

Operations Manual

WHITE GAUSSIAN NOISE GENERATOR

WGN



RF Test Equipment for Wireless Communications

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Preface

This manual contains operation instructions and reference information for the **dBm** WGN. The WGN automatically combines AWGN with the user supplied signal.

This manual is prepared as a reference source for engineers and technicians to use the WGN as part of their Development and/or Production test effort

The WGN operations manual is divided into the following sections:

- **Section 1: Introduction** shows the WGN equipment, control and connector locations, and describes connector functions.
- **Section 2: Local Operation** describes how to operate the WGN from the front panel.
- **Section 3: Remote Operation** shows how to operate the WGN through the IEEE-488 connection.
- **Appendix A: Installation and Troubleshooting** describes installation procedures and lists error messages.
- **Appendix B: Description and Specifications** gives an overview of the WGN technical design and provides technical specifications, and verification testing .
- **Appendix C: Maintenance and Warranty** describes the WGN warranty and directs how to return the WGN for repair or calibration.

Conventions Used in This Manual

Text Conventions

This manual uses the following text conventions:

- *Italic text* indicates new terms, directories and/or filenames.
- **Bold Text** indicates WGN selections or key presses.
- Monospaced text indicates WGN commands entered through remote mode.
- **Bold monospaced text** indicates WGN responses through remote mode.

Symbols

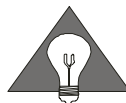
The following symbols appear in the manual.

See also, 

This symbol and its “see also” text is placed next to subject matter in the manual to tell you where to find more information.



*This icon indicates a **warning**. Failure to follow the instructions given here may result in **personal injury** or **damage to the equipment**.*



*This icon indicates a **tip**. Text marked this way may be an optional procedure for accomplishing a task, or a time-saving procedure for advanced or familiar users.*

Contacting

We encourage you to contact us if you want more information or have any questions or concerns about this or any other dBm product or manual. Use any of the following methods:

Mail	dBm 32A Spruce Street Oakland, NJ 07436
Telephone	(201) 677-0008
Fax	(201) 677-9444
E-mail—Technical Support	<i>Info@dbmcorp.com</i>
www	<i>http://www.dbmcorp.com</i>

Introduction Section



Introduction

This section introduces you to the White Gaussian Noise Generator instrument and describes the features and controls.

Topics include:

- Front, rear, and interior views.
- Power and cable connections.
- Startup and shutdown procedures.

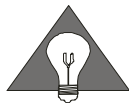
GENERAL INFORMATION

Front Panel View.

The White Gaussian Noise Generator output can be set in terms of noise power in a user specified bandwidth or in terms of noise density. The absolute output power is calibrated over the entire frequency band and is very accurate. The user can inject a signal that is added to the noise, the signal can also be switched off. With the WGNoptS option (63 dB signal attenuator) the signal may be attenuated.



Figure 1. Instrument Front Panel View



For custom WGN units, consult additional documentation provided with the instrument.

Rear Panel Connections

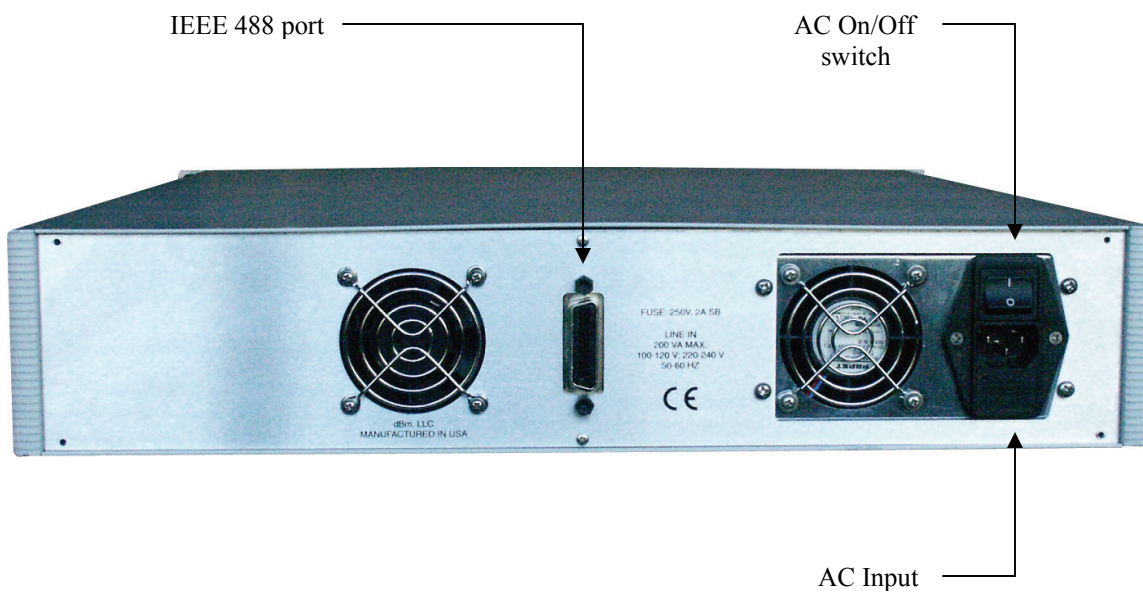
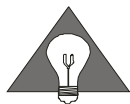


Figure 2. Instrument Rear Panel View



For custom WGN units, consult additional documentation provided with the instrument.

Instrument Modules

The WGN is constructed using modular self-contained sub-assembly trays. Each sub-assembly tray contains all its own necessary calibration data stored on flash memory, allowing individual modules to be easily changed in the field.

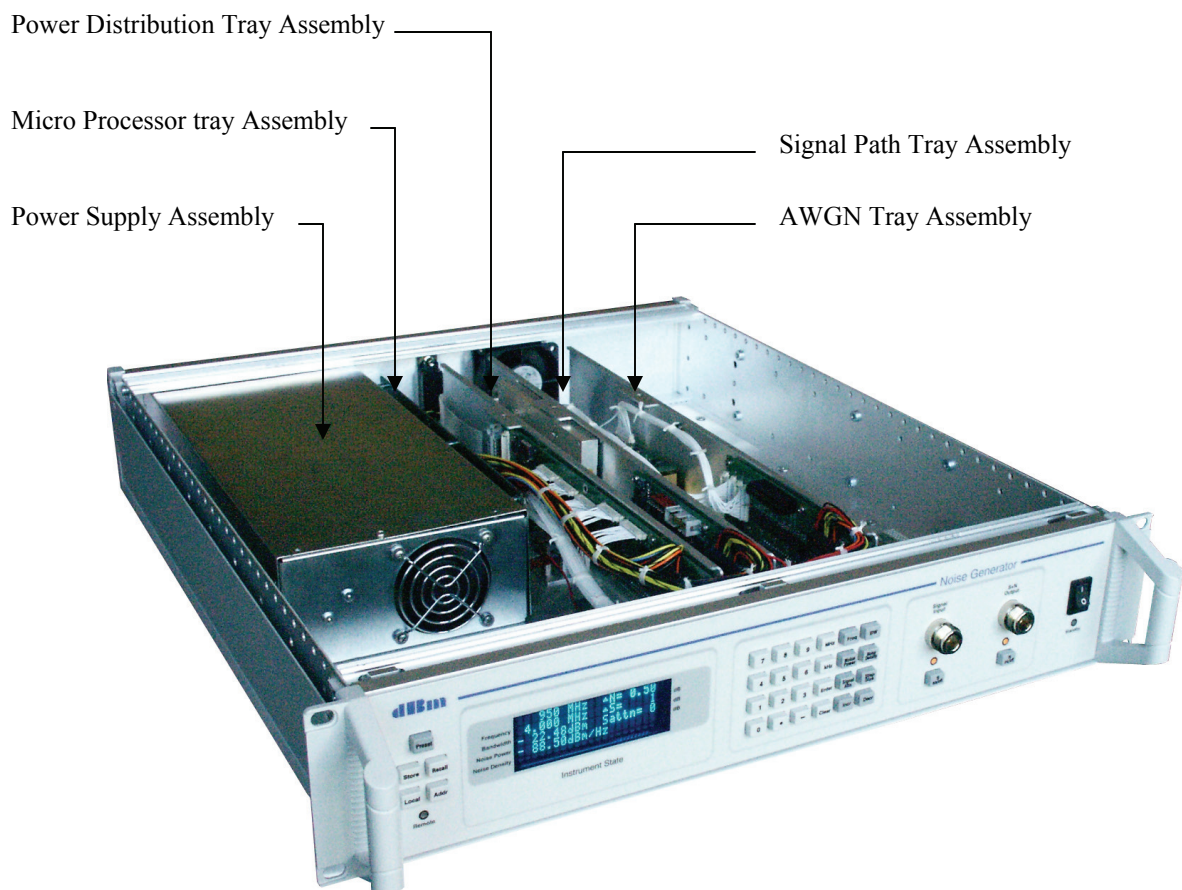


Figure 3. Interior View of WGN

Start and Shutdown Procedures

Starting the WGN

1. Press the Line on/off switch on the rear panel. The standby indicator should light. If not lighted make sure the power cable is properly connected. Press the power on switch on the front panel. The standby LED turns off and the instrument powers on.
2. Allow power to be applied 30 minutes before using, so that the internal ovens may stabilize.

Shutting Down the WGN

1. Press the standby/on switch to standby. The standby LED illuminates.



If the WGN is going to be off for an extended period of time, you may wish to remove the main power by pressing the Line on/off switch on the rear of the instrument.

2

Local Operation Section

Local Operation

The WGN is a laboratory instrument that generates outputs white Gaussian Noise, at levels that can be set precisely in terms of noise power in a specified bandwidth. A dBm smart attenuator is used to provide accurate attenuation of the noise, along with the internal circuitry being temperature stabilized to give extremely good power accuracy.

Optionally, the user can inject a signal that is added to the noise. The signal amplitude can be attenuated and the signal can be switched off.

The default state of the instrument is with maximum noise output power and minimum signal attenuation.

Operating States

Power up and Preset

Upon power-up or reset, the instrument is set to a predetermined state. The display will momentarily (3-5 sec) indicate the model number and the version of the installed firmware.

Instrument Ready

The noise output is enabled and the signal path is enabled. All front panel keys are immediately operational.

Instrument State Keys

- | | |
|-----------------|---|
| S on/off | Press S <u>on/off</u> to toggle the output signal on and off. The default setting is with the signal enabled. The S on/off LED is lit when the output signal path is on. |
| N on/off | Press N <u>on/off</u> to toggle the noise on and off. The default setting is with the noise enabled. The N on/off LED is lit when noise is on. |

Utility Keys

To preset the instrument settings

- Pressing **Preset** causes the instrument to return to the default state. Preset does not affect the IEEE488 address

To store the instrument settings

- Press **Store**. The utility display appears and the pointer is adjacent to the STORE field.
- Press a number from 0-8, designating a register to store the current instrument settings. The parameters that are saved are the values in the main display and all of the instrument state buttons. The IEEE address is not part of this storage register and is saved separately. Register 0 defines the power-up and Preset state, and therefore the user can define the default parameter settings.
- Press **Enter** to overwrite the register, or **Clear** to abort.

To recall a saved instrument setting

- Press **Recall**. The utility display appears and the pointer appears adjacent to the Recall field.
- Press a number from 0-9, designating a register to recall instrument settings. Register is the factory default parameter settings, and cannot be modified.
- Press **Enter** to recall the instrument state, or **Clear** to abort.

To return the instrument to local control

During remote operation, all keys except **Local** are inactive. **Local** brings the instrument back to the local mode and activates the front panel keys.

- Press **Local**

To set the IEEE-488 address

- Press **Addr.** The utility display appears and the pointer appears adjacent to the ADDR field.
- Press a number from 1 to 30, designating the IEEE address.
- Press **Enter** to enter the new address, or press **Clear** to abort.

Data Entry Keys

This section describes how the Data Entry Keys are used:

When a parameter key is pressed (for example **Freq**), a pointer appears adjacent to the corresponding field. The presence of the pointer indicates that the field can be edited. Note that the pointer can be visible at any one, but only one, of six locations.

The user enters the new value via the keypad. After the **Enter** key has been pressed, the new value is stored and the pointer disappears. Anytime the pointer is adjacent to a field, that field may be edited. If a different parameter key is depressed while the pointer is present, the pointer immediately moves to the appropriate field.

Clear Key

The **Clear** key can be used to delete an inadvertent numeric value prior to pressing the **Enter** key.

Example

- Press **Freq** to select the frequency field. The pointer appears at the frequency field.
- Type a new value for the desired frequency.
- Press **Enter**. The new value is entered and the pointer disappears.
- Press **Freq** to select the frequency field. The pointer appears at the frequency field.
- Type a new value via the keypad. The numeric values appear as the new value is typed.
- Press **Clear**. The previously programmed frequency value appears, and the pointer remains visible.
- Press **Noise Power**. The pointer moves to the Noise Power field.
- Press **Clear** again. The pointer is removed and no display value can be edited.

Change the Sign of a Value

- Press “-“ while editing a parameter to change the sign of the entered value.

Parameter Keys

Editing Parameters

- Press the desired parameter key (for example **Freq**).
- Press the desired numeric value then press **Enter** to change the current value and remove the pointer.

Set Center Frequency

- Press Output Power (valid during Ready state only).
- Press **Freq** (valid during READY state only)
- Press numeric value of frequency (valid range: F low to F hi, 1 MHz steps)
- Press **MHz** or **kHz** to enter current value and remove the pointer. (Enter is invalid since min freq is 1 MHz.)

Set Noise Bandwidth

- Press **BW**
- Press numeric value (valid range: 1 to F high – F low)
- Press **MHz** to multiply by 1E6, enter the value and remove the pointer or
- Press **kHz** to multiply by 1E3, enter the value and remove the pointer or
- Press **Enter** to enter the value and remove the pointer

Set Noise Output Power

- Press **Noise Power**
- Press numeric value (valid range: +0.0 to –174.0, 0.015625 dB resolution, .01 displayed)
- Press **Enter** to enter and remove the pointer

Set Noise Density

- Press **Density**
- Press numeric value (valid range: -40.0 to –174.0, 0.015625 dB resolution, .01 displayed)
- Press **Enter** to enter and remove the pointer

Set Signal Attenuation

Note: If the WGN was purchased without the WGNoptS option, no output attenuator is present, and therefore this paragraph should be ignored.

- Press **Signal Attn**
- Press numeric value (valid range: +0.0 to 63, 1.0 dB resolution)
- Press **Enter** to enter and remove the pointer

Set Signal Attenuation Step Size

Note: If the WGN was purchased without the WGNoptS option, no output attenuator is present, and therefore this paragraph should be ignored.

- Press **Step** twice so that the cursor appears next to the signal step field.
- Press numeric value (valid range: +0.0 to 63, 1.0 dB resolution)
- Press **Enter** to enter and remove the pointer

Set Noise Power Step Size

- Press **Step** so that the cursor appears next to the noise step field.
- Press numeric value (valid range: +0.0 to 127, 0.25 dB resolution)
- Press **Enter** to enter and remove the pointer

Increment or Decrement the Noise Power and Noise Density

- Press either **Noise Power** or **Noise Density**. The cursor appears next to the corresponding field
- Press **Incr** to increase the power and density (the noise attenuator value decreases). The amount of change is determined by the value of **ΔS**.
- Press **Decr** to decrease the power and density (the noise attenuator value increases). The amount of change is determined by the value of **ΔS**.

Note: If the step size forces the noise power out of range, then the step is not implemented, and the power remains at its previous value.

Increment or Decrement the Signal Attenuation

Note: If the WGN was purchased without the WGNoptS option, no output attenuator is present, and therefore this paragraph should be ignored.

- Press **Signal Attenuation**. The cursor appears next to the Sattn field.
- Press **Incr** to increase the signal attenuation. The amount of change is determined by the value of **ΔS**.
- Press **Decr** to decrease the signal attenuation. The amount of change is determined by the value of **ΔS**.

Note: If the step size forces the signal attenuator out of range, then the step is not implemented, and the attenuation remains at its previous value.

Turn Noise Output On or Off

- Non/off - Press **N on/off** to toggle the noise output on and off. LED is active when N is on.

Turn Signal Output On or Off

Note: If the WGN was purchased without the WGNoptS option, no output attenuator is present, and therefore this paragraph should be ignored.

- Son/off - Press **S on/off** to toggle the signal output on and off. LED is active when S is on.

Displayed Parameters

There are 7 parameter fields visible on the main display page.

Main Display

There are 7 parameters shown. The display will be updated whenever any of the parameters are changed.

Fc	The current value for center frequency. Units: MHz Default value: Lowest frequency Resolution: 1 MHz
BW	The current value for noise bandwidth Units: Hz, kHz, MHz Default: 1 Hz Range: 1 to (F hi – F low) Resolution: lesser of 1 Hz or 3 decimal places
Density	The current value for noise power spectral density. Units: dBm/Hz Default NDF Range: -174.0 to -40.0 dBm /Hz Resolution: 0.015625 dB
Power	The current value for noise output power. Units: dBm Default: maximum Range: -174.0 to +0.0 dBm. Resolution: 0.015625 dB
Sattn	The current value for signal attenuation. Units: dB Default: 0 dB Range: 0 to 63 dB Resolution: 1.0 dB

- ♦ **S** The current value for the signal attenuation step size.
 Units: dB
 Default 1 dB
 Range: 0 to 63 dB
 Resolution: 1.0 dB
- ♦ **N** The current value for the noise power step size.
 Units: dB
 Default 0.25 dB
 Range: 0 to max attn
 Resolution: 0.25 dB

Utility Display

Press **Store**, **Recall**, or **Addr** to select this display and the pointer will appear in front of the field to be edited.

- Store** Displays the available registers (0-8)
- Recall** Displays the available registers (0-9)
- Addr** Displays the current IEEE-488 address.

LED Functions

This section describes how the front panel LEDs function.

Standby LED

On while main power switch is in off position, to indicate that power is applied to the instrument. This LED is not under software control.

Remote LED

Illuminates when a valid IEEE-488 command is received. Turns off when LOCAL is pressed, and is off on power-up or RESET.

S on/off LED

Illuminates when the signal path switch is enabled. The switch state toggles each time S on/off is pressed. This LED is disabled when “WGNOptS” is not installed.

N on/off LED

Illuminates when the noise output switch is enabled. The switch state toggles each time N on/off is pressed.

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Remote Operation Section

Remote Commands

All WGN commands are compliant with IEEE-488.2. The instrument can function as a talker or a listener, but not as a controller.

The instrument switches to remote mode upon receipt of the remote command (REN) and the correct address.

The instrument switches to local mode upon pressing the **Local** key or upon power-up. To return to local operation, press and hold the **Local** key until the REMOTE LED is no longer illuminated.

Command Syntax

Terminator Codes

When sending data to the WGN, any of the following terminator codes are valid:

- Send EOI at end of Write
- Terminate read on EOS
- Set EOI w/EOS on Write
- 8-bit EOS (compare)

Concatenation Terminator

Multiple commands on a single line are separated by the semi-colon concatenation terminator ";".

Example: BW100E6;OUTP-45.3

Spaces

The ASCII space character may appear after any command, or after the concatenation terminator.

Case Insensitivity

Commands and queries may be sent in upper and/or lower case characters.

GPIO Timeout

If the response to any query exceeds the GPIO timeout, a timeout error will occur. To avoid timeout errors, the programmer can insert a delay prior to a query. The WGN response time is very small. However in the event that the timeout is set very low, the programmer can do the following:

Replace

BW100E6;OPC?

with

BW100E6
<insert delay here>
*OPC?

GPIB Commands

When addressed to listen, the WGN responds to the following commands:

Function	Listener Codes
GPIB address	ADDR XX, X = 0 to 30
Noise ON	NON
Noise OFF	NOFF
Signal ON	SON
Signal OFF	SOFF
Frequency	FREQ XXXXEX
Noise bandwidth	BW X>XXXEX
Noise power	OUTP +/-XXX>X
Noise density	No -XXX.XX
Signal attenuation	SATTN XX
Signal attenuation step size	SSTEP XX
Noise attenuation step size	NSTEP XXX.XX
Increment noise power	INCN
Decrement noise power	DECN
Increment signal attenuation	INCS
Decrement signal attenuation	DECS
Store	*SAVx (x is 0 to 9)
Recall	*RCLx (x is 0 to 9)
Identification Query	*IDN?
Reset Command	*RST
Self-Test Query (return "0" on success)	*TST
Operation Complete Command	*OPC
Operation Complete Query	*OPC?
Wait-to-Continue	*WAI
Clear Status	*CLS
Event Status Enable	*ESE
Event Status Enable Query	*ESE?
Event Status Register Query	*ESR?
Service Request Enable Command	*SRE
Service Request Enable Query	*SRE?
Read Status Byte	*STB

Figure 4. GPIB Commands

Notes:

- Mandatory IEEE 488.2 commands begin with an '*'. Details about these commands can be found in IEEE Std 488.2.
- X represents numeric values from 0 to 9.
- Spaces within the command are ignored.
- All parameters have the same units and ranges as the equivalent front panel controls.

IEEE 488.2 Status Reporting and Queries

The WGN supports IEEE-488.2 status reporting. Status is reported using an 8 bit Status Byte and an 8 bit Standard Event Status Register.

Status Register Bit Assignments

<i>Bit #</i>	<i>Description</i>
0	not used
1	not used
2	not used
3	not used
4	MAV
5	ESB
6	MSS
7	not used

Event Status Register Bit Assignments

<i>Bit #</i>	<i>Description</i>
0	Operation Complete
1	Request Control
2	Query Error
3	Device Dependent Error
4	Execution Error
5	Command Error
6	User Request
7	Power On

The Device Dependent Error bit is set when the noise is out of range. The Command Error bit is set when an unknown command or query is received.

Mandatory IEEE 488.2 Commands

*RST - Reset Command

The Reset command performs a WGN reset. It does not affect the state of the IEEE 488 interface, nor any Event Enable Register setting including the Standard Event Status Enable Register settings.

*RCL

The recall function is used to configure the WGN in one of ten user-defined states. The recall registers are labeled 0 – 9. Registers for which the user has not written to will contain default settings. The recall function does not disturb the state of the IEEE-488 interface or any Event Enable Register settings.

*SAV

The save function is used to store the current WGN configuration in one of ten user-defined states. The save registers are labeled 0 – 8.

*IDN - Identification Query

The Identification query allows the WGN to identify itself over the system interface. The response is composed of four fields:

- Field 1 Manufacturer
- Field 2 Model
- Field 3 Serial number (not used)
- Field 4 Firmware level

Manufacturer: dBm LLC

Model: WGN- $\langle$ low frequency $\rangle$ / $\langle$ high frequency $\rangle$ Ex.:
WGN-2-50/180

Serial number: ASCII character "0", zero

Firmware level: Version number

An example response to the *IDN? query is:

"dBm LLC,WGN-50/2500,0,1.18"

***TST? - Self-Test Query**

The self-test query causes the ASCII character "0" (zero) to be placed in the Output Queue upon successful completion of a self-test.

***OPC - Operation Complete Command**

The Operation Complete command causes the WGN to set the Operation Complete bit of the Standard Event Status Register when all operations are finished.

***OPC? - Operation Complete Query**

The Operation Complete query places an ASCII character "1" (one) into the WGN's Output Queue when all operations are finished.

***WAI - Wait-to-Continue Command**

The Wait-to-Continue command has no functional affect on the WGN since the WGN implements all commands sequentially. No commands are overlapped, that is, one command must finish before the next command is executed.

***CLS - Clear Status Command**

The Clear Status command clears status data structures. The Clear Status command clears all bits in the Standard Event Status Register and its summary ESB bit in the Status Register. It does not necessarily clear all bits in the Status Byte Register. For example, the MAV bit may not be cleared by the *CLS command.

***ESE - Standard Event Status Enable Command**

The Standard Event Status Enable command sets the Standard Event Status Enable (ESE) Register bits. The ESE is involved in the setting and clearing of the Event Summary Bit (ESB) of the Status Byte Register. The ESB is the inclusive OR of the bitwise combination of the Standard Event Status Register (ESR) and the ESE Register.

ESB is defined as

(ESR bit 0 AND ESE Register bit 0)
OR
(ESR bit 1 AND ESE Register bit 1)
OR
(ESR bit 2 AND ESE Register bit 2)
OR
(ESR bit 3 AND ESE Register bit 3)
OR
(ESR bit 4 AND ESE Register bit 4)
OR
(ESR bit 5 AND ESE Register bit 5)
OR
(ESR bit 6 AND ESE Register bit 6)
OR
(ESR bit 7 AND ESE Register bit 7)

***ESE? - Standard Event Status Enable Query**

The Standard Event Status Enable query lets the programmer determine the contents of the Standard Event Status Enable Register.

***ESR? - Standard Event Status Register Query**

The Standard Event Status Register query lets the programmer determine the contents of the Standard Event Status Register. The Standard Event Status Register is destructively read, that is, it is read and cleared with the *ESR? query.

Event Status Register Bit Assignments

Bit #	Description
0	Operation Complete
1	(Request Control)
2	(Query Error)
3	Device Dependent Error
4	(Execution Error)
5	Command Error
6	(User Request)
7	(Power On)

Bit assignments in parentheses are bits that have been assigned by the IEEE 488.2 standard but may not be currently used by the WGN.

Operation Complete Bit - set upon execution of the *OPC command.

Device Dependent Error Bit - set when any of the following errors occur:

- Noise Power Too High
- Noise Power Too Low
- Noise Density Too High
- Noise Density Too Low

Command Error Bit - set whenever an unknown command or query is received.

***SRE - Service Request Enable Command**

The Service Request Enable command sets the Service Request Enable (SRE) Register bits. The SRE is involved in the setting and clearing of the Master Summary Status (MSS) bit of the Status Byte Register. The MSS bit indicates that the WGN has at least one reason for requesting service. The MSS bit of the Status Byte Register is the inclusive OR of the bitwise combination (excluding bit 6) of the Status Byte (SB) Register and the SRE Register.

MSS is defined as

(SB Register bit 0 AND SRE Register bit 0)
OR
(SB Register bit 1 AND SRE Register bit 1)
OR
(SB Register bit 2 AND SRE Register bit 2)
OR
(SB Register bit 3 AND SRE Register bit 3)
OR
(SB Register bit 4 AND SRE Register bit 4)
OR
(SB Register bit 5 AND SRE Register bit 5)
OR
(SB Register bit 7 AND SRE Register bit 7)

***SRE? - Service Request Enable Query**

The Standard Event Status Enable query lets the programmer determine the contents of the Service Request Enable Register. This register is set to 16 (decimal) at power-on.

***STB? - Read Status Byte Query**

The Read Status Byte query lets the programmer read the status byte.

Bit #	Description
0	-
1	-
2	-
3	-
4	MAV
5	ESB
6	MSS
7	-

Status Byte Register Bit Assignments



Installation and Troubleshooting

Installation and Troubleshooting

If your WGN unit does not appear to be performing as expected, verification tests can determine whether the unit is functioning properly.

This section describes installation instructions, WGN verification tests and provides a checklist for results.

Topic includes:

- System Installation
- Error messages

Installation

Unpacking the WGN

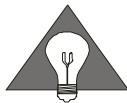
Remove the WGN materials from the shipping containers. Save the containers for future use.

The standard WGN shipment includes:

Quantity	Description
1	White Gaussian Noise Generator
1	AC power cord
1	WGN User Manual

Initial Inspection

Inspect the shipping container (s) for damage. If container is damaged, retain it until contents of the shipment have been verified against the packing list and instruments have been inspected for mechanical and electrical operation.



If the WGN appears to have been damaged during shipping, do not install the unit. Contact  immediately.

Applying Power

1. Place the WGN on the intended workbench and connect the AC power cord to the receptacle on the rear of the unit.
2. Press the Line on/off switch on the rear panel. The standby indicator should illuminate
3. Press the power on switch on the front panel. The standby LED should turn off and the instrument should power on.

System verification

The following section provides the procedure to verify correct operation of the WGN.

1. Attach a main AC power cord and set the rear panel main power switch to the up position. The front panel standby LED will illuminate.
2. Turn on the front panel power switch. The model number and software version will appear in the display, followed by the Instrument State display.

Note: Power must be applied to the WGN for 30 minutes for full accuracy.

3. Connect a spectrum analyzer or other device capable of measuring noise density at the S+N output connector. Verify that the measured value corresponds to the WGN settings.
4. Decrease the noise power in 0.25 dB steps and verify that the output power density changes by the respective amount.

The following applies to units with option WGNOptS only:

5. Inject a CW signal into the “Signal Input” port. Disable the WGN noise output.
6. Measure the signal level with Signal attenuation set to 0 dB. The insertion loss should be approximately 5 dB.
7. Increase the WGN signal attenuation in 1 dB steps and verify the output power changes accordingly.

Error messages

Certain conditions will prevent the instrument from setting the desired output noise power. If an output power cannot be achieved, the instrument will indicate what limit has been exceeded with one of the following error messages being displayed in place of the main display. The message is reset when either the **Clear** or **Enter** key is pressed.

Noise Power Too High

occurs if the noise power is above the operating range. Correct the problem by reducing the selected noise power.

Noise Power Too Low

occurs if the noise power is below the operating range. Correct the problem by increasing the selected noise power.

Noise Density Too High

occurs if the noise density is above the operating range. Correct the problem by reducing the selected noise density.

Noise Density Too Low

occurs if the noise density is below the operating range. Correct the problem by increasing the selected noise density.



Description and Specifications Section

Description and Specifications

This section describes the WGN technical details and specifications.
Topics include:

- Functional description of the instrument
- Specifications

Functional Description

A white Gaussian noise source with a high crest factor is fed into a proprietary designed attenuator. The attenuator uses a dedicated microprocessor to compensate every attenuation setting in 1 MHz frequency steps across the operating frequency band. Attenuation is implemented with solid state devices to ensure high reliability. Temperature compensation is also incorporated. The resulting performance is very good accuracy, reliability, and repeatability. Attenuation resolution is 0.015625 dB.

A signal may be applied which is summed with the noise output. With Option WGNoptS installed, the signal can be attenuated up to 63 dB, independent of the noise power.

The noise output can be set in terms of noise power in a specified bandwidth. Alternatively, the noise output can be specified in terms of noise density. If the selected noise bandwidth is 1 Hz, then the noise power and noise density values are identical.

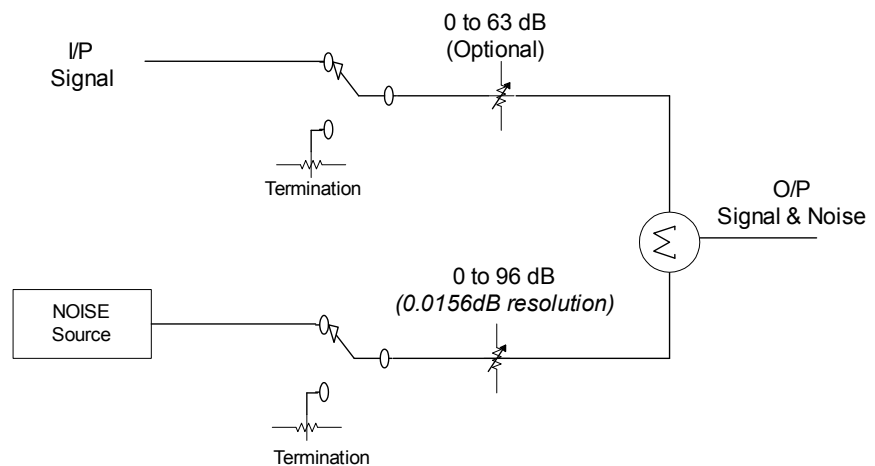
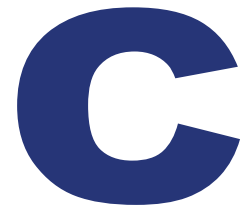


Figure 7. Simplified functional block diagram of the WGN

Specifications

Output Type	White Gaussian Noise
Crest Factor	15 dB minimum
Noise Power range	95.98 dB below max output, up to 2.7 GHz
	63.98 dB below max output, above 2.7 GHz
Noise Power Resolution	0.015625 dB
Noise Power accuracy	+/- 0.1 dB at maximum output power
	+/- 0.2 dB at any output power setting
Maximum input signal power	+20 dBm
Signal insertion loss	5 dB nominal
Signal attenuation range	63 dB
Signal attenuation resolution	1 dB
Impedance	50 ohms
VSWR	<1.5:1
Connectors	Type N female
Control and interface	
Local interface	Front panel keypad & display
Remote interface	IEEE-488.2 compatible
Save/Recall	10 states
Primary power	
Voltage	90-264 VAC autoranging
Frequency	48-66 Hz
Consumption	100 VA, maximum
Fuse	2A, slow-blow
Ambient operating temp	0° to 35° C
Dimensions	17" W x 5.25" H x 21" D

Figure 8. WGN Specifications



Maintenance and Warranty Section

Maintenance and Warranty

This section describes the WGN maintenance procedures and warranty information.

- Maintenance Information.
- Warranty Information.

Maintenance Information

Adjustments and Calibration

To maintain optimum measurement performance, the WGN should be calibrated every year. It is recommended that the WGN be returned to **dBm** or to an authorized calibration facility. For more information please contact our Customer Service Department at (201) 677-0008

Repair

The WGN should only be serviced by **dBm** service personnel or trained customer maintenance personnel using the **dBm** Service Manual for the WGN.

For instruments requiring service, either in or out of warranty, contact **dBm** Customer Service Department at (201) 677-0008 for pricing and instructions before returning your instrument. When you call, be sure to have the following information available:

- Model number.
- Serial number.
- Full description of the failure condition.

Note: Model and serial number can be found on the rear of the WGN unit, next to the AC outlet.

Equipment Returns

All instruments returned to **dBm** for repair must be shipped prepaid. Instruments that are eligible for in-warranty repair will be returned prepaid to the customer. For all other situations the customer is responsible for all shipping charges. An evaluation fee may be charged for processing units that are found to have no functional or performance defects.

For out of warranty instruments, **dBm** will provide an estimate for the cost of repair. Customer approval of the charges will be required before repairs can be made. For units deemed to be beyond repair, or in situations which the customer declines to authorize repair, an evaluation charge may be assessed by **dBm**.

Warranty Information

All **dBm** products are warranted against defects in material and workmanship for a period of one year from the date of shipment.

dBm will, at its option, repair or replace products that prove to be defective during the warranty period, provided they are returned to **dBm** and provided the preventative maintenance procedures are followed. Repairs necessitated by misuse of the product are not covered by this warranty. No other warranties are expressed or implied, including but not limited to implied warranties of merchantability and fitness for a particular purpose.

dBm is not liable for consequential damages. Please refer to the previous section for contact information and procedures to return the instrument to **dBm**.