrier Leakage measurement result (Maximum)
min	Carrier Leakage measurement result (Minimum)
Resolution	0.01 dB
Unit	dBc

Example of Use

To query the average of Carrier Leakage measurement result:

```
CARRLEAK? AVG
> 20.00
```

CFERR?

Carrier Frequency Error Result

Function

Queries the Frequency Error measurement result.

Query

```
CFERR? mode
```

Response

When mode = AVG, MAX, MIN, DVT,

```
freq_ppm,freq_Hz
```

When mode = TTL,

```
avg_ppm,avg_Hz,max_ppm,max_Hz,min_ppm,min_Hz
```

Parameters

mode	Storage mode	
AVG	Average	
MAX	Maximum	
MIN	Minimum	
TTL	Average・Maximum・Minimum	
DVT	Standard deviation	
avg_ppm	Measurement result in ppm (Average)	
avg_Hz	Measurement result in Hz (Average)	
max_ppm	Measurement result in ppm (Maximum)	
max_Hz	Measurement result in Hz (Maximum)	
min_ppm	Measurement result in ppm (Minimum)	
min_Hz	Measurement result in Hz (Minimum)	
freq_ppm	Measurement result in ppm in specified Storage mode	
freq_Hz	Measurement results in Hz in specified Storage mode	
Resolution	0.01 ppm	(Measurement result in ppm)
	0.1 Hz	(Measurement result in Hz)
Unit	ppm	(Measurement result in ppm)
	Hz	(Measurement result in Hz)

Example of Use

To query the average of Frequency Error measurement result:

```
CFERR? AVG
> 0.03,60.0
```

CFERR_WORST?

Worst Carrier Frequency Error Result

Function

Queries the worst value in Frequency Error measurement results.

Query

```
CFERR_WORST?
```

Response

```
freq_ppm,freq_Hz
```

Parameters

freq_ppm	Worst value in Frequency Error measurement results in ppm
Resolution	0.01 ppm
Unit	ppm
freq_Hz	Worst value in Frequency Error measurement results in Hz
Resolution	0.1 Hz
Unit	Hz

Example of Use

To query the worst value in Frequency Error measurement results:

```
CFERR_WORST?
> 0.03,60.0
```

CHCODING

Channel Coding

Function

Sets or queries the channel coding.

Command

```
CHCODING object
```

Query

```
CHCODING?
```

Response

```
object
```

Parameter

object	Target for channel coding
RMC	Reference Measurement Channel
Default	RMC

Examples of Use

To set the channel coding to RMC:

```
CHCODING RMC
CHCODING?
> RMC
```

CHPWR?

Channel Power Result

Function

Queries the Channel Power measurement result.

Query

```
CHPWR? [mode]
```

Response

When mode = AVG, MAX, MIN or DVT,

```
pwr
```

When mode = TTL,

```
avg,max,min
```

When mode = IND,

```
s,pwr(1),pwr(2),pwr(3),…,pwr(s)
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
IND	Individual measurement result
Omitted	Average
pwr	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
pwr(n)	The n-th measurement result (n=1 to s)
Resolution	0.01 dB
Unit	dBm
s	Number of valid measurement results

Example of Use

To query the average of Channel Power measurement result:

```
CHPWR? AVG
> -20.00
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

COEXBANDWIDTH

Coexisting Bandwidth

Function

Sets or queries the LTE Bandwidth when Operation Mode is Guard-band.

Command

```
COEXBANDWIDTH bandwidth
```

Query

```
COEXBANDWIDTH?
```

Response

bandwidth

Parameter

bandwidth	Bandwidth
1.4MHZ	1.4 MHz
3MHZ	3 MHz
5MHZ	5 MHz
10MHZ	10 MHz
15MHZ	15 MHz
20MHZ	20 MHz
Default	5 MHZ

Example of Use

To set the Coexisting Bandwidth to 1.4 MHz:

```
COEXBANDWIDTH 1.4MHZ
COEXBANDWIDTH?
> 1.4MHZ
```

DELTASS

Delta SS

Function

Sets or queries the Delta SS.

Command

```
DELTASS val
```

Query

```
DELTASS?
```

Response

```
val
```

Parameter

val	Delta SS
Range	0 to 29
Resolution	1
Default	0
Suffix code	None

Example of Use

To set the Delta SS to 0:

```
DELTASS 0
DELTASS?
> 0
```

DLCHAN

Downlink Channel

Function

Sets or queries the Downlink Channel.

Command

```
DLCHAN dl_ch
```

Query

```
DLCHAN?
```

Response

```
dl_ch
```

Parameter

dl_ch	Downlink Channel
Range	0 to 262143
Resolution	1
Default	300
Suffix code	None

Details

When the Downlink Channel is updated, Operation Band, Uplink Channel, Downlink Frequency and Uplink Frequency are changed accordingly.
For the relationship between the channel and frequency settings refer to Table 2.1.6-1 “Relationship between Uplink Channel Number and Downlink Channel Number” and Table 2.1.6-2 “E-UTRA Channel Numbers and Default UE TX-RX Frequency Separation”.

Example of Use

To set the Downlink Channel to 300:

```
DLCHAN 300
DLCHAN?
> 300
```

DLFREQ

Downlink Frequency

Function

Sets or queries the downlink frequency.

Command

```
DLFREQ dl_freq
```

Query

```
DLFREQ?
```

Response

```
dl_fleq
```

Parameter

dl_freq	Downlink frequency
Range	400 000 000 to 3800.000 000 Hz
	400 000 000 to 6000.000 000 Hz (with MU887000A-001/101)
Resolution	1 Hz
Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
Default	2140 000 000 Hz
Unit	Hz

Details

The Rx frequency for the mobile station is set.
Updating the Downlink Frequency setting does not affect the Downlink Channel setting.

Example of Use

To set the downlink frequency to 2140 MHz:

```
DLFREQ 2140MHZ
DLFREQ?
>2140000000
```

DUPLEXMODE

Duplex Mode

Function

Sets or queries the Duplex Mode.

Command

```
DUPLEXMODE mode
```

Query

```
DUPLEXMODE?
```

Response

```
mode
```

Parameter

mode	Duplex Mode
HALF	Half Duplex
Default	HALF

Example of Use

To set the Duplex Mode to HALF:

```
DUPLEXMODE HALF
DUPLEXMODE?
> HALF
```

EVM?

EVM Result

Function

Queries the EVM (Error Vector Magnitude) measurement result.

Query

```
EVM? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT

```
evm
```

When mode = TTL,

```
avg,max,min
```

When mode = IND,

```
s,evm(1),evm(2),...,evm(s)
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
evm	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
evm(n)	n-th EVM measurement result (n=1 to s)
Resolution	0.01%
Unit	%
s	Number of valid measurement results

Example of Use

To query the average of EVM measurement result:

```
EVM? AVG
> 1.50
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

EVM_H?

EVM Result (High)

Function

Queries the EVM (Error Vector Magnitude) measurement result.

Query

`EVM_H? [mode]`

Response

When mode = AVG, MAX, MIN, DVT

`evm`

When mode = TTL,

`avg,max,min`

When mode = IND,

`s,evm(1),evm(2),...,evm(s)`

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
evm	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
evm(n)	n-th EVM measurement result (n=1 to s)
Resolution	0.01%
Unit	%
s	Number of valid measurement results

Example of Use

To query the average of EVM measurement result:

```
EVM_H? AVG
> 1.50
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

EVM_L?

EVM Result (Low)

Function

Queries the EVM (Error Vector Magnitude) measurement result.

Query

```
EVM_L? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT

```
evm
```

When mode = TTL,

```
avg,max,min
```

When mode = IND,

```
s,evm(1),evm(2),...,evm(s)
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
evm	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
evm(n)	n-th EVM measurement result (n=1 to s)
Resolution	0.01%
Unit	%
s	Number of valid measurement results

Example of Use

To query the average of EVM measurement result:

```
EVM_L? AVG
> 1.50
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

FRAMETYPE

Frame Structure

Function

Sets or queries the frame structure.

This setting determines the duplex mode.

Command

```
FRAMETYPE mode
```

Query

```
FRAMETYPE?
```

Response

```
mode
```

Parameter

mode	Frame Structure
FDD	Frequency Division Multiplexing
Default	FDD

Example of Use

To set the frame structure to FDD:

```
FRAMETYPE FDD
FRAMETYPE?
> FDD
```

GROUPHOP

Group Hopping

Function

Sets or queries the Group Hopping On/Off state.

Command

```
GROUPHOP on_off
```

Query

```
GROUPHOP?
```

Response

```
on_off
```

Parameter

on_off	Enables/disables Group hopping.
ON	Enables Group hopping.
OFF	Disables Group hopping.
Default	ON

Example of Use

To enable Group hopping:

```
GROUPHOP ON
GROUPHOP?
> ON
```

ILVL

Input Level

Function

Sets or queries the input level of the MU887000A connector.

Command

```
ILVL level
```

Query

```
ILVL?
```

Response

```
level
```

Parameter

level	Input level of PCC	
Range	–65.0 to +35.0 dBm	(Port 1/Port 2)
	–65.0 to +25.0 dBm	(Port 3/Port 4)
Resolution	0.1 dB	
Suffix Code	DBM, (uses dBm when omitted)	
Default	–1.0 dBm	
Unit	dBm	

Details

The setting range varies according to the External Loss setting.
When Cable Loss Correction is ON, the cable loss is added to the input level setting range.
When the cable loss is 5 dB, the Port1/Port2 setting range is –60.0 to +40.0 dBm.

Range	–65.0＋Cable loss to +35.0＋Cable loss [dBm]	(Port 1/Port 2)
	–65.0＋Cable loss to +25.0＋Cable loss [dBm]	(Port 3/Port 4)

Example of Use

To set the input level to –10.0 dBm:

```
ILVL -10.0
ILVL?
>-10.0
```

Related Commands

EXTLOSSW
LOSSTBL
LOSSTBLVAL

For details of the commands, refer to Chapter 6 “Native Command Reference” in the *MU887000A TRX Test Module Operation Manual*.

INBANDEITEM?

In-Band Emissions Measured Item

Function

Queries whether each in-band emission measurement item is measured or not.

Query

```
INBANDEITEM?
```

Response

```
flag
```

Parameter

flag	Measured/Not measured flag (0 to 7)
	Returns the sum of the following measurement items.
0	Not measured
1	Measure General
2	Measure IQ Image
4	Measure Carrier Leakage
Unit	None

Example of Use

To query whether each in-band emission measurement item is measured or not.

```
INBANDEITEM?
> 4
```

INBANDEPASS?

In-Band Emissions Judgement

Function

Queries the judgement on the in-band emission measurement result.

Query

```
INBANDEPASS?
```

Response

```
judgement
```

Parameter

judgement	Judgement
PASS	Pass
FAIL	Fail
–	Not measured

Example of Use

To query the judgement on the in-band emission measurement result:

```
INBANDEPASS?
> PASS
```

INBANDE_GEN?

In-Band Emissions (General) Result

Function

Queries in-band emissions (General) for non-allocated RB measurement result.

Query

```
INBANDE_GEN? [mode]
```

Response

When mode =AVG, MAX, MIN, DVT,

```
ibe
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Maximum
ibe	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the maximum of in-band emissions (General) measurement result:

```
INBANDE_GEN? MAX
> 0.04
```

INBANDE_GENUL?

In-Band Emissions limit (General)

Function

Queries the limit of the in-band emission (General).

Query

```
INBANDE_GENUL?
```

Response

```
level
```

Parameter

level	Limit
Resolution	0.1 dB
Unit	dB

Example of Use

To query the limit of in-band emission (General):

```
INBANDE_GENUL?
> 2.4
```

INBANDE_IMG?

In-Band Emissions (IQ Image) Result

Function

Queries in-band emissions (IQ Image) measurement result.

Query

```
INBANDE_IMG? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
ibe
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Maximum
ibe	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the maximum of in-band emissions (IQ Image) measurement result:

```
INBANDE_IMG? MAX
> 0.04
```

INBANDE_IMGUL?

In-Band Emissions limit (IQ Image)

Function

Queries the limit of in-band emission (IQ Image).

Query

```
INBANDE_IMGUL?
```

Response

```
level
```

Parameter

level	Limit
Resolution	0.1 dB
Unit	dB

Example of Use

To query the limit of in-band emission (IQ Image).

```
INBANDE_IMGUL?
> 1.4
```

INBANDE_LEAK?

In-Band Emissions (Carrier Leakage) Result

Function

Queries the In-band emissions (Carrier Leakage) measurement result.

Query

```
INBANDE_LEAK? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
ibe
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Maximum
ibe	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the maximum of in-band emissions (Carrier Leakage) measurement result:

```
INBANDE_LEAK? MAX
> 0.04
```

INBANDE_LEAKUL?

In-Band Emissions limit (Carrier Leakage)

Function

Queries the limit of in-band emission (Carrier Leakage).

Query

```
INBANDE_LEAKUL?
```

Response

```
level
```

Parameter

level	Limit
Resolution	0.1 dB
Unit	dBc

Example of Use

To query the limit of in-band emission (Carrier Leakage).

```
INBANDE_LEAKUL?
> 1.4
```

INBANDE_MARG?

In-Band Emissions Margin

Function

Queries the worst margin in the entire bandwidth for in-band emission measurement.

Query

`INBANDE_MARG?`

Response

`margin`

Parameter

margin	Worst margin
Resolution	0.01 dB
Unit	dB

Example of Use

Queries the worst margin in the entire bandwidth of in-band emission measurement:

```
INBANDE_MARG?
> 1.40
```

IQIMB_DB?

IQ Imbalance (dB) Result

Function

Queries the IQ Imbalance measurement result.

Query

```
IQIMB_DB? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
magnitude
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
magnitude	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01 dB
Unit	dB

Example of Use

To query the average of IQ Imbalance measurement result:

```
IQIMB_DB? AVG
> 0.05
```

IQIMB_PER?

IQ Imbalance (%) Result

Function

Queries the IQ Imbalance measurement result.

Query

`IQIMB_PER? [mode]`

Response

When mode = AVG, MAX, MIN, DVT,

`percent`

When mode = TTL,

`avg,max,min`

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
`percent`	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01%
Unit	%

Example of Use

To query the average of IQ Imbalance measurement result:

```
IQIMB_PER? AVG
> 0.05
```

MAGTDERR?

Magnitude Error Result

Function

Queries the Magnitude Error measurement result.

Query

```
MAGTDERR? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
magnitude
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
magnitude	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01%
Unit	%

Example of Use

To query the average of Magnitude Error measurement result:

```
MAGTDERR? AVG
> 1.05
```

MEASITEM

Measurement Item

Function

Sets or queries the Measurement Item in Fundamental Measurement.

Command

```
MEASITEM item
```

Query

```
MEASITEM?
```

Response

```
item
```

Parameters

item	Measurement Item in Fundamental Measurement
NORMAL	Normal
Default	NORMAL

Example of Use

To set the Measurement Item in Fundamental Measurement to Normal:.

```
MEASITEM NORMAL
MEASITEM ?
> NORMAL
```

MOD_SET

Modulation Analysis On/Off and Meas. Count

Function

Sets or queries the Modulation Analysis On/Off state and measurement count.

Command

```
MOD_SET on_off[,avg_count]
```

Query

```
MOD_SET?
```

Response

```
on_off,avg_count
```

Parameters

on_off	Enables/disables measurement.
ON	Enables measurement.
OFF	Disables measurement.
Default	OFF
avg_count	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set the Modulation Analysis to On and measurement count to 200:

```
MOD_SET ON,200
MOD_SET?
> ON,200
```

NBOPEMODE

NB Operation Mode

Function

Sets or queries the Operation Mode of NB-IoT.

Command

```
NBOPEMODE mode
```

Query

```
NBOPEMODE?
```

Response

```
mode
```

Parameters

mode	Operation Mode
STANDALONE	Stand-alone
GUARDBAND	Guard-band
INBAND	In-band
Default	STANDALONE

Example of Use

To set the Operation Mode of NB-IoT to Stand-alone:

```
NBOPEMODE STANDALONE
NBOPEMODE?
> STANDALONE
```

NCELLID

NCell ID

Function

Sets or queries the NCell ID.

Command

```
NCELLID id
```

Query

```
NCELLID?
```

Response

```
id
```

Parameters

id	NCell ID
Range	0 to 503
Resolution	1
Default	0
Suffix code	None

Examples of Use

To set the NCell ID to 0:

```
NCELLID 0
NCELLID?
> 0
```

NPUSCH

NPUSCH Format

Function

Sets or queries the NPUSCH Format.

Command

```
NPUSCH format
```

Query

```
NPUSCH?
```

Response

```
format
```

Parameters

format	Format
1	format 1
2	format 2
Default	1

Details

When the NPUSCH Format is updated, Subcarrier spacing, Number of subcarrier, Starting subcarrier, Modulation, Cyclic Shift Index, and Number of Resource Units are changed accordingly.

NPUSCH format	Subcarrier spacing	Number of subcarrier	Starting subcarrier	Modulation	Cyclic Shift Index	Number of Resource Units
1	3.75 kHz	1	0	QPSK	0	1
2	3.75 kHz	1	0	BPSK	0	1

Example of Use

To set the NPUSCH Format to format 1:

```
NPUSCH 1
NPUSCH?
> 1
```

OBW?

OBW Result

Function

Queries the OBW (Occupied Bandwidth) measurement result.

Query

```
OBW?
```

Response

```
bw
```

Parameter

bw	Occupied Bandwidth
Resolution	1 Hz
Unit	Hz

Example of Use

To query the OBW measurement result:

```
OBW?
> 3840000
```

OBWFREQ?

OBW Frequency Result

Function

Queries the upper, lower and center frequency of OBW (Occupied Bandwidth) measurement results.

Query

```
OBWFREQ? pos
```

Response

```
freq
```

Parameters

pos	Offset type
UPPER	Upper frequency
LOWER	Lower frequency
CENTER	Center frequency
freq	Offset frequency
Resolution	0.1 Hz
Unit	Hz

Example of Use

To query the upper frequency of OBW measurement result:

```
OBWFREQ? UPPER
> 1951920000.0
```

OBW_SET

OBW On/Off and Meas. Count

Function

Sets or queries the OBW (Occupied Bandwidth) measurement On/Off state and measurement count.

Command

```
OBW_SET on_off[,avg_count]
```

Query

```
OBW_SET?
```

Response

```
on_off,avg_count
```

Parameters

on_off	Enables/disables measurement.
ON	Enables measurement.
OFF	Disables measurement.
Default	ON
avg_count	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set OBW measurement on and set the measurement count to 50:

```
OBW_SET ON,50
OBW_SET?
> ON,50
```

OLVL

Output Level

Function

Sets or queries the total output level of all channels.

Command

```
OLVL level
```

Query

```
OLVL?
```

Response

```
level
```

Parameter

level	Output level
Range	–130.0 to –10.0 dBm (Port 1/Port 2)
	–120.0 to 0.0 dBm (Port 3/Port 4)
Resolution	0.1 dB
Suffix Code	DBM (uses dBm when omitted)
Default	–60.2 dBm
Unit	dBm

Details

The setting range varies with the output port setting.
When the Cable Loss Calibration is ON, the cable loss is subtracted from the output level setting range.
When the cable loss is 5 dB, the Port1/Port2 setting range is –135.0 to –15.0 dBm.

Range	–130.0 – Cable loss to –10.0 – Cable loss [dBm] (Port 1/Port 2)
	–120.0 – Cable loss to 0.0 – Cable loss [dBm] (Port 3/Port 4)

Example of Use

To set the output level to –50.0 dBm:

```
OLVL -50.0
OLVL?
> -50.0
```

Related Commands

EXTLOSSW
LOSSTBL
LOSSTBLVAL
For details of the commands, refer to Chapter 6 "Native Command Reference" in the *MU887000A TRX Test Module Operation Manual*.

PHASEERR?

Phase Error Result

Function

Queries the Phase Error measurement result.

Query

```
PHASEERR? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
phase
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
phase	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01 deg.
Unit	deg.

Example of Use

To query the average of Phase Error measurement result:

```
PHASEERR? AVG
> 1.55
```

POWER?

Tx Power Result

Function

Queries the Tx Power measurement result.

Query

```
POWER? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
pwr
```

When mode = TTL,

```
avg,max,min
```

When mode = IND

```
s,pwr(1),pwr(2),...,pwr(s)
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
pwr	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
pwr(n)	The n-th Measurement result (n=1 to s)
Resolution	0.01 dB
Unit	dBm
s	Number of valid measurement results

Example of Use

To query the Tx Power measurement result:

```
POWER? AVG
> -20.00
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

PVECTERR?

Peak EVM Result

Function

Queries the peak EVM (Error Vector Magnitude) measurement result.

Query

```
PVECTERR? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
pevm
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
pevm	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.01%
Unit	%

Example of Use

To query the average of Peak EVM measurement result:

```
PVECTERR? AVG
> 1.75
```

PWR_SET

Power Measurement On/Off and Meas. Count

Function

Sets or queries the Tx Power Measurement On/Off state and measurement count.

Command

```
PWR_SET on_off[,avg_count]
```

Query

```
PWR_SET?
```

Response

```
on_off,avg_count
```

Parameters

on_off	Enables/disables measurement.
ON	Enables measurement.
OFF	Disables measurement.
Default	ON
avg_count	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set Tx Power measurement ON and set the measurement count to 200:

```
PWR_SET ON,200
PWR_SET?
> ON,200
```

RHO?

Rho Result

Function

Queries the Rho (waveform quality) measurement result.

Query

```
RHO? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
rho
```

When mode = TTL,

```
avg,max,min
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
DVT	Standard deviation
Omitted	Average
rho	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
Resolution	0.00001

Example of Use

To query the average of Signal Quality measurement (Rho) result:

```
RHO? AVG
> 0.00004
```

RSEVM?

Reference Signal EVM Result

Function

Queries the EVM measurement result of Reference Signal.

Query

```
RSEVM? [mode]
```

Response

When mode = AVG, MAX, MIN, DVT,

```
rsevm
```

When mode = TTL,

```
avg,max,min
```

When mode = IND,

```
s,rsevm(1),rsevm(2),...,rsevm(s)
```

Parameters

mode	Storage mode
AVG	Average
MAX	Maximum
MIN	Minimum
TTL	Average・Maximum・Minimum
IND	Individual measurement result
DVT	Standard deviation
Omitted	Average
rsevm	Measurement result in specified Storage mode
avg	Measurement result (Average)
max	Measurement result (Maximum)
min	Measurement result (Minimum)
rsevm(n)	The n-th Measurement result (n=1 to s)
Resolution	0.01%
Unit	%
s	Number of valid measurement results

Example of Use

To query the average of Reference Signal EVM measurement result:

```
RSEVM? AVG
> 1.51
```

Remarks

By specifying the argument IND, the measurement results for the average count can be queried.

RXFREQ

Downlink Frequency

Function

Sets or queries the downlink frequency.

Command

```
RXFREQ dl_freq
```

Query

```
RXFREQ?
```

Response

```
dl_freq
```

Parameter

dl_freq	Downlink frequency
Range	400 000 000 to 3800 000 000 Hz 400 000 000 to 6000 000 000 Hz (with MU887000A-001/101)
Resolution	1 Hz
Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
Default	2140 000 000 Hz
Unit	Hz

Details

The Rx frequency for the mobile station is set.
Updating the Downlink Frequency setting does not affect the Downlink Channel setting.

Example of Use

To set the downlink frequency to 2140 MHz:

```
RXFREQ 2140MHZ
RXFREQ?
>2140000000
```

SEMPASS?

SEM Judgement

Function

Queries the judgement result of SEM (Spectrum Emission Mask) measurement.
Fail when any part of spectrum exceeds limit, otherwise Pass.

Query

```
SEMPASS? [target]
```

Response

```
judgement
```

Parameter

target	Judgement target
GEN	General
GB	Guard-band
省略	General and Guard-band
judgement	Judgement result
PASS	Pass
FAIL	Fail
–	Not measured

Example of Use

To query the judgement result of SEM measurement:

```
SEMPASS?
> PASS
```

SEM_SET

SEM On/Off and Meas. Count

Function

Sets or queries the SEM (Spectrum Emission Mask) Measurement On/Off state and measurement count.

Command

```
SEM_SET on_off[,avg_count]
```

Query

```
SEM_SET?
```

Response

```
on_off,avg_count
```

Parameters

on_off	Enables/disables the measurement.
ON	Enables the measurement.
OFF	Disables the measurement.
Default	ON
avg_count	Measurement count
Range	1 to 500
Resolution	1
Suffix code	None
Default	1

Example of Use

To set the SEM measurement to On and set the measurement count to 100:

```
SEM_SET ON,100
SEM_SET?
> ON,100
```

TTL_WORST_SEM?

SEM Template Margin (All range)

Function

Queries the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
TTL_WORST_SEM?
```

Response

```
margin(-1),freq(-1),…,margin(-5),freq(-5),margin(1),freq(1),…,
margin(5),freq(5)
```

Parameters

margin(n)	Worst margin in each frequency range (Frequency range: n= –5 to –1, 1 to 5)
Resolution	0.01 dB
Unit	dB
freq(n)	Offset frequency of the worst margin in each frequency range (Frequency range: n= –5 to –1, 1 to 5)
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).

If the measured value exceeds the limit value, the margin becomes negative.

Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement:

```
TTL_WORST_SEM?
>
-20.01,20,-20.02,20,-20.03,20,-20.04,20,-20.05,20,-20.06,20,-20.07,20,-20
.08,20,-20.09,20,-20.00,20
```

TTL_WORST_SEM_GB?

SEM Template Margin (Guard-band) (All range)

Function

Queries the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
TTL_WORST_SEM_GB?
```

Response

```
margin(-1),freq(-1),…,margin(-4),freq(-4),margin(1),freq(1),…,
margin(4),freq(4)
```

Parameters

margin(n)	Worst margin in each frequency range (Frequency range: n= –4 to –1, 1 to 4)
Resolution	0.01 dB
Unit	dB
freq(n)	Offset frequency of the worst margin in each frequency range (Frequency range: n= –4 to –1, 1 to 4)
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
The frequency range varies according to the channel bandwidth.
Refer to Table 2.4-2 “Frequency ranges of Range 1 to Range 4 (Guard-band)” for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in each frequency range of SEM measurement:

```
TTL_WORST_SEM_GB?
>
-20.01,30,-20.02,30,-20.03,30,-20.04,30,-20.05,30,-20.06,30,-20.07,30,-20
.08,30
```

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Native Command Reference

TTL_WORST_SEM_LV?

SEM Worst Value (All range)

Function

Queries the worst spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
TTL_WORST_SEM_LV?
```

Response

```
level(-1),freq(-1),…,level(-5),freq(-5),level(1),freq(1),…,
level(5),freq(5)
```

Parameters

level(n)	Worst spectrum level in each frequency range (Frequency range: n = –5 to –1, 1 to 5)
Resolution	0.01 dB
Unit	dBm
freq(n)	Offset frequency of the worst spectrum level in each frequency range (Frequency range: n = –5 to –1, 1 to 5)
Resolution	1 Hz
Unit	Hz

Details

Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in each frequency range of SEM measurement:

```
TTL_WORST_SEM_LV?
>
-20.01,30,-20.02,30,-20.03,30,-20.04,30,-20.05,30,-20.06,30,-20.07,30,-20
.08,30,-20.09,30,-20.00,30
```

TTL_WORST_SEM_GB_LV?

SEM Worst Value (Guard-band) (All range)

Function

Queries the worst spectrum level with offset frequency in each frequency range of SEM measurement.

Query

```
TTL_WORST_SEM_GB_LV?
```

Response

```
level(-1),freq(-1),…,level(-4),freq(-4),level(1),freq(1),…,
level(4),freq(4)
```

Parameters

level(n)	Worst spectrum level in each frequency range (Frequency range: n = –4 to –1, 1 to 4)
Resolution	0.01 dB
Unit	dBm
freq(n)	Offset frequency of the worst spectrum level in each frequency range (Frequency range: n = –4 to –1, 1 to 4)
Resolution	1 Hz
Unit	Hz

Details

The frequency range varies according to the channel bandwidth.
Refer to Table 2.4-2 “Frequency ranges of Range 1 to Range 4 (Guard-band)” for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in each frequency range of SEM measurement:

```
TTL_WORST_SEM_GB_LV?
>
-20.01,30,-20.02,30,-20.03,30,-20.04,30,-20.05,30,-20.06,30,-20.07,30,-20
.08,30
```

TRGDLY

Trigger Delay

Function

Sets or queries the Trigger Delay.

Command

```
TRGDLY delay
```

Query

```
TRGDLY?
```

Response

delay

Parameters

delay	Trigger Delay
Range	0.000 to 10.000 ms
Resolution	0.001 ms
Suffix code	S MS US NS (uses ms when omitted)
Default	0.000 ms
Unit	ms

Details

This command is available when trigger source is set to other than Freerun.

Example of Use

To set the Trigger Delay to 0.001 ms:

```
TRGDLY 0.001
TRGDLY?
> 0.001
```

TRGLVL

Trigger Level

Function

Sets or queries the Trigger Level.

Command

```
TRGLVL level
```

Query

```
TRGLVL?
```

Response

```
level
```

Parameters

level	Trigger Level
Range	–40 to 0 dB
Resolution	1 dB
Suffix code	DB
Default	–30 dB
Unit	dB

Details

This command is available when trigger source is set to Rise Config.

Example of Use

To set the Trigger Level to –30 dB:

```
TRGLVL -30
TRGLVL?
> -30
```

TRGSRC

Trigger Source

Function

Sets or queries the Trigger Source.

Command

```
TRGSRC source
```

Query

```
TRGSRC?
```

Response

source

Parameters

source	Trigger Source
FREE	Freerun
RISE_CONFIG	Rise Config
Default	FREE

Example of Use

To set the Trigger Source to Freerun:

```
TRGSRC FREE
TRGSRC?
> FREE
```

TRGTOUT

Trigger Timeout

Function

Sets or queries the Trigger Timeout.

Command

```
TRGTOUT time
```

Query

```
TRGTOUT?
```

Response

```
time
```

Parameters

trgtime	Trigger Timeout
Range	1 to 60 s
Unit	s
Resolution	1 s
Suffix code	NS, US, MS, S (uses s when omitted)
Default	10 s

Example of Use

To set the Trigger Timeout to 10 s:

```
TRGTOUT 10
TRGTOUT?
> 10
```

TXFREQ

Uplink Frequency

Function

Sets or queries the uplink frequency.
This command has the same function as ULFREQ.

Command

```
TXFREQ ul_freq
```

Query

```
TXFREQ?
```

Response

```
ul_freq
```

Parameter

ul_freq	Uplink frequency
Range	400 000 000 to 3800 000 000 Hz
	400 000 000 to 6000 000 000 Hz (with MU887000A-001/101)
Resolution	1 Hz
Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
Default	1950 000 000 Hz
Unit	Hz

Details

This setting corresponds to the mobile station Tx frequency setting.
Updating this Uplink frequency does not affect the Uplink Channel parameters.

Example of Use

To set the Uplink frequency to 1950 MHz:

```
TXFREQ 1950MHZ
TXFREQ?
>1950000000
```

ULCHAN

Uplink Channel

Function

Sets or queries the Uplink Channel.

Command

```
ULCHAN ul_ch
```

Query

```
ULCHAN?
```

Response

```
ul_ch
```

Parameter

ul_ch	Uplink Channel
Range	0 to 262143
Resolution	1
Suffix code	None
Default	18300

Details

When the Uplink Channel is updated, the related Operation Band, Downlink Channel, Uplink Frequency, Downlink Frequency are changed accordingly.
For the relationship between the parameter and frequency settings of channels refer to Table 2.1.6-1 “Relationship between Uplink Channel Number and Downlink Channel Number” and to Table 2.1.6-2 “E-UTRA Channel Numbers and Default UE TX-RX Frequency Separation”.

Example of Use

To set the Uplink Channel to 18300:

```
ULCHAN 18300
ULCHAN?
> 18300
```

ULFREQ

Uplink Frequency

Function

Sets or queries the Uplink frequency.

Command

```
ULFREQ ul_freq
```

Query

```
ULFREQ?
```

Response

```
ul_fleq
```

Parameter

ul_freq	Uplink frequency
Range	400 000 000 to 3800 000 000 Hz
	400 000 000 to 6000 000 000 Hz (with MU887000A-001/101)
Resolution	1 Hz
Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
Default	1950 000 000 Hz
Unit	Hz

Details

This setting corresponds to the mobile station Tx frequency setting.
Updating this Uplink frequency does not affect the Uplink Channel parameters.

Example of Use

To set the Uplink frequency to 1950 MHz:

```
ULFREQ 1950MHZ
ULFREQ?
>1950000000
```

ULICSHIFT

UL RMC Cyclic Shift Index

Function

Sets or queries the Cyclic Shift Index of NPUSCH.

Command

```
ULICSHIFT index
```

Query

```
ULICSHIFT?
```

Response

```
index
```

Parameter

index		Cyclic Shift Index
	Range	0 to 2 (Number of Subcarrier = 3)
		0 to 3 (Number of Subcarrier = 6)
		0 (Number of Subcarrier = 1 or 12)
	Resolution	1
	Default	0
	Suffix code	None

Details

When the UL RMC Number of Subcarrier is 3 or 6, Cyclic Shift Index is required.
When the UL RMC Number of Subcarrier is updated, the Cyclic Shift Index is set to 0.

Example of Use

To set the Cyclic Shift Index to 0:

```
ULICSHIFT 0
ULICSHIFT?
> 0
```

ULIMCS

UL RMC MCS Index

Function

Sets or queries the MCS Index of Uplink signal.

Command

```
ULIMCS ulimcs
```

Parameter

ulimcs	UL MCS Index
Range	0 to 10 (UL RMC Number of Subcarrier = 1.)
	0 to 12 (UL RMC Number of Subcarrier > 1.)
Resolution	1
Default	6
Suffix code	None

Details

When the UL RMC Number of Subcarrier is 1, Modulation scheme is set according to “Table 2.1.6-4”.
When the UL RMC Number of Subcarrier is more than 1, Modulation scheme is set according to “Table 2.1.6-4”.

Example of Use

To set the UL RMC MCS Index to 1:

```
ULIMCS 1
```

ULRMC_MOD

Modulation

Function

Sets or queries the Modulation scheme of uplink signal.
When the MCS Index is updated, the this parameter is changed accordingly.

Command

```
ULRMC_MOD ul_rmc_mod
```

Query

```
ULRMC_MOD?
```

Response

```
ul_rmc_mod
```

Parameter

ul_rmc_mod	Modulation scheme
BPSK	BPSK
QPSK	QPSK
Default	QPSK

Example of Use

To set the Modulation scheme to BPSK:

```
ULRMC_MOD BPSK
ULRMC_MOD?
> BPSK
```

Remarks

When the NPUCH is format 1 and the Number of Subcarrier is more than 1, Modulation scheme is fixed to QPSK.
When the NPUCH is format 2, Modulation scheme is fixed to BPSK.

ULRMC_RU

UL RMC Number of Resource Units

Function

Sets or queries the Number of Resource Units for NPUSCH.

Command

```
ULRMC_RU ul_rmc_ru
```

Query

```
ULRMC_RU?
```

Response

```
ul_rmc_ru
```

Parameter

ul_rmc_ru	Number of Resource Unit
1	1
2	2
3	3
4	4
5	5
6	6
8	8
Default	1

Example of Use

To set the Number of Resource Units to 1:

```
ULRMC_RU 1
ULRMC_RU?
> 1
```

ULRMC_SC

UL RMC Number of Subcarrier

Function

Sets or queries the Number of Subcarrier for NPUSCH.

Command

```
ULRMC_SC ul_rmc_sc
```

Query

```
ULRMC_SC?
```

Response

```
ul_rmc_sc
```

Parameter

ul_rmc_sc	Number of Subcarrier
1	1
3	3
6	6
12	12
Default	1

Details

Number of Subcarrier is set to 1 when UL RMC Subcarrier Spacing is 3.75 kHz.
When the UL RMC start subcarrier number falls outside the setting range, it will be changed to a value within the range.

Example of Use

To set the Number of Subcarrier to 1:

```
ULRMC_SC 1
ULRMC_SC?
> 1
```

ULSC_SPACE

UL RMC Subcarrier Spacing

Function

Sets or queries the Subcarrier Spacing for NPUSCH.

Command

```
ULSC_SPACE sc_spacing
```

Query

```
ULSC_SPACE?
```

Response

```
sc_spacing
```

Parameter

sc_spacing	Subcarrier Spacing
3.75KHZ	3.75 kHz
15KHZ	15 kHz
Default	3.75KHZ

Details

When editing the Subcarrier Spacing, the UL RMC start subcarrier number is changed to a value within the range if it falls outside the range. Also, the subcarrier number is changed to "1".

Example of Use

To set the Subcarrier Spacing for NPUSCH to 3.75 kHz:

```
ULSC_SPACE 3.75KHZ
ULSC_SPACE?
> 3.75KHZ
```

ULSC_START

UL RMC Starting Subcarrier

Function

Sets or queries the Starting Subcarrier number for NPUSCH.

Command

```
ULSC_START ulsc
```

Query

```
ULSC_START?
```

Response

```
ulsc
```

Parameter

ulsc	Starting Subcarrier number
Range	0 to (SCmax – SCn)
	SCmax=12 (Subcarrier Spacing = 15 kHz)
	SCmax=48 (Subcarrier Spacing = 3.75 kHz)
	SCn is set by using ULRMC_SC.
Resolution	1
Default	0
Suffix code	None

Example of Use

To set the Starting Subcarrier number to 0:

```
ULSC_START 0
ULSC_START?
> 0
```

WAVEFMEAS?

Waveform

Function

Queries the spectrum waveform data of each measurement result.

Query

```
WAVEFMEAS? format,position,length[,symbol]
```

Response

```
data(1),…,data(length)
```

Parameter

format		Format
	1	Occupied Bandwidth
	3	Constellation (I)
	4	Constellation (Q)
	5	EVM (Average)
	6	EVM (Maximum)
	7	Phase Error (Average)
	8	Phase Error (Maximum)
	9	Magnitude Error (Average)
	10	Magnitude Error (Maximum)
	11	In-band Emissions (dB) (Average)
	12	In-band Emissions (dB) (Maximum)
	13	In-band Emissions (dBc) (Average)
	14	In-band Emissions (dBc) (Maximum)
	19	Spectrum Emission Mask General
	20	Spectrum Emission Mask Guard-band
position		Start point of waveform data
	Range	0 to 278 (Occupied Bandwidth)
		0 to 1934 (Spectrum Emission Mask General)
		0 to 1134 (Spectrum Emission Mask Guard-band 1.4 MHz)
		0 to 2254 (Spectrum Emission Mask Guard-band 3 MHz)
		0 to 3694 (Spectrum Emission Mask Guard-band 5 MHz)
		0 to 5486 (Spectrum Emission Mask Guard-band 10 MHz)
		0 to 7246 (Spectrum Emission Mask Guard-band 15 MHz)
		0 to 9038 (Spectrum Emission Mask Guard-band 20 MHz)
		0 to 47 (EVM, Phase Error, Magnitude Error, Subcarrier Spacing = 3.75 kHz)
		0 to 11 (EVM, Phase Error, Magnitude Error, Subcarrier Spacing = 15 kHz)
	Resolution	1
	Suffix code	None

length	Number of read data	
Range	1 to 279	(Occupied Bandwidth)
	1 to 1935	(Spectrum Emission Mask General)
	1 to 1135	(Spectrum Emission Mask Guard-band 1.4 MHz)
	1 to 2255	(Spectrum Emission Mask Guard-band 3 MHz)
	1 to 3695	(Spectrum Emission Mask Guard-band 5 MHz)
	1 to 5487	(Spectrum Emission Mask Guard-band 10 MHz)
	1 to 7247	(Spectrum Emission Mask Guard-band 15 MHz)
	1 to 9039	(Spectrum Emission Mask Guard-band 20 MHz)
	1 to 48	(Constellation, EVM, Phase Error, Magnitude Error, In-band Emissions, Subcarrier Spacing = 3.75 kHz)
	1 to 12	(Constellation, EVM, Phase Error, Magnitude Error, In-band Emissions, Subcarrier Spacing = 15 kHz)
Resolution	1	
Suffix code	None	
symbol	Position of SC-FDMA symbol	
Range	0 to 6 (Constellation, EVM, Phase Error, Magnitude Error)	
data(n)	Waveform data	
Resolution	0.01 dB	(Occupied Bandwidth, Spectrum Emission Mask, In-band Emissions)
	0.01 deg.	(Phase Error)
	0.01 %	(EVM, Magnitude Error)
	0.0001	(Constellation)
Unit	dBm	(Spectrum Emission Mask)
	dB	(Occupied Bandwidth, In-band Emissions (dB))
	dBc	(In-band Emissions (dBc))
	degree	(Phase Error)
	%	(EVM, Magnitude Error)
	None	(Constellation)

Details

Refer to Table 2.7-1 “Waveform Data Type and Data Interval” for Data Interval.

Example of Use

To query the Occupied Bandwidth of 20 data from 25 of each measurement:

```
WAVEFMEAS? 1,25,20
> -42.12,-40.14,…,-41.22
```

WORST_SEM?

SEM Template Margin

Function

Queries the worst margin from the template of the spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
WORST_SEM? range
```

Response

```
margin,freq
```

Parameter

range	Frequency Range
Range	–5 to –1, 1 to 5
Resolution	1
Suffix code	None
margin	Worst margin in the specified frequency range
Resolution	0.01 dB
Unit	dB
freq	Offset frequency of the worst margin in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
WORST_SEM? 1
> -20.01,705
```

WORST_SEM_GB?

SEM Template Margin (Guard-band)

Function

Queries the worst margin from the template of the spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
WORST_SEM_GB? range
```

Response

```
margin,freq
```

Parameter

range	Frequency Range
Range	–4 to –1, 1 to 4
Resolution	1
Suffix code	None
margin	Worst margin in the specified frequency range
Resolution	0.01 dB
Unit	dB
freq	Offset frequency of the worst margin in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

The margin is calculated as (limit value – measured value).
If the measured value exceeds the limit value, the margin becomes negative.
Refer to Table 2.4-2 "Frequency ranges of Range 1 to Range 4 (Guard-band)" for Frequency ranges.

Example of Use

To query the worst margin from the template of the spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
WORST_SEM_GB? 1
> -20.01,705
```

WORST_SEM_LV?

SEM Worst Value

Function

Queries the worst spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
WORST_SEM_LV? range
```

Response

```
level,freq
```

Parameter

range	Frequency Range
Range	–5 to –1, 1 to 5
Resolution	1
Suffix code	None
level	Worst spectrum level in the specified frequency range
Resolution	0.01 dB
Unit	dB
freq	Offset frequency of the worst spectrum level in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

Refer to Table 2.4-1 “Frequency ranges of Range 1 to Range 5 (General)” for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
WORST_SEM_LV? 1
> -20.01,705
```

WORST_SEM_GB_LV?

SEM Worst Value (Guard-band)

Function

Queries the worst spectrum level with offset frequency in the specified frequency range of SEM measurement.

Query

```
WORST_SEM_GB_LV? range
```

Response

```
level,freq
```

Parameter

range	Frequency Range
Range	–4 to –1, 1 to 4
Resolution	1
Suffix code	None
level	Worst spectrum level in the specified frequency range
Resolution	0.01 dB
Unit	dB
freq	Offset frequency of the worst spectrum level in the specified frequency range
Resolution	1 Hz
Unit	Hz

Details

The frequency range varies according to the channel bandwidth.
Refer to Table 2.4-2 “Frequency ranges of Range 1 to Range 4 (Guard-band)” for Frequency ranges.

Example of Use

To query the worst spectrum level with offset frequency in Frequency Range 1 of SEM measurement:

```
WORST_SEM_GB_LV? 1
> -20.01,705
```

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Native Command Reference

Chapter 6 Performance Test

This chapter explains how to setup the measuring instruments required for the MX887067A NB-IoT Uplink TX Measurement performance tests as well as the test procedures.

6.1 Outline

The performance tests are performed to assure that the MU887000A performance does not deteriorate. Test the performance of the MU887000A at the initial acceptance inspection, at periodic inspections, and after repairs. Test important items periodically to assure the performance. This chapter explains the following test items.

- Tx Power measurement accuracy (CW)
- Frequency/modulation measurement Carrier frequency accuracy
  Residual EVM
- In-Band Emission measurement
- Adjacent Channel Leakage Power Ratio measurement (ACLR)

We recommend testing the performance periodically once or twice a year. If the test results do not meet the specifications, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the PDF version.

⚠ CAUTION

Warm-up the MU887000A and the required measuring instruments for at least 30 minutes (except when specified otherwise) to stabilize them. To achieve the highest accuracy, the test should be performed at room temperature using a power supply with as little voltage fluctuation as possible in an environment free from noise, vibration, dust and humidity.

6.2 Instruments for Testing Performance

The following table lists the measuring instruments required for testing the MU887000A performance and the specifications for each instrument.

Table 6.2-1 Measuring Instruments for Performance Tests

Test Item	Required Specifications*	Recommendation
Tx Power Measurements ● Measurement Accuracy (CW)	Signal Generator ● Frequency Range: 600 to 3800 MHz With MU887000A-001/101: 3800 to 4200 MHz ● Frequency Resolution: 1 Hz ● Output Level Range Unmodulated: –143 to +13 dBm Resolution: 0.01 dB	Vector Signal Generator (MG3700A) Mechanical Attenuator (MG3700A-002) High Frequency 6 GHz (MG3700A-011)
	Signal Analyzer Same as above	Signal Analyzer (MS2690A or MS2830A)
	Power Meter ● Frequency Range: 600 to 3800 MHz With MU887000A-001/101: 3800 to 4200 MHz ● Level Accuracy: ±0.02 dB ● Level Resolution: 0.01 dB	Power Meter (ML2437A)
	Power Sensor ● Frequency Range: 600 to 3800 MHz With MU887000A-001/101: 3800 to 4200 MHz ● Level Range: –40 to +20 dBm ● Input Connector: N type	Power Sensor (MA2442D)

*: The performance covers the test item measurement range.

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Performance Test

Table 6.2-1 Measuring Instruments for Performance Tests (Cont'd)

Test Item	Required Specifications*	Recommendation
Frequency/Modulation Measurements ● Carrier Frequency Accuracy ● Residual EVM Adjacent Channel Leakage Power Ratio In-Band Emissions	Signal generator supporting output of 3GPP NB-IoT modulation signals Same as above	Same as above
	Power Meter Same as above	Same as above
	Power Sensor ● Frequency Range: 600 to 3800 MHz With MU887000A-001/101: 3800 to 4200 MHz ● Level Range: –30 to +20 dBm ● Input Connector: N type	Power Sensor (MA24002A)
Common	3-dB Attenuator	3-dB Attenuator (AT-103)

6.3 Calibration (MX887067A)

This section explains how to obtain the calibration values of the instrument used for the performance tests.

6.3.1 SG Calibration (CW)

This section explains how to obtain the calibration values of the CW (unmodulated) signal source.

(1) Measuring instruments

- Vector signal generator: MG3700A
- Power Meter: ML2437A
- Power Sensor: MA2442D
- 3-dB Attenuator: AT-103 (2 sets)

(2) Setup

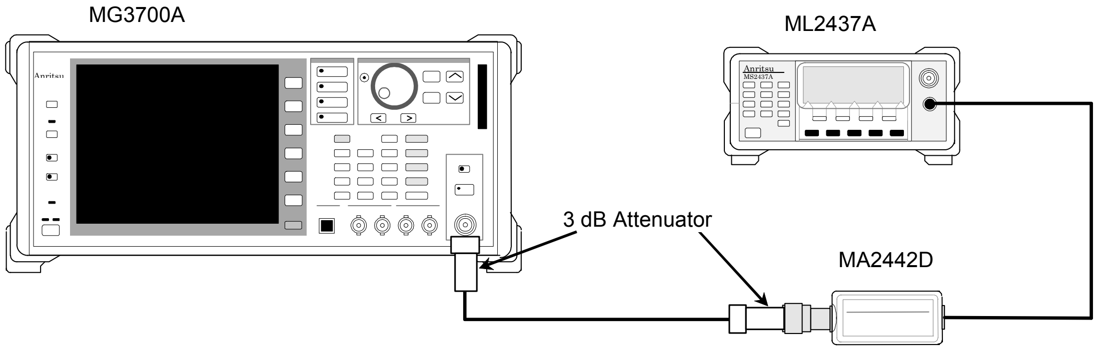

Figure 6.3.1-1 SG Calibration (CW)

(3) Test Procedure

1. Setup the instruments as shown in Figure 6.3.1-1.
2. Set the vector signal generator (SG) as follows:

   Modulation: OFF

   Output frequency: 599.99 MHz (600 MHz –10 kHz)

   Output level: 6 dBm (0 dBm + 6 dB)
3. Adjust the SG output level so that the level measurement value of the power meter is 0 dBm, and obtain the calibration values for the setting frequency and setting level.
4. Set frequencies in accordance with the table in 6.3.4, “Measurement Frequencies”, and obtain the calibration values of each frequency.
5. Replace 0 dBm with –10 dBm and –20 dBm at step 2, repeat steps 2 to 4 respectively, and obtain the calibration values.

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6.3.2 SG Calibration (MOD)

This section explains how to obtain the calibration values of the modulation wave signal source.

(1) Measuring instruments

- Vector signal generator: MG3700A
- Power Meter: ML2437A
- Power sensor: MA24002A
- 3-dB Attenuator: AT-103 (2 sets)

(2) Setup

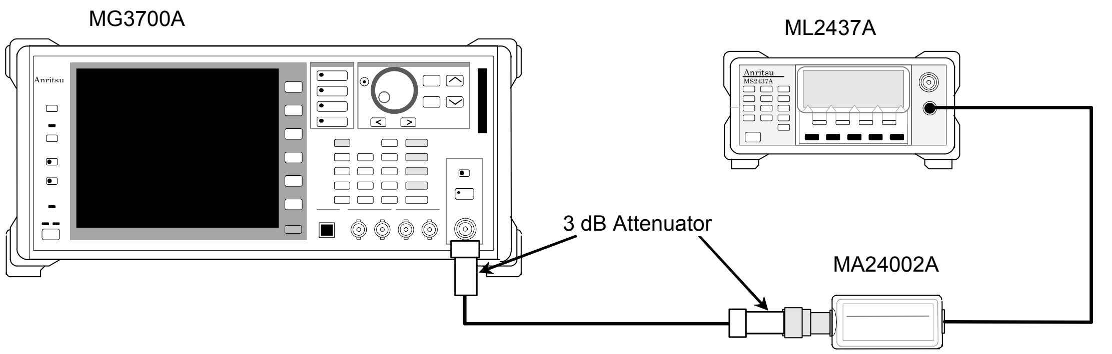

Figure 6.3.2-1 SG Calibration (MOD)

(3) Test procedure

1. Setup the instruments as shown in Figure 6.3.2-1.
2. Set the vector signal generator (SG) as follows:

   Modulation: ON

   Modulation wave: Analyzable waveform pattern in 6.4.2, "Frequency/Moduration"

   Output frequency: 599.99 MHz (600 MHz –10 kHz)

   Output level: –4 dBm (–10 dBm + 6 dB)
3. Adjust the SG output level so that the level measurement value of the power meter is –10 dBm, and obtain the calibration values for the setting frequency and setting level.
4. Set frequencies in accordance with the table in 6.3.4, "Measurement Frequencies", and obtain the calibration values of each frequency.

6.3.3 Linearity Calibration

This section explains how to obtain the calibration values for linearity.

(1) Measuring instruments

- Vector signal generator: MG3700A
- Signal Analyzer: MS269XA or MS2830A
- 3-dB Attenuator: AT-103 (2 sets)

(2) Setup

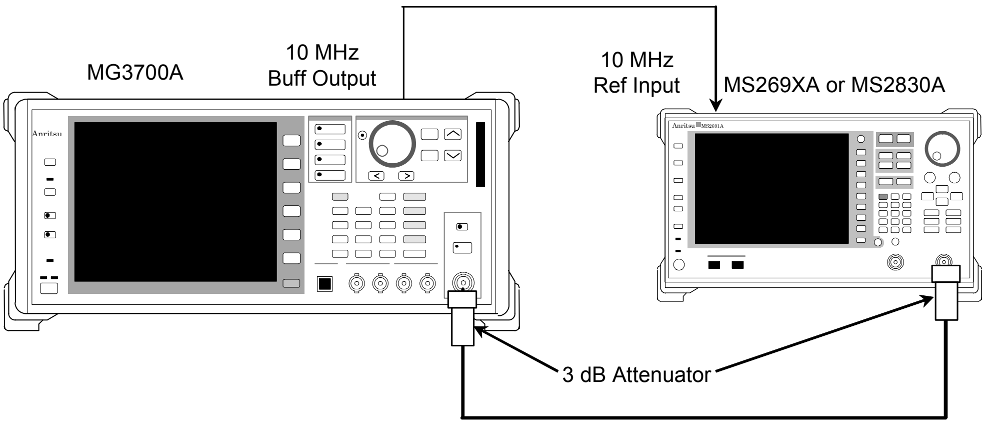

Figure 6.3.3-1 Linearity Calibration

(3) Test procedure

1. Setup the instruments as shown in Figure 6.3.3-1.
2. Set the signal analyzer (SA) as shown in #1 of Table 6.3.3-1 "Signal Analyzer Settings".
3. Set the vector signal generator (SG) as follows:

   Modulation: OFF

   Output frequency: 599.99 MHz (600 MHz –10 kHz)

   Output level: Setting level when the level measurement value of the power meter is 0 dBm in the SG calibration (Section 6.3.1)
4. Connect the output of the SG to the SA and measure the SG output level with the SA (A dBm).
5. Decrease the SG output level in 10-dB steps down to 40 dB and measure the level at each step (B dBm). (The calibration value is B – A.)
6. Set frequencies in accordance with the table in 6.3.4, "Measurement Frequencies", and obtain the calibration values of each frequency.

7. Set the SA as shown in #2 of Table 6.3.3-1 “Signal Analyzer Settings”.
8. Replace 0 dBm with –20 dBm at step 3, and repeat steps 3 to 6.

Table 6.3.3-1 Signal Analyzer Settings

	MS269XA or MS2830A						
	Application Switch	RBW	Zone Width	Time Length	ATT	Preamp	Ref Lev
#1	Signal Analyzer	100 Hz	781.3 Hz	AUTO	20 dB	OFF	0 dBm
#2	Signal Analyzer	100 Hz	781.3 Hz	AUTO	0 dB	OFF	–20 dBm

6.3.4 Measurement Frequencies

Table 6.3.4-1 lists the frequencies set in the performance tests for the calibration and calibrated test system. The 4000 MHz and more frequency is measured only when MU887000A-001/101 is installed.

Table 6.3.4-1 Measurement Point and Frequency

Meas. Point	Frequency (MHz)	Meas. Point	Frequency (MHz)
1	600	8	2200
2	700	9	2700
3	880	10	3400
4	940	11	3600
5	1000	12	3800
6	1800	13	4000
7	2000	14	4200

Note:

Add an offset of –10 kHz to the frequency in the above table and set the frequency as SG output frequency, except for the measurement described in section 6.4.2, 6.4.3 and 6.4.4.

6.4 Performance Tests (MX887067A)

Common test items

The following list shows the common settings for each measurement at the MU887000A.

Application Select:	Cellular
Standard Select:	NBIOT
Channel Coding:	RMC
Uplink RMC Modulation:	QPSK

6.4.1 Tx Power Measurement Accuracy (CW)

This test is related to the accuracy of Tx power measurements.

(1) Test specifications

Test Port1/2
(600 MHz ≤ Frequency ≤ 2700 MHz, 3400 MHz ≤ Frequency ≤ 3800 MHz)

Measurement Accuracy	Input Level	Temperature
±0.5 dB	–20 dBm ≤, ≤+35 dBm	10 to 40°C
±0.7 dB	–50 dBm ≤, <–20 dBm	10 to 40°C
±0.9 dB	–60 dBm ≤, <–50 dBm	10 to 40°C

Test Port1/2 (3800 MHz < Frequency ≤ 4200 MHz)

Measurement Accuracy	Input Level	Temperature
±0.7 dB	–20 dBm ≤, ≤+35 dBm	20 to 30°C
±0.9 dB	–50 dBm ≤, <–20 dBm	20 to 30°C
±1.1 dB	–60 dBm ≤, <–50 dBm	20 to 30°C

Test Port3/4
(600 MHz ≤ Frequency ≤ 2700 MHz, 3400 MHz ≤ Frequency ≤ 3800 MHz)

Measurement Accuracy	Input Level	Temperature
±0.7 dB	–20 dBm ≤, ≤+25 dBm	10 to 40°C
±0.9 dB	–50 dBm ≤, <–20 dBm	10 to 40°C
±1.1 dB	–60 dBm ≤, <–50 dBm	10 to 40°C

Test Port3/4 (3800 MHz < Frequency ≤ 4200 MHz)

Measurement Accuracy	Input Level	Temperature
±0.7 dB	–20 dBm ≤, ≤+25 dBm	20 to 30°C
±0.9 dB	–50 dBm ≤, <–20 dBm	20 to 30°C
±1.1 dB	–60 dBm ≤, <–50 dBm	20 to 30°C

(2) Measuring instruments

- Vector signal generator: MG3700A
- 3-dB Attenuator: AT-103 (2 sets)

(3) Setup

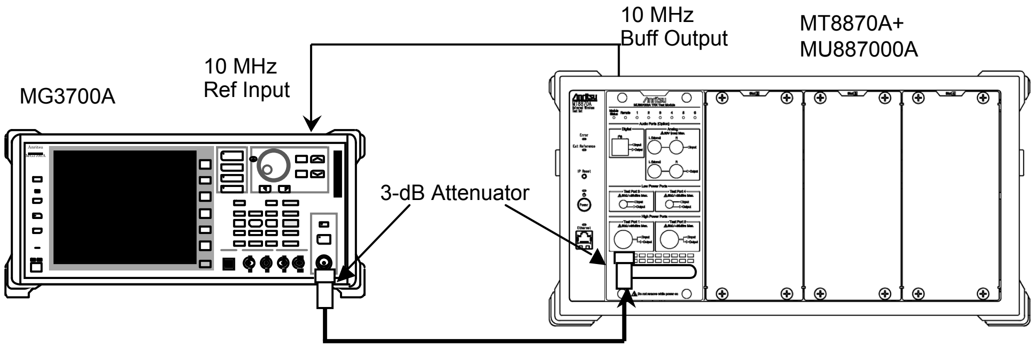

Figure 6.4.1-1 Setup for Measuring Amplitude Measurement Accuracy

(4) Test procedure

1. Setup the instruments as shown in Figure 6.4.1-1.
2. Set the MU887000A as follows:

Connect port:	Test Port1
Output level ON/OFF:	OFF
Input level:	–10 dBm
Uplink frequency:	600 MHz
Trigger Source:	Free Run (TRGSRC FREE_CW)
Operation Mode:	Stand Alone
Group Hopping:	OFF
Subcarrier Spacing:	15 kHz
Subcarrier Number:	12
Subcarrier Start Position:	0
Turn Off All measurement:	OFF
Tx Power measurement:	ON, 1 time

3. Set the Vector signal generator (SG) as follows:

Modulation:	OFF
Output frequency:	599.99 MHz
Output level:	–10 dBm (This output level reflects the calibration value for item 6.3.1.)

4. Change the frequency of the MU887000A and SG according to Table 6.3.4 “Measurement Frequencies” and measure the Tx power.

   Tx Power Measurement Results: Average value

5. Change the SG output level and MU887000A input level each to –50, and –60 dBm and repeat steps 2 to 4 over and measure the Tx power. (This output level reflects the calibration value for item 6.3.3.)

6. Change the Connect port setting for the connection with the MU887000A to Test Port2/3/4 successively, and repeat steps 2 to 5 over.

6.4.2 Frequency/Modulation

This test is related to the following modulation analyses.

- Carrier frequency accuracy
- Residual EVM

(1) Test specifications

	Measurement Accuracy
Carrier frequency accuracy	±(Set frequency × Reference oscillator accuracy + 15 Hz)
Residual EVM	≤ 1.0% (rms)

Test Port1/2 Input Level range: –40 dBm ≤, ≤ +35 dBm

Test Port3/4 Input Level range: –40 dBm ≤, ≤ +25 dBm

(2) Measuring instruments

- Vector signal generator: MG3700A
- 3-dB Attenuator: AT-103 (2 sets)

(3) Setup

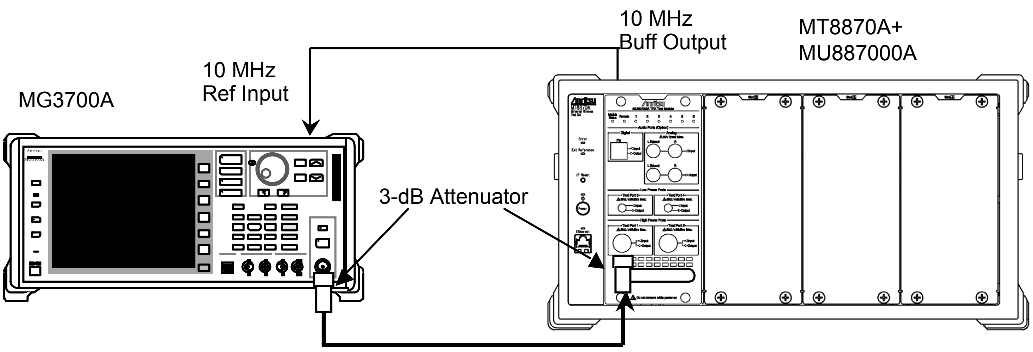

Figure 6.4.2-1 Setup for Measuring Frequency/Modulation

(4) Test procedure

1 Setup the instruments as shown in Figure 6.4.2-1.

2. Set the MU887000A as follows:

Connect port:	Test Port1
Output level ON/OFF:	OFF
Input level:	–10 dBm
Uplink frequency:	600 MHz
Trigger Source:	Rise Config
Trigger Level:	–15 dBm
Operation Mode:	Stand Alone
Group Hopping:	OFF
Subcarrier Spacing:	15 kHz
Subcarrier Number:	12
Subcarrier Start Position:	0
Turn Off All measurement:	OFF
Modulation Analysis measurement:	ON, 20 times

3. Set the Vector signal generator (SG) as follows:

Modulation:	ON
Modulation wave:	Analyzable waveform pattern in Step 2 above.
Output frequency:	600 MHz
Output level:	–10 dBm (This output level reflects the calibration value for item 6.3.2.)

4. Measure the frequency error and EVM.

Carrier Frequency Error Result:	Worst value
EVM Result:	Average value

5. Change the MU887000A and SG frequencies according to 6.3.4 “Measurement Frequencies” and repeat steps 2 to 4 over.

6. Change the SG output level and the MU887000A input level to –40 dBm and measure by repeating steps 2 to 5 over. (This output level reflects the calibration value for item 6.3.2.)

7. Change the Connect port setting for the connection with the MU887000A to Test Port2/3/4 successively, and repeat steps 2 to 6 over.

6.4.3 In-band Emissions

This test is related to in-band emissions.

(1) Test specifications

(600 MHz ≤ Frequency ≤ 2700 MHz, 3400 MHz ≤ Frequency ≤ 4200 MHz)

In-Band Emissions	≤–40 dBc

Input level: ≥–10 dBm

Allocated RB ≤18

(2) Measuring instruments

- Vector signal generator: MG3700A
- 3-dB Attenuator: AT-103 (2 sets)

(3) Setup

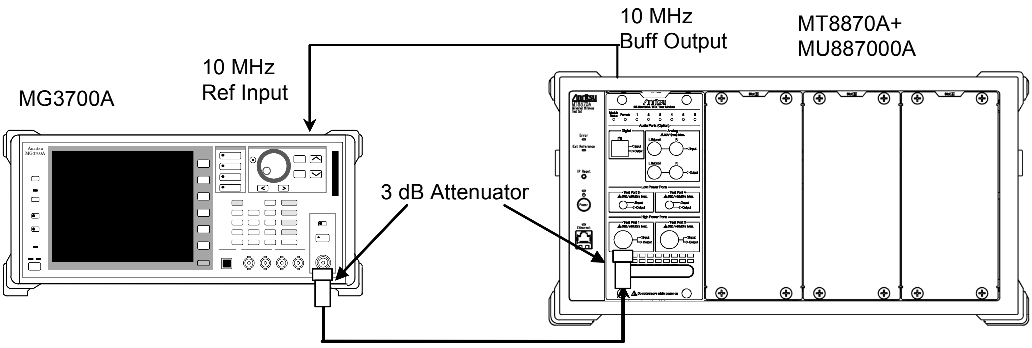

Figure 6.4.3-1 In-Band Emissions Measurement Setup

(4) Test procedure

1. Setup the instruments as shown in Figure 6.4.3-1.
2. Set the MU887000A as follows:

Connect port:	Test Port1
Output level ON/OFF:	OFF
Input level:	–10 dBm
Uplink frequency:	600 MHz
Trigger Source:	Rise Config
Trigger Level:	–15 dBm
Operation Mode:	Stand Alone
Group Hopping:	OFF
Subcarrier Spacing:	3.75 kHz
Subcarrier Number:	1
Subcarrier Start Position:	0
Turn Off All measurement:	OFF
Modulation Analysis measurement:	ON, 20 times

3. Set the Vector signal generator (SG) as follows:

Modulation:	ON
Modulation wave:	Analyzable waveform pattern in Step 2 above.
Output frequency:	600 MHz
Output level:	–10 dBm (This output level reflects the calibration value for item 6.3.2.)

4. Measure the in-band emissions and read the following value:

   In-band emissions (General) Result: Max value

5. Change the MU887000A and SG frequencies according to 6.3.4 “Measurement Frequencies” and repeat steps 2 to 4 over.
6. Change the Connect port setting for the connection with the MU887000A to Test Port2/3/4 successively, and repeat steps 2 to 5 over.

6.4.4 Adjacent Channel Leakage Power Ratio (ACLR)

This test is related to Adjacent Channel Leakage Power Ratio measurements.

(1) Test specifications

(600 MHz ≤ Frequency ≤ 2700 MHz, 3400 MHz ≤ Frequency ≤ 4200 MHz)

Adjacent Channel Leakage Power Ratio	Measurement Point
≥ 33 dB	GSM ACLR
≥ 50 dB	UTRA ALCR

Test Port1/2 Input Level range: –10 dBm ≤, ≤+35 dBm

Test Port3/4 Input Level range: –10 dBm ≤, ≤+25 dBm

(2) Measuring instruments

- Vector signal Generator: MG3700A
- 3 dB Attenuator: AT-103 (2 sets)

(3) Setup

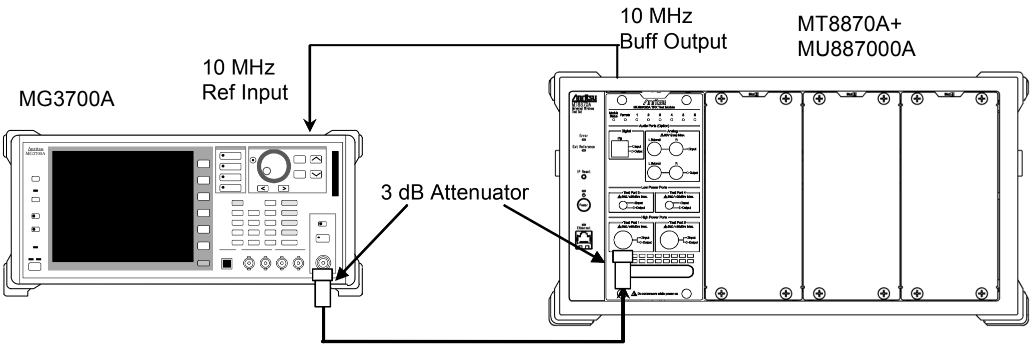

Figure 6.4.4-1 Setup for Measuring Adjacent Channel Leakage Power Ratio

(4) Test procedure

1. Setup the instruments as shown in Figure 6.4.4-1.
2. Set the MU887000A as follows:

Connect port:	Test Port1
Output level ON/OFF:	OFF
Input level:	–10 dBm
Uplink frequency:	600 MHz
Trigger Source:	Rise Config
Trigger Level:	–15 dBm
Operation Mode:	Stand Alone
Group Hopping:	OFF
Subcarrier Spacing:	15 kHz
Subcarrier Number:	12
Subcarrier Start Position:	0
Turn Off All measurement:	OFF
ACLR measurement:	ON, 20 times

3. Set the Vector signal generator (SG) as follows:

Modulation:	ON
Modulation wave:	Analyzable waveform pattern in Step 2 above.
Output frequency:	600 MHz
Output level:	–10 dBm (This output level reflects the calibration value for item 6.3.2.)

4. Measure the Adjacent Channel Leakage Power and read the following value:

   ACLR Result: Max value

5. Change the MU887000A and SG frequencies according to 6.3.4 “Measurement Frequencies” and repeat steps 2 to 4 over.
6. Change the Connect port setting for the connection with the MU887000A to Test Port2/3/4 successively, and repeat steps 2 to 5 over.

6.4.5 Sample Format for Test Result Sheets

Use the following test result sheets when testing the MX887067A performance. Duplicate these sheets as necessary for tests.

Test location	____________	Report No.	____________
	____________	Date	____________
	____________	Person-in-charge	____________

Model:

Serial No.	____________	Ambient temperature	°C
Power source frequency	Hz	Relative humidity	%

Remarks

SG Calibration (CW)

SG Calibration Value (CW)

MG3700A Unmodulated Wave

Frequency (MHz)	SG Setting (dBm)		
	0 dBm	–10 dBm	–20 dBm
600			
700			
880			
940			
1000			
1800			
2000			
2200			
2700			
3400			
3600			
3800			
4000			
4200			

SG Calibration (MOD)

SG Calibration Value (MOD)

MG3700A Modulation Wave

Frequency (MHz)	SG Setting (dBm)
	–10 dBm
600	
700	
880	
940	
1000	
1800	
2000	
2200	
2700	
3400	
3600	
3800	
4000	
4200	

Linearity Calibration

Linearity Calibration

Frequency (MHz)	SG Level (dBm)	SA Measured Value (dBm)	Calibration Value (C) (B) – (A) (dB)	SG Level (dBm)	SA Measured Value (dBm)	Calibration Value (C) (B) – (A) (dB)
600	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
700	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
880	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
940	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
1000	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
1800	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	

6

Performance Test

Linearity Calibration (Cont'd)

Linearity Calibration (Cont'd)

Frequency (MHz)	SG Level (dBm)	SA Measured Value (dBm)	Calibration Value (C) (B) – (A) (dB)	SG Level (dBm)	SA Measured Value (dBm)	Calibration Value (C) (B) – (A) (dB)
2000	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
2200	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
2700	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
3400	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
3600	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
3800	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	

Linearity Calibration (Cont'd)

Linearity Calibration (Cont'd)

Frequency (MHz)	SG Level (dBm)	SA Measured Value (dBm)	Calibration Value (C) (B) – (A) (dB)	SG Level (dBm)	SA Measured Value (dBm)	Calibration Value (C) (B) – (A) (dB)
4000	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	
4200	0	(A)		–20	(A)	
	–10	(B)		–30	(B)	
	–20	(B)		–40	(B)	
	–30	(B)		–50	(B)	
	–40	(B)		–60	(B)	

Tx Power Measurement Accuracy (CW)

Tx Power Measurement Accuracy Port1/2

MU887000A Input Level: –10 dBm (Item 6.3.1 Calibration Value)

Frequency (MHz)	MX887067A Measured Value (Pow) (dBm)	Measurement Accuracy (dB)			
		Lo Limit	Measurement Accuracy –10 – (Pow)	Hi Limit	Measurement uncertainty
600		–0.5		+0.5	±0.15
700					
880					
940					
1000					
1800					
2000					
2200					
2700					
3400					
3600					
3800					
4000		–0.7		+0.7	0.33
4200					

Tx Power Measurement Accuracy Port1/2

MU887000A Input Level: –50 dBm (Item 6.3.3 Calibration Value)

Frequency (MHz)	Item 6.3.3 –50 dBm Calibration Value (C) (dB)	MX887067A Measured Value (Pow) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –20 + (C) – (Pow)	Hi Limit	Measurement uncertainty
600			–0.7		+0.7	±0.14
700						
880						
940						
1000						
1800						
2000						
2200						
2700						
3400						
3600						
3800						
4000			–0.9		+0.9	±0.33
4200						

Tx Power Measurement Accuracy (CW) (Cont'd)

Tx Power Measurement Accuracy Port1/2

MU887000A Input Level :–60 dBm (Item 6.3.3 Calibration Value)

Frequency (MHz)	Item 6.3.3 –60 dBm Calibration Value (C) (dB)	MX887067A Measured Value (Pow) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –20 + (C) – (Pow)	Hi Limit	Measurement uncertainty
600			–0.9		+0.9	±0.14
700						
880						
940						
1000						
1800						
2000						
2200						
2700						
3400						
3600						
3800						
4000			–1.1		+1.1	±0.33
4200						

Tx Power Measurement Accuracy (CW) (Cont'd)

Tx Power Measurement Accuracy Port3/4

MU887000A Input Level: –10 dBm (Item 6.3.1 Calibration Value)

Frequency (MHz)	MX887067A Measured Value (Pow) (dBm)	Measurement Accuracy (dB)			
		Lo Limit	Measurement Accuracy –10 – (Pow)	Hi Limit	Measurement uncertainty
600		–0.7		+0.7	±0.17
700					
880					
940					
1000					
1800					
2000					
2200					
2700					
3400					
3600					
3800					
4000		–0.7		+0.7	±0.28
4200					

Tx Power Measurement Accuracy Port3/4

MU887000A Input Level: –50 dBm (Item 6.3.3 Calibration Value)

Frequency (MHz)	6 Item 6.3.3 –50 dBm Calibration Value (C) (dB)	MX887067A Measured Value (Pow) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –20 + (C) – (Pow)	Hi Limit	Measurement uncertainty
600			–0.9		+0.9	±0.14
700						
880						
940						
1000						
1800						
2000						
2200						
2700						
3400						
3600						
3800						
4000			–0.9		+0.9	±0.20
4200						

Tx Power Measurement Accuracy (CW) (Cont'd)

Tx Power Measurement Accuracy Port3/4

MU887000A Input Level :–60 dBm (Item 6.3.3 Calibration Value)

Frequency (MHz)	Item 6.3.3 –60 dBm Calibration Value (C) (dB)	MX887067A Measured Value (Pow) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –20 + (C) – (Pow)	Hi Limit	Measurement uncertainty
600			–1.1		+1.1	±0.14
700						
880						
940						
1000						
1800						
2000						
2200						
2700						
3400						
3600						
3800						
4000			–1.1		+1.1	±0.20
4200						

Frequency/Modulation Measurement

Residual EVM/Carrier Frequency Accuracy

MU887000A Input Level: –10 dBm/–40 dBm

Frequency (MHz)	Residual EVM (%)			Carrier Frequency Accuracy (Hz)		
	Measured Value	Spec.	Measurement uncertainty	Measured Value	Spec.	Measurement uncertainty
600		≤ 1.0	±0.1		±15.0	±2.8
700						
880						
940						
1000						
1800						
2000						
2200						
2700						
3400						
3600						
3800						
4000						
4200						

In-Band Emission Measurement

In-Band Emission

Frequency (MHz)	Input Level: –10 dBm	
	Measured Value (dB)	Spec.
600		≤–40 dBc
700		
880		
940		
1000		
1800		
2000		
2200		
2700		
3400		
3600		
3800		
4000		
4200		

Adjacent Channel Leakage Power Measurement (ACLR)

Adjacent Channel Leakage Power (Cont'd)

MU887000A Input Level: –10 dBm

Frequency (MHz)	Adjacent Channel Leakage Power Ratio (dB)			
	Band			
	GSM ACLR (–1)	GSM ACLR (+1)	UTRA ACLR (–1)	UTRA ACLR (+1)
600				
700				
880				
940				
1000				
1800				
2000				
2200				
2700				
3400				
3600				
3800				
4000				
4200				
Spec. (dB)	≥ 33 dB	≥ 33 dB	≥ 50 dB	≥ 50 dB
Measurement uncertainty	1 dB			

6.5 Servicing

If any unit is found to be broken or does not operate as described in the specifications, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the PDF version.

When requesting repair, supply the following information:

(a) Model name and serial number marked on rear panel

(b) Failure symptoms

(c) Person to contact about nature of failure and repair completion notification

(d) Software version

Appendix A Specifications

This appendix lists the specifications of the MX887067A NB-IoT Uplink TX Measurement. Refer to section 1.2 "Composition" for details of the product configuration.

This section explains the specifications of MX887067A NB-IoT Uplink TX Measurement.

These specifications assume use of the system at a constant temperature after warming-up the instruments for 30 minutes. The abbreviation (typ.) indicates the reference data at 20 to 30°C and is not a guaranteed value.

Table A-1 MX887067A Specifications

Item	Specification
Common Items	
Frequency	600 to 2700 MHz, 3400 to 3800 MHz 600 to 2700 MHz, 3400 to 4200 MHz (with MU887000A-001/101)
Measuring Object	NPUSCH

Table A-1 MX887067A Specifications (Cont'd)

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>RF Power
Input Level Range
Measurement Accuracy</td><td>
Port1, Port2: –65.0 to +35.0 dBm
Port3, Port4: –65.0 to +25.0 dBm

Port1, Port2:
Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 3800 MHz
(After calibration, 20 to 30°C)
<table><tr><th>Input Level</th><th>Measurement Accuracy</th></tr><tr><td>–20 to +35 dBm</td><td>±0.3 dB (typ.)</td></tr></table>
Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 3800 MHz
(After calibration, 10 to 40°C)
<table><tr><th>Input Level</th><th>Measurement Accuracy</th></tr><tr><td>–20 to +35 dBm</td><td>±0.5 dB</td></tr><tr><td>–50 to –20 dBm</td><td>±0.7 dB</td></tr><tr><td>–60 to –50 dBm</td><td>±0.9 dB</td></tr></table>
Frequency: 3800 MHz < f ≤ 4200 MHz (After calibration, 20 to 30°C)
<table><tr><th>Input Level</th><th>Measurement Accuracy</th></tr><tr><td>–20 to +35 dBm</td><td>±0.7 dB</td></tr><tr><td>–50 to –20 dBm</td><td>±0.9 dB</td></tr><tr><td>–60 to –50 dBm</td><td>±1.1 dB</td></tr></table>
Port3, Port4:
Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 3800 MHz
(After calibration, 10 to 40°C)
<table><tr><th>Input Level</th><th>Measurement Accuracy</th></tr><tr><td>–20 to +25 dBm</td><td>±0.7 dB</td></tr><tr><td>–50 to –20 dBm</td><td>±0.9 dB</td></tr><tr><td>–60 to –50 dBm</td><td>±1.1 dB</td></tr></table>
Frequency: 3800 MHz < f ≤ 4200 MHz (After calibration, 20 to 30°C)
<table><tr><th>Input Level</th><th>Measurement Accuracy</th></tr><tr><td>–20 to +25 dBm</td><td>±0.7 dB</td></tr><tr><td>–50 to –20 dBm</td><td>±0.9 dB</td></tr><tr><td>–60 to –50 dBm</td><td>±1.1 dB</td></tr></table>
</td></tr>
</table>

Table A-1 MX887067A Specifications (Cont'd)

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Modulation Analysis</td><td></td></tr>
<tr><td>Input Level Range</td><td>Port1, Port2: –40.0 to +35.0 dBm
Port3, Port4: –40.0 to +25.0 dBm</td></tr>
<tr><td>Carrier Frequency Accuracy</td><td>±(Set frequency × Reference oscillator accuracy + 15 Hz)
Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 4200 MHz</td></tr>
<tr><td>Modulation accuracy</td><td>Residual Vector Error: ≤ 1.0% (20 averaging times)
Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 4200 MHz</td></tr>
<tr><td>In-Band Emissions</td><td>≤ –40 dBc (Input Level ≥–10 dBm)
Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 4200 MHz</td></tr>
<tr><td>Occupied Bandwidth</td><td></td></tr>
<tr><td>Input Level Range</td><td>Port1, Port2: –10.0 to +35.0 dBm
Port3, Port4: –10.0 to +25.0 dBm</td></tr>
<tr><td>Adjacent Channel Leakage Power Ratio</td><td></td></tr>
<tr><td>Input Level Range</td><td>Port1, Port2: –10.0 to +35.0 dBm
Port3, Port4: –10.0 to +25.0 dBm</td></tr>
<tr><td>Measurement Range</td><td>Frequency: 600 MHz ≤ f ≤ 2700 MHz, 3400 MHz ≤ f ≤ 4200 MHz<table><tr><td>Adjacent Channel</td><td>Measurement Range</td></tr><tr><td>GSM ACLR</td><td>≥ 47 dB</td></tr><tr><td>UTRA ACLR</td><td>≥ 50 dB</td></tr></table></td></tr>
<tr><td>Spectrum Emission Mask (SEM)</td><td></td></tr>
<tr><td>Input Level Range</td><td>Port1, Port2: –10.0 to +35.0 dBm
Port3, Port4: –10.0 to +25.0 dBm</td></tr>
</table>

Index

References are page numbers.