MU368060A
AWGN Unit
Operation Manual

Fourth Edition

- **Read this manual before using the equipment.**
- **To ensure that the equipment is used safely, read the "For Safety" in the MG3681A Digital Modulation Signal Generator Operation Manual first.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W1955AE-4.0

MU368060A
AWGN Unit
Operation Manual

1 August 2001 (First Edition)
1 December 2003 (Fourth Edition)

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the National Institute of Advanced Industrial Science and Technology, and the Communications Research Laboratory, and was found to meet the published specifications.

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CE marking

1. Product Model

Plug-in Units: MU368060A AWGN Unit

2. Applied Directive and Standards

When the MU368060A AWGN Unit is installed in the MG3681A, the applied directive and standards of this Unit are conformed to those of the MG3681A main frame.

PS: About main frame
The kind of main frame (a measuring apparatus) will be to increase.
Please, contact us about the newest information of the main frame.

C-tick Conformity marking

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

C-tick marking

1. Product Model

Plug-in Units: MU368060A AWGN Unit

2. Applied Directive and Standards

When the MU368060A AWGN Unit is installed in the MG3681A, the applied directive and standards of this Unit are conformed to those of the MG3681A main frame.

PS: About main frame
The kind of main frame (a measuring apparatus) will be to increase.
Please, contact us about the newest information of the main frame.

About This Manual

This operation manual offers an overview, sample measurement and remote control of the MU368060A AWGN Unit.
The MU368060A AWGN Unit is mounted to the MG3681A Digital Modulation Signal Generator.
[ ] represents a panel key.
The "MG3681A Digital Modulation Signal Generator Operation Manual" is provided separately. Refer to them together with this manual.

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Section 1 Overview

This section describes the product outline and manual configuration for the MU368060A AWGN Unit.

1.1 Product Outline

The MU368060A is an AWGN (Additive White Gaussian Noise) Unit mounted on the MG3681A Digital Modulation Signal Generator (hereafter, main frame).

Mounting the MU368060A on the main frame enables noise signals to be generated for reception sensitivity test of CDMA 2000 modulation radio equipment.

1.2 Product Configuration

The standard configuration of the MU368060A is shown below. When unpacking, check that the listed products are provided. If a missing or damaged component is found, please contact Anritsu or its distributors.

Item	Model name and number	Part name	Quan-tity	Remarks
Main Unit	MU368060A	AWGN Unit	1	
Accessory	W1955AE	Operation Manual	1	

Section 2 Storage and Transportation

This section describes precautions on storage and transportation of MU368060A.

2.1 Precautions for Long-term Storage

Avoid storing the MU368060A in places where:

- It may be exposed to direct sunlight
- It is dusty
- It is humid and condensation may form
- It may be exposed to active gases
- It may oxidize
- The following temperature and humidity exists
  Temperature : < –20°C, > 60°C
  Humidity : ≥ 90%

Recommended Storage Conditions

When MU368060A is stored for long periods, we recommend observing the following conditions in addition to those described above:

- Temperature : 0 to 50°C
- Humidity : 40 to 80%
- A location where the temperature and humidity are stable throughout the day.

2.2 Repacking and Transportation

Precautions on transportation of MU368060A are shown below.

Repacking

Use the original packing material (box), if available. If not available, follow the procedures shown below to repack the MU368060A.

[1] Cover the MU368060A with a conductive vinyl.

[2] Prepare a cardboard/wood/aluminum box large enough to store the MU368060A and the cushioning material to cover it.

[3] Put the MU368060A into the box. Then put cushioning material around it to prevent it from moving in the box.

[4] Firmly close the box with packing string, adhesive tape or bands.

Transportation

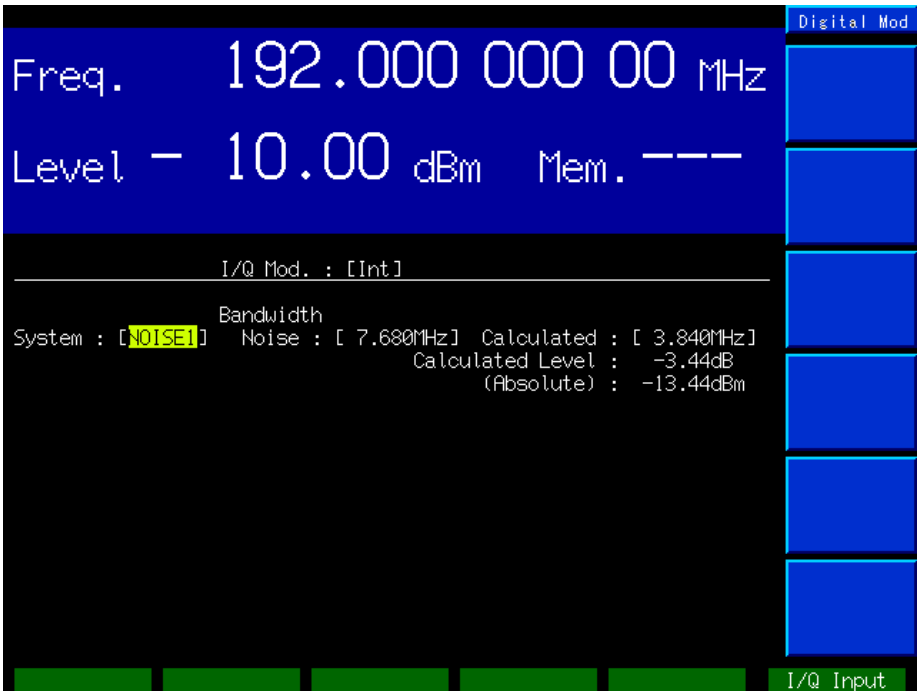
During transportation, avoid vibration where possible and maintain the "Recommended Storage Conditions" above.

Section 3 Operation Overview

This section explains the basic screens when MU368060A is mounted on the main frame.

3.1 Setting the Parameters

When [Digital Mod] is pressed, the key lamp lights and the Main screen appears. This screen is for basic parameter settings on digital modulation. Details on the Main screen settings are described below.



[1] I/Q Mod.

When Digital Modulation is set to "On", this unit outputs noise. When set to "Off", it outputs CW signal.

Setting item : Int, Ext, Off

[2] System

Sets the communication system.

Setting item : NOISE1

[3] Noise

Sets the bandwidth for the noise to be generated.

Setting range : 1.5 to 16 MHz, resolution: 1 kHz

[4] Calculated

Sets the calculated bandwidth.

Setting range : 10 to 80% of the inputted setting value for the noise bandwidth

Resolution : 1 kHz

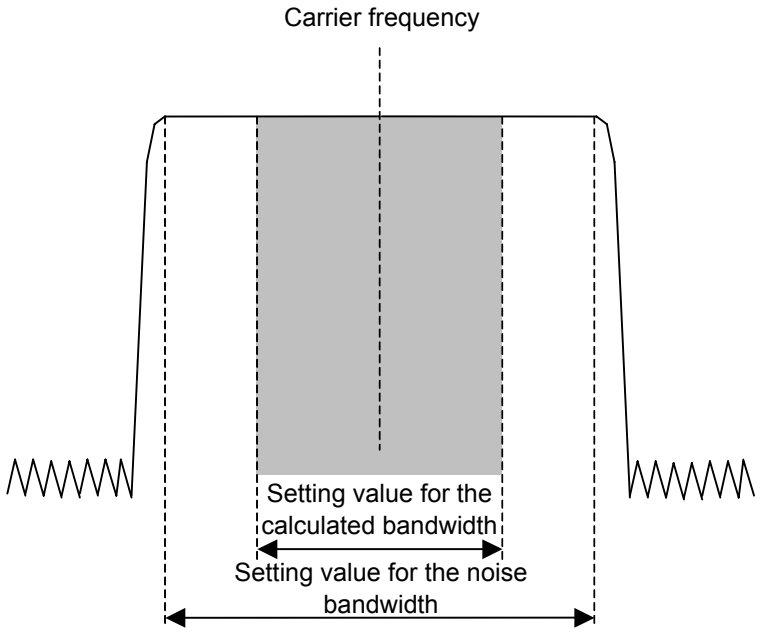
[5] Calculated Level

Calculates the calculated level internally based on the inputted calculated bandwidth. Displays the power ratio of the band specified in [4] to the total power for the RF output of the signal generator.

[6] (Absolute)

Displays the power in the calculated bandwidth.
Displayed value = RF output level + Calculated Level

- Calculating the power for the calculated bandwidth
  The noise generator can be explained by the following three parameters.
  Noise Bandwidth:
  Sets the band for the noise to be generated.
  Bandwidth set here is for the flat part of the noise as shown in the figure below.
  Calculated Bandwidth:
  Normally, same as the channel bandwidth for the communication system to be measured.
  Calculated Level:
  Displays the power ratio of the calculated bandwidth (part) to the total power of the spectrum in the figure below.



Ideal spectrum for the noise signal

The power within the calculated bandwidth is therefore figured out with the following formula:

The power within the calculated bandwidth = RF output level (total power) + Calculated level

… (1)

Example:

Suppose that the following parameters are set for this unit:

Output Level	: –10 dBm
Digital Mod	: On
System	: Noise1
Noise Bandwidth	: 7.68 MHz
Calculated Bandwidth	: 3.84 MHz

From Formula (1),

Power within the calculated bandwidth

= RF output level + Calculated level

= –10 dBm + (–3.45 dB)

= –13.45 dBm

Therefore, the power within the calculated bandwidth for the RF output is –13.45 dBm.

The power –13.45 dBm is displayed at "(Absolute)".

3.2 Power Accuracy for the Calculated Bandwidth

From Formula (1) in Section 3.1, accuracy for the power within the calculated bandwidth varies depending on the accuracy for the RF output level and the power calculation level. When the user does not perform calibration, accuracy is the added value of these two error elements.

Accuracy of the power within the calculated bandwidth

= RF output level error + Calculated level error .....(2)

= (Level accuracy at CW ± 3.0 dB) + (± 0.6 dB or ± 2.0 dB)* ....(3)

*: ±0.6 dB when the setting value for noise bandwidth is ≤8 MHz.

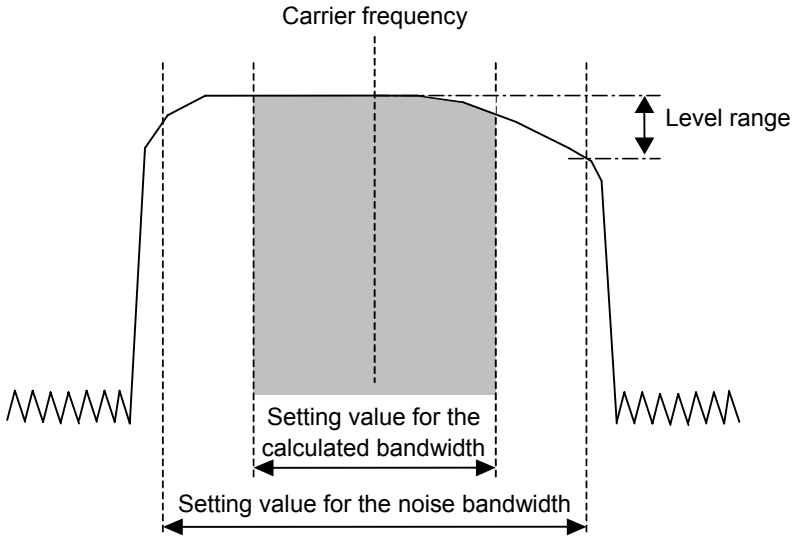
±2.0 dB when the setting value for noise bandwidth is >8 MHz.

- RF output level accuracy

  The standard for the RF output level accuracy is ±3 dB level accuracy at CW. However, it is relatively easy to calibrate it by using the power meter. When calibrated, the error for the RF output level can be reduced to the measurement accuracy of the power meter.

- Calculated level accuracy

  The calculated level displayed is figured out under ideal conditions and with the frequency characteristic for the analogue circuit flat. On the other hand, the actual RF output signal may not be flat according to the frequency characteristic for the analogue circuit. The distortion of frequency characteristic results in an error in the calculated level.



Spectrum for MU368060A

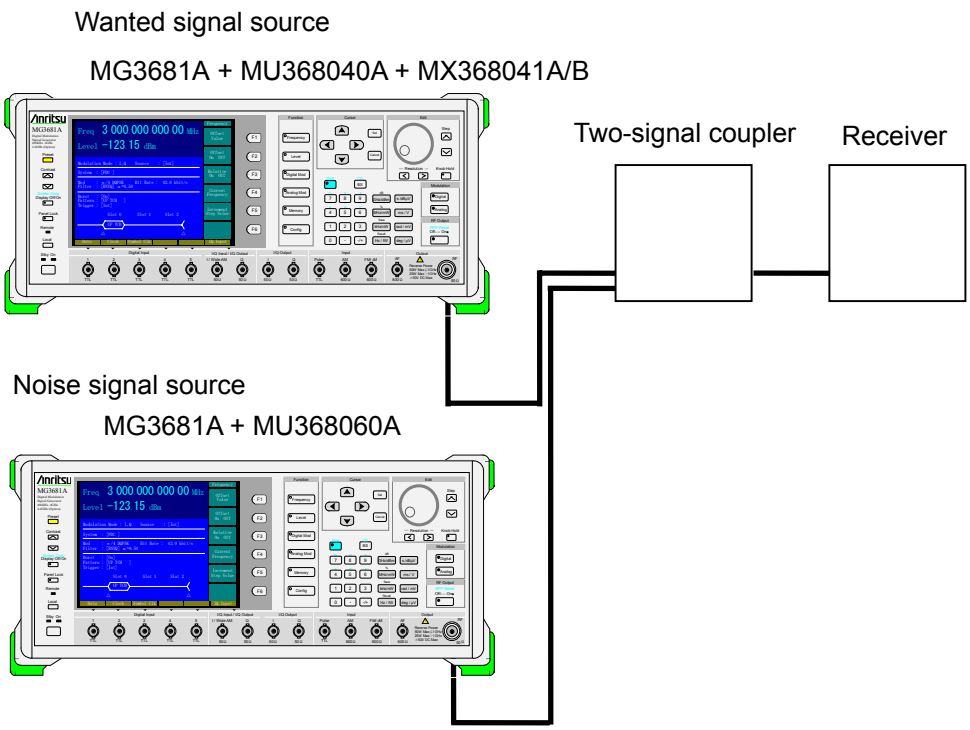
Section 4 Sample Measurement

This section explains sample measurement when MU368060A is mounted on the main frame.

4.1 Evaluation Measurement for the Receiver

The evaluation measurement procedure for the W-CDMA receiver is described below.

Setup



Measurement procedure

[1] Set the frequency for the wanted signal source to the testing frequency.

[2] Set the output level of the unit to the proper level for the input connector of the receiver.

[3] Set the unit to W-CDMA modulation.

[4] Set the modulation parameter of the unit so that the receiver can receive the signal.

[5] Set the frequency for the noise signal source to that set in Step [1].

[6] Set the noise bandwidth for the unit to that wide enough for the wanted signal.

[7] Set the calculated bandwidth for the unit to that for the wanted signal.

[8] Set the output level for the unit to the optimum level for the input connector of the receiver. However, it should be higher by the noise band calculation level.

[9] Measure the reception sensitivity of the receiver.

Section 5 Sample Calibration

This section describes the calibration procedure for the output level when using the MU368060A AWGN Unit. This example uses a W-CDMA system.

5.1 Calibration of the Output Level

5.1.1 Adjusting the output level for the signal generator

Calibration of the output level at the RF connector terminal for the signal generator is explained here.
A sample power setting with a 7.68 MHz noise signal bandwidth and –20 dBm/3.84 MHz at the RF output connector terminal is shown below.

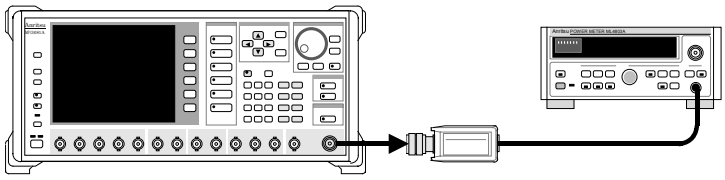
<Calibration procedure>

(1) Set the following parameters for this unit.

Digital Mod	: On
System	: Noise1
Noise Bandwidth	: 7.68 MHz
Calculate Bandwidth	: 3.84 MHz

(2) Calculate the total noise power for –20 dBm/3.84 MHz.
Read the Calculated Level on the display. With the parameter set in Step (1), this value should be –3.45 dBm. Figure out the total noise power using the formula below:
Total power = –20 dBm – (–3.45 dB) = –16.55 dBm

(3) Connect the power meter to the RF output connector for this unit.



(4) Set the output level for this unit so that the indication value of the power meter becomes the total power found in Step (2). This completes calibration to the –20 dBm/3.84 MHz noise level at the RF output connector terminal.

<Level accuracy>

Consider the level accuracy for the setting of this calibration method. It is figured out by the following formula:
Level accuracy
= Band calculated accuracy (Calculated Level accuracy) + power meter accuracy
= ±0.6 dB (when the noise band is 7.68 MHz) + power meter accuracy

<Points>

In this calibration method, the output level accuracy of this unit can be ignored because the output level is directly measured by the power meter. Conversely, by changing the output level of this unit after calibration, its accuracy affects the level accuracy. The output level accuracy applies because the step accuracy (relative accuracy) of the output level is not specified for this unit. In this case, the noise level accuracy is the sum of the level accuracy of this unit and the power meter accuracy.

5.1.2 Adjusting the level at the input connector terminal of the receiver

Calibration of the noise level at the input connector terminal of the receiver is explained here.

A sample power setting with a 7.68 MHz noise signal bandwidth and –73 dBm/3.84 MHz at the input connector terminal of the receiver is shown below.

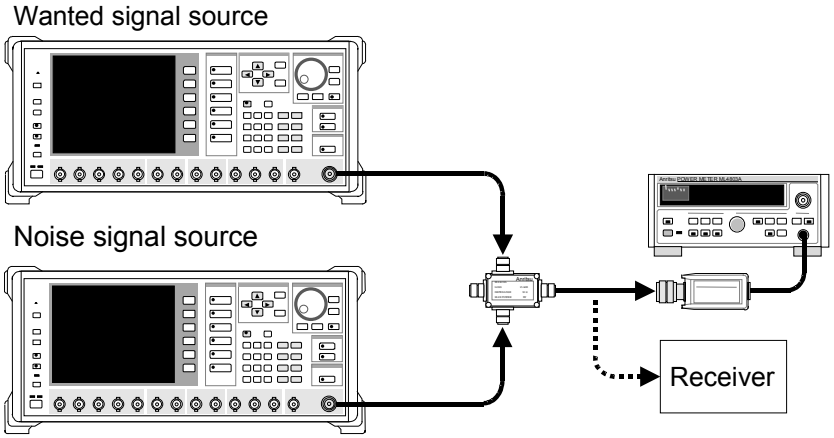
<Calibration procedure>

(1) Set the following parameters for this unit.

Digital Mod	: On
System	: Noise1
Noise Bandwidth	: 7.68 MHz
Calculate Bandwidth	: 3.84 MHz

(2) Calculate the total noise power for –73 dBm/3.84 MHz.
Read the Calculated Level on the display. With the parameter set in Step (1), this value should be –3.45 dBm. Figure out the total noise power using the formula below:
Total power = –73 dBm – (–3.45 dB) = –69.55 dBm

(3) Set the RF output for the desired frequency signal generator to Off and then connect the power meter to the input connector terminal of the receiver.



(4) Set the output level for this unit so that the indication value of the power meter becomes the total power found in Step (2). This completes calibration to the –73 dBm/3.84 MHz noise level at the input connector terminal of the receiver.

<Level accuracy>

See Section 5.1.1 for level accuracy.

<Points>

When –69.55 dBm is not able to be directly measured by the power meter, insert a fixed attenuator into the receiver input and perform calibration up to the necessary level of attenuation.
However, the calibration value for the attenuation of the fixed attenuator should be measured in advance. Calibration accuracy for the fixed attenuator is added to the level accuracy.

5.1.3 Measuring the level of the outputted noise

Measurement of the noise signal level outputted at an unknown level is explained here.
A sample power setting with a 7.68 MHz noise signal bandwidth and 3.84 MHz calculated bandwidth is shown below.

< Measurement procedure>

(1) The following parameters should be set for this unit.

Digital Mod	: On
System	: Noise1
Noise Bandwidth	: 7.68 MHz
Calculate Bandwidth	: 3.84 MHz

(2) Measure the total noise power using the power meter.
Read the Calculated Level on the display. With the parameter set in Step (1), this value should be –3.45 dBm. Figure out the noise power for the calculated bandwidth using the formula below:
Noise power for the calculated bandwidth = power meter indication + (–3.45 dB)

<Level accuracy>

Consider the level accuracy for this measurement. It is figured out using the following formula:
Level accuracy

= Band calculated accuracy (Calculated Level accuracy) + power meter accuracy
= ±0.6 dB (when the noise band is 7.68 MHz) + power meter accuracy

5.1.4 Calibration using the offset setting function of the RF output level

Using the offset setting function of the RF output level of the MG3681A with "(Absolute)" display, the noise level can be easily calibrated, as described below.

A sample on the same condition as that in Section 5.1.3 is shown below.

<Measurement procedure>

(1) Set the MU368060A as in Section 5.1.3 (1).

(2) Measure the total noise power using the power meter.

(3) Set the offset level of the MU368060A. The set value is as follows:
Set value of offset level = Reading of power meter − Set value of RF output level of MU368060A

(4) Press Offset On Off to set Offset mode to On.

(5) The value displayed on "(Absolute)" becomes the noise power for the calculated bandwidth.

<Level accuracy>

Immediately after calibration by power meter, the accuracy of the noise power value displayed on "(Absolute)" is shown in the formula below:

Level accuracy = Band calculated accuracy (Calculated Level accuracy) + power meter accuracy

If the MU368060A output level is changed after calibration by power meter, the accuracy of the noise power value displayed on Calculate Absolute Level is shown in the formula below:

Level accuracy = Band calculated accuracy (Calculated Level accuracy) + RF output level accuracy

Section 6 AWGN Internal Adder Function

This section explains the AWGN internal adder function available when MU368060A is mounted with both MU368040A and MX368041A/B.

6.1 Product Outline

The MU368060A is capable of outputting I/Q and RF signals added with W-CDMA uplink modulation wave and noise when mounted with both the MU368040A and the MX368041A/B.

W-CDMA modulation wave and noise can be internally added in the following conditions:

Simulation Link	Up Link
W-CDMA Phase	1
Chip Rate	3.84 Mcps
Maximum Code Number	1 to 6

Noise parameters that can be set at noise internal addition are shown below:

Noise Bandwidth	Chip Rate x1.5 or x2.0
C/N	–30.0 to –20.0 dB (0.2 dB step) –19.9 to –8.0 dB (0.1 dB step)

In addition, the MU368060A is capable of outputting I/Q and RF signals added with a single carrier 1xEVDO modulation wave and noise when mounted with both the MU368040A and the MU368030A+MX368033A.

1xEVDO modulation wave and noise can be internally added in the following conditions.

Over Sampling	8
Carrier	1

Note:

A single carrier 1xEVDO modulation wave, which is provided for MX368033A as a standard, is satisfied with the above conditions.

Noise parameters that can be set at noise internal addition are shown below:

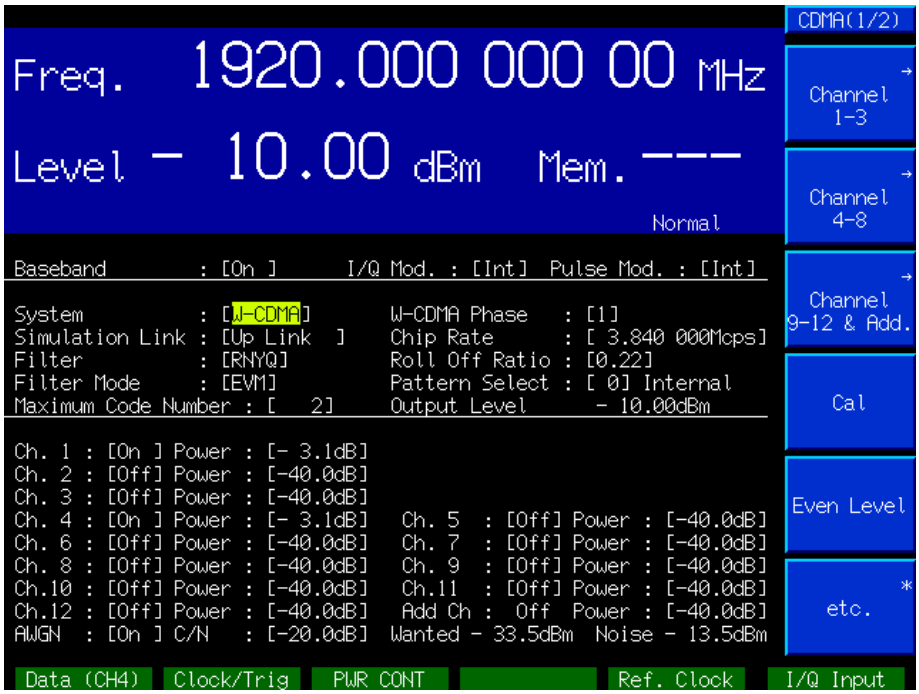
Noise Bandwidth	Chip Rate x4, x3, x2 or Tone
C/N	–30.0 to +30.0 dB (0.1 dB step)

6.2 Operation When Selecting W-CDMA

When W-CDMA is selected for System while setting Up Link for Simulation Link, setting items for the AWGN internal adder function appear in the Digital modulation setting screen for W-CDMA modulation.

Items not specifically mentioned can be set in the same as for the MX368041A/B. Refer to the "MX368041A or MX368041B Operation Manual."

6.2.1 Main screen



[1] W-CDMA Phase
Setting a value other than "1" for Phase turns the AWGN internal adder function Off.

[2] Simulation Link
Setting "Down Link" for Simulation Link turns the AWGN internal adder function Off.

[3] Chip Rate
Setting a value other than "3.84 Mcps" for Chip Rate turns the noise internal adder function Off.

[4] Filter Mode
This item is disabled while AWGN is set to On.

[5] Maximum Code Number
Selecting a value of "7" or larger for Simulation Link turns the AWGN internal adder function Off.

[6] Output Level

Displays [(noise power for all bands)+(total power for multiplex channels of W-CDMA modulation wave)]

[7] AWGN

Sets the AWGN internal adder function On/Off. When set to Off, the MX368041A/B standards apply to all items. When set to On, the MU368060A, not the MX368041A/B, standards apply.:

- Carrier frequency range
- Number of multiplex channel
- I/Q output signal
- RF output signal

Setting item: On, Off
Initial value: Off

[8] C/N

Sets the ratio between noise power within 3.84 MHz bandwidth and W-CDMA modulation wave power. Note that this is not the ratio for noise power of all bands.

Setting range: –30.0 to –20.0 dB (0.2 dB step)
–19.9 to –8.0 dB (0.1 dB step)
Initial value: –20.0 dB

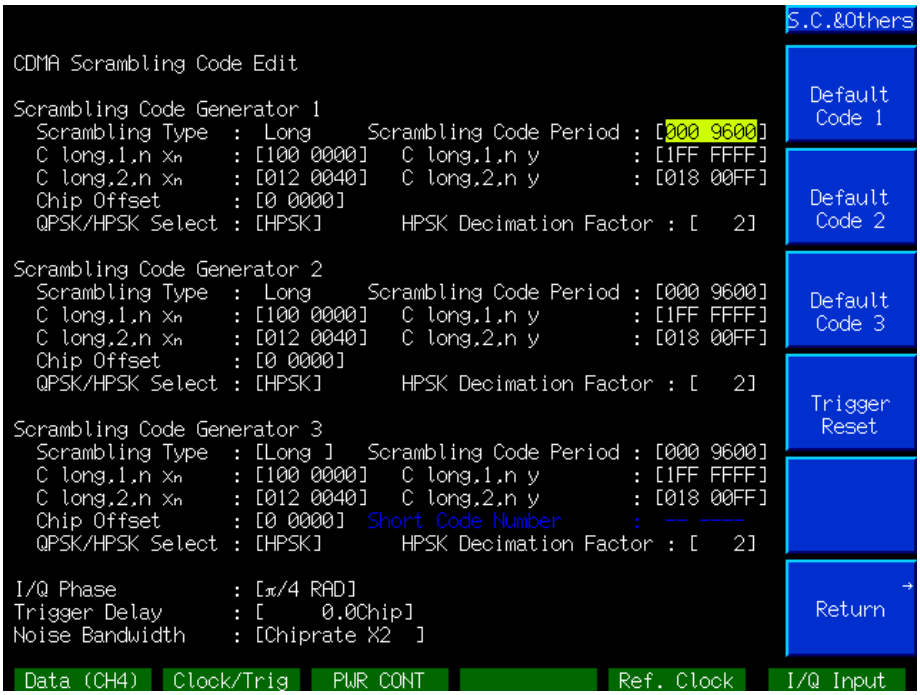
[9] Noise

Displays the ratio between Output Level and noise power within 3.84 MHz bandwidth.
When a warning message "Power under 0dB" is displayed, the displayed value does not match with actual output.

[10] Wanted

Displays the ratio between Output Level and W-CDMA modulation wave power.
When a warning message "Power under 0dB" is displayed, the displayed value does not match with actual output.

6.2.2 Scrambling Code & Others Edit screens



[1] Noise Bandwidth

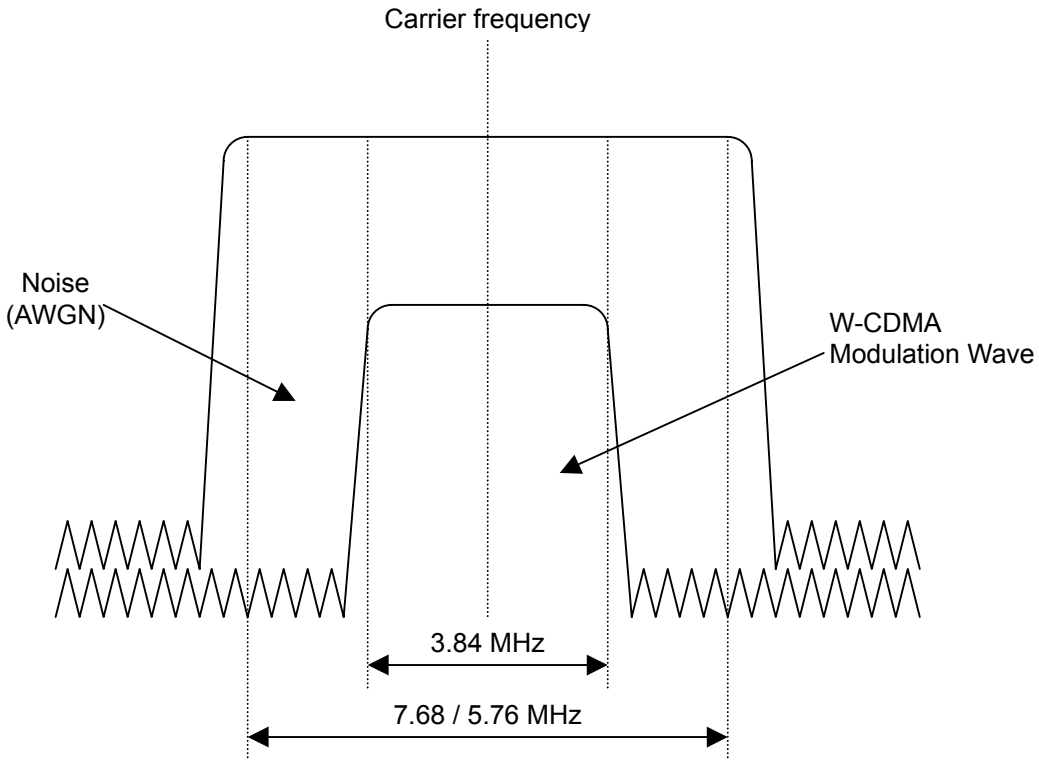
Sets the noise bandwidth.

Setting item: Chip Rate x 1.5, Chip Rate x 2

Initial value: Chip Rate x 2

6.3 Function Details

Image diagram for the AWGN internal adder function is shown below:



Noise is added to the same carrier as the W-CDMA modulation wave and outputted as I/Q and RF signals.
Setting and displayed values for the AWGN internal adder function are shown below:

[1] C/N
Is the ratio between noise power within 3.84 MHz bandwidth and W-CDMA modulation wave power. The total power of noise and W-CDMA modulation wave is fixed to the set value for RF Level. Therefore, the lower C/N is set, the larger the noise power becomes and the lower the W-CDMA modulation wave power becomes. To change the noise power while fixing W-CDMA modulation wave power, both C/N and RF Level settings must be changed.

[2] Output Level
Is total of noise power and W-CDMA modulation wave power. Same as the setting value for RF Level while using the AWGN internal adder function.

[3] Wanted
Is the ratio between Output Level and W-CDMA modulation wave power. This value is correct without a warning message "Power Under 0 dB" displayed.
W-CDMA modulation wave power = Output Level + Wanted

[4] Noise
Is the ratio between Output Level and noise power within 3.84 MHz bandwidth. This is not the ratio for power of all bands. The difference between this value and the display value for Wanted is the same as the setting value for C/N.

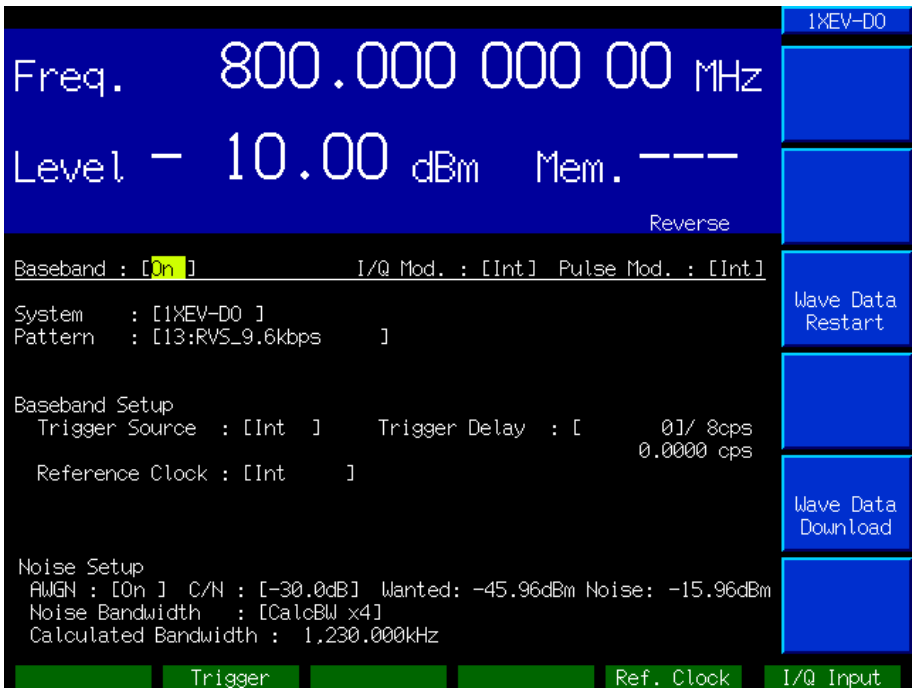
Note the following points when using the AWGN internal adder function:

- When AWGN is set to On, the noise power and W-CDMA modulation wave power are set to match the setting value for RF Level. When AWGN is set to Off, W-CDMA modulation wave power is set to match the setting value for RF Level. For this reason, the transmission power for W-CDMA modulation wave changes when AWGN is switched between On and Off.
- Setting values such as for C/N and the display value such as for Wanted become correct only when the total level for W-CDMA multiplex channels is 0 dB. Use the AWGN internal adder function under conditions whereby a warning message "Power Under 0 dB" is not displayed.

6.4 Operation When Selecting 1xEVDO

When 1xEVDO is selected for System, additionally, Over sampling is 8 and 1xEVDO modulation wave of single carrier is set to Pattern, setting items of AWGN internal adder function appear in the Digital modulation setting screen for 1xEVDO modulation.

Items not specially mentioned can be set in the same as for the MX368033A. Refer to the "MX368033A" operation manual.



[1] AWGN

Sets the AWGN internal adder function On/Off. When set to Off, the MX368033A standards apply to all items. When set to On, the MU368060A, not the MX368033A, standards apply to the following specifications.

- Carrier frequency range
- I/Q output signal
- RF output signal

Setting item: On, Off

Initial value: Off

[2] C/N

Sets the ratio between noise power within 1.23 MHz band and 1xEVDO modulation wave power. Note that this is not the ratio for noise power of all bands.

Setting range: –30.0 to +30.0 dB (0.1 step)

Initial value: –30.0 dB

[3] Wanted
Displays power of 1xEVDO modulation wave.

[4] Displays noise power within 1.23 MHz band.

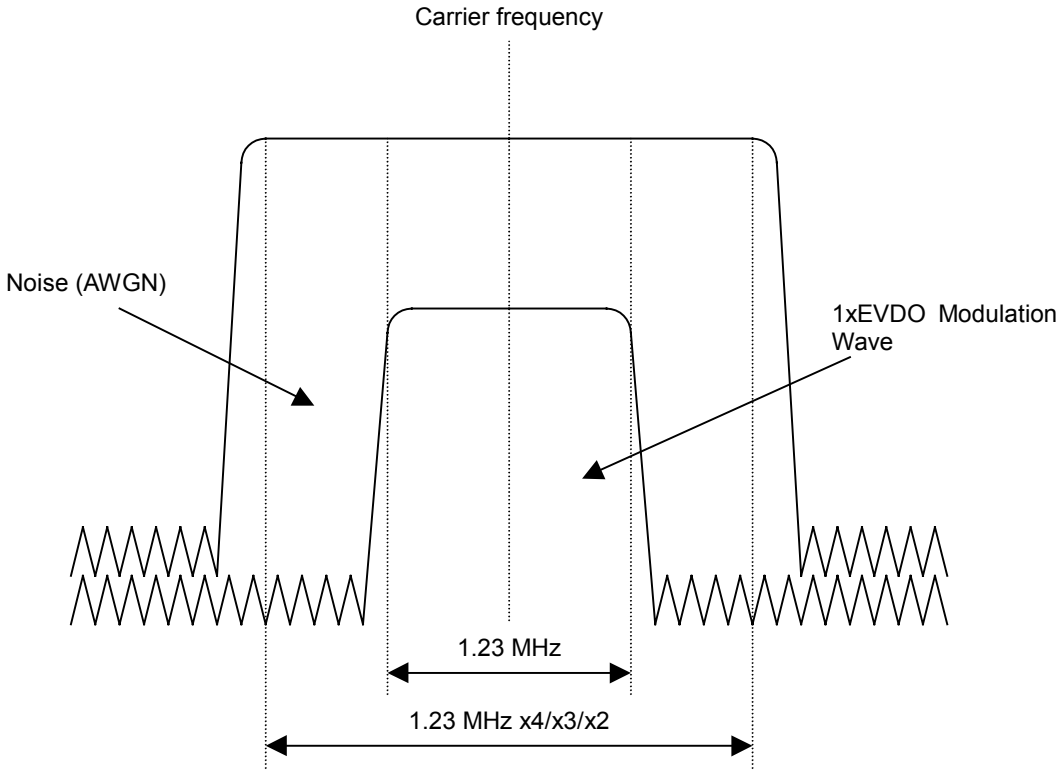
[5] Noise Bandwidth
Sets noise bandwidth and selected in multiples of Calculated Bandwidth.
When Tone is selected, the tone signal of the same power as selected for x4 is added, but not for AWGN.
Two times offset of Chip Rate from carrier frequency is added to the frequency of tone signal.

Setting items: CalcBWx4, CalcBWx3, CalcBWx2, Tone
Initial value: CalcBWx4

[6] Calculated Bandwidth
Displays calculated bandwidth and fixed with1.23 MHz.

6.5 Function Details When Selecting 1xEVDO

Image diagram for the AWGN internal adder function is shown below:



Noise is added to the same carrier as the 1xEVDO modulation wave and outputted as I/Q and RF signal.

Setting and displayed values for the AWGN internal adder function are shown below:

[1] C/N

Sets the ratio between noise power within 1.23 MHz band and 1xEVO modulation wave power.

The total power of noise and 1xEVDO modulation wave is fixed to the setting value for RF Level.

Therefore, the lower C/N is set, the larger the noise power becomes. To change the noise power while fixing 1xEVDO modulation power, both C/N and RF Level settings must be changed.

[2] Wanted

Displays power of 1xEVDO modulation wave.

[3] Noise

Displays noise power within 1.23 MHz band. This is not power for all noise bands.

The difference between this value and the display value for Wanted is the same as the setting vale for C/N.

Note the following points for using the AWGN internal adder function.

- When AWGN is set to On, the power for 1xEVDO modulation wave are set to match the setting value for RF Level. In addition, when AWGN is Off, the power for 1xEVDO modulation wave is set to the setting for RF Level.

  For this reason, the transmission power for 1xEVDO modulation wave changes when AWGN is switched between On and Off.

Section 7 Remote Controls

This section provides the function list for the GPIB device messages and describes the messages in alphabetical order, when the MU368060A AWGN Unit is mounted on the main frame.

For a description of the other remote controls, refer to Section 6 "Remote Controls" in the "MG3681A Main Unit Operation Manual."

7.1 Device Message List by Function

Command messages and query messages

The header of the command message is a reserved word represented by uppercase alphanumeric characters. The header field of the query message ends with "?". The argument section of the command message and the query message can contain multiple arguments delimited by a separator ",". Argument types are explained below:

[1] Uppercase characters : reserved words

[2] Numeric : reserved words

[3] Lowercase characters in the argument section:

f (Frequency) : numeric data (NR1, NR2 and NR3)

Suffix code : GHZ, GZ, MHZ, MZ, KHZ, KZ, HZ
When the unit is omitted, HZ applies.

l (Level) (relative value) : numeric data
(NR1, NR2 and NR3-formats)

Suffix code : DB
When the unit is omitted, DB applies.

n (integer without unit) : numeric data (NR1-format)

r (real number without unit) : numeric data (NR2-format)

h (hexadecimal without unit) : numeric data (hexadecimal)

s (string) : alphanumeric character enclosed in " " or ' '.

Response message

A response message is returned to the external controller when a query message is received, which is represented in the form "response header field + response data section". Multiple response data may be included by delimiting the response data section by a separator ",". Response data types are explained below:

[1] Uppercase characters : reserved word

[2] Numeric : reserved word

[3] Lowercase characters in the argument section:

f (Frequency) : numeric data (NR1-format)

Suffix code : HZ

l_1 (Level) (relative form) : numeric data (NR2-format)

Suffix code : DB

l_2 (Level) (absolute form): numeric data (NR2-format)

Suffix code : DBm

n (integer without unit) : numeric data (NR1-format)

r (real number without unit) : numeric data (NR2-format)

h (hexadecimal without unit): numeric data (hexadecimal)

Note:

When the header is set to Off, the header of the response message and the suffix code of the numeric data are not outputted. For header On/Off settings, refer to the "MG3681A Operation Manual."

Device message list

<Common>

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
I/Q Source Internal	MODE INT IQSRC INT	MODE? IQSRC?	MODE INT IQSRC INT
I/Q Source External	MODE EXT IQSRC EXT	MODE? IQSRC?	MODE EXT IQSRC EXT
I/Q Source OFF	MODE OFF IQSRC OFF	MODE? IQSRC?	MODE OFF IQSRC OFF
System NOISE1	SYS NOISE1	SYS?	SYS NOISE1

<Noise Generation>

Item	Device message		
Controlled item	**Command message**	**Query message**	**Response message**
Bandwidth (Noise)	NOISEBW bandwidth	NOISEBW? (bandwidth)	NOISEBW
Bandwidth (Calc.)	CALCBW bandwidth	CALCBW? (bandwidth)	CALCBW
Power in Calc. B.W.	-----	CALCLVL?	CALCLVL (level value)
Absolute Power in Calc. B.W.	-----	CALCALVL?	CALCALVL (level value)

7.2 Alphabetical Device Message List

<Example>

FREQ Frequency

Function	Sets the frequency.
Command message	FREQ f (A space is required between the command message and f.)
Value of f	(Input value / Input value explanation) –2.99975 to 3 GHZ : –2.99975 to 3 GHz –2999.75 to 3000 MHZ : –2999.75 to 3000 MHz –2999750 to 3000000 KHZ : –2999750 to 3000000 kHz –2999750000.00 to 3000000000 HZ : –2999750000.00 to 3000000000 Hz
Query message	FREQ?
Response message	FREQ f
Application example	FREQ 123 MHZ

CALCBW

Calculation Bandwidth

Function	Sets the calculated bandwidth. The possible setting range is 10 to 80% of the noise bandwidth.
Command message	CALCBW f
Query message	CALCBW?
Response message	CALCBW f
Value of f	Within the range of 10 to 80% of the noise bandwidth.
Application example	CALCBW 3.84MHZ

CALCALVL

Calculation Absolute Level

Function	Reads power in the calculated band. Available for query command only.
Query message	CALCALVL?
Response message	CALCALVL l_2

CALCLVL

Calculation Bandwidth Level

Function	Reads the bandwidth calculation level. Available for query command only.
Query message	CALCLVL?
Response message	CALCLVL l_1

IQSRC

I/Q Source

Function	Selects between internal generation or external input for the I/Q signal.
Command message	IQSRC a
Value of a	INT : Internal (Internal I/Q signal) EXT : External (External I/Q signal) OFF : I/Q modulation stops (Only Pules modulation is available.)
Query message	IQSRC?
Response message	IQSRC a
Application example	IQSRC EXT

MODE

I/Q Source

Function	Selects between internal generation or external input for the I/Q signal.
Command message	MODE a
Value of a	INT : Internal (Internal I/Q signal) EXT : External (External I/Q signal) OFF : I/Q modulation stops (Only pulse modulation is available.)
Query message	MODE?
Response message	MODE a
Application example	MODE EXT

NOISEBW

Noise Bandwidth

Function	Sets the noise bandwidth.
Command message	NOISEBW f
Value of f	1.5 to 16 MHz
Query message	NOISEBW?
Response message	NOISEBW f
Restriction	When Ext is set for I/Q signal source, screen display and remote control are disabled.
Application example	NOISEBW 10MHZ

SYS

Noise System

Function	Sets the communication system.
Command message	SYS a
Value of a	NOISE1 : selects noise
	*** : other system such as TDMA unit
Query message	SYS?
Response message	SYS a
Application example	SYS NOISE1

7.3 Device Message List for AWGN Internal Adder Functions When Selecting W-CDMA

This section provides the functional list of GPIB device messages when using the AWGN internal adder function with W-CDMA selected as explained in Section 6.

Refer to Section 7.1 for details on command, query and response messages.

Item	Device Message		
Control Item	Command Message	Query Message	Response Message
AWGN Addition ON	NOISEADD ON	NOISEADD?	NOISEADD ON
AWGN Addition OFF	NOISEADD OFF	NOISEADD?	NOISEADD OFF
C/N	PWRCNR 1	PWRCNR?	PWRCNR 1
Wanted Signal Power	–	PWRWS?	PWRWS 1
Noise Signal Power	–	PWRNS?	PWRNS 1
Noise Bandwidth Chip Rate x1.5	NOISEBW CR1H	NOISEBW?	NOISEBW CR1H
Noise Bandwidth Chip Rate x2	NOISEBW CR2	NOISEBW?	NOISEBW CR2

7.4 Alphabetical Device Message List for AWGN Internal Adder Functions When Selecting W-CDMA

This section details the alphabetical list of GPIB device messages when using the AWGN internal adder function with W-CDMA selected as explained in Section 6.

NOISEADD

AWGN Addition

Function	Sets internal addition of noise and W-CDMA modulation wave On/Off.
Command message	NOISEADD a
Value of a	ON : Sets the internal adder function On. OFF : Sets the internal adder function Off.
Query message	NOISEADD?
Response message	NOISEADD a
Application example	NOISEADD ON

NOISEBW

Noise Bandwidth

Function	Sets the noise bandwidth.
Command message	NOISEBW a
Value of a	CR1H : Sets the noise bandwidth to 1.5 times the Chip Rate. CR2 : Sets the noise bandwidth to twice the Chip Rate.
Query message	NOISEBW?
Response message	NOISEBW a
Application example	NOISEBW CR2

PWRCNR

C/N

Function	Sets the ratio of modulation wave power to noise within bandwidth power (C/N).
Command message	PWRCNR I
Value of I	–30.0 to –8.0 dB
Query message	PWRCNR?
Response message	PWRCNR I
Application example	PWRCNR –8.0 dB

PWRNS

Noise Signal Power

Function	Queries the noise power ratio within the bandwidth.
Query message	PWRNS?
Response message	PWRNS I
Value of I	–143.0 to 17.0 dB
Application example	PWRNS?

PWRWS

Wanted Signal Power

Function	Queries the modulation wave power ratio.
Query message	PWRWS?
Response message	PWRWS I
Value of I	–143.0 to 17.0 dB
Application example	PWRWS?

7.5 Device Message List for AWGN Internal Adder Functions When Selecting 1xEVDO

This section provides the function list of the GPIB device message when using AWGN internal function with 1xEVDO selected as explained in Section 6.

Refer to Section 7.1 for details on command, query and response messages.

Item	Device message		
Control item	Command message	Query message	Response message
AWGN Addition On	NOISE ON	NOISE?	NOISE ON
AWGN Addition Off	NOISE OFF	NOISE?	NOISE OFF
C/N	NOISECN 1	NOISECN?	NOISECN 1
Wanted Signal Power	—	WNTSGPWR?	WNTSGPWR 1
Noise Signal Power	—	NOISEPWR?	NOISEPWR 1
Noise Bandwidth x4	NOISEBW CBWX4	NOISEBW?	NOISEBW CBWX4
Noise Bandwidth x3	NOISEBW CBWX3	NOISEBW?	NOISEBW CBWX3
Noise Bandwidth x2	NOISEBW CBWX2	NOISEBW?	NOISEBW CBWX2
Noise Bandwidth Tone	NOISEBW TONE	NOISEBW?	NOISEBW TONE

7.6 Alphabetical Device Message List for AWGN Internal Adder Function When Selecting 1xEVDO

This section details the alphabetical device message for GPIB device message when using AWGN internal adder function with 1xEVDO selected as explained in Section 6.

Refer to an example in Section 7.2 regarding this format.

NOISE

AWGN Addition

Function	Sets AWGN and 1xEVDO modulation wave internal adder On/Off.
Command message	NOISE a
Value of a	ON : Sets the internal adder function On.
	OFF : Sets the internal adder function Off.
Query message	NOISE?
Response message	NOISE a
Application example	NOISE ON

NOISEBW

Noise Bandwidth

Function	Sets AWGN bandwidth.
Command message	NOISEBW a
Value of a	X4 : Sets the noise bandwidth to 4 times the chip Rate.
	X3 : Sets the noise bandwidth to 3 times the chip Rate.
Value of a	X2 : Sets the noise bandwidth to 2 times the chip Rate.
	TONE : Sets tone signal of power equivalent to noise.
Query message	NOISEBW?
Response message	NOISEBW a
Application example	NOISEBW X4

NOISECN

C/N

Function	Sets the ratio between modulation wave power and noise power within band (C/N).
Command message	NOISECN I
Value of 1	–30.0 to +30.0 dB
Query message	NOISECN?
Response message	NOISECN I
Application example	NOISECN –8.0DB

NOISEPWR

Noise Signal Power

Function	Queries noise power within band.
Query message	NOISEPWR?
Response message	NOISEPWR I
Value of 1	–143.0 to +17.0 dB
Application example	NOISEPWR?

WNTSGPWR

Wanted Signal Power

Function	Queries the modulation power
Query message	WNTSGPWR?
Response message	WNTSGPWR I
Value of 1	–143.0 to +17.0 dB
Application example	WNTSGPWR?

Section 8 Performance Test

This section explains the required measuring instruments and procedures for setup, calibration and performance test to confirm that the MU368060A satisfies the standards.

8.1 Performance Test

The performance test is required to check that the MU368060A satisfies the standards.

Conduct the performance test when required such as on acceptance inspection, periodic inspection or after repair.

If the performance test result shows that the MU368060A does not satisfy the standards, please contact Anritsu's service division.

The performance test for the MU368060A consists of the following test items:

- RF output level accuracy
- In-band power calculation accuracy

Conduct the performance test periodically for important items as preventive maintenance. It is recommended to conduct the test once or twice a year.

Save the result of the performance test using Appendix C "Performance Test Result Sheet."

Caution

Before conducting the performance test, turn MU368060A and devices used ON for at least 30 minutes to fully stabilize them. Conduct the test at room temperature, with stable AC power source voltage and without noise, vibration, dust and humidity for the best measurement accuracy.

8.2 Devices used in Performance Test

The devices used in the performance test of the MU368060A are shown in the table below:

Performance Test Item	Recommended Device Name	Anritsu Model Name
RF output level accuracy	Power meter	ML4803A
	Power sensor	MA4601A
In-band power calculation accuracy	Spectrum analyzer (with RMS detection mode)	MS2683A + Opt04

8.3 RF Output Level Accuracy

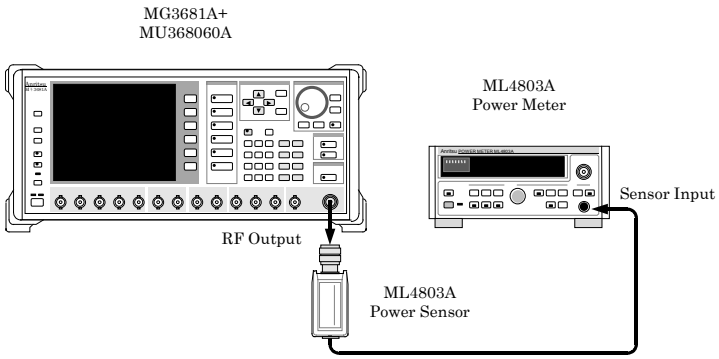
(1) Test criteria

ALC On, output: –3 dBm, level difference from results during CW and during modulation at noise bandwidth of 7.68 MHz: ±3 dB (excluding when noise internal adder function is On.)

(2) Measuring instruments for test

- Power meter.....ML4803A
- Power sensor.....MA4601A

(3) Setup



(4) Test procedures

[1] Set the communication system for the MU368060A to "NOISE1".

[2] Press the [Preset] button and then set the following parameters:
Baseband : On
Noise : 7.68 MHz

[3] Set the RF Output on the MU368060A to Off.

[4] Perform zero point adjustment and sensor sensitivity calibration of the power meter.

[5] Set the output level of the MU368060A to –3 dBm.

[6] Set the frequency to be measured on the MU368060A.

[7] Set the sensor calibration factor for the power meter.

[8] Set the RF Output on the MU368060A to On and then measure the output level.

[9] Set the following prameters.
Digital Modulation : On

[10] Repeat procedures from [3] to [8].

[11] Find the level difference from the results [7] during CW and [9] during modulation.

8.4 In-band Power Calculation Accuracy

(1) Test criteria

Power ratio accuracy within the calculated bandwidth to total power (when RF output level is –3 dBm)

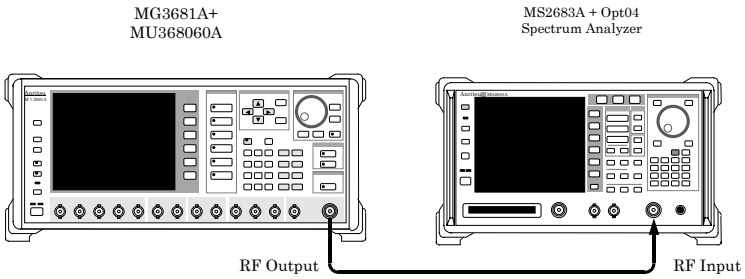
±0.6 dB (1920 to 2170 MHz, noise band width set value: 4 to 8 MHz)
±2.0 dB (1920 to 2170 MHz, noise band width set value: 8 to 16 MHz)

(excluding when the noise internal adder function is On.)

(2) Measuring instruments for test

- Spectrum analyzer (with RMS detection mode).....MS2683A + Opt04

(3) Setup



(4) Test procedures

[1] Set the communication system for the MU368060A to "NOISE1".

[2] Press the [Preset] button and then set the following parameters:
Digital Modulation: On

[3] Set Noise Bandwidth and Calculate Bandwidth to be measured on the MU368060A.

[4] Set the output level of the MU368060A to –3 dBm.

[5] Set the frequency to be measured on the MU368060A.

[6] Set the following parameters on the MS2683A. (For MS2683A operations, refer to its operation manual.)

SPAN	: 1.25 times or more of Noise Bandwidth
RBW	: 1/150 times or less of Noise Bandwidth
VBW	: Auto
Detector Mode	: Rms
Storage Mode	: Linear Average
Average Count	: 50
Sweep Time	: Auto

Reference Level : 10 dBm
Amplitude Scale : 10 dBm

[7] Perform waveform averaging with the spectrum analyzer.

[8] Measure the power for calculated bandwidth by using the noise measurement function of the spectrum analyzer.

[9] Measure the power for all bands by using the noise measurement function of the spectrum analyzer.

[10] Calculate the calculated level from the values measured in Step [3] and [4].
Calculated Level = all bands [dBm] - calculated bandwidth [dBm]

[11] Calculate the difference between the calculated level obtained using the formula above and that displayed on the MG3681A screen.

Appendix

Appendix A Specifications

Item		Specifications
Application		Noise (AWGN) signal source for reception sensitivity test of CDMA modulation radio equipment.
Carrier frequency range		1920 to 2170 MHz
Noise data	Probability distribution	Gauss distribution
	Bandwidth	1.5 to 16 MHz (excluding when the AWGN internal adder function is On.)
	Crest factor	≥14 dB (RF signal, output level: ≤–3 dBm, excluding the continuous mode)
	Calculated bandwidth	10 to 80% of the setting value for noise bandwidth (excluding when the AWGN internal adder function is On.)
	In-band Power calculation accuracy	Power ratio accuracy within the calculated bandwidth to total power at 18 to 35°C ±0.6 dB (noise band width set value: 1.5 to 4 MHz, typical) ±0.6 dB (noise band width set value: 4 to 8 MHz) ±2.0 dB (noise band width set value: 8 to 16 MHz) (excluding when the AWGN internal adder function is On.)
	C/N setting range	When the AWGN internal adder function is On: For W-CDMA selected –30.0 to –20.0 dB (resolution: 0.2 dB) –19.9 to –8.0 dB (resolution: 0.1 dB) For 1xEVDO selected –30.0 to +30.0 dB (resolution: 0.1 dB)
RF output signal	Output level setting range	–143 to –3 dBm
	Level accuracy	Within ±3.0 dB for the level at CW when ALC: On, output: –3 dBm, noise bandwidth: 7.68 MHz, (excluding when the AWGN internal adder function is On)
Number of used slots		1 slot
Mass		≤400 g

B Initial Value List

When Noise is selected for System

Setting	Initial value
Noise	7.68 MHz
Calculated	3.84 MHz

When the AWGN internal adder function is On with W-CDMA selected

Setting	Initial value
AWGN	Off
C/N	–20.0 dB
Noise Bandwidth	Chip Rate x2

When the AWGN internal adder function is On with 1xEVD selected

Setting	Initial value
AWGN	Off
C/N	–30.0 dB
Noise Bandwidth	CalcBWx4

C Performance Test Result Sheet

Test site :_____ Report No. _____
_____ Date _____
_____ Person in charge _____

Model MG3681A Digital Modulation Signal Generator
+ MU368060A AWGN Unit

Serial No. _____ Ambient temperature ___°C
Power source frequency _____Hz Relative humidity ____%

Remarks:

_____
_____
_____
_____

Output level accuracy (Section 8.3)

Output level : –3 dBm
Measurement uncertainty : ±0.2 dB

Frequency	Result	Maximum Specification Value
1920 MHz		Level accuracy at CW: ±3.0 dB
1970 MHz		
2020 MHz		
2070 MHz		
2120 MHz		
2170 MHz		

In-band power calculation accuracy (Section 8.4)

Output level : –3 dBm
Noise bandwidth _____MHz
Calculated bandwidth :_____MHz
Measurement uncertainty : ±0.1 dB

Frequency	Result	Maximum Specification Value
1920 MHz		±0.6 dB when noise bandwidth is ≤8 MHz ±2.0 dB when noise bandwidth is ≤16 MHz
1970 MHz		
2020 MHz		
2070 MHz		
2120 MHz		
2170 MHz		

[Alphabetical Order]