MS8608A/MS8609A

Digital Mobile Radio Transmitter Tester

Operation Manual

Vol. 1

(Main Unit)

Fifth Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

JAN.
2003

ANRITSU CORPORATION

Document No.: M-W1709AE-5.0

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. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.
Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.

Symbols used in manual

DANGER ⚠ This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

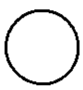
WARNING ⚠ This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION ⚠ This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

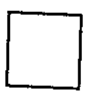
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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

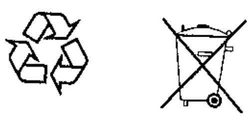


This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates 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.

MS8608A/MS8609A
Digital Mobile Radio Transmitter Tester
Operation Manual Vol.1 (Main Unit)

17 March 2000 (First Edition)
13 August 2001 (Fifth Edition)

For Safety

WARNING ⚠

1. ALWAYS refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING ⚠

3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

Falling Over

4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

For Safety

WARNING ⚠

Battery fluid

5. DO NOT short the battery terminals and never attempt to disassemble it or dispose of it in a fire. If the battery is damaged by any of these actions, the battery fluid may leak.
   This fluid is poisonous.
   DO NOT touch it, ingest it, or get in your eyes. If it is accidentally ingested, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

LCD

6. This instrument uses a Liquid Crystal Display (LCD); DO NOT subject the instrument to excessive force or drop it. If the LCD is subjected to strong mechanical shock, it may break and liquid may leak.
   This liquid is very caustic and poisonous.
   DO NOT touch it, ingest it, or get in your eyes. If it is ingested accidentally, spit it out immediately, rinse your mouth with water and seek medical help. If it enters your eyes accidentally, do not rub your eyes, irrigate them with clean running water and seek medical help. If the liquid gets on your skin or clothes, wash it off carefully and thoroughly.

For Safety

CAUTION ⚠

Changing Fuse

CAUTION ⚠

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. ALWAYS use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

   T6.3A indicates a time-lag fuse.

   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

Cleaning

2. Keep the power supply and cooling fan free of dust.
   - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
   - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Input Level

⚠

3. Maximum DC voltage ratings:

   RF Input ±DC 0 V

   Maximum AC power (continuous wave) ratings:

   For MS8608A,

   High Power Input connector: +40 dBm

   Low Power Input connector: +20 dBm

   For MS8609A,

   +20 dBm

   NEVER input a over maximum ratings to RF Input, excessive power may damage the internal circuits.

For Safety

CAUTION ⚠

Replacing Memory Back-up Battery

4. The power for memory backup is supplied by a Poly-carbonmonofluoride Lithium Battery. This battery should only be replaced by a battery of the same type; since replacement can only be made by Anritsu, contact the nearest Anritsu representative when replacement is required.

   Note: *The Battery life is about 7 years. Early battery replacement is recommended.*

Storage Medium

5. This equipment stores data and programs using Plug-in Memory card. Data and programs may be lost due to improper use or failure. ANRITSU therefore recommends that you backup the memory.

   <u>Anritsu Corporation will not accept liability for lost data.</u>

   Please pay careful attention to the following points.

   - Do not remove the memory card from equipment being accessed.
   - Isolate the card from static electricity.

Disposing of The Product

6. This equipment uses chemical compound semiconductor including arsenide.
   At the end of its life, the equipment should be recycled or disposed properly according to the local disposal regulations.

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 Electrotechnical Laboratory, the National Research Laboratory of Metrology and the Communications Research Laboratory, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

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

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact Anritsu Corporation or its representatives at the address in this manual.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.
Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.

Trade Mark

MS-DOS is a registered trademark of Microsoft Corporation US in US and other countries.
IBM PC/AT is a registered trade mark of International Business Machines Corporation.

Front Panel Power Switch

To prevent malfunction caused by accidental touching, the front power switch of this equipment turns on the power if it is pressed continuously for about one second in the standby state. If the switch is pressed continuously for one second in the power-on state, the equipment enters the standby state.

In the power-on state, if the power plug is removed from the outlet, then reinserted into it, the power will not be turned on. Also, if the lines are disconnected due to momentary power supply interruption or power failure, the power will not be turned on (enters the standby state) even if the line is recovered.

This is because this equipment enters the standby state and prevents incorrect data from being acquired when the line has to be disconnected and reconnected.

For example, if the sweep time is 1,000 seconds and data acquisition requires a long time, momentary power supply interruption (power failure) might occur during measurement and the line could be recovered automatically to power-on. In such a case, the equipment may mistake incorrect data for correct data without recognizing the momentary power supply interruption.

If this equipment enters the standby state due to momentary power supply interruption or power failure, check the state of the measuring system and press the front power switch to restore power to this equipment.

Further, if this equipment is built into a system and the system power has to be disconnected then reconnected, the power for this equipment must also be restored by pressing the front power switch.

Consequently, if this equipment is built into remote monitoring systems that use MODEMs, please install option 46 "Auto Power Recovery" to equipment.

CE Marking

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 with the EMC directive of the European Union (EU).

CE Conformity Marking

1. Product Name/Model Name

Product Name: Digital Mobile Radio Transmitter Tester
Model Name: MS8608A/MS8609A

2. Applied Directive

EMC: Council Directive 89/336/EEC
LVD: Council Directive 73/23/EEC

3. Applied Standards

EMC:
Emission: EN61326: 1997/A1: 1998 (Class A)
Immunity: EN61326: 1997/A1: 1998 (Annex A)

	Performance Criteria*
IEC61000-4-2 (ESD)	B
IEC61000-4-3 (EMF)	A
IEC61000-4-4 (Burst)	B
IEC61000-4-5 (Surge)	B
IEC61000-4-6 (CRF)	A
IEC61000-4-8 (RPFMF)	A
IEC61000-4-11 (V dip/short)	B

*: Performance Criteria
A: During testing normal performance within the specification limits.
B: During testing, temporary degradation, or loss of function or which is self-recovering.

Harmonic current emissions:
EN61000-3-2: 1995/A2: 1998 (Class A equipment)
LVD:EN61010-1: 1993/A2: 1995 (Installation Category II, Pollution Degree 2)

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

N274

1. Product Name/Model Name

Product Name: Digital Mobile Radio Transmitter Tester
Model Name: MS8608A/MS8609A

2. Applied Standards

EMC:

Emission:

AS/NZS 2064.1/2 (ISM, Group 1, Class A equipment)

Immunity:

AS/NZS 4252.1

	*Performance Criteria
IEC61000-4-2 (ESD)	B
IEC61000-4-3 (EMF)	A
IEC61000-4-4 (Burst)	B
IEC61000-4-5 (Surge)	B
IEC61000-4-6 (CRF)	A
IEC61000-4-8 (RPFMF)	A
IEC61000-4-11 (V dip/short)	B

*: Performance Criteria

A: During testing normal performance within the specification limits.

B: During testing, temporary degradation, or loss of function or which is self-recovering.

Caution for the operation with Option 05 installed

- Transport condition

  Be sure to use a carrying case for transport or carriage in a plant or a room. Turn off the power of the MS8608A/MS8609A at least 30 minutes before carriage to reduce the Rubidium oscillator's temperature.

- Operating condition

  Do not place things that possess magnetism (more than 0.5 gauss) such as magnets near the MS8608A/MS8609A since the frequency of Option 05 (Standard Rubidium oscillator) varies depending on the magnetic field.

Power Line Fuse Protection

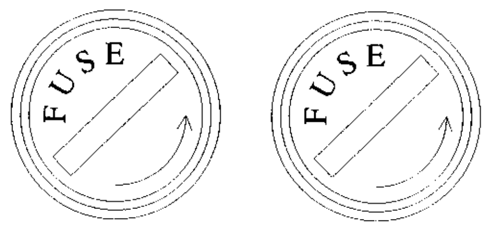
For safety, Anritsu products have either one or two fuses in the AC power lines as requested by the customer when ordering.

Single fuse: A fuse is inserted in one of the AC power lines.

Double fuse: A fuse is inserted in each of the AC power lines.

Example: An example of the double fuse is shown below:

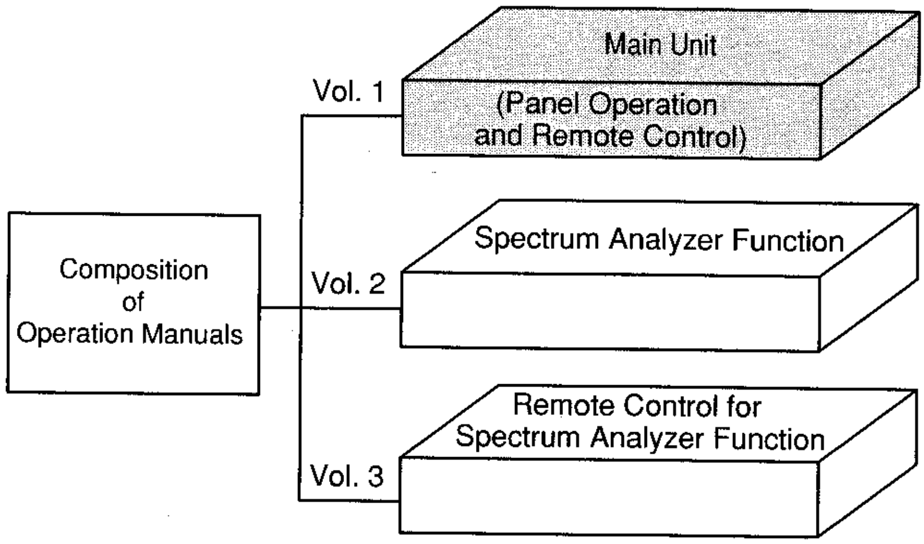
Fuse Holders



About This Manual

Composition of MS8608A/MS8609A Digital Mobile Radio Transmitter Tester Operation Manuals

The MS8608A/MS8609A Digital Mobile Radio Transmitter Tester operation manuals of the standard type are composed of the following three documents. Use them properly according to the usage purpose.



Main Unit:

Provides information on the MS8608A/MS8609A outline, preparation before use, panel description, basic operation, soft-key menu of the commonly-used functions, performance tests and remote control for the main unit.

Spectrum Analyzer Function:

Spectrum Analyzer Function: Provides information on operating the spectrum analyzer function of the MS8608A/MS8609A.

Remote Control for Spectrum Analyzer Function:

Remote Control for Spectrum Analyzer Function: Provides information on remotely-operating the spectrum analyzer function of the MS8608A/MS8609A using an external controller.

For the operating instructions to use the MS8608A/MS8609A as a transitter tester, refer to the separate operation manuals of the measurement software.

II .

MS8608A/MS8609A
Digital Mobile Radio Transmitter Tester
Operation Manual
Vol. 1
(Main Unit: Panel Operation)

Table of Contents

Section 1 General

This section outlines the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester and explains the configuration of MS8608A/MS8609A standard accessories, options, the optional accessories, and peripherals for expanding the MS8608A/MS8609A capabilities, and the MS8608A/MS8609A specifications.

Product Outline

The MS8608A/MS8609A Digital Mobile Radio Transmitter Tester (hereafter MS8608A/MS8609A) is a measuring device with a performance necessary for testing various terminals for digital mobile communications.
The MS8608A/MS8609A can efficiently evaluate the performance of terminals for digital mobile communications which support various digital modulation methods.
The MS8608A/MS8609A can also be used as a spectrum analyzer without any measuring software.

■ Fast and precision measurement

Main transmission measurement of the MS8608A/MS8609A uses fast digital signal processing technology to achieve fast and precision measurements.

■ One MS8608A/MS8609A can support various digital modulations

The MS8608A/MS8609A can measure mobile radio terminals which support various digital modulation methods by the installation of an optional measurement software.
You can easily change and measure with various digital modulation methods when the necessary measurement software has been installed.

■ Standard spectrum analyzer function

The MS8608A/MS8609A is equipped with a spectrum analyzer function as a standard composition.
This is a full spectrum analyzer with most functions and performances as that provided by our other spectrum analyzers.

Equipment Configuration

This paragraph describes the configuration of the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester with standard accessories and the various options to expand the functions.

Standard configuration

The table below shows the configuration of the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester with the standard accessories.

Standard Composition

Item	Model/Order NO.	Name	Qty.	Remarks
Main unit	MS8608A/MS8609A	Digital Mobile Radio Transmitter Tester		
Accessories	J0017F	Power cord	1	Approx. 2.6 m
	J0266	Power cord adaptor	1	3-pole to 2-pole conversion
	F0014	Fuse, 6.3 A	1	T6.3 A 250 V
	J0576	Coaxial cable	1	N-P · 5D2W · N-P, 1 m
	J0966B*	RS-232C Cable	1	1.5 m
	JT32MA3-NT1	ATA Flash Card	1	32 MB
	MX268001A	File Utility Software	1	
	W1709AE	Operation manual VOL.1	1	Main unit
	W1744AE	Operation manual VOL.2	1	Spectrum analyzer function
	W1745AE	Operation manual VOL.3	1	Remote control for spectrum analyzer

* : Equivalent is attached

Options

The table below shows the options for MS8608A/MS8609A which are sold separately.

Model † - Order No. †	Name	Remarks
MS8608A-01/MS8609A-01	Precision frequency reference oscillator	Aging rate: $\leq 5 \times 10^{-10}$ /day
MS8608A-02/MS8609A-02	Narrow Resolution Bandwidths (FFT)	1 Hz to 1 kHz
MS8608A-03	Extension of preselector lower limit to 1.6 GHz	Expands lower frequency limit of pre-selector from 3.15 to 1.6 GHz.
MS8608A-04/MS8609A-04	Digital resolution bandwidth	10 Hz to 1 MHz
MS8608A-05/MS8609A-05	Rubidium reference oscillator	Starting characteristics: $\leq \pm 1 \times 10^{-9}$/7 minutes (at 25°C) Aging rate: $\leq \pm 1 \times 10^{-10}$/month
MS8608A-08/MS8609A-08	Pre-amplifier	100 kHz to 3 GHz
MS8608A-09/MS8609A-09	Ethernet interface	10 Base-T
MS8609A-32	Maximum input level expansion	Expands the measurement level range from +20 to +26 dBm. Maximum allowable level: +30 dBm
MS8609A-33	High-accuracy power measurement	Effective when W-CDMA measurement software is installed. 1848 to 2171 MHz
MS8608A-35	Extension of frequency upper limit to 7.9 GHz	
MS8608A-46/MS8609A-46	Auto Power Recovery	
MS8608A-47/MS8609A-47	Rack mount (IEC)	When using the rack mount, the tilt handle (standard accessories) should be removed.
MS8608A-48/MS8609A-48	Rack mount (JIS)	When using the rack mount, the tilt handle (standard accessories) should be removed.

† Please specify the model/order number, name, and quantity when ordering.

Measurement software

The measurement software is optional.
Contact us or our representatives for the detailed functions and performances of the measurement software.
The following measurement software is available for the MS8608A/MS8609.

MX860801A/B/MX860901A/B W-CDMA measurement softwares
These measurement softwares are used for evaluating the performance of a W-CDMA device, a base station and mobile station terminals.
You can perform the modulation analysis, code domain analysis, RF power, occupied bandwidth and adjacent channel leakage power measurements.

MX860802A/MX860902A GSM measurement softwares
These measurement softwares are used for evaluating the performance of a GSM/EDGE device, a base station, and mobile station terminals.
You can perform the modulation analysis (GMSK, 8PSK), RF power (GSM, EDGE), output RF power, and spurious measurements.

Optional Accessories and Peripherals

The following table shows the optional accessories and peripherals for MS8608A/ MS8609A which are all sold separately.

Optional Accessories

Model † - Order No. †	Name	Remarks
J0576D	Coaxial cord, 1 m	N-P · 5D-2W · N-P
J0127C	Coaxial cord, 0.5 m	BNC-P · RG-58A/U · BNC-P
J0127A	Coaxial cord, 1 m	BNC-P · RG-58A/U · BNC-P
J1066	Coaxial cord, 0.15 m	An accessory for Option 05, BNC211-LP4 · RG-58A/U · BNC211-LP4
B0329G	Front cover	3/4MW4U
J0395	Fixed attenuator for high power	30 dB (30 W, DC to 8 GHz)
J0007	GPIB cable, 1 m	408JE-101
J0008	GPIB cable, 2 m	408JE-102
B0452A	Carring Case	With casters
B0452B	Carring Case	Without casters
B0488	Rear panel protective pad	For rear panel protection when standing on itself.
MA1612A	Pad for 3-signal characteristics measurement	5 to 3000 MHz
B0472	High-power attenuator	30 dB (100 W, Dc to 18 GHz)
J1047	Ethernet cross cable, 5 m	Cross connection

† Please specify the model/order number, name, and quantity when ordering.

Specifications

Except were noted otherwise, specified values were obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration. The typical values are given for reference, and are not guaranteed.

- MS8608A/MS8609A Main Unit specifications

Item	Specifications
Model	MS8608A/MS8609A Digital Mobile Radio Transmitter Tester
Frequency range	9 kHz to 7.8 GHz (MS8608A), 9 kHz to 13.2 GHz (MS8609A)
Maximum input level	+40 dBm (10 W): High Power Input +20 dBm (100 mW): Low Power Input (MS8608A) +20 dBm (100 mW): RF Input (MS8609A) Continuous averaged power
Input connector MS8608A High Power Input Connector type Impedance Low Power Input Connector type Impedance MS8609A RF Input Connector type Impedance	 N-type connector 50 Ω, VSWR≤1.2 (Frequency≤3 GHz), VSWR≤1.3 (Frequency>3 GHz) SMA-type connector With Power Meter 50 Ω, VSWR≤1.3 (Frequency: 30 MHz to 3 GHz) Without Power Meter 50 Ω, VSWR≤1.5 (Frequency≤3 GHz at input attenuator≥4 dB) 50 Ω, VSWR≤2.0 (Frequency>3 GHz at input attenuator≥4 dB) N-type connector With Power Meter 50 Ω, VSWR≤1.3 (Frequency: 30 MHz to 3 GHz) Without Power Meter 50 Ω, VSWR≤1.5 (Frequency≤3 GHz at input attenuator≥4 dB) 50 Ω, VSWR≤2.3 (Frequency>3 GHz at input attenuator≥10 dB)
IQ input Input type Connector type Input impedance Input level range Balance input Unbalance input	 Balanced/Unbalanced selectable BNC-type connector 1 MΩ (parallel capacitance <100 pF) or 50 Ω, selectable Differential voltage range: 0.1 to 1 Vp-p (at input connector) Common-mode voltage range: ±2.5 V (at input connector) 0.1 to 1 Vp-p (at input connector) DC/AC coupled, selectable
Reference oscillator Frequency Starting characteristics Aging rate Temperature characteristics	 10 MHz $\leq 5 \times 10^{-8}$ After 10 minutes of warm-up, referred to frequency after 24 hours of warm-up $\leq 2 \times 10^{-8}$/d $\leq 1 \times 10^{-7}$/year Referred to frequency after 24 hours of warm-up $\leq \pm 5 \times 10^{-8}$ (0 to 50°C) Referred to frequency at 25°C
Power meter function Frequency range Level range Measurement level accuracy	 30 MHz to 3 GHz 0 to +40 dBm: High Power Input, −20 to +20 dBm: Low Power Input (MS8608A) −20 to +20 dBm: RF Input (MS8609A) After zero point calibration ±10%

Model			MS2683A
General specification	Display		Color TFT-LCD, Size: VGA 17 cm (6.5" Type), Number of colors: 4096 (RGB, 16-scale settable) Brightness: 5-scale settable (include OFF)
	Hard copy		Display data can be hard-copied via the parallel interface (model corresponded to PCL Level 3 or less, or to ESC/P-J83 or -J84)
	PC Card interface		ATA flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement settings and waveform data Save bitmap files of waveform display Connector: JEIDA Ver 4/4.1 PCMCIA Re12.0, 1 slot
	RS-232C		Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, jack
	GPIB	Function	Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch)
		Interface	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel interface		Based on centoronics, output printing data to printer Connector: D-Sub 25 pins, plug
	IF Output		BNC connector Frequency: 10.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 50 MHz, at upper edge of display scale, 50 Ω termination)
	Wideband IF Output		BNC connector, 50 Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ. (frequency 50 MHz, input attenuator 0 dB)
	Video Output (Y)		BNC connector Output level: 0 to 0.5 V ± 0.1 V (log scale) 0 to 0.4 V ± 0.1 V (linear scale) (Frequency 50 MHz, at display scale range of upper-end to lower-end in 10 dB/div and 10%/div, 75 Ω termination)
	Video Output		Analog RGB Connector: D-Sub15pins, jack
General specification	External reference signal input		BNC connector Frequency: 10 MHz±10 Hz, 13 MHz±13 Hz Level: ≥ 0 dBm (50 Ω termination)
	Buffered Output		BNC connector Frequency: 10 MHz Output level p-p:2 to 5 V (200 Ω termination)
	Sweep Output (X)		BNC connector Output level: 0 to 10 V±1 V (100 kΩ termination, from left edge to right edge in display scale, single band sweep)
	Sweep Status Output (Z)		BNC connector Output level: TTL (when sweeping, at low level)
	Probe source		4-pin connector, +12 V, –12 V, each ±10%, each max 110 mA
	Trig/Gate input		BNC connector Input level: ±10 V (0.1 V resolution), or TTL level
Others	Dimension		177 mm (H), 320 mm (W), 411 mm (D) (exclude handle, legs, front cover, fan cover)
	Mass		≤ 16 kg (MS8608A), ≤ 16.5 kg (MS8609A) Nominal values
	Power (operating range)		85 to 132 V, 170 to 250V (wide range ac voltage), 47.5 to 63 Hz, ≤ 400 VA
	Temperature range		Operating 0 to 50°C, ≤ RH85% Preservation –20 to +60°C
	Conduced emission		Meets to EN61326:1998
	Radiated emission		Meets to EN61326:1998
	Electrostatic discharge		Meets to EN61326:1998
	Radiation field		Meets to EN61326:1998
	Steady Harmonic current emission		Meets to EN61000-3-2:1995
	Conducted susceptibility		Meets to EN61326:1998

*1: Typical value and nominal value are reference data, so that not warrant them as spec.

Item		Specifications
Others	Surges	Meets to EN61326:1998
	Conducted RF signal	Meets to EN61326:1998
	Power-source frequency magnetic field	Meets to EN61326:1998
	Voltage down, instant power loss	Meets to EN61326:1998
	Vibration	Meets to MIL-STD-810D

• Specifications of spectrum analyzer function (MS8608A)

Item			Specifications
Frequency	Frequency range		9 kHz to 7.8 GHz
	Frequency band		Band0 (9 kHz to 3.2 GHz), Band 1–L : 1.6 to 3.2 GHz (Option 03), Band1– (3.15 to 6.3 GHz), Band1+ (6.2 to 7.8 GHz)
	Pre-selector range		3.15 to 7.8 GHz (Band1–, 1+) Option 03 : 1.6 to 7.8 GHz (Band 1–L, 1–, 1+)
	Setting frequency resolution		Minimum 1 Hz
	Frequency readout accuracy		± (frequency readout × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)
	Marker frequency readout accuracy		Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution	1 Hz, 10 Hz, 100 Hz, 1 kHz
		Accuracy	± (frequency readout × reference frequency accuracy + 1 LSD + 2 Hz) (S/N ≥ 20 dB, RBW ≤ 3 MHz)
	Frequency span	Setting range	0 Hz, 5 kHz to 7.8 GHz
		Accuracy	±1.0% (Single band sweep, data point : 1001 point)
	Resolution bandwidth (3 dB BW) (RBW)		Setting range: 300 Hz,1 kHz,3 kHz,10 kHz,30 kHz,100 kHz,300 kHz,1 MHz,3 MHz,5 MHz, 10 MHz, 20 MHz (only 0 Band) (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW=300 Hz to 10 MHz), ±40% (RBW=20 MHz) Selectivity (60 dB: 3 dB): ≤15:1
	Video bandwidth (VBW)		1 Hz to 3 MHz, 1–3 sequence, Off (manually or automatically settable according to resolution bandwidth)
	Signal purity		Noise side bands: ≤–108 dBc/Hz (1 GHz,10 kHz offset) ≤–120 dBc/Hz (1 GHz,100 kHz offset) Typical value: –146 dBc (at 1 GHz, 6 MHz offset)
Amplitude	Level measurement	Measuring range	Average noise level to +40 dBm (High power input) Average noise level to +20 dBm (low power input)
		Maximum input level	+40 dBm (continuous average power, High power input) +20 dBm (continuous average power, Low power input) ±0 Vdc
		Display average noise level	At resolution bandwidth 300 Hz and video bandwidth 1 Hz
		High power Input	At input attenuator 20 dB, without Option 08: ≤–104 dBm+1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–100 dBm+1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–100 dBm+0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1) At input attenuator 20 dB, with Option 08: ≤–102 dBm+1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–100 dBm+1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–100 dBm+0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)
		Low power Input	At input attenuator 0 dB, without Option 08: ≤–124 dBm+1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm+1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–120 dBm+0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1) At input attenuator 0 dB, with Option 08: ≤–122 dBm+1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm+1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–120 dBm+0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

Item			Specifications
Amplitude	Level measurement	Residual response	
		High Power Input	At 20 dB input attenuator, input 50 Ω termination ≤−80 dBm (1 MHz to 3.2 GHz, Band 0) ≤−70 dBm (3.15 to 7.8 GHz, Band 1)
		Low Power Input	At 0 dB input attenuator, input 50 Ω termination ≤−100 dBm (1 MHz to 3.2 GHz, Band 0) ≤−90 dBm (3.15 to 7.8 GHz, Band 1)
	Reference level	Setting range	
		Log scale	−80 to +50 dBm, or equivalent level (High power Input) −100 to +30 dBm, or equivalent level (Low power Input)
		Linear scale	224 μV to 70.7 V (High power input) 22.4 μV to 7.07 V (Low power input)
		Setting resolution	0.1 dB or equivalent level
		Level step setting range	0.1 to 100 dB
		Unit	
		Log scale	dBm, dBμV, dBmV, dBμV (e.m.f.), W, V, dBμV/m
		Linear scale	V
		Reference level accuracy	After calibration, for 50 MHz frequency, 1 MHz span, input attenuator, resolution bandwidth, video bandwidth and auto sweep time
		High power Input	±0.75 dB (+20.1 to 40 dBm) ±0.5 dB (−29.9 to +20 dBm) ±0.75 dB (−49.9 to −30 dBm) ±1.5 dB (−60 to −50 dBm)
		Low power Input	±0.75 dB (+0.1 to 20 dBm) ±0.5 dB (−49.9 to 0 dBm) ±0.75 dB (−69.9 to −50 dBm) ±1.5 dB (−80 to −70 dBm)
		Resolution bandwidth switching deviation	After calibration, 3 kHz resolution bandwidth as a reference ±0.3 dB (300 Hz to 5 MHz) ±0.5 dB (10 MHz, 20 MHz)
		Input attenuator	
		Setting range	20 to 82 dB (High Power Input), 0 to 62 dB (Low Power Input), 2 dB step, manual setting and automatic setting depending on reference level
		Switching deviation	50 MHz frequency, 30 dB input attenuator (for High Power Input) or 10 dB (Low Power Input) as reference ±0.3 dB (30 to 70 dB, High Power Input) (10 to 50 dB, Low Power Input) ±0.5 dB (72 to 82 dB, High Power Input) (52 to 62 dB, Low Power Input)
		Switching mode	2 dB Step mode, 10dB Step mode
	Frequency characteristics		50 MHz as a reference At 30 dB input attenuator for High Power Input or 10 dB for Low Power Input, 18 to 28 °C temperature range ±0.6 dB (9 kHz to 3.2 GHz, Band 0) ±1.0 dB (3.15 to 7.8 GHz, Band 1), (Option 03: 1.6 to 7.8 GHz, Band 1) At 20 to 82 dB input attenuator for High Power Input or 10 to 62 dB for Low Power input ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±2.0 dB (3.15 to 7.8 GHz, Band 1), (Option 03: 1.6 to 7.8 GHz, Band 1) * Band 1 characteristics after pre-selector tuning

(Continued)

Item		Specifications
Amplitude	Scale Fidelity	Scale:10 div (at single scale) Log scale: 10 dB, 5 dB, 2 dB, 1 dB/div Linear scale: 10%, 5%, 2%, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW≤1 kHz), ±1.0 dB (0 to –90 dB, RBW≤1 kHz) Linear scale: ±4% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02%
Amplitude	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, Band 0, mixer input level:–30 dBm) ≤–75 dBc (0.2 to 0.85 GHz, Band 0, mixer input level:–30 dBm) ≤–70 dBc (0.85 to 1.6 GHz, Band 0, mixer input level:–30 dBm) ≤–90 dBc (1.6 to 3.9 GHz, Band 1, mixer input level:–10 dBm) (Option 03: 0.8 to 3.9 GHz, Band 1, mixer input level: –10 dBm) 2-signal 3rd-order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 7.8 GHz) *Frequency reference of two signal: ≥50 kHz, mixer input level –30 dBm
		Image response: ≤–70 dBc Multiple response: ≤–70 dBc (Band 1)
Amplitude	1dB gain compression	At mixer input level ≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, Band 0), ≥0 dBm (Band 1)
Amplitude	Maximum dynamic range	1 dB gain compression vs. averaging noise level Without Option 08 ≥127 dB–1.5 × f [GHz] dB (0.5 to 2.5 GHz, Band 0) ≥123 dB–1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≥120 dB–0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1) With Option 08 ≥125 dB–1.8 × f [GHz] dB (0.5 to 2.5 GHz, Band 0) ≥123 dB–1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≥120 dB–0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)
Frequency domain	Sweep time	In frequency sweep Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (10 ms to 1s), most significant 3-digits (≥1 s) Accuracy: ±3%
Frequency domain	Sweep mode	Continuous, single
Frequency domain	Trigger switch	Freerun, Triggered
Frequency domain	Trigger source	Wide IF Video, Line, Ext (±10V), Ext (TTL)
Frequency domain	Gate mode	Off, Random sweep mode Gate delay: 0 s to 65.5 ms, resolution 1 µs Gate length: 2 µs to 65.5 ms, resolution 1 µs Gate end: Internal/External
Frequency domain	Zone sweep	Sweeps only in frequency range indicated by zone marker
Frequency domain	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time domain	Sweep time	Setting range: 1 µs to 1000 s Setting resolution: 1, 2, 5 sequence (1 to 50 µs), 100 µs (100 µs to 4.9 ms), 5 ms (5 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±1% (10 µs to 1000s)
Time domain	Sweep mode	Continuous, single
Time domain	Trigger switch	Freerun, Triggered
Time domain	Trigger source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
Time domain	Trigger delay	Pre-trigger: Display waveform before triggering Setting range: – (time span) to 0 s Setting resolution: bigger value between (time span)/500 and 100 ns Post-trigger: Display waveform before triggering Setting range: 0 s to 65.5 ms, Setting resolution: 100 ns (sweep time ≤ 4.9 ms), 1 µs (sweep time ≥ 5 ms)

Item		Specifications
Frequency	Numbers of point	Can be either 501 or 1001 point.
	Detection mode	Normal Positive Peak Negative Peak Sample Average
	Display function	Trace A, Trace B, Trace A/B, Trace A/BG, Trace A/Time
	Trace calculation	A→B, B→A, A↔B, A+B→A, A−B→A, A−B+DL→A
	Storage function	Normal, View, Max Hold, Min Hold, Average, Linear Average, Cumulative, Over Write
	Signal search	Auto Tune, Peak→CF, Peak→Ref, Scroll
	Zone marker	Normal, Delta
	Marker function	Marker→CF, Marker→Ref, Marker→CF Step Size, ΔMarker→Span, Zone→Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip
	Multi marker	Number of markers: 10 max. (Highest 10, Harmonics, Manual Set)
	Measure function	Noise power (dBm/Hz, dBm/ch, dBμV/√Hz), C/N (dBc/ Hz, dBc/ch), occupied bandwidth (power N% method, X dB down method), adjacent channel leakage power (REF: total power method, reference level method, inband method, channel designate display: 3 channels × 2, graphic display), average power of burst signal (average power in designate time range of time domain waveform), channel power (dBm/Hz, dBm), template comparison (upper/lower limits × each 2, time domain), MASK (upper/lower limits × each 2, frequency domain)
	Correction	The user can correct frequency response optionally, max 150 points

• Specifications of spectrum analyzer function (MS8609A)

Item			Specifications
Frequency	Frequency range		9 kHz to 13.2 GHz
	Frequency band		Band0 (9 kHz to 3.2 GHz), Band1– (3.15 to 6.3 GHz), Band1+ (6.2 to 7.8 GHz), Band 2+ (7.7 to 13.2 GHz)
	Mixer harmonic order		1: Band 0, 1–, 1+ 2: Band 2
	Pre-selector range		3.15 to 13.2 GHz (Band1–, 1+, 2+) Option 03 : 1.6 to 7.8 GHz (Band 1–L, 1–, 1+)
	Setting frequency resolution		Minimum 1 Hz
	Frequency readout accuracy		± (frequency readout × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 × N Hz)
	Marker frequency readout accuracy		Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution	1 Hz, 10 Hz, 100 Hz, 1 kHz
		Accuracy	± (frequency readout × reference frequency accuracy + 1 LSD + 2 × N Hz) (S/N ≥ 20 dB, RBW ≤ 3 MHz)
	Frequency span	Setting range	0 Hz, 5 kHz to 13.2 GHz
		Accuracy	±1.0% (Single band sweep, data point: 1001 point)
	Resolution bandwidth (3dB BW) (RBW)		Setting range: 300 Hz,1 kHz,3 kHz,10 kHz,30 kHz,100 kHz,300 kHz,1 MHz,3 MHz,5 MHz, 10 MHz, 20 MHz (only 0 Band) (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW=300 Hz to 10 MHz), ±40% (RBW=20 MHz) Selectivity (60 dB:3 dB): ≤15:1
	Video bandwidth (VBW)		1 Hz to 3 MHz, 1–3 sequence, Off (manually or automatically settable according to resolution bandwidth)
	Signal purity		Noise side bands: ≤–108 dBc/Hz (1 GHz,10 kHz offset) ≤–120 dBc/Hz (1 GHz,100 kHz offset) Typical value: –146 dBc (at 1 GHz, 6 MHz offset)
Amplitude	Level measurement	Measuring range	Average noise level to +20 dBm
		Maximum input level	+20 dBm (continuous average power ±0 Vdc
		Display average noise level	At resolution bandwidth 300 Hz and video bandwidth 1 Hz At input attenuator 0 dB Without Option 08 ≤–124 dBm+1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm+1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–116 dBm (3.15 to 7.8 GHz, Band 1) ≤ –107 dBm (7.7 to 13.2 GHz, Band 2) With Option 08 ≤–122 dBm+1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm+1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–116 dBm (3.15 to 7.8 GHz, Band 1) ≤–107 dBm (7.7 to 13.2 GHz, Band 2)
		Residual response	At 0 dB input attenuator, input 50 Ω termination ≤–100 dBm (1 MHz to 3.2 GHz, Band 0) ≤–90 dBm (3.15 to 7.8 GHz, Band 1)

	Item	Specifications
Amplitude	Reference level	
	Setting range	
	Log scale	−100 to +30 dBm, or equivalent level
	Linear scale	22.4 μV to 7.07 V
	Setting resolution	
	Level step	0.1 dB or equivalent level
	setting range	0.1 to 100 dB
	Unit	
	Log scale	dBm, dBμV, dBmV, dBμV (e.m.f.), W, V, dBμV/m
	Linear scale	V
	Reference level accuracy	After calibration, for 50 MHz frequency, 1 MHz span, input attenuator, resolution bandwidth, video bandwidth and auto sweep time ±0.75 dB (+0.1 to +20 dBm) ±0.5 dB (−49.9 to 0 dBm) ±0.75 dB (−69.9 to −50 dBm) ±1.5 dB (−80 to −70 dBm)
	Resolution bandwidth switching deviation	After calibration, 3 kHz resolution bandwidth as reference ±0.3 dB (300 Hz to 5 MHz) ±0.5 dB (10 MHz, 20 MHz)
	Input attenuator	
	Setting range	0 to 62 dB, 2 dB step, manual setting and automatic setting depending on reference level
	Switching deviation	50 MHz frequency, 10 dB input attenuator as reference ±0.3 dB (10 to 50 dB) ±0.5 dB (52 to 62 dB)
	Switching mode	2 dB Step mode, 10 dB Step mode
Frequency	Frequency characteristics	
	Absolute flatness	50 MHz as a reference At input attenuator 10 dB, 18 to 28°C temperature range ±0.6 dB (9 kHz to 3.2 GHz, Band 0) ±1.5 dB (3.15 to 7.8 GHz, Band 1) ±2.0 dB (7.7 to 13.2 GHz, Band 2) At input attenuator 10 to 62 dB ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±2.0 dB (3.15 to 7.8 GHz, Band 1) ±3.0 dB (7.7 to 13.2 GHz, Band 2)
	Relative flatness	At input attenuator 10 to 62 dB ±1.0 dB (9 kHz to 3.2 GHz, Band 0) ±1.5 dB (3.15 to 7.8 GHz, Band 1) ±2.0 dB (7.7 to 13.2 GHz, Band 2) * Band 1 and 2 characteristics after pre-selector tuning

Item		Specifications
Amplitude	Scale Fidelity	Scale:10 div (at single scale) Log scale: 10 dB, 5 dB, 2 dB, 1 dB/div Linear scale: 10%, 5%, 2%, 1%/div Linearity (after calibration) Log scale: ±0.4 dB (0 to –20 dB, RBW≤1 kHz), ±1.0 dB (0 to –90 dB, RBW≤1 kHz) Linear scale: ±4% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02%
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, Band 0, mixer input level:–30 dBm) ≤–75 dBc (0.2 to 0.85 GHz, Band 0, mixer input level:–30 dBm) ≤–70 dBc (0.85 to 1.6 GHz, Band 0, mixer input level:–30 dBm) ≤–90 dBc (1.6 to 3.9 GHz, Band 1, mixer input level:–10 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 3.2 GHz) ≤–80 dBc (3.15 to 7.8 GHz) ≤–75 dBc (7.7 to 13.2 GHz) *Frequency reference of two signal: ≥50 kHz, mixer input level –30 dBm
		Image response: ≤–70 dBc Multiple response/out-of-band spurious: ≤–60 dBc
	1dB gain compression	At mixer input level ≥0 dBm (≥100 MHz) ≥+3 dBm (≥500 MHz, Band 0), ≥–3 dBm (Band 1, 2)
	Maximum dynamic range	1 dB gain compression vs. averaging noise level Without Option 08 ≥127 dB–1.5 × f [GHz] dB (0.5 to 2.5 GHz, Band 0) ≥123 dB–1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≥113 dB (3.15 to 7.8 GHz, Band 1) ≥104 dB (7.7 to 13.2 GHz, Band 2) With Option 08 ≥125 dB–1.8 × f [GHz] dB (0.5 to 2.5 GHz, Band 0) ≥123 dB–1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≥113 dB (3.15 to 7.8 GHz, Band 1) ≥104 dB (7.7 to 13.2 GHz, Band 2)
Frequency domain	Sweep time	In frequency sweep Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (10 ms to 1s), most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Line, Ext (±10V), Ext (TTL)
	Gate mode	Off, Random sweep mode Gate delay: 0 to 65.5 ms, resolution 1 µs Gate length: 2 µs to 65.5 ms, resolution 1 µs Gate end: Internal/External
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)

Item		Specifications
Time domain	Sweep time	Setting range: 1 μs to 1000 s Setting resolution: 1, 2, 5 sequence (1 to 50 μs), 100 μs (100 μs to 4.9 ms), 5 ms (5 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±1% (10 μs to 1000 s)
	Sweep mode	Continuous, single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Video, Line, Ext (±10V), Ext (TTL)
	Trigger delay	Pre-trigger: Display waveform before triggering Setting range: – (time span) to 0 s Setting resolution: bigger value between (time span)/500 and 100 ns Post-trigger: Display waveform before triggering Setting range: 0 s to 65.5 ms, Setting resolution: 100 ns (sweep time ≤ 4.9 ms), 1 μs (sweep time ≥ 5 ms)
Frequency	Numbers of point	Can be either 501 or 1001 point.
	Detection mode	Normal Positive Peak Negative Peak Sample Average
	Display function	Trace A, Trace B, Trace A/B, Trace A/BG, Trace A/Time
	Trace calculation	A→B, B→A, A↔B, A+B→A, A–B→A, A–B+DL→A
	Storage function	Normal, View, Max Hold, Min Hold, Average, Linear Average, Cumulative, Over Write
	Signal search	Auto Tune, Peak→CF, Peak→Ref, Scroll
	Zone marker	Normal, Delta
	Marker function	Marker→CF, Marker→Ref, Marker→CF Step Size, ΔMarker→Span, Zone→Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip
	Multi marker	Number of markers: 10 max. (Highest 10, Harmonics, Manual Set)
	Measure function	Noise power (dBm/Hz, dBm/ch, dBμV/√Hz), C/N (dBc/ Hz, dBc/ch), occupied bandwidth (power N% method, X dB down method), adjacent channel leakage power (REF: total power method, reference level method, inband method, channel designate display: 3 channels × 2, graphic display), average power of burst signal(average power in designate time range of time domain waveform), channel power (dBm/Hz, dBm), template comparison (upper/lower limits × each 2, time domain), MASK (upper/lower limits × each 2, frequency domain)
	Correction	The user can correct frequency response optionally, max 150 points

• Option 01: Precision frequency reference oscillator

Frequency	10 MHz
Aging rate	$\leq 5 \times 10^{-10}$/day (referred to frequency after 24 houre warm-up)
Temparature stability	$\leq 5 \times 10^{-10}$ (0 to 50°C, referred to frequency at 25°C)
Warm-up time within $\leq 5 \times 10^{-8}$	$\leq$ 7 minutes Typ. (time to reach to 5×10^{-8}, at 25°C)

• Option 02: Narrow Resolution Bandwidths (FFT)

Model	MS8608A	
Resolution Bandwidth	Setting range: 1 Hz to 1 kHz Switching uncertainly: ±0.5 dB *reference to RBW 3 kHz (analog)	
	Resolution bandwidth accuracy	±10% (RBW=30 Hz, 300 Hz) ±10% Typ. (RBW=1, 10, 100, 1 kHz)
	Selectivity (60 dB: 3 dB)	≤5:1 (RBW=30 Hz, 300 Hz) ≤5:1 Typ. (RBW=1, 10, 100, 1 kHz)
Minimum SPAN	100 Hz	
Average Noise Level Low Power input	At Input attenuator: 0 dB, RBW: 1 Hz, Detection mode: Sample [without Option 08 Pre-amplifier] ≤–148.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–144.5 dBm + 1.5 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–144.5 dBm + 0.8 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1) [with Option 08 Pre-amplifier,when Pre-amplifier Off] ≤–146.5 dBm + 1.8 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–144.5 dBm + 1.8 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–144.5 dBm + 0.8 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1)	
High Power input	At Input attenuator: 0 dB, RBW: 1 Hz, Detection mode: Sample [without Option 08 Pre-amplifier] ≤–128.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–124.5 dBm + 1.5 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–124.5 dBm + 0.8 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1) [with Option 08 Pre-amplifier,when Pre-amplifier Off] ≤–126.5 dBm + 1.8 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–124.5 dBm + 1.8 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–124.5 dBm + 0.8 × f [GHz] dB Typ. (3.15 to 7.8 GHz, Band 1)	

Model	MS8609A	
Resolution Bandwidth	Setting range: 1 Hz to 1 kHz Switching uncertainly: ±0.5 dB *reference to RBW 3 kHz (analog)	
	Resolution bandwidth accuracy	+10% (RBW=30 Hz, 300 Hz) +10% Typ. (RBW=1, 10, 100, 1 kHz)
	Selectivity (60 dB: 3 dB)	≤5:1 (RBW=30 Hz, 300 Hz) ≤5:1 Typ. (RBW=1, 10, 100, 1 kHz)
Minimum SPAN	100 Hz	
Average Noise Level	At Input attenuator: 0 dB, RBW: 1 Hz, Detection mode: Sample [without Option 08 Pre-amplifier] ≤–148.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–144.5 dBm + 1.5 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–138.5 dBm Typ. (3.15 to 7.8 GHz, Band 1) ≤–129.5 dBm Typ. (7.7 to 13.2 GHz, Band 2) [with Option 08 Pre-amplifier,when Pre-amplifier Off] ≤–146.5 dBm + 1.5 × f [GHz] dB Typ. (1 MHz to 2.5 GHz, Band 0) ≤–144.5 dBm + 1.5 × f [GHz] dB Typ. (2.5 to 3.2 GHz, Band 0) ≤–138.5 dBm Typ. (3.15 to 7.8 GHz, Band 1) ≤–129.5 dBm Typ. (7.7 to 13.2 GHz, Band 2)	

• Option 03: Extension of preselector lower limit (only for MS8608A)

Outline	Expands lower frequency limit of pre-selector from 3.15 to 1.6 GHz.
Frequency band	Band 0: 9 kHz to 3.2 GHz, Band 1–L: 1.6 to 3.2 GHz, Band 1–: 3.15 to 6.3 GHz Band 1+: 6.2 to 7.8 GHz
Pre-selector range	1.6 to 7.8 GHz (Band 1–L, 1–, 1+)
Average noise level High Power Input Low Power Input	 At RBW 300 Hz, VBW 1 Hz At input attenuator 20 dB ≤–100 dBm + 0.8 × f[GHz] dB (1.6 to 7.8 GHz, Band 1) At input attenuator 0 dB ≤–120 dBm + 0.8 × f[GHz] dB (1.6 to 7.8 GHz, Band 1)
Residual response	≤–90 dBm (1.6 to 7.8 GHz, Band 1, RF ATT: 0 dB, Input: 50 Ω termination)
Frequency response	50 MHz as reference At input attenuator: 30 dB (High Power Input) or 10 dB (Low Power Input), temperature: 18 to 28 °C ±1.0 dB (1.6 to 7.8 GHz, Band 1) At input attenuator: 20 to 82 dB (High Power Input) or 2 to 62 dB (Low Power Input), ±2.0 dB (1.6 to 7.8 GHz, Band 1) *After executing pre-select tuning.
2nd harmonic distortion	≤–90 dBc (0.8 to 3.9 GHz, Band 1, mixer input level: –10 dBm)
1 dB gain compression	≥0 dBm (1.6 to 7.8 GHz, Band 1)
Maximum dynamic range	≥120 dB–0.8 × f [GHz] dB (1.6 to 7.8 GHz, Band 1)

• Option 04: Digital resolution bandwidth

Resolution bandwidth (RBW)	Setting range: 10 Hz to 1 MHz (1-3 sequence) Bandwidth accuracy: ±10% (RBW ≥100 Hz), ≥10 % (RBW ≤30 Hz) Selectivity (60 dB : 3 dB): ≤5:1 (RBW ≥100 Hz), ≤5:1 Nominal (RBW ≤30 Hz) RBW switching deviation: RBW 3 kHz as reference, ±0.5 dB
Detection mode	Normal, Positive Peak, Negative Peak, Sample, RMS RMS: Displays average value between samples.
Span setting	Min. span: 1 kHz
Average noise level Level MS8609A	At RBW: 10 Hz, RF ATT: 0 dB [Without Option 08] ≤–136.5 dBm +1.5 × f [GHz] dB Nominal (1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm +1.5 × f [GHz] dB Nominal (2.5 GHz to 3.2 GHz, band 0) ≤–128.5 dBm Nominal (3.15 GHz to 7.8 GHz, band 1) ≤–119.5 dBm Nominal (7.7 GHz to 13.2 GHz, band 2) [With Option 08] ≤–134.5 dBm + 1.8 × f [GHz] dB Nominal (1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm + 1.8 × f [GHz] dB Nominal (2.5 GHz to 3.2 GHz, band 0) ≤–128.5 dBm Nominal (3.15 GHz to 7.8 GHz, band 1) ≤–119.5 dBm Nominal (7.7 GHz to 13.2 GHz, band 2)
MS8608A High Power Input	At input attenuator 20 dB [Without Option 08] ≤–116.5 dBm +1.5 × f [GHz]dB Nominal (1 MHz to 2.5 GHz, band 0) ≤–112.5 dBm +1.5 × f [GHz] dB Nominal (2.5 GHz to 3.2 GHz, band 0) ≤–112.5 dBm +0.8 × f [GHz] dB Nominal (3.15 GHz to 7.8 GHz, band 1) [With Option 08] ≤–114.5 dBm +1.8 × f [GHz] dB Nominal (1 MHz to 2.5 GHz, band 0) ≤–112.5 dBm +1.8 × f [GHz] dB Nominal (2.5 GHz to 3.2 GHz, band 0) ≤–112.5 dBm +0.8 × f [GHz] dB Nominal (3.15 GHz to 7.8 GHz, band 1)
MS8608A Low Power Input	At input attenuator 0 dB [Without Option 08] ≤–136.5 dBm +1.5 × f [GHz] dB Nominal (1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm +1.5 × f [GHz] dB Nominal (2.5 GHz to 3.2 GHz, band 0) ≤–132.5 dBm +0.8 × f [GHz] dB Nominal (3.15 GHz to 7.8 GHz, band 1) [With Option 08] ≤–134.5 dBm +1.8 × f [GHz] dB Nominal (1 MHz to 2.5 GHz, band 0) ≤–132.5 dBm +1.8 × f [GHz] dB Nominal (2.5 GHz to 3.2 GHz, band 0) ≤–132.5 dBm +0.8 × f [GHz] dB Nominal (3.15 GHz to 7.8 GHz, band 1)

• Option 05: Rubidium reference oscillator

Frequency	10 MHz
Aging rate	$\leq \pm 1 \times 10^{-10}$/month (23 to 28°C, refered to frequency after 60 min warm-up)
Starting characteristics	$\leq \pm 1 \times 10^{-9}$/7 minutes (at 25°C, after 7 min warm-up, refered to frequency after 60 min warm-up)
Temperature stability	$\leq \pm 1 \times 10^{-9}$, (0 to 45°C, referred to frequency at 25°C)

• Option 08: Pre-amplifier

Outline	When Pre-amplifier is On, the following performance is specified for the Main Unit specifications. (For the MS8608A, these are applied on Low Power Input.)
Gain	20 dB typical
Noise figure	6.5 dB typical (Input frequency ≤ 2 GHz), 12 dB typical (Input frequency > 2 GHz)
Frequency range	100 kHz to 3 GHz
Frequency band composition	Band 0: 100 kHz to 3.0 GHz, Band 1–: 3.15 to 6.3 GHz, Band 1+: 6.2 to 7.8 GHz, Band 2+: 7.7 to 13.2 GHz (MS8609A only) Pre-amplifier can be used only for Band 0.
Level measurement Level range Max. input range Average noise level	 Average noise level to +10 dBm +10 dBm At RBW 300 Hz, VBW 1 Hz, Input attenuator 0 dB ≤–137 dBm + 2.0 × f [GHz] dB (1 MHz to 3 GHz, Band 0)
Reference level setting range Log scale Linear scale	 –120 to +10 dBm, or the equivalent 2.24 uV to 707 mV
Reference level accuracy	After calibration; at frequency 50 MHz, span 1 MHz, and Auto of input attenuator, RBW, VBW and sweep time ±0.75 dB (–19.9 to +10 dBm) ±0.90 dB (–69.9 to –20 dBm) ±1.5 dB (–90 to –70 dBm)
RBW switching deviation	After calibration; RBW 3 kHz as reference ±0.5 dB (300 Hz to 5 MHz), ±0.75 dB (10 MHz, 20 MHz)
Input attenuator switching deviation	±0.5 dB (10 to 50 dB), 1.0 dB (52 to 62 dB)
Frequency characteristics	100 MHz as reference; at input attenuator 10 to 50 dB, temperature 18 to 28°C ±2.0 dB (100 kHz to 3 GHz)
Waveform display linearity Log scale Linear scale	 ±0.5 dB (0 to –20 dB, RBW ≤ 1 kHz) ±1.0 dB (0 to –60 dB, RBW ≤ 1 kHz) ±1.5 dB (0 to –75 dB, RBW ≤ 1 kHz) ±5% (Referred to reference level)
2-signal 3rd-order distortion	At frequency difference between 2 signal ≥ 50 kHz, input level*1 to pre-amplifier –55 dBm ≤–70 dBc (10 MHz to 3.0 GHz)
1-dB gain compression	At input level*1 to pre-amplifier ≥–35 dBm (≥100 MHz)

*1: Input level to pre-amplifier is as follows.
Input level to pre-amplifier = RF input level - Input attenuator setting value

• Option 09: Ethernet Interface

Outline	Controlled by external controller (Excluding power switch)
Connector	10 base-T

- **Option 32: Maximum input level Extension**

Main unit (Specifications for the items below are changed by mounting Option 32.)

Maximum allowable level	+30 dBm (1 W) average power for continuous wave
Power meter function Level range	 −14 to +26 dBm
Amplitude Level measurement Level measurement range Maximum input level Average power for continuous wave	 Average noise level to +30 dBm +30 dBm
Reference level Setting range Log scale Linear scale Reference level accuracy	 −100 to +40 dBm or equivalent level 22.4 μ to 22.4 V After calibration, with a frequency of 50 MHz, span of 1 MHz, and when input attenuator, resolution bandwidth, video bandwidth, sweeping time are set to Auto: ±0.75 dB (+0.1 to +30 dBm)

- **Option 33: High-accuracy power measurement**

Outline	Used in combination with W-CDMA measurement software improve power measurement accuracy without using the internal power meter in the transmission power measurement screen.
Frequency range	1848 to 2171 MHz (excluding ranges from1995 to 2105 MHz)
Transmission power measurement range	−50 to +20 dBm (average power)
Reference level	−20 to +20 dBm
Transmission power accuracy	When the reference level input is 25ºC ±3ºC and input attenuator is set to Auto after automatic calibration: ±0.4 dBm * Excluding mismatch error
Power measurement linearity	With input level of −10 dBm and without changing the level setting after range optimization: ±0.2 dB (0 to 40 dB)
Temperature coefficient	0.015 dB/ºC
Accessory	ATA flash memory card
Calibration interval	6 months

- **Option 35: Extension of frequency upper limit to 7.9 GHz (only for MS8608A)**

Outline	Expands upper frequency limit to 7.9 GHz.
Frequency band	Band 0: 9 kHz to 3.2 GHz, Band 1−L: 1.6 to 3.2 GHz, Band 1−: 3.15 to 6.3 GHz Band 1+: 6.2 to 7.9 GHz
Pre-selector range	3.15 to 7.9 GHz (Band 1−L, 1−, 1+)
Average noise level High Power Input Low Power Input	At RBW 300 Hz, VBW 1 Hz At input attenuator 20 dB ≤−100 dBm + 0.8 × f [GHz] dB (3.15 to 7.9 GHz, Band 1) At input attenuator 0 dB ≤−120 dBm + 0.8 f [GHz] dB (3.15 to 7.9 GHz, Band 1)
Residual response	≤−90 dBm (3.15 to 7.9 GHz, Band 1, RF ATT: 0 dB, Input: 50 Ω termination)
Frequency response	50 MHz as reference At input attenuator 30 dB (High Power Input) or 10 dB (Low Power Input), 18 to 28 °C ±1.0 dB (3.15 to 7.9 GHz, Band 1) At input attenuator 20 to 82 dB (High Power Input) or 2 to 62 dB (Low Power Input) ±2.0 dB (3.15 to 7.9 GHz, Band 1) *After executing pre-select tuning.
2nd harmonic distortion	≤−90 dBc (1.6 to 3.95 GHz, Band 1, mixer input level: −10 dBm)
1 dB gain compression	≥0 dBm (3.15 to 7.9 GHz, Band 1)
Maximum dynamic range	≥120 dB−0.8 × f [GHz] dB (3.15 to 7.9 GHz, Band 1)

• Option 46: Auto power recovery

Outline	Cancels the power switch on front panel and automatically recovers to power-on after power failure.

* This equipment enters the standby state when the line has to be disconnected and reconnected, because power switch on front panel doesn't have latch function. If this equipment is built into remote systems, please install this option.

• Option 47: Rack mount (IEC)

Outline	Attachment of rack mount which meets IEC spec The standard tilt handle is eliminated when rack mount kit is attached.

• Option 48: Rack mount (JIS)

Outline	Attachment of rack mount which meets JIS spec The standard tilt handle is eliminated when rack mount kit is attached.

Section 2 Preparations Before Use

This section explains the preparations and safety procedures that should be performed before using the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester. The safety procedures are to prevent the risk of injury to the operator and damage to the equipment. Insure that you understand the contents of the pre-operation preparations before using the MS8608A/MS8609A.

For connecting the GPIB cable and setting the GPIB address, see the Main Unit (Remote Control) of the Operation Manual Vol.1.

Installation Site and Environmental Conditions

Locations to be avoided

The MS8608A/MS8609A Digital Mobile Radio Transmitter Tester operates normally at temperatures from 0 to 50°C and below RH 85%. (When Option 05: Rubidium Reference Oscillator is mounted, its ambient temperature range becomes 0 to 45°C.) However, for the best performance, the following locations should be avoided.

- Where there is severe vibration
- Where the humidity is high
- Where the equipment will be exposed direct sunlight
- Where the equipment will be exposed active gases

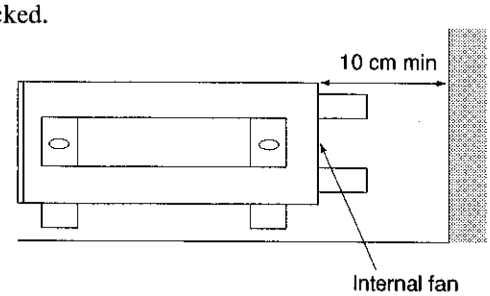
In addition to meeting the above conditions, to insure long-term trouble-free operation, the equipment should be used at room temperature and in a location where the power supply voltage does not fluctuate greatly.

CAUTION ⚠

If the MS8608A/MS8609A is used at normal temperatures after it has been used or stored for a long time at low temperatures, there is a risk of short-circuiting caused by condensation. To prevent this risk, do not turn the spectrum analyzer on until it has been allowed to dry out sufficiently.

Fan clearance

To suppress any internal temperature increase, the spectrum analyzer has a fan on the rear panel as shown in the diagram below. Leave a gap of at least 10 cm between the rear panel and the wall, nearby equipment or obstructions so that fan ventilation is not blocked.



Safety Measures

This paragraph explains the safety procedures which should be followed under all circumstances not to counter the risk of an accidental electric shock, damage to the equipment or a major operation interruption.

Power-on

WARNING ⚠

- **Before power-on: The MS8608A/MS8609A must be connected to protective ground. If the power is switched on without taking this countermeasure, there is a risk of receiving a accidental electric shock. In addition, it is essential to check the power supply voltage. If an abnormal voltage that exceeds the specified value is input, there is an accidental risk of damage to this MS8608A/ MS8609A and fire.**
- **During power-on To maintain the MS8608A/MS8609A, sometimes it is necessary to make internal checks and adjustments with the covers removed while power is supplied. Very-high, dangerous voltages are used in this spectrum analyzer, if insufficient care is taken, there is a risk of an accidental electric shock being received or of damage to the equipment. To maintain the MS8608A/ MS8609A, request service by a service personnel who has received the required training.**

In the following, special notes on safety procedures are extracted from sections other than Section 2.
To prevent accidents, read this section together with the related sections before beginning operation.

Input level to RF Input

Frequency range:	9 kHz to 7.8 GHz (MS8608A), 9 kHz to 13.2 GHz (MS8609A)
Measurement level:	Apply the measured signal with average noise level up to +40 dBm (MS8608A) or +20 dBm (MS8609A) to the N-type connector High Power (MS8608A) or RF (MS8609A) Input of 50 Ω input impedance, respectively.

CAUTION ⚠

The RF Input (MS8609A) and High/Low Power Input (MS8608A) circuits are not protected against excessive power.
If a signal exceeding +40 dBm (High Power Input of MS8908A) or 20 dBm (RF Input of MS8609A and Low Power Input of MS8608A) is applied, respectively; the power sensor, input attenuator and input mixer may be burned.
⚠ is a warning mark to prevent such damage.

Caution of handling the RF Input Connector

Use the N-type connector for the RF Input of the MS8609A and High Power Input of the MS8608A, and SMA-type connector for the Low Power Input of the MS8608A. If different connector is connected, there is an accidental risk of damage to the RF input connector.

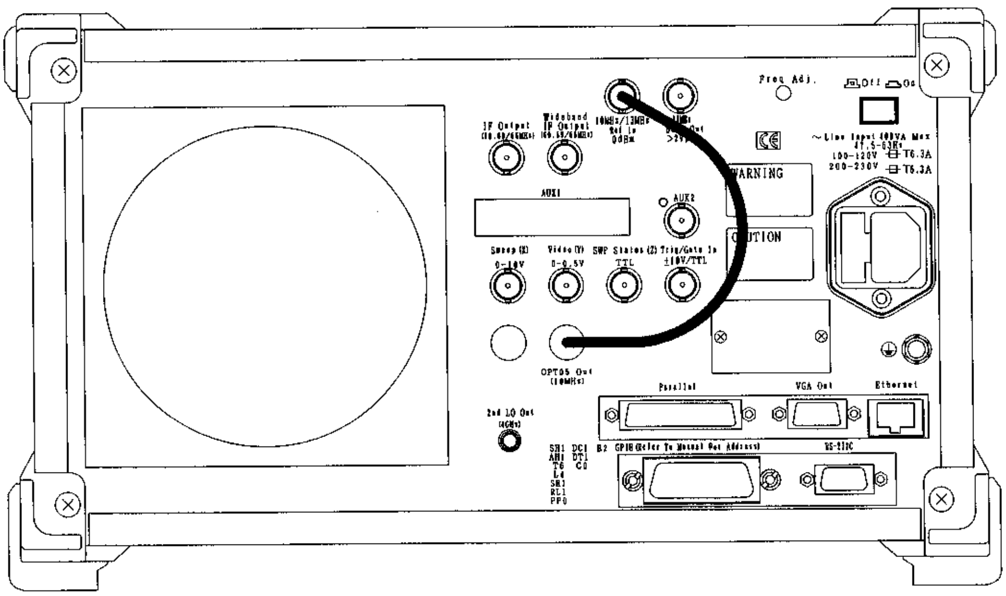
Installation

Rack mounting

The Option 47 Rack Mount (IEC) or Option 48 Rack Mount (JIS) (sold separately) is required to mount this unit in a rack.
The installation method is included in the rack mount kit diagram.

Using Option 05 Rubidium reference oscillator

Connect the connectors at rear panel with the J1066 coaxial cord of an accessory for Option 05, as shown below.



Preparations Before Power-on

This unit operates normally when it is connected to an AC 85 to 132 V, or AC 170 to 250 V (wide voltage range input) 47.5 to 63 Hz AC power supply. To prevent the following problems, take the necessary procedures described on the following pages before power is supplied.

- Accidental electric shock
- Damage caused by abnormal voltage
- Ground current problems

Note:

- The voltage and current rating are indicated on the rear panel when the instrument is shipped from the factory.
- In this manual, the power supply voltage and current ratings are represented by AC ** Vac and *** A, respectively.

To protect the operator, the following WARNING and CAUTION notices are attached to the rear panel of the MS8608A/MS8609A.

WARNING ⚠
NO OPERATOR SERVICE-
ABLE PARTS INSIDE.
REFER SERVICING TO
QUALIFIED PERSONNEL.

CAUTION ⚠
FOR CONTINUED FIRE
PRORECTION REPLACE
ONLY WITH SPECIFIED
TYPE AND RATED FUSE.

CAUTION ⚠

Replace fuses with the specified type and the rated voltage and current. Or, there may be a risk of fire.

WARNING ⚠

Disassembly, adjustment, maintenance, or other access inside this instrument by unqualified personnel should be avoided. Maintenance of this instrument should be performed only by Anritsu trained service personnel who are familiar with the risk involved of fire and electric shock. Potentially lethal voltages existing inside this instrument, if contacted accidentally, may result in personal injury or death, or in the possibility of damage to precision components.

Always follow the instructions on the following pages.

Protective grounding

(1) Grounding with 3-pole power outlet

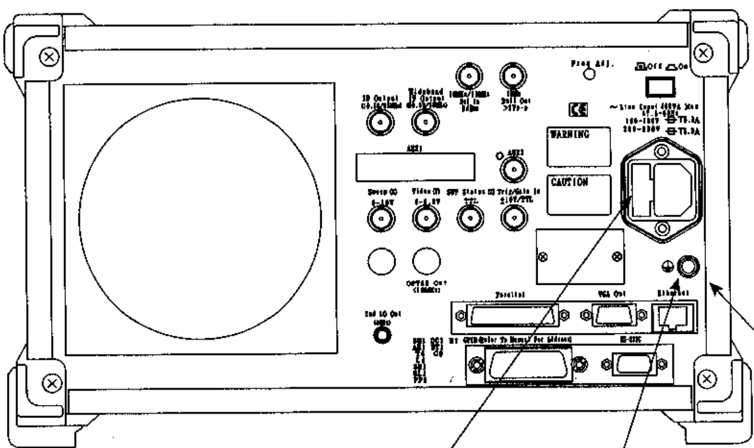
When connecting to a 3-pole (grounded, 2-pole type) AC power-supply outlet, the frame of the MS8608A/MS8609A is connected to ground potential. As a result, it is not necessary to connect the FG terminal to ground. And the 3-pole to 2-pole conversion adapter is not required.

(2) Grounding with frame ground (FG) terminal

When there is no 3-pole AC power-supply outlet, the protective frame-ground (FG) terminal on the rear panel must be connected directly to ground potential.

WARNING ⚠

If power is supplied without protective grounding, there is a risk of accidental electric shock. When a 3-pole AC power-supply outlet is not available, the protective frameground (FG) terminal on the rear panel, or the ground pin of the supplied power cord must be connected to ground potential before power is supplied to this instrument.



Replacing fuse

WARNING ⚠

- If the fuses are replaced while power is supplied, there is a serious risk of electric shock. Before replacing the fuses, set the power switch to OFF and remove the power cord from the power outlet.
- If power is supplied without protective grounding, there is a risk of accidental electric shock. In addition, if the AC power supply voltage is unsuitable, there is a risk of the internal circuits of the MS8608A/MS8609A being damaged by the abnormal voltage. Before supplying power again after changing the fuses, check that the protective grounding described previously is still connected, and check that the AC power supply voltage is suitable. Then, set the power switch to ON.

CAUTION ⚠

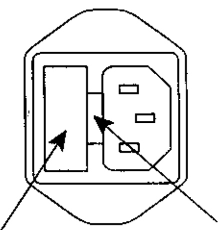
When there are no supplied spare fuses, the replacement fuses must have the same rated voltage and current as the fuses in the fuse holders.

- If the replacement fuses are not of the same type, they may not fit correctly, there may be a faulty connection, or the time taken to for the fuses to blow may be too long.
- When an abnormality occurs again, if the voltage and current rating of the fuses is incorrect, the fuses may not blow with a consequent risk of damage to the equipment by fire.

This instrument with standard accessories has a spare fuse. The fuse is mounted in the fuse holder and must be replaced if they blow. If the fuse must be replaced, locate and remedy the cause before replacing the blown fuse.

After performing the safety procedures described on the preceding page, replace the fuse according to the following procedure.

Step	Procedure
1	Set the front-panel [Power] switch to Stby and the rear-panel [Line] switch to OFF. Then, remove the power cord from the power-supply outlet.
2	Catch the gap with pen point, and remove the fuse-holder to pull forward. The cap and fuse are removed as a unit from the fuse holder.



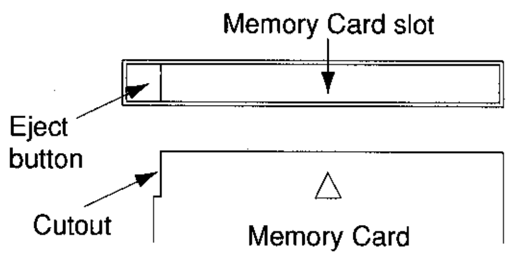
Step	Procedure
3	Remove the fuse from the fuse cap and replace it with a spare fuse. (The direction does not matter.)
4	Return the fuse cap with fuse to the fuse holder.

Precaution for Handling Memory Card

The MS8608A/MS8609A use an ATA flash card as the memory card.
Notes on using the ATA flash card are given bellow:

- Never remove the ATA flash card while it is being accessed. If it is removed while it is being accessed, data on it will be lost and the card may be damaged.
- The ATA flash card may be damaged if static electricity is applied to it. Therefore, it is recommended that you make a back up of the ATA flash card. Anritsu accepts no liability for the loss of data on the ATA flash card.

- Installing Memory Card
  Install the memory card to this instrument, with the cutout of the card at the position as shown below. One card can be installed.



- Removing Memory Card
  Push the left eject button to remove the memory card.

ATA card list

<Name>	<Model No.>
ADTEC Compact Flash Card 16M	AD-CFD16
EPPSON ATA-Card 10M	SEATA-10M
EPPSON ATA-Card 15M	SEATA-20M
FUJISOKU ATA-Card 12M	JT12MA3-BD
FUJISOKU ATA-Card 20M	JT20MA3-BD
FUJISOKU ATA-Card 40M	JT40MA3-BD
Panasonic ATA-Card 8M	BN-008AB
TDK Compact Flash 16MB	TCO16H
BUFFALO Compact Flash Card 15MB	RCF-C
ScanDisk Compact Flash Card 32MB	SDCFB

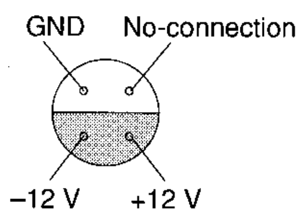
Section 3 Panel Description

In this section, the front and rear panels (Figs. 3-1 and 3-2) are described about the case in which all the options are attached to.

Table of Front and Rear Panel Features

No.	Panel Marking	Explanation of Function
1	(LCD)	This is a 6.5 inch type color TFT liquid crystal display (LCD). It displays the trace waveforms, the parameter settings, the values of marker, and the soft menu keys, etc.
2	Spectrum	This sets the MS8608A/MS8609A to the spectrum analyzer mode.
3	Tx Tester	This sets the MS8608A/MS8609A to the transmitter (Tx) tester mode in which the measurement software operates.
4	Config	This displays the setup menu for GPIB interface or printer, etc.
5	F 1 - F 6	These are the soft keys for selecting the soft-key menus linked to the panel key operation. [More] This displays the next page of soft-key menus.
6	Freq/Ampl	This is the frequency and level parameter data input section. [Freq/Channel] Sets frequency. [Span] Sets frequency span. [Amplitude] Sets reference level. [–> CF] Sets peak level signal frequency on screen to center frequency. [–> RLV] Sets peak level on screen to reference level.
7	Marker	This section is related to operation of marker functions. [Marker] Sets marker. [Multi Mkr] Sets multimarkers. Press this key after pressing the [Shift] key. [Peak Search] Moves marker to currently-displayed peak level. [Marker –>] Sets parameter according to marker value. Press this key after pressing the [Shift] key.
8	System	This switches the measurement system in Tx tester mode.
9	Single	This sets the sweep mode. [Single] Executes single sweep. [Continuous] Executes continuous sweeping. Press this key after pressing the [Shift] key. The initial default is continuous sweeping.

No.	Panel Marking	Explanation of Function	
10	Recall	This executes recall/save.	
		[Recall]	Reads measurement parameters and waveform data from internal memory or memory card.
		[Save]	Saves measurement parameters and waveform data to internal memory or memory card.
11	Measure	This menu is for performing the various application measurements including frequency measurement, noise measurement, adjacent-channel leakage power measurement, etc.	
12	Hi Power	This sets the RF input connectors. The MS8609A have not this key.	
		[High Power]	Enables the High Power input connector.
		[Low Power]	Enables the Low Power input connector.
13	Display	This section is for selecting the trace waveform. Normally, in the frequency domain, up to two trace waveforms can be displayed. The zero-span (Time Domain) mode is selected simply by pressing the [Time] key.	
		[A, B]	Displays trace A or B waveform in frequency domain.
		[A/B, A/BG]	Displays trace A and B waveforms simultaneously, or displays trace A and BG (background frequency spectrum including trace A) simultaneously.
		[Time]	Switches to zero span (Time domain) mode to display time domain waveforms.
		[A/Time]	Displays trace A and the time domain waveform simultaneously.
14	Trig/Gate	This sets the trigger/gate functions.	
		[Trig/Gate]	Sets the sweep-start trigger and gate (to control waveform-data write timing) functions.
15	Coupled Function	This sets the RBW, VBW, sweep time and input attenuator.	
16	Entry	These keys set the numeric data, units and special functions.	
		[Rotary knob]	Used for moving marker and inputting data.
		[∨ , ∧]	Increments and decrements input data.
		[Shift]	To execute panel functions indicated by blue letters, press this key and then press the blue-lettered key.
		[BS]	Backspace key for correcting input mistakes.
		[0-9, . , +/–]	Numeric-data setting keys.
		[GHz, MHz, kHz, Hz]	Units keys for frequency, level, time, etc.
		[set]	Key for setting parameters.
		[Cancel]	This cancels the entry which is able to set with [set] key.

No.	Panel Marking	Explanation of Function
17	Preset	This sets the measurement parameters to the default values.
18	Local	This changes the remote status to the local status.
19	Disp On/Off	This sets the liquid crystal display On/Off.
20	Copy	This outputs a hard copy of the screen to a printer or memory card.
21	Stby/On	This is the power switch. It can be used when the back-panel power switch is on. The power-on condition is fetched from the Stby condition when the key is pressed for about 1 seconds. The equipment is returned to the Stby condition from the power-on condition when the key is pressed again for about 1 second.
22	RF Input	This is the RF input connector.
23	I/Q Input	This is the I/Q Input connector. (Input I and Q for Unbalanced, and $I/\bar{I}$ and $Q/\bar{Q}$ for Balanced.)
24	Probe Power	This is the connector that supplies ±12V for a FET probe. Pin allocation is shown below. 
25	Memory Card	This is the slot to set memory cards which save/load the waveform data and measurement parameters etc.
50	(Fan)	This is the cooling fan for ventilating internally-generated heat. Leave a clearance of at least 10 cm around the fan.
51	10 MHz STD	They are the input connector for an external reference crystal oscillator and the output connector of the 10 MHz Reference signal. When an external reference signal is input, the equipment switches automatically from the internal signal to the external signal. If an external signal is input, the heater of the internal OCXO is switched off.
52	IF Out put	This is the IF output connector. This signal is bandwidth controlled by the RBW setting.

No.	Panel Marking	Explanation of Function
53	Wideband IF OUT	This is the wideband IF output connector. This signal is not bandwidth controlled by the RBW setting.
54	Sweep (X)	This is an output connector for sweep signal (X).
55	Video (Y)	This connector, outputs a Y-axis signal that is proportional to the video detection signal output, is band-limited according to the RBW set value, and is logarithmically compressed at log scale.
56	Sweep Status (Z)	This is an output connector for sweep status signal (Z).
57	Trig/Gate In (±10 V)	This is an input connector for external trigger/gate signal.
58	Off/On	This is the AC line power switch.
59	(Inlet)	This is the fused AC power inlet to which the supplied power cord is connected. It contains a time-lag fuse.
60	(Ground Terminal)	Connect this frame ground terminal to ground to prevent risk of an accidental electric shock.
61	Parallel	This is the Parallel connector. Connect it to a printer.
62	VGA Out	This is the VGA signal output connector.
63	GPIB	This connector is for use with a GPIB interface. It is connected to an external system controller.
64	RS-232C	This is the RS-232C connector. Connect it to an external system controller.
65	Ethernet	This is the 10 Base-T connector for Ethernet. Connect this to the external system controller.
66	Name plate	This shows a production number and options.
67	OPT05 Out	This is an output connector for Option 05 Rubidium reference oscillator (10 MHz). Connect this connector to the 10 MHz/13 MHz Ref In connector using the J1066 coaxial cord of an accessory for Option 05.

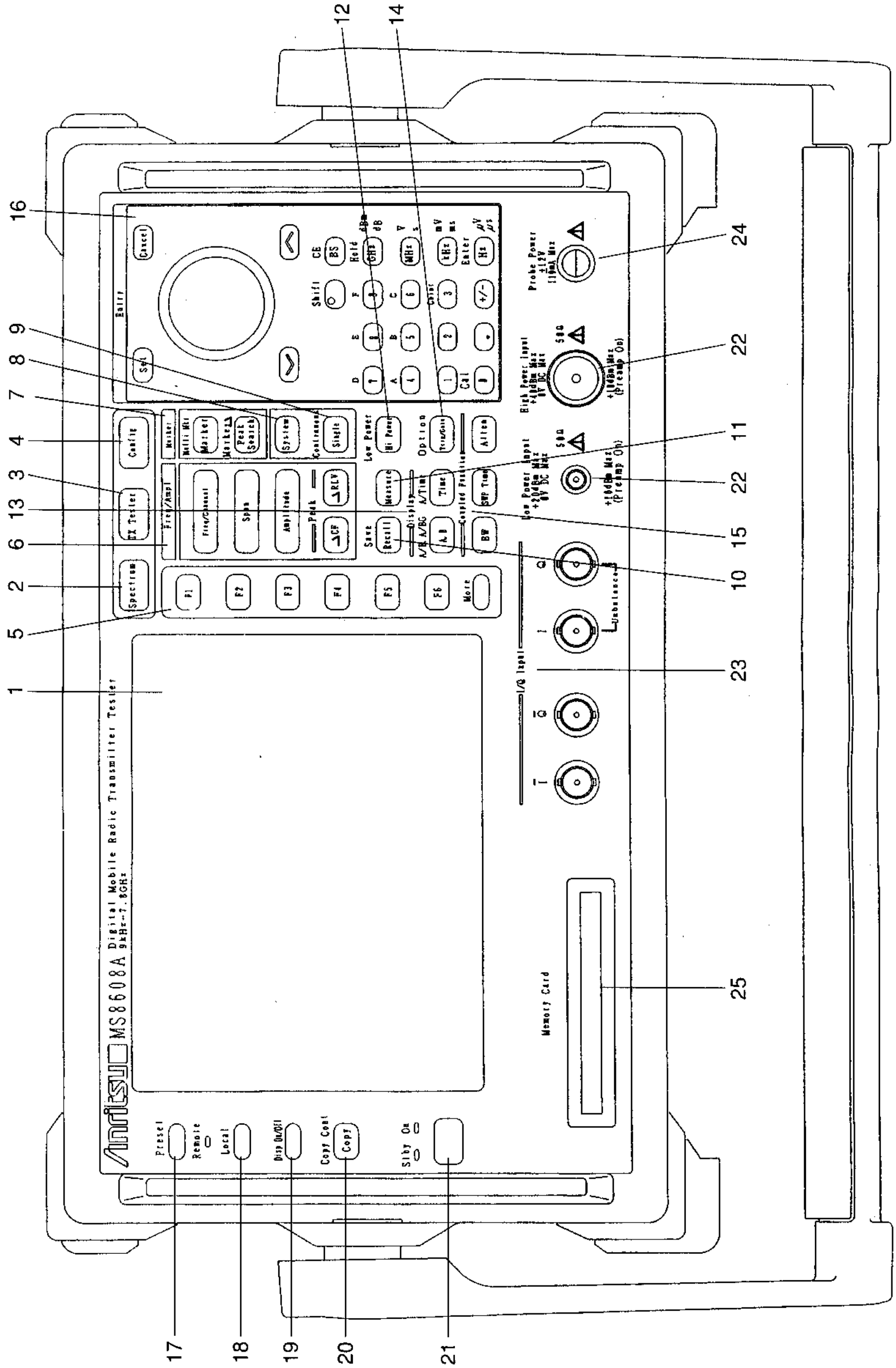


Fig. 3-1 Front Panel

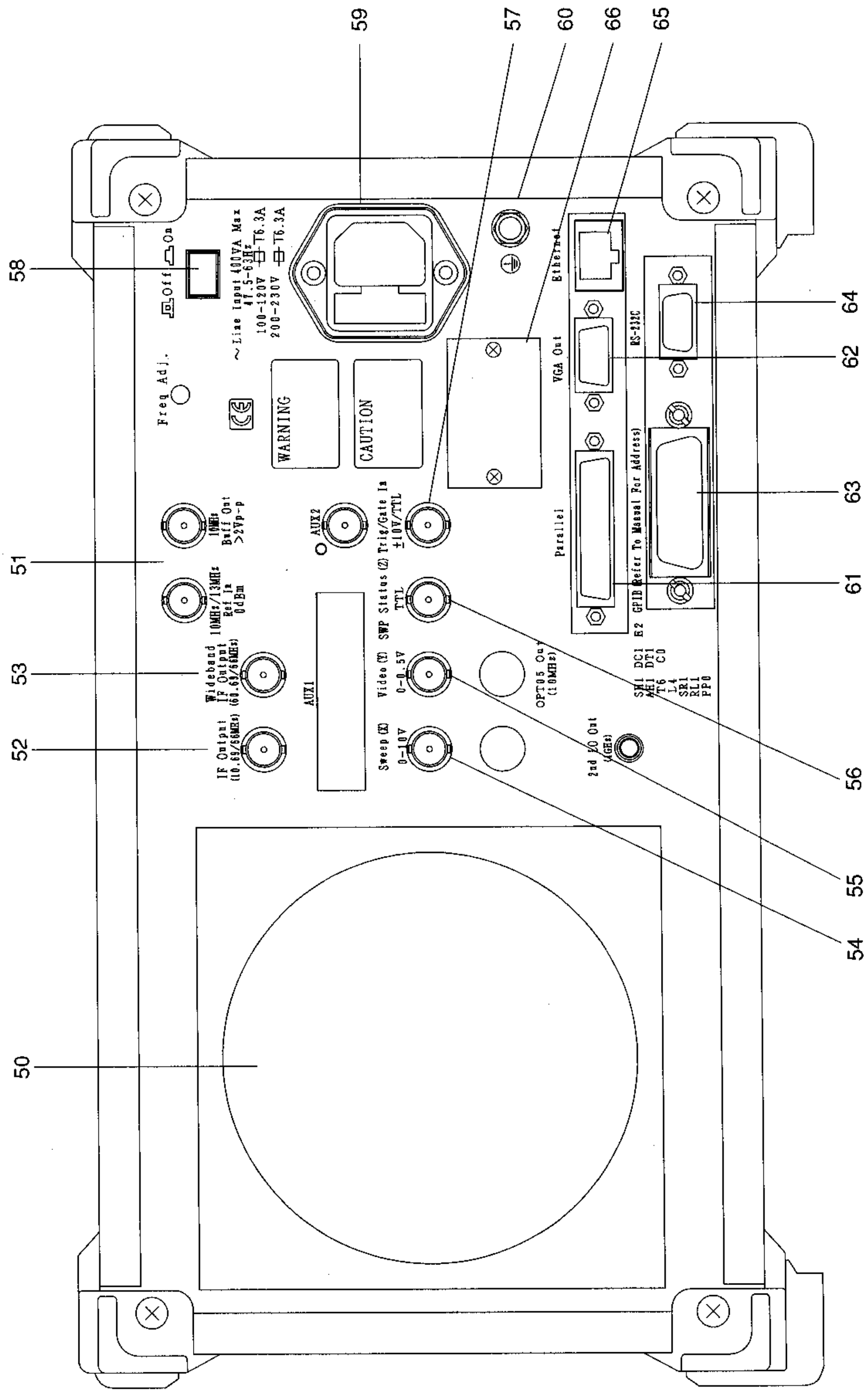


Fig. 3-2 Rear Panel

Section 4 Basic Operation Procedure

The basic operation procedure of this equipment is explained here. The operations are listed on the right. Also, the explanation will advance assuming that a 500 MHz signal is applied to the input connector. Please refer to this manual while operating this equipment.
(⬭ : Panel key, ____ : Soft key)

<Actual operations>

(I) Signal display
1) Turn the power on,
2) Move to spectrum analyzer mode,
3) Execute automatic calibration,
4) Set the signal to the center of the screen, and
5) Enlarge and display the signal.

(II) Marker operation
Check of the zone marker function.
The "marker → CF" function check.

(III) "Measure" function check

(IV) Screen hard copy

Signal Display

Turn the power on

Press the standby button on the rear panel, then press the power switch on the front panel. In this case, continue pressing the power switch for one second or more.

The power is turned on/off only when the power switch is pressed for one second or more. This prevents the power from being turned on/off easily by mistake.

Move to spectrum analyzer mode

Press (Spectrum) key.

Pressing this (Spectrum) key moves any mode to the spectrum analyzer mode. In the spectrum analyzer mode, the transmitter tester function (using a measurement software) cannot be performed.

Press (Preset) key.

Press Preset All key in the menu.

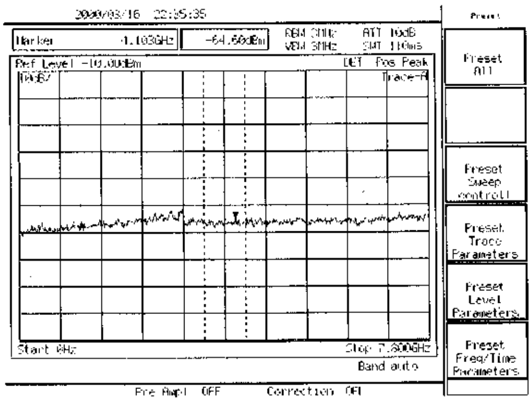


Fig. 4-1

Rule and features of operation

When (panel) key (hard key) is pressed, the related soft key menu is displayed.

Partial resettings are enabled. This resetting includes only the display-related resetting or the resetting of special modes such as zone sweep.

Execute automatic calibration

Wait after switching on the power supply of the machine (warm up period) till the internal temperature becomes stable. This period is approximately 10 minutes.

After warm up, execute automatic calibration.

Press (Shift) key then (0) key. (CAL)

Select All Cal from the menu displayed on the display.

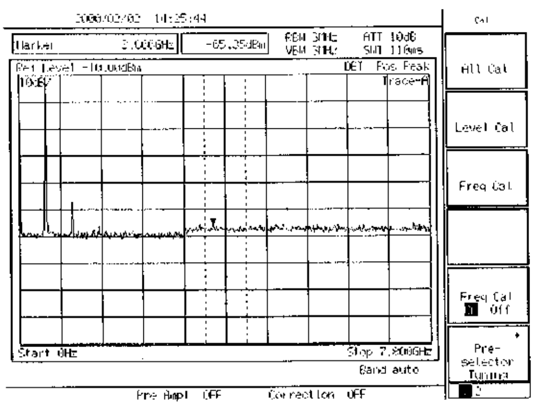


Fig. 4-2

Automatic Calibration is carried out by using an internal source without need for any external cable connection.
See Vol.2 Section 8 for detail information about contents of calibration.

Set the signal to the center of the screen

Press (Freq/Channel) key.

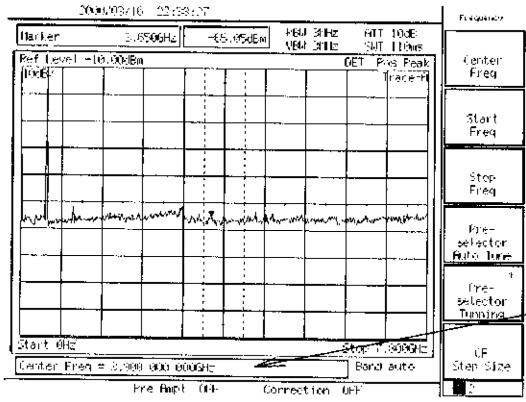


Fig. 4-3

When pressing Frequency, Span, Amplitude or Coupled Function key (s) which is used frequently, Center Frequency, Span, Reference Level, RBW or VBW function is selected and numeric value for the function can be entered into Entry area. This reduce key operation times.

This display section is called Entry area. Selecting the menu displays the current set value of the parameter. The set value can be changed by entering data in Entry area.

Press (Shift) (GHZ) key (Hold)

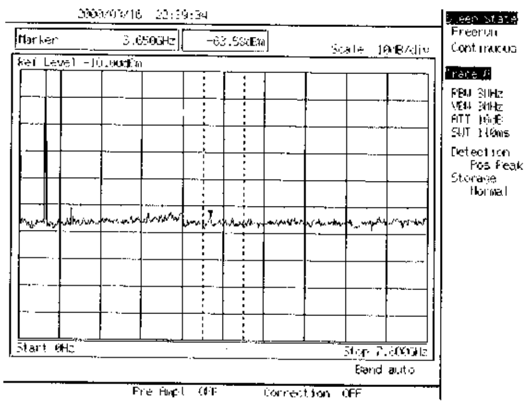


Fig. 4-4

The display of the soft key menu can be erased using (Shift) (GHZ) (Hold) key. When the menu disappears, the set up parameters are displayed.

Press (Freq/Channel) key, then use the ten-key pad (numeric keys) to enter 500 MHz (press (5) (0) (0) (MHz) keys).

The following three methods to input numeric values to parameters are provided: direct input by the ten-key pad (numeric keys), up/down keys, and rotary knob.

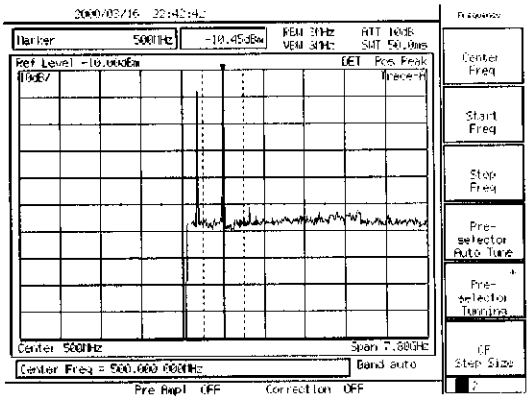


Fig. 4-5

Enlarge and display the signal

Press (Span) key , then press the (﹀) down key several times to enlarge the signal display.

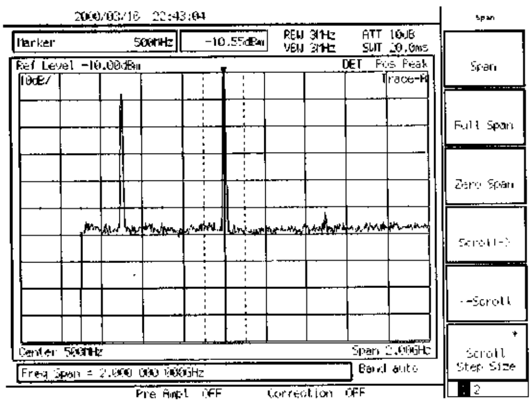


Fig. 4-6

Marker Operation

Here, check that the signal frequency and level are displayed in a marker display area. The zone marker automatically fetches the highest level signal within the zone and displays the frequency and level.

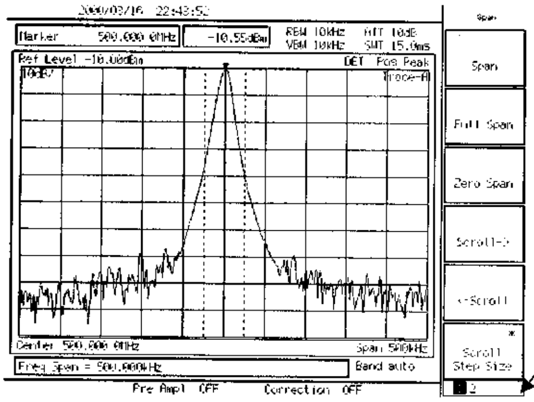


Fig. 4-7

The following items can easily be checked by the soft key menu tab: How many pages of the soft key menu being displayed currently are there?, and what page is displayed now?

To turn over the page, press (More) key.

To check Marker → CF function, shift the signal from the center intentionally.
Press (Span) key, and then Scroll → key two times.

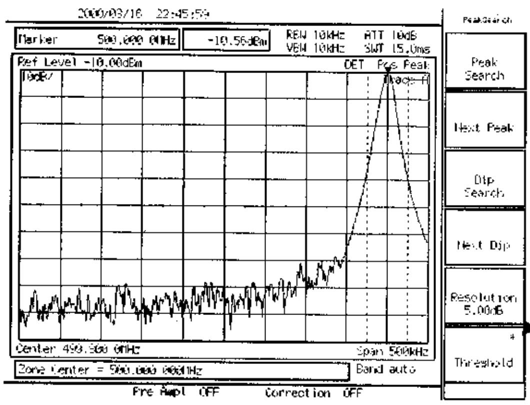


Fig. 4-8

The soft key menu marked by an asterisk on the upper right indicates that the menu can further be opened by pressing the key. Adversely, the soft key menu not marked indicates that the menu cannot be opened any more, so to speak, the end of menu opening.

Press (Peak Search) key.
Then, press Peak Search function key.

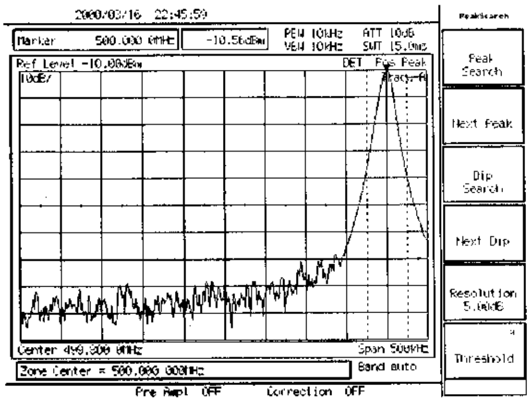


Fig. 4-9

*Advanced operation memo: It is convenient that the page can also be turned over by repeatedly pressing the panel key. This method is used when key (s), such as (Measure) key, has a number of pages. Besides, the Freq/Ampl and Marker-related keys do not turn over the page by repeatedly pressing the panel key. For these keys, because the first page is important especially, it should always be displayed when the panel key is pressed.

The marker fetches the signal.

Press (Shift) (Marker → Peak Search) key.

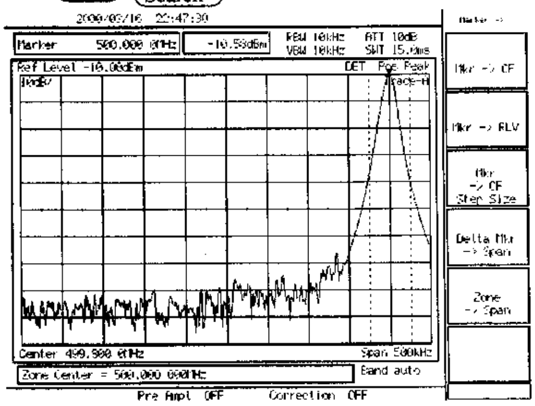


Fig. 4-10

Press marker → CF key.

The signal moves to the center of the screen.

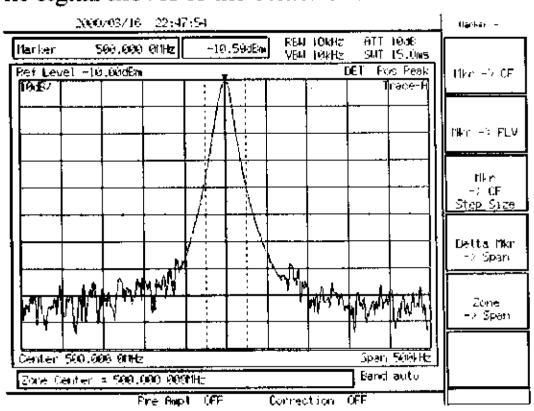


Fig. 4-11

The page opened by pressing the soft key can return to the preceding page by the Return key. Besides, it can be checked that which soft key menu was pressed previously to open the current menu, as the menu title is displayed on the upper row of the soft key.

Here, return to the screen of Fig. 4-8 and ensure that the screen changes to that of Fig. 4-11 only by pressing the (→ CF) key.

"Measure" Function Check

Press (Preset) key and Preset All key in order.
Press (Peak Search) key.
If the zero beat signal level (local feed through) is larger than the signal level and the marker fetches the zero beat level, press Next peak key and put the marker on the signal (frequency 500 MHz).

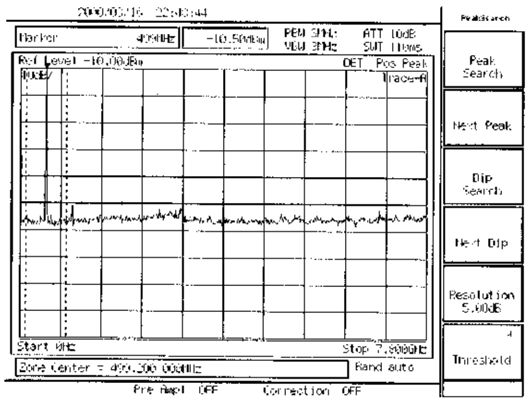


Fig. 4-12

Press the (Measure) key and Frequency Count key to set the function of high accuracy frequency measurement of the marker points.
Then, press the Count On key and start measurement.

From the screen after executing measurement, press another panel key and change parameters, and then, pressing again the (Measure) key will automatically return to the menu of this screen and not to page 1 of the menu (page learning function).
It is a useful function when repeating measurement.

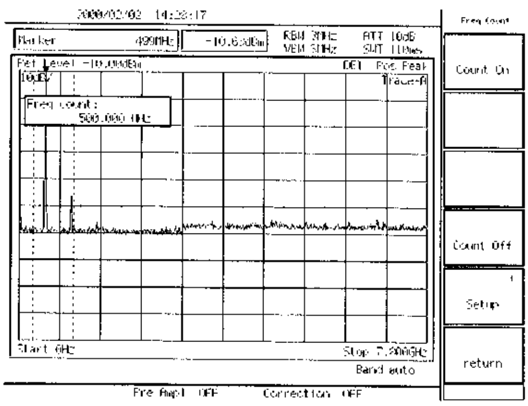


Fig. 4-13

The frequency of marker point is displayed at the top left of the screen.
Incidentally, the internal counter correctly operates even at the full span condition, so an operation to reduce frequency span otherwise required is not necessary in this model.

Shifting of result position

Press (Measure) key and Result Position* key in order.

User can select a displayed position of measured result from 4 patterns. Displayed position is upper right, upper left, lower right, or lower left.

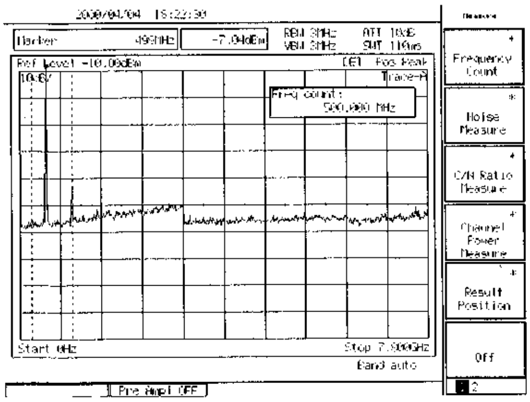


Fig. 4-14

Section 5 Setting Functions

This section explains the operational settings for the MS8608A/MS8609A and how to switch the mode between the transmitter tester mode and the spectrum analyzer mode. Refer to the separate "Vol. 2 Spectrum Analyzer Function" for details of the spectrum analyzer mode. For details of the transmitter tester mode, refer to the separate operation manual for each measurement system. In this section, the symbol ( ) represents a panel key.

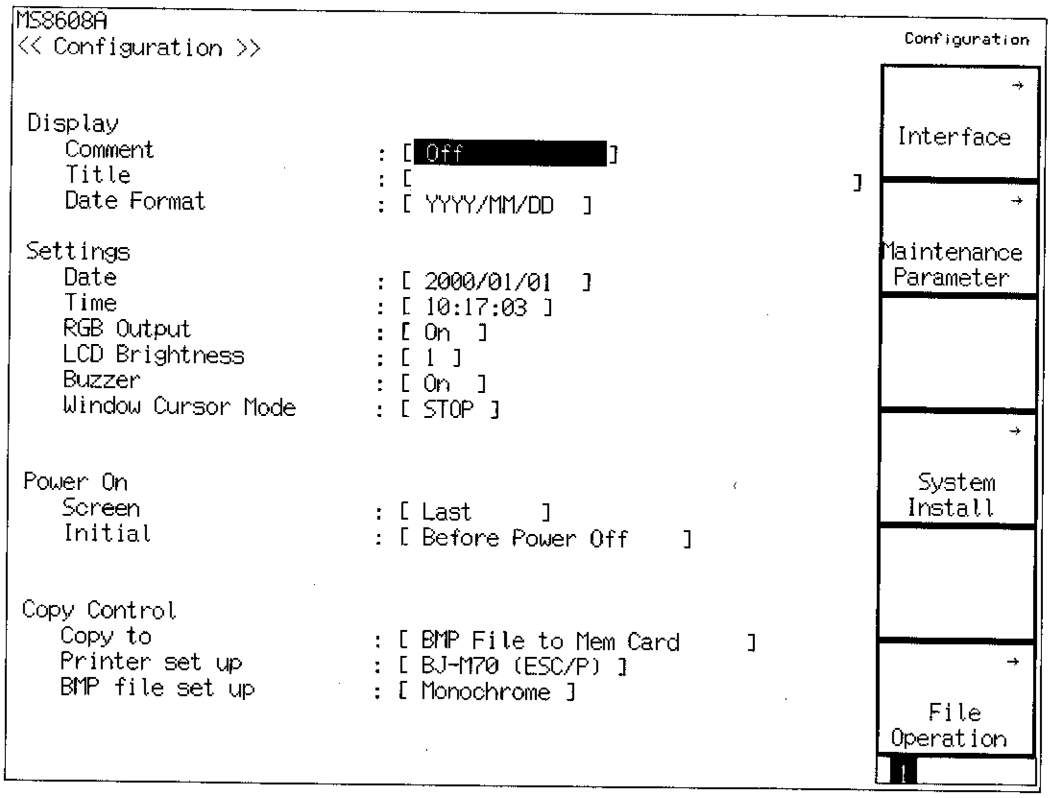
Setting Operation Status

This section explains the basic settings of the MS8608A/MS8609A.

The basic operation status settings can be made on the Config screen.

Press the (Config) key to display the Config screen.

The Config screen is shown below:



Setting Title (Display)

This section explains how to set a title on the title area (top of the display).
The title items that can be set are the comment, title, and format of date.

Setting comment

Step	Procedure
1	Move the cursor to "Comment" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to the item (Off, Clock, Title, or Clock&Title) to be selected using the (∧) (∨) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the item selected above is displayed on the title area of the Config Screen.
The following items are selectable:

- Off: Displays the product model name.
- Clock: Displays the product model name and the time.
- Title: Displays the product model name and the set title.
- Clock&Title: Displays the product model name, time and the set title.

Setting title

Step	Procedure
1	Move the cursor to "Title" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The title input window appears.
4	Input the title. See the paragraph "Inputting Title" below for details of the title input method.
5	Exit the title input screen.

After the title input is completed, the title appears in the square brackets [ ] in the "Title" field.
When "Title" or "Clock&Title" is selected in "Comment", the title set here is displayed.

Setting date format

Move the cursor to "Date Format" in the same manner on "Comment" and then set the date format. After the setting is completed, date is displayed by the selected format in the square brackets [ ] in the "Date Format" field.
The following formats are available:

- YYYY/MM/DD: The date is displayed in the format "2000/12/31"
- DD-MMM-YYYY: The date is displayed in the format "31-Dec-2000"
- MMM-DD-YYYY: The date is displayed in the format "Dec-31-2000"

Inputting Title

After the title input screen is displayed, follow the steps below:

Step	Procedure
1	Move the cursor to the character input position in the entry area by pressing the (F1) (←) or (F2) (→) key.
2	Select the character to be input on the character table by moving the cursor using the (∧) (∨) Entry keys or the rotary knob.
3	Confirm the selected input character by pressing (F3) (Enter), then the confirmed character is entered on the cursor position in the entry area.
4	To insert a character into the character string on the cursor position in the entry area, select the desired character and press (F4) (Insert).
5	Input a title by repeating Steps 2 to 4.
6	After the title input is completed, press the (Set) Entry key to go back to the Config screen from the title input screen.

After the title setting is completed, the title appears in the square brackets [ ] in the "Title" field.

On the title input screen, you can insert/delete characters or delete the whole title, as follows.

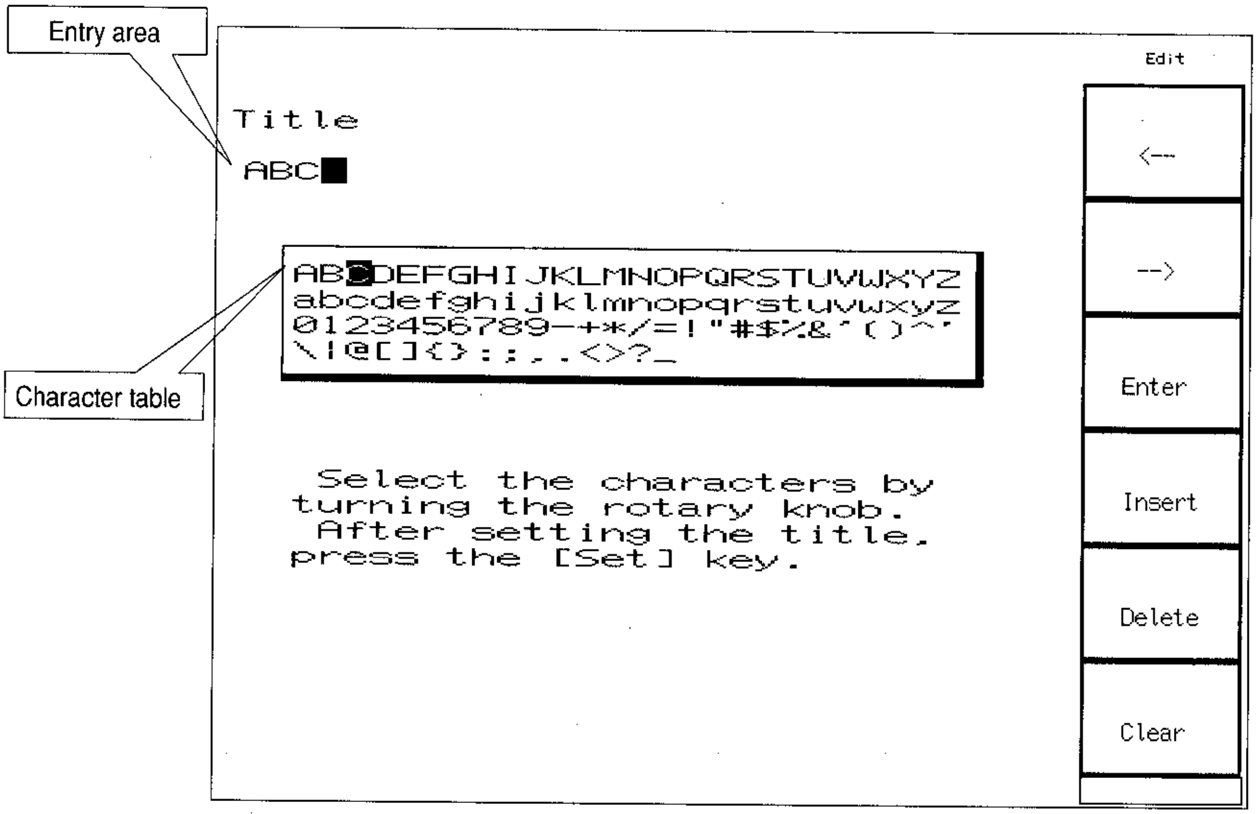
(F4) (Insert): The character at the cursor position on the character table is inserted at the cursor position in the entry area.

(F5) (Delete): The character at the cursor position in the entry area is deleted.

(F6) (Clear): The whole character string displayed in the entry area is cleared.

Note:

If (Cancel) key is pressed instead of (Set) key in Step 6 above, the input title is canceled and the screen returns to the Config screen.



Setting Connection to External Monitor (CRT)

Perform the following settings to use an external monitor connected to the RGB Output connector on the rear panel.

Step	Procedure
1	Move the cursor to "RGB Output" using the ∧ ∨ Entry keys or the rotary knob.
2	Press the Set Entry key.
3	The selection window opens.
4	Move the cursor to "On" or "Off" using the ∧ ∨ keys or the rotary knob.
5	Press the Set key.

After the setting is completed, the selected "On" or "Off" is displayed in the square brackets [ ] in the "RGB Output" field. An external monitor can be used when "On" is set.

Adjusting LCD Brightness (LCD BRIGHTNESS)

Adjust the brightness of the LCD display, as follows:

Step	Procedure
1	Move the cursor to "LCD Brightness" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Set the brightness value using the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set value appears in the square brackets [ ] in the "LCD Brightness" field. When using an external controller, this item can be set to Off. However, it cannot be set to Off by the panel operation.

Setting Alarm Sound On/Off (Buzzer)

Set the buzzer (that sounds when an invalid value is set) on or off, as follows:

Step	Procedure
1	Move the cursor to "Buzzer" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "On" or "Off" using the (∧) (∨) keys or the rotary knob.
5	Press the [Set] key.

After the setting is completed, the set "On" or "Off" is displayed in the square brackets [ ] in the "Buzzer" field. The buzzer sounds as an alarm when "On" is set.

Setting Window Cursor Operation Mode (Window Cursor Mode)

Set the movement of the cursor in a window, as follows:

Step	Procedure
1	Move the cursor to "Window Cursor Mode" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "TURN" or "STOP" using the (∧) (∨) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set "TURN" or "STOP" is displayed in the square brackets [ ] in the "Window Cursor Mode" field. If you try to move the cursor in the same direction when it has reached the end of a window, the cursor moves as follows:

- TURN: The cursor moves the opposite end of the window after it reaches the end of a window.
- STOP: The cursor stops when it reaches the end of a window.

Setting Date and Time

Set the internal date and time of the MS8608A/MS8609A, as follows:

Setting Date

Step	Procedure
1	Move the cursor to "Date" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The setting window opens.
4	Move the cursor to "Year", "Month" and "Day" to be set using the (∧) (∨) keys.
5	Set the Year/Month/Day values using the numeric keys or the rotary knob.
6	Press the (Set) key.

This sets the date.

Setting Time

Step	Procedure
1	Move the cursor to "Time" using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The setting window opens.
4	Move the cursor to "Hour", "Minute" and "Second" to be set using (∧) (∨) keys.
5	Set the Hour/Minute/Second values using the numeric keys or the rotary knob.
6	Press the (Set) key.

This sets the time.

Setting Start-up Screen (Screen)

Set the start-up screen, as follows:

Step	Procedure
1	Move the cursor to "Screen" using the (︿) (﹀) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "Spectrum", "System" or "Last" using the (︿) (﹀) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set "Spectrum," "System" or "Last" appears in the square brackets [ ] in the "Screen" field.

- Spectrum: Always starts up in the Spectrum Analyzer screen when the power is turned on.
- System: Always starts up in the Measurement System screen when the power is turned on.
- Last: The screen (displayed immediately before the previous power off) appears when the power is turned on.

Setting Initial State (Initial)

Set the initial state immediately after power-on, as follows:

Step	Procedure
1	Move the cursor to "Initial" using the (︿) (﹀) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "Before Power Off" or "Fixed State" using the (︿) (﹀) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set "Before Power Off" or "Fixed State" appears in the square brackets [ ] in the "Initial" field.

- Before Power Off: Starts up in the status immediately before the previous power-off. Initialization is not performed.
- Fixed State: Initialized at power-on. (However, the parameters in Config screen are not initialized.)

Setting Copy Destination (Copy to)

Set the copy destination, as follows:

Step	Procedure
1	Move the cursor to "Copy to" using the (︿) (﹀) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "Printer" or "BMP file to Mem Card" using the (︿) (﹀) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set "Printer" or "BMP file to Mem Card" appears in the square brackets [ ] in the "Copy to" field.
This item can also be set using the "Copy Cont" function explained in the paragraph "Setting Print Destination".

- Printer: Outputs a BMP file image to the printer.
- BMP file to Mem Card: Outputs a BMP file to the memory card.

Setting Printer Type (Printer setup)

Set the printer type to be used, as follows:

Step	Procedure
1	Move the cursor to "Printer set up" using the (︿) (﹀) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "BJ-M70" or "HP 815C" using the (︿) (﹀) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set "BJ-M70" or "HP 815C" appears in the square brackets [ ] in the "Printer set up" field.
This item can also be set using the "Copy Cont" function explained in "Setting Print Destination".

- BJ-M70: Sets the printer control to the ESC/P system.
- HP 815C: Sets the printer control to the HP system.

Setting Type of BMP File (BMP file setup)

Set the type of the BMP file to be output, as follows:

Step	Procedure
1	Move the cursor to "BMP file set up" using the (︿) (﹀) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The selection window opens.
4	Move the cursor to "Color" or "Monochrome" using the (︿) (﹀) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set "Color" or "Monochrome" appears in the square brackets [ ] in the "BMP file set up" field.

This item can also be set using the "Copy Cont" function explained in "Setting Print Destination".

- Color: Creates a 256-color BMP file.
- Monochrome: Creates a monochrome BMP.

Setting Print Destination

These settings are used to print the displayed data.

Printer control, printer type, and the color and output destination for BMP files to be created can be set.

After pressing (Shift) (a lamp turns on) and then (Copy) (Copy Cont), take the following procedures.

Procedures:

Select the setting displayed on the function label, as follows.

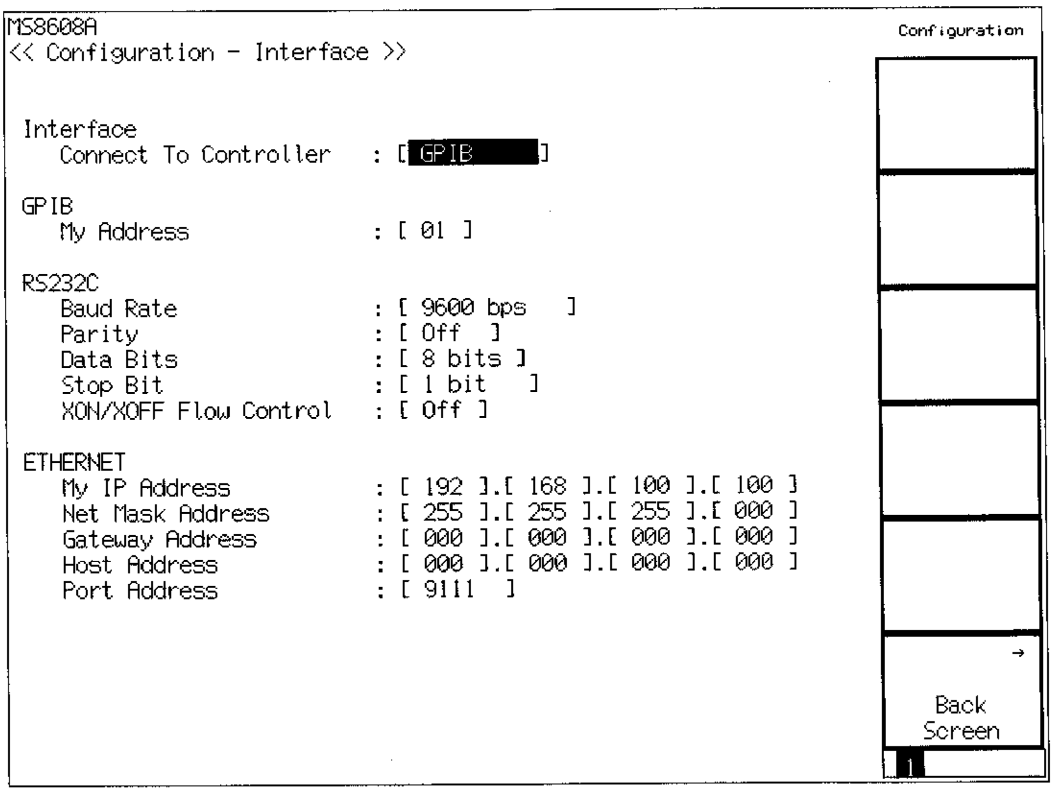
- Pressing (F1) (Copy to) toggles the print destination between "Printer" and "BMP file".
- Pressing (F2) (Paper Feed) feeds the printer paper.
- Pressing (F3) (Stop Print) cancels printing.
- Pressing (F4) (Printer setup) displays the following function labels for printer selection.
  - (F1) (BJ-M70(ESC/P))
  - (F2) (HP 815C)
  - (F6) (Return): Returns to the previous function label display
- Pressing (F5) (BMP file setup) displays the following function labels for the color and destination selection of BMP files.
  - (F1) (Color): Creates 256-color BMP files
  - (F2) (Monochrome): Creates monochrome BMP files
  - (F6) (Return): Returns to the previous function label display
- Pressing (F6) (Return) returns to the previous function label display.
  In the Spectrum Analyzer mode, however, the "Return" label is not displayed.

Setting External Interface

Performs the settings for the external interface on the Interface screen.

Displaying Interface screen

Step	Procedure
1	When the Config screen is displayed, press (F1) (Interface) to display the Interface screen.
2	The Interface screen opens.



Pressing (F6) (Back Screen) returns the screen to the Config screen.

Selecting interface to be used (Connect To Controller)

Step	Procedure
1	Move the cursor to "Connect To Controller" using the ∧ ∨ Entry keys or the rotary knob.
2	Press the Set Entry key.
3	The selection window opens.
4	Move the cursor to the preferred interface using the ∧ ∨ keys or the rotary knob.
5	Press the Set key.

After the setting is completed, the set interface appears in the square brackets [ ] in the "Connect To Controller" field.
The set items are as follows:

- GPIB: Enables the use of the GPIB interface
- RS-232C: Enables the use of the RS-232C interface
- ETHERNET: Enables the use of the ETHERNET interface when Option 09 is installed.

Setting GPIB Address (My Address)

Step	Procedure
1	Move the cursor to "My Address" using the ∧ ∨ Entry keys or the rotary knob.
2	Press the Set Entry key.
3	The setting window opens.
4	Set the desired address using the ∧ ∨ keys or the rotary knob.
5	Press the Set key.

After the setting is completed, the set address appears in the square brackets [ ] in the "Connect To Controller" field.
GPIB address range is from 0 to 30.
However, the "My Address" setting is ignored when the GPIB is not set for "Connect To Controller."

Setting RS-232C (RS-232C)

Step	Procedure
1	Move the cursor to the item to be set using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The setting window opens.
4	Set the value for each item using the (∧) (∨) keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set value for each RS-232C item appears on the screen.

The description of each item is shown below. Set the same values as in the external controller to be connected.

- Baud Rate (transmission speed)
  Sets data transmission speed for RS-232C interface. Range: 1200 to 115200 bps
- Parity (parity check)
  Sets parity check method. Range: Even/Odd/Off
- Data Bit (data bit length)
  Sets bit length for transmission data. Range: 7 bits/8 bits
- Stop Bit (stop bit length)
  Sets bit length for the stop bit. Ranges: 1 bit/2 bits
- XON/XOFF Flow Control
  XON/XOFF flow control is fixed to On, and always performed.

Setting Ethernet

Step	Procedure
1	Move the cursor to the item to be set using the (∧) (∨) Entry keys or the rotary knob.
2	Press the (Set) Entry key.
3	The setting window opens.
4	Set the value using the numeric keys or the rotary knob.
5	Press the (Set) key.

After the setting is completed, the set value for each ETHERNET item appears on the screen.

The description of each item is shown below.

- My IP Address
  Sets the IP address for the equipment.
- Net Mask Address
  Sets the net mask address.
- Gateway Address
  Sets the gateway address.
- Host Address
  Sets the IP address for the controller.
  When a value other than 0 is set, the communication object is fixed.
  When 0 is set, the communication object is not fixed.
- Port Address
  Set the same value as for the Port Address of the controller.

Note:

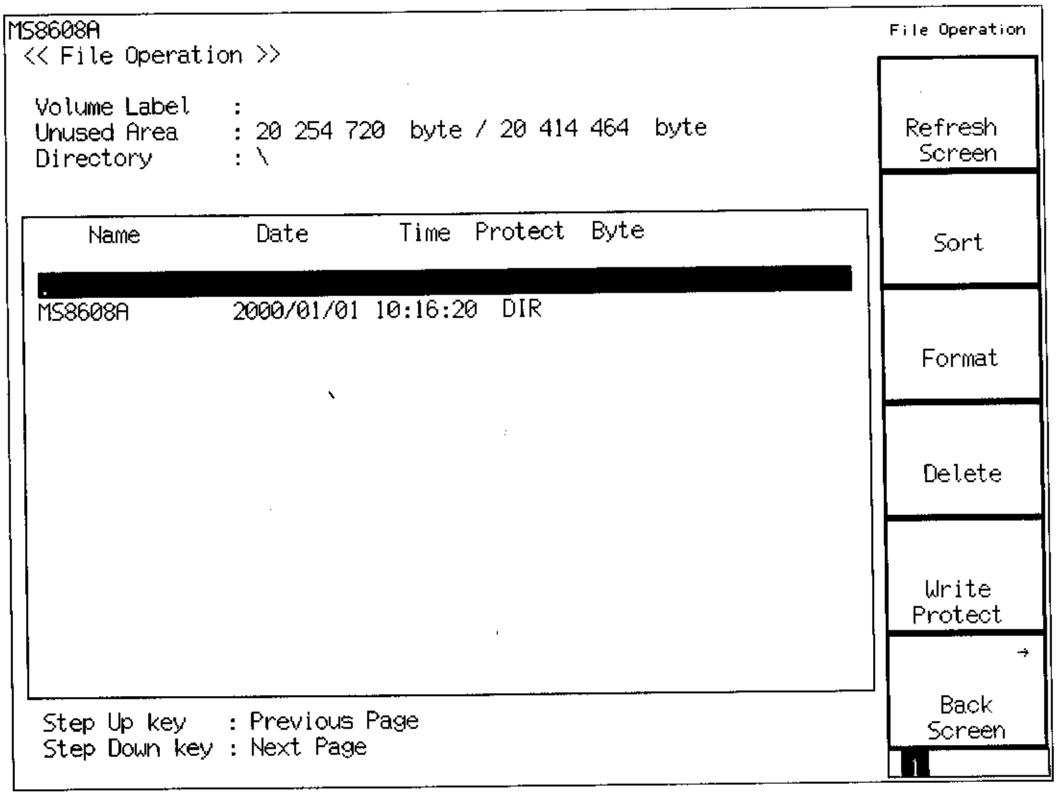
When the Ethernet address is set/changed, turn Off and then On the power. Without this operation, the new address setting takes some times.

File Operations

This section explains the operations that can be performed on the File Operation screen. For other file operations, refer to the separate "Vol. 2 Spectrum Analyzer Function" or the operation manual for each the measurement software.

Opening File Operation screen

Step	Procedure
1	Press (F6) (File Operation) when the Config screen is displayed.
2	The File Operation screen appears, as shown below.



Selecting File

Select the desired file in the memory card, as follows:

- Selecting file on the screen
  Rotate the rotary knob to move the cursor to the desired file.
- Selecting a file not shown on the screen because of too many files
  Press (∧) (Previous Page) or (∨) (Next Page) to display the desired file on the screen.
  After it is displayed, rotate the rotary knob to move the cursor to it.
- Changing directory
  Rotate the rotary knob to move the cursor to the directory to be opened, then press the (Set) Entry key to display the files in the opened directory on the screen.
  Move the cursor to [..] and then press the (Set) key to move to the upper directory.

Deleting File

Delete a file on the memory card, as follows:

Move the cursor to the file to be deleted.
See the paragraph "Selecting File" for the explanation of how to move the cursor.

After moving the cursor to the file, press (F4) (Delete).
The confirmation window opens.
Move the cursor to "Yes" using the rotary knob, then press the (Set) Entry key for deletion.

CAUTION ⚠

Note: The deleted file cannot be restored.
Anritsu accepts no liability for data on the memory card.
Make a backup and store it yourself.

Write-Protecting Files

Files stored on the memory card can be write-protected, as follows:
The setting disables changing or deleting the file.

Move the cursor to the file to be write-protected.
See the paragraph "Selecting File" for the explanation of how to move the cursor.

After moving the cursor to a file, press (F5) (Write Protect).
The file is write-protected.

Move the cursor to a write-protected file and then press (F5) (Write Protect) to cancel the write-protection.

Formatting Memory Card

Insert the memory card to be formatted into the slot on the panel.
Press (F3) (Format).

The confirmation window opens.
Move the cursor to "Yes" using the rotary knob.

Press the (Set) key to start formatting the memory card.

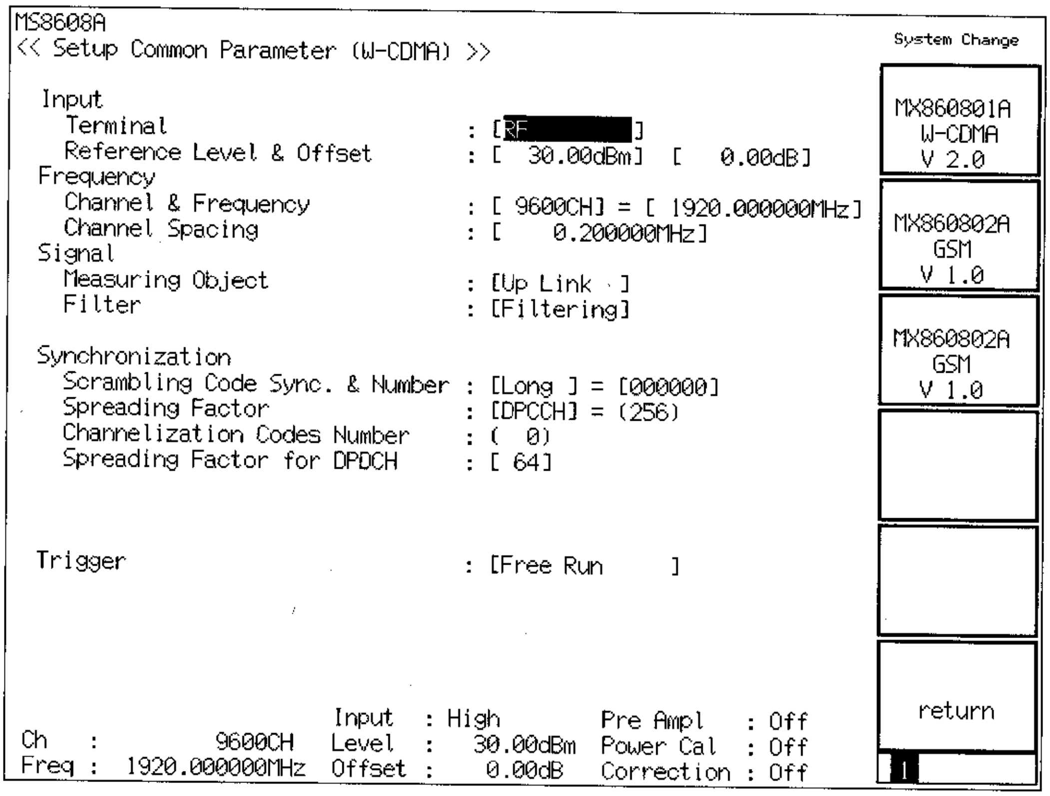
CAUTION ⚠

Initializing a memory card clears all the data in it.
Note: The deleted data cannot be restored.
Anritsu accepts no liability for data on the memory card.
Make a backup and store it yourself.

Changing Measurement System

To use the MS8608A/MS8609A with multiple measurement software (sold separately) installed, in the Transmitter Tester mode; change the measurement system to the desired system, as follows:

Step	Procedure
1	Press the (Tx Tester) key to display the measurement system screen.
2	Press the (System) key to display the System Change function label (shown below).

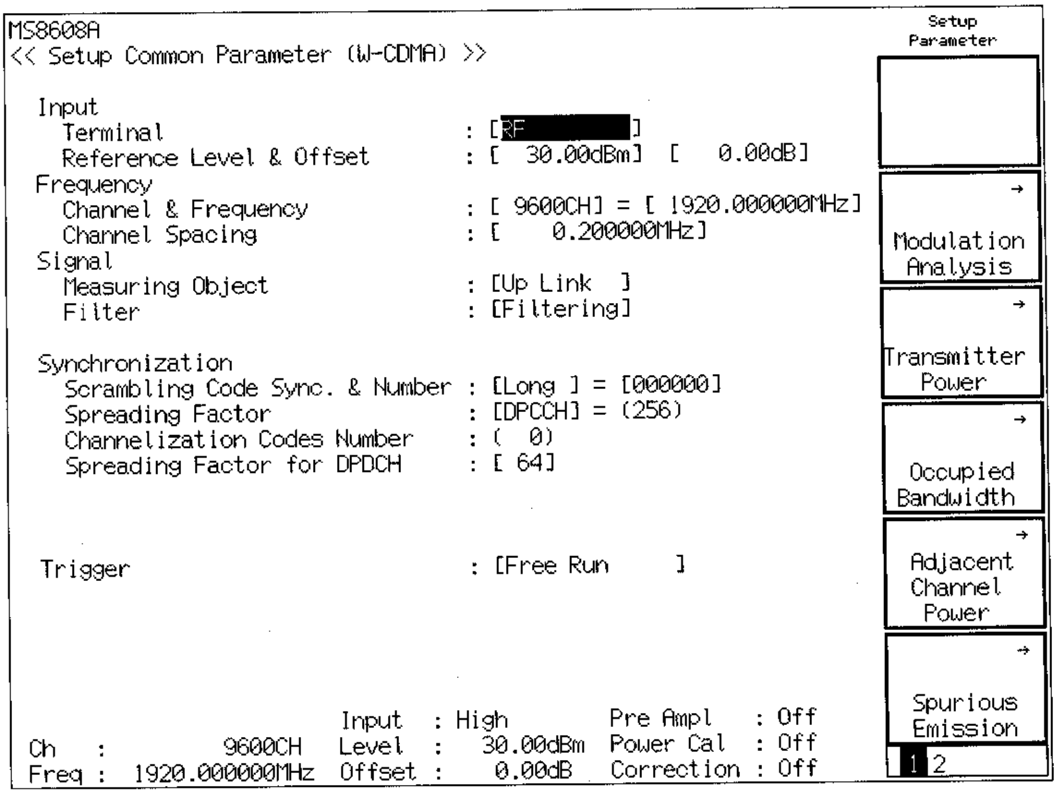


Step	Procedure
3	All the installed measurement systems are displayed at function labels.
4	Press the function key for the measurement system to be set.
5	The measurement system is changed over.
6	After the setting is completed, a new system screen appears.

A measurement system not displayed in the function labels cannot be set. Refer to "Installing Measurement Software" to install a new measurement system.

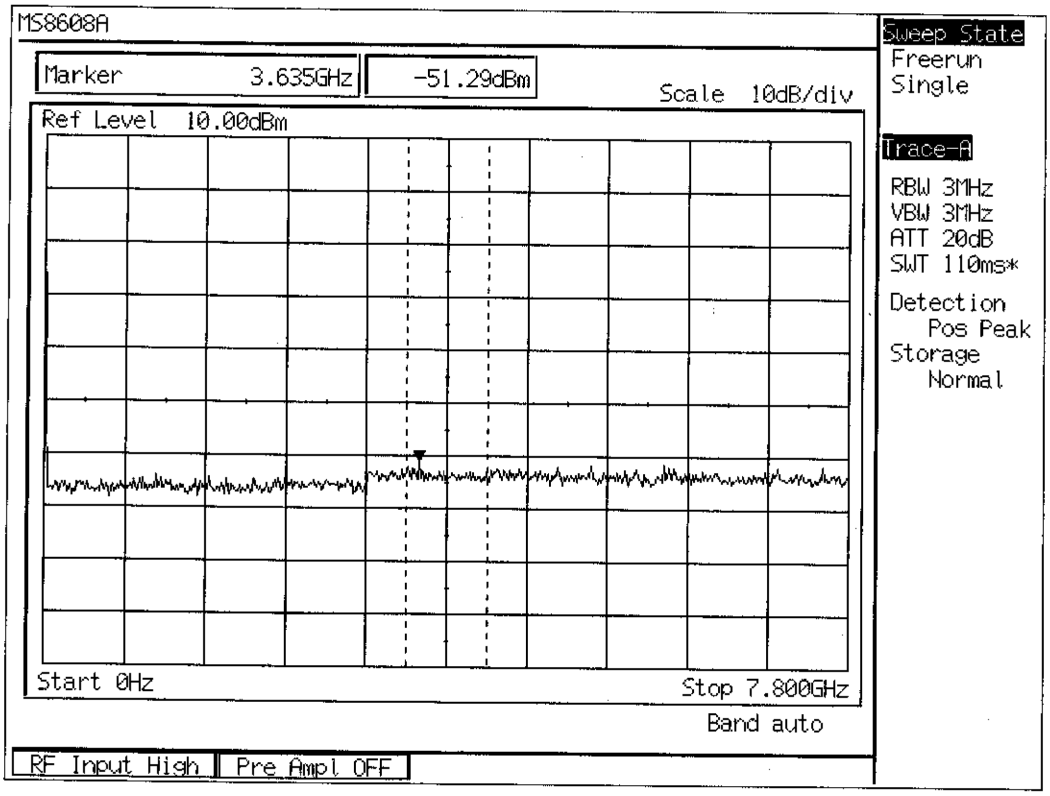
Moving to Transmitter Tester Mode

Press the (Tx Tester) key to change mode from the Config screen or Spectrum Analyzer mode to the Transmitter Tester mode. This changes the mode to the Transmitter Tester mode, and displays the transmitter tester screen.



Moving to Spectrum Analyzer Mode

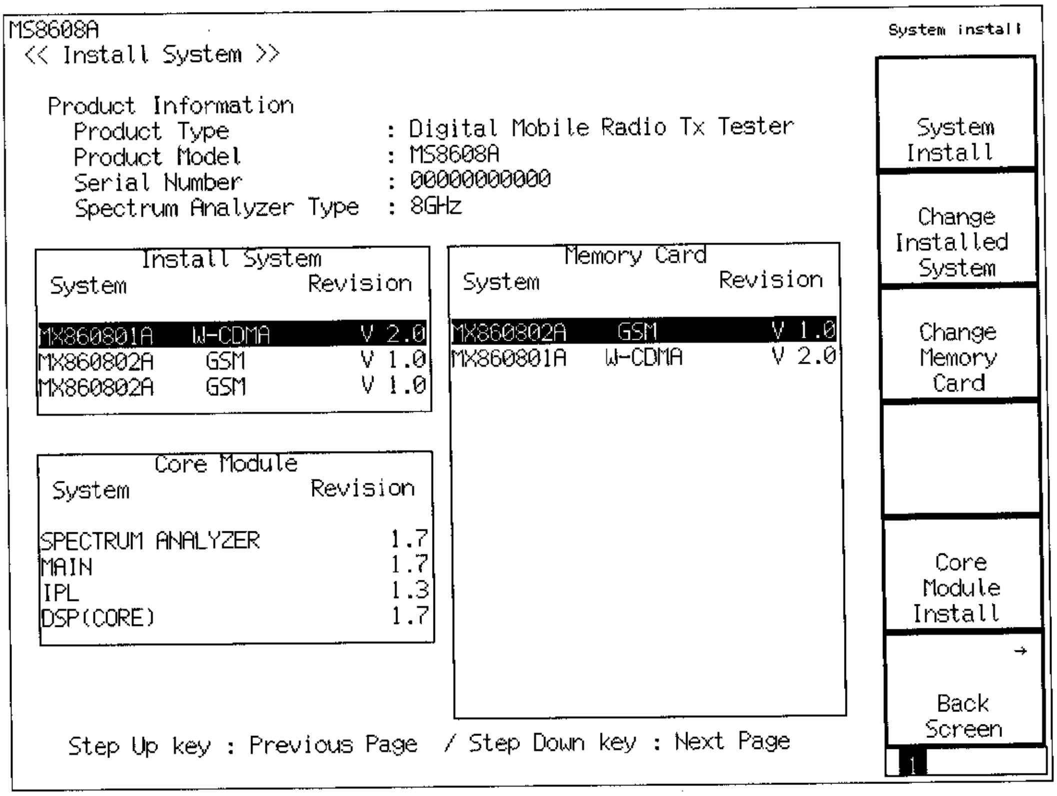
Press the (Spectrum) key to change mode from the Config screen or Transmitter Tester modes to the Spectrum Analyzer mode. This changes the mode to the Spectrum Analyzer mode, and displays the spectrum analyzer screen.



Installing Measurement Software

Install the desired measurement software (sold separately) of the MS8608A/MS8609A in the Transmitter Tester mode, as follows:

Step	Procedure
1	Insert a memory card on which the measurement software is saved into the memory card slot on the panel.
2	Press the (Config) key to display the Config screen.
3	Press (F4) (System Install) to display the Install System screen (shown below).



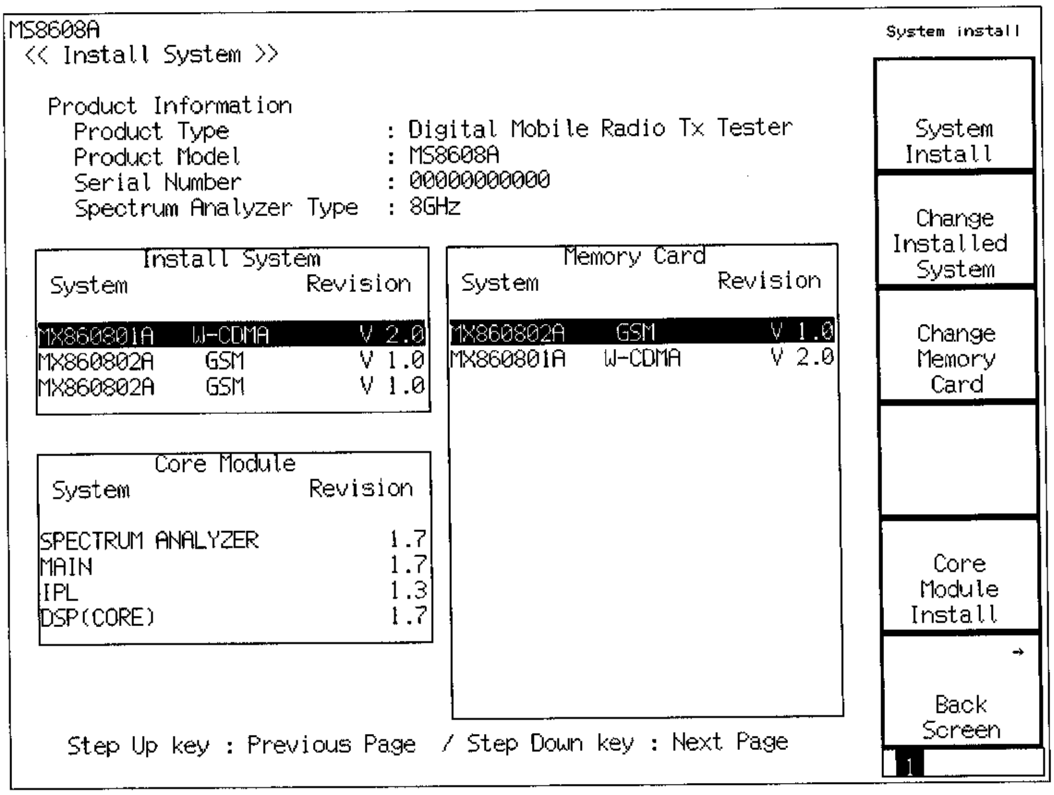
Step	Procedure
4	Press (F2) (Change Installed System) to make the Install System box active.
5	Select the install destination for the new measurement system using the rotary knob.
6	Press (F3) (Change Memory Card) to make the Memory Card box active.

Step	Procedure
7	Select the new measurement system using the rotary knob.
8	Press (F1) (System Install) to install the new system.
9	The confirmation window opens. Move the cursor to "Yes" using the rotary knob.
10	Press the (Set) Entry key to start installation.
11	After installation is completed, the new measurement system screen appears.

Installing Core Module Software

Install a new Core Module software on the MS8608A/MS8609A, as follows:

Step	Procedure
1	Insert a memory card on which a new Core Module software is saved into the memory card slot on the panel.
2	Press the (Config) key to display the Config screen.
3	Press (F4) (System Install) to display the Install System screen (shown below).



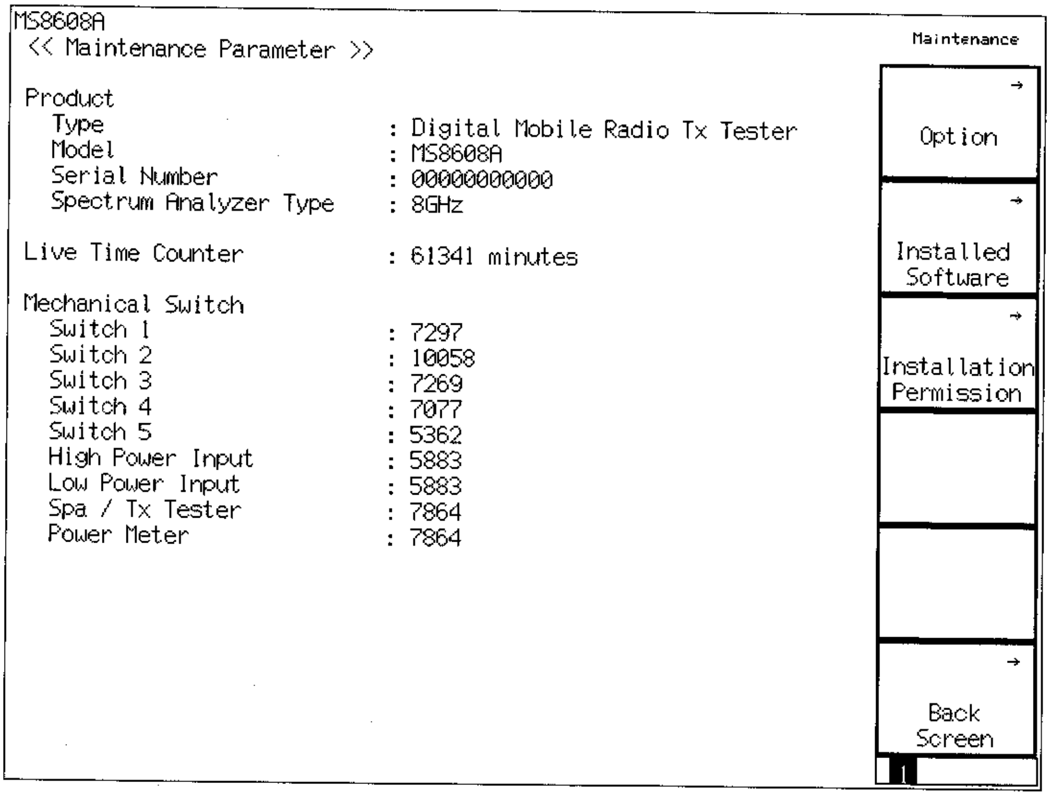
Step	Procedure
4	Press (F5) (Core Module Install).
5	The confirmation window opens. Move the cursor to "Yes" using the rotary knob.
6	Press the (Set) Entry key to start installation.
7	After installation is completed, turn the power off by following screen instruction.

Displaying Maintenance Parameter Information

Display the maintenance parameter information for the MS8608A/MS8609A, as follows:

Maintenance Parameter screen

Step	Procedure
1	Press the (Config) key to display the Config screen.
2	Press (F2) (Maintenance Parameter) to display the Maintenance Parameter screen (shown below).



The following information is displayed on the Maintenance Parameter screen:

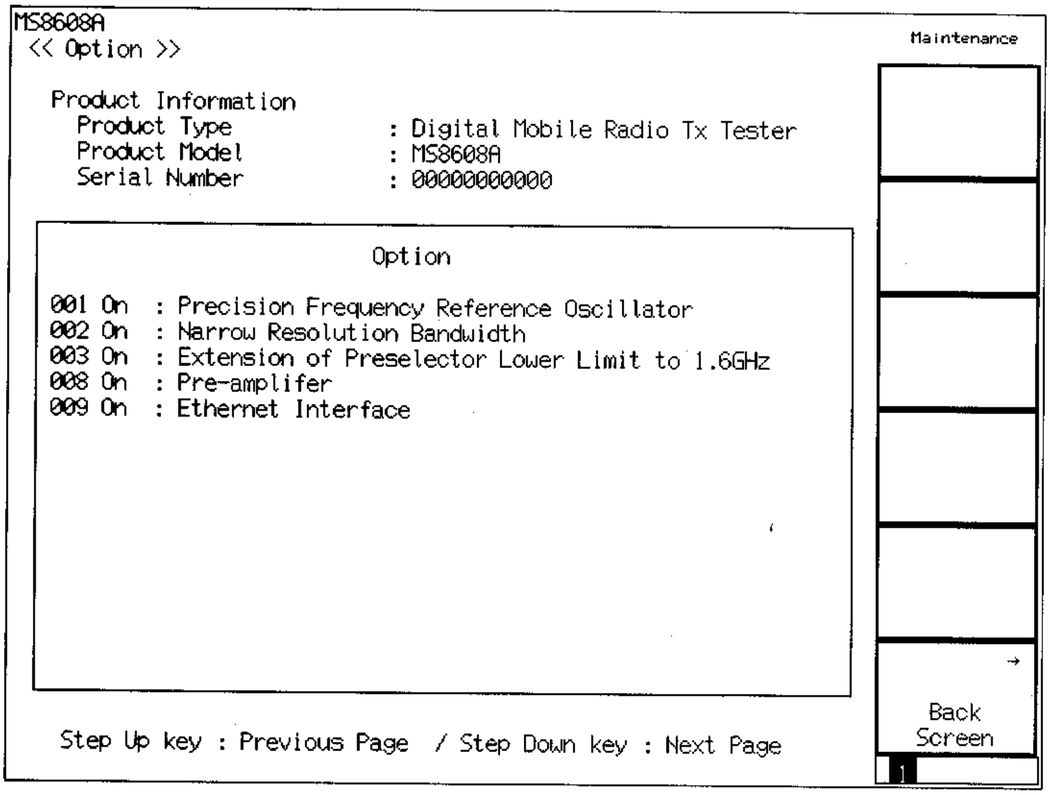
1. Product information
   a. Type .... Product name
   b. Model .... Model number
   c. Serial Number
   d. Spectrum Analyzer Type ...... Type of the spectrum analyzer installed

2. Live Timer Counter information
   a. Elapsed power-on time (in unit of minutes)

3. Mechanical Switch information
   a. Switch 1 .... Number of switchings for ATT 2-dB
   b. Switch 2 .... Number of switchings for ATT 4-dB
   c. Switch 3 .... Number of switchings for ATT 8-dB
   d. Switch 4 .... Number of switchings for ATT 16-dB
   e. Switch 5 .... Number of switchings for ATT 32-dB
   f. High Power Input .... Number of switchings for High Power Input
   g. Low Power Input .... Number of switchings for Low Power Input
   h. Spa/Tx Tester........................ Number of switchings between Spectrum analyzer and Measurement system
   i. Power Meter .... Number of switchings for Power Meter

Option screen

Step	Procedure
1	Press (F1) (Option) to display the Option screen (shown below).



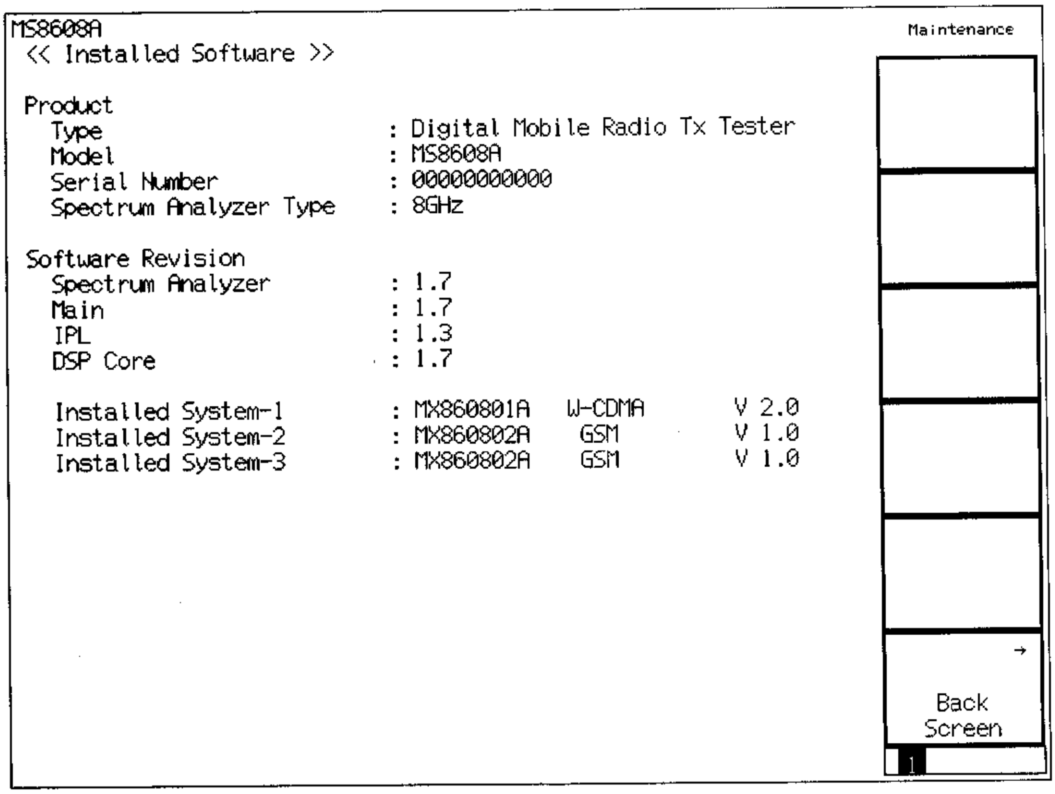
The following information is displayed on the Option screen:

1. Product information
   a. Type .... Product name
   b. Model .... Model number
   c. Serial Number

2. Option information
   a. Option No.
   b. Option status — On/Off
   c. Option name

Installed Software screen

Step	Procedure
1	Press (F2) (Installed software) to display the Installed Software screen (shown below).



The following information is displayed on the Installed Software screen:

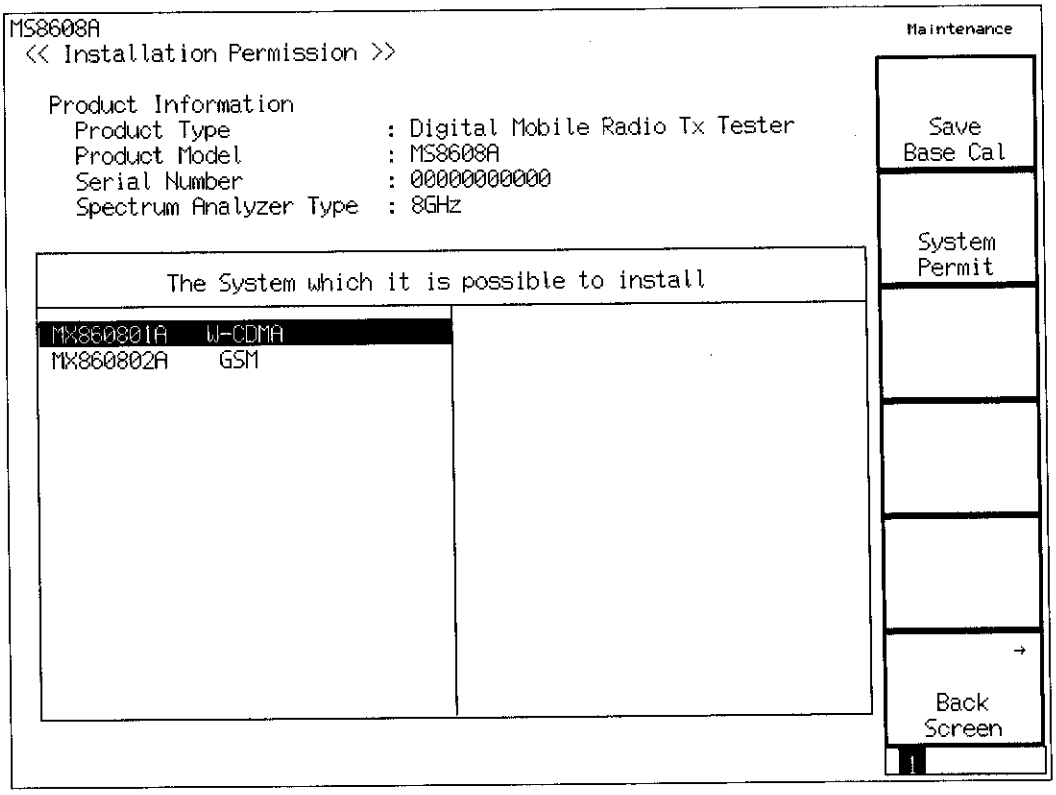
1. Product information
   a. Type .... Product name
   b. Model .... Model number
   c. Serial Number
   d. Spectrum Analyzer Type ...... The type of the spectrum analyzer installed

2. Software Revision information
   a. Spectrum Analyzer .... Revision of the spectrum analyzer software
   b. Main .... Revision of the Main software
   c. IPL .... Revision of the IPL software
   d. DSP Core .... Revision of the DSP Core Module software
   e. Installed System-1 .... Revision of the software for installed system-1
   f. Installed System-2 .... Revision of the software for installed system-2
   g. Installed System-3 .... Revision of the software for installed system-3

Registering Installation Key

To install a new measurement software on the MS8608A/MS8609A, an installation key for the system must be registered. Register the install key, as follows:

Step	Procedure
1	Insert a memory card on which the installation key is saved into the slot.
2	Press the (Config) key to display the Config screen.
3	Press (F2) (Maintenance Parameter) to display the Maintenance Parameter screen.
4	Press (F3) (Installation Permission) to display the Installation Permission screen (shown below).



Step	Procedure
5	Press (F2) (System Permit).
6	The new measurement software is added to the Permission table.
7	Press (F1) (Save Base Cal).

Note:

Step 5 above registers the installation key in the table. However, it is not registered in the internal memory until you perform Step 7. The installation key becomes valid after being registered in the internal memory.

Section 6 Performance Tests

This section explains measuring instruments, setup and operations necessary for conducting performance tests of the spectrum analyzer function of the MS8608A/MS8609A Digital Mobile Radio Transmitter Tester.

Requirement for Performance Tests

Performance tests are used as preventive maintenance to prevent degradation of the MS8608A/MS8609A performance before it occurs.
Use the performance tests whenever necessary such as at acceptance and periodic inspection of the MS8608A/MS8609A and to verify performance after repair. Execute the performance tests listed below to verify the MS8608A/MS8609A performance at acceptance inspection, periodic inspection and after repair.

- Reference oscillator frequency stability
- Rubidium reference oscillator frequency stability
- Frequency readout accuracy
- Frequency span readout accuracy
- Resolution bandwidth and selectivity
- Sideband phase noise
- Frequency measurement accuracy
- Amplitude display linearity
- Frequency response
- Reference level accuracy
- Average noise level
- Second harmonic distortion
- Resolution bandwidth (RBW) switching uncertainty
- Input attenuator switching uncertainty
- Sweep time and time span accuracy

Execute the performance tests at regular intervals as preventive maintenance for important evaluation items.
We recommend that the performance be inspected regularly once or twice a year.

If the specifications are not met at the performance tests, please contact Anritsu Corporation.

Instruments Required for Performance Test

A list of instruments required for performance test is shown below.

Instruments Required for Performance Test (1/2)

Recommended instrument name (Model name)	Required Performance †	Test item
Frequency standard (HP5071A with Option 001)	• Aging Rate $\leq 3 \times 10^{-14}$/day	Reference oscillator frequency stability
Synthesized signal generator (MG3633A)	• Frequency range 100 MHz to 1 GHz Resolution of 1 Hz possible • Output level range −20 to 0 dBm Resolution of 0.1 dB possible • SSB phase noise ≤−130 dBc/Hz (at 10 kHz offset) • Second harmonic ≤−30 dBc • Amplitude modulation (0 to 100%, 0.1 to 400 Hz) possible • External reference input (10 MHz) possible	Resolution bandwidth, selectivity Sideband noise Amplitude display linearity Reference-level accuracy Second-harmonic distortion Resolution-bandwidth switching error Input-attenuator switching error
Swept Frequency Synthesizer (69269A with Option 2B)	• Frequency range 10 MHz to 13.2 GHz Resolution of 2 kHz possible • Output level range −20 to 0 dBm Resolution of 0.1 dB possible • Pulse modulation possible Pulse width: 0.5 to 10 µ sec Repetitive cycle: 5 µ sec to 5 msec • External reference input (10 MHz) possible	Frequency readout accuracy Frequency-span display accuracy Frequency measurement accuracy Frequency response Time-span accuracy Frequency domain sweep time accuracy Time domain sweep time accuracy
Attenuator (MN510C)	• Frequency 100 MHz • Maximum attenuation 70 dB (resolution 0.1 dB) possible with calibrated data	Amplitude display linearity Input-attenuator switching error

† Extracts part of performance which can cover the measurement range of the test item.

Instruments Required for Performance Test (2/2)

Recommended instrument name (Model name)	Required Performance †	Test item
Power meter (ML2437A)	• Main instrument accuracy ±0.02 dB • Frequency range 10 MHz to 13.2 GHz (depending on the power sensor type)	Frequency response Reference-level accuracy Input-attenuator switching error
Power sensor (MA2422B)	• Frequency range 10 MHz to 13.2 GHz • Measurement power range −30 to +10 dBm • Input connector N type	Frequency response Reference-level accuracy Input-attenuator switching error
50Ω terminator (MP752A)	• Frequency range DC to 8.1 GHz • VSWR ≤1.2	Average noise level
Low-pass filter • VLF-141 (fp = 50 MHz) • VLF-141 (fp = 100 MHz) • VLF-141 (fp = 200 MHz) • VLF-141 (fp = 400 MHz) • VLF-141 (fp = 800 MHz) • VLF-141 (fp = 1600 MHz) • VLF-141 (fp = 3200 MHz) • VLF-141 (fp = 4000 MHz)	• Attenuation ≥40 dB (at frequency 2× fp)	Second-harmonic distortion
Frequency counter (MF1601A)	10 MHz measurement possible Number of display digits: 10 • External reference input (10 MHz) possible	Reference-oscillator frequency stability Frequency domain sweep time accuracy Time domain sweep time accuracy

† Extracts part of performance which can cover the measurement range of the test item.

Performance Test

The warm-up time depends on the test item. For test item other than oscillator frequency, warm-up the equipment for at least for thirty minutes and test the performance after the MS8608A/MS8609A stabilizes completely. Also, begin measurement after taking the warm-up time of the calibration instrument into full consideration. In addition, the test must be conducted at room temperature; there must be little AC power supply voltage fluctuation, and no noise, vibration, dust, humidity, etc.

Reference oscillator frequency stability

The 10 MHz reference oscillator is tested for frequency stability.
Stability is determined by measuring frequency variation after 24 hours and after 48 hours of power on at ambient temperature of 25°C, and frequency variation at ambient temperatures of 0°C and 50°C.

(1) Specifications

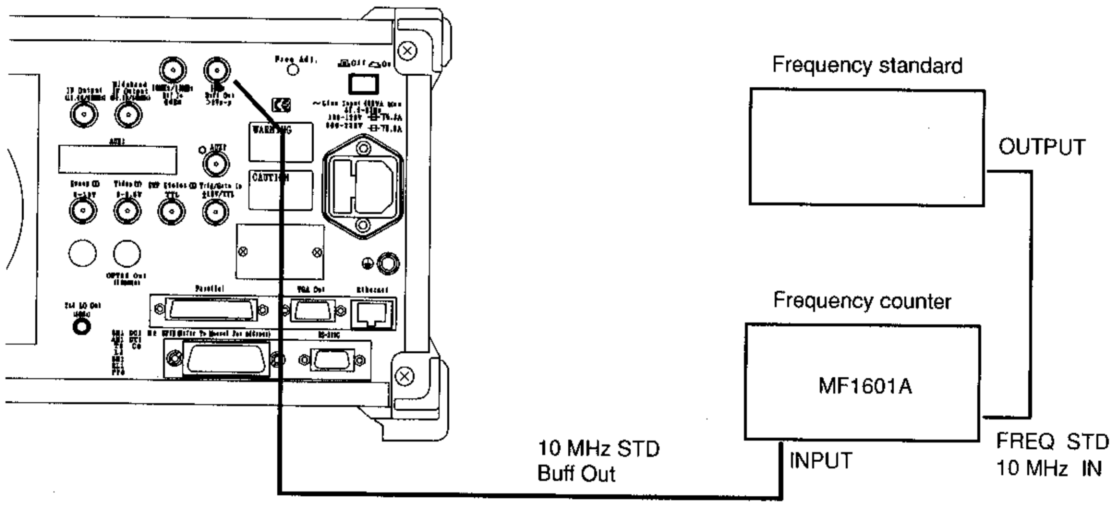
■ Reference oscillator

- Frequency: 10 MHz
- Aging rate: $\leq 2 \times 10^{-8}$/day
  After 24 hour warm-up at 25°C ± 5°C
- Temperature stability: $\pm 5 \times 10^{-8}$ at 0 and 50°C referred to frequency at 25°C

(2) Test instruments

- Frequency counter: MF1601A
- Frequency standard: with accuracy of $\leq \pm 5 \times 10^{-13}$/day

(3) Setup



Reference Oscillator Frequency Stability Test

(4) Procedure

Aging rate/day: Test this at the ambient temperature ±2°C in a vibration-free place.

Step	Procedure
1	Set the change over switch (FREQ STD: INT/EXT) on the MF1601A counter rear panel to EXT.
2	Set the power supply switch on the spectrum analyzer rear panel to On and then the Power switch on the front panel to On.
3	Measure the frequency using the counter after 24 hours has passed after turning the power ON. (Sample rate of the counter: ≥20 sec, read out 0.1 mHz resolution)
4	Measure the frequency using the counter after 24 more hours have passed from the step 3 measurement.
5	Calculate the stability by using the following equation. $\text{Frequency stability} = \dfrac{(\text{2nd reading of the counter}) - (\text{1st reading of the counter})}{(\text{1st reading of the counter})}$

Temperature stability: Test this performance in a vibration-free constant-temperature chamber.

Step	Procedure
1	Set up the MS8608A/MS8609A in a constant-temperature chamber at 25°C in the same setup.
2	Set the LINE and Power switches on the MS8608A/MS8609A to On and wait until the internal temperature stabilizes (approx. 1.5 hours after the chamber temperature stabilizes).
3	When the internal temperature stabilizes, measure the frequency by using the counter with 0.1 mHz resolution.
4	Change the chamber temperature to 50°C.
5	When the chamber temperature and the MS8608A/MS8609A internal temperature re-stabilize, measure the frequency by using the counter.
6	Calculate the stability by using the following equation. $$\text{Temperature stability} = \frac{\text{(counter reading at 50°C)} - \text{(counter reading at 25°C)}}{\text{(counter reading at 25°C)}}$$
7	Change the chamber temperature to 0°C and repeat steps 5 and 6.

Rubidium reference oscillator frequency stability (Option 05)

The 10 MHz Rubidium reference oscillator of Option 05 is tested for frequency stability. Starting characteristic is determined by measuring frequency variation after 7 minutes and then after 1 hour of power on at ambient temperature of 25°C, and also the frequency variation (temperature stability) is measured at ambient temperature of 0°C and 45°C.

(1) Specifications

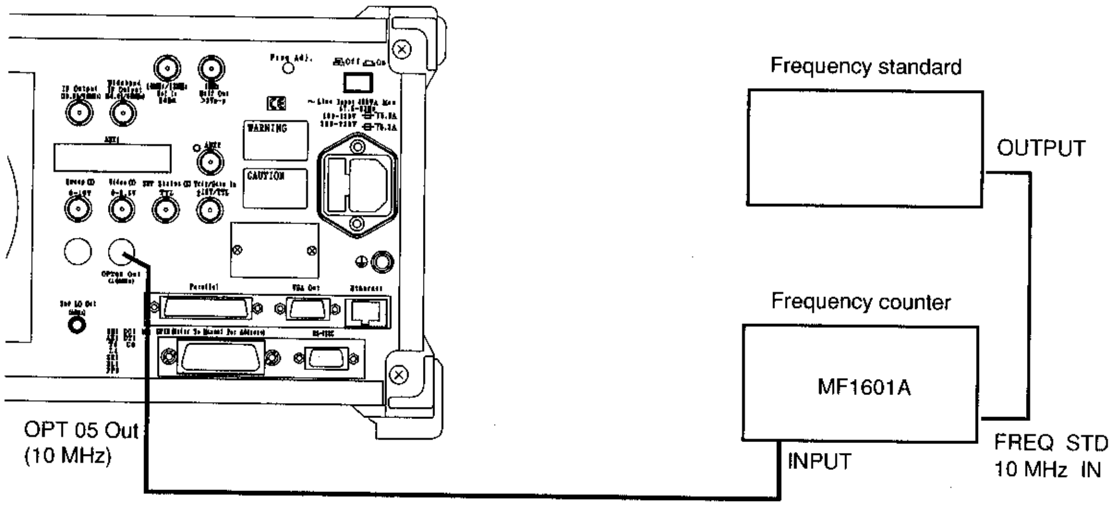
■ Rubidium reference oscillator (Option 05)

- Frequency: 10 MHz
- Aging rate: $\leq 1 \times 10^{-10}$/month
- Starting characteristic: $\leq \pm 1 \times 10^{-9}$/7 min. (referred to frequency at 25°C)
- Temperature stability: $\pm 5 \times 10^{-9}$ at 0 and 45°C (referred to frequency at 25°C)

(2) Test instruments

- Frequency counter: MF1601A
- Frequency standard: with accuracy of $\leq \pm 5 \times 10^{-13}$/day

(3) Setup



Rubidium reference Oscillator Frequency Stability Test

(4) Procedure

Starting characteristic: Test this at the ambient temperature ±2°C in a vibration-free place.

Step	Procedure
1	Set the change over switch (FREQ STD: INT/EXT) on the MF1601A counter rear panel to EXT.
2	Set the power supply switch on the spectrum analyzer rear panel to On and then the Power switch on the front panel to On.
3	Measure the frequency using the counter after 7 minutes has passed after turning the power ON. (Sample rate of the counter: ≥20 sec, read out 0.1 mHz resolution)
4	Measure the frequency using the counter after 1 more hour have passed from the step 3 measurement.
5	Calculate the Starting characteristic by using the following equation. $\text{Starting characteristic} = \dfrac{\text{(reading of the counter after 7 minutes)} - \text{(reading of the counter after 1 hour)}}{\text{(reading of the counter after 1 hour)}}$

Temperature stability: Test this performance in a vibration-free constant-temperature chamber.

Step	Procedure
1	Set up the MS8608A/MS8609A in a constant-temperature chamber at 25°C in the same setup.
2	Set the LINE and Power switches on the MS8608A/MS8609A to On and wait until the internal temperature stabilizes (approx. 1.5 hours after the chamber temperature stabilizes).
3	When the internal temperature stabilizes, measure the frequency by using the counter with 0.1 mHz resolution.
4	Change the chamber temperature to 45 (0) °C.
5	When the chamber temperature and the MS8608A/MS8609A internal temperature re-stabilize, measure the frequency by using the counter.
6	Calculate the stability by using the following equation. $$\text{Temperature stability} = \frac{(\text{counter reading at 45 [0] °C}) - (\text{counter reading at 25°C})}{(\text{counter reading at 25°C})}$$
7	Change the chamber temperature to 0 °C and repeat steps 5 and 6.

Frequency readout accuracy

Add the known frequency which serves as the center frequency reference to the MS8608A/MS8609A as shown in the figure below and set CF (same value as the known reference frequency) and SPAN. At this time, check that the difference between the reading of the marker readout frequency (thick arrow in the figure) of the center frequency peak point.

As shown in the figure, the Synthesized Signal Generator uses the signal source phase-locked with the same accuracy as the 10 MHz reference oscillator of the MS8608A/ MS8609A.

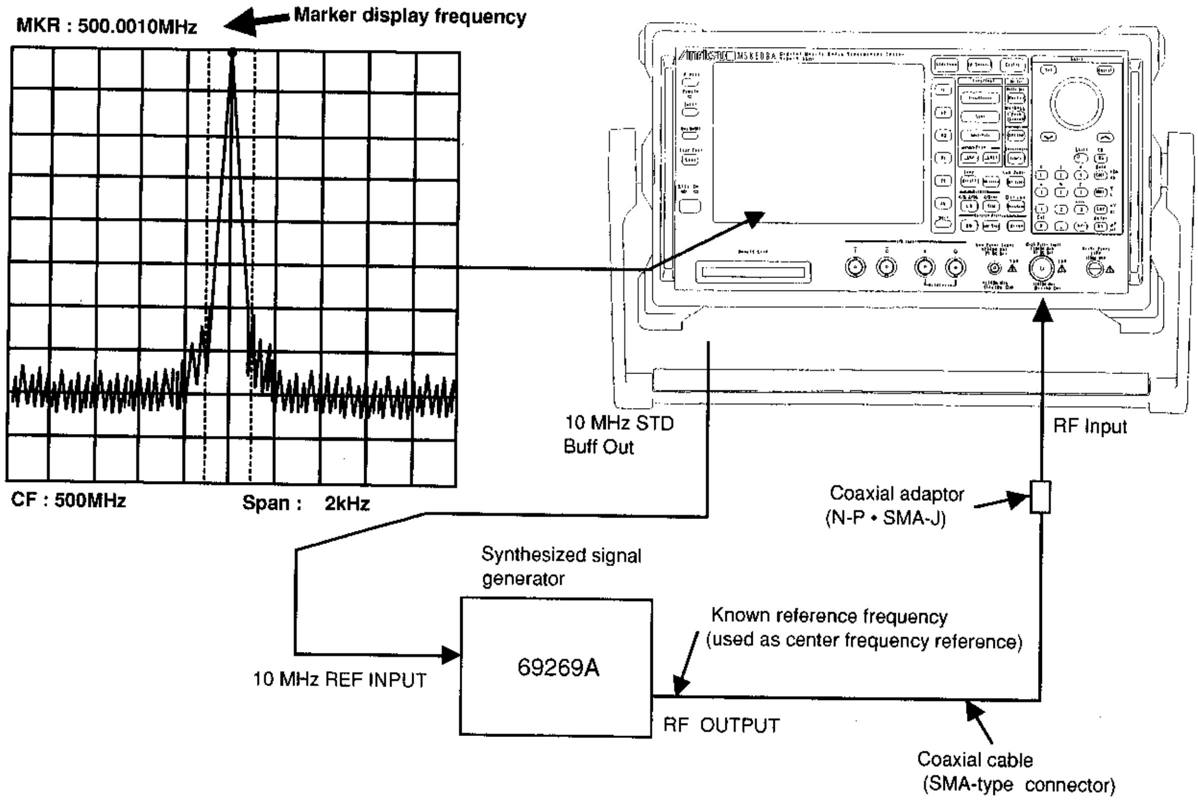
(1) Specification

- Frequency readout accuracy: ± (Readout frequency × reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)

(2) Test instrument

- Synthesized signal generator: 69269A

(3) Setup



Center-Frequency Readout-Accuracy Test

(4) Precaution

Set the signal generator output level to approximately –10 to –20 dBm.

(5) Procedure

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate Freq Cal.
3	Set the signal generator output frequency equal to the center frequency (500 MHz) in the following table.
4	Set the MS8608A/MS8609A to the center frequency in the following table.
5	Set the span (10 kHz) that corresponds to the center frequency (500 MHz) in the table by using the numeric/unit keys.
6	Read the marker frequency (indicated by thick arrow in the figure on the previous page) and check that the value is within the range between the maximum and minimum values shown in the following table.
7	Repeat steps 3 to 6 for other combination of the center frequency and span according to the combinations shown in the following table.

Frequency readout accuracy test

Signal generator	MS8608A/MS8609A Spectrum analyzer			
Output frequency	Center frequency	Span frequency	Resolution bandwidth	Readout frequency
500 MHz	500 MHz	10 kHz	300 Hz	
		200 kHz	3 kHz	
		100 MHz	300 kHz	
5 GHz	5 GHz	10 kHz	300 Hz	
		200 kHz	3 kHz	
		100 MHz	300 kHz	
7 GHz	7 GHz	10 kHz	300 Hz	
		200 kHz	3 kHz	
		100 MHz	300 kHz	

Frequency span readout accuracy

Using the setup shown in the figure below, set the frequencies corresponding the 1st and 9th division from the left side of the screen scale with the SG. The frequency difference between the peak levels at the 1st and 9th divisions is equal to the frequency span × 0.8. This enables to obtain the span accuracy.

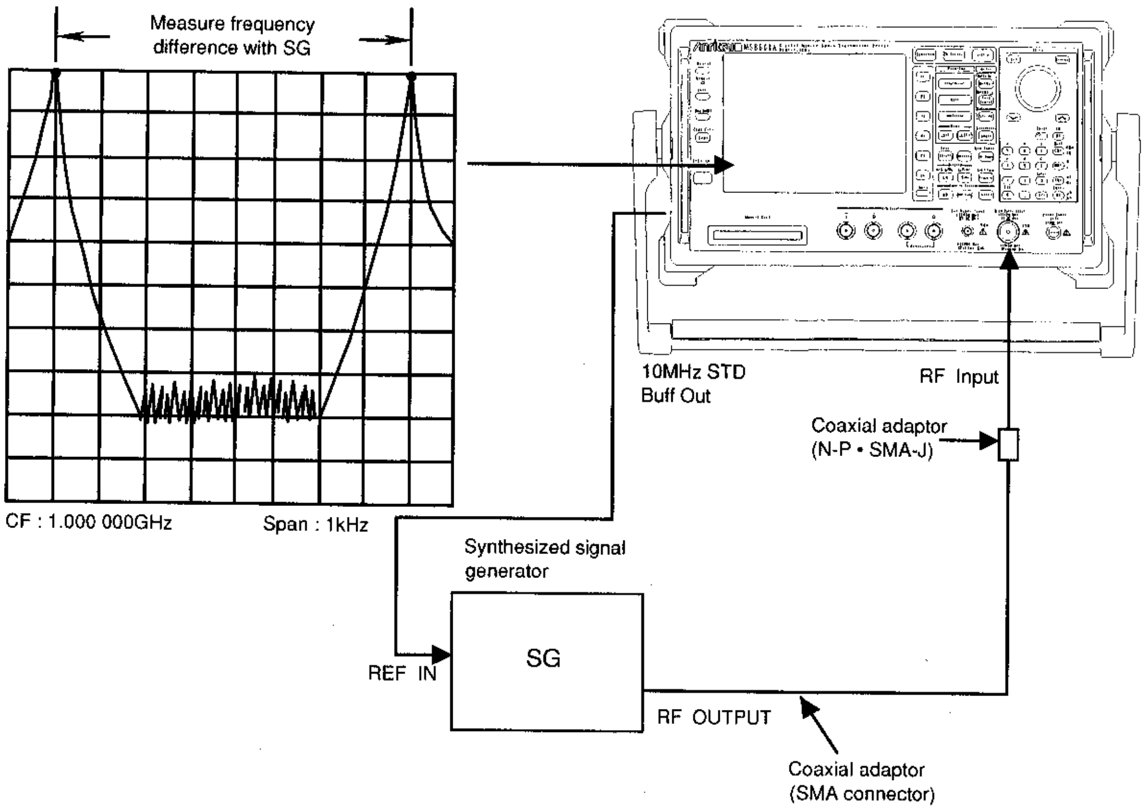
(1) Specification

- Frequency span accuracy: ±1.0% (single band sweep)

(2) Test instrument

- Synthesized signal generator: 69269A

(3) Setup



Frequency Span Readout Accuracy Test

(4) Precaution

Set the signal generator output level to approximately –10 to –20 dBm.

(5) Procedure

Step	Procedure
1	Press the (Preset) key.
2	Operate Freq Cal.
3	Connect the 69269A output to the MS8608A/MS8609A RF Input.
4	Set the MS8608A/MS8609A as shown below: Span .... 20 kHz Center Freq .... 1000 MHz
5	Set the 69269A output frequency to the f_1 frequency (999.992 MHz) shown in the table on the next page.
6	Adjust the 69269A output frequency to set the spectrum peak at the 1st division from the left end of the screen scale. Remember the frequency as f_1'.
7	After setting the 69269A output frequency to the f_2 frequency (1000.008 MHz), adjust it to set the spectrum peak at the 9th division. Remember the frequency as f_2'.
8	Calculate (f_2'-f_1')/0.8 and check that the value is within the specified range (minimum to maximum values) shown in the table on the next page.
9	Repeat steps 4 through 8 for each frequency span with 1 GHz center frequency shown in the table on the next page.

Frequency-Span Readout-Accuracy Test

MS8608A/MS8609A		Signal generator		Measured result
Center frequency	Span frequency	f1	f2	(f2' – f1')/0.8
1.5 GHz	20 kHz	1499992000 Hz	1500008000 Hz	
	200 kHz	1499920000 Hz	1500080000 Hz	
	2 MHz	1499200000 Hz	1500800000 Hz	
	20 MHz	1492000000 Hz	1508000000 Hz	
	200 MHz	1420000000 Hz	1580000000 Hz	
	2 GHz	700000000 Hz	2300000000 Hz	
5 GHz	20 MHz	4992000000 Hz	5008000000 Hz	
	200 MHz	4920000000 Hz	5080000000 Hz	
	2 GHz	4200000000 Hz	5800000000 H	

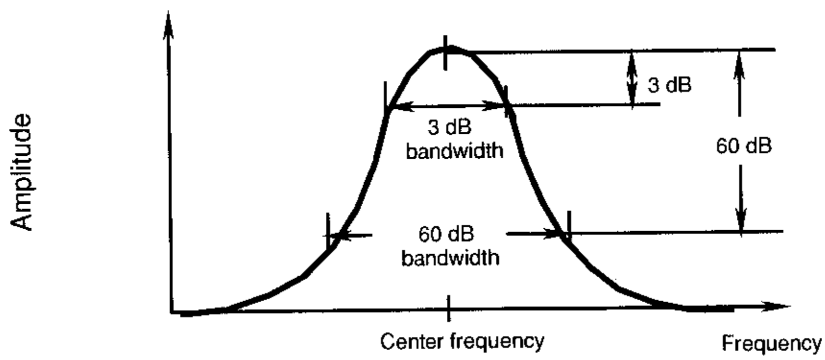
Resolution bandwidth (RBW) and selectivity

If there are two input signals with the frequency difference corresponding to 3 dB bandwidth (of IF final stage), these signals can be resolved as two spectrum waveforms.

This is called the resolution bandwidth.

Selectivity can be improved by narrowing the 60 dB bandwidth. The selectivity is defined by the ratio of the filter width, in Hz, at the –60 dB point, to the filter width, in Hz, at the –3 dB point, as shown in the formula below.

$$\text{Selectivity} = \frac{\text{60 dB bandwidth (Hz)}}{\text{3 dB bandwidth (Hz)}}$$



To test the resolution bandwidth and selectivity, first measure the resolution bandwidth (3 dB bandwidth), then the 60 dB bandwidth and calculate the 60 dB/3 dB bandwidth ratio.

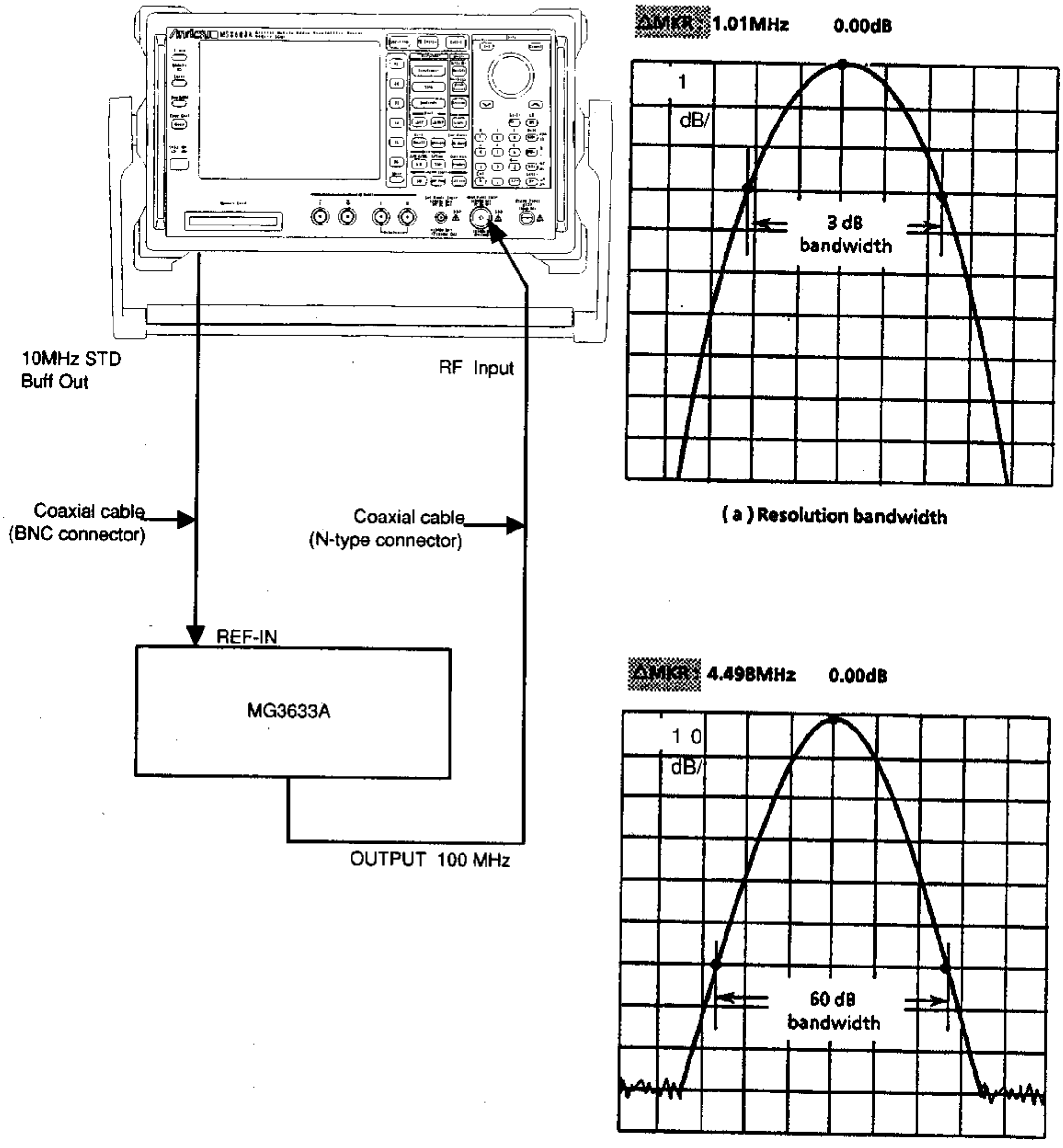
(1) Specifications

- Resolution bandwidth accuracy: ±20% (RBW=300 Hz to 10 MHz)
  ±40% (RBW=20 MHz)
- Selectivity (60 dB/3 dB bandwidth): ≤15:1

(2) Test instrument

- Synthesized signal generator: MG3633A

(3) Setup



(a) Resolution bandwidth

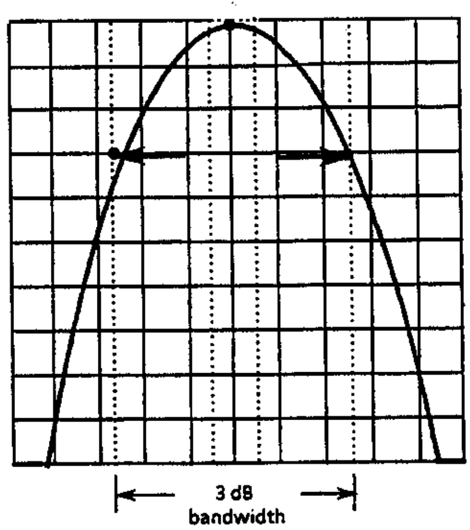
(b) 60 dB dropped bandwidth

Resolution Bandwidth/Selectivity Test

(4) Procedure

(a) Resolution bandwidth accuracy

Step	Procedure
1	Press the (Preset) key.
2	Perform all calibration.
3	Set the MS8608A/MS8609A as shown below: Center Freq .... 100 MHz Span .... 1 kHz RBW (MANUAL) .... 300 Hz Scale .... LOG 1 dB/div
4	Press the (→ RLV) key and match the peak of the signal trace to the top line (REF LEVEL) on the screen.
5	Press the (Single) key to execute a single sweep, then check that the single sweep has been completed.
6	After pressing the (Measure) key, press the (more) key and then select Occ BW Measure.
7	After selecting X dB Down method, set X dB value to 3 dB.
8	Set the Occupied Bandwidth to on state by operating menu key.
9	The 3 dB resolution bandwidth value is displayed in the upper left-hand corner of the screen. Fill in this value in the table on the next page.
10	Repeat steps 3 to 9 for the frequencies other than the resolution bandwidth 300 Hz and the frequency span 1 kHz according to the combinations of resolution bandwidth and frequency span shown in the table on the next page.



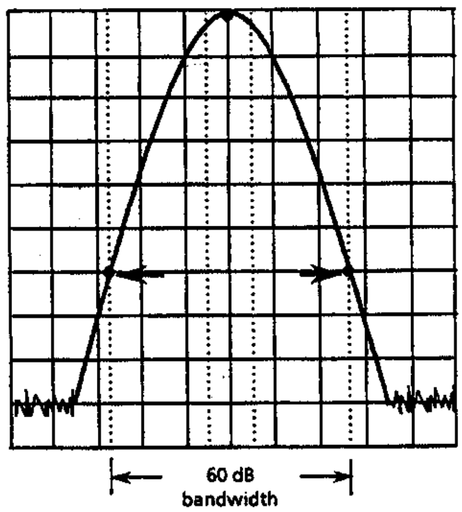
Bandwidth Measurement

Resolution Bandwidth (3 dB)

Resolution bandwidth	Span frequency	3dB bandwidth
300 Hz	1 kHz	
1 kHz	3 kHz	
3 kHz	10 kHz	
10 kHz	30 kHz	
30 kHz	100 kHz	
100 kHz	300 kHz	
300 kHz	1 MHz	
1 MHz	3 MHz	
3 MHz	10 MHz	
5 MHz	15 MHz	
10 MHz	30 MHz	
20 MHz	60 MHz	

(b) Resolution bandwidth selectivity

Step	Procedure
1	Set the MS8608A/MS8609A as shown below: Center Freq .... 200 MHz Span .... 10 kHz RBW (MANUAL) .... 300 Hz Scale .... LOG 10 dB/div VBW .... 100 Hz Marker .... NORMAL Zone Width .... 1 div
2	Press the (→ RLV) key to match the peak of the signal trace to the top line (REF LEVEL) on the screen.
3	Press the (Single) key to execute a single sweep, then check that the single sweep has been completed.
4	After pressing the (Measure) key, press the (more) key and then select Occ BW Measure.
5	After selecting X dB Down method, set it to 60 dB.
6	Set the Occupied Bandwidth to on state by operating menu key.
7	The 60 dB resolution bandwidth value is displayed in the upper left-hand corner of the screen. Fill in this value in the table on the next page.
8	Repeat steps 1 to 7 for the frequencies other than the resolution bandwidth 300 Hz and the frequency span 10 kHz according to the combinations of resolution bandwidth and frequency span shown in the table on the next page.
9	For the 3 dB bandwidth, too, write the value of the Resolution Bandwidth (3 dB) table on the preceding page in the table on the next page. And for each resolution bandwidth in the table on the next page, confirm that the value calculated from (60 dB BW/3 dB BW) is ≤15.



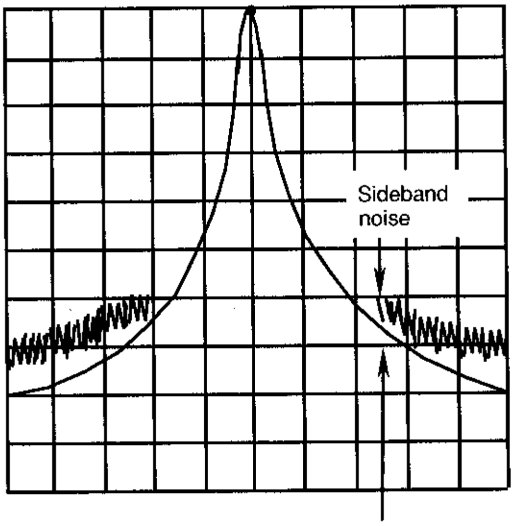
60 dB Bandwidth Measurement

Selectivity Test (60 dB/3 dB Bandwidth Ratio)

Setting the MS8608A/MS8609A spectrum analyzer		Measured result		Calculated result
Resolution bandwidth	Span frequency	60dB bandwidth	3dB bandwidth	Selectivity (60 dB BW ÷ 3 dB BW)
300 Hz	10 kHz			
1 kHz	30 kHz			
3 kHz	100 kHz			
10 kHz	300 kHz			
30 kHz	1 MHz			
100 kHz	3 MHz			
300 kHz	10 MHz			
1 MHz	30 MHz			
3 MHz	100 MHz			
5 MHz	150 MHz			
10 MHz	200 MHz			
20 MHz	200 MHz			

Sideband phase noise

When the resolution bandwidth is set to a fixed value and a signal that has far less sideband-noise level than the equipment to be tested is input, check the level of the noise as compared to the peak signal (dBc) at the specified frequency away from the peak.



Since the average value is measured for noise level, use a video filter for measurement.

This sideband noise is a spectrum response which is modulated by the internal noise of the spectrum analyzer. If this response is large, the actual filter envelope is masked by the noise as shown, which makes measurement impossible.

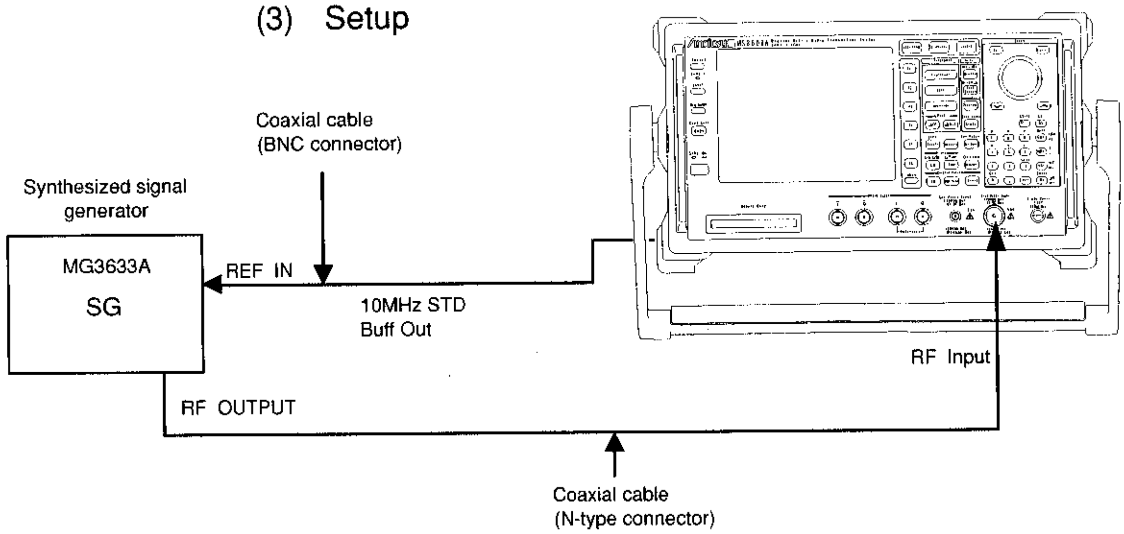
(1) Specification

- Sideband noise: ≤–108 dBc/Hz (Frequency: 1 GHz, 10 kHz offset)
  ≤–120 dBc/Hz (Frequency: 1 GHz, 100 kHz offset)

(2) Test instrument

- Signal generator: MG3633A Synthesized Signal Generator

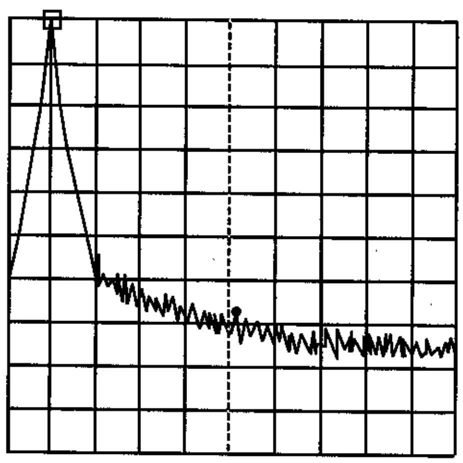
(3) Setup



Sideband Noise Test

(4) Procedure

Step	Procedure
1	Press the (Preset) key.
2	Operate All Cal.
3	Set the MG3633A output to 1000 MHz and 0 dBm.
4	Set the MS8608A/MS8609A as shown below: Center Freq .... 1.000 010 GHz Span .... 25 kHz Reference Level .... 0 dBm Attenuator .... 10 dB RBW .... 300 Hz VBW .... 10 Hz DET MODE .... SAMPLE
5	Press the (Peak Search) key to search for a peak point so that the peak point on the signal trace is included in the zone marker.
6	Press the (→ RLV) key to match the peak of the signal trace to the top line (REF LEVEL) on the screen.
7	After pressing the (Measure) key, select C/N Ratio Measure.
8	Press the Meas On key to start C/N measurement.
9	Set Zone Width of Marker to Spot.
10	Press the (Marker) key, then turn the rotary knob to move the zone marker to the right so that the zone center frequency is 10.0 kHz.
11	Repeat steps 4 to 10 for offset frequency 100 kHz according to the below setup table.



Sideband Noise Measurement

Frequency offset	Setting the MS8608A/MS8609A spectrum analyzer				Measured result
	Center frequency	Span	RBW	VBW	
10 kHz	1.00001 GHz	25 kHz	300 Hz	10 Hz	
100 kHz	1.0001 GHz	250 kHz	10 kHz	10 Hz	

Frequency measurement accuracy

Set the marker point to the position at least 20 dB higher than the noise (or adjacent interference signal) to operate the built-in counter with the higher-S/N signal, and test the frequency measurement accuracy using Count On mode.

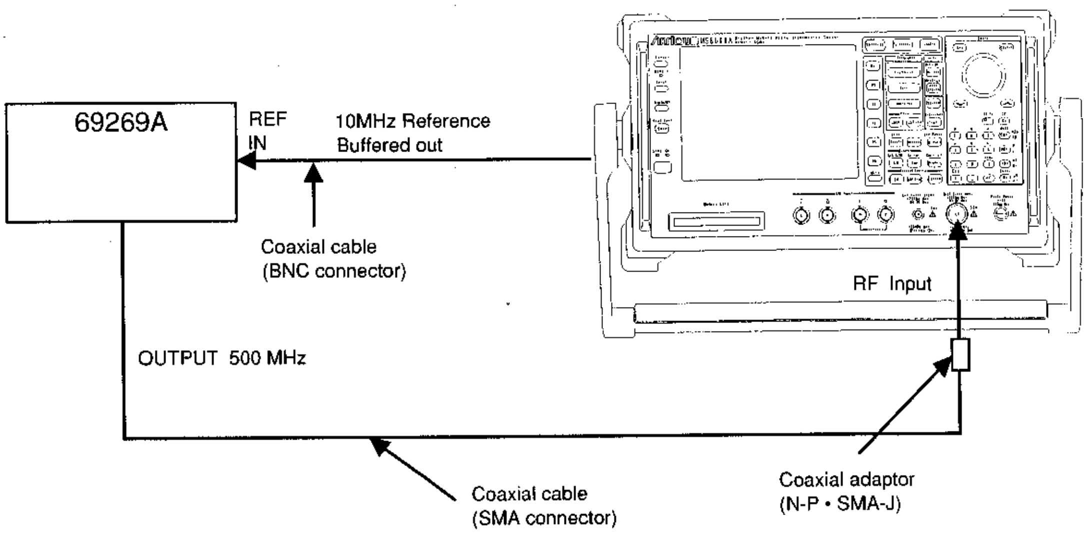
(1) Specifications

- Accuracy: ≤ (Readout frequency × reference oscillator accuracy ± (1 count) ±2 Hz)
- Resolution: 1 Hz, 10 Hz, 100 Hz, 1 kHz

(2) Test instrument

- Signal generator: 69269A

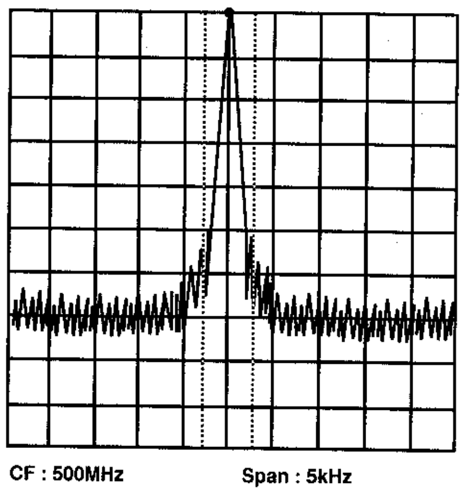
(3) Setup



Frequency Measurement Accuracy Test

(4) Procedure

Step	Procedure
1	Press the (Preset) key.
2	Set the 69269A to 500 MHz and -10 dBm.
3	Set the spectrum analyzer as shown below: Center Freq .... 500 MHz Span .... 5 kHz
4	Press the (Measure) key and set to Frequency Count. Press Setup and set Resolution to 1 Hz. Then, press the Return key and set to Count On.
5	Confirm that the FREQ reading at the upper-left of the screen is the RF INPUT frequency 500 MHz ± 3 Hz or less.
6	Change the counter resolution to 10 Hz and confirm that the Freq reading is 500 MHz ±10 Hz or less.
7	• Change the counter resolution to 100 Hz and confirm that the Freq reading is 500 MHz ±100 Hz or less. • Change the counter resolution to 1 kHz and confirm that the Freq reading is 500 MHz ±1 kHz or less.



Frequency Measurement

Amplitude display linearity

Test the error per vertical graduation for the LOG display. For the LOG display linearity, test that the graduation is equal to the logarithm (dB) of the input signal level.

Input the correct level signal to the RF Input via an external attenuator and calculate the error from the attenuation of the attenuator and the Δ marker reading at the trace waveform peak.

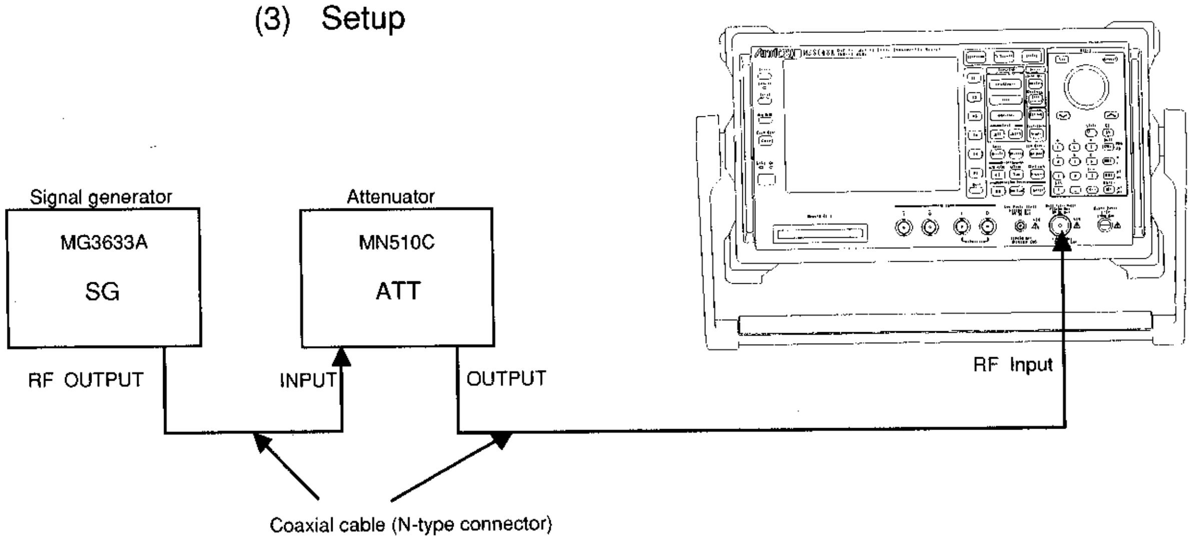
(1) Specification

- Amplitude display linearity: After automatic calibration
  LOG: ±1.0 dB for 0 to −90 dB, RBW ≤1 kHz
  ±0.4 dB for 0 to −20 dB, RBW ≤1 kHz

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C

(3) Setup



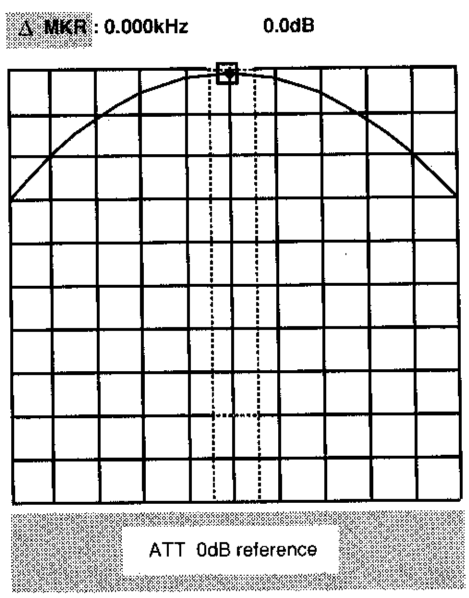
Amplitude Display Linearity Test

(4) Procedure

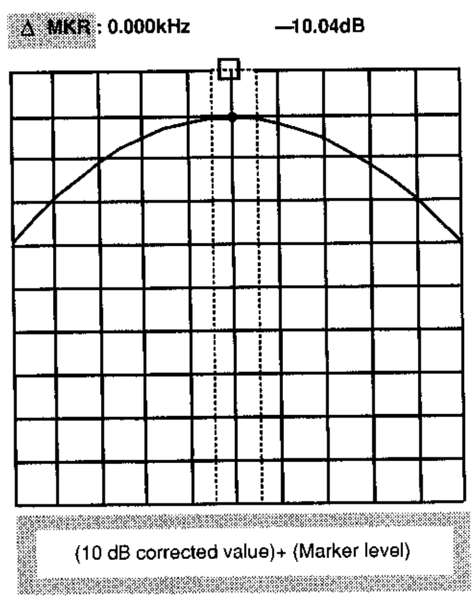
LOG display linearity

Step	Procedure
1	Press the (Preset) key.
2	Operate All Cal.
3	Set the MG3633A to 100 MHz, 0 dBm.
4	Set the MN510C to 0 dB.
5	Set the spectrum analyzer as shown below: Center Freq .... 100 MHz Span .... 10 kHz Reference Level .... 0 dBm Attenuator .... 10 dB RBW .... 1 kHz VBW .... 300 Hz
6	Press the (→ CF) key to set the spectrum waveform peak to the center of the screen.
7	Adjust the MG3633A output level so that the marker level reading is 0.0 dBm.
8	Press the (Marker) key sequentially to set the marker to Δ marker after the sweep is completed.

Step	Procedure
9	As shown on Fig. (b), read the level of the current marker when ATT is set at 10 dB. An error is determined as calibrated ATT 10 dB value +Δ marker level.
10	Add a marker level corresponding to the calibrated ATT value when ATT is set as 10 to 90 DB (with 10 dB steps) and determine the error.



(a) Reference Point Setting



(b) Δ Marker Level when ATT is 10

Log Display Linearity (10 dB/div)

ATT setting (dB)	A ATT calibration value (dB)	B Δ marker level (dB)	Error (dB)=A+B
0	0 (reference)	0 (reference)	0 (reference)
10	—	—	—
20	—	—	—
30	—	—	—
40	—	—	—
50	—	—	—
60	—	—	—
70	—	—	—
80	—	—	—
90	—	—	—

Frequency response

Generally, when one or more signals with a different frequency but the same amplitude are input, the MS8608A/MS8609A displays the same amplitude for each spectrum on the screen.

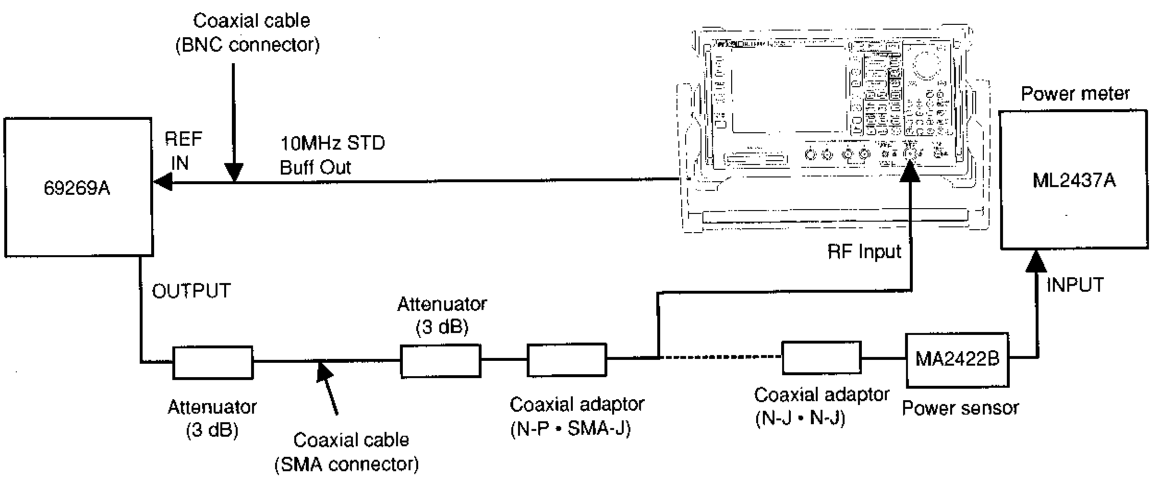
(1) Specifications

- Frequency response:
  Referenced to 50 MHz, RF ATT 10 dB and temperature range 18 to 28°C
  ±0.6 dB (9 kHz to 3.2 GHz, band 0)
  ±1.0 dB (3.15 to 7.8 GHz, band 1-/1+)
  Referenced to 50 MHz, RF ATT 10 to 62 dB
  ±1.0 dB (9 kHz to 3.2 GHz, band 0)
  ±2.0 dB (3.15 to 7.8 GHz, band 1-/1+)
  * For band 1- and 1+, after the pre-selector is tuned.....

(2) Test instruments

- Signal generator: 69269A
- Power meter: ML2437A
- Power sensor: MA2422B

(3) Setup



Frequency Response Test

(4) Precaution

This test should be performed at an ambient temperature of 18 to 28°C after allowing the instrument to warm up for 60 minutes or more.

(5) Procedure

(a) Calibration of signal-generator 69269A

Step	Procedure
1	Set the 69269A as shown below: OUTPUT FREQ .... 50 MHz OUTPUT LEVEL .... –6 dBm
2	Connect the 69269A output to the power sensor input with a coaxial cable.
3	Read the power meter display.
4	Change the 69269A output frequency as shown in the tables on the next page and read the power meter display with level at 50 MHz as reference. This data is the calibration data.

(b) Readout of measured amplitude deviation (frequency response)

Step	Procedure
1	Connect the 69269A OUTPUT to the MS8608A/MS8609A RF Input with a coaxial cable.
2	Press the MS8608A/MS8609A (Preset) key.
3	Perform all calibration. (Refer to Section 8 of Vol.2)
4	Set the MS8608A/MS8609A as shown below: Center Freq .... 50 MHz Span .... 200 kHz Reference Level .... –10 dBm
5	Press the (→ CF) key.
6	Set the marker mode to delta marker.
7	Set the MS8608A/MS8609A center frequency as shown in the tables on the next page, then obtain the deviation from the formula below by reading the delta marker level at each frequency. Deviation = Delta marker level reading - Measurement frequency calibration value For Band 1- and 1+, the pre-selector is peaked. (Refer to Section 8 of Vol.2)

Frequency Response (Band 0)

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
50 MHz	0 (reference)	0 (reference)	0 (reference)
200 MHz	__________	__________	__________
500 MHz	__________	__________	__________
1 GHz	__________	__________	__________
1.5 GHz	__________	__________	__________
2 GHz	__________	__________	__________
3 GHz	__________	__________	__________

Frequency Response (Band 1-)

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
3.2 GHz	__________	__________	__________
4 GHz	__________	__________	__________
5 GHz	__________	__________	__________
6 GHz	__________	__________	__________
6.2 GHz	__________	__________	__________

Frequency Response (Band 1+)

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
6.3 GHz	__________	__________	__________
7 GHz	__________	__________	__________
7.5 GHz	__________	__________	__________
7.8 GHz	__________	__________	__________

Reference level accuracy

Here the absolute amplitude level at only 50 MHz is tested. Confirm the level accuracy after inputting an SG output (calibrated by a standard power meter) to the MS8608A/ MS8609A.

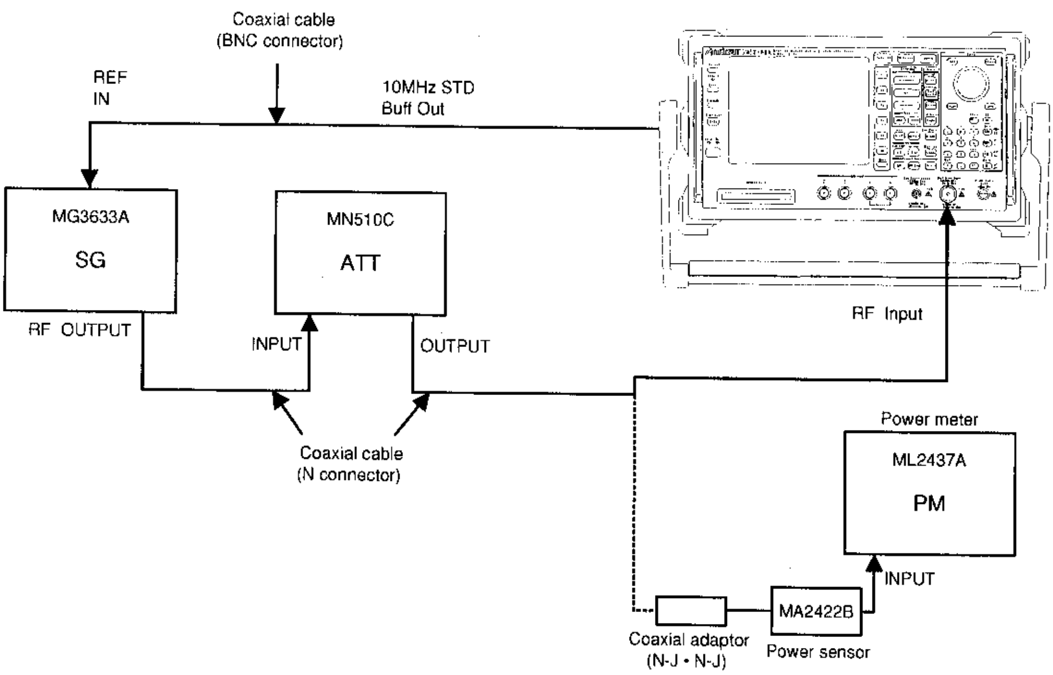
(1) Specification

- Reference level accuracy: At 50 MHz frequency and 1 MHz span after automatic calibration
  (Resolution bandwidth, video bandwidth, RF ATT and sweep time set to AUTO)
  ■ MS8608A High power input
  ≤±0.5 dB (–29.9 to +20 dBm)
  ≤±0.75 dB (–49.9 to –30 dBm, +20.1 to +40 dBm)
  ≤±1.5 dB (–60 to –50 dBm)
  ■ MS8608A Low power or MS8609A input
  ≤ ± 0.5 dB (0 to –49.9 dBm)
  ≤ ± 0.75 dB (–69.9 to –50 dBm, 0.1 to +30 dBm)
  ≤ ± 1.5 dB (–80 to –70 dBm)

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C
- Power sensor: MA2422B
- Power meter: ML2437A

(3) Setup



Reference Level Accuracy Test

(4) Precautions

1) Set the resolution bandwidth, video bandwidth, RF ATT and sweep time to Auto.
2) This test should be performed after warming up this instrument for 60 minutes or more.

(5) Procedure

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Connect the attenuator OUTPUT to the power sensor input.
4	Set the SG frequency to 50 MHz and adjust the SG level so that the power meter indication is 0 dBm. At this time, set the attenuator to 0 dB.
5	Connect the attenuator OUTPUT to the MS8608A/MS8609A RF Input connector.
6	Set the MS8608A/MS8609A as shown below: Center Freq .... 50 MHz Span .... 1 MHz Reference Level .... 0 dBm
7	Press the (→ CF) to move the peak point of the spectrum waveform to the center of the screen.
8	Read the marker level.

Step	Procedure

9 Change the attenuator in 10 dB steps, set the reference level as shown in the table below and read the marker level each time.

Reference level setting	Marker readout	Correction factor of ATT	Error
0 dBm	dBm	dB	dB
–10 dBm	dBm	dB	dB
–20 dBm	dBm	dB	dB
–30 dBm	dBm	dB	dB
–40 dBm	dBm	dB	dB
–50 dBm	dBm	dB	dB
–60 dBm	dBm	dB	dB
–70 dBm	dBm	dB	dB
–80 dBm	dBm	dB	dB

10 Calculate the error from the following equation.

Error = Marker readout - reference level set value - correction factor of ATT

Average noise level

The internal noise distributed evenly in proportion to the resolution bandwidth over the whole measurement frequency band is called the average noise level.

(1) Specification

- Average noise level: At 300 Hz resolution bandwidth, 1 Hz video bandwidth, and 0 dB RF ATT:

■ MS8608A High Power input
[without Option08 Pre-amplifier]
≤–104 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)
≤–100 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)
≤–100 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)
[with Option08 Pre-amplifier,when Pre-amplifier Off]
≤–102 dBm + 1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)
≤–100 dBm + 1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)
≤–100 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

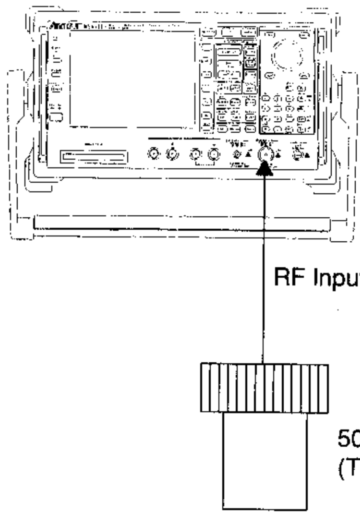
■ MS8608A Low Power input
[without Option08 Pre-amplifier]
≤–124 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)
≤–120 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)
≤–120 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)
[with Option08 Pre-amplifier,when Pre-amplifier Off]
≤–122 dBm + 1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)
≤–120 dBm + 1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)
≤–120 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

■ MS8609A input
[without Option08 Pre-amplifier]
≤–124 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)
≤–120 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)
≤–116 dBm (3.15 to 7.8 GHz, Band 1)
≤–107 dBm (7.7 to 13.2 GHz, Band 2)
[with Option08 Pre-amplifier,when Pre-amplifier Off]
≤–122 dBm + 1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)
≤–120 dBm + 1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)
≤–116 dBm (3.15 to 7.8 GHz, Band 1)
≤–107 dBm (7.7 to 13.2 GHz, Band 2)

(2) Test instrument

- 50 Ω terminator: MP752A

(3) Setup



Average Noise Level Test

(4) Procedure

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Terminate the RF Input with a 50 Ω terminator.
4	Set the MS8608A/MS8609A as shown below: (Time Domain) Band .... 0 Center Freq .... 1 MHz Span .... 0 Hz Reference Level .... –100 dBm RBW .... 300 Hz VBW .... 1 Hz Attenuator .... 0 dB Detection .... Sample
5	Press (Time), Storage, Average and Average Count keys in order and set the average count to 16.
6	Press the Continue key to start the averaging, and wait until the 16-time averaging sweep is completed.
7	Press the (Peak Search) key to execute peak search. At this point, read the level value at the marker.

Step	Procedure
8	The marker reading is the average noise level.

Setting the MS8608A/MS8609A		Measured result
Band	Center frequency	
0	1 MHz	
	99 MHz	
	499 MHz	
	999 MHz	
	1499 MHz	
	1999 MHz	
	2499 MHz	
	2999 MHz	
	3199 MHz	
1-	3201 MHz	
	3499 MHz	
	3999 MHz	
	4499 MHz	
	4999 MHz	
	6299 MHz	
1+	6201 MHz	
	6499 MHz	
	6999 MHz	
	7799 MHz	
2+	7701 MHz	
	8499 MHz	
	9499 MHz	
	10499 MHz	
	11499 MHz	
	12499 MHz	
	13199 MHz	

MS8608A: 1 to 7799 MHz
MS8609A: 1 to 13199 MHz

9 Repeat steps 4 to 7 while setting Band and Center Freq from the below table so that the average noise level can be obtained.

Second harmonic distortion

Even if a signal without harmonic distortion is input to a spectrum analyzer, the higher harmonics are generated by the analyzer input-mixer non-linearity and are displayed on the screen.

The second harmonic level is the highest harmonic displayed on the MS8608A/MS8609A. The main point of the test is to apply a signal (with a distortion that is lower than the MS8608A/MS8609A internal harmonic distortion [at least 20 dB below]) to the MS8608A/MS8609A and measure the level difference between the fundamental wave and the second harmonic. If a low-distortion signal source cannot be obtained, apply a low-distortion signal to the MS8608A/MS8609A after passing the signal through a low-pass filter (LPF).

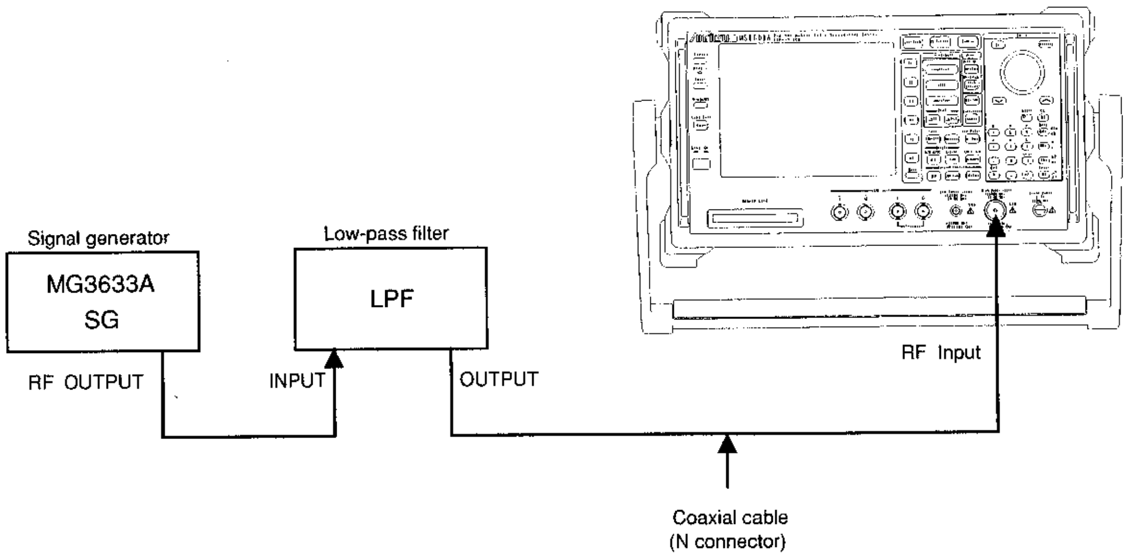
(1) Specification

- Second harmonic distortion:
  At mixer input level –30 dBm:
  ≤–60 dBc (10 to 200 MHz, Band 0)
  ≤–75 dBc (0.2 to 0.85 GHz, Band 0)
  ≤–70 dBc (0.85 to 1.6 GHz, Band 0)
  At mixer input level –10 dBm:
  ≤–90 dBc (1.6 to 3.9 GHz, Band 1–/1+)

(2) Test instruments

- Signal generator: MG3633A
- LPF: With attenuation of 70 dB or more at twice the fundamental frequencies

(3) Setup



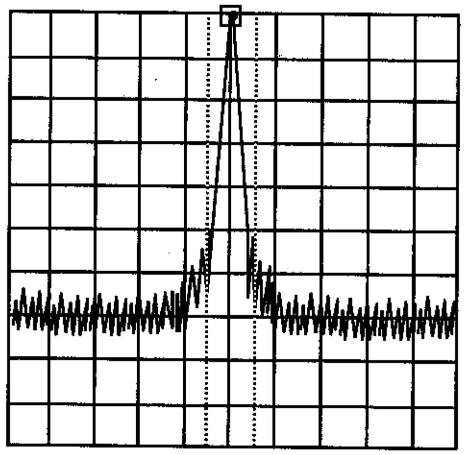
Second Harmonic Distortion Test

(4) Procedure

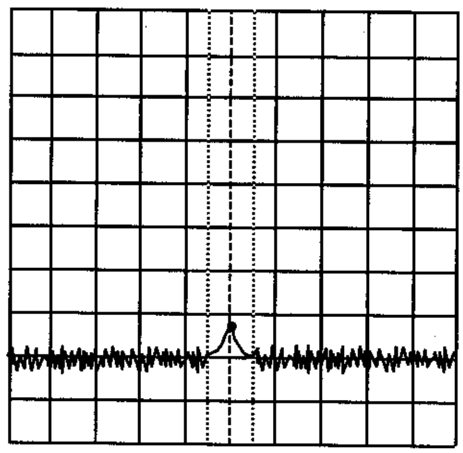
Step	Procedure
1	Press the (Preset) key.
2	Operate All Cal.
3	Connect the LPF VLF-141 (fp=50 MHz)
4	Set the SG output frequency to 48 MHz and the output level to -20 dBm.
5	Set the MS8608A/MS8609A as shown below: Center Freq .... 48 MHz Span .... 10 kHz Reference Level .... –20 dBm Attenuator .... 10 dB
6	Adjust the SG output level so that peak of the spectrum waveform is at the REF LEVEL (the top horizontal line of the screen).

Step	Procedure

7 Move the marker to the peak of the spectrum waveform and make the marker the Δ marker.



8 Set the center frequency to twice the fundamental wave frequency to display the second harmonic on the screen.
The Δ marker reading indicates the level difference between the fundamental wave and the second harmonic.
If the level difference is 80 dB or more, set the REF LEVEL to –50 dBm. Confirm that the ATT set value is 0 dB.



9 Connect the LPF VLF-141 (fp=800 MHz)

10 Set the SG as follows:

OUTPUT FREQ .... 780 MHz
OUTPUT LEVEL .... –20 dBm

11 Set the MS8608A/MS8609A as follows:

Center Freq .... 780 MHz
Span .... 10 kHz
Reference Level .... –20 dBm
Attenuator .... 10 dB

12 Repeats steps 6 to 8.

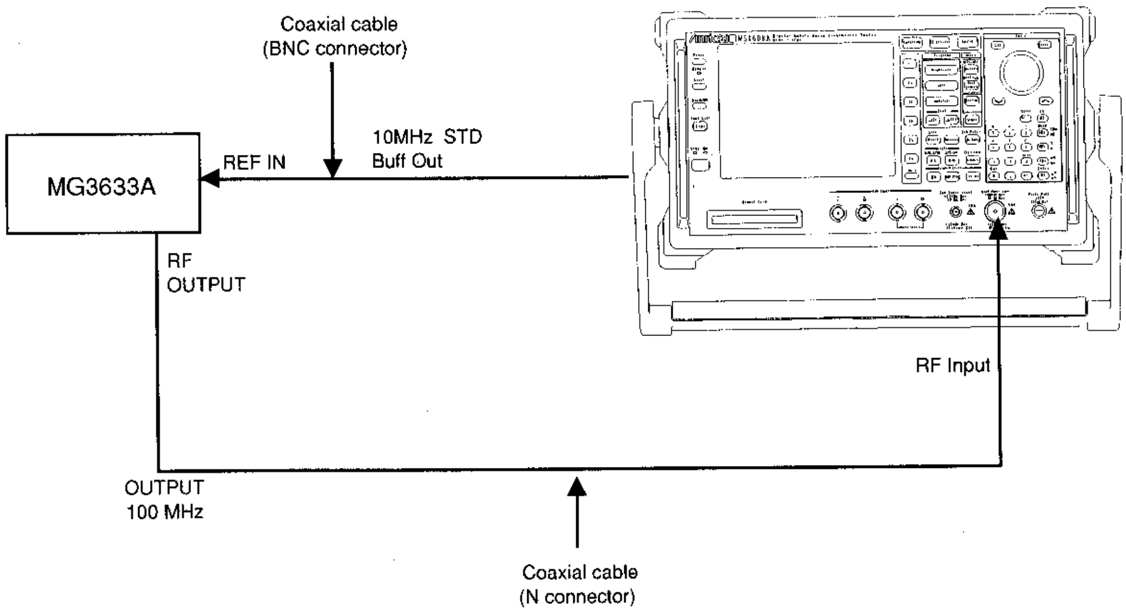
Resolution bandwidth (RBW) switching uncertainty

When the resolution bandwidth (RBW) is switched, its level error at the peak point is measured.

(1) Specification

- Resolution bandwidth switching uncertainty: ± 0.3 dB (RBW=300 Hz to 5 MHz) (referenced to RBW: 3 kHz) ± 0.5 dB (RBW=10 MHz, 20 MHz)

(2) Setup



Resolution Bandwidth Switching Error Test

(4) Procedure

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Set the signal generator MG3633A as shown below. OUTPUT FREQ .... 100 MHz OUTPUT LEVEL .... 0 dBm
4	Set the MS8608A/MS8609A as shown below. Center Freq .... 100 MHz Span .... 15 kHz Reference Level .... 0 dBm RBW .... 3 kHz
5	Press the (→ CF) key to move the signal spectrum peak to the center.
6	Press (Marker) to set the marker to Δ marker.
7	Set RBW and SPAN as shown in the table on the next page and measure the level deviation (error) of each RBW by following steps 8 and 9 below.
8	Press (Peak Search) key to conduct peak search and move the current marker to the peak point of the signal spectrum.
9	Read the Δ marker level value.

Resolution bandwidth (RBW) switching uncertainty

Setting the MS8608A/MS8609A		Measured result
Resolution bandwidth	Frequency span	Δ marker readout
300Hz	2kHz	
1kHz	5kHz	
3kHz	15kHz	
10kHz	50kHz	
30kHz	150kHz	
100kHz	500kHz	
300kHz	1.5MHz	
1MHz	5MHz	
3MHz	15MHz	
5MHz	25MHz	
10MHz	50MHz	
20MHz	100MHz	

Input attenuator (RF ATT) switching uncertainty

At this point, measure the switching error when the amount of attenuation in the RF input section is switched. When the input attenuator is switched, IF-section step-amplifier gain is switched. To keep this step-amplifier gain constant, the reference level is switched according to the amount of input attenuator attenuation.

(1) Specification

Referenced to 50 MHz, RF ATT 10 dB: MS8608A Low input or MS8609A input (30 dB: MS8608A High input)

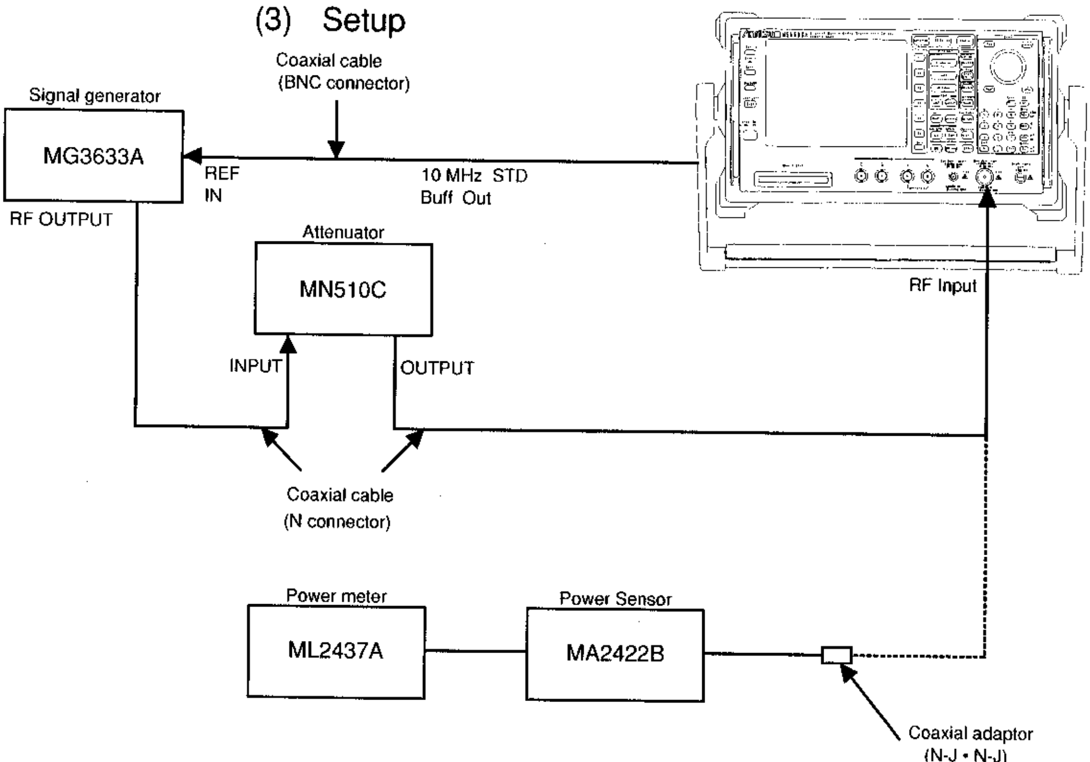
- Input attenuator switching error:

  ±0.3 dB (30 to 70 dB, MS8608A High power input)
  (10 to 50 dB, MS8608A Low power input or MS8609A input)
  ±0.5 dB (72 to 82 dB, MS8608A High power input)
  (52 to 62 dB, MS8608A Low power input or MS8609A input)

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C
- Power meter: ML2437A
- Power sensor: MA2422B

(3) Setup



Input Attenuator Switching Error Test

(4) Procedure

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Set the MS8608A/MS8609A as shown below: Center Freq .... 50 MHz Span .... 200 kHz
4	Set the signal generator MG3633A as shown below: OUTPUT FREQ .... 50 MHz OUTPUT LEVEL .... −10 dBm
5	Set the amount of attenuation of the attenuator MN510C to 0 dB.
6	Connect the output of the attenuator MN510C to the power meter via coaxial cable.
7	Adjust the signal-generator output level so that the indicated value of the power meter is -10.0 dBm.
8	Connect the coaxial cable of the attenuator output to the spectrum analyzer RF Input.
9	Press the (→ CF) key.
10	Set the reference level to −10 dBm and attenuation to 50 dB.
11	Read the marker level.
12	Set Reference Level, RF ATT of this device and the external ATT as shown in the table on the next page, and read the level of each marker.
13	Find the error by the formula below: Error = marker readout - Reference Level - correction factor of attenuator
14	Find the deviation by the formula below: Deviation = Error - error when RF ATT at 10 dB

Setting MS8608A/MS8609A		Attenuator		Measured result	Calculated result	
Ref Level	Input attenuator	Setting	Correction	Marker level	Error	Deviation
-10dBm	60dB	0dB				
-20dBm	50dB	10dB				
-30dBm	40dB	20dB				
-40dBm	30dB	30dB				
-50dBm	20dB	40dB				
-60dBm	10dB	50dB				0dB(reference)

Frequency domain sweep time accuracy

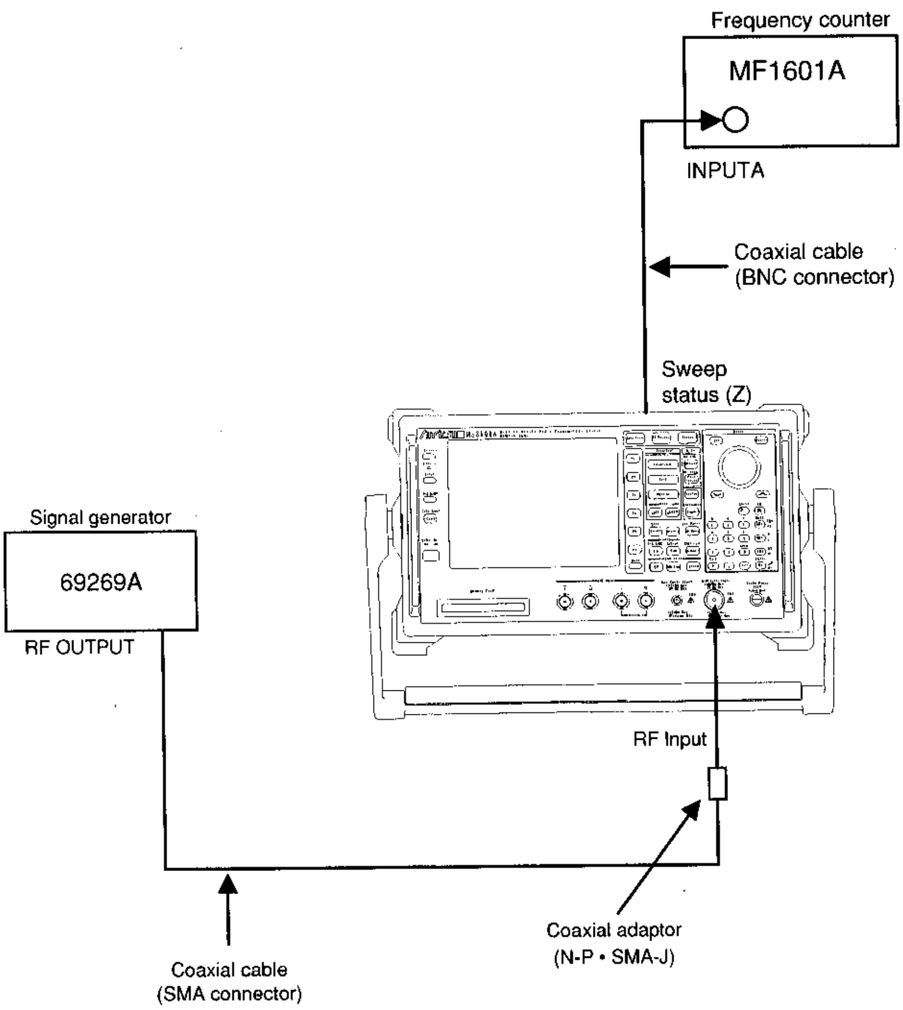
(1) Specification

- Sweep time accuracy: ±3% (10 msec to 100 sec)

(2) Test instruments

- Signal generator: 69269A
- Frequency counter: MF1601A

(3) Setup



Sweep Time Accuracy

(4) Procedure

(a) sweep time ≥100 ms

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Connect the Sweep Status (Z) output of MS8608A/MS8609A to Input A of MF1601A.
4	Set the MS2683A MS8608A/MS8609A as shown below: Center Frequency .... 300 MHz Span .... 2 MHz Ref Level .... 0 dBm RBW .... 3 MHz VBW .... Auto Detection .... Sample Sweep Time .... 100 ms
5	Set the MF1601A as shown below: Input .... A Function .... Pulse width Couple .... DC Slope .... Rise
6	Press the MS8608A/MS8609A (Single) key.
7	Reset the MF1601A.
8	Press the MS8608A/MS8609A (Single) key, and measure the pulse width of sweep status output.
9	Repeats steps 6 to 8 at each sweep time of below table.

Setting the MS8608A/MS8609A Sweep time	Measured result
100 ms	
500 ms	
10 s	
100 s	

(b) sweep time <100ms

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Connect the output of 69269A to the MS8608A/MS8609A according to setup figure.
4	Set the MS8608A/MS8609A as shown below: Center Frequency .... 300 MHz Span .... 2 MHz Ref Level .... 0 dBm RBW .... 3 MHz VBW .... Auto Detection .... Sample Sweep Time .... 50 ms Marker Zone Width .... 100 kHz
5	Set the 69269A as shown below. Frequency .... 300 MHz Pulse Modulation .... On Period .... 5 ms Width .... 20 µs Output Level .... 0 dBm
6	Press the MS8608A/MS8609A (Single) key.
7	Move the marker to the left most peak of the screen.
8	Set the marker mode to Δ marker.
9	Move the current Δ marker to the right. Move the Δ marker to the 8th peak point and read the frequency difference of the Δ marker.
10	Calculate the actual sweep time using the below equation. (Actual sweep time) = (((frequency difference) ÷ (2MHz)) × (Pulse Period)) ÷ 0.8
11	Repeats steps 6 to 10 at each sweep time and setting the Pulse Period of 69269A of below table.

Setting the MS8608A/MS8609A	Signal generator	Measured result	Calculated result
Sweep time	Pulse Period	Frequency difference	Actual sweep time
50 ms	5 ms		
20 ms	2 ms		
10 ms	1 ms		

Time domain sweep time accuracy

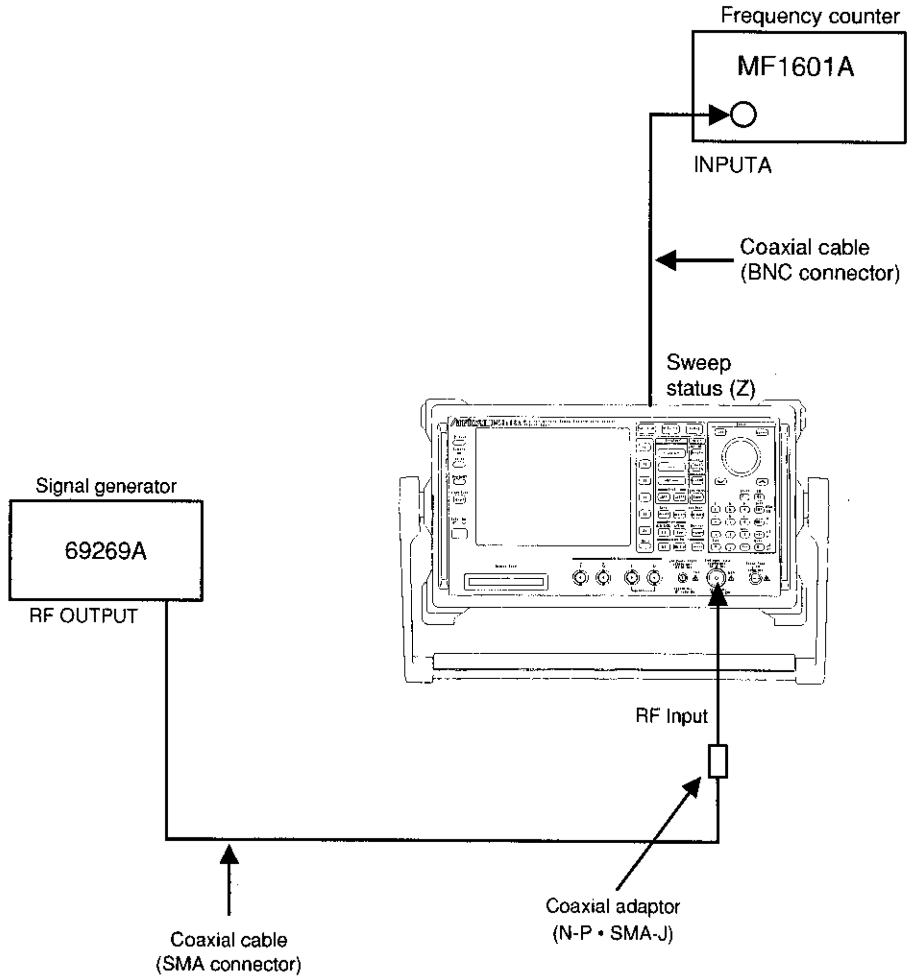
(1) Specification

- Time domain sweep time accuracy: ±1.0%

(2) Test instruments

- Signal generator: 69269A
- Frequency counter: MF1601A

(3) Setup



Sweep Time Accuracy

(4) Procedure

(a) Sweep time ≥100 ms

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Connect the Sweep Status (Z) output of MS8608A/MS8609A to Input A of MF1601A.
4	Set the MS8608A/MS8609A as shown below: Center Frequency ....300 MHz Span ....0 MHz Ref Level .... 0 dBm RBW ....5 MHz VBW .... Off Detection ....Sample Sweep Time .... 100 ms
5	Set the MF1601A as shown below: Input .... A Function .... Pulse width Couple .... DC Slope ....Rise
6	Press the MS8608A/MS8609A (Single) key.
7	Reset the MF1601A.
8	Press the MS8608A/MS8609A (Single) key, and measure the pulse width of sweep status output.
9	Repeats steps 6 to 8 at each sweep time of below table.

Setting the MS8608A/MS8609A	Measured result
Sweep time	Pulse width
100 ms	
500 ms	
10 s	
100 s	

(b) Sweep time <100ms

Step	Procedure
1	Press the MS8608A/MS8609A (Preset) key.
2	Operate All Cal.
3	Connect the output of 69269A to the MS8608A/MS8609A according to setup figure.
4	Set the MS8608A/MS8609A as shown below: Center Frequency .... 300 MHz Span .... 0 MHz Ref Level .... 0 dBm RBW .... 5 MHz VBW .... Off Detection .... Sample Sweep Time .... 50 ms Display Line .... On, Absolute Display Line .... –20 dB
5	Set the 69269A as shown below. Pulse Modulation .... On Period .... 5 ms Width .... 2.5 ms Output Level .... 0 dBm
6	Press the MS8608A/MS8609A (Single) key.
7	As shown below figure, shift the marker to the point which is most left of the screen, and where intersect display line and up-slope of wave.
8	Set the marker mode to Δ marker.
9	Move the current Δ marker to the right and the 8th point where intersect display line and up-slope of wave, and read the difference time of the Δ marker.
10	Repeats steps 6 to 9 at each sweep time and setting the Pulse Period of 69269A, Pulse width of the below table.

MS8608A/MS8609A Setting	Signal generator	Measured result	Calculated result
Sweep time	Pulse Period	Pulse Width	
50 ms	5 ms	2.5 ms	
20 ms	2 ms	1 ms	
10 ms	1 ms	0.5 ms	
5 ms	0.5 ms	0.25 ms	
1 ms	0.1 ms	50 μs	
100 μs	10 μs	5 μs	
10 μs	1 μs	0.5 μs	

Service

If the instrument is damaged or does not operate as specified, contact your nearest Anritsu dealer or business office for repair. When you request repair, provide the following information.

(a) Model name and serial number on rear panel

(b) Fault description

(c) Name of a personnel-in-charge and address for contact when fault confirmed or at a completion of repair

Section 7 Storage and Transportation

This section describes the long-term storage, repacking and transportation of MS8608A/MS8609A Digital Mobile Radio Transmitter Tester as well as the regular care procedures and the timing.

Cleaning Cabinet

Always turn the MS8608A/MS8609A POWER switch OFF and disconnect the power plug from the AC power inlet before cleaning the cabinet. To clean the external cabinet:

- Use a soft, dry cloth for wiping off.
- Use a cloth moistened with diluted neutral cleaning liquid if the instrument is very dirty with dust and dirt, after use at dusty place, or before long-term storage. After insuring that the cabinet has been thoroughly dried, use a soft, dry cloth for wiping off.
- If loose screws are found, tighten them with the appropriate tools.

CAUTION ⚠

Never use benzene, thinner, or alcohol to clean the external cabinet; it may damage the coating, or cause deformation or discoloration.

Storage Precautions

This paragraph describes the precautions to take for long-term storage of the MS8608A/MS8609A.

Precautions before storage

(1) Before storage, wipe dust, finger-marks, and other dirt off the MS8608A/MS8609A.

(2) Avoid storing the MS8608A/MS8609A where:

1) It may be exposed to direct sunlight or high dust levels.
2) It may be exposed to high humidity.
3) It may be exposed to active gases.
4) It may be exposed to extreme temperatures (>60°C , <–20°C) or high humidity (≥90%).

Recommended storage precautions

The recommended storage conditions are as follows:

- Temperature .... 0 to 30°C
- Humidity .... 40 to 80%
- Stable temperature and humidity over 24-hour period

Repacking and Transportation

The following precautions should be taken if the MS8608A/MS8609A must be returned to Anritsu Corporation for servicing.

Repacking

Use the original packing materials. If the MS8608A/MS8609A is packed in other materials, observe the following packing procedure:

(1) Wrap the MS8608A/MS8609A in a plastic sheet or similar material.
(2) Use a cardboard, wooden box, or aluminum case which allows shock-absorbent material to be inserted on all sides of the equipment.
(3) Use enough shock-absorbent material to protect the MS8608A/MS8609A from shock during transportation and to prevent it from moving in the container.
(4) Secure the container with packing straps, adhesive tape or bands.

Transportation

Do not subject the MS8608A/MS8609A to severe vibration during transport. It should be transported under the storage conditions recommended before.

Appendixes

Appendix A Front and Rear Panel Layout

This appendix shows the front and rear panel layout.

Fig. NO.	Name
Fig. A-1	MS8608A Front Panel
Fig. A-2	MS8608A Rear Panel

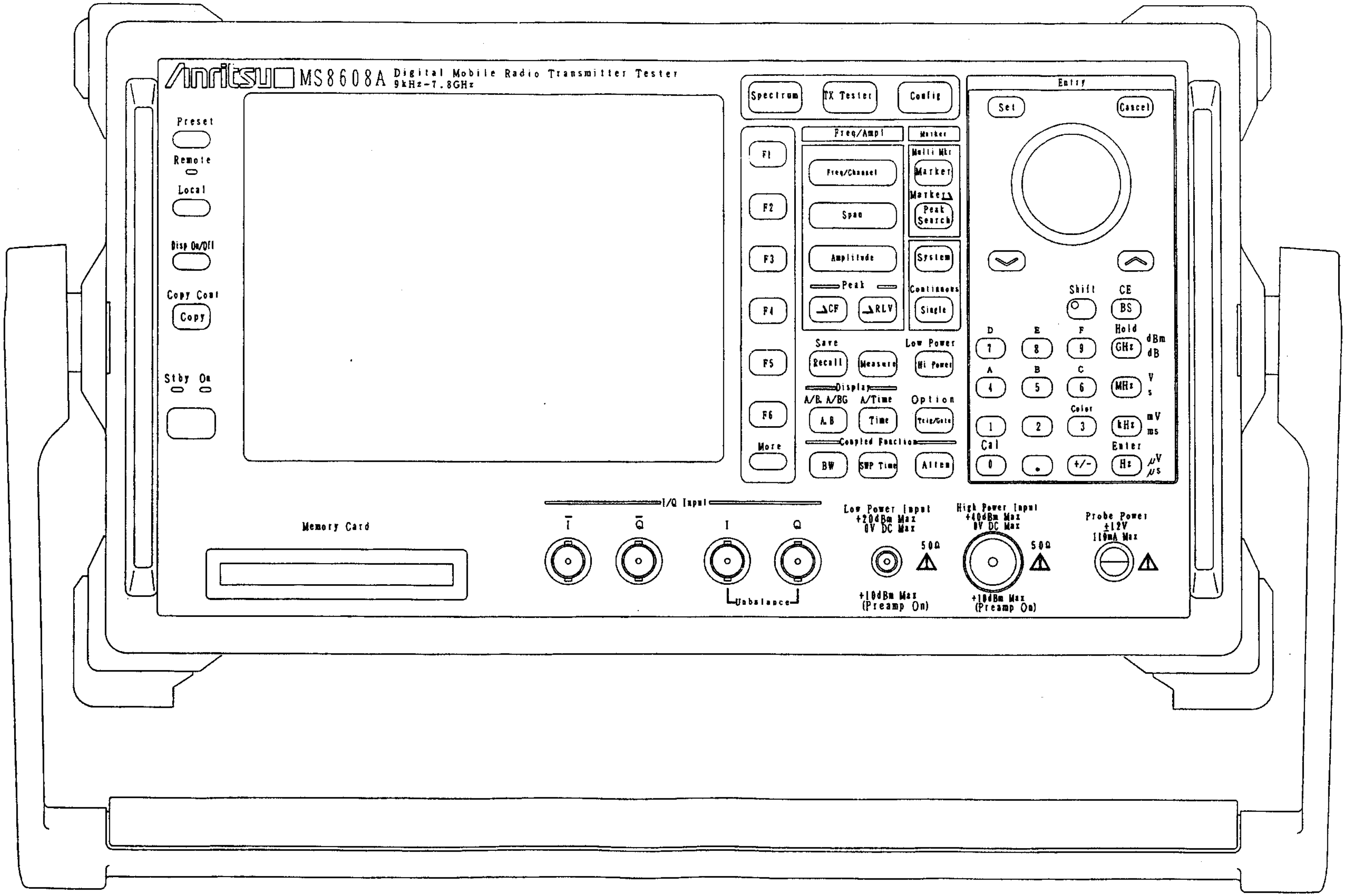


Fig. A-1 MS8608A Front Panel

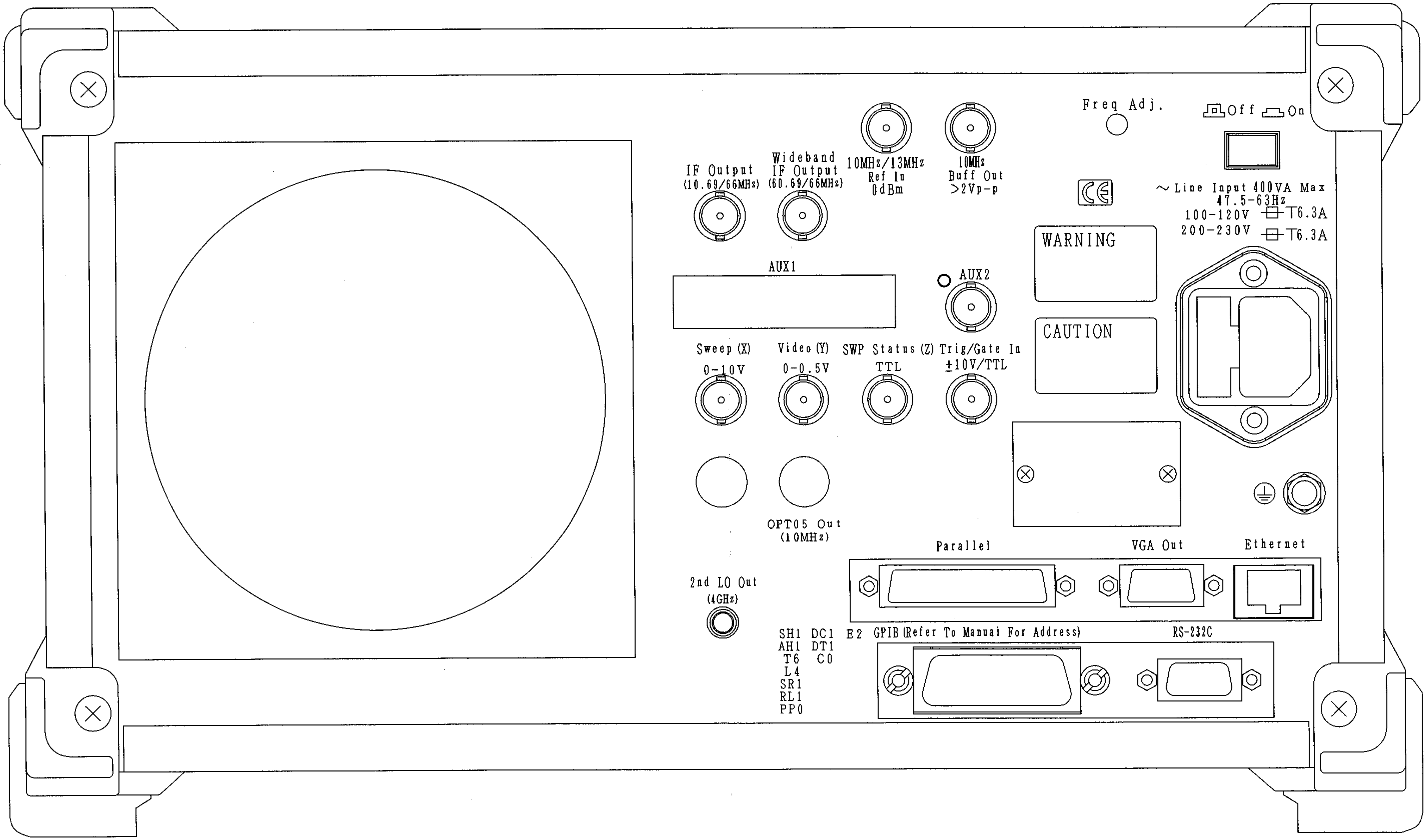
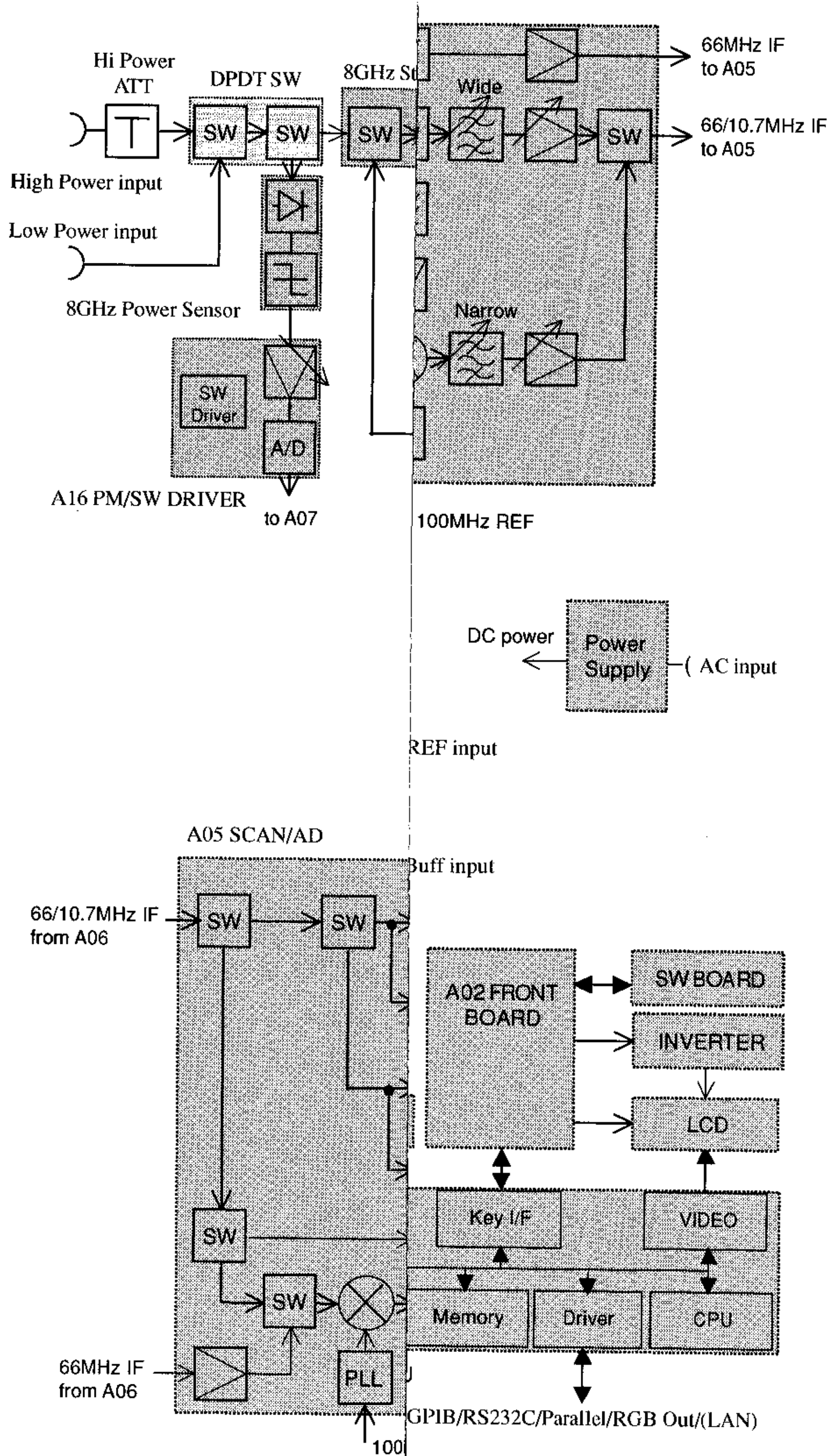


Fig. A-2 MS8608A Rear Panel

Appendix B Block Diagram

This appendix shows the Block Diagram of the MS8608A

Fig. NO.	Name
Fig. B-1	MS8608A Block Diagram


Hi Power
ATT
DPDT SW
SW
SW
SW
66MHz IF
to A05
Wide
SW
66/10.7MHz IF
to A05
High Power input
Low Power input
8GHz Power Sensor
Narrow
SW
Driver
A/D
A16 PM/SW DRIVER
to A07
100MHz REF
DC power
Power
Supply
AC input
REF input
A05 SCAN/AD
66/10.7MHz IF
from A06
SW
SW
A02 FRONT
BOARD
SW BOARD
INVERTER
LCD
SW
Key I/F
VIDEO
SW
Memory
Driver
CPU
66MHz IF
from A06
PLL
GPIB/RS232C/Parallel/RGB Out/(LAN)

Appendix C Performance Test Record

Performance Test Record

(1/15)

NO. ___________

DATE _________

Model ______________________

Serial NO. ______________________

Options ______________________

Date ______________________

Tested by ______________________

Ambient temparature ____________ °C

Relative humidity ______________ %

Perwer mains line voltage (nominal) ________ Vac

Power mains line frquency (nominal) _______ Hz

Test Equipment used

Descriptions	MODEL NO.	Cal Date
Synthesized signal generator		
Synthesized Sweeper		
Attenuator		
Power meter		
Power senser		
50 Ω Termination		
Low pass filter		
Frequency counter		
Frequency standard		

Model Name ______________________ date ______________________

Serial NO. ______________________

Tested by ______________________

Reference oscillator frequency stability

• Frequency stability

Referred to the frequency after 24 hour warm-up

$\pm 2 \times 10^{-8}$

	Min.	Result	Max.	Cumulative error
Frequency stability/day	-2×10^{-8}		$+2\times10^{-8}$	$+2\times10^{-10}$

• Temperature stability

Referred to the frequency at 25°C

$\pm 5 \times 10^{-8}$

Ambient temperature	Min.	Result	Max.	Cumulative error
0°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$
50°C	-5×10^{-8}		$+5\times10^{-8}$	$+2\times10^{-10}$

Rubidium reference oscillator frequency stability (Option 05)

• Starting characteristic

Referred to the frequency after 24 hour warm-up.

$\pm 1 \times 10^{-9}$

	Min.	Result	Max.	Cumulative error
Starting characteristic	-1×10^{-9}		$+1\times10^{-9}$	

• Temperature stability

Referred to the frequency at 25°C

$\pm 1 \times 10^{-9}$

Ambient temperature	Min.	Result	Max.	Cumulative error
0°C	-1×10^{-9}		$+1\times10^{-9}$	
45°C	-1×10^{-9}		$+1\times10^{-9}$	

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Frequency readout accuracy

±((Displayed frequency) × (reference frequency accuracy) + (span) × (span accuracy) + (resolution bandwidth) × 0.15 + 10 Hz)

)

Center frequency	Span frequebcy	Resolution bandwidth	Min. (Hz)	Result (Hz)	Max. (Hz)	Cumulative error (Hz)
500 MHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
5 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000
7 GHz	10 kHz	300 Hz	-110		+110	21
	200 kHz	3 kHz	-2 010		+2 010	401
	100 MHz	300 kHz	-1 000 010		+1 000 010	20 000

)

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Frequency span readout accuracy

Single band sweep
±1.0%

MS8608A/MS8609A		Min.	Result	Max.	Cumulative
Center frequency	Span frequency	(Hz)	(Hz)	(Hz)	error (Hz)
1.5 GHz	20 kHz	-200		+200	40
	200 kHz	-2 000		+2 000	400
	2 MHz	-20 000		+20 000	4 000
	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000
5 GHz	20 MHz	-200 000		+200 000	40 000
	200 MHz	-2 000 000		+2 000 000	400 000
	2 GHz	-20 000 000		+20 000 000	4 000 000

(5/15)

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Resolution bandwidth accuracy and selectivity

• Resolution bandwidth accuracy

±20% (300 Hz to 10 MHz)

±40% (20 MHz)

MS8608A/MS8609A Resolution bandwidth	Span frequency	Min. Cumulative error (Hz)	Min. (Hz)	Result (Hz)	Max. (Hz)	Max. Cumulative error (Hz)
300 Hz	10 kHz	+8	240		360	-8
1 kHz	30 kHz	+22	800		1 200	-24
3 kHz	100 kHz	+80	2 400		3 600	-80
10 kHz	300 kHz	+220	8 000		12 000	-240
30 kHz	1 MHz	+800	24 000		36 000	-800
100 kHz	3 MHz	+2 200	80 000		120 000	-2 400
300 kHz	10 MHz	+8 000	240 000		360 000	-8 000
1 MHz	30 MHz	+22 000	800 000		1 200 000	-24 000
3 MHz	100 MHz	+80 000	2 400 000		3 600 000	-80 000
5 MHz	150 MHz	+110 000	4 000 000		6 000 000	-120 000
10 MHz	200 MHz	+220 000	8 000 000		1 200 000	-240 000
20 MHz	200 MHz	+480 000	12 000 000		28 000 000	-520 000

• Resolution bandwidth selectivity

≤15 : 1

MS8608A/MS8609A		Result		Calculated result	Spec.	Max. Cumulative error (Hz)
Resolution bandwidth	Span frequency	60 dB bandwidth (Hz)	3 dB bandwidth (Hz)	Selectivity		
300 Hz	10 kHz				≤15:1	+0.14
1 kHz	30 kHz				≤15:1	+0.12
3 kHz	100 kHz				≤15:1	+0.14
10 kHz	300 kHz				≤15:1	+0.12
30 kHz	1 MHz				≤15:1	+0.14
100 kHz	3 MHz				≤15:1	+0.12
300 kHz	10 MHz				≤15:1	+0.14
1 MHz	30 MHz				≤15:1	+0.12
3 MHz	100 MHz				≤15:1	+0.14
5 MHz	150 MHz				≤15:1	+0.12
10 MHz	200 MHz				≤15:1	+0.08
20 MHz	200 MHz				≤15:1	+0.08

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Sideband phase noise

≤–108 dBc/Hz (Frequency: 1 GHz, frequency offset: 10 kHz)

≤–120 dBc/Hz (Frequency: 1 GHz, frequency offset: 100 kHz)

Frequency offset	MS8608A/MS8609A Span frequency	Result	Spec	Cumulative error
10 kHz	25 kHz		-108 dBc/Hz	-1.1 dB
100 kHz	250 kHz		-120 dBc/Hz	-1.1 dB

Frequency measurement accuracy

≤± (displayed frequency × reference oscillator accuracy ± 1 count ± 2 Hz)

Signal generator Output frequency	MS8608A/MS8609A Count resolution	Min.	Result	Max.
500 MHz	1 Hz	499.999 997 MHz		500.000 003 MHz
500 MHz	10 Hz	499.999 99 MHz		500.000 01 MHz
500 MHz	100 Hz	499.999 9 MHz		500.000 1 MHz
500 MHz	1 kHz	499.999 MHz		500.001 MHz

Amplitude display accuracy

After executing calibration

±0.4 dB (RBW ≤ 1 kHz, 0 to –20 dB)

±1.0 dB (RBW ≤ 1 kHz, 0 to –90 dB)

ATT ATT setting (dB)	Correction (dB)	Measured result (dB)	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0				±0.4	±0.06
10				±0.4	±0.06
20				±1.0	±0.09
30				±1.0	±0.09
40				±1.0	±0.09
50				±1.0	±0.09
60				±1.0	±0.21
70				±1.0	±0.21
80				±1.0	±0.21
90				±1.0	±0.21

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Frequency response

Referred to 50 MHz, RF ATT10 dB, Temperature18 to 28°C
±0.6 dB (9 kHz to 3.2 GHz, Band 0)
±1.0 dB (3.15 to 7.8 GHz, Band 1)
*Band 1: After executing preselector tuning

MS8608A/MS8609A		Correction (dB)	Result (dB)	Calculated result (dB)	Spec. (dB)	Cumulative error (dB)
Band	Frequency					
0	50 MHz			0.00 (referrence)	—	—
0	200 MHz				±0.6	±0.16
0	500 MHz				±0.6	±0.16
0	1 GHz				±0.6	±0.16
0	1.5 GHz				±0.6	±0.16
0	2 GHz				±0.6	±0.16
0	3 GHz				±0.6	±0.16
1–	3.2 GHz				±1.0	±0.14
1-	4 GHz				±1.0	±0.14
1-	5 GHz				±1.0	±0.14
1-	6.2 GHz				±1.0	±0.14
1+	6.3 GHz				±1.0	±0.14
1+	7 GHz				±1.0	±0.14
1+	7.5 GHz				±1.0	±0.14
1+	7.8 GHz				±1.0	±0.14

Model Name ______________________ date ______________________

Serial NO. ______________________

Tested by ______________________

Reference level accuracy

After calibration, frequency: 50 MHz, Span: 1 MHz (RBW, VBW, RF ATT, SWT: Auto)

■ MS8608A Low power input or MS8609A input

±0.5 dB (0 to −49.9 dBm)

±0.75 dB (−69.9 to −50 dBm, +0.1 to +30 dBm)

±1.5 dB (−70 to −80 dBm)

MS8608A/MS8609A Reference level	Attenuator Correction (dB)	Result (dB) Marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
0 dBm				±0.5	±0.10
-10 dBm				±0.5	±0.10
-20 dBm				±0.5	±0.10
-30 dBm				±0.5	±0.12
-40 dBm				±0.5	±0.12
-50 dBm				±0.75	±0.12
-60 dBm				±0.75	±0.22
-70 dBm				±1.5	±0.22
-80 dBm				±1.5	±0.22

After calibration, frequency: 50 MHz, Span: 1 MHz (RBW, VBW, RF ATT, SWT: Auto)

■ MS8608A High power input

±0.5 dB (−29.9 to +26 dBm)

±0.75 dB (−49.9 to −30 dBm, +20.1 to +40 dBm)

±1.5 dB (−60 to −50 dBm)

MS8608A/MS8609A Reference level	Attenuator Correction (dB)	Result (dB) Marker level	Calculated result (dB)	Spec.(dB)	Cumulative error (dB)
+20 dBm				±0.5	±0.10
+10 dBm				±0.5	±0.10
0 dBm				±0.5	±0.10
-10 dBm				±0.5	±0.12
-20 dBm				±0.5	±0.12
-30 dBm				±0.75	±0.12
-40 dBm				±0.75	±0.22
-50 dBm				±1.5	±0.22
-60 dBm				±1.5	±0.22

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Average noise level

Resolution bandwidth: 300 Hz, VBW: 1 Hz, Input attenuator: 0 dB

■ MS8608A High Power input

[without Option 08 Pre-amplifier]

≤–104 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–100 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–100 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

[with Option 08 Pre-amplifier, when Pre-amplifier Off]

≤–102 dBm + 1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–100 dBm + 1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–100 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

Setting Equipment		Measurement result (dBm)	Standard (dBm)	Maximum accumulation error (dB)
Band	Center frequency			
0	1 MHz		-104.0 (-102.0)	±1.23
	99 MHz		-103.9 (-101.8)	±1.23
	499 MHz		-103.3 (-101.1)	±1.23
	999 MHz		-102.5 (-100.2)	±1.23
	1499 MHz		-101.8 (-99.3)	±1.23
	1999 MHz		-101.0 (-98.4)	±1.23
	2499 MHz		-100.3 (-97.5)	±1.23
	2999 MHz		-95.5 (-94.6)	±1.23
	3199 MHz		-95.2 (-94.2)	±1.23
1-	3201 MHz		-97.4 (-97.4)	±1.23
	3499 MHz		-97.2 (-97.2)	±1.23
	3999 MHz		-96.8 (-96.8)	±1.23
	4499 MHz		-96.4 (-96.4)	±1.23
	4999 MHz		-96.0 (-96.0)	±1.23
	6299 MHz		-95.0 (-95.0)	±1.23
1+	6201 MHz		-95.0 (-95.0)	±1.23
	6499 MHz		-94.8 (-94.8)	±1.23
	6999 MHz		-94.4 (-94.4)	±1.23
	7799 MHz		-93.8 (-93.8)	±1.23

Inside of a parenthesis is a standard value with Option 08.

(10/15)

Model Name ______________________ date ______________________

Serial NO. ______________________

Tested by ______________________

Average noise level

Resolution bandwidth: 300 Hz, VBW: 1 Hz, Input attenuator: 0 dB

■ MS8608A Low Power input

[without Option 08 Pre-amplifier]

≤–124 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–120 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

[with Option 08 Pre-amplifier,when Pre-amplifier Off]

≤–122 dBm + 1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + 1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–120 dBm + 0.8 × f [GHz] dB (3.15 to 7.8 GHz, Band 1)

Setting Equipment		Measurement result (dBm)	Standard (dBm)	Maximum accumulation error (dB)
Band	Center frequency			
0	1 MHz		-124.0 (-122.0)	±1.23
	99 MHz		-123.9 (-121.8)	±1.23
	499 MHz		-123.3 (-121.1)	±1.23
	999 MHz		-122.5 (-120.2)	±1.23
	1499 MHz		-121.8 (-119.3)	±1.23
	1999 MHz		-121.0 (-118.4)	±1.23
	2499 MHz		-120.3 (-117.5)	±1.23
	2999 MHz		-115.5 (-114.6)	±1.23
	3199 MHz		-115.2 (-114.2)	±1.23
1-	3201 MHz		-117.4 (-117.4)	±1.23
	3499 MHz		-117.2 (-117.2)	±1.23
	3999 MHz		-116.8 (-116.8)	±1.23
	4499 MHz		-116.4 (-116.4)	±1.23
	4999 MHz		-116.0 (-116.0)	±1.23
	6299 MHz		-115.0 (-115.0)	±1.23
1+	6201 MHz		-115.0 (-115.0)	±1.23
	6499 MHz		-114.8 (-114.8)	±1.23
	6999 MHz		-114.4 (-114.4)	±1.23
	7799 MHz		-113.8 (-113.8)	±1.23

Inside of a parenthesis is a standard value with Option 08.

(11/15)

Model Name ______________________ date ______________________

Serial NO. ______________________

Tested by ______________________

Average noise level

Resolution bandwidth: 300 Hz, VBW: 1 Hz, Input attenuator: 0 dB

■ MS8609A input

[without Option 08 Pre-amplifier]

≤–124 dBm + 1.5 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + 1.5 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–116 dBm (3.15 to 7.8 GHz, Band 1)

≤–107 dBm (7.7 to 13.2 GHz, Band 2)

[with Option 08 Pre-amplifier,when Pre-amplifier Off]

≤–122 dBm + 1.8 × f [GHz] dB (1 MHz to 2.5 GHz, Band 0)

≤–120 dBm + 1.8 × f [GHz] dB (2.5 to 3.2 GHz, Band 0)

≤–116 dBm (3.15 to 7.8 GHz, Band 1)

≤–107 dBm (7.7 to 13.2 GHz, Band 2)

Setting Equipment		Measurement result (dBm)	Standard (dBm)	Maximum accumulation error (dB)
Band	Center frequency			
0	1 MHz		-104.0 (-102.0)	±1.23
	99 MHz		-103.9 (-101.8)	±1.23
	499 MHz		-103.3 (-101.1)	±1.23
	999 MHz		-102.5 (-100.2)	±1.23
	1499 MHz		-101.8 (-99.3)	±1.23
	1999 MHz		-101.0 (-98.4)	±1.23
	2499 MHz		-100.3 (-97.5)	±1.23
	2999 MHz		-95.5 (-94.6)	±1.23
	3199 MHz		-95.2 (-94.2)	±1.23
1-	3201 MHz		-97.4 (-97.4)	±1.23
	3499 MHz		-97.2 (-97.2)	±1.23
	3999 MHz		-96.8 (-96.8)	±1.23
	4499 MHz		-96.4 (-96.4)	±1.23
	4999 MHz		-96.0 (-96.0)	±1.23
	6299 MHz		-95.0 (-95.0)	±1.23
1+	6201 MHz		-95.0 (-95.0)	±1.23
	6499 MHz		-94.8 (-94.8)	±1.23
	6999 MHz		-94.4 (-94.4)	±1.23
	7799 MHz		-93.8 (-93.8)	±1.23
2+	7701 MHz		-95.0 (-95.0)	±1.23
	8499 MHz		-94.8 (-94.8)	±1.23
	9499 MHz		-94.4 (-94.4)	±1.23
	10499 MHz		-93.8 (-93.8)	±1.23
	11499 MHz		-95.0 (-95.0)	±1.23
	12499 MHz		-94.8 (-94.8)	±1.23
	13199 MHz		-94.4 (-94.4)	±1.23

Inside of a parenthesis is a standard value with Option 08.

(12/15)

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Second harmonic distortion

Mixer input level: –30 dBm
≤–60 dBc (Frequency:10 to 200 MHz)
≤–75 dBc (Frequency: 0.2 to 0.85 GHz, Band 0)
≤–70 dBc (Frequency: 0.85 to 1.6 GHz, Band 0)
Mixer input level: –10 dBm
≤–90 dBc (Frequency: 1.6 to 3.9 GHz, Band 1)

Signal generator	MS8608A/MS8609A setting	Result (dB)	Spec.(dBc)	Cumulative error (dB)
Output frequency	Band			
48 MHz	0		-60	±1.09
780 MHz	0		-75	±1.09

Resolution bandwidth (RBW) switching error

Referred to RBW 3kHz
±0.3 dB (300 Hz to 5 MHz)
±0.5 dB (10 MHz, 20 MHz)

MS8608A/MS8609A setting		Result (dB)	Spec. (dB)	Cumulative error (dB)
RBW	Span frequency			
300 Hz	2 kHz		±0.3	±0.02
1 kHz	5 kHz		±0.3	±0.02
3 kHz	15 kHz		0.00 (referrence)	—
10 kHz	50 kHz		±0.3	±0.02
30 kHz	150 kHz		±0.3	±0.02
100 kHz	500 kHz		±0.3	±0.02
300 kHz	1.5 MHz		±0.3	±0.02
1 MHz	5 MHz		±0.3	±0.02
3 MHz	15 MHz		±0.3	±0.02
5 MHz	25 MHz		±0.3	±0.02
10 MHz	50 MHz		±0.5	±0.02
20 MHz	100 MHz		±0.5	±0.02

(13/15)

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Input attenuator (RF ATT) switching error

Referred to 50 MHz, RF ATT 10 dB

■ MS8608A Low Power input or MS8609A

±0.3 dB (10 to 50 dB)

±0.5 dB (52 to 62 dB)

MS8608A/MS8609A setting		Attenuator		Result (dB)	Calculated	Spec. (dB)	Cumulative
Reference level	RF ATT	Setting	Correction	marker level	result (dB)		error (dB)
-10 dBm	60 dB	0 dB				±0.5	±0.11
-20 dBm	50 dB	10 dB				±0.3	±0.11
-30 dBm	40 dB	20 dB				±0.3	±0.11
-40 dBm	30 dB	30 dB				±0.3	±0.13
-50 dBm	20 dB	40 dB				±0.3	±0.13
-60 dBm	10 dB	50 dB			0.00 (reference)	—	—

Referred to 50 MHz, RF ATT 30 dB

■ MS8608A High Power input

±0.3 dB (30 to 70 dB)

±0.5 dB (72 to 82 dB)

MS8608A/MS8609A setting		Attenuator		Result (dB)	Calculated	Spec. (dB)	Cumulative
Reference level	RF ATT	Setting	Correction	marker level	result (dB)		error (dB)
-10 dBm	80 dB	0 dB				±0.5	±0.11
-20 dBm	70 dB	10 dB				±0.3	±0.11
-30 dBm	60 dB	20 dB				±0.3	±0.11
-40 dBm	50 dB	30 dB				±0.3	±0.13
-50 dBm	40 dB	40 dB				±0.3	±0.13
-60 dBm	30 dB	50 dB			0.00 (reference)	—	—

Model Name ____________________ date ____________________

Serial NO. ____________________

Tested by ____________________

Frequency domain sweep time accuracy

±3% (10 ms to 1000 s)

MS8608A/MS8609A setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	97 ms		103 ms	±3%	±11 ns
500 ms	485 ms		515 ms	±3%	±11 ns
10 s	9.7 s		10.3 s	±3%	±11 ns
100 s	97 s		103 s	±3%	±11 ns

MS8608A/MS8609A setting Sweep time	Result Frequency difference	Min.	Calculated result	Max.	Spec.	Cumulative error
50 ms		48.5 ms		51.5 ms	±3%	±141 µs
20 ms		19.4 ms		20.6 ms	±3%	±56.5 µs
10 ms		9.7 ms		1.03 ms	±3%	±28.2 µs

(15/15)

Model Name ______________________ date ______________________

Serial NO. ______________________

Tested by ______________________

Time domain sweep time accuracy

±1% (10 μs to 1000 s)

MS8608A/MS8609A setting Sweep time	Min.	Result	Max.	Spec.	Cumulative error
100 ms	99 ms		101 ms	±1%	±11 ns
500 ms	495 ms		505 ms	±1%	±11 ns
10 s	9.9 s		1.01 s	±1%	±11 ns
100 s	99 s		101 s	±1%	±11 ns

MS8608A/MS8609A setting Sweep time	Min.	Calculated result	Max.	Spec.	Cumulative error
50 ms	49.5 ms		50.5 ms	±1%	±141 μs
20 ms	19.8 ms		20.2 ms	±1%	±56.5 μs
10 ms	9.9 ms		1.01 ms	±1%	±28.2 μs
5 ms	4.95 ms		5.05 ms	±1%	±14.1 μs
1 ms	0.99 ms		1.01 ms	±1%	±2.82 μs
100 μs	99 μs		101 μs	±1%	±0.282 μs
10 μs	9.9 μs		10. 1μs	±1%	±28.2 ns

MS8608A/MS8609A
Digital Mobile Radio Transmitter Tester
Operation Manual
Vol. 1
(Main Unit: Remote Control)

TABLE OF CONTENTS

IV.

SECTION 1 GENERAL

This section outlines the remote control and gives examples of system upgrades.

General

The MS8608A/MS8609A when combined with an external controller (host computer, personal computer, etc.), can automate your measurement system. For this purpose, the MS8608A/MS8609A is equipped with an RS-232C interface, GPIB interface (IEEE std 488.2-1987) and Ethernet interface (Option 09).

Remote control functions

The remote control functions of the MS8608A/MS8609A are used to do the following:

(1) Control all functions except a few like the power switch and [LOCAL] key

(2) Read all parameter settings.

(3) Set the RS-232C interface settings from the panel

(4) Set the GPIB address from the panel

(5) Set the Ethernet (Option 09) IP address the panel

(6) Select the connection port to an external controller from the panel

(7) Configure the automatic measurement system when the MS8608A/MS8609A is combined with a personal computer and other measuring instruments.

Interface port selection functions

The MS8608A/MS8609A has the standard RS-232C interface, GPIB interface bus and Parallel interface. Also, the MS8608A/MS8609A enables to have a Ethernet interface as an option. Use the panel to select the interface port to be used to connect external devices as shown below.

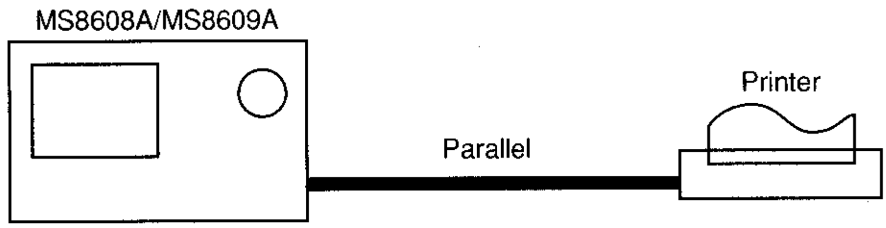
Port for the external controller: Select RS-232C, GPIB or Ethernet (Option 09).

Port for the printer or plotter: Parallel.

Examples of system upgrades using various interfaces

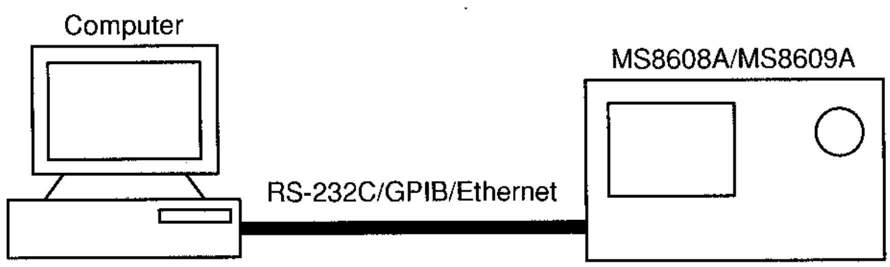
(1) Stand-alone

Waveforms measured with the MS8608A/MS8609A are output to the printer.



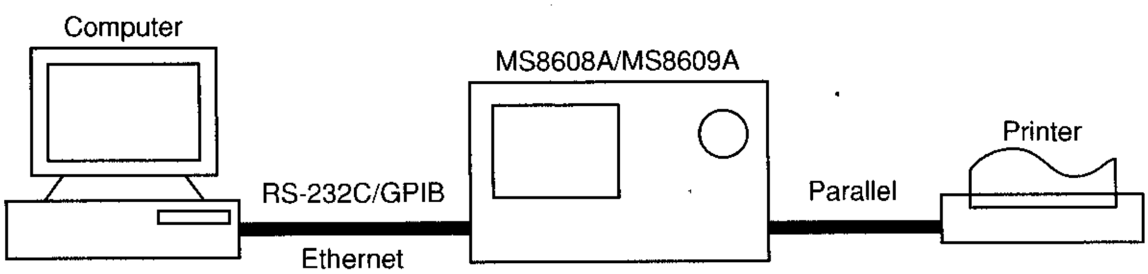
(2) Control by the host computer (1)

The MS8608A/MS8609A is controlled automatically or remotely from the computer.



(3) Control by the host computer (2)

The waveforms measured by controlling MS8608A/MS8609A automatically or remotely are output to the printer.



Specifications of RS-232C

The table below lists the specifications of the RS-232C provided as standard in the MS8608A/MS8609A.

Item	Specification
Function	Control from the external controller (except for power-ON/OFF)
Communication system	Asynchronous (start-stop synchronous system), half-duplex
Communication control system	X-ON/OFF control
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 56000, 115200 bps
Data bits	7 or 8 bits
Parity	Odd number (ODD), even number (EVEN), none (NON)
Start bit	1 bit
Stop bit (bits)	1 or 2 bits
Connector	D-sub 9-pin, male

Specifications of GPIB

The table below lists the specifications of the GPIB provided as standard for the MS8608A/MS8609A.

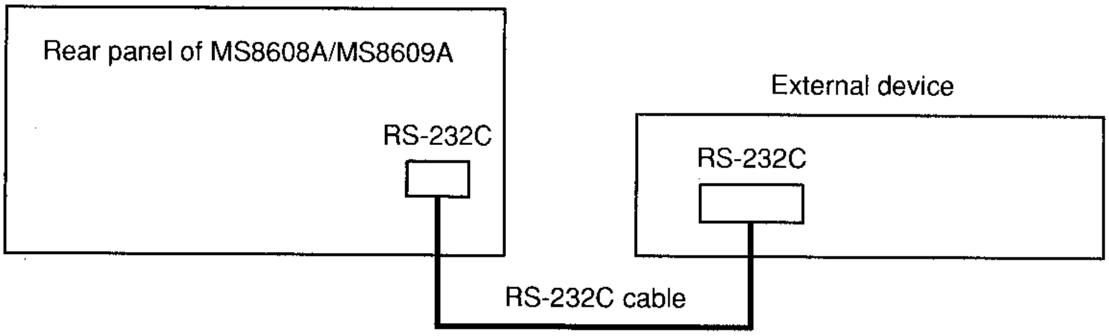
Item	Specification and supplementary explanation
Function	Conforms to IEEE488.2. The MS8608A/MS8609A is controlled from the external controller as a device. (except for power-on/off).
Interface function	SH1: All source handshake functions are provided. Synchronizes the timing of data transmission. AH1: All acceptor handshake functions are provided. Synchronizes the timing of data reception. T6: The basic talker functions and serial poll function are provided. The talk only function is not provided. The talker can be canceled by MLA. L4: The basic listener functions are provided. The listen only function is not provided. The listener can be canceled by MTA. SR1: All service request and status byte functions are provided. RL1: All remote/local functions are provided. The local lockout function is provided. PP0: The parallel poll functions are not provided. DC1: All device clear functions are provided. DT1: Device trigger functions are provided. C0: The controller function is not provided. E2: Output is tri-state.

SECTION 2 CONNECTING DEVICE

This section describes how to connect the MS8608A/MS8609A to external devices such as the host computer, personal computer, and printer with RS-232C and GPIB cables. This section also describes how to setup the interfaces of the MS8608A/MS8609A.

Connecting an external device with an RS-232C cable

Connect the RS-232C connector (D-sub 9-pin, male) on the rear panel of the MS8608A/MS8609A to the RS-232C connector of the external device with an RS-232C cable.

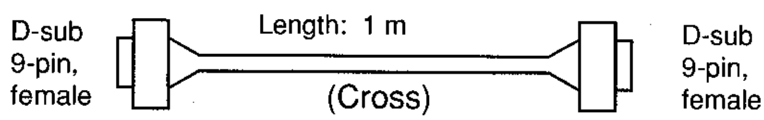


Notes:

The following RS-232C cable is provided as a peripheral part of the MS8608A/MS8609A.

• RS-232C cable (for IBM PC/AT Compatible)

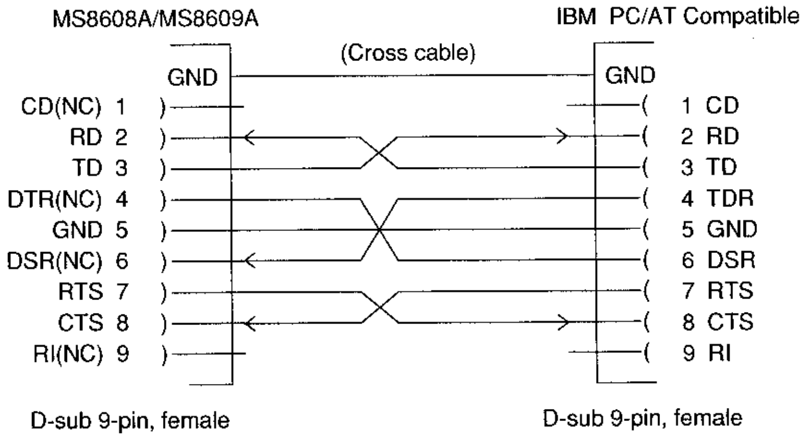
MS8608A/MS8609A side AT Compatible personal computer side



Connection diagram of RS-232C interface signals

The diagram below shows the RS-232C interface signal connections between the MS8608A/MS8609A and devices such as a personal computer or printer.

- Connection with IBM PC/AT Compatible personal computer



Setting the connection port interfaces

Refer to the Section 5 "Setting external interface" on the MS8608A/MS8609A Operation Manual Vol. 1 (Main Unit: Panel Operation) for the setting method.

Setting the RS-232C interface conditions

Set the RS-232C interface conditions of this equipment to those of the external device to be connected.

Refer to the Section 5 "Setting external interface" on the MS8608A/MS8609A Operation Manual Vol. 1 (Main Unit: Panel Operation) for the setting method.

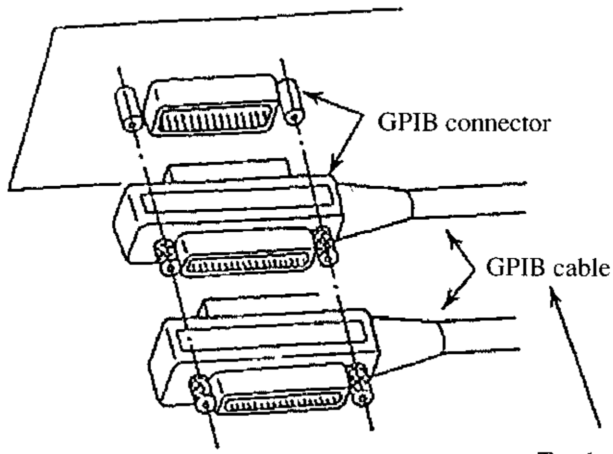
For how to set the RS-232C interface of an external device, refer to the operation manual of the external device.

Connecting a device with a GPIB cable

Connect the GPIB connector on the rear panel of this equipment to the GPIB connector of an external device with a GPIB cable.

Note: *Be sure to connect the GPIB cable before turning the equipment power on.*

Up to 15 devices, including the controller, can be connected to one system. Connect devices as shown below.



Total cable length: Up to 20 m
Cable length between devices: Up to 4 m
Number of devices that can be connected: Up to 15

Setting the GPIB address

Refer to the Section 5 "Setting external interface" on the MS8608A/MS8609A Operation Manual Vol. 1 (Main Unit: Panel Operation) for the setting method.

SECTION 3 DEVICE MESSAGE FORMAT

This section describes the format of the device messages transmitted between a controller (host computer) and device (MS8608A/MS8609A) via the RS-232C, GPIB/Ethernet system.

General description

The device messages are data messages transmitted between the controller and devices, program messages transferred from the controller to this instrument (device), and response messages input from this instrument (device) to the controller. There are also two types of program commands and program queries in the program message. The program command is used to set this instrument's parameters and to instruct it to execute processing. The program query is used to query the values of parameters and measured results.

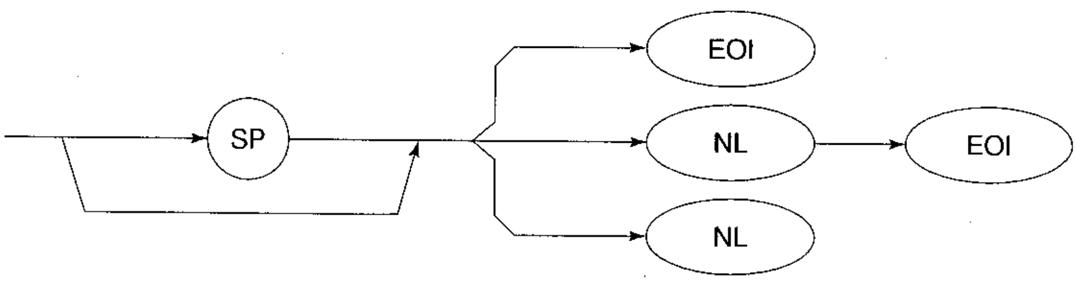
Program message format

To transfer a program message from the controller program to this instrument using the WRITE statement, the program message formats are defined as follows.


```
WRITE   #1,"CF 1GHZ"
```

PROGRAM MESSAGE: When the program message is transmitted from the controller to this instrument, the specified terminator is attached to the end of the program message to terminate its transmission.

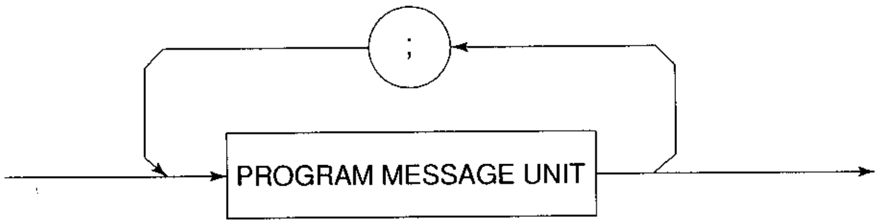
(1) PROGRAM MESSAGE TERMINATOR



NL: Called New line.
LF (Line Feed)

Carriage Return (CR) is ignored and is not processed as a terminator.

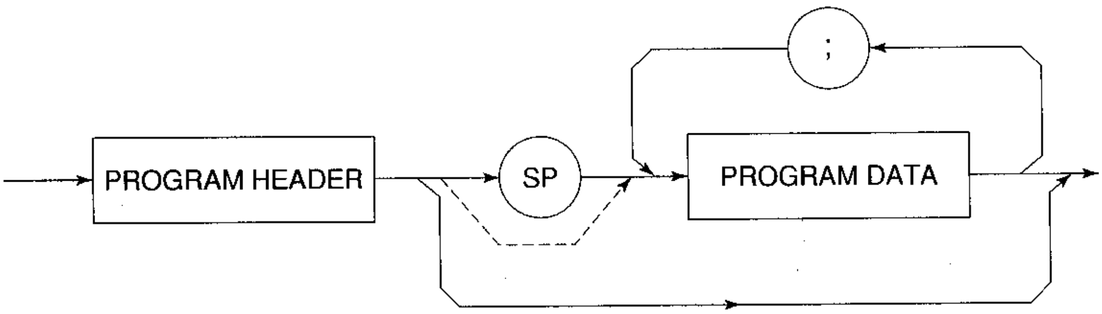
(2) PROGRAM MESSAGE



Multiple program message units can be output sequentially by separating them with a semicolon.

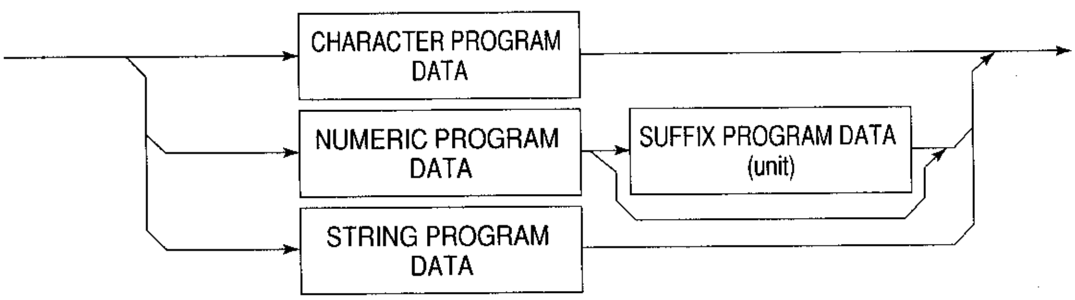
<Example> `WRITE #1;"CF 1GHZ;SP 5ØØKHZ`

(3) PROGRAM MESSAGE UNIT



- The program header of an IEEE488.2 common command always begins with an asterisk.
- For numeric program data, the (SP) between the header and data can be omitted.
- The program header of a program query always ends with a question mark.

(4) PROGRAM DATA



(5) CHARACTER PROGRAM DATA

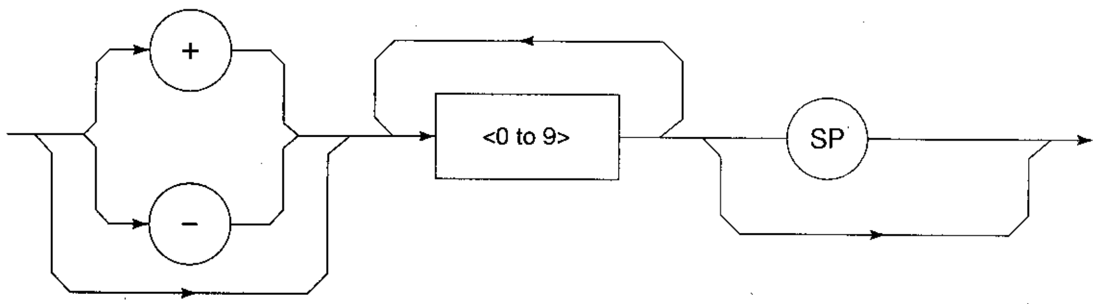
Character program data is specific character string data consisting of the uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, numbers 0 to 9, and underline (_).

<Example> `WRITE #1;"ST AUTO"`.............. Sets Sweep Time to AUTO.

(6) NUMERIC PROGRAM DATA

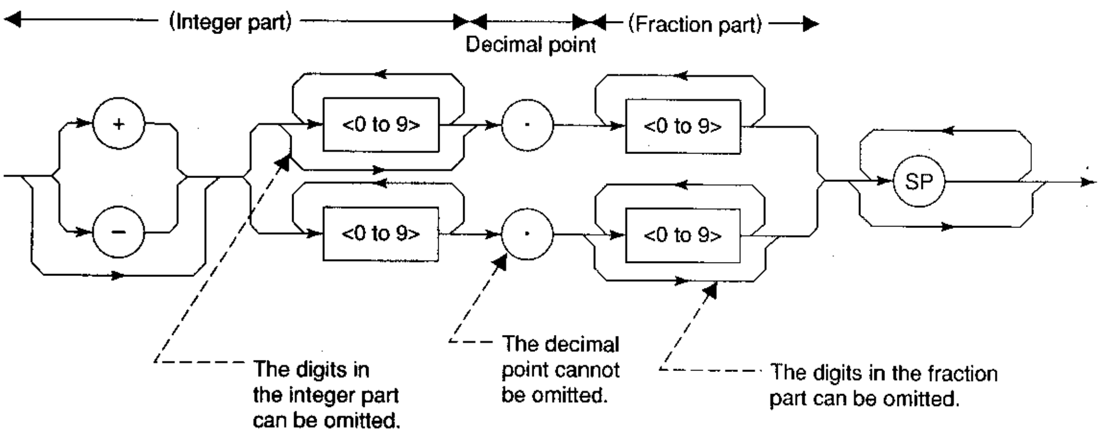
Numeric program data has two types of formats: integer format (NR1) and fixed-point format (NR2).

< Integer format (NR1) >



- Zeros can be inserted at the beginning → 005, +000045
- There must be no spaces between a + or – sign and a number → +5, +△ 5 (×)
- Spaces can be inserted after a number → +5△△△
- A + sign is optional → +5, 5
- Commas cannot be used to separate digits → 1,234,567 (×)

<Fixed-point format (NR2)>



- The numeric expression of the integer format applies to the integer part.
- There must be no spaces between numbers and the decimal point → +753△.123 (×)
- Spaces can be inserted after the digits in the fraction part → +753.123△△△
- A number needs not be placed before the decimal point → .05
- A + or - sign can be placed before the decimal point → +.05, –.05
- A number can end with a decimal point → 12.

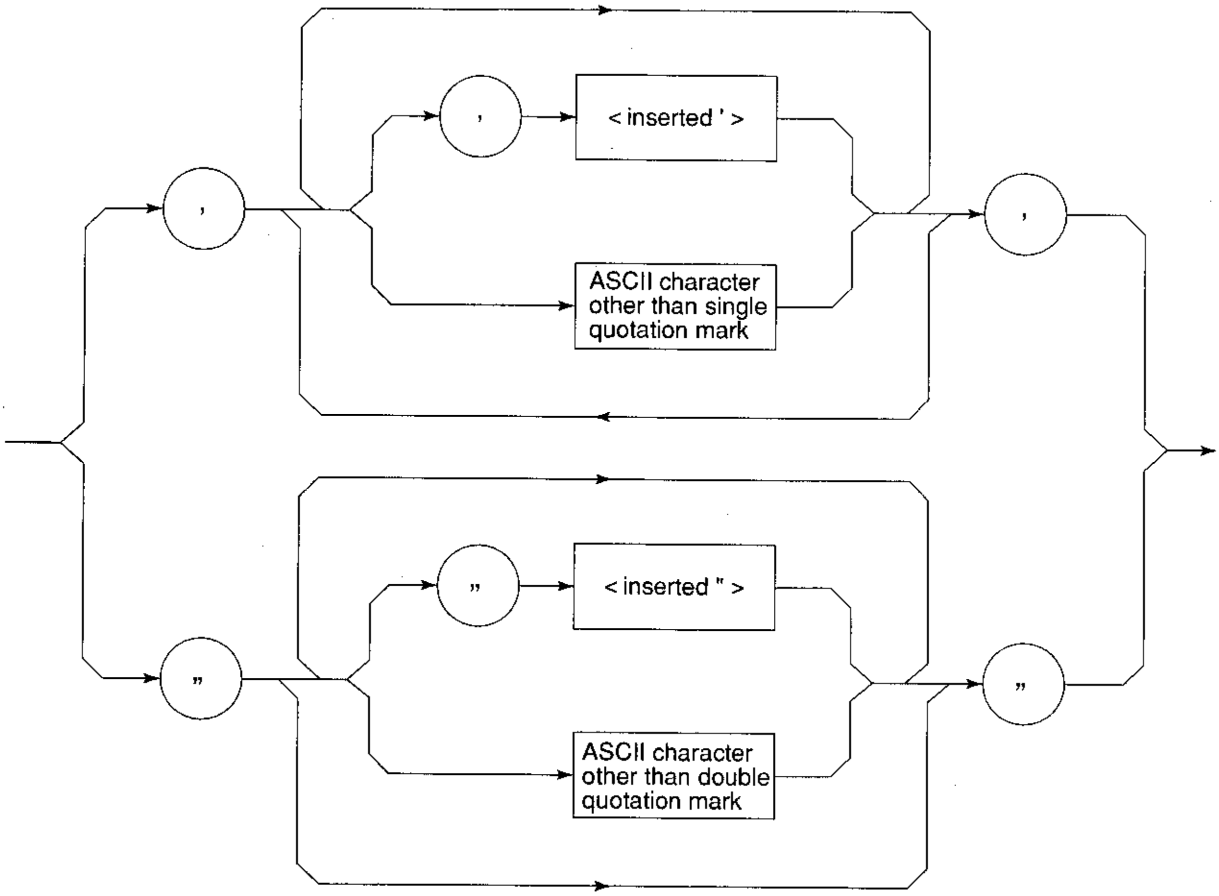
(7) SUFFIX PROGRAM DATA (unit)

The table below lists the suffixes used for the MS8608A/MS8609A.

Table of Suffix Codes

Classification	Unit	Suffix code
Frequency	GHz	GHZ, GZ
	MHz	MHZ, MZ
	kHz	KHZ, KZ
	Hz	HZ
	Default	HZ
Time	s	S
	ms	MS
	μs	US
	Default	MS
Level (dB system)	dB	DB
	dBm	DBM, DM
	dBμV	DBUV
	dBmV	DBMV
	dBμV(emf)	DBUVE
	dBμV/m	DBUVM
	Default	Determined in conformance with the set scale unit
Level (V system)	V	V
	mV	MV
	μV	UV
	Default	UV
Level (W system)	W	W
	mW	MW
	μW	UW
	nW	NW
	pW	PW
	fW	FW
	Default	UW

(8) STRING PROGRAM DATA



- String program data must be enclosed with single quotation marks ('...').

  `WRITE #1:"TITLE'MS86Ø8A'"`

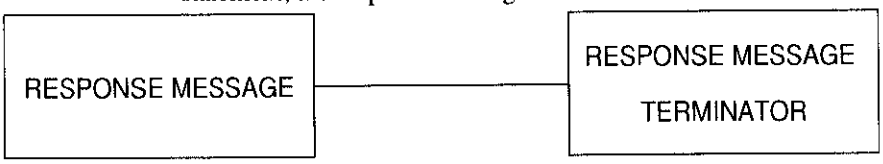
  A single quotation mark used within a character string must be repeated as shown in the double quotation marks.

  `WRITE #1,"TITLE'MS86Ø8A''NOISE MEAS'''"`

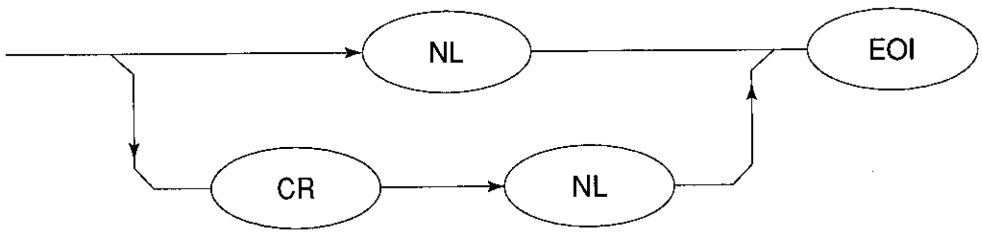
  MS8608A 'NOISE MEAS' is set as the title.

Response message format

To transfer the response messages from this instrument to the controller using the READ statement, the response message formats are defined as follows.

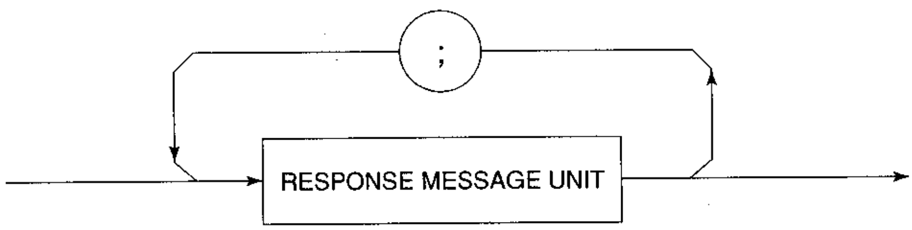


(1) RESPONSE MESSAGE TERMINATOR



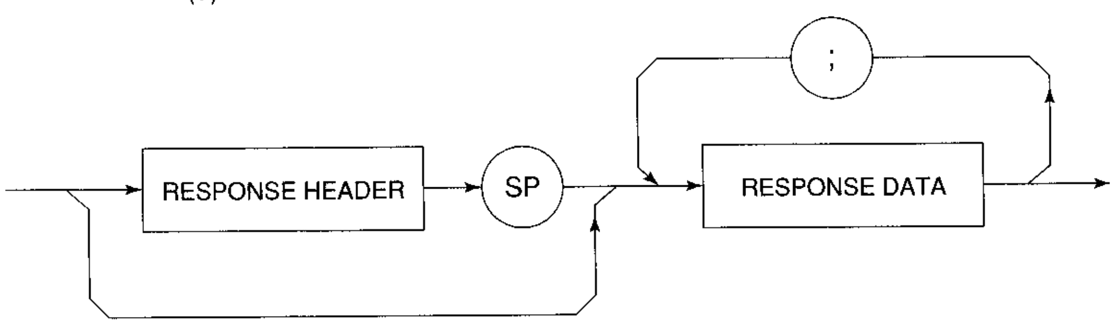
The response message terminator to be used depends on the TRM command specification.

(2) RESPONSE MESSAGE

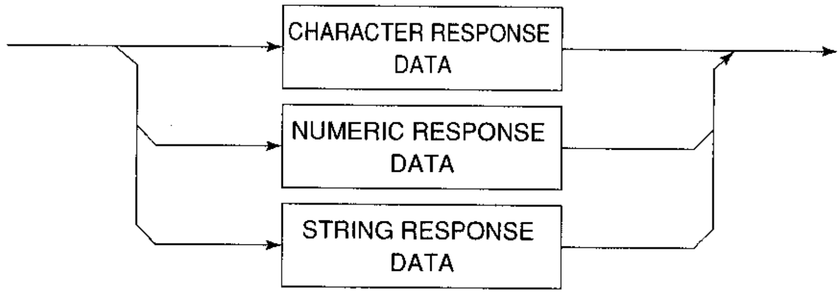


When a query is sent by the WRITE statement with one or more program queries, the response message also consists of one or more response message units.

(3) Usual RESPONSE MESSAGE UNIT



(4) RESPONSE DATA

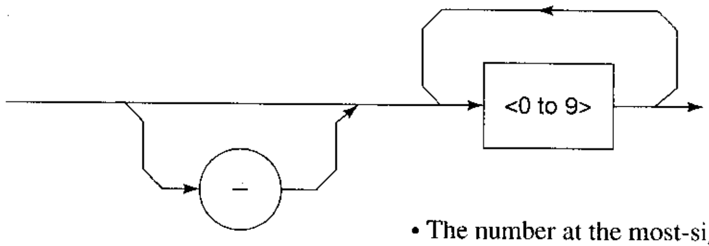


(5) CHARACTER RESPONSE DATA

Character response data is specific character string data consisting of the uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, numbers 0 to 9, and underline (_).

(6) NUMERIC RESPONSE DATA

< Integer format (NR1) >

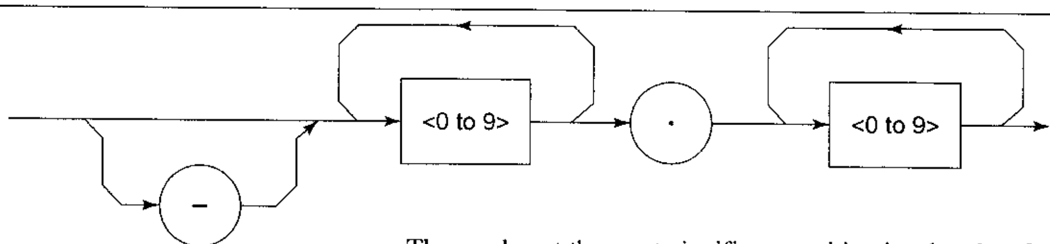


< Example >

```
123
-1234
```

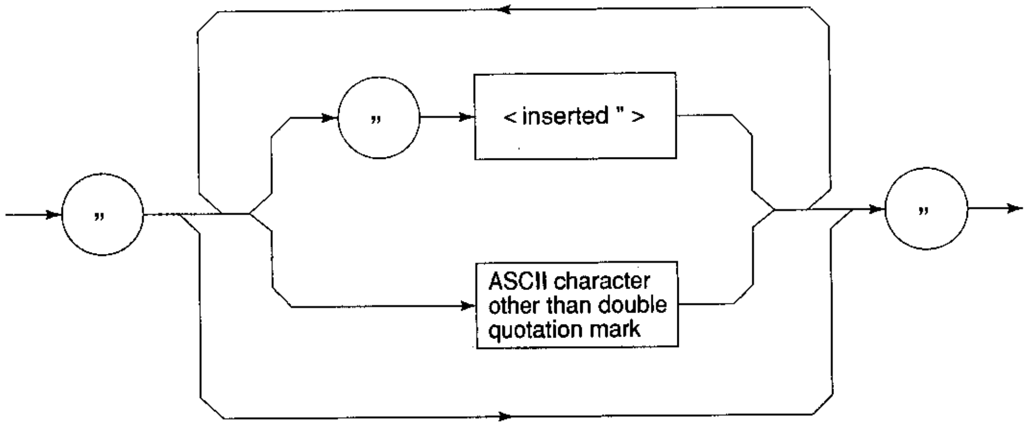
- The number at the most-significant position is other than 0.
- A + sign needs not be placed before a positive number.

< Fixed-point format (NR2) >



- The number at the most-significant position is other than 0.
- A + sign needs not be placed before a positive number.
- If there are zeros after the decimal point, the numeric data is transmitted in the integer format.

(7) CHARACTER RESPONSE DATA



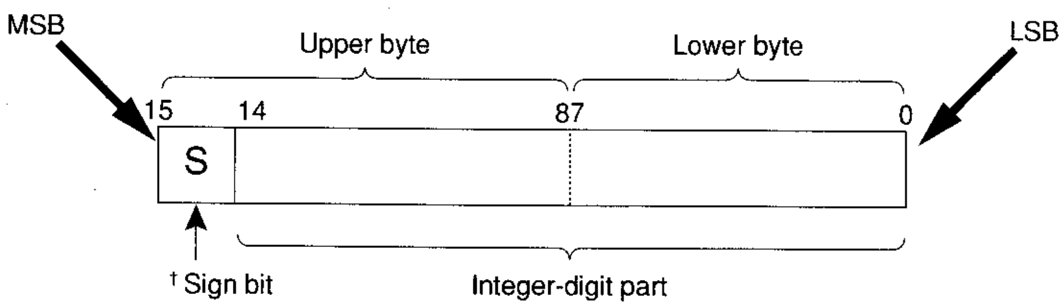
String response data is transmitted as an ASCII character enclosed with double quotation marks.

(8) Response message for input of waveform data using binary data

The waveform binary data is two-byte 65536 integer data from –32768 to 32767, as shown below; and sent in the sequence of upper byte and lower byte.

16-Bit Binary	With Sign	No Sign
1000000000000000	-32768	32768
1000000000000001	-32767	32769
1000000000000010	-32766	32770
1111111111111101	-3	65533
1111111111111110	-2	65534
1111111111111111	-1	65535
0000000000000000	0	0
0000000000000001	1	1
0000000000000010	2	2
0000000000000011	3	3
0111111111111101	32765	32765
0111111111111110	32766	32766
0111111111111111	32767	32767

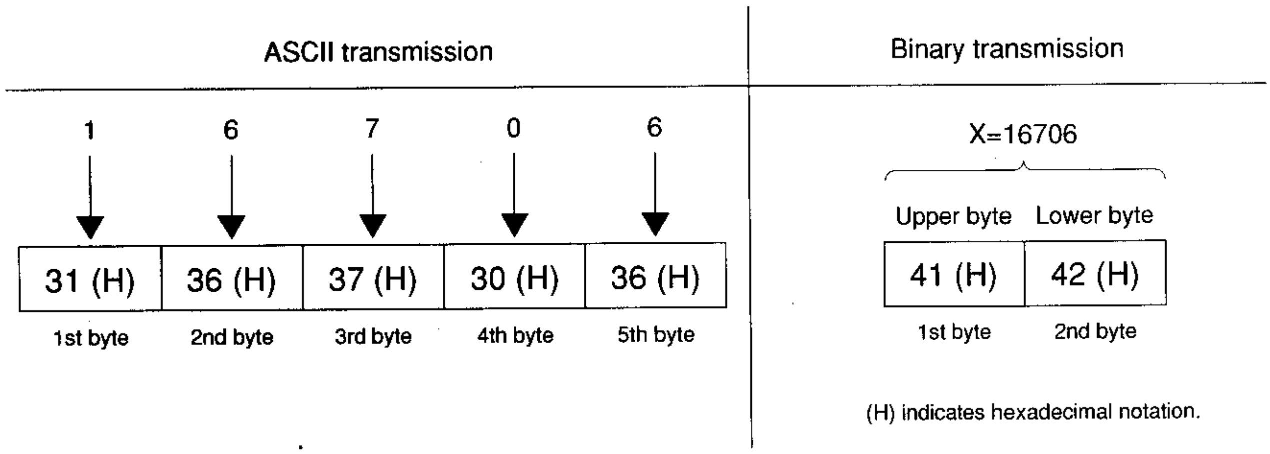
Sign bit: Bit 15(MSB) is used.
Integer-digit part: Bits 0 to 14 are used.
So, 16 bits(two bytes) are used.



Internal Representation of 2-byte Binary Data

† When a negative number is stored in a numeric variable, the sign bit 1 is set in the MSB to indicate the negative value. The value is stored in a numeric variable in a 2's complement format.

For example, to transmit an integer of 16706, the ASCII format is compared with the Binary format, below.
The ASCII format requires 5 bytes. Whereas, the Binary format requires only 2 bytes, and does not need the data format transformation. So, the Binary format is used for a high-speed transmission.



$$16706\ (D) = 4 \times 16^3 + 1 \times 16^2 + 4 \times 16^1 + 2 \times 16^0$$

Binary notation

	Upper byte								Lower byte							
bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X=16706	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0

1st byte → 2nd byte (Transmission order)

bit	7	6	5	4	3	2	1	0	
1st byte	0	1	0	0	0	0	0	1	(Upper byte) = 41 (H)
2nd byte	0	1	0	0	0	0	1	0	(Lower byte) = 42 (H)

The waveform binary data has a number of bytes for
(Number of points to be specified) × 2 bytes + termination code.
Where, termination code is specified by the TRM command, and is LF(0D(H): 1 byte) or CR+LF(0A0D(H): 2 bytes).

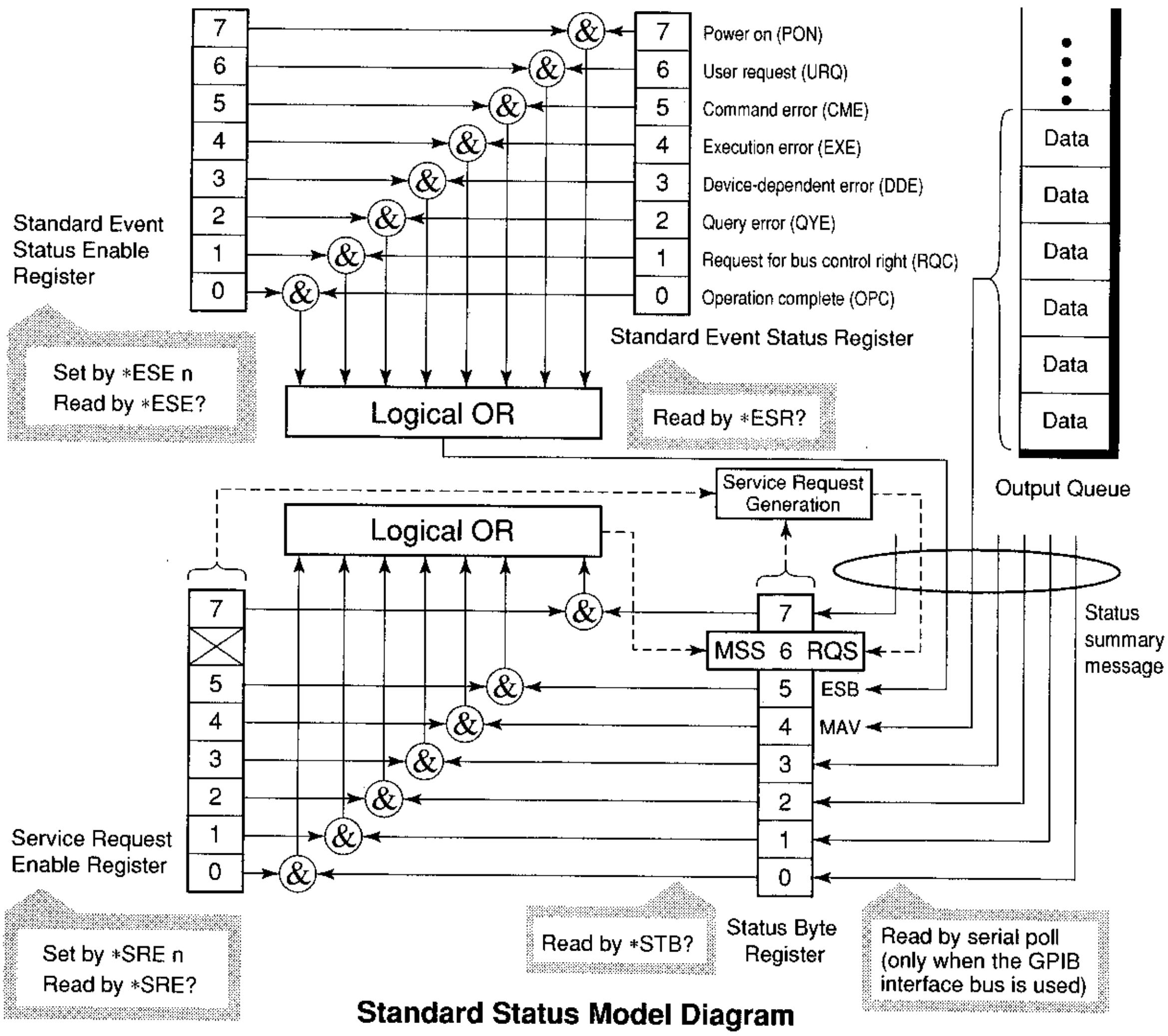
SECTION 4 STATUS STRUCTURE

This section describes the device-status reporting and its data structure defined by the IEEE488.2 when the GPIB interface bus is used. This section also describes the synchronization techniques between a controller and device.
These functions are used to control a device from an external controller using the GPIB interface bus. Most of these functions can also be used to control a device from an external controller using the RS-232C/Ethernet interface.

The Status Byte (STB) sent to the controller is based on the IEEE488.1 standard. The bits comprising the STB are called status summary messages because they represent a summary of the current data in registers and queues.

IEEE488.2 Standard Status Model

The diagram below shows the standard model for the status data structures stipulated in the IEEE488.2 standard.



Standard Status Model Diagram

In the status model, IEEE488.1 status bytes are used for the lowest grade status. This status byte is composed of seven summary message bits from the higher grade status structure. To create these summary message bits, the status data structure is composed of two types of register and queue models.

Register model	Queue model
The register model consists of two registers used for recording events and conditions encountered by a device. These two registers are the Event Status Register and Event Status Enable Register. When the results of the AND operation of both register contents are other than 0, the corresponding bit of the status bit becomes 1. In other cases, the corresponding bit becomes 0. When the result of their Logical OR is 1, the summary message bit also becomes 1. If the Logical OR result is 0, the summary message bit also becomes 0.	The queue in the queue model is used to sequentially record the waiting status values or information. If the queue is not empty, the queue structure summary message becomes 1. If the queue is empty, the message becomes 0.

In IEEE488.2, there are three standard models for the status data structure. Two are register models and one is a queue model based on the register model and queue model described above. The three standard models are:

1) Standard Event Status Register and Standard Event Status Enable Register
2) Status Byte Register and Service Request Enable Register
3) Output Queue

Standard Event Status Register	Status Byte Register	Output Queue
The Standard Event Status Register has the same structure as the previously described register model. In this register, the bits for eight types of standard events encountered by a device are set as follows: 1) Power on 2) User request 3) Command error 4) Execution error 5) Device-dependent error 6) Query error 7) Request for bus control right 8) Operation complete The Logical OR output bit is represented by Status Byte Register bit 5 (DIO6) as a summary message for the Event Status Bit (ESB).	The Status Byte Register is a register in which the RQS bit and the seven summary message bits from the status data structure can be set. This register is used together with the Service Request Enable Register. When the results of the OR operation of both register contents are other than 0, SRQ becomes ON. To indicate this, bit 6 of the Status Byte Register (DIO7) is reserved by the system as the RQS bit. The RQS bit is used to indicate that there is a service request for the external controller. The mechanism of SRQ conforms to the IEEE488.1 standard.	The Output Queue has the structure of the queue model described above. Status Byte Register bit 4 (DIO5) is set as a summary message for Message Available (MAV) to indicate that there is data in the output buffer.

Status Byte (STB) Register

The STB register consists of the STB and RQS (or MSS) messages of the device.

ESB and MAV summary messages

This paragraph describes the ESB and MAV summary messages.

(1) ESB summary message

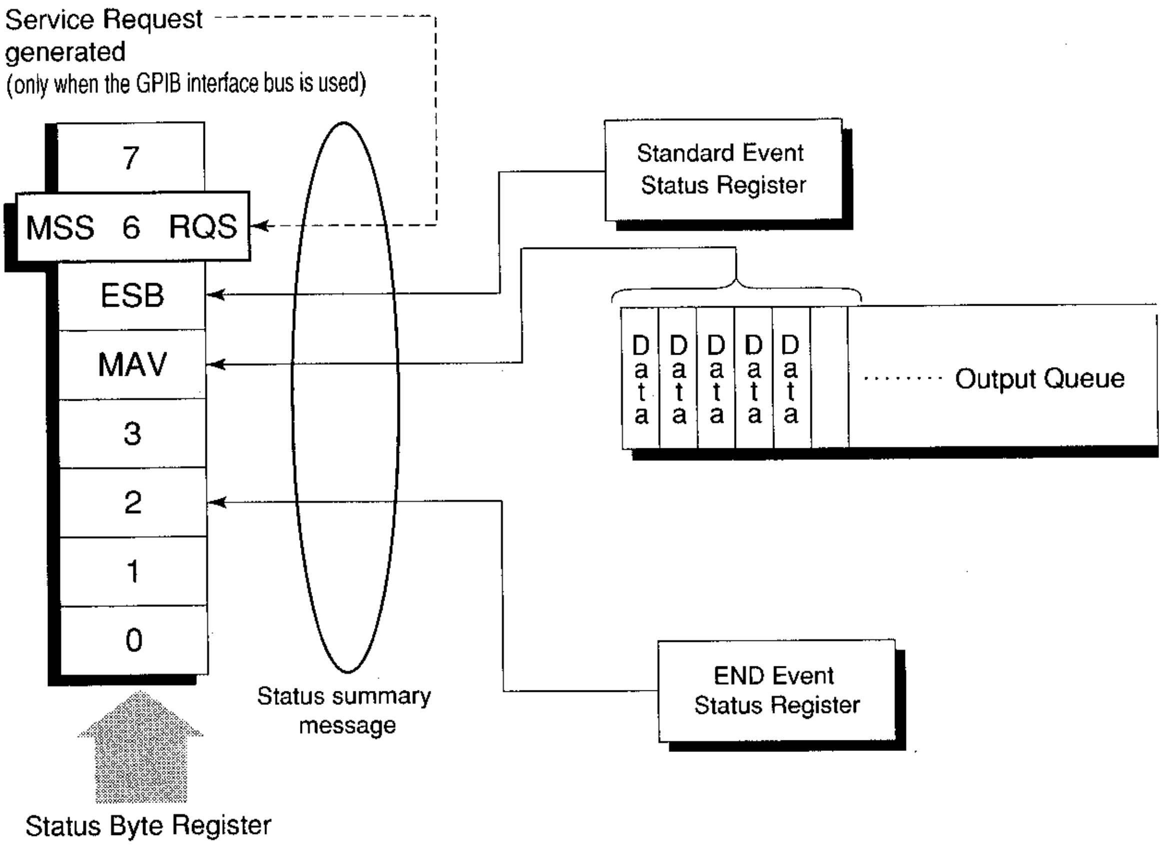
The ESB (Event Summary Bit) is a message defined by IEEE488.2 which uses bit 5 of the STB register. When the setting permits events to occur, the ESB summary message bit becomes 1 if any one of the events recorded in the Standard Status Register becomes 1. Conversely, the ESB summary message bit becomes 0 if one of the recorded events occurs, even if events are set to occur.
This bit becomes 0 when the ESR register is read by the *ESR? query or when it is cleared by the *CLS command.

(2) MAV summary message

The MAV (Message Available) summary bit is a message defined by IEEE488.2 which uses bit 4 of the STB register. This bit indicates whether the output queue is empty. The MAV summary message bit is set to 1 when a device is ready to receive a request for a response message from the controller. When the output queue is empty, this bit is set to 0. This message is used to synchronize the information exchange with the controller. For example, this message is available when, after the controller sends a query command to a device, the controller waits until MAV becomes 1. While the controller is waiting for a response from the device, other jobs can be processed. Reading the Output Queue without first checking MAV will cause all system bus operations to be delayed until the device responds.

Device-dependent summary messages

As shown in the diagram below, the MS8608A/MS8609A does not use bits 0, 1, 3, and 7, and it uses bit 2 as the summary bit of the Event Status Register.



Reading and clearing the STB register

The STB register can be read using serial polling or the *STB? common query. The IEEE488.1 STB message can be read by either method, but the value sent to bit 6 (position) is different for each method.
The STB register contents can be cleared using the *CLS command.

(1) Reading by serial polling (only when the GPIB interface bus is used)

The IEEE488.1 serial polling allows the device to return a 7-bit status byte and an RQS message bit which conforms to IEEE488.1. The value of the status byte is not changed by serial polling. The device sets the RQS message to 0 immediately after being polled.

(2) Reading by the *STB? common query

The *STB? common query requires the devices to send the contents of the STB register and the integer format response messages, including the MSS (Master Summary Status) summary message. Therefore, except for bit 6, which represents the MSS summary message, the response to *STB? is identical to that of serial polling.

(3) Definition of MSS (Master Summary Message)

MSS indicates that there is at least one cause for a service request. The MSS message is represented at bit 6 response to an *STB? query, but it is not produced as a response to serial polling. It should not be taken as part of the status byte specified by IEEE488.1.
MSS is configured by the overall logical OR in which the STB register and SRQ enable (SRE) register are combined.

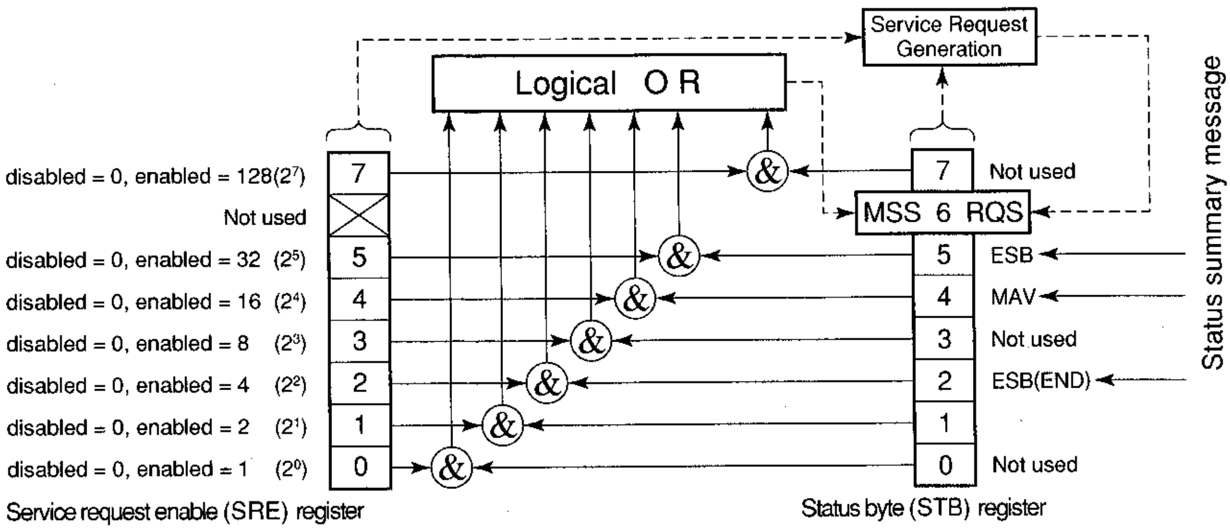
(4) Clearing the STB register using the *CLS common command

The *CLS common command clears all status data structures as well as the summary messages corresponding to them.
The *CLS command does not affect the settings in the Enable Register.

Service Request (SRQ) Enabling Operation

Bits 0 to 7 of the Service Request Enable Register (SRE) determine which bit of the corresponding STB register can generate SRQ.

The bits in the Service Request Enable Register correspond to the bits in the Status Byte Register. If a bit in the Status Byte Register corresponding to an enabled bit in the Service Request Enable Register is set to 1, the device makes a service request to the controller with the RQS bit set to 1.



(1) Reading the SRE register

The contents of the SRE register are read using the *SRE? common query. The response message to this query is an integer from 0 to 255 which is the sum of the bit digit weighted values in the SRE register.

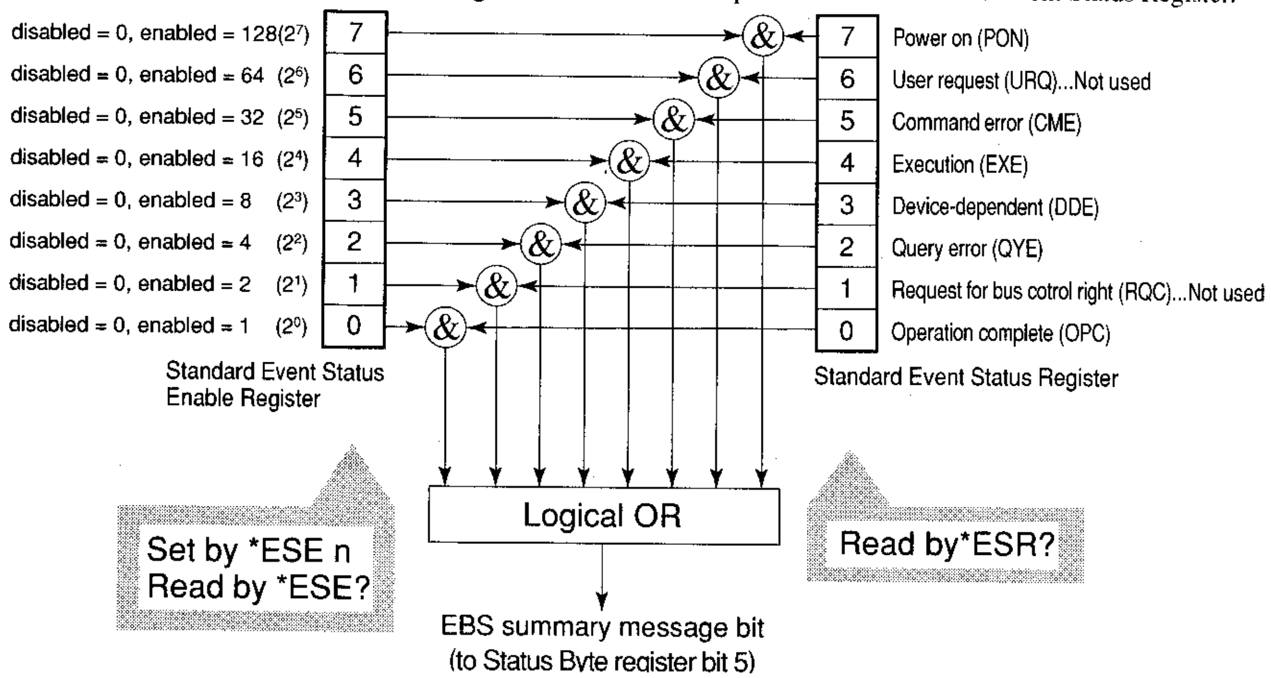
(2) Updating the SRE register

The SRE register is written using the *SRE common command. An integer from 0 to 255 is assigned as a parameter to set the SRE register bit to 0 or 1. The value of bit 6 is ignored.

Standard Event Status Register

Bit definition of Standard Event Status Register

The diagram below shows the operation of the Standard Event Status Register.



The Standard Event Status Enable (ESE) Register on the left is used to select which bits in the corresponding Event Register will cause a TRUE summary message when set.

Bit	Event name	Description
7	Power on (PON-Power on)	A transition from power-off to power-on occurred during the power-up procedure.
6	Not used	
5	Command error (CME-Command Error)	An illegal program message or a misspelled command was received.
4	Execution error (EXE-Execution Error)	A legal but unexecutable program message was received.
3	Device-dependent error (DDE-Device-dependent Error)	An error not caused by CME, EXE, or QYE occurred (parameter error, etc.).
2	Query error (QYE-Query Error)	An attempt was made to read data in the Output Queue when it was empty. Or, the data in the Output Queue was lost before it was read.
1	Not used	
0	Operation complete (OPC-Operation Complete)	This bit becomes 1 when this instrument has processed the *OPC command.

Reading, writing, and clearing the Standard Event Status Register

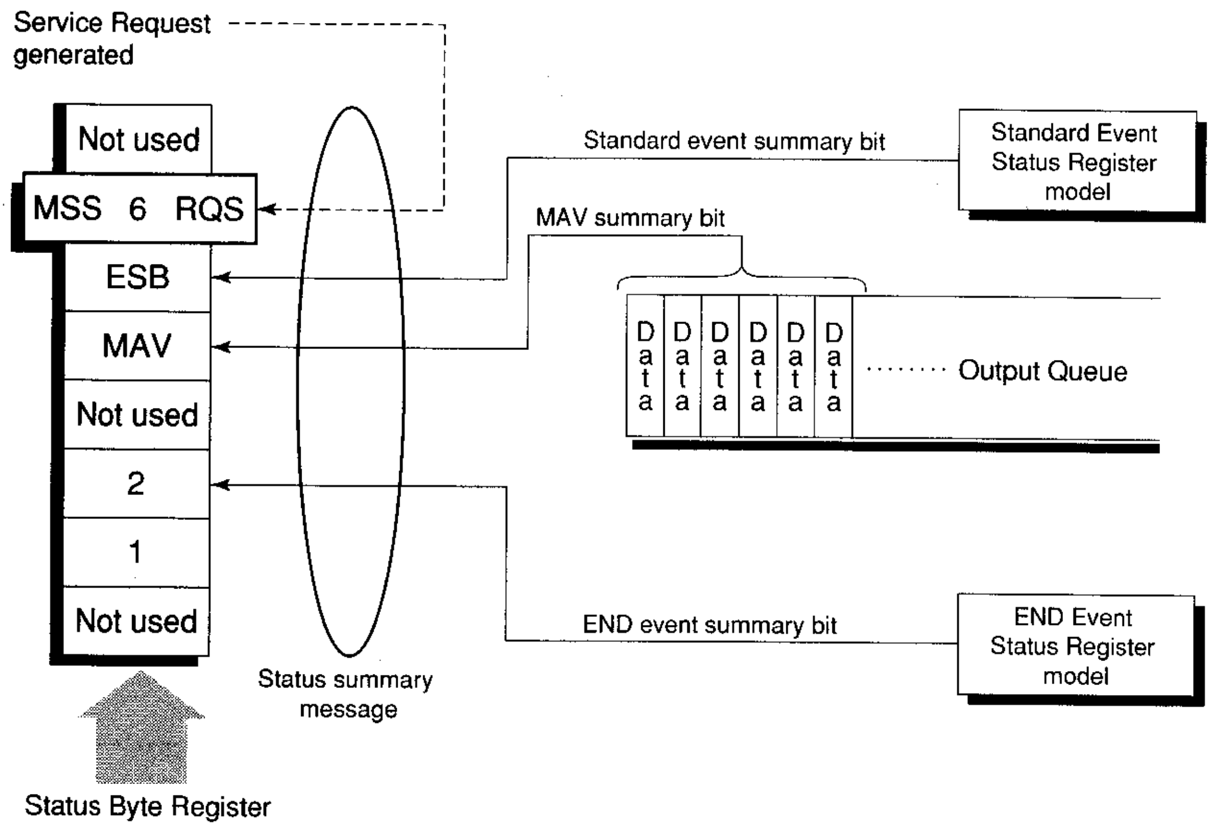
Reading	The register is read using the *ESR? command query. The register is cleared after being read. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	With the exception of clearing, data cannot be written to the register from outside.
Clearing	The register is cleared when: [1] A *CLS command is received [2] The power is turned on Bit 7 is set to ON, and the other bits are cleared to 0 [3] An event is read for the *ESR? query command

Reading, writing, and clearing the Standard Event Status Enable Register

Reading	The registers is read using the *ESE? command. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	The register is written using the *ESE common command.
Clearing	The register is cleared when: [1] An *ESE command with a data value of 0 is received [2] The power is turned on The Standard Event Enable Register is not affected when: [1] The device clear function status of IEEE488.1 is changed [2] An *RST common command is received [3] A *CLS common command is received

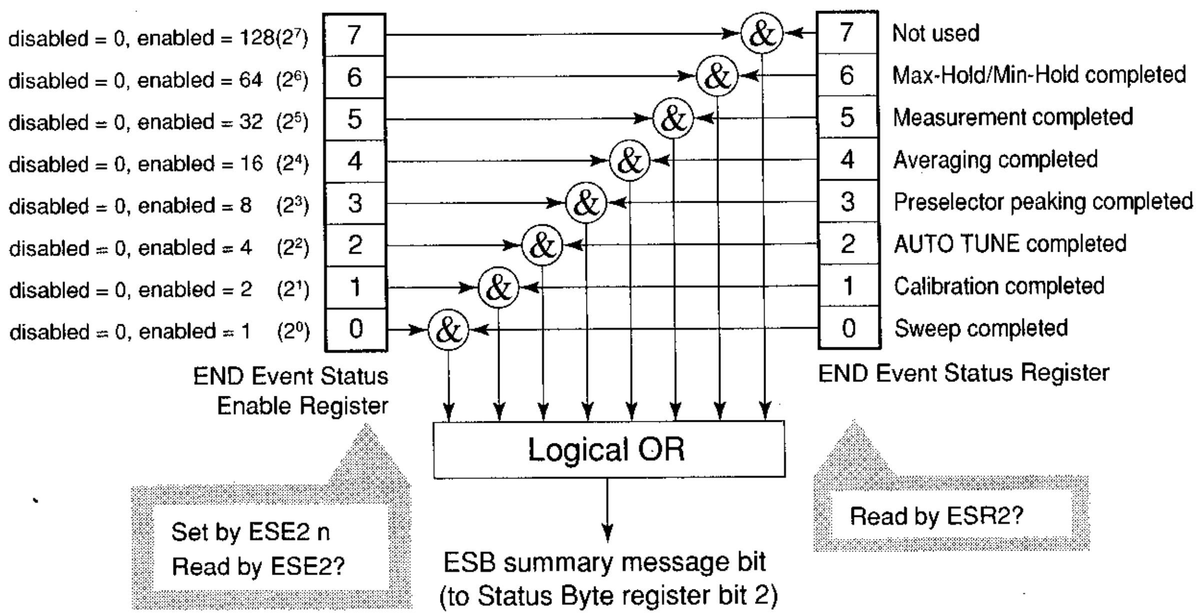
Extended Event Status Register

For the MS8608A/MS8609A, bits 7, 3, 1, and 0 are unused. Bit 2 is assigned to the END summary bit as the status-summary bit supplied by the extended register model as shown below.



Bit definition of END Event Status Register

The diagram below shows the operation and event-bit names of the END Event Status Register.



The END Event Status Enable Register on the left is used to select which bits in the corresponding Event Register will cause a TRUE summary message when set.

Bit	Event name	Description
7	Not used	Not used
6	Max Hold/Min Hold	Sweeping according to the specified HOLD number has been completed.
5	Measurement completed	Calculation processing for measurements (frequency count, noise, etc.) has been completed.
4	Averaging completed	Sweeping according to the specified AVERAGE number has been completed.
3	Preselector peaking completed	Preselector peaking has been completed
2	AUTO TUNE completed	AUTO TUNE has been completed.
1	Calibration completed	ALL CAL, LEVEL CAL, or FREQ CAL has been completed.
0	Sweep completed	A single sweep has been completed or is in standby.

Reading, writing, and clearing the Extended Event Status Register

Reading	The ESR? common query is used to read the register. The register is cleared after being read. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimal.
Writing	With the exception of clearing, data cannot be written to the register from outside.
Clearing	The register is cleared when: [1] A *CLS command is received [2] The power is turned on [3] An event is read for the ESR2? query command

Reading, writing, and clearing the Extended Status Enable Register

Reading	The ESE2? query is used to read the register. The response message is integer-format data with the binary weight added to the event bit and the sum converted to decimals.
Writing	The ESE2 program command is used to write the register. Because bits 0 to 7 of the registers are weighted with values 1, 2, 4, 8, 16, 32, 64, and 128, respectively, the write data is transmitted as integer-format data that is the sum of the required bit digits selected from the weighted value.
Clearing	The register is cleared when: [1] An ESE2 program command with a data value of 0 is received [2] The power is turned on The Extended Event Status Enable register is not affected when: [1] The device clear function status of IEEE488.1 is changed [2] An *RST common command is received [3] A *CLS common command is received

Techniques for Synchronizing MS8608A/MS8609A with a Controller

The MS8608A/MS8609A usually treats program messages as sequential commands that do not process newly-received commands until they complete the processing of the previous command. Therefore, no special consideration is necessary for pair-synchronization between the MS8608A/MS8609A and the controller.

If the controller controls and synchronizes with one or more devices, after all the commands specified for the MS8608A/MS8609A have been processed, the next commands must be sent to other devices.

There are two ways of synchronizing the MS8608A/MS8609A with the controller:

[1] Wait for a response after the *OPC? query is sent.

[2] Wait for SRQ after *OPC is sent.

Wait for a response after the *OPC? query is sent

The MS8608A/MS8609A outputs "1" as the response message when executing the *OPC? query command. The controller is synchronized with the MS8608A/MS8609A by waiting for the response message to be entered.

< Controller program >

[1] Send one or more commands sequentially.

⇩

[2] Send the *OPC? query.

⇩

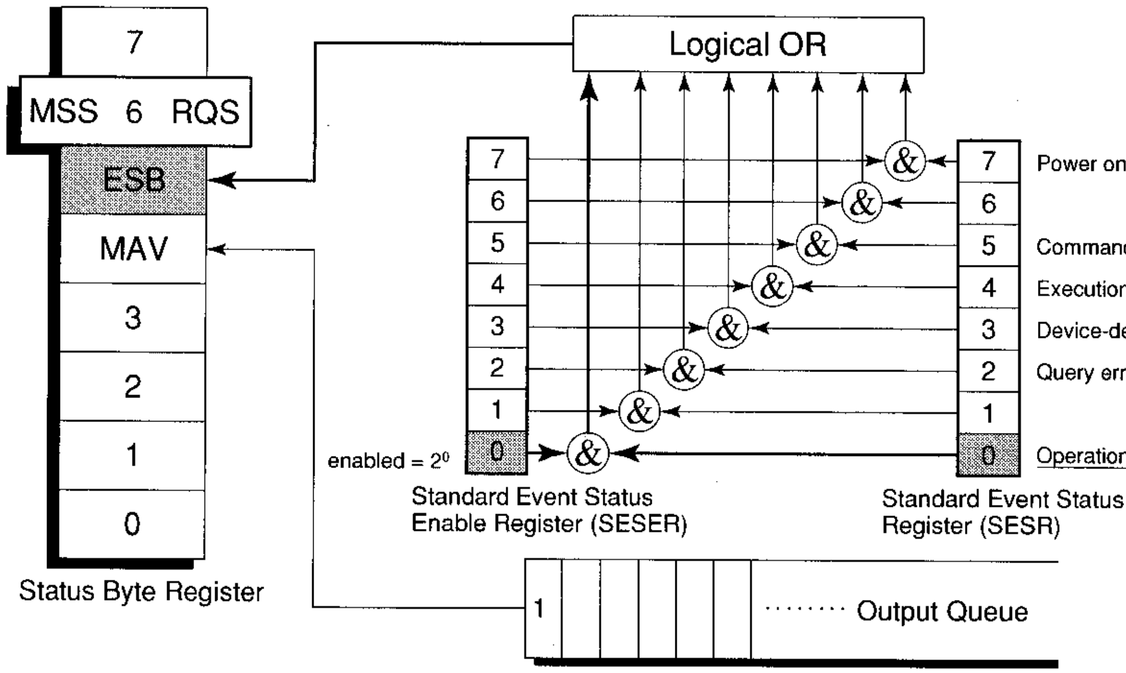
[3] Read the response message. .... [The read "1" is ignored. The program then goes to the next operation.]

⇩

To the next operation

Wait for a service request after *OPC is sent (only when the GPIB interface bus is used)

The MS8608A/MS8609A sets the operation-complete bit (bit 0) to 1 when executing the *OPC command. The controller is synchronized with the spectrum analyzer for SRQ when the operation-complete bit is set for SRQ.



■ < Controller program >

[1] Enable the 2^0 bit of the Standard Event Status Enable Register.	`PRINT @1;"*ESE 1"`
⇩	
[2] Enable the 2^5 bit of the Service Request Enable Register.	`PRINT @1;"*SRE 32"`
⇩	
[3] Make the device execute the specified operation.	
⇩	
[4] Send the *OPC command.	`PRINT @1;"*OPC"`
⇩	
[5] Wait for the SRQ interrupt (ESB summary message).	...... Value of status byte: $2^6 + 2^5 = 96$

SECTION 5 INITIAL SETTINGS

The MS8608A/MS8609A perform the initialization with 3-stage levels in accordance with the IEEE488.2 specifications. This section describes how these three levels of initialization are processed, and how to instruct initialization from the controller.

In the IEEE488.2 standard, there are three levels of initialization. The first level is "bus initialization," the second level is "initialization for message exchange," and the third level is "device initialization." This standard also stipulates that a device must be set to a known state when the power is turned on.

Level	Initialization type	Description	Level combination and sequence
1	Bus initialization	The IFC message from the controller initializes all interface functions connected to the bus.	Level 1 can be combined with other levels, but must be executed before level 2.
2	Initialization for message exchange	Message exchanges of all devices and specified devices on the GPIB are initialized using the SDC and DCL GPIB bus commands, respectively. These commands also nullify the function that reports operation completion to the controller.	Level 2 can be combined with other levels, but must be executed before level 3.
3	Device initialization	The *RST or INI/IP command returns a specified device to a known device-specific state, regardless of the conditions under which it was being used.	Level 3 can be combined with other levels, but must be executed after levels 1 and 2.

When using the standard RS-232C interface port or the optional Ethernet interface port to control the MS8608A/MS8609A from the controller, the level-3 device initialization function of can be used, and the level-2 initialization function cannot be used. When using the standard GPIB interface bus to control the MS8608A/MS8609A from the controller, the initialization functions of levels 1, 2, and 3 can be used.

The following paragraph describes the commands for initialization at levels 1, 2, and 3 and the items that are initialized. This paragraph also describes the known state which is set when the power is turned on.

Bus Initialization using the IFC Statement

■ Example

```
board% = 0
CALL SendIFC (board%)
```

■ Explanation

This function can be used when using the GPIB interface bus is used to control the MS8608A/MS8609A from the controller.
The IFC statement initializes the interface functions of all devices connected to the GPIB bus line.
The initialization of interface functions involves clearing the interface function states of devices set by the controller, and resetting them to their initial states. In the table below, indicates the functions which are initialized, and indicates the functions which are partially initialized.

No	Function	Symbol	Initialization by IFC
1	Source handshake	SH	○
2	Acceptor handshake	AH	○
3	Talker or extended talker	T or TE	○
4	Listener or extended listener	L or LT	○
5	Service request	SR	△
6	Remote/local	RL	
7	Parallel poll	PP	
8	Device clear	DC	
9	Device trigger	DT	
10	Controller	C	○

Bus initialization by the IFC statement does not affect the device operating state (frequency settings, lamp on/off, etc.).

Initialization for Message Exchange by DCL and SDC Bus Commands

■ Example

Initializes all devices on the bus for message exchange (sending DCL).

```
board% = 0
addresslist% = NOADDR
CALL DevClearList(board%, addresslist%)
```

Initializes only the device at address 3 for message exchange (sending SDC).

```
board% = 0
address% = 3
CALL DevClear(board%, address%)
```

■ Explanation

This function can be used when the GPIB interface is used to control the MS8608A/MS8609A from the controller.
This statement executes initialization for message exchange of all devices or a specified device on the GPIB having the specified select code.

■ Items to be initialized for message exchange

When the MS8608A/MS8609A accepts the DCL or SDC bus command, it does the following:

(1) Input Buffer and Output Queue:	Clears them and also clears the MAV bit.
(2) Parser, Execution Controller, and Response Formatter:	Resets them.
(3) Device commands including *RST:	Clears all commands that prevent these commands from being executed.
(4) Processing of the *OPC? command:	Puts a device in OCIS (Operation Complete Command Idle State). As a result, the operation complete bit cannot be set in the Standard Event Status Register.
(5) Processing of the *OPC? query:	Puts a device in OQIS (Operation Complete Query Idle State). As a result, the operation complete bit 1 cannot be set in the Output Queue.
(6) Device functions:	Puts all functions associated with message exchange in the idle state. The device continues to wait for a message from the controller.

CAUTION ⚠

The following are not affected even if the DCL and SDC commands are processed.

(1) Current data set or stored in the device
(2) Front panel settings
(3) Status of status byte other than MAV bit
(4) Device operation in progress

Device Initialization using the *RST Command

Syntax

```
*RST
```

Example

For RS-232C

```
WRITE #1,"*RST"
```

For GPIB

```
SPA%=1
CALL Send(0,SPA,"*RST",NLend)
```

Initializes the device (MS8608A) at address 1 at level 3.

Explanation

The *RST (Reset) command is an IEEE488.2 common command that resets a device at level 3.
The *RST (Reset) command is used to reset a device (MS8608A/MS8609A) to a specific initial state. For details of the items that are initialized and the settings after initialization, see Appendix C.

Note:

The *RST command does not affect the following.

(1) IEEE488.1 interface state
(2) Device address
(3) Output Queue
(4) Service Request Enable register
(5) Standard Event Status Enable register
(6) Power-on-status-clear flag setting
(7) Calibration data affecting device specifications
(8) Parameters preset for control of external device, etc.

Device Initialization using the INI/IP Command

■ Syntax

```
INI
IP
```

■ Example (program message)

For RS-232C

```
WRITE #1,"INI"
```

For GPIB

```
SPA%=1
CALL Send(0,SPA%,"INI",NLend)
```

Initializes the device (MS8608A/MS8069A) at address 1 at level 3.

■ Explanation

The INI and IP commands are the MS8608A/MS8609A spectrum analyzer function device-dependent messages that initialize a device at level 3.

For details of the items that are initialized by the INI and IP commands, and the settings after initialization, see Appendix C.

Device Status at Power-on

When the power is turned on:

(1) The device is set to the status it was in at power-off.

(2) The Input Buffer and Output Queue are cleared.

(3) The Parser, Execution Controller, and Response Formatter are initialized.

(4) The device is put into OCIS (Operation Complete Command Idle State).

(5) The device is put into OQIS (Operation Complete Query Idle State).

(6) The Standard Event Status and Standard Event Status Enable Registers are cleared. Events can be recorded after the registers have been cleared.

SECTION 6 TABLES OF DEVICE MESSAGES

This section lists the commands for main-unit common function on the device messages used by main unit. Refer to the Section 7 for the detailed descriptions of these commands.

How to Read the Command List

Program Messages and Query Messages

(a) Upper case letters: Reserved word

(b) Numerical values: Reserved word (Numerical value code)

(c) Lower case letters in Argument

Argument	Meaning	Type	Unit/Suffix code
f	frequency	Real number with decimal point or integer	GHZ, MHZ, KHZ, HZ, GZ, MZ, KZ, None (HZ)
t	time	Real number with decimal point or integer	S, SC, MS, US, None (MS)
l	level	Real number with decimal point or integer	DB, DBM, DM, DBMV, DBUV, DBUVE, V, MV, UV, W, MW ,UW, NW, None (Fixed unit)
n	Non-unit integer or integer with specified unit	Decimal integer	None or specified
o	Non-unit integer	Octal integer	None
h	Non-unit integer	Hexadecimal integer	None
r	Non-unit real number or real number with specified unit	Real number	None or specified
txt	Character string	Character string enclosed within double quotation marks	None

Response Messages

(a) Upper case letters: Reserved word

(b) Numerical values: Reserved word (Numerical value code)

(c) Lower case letters in Argument

Argument	Meaning	Type	Unit
f	frequency	Real number with decimal point or integer	Hz
t	time	Real number with decimal point or integer	ms
l	level	Real number with decimal point or integer	Fixed or specified
n	Non-unit integer or integer with specified unit	Decimal integer. Number of digits can be changed (valid digits output)	None or specified
o	Non-unit integer	Octal integer	None
h	Non-unit integer	Hexadecimal integer	None
r	Non-unit real number or real number with specified unit	Real number with decimal point, Number of digits can be changed (valid digits output)	None or specified
j	Numerical value judgment	PASS (passed) or FAIL (failed)	None
u	Unit specification	DB, DBM, DM, DBMV, DBUV, DBUVE, V, MV, UV, W, MW ,UW, NW	None
txt	Character string	Character string	None

Command List

Function	Item	Program Message	Query Message	Response Message	Remarks
Display					
Comment	Title	COMMENT TITLE	COMMENT?	TITLE	
		TTL 1	TTL?	ON	
		TTL ON	TTL?	ON	
		TTL USER	TTL?	ON	
	Clock	COMMENT TIME	COMMENT?	TIME	
		TIMEDSP ON	TIMEDSP?	ON	
		TTL DATE	TTL?	OFF	
	Clock & Title	COMMENT FULL	COMMENT?	FULL	
		TIMEDSP FULL	TIMEDSP?	ON	
		TTL FULL	TTL?	ON	
	Off	COMMENT OFF	COMMENT?	OFF	
		TIMEDSP OFF	TIMEDSP?	OFF	
		TTL 0	TTL?	OFF	
		TTL OFF	TTL?	OFF	
Title		TITLE txt	TITLE?	txt	txt: Up to 32 characters (excluding leading and trailing double quotation marks)
		KSE txt	TITLE?	txt	txt: Up to 32 characters (excluding leading and trailing double quotation marks)
Date Format	YYYY/MM/DD	DATEMODE YMD	DATEMODE?	YMD	
	MMM-DD-YYYY	DATEMODE DMY	DATEMODE?	DMY	
	DD-MMM-YYYY	DATEMODE MDY	DATEMODE?	MDY	
Settings					
Date		DATE n1,n2,n3	DATE?	n1,n2,n3	n1: 1980 to 2079 (Year) n2: 1 to 12 (Month) n3: 1 to 31 (Day)
Time		TIME n1,n2,n3	TIME?	n1,n2,n3	n1: 0 to 23 (Hour) n2: 0 to 59 (Minute) n3: 0 to 59 (Second)
RGB Output	On	RGB ON	RGB?	ON	
	Off	RGB OFF	RGB?	OFF	

Function	Item	Program Message	Query Message	Response Message	Remarks
LCD Brightness	Bright Setting	BRIGHT n	BRIGHT?	n	n: 1 to 5
	Off	BRIGHT OFF	BRIGHT?	OFF	
Buzzer	On	ALARM ON	ALARM?	ON	
		BEP 1	BEP?	ON	
		BEP ON	BEP?	ON	
	Off	ALARM OFF	ALARM?	OFF	
		BEP 0	BEP?	OFF	
		BEP OFF	BEP?	OFF	
Window Cursor Mode	Turn	CURSORMODE TURN	CURSORMODE?	TURN	
	Stop	CURSORMODE STOP	CURSORMODE?	STOP	
Power On					
Screen	Spectrum	SCREENMODE SPECT	SCREENMODE?	SPECT	
	System	SCREENMODE SYSTEM	SCREENMODE?	SYSTEM	
	Last	SCREENMODE LAST	SCREENMODE?	LAST	
Initial	Before Power Off	POWERON LAST	POWERON?	LAST	
	Fixed State	POWERON IP	POWERON?	IP	
Copy Control					
Copy Mode	Printer (HP815C)	PMOD 3	PMOD?	3	
	Printer (BJ-M70)	PMOD 6	PMOD?	6	
	BMP File to Memory Card (Mono)	PMOD 13	PMOD?	13	
	BMP File to Memory Card (Color)	PMOD 14	PMOD?	14	
Copy		PRINT	---	---	
		PLS 0	---	---	
GPIB					
Terminator (Remote Only)	LF	TRM 0	TRM?	0	
	CR/LF	TRM 1	TRM?	1	
RS232C					
Baud Rate		BAUD n	BAUD?	n	n: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200

Function	Item	Program Message	Query Message	Response Message	Remarks
Parity	Even	PRTY EVEN	PRTY?	EVEN	
	Odd	PRTY ODD	PRTY?	ODD	
	Off	PRTY OFF	PRTY?	OFF	
Data Bits		DATB n	DATB?	n	n: 7, 8
Stop Bit		STPB n	STPB?	n	n: 1, 2
XON/XOFF Flow Control	On	FLWCTRL ON	FLWCTRL?	ON	
	Off	FLWCTRL OFF	FLWCTRL?	OFF	
Timeout (Remote Only)		TOUT n	TOUT?	n	n: 0 to 255(sec)
Terminator (Remote Only)	LF	DELM 0	DELM?	0	
	CR/LF	DELM 1	DELM?	1	
Ethernet *Option					
My IP Address		IPADRS n1,n2,n3,n4	IPADRS?	n1,n2,n3,n4	*Option n1,n2,n3,n4: 0 to 255
Net Mask Address		NETMASK n1,n2,n3,n4	NETMASK?	n1,n2,n3,n4	*Option n1,n2,n3,n4: 0 to 255
Gateway Address		GATEWAY n1,n2,n3,n4	GATEWAY?	n1,n2,n3,n4	*Option n1,n2,n3,n4: 0 to 255
Host Address		HOSTADRS n1,n2,n3,n4	HOSTADRS?	n1,n2,n3,n4	*Option n1,n2,n3,n4: 0 to 255
Port Address		PORTADRS n	PORTADRS?	n	*Option n: 3000 to 30000
Common					
Display Color	Color Pattern 1	COLORPTN COLOR1	COLORPTN?	COLOR1	
	Color Pattern 2	COLORPTN COLOR2	COLORPTN?	COLOR2	
	Color Pattern 3	COLORPTN COLOR3	COLORPTN?	COLOR3	
	Color Pattern 4	COLORPTN COLOR4	COLORPTN?	COLOR4	
	User Color	COLORPTN USERCOLOR	COLORPTN?	USERCOLOR	
User Color Copy Pattern from	Color Pattern 1	COPYCOLOR COLOR1	---	---	
	Color Pattern 2	COPYCOLOR COLOR2	---	---	
	Color Pattern 3	COPYCOLOR COLOR3	---	---	
	Color Pattern 4	COPYCOLOR COLOR4	---	---	

Function	Item	Program Message	Query Message	Response Message	Remarks
Recall Data	Current System	RCM n	---	---	n: 0 to 999 (Specturm Analyzer), 0 to 99 (Tx Tester)
	Spectrum Analyzer	RCM n,SPECT	---	---	n: 0 to 999
	Tx Tester	RCM n,SYSTEM	---	---	n: 0 to 99
Save Data	Current System	SVM n	---	---	n: 0 to 999 (Specturm Analyzer), 0 to 99 (Tx Tester)
	Spectrum Analyzer	SVM n,SPECT	---	---	n: 0 to 999
	Tx Tester	SVM n,SYSTEM	---	---	n: 0 to 99
LCD Power	On	DISPLAY ON	DISPLAY?	ON	
	Off	DISPLAY OFF	DISPLAY?	OFF	
Drawing	On	SCREEN ON	SCREEN?	ON	
	Off	SCREEN OFF	SCREEN?	OFF	
Preset		PRE	---	---	
		INI	---	---	
		IP	---	---	
RF Input	High	RFINPUT HIGH	RFINPUT?	HIGH	
	Low	RFINPUT LOW	RFINPUT?	LOW	
System Change	System - 1	SYS 1	SYS?	1	
	System - 2	SYS 2	SYS?	2	
	System - 3	SYS 3	SYS?	3	
System Mode	Spectrum Analyzer	PNLMD SPECT	PNLMD?	SPECT	
	Tx Tester	PNLMD SYSTEM	PNLMD?	SYSTEM	
	Config	PNLMD CONFIG	PNLMD?	CONFIG	
END Event Status Enable		ESE2	ESE2?	n	n: 0 to 255
		---	ESR2?	n	n: 0 to 255
Data Output Format	Binary	BIN ON	BIN?	ON	
		BIN 1	BIN?	ON	
	ASCII	BIN OFF	BIN?	OFF	
		BIN 0	BIN?	OFF	
Time Count Read		---	TMCNT?	n	n: 0 to 100000
Close Error Window		HOLD	---	---	

Function	Item	Program Message	Query Message	Response Message	Remarks
IEEE488.2 Standard					
Clear Status		*CLS	---	---	
Standard Event Status Enable		*ESE n	*ESE?	n	n: 0 to 255
Standard Event Status Register		---	*ESR?	n	n: 0 to 255
Identified Query		---	*IDN?	ANRITSU,txt,n,r	txt: (Model name) n: (Serial Number) r: (Main2 Firmware Revision)
Operation Complete		*OPC	*OPC?	1	
Reset		*RST	---	---	
Service Request Enable		*SRE	*SRE?	n	n: 0 to 63, 128 to 191
Read Status Byte		---	*STB?	n	n: 0 to 255
Trigger		*TRG	---	---	
Self Test		---	*TST?	0	
Wait to Continue		*WAI	---	---	

SECTION 7 DETAILED DESCRIPTION OF COMMANDS

This section describes the details of commands for main-unit common function and system change on the device messages used by main unit in alphabetical order. Refer to the Section 6 for the list of these commands.

How To Read Detailed Command Description on Measurement Screen

Example: Setting impedance

DATE [1]

Date Setting [2]
[3]

Program Message	Query Message	Response Message
DATE a,b,c	DATE?	a,b,c

■ Function [4]

Sets year, month and day

■ Value of a [5]

Year

a	Year
1980 to 2079	1980 to 2079

■ Value of b

Month

b	Month
1 to 12	January to December

■ Value of c

Day

c	Day
1 to 31	1 to 31

■ Restrictions [6]

- Invalid dates (such as February 31) can not be set.

■ Use Example [7]

"Setting the date to July 21, 2000."

<Program>

DATE 2000,7,21
DATE?

<Response>

2000,7,21

[1] Message header for Program Message and Query Message
[2] Name of Setting/Recalling item (Note: This is not always the same as that on the measuring equipment screen.)
[3] Syntax for Program Message, Query Message and Response Message. Upper case letters indicate reserved words. Lower case letters indicate the argument of the device message or the response data described in paragraph [5] below.
[4] Outline of Setting/Recalling function in Program Message and Query Message
[5] Description of lower case letters on Table in [3]. In case of set value, each argument includes the meaning of set item, initial value, range, resolution and restrictions. In case of Response Message, the argument includes the meaning of output data, resolution, unit, etc.
[6] Description of restrictions and precautions on using the command. The command is not properly set or recalled if these restrictions are not met.
[7] An example of command use. The example <Program> is given here only to show the examples of the sending Program Message, Query Message and their order. It is not an actual program code. (Program code depends on the environment.) The values in <Response> differ from actual measured values.

*CLS

Clear Status

Program Message	Query Message	Response Message
*CLS	–	–

■ Function

Performs zero-clear of the standard event-status byte register.

■ Use Example

"Performing zero-clear of the status byte ("xxxxx?" is an invalid command)."

<Program>

xxxxx?
*CLS
*ESR?

<Response>

0

*ESE

Standard Event Status Enable

Program Message	Query Message	Response Message
*ESE a	*ESE?	a

■ Function

Sets or clears the standard event status enable register.

■ Value of a

Standard event status enable

a	Standard event status enable
0	Operation completed
2	Bus control right request (RQC)...unused
4	Query error (QYE)
8	Device-specific error (DDE)
16	Execution error (EXE)
32	Command error (CME)
64	User request (URQ)...unused
128	Power-on (PON)
Total of the above numerical values	Above each standard event status enable above

■ Use Example

"Enabling the standard event status enable register for Power-on (PON)."

<Program>

*ESE 128
*ESE?

<Response>

128

*ESR

Standard Event Status

Program Message	Query Message	Response Message
–	*ESR?	a

■ Function

Reads out the standard event status register.

■ Value of a

Standard event status

a	Standard event status
0	Operation completed
2	Bus control-right request (RQC)...unused
4	Query error (QYE)
8	Device-specific error (DDE)
16	Execution error (EXE)
32	Command error (CME)
64	User request (URQ)...unused
128	Power-on (PON)
Total of the above numerical value	Above each standard event status above

■ Use Example

"Reading out the standard event status register (response to command error)."

<Program>

*ESR?

<Response>

32

*IDN

Identified Query

Program Message	Query Message	Response Message
*IDN?	–	ANRITSU,a,b,c

■ Function

Reads out the product's model name, serial number and firmware version.

■ Value of a

Product model name of up to 32 characters

■ Value of b

Serial number of up to 32 characters

■ Value of c

Firmware revision

■ Use Example

"Reading out the product information."

<Program>

IDN?

<Response>

ANRITSU,MS8608A,P001,1.7

*OPC

Operation Complete

Program Message	Query Message	Response Message
*OPC	–	–

■ Function

Sets the bit of the standard event status to 0 when the operation of the selected pending device is completed.

■ Use Example

<Program>

*OPC

<Response>

None

*RST

Reset

Program Message	Query Message	Response Message
*RST	–	–

■ Function

Initializes the setting parameters of initialized object.

■ Use Example

<Program>

*RST

<Response>

None

*SRE

Service Request Enable

Program Message	Query Message	Response Message
*SRE	*SRE?	a

■ Function

Sets the bits of the service request enable register.

■ Value of a

Current value of the service request enable register

Range	Resolution	Initial value
0 to 63, 128 to 191	1	

■ Use Example

<Program>

*SRE

<Response>

None

*STB

Read Status Byte Command

Program Message	Query Message	Response Message
–	*STB?	a

■ Function

Returns the current value of the status byte that contains the MSS bit.

■ Value of a

Status byte

a	Status byte
64	MSS service request
32	
16	
4	
2	

■ Use Example

"Reading out the current value of the status byte."

<Program>

TTL FULL
TTL?

<Response>

ON

*TRG

Trigger

Program Message	Query Message	Response Message
*TRG	–	–

■ Function

This function has the same effect as the IEEE488.x GET Group-Execute Trigger path command. On the MS8608A/MS8609A, it executes single sweep.

■ Use Example

<Program>

*TRG

<Response>

None

*TST

Self Test Query

Program Message	Query Message	Response Message
–	*TST?	a

■ Function

Executes the internal self-test and returns the presence/none-presence of errors.

■ Value of a

Self-test result

a	Test result
0	Test completed without error.
32767 to −1, 1 to 32767	No test conducted or error occurred.

■ Use Example

<Program>

*TST?

<Response>

0

*WAI

Wait to Continue

Program Message	Query Message	Response Message
*WAI	–	–

■ Function

Makes the next command wait while the device is executing a command.

■ Use Example

<Program>

*WAI

<Response>

None

ALARM

Buzzer

Program Message	Query Message	Response Message
ALARM a	ALARM?	a

■ Function

Sets the buzzer that sounds when an error occurs and at other times. This function has the same effect as the BEP command.

■ Value of a

Setting buzzer

a	Buzzer setting	Initial value
ON	Sets buzzer to On.	*
OFF	Sets buzzer to Off.	

■ Use Example

"Setting the buzzer to Off."

<Program>

ALARM OFF
ALARM?

<Response>

OFF

BAUD

Baud Rate

Program Message	Query Message	Response Message
BAUD a	BAUD?	a

■ Function

Sets the communication speed of the communication port used for RS-232C.

■ Value of a

Communication speed

Range	Unit	Initial value
1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	bit/sec	9600

■ Use Example

"Setting the communication speed to 115200 bps."

<Program>

BAUD 115200
BAUD?

<Response>

115200

BEP

Buzzer

Program Message	Query Message	Response Message
BEP a	BEP?	b

■ Function

Sets the buzzer that sounds when an error occurs and at other times. This function has the same effect as the ALARM command.

■ Values of a and b

Setting buzzer

a	b	Buzzer setting	Initial value
ON	ON	Buzzer is sounded.	*
1			
OFF	OFF	Buzzer is not sounded.	
0			

■ Use Example

"Setting the buzzer to Off."

<Program>

BEP OFF
BEP?

<Response>

OFF

BIN

Data Outuput Format

Program Message	Query Message	Response Message
BIN a	BIN?	a

■ Function

Sets whether to read out the waveform data output in ASCII code or in binary code.

■ Value of a

ASCII/Binary specification

a	ASCII/Binary specification	Initial value
ON	Binary format	*
1		
OFF	ASCII format	
0		

■ Use Example

"Reading out the waveform data in the binary format."

<Program>

BIN ON
BIN?

<Response>

ON

BRIGHT

Set Brightness

Program Message	Query Message	Response Message
BRIGHT a	BRIGHT?	b

■ Function

Sets the brightness of the LCD display.

■ Value of a

Brightness level

a	Brightness level	Resolution	Initial value
1 to 5	1 (dark) to 5 (bright)	1	1
OFF	0 (off state)	–	–

Note:
Even if the response of the "DISPLAY?" command is "ON", the response of the "BRIGHT?" command may be "OFF" when the screen is off.

■ Use Example

"Setting the brightness of the screen to 4."

<Program>

BRIGHT 4
BRIGHT?

<Response>

4

COLORPTN

Display Color Pattern

Program Message	Query Message	Response Message
COLORPTN a	COLORPTN?	a

■ Function

Sets the color of the screen.

■ Value of a

Color pattern

a	Color pattern
COLOR1	Pattern 1
COLOR2	Pattern 2
COLOR3	Pattern 3
COLOR4	Pattern 4
USERCOLOR	User definition

■ Use Example

"Setting the screen color to Pattern 4."

<Program>

COLORPTN COLOR4
COLORPTN?

<Response>

COLOR4

COMMENT

comment

Program Message	Query Message	Response Message
COMMENT a	COMMENT?	a

■ Function

Sets the title and clock display on the screen.

■ Value of a

Display item

a	Item	Initial value
TITLE	Title	
TIME	Clock	*
FULL	Title and clock	
OFF	None	

■ Use Example

"Setting the display item to title and clock."

<Program>

COMMENT FULL
COMMENT?

<Response>

FULL

COPYCOLOR

Copy Pattern from

Program Message	Query Message	Response Message
COPYCOLOR a	–	–

■ Function

Selects the base color pattern used for the user definition color.

■ Value of a

Color pattern

a	Color pattern
COLOR1	Pattern 1
COLOR2	Pattern 2
COLOR3	Pattern 3
COLOR4	Pattern 4

■ Use Example

"Making the user definition color using the screen color of Pattern 1."

<Program>

COPYCOLOR COLOR1

<Response>

None

CURSORMODE

Window Cursor mode

Program Message	Query Message	Response Message
CURSORMODE a	CURSORMODE?	a

■ Function

Sets the movement mode of the cursor displayed on the window.

■ Value of a

Cursor movement mode

a	Cursor movement mode	Initial value
TURN	Turn: The cursor moves to the start point after reaching the end of the selections.	
STOP	Stop: The cursor does not move any more after reaching the end of the selections.	*

■ Use Example

"Setting the cursor movement mode to Turn."

<Program>

CURSORMODE TURN
CURSORMODE?

<Response>

TURN

DATB

Data Bits

Program Message	Query Message	Response Message
DATB a	DATB?	a

■ Function

Sets the data length of the communication port used for RS-232C.

■ Value of a

Data length

a	Data length	Initial value
7	7bits	
8	8bits	*

■ Use Example

"Setting the data length to 7 bits."

<Program>

DATB 7
DATB?

<Response>

7

DATE

Date Setting

Program Message	Query Message	Response Message
DATE a,b,c	DATE?	a,b,c

■ Function

Sets the date: year, month, and day.

■ Value of a

a: Year

a	Year
1980 to 2079	Year 1980 to 2079

■ Value of b

b: Month

b	Month
1 to 12	January to December

■ Value of c

c: Day

c	Day
1 to 31	1 to 31

■ Restrictions

Invalid dates (such as February 31) can not be set.

■ Use Example

"Setting the date to July 21, 2000."

<Program>

DATE 2000,7,21
DATE?

<Response>

2000,7,21

DATEMODE

Date Format

Program Message	Query Message	Response Message
DATEMODE a	DATEMODE?	a

■ Function

Sets the display format for the date: year, month and day.

■ Value of a

a: Display format for the date: year, month and day

a	Format	Initial value
YMD	YYYY/MM/DD	*
DMY	MMM-DD-YYYY	
MDY	DD-MMM-YYYY	

■ Use Example

"Setting the display format for the date to MMM-DD-YYYY."

<Program>

DATEMODE DMY
DATEMODE?

<Response>

DMY

DELM

RS-232C Terminator

Program Message	Query Message	Response Message
DELM a	DELM?	a

■ Function

Sets the type of terminator that is added to the RS-232C message.

■ Value of a

Terminator

a	Terminator	Initial value
0	LF	*
1	CR/LF	

■ Use Example

"Setting the RS-232C terminator to CR/LF."

<Program>

DELM 1
DELM?

<Response>

1

DISPLAY

LCD Power

Program Message	Query Message	Response Message
DISPLAY a	DISPLAY?	a

■ Function

Turns On/Off the power supply of the LCD display.

■ Value of a

Power supply setting

a	Power supply setting	Initial value
ON	Sets the power supply of the LCD display to On.	*
OFF	Sets the power supply of the LCD display to Off.	

■ Use Example

"Setting the power supply of the LCD display to off."

<Program>

DISPLAY OFF
DISPLAY?

<Response>

OFF

ESE2

END Event Status Enable

Program Message	Query Message	Response Message
ESE2 a	ESE2?	a

■ Function

Selects which bits of the event register (that corresponds to the END event status enable register) are enabled to make the ESB summary message bit 2 to true.

■ Value of a

EDN event status enable register

a	Resolution
0 to 255	1

* Value of a is the sum of the bit values obtained when the enabled bits are selected from among weighted values 1, 2, 4, 8, 16, 32, 64 and 128, corresponding to the END event status register bits 0, 1, 2, 3, 4, 5, 6 and 7.

■ Use Example

"Making the ESB summary message bit 2 True when sweep and measurement are completed."

<Program>

ESE2 1
ESE2?

<Response>

1

FLWCTRL

XON/XOFF Flow Control

Program Message	Query Message	Response Message
FLWCTRL a	FLWCTRL?	a

■ Function

Sets XON/XOFF flow control On/Off for the communication port used for RS-232C.

■ Value of a

Sets XON/XOFF flow control On/Off.

a	Control	Initial value
ON	XON/XOFF flow control is executed.	
OFF	XON/XOFF flow control is not executed.	*

■ Use Example

"Executing XON/XOFF flow control."

<Program>

FLWCTRL ON
FLWCTRL?

<Response>

ON

GATEWAY

Gateway Address

Program Message	Query Message	Response Message
NETMASK a,b,c,d	NETMASK?	a,b,c,d

■ Function

Sets Gateway Address of Ethernet.

■ Value of a, b and c

Gateway Address

Range	Resolution
0 to 255	1

■ Use Example

"Setting Gateway Address to 255.214.65.88."

<Program>

GATEWAY 255.214.65.88
GATEWAY?

<Response>

255.214.65.88

HOLD

Close Error Window

Program Message	Query Message	Response Message
HOLD	–	–

■ Function

Deletes the error message currently displayed.

■ Use Example

"Deleting the error message."

<Program>

HOLD

<Response>

None

HOSTADRS

Host Address

Program Message	Query Message	Response Message
HOSTADRS a,b,c,d	HOSTADRS?	a,b,c,d

■ Function

Sets Host Address of Ethernet.

■ Values of a, b, c and d

Host Address

Range	Resolution
0 to 255	1

■ Use Example

"Setting Host Address to 255.214.65.88."

<Program>

HOSTADRS 255.214.65.88
HOSTADRS?

<Response>

255.214.65.88

INI

Initialize

Program Message	Query Message	Response Message
INI	–	–

■ Function

Initializes all the setting parameters of the initialized object. This function has the same effect as the PRE and IP commands. In the Config mode, there are no setting parameters to be initialized.

■ Use Example

"Initializing parameters of the initialized object."

<Program>

INI

IP

Preset

Program Message	Query Message	Response Message
IP	–	–

■ Function

Initializes all the setting parameters of the initialized object. This function has the same effect as the PRE and INI commands. In the Config mode, there are no setting parameters to be initialized.

■ Use Example

"Initializing parameters of the initialized object."

<Program>

IP

IPADRS

My IP Address

Program Message	Query Message	Response Message
IPADRS a,b,c,d	IPADRS?	a,b,c,d

■ Function

Sets My IP Address of Ethernet.

■ Value of a, b, c and d

IP Address

Range	Resolution
0 to 255	1

■ Use Example

"Setting My IP Address to 255.214.65.88."

<Program>

IPADRS 255.214.65.88
IPADRS?

<Response>

255.214.65.88

KSE

Title Setting

Program Message	Query Message	Response Message
KSE "a"	TITLE?	a

■ Function

Sets the screen title. This function has the same effect as the TITLE command. However, the query message is only "TITLE?".

■ Value of a

a: Title character string (needs to be enclosed in double quotation marks)
Initial value: None

■ Use Example

"Setting the title to "TEST MODE1"."

<Program>

KSE "TEST MODE1"
TITLE?

<Response>

TEST MODE1

NETMASK

Net Mask Address

Program Message	Query Message	Response Message
NETMASK a,b,c,d	NETMASK?	a,b,c,d

■ Function

Sets Net Mask Address of Ethernet.

■ Value of a, b, c and d

Net Mask Address

Range	Resolution
0 to 255	1

■ Use Example

"Setting Net Mask Address to 255.214.65.88."

<Program>

NETMASK 255.214.65.88
NETMASK?

<Response>

255.214.65.88

PLS

Print

Program Message	Query Message	Response Message
PLS 0	–	–

■ Function

Performs hard copying. This function has the same effect as the PRINT command.

■ Use Example

"Performing hard copying."

<Program>

PLS 0

<Response>

None

PMOD

Copy Mode

Program Message	Query Message	Response Message
PMOD a	PMOD?	a

■ Function

Sets the output format for hard copy.

■ Value of a

Output format of hard copy

a	Format	Initial value
3	Printer Hewlett-Packard HP815C	
6	Printer Canon BJ-M70	*
13	Memory card BMP color	
14	Memory card BMP monochrome	

■ Use Example

"Setting the output to BMP color memory card."

<Program>

PMOD 13
PMOD?

<Response>

13

PNLMD

System Mode

Program Message	Query Message	Response Message
PNLMD a	PNLMD?	a

■ Function

Switches the measurement mode.

■ Value of a

Measurement mode

a	Measurement mode
SPECT	Spectrum Analyzer
SYSTEM	Tx Tester
CONFIG	Config

■ Use Example

"Switching the mode to the Tx Tester mode."

<Program>

PNLMD SYSTEM
PNLMD?

<Response>

SYSTEM

PORTADRS

Port Address

Program Message	Query Message	Response Message
PORTADRS a,b,c,d	PORTADRS?	a,b,c,d

■ Function

Sets Port Address of Ethernet.

■ Value of a

Port Address

Range	Resolution
3000 to 30000	1

■ Use Example

"Setting Port Address to 3000."

<Program>

PORTADRS 3000
PORTADRS?

<Response>

3000

POWERON

Initial at power on

Program Message	Query Message	Response Message
POWERON a	POWERON?	a

■ Function

Sets the initial values after the power is turned on.

■ Value of a

Initial values after power on

a	Initial value	Initial value
LAST	Uses the settings immediately before the previous power-off as the initial values.	*
IP	Uses the initial values of the initialization level set by the Preset key.	

■ Use Example

"Starting up with the initial values set by the Preset key."

<Program>

POWERON IP
POWERON?

<Response>

IP

PRE

Preset

Program Message	Query Message	Response Message
PRE	–	–

■ Function

Initializes all the setting parameters of the initialized object. This function has the same effect as the INI and IP commands. In the Config mode, there are no setting parameters to be initialized.

■ Use Example

"Initializing all the parameters of initialized object."

<Program>

PRE

PRINT

Print

Program Message	Query Message	Response Message
PRINT	–	–

■ Function

Executes hard copying.

■ Use Example

"Executing hard copying."

<Program>

PRINT

<Response>

None

PRTY

Parity

Program Message	Query Message	Response Message
PRTY a	PRTY?	a

■ Function

Sets the parity check for the communication port used for RS-232C.

■ Value of a

Parity check

a	Parity	Initial value
EVEN	Even parity	
ODD	Odd parity	
OFF	No parity	*

■ Use Example

"Setting even parity."

<Program>

PRTY EVEN
PRTY?

<Response>

EVEN

RCM

Recall Data

Program Message	Query Message	Response Message
RCM a,b	–	–

■ Function

Recalls the setting parameters and waveform data in the Spectrum Analyzer mode and the setting parameters in the Tx Tester mode from the respective files, after switching to the respective system mode. The memory card needs to be inserted to recall them.

■ Value of a

Saved file number

Range	System
0 to 99	Spectrum Analyzer
0 to 999	Tx Tester

■ Value of b

System

b	System
SPECT	Spectrum Analyzer
SYSTEM	Tx Tester
None	Current system

■ Use Example

"Recalling the setting parameter file of the Tx Tester."

<Program>

RCM 0,SYSTEM

<Response>

None

RFINPUT

RF Input connector

Program Message	Query Message	Response Message
RFINPUT a	RFINPUT?	a

■ Function

Sets the level of the RF signal to be input.

■ Value of a

RF signal level

a	RF signal level	Initial value
HIGH	High Power	*
LOW	Low Power	

■ Initializing set parameters

*RST

■ Use Example

"Setting the RF signal level to High Power."

<Program>

RFINPUT HIGH
RFINPUT?

<Response>

HIGH

RGB

RGB Output

Program Message	Query Message	Response Message
RGB a	RGB?	a

■ Function

Sets the external output of the RGB signal On/Off.

■ Value of a

a	Item	Initial value
ON	On	*
OFF	Off	

■ Use Example

"Setting the RGB output to Off."

<Program>

RGB OFF
RGB?

<Response>

OFF

SCREEN

Drawing

Program Message	Query Message	Response Message
SCREEN a	SCREEN?	a

■ Function

Sets On/Off the drawing operation on the screen. If the drawing operation is set to Off, the measurement delay due to the drawing operation can be eliminated.

■ Value of a

Setting On/Off of drawing operation.

a	Drawing operation setting	Initial value
ON	Characters and figures are drawn.	*
OFF	No characters and figures are drawn.	

■ Use Example

"Setting the drawing operation to Off."

<Program>

```
SCREEN OFF
SCREEN?
```

<Response>

```
OFF
```

SCREENMODE

Screen mode at Power on

Program Message	Query Message	Response Message
SCREENMODE a	SCREENMODE?	a

■ Function

Sets the measurement mode to be displayed immediately after the power on.

■ Value of a

Measurement mode

a	Measurement mode	Initial value
SPECT	Spectrum Analyzer mode	
SYSTEM	Tx Tester mode	
LAST	Previous measurement mode immediately before power-off	*

■ Use Example

"Starting up in the Tx Tester mode after the power on."

<Program>

SCREENMODE SYSTEM
SCREENMODE?

<Response>

SYSTEM

STPB

Stop Bit

Program Message	Query Message	Response Message
STPB a	STPB?	a

■ Function

Sets the stop bit of the communication port used for RS-232C.

■ Value of a

Stop bit

a	Data length	Initial value
1	1bit	*
2	2bit	

■ Use Example

"Setting the stop bit to 1 bit."

<Program>

STPB 1
STPB?

<Response>

1

SVM

Save Data

Program Message	Query Message	Response Message
SVM a,b	–	–

■ Function

Saves the setting parameters and waveform data in the Spectrum Analyzer mode and the setting parameters in the Tx Tester mode on the respective files, after switching to the respective system. Saving is not allowed when the memory card has not been set.

■ Value of a

Saved file number

Range	System
0 to 99	Spectrum Analyzer
0 to 999	Tx Tester

■ Value of b

System

b	System
SPECT	Spectrum Analyzer
SYSTEM	Tx Tester
None	Current system

■ Use Example

"Saving the setting parameter file of the Tx Tester."

<Program>

SVM 0,SYSTEM

<Response>

None

SYS

System Change

Program Message	Query Message	Response Message
SYS a	SYS?	a

■ Function

Switches the system (measurement software) in the Tx Tester mode. You can only select the measurement software that has been installed in one of the three system areas. You need to know in advance what system is installed in each of the three system areas.
When no system is installed in a specified area, the current system will be maintained and no error will be returned.

■ Value of a

Tx Tester system area number (where the measurement software is installed)

a	Tx Tester system area number
1	System-1
2	System-2
3	System-3

■ Use Example

"Switching the system to the measurement software installed in the System-1 area."

<Program>

SYS 1
SYS?

<Response>

1

TIME

Time Setting

Program Message	Query Message	Response Message
TIME a,b,c	TIME?	a,b,c

■ Function

Sets the clock. The clock is adjusted when the TIME command is received.

■ Value of a

a: Hour

a	Hour
0 to 23	0 to 23

■ Value of b

b: Minute

b	Minute
0 to 59	0 to 59

■ Value of c

c: Second

c	Second
0 to 59	0 to 59

■ Use Example

"Setting the clock to 12:00:00."

<Program>

TIME 12,0,0

<Response>

None

TIMEDSP

Time

Program Message	Query Message	Response Message
TIMEDSP a	TIMEDSP?	b

■ Function

Sets clock display on the screen On/Off.

■ Values of a and b

a: Display item

b: Clock display On/Off

a	b	Item	Initial value
ON	ON	Clock	*
FULL	ON	Title and clock	
OFF	OFF	None	

■ Use Example

"Setting the display item to title and clock."

<Program>

TIMEDSP FULL
TIMEDSP?

<Response>

ON

TITLE

Title Setting

Program Message	Query Message	Response Message
TITLE "a"	TITLE?	a

■ Function

Sets the screen title. This function has the same effect as the KSE command.

■ Value of a

a: Title character string (needs to be enclosed by double quotation marks.)

Initial value: None

■ Use Example

"Setting the title to 'TEST MODE1'."

<Program>

TITLE "TEST MODE1"
TITLE?

<Response>

TEST MODE1

TMCNT

Live Time Count Read

Program Message	Query Message	Response Message
–	TMCNT?	a

■ Function

Reads out the total power-on time.

■ Value of a

Total power-on time

Range	Unit
0 to 100000	Minute

■ Use Example

"Reading out the total power-on time."

<Program>

TMCNT?

<Response>

6789

TOUT

RS-232C Timeout

Program Message	Query Message	Response Message
TOUT a	TOUT?	a

■ Function

Sets the RS-232C communication timeout.

■ Value of a

Timeout period

a	Resolution	Initial value	Unit
0 (No timeout) to 255	1	5	Second

■ Use Example

"Setting the timeout to 10 seconds."

<Program>

TOUT 10
TOUT?

<Response>

10

TRM

GPIB Terminator

Program Message	Query Message	Response Message
TRM a	TRM?	a

■ Function

Sets the type of terminator that is added to a GPIB message.

■ Value of a

Terminator

a	Terminator	Initial value
0	LF	*
1	CR/LF	

■ Use Example

"Setting the terminator of GPIB to CR/LF."

<Program>

TRM 1
TRM?

<Response>

1

TTL

Title

Program Message	Query Message	Response Message
TTL a	TTL?	b

■ Function

Sets title display on the screen On/Off.

■ Values of a and b

a: Display item

b: Title display On/Off

a	b	Item	Initial Value
1	ON	Title	
ON	ON	Title	
USER	ON	Title	
DATE	OFF	Clock	*
FULL	ON	Title and clock	
0	OFF	None	
OFF	OFF	None	

■ Use Example

"Setting the display item to title and clock."

<Program>

TTL FULL
TTL?

<Response>

ON

APPENDIXES

APPENDIX A

ASCII*CODE TABLE

B7 B6 B5 BITS B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0 NUL 0 0	20 DLE 10 16	40 SP 20 32	60 0 30 48	100 @ 40 64	120 P 50 80	140 ` 60 96	160 p 70 112
0 0 0 1	1 GTL SOH 1 1	21 LLO DC1 11 17	41 ! 21 33	61 1 31 49	101 A 41 65	121 Q 51 81	141 a 61 97	161 q 71 113
0 0 1 0	2 NUL 2 2	22 DC2 12 18	42 " 22 34	62 2 32 50	102 B 42 66	122 R 52 82	142 b 62 98	162 r 72 114
0 0 1 1	3 ETX 3 3	23 DC3 13 19	43 # 23 35	63 3 33 51	103 C 43 67	123 S 53 83	143 c 63 99	163 s 73 115
0 1 0 0	4 SDC EOT 4 4	24 DCL DC4 14 20	44 $ 24 36	64 4 34 52	104 D 44 68	124 T 54 84	144 d 64 100	164 t 74 116
0 1 0 1	5 PPC ENO 5 5	25 PPU NAK 15 21	45 % 25 37	65 5 35 53	105 E 45 69	125 U 55 85	145 e 65 101	165 u 75 117
0 1 1 0	6 ACK 6 6	26 SYN 16 22	46 & 26 38	66 6 36 54	106 F 46 70	126 V 56 86	146 f 66 102	166 v 76 118
0 1 1 1	7 BEL 7 7	27 ETB 17 23	47 ' 27 39	67 7 37 55	107 G 47 71	127 W 57 87	147 g 67 103	167 w 77 119
1 0 0 0	10 GET BS 8 8	30 SPE CAN 18 24	50 (28 40	70 8 38 56	110 H 48 72	130 X 58 88	150 h 68 104	170 x 78 120
1 0 0 1	11 TCT HT 9 9	31 SPD EM 19 25	51) 29 41	71 9 39 57	111 I 49 73	131 Y 59 89	151 i 69 105	171 y 79 121
1 0 1 0	12 LF A 10	32 SUB 1A 26	52 * 2A 42	72 : 3A 58	112 J 4A 74	132 Z 5A 90	152 j 6A 106	172 z 7A 122
1 0 1 1	13 VT B 11	33 ESC 1B 27	53 ÷ 2B 43	73 ; 3B 59	113 K 4B 75	133 [5B 91	153 k 6B 107	173 { 7B 123
1 1 0 0	14 FF C 12	34 FS 1C 28	54 , 2C 44	74 < 3C 60	114 L 4C 76	134 \ 5C 92	154 l 6C 108	174 ¦ 7C 124
1 1 0 1	15 CR D 13	35 GS 1D 29	55 - 2D 45	75 = 3D 61	115 M 4D 77	135 [5D 93	155 m 6D 109	175 } 7D 125
1 1 1 0	16 SO E 14	36 RS 1E 30	56 . 2E 46	76 > 3E 62	116 N 4E 78	136 ∧ 5E 94	156 n 6E 110	176 ~ 7E 126
1 1 1 1	17 SI F 15	37 US 1F 31	57 / 2F 47	77 ? 3F 63	117 O 4F 79	137 UNT _ 5F 95	157 o 6F 111	177 RUBOUT (DEL) 7F 127
	Address command	Universal command	Listen address		Talk address		Secondary address or command	

KEY

octal	25 PPU	GPIB code
	NAK	ASCII character
hex	15 21	decimal

*USA Standard Code for Information Interchange

Table of GPIB Interface Messages (extended)

Bits b7 b6 b5 →					0 0 0	[1] MSG	0 0 1	MSG	0 1 0	MSG	0 1 1	MSG	1 0 0	MSG	1 0 1	MSG	1 1 0	MSG	1 1 1	MSG
↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → ROW ↓	0		1		2		3		4		5		6		7	
[2] 0	0	0	0	0	NUL		DLE		SP	Listener address allocated to device (MLA)	0	Listener address allocated to device (MLA)	@	Listener address allocated to device (MTA)	P	Listener address allocated to device (MTA)	`	Meaning is defined by PCG.	p	Meaning is defined by PCG.
0	0	0	1	1	SOH	GTL	DC1	LLO	!		1		A		Q		a		q	
0	0	1	0	2	STX		DC2		"		2		B		R		b		r	
0	0	1	1	3	ETX		DC3		#		3		C		S		c		s	
0	1	0	0	4	EOT	SDC	DC4	DCL	$		4		D		T		d		t	
0	1	0	1	5	ENQ	PPC	NAK	PPU	%		5		E		U		e		u	
0	1	1	0	6	ACK		SYN		&		6		F		V		f		v	
0	1	1	1	7	BEL		ETB				7		G		W		g		w	
1	0	0	0	8	BS	GET	CAN	SPE	(		8		H		X		h		x	
1	0	0	1	9	HT	TCT	EM	SPD	)		9		I		Y		i		y	
1	0	1	0	A	LF		SUB		*		:		J		Z		j		z	
1	0	1	1	B	VT		ESC		+		;		K		[		k		{	
1	1	0	0	C	FF		FS		,		<		L		\		l		|	
1	1	0	1	D	CR		GS		—		=		M		]		m		}	
1	1	1	0	E	SO		RS		.		>		N		^		n		~	
1	1	1	1	F	SI		US		/		?	UNL	O		—	UNT	o		DEL	

Address command group (ACG)

Universal command group (UCG)

Listen address group (LAG)

Talk address group (TAG)

Primary command group (PCG)

Secondary command group (SCG)

Notes:

[1] MSG=INTERFACE MESSAGE (Sent by ATN of True: Low level.)
[2] b1=DI 01……b7=DI 07 (b1 through b7 correspond to DI01 to DI07 sequence.)

GTL	Go to Local
SDC	Select Device Clear
PPC	Parallel Poll Configure
GET	Group Execute Trigger
TCT	Take Control
LLO	Local Lockout
(ACG)	Addressed Command Group
(UCG)	Universal Command Group
(LAG)	Listen Address Group
(TAG)	Talk Address Group
(PCG)	Primary Command Group
(SCG)	Secondary Command Group
DCL	Device Clear
PPU	Parallel Poll Unconfigure
SPE	Serial Poll Enable
SPD	Serial Poll Disable
UNL	Unlisten
UNT	Untalk

Table of Interface Message group

DI08	DI07	DI06	DI05	DI04	DI03	DI02	DI01	Interface message group (G)
×	0	0	0	b4	b3	b2	b1	Addressed command G
×	0	0	1	b4	b3	b2	b1	Universal command G
×	0	1	b5	b4	b3	b2	b1	Listen address G
×	0	1	1	1	1	1	1	Unlisten (UNL)
×	1	0	b5	b4	b3	b2	b1	Talker Address G
×	1	0	1	1	1	1	1	Untalk (UNT)
×	1	1	b5	b4	b3	b2	b1	Secondary command G

Table of Address Assignmemts

Address character		Address swich setting					Primary address	Factory address set device
Talk	Listen	5	4	3	2	1		
b_7 b_6	b_7 b_6	b_5	b_4	b_3	b_2	b_1		
1 0	0 1	↓	↓	↓	↓	↓	10 Decimal	
@	SP	0	0	0	0	0	0	Printer
A	!	0	1	0	0	1	1	
B	"	0	0	0	1	0	2	
C	#	0	0	0	1	1	3	
D	$	0	0	1	0	0	4	
E	%	0	0	1	0	1	5	
F	&	0	0	1	1	0	6	
G	'	0	0	1	1	1	7	
H	(	0	1	0	0	0	8	
I	)	0	1	0	0	1	9	
J	*	0	1	0	1	0	10	
K	+	0	1	0	1	1	11	
L	,	0	1	1	0	0	12	
M	-	0	1	1	0	1	13	
N	.	0	1	1	1	0	14	
O	/	0	1	1	1	1	15	
P	0	1	0	0	0	0	16	
Q	1	1	0	0	0	1	17	
R	2	1	0	0	1	0	18	
S	3	1	0	0	1	1	19	
T	4	1	0	1	0	0	20	
U	5	1	0	1	0	1	21	
V	6	1	0	1	1	0	22	
W	7	1	0	1	1	1	23	
X	8	1	1	0	0	0	24	
Y	9	1	1	0	0	1	25	
Z	:	1	1	0	1	0	26	
[	;	1	1	0	1	1	27	
\	<	1	1	1	0	0	28	
]	=	1	1	1	0	1	29	
^	>	1	1	1	1	0	30	
?	—	1	1	1	1	1	31	UNL,UNT

APPENDIX B

COMPARISON TABLE OF CONTROLLER'S GPIB INSTRUCTIONS

Function	Controller		
	IBM-PC (NI-488.2)	IBM-PC (NI-488)	HP9000 series
Outputs data to a device	CALL Send( )	CALL IBWRT( )	OUTPUT device selector; data
Outputs binary data to a device	CALL SEND Cmds( )		
Assigns data entered from a device to a variable	CALL Receive( )	CALL IBRD( )	ENTER device selector; variable
Assigns binary data entered from a device to a variable			
Initializes an interface	CALL Send IFC( )	CALL IBSIC( )	ABORT select code
Turns REN line on	CALL Enable Remote( )	CALL IBSRE( )	REMOTE device selector (select code)
Turns REN line off	CALL Enable Local( )	CALL IBSRE( ) CALL IBLOC( )	LOCAL device selector (select code) LOCAL device selector (select code + primary address)
Outputs interface message(s) and data		CALL IBCMD( ) CALL IBCMDA( ) (asynchronous)	SEND select code; message string
Triggers a specified device	CALL Trigger( )	CALL IBTRG( )	TRIGGER device selector

Function	Controller		
	IBM-PC (NI-488.2)	IBM-PC (NI-488)	HP9000 series
Initializes devices	CALL DevClear( )	CALL IBCLR( )	CLEAR device selector (select code) CLEAR device selector (select code + primary address)
Prevents a device from being switched over from remote to local	CALL SendLLO( ) CALL SetRWLS( )	LOCAL LOCKOUT	
Transfers control to a specified device	CALL Pass Control( )	CALL IBPCT( )	PASS CONTROL
Sends out a service request		CALL IBRSV( )	REQUEST select code
Performs serial polling	CALL Read Status Byte( ) CALL AllSpoll( )	CALL IBRSP( )	SPOLL (device selector) (function)
Sets a terminator code		CALL IBEOS( ) CALL IBEOT( )	
Sets a limit value for checking a time-out		CALL IBTOM( )	
Wait to SRQ	CALL WaitSRQ( )	CALL IBWAIT( )	

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