MX887061A
Z-Wave
TX Measurement
Operation Manual

First Edition

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

ANRITSU CORPORATION

Document No.: M-W3789AE-1.0

Safety Symbols

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

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

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

These indicate that the marked part should be recycled.

MX887061A
Z-Wave Measurement
Operation Manual

21 January 2016 (First Edition)

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  Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.
  All other required files should be transferred by means of USB or CompactFlash media after undergoing a thorough virus check.
- Adding software
  Do not download or install software that has not been specifically recommended or licensed by Anritsu.
- Network connections
  Ensure that the network has sufficient anti-virus security protection in place.

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Anritsu affixes the CE conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Software: MX887061A Z-Wave TX Measurement

2. Applied Directive and Standards

When the MX887061A Z-Wave TX Measurement is installed in the MT8870A, the applied directive and standards of this software conform to that of the MT8870A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX887061A can be used with.

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

C-Tick mark

1. Product Model

Software: MX887061A Z-Wave TX Measurement

2. Applied Directive and Standards

When the MX887061A Z-Wave TX Measurement is installed in the MT8870A, the applied directive and standards of this software conform to that of the MT8870A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX887061A can be used with.

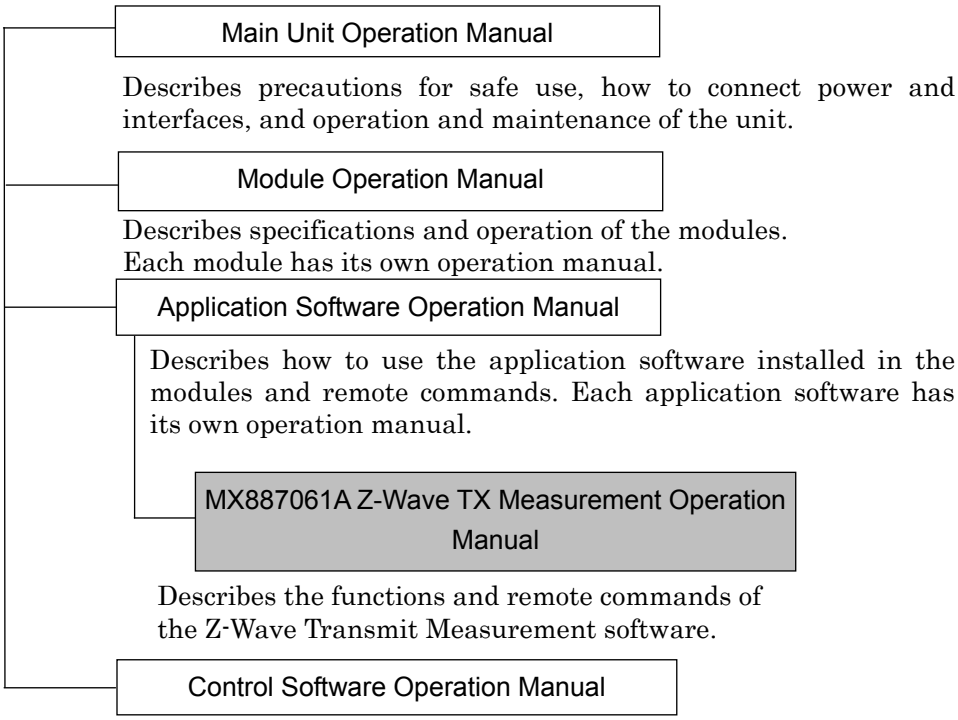
About This Manual

This manual mainly describes the use, panels, and specifications of the MX887061A Z-Wave TX Measurement.

Products related to the MT8870A Universal Wireless Test Set include:

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

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



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IV.

Chapter 1 Outline

This chapter outlines the MX887061A Z-Wave Tx Measurement. Refer to Appendix A “Specifications” for the software function and specifications.

1.1 Outline

The MX887061A Z-Wave TX Measurement (hereafter MX887061A) is software for measuring radio characteristics of the device under test (DUT) complying with ITU-T G.9959 Short range narrow-band digital radiocommunication transceivers – PHY, MAC, SAR and LLC layer specifications that are adopted by the Z-Wave Alliance as the standard for PHY and MAC layers.

The RF signal output from the MU887000A is input to the RF connector of the DUT and the signal output from the DUT is input to the MU887000A. Any file pattern can be specified at the MX887061A to send to DUT as the signal waveform.
The MX887061A is sent as a modulation signal pattern read from memory, irrespective of the DUT signal information (non-signalling).

The MX887061A software does not support signalling transmission methods in which the DUT signal information is detected and the output signal modulation is changed.

1.2 Features

The MX887061A software features:

High-speed measurement

High-speed measurement is supported by the latest processor and measurement algorithm.

1.3 Composition

The composition of the MX887061A is shown in the Table 1.3-1. The electronic files are stored in one or more storage media (DVD, etc.).

Table 1.3-1 Composition

Model/Code	Name	Remarks
MX887061A	Z-Wave TX Measurement	—
W3789AE	MX887061A Z-Wave TX Measurement Operation Manual	English

1.4 License Registration

Before the MX887061A software can be used, the software license must be registered in the MU887000A.

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

1.5 Abbreviations

The abbreviations used in this manual are listed in Table 1.5-1.

Table 1.5-1 Abbreviations

Abbreviations	Name
ACK	Acknowledge
AVG	Average
CRC	Cyclic Redundancy Check
Dst	Destination
DUT	Device Under Test
EHR	End Header
EOF	End of Frame delimiter
FCS	Frame Check Sequence
FER	Frame Error Rate
ISM	Industrial, Scientific and Medical
MHR	MAC Header
MSDU	MAC Service Data Unit
NRZ	No Return to Zero
PHR	PHY Header
PHY	Physical layer
PPDU	Protocol Data Unit
PSDU	PHY Service Data Unit
R1	Data Rate type1 (9.6kbit/s)
R2	Data Rate type2 (40kbit/s)
R3	Data Rate type3 (100kbit/s)
RX	Receive/Receiver
SFD	Start Frame Delimiter
SHR	Start Header
Src	Source
SOF	Start of Frame delimiter
TRX	Transceiver
TX	Transmit/Transmitter

Chapter 2 Fundamental Measurement

This chapter describes the fundamental functions and commands of the MX887061A. For details of the commands, refer to Chapter 3 “SCPI Command Reference” and Chapter 4 “Native Command Reference”.

2.1 Common Operations

This section explains operation of MX887061A software.
Both Native and SCPI commands are described in the introduction to commands.

2.1.1 Selecting application

Switch the MU887000A application software to Z-Wave by using the following command.

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

2.1.2 Setting ports

Set the MU887000A ports to be used. The following command sets both the port for outputting the signal and the port for receiving the signal of the device under test (DUT).
Set Port1 to Port4 at the parameter

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

When setting the sequence table in sequence measurement, the sequence commands set only the output port to Port 1 to Port 4.
The above-mentioned command sets the receiving port.

2.1.3 Frequency and level

Frequency

Set the MU887000A receiving frequency and MU887000A transmitting frequency using the following commands.

- Measuring Frequency (Transmitting frequency of DUT)
  `CONF:ZWAV:FREQ`
  `:CONFigure:ZWAVe:FREQuency`
- Transmitting Frequency (Receiving frequency of DUT)
  `SOUR:GPRF:GEN:RFS:FREQ`
  `:SOURce:GPRF:GENerator:RFSettings:FREQuency`

Level

Set the level of the signal received by and sent from the MU887000A using the following commands.

- Input Level
  `CONF:ZWAV:POW`
  `:CONFigure:ZWAVe:POWer`
- Output Level
  `SOUR:GPRF:GEN:RFS:LEV`
  `:SOURce:GPRF:GENerator:RFSettings:LEVel`

Refer to Chapter 5 “SCPI Command Reference” in the *MU887000A TRX Test Module Operation Manual* for detail descriptions of the commands setting the transmitting frequency and output level.

Cable loss correction

The loss of coaxial cables can be corrected for the output, input, and measured levels.
Refer to Chapter 3 “Fundamental Operation” in the *MU887000A TRX Test Module Operation Manual* for an explanation of the commands and loss correction data.

2.1.4 Setting transmission signal

To transmit the waveform pattern from MU887000A, load the waveform file into the waveform memory, and then follow the procedure below:

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

Use the following commands to set these settings.
Refer to Chapter 5 "SCPI Command Reference" in the *MU887000A TRX Test Module Operation Manual* for detail descriptions of the commands.

- To load the waveform file into the waveform memory
  `SOUR:GPRF:GEN:ARB:FILE:LOAD`
  `:SOURce:GPRF:GENerator:ARB:FILE:LOAD`
- To query the file name in the waveform memory
  `SOUR:GPRF:GEN:ARB:WAV:NAME`
  `:SOURce:GPRF:GENerator:ARB:WAVeform:NAME`
- To optimize the waveform memory capacity
  `SOUR:GPRF:GEN:ARB:WAV:DEFR`
  `:SOURce:GPRF:GENerator:ARB:WAVeform:DEFRag`
- To delete the waveform file in the waveform memory
  `SOUR:GPRF:GEN:ARB:WAV:DEL`
  `:SOURce:GPRF:GENerator:ARB:WAVeform:DELete`
- To query the waveform memory free space
  `SOUR:GPRF:GEN:ARB:WAV:FREE`
  `:SOURce:GPRF:GENerator:ARB:WAVeform:FREE`

- Waveform Pattern Select
  `SOUR:GPRF:GEN:ARB:WAV:PATT:SEL`
  `:SOURce:GPRF:GENerator:ARB:WAVeform:PATTern:SELect`
- Modulation On/Off
  `SOUR:GPRF:GEN:BBM`
  `:SOURce:GPRF:GENerator:BBMode`
- Output On/Off
  `SOUR:GPRF:GEN:STAT`
  `:SOURce:GPRF:GENerator:STATe`

2.1.5 Waveform patterns

To send a Z-Wave waveform pattern, specify a file of MV887061A Z-Wave waveform files as the waveform file.

Refer to Chapter 3, “Waveform File Details” in the *Waveform File for Z-Wave Application Operation Manual* for an explanation of the MV887061A Z-Wave Waveform files.

2.1.6 Setting Z-Wave signal

Set the following items to measure the Z-Wave signal.

Data Rate

Sets the Data Rate type. Z-Wave defines the characteristics of the signal to use by their Data Rate.

Table 2.1.6-1 Data Rate and Signal Characteristics

Data Rate	Modulation	Bit Rate	Symbol Rate	Coding	Separation
R1	FSK	9.6 (kb/s)	19.2 (kbaud)	Manchester	40 (kHz)
R2	FSK	40 (kb/s)	40 (kbaud)	NRZ	40 (kHz)
R3	GFSK (BT=0.6)	100 (kb/s)	100 (kbaud)	NRZ	58 (kHz)

The mapping of Manchester symbols to frequencies is shown below.

Table 2.1.6-2 Manchester Symbol Mapping

Symbol	Frequency
0	Transition from ($f_{\text{center frequency}}$ – separation/2) to ($f_{\text{center frequency}}$ + separation/2)
1	Transition from ($f_{\text{center frequency}}$ + separation/2) to ($f_{\text{center frequency}}$ – separation/2)

The mapping of NRZ symbols to frequencies is shown below.

Table 2.1.6-3 NRZ Symbol Mapping

Symbol	Frequency
0	$f_{\text{center frequency}}$ + separation/2
1	$f_{\text{center frequency}}$ – separation/2

Preamble Length

Sets the length of the preamble, in bytes, to be sent at the beginning of the signal.

The following commands are used to set the Z-Wave signal.

- Data Rate
  `CONF:ZWAV:PHY:DATA:RATE`
  `:CONFigure:ZWAVe:PHY:DATA:RATE`
- Preamble Length
  `CONF:ZWAV:PHY:PRE:LENG`
  `:CONFigure:ZWAVe:PHY:PREamble:LENGth`

2.1.7 Common settings on Measurement items

Signal Format

Specifies the signal format.

Burst: Used for measuring Z-Wave signals.

Continuous: Used for measuring Z-Wave continuous signals and CW power (unmodulated continuous wave). However, when measuring CW, the results other than Transmit Power will be invalid. Used for 5 “Performance Test”.

Trigger Source

Selects a method to detect the position to start loading waveform after the measurement starts.

LEVEL: Detects the rise in the DUT signal level and starts loading waveform. Sets the signal detection level by Trigger Level.

SG MARKER1: Detects the Marker position set for the waveform selected as transmission signal, and starts loading waveform.

FREERUN: Starts loading waveforms right after measurement starts. Available only when Signal Format is continuous.

Note:

Select FREERUN when Signal Format is Continuous. When LEVEL or SG MARKER1 is selected, loading waveform does not start after the measurement starts, and a timeout error occurs.

Trigger Level

Sets the signal detection level in dB.
The total of the input level described in 2.1.3 “Frequency and level” and this setting value will be detection level.

Example: When the input level value is –10 dBm and the Trigger Level value is –20 dB:
Signal Detection Level = –10 + (–20) = –30 dBm

When Signal Format is Burst, a trigger signal is detected based on the set value of this parameter regardless of Trigger Source type. The signals below the detection level are not the target for detection.
Also, after one trigger signal is detected, the following signals detected during the interval of Measurement Offset value + Measurement Interval value cannot be triggers.

When Signal Format is Burst, transmit burst signals with Off intervals of 1 byte or more between them.

Capture Time

Sets an interval to capture waveforms after measurement starts.
The timing to start loading waveforms depends on the Trigger Source setting.
Capturing waveforms is aborted when the signal analysis set by Storage Count is completed while loading waveforms is still in progress.

Storage Count

Sets the signal number (Packet number) to measure.
When failed to detect signals in the number set by Storage Count within the time set by Capture Time, only the detected signals are measured. In this case, the measurement status is 14. (Refer to Section 2.1.8 "Starting/stopping measurement".)

Sync Mode

Sets how to specify reference position for deciding analysis position.

- Off: Does not synchronize signals. The time when a signal rise is detected will be the reference position.
- SFD: Detects a signal rise, and then searches for the SFD pattern. The position of the SFD and the value set for Preamble Length are referred to when locating the signal PPDU's first component, which is used as a reference position for Measurement Offset.

Measurement Offset

Sets the position to start analyzing.
The measurement starts after the interval from the reference position to this parameter value is over.

Measurement Interval

Decides the analysis interval.
The interval from the measurement start position to this parameter value is the analysis target.

The following commands are used for the Common settings among measurement items.

- Signal Format
  CONF:ZWAV:SIGN:FORM
  :CONFigure:ZWAVe:SIGNal:FORMat
- Trigger Source
  CONF:ZWAV:TRIG
  :CONFigure:ZWAVe:TRIGger
- Trigger Level
  CONF:ZWAV:TLEV
  :CONFigure:ZWAVe:TLEVel
- Sync Mode
  CONF:ZWAV:SYNC:MODE
  :CONFigure:ZWAVe:SYNC:MODE
- Measurement Offset
  CONF:ZWAV:MEAS:OFFS:BIT
  :CONFigure:ZWAVe:MEAS:OFFSet:BIT
- Measurement Interval
  CONF:ZWAV:MEAS:INT:BIT
  :CONFigure:ZWAVe:MEAS:INTerval:BIT
- Storage Count
  CONF:ZWAV:STOR:COUN
  :CONFigure:ZWAVe:STORage:COUNt
- Capture Time
  CONF:ZWAV:CAPT:TIME
  :CONFigure:ZWAVe:CAPTure:TIME

2.1.8 Starting/stopping measurement

Starting measurement

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

```
INIT:ZWAV
:INITiate:ZWAVe
```

Stopping measurement

To stop measurement, send the following command.

```
ABOR:ZWAV
:ABORt:ZWAVe
```

Checking measurement status

To query the measurement status and errors, send the following command.

```
STAT:ZWAV:MEAS?
:STATus:ZWAVe:MEASurement?
```

Table 2.1.8-1 Query Responses

Response	Meaning
0	Measurement completed normally
2	Level exceeded The MU887000A receive level is higher than the set input level.
4	Signal Abnormal The value set for Preamble Length is longer than the actual signal. When the sync mode is set to SFD, the signal start position calculated from the detected SFD and the set preamble length is at the earlier time-scale point than the level trigger detection point.
5	Synchronization word not detected Failed to detect SFD when Sync Mode was SFD, because the correct Z-Wave signal was not output.
9	Measurement in progress or not executed
12	Tx measurement timeout No trigger occurred before measurement timed out
14	Transmission measurement timeout. The signals that are set by storage are not detected within the time for loading waveforms.

The measurement status and errors can be queried using the status registers.
Refer to Chapter 3 “Fundamental Operation” in the *MU887000A TRX Test Module Operation Manual* for an explanation of the status registers.
The allocations of MX887061A status registers are described in the following tables.

Native command mode:

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

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

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

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

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

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

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

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

SCPI command mode:

Table 2.1.8-6 Bit Definitions of Signal Generator Status Register

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

Table 2.1.8-7 Bit Definitions of Measurement Status Register

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

Table 2.1.8-8 Bit Definitions of Signal Generator Questionable Register

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

Table 2.1.8-9 Bit Definitions of Measurement Questionable Register

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

2.2 Modulation Analysis

Modulation Analysis measures the following items of DUT.

Transmit frequency error
Transmit power
Deviation

Refer to section 2.2.1 to 2.2.2 for details of the items.

Modulation Analysis settings are:

Frequency of input signals

Set the frequency of the RF signal input to the MU887000A by referring to the Measuring Frequency command in section 2.1.3 “Frequency and level”.

Input level

Set the level of the RF signal input to the MU887000A by referring to the Input Level command in section 2.1.3 “Frequency and level”.

Port

Set the input port for the MU887000A by referring to the command in section 2.1.2 “Setting ports”.

Signal Setting

Perform the settings in section 2.1.6 “Setting Z-Wave signal.”

Common settings on Measurement items

Perform the settings in section 2.1.7 “Common settings on Measurement items.”

Measurement On/Off

Set the measurement On/Off using the following commands.

```
CONF:ZWAV:SEL:MOD
:CONFigure:ZWAVe:SELect:MODulation
```

The commands for querying the Modulation Analysis measurement results are:

```
FETC:ZWAV:MOD[n]?
:FETCh:ZWAVe:MODulation[n]?
```

Refer to Chapter 3 for the details of the responses.

2.2.1 Transmit frequency error

Transmit frequency error measures frequency errors of the DUT signals.

For the reference frequency for error measurement, set the measurement frequency described in Section 2.1.3 “Frequency and level”.

When the storage count value is 2 or bigger, the maximum frequency error is a value with the maximum absolute value in the storage measurement results.

2.2.2 Transmit power

Transmit power measures the transmit power of the DUT signals.

2.2.3 Deviation

Deviation measures the following results of the DUT signals. Calculation uses the data of Symbol time within the measurement interval.

Deviation Average
: Measures the average of the deviation.

Deviation Peak +
: Measures the upper side peak value of the deviation.

Deviation Peak –
: Measures the lower side peak value of the deviation.

Deviation (Peak-Peak)/2
: Calculates the half maximum deviation range.

2.3 Power vs Time

Power vs Time outputs temporal changes in the DUT signal level.

The range to output is as below.

Output start position: Signal detection time – 1000 samples
Output end position: End position of analysis interval (Measurement Interval) + 1000 samples

Note:

The sampling rate for signal acquisition is 2 MHz. 1000 samples are equivalent to the data for 500 µs.

When a trigger is detected, smoothing equivalent to 1 symbol is performed. Therefore, a difference may occur between the output start position shown above, and the position where the obtained result exceeds the value set for the level trigger.

Only the last storage result is output as the result of this measurement.

Power vs Time settings are as below:

Frequency of input signals

Set the frequency of the RF signal input to the MU887000A by referring to the Measuring Frequency command in Section 2.1.3 “Frequency and level”.

Input Level

Set the level of the RF signal input to the MU887000A by referring to the Input Level command in section 2.1.3 “Frequency and level”.

Port

Set the input port for the MU887000A by referring to the command in section 2.1.2 “Setting ports”.

Signal Setting

Perform the settings in section 2.1.6 “Setting Z-Wave signal.”

Common settings on Measurement items

Perform the settings in section 2.1.7 “Common settings on Measurement items.”

Measurement On/Off

Set the measurement On/Off using the following commands.

```
CONF:ZWAV:SEL:PVT
:CONFigure:ZWAVe:SELect:PVTime
```

Use the following commands to query the Power vs Time graph data:

- Power vs Time graph data
  `FETC:ZWAV:PVT:GRAP?`
  `:FETCh:ZWAVe:PVTime:GRAPh?`
- Power vs Time graph data number
  `FETC:ZWAV:PVT:GRAP:NUMB?`
  `:FETCh:ZWAVe:PVTime:GRAPh:NUMBer?`

2.4 Frequency vs Time

Frequency vs Time outputs temporal changes in the DUT signal frequency, at 1/8-sample intervals.

The range to output is as below.

Output start position: Start position of Measurement Interval
Output end position: End position of Measurement Interval

Only the last storage result is output as the result of this measurement.

Frequency vs Time settings are as below:

Frequency of input signals

Set the frequency of the RF signal input to the MU887000A by referring to the Measuring Frequency command in Section 2.1.3 “Frequency and level”.

Input Level

Set the level of the RF signal input to the MU887000A by referring to the Input Level command in section 2.1.3 “Frequency and level”.

Port

Set the input port for the MU887000A by referring to the command in section 2.1.2 “Setting ports”.

Signal Setting

Perform the settings in section 2.1.6 “Setting Z-Wave signal.”

Common settings on Measurement items

Perform the settings in section 2.1.7 “Common settings on Measurement items.”

Measurement On/Off

Set the measurement On/Off using the following commands.

```
CONF:ZWAV:SEL:FVT
:CONFigure:ZWAVe:SELect:FVTime
```

Use the following commands to query the Frequency vs Time graph data:

- Frequency vs Time graph data

```
FETC:ZWAV:FVT:GRAP?
:FETCh:ZWAVe:FVTime:GRAPh?
```

- Frequency vs Time graph data number

```
FETC:ZWAV:FVT:GRAP:NUMB?
:FETCh:ZWAVe:FVTime:GRAPh:NUMBer?
```

2.5 Data Table

This section explains outputting demodulated data of measurement signals.

Phase I and Phase Q data are output alternately in either 0 or 1 for each bit datum or symbol data. The definitions of bits and symbols for the MX887061A are shown below.

When Data Rate = R1

Measurement results are outputted, defining bits and symbols to be "values before Manchester coding" and "Manchester-coded values", respectively. Read Table 2.1.6-2 "Manchester Symbol Mapping" as follows.

Table 2.5-1 Bit and Symbol Definitions For Manchester Symbol Mapping

Bit	Symbol	Frequency
0	10	Transition from ($f_{\text{center frequency}}$ – separation/2) to ($f_{\text{center frequency}}$ + separation/2)
1	01	Transition from ($f_{\text{center frequency}}$ + separation/2) to ($f_{\text{center frequency}}$ – separation/2)
E	00 or 11	Transition from ($f_{\text{center frequency}}$ + separation/2) to ($f_{\text{center frequency}}$ + separation/2) or Transition from ($f_{\text{center frequency}}$ – separation/2) to ($f_{\text{center frequency}}$ – separation/2)

When Data Rate = R2 or R3

The bit and symbol definitions are same as those of when Data Rate = R1.
0 and 1 are defined as shown below like Table 2.1.6-3 NRZ Symbol Mapping.

Table 2.5-2 Bit and Symbol Definitions For NRZ Symbol Mapping

Bit, Symbol	Frequency
0	$f_{\text{center frequency}}$ + separation/2
1	$f_{\text{center frequency}}$ – separation/2

The required settings for outputting the data table are as below.

Settings for Modulation Analysis

The data in the data table is calculated in the process of Modulation Analysis measurement. The same settings as Modulation Analysis are required.
Refer to Section 2.2 " Modulation Analysis."

Data Table On/Off

Set the measurement On/Off using the following commands.

```
CONF:ZWAV:SEL:DATA
:CONFigure:ZWAVe:SELect:DATA
```

Use the following commands to query the Data Table graph data:

Bit data

- Data Table results

```
FETC:ZWAV:DATA:BIT?
:FETCh:ZWAVe:DATA:BIT?
```

- Data Table results number

```
FETC:ZWAV:DATA:BIT:NUMB?
:FETCh:ZWAVe:DATA:BIT:NUMBer?
```

Symbol Data

- Data Table results

```
FETC:ZWAV:DATA:SYMB?
:FETCh:ZWAVe:DATA:SYMBol?
```

- Data Table results number

```
FETC:ZWAV:DATA:SYMB:NUMB?
:FETCh:ZWAVe:DATA:SYMBol:NUMBer?
```

2.6 Power Monitor

This section explains the calculation of the following values for each storage signal.
Make sure the analysis interval is set within the storage signal On section

- Difference between storage signal trigger detection time and analysis start position
- Ratio of the storage signal On section within the analysis interval
- Time difference between the first signal detection and trigger detection of each storage signal.

Frequency of input signals

Set the frequency of the RF signal input to the MU887000A by referring to the Measuring Frequency command in Section 2.1.3 “Frequency and level”

Input level

Set the level of the RF signal input to the MU887000A by referring to the Input Level command in Section 2.1.3 “Frequency and level”.

Port

Set the input port for the MU887000A by referring to the command in section 2.1.2 “Setting ports”.

Signal Setting

Perform the settings in Section 2.1.6 “Setting Z-Wave signal.”

Common settings on Measurement items

Perform the settings in Section 2.1.7 “Common settings on Measurement items.”

Measurement On/Off

Set the measurement On/Off using the following commands.

```
CONF:ZWAV:SEL:PMON
:CONFigure:ZWAVe:SELect:PMONitor
```

Use the following commands to query the Power Monitor results:
The number of responses is the same as the set value for Storage Count.

- Difference between storage signal trigger detection time and analysis start position

```
FETC:ZWAV:PMON1?
:FETCh:ZWAVe:PMONitor1?
```

- Ratio of the storage signal On section within the analysis interval

```
FETC:ZWAV:PMON2?
:FETCh:ZWAVe:PMONitor2?
```

- Time difference between the first signal detection and trigger detection of each storage signal.
  `FETC:ZWAV:PMON3?`
  `:FETCh:ZWAVe:PMONitor3?`

2.7 Detected Signal

The detected signal number is queried when the signals set by Storage Count are not detected within the time set by Capture Time.

The following values are returned to the query of signal detection result.

- Set number for Storage
- Detected signal number

Use the following commands to query.

```
FETC:ZWAV:DSIG?
:FETCh:ZWAVe:DSIGnals?
```

2.8 Frame Error Rate

Signals are output from the MU887000A to measure Frame Error Rate at DUT.

Note:

DUT needs a function to measure Frame Error Rate based on FCS information.

Use the following waveform pattern for Packet Error Rate measurement.

File Name: MV887061A_ZW_R1_0001
MV887061A_ZW_R2_0001
MV887061A_ZW_R3_0001

Group Number: 1

For details of the functions and commands to control the transmit signal, refer to Chapter 5 “SCPI Command Reference” in the *MU887000A TRX Test Module Operation Manual*.

For details of the waveform pattern, refer to the *Waveform Files for Z-Wave Application Operation Manual*.

2.9 Sample Program

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

2.9.1 Example of Transmit measurement

An example of Measurement Sample Program using the SCPI command mode is described here.

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

Processing Flow

1. Set the application software type to the MX887061A.
2. Set the following measurement conditions:

Test Port	Port 2
Input Level	–10 dBm
Measuring Frequency	868.4 MHz
Data Rate	R1
Preamble Length	10
Signal Format	Burst
Trigger Source	Level
Trigger Level	–20 dB
Capture Time	2 s
Storage Count	1
Sync Mode	SFD
Measurement Offset	0
Measurement Interval	288
Modulation Analysis On/Off	ON

3. Start measurement.
4. Read the measurement status
5. After measurement is completed, query the following measurement results:
   Transmit frequency error, Transmit Power

```
; Sample program for Modulation Analysis
; Anritsu Corporation September,2015
; Macro for Tera Term Version 4.69
;
; set local echo to on
setecho 1
flushrecv
; time out 3 second
timeout=3

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

; Set application type to "Z-Wave".
sendln ':INSTrument:SELect ZWAVE'
call check_error_code

; Set standard to "Z-Wave".
sendln ':CONFigure:ZWAVe:STANdard ZWAVE'
call check_error_code

; Set test port to "PORT2".
sendln ':ROUTe:PORT:CONNect:DIRection PORT2,PORT2'
call check_error_code

; Set Input Range to "-10 dBm".
sendln ':CONFigure:ZWAVe:POWer -10'
call check_error_code

; Set center frequency to "868.4 MHz".
sendln ':CONFigure:ZWAVe:FREQuency 868.4MHZ'
call check_error_code

; Set Data Rate to "R1".
sendln ':CONFigure:ZWAVe:PHY:DATA:RATE R1'
call check_error_code

; Set Preamble Length to "10".
sendln ':CONFigure:ZWAVe:PHY:PREamble:LENGth 10'
call check_error_code

; Set Signal Format to "Burst".
sendln ':CONFigure:ZWAVe:SIGNal:FORMat BURSt'
```

```
call check_error_code

; Set Trigger Source to "Level".
sendln ':CONFigure:ZWAVe:TRIGger LEVEL'
call check_error_code

; Set Trigger Level to "-20 dB".
sendln ':CONFigure:ZWAVe:TLEVel -20'
call check_error_code

; Set Capture Time to "2 s".
sendln ':CONFigure:ZWAVe:CAPTure:TIME 2'
call check_error_code

; Set Storage Count to "1".
sendln ':CONFigure:ZWAVe:STORage:COUNt 1'
call check_error_code

; Set Sync Mode to "SFD".
sendln ':CONFigure:ZWAVe:SYNC:MODE SFD'
call check_error_code

; Set Measurement Offset to "0".
sendln ':CONFigure:ZWAVe:MEAS:OFFSet:BIT 0'
call check_error_code

; Set Measurement Interval to "500".
sendln ':CONFigure:ZWAVe:MEAS:INTerval:BIT 288'
call check_error_code

; Set Measurement of Modulation Analysis to "ON".
sendln ':CONFigure:ZWAVe:SELect:MODulation ON'
call check_error_code

; Start measurement
sendln ':INITiate:ZWAVe'
call check_error_code

; waiting measurement up to 10 second
for i 1 10

 sendln ':STATus:ZWAVe:MEASurement?'
 pause 1     ; wait 1 second
 recvln
```

```
 recvln
 str2int inputstrNum inputstr
 if inputstrNum=0 then
       ;call check_response    ; debug
       if result=0 goto _timeout
       if result=1 then
             break
       endif
       call check_error_code
 endif
next

; Query  Transmit frequency error, Transmit Power
sendln ':FETCh:ZWAVe:MODulation?'
call check_error_code

messagebox  'Macro end successfully' 'Finish'

End

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

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

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

 ; in case of no error

return

:check_response

 ;for debug
```

```
messagebox inputstr 'debug1'
int2str result_str result
messagebox result_str 'debug2'

return

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

2.9.2 Example of transmit the waveform for Frame Error Rate

An example of Measurement Sample Program using the SCPI command mode is described here.

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

Purpose of Process

To transmit the waveform “MV887061A_ZW_R1_0001” 100 times.

Processing Flow

1. Set VSG operation mode to NORMAL and set the signal output conditions as below.

Test Port	Port 1, Port 2 (Output Port: Port 2)
VSG operation mode	NORMAL
Operation mode after sequence ends	1 (NORMAL)
RF signal output	ON
Baseband mode	CW
RF output level	–120 dBm
Waveform to load in waveform memory	MV887061A_ZW_R1_0001 ZERO_614400HZ_1000P
Sequence start segment number and end segment number	Sequence Table 1, 1 to 2
Sequence repeat method	Sequence Table 1, SINGLE
Start segment number of the 2nd sequence or later in repetition	Sequence Table 1, 1
End conditions for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, TRIGGER Sequence Table 1, 2, SNUMBER
Trigger source for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, WFGEND Sequence Table 1, 2, WFGEND
Delay time for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, 0 ms Sequence Table 1, 2, 0 ms
Repetition control for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, NSEGMENT Sequence Table 1, 2, LOOP
Baseband mode for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, ARB (Modulation Output) Sequence Table 1, 2, ARB (Modulation Output)
Waveform change trigger for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, OFF Sequence Table 1, 2, OFF

Output level for the specified 1 segment of SG sequencer data	Sequence Table 1, 2, –120 dBm
Output port for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, Port 2 Sequence Table 1, 2, Port 2
Waveform file name and group number in waveform list table	Sequence Table 1, Waveform list index 1,ZERO_614400HZ_1000P, 1 Sequence Table 1, Waveform list index 2,ZERO_614400HZ_1000P, 1 Sequence Table 1, Waveform list index 3,ZERO_614400HZ_1000P, 1
Remove waveform file from waveform list table	Sequence Table 1, Waveform list index 4
Change conditions for waveform list table	Sequence Table 1, Waveform list index 1, REPEAT Sequence Table 1, Waveform list index 2, REPEAT Sequence Table 1, Waveform list index 3, REPEAT
Repetition count of waveform pattern	Sequence Table 1, Waveform list index 1, 1 time Sequence Table 1, Waveform list index 2, 1 time Sequence Table 1, Waveform list index 3, 1 time
Trigger output for SG sequencer when switching waveform patterns in waveform list table	Sequence Table 1, Waveform list index 1, OFF Sequence Table 1, Waveform list index 2, ON Sequence Table 1, Waveform list index 3, OFF
Number of sequence tables and execution order	1, Sequence Table 1

2. Set VSG operation mode to SEQUENCE, and set the signal output conditions as below.

Test Port	Port 1, Port 2
VSG operation mode	SEQUENCE
Waveform file name and group number in waveform list table	Sequence Table 1, Waveform list index 2, MV887061A_ZW_R1_0001,1
Repetition count of waveform patterns	Sequence Table 1, Waveform list index 2, 100 times
Frequency for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, 868.4 MHz Sequence Table 1, 2, 868.4 MHz
Output level for the specified 1 segment of SG sequencer data	Sequence Table 1, 1, –10 dBm

3. Starts signal output.

```
; Sample program for Frame Error Rate
; Anritsu Corporation September,2015
; Macro for Tera Term Version 4.69
;
; set local echo to on
setecho 1
flushrecv
; time out 3 second
timeout=3

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

; Set test port to "PORT1, PORT2".
sendln ':ROUT:PORT:CONN:DIR PORT1,PORT2'
call check_error_code

; Set VSG Mode  to "NORMAL".
sendln ':SOURce:GPRF:GENerator:MODE NORMAL'
call check_error_code

; Set Sequence Reinitialization  to "1".
sendln ':SOURce:GPRF:GENerator:SEQuence:REINitialization 1'
call check_error_code

; Set RF Output   to "ON".
sendln ':SOURce:GPRF:GENerator:STATe ON'
call check_error_code

; Set Modulation  to "CW".
sendln ':SOURce:GPRF:GENerator:BBMode CW'
call check_error_code

; Set Level to "-120dBm".
sendln ':SOURce:GPRF:GENerator:RFSettings:LEVel -120'
call check_error_code

; Deleting All Waveform Files in ARB Memory.
sendln ':SOURce:GPRF:GENerator:ARB:WAVeform:DELete:ALL'
call check_error_code

; Waveform File Loading " MV887061A_ZW_R1_0001".
sendln ':SOURce:GPRF:GENerator:ARB:FILE:LOAD "MV887061A_ZW_R1_0001"'
```

```
call check_error_code
sendln '*WAI'

; Waveform File Loading "ZERO_614400HZ_1000P".
sendln ':SOURce:GPRF:GENerator:ARB:FILE:LOAD "ZERO_614400HZ_1000P"'
call check_error_code
sendln '*WAI'
; Set Sequence Start and Stop Segment to "1","1","2".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:GENeral:SSTop 1,1,2'
call check_error_code

; Set Sequence Repetition Mode to "1","SINGLE".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:GENeral:REPetition 1,SINGLE'
call check_error_code

; Set Sequence Start Index for continuous mode to "1","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:GENeral:GOTO 1,1'
call check_error_code

; Set End Condition of Segment in Sequence to "1","1","TRIGGER".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:ENDCondition 1,1,TRIGGER'
call check_error_code

; Set End Condition of Segment in Sequence to "1","2","SNUMBER".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:ENDCondition 1,2,SNUMBER'
call check_error_code

; Set Trigger Source of Segment in Sequence to "1","1","WFGEND".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:TRIGger:SOURce 1,1,WFGEND'
call check_error_code

; Set Trigger Source of Segment in Sequence to "1","2","WFGEND".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:TRIGger:SOURce 1,2,WFGEND'
call check_error_code

; Set Trigger Delay of Segment in Sequence to "1","1","0 ms".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:TRIGger:DELay 1,1,0.000'
call check_error_code

; Set Trigger Source of Segment in Sequence to "1","2","0 ms".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:TRIGger:DELay 1,2,0.000'
call check_error_code

; Set Loop Control of Segment in Sequence to "1","1","NSEGMENT".
```

```
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:NSLControl 1,1,NSEGMENT'
call check_error_code

; Set Loop Control of Segment in Sequence to "1","2","LOOP".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:NSLControl 1,2,LOOP'
call check_error_code

; Set Base Band Mode of Segment in Sequence to "1","1","ARB".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:BBMode 1,1,ARB'
call check_error_code

; Set Base Band Mode of Segment in Sequence to "1","2","ARB".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:BBMode 1,2,ARB'
call check_error_code

; Set Waveform Change Trigger of Segment in Sequence to "1","1","OFF".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:WCTRigger 1,1,OFF'
call check_error_code

; Set Waveform Change Trigger of Segment in Sequence to "1","2","OFF".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:WCTRigger 1,2,OFF'
call check_error_code

; Set Level of Segment in Sequence to "1","2","-120 dBm".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:LEVel 1,2,-120DBM'
call check_error_code

; Set Output Port of Segment in Sequence to "1","1","PORT2".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:OUTPut:STATe 1,1,PORT2'
call check_error_code

; Set Output Port of Segment in Sequence to "1","2","PORT2".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:OUTPut:STATe 1,2,PORT2'
call check_error_code

; Set Sequence Waveform Pattern Configuration to
"1","1","ZERO_614400HZ_1000P","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:PATTern:SELect
1,1,"ZERO_614400HZ_1000P",1'
call check_error_code

; Set Sequence Waveform Pattern Configuration to "1","2","ZERO_614400HZ_1000P",
"1".
```

```
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:PATTern:SELect
1,2,"ZERO_614400HZ_1000P",1'
call check_error_code

; Set Sequence Waveform Pattern Configuration to
"1","3","ZERO_614400HZ_1000P","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:PATTern:SELect
1,3,"ZERO_614400HZ_1000P",1'
call check_error_code

; Set Sequence Waveform Pattern Delete "1","4".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:PATTern:DELete 1,4'
call check_error_code

; Set Pattern End Condition of Sequence Waveform to "1",”1”,”REPEAT”.
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:ENDCondition 1,1,REPEAT'
call check_error_code

; Set Pattern End Condition of Sequence Waveform to "1","2","REPEAT".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:ENDCondition 1,2,REPEAT'
call check_error_code

; Set Pattern End Condition of Sequence Waveform to "1","3","REPEAT".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:ENDCondition 1,3,REPEAT'
call check_error_code

; Set Repetition Count of Sequence Waveform Pattern to "1","1","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:IREPetition 1,1,1'
call check_error_code

; Set Repetition Count of Sequence Waveform Pattern to "1","2","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:IREPetition 1,2,1'
call check_error_code

; Set Repetition Count of Sequence Waveform Pattern to "1","3","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:IREPetition 1,3,1'
call check_error_code

; Set Group End Trigger of Sequence Waveform Pattern to "1","1","0".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:GETRigger 1,1,0'
call check_error_code

; Set Group End Trigger of Sequence Waveform Pattern to "1","2","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:GETRigger 1,2,1'
```

```
call check_error_code

; Set Group End Trigger of Sequence Waveform Pattern to "1","3","0".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:GETRigger 1,3,0'
call check_error_code

; Set Sequence Table Combination Selection to "1","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:COMBination:PATTern 1,1'
call check_error_code

; Set VSG Mode  to "SEQUENCE".
sendln ':SOURce:GPRF:GENerator:MODE SEQUENCE'
call check_error_code

; Set Sequence Waveform Pattern Configuration to
"1","2","MV887061A_ZW_R1_0001","1".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:PATTern:SELect
1,2,"MV887061A_ZW_R1_0001",1'
call check_error_code

; Set Repetition Count of Sequence Waveform Pattern to "1","2","100".
sendln ':SOURce:GPRF:GENerator:SEQuence:WAVeform:IREPetition 1,2,100'
call check_error_code

; Set Frequency of Segment in Sequence to "1",”1”,”868.4 MHz”.
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:FREQuency 1,1,868.4MHZ'
call check_error_code

; Set Frequency of Segment in Sequence to "1","2","868.4 MHz".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:FREQuency 1,2,868.4MHZ'
call check_error_code

; Set Level of Segment in Sequence to "1","1","-10 dBm".
sendln ':SOURce:GPRF:GENerator:SEQuence:RX:LEVel 1,1,-10DBM'
call check_error_code

; Sequence Execution.
sendln ':SOURce:GPRF:GENerator:SEQuence:EXECute'
call check_error_code
messagebox  'Macro end successfully' 'Finish'

End

;       ------------ subroutines -----------
```

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

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

 ; in case of no error

return

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

 return

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

Chapter 3 SCPI Command Reference

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

3.1 List of Commands

The following shows the rules for describing messages.

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

3.1.1 Common commands

Operation Status Register

Function	Command	Query	Response
Measurement Status	-----	:STATus:ZWAVe:MEASurement?	<m_status>

Common

Function	Command	Query	Response
Set Connect Port Direction	:ROUTe:PORT:CONNect:DIRection <in>,<out>	:ROUTe:PORT:CONNect:DIRection?	<in>,<out>

Measurements

Function	Command	Query	Response
Measurement Stop	:ABORt:ZWAVe	-----	-----
Measurement Start	:INITiate:ZWAVe	-----	-----

Common Parameters

Function	Command	Query	Response
Data Rate	:CONF:ZWAV:PHY:DATA:RATE <mode>	:CONF:ZWAV:PHY:DATA:RATE?	<mode>
Bit Rate	-----	:CONFigure:ZWAVe:PHY:INFO:BIT:RATE?	<mode>
Symbol Rate	-----	:CONFigure:ZWAVe:PHY:INFO:SYMBol:RATE?	<mode>
Preamble Length Mode	:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE <mode>	:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE?	<mode>
Preamble Length	:CONFigure:ZWAVe:PHY:PREamble:LENGth <num>	:CONFigure:ZWAVe:PHY:PREamble:LENGth?	<num>

System

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

3.1.2 Fundamental measurement commands

Common Parameters

Function	Command	Query	Response
Center Frequency	:CONFigure:ZWAVe:FREQuency <freq>	:CONFigure:ZWAVe:FREQuency?	<freq>
Input Level	:CONFigure:ZWAVe:POWer <level>	:CONFigure:ZWAVe:POWer?	<level>
Trigger Source	:CONFigure:ZWAVe:TRIGger <mode>	:CONFigure:ZWAVe:TRIGger?	<mode>
Trigger Level	:CONFigure:ZWAVe:TLEVel <trglevel>	:CONFigure:ZWAVe:TLEVel?	<trglevel>

Fundamental Measurement Parameters

Function	Command	Query	Response
Signal Format	:CONFigure:ZWAVe:SIGNal:FORMat <mode>	:CONFigure:ZWAVe:SIGNal:FORMat?	<mode>
Sync Mode	:CONFigure:ZWAVe:SYNC:MODE <mode>	:CONFigure:ZWAVe:SYNC:MODE?	<mode>
Measurement Interval (bit)	:CONFigure:ZWAVe:MEAS:INTerval:BIT <range>	:CONFigure:ZWAVe:MEAS:INTerval:BIT?	<range>
Measurement Offset (bit)	:CONFigure:ZWAVe:MEAS:OFFSet:BIP <range>	:CONFigure:ZWAVe:MEAS:OFFSet:BIT?	<range>
Capture time	:CONFigure:ZWAVe:CAPTure:TIME <range>	:CONFigure:ZWAVe:CAPTure:TIME?	<range>
Storage Count	:CONFigure:ZWAVe:STORage:COUNt <range>	:CONFigure:ZWAVe:STORage:COUNt?	<range>
Modulation Analysis On/Off	:CONFigure:ZWAVe:SELect:MODulation <mode>	:CONFigure:ZWAVe:SELect:MODulation?	<mode>
Power vs Time On/Off	:CONFigure:ZWAVe:SELect:PVTime <mode>	:CONFigure:ZWAVe:SELect:PVTime?	<mode>
Frequency vs Time On/Off	:CONFigure:ZWAVe:SELect:FVTime <mode>	:CONFigure:ZWAVe:SELect:FVTime?	<mode>
Power Monitor On/Off	:CONFigure:ZWAVe:SELect:PMONitor <mode>	:CONFigure:ZWAVe:SELect:PMONitor?	<mode>
Data Table On/Off	:CONFigure:ZWAVe:SELect:DATA <mode>	:CONFigure:ZWAVe:SELect:DATA?	<mode>
All Measurement On/Off	:CONFigure:ZWAVe:SELect:ALL <mode>	-----	<mode>

Results

Function	Command	Query	Response
Modulation Analysis Result	-----	:FETCh:ZWAVe:MODulation[n]?	Refer to Table 3.2.2-1.
Data Table Bit	-----	:FETCh:ZWAVe:DATA:BIT?	<res1>,<res2>,...<resN>
Data Table Bit (data number)	-----	:FETCh:ZWAVe:DATA:BIT:NUMBer?	<res>
Data Table Symbol	-----	:FETCh:ZWAVe:DATA:SYMBol?	<res1>,<res2>,...<resN>
Data Table Symbol (data number)	-----	:FETCh:ZWAVe:DATA:SYMBol:NUMBer?	<res>
Frequency vs Time (graph)	-----	:FETCh:ZWAVe:FVTime:GRAPh?	<res1>,<res2>,...<resN>
Frequency vs Time (graph data number)	-----	:FETCh:ZWAVe:FVTime:GRAPh:NUMBer?	<res>
Frequency vs Time (graph symbol)	-----	:FETCh:ZWAVe:FVTime:GRAPh:SYMBol?	<res1>,<res2>,...<resN>
Power vs Time (graph)	-----	:FETCh:ZWAVe:PVTime:GRAPh?	<res1>,<res2>,...<resN>
Power vs Time (graph data number)	-----	:FETCh:ZWAVe:PVTime:GRAPh:NUMBer?	<res>
Power vs Time (graph time)	-----	:FETCh:ZWAVe:PVTime:GRAPh:TIME?	<res1>,<res2>,...<resN>
Power Monitor	-----	:FETCh:ZWAVe:PMONitor[n]?	<res1>,<res2>,...<resN>
Detected Signals	-----	:FETCh:ZWAVe:DSIGnals?	<res1>,<res2>

3.2 Details of Commands

This section describes commands in alphabetic order.

■ Terms in this command list

EX ..... Command name (header)

Example ..... Command function name

Function ..... Command function

Command..... Programming command syntax

Query ..... Query syntax

Response .....Response syntax

Parameter ..... Parameter definition

Details ..... Command restrictions and others

Example of Use..... Command usage example

Related Commands .....Introduction of related commands

■ Suffix Code list

Suffix Code	Unit	Suffix Code	Unit
%	%	MS	ms
DB	dB	MW	mW
DBM	dBm	MZ	MHz
FW	fW	NS	ns
GHZ	GHz	NW	nW
GZ	GHz	PW	pW
HZ	Hz	S	s
KHZ	kHz	US	µs
KZ	kHz	UW	µW
KW	kW	W	W
MHZ	MHz		

3.2.1 Common commands

:ABORt:ZWAVe

Measurement Stop

Function

Stops current measurement.

Command

```
:ABORt:ZWAVe
```

Example of Use

To stop measurement:
:ABOR:ZWAV

:CONFigure:ZWAVe:PHY:DATA:RATE <mode>

Data Rate

Function

Sets or queries Data Rate mode.

Command

```
:CONFigure:ZWAVe:PHY:DATA:RATE <mode>
```

Query

```
:CONFigure:ZWAVe:PHY:DATA:RATE?
```

Response

<mode>

Parameter

<mode>	Data Rate
R1	R1
R2	R2
R3	R3
Default	R1

Example of Use

To set Data Rate to R2:
:CONF:ZWAV:PHY:DATA:RATE R2
:CONF:ZWAV:PHY:DATA:RATE?
> R2

:CONFigure:ZWAVe:PHY:INFO:BIT:RATE?

Bit Rate

Function

Queries the signal bit rate [kbit/s]. The Bit Rate value depends on the setting of Data Rate.

Query

```
:CONFigure:ZWAVe:PHY:INFO:BIT:RATE?
```

Response

<mode>

Parameter

<mode>	Bit Rate
9.6	9.6 kbit/s, Data Rate = R1
40	40 kbit/s, Data Rate = R2
100	100 kbit/s, Data Rate = R3
Default	9.6

Example of Use

To query the bit rate.

:CONF:ZWAV:PHY:INFO:BIT:RATE?

> 40

:CONFigure:ZWAVe:PHY:INFO:SYMBol:RATE?

Symbol Rate

Function

Queries the signal symbol rate [kbaud/s]. The Symbol Rate value depends on the setting of Data Rate.

Query

```
:CONFigure:ZWAVe:PHY:INFO:SYMBol:RATE?
```

Response

<mode>

Parameter

<mode>	Symbol Rate
19.2	19.2 kbaud/s, Data Rate = R1
40	40 kbaud/s, Data Rate = R2
100	100 kbaud/s, Data Rate = R3
Default	19.2

Example of Use

To query the symbol rate.

:CONF:ZWAV:PHY:INFO:SYMB:RATE?

> 40

:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE <mode>

Preamble Length Mode

Function

Sets and queries the mode of specifying the length of the preamble of the signal.

Command

```
:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE <mode>
```

Query

```
:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE?
```

Response

<mode>

Parameter

<mode>	Mode of specifying
MANual	Specifying the length of the preamble as a numeric value

Remarks

In the Manual mode, specify the length of the preamble using the following command:
":CONFigure:ZWAVe:PHY:PREamble:LENGth <num>"

Example of Use

To manually set the length of the preamble:
:CONF:ZWAV:PHY:PRE:LENG:MODE MAN
:CONF:ZWAV:PHY:PRE:LENG:MODE?
> MAN

:CONFigure:ZWAVe:PHY:PREamble:LENGth <num>

Preamble Length

Function

Sets or queries the length of the signal preamble, in bytes.

Command

```
:CONFigure:ZWAVe:PHY:PREamble:LENGth <num>
```

Query

```
:CONFigure:ZWAVe:PHY:PREamble:LENGth?
```

Response

<num>

Parameter

<num>	Preamble length
Range	8 to 40
Resolution	1
Default	10
Unit	byte

Remarks

When the sync mode is set to SFD, the start of the PPDU is calculated from the detected SFD and the set preamble length. If the calculated position of PPDU comes before the position of the detected signal level trigger, the measurement results in an error.

Example of Use

To set the preamble length to 10 bytes:
:CONF:ZWAV:PHY:PRE:LENG 10
:CONF:ZWAV:PHY:PRE:LENG?
> 10

:INITiate:ZWAVe

Measurement Start

Function

Executes measurement.

Command

```
:INITiate:ZWAVe
```

Details

When this command is sent, the measurement is executed only once.
If sending this command during the measurement, the measurement is interrupted for a moment and is resumed.
The timing of measurement completion needs synchronous processing by *WAI.

Example of Use

To start measurement:
:INIT:ZWAV
*WAI
:FETC:ZWAV:MOD1?
> 1.67,2.28,0.00068163,0.00093061,-10.77,-10.77,999.99,999.99,...

Related Commands

:STATus:ZWAVe:MEASurement?

:INSTrument[:SELect]

Application Select

Function

Sets or queries type of application software executing on MU887000A.

Command

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

Query

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

Response

<app>

Parameter

<app>		Type of application software
	CELLULAR	Cellular Application MX887010A, MX887011A, MX887012A,MX887013A, MX887014A, MX887015A, MX887016A, or MX887017A
	SRW	Short Range Wireless Application MX887030A, MX8877031A, MX8867040A, or MX887050A
	LRWPAN	IEEE 802.15.4 Application MX887060A
	ZWAVE	Z-Wave Application MX887061A

Details

Set the parameter to ZWAVE and send the command before using the MX887061A.

Example of Use

To set the application software to Z-Wave Application:

:INST ZWAVE

:INST?

> ZWAVE

:ROUTe:PORT:CONNect:DIRection

Set Connect Port Direction

Function

Sets or queries connector settings for inputting and outputting RF signals.

Command

```
:ROUTe:PORT:CONNect:DIRection <in>,<out>
```

Query

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

Response

<in>,<out>

Parameter

<in>	Test Port No.
PORT1	Test Port1
PORT2	Test Port2
PORT3	Test Port3
PORT4	Test Port4
Default	PORT1
<out>	Test Port No.
PORT1	Test Port1
PORT2	Test Port2
PORT3	Test Port3
PORT4	Test Port4
Default	PORT1

Details

MU887000A:
Both Test Port1 and Test Port2 can be set to input and output simultaneously.
Test Port3 and Test Port4 can be set to either input or output at one time.
MU887001A:
Test Port1 to 4 can be set to input and output simultaneously.

Example of Use

To set Test Port1 as RF signal input connector and Test Port2 as RF signal output connector:
:ROUT:PORT:CONN:DIR PORT1,PORT2
:ROUT:PORT:CONN:DIR?
> PORT1,PORT2

:SYSTem:LANGuage

Language Selection of Remote Command

Function

Switches language mode of remote control command.

Command

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

Query

```
:SYSTem:LANGuage?
```

Response

<mode>

Parameter

<mode>	Language mode
NAT	Native
SCPI	SCPI
Default	NATive

Example of Use

To switch the remote control command language mode to Native:

:SYST:LANG NAT

:SYST:LANG?

>NAT

:STATus:ZWAVe:MEASurement?

Measurement Status

Function

Queries the current measurement status.

Query

```
:STATus:ZWAVe:MEASurement?
```

Response

<m_status>

Parameter

<m_status>	Measurement Status
0	Measurement completed normally
2	Level over
4	Signal abnormal
5	Failed to detect synchronous words
9	Measurement is in progress, or Not measured
12	No time out or trigger occurred (at Burst measurement only)
14	Time out or trigger occurred, but the signals up to the number set by storage count cannot be detected (only at Burst measurement).

Details

The measurement is aborted when the measurement state is 2, 4, 5.

Example of Use

To query the current measurement status:

:STAT:ZWAV:MEAS?

> 0

3.2.2 Fundamental measurement commands

:CONFigure:ZWAVe:CAPTure:TIME

Capture time

Function

Sets or queries the time length to capture the analysis target signals.

Command

```
:CONFigure:ZWAVe:CAPTure:TIME <range>
```

Query

```
:CONFigure:ZWAVe:CAPTure:TIME?
```

Response

<range>

Parameter

<range>	Capture time
Range	0.001 to 10 s
Resolution	0.001 s
Suffix code	S, MS, US, NS (uses S when omitted)
Default	10 s
Unit	s

Details

The signals that satisfy the following conditions are measurement targets.

The signals captured from the trigger's detection time to this parameter's setting time length up to the number set by storage count.

The capturing ends when the signals up to the number set by storage count are detected and analyzed.

Example of Use

To set the time length for capturing the analysis target signals to 2s.

```
:CONF:ZWAV:CAPT:TIME 2
:CONF:ZWAV:CAPT:TIME?
> 2.000
```

:CONFigure:ZWAVe:FREQuency

Center Frequency

Function

Sets or queries the MU887000A receiving frequency.

Command

```
:CONFigure:ZWAVe:FREQuency <freq>
```

Query

```
:CONFigure:ZWAVe:FREQuency?
```

Response

<freq>

Parameter

<freq>		Receiving frequency
	Range	400.000000 to 6000.000000 MHz
	Resolution	1 Hz
	Suffix code	HZ, KHZ, KZ, MHZ, MZ, GHZ, GZ (uses Hz when omitted)
	Default	900000000 Hz
	Unit	Hz

Remarks

The Tx frequency is set for the mobile station.

Example of Use

To set the Center Frequency to 868 MHz:
:CONF:ZWAV:FREQ 868MHZ
:CONF:ZWAV:FREQ?
> 868000000

:CONFigure:ZWAVe:MEAS:INTerval:BIT

Measurement Interval

Function

Sets or queries the analysis interval in bit unit.

Command

```
:CONFigure:ZWAVe:MEAS:INTerval:BIT <range>
```

Query

```
:CONFigure:ZWAVe:MEAS:INTerval:BIT?
```

Response

<range>

Parameter

<range>		Analysis interval
	Range	160 to 1000 (Data Rate = R1 or R2) 160 to 2000 (Data Rate = R3)
	Resolution	1
	Default	192
	Unit	bit

Details

Analysis interval is as below.

Analysis start position: Reference position + Measurement Offset value

Analysis end position: Reference position + Measurement Offset value + Measurement Interval value

To decide reference position, refer to the description of the command below.

:CONFigure:ZWAVe:SYNC:MODE

Example of Use

To set the Analysis interval to 320 bits:

:CONF:ZWAV:MEAS:INT:BIT 320

:CONF:ZWAV:MEAS:INT:BIT?

>320

Remarks

If the set value goes out of the range due to the change of Data Rate mode, it is rounded to the maximum value for the new Data Rate mode.

The relationship between bit and symbol is:

1 bit = 2 symbols (Data Rate = R1)

1 bit = 1 symbol (Data Rate = R2 or R3)

:CONFigure:ZWAVe:MEAS:OFFSet:BIT

Measurement Offset

Function

Sets or queries offset from the reference position to analysis interval.

Command

```
:CONFigure:ZWAVe:MEAS:OFFSet:BIT <range>
```

Query

```
:CONFigure:ZWAVe:MEAS:OFFSet:BIT?
```

Response

<range>

Parameter

<range>		Offset to the analysis interval
	Range	0 to 1000 (Data Rate = R1 or R2)
		0 to 2000 (Data Rate = R3)
	Resolution	1
	Default	0
	Unit	bit

Details

For how to decide reference position, refer to the description of the command below.
:CONFigure:ZWAVe:SYNC:MODE

Example of Use

To set the offset to the analysis interval to 200 bits.
:CONF:ZWAV:MEAS:OFFS:BIT 200
:CONF:ZWAV:MEAS:OFFS:BIT?
>200

Remarks

If the set value goes out of the range due to the change of Data Rate mode, it is rounded to the maximum value for the new Data Rate mode.
The relationship between bit and symbol is:
1 bit = 2 symbols (Data Rate = R1)
1 bit = 1 symbol (Data Rate = R2 or R3)

:CONFigure:ZWAVe:POWer

Input Level

Function

Sets or queries RMS Power of input signal in dBm unit.

Command

```
:CONFigure:ZWAVe:POWer <level>
```

Query

```
:CONFigure:ZWAVe:POWer?
```

Response

<level>

Parameter

<level>		Input level
	Range	
	MU887000A	–65.0 to +35.0 dBm (Port1/2)
		–65.0 to +25.0 dBm (Port3/4)
	MU887001A	–65.0 to +35.0 dBm (Port1/2/3/4)
	Resolution	0.1 dB
	Suffix code	DBM
		(uses dBm when omitted)
	Default	–10 dBm
	Unit	dBm

Example of Use

To set the RMS Power of input signal to –10.0 dBm:

```
:CONF:ZWAV:POW -10
:CONF:ZWAV:POW?
> -10.0
```

:CONFigure:ZWAVe:SELect:ALL <mode>

All Measurement On/Off

Function

Sets all measurement items to On or Off collectively.

Command

```
:CONFigure:ZWAVe:SELect:ALL <mode>
```

Parameter

<mode>	Measurement Execution
ON｜1	Measures all measurement items.
OFF|0	Measures no measurement items.

Example of Use

To set all measurement items to On collectively.

:CONF:ZWAV:SEL:ALL ON

:CONFigure:ZWAVe:SELect:DATA

Data Table On/Off

Function

Sets or queries the demodulated data acquisition On/Off of measurement signal

Command

```
:CONFigure:ZWAVe:SELect:DATA <mode>
```

Query

```
:CONFigure:ZWAVe:SELect:DATA?
```

Response

<mode>

Parameter

<mode>	Demodulated data acquisition
ON | 1	On
OFF | 0	Off
Default	OFF

Example of Use

To set the demodulated data acquisition to On:

:CONF:ZWAV:SEL:DATA ON

:CONF:ZWAV:SEL:DATA?

>1

:CONFigure:ZWAVe:SELect:FVTime

Frequency vs Time On/Off

Function

Sets or queries Frequency vs Time measurement On/Off

Command

```
:CONFigure:ZWAVe:SELect:FVTime <mode>
```

Query

```
:CONFigure:ZWAVe:SELect:FVTime?
```

Response

<mode>

Parameter

<mode>	Frequency vs Time measurement
ON | 1	On
OFF|0	Off
Default	OFF

Example of Use

To set Frequency vs Time measurement to On:

:CONF:ZWAV:SEL:FVT ON

:CONF:ZWAV:SEL:FVT?

>1

:CONFigure:ZWAVe:SELect:MODulation

Modulation Analysis On/Off

Function

Sets or queries the modulation analysis On/Off.

Command

```
:CONFigure:ZWAVe:SELect:MODulation <mode>
```

Query

```
:CONFigure:ZWAVe:SELect:MODulation?
```

Response

<mode>

Parameter

<mode>	Modulation Analysis
ON | 1	On
OFF | 0	Off
Default	ON

Example of Use

To set the modulation analysis to On

:CONF:ZWAV:SEL:MOD ON

:CONF:ZWAV:SEL:MOD?

>1

:CONFigure:ZWAVe:SELect:PVTime

Power vs Time On/Off

Function

Sets or queries Power vs Time measurement On/Off.

Command

```
:CONFigure:ZWAVe:SELect:PVTime <mode>
```

Query

```
:CONFigure:ZWAVe:SELect:PVTime?
```

Response

<mode>

Parameter

<mode>	Power vs Time measurement
ON | 1	On
OFF | 0	Off
Default	OFF

Example of Use

To set Power vs Time measurement to On:

:CONF:ZWAV:SEL:PVT ON

:CONF:ZWAV:SEL:PVT?

>1

:CONFigure:ZWAVe:SELect:PMONitor

Power Monitor On/Off

Function

Sets or queries Power Monitor measurement On/Off

Command

```
:CONFigure:ZWAVe:SELect:PMONitor <mode>
```

Query

```
:CONFigure:ZWAVe:SELect:PMONitor?
```

Response

<mode>

Parameter

<mode>	Power Monitor measurement
ON｜1	On
OFF|0	Off
Default	OFF

Example of Use

To set Power Monitor measurement to On:

:CONF:ZWAV:SEL:PMON ON

:CONF:ZWAV:SEL:PMON?

>1

:CONFigure:ZWAVe:SIGNal:FORMat

Signal Format

Function

Sets or queries the measurement signal format.

Command

```
:CONFigure:ZWAVe:SIGNal:FORMat <mode>
```

Query

```
:CONFigure:ZWAVe:SIGNal:FORMat?
```

Response

<mode>

Parameter

<mode>		Signal format
	BURSt	Burst wave of Z-Wave is the measurement target.
	CONTinuous	Continuous wave of Z-Wave or CW (unmodulated continuous wave) is the measurement target.
	Default	BURSt

Details

When the signal format is Continuous, the measurement target is Z-Wave continuous signals or CW.
Specify as Sync Mode = OFF and Trigger Source = Free Run, and then start measurement.
Immediately after executing :INITiate:ZWAVe, the power of "Measurement Interval" in a continuous wave is measured repeatedly, in the cycle of "Measurement Offset + Measurement Interval".
When the measurement target is CW, only the Transmit power at Modulation analysis is valid.

Example of Use

To set the measurement signal format to the burst wave of Z-Wave
:CONF:ZWAV:SIGN:FORM BURS
:CONF:ZWAV:SIGN:FORM?
> BURS

:CONFigure:ZWAVe:STORage:COUNt

Storage Count

Function

Sets or queries Storage Count.
The measurement ends when the specified storage count is not satisfied in the capture time.

Command

```
:CONFigure:ZWAVe:STORage:COUNt <range>
```

Query

```
:CONFigure:ZWAVe:STORage:COUNt?
```

Response

<range>

Parameter

<range>	Storage Count
Range	1 to 100
Resolution	1
Default	1
Unit	None

Details

When failed to detect the signals up to the number set by storage count during the capture time, only the detected signals are measurement targets.
When failed to detect the signals up to the number set by storage count, the measurement status obtainable by the following command is 14.

:STATus:ZWAVe:MEASurement?

Example of Use

To set the storage count to 100:
:CONF:ZWAV:STOR:COUN 100
:CONF:ZWAV:STOR:COUN?
>100

:CONFigure:ZWAVe:SYNC:MODE

Sync Mode

Function

Sets or queries the synchronous mode of the signal to decide the analysis reference position.

When SFD is selected, the analysis position is decided by the signal's SFD pattern.

Command

```
:CONFigure:ZWAVe:SYNC:MODE <mode>
```

Query

```
:CONFigure:ZWAVe:SYNC:MODE?
```

Response

<mode>

Parameter

<mode>		Sync Word Search
	OFF	Disabled
	SFD	Detect the signal's SFD pattern to decide analysis position.
	Default	SFD

Details

The reference position for specifying the analysis range is decided by the method below.

When Signal Format is Burst:

When the sync mode is set to OFF:

The signal detection time (when the signal rise exceeds the threshold set by Input Level + Trigger Level) is the reference position.

When the sync mode is set to SFD:

Search for SFD pattern from the signal detection time. After the position of the SFD is identified, the start of the PPDU in the signal is calculated from the set preamble length and is used as a reference position.

If the start of the PPDU comes before the signal detection position, this command results in an error.

When Signal Format is Continuous:

Specify as follows: Sync Mode = OFF and Trigger Source = Free Run.

The time information of the "Measurement Offset + Measurement Interval" cycle including the measurement start time is used as a reference position.

Example of Use

To set Sync Word Search to SFD:

:CONF:ZWAV:SYNC:MODE SFD

:CONF:ZWAV:SYNC:MODE?

>SFD

:CONFigure:ZWAVe:TLEVel

Trigger Level

Function

Sets or queries Trigger detection level.

Command

```
:CONFigure:ZWAV:TLEVel <trglevel>
```

Query

```
:CONFigure:ZWAV:TLEVel?
```

Response

<trglevel>

Parameter

<trglevel>	Trigger detection level
Range	–40 to 0 dB
Resolution	0.1 dB
Suffix code	DB
Default	–20 dB
Unit	dB

Remarks

Judged by average power of 1 symbol interval.

Example of Use

To set the trigger detection level to –20 dB:

:CONF:ZWAV:TLEV -20

:CONF:ZWAV:TLEV?

> -20.0

:CONFigure:ZWAVe:TRIGger

Trigger Source

Function

Sets or queries trigger source.

Command

```
:CONFigure:ZWAVe:TRIGger <mode>
```

Query

```
:CONFigure:ZWAVe:TRIGger?
```

Response

<mode>

Parameter

<mode>	Trigger source
LEVEL	Level trigger
MARKer1	SG Marker1
FREERUN	Free run
Default	LEVEL

Details

When the trigger source is set to Level Trigger, the total of Input Level and Trigger Level is a threshold for signal detection. The measurement starts when the signal above the threshold is detected.
When the trigger source is set to SG Marker1, the measurement starts at the detection of the timing information embedded in the signals output from the MU887000A/ MU887001A.
Whichever is set, only the signals exceeding the Level Trigger threshold are the measurement targets.
Additionally, after the first trigger signal is detected, the following signals within the interval of Measurement Interval + Measurement Offset cannot be triggers.
Free run can be selected only when signal format is Continuous, and the signal is CW (unmodulated continuous wave).

Example of Use

To set the trigger source to Level trigger:
:CONF:ZWAV:TRIG LEVEL
:CONF:ZWAV:TRIG?
>LEVEL

:FETCh:ZWAVe:DATA:BIT?

Data Table Bit

Function

Queries the demodulated bit data (0, 1, E) of the last measured burst signal.

Query

```
:FETCh:ZWAVe:DATA:BIT?
```

Response

<res1>,<res2>,...<resN>

Parameter

<resN> Demodulated data (0, 1, E)

When Not measured/Signal Abnormal: –

Details

Queries the demodulated data in Measurement Interval.
Refer to the :FETCh:ZWAVe:DATA:BIT:NUMBer? command for the response number N.

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response will be undefined.
"E" may be returned only when Data Rate is set to R1. Refer to Section 2.5 "Data Table" for detail.

Example of Use

To query the bit data (0, 1, E) of the demodulated data.
:FETC:ZWAV:DATA:BIT?
> 1,1,0,1,1,0,0,1,1,1,...

:FETCh:ZWAVe:DATA:BIT:NUMBer?

Data Table Bit (data number)

Function

Queries the number of output demodulated bit data of the last measured burst signal.

Query

```
:FETCh:ZWAVe:DATA:BIT:NUMBer?
```

Response

<res>

Parameter

<res>		Number of output data
	Value	Measurement Interval setting value [bit]
	When Not measured/Signal Abnormal: 99999	

Details

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response will be undefined.

Example of Use

To query the number of output data:
:FETC:ZWAV:DATA:BIT:NUMB?
> 1000

:FETCh:ZWAVe:DATA:SYMBol?

Data Table Symbol

Function

Queries the demodulated symbol data (0, 1) of the last measured burst signal.

Query

```
:FETCh:ZWAVe:DATA:SYMBol?
```

Response

<res1>,<res2>,...<resN>

Parameter

<resN> Demodulated data (0, 1)

When Not measured/Signal Abnormal: –

Details

Queries the demodulated data in Measurement Interval.
Refer to the :FETCh:ZWAVe:DATA:SYMBol:NUMBer? command for the response number N.

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response will be undefined.

Example of Use

To query the demodulated data.
:FETC:ZWAV:DATA:SYMB?
> 1,1,0,1,1,0,0,1,1,1,...

:FETCh:ZWAVe:DATA:SYMBol:NUMBer?

Data Table Symbol (data number)

Function

Queries the number of output demodulated symbol data of the last measured burst signal.

Query

```
:FETCh:ZWAVe:DATA:SYMBol:NUMBer?
```

Response

<res>

Parameter

When Data Rate = R1

<res> Number of output data

Value (Measurement Interval setting value [bit] × 2) [symbol]

When Not measured/Signal Abnormal: 99999

When Data Rate = R2 or R3

<res> Number of output data

Value (Measurement Interval setting value) [symbol]

When Not measured/Signal Abnormal: 99999

Details

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response will be undefined.

Example of Use

To query the output data number

:FETC:ZWAV:DATA:SYMB:NUMB?

> 1000

:FETCh:ZWAVe:DSIGnals?

Detected Signals

Function

Queries the number of bursts signal to be measured and the number of detected bursts.

Query

```
:FETCh:ZWAVe:DSIGnals?
```

Response

<res1>,<res2>

Parameter

<res1> Number of burst signal to be measured (Storage Count)

Resolution 1

When Not measured/Signal Abnormal: 999.

<res2> Number of detected bursts

Resolution 1

When Not measured/Signal Abnormal: 999.

Example of Use

To query the number of burst signal to be measured and the number of detected bursts:

:FETC:ZWAV:DSIG?

> 5,5

:FETCh:ZWAVe:FVTime:GRAPh?

Frequency vs Time (graph)

Function

Queries the Frequency vs Time values of the last measured burst signal.
The frequency values are returned at 1/8 symbol intervals.

Query

```
:FETCh:ZWAVe:FVTime:GRAPh?
```

Response

<res1>,<res2>,...<resN>
N: response number

Parameter

<resN>	Frequency vs Time value
Resolution	0.001 kHz
Unit	kHz

When Not measured/Signal Abnormal: 999999.999 (one datum)

Details

The frequency values are returned in the following range.

Start position:	First symbol of Measurement Interval
End position:	Last symbol of Measurement Interval

Refer to the :FETCh:ZWAVe:FVTime:GRAPh:NUMBer? command for the response number N.

Example of Use

To query the Frequency vs Time values:
:FETC:ZWAV:FVT:GRAP?
> -20.001,-20.120, 20.024, -20.010, 20.103,,,,,,,

:FETCh:ZWAVe:FVTime:GRAPh:NUMBer?

Frequency vs Time (graph data number)

Function

Queries the number of Frequency vs Time measurement data.

Query

```
:FETCh:ZWAVe:FVTime:GRAPh:NUMBer?
```

Response

<res>

Parameter

<res> Number of Frequency vs Time measurement data
Measurement Interval [symbol] × 8
When Not measured/Signal Abnormal: 99999

Example of Use

To query the number of Frequency vs Time measurement data
:FETC:ZWAV:FVT:GRAP:NUMB?
> 1600

:FETCh:ZWAVe:FVTime:GRAPh:SYMBol?

Frequency vs Time (graph symbol)

Function

Queries the measured Frequency vs Time values of the time axis.

Query

```
:FETCh:ZWAVe:FVTime:GRAPh:SYMBol?
```

Response

<res1>,<res2>,...<resN>

N: response number

Parameter

<resN>	Measured Frequency vs Time value of time axis
Start value	0
End value	(8 × N – 1) × 0.125
Resolution	0.125 symbol
Unit	symbol

When Not measured/Signal Abnormal: 99999.999 (one datum)

Details

Refer to the :FETCh:ZWAVe:FVTime:GRAPh:NUMBer? command for the response number N.

Example of Use

To query the measured Frequency vs Time values of the time axis:

:FETC:ZWAV:FVT:GRAP:SYMB?

> 0.000,0.125,0.250,0.375,0.500,0.625,0.750,,,,,,,

:FETCh:ZWAVe:MODulation[n]?

Modulation Analysis Result

Function

Queries the modulation analysis results.

Query

```
:FETCh:ZWAVe:MODulation[n]?
```

Response

Table 3.2.2-1 lists the responses to parameter [n]

Table 3.2.2-1 Responses to Modulation Analysis result

n	Response
1 or omitted	Resposes are returned with comma separated value format in the following order. <res_1>,<res_2>,...<res_n>,...<res_18> 1. Transmit frequency error [Hz] (Average value for Storage Count) [Resolution 0.01 Hz] When Not measured/Signal Abnormal: 99999999999.99 2. Transmit frequency error [Hz] (Maximum value for Storage Count) [Resolution 0.01 Hz] When Not measured/Signal Abnormal: 99999999999.99 3. Transmit frequency error [ppm] (Average value for Storage Count) [Resolution 0.00000001 ppm] When Not measured/Signal Abnormal: 99999.99999999 4. Transmit frequency error [ppm] (Maximum value for Storage Count) [Resolution 0.00000001 ppm] When Not measured/Signal Abnormal: 99999.99999999 5. Transmit power [dBm] (Average value for Storage Count) [Resolution 0.01 dB] When Not measured/Signal Abnormal: 999.99 6. Transmit power [dBm](Maximum value for Storage Count) [Resolution 0.01 dB] When Not measured/Signal Abnormal: 999.99 7. 999.99 8. 999.99 9. Deviation Average [kHz](Average value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 10. Deviation Average [kHz](Maximum value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 11. Deviation Peak (+1) [kHz](Average value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 12. Deviation Peak (+1) [kHz] (Maximum value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 13. Deviation Peak (-1) [kHz](Average value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 14. Deviation Peak (-1) [kHz] (Maximum value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 15. Deviation (Peak -Peak)/2 [kHz](Average value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 16. Deviation (Peak -Peak)/2 [kHz](Maximum value for Storage Count) [Resolution 0.001 kHz] When Not measured/Signal Abnormal: 999.999 17 to 20. 999.99

Table 3.2.2-1 Responses to Modulation Analysis result (Cont'd)

n	Response
2	Returns 100 data with comma-separated value formats: <res_1>,<res_2>,...<res_n>,...<res_100> Transmit power of the nth storage, [Unit dBm], [Resolution 0.01 dB] When Not measured/Signal Abnormal: 999.99
3	Returns 100 data with comma-separated value formats: <res_1>,<res_2>,...<res_n>,...<res_100> Transmit center frequency tolerance of the nth storage, [Unit Hz], [Resolution 0.01 Hz] When Not measured/Signal Abnormal: 999.99

Parameter

Refer to Response Table.

Details

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the responses except the parameter [n]=1 or below will be undefined or the same as for Not measured.

5. Transmit power [dBm] (Average value for Storage Count)
6. Transmit power [dBm] (Maximum value for Storage Count)

Example of Use

To query the modulation analysis results:

:FETC:ZWAV:MOD1?

> 1.67,2.28,0.00068163,0.00093061,-10.77,-10.77,999.99,999.99,...

:FETCh:ZWAVe:PMONitor[n]?

Power Monitor

Function

When n is set to 1:
Queries the Offset value from the head of res = storage_n signal detected position to the head of Measurement Interval.
When n is set to 2:
Queries ratio of On interval during Measurement Interval.
When n is set to 3:
Queries the time from the measurement start position to the signal detection position of each burst signal to be measured.

Query

```
:FETCh:ZWAVe:PMONitor[n]?
```

Response

<res1>,<res2>,...<resN>
N = 1 to 100

Parameter

When n is set to 1 or omitted:

<resN>	Offset value from the head of res = storage_n signal detected position to the head of Measurement Interval.
Resolution	1
Unit	bit

When Not measured/Signal Abnormal: 99999

When n is set to 2:

<resN>	Ratio of On interval during Measurement Interval.
Resolution	0.01
Unit	%

When Not measured/Signal Abnormal: 999.99

When n is set to 3:

<resN>	The time from the measurement start position to the signal detection position of each burst signal to be measured.
Resolution	0.001
Unit	ms

When Not measured/Signal Abnormal: 99999.999

Details

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response is the same as for Not measured.

Example of Use

To query the Offset value from the head of res = storage_n On interval to the head of Measurement Interval:
:FETC:ZWAV:PMON1?
> 0,0,0,0,99999,99999,99999,99999,99999,99999,...

:FETCh:ZWAVe:PVTime:GRAPh?

Power vs Time (graph)

Function

Queries the Power vs Time values of the last measured burst signal.
The power values of each sample are returned.

Query

```
:FETCh:ZWAVe:PVTime:GRAPh?
```

Response

<res1>,<res2>,...<resN>
N: response number

Parameter

<resN>	Power vs Time value
Resolution	0.01 dB
Unit	dBm

When Not measured/Signal Abnormal: 999.99 (one datum)

Details

The power value [dBm] is returned in the range below.

Start position:	Latch Address detection sample – 1000 samples
End position:	The last sample of Measurement Interval + 1000 samples

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response is the same as for Not measured.

Example of Use

To query the Power vs Time values:
:FETC:ZWAV:PVT:GRAP?
> -65.74,-61.62,-63.97,-65.01,-63.49,-63.35,-65.24,-63.11,-65.45,-64.25,...

:FETCh:ZWAVe:PVTime:GRAPh:NUMBer?

Power vs Time (graph data number)

Function

Queries the number of Power vs Time measurement data.

Query

```
:FETCh:ZWAVe:PVTime:GRAPh:NUMBer?
```

Response

<res>

Parameter

<res>	The number of Power vs Time measurement data	
Range	Start position:	Latch Address detection sample – 1000 sample
	End position:	The last sample of Measurement Interval + 1000 sample

When Not measured/Signal Abnormal: 99999

Details

When Signal Format is Continuous and the signal is CW (unmodulated continuous wave), the response is the same as for Not measured.

Example of Use

To query the number of Power vs Time measurement data:
:FETC:ZWAV:PVT:GRAP:NUMB?
> 1100

:FETCh:ZWAVe:PVTime:GRAPh:TIME?

Power vs Time (graph time)

Function

Queries time data of the Power vs Time measurement points.

Query

```
:FETCh:ZWAVe:PVTime:GRAPh:TIME?
```

Response

<res1>,<res2>,...<resN>

N: response number

Parameter

<res>	Time data of Power vs Time measurement	
Range	Start position:	–500 µs
	End position:	((MeasOffset[bit] + MeasInterval[bit]) / BitRate[bit/s]) × 10^6 + 500 µs
Data interval	0.5 µs	
Unit	µs	

When Not measured/Signal Abnormal: 999999.9 (one datum)

Details

When the signal format is Continuous, and the signal is CW (unmodulated continuous wave), the response is the same as for Not measured.

Example of Use

To query time data of the Power vs Time measurement:

:FETC:ZWAV:PVT:GRAP:TIME?

> -500.0,-499.5,-499.0,-498.5,,,,,,,,,,

Chapter 4 Native Command Reference

Native commands of this application are the same as short forms of SCPI commands. Comparison tables of SCPI commands and Native commands are shown in List of Commands.

For details of commands, refer to Chapter 3 “SCPI Command Reference”.

To switch to the Native command mode, send the command SYST:LANG NAT.

4.1 List of Commands

The following table shows the rules for describing messages.

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

4.1.1 Common commands

Operation Status Register

Function	SCPI Command, Query	Native Command, Query
Measurement Operation Status Register Query	:STATus:ZWAVe:MEASurement?	STAT:ZWAV:MEAS?

Common

Function	SCPI Command, Query	Native Command, Query
Set Connect Port Direction	:ROUTe:PORT:CONNect:DIRection <in>,<out>	PORT <in>,<out>
	:ROUTe:PORT:CONNect:DIRection?	PORT?

Measurements

Function	SCPI Command, Query	Native Command, Query
Measurement Stop	:ABORt:ZWAVe	ABOR:ZWAV
Measurement Start	:INITiate:ZWAVe	INIT:ZWAV

Common Parameters

Function	SCPI Command, Query	Native Command, Query
Data Rate	:CONFigure:ZWAVe:PHY:DATA:RATE <mode>	CONF:ZWAV:PHY:DATA:RATE <mode>
	:CONFigure:ZWAVe:PHY:DATA:RATE?	CONF:ZWAV:PHY:DATA:RATE?
Bit Rate	:CONFigure:ZWAVe:PHY:INFO:BIT:RATE?	CONF:ZWAV:PHY:INFO:BIT:RATE?
Symbol Rate	:CONFigure:ZWAVe:PHY:INFO:SYMBol:RATE?	CONF:ZWAV:PHY:INFO:SYMB:RATE?
Preamble Length Mode	:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE <mode>	CONF:ZWAV:PHY:PRE:LENG:MODE <mode>
	:CONFigure:ZWAVe:PHY:PREamble:LENGth:MODE?	CONF:ZWAV:PHY:PRE:LENG:MODE?
Preamble Length	:CONFigure:ZWAVe:PHY:PREamble:LENGth <num>	CONF:ZWAV:PHY:PRE:LENG <num>
	:CONFigure:ZWAVe:PHY:PREamble:LENGth?	CONF:ZWAV:PHY:PRE:LENG?

System

Function	SCPI Command, Query	Native Command, Query
Application Select	:INSTrument[:SELect] <app>	SYSSEL <app>
	:INSTrument[:SELect]?	SYSSEL?
Language Selection of Remote Command	:SYSTem:LANGuage <mode>	SYST:LANG <mode>
	:SYSTem:LANGuage?	SYST:LANG?

4.1.2 Fundamental measurement commands

Common Parameters

Function	SCPI Command, Query	Native Command, Query
Center Frequency	:CONFigure:ZWAVe:FREQuency <freq>	CONF:ZWAV:FREQ <freq>
	:CONFigure:ZWAVe:FREQuency?	CONF:ZWAV:FREQ?
Input Level	:CONFigure:ZWAVe:POWer <level>	CONF:ZWAV:POW <level>
	:CONFigure:ZWAVe:POWer?	CONF:ZWAV:POW?
Trigger Source	:CONFigure:ZWAVe:TRIGger <mode>	CONF:ZWAV:TRIG <mode>
	:CONFigure:ZWAVe:TRIGger?	CONF:ZWAV:TRIG?
Trigger Level	:CONFigure:ZWAVe:TLEVel <trglevel>	CONF:ZWAV:TLEV <trglevel>
	:CONFigure:ZWAVe:TLEVel?	CONF:ZWAV:TLEV?

Fundamental Measurement Parameters

Function	SCPI Command, Query	Native Command, Query
Signal Format	:CONFigure:ZWAVe:SIGNal:FORMat <mode>	CONF:ZWAV:SIGN:FORM <mode>
	:CONFigure:ZWAVe:SIGNal:FORMat?	CONF:ZWAV:SIGN:FORM?
Sync Mode	:CONFigure:ZWAVe:SYNC:MODE <mode>	CONF:ZWAV:SYNC:MODE <mode>
	:CONFigure:ZWAVe:SYNC:MODE?	CONF:ZWAV:SYNC:MODE?
Measurement Interval	:CONFigure:ZWAVe:MEAS:INTerval:BIT <range>	CONF:ZWAV:MEAS:INT:BIT <range>
	:CONFigure:ZWAVe:MEAS:INTerval:BIT?	CONF:ZWAV:MEAS:INT:BIT?
Measurement Offset	:CONFigure:ZWAVe:MEAS:OFFSet:BIT <range>	CONF:ZWAV:MEAS:OFFS:BIT <range>
	:CONFigure:ZWAVe:MEAS:OFFSet:BIT?	CONF:ZWAV:MEAS:OFFS:BIT?
Capture time	:CONFigure:ZWAVe:CAPTure:TIME <range>	CONF:ZWAV:CAPT:TIME <range>
	:CONFigure:ZWAVe:CAPTure:TIME?	CONF:ZWAV:CAPT:TIME?
Storage Count	:CONFigure:ZWAVe:STORage:COUNt <range>	CONF:ZWAV:STOR:COUN <range>
	:CONFigure:ZWAVe:STORage:COUNt?	CONF:ZWAV:STOR:COUN?
Modulation Analysis On/Off	:CONFigure:ZWAVe:SELect:MODulation <mode>	CONF:ZWAV:SEL:MOD <mode>
	:CONFigure:ZWAVe:SELect:MODulation?	CONF:ZWAV:SEL:MOD?
Power vs Time On/Off	:CONFigure:ZWAVe:SELect:PVTime <mode>	CONF:ZWAV:SEL:PVT <mode>
	:CONFigure:ZWAVe:SELect:PVTime?	CONF:ZWAV:SEL:PVT?
Frequency vs Time On/Off	:CONFigure:ZWAVe:SELect:FVTime <mode>	CONF:ZWAV:SEL:FVT <mode>
	:CONFigure:ZWAVe:SELect:FVTime?	CONF:ZWAV:SEL:FVT?
Power Monitor On/Off	:CONFigure:ZWAVe:SELect:PMONitor <mode>	CONF:ZWAV:SEL:PMON <mode>
	:CONFigure:ZWAVe:SELect:PMONitor?	CONF:ZWAV:SEL:PMON?
Data Table On/Off	:CONFigure:ZWAVe:SELect:DATA <mode>	CONF:ZWAV:SEL:DATA <mode>
	:CONFigure:ZWAVe:SELect:DATA?	CONF:ZWAV:SEL:DATA?
All Measurement On/Off	:CONFigure:ZWAVe:SELect:ALL <mode>	CONF:ZWAV:SEL:ALL?

Results

Function	SCPI Command, Query	Native Command, Query
Modulation Analysis Result	:FETCh:ZWAVe:MODulation[n]?	FETC:ZWAV:MOD[n]?
Data Table Bit	:FETCh:ZWAVe:DATA:BIT?	FETC:ZWAV:DATA:BIT?
Data Table Bit (data number)	:FETCh:ZWAVe:DATA:BIT:NUMBer?	FETC:ZWAV:DATA:BIT:NUMB?
Data Table Symbol	:FETCh:ZWAVe:DATA:SYMBol?	FETC:ZWAV:DATA:SYMB?
Data Table Symbol (data number)	:FETCh:ZWAVe:DATA:SYMBol:NUMBer?	FETC:ZWAV:DATA:SYMB:NUMB?
Frequency vs Time (graph)	:FETCh:ZWAVe:FVTime:GRAPh?	FETC:ZWAV:FVT:GRAP?
Frequency vs Time (graph data number)	:FETCh:ZWAVe:FVTime:GRAPh:NUMBer?	FETC:ZWAV:FVT:GRAP:NUMB?
Frequency vs Time (graph symbol)	:FETCh:ZWAVe:FVTime:GRAPh:SYMBol?	FETC:ZWAV:FVT:GRAP:SYMB?
Power vs Time (graph)	:FETCh:ZWAVe:PVTime:GRAPh?	FETC:ZWAV:PVT:GRAP?
Power vs Time (graph data number)	:FETCh:ZWAVe:PVTime:GRAPh:NUMBer?	FETC:ZWAV:PVT:GRAP:NUMB?
Power vs Time (graph time)	:FETCh:ZWAVe:PVTime:GRAPh:TIME?	FETC:ZWAV:PVT:GRAP:TIME?
Power Monitor	:FETCh:ZWAVe:PMONitor[n]?	FETC:ZWAV:PMON[n]?
Detected Signals	:FETCh:ZWAVe:DSIGnals?	FETC:ZWAV:DSIG?

Chapter 5 Performance Test

This chapter explains how to setup the measuring instruments required for the MX887061A Z-Wave TX Measurement as well as the test procedures.

5.1 Outline

The performance tests are performed to assure that the MU887000A performance does not deteriorate. Test the performance of the MU887000A at the initial acceptance inspection, at periodic inspections, and after repairs. Test important items periodically to assure the performance. This chapter explains the following test items.

- Tx Power measurement accuracy (CW)
- Frequency/Modulation measurement Carrier frequency accuracy

We recommend testing the performance periodically once or twice a year. If the test results do not meet the specifications, contact information is available in a separate file (for the PDF version), and on the last page of this manual (for the printed version).

⚠ CAUTION

Warm-up the MU887000A and the required measuring instruments for at least 30 minutes (except when specified otherwise) to stabilize them. To achieve the highest accuracy, the test should be performed at room temperature using a power supply with as little voltage fluctuation as possible in an environment free from noise, vibration, dust and humidity.

5.2 Instruments for Testing Performance

The following table lists the measuring instruments required for testing the MU887000A performance and the specifications for each instrument.

Table 5.2-1 Measuring Instruments for Performance Test

Performance Test Item	Instrument Required Specifications*1	Recommended Instrument (Anritsu Model)
Tx Power Measurements ● Measurement Accuracy	Signal Generator ● Frequency Range: 440 to 1000 MHz ● Resolution: 1 Hz ● Output Level Range Unmodulated: –143 to +13 dBm Resolution: 0.01 dB	Vector Signal Generator (MG3710A)
	Signal Analyzer Same as above	Signal Analyzer (MS269xA or MS2830A)
	Power Meter ● Main Frame Accuracy: ±0.02 dB ● Frequency Range: 440 to 1000 MHz ● Resolution: 0.01 dB	Power Meter (ML2437A)
	Power sensor ● Frequency Range: 440 to 1000 MHz ● Measured Power Range: –40 to +20 dBm ● Input Connector: N type	Power Sensor (MA2442D)
Frequency/Modulation Measurements ● Carrier Frequency Accuracy	Signal generator supporting output of Z-Wave "ITU-T G9959 - 2015" modulation signals Same as above	Same as above
	Power Meter Same as above	Same as above
	Power sensor ● Frequency Range: 440 to 1000 MHz ● Measured Power Range: –30 to +20 dBm ● Input Connector: N type	Power Sensor (MA24002A)
Common	3-dB Attenuator	3-dB Attenuator (AT-103)

*1: The performance covers the test item measurement range.

5.3 Performance Test for Each Measurement

Common test items

The following list shows the common settings for each measurement at the MU887000A.

Application: ZWAVE

5.3.1 Calibrating signal generator (CW)

This procedure captures the calibration value for measurements using an unmodulated waveform (CW).

(1) Measuring instruments

- Vector signal generator: MG3710A
- Power meter: ML2437A
- Power sensor: MA2442D
- 3-dB Attenuator: AT-103 (2 sets)

(2) Setup

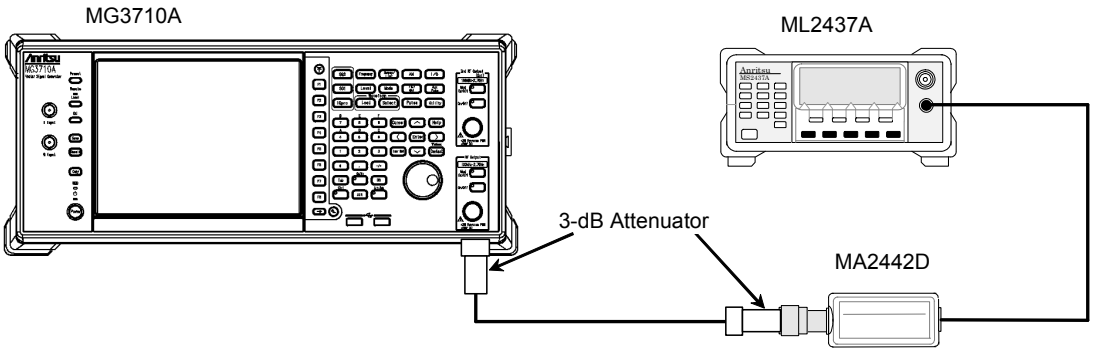

Figure 5.3.1-1 Signal Generator Calibration Setup (CW)

(3) Procedure

1. Setup the instruments as shown in Figure 5.3.1-1.
2. Output a CW 439.99 MHz signals from the Vector signal generator (SG) at a level of +6 dBm
3. Measure the level with the ML2437A power meter and adjust the SG so that the output level is 0 dBm.
4. Change the frequency as shown in Table 5.3.1-1 "Measurement Points and Frequency" and perform the same measurement to obtain the calibration value.
5. Repeat steps 3 and 4 over while changing the output level (value measured with power meter) to –10, –25 dBm, successively to measure and obtain the calibration value.

Table 5.3.1-1 Measurement Point and Frequency

Meas. Point	Frequency (MHz)
1	440
2	1000

Note:

Add an offset of −10 kHz to the frequency in the above table and set the frequency as SG output frequency, except for the measurement described in section 5.3.4.

5.3.2 Calibrating signal generator (MOD)

This procedure captures the calibration value for measurement using a modulated waveform.

(1) Measuring instruments

- Vector signal generator: MG3710A
- Power meter: ML2437A
- Power sensor: MA24002A
- 3-dB Attenuator: AT-103 (2 sets)

(2) Setup

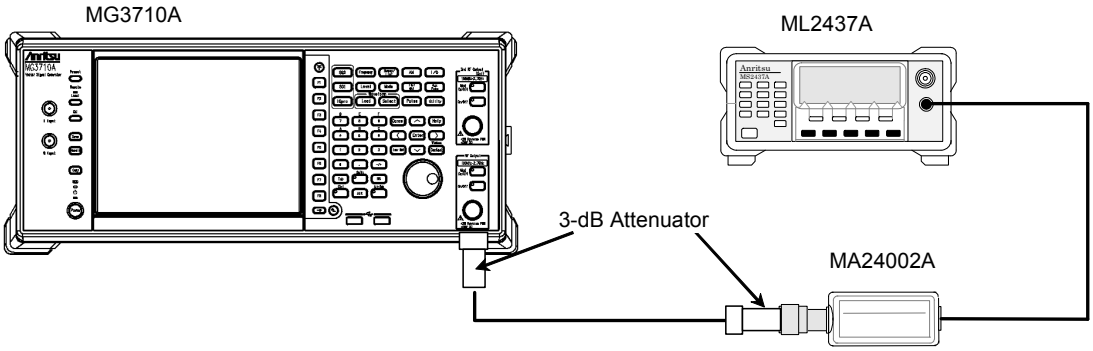

Figure 5.3.2-1 Signal Generator Calibration Setup (MOD)

(3) Procedure

1. Setup the instruments as shown in Figure 5.3.2-1.
2. Output a modulated 439.99 MHz signal from the Vector signal generator (SG) at a level of –4 dBm with Continuous waveform pattern equivalent to MV887061A_ZW_R1_0001.
3. Measure the level with the ML2437A Power Meter and adjust the SG so that the output level is –10 dBm.
4. Change the frequency as shown in Table 5.3.1-1 “Measurement Point and Frequency” and perform the same measurements to obtain the calibration value.

5.3.3 Tx Power measurement accuracy (CW)

This test is related to the accuracy of Tx power measurements.

(1) Test specifications

Test Port1/2

Measurement Accuracy	Input Level	Temperature
±0.5 dB	–25 dBm ≤, ≤+35 dBm	10 to 40°C
±0.7 dB	–55 dBm ≤, <–25 dBm	10 to 40°C
±0.9 dB	–65 dBm ≤, <–55 dBm	10 to 40°C

Test Port3/4

Measurement Accuracy	Input Level	Temperature
±0.7 dB	–25 dBm ≤, ≤+25 dBm	10 to 40°C
±0.9 dB	–55 dBm ≤, <–25 dBm	10 to 40°C
±1.1 dB	–65 dBm ≤, <–55 dBm	10 to 40°C

(2) Measuring instruments

- Vector signal generator: MG3710A
- 3-dB Attenuator: AT-103 (2 sets)

(3) Setup

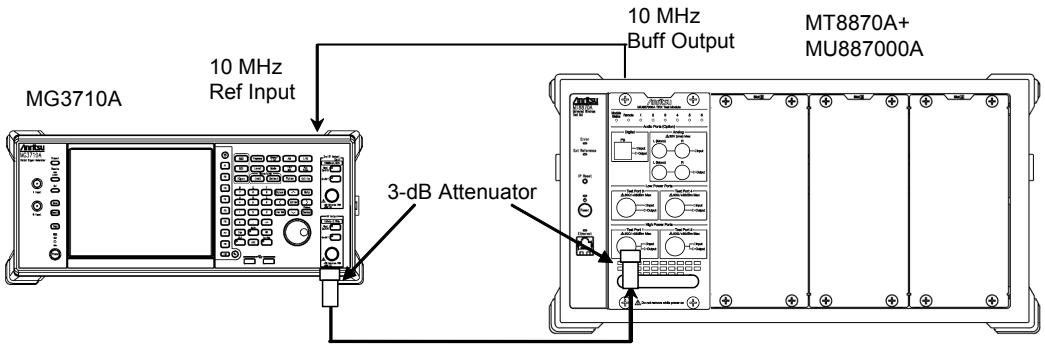

Figure 5.3.3-1 Setup for Measuring Amplitude Measurement Accuracy

(4) Test procedure

1. Setup the instruments as shown in Figure 5.3.3-1.
2. Set the MU887000A as follows:

Connect Port :	Test Port1
Output Level On/Off :	OFF
Input Level :	–10 dBm
Center frequency :	440 MHz
Data Rate:	R1
Preamble Length Mode:	Manual
Preamble Length:	10
Signal Format :	Continuous
Trigger Source :	Free Run
Sync Mode :	Off
Measurement Offset :	0
Measurement Interval :	200
Storage Count :	1
Modulation Analysis :	ON

3. Set the Vector signal generator (SG) as follows:

Modulation:	OFF
Output frequency:	439.99 MHz
Output level:	–10 dBm (This output level reflects the calibration value for item 5.3.1.)

4. Change the frequency of the MU887000A and SG according to Table 5.3.1-1 “Measurement Point and Frequency” and measure the Transmit power.
5. Change the SG output level and MU887000A input level each to –55, and –65 dBm and repeat steps 2 to 4 over and measure the Transmit power. (This output level reflects the calibration value for item 5.3.1.)

Note:

Add the differences from –55 dBm and –65 dBm respectively to the calibration value of –25 dBm described in Section 5.3.1 and use these values.

6. Change the Connect Port setting for the connection with the MU887000A to Test Port2/3/4, successively, and repeat steps 2 to 5 over.

5.3.4 Frequency error measurement

This test is related to the following modulation analyses.

- Carrier frequency accuracy

(1) Test specifications

Test Port1/2

Carrier frequency accuracy	±(Set frequency × Reference oscillator accuracy + 100 Hz)

Input level: –30 dBm ≤, ≤+35 dBm

Test Port3/4

Carrier frequency accuracy	±(Set frequency × Reference oscillator accuracy + 100 Hz)

Input level: –30 dBm ≤, ≤+25 dBm

(2) Measuring instruments

- Vector signal generator: MG3710A
- 3-dB Attenuator: AT-103 (2 sets)

(3) Setup

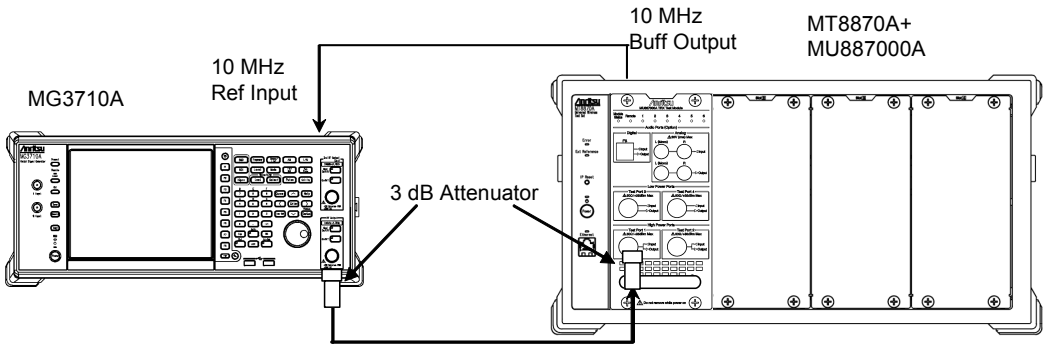

Figure 5.3.4-1 Setup for Measuring Frequency Error

(4) Test procedure

1. Setup the instruments as shown in Figure 5.3.4-1.
2. Set the MU887000A as follows:

Connect Port :	Test Port1
Output Level On/Off :	OFF
Input Level :	–10 dBm
Center frequency :	440 MHz
Signal Format :	Burst
Trigger Source :	LEVEL
Trigger Level :	–10 dB
Data Rate :	R1
Preamble Length Mode	Manual
Preamble Length	10
Sync Mode :	SFD
Measurement Offset :	0
Measurement Interval :	200
Storage Count :	1
Modulation Analysis :	ON

3. Set the Vector signal generator (SG) as follows:

Modulation:	ON
Waveform pattern:	MV887061A_ZW_R1_0001
Output frequency:	440 MHz
Output level:	–10 dBm (This output level reflects the calibration value for item 5.3.2.)

4. Measure the frequency error.

   Center frequency tolerance: Average value

5. Change the MU887000A and SG frequencies according to Table 5.3.1-1 “Measurement Point and Frequency” and repeat steps 2 to 4 over.
6. Change the SG output level and the MU887000A input level to –30 dBm and measure by repeating steps 2 to 5 over. (This output level reflects the calibration value for item 5.3.2.)
7. Change the Connect Port setting for the connection with the MU887000A to Test Port2/3/4 successively, and repeat steps 2 to 6 over.

5.3.5 Evaluation signals

The evaluation signals (Waveform pattern) described in the performance test items 5.3.2, 5.3.4 are set as follows. When the user is executing performance tests, set the SG actually used based on the following setting contents.

Outline of Evaluation Signals

Evaluation signals are generated according to the PHY standard in ITU-T G9959, with the measurement conditions set as follows: Data Rate = R1, Preamble Length = 10, PSDU = 4 bytes

To obtain calibration values for SG when using modulated wave in 5.3.2 “SG Calibration (MOD)”, use the above-mentioned signal with converted into continuous wave.

5.3.6 Sample format for performance test result sheets

Use the following test result sheets when testing the MX887061A performance. Duplicate these sheets as necessary for tests.

Test location _____ Report No. _____

Date _____

Person-in-charge _____

Model:

Serial No. _____ Ambient temperature _____ °C

Power source frequency _____ Hz Relative humidity _____ %

Remarks _____

SG Calibration (CW)

SG Calibration (CW)

MG3710A Modulation Wave

Frequency (MHz)	SG Setting (dBm)	
	–10 dBm	–25 dBm
440		
1000		

SG Calibration (MOD)

SG Calibration (MOD)

MG3710A Modulation Wave

Frequency (MHz)	SG Setting (dBm)
	–10 dBm
440	
1000	

Tx Power Measurement Accuracy (CW)

Tx Power Measurement Accuracy Port1/2

MU887000A Input Level: –10 dBm (Item 5.3.1 Calibration Value)

Frequency (MHz)	MX887061A Measured Value (P) (dBm)	Measurement Accuracy (dB)			
		Lo Limit	Measurement Accuracy –10 – (P)	Hi Limit	Measurement uncertainty
440		–0.5		+0.5	±0.15
1000					

Tx Power Measurement Accuracy Port1/2

MU887000A Input Level: –55 dBm (Item 5.3.1 Calibration Value)

Frequency (MHz)	Item 5.3.1 –55 dBm Calibration Value (C) (dB)	MX887061A Measured Value (P) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –25 + (C) – (P)	Hi Limit	Measurement uncertainty
440			–0.7		+0.7	±0.13
1000						

Tx Power Measurement Accuracy Port1/2

MU887000A Input Level: –65 dBm (Item 5.3.1 Calibration Value)

Frequency (MHz)	Item 5.3.1 –65 dBm Calibration Value (C) (dB)	MX887061A Measured Value (P) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –25 + (C) – (P)	Hi Limit	Measurement uncertainty
440			–0.9		+0.9	±0.13
1000						

Tx Power Measurement Accuracy (CW) (continued)

Tx Power Measurement Accuracy Port3/4

MU887000A Input Level: –10 dBm (Item 5.3.1 Calibration Value)

Frequency (MHz)	MX887061A Measured Value (P) (dBm)	Measurement Accuracy (dB)			
		Lo Limit	Measurement Accuracy –10 – (P)	Hi Limit	Measurement uncertainty
440		–0.7		+0.7	±0.17
1000					

Tx Power Measurement Accuracy Port3/4

MU887000A Input Level: –55 dBm (Item 5.3.1 Calibration Value)

Frequency (MHz)	Item 5.3.1 –55 dBm Calibration Value (C) (dB)	MX887061A Measured Value (P) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –25 + (C) – (P)	Hi Limit	Measurement uncertainty
440			–0.9		+0.9	±0.14
1000						

Tx Power Measurement Accuracy Port3/4

MU887000A Input Level: –65 dBm (Item 5.3.1 Calibration Value)

Frequency (MHz)	Item 5.3.1 –65 dBm Calibration Value (C) (dB)	MX887061A Measured Value (P) (dBm)	Measurement Accuracy (dB)			
			Lo Limit	Measurement Accuracy –25 + (C) – (P)	Hi Limit	Measurement uncertainty
440			–1.1		+1.1	±0.14
1000						

Frequency Measurement

Carrier Frequency Accuracy

MU887000A Input Level: –10 dBm

Frequency (MHz)	Carrier Frequency Accuracy (Hz)		
	Measured Value	Spec.	Measurement uncertainty
440		±100.0	±30.0
1000			

MU887000A Input Level: –30 dBm

Frequency (MHz)	Carrier Frequency Accuracy (Hz)		
	Measured Value	Spec.	Measurement uncertainty
440		±100.0	±30.0
1000			

5.4 Servicing

If any unit is found to be broken or does not operate as described in the specifications, contact an Anritsu Service and Sales office. Contact information is available in a separate file (for the PDF version), and on the last page of this manual (for the printed version).

When requesting repair, supply the following information:

(a) Model name and serial number marked on rear panel

(b) Failure symptoms

(c) Person to contact about nature of failure and repair completion notification

(d) Software version

Appendix A Specifications

This appendix lists the specifications of the MX887061A Z-Wave TX Measurement. Refer to section 1.3 “Composition” for details of the product configuration.

These specifications assume use of the system at a constant temperature after warming-up the instruments for 30 minutes. The abbreviation (typ.) indicates the reference data at 20 to 30°C and is not a guaranteed value.

Table A-1 MX887061A Specifications

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Tx Power Measurement
Input Level Range

Input Frequency Range
Measurement Accuracy</td><td>Port1, Port2: –65.0 to +35.0 dBm
Port3, Port4: –65.0 to +25.0 dBm
440 to 1000 MHz

Port1, Port2: After calibration, 10 to 40°C
<table>
<tr><th>Input Level</th><th>Measurement Accuracy</th></tr>
<tr><td>–25 to +35 dBm</td><td>±0.3 dB (typ.)
±0.5 dB</td></tr>
<tr><td>–55 to –25 dBm</td><td>±0.7 dB</td></tr>
<tr><td>–65 to –55 dBm</td><td>±0.9 dB</td></tr>
</table>
Port3, Port4: After calibration, 10 to 40°C
<table>
<tr><th>Input Level</th><th>Measurement Accuracy</th></tr>
<tr><td>–25 to +25 dBm</td><td>±0.7 dB</td></tr>
<tr><td>–55 to –25 dBm</td><td>±0.9 dB</td></tr>
<tr><td>–65 to –55 dBm</td><td>±1.1 dB</td></tr>
</table></td></tr>
</table>

Table A-1 MX887061A Specifications (Cont'd)

Item	Specification
Modulation Analysis	
Input Level Range	Port1, Port2: –30.0 to +35.0 dBm Port3, Port4: –30.0 to +25.0 dBm
Input Frequency Range	440 to 1000 MHz
Carrier Frequency Accuracy	±(Set frequency × Reference oscillator accuracy + 100 Hz)

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References are page numbers.