Anritsu Advancing beyond

Universal Wireless Test Set

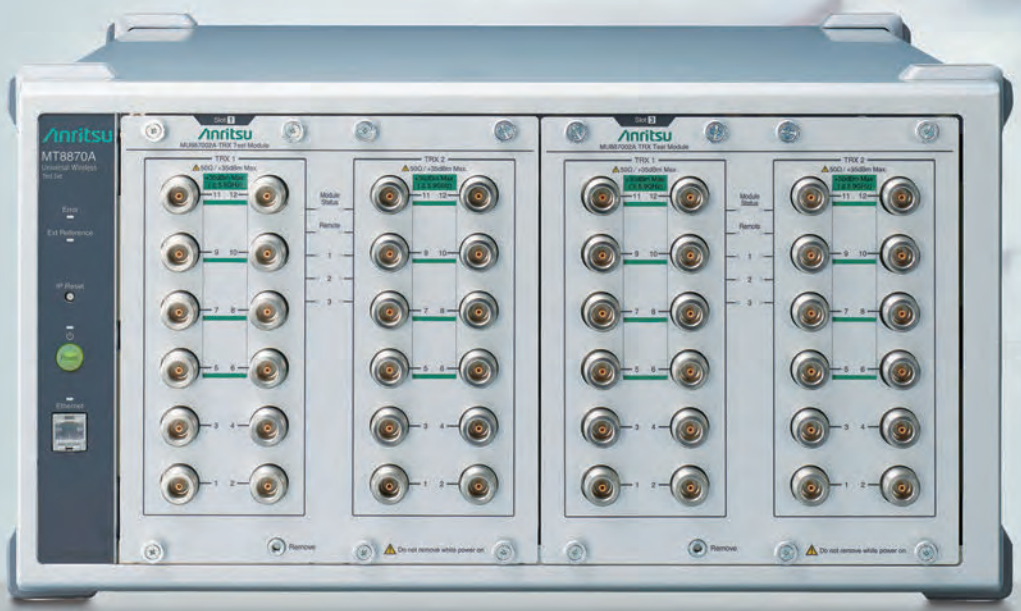
MT8870A/MT8872A

Excellent Eco Product

Two Anritsu Solutions

4 Slot

MT8870A



5G NR

LTE/
LTE-Advanced

LTE-V2X

WLAN
802.11ax/be

Bluetooth5

for High-Density Production Lines

2 Slot

MT8872A

For Production Lines of Smartphones and Wireless Modules

With the recent rollout of commercial 5G service, wireless communications are expanding from smartphones into new markets, such as automotive and IoT-based communications devices. Additionally, use of wider frequency bands and more efficient transmission methods is in planning with progressive development of newer versions of communications standards, including 5G, IEEE 802.11ax/be, Bluetooth®, etc., all for simultaneous deployment in one wireless communications device.

Against this background, testing of wireless communications products is becoming more complex, and there is increasing demand for test equipment enabling both efficient mass-production and, simultaneously, flexible support for diverse communications standards.

Anritsu's MT8870A and MT8872A solutions support a customized choice of shared MU887000A/01A/02A TRX test modules matching the measurement objective.

The MT8870A accommodates up to four TRX test modules in one main chassis for efficient calibration/verification and high productivity on busy production lines.

The space-saving MT8872A is fully compatible with the MT8870A but has been designed for use in tighter spaces than the standard 19-inch rackmount. It shares the same MU887002A TRX test modules and has 24 RF test ports for help in configuring high-density production lines.

High Performance Coupled with Flexibility and Expandability

MU887000A/01A/02A

TRX Test Module
MU887000A

TRX Test Module
MU887000A
with MU887000A-002 (Audio)

TRX Test Module
MU887001A

TRX Test Module
MU887001A
with MU887001A-002 (Audio)

TRX Test Module
MU887002A

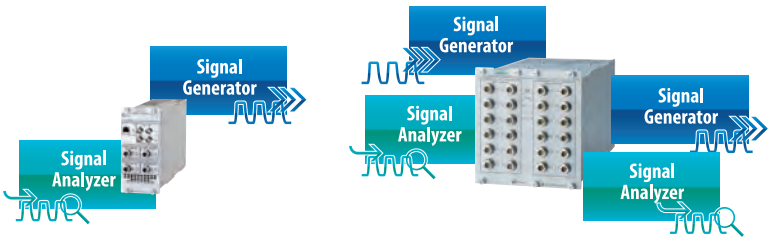
TRX Test Module
MU887002A
with MU887007A-007
(7 GHz Extension Function)

Future-proof Production Lines

Mobile terminal manufacturers require not only production line efficiency but also the flexibility to adapt to changes in wireless standards. The MT8870A is the ideal instrument to meet these needs.

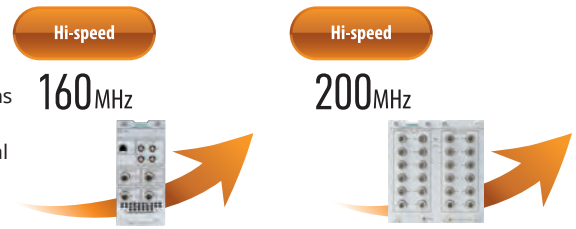
1 Built-in Signal Generator and Signal Analyzer in Each Test Module

The TRX Test Module MU887000A/01A/02A (MU88700xA) has been developed for communication terminal device production lines. Each installed test module has an independent high-performance signal generator and signal analyzer.



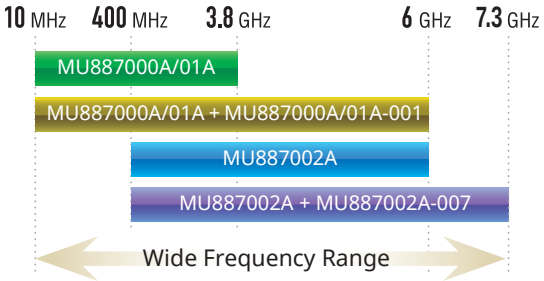
2 Wide Bandwidth

To support the NR Sub-6 GHz, WLAN 802.11ax and 11be, wireless communications standards requiring bandwidths of more than 100 MHz, the analysis bandwidth of the signal analyzer (SA) and modulation bandwidth of the signal generator (SG) in the MU887000A/01A is 160 MHz as standard, while that in the MU887002A is 200 MHz.



3 Wide Frequency Range up to 6 GHz

The signal generator and signal analyzer in the MU887000A/01A have an upper frequency limit of 3.8 GHz as standard, but this can be extended to 6 GHz as an option.
The signal generator and signal analyzer in the MU887002A have an upper frequency limit of 6 GHz as standard and it can be extended to 7.3 GHz as an option.
They flexibly support new wireless communication standards that cannot be supported by dedicated instruments for specific frequencies.

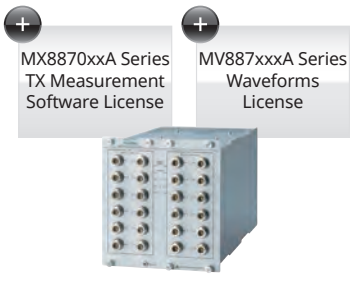


4 Each Test Module Supports Multiple Wireless Standards

One MU88700xA supports multiple wireless communication standards.

Each standard is supported easily using a cost-effective licensing scheme

Licenses are obtained by adding TX measurement software packages and waveform files.



TRX Test Module
MU88700xA

Wireless Standards	Specifications
5G NR sub-6 GHz	3GPP TS 38.101-1V15.0.0
W-CDMA/HSDPA	3GPP TS 34.121-1 3GPP TS 25.141
GSM/EDGE	3GPP TS 51.010-1
LTE/LTE-Advanced/ LTE-V2X/NB-IoT/Cat-M	3GPP TS 36.521-1 3GPP TS 36.141
CDMA2000	3GPP2 TSG-C.S0011-C
1xEV-DO	3GPP2 TSG-C.S0033-B
TD-SCDMA	3GPP TS 34.122
WLAN	IEEE 802.11a/b/g/n/p/ac (Wave 2)/ax/be*2
Bluetooth®	Basic Rate/EDR/Bluetooth low energy (Bluetooth v5.4)
ZigBee	IEEE 802.15.4
Z-Wave	ITU-T G.9959
FM*1	RDS (IEC 62106 Edition 2.0)
GPS	GPS standard Positioning Service Signal
Galileo	European GNSS (Galileo) Open Service Signal In Space Interface Control Document
GLONASS	GLONASS ICD Navigational radiosignal In bands L1, L2
BeiDou	BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal (Version 2.0)
QZSS	Quasi-Zenith Satellite System Interface Specification
DVB-H	ETSI EN300 744
ISDB-T/Tmm*1	ARIB STD-B31/B46

*1: MU887000A/MU887001A only
*2: MU887002A only

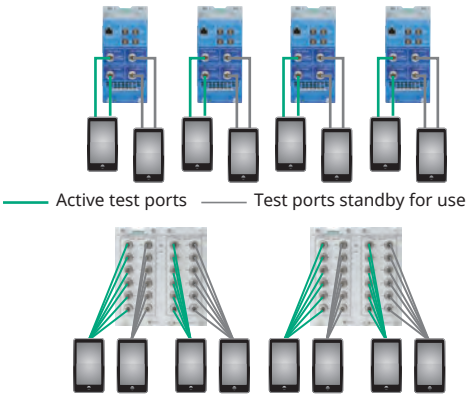
One License Supports Four Modules

The TX measurement software packages and waveforms can each be licensed separately. One license can be used for up to four TRX test modules, cutting test equipment costs.
A TX measurement software package is required for TX tests for each communication standard and a waveform is required for RX tests.

Flexible Test System Configuration

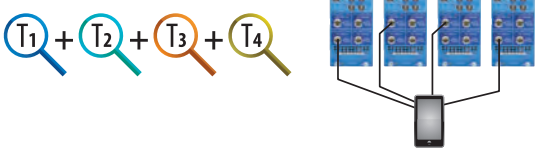
Up to 8 Units Connection

Ping-Pong Measurement of Eight Simultaneously Connected UE Units:
Production line efficiency can be improved using a Ping-Pong measurement method which measures by connecting two UE units alternately to the MU88700xA.
Installing up to four test units in the MT8870A supports alternate connection and testing of four test units.
With four RF test ports per module, the MU887000A/01A supports connection of up to 8 dual-antenna UE.
With two TRX test functions per MU887002A unit and 12 RF test ports per TRX test function, the MU887002A supports connection of up to 8 six-antenna UE.



Up to 4 Measurement Types

Four Simultaneous Measurements:
Recent smartphones support various wireless interfaces, such as Bluetooth® and WLAN, in addition to cellular.
Test times are cut by testing multiple wireless standards simultaneously.

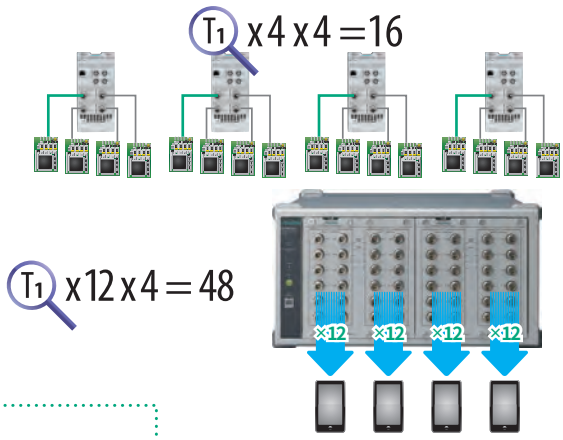


Continuous Measurements by 1 Module

Continuous Measurements of Multiple Communications Standards:
Licensing the TX measurement software packages and waveforms support continuous multiple measurements with one MU88700xA.

Up to 48 Test Devices

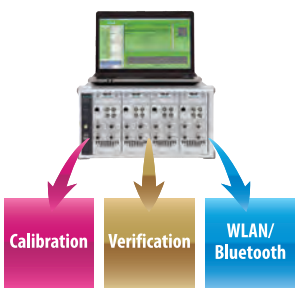
16 Simultaneous Connections:
Each MU88700xA has four test ports. Up to four test modules can be installed in one MT8870A, supporting simultaneous connection of 16 test devices.
This versatility eliminates the need for external combiners and also reduces test fixture calibration.



POINT

Supports Flexible Line Changes

Generally, wireless device production lines are divided into different processing stages such as calibration, verification, and function testing. Using different equipment at each stage causes problems, such as different test times, as well as the need to provide spare capacity to cover any faults at each process. Since the MT8870A has high versatility due to its modular configuration, it minimizes the need for spare capacity when reconfiguring the production line, etc.



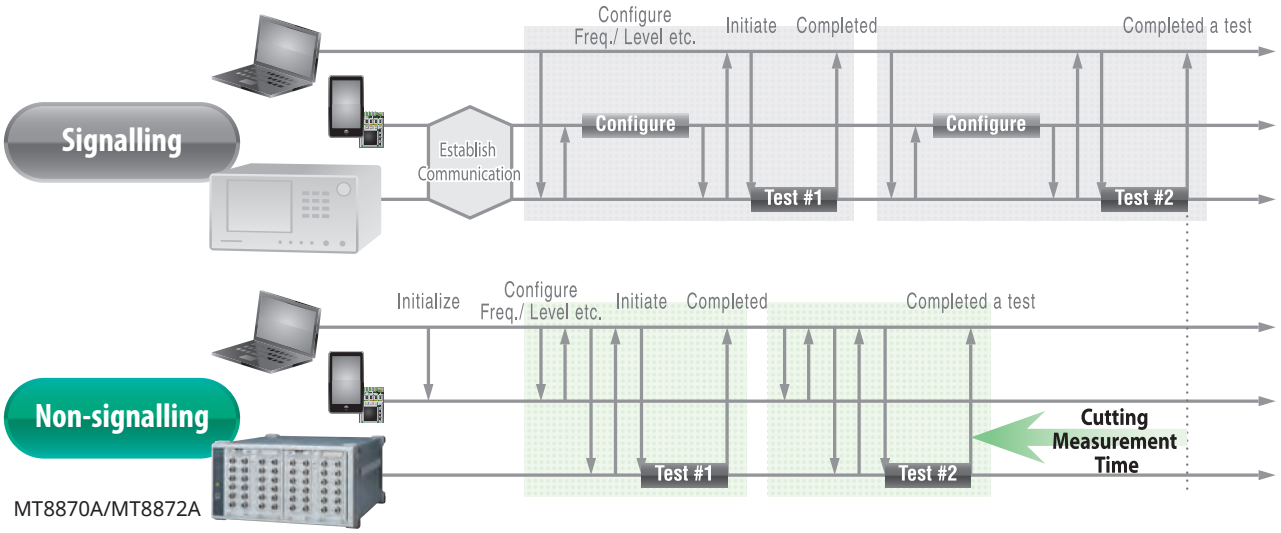
TRX Test Module MU887000A/01A/02A Features

Integration with Leading-edge High-speed Measurement Methods MU887000A/01A/02A

Times for manufacturing and testing mobile terminals have been slashed using leading-edge hardware architecture and parallel measurement technology. Additionally, multiple items for batch measurement processing can be freely selected for any number of repeat measurements. Batch measurement of selected items greatly simplifies and speeds up key tests.

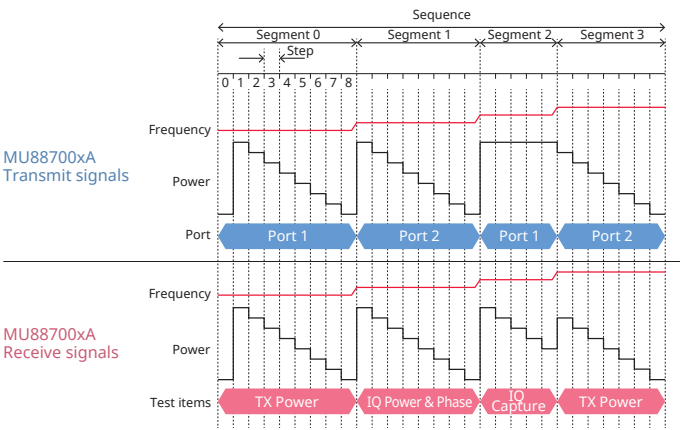
Non-signalling Measurement Support MU887000A/01A/02A

The MT8870A/MT8872A performs measurements in a non-signalling environment. As shown in the figure below, alleviating the need to establish direct communication with the DUT brings considerable savings in both time and manufacturing costs.



Sequence Measurement (Mobile Communication Terminals) MU887000A/01A/02A

- For mobile terminals supporting sequence measurements (list mode), TRX tests are performed in accordance with a sequence table (list) where measurement conditions are recorded while changing the test conditions.
- Since each measurement is executed at high speed in accordance with a predetermined sequence without using remote control commands, line tact times are greatly reduced, increasing line throughput and efficiency.



Ease of Configuration MU887000A/01A/02A

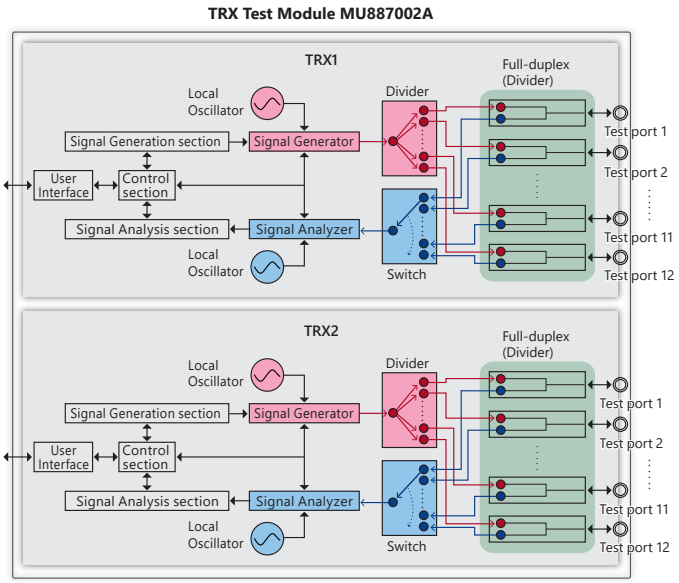
Line capacity can change from week to week or month to month, depending on customers' needs and the specifications of the device under test. The number of test modules installed*1 in the chassis can be tailored to meet changes in line test stations and items, keeping the line efficiency high without needing major configuration changes to the line and stations.

*1: Test modules cannot be hot-swapped with the power on.

TRX Test Module MU887002A Features

12 RF Test Ports MU887002A

The MU887002A has two TRX functions in one module and each TRX function has 12 built-in RF test ports.



The MU887002A has 12 test ports supporting high level accuracy over a wide range from 400 MHz to 6.0 GHz. Installing the MU887002A-007 option increases the upper frequency of test ports 5 to 12 to 7.3 GHz with a maximum output level of 0 dBm. A built-in divider at the output side supporting simultaneous signal output from all 12 ports facilitates shorter test times by receiving the signal simultaneously at multiple antennas without requiring an external divider (Broadcast function).

Measurement is performed by switching the 12 test ports using the internal switch at the input side.

Test Port and Wireless Technology MU887002A

MU887002A

	TRX1 Test Ports 1 to 12	TRX2 Test Ports 1 to 12
Connector	N (female)	
Type (Configuration)	Full-Duplex (divider) f ≤ 5900 MHz Half-Duplex (switch) Test port 5 to 12 5900 MHz ≤ f, when MU887002A-007 installed	
Outline	Can use both VSA and VSG required for mobile wireless standard measurements simultaneously Signal output from all port simultaneously*1	
Wireless Standards*2	Supported standards: 5G NR/ENDC FDD/TDD sub-6 GHz, LTE/LTE-Advanced FDD/TDD, LTE-V2X, W-CDMA/HSPA, GSM/EDGE, CDMA2000/1xEV-DO, TD-SCDMA, NB-IoT, Category M, WLAN 802.11a/b/g/n/p/ac/ax/be, Bluetooth, IEEE802.15.4, Z-Wave, GPS, Galileo, GLONASS, BeiDou, QZSS, DVB-T, ISDB-T	

*1: The MU887002A-007 is required when f ≥ 6000 MHz, and test ports 5 to 12 support simultaneous output.
*2: See "Measurement Software/Waveforms Ordering Information" for details of support for future expected standards.

200-MHz Bandwidth as Standard MU887002A

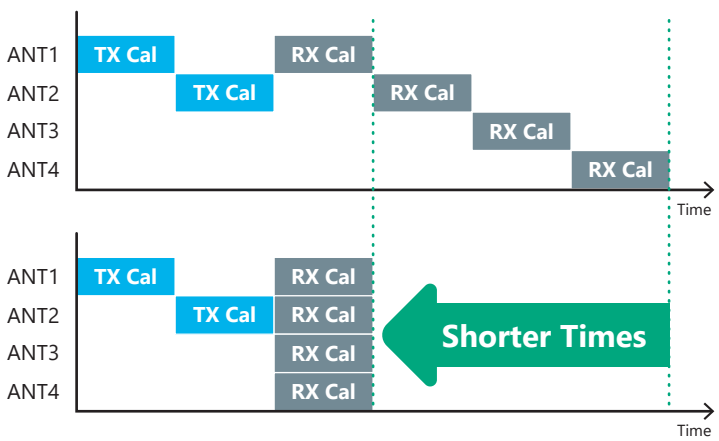
Supporting the new 5G NR Sub-6 GHz and 802.11ax wireless standards generally requires additional costs for changing instruments and purchasing options to extend the instrument bandwidth, but the standard 200-MHz bandwidth of the MU887002A eliminates the need to change hardware to support future NR 5G Sub-6 GHz 2CC tests.

High Output Overcoming Measurement System Power Loss MU887002A

Generally, TRx tests must take power losses due to external devices such as RF cables, switches, dividers, and spaces between them into consideration. Since the tester output level can be inadequate in overcoming these power losses, sometimes the input level to the UE under test is insufficient. Consequently, it may be necessary to add an amplifier to the test system.
With a total of 24 RF ports each capable of outputting a 0 dBm modulated signal simultaneously, the MU887002A can perform tests, such as Max Input Level measurements (Rx test), without requiring an external amplifier. (The signal quality at levels exceeding the maximum specified level differs with the frequency and waveform being used.)
The MU887002A is the only measurement module supporting simultaneous over the air (OTA) Rx tests of multiple UE units.

Shorter Rx Test Times using Broadcast Function at Calibration MU887002A

The increasing number of bands supported by mobile terminals resulting in increasing numbers of internal antennas causes longer production times. Using the MU887002A Broadcast function to receive signals at multiple antennas simultaneously helps cut calibration times.



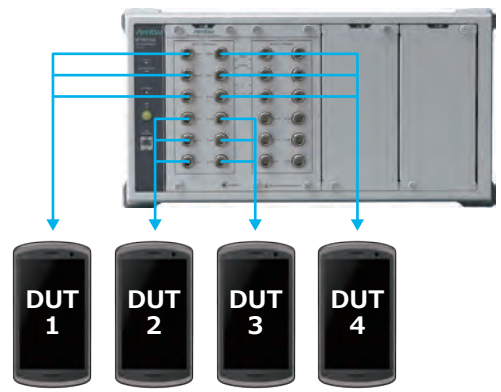
Broadcasting cal.

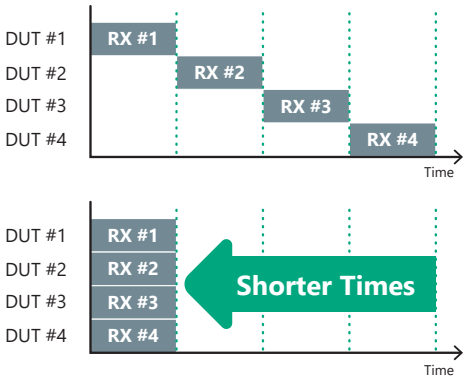
Efficient Rx Verification Tests using Broadcast Function MU887002A

Connecting multiple UE units to one tester for sequential verification is becoming a common verification method. Since the MU887002A can output the same signal at up to 12 ports, the Rx test can be executed simultaneously at multiple UE to cut Rx test times.

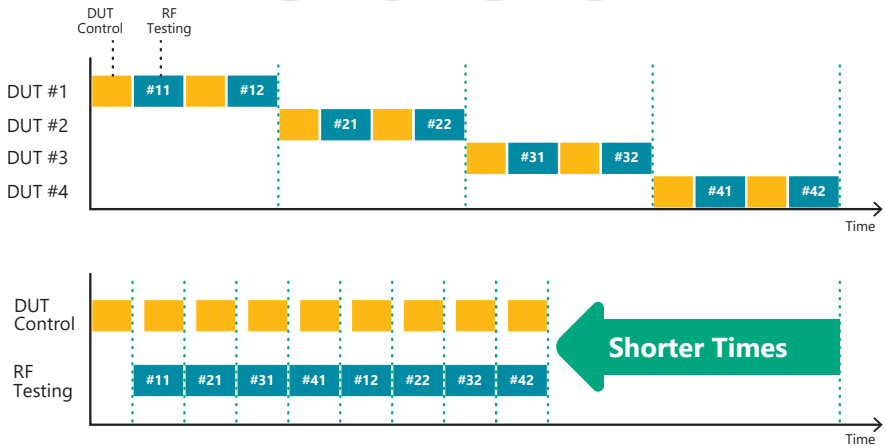
Efficient Tx Verification Tests using Multi-DUT Measurement Scheduler Function MU887002A

The MU887002A has a function for operating as multiple virtual testers by managing the software and hardware resources using a built-in dedicated controller, which optimizes the tester operation and cuts the test time for each UE.





Shorter Rx Tests by Simultaneous Receiving at Multiple DUTs using Simultaneous Output Function



Shorter Multiple DUT Tx Test Times using Multi-DUT Measurement Scheduler Function

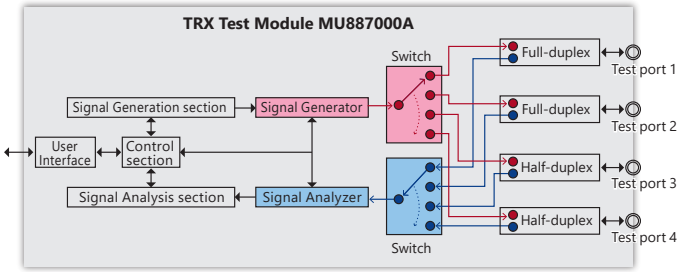
TRX Test Module MU887000A/01A Features

Four Test Ports per Module MU887000A/01A

Each MU887000A has two duplex and two half-duplex RF connectors.

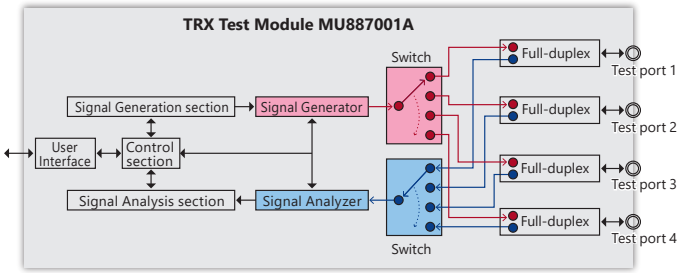
The duplex ports (Test port 1 and 2) incorporate dividers at the front end to support simultaneous tests in both TX and RX directions when testing typical wireless standards.

The half-duplex ports (Test port 3 and 4) incorporate switches at the front end to switch between each test port when used either for TX or RX tests. These half-duplex ports have higher sensitivity than the full-duplex ports and are ideal for low-level wireless signals.



The MU887001A has four duplex RF connectors.

Each MU887001A has four duplex RF connectors so that the test module can connect four mobile terminals at once to test them by high speed switching with the internal RF switches. Also the isolation performance between each test port is better than MU887000A.



The four test ports can be used for level calibration because they have high level accuracy over a wide frequency range from 10 MHz to 6 GHz (option). Internal switches can switch the TRX ports between input and output. Normally, simultaneous coupling measurements of multiple antennas require troublesome calibration corrections when using the required external dividers and external switches. With four test ports each incorporating the internal switch level deviation, the MU887000A/01A supports high level accuracy measurements over a wide frequency range.

Test Port and Wireless Technology MU887000A/01A

MU887000A

	Test port 1 and 2	Test port 3 and 4
Name	High power port	Low power port
Connector	N (female)	N (female)
Type (Configuration)	Full-Duplex (divider)	Half-Duplex (switch)
Outline	Support simultaneous use of VSG and VSA required for measuring mobile terminal standards	Do not support simultaneous use of VSA and VSG each of which must be used separately High accuracy supports measurement of low-level signals
Wireless Standards and Recommended Port	5G NR/ENDC FDD/TDD sub-6 GHz, LTE/LTE-Advanced FDD/TDD, LTE-V2X, W-CDMA, GSM/EDGE, CDMA2000/ 1xEV-DO, TD-SCDMA, NB-IoT, Category M, WLAN 802.11a/b/ g/n/p/ac/ax*, Bluetooth*, IEEE 802.15.4*, Z-Wave, FM/RDS, GPS, Galileo, GLONASS, BeiDou, QZSS, DVB-T, ISDB-T/Tmm	Cellular Diversity, WLAN 802.11a/b/g/n/p/ac/ax, Bluetooth, IEEE 802.15.4, Z-Wave, FM/RDS, GPS, Galileo, GLONASS, BeiDou, QZSS, DVB-T, ISDB-T/Tmm

MU887001A

	Test port 1 to 4
Name	High power port
Connector	N (female)
Type (Configuration)	Full-Duplex (divider)
Outline	Support simultaneous use of VSG and VSA required for measuring mobile terminal standards
Wireless Standards and Recommended Port	5G NR/ENDC FDD/TDD sub-6 GHz, LTE/LTE-Advanced FDD/ TDD, LTE-V2X, W-CDMA, GSM/EDGE, CDMA2000/1xEV-DO, TD-SCDMA, NB-IoT, Category M, WLAN 802.11a/b/g/n/p/ac/ax, Bluetooth, IEEE 802.15.4, Z-Wave, FM/RDS, GPS, Galileo, GLONASS, BeiDou, QZSS, DVB-T, ISDB-T/Tmm

*: Since test ports 1 and 2 have higher input levels than ports 3 and 4, use ports 3 and 4 when the MU88700xA input level is low.

TRX Test Module MU887000A/01A Features

Built-in Audio Analyzer/Audio Generator MU887000A/01A

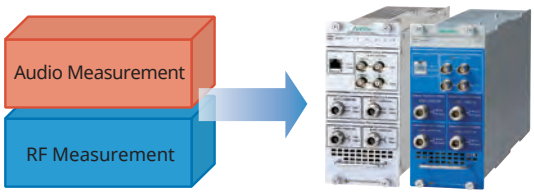
Installing the Audio Measurement Hardware MU887000A/01A-002 in the MU887000A/01A supports a built-in audio analyzer and audio generator.

The MU887000A/01A-002 supports both analog and digital audio. The stereo and monaural analog audio inputs and outputs of a communications device can be measured using the four BNC connectors (input and output for both left and right channels). Additionally, digital audio communications modules without analog audio inputs and outputs are supported without needing an AD/DC converter using the RJ-45 connector on the MU887000A/01A to measure digital audio signals using the standard inter-IC Sound (I2S) format.

Audio Measurement Hardware
MU887000A/01A-002

TRX Test Module
MU887000A/01A

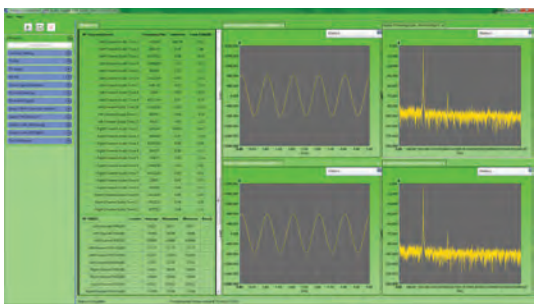
The MU887000A/01A-002 solution saves spaces and cuts costs by combining RF and audio measurements into one unit, eliminating the need for separate production lines for RF measurements and audio measurements.



TRX Test Module
Audio Measurement Hardware

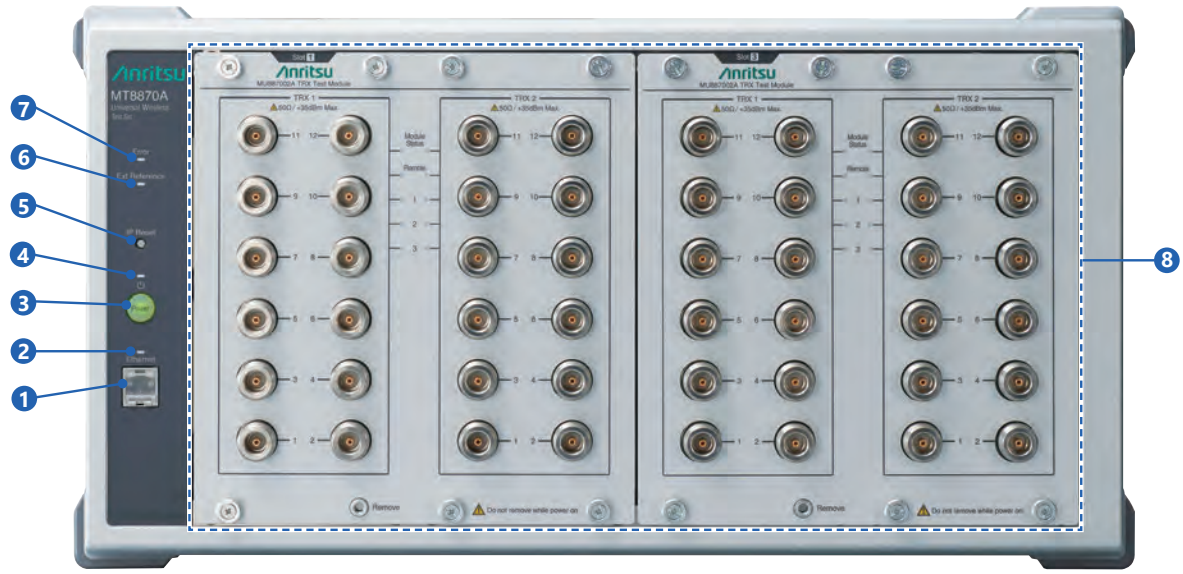
MU887000A/01A
MU887000A/01A-002

*: The audio analyzer and audio generator functions cannot be used simultaneously.

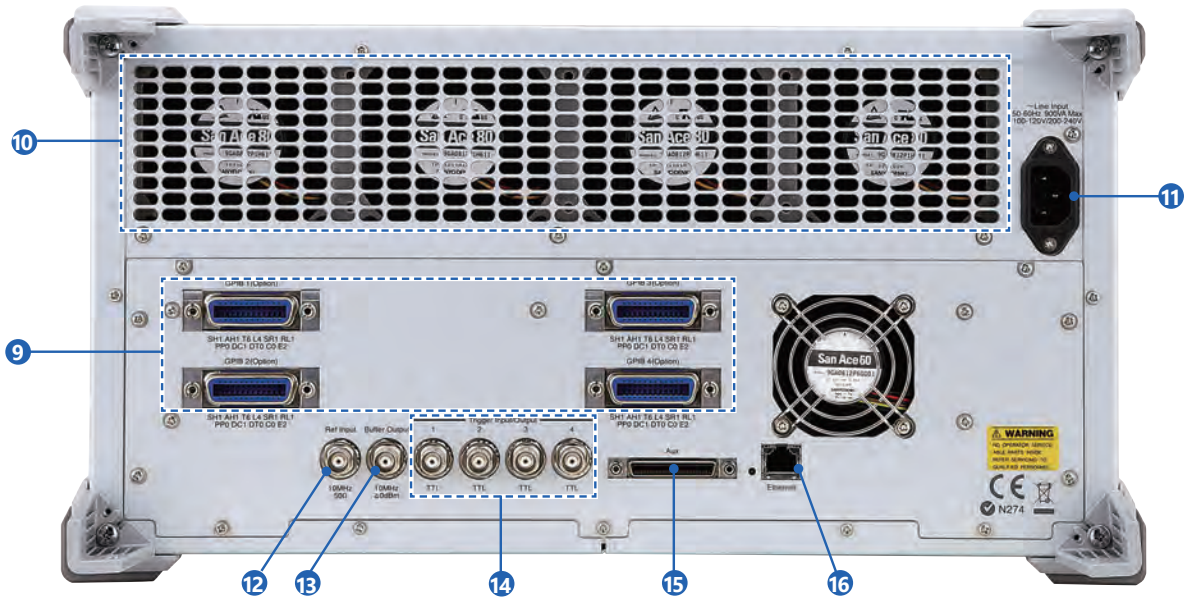


CombiView Audio Measurement Screen

Universal Wireless Test Set MT8870A Panel Layout



Front panel

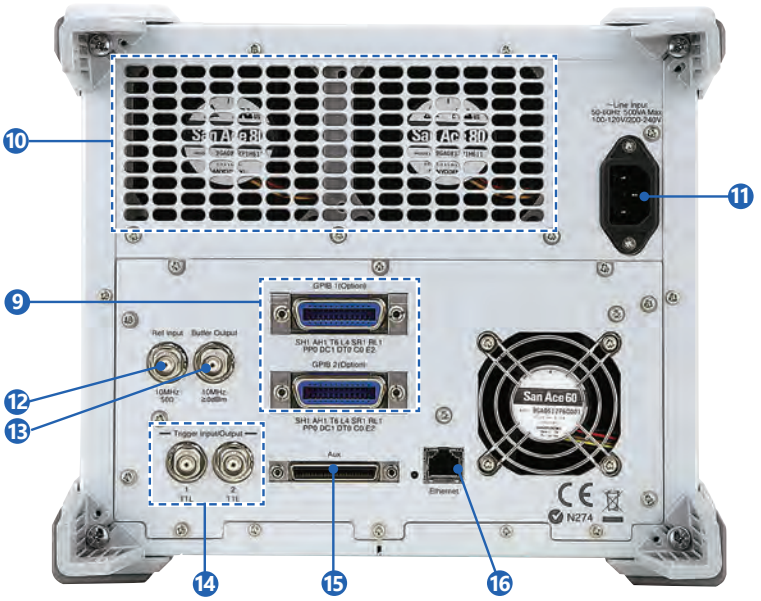


Rear panel

1. Ethernet Connector
2. Access Lamp
3. Power Switch
4. Standby Lamp
5. IP Address Reset Button (IP reset)
6. External Reference Signal Lamp (ext. reference)
7. Error Lamp
8. Slot 1 to 4
9. GPIB Connector (option)
10. Cooling Fan
11. Power Cord Connector
12. External Reference Signal Input (ref input)
13. Reference Signal Output (buffer output)
14. Trigger Input/Output Connector
15. AUX Connector
16. Ethernet Connector

Universal Wireless Test Set MT8872A Panel Layout

Front Panel



Rear Panel

1. Ethernet Connector
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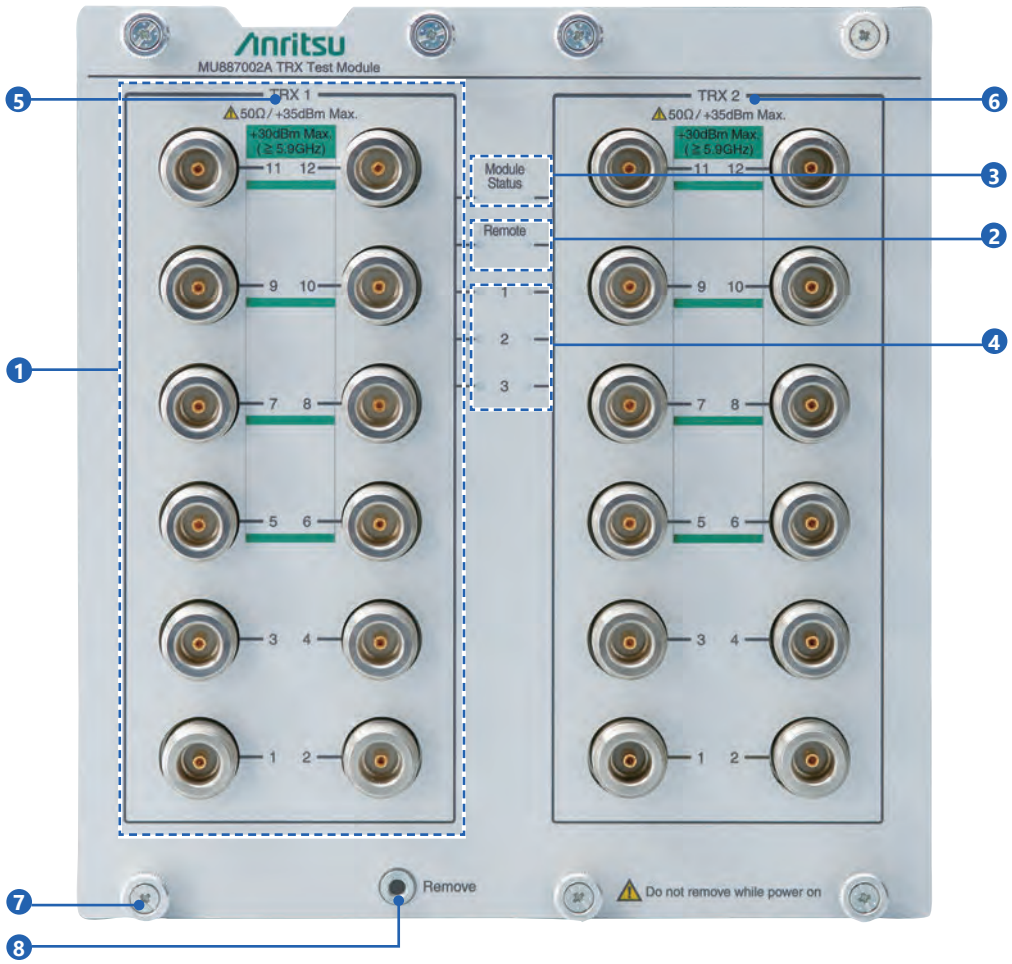
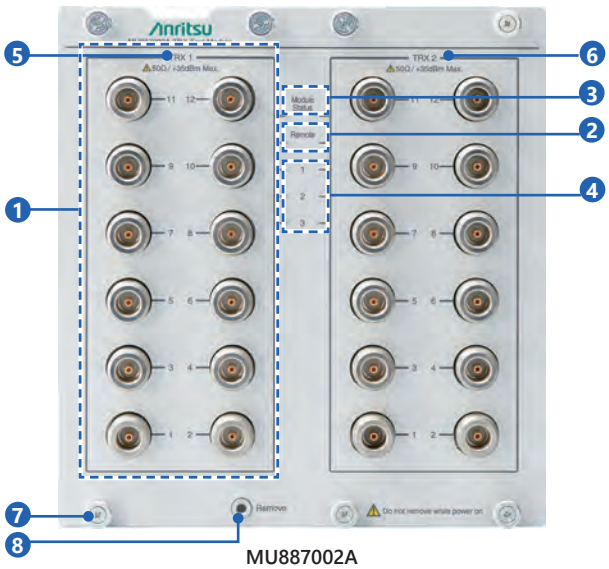
TRX Test Module MU887002A Panel



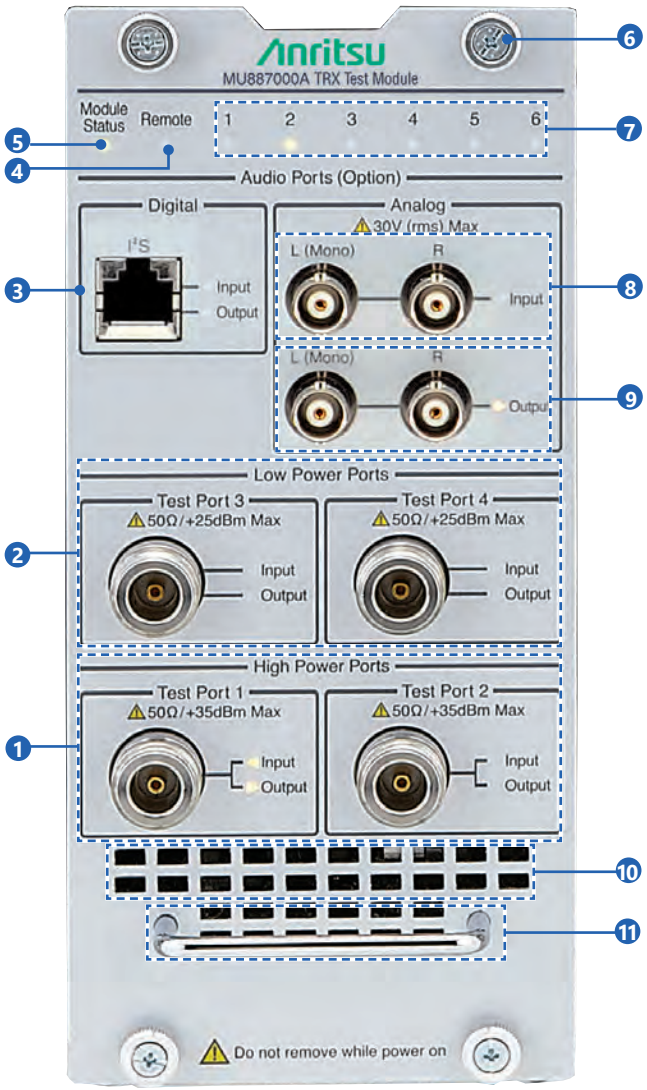
MU887002A (with MU887002A-007)

1. Test Ports 1 to 12
2. Remote Lamps (Remote)
3. Status Lamps (Module Status)
4. Status Lamps
5. TRX 1
6. TRX 2
7. Mounting Screws (7)
8. Hole for Unmounting Tool (one location)

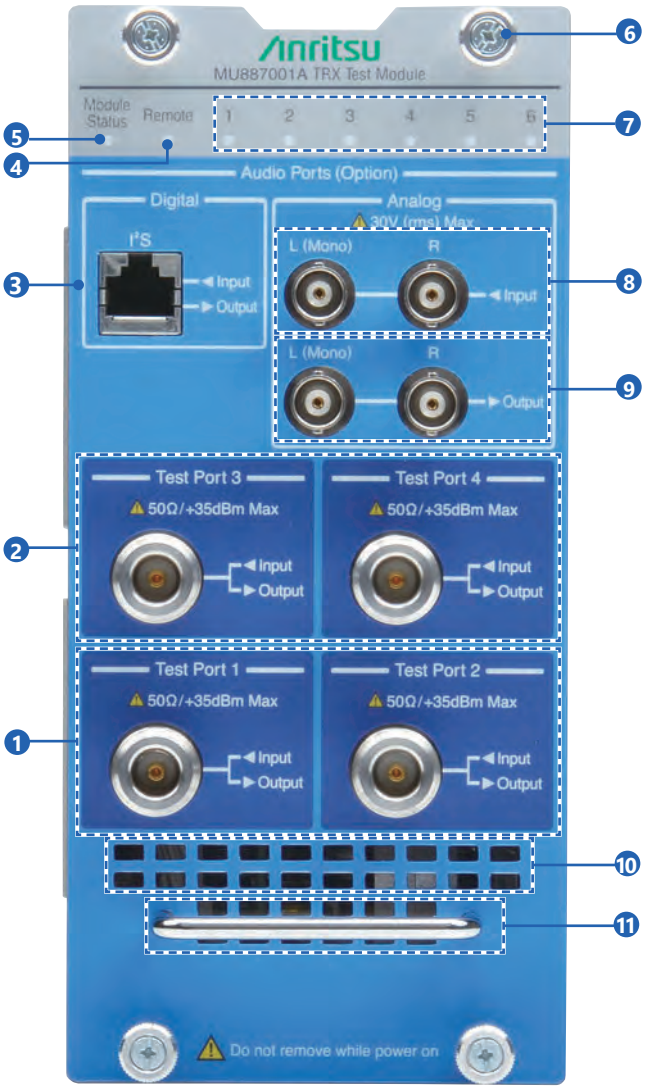


MU887002A

TRX Test Module MU887000A/01A Panel Layout



MU887000A

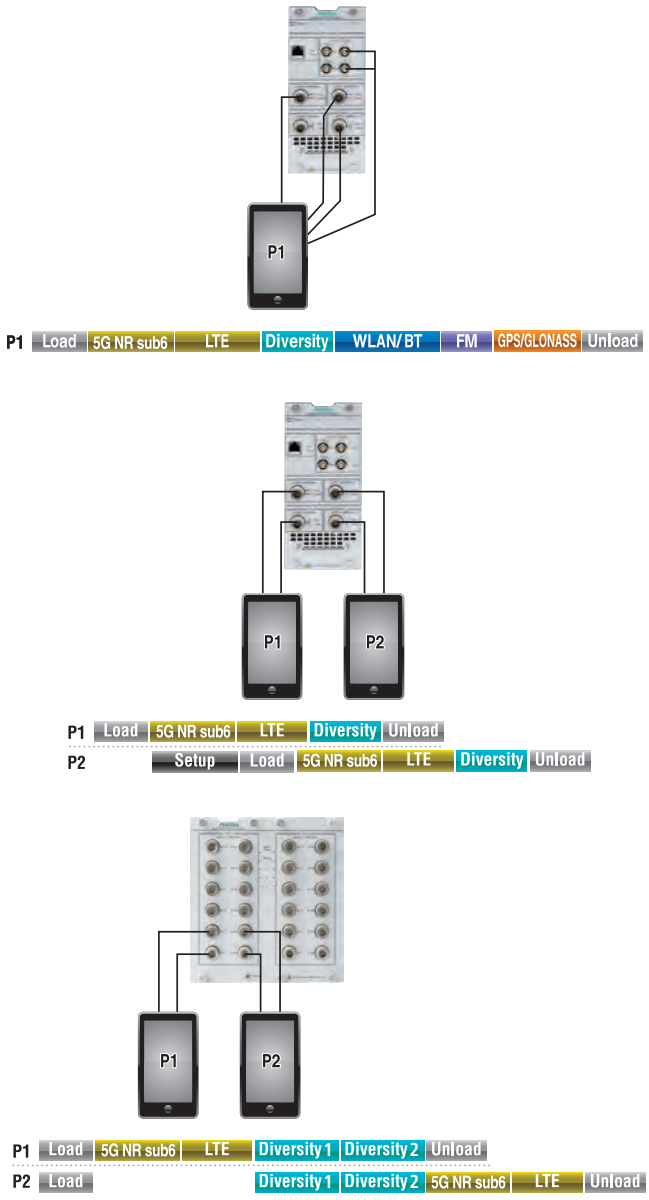


MU887001A

1. **Test Port 1, 2**
2. **Test Port 3, 4**
3. **Digital Audio Input/Output (option)**
4. **Remote Lamp (remote)**
5. **Status Lamp (module status)**
6. **Mounting screws**
7. **Status Lamp (1 to 6)**
8. **Analog Audio Input (option)**
9. **Analog Audio Output (option)**
10. **Vent**
11. **Handle**

Smartphones/Automotive

Smartphone/Automotive Measurement (Simultaneous Measurement of Multiple Wireless Technologies)



Two TRX Test Modules can be used to measure multiple wireless technologies in one wireless device or module.
The multiple antennas for the various wireless technologies in the wireless device or module are connected all at one time to execute measurements in parallel, greatly reducing the problems of moving smartphones between test stations and re-booting time for smartphone.

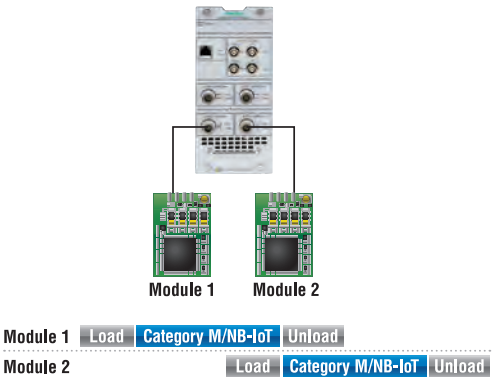
Recommended Configuration

Model	Description	Qty.
MT8870A/MT8872A	Universal Wireless Test Set	1
MU88700xA	TRX Test Module	1
MU88700xA-001*1	6 GHz Frequency Extension	1
MU88700xA-002*1	Audio Measurement Hardware	1
MX887010A	Cellular Standards Sequence Measurement	1
MX887013A	LTE FDD Uplink TX Measurement	1
MX887013A-001	LTE-Advanced FDD Uplink CA TX Measurement	1
MX887018A	NR FDD sub-6 GHz Uplink Measurement	1
MX887018A-001	NR FDD Contiguous ENDC TX Measurement	1
MX887019A	NR TDD sub-6 GHz Uplink Measurement	1
MX887019A-001	NR TDD Contiguous ENDC TX Measurement	1
MX887030A	WLAN 802.11b/g/a/n TX Measurement	1
MX887031A	WLAN 802.11ac TX Measurement	1
MX887033A	WLAN 802.11ax TX Measurement	1
MX887034A*2	WLAN 802.11be TX Measurement	1
MX887040A	Bluetooth TX Measurement	1
MX887040A-001	DLE TX Measurement	1
MX887040A-002	2LE TX Measurement	1
MX887040A-003	BLR TX Measurement	1
MX887040A-004	BLE AoA/AoD TX Measurement	1
MX887068A	LTE-V2X TX Measurement	1
MX887068A-001	LTE-V2X PSCCH TX Measurement	1
MX887070A*1	FM/Audio TRX Measurement	1
MX887090A	Multi-DUT Measurement scheduler	1
MX887092A*2	Pathloss Measurement Function for MU887002A	1
MV887013A	LTE FDD Downlink Waveforms	1
MV887018A	NR FDD sub-6 GHz Downlink Waveforms	1
MV887019A	NR TDD sub-6 GHz Downlink Waveforms	1
MV887030A	WLAN 802.11b/g/a/n Waveforms	1
MV887031A	WLAN 802.11ac Waveforms	1
MV887033A	WLAN 802.11ax Waveforms	1
MV887034A*2	WLAN 802.11be Waveforms	1
MV887040A	Bluetooth Waveforms	1
MV887040A-001	DLE Waveforms	1
MV887040A-002	2LE Waveforms	1
MV887040A-003	BLR Waveforms	1
MV887040A-004	BLE AoA/AoD Waveforms	1
MV887068A	LTE-V2X Waveforms	1
MV887070A*1	FM RDS Waveforms	1
MV887100A	GPS Waveforms	1
MV887100A-002	GPS L5 Waveforms	1
MV887101A	Galileo Waveforms	1
MV887102A	GLONASS Waveforms	1
MV887103A	BeiDou Waveforms	1
MV887104A	QZSS Waveforms	1

*1: Can only install MU887000A/01A
*2: Can only install MU887002A

Cellular LPWA Devices

NB-IoT Module Measurement

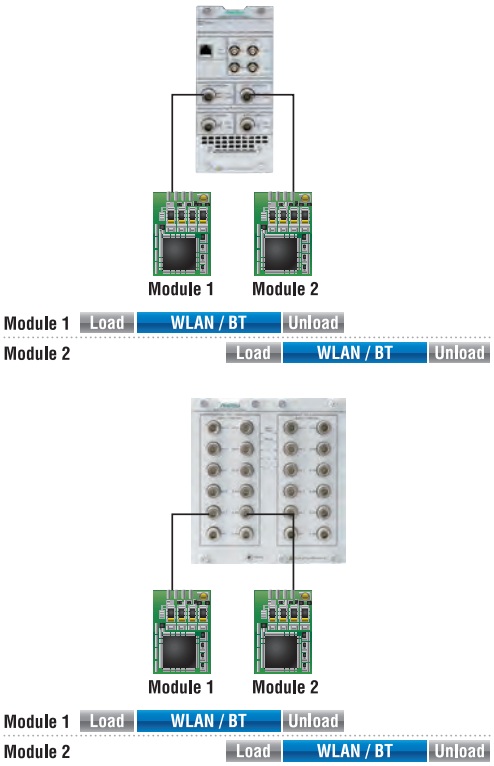


Recommended Configuration

Model	Description	Qty.
MT8870A/MT8872A	Universal Wireless Test Set	1
MU88700xA	TRX Test Module	1
MX887010A	Cellular Standards Sequence Measurement	1
MX887065A	Category M FDD Uplink TX Measurement	1
MX887067A	NB-IoT Uplink TX Measurement	1
MX887090A	Multi-DUT Measurement scheduler	1
MV887065A	Category M FDD Downlink Waveforms	1
MV887067A	NB-IoT Downlink Waveforms	1

Connectivity Devices

Combo Module Measurement



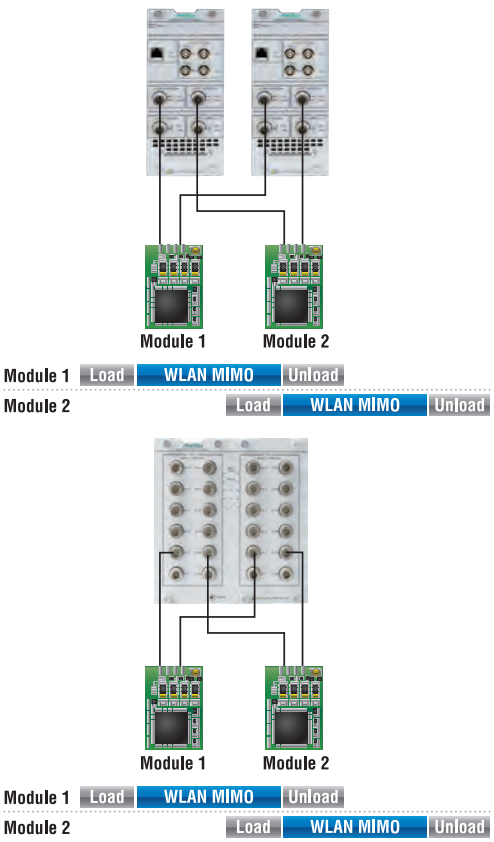
One TRX Test Module can be used to measure WLAN 802.11b/g/a/n/p/ac, 11ac (Wave 2), 11ax, 11be*2 and Bluetooth v5 modules.

Recommended Configuration

Model	Description	Qty.
MT8870A/MT8872A	Universal Wireless Test Set	1
MU88700xA	TRX Test Module	1
MU88700xA-001*1	6 GHz Frequency Extension	1
MU887002A-007*2	7 GHz Extension Function	1
MX887030A	WLAN 802.11b/g/a/n TX Measurement	1
MX887031A	WLAN 802.11ac TX Measurement	1
MX887032A	WLAN 802.11p TX Measurement	1
MX887033A	WLAN 802.11ax TX Measurement	1
MX887034A*2	WLAN 802.11be TX Measurement	1
MX887040A	Bluetooth TX Measurement	1
MX887040A-001	DLE TX Measurement	1
MX887040A-002	2LE TX Measurement	1
MX887040A-003	BLR TX Measurement	1
MX887040A-004	BLE AoA/AoD TX Measurement	1
MX887090A	Multi-DUT Measurement scheduler	1
MV887030A	WLAN 802.11b/g/a/n Waveforms	1
MV887031A	WLAN 802.11ac Waveforms	1
MV887032A	WLAN 802.11p Waveforms	1
MV887033A	WLAN 802.11ax Waveforms	1
MV887034A*2	WLAN 802.11be Waveforms	1
MV887040A	Bluetooth Waveforms	1
MV887040A-001	DLE Waveforms	1
MV887040A-002	2LE Waveforms	1
MV887040A-003	BLR Waveforms	1
MV887040A-004	BLE AoA/AoD Waveforms	1

*1: Can only install MU887000A/01A
*2: Can only install MU887002A

WLAN 2×2 MIMO Module Measurement (True MIMO)



Using two TRX Test Modules supports True MIMO measurement of WLAN 802.11n and 11ac 2×2 MIMO modules.

Recommended Configuration

Model	Description	Qty.
MT8870A/MT8872A	Universal Wireless Test Set	1
MU88700xA	TRX Test Module	2
MU88700xA-001*	6 GHz Frequency Extension	2
MX887030A	WLAN 802.11b/g/a/n TX Measurement	1
MX887031A	WLAN 802.11ac TX Measurement	1
MX887090A	Multi-DUT Measurement scheduler	1
MV887030A	WLAN 802.11b/g/a/n Waveforms	1
MV887031A	WLAN 802.11ac Waveforms	1

*: Can only install MU887000A/01A

Universal Wireless Test Set MT8870A/MT8872A PC Applications

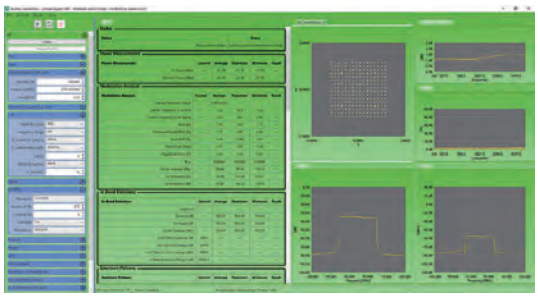
CombiView

CombiView is a PC application used to control the MT8870A/MT8872A and display graphical and numerical test results.
It has the following functions:

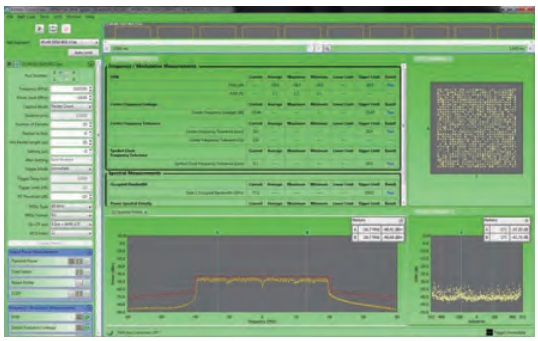
Key Features

- Windows interface displays graphs of Tx measurement results, and controls signal generator for Rx test
- Remote control of MT8870A/MT8872A (MU88700xA) via Ethernet and GPIB (option)*
- Setting of MT8870A/MT8872A (MU88700xA)

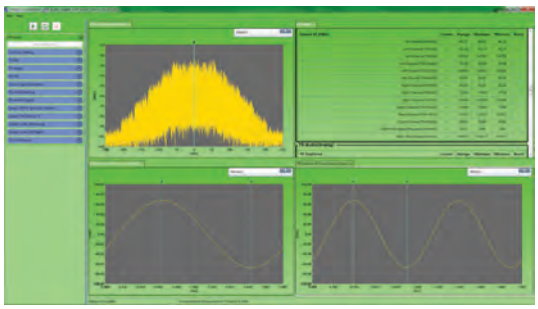
*: MU887002A supports Ethernet I/F only



NR FDD sub-6 GHz Uplink TX Measurement with Cellular Application Applet



WLAN 802.11ax TX Measurement with SRW Application Applet



Audio Measurement with FM/Audio Application Applet

Utility Tool

The utility tool is a PC application used to detect the network and perform firmware updates.

Key Features

- Displays details of MT8870A/MT8872A and MU88700xA TRX Test Module(s) detected on network
- TRX Test Module MU88700xA firmware upgrade
- Waveform file transfer
- License registration

Cellular Measurement Solution

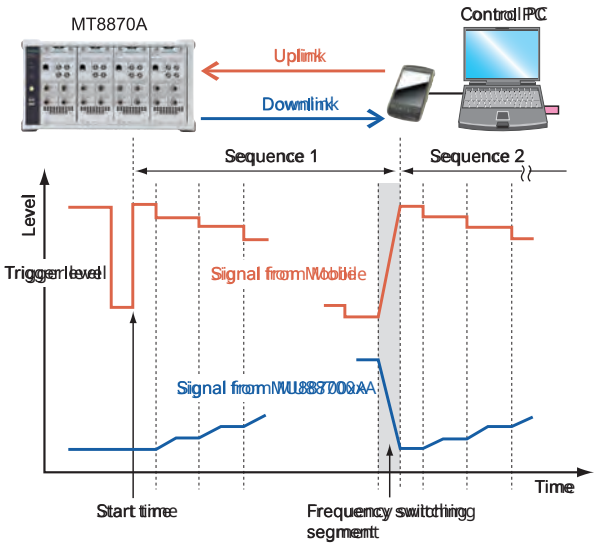
Cellular Standards Sequence Measurement MX887010A

MU887000A/01A/02A

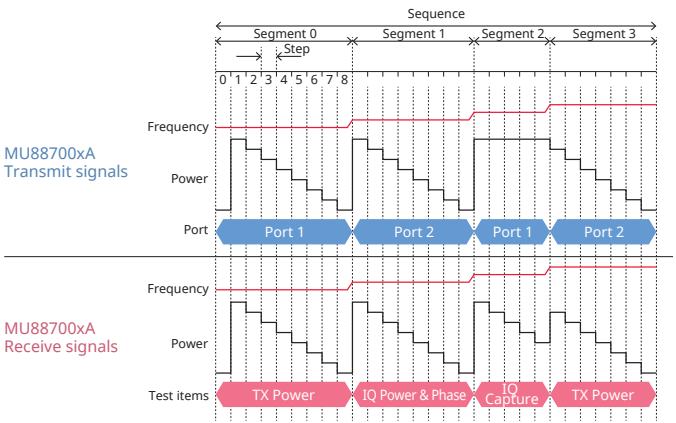
Installing the Cellular Standards Sequence Measurement software MX887010A package in the MT8870A/MT8872A can be operated with preconfigured frequency and level in a sequence list to the signal generator and signal analyzer.

This software is able to greatly reduce calibration and verification time in conjunction with a chipset that supports capability for high-speed calibration and sequence measurement.

*1: Sequence measurement requires TX Measurement software MX88701xA
*2: Requires Waveforms MV88701xA for downlink signal modulation waveforms



TRX vs. Frequency Measurement



Sequence Measurement

W-CDMA/HSPA Uplink TX Measurement MX887011A

MU887000A/01A/02A

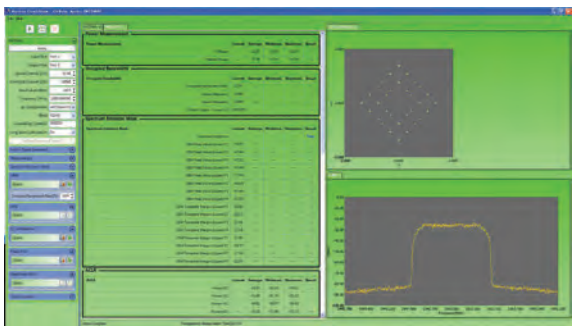
W-CDMA/HSPA Downlink Waveforms MV887011A

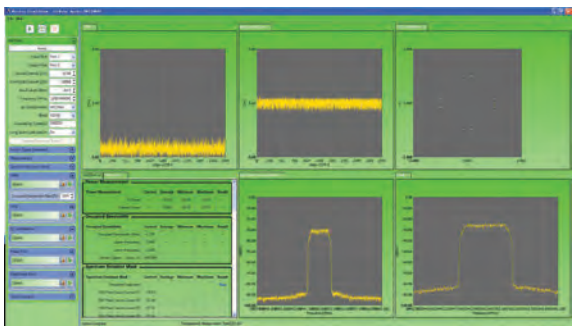
MU887000A/01A/02A

Installing the W-CDMA/HSPA Uplink TX Measurement software MX887011A in the MT8870A/MT8872A provides support for the following 3GPP W-CDMA and HSPA related TX characteristics measurements.

- TX Power
- Frequency Error
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of W-CDMA/HSPA Downlink Waveforms MV887011A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.





W-CDMA/HSPA Uplink TX Measurement using CombiView

Cellular Measurement Solution (continued)

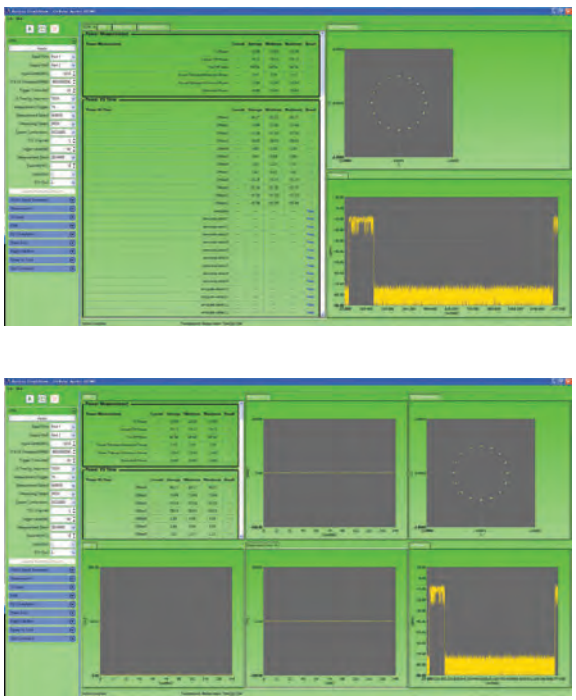
GSM/EDGE Uplink TX Measurement **MX887012A**
MU887000A/01A/02A

GSM/EDGE Downlink Waveforms **MV887012A**
MU887000A/01A/02A

Installing the GSM/EDGE Uplink TX Measurement software MX887012A in the MT8870A/MT8872A provides support for the following 3GPP GSM and EDGE related TX characteristics measurements.

- TX Power
- Power vs. Time
- TX Frequency
- Phase Error
- EVM
- Origin Offset
- Output RF Spectrum

Additionally, the package of GSM/EDGE Downlink Waveforms MV887012A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.



GSM/EDGE Uplink TX Measurement using CombiView

LTE FDD Uplink TX Measurement **MX887013A**
MU887000A/01A/02A

LTE-Advanced FDD Uplink CA TX Measurement **MX887013A-001**
MU887000A/01A/02A

LTE FDD Downlink Waveforms **MV887013A**
MU887000A/01A/02A

Installing the LTE FDD Uplink TX Measurement software MX887013A in the MT8870A/MT8872A provides support for the following 3GPP LTE FDD related TX characteristics measurements.

- TX Power
- Frequency Error
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Installing the LTE-Advanced FDD Uplink CA TX Measurement software MX887013A-001, extend LTE-Advanced Uplink CA (Carrier Aggregation) measurement on existing LTE FDD TX measurement software. Additionally, the package of LTE FDD Downlink Waveforms MV887013A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

LTE TDD Uplink TX Measurement **MX887014A**
MU887000A/01A/02A

LTE-Advanced TDD Uplink CA TX Measurement **MX887014A-001**
MU887000A/01A/02A

LTE TDD Downlink Waveforms **MV887014A**
MU887000A/01A/02A

Installing the LTE TDD Uplink TX Measurement software MX887014A in the MT8870A/MT8872A provides support for the following 3GPP LTE TDD related TX characteristics measurements.

- TX Power
- Frequency Deviation
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Installing the LTE-Advanced TDD Uplink CA TX Measurement software MX887014A-001, extend LTE Uplink CA (Carrier Aggregation) measurement on existing LTE TDD TX measurement software. Additionally, the package of LTE TDD Downlink Waveforms MV887014A contains downlink signals required for non-signaling measurements, sending the downlink signal for production is as easy as selecting the waveform file.

CDMA2000 Reverse Link TX Measurement **MX887015A**
MU887000A/01A/02A

CDMA2000 Forward Link Waveforms **MV887015A**
MU887000A/01A/02A

Installing the CDMA2000 Reverse Link TX Measurement software MX887015A in the MT8870A/MT8872A provides support for the following 3GPP2 CDMA2000 related TX characteristics measurements.

- TX Power
- Modulation Analysis
- Occupied Bandwidth
- Code Domain Power
- Spurious Emissions

Additionally, the package of CDMA2000 Forward Link Waveforms MV887015A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

Cellular Measurement Solution (continued)

1xEV-DO Reverse Link TX Measurement **MX887016A**
MU887000A/01A/02A

1xEV-DO Forward Link Waveforms **MV887016A**
MU887000A/01A/02A

Installing the 1xEV-DO Reverse Link TX Measurement software MX887016A in the MT8870A/MT8872A provides support for the following 3GPP2 CDMA2000 1xEV-DO related TX characteristics measurements.

- TX Power
- Modulation Analysis
- Occupied Bandwidth
- Code Domain Power
- Spurious Emissions

Additionally, the package of 1xEV-DO Forward Link Waveforms MV887016A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

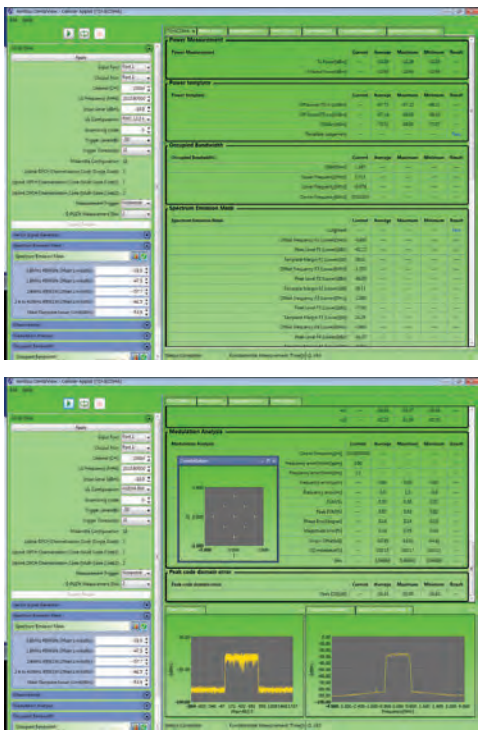
TD-SCDMA Uplink TX Measurement **MX887017A**
MU887000A/01A/02A

TD-SCDMA Downlink Waveforms **MV887017A**
MU887000A/01A/02A

Installing the TD-SCDMA Uplink TX Measurement software MX887017A in the MT8870A/MT8872A provides support for the following 3GPP TD-SCDMA (1.28 Mcps TDD) related TX characteristics measurements.

- TX Power
- Frequency Deviation
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of TD-SCDMA Downlink Waveforms MV887017A contains downlink signals required for non-signaling measurements, sending the downlink signal for production is as easy as selecting the waveform file.



TD-SCDMA Uplink TX Measurement using CombiView

NR FDD sub-6 GHz Uplink TX Measurement **MX887018A**
MU887000A/01A/02A

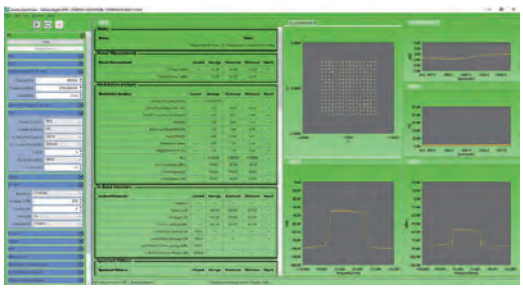
NR FDD Contiguous ENDC TX Measurement **MX887018A-001**
MU887000A/01A/02A

NR FDD sub-6 GHz Downlink Waveforms **MV887018A**
MU887000A/01A/02A

Installing the NR FDD sub-6 GHz Uplink Measurement MX887018A in the MT8870A/MT8872A provides support for the following 3GPP 5G NR FDD sub-6 GHz related TX characteristics measurements.

- TX Power
- Frequency Deviation
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of NR FDD sub-6 GHz Downlink Waveforms MV887018A contains downlink signals required for non-signaling measurements, sending the downlink signal for production is as easy as selecting the waveform file.



NR FDD sub-6 GHz Uplink TX Measurement using CombiView

NR TDD sub-6 GHz Uplink TX Measurement **MX887019A**
MU887000A/01A/02A

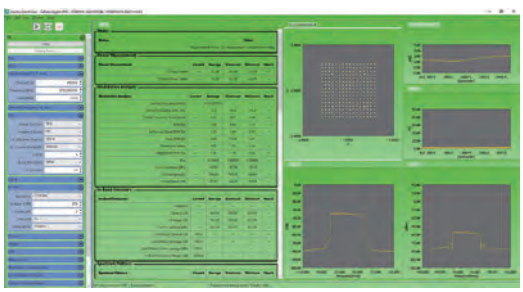
NR TDD Contiguous ENDC TX Measurement **MX887019A-001**
MU887000A/01A/02A

NR TDD sub-6 GHz Downlink Waveforms **MV887019A**
MU887000A/01A/02A

Installing the NR TDD sub-6 GHz Uplink Measurement MX887019A in the MT8870A/MT8872A provides support for the following 3GPP 5G NR TDD sub-6 GHz related TX characteristics measurements.

- TX Power
- Frequency Deviation
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of NR TDD sub-6 GHz Downlink Waveforms MV887019A contains downlink signals required for non-signaling measurements, sending the downlink signal for production is as easy as selecting the waveform file.



NR TDD sub-6 GHz Uplink TX Measurement using CombiView

Cellular Measurement Solution (continued)

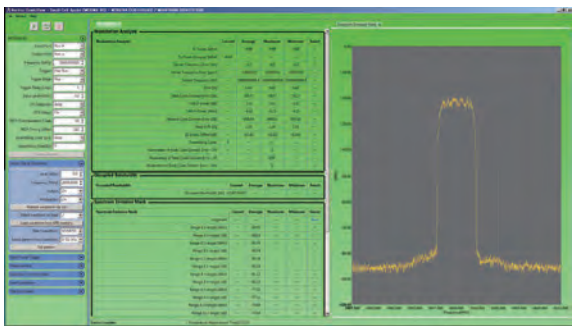
W-CDMA/HSPA Downlink TX Measurement **MX887021A**
MU887002A

W-CDMA/HSPA Uplink Waveforms **MV887021A**
MU887002A

Installing the W-CDMA/HSPA Downlink TX Measurement software MX887021A in the MT8870A/MT8872A provides support for the following 3GPP W-CDMA and HSPA related TX characteristics measurements.

- TX Power
- Frequency Deviation
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of W-CDMA/HSPA Uplink Waveforms MV887021A contains uplink signals required for non-signaling measurements, sending the uplink signal for production is as easy as selecting the waveform file.



W-CDMA/HSPA Downlink TX Measurements using CombiView

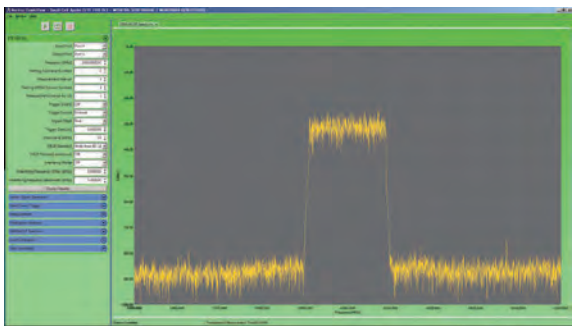
LTE FDD Downlink TX Measurement **MX887023A**
MU887002A

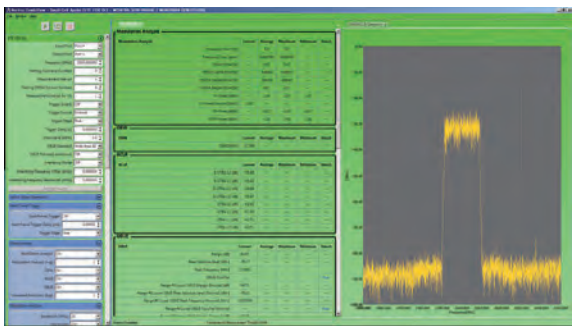
LTE FDD Uplink Waveforms **MV887023A**
MU887002A

Installing the LTE FDD Downlink TX Measurement software MX887023A in the MT8870A/MT8872A provides support for the following 3GPP LTE FDD related TX characteristics measurements.

- TX Power
- Frequency Deviation
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of LTE FDD Uplink Waveforms MV887023A contains uplink signals required for non-signaling measurements, sending the uplink signal for production is as easy as selecting the waveform file.





LTE FDD Downlink TX Measurements using CombiView

Cellular-IoT Measurement Solution (Cellular-LPWA Solution)

Category M FDD Uplink TX Measurement **MX887065A**
MU887000A/01A/02A

Category M FDD Downlink Waveforms **MV887065A**
MU887000A/01A/02A

Installing the Category M FDD Uplink TX Measurement software MX887065A in the MT8870A/MT8872A provides support for the following 3GPP LTE Category M related TX characteristics measurements.

- TX Power
- Frequency Error
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

Additionally, the package of Category M FDD Downlink Waveforms MV887065A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.

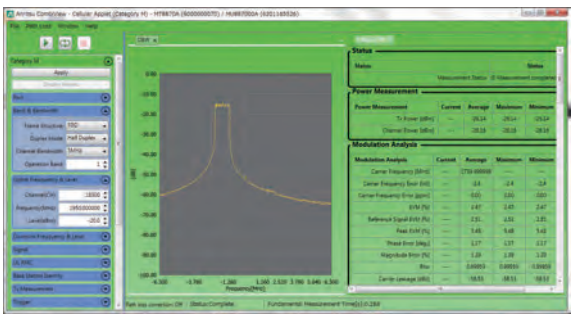
NB-IoT Uplink TX Measurement **MX887067A**
MU887000A/01A/02A

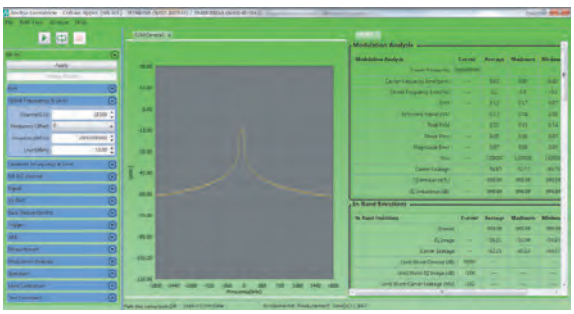
NB-IoT Downlink Waveforms **MV887067A**
MU887000A/01A/02A

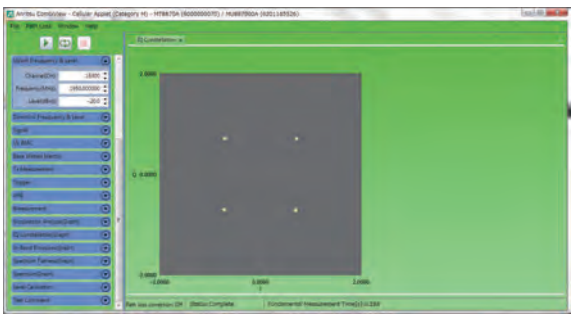
Installing the NB-IoT Uplink TX Measurement software MX887067A in the MT8870A/MT8872A provides support for the following 3GPP LTE NB-IoT related TX characteristics measurements.

- TX Power
- Frequency Error
- Occupied Bandwidth
- Spectrum Mask
- Adjacent Channel Leakage Power
- Modulation Analysis

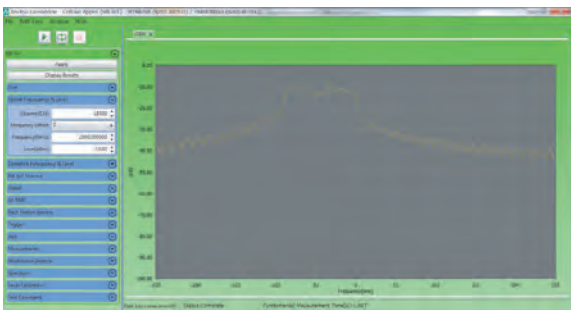
Additionally, the package of NB-IoT Downlink Waveforms MV887067A contains downlink signals required for non-signaling measurements; sending the downlink signal for production is as easy as selecting the waveform file.







Category M FDD Uplink TX Measurement using CombiView



NB-IoT Uplink TX Measurement using CombiView

WLAN Measurement Solution

WLAN 802.11b/g/a/n TX Measurement **MX887030A** MU887000A/01A/02A
WLAN 802.11b/g/a/n Waveforms **MV887030A** MU887000A/01A/02A

The MT8870A/MT8872A/MU88700xA supports non-signalling transmitter and receiver tests for all WLAN 802.11b/g/a/n-compliant devices. Requires installation of 6 GHz Frequency Expansion MU887000A/01-001 option (sold separately) when measuring 5-GHz band IEEE 802.11a/n using MU887000A/01A.

Transmitter Test

Installing the MX887030A in the MT8870A/MT8872A provides support for measurement of key IEEE 802.11 - March 2012 : 802.11b TX Test using all installed TRX test modules.

802.11b TX Measurement

IEEE 802.11 TX characteristics

802.11b	Test Items
16.3.7.2	Transmit Power Levels
16.3.7.3	Transmit Power Level Control
16.3.7.4	Transmit Spectrum Mask
16.3.7.5	Transmit Center Frequency Tolerance
16.3.7.6	Chip Clock Frequency Tolerance
16.3.7.7	Transmit power-on and power-down ramp
16.3.7.8	RF Carrier Suppression
16.3.7.9	Transmit Modulation Accuracy

Additional 802.11b Measurements

Test Items
Power crest factor
CCDF
IQ offset
Phase & magnitude error
Occupied bandwidth
Power spectral density

802.11g/a/n TX Measurement

IEEE 802.11a/g/n TX Test

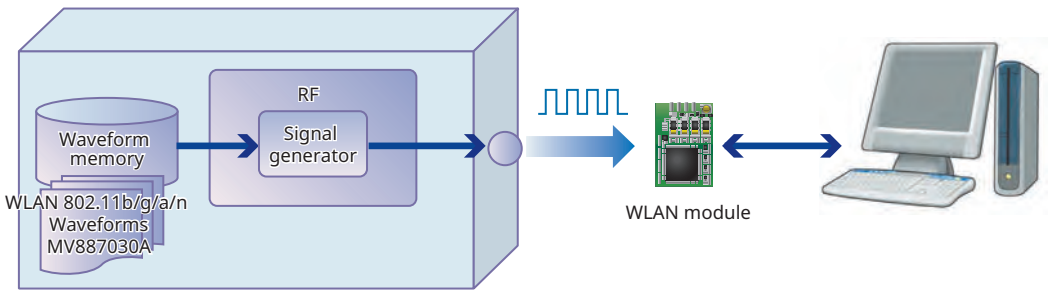
802.11a	802.11g	802.11n	Test Items
17.3.9.2	18.4.7.2	19.3.18.3	Transmit Power Levels
17.3.9.3	18.4.7.3	19.3.18.1	Transmit Spectrum Mask
17.3.9.5	18.4.7.4	19.3.18.4	Transmit center frequency tolerance
17.3.9.6	18.4.7.5	19.3.18.6	Symbol Clock frequency tolerance
17.3.9.7.2	17.3.9.7.2	19.3.18.7.2	Transmitter center frequency leakage
17.3.9.7.3	17.3.9.7.3	19.3.18.2	Transmitter spectral flatness
17.3.9.7.4	17.3.9.7.4	19.3.18.7.3	Transmitter constellation error
17.3.9.8	17.3.9.8	19.3.18.7.4	Transmitter modulation accuracy test

Additional 802.11g/a/n Measurements

Test Items
Power crest factor
CCDF
Occupied bandwidth
Power spectral density

Receiver Test

The MV887030A application provides support for transmission of WLAN 802.11b/g/a/n signals from the vector signal generator to the device under test (DUT). The number of received packets can then be read using the chipset vendor's control software.



TRX Test Module

Waveform Parameter

802.11 Standard	Data Rate/Modulation	Bandwidth	Packet Length	Remarks
802.11b	11, 5.5, 2, 1 Mbps	–	1024 or 100 bytes	Long preamble
802.11a/g	54, 48, 36, 24, 18, 12, 9 and 6 Mbps	–	1000 or 100 bytes	
802.11n	MCS 0 to 7 and 32	20 MHz and 40 MHz	4096 or 500 bytes	Nss: 1, Guard interval: Long

802.11b RX Measurement

IEEE 802.11b RX Test

802.11b	Test Items
16.3.8.2	Receiver minimum input level sensitivity
16.3.8.3	Receiver maximum input level

802.11g/a/n RX Measurement

IEEE 802.11a/g/n RX Test

802.11a	802.11g	802.11n	Test Items
17.3.10.2	18.4.8.2	19.3.19.1	Receiver minimum input level sensitivity
17.3.10.5	18.4.8.4	19.3.19.4	Receiver maximum input level

WLAN Measurement Solution

WLAN 802.11ac TX Measurement **MX887031A** MU887000A/01A/02A
WLAN 802.11ac Waveforms **MV887031A** MU887000A/01A/02A

The MT8870A/MT8872A/MU88700xA supports non-signalling transmitter and receiver tests for all WLAN 802.11ac-compliant devices.
The 6 GHz Frequency Extension option MU887000A/01A-001 is required when using MU887000A/01A.

Transmitter Test

Installing the WLAN 802.11ac TX Measurement software MX887031A in the MT8870A/MT8872A supports in-band wireless measurements defined by the IEEE 802.11ac on all installed TRX test modules.

802.11ac TX Measurement

IEEE 802.11ac TX Test

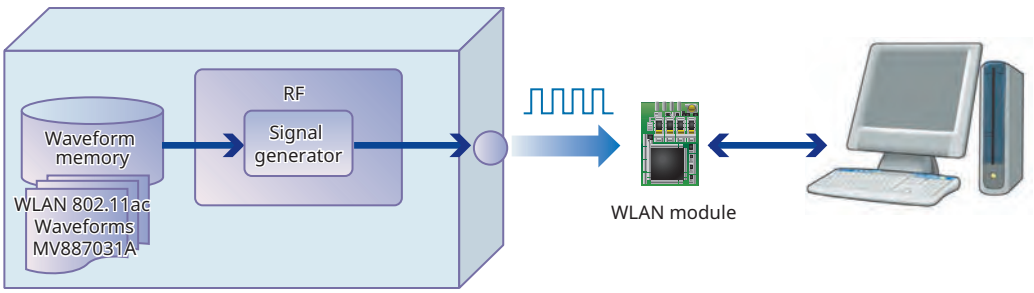
802.11ac	Test Items
21.3.17.1	Transmit spectrum mask
21.3.17.2	Spectral flatness
21.3.17.3	Transmit center frequency tolerance
21.3.17.3	Symbol Clock frequency tolerance
21.3.17.4	Modulation accuracy
21.3.17.4.2	Transmitter center frequency leakage
21.3.17.4.3	Transmitter constellation error
21.3.17.4.4	Transmitter modulation accuracy (EVM) test
	Transmit power level

Additional 802.11ac Measurements

Test Items
Power crest factor
CCDF
Occupied bandwidth
Power spectral density

Receiver Test

The MV887031A application provides support for transmission of WLAN 802.11ac signals from the vector signal generator to the device under test.
The number of received packets can then be read using the chipset vendor's control software.



TRX Test Module

Waveform Parameter

802.11 Standard	Data Rate/Modulation	Bandwidth	Packet Length	Remarks
802.11ac	MCS 0 to 9	20, 40, 80, 160 MHz	4096 or 500 bytes	Nss: 1, Guard interval: Long

802.11ac RX Measurement

IEEE 802.11ac RX Test

802.11ac	Test Items
21.3.18.1	Receiver minimum input level sensitivity
21.3.18.4	Receiver maximum input level

V2X Measurement Solution

WLAN 802.11p TX Measurement **MX887032A** MU887000A/01A/02A
WLAN 802.11p Waveforms **MV887032A** MU887000A/01A/02A

The MT8870A/MT8872A/MU88700xA supports non-signalling TRX tests for all WLAN 802.11p-compliant communications devices.
The 6 GHz Frequency Extension option MU887000A/01A-001 is required to measure 802.11p in 5.9 GHz band when using MU887000A/01A.

Transmitter Test

Installing the WLAN 802.11p TX Measurement software MX887032A in the MT8870A/MT8872A supports in-band wireless measurements for the 700 MHz and 5.9 GHz bands defined by IEEE 802.11p.

Using the CombiView PC application displays graphs of WLAN 802.11p TX measurements.

WLAN 802.11p TX Measurement using CombiView

802.11p TX Measurement

IEEE 802.11p TX Test

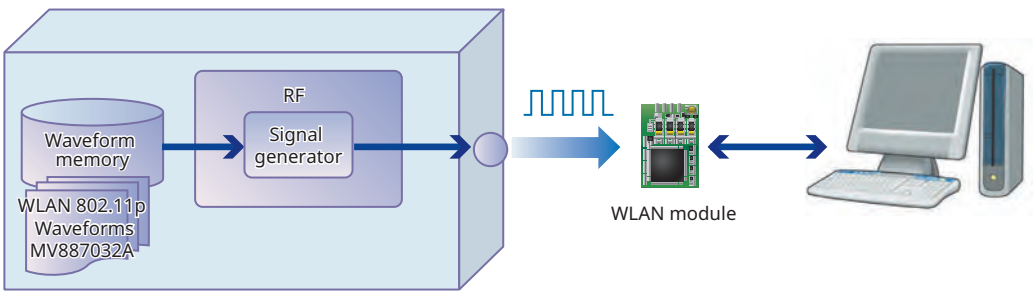
802.11p	Test Items
17.3.9.2	Transmit power levels
17.3.9.3	Transmit spectrum mask
17.3.9.5	Transmit center frequency tolerance
17.3.9.6	Symbol clock frequency tolerance
17.3.9.7.2	Transmitter center frequency leakage
17.3.9.7.3	Transmitter spectral flatness
17.3.9.7.4	Transmitter constellation error

Additional 802.11p Measurements

Test Items
Power crest factor
CCDF
Occupied bandwidth
Power spectral density

Receiver Test

The MV887032A supports non-signalling RX tests of WLAN 802.11p devices under test (DUT) by sending WLAN 802.11p test signals from the MU88700xA installed in the vector signal generator. Reading the number of packets received by the DUT requires the chipset vendor's control software.



TRX Test Module

Waveform Parameter

Bandwidth	Data Rate	Packet Length
5 MHz	1.5, 2.25, 3, 4.5, 6, 9, 12, 13.5 Mbps	1000 bytes
10 MHz	3, 4.5, 6, 9, 12, 18, 24, 27 Mbps	1000 bytes
20 MHz	6, 9, 12, 18, 24, 36, 48, 54 Mbps	1000 bytes

802.11p RX Measurement

IEEE 802.11p RX Test

802.11p	Test Items
17.3.10.2	Receiver minimum input sensitivity
17.3.10.5	Receiver maximum input level

V2X Measurement Solution

LTE-V2X Tx Measurement **MX887068A**
MU887000A/01A/02A

LTE-V2X PSCCH TX Measurement **MX887068A-001**
MU887000A/01A/02A

LTE-V2X Waveforms **MV887068A**
MU887000A/01A/02A

LTE-V2X Tx characteristics specified by 3GPP can be measured by installing the LTE-V2X Tx Measurement MX887068A software.

Tx Power
Frequency Deviation
Occupied Frequency Bandwidth
Spectrum Emission Mask
Adjacent Channel Leakage Power
Modulation Analysis

Installing the LTE-V2X PSCCH TX Measurement software MX887068A-001, measures the transmission characteristics including PSCCH. In addition, the bundled LTE-V2X Waveforms MV887068A package includes general RF test signal waveform files required for non-signaling manufacturing for easy output of RF test signals at manufacturing simply by selecting the waveform file.

LTE-V2X Tx Measurement using CombiView

WLAN MIMO Measurement Solution

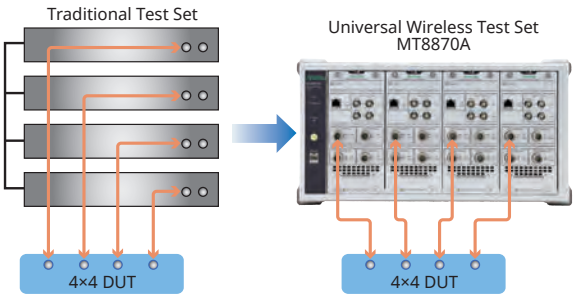
WLAN 802.11n/11ac MIMO Measurement Function MU887000A/01A/02A

Installing the MU88700xA*1 in the MT8870A/MT8872A with the installed WLAN TRX Measurement software supports easy set-up and measurement of up to 4×4 WLAN MIMO devices.

*1: Requires 6 GHz Frequency Extension option MU887000A/01A-001 when measuring WLAN 802.11n (5 GHz) or 802.11ac

Normally, measuring each antenna of a MIMO device (streaming) requires a system set-up composed of up to four measuring instruments of the same type as well as synchronized timing of the signal generators required for MIMO measurement and the 10-MHz reference signal generators, plus complex cable connections to control each measuring instrument.

This type of system set-up is not only troublesome for technicians performing MIMO measurements, but also wastes man hours and money. Integrating the MU88700xA into the MT8870A/MT8872A main frame solves the problems of synchronizing signals over external cables experienced with conventional MIMO measurement systems to simplify system set-up and slash time and costs.



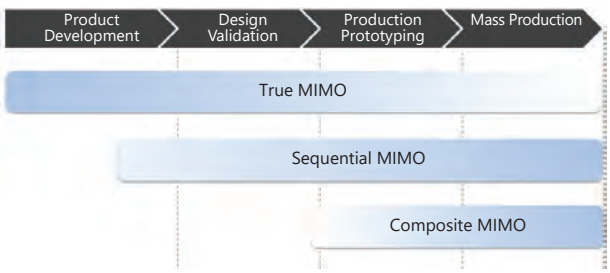
The MX887030A and MV887030A are required for WLAN 802.11n MIMO measurements.

The MX887031A and MV887031A are required for WLAN 802.11ac MIMO measurements*2.

*2: Supports up to 4×4 MIMO WLAN 802.11ac measurements

MIMO Measurement Solutions

The MT8870A/MT8872A is the ideal MIMO measurement solution for WLAN MIMO devices at every stage from R&D to production.



True MIMO MU887000A/01A/02A

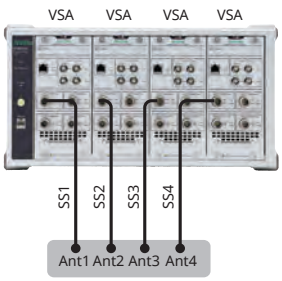
Features

The MT8870A/MT8872A supports parallel measurement of WLAN device streaming characteristics using multiple MU88700xA units installed in the main frame.

It is ideal for performing streaming measurements from each antenna under conditions closely mimicking a real usage environment at the R&D and design stages. There is no need for troublesome external cable connections, because the timing of each MU88700xA unit and the 10-MHz reference frequency are synchronized by the internal connections, offering easy True MIMO measurement.

Transmitter Test

- DUT transmits four MIMO signals simultaneously.
- MU88700xA in each slot tests each antenna (stream)
- Fully independent measurements with parallel processing by each MU88700xA
- Test results
  Each TX power (Cross power), EVM, Spectral mask, etc.



Test sequence:

Antenna 1
Antenna 2
Antenna 3
Antenna 4

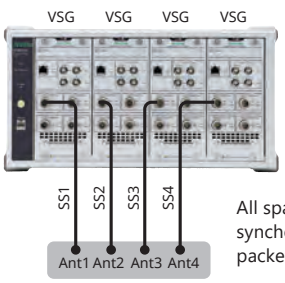
Test results:

Antenna 1: EVM_1, Power_1, Spectral mask_1 ...
Antenna 2: EVM_2, Power_2, Spectral mask_2 ...
Antenna 3: EVM_3, Power_3, Spectral mask_3 ...
Antenna 4: EVM_4, Power_4, Spectral mask_4 ...

Receiver Test

- Sends test packets for each antenna to TRX Test Module in each slot
- Test results
  RX sensitivity of each antenna
- Synchronization
  10-MHz reference frequency
  Digital timing

Note: RF local frequency sync. not supported



All spatial streams must be synchoronized to the start of the packet.

WLAN MIMO Measurement Solution (continued)

Sequential MIMO MU887000A/01A/02A

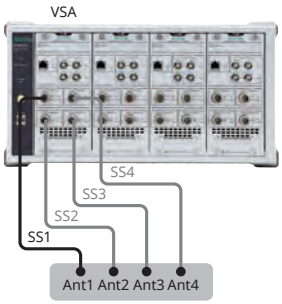
Features

WLAN device MIMO measurements at R&D design require stream measurements from each antenna. Although True MIMO measurement supports an environment in which each antenna is measured simultaneously in parallel, the cost is high because multiple MU88700xA units are required. Since one MU88700xA can support up to four test ports, the Sequential MIMO measurement functions helps cut costs by switching between antennas to perform accurate sequential measurement of each antenna of the MIMO device.

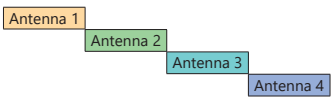
Transmitter Test

- DUT transmits four MIMO signals simultaneously
- MT8870A/MT8872A switches connected test port and performs TRX test at each antenna (stream)
- Test results
  Each TX power (Cross power*3), EVM, Spectral mask, etc.

*3: There are limitation on the combination of test ports used for cross power measurements.



Test sequence:

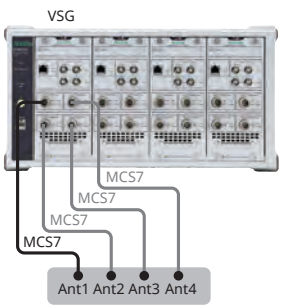


Test results:

Antenna 1: EVM_1, Power_1, Spectral mask_1 ...
Antenna 2: EVM_2, Power_2, Spectral mask_2 ...
Antenna 3: EVM_3, Power_3, Spectral mask_3 ...
Antenna 4: EVM_4, Power_4, Spectral mask_4 ...

Receiver Test

- MT8870A/MT8872A switches test port and sends test signal to each antenna to perform RX sensitivity test
- Waveform uses SISO signal
- Test results
  RX test for each antenna



Composite MIMO MU887000A/01A/02A

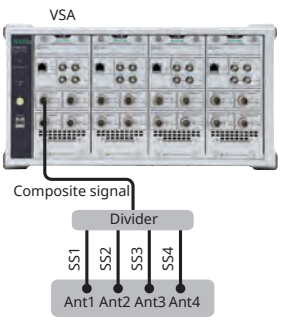
Features

Production-line operators urgently need ways to cut production costs by shortening tact times through reduced measurement times. MIMO device measurement methods currently focus on measuring each antenna one-by-one but viewed from the perspective of reduced tact time and lower costs, production lines could achieve better efficiency and profits with one single measurement of all MIMO device antennas instead of separate measurements of all antennas (total streaming). Installing the MT8870A/MT8872A with one MU88700xA supports use of the Composite MIMO measurement function to measure WLAN RF characteristics at one time by combining and dividing multiple MIMO signals using an external divider (combiner)*.

*: Recommended product
Mini-Circuits, ZN4PD1-63 + (Frequency range: 2000 MHz to 6000 MHz)

Transmitter Test

- DUT transmits three MIMO signals simultaneously
- MT8870A/MT8872A receives composite test signal via divider (combiner), which combines each streaming MIMO signal output from each antenna, and evaluates RF characteristics
- Test results
  Composite power (individual powers)
  Composite EVM and spectral mask values



Test sequence:

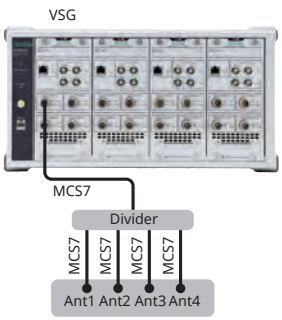
Composite

Test results:

EVM_Avg, Power_Avg, Spectral mask_Avg ...

Receiver Test

- Diversity test (SISO signal)
- Transmits test signal from MT8870A/MT8872A and splits into identical signals at divider (combiner) for input to each antenna
- Since same signal received by multiple antennas, performs better evaluation than RX sensitivity results obtained from one antenna
- Test results
  RX sensitivity (result is one value only; test specifications of sensitivity changed by number of antennas)



WLAN Measurement Solution

WLAN 802.11ax TX Measurement **MX887033A** MU887000A/01A/02A
WLAN 802.11ax Waveforms **MV887033A** MU887000A/01A/02A

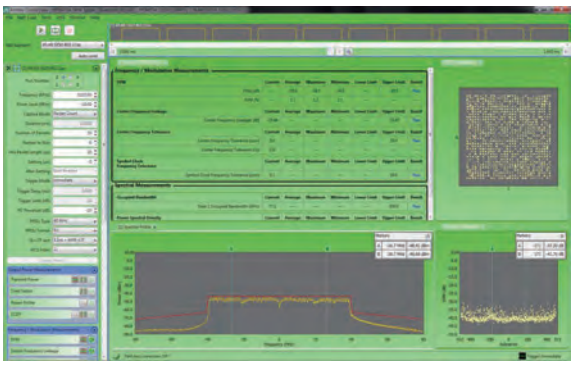
Non-signaling Tx and Rx tests of WLAN 802.11ax-compliant communications devices are supported.
The MU887000A/01A requires installation of the MU887000A/01A-001 option extending the frequency to 6 GHz.
The MU887002A requires installation of the MU887002A-007 option extending the frequency to 7 GHz.

	2.4-GHz/5-GHz Band	6-GHz Band
MU887000A/01A (with MU887000A/01A-001)	✓	
MU887002A	✓	
MU887002A (with MU887002A-007)	✓	✓

Transmitter Test

Installing the WLAN 802.11ax TX Measurement software MX887033A in the MT8870A/MT8872A supports in-band wireless measurements defined by the IEEE 802.11ax-2021 standard on all installed TRX test modules.
The 802.11ax 20/40/80/160 MHz bandwidths and 4096QAM (MCS12/13) modulation method are supported.

Using the CombiView PC application bundle displays graphs of 802.11ax TX measurements.



WLAN 11ax TX Measurement using CombiView

802.11 ax TX Measurement
IEEE 802.11ax-2021

Chapter	Measurement Item
27.3.19.1	Transmit spectral mask
27.3.19.2	Spectral flatness
27.3.19.3	Transmit center frequency and symbol clock frequency tolerance
27.3.19.4.2	Transmit center frequency leakage
27.3.19.4.3	Transmitter constellation error
27.3.19.4.4	Transmitter modulation accuracy (EVM) test

Receiver Test

The MV887033A application provides support for transmission of WLAN 802.11ax signals from the vector signal generator to the device under test. The number of received packets can then be read using the chipset vendor's control software.

Waveform Parameter

802.11 Standard	Data Rate/Modulation	Bandwidth	Packet Length	Remarks
802.11ax	MCS 0 to 13	20, 40, 80, 160 MHz	4096 bytes	Nss: 1, Guard interval: 800 ns

802.11 ax RX Measurement
IEEE 802.11ax-2021

Chapter	Measurement Item
27.3.20.2	Receiver minimum input sensitivity
27.3.20.5	Receiver maximum input level

WLAN Measurement Solution

WLAN 802.11be TX Measurement **MX887034A** MU887002A
WLAN 802.11be Waveforms **MV887034A** MU887002A

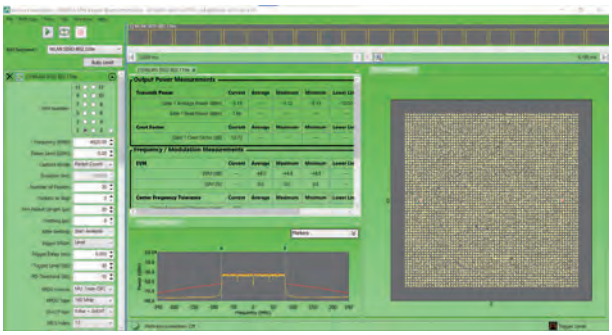
Non-signaling Tx and Rx tests of WLAN 802.11be-compliant communications devices are supported.

	2.4-GHz/5-GHz Band	6-GHz Band
MU887002A	✓	
MU887002A (with MU887002A-007)	✓	✓

Transmitter Test

Installing the WLAN 802.11be TX Measurement software MX887034A in the MT8870A/MT8872A supports in-band wireless measurements defined by the IEEE802.11be D2.0 standard on all installed TRX test modules.
The 802.11be 20/40/80/160/320 MHz bandwidths and 4096QAM (MCS12/13) modulation method are supported.

Using the CombiView PC application bundle displays graphs of 802.11be TX measurements.



WLAN 11be TX Measurement using CombiView

802.11 be TX Measurement
IEEE802.11be D2.0

Chapter	Measurement Item
36.3.19.1	Transmit spectral mask*
36.3.19.2	Spectral flatness
36.3.19.3	Transmit center frequency and symbol clock frequency tolerance
36.3.19.4.2	Transmit center frequency leakage
36.3.19.4.4	Transmitter modulation accuracy (EVM) test

Supports 20/40/80/160/320 MHz BW

* Excluding 320 MHz BW

Receiver Test

The MV887034A application provides support for transmission of WLAN 802.11be signals from the vector signal generator to the device under test. The number of received packets can then be read using the chipset vendor's control software.

Waveform Parameter

802.11 Standard	Data Rate/Modulation	Bandwidth	Packet Length	Remarks
802.11be	MCS 0 to 13	20, 40, 80, 160 MHz	4096 bytes	Nss: 1, Guard interval: 800 ns

802.11 be RX Measurement
IEEE Std 802.11be-D2.0

Chapter	Measurement Item
36.3.20.2	Receiver minimum input sensitivity
36.3.20.3	Adjacent channel rejection
36.3.20.4	Nonadjacent channel rejection
36.3.20.5	Receiver maximum input level

Bluetooth Measurement Solution

Bluetooth TX Measurement	**MX887040A**	MU887000A/01A/02A
DLE TX Measurement	**MX887040A-001**	MU887000A/01A/02A
2LE TX Measurement	**MX887040A-002**	MU887000A/01A/02A
BLR TX Measurement	**MX887040A-003**	MU887000A/01A/02A
BLE AoA/AoD TX Measurement	**MX887040A-004**	MU887000A/01A/02A

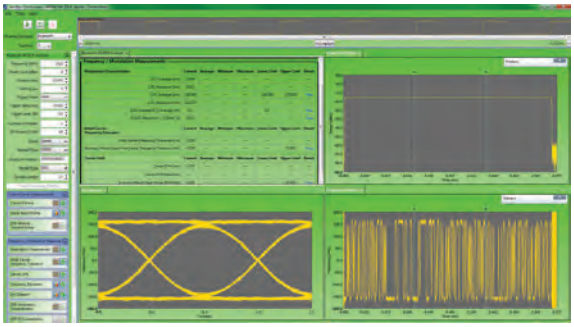
Bluetooth Waveforms	**MV887040A**	MU887000A/01A/02A
DLE Waveforms	**MV887040A-001**	MU887000A/01A/02A
2LE Waveforms	**MV887040A-002**	MU887000A/01A/02A
BLR Waveforms	**MV887040A-003**	MU887000A/01A/02A
BLE AoA/AoD Waveforms	**MV887040A-004**	MU887000A/01A/02A

The MT8870A/MT8872A/MU88700xA supports non-signalling transmitter and receiver tests for Basic Rate (BR), Enhanced Data Rate (EDR) and Bluetooth low-energy (BLE) devices.

Transmitter Test

The Bluetooth TX Measurement software MX887040A has two Bluetooth TX test modes. The SIG Standard mode measures TX test packets sent from the device under test according to the Bluetooth RF Test Specifications. In SIG standard mode, the system returns only measurements that are compatible with the payload type of the captured packets. In Speed Test mode, the system returns results for all enabled measurements regardless of the packet payload.

Because the Speed Test mode supports all BR/EDR measurements for individual packet types, it is ideal for rapid testing on production lines.



Bluetooth TX Measurement using CombiView

Bluetooth TX Measurement

Basic Rate and Enhanced Data Rate (EDR)

Basic Rate measurements and Enhanced Data Rate measurements made in compliance with Bluetooth RF Test Specification RF.TS.P31

Specification	Measurement Item
RF/TRM/CA/BV-01-C	[Output Power]
RF/TRM/CA/BV-03-C	[Power Control]
RF/TRM/CA/BV-05-C	[TX Output Spectrum – 20 dB Bandwidth]
RF/TRM/CA/BV-06-C	[TX Output Spectrum – Adjacent Channel Power]
RF/TRM/CA/BV-07-C	[Modulation Characteristics]
RF/TRM/CA/BV-08-C	[Initial Carrier Frequency Tolerance]
RF/TRM/CA/BV-09-C	[Carrier Frequency Drift]
RF/TRM/CA/BV-10-C	[EDR Relative Transmit Power]
RF/TRM/CA/BV-11-C	[EDR Carrier Frequency Stability and Modulation Accuracy]
RF/TRM/CA/BV-12-C	[EDR Differential Phase Encoding]
RF/TRM/CA/BV-13-C	[EDR In-band Spurious Emissions]*1
RF/TRM/CA/BV-14-C	[Enhanced Power Control]
RF/TRM/CA/BV-15-C	[EDR Guard Time]

*1: Can measure up to ±5 channels

Bluetooth Low Energy

Bluetooth low energy measurements made in compliance with Bluetooth RF Test Specification RF-PHY.TS.P16

Specification	Measurement Item	Required Option			
		MX887040A-001	MX887040A-002	MX887040A-003	MX887040A-004
RFPHY/TRM/BV-01-C	[Output power]	✓*3			
RFPHY/TRM/BV-03-C	[In-band emissions, uncoded data at 1 Ms/s]*2	✓*3			
RFPHY/TRM/BV-05-C	[Modulation Characteristics, uncoded data at 1 Ms/s]	✓*3			
RFPHY/TRM/BV-06-C	[Carrier frequency offset and drift, uncoded data at 1 Ms/s]	✓*3			
RFPHY/TRM/BV-08-C	[In-band emissions at 2 Ms/s]*2	✓	✓		
RFPHY/TRM/BV-09-C	[Stable Modulation Characteristics, uncoded data at 1 Ms/s]	✓*3			
RFPHY/TRM/BV-10-C	[Modulation Characteristics at 2 Ms/s]	✓	✓		
RFPHY/TRM/BV-11-C	[Stable Modulation Characteristics at 2 Ms/s]	✓	✓		
RFPHY/TRM/BV-12-C	[Carrier frequency offset and drift at 2 Ms/s]	✓	✓		
RFPHY/TRM/BV-13-C	[Modulation Characteristics, LE Coded (S = 8)]	✓		✓	
RFPHY/TRM/BV-14-C	[Carrier frequency offset and drift, LE Coded (S = 8)]	✓		✓	
RFPHY/TRM/BV-15-C	[Output power, With Constant Tone Extension]	✓	✓		✓
RFPHY/TRM/BV-16-C	[Carrier frequency offset and drift, uncoded data at 1 Ms/s, Constant Tone Extension]	✓	✓*4		✓
RFPHY/TRM/BV-17-C	[Carrier frequency offset and drift at 2 Ms/s, Constant Tone Extension]	✓	✓		✓
RFPHY/TRM/PS/BV-01-C	[Tx Power Stability, AoD Transmitter at 1 Ms/s with 2 µs Switching Slot]	✓	✓*4		✓
RFPHY/TRM/PS/BV-02-C	[Tx Power Stability, AoD Transmitter at 1 Ms/s with 1 µs Switching Slot]	✓	✓*4		✓
RFPHY/TRM/PS/BV-03-C	[Tx Power Stability, AoD Transmitter at 2 Ms/s with 2 µs Switching Slot]	✓	✓		✓
RFPHY/TRM/PS/BV-04-C	[Tx Power Stability, AoD Transmitter at 2 Ms/s with 1 µs Switching Slot]	✓	✓		✓

*2: Can measure BLE: ±5 channels, and 2LE: ±8 channels
*3: Required when measuring signal with PSDU Length >37 bytes
*4: Recommended Option

Graphical Displays (BR/BLE)

Graphs
Power Burst profile
Frequency deviation
Eye diagram
Spectral profile

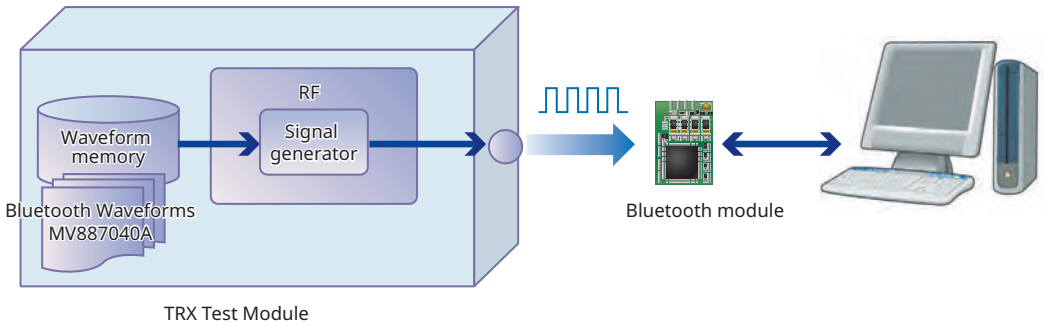
Graphical Displays (EDR)

Power burst profile
Frequency deviation
IQ constellation diagram
DEVM against symbol
Vector diagram
Spectral profile

Bluetooth Measurement Solution (continued)

Receiver Test

The MV887040A application provides support for transmission of Bluetooth signals from the vector signal generator to the device under test. The number of received packets can then be read using the chipset vendor's control software.



TRX Test Module

Standard Waveforms

Bluetooth	Waveform Type
Basic Rate (BR)	DH1/DH3/DH5
Enhanced Data Rate (EDR)	2-DH1/2-DH3/2-DH5/3-DH1/3-DH3/3-DH5
Bluetooth Low Energy (BLE)	BLE/PER Report Integrity Test
Others	GFSK/PSK CW (Interference Waveform)

Bluetooth RX Measurement

Basic Rate and Enhanced Data Rate (EDR)
Basic Rate measurements and Enhanced Data Rate measurements made in compliance with Bluetooth RF Test Specification RF.TS.P31

Specification	Measurement Item
RF/RCV/CA/BV-01-C	[Sensitivity – single slot packets]
RF/RCV/CA/BV-02-C	[Sensitivity - multi-slot packets]
RF/RCV/CA/BV-06-C	[Maximum Input Level]
RF/RCV/CA/BV-07-C	[EDR Sensitivity]
RF/RCV/CA/BV-08-C	[EDR BER Floor Performance]
RF/RCV/CA/BV-10-C	[EDR Maximum Input Level]

Bluetooth Low Energy
Bluetooth low energy measurements made in compliance with Bluetooth RF Test Specification RF-PHY.TS.P16

Specification	Measurement Item	Required Option		
		MV887040A-001	MV887040A-002	MV887040A-003
RF-PHY/RCV/BV-01-C	[Receiver sensitivity, uncoded data at 1 Ms/s]	✓*		
RF-PHY/RCV/BV-06-C	[Maximum input signal level, uncoded data at 1 Ms/s]	✓*		
RF-PHY/RCV/BV-07-C	[PER Report Integrity, uncoded data at 1 Ms/s]	✓*		
RF-PHY/RCV/BV-08-C	[Receiver sensitivity at 2 Ms/s]	✓	✓	
RF-PHY/RCV/BV-12-C	[Maximum input signal level at 2 Ms/s]	✓	✓	
RF-PHY/RCV/BV-13-C	[PER Report Integrity at 2 Ms/s]	✓	✓	
RF-PHY/RCV/BV-14-C	[Receiver Sensitivity, uncoded data at 1 Ms/s, Stable Modulation Index]	✓*		
RF-PHY/RCV/BV-18-C	[Maximum input signal level, uncoded data at 1 Ms/s, Stable Modulation Index]	✓*		
RF-PHY/RCV/BV-19-C	[PER Report Integrity, uncoded data at 1 Ms/s, Stable Modulation Index]	✓*		
RF-PHY/RCV/BV-20-C	[Receiver sensitivity at 2 Ms/s, Stable Modulation Index]	✓	✓	
RF-PHY/RCV/BV-24-C	[Maximum input signal level at 2 Ms/s, Stable Modulation Index]	✓	✓	
RF-PHY/RCV/BV-25-C	[PER Report Integrity at 2 Ms/s, Stable Modulation Index]	✓	✓	
RF-PHY/RCV/BV-26-C	[Receiver sensitivity, LE Coded (S = 2)]	✓		✓
RF-PHY/RCV/BV-27-C	[Receiver sensitivity, LE Coded (S = 8)]	✓		✓
RF-PHY/RCV/BV-30-C	[PER Report Integrity, LE Coded (S = 2)]	✓		✓
RF-PHY/RCV/BV-31-C	[PER Report Integrity, LE Coded (S = 8)]	✓		✓
RF-PHY/RCV/BV-32-C	[Receiver sensitivity, LE Coded (S = 2), Stable Modulation Index]	✓		✓
RF-PHY/RCV/BV-33-C	[Receiver sensitivity, LE Coded (S = 8), Stable Modulation Index]	✓		✓
RF-PHY/RCV/BV-36-C	[PER Report Integrity, LE Coded (S = 2), Stable Modulation Index]	✓		✓
RF-PHY/RCV/BV-37-C	[PER Report Integrity, LE Coded (S = 8), Stable Modulation Index]	✓		✓

*: Required when measuring signal with PSDU Length >37 bytes

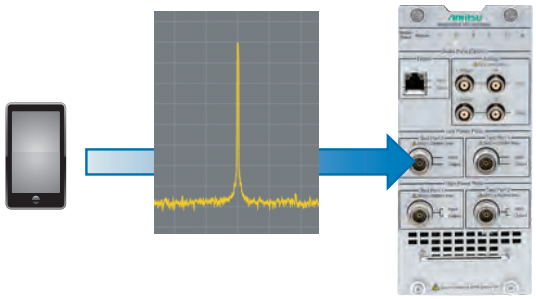
Simple Test Solution

Short Range Wireless Average Power and Frequency Measurement MX887050A MU887000A/01A/02A

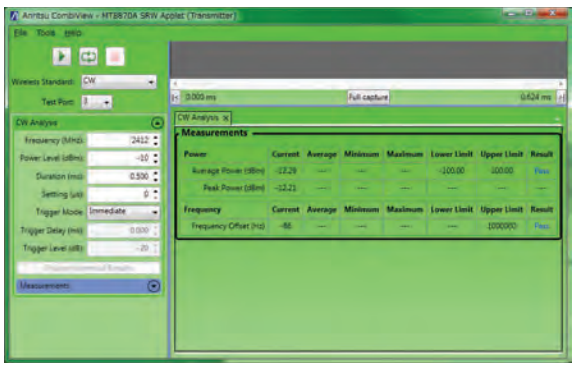
Installing the Short Range Wireless Average Power and Frequency Measurement software MX887050A in the MT8870A/MT8872A provides support for simple tests for WLAN and Bluetooth connectivity wireless. The MX887050A supports CW power and frequency measurements on unmodulated signals and on signals modulated using the methods shown in the table below.
MX887050A is also utilized for the RF calibration test of connectivity devices using unmodulated signals.

Supported Modulation Methods	
WLAN	DSSS, OFDM
Bluetooth	GFSK, PSK

For Simple Tests



Short Range Wireless Average Power and Frequency Measurement MX887050A



CW Measurement using CombiView

IEEE 802.15.4 Measurement Solution

IEEE 802.15.4 TX Measurement **MX887060A** MU887000A/01A/02A
IEEE 802.15.4 Waveforms **MV887060A** MU887000A/01A/02A

The MT8870A/MT8872A/MU88700xA support IEEE 802.15.4-recommended O-QPSK modulation signal TRX tests of communications devices.

Transmitter Test

Installing the IEEE 802.15.4 TX Measurement software MX887060A in the MT8870A/MT8872A supports measurement of the key TX characteristics recommended by the IEEE 802.15.4 standard released in 2011.

802.15.4 TX Measurement

IEEE 802.15.4 - 2011: 802.15.4 TX Measurements

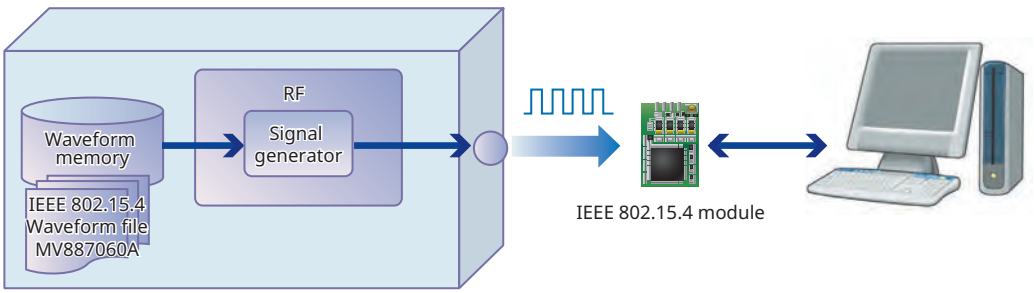
802.15.4	Test Items
10.3.2	Transmit power spectral density (PSD) mask
10.3.3	Symbol rate
10.3.7	RX-to-TX turnaround time
10.3.8	Error vector magnitude (EVM)
10.3.9	Transmit center frequency tolerance
10.3.10	Transmit power

Graphical Displays

Spectral mask
Constellation diagram
Power vs. Time

Receiver Test

With a vector signal generator built into the MU88700xA, transmitting the test signal from the selected package of IEEE 802.15.4 Waveforms MV887060A supports RX tests of IEEE 802.15.4 devices. The specified number of packets is sent from the MU88700xA to the device under test (DUT). The chipset developer's control software is required to capture packets received by the DUT.



TRX Test Module

Waveform Parameter

Waveform Name	Modulation	Band	Data Rate	Chip Rate	Filter	Signal Length
MV887060A_ZB2450_0001	O-QPSK	2450 MHz	250 kbps	2000 kchip/s	Half-sine	1664 chip
MV887060A_ZB2450_0002	O-QPSK	2450 MHz	250 kbps	2000 kchip/s	Half-sine	1024 chip
MV887060A_ZB915_0001	O-QPSK	915 MHz	250 kbps	1000 kchip/s	Half-sine	832 chip
MV887060A_ZB915_0002	O-QPSK	915 MHz	250 kbps	1000 kchip/s	Half-sine	1024 chip
MV887060A_ZB868_0001	O-QPSK	868 MHz	100 kbps	400 kchip/s	Half-sine	832 chip
MV887060A_ZB868_0002	O-QPSK	868 MHz	100 kbps	400 kchip/s	Half-sine	1024 chip
MV887060A_ZB780_0001	O-QPSK	780 MHz	250 kbps	1000 kchip/s	Raised cosine (roll-off 0.8)	832 chip
MV887060A_ZB780_0002	O-QPSK	780 MHz	250 kbps	1000 kchip/s	Raised cosine (roll-off 0.8)	1024 chip

802.15.4 RX Measurement

IEEE 802.15.4 - 2011: 802.15.4 RX Measurements

802.15.4	Test Items
10.3.4	Receiver sensitivity
10.3.11	Receiver maximum input level of required signal

Z-Wave Measurement Solution

Z-Wave TX Measurements **MX887061A** MU887000A/01A/02A
Z-Wave Waveforms **MV887061A** MU887000A/01A/02A
The MT8870A/MT8872A/MU88700xA supports non-signalling TRX tests of ITU-T G.9959-compliant communications devices.

Transmitter Test

Installing the Z-Wave TX Measurement software MX887061A in the MT8870A/MT8872A supports the key TX measurements defined by ITU-T G.9959 - 2012.

ITU-T G.9959 TX Measurement

ITU-T G.9959 2012 TX Measurements

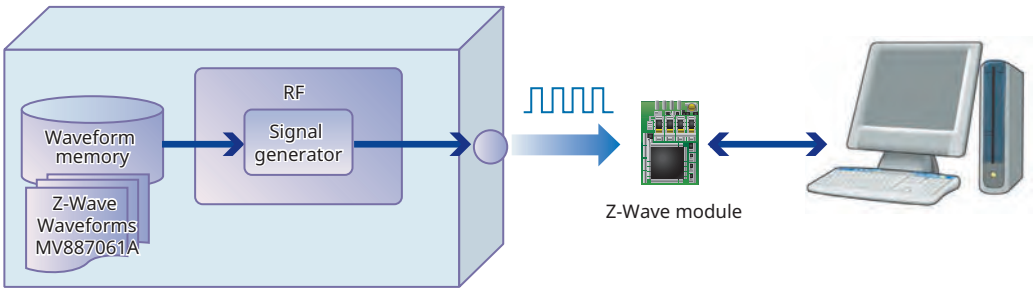
ITU-T G.9959	Test Items
7.1.2.2	Data rates
7.1.2.5.1	Transmit frequency error
7.1.2.5.2	Transmit power adjustments (conducted)

Graphical Displays

Data table
Power vs. Time
Frequency vs. Time

Receiver Test

The MV887061A supports RX tests of Z-Wave devices under test (DUT) by sending Z-Wave test signals from the MU88700xA installed in the vector signal generator. Reading the number of packets received by the DUT requires the chipset vendor's control software.



TRX Test Module

Waveform Parameter

Waveform Name	Modulation	Data Rate	Bit Rate	Symbol Rate	Filter	PPDU	Preamble Sequence	SFD	PSDU
MV887061A_ZW_R1_0001	2FSK	R1	9.6 kbps	19.2 kbaud	Gaussian (BT=1.0)	26 bytes (208 bits)	10 bytes	1 byte	14 bytes (incl. MPSU 4 bytes)
MV887061A_ZW_R2_0001	2FSK	R2	40 kbps	40 kbaud	Gaussian (BT=1.0)	35 bytes (280 bits)	20 bytes	1 byte	14b ytes (incl. MPSU 4 bytes)
MV887061A_ZW_R3_0001	2FSK	R3	100 kbps	100 kbaud	Gaussian (BT=0.6)	40 bytes (320 bits)	24 bytes	1 byte	15 bytes (incl. MPSU 4 bytes)
MV887061A_ZW_R1_0002	2FSK	R1	9.6 kbps	19.2 kbaud	Gaussian (BT=1.0)	76 bytes (608 bits)	10 bytes	1 byte	64 bytes (incl. MPSU 54 bytes)
MV887061A_ZW_R2_0002	2FSK	R2	40 kbps	40 kbaud	Gaussian (BT=1.0)	85 bytes (680 bits)	20 bytes	1 byte	64 bytes (incl. MPSU 54 bytes)
MV887061A_ZW_R3_0002	2FSK	R3	100 kbps	100 kbaud	Gaussian (BT=0.6)	211 bytes (1688 bits)	40 bytes	1 byte	170 bytes (incl. MPSU 159 bytes)

ITU-T G.9959 RX Measurement

ITU-T G.9959 2012 RX Measurement

802.15.4	Test Items
ITU-T G.9959	Test Items
7.1.2.5.3	Receiver sensitivity

Receiver Measurement Solution

MV8871xxA Series Waveforms

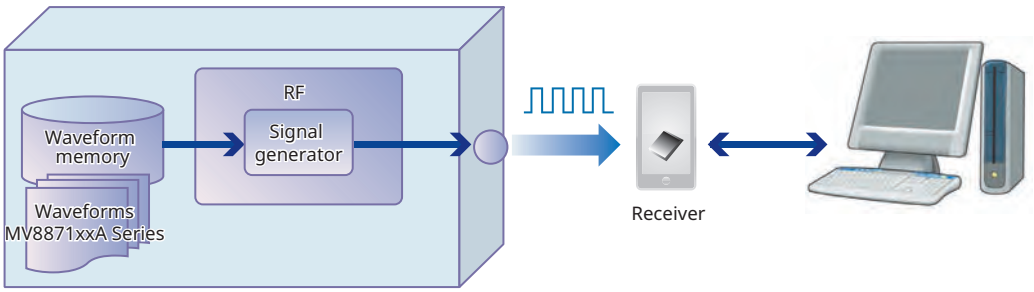
The MT8870A/MT8872A/MU88700xA supports RX tests of receivers using the various common communications technologies in widespread use today.

RX Test Using Waveforms

The Waveforms MV8871xxA series is a file of waveforms for generating any output waveform standardized by each communications technology. Saving and selecting these files in the internal waveform memory of the MU88700xA makes it easy to output a signal for any waveform pattern from the built-in vector signal generator.

Waveform file generated from the MU88700xA vector signal generator can be used to run sensitivity tests and simple BER RX tests* on GPS and digital broadcast equipment supporting mobile terminals and communications appliances.

*: An external attenuator is required when running RX tests at lower levels than the lower output limit of the signal generator.



TRX Test Module

Main Specifications of MV8871xxA Series Waveforms

GPS Waveforms MV887100A MU887000A/01A/02A

Waveform File Name	MV887100A_GPS_0002	MV887100A_GPS_0003
Application	Sensitivity test/BER measurement	Parity detection/Sensitivity test
Transmitted Data Modulation Method	BPSK	
Satellite ID Number	1	
Reference Standard	GLOBAL POSITIONING SYSTEM STANDARD POSITIONING SERVICE SIGNAL SPECIFICATION	

GPS L5 Waveforms MV887100A-002 MU887000A/01A/02A

Waveform File Name	MV887100A_GPS_0040
Application	Sensitivity test
Transmitted Data Modulation Method	BPSK
Satellite ID Number	1
Reference Standard	GLOBAL POSITIONING SYSTEM STANDARD POSITIONING SERVICE SIGNAL SPECIFICATION

*: MV887100A GPS waveforms license is required.

Galileo Waveforms MV887101A MU887000A/01A/02A

Waveform File Name	MV887101A_GALILEO_0001
Application	Parity detection/Sensitivity test
Transmitted Data Modulation Method	QPSK or CBOC (depending on selecting waveforms)
Satellite ID Number	1
Reference Standard	European GNSS (Galileo) Open Service Signal In Space Interface Control Document

GLONASS Waveforms MV887102A MU887000A/01A/02A

Waveform File Name	MV887102A_GLONASS_0001	MV887102A_GLONASS_010x MV887102A_GLONASS_011x
Application	Sensitivity test/BER measurement	Simultaneous GPS and GLONASS measurements*1, C/No measurements
Transmitted Data Modulation Method	BPSK	BPSK
Satellite ID Number	3	–
Reference Standard	INTERFACE CONTROL DOCUMENT Navigational radio signal In bands L1, L2 Edition 5.1	

*1: MV887100A GPS waveforms license is required to perform simultaneous GPS and GLONASS measurements.

BeiDou Waveform MV887103A MU887000A/01A/02A

Waveform File Name	MV887103A_BEIDOU_0002
Application	Parity detection/Sensitivity test
Transmitted Data Modulation Method	QPSK (Only I phase)
Satellite ID Number	1, 6 (depending on selected waveforms)
Reference Standard	BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal (Version 2.0)

QZSS Waveforms MV887104A MU887000A/01A/02A

Waveform File Name	MV887104A_QZSS_0001
Application	Parity detection/Sensitivity test/BER measurement
Transmitted Data Modulation Method	BPSK
Satellite ID Number	193
Reference Standard	Quasi-Zenith Satellite System Interface Specification

DVB-H Waveforms MV887110A MU887000A/01A/02A

Waveform File Name	MV887110A_DVBH_0001
Application	Simple BER measurement
Transmitted Data	PN9fix*2
Transmitted Data Modulation Method	QPSK
Encoding Rate	2/3
System Bandwidth	8 MHz
Cell ID	0x0000
Reference Standard	ETSI EN 300 744 V1.5.1 (2004-11)

*2: fix indicates the PN sequence is not continued if the waveform is regenerated from the first position.

Main Specifications of MV8871xxA Series Waveforms

ISDB-T Waveforms MV887111A MU887000A/01A/02A

Waveform File Name	MV887111A_ISDBT_0001	MV887111A_ISDBT_0002	MV887111A_ISDBT_0003	MV887111A_ISDBT_0004
Application	Device evaluation	Video and audio evaluation*3		Simple BER measurement
Waveform Cycle/Group	2 [Frame]	40 [Frame]	40 [Frame]	4 [Frame]
Transmitted Data	PN23fix*4			
Transmitted Data Modulation Method	Layer A: 64QAM and Layer A: QPSK Layer B: 64QAM	Layer A: QPSK Layer B: 64QAM		Layer A: QPSK or 16QAM Layer B: 64QAM
Guard Interval	1/8			
Encoding Rate	No Encoding	Layer A: 2/3 Layer B: 7/8	Layer A: 2/3 Layer B: 3/4	Layer A: 2/3 or 1/2 Layer B: 3/4 or 7/8
Mode	3			
Reference Standard	ARIB STD-B31			

*3: RX not guaranteed for all receivers
*4: fix indicates the PN sequence is not continued if the waveform is regenerated from the first position.

ISDB-Tmm Waveforms MV887112A MU887000A/01A

Waveform File Name	MV887112A_ISDBTmm_SSpatA_000x_0M (x = 1 to 6) MV887112A_ISDBTmm_SSpatA_000x_8M (x = 1 to 6) MV887112A_ISDBTmm_SSpatC_000x_0M (x = 7 to 12) MV887112A_ISDBTmm_SSpatC_000x_8M (x = 7 to 12) The XXXX_8M waveform pattern is a waveform with the file name XXXX_0M to which an 8-MHz offset has been added.
Application	Simple BER measurement
Waveform Cycle/Group	4 [Frame]
Transmitted Data	PN23fix*5
Transmitted Data Modulation Method	QPSK or 16QAM
Waveform Format	A type or C type
Guard Interval	1/4
Encoding Rate	1/2 or 2/3
Mode	3
Reference Standard	ARIB STD-B46

*5: fix indicates the PN sequence is not continued if the waveform is regenerated from the first position.

Consult Anritsu for details about each waveforms.

FM/RDS Measurement Solution

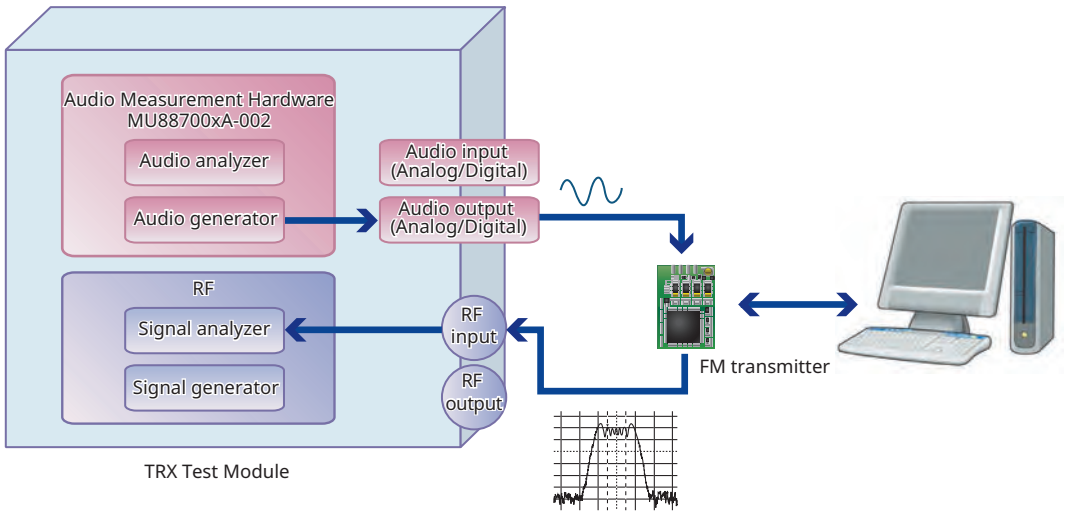
FM/Audio TRX Measurement **MX887070A** MU887000A/01A
FM RDS Waveforms **MV887070A** MU887000A/01A
(RDS: Radio Data System)

The MT8870A/MT8872A/MU88700xA supports TRX tests of FM transceivers and adding an option also supports audio tests.

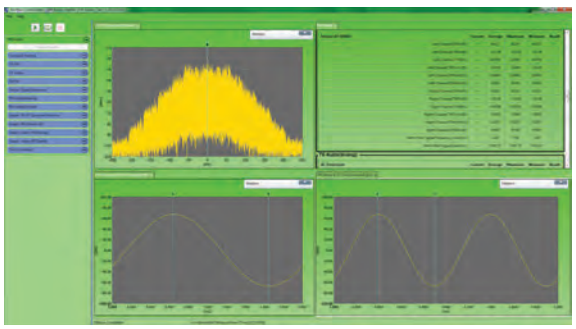
FM Transmitter Test

Installing the Audio Measurement Hardware MU887000A/01A-002 in the MU887000A/01A outputs either analog or digital format audio signals for up to 8 multi-tones (stereo left and right channels) from the output connector. The audio signal is available for input to the FM transmitter audio input connector.

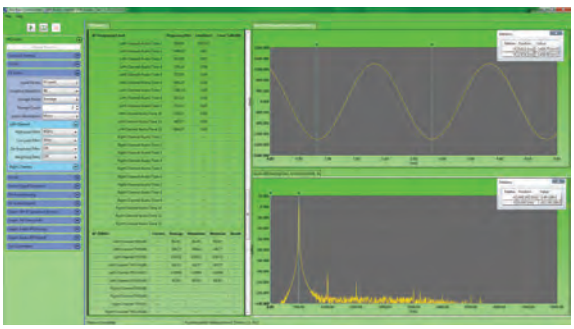
The FM/Audio TRX Measurement software MX887070A is used with the built-in signal analyzer of the MU887000A/01A to execute various audio tests, such as measurement of RF frequency, level and frequency deviation of audio FM signals output from FM transmitters, as well as AF signal frequency, level (up to 12 multi-tones), distortion, stereo crosstalk, etc., when using AF signal waveforms, and analysis of internal data and output of RDS data by decoding data when receiving RDS waveforms.



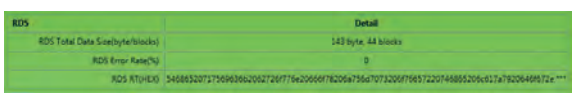
TRX Test Module



FM Transmitter Test using CombiView



FM Receiver Test using CombiView
(device audio output measurement)



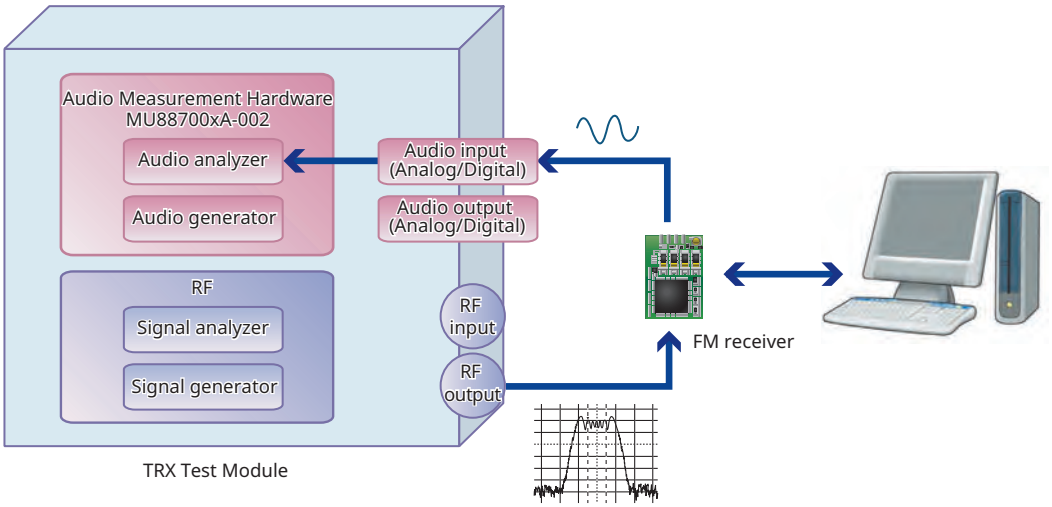
RDS Measurement Results using CombiView

FM/RDS Measurement Solution (continued)

FM Receiver Test

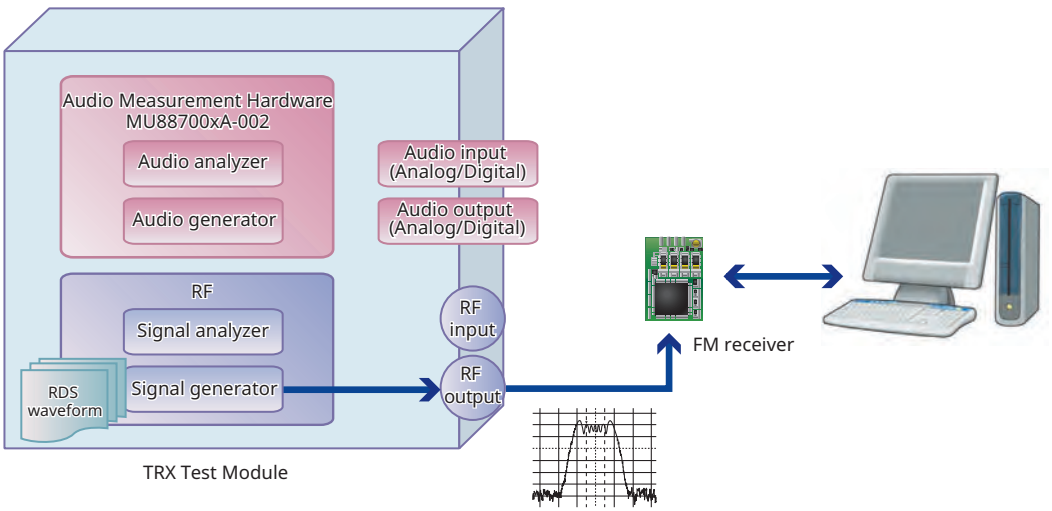
To test FM receivers using the FM/Audio TRX Measurement software MX887070A, the specified test audio signal is frequency modulated and a signal is output from the vector signal generator.

Installing the Audio Measurement Hardware MU887000A/01A-002 in the MU887000A/01A inputs either analog or digital format audio signals output from the FM receiver to the built-in audio analyzer of the MU887000A/01A to perform audio tests including AF signal frequency and level (up to 12 multi-tones), distortion rate, stereo crosstalk, etc.



FM Receiver Test RDS (Radio Data System)

Loading the FM RDS Waveforms MV887070A supports output of waveforms including transmitted data such as radio text data from the built-in vector signal generator based on the FM RDS (Radio Data System) standard.



Main Specifications of FM RDS Waveforms

Waveform File Name		MV887070A_FMRDS_0001	MV887070A_FMRDS_0002	MV887070A_FMRDS_0003	MV887070A_FMRDS_0004
Application		DUT RDS RX function test			DUT RX test
AF Left Channel	Tone Count	1			
	Tone Frequency	1 kHz			
	Tone Deviation	75 kHz × 0.9			
AF Right Channel	Tone Count	1			
	Tone Frequency	2 kHz			
	Tone Deviation	75 kHz × 0.9			
Pilot Deviation		75 kHz × 0.1			
RDS Deviation		75 kHz × 0.05			
Reference Standard		IEC 62106 Edition 2.0			

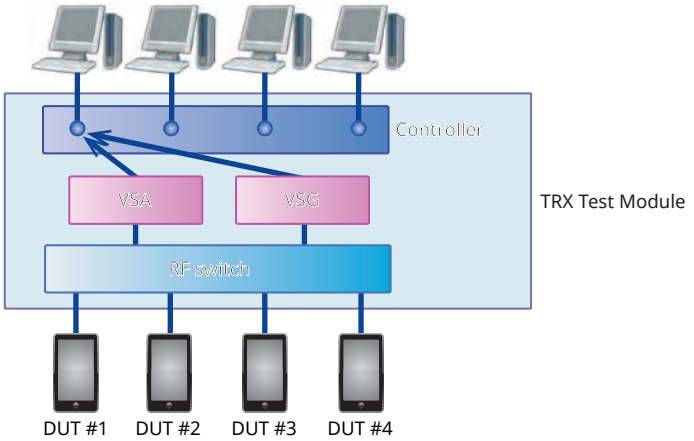
Consult Anritsu for details about the FM RDS waveform file.

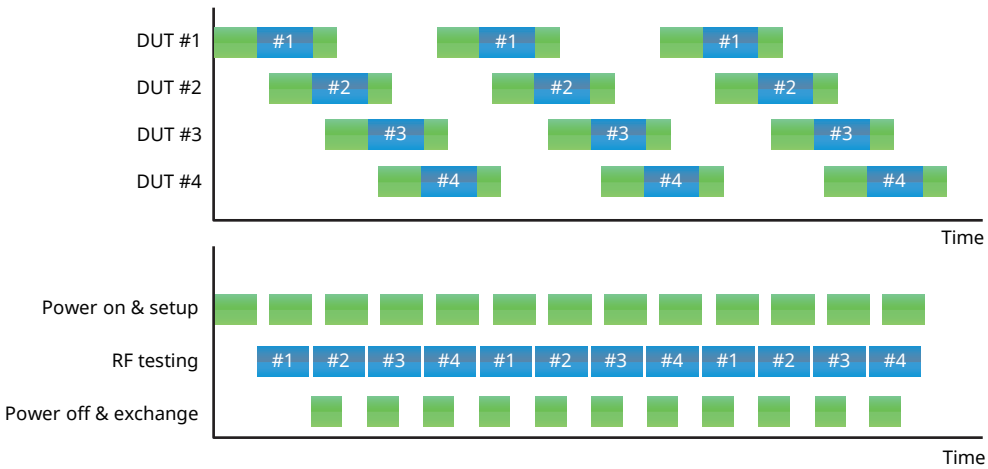
High Speed Measurement Solution

Multi-DUT Measurement Scheduler MX887090A MU887000A/01A/02A

Installing the Multi-DUT Measurement Scheduler software MX887090A in one MU88700xA with built-in dedicated control offers functions for operating multiple measurement systems virtually by managing software and hardware. Optimizing measuring instrument operations like this helps cut DUT production costs.

*: Multi-DUT Measurement Scheduler software does not support for W-CDMA/HSPA Downlink TX Measurement MX887021A, LTE FDD Downlink TX Measurement MX887023A, FM/Audio TRX Measurement MX887070A.

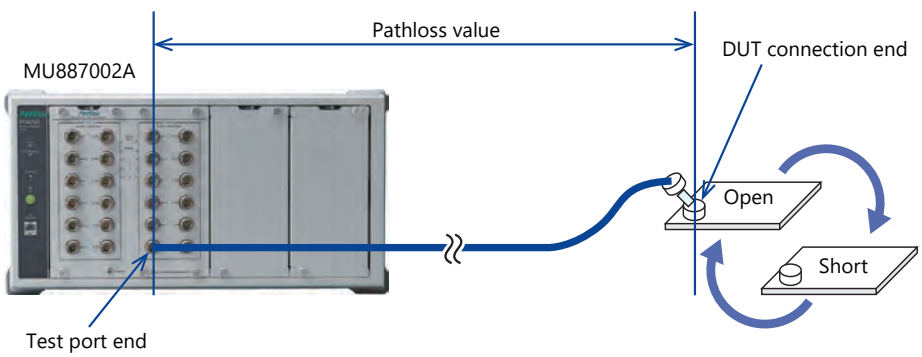




Pathloss Measurement Function for MU887002A MX887092A MU887002A

The MX887092A Pathloss Measurement Function provides the function to measure the path loss value from the test port end of the MU887002A to the connection end of the DUT by connecting the Open and Short devices alternately to the DUT and measuring the reflection signals from them.

*: Open/Short devices connected to the DUT connector are asked to be prepared by customer.



f : frequency
p: level/power

Electrical Characteristics

Number of Slots	4
Internal Reference Oscillator	Starting characteristics 25°C, Referenced to frequency at 24-hour after power-on ±5 × 10^{-7} (2 minutes after power-on) ±5 × 10^{-8} (5 minutes after power-on) Aging rate: ±1 × 10^{-7}/year Temperature characteristics: ±2 × 10^{-8} (+5°C to +45°C) Initial calibration accuracy +20°C to +30°C, 1 hour after power-on ±2.2 × 10^{-8}
Connector	External reference input Connector: BNC-J (rear panel), 50Ω (Nom.) Frequency: 10 MHz Operating range: ±1 ppm Input level: –15 to +20 dBm, 50Ω (AC coupling) Reference signal output Connector: BNC-J (rear panel), 50Ω (Nom.) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling) Trigger Input/Output switching: Trigger input/output selectable Connector: BNC-J (rear panel, 4 ports) Input/Output level: TTL level Ethernet controller Control from external controller (excluding power-on/off) Ethernet (1000BASE-T) Connector: RJ-45 (front panel, rear panel) GPIB (with MT8870A-001) Connector: IEEE488 bus connector (rear panel, 4 ports) AUX Connector: 50-pin (correspond to DX10BM-50S, rear panel)

General

Dimensions and Mass		426 (W) × 221.5 (H) × 498 (D) mm (excluding projections) ≤11.5 kg (excluding all options and test modules) ≤30.0 kg (including options and test modules)
Power Supply		Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC Frequency: 50 Hz/60 Hz Power consumption: ≤900 VA (including all options and test modules)
Temperature Range		+5°C to +45°C (operating), –20°C to +60°C (storage)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

Electrical Characteristics

Number of Slots	2
Internal Reference Oscillator	Starting characteristics 25°C, Referenced to frequency at 24-hour after power-on ±5 × 10^{-7} (2 minutes after power-on) ±5 × 10^{-8} (5 minutes after power-on) Aging rate: ±1 × 10^{-7}/year Temperature characteristics: ±2 × 10^{-8} (5°C to 45°C)
Connector	External Reference Input Connector: BNC-J (Rear panel), 50Ω (Nom.) Frequency: 10 MHz Operating range: ±1 ppm Input level: –15 to +20 dBm, 50Ω (AC coupling)
	Reference Signal Output Connector: BNC-J (Rear panel), 50Ω (Nom.) Frequency: 10 MHz Output level: ≥0 dBm (AC coupling)
	Trigger Input/Output switching: Trigger Input/Output selectable Connector: BNC-J (Rear panel: 2 ports) Input/Output level: TTL level
	Ethernet Controller Control from external controller (Excluding power-On/Off) Ethernet (1000BASE-T) Connector: RJ-45 (Front panel, Rear panel) GPIB (With MT8872A-001) Connector: IEEE488 bus connector (Rear panel: 2 ports) Aux Connector: 50-pin (Correspond to DX10BM-50S, Rear panel)

General

Dimensions and Mass		250 (W) × 221.5 (H) × 498 (D) mm (Exclusive of surface projections) ≤9.5 kg (Excluding all options and modules) <18.0 kg (Including options and modules)
Power Supply		Power voltage: 100 VAC to 120 VAC/200 VAC to 240 VAC Frequency: 50 Hz/60 Hz Power consumption: ≤500 VA (Including all options and modules)
Temperature Range		+5°C to +45°C (Operating), –20°C to +60°C (Storage)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

Input/Output Connector

RF Test Ports	Number of ports 4 Connector N (female) Impedance 50Ω (Nom.) VSWR Test port 1 and 2 <1.5 (10 MHz ≤ f < 400 MHz) <1.2 (400 MHz ≤ f ≤ 2.7 GHz) <1.3 (2.7 GHz < f ≤ 3.8 GHz) <1.5 (3.8 GHz < f ≤ 6.0 GHz) Test port 3 and 4 <1.8 (10 MHz ≤ f < 30 MHz) <1.5 (30 MHz ≤ f ≤ 3.8 GHz) <1.6 (3.8 GHz < f ≤ 6.0 GHz) Maximum input level +35 dBm (Test port 1 and 2) +25 dBm (Test port 3 and 4)
AF Test Ports	Ports Analog port, Digital port Connector Analog port: BNC (female) Digital port: RJ-45

Signal Generator

Frequency	Setting range 10 MHz to 3.8 GHz 10 MHz to 6.0 GHz (with MU887000A-001) Setting Resolution 1 Hz Accuracy Depends on MT8870A reference oscillator accuracy
Amplitude	Setting range Test port 1 and 2 –130 to –10 dBm (≤3.8 GHz) –130 to –18 dBm (>3.8 GHz) Test port 3 and 4 –120 to 0 dBm (≤3.8 GHz) –120 to –8 dBm (>3.8 GHz) Setting Resolution 0.1 dB Accuracy CW, After CAL, 10°C to 40°C Test port 1 and 2 Output level: ≥–120 dBm (≤3.8 GHz), ≥–100 dBm (>3.8 GHz) ±1.3 dB (10 MHz ≤ f < 400 MHz) (Signal Analyzer input level: +15 dBm) ±1.0 dB, ±0.7 dB (typ.) (400 MHz ≤ f ≤ 3.8 GHz) ±1.3 dB, ±1.0 dB (typ.) (3.8 GHz < f ≤ 6.0 GHz) Test port 3 and 4 Output level: ≥ –110 dBm ±1.3 dB (10 MHz ≤ f < 400 MHz) ±1.0 dB, ±0.7 dB (typ.) (400 MHz ≤ f ≤ 3.8 GHz) ±1.3 dB, ±0.7 dB (typ.) (3.8 GHz < f ≤ 6.0 GHz)
Spurious Response	Harmonic distortion <–25 dBc
Vector Modulation	Bandwidth 160 MHz (max.)

TRX Test Module MU887000A Specifications

Signal Analyzer

Frequency	Setting range 10 MHz to 3.8 GHz 10 MHz to 6.0 GHz (with MU887000A-001) Setting resolution 1 Hz Measurement resolution 0.1 Hz
Amplitude	Setting range CW Test port 1 and 2 –65 to +15 dBm (10 MHz ≤ f < 350 MHz) –65 to +35 dBm (350 MHz ≤ f ≤ 6.0 GHz) Test port 3 and 4 –65 to +15 dBm (10 MHz ≤ f < 350 MHz) –65 to +25 dBm (350 MHz ≤ f ≤ 6.0 GHz) Setting resolution 0.1 dB Measurement resolution 0.01 dB Accuracy CW, After CAL, Measurement bandwidth: 300 kHz, RBW: 100 kHz Test port 1 and 2 10 MHz ≤ f < 400 MHz, Signal Generator: Off, +10°C to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +15 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 400 MHz ≤ f ≤ 3.8 GHz, +10°C to +40°C ±0.3 dB (typ.), ±0.5 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.7 dB (–55 dBm ≤ p < –30 dBm) ±0.9 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f ≤ 6.0 GHz, +20°C to +30°C ±0.7 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) Test port 3 and 4 10 MHz ≤ f < 400 MHz, +10°C to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +15 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 400 MHz ≤ f ≤ 3.8 GHz, +10°C to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f ≤ 6.0 GHz, +20°C to +30°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) Linearity CW, Measurement bandwidth: 300 kHz, RBW: 100 kHz ±0.2 dB (0 to –40 dB, ≥ –55 dBm) ±0.4 dB (0 to –40 dB, ≥ –65 dBm)
Modulation Analysis	Maximum bandwidth 25 MHz (10 MHz ≤ f < 500 MHz) 80 MHz (500 MHz ≤ f < 1.9 GHz) 160 MHz (1.9 GHz ≤ f ≤ 6.0 GHz)

General

Interface		Trigger Trigger signals input/output at trigger connectors (rear panel) Remote control Ethernet: via MT8870A interface GPIB: with MT8870A GPIB option (MT8870A-001) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Dimensions and Mass		90 (W) × 193.6 (H) × 325 (D) mm (excluding projections) ≤5 kg (including options)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

TRX Test Module MU887001A Specifications

Audio Measurement Hardware MU887000A-002

Analog Audio	Audio generator Frequency range: 20 Hz to 20 kHz Output level range: 0 (off), 1 mV to 5 Vpeak (100 kΩ termination) Impedance: 1Ω (AC coupling) (Nom.) Audio analyzer Frequency range: 20 Hz to 20 kHz Input level range: 1 mVpeak to 5 Vpeak (30 V rms max.) Impedance: 100 kΩ (AC coupling)
Digital Audio	Audio generator Frequency range: 20 Hz to 20 kHz (Sampling rate: 44.1 kHz, 48 kHz) 20 Hz to 14 kHz (Sampling rate: 32 kHz) 20 Hz to 7 kHz (Sampling rate: 16 kHz) Bit resolution: 16 bits/24 bits Audio analyzer Sampling rate: 16, 32, 44.1, 48 kHz Bit resolution: 16 bits/24 bits

Input/Output Connector

RF Test Ports	Number of ports 4 Connector N (female) Impedance 50Ω (Nom.) VSWR <1.5 (10 MHz ≤ f < 400 MHz) <1.2 (400 MHz ≤ f ≤ 2.7 GHz) <1.3 (2.7 GHz < f ≤ 3.8 GHz) <1.5 (3.8 GHz < f ≤ 6.0 GHz) Maximum input level +35 dBm
AF Test Ports	Ports Analog port, Digital port Connector Analog port: BNC (female) Digital port: RJ-45

Signal Generator

Frequency	Setting range 10 MHz to 3.8 GHz 10 MHz to 6.0 GHz (with MU887001A-001) Setting Resolution 1 Hz Accuracy Depends on MT8870A reference oscillator accuracy
Amplitude	Setting range –130 to –10 dBm (≤3.8 GHz) –130 to –18 dBm (>3.8 GHz) Setting Resolution 0.1 dB Accuracy CW, After CAL, 10°C to 40°C Output level: ≥–120 dBm (≤3.8 GHz), ≥–100 dBm (>3.8 GHz) ±1.3 dB (10 MHz ≤ f < 400 MHz) (Signal Analyzer input level: +15 dBm) ±1.0 dB, ±0.7 dB (typ.) (400 MHz ≤ f ≤ 3.8 GHz) ±1.3 dB, ±1.0 dB (typ.) (3.8 GHz < f ≤ 6.0 GHz)
Spurious Response	Harmonic distortion <–25 dBc
Vector Modulation	Bandwidth 160 MHz (max.)

Signal Analyzer

Frequency	Setting range 10 MHz to 3.8 GHz 10 MHz to 6.0 GHz (with MU887001A-001) Setting resolution 1 Hz Measurement resolution 0.1 Hz
Amplitude	Setting range CW –65 to +15 dBm (10 MHz ≤ f < 350 MHz) –65 to +35 dBm (350 MHz ≤ f ≤ 6.0 GHz) Setting resolution 0.1 dB Measurement resolution 0.01 dB Accuracy CW, After CAL, Measurement bandwidth: 300 kHz, RBW: 100 kHz 10 MHz ≤ f < 400 MHz, Signal Generator: Off, +10°C to +40°C ±0.7 dB (–30 dBm ≤ p ≤ +15 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 400 MHz ≤ f ≤ 3.8 GHz, +10°C to +40°C ±0.3 dB (typ.), ±0.5 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.7 dB (–55 dBm ≤ p < –30 dBm) ±0.9 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f ≤ 6.0 GHz, +20°C to +30°C ±0.7 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) Linearity CW, Measurement bandwidth: 300 kHz, RBW: 100 kHz ±0.2 dB (0 to –40 dB, ≥ –55 dBm) ±0.4 dB (0 to –40 dB, ≥ –65 dBm)
Modulation Analysis	Maximum bandwidth 25 MHz (10 MHz ≤ f < 500 MHz) 80 MHz (500 MHz ≤ f < 1.9 GHz) 160 MHz (1.9 GHz ≤ f ≤ 6.0 GHz)

General

Interface		Trigger Trigger signals input/output at trigger connectors (rear panel) Remote control Ethernet: via MT8870A interface GPIB: with MT8870A GPIB option (MT8870A-001) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Dimensions and Mass		90 (W) × 193.6 (H) × 325 (D) mm (excluding projections) ≤5 kg (including options)
CE	EMC	2014/30/EU, EN61326-1, EN61000-3-2
	LVD	2014/35/EU, EN61010-1
	RoHS	2011/65/EU, (EU) 2015/863, EN IEC 63000: 2018
UKCA	EMC	S.I. 2016 No.1091, EN 61326-1, EN61000-3-2
	LVD	S.I. 2016 No.1101, EN 61010-1
	RoHS	S.I. 2012 No.3032, EN IEC 63000:2018

Audio Measurement Hardware MU887001A-002

Analog Audio	Audio generator Frequency range: 20 Hz to 20 kHz Output level range: 0 (off), 1 mV to 5 Vpeak (100 kΩ termination) Impedance: 1Ω (AC coupling) (Nom.) Audio analyzer Frequency range: 20 Hz to 20 kHz Input level range: 1 mVpeak to 5 Vpeak (30 V rms max.) Impedance: 100 kΩ (AC coupling)
Digital Audio	Audio generator Frequency range: 20 Hz to 20 kHz (Sampling rate: 44.1 kHz, 48 kHz) 20 Hz to 14 kHz (Sampling rate: 32 kHz) 20 Hz to 7 kHz (Sampling rate: 16 kHz) Bit resolution: 16 bits/24 bits Audio analyzer Sampling rate: 16, 32, 44.1, 48 kHz Bit resolution: 16 bits/24 bits

TRX Test Module MU887002A Specifications

I/O Connectors

RF Test Ports	Number of ports TRX1: 12 TRX2: 12 Connectors N (female) Impedance 50 Ω (Nom.) VSWR <1.4 (20°C to 30°C) 400 MHz ≤ f < 450 MHz <1.3 (20°C to 30°C) 450 MHz ≤ f ≤ 2700 MHz <1.4 (20°C to 30°C) 2700 MHz < f ≤ 3800 MHz <1.4 (20°C to 30°C) 3800 MHz < f ≤ 6000 MHz Test ports 5 to 12 when MU887002A-007 installed Setting frequency <5900 MHz <1.4 (20°C to 30°C) 400 MHz ≤ f < 450 MHz <1.3 (20°C to 30°C) 450 MHz ≤ f ≤ 2700 MHz <1.4 (20°C to 30°C) 2700 MHz < f ≤ 3800 MHz <1.4 (20°C to 30°C) 3800 MHz < f < 6000 MHz Setting frequency ≥5900 MHz <1.7 (20°C to 30°C) 5800 MHz ≤ f ≤ 7400 MHz Max. input level +35 dBm +30 dBm (when MU887002A-007 installed, Test port 5 to 12, f ≥ 5900 MHz)

Signal Generator

Frequency	Setting range 400 MHz to 6.0 GHz 400 MHz to 7.3 GHz (test ports 5 to 12 when MU887002A-007 installed) Resolution 1 Hz Accuracy Depends on MT8870A reference oscillator accuracy
Amplitude	Setting range –130 to 0 dBm Assured upper range –5 dBm (≤3.8 GHz) –8 dBm (>3.8 GHz) Test ports 5 to 12 when MU887002A-007 installed –5 dBm (400 MHz ≤ f ≤ 3.8 GHz) –8 dBm (3.8 GHz < f < 5.9 GHz) –10 dBm (f ≥ 5.9 GHz) * RMS value at modulation wave Resolution 0.1 dB Accuracy CW, after CAL, 20°C to 30°C ±0.7 dB (typ.) (–120 dBm ≤ p ≤ 0 dBm), ±1.0 dB (–120 dBm ≤ p ≤ –5 dBm), 400 MHz ≤ f ≤ 3800 MHz ±1.0 dB (typ.) (–100 dBm ≤ p ≤ 0 dBm), ±1.3 dB (–100 dBm ≤ p ≤ –8 dBm), 3800 MHz < f ≤ 6000 MHz when MU887000A-007 installed, Test port 5 to 12 ±0.7 dB (typ.) (–120 dBm ≤ p ≤ 0 dBm), ±1.0 dB (–120 dBm ≤ p ≤ –5 dBm), 400 MHz ≤ f ≤ 3800 MHz ±1.0 dB (typ.) (–100 dBm ≤ p ≤ 0 dBm), ±1.3 dB (–100 dBm ≤ p ≤ –8 dBm), 3800 MHz < f < 5900 MHz ±1.0 dB (typ.) (–100 dBm ≤ p ≤ 0 dBm), ±1.3 dB (–100 dBm ≤ p ≤ –10 dBm), 5900 MHz ≤ f ≤ 7300 MHz
Level Linearity at Cable Loss Setting	At Broadcast with different cable loss value at each test port Referenced to 0 dB cable loss ±0.2 dB (typ.) However, difference in values of loss-calibration cables between test ports: ≤8 dB
Output Level Deviation	Broadcast ≤0.6 dB (Nom.)
Spurious	Harmonic distortion CW, 800 MHz ≤ Harmonic Frequency ≤ 6.0 GHz, –120 dBm ≤ p ≤ –5 dBm, 20°C to 30°C <–25 dBc CW, 800 MHz ≤ Harmonic Frequency ≤ 7.3 GHz (test ports 5 to 12 when MU887002A-007 installed), –120 dBm ≤ p ≤ –5 dBm, 20°C to 30°C <–25 dBc
Vector Modulation	Bandwidth 200 MHz (max.)

TRX Test Module MU887002A Specifications

Signal Analyzer

Frequency	Setting range 400 MHz to 6.0 GHz 400 MHz to 7.3 GHz (test ports 5 to 12 when MU887002A-007 installed) Setting resolution 1 Hz Measurement resolution 0.1 Hz
Amplitude	Setting range CW Test ports 1 to 12, test ports 1 to 4 when MU887000A-007 installed –65 to +35 dBm (400 MHz ≤ f ≤ 6.0 GHz) Test ports 5 to 12 when MU887000A-007 installed –65 to +35 dBm (400 MHz ≤ f < 5.9 GHz) –65 to +30 dBm (5.9 GHz ≤ f ≤ 7.3 GHz) Setting resolution 0.1 dB Measurement resolution 0.01 dB Accuracy CW, Measurement bandwidth: 300 kHz, RBW: 100 kHz, after CAL, 20°C to 30°C Test ports 1 to 12, test ports 1 to 4 when MU887000A-007 installed 400 MHz ≤ f ≤ 3.8 GHz ±0.3 dB Typ. ±0.5 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.7 dB (–55 dBm ≤ p < –30 dBm) ±0.9 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f ≤ 6.0 GHz ±0.7 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) Test ports 5 to 12 when MU887000A-007 installed 400 MHz ≤ f ≤ 3.8 GHz ±0.3 dB Typ. ±0.5 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.7 dB (–55 dBm ≤ p < –30 dBm) ±0.9 dB (–65 dBm ≤ p < –55 dBm) 3.8 GHz < f < 5.9 GHz ±0.7 dB (–30 dBm ≤ p ≤ +35 dBm) ±0.9 dB (–55 dBm ≤ p < –30 dBm) ±1.1 dB (–65 dBm ≤ p < –55 dBm) 5.9 GHz ≤ f ≤ 7.3 GHz ±1.0 dB (–30 dBm ≤ p ≤ +30 dBm) ±1.2 dB (–55 dBm ≤ p < –30 dBm) ±1.8 dB (–65 dBm ≤ p < –55 dBm) Linearity CW, Measurement bandwidth: 300 kHz, RBW: 100 kHz, after CAL, 20°C to 30°C 400 MHz ≤ f ≤ 7.3 GHz ±0.2 dB (0 to –40 dB, ≥ –55 dBm) ±0.4 dB (0 to –40 dB, ≥ –65 dBm)
Modulation Analysis	Bandwidth 200 MHz (max.)

General

Interface	Trigger Trigger I/O connector (back panel) Remote control Ethernet: Via MT8870A interface
Dimensions and Mass	181 (W) × 193.6 (H) × 325 (D) mm (excluding projections) ≤12.5 kg
Operating Temperature Range	+5°C to +40°C
Storage Temperature Range	–20°C to +60°C

Cellular Standards Sequence Measurement MX887010A

<table>
<tr><td>Common Item</td><td>Measuring object
LTE-Advanced/NR sub-6 GHz
Frequency range
400 MHz to 6.0 GHz</td></tr>
<tr><td>Spectrum Monitor</td><td>Analysis time
1 ms, 10 ms
Span
1, 2.5, 5, 10, 25, 50, 100, 160, 200* MHz
RBW
<table>
<tr><th>Span</th><th>RBW</th></tr>
<tr><td>1 MHz</td><td>100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz</td></tr>
<tr><td>2.5 MHz</td><td>1 kHz, 3 kHz, 10 kHz, 30 kHz</td></tr>
<tr><td>5 MHz</td><td>3 kHz, 10 kHz, 30 kHz, 100 kHz</td></tr>
<tr><td>10 MHz</td><td>3 kHz, 10 kHz, 30 kHz, 100 kHz</td></tr>
<tr><td>25 MHz</td><td>10 kHz, 30 kHz, 100 kHz, 300 kHz</td></tr>
<tr><td>50 MHz</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
<tr><td>100 MHz</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
<tr><td>160 MHz</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
<tr><td>200 MHz*</td><td>30 kHz, 100 kHz, 300 kHz, 1 MHz</td></tr>
</table>
Detection mode
Average, Peak
Power measurement bandwidth
Range: 0.001 MHz to (setting span) MHz, Resolution: 0.001 MHz</td></tr>
<tr><td>Multiple Power Measurement</td><td>Number of steps
10 to 100 steps
Power step time
0.5, 1,2, 4, 5, 10, 20, 30, 40, 50, 60, 70, 80 ms
Filter type
Low-pass filter: 1.23, 1.4, 3, 5, 10, 15, 20 MHz
RRC filter: 3.84 MHz
Measurement window
Range: 1 to 90%, Resolution 1%
Trigger level
–40 to 0 dB (based on the input level)</td></tr>
<tr><td>TX/RX vs. Frequency</td><td>Segment duration
Range: 1 to 80 ms, Resolution: 1 ms
Measurement filter
Low-pass filter: 1.23, 1.4, 3, 5, 10, 15, 20 MHz
RRC filter: 3.84 MHz
Measurement window
Range: 1 to 90%, Resolution: 1%
Number of segment
1 to 1600
Number of sequence
1 to 400</td></tr>
<tr><td>Narrowband Power vs. Time</td><td>Segment duration
Range: 200 µs to 20000 µs, Resolution: 1 µs
Measurement bandwidth
15 kHz
Measurement window
Range: 1 to 90%, Resolution: 1%
Number of segment
1 to 1000</td></tr>
<tr><td>IQ Capturing</td><td>Time span
Range: 1000 µs to 10000 µs, Resolution : 1 µs
Measurement bandwidth
Low-pass filter: 100, 300, 500 kHz, 1, 3, 5, 20 MHz
Gaussian filter: 1 MHz</td></tr>
</table>

*: MU887002A only

W-CDMA/HSPA Uplink TX Measurement MX887011A

Common Item	Measuring object W-CDMA uplink Frequency range 400 MHz to 2.7 GHz (MU887000A/01A) 400 MHz to 2.7 GHz (MU887002A includes measured target signal band described in frequency range at left)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C MU887000A test port 1 and 2, MU887001A all test port, MU887002A(TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) MU887000A test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm) Linearity 0 to 40 dB ±0.2 dB (≥–55 dBm) ±0.4 dB (≥–65 dBm) Relative level accuracy At the power level difference within 2 dB, ≥–55 dBm, 0 to 40 dB ±0.1 dB (typ.)
Frequency/ Modulation Analysis	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy Residual EVM: at input of single DPCCH and single DPDCH ≤2.5%
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) OBW ratio 80.0 to 99.9%
Adjacent Channel Leakage Power Ratio	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) Measurement points ±5 MHz, ±10 MHz Measurement range ≥50 dB (±5 MHz), ≥55 dB (±10 MHz)

GSM/EDGE Uplink TX Measurement MX887012A

Common Item	Measuring object Normal burst (GMSK, 8PSK) Frequency range 400 MHz to 2.0 GHz (MU887000A/01A) 400 MHz to 2.0 GHz (MU887002A includes measured target signal band described in frequency range at left)
RF Power	Input level range Average power of burst signal –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) MU887000A test port 1 and 2, MU887001A all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) MU887000A test port 3 and 4 ±0.7 dB (–30 to +25 dBm) Linearity ±0.2 dB (≥–30 dBm, 0 to 40 dB) Carrier off power ≥65 dB (≥–10 dBm), ≥45 dB (–30 to –10 dBm)
Frequency/Modulation Measurement	Input level range Average power of burst signal –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy Residual phase error (GMSK) ≤0.5°rms (f ≥500 MHz), ≤0.7°rms (f <500 MHz) ≤2° peak Residual EVM (8PSK) ≤1.5% rms
Output RF Spectrum Measurement	Input level range Average power of burst signal –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) Measurement point ±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz Measurement range of due to modulation Average of 10 measurements ≤–55 dB (200 kHz, 250 kHz offset), ≤–66 dB (≥400 kHz offset) Measurement range of switching transient ≤–57 dB (≥400 kHz offset)

LTE FDD Uplink TX Measurement MX887013A
LTE TDD Uplink TX Measurement MX887014A

Common Item	Measuring object PUSCH, PUCCH Frequency range 600 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz (MU887000A/01A) 600 MHz to 2.7 GHz, 3.4 GHz to 4.2 GHz (with MU887000A/01A-001/101 option) 600 MHz to 2.7 GHz, 3.4 GHz to 4.2 GHz (MU887002A)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy 600 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–50 to –20 dBm) ±0.9 dB (–60 to –50 dBm) MU887000A test port 3 and 4 ±0.7 dB (–20 to +25 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) 3.8 GHz to 4.2 GHz, After CAL, 20°C to 30°C MU887000A all test ports and MU887001A all test ports, MU887002A (TRX1/2) all test port ±0.7 dB (–20 to +35 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) Linearity 0 to 40 dB ±0.2 dB (≥–50 dBm) ±0.4 dB (≥–60 dBm) Relative level accuracy At the power level difference within 2 dB ±0.1 dB (typ.)
Frequency/Modulation Measurement	Input level range –40 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –40 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy Residual EVM (average of 20 measurements) ≤2.5% In-band emission Input level: ≥–10 dBm, Allocated RB: ≤18 ≤–40 dBc
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) OBW ratio 80.0 to 99.9%
Adjacent Channel Leakage Power Ratio	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port) –10 to +25 dBm (MU887000A test port 3 and 4) –10 to +35 dBm (MU887002A (TRX1/2) all test port, 600 MHz ≤ f ≤ 2700 MHz) –14 to +35 dBm (MU887002A (TRX1/2) all test port, 3400 MHz ≤ f ≤ 4200 MHz) Measurement range ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2)
Spectrum Emission Mask	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)

LTE-Advanced FDD Uplink CA TX Measurement MX887013A-001
LTE-Advanced TDD Uplink CA TX Measurement MX887014A-001

Common Item	Measuring object PUSCH Frequency range 698 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz 698 MHz to 2.7 GHz, 3.4 GHz to 4.2 GHz (with MU88700xA-001/101 option) 698 MHz to 2.7 GHz, 3.4 GHz to 4.2 GHz (with MU887002A)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port Excluding when measuring Intraband Contiguous CA SCC and PCC + SCC 698 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz , After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–50 to –20 dBm) ±0.9 dB (–60 to –50 dBm) 3.8 GHz to 4.2 GHz, After CAL, 10°C to 40°C ±0.7 dB (–20 to +35 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port When measuring Intraband Contiguous CA SCC and PCC + SCC 698 MHz to 2.7 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) ±0.5 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.7 dB (–50 to +35 dBm) ±0.9 dB (–60 to –50 dBm) 3.4 GHz to 3.8 GHz, After CAL, 10°C to 40°C 3.8 GHz to 4.2 GHz, After CAL, 20°C to 30°C ±1.0 dB (–50 to +35 dBm) ±1.3 dB (–60 to –50 dBm) MU887000A test port 3 and 4 Excluding when measuring Intraband Contiguous CA SCC and PCC + SCC 698 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz , After CAL, 10°C to 40°C 3.8 GHz to 4.2 GHz , After CAL, 20°C to 30°C ±0.7 dB (–20 to +25 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) MU887000A test port 3 and 4 When measuring Intraband Contiguous CA SCC and PCC + SCC 698 MHz to 2.7 GHz, After CAL, 10°C to 40°C ±0.7 dB (–20 to +25 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) 3.4 GHz to 3.8 GHz, After CAL, 10°C to 40°C 3.8 GHz to 4.2 GHz, After CAL, 20°C to 30°C ±1.0 dB (–50 to +25 dBm) ±1.3 dB (–60 to –50 dBm) Linearity 0 to 30 dB, 20 to 30°C ±0.2 dB (≥–50 dBm) ±0.4 dB (≥–60 dBm)
Frequency/Modulation Measurement	Input level range –40 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port) –40 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 15 Hz) Modulation accuracy Residual EVM (average of 20 measurements) ≤2.5% In-band emission Input level: ≥–10 dBm, Allocated RB: ≤18 ≤–40 dBc
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) OBW ratio 80.0 to 99.9%
Adjacent Channel Leakage Power Ratio	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port) –10 to +25 dBm (MU887000A test port 3 and 4) –10 to +35 dBm (MU887002A (TRX1/2) all test port, 698 MHz ≤ f ≤ 2700 MHz) –14 to +35 dBm (MU887002A (TRX1/2) all test port, 3400 MHz ≤ f ≤ 4200 MHz) Measurement range ≥45 dB (E-UTRA ACLR1), ≥50 dB (UTRA ACLR1), ≥55 dB (UTRA ACLR2)
Spectrum Emission Mask	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)

CDMA2000 Reverse Link TX Measurement MX887015A

Common Item	Measuring object Reverse RC-1/2/3/4 Frequency range 400 MHz to 2.7 GHz (MU887000A/01A) 400 MHz to 2.7 GHz (MU887002A includes measured target signal band described in frequency range at left)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) MU887000A test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm) Linearity 0 to 40 dB ±0.2 dB (≥–55 dBm) ±0.4 dB (≥–65 dBm)
Frequency/Modulation Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Waveform quality >0.999
Code Domain Power Measurement	Reverse RC3 or RC4 Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy ±0.2 dB (Code power: ≥–15 dBc), ±0.4 dB (Code power: ≥–23 dBc)
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) OBW ratio 80.0 to 99.9%

1xEV-DO Reverse Link TX Measurement MX887016A

Common Item	Measuring object Reverse link Rev. 0/Rev. A Frequency range 400 MHz to 2.7 GHz (MU887000A/01A) 400 MHz to 2.7 GHz (MU887002A includes measured target signal band described in frequency range at left)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) MU887000A test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm) Linearity 0 to 40 dB ±0.2 dB (≥–55 dBm) ±0.4 dB (≥–65 dBm)
Frequency/Modulation Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Waveform quality >0.999
Code Domain Power Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy ±0.2 dB (Code power: ≥–15 dBc), ±0.4 dB (Code power: ≥–23 dBc)
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) OBW ratio 80.0 to 99.9%

TD-SCDMA Uplink TX Measurement MX887017A

Common Item	Measuring object TD-SCDMA uplink Frequency range 400 MHz to 2.7 GHz (MU887000A/01A) 400 MHz to 2.7 GHz (MU887002A includes measured target signal band described in frequency range at left)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) MU887000A test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm) Linearity 0 to 40 dB ±0.2 dB (≥–55 dBm) ±0.4 dB (≥–65 dBm)
Frequency/Modulation Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 10 Hz) Modulation accuracy Residual EVM (at input of single code) ≤2.5%
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) OBW ratio 99.0%
Adjacent Channel Leakage Power Ratio	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) Measurement points ±1.6 MHz, ±3.2 MHz Measurement range ≥50 dB (±1.6 MHz), ≥55 dB (±3.2 MHz)

NR FDD sub-6 GHz Uplink TX Measurement MX887018A
NR TDD sub-6 GHz Uplink TX Measurement MX887019A

<table>
<tr><td>Common Item</td><td>Measuring object
PUSCH
Channel Bandwidth (MHz)
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100
Modulation
π/2BPSK, QPSK, 16QAM, 64QAM</td></tr>
<tr><td>RF Power</td><td>Input level range
MU887000A
–65.0 to +35.0 dBm Test port1 and 2
–65.0 to +25.0 dBm Test port 3 and 4
MU8870001A
–65.0 to +35.0 dBm Test port 1 to 4
MU887002A
–65.0 to +35.0 dBm Test port 1 to 12, 600 MHz to 2700MHz, 3300 MHz to 5000 MHz
–65.0 to +30.0 dBm Test port 5 to 12, 5900 MHz to 7125 MHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz)
Measurement accuracy
MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port
600 MHz to 2.7 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A)
±0.5 dB (typ.) (–20 to +35 dBm, 20°C to 30°C)
±0.7 dB (–20 to +35 dBm)
±0.7 dB (–50 to –20 dBm)
±0.9 dB (–60 to –50 dBm)
3.3 GHz to 3.8 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A)
±1.0 dB (–50 to +35 dBm)
±1.3 dB (–60 to –50 dBm)
3.8 GHz to 5.0 GHz, After CAL, 20°C to 30°C
±1.0 dB (–50 to +35 dBm)
±1.3 dB (–60 to –50 dBm)
MU887000A test port 3 and 4
600 MHz to 2.7 GHz, After CAL, 10°C to 40°C
±0.7 dB (–20 to +25 dBm)
±0.9 dB (–50 to –20 dBm)
±1.1 dB (–60 to –50 dBm)
3.3 GHz to 3.8 GHz, After CAL, 10°C to 40°C
±1.0 dB (–50 to +25 dBm)
±1.3 dB (–60 to –50 dBm)
3.8 GHz to 5.0 GHz, After CAL, 20°C to 30°C
±1.0 dB (–50 to +25 dBm)
±1.3 dB (–60 to –50 dBm)
MU887002A (TRX1/2) Test port 5 to 12, when MU887000A-007 installed, Channel Edge ≤ 7125 MHz
5900 MHz to 7125 MHz, After CAL, 20°C to 30°C
±1.3 dB (–50 to +30 dBm)
±2.0 dB (–60 to –50 dBm)</td></tr>
<tr><td>Frequency/Modulation Measurement</td><td>Input level range
Minimum output power* to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port)
Minimum output power* to +30 dBm (MU887002A (TRX1/2) Test port 5 to12, when MU887000A-007 installed, Channel Edge ≤ 7125 MHz.)
Minimum output power* to +25 dBm (MU887000A test port 3 and 4)
*: Minimum output power
<table>
<tr><th>Channel Bandwidth (MHz)</th><th>Minimum output power (dBm)</th></tr>
<tr><td>5, 10, 15, 20</td><td>–40</td></tr>
<tr><td>25</td><td>–39</td></tr>
<tr><td>30</td><td>–38.2</td></tr>
<tr><td>40</td><td>–37</td></tr>
<tr><td>50</td><td>–36</td></tr>
<tr><td>60</td><td>–35.2</td></tr>
<tr><td>70</td><td>–34.6</td></tr>
<tr><td>80</td><td>–34</td></tr>
<tr><td>90</td><td>–33.5</td></tr>
<tr><td>100</td><td>–33</td></tr>
</table>
Carrier frequency accuracy
600 MHz to 2.7 GHz
± (Setting frequency × Reference oscillator accuracy) + 15 Hz
3.3 GHz to 5.0 GHz
5.9 GHz to 7.125 GHz (MU887002A (TRX1/2) Test port 5 to12, when MU887000A-007 installed, Channel Edge ≤ 7125 MHz)
± (Setting frequency × Reference oscillator accuracy) + 36 Hz
Modulation accuracy
Residual EVM (average of 20 measurements)
–25 dBm < Input Level Range
≤2.5%
Minimum output power ≤ Input Level Range ≤ –25 dBm
≤3.0% (600 MHz ≤ f ≤ 2.7 GHz, 3.3 GHz ≤ f ≤ 4.2 GHz)
≤3.0% (4.2 GHz < f ≤ 5.0 GHz, 5.9 GHz ≤ f ≤ 7.125 GHz (Channel Edge ≤ 7.125 GHz, 20°C to 30°C))</td></tr>
</table>

Occupied Bandwidth	Frequency range Channel Bandwidth ≤ 60 MHz 600 MHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 5.9 GHz to 7.125 GHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) 60 MHz < Channel Bandwidth 2.0 GHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 5.9 GHz to 7.125 GHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +30 dBm (MU887002A (TRX1/2) test port 5 to 12, when MU887000A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) –10 to +25 dBm (MU887000A test port 3 and 4)
Adjacent Channel Leakage Power Ratio	Frequency range Channel Bandwidth ≤ 60 MHz 600 MHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 5.9 GHz to 7.125 GHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) 60 MHz < Channel Bandwidth 2.0 GHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 5.9 GHz to 7.125 GHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +30 dBm (when MU887002A-007 installed, (TRX1/2) test port 5 to 12, 5900 MHz to 7125 MHz, Channel Edge ≤ 7125 MHz) –10 to +25 dBm (MU887000A test por 3, 4) Measurement range ≥42 dB (NR ACLR), ≥45 dB (UTRA ACLR1), ≥48 dB (UTRA ACLR2)
Spectrum Emission Mask	Frequency range Channel Bandwidth ≤ 60 MHz 600 MHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 5.9 GHz to 7.125 GHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) 60 MHz < Channel Bandwidth 2.0 GHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 5.9 GHz to 7.125 GHz (when MU887002A-007 installed, Channel Edge ≤ 7125 MHz, Test port 5 to 12) Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port) –10 to +30 dBm (when MU887000A-007 installed, Channel Edge ≤ 7125 MHz (TRX1/2) Test port 5 to 12) –10 to +25 dBm (MU887000A test port 3 and 4)

NR FDD Contiguous ENDC TX Measurement MX887018A-001
NR TDD Contiguous ENDC TX Measurement MX887019A-001

<table>
<tr><td>Common Item</td><td>Measuring object
PUSCH
Channel Bandwidth (MHz)
5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100
Modulation
π/2BPSK, QPSK, 16QAM, 64QAM</td></tr>
<tr><td>RF Power</td><td>Input level range
–65 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port)
–65 to +25 dBm (MU887000A test port 3 and 4)
Measurement accuracy
MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port
600 MHz to 2.7 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A)
±0.7 dB (Nom., –50 to +35 dBm)
±0.9 dB (Nom., –60 to –50 dBm)
3.3 GHz to 3.8 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A)
±1.0 dB (Nom., –50 to +35 dBm)
±1.3 dB (Nom., –60 to –50 dBm)
3.8 GHz to 5.0 GHz, After CAL, 20°C to 30°C
±1.0 dB (Nom., –50 to +35 dBm)
±1.3 dB (Nom., –60 to –50 dBm)
MU887000A test port 3 and 4
600 MHz to 2.7 GHz, After CAL, 10°C to 40°C
±0.7 dB (Nom., –20 to +25 dBm)
±0.9 dB (Nom., –50 to –20 dBm)
±1.1 dB (Nom., –60 to –50 dBm)
3.3 GHz to 3.8 GHz, After CAL, 10°C to 40°C
±1.0 dB (Nom., –50 to +25 dBm)
±1.3 dB (Nom., –60 to –50 dBm)
3.8 GHz to 5.0 GHz, After CAL, 20°C to 30°C
±1.0 dB (Nom., –50 to +25 dBm)
±1.3 dB (Nom., –60 to –50 dBm)</td></tr>
<tr><td>Frequency/Modulation Measurement</td><td>Input level range
Input level range (E-UTRA non-allocated)
Minimum output power* to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port)
Minimum output power* to +25 dBm (MU887000A test port 3 and 4)
*: Minimum output power
<table>
<tr><th>Channel Bandwidth (MHz)</th><th>Minimum output power (dBm)</th></tr>
<tr><td>5, 10, 15, 20</td><td>–40</td></tr>
<tr><td>25</td><td>–39</td></tr>
<tr><td>30</td><td>–38.2</td></tr>
<tr><td>40</td><td>–37</td></tr>
<tr><td>50</td><td>–36</td></tr>
<tr><td>60</td><td>–35.2</td></tr>
<tr><td>70</td><td>–34.6</td></tr>
<tr><td>80</td><td>–34</td></tr>
<tr><td>90</td><td>–33.5</td></tr>
<tr><td>100</td><td>–33</td></tr>
</table></td></tr>
<tr><td>Occupied Bandwidth</td><td>Frequency range
Channel Bandwidth ≤ 60 MHz
600 MHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A)
600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option)
600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A)
60 MHz < Channel Bandwidth
2.0 GHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A)
2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option)
2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A)
Input level range
–10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port))
–10 to +25 dBm (MU887000A test port 3 and 4)</td></tr>
</table>

Adjacent Channel Leakage Power Ratio	Frequency range Channel Bandwidth ≤ 60 MHz 600 MHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 60 MHz < Channel Bandwidth 2.0 GHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port) –10 to +25 dBm (MU887000A test port 3 and 4) –10 to +35 dBm (MU887002A (TRX1/2) all test port, 600 MHz ≤ f ≤ 2700 MHz) –14 to +35 dBm (MU887002A (TRX1/2) all test port, 3300 MHz ≤ f ≤ 5000 MHz) Measurement range ≥42 dB
Spectrum Emission Mask	Frequency range Channel Bandwidth ≤ 60 MHz 600 MHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 600 MHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) 60 MHz < Channel Bandwidth 2.0 GHz to 2.7 GHz, 3.3 GHz to 3.8 GHz (MU887000A/01A) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887000A/01A-001/101 option) 2.0 GHz to 2.7 GHz, 3.3 GHz to 5.0 GHz (MU887002A) Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A all test port, MU887002A (TRX1/2) all test port)) –10 to +25 dBm (MU887000A test port 3 and 4)

W-CDMA/HSPA Downlink TX Measurement MX887021A

Common Item	Measuring object W-CDMA/HSPA downlink Frequency range 600 MHz to 2.7 GHz
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2, with Option 097) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C MU887000A test port 1 and 2, MU887001A all test port ±0.3 dB (typ.) (–15 to +35 dBm, 20°C to 30°C) ±0.5 dB (–15 to +35 dBm) MU887000A test port 3 and 4 ±0.7 dB (–15 to +25 dBm) MU887002A (TRX1/2, with Option 097) all test port ±0.3 dB (Nom.) (–15 to +35 dBm, 20°C to 30°C)
Frequency/Modulation Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2, with Option 097) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy Average of 10 measurements, test model 4 signals MU887000A/01A: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) MU887002A: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) (Nom.) (With Option 097) Modulation accuracy Average of 10 measurements, test model 4 signals MU887000A/01A: ≤1% MU887002A: ≤1% (Nom.) (With Option 097)
Adjacent Channel Leakage Power Ratio	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2, with Option 097) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) Measurement points ±5 MHz, ±10 MHz Measurement range MU887000A/01A: ≥55 dB (UTRA Adj./Alt.) MU887002A: ≥55 dB (Nom.) (UTRA Adj./Alt.) (With Option 097)

LTE FDD Downlink TX Measurement MX887023A

Common Item	Measuring object LTE FDD downlink signal Frequency range 600 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2, with Option 097) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 10°C to 40°C MU887000A test port 1 and 2, MU887001A all test port ±0.3 dB (typ.) (–15 to +35 dBm, 20°C to 30°C) ±0.5 dB (–15 to +35 dBm) MU887000A test port 3 and 4 ±0.7 dB (–15 to +25 dBm) MU887002A (TRX1/2, with Option 097) all test port with option 097 (20°C to 30°C) ±0.3 dB (Nom.) (–15 to +25 dBm)
Frequency/Modulation Measurement	Input level range –15 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2, with Option 097) all test port) –15 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy Measurement interval: 10, test model 3.1 signals MU887000A/01A: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) MU887002A: ± (Setting frequency × Reference oscillator accuracy + 10 Hz) (Nom.) (With Option 097) Modulation accuracy Residual EVM Measurement interval: 10, Test model 3.1 signals, Channel bandwidth: 3, 5, 10, 15, 20 MHz MU887000A/01A: ≤1% MU887002A: ≤1% (Nom.) (With Option 097)
Adjacent Channel Leakage Power Ratio	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2, with Option 097) all test port) –10 to +25 dBm (MU887000A test port 3 and 4) Measurement range Channel bandwidth: 1.4, 3, 5 MHz MU887000A/01A: ≥54 dB (E-UTRA Adj.), ≥57 dB (E-UTRA Alt.) MU887002A: ≥54 dB (Nom.) (E-UTRA Adj.), ≥57 dB (Nom.) (E-UTRA Alt.) (With Option 097) Channel bandwidth: 10, 15, 20 MHz MU887000A/01A: ≥50 dB (E-UTRA Adj./Alt.) MU887002A: ≥50 dB (Nom.) (E-UTRA Adj./Alt.) (With Option 097) Full channel bandwidth MU887000A/01A: ≥54 dB (UTRA Adj./Alt.) MU887002A: ≥54 dB (Nom.) (UTRA Adj./Alt.) (With Option 097)

W-CDMA/HSPA Downlink Waveforms MV887011A

EVM	≤3% rms (400 MHz ≤ f ≤ 2.7 GHz) With the MU887002A, the output signal band must be within the above-described frequency range.

GSM/EDGE Downlink Waveforms MV887012A

Phase Error	≤1° rms (400 MHz ≤ f ≤ 2.7 GHz, GMSK) With the MU887002A, the output signal band must be within the above-described frequency range.
EVM	≤1.8% rms (400 MHz ≤ f ≤ 2.7 GHz, 8PSK) With the MU887002A, the output signal band must be within the above-described frequency range.

LTE FDD Downlink Waveforms MV887013A

Max. Output Level	MU887000A test port 1 and 2, MU887001A all test port –12 dBm (f ≤ 3.8 GHz), –20 dBm (f > 3.8 GHz) MU887000A test port 3 and 4 –2 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz) MU887002A (TRX1/2) all test port –7 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz)
EVM	≤2% rms (400 MHz ≤ f ≤ 2.7 GHz), ≤3% rms (3.4 GHz ≤ f ≤ 3.8 GHz), ≤4% rms (3.8 GHz < f ≤ 6.0 GHz) With the MU887002A, the output signal band must be within the above-described frequency range.

LTE TDD Downlink Waveforms MV887014A

Max. Output Level	MU887000A test port 1 and 2, MU887001A all test port –12 dBm (f ≤ 3.8 GHz), –20 dBm (f > 3.8 GHz) MU887000A test port 3 and 4 –2 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz) MU887002A (TRX1/2) all test port –7 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz)
EVM	≤2% rms (400 MHz ≤ f ≤ 2.7 GHz), ≤3% rms (3.4 GHz ≤ f ≤ 3.8 GHz), ≤4% rms (3.8 GHz < f ≤ 6.0 GHz) With the MU887002A, the output signal band must be within the above-described frequency range.

CDMA2000 Forward Link Waveforms MV887015A

Waveform Quality	>0.99 (400 MHz ≤ f ≤ 2.7 GHz) With the MU887002A, the output signal band must be within the above-described frequency range.

1xEV-DO Forward Link Waveforms MV887016A

Waveform Quality	>0.99 (400 MHz ≤ f ≤ 2.7 GHz, Pilot channel) With the MU887002A, the output signal band must be within the above-described frequency range.

TD-SCDMA Downlink Waveforms MV887017A

EVM	≤3% rms (400 MHz ≤ f ≤ 2.7 GHz) With the MU887002A, the output signal band must be within the above-described frequency range.

NR FDD sub-6 GHz Downlink Waveforms MV887018A
NR TDD sub-6 GHz Downlink Waveforms MV887019A

Max. Output Level	MU887000A test port 1 and 2, MU887001A all test port –10 dBm (f ≤ 3.8 GHz), –18 dBm (f > 3.8 GHz) MU887000A test port 3 and 4 0 dBm (f ≤ 3.8 GHz), –8 dBm (f > 3.8 GHz) MU887002A (TRX1/2) all test port –5 dBm (f ≤ 3.8 GHz), –8 dBm (f > 3.8 GHz) MU887002A (TRX1/2), when MU887002A-007 installed –5 dBm (test port 1 to 4, f ≤ 3.8 GHz) –8 dBm (test port 1 to 4, 3.8 GHz < f ≤ 6 GHz) –8 dBm (test port 5 to 12, 3.8 GHz < f < 5.9 GHz) –10 dBm (test port 5 to 12, 5.9 GHz ≤ f ≤ 7.125 GHz (when MU887002A-007 installed, test port 5 to 12, Channel Edge ≤ 7.125 GHz)) With the MU887002A, the output signal band must be within the above-described frequency range.
EVM	≤2% rms (600 MHz ≤ f ≤ 2.7 GHz), ≤3% rms (3.3 GHz ≤ f ≤ 3.8 GHz), ≤4% rms (3.8 GHz < f ≤ 5.0 GHz, 5.9 GHz ≤ f ≤ 7.125 GHz (when MU887002A-007 installed, test port 5 to 12, Channel Edge ≤ 7.125 GHz)) With the MU887002A, the output signal band must be within the above-described frequency range.

WLAN 802.11b/g/a/n TX Measurement MX887030A

Common Item	Measuring object WLAN signal packet Frequency range 2.4 GHz band: 2412 MHz to 2484 MHz 5 GHz band: 4920 MHz to 5825 MHz (For MU887000A/01A, required MU887000A/01A-001)
RF Power	Input level range –65 to +25 dBm (MU887000A test port 3 and 4) –55 to +35 dBm (MU887001A all test port, MU887002A (TRX1/2) all test port) Accuracy After CAL, 20°C to 30°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ p < –30 dBm) (MU887000A) ±0.7 dB (–20 dBm ≤ p ≤ +35 dBm), ±1.0 dB (–40 dBm ≤ p < –20 dBm) (MU887001A, MU887002A) Bandwidth 40 MHz, 20 MHz (802.11n) 20 MHz (802.11a/b/g) Capture time 1.34 s Pre-trigger 1.33 s Resolution (time domain profile) 5 ns/sample CCDF CCDF defined as a percentage of samples against dB, where percentage of samples is normalized to the average power in the 'gate', and dB is defined as the relative value of samples greater than the average. Power distribution value A single numeric value called the power distribution value defines the number of dB above the average power below which a user defined percentage of the total number of samples falls.
Spectral Profile Measurement	Span ±65 MHz (802.11n) ±35 MHz (802.11a/b/g) Capture time 50 µs Measurement range (RBW: 100 kHz) –27 to +25 dBm (MU887000A) –17 to +35 dBm (MU887001A, MU887002A) Linearity CW, RBW: 100 kHz, Same as level linearity (MU887000A test port 3 and 4, MU887001A all test port, MU887002A (TRX1/2) all test port) ±0.2 dB (≥ –55 dBm, –40 to 0 dB) Resolution 0.1 dB Bandwidth 100 kHz
EVM (Modulation Accuracy)	Measurement range –20 to +25 dBm (MU887000A) –10 to +35 dBm (MU887001A, MU887002A) Residual EVM Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A) all test port), Averaged over 20 packets <–28 dB (DSSS) <–40 dB (OFDM, Channel estimation: FULLPACKET) EVM data format dB, % Resolution 0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution Speed >20 readings/second
DSSS EVM Measurement Setting	RX filter type None, Gaussian, Root raised cosine Gaussian filter setting BT BT 0.3 to 1.0, Resolution: 0.1 Root raised cosine filter setting α 0.30 to 1.00, Resolution: 0.01 Measurement start It shall be possible to measure EVM from the first data chip of the packet Measurement method Header or payload. Header measures the EVM of the first 1000 chips of the PLCP preamble and header. User specified measurement range 220 to 11000 chips Measurement functional range Measurement only possible if channel frequency error <±150 kHz (±60 ppm) Carrier lock Phase tracking automatically applied as per carrier lock 802.11-2007 18.4.7.8

OFDM EVM Measurement Setting	Channel estimation User selection of Long training sequence or Full packet. User specified measurement range 16 symbols (min.), 1000 symbols (max.) OFDM pilot tracking "Phase tracking only" or "Phase and Amplitude tracking". Peak and Average EVM on all sub-carriers, dB or percentage Peak and Average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max
DSSS Additional Measurement	Transmit center frequency tolerance Definition: Average frequency of the DSSS carrier signal Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) Resolution: Hz to no decimal places, ppm to one decimal place Chip clock frequency tolerance Definition: Frequency error relative to the 11 MHz chip clock. Measurement averaged over a fully coded DSSS packet with minimum payload length 3300 chips, 300 µs Display format: Hz, ppm Range: ±50 ppm Resolution: Hz to no decimal places, ppm to one decimal place Data analysis width: 20 µs (220 chips) (min.) User specified measurement range: 3300 to 30250 chips Transmit power-on and power down ramp Definition: Time for burst to transit from 10 to 90% or 90 to 10% of linear power. Data outputs: 10%, 90%, Delta values Resolution: 5 ns RF carrier suppression Method: IEEE Std 802.11-2007 (18.4.7.7), IQ offset method IEEE method: Relative level of the carrier to the highest sideband for a 10101010 test pattern with scrambler disabled, data rate 2 Mbps. IQ offset method: Calculated from the relative values of the peak frequency response and the channel center frequency with the data rate processing gain.
OFDM Additional Measurement	Transmit center frequency tolerance Definition: Average frequency of the OFDM carrier signal Data output format: Hz, ppm Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) (>1 ms packet) Resolution: Hz to no decimal places, ppm to one decimal place Symbol clock frequency tolerance Definition: Frequency error relative to the 250 kHz symbol clock as per 19.4.7.3/17.3.9.5 Measurement averaged over a fully coded OFDM packet with a minimum payload length of 16 symbols (64 µs) Data output format: Hz, ppm Range: ±40 ppm Resolution: ppm to one decimal place User specified measurement range: 16- (define numbers) Transmitter center frequency leakage Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Unit of measurement: dB
Additional Measurement (DSSS and OFDM)	Power spectral density The maximum power measured in a 1 MHz bandwidth within the occupied bandwidth of the signal Occupied bandwidth Measures the frequency range within which the specified percentage power is contained Occupied bandwidth percentage range 1 to 99%

WLAN 802.11ac TX Measurement MX887031A

Common Item	Measuring object WLAN signal packet Frequency range 5 GHz band: 4920 MHz to 5825 MHz (For MU887000A/01A, required MU887000A/01A-001)
RF Power	Input level range –65 to +25 dBm (MU887000A test port 3 and 4) –55 to +35 dBm (MU887001A all test port, MU887002A (TRX1/2) all test port) Accuracy After CAL, 20°C to 30°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ p < –30 dBm) (MU887000A) ±0.7 dB (–20 dBm ≤ p ≤ +35 dBm), ±1.0 dB (–40 dBm ≤ p < –20 dBm) (MU887001A, MU887002A) Bandwidth 160, 80, 40, 20 MHz Capture time 1.34 s Pre-trigger 1.33 s Resolution (time domain profile) 5 ns/sample CCDF CCDF defined as a percentage of samples against dB, where percentage of samples is normalized to the average power in the 'gate', and dB is defined as the relative value of samples greater than the average. Power distribution value A single numeric value called the power distribution value defines the number of dB above the average power below which a user defined percentage of the total number of samples falls.
Spectral Profile Measurement	Spectral profile measurement span ±80 MHz Capture time 50 µs Measurement range (RBW: 100 kHz) –27 to +25 dBm (MU887000A) –17 to +35 dBm (MU887001A, MU887002A) Linearity CW, RBW: 100 kHz, Same as level linearity (MU887000A test port 3 and 4, MU887001A all test port, MU887002A (TRX1/2) all test port) ±0.2 dB (≥ –55 dBm, –40 to 0 dB) Resolution 0.1 dB Bandwidth 100 kHz
EVM (Modulation Accuracy)	EVM measurement range –20 to +25 dBm (MU887000A) –10 to +35 dBm (MU887001A, MU887002A) Residual EVM (Bandwidth: ≤80 MHz) Signal level: >–10 dBm (MU887000A), 0 dBm (MU887001A, MU887002A), Averaged over 20 packets, Channel estimation: FULLPACKET <–38 dB EVM data format dB, % Resolution 0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution Speed >20 readings/second
OFDM EVM Measurement Setting	Channel estimation User selection of long training sequence or full packet. User specified measurement range 16 symbols (min.), 1000 symbols (max.) OFDM pilot tracking "Phase tracking only" or "Phase and Amplitude tracking". Peak and Average EVM on all sub-carriers, dB or percentage Peak and Average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max.

OFDM Additional Measurement	Transmit center frequency tolerance Definition: Average frequency of the OFDM carrier signal Data output format: Hz, ppm Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) (>1 ms packet) Resolution: Hz to no decimal places, ppm to one decimal places Symbol clock frequency tolerance Definition: Frequency error relative to the 250 kHz symbol clock as per 19.4.7.3/17.3.9.5 Measurement averaged over a fully coded OFDM packet with a minimum payload length of 16 symbols (64 µs) Data output format: Hz, ppm Range: ±40 ppm Resolution: ppm to one decimal places User specified measurement range: 16- (Define numbers) Transmitter center frequency leakage Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Unit of measurement: dB

WLAN 802.11p TX Measurement MX887032A (Automotive Connectivity V2X)

Common Item	Measuring object WLAN single packet Frequency range 715 MHz to 765 MHz 902 MHz to 928 MHz 5725 MHz to 5925 MHz (For MU887000A/01A, required MU887000A/01A-001)
RF Power	Input level range –65 to +25 dBm (MU887000A test port 3 and 4) –55 to +35 dBm (MU887001A, MU887002A (TRX1/2) all test port) Measurement accuracy After CAL, 20 to 30°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ p < –30 dBm) (MU887000A) ±0.7 dB (–20 dBm ≤ p ≤ +35 dBm), ±1.0 dB (–40 dBm ≤ p < –20 dBm) (MU887001A, MU887002A) Bandwidth 5, 10, 20 MHz
EVM (Modulation Accuracy)	Measurement range –20 to +25 dBm (MU887000A) –10 to +35 dBm (MU887001A, MU887002A) Residual EVM (OFDM) Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A), Averaged over 20 packets, Channel estimation: FULLPACKET <–40 dB EVM data format dB or % Measurement resolution 0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution
OFDM EVM Measurement Setting	Channel estimation User selection of Long training sequence or Full packet User specified measurement range 16 symbols (min.), 1000 symbols (max.) OFDM pilot tracking “Phase tracking only” or “Phase and amplitude tracking”, default: Phase tracking only Peak and average EVM on all sub-carriers, dB or percentage Peak and average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max
OFDM Additional Measurement	Transmit center frequency tolerance Definition: Average frequency of the OFDM carrier signal Data output format: Hz and ppm Measurement accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) (packet: >1 ms) Resolution: Hz to no decimal places, ppm to 1 decimal place Transmit center frequency leakage Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Data output format: dB

WLAN 802.11ax TX Measurement MX887033A

Common Item	Measuring object WLAN signal packet Frequency range MU887000A/01A 5 GHz Band: (with MU887000A/01A-001) 160 MHz BW: 4920 MHz to 5815 MHz 80 MHz BW: 4920 MHz to 5775 MHz 40 MHz BW: 4920 MHz to 5795 MHz 20 MHz BW: 4920 MHz to 5825 MHz 2.4 GHz Band: 40 MHz BW: 2412 MHz to 2472 MHz 20 MHz BW: 2412 MHz to 2484 MHz MU887002A 6 GHz Band: (With MU887002A-007, test port 5 to 12) 160 MHz BW: 5900 MHz to 7135 MHz 80 MHz BW: 5900 MHz to 7175 MHz 40 MHz BW: 5900 MHz to 7195 MHz 20 MHz BW: 5900 MHz to 7205 MHz 5 GHz Band: 160 MHz BW: 4920 MHz to 5815 MHz 80 MHz BW: 4920 MHz to 5855 MHz 40 MHz BW: 4920 MHz to 5885 MHz 20 MHz BW: 4920 MHz to 5885 MHz 2.4 GHz Band: 40 MHz BW: 2412 MHz to 2472 MHz 20 MHz BW: 2412 MHz to 2484 MHz
RF Power	Input level range MU887000A test port 3 and 4 –65 to +25 dBm MU887001A test port 1 to 4 –55 to +35 dBm MU887002A Test port 1 to 12 (without MU887002A-007), f ≤ 6000 MHz –55 to +35 dBm Test port 1 to 4 (when MU887000A-007 installed), f ≤ 6000 MHz –55 to +35 dBm Test port 5 to 12 (when MU887000A-007 installed), f < 5900 MHz –55 to +35 dBm Test port 5 to 12 (with MU887002A-007), 5900 MHz ≤ f ≤ 7300 MHz –55 to +30 dBm Accuracy After CAL, 20°C to 30°C MU887000A test port 3 and 4 ≤ BW 80 MHz: ±0.7 dB (–30 dBm ≤ Level ≤ +25 dBm) ±1.0 dB (–50 dBm ≤ Level < –30 dBm) BW 160 MHz: ±1.0 dB (–30 dBm ≤ Level ≤ +25 dBm) ±1.3 dB (–50 dBm ≤ Level < –30 dBm) MU887001A test port 1 to 4 ≤ BW 80 MHz: ±0.7 dB (–20 dBm ≤ Level ≤ +35 dBm) ±1.0 dB (–40 dBm ≤ Level < –20 dBm) BW 160 MHz: ±1.0 dB (–20 dBm ≤ Level ≤ +35 dBm) ±1.3 dB (–40 dBm ≤ Level < –20 dBm) MU887002A (TRX1/2) test port 1 to 12, 2.4/5 GHz Band ≤ BW 80 MHz: ±0.7 dB (–20 dBm ≤ Level ≤ +35 dBm) ±1.0 dB (–40 dBm ≤ Level < –20 dBm) BW 160 MHz: ±1.0 dB (–20 dBm ≤ Level ≤ +35 dBm) ±1.3 dB (–40 dBm ≤ Level < –20 dBm) MU887002A (TRX1/2) test port 5 to 12, with MU887002A-007, 6 GHz Band ±1.0 dB (–20 dBm ≤ Level ≤ +30 dBm) ±1.3 dB (–40 dBm ≤ Level < –20 dBm) Bandwidth 160, 80, 40, 20 MHz Capture time 1.34 s Pre-trigger 1.33 s Resolution (time domain profile) 5 ns/sample CCDF CCDF defined as a percentage of samples against dB, where percentage of samples is normalized to the average power in the 'gate', and dB is defined as the relative value of samples greater than the average. Power distribution value A single numeric value called the power distribution value defines the number of dB above the average power below which a user defined percentage of the total number of samples falls.

Spectral Profile Measurement	Spectral profile measurement span ±80 MHz Capture time 50 µs Measurement range (RBW: 100 kHz) MU887000A test port 3 and 4 –27 to +25 dBm MU887001A test port 1 to 4 –17 to +35 dBm MU887002A (TRX1/2) test port 1 to 12, Setting Frequency 2.4/5 GHz Band –17 to +35 dBm MU887002A (TRX1/2) test port 5 to 12, with MU887002A-007, Setting Frequency 6 GHz Band –17 to +30 dBm Linearity CW, RBW: 100 kHz ±0.2 dB (≥ –55 dBm, –40 to 0 dB) Resolution 0.1 dB Bandwidth 100 kHz
EVM (Modulation Accuracy)	EVM measurement range MU887000A test port 3 and 4 –20 to +25 dBm MU887001A test port 1 to 4 –10 to +35 dBm MU887002A (TRX1/2) test port 1 to 12, Setting Frequency 2.4/5 GHz Band –10 to +35 dBm MU887002A (TRX1/2) test port 5 to 12, with MU887002A-007, Setting Frequency 6 GHz Band –10 to +30 dBm Residual EVM 20°C to 30°C Signal level: >–10 dBm (MU887000A), 0 dBm (MU887001A, MU887002A), averaged over 20 packets, where each packet is no less than 16 data OFDM symbols long. And for each subcarrier except Pilots, all data OFDM symbol should have same data field pattern. Channel estimation: FULLPACKET <–45 dB, Measured at 5210 MHz MU887000A Test port 3 and 4, MU887001A Test port 1 to 4 <–40 dB (≤BW 80 MHz) <–40 dB (BW 160 MHz, Nom.) MU887002A (TRX1/2) test port 1 to 12, 2.4/5 GHz Band, <–40 dB (≤BW 80 MHz) <–43 dB (BW 160 MHz, Nom.) MU887002A (TRX1/2) test port 5 to 12, with MU887002A-007 installed, 6 GHz Band <–45 dB (≤BW 80 MHz, Nom.) <–41 dB (BW 160 MHz, Nom.) EVM data format dB, % Resolution 0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution
OFDM EVM Measurement Setting	Channel estimation User selection of long training sequence or full packet. User specified measurement range 16 symbols (min.), 1000 symbols (max.) OFDM pilot tracking “Phase tracking only” or “Phase and Amplitude tracking”. Peak and Average EVM on all sub-carriers, dB or percentage Peak and Average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max.
OFDM Additional Measurement	Transmit center frequency tolerance Definition: Average frequency of the OFDM carrier signal Data output format: Hz, ppm Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) (Averaged over 20 packets, where each packet is no less than 16 data OFDM symbols long) Resolution: Hz to no decimal places, ppm to one decimal places Symbol clock frequency tolerance Definition: Frequency error relative to the symbol clock depends on Signal’s Guard interval. If GI is 0.8 us, Symbol Clock is (1 / (12.8 us + 0.8 us)) = 73.529 kHz approx. If GI is 1.6 us, Symbol Clock is (1 / (12.8 us + 1.6 us)) = 69.444 kHz approx. If GI is 3.2 us, Symbol Clock is (1 / (12.8 us + 3.2 us)) = 62.500 kHz approx. Measurement averaged over a fully coded OFDM packet with a minimum payload length of 16 symbols. Data output format: Hz, ppm Range: ±40 ppm Resolution: ppm to one decimal places User specified measurement range: 16- (Define numbers) Transmitter center frequency leakage Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Unit of measurement: dB

WLAN 802.11be TX Measurement MX887034A

Common Item	Measuring object WLAN signal packet Frequency range MU887002A 6 GHz Band: (With MU887002A-007, test port 5 to 12) 320 MHz BW: 5900 MHz to 7055 MHz 160 MHz BW: 5900 MHz to 7135 MHz 80 MHz BW: 5900 MHz to 7175 MHz 40 MHz BW: 5900 MHz to 7195 MHz 20 MHz BW: 5900 MHz to 7205 MHz 5 GHz Band: 160 MHz BW: 4920 MHz to 5815 MHz 80 MHz BW: 4920 MHz to 5855 MHz 40 MHz BW: 4920 MHz to 5885 MHz 20 MHz BW: 4920 MHz to 5885 MHz 2.4 GHz Band: 40 MHz BW: 2412 MHz to 2472 MHz 20 MHz BW: 2412 MHz to 2484 MHz
RF Power	Input level range MU887002A Test port 1 to 12 (without MU887002A-007), f ≤ 6000 MHz –55 to +35 dBm Test port 1 to 12 (without MU887002A-097/197/297), f ≤ 6000 MHz –55 to +34 dBm Test port 1 to 4 (when MU887000A-007 installed), f ≤ 6000 MHz –55 to +35 dBm Test port 5 to 12 (when MU887000A-007 installed), f < 5900 MHz –55 to +35 dBm Test port 5 to 12 (with MU887002A-007), 5900 MHz ≤ f ≤ 7300 MHz –55 to +30 dBm Accuracy After CAL, 20°C to 30°C MU887002A (TRX1/2) test port 1 to 12, without MU887002A-097/197/297, 2.4/5 GHz Band ≤ BW 80 MHz: ±0.7 dB (–20 dBm ≤ Level ≤ +34 dBm) ±1.0 dB (–40 dBm ≤ Level < –20 dBm) BW 160 MHz: ±1.0 dB (–20 dBm ≤ Level ≤ +34 dBm) ±1.3 dB (–40 dBm ≤ Level < –20 dBm) MU887002A (TRX1/2) test port 1 to 12, with MU887002A-097/197/297 installed, 2.4/5 GHz Band ≤ BW 80 MHz: ±0.7 dB (–20 dBm ≤ Level ≤ +35 dBm) ±1.0 dB (–40 dBm ≤ Level < –20 dBm) BW 160 MHz: ±1.0 dB (–20 dBm ≤ Level ≤ +35 dBm) ±1.3 dB (–40 dBm ≤ Level < –20 dBm) MU887002A (TRX1/2) test port 5 to 12, with MU887002A-007, 6 GHz Band ≤ BW 160 MHz: ±1.0 dB (–20 dBm ≤ Level ≤ +30 dBm) ±1.3 dB (–40 dBm ≤ Level < –20 dBm) BW 320 MHz: ±2.0 dB Nom. (–20 dBm ≤ Level ≤ +30 dBm) ±2.6 dB Nom. (–40 dBm ≤ Level < –20 dBm) Bandwidth 320, 160, 80, 40, 20 MHz Capture time 0.67 s Pre-trigger 0.665 s Resolution (time domain profile) 5 ns/sample CCDF CCDF defined as a percentage of samples against dB, where percentage of samples is normalized to the average power in the 'gate', and dB is defined as the relative value of samples greater than the average. Power distribution value A single numeric value called the power distribution value defines the number of dB above the average power below which a user defined percentage of the total number of samples falls.

Spectral Profile Measurement	Spectral profile measurement span ±80 MHz Capture time 50 µs Measurement range (RBW: 100 kHz) MU887002A (TRX1/2) Test port 1 to 12, without MU887002A-097/197/297 –17 to +34 dBm Test port 1 to 12, without MU887002A-007, with MU887002A-097/197/297 –17 to +35 dBm Test port 1 to 12, with MU887002A-007, Setting Frequency 2.4/5 GHz Band –17 to +35 dBm Test port 5 to 12, with MU887002A-007, Setting Frequency 6 GHz Band –17 to +30 dBm Resolution 0.1 dB Bandwidth 100 kHz
EVM (Modulation Accuracy)	EVM measurement range MU887002A Test port 1 to 12, without MU887002A-097/197/297 –10 to +34 dBm Test port 1 to 12, without MU887002A-007, with MU887002A-097/197/297 –10 to +35 dBm Test port 1 to 12, with MU887002A-007, Setting Frequency 2.4/5 GHz Band –10 to +35 dBm Test port 5 to 12, with MU887002A-007, Setting Frequency 6 GHz Band –10 to +30 dBm Residual EVM 20°C to 30°C Signal level: >–10 dBm, averaged over 20 packets, where each packet is no less than 16 data OFDM symbols long. Channel estimation: FULLPACKET MU887002A (TRX1/2) test port 1 to 12, without MU887002A-007, 2.4/5 GHz Band, <–43 dB (BW 160 MHz, Nom.) MU887002A (TRX1/2) test port 5 to 12, with MU887002A-007 installed, 6 GHz Band <–43 dB (≤BW 160 MHz, Nom.) <–41 dB (BW 320 MHz, Nom.) EVM data format dB, % Resolution 0.1% or 0.1 dB, All limit checking in dB to 0.1 dB resolution
OFDM EVM Measurement Setting	Channel estimation User selection of long training sequence or full packet. User specified measurement range 16 symbols (min.), 1000 symbols (max.) OFDM pilot tracking “Phase tracking only” or “Phase and Amplitude tracking”. Data output format: Peak and Average EVM on all sub-carriers, dB or percentage Peak and Average on each sub-carrier – frequency domain % vs. sub-carrier EVM vs. Symbol – time domain % vs. Symbol number, 1 to max.
OFDM Additional Measurement	Transmit center frequency tolerance Definition: Average frequency of the OFDM carrier signal Data output format: Hz, ppm Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) (Averaged over 20 packets, where each packet is no less than 16 data OFDM symbols long, ≤BW 160 MHz) Accuracy: ± (Setting frequency × Reference oscillator accuracy + 1 kHz) Nom. (Averaged over 20 packets, where each packet is no less than 16 data OFDM symbols long, BW 320 MHz) Resolution: Hz to no decimal places, ppm to one decimal places Symbol clock frequency tolerance Definition: Frequency error relative to the symbol clock depends on Signal’s Guard interval. If GI is 0.8 us, Symbol Clock is (1 / (12.8 us + 0.8 us)) = 73.529 kHz approx. If GI is 1.6 us, Symbol Clock is (1 / (12.8 us + 1.6 us)) = 69.444 kHz approx. If GI is 3.2 us, Symbol Clock is (1 / (12.8 us + 3.2 us)) = 62.500 kHz approx. Measurement averaged over a fully coded OFDM packet with a minimum payload length of 16 symbols. Data output format: Hz, ppm Range: ±40 ppm Resolution: ppm to one decimal places User specified measurement range: 16- (Define numbers) Transmitter center frequency leakage Definition: Measurement of the leakage of the center carrier Data output format: dB Resolution: dB to two decimal places Transmitter spectral flatness Definition: Measurement of RF sub-carrier power level Unit of measurement: dB

Bluetooth TX Measurement MX887040A

Common Item	Measuring object Bluetooth signal packet (DH-1, 3, 5 2-DH-1, 3, 5 3-DH-1, 3, 5 LE) Frequency range 2402 MHz to 2480 MHz Measurement mode 'SIG Standard' Supports RF measurements on selected packet types as per the Bluetooth SIG RF test specification.
RF Power	Input level range –65 to +25 dBm (MU887000A test port 3 and 4) –55 to +35 dBm (MU887001A, MU887002A (TRX1/2) all test port) Measurement accuracy After CAL, 20°C to 30°C ±0.7 dB (–30 dBm ≤ p ≤ +25 dBm), ±1.0 dB (–50 dBm ≤ p < –30 dBm) (MU887000A) ±0.7 dB (–20 dBm ≤ p ≤ +35 dBm), ±1.0 dB (–40 dBm ≤ p ≤ –20 dBm) (MU887001A, MU887002A)
EDR Relative Transmit Power	Input level range –35 to +25 dBm (MU887000A) –25 to +35 dBm (MU887001A, MU887002A) Measurement Value Maximum, Minimum, Average differential power Relative power measurement range Relative power measurement range between the GFSK and π/4-DQPSK, 8-DSPK sections of the packet. Bandwidth 1.3 MHz (IF filter response 'flat' fc ±550 kHz) Resolution (time domain) 0.01 dB
Bluetooth Modulation	GFSK, π/4-DQPSK, 8-DSPK Input level range –20 to +25 dBm (MU887000A) –10 to +35 dBm (MU887001A, MU887002A) Residual DEVM Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A), Averaged over 10 packets <5% Resolution 0.1% GFSK Deviation measurement range: 0 to 350 kHz Accuracy: Modulation index: 0.32, Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A), Averaged over 10 packets 1% (±0.01 × expected deviation [Hz]) (Nom.) Initial carrier frequency tolerance Input level range: –35 to +25 dBm (MU887000A) –25 to +35 dBm (MU887001A, MU887002A) Initial frequency range: 0 to ±150 kHz Resolution: 1 kHz Carrier-frequency drift Input signal range: –35 to +25 dBm (MU887000A) –25 to +35 dBm (MU887001A, MU887002A) Frequency drift range: 0 to ±200 kHz Time settings: 50 µs, >2000 µs
EDR Carrier Frequency Stability	Measurement range ±100 kHz Resolution 1 kHz Accuracy Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A), Averaged over 10 packets ± (Setting frequency × Reference oscillator accuracy + 500 Hz) Displayed results Initial frequency error ωi, Frequency error ωo, Frequency error ωi + ωo
EDR Modulation Accuracy	RMS DEVM range 0 to 30% (π/4-DQPSK), 0 to 20% (8-DSPK) Peak DEVM range 0 to 50% (π/4-DQPSK), 0 to 30% (8-DSPK)
BLE Modulation Characteristics	GFSK Input level range –35 to +25 dBm (MU887000A) –25 to +35 dBm (MU887001A, MU887002A) Frequency deviation range 0 to ±500 kHz peak Resolution 1 kHz Accuracy Modulation index: 0.5, Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A), Averaged over 10 packets 1% (±0.01 × expected deviation [Hz]) (Nom.)

BLE Carrier Frequency Offset and Drift	Input level range –35 to +25 dBm (MU887000A) –25 to +35 dBm (MU887001A, MU887002A) Frequency range 0 to ±500 kHz Accuracy Signal level: >–20 dBm (MU887000A), >–10 dBm (MU887001A, MU887002A), Averaged over 10 packets BLE/2LE/BLR: ± (Setting frequency × Reference oscillator accuracy + 500 Hz) BLEC/2LEC: ± (Setting frequency × Reference oscillator accuracy + 1000 Hz) Displayed results Carrier frequency error, Frequency drift, Drift rate

Short Range Wireless Average Power and Frequency Measurement MX887050A

RF Power (CW and Continuously Modulated)	Frequency range 2.4 GHz band: 2402 MHz to 2484 MHz 5 GHz band: 4920 MHz to 5825 MHz (For MU887000A/01A, required MU887000A/01A-001) Input level range –65 to +25 dBm (MU887000A test port 3 and 4) –55 to +35 dBm (MU887001A, MU887002A) Accuracy After CAL 400 MHz ≤ f < 3.8 GHz, 10°C to 40°C ±0.7 dB (–30 ≤ p ≤ +25 dBm) ±0.9 dB (–55 ≤ p < –30 dBm) ±1.1 dB (–65 ≤ p < –55 dBm) 3.8 GHz ≤ f ≤ 6 GHz, 20°C to 30°C ±0.7 dB (–30 ≤ p ≤ +25 dBm) ±0.9 dB (–55 ≤ p < –30 dBm) ±1.1 dB (–65 ≤ p < –55 dBm) Linearity CW, RBW: 100 kHz ±0.2 dB (≥–55 dBm, –40 to 0 dB)
Frequency (CW)	Input level range –35 to +25 dBm (MU887000A) –25 to +35 dBm (MU887001A, MU887002A) Frequency range 0 to ±500 kHz Accuracy ± (Setting frequency × Reference oscillator accuracy + 500 Hz)

IEEE 802.15.4 TX Measurement MX887060A

Common Item	Frequency range 440 MHz to 2500 MHz
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Accuracy After CAL, 10°C to 40°C MU887000A test port 1 and 2, MU887001A all test port ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) MU887000A test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm) MU887002A (TRX1/2) all test port, 20°C to 30°C ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm)
Modulation Analysis	Input level range Analysis length: 1000 chips or more –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Modulation accuracy Residual EVM ≤1.5% Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 20 Hz)

Z-Wave TX Measurement MX887061A

Common Item	Frequency range 440 MHz to 1000 MHz
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Accuracy After CAL, 10°C to 40°C MU887000A test port 1 and 2, MU887001A all test port ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm) MU887000A test port 3 and 4 ±0.7 dB (–25 to +25 dBm) ±0.9 dB (–55 to –25 dBm) ±1.1 dB (–65 to –55 dBm) MU887002A (TRX1/2) all test port, 20°C to 30°C ±0.3 dB (typ.), ±0.5 dB (–25 to +35 dBm) ±0.7 dB (–55 to –25 dBm) ±0.9 dB (–65 to –55 dBm)
Modulation Analysis	Input level range Analysis length: 200 bits –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 20 Hz)

Category M FDD Uplink TX Measurement MX887065A

Common Item	Measuring Object PUSCH, PUCCH Frequency Range 600 MHz to 2.7 GHz, 3.4 GHz to 4.2 GHz (For MU887000A/01A, required MU887000A/01A-001)
RF Power	Input Level Range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement Accuracy 600 MHz to 2.7 GHz, 3.4 GHz to 3.8 GHz, After CAL, 10°C to 40°C (MU887000A/01A), 20°C to 30°C (MU887002A) MU887000A test port 1 and 2, MU887001A all test ports, MU887002A (TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm, 20°C to 30°C) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–50 to –20 dBm) ±0.9 dB (–60 to –50 dBm) MU887000A test port 3 and 4 ±0.7 dB (–20 to +25 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) 3.8 GHz to 4.2 GHz, After CAL, 20°C to 30°C MU887000A all test ports and MU887001A all test ports, MU887002A (TRX1/2) all test port ±0.7 dB (–20 to +35 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm)

Frequency/Modulation Measurement	Input Level Range –40 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –40 to +25 dBm (MU887000A test port 3 and 4) Carrier Frequency Accuracy ± (Setting frequency × Reference oscillator accuracy + 15 Hz) Modulation Analysis Residual EVM: Average of 20 measurements ≤2.5% In-Band Emission In signal condition with Input Level ≥–10 dBm ≤–40 dBc
Occupied bandwidth	Input Level Range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)
Adjacent channel leakage power ratio	Input Level Range MU887000A –10 to +35 dBm (test port 1 and 2) –10 to +25 dBm (test port 3 and 4) MU887001A –10 to +35 dBm MU887002A (TRX1/2) –10 to +35 dBm (600 MHz to 2.7 GHz) –14 to +35 dBm (3.4 GHz to 4.2 GHz) Measurement Range ≥45 dB (E-UTRA ACLR1) ≥50 dB (UTRA ACLR1) ≥55 dB (UTRA ACLR2)
Spectrum Emission Mask	Input Level Range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)

NB-IoT Uplink TX Measurement MX887067A

Common Item	Measuring object NPUSCH Frequency range 600 MHz to 2.7 GHz, 3.4 GHz to 4.2 GHz (For MU887000A/01A, required MU887000A/01A-001)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy 600 MHz to 2.7 GHz, After CAL, 20°C to 30°C MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port ±0.3 dB (typ.) (–20 to +35 dBm) ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–50 to –20 dBm) ±0.9 dB (–60 to –50 dBm) MU887000A test port 3 and 4 ±0.7 dB (–20 to +25 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm) 3.4 GHz to 3.8 GHz, After CAL, 20°C to 30°C MU887000A test port 1 and 2, MU887001A all test port ±0.5 dB (–20 to +35 dBm) ±0.7 dB (–50 to –20 dBm) ±0.9 dB (–60 to –50 dBm) MU887002A (TRX1/2) all test port ±0.5 dB (typ.) (–20 to +35 dBm) ±0.7 dB (–50 to +35 dBm) ±0.9 dB (–60 to –50 dBm) 3.8 GHz to 4.2 GHz, After CAL, 20°C to 30°C MU887000A/01A/MU887002A (TRX1/2) all test port ±0.7 dB (–20 to +35 dBm) ±0.9 dB (–50 to –20 dBm) ±1.1 dB (–60 to –50 dBm)
Frequency/Modulation Measurement	Input level range –40 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –40 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy ± (Setting frequency × Reference oscillator accuracy + 15 Hz) Modulation analysis Residual EVM: Average of 20 measurements ≤1% In-band emission In signal condition with Input Level ≥–10 dBm ≤–40 dBc
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)
Adjacent Channel Leakage Power Ratio	Input level range MU887000A –10 to +35 dBm (test port 1 and 2) –10 to +25 dBm (test port 3 and 4) MU887001A –10 to +35 dBm MU887002A (TRX1/2) –10 to +35 dBm (600 MHz to 2.7 GHz) –14 to +35 dBm (3.4 GHz to 4.2 GHz) Measurement range ≥47 dB (GSM ACLR) ≥50 dB (UTRA ACLR)
Spectrum Emission Mask	Input level range –10 to +35dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –10 to +25dBm (MU887000A test port 3 and 4)

LTE-V2X Tx Measurement MX887068A

Common Item	Measuring object PSSCH Frequency range 5855 MHz to 5925 MHz (For MU887000A/01A, required MU887000A/01A-001)
RF Power	Input level range –65 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –65 to +25 dBm (MU887000A test port 3 and 4) Measurement accuracy After CAL, 20°C to 30°C MU887000A test port 1 and 2, MU887001A all test port ±0.7 dB (–20 to +35 dBm) ±1.1 dB (–50 to –20 dBm) MU887000A test ports 3, 4 ±0.7 dB (–30 to +25 dBm) ±1.1 dB (–50 to –30 dBm) MU887002A (TRX1/2) all test port ±0.7 dB (typ.) (–20 to +35 dBm) ±0.9 dB (–20 to +35 dBm) ±1.1 dB (–50 to –20 dBm)
Frequency/Modulation Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy 20°C to 30°C ± (Setting Frequency × Reference Oscillator Accuracy + 36 Hz) Modulation analysis Residual EVM: Average of 20 measurements 20°C to 30°C ≤2.5% In-band emission In signal condition with Input Level ≥–10 dBm, Allocated RB ≤18 20°C to 30°C ≤–40 dBc
Occupied Bandwidth	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)
Adjacent Channel Leakage Power Ratio	Input level range MU887000A –10 to +35 dBm (test port 1 and 2) –10 to +25 dBm (test port 3 and 4) MU887001A –10 to +35 dBm MU887002A (TRX1/2) –14 to +35 dBm Measurement range 20°C to 30°C ≥42 dB (E-UTRA ACLR1)
Spectrum Emission Mask	Input level range –10 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –10 to +25 dBm (MU887000A test port 3 and 4)

LTE-V2X PSCCH TX Measurement MX887068A-001

Common Item	Measuring object PSCCH Frequency range 5855 MHz to 5925 MHz (For MU887000A/01A, required MU887000A/01A-001)
Frequency/Modulation Measurement	Input level range –30 to +35 dBm (MU887000A test port 1 and 2, MU887001A/MU887002A (TRX1/2) all test port) –30 to +25 dBm (MU887000A test port 3 and 4) Carrier frequency accuracy 20°C to 30°C ± (Setting Frequency × Reference Oscillator Accuracy + 36 Hz) Modulation analysis Residual EVM: Average of 20 measurements 20°C to 30°C ≤2.5%

WLAN 802.11b/g/a/n Waveforms MV887030A

EVM	802.11b Packet length: 1024 byte, Gaussian filter: BT 0.5 ≤–38 dB rms (2402 MHz to 2484 MHz) 802.11g Packet length: 1000 byte, 20°C to 30°C ≤–40 dB rms (2402 MHz to 2484 MHz) 802.11a Packet length: 1000 byte, 20°C to 30°C ≤–38 dB rms (4920 MHz to 5825 MHz) 802.11n Packet length: 4096 byte, Long guard interval, Channel bandwidth: 40 MHz, 20°C to 30°C ≤–40 dB rms (2402 MHz to 2484 MHz) ≤–38 dB rms (4920 MHz to 5825 MHz)

WLAN 802.11ax Waveforms MV887033A

EVM	Packet length: 4096 byte, Guard Interval 0.8 µs, Channel Bandwidth: 80 MHz, 20°C to 30°C MU887002A ≤–43 dB Nom. (when MU887002A-007 installed, 5900 MHz to 7175 MHz)

WLAN 802.11be Waveforms MV887034A

EVM	Packet length: 4096 byte, Guard Interval 0.8 µs, 20°C to 30°C MU887002A ≤–38 dB Nom. (MCS13)

Bluetooth Waveforms MV887040A

Deviation	Frequency: 2402 MHz to 2480 MHz, GFSK modulation 1% (±0.01 × deviation Hz) (Nom.)
DEVM	Frequency: 2402 MHz to 2480 MHz, π/4-DQPSK, 8-DPSK modulation <5% rms

IEEE 802.15.4 Waveforms MV887060A

EVM	440 MHz ≤ f ≤ 2500 MHz ≤3.0%

Z-Wave Waveforms MV887061A

EVM	440 MHz ≤ f ≤ 2500 MHz ≤3.0%

Category M FDD Downlink Waveforms MV887065A

Max. Output Level	MU887000A test port 1 and 2, MU887001A all test port –12 dBm (f ≤ 3.8 GHz), –20 dBm (f > 3.8 GHz) MU887000A test port 3 and 4 –2 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz) MU887002A (TRX1/2) all test port –7 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz)

NB-IoT Downlink Waveforms MV887067A

Max. Output Level	MU887000A test port 1 and 2, MU887001A all test port –12 dBm (f ≤ 3.8 GHz), –20 dBm (f > 3.8 GHz) MU887000A test port 3 and 4 –2 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz) MU887002A (TRX1/2) all test port –7 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz)

LTE-V2X Waveform Files MV887068A

Max. Output Level	MU887000A test port 1 and 2, MU887001A all test port –12 dBm (f ≤ 3.8 GHz), –20 dBm (f > 3.8 GHz) MU887000A test port 3 and 4 –2 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz) MU887002A (TRX1/2) all test port –7 dBm (f ≤ 3.8 GHz), –10 dBm (f > 3.8 GHz)

ISDB-Tmm Waveforms MV887112A

MER	Frequency: 214.714285 MHz ≥37 dB (total)

FM/Audio TRX Measurement MX887070A

FM Signal Measurements

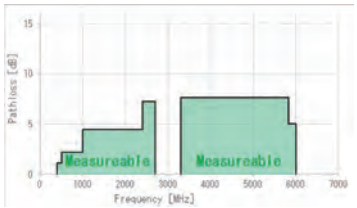
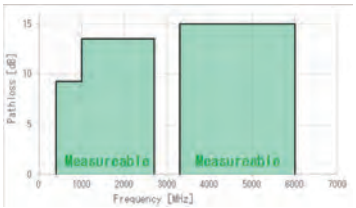
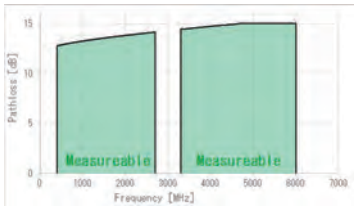
Common Item	Target signals FM/FM stereo/RDS (Radio Data System) signals Frequency range 65 MHz to 110 MHz
TX Measurements	Measurement functions Amplitude Carrier frequency Frequency deviation Occupied bandwidth Pilot frequency deviation Audio frequency deviation Audio frequency Pilot frequency THD THD+N/SINAD SNR Audio filter Low-pass: Off, 3 kHz,15 kHz, 20 kHz, 30 kHz High-pass: Off, 20 Hz, 100 Hz, 400 Hz De-emphasis: Off, 50 µs, 75 µs Bandpass (Weighting filter): Off, A-Weighting (IEC 61672: 2003), C-Message, CCITT (ITU-T O.41) Input level range –30 to +15 dBm Level accuracy 10°C to 40°C, Measurement bandwidth: 1.2 MHz, –30 dBm ≤ p ≤ +15 dBm ±0.7 dB Carrier frequency accuracy FM monaural modulation, Tone: 1 kHz, Deviation: 75 kHz ± (Setting frequency × Reference oscillator accuracy + 1 Hz) FM deviation range 1 kHz to 100 kHz Residual FM Monaural modulation, Tone: 1 kHz, Deviation: 75 kHz, Demodulation bandwidth: 20 Hz to 15 kHz, using De-emphasis filter (50 µs) >55 dB Demodulation signal analysis No. of FFT points: 65536 Sampling rate: 152 kHz FFT window function: Hanning window
RX Measurements	Measurement functions FM waveform output Modulation method FM Monaural, FM stereo Frequency deviation Setting range: 20 kHz to 100 kHz Distortion 65 MHz to 110 MHz, (SINAD, 20 Hz to 15 kHz, Emphasis on, Monaural), Tone: 1 kHz, Deviation: 75 kHz >50 dB (SINAD) Resolution: 0.1 Hz Internal modulation signal AF tone L channel (Mono): 1 to 8 tones R channel: 1 to 8 tones Frequency range 20 Hz to 20 kHz, Resolution: 0.1 Hz

Audio Signal Measurements

With MU887000A/01A-002 Audio Measurement Hardware installed, TRX measurements of analog audio signal from AF input/output connector or digital audio signal from AF digital connector

TX Measurements	Measurement functions Amplitude Frequency Distortion ratio measurement Crosstalk THD THD+N/SINAD SNR Analog measurements All single-tone measurement standard values Impedance: 100 kΩ (AC coupling) Frequency Frequency range: 20 Hz to 20 kHz Input level Level range: 1 mVpeak to 5 Vpeak (30 V rms, max.) Setting range: 50 mVpeak, 500 mVpeak, 5 Vpeak Level accuracy: ±0.4 dB (20°C to 30°C) THD+N (total harmonic distortion + noise) <–60 dB (at 1 kHz, 2 Vpeak, 20 Hz to 20 kHz bandwidth, 5 Vpeak range, 20°C to 30°C) Crosstalk L/R: >60 dB AF signal analysis Sampling rate: 192 kHz No. of FFT points: 65536 FFT window function: Hanning window Digital measurement All single-tone measurement standard values Bit resolution: 16 bits/24 bits Sampling rate Frequency: 16, 32, 44.1, 48 kHz AF signal analysis No. of FFT points: 16384 (sampling rates of 48 kHz, 44.1 kHz) 8192 (sampling rate of 32 kHz) 4096 (sampling rate of 16 kHz) FFT window function: Hanning window
RX Measurement	Analog measurements All single-tone measurement standard values Impedance: 1 Ω (AC coupling) (Nom.) Output waveform: Single tone, Multi-tone Frequency Frequency range: 20 Hz to 20 kHz Frequency resolution: 0.01 Hz Output level Level range: 0 (off), 1 mV to 5 Vpeak (100 kΩ termination) Resolution: 1 mV (≤5 Vpeak) 100 µV (≤500 mVpeak) 10 µV (≤50 mVpeak) Accuracy: ±0.3 dB (at 1 kHz, 100 kΩ termination, 20°C to 30°C) Maximum output current 100 mA (Nom.) (Do not do short circuit) THD+N (Total harmonic distortion + noise) <–60 dB (at 1 kHz, 1 Vpeak, 20 Hz to 20 kHz bandwidth, 100 kΩ termination, 20°C to 30°C) Digital measurement All single-tone measurement standard values Output waveform: Single tone, Multi-tone Frequency Frequency range: 20 Hz to 20 kHz (44.1 kHz, 48 kHz sampling) 20 Hz to 14 kHz (32 kHz sampling) 20 Hz to 7 kHz (16 kHz sampling) Resolution: 0.01 Hz Output level Level range: Full scale to (Full scale – 40 dB) Resolution: 0.1 dB Bit resolution: 16 bits/24 bits Sampling rate Frequency: 16, 32, 44.1, 48 kHz

Pathloss Measurement Function for MU887002A MX887092A

Frequency Range	400 MHz ≤ Setting Frequency ≤ 6000 MHz
Application	MU887002A TRX 1/2 Port 1 to 12
Measurement Range	0 dB ≤ Pathloss ≤ 15 dB 1 m ≤ Route Length ≤ 3 m (When using a coaxial cable with a relative permittivity of 2.03)  Measurable Range (Route length 1 m)  Measurable Range (Route length 1.5 m)  Measurable Range (Route length 3 m)
Measurement Accuracy	400 MHz ≤ Setting Frequency ≤ 2700 MHz, 11 moving average intervals, route length 1.5 m, a coaxial cable with a relative permittivity of 2.03 ±0.3 dB (typ.) ±0.5 dB 3300 MHz ≤ Setting Frequency ≤ 6000 MHz, 11 moving average intervals, route length 1.5 m, a coaxial cable with a relative permittivity of 2.03 ±0.6 dB (typ.) ±0.9 dB
Measurement Reproducibility	At Pathloss ≤ 6 dB, 11 moving average intervals ±0.1 dB (Nom.) At Pathloss ≤ 15 dB, 11 moving average intervals ±0.15 dB (Nom.)

Universal Wireless Test Set MT8870A Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main frame
MT8870A	Universal Wireless Test Set
	Standard Accessories
	Power Cord: 1 pc
B0666B	Blank Panel: 0 to 4 pcs*1
	DVD-R: 1 pc
MX880050A	CombiView (DVD-R)
MX880051A	Cellular Application Applet (DVD-R)
MX880052A	SRW Application Applet (DVD-R)
MX880053A	FM/Audio Application Applet (DVD-R)
MX880054A	Signal Generator Application Applet (DVD-R)
MX880055A	Small Cell Application Applet (DVD-R)
MX880056A	IEEE 802.15.4 Application Applet (DVD-R)
MX887900A	MT8870A Utility Tool (DVD-R)
W3605AE	MT8870A Operation Manual (DVD-R)
W3606AE	MU887000A Operation Manual (DVD-R)
	Options
MT8870A-001	GPIB Control*2
MT8870A-101/201	GPIB Control Retrofit*2
	Warranty
MT8870A-ES210	2 Years Extended Warranty Service
MT8870A-ES310	3 Years Extended Warranty Service
MT8870A-ES510	5 Years Extended Warranty Service
	Application Parts
B0666B	Blank Panel
B0664A	Rack Mount Kit (MT8870A)
B0665A	Carrying Case (MT8870A)
B0775A	Carrying Case (MU88700xA)
B0669A	Front Cover for 1MW5U (MT8870A)*3
J0006	GPIB Cable, 0.5 m
J0007	GPIB Cable, 1.0 m
J0008	GPIB Cable, 2.0 m
J0127A	Coaxial Cord, 1 m (BNC-P · RG-58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG-58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG-58A/U · BNC-P)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322B	Coaxial Cord, 1.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322C	Coaxial Cord, 1.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322D	Coaxial Cord, 2.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0004	Coaxial Adapter (N-P · SMA-J)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Crossover, 1 m)
J1261D	Ethernet Cable (Shield type, Crossover, 3 m)
J1941A	2way Low Amplitude Error Divider
J1942A	4way Low Amplitude Error Divider

*1: Installed in empty slots
*2: Supports MU887000A/01A only
*3: Cannot be shipped to EU because not RoHS10 compliant

Model/Order No.	Name
	Application Instruments
MN8116A	Multi-Port Switch (16 ports)
MN8116A-001	16 Port Expansion Bank
MN8116A-101	16 Port Expansion Bank Retrofit
	Warranty
MN8116A-ES210	2 Years Extended Warranty Service
MN8116A-ES310	3 Years Extended Warranty Service
MN8116A-ES510	5 Years Extended Warranty Service

Model/Order No.	Name
	Test Module
MU887000A	TRX Test Module
MU887001A	TRX Test Module
MU887002A	TRX Test Module
	Standard Accessories
	DVD-R: 1 pc
W3606AE	MU887000A Operation Manual (DVD-R)
W3720AE	MU887001A TRX Test Module Operation Manual
W4048AE	MU887002A TRX Test Module Operation Manual
KUWM-32-M4-16-OR	Plastic Wing Knob
	Options
MU887000A-001	6 GHz Frequency Extension
MU887000A-101/201	6 GHz Frequency Extension Retrofit
MU887000A-002	Audio Measurement Hardware
MU887000A-102/202	Audio Measurement Hardware Retrofit
MU887001A-001	6 GHz Frequency Extension
MU887001A-101/201	6 GHz Frequency Extension Retrofit
MU887001A-002	Audio Measurement Hardware
MU887001A-102/202	Audio Measurement Hardware Retrofit
MU887002A-007	7 GHz Extension Function
MU887002A-107/207	7 GHz Extension Function Retrofit
MU887002A-UG107/UG207	7 GHz Extension Function Upgrade
MU887002A-097	7 GHz Extension Hardware*4
	Warranty
MU887000A-ES210	2 Years Extended Warranty Service
MU887000A-ES310	3 Years Extended Warranty Service
MU887000A-ES510	5 Years Extended Warranty Service
MU887001A-ES210	2 Years Extended Warranty Service
MU887001A-ES310	3 Years Extended Warranty Service
MU887001A-ES510	5 Years Extended Warranty Service
MU887002A-ES210	2 Years Extended Warranty Service
MU887002A-ES310	3 Years Extended Warranty Service
MU887002A-ES510	5 Years Extended Warranty Service

*4: MU887002A-097 is a standard option.
Simultaneous order is required MU887002A and MU887002A-097.

Universal Wireless Test Set MT8872A Ordering Information

Model/Order No.	Name
	Main Frame
MT8872A	Universal Wireless Test Set
	Standard Accessories
	Power Cord: 1 pc
B0666B	Blank Panel: 0 to 2 pcs*1
	DVD-R: 1 pc
MX880050A	CombiView (DVD-R)
MX880051A	Cellular Application Applet (DVD-R)
MX880052A	SRW Application Applet (DVD-R)
MX880053A	FM/Audio Application Applet (DVD-R)
MX880054A	Signal Generator Application Applet (DVD-R)
MX880055A	Small Cell Application Applet (DVD-R)
MX880056A	IEEE 802.15.4 Application Applet (DVD-R)
MX887900A	MT8870A Utility Tool (DVD-R)
W3605AE	MT8872A Operation Manual (DVD-R)
W3606AE	MU887000A Operation Manual (DVD-R)
	Options
MT8872A-001	GPIB Control*2
MT8872A-101/201	GPIB Control Retrofit*2
	Warranty
MT8872A-ES210	2 Years Extended Warranty Service
MT8872A-ES310	3 Years Extended Warranty Service
MT8872A-ES510	5 Years Extended Warranty Service
	Application Parts
B0666B	Blank Panel
B0774A	Carrying Case (MT8872A)
B0775A	Carrying Case (MU88700xA)
J0006	GPIB Cable, 0.5 m
J0007	GPIB Cable, 1.0 m
J0008	GPIB Cable, 2.0 m
J0127A	Coaxial Cord, 1 m (BNC-P · RG-58A/U · BNC-P)
J0127B	Coaxial Cord, 2.0 m (BNC-P · RG-58A/U · BNC-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P · RG-58A/U · BNC-P)
J0576B	Coaxial Cord, 1.0 m (N-P · 5D-2W · N-P)
J0576D	Coaxial Cord, 2.0 m (N-P · 5D-2W · N-P)
J0322A	Coaxial Cord, 0.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322B	Coaxial Cord, 1.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322C	Coaxial Cord, 1.5 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0322D	Coaxial Cord, 2.0 m (SMA-P · SMA-P, DC to 18 GHz, 50Ω)
J0004	Coaxial Adapter (N-P · SMA-J)
J1261A	Ethernet Cable (Shield type, Straight, 1 m)
J1261B	Ethernet Cable (Shield type, Straight, 3 m)
J1261C	Ethernet Cable (Shield type, Crossover, 1 m)
J1261D	Ethernet Cable (Shield type, Crossover, 3 m)

*1: Installed in empty slots
*2: Supports MU887000A/01A only

Model/Order No.	Name
	Test Module
MU887000A	TRX Test Module
MU887001A	TRX Test Module
MU887002A	TRX Test Module
	Standard Accessories
	DVD-R: 1 pc
W3606AE	MU887000A Operation Manual (DVD-R)
W3720AE	MU887001A TRX Test Module Operation Manual
W4048AE	MU887002A TRX Test Module Operation Manual
KUWM-32-M4-16-OR	Plastic Wing Knob
	Options
MU887000A-001	6 GHz Frequency Extension
MU887000A-101/201	6 GHz Frequency Extension Retrofit
MU887000A-002	Audio Measurement Hardware
MU887000A-102/202	Audio Measurement Hardware Retrofit
MU887001A-001	6 GHz Frequency Extension
MU887001A-101/201	6 GHz Frequency Extension Retrofit
MU887001A-002	Audio Measurement Hardware
MU887001A-102/202	Audio Measurement Hardware Retrofit
MU887002A-007	7 GHz Extension Function
MU887002A-107/207	7 GHz Extension Function Retrofit
MU887002A-UG107/UG207	7 GHz Extension Function Upgrade
MU887002A-097	7 GHz Extension Hardware*3
	Warranty
MU887000A-ES210	2 Years Extended Warranty Service
MU887000A-ES310	3 Years Extended Warranty Service
MU887000A-ES510	5 Years Extended Warranty Service
MU887001A-ES210	2 Years Extended Warranty Service
MU887001A-ES310	3 Years Extended Warranty Service
MU887001A-ES510	5 Years Extended Warranty Service
MU887002A-ES210	2 Years Extended Warranty Service
MU887002A-ES310	3 Years Extended Warranty Service
MU887002A-ES510	5 Years Extended Warranty Service

*3: MU887002A-097 is a standard option.
Simultaneous order is required MU887002A and MU887002A-097.

Measurement Software/Waveforms Ordering Information

Measurement Software	
MX887010A	Cellular Standards Sequence Measurement
MX887011A	W-CDMA/HSPA Uplink TX Measurement
MX887012A	GSM/EDGE Uplink TX Measurement
MX887013A	LTE FDD Uplink TX Measurement
MX887013A-001	LTE-Advanced FDD Uplink CA TX Measurement*1
MX887014A	LTE TDD Uplink TX Measurement
MX887014A-001	LTE-Advanced TDD Uplink CA TX Measurement*2
MX887015A	CDMA2000 Reverse Link TX Measurement
MX887016A	1xEV-DO Reverse Link TX Measurement
MX887017A	TD-SCDMA Uplink TX Measurement
MX887018A	NR FDD sub-6 GHz Uplink TX Measurement*3
MX887018A-001	NR FDD Contiguous ENDC TX Measurement
MX887019A	NR TDD sub-6 GHz Uplink TX Measurement
MX887019A-001	NR TDD Contiguous ENDC TX Measurement*4
MX887021A	W-CDMA/HSPA Downlink TX Measurement*5
MX887023A	LTE FDD Downlink TX Measurement*5
MX887030A	WLAN 802.11b/g/a/n TX Measurement*6
MX887031A	WLAN 802.11ac TX Measurement*6
MX887032A	WLAN 802.11p TX Measurement*6
MX887033A	WLAN 802.11ax TX Measurement*6
MX887034A	WLAN 802.11be TX Measurement*5
MX887040A	Bluetooth TX Measurement
MX887040A-001	DLE TX Measurement*7
MX887040A-002	2LE TX Measurement*7, *8
MX887040A-003	BLR TX Measurement*7, *8
MX887040A-004	BLE AoA/AoD TX Measurement*7, *8, *9
MX887050A	Short Range Wireless Average Power and Frequency Measurement
MX887060A	IEEE 802.15.4 TX Measurement
MX887061A	Z-Wave TX Measurement
MX887065A	Category M FDD Uplink TX Measurement
MX887067A	NB-IoT Uplink TX Measurement
MX887068A	LTE-V2X Tx Measurement*10
MX887068A-001	LTE-V2X PSCCH TX Measurement*10, *11
MX887070A	FM/Audio TRX Measurement*12, *13
MX887090A	Multi-DUT Measurement Scheduler
MX887092A	Pathloss Measurement Function for MU887002A*5

Waveforms	
MV887011A	W-CDMA/HSPA Downlink Waveforms
MV887012A	GSM/EDGE Downlink Waveforms
MV887013A	LTE FDD Downlink Waveforms
MV887014A	LTE TDD Downlink Waveforms
MV887015A	CDMA2000 Forward Link Waveforms
MV887016A	1xEV-DO Forward Link Waveforms
MV887017A	TD-SCDMA Downlink Waveforms
MV887018A	NR FDD sub-6 GHz Downlink Waveforms
MV887019A	NR TDD sub-6 GHz Downlink Waveforms
MV887021A	W-CDMA/HSPA Uplink Waveforms*5
MV887023A	LTE FDD Uplink Waveforms*5
MV887030A	WLAN 802.11b/g/a/n Waveforms*6
MV887031A	WLAN 802.11ac Waveforms*6
MV887032A	WLAN 802.11p Waveforms*6
MV887033A	WLAN 802.11ax Waveforms*6
MV887034A	WLAN 802.11be Waveforms*5
MV887040A	Bluetooth Waveforms
MV887040A-001	DLE Waveforms*14
MV887040A-002	2LE Waveforms*14, *15
MV887040A-003	BLR Waveforms*14, *15
MV887040A-004	BLE AoA/AoD Waveforms*14, *15, *16
MV887060A	IEEE 802.15.4 Waveforms
MV887061A	Z-Wave Waveforms
MV887065A	Category M FDD Downlink Waveforms
MV887067A	NB-IoT Downlink Waveforms
MV887068A	LTE-V2X Waveforms*10
MV887070A	FM RDS Waveforms*13
MV887100A	GPS Waveforms
MV887100A-002	GPS L5 Waveforms*17
MV887101A	Galileo Waveforms
MV887102A	GLONASS Waveforms
MV887103A	BeiDou Waveforms
MV887104A	QZSS Waveforms
MV887110A	DVB-H Waveforms
MV887111A	ISDB-T Waveforms
MV887112A	ISDB-Tmm Waveforms*13

*1: Requires MX887013A.
*2: Requires MX887014A.
*3: Requires MX887018A.
*4: Requires MX887019A.
*5: Supports MU887002A only.
*6: Requires MU887000A/01A-001 for 5 GHz (802.11a/n/p/ac) frequency measurements.
*7: Requires MX887040A.
*8: Requires MX887040A-001.
*9: Recommend MX887040A-002.
*10: When measuring with MU887000A/01A, MU887000A/01A-001 is required.
*11: Requires MX887068A.
*12: Requires MU887000A/01A-002 for audio signal measurements.
*13: Supports MU887000A/01A only.
*14: Requires MV887040A.
*15: Requires MV887040A-001.
*16: Recommend MV887040A-002.
*17: Requires MV887100A.

Note

Anritsu Advancing beyond

Specifications are subject to change without notice.

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