MS8606A

Digital Mobile Radio Transmitter Tester
With
Option 01: AF Measurement
Operation Manual

Second Edition

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

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

NOV.
1997

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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 symbols may not 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.

MS8606A Digital Mobile Radio Transmitter Tester, With Option 01: AF Measurement
Operation Manual

1 July 1997 (First Edition)
22 September 1997 (Second Edition)

Printed in Japan

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.

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.

   T□□□A indicates a time-lag fuse.
   □□□A or F□□□A indicates a ordinary melt type 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.

Heavy weight

⚠ CAUTION
>18 kg
Heavy weight

3. Use two or more people to lift and move this equipment, or use a trolley. There is a risk of back injury, if this equipment is lifted by one person.

Check Terminal

⚠

4. Never input a signal of more than the specified voltage between the measured terminal and ground. Input of an excessive signal may damage the equipment.

5. Do not take out the floppy disk if LED lamp of the floppy disk drive is on. If it is taken out, the contents of the storage medium will be damaged, resulting in floppy disk drive failure.

CAUTION ⚠

Memory Back-up Battery

6. The power for memory back-up of the MS8606A is supplied by a poly-carbomonofluoride 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.
At the end of it's life, the battery should be recycled or disposed properly.
Note: The Battery life is about 7 years. Early battery replacement is recommended.

Storage Medium

7. The MS8606A stores data and programs using a floppy disk (FD), memory card (MC), and backed-up memories.
Data and programs may be lost due to improper use or failure.
Anritsu therefore recommends that you back up the memory.
ANRITSU CANNOT COMPENSATE FOR ANY MEMORY LOSS.

Please pay careful attention to the following points. Do not remove the floppy disk from the equipment being accessed.

(FD)
- Do not touch the FD directly or by using any object.
- Do not place the equipment where dirty and dusty.
- Isolate the FD and memory card from static electricity.
- Avoid to placing the FD in direct sunlight or near heating sources.
- Store under temperature of 40° to 54°C, humidity of 8 to 90% (No condensation).

(Memory card)
- Isolate the memory card from static electricity.

(Backed-up memory)
- Isolate the memory from ststic electricity.

Disposing of The Product

8. The MS8606A uses chemical compound semiconductor including arsenic.
At the end of its life, the MS8606A 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 and the Communication 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 misoperation, 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 and 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.

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 is 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 data acquisition requires a long time at the BER measurement, 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, the standby function of this equipment must be modified.

Trade Mark

CE Marking

Anritsu affix the CE Conformity Marking on the following product (s) 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

CE

1. Product Name/Model Name

Product Name:	Digital Mobile Radio Transmitter Tester
Model Name:	MS8606A

2. Applied Directive

EMC : Council Directive 89/336/EEC

Safety: Council Directive 73/23/EEC

3. Applied Standards

EMC:

Electromagnetic radiation:

EN55011(ISM, Group 1, Class A equipment)

Immunity:

EN50082-1

		Performance Criteria*
IEC801-2 (ESD)	4 kVCD, 8 kVAD	B
IEC801-3 (Rad.)	3 V/m	A
IEC801-4 (EFT)	1 kV	B

*: Performance Criteria

A: No performance degradation or function loss

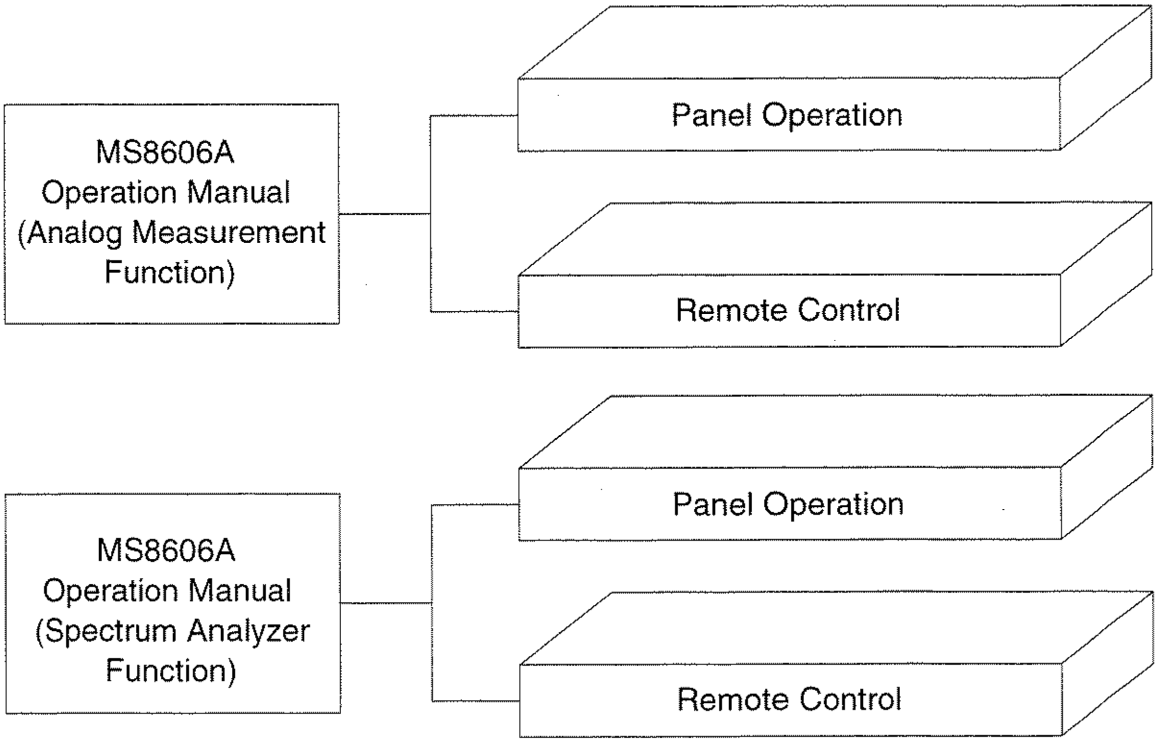
B: Self-recovered temporary degradation of performance or temporary loss of function

Safety: EN61010-1 (Installation Category II, Pollution Degree 2)

ABOUT THIS MANUAL

(1) MS8606A Operation Manual (with Option 01)

The MS8606A Digital Mobile Radio Transmitter Tester (Option 01)operation manual consists of the following two manuals. Use the manuals matching the usage objective.



Panel operation:	Outlines the MS8606A and describes its preparations, panel explanations, operations, performance text, calibrations, storage and transportation.
Remote Control:	Describes RS-232C/GPIB remote control and the sample programs etc.

MS8606A

Digital Mobile Radio Transmitter Tester
(Analog Measurement Function)

Operation Manual
(Panel Operation)

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SECTION 1
GENERAL

TABLE OF CONTENTS

1.1 General

The MS8606A Digital Mobile Radio Transmitter Tester is a measuring-instrument platform that consists of the hardware components necessary for testing digital mobile telecommunication terminals. Using the MS8606A along with the optionally available measurement software allows you to evaluate the performance of mobile telecommunication equipment with efficiency.

By using the Option 01: Analog Measurement, you can use the MS8606A as an integrated measuring instrument (hereafter called this analyzer) that can evaluate the functions and performances of the mobile telecommunication equipment of the analog system.

Measurement functions offered by this Option 01 are as follows:

- RF counter: Measures the RF signal frequency up to 3 GHz.
- AF counter: Measures the AF signal frequency up to 20 kHz. (with option 01)
- AF oscillator: Generates the AF signal up to 20 kHz. (with option 01)
- Power meter: Measures the RF signal power up to 3 GHz.
- FM measurement: Measures the frequency deviation of RF signal up to 20 kHz.
- øM measurement: Measures the phase deviation of RF signal up to 10 rad.
- AF level meter: Measures the level and distortion of the AF signal up to 20 kHz. (with option 01)
- Noise generator: Generates the white noise of the audio band. (with option 01)
- Demodulated output: Outputs the FM-detected demodulation signal. (with option 01)

This analyzer is equipped with a high-speed digital signal processing technology, allowing you to carry out transmission and measurements quickly and with high accuracy.

1.2 Manual Composition

This manual is made up of the following sections.

Section 1 General

Describes the introduction, composition, function specifications and performance of this instrument.

Section 2 Preparations before Use

Explains various work to be performed before using this instrument.

Section 3 Panel Layout and Overview of Operation

Explains the basic items for operating this equipment.

Section 4 Operation

Explains basic operation and how to operate for each measurement item.

Section 5 Performance Test

Explains the performance test method for this instrument.

Section 6 Calibration

Describes calibration items and methods for the periodical calibration of this equipment.

Section 7 Storage and Transportation

Describes how to store and transport this equipment.

Appendix A Screens and Function Key Transition Diagrams

Appendix B Initial Values

Appendix C Index

1.3 Equipment Configuration

This paragraph describes the configuration of the MS8606A Digital Mobile Radio Transmitter Tester (with option 01) with standard accessories.

1.3.1 Standard configuration

The table below shows the configuration of the MS8606A with the standard accessories.

Table 1-1 Standard Composition

Item	Order No.	Name	Qty	Remarks
Main instrument	MS8606A	Digital Mobile Radio Transmitter Tester	1	
	J0576B	Coaxial cord	1	N-P · 5D2W · N-P, 1 m
	J0768	Coaxial adapter	1	N-J · TNC-P
Accessories	W1297AE	Operation manual	1	For option 01J0576B
	J0017F	Power cord	1	2.6 m
	J0266	Power adapter	1	3 pole→2 pole Conversion plug
	F0014	Fuse	1	100 V/200 V, 6.3 A

1.3.2 Options

The table below shows the MS8606A options.

These are sold separately.

Table 1-2 Options

Option No.	Name	Remarks
01	AF measurement	
MX860601A	CDMA measurement software	
MX860602A	PDC measurement software	

1.4 Optional Accessories and Peripherals

The following table shows the optional accessories and peripherals for the MS8606A which are all sold separately.

Table 1-3 Optional Accessories and Peripherals

<Optional accessories>

Model*/Order No.	Name*	Remarks
J0127C	Coaxial cord	BNC-P•RG-58A/U•BNC-P, 0.5m
J0769	Coaxial adapter	BNC-J•TNC-P
J0040	Coaxial adapter	N-P•BNC-J
J0007	GPIB connection cable	408JE-101, 1m
J0008	GPIB connection cable	408JE-102, 2m
J0742A	RS-232C cable	1m, D-sub 25pins, for PC-9800 Series personal computer of NEC Corp.
J0743A	RS-232C cable	1m, D-sub 9pins, for IBM PC/AT personal computer
MN1607A	Coaxial switch	DC to 3GHz, 50Ω, externally controllable
MA1612A	4-Port junction pad	5 to 3000MHz
J0395	Attenuator for high power	30dB, 30W, DC to 9GHz
B0329D	Protective cover	
B0331D	Front handle kit	2 pcs/set
B0332	Coupling plate	4 pcs/set
B0333D	Rack mounting kit	
B0334D	Carrying case	With casters and protective cover

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

<Peripherals and applicable units>

Model*/Order No.*	Name*
MS8604A	Digital mobile radio transmitter tester
MT8801B	Radio communication analyzer
MD1620B	Signaling tester (PDC)
MD1620C	Signaling tester (PHS)
MD6420A	Data transmission analyzer
MS2602A	Spectrum analyzer
MG3670B/C	Digital modulation signal generator
MG3671A/B	Digital modulation signal generator

1.5 Specifications

The MS8606A specifications are listed in Tables 1-4 to 1-5 below.

Table 1-4 MS8606A Specifications

General	Frequency range		300 kHz to 3 GHz
	Maximum input level		+40 dBm(10 W) (MAIN connector) +20 dBm (100 mW) (auxiliary input connector)
	Input connector	MAIN connector	N-type connector Impedance 50 Ω, VSWR≤1.2 (Frequency≤2.2 GHz) VSWR≤1.3 (Frequency>2.2 GHz)
		Auxiliary input connector	TNC connector
	Reference oscillator	Frequency	10 MHz
		Starting characteristic	≤5 x 10^{-8}/day After 10 minutes of warm-up, refered to frequency after 24 hours of warm-up
		Aging rate	≤2 x 10^{-8}/day ≤1 x 10^{-7}/year Refered to frequency after 24 hours of warm-up,
		Temperature characteristic	5 x 10^{-8} (0 to 50°C) Refered to frequency at 25°C,
		External standard input	10 MHz or 13 MHz(within ±1 ppm), Input level : 2 to 5 Vp-p
Power meter	Frequency range		300 kHz to 3 GHz
	Level range		0 to +40 dBm
	Measurment accuracy		±10% after zero point calibration
RF analyzer	Power meter (wide-band)	Frequency range	300 kHz to 3 GHz
		Level range	0 to +40 dBm (MAIN connector)
		Accuracy	±10% after zero-point calibration
	Power meter (narrow-band)	Frequency range	10 MHz to 3 GHz
		Level range	0 to +40 dBm (MAIN connector)
		Accuracy	±10% (MAIN connector, after calibration with built-in wide-band power meter)
		Linearity	±0.3 dB (0 to -30 dB)
	Frequency counter	Frequency range	10 MHz to 3 GHz
		Input level range	-15 dBm to +40 dBm (MAIN connector) -40 dBm to +20 dBm (AUX connector)
		Resolution	1 Hz
		Accuracy	±(Accuracy of standard crystal oscillator +10 Hz)
		Measurement method	Measurement by IF frequency, reception band : ±30 kHz
FM/øM measurement	Frequency range		10 MHz to 3 GHz
	Input level range		-15 dBm to +40 dBm (MAIN connector) -40 dBm to +20 dBm (AUX connector)
	Band limited filter		HPF : 50 Hz, 300 Hz (3-dB loss point) LPF : 3 kHz, 15 kHz (3-dB loss point)
	FM measurement	Frequency deviation	0 to 20 kHz
		Demodulation frequency range	20 Hz to 20 kHz
		Accuracy	1% of indicated value + residual FM (Demodulation frequency : 1 kHz)
		Frequency characteristics	±0.5 dB (Refered to demodulation frequency : 1 kHz as reference)
		Residual FM	8 Hz rms (demodulation band : 0.3 to 3 kHz)
		Demodulation distortion	0.3% (Demodulation frequency : 1 kHz, frequency deviation:5 kHz, demodulation band : 0.3 to 3 kHz)

Table 1-4 MS8606A Specifications

(Cont.)

FM/øM measurement	øM measurement	Phase deviation	0 to 10 rad
		Demodulation frequency range	300 Hz to 3 kHz
		Accuracy	1% of indicated value + residual øM (Demodulation frequency : 1 kHz)
		Frequency characteristics	±0.5 dB (Refered to demodulation frequency : 1 kHz as reference)
		Residual øM	0.01 rad rms (demodulation band : 0.3 to 3 kHz)
		Demodulation distortion	0.50% (Demodulation frequency : 1 kHz, phase deviation : 5 rad, demodulation band : 0.3 to 3 kHz)
	FM demodulation output	Frequency deviation	0 to 40 kHz (range : 4/40 kHz)
		Demodulation frequency range	50 Hz to 10 kHz
		Output level	4 V peak (EMF) (for full-scale input of range)
		Output impedance	600 Ω
		Frequency characteristics	±1 dB (refered to demodulation frequency : 1 kHz as reference)
		Demodulation distortion	1% (Demodulation frequency : 1 kHz, frequency deviation : 4 kHz, 4 kHz range, demodulation band : 0.3 to 3 kHz)
		Band limited filter	HPF : 300 Hz (3-dB loss point) LPF : 3 kHz (3-dB loss point) De-emphasis : 750 µs
Others	Display		Color TFT LCD display Size: 7.8 inches Number of dots: 640 x 480
	Hard copy		Enables data hard copy on the display through a parallel interface. (applicable only for EPSON VP-series or equivalent)
	External control	GPIB	Function: This equipment is specified as a device, can be controlled from external controller. (excluding power switch and FD ejection key) No controller function Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, and E2
		Parallel	Function: Conforms to the Centronics. Outputs printing data to a printer. Data line exclusive for output: 8 Control line: 4 (BUSY, $\overline{\text{DTSB}}$, $\overline{\text{ERROR}}$, PE) Connectors: D-sub 25 pins, Female (Equivalent to the connector of IBM-PC/AT built-in printer)
		RS-232C	Controlled from an external controller (except for the power switch) Baud rate: 1200, 2400, 4800, or 9600 bps
Dimensions Mass Power supply	Dimensions		221.5 mm (H) X 426 mm (W) X 451 mm (D)
	Mass		≤22 kg (when option not installed.)
	Power supply		100 to 120 V, 200 to 240 V 47.5 to 63 Hz, ≤300 VA Automatic voltage switch system
	Operating temperature range		0 to 50°C

Table 1-5 Option 01: AF Measurement

AF oscillator (2 routes)	Frequency	Range	20Hz to 20 kHz
		Resolution	0.1 Hz
		Accuracy	Sychronized to standard crystal oscillator
	Output	Level range	0.01 mV rms to 3 V rms (EMF) (main Output impedance : 600 Ω) 0.01 mV rms to 0.3 V rms (EMF) (main output impedance : 50 Ω)
		Resolution	1 µV (output level ≤ 4 mV) 10 µV (output level ≤ 40 mV) 100 µV(output level ≤ 0.4 V) 1 mV (output level ≤ 3 V)
		Accuracy*	Unbalanced output : ±0.5 dB Floating output : ±2 dB (frequency : 1 kHz, output level ≥ 1 mV) Unbalanced output : ±1 dB (20 Hz ≤ frequency ≤ 20 kHz, output level ≥ 1 mV) * Measured at < 30 kHz bandwidth
		Output impedance	Main Output : 600Ω/50Ω changeable, Unbalanced, BNC Mike Input use : 600 Ω (floating), DUT Interface
		Waveform distortion	< -50 dBc (frequency : 1 kHz, output level : 1 V) < -45 dBc (20 Hz ≤ frequency ≤ 20 kHz, output level : 1 V) * Measured at < 30 kHz bandwidth
	Noise generator		White noise through evaluation filter (ITU-T recommendation : G.227)
Audio analyzer	Input impedance		600Ω/100kΩ changeable, Unbalanced, BNC
	Band limited filter		HPF : 400 Hz (for tone rejection) De-emphasis : 750 µs
	Evaluation filter		ITU-T P.53 and C-MESSAGE, selectable
	AF level measurement	Frequency range	30 Hz to 20 kHz
		Input level range	1 mV rms to 30 V rms
		Accuracy	±0.5 dB
	Distortion rate measurement	Frequency range	100 Hz to 5 kHz
		Input level range	30 mV rms to 30 V rms
		Accuracy	±1 dB (frequency : 1 kHz, distortion rate : 1%)
	AF frequency measurement	Frequency range	30 Hz to 20 kHz
		Level range	30 mV rms to 30 V rms
		Accuracy	±0.1 Hz
Mass		≤0.5 kg	

SECTION 2
PREPARATIONS BEFORE USE

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2.1 Installation Site and Environmental Conditions

The MS8606A Digital Mobile Radio Transmitter Tester operates normally at temperatures from 0° to 50°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 to direct sunlight
- Where the equipment will be exposed to active gases

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.

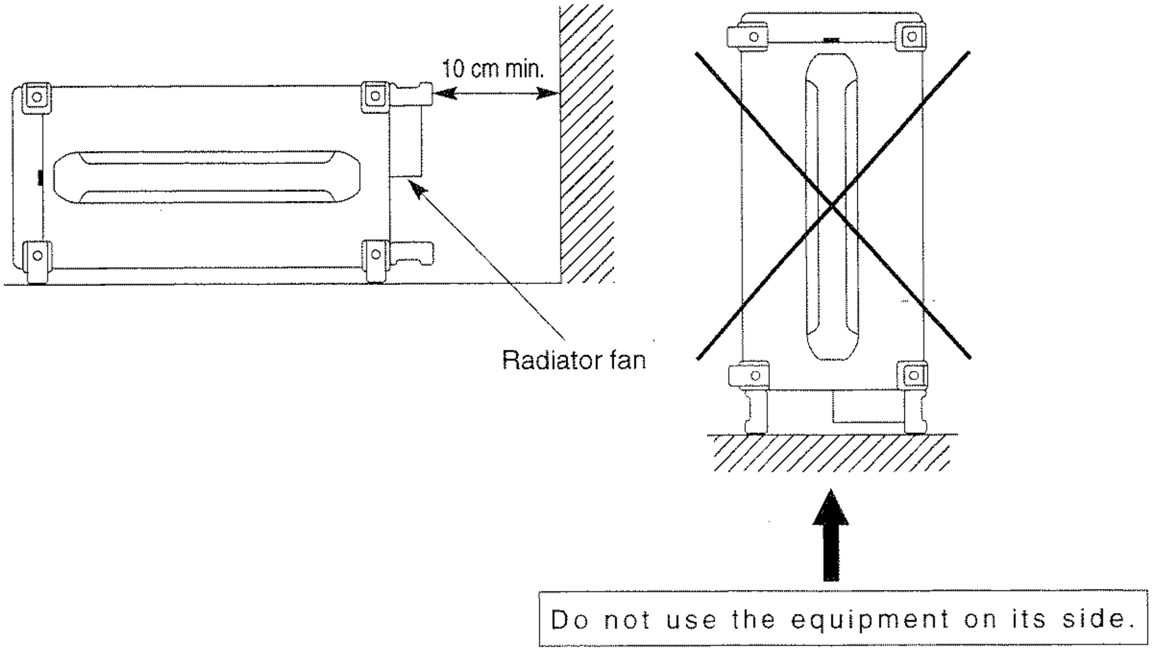
CAUTION ⚠

- Prevention of failure due to condensation

If the MS8606A is used at normal temperatures after it has been used or stored for a long time at low temperature, there is a risk of short-circuiting caused by condensation.
To prevent this risk, do not turn the power on until the MS8606A has been allowed to dry out sufficiently.

Fan clearance:

To suppress any internal temperature increase, the MS8606A 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.



Do not use the equipment on its side.

2.2 Safety Measures

This paragraph explains the safety procedures which should be followed under all circumstances to counter the risk of an accidental electric shock, damage to the equipment or a major operation interruption.

2.2.1 Safety measures for power supply

WARNING ⚠

Before power-on:
- Protective grounding

The MS8606A must be connected to ground. If the power is turned on without taking this countermeasure, there is a risk of receiving an accidental electric shock.
- Power supply voltage

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 the MS8606A and fire.

During power on:
- To maintain the MS8606A, sometimes it is necessary to make internal checks and adjustments with the top, bottom or side covers removed while power is supplied. Very-high, dangerous voltages are used in the MS8606A; 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 MS8606A, request service by service personnel who has received the required training.

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

2.2.2 Maximum power to connector

The allowable maximum power to the MS8606A connectors are as follows.

Connector	Allowable maximum power
Main Input	10 W (40 dBm)
AUX Input	100 mW (20 dBm)
AF Input	30 Vrms
AF Output	Dedicated output connector, 6 Vrms (output impedance : 600 Ω), 0.6 Vrms (output impedance : 50 Ω)
DUT Interface	TTL level
Reference Input	2 to 5 Vp-p
10MHz Buffered Output	Dedicated output connector, TTL level
Detector Output	Dedicated output connector, TTL level
BER Input connectors	TTL level
Ext Trig Input	TTL level
Demod Output	Dedicated output connector, ±8 Vp-p

CAUTION ⚠

- Excessive power protection

Never apply power more than the allowable maximum power. Also, do not input external signal to the output connector.

2.3 Preparations before Power-on

The MS8606A operates normally when connected to 100 to 120 Vac, 47.5 to 63 Hz, or 200 to 240 Vac, 47.5 to 63 Hz AC power supply via the power inlet.

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

To protect the operator, the following WARNING and CAUTION notices are attached to the rear panel of the MS8606A.

WARNING ⚠

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

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 risks involved of fire and electric shock.

CAUTION ⚠

FOR CONTINUED FIRE
PROTECTION REPLACE
ONLY WITH SPECIFIED
TYPE AND RATED FUSE.

CAUTION
Replace only with fuses of the specified type and rating. The use of improper fuses may cause fire.

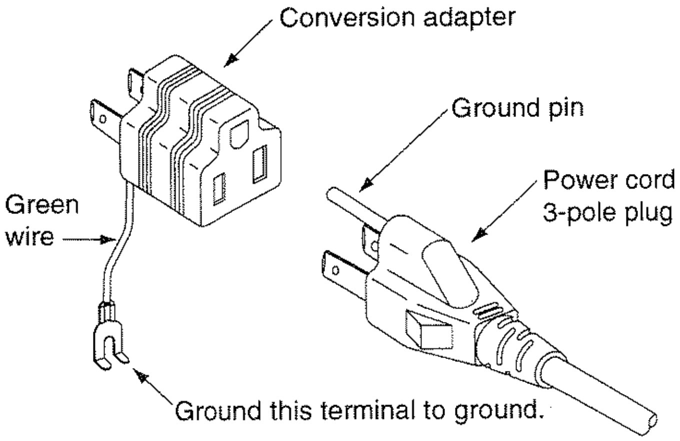
2.3.1 Protective grounding

(1) Grounding with 3-pole power outlet

The power supply polarity of the 3-pole (grounded, 2-pole type) matches that of the 3-core power cord plug. Therefore, the MS8606A is connected to ground potential when the power cord is connected to the plug. As a result, it is not necessary to connect the FG terminal to ground.

(2) Grounding with conversion adapter

If a 3-pole power socket is not provided, use the 3-pole to 2-pole conversion adapter as shown in the figure below. Connect the green wire protruding from the 3 to 2 conversion adapter to ground.



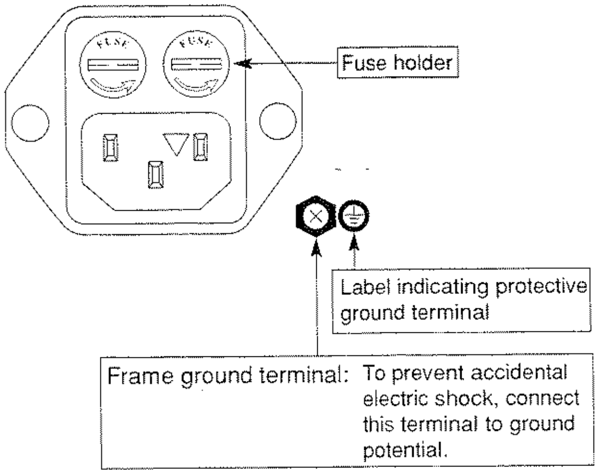
(3) Grounding with frame ground (FG) terminal

If a 3-pole ac power supply outlet is not available and the green wire cannot be grounded, the protective frame ground (FG) terminal on the rear panel must be connected directly to ground potential.

WARNING ⚠

- Prevention of danger using protective ground terminal

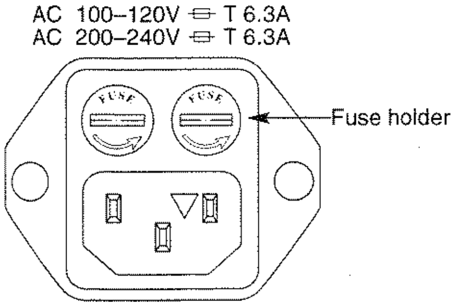
If power is supplied without protective grounding, there is a risk of accidental electric shock. If a 3-pole power supply outlet is not available and the green wire cannot be grounded, the protective frame-ground (FG) terminal on the rear panel must be connected to ground potential before power is supplied to the MS8606A.



2.3.2 Replacing fuse

The MS8606A with standard accessories has two spare fuses (T6.3A250V). Use these fuses to replace the blown fuses. If the fuses must be replaced, locate and remedy the cause before replacing the blown fuses.

Power supply system	Voltage range	Fuse rating plate	Fuse rating	Fuse name	Model/Order No.
100 Vac	100 – 120V	T6.3A	6.3A, 250V	T6.3A 250V	F0014
200 Vac	200 – 240V	T6.3A			



WARNING ⚠

- Prevention of electric shock

Before replacing the fuses, turn the power switch off and remove the power cord from the power outlet. If the fuses are replaced while power is being supplied,there is a serious risk of electric shock.

- Confirmation before turning the power on

After replacing fuses, the protective grounding mentioned above must be provided before turning the power on again, and the proper AC power supply voltage must be confirmed.

If the AC power supply voltage is improper, there is a risk of the internal circuits of the MS8606A being damaged.

CAUTION ⚠

- Check on replacing fuses

If the replacement fuses are not provided, obtain replacement fuses of 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, and failure will occur due to melting of the fuse.

When the rated voltage and current are over-sufficient, the fuses may not blow even if there is a risk of damage to the equipment by fire.

After performing the safety procedures, replace the fuses according to the following procedure.

Step	Procedure
1	Turn off the power switches on the front and rear panels, then remove the power cord from the power supply outlet.
2	Use a screwdriver to turn the fuse holder cap shown in the figure counterclockwise. The cap and fuse are removed together as a unit from the AC inlet.
3	Remove the fuse from the fuse cap and replace it with a spare fuse.
4	Return the fuse cap with the fuse to the fuse holder, then fasten it by turning it clockwise with the screwdriver.

* Contact the Anritsu service department for fuses by specifying the model name, order number, name, and quantity.

2.4 Installation

2.4.1 Rack mounting

The B0333D Rack Mounting Kit (sold separately, Table 1-3) is required to mount the MS8606A in a rack.
The installation method is included in the rack mount kit diagram.

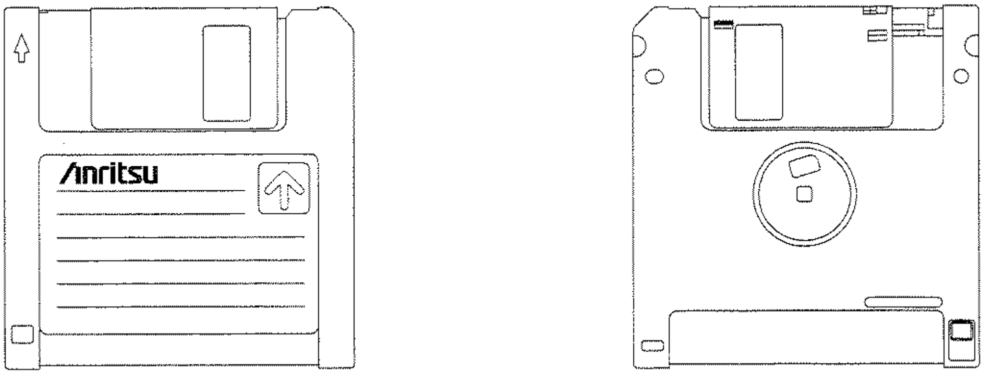
2.4.2 Stacking

When stacking several MS8606As or stacking the MS8606A with equipment of the same width as the MS8606A, the B0332 Coupling Plate (sold separately, Table 1-3) are required.

2.5 Precautions for Handling Storage Media

2.5.1 Floppy disk

The following explains how to handle the floppy disk media of this instrument.



Front

Rear

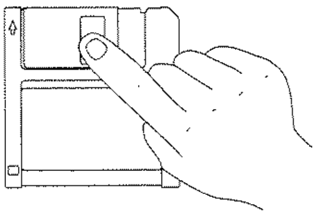
Fig. 2-1 3.5-inch Floppy Disk

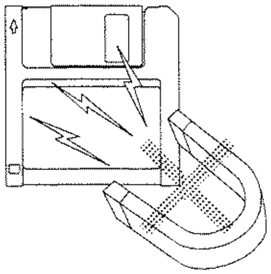
(1) Precautions

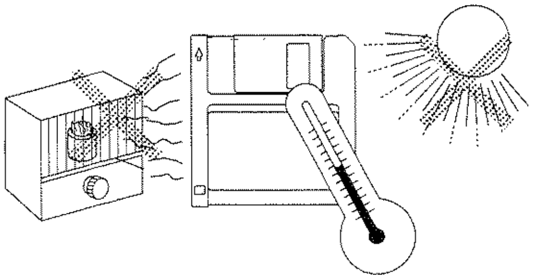
The plastic case of the 3.5-inch floppy disk has a shutter to protect the disk inside. When the disk is inserted into the disk drive, the shutter opens to expose part of the disk. Do not touch the shutter.

The following care must be taken for handling the disk.

(a) When a floppy disk is inserted, and LED lamp on the disk drive lights, do not eject the disk. Otherwise, the memory contents may be damaged, resulting in disk drive failure.
(b) Do not directly touch the magnetic surface with your hand or any object.
(c) Do not expose the disk to dust.
(d) Do not place the disk near any magnetic objects.
(e) Do not place the disk in direct sunlight or near heater.
(f) Store the disk under a temperature range of 4° to 53°C, and humidity of 8 to 90% (no condensation).







(2) Write-protection tab

A write-protection tab is provided on the 3.5-inch floppy disk.

Sliding this tab downward in the arrow direction beforehand prevents accidental writing and deletion. (A write operation is disabled in this state.)

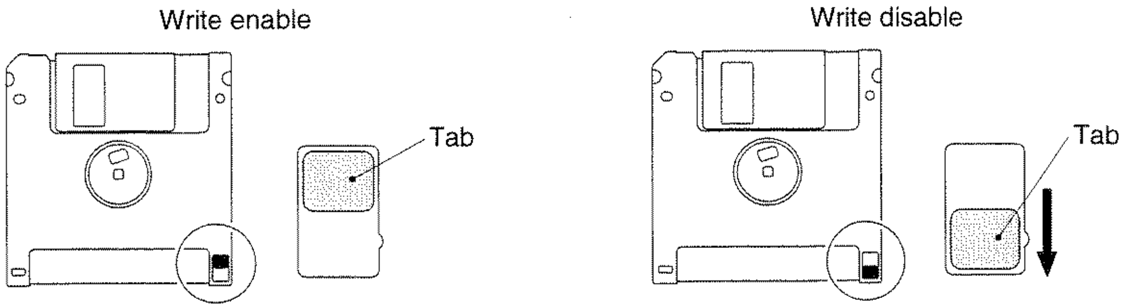


Fig. 2-2 Write-protection Tab for 3.5-inch Floppy Disk

(3) Inserting and ejecting the floppy disk

With the front surface of the floppy disk facing ups, fully insert the disk in the arrow direction until a clicking sound is heard.

To eject, press the eject button on the right side of the disk drive. Remove the disk after confirming that the LED lamp is off.

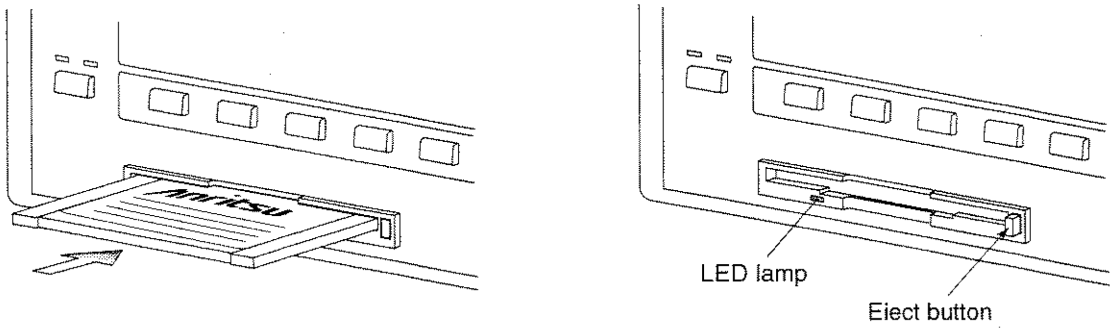


Fig. 2-3 Inserting and Ejecting the 3.5-inch Floppy Disk

SECTION 3

PANEL LAYOUT AND OVERVIEW OF OPERATION

TABLE OF CONTENTS

3.1 Panel Layout

This paragraph describes the keys, switches, LEDs, and connectors on the front and rear panels of the MS8606A Digital Mobile Radio Transmitter Tester.

3.1.1 Front panel layout

This paragraph describes the keys, switches, LED, connectors, and the rotary knob on the front panel.

No.	Display	Function
1	F1,F2,F3,F4,F5,F6	Main function keys Group of keys that select and execute the corresponding menus displayed on the LCD screen. When the [Main Func] F6 key is on, the menus for F1 to F5 are placed in MS8606A measurement mode. When the [Main Func] F6 key is off, the menus of F1 to F5 are displayed for the currently used screen function.
2	F7,F8,F9,F10,F11,F12	Function keys Group of keys that select and execute the corresponding menus displayed on the LCD screen. These screen functions are related to the current operation.
3	Next Menu	
	▲	Displays the next page of the function key menu.
	◀	Displays the next page of the main function key menu.

No.	Display	Function outline
4		Key group for entering data.
	Shift	Switches the function of keys with a shift function. When the shift key is pressed, the key's LED goes on. Subsequent operation must be started with this LED on.
	BS	Back space key used to correct input data.
	0,.,-/+,1,2,3, A/4,B/5,C/6,D/7,E/8,F/9	Numeric keys (ten-keypad) used for data input. These keys become alphanumeric keys at shift function activation.
	(Definition key group)	The data input using the numeric keys is defined with these keys.
	W/GHz/dBm/dB	Validates data when W/GHz/dBm/dB unit system data is input.
	mW/MHz/dBμ/sec	Validates data when mW/MHz/dBμ/sec unit system data is input.
	μW/kHz/mV/ms	Validates data when μW/kHz/mV/ms unit system data is input.
	nW/Hz/μV/μs/Enter	Validates data when nW/Hz/μV/μs unit system data or non-unit system data is input.
5	Measure	Key group used to start measurement.
	Single	Key used to execute measurement once.
	Continuous	Key used to execute measurement continuously .
6	Copy	Outputs display screen to the specified printer.(Hard copy function)
7	Cursor	Key group used to control the cursor on the LCD screen.
	Set	Opens the input window for data in the item pointed to by the cursor. After the completion of data entry, the window is closed.
	Cancel	Closes the window. The input data becomes invalid.
	︿ < > ﹀	Moves the cursor.
8	Step	Key group increment or decrement numeric data.
	︿	Increments numeric data by the specified step value.
	﹀	Decrements numeric data by the specified step value. Entry using these keys is always validated every time the data incremented or decremented.
9	(Rotary knob)	Knob used for data input. When this knob is turned clockwise, the value increases and when it is turned counterclockwise, the value decreases. For input by the rotary knob, data is validated each time it is incremented/decremented. This knob is also used in item selection.

No.	Display	Function outline
10	Main Input	Input connector for RF signal.(N type connector)
11	AUX	Auxiliary input connectors for RF signal.(TNC connector)
	Input	Auxiliary input connector for RF signal. This is used when the output level of DUT is too low.
12	AF Input	AF signal input connector for Option 01(AF), (BNC connector)
	AF Output	AF signal output connector for Option 01(AF), (BNC connector)
13	DUT Interface	Multi-pole connector used to control the DUT and measure the BER (D-SUB connector, 25-pin, female).
14	(Floppy disk drive)	Slot in which the floppy disk is loaded for saving and recalling data, and loading system program.
15	Stby On	Change-over switch to turn the standby power supply on when the Line Input on/off switch on the rear of this instrument is turned on. In Standby mode, power is only supplied to the reference crystal oscillator.
16	Panel Lock	Invalidates all key operations except the Panel Lock key and the Stby On power supply switch on the front panel. In lock mode, the LED on this key goes on.
17	Remote Local	Resets GPIB remote mode and returns to local mode. In GPIB remote mode, the LED (Remote) goes on.
18	Preset	Initializes measurement parameters.

3.1.2 Rear panel layout

This paragraph describes the switch and connectors on the rear panel.

No.	Display	Function
19	O I	Input switch for AC power supply. If this switch is turned off, the Power switch on the front panel cannot be turned on.
20	(Fuses)	Power supply fuses. For safety, always use fuses of the specified rating.
21	⏚	Frame grounding terminal. For safety, always ground this terminal.
22	(Memory card cover)	The memory card is built-in. Close the cover for card use.
23	(Power supply inlet)	For safety, always use a power supply of the rated voltage.
24	GPIB	GPIB interface connector.
25	Parallel	Parallel interface connector (conforms to Centronics type). Used to connect printer (D-SUB connector, 25-pin, female).
26	Serial	RS232C interface connector (D-SUB connector, 9-pin, female).
27	10MHz Buffered Output	10 MHz reference signal (TTL level) for internal use is output (BNC connector).
28	10MHz/13MHz Reference Input	10 MHz or 13 MHz reference signal (2 to 5 Vp-p) is input (BNC connector).
29	Detector Output	RF burst signal detection output connector (BNC connector).
30	BER Input	Signal input connectors for measuring bit error rate (BNC connector).
	Data	Input connector for measurement data of bit error rate (BNC connector). TTL level signal is input.
	Clock	Input connector for clock of bit error rate (BNC connector). TTL level signal is input.
31	Demod Output	FM demodulated signal output connector for Option 01(AF), (BNC connector)
32	Ext Trig Input	Input connector for external trigger signal (BNC connector). TTL level signal is input.
33	(Fan)	Instrument internal air cooling fan.

3.1.3 Panel layout

The front panel and rear panel layouts are shown in Figs. 3-1 and 3-2, respectively.

The numbers in the diagram correspond to those in paragraphs 3.1.1 and 3.1.2.

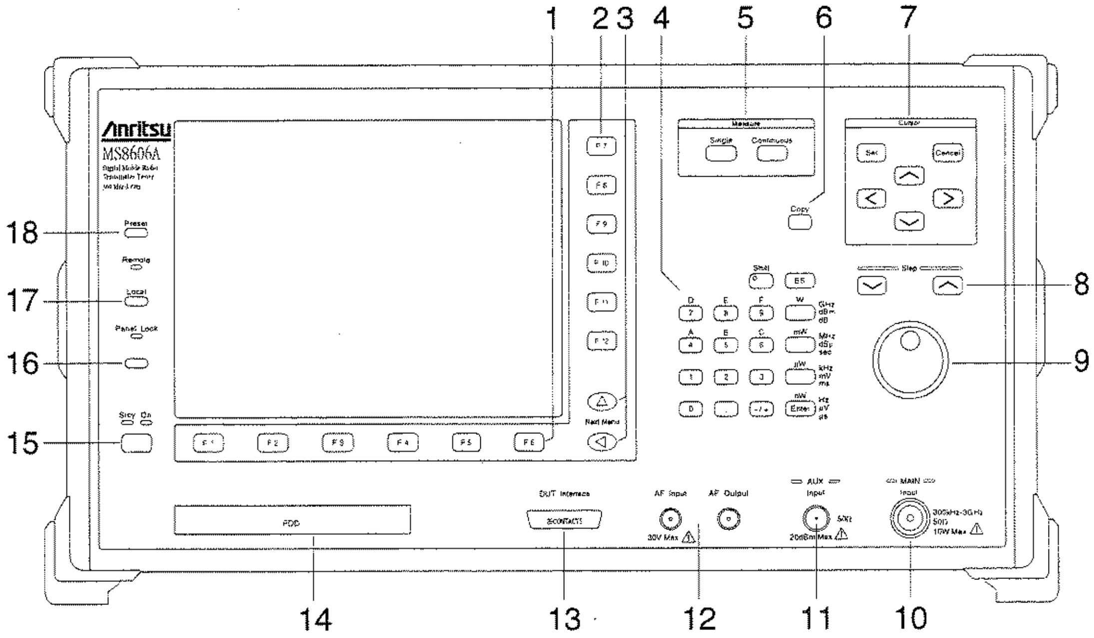


Fig. 3-1 Front Panel

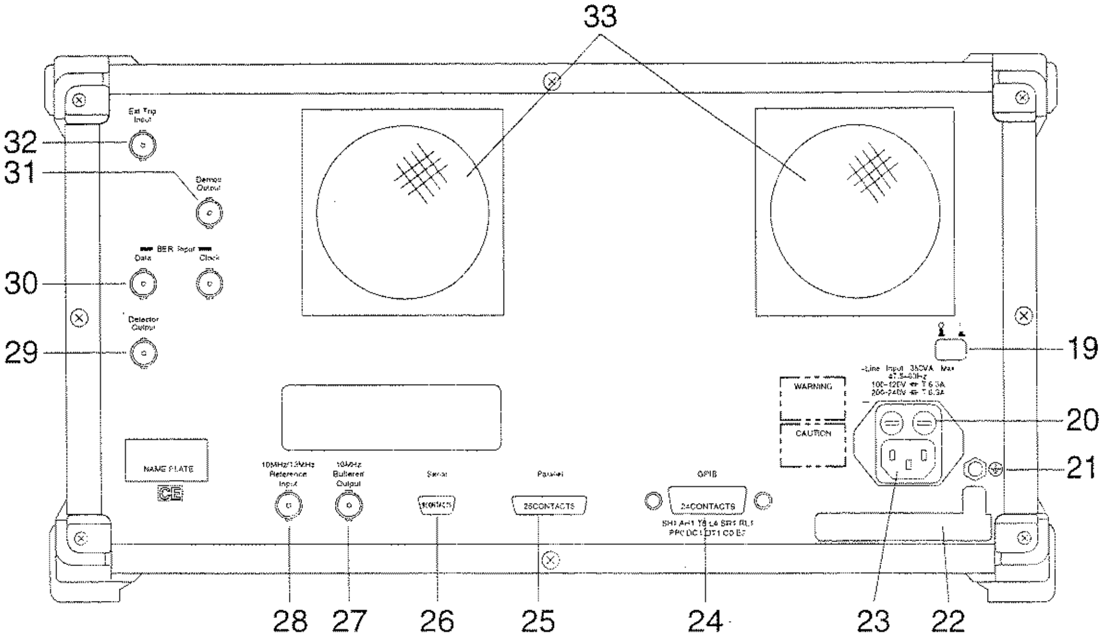


Fig. 3-2 Rear Panel

3.2 Overview of Operation

3.2.1 Overview of functions

The analog measurement function of the MS8606A Digital Mobile Radio Transmitter Tester can be used to measure analog FM/ϕM modulation characteristics of transmitters. By installing option 01 for AF measurement in the MS8606A, low frequency characteristics of electronics devices can also be measured.

Using the function menu displayed on the screen, carry out the following measurements:

1. Transmitter measurement---TX Measure mode

   The MS8606A outputs the modulation signal (AF) at the microphone terminal (Mic) of the transmitter(TX) to control the Press-To-Talk (PTT) on/off. (AF signals can be output by installing option 01.)

   The MS8606A also receives the RF signal from the transmitter to measure the items below:

   - RF frequency
   - RF power
   - FM/ϕM deviation
   - Modulation signal (AF) level
   - Modulation (AF) distortion
   - Modulation (AF) frequency

2. AF signal measurement---AF Measure mode (with option 01)

   The MS8606A outputs an AF signal from the AF Output connector to the input terminal of the DUT.

   The MS8606A also receives the AF signal from the DUT using the AF Input connector to measure the items below:

   - AF Input signal level
   - AF Input signal frequency
   - AF Input signal distortion

In addition to the above functions, the MS8606A also supports the following functions:

- Save/recall
  A maximum of 100 measurement conditions (parameters) can be saved on, or recalled from, a 3.5-inch floppy disk.
- Copy
  The screen display can be printed out on the external printer via a parallel interface (Centronics).
- GPIB
  The MS8606A can be remotely controlled using an external controller via a GPIB interface.
- RS232C
  The MS8606A can be remotely controlled using an external controller via a serial interface (RS232C).

3.2.2 Overview of operation

At power-on operation begins in "TX&RX Tester" (Transmitter test) status (Setup Common Parameter screen).

If measurement is to be started from another mode, or from other than a measurement mode, first select one of the main menu items, as shown below.

TX&RX Tester (Transmitter test)

Analog Tester (Analog measurement)

Recall (Parameter file recall)

Save (Parameter file save)

Change System (Measurement system change)

Instrument Set (MS8606A main-frame setting)

Change Color (Selection of screen color)

File Operation (File retrieval/deletion/protect, FD initialization)

Describes the overview of operation in the analog measurement mode.

(1) Selection of analog measurement mode

Press the [Main Func On/Off]F6 key to turn on the main menu.

The 1st page of the main menu is displayed at the bottom of the screen, horizontally. Press the main menu [Analog Tester]F3 key to enter the AF measurement mode.

If the AF measurement mode is desired to be started from another mode, press the [Main Func On/Off]F6 key to turn on the main function. Then, the 1st page of the main menu is displayed at the bottom of the screen, horizontally. Press the main menu [Analog Tester]F3 key to enter the analog tester mode.

(2) Selection of measurement items

Items are set by using cursor keys ([∧],[∨],[<], [>]), and other function keys while observing the screen menu.

Press the [Set] key to open the input window.

(3) Item input

For selection items displayed: Select the required value by using the cursor keys or rotary knob.

For numeric values: Input data using the numeric keys, and validate by pressing a unit key, [Enter] key, or [Set] key. The window closes.

(4) Outline of screen configuration

The screen configuration is shown below. A tree-shaped Hierarchical configuration of items below the main menu [Analog Tester] is indicated. (Details of operation are explained in Section 4. The screens, setup items and function key flowchart for each screen are summarized in Appendix A, "Screen and Function Key Transition Diagrams.")

[Overview of screens in analog tester mode]

- Analog Tester mode
  - Setup Common Parameter (Analog) screen
    (TX/AF analog common measurement parameter set screen)
    - TX Measure mode
      - Setup TX Measure Parameter (Analog) screen
        (TX Analog Measurement parameter set screen)
      - TX Measure (Analog) screen
        (Simplex TX Analog Measurement screen)
    - AF Measure mode
      - AF Measure(Analog) screen
        (AF Analog Measurement screen)

- Recall mode
  - Recall Parameter screen
    (Screen for recalling parameter-file/template-file/pattern-file)

- Save mode
  - Save Parameter screen
    (Screen for saving parameter-file/template-file/pattern-file)

- File Operation mode
  - File Operation screen
    (Screen for file retrieval/deletion/protection-setup in FD, and FD initialization)

- Change System mode
  - Change System screen
    (Screen for changing TX&RX Tester mode measurement system)

- Instrument Setup mode
  - Instrument Setup screen
    (Screen for setting up RS232C/GPIB, etc. for MS8606A main frame)

Note: Change Color mode (Selection for screen display color) is setup using the function key menu. There is no screen in Change Color mode.

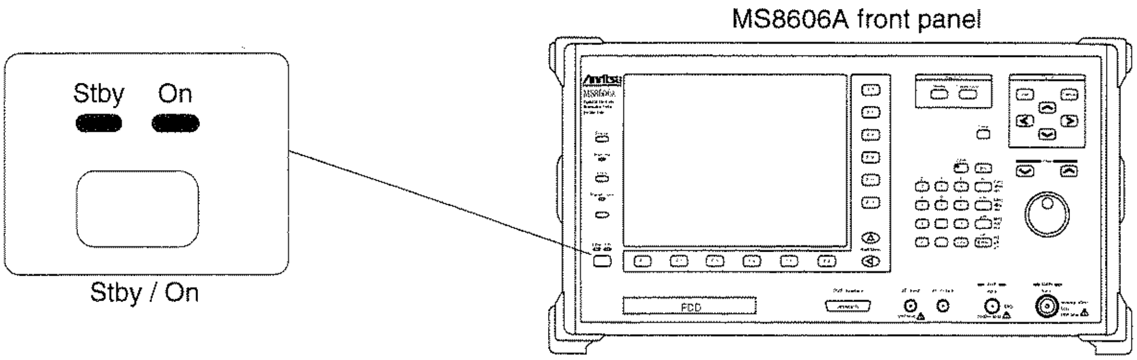
SECTION 4
OPERATION

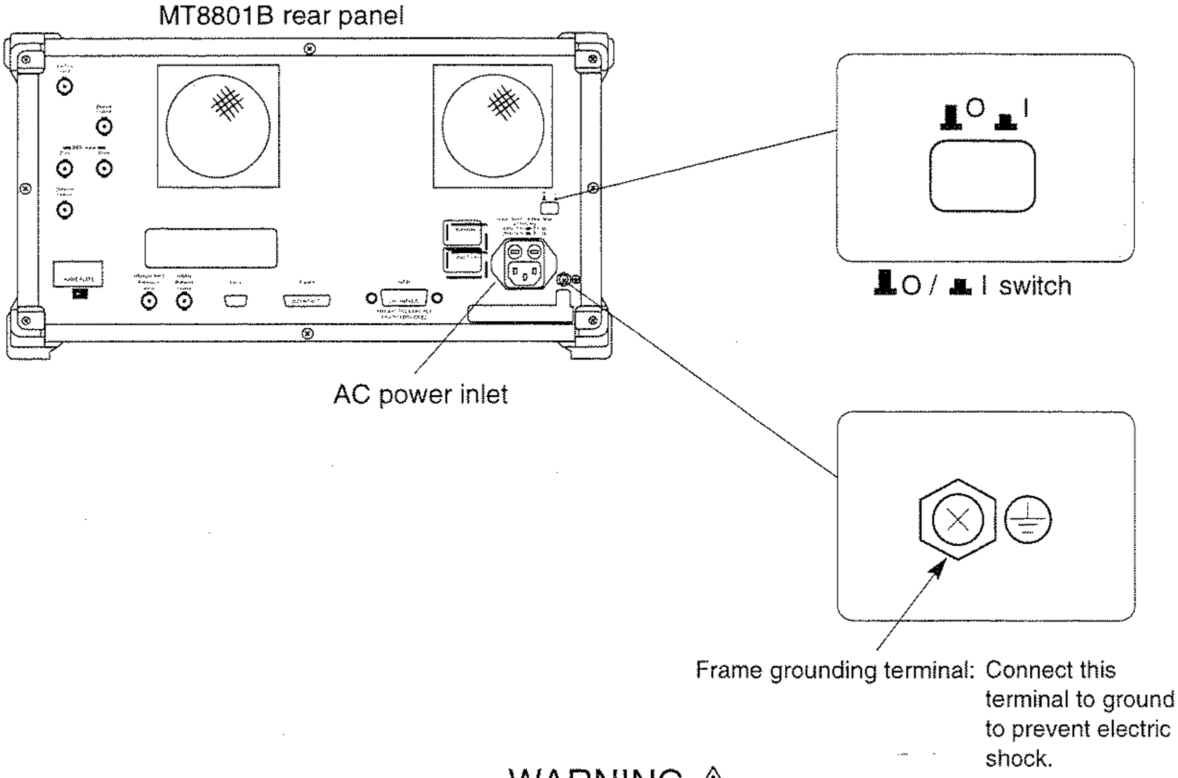
Describes the operation of the Option 01: AF Measurement of the MS8606A Digital Mobile Radio Transmitter Tester.

TABLE OF CONTENTS

4.1 Turning on and off the Power

The MS8606A has two power switches: The Stby/On switch on the front panel and ■○■I (main power) switch on the rear panel.





WARNING ⚠

- Protective grounding

If the power is turned on without protective grounding, operator runs the risk of electric shock. If the MS8606A does not have a three-pole (grounding type two-pole) power outlet, be sure to connect the frame grounding (FG) terminal on the rear panel or ground terminal of the accessory power cable to ground before turning on the MS8606A power.

CAUTION ⚠

- Checking the power supply voltage

If the AC power supply voltage is improper, abnormal voltage may damage the mechanism inside the equipment. Confirm that the AC power supply voltage is within the specified rating before turning on the MS8606A power.

The following shows the specified power supply voltage and frequency:

Voltage: 100 to 120 Vac or 200 to 240 Vac (Because an automatic input voltage rating switching system is used, the rating need not be switched.)

Frequency: 47.5 Hz

For normal MS8606A operation, leave the power switch on the rear panel set to on when the AC power inlet is connected to the power outlet, and only use the Stby/On switch on the front panel to turn the power on and off.

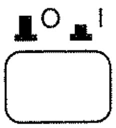
Check the power display lamps at the lower-left part of the front panel as listed in the table below to confirm the power supply state.

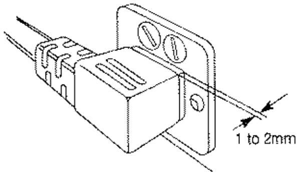
Table 4.1 Power Display Lamp Indications and Power Supply States

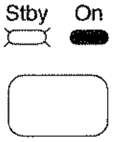
Display lamp / State	Power standby display lamp (green) (Stby)	Power on display lamp (orange) (On)
Main power off	Off	Off
Only main power on	On	Off
All power supplies on	Off	On

4.1.1 Turning on the Power

Perform the power-on procedure through warming up the internal reference oscillator to normal MS8606A operation in order of the following steps:

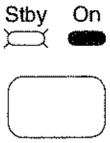
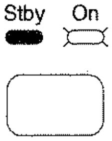
Step	Operation	Description
1.	Connect the frame grounding terminal on the rear panel to ground.	• When using a three-pole power cable with a grounding terminal, the MS8606A need not be grounded.
2.	 Set the O I switch on the rear panel to O (Off).	• When the button is pressed down and set, it is I (On). Press the button again to release it. When the button is set Off, the AC power is turned off even if the power switch on the front panel is set On.
3.	Connect the power cable jack to the AC power inlet on the rear panel.	• Fully insert the power cable jack so that there is a gap of 1 to 2 mm as shown in the figure below.
4.	Connect the power cable plug to the AC power outlet.	



Step	Operation	Description
5.	Set the O I switch on the rear panel to I (On)	 • The Stby lamp on the front panel power switch lights. • The reference crystal oscillator circuit built in the MS8606A starts to warmed up. Before operating the MS8606A under low temperatures, warm up the crystal oscillator for 24 hours. The table below lists the stability of the crystal oscillator based on the warm-up time.

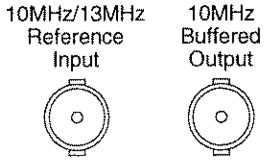
Crystal oscillator stability

Item		Stability
Starting characteristics	After 30-minute operation	5 x 10^{-8}/day or less
Aging rate (after 24-hour operation)		2 x 10^{-8}/day or less
Stability at ambient temperature change of crystal oscillator (25˚C ±25˚C)		±5 x 10^{-8} or less

6.	 Hold down the Stby/On switch on the front panel for a few seconds to set it On.	 • The On lamp on the front panel power switch lights and the Stby lamp goes off. • Power is supplied to all circuits in the MS8606A, then the MS8606A becomes operable.

Notes : If neither power display lamp lights, check the following :

1. Are the power cables properly connected to the power inlet and power plug?
2. Are the specified fuses set in the fuse holders?
3. Is the power supply voltage correct?



Notes: The left figure shows the reference signal input/output connectors on the MS8606A rear panel. The internal 10 MHz reference signal is output from the 10 MHz OUTPUT connector at TTL level. When the internal reference signal is not used, input an external reference signal satisfying the following conditions to the 10 MHz/13 MHz Reference Input connector:

i) Frequency: 10 MHz ±1 ppm, signal level: 2 to 5 Vp-p

ii) Frequency: 13 MHz ±1 ppm, signal level: 2 to 5 Vp-p

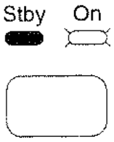
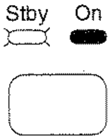
Set the reference frequency on the Instrument Setup screen (see paragraph 4.3.5) according to the external reference signal used as described in i) and ii) above.

Warm up the external reference signal equipment separately from warming up the MS8606A.

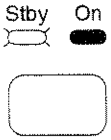
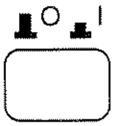
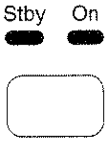
4.1.2 Turning off the Power

Turn off the power as described below.

(1) Normal power-off procedures

Step	Operation	Result check
1.	 Press the Stby/On switch on the front panel for a few seconds to set it to Stby state.	• The On lamp of the Power switch on the front panel goes off, and the Stby lamp lights. • Only the internal reference crystal oscillator is turned on. 

(2) Power-off procedures for storage or long stop

Step	Operation	Result check
1.	 Press the Stby/On switch on the front panel for a few seconds to set it to Stby state.	• The On lamp of the power switch on the front panel goes off and the Stby lamp lights. • Only the internal reference crystal oscillator is turned on. 
2.	 Set the O I switch on the rear panel to the I (off) position.	• The AC power is turned off. Both the Stby and On lamps of the Power switch on the front panel go off. • Only the internal reference crystal oscillator is turned on. 

4.1.3 Setup state after power-on

- The Setup Common Parameter screen is displayed shortly after power-on. At this time, parameters can be set by specifying Power-On Initial on the Instrument Setup screen.(See paragraph 4.3.6.)
- If a short power failure occurs, the power switch on the front panel goes Off. In this case, press the power switch On again.

4.2 Screen Descriptions

This paragraph describes the common items displayed on the screen.

(1) Screen layout

The composition of the measurement screen is described below.

- Title display area
  The type MS8606A, and date (**_**_**) time (**:**:**), or user-defined character string (title) are displayed on the top left line. These are set on the Instrument Setup Screen.
- Screen name display area
  The screen name (paragraph 3.2.2 (4)) and measurement system name are displayed on the second line from the top left.
- Measurement error messages display area
  Messages for errors generated during measurement are reverse displayed on the third line from the top left. There are 7 measurement error messages as follows. Messages are shown in high priority order.

  [RF measurement]

  Priority

High	Input Level Over	RF input level exceeded the hardware limit.
↑	Level Over	Level too high
↓	Level Under	Level too low
Low	Deviation under	Deviation too small

  [AF measurement]

High	Input Level Over	AF input level exceeded the hardware limit
↕	Level Over	AF level too high
Low	Level Under	AF level too low

- RF input/output display
  "M" or "A" displayed on the first line from the top center indicates the RF connector used.
  M: Main Input
  A: AUX Input
- Calibrated display
  If the MS8606A is already calibrated, "C" is displayed on the second line from the top center.
  This is appeared after executing calibration in the RF Level/Power on the TX Measure screen.
  C: Calibrated
- User calibration factor setting display
  If a user calibration coefficient is being set, "U" is displayed on the third line from the top center.
  This is appeared when the user Cal. factor is set at the Setup TX Measure Parameter Screen.
  U: User Cal. Factor

- Measurement mode display area

The measurement mode is displayed on the first line from the top center.
This is appeared depending on the Measure key (Continuous/Single).

Measure: Continuous: Continuous measurement
Measure: Single: Single (one time) measurement

- Storage mode display area

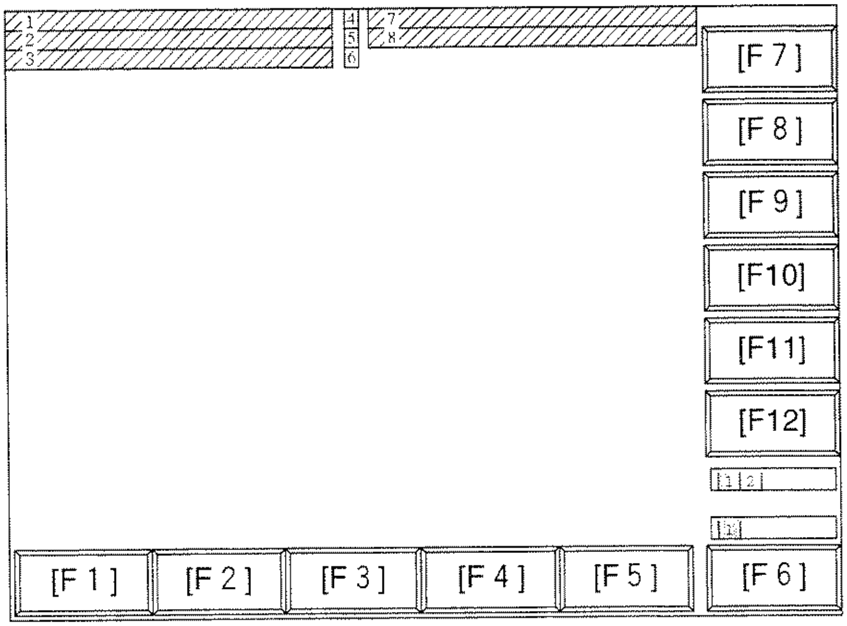
The displayed value or waveform storage mode is displayed on the second line from the top right.
This is the setting value of the storage mode on the current measurement screen.

Storage:
Normal: Normal display
Average : Averaging
(order of storage operations performed and total number of operations)

- Menu display area

The titles of up to six main function keys (F1 to F6) are displayed horizontally along the bottom.
When the [Main Fucn on off] (F6) key on the right is set On, the main function menu is displayed.
When the [Main Func on off] (F6) key is set Off, the menu is displayed according to the screen contents.
Use the Next Menu [◀] key to display the next page.
The display of 1 (first page), 2 (second page), or later above the F6 menu indicates the current page.

The titles of up to six function keys (F7 to F12) are displayed vertically along the right side.
The display of 1 (first page), 2 (second page), or later under function key F12 indicates the menu page number.
The current page is reverse displayed. If there are multiple pages, use the Next Menu [▲] key to display the next page under the F12 key.



1. Title/date and time
2. Screen name
3. Measurement error or measurement being performed
4. RF input switching
5. Calibrated display
6. User Cal display
7. Measurement mode
8. Storage mode

Fig. 4-1 Screen Layout

(2) Function keys

The symbols displayed on the top right of the function keys indicate the following functions:

* : Indicates a lower level function key is displayed when this function key is pressed.

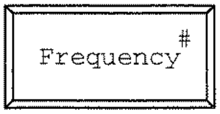
→ : Indicates the screen is changed by pressing this function key.

: Indicates a window is opened to set a value using the ten-keypad, Step key, or rotary knob when this function key is pressed.

(a) Menu for transition to lower hierarchy screen
(The Back screen key switches the current screen to the higher hierarchy screen.)

(b) Menu for transition to lower hierarchy menu

(c) Menu for opening the value setting window

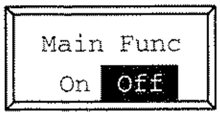


- Function key menu that select setting item:

One of the multiple selection keys (displayed in the same menu hierarchy) can be selected. The top and right frames of the selected key are reverse displayed. (See para. (e) below.)

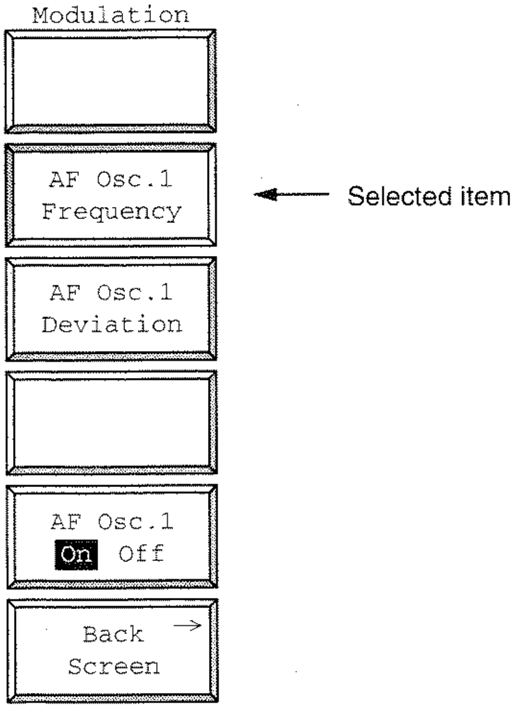
The setting values displayed in a key are changed alternately. When such a key is selected, the set value is reverse displayed. (See para. (d) below.)

(d) Menu on which set items are switched alternately (alternate key menu)

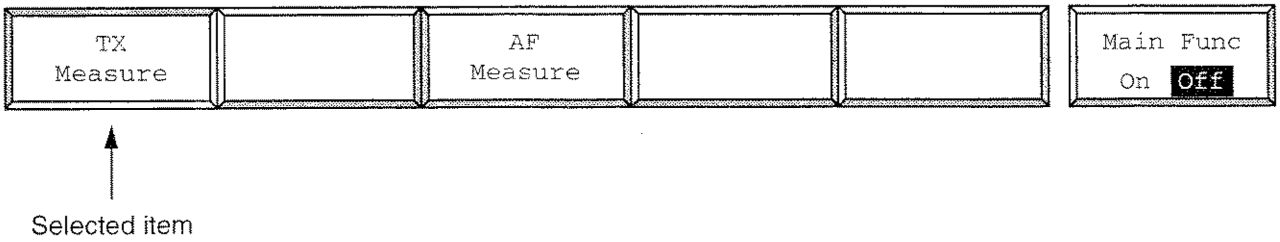


(e) Menu on which a set item is selected

[Example of the function key menu]



[Example of the main function key menu]

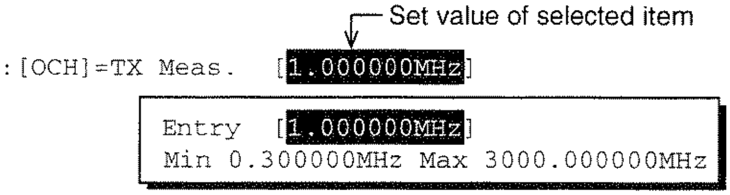


(3) Entering the data

(a) Entering numeric data by opening/closing the window

(i) Entering numeric data by moving the cursor and opening/closing the window

Move the cursor to the brackets enclosing the item to be set, then press the Set key. The value setting window shown below is opened and numeric data can be set.



Set value of selected item

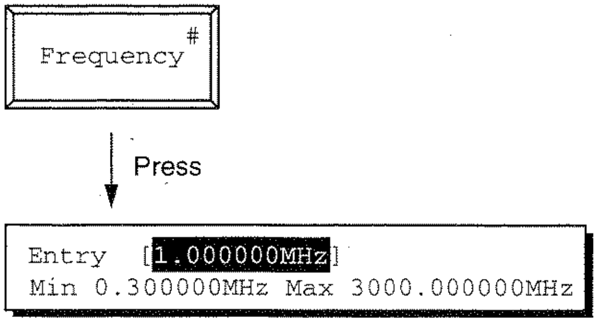
```
:[OCH]=TX Meas.    [1.000000MHz]

Entry   [1.000000MHz]
Min 0.300000MHz Max 3000.000000MHz
```

When a value is entered using the ten-keypad, Step key, or encoder, then press the unit or Set key, the numeric data is defined and the window is closed

If the Cancel key, a function key or main function key is pressed while the window is open, the window is closed and the previously set value is displayed.

(ii) Entering numeric data by pressing a function key or main function key

When the key marked # on the top right of the menu is pressed, the value setting window shown below is opened and numeric data can be set.



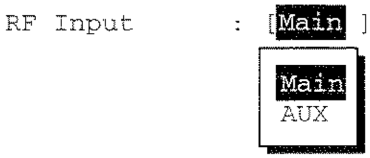
```
#
Frequency

Entry   [1.000000MHz]
Min 0.300000MHz Max 3000.000000MHz
```

When a value is entered using the ten-key pad, Step key, or encoder, then press the unit or Set key, the numeric data is defined and the window is closed.

If the Cancel key, a function key or main function key is pressed while the window is open, the window is closed and the previously set value is displayed.

(b) Entering selection item by opening/closing the window

Move the cursor to the brackets enclosing the item to be set, then press the Set key. The selected item setting window shown below is opened and the selected item can be set.



```
RF Input      : [Main ]
                 Main
                 AUX
```

When an item in the window is selected using the cursor keys and the Set key is pressed, the set value is defined and the window is closed.

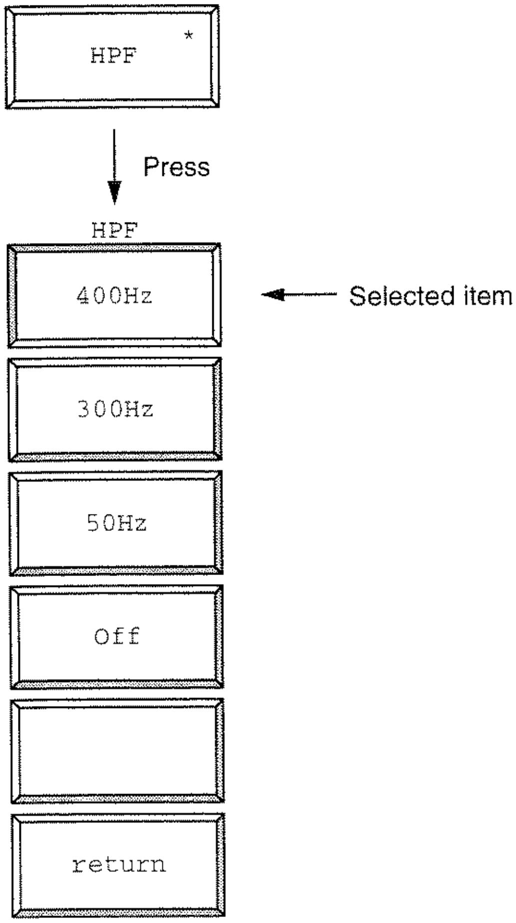
(c) Entering selected items using alternate keys

Selection items are displayed on the function key menu. Each time one of these keys is pressed, set values are switched alternately. The currently selected item is reverse displayed.

(d) Entering selected items using function keys with lower hierarchy

When the key marked * on the top right of the menu is pressed, the menu set of the lower hierarchy shown below is displayed.

Select an item from the menu set and press the corresponding function key. The menu display of the selected item is changed. When the return function key is pressed, display returns to the menu set of the higher hierarchy.



(e) Entering the title

See paragraph 4.3.5, "Instrument Setup screen."

4.3 Preparations

4.3.1 Setup for transmitter measurement (Simplex transmitter (TX) measurement by TX Measure screen)

In the TX measurement, the MS8606A sends the AF signal to the DUT for modulating the transmission signal of the DUT, and receives the transmission signal. Then, modulates the signal to measure the modulation degree. (AF output is optional.)

There are 2 methods for sending the AF signal to the DUT for modulation.

1. Sending AF signal with AF Output connector (front panel)
2. Sending AF signal with DUT Interface connector (front panel)

Setup is described depending on these methods, below.

(a) Setup using AF Output connector (at front panel)

There are two connection modes depending on the transmission level ranges of the device under test:

(i) Condition: output level of the transmitter: +10 to 40 dBm

Setup:

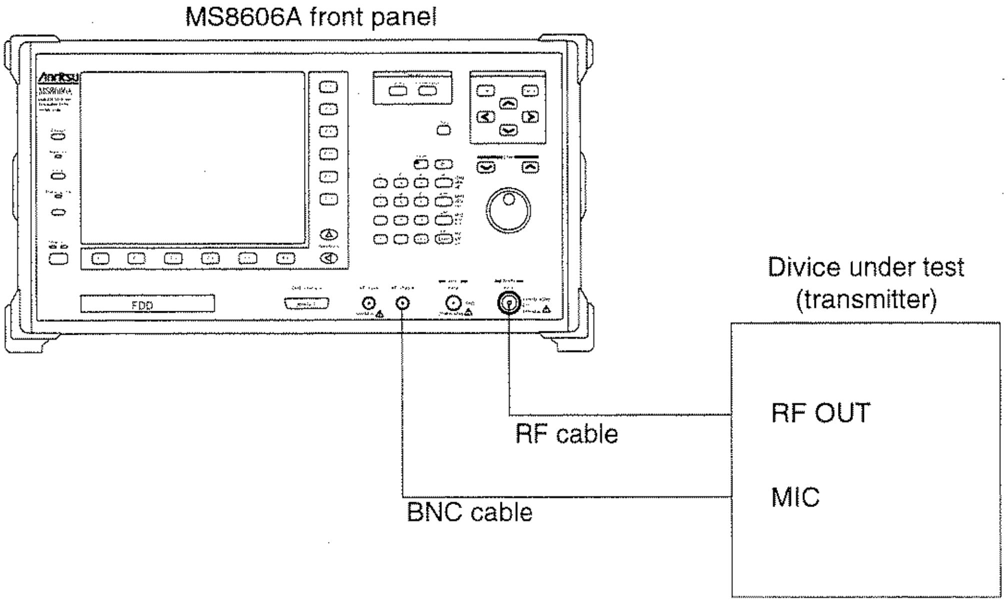


Fig. 4-2

(ii) Condition: Output level of the transmitter: -30 to +5 dBm

Setup:

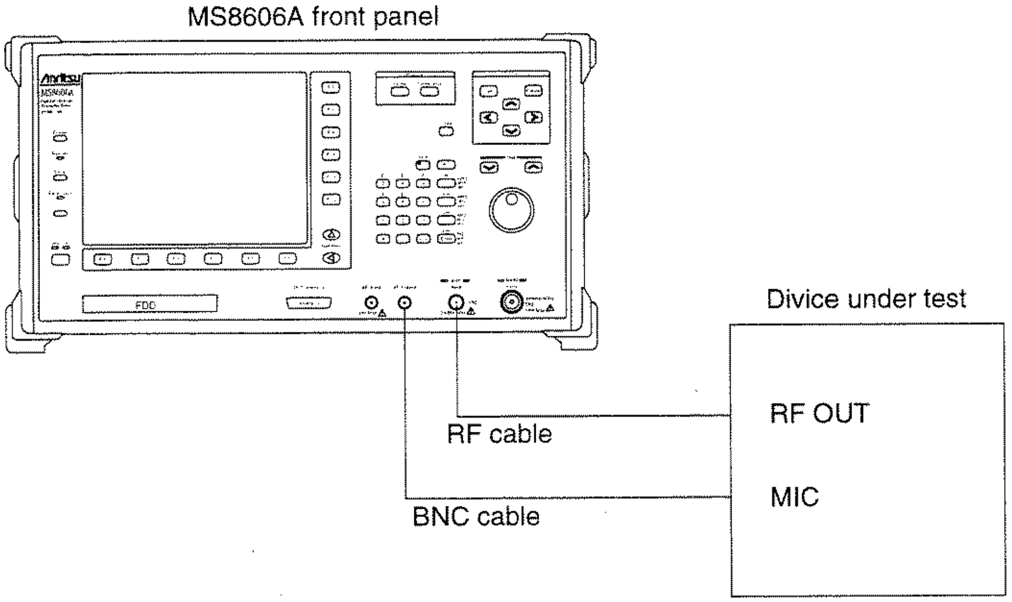


Fig. 4-3

Note 1: When measurement is performed using the Main Input connector, highly accurate measurement is enabled by measurement and absolute value calibration using the power meter built in the MS8606A at RF Level/Powermeasurement.

Note 2: The RF receiving sensitivity can be increased for measurement by using the AUX Input connector.
The lowest level of the signal input to the AUX Input connector (-30 dBm) is 25 dB below that of the Main Input connector (-5 dBm).

CAUTION ⚠

- The maximum input level of the AUX Input connector

The maximum input level of the AUX Input connector is +20 dBm. If a signal whose level exceeds the specified value is input, the internal circuit of the MS8606A may be damaged.

[DUT Interface connector]

The DUT Interface connector is equipped on the bottom of the MS8606A front panel to receive signals for control and measurement.

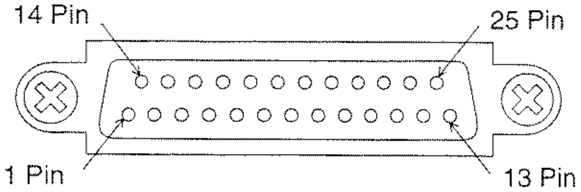
The following lists the specifications and functions of the DUT connector and gives and notes on its use.

1) Specifications of the DUT Interface connector

The DUT Interface connector is a 25-pin female D-SUB connector.

Signal assignmen

Pin number	Signal name	Signal type	Specification	Direction
1	GND	Signal ground		– – –
2	DUT_TXD12	Spare output	12 V level	MT8801B → DUT
3	DUT_RXD	Spare input	5V TTL / 3V C-MOS / 12V	MT8801B ← DUT
4	DUT_RTS12	Spare output	12 V level	MT8801B → DUT
5	DUT_CTS	Spare input	5V TTL / 3V C-MOS / 12V	MT8801B ← DUT
6	AF_SHELL	AF signal output (balanced output -)		MT8801B → DUT
7	GND	Signal ground		– – –
8	DUT_RTS5	Spare output	5 V TTL level	MT8801B → DUT
9	DUT_IN0	Spare input	5 V TTL/3 V C-MOS level	MT8801B ← DUT
10	DUT_IN1	Spare input	5 V TTL/3 V C-MOS level	MT8801B ← DUT
11	DUT_IN2	Spare input	5 V TTL/3 V C-MOS level	MT8801B ← DUT
12	DUT_IN3	Spare input	5 V TTL/3 V C-MOS level	MT8801B ← DUT
13	PRSS_TLK0	Press talk switch 0	Current capacity: 0.5 A or less	MT8801B → DUT
14	DUT_OUT0	Spare output	5 V TTL/3 V C-MOS level	MT8801B → DUT
15	DUT_OUT1	Spare output	5 V TTL/3 V C-MOS level	MT8801B → DUT
16	DUT_OUT2	Spare output	5 V TTL/3 V C-MOS level	MT8801B → DUT
17	DUT_OUT3	Spare output	5 V TTL/3 V C-MOS level	MT8801B → DUT
18	AF_SIGNAL	AF signal output (balanced output +)		MT8801B → DUT
19	DUT_TXD5	Spare output	5 V TTL level	MT8801B → DUT
20	12VOUT	+12 V power output	12 V, 50 mA or less	MT8801B → DUT
21	BCLK_IN	BER measurement clock	5 V TTL/3 V C-MOS level	MT8801B ← DUT
22	BDAT_INBER	Measurement data	5 V TTL/3 V C-MOS level	MT8801B ← DUT
23	DUT_TXD3	Spare output	3 V C-MOS level	MT8801B → DUT
24	DUT_RTS3	Spare output	3 V C-MOS level	MT8801B → DUT
25	PRSS_TLK1	Press talk switch 1	Current capacity: 0.5 A or less	MT8801B → DUT



2) Pin descriptions

2.1) Signal ground (GND)

This signal ground is the common grounding terminal of all signals using this connector.

2.2) 12 V power output

The 12 V power output can be used for the DUT or external interface for the DUT.
The maximum current capacity of this output is 50 mA.

2.3) AF signal output (Option 01)

AF signal output is used for mudulation. (Balanced output)
Use the shield wire for the MIC input cable. Ground the outer sheath.

2.4) Press talk switch

This terminal is used to control the press-to-talk switch of the DUT.

2.5) BER measurement signal

The BER measurement signal is applied to this terminal to receive the data output from the DUT when measuring receiving sensitivity of the digital radio.
Since this terminal is not used for the Option 01 (Analog measurement), leave this terminal unconnected.

2.6) Spare input and output

Spare input and output are terminals provided for future expansion. The MS8606A (Analog measurement) does not support these terminals. Leave these terminals unconnected.

(b) Setup using DUT Interface connector (at front panel)

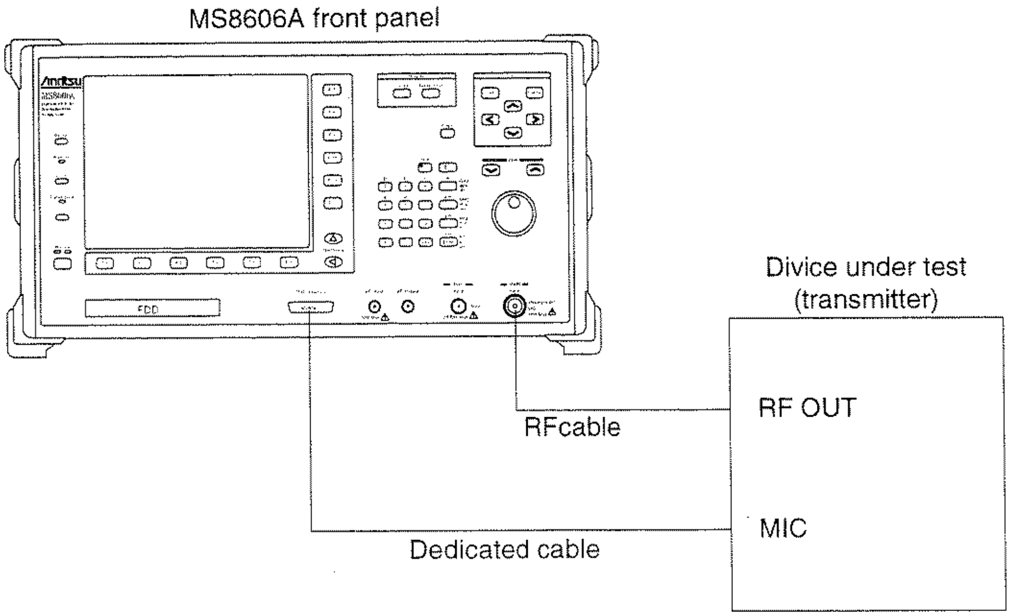


Fig. 4-4

4.3.2 Setup for AF signal measurement (AF Measure screen) (with option 01)

Setup:

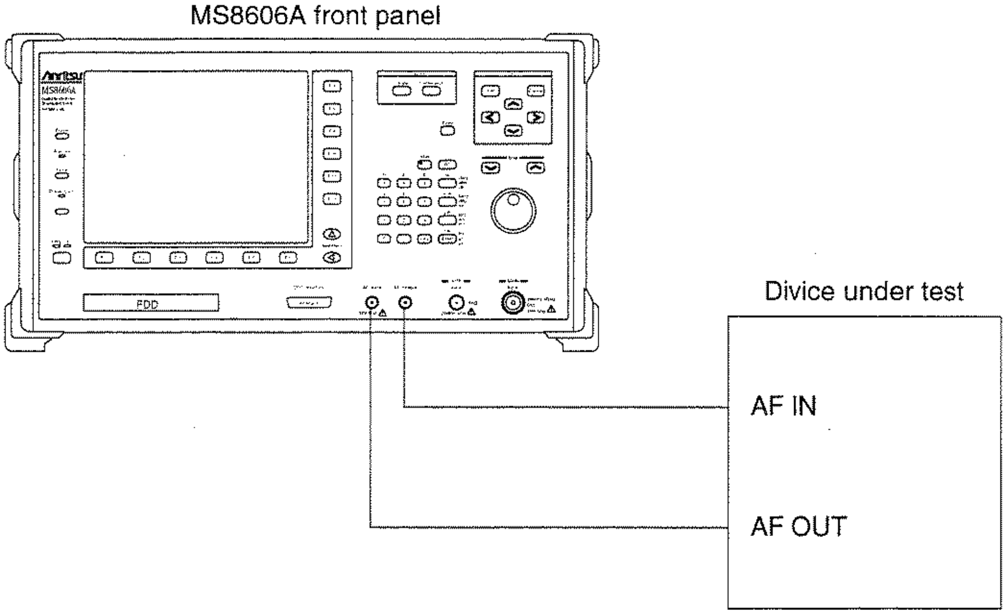


Fig. 4-6

4.3.3 Calibration before measurement

The MS8606A has two types of power measurement functions.
For high precision measurements, calibrate the MS8606A as shown below.

(a) Power meter function

Select Power Meter for Power measure method on the Setup TX Measure Parameter screen to use the power meter function.
The power meter function uses a thermo-couple to measure the average power with high precision.
Calibrate the MS8606A at the zero power point for high-precision measurements.

Zero-point calibration: Disconnect anything from the Main Input connector to set no input power, and press the [Zero Set] F11 key to automatically calibrate the power meter at the zero power point.

Note: The power meter function is effective only when the Main connector is used.

(b) IF Level Meter function

Select IF Level Meter for Power measure method on the Setup TX Measure Parameter screen to use the IF level meter function, which measures the level with an excellent linearity. For high precision measurement, internal calibration is required.
There are two types of internal calibrations of the Adjust Range and Manual Calibration, as described below.

Adjust Range:	Optimizes the internal RF ATT, A/D input level, and power meter range of the MS8606A for the signal to be measured.
Manual Calibration:	Calibrates the measured power value in the RF Power screen using the MS8606A built-in power meter or Calibration oscillator. Pressing the Calibration Cancel key clears the calibration factor to 0 dB. The calibration factor may become incorrect when the internal temperature rises, the ambient temperature changes, the measurement frequency changes etc.. For precise measurement of the TX power, perform Manual Calibration at that time.

Notes:

1. Manual Calibration is effective only when the Main connector is used.
   Manual Calibration is performed by the Power Meter for the main terminal, and the Calibration oscillator for the AUX terminal.
2. If the MS8606A input level is small or the input frequency does not match the setup frequency, the Adjust Range and Manual Calibration may not be performed properly.
3. Execute Adjust Range and Manual Calibration while the measurement signals are input stationary.
4. Performing Manual Calibration results in an error (corrected data cannot be generated), and calibration factor of the Manual Calibration (held before the execution) is lost.

4.3.4 Compensation for RF cable loss at transmitter measurement (TX Measure screen) --- Setting User Cal Factor

When conducting the transmitter (TX) measurement, set the loss of the RF cable connecting the MS8606A and transmitter under test as a correction value (User Cal Factor) to measure RF power in the transmitter under test.

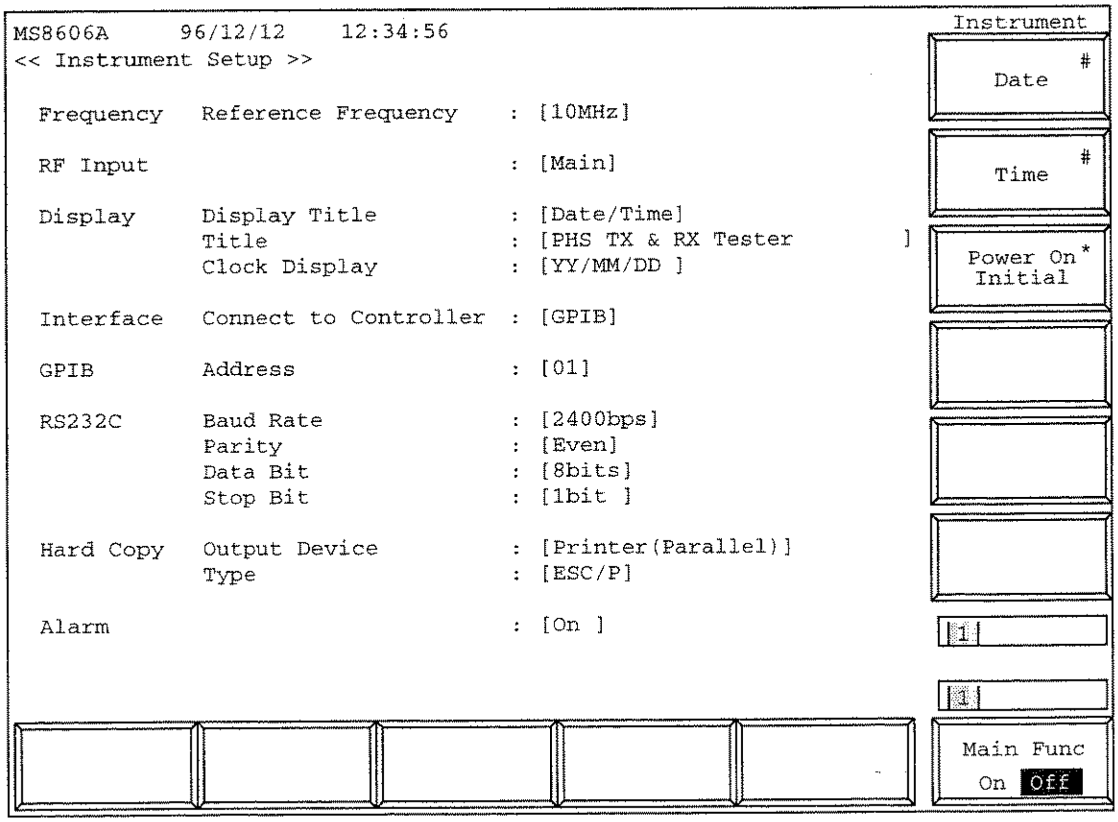
Step	Key operation	Description
1.	[Main Func on off]F6	Sets Main Func on to display the first page of the Main Menu at the bottom of the screen.
2.	[Analog Tester]F1	Displays the Setup Common Parameter (Analog) screen.
3.	[TX Measure]F1	Displays the first page of the TX Measure menu.
	Next Menu [▲]	Displays the second page of the TX Measure menu.
	[Setup TX Parameter]F7	Displays the Setup TX Measure Parameter (Analog) screen.
4.	Cursor [∧] [∨]	Moves the cursor to User Cal Factor.
5.	[Set][-/+] [0] [1] to [9] [BS]	Enter the RF cable loss. Example: For 5dB loss, enter 5.00 dB.
6.	[Enter]	Defines the entered value.
7.	[Back Screen]F12	Returns to the Setup Common Parameter (Analog) screen.

4.3.5 Setting the measurement system conditions: Instrument Setup screen

Set the standard frequency of the measurement system (10 MHz or 13 MHz), RF connector (Main or AUX), screen title/ date/time display, interface (GPIB or RS232C), printer (ESC/P), and alarm (on or off) on this screen.

Procedure for transition to the Instrument Setup screen

Step	Key operation	Description
1.	[Main Func on off]F6	Set Main Func on. The first page of the Main Menu appears at the bottom of the screen.
	Next Menu [◀]	Displays the second page of the Main Menu.
2.	[Instrument Setup]F2	Sets Instrument Setup mode. The Instrument Setup screen appears. The Instrument Setup function key menu appears on F7 to F12.



```
MS8606A      96/12/12     12:34:56
<< Instrument Setup >>

  Frequency    Reference Frequency       :  [10MHz]

  RF Input                               :  [Main]

  Display      Display Title             :  [Date/Time]
               Title                     :  [PHS TX & RX Tester          ]
               Clock Display             :  [YY/MM/DD ]

  Interface    Connect to Controller     :  [GPIB]

  GPIB         Address                   :  [01]

  RS232C       Baud Rate                 :  [2400bps]
               Parity                    :  [Even]
               Data Bit                  :  [8bits]
               Stop Bit                  :  [1bit ]

  Hard Copy    Output Device             :  [Printer(Parallel)]
               Type                      :  [ESC/P]

  Alarm                                  :  [On ]
```

Fig. 4-7 Instrument Setup Screen

- Set the following items:

Item	Range	Initial value
Frequency		
Reference Frequency		
	10MHz, 13MHz	10MHz
RF Input	Main, AUX	Main
Display		
Display Title		
	User Define, Date/Time, Off	User Define
Title	User Define, Date/Time, Off	
	(32 alphanumeric characters) (*1)	
Clock Display		
	YY/MM/DD (year, month, day)	
	MMM-DD-YY (month, day, year)	
	DD-MMM-YY (day, month, year)	YY/MM/DD (year, month, day)
Interface		
Connect to Controller		
	GPIB, RS232C	GPIB
GPIB		
Address	00 to 30	01
RS232C		
Baud Rate	1200, 2400, 4600, 9600(bps)	2400
Parity	Even, Odd, Off	Even
Data Bit	7 bits, 8 bits	8 bits
Stop Bit	1 bit, 2 bits	1 bit
Hard Copy		
Output device	Printer (Parallel), File	Printer (Parallel)
Type	ESC/P, HP2225… for Printer (Parallel)	ESC/P
	BMP (B&W)… for File	
Alarm	On, Off	On

*1 Entering the title:
A title up to 32 characters can be entered in the title display area. (User Define)
MS8606A**_**_**(date)**:**:**(time) is displayed as an initial value. (Date/Time)
Enter a title according to the following steps. (User Define)

Step	Key operation	Description
1.	Cursor [∧] [∨]	Moves the cursor to the Title entry area.
2.	[Set]	Opens the Tile entry window.
3.	Step [∧] [∨]	Moves the cursor into position in the Title entry area to enter character.
4.	Cursor [<] [>]	Select a character.
5.	[Enter]	Defines the character.
6.	[BS]	Correct any incorrect character.
7.		Repeat steps 3 to 6 to enter all characters in the Title entry area.
8.	[Set]	Defines the entered character string.

- Function keys

Main function key:	None
Function keys:	
[Date]F7:	Opens the date entry window.
[Time]F8:	Opens the time entry window.
[Power On Initial]F9:	Displays the Power On menu to select Initialization modes, which are classified into Previous Status and Recall File.
	Initial value: Previous Status
	When Previous Status mode is selected, the parameters after power-on retain the status held before the previous power-off.
	When Recall File mode is selected, the parameters after power-on are set by reading the specified file.
[Previous Status]F7	Sets the parameters after power-on to the status held before the previous power-off.
[Recall File]F8	Accesses the floppy disk to call the parameter file list.
[File No.]F9	Opens the parameter-file setting-location (number) entry window.
	File No.: 0 to 99, Initial value: 0
[return]F12	Returns to the previous menu.

• Selecting Power On Initial mode

The following describes how to select parameter initialization mode after power-on.

1. Selecting Previous Status mode

Step	Operation
1.	Press the [Power On Initial] (F9) key.
2.	Press the [Previous Status] (F7) key.
3.	Press the [return] (F12) key to define the parameters then return to the previous menu.

2. Selecting Recall File mode (being developed)

Step	Operation
1.	Press the [Power On Initial] (F9) key.
2.	Set the floppy disk (on which parameters to be read before power-on are written) in the floppy disk drive.
3.	Press the [Recall File] (F8) key. (Access the floppy disk to call the parameter list file.)
4.	Display the parameter file to be set on the screen.
5.	Press the [File No.] (F9) key. (Open the parameter-file setting-location [number] window.)
6.	Enter the number of the parameter file to be set.
7.	Press the [Set] key to define the parameters, then press the [return] (F12) key to return to the previous menu.

Notes:
- If no floppy disk is set before power-on or a floppy disk other than that used at setting is used, parameters may be set in Previous Status mode or different parameters may be set.
- The ambient temperature range of the floppy disk is specified as 5 to 45 °C. If a set temperature is outside the specified range, operation is not guaranteed.

- Changing the time and date of the built-in clock

1. Changing the date

Step		Operation
1.	[Date] F7	Opens the date setting window. Displays the current date and time of the built-in clock.
2.	Cursor [∧] [∨]	Moves the cursor to the part to be changed.
3.	[Set]	Opens the setting window.
4.	0 to 9, [BS]	Sets the data.
5.	[Set]	Closes the setting window and establishes the set value.

2. Changing the time

Step		Operation
1.	[Date] F7	Opens the time setting window. Displays the current time of the built-in clock.
2.	Cursor [∧] [∨]	Moves the cursor to the part to be changed.
3.	[Set]	Opens the setting window.
4.	0 to 9, [BS]	Sets the data.
5.	[Set]	Closes the setting window and establishes the set value.

Note: To stop changing the date or time of the built-in clock

To stop changing the date or time after opening the setting window of the built-in clock, press the [Cancel] key in the above Step 4 or 5 (do not use the [Set] key). If the [Set] key is pressed again after the date and time window is opened, the value on the setting window is set again. The date and time window remains in the state when the window was opened. Therefore, if the [Set] key is pressed without changing the display on the window, the date and time of the built-in clock are delayed.

4.3.6 Setting the screen display color: Change Color menu

To set a screen color, display the Change Color menu as follows.

(The F7 to F12 function keys menu changes to the Change Color menu, but the screen does not change.)

Step	Key operation	Description
1.	[Main Func on off]F6	Sets Main Func on. The first page of the Main Menu appears at the bottom of the screen.
	Next Menu [◀]	Displays the second page of the Main Menu.
2.	[Change Color]F3	Sets Change Color mode. The Change Clr. function key menu appears on F7 to F12.
3.		Use the function key on the next page to set a color.
4.	[return]F12	Returns to the previous menu.

- Function keys

Main function key: None

Function keys:

Change Color menu: Initial value: Color Pattern 1

[Color Pattern 1] F7: Selects Anritsu-specified color 1.

[Color Pattern 2] F8: Selects Anritsu-specified color 2.

[Color Pattern 3] F9: Selects Anritsu-specified color 3.

[Color Pattern 4] F10: Selects Anritsu-specified color 4.

[Define User Color] F11: Displays the Define Clr. menu to set a user-specified color.

  [Copy Color Ptn from] F7 Displays the [Copy from] menu to select an Anritsu-specified color as an original color to set a user-specified color.

    [Color Pattern 1] F7: Selects Anritsu-specified color 1 as an original color.

    [Color Pattern 2] F8: Selects Anritsu-specified color 2 as an original color.

    [Color Pattern 3] F9: Selects Anritsu-specified color 3 as an original color.

    [Color Pattern 4] F10: Selects Anritsu-specified color 4 as an original color.

    [return] F12: Returns to the previous menu.

  [Select Item frame **] F8: Selects the screen configuration field to set a display color. Use a number ** from 0 to 16 for this setting. The number increases in step of one by pressing this key.

  [Red *] F9: Set red intensity of the item frame selected by F8.

  [Green *] F10: Set green intensity of the item frame selected by F8.

  [Blue *] F11: Set blue intensity of the item frame selected by F8.

  [return] F12: Returns to the previous menu.

[return] F12: Returns to the previous menu.

- Relation between screen assignment and number ** in [Select Item Frame **] F8 key

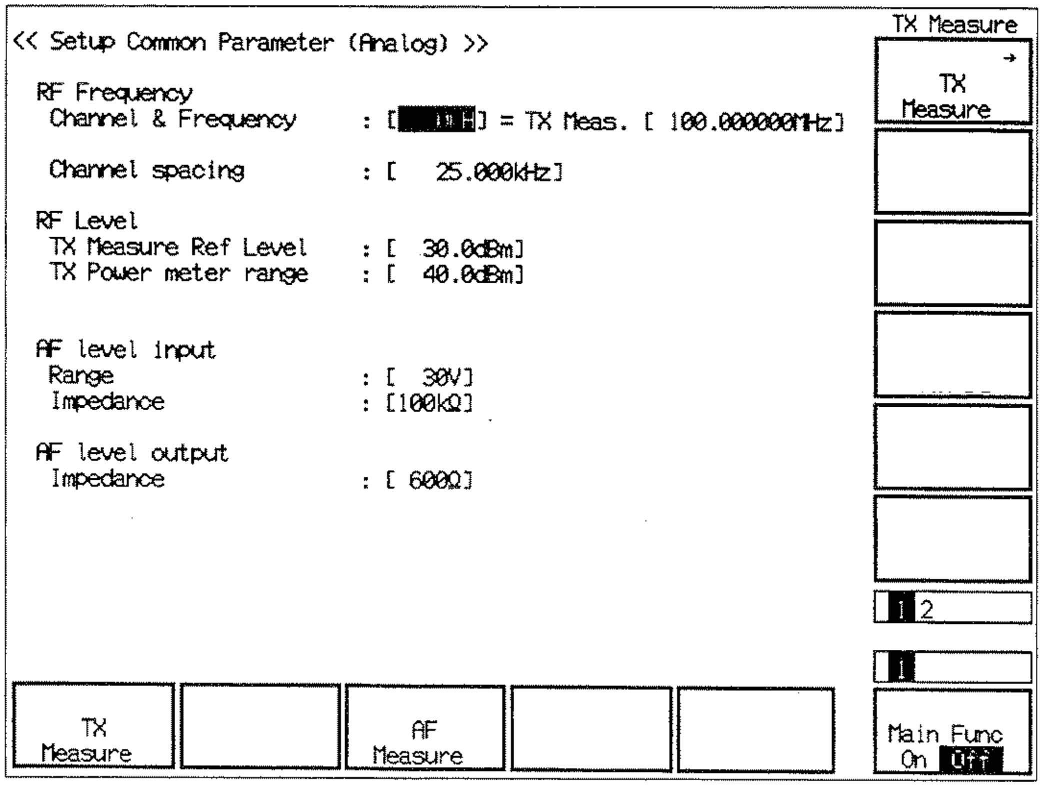
[Select Item Frame 0]	Back-screen of function keys
[Select Item Frame 1]	Back-screen of the main function keys
[Select Item Frame 2]	Display frame of function and main function keys
[Select Item Frame 3]	Characters and display frame of function and main function keys
[Select Item Frame 4]	Back-screen of waveform display
[Select Item Frame 5]	Scale line and frame of waveform display
[Select Item Frame 6]	Waveform display (1)
[Select Item Frame 7]	Waveform display (2)
[Select Item Frame 8]	Display other than function and main function keys
[Select Item Frame 9]	Characters right over the main function keys
[Select Item Frame 10]	Measurement execution error display
[Select Item Frame 11]	Template and zone frames
[Select Item Frame 12]	Marker
[Select Item Frame 13]	Window back-screen
[Select Item Frame 14]	Window shade and characters
[Select Item Frame 15]	(Not used)
[Select Item Frame 16]	Back-screen

4.4 Setting Common Measurement Parameter — Setup Common Parameter(Analog) screen

Set the common measurement parameters on Setup Common Parameter(Analog) screen befor the TX/AF-analog signal measurements.

Procedure for transition to the Setup Common Parameter(Analog) screen:

Step	Key operation	Description
1.	[Main Func on off]F6	Sets Main Func on. The Main-menu 1st page appears at the bottom of the screen.
2.	[Analog Tester]F3	Displays the Setup Common Parameter(Analog) screen.



<< Setup Common Parameter (Analog) >>

RF Frequency

Channel & Frequency : [10 H] = TX Meas. [100.000000MHz]

Channel spacing : [25.000kHz]

RF Level

TX Measure Ref Level : [30.0dBm]

TX Power meter range : [40.0dBm]

AF level input

Range : [30V]

Impedance : [100kΩ]

AF level output

Impedance : [600Ω]

Fig. 4-8 Setup Common Parameter(Analog) screen

- Set the following items.

Item	Range	Initial value	
RF Frequency			
Channel & Frequency	Channel : 0 to 9 999 CH	0 CH	Note 1
	TX Frequency : 0.300 000 to 3 000.000 000 MHz	100.000 000 MHz	
Channel spacing	-9 999.999 to 9 999.999 kHz	25.000 kHz	
RF Level			
TX Measure Ref Level	Main connector: -5 to 42 dBm	30.0 dBm	
	AUX connector: -30 to 22 dBm	22.0 dBm	
TX Power meter range	40.0 dBm/30.0 dBm/20.0 dBm/10.0 dBm	40.0 dBm	Note 2
AF Level input			
Range	30 V/4 V/400 mV/40 mV	30 V	
Impedance	100 kΩ/600 Ω	100 kΩ	
AF Level output			
Impedance	50 Ω/600 Ω	600 Ω	

Note 1 : Any combination of frequency with Channel can be used.
When the Channel is changed, the frquency changes automatically with keeping the channel spacing.
However, if the Channel is changed using the ten-key pad, the frquency does not change.
When the frequency is set, the channel set value does not change.

Note 2 : Display value of TX Power Meter range [dBm] = TX Power Meter set value[dBm] + User Cal Factor[dB] (User Cal factor[dB] is set on the Setup TX Measure Parameter(Analog) screen.)

Note 3: The AF Level input and AF Level output cannot be specified unless option 01 is installed.

- Main-function keys:

[TX Measure]F1	Displays the TX Measure(transmitter measurement) function keys on F7 to F12.
[AF Measure]F3	Diaplays the AF Measure(AF signal measurement) function keys on F7 to F12.

- TX Measure(transmitter measurement) function keys:

1st page	
[TX Measure]F7	Displays the TX Measure screen.
2nd page	
[Setup TX Param.]F9	Displays the Setup TX Measure Parameter(Analog) screen.

- AF Measure(AF signal measurement) function key:

[AF Measure]F7	Displays the AF Measure screen.

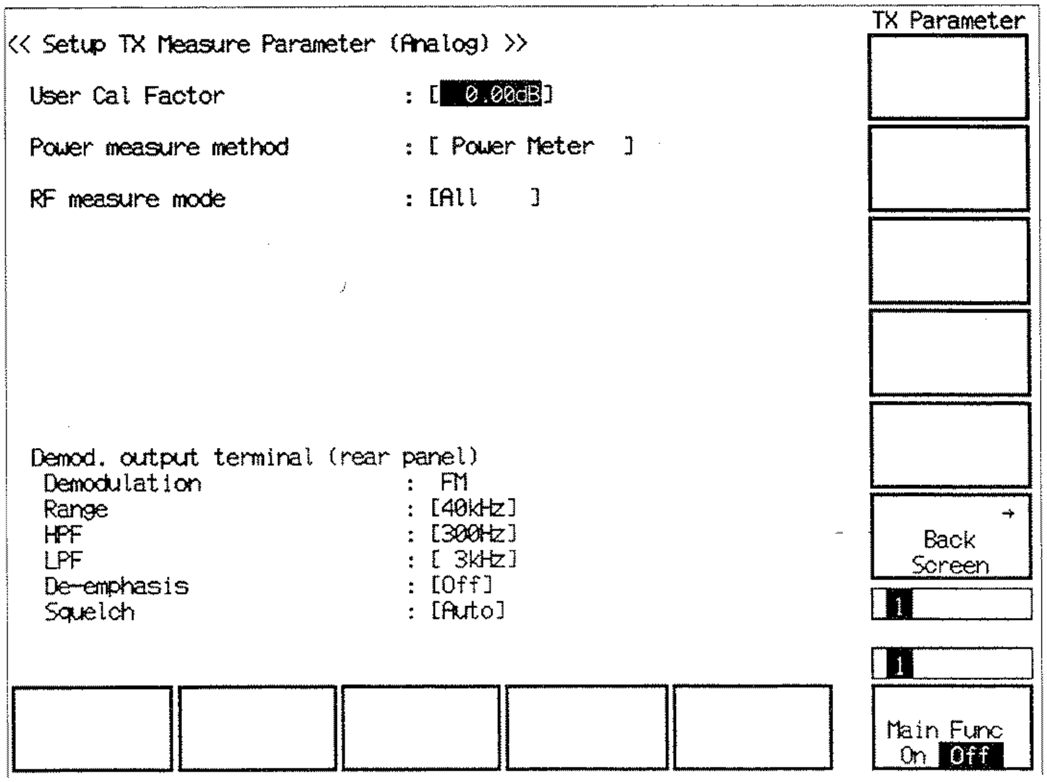
4.5 Transmitter (TX) Measurement — Setup TX Measure Parameter(Analog) screen, TX Measure (Analog) screen

4.5.1 Setting transmitter (TX) measurement parameter — Setup TX Measure Parameter(Analog) screen

Set the TX measurement parameters on Setup TX Measure Parameter(Analog) screen befor the TX-analog signal measurements.

Procedure for transition to the Setup TX Measure Parameter(Analog) screen:

Step	Key operation	Description
1.	[Main Func on off]F6	Sets the Main Func on to display the Main-Menu 1st page at the bottom of the screen.
2.	[Analog Tester]F3	Displays the Setup Common Parameter(Analog) screen.
3.	[TX Measure]F1	Displays the TX Measure (transmitter measurement) function-key 1st page on F7 to F12.
4.	Next Menu[︿]	Displays TX Measure function-key 2nd page on F7 to F12.
5.	[Setup TX Param.]F9	Displays the Setup TX Measure Parameter(Analog) screen.



<< Setup TX Measure Parameter (Analog) >>

User Cal Factor : [0.00dB]

Power measure method : [Power Meter]

RF measure mode : [All]

Demod. output terminal (rear panel)

Demodulation : FM

Range : [40kHz]

HPF : [300Hz]

LPF : [3kHz]

De-emphasis : [Off]

Squelch : [Auto]

Fig. 4-9 Setup TX Measure Parameter(Analog) screen

- Set the following items.

Item	Range	Initial value	
User Cal Factor	-30.00 to 30.00 dB, 0.01dB step	0.00 dB	
Power measure method	Power meter, IF Level meter	Power meter	Note 1
RF measure mode	All, RF only	All	Note 2
Demod. output terminal			
Range	40 kHz, 4 kHz	40 kHz	
HPF	300 Hz, off	300 Hz	
LPF	3 kHz, off	3 kHz	
De-emphasis	on, off	off	
Squelch	Auto, off	Auto	

Note 1 : IF Level Meter is fixed to be used for AUX Input.

Note 2 : In the RF Only mode, only both the RF Freq. and RF Power are measured for transmitter measurement.
AF values (Deviation, AF Level, AF Freq., and Distortion) are not measured. These not-measured AF items are indicated by - mark.

Note 3: The Demod output terminal is enabled by installing option 01.

- Main-function key: None

- Function key:

[Back Screen]F12 Returns to the Setup Common Parameter (Analog) screen.

4.5.2 Transmitter (TX) measurement — TX Measure (Analog) screen

Simplex transmitter (TX) analog measurement is performed on the TX Measure (Analog) screen. (Para. (1))

Note : When the RF Measure mode is set to the RF Only mode on the Setup TX Measure Parameter(Analog) screen, only both the RF Freq. and RF Power are measured for transmitter measurement.

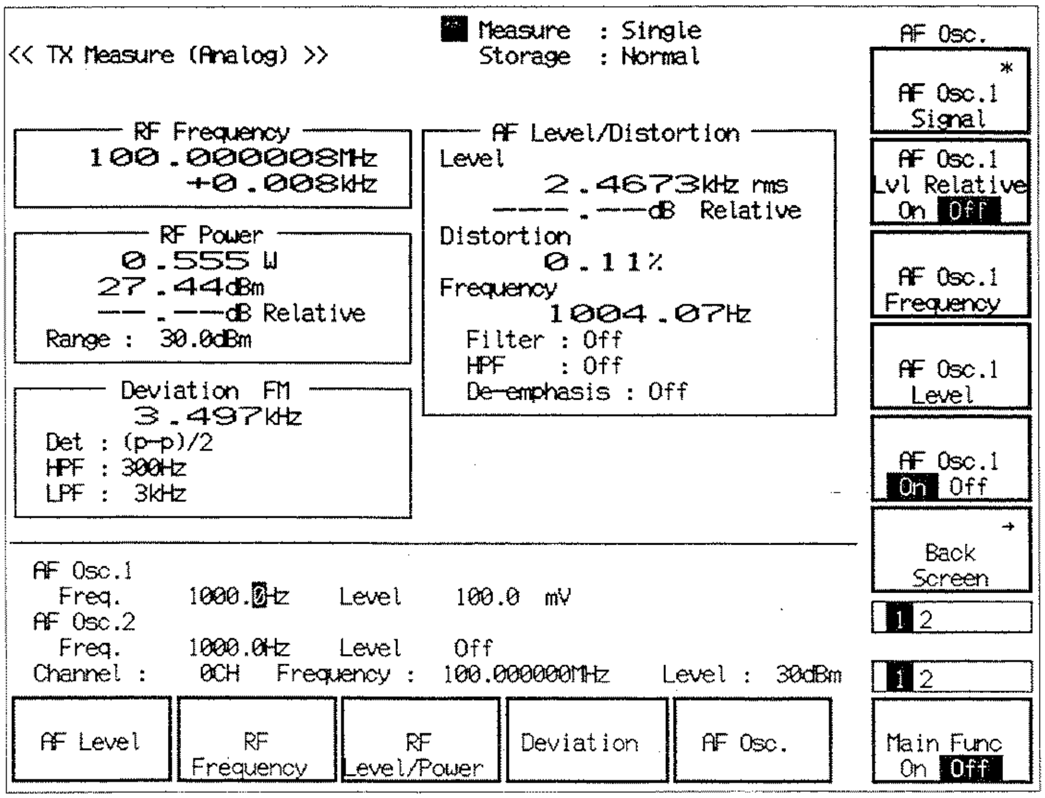
AF values (Deviation, AF Level, AF Freq., and Distortion) are not measured. These not-measured items are indicated by - mark.

(1) Simplex transmitter(TX) measurement — TX Measure (Analog) screen

In the TX Measure (Analog) screen, simplex-transmitter(TX) analog signal is measured.

Procedure for transition to the TX Measure (Analog) screen:

Step	Key operation	Description
1.	[Main Func on off]F6	Sets the Main Func on to display the Main-Menu 1st page at the bottom of the screen.
2.	[Analog Tester]F3	Displays the Setup Common Parameter (Analog) screen.
3.	[TX Measure]F1	Displays the TX Measure(transmitter measurement) function-key 1st page on F7 to F12.
4.	[TX Measure]F7	Displays the TX Measure (Analog) screen.


<< TX Measure (Analog) >>

Measure : Single
Storage : Normal

RF Frequency
100.000008MHz
+0.008kHz

RF Power
0.555 W
27.44dBm
--.---dB Relative
Range : 30.0dBm

Deviation FM
3.497kHz
Det : (p-p)/2
HPF : 300Hz
LPF : 3kHz

AF Level/Distortion
Level
2.4673kHz rms
----.---dB Relative
Distortion
0.11%
Frequency
1004.07Hz
Filter : Off
HPF : Off
De-emphasis : Off

AF Osc.1
Freq. 1000.0Hz Level 100.0 mV
AF Osc.2
Freq. 1000.0Hz Level Off
Channel : 0CH Frequency : 100.000000MHz Level : 30dBm

Fig. 4-10 TX Measure (Analog) screen

Note 1: Relative values (RF Power and AF Level, which are always displayed) are displayed with —.-dB until the [Set Relative]F8 key is pressed.

Note 2: Display value of RF Power Meter range [dBm] = TX Power Meter set value[dBm] + User Cal Factor [dB]
(User Cal Factor[dB] is set on the Setup TX Measure Parameter(Analog) screen.)
IF Level Meter is fixed to be used for AUX Input. Then, Power Meter is not used and the Range is not displayed.

- Main-function keys:

1st page

[AF Level]F1	Displays the AF Level function keys on F7 to F12. (Settings for demodulating RF signal from transmitter)
[RF Frequency]F2	Displays the RF Frequency function keys on F7 to F12. (Settings for changing the frequency of the RF signal from transmitter)
[RF Level/Power]F3	Displays the RF Level/Power function keys on F7 to F12. (Settings for measuring the level and power of the RF signal from transmitter)
[Deviation]F4	Displays the Deviationfunction keys on F7 to F12. (Settings for measuring the FM/øM of the RF signal from transmitter)
[AF Osc.]F5	Displays the AF Osc.function keys on F7 to F12. (Settings modulation signal to transmitter, enabled by installing option 01.)

2nd page

[PTT On Off]F4	Turns press-talk function on/off. When on, displays PTT On. When removed from TX Measure screen, PTT is set to off, automatically.

- AF Level function keys:

1st page

[Distortion Unit]F7	Selects the distortion measurement unit of dB or %. Initial value: %
[Set Relative]F8	Displays the relative value with the reference value that is the measured level when this key is pressed.
[Filter]F9	Selects the estimation filter of ITU-T P.53, C-MESSAGE, 6kHz BPF, or Off. Initial value: Off Note : The HPF of 400 Hz is the filter for tone signal rejection.
[HPF]F10	Selects the HPF of 400Hz or Off. Initial value: Off
[De-emphasis]F11	Selects the De-emphasis of 750µs or Off. Initial value: Off
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

2nd page

[Storage Mode]F9	Displays the Storage Mode menu for all the measured results on the screen.
[Normal]F7	Sets normal mode. (Initial value)
[Average]F8	Sets average mode.
[Average Count]F9	Sets number of Averaging processings. 2 ≤ Set value ≤ 9999 Initial value: 10 (In the average mode, the measurement is of single mode, which displays the averaged results in each measurement, and stops measurement when the Average Count reached.) Note that the Power Meter has not the average mode.
[return]F12	Returns to the AF Level menu.
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

- RF Frequency function keys:

[Frequency]F7	Changes the RF frequency. (See para. 4.4 for the changing method.)
[Channel]F8	Changes the channel number. (See para. 4.4 for the changing method.)
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

- RF Level/Power function keys:

1st page

[Ref Level]F7	Changes the reference level. (See para. 4.4 for the changing method.)
[Set Relative]F8	Displays the relative value with the reference value of 0 dB that is the level when the key is pressed.
[Storage Mode]F9	Displays the Storage Mode menu for all the measured results on the screen.
[Normal]F7	Sets normal mode. (Initial value)
[Average]F8	Sets average mode.
[Average Count]F9	Sets number of Averaging processings. 2 ≤ Set value ≤ 9999 Initial value: 10 (In the average mode, the measurement is of single mode, which displays the averaged results in each measurement, and stops measurement when the Average Count reached.) Note that the Power Meter has not the average mode.
[return]F12	Returns to the RF Level/Power menu.
[Calibration]F10	Displays the level calibration menu. Disappears when the Power measure method is set to Power Meter on the Setup TX Measure Parameter(Analog) screen.
[Manual Calibration]F7	Performs the level calibration. Calibrates the absolute value of the measured results of the IF Level Meter with the built-in Power Meter or Calibration oscillator. During calibration, the window indicating calibration in progress is displayed on the screen.
[Calibration Cancel]F8	Deletes level calibration data.
[return]F12	Returns to the RF Level/Power menu.

[Adjust Range]F11	Sets the measurement level ranges (RF power meter range and reference level) to the status appropriate for measurement signals.
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

2nd page (Disappears when the Power measure method is set to IF Level meter on the Setup TX Measure Parameter (Analog) screen.)

[Power Meter Range Up]F7	Up the Power-Meter measurement range.
[Power Meter Range Down]F8	Down the Power-Meter measurement range.
[Power Meter Zero Set]F11	Calibrates the Power-Meter zero point. (Sets the input level of the Main Input connector to 0, and press this key to calibrate zero point of the power meter, automatically.)
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

Note : When the unit key [dBμ/V] pressed, it is assumed as "dBμ" for RF level setting, and as "V" for AF level setting.

- Deviation function keys:

1st page

[Demod.]F7	Selects the demodulation function of FM (measurement unit: kHz) or øM (measurement unit: rad).Initial value: FM
[Relative On Off]F8	Displays the relative value with the reference value that is the measured level when the key is pressed. Initial value: Off
[Det Mode]F9	Selects the detection mode of: 1st page: (P-P)/2, +P, -P, RMS 2nd page: (P-P)/2 Hold, +P Hold, -P Hold Initial value:(P-P)/2
[HPF]F10	Selects the HPF of 300 Hz, 50 Hz, or Off. Initial value: Off
[LPF]F11	Selects the LPF of 3 kHz, 15 kHz, or Off. Initial value: Off
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

2nd page

[Storage Mode]F9	Displays the Storage Mode menu for all the measured results on the screen.
[Normal]F7	Sets normal mode. (Initial value)
[Average]F8	Sets average mode.
[Average Count]F9	Sets number of Averaging processings. $2 \leq$ Set value ≤ 9999 Initial value: 10 (In the average mode, the measurement is of single mode, which displays the averaged results in each measurement, and stops measurement when the Average Count reached.) Note that the Power Meter has not the average mode.
[return]F12	Returns to the Deviation menu.
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

- AF Osc. function keys: (Cannot be displayed without installing option 01.)

1st page —— Sets AF Osc. 1, independently from AF Osc. 2.

[AF Osc.1 Signal]F7	Selects AF-Osc.1 signal type of Tone, Noise(ITU-T G.227), or Noise(White). When Noise is set, displays "Noise({$Noise type})" at the frequency display area. Initial value: Tone
[AF Osc.1 Lvl Relative On Off]F8	Displays the relative value with the reference value that is the value when this key is pressed. Initial value: Off
[AF Osc.1 Frequency]F9	Sets AF-Osc.1 frequency. 20.0 Hz ≤ Set value ≤ 20 000.0 Hz, 0.1 Hz step Initial value: 1 000.0 Hz (When setting the same frequency as AF Osc.2, the AF Osc. output level becomes the sum of the set values.)
[AF Osc.1 Level]F10	Sets the AF-Osc. 1 level. Initial value: 100.0 mV When 600 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 0.400 V< Set value ≤ 3.000 V, 0.001 V step 40.0 mV< Set value ≤ 400.0 mV, 0.1 mV step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV step • For Noise of signal type 0.150 V< Set value ≤ 1.500 V, 0.001 V step 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV step When 50 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 40.0 mV< Set value ≤ 400.0 mV, 0.1 mV step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV step • For Noise of signal type 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV step
[AF Osc.1 On Off]F11	Turns on/off the AF-Osc. 1 output level. When off, displays off at the level display area. Initial value:On (When off, the [AF Osc.1 Level]F10 key is not displayed, so level cannot be set.)
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

2nd page —— Sets AF Osc. 2. independently from AF Osc. 1.

[AF Osc.2 Signal]F7	Selects AF-Osc. 2 signal type of Tone, Noise(ITU-T G.227), or Noise(White). Initial value: Tone When Noise is set, displays "Noise({$Noise type})" at the frequency display area.
[AF Osc.2 Lvl Relative On Off]F8	Displays the relative value with the reference value that is the value when this key is pressed. Initial value: Off
[AF Osc.2 Frequency]F9	Sets AF-Osc. 2 frequency. 20.0 Hz ≤ Set value ≤ 20 000.0 Hz, 0.1 Hz step Initial value: 1 000.0 Hz (When setting the same frequency as AF Osc. 1, the AF Osc. output level becomes the sum of the set values.)
[AF Osc.2 Level]F10	Sets the AF-Osc. 2 level. Initial value: 100.0 mV When 600 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 0.400 V< Set value ≤ 3.000 V, 0.001 V step 40.0 mV< Set value ≤ 400.0 mV, 0.1 mV step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV step • For Noise of signal type 0.150 V< Set value ≤ 1.500 V, 0.001 V step 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV step When 50 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 40.0 mV< Set value ≤ 400.0 mV, 0.1 mV step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV step • For Noise of signal type 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV step
[AF Osc.2 On Off]F11	Turns on/off the AF-Osc. 2 output level. When off, displays off at the level display area. Initial value:Off (When off, the [AF Osc.2 Level]F10 key is not displayed, so level cannot be set.)
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

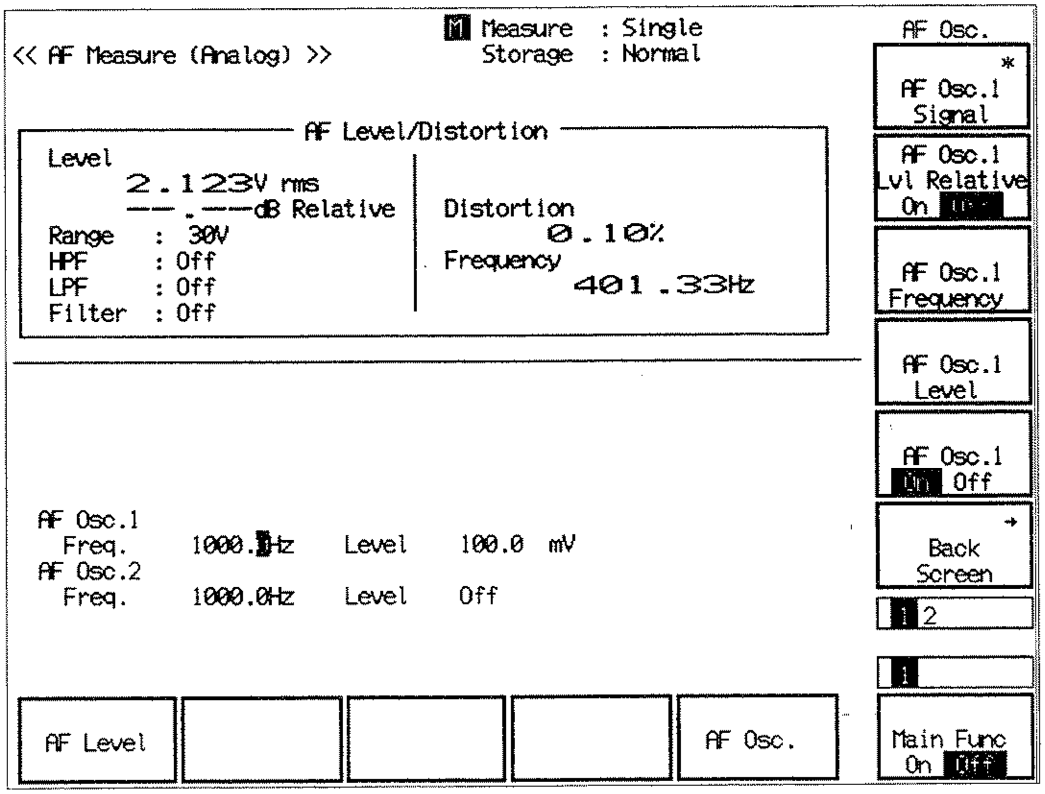
4.6 AF Signal Measurement —AF Measure (Analog) screen (with option 01)

In the AF Measure (Analog) screen, the MS8606A outputs an AF signal from the AF Output connector to the device under test (DUT).

The MS8606A also receives the AF signal from the DUT at the AF Input connector to measure the level, frequency, and distortion.

Procedure for transition to the AF Measure (Analog) screen:

Step	Key operation	Description
1.	[Main Func on off]F6	Set Main Func on. The Main-Menu 1st page appears at the bottom of the screen.
2.	[Analog Tester]F3	Displays the Setup Common Parameter(Analog) screen.
3.	[AF Measure]F3	Displays the AF Measure function keys at F7 to F12.
4.	[AF Measure]F7	Displays the AF Measure (Analog) screen.



<< AF Measure (Analog) >>

M Measure : Single
Storage : Normal

AF Level/Distortion

Level
2.123V rms
--.---dB Relative
Range : 30V
HPF : Off
LPF : Off
Filter : Off

Distortion
0.10%
Frequency
401.33Hz

AF Osc.1
Freq. 1000.0Hz Level 100.0 mV
AF Osc.2
Freq. 1000.0Hz Level Off

Fig. 4-13 AF Measure (Analog) screen

- Main-function keys:

[AF Level]F1	Displays the AF Level function keys on F7 to F12. (The same as the AF Level menu of the RX Measure screen.)
[AF Osc.]F5	Displays the AF Osc. function keys on F7 to F12. (The same as the AF Osc. menu of the TX Measure screen.)

- AF Level function keys:

1st page

[Adjust Range]F7	Sets the measurement AF level ranges to the status appropriate for the measurement signals.
[Set Relative]F8	Displays the relative value with the reference value that is the set value when this key is pressed.
[HPF]F9	Selects the HPF of 400 Hz, 300 Hz, 50 Hz, or Off. Initial value: Off Note : The HPF of 400 Hz is the filter for tone signal rejection.
[LPF]F10	Selects the LPF of 3 kHz, 15 kHz, or Off. Initial value: Off
[Filter]F11	Selects the estimation filter of ITU-T P.53, C-MESSAGE, 6kHz BPF, or Off. Initial value: Off
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

2nd page

[Range Up]F7	Up the measurement range of the AF level meter.
[Range Down]F8	Down the measurement range of the AF level meter.
[Storage Mode]F9	Displays the Storage Mode menu for all the measured results on the screen.
[Normal]F7	Sets normal mode. (Initial value)
[Average]F8	Sets average mode.
[Average Count]F9	Sets number of Averaging processings. 2 ≤ Set value ≤ 9999 Initial value: 10 (In the average mode, the measurement is of single mode, which displays the averaged results in each measurement, and stops measurement when the Average Count reached.) Note that the Power Meter has not the average mode.
[return]F12	Returns to the AF Level menu.
[AF Level Unit]F10	Selects the unit of the AF Level measurement value of dBm (valid for 600 Ω of input impedance) or V. Initial value: V When the 100 kΩ of Impedance of AF Level Input is set on the Setup Common Parameter(Analog) screen, this menu is not displayed.
[Distortion Unit]F11	Selects the unit of the distortion measurement value of dB or %. Initial value: %
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

- AF Osc. function key:

1st page —— Sets AF Osc. 1, independently from AF Osc. 2.

[AF Osc.1 Signal]F7	Selects AF-Osc.1 signal type of Tone, Noise(ITU-T G.227), or Noise(White). When Noise is set, displays "Noise({$Noise type})" at the frequency display area. Initial value: Tone
[AF Osc.1 Lvl Relative On Off]F8	Displays the relative value with the reference value that is the set value when this key is pressed. Initial value: Off
[AF Osc.1 Frequency]F9	Sets AF Osc.1 frequency. Range: 20.0 Hz ≤ Set value ≤ 20 000.0 Hz, 0.1 Hz step Initial value: 1 000.0 Hz (When setting the same frequency as AF Osc.2, the AF Osc. output level becomes the sum of the set values.)
[AF Osc.1 Level]F10	Sets AF Osc.1 output level. Initial value: 100.0 mV When 600 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 0.400 V< Set value ≤ 3.000 V, 0.001 V Step 40.0 mV< Set value ≤ 400.0 mV, 0.1 mV Step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV Step • For Noise of signal type 0.150 V< Set value ≤ 1.500 V, 0.001 V Step 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV Step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV Step When 50 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 40.0 mV< Set value ≤ 300.0 mV, 0.1 mV Step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV Step • For Noise of signal type 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV Step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV Step
[AF Osc.1 On Off]F11	Turns on/off the AF-Osc. 1 output level. When off, displays "Off" at the level display area. (When off, the [AF Osc.1 Level]F10 key disappears, and level cannot be set.) Initial value: On
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

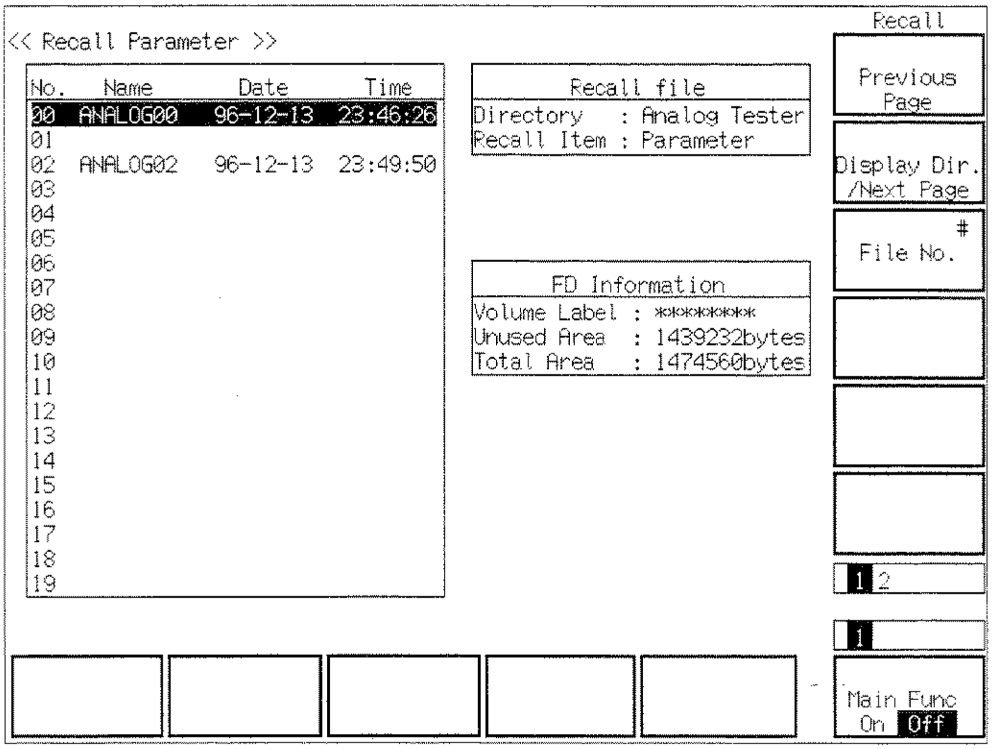
2nd page —— Sets AF Osc. 2, independently from AF Osc. 1.

[AF Osc.2 Signal]F7	Selects AF-Osc. 2 signal type of Tone, Noise(ITU-T G.227), or Noise(White). When Noise is set, displays "Noise({$Noise type})" at the frequency display area. Initial value: Tone
[AF Osc.2 Lvl Relative On Off]F8	Displays the relative value with the reference value that is the set value when this key is pressed. Initial value: Off
[AF Osc.2 Frequency]F9	Sets AF Osc.2 frequency. Range: 20.0 Hz ≤ Set value ≤ 20 000.0 Hz, 0.1 Hz step Initial value: 1 000.0 Hz (When setting the same frequency as AF Osc.1, the AF Osc. output level becomes the sum of the set values.)
[AF Osc.2 Level]F10	Sets AF Osc.2 output level. Initial value: 100.0 mV When 600 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 0.400 V< Set value ≤ 3.000 V, 0.001 V Step 40.0 mV< Set value ≤ 400.0 mV, 0.1 mV Step 4.00 mV< Set value ≤ 40.00 mV. 0.01 mV Step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV Step • For Noise of signal type 0.150 V< Set value ≤ 1.500 V, 0.001 V Step 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV Step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV Step When 50 Ω is set for Impedance of AF level output on the Setup Common Parameter screen: • For Tone of signal type 40.0 mV< Set value ≤ 300.0 mV, 0.1 mV Step 4.00 mV< Set value ≤ 40.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 4.000 mV, 0.001 mV Step • For Tone of signal type 15.0 mV< Set value ≤ 150.0 mV, 0.1 mV Step 1.50 mV< Set value ≤ 15.00 mV, 0.01 mV Step 0.010 mV< Set value ≤ 1.500 mV, 0.001 mV Step
[AF Osc.2 On Off]F11	Turns on/off the AF-Osc. 2 output level. When off, displays "off" at the level display area. (When off, the [AF Osc.2 Level]F10 key disappears, and level cannot be set.)
[Back Screen]F12	Returns to the Setup Common Parameter(Analog) screen.

4.7 Saving and recalling parameter data:
Save Parameter screen, Recall Parameter screen

Display the Save Parameter and Recall Parameter screens according to the following steps to save or recall parameters set for the AF Measurement.

Step	key operation	Description
1.	[Main Func on off]F6	Sets the Main Func on. The first page of the Main Menu appears at the bottom of the screen.
2.	[Recall]F4	Sets Recall Parameter mode. The Recall Parameter screen appears. The Recall function key menu appears on F7 to F12.
2'	[Save]F5	Sets Save Parameter mode. The Save Parameter screen appears.The Save function key menu appears on F7 to F12.



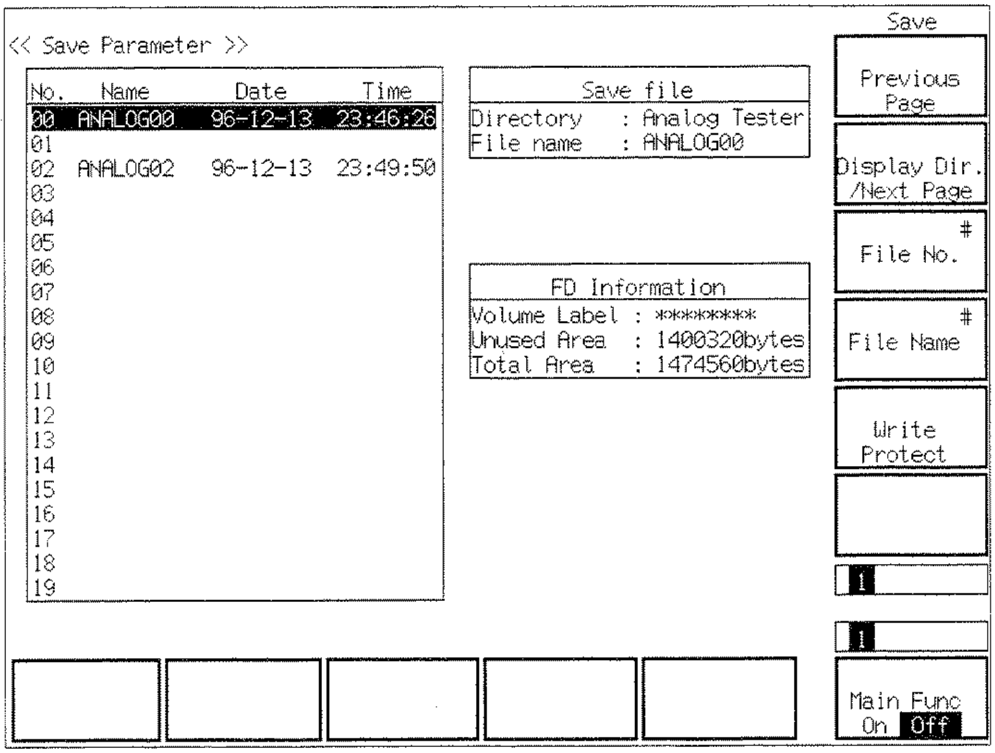
<< Recall Parameter >>

No.	Name	Date	Time
00	ANALOG00	96-12-13	23:46:26
01			
02	ANALOG02	96-12-13	23:49:50
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			

Recall file
Directory : Analog Tester
Recall Item : Parameter

FD Information
Volume Label : ********
Unused Area : 1439232bytes
Total Area : 1474560bytes

Fig. 4-14 Recall Parameter Screen


<< Save Parameter >>

No.	Name	Date	Time
00	ANALOG00	96-12-13	23:46:26
01			
02	ANALOG02	96-12-13	23:49:50
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			

Save file

Directory : Analog Tester

File name : ANALOG00

FD Information

Volume Label : *********

Unused Area : 1400320bytes

Total Area : 1474560bytes

Fig. 4-15 Save Parameter Screen

- Floppy disk to be used:

  For saving and loading parameters and data, use the floppy disk described in Section 3. When the floppy disk is required to be formatted, use the File Operation screen in Paragraph 4.9.

- Notes when displaying the Save Parameter screen and Recall Parameter screen:

  Before pressing the [Save]F5 or [Recall]F4 function key, insert a floppy disk(FD) in the FD driver of the MS8606A. Then press the key. The MS8606A automatically starts the FD-driver operation.

- Screen display and function key display:

  Pressing the [Save]F5 or [Recall]F4 function key changes only the display of the F7 to F12 function keys.

  The screens (Figs. 4-14, 4-15) appear when the [Display Dir./Next Page] F8 key is pressed to display the contents of the FD. These screens also display the function keys used to select any directory and any file.

- Information to be saved and recalled:

The [Save] and [Recall] keys on the main function keys saves and recalls all the measurement parameters.

- Function keys on the Recall Parameter screen

Main function key: None

Recall function keys:

[Display Dir.]F8:	Accesses the floppy disk and displays the directory of the parameter data file. The lower-order Recall menu appears.

** 1st page**

[Previous Page]F7:	Displays the previous page of the directory.
[Display Dir./Next Page]F8:	Accesses the floppy disk and displays the next page of the directory.
[File No.]F9:	Opens the window for entering the recall position (number) of the setup parameter data file. 0 to 99, Resolution: 1, Initial value: 0

** 2nd page **

[Select Display Mode]F7:	Displays the Display Mode menu to select a display mode.
[Wide]F7:	Displays file numbers in ascending order from 0 regardless of whether all files are saved.
[Narrow]F8:	Skips the numbers of files not saved and displays only the numbers of saved files in ascending order.
[return]F12:	Returns to the previous menu.

[File No.]F9:	Opens the window for entering the recall position (number) of the setup parameter file. 0 to 99, Resolution: 1, Initial value: 0
[return]F12:	Returns to the previous menu.

- Function keys on the Save Parameter screen

Main function key: None

Save function keys:

[Display Dir.]F8: Accesses the floppy disk and displays the directory of the parameter data file. The low-order Save menu appears.

- [Previous Page]F7: Displays the previous page of the directory.
- [Display Dir./Next Page]F8: Accesses the floppy disk and displays the next page of the directory.
- [File No.]F9: Opens the window for entering the save position (number) of the setup parameter data file.
  0 to 99, Resolution: 1, Initial value: 0
- [File Name]F10: Opens the window for entering the name of the parameter data file to be saved.
  The data file name consists of up to eight characters.
- [Write Protect]F11: Write-protects the specified parameter data file.
  An asterisk (*) is displayed at the end of the name of the write-protected file.
  If the specified parameter data file is already write-protected, this key cancels write protect.

  Note: This function can only be executed through panel operation.

[File No.]F9: Opens the window for entering the save position (number) of the setup parameter data file.
0 to 99, Resolution: 1, Initial value: 0

[return]F12: Returns to the previous menu.

- Saving parameters and data

This paragraph describes how to save the measurement parameters of the AF Measurement to a floppy disk.

Step	key operation	Description
1.		Insert a saving floppy disk(FD) into the FD driver on the bottom left of the MS8606A.
2.	[Main Func on off]F6	Sets Main Func to on. The Main Menu 1st page is displayed on the screen bottom.
3.	[Save] F5	Changes to Save Parameter mode. Displays the Save function keys in F7 to F12, and then moves to the Save screen for parameter and data. Searches the FD for parameter and data files, and displays them on the screen.
4.	[Display Dir./Next Page]F8	Displays existing files to check the number of the file to be saved.
5.	[File Name]F10	Sets the file name used for save within 8 alphanumeric characters if necessary.
6.		Check the number of the file to be saved and the file status (whether the file exists and whether the file is write-enabled). To write-enable the file, proceed to Steps 7a and later. Otherwise, proceed to Step 8.
7a.	Cursor [∧] and [∨]	Select the file to be write-enabled.
7b.	[Write Protect] F11	Write-enables the file for over-writing.
8.	[File No.] F9	Specify the number of the file to be saved.
9.	[Set]	Saves the file.
10.	SAVE? Yes No	Opens SAVE confirmation window. Select YES.

- Write-protecting or write-enabling the file to be saved

This paragraph describes how to write-protect or write-enable the file containing data in the Save screen.

Step	key operation	Description
1.		Execute the Steps 1 to 3 of the saving procedure in the previous paragraph to display the Save menu.
2.	[Display Dir./Next Page]F8	Displays the existing files. Check the number of the file to be saved.
3.	Cursor [∧], [∨]	Select the file to be write-enabled.
4.	[Write Protect]F11	Write-protects or write-enables the file to be saved.

- Recalling parameters and data

This paragraph describes how to recall AF measurement parameters from the floppy disk.

Step	key operation	Description
1.		Insert a recall floppy disk(FD) into the FD driver at the bottom left of the MS8606A.
2.	[Main Func on off]F6	Sets Main Func to on. Displays Main Menu 1st page on the screen bottom.
3.	[Recall]F5	Changes to Recall Parameter mode. Displays the Recall function keys in F7 to F12, and moves to the Recall screen for parameter and data. Searches the FD for parameter and data files, and displays them on the screen.
4.	[Display Dir./Next Page]F8	Displays the directory containing the file to be recalled. Check the file to be recalled.
5.	Cursor[∧][∨]	Select the file to be recalled.
6.	[File No.]F9	Sets the number of any file to be recalled.
	(The file to be recalled can be specified by the file number, too.)	
7.	[Set]	Confirms the file to be recalled.
8.	RECALL? Yes No	Opens RECALL confirmation window. Select YES. The MS8606A reads the specified file. Then, returns to the previous screen, automatically.

- Changing the recall-file display format(WIDE/NARROW)

This paragraph describes how to change the recall-file display format(WIDE/NARROW).

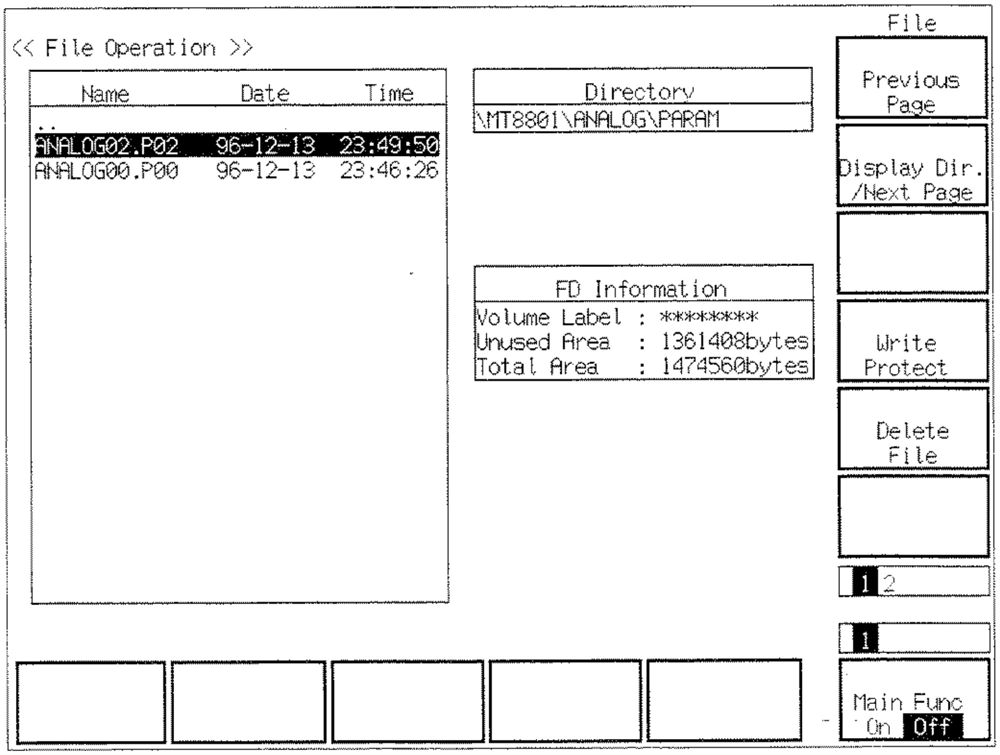
Step	key operation	Description
1.		Execute the Steps 1 to 3 of the recalling procedure in the previous paragraph to display the recalled file.
2.	Next Menu [∧]	Displays the second page of the function keys.
3.	[Select Display Mode]F7	Displays the file display format selection menu.
4.	[Wide]F7 or [Narrow]F8	Specify the display format.
5.	[return]F12	Returns to the previous menu.

4.8 Operating the file: File Operation screen

To access the floppy disk and display the parameter file directory, delete or write-protect the parameter file, and initialize the floppy disk; display the File Operation screen according to the following steps.

Note: This function can only be executed through panel operation.

Step	key operation	Description
1.	[Main Func on off]F6	Sets the Main Func on. The Main Menu 1st page appears at the bottom of the screen
	Next Menu [◀]	Displays the second page of the Main Menu.
2.	[File Operation]F4	Sets File Operation mode. The File Operation screen appears. The File function key menu appears on F7 to F12.



<< File Operation >>

Name	Date	Time
..		
ANALOG02.P02	96-12-13	23:49:50
ANALOG00.P00	96-12-13	23:46:26

Directory
\MT8801\ANALOG\PARAM

FD Information
Volume Label : ********
Unused Area : 1361408bytes
Total Area : 1474560bytes

Fig. 4-16 File Operation Screen

- Functions keys on the File Operation screen

Main function key: None

Function keys: 2 pages. Use the Next Menu [▲] key to scroll to the next page.

** 1st page **

[Previous Page]F7:	Displays the previous page of the directory.
[Display Dir./Next Page]F8:	Accesses the floppy disk and displays the next page of the directory.
[Write Protect]F10:	Write-protects the specified parameter data file. An asterisk (*) is displayed at the end of the name of the write-protected file. If the specified parameter data file is already protected, write protect can be canceled by pressing this key. Note: This function can only be executed through panel operation.
[Delete File]F11:	Opens the window for entering the position (number) of the parameter data file to be deleted. Setup range: 0 to 99 (integer) Initial value: 0

** 2nd page **

[Format]F7:	Initializes the floppy disk to the specified type. The initialization format is MS-DOS 1.44 MB or 720 kB. Note: The format is MS-DOS 1.44 MB or 720 kB. Use the 2HD or 2DD type of 3.5-inch floppy disk.

- Displaying files

This paragraph describes how to display the files in FD.

Step	key operation	Description
1.		Insert a floppy disk(FD) into the FD driver at the bottom left of the MS8606A.
2.	[Main Func on off]F6	Turn the Main Func on to display the first page of the Main Menu at the bottom of the screen.
3.	Next Menu [◀]	Displays the second page of the Main Menu.
4.	[File Operation]F4	Moves to the File Operation screen. Accesses the FD to display the root directory.
5.	Cursor [∧][∨]	Specify the directory to be required.
6.	[Set] or [Enter]	Moves to the specified directory to display its contents.
7.		Repeat the Steps 5 and 6 above to display the required directory.

Note: The sub-directories and file name under the selected directory are displayed in the frame on the left of the screen.
For directories, only their names are displayed in the "Name" field.
For files, Name/Date/Time are displayed.
The Directory field at the upper right of the screen displays the layer and location of the selected directory.

- Write-enabling/write-protecting files

This paragraph describes how to change the file write mode between the write-protected and write-enabled modes.

Step	key operation	Description
1.		Select the directory of the desired file by the displaying-file procedure above.
2.	Cursor [∧][∨]	Specify the file.
3.	[Write Protect]F10	Changes the file write mode.

- Deleting files

This paragraph describes how to delete the parameter/data files.

Step	key operation	Description
1.		Select the directory of the desired file by the displaying-file procedure above.
2.	Cursor [∧][∨]	Specify the file.
3.	[Delete File]F11	Opens the confirmation window.
4.	DELETE FILE? Yes No	Select Yes or No. "Yes" deletes the specified file.

Note: Once a file is deleted, it cannot be restored.

- Initializing(formatting) floppy disk

This paragraph describes how to initialize a floppy disk.

Step	key operation	Description
1.		Insert a floppy disk(FD) into the FD driver at the lower left of the MS8606A. The acceptable FD is the 2HD(1.44 M-bytes) or 2DD(720 k-bytes) type.
2.		Set File Operation mode, as described previously.
3.	Next Menu [^]	Displays the second page of the function keys.
4.	[Format]F7	Specifies initialization.
5.	FORMAT DISK? Yes No	The window confirming FORMAT DISK appears on the screen. Select Yes.
6.	Next Menu [^]	Returns to the first page of the function keys.

Note: Once a floppy disk is initialized, the data recorded on the disk is all lost.

4.9 Screen hard copy ... Copy

The copy function transfers a screen display to the printer or floppy disk. Specify a transfer destination and mode on the Instrument Setup screen. Press the Copy key on the front panel to activate the Copy function. While the Copy function is operating, operations (including remote control) such as measurement or internal setting are disabled.

(1) Transfer to the printer

If Hard Copy is set to the Output Device Printer (Parallel) on the Instrument Setup screen, screen display can be printed via the Parallel interface on the rear panel. Printers using the ESC/P command system can be used.

(2) Transfer to the floppy disk

If Hard Copy is set to File on the Instrument Setup screen, the floppy disk driver on the front panel can be used to store data displayed on the screen in the floppy disk. Paragraph 4.9 describes the floppy disks that can be used. Data created on the floppy disk is the image file of the monochrome BMP data format. While the Copy is being executed, the name of the created file "RCA_***.BMP" is displayed on the bottom of the screen (*** is a number beginning with 000).

(Reference) Number of storable BMP files
2DD (720K bytes): Up to 18
2HD (1.44M bytes): Up to 37

4.10 Settings relating to remote control and panel key control

1. Remote control interfaces

The remote control interfaces of the MS8606A are classified into the GPIB interface and serial interface (RS-232C interface). Select an interface used on the Instrument Setup screen (see paragraph 4.3.5).

2. Remote control and panel control keys

The keys and lamps described in this section are assigned on the front panel as exclusive keys and lamps.

1) REMOTE lamp and LOCAL key

The REMOTE lamp indicates that the MS8606A is controlled remotely using the GPIB interface or RS-232C interface. When the MS8606A is controlled remotely from an external controller via the GPIB interface or RS-232C interface, the REMOTE lamp lights. While the REMOTE lamp is on, key entry and rotary encoder entry from the front panel are disabled. The LOCAL key is used to cancel the remote control status of the GPIB interface or RS-232C interface. When the LOCAL key is pressed, the REMOTE lamp goes off and key entry and rotary encoder entry from the front panel are enabled.

2) PANEL LOCK key

The PANEL LOCK key is used to enable and disable key entry and rotary encoder entry from the front panel. Use the PANEL LOCK key to prevent an incorrect operation on the front panel for automatic measurement or status holding. When the panel is locked, the green lamp on the PANEL LOCK key lights.

3. Remote control status

If the MS8606A is controlled remotely, the REMOTE lamp on the left of the front panel lights. While the REMOTE lamp is on, key entry and rotary encoder entry from the front panel are disabled. To change from the remote control status to the front panel entry status, execute the following steps:

1) Halt the remote control.
2) If the REMOTE lamp is on, press the LOCAL key to cancel the REMOTE status.

SECTION 5
PERFORMANCE TESTS

This section lists the equipment used in performing the MS8606A performance tests, and explains the setup and the performance test items.

TABLE OF CONTENTS

5.1 Requirement for Performance Tests

The performance tests are carried out as a part of preventive maintenance to prevent deterioration of option 01 AF measurement of the MS8606A.

Use the performance test procedures during acceptance inspection, periodic inspection, and after repair of option 01 analog measurement of the MS8606A. Do the important parts of preventive maintenance periodically. This section explains the following test procedures:

- AF oscillator
  Output level accuracy and waveform distortion

- RF analyzer
  Power meter (wide-band)
  FM demodulation deviation accuracy
  FM demodulating frequency characteristics
  Demodulation residual FM
  FM demodulation distortion
  øM demodulation deviation accuracy
  Demodulation residual øM
  FM demodulation output frequency characteristics
  FM demodulation output distortion

- Audio analyzer
  Evaluation filter characteristics
  AF level measurement accuracy
  Distortion rate measurement accuracy

For important evaluation items, execute the performance tests at regular intervals for preventive maintenance. The performance should be inspected regularly once or twice a year.

If the specifications are not met in the performance tests, please contact the Service Department of Anritsu Corporation.

5.2 Instruments Required for Performance Test

The instruments required for performance tests are shown below.

Instruments Required for Performance Test

Check item		Measuring instrument	Recommended instrument name (model name)	Reference paragraph
AF oscillator	Output level accuracy and waveform distortion	AF level meter and AF distortion rate meter	8903B(HP)	5.3.2.1
RF analyzer	Power meter (wide-band)	Signal generator Fixed attenuator Power meter and sensor	MG3633A MP721B ML4803A, MA4601A	5.3.3.1
	FM demodulation deviation accuracy	Signal generator Spectrum analyzer	MG3633A MS2602A	5.3.3.2
	FM demodulating frequency characteristics	Signal generator Modulation analyzer AF oscillator and AF level meter	MG3633A MS616B 8903B(HP)	5.3.3.3
	Demodulation residual FM	Signal generator	MG3633A	5.3.3.4
	FM demodulation distortion	Signal generator AF oscillator	MG3633A 8903B(HP)	5.3.3.5
	øM demodulation deviation accuracy	Signal generator Spectrum analyzer AF oscillator	MG3633A MS2602A 8903B(HP)	5.3.3.6
	Demodulation residual øM	Signal generator	MG3633A	5.3.3.7
	FM demodulation output frequency characteristics	Signal generator Modulation analyzer AF oscillator and AF level meter	MG3633A MS616B 8903B(HP)	5.3.3.8
	FM demodulation output distortion	Signal generator AF oscillator and AF distortion rate meter	MG3633A 8903B(HP)	5.3.3.9
Audio analyzer	Evaluation filter characteristics	AF oscillator	8903B(HP)	5.3.4.1
	AF level measurement accuracy	AF oscillator	8903B(HP)	5.3.4.2
	Distortion rate measurement accuracy	AF oscillator and AF level meter	8903B(HP)	5.3.4.3

5.3 Performance Test

Do not start the performance tests until the equipment to be tested and the measuring instruments have warmed up for at least 30 minutes and option 01 analog measurement of the MS8606A is completely stabilized. Keep AC supply voltage fluctuations, noise, vibration, dust, humidity and other factor which could affect results to a minimum.

5.3.1 AF oscillator

5.3.1.1 Output level accuracy and waveform distortion

(1) Specifications

Accuracy*:	Unbalanced output:	±0.5 dB
	Floating output:	±2 dB (frequency : 1 kHz, output level ≥ 1 mV)
	Unbalanced output:	±1 dB (20 Hz ≤ frequency ≤ 20 kHz, output level ≥ 1 mV)
	Measured at < 30 kHz bandwidth	
Waveform distortion:	< -50 dBc (frequency : 1 kHz, output level : 1 V)	
	< -45 dBc (20 Hz ≤ frequency ≤ 20 kHz, output level : 1 V)	
	Measured at < 30 kHz bandwidth	

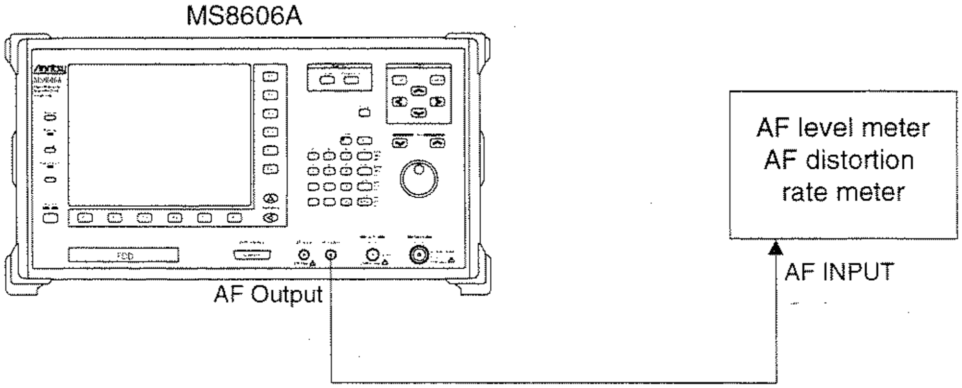
(2) Test instrument

- AF level meter and AF distortion rate meter: 8903B

(3) Note on test

- Set the bandwidth of the AF level meter and AF distortion rate meter to less than 30 kHz.

(4) Setup



(5) Test procedures

Step Procedure

Output level accuracy

1. Set the AF level output impedance on the Setup Common Parameter screen.
2. Set the MS8606A to TX Measure (Analog) mode.
3. Specify AF OSC.1:Tone and the AF frequency for the MS8606A.
   (If AF OSC.2 is ON, set it to OFF.)
4. Set the AF level of AF OSC.1 and read the value indicated on the AF level meter.
5. Change the AF level of AF OSC.1 in accordance with the table below, and repeat the measurement.

Output level accuracy of AF oscillator

AF level set value (V))	0.001	0.01	0.1	0.3	1	3
Level measured value (V)						

(AF level output Impedance=600Ω)

Waveform distortion

1. Set the MS8606A to TX Measure (Analog) mode.
2. Specify OSC.1:Tone. Level=1V, and AF Frequency for the MS8606A.
   (If AF OSC.2 is ON, set it to OFF.)
3. Read the value indicated on the AF distortion rate meter.
4. Change the AF frequency of MS8606A AF OSC.1 in accordance with the table below, and repeat the measurement.

Waveform distortion of AF oscillator

AF Frequency(kHz)	0.02	0.3	1	3	10	20
Waveform distortion (dB)						

5.3.2 RF analyzer

5.3.2.1 Power meter (wide-band)

(1) Specifications

Frequency range:	300 kHz to 3 GHz
Accuracy:	±10% after zero-point calibration

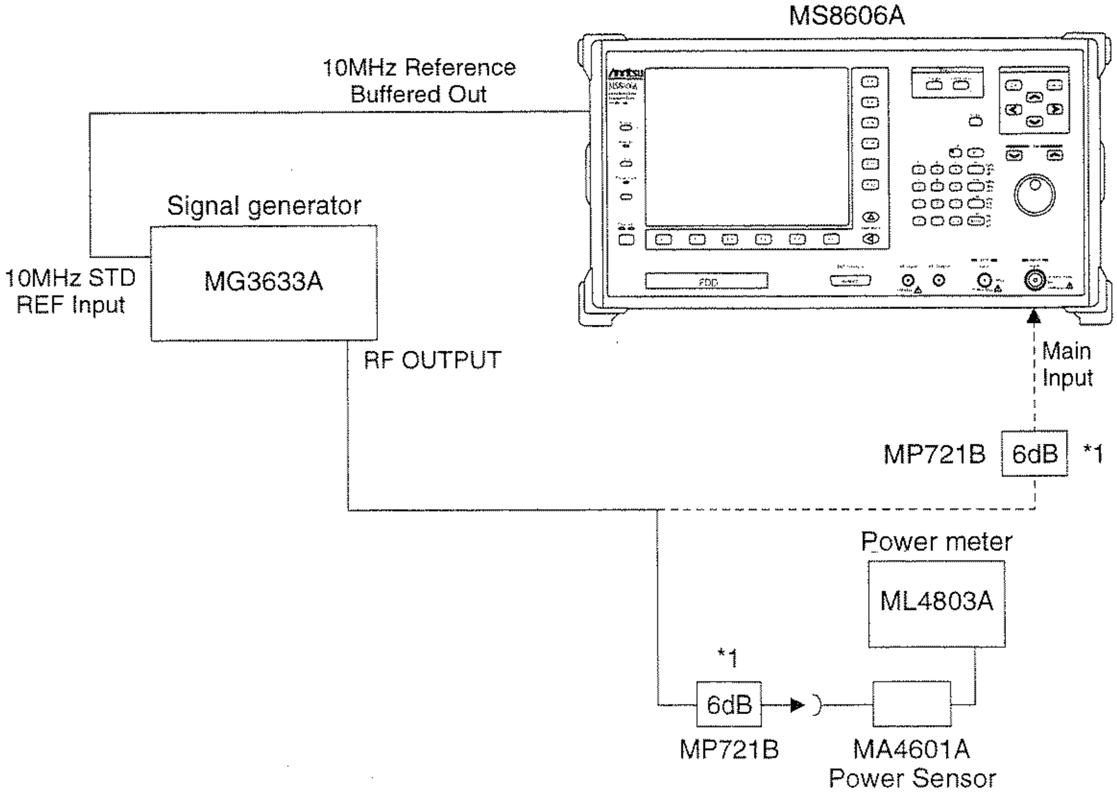
(2) Test instruments

• Signal generator:	MG3633A
• Fixed attenuator:	MP721B
• Power meter and sensor:	ML4803A and MA4601A

(3) Notes on test

- Calibrate the power meter and power sensor properly before performing a test.
- If the measurement frequency is changed, also correct the calibration coefficient of the power sensor.
- Use the 6 dB attenuator to improve the impedance of the signal source.

(4) Setup



*1 The 6 dB attenuator is used to improve the impedance of the signal source.

(5) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Specify Power Measure Method=Power Meter and TX Power Measure Range=+10.0 dBm on the Setup TX Measure Parameter (Analog) screen.
3.	Set the MS8606A to TX Measure (Analog) mode.
4.	Execute Power Meter Zero Set of the RF Level/Power function.
5.	Specify the RF frequency of the MS8606A.
6.	Specify the RF frequency of the signal generator.
7.	Connect the output of the signal generator to the power sensor and calibrate the output level of the signal generator so that the value indicated on the power meter becomes +10.0 dBm.
8.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
9.	After executing Adjust Range, read the RF Power value indicated on the MS8606A.
10.	Change the RF frequency of the MS8606A in accordance with the table below, and repeat the measurement (steps 5 to 9).

RF analyzer power meter (wide-band) accuracy

RF Frequency(MHz)	0.3	1	10	100	300	1000	1500	2000	2700
RF Power(dBm)									

(Input + 10.0 dBm)

5.3.2.2 FM demodulation deviation accuracy

(1) Specifications

Accuracy:	1% of indicated value + residual FM (Demodulation frequency : 1 kHz)

(2) Test instruments

• Signal generator:	MG3633A
• Spectrum analyzer:	MS2602A
• AF oscillator:	8903B

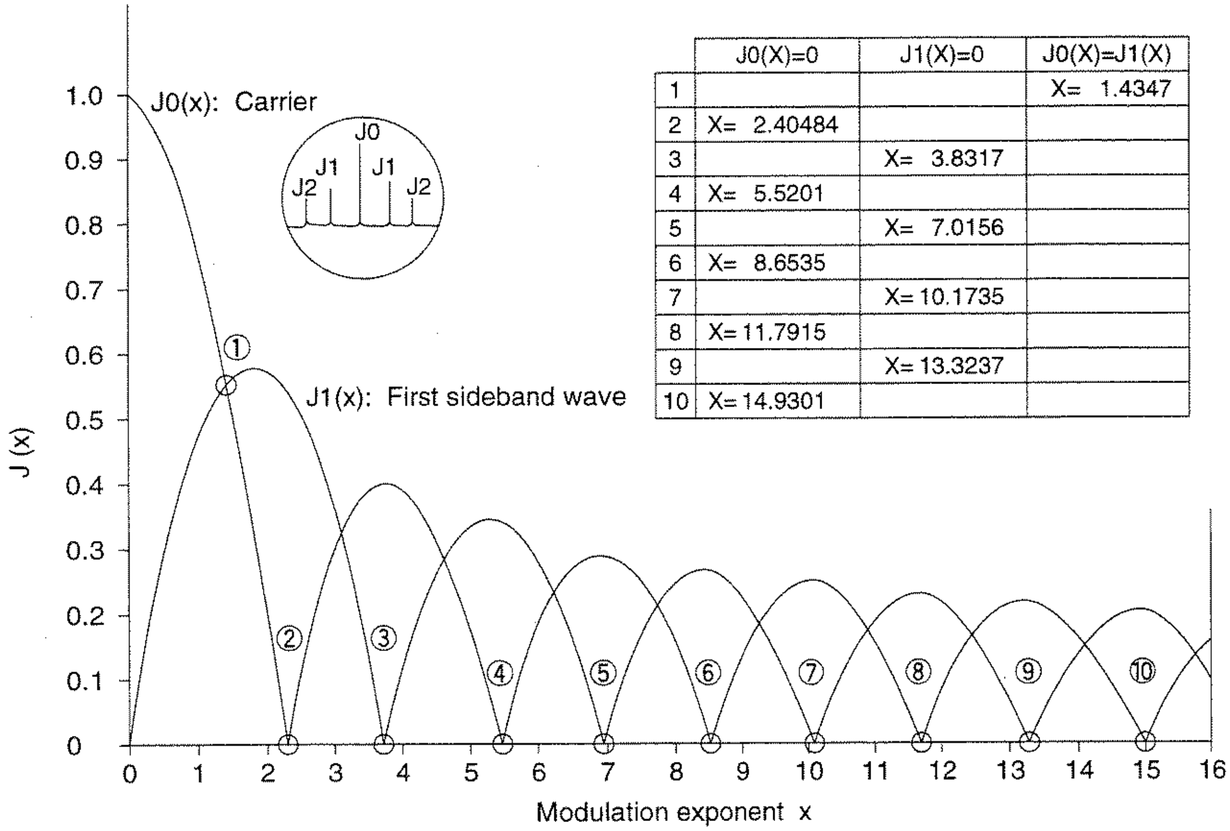
(3) Notes on test

- Calibrating FM deviation of signal generator

The figure below shows the relationship among modulation exponent x, carrier element J0(x), and first sideband wave element J1(x) of the FM-modulated signal. The relationship among modulation exponent x, FM deviation fd, and modulating frequency fp can be represented by fd = fp*x. Therefore, when the modulating frequency is 1 kHz, the FM deviations listed in the table below make carrier element jo(x) zero. The table below lists the residuals of the carrier erasing elements and calibration accuracies of the FM deviations.

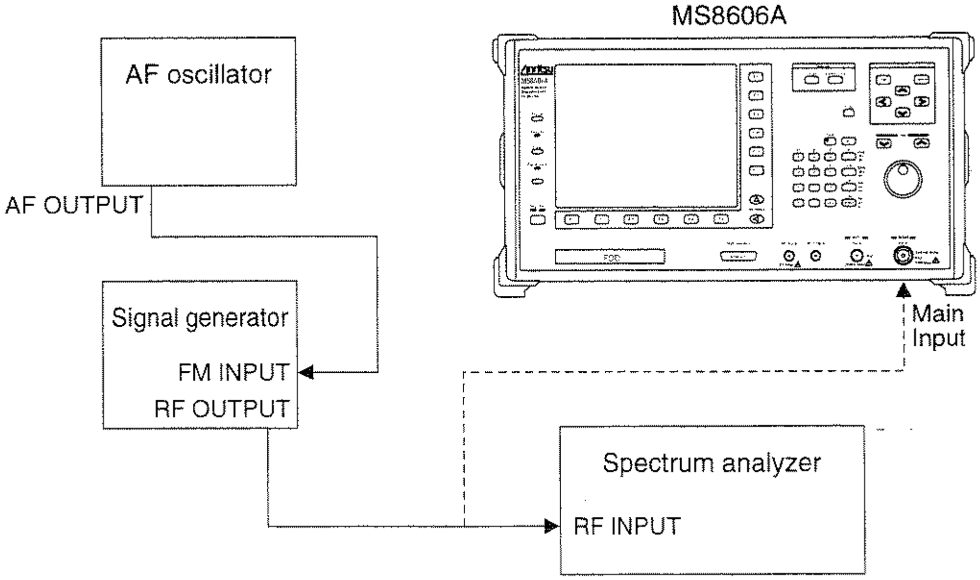
FM deviations to be calibrated and calibration accuracies for modulating frequency of 1 kHz

Jo(x)=0(W=0) count and FM deviation to be calibrated	Erasing element residual		
	Calibration accuracy = ±0.2%	Calibration accuracy = ±0.5%	Calibration accuracy = ±1%
CW=0 (1st time) 2.40484kHz	-52dB (0.00250)	-43.6dB (0.00663)	-38.1dB (0.0124)
CW=0 (2nd time) 5.52009kHz	-48.6dB (0.00374)	-40.6dB (0.00937)	-34.6dB (0.0187)
CW=0 (3rd time) 8.6535kHz	-46.6dB (0.00468)	-38.6dB (0.0117)	-32.7dB (0.0233)
CW=0 (4th time) 11.7915kHz	-45.8dB (0.0515)	-37.2dB (0.0138)	-31.3dB (0.0271)
CW=0 (5th time) 14.9301kHz	-44.2dB (0.0615)	-36.3dB (0.0154)	-30.3dB (0.0306)



	J0(X)=0	J1(X)=0	J0(X)=J1(X)
1			X= 1.4347
2	X= 2.40484		
3		X= 3.8317	
4	X= 5.5201		
5		X= 7.0156	
6	X= 8.6535		
7		X= 10.1735	
8	X= 11.7915		
9		X= 13.3237	
10	X= 14.9301		

(4) Setup



(5) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Set the MS8606A to TX Measure (Analog) mode.
3.	Specify the RF frequency of the MS8606A.
4.	Specify Demod.=FM, HPF=300 Hz, and LPF=3 kHz with the Deviation function of the MS8606A.
5.	Specify Level=10 mV and Freq=1 kHz for the AF oscillator.
6.	Set the output level to 0 dBm, RF frequency, external FM, and FM deviation to 5 kHz for the signal generator.
7.	Increase the AF level of the AF oscillator gradually. At this time, fix the AF level of the AF oscillator at the location where the carrier element of the waveform (FM modulation wave) observed by the spectrum analyzer is erased first.
8.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
9.	Read the deviation value indicated on the MS8606A.

FM demodulation deviation accuracy of RF analyzer

FM deviation calibrated value (kHz)	
FM demodulation deviation (kHz)	

5.3.2.3 FM demodulating frequency characteristics

(1) Specifications

Demodulation frequency range:	20 Hz to 20 kHz
Frequency characteristics:	±0.5 dB (Refered to demodulation frequency : 1 kHz as reference)

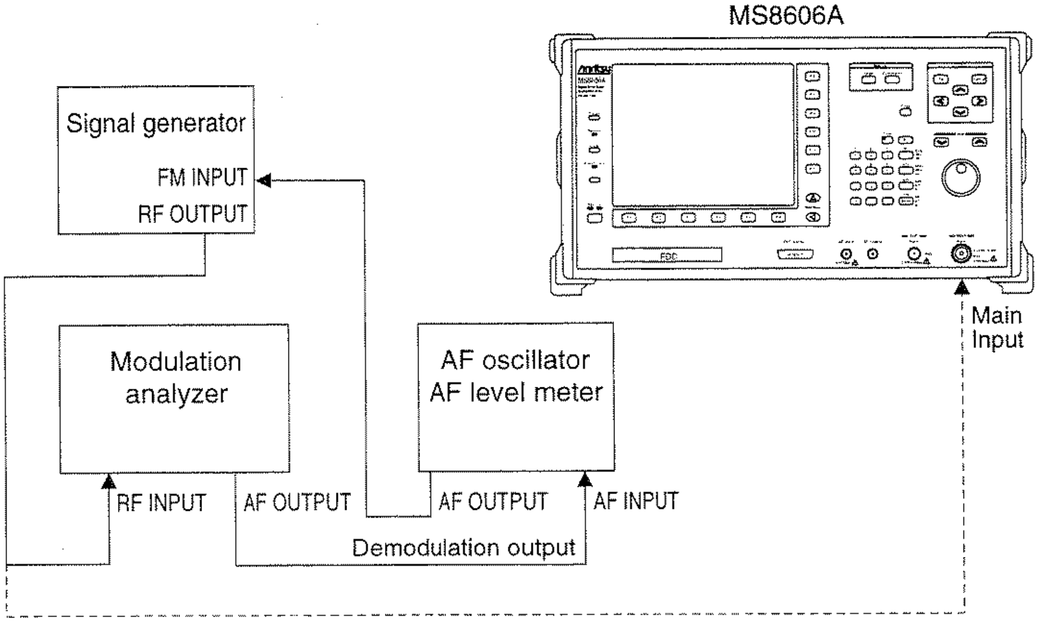
(2) Test instruments

• Signal generator:	MG3633A
• Modulation analyzer:	MS616B
• AF oscillator and AF level meter:	8903B

(3) Note on test

- Set the demodulation band of the modulation analyzer from less than 20 Hz to more than 200 kHz.

(4) Setup



(5) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Set the MS8606A to TX Measure (Analog) mode.
3.	Specify the RF frequency of the MS8606A.
4.	Specify Demod.=FM, HPF=OFF, and LPF=OFF with the Deviation function of the MS8606A.
5.	Specify Freq=1 kHz for the AF oscillator.
6.	Set the output level to 0 dBm, RF frequency, external FM, and FM deviation to 20 kHz for the signal generator.
7.	Adjust the AF oscillator level so that the deviation value indicated on the modulation analyzer becomes 5 kHz. Specify the value indicated on the AF level meter (demodulation output of the modulation analyzer) at this time to AF0.
8.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
9.	Read the AF level value indicated on the MS8606A.
10.	Specify Freq=20 Hz for the AF oscillator.
11.	Reconnect the output of the signal generator to RF INPUT of the modulation analyzer.
12.	Adjust the AF oscillator level so that the deviation value indicated on the modulation analyzer becomes 5 kHz. At this time, adjust the AF oscillator level so that the value indicated on the AF level meter (demodulation output of the modulation analyzer) becomes AF0 obtained in step 7.
13.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
14.	Read the level value indicated on the MS8606A.
15.	Change the frequency of the AF oscillator in accordance with the table below, and measure deviations against the AF level at 1 kHz (steps 11 to 14).

FM demodulating frequency characteristics of RF analyzer

Modulating frequency (kHz)	0.02	0.3	1	3	10	20
Deviation (dB)			0.0			

5.3.2.4 Demodulation residual FM

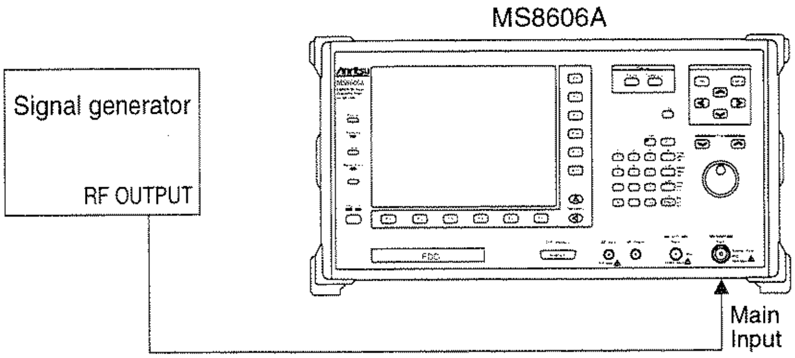
(1) Specifications

Residual FM:	8 Hz rms (demodulation band : 0.3 to 3 kHz)

(2) Test instrument

- Signal generator: MG3633A

(3) Setup



(4) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Set the MS8606A to TX Measure (Analog) mode.
3.	Specify the RF frequency of the MS8606A.
4.	Specify Demod.=FM, Det mode=rms, HPF=300 Hz, and LPF=3 kHz with the Deviation function of the MS8606A.
5.	Set the output level to 0 dBm and RF frequency for the signal generator.
6.	Read the deviation value (demodulation residual FM) indicated on the MS8606A.

Demodulation residual FM of RF analyzer

Demodulation residual FM (Hz rms)	

5.3.2.5 FM demodulation distortion

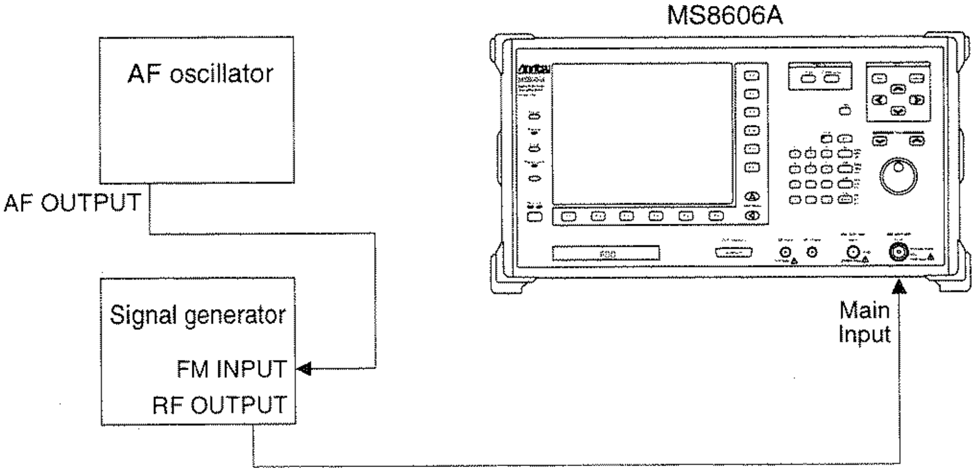
(1) Specifications

Demodulation distortion: 0.30% (Demodulation frequency : 1 kHz, frequency deviation:5 kHz, demodulation band : 0.3 to 3 kHz)

(2) Test instruments

- Signal generator: MG3633A
- AF oscillator: 8903B

(3) Setup



(4) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Set the MS8606A to TX Measure (Analog) mode.
3.	Specify the RF frequency of the MS8606A.
4.	Specify Demod.=FM, HPF=300 Hz, and LPF=3 kHz with the Deviation function of the MS8606A.
5.	Specify Freq=1 kHz for the AF oscillator.
6.	Set the output level to 0 dBm, RF frequency, external FM, and FM deviation to 20 kHz for the signal generator.
7.	Adjust the AF oscillator level so that the Deviation value indicated on the MS8606A becomes 5 kHz.
8.	Read the Distortion value indicated on the MS8606A.

FM demodulation distortion of RF analyzer

FM demodulation distortion (%)	

5.3.2.6 øM demodulation deviation accuracy

(1) Specifications

Accuracy: 1% of indicated value + residual øM (Demodulation frequency : 1 kHz)

(2) Test instruments

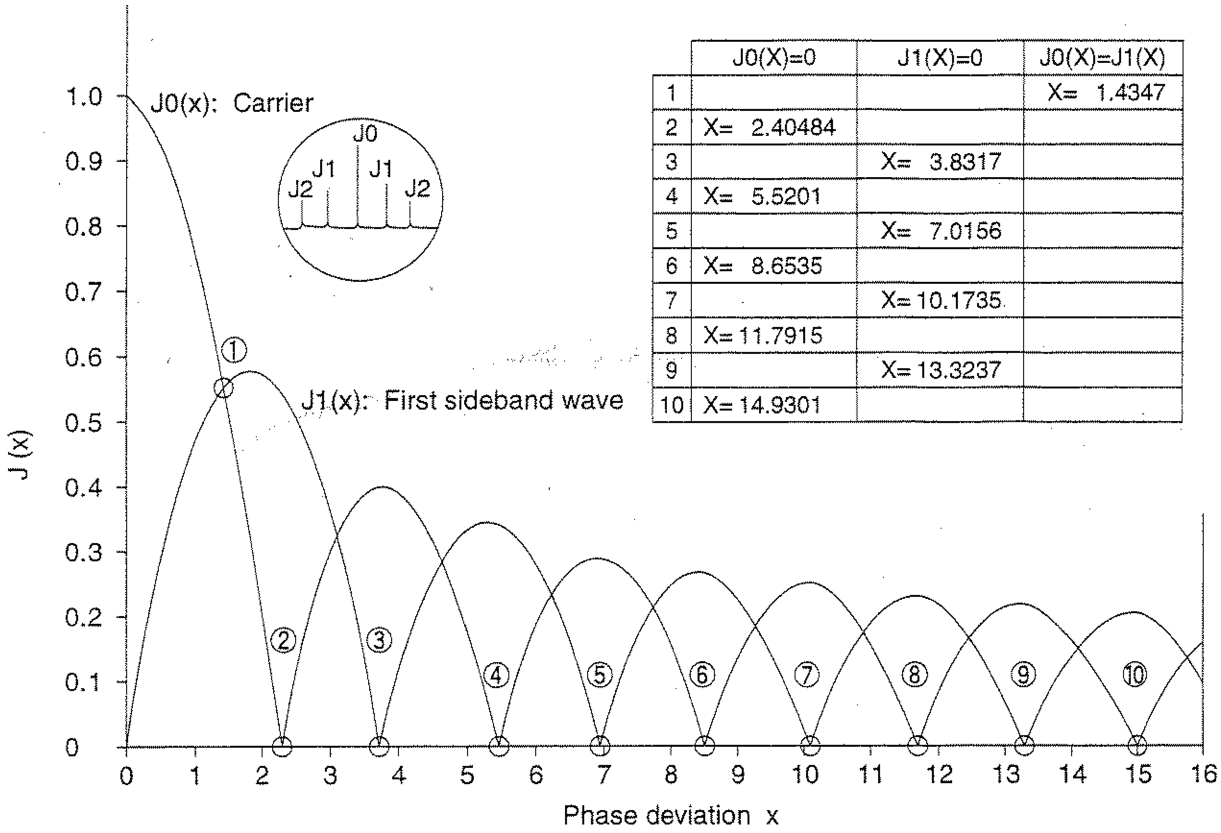
- Signal generator: MG3633A
- Spectrum analyzer: MS2602A
- AF oscillator: 8903B

(3) Notes on test

- Calibrating øM deviation of signal generator
  The figure below shows the relationship among phase deviation x, carrier element J0(x), and first sideband wave element J1(x) of the øM-modulated signal. The table below lists the residuals of carrier erasing elements and calibration accuracies of øM deviations at this time.

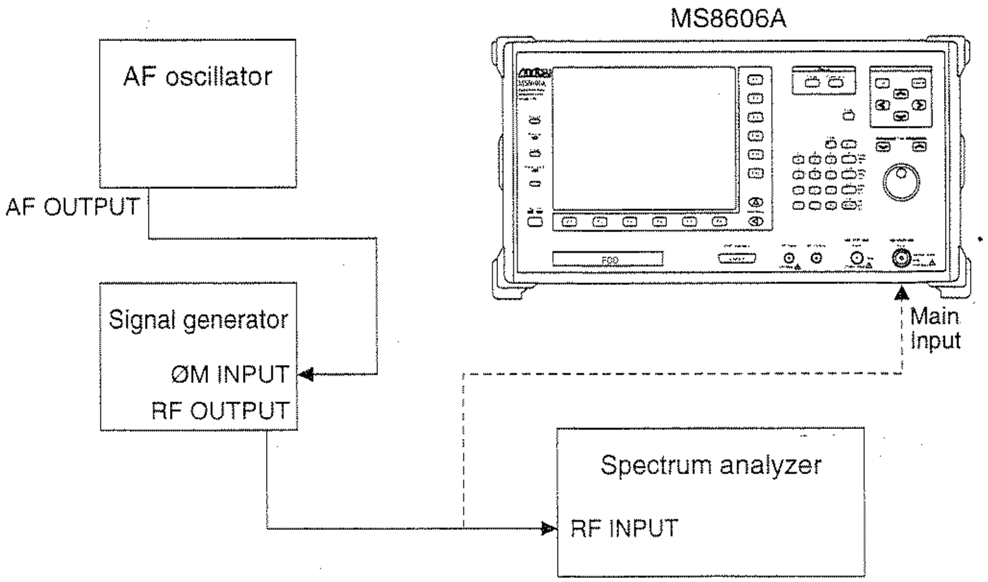
øM deviations to be calibrated for J0(x)=0(CW=0) counts and calibration accuracies

J0(x)=0(CW=0) count and øM deviation to be calibrated	Erasing element residual		
	Calibration accuracy = ±0.2%	Calibration accuracy = ±0.5%	Calibration accuracy = ±1%
CW=0 (1st time) 2.40484rad	-52dB (0.00250)	-43.6dB (0.00663)	-38.1dB (0.0124)
CW=0 (2nd time) 5.52009rad	-48.6dB (0.00374)	-40.6dB (0.00937)	-34.6dB (0.0187)
CW=0 (3rd time) 8.6535rad	-46.6dB (0.00468)	-38.6dB (0.0117)	-32.7dB (0.0233)
CW=0 (4th time) 11.7915rad	-45.8dB (0.0515)	-37.2dB (0.0138)	-31.3dB (0.0271)
CW=0 (5th time) 14.9301rad	-44.2dB (0.0615)	-36.3dB (0.0154)	-30.3dB (0.0306)



	J0(X)=0	J1(X)=0	J0(X)=J1(X)
1			X= 1.4347
2	X= 2.40484		
3		X= 3.8317	
4	X= 5.5201		
5		X= 7.0156	
6	X= 8.6535		
7		X= 10.1735	
8	X= 11.7915		
9		X= 13.3237	
10	X= 14.9301		

(4) Setup



(5) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Set the MS8606A to TX Measure (Analog) mode.
3.	Specify the RF frequency of the MS8606A.
4.	Specify Demod.=øM, HPF=300 Hz, and LPF=3 kHz with the Deviation function of the MS8606A.
5.	Specify Level=10 mV and Freq=1 kHz for the AF oscillator.
6.	Set the output level to 0 dBm, RF frequency, external øM, and øM deviation to 5 rad for the signal generator.
7.	Increase the AF level of the AF oscillator gradually. At this time, fix the AF level of the AF oscillator at the location where the carrier element of the waveform (øM-modulated wave) observed by the spectrum analyzer is erased first.
8.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
9.	Read the Deviation value indicated on the MS8606A.

øM demodulation deviation accuracy of RF analyzer

øM deviation calibrated value (rad)	
øM modulation deviation (rad)	

5.3.2.7 Demodulation residual øM

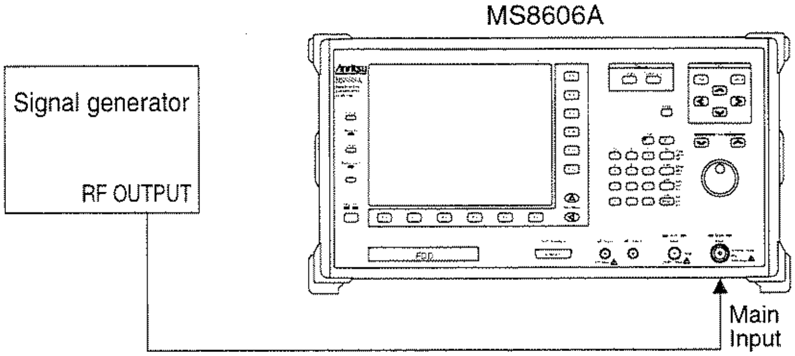
(1) Specifications

Residual øM: 0.01 rad rms (demodulation band : 0.3 to 3 kHz)

(2) Test instrument

- Signal generator: MG3633A

(3) Setup



(4) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Set the MS8606A to TX Measure (Analog) mode.
3.	Specify the RF frequency of the MS8606A.
4.	Specify Demod.=øM, Det mode=rms, HPF=300 Hz, and LPF=3 kHz with the Deviation function of the MS8606A.
5.	Set the output level to 0 dBm and RF frequency for the signal generator.
6.	Read the Deviation value (modulation residual øM) indicated on the MS8606A.

Demodulation residual øM of RF analyzer

Demodulation residual øM (rad rms)	

5.3.2.8 FM demodulation output frequency characteristics

(1) Specifications

Demodulation frequency range: 50 Hz to 10 kHz

Frequency characteristics: ±1 dB (refered to demodulation frequency : 1 kHz as reference)

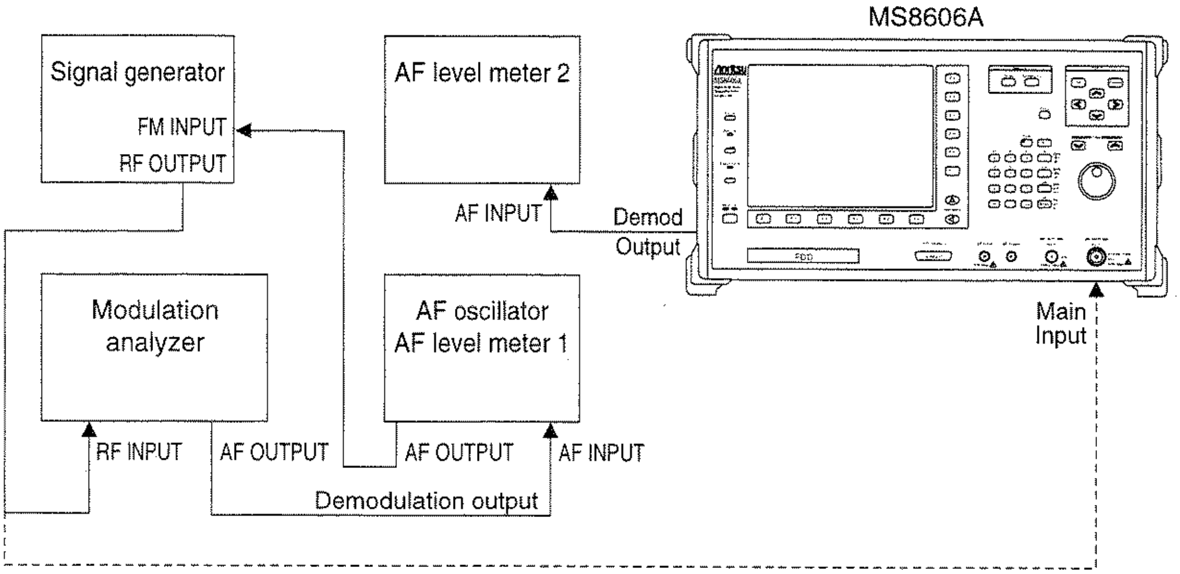
(2) Test instruments

- Signal generator: MG3633A
- Modulation analyzer: MS616B
- AF oscillator and AF level meter: 8903B

(3) Note on test

- Set the demodulation band of the modulation analyzer from less than 20 Hz to more than 200 kHz.

(4) Setup



(5) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Specify Range=40 kHz, HPF=OFF, and LPF=OFF on the Setup TX Measure Parameter (Analog) screen.
3.	Set the MS8606A to TX Measure (Analog) mode.
4.	Specify the RF frequency of the MS8606A.
5.	Specify Demod.=FM, HPF=OFF, and LPF=OFF with the Deviation function of the MS8606A.
6.	Specify Freq=1 kHz for the AF oscillator.
7.	Set the output level to 0 dBm, RF frequency, external FM, and FM deviation to 20 kHz for the signal generator.
8.	Adjust the AF oscillator level so that the Deviation value indicated on the modulation analyzer becomes 5 kHz. Specify the value indicated on AF level meter 1 (demodulation output of the modulation analyzer) at this time to AF1.
9.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
10.	Measure Demod Output of the MS8606A with AF level meter 2.
11.	Specify Freq=50 Hz for the AF oscillator.
12.	Reconnect the output of the signal generator to RF INPUT of the modulation analyzer.
13.	Adjust the AF oscillator level so that the Deviation value indicated on the modulation analyzer becomes 5 kHz. Adjust the AF oscillator level so that the value indicated on AF level meter 1 (demodulation output of the modulation analyzer) becomes AF1 obtained in step 8.
14.	Reconnect the output of the signal generator to the Main input connector of the MS8606A.
15.	Measure Demod Output of the MS8606A with AF level meter 2.
16.	Change the frequency of the AF oscillator in accordance with the table below, and measure deviations against the AF level at 1 kHz (steps 12 to 15).

FM demodulation output frequency characteristics of RF analyzer

Modulating frequency (kHz)	0.05	0.3	1	3	10
Deviation (dB)			0.0		

5.3.2.9 FM demodulation output distortion

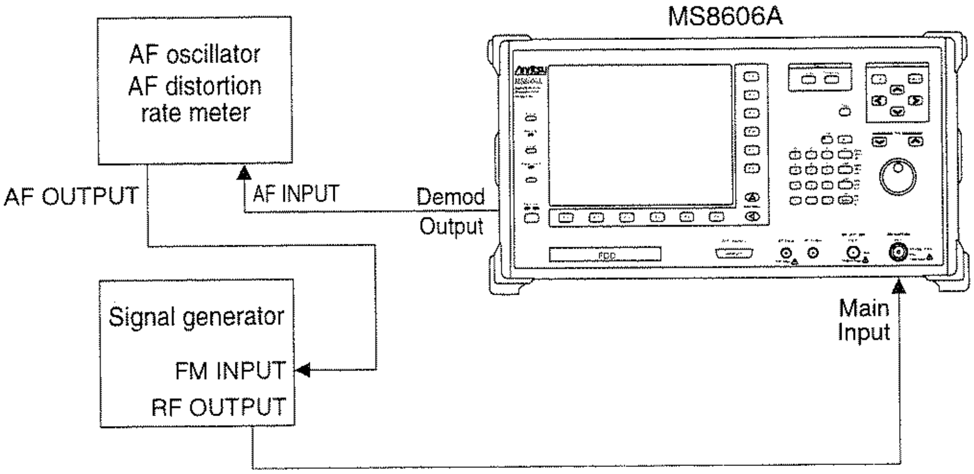
(1) Specifications

Demodulation distortion: 1% (Demodulation frequency : 1 kHz, frequency deviation : 4 kHz, 4 kHz range, demodulation band : 0.3 to 3 kHz)

(2) Test instruments

- Signal generator: MG3633A
- AF oscillator and AF distortion rate meter: 8903B

(3) Setup



(4) Test procedures

Step	Procedure
1.	Set the MS8606A input connector to Main on the Instrument Setup screen.
2.	Specify Range=4 kHz, HPF=300 Hz, and LPF=3 kHz on the Setup TX Measure Parameter (Analog) screen.
3.	Set the MS8606A to TX Measure (Analog) mode.
4.	Specify the RF frequency of the MS8606A.
5.	Specify Demod.=FM, HPF=300 Hz, and LPF=3 kHz with the Deviation function of the MS8606A.
6.	Specify Freq=1 kHz for the AF oscillator.
7.	Set the output level to 0 dBm, RF frequency, external FM, and FM modulation to 20 kHz for the signal generator.
8.	Adjust the AF oscillator level so that the Deviation value indicated on the MS8606A becomes 4 kHz.
9.	Measure Demod Output of the MS8606A with the AF distortion rate meter.

FM demodulation output distortion of RF analyzer

FM demodulation distortion (%)	

5.3.3 Audio analyzer

5.3.3.1 Evaluation filter characteristics

(1) Specifications

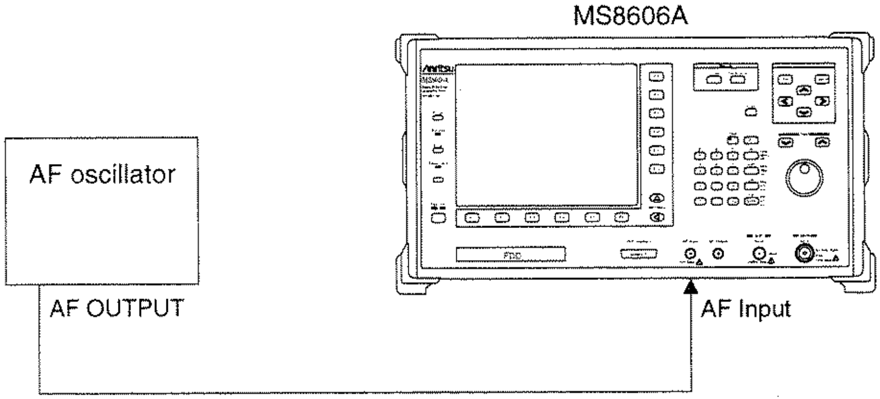
Conforms to ITU-T P.53.

Conforms to C-MESSAGE.

(2) Test instrument

- AF oscillator: 8903B

(3) Setup



(4) Test procedures

Step	Procedure
ITU-T P.53 features	
1.	Set the MS8606A to AF Measure (Analog) mode.
2.	Specify Filter=ITU-T P.53 with the AF Level function of the MS8606A.
3.	Specify Freq=800 Hz and Level=1 V for the AF oscillator.
4.	Read the AF level indicated on the MS8606A.
5.	Change the frequency of the AF oscillator in accordance with the table below, and measure deviations against the AF level at 800 Hz.
For C-MESSAGE, measure the deviations in the same procedures with the reference frequency of 1 kHz.	

< ITU-T P.53 >

Frequency (Hz)	Attenuation (dB)	Measured value (dB)
50	63±5	
100	41±2	
150	29±2	
200	21±2	
300	10.6±1	
400	6.3±1	
500	3.6±1	
600	2.0±1	
800	0.0(standard)	
1 k	-1.0±1	
1.2 k	0.0±1	
1.5 k	1.3±1	
2 k	3.0±1	
2.5 k	4.2±1	
3 k	5.6±1	
3.5 k	8.5±1	
4 k	15±3	
5 k	36±3	

< C-MESSAGE >

Frequency (Hz)	Attenuation (dB)	Measured value (dB)
60	55.7±5	
100	42.5±2	
200	25.0±2	
300	16.5±1	
400	11.4±1	
500	7.5±1	
600	4.7±1	
700	2.7±1	
800	1.5±1	
900	0.6±1	
1 k	0.0(standard)	
1.2 k	0.2±1	
1.3 k	0.5±1	
1.5 k	1.0±1	
1.8 k	1.3±1	
2 k	1.3±1	
2.5 k	1.4±1	
2.8 k	1.9±1	
3 k	2.5±1	
3.3 k	5.2±2	
3.5 k	7.6±2	
4 k	14.5±3	
4.5 k	21.5±3	
5 k	28.5±3	
5 k or more	≥12 dB/oct (must be attenuated to 60 dB)	

5.3.3.2 AF level measurement accuracy

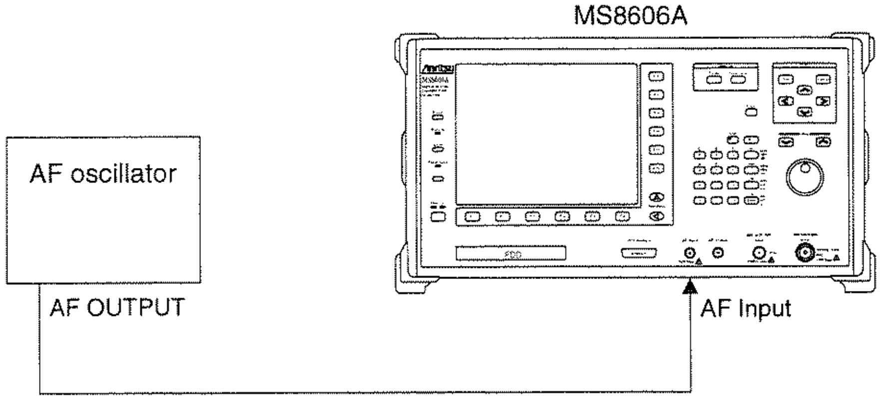
(1) Specifications

Frequency range:	30 Hz to 20 kHz
Input level range:	1 mV rms to 30 V rms
Accuracy:	±0.5 dB

(2) Test instrument

- AF oscillator: 8903B

(3) Setup



(4) Test procedures

Step	Procedure
1.	Set the MS8606A to AF Measure (Analog) mode.
2.	Specify the AF oscillator level.
3.	Specify the AF oscillator frequency and read the AF level value indicated on the MS8606A.
4.	Change the frequency of the AF oscillator in accordance with the table below, and repeat the measurement.

AF level measurement accuracy of audio analyzer

Frequency(kHz)	0.03	0.1	0.3	1	3	10	20
AF Level(V)							

5.3.3.3 Distortion rate measurement accuracy

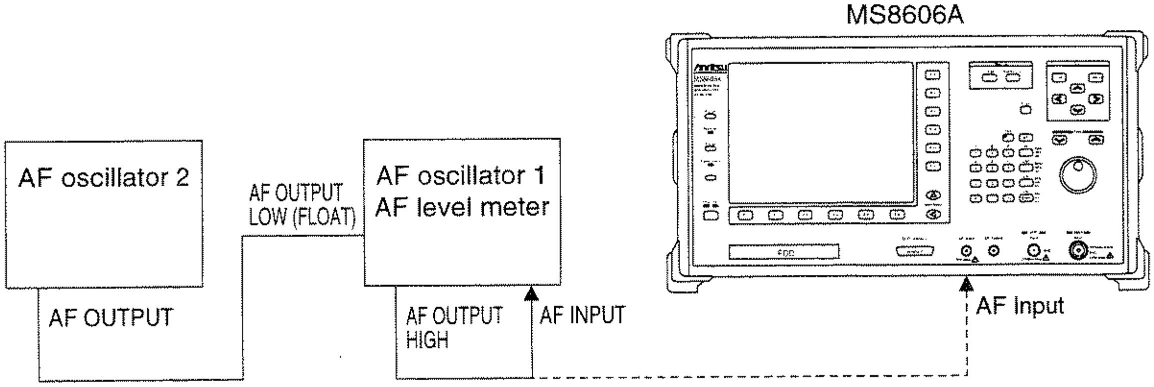
(1) Specifications

Frequency range:	100 Hz to 5 kHz
Input level range:	30 mV rms to 30 V rms
Accuracy:	±1 dB (frequency : 1 kHz, distortion rate : 1%)

(2) Test instrument

- AF oscillator and AF level meter: 8903B

(3) Setup



(4) Test procedures

Step	Procedure
1.	Set the MS8606A to AF Measure (Analog) mode.
2.	Specify Level=6 V and Frequency=1 kHz for AF oscillator 1, and specify Level=0 V and Frequency=2 kHz for AF oscillator 2.
3.	Adjust the AF oscillator 1 level so that the value indicated on the AF level meter becomes 6 V. Specify the level value set at this time to AF1.
4.	Specify Level=0 V for AF oscillator 1, then adjust the AF oscillator 2 level so that the value indicated on the AF level meter becomes 60 mV.
5.	Specify Level=AF1 for AF oscillator 1, then reconnect the output of AF oscillator 1 (distortion rate = -40 dB) to the AF Input connector of the MS8606A.
6.	Read the Distortion value indicated on the MS8606A.

Distortion rate measurement accuracy of audio analyzer

Distortion rate (dB)	
Deviation (dB)	

5.3.4 Example of performance test result entry sheet

This paragraph gives an example of sheets used to summarize the results of a performance test on Analog measurement (Including Option 01) of the MS8606A.

Use a copy of this sheet for the performance test.

AF oscillator

Output level accuracy

AF level set value (V))	0.001	0.01	0.1	0.3	1	3
Level measured value (V)						

(AF level output Impedance=600Ω)

Waveform distortion

AF Frequency(kHz)	0.02	0.3	1	3	10	20
Waveform distortion (dB)						

RF analyzer

Power meter (wide-band) accuracy

RF Frequency(MHz)	0.3	1	10	100	300	1000	1500	2000	2700
RF Power(dBm)									

(Input + 10.0 dBm)

FM demodulation deviation accuracy

FM deviation calibrated value (kHz)	
FM demodulation deviation (kHz)	

FM demodulating frequency characteristics

Modulating frequency (kHz)	0.02	0.3	1	3	10	20
Deviation (dB)			0.0			

Demodulation residual FM

Demodulation residual FM (Hz rms)	

FM demodulation distortion

FM demodulation distortion (%)	

øM demodulation deviation accuracy

øM deviation calibrated value (rad)	
øM modulation deviation (rad)	

Demodulation residual øM

Demodulation residual øM (rad rms)	

FM demodulation output frequency characteristics

Modulating frequency (kHz)	0.05	0.3	1	3	10
Deviation (dB)			0.0		

FM demodulation output distortion

FM demodulation distortion (%)	

Audio analyzer

Evaluation filter characteristics

AF level measurement accuracy

Frequency(kHz)	0.03	0.1	0.3	1	3	10	20
AF Level(V)							

Distortion rate measurement accuracy

Distortion rate (dB)	
Deviation (dB)	

SECTION 6
CALIBRATION

This section describes the measuring instruments required to calibrate the MS8606A, and the setup and calibration method for these instruments.

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6.1 Calibration Requirements

Calibration is done to help maintain the MS8606A's performance.

Calibration should be performed periodically even if the MS8606A is operating normally.

We recommend that the MS8606A be calibrated once or twice a year.

Contact the Service Department of Anritsu Corporation if the MS8606A fails to meet the specifications during calibration.

6.2 Equipment Required for Calibration

The table below shows the equipment required to calibrate each item.

Table 6.1 Equipment Required for Calibration

Recommended equipment	Required performance†	Calibration item
Frequency counter (MF1603A)	• 100 KHz to 3 GHz • Resolution: 1 Hz • External reference input: 10 MHz	Frequency accuracy of reference crystal oscillator
Frequency standard	Standard radio-wave receiver or equipment having equivalent function (accuracy better than 1 x 10^{-9})	Frequency accuracy of reference crystal oscillator

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

6.3 Calibration

Do not start the performance tests until the MS8606A and measuring instruments have warmed up for at least 24 hours and they have stabilized completely. To obtain the best measurement accuracy, do the calibration at room temperature. Keep AC power voltage fluctuations, noise, vibration, dust, humidity, and any other facxtors which can affect results to a minimum.

6.3.1 Calibrating the reference crystal oscillator

The stability of the MS8606A reference crystal oscillator is ±2 x 10^{-8}/day. Calibrate the frequency of the reference crystal oscillator by using a reference signal generator generating a reference signal that is either locked to a standard wave or to the sub-carrier of a TV broadcast on a color TV (the sub-carrier will be locked to a rubidium atomic standard).

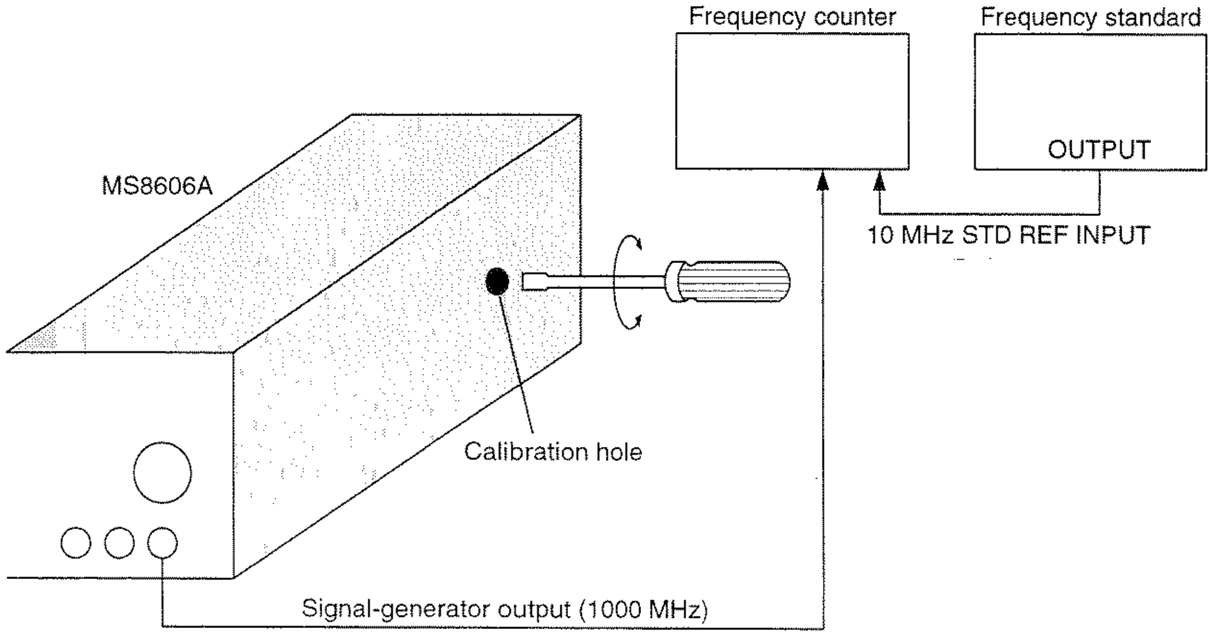
(1) Specifications

Reference oscillator	Frequency	Aging rate	Temperature characteristics
Standard type (after 24-hour operation)	10MHz	2 x 10^{-8}/day	±5 x 10^{-8} (0°C to 50°C)

(2) Instruments required for calibration

- Frequency counter: 10 MHz external reference input, resolution: 1 Hz
- Frequency standard: Standard radio-wave receiver or equipment having equivalent function (accuracy better than 1 x 10^{-9})

(3) Setup



(4) Calibration procedure

Step	Procedure
1.	Setup the equipment as shown in the figure above. The ambient temperature must be 23°C ± 5°C.
2.	Set the Power switch on the rear panel to On and the Power switch on the front panel to the Standby position. Then, allow the MS8606A reference crystal oscillator to warm-up for 24 hours.
3.	Set the Power switch on the MS8606A front panel to On.
4.	Apply the standard frequency signal to the external reference input of the frequency counter.
5.	Set the frequency of the signal generator of the MS8606A to 1 000.000 000 MHz, the level to –28 dBm, and the modulation to off.
6.	Adjust the calibration trimmer of the crystal oscillator so that the frequency-counter reading is 1 000.000 000 MHz +/–10 Hz.

SECTION 7

STORAGE AND TRANSPORTATION

This section describes the long-term storage, repacking, and transportation of the MS8606A and the regular maintenance procedures.

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7.1 Cleaning the Cabinet

Always turn the MS8606A 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.
- Use a cloth moistened with diluted neutral cleaning liquid if the instrument is very dirty or before long-term storage. Then, use a soft, dry cloth to wipe the instrument dry.
- If loose screws are found, tighten them with the appropriate tools.

CAUTION ⚠

Never use benzine, thinner, or alcohol to clean the cabinet; these chemicals may damage the coating or cause deformation or discoloration.

7.2 Storage Precautions

This paragraph describes the procedures for long-term storage of the MS8606A.

7.2.1 Precautions before storage

(1) Before storage, wipe dust, finger-marks, and other contaminants off the MS8606A.

(2) Avoid storing the MS8606A where it may be exposed to:

1) Direct sunlight or high dust levels.

2) High humidity.

3) Active gasses or acid.

4) The following temperatures or humidity:

- Temperature: .... > 60 °C, < -20 °C
- Humidity: .... ≥ 90%

7.2.2 Recommended storage conditions

The recommended storage conditions are as follows:

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

7.3 Repacking and Transportation

Take the following precautions if the MS8606A must be returned to Anritsu Corporation for servicing.

7.3.1 Repacking

Use the original packing materials. If the MS8606A is packed in other materials, observe the following packing procedure:

(1) Wrap the MS8606A in a plastic sheet or similar material.

(2) Use a cardboard box, wooden box, or aluminum case which allows shock-absorbing material to be inserted on all sides of the MS8606A.

(3) Use enough shock-absorbing material to protect the MS8606A during transportation and to prevent it from moving in the container.

(4) Secure the container with packing straps, adhesive tape,or bands.

7.3.2 Transportation

Do not subject the MS8606A to severe vibration during transport. Also, transport under the storage conditions recommended in paragraph 7.2.

APPENDIXES

TABLE OF CONTENTS

Appendix A

Screen/ Function Key Change Figure

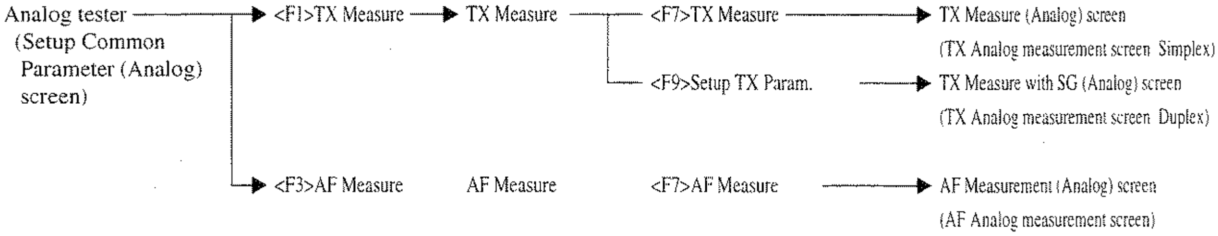
The change of screen and the change of function keys for each screen are illustrated in the figure.

[Screen Change] Refer to Item 3.2.

In any screen, when [Main Func: On Off] F6 key is turned on, the following main menu is displayed. When a main menu item is selected using the main function keys F1 to F5 or Next Menu key [<], the screen will change to the corresponding screen or key menu.

Note: Change Color is a function key menu, therefore there is no corresponding screen.

<F1>TX&RX → Setup Common Parameter screen
<F3>Analog Tester → Setup Common Parameter (Analog) screen
<F4>Recall → Recall Parameter screen
<F5>Save → Save Parameter screen
↑ By pressing the Next Menu key ◀,
↓ the screen changes up and down.
<F1>Change System → Change System screen
<F2>Instrument Setup → Instrument Setup screen
<F3>Change Color → Change Color menu
<F4>File Operation → File Operation screen

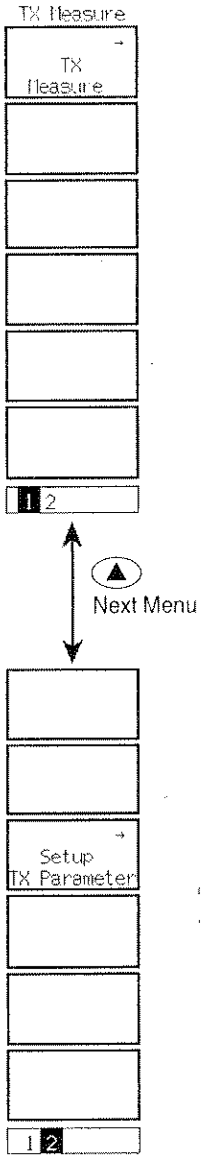


[Change of function keys for each screen]

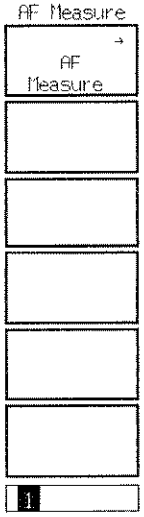
Note: When (Back Screen) or (Return) of F12 at the bottom of the displayed function keys is selected, the screen returns to the upper screen.

Setup common Parameter screen

If (F1) TX Measure is selected

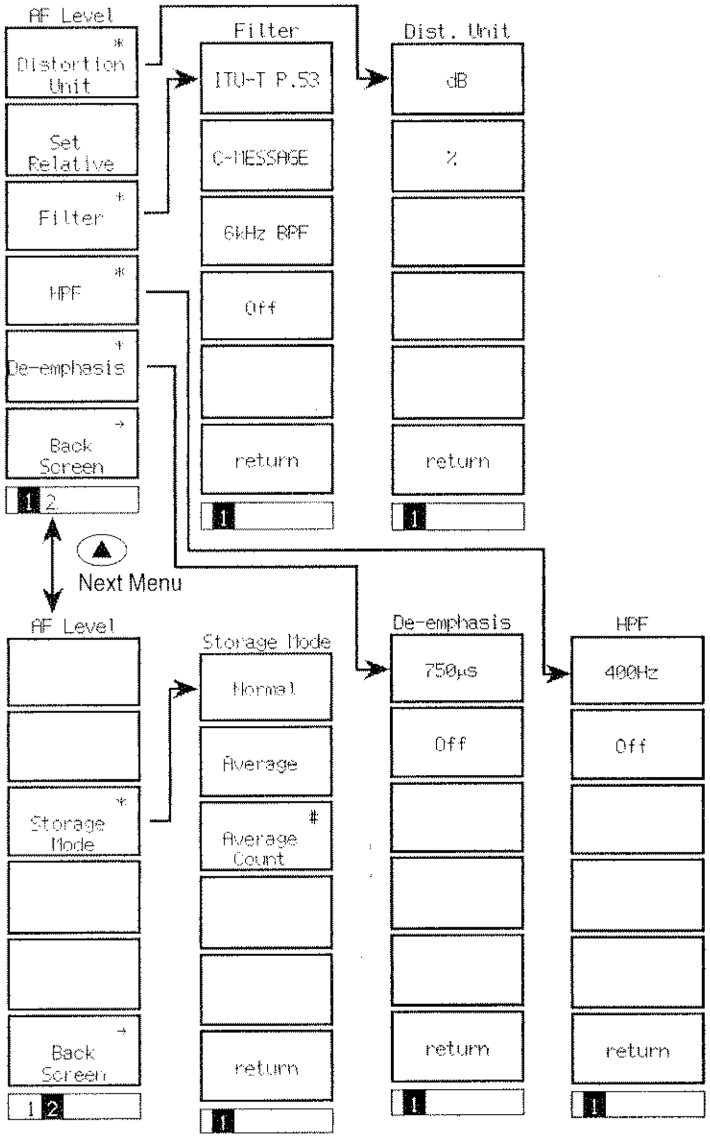


If (F3) AF Measure is selected

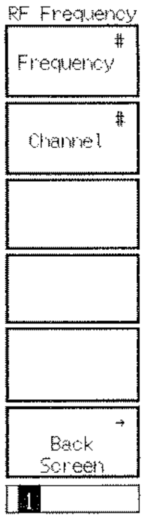


TX Measure (Analog) screen

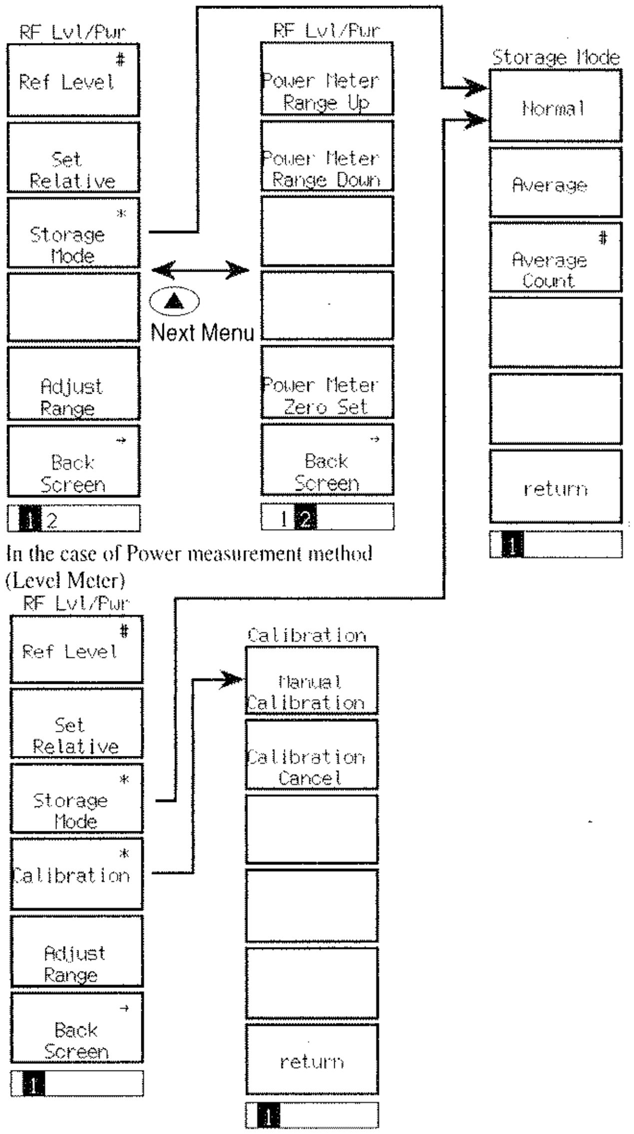
If (F1) AF Level is selected



If (F2) RF Frequency is selected



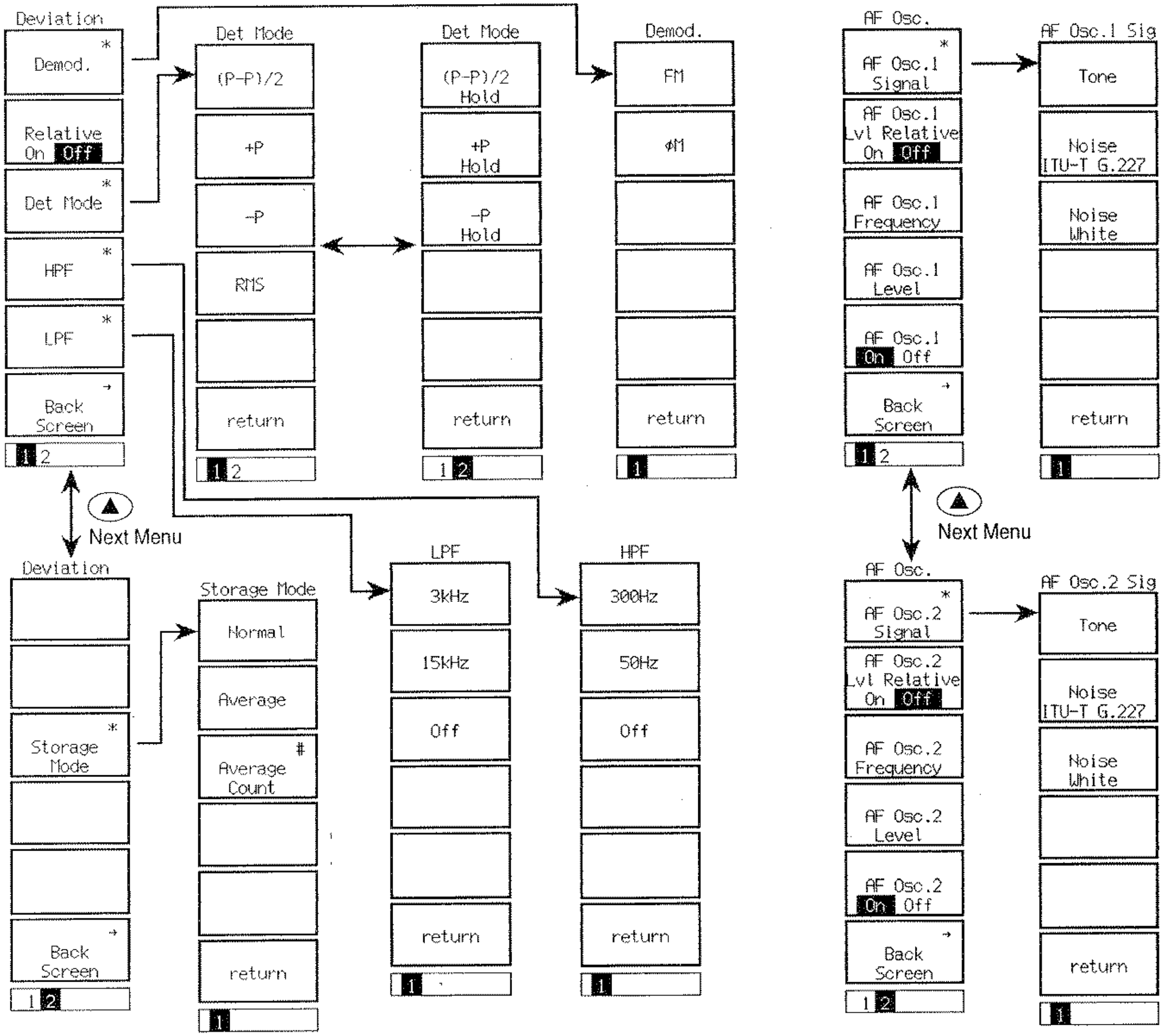
If (F3) RF Level/ Power is selected
In the case of Power measurement method (Power meter)



TX Measurement (Analog) screen

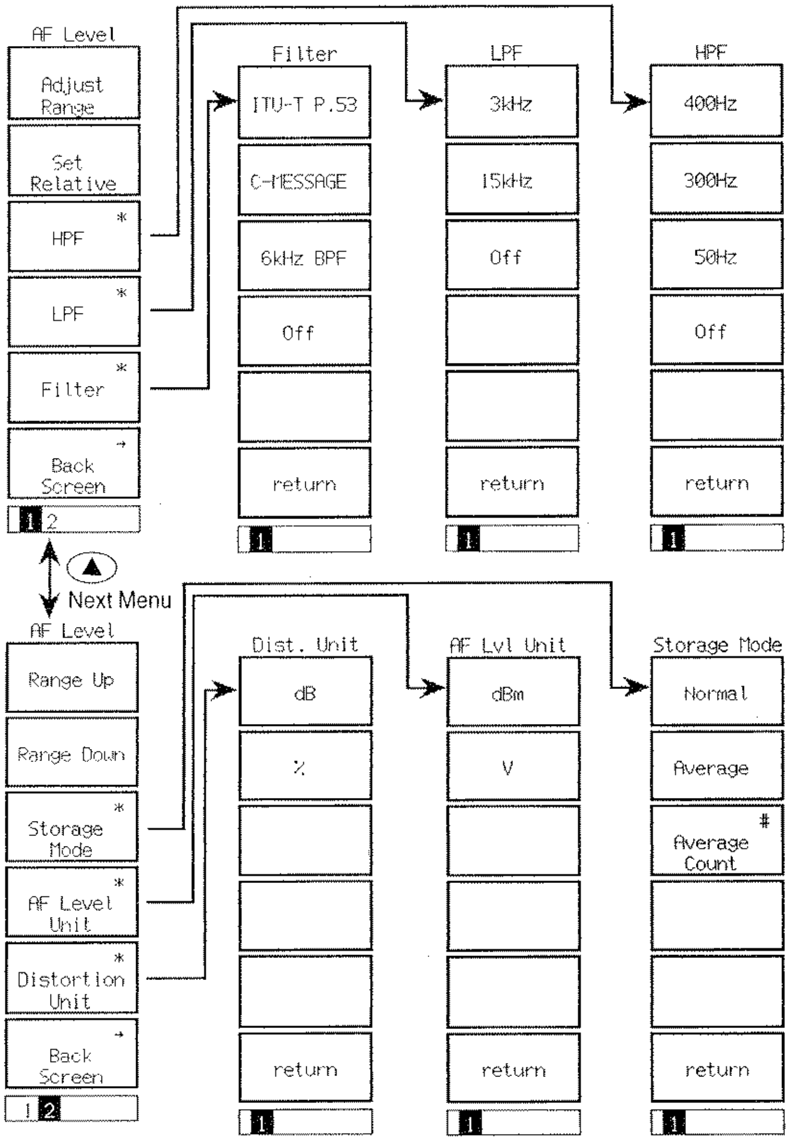
If (F4) Deviation is selected

If (F5) AF Osc. is selected (Enabled when option 01 is installed)

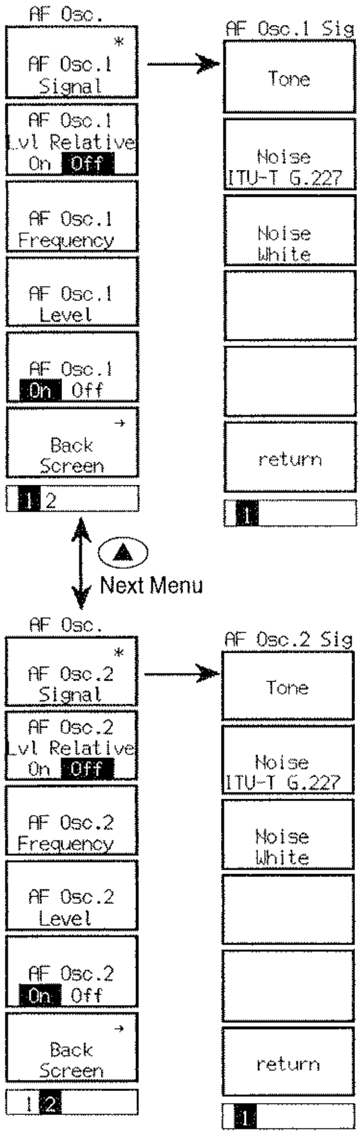


AF Measurement (Analog) screen

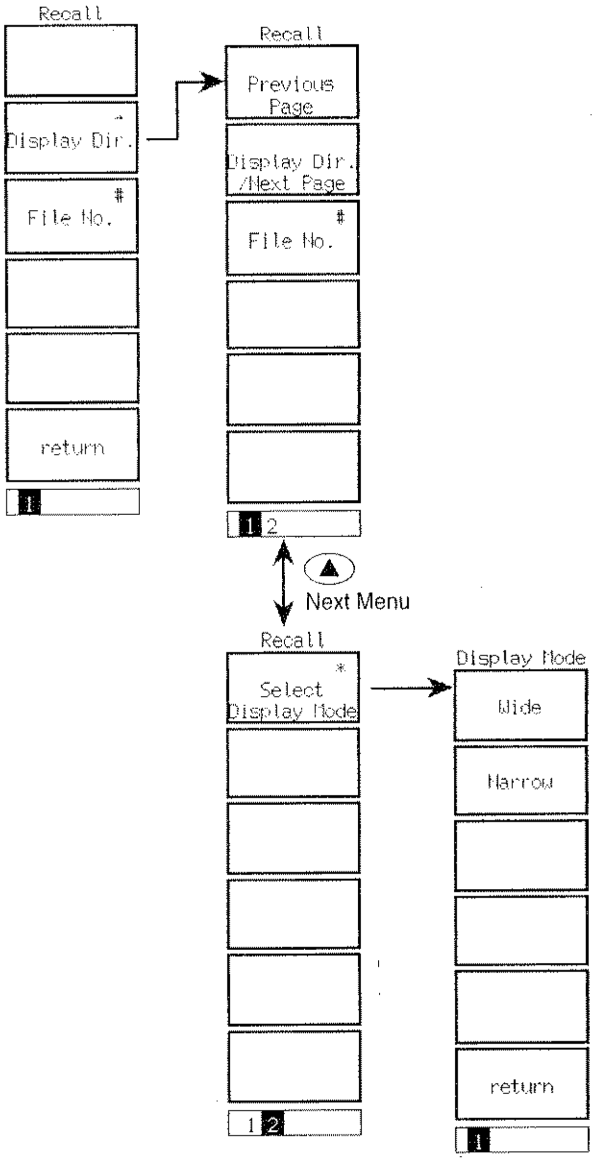
If (F1) AF Level is selected (Enabled when option 01 is installed)



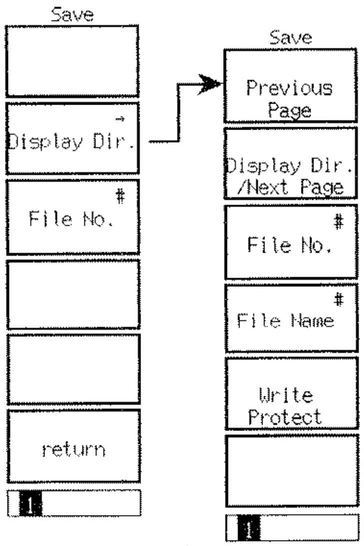
If (F5) AF Osc. is selected



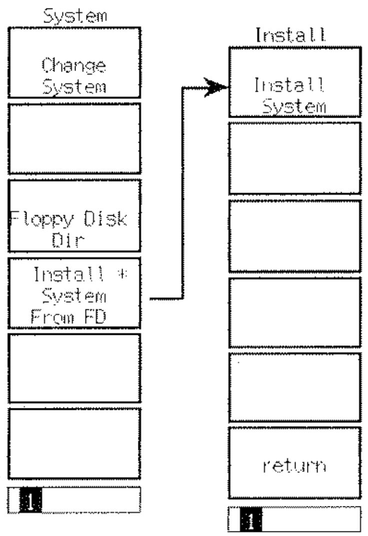
Recall screen



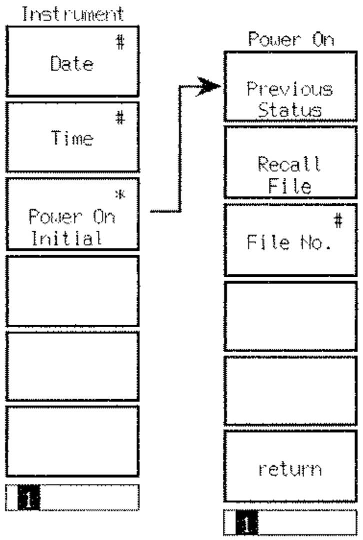
Save screen



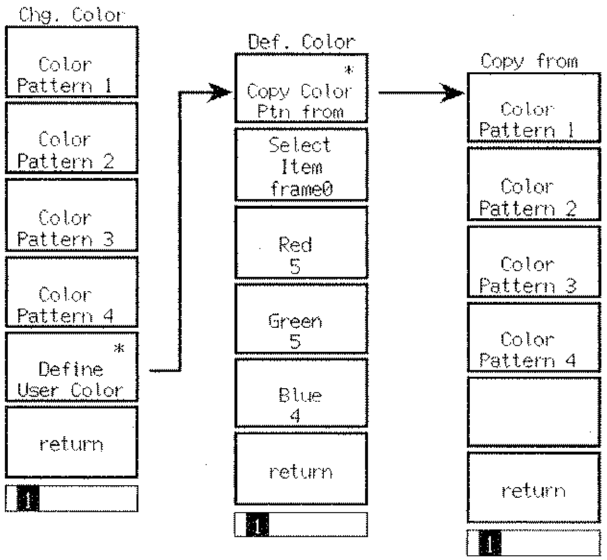
Change System screen



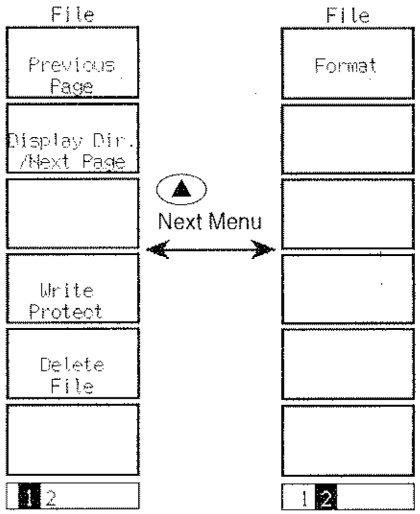
Instrument Setup screen



Change Color menu



File Operation screen



Appendix B
List of Initial Values

- Initial values are the values at the time of shipping from the factory.
- The items marked with an asterisk are those which are not indicated or selected by default.
- EPS in the "Outset" column on the right end of the table means an item which is initialized by the [Preset] key on the panel and "PRE" "INI" remote control command. PW in the same column means an item which is initialized by the "RST" remote control command. An item which is initialized by the "PRE" or "INI" command can be initialized also by the "RST" command.
- An item which is not initialized by either method is marked "NO".

- Setup Common Parameter (Analog) screen

Item	Initial value	Outset
RF Frequency		
Channel & Frequency		
Channel	0 CH	PW
Frequency TX Meas.	100.000 000 MHz	PW
Channel spacing	25.000 kHz	PW
RF Level		
TX Measure Ref Level (MAIN)	30.0 dBm	PW
(AUX)	22.0 dBm	PW
TX Power Meter Range	40.0 dBm	PW
AF Level input		
Range	30V	PW
Impedance	100kΩ	PW
AF Level output		
Impedance	600Ω	PW

- Setup TX Measure Parameter(Analog) screen

Item	Initial value	Outset
User Cal Factor	0.00 dB	PW
Power measure method	Power Meter (For AUX input, IF Level Meter is fixed.)	PW
RF measure mode	All	PW
DemodÅDoutput terminal		
Range	40 kHz	PW
HPF	300 Hz	PW
LPF	3 kHz	PW
De-emphasis	off	PW
Squelch	Auto	PW

- TX Measure(Analog) screen

Item	Initial value	Outset
• Main function key :		
Second page		
[PTT On Off]F4	Off	PS
• AF Level function key :		
First page		
[Distortion Unit]F7	%	PS
[Filter]F9	Off	PW
[HPF]F10	Off	PW
[De-emphasis]F11	Off	PW
Second page		
[Strage Mode]F9Normal	PS	
[Average Count]F9	10	PS
• RF Frequency function key :		
[Frequency]F7	100.000 000 MHz	PW
[Channel]F8	0 CH	PW
• RF Level/Power function key :		
[Ref level]F7	(MAIN) 30.0 dBm	PW
	(AUX) 22.0 dBm	PW
[Strage Mode]F9	Normal	PS
[Average Count]F9	10	PS
• Deviation function key :		
First page		
[Demod.]F7	FM	PW
[Relative On Off]F8		Off
PS		
[Det Mode]F9	(P-P)/2	PW
[HPF]F10	Off	PW
[LPF]F11	Off	PW
Second page		
[Strage Mode]F9Normal		PS
[Average Count]F9	10	PS
• AF Osc. function key :		
First page		
[AF Osc.1 Signal]F7	Tone	PW
[AF Osc.1 Lvl Relative On Off]F8	Off	PS
[AF Osc.1 Frequency]F9	1 000.0 Hz	PW
[AF Osc.1 Level]F10	100.0 mV	PW
[AF Osc.1 On Off]F11	On	PS
Second page		
[AF Osc.2 Signal]F7	Tone	PW
[AF Osc.2 Lvl Relative On Off]F8	Off	PS
[AF Osc.2 Frequency]F9	1 000.0 Hz	PW
[AF Osc.2 Level]F10	100.0 mV	PW
[AF Osc.2 On Off]F11	Off	PS

- AF Measure(Analog) screen

Item	Initial value	Outset
• AF Level function key :		
First page		
[HPF]F9	Off	PW
[LPF]F10	Off	PW
[Filter]F11	Off	PW
Second page		
[Strage Mode]F9Normal	PS	
[Average Count]F9	10	PS
[AF Level Unit]F10	V	PS
[Distortion Unit]F11	%	PS
• AF Osc. function key :		
First page		
[AF Osc.1 Signal]F7	Tone	PW
[AF Osc.1 Lvl Relative On Off]F8	Off	PS
[AF Osc.1 Frequency]F9	1 000.0 Hz	PW
[AF Osc.1 Level]F10	100.0 mV	PW
[AF Osc.1 On Off]F11	On	PS
Second page		
[AF Osc.2 Signal]F7	Tone	PW
[AF Osc.2 Lvl Relative On Off]F8	Off	PS
[AF Osc.2 Frequency]F9	1 000.0 Hz	PW
[AF Osc.2 Level]F10	100.0 mV	PW
[AF Osc.2 On Off]F11	Off	PS

- Recall screen

Item	Initial value	Outset
[File No.] F9	0	---
[Select display Mode]F7	Narrow	PW

- Save screen

Item	Initial value	Outset
[File No.] F9	0	---

- Change System screen

No initial value exists.

- Instrument Setupscreen

Item	Initial value	Outset
Frequency		
Reference Frequency	10MHZ	No
RF Input	Main	No
Display		
Display Title	User Define	No
Title		No
Clock Display	YY/MM/DD (Year, Month, Day)	No
Interface		
Connect to Controller	GPIB	No
GPIB		
Adress	1	No
RS232C		
Baud Rate	2400	No
Parity	Even	No
Data Bit	8bit	No
Stop Bit	1bit	No
Hard Copy		
Output Divice	Printer (Parallel)	No
Type	ESC/P	No
Alarm	On	No
[Power On Initial]F9:	Previous Status	No
[File No.]F9	0	No

- Change Color menu

Item	Initial value	Outset
Chg. Color menu	Color Pattern 1	No
[Define User Color] F11		No

- File Operation screen

No initial value exists.

Appendix C
INDEX

- The numbers on the right indicate section and paragraph numbers in this operation manual.

MS8606A

Digital Mobile Radio Transmitter Tester

(Analog Measurement Function)

Operation Manual

(Remote Control)

TABLE OF CONTENTS

SECTION 1

GENERAL

This section outlines the Remote Control functions of the MS8606A Digital Mobile Radio Transmitter Tester.

TABLE OF CONTENTS

1.1 General Description

The MS8606A Digital Mobile Radio Transmitter Tester, when combined with an external controller, can automate your measurement system. For this purpose, the MS8606A is equipped with an RS-232C interface port and a GPIB interface bus (IEEE Std 488.2-1987) as a standard feature.

1.2 Remote Control Functions

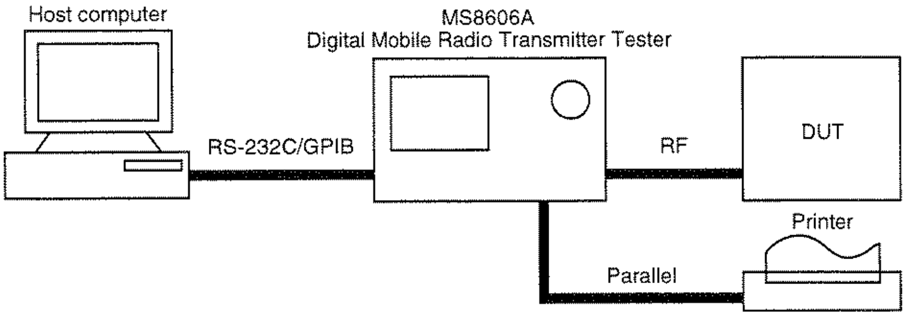
The Remote Control functions of the MS8606A are as follows:

(1) Controls all functions except the power switch, floppy disk unloading , and some keys including the [Local] key
(2) Reads out all setting conditions
(3) Sets the RS-232C interface conditions and GPIB address from the panel
(4) Executes interrupts and serial polling

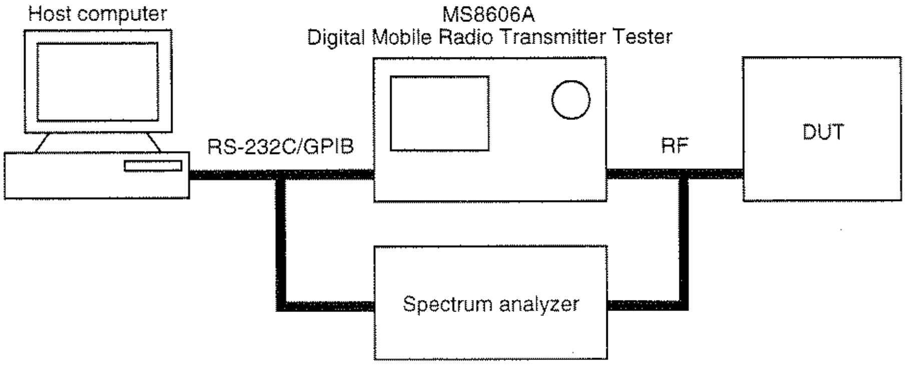
These functions enable to configure the automatic measurement system when the MS8606A is combined with a personal computer and other measuring instruments

1.3 Example of System Configuration Using RS-232C/GPIB

(1) Control by the host computer (1)



(2) Control by the host computer (2)



1.4 RS-232C Specifcations

The RS-232C specifications of the MS8606A are shown in the table below.

Item	Specification
Function	Control from an external controller (except power switch)
Communication system	Asynchronous (start-stop method), half-duplex
Communication control	X-ON/OFF control
Baud rate	1200, 2400, 4800, 9600 bps
Data bits	7 bits, 8 bits
Parity	Odd, Even, None
Start bit	1 bit
Stop bit	1 bit, 2 bits
Connector	D-sub 9 pins, female

1.5 GPIB Specifications

The GPIB of the MS8606A provides the IEEE488.1 interface function subsets listed in the table below.

GPIB Interface Functions

Code	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 for receiving data.
T6	Synchronizes the timing for receiving data. The serial poll function is provided. The talk-only function is not provided. The talker can be canceled by MLA.
L4	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	Parallel poll functions are not provided.
DC1	All device clear functions are provided.
DT1	The device trigger function is provided.
C0	Controller functions are not provided.

SECTION 2
DEVICE MESSAGES

This section outlines and lists the device messages of the MS8606A.

TABLE OF CONTENTS

2.1 General Description

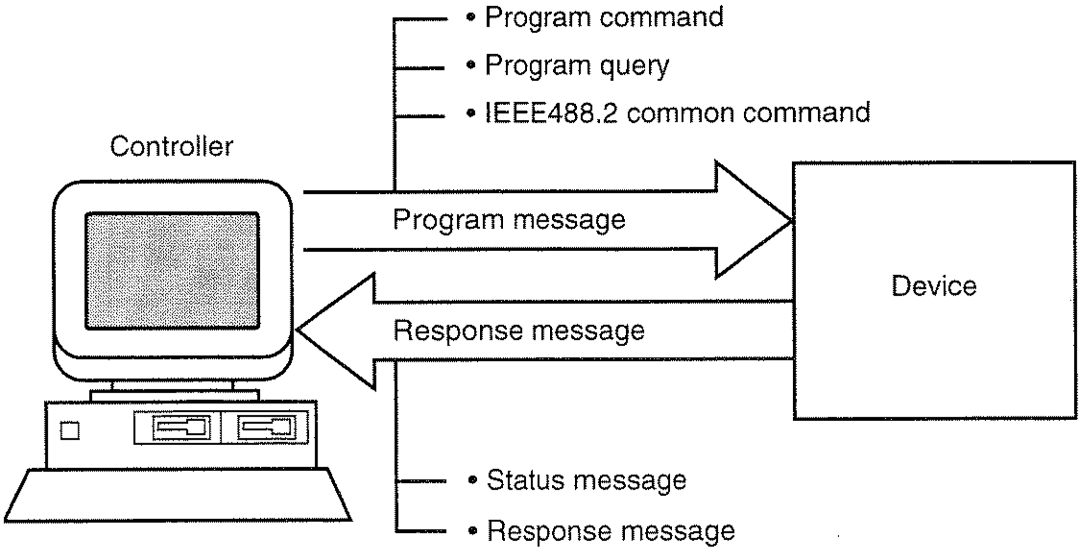
A device message is a data message transmitted between the controller and device via the system interface. Device messages are classified into program messages and response messages.

A program message is an ASCII data message transferred from the controller to the device. Program messages are classified into program commands and program queries.

Program commands are classified into device-specific commands used exclusively to control the MS8606A, and IEEE488.2 common commands. IEEE488.2 common commands are also used for other measuring instruments conforming to IEEE488.2 connected to the bus.

A program query is a command used to obtain a response message from the device. It is transferred from the controller to the device in advance, then the controller receives the response message from the device.

A response message is an ASCII data message transferred from the device to the controller.



Program messages and response messages may have a suffix (units) at the end of the numeric data.

2.2 Suffix Code

The table below shows the suffixes used for the MS8606A.

MS8606A Suffix Codes

Type	Unit	Suffix code
Frequency	GHz	GHZ, GZ
	MHz	MHZ, MZ
	kHz	KHZ, KZ
	Hz	HZ
	Default	HZ
Time	second	S
	m second	MS
	μsecond	US
	Default	MS
Level (dB)	dB	DB
	dBm	DBM, DM
	dBμ	DBU
	Default	Determined in conformance with the set scale unit
Level (W)	W	W
	mW	MW
	μW	UW
	nW	NW
	Default	UW

2.3 IEEE488.2 Common Commands and Supported Commands

The table below lists 39 common commands specified in the IEEE488.2 standard. IEEE488.2 common commands which are supported by the MS8606A are indicated with the ◎ symbol in the table.

Mnemonic	Command name	IEEE488.2 standard	MS8606A supported commands
*ADD	Accept Address Command	Optional	
*CAL	Calibration Query	Optional	
*CLS	Clear Status Command	Mandatory	◎
*DDT	Define Device Trigger Command	Optional	
*DDT?	Define Device Trigger Query	Optional	
*DLF	Disable Listenner Function Command	Optional	
*DMC	Define Macro Command	Optional	
*EMC	Enable Macro Command	Optional	
*EMC?	Enable Macro Query	Optional	
*ESE	Standard Event Status Enable Command	Mandatory	◎
*ESE?	Standard Event Status Enable Query	Mandatory	◎
*ESR?	Standard Event Status Register Query	Mandatory	◎
*GMC?	Get Macor contents Query	Optional	
*IDN?	Identification Query	Mandatory	◎
*IST?	Individual Status Query	Optional	
*LMC?	Learn Macro Query	Optional	
*LRN?	Learn Device Setup Query	Optional	
*OPC	Operation Complete Command	Mandatory	◎
*OPC?	Operation Complete Query	Mandatory	◎
*OPT?	Option Identification Query	Optional	
*PCB	Pass Control Back Command	Mandatory if other than C0	
*PMC	Purge Macro Command	Optional	
*PRE	Parallel Poll Register Enable Command	Optional	
*PRE?	Parallel Poll Register Enable Query	Optional	
*PSC	Power On Status Clear Command	Optional	
*PSC?	Power On Status Clear Query	Optional	
*PUD	Protected User Data Command	Optional	
*PUD?	Protected User Data Query	Optional	
*RCL	Recall Command	Optional	
*RDT	Resource Description Transfer Command	Optional	
*RDT?	Resource Description Transfer Query	Optional	
*RST	Reset Command	Mandatory	◎
*SAV	Save Command	Optional	
*SRE	Service Request Enable Command	Mandatory	◎
*SRE?	Service Request Enable Query	Mandatory	◎
*STB?	Read Status Byte Query	Mandatory	◎
*TRG	Trigger Command	Mandatory if DT1	◎
*TST?	Self Test Query	Mandatory	◎
*WAI	Wait to Continue Command	Mandatory	◎

Note:The first character of IEEE488.2 common commands is always *.

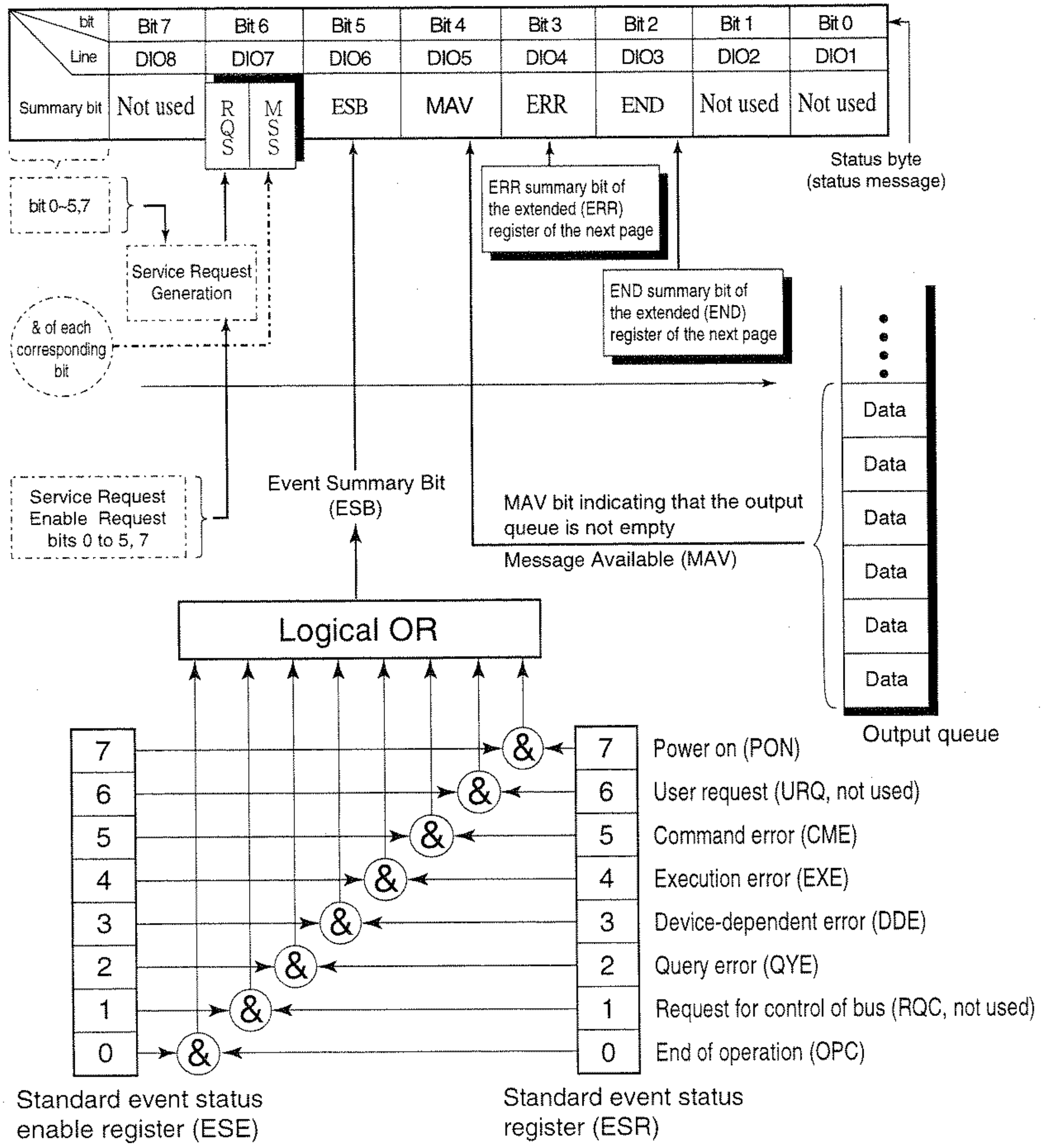
Table below lists the IEEE488.2 common commands used in the MS8606A.

IEEE488.2 common command

Command name	Program Msg.	Query Msg.	Response Msg.	Remarks
Clear status	*CLS	— — —	— — —	
Standard event status enable	*ESE n	*ESE?	n	n:0～255
Standard event status register	— — —	*ESR?	n	n:0～255
Identification query	— — —	*IDN?	id	ID:Manufacturer name, model name, etc.
Operation complete	*OPC	*OPC?	1	
Reset	*RST	— — —	— — —	
Service request enable	*SRE	*SRE?	n	"n:0～63,128～191"
Read status byte	— — —	*STB?	n	
Trigger	*TRG	— — —	— — —	
Self test	— — —	*TST?	n	
Wait to continue	*WAI	— — —	— — —	

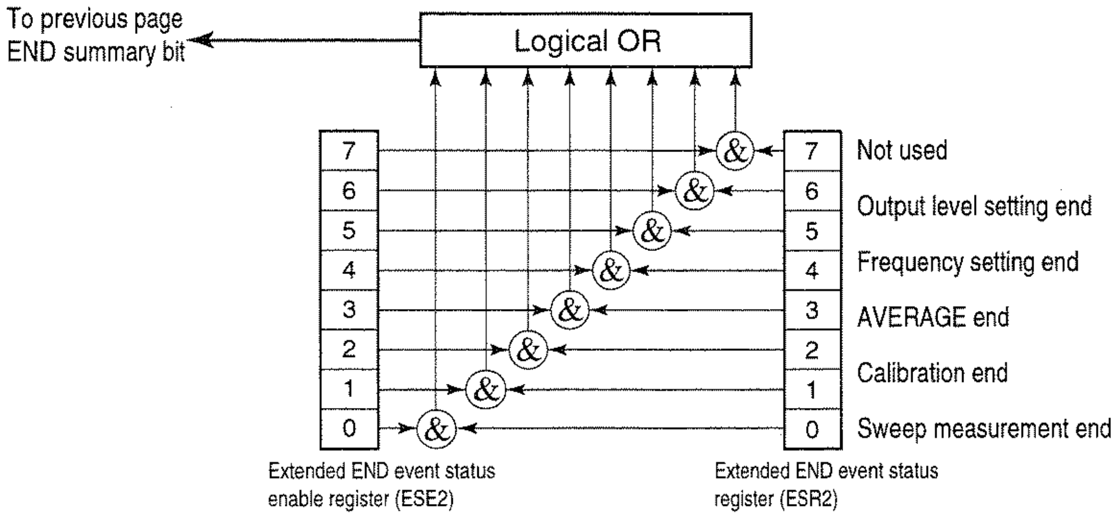
2.4 Status Messages

The diagram below shows the structure of service-request summary messages for the status byte register (STB) used with the MS8606A.

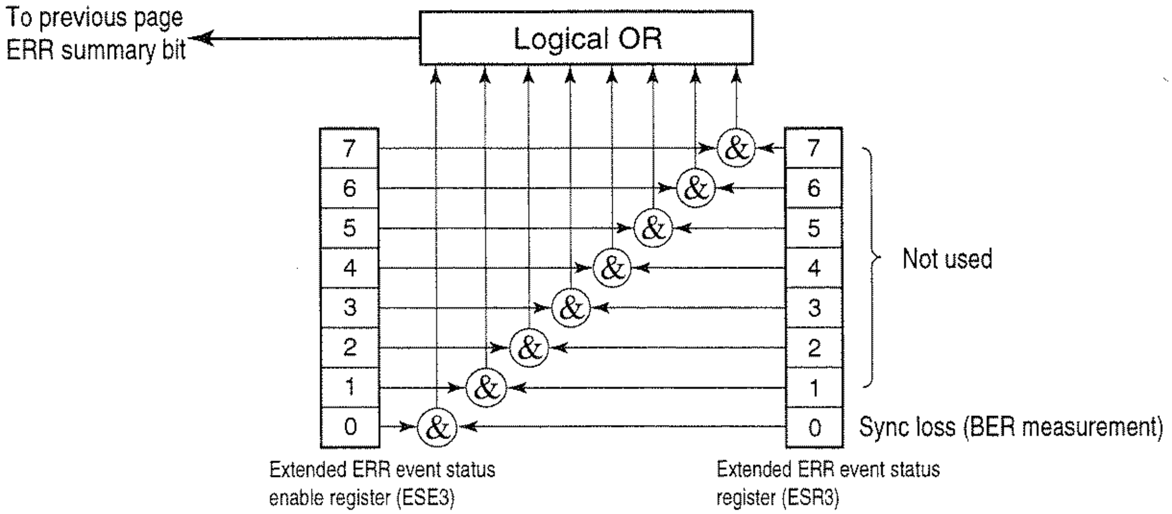


Standard Event Status (STB) Register

Note: & indicates a logical product (AND).



Extended Event Status (END) Register



Extended Event Status (ERR) Register

2.5 Device Message List

MS8606A-specific program commands, query messages, and response messages are listed from paragraph 2.5.1.

- Device message table

(a) Program messages (Program Msg)/query message (Query Msg)

(i) Uppercase characters : Reserved words
(ii) Numeric : Reserved words (numeric code)
(iii) Lowercase characters in argument

f (frequency) : Real number or integer with decimal point
Units : GHZ, MHZ, KHZ, HZ, GZ, MZ, KZ, no units = HZ
t(time) : Real number or integer with decimal point
Units : S, SC, MS, US, no unit = US
ℓ (level) : Real number or integer with decimal point
Units : DB, DBM, DM, DBU, W, MW, UW, NW, no units = set SCALE units
n (no units integer) : Integer
r (no units real number) : Real number
h (no units hexadecimal number) : Hexadecimal number
Others : Listed in remarks columns of the table

(b) Response messages (Response Msg)

(i) Uppercase characters : Reserved words
(ii) Numeric : Reserved words (numeric code)
(iii) Lowercase characters in argument
f (frequency) : 12-character fixed integerunits = HZ
t (time) : Real number or integer with decimal point
ℓ (level) : Real number or integer with decimal point
u (ratio) : Real number or integer with decimal point
s (symbol) : Real number or integer with decimal point
n (no units integer) : Integer, variable number of digits (Significant digits are output.)
r (no units real number) : Real number with decimal point, variable number of digits (Significant digits are output.)
h (no units hexadecimal number) : Hexadecimal number
Others : Written in remarks columns of the table

Notes:
- Integer:NR1 format, real number:NR2 format
- 0/:Zero

Device messages are classified into 7 types according to their valid ranges:

1.MS8606A common commands : Valid in all MS8606A modes
2.Instrument Setup command : Valid in Instrument Setup panel mode
3.Analog tester commands : Valid in Analog tester panel mode
4.Setup common parameter command : Valid on the Setup common parameter screen
5.Setup TX Measure Parameter commands : Valid on Setup TX Measure Parameter screen
6.TX Measure commands : Valid on TX Measure screen
7.AF Measure command : Valid on AF Measure screen
These device messages are listed below.

• Relationship between screen hierarchies and commands

[MS8606A common commands]:Valid in all MS8606A modes regardless of screen hierarchies

- Save/Recall command
- FD command (Verify)
- Copy command
- Single/Continuous switching command
- Preset command
- Panel mode switching command
- Switch to upper screen command (BS: Back Screen)
- Extended event status command (END, ERR)

[Screen hierarchies and commands]

Panel mode switching commands
→Instrument Setup mode:
  Instrument Setup screen: Instrument Setup command
→ Analog Tester mode
  Setup common parameter screen: Setup common parameter command

  Analog Tester commond
  → TX measurement screen switching command
    TX Measure screen ***TX Measure command***
    Setup TX Measure parameter screen : Setup TX Measure parameter command
    TX Measure screen : TX Measure command

  → AF Measure screen switching command
    AF Measure screen ***AF Measure command***
    AF Measure screen : AF Measure command

2.5.1 MS8606A common commands

MS8606A common commands are valid in all MS8606A modes.

(1) Save/Recall commands (parameter saving and recalling)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Recall	Recall file	File No.	RCM n	---	---	
Save	Save file	File No.	SVM n	---	---	

(2) FD commands (verify)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Verify	On	VERIFY ON	VERIFY?	ON	
		Off	VERIFY OFF	VERIFY?	OFF	

(3) Copy commands (copy)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Copy		PRINT	---	---	
			PLS 0	---	---	

(4) Single/Continuous switching commands

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Single sweep	Measurement/ Sweep start	SNGLS	---	---	
			S2	---	---	
		Measurement/ Sweep synchronization	SWP	---	---	
			TS	---	---	
	Continuous		CONTS	---	---	
			S1	---	---	
	Measurement/ Sweep status	Measurement/Sweep end	---	SWP?	SWP 0	
		Measurement/Sweep	---	SWP?	SWP 1	

(5) Preset commands (initialization, power-on setting)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Preset		PRE	---	---	
			INI	---	---	
			IP	---	---	
	Preset value	Previous state	POWERON LAST	POWERON?	LAST	
		Recall memory No.	POWERON n	POWERON?	n	

(6) Panel-mode switching commands (Analog tester mode, Instrument Setup mode)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Analog tester		PNLMD ANALOG	PNLMD?	ANALOG	
	Instrument setup		PNLMD SYSTEM	PNLMD?	SYSTEM	

(7) Switch to upper screen command (BS)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Back screen		BS	---	---	

(8) Extended event status commands (END)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Event status	END event status	Event status enable	ESE2 n	ESE2?	n	
		Event status register	---	ESR2?	n	
	ERR event status	Event status enable	ESE3 n	ESE3?	n	
		Event status register	---	---	n	

2.5.2 Instrument Setup command

The Instrument Setup command is valid in Instrument Setup Panel mode.

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Hardware	Reference frequency	10MHz	REF 10MHZ	REF?	10MHZ	
		13MHz	REF 13MHZ	REF?	13MHZ	
	RF in/out	Main	RFINOUT MAIN	RFINOUT?	MAIN	
		AUX	RFINOUT AUX	RFINOUT?	AUX	
Display	Display	On	DSPL ON	---		
		Off	DSPL OFF	---		
	Title display	DATE/TIME	TTL DATE	TTL?	DATE	
		USER define	TTL USER	TTL?	USER	
		OFF	TTL OFF	TTL?	OFF	
	Title input	User title	TITLE a	TITLE?	a	
			KSE a	---	---	
	Select date display mode	Japan (yy/mm/dd)	DATEMODE YMD	DATEMODE?	YMD	
		USA (mm-dd-yy)	DATEMODE MDY	DATEMODE?	MDY	
		Europe (dd-mm-yy)	DATEMODE DMY	DATEMODE?	DMY	
	Set and read date	Japan (yy/mm/dd)	DATE yy,mm,dd	DATE?	yy,mm,dd	
	Set and read time		TIME hh,mm,ss	TIME?	hh,mm,ss	
Buzzer	Buzzer switch	On	ALARM ON	ALARM?	ON	
			BEP 1	---	---	
			BEP ON	---	---	
		Off	ALARM OFF	ALARM?	OFF	
			BEP 0	---	---	
			BEP OFF	---	---	
	Sounds buzzer		BZR	---	---	
GPIB	Terminater	LF	TRM 0	---	---	
		CR/LF	TRM 1	---	---	
RS232C	Baud rate	9600	BAUD 9600	BAUD?	9600	
		4800	BAUD 4800	BAUD?	4800	
		2400	BAUD 2400	BAUD?	2400	
		1200	BAUD 1200	BAUD?	1200	
	Parity	Even	PRTY EVEN	PRTY?	EVEN	
		Odd	PRTY ODD	PRTY?	ODD	
		Off	PRTY OFF	PRTY?	OFF	
	Data bit	7bits	DTAB 7	DTAB?	7	
		8bits	DTAB 8	DTAB?	8	
	Stop bit	1bit	STPB 1	STPB?	1	
		2bits	STPB 2	STPB?	2	

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Time out		TOUT t	TOUT?	t	
	Delimiter	LF	DELM 0	---	---	
		CR/LF	DELM 1	---	---	
Print	Type	ESC/P (24DOT)	PMOD 6	PMOD?	6	
		HP	PMOD 3	PMOD?	3	
		BMP(B&W)	PMOD11	PMOD?	11	
Color	Select pattern	Pattern1	COLORPTN COLOR1	COLORPTN?	COLOR1	
		Pattern2	COLORPTN COLOR2	COLORPTN?	COLOR2	
		Pattern3	COLORPTN COLOR3	COLORPTN?	COLOR3	
		Pattern4	COLORPTN COLOR4	COLORPTN?	COLOR4	
		User pattern	COLORPTN USERCOLOR	COLORPTN?	USERCOLOR	
	Copy from	Pattern1	COPYCOLOR COLOR1	---	---	
		Pattern2	COPYCOLOR COLOR2	---	---	
		Pattern3	COPYCOLOR COLOR3	---	---	
		Pattern4	COPYCOLOR COLOR4	---	---	
	User define	Red, green, blue	COLORDEF n,r,g,b,	COLORDEF? n	r,g,b	n:Frame number

2.5.3 Analog tester commands

- The Analog tester commands are valid in Analog tester panel mode (on all Analog test screens).

(1) Measure-mode switching commands

Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Setup Common Parameter		MEAS SETCOM	MEAS?	SETCOM	
Setup TX Measure Parameter		MEAS SETTX	MEAS?	SETTX	
TX Measure		MEAS TX	MEAS?	TX	
AF Measure		MEAS AF	MEAS?	AF	

(2) Measure result status command

Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Status		---	MSTAT?	n	

- Response value n of MSTAT?

The table below lists the meanings of response value n of MSTAT? (measurement result status command).

Value of n	Explanation
0	Normal termination
1	RF input limit
2	Level over
3	Level under
4	Unmeasurable
5	Deviation under
9	Unmeasured

2.5.4 Setup common parameter command

- Note that RF Frequency and RF Level program messages are also valid on all measurement screens of the TX Mesure.

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
RF Frequency	Channel		CHAN n	CHAN?	n [ch / 1ch]	
	TX Measure Frequency		TXFREQ f	TXFREQ?	f [Hz / 1Hz]	
	Channel Spacing		CHSPC f	CHSPC?	f [Hz / 1Hz]	
RF Level	TX Measure Ref Level		RFLVL ℓ	RFLVL?	ℓ [dBm / 1dB]	
	TX Power Meter Range	40.0dBm	PRNG 40	PRNG?	40	
		30.0dBm	PRNG 30	PRNG?	30	
		20.0dBm	PRNG 20	PRNG?	20	
		10.0dBm	PRNG 10	PRNG?	10	
	TX Power Meter Range (without Parameter)	40.0dBm	PRNG5	---	---	
		30.0dBm	PRNG4	---	---	
		20.0dBm	PRNG3	---	---	
		10.0dBm	PRNG2	---	---	
AF Level Input	Range	30V	ARNG 30	ARNG?	30	
		4V	ARNG 4	ARNG?	4	
		400mV	ARNG 400M	ARNG?	400M	
		40mV	ARNG 40M	ARNG?	40M	
	Impedance	600Ω	AIMP 600	AIMP?	600	
		100kΩ	AIMP 100K	AIMP?	100K	
AF Level Input	Impedance	600 Ω	AOIMP 600	AOIMP?	600	
		50Ω	AOIMP 50	AOIMP?	50	

2.5.5 TX Measure commands

- Program messages of the TX Measure commands are valid in ranges defined on TX Mesure screens.

2.5.5.1 Setup TX Measure Parameter command

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	User Cal Factor		UCAL ℓ	UCAL?	ℓ [dB / 0.01dB]	
	Power Meter Method	Power Meter	PMTH POW	PMTH?	POW	
		IF Level Meter	PMTH IF	PMTH?	IF	
	RF Measure Mode	All	RFMM ALL	RFMM?	All	
		RF Only	RFMM RF	RFMM?	RF	
	Range	40kHz	RRNG 40K	RRNG?	40K	
		4kHz	RRNG 4K	RRNG?	4K	
	High Pass Filter	300Hz	RHPF 300	RHPF?	300	
		Off	RHPF OFF	RHPF?	OFF	
	Low Pass Filter	3kHz	RLPF 3K	RLPF?	3K	
		Off	RLPF OFF	RLPF?	OFF	
	De-emphasis	On	RDEMP ON	RDEMP?	ON	
		Off	RDEMP OFF	RDEMP?	OFF	
	Squelch	Auto	RSQL AUTO	RSQL?	AUTO	
		Off	RSQL OFF	RSQL?	OFF	

2.5.5.2 TX Measure command

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Storage Mode	Storage Mode	Normal	STRG NRM	STRG?	NRM	
		Average	STRG AVG	STRG?	AVG	
	Average On		VAVG ON	---	---	
			VAVG 1	---	---	
			KSG	---	---	
	Average Off		VAVG OFF	---	---	
			VAVG 0	---	---	
			KSH	---	---	
	Average Count		AVR n	AVR?	n	
			VAVG n	VAVG?	n	
RF Power	Adjust Range		ADJRNG			
	Manual Calibration		PWRCAL	---	---	
	Calibration Cancel		CALCANCEL	---	---	
	Power Meter Range	Range Up	PMRNG UP	---	---	
		Range Down	PMRNG DN	---	---	
	Power Meter Range (without Parameter)	40.0dBm	PRNG5	---	---	
		30.0dBm	PRNG4	---	---	
		20.0dBm	PRNG3	---	---	
		10.0dBm	PRNG2	---	---	
	Power Meter Zero Set		ZEROSET	---	---	
	Set Relative		RFPWRSRL	---	---	
Deviation	Demod.	FM	DDMOD FM	DDMOD?	FM	
		øM	DDMOD PM	DDMOD?	PM	
	Detect Mode	(P-P)/2	DETMD PP	DETMD?	PP	
		+P	DETMD +P	DETMD?	-P	
		-P	DETMD -P	DETMD?	+P	
		RMS	DETMD RMS	DETMD?	RMS	
		(P-P)/2 Hold	DETMD PPH	DETMD?	PPH	
		+P Hold	DETMD +PH	DETMD?	+PH	
		-P Hold	DETMD -PH	DETMD?	-PH	
	High Pass Filter	300Hz	DHPF 300	DHPF?	300	
		50Hz	DHPF 50	DHPF?	50	
		Off	DHPF OFF	DHPF?	OFF	
	Low Pass Filter	3kHz	DLPF 3	DLPF?	3	
		15kHz	DLPF 15	DLPF?	15	
		Off	DLPF OFF	DLPF?	OFF	
	Relative On/Off	On	RDEVRL ON	RDEVRL?	ON	
		Off	RDEVRL OFF	RDEVRL?	OFF	

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
AF Level/Distortion	Filter	ITU-T P.53	AFLT P53	AFLT?	P53	
		C-MESSAGE	AFLT CMESS	AFLT?	CMESS	
		6kHz BPF	AFLT BPF	AFLT?	BPF	
		Off	AFLT OFF	AFLT?	OFF	
	High Pass Filter	400Hz	AHPF 400	AHPF?	400	
		Off	AHPF OFF	AHPF?	OFF	
	De-emphasis	750µs	ADEMP 750	ADEMP?	750	
		Off	ADEMP OFF	ADEMP?	OFF	
	Distortion Unit	dB	ADSTU DB	ADSTU?	DB	
		%	ADSTU PER	ADSTU?	PER	
	AF Level Set Relative		TALVLSRL	---	---	
PTT		On	PTT ON	PTT?	ON	
		Off	PTT OFF	PTT?	OFF	
RF Frequency	Channel		CHAN n	CHAN?	n[ch / 1ch]	
	TX Measure Frequency		TXFREQ f	TXFREQ?	f[Hz / 1Hz]	
RF Level	TX Measure Ref Level		RFLVL ℓ	RFLVL?	ℓ [dBm / 1dB]	
AF Oscillator 1	Frequency		AFREQ1 f	AFREQ1?	f[Hz / 0.1Hz]	
	Level	Specifies the input/output level with V unit.	ALVL1 vV(V,MV,UV)	ALVL1? V	v[V / 1µV]	
		Specifies the input/output level with dBm unit.	ALVL1 ℓ DBM	ALVL1? DBM	ℓ [dBm / 0.1dBm]	
		Specifies the input/output level with current selected unit.	ALVL1 ℓ (or ALVL1 v)	ALVL1?	ℓ (or v)	
	Signal	Tone	ASIG1 TONE	ASIG1?	TONE	
		Noise(ITU-T G.227)	ASIG1 G227	ASIG1?	G227	
		Noise(White)	ASIG1 WHITE	ASIG1?	WHITE	
	Level Relative	On	ALVL1RL ON	ALVL1RL?	ON	
		Off	ALVL1RL OFF	ALVL1RL?	OFF	
	Relative Value		---	ALVL1RLV?	ℓ [dB / 0.1dB]	
	Oscillator Switch	On	AOUT1 ON	AOUT1?	ON	
		Off	AOUT1 OFF	AOUT1?	OFF	
AF Oscillator 2	Frequency		AFREQ2 f	AFREQ2?	f[Hz / 0.1Hz]	
	Level	Specifies the input/output level with V unit.	ALVL2 vV(V,MV,UV)	ALVL2? V	v[V / 1µV]	
		Specifies the input/output level with dBm unit.	ALVL2 ℓ DBM	ALVL2? DBM	ℓ [dBm / 0.1dB]	
		Specifies the input/output level with current selected unit.	ALVL2 ℓ (or ALVL2 v)	ALVL2?	ℓ (or v)	
	Signal	Tone	ASIG2 TONE	ASIG2?	TONE	
		Noise(ITU-T G.227)	ASIG2 G227	ASIG2?	G227	
		Noise(White)	ASIG2 WHITE	ASIG2?	WHITE	
	Level Relative	On	ALVL2RL ON	ALVL2RL?	ON	
		Off	ALVL2RL OFF	ALVL2RL?	OFF	
	Relative Value		---	ALVL2RLV?	ℓ [dB / 0.1dB]	
	Oscillator Switch	On	AOUT2 ON	AOUT2?	ON	
		Off	AOUT2 OFF	AOUT2?	OFF	

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Measure Result	Status		---	MSTAT?	n	
	RF Frequency		---	RFFREQ?	f[Hz / 0.01Hz]	
	RF Frequency Error		---	RFFREQERR?	f[Hz / 0.01Hz]	
	RF Freq. Error ppm		---	RFFREQERRPPM?	m[ppm / 0.0001ppm]	
	RF Power		---	RFPWR? W	w[W / 1pW]	
			---	RFPWR? DBM	ℓ[dBm / 0.01dB]	
		Relative Value	---	RFPWRRLV?	ℓ[dB / 0.01dB]	
	Deviation	Demod. FM	---	RDEV?	f[Hz / 0.1Hz]	
		Demod. øM	---	RDEV?	r[rad / 0.0001rad]	
		Relative Value	---	RDEVRLV?	ℓ[dB / 0.01dB]	
	Deviation Readouts all the measurexd results.	Demod. FM	---	RDEVALL?	f[Hz / 0.1Hz]	*1
		Demod. øM	---	RDEVALL?	r[rad / 0.0001rad]	
	AF Level	Demod. FM	---	TALVL?	f[Hz / 0.1Hz]	
		Demod. øM	---	TALVL?	r[rad / 0.1rad]	
		Relative Value	---	TALVLRLV?	ℓ[dB / 0.01dB]	
	AF Level Readouts all the measured results.	Demod. FM	---	TALVLALL?	f[Hz / 0.1Hz]	*2
		Demod. øM	---	TALVLALL?	r[rad / 0.0001rad]	
	Distortion		---	DSTN? DB	ℓ[dB / 0.01dB]	
			---	DSTN? PER	p[% / 0.01%]	
			---	DSTN?	Output with current selected unit.	
	AF Frequency		---	AFFREQ?	f[Hz / 0.001Hz]	
	Freq. Characteristics		---	FREQCHAR? n	ℓ[dB / 0.01dB]	*3

*1 RDEVALL? command (which readouts all the measured results of the Deviation) outputs the measured results of the (P-P)/2, +P, -P, RMS, (P-P)/2 Hold, +P Hold, and -P Hold, in this order with commas for these data separation.

Output format is shown below, where one data is indicated with 7 characters.

Example 1: Outputs with kHz unit. (One digit under decimal point)

"10000.0, 1000.0, 100.0, 10.0, 1.0, 12.3, 123.4, 1234.5"

Example 2: Outputs with rad unit. (Four digits under decimal point)

"10.0000, 1.0000, 0.1000, 0.0100, 0.0001, 0.0003, 0.1234, 1.2345"

*2 TALVLALL? command (which readouts all the measured results of the AF Level) outputs the 8 types of the measured results, depending on the combination of the Filter and De-emphasis.

This command outputs the measured results of the ITU-T/750µs, C-MESSAGE/750µs, 6kHz BPF/750µs, Off/750µs, ITU-T/Off, C-MESSAGE/Off, 6kHz BPF/Off, and Off/Off,in this order with commas for these data separation.

Output format is shown below, where one data is indicated with 8 characters.

Example 1: Outputs with Hz unit. (One digit under decimal point)

"100000.0, 10000.0, 1000.0, 10.0, 1.0, 12.3, 123.4, 1234.5"

Example 2: Outputs with rad unit. (Four digits under decimal point)

"100.0000, 10.0000, 1.0000, 0.1000, 0.0100, 0.0003, 0.1234, 1.2345"

*3 FREQCHAR? command (which readouts the measured results of the frequency characteristics) performs FFT of the demodulated AF signal, and outputs the frequency characteristics (from 50 Hz to 10 kHz, in 50 Hz steps, with the reference of the data at 1 kHz).

When inputing this command, specify multiple integer values of n (range: 1 to 200) which are integer-type parameters to determine the measurement frequencies.

The relation between n and the measurement frequency (f) is as follows:

$f = 50n$ (n: 1 to 200)

2.5.6 AF Measure commands

- Program messages of the AF Measure command are valid on the AF Measure screen.

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
Storage Mode	Storage Mode	Normal	STRG NRM	STRG?	NRM	
		Average	STRG AVG	STRG?	AVG	
	Average On		VAVG ON	---	---	
			VAVG 1	---	---	
			KSG	---	---	
	Average Off		VAVG OFF	---	---	
			VAVG 0	---	---	
			KSH	---	---	
	Average Count		AVR n	AVR?	n	
			VAVG n	VAVG?	n	
AF Level	Adjust Range		ADJRNG	---	---	
	Set Relative		AFLVLSRL	---	---	
	Level Range	Up	ALRNG UP	---	---	
		Down	ALRNG DN	---	---	
	High Pass Filter	400Hz	AHPF 400	AHPF?	400	
		300Hz	AHPF 300	AHPF?	300	
		50Hz	AHPF 50	AHPF?	50	
		Off	AHPF OFF	AHPF?	OFF	
	Low Pass Filter	3kHz	ALPF 3	ALPF?	3	
		15kHz	ALPF 15	ALPF?	15	
		Off	ALPF OFF	ALPF?	OFF	
	Filter	ITU-T P.53	AFLT P53	AFLT?	P53	
		C-MESSAGE	AFLT CMESS	AFLT?	CMESS	
		6kHz BPF	AFLT BPF	AFLT?	BPF	
		OFF	AFLT OFF	AFLT?	OFF	
	AF Level Unit	dBm	ALUT DBM	ALUT?	DBM	
		V	ALUT V	ALUT?	V	
	Distortion Unit	dB	ADUT DB	ADUT?	DB	
		%	ADUT PER	ADUT?	PER	

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
AF Oscillator 1	Frequency		AFREQ1 f	AFREQ1?	f[Hz / 0.1Hz]	
	Level	Specifies the input/output level with V unit.	ALVL1 vV(V,MV,UV)	ALVL1? V	v[V / 1µV]	
		Specifies the input/output level with dBm unit.	ALVL1 ℓ DBM	ALVL1? DBM	ℓ [dBm / 0.1dB]	
		Specifies the input/output level with current selected unit.	ALVL1 ℓ (or ALVL1 v)	ALVL1?	ℓ (or v)	
	Signal	Tone	ASIG1 TONE	ASIG1?	TONE	
		Noise(ITU-T G.227)	ASIG1 G227	ASIG1?	G227	
		Noise(White)	ASIG1 WHITE	ASIG1?	WHITE	
	Level Relative	On	ALVL1RL ON	ALVL1RL?	ON	
		Off	ALVL1RL OFF	ALVL1RL?	OFF	
	Relative Value		---	ALVL1RLV?	ℓ [dB / 0.1dB]	
	Oscillator Switch	On	AOUT1 ON	AOUT1?	ON	
		Off	AOUT1 OFF	AOUT1?	OFF	
AF Oscillator 2	Frequency		AFREQ2 f	AFREQ2?	f[Hz / 0.1Hz]	
	Level	Specifies the input/output level with V unit.	ALVL2 vV(V,MV,UV)	ALVL2? V	v[V / 1µV]	
		Specifies the input/output level with dBm unit.	ALVL2 ℓ DBM	ALVL2? DBM	ℓ [dBm / 0.1dB]	
		Specifies the input/output level with current selected unit.	ALVL2 ℓ (or ALVL2 v)	ALVL2?	ℓ (or v)	
	Signal	Tone	ASIG2 TONE	ASIG2?	TONE	
		Noise(ITU-T G.227)	ASIG2 G227	ASIG2?	G227	
		Noise(White)	ASIG2 WHITE	ASIG2?	WHITE	
	Level Relative	On	ALVL2RL ON	ALVL2RL?	ON	
		Off	ALVL2RL OFF	ALVL2RL?	OFF	
	Relative Value		---	ALVL2RLV?	ℓ [dB / 0.1dB]	
	Oscillator Switch	On	AOUT2 ON	AOUT2?	ON	
		Off	AOUT2 OFF	AOUT2?	OFF	
Measure Result	Status		---	MSTAT?	n	
	AF Level	dBm	---	AFLVL? DBM	ℓ [dBm / 0.01dB]	*The input level with 100kΩ is invalid.
		V	---	AFLVL? V	v[V / 0.1µV]	
			---	AFLVL?	Output with current selected unit.	
		Relative Value	---	AFLVLRLV?	ℓ [dB / 0.01dB]	
	AF Level Readouts all the measured results.		---	AFLVLALL? DBM	ℓ [dBm / 0.01dB]	*1
			---	AFLVLALL? V	v[V / 0.1µV]	
			---	AFLVLALL?	Output with current selected unit.	
	AF Distortion	dB	---	DSTN? DB	ℓ [dB / 0.01dB]	
		%	---	DSTN? PER	p[% / 0.01%]	
			---	DSTN?	Output with current selected unit.	
	AF Frequency		---	AFFREQ?	f[Hz / 0.001Hz]	
	Freq. Characteristics		---	FREQCHAR? n	ℓ [dB / 0.01dB]	*2

*1 AFLVLALL? command (which readouts all the measured results of the AF Level) outputs the 8 types of the measured results, depending on the combination of the Filter and De-emphasis.

This command outputs the measured results of the ITU-T/750µs, C-MESSAGE/750µs, 6kHz BPF/750µs, Off/750µs, ITU-T/Off, C-MESSAGE/Off, 6kHz BPF/Off, and Off/Off,in this order with commas for these data separation.

Output format is shown below, where one data is indicated with 9 characters.

Example 1: Outputs with dBm unit. (Two digits under decimal point)

"100000.00, 10000.00, _1000.00, __0.01, 1234.56, _123.45, _-12.34, __-0.10"

Example 2: Outputs with Volt unit. (Exponent form)

"1.234E+01,2.324E-03,5.325E-05,4.448E-06,1.568E+01,3.525E-04,4.256E-03,1.825E-02"

*2 FREQCHAR? command (which readouts the measured results of the frequency characteristics) performs FFT of the demodulated AF signal, and outputs the frequency characteristics (from 50 Hz to 10 kHz, in 50 Hz steps, with the reference of the data at 1 kHz).

When inputing this command, specify multiple integer values of n (range: 1 to 200) which are integer-type parameters to determine the measurement frequencies.

The relation between n and the measurement frequency (f) is as follows:

f = 50n (n: 1 to 200)

SECTION 3

SETUP

This section describes the RS-232C/GPIB connections to external devices and setting the remote-control interface of the MS8606A.

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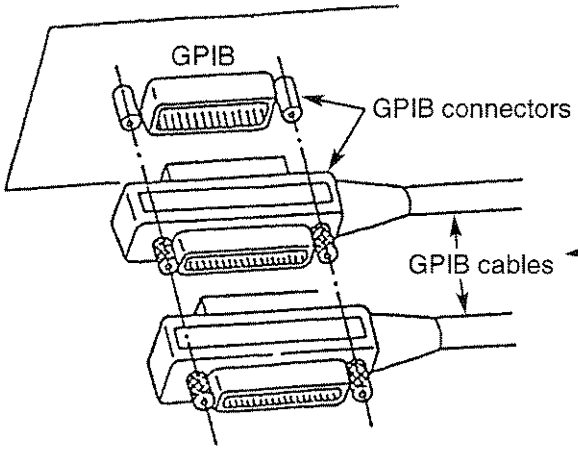
3.1 Connecting Devices with GPIB Cables

The rear panel has connectors for connecting GPIB cables.

Up to 15 devices, including the controller, can be connected to one system. Connect devices under the conditions described to the right of the diagram below.



Total cable length ≤20 m
Cable length between devices ≤4 m
Number of devices which can be connected ≤15

Mounting and dismounting of the GP-IB cable must be done after turning off the power switch and pulling out the power cord from the socket. If the power remains on, only signal common line may disconnected before the other lines, then AC leak voltages are applied to the ICs, and there is a possibility that components such as ICs in the interface unit will be damaged.

⚠ CAUTION

The GPIB cables must be connected before the power is turned on.

3.2 Setting GPIB Interface Conditions

Set the GPIB interface on the Instrument Setup screen at the front panel.

Set the following items:

1) Interface: Connect to Controller (Initial value: GPIB)

2) GPIB: Address (Initial value: 01)

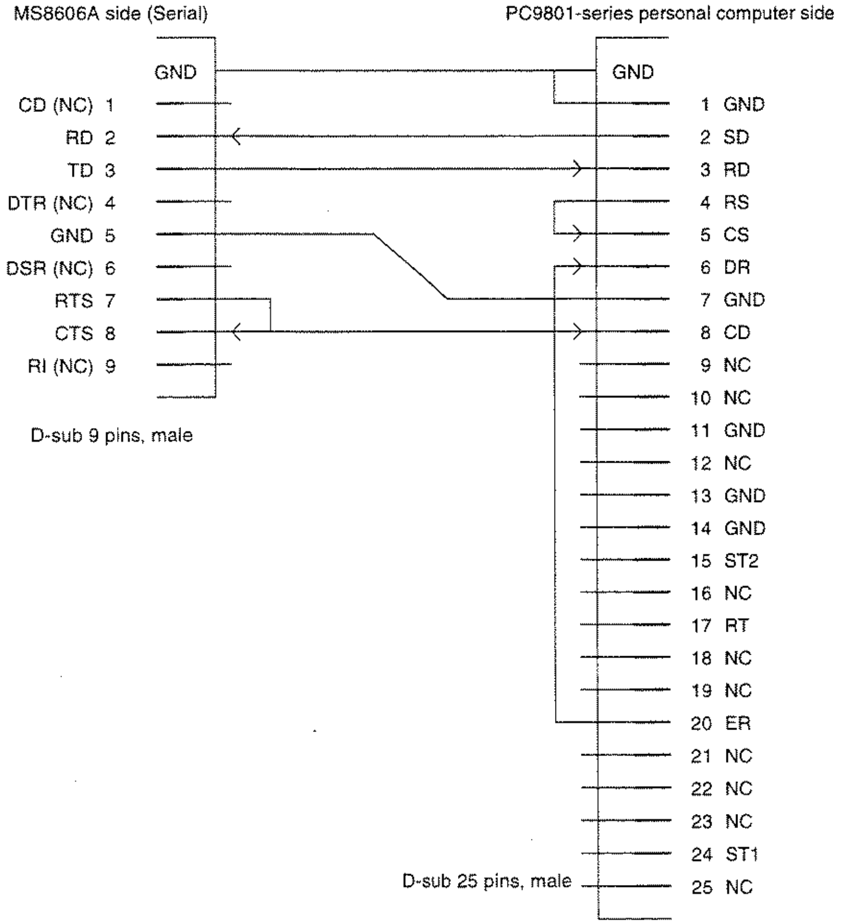
An example of the setting when the GPIB interface is set with the GPIB address03 is given below.

Step	Key operation	Explanation
(Switching to the Instrument Setup screen)		
1.	[Main Func on off] F6	Sets the Main Func on to display the main menu.
2.	Next Menu[◀]	Sets the Instrument Setup mode.
	[Instrument Setup] F2	Displays the Instrument Setup screen.
(Selecting the remote control interface)		
3.	Cursor [∧] [∨]	Uses these cursor keys to select "Interface Connect to Controller.".
4.	[Set]	Opens the setup window.
5.	Cursor [∧] [∨]	Selects GPIB on the setting window.
6.	[Set]	Closes the setting window and determines the set value.
(Setting the GPIB address)		
7.	Cursor [∧] [∨]	Use these cursor keys to select a GPIB address.
8.	[Set]	Opens the setup window.
9.	[0] [3] [Set]	Set the GPIB address to 03.

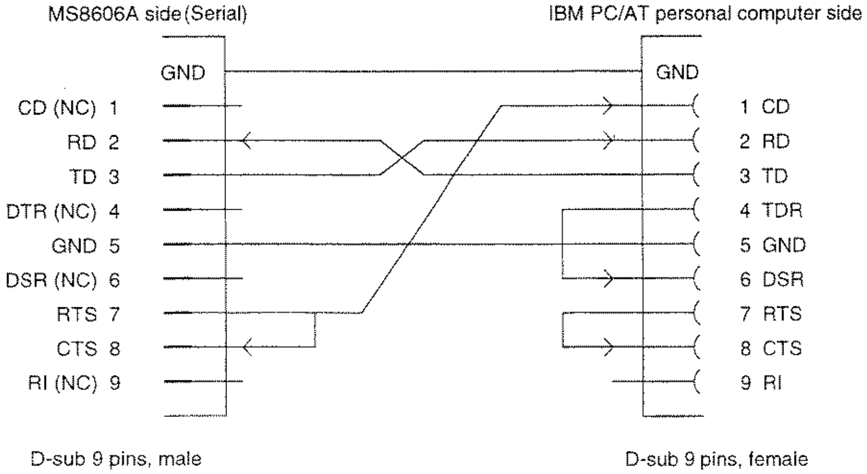
3.3 Connection of RS-232C Interface Signal

Connection of RS-232C interface signal between the MS8606A and a personal computer is shown below.

- Connection to PC98-series personal computer(NEC)



- Connection to IBM PC/AT personal computer



3.4 Setting RS-232C Interface Conditions

Set the RS-232C interface on the Instrument Setup screen at the front panel.

Set the following items:

1) Interface: Connect to Controller (Initial value: GPIB)

2) RS-232C: Baud Rate (Initial value: 2400)

Parity (Initial value: Even)

Data Bit (Initial value: 8 bits)

Stop Bit (Initial value: 1 bit)

Set the RS-232C interface conditions, as desribed below.

Step	Key operation	Explanation
(Switching to the Instrument Setup screen)		
1.	[Main Func On/Off] F6	Sets the Main Func on to display the main menu.
2.	Next Menu [◀]	Sets the Instrument Setup mode.
	[Instrument Setup] F2	Displays the Instrument Setup screen.
(Selecting the remote control interface)		
3.	Cursor [∧] [∨]	These cursor keys are used to select "Interface Connect to Controller."
4.	[Set]	Opens the setup window.
5.	Cursor [∧] [∨]	Selects RS-232C on the setting window.
6.	[Set]	Closes the setting window and establishes the set value.
(Setting the RS-232C interface)		
7.	Cursor [∧] [∨]	Uses these cursor keys to select the setting item Baud rate.
8.	[Set]	Opens the setup window.
9.	[∧] [∨] [Set]	Uses these cursor keys to select a Baud rate value (9600 [bps] etc.).
10.	[∧] [∨]	Sets other interface conditions in the same way.

3.5 Setting the Items Relating to Remote Control and Panel Key Control

3.5.1 Remote control and panel control keys

The keys and lamps described in this paragraph are assigned on the front panel as exclusive keys and lamps.

1) REMOTE lamp and LOCAL key

The REMOTE lamp indicates that the MS8606A is controlled remotely via the GPIB interface. When the MS8606A is controlled remotely from an external controller via the GPIB interface on the rear panel, the REMOTE lamp lights. While the REMOTE lamp is on, key entry and rotary encoder entry from the front panel are disabled.The LOCAL key is used to cancel the remote control status of the GPIB interface. When the LOCAL key is pressed, the REMOTE lamp goes off and key entry and rotary encoder entry from the front panel are enabled.

2) PANEL LOCK key

The PANEL LOCK key is used to enable and disable key entry and rotary encoder entry from the front panel. Use the PANEL LOCK key to prevent an operation error on the front panel for automatic measurement or status holding. When the panel is locked, the green lamp on the PANEL LOCK key lights.

3.5.2 Remote control status

If the MS8606A is controlled remotely, the REMOTE lamp on the left of the front panel lights. While the REMOTE lamp is on, key entry and rotary encoder entry from the front panel are disabled. To change from the remote control to front panel entry status, execute the following steps:

1) Halt the remote control.

2) If the REMOTE lamp is on, press the LOCAL key to cancel the REMOTE status.

SECTION 4

DEVICE MESSAGE FORMAT

This section describes the format of the device messages transmitted between a controller and the MS8606A via the GPIB system.

TABLE OF CONTENTS

4.1 General Description

The device messages are data messages that are transmitted between the controller and devices. There are two types of data messages:program messages output from the controller to the MS8606A, and response messages input from the MS8606A by 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.

4.2 Program Message Format

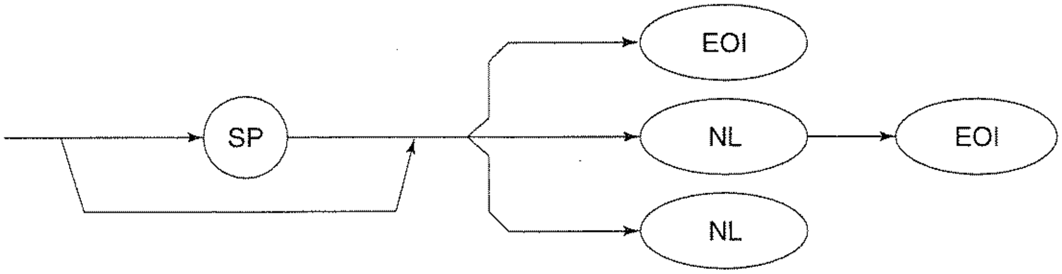
To transfer program messages from the controller to the MS8606A using the PRINT statement, the program message formats are defined as follows:

```
PRINT△@1,"TFREQ△3GHZ"
```

Program message

When the program message is transmitted from the controller to the MS8606A, the specified terminator is attached.

(1) PROGRAM MESSAGE TERMINATOR

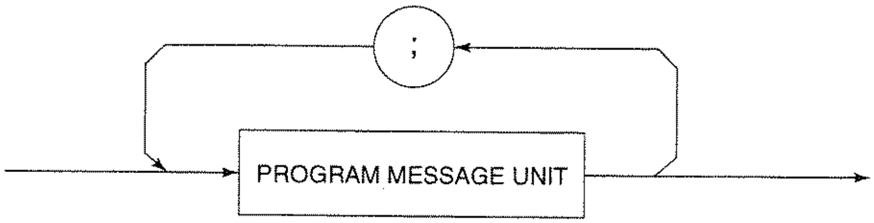


NL : New line or LF (Line Feed)

EOI : The EOI signal of the GPIB interface is used to indicate message termination.

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

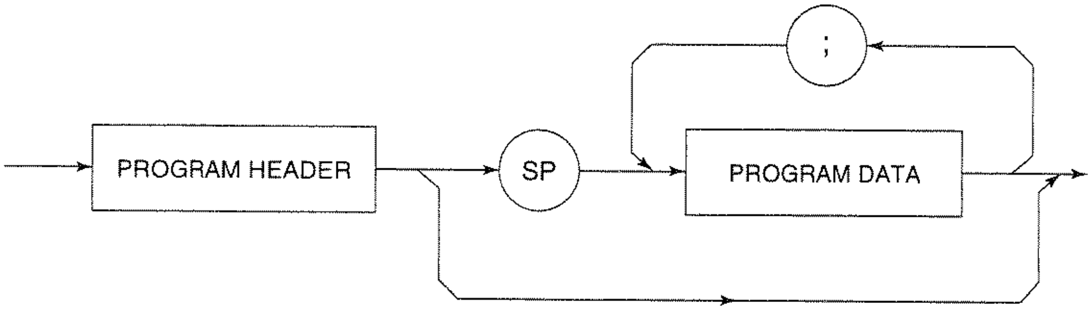
(2) PROGRAM MESSAGE



Multiple commands can be output sequentially by concatenating each of them with a semicolon.

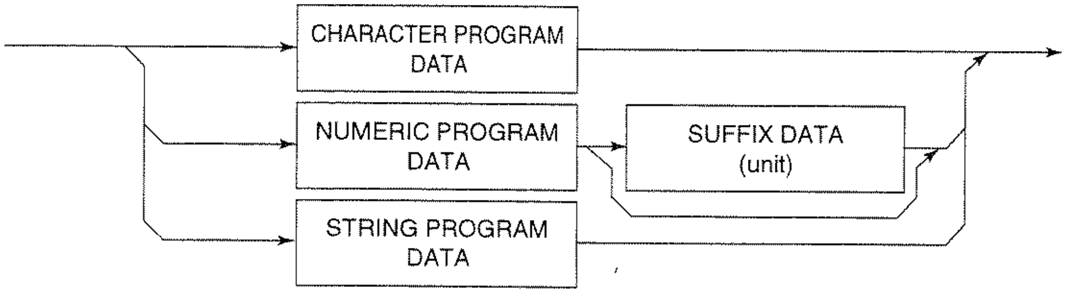
<Example> `PRINT△@1,"TFREQ△1GHZ;RFLVL△UP"`

(3) PROGRAM MESSAGE UNIT



- Each IEEE488.2 common command has a leading asterisk "*" that is always placed before the program header.
- The program query has a trailing question mark "?" that is always added at the end of the program header.

(4) PROGRAM DATA



(5) CHARACTER PROGRAM DATA

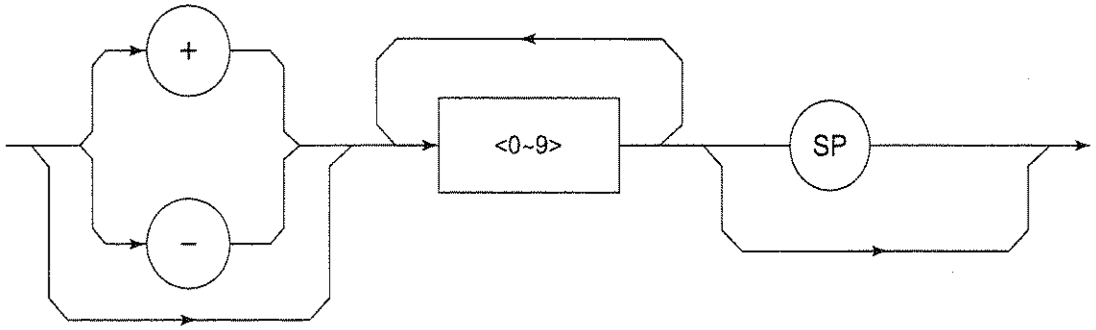
Character program data consists of uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, the underline "_", and the numbers 0 to 9. These characters can be used in specified combinations.

<Example> `PRINT△@1,△"MKR△NRM"` . . . . Sets Marker to Normal.

(6) NUMERIC PROGRAM DATA

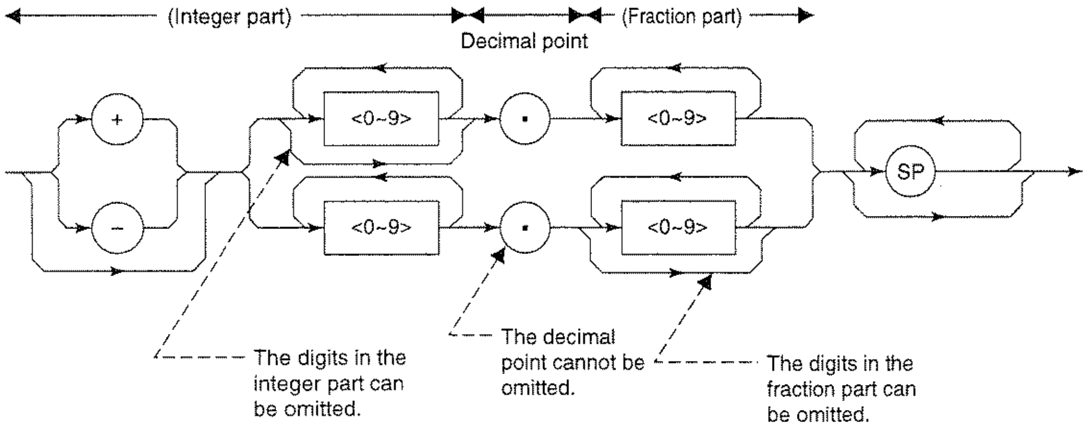
Numeric program data has two types of formats:integer format (NR1) and fixed-point real number format (NR2).

<Integer Format (NR1)>



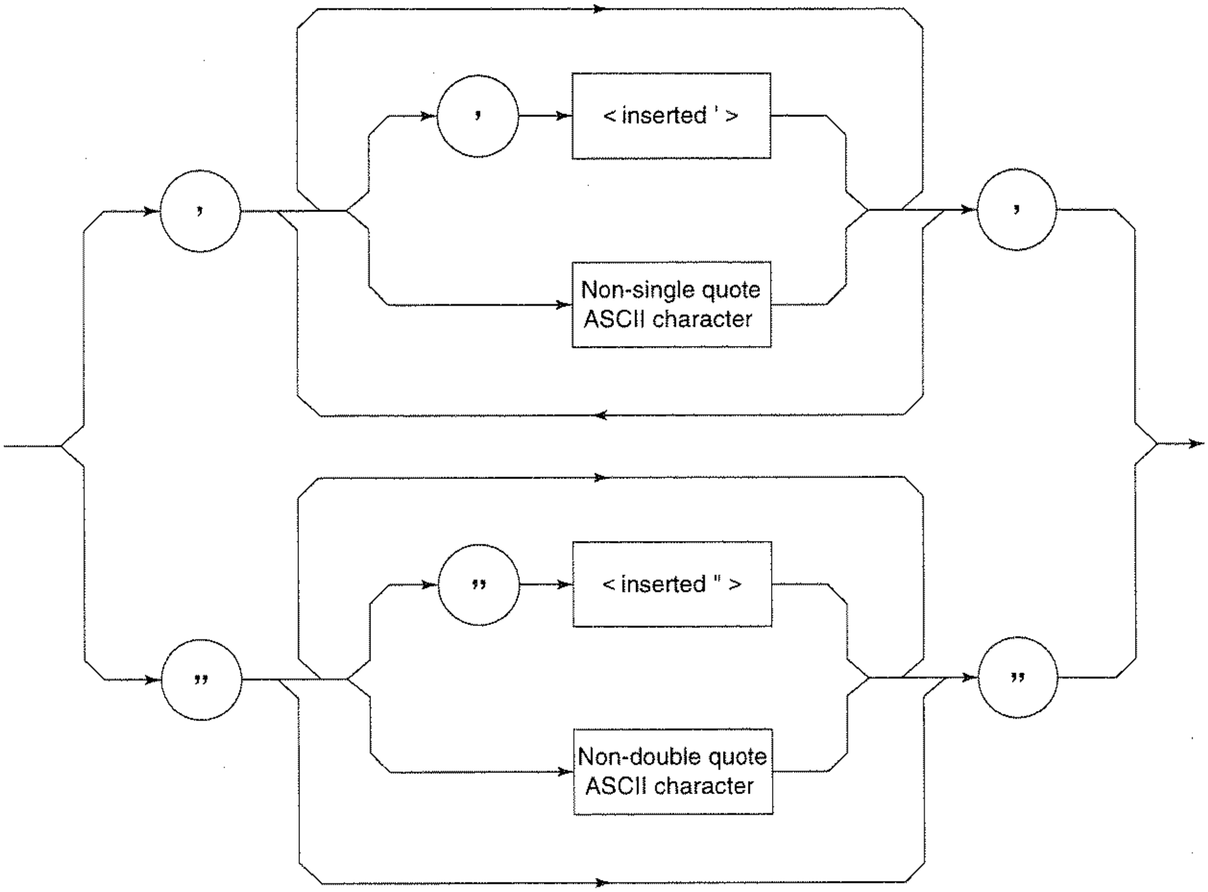
- Zeros can be inserted at the beginning. → 005, +000045
- No spaces can be inserted between a + or - sign and a number. → 5, +△5 (×)
- Spaces can be inserted after a number. → +5△△△
- The + sign is optional. → +5,5
- Commas cannot be used to separate digits. → 1,234,567 (×)

<Fixed-Point (real number) Format (NR2)>



- The numeric expression of the integer format is applied to the integer part.
- No spaces can be inserted between numbers and the decimal point. → +753△.123 (×)
- Spaces can be inserted between numbers and the decimal point. → +753.123△△△△
- A number may not always 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) STRING PROGRAM DATA



•Both ends of string program data must have a pair of double quotation marks "___".

```
PRINT @1,"TITLE 'MS8606A'"
```

A single quotation mark used within the character string must be repeated as shown in ' or ''.

```
PRINT @1,"TITLE 'MS8606A''NOISE MEAS''' "
```

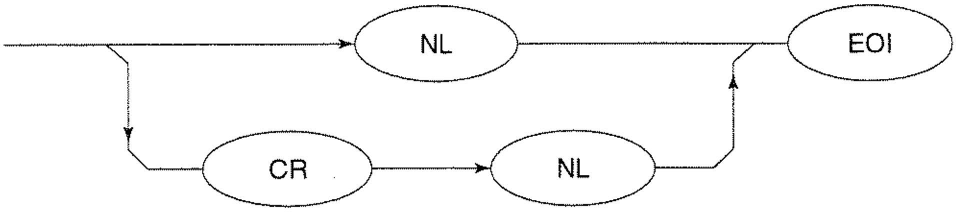
Executing TITLE results in MS8606A 'NOISE MEAS'.

Note:To use the double quotation mark " in the PRINT statement, specify CHR$ (&H22).

4.3 Response Message Format

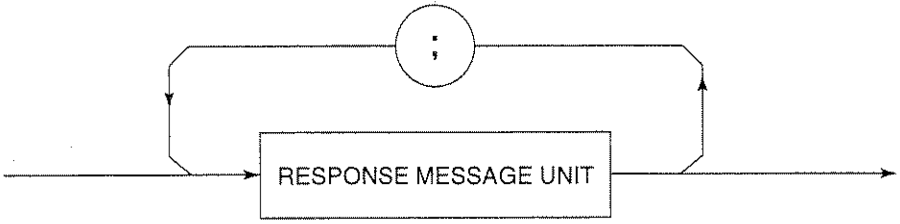
To transfer responses messages from the MS8606A to the controller by using the INPUT statement, the response message formats are defined as follows:

(1) RESPONSE MESSAGE TERMINATOR



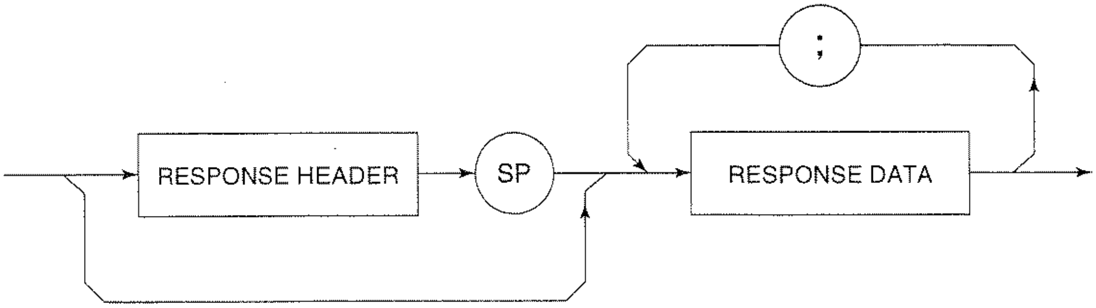
The response message terminator to be used depends on the TRM command.

(2) RESPONSE MESSAGE

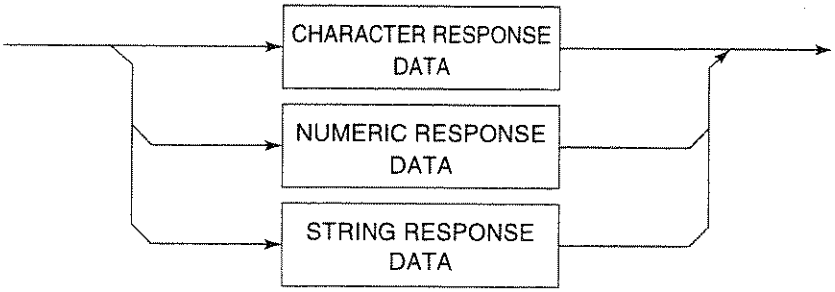


When a query is sent by the PRINT statement with one or more program queries, the response message also consists of one or more response message units.

(3) Normal RESPONSE MESSAGE UNIT



(4) RESPONSE DATA

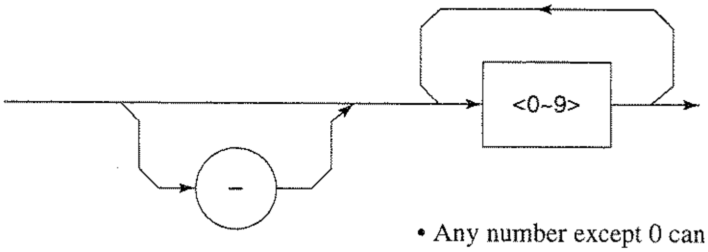


(5) CHARACTER RESPONSE DATA

Character response data consists of uppercase alphabetic characters from A to Z, lowercase alphabetic characters from a to z, the underline "_", and the numbers 0 to 9.These characters can be used in specified combinations.

(6) NUMERIC RESPONSE DATA

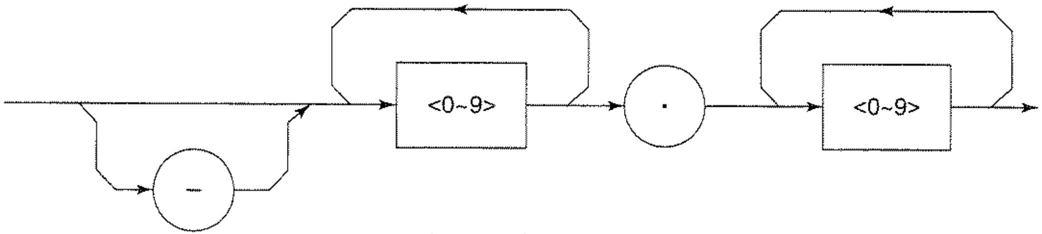
<Integer Format (NR1)>



<Example>
123
–1234

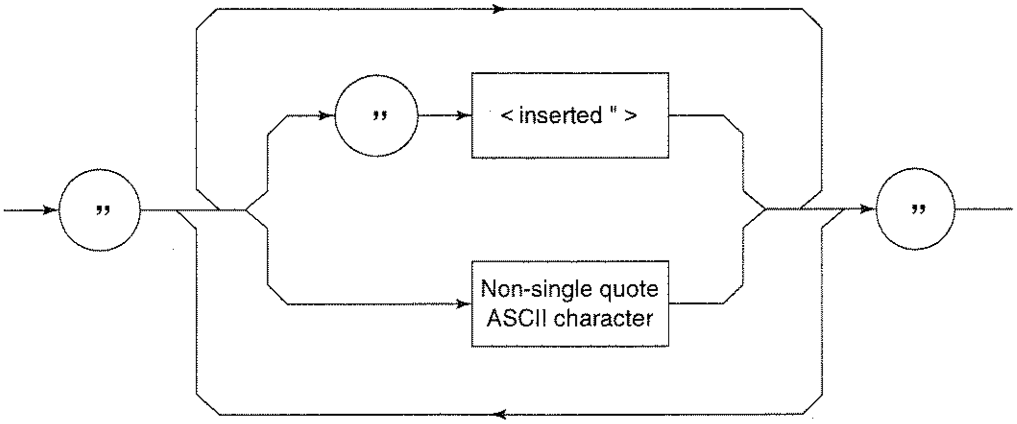
- Any number except 0 can be placed at the beginning digit.
- There is no need for a + sign before a positive number.

<Integer Format (NR1)>



- Any number except 0 can be placed at the beginning digit.
- There is no need for a + sign before a positive number
- If there are zeros after the decimal point, the numeric data is output in integer format.

(7) STRING RESPONSE DATA



String response data is output as an ASCII character string, which is enclosed with double quotation marks.

(8) Response message to input the waveform data using binary data

For details on reading binary format, see paragraph 8.2.2 (4) in Section 8, "SAMPLE PROGRAMS. "

SECTION 5
STATUS MESSAGES

This section describes MS8606A status messages, their data structure and models, and explains the techniques for synchronizing the controller and the MS8606A.

To obtain more detailed status information, the IEEE488.2 standard has more common commands and common queries than the IEEE488.1 standard.

TABLE OF CONTENTS

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

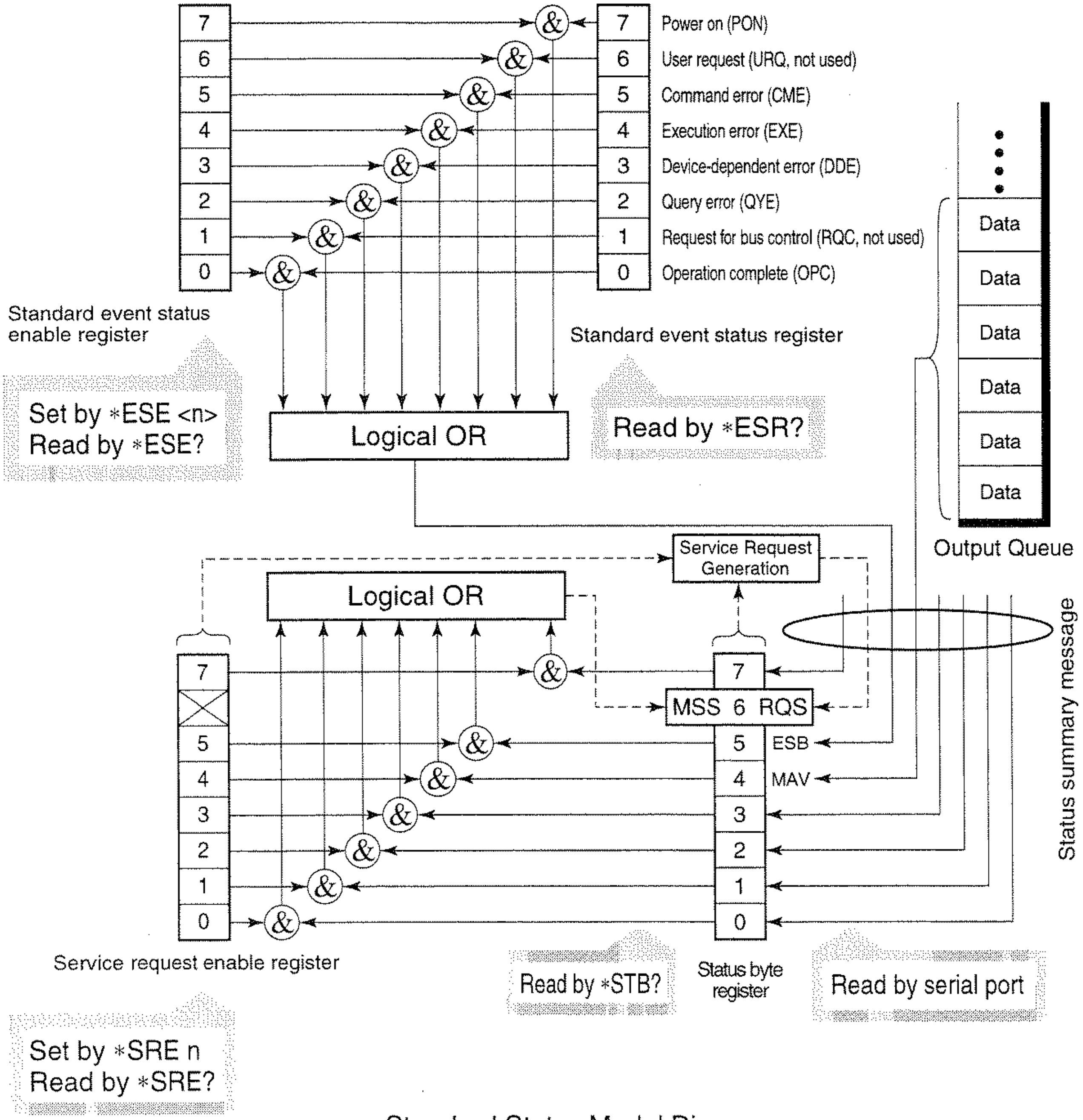
The following pages explain the status summary message and structure of status data that constitutes the status summary message bits, as well as techniques for synchronizing the MS8606A and controller, which use these status messages.

These functions are used by an external controller with the GPIB interface bus.

Almost functions can be used by an external controller with the RS-232C interface.

5.1 IEEE488.2 Standard Status Model

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



Standard Status Model Diagram

The IEEE488.1 status byte is used in the status model. This status byte is composed of seven summary message bits given from the status data structure. To create the summary message bits, there are two models for the data structure:the register model and the queue model.

Register model	Queue model
The register model consists of the 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 result of the AND operation of both register contents is not 0, the corresponding bit of the status bit becomes 1.In other cases, it becomes 0.And, 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 for sequentially recording the waiting status values and data. The queue structure is such that the relevant bit is set to 1 when there is data in it and 0 when it is empty.

In IEEE488.2, there are three standard models for status data structure, two register models and one queue model, based on the register model and queue model explained above. They 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 structure of the previously described register model. In this register, bits are set for eight types of standard events encountered by a device. ① Power on, ② User request, ③ Command error, ④ Execution error, ⑤ Device-dependent error, ⑥ Query error,⑦ Request for bus control and 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. It is used together with the Service Request Enable Register. When the result of the OR operation of both register contents is not 0, SRQ goes ON. To indicate this, bit 6 of the Status Byte Register (DIO7) is reserved by the system as the RQS bit, which indicates 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 mentioned 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.

5.2 Status Byte (STB) Register

The STB register consists of device STB and RQS (or MSS) messages. The IEEE488.1 standard defines the method of reporting STB and RQS messages, but not the setting and clearing of protocols or the meaning of STB. The IEEE488.2 standard defines the device status summary message and the Master Summary Status (MSS) which is sent to bit 6 together with STB in response to an *STB? common query.

5.2.1 ESB and MAV summary messages

The following describes the ESB and MAV summary messages.

(1) ESB summary messages

The ESB (Event Summary Bit) summary message is a message defined by IEEE488.2, and is represented by bit 5 of the STB register. This bit indicates whether at least one of the events defined in IEEE488.2 has occurred when the service request enable register is set to enable events after the final reading or clearing of the standard event register.

The ESB summary message bit becomes 1 when the setting permits events to occur if any of the events recorded in the standard event status register becomes 1.The ESB summary bit becomes true when the setting permits events to occur if any of the events registered in the standard event status register is true. Conversely, it is false if none of the recorded events occurs even if events are set to occur.

This bit becomes FALSE (0) when the ESR register is read by the *ESR? query and the ESR register is cleared by the *CLS command.

(2) MAV summary messages

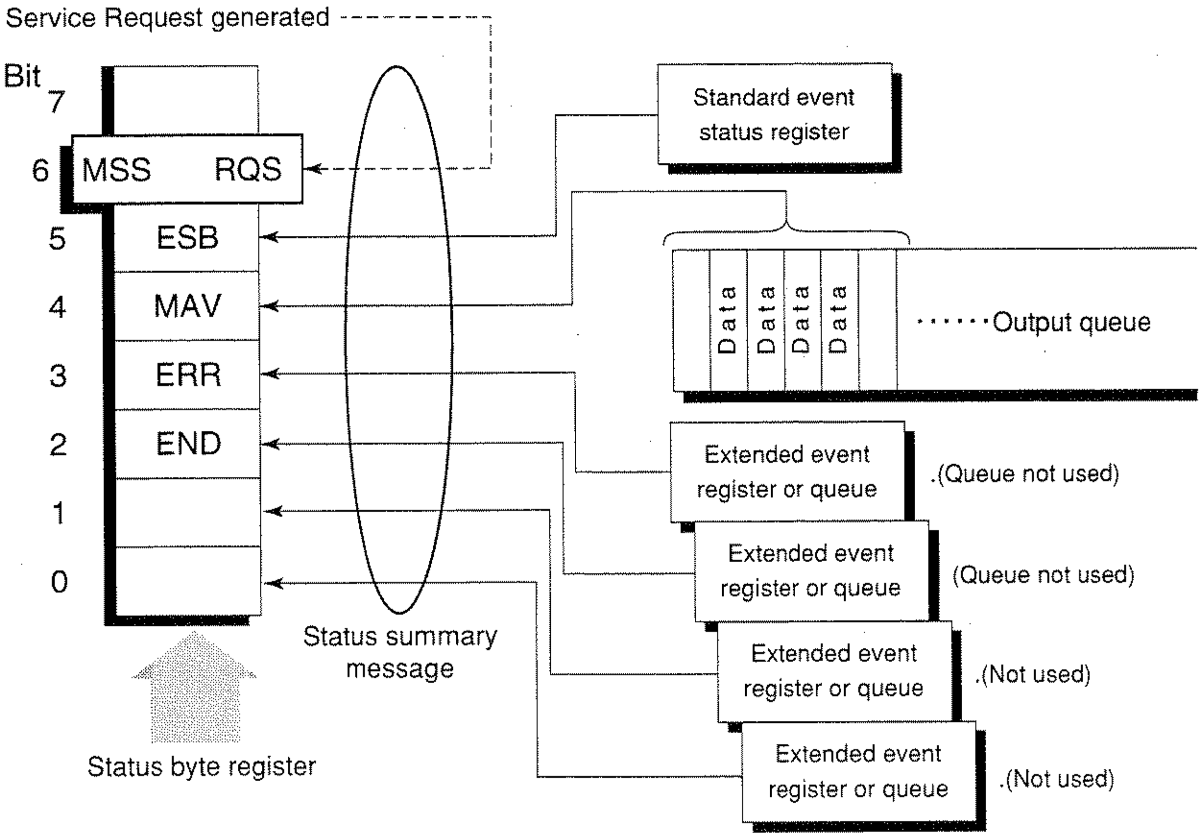
The MAV summary message is a message defined in IEEE488.2 and represented by bit 4 in the STB register. This bit indicates whether the output queue is empty. The MAV summary message bit is set to 1 (true) when a device is ready to receive a request for a response message from the controller and to 0 (false) when the output queue is empty. This message is used to synchronize the exchange of information with the controller. For example, this message can be used to make the controller wait until MAV is true after it sends a query command to the device. While the controller is waiting for a response from thedevice, it can process other jobs. Reading the output queue without first checking MAV delay all system bus operations until the device responds.

5.2.2 Device-dependent summary messages

The IEEE488.2 standard specifies that bits 7 (DIO8) and 3 (DIO4) to 0 (DIO1) of the status byte register can be used as status register summary bits, or to indicate that there is data in a queue.

Device-dependent summary messages have the respective status data structures of the register model or the queue model. Thus, the status data structure may be either the register to report events and status in parallel or the queue to report conditions and status in sequence. The summary bit represents a summary of the current status of the corresponding status data structure. For the register model, the summary message is true when there is an event set to permit the occurrence of more than one true event; while for the queue model, it is true if the queue is not empty.

As shown below, the MS8606A does not use bits 0, 1 and 7. As it uses bits 2 and 3 as the summary bit of the status register, it has 3 register model types (where 2 types are extended) and one queue model type(with no extension).



5.2.3 Reading and clearing the STB register

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

(1) Reading by serial poll (only when using the GPIB interface)

When using serial poll conforming to IEEE488.1, the device must return a 7-bit status byte and an RQS message bit which conforms to IEEE488.1.According to IEEE488.1, the RQS message indicates whether the device sent SRQ as true or not. The value of the status byte is not changed by serial poll. The device must set the RQS message to false immediately after being polled. As a result, if the device is again polled before there is a new cause for a service request, the RQS message is false.

(2) Reading by the *STB common query

The *STB? common query requires the device to send the contents of the STB register and an integer format response message from the MSS (Master Summary Status) summary message. The response represents the total binary weighted value of the STB register and the MSS summary message. STB register bits 0 to 5 and 7 are weighted to 1, 2, 4, 8, 16, 32, and 128; and the MSS to 64, respectively. Thus, excepting the fact that bit 6 represents the MSS summary message instead of the RQS message, the response to *STB? is identical to that for serial poll.

(3) Definition of MSS (Master Summary Status)

MSS indicates that there is at least one cause for a service request. The MSS message is represented by bit 6 in a device response to the *STB? query, but it is not generated response to serial poll. In addition, it is not part of the status byte specified by IEEE488.1.MSS is generated by the logical OR operation of the STB register with SRQ enable (SRE) register. In concrete terms, MSS is defined as follows:

(STB Register bit0 AND SRE Register bit0)

OR

(STB Register bit1 AND SRE Register bit1)

OR

:

:

(STB Register bit5 AND SRE Register bit5)

OR

(STB Register bit7 AND SRE Register bit7)

Since bit-6 status of the STB and SR enable registers is ignored in the definition of MSS, it can be considered that bit-6 status is always being 0 when calculating the value of MSS.

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

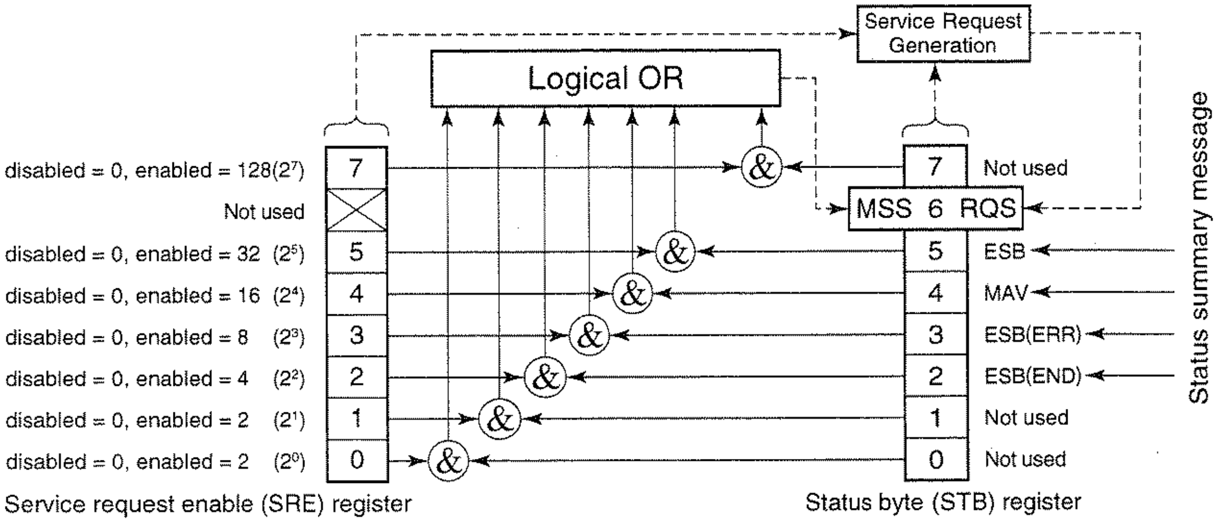
With the exception of the output queue and its MAV summary message, the ∗CLS common command clears all status data structures (status event registers and queues) as well as the corresponding summary messages.

The ∗CLS command does not affect settings in the enable registers.

5.3 Enabling the Service Request (SRQ)

All types of summary messages in the STB register can be enabled or disabled for service requests (SRE) by using the program-controlling service request (SRQ) enable operation. The service request enable (SRE) register controls the generation of SRQ in bits 0 to 7 as shown in the diagram below.

Bits in the service request enable register correspond to bits in the status byte register. If a bit in the status byte 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.For example, if bit 4 in the service request enable register is enabled, the device makes a request for service to the controller each time the MAV bit is set to 1 when there is data in the output queue.



(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. SRE register bits 0 to 5 and 7 are respectively weighted to 1, 2, 4, 8, 16, 32, and 128.The unused bit 6 must always be set to 0.

(2) Updating the SRE register

The *SRE common instruction is used to write data to the SRE register. An integer from 0 to 255 is added after the *SRE . fm3common instruction.

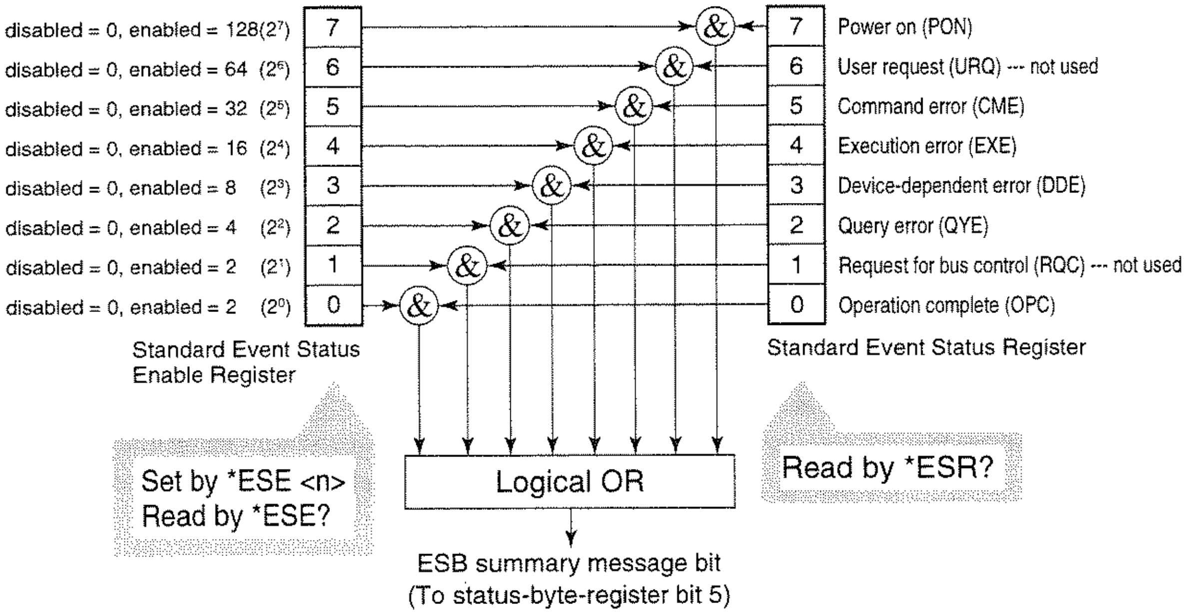
This integer indicates the total number of bits in the SRE register (weighted values:1, 2, 4, 8, 16, 32, and 128), and sets the corresponding SRE register bit to 0 or 1.

A bit value of 1 indicates an enabled state; 0 indicates a disabled state. Always ignore the value of bit 6.

5.4 Standard Event Status Register

5.4.1 Bit definition of standard event status register

The standard event status register must be available on all devices conforming to the IEEE488.2 standard. The diagram below shows the operation of the standard event status register model. Because the operation of the model is the same as that for the other models already described, the following only explains the meaning of each bit in the standard event status register as defined in the IEEE488.2 standard.



Standard event status enable (ESE) register selects whether the register makes the summary message true when the corresponding bit of the event status register is set.

Bit	Event name	Description
7	Power on (PON)	The power is turned on.
6	User Request (URQ)	Request for local control (rtl). This bit is produced regardless of whether a device is in remote or local mode. It is not used for the MS8606A so, it is always set to 0.
5	Command Error (CME)	An illegal program message, a misspelt command or a GET command within a program is received.
4	Execution error (EXE)	A legal program message, which cannot be executed, is received.
3	Device-dependent Error (DDE)	An error caused by other than CME, EXE or QYE (e.g., parameter error) occurred.
2	Query Error (QYE)	An attempt is made to read data in the output queue though there is none there, or data is lost from the output queue due to some reason (e.g., overflow).
1	Request Control (RQC)	A device is requesting an active controller.This bit is not used for the MS8606A so, it is always set to 0.
0	Operation Complete (OPC)	A device has completed specified operations and is ready to receive new commands. This bit is only set in response to the *OPC command.

5.4.2 Query error details

No.	Item	Description
1	Incomplete program message	If a device receives an MTA from the controller before it receives the terminator of the program message it is receiving, it aborts the incomplete program message and waits for the next one. To abort the incomplete message, the device clears its input-output buffer, reports a query error to the status report section and sets bit 2 in the standard status register to indicate the query error.
2	Interruption of response message output	If a device receives an MLA from the controller before it has sent the terminator of the response message it is sending, it automatically interrupts response message output and waits for the next program. To interrupt the response message output, the device clears its output buffer, reports a query error to the status report section, and sets bit 2 in the standard status register to indicate the query error.
3	Sending the next program message without reading the previous response message	When a device becomes unable to send a response message because the controller has sent another program message immediately following a program or query message, the device aborts the response message and waits for the next program message. It then reports a query error to the status report section as in No.2 above.
4	Output queue overflow	When several program and query messages are executed in succession, too many response messages for the output queue (256 bytes) may be generated. If further query messages are received when the output queue is full, the output queue cannot send corresponding responses due to the overflow situation. If there is overflow in the output queue, the device clears it and resets the section where response messages are created. Then it sets bit 2 in the standard event status register to indicate a query error.

5.4.3 Reading, writing to and clearing the standard event status register

Reading	The register is read by the *ESR? common query. The register is cleared after being read. The response message is an integer format data value obtained by binary weighting the event bit and converting it to a decimal number.
Writing	With the exception of clearing, writing operations cannot be performed externally.
Clearing	The register is only cleared in the following cases: ① A *CLS command received. ② The power is turned on. Devices first clear their standard event status registers but later record events that occurred during the sequence in the registers (e.g., setting of the PON event bit). ③ An event is read for the *ESR? command.

5.4.4 Reading, writing to and clearing the standard event status enable register

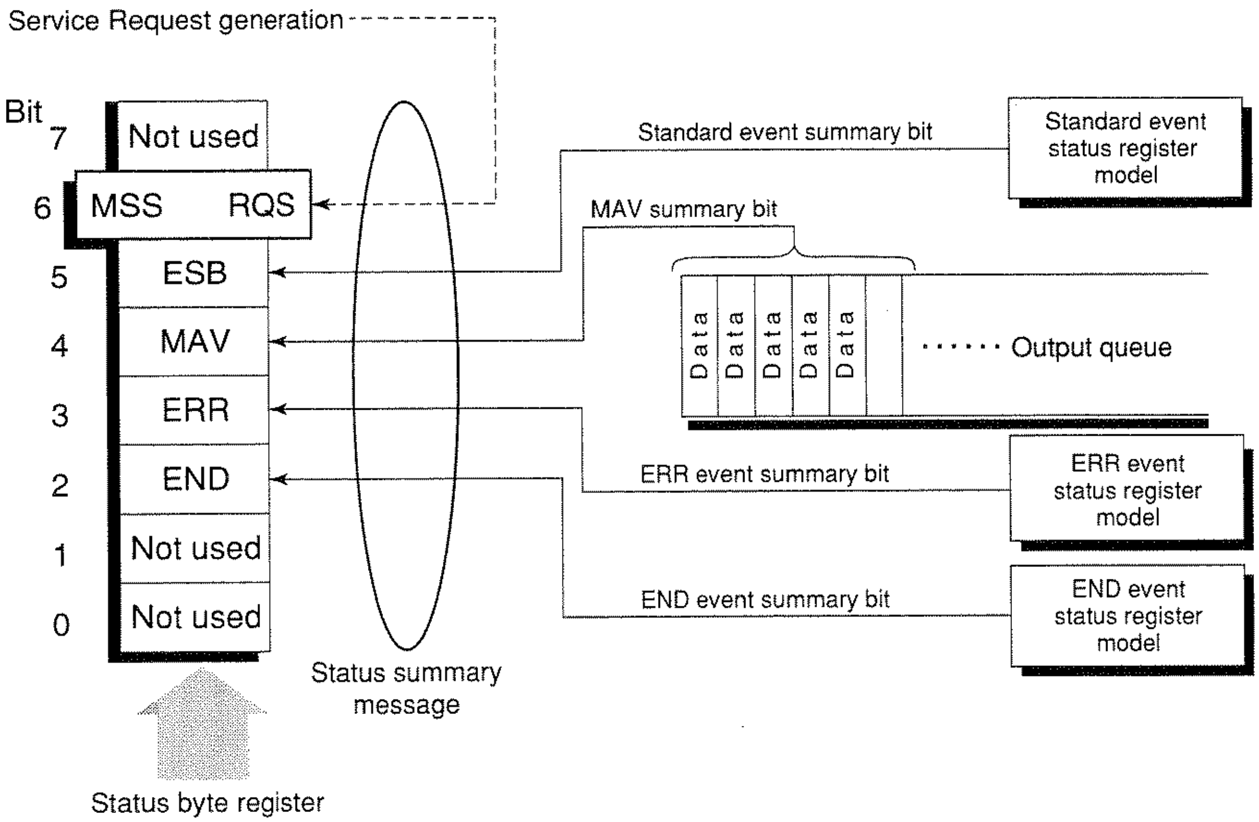
Reading	The register is read by the *ESE? common query. The response message is an integer format data value obtained by binary weighting the event bit and converting to a decimal number.
Writing	The register is written to by the *ESE common command. As bits 0 to 7 of the register are respectively weighted to 1, 2, 4, 8, 16, 32, 64, and 128, data to be written is sent by <DECIMAL NUMERIC PROGRAM DATA> which is the digit total of the bits selected from these bits.
Clearing	The register is cleared in the following cases: ① An *ESE command with a data value of 0 is received. ② The power is turned on. The standard event status enable register is not affected by the following: ① Changes of the status of the IEEE488.1 device clear function ② An *RST common command is received. ③ A *CLS common command is received.

5.5 Extended Event Status Register

The register models of the status byte register, standard event status register and enable registers are mandatory for equipment conforming to the IEEE488.2 standard.

In IEEE488.2, status-byte-register bits 7 (DIO8), 3 (DIO4) to 0 (DIO1) are assigned to status summary bits supplied by the extended-register and extended-queue models.

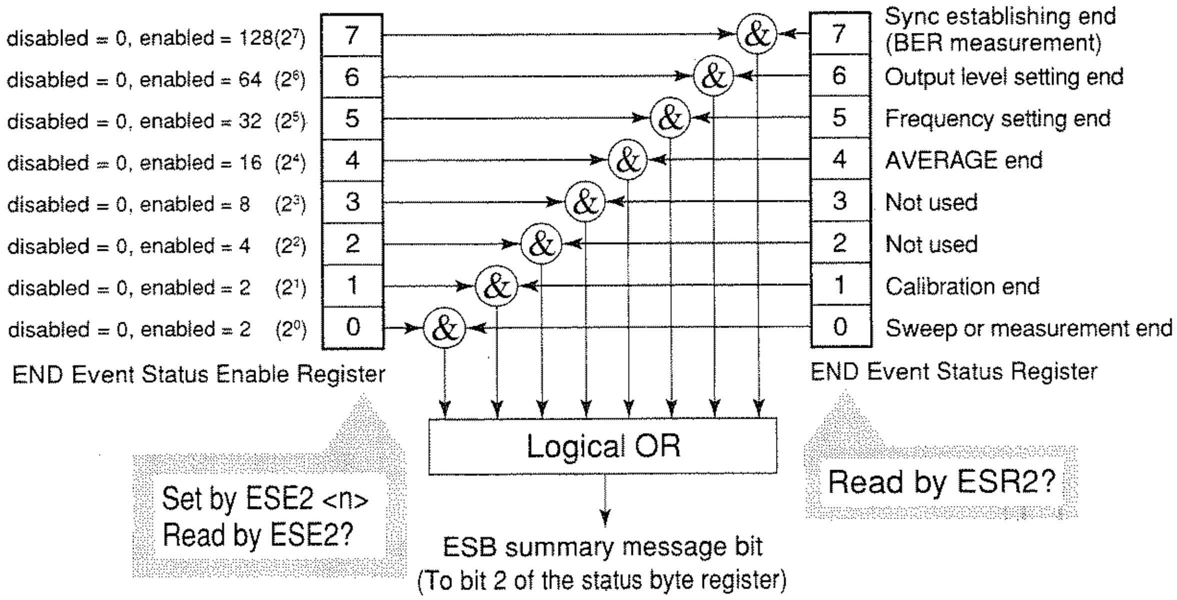
For the MS8606A, as shown in the diagram below, bits 7, 1 and 0 are unused; bits 2 and 3 are assigned to the END and ERR summary bits as the status-summary bits supplied by the extended-register model. As the queue model is not extended, there is only one type of queue: the output queue.



The following pages describe bit definition, the reading, writing to and clearing of bits for the END extended event register model.

5.5.1 Bit definition of END event status register

The following describes the operation of the END event status register model, the naming of its event bits, and what they mean.

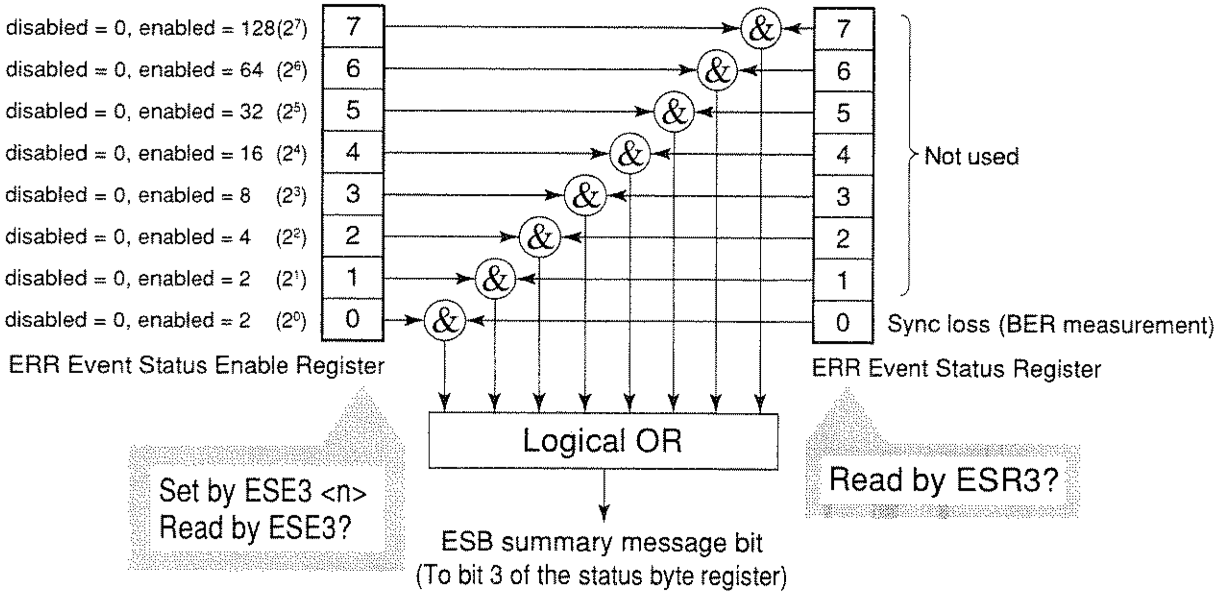


The END event status register selects whether the register makes the summary message true when the corresponding bit of the status register is set.

Bit	Event name	Description
7	Sync establishing end	This bit is set to 1 when synchronization is established after BER measurement starts.
6	Output level setting end	This bit is set to 1 when output level setting ends.
5	Frequency setting end	This bit is set to 1 when frequency setting ends.
4	AVERAGE end	This bit is set to 1 when averaging ends.
3	(Not used)	(Not used)
2	(Not used)	(Not used)
1	CAL end	This bit is set to 1 when calibration ends.
0	Sweep or measurement end	This bit is set to 1 when sweep or measurement ends.

5.5.2 Bit definition of ERR event status register

The following describes the operation of the ERR event status register model, the naming of its event bits, and what they mean.



The ERR event status register selects whether the register makes the summary message true when the corresponding bit of the status register is set.

Bit	Event name	Description
7	(Not used)	(Not used)
6	(Not used)	(Not used)
5	(Not used)	(Not used)
4	(Not used)	(Not used)
3	(Not used)	(Not used)
2	(Not used)	(Not used)
1	(Not used)	(Not used)
0	Sync loss	This bit is set to 1 when synchronization loss is occurred.

5.5.3 Reading, writing to and clearing the extended event status register

Reading	The register is destructively read by a query (e.g., it cleared after being read). The END/ERR event status register is read by ESR2?/ESR3? query. The read value, an integer format data (NR1), is obtained by binary weighting the event bit and converting it to decimal.
Writing	With the exception of clearing, writing operations cannot be performed externally.
Clearing	The register is cleared in the following cases: ① A *CLS command is received. ② The power is turned on. ③ An event is read by the ESR2?/ESR3? query command.

5.3.4 Reading, writing to and clearing the extended event status enable register

Reading	The register is non-destructively read by a query (i.e., not cleared after being read). The END/ERR event status register is read by the ESE2?/ESE3? query. The read value, an integer format data (NR2), is obtained by binary total weighting the event bit and converting it to decimal.
Writing	The END/ERR event status register is written to by the ESE2/ESE3 program command. As bits 0 to 7 of the registers are respectively binary weighted to 1, 2, 4, 8, 16, 32, 64, and 128, write data is sent as the integer format data obtained by total weighting the digit value of bits selected from among them.
Clearing	The register is cleared in the following cases: ① The ESE2/ESE3 program command with a data value of 0 is received for the END/ERR event status register. ② The power is turned on the power-on-status-clear flag is true. The extended event status enable register is not affected by the following: ③ Changes of the status of the IEEE488.1 device clear function ④ An *RST common command is received. ⑤ A *CLS common command is received.

5.6 Techniques for Synchronizing the MS8606A with a Controller

The MS8606A usually treats program messages as sequential commands that do not execute the processing of newly received commands until the previous command has been processed. Thus, special consideration need not be taken for pair-synchronization between the MS8606A and the controller.

If the controller controls one or more devices and synchronizes with them, after all the commands specified for the MS8606A have been processed, the next commands must be sent to other devices.

There are five ways of synchronizing the MS8606A with the controller:

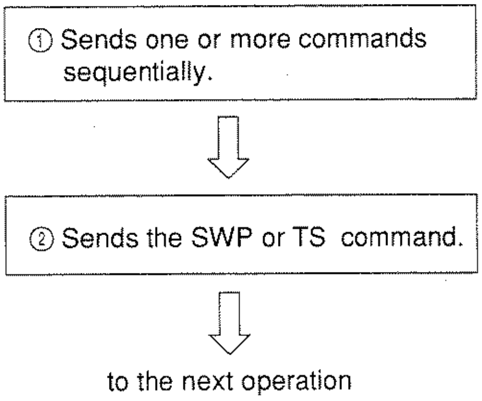
① Wait for SWP or TS command termination.
② Wait for a response after the *OPC? query is sent.
③ Wait for SRQ after *OPC is sent.
④ Wait for status generation of the status register.
⑤ Wait for SRQ by the status register.

5.6.1 Wait for SWP or TS command termination

When the MS8606A starts measurement using the SWP or TS command, it stops accepting the next measurement command until it terminates the measurement. Use this feature to set a synchronization.

Note: A response may not be returned if there is no measurement termination condition (permanent measurement of BER, etc.). In Average measurement mode, a response may be returned before averaging.

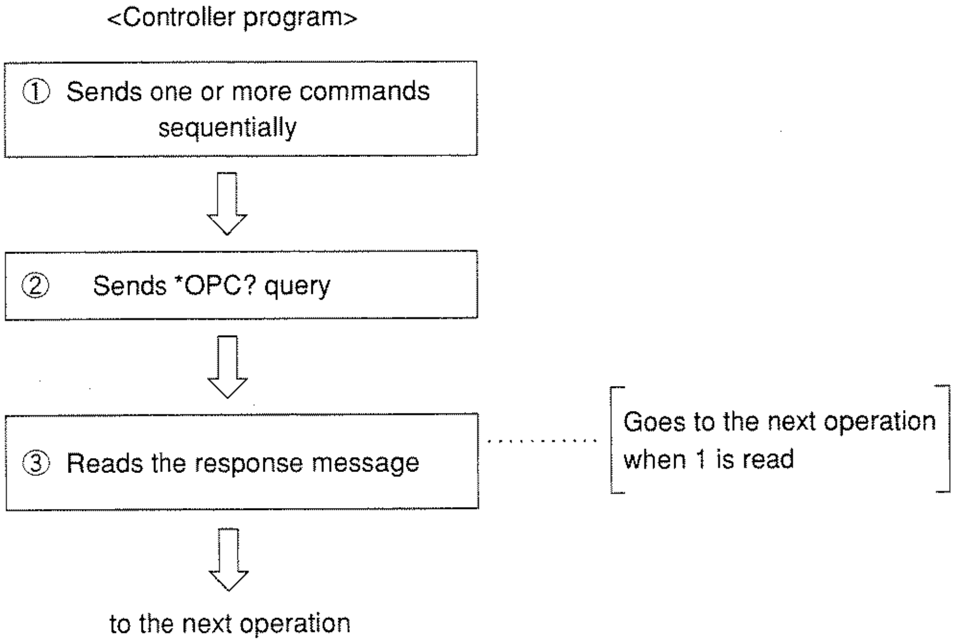
<Controller program>



5.6.2 Wait for response after *OPC? query is sent

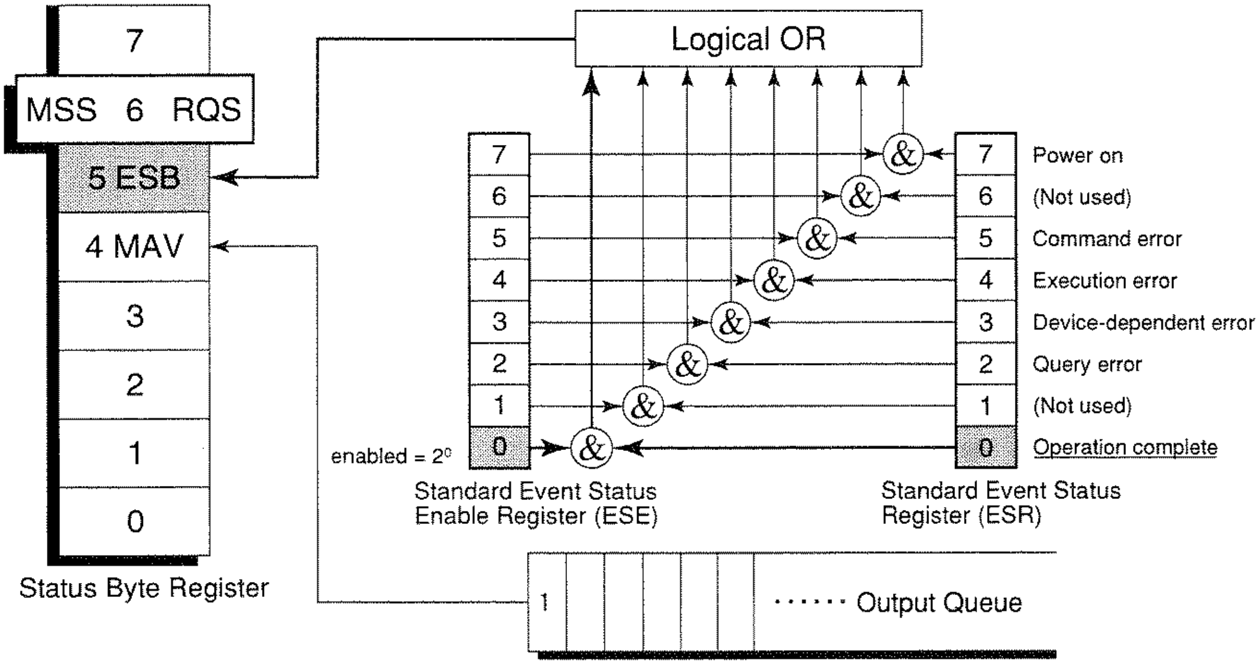
When executing the *OPC? query command, the MS8606A outputs "1" as the response message at the end of the previous command. The controller is synchronized with the MS8606A by waiting for the request message to be entered.

Note: When the read response message is "Q" (command is being executed), wait for about 50 ms until the controller moves to the next operation.



5.6.3 Wait for service request after *OPC is sent

The MS8606A sets the operation-complete bit (bit 0) to 1 when executing the *OPC command. The controller is synchronized with the MS8606A by waiting for SRQ when the operation-complete bit is set for SRQ.



■ <Controller program>

① Enables the 20 bit (1) of the Standard Event Status Enable Register `PRINT△@1;"*ESE△1"`

⇩

② Enables the 25 bit (32) of the Service Request Enable Register `PRINT△@1;"*SRE△32"`

⇩

③ Makes the device execute the specified operation

⇩

④ Sends the *OPC command `PRINT△@1;"*OPC"`

⇩

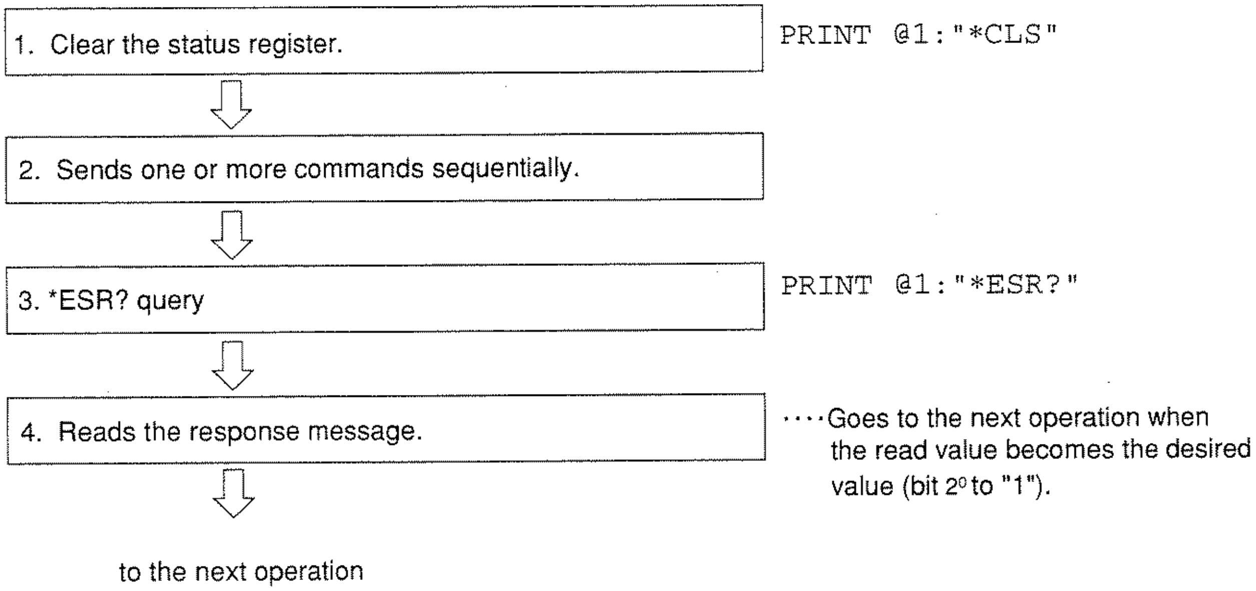
⑤ Wait for an SRQ interrupt (ESB summary message) ····Value of status byte: $2^6 + 2^5 = 96$

5.6.4 Wait for status generation of the status register

An event status register bit of the MS8606A is set to 1 when the corresponding event occurs.When the *ESR?, ESR2?, or ESR3? query is executed, the MS8606A outputs the value of the corresponding status register as a response message. The controller reads this response message and waits until the response becomes the specified value for synchronization.Reset the event status register immediately before making a desired event occur.

Note: Wait for 50 ms for the controller to go to the next operation after reading a response message.

- <Controller program : Synchronization by operation termination bit>



1. Clear the status register.

`PRINT @1:"*CLS"`

2. Sends one or more commands sequentially.

3. *ESR? query

`PRINT @1:"*ESR?"`

4. Reads the response message.

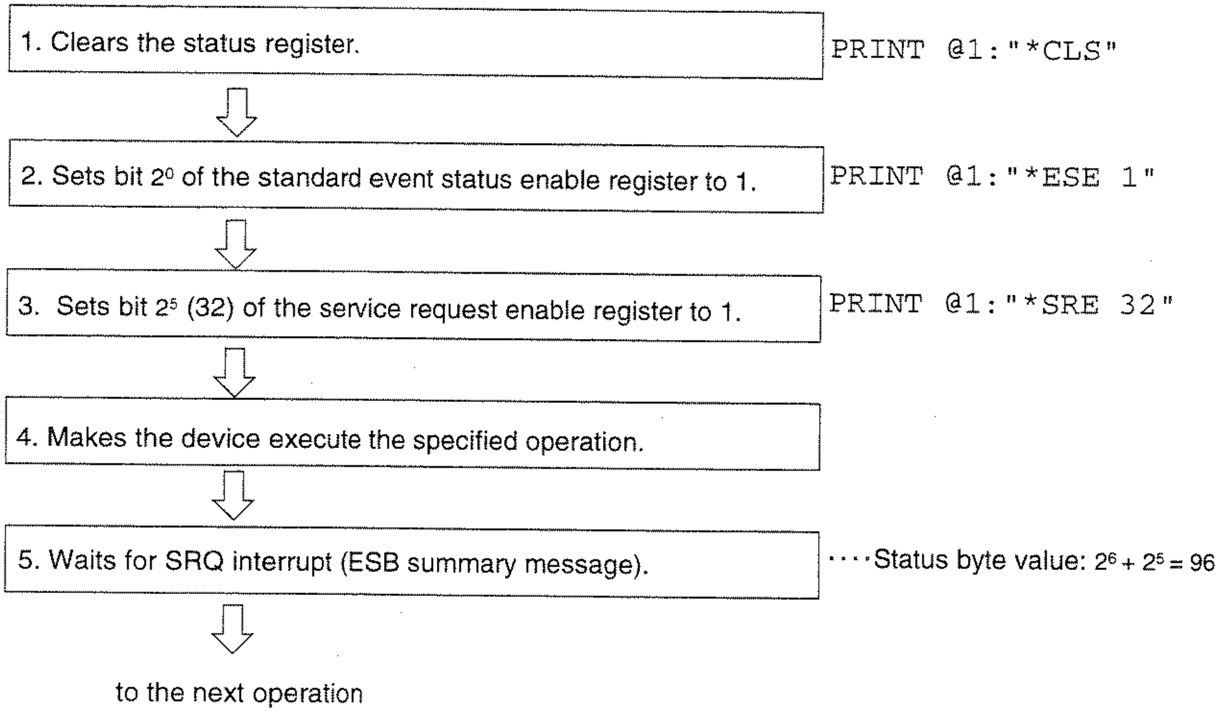
····Goes to the next operation when the read value becomes the desired value (bit 2^0 to "1").

to the next operation

5.6.5 Wait for service request issuance from the status register

An event status register bit of the MS8606A is set to 1 when the corresponding event occurs. After setting these bits to set the RQS, the controller waits the SRQ for synchronization. Reset the event status register immediately before making a desired event occur.

- <Controller program 1: Synchronization by operation termination bit>



1. Clears the status register. `PRINT @1:"*CLS"`

2. Sets bit 2^0 of the standard event status enable register to 1. `PRINT @1:"*ESE 1"`

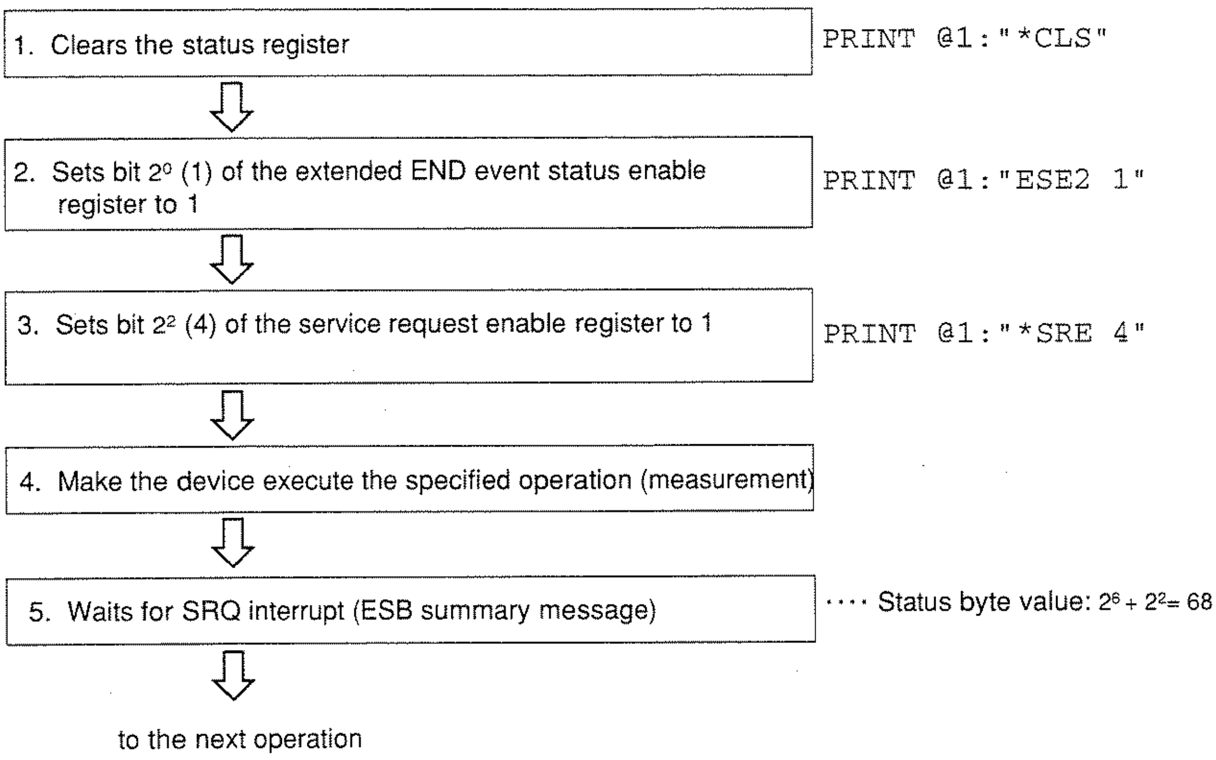
3. Sets bit 2^5 (32) of the service request enable register to 1. `PRINT @1:"*SRE 32"`

4. Makes the device execute the specified operation.

5. Waits for SRQ interrupt (ESB summary message). ····Status byte value: $2^6 + 2^5 = 96$

to the next operation

- <Controller program 2: Synchronization by the sweep/measurement termination bit>



1. Clears the status register `PRINT @1:"*CLS"`

2. Sets bit 2^0 (1) of the extended END event status enable register to 1 `PRINT @1:"ESE2 1"`

3. Sets bit 2^2 (4) of the service request enable register to 1 `PRINT @1:"*SRE 4"`

4. Make the device execute the specified operation (measurement)

5. Waits for SRQ interrupt (ESB summary message) ···· Status byte value: $2^6 + 2^2 = 68$

to the next operation

SECTION 6

INITIAL SETTINGS

This section outlines initialization for the system and describes how to initialize the system. An example of initial settings are written for IBM-PC commands.

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6.1 General Description

There are three levels of initialization for the GPIB system.

The first level is bus initialization using the IFC statement with the system bus in the idle state.

The second level is initialization for message exchange using the DCL command to enable devices to receive program messages.

The third level is device initialization using the PRE or *RST command to initialize device functions. These levels of initialization prepare a device for operation.

A device must be set to a known state when the power is switched 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.	Can be combined with other levels, level 1 must be executed before level 2.
2	Initialization for message exchange	The message exchanges of all devices and specified devices on the GPIB are initialized respectively by the DCL (Device Clear) and SDC (Select Device Clear) GPIB bus commands, which also nullify the function that reports to the controller that operation has completed.	Can be combined with other levels, level 2 must be executed before level 3.
3	Device initialization	The *RST or PRE/INI/IP command returns the specified device to the device-dependent known state, regardless of the conditions of previous device use.	Can be combined with other levels; level 3 must be executed after levels 1 and 2.

The following paragraph describes the commands for executing levels 1, 2, and 3, and the items initialized by execution. It also describes the known state which is set when the power is switched on.

When controlling with an external controller through the GPIB interface bus, all the initialization functions of the first/second/third levels can be used.

When controlling with an external controller through the RS-232C interface port, the initialization function of the third level (device initialization) can be used. The initialization functions of the first/second levels cannot be used.

6.2 Bus Initialization by the IFC Statement

■ Example

```
Call ibsic(ud%)
```

■ Explanation

IThe IFC statement initializes the interface functions of all devices connected to the GPIB bus line.

The initialization of interface functions involves erasing the settings (e.g. talker, listener) made by the controller and resetting to the initial states. In the table below, ○ indicates the initialized functions; △ indicates partially initialized functions.

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 (e.g. frequency settings, lamp on/off).

6.3 Initialization for Message Exchange by DCL and SDC Bus Commands

■ Example

`Call ibclr(ud%)`	Initializes only the device which is specified by ud% for message exchange (sending SDC)

■ Explanation

This statement executes initialization for message exchange by all devices or only the specified device on the GPIB of the specified select code.

■ Items to be initialized for message exchange

The MS8606A by which the DCL or SDC bus command is accepted executes the following:

① Input buffer and Output Queue : Cleared ; the MAV bit is also cleared at the same time.

② Parser, Execution Controller, and Response Formatter : Reset

③ Device commands including *RST : Clears all commands that prevent these commands from executing.

④ Processing 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 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 function : Puts sections relating to message exchange in an idle state. The device keeps waiting for a message from a controller.

Note: The items listed below are not affected even if DCL and SDC bus command processing is executed:

① The current data set or stored in the device

② Front panel settings

③ Other status byte state except MAV bit

④ Device operation in progress

6.4 Device Initialization by the *RST Command

■ Syntax

```
*RST
```

■ Example

`PCall ibwrt(ud%,"*RST")`: Initializes the device (MS8606A) whose address is 1 with level 3.

■ Explanation

The *RST(Reset) command is an IEEE488.2 common command which resets a device with level 3.

The *RST(Reset) command is used to reset a device (MS8606A) to a specific initial state. Refer to the Operation Manual Appendix B for details of initialization items and initial values.

Note: The *RST command does not affect the items listed below.

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 controlling external devices, etc.

6.5 Device Initialization by the PRE/INI/IP Command

■ Syntax

```
PRE

INI

IP
```

■ Example (program message)

`Call ibwrt(ud%,"PRE"):` Initializes the device (MS8606A) whose address is 1 with level 3.

■ Explanation

The PRE, INI and IP commands are MS8606A device-dependent messages which initialize a device with level 3.

Refer to the Operation Manual Appendix B for details of items initialized by the PRE, INI, and IP commands and initial values.

6.6 Device Status at Power-on

When the power is switched on:

① Preset value : When a power-off time (POWERON LAST) is selected, the device is set to the status before the last power off.

Preset value : When Recall memory No. (POWERON n) is selected, the device is set to file (number [n]) status.

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.

For the special case of ①, when the power supply is first turned on after the device is shipped, the initial values are set to those in the initial setting table (refer to separate Operation Manual Vol. 1 Appendix B).

SECTION 7

SAMPLE PROGRAM

In this section, the program flow is explained for controlling MS8606A (AF measurement) and for conducting automatic measurement by using the controller.

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7.1 Notes on creating the Program

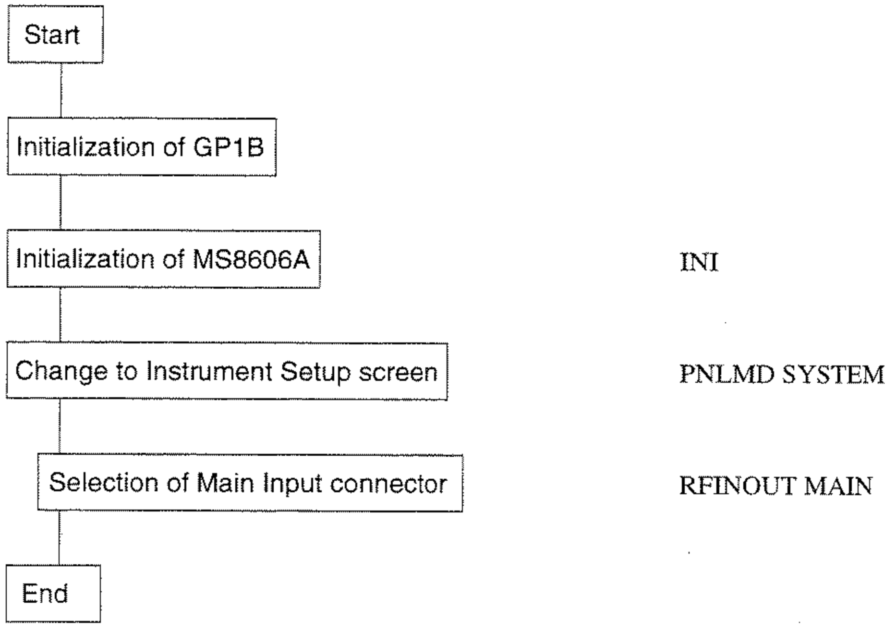
When a remote control program is creating, carefully note the following points.

No.	Key points	Explanation
1	Each device must be initialized.	Each device is not always in the appropriate condition during actual usage due to operation of the device itself on the panel or the execution of other programs. Therefore, each device must be initialized to make the conditions at the start of usage constant. Do the following: ① Initialize the interface function ② Initialize the message exchange function of the device ③ Initialize the specific function of the device
2	The remote condition of the device must be RWLS (Remote With Lock-out State).	Device is set to local lockout to prevent the device returning to local. In the simple remote condition, when the [local] key is pressed, the device will enter the local condition. In this situation, if a panel key is pressed, auto-measurement will not function normally and measurement data may become unreliable.
3	If an inquiry is sent, commands which are related to the device must not be sent immediately, except after the reading of result.	Immediately after the inquiry command, the result of reading must be described in succession. If commands other than result reading are sent to the controller before the result of inquiry is read, and MLA is received, the output buffer will be cleared and the response message will be deleted.
4	Program avoiding exceptional protocol operation	No.3 above is one of the exceptional protocol operation, but try to avoid exceptional operation unless necessary. As for expected exceptions, set exception treatment parts in the program to avoid errors of stopping execution of the program.
5	Confirmation of interface function (subset) of each device	Confirm the subset of each device. When a program is executed for a device without the necessary subset, processing will not continue. Also check that the machine type conforms to IEEE488.2.

7.2 Sample Program

7.2.1 Analog measurement common settings

Use the common settings for analog measurement.

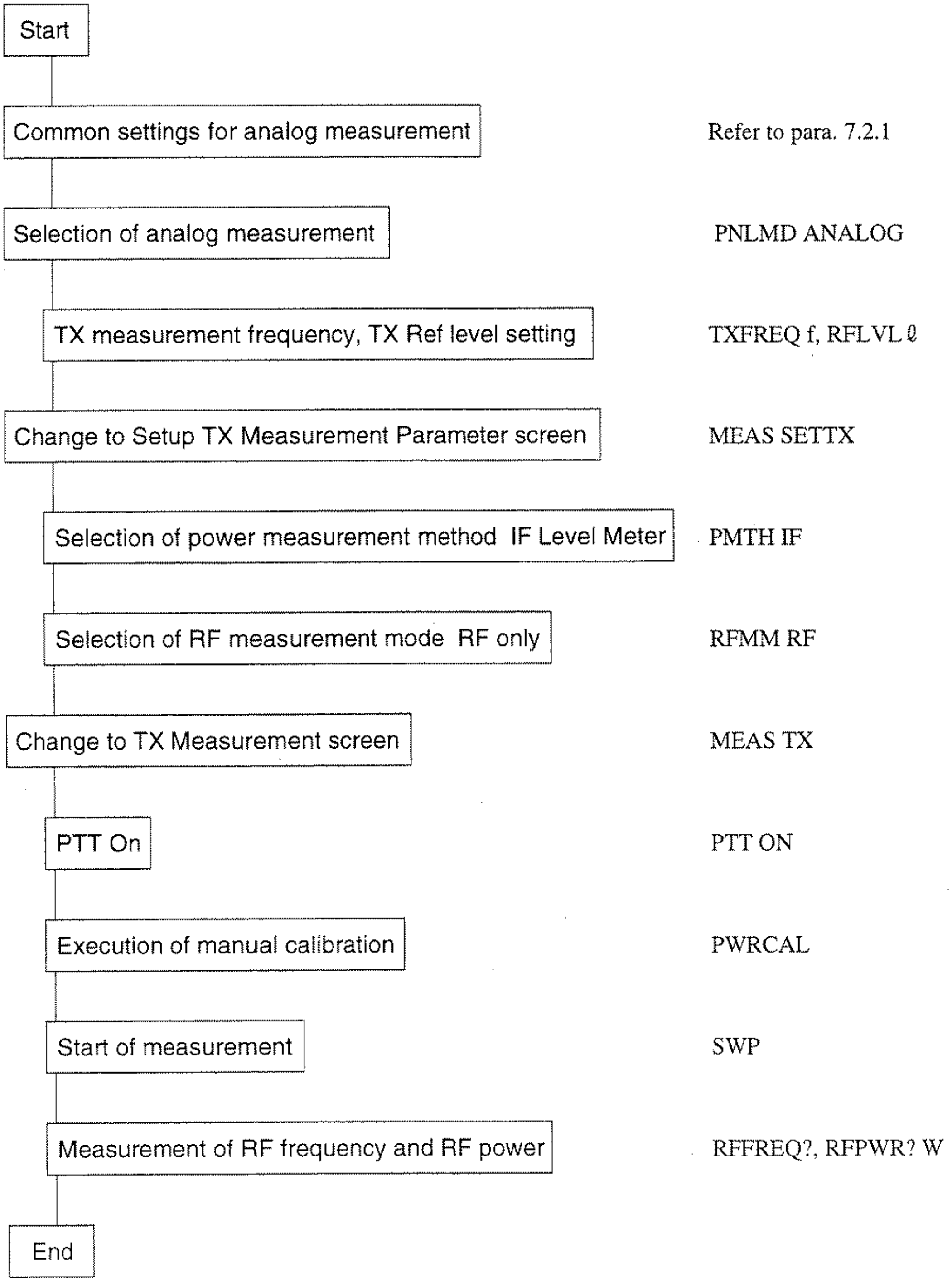


Refer to Section 6 concerning the initialization of GP1B.

There are four commands, namely IP, PRE, INI, *RST, for initializing the MS8606A. IP, PRE and INI can be used as the same function. *RST is for initializing a wider range than the other initialization commands. The parameters initialized by these commands are shown in the list of initial values in Appendix B, Panel Operation.

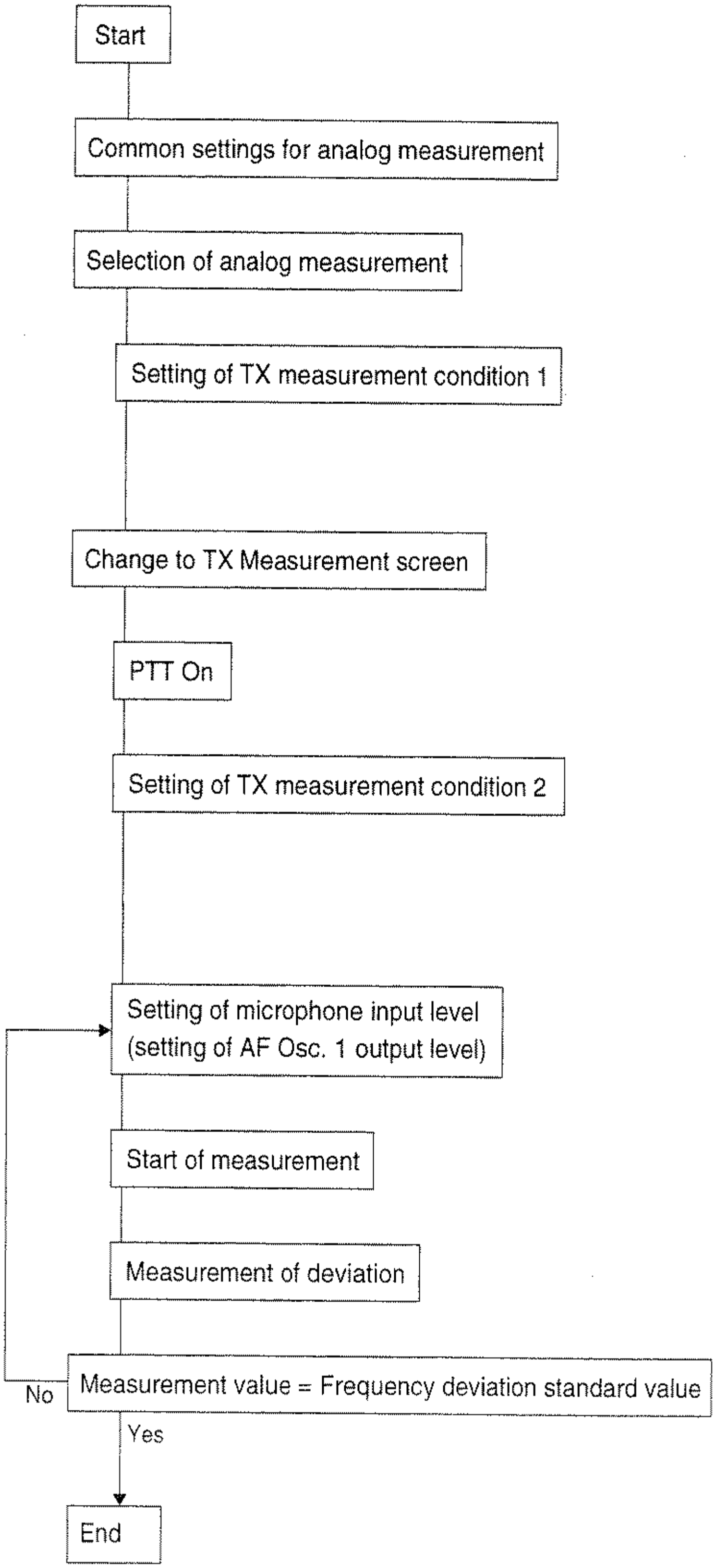
7.2.2 Transmitter frequency and power measurement

Measure the output frequency and power of the transmitter.



7.2.3 Transmitter microphone input sensitivity measurement

Measure the microphone input level of AF signal necessary for obtaining the standard frequency change (for example 3.5 kHz) for the transmitter.



Refer to para. 7.2.1.

PNLMD ANALOG

TX measurement frequency: TXFREQ f
TX measurement Ref level: RFLVL ℓ
AF Level Output Impeadance : AOIMP*

MEAS TX

PTT ON

Detect Mode : DETMD *
Demodulation band
AF Filter : AFLT *, AHPF *
De-emphasis : ADEMP *
AF Osc.1 output frequency: AFREQ1 f

ALVL ℓ

SWP

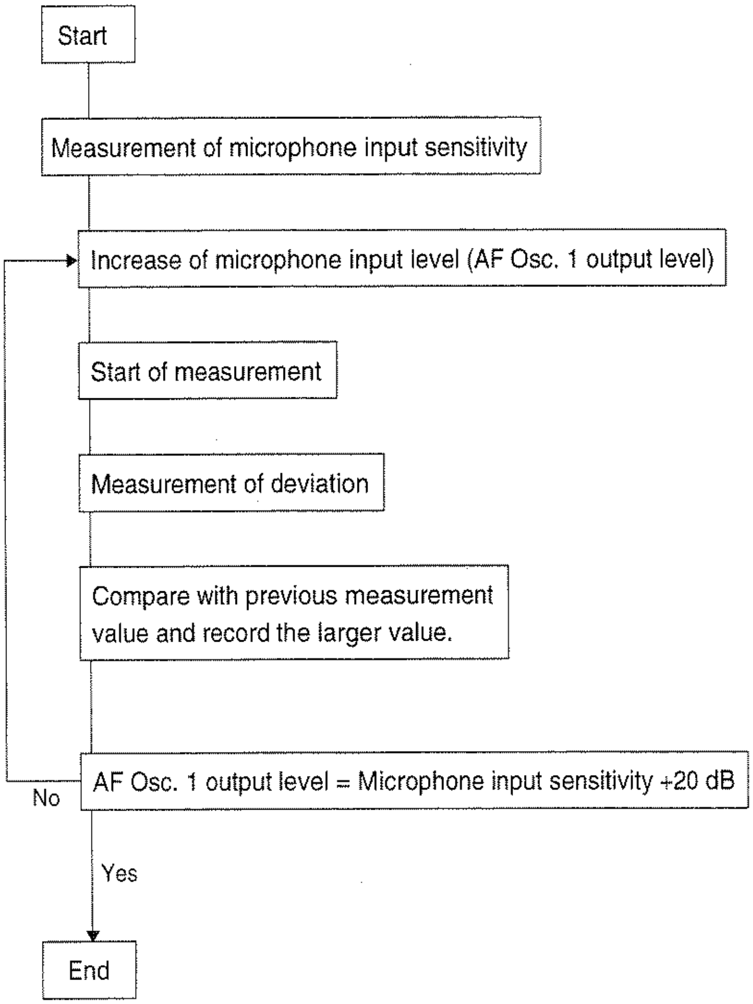
RDEV?

If the measured value does not reach the standard frequency deviation, repeat the measurement by changing the microphone input level.

The microphone input level (at the time when standard frequency deviation is reached) gives the microphone input sensitivity.

7.2.4 Transmitter maximum frequency deviation measurement

Increase the microphone input level from the microphone input level (at which the standard frequency deviation is obtained) to +20 dB, then measure the maximum value of the frequency deviation thus obtained.



Refer to para. 7.2.3.

ALVL ℓ

SWP

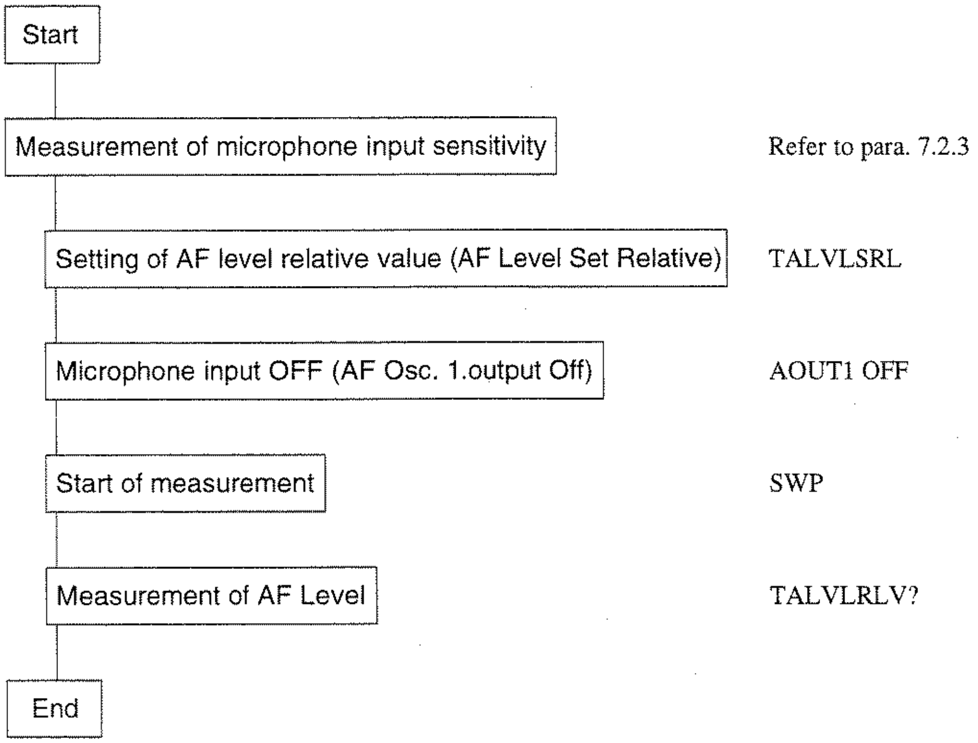
RDEV?

Increase AF Osc. 1 output level till the microphone input sensitivity (reached at the time of obtaining standard frequency deviation) +20 dB, then repeat the measurement.

The maximum value of frequency deviation obtained when increasing AF Osc. 1 output level to +20 dB will be the maximum frequency deviation.

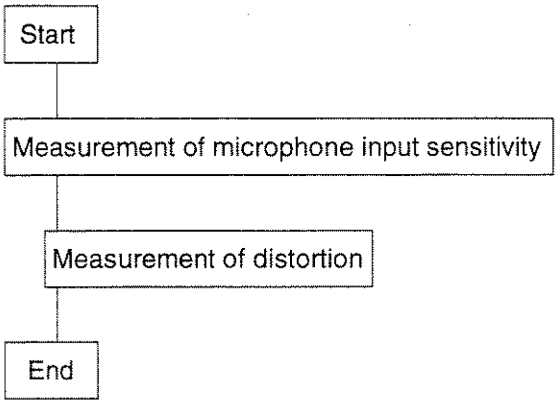
7.2.5 Transmitter modulation S/N measurement

Measure the ratio of modulation signal level (S) (at the time of modulation by the standard frequency deviation) against the residual modulation noise (N) (at the time of non-modulation).



7.2.6 Transmitter modulation distortion measurement

Measure the distortion of the modulation signal at the time of modulation by the standard frequency deviation.

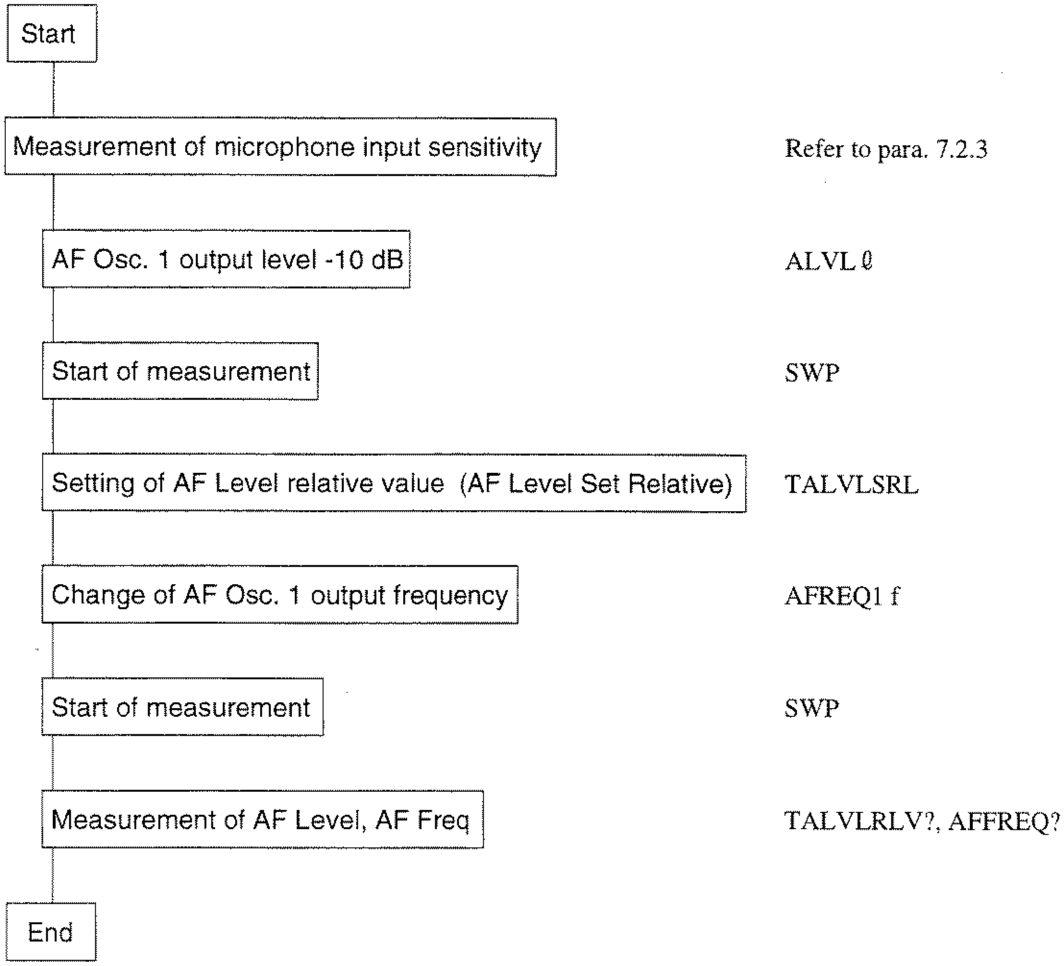


Refer to para. 7.2.3

DSTN?

7.2.7 Transmitter modulation frequency-characteristic measurement

Change the modulation frequency and measure the change of demodulation level. The measured value is expressed as the deviation compared to the level at modulation frequency of 1 kHz.



APPENDIXES

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APPENDIX A ASCII* CODE TABLE

B7 B6 B5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
BITS B4 B3 B2 B1	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 S 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

*American Standard Code for Information Interchange

Table A-1 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
② ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → ROW ↓	0		1		2		3		4		5		6		7	
0	0	0	0	0	NUL		DLE		SP	Listener address (MLA) assigned to equipment	0	Listener address (MLA) assigned to equipment	@	Listener address (MLA) assigned to equipment	P	Listener address (MLA) assigned to equipment	`	Meaning defined by PCG	p	Meaning 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=DI01...b7=DI07 (b1 through b7 correspond to DI01 to DI07 sequence.)GTL

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

Table A-2 Interface Message Groups

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 A-3 Address Assignments

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	↓	↓	↓	↓	↓	Decimal	
@	SP	0	0	0	0	0	0	
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	Printer
N	.	0	1	1	1	0	14	Plotter
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	
Λ	>	1	1	1	1	0	30	
?	—	1	1	1	1	1	31	UNL,UNT

APPENDIX B COMPARISON TABLE OF CONTROLLERS' GPIB INSTRUCTIONS

Function	Controller			
	PACKET V (Anritsu)	PC-9800 series (NEC)	IBM-PC	HP9000 series
Outputs data to a device	WRITE @ device number; data	PRINT @ listener address; data	CALL IBWRT( )	OUTPUT device selector;data
Outputs binary data to a device	BIN WRITE @ device number; data	WBYTE command;data		
Assigns data entered from a device to a variable	READ @ device number:variable	INPUT @ talker address, listener address;variable LINE INPUT @ talker address, listener address;variable	CALL IBRD( )	ENTER device selector;variable
Assigns binary data entered from a device to a variable	BIN READ @ device number; variable	RBYTE command;variable		
Initializes an interface function	IFC @ select code	ISET IFC	CALL IBSIC( )	ABORT select code
Turns REN line on	REN @ select code	ISET REN	CALL IBSRE( )	REMOTE device selector (select code)
Turns REN line off	LCL @ select code (sets all devices local) LCL @ device number (sets only specified devices to listeners, and sends out GTL command)	IRESET REN WBYTE &H3F,listener address,secondary address,&H01;	CALL IBSRE( ) CALL IBLOC( )	LOCAL device selector (select code) LOCAL device selector (select code + primary address)
Outputs interface messages (messages) and data	COMMAND @ select code : character string for message [;data]		CALL IBCMD() CALL IBCMDA() (asynchronous)	SEND select code ;message string
Triggers a specified device	TRG @ device number	WBYTE &H3F,listener address,secondary address,&H08;	CALL IBTRG( )	TRIGGER device selector

Function	Controller			
	PACKET V (Anritsu)	PC-9800 series (NEC)	IBM-PC	HP9000 series
Initializes devices	DCL @ select code (all devices bearing a specified select code) DCL @ device number (specified devices only)	WBYTE &H3F,&H14; WBYTE &H3F, listener address, secondary address,&H04;	CALL IBCLR( )	CLEAR device selector (selector code) CLEAR device selector (selector code + primary address)
Disables a device from being switched over from remote to local	LLO @ select code	WBYTE &H3F, &H11;		LOCAL LOCKOUT
Transfers control to a specified device	RCT @ device number	WBYTE talker address, &H09;	CALL IBPCT( )	PASS CONTROL
Sends out a service request	SRQ @ select code	ISET SRQ	CALL IBRSV( )	REQUEST select code
Performs serial polling	STATUS @ device number	POLL	CALL IBRSP( )	SPOLL (device selector) (function)
Sets a terminator code	TERM IS	CMD DELIM	CALL IBEOS( ) CALL IBEOT( )	
Sets a limit value for checking a timeout		CMD TIMEOUT	CALL IBTOM( )	

APPENDIX C INDEX

- The numbers on the right indicate section and paragraph numbers in this operation manual.

MS8606A

Digital Mobile Radio Transmitter Tester

(Spectrum Analyzer function)

Operation Manual

(Panel Operation)

TABLE OF CONTENTS

SECTION 1

GENERAL

TABLE OF CONTENTS

1.1 General

The MS8606A Digital Mobile Radio Transmitter Tester is a test platform having all the hardware needed to test digital mobile communication terminals. The performance of radio equipment can be efficiently evaluated by using it with optional test software.

The frequency usage of radio equipment is becoming more efficient, and the equipment is becoming faster and more digitalized. The MS8606A Spectrum Analyzer function is suitable for signal analysis of such equipment.

Its C/N, distortion, frequency and level accuracy, and other basic performances are excellent. Operation can be performed easily using software menu screens.

Because frequency domain and time domain waveforms can be switched and displayed with one touch, signal analysis of radio equipment can be carried out efficiently.

A MEASURE function allows measurements corresponding to various applications. Noise measurements, C/N ratio measurements, occupied frequency bandwidth measurements, adjacent channel leakage power measurements, mean power measurements, and evaluation of other radio equipment performances can be easily performed.

Because the Spectrum Analyzer function uses high-speed digital signal processing technology, its main transmitting and measurements can be performed quickly and accurately.

1.2 Manual Composition

This manual is made up of the following sections.

Section 1 General

Describes the introduction, function specifications and performance of this instrument.

Section 2 Panel Layout

Explains the basic items for operating this equipment.

Section 3 Operation

Explains basic operation and how to operate for each measurement item.

Section 4 Performance Test

Explains the performance test method for this instrument.

Appendix A SOFT-KEY MENU

Appendix B KEYWORDS INDEX

1.3 Specifications

The MS8606A Digital Mobile Radio Transmitter Tester specifications are listed in Tables 1-1 below.

Table 1-1 Option 01: Spectrum Analyzer

Frequency	Frequency setting range		0Hz to 3GHz (Band 0)/10MHz to 3GHz (Band 1) Setting resolution : 1Hz
	Frequency display accuracy		± (display frequency × reference frequency accuracy + span x span accuracy)
	Marker frequency display accuracy		Normal marker: Same as display frequency accuracy, Digital marker: Same as span accuracy
	Frequency span		Span setting range: 0Hz and 10kHz to 3GHz (Band 0) 0Hz and 10kHz to 2.99GHz (BAND 1) Span accuracy: ±2.5%
	Resolution bandwidth		Setting range: 300Hz to 1MHz (3dB BW), 1-3 sequence Accuracy: ±2% (300Hz to 300kHz), ±10% (1MHz) Selectivity (60dB:3dB): ≤ 5:1
	Video bandwidth		3Hz to 100kHz (1-3 sequence) and thru (The resolution bandwidth limits the setting range.)
	Sideband noise		≤ – 95dBc/Hz (frequency 1GHz, 10kHz offset) ≤ – 115dBc/Hz (frequency 1GHz, 10kHz offset)
Amplitude			Band 1
	Level measurement	Maximum input level	Continuous average power : +40dBm (MAIN connector) +20dBm (AUX connector) DC : 0 V
		Average noise level	At 1kHz resolution bandwidth, 10Hz video bandwidth MAIN connector, input attenuator 20dB ≤ – 90dBm (10MHz to 1GHz) ≤ – 90dBm+fdB (>1GHz, f: Frequency (GHz)) At AUX connector, input attenuator 0dB ≤ – 110dBm (10MHz to 1GHz) ≤ – 110dBm+fdB (>1GHz, f: Frequency (GHz))
		Residual response	≤ – 70dBm (MAIN connector, input attenuator 20dB) ≤ – 90dBm (AUX connector, input attenuator 0dB)
	Overall level accuracy		At MAIN connector, reference level +10.1 to +40dBm, 0 to -50dB of reference level ±1.5dB At AUX connector, reference level -9.9 to +20dB, 0 to -50dB of reference level ±1.5dB
	Reference level		Setting range: – 50 to +50dBm (MAIN connector) – 75 to +30dBm (AUX connector) Setting resolution: 0.1dB Accuracy : When input attenuator, resolution bandwidth, video bandwidth, and sweep time are set to auto at frequency 100MHz and span 2MHz after calibration MAIN connector ±0.5dB (+10.1 to +40dBm) ±1.0dB (– 50 to +10dBm) AUX connector ±0.5dB (– 9.9 to +20dBm) ±1.0dB (– 75 to – 10dBm) Resolution bandwidth switching deviation : ±0.1dB referenced to 3kHz resolution bandwidth
	Frequency response		±0.5dB at input attenuator 30dB (AUX: 10dB), ambient temperature 18 to 28 C, referenced to 100MHz

Table 1-1 Option 01: Spectrum Analyzer

Amplitude	Log linearity	Frequency 10MHz to 2.2GHz, reference level ≥ +5dBm (MAIN connector), ≥ – 20dBm (AUX connector) ±0.5dB (0 to -50dB, resolution bandwidth ≤ 1MHz) ±1.0dB (0 to -70dB, resolution bandwidth ≤ 30kHz) ±1.0dB (0 to -80dB, resolution bandwidth ≤ 3kHz)
	Spurious response	Second harmonic distortion : Mixer input level – 30dBm ≤ – 55dBc (input frequency 10 to 100MHz) ≤ – 60dBc (input frequency 100 to 1500MHz)
Sweep	Sweep time setting range	100ms to 1000s (frequency domain sweep) 100ms to 1000s (time domain sweep, resolution bandwidth ≤ 3kHz) 10ms to 1000s (time domain sweep, 3kHz<resolution bandwidth ≤ 10kHz) 1ms to 1000s (time domain sweep, resolution bandwidth ≤ 30kHz)
	Trigger switch	FREERUN, TRIGGERED
	Trigger source	WIDEIFVIDEO : Bandwidth (3dB) : ≥ 20MHz EXT : Trigger level: TTL level Trigger slope : RISE/FALL
	Trigger delay	Range: 0µs to 100ms, resolution: 2µs
	Gate sweep	Displays the spectrum of the signal input in the specified gate zone on the frequency domain display. Gate delay : Range : 2µs to 100ms from trigger point, resolution : 2µs Gate width : Range : 2µs to 100ms from gate delay point, resolution : 2µs
Functions	Marker function	Signal search: PEAK→ CF, PEAK→ REF Zone marker: NORMAL, DELTA Marker→ function: MARKER → CF, MARKER → REF, ZONE → SPAN Peak search: PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK
	MEASURE function	Noise power: dBm/Hz, dBm/ch C/N ratio: dBc/Hz, dBc/ch Occupied frequency bandwidth: N% of POWER method, XdB down method Adjacent channel leakage power : REF:TOTAL POWER method, REF:REF LEVEL method Specified channel display (2 channels x 2), graph display Average power in burst: Average power in specified time range of time domain waveform
	Number of data points	501 points
	Detection modes	POS PEAK : Displays the highest point among the sample points NEG PEAK : Displays lowest point among the sample points SAMPLE : Displays the instantaneous value at the sample point
	Display function	Trace A : Displays the frequency spectrum. Trace B : Displays the frequency spectrum. Trace Time : Displays the time domain waveform at the center frequency.
	Storage function	NORMAL (Update display) VIEW (Display hold) MAX HOLD (Maximum envelop display) MIN HOLD (Minimum envelop display) AVERAGE (Average value display) CUMULATIVE (cumulative display) OVER WRITE (Overwrite display)

SECTION 2

PANEL LAYOUT

The contents of this section are the same as the contents of this manual [3.1 Panel Layout] in this manual. Therefore, refer to this manual [3.1 Panel Layout].

SECTION 3
OPERATION

This section describes how to operate the spectrum analyzer.

Section 3.1 describes the basic operation procedure using switching the operation screen.

Section 3.2 and later sections describe the operation procedure for each function key in detail.

▭ in the following descriptions indicates main function keys (F1 to F6), and _____ indicates function keys (F7 to F12).

TABLE OF CONTENTS

3.1 Basic Operation

Operation contents
3.1.1 Signal display
3.1.2 Marker operation
3.1.3 Screen hard copy

The basic operation rules and features of the spectrum analyzer are explained using basic operations.

The operation contents are shown on the right.

The following descriptions assume that an external 500MHz signal is applied to the input connector.

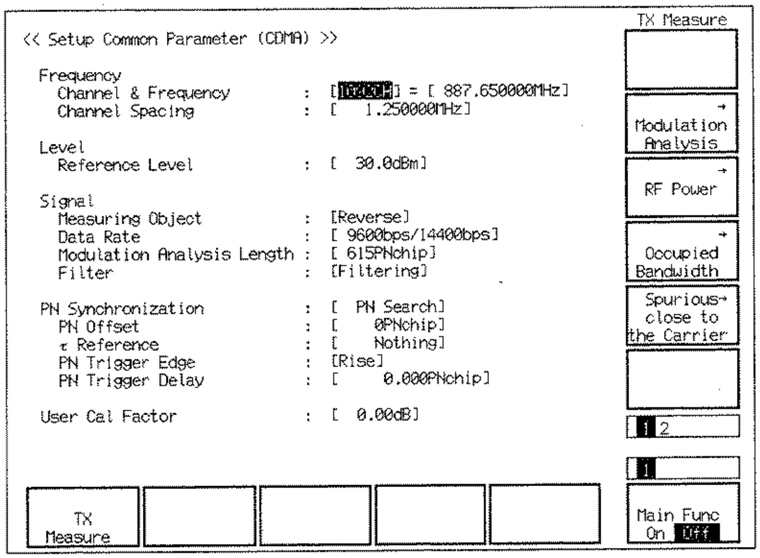
We recommend that you read this section while actually operating the MS8606A.

3.1.1 Signal display

(1) Turn on the power.

Press the rear panel power switch, then press the front panel power switch.

The Setup Common Parameter screen shown below is displayed. (Fig. 3-1)



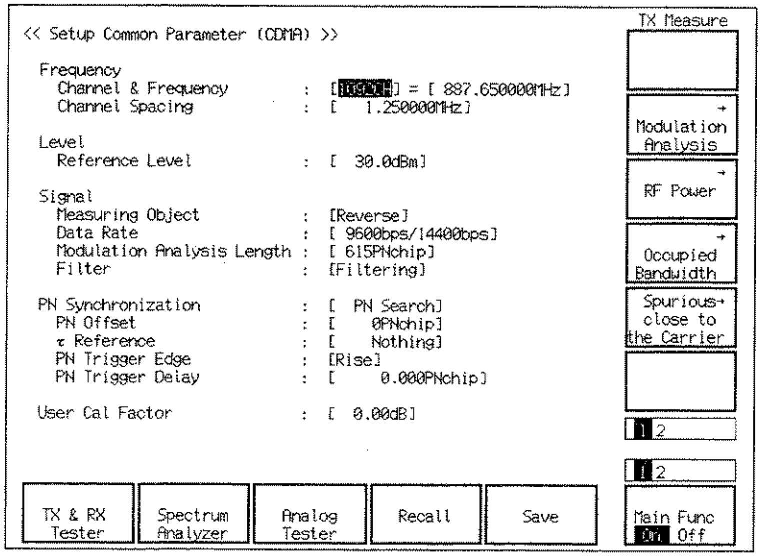
```
<< Setup Common Parameter (CDMA) >>

  Frequency
    Channel & Frequency           : [[illegible]] = [ 887.650000MHz]
    Channel Spacing               : [   1.250000MHz]

  Level
    Reference Level               : [  30.0dBm]

  Signal
    Measuring Object              : [Reverse]
    Data Rate                     : [ 9600bps/14400bps]
    Modulation Analysis Length    : [ 615PNchip]
    Filter                        : [Filtering]

  PN Synchronization              : [  PN Search]
    PN Offset                     : [    0PNchip]
    τ Reference                   : [    Nothing]
    PN Trigger Edge               : [Rise]
    PN Trigger Delay              : [      0.000PNchip]

  User Cal Factor                 : [  0.00dB]
```

Fig. 3-1

This is the radio equipment test software setup screen. Switch to the MS8606A initialization and spectrum analyzer mode screen.

(2) MS8606A initialization

Press the [Main Func] key (F6). (Fig. 3-2)



```
<< Setup Common Parameter (CDMA) >>                                TX Measure

  Frequency
    Channel & Frequency          :  [[illegible]] = [ 887.650000MHz]
    Channel Spacing              :  [   1.250000MHz]

  Level
    Reference Level              :  [  30.0dBm]

  Signal
    Measuring Object             :  [Reverse]
    Data Rate                    :  [ 9600bps/14400bps]
    Modulation Analysis Length   :  [ 615PNchip]
    Filter                       :  [Filtering]

  PN Synchronization             :  [  PN Search]
    PN Offset                    :  [     0PNchip]
    τ Reference                  :  [    Nothing]
    PN Trigger Edge              :  [Rise]
    PN Trigger Delay             :  [      0.000PNchip]

  User Cal Factor                :  [  0.00dB]
```

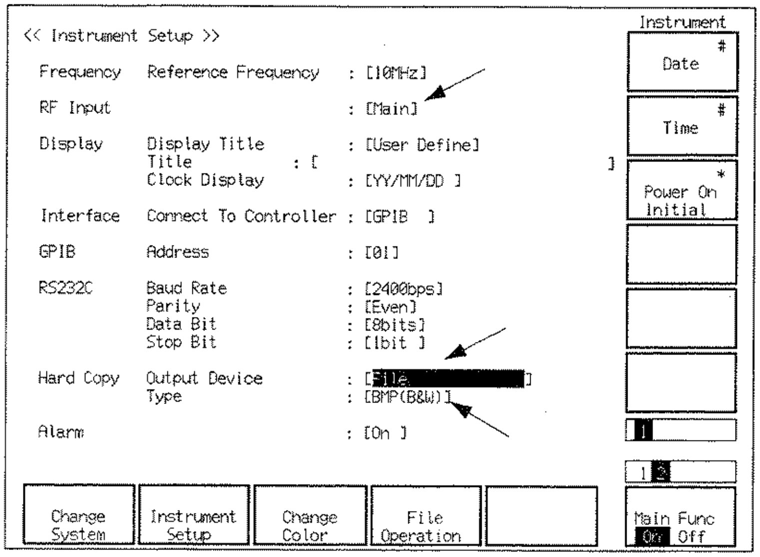
Fig. 3-2

When the Main Func key is On, keys F1 to F5 indicate the MS8606A measuring instrument modes.

When the Main Func key is Off, keys F1 to F5 indicate the menus related to the current screen.

Press the Next Menu key ◀ .

Press the Instrument Setup key (F2). (Fig. 3-3)



```
<< Instrument Setup >>                                              Instrument

  Frequency   Reference Frequency    : [10MHz]
  RF Input                           : [Main]
  Display     Display Title          : [User Define]
              Title          : [                                     ]
              Clock Display          : [YY/MM/DD ]
  Interface   Connect To Controller : [GPIB  ]
  GPIB        Address                : [01]
  RS232C      Baud Rate              : [2400bps]
              Parity                 : [Even]
              Data Bit               : [8bits]
              Stop Bit               : [1bit ]
  Hard Copy   Output Device          : [File              ]
              Type                   : [BMP(B&W)]
  Alarm                              : [On ]
```

Fig. 3-3

Change the settings of this screen with the cursor keys:

Set Cancel < > ∨ ∧

Move the cursor to the item you want to change using the arrow keys, and press the Set key. A list of parameters that can be changed appears. Select the desired parameter using the arrow key, and enter the selected parameter by pressing the Set key.]

Set the input connector (RF Input) and hard copy here.

Set the parameters indicated by the arrows in Fig. 5-3 to [Main], [Printer(Parallel)], and [ESC/P] respectively.

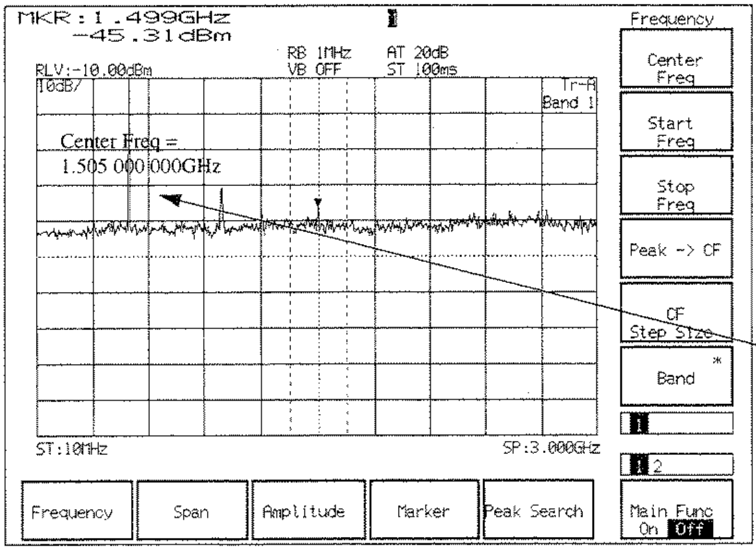
(3) Enter the spectrum analyzer mode.

Return to the screen of Fig. 3-2 by pressing the Next Menu key ◀ .

Enter the spectrum analyzer mode by pressing the Spectrum Analyzer key (F2).

(4) Move the signal to the center of the screen.

Press the Frequency key (F1). (Fig. 3-4)

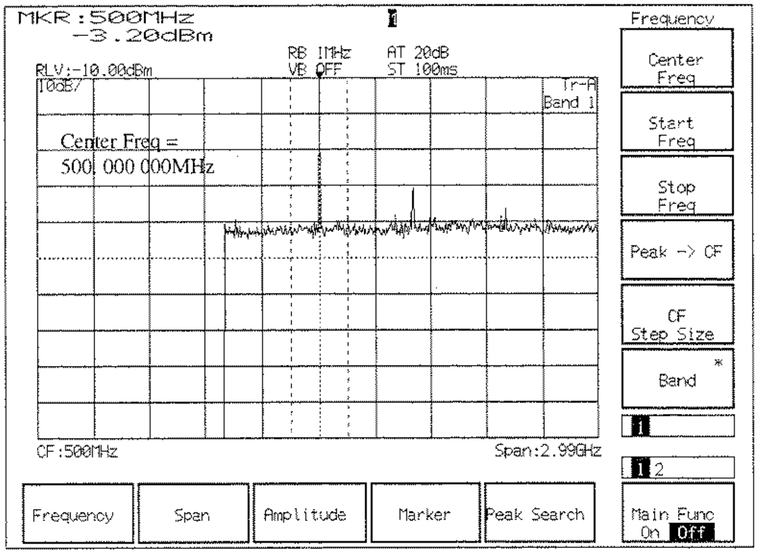

MKR:1.499GHz
-45.31dBm
RB 1MHz AT 20dB
VB OFF ST 100ms
RLV:-10.00dBm
10dB/
Center Freq =
1.505 000 000GHz
ST:10MHz SP:3.000GHz

When frequently used keys such as Frequency, Span, and Amplitude are pressed, they automatically enter the state in which Center frequency, Span, Reference Level are selected, and values can be set to the entry area shown below.

This part of the display is called the entry area. When a menu is selected, this area displays the current setting of that parameter. The set value can be changed by entering data in this area.

Fig. 3-4

Set the center frequency to 500MHz by entering 5 0 0 MHz from the numeric keypad. (Fig. 3-5)

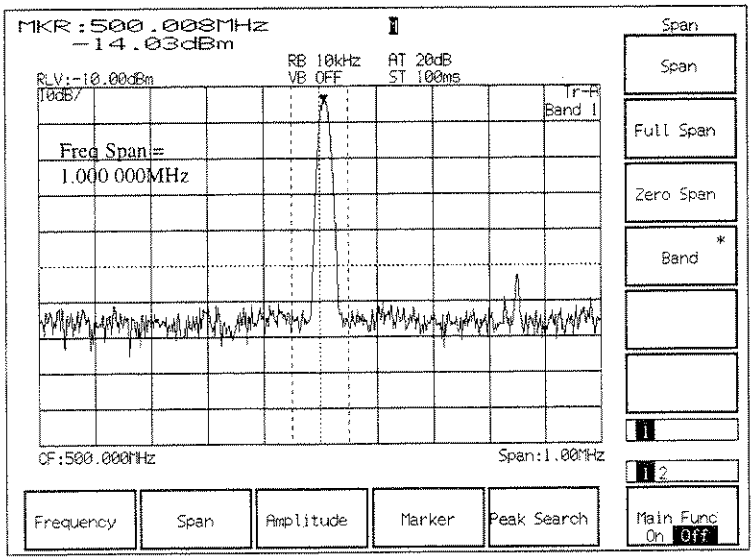

MKR:500MHz
-3.20dBm
RB 1MHz AT 20dB
VB OFF ST 100ms
RLV:-10.00dBm
10dB/
Center Freq =
500 000 000MHz
CF:500MHz Span:2.99GHz

There are three methods of entering parameters: direct entry from the numeric keypad, step key, and rotary knob.

Fig. 3-5

(5) Expand and display the signal.

Press the Span key (F2), then expand the signal by pressing the step key ⌄ several times. (Fig. 3-6)



MKR:500.008MHz
-14.03dBm
RB 10kHz AT 20dB
VB OFF ST 100ms
RLV:-10.00dBm
10dB/
Tr-A
Band 1
Freq Span =
1.000 000MHz
CF:500.000MHz
Span:1.00MHz

Fig. 3-6

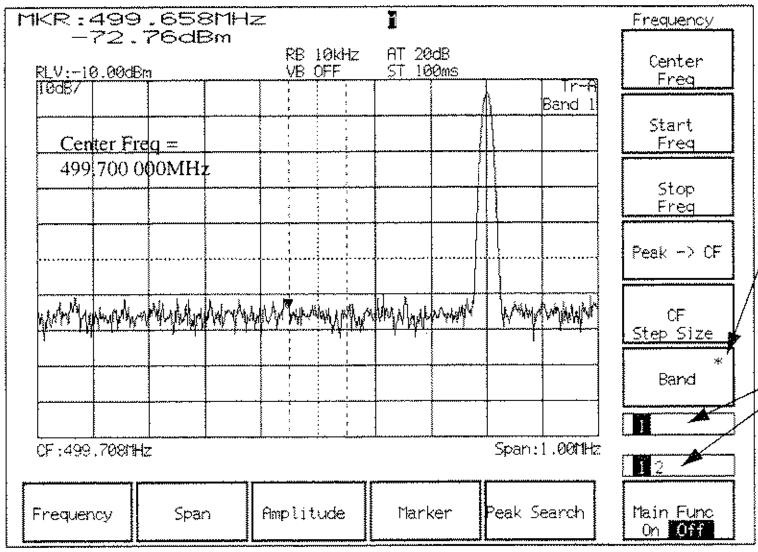
3.1.2 Marker operation

Check that the signal frequency and level are displayed in the marker display area.

The zone marker automatically captures the peak signal in the zone range and displays its frequency and level.

To check the Peak → CF function, move the signal away from the center of the screen.

Press the Frequency key (F1), then change Center Freq by turning the rotary knob. (Fig. 3-7)



Pressing the function key indicated by * opens another menu.

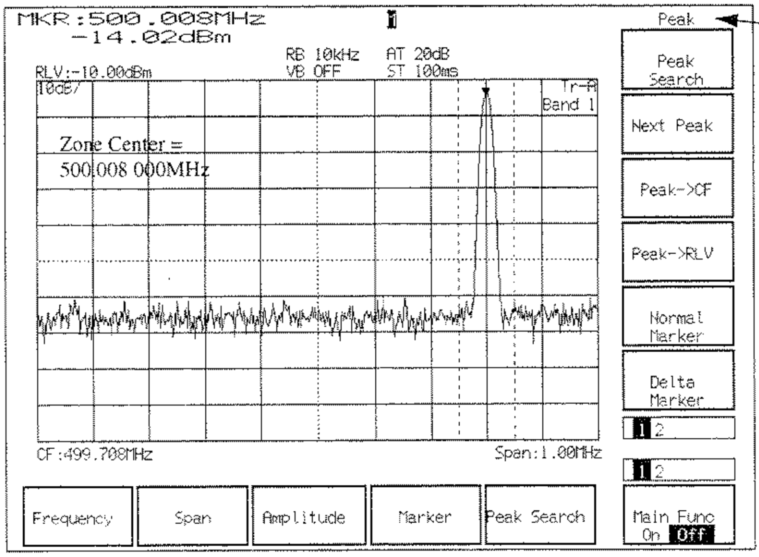
How many pages the function key menu has and which page is currently displayed can be checked.

To change the page, press the Next Menu key.

Fig. 3-7

Press the Peak Search key (F5). (Fig. 3-8)

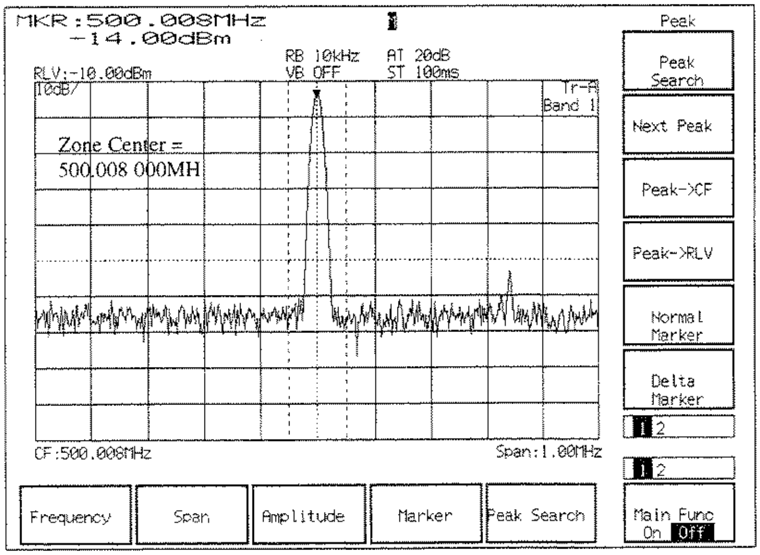
The marker seizes the signal.



The menu title is displayed above the function keys. You can check which function key corresponds to the current menu status.

Fig. 3-8

Press the <u>Peak → CF</u> key (F9). The signal moves to the center of the screen. (Fig. 3-9)



MKR:500.008MHz
-14.00dBm

RB 10kHz AT 20dB
VB OFF ST 100ms

RLV:-10.00dBm

Zone Center =
500.008 000MH

CF:500.008MHz Span:1.00MHz

Fig. 3-9

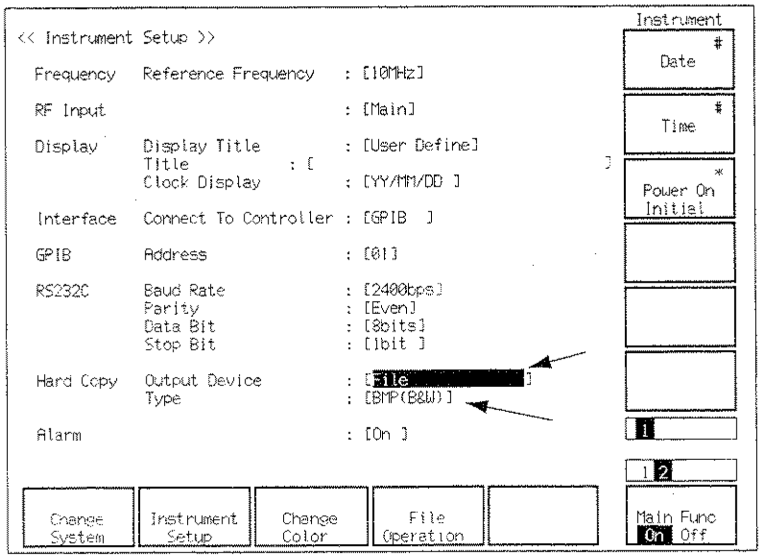
3.1.3 Screen hard copy

The screen display can be printed on a printer via the rear panel parallel interface. Any ESC/P command system printer can be used.

Press the [Copy] key at the top of the numeric keypad.

The screen currently displayed is printed.

The screen display data can be stored to a floppy disk by setting the Hard Copy in the screen below to [file] and [BMP(B&W)].



```
<< Instrument Setup >>
 Frequency   Reference Frequency   : [10MHz]
 RF Input                          : [Main]
 Display     Display Title         : [User Define]
             Title           : [                              ]
             Clock Display         : [YY/MM/DD ]
 Interface   Connect To Controller : [GPIB  ]
 GPIB        Address               : [01]
 RS232C      Baud Rate             : [2400bps]
             Parity                : [Even]
             Data Bit              : [8bits]
             Stop Bit              : [1bit ]
 Hard Copy   Output Device         : [File          ]
             Type                  : [BMP(B&W)]
 Alarm                             : [On ]
```

Fig. 3-10

3.2 Position of Operation Keys

This sections shows the position of the operation keys described in Section 3.3 and subsequent sections.

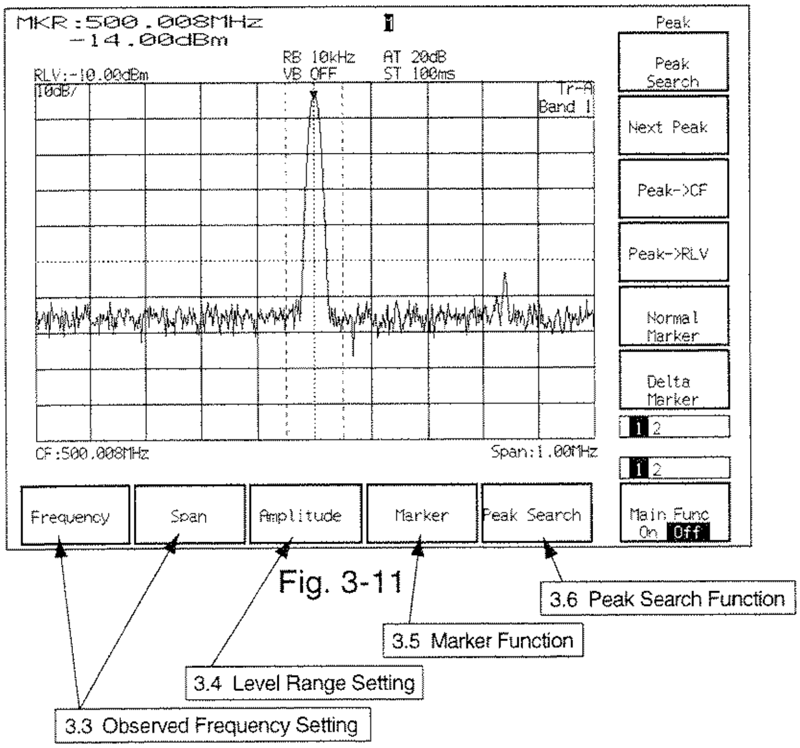


Fig. 3-11

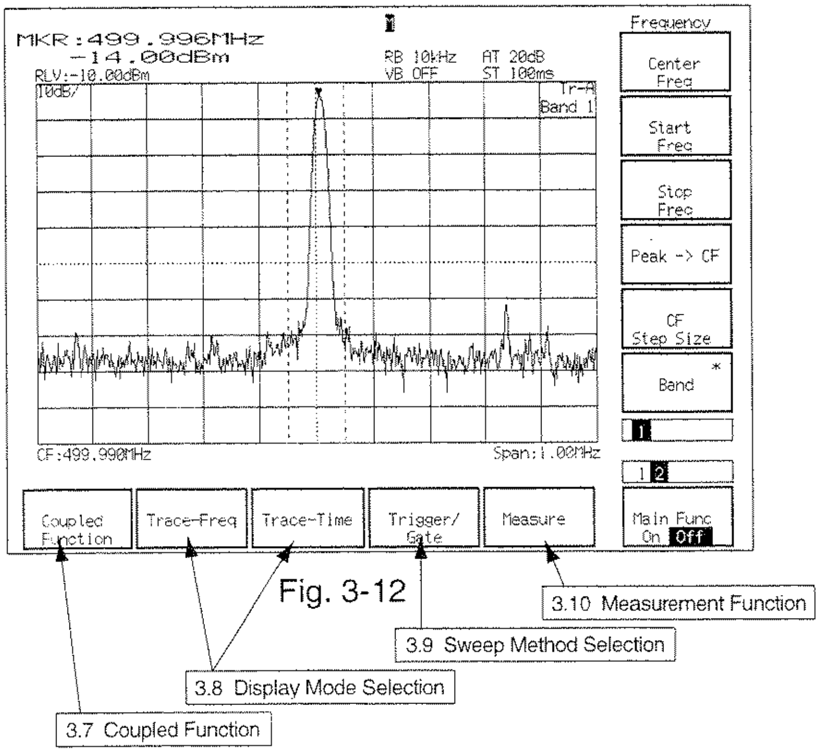
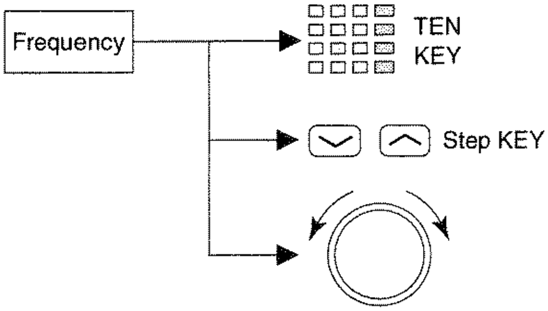


Fig. 3-12

3.3 Setting Observation of Frequency

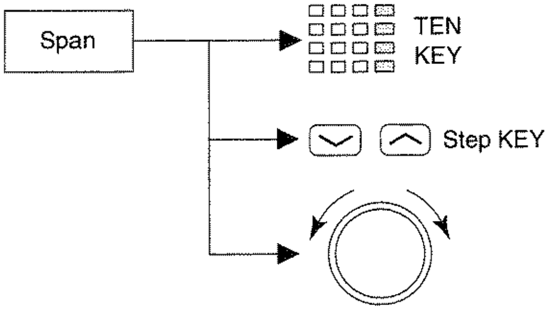
3.3.1 Center-Span Mode

(1) Setting center frequency



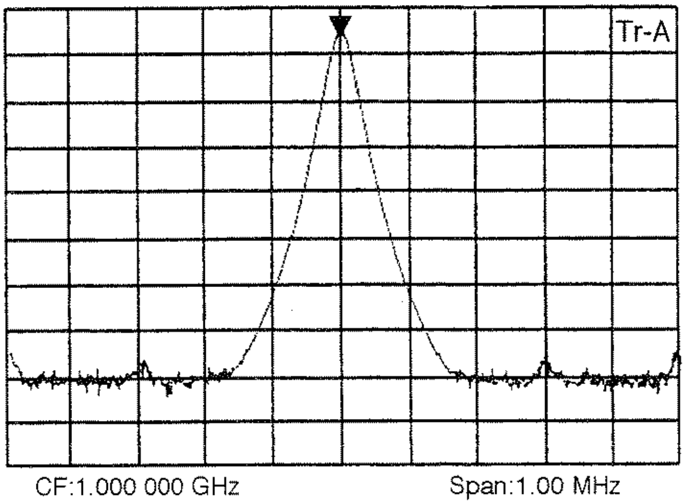
(Use the CF Step Size key to set the step size.)

(2) Setting frequency span



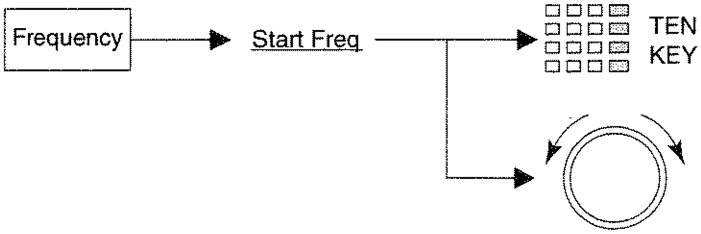
(1/2/5 sequence)

Note: *When frequency span is 200kHz or less, warming up might be necessary until the observation frequency becomes stable after turning on the power.*

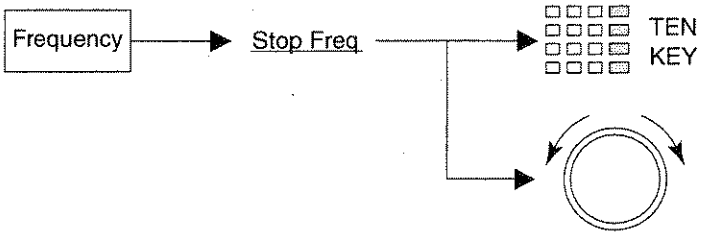


3.3.2 Start-Stop Mode

(1) Start frequency

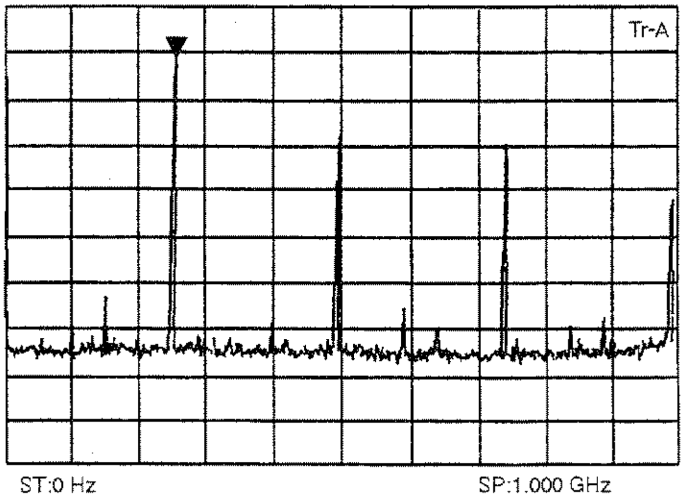


(2) Stop frequency

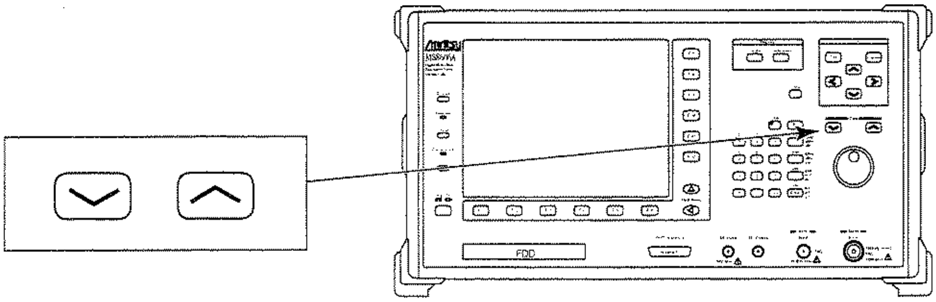


Notes:

- *Because the step keys[* ∨ ∧ *] are the step keys for the center frequency, the start and stop frequencies are also changed.*
- *The stop frequency may also vary depending on the values of the frequency span setting resolution and start frequency.*

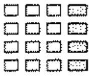


3.3.3 Setting Step Size with Step Keys



To use the step keys[∨ ∧] to change the step size of the center frequency, register the step size as follows:

Frequency → CF Step Size →



TEN
KEY

3.3.4 Setting Full Span/Zero Span

(1) Setting Full Span

In the normal operating state, pressing Preset the key allows the entire frequency range of the spectrum analyzer to be swept over the full span. However, this setting also initializes the parameters except the frequency range.

To set the full span and leave the other parameters unchanged, perform the following key operations.

Span → Full Span

For Band 0, 0 to 3 GHz
For Band 1, 10 MHz to 3 GHz

(2) Setting Zero Span

The Spectrum Analyzer can operate as a selective level meter in which the horizontal axis is graduated as a time axis by setting the frequency span to 0 Hz. The rising and falling edges of burst waves can also be observed and measured.

Performing any of the following key operations allows the spectrum analyzer to operate in the zero panel (time domain) mode.

- Span → 0 → Hz
- Span → Zero Span
- Trace-Time

For further details on the zero span (time domain) mode, see SECTION 3-8, "SELECTING THE DISPLAY MODE."

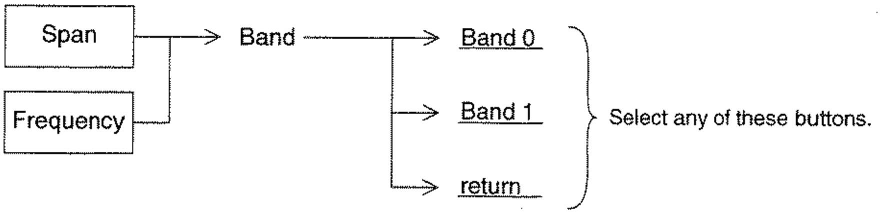
3.3.5 Frequency Bands

In the Spectrum Analyzer, the 0 to 3 GHz frequency range consists of the following two bands:

- Band 0 .... 0 to 3 GHz
- Band 1 .... 10 MHz to 3 GHz

In the initial state, the wide dynamic renge Band 1 mode that is selected.

Perform the following to set the Band 0, when the observe the frequency lower 10 MHz.



3.4 Level Range Setting

The following table shows the reference level (top of amplitude scale) range of this spectrum analyzer.

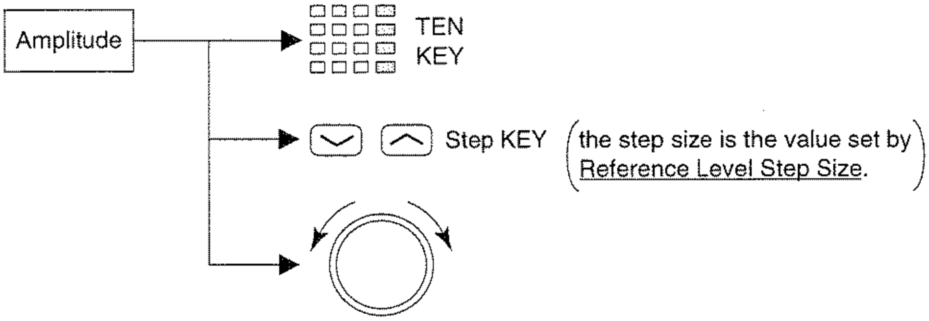
Input terminal	Units	Reference level range
Main	dBm	– 60 to +50 dBm
Aux	dBm	– 80 to +30 dBm

dBm: Units system that assumes 1 mW/50 Ω is 0 dBm.

Use the unit key [dBm and Enter] is possible.

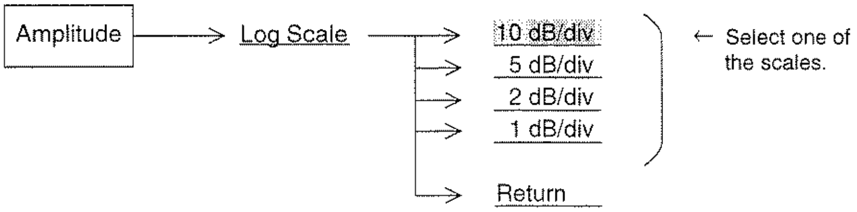
3.4.1 Setting Reference Level

Select the reference level (top graticule of the amplitude scale) by performing the following key operations.



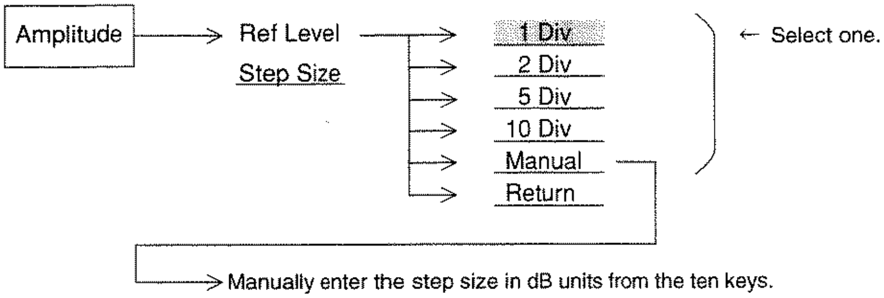
3.4.2 Setting Log Scale

To set the amplitude scale to log scale, perform the following key operations.



3.4.3 Setting Reference Level Step Size

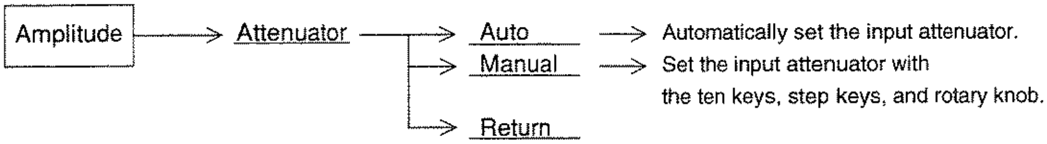
To change the reference level with the step keys[﹀ ︿], set the step size by performing the following key operations.



← Select one.

Manually enter the step size in dB units from the ten keys.

3.4.4 Setting Attenuator



Automatically set the input attenuator.

Set the input attenuator with the ten keys, step keys, and rotary knob.

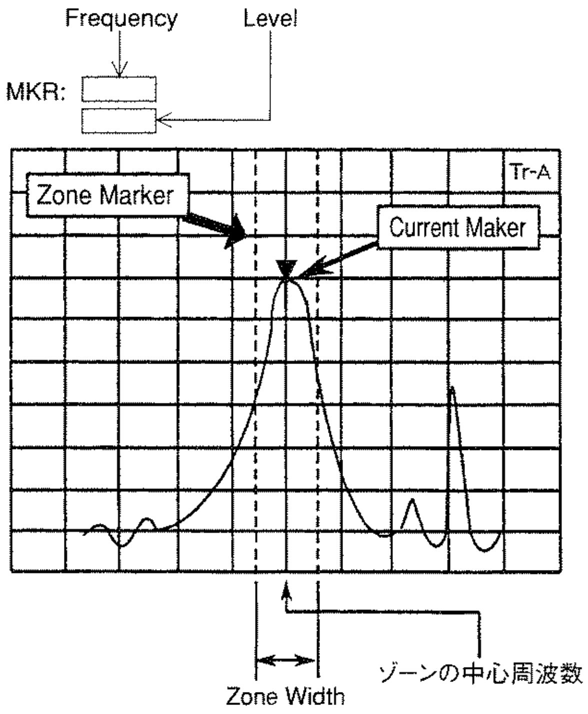
3.5 Marker Function

3.5.1 Zone Marker/Current Maker

The part enclosed in dotted lines in the center of the screen shown in the figure below is called the zone marker.

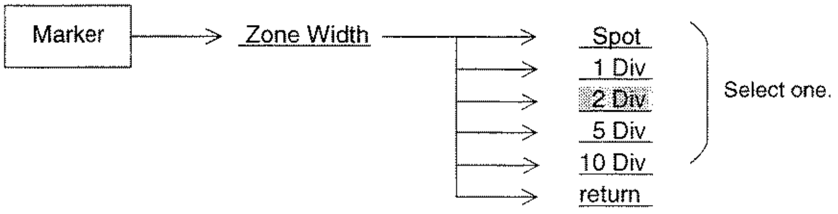
The current marker within this zone marker normally moves to the maximum level.

The frequency (or time for time domain mode) and level at the current marker point (intensified point) are displayed at the top left-hand corner of the screen.



(1) Changing Zone Marker Width

The zone marker width is initially set to 1 division, but can be changed from 1 point to 10 divisions by performing the following key operations.

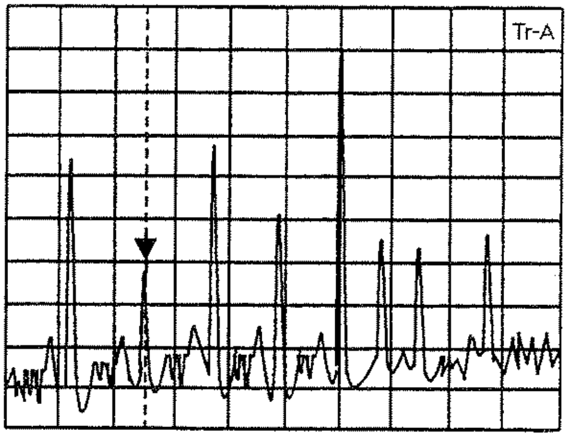


The zone marker width can be arbitrarily set from 1 point to 10 divisions by rotary knob.

The zone marker width can be arbitrarily set from 1 point to 10 divisions by the corresponding frequency input from the ten keys.

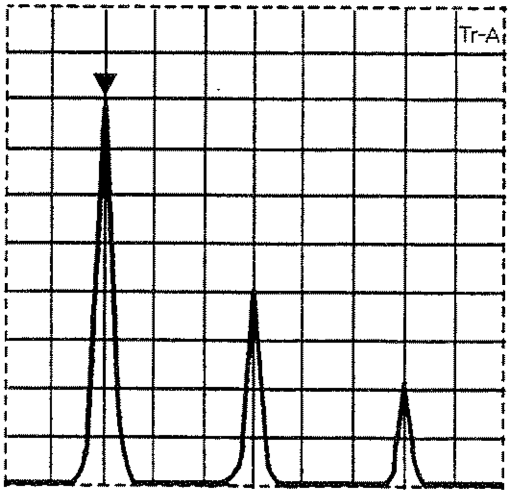
When the zone marker width is set to 1 point (Spot), the zone marker becomes a vertical line. This is called a spot marker. Since the marker center frequency and the current marker frequency coincide, the level at the desired frequency can be measured.

Example of Spot Marker (Zone Width: 1 Point)



If the zone marker is set to 10 divisions when the zone center frequency is at the center of the frequency axis on the screen, the current marker will always move to the maximum peak level over the entire range of the observation frequency.

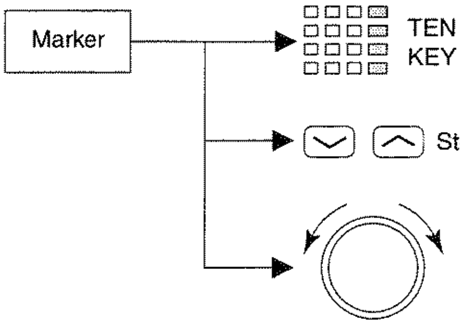
Example of Zone Width: 10 Divisions



Since the zone width in the time domain mode always becomes 1 (Spot), it cannot be changed.

(2) Changing Zone Marker Position

The center frequency (time) of the zone marker is initially centered on the frequency (time) axis on the screen. By performing the following key operations, the zone marker can be moved from the left end to the right end of the frequency axis (time) on the screen.



(Use the ten keys to set the zone marker position as frequency or time.)

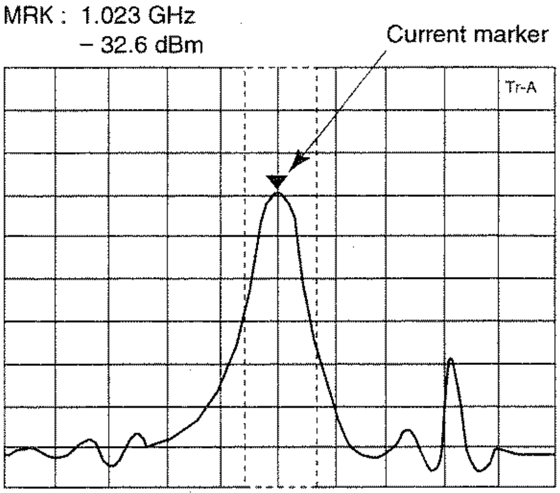
(Use the up-down keys to move the zone marker position in 1 division steps.)

In the delta marker mode, setting the zone marker center frequency (time) with the ten keys results in entry of the delta marker value (difference between reference marker and current marker).

3.5.2 Normal Marker

A single marker is indicated by ▼ at the maximum level within the zone marker. The frequency and level at that point are displayed digitally.

The normal marker is initially set to ON. When the current state is another marker mode, or when the normal marker is set to OFF, perform the following key operations to set the normal marker to ON.



The normal marker displays the absolute level. By setting a display line, the normal marker can also display the level relative to a given level specified as a reference line.

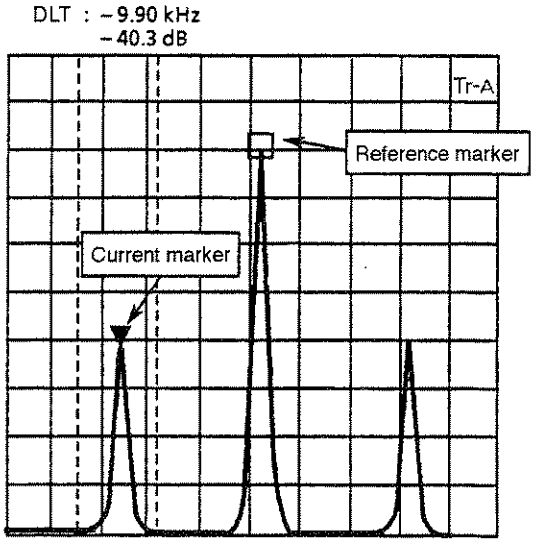
3.5.3 Delta Marker

The current marker position when the delta marker is set to On is fixed as the reference marker (reference point). Then, as the current marker is moved, the reference marker and current marker frequency (time) and level differences are displayed digitally as delta marker values.

In the delta marker mode, the reference marker is indicated by □ .

To set the delta marker to On, perform the following key operations.

Marker → Delta Marker

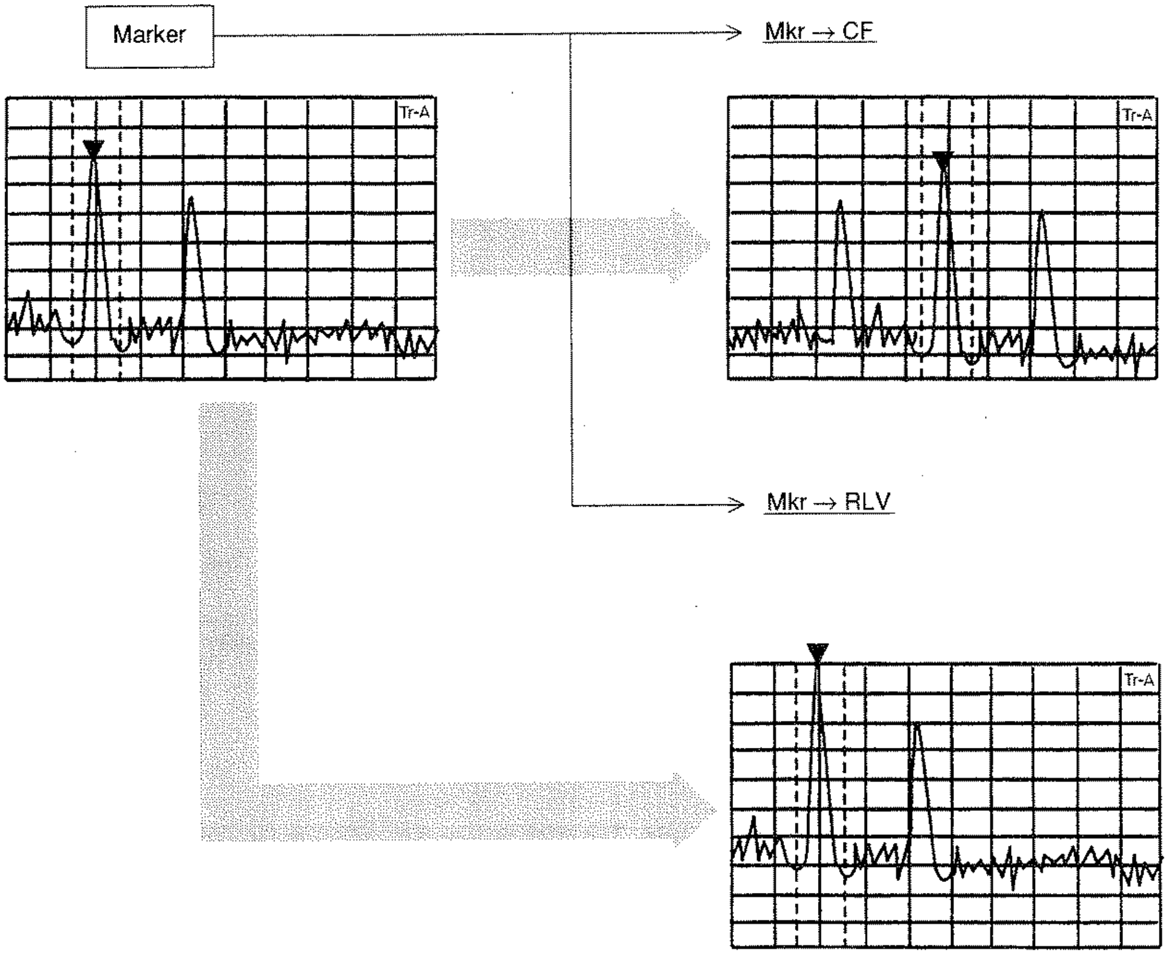


Press the Delta Marker key in the delta maker mode. The reference marker moves to the current marker position and switches to the delta marker mode with that point as the reference point.

Varying the spectrum waveform in the delta marker mode does not change the marker frequency level. The reference marker is not necessarily always on the waveform because it remains unchanged. Also, when the reference marker cannot be positioned on the screen by changing the observation frequency and level and range, it is at the edge of the scale lines.

3.5.4 Mkr → CF/Mkr → RLV

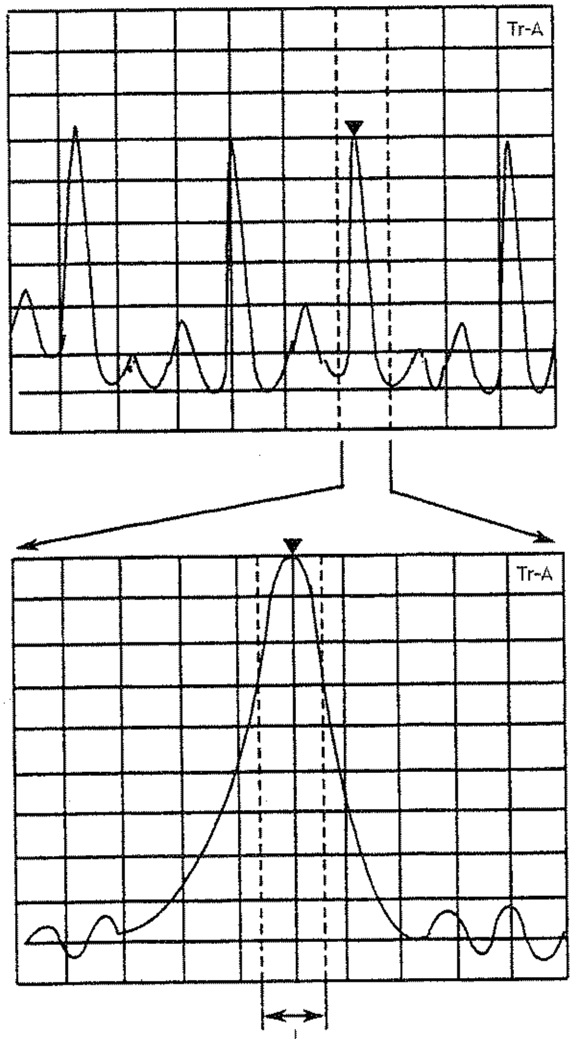
Sets the current marker frequency or level to the center frequency or reference level.



3.5.5 Zone → Span

To set the zone marker center frequency and width to the center frequency and frequency span, respectively, perform the following key operations.

Marker → Zone → Span



The zone width remains unchanged.

3.5.6 Marker Off

Marker → <u>Marker Off</u>
(Display page 2 of the menu by pressing the Next Menu key.)

The marker disappears from the screen. When the Normal Marker key is pressed, the marker is displayed.

3.5.7 Display Line

In the state in which a horizontal line which indicates a given level is displayed on the scale, the display line can be used as the frequency response measurement guideline, or as the reference line of the marker level measurement or pass/fail judgement with a standard line.

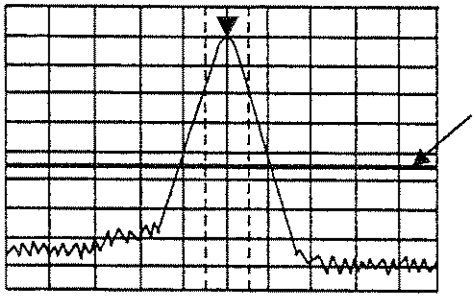
(1) Setting Display Line

To turn the display-line On and Off and to set the display-line level, perform the following key operations.

Marker → Display Line

(Display page 2 of the menu by pressing the Next Menu key.)

→ Display Line On Off	Turn the display line On and Off by pressing this key.
→ Display Line Level − 50.00 dBm	Enter the display line level from the ten keys, etc.
→ Marker Level Abs Rel	Select if the marker level is set by absolute value or relative value (relative to display line) by pressing this key.
→ Return	



Display-line On and Off are common to all traces (A, B, Time).

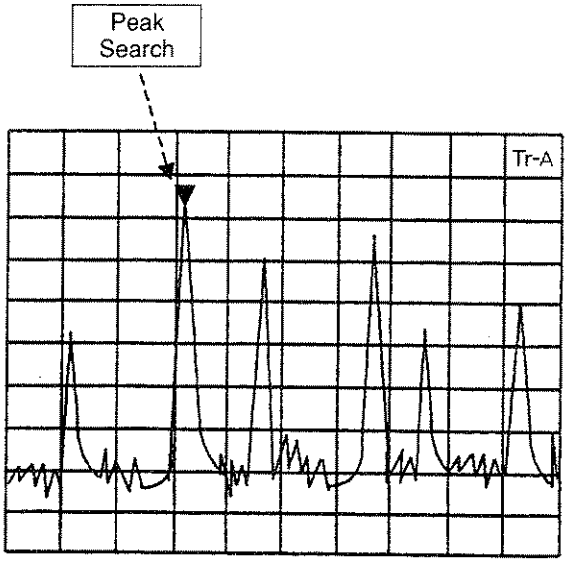
The display-line level and Abs/Rel can be selected independently for each trace.

3.6 Marker Search Function

3.6.1 Peak Search

Peak Search detects the maximum level point from the entire trace in which a marker is displayed and moves the marker to that point.

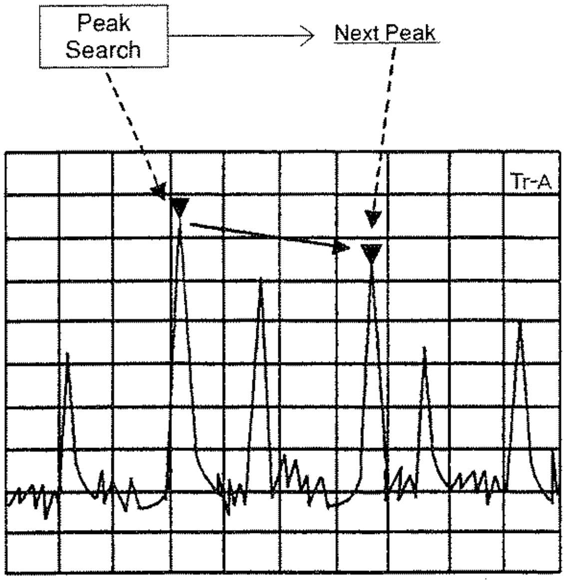
To Execute Peak search, perform the following key operations.



3.6.2 Next Peak Search

Next Peak Search detects the next largest peak relative to the current marker level and moves the marker to that point. (When there are two or more peaks with the same level on the screen, the leftmost peak is detected.)

Execute Next Peak search by performing the following key operations.

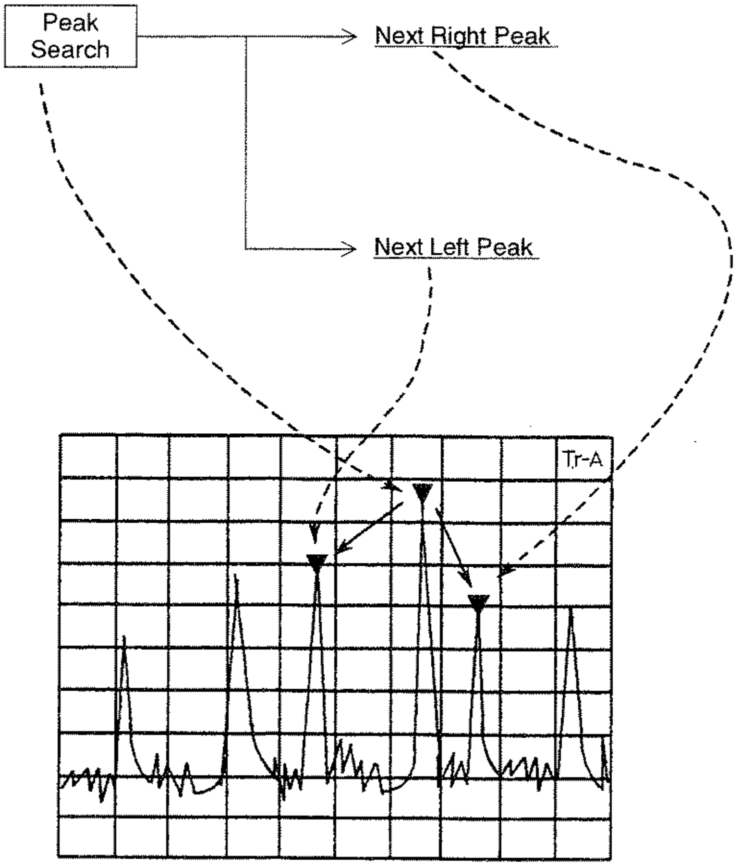


The next largest peaks can be detected and the marker can be moved to those peaks by executing Next Peak Search consecutively.

3.6.3 Next Right Peak Search/Next Left Peak Search

Next Right Peak search and Next Left Peak Search detect the adjacent peak level to the right or left of the current marker and move the marker to that point.

To execute Next Right Peak Search and Next Left Peak Search, perform the following key operations.



The adjacent peak level to the right or left can be detected and the marker moved to that peak by executing Next Right Peak Search or Next Left Peak Search consecutively.

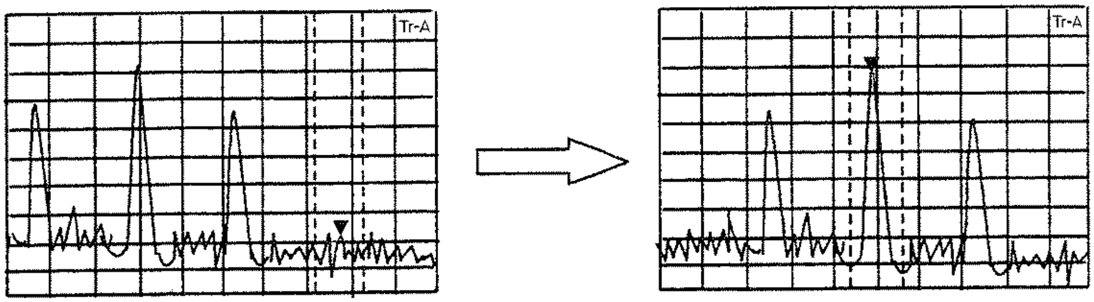
> *Note:* *When marker search is executed, the marker is moved to the specified Peak or Dip point, and the zone marker center frequency is simultaneously moved to the marker point. After that, when sweep is executed within the zone marker, the marker moves to the maximum point within the zone marker. Therefore, marker search other than Peak search should be executed with sweep stopped or with the zone width set to 1 point (spot marker mode).*

3.6.4 Peak → CF / Peak → RLV

(1) Peak → CF

Peak Search ——→ Peak → CF

Sets the maximum peak point on screen and the zone marker to the center frequency.

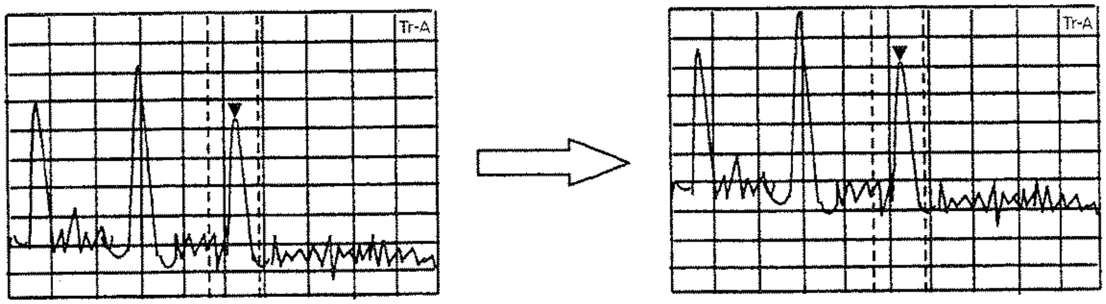


Notes:
- *When the frequency at the maximum peak point is less than 0 Hz, the center frequency is set to 0 Hz.*
- *If there are two or more maximum peak points with the same level on the screen, the peak point with the lowest frequency is moved to the center frequency.*
- *Peak → CF does not operate in the Time Domeine.*

(2) Peak → RLV

Peak Search ——→ Peak → RLV

Sets the maximum peak level on screen to the reference level.



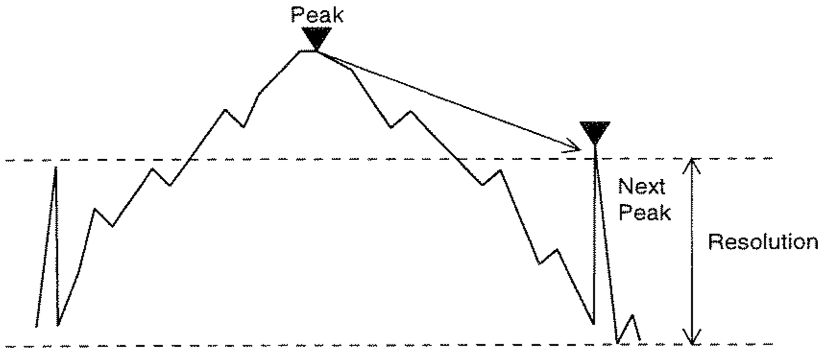
Note:
- *If the level at the peak point exceeds the permitted range for the reference level, the reference level is set to the maximum (minimum) reference level that can be set.*
- *If the level at the peak point exceeds the reference level(scale over), one operation of the Peak → RLV may not be able to set the correct reference level. In this case, repeat the Peak → RLV operations a few times.*

3.6.5 Setting Search Resolution

Sets the Peak search resolution. When searching for the next peak, the marker moves to the point of the set resolution or higher.

Peak Search → Resolution /Threshold
(Display page 2 of the menu by pressing the Next Menu key.)

→ Enter the resolution in dB units from the ten keys.



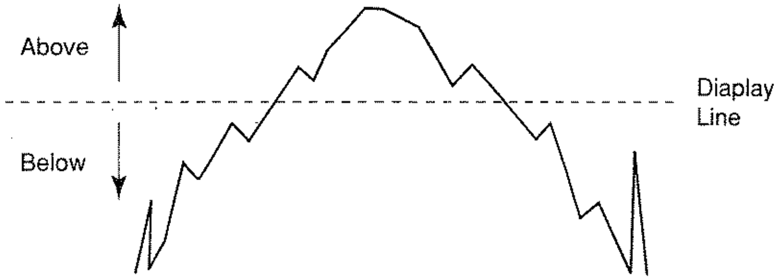
3.6.6 Setting Search Threshold

Sets the display line to the threshold and searches for the level above or below the display line.

Peak Search → Resolution /Threshold

(Display page 2 of the menu by pressing the Next Menu key.)

Treshold On Off	Turn threshold On and Off by pressing this key.
Search Above Below	Select search above or below the display line by pressing this key.
Display Line On Off	Turn the display line display On and Off by pressing this key.
Disp Line Level −50.00 dBm	Sets the display line level.
Return	

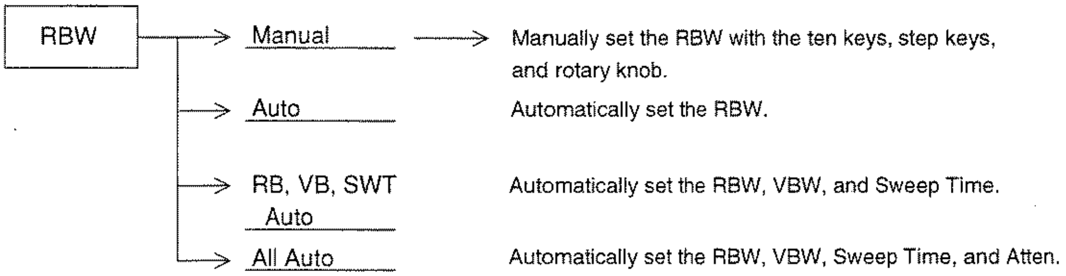


Note: *Note:* *This function will be effective with the Display Line On.*

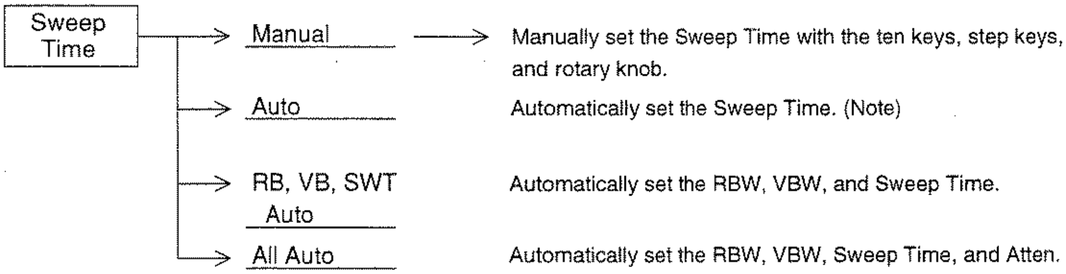
3.7 Coupled Function

3.7.1 Resolution Bandwidth (RBW) and Sweep Time

To set the RBW and Sweep Time, perform the following key operations.



RBW	Manual	Manually set the RBW with the ten keys, step keys, and rotary knob.
	Auto	Automatically set the RBW.
	RB, VB, SWT Auto	Automatically set the RBW, VBW, and Sweep Time.
	All Auto	Automatically set the RBW, VBW, Sweep Time, and Atten.



Sweep Time	Manual	Manually set the Sweep Time with the ten keys, step keys, and rotary knob.
	Auto	Automatically set the Sweep Time. (Note)
	RB, VB, SWT Auto	Automatically set the RBW, VBW, and Sweep Time.
	All Auto	Automatically set the RBW, VBW, Sweep Time, and Atten.

(1) Auto mode

The RBW. Sweep Time, and VBW parameters are set to Auto so that even if the frequency span is varied, the respective parameters are automatically set to the optimum values so that frequency and level measurement errors do not occur.

The following shows the Swp Time Auto setting range:

- Lower limit value

  100 msec
- Upper limit value

  1000 sec

(2) Manual setting

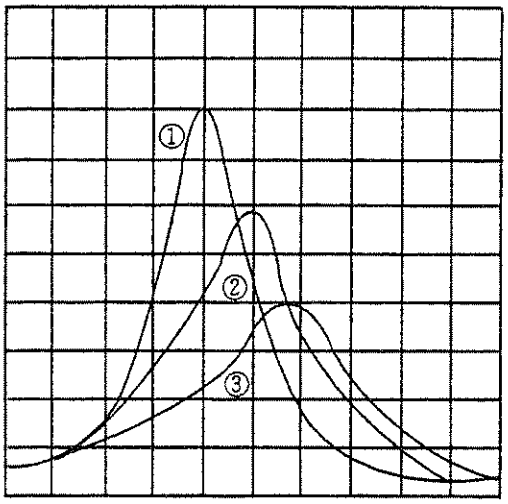
If RBW, VBW, and Sweep Time are set to the Auto mode, normal measurements can be made without considering their settings.

However, in the following cases, RBW should be set to the Manual mode.

① General measurements:	When observing two adjacent signals, increasing the frequency by narrowing the RBW can reduce the noise level (a tenth part of the current RBW results in a 10 dB reduction). However, if the RBW is too narrow, the spectrum waveforms will become too steep, the response characteristics become worse, and the sweep time will also become longer. Therefore, the RBW value should be determined to give a practical sweep speed.
② Intermodulation distortion measurement:	When measuring two signal intermodulation distortion with a comparatively wide frequency span and a reduced noise level, the RBW value should be narrowed by manual setting. However, the sweep time increases in inverse proportion to the square of the RBW.

The RBW can be selected from among the following by Manual setting:

300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz

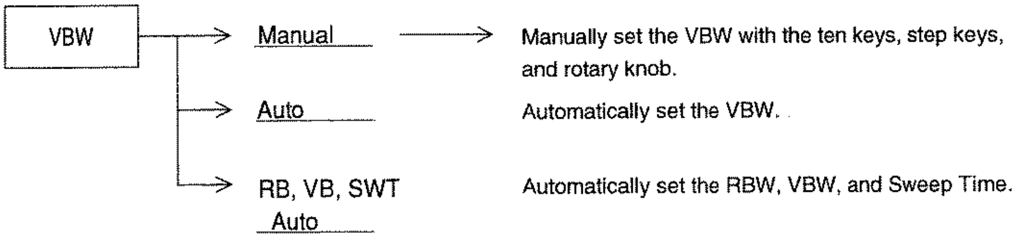


Note: The spectrum traces on the screen are displayed as shown at the left according to the sweep time. The optimum sweep time gives a waveform like ①. However, a sweep time that is too fast decreases the waveform amplitude on the display as shown in ② and ③. Therefore, the apparent bandwidth gets wider, and the frequency also shifts. When waveform ① cannot be maintained, "UNCAL" is displayed.

①	Optimum trace waveform
②, ③	UNCAL trace waveforms

3.7.2 Video Bandwidth (VBW)

To set the VBW, perform the following key operations.



Manual	Manually set the VBW with the ten keys, step keys, and rotary knob.
Auto	Automatically set the VBW.
RB, VB, SWT Auto	Automatically set the RBW, VBW, and Sweep Time.

(1) Auto mode

The spectrum analyzerdifferent with converntional spectrum annalyzer, does not require any analog curcuit such as a log amplifier after the RBW filter.

As t he result, therefore, tehre is no noise source after the RBW filter, shich allows th eVBW filter OFF (through) when setting "Automatic" operation.

(2) Manual setting

When wanting to average the noise by making the VBW narrow without regard to the RBW set value, or when wanting to make the VBW wide to observe the waveform of signals modulated at a high frequency, use Manual setting.

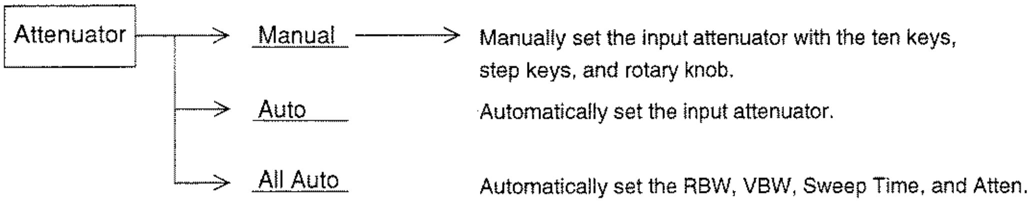
The VBW value can be manually set from among the following values:

3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, OFF

Note:
- *When VBW ≥ RBW is set, noise is not averaged and the sweep speed in increased.*
- *Noise can also be averaged without narrowing the VBW (without decreasing the sweep time) by performing video averaging. For further details, see par. 3.8.5.*

4.7.3 Input Attenuator (Attenuator)

To set the input attenuator, perform the following key operations.



(1) Auto mode

When the reference level is set while Auto is selected, the input attenuator is automatically set to the optimum value according to the reference level.

(2) Manual setting

When a signal with the same level as the reference level is input, the input attenuator value in the Auto mode is controlled so that high accuracy measurements can be made without being influenced by gain compression and the noise level can be reduced. However, when you want to measure a low level signal by raising the sensitivity when measuring nonharmonic spurious response and the spurious response of adjacent signals, measurement may be impossible because the Attenuator values in the Auto mode are too large. In this case, set the input attenuator manually according to the table below.

Reference Level and Input Attenuator (Manual)

Referrence Level effective range (dBm)	Attenuator Manual Mainconnector (dB)	Reference Level effective range (dBm)	Attenuator Manual AUX connector (dB)
+50 to –60	90	+30 to –80	70
+50 to –60	80	+30 to –80	60
+50 to –60	70	+30 to –80	50
+50 to –60	60	+30 to –80	40
+40 to –60	50	+20 to –80	30
+30 to –60	40	+10 to –80	20
+20 to –60	30	0 to –80	10
+10 to –60	20	+10 to –80	0

3.7.4 Automatic Calibration

Execute spectrum analyzer automatic calibration by performing the following key operations.

Coupled Function → Cal Automatically calibrate Level.

It is recommondable to execute the process of automatic calibration, whe more accurate measurements is needed, or it would not correspod to the standard, or environments such as ambient temperature have greatly changed.

WARNING ⚠

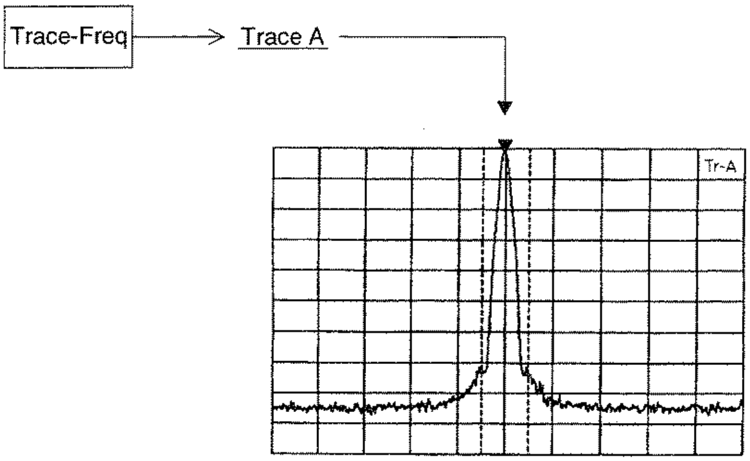
Execution of calibration with external signal to the RF input will not porvide correct calibration values. Make sure that no signal should be given to the RF input when calibration is made.

3.8 Selecting the Display Mode

3.8.1 Trace Freq

(1) Trace A

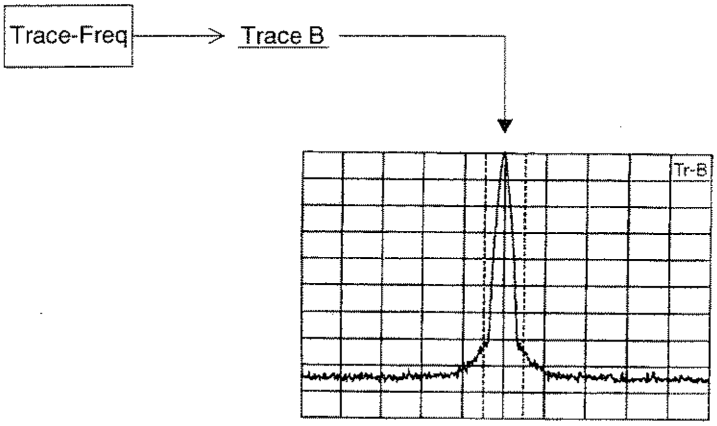
Trace A is used to analyze signals in the normal frequency domain.



(2) Trace B

Like trace A, trace B is used to analyze signals in the normal frequency domain.

When used with trace A, it is possible to compare waveform A and waveform B.

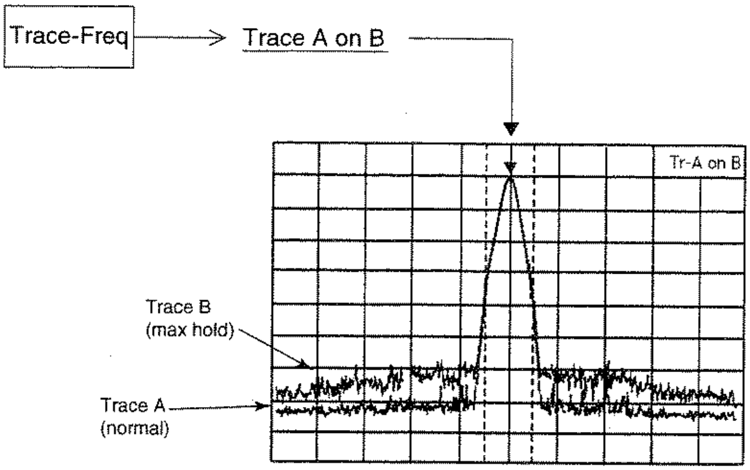


Parameters of the trace A and trace B can be set independently.

(3) Trace A and Trace B Overwrite Display

Overwrites trace A and trace B on one screen. At this time, the trace B frequency range, reference level, and other parameters are the same as trace A.

However, in the threshold mode and detection mode, the parameters can be set independently at trace A and trace B. For instance, comparison measurement with a standard waveform and simultaneous observation of the same waveform in a mode different from the normal mode and max hold (or averaging, etc.) mode are possible.



(4) Setting Active Trace

When trace A and trace B were overwritten on the same screen, select the marker trace by pressing this key.

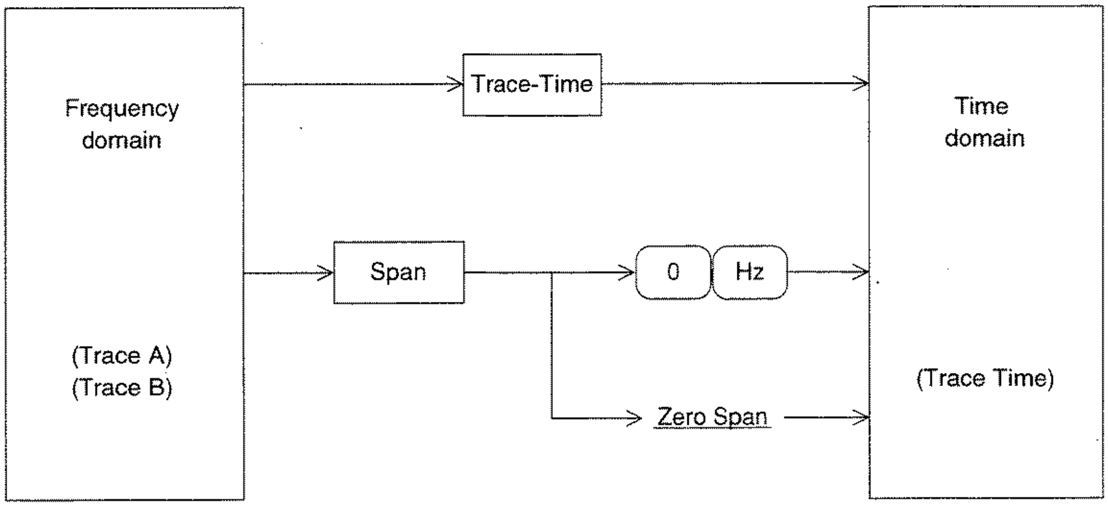
Trace-Freq → Active Trace A B

3.8.2 Time Domain

Since the spectrum analyzer stops sweeping the frequency when set to a frequency span of 0 Hz, the spectrum analyzer becomes a selective level meter that continues to receive only the center frequency. In this case, the horizontal axis of the time-axis sweep waveform is graduated in time and displayed on the spectrum analyzer screen. This display method is called "time domain display".

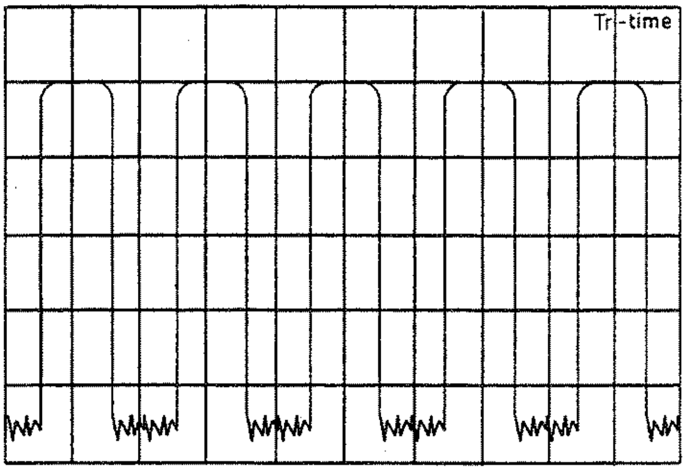
(1) Setting Time Domain

The time domain can normally be set by pressing the Trace-Time key in the Display section. It can also be set by setting the frequency span to 0 Hz in the frequency domain mode.



(2) Trace Time

Trace Time displays the time axis waveform at the center frequency of trace A or trace B. To display trace Time, press the Trace-Time key.



Trace-Time

Delay Time 10.0 ms	Sets the delay time from trigger to sweep. A negative value is not input.
Time Span 200 us	Sets the time span (time domain sweep time).
Trigger Freerun Triggered	Select freerun or trigger sweep by pressing this key.
Trigger Source	Selects the trigger signal source.
Strage	Selects the storage display mode.
Detection	Selects the detection mode.

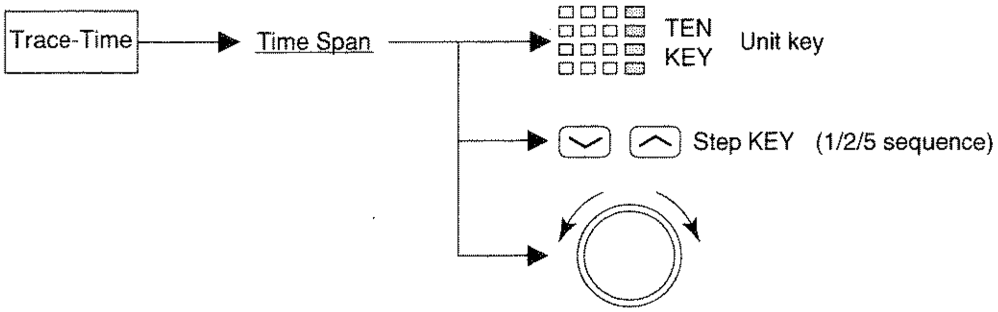
The following parameters can be set independently in the frequency domain or time domain mode.

- Vertical scale range (10 dB/div, etc.)
- Storage mode (Normal, Max Hold, Average, etc.)
- Detection mode (Pos Peak, Sample, Neg Peak)
- Resolution bandwidth (RBW)
- Video bandwidth (VBW)
- Sweep time (Sweep Time/Time Span)
- Trigger switch (Freerun/Triggered)

Note: The time domain mode marker function uses a spot marker. A zone marker cannot be used.

(3) Setting Time Span

In the time domain mode, the measurement range on the horizontal axis does not set the frequency span, but sets the time span. To set the time span, perform the following key operations.

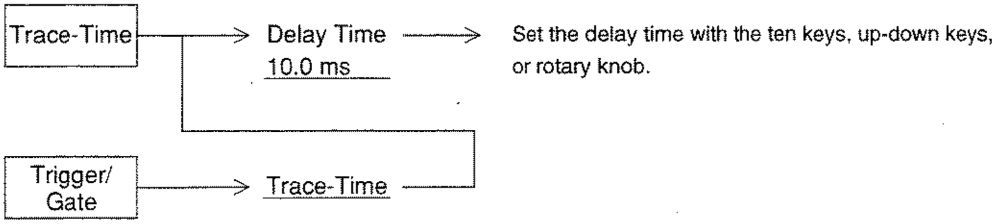


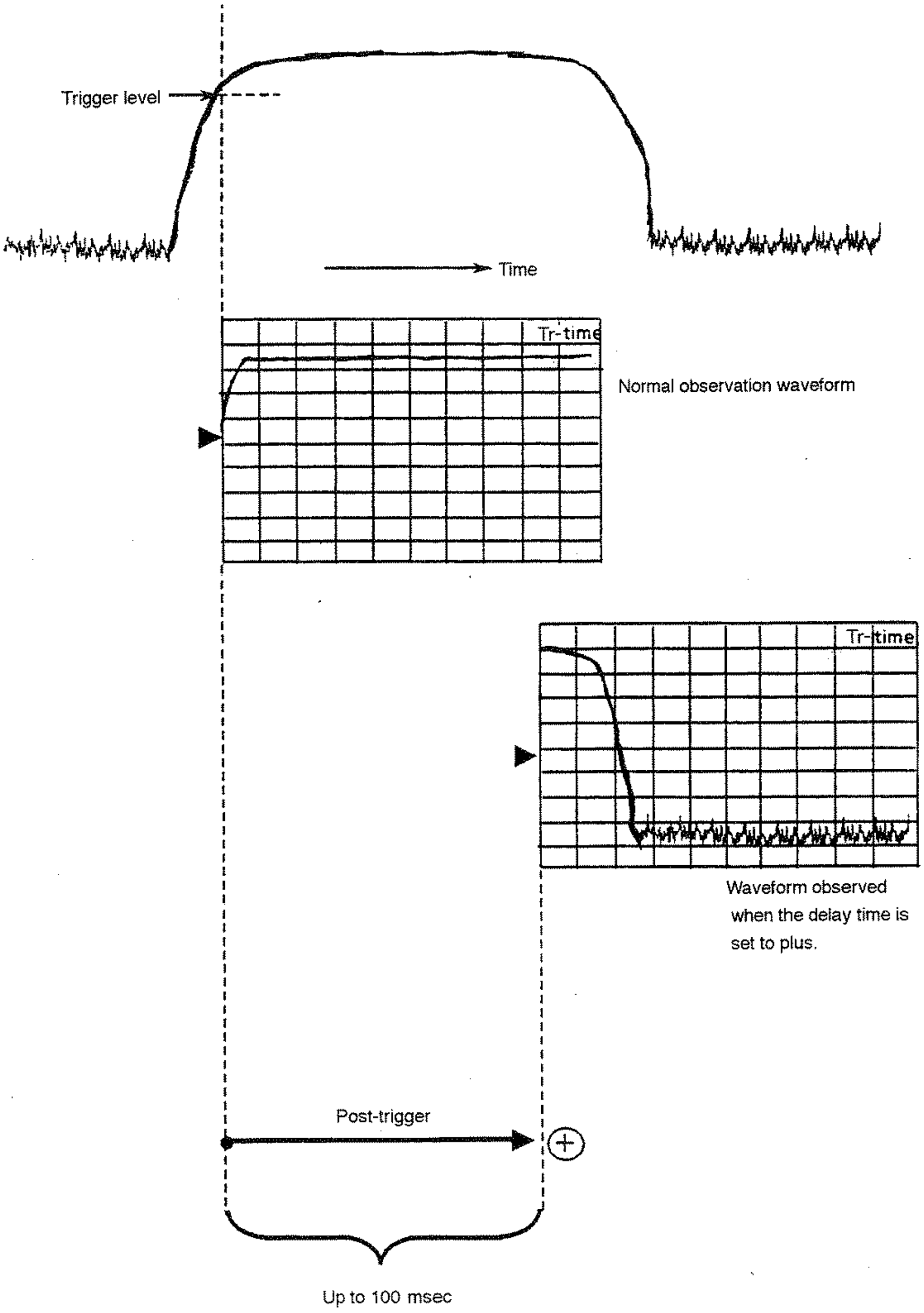
(4) Delay Time

When the trigger mode is set to Triggered in the time domain mode, the trigger point is usually positioned at the left end of the screen. This, however, means that it is not possible to see the waveform before the trigger point and the waveform beyond the right end of the screen.

With the spectrum analyzer, a waveform away from the trigger point can be displayed by changing the delay time.

To set the delay time, perform the following key operations.



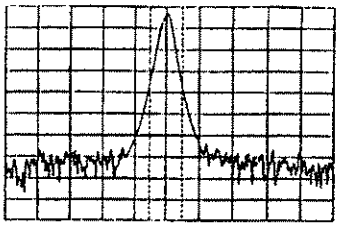
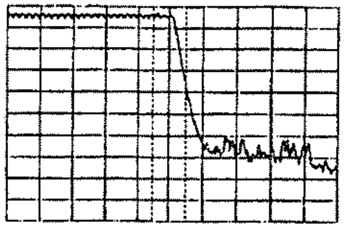
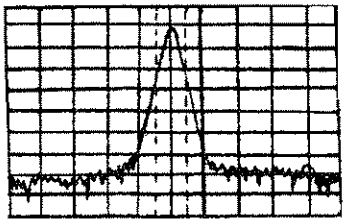
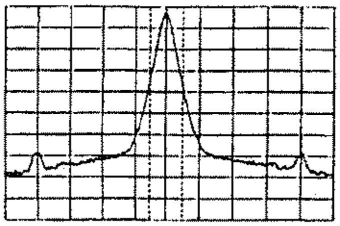


Example of Waveform With Delay Time

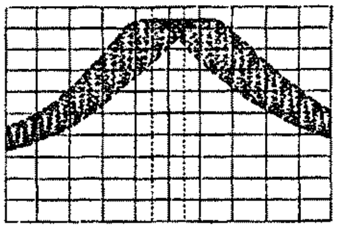
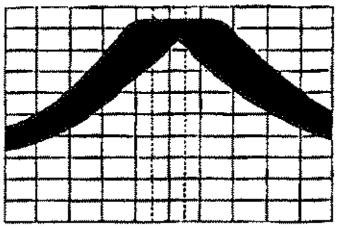
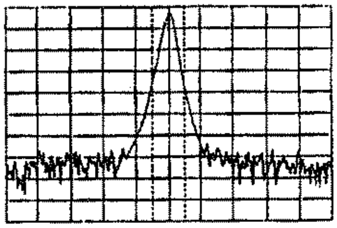
3.8.3 Storage Mode

The following seven storage modes can be selected for Display modes trace A, trace B, and trace Time.

Types of Trace Modes (1/2)

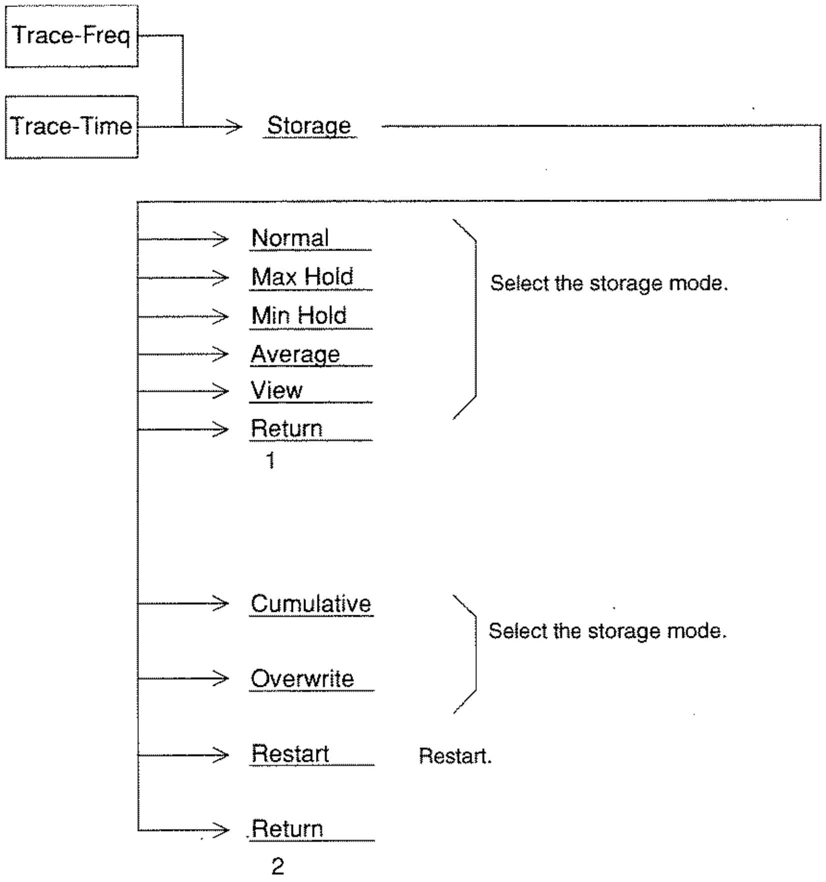
NO.	Mode	Explanation	Display example
1	Normal	Refreshes and displays the trace data at each sweep. This is used for normal measurement.	
2	Max Hold	At each sweep, compares the new trace data with the old data at each X axis point, then displays the larger value data. It is used to record a frequency-drifting signal.	
3	Mim Hold	At each sweep, compares the new trace data with the old data at each X axis point, then displays the smaller value data.	
4	Average	At each sweep, calculates the average data at each X axis point, then displays the averaged results. This mode is used to improve the S/N ratio. For further details on the averaging function, see page 3.8.5.	

Types of Trace Modes (2/2)

NO.	Mode	Explanation	Display example
5	Cumulative	Displays the cumulative waveform at each sweep. The waveform data, which are not connected by lines, are displayed by plotting the data.	
6	Over write	Displays the waveform overwritten without deleting the old trace data.	
7	View	Continues displaying the waveform as it is, without refreshing the currently-displayed trace data. This mode is used to observe waveforms with the trace data stopped temporarily.	

3.8.4 Setting Storage Mode

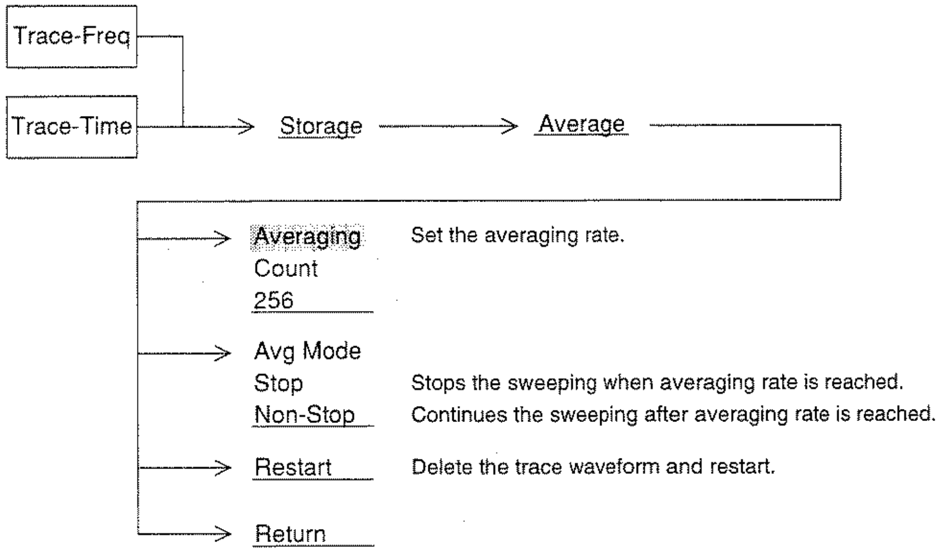
The storage mode can be selected by operating the function keys shown below while the spectrum analyzer is operating in the trace A, trace B, or trace Time mode.



(Display page 2 of the menu by pressing the Next Menu key.)

3.8.5 Averaging Function

The digital averaging function calculates the average data at each X axis point at each sweep and displays the results. It is executed by selecting Average in the trace A, trace B, and trace Time display modes.



Averaging Count: Set the averaging rate.

Stop: Stops the sweeping when averaging rate is reached.

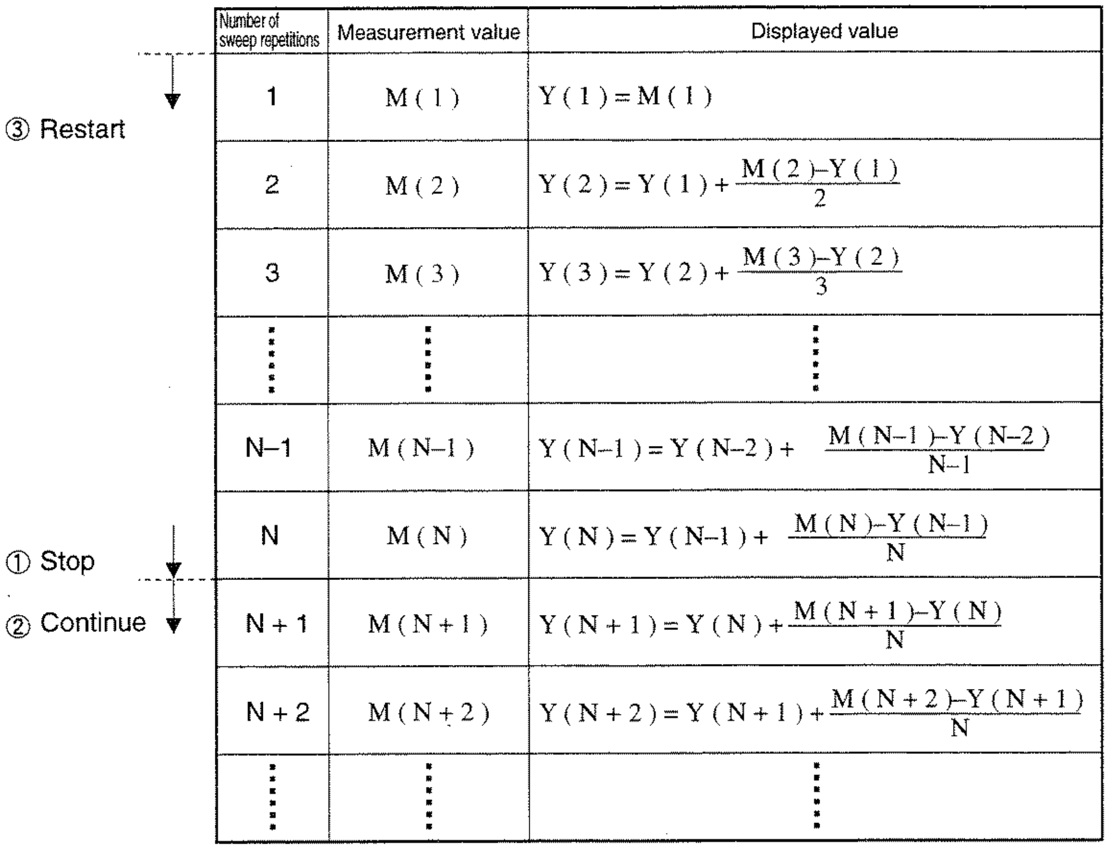
Non-Stop: Continues the sweeping after averaging rate is reached.

Restart: Delete the trace waveform and restart.

The averaging function improves the S/N ratio depending on the averaging rate and the number of sweep repetitions as shown on the next page.

Digital video averaging is performed by the method shown below.

Averaging Rate = N



Number of sweep repetitions	Measurement value	Displayed value
1	M (1)	$Y(1)=M(1)$
2	M (2)	$Y(2)=Y(1)+\frac{M(2)-Y(1)}{2}$
3	M (3)	$Y(3)=Y(2)+\frac{M(3)-Y(2)}{3}$
⋮	⋮	⋮
N–1	M (N–1)	$Y(N-1)=Y(N-2)+\frac{M(N-1)-Y(N-2)}{N-1}$
N	M (N)	$Y(N)=Y(N-1)+\frac{M(N)-Y(N-1)}{N}$
N + 1	M (N + 1)	$Y(N+1)=Y(N)+\frac{M(N+1)-Y(N)}{N}$
N + 2	M (N + 2)	$Y(N+2)=Y(N+1)+\frac{M(N+2)-Y(N+1)}{N}$
⋮	⋮	⋮

At a time of Continuous Sweep:

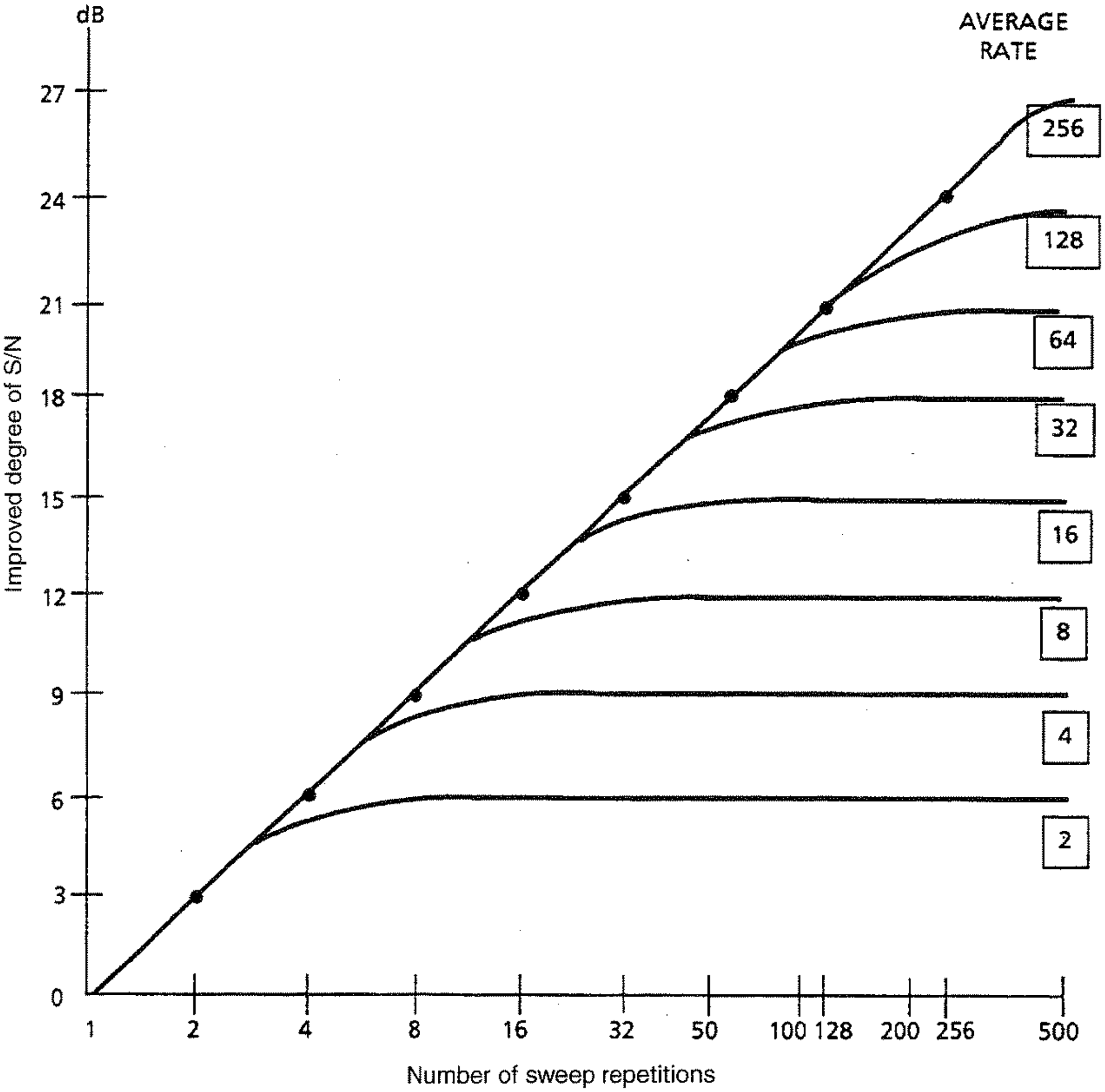
① Sweep stops after N repetitions. (When Avg Mode is Stop)

② The above stop condition is released by restarting sweep by Continue. The averaging operation resumes, while counting the number of sweep repetitions as N+1, N+2....

③ When Restart is performed during sweep or Stop, averaging is repeated from sweep count 1.

④ When the "Signal Sweep" is zctivated, the sweep wil be limited one time.

⑤ When the "Signal Sweep" is activated duraing "Sweep" or "Stop" modes, an additional sweep wil be made.



S/N Improvement by Digital Video Averaging

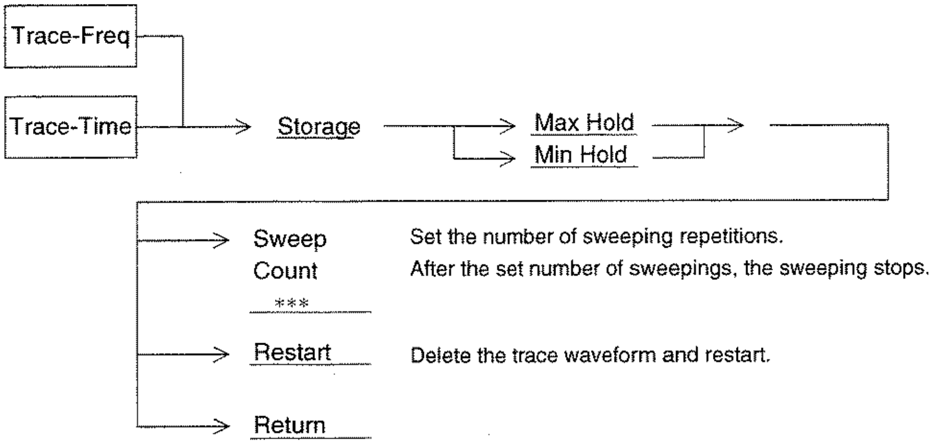
Averaging by video filter has the disadvantage that the sweep time becomes longer when the video bandwidth is narrowed to improve the averaging effect.

On the other hand, digital video averaging smoothes the trace display by averaging the digital data after A/D conversion at each sweep, without narrowing the video bandwidth (VBW). Since the video bandwidth (VBW) gets comparatively wider and the time required for each sweep can be shortened, the entire spectrum image can be verified quickly and the repetitive sweep can be stopped when the required smoothing has been obtained. The problem of averaging with the video filter is that the time required for each sweep becomes longer and it takes a long time to verify the entire spectrum image.

Since the averaging rate is initially eight, the above figure shows than an S/N improvement of 9 dB is obtained with eight sweeps.

3.8.6 Max Hold and Min Hold Functions

When Max Hold or Min Hold is selected, the sweeping can be performed by the number of specified repetitions, and then stops.



Sweep Count: Set the number of sweeping repetitions. After the set number of sweepings, the sweeping stops.

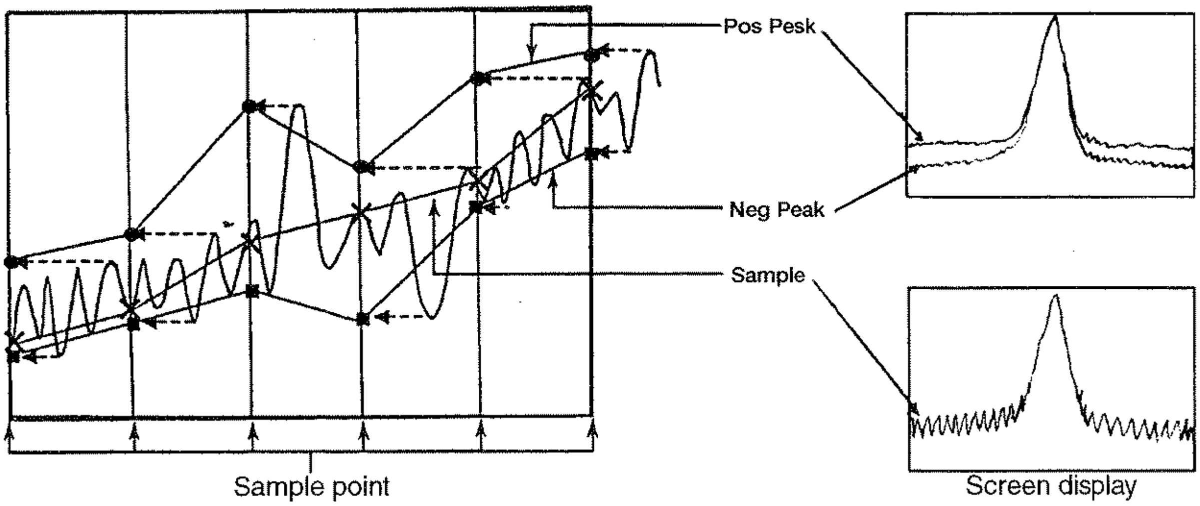
Restart: Delete the trace waveform and restart.

3.8.7 Explanation of Detection Mode

The spectrum analyzer has 501 horizontal-axis measurement sample points. This corresponds to 501 storage trace memories.

The detection mode determines what type of measured value should be stored in the trace memory at each measurement sample point.

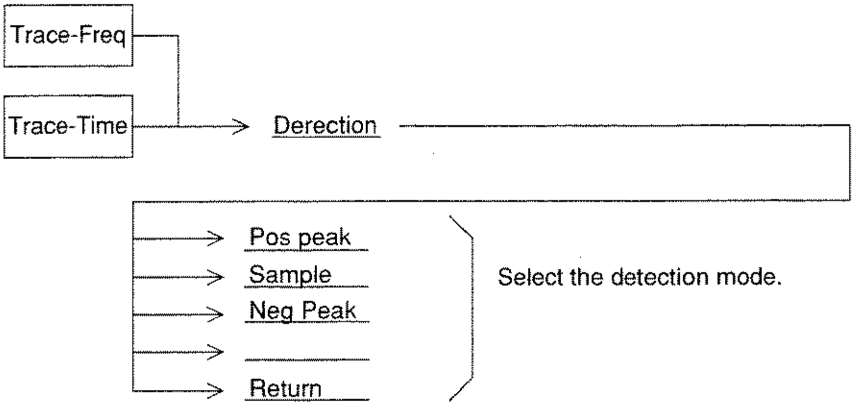
Detection mode	Description
Pos Peak	Holds the maximum level present between the current sample point and the next sample point, then stores the maximum value in the trace memory corresponding to the current sample point. Pos Peak is used to measure the peak value of signals near the noise level.
Sample	Stores the instantaneous signal level at each sample point to the trace memory. Sample is used for noise level measurement, time domain measurement, and other measurements.
Neg Peak	Holds the minimum level present between the current sample point and the next sample point, then stores the minimum value to the trace memory corresponding to the current sample point. The Neg Peak mode is used to measure the lower envelope side of a modulated waveform.



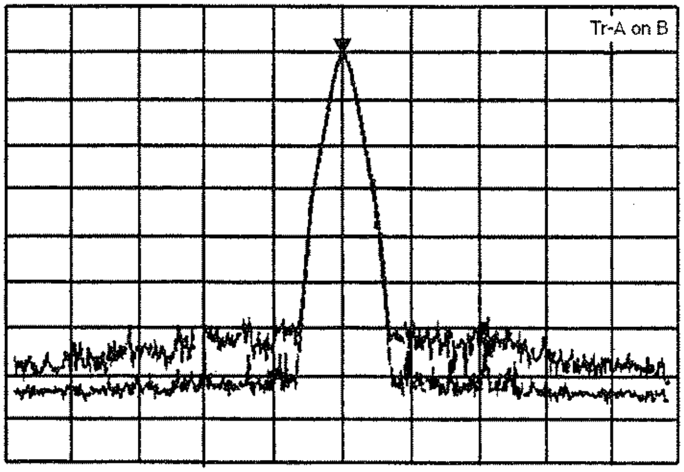
Note: *When the detection mode is set to Sample or Neg Peak while the frequency span and resolution bandwidth are set so that the spectrum is displayed as discrete vertical lines, the spectrum peak is incorrectly displayed.*

3.8.8 Selecting Detection Mode

Select the detection mode for trace A, trace B, or trace Time by performing the following key operations.



Select the detection mode.



Waveforms when trace A is in the Pos Peak mode and trace B is in the NegPeak mode

3.9 Selecting the Sweep Method

3.9.1 Continuous Sweep Mode

When the trigger mode is set to Freerun, sweep is performed continuously. When the trigger mode is set to Triggered, sweep is executed each time the trigger conditions are met.

To set the continuous sweep mode, perform the following key operation. (The continuous sweep mode is initially set.)

Continuous

3.9.2 Single Sweep Mode

When the trigger mode is set to Freerun, sweep is executed once immediately after the Single key is pressed.

When the trigger mode is set to Triggered, sweep is executed only once when the trigger conditions are met after the Single key is pressed.

To set (sweep start) the single sweep mode, operate the following key.

Single

3.9.3 Trigger Mode

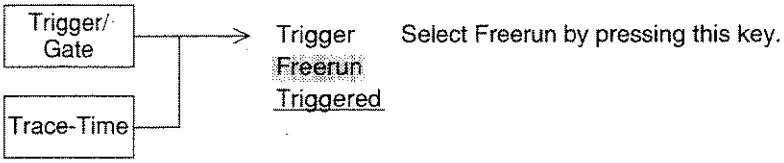
The spectrum analyzer trigger mode can be divided into Freerun and Triggered.

In the Triggered mode, Wide IF Video and External can be selected as the trigger source.

(1) Freerun

When the sweep mode is set to continuous, sweep is repeated continuously. When the sweep mode is set to single sweep, sweep is started immediately after the Single key is pressed.

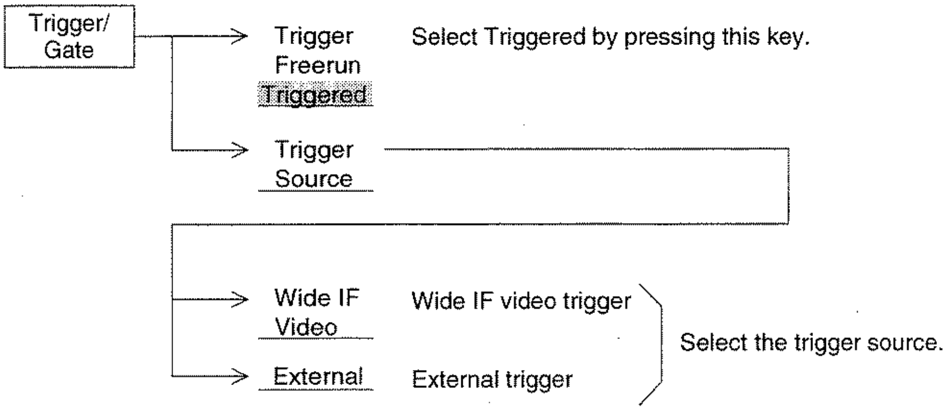
To set the Freerun mode, perform the following key operations. (The Freerun mode is initially set.)



(2) Triggered

When the conditions of the pre-selected trigger source are met, sweep is started.

To set the Triggered mode and to select the trigger source, perform the following key operations.

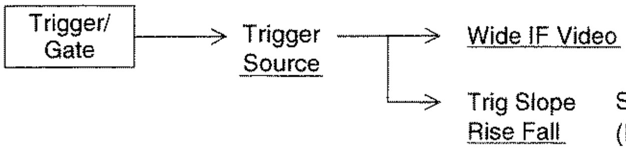


(3) Wide IF Video Trigger

A wide bandwidth IF signal of at least 30 MHz is detected and sweep is started in synchronization with its positive leading edge or negative leading edge.

To select the trigger level and trigger slope, perform the following key operations.

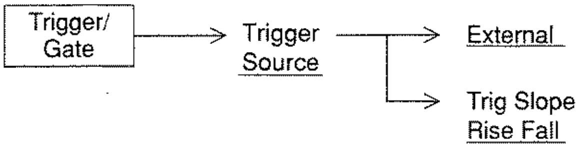
Generally, there is no burst synchronizing signal and this signal is used as a burst wave gate control signal.



Select the positive leading edge (Rise) or negative leading edge (Fall) as the trigger slope by pressing this key.

(4) External Trigger

Sweep is started in synchronization with the positive leading edge or negative leading edge of the TTL signal input to the Ext Input connector on the rear panel.



Select the positive leading edge (Rise) or negative leading edge (Fall) as the trigger slope by pressing this key.

3.9.4 Explanation of Time Gate Function

The time gate function is a sweep mode which turns the waveform data display On and Off by the gate control signal generated in the spectrum analyzer based on an external signal or video trigger signal.

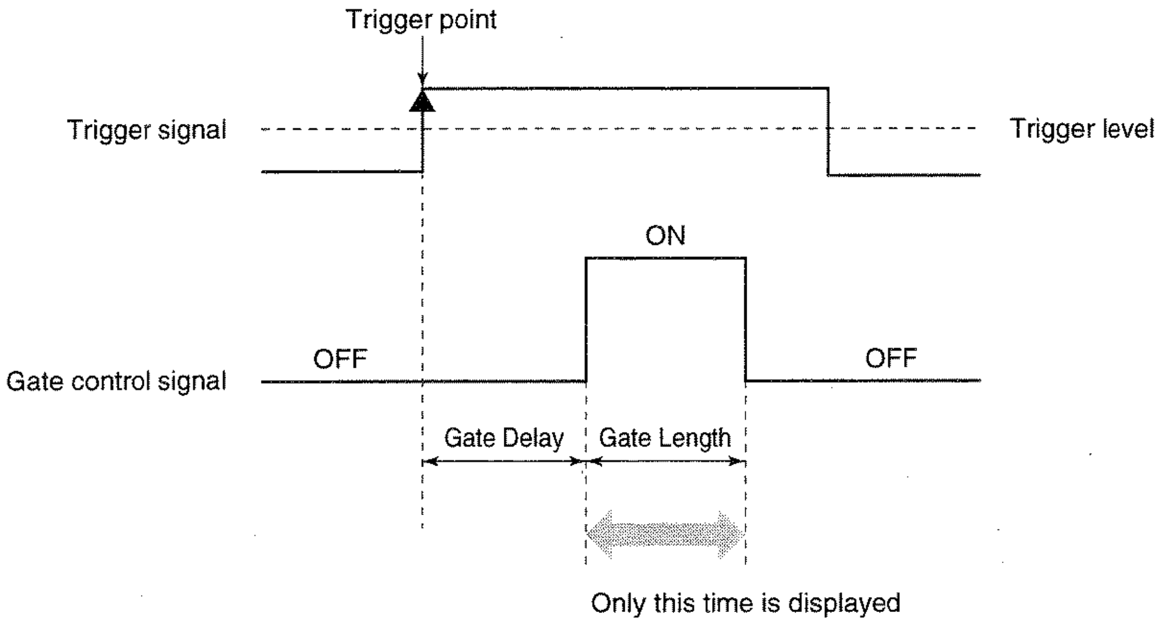
Since the timing that displays the spectrum waveform can be set by using this mode, the spectrum when the burst signal is On can be analyzed.

In order to use the time gate function, an external trigger signal synchronized with burst wave On/Off or other signal change is required to create the gate control signal.

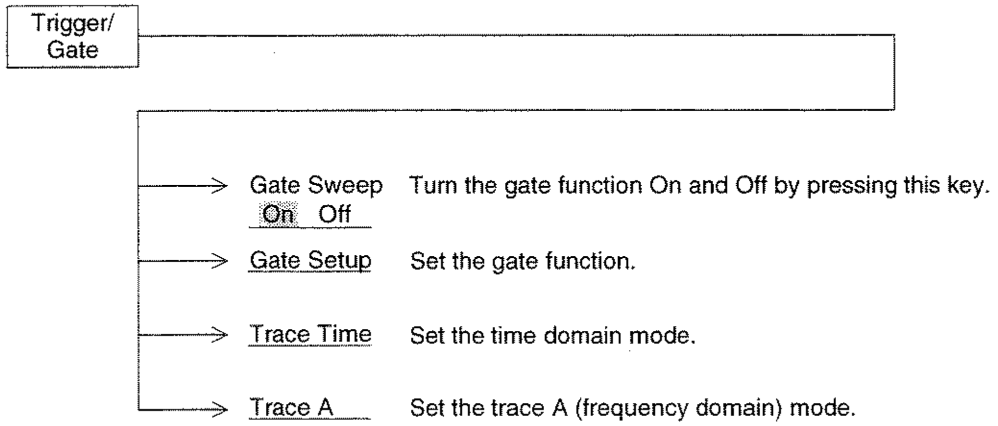
When an external synchronizing signal is unavailable, set the trigger source to wide IF video trigger. A synchronizing signal can be obtained internally.

3.9.5 Creating a Gate Control Signal

If the point where an external trigger signal or a wide IF video trigger signal is triggered is assumed to be the reference position, the gate control signal remains On over the period from the point immediately after the Gate Delay time has elapsed from the reference position to the time set by Gate Length.



To turn the gate time analysis function On and Off and to create the gate control signal, perform the following key operations.



Gate Sweep On Off	Turn the gate function On and Off by pressing this key.
Gate Setup	Set the gate function.
Trace Time	Set the time domain mode.
Trace A	Set the trace A (frequency domain) mode.

3.9.6 Setting Gate Function

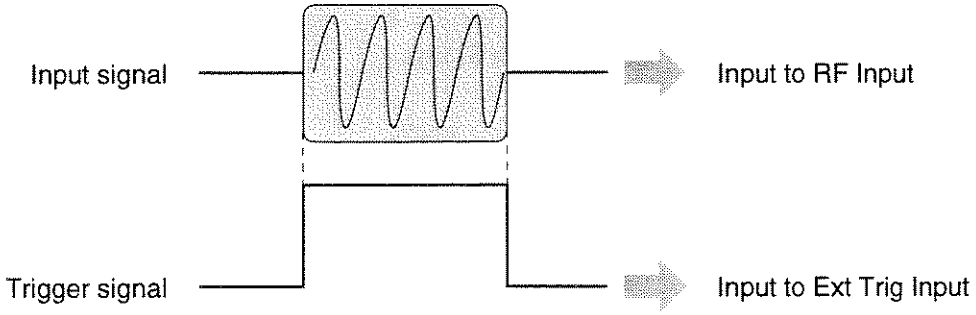
Trigger/Gate → Gate Setup

Gate Delay 0 us	Set the gate delay time.
Gate Length 10 ms	Set the gate time length.
Gate Trig Source	Select the gate trigger source from Wide IF Video and external.
Trig Slope Rise Fall	Select the positive leading edge (Rise) or negative leading edge (Fall) as the trigger slope by pressing this key.
return	

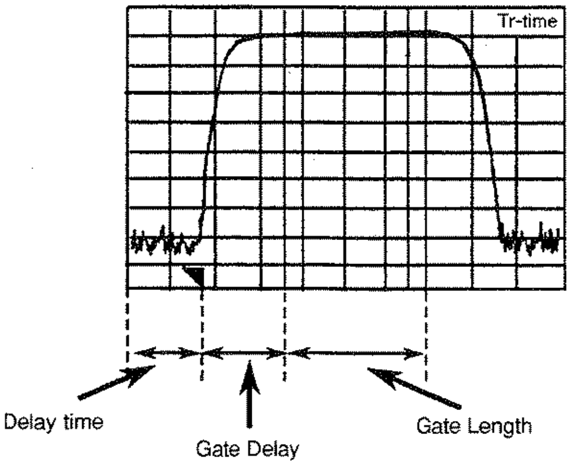
The time domain mode facilitates setting the gate control signal time. The following shows an example of how to use the Time Gate function that uses the time domain mode.

Step Procedure

1 Input the following signals to the spectrum analyzer.

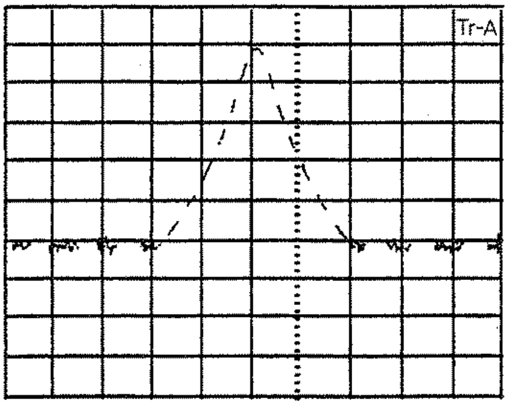


2 Display the waveform in the time domain mode. Synchronize the input signal by setting the trigger mode to Triggered and the trigger source to Ext Input 1 (–10 to 10V).

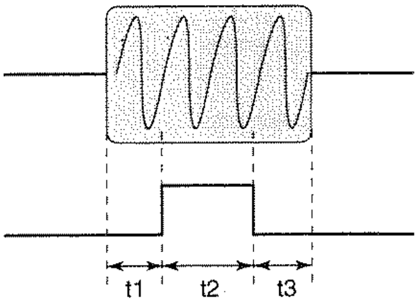


3 Set Gate to On. Vertical lines (gate cursor) should appear at the Gate Delay and Gate Length positions. Set GateDelay and Gate Length to appropriate positions while observing the waveform. At this time, adjust the resolution bandwidth and video bandwidth in the time domain mode to equal those in the frequency domain mode, then set the gate cursor positions. The influence of spike-like noises independent of the conditions shown in Note 1 described later can be avoided.

Note: Delay Time is set to OnS.

Step	Procedure
4	Set the frequency domain mode. The trigger mode becomes Freerun and the waveform data is displayed only for the time set by Gate Length. 

Notes: ① *The detector output is delayed compared to the positive leading edge of the input waveform when the resolution bandwidth (RBW) is narrowed in the frequency domain measurement mode. As a result, spike-like noises may appear on the trace. To prevent this from appearing, set Gate Delay and Gate Length to values that satisfy the following conditions.*



RBW	t1	t2	t3
1 kHz	≥ 3 ms	≥ 20 μs	≥ 1 μs
3 kHz	≥ 1 ms		
10 kHz	≥ 230 μs		
30 kHz	≥ 200 μs		
100 kHz	≥ 20 μs		
300 kHz	≥ 15 μs		
1 MHz	≥ 10 μs		

② *When the resolution bandwidth (RBW) is extremely narrow for the frequency span, some waveforms cannot be displayed correctly. Set each parameter so that the following conditions are satisfied.*

$$\text{RBW} \geq \frac{\text{Span}}{\text{Number of data points (501)}} \times 5$$

Trigger can be applied by the gate control signal created internally by setting the trigger source to Wide IF Video.

3.10 Measurement

3.10.1 Measurement Function

Various application measurements can be selected by performing the following key operations.

Measure	Noise Measure	Measure the carrier signal and noise power ratio.
	C/N Ratio Measure	Measure the occupied bandwidth. Select the XdBDOWN mode or N% of POWER mode.
	Occ BW Measure	Measure the adjacent channel leakage power.
	AdJ ch pwr Measure	Select the channel separation, channel bandwidth, measurement mode, ACP graph display On/Off, channel center line On/Off, channel BW line On/Off, and measurement low band/high band/both bands channel, etc.
	Burst AvgPower	Measure the average power of a burst signal in the time domain.
	Off	Select the start/end points.

(1) Measuring Noise Power

To measure the total noise power of the zone marker range, perform the following key operations.

Measure	Noise Measure	Meas On	Start measurement.
		Off	End measurement.
		return	

(2) Measuring C/N Ratio

To measure the C/N ratio, perform the following key operations.

Measure	C/N Ratio Measure	Meas On	Start measurement.
		Off	End measurement.
		return	

(3) Measuring Occupied Bandwidth

To measure the occupied bandwidth, perform the following key operations.

Measure	Occ BW Measure	Execute	Execute measurement.
		Setup	Select the XdBDown mode or N% of Power mode.
		return	

(4) Measuring Adjacent Channel Leakage Power

To measure the adjacent channel leakage power, perform the following key operations.

Measure	Adj ch pwr Measure	Execute	Execute measurement.
		Ch Sepa-1 12.5 kHz	Set channel separation to 12.5 kHz.
		Ch Sepa-2 25.0 kHz	Set channel separation to 25.0 kHz.
		Ch BW 8.5 kHz	Set the channel bandwidth.
		Set Up	Select the measurement mode, ACP graph display On/Off, channel centerline/BW line display On/Off and low/high/both channel.
		return	

Note: *Since the graph display etc. displayed in the Set Up mode use the Trace B, the waveform data saved in the Trace B is erased. When erasing the graph etc., refresh the Trace B.*

(5) Measuring Burst Average Power

To measure the average power of a burst wave in the time domain mode, perform the following key operations.

Measure	Burst Avg Power	Execute	Execute measurement.
		Start Point 100	Set the measurement start point of the burst signal on the screen with the ten keys or the rotary knob.
		Stop Point 200	Set the measurement end point of the burst signal on the screen with the ten keys or the rotary knob.
		return	

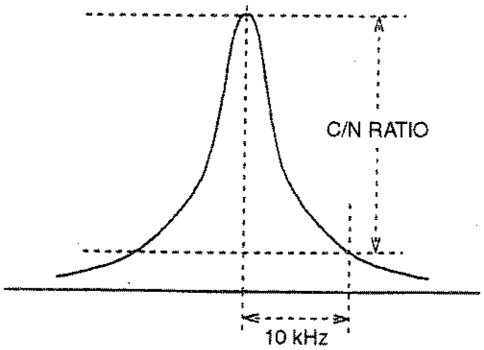
3.10.2 Measurement Examples

The following describes the measurement block diagram and measurement operating procedure of actual measurement examples.

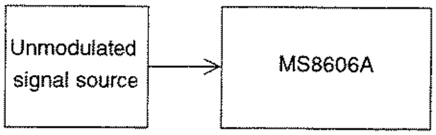
In the measurement examples, [ ] indicates a panel key, F*: ☐ indicates a Main Function key and F*: ____ indicates a Main Function key.

(1) Example of C/N Ratio Measurement

- In C/N measurement, set the detection mode set to the Sample mode, unless specified otherwise.



(1) Measurement block diagram



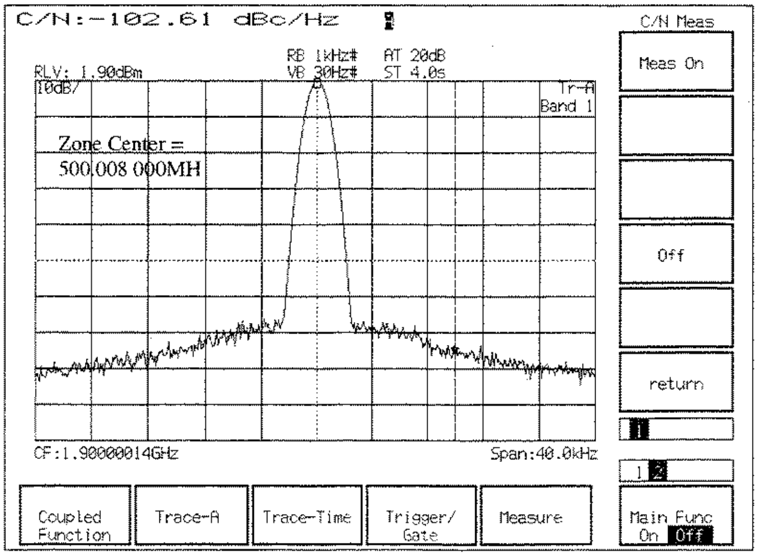
- Center frequency : 1.9 GHz
- Offset frequency : 100 kHz

(2) Measurement procedure

Step	Operation procedure
1	Press the spectrum analyzer [Preset] key.
2	Span frequency setting: F2: Span, [4], [0], [kHz] Sets the span frequency to 3 or 4 times the offset frequency.
3	Reference level setting: F3: Amplitude, [2], [0], [dBm]
4	Center frequency setting: F1: Frequency, [1], [.], [9], [GHz]
5	RBW setting: [Next Menu], F1: Coupled Function, F7: RBW, [1], [kHz]
6	VBW setting: F12: return, F8: VBW, [3], [0], [Hz]
7	Marker setting: [Next Menu], F4: Marker, F12: Zone Width, F7: Spot
8	Peak setting: After one sweep, F5: Peak Search, F11: Peak → CF, F12: Peak → RLV
9	Marker position setting: F4: Marker, F8: Delta Marker, [1], [0], [kHz] (Becomes the offset frequency.)
10	C/N measurement: [Next Menu], F5: Measure, F8: C/N Ratio Measure: F7: Meas On The measured result is displayed at the top left-hand corner of the screen each time the sweep is updated.

★ Example of measured result: – 102.61 dBc/Hz

★ Select the best C/N measured value by changing the RBW value. Also, make the ATT value minimum.



C/N:−102.61 dBc/Hz

RB 1kHz# AT 20dB

VB 30Hz# ST 4.0s

RLV: 1.90dBm

Zone Center =
500.008 000MH

CF:1.90000014GHz

Span:40.0kHz

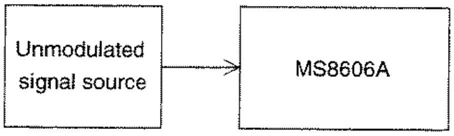
C/N ratio measurement example

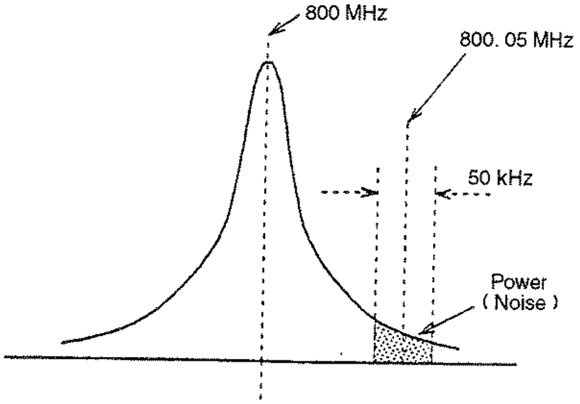
Note: *In this measurement, the measured value does not become 0dBm even when the marker frequency is moved to the reference level (carrier signal peak). This is because a correction value is also added as noise relative to the reference marker carrier.*

(2) Example of Power (Noise) Measurement (Frequency Domain, Continuous Wave)

- When making power measurements, set the detection mode to the Sample mode, unless specified otherwise. When measuring the carrier-off leakage power and adjacent channel leakage power of Japan digital cordless telephone systems (burst wave), set the detection mode to the Pos Peak mode.

(1) Measurement block diagram





- Center frequency : 800 MHz
- Span frequency width : 400 kHz
- Measurement center frequency : 800.05 MHz
- Measurement frequency bandwidth : 50 kHz

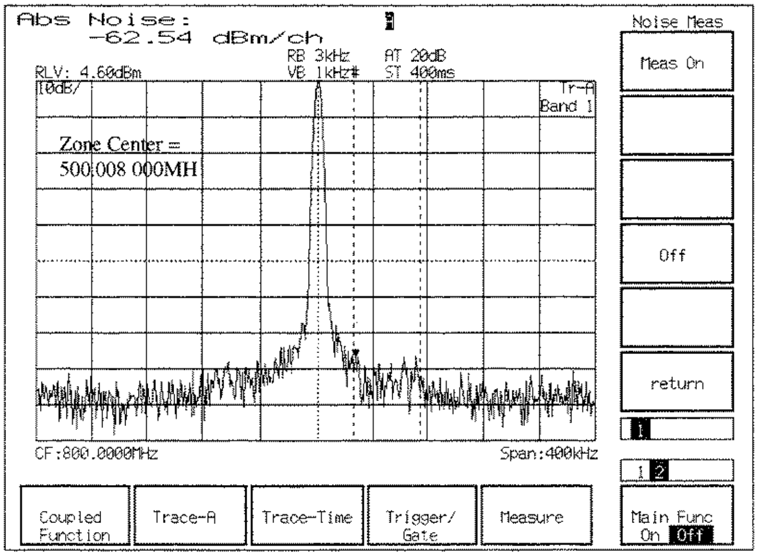
(2) Measurement procedure

Step	Procedure
1	Press the spectrum analyzer [Preset] key.
2	Span frequency setting: F2: Span , [4], [0], [0], [kHz]
3	Reference level setting: F3: Amplitude , [2], [0], [dBm]
4	Center frequency setting: F1: Frequency , [8], [0], [0], [MHz]
5	RBW setting: [Next Menu], F1: Coupled Function , F7: RBW, [3], [kHz]
6	VBW setting: F12: return, F8: VBW, [1], [kHz]
7	Peak setting: After one sweep, [Next Menu], F5: Peak Search , F11: Peak → CF, F12: Peak → RLV
8	Zone center position setting: F4: Marker , F12: Zone Width, F7: Spot, F12: return, F7: Normal Marker, [8], [0], [0], [.], [5], [MHz]
9	Zone marker width setting: F12: Zone Width, [5], [0], [kHz]
10	Power (noise) measurement: [Next Menu], F5: Measure , F8: Noise Measurement, F7: Meas On The total power value of the zone marker range (measured value) is displayed at the top left-hand corner of the screen each time the sweep is updated.

★ Example of measured result: – 62.54 dBm/ch

★ Applications: * Carrier-off leakage power (PHS) measurement

* Adjacent channel leakage power (PHS) measurement



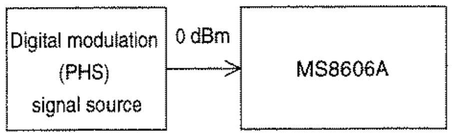
Abs Noise:
-62.54 dBm/ch
RB 3kHz AT 20dB
VB 1kHz# ST 400ms
RLV: 4.60dBm
10dB/
Tr-A
Band 1
Zone Center =
500.008 000MH
CF:800.0000MHz
Span:400kHz

Power (noise) measurement example

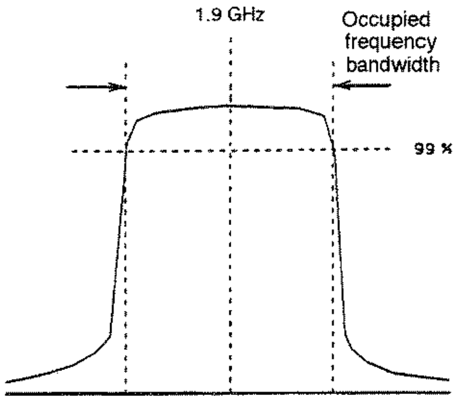
(3) Example for Occupied Frequency Bandwidth (Burst Wave)

- For burst waves, set the detection mode to the Pos Peak mode.

(1) Measurement block diagram



- Center frequency : 1.9 GHz
- Span frequency width : 800 kHz
- RBW : 1 kHz
- VBW : 1 kHz
- Sweep time : 3 s

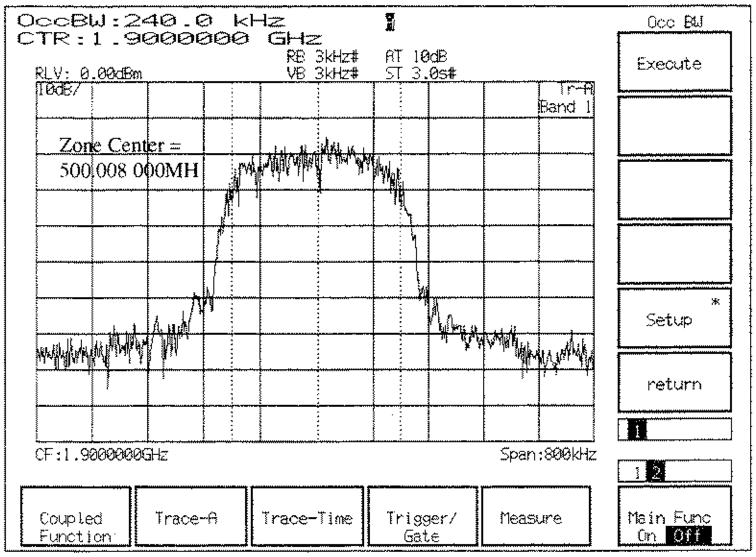


(2) Measurement procedure

Step	Operation procedure
1	Press the spectrum analyzer [Preset] key.
2	Span frequency setting: F2: Span, [8], [0], [0], [kHz]
3	Reference level setting: F3: Amplitude, [0], [dBm]
4	Center frequency setting: F1: Frequency, [1], [.], [9], [GHz]
5	RBW setting: [Next Menu], F1: Coupled Function, F7: RBW, [1], [kHz]
6	VBW setting: F12: return, F8: VBW, [1], [kHz]
7	Sweep time setting: F12: return, F9: Sweep Time, [3], [s]
8	Single sweep: [Single]
9	Measurement preparations: Select F5: Measure, F9: Occ BW Measure, F11, Setup, F7: Method, and N% of PWR. F8: N%Ratio, [9], [9], [Enter]
10	Power (noise) measurement: F12: return, F7: Execute The measured value is displayed at the top left-hand corner of the screen.

★ Example of measured result : Occ BW: 240kHz, CTR; 1.9000000GHz

★ Application : Occupied frequency bandwidth (PDC, PHS, etc.)

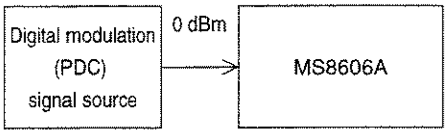


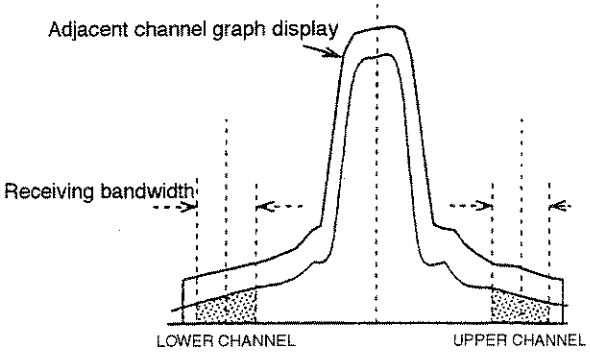
OccBW:240.0 kHz
CTR:1.9000000 GHz
RB 3kHz# AT 10dB
VB 3kHz# ST 3.0s#
RLV: 0.00dBm
CF:1.9000000GHz
Span:800kHz

Occupied frequency bandwidth measurement example

(4) Example of Measurement of Adjacent Channel Leakage Power

(1) Measurement block diagram

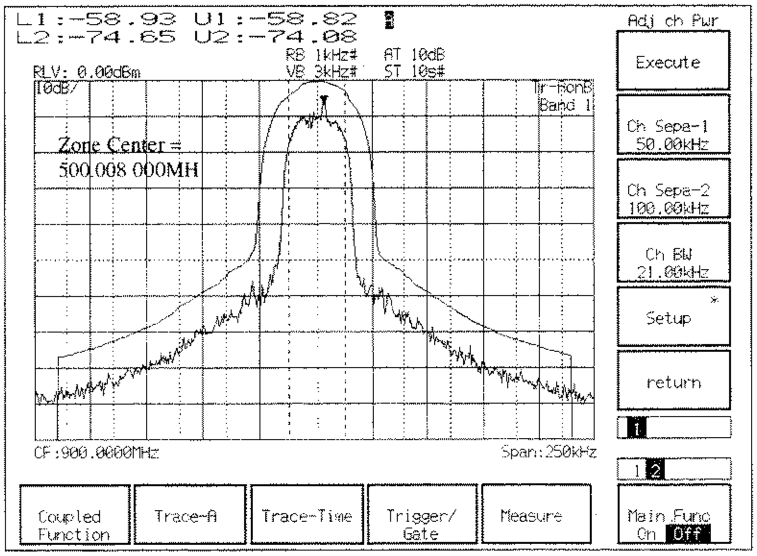




- Center frequency : 900 MHz
- Span frequency width : 250 kHz
- RBW : 1 kHz
- VBW : 3 kHz
- Sweep time : 10 s

(2) Measurement procedure

Step	Procedure
1	Press the spectrum analyzer [Preset] key.
2	Span frequency setting: F2: Span , [2], [5], [0], [kHz]
3	Reference level setting: F3: Amplitude , [0], [dBm]
4	Center frequency setting: F1: Frequency , [9], [0], [0], [MHz]
5	RBW setting: [Next Menu], F1: Coupled Function , F7: RBW, [1], [kHz]
6	VBW setting: F12: return, F8: VBW, [3], [kHz]
7	Sweep time setting: F12: return, F9: Sweep Time, [1], [0], [s]
8	ATT setting: F12: return, F10: Attenuator, set to minimum value using a control.
9	Single sweep: [Single]
10	Measurement preparations: F5: Measure , F10: Adj Ch Pwr Measure
11	Adjacent channel setting: F8: Ch Sepa-1, [5], [0], [kHz] F9: Ch Sepa-2, [1], [0], [0], [kHz]
12	Receiving bandwidth setting: F10: Ch BW, [23], [1], [kHz]
13	Graph display method: F11: Setup, F7: Method, select Total Pwr or Ref Level. (The graph display method is set to Total Pwr here.)
14	Graph display: When On is selected with F8: ACP Graph, a graph is displayed.
15	Channel display: When On is selected with F9: Ch Center Line, a line that shows the center frequency of the adjacent channel is displayed. When On is selected with F10: Ch BW Line, a line that shows the bandwidth of the adjacent channel is displayed.
16	Measurement channel setting: [Next Menu], F7: Both Channel
17	Power (noise) measurement: F12: return, F7: Execute The measured value is displayed at the top left-hand corner of the screen.



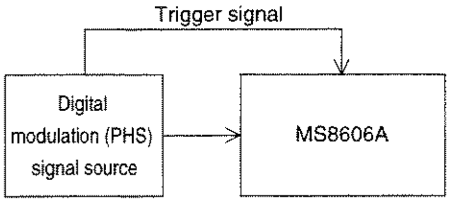
```
L1:-58.93 U1:-58.82
L2:-74.65 U2:-74.08
```

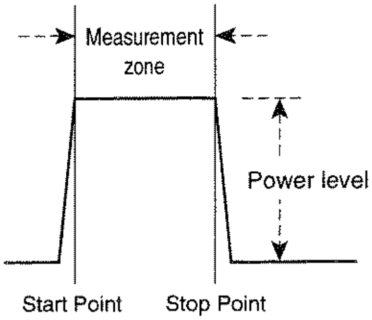
Adjacent channel leakage power measurement example

(5) Example of Power Measurement (Time Domain)

- Find the effective average value of the zone set by the two cursors on the screen.

(1) Measurement block diagram





- Center frequency : 1.9 GHz
- Time span : 1 ms

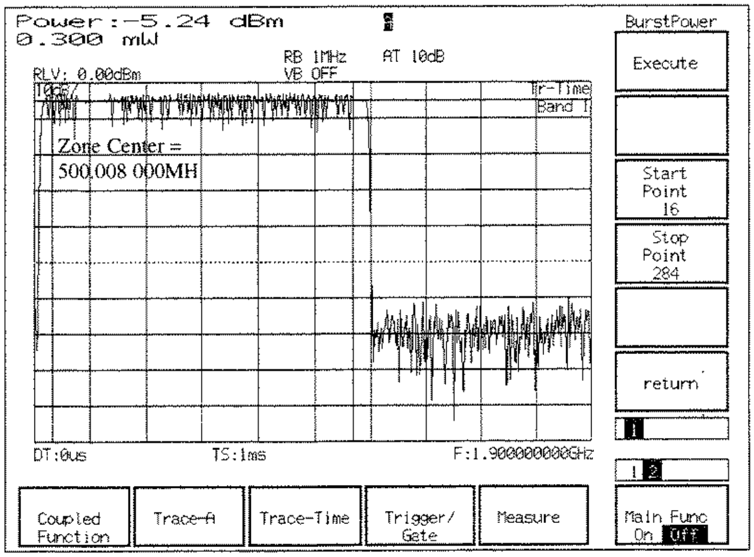
(2) Measurement procedure

Step	Operation procedure
1	Press the spectrum analyzer [Preset] key.
2	Time domain setting: F2: Span, [0], [kHz]
3	Reference level setting: F3: Amplitude, [2], [0], [dBm]
4	Center frequency setting: F1: Frequency, [1], [.], [9], [GHz]
5	RBW setting: [Next Menu], F1: Coupled Function, F7: RBW, [1], [MHz]
6	Time span setting: F3: Trace-Time, F8: Time Span, [5], [ms]
7	Reference level setting: After one sweep, [Next Menu], F5: Peak Search, F12: Peal → RLV, F3: Amplitude, raise the reference level several dB using the control.
8	Time span setting: [Next Menu], F3: Trace-Time, F8: Time Span, [1], [ms]
9	Trigger setting: F4: Trigger/Gate, F7: Trigger, select Triggered F8: Trigger Source, F9: External Select Rise with F10: Trig Slope.
10	Single sweep: [Single]
11	Measurement preparations: F5: Measure, F11: Burst Avr Power F8: Start Point, set the start point in the measurement zone using the control. F9: Stop Point, set the stop point in the measurement zone using the control.
12	Power measurement: F7: Execute The measured value is displayed at the top left-hand corner of the screen.

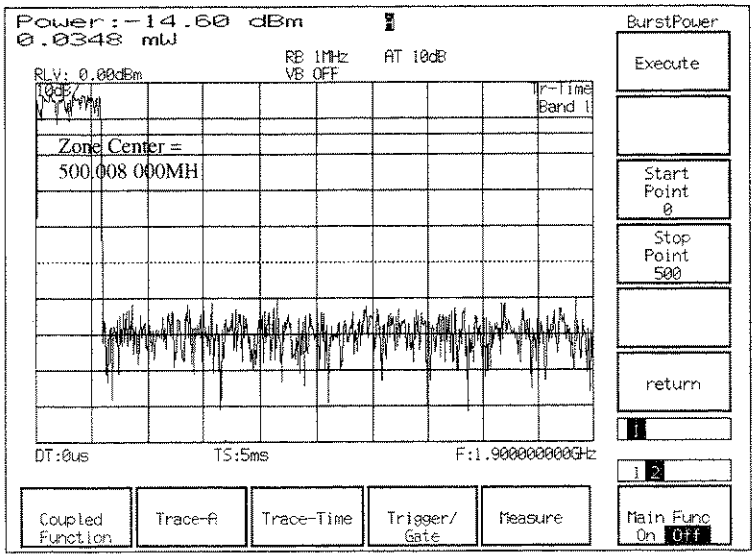
★ Example of measured value: – 5.24 dBm, 0.300 mW

★ To find the average power between burst frames, set the measurement zone to the burst frame time. (Example 2)

★ Applications: * Spurious radiation strength measurement (PDC, PHS)
  * Antenna power measurement (PDC, PHS)


Power:-5.24 dBm
0.300 mW
RB 1MHz AT 10dB
VB OFF
RLV: 0.00dBm
10dB/
Zone Center =
500.008 000MH
DT:0us TS:1ms F:1.900000000GHz
Start Point 16
Stop Point 284

Power measurement (time domain) example 1


Power:-14.60 dBm
0.0348 mW
RB 1MHz AT 10dB
VB OFF
RLV: 0.00dBm
10dB/
Zone Center =
500.008 000MH
DT:0us TS:5ms F:1.900000000GHz
Start Point 0
Stop Point 500

Power measurement (time domain) example 2

SECTION 4
PERFORMANCE TESTS

This section describes the test equipment, setup, and performance check procedure for testing the performance of the MS8606A Spectrum Analyzer function.

TABLE OF CONTENTS

4.1 Requirement for Performance Tests

Performance checks are carried out as part of preventive maintenance to prevent performance degradation in the MS8606A Spectrum Analyzer function.

Use performance checks to check the instrument performance during receiving inspection and routine inspection and after repair.

This section describes the following performance checks:

- Center frequency display accuracy
- Frequency span display accuracy
- Resolution bandwidth and selectivity
- Sideband noise level
- Screen amplitude display linearity
- Frequency response
- Reference level accuracy
- Average noise level
- Second harmonic distortion
- Resolution bandwidth switching deviation

For preventive maintenance, periodically perform the performance check items that are important to your application. The recommended routine inspection interval is once or twice a year.

If you find any item that does not satisfy the specifications, contact the Anritsu Service Department.

4.2 Instruments Required for Performance Test

The instruments required for performance tests are shown below.

Instruments Required for Performance Test

Test item	Test equipment name	Recommended model	Reference
Center frequency display accuracy	Signal generator	MG3633A	4.3.2
Frequency span display accuracy	Signal generator	MG3633A	4.3.3
Resolution bandwidth and selectivity	Signal generator	MG3633A	4.3.4
Sideband noise level	Signal generator	MG3633A	4.3.5
Screen amplitude display linearity	Signal generator Attenuator	MG3633A MN510C	4.3.6
Frequency response	Signal generator Power meter Power sensor	Wiltron 6769A ML4803A MA4601A	4.3.7
Reference level accuracy	Signal generator Attenuator Power meter Power sensor	Wiltron 6769A MN510C ML4803A MA4601A	4.3.8
Average noise level	50 Ω terminator	MP752A	4.3.9
Second harmonic distortion	Low-pass filter Fundamental frequency (Device with a attenuation of at least 70 dB at double the frequencies 10 MHz and 1 GHz)		4.3.10
Resolution bandwidth switching deviation	Signal generator	MG3633A	4.3.11

4.3 Performance Tests

Unless otherwise specified, warm up the device under test and the measuring instruments for at least 30 minutes before making out the performance tests. Also, to display the maximum measurement accuracy, checks must be carried out at normal room temperature with minimum AC power supply voltage variations, noise, vibration, dust, and humidity.

4.3.1 Reference oscillator frequency stability

Refer to the MS8606A mainframe performance check.

4.3.2 Center frequency display accuracy

Apply a reference frequency with a known center frequency to the spectrum analyzer as shown in the figure below and set the center frequency and frequency span. Then, check the difference between the peak maker display frequency and the center frequency setting (same value as the known frequency).

In the synthesized signal generator, use a phase-locked signal source having the same accuracy as the 10 MHz reference oscillator of the spectrum analyzer as shown in the figure below.

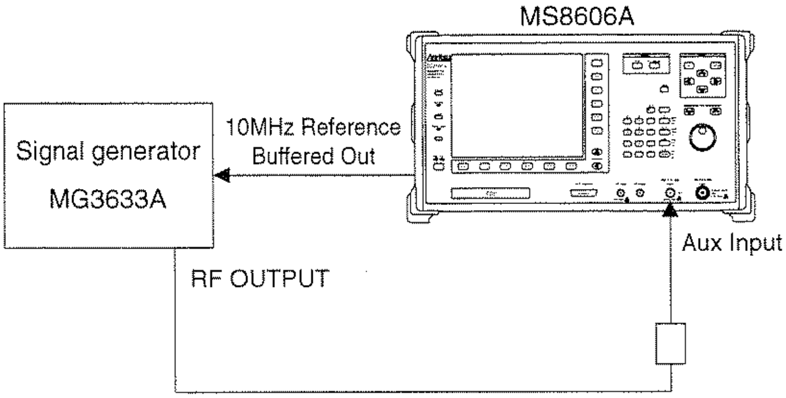
(1) Test target rating

- Center frequency display accuracy: ± (display frequency × reference frequency accuracy + span × span accuracy)

(2) Test equipment

- Synthesized signal generator: MG3633A

(3) Setup



(4) Test precautions

Set the signal generator output level to about −10 dBm.

(5) Test procedure

Step	Operation procedure
1	Set the signal generator output frequency to 500MHZ.
4	Press the spectrum analyzer Preset key.
3	Execute Cal.
4	Set the MS8606A center frequency to 500 MHz.
5	Set the frequency span in accordance with the table below.
6	Read the marker frequency value, and check that it is within the maximum and minimum values shown in the table below.
7	Repeat steps 5 and 6 in accordance with the frequency span shown in the table below.

Center Frequency Display Accuracy Test

Signal generator output frequency	Center frequency	Frequency span	Center frequency reading		
			Minimum value	Marker value	Maximum value
500MHz	500MHz	10 kHz	499.99975 MHz		500.00025 MHz
		200 kHz	499.99500 MHz		500.00500 MHz
		100 MHz	497.50000 MHz		502.50000 MHz

4.3.3 Frequency span display accuracy

Setup the equipment as shown in the figure below and set the signal generator output to the frequency of the 1st and 9th divisions.

Read these frequencies with the marker, and find the span accuracy.

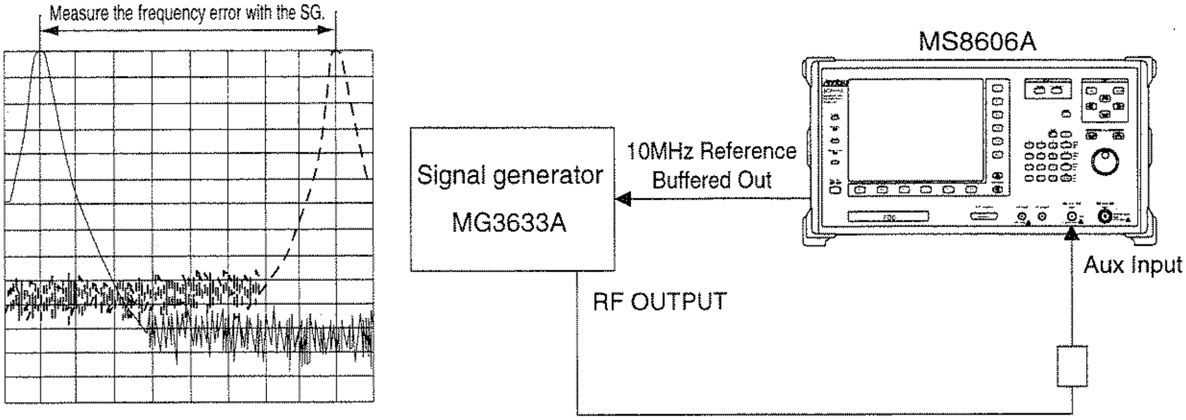
(1) Test target rating

- Frequency span accuracy: ±2.5%

(2) Test equipment

- Synthesized signal generator: MG3633A

(3) Setup



(4) Test precautions

Set the signal generator output level to about −10 dBm.

(5) Test procedure

Step	Operation procedure
1	Press the spectrum analyzer Preset key.
2	Execute Cal.
3	Set the MS8606A center frequency to 1 GHz.
4	Set the signal generator output to the first f1 frequency shown in the table below.
5	Read the spectrum waveform peak marker frequency, and record it as f1'.
6	Set the signal generator output to the first f2 frequency shown in the table below.
7	Read the spectrum waveform peak marker frequency, and record it as f2'.
8	Calculate (f2'-f1')/0.8, and check that the result is within the maximum and minimum values shown in the table below.
9	Repeat steps 3 through 8 for the remaining frequencies in the table.

Frequency Span Display Accuracy

Signal generator		Spectrum analyzer				
f1	f2	Center frequency	Frequency span	Minimum value	Calculated value	Maximum value
999.992MHz	1000.008MHz	1GHz	20kHz	19.5kHz		20.5kHz
999.92MHz	1000.08MHz		200kHz	195kHz		205kHz
999.2MHz	1000.8MHz		2MHz	1.95MHz		2.05MHz
992MHz	1008MHz		20MHz	19.5MHz		20.5MHz
920MHz	1080MHz		200MHz	195MHz		205MHz
200MHz	1800MHz		2GHz	1.95GHz		2.05GHz

Expression : $\frac{(f2' - f1')}{0.8}$

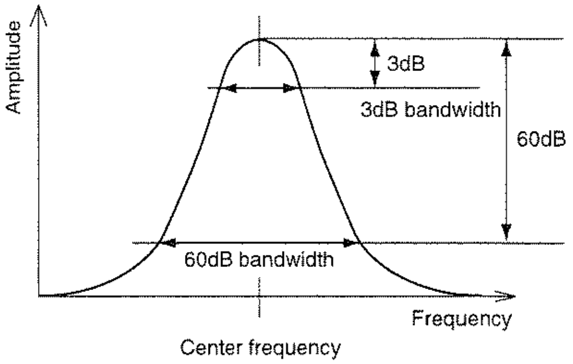
4.3.4 Resolution bandwidth and selectivity

If two input signals are separated by only 3dB (IF final stage), analysis can be performed with these two signals as a two-spectrum waveform.

This is called "resolution bandwidth (RBW).

On the other hand, selectivity improves as the 60dB bandwidth becomes narrower. Therefore, measure the bandwidth at points 3dB and 60dB down from the center frequency peak point as shown in the figure below, and calculate the selectivity from the following expression:

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



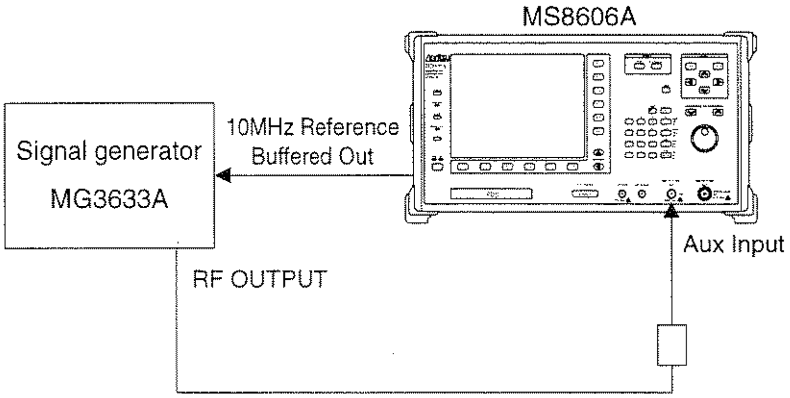
(1) Test target ratings

- Resolution bandwidth: ±2% (300HZ to 300 kHz), ±10% (1 MHz)
- Selectivity: ≤ 5:1

(2) Test equipment

- Synthesized signal generator: MG3633A

(3) Setup



(4) Test precautions

Set the signal generator output level to about +10 dBm.

(5) Test procedure

Step	Operation procedure
1	Press the spectrum analyzer Preset key.
2	Execute Cal.
3	Set the MS8606A as follows: Trace-Time Freq: 100 MHz RBW (Manual): 1 MHz VBW (Manual): Value at which 60 dB down level is read smoothly.
4	Set the signal generator output frequency to 100 MHz.
5	Execute Peak → RLV to move the signal level to the line at the top of the screen.
6	Select Delta Marker.
7	Lower the signal generator output frequency to the frequency at which the marker reads –3 dB. Make the signal generator output frequency at this time f1.
8	Raise the signal generator output frequency to the frequency at which the marker reads –3 dB. Make the signal generator output frequency at this time f2.
9	Lower the signal generator output frequency to the frequency at which the marker reads –60 dB. Make the signal generator output frequency at this time f3.
10	Raise the signal generator output frequency to the frequency at which the marker reads –60 dB. Make the signal generator output frequency at this time f4.
11	Calculate the 3 dB bandwidth, 60dB bandwidth, and selectivity as follows: 3 dB bandwidth = f2-f1 60 dB bandwidth = f4-f3 Selectivity = 60 dB bandwidth/3 dB bandwidth Check that the 3 dB bandwidth is within the maximum and minimum values. Check that the calculated selectivity is 5 or less.
12	Repeat steps 4 through 11 in accordance with RBW shown in the table below.

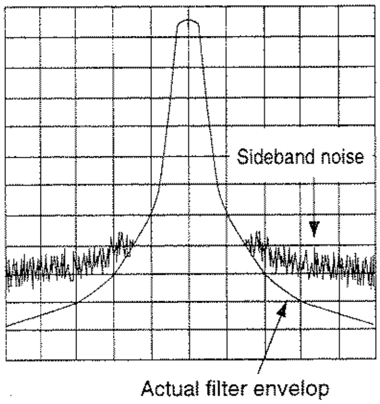
Resolution Bandwidth Test

RBW	f1	f2	3dB bandwidth	Minimum value	Maximum value
1MHz				980kHz	1020kHz
300kHz				294 kHz	306 kHz
100kHz				98 kHz	102 kHz
30kHz				29.4 kHz	30.6 kHz
10kHz				9.8 kHz	10.2 kHz
3kHz				2.94 kHz	3.06 kHz
1kHz				980 Hz	1020 Hz
300Hz				294 Hz	306 Hz

Selectivity Test

RBW	f3	f4	60dB bandwidth	3dB bandwidth	Selectivity
1MHz					
300kHz					
100kHz					
30kHz					
10kHz					
3kHz					
1kHz					
300Hz					

4.3.5 Sideband noise level



This test checks the noise dB level at a point of a certain frequency from the spectrum waveform peak point when a signal with a very low sideband noise level is input from the device under test with the resolution bandwidth kept constant.

Since the average noise level is taken, measure the noise level by inserting a video filter (VBW).

The sideband noise level is the spectrum response modulated by the internal noise of the spectrum analyzer.

If this response is large, the actual filter envelop will be masked by noise as shown in the figure at the left and measurement will become impossible.

(1) Test target ratings

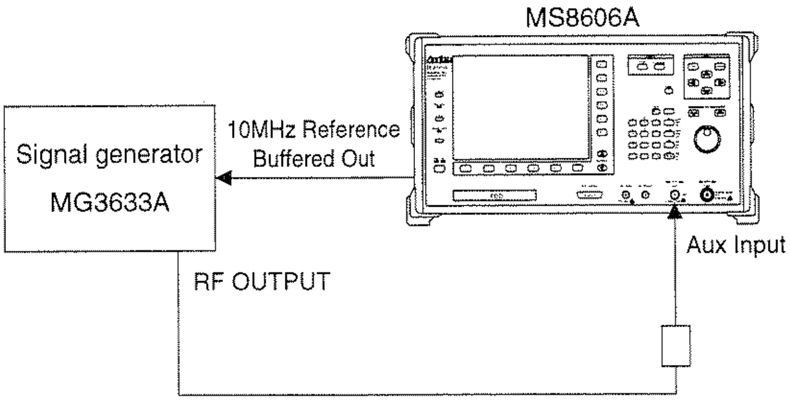
- Sideband noise (C/N): ≤ –115dBc/HZ (frequency 1 GHz, 10 kHz offset)

  ≤ –95dBc/Hz (frequency 1 GHz, 100 kHz offset)

(2) Test equipment

- Synthesized signal generator: MG3633A

(3) Setup



(4) Test procedure

Step	Operation procedure
1	Set the signal generator to 1 GHz, +10 dBm.
2	Press the spectrum analyzer Preset key.
3	Execute Cal.
4	Set the MS8606A as follows: Center Freq: 1 GHz Span: 40 kHz (table below) Reference Level: +10 dBm Detection: Sample RBW: 1 kHz (table below) VBW: 10 Hz (table below) Zone Width: Spot
5	Press the Peak Search key. The current marker is set to the peak point.
6	Press the Measure key, and select C/N Ratio Measure.
7	Press the Meas On key, and execute C/N measurement.
8	Press the Marker key. Then, turn the rotary knob to move the marker to the right so that the Zone Center display frequency becomes the frequency shown in the table below.
9	Check that the sideband noise value does not exceed the rated value.
10	Repeat steps 4 through 9 in accordance with the table shown below.

Sideband Noise Level Test

Frequency span	RBW	VBW	Zone Center (offset)	Sideband noise	
				Measured value	Rating
40kHz	1kHz	10Hz	10kHz		≤ – 95 dBc
400kHz	10kHz	100Hz	100kHz		≤ – 115 dBc

4.3.6 Screen amplitude display linearity

This check tests the LOG display error per division of the vertical axis of the screen. LOG display linearity tests if the scale is proportional to the logarithm (dB) of the input level.

Apply a signal with an accurate input level to the spectrum analyzer Aux Input connector through an external attenuator. Calculate the error from the attenuator attenuation and the delta marker reading at the peak of the trace waveform.

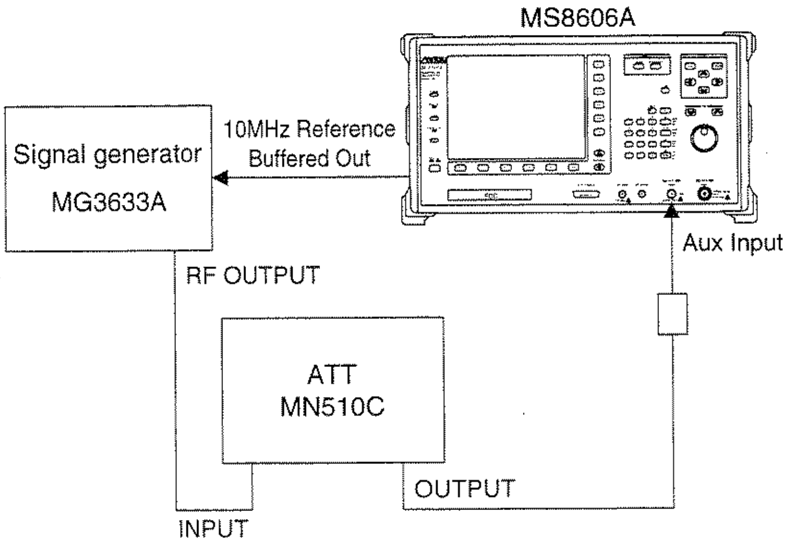
(1) Test target specifications

• LOG linearity:	±0.5dB (0 to –50dB, resolution bandwidth ≤1 MHz
	±1.0dB (0 to –70dB, resolution bandwidth ≤30 kHz)
	±1.0dB (0 to –80dB, resolution bandwidth ≤3 kHz)

(2) Test equipment

• Synthesized signal generator:	MG3633A
• Attenuator:	MN510C

(3) Setup



(4) Test procedure

Step	Operation procedure
1	Set the signal generator to 100 MHz, 0 dBm.
2	Set the MN510C Attenuator to 0dB.
3	Press the spectrum analyzer Preset key.
4	Execute Cal.
5	Set the MS8606A as follows: Center Freq: 100 MHz Span: 40 kHz Reference Level: 0 dBm Attenuator: 10dB RBW: 3 kHz VBW: 300Hz
6	Press the Peak → CF key. The peak point of the spectrum waveform is set to the center of the screen.
7	Adjust the signal generator output level so that the marker level reads 0.0 dBm.
8	At the end of one sweep, press the Delta Marker key.
9	Read the delta marker level when the MN5120C ATT value is changed as shown in the table below.
10	Repeat steps 2 through 8 in accordance with the table below.

LOG Linearity Test

ATT setting (dB)	A	B	Error A+B (dB)
	ATT calibration value (dB)	Delta marker level (dB)	
0	0 (reference)	0 (reference)	0 (reference)
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
80			

3.3.7 Frequency response

When two or more signals of different frequencies but equal amplitude are input, the spectrum analyzer must display the spectrums at the same amplitude.

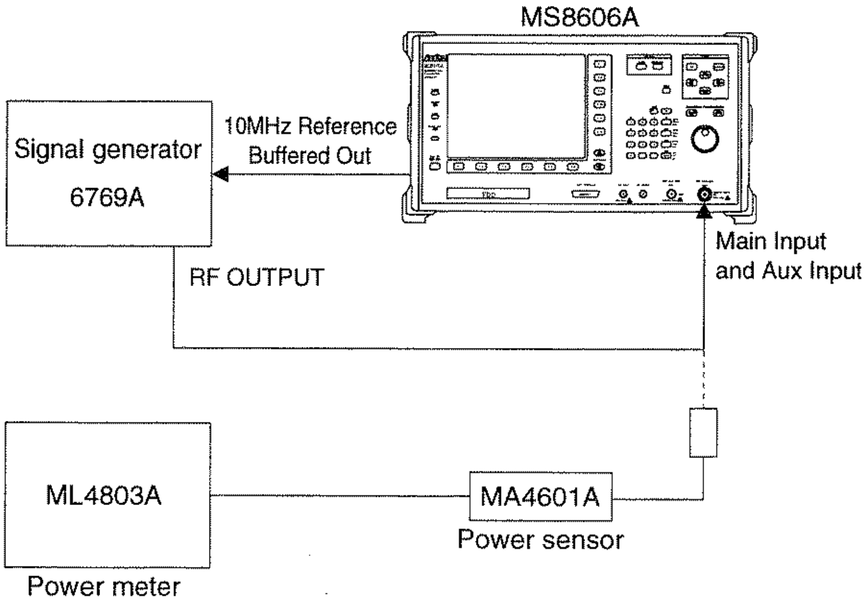
(1) Test target ratings

- Frequency response: 100 MHz reference frequency, ambient temperature 18 to 28 °C
  Input connector Main, input ATT 30dB
  ±0.5dB
  Input connector Aux, input ATT 10dB
  ±0.5dB

(2) Test equipment

• Signal generator:	Wiltron 6769A
• Power meter:	ML4803A
• Power sensor:	MA4601A

(3) Setup



(4) Test precautions

Carry out this test after a warm-up of at least 60 minutes at an ambient temperature of 18 to 28 °C.

(5) Test procedure 1

Step	Operation procedure
1	Set the 6769A signal generator to 100 MHz, 0 dBm.
2	Connect the signal generator output to the power sensor of the power meter through a coaxial cable.
3	Read the power meter display.
4	Change the signal generator output frequency as shown in the table, and find the calibration value at each frequency referenced to the level at 100 MHz.

Test procedure 2

Step	Operation procedure
1	Connect the 6769A signal generator output to the spectrum analyzer Aux Input connector.
2	Press the spectrum analyzer Preset key.
3	Execute Cal.
4	Set the spectrum analyzer as follows: Center Freq: 100 MHz Span: 200 kHz Attenuator: 10dB Reference Level: 0 dBm
5	Press the Peak → CF key, then press the Delta Marker key.
6	Set the spectrum analyzer center frequency as shown in the table below. Then, read the delta marker level at each frequency and find the deviation from the following expression: Deviation = Delta marker level – test frequency calibration value

Test procedure 3

Step	Operation procedure
1	Connect the 6769A signal generator output to the spectrum analyzer Main Input/Output connector.
2	Press the spectrum analyzer Preset key.
3	Set the spectrum analyzer as follows: Center Freq: 100 MHz Span: 200 kHz Attenuator: 35dB Reference Level: 0 dBm
4	Press the Peak → CF key, then press the Delta Marker key.
5	Set the spectrum analyzer center frequency as shown in the table. Then, read the delta marker level at each frequency, and find the deviation from the following expression: Deviation = Delta marker level – test frequency calibration value

Frequency Response Test (Aux Input)

Test frequency	Calibration value (dB)	Delta marker level (dB)	Deviation (dB)
100MHz	0 (reference)	0 (reference)	0 (reference)
200MHz			
500MHz			
1GHz			
1.5GHz			
2GHz			
2.5GHz			
3GHz			

Frequency Response Test (Main Input)

Test frequency	Calibration value (dB)	Delta marker level (dB)	Deviation (dB)
100MHz	0 (reference)	0 (reference)	0 (reference)
200MHz			
500MHz			
1GHz			
1.5GHz			
2GHz			
2.5GHz			
3GHz			

4.3.8 Reference level accuracy

This performance check tests the absolute amplitude level at 100 MHz. Check the level accuracy by applying the output of a signal generator calibrated with a standard power meter to the spectrum analyzer.

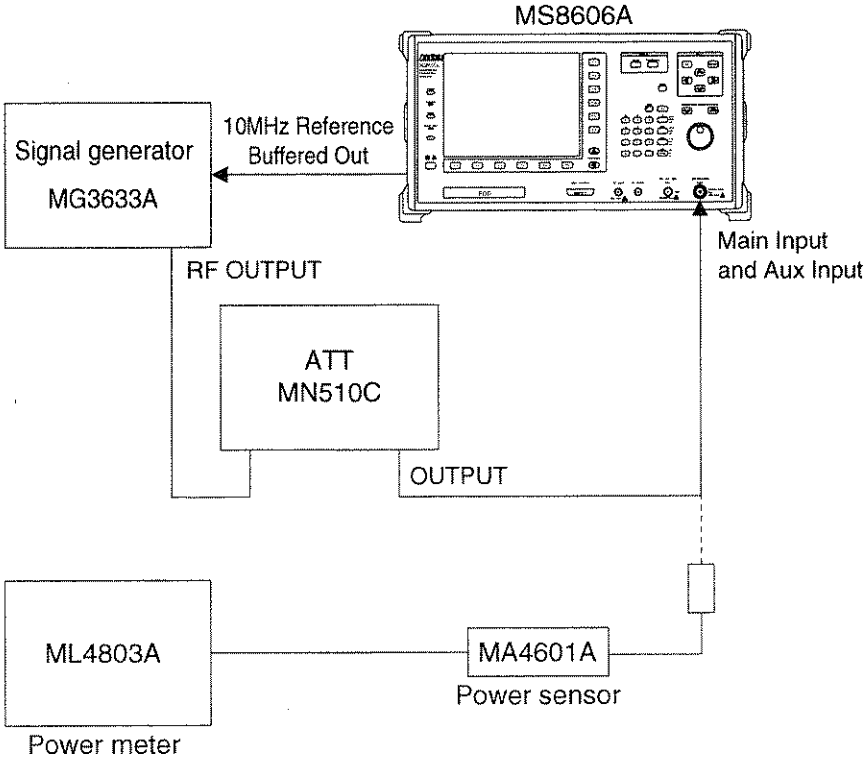
(1) Test target specifications

- Reference level accuracy: Frequency 100 MHz, span 2 MHz (RBW, VBW, and Sweep Time set to Auto) after automatic calibration
  Main Input/Output connector
  ±0.5 dB (+15.1 to +40 dBm)
  ±1.0 dB (–50 to +15 dBm)
  Aux Input connector
  ±0.5 dB (–9.9 to +20 dBm)
  ±1.0 dB (–75 to –10 dBm)

(2) Test equipment

• Signal generator:	MG3633A
• Attenuator:	MN510C
• Power meter:	ML4803A
• Power sensor:	MA4601A

(3) Setup



(4) Test precautions

1) Always set the resolution bandwidth (RBW), video bandwidth (VBW) and sweep time (Sweep Time) to Auto.

2) Do this test after a warm-up of at least 60 minutes.

(5) Test procedure

Step	Operation procedure
1	Press the spectrum analyzer Preset key.
2	Execute Cal.
3	Connect the attenuator OUTPUT connector to the power sensor.
4	Set the MG3633A signal generator frequency to 100 MHz, and adjust the signal generator level so that the power meter indicates +10 dBm. Set the MN510C Attenuator to 0dB.
5	Connect the attenuator output to the spectrum analyzer Aux Input connector.
6	Set the spectrum analyzer as follows: Center Freq: 100 MHz Span: 2 MHz Reference Level: 10 dBm
7	Press the Peak → CF key. The peak point of the spectrum waveform moves to the center of the screen.
8	Read the marker level.
9	Set the MN510C Attenuator and Reference Level as shown in the table below, and read the marker level at each setting.
10	Find the error from the following expression: Error = Marker level – reference level setting – ATT calibration value
11	Change the spectrum analyzer input connector to the Main Input connector, and repeat steps 6 to 10.

Reference Level Accuracy Test (Aux Input)

Reference Level setting	ATT setting	Marker level	MN510C ATT calibration value	Error
+10dBm	0dB			
0dBm	10dB			
– 10dBm	20dB			
– 20dBm	30dB			
– 30dBm	40dB			
– 40dBm	50dB			
– 50dBm	60dB			
– 60dBm	70dB			
– 70dBm	80dB			
– 75dBm	85dB			

Reference Level Accuracy Test (Main Input)

Reference Level setting	ATT setting	Marker level	MN510C ATT calibration value	Error
+10dBm	0dB			
0dBm	10dB			
– 10dBm	20dB			
– 20dBm	30dB			
– 30dBm	40dB			
– 40dBm	50dB			
– 50dBm	60dB			

4.3.9 Average noise level

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

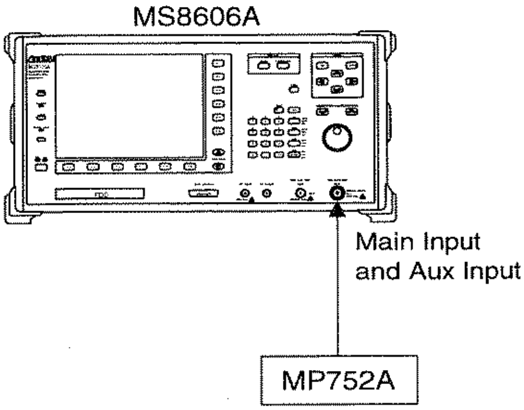
(1) Test target ratings

- Average noise level: Resolution bandwidth 1 kHz, video bandwidth 10 Hz
  Main Input/Output connector, input attenuator 25 dB
  ≤ –85 dBm (10 MHz to 1 GHz)
  ≤ –85 dBm+fdB (< 1 GHz, where f is the measurement frequency (GHz))
  Aux Input connector, input attenuator 0 dB
  ≤ –110 dBm (10 MHz to 1 GHz)
  ≤ –110 dBm+fdB (> 1 GHz, where f is the measurement frequency (GHz))

(2) Test equipment

- 50 Ω terminator: MP752A

(3) Setup



(4) Test procedure

Step	Operation procedure
1	Press the spectrum analyzer Preset key.
2	Execute Cal.
3	Terminate the spectrum analyzer Aux Input connector with the MP752A 50_ terminator.
4	Set the spectrum analyzer as follows: Start Freq: 10 MHz Stop Freq: 1 GHz Reference level: –50 dBm Attenuator: 0 dB RBW: 30 kHz VBW: 3 kHz Detection: Sample
5	Press the Single key, and perform one sweep.
6	Press the Peak → CF key to set the peak frequency to the center frequency.
7	Set the spectrum analyzer as follows (time domain): Span: 0 Hz RBW: 1 kHz VBW: 10 Hz
8	Sequentially press the Trace-Time, Storage, Average, and Averaging Count keys, and set the averaging count to 16.
9	Press the Continuous key, and make 16 averaging count sweeps.
10	Press the Peak Search key, and read the marker level.
11	Change the input terminal to the spectrum analyzer Main Input connector, and repeat steps 3 through 10.

Average Noise Level Test

Input terminal	Spectrum analyzer setting		Average noise level	
	Start Freq	Stop Freq	Marker reading	Rating
Main Input	10MHz	1GHz		≤ – 85 dBm
	1GHz	3GHz		≤ – 84 to – 82 dBm
Aux Input	10MHz	1GHz		≤ – 110 dBm
	1GHz	3GHz		≤ – 109 to – 107 dBm

4.3.10 Second harmonic distortion

Even when a signal with no harmonic distortion is applied to the spectrum analyzer, the input mixer nonlinearity of the spectrum analyzer generates harmonics that can be seen on the screen.

Of the harmonics displayed on the screen, the second harmonic has the highest level.

The test point measures the level difference between the fundamental wave and the second harmonic wave when a signal having a distortion at least 20 dB lower than the internal distortion of the spectrum analyzer is applied to the spectrum analyzer. If a low distortion signal source is not available, a low distortion signal is applied to the spectrum analyzer through an LPF.

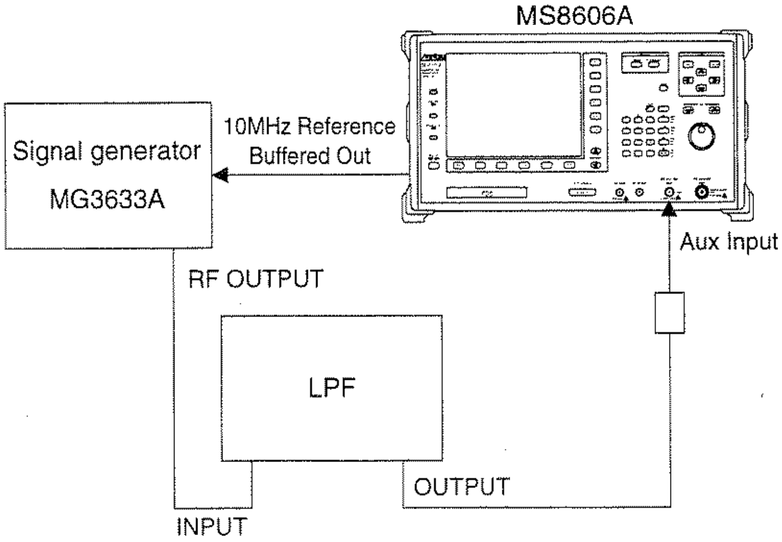
(1) Test target specifications

- Second harmonic distortion: Mixer input level –30 dBm
  ≤ –55dBc (input frequency 10 to 100 MHz)
  ≤ –60dBc (input frequency 100 to 1500 MHz)

(2) Test equipment

- Signal generator: MG3633A
- LPF: Device with an attenuation of at least 70dB at double the fundamental frequency

(3) Setup



(4) Test procedure

Step	Operation procedure
1	Press the spectrum analyzer Preset key.
2	Execute Cal.
3	Set the LPF cutoff frequency to approximately 12.8 MHz.
4	Set the signal generator output to 10 MHz, –30 dBm.
5	Set the spectrum analyzer as follows: Center Freq: 10 MHz Span: 10 kHz Reference Level: –30 dBm Attenuator: 0 dB Input terminal: Aux Input
6	Adjust the signal generator output level so that the spectrum waveform peak point moves to the Reference Level (line at the top of the screen scale).
7	Move the marker to the peak of the spectrum waveform, and set the marker to Delta Marker.
8	To display the second harmonic on the screen, set the center frequency to double the fundamental frequency. Since the delta marker level indicates the level difference between the fundamental wave and the second harmonic. Read the delta maker level.
9	Change the input frequency in accordance with the table below, and repeat steps 3 through 8.

Second Harmonic Distortion Test

Signal generator output frequency	LPF cutoff frequency	Delta marker level	Rating
10MHz	12.8MHz		– 55dBc
1GHz	1.2GHz		– 60dBc

4.3.11 Resolution bandwidth (RBW) switching deviation

This performance check measures the peak level deviation when the resolution bandwidth (RBW) is switched.

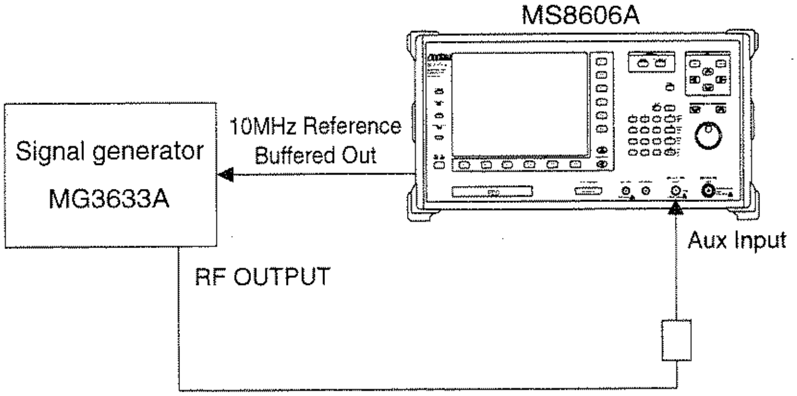
(1) Test target specifications

- Resolution bandwidth switching deviation: ±0.1dB referenced to 3 kHz resolution bandwidth

(2) Test equipment

- Signal generator: MG3633A

(3) Setup



(4) Test procedure

Step	Operation procedure
1	Press the spectrum analyze Preset key.
2	Execute Cal.
3	Set the signal generator output to 100 MHz, 0 dBm.
4	Set the spectrum analyzer as follows: Center Freq: 100 MHz Span: 15 kHz Reference Level: 0 dBm RBW: 3 kHz Input terminal: Aux Input
5	Press the Peak → CF key to set the peak frequency to the center frequency.
6	Set the marker to Delta Marker.
7	Set RBW and Span in accordance with the table below, and measure the level deviation for each RBW as described in Step 8.
8	Press the Peak Search key, and move the current marker to the spectrum waveform peak point. Read the delta marker level.

Resolution Bandwidth Switching Deviation Test

Spectrum analyzer setting		Delta marker level	Rating
RBW	Span		
300Hz	10kHz		±0.1 dB
1kHz	10kHz		
3kHz	15kHz	0.0 dB (reference)	
10kHz	50kHz		
30kHz	150kHz		
100kHz	500kHz		
300kHz	1.5MHz		
1MHz	5MHz		

4.3.12 Performance test results entry form examples

Examples of forms for summarizing the results of MS8606A Spectrum Analyzer function performance checks are shown below.

When making performance checks, copy and use this section.

1. Center frequency display accuracy

Signal generator output frequency	Center frequency	Frequency span	Center frequency reading		
			Minimum value	Marker value	Maximum value
500MHz	500MHz	10 kHz	499.99975 MHz		500.00025 MHz
		200 kHz	499.99500 MHz		500.00500 MHz
		100 MHz	497.50000 MHz		502.50000 MHz

2. Frequency span accuracy

Signal generator		Spectrum analyzer				
f1	f2	Center frequency	Frequency span	Minimum value	Calculated value	Maximum value
999.992MHz	1000.008MHz	1GHz	20kHz	19.5kHz		20.5kHz
999.92MHz	1000.08MHz		200kHz	195kHz		205kHz
999.2MHz	1000.8MHz		2MHz	1.95MHz		2.05MHz
992MHz	1008MHz		20MHz	19.5MHz		20.5MHz
920MHz	1080MHz		200MHz	195MHz		205MHz
200MHz	1800MHz		2GHz	1.95GHz		2.05GHz

3. Resolution bandwidth and selectivity

Resolution Bandwidth and Selective Test

RBW	f1	f2	3dB bandwidth	Minimum value	Maximum value
1MHz				980kHz	1020kHz
300kHz				294 kHz	306 kHz
100kHz				98 kHz	102 kHz
30kHz				29.4 kHz	30.6 kHz
10kHz				9.8 kHz	10.2 kHz
3kHz				2.94 kHz	3.06 kHz
1kHz				980 Hz	1020 Hz
300Hz				294 Hz	306 Hz

Selectivity Test

RBW	f3	f4	60dB bandwidth	3dB bandwidth	Selectivity
1MHz					
300kHz					
100kHz					
30kHz					
10kHz					
3kHz					
1kHz					
300Hz					

4. Sideband noise level

Frequency span	RBW	VBW	Zone Center (offset)	Sideband noise	
				Measured value	Rating
40kHz	1kHz	10Hz	10kHz		≤ – 95 dBc
400kHz	10kHz	100Hz	100kHz		≤ – 115 dBc

5. Screen amplitude display linearity

ATT setting (dB)	A	B	Error A+B (dB)
	ATT calibration value (dB)	Delta marker level (dB)	
0	0 (reference)	0 (reference)	0 (reference)
5			
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
80			

6. Frequency response

Frequency Response Test (Aux Input)

Test frequency	Calibration value (dB)	Delta marker level (dB)	Deviation (dB)
100MHz	0 (reference)	0 (reference)	0 (reference)
200MHz			
500MHz			
1GHz			
1.5GHz			
2GHz			
2.5GHz			
3GHz			

Frequency Response Test (Main Input)

Test frequency	Calibration value (dB)	Delta marker level (dB)	Deviation (dB)
100MHz	0 (reference)	0 (reference)	0 (reference)
200MHz			
500MHz			
1GHz			
1.5GHz			
2GHz			
2.5GHz			
3GHz			

7. Reference level accuracy

Reference Level Accuracy Test (Aux Input)

Reference Level setting	ATT setting	Marker level	MN510C ATT calibration value	Error
+10dBm	0dB			
0dBm	10dB			
– 10dBm	20dB			
– 20dBm	30dB			
– 30dBm	40dB			
– 40dBm	50dB			
– 50dBm	60dB			
– 60dBm	70dB			
– 70dBm	80dB			
– 75dBm	85dB			

Reference Level Accuracy Test (Main Input)

Reference Level setting	ATT setting	Marker level	MN510C ATT calibration value	Error
+10dBm	0dB			
0dBm	10dB			
– 10dBm	20dB			
– 20dBm	30dB			
– 30dBm	40dB			
– 40dBm	50dB			
– 50dBm	60dB			

8. Average noise level

Input terminal	Spectrum analyzer setting		Average noise level	
	Start Freq	Stop Freq	Marker reading	Rating
Main Input / Output	10MHz	1GHz		≤ – 85 dBm
	1GHz	3GHz		≤ – 84 to – 82 dBm
Aux Input	10MHz	1GHz		≤ – 110 dBm
	1GHz	3GHz		≤ – 109 to – 107 dBm

9. Second harmonic distortion

Signal generator output frequency	LPF cutoff frequency	Delta marker level	Rating
10MHz	12.8MHz		– 55dBc
1GHz	1.2GHz		– 60dBc

10. Resolution bandwidth switching deviation test

Spectrum analyzer setting		Delta marker level	Rating
RBW	Span		
300Hz	10kHz		±0.1 dB
1kHz	10kHz		
3kHz	15kHz	0.0 dB (reference)	
10kHz	50kHz		
30kHz	150kHz		
100kHz	500kHz		
300kHz	1.5MHz		
1MHz	5MHz		

APPENDIXES

TABLE OF CONTENTS

APPENDIX A
SOFT-KEY MENU

In this section, soft-key menu functions and its hierarchical system are described using a tree.

Matters to be noted about the tree are shown below.

(1) Main function Key indicates [F1 to F6] key on the front panel.

(2) Function Key are the menus at the top level which are displayed on the right side of screen when the [F7 to F12] key is pressed. Lower menus indicates other menus below the top menus.

(3) When a soft key with an appended asterisk (*) is pressed in these menus, the menu moves to the lower menu indicated by the arrow symbol (→).

(4) When the Return key is pressed at a lower menu, the next-higher menu is returned.

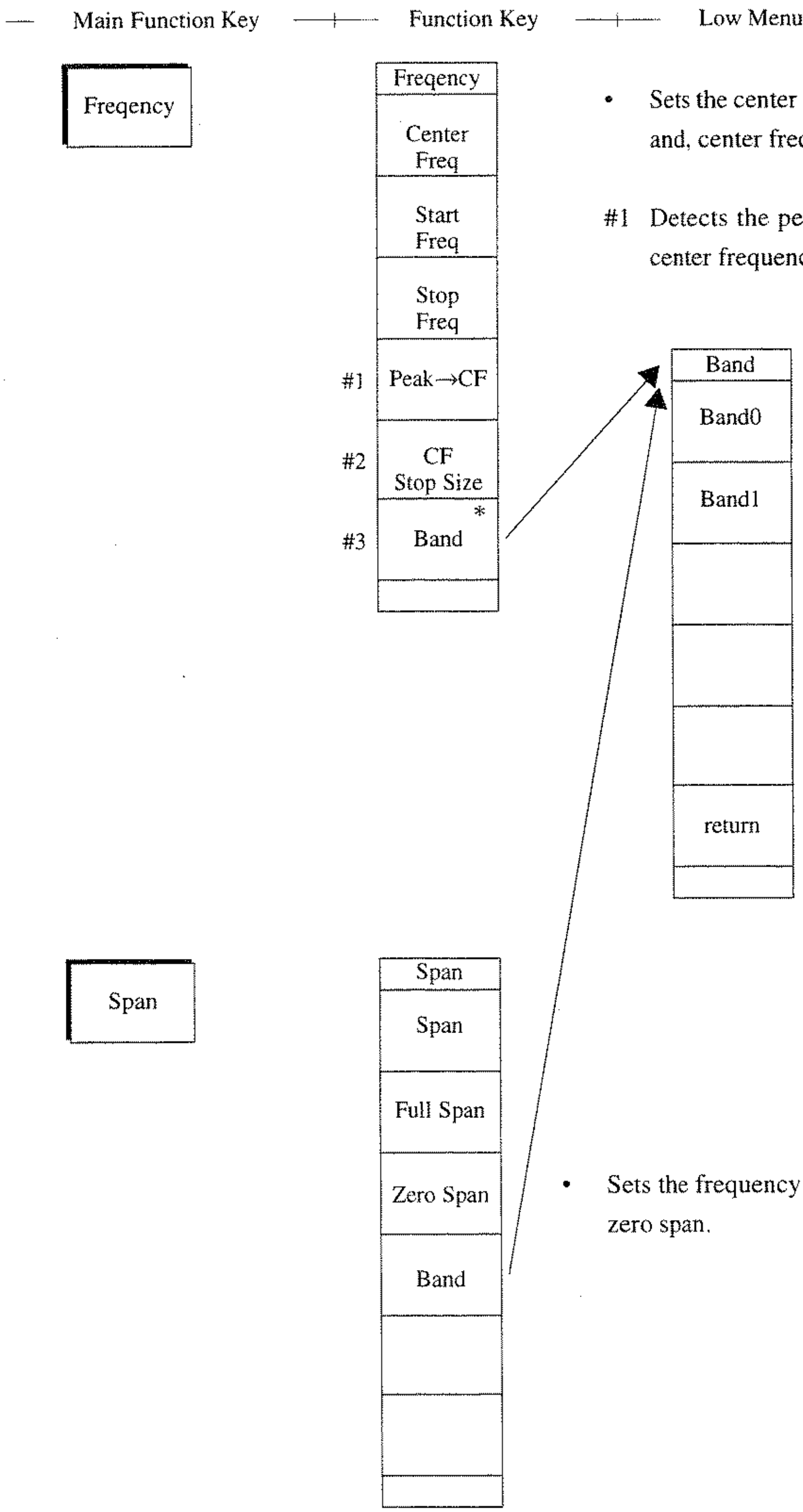
(5) Menus with more than six items are split into several pages.

(6) The menu page construction and currently-displayed page are indicated in the lower part of the menu. To move to the next page, press the [Next Menu] key.

(7) Function key and soft keys prefixed by a sharp symbol (#) at the left of the menu frame, give an outline explanation of the function.

A.1 Menu Tree

Menu Tree (1 / 9)



- Sets the center frequency, start/stop frequencies, Peak → CF and, center frequency step size.

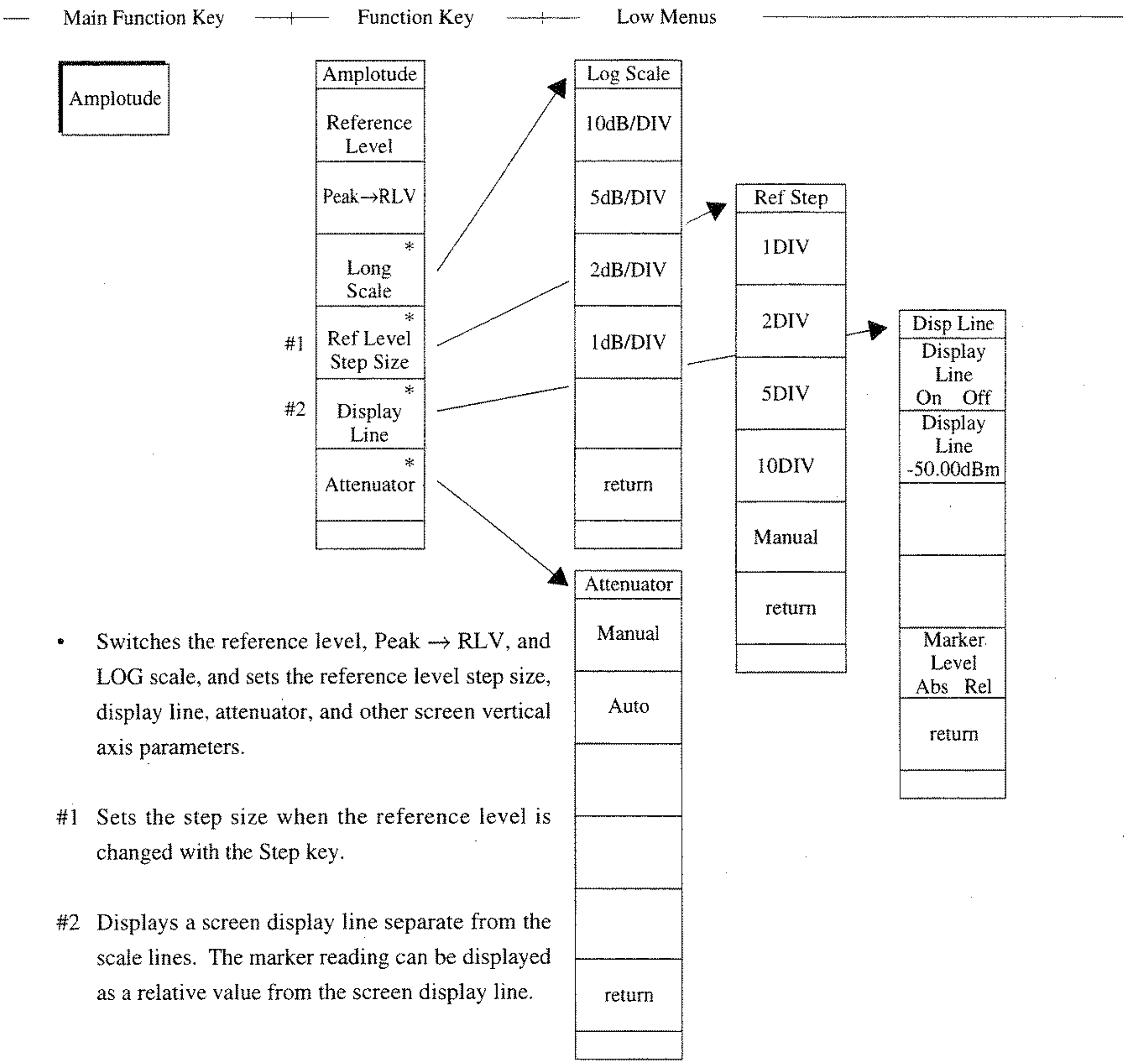
#1 Detects the peak in the measurement screen, and sets the center frequency to the peak frequency.

#2 Sets the step size when the center frequency is changed using the Step key.

#3 Switches the measurable range.

- Sets the frequency spans such as frequency span, full span, and zero span.

Menu Tree (2 / 9)

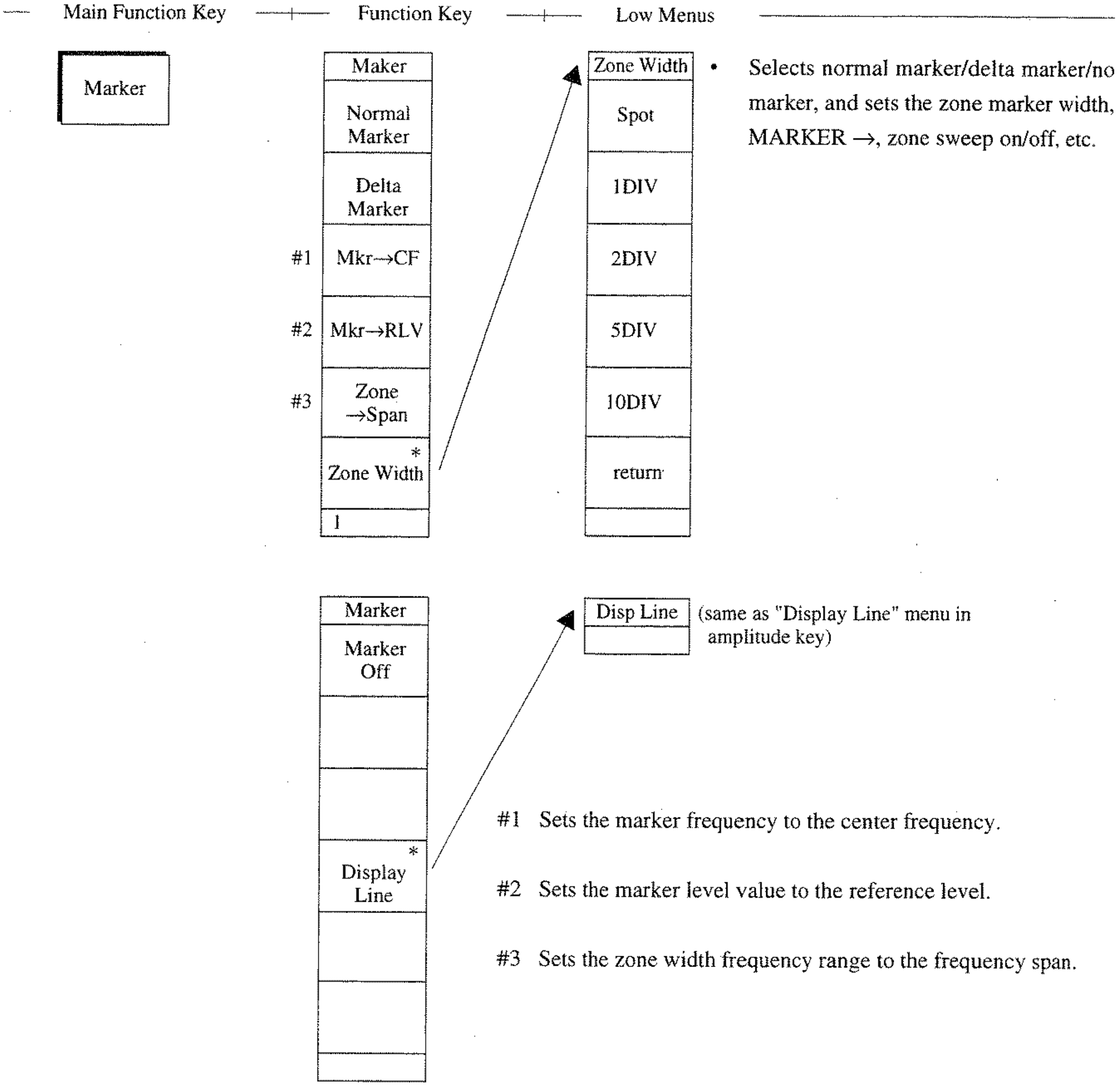


- Switches the reference level, Peak → RLV, and LOG scale, and sets the reference level step size, display line, attenuator, and other screen vertical axis parameters.

#1 Sets the step size when the reference level is changed with the Step key.

#2 Displays a screen display line separate from the scale lines. The marker reading can be displayed as a relative value from the screen display line.

Menu Tree (3 / 9)



- Selects normal marker/delta marker/no marker, and sets the zone marker width, MARKER →, zone sweep on/off, etc.

(same as "Display Line" menu in amplitude key)

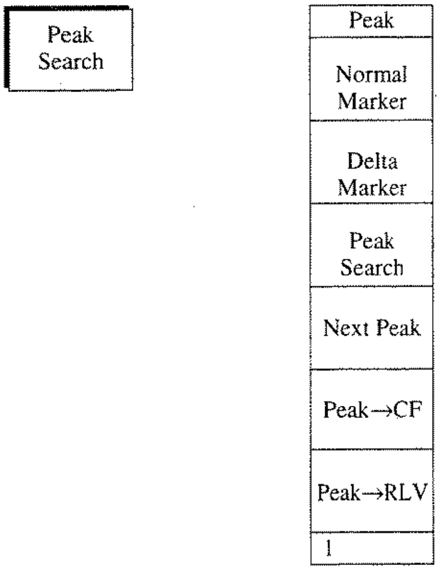
#1 Sets the marker frequency to the center frequency.

#2 Sets the marker level value to the reference level.

#3 Sets the zone width frequency range to the frequency span.

Menu Tree (4 / 9)

Main Function Key — Function Key — Low Menus

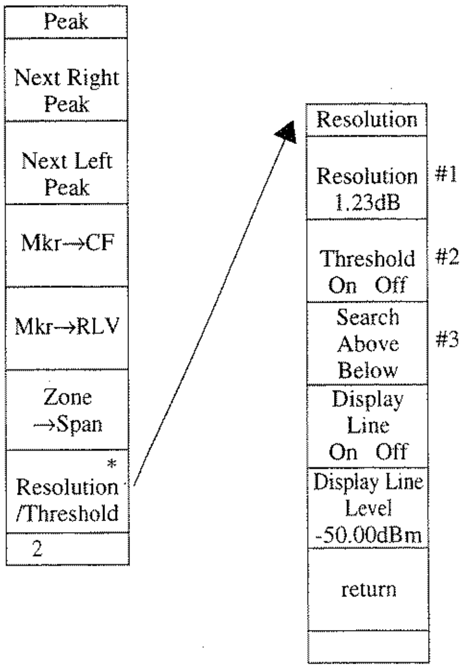


- Sets the peak level search, next peak/next right peak/next left peak search, Peak->, Marker->, search level resolution, threshold level on/off, etc.

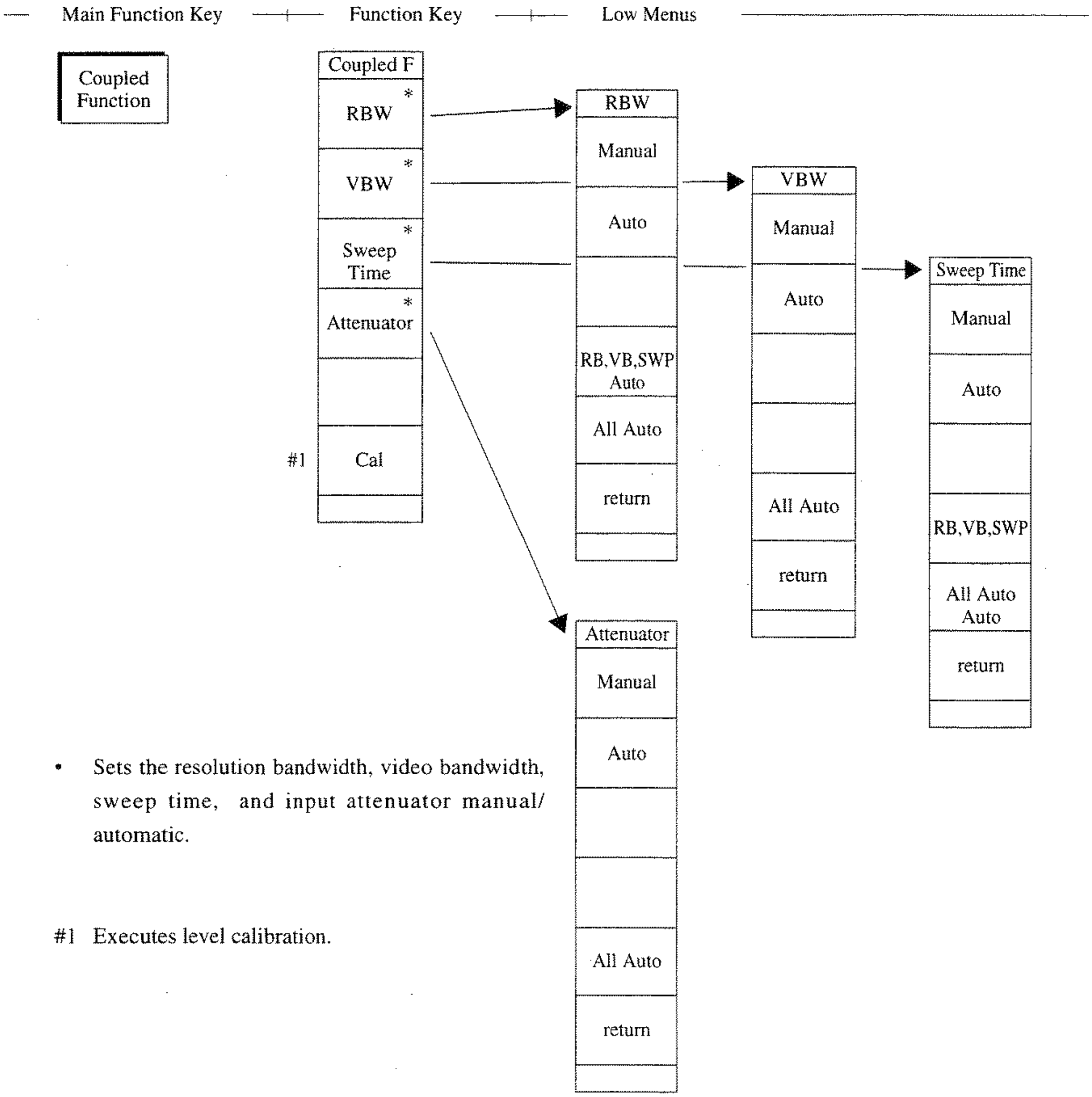
#1 Sets the peak search level resolution.

#2 Sets whether a peak search upper limit/lower limit is specified.

#3 Sets the upper limit/lower limit.



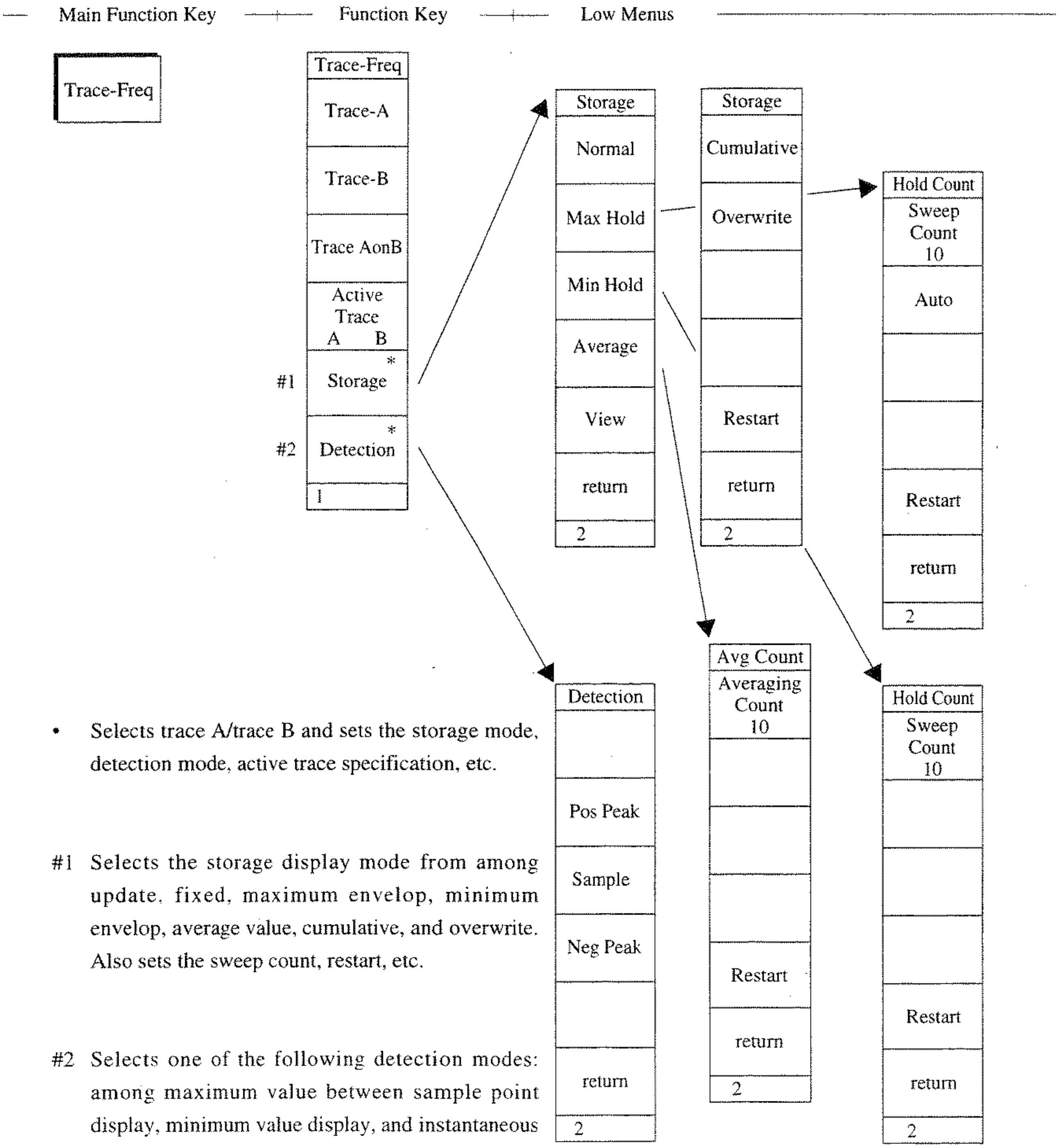
Menu Tree (5 / 9)



- Sets the resolution bandwidth, video bandwidth, sweep time, and input attenuator manual/ automatic.

#1 Executes level calibration.

Menu Tree (6 / 9)



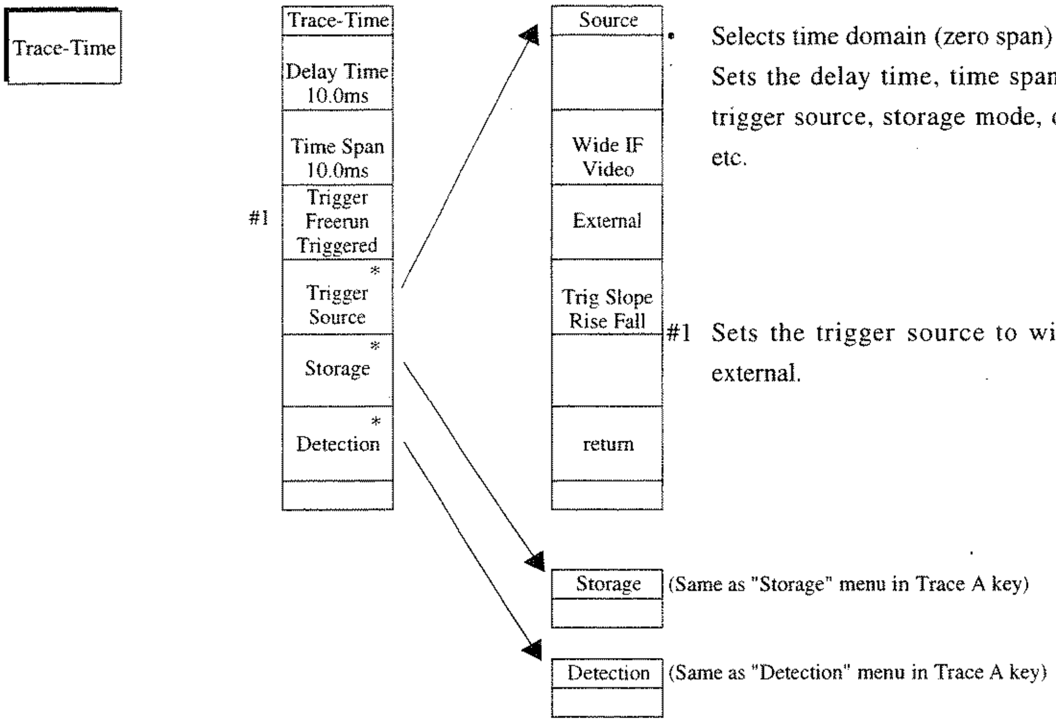
- Selects trace A/trace B and sets the storage mode, detection mode, active trace specification, etc.

#1 Selects the storage display mode from among update, fixed, maximum envelop, minimum envelop, average value, cumulative, and overwrite. Also sets the sweep count, restart, etc.

#2 Selects one of the following detection modes: among maximum value between sample point display, minimum value display, and instantaneous value display.

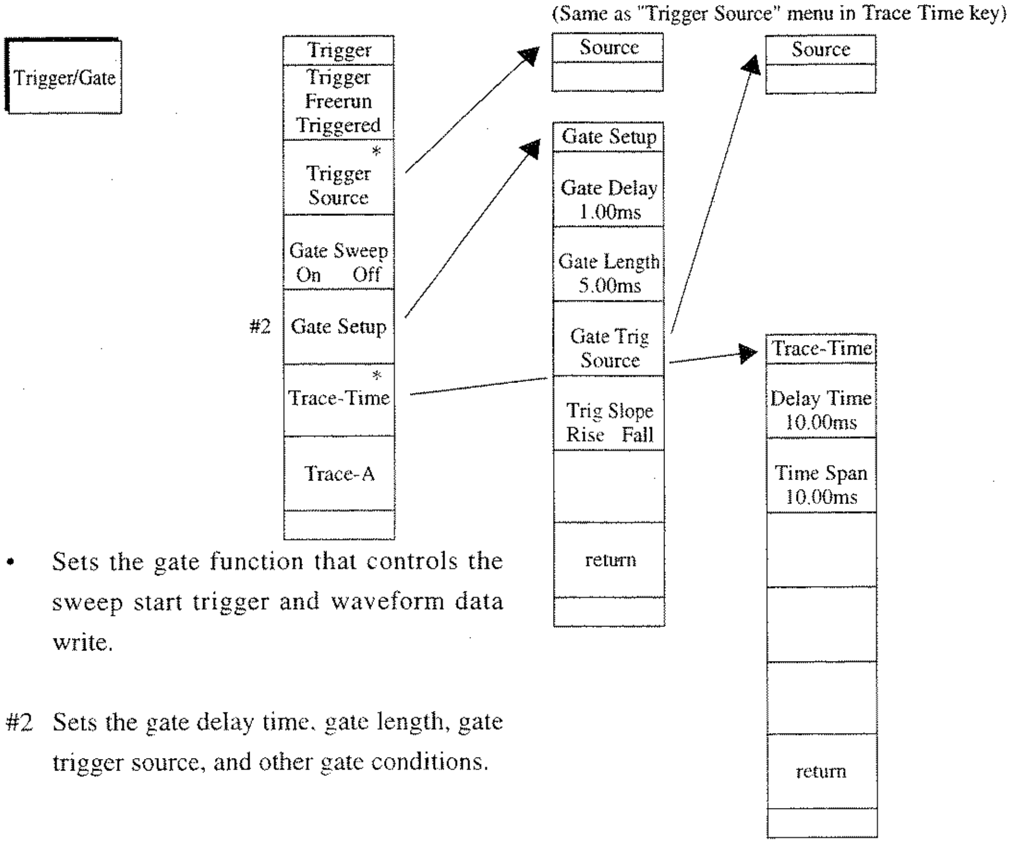
Menu Tree（7/9）

Main Function Key — Function Key — Low Menus



- Selects time domain (zero span) display. Sets the delay time, time span, trigger mode, trigger source, storage mode, detection mode, etc.

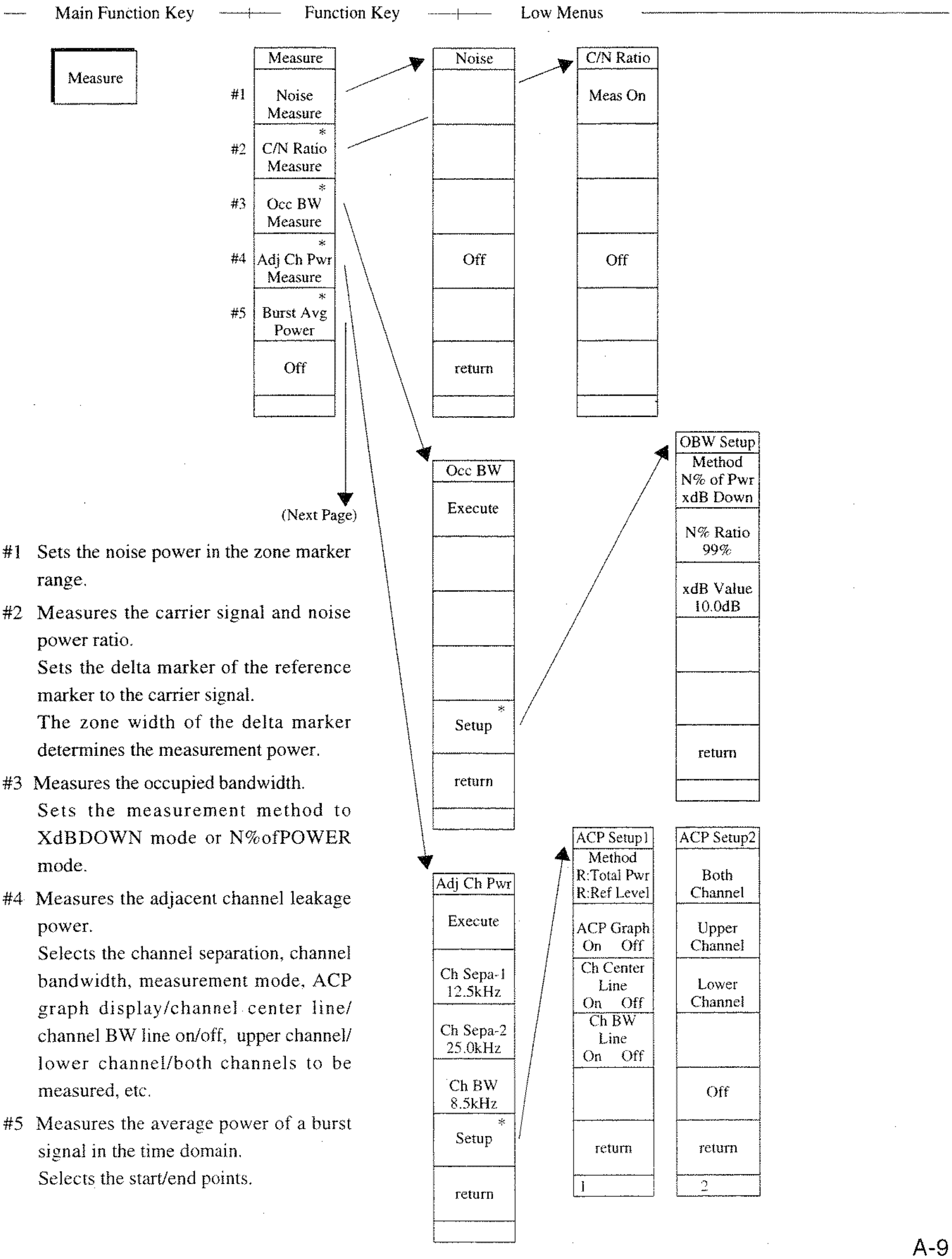
#1 Sets the trigger source to wide IF video or external.



- Sets the gate function that controls the sweep start trigger and waveform data write.

#2 Sets the gate delay time, gate length, gate trigger source, and other gate conditions.

Menu Tree (8 / 9)



#1 Sets the noise power in the zone marker range.

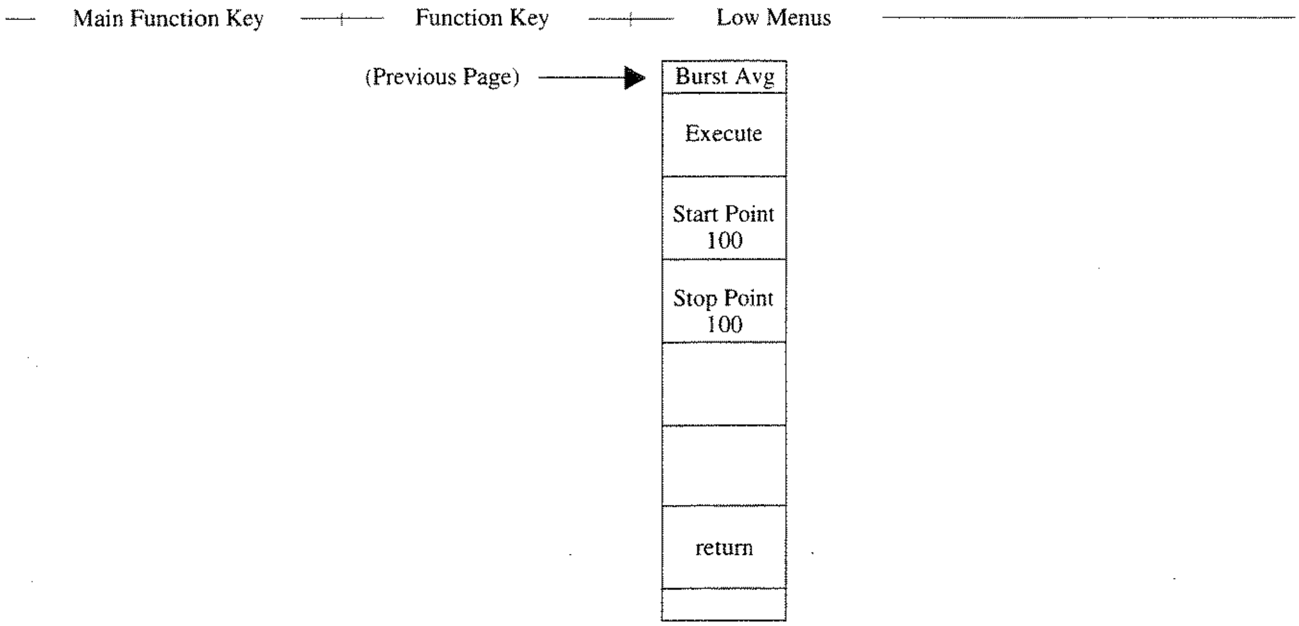
#2 Measures the carrier signal and noise power ratio.
Sets the delta marker of the reference marker to the carrier signal.
The zone width of the delta marker determines the measurement power.

#3 Measures the occupied bandwidth.
Sets the measurement method to XdBDOWN mode or N%ofPOWER mode.

#4 Measures the adjacent channel leakage power.
Selects the channel separation, channel bandwidth, measurement mode, ACP graph display/channel center line/channel BW line on/off, upper channel/lower channel/both channels to be measured, etc.

#5 Measures the average power of a burst signal in the time domain.
Selects the start/end points.

Menu Tree (9 / 9)


Main Function Key
Function Key
Low Menus
(Previous Page)
Burst Avg
Execute
Start Point
100
Stop Point
100
return

A.2 Soft-key Menu List

	Menu	Menu Tree (page/ 9)
A)	Active trace	6
	Ajd ch Pwr Measure	8
	Amplitude	2
	Attenuator	2 , 5
	Average	6
	Averaging Count	6
B)	Band	1
	Burst Avg Power	8
C)	C/N Ratio Measure	8
	Cal	5
	Center Freg	1
	CF Step Size	1
	Coupled Function	5
	Cumulative	6
D)	Delay Time	7
	Delta Marker	3 , 4
	Detection	6 , 7
	Display Line	2 , 3 , 4
E)	External	7
F)	Frequency	1
	Full Span	1
G)	Gate	7
	Gate Delay	7
	Gate length	
	Gate Setup	7
L)	Log Scale	2
M)	Marker	3
	Marker → CF	3 , 4
	Marker → RLV	3 , 4
	Max Hold	6
	Min Hold	6
N)	Next Peak	4
	Neg Peak	6
	Noise Measure	8
	Normal Marker	3 , 4
O)	Occ BW Measure	8
	Overwrite	6

	Menu	Menu Tree (page/ 9)
P)	Peak Search	4
	Peak → CF	1
	Peak → RLV	2
	Pos Peak	6
R)	RBW	5
	Reference Level	1
	Ref Level Step Size	2
	Resolution	4
	Restart	6
S)	Sample	6
	Span	1
	Start Freq	1
	Stop Freq	1
	Storage	6 , 7
	Sweep Time	5
	Sweep Count	6
T)	Threshold	4
	Time Span	7
	Trace A,B	6 , 7
	Trace Freq	6
	Trace Time	7
	Trigger	7
	Trigger Slope	7
	Trigger Source	7
V)	VBW	5
	View	6
W)	Wide IF Video	7
Z)	Zero Span	1
	Zero → Span	3 , 4
	Zone Width	3

APPENDIX B
KEYWORDS INDEX

The followiong lists the main keywords used in this operation manual and the number of the pages on which they are used. Use it to search for the soft keys, function descriptions, etc.

[KEYWORDS INDEX]

MS8606A

Digital Mobile Radio Transmitter Tester

(Spectrum Analyzer function)

Operation Manual

(Remote Control)

TABLE OF CONTENTS

SECTION 1
DEVICE MESSAGES

This section outlines and lists the device messages of the MS8606A.

TABLE OF CONTENTS

1.1 Device Message List

MS8606A-specific program commands, query messages, and response messages are listed from paragraph 1.1.1.

- Device message table

(a) Program messages (Program Msg)/query message (Query Msg)

(i) Uppercase characters : Reserved words
(ii) Numeric : Reserved words (numeric code)
(iii) Lowercase characters in argument

f (frequency) : Real number or integer with decimal point
Units : GHZ, MHZ, KHZ, HZ, GZ, MZ, KZ, no units = HZ
t(time) : Real number or integer with decimal point
Units : S, SC, MS, US, no unit = US
ℓ (level) : Real number or integer with decimal point
Units : DB, DBM, DM, DBU, W, MW, UW, NW, no units = set SCALE units
n (no units integer) : Integer
r (no units real number) : Real number
h (no units hexadecimal number) : Hexadecimal number
Others : Listed in remarks columns of the table

(b) Response messages (Response Msg)

(i) Uppercase characters : Reserved words
(ii) Numeric : Reserved words (numeric code)
(iii) Lowercase characters in argument
f (frequency) : 12-character fixed integerunits = HZ
t (time) : Real number or integer with decimal point
ℓ (level) : Real number or integer with decimal point
u (ratio) : Real number or integer with decimal point
s (symbol) : Real number or integer with decimal point
n (no units integer) : Integer, variable number of digits (Significant digits are output.)
r (no units real number) : Real number with decimal point, variable number of digits (Significant digits are output.)
h (no units hexadecimal number) : Hexadecimal number
Others : Written in remarks columns of the table

Notes:
- Integer:NR1 format, real number:NR2 format
- 0/:Zero

Device messages are classified into 7 types according to their valid ranges:

1. MS8606A common commands	:	Valid in all MS8606A modes (except for Spectrum Analyzer)
2. Instrument Setup command	:	Valid in Instrument Setup panel mode
3. TX/RX tester commands	:	Valid in TX/RX tester panel mode (on all TX/RX test screens)
4. Setup command parameter command	:	Valid on the Setup common parameter screen
5. TX tester commands	:	Valid in a range defined on each TX test screen
6. RX tester commands	:	Valid in a range defined on each RX test screen
7. Spectrum Analyzer commands	:	Valid in a range defined on each Spectrum Analyzer screen

These device messages are listed below in Spectrum Analyzer.

1.1.1 MS8606A common commands in Spectrum Analyzer

(1) Copy commands (copy)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Copy		PRINT	---	---	
			PLS 0	---	---	

(2) Preset commands (initialization, power-on setting)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	Preset		PRE			
			INI			
			IP			

(3) Panel-mode switching commands (TX/RX tester mode, Instrument Setup mode)

Intermediate class	Function	Function details	Program Msg	Query Msg	Response Msg	Remarks
	TX/RX tester		PNLMD ANALOG	PNLMD?	TESTER	
	Instrument setup	PNLMD SYSTEM	PNLMD?	SYSTEM		
	Spectrum analyzer	PNLMD SPECT	PNLMD?	SPECT		

1.1.2 Spectrum Analyzer Command

Table of Device Messages (1/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ <u>Frequency/ Amplitude</u>	**<u>FREQUENCY/ AMPLITUDE</u>**			
<u>• Frequency</u>	**<u>FREQUENCY</u>**			
Selects the mode for setting the frequency band.	FREQ MODE CENTER-SPAN START-STOP	 FRQ△0 FRQ△2	 FRQ? FRQ?	 FRQ△0 FRQ△2
Sets the center frequency.	CENTER FREQ	CF△f	CF?	f
Steps up the center frequency.	FREQ STEP UP	CF△UP	———	———
Steps down the center frequency.	FREQ STEP DOWN	CF△DN	———	———
Sets the start frequency.	START FREQ	FA△f	FA?	f
Sets the stop frequency.	STOP FREQ	FB△f	FB?	f
Sets the frequency step size.	FREQ STEP SIZE	SS△f	SS?	f
<u>• Span</u>	**<u>SPAN</u>**			
Sets the frequency span.	FREQ SPAN	SP△f	SP?	f
Steps up the frequency span.	FREQ SPAN STEP UP	SP△UP	———	———
Steps down the frequency span.	FREQ SPAN STEP DOWN	SP△DN	———	———
Sets to full span.	FULL SPAN	FS	———	———
Sets to zero span.	ZERO SPAN	SP△0	———	———
Select the band	BAND SELECT 0: 0 Hz to 3.0 GHz 1: 10 MHz to 3.0 GHz	 BNDC△0 BNDC△1	 BNDC? BNDC?	 0 1

Note: △ is a space.

Table of Device Messages (2/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Frequency/ Amplitude	**FREQUENCY/ AMPLITUDE**			
• Level	**AMPLITUDE**			
Sets the reference level.	REFERENCE LEVEL	RL△1	RL?	1
Steps up the reference level.	REF LEVEL STEP UP	RL△UP		
Steps down the reference level.	REF LEVEL STEP DOWN	RL△DN		
Sets the LOG scale step size.	LOG SCALE STEP SIZE MANUAL	LSS△1	LSS?	LSS△1
	AUTO			
	1div	LSSA△1	LSSA?	LSSA△1
	2div	LSSA△2	LSSA?	LSSA△2
	5div	LSSA△5	LSSA?	LSSA△5
	10div	LSSA△10	LSSA?	LSSA△10
Sets the LOG scale.	LOG SCALE RANGE			
	1dB/div	LG△1DB	LG?	1
	2dB/div	LG△2DB	LG?	2
	5dB/div	LG△5DB	LG?	5
	10dB/div	LG△10DB	LG?	10
	SCALE UP	LG△UP	———	———
	SCALE DOWN	LG△DN	———	———
• Display line	**DISPLAY LINE**			
Sets the Display line ON/OFF.	DISPLAY LINE			
	OFF	DL△OFF	DL?	OFF
	ON	DL△ON	———	———
Sets the Display line level.	DISPLAY LINE LEVEL	DL△1	DL?	1
Marker level/ waveform data Absolute/relative display line.	TRACE-A ABS	DSPLVM△TRA,ABS	DSPLVM?△TRA	ABS
	REL	DSPLVM△TRA,REL	DSPLVM?△TRA	REL
	TRACE-B ABS	DSPLVM△TRB,ABS	DSPLVM?△TRB	ABS
	REL	DSPLVM△TRB,REL	DSPLVM?△TRB	REL
	TRACE-TIME ABS	DSPLVM△TRTIME,ABS	DSPLVM?△TRTIME	ABS
	REL	DSPLVM△TRTIME,REL	DSPLVM?△TRTIME	REL

Table of Device Messages (3/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ **Display function**	**DISPLAY**			
• **Display mode**	**DISPLAY FUNCTION**			
Selects the display format.	DISPLAY FORMAT			
	TRACE-A	DFMT△A	DFMT?	A
	TRACE-B	DFMT△B	DFMT?	B
	TRACE-TIME	DFMT△TIME	DFMT?	TIME
	TRACE-A/B(A&B)	DFMT△AB1	DFMT?	AB1
• **Waveform writing**	**WRITE SWITCH**			
Controls writing of the waveform to trace A.	TRACE-A WRITE SWITCH			
	VEIW	AWR△0	—	—
		AWR△OFF	AWR?	AWR△OFF
		VIEW△TRA	—	—
	WRITE	AWR△1	—	—
		AWR△ON	AWR?	AWR△ON
		CLRW△TRA	—	—
Controls writing of the waveform to trace B.	TRACE-B WRITE SWITCH			
	VIEW	BWR△0	—	—
		BWR△OFF	BWR?	BWR△OFF
		VIEW△TRB	—	—
	WRITE	BWR△1	—	—
		BWR△ON	BWR?	BWR△ON
		CLRW△TRB	—	—
Controls writing of the waveform to trace TIME.	TRACE-TIME WRITE SWITCH			
	VIEW	TMWR△0	—	—
		TMWR△OFF	TMWR?	TMWR△OFF
		VIEW△TRTIME	—	—
	WRITE	TMWR△1	—	—
		TMWR△ON	TMWR?	TMWR△ON
		CLRW△TRTIME	—	—

Table of Device Messages (4/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Display function	DISPLAY			
• Storage mode	STORAGE MODE			
Selects the mode for processing the trace A waveform.	TRACE MODE(A)			
	NORMAL	AMD△0	AMD?	AMD△0
	MAX HOLD	AMD△1	——	AMD△1
		MXMH△TRA	——	——
	AVERAGE	AMD△2	AMD?	AMD△2
	MIN HOLD	AMD△3	AMD?	AMD△3
	CUMULATIVE	AMD△4	AMD?	AMD△4
	OVER WRITE	AMD△5	AMD?	AMD△5
Selects the mode for processing the trace B waveform.	TRACE MODE(B)			
	NORMAL	BMD△0	BMD?	BMD△0
	MAX HOLD	BMD△1	——	BMD△1
		MXMH△TRB	——	——
	AVERAGE	BMD△2	BMD?	BMD△2
	MIN HOLD	BMD△3	BMD?	BMD△3
	CUMULATIVE	BMD△4	BMD?	BMD△4
	OVER WRITE	BMD△5	BMD?	BMD△5
Selects the mode for processing the trace TIME waveform.	TRACE MODE(TIME)			
	NORMAL	TMMD△0	TMMD?	TMMD△0
	MAX HOLD	TMMD△1	TMMD?	TMMD△1
	AVERAGE	TMMD△2	TMMD?	TMMD△2
	MIN HOLD	TMMD△3	TMMD?	TMMD△3
	CUMULATIVE	TMMD△4	TMMD?	TMMD△4
	OVER WRITE	TMMD△5	TMMD?	TMMD△5
Average processing.	AVERAGE			
	OFF	VAVG△0	——	——
		VAVG△OFF	——	——
	ON	VAVG△1	——	——
		VAVG△ON	——	——
Number of trace averaged.	NUMBER of TRACE AVERAGE n	VAVG△n	VAVG?	n
Hold sweep mode pause.	HOLD SWEEP MODE PAUSE (Specifies number)	HOLDPAUSE△n	HOLDPAUSE?	n

Table of Device Messages (5/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Display function	**DISPLAY**			
• Storage mode (Cont)	**STORAGE MODE**			
Selects detection mode.	TRACE-A DETECTION MODE			
	POS PEAK	DETM△TRA,POS	DETM?△TRA	POS
	SAMPLE	DETM△TRA,SMP	DETM?△TRA	SMP
	NEG PEAK	DETM△TRA,NEG	DETM?△TRA	NEG
	TRACE-B DETECTION MODE			
	POS PEAK	DETM△TRB,POS	DETM?△TRB	POS
	SAMPLE	DETM△TRB,SMP	DETM?△TRB	SMP
	NEG PEAK	DETM△TRB,NEG	DETM?△TRB	NEG
	TRACE-TIME DETECTION MODE			
	POS PEAK	DETM△TRTIME,POS	DETM?△TRTIME	POS
	SAMPLE	DETM△TRTIME,SMP	DETM?△TRTIME	SMP
	NEG PEAK	DETM△TRTIME,NEG	DETM?△TRTIME	NEG
• Time	**TIME**			
Sets the time delay in the time axis sweep mode.	DELAY TIME	TDLY△t	TDLY?	t
Sets the time span in the time axis sweep mode.	TIME SPAN	TSP△t	TSP?	t
• A/B				
Active marker Trace.	ACTIVE MARKER TRACE			
	TRACE A	MKTRACE△TRA		
	TRACE B	MKTRACE△TRB		
■ Signal search	**SIGNAL SEARCH**			
Sets the maximum peak point to the center frequency.	PEAK to CF	PCF	——	——
Sets the maximum peak point to the REF level.	PEAK to REF	PRL	——	——

Table of Device Messages (6/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Marker function	**MARKER**			
Selects the marker mode.	MARKER MODE			
	MORMAL	MKR△0	MKR?	MKR△0
	DELTA	MKR△1	MKR?	MKR△1
		MKD	———	———
	OFF	MKR△2	MKR?	MKR△2
		MKOFF	———	———
		MKOFF△ALL	———	———
Specifies the zone marker center position as a point.	ZONE POSITION (point)	MKP△p	MKP?	p
Specifies the zone marker center position as a frequency or time.	ZONE POSITION (freq or time)			
	FREQ SET	MKN△f	MKN?	f
	UP	MKN△UP	———	———
	DOWN	MKN△DN	———	———
	TIME SET	MKN△t	MKN?	t
	UP	MKN△UP	———	———
	DOWN	MKN△DN	———	———
Specifies the zone marker width as a frequency.	ZONE WIDTH(freq)	MZWF△f	MZWF?	f
Specifies the zone marker width as a division.	ZONE WIDTH(div)			
	SPOT	MKW△1	MKW?	MKW△1
	0.5 div	MKW0	MKW?	MKW△0
	1 div	MKW△5	MKW?	MKW△5
	2 div	MKW△6	MKW?	MKW△6
	5 div	MKW△7	MKW?	MKW△7
	10 div	MKW△2	MKW?	MKW△2

Table of Device Messages (7/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Marker function (Cont)	**MARKER**			
• Multimarker	**MARKER FUNCTION**			
Moves the marker frequency to the center frequency.	MKR to CF	MKR△3 MKCF	—— ——	—— ——
Sets the level at the marker point to the REF level.	MKR to REF	MKR△4 MKRL	—— ——	—— ——
Sets the zone frequency to the span.	ZONE to SPAN	MKR△7	——	——
• Peak search	**PEAK SEARCH**			
Peak search mode	PEAK SEARCH MODE	MKPK	——	——
	PEAK	MKPK△HI	——	——
	NEXT PEAK	MKPK△NH	——	——
	NEXT RIGHT PEAK	MKPK△NR	——	——
	NEXT LEFT PEAK	MKPK△NL	——	——
	SEARCH RESOLUTION	MKPX△1	MKPX?	1
	SEARCH THRESHOLD			
	OFF	SRCHTH△0 SRCHTH△OFF	—— SRCHTH?	—— OFF
	ON	SRCHTH△1 SRCHTH△ON	—— SRCHTH?	—— ON
Search resolution	ABOVE	SRCHTH△ABOVE	SRCHTH?	ABOVE
Search threshold value	BELOW	SRCHTH△BELOW	SRCHTH?	BELOW

Table of Device Messages (8/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Marker function	**MARKER**			
• Input position	**INPUT POSITION**			
Reads the reference marker position.	REFERENCE MARKER POSITION	——	RMK?	RMK△p
Reads the current marker position.	CURRENT MARKER POSITION	——	CMK?	CMK△p
Reads the frequency at the marker point.	MARKER FREQ QUERY			
	FREQ	——	MKF?	f
	TIME	——	MKF?	t
Reads the level at the marker point.	MARKER LEVEL	——	MKL?	l
■ Coupled function	**COUPLED FUNCTION**			
Sets the resolution bandwidth.	RESOLUTION BANDWIDTH			
	AUTO	RB△AUTO	——	——
	300 Hz	RB△300HZ	RB?	300
	1 kHz	RB△1KHZ	RB?	1000
	3 kHz	RB△3KHZ	RB?	3000
	10 kHz	RB△10KHZ	RB?	10000
	30 kHz	RB△30KHZ	RB?	30000
	100 kHz	RB△100KHZ	RB?	100000
	300 kHz	RB△300KHZ	RB?	300000
	1 MHz	RB△1MHZ	RB?	1000000
	RBW UP	RB△UP	——	——
	RBW DOWN	RB△DN	——	——

Table of Device Messages (9/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Coupled function (Cont)	**COUPLED FUNCTION**			
Sets the video bandwidth.	VIDEO BANDWIDTH			
	AUTO	VB△AUTO	—	—
	3 Hz	VB△30HZ	VB?	3
	10 Hz	VB△10HZ	VB?	10
	30 Hz	VB△30HZ	VB?	30
	100 Hz	VB△100HZ	VB?	100
	300 Hz	VB△300HZ	VB?	300
	1 kHz	VB△1KHZ	VB?	1000
	3 kHz	VB△3KHZ	VB?	3000
	10 kHz	VB△10KHZ	VB?	10000
	30 kHz	VB△30KHZ	VB?	30000
	100 kHz	VB△100KHZ	VB?	100000
	OFF	VB△OFF	VB?	OFF
	VBW UP	VB△UP	—	—
	VBW DOWN	VB△DN	—	—
Sets the sweep time.	SWEEP TIME			
	AUTO	ST0AUTO	—	—
	SWEEP△TIME SET			
	TIME=t	ST△t	ST?	t
	UP	ST△UP	—	—
	DOWN	ST△DN	—	—
Sets the RF attenuator.	RF ATTENUATOR			
	AUTO	AT△AUTO	—	—
	0 dB	AT0	AT?	0
	10 dB	AT△10	AT?	10
	20 dB	AT△20	AT?	20
	30 dB	AT△30	AT?	30
	40 dB	AT△40	AT?	40
	50 dB	AT△50	AT?	50
	60 dB	AT△60	AT?	60
	70 dB	AT△70	AT?	70
	UP	AT△UP	—	—
	DOWN	AT△DN	—	—
Sets the bandwidth/sweep time automatically.	RBW, VBW/SWEEP TIME, AUTO	BSAUTO	—	—
Sets the coupled function automatically.	COUPLED FUNCTION AUTO	AUTO	—	—

Table of Device Messages (10/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Sweep function	**SWEEP CONTROL**			
Sets the sweep mode to single.	SINGLE SWEEP MODE	SNGLS	——— ———	——— ———
Executes/checks single sweep.	SINGLE SWEEP/ SWEEP STATUS			
	Executing single sweep	SWP	———	———
	Checking the sweep status			
	Sweep completed	———	SWP?	SWP△0
	Sweep in progress	———	SWP?	SWP△1
Executes average sweep.	TAKE AVERAGE SWEEP	TSAVG	———	———
Executes hold sweep.	TAKE HOLD SWEEP	TSHOLD	———	———
Continuous sweep mode.	COTINUOUS SWEEP MODE	CONTS	———	———
Restarts the sweep.	SWEEP RESTART	SWSTART	———	———
■ Measure function	**MEASURE**			
Sets the measure function to OFF.	MEASURE FUNCTION ALL OFF	MEAS△OFF	———	———
• Noise measurement	**NOISE MEASURE**			
Measures the noise.	NOISE MEASURE			
	OFF	MEAS△NOISE,OFF	———	———
	ON	MEAS△NOISE,ON	———	———
	ABSOLUTE executed	MEAS△NOISE,ABS	———	———
	C/N RATIO executed	MEAS△NOISE,CN	———	———
		———	RES?	1
Calculation method.	ABSOLUTE	MNOISE△ABS	MNOISE?	ABS
	C/N RATIO	MNOISE△CN	MNOISE?	CN

Table of Device Messages (11/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Measure function (Cont)	**MEASURE**			
• Occupied frequency bandwidth measurement	**OBW MEASURE**			
Measures the occupied frequency bandwidth.	OBW MEASURE			
	Executes calculation.	MEAS△OBW, EXE	———	———
Calculation method	Executes(X dB DOWN).	MEAS△OBW, XDB	———	———
	Executes (N%).	MEAS△OBW, N	———	———
Sets the conditions of occupied frequency bandwidth.	Transferring measured results (f1: Occupied bandwidth f2: Center frequency)	———	RES?	f1, f2
	X dB DOWN method	MOBW△XDB	MOBW?	XDB
	N% method	MOBW△N	MOBW?	N
	OBW VALUE			
	x dB	OBWXDB△XDB	OBWXDB?	x
	n%	OBWN△n	OBWN?	n
• Adjacent channel measurement	**ADJACENT CH MEASURE**			
Measures the adjacent channel.	ADJACENT CH MEASURE			
	Executes calculation.	MEAS△ADJ, EXE	———	———
	Executes (UNMODULATED CARRIER).	MEAS△ADJ, UNMD	———	———
	Executes(MODULATED CARRIER)	MEAS△ADJ, MOD	———	———
	Transferring measured results (lL1: CH1 lower sideband lU1: CH1 upper sideband lL2: CH2 lower sideband lU2: CH2 upper sideband)	———	RES?	lL1, lU1, lL2, lU2
Selects the adjacent channel.	ADJACENT CH SELECT			
	BOTH SIDES	ADJCH△BOTH	ADJCH?	BOTH
	UPPER SIDE	ADJCH△UP	ADJCH?	UP
	LOWER SIDE	ADJCH△LOW	ADJCH?	LOW
	OFF	ADJCH△OFF	ADJCH?	OFF
Sets the adjacent channel bandwidth.	ADJACENT CH BANDWIDTH	ADJCHBW△f	ADJCHBW?	f

Table of Device Messages (12/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Measure function (Cont)	**MEASURE**			
• Adjacent channel measurement	**ADJACENT CH MEASURE**			
Sets adjacent channel 1 separation.	ADJACENT CH1 SEPARATION	ADJCHSP△f	ADJCHSP?	f
Sets adjacent channel 2 separation.	ADJACENT CH2 SEPARATION	ADJCHSPF△f	ADJCHSPF?	f
Selects the calculation method.	R:TOTAL POWER(MOD)	MADJMOD△MOD	MADJMOD?	MOD
	R:REF LEVEL (UNMOD)	MADJMOD△UNMD	MADJMOD?	UNMD
Sets the graph display ON/OFF.	GRAPH			
	OFF	MADJGRAPH△OFF	MADJGRAPH?	OFF
	ON	MADJGRAPH△ON	MADJGRAPH?	ON
Sets the channel center line display ON/OFF.	CHANNEL CENTER LINE			
	OFF	MADJCTRLN△OFF	MADJCTRLN?	OFF
	ON	MADJCTRLN△ON	MADJCTRLN?	ON
Sets the channel range line display ON/OFF.	CHANNEL BAND LINE			
	OFF	MADJBWLN△OFF	MADJBWLN?	OFF
	ON	MADJBWLN△ON	MADJBWLN?	ON
• Power measurement	**POWER MEASURE**			
Measures the power.	POWER MEASURE			
	MEASURE	MEAS△POWER,EXE	——	——
	Transferring measured results (l:dBm value w: pW value)	——	RES?	l,w
Sets the point where power measurement starts.	POWER MEASURE START	PWRSTART△p	PWRSTART?	p
Sets the point where power measurement ends.	POWER MEASURE STOP	PWRSTOP△p	PWRSTOP?	p

Table of Device Messages (13/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Calibration	**CALIBRATION**			
Executes calibration with the internal CAL signal.	CALIBRATION	CAL	——	——
■ CAL/UNCAL	**CAL/UNCAL**			
Couple failure	UNCAL UNCAL DISPLAY			
	OFF	UNC△0 UNC△OFF	—— UNC?	—— UNC△OFF
	ON	UNC△1 UNC△ON	—— UNC?	—— UNC△ON
	UNCAL STATUS			
	NORMAL	——	UCL?	UCL△0
	UNCAL	——	UCL?	UCL△1
■ Spectrum data	**SPECTRUM DATA**			
Trace A memory	TRACE-A MEMORY	XMA△p,b	XMA?△p,b	b
Trace B memory	TRACE-B MEMORY	XMB△p,b	XMB?△p,b	b
Trace TIME memory Selects ASCII/ Binary.	TRACE-TIME MEMORY	XMT△p,b	XMT?△p,b	b
	ASCII DATA	BIN△0 BIN△OFF	—— ——	—— ——
	BINARY DATA	BIN△1 BIN△ON	—— ——	—— ——

Table of Device Messages (14/14)

Parameter		Program command	Query	Response
Outline	Control item			
■ Trigger/gate sweep	**TRIGGER/GATE SWEEP**			
Gate function	GATE MODE			
	OFF	GATE△0	———	———
		GATE△OFF	GATE?	OFF
	ON	GATE△1	———	———
		GATE△ON	GATE?	ON
Sets the gate delay time.	GATE DELAY TIME	GD△t	GD?	t
Sets the gate length.	GATE LENGTH	GL△t	GL?	t
Sets the trigger mode (sets the trigger source/ trigger switch).	TRIGGER MODE			
	FREERUN	TRG△0	TRG?	TRG△0
		TM△FREE	TM?	FREE
	EXT	TM△EXT	TM?	EXT
	WIDE IF VIDEO	TM△WIDEVID	TM?	WIDEVID
	EXTERNAL	TM△EXT	TM?	EXT
Sets the trigger switch.	TRIGGER SWITCH			
	FREERUN	TRGS△FREE	TRGS?	FREE
	TRIGGERD	TRGS△TRGD	TRGS?	TRGD
Sets the trigger source.	TRIGGER SOURCE			
	EXT	TRGSOURCE△EXT	TRGSOURCE?	EXT
	WIDE IF VIDEO	TRGSOURCE△ WIDEVID	TRGSOURCE?	WIDEVID
	EXTERNAL	TRGSOURCE△EXT EXT	TRGSOURCE?	EXT
Selects the sweep trigger slope.	TRIGGER SLOPE			
	RISE	TRGSLP△RISE	TRGSLP?	RISE
	FALL	TRGSLP△FALL	TRGSLP?	FALL
Sets the time-out period for the trigger sweep wait (this is also the time-out period of the GP-IB talker function).	SWEEP TIME OUT	GTOUT△t	GTOUT?	t

SECTION 2

DETAILED DESCRIPTION OF COMMANDS

This section describes the usable device and response messages in alphabetic order.

TABLE OF CONTENTS

SECTION 2 DETAILED DESCRIPTION OF COMMANDS

This section gives detailed descriptions of the device messages for the MS8606A series spectrum analyzer function in alphabetical order.

Message name spelled out

Message headline

CNF

CNF Center Frequnecy

■ Function Sets the center frequency (same function as CF).

Program command message

Program query message

Response message

Header	Program command	Query	Response
CNF	CNF△f	CNF?	CNF△f f=-100000000 to 0 to 3000000000 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f –100MHz to 3.0GHz

■ Suffix code

None:	Hz(10^0)
HZ:	Hz(10^0)
KHZ, KZ:	kHz(10^3)
MHZ, MZ:	MHz(10^6)
GHZ, GZ:	GHz(10^9)

- The data to the left of the colon is part of the program or response data
- The data is to the right of the colon.

■ Initial setting Value of f=1.50 GHz

Device-dependent initial setting value

■ Example

```
CNF△123456
CNF△50MHz
CNF?
```

ADJCH

ADJCH Adjacent CH Select

■ Function Selects the subject channel to be calculated for an adjacent channel.

Header	Program command	Query	Response
ADJCH	ADJCH△a	ADJCH?	a

■ Value of a

BOTH :	BOTHSIDES
UP :	UPPERSIDE
LOW :	LOWERSIDE
OFF :	OFF

■ Suffix code None

■ Initial setting BOTH : BOTHSIDES

■ Example ADJCH△BOTH
ADJCH△LOW

ADJCHBW

ADJCHBW Adjacent CH Bandwidth

■ Function Sets the bandwidth of the adjacent channel.

Header	Program command	Query	Response
ADJCHBW	ADJCHBW△f	ADJCHBW?	f f=10 to 9999990 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f 10 Hz to 9.99999 MHz (10 Hz resolution. Data below 10 Hz is truncated.)

■ Suffix code

None :	Hz(10^0)
HZ :	Hz(10^0)
KHZ,KZ :	kHz(10^3)
MHZ,MZ :	MHz(10^6)
GHZ,GZ :	GHz(10^9)

■ Initial setting 8.5KHZ : 8.5kHz

■ Example ADJCHBW△8.5KHZ

ADJCHSP Adjacent CH Sepalation

■ Function Sets the separation of adjacent channel 1.

Header	Program command	Query	Response
ADJCHSP	ADJCHSP△f	ADJCHSP?	f f=10 to 9999990 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f 10 Hz to 9.99999 MHz (10 Hz resolution. Data below 10 Hz is truncated.)

■ Suffix code

None :	Hz(10^0)
HZ :	Hz(10^0)
KHZ, KZ :	kHz(10^3)
MHZ, MZ :	MHz(10^6)
GHZ, GZ :	GHz(10^9)

■ Initial setting 12.5KHZ : 12.5kHz

■ Example `ADJCHSP△12.5kHz`

ADJCHSPF Adjacent CH2 Separation

■ Function Sets the separation of adjacent channel 2.

Header	Program command	Query	Response
ADJCHSP	ADJCHSPF△f	ADJCHSPF?	f f=10 to 9999990 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f 10 Hz to 9.99999 MHz (10 Hz resolution. Data below 10 Hz is truncated.)

■ Suffix code

None :	Hz(10^0)
HZ :	Hz(10^0)
KHZ, KZ :	kHz(10^3)
MHZ, MZ :	MHz(10^6)
GHZ, GZ :	GHz(10^9)

■ Initial setting 12.5KHZ : 12.5kHz

■ Example `ADJCHSPF△12.5kHz`

AMD

AMD Trace A Storage Mode

■ Function Selects the mode for processing the trace A waveform.

Header	Program command	Query	Response
AMD	AMD△n	AMD	AMD△n

■ Value of n
0: NORMAL
1: MAXHOLD
2: AVERAGE
3: MINHOLD
4: CUMULATIVE
5: OVERWRITE

■ Suffix code None

■ Initial setting 0: NORMAL

■ Example AMD△0

AT

AT RF Attenuator

■ Function Sets the RF attenuator.

Header	Program command	Query	Response
AT	AT△a AT△n	AT?	n

■ Value of a
AUTO: AUTO
UP: UP
DN: DOWN

■ Value of n 0 to 70 (10step): 0 to 70dB(10dB step)

■ Suffix code
None: dB
DB : dB

■ Initial setting ATT=Calculated value when AUTO is selected for ATT

■ Example
AT△10
AT△50

AUTO Coupled Function All Auto

■ Function Executes all coupled functions (RBW, VBW, SWT, and ATT) in AUTO mode.

Header	Program command	Query	Response
AUTO	AUTO		

■ Example AUTO

AWR Trace A Write Switch

■ Function Controls writing of the waveform data to trace A.

Header	Program command	Query	Response
AWR	AWR△sw a=ON,1,OFF,0	AWR?	AWR△sw sw=ON,OFF

■ Value of sw 1, ON: TRACE A WRITE ON (same function as CLRW△TRA)
0, OFF: TRACE A WRITE OFF(same function as VIEW△TRA)

■ Suffix code None

■ Initial setting 1: TRACE A WRITE ON

■ Example AWR△0

BIN

BIN ASCII / Binary Date Out

■ Function Sets the format of output trace data to ASCII or BINARY.

Header	Program command	Query	Response
BIN	BIN△sw	———	———

■ Value of sw 0,OFF: ASCII
1,ON: BINARY

■ Suffix code None

■ Initial setting 0: ASCII

■ Example BIN△0
BIN△ON

BMD

BMD Trace B Storage Mode

■ Function Selects the mode for processing the trace B waveform.

Header	Program command	Query	Response
BMD	BMD△n	BMD?	BMD△n

■ Value of n 0: NORMAL
1: MAX HOLD
2: AVERAGE
3: MIN HOLD
4: CUMULATIVE
5: OVER WRITE

■ Suffix code None

■ Initial setting 0: NORMAL

■ Example BMD△0

BNDC Band Select

■ Function Sets the band 0 to8.1 GHz.

Header	Program command	Query	Response
BNDC	BNDC△a a=0,1	BNDC?	a a=0,1

■ Value of a
0: BAND 0= 0 HZ to 3.0 GHZ
1: BAND 1= 10 MHZ to 3.0 GHZ

■ Suffix code None

■ Initial setting AUTO: BAND 1= 10 MHZ to 3.0 GHZ

■ Example
BNDC△0
BNDC△1

BSAUTO BW / SWT Auto

■ Function Allows RBW, VBW, and the sweep time to be set in AUTO mode.

Header	Program command	Query	Response
BSAUTO	BSAUTO	———	———

■ Example BSAUTO

BWR Trace B Write Switch

■ Function Controls writing of the waveform data to trace B.

Header	Program command	Query	Response
BWR	BWR△sw	BWR?	BWR△sw sw=ON,OFF

■ Value of sw `1,ON:` TRACE B WRITE ON (same function as CLRW△TRB)
`0,OFF:` TRACE B WRITE OFF (same function as VIEW△TRG)

■ Suffix code None

■ Initial setting `1:` TRACE B WRITE ON

■ Example `BWR△0`

CAL Calibration

■ **Function** Performs calibration using the internal CAL signal.

Header	Program command	Query	Response
CAL	CAL	————	————

■ **Example** `CAL`

CF Center Frequency

■ **Function** Sets the center frequency (same function as CNF).

Header	Program command	Query	Response
CF	CF△f CF△a	CF?	f f=-50000000 to 3050000000 Transfers the data with no suffix code in units of **1 Hz.**

■ **Value of f** 50MHz to 3.05GHz

■ **Value of a**
UP : CENTER FREQSTEP UP
DN : CENTER FREQSTEP DOWN

■ **Suffix code**

f :	None :	Hz(10^0)
	HZ :	HZ(10^0)
	KHZ , KZ	kHz(10^3)
	MHZ , MZ	MHz(10^6)
	GHZ , GZ	GHz(10^9)
a :	None	

■ **Initial setting** Initial value of a = 1.505 GHz

■ **Example**
CF△1235456
CF△50MHz
CF△UP

CLRW

CLRW Clear & Write

■ **Function** Clears the trace waveform data to set the write mode to ON.

Header	Program command	Query	Response
CLRW	CLRW△tr	———	———

■ **Value of tr**

TRA :	Trace A (same function as AWR△1)
TRB :	Trace B (same function as BWR△1)
TRIME :	Trace TIME (same function as TMWR△1)

■ **Example** `CLRW△TRA`

CMK?

CMK? Current Marker Position

■ **Function** Reads the current marker position.

Header	Program command	Query	Response
CMK?	———	CMK?	CMK△p

■ **Value of p** 0 to 500

■ **Example** `CMK?`

CONTS Continuous Sweep Mode

■ Function Sets the sweep mode to continuous mode (same function as S1).

Header	Program command	Query	Response
`CONTS`	`CONTS`	———	———

■ Example `CONTS`

DETM Detection Mode

■ Function Selects the detection mode for the specified trace.

Header	Program command	Query	Response
DETM	DETM△tr,a	DETM?△tr	a

■ Value of tr

TRA: Trace A
TRB: Trace B
TRIME: Trace TIME

■ Value of a

POS: POSITIVEPEAK
SMP: SAMPLE
NEG: NAGETIVEPEAK

■ Suffix code None

■ Initial setting POS: POSITIVEPEAK

■ Example

```
DETM△TRA,POS
DETM△TRB,SMP
DETM△TRIME,SMP
```

DFMT Display Format

■ Function Specifies the display mode/format.

Header	Program command	Query	Response
DFMT	DFMT△a	DFMT?	a

■ Value of a

A:	Trace A
B:	Trace B
TIME:	Trace TIME
AB1:	Trace A/Trace B (A & B)

■ Suffix code None

■ Initial setting A: Trace A

■ Example `DFMT△TIME`

DL

DL Display line,Display-line Level

■ Function Turns the display line on or off, and sets its level.

Header	Program command	Query	Response
DL	DL△sw DL△l	DL?	OFF

■ Value of sw

ON:	ON
OFF:	OFF

■ Value of ℓ Value equivalent to full scale of current Y-axis.
For LOG scale: RLV-100 to RLV

■ Suffix code None:dBm
DB, DBM, DM: dBm

■ Initial setting -60.00 dBm(Level equivalent to center point of the scale)

■ Example `DL△OFF`
`DL△-10.0DBM`

DSPLVM

DSPLVM Marker Level Absolute/Relative

■ Function With the trace mode specified, also specifies the marker level in the absolute value display or in the relative value display when seen from the display line.

Header	Program command	Query	Response
`DSPLVM`	`DSPLVM△tr,a`	`DSPLVM?△tr`	`a`

■ Value of tr	`TRA:`	Trace A
	`TRB:`	Trace B
	`TRIME:`	Trace Time
■ Value of a	`ABS:`	Absolute value
	`REL:`	Relative value
■ Suffix code	None	
■ Initial setting	`ABS:`	Absolute value
■ Example	`DSPLVM△TRA,REL`	

FA Start Frequency

■ Function Sets the start frequency.

Header	Program command	Query	Response
FA	FA△f	FA?	f f=–50000000 to 3050000000 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f –50MHz to 3.05GHz

■ Suffix code

None :	Hz(10^0)
HZ :	Hz(10^0)
KHZ , KZ :	kHz(10^3)
MHZ , MZ :	MHz(10^6)
GHZ , GZ :	GHz(10^9)

■ Initial setting Initial value of f = 10 MHz

■ Example `FA△1GZ`

FB Stop Frequency

■ Function Sets the stop frequency (same function as SOF).

Header	Program command	Query	Response
FB	FB△f	FB?	f f=–50000000 to 3050000000 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f –50MHz to 3.05GHz

■ Suffix code

None :	Hz(10^0)
HZ :	Hz(10^0)
KHZ , KZ :	kHz(10^3)
MHZ , MZ :	MHz(10^6)
GHZ , GZ :	GHz(10^9)

■ Initial setting Initial value of f = 3.0 GHz

■ Example `FB△2GHZ`

FRQ

FRQ Frequency Mode

■ Function Selects the mode for setting the FG frequency band.

Header	Program command	Query	Response
FRQ	FRQ△n	FRQ?	FRQ△n

■ Value of n
0: CENTER-SPAN
2: START-STOP

■ Suffix code None

■ Initial setting 2: START-STOP

■ Example
FRQ△0
FRQ△1

FS

FS Full Span

■ Function Sets the frequency span to the maximum value settable in the frequency band being set.

Header	Program command	Query	Response
FS	FS	———	———

■ Example FS

GATE Gate Sweep ON / OFF

■ Function Sets the gate function to be set to ON or OFF.

Header	Program command	Query	Response
GATE	GATE△sw	GATE?	sw sw=ON,OFF

■ Value of sw 1,ON: ON
0,OFF: OFF

■ Suffix code None

■ Initial setting OFF: OFF

■ Example GATE△ON

GD Gate Delay

■ Function Sets the delay time of the gate.

Header	Program command	Query	Response
GD	GD△t	GD?	t t=2 to 100000 Transfers the data with no suffix code in units of 1 µs.

■ Value of t 2µsec to 100ms

■ Suffix code

None:	ms
US:	µs
MS:	ms
S:	s

■ Initial setting Initial value of a = 200µsec

■ Example GD△20MS

GL

GL Gate Length

■ **Function** Sets the width of the gate.

Header	Program command	Query	Response
GL	GL△t	GL?	t t=2 to 100000 Transfers the data with no suffix code in units of 1 µs.

■ **Value of t** 2µsec to 100msec

■ **Suffix code**

None :	ms
US :	µs
MS :	ms
S :	s

■ **Initial setting** Initial value of t = 1 ms

■ **Example** GL△20MS

HOLDPAUSE

HOLDPAUSE Max/Min Hold Sweep Mode

■ **Function** Specifies the processing (step or continue) after a specified number of averagings of sweep.

Header	Program command	Query	Response
HOLDPAUSE	HOLDPAUSE△a	HOLDPAUSE?	a

■ **Value of a**

0, OFF :	Continue (∞)
2 to 1024	

■ **Suffix code** None

■ **Initial setting** 0 : Continue (∞)

■ **Example** HOLDPAUSE△32

LG Scale

■ Function Sets the Y axis magnification and scale.

Header	Program command	Query	Response
LG	LG△l LG△a	LG?	l

■ Value of l
1: 1dB/div
2: 2dB/div
5: 5dB/div
10: 10dB/div

■ Value of a
UP: SCALE UP
DN: SCALE DOWN

■ Suffix code
None: dB/div
DB, DBM, DM: dB/div

■ Initial setting 10: 10dB/div

■ Example
LG△UP
LG△5DB

LSS

LSS Reference Level Step size(Manual)

■ Function Sets the step size (manual values) for increasing and decreasing the reference level.

Header	Program command	Query	Response
LSS	LSS△l	LSS?	LSS△l l=0.1 to 100.0 Transfers the data with no suffix code in units of 1 dB.

■ Value of l 0.1 to 100.00dB (0.01dBstep)

■ Suffix code
None: dB
DB, DBM, DM: dB

■ Initial setting Value of ℓ = 10 dB

■ Example
LSS△6
LSS△10

LSSA Reference Level Step Size(Auto)

■ **Function** Sets the step size (auto values) for increasing and decreasing the reference level during LOG SCALE operation.

Header	Program command	Query	Response
LSSA	LSSA△n	LSSA?	LSSA△n a=1,2,5,10

■ **Value of n**
1: 1div
2: 2div
5: 5div
10: 10div

■ **Suffix code** None

■ **Initial setting** 1: 1div

■ **Example** LSSA△10

MADJBWLN ADJ-CH Band Line

■ Function Sets the display of the adjacent channel range line ON/OFF.

Header	Program command	Query	Response
MADJBWLN	MADJBWLN△sw	MADJBWLN?	sw

■ Value of sw OFF: OFF
ON: ON

■ Suffix code None

■ Initial setting OFF: OFF

■ Example MADJBWLN△OFF

MADJCTRLN ADJ-CH Center Line

■ Function Sets the display of the adjacent channel center line ON/OFF.

Header	Program command	Query	Response
MADJCTRLN	MADJCTRLN△sw	MADJCTRLN?	sw

■ Value of sw OFF: OFF
ON: ON

■ Suffix code None

■ Initial setting ON: ON

■ Example MADJCTRLN△OFF

MADJGRAPH

MADJGRAPH Adjacent CH Graph

■ Function Sets the graph display function of ADJ-CH measure ON/OFF.

Header	Program command	Query	Response
MADJGRAPH	MADJGRAPH△sw	MADHGRAPH?	sw

■ Value of sw OFF: GRAPH OFF
ON: GRAPH ON

■ Suffix code None

■ Initial setting ON: Graph ON

■ Example MADJGRAPH△ON

MADJMOD

MADJMOD ADJ-CH Measure Method

■ Function Selects the calculation method of ADJ-CH measure.

Header	Program command	Query	Response
MADJMOD	MADJMOD△a	MADJMOD?	a

■ Value of a MOD: Reference=Total Power (Mod method)
UNMD: Reference=REF LEVEL(Un-mod method)

■ Suffix code None

■ Initial setting MOD: R: Total Power

■ Example MADJMOD△MOD

MEAS Measure Function

■ Function Executes each item of the Measure functions when specified.

Header	Program command	Query	Response
MEAS	MEAS△data1,data2	MEAS?	data1 data1=OFF,NOISE,OBW, ADJ, POWER

■ Value of data1,data2

Format1:Specifies the measurement item and whether to switch it ON/OFF or execute it.

OFF:	Measurement off
NOISE, ON:	Noise calculation ON
NOISE, OFF:	Noise calculation OFF
OBW, EXE:	Executes the OBW calculation.
ADJ, EXE:	Executes theADJ-CH calculation.
POWER, EXE:	Executes the burst power calculation.

Format2: Specifies the measurement item and calculation system. Then, specifies whether to switch it ON/OFF or execute it.

NOISE,ABS:	Sets the noisecalculation (Absolute method) to ON.
NOISE,CN:	Sets the noise calculation (C/N ratio method) to ON.
OBW, XDB:	Executes the OBW calculation (X dB down method).
OBW, N:	Executes the OBW calculation (N% method).
ADJ, UNMD:	Executes the ADJ-CH calculation (R: Ref Level method).
ADJ, MOD:	Executes the ADJ-CH calculation (R: Total Power method).

MKCF

MKCF Marker to CF

■ Function Sets the marker to the center frequency (same function as MKR△3).

Header	Program command	Query	Response
MKCF	MKCF	—	—

■ Example `MKCF`

MKD

MKD Delta Marker Mode

■ Function Sets the marker mode to the delta marker mode.

Header	Program command	Query	Response
MKD	MKD	—	—

■ Example `MKD`

MKF? Marker Frequency Read

■ **Function** Reads out the frequency or time data at the marker point. In the delta marker mode, the frequency or time differences are read out.

Header	Program command	Query	Response
`MKF?`	———	`MKF?`	`f` `t`

■ **Value of f** No unit, frequency data with 1 Hz unit, Resolution 0.1 Hz

■ **Value of t** No unit, time data with 1 µs unit, Resolution 0.1 µs

■ **Example** `MKF?`

MKL? Marker Level Read

■ **Function** Reads out the level data at the marker point. In the delta marker mode, the level differences are read out.

Header	Program command	Query	Response
`MKL?`	———	`MKL?`	`l`

■ **Value of l** No unit. Level data in units of 1 dB (when display unit system for marker level is dB). Resolution is 0.01 dB.

■ **Example** `MKL?`

MKN Marker Position

■ Function Specifies the zone marker center position on the X axis in the frequency or time unit.

Header	Program command	Query	Response
MKN	MKN△f MKN△t MKN△a	MKN?	f,t f=–50000000 to 3050000000 Transfers the data with no suffix code in units of 1 Hz. t=0 to 1000000000 Transfers the data with no suffix code in units of 1 µs.

■ Value of f –50 MHz to 3.05 MHz (specified when the valid trace is A, B)

■ Value of t 0sec to 1000sec (specified when the valid trace is TIME)

■ Value of a

UP:	UP	
DN:	DOWN	

■ Suffix code

f:	None:	Hz(10^0)
	HZ:	Hz(10^0)
	KHZ,KZ:	kHz(10^3)
	MHZ,MZ:	MHz(10^6)
	GHZ,GZ:	GHz(10^9)
t:	None:	ms
	US:	µs
	MS:	ms
	S:	s

■ Example

```
MKN△100MHZ
MKN△UP
```

MKOFF Marker Mode

■ Function Turns off the marker mode.

Header	Program command	Query	Response
MKOFF	MKOFF△a	————	————

■ Value of a ALL: Marker off
None: Marker off

■ Suffix code None

■ Example MKOFF△ALL
MKOFF

MKP Marker Position

■ Function Specifies the zone marker center position on the X axis in the point unit (same function as MKZ).

Header	Program command	Query	Response
MKP	MKP△p	MKP?	p p=0 to 500

■ Value of p 0 to 500

■ Suffix code None

■ Initial setting Value of p=250

■ Example MKP△250
MKP△500

MKPK

MKPK Peak Search

■ Function Searches the spectrum being displayed for one of the special points, and moves the marker to that point.

Header	Program command	Query	Response
MKPK	MKPK△a	———	———

■ Value of a
None : SEARCH PEAK(MAX)
HI : SEARCH PEAK(MAX)
NH : SEARCH NEXT PEAK
NR : SEARCH NEXT RIGHT PEAK
NL : SEARCH NEXT LEFT PEAK

■ Suffix code None

■ Example
MKPK△HI
MKPK△NL

MKPX

MKPX Peak Resolution(Excursion)

■ Function Switches the marker mode and executes the 'MKR to 'functions.

Header	Program command	Query	Response
MKPX	MKPX△1	MKPX?	1 l=0.01 to 50.00 Transfers the data with no suffix code in units of 1 dB.

■ Value of 1 0.01dB to 50.00dB

■ Suffix code
None : dB
DB : dB

■ Initial setting 5.0 : 5dB

■ Example MKPX△10DB

MKR Marker Mode

■ Function Switches the marker mode and executes the 'MKR to 'functions.

Header	Program command	Query	Response
MKR	MKR△n	MKR?	MKR△n n=0 to 7

■ Value of n

0: NORMAL
1: DELTA
2: OFF
3: MKR to CF
4: MKR to REF
7: ZONE to SPAN

■ Suffix code None

■ Initial setting 0: NORMAL

■ Example MKR△0

MKRL Marker to REF

■ Function Sets the detection resolution of the peak point.

Header	Program command	Query	Response
MKRL	MKRL	——	——

■ Example MKRL

MKTRACE

MKTRACE Active Marker Trace

■ Function Specifies the marker display trace when the display format is TRACE A on B.

Header	Program command	Query	Response
MKTRACE	MKTRACE△tr	MKTRACE?	tr

■ Value of tr TRA: Trace A
TRB: Trace B
■ Suffix code None
■ Initial setting TRA: Trace A
■ Example MKTRACE△TRB

MKW

MKW Zone Marker Width

■ Function Specifies the zone marker width in the div unit.

Header	Program command	Query	Response
MKW	MKW△n	MKW?	MKW△n a=0 to 2,5 to 7

■ Value of n 0: 0.5div
1: Spot
2: 10div
5: 1div
6: 2div
7: 5div
■ Suffix code None
■ Initial setting 5: 1div
■ Example MKW△1
MKW△5

MNOISE Noise Measure Method

■ Function Selects the calculation method for noise measurement.

Header	Program command	Query	Response
`MNOISE`	`MNOISE△a`	`MNOISE?`	`a`

■ Value of a	`ABS:`	Absolute method
	`CN:`	C/N Ratio method
■ Suffix code	None	
■ Initial setting	`ABS:`	Absolute method
■ Example	`MNOISE△ABS`	

MOBW OBW Measure Method

■ Function Selects the calculation method for OBW.

Header	Program command	Query	Response
`MOBW`	`MOBW△a`	`MOBW?`	`a`

■ Value of a	`XDB:`	XdB Down method
	`N:`	N% method
■ Suffix code	None	
■ Initial setting	`N:`	N% method
■ Example	`MOBW△N`	

MXMH

MXMH Max Hold

■ Function Sets the mode for processing the trace waveform to MAX HOLD.

Header	Program command	Query	Response
MXMH	MXMH△tr	—	—

■ Value of tr TRA: Trace A
TRA: Trace B

■ Suffix code None

■ Example MXMH△TRA

MZWF

MZWF Zone Marker Width

■ Function Specifies the zone marker width on the X axis in one of the frequency units.

Header	Program command	Query	Response
MZWF	MZWF△f	MZWF?	f f=1 to 3000000000 Transfers the data with no suffix code in units of 1

Hz

■ Value of f 1Hz to 3.0GHz

■ Suffix code
None: Hz(10^0)
HZ: Hz(10^0)
KHZ, KZ: kHz(10^3)
MHZ, MA: MHz(10^6)
GHZ, GZ: GHz(10^9)

■ Initial setting Width equivalent to 1 div (299MHz)

■ Example
MZWF△100
MZWF△1MHZ

OBWN OBW N% Value

■ Function Sets the conditions of the occupied frequency bandwidth in units of 1%.

Header	Program command	Query	Response
OBWN	OBWN△n	OBWN?	n

■ Value of n 0.01 to 99.99 (0.01 step) : 0.01 to 99.99% (0.01%step)
■ Suffix code None
■ Initial setting 99%
■ Example OBWN△80

OBWXDB OBW XdB Value

■ Function Sets the conditions of the occupied frequency bandwidth in units of 1 dB.

Header	Program command	Query	Response
OBWXDB	OBWXDB△l	OBWXDB?	l

■ Value of l 0.01 to 100 (0.01 step) : 0.01 to 100dB (0.01dB step)
■ Suffix code None : dB
DB : dB
■ Initial setting 25dB
■ Example OBWXDB△6DB

PCF

PCF Peak to Center Frequency

■ **Function** Finds the maximum point of the spectrum being displayed, and sets the center frequency to that point.

Header	Program command	Query	Response
PCF	PCF	———	———

■ **Example** `PCF`

PRL

PRL Peak to Reference Level

■ **Function** Finds the maximum point of the spectrum being displayed, and sets it level to the reference level.

Header	Program command	Query	Response
PRL	PRL	———	———

■ **Example** `PRL`

PWRSTART Power Measure Start Point

■ Function Specifies the point at which to start burst-power measurement.

Header	Program command	Query	Response
PWRSTART	PWRSTART△p	PWRSTART?	p

■ Value of p	0 to 500
■ Suffix code	None
■ Initial setting	100point
■ Example	PWRSTART△100

PWRSTOP Power Measure Stop Point

■ Function Specifies the point at which to terminate burst-power measurement.

Header	Program command	Query	Response
PWRSTOP	PWRSTOP△p	PWRSTOP?	p

■ Valur of p	0 to 500
■ Suffix code	None
■ Initial setting	400point
■ Example	PWRSTOP△400

RB Resolution Bandwidth

■ Function Sets the resolution bandwidth (same function as RBW).

Header	Program command	Query	Response
RB	RB△f RB△a	RB?	f f=300 to 1000000 Transfers the data with no suffix code in units of 1 Hz

■ Value of f 300 Hz to 1 MHz (1/3 sequence)

■ Value of a

UP:	RBW UP
DN:	RBW DOWN
AUTO:	RBW AUTO

■ Suffix code

f: None: Hz(10^0)

HZ:	Hz(10^0)
KHZ, KZ:	kHz(10^3)
MHZ, MZ:	MHz(10^6)
GHZ, GZ:	GHz(10^9)

a: None

■ Initial setting RBW=calculated value when AUTO is selected for RBW

■ Example `RB△3KHZ`

RES? Measure Result

■ Function Reads out the results functions.

Header	Program command	Query	Response
RES?	————	RES?	data1 data1.data2 data1.data2.data3.data4

■ Values of data1,data2,data3, and data4

Measure control item (corresponding command)	Response	Value of data1	Value of data2	Value of data3	Value of data4
When the measure item or sub item is OFF	OFF	Not transferred	Not transferred	————	————
NOISE MEASURE (MEAS△NOISE,ABS) (MEAS△NOISE,C/N)	l	Value of l with no suffix code in units of 1 dB (dBm/ch, dBm/Hz, dBc/ch, dBc/Hz). Resolution: 0.01 dB	————	————	————
OBW MEASURE (MEAS△OBW,XDB) (MEAS△OBW,N)	f1,f2	Occupied bandwidth of f1 with no suffix code in units of 1 Hz. Resolution: 1 Hz	Center frequency of f2 with no suffix code in units of 1 Hz. Resolution: 1 Hz	————	————
ADJ CH MEASURE (MEAS△ADJ,UNMD) (MEAS△ADJ,MOD)	lL1,lU1 lL2,lU2	Lower channel of CHSEPA1 of lL1 with no suffix code in units of 1 dB. Resolution: 0.01 dB	Upper channel fo CH SEPA2 of lU1 with no suffix code in units of 1 dB. Resolution: 0.01 dB	Lower channel of CH SEPA2 of lL2 with no suffix code in units of 1 dB. Resolution: 0.01 dB	Upper channel of CH SEPA2 of lU2 with no suffix code in units of 1 dB. Resolution: 0.01 dB
BURST POWER MEASURE (MEAS△POWER,EXE)	l,w	dB m value of l with no suffix code in units of 1 dBm. Resolution: 0.01 dBm	pW value of w with no suffix code in units of 1 pW. Resolution: 1 pW	————	————

If the MEASURE function has caused a calculation error or execution error, the affected value is represented by "***".

■ Example RES?

RL

RL Reference Level

■ Function Sets the reference level (same function as RLV).

Header	Program command	Query	Response
RL	RL△l RL△a	RL?	l l: No units.

■ Value of l Value from –75 dBm to +30 dBm (Aux Input connector) (0.01 dB step)
Value from –50 dBm to +50 dBm (Main Input/Output connector)

■ Value of a

UP: LEVEL STEP UP
DN: LEVEL STEP DOWN

■ Suffix code

None : dBm
DB, DBM, DM: dBm

■ Initial setting l = -10 dBm

■ Example

```
RL△-100DBM
RL△5V
RL△-10V
RL△UP
```

RMK?

RMK? Reference Marker Position

■ Function Reads out the position of the reference marker.

Header	Program command	Query	Response
RMK?	————	RMK?	RMK△a

■ Value of a 0 to 500

■ Example RMK?

SNGLS Single Sweep Mode

■ Function Sets the sweep mode to single sweep.

Header	Program command	Query	Response
SNGLS	SNGLS	————	————

■ Example `SNGLS`

SP

SP Frequency Span

■ Function Sets the frequency span (same function as SPF).

Header	Program command	Query	Response
SP	SP△f SP△a	SP?	f f=-0 to 3000000000 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f 0Hz, 10kHz to 3.0GHz

■ Value of a
UP: FREQ SPAN STEP UP (same function as SPU)
DN: FREQ SPAN STEP DOWN(same function as SPD)

■ Suffix code
None: Hz(10^0)
HZ: Hz(10^0)
KHZ, KZ: kHz(10^3)
MHZ, MA: MHz(10^6)
GHZ, GZ: GHz(10^9)

■ Initial setting f=2.99GHz

■ Example `SP△1GHZ`

SRCHTH

SRCHTH Peak Search Threshold

■ Function Sets the threshold function for detecting a peak point.

Header	Program command	Query	Response
SRCHTH	SRCHTH△a	SRCHTH?	sw sw=OFF.ABOVE,BELOW

■ Value of sw 0,OFF: No threshold function
1,ON: Threshold function

■ Value of a ABOVE: Above detection
BELOW: Below detection

■ Suffix code None

■ Initial setting OFF: No threshold function

■ Example SRCHTH△ABOVE

SS

SS Frequency Step Size

■ Function Sets the frequency step size for stepping up/down the frequency.

Header	Program command	Query	Response
SS	SS△f	SS?	f f=0 to 3000000000 Transfers the data with no suffix code in units of 1 Hz.

■ Value of f 0Hz to 3.0GHz

■ Suffix code None: Hz(10^0)
HZ: Hz(10^0)
KHZ,KZ: kHz(10^3)
MHZ,MA: MHz(10^6)
GHZ,GZ: GHz(10^9)

■ Example SS△1MHZ

ST Sweep Time

■ Function Sets the frequency sweep time/time span.

Header	Program command	Query	Response
ST	ST△t ST△a	ST?	t t=1000 to 1000000000 Transfers the data with no suffix code in units of 1 μs.

■ Value of t 1msec to 1000 s (100 msec for frequency axis)

■ Value of a
UP: SWT UP
DN: SWT DOWN
AUTO: SWT AUTO

■ Suffix code
t: None : ms
US: μs
MS: ms
S: s
a: None

■ Initial setting Calculated value when AUTO is selected for SWT

■ Example
ST△AUTO
ST△20MS

SWP Single Sweep/ Sweep Status

■ Function Executes single sweep/Responds to sweep status (sweep completed/sweep in progress).
When accepted by the spectrum analyzer, the SWP command causes a single sweep to be executed by setting the sweep mode to 'SINGLE'.
The next command waits without being processed until its single sweep is completed (same function as TS). The SWP? Query command is used to Query the current sweep status (sweep completed/sweep in progress).

Header	Program command	Query	Response
SWP	SWP	SWP?	SWP△sw

■ Value of sw
0: Sweep completed
1: Sweep progress

■ Example
SWP
SWP?

SWSTART

SWSTART Restart Sweep

■ **Function** Restarts the sweep.

Header	Program command	Query	Response
`SWSTART`	`SWSTART`	—	—

■ **Example** `SWSTART`

TDLY

TDLY Delay Time

■ Function Sets the delay time from the point where trace time triggering occurs.

Header	Program command	Query	Response
TDLY	TDLY△t	TDLY?	t t=0 to 100000 Transfers the data with no suffix code in units of 1 μs.

■ Value of t 0sec to 100msec

■ Suffix code
None: ms
US: μs
MS: ms
S: s

■ Initial setting 0: 0s

■ Example `TDLY △20MS`

TM

TM Trigger

■ Function Sets the trigger switch and trigger source.

Header	Program command	Query	Response
TM	TM△a	TM?	a

■ Value of a
FREE: FREERUN
WIDEVID: wide IF Video
EXT: EXT

■ Suffix code None

■ Initial setting FREE: FREERUN

■ Example `TM△FREE`

TMMD

TMMD Trace Time Storage Mode

■ Function Selects the mode for processing the trace TIME waveform.

Header	Program command	Query	Response
TMMD	TMMD△n	TMMD?	TMMD△n

■ Value of n
0: NORMAL
1: MAX HOLD
2: AVERAGE
3: MIN HOLD
4: CUMULATIVE
5: OVER WRITE

■ Suffix code None
■ Initial setting 0: NORMAL
■ Example TMMD△0

TMWR

TMWR Trace Time Write Switch

■ Function Controls writing of the waveform to trace TIME.

Header	Program command	Query	Response
TMWR	TMWR△sw	TMWR?	TMWR△sw sw=ON,OFF

■ Value of sw
1,ON: ON
0,OFF: OFF

■ Suffix code None
■ Initial setting ON: ON
■ Example TMWR△ON

TRGS Trigger Switch

■ Function Switches the trigger switch to Free run or Triggered.

Header	Program command	Query	Response
TRGS	TRGS△a	TRGS?	a

■ Value of sw	FREE:	FREERUN
	TRGD:	TRIGGERED
■ Suffix code	None	
■ Initial setting	FREE:	FREERUN
■ Example	TRGS△FREE	

TRGSLP Trigger Slope

■ Function Selects the rising or falling slope of the trigger when trigger source is VIDEO or EXT mode.

Header	Program command	Query	Response
TRGSLP	TRGSLP△a	TRGSLP?	a

■ Value of a	RISE:	Rising edge
	FALL:	Falling edge
■ Suffix code	None	
■ Initial setting	RISE:	Rising edge
■ Example	TRGSLP△RISE	

TRGSOURCE

TRGSOURCE Trigger Source

■ **Function** Selects the trigger source. The trigger switch setting is not changed by this command.

Header	Program command	Query	Response
TRGSOURCE	TRGSOURCE△a	TRGSOURCE?	a

■ **Value of a** `WIDEVID:` WIDE IF VIDEO
`EXT:` EXT

■ **Suffix code** None

■ **Initial setting** `VID:` VIDEO

■ **Example** `TRGSOURCE△VID`

TSAVG

TSAVG Take Sweep with Averaging

■ **Function** Performs synchronous sweeping the number of times specified in the current Averaging setting.

Header	Program command	Query	Response
TSAVG	TSAVG	————	————

■ **Example** `TSAVG`

TSHOLD

TSHOLD Take Sweep with Max/Min Holding

■ Function Performs synchronous sweeping by the number of times specified in the current holding setting.

Header	Program command	Query	Response
`TSHOLD`	`TSHOLD`	—	—

■ Example `TSHOLD`

TSP

TSP Time Span

■ Function Sets the time span of the trace.

Header	Program command	Query	Response
`TSP`	`TSP△t`	`TSP?`	`t` t=1000 to 1000000000 Transfers the data with no suffix code in units of 1 µs

■ Value of t 1msec to 1000sec

■ Suffix code

None :	ms
US :	µs
MS :	ms
S :	sec

■ Initial setting 200msec

■ Example

`TSP△100`
`TSP△100S`

■ Restrictions according to model type and options

If there is no opt.04 high-speed time domain, the value of t becomes 20 ms to 1000 s.

UCL?

UCL? Query Uncal Status

■ **Function** Reads out the UNCAL status.

Header	Program command	Query	Response
UCL?	————	UCL?	UCL△n

■ **Value of n**
0: NORMAL
1: During UNCAL

■ **Example** UCL?

UNC

UNC Uncal Display ON/OFF

■ **Function** Specifies whether 'UNCAL' is displayed when UNCAL occurs.

Header	Program command	Query	Response
UNC	UNC△sw	UNC?	UNC△sw sw=ON,OFF

■ **Value of sw**
1,ON: ON
0,OFF: OFF

■ **Suffix code** None

■ **Initial setting** ON: ON

■ **Example** UNC△ON

VAVG Average

Function Sets averaging ON or OFF and sets the number of averaging processes.

Header	Program command	Query	Response
VAVG	VAVG△sw VAVG△n	VAVG?	n

Value of sw 1,ON: ON
0,OFF: OFF
Value of n 2 to 1024: Number of averaging processes
Suffix code None
Initial setting 8: 8 times
Example VAVG△ON
VAVG△128

VB

VB Video Bandwidth

Function Sets the video bandwidth (same function as VBW).

Header	Program command	Query	Response
VB	VB△f VB△a	VB?	f f=3 to 100000 or OFF Transfers the data with no suffix code in units of 1 Hz.

Value of f 3Hz to 100kHz
Value of a OFF: OFF
AUTO: AUTO
UP: VBW UP
DN: VBW DOWN
Suffix code f: None: Hz(10^0)
HZ: Hz(10^0)
KHZ,KZ: kHz(10^3)
MHZ,MA: MHz(10^6)
GHZ,GZ: GHz(10^9)
a: None
Initial setting Calculated value when VBW=AUTO.
Example VB△300HZ

VIEW

VIEW View

■ Function Stops writing of the waveform data.

Header	Program command	Query	Response
VIEW	VIEW△tr	———	———

■ Value of tr

TRA:	Trace A
TRB:	Trace B
TRTIME:	Trace TIME

■ Suffix code None

■ Example VIEW△TRB

XMA Trace A Spectrum Data

■ Function Writes/reads the spectrum data to/from trace A (main trace) memory.

Header	Program command	Query	Response
XMA	XMA△p,b	XMA?△p,d	b1,b2,b3 · · (ASCII) b1 b2 b3 · (BINARY)

■ Value of p 0 to 500(point No.)

■ Value of b `LOG scale:` Integer of 0.01 dBm unit (independent of display unit system) When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ Value of d 1 to 501(number of points)

■ Example `XMA△1,-2000`
`XMA?△1,2`(reads two-point data items starting from point 1)

XMB Trace B Spectrum Data

■ Function Writes/reads the spectrum data to/from to trace B (main trace) memory.

Header	Program command	Query	Response
XMB	XMB△p,b	XMB?△p,d	b1,b2,b3 · · (ASCII) b1 b2 b3 · (BINARY)

■ Value of p 0 to 500(point No.)

■ Value of b `LOG scale:` Integer of 0.01 dBm unit (independent of display unit system) When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ Value of d 1 to 501(number of points)

■ Example `XMB△1,-2000`
`XMB?△1,2`(reads two-point data items starting from point 1)

XMT Trace TIME Spectrum Data

■ Function Write/reads the spectrum data to/from the trace TIME memory.

Header	Program command	Query	Response
XMB	XMT△p,b	XMT?△p,d	b1,b2,b3 · · (ASCII) b1 b2 b3 · (BINARY)

■ Value of p 0 to 500(point No.)

■ Value of b LOG scale: Integer of 0.01 dBm unit (independent of display unit system)
When binary format is specified for response data, data for each point is composed of two bytes. The high-order byte is sent first.

■ Value of d 1 to 501(number of points)

■ Example XMT△1,-2000
XMT?△1,2(reads two-point data items starting from point 1)

SECTION 3
SAMPLE PROGRAMS

This section gives some examples of the Microsoft Quick Basic program that controls the MS8606A Spectrum Analyzer function from a personal computer which is used as a controller.

Note: Microsoft Quick Basic is a trade mark of the Microsoft Corporation.

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3.1 Precautions on Creating the Remote Control Program

Note the following points when writing remote control programs.

No.	Precaution	Description
1	Be sure to initialize each device.	There may be a number of the state in which each device is not proper to be actually sued due to operation on its own panel or execution of other programs. It is necessary to using individual devices with a prescribed condition resulting from initializing them. Execute initialization (INIT or *RST) of the functions proper to each device.
2	Do not send any command (related to the device) other than the INPUT #statement immediately after sending a query.	When a command other than the INPUT #statement is sent to the controller before the response to a query is read, the output buffer is cleared, and the response message disappears. For this reason, write the INPUT #statement in immediate succession to a query.
3	Create a program that avoids the exception processing of the protocol.	No.2 described above is one type of exception processing of the protocol. Avoid exception processing from occurring as requested. Avoid stoppage of execution caused by an error by providing a program with exception-processing section against exceptions that can be foreseen.
4	Protect RS-232C buffer overflow.	The RS-232C interface has a 512-byte data area as the internal receive buffer. The buffer overflow may occur depending on the processing. To protect the overflow, don't send a large amount of data(i.e. control commands) at a time for remote control using RS-232C. After sendind a command group, send *OPC? command to check the response for the synchronization before sending the next command.

3.2 Sample Programs

3.2.1 Initializing

<Example 1> Initializes the Spectrum Analizer

```
'+++++++++++++++++++++++++++++++++++++
   Sample program
'  <<Initialize>>
'+++++++++++++++++++++++++++++++++++++
'
' Setup parameter of PC Com. port
'   BAUD       : 2400 BPS
'   Parity     : NONE
'   Data bit   : 8 bits
'   Stop bit   : 1 bit
'   Terninator : LineFeed
'
OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
'
PRINT #1, "INI"'   Initializes Spectrum Analizer
'
END
```

There is a '*RST' command in another command for executing initialization. The '*RST' command is used to execute initialization over a wider range. The usage of the 'IP' command is identical to the 'INI' command.

For general usage of INI and *RST, first initialize the Spectrum Analyzer device functions with the IP or INI command, then use the program commands to set only the functions to be changed. This prevents the spectrum analyzer from being controlled while unnecessary functions are set.

3.2.2 Reading the frequency and level at marker point

<Example 2> Sets the center frequency to 500 MHz and span to 10 MHz, then displays the frequency and level reading at the peak point on the controller screen when a signal to be measured is received.

```
 1 '++++++++++++++++++++++++++++++++++++++++++
 2 '  Sample program
 3 '  <<Read out marker frequency & level>>
 4 '++++++++++++++++++++++++++++++++++++++++++
 5 '
 6 ' Setup parameter of PC Com. port
 7 '
 8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
 9 '
10 PRINT #1, "INI"'  Initialize Spectrum Analizer
11 '
12 PRINT #1, "CF 500MHZ"' Center fequency :500MHz
13 PRINT #1, "SP 10MHZ"'  Span frequency  :10MHz
14 PRINT #1, "SWP"'  Take a sweep
15 '
16 PRINT #1, "PCF"'  Set peak to center frequency
17 PRINT #1, "PRL"'  Set peak to reference level
18 PRINT #1, "MKPK"' Search peak
19 '
20 PRINT #1, "MKF?"' Query marker frequency
21 INPUT #1, FREQ'   Input marker frequency data
22 PRINT #1, "MKL?"' Query marker level
23 INPUT #1, LEVEL'  Input marker level data
24 '
25 'Print out the result(Frequency/Level)
26 PRINT USING "Marker  Frequency=####.### MHz";FREQ/1000000
27 PRINT USING "Marker  LEVEL=####.##  dBm";LEVEL
28 '
29 END
```

The center frequency and frequency span are set at line 12 and line 13 respectively. The SWP sweep command at line 14 does not execute the next message unless the sweep is completed. This command thus prevents the peak search and other program lines from being executed before the sweep is completed.

The PCF and PRL commands at lines 16 and 17 operate as follows: The former sets the peak point on the screen to the center frequency, and the latter sets its peak level center frequency to the reference level.

The "MKF?" and "MKL?" at lines 20 and 22 query the frequency and level at the marker point respectively, and the data is read with the INPUT#statement on the next line. When a command other than the INPUT#statement is sent before the response to a query is read, the output buffer is cleared, and the response message is deleted. For this reason, write the INPUT#statement immediately after a query.

Program execution result of <Example 2>

```
Marker Frequency=501.251△MHz
Marker LEVEL=-15.53dBm
```

Note: △is a space.

3.2.3 Reading trace data

<Example 3-1> Reads the trace level at all points when CF and SPAN are set to 500 MHz and 10 MHz respectively.

```
 1 '++++++++++++++++++++++++++++++++++++
 2 '  Sample program
 3 '  <<Read out trace data(ASCII)>>
 4 '++++++++++++++++++++++++++++++++++++
 5 '
 6 ' Setup parameter of PC Com. port
 7 '
 8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
 9 '
10 PRINT #1, "INI"'  Initialize Spectrum Analizer
11 '
12 PRINT #1, "CF 500MHZ"' Center fequency :500MHz
13 PRINT #1, "SP 10MHZ"'  Span frequency  :10MHz
14 PRINT #1, "TS"'   Take a sweep
15 '
16 DIM TRACE(501)'   Define read data area.
17 PRINT #1, "BIN 0"'Set read out data type to ASCII
18 '
19 FOR I = 0 TO 500' Repeat trace(0) to trace(500):501 points
20 PRINT #1, "XMA? " + STR$(I) + ",1"'   Query trace data
21 INPUT #1, TRACE(I)'    Read out trace data
22 'Print out trace data
23 PRINT USING "###.##dBm"; TRACE(I) / 100
24 NEXT I
25 '
26 END
```

The "BIN_0" at line 17 is a command for specifying ASCII as the response data format. The ASCII or BINARY transfer format can be specified for the "XMA?", "XMB?" and "XMT?" queries for reading trace data.

The example 3-2 blocks the trace data at every 10 points, and reads it.

<Example 3-2>   Blocks the trace data at every 10 points, and reads it.

```
 1 '++++++++++++++++++++++++++++++++++++++
 2 '  Sample program
 3 '  <<Read out trace data(ASCII) BLOCKING>>
 4 '++++++++++++++++++++++++++++++++++++++
 5 '
 6 ' Setup parameter of PC Com. port
 7 '
 8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
 9 '
10 PRINT #1, "INI"'  Initialize Spectrum Analizer
11 '
12 PRINT #1, "CF 500MHZ"' Center fequency :500MHz
13 PRINT #1, "SP 10MHZ"'  Span frequency  :10MHz
14 PRINT #1, "WSP"'  Take a sweep
15 '
16 DIM TRACE(501)'   Define read data area
17 PRINT #1, "BIN 0"'Set read out data type to ASCII
18 '
19 FOR I = 0 TO 490 STEP 10
20  Repeat trace(0) to trace(499):500 points
21  Blocking 10 trace data
22     PRINT #1, "XMA? " + STR$(I) + ",10"'   Query trace data
23                  Read out trace data
24      INPUT #1, TRACE(I), TRACE(I + 1), TRACE(I + 2), TRACE(I + 3),
TRACE(I + 4), TRACE(I + 5), TRACE(I + 6), TRACE(I + 7), TRACE(I + 8),
TRACE(I + 9)
25     PRINT TRACE(I), TRACE(I + 1), TRACE(I + 2), TRACE(I + 3), TRACE(I
+ 4), TRACE(I + 5), TRACE(I + 6), TRACE(I + 7), TRACE(I + 8),TRACE(I + 9)
26 NEXT I
27 PRINT #1, "XMA? 500,1"'     Query last trace data:trace(500)"
28 INPUT #1, TRACE(500)
29'
30 FOR I = 0 TO 500' Print out trace data
31     PRINT USING "###.##dBm"; TRACE(I) / 100
32 NEXT I
33 '
34 END
```

3.2.4 Delta marker

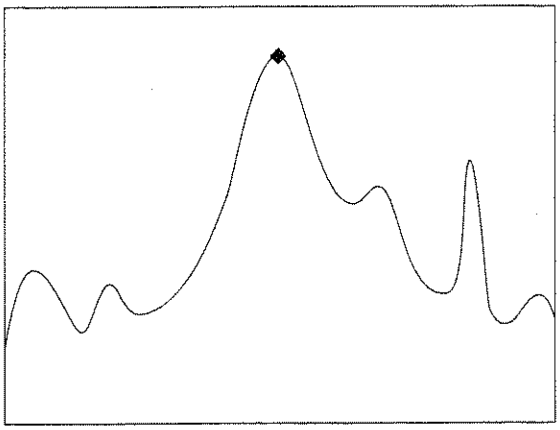
<Example 4> Using a delta marker, reads out the frequency and level differences between a peak point and the next peak point.

```
1 '+++++++++++++++++++++++++++++++++++++++++++++++
2 ' Sample program
3 '  <<Read out delta marker frequency & level>>
4 '+++++++++++++++++++++++++++++++++++++++++++++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI"'          Initialize Spectrum Analizer
11 '
12 PRINT #1, "FA 50MHZ"'     Start fequency :500MHz"
13 PRINT #1, "FB 2GHZ"'      Stop frequency   :2GHz
14 PRINT #1, "TS"'           Take a sweep
15 '
16 PRINT #1, "MKR 0"'        Set marker to "Normal"
17 PRINT #1, "MKPK"'         search peak
18 PRINT #1, "MKR 1"'        Set marker to "Delta"
19 PRINT #1, "MKPK NH"'      search Next peak
20 '
21 PRINT #1, "MKF?"'         Query Delta marker frequency
22 INPUT #1, DFREQ'          Input Delta marker frequency data
23 PRINT #1, "MKL?"'         Query Delta marker level
24 INPUT #1, DLEVEL'         Input Delta marker level data
25 '                         Print out the result(Frequency/Level)
26 PRINT USING "Delta Frequency=####.### MHz"; DFREQ / 1000000
27 PRINT USING "Delta     level=####.##  dB"; DLEVEL
28 '
29 END
```

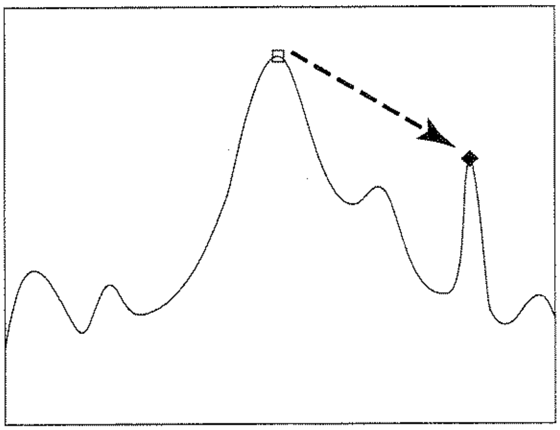
The "MKR △ 1" at line 18 is used to set the marker mode to DELTA, so that the reference marker can also be set together to the current marker position.

The "MKPK △ NH" at line 19 sets the marker search to NEXT PEAK to move the current marker to NEXT PEAK point.

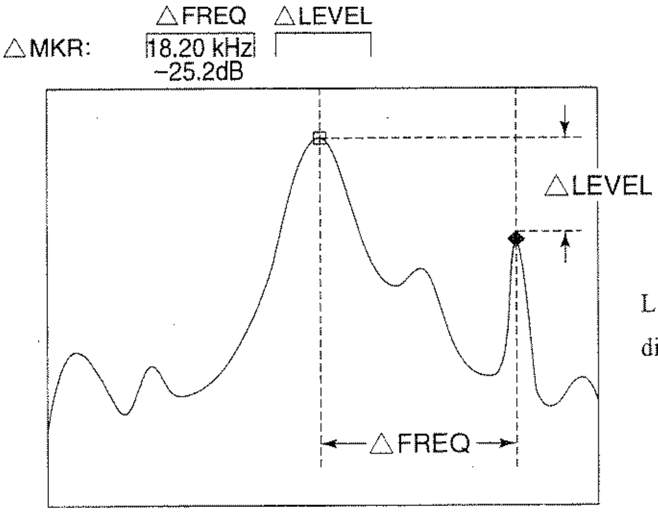
The "MKF?" and "MKL?" at lines 21 and 23 query reading the frequency and level at the current marker position while the marker mode is NORMAL. It is also used to query reading the frequency and level differences between the current marker and the reference marker while the marker mode is DELTA.



Executing PEAK SEARCH (MKPK) at line 17 allows the current marker to be set to the peak point.



Line 19 allows the reference marker to be set together to the current marker position. Executing NEXT PEAK SEARCH MKPK△NH at line 18 allows the current marker



Lines 21 to 24 read out the △FREQ and △LEVEL displayed in the upper left of screen.

3.2.5 Gate functions

<Example 5>   Reads out spectrum data by observing the burst wave using the gate function.

```
 1 '++++++++++++++++++++++++++++++++++++++
 2 '  Sample program
 3 '  <<Gate sweep>>
 4 '++++++++++++++++++++++++++++++++++++++
 5 '
 6 ' Setup parameter of PC Com. port
 7 '
 8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
10 '
11 PRINT #1, "INI"'          Initialize Spectrum Analizer
12 '
13 DIM TRACE(501)'                    Define read data area
14 PRINT #1, "CF 500MHZ"'             Center fequency :500MHz
15 PRINT #1, "SP 10MHZ"'              Span frequency  :10MHz
16 PRINT #1, "RB 100KHZ"'             Resolution BW   :100kHz
17 PRINT #1, "TRGSOURCE WIDEVID"'     Trigger source  :Wide IF video
18 PRINT #1, "GD 50US"'               Gate delay      :50 usec
19 PRINT #1, "GL 400US"'              Gate length     :400 usec
20 '
21 PRINT #1, "GATE ON"'               Gate sweep On
22 '
23 FOR TMR = 0 TO 25000
24 NEXT TMR'                          Wait
25 '
26 FOR I = 0 TO 500'                  Read out & print trace data
27     PRINT #1, "XMA? " + STR$(I) + ",1"
28     INPUT #1, TRACE(I)
29     PRINT USING "###.##dBm"; TRACE(I) / 100
30 NEXT I
31 '
32 END
```

When the burst waveform shown in Fig. 8-1 is observed, the spectrum shown in Fig. 8-2 (a) is output. This function can conveniently be used to observe the spectrum of the ON interval (interval shown by A in Fig. 8-1) in this waveform. This program uses the wide IF video trigger signal as a gate source signal.

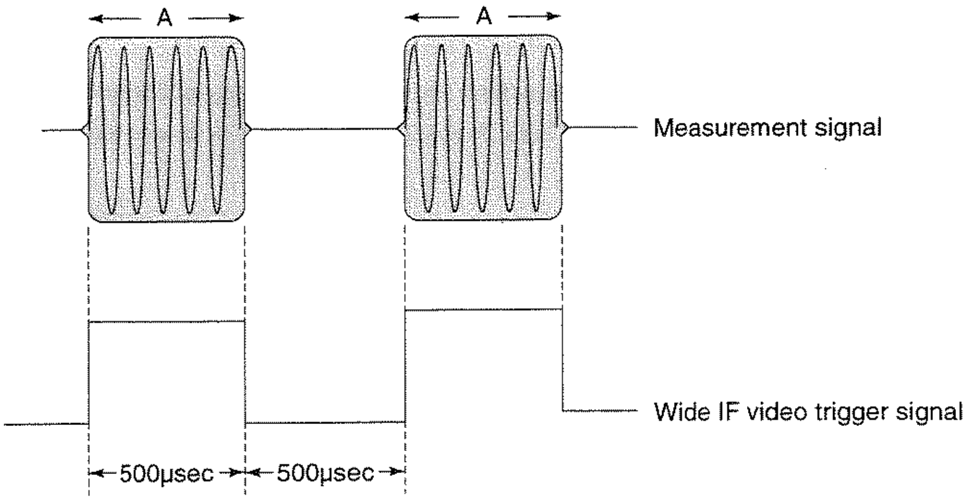


Fig. 8-1 Burst Waveform

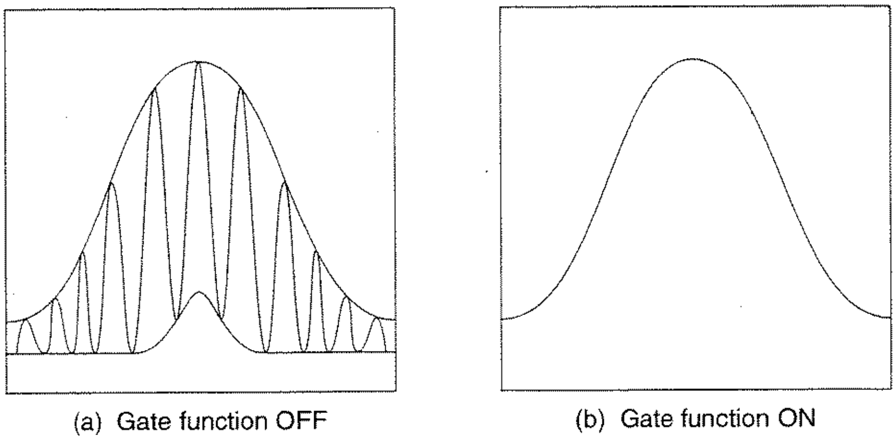


Fig. 8-2 Burst Wave Spectrum

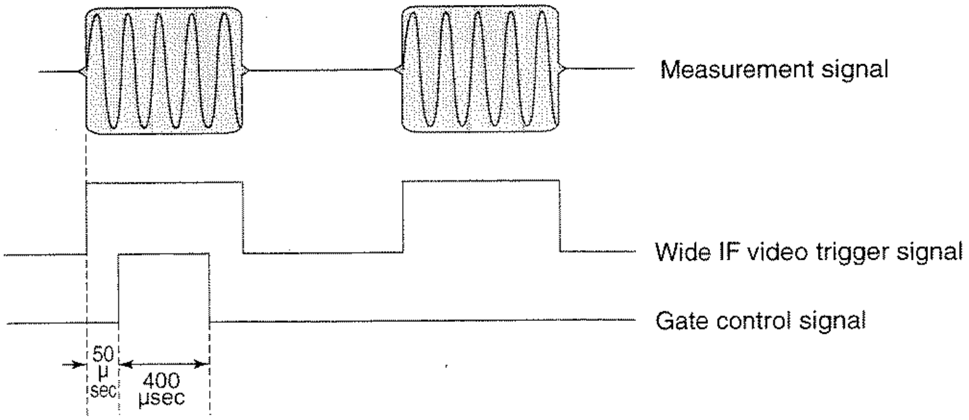


Fig. 8-3 Sample Program for Gate-Control Signal Generation Timing

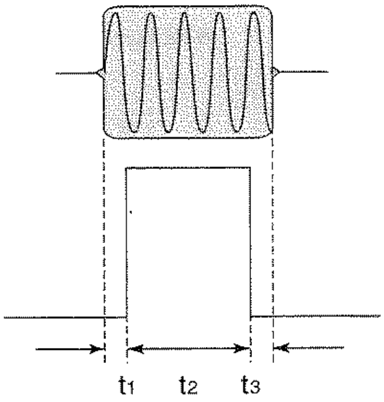
The RBW command at line 16 sets RBW to the optimum value depending on the GATE conditions (GATE DELAY: t1, GATE LENGTH: t2) as shown in Table 8-1 below.

The block from line 17 sets the trigger signal, and the block from lines 18 to 20 sets the gate conditions. The gate function is set to ON at line 21. The waiting time is granted at liens 23 and 24 because it takes time to form a perfect waveform which is fully connected.

The block from liens 26 to 30 allows trace data to be output by the "XMA?" query. The spectrum can be observed as shown in Fig. 8-2(b) by executing this program.

Table 8-1 RBW Optimum Values

RBW	t_1	t_2	t_3
1 kHz	≧3 msec	≧20 μsec	≧1 μsec
3 kHz	≧1 ms		
10 kHz	≧230 μsec		
30 kHz	≧200 μsec		
100 kHz	≧20 μsec		
300kHz	≧15 μsec		
1 MHz	≧10 μsec		



3.2.6 Adjacent-channel leakage power measurement

<Example 6> Subroutine for adjacent-channel leakage power measurement

```
 1 '+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 2 '  Sample program
 3 '  <<Adj ch Power measure>>
 4 '+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 5 '
 6 ' Setup parameter of PC Com. port
 7 '
 8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
 9 '
10 PRINT #1, "INI"'            Initialize Spectrum Analizer
11 '
12 PRINT #1, "CF 500MHZ"'      Center fequency :500 MHz
13 PRINT #1, "SP 80KHZ"'       Span frequency  :80 kHz
14 '
15 GOSUB ADJ'                  Call Adj. CH. Power measure subroutine
16 END
17 '
18 '[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[
19 ' Adj ch Power MEASURE SUBROUTINE
20 ']]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]
21 ADJ:
22 '
23 PRINT #1, "ADJCH BOTH"
24 PRINT #1, "ADJCHBW 8.5KHZ"
25 PRINT #1, "ADJCHSP 12.5KHZ"
26 PRINT #1, "ADJCHSPF 25KHZ"
27 PRINT #1, "MADJMOD MOD"
28 '
29 PRINT #1, "SWP"
30 PRINT #1, "MEAS ADJ,EXE"
31 '
32 PRINT #1, "RES?"'           Query the result
33 INPUT #1, LWLVL1, UPLVL1, LWLVL2, UPLVL2' Read out the result data
34 '                           response-1:Lower channel power (near)
35 '                           response-2:Upper channel power (near)
36 '                           response-3:Lower channel power (Far)
37 '                           response-4:Upper channel power (Far)
38 '
39 PRINT USING "Lower side CH1 Level=####.###dBm"; LWLVL1
40 PRINT USING "Upper side CH1 Level=####.###dBm"; UPLVL1
41 PRINT USING "Lower side CH2 Level=####.###dBm"; LWLVL2
42 PRINT USING "Upper side CH3 Level=####.###dBm"; UPLVL2
43 '
44 RETURN
```

This ADJ program is a subroutine, which requires the center frequency and frequency span to be set to appropriate values in the main program. Then it is executed.

The block from lines 23 to 26 sets adjacent-channel measurement conditions, which is both the upper and lower channels, the 8.5 kHz channel width, 12.5 kHz channel 1 separation , and 25.0 kHz channel 2 separation. After the sweep is executed by the "TS" command at line 29, the adjacent-channel leakage power is measured at line 30. Line 32 queries reading the measured value at line 33.

The program in <Example 8> for measuring a modulated wave relative to the total power can be changed to a program for measurement relative to the reference level by rewriting line 27 as shown below:

```
        PRINT #1, "MADJMOD UNMD"
```

In this case, perform the following operations before activating this subroutine.

Put the input signal in the unmodulated state and execute PEAK → CF and PEAK → REF. Then return to the modulated state.

3.2.7 Occupied frequency bandwidth measurement

<Example 7> Subroutine for occupied frequency bandwidth measurement using N% of POWER method

```
1 '++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
2 '  Sample program
3 '  <<Occ BW measure>>
4 '++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
5 '
6 ' Setup parameter of PC Com. port
7 '
8 OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
9 '
10 PRINT #1, "INI"'          Initialize Spectrum Analizer
11 '
12 PRINT #1, "CF 500MHZ"'    Center fequency :500MHz
13 PRINT #1, "SP 50KHZ"'     Span frequency  :50kHz
14 '
15 GOSUB OBW'                Call Occ BW measure subroutine
16 END
17 '
18 '[[[[[[[[[[[[[[[[[[[[[[[[[
19' OBW MEASURE SUBROUTINE
20 ']]]]]]]]]]]]]]]]]]]]]]]]]
21 OBW:
22 '
23 PRINT #1, "MOBW N"'       OccBW measure method : n% method
24 PRINT #1, "OBWN 99"'      n%                   : 99%
25 PRINT #1, "DETM SMP"'     Detection mode       : Sample
26 PRINT #1, "VAVG 16"'      Average sweep count  : 16
27 PRINT #1, "VAVG ON"'      Average sweep On
28 '
29 PRINT #1, "TSAVG"'        Take average sweep
10 '
31 PRINT #1, "MEAS OBW,EXE"' Perform OccBW measure
32 '
33 PRINT #1, "RES?"'         Query the result
34 INPUT #1, OBWFREQ, CNTRFRQ'   Read out the result data
35 '                          response-1:Occ BW frequency
37 '                         response-2:Signal center frequency
38 '
39 PRINT USING "CENTER FREQ=####.###MHz"; CNTRFRQ / 1000000!
40 PRINT USING "##%BW  FREQ=####.###kHz"; NPC; OBWFREQ / 1000
41 '
42 RETURN
```

Line 24 sets the N% value to set n = 99% in <Example 9> by sending the OBWN command for setting the occupied frequency bandwidth to MS8606A at line 23 and 24. Line 25 sets the detection mode to SAMPLE. Line 26 set the averaging count and line 27 averaging to ON respectively.

Line 29 issues the "TSAVG command to repeat the sweep by the required number of times for averaging processing. Line 31 measures the occupied frequency bandwidth of the averaging-processed waveform. Line 33 queries reading the occupied frequency bandwidth and the center frequency of the frequency bandwidth at line 34.

To make a measurement using X dB DOWN, rewrite lines 23 and 24 as shown below:

```
                    .
                    .
PRINT @SPA;"OBWXDB 25"
PRINT @SPA;"MOBW XDB"
                    .
                    .
```

3.2.8 Burst wave average power measurement

<Example 8>   Subroutine for burst wave average power measurement Fig.

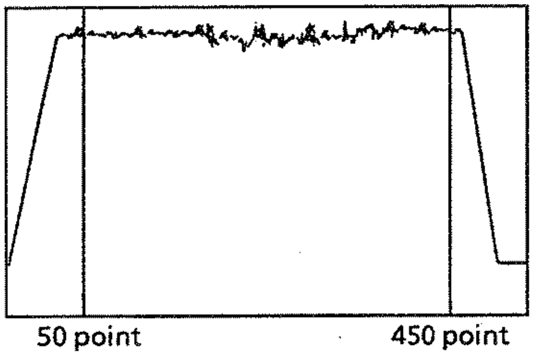
```
'++++++++++++++++++++++++++++++++++++++
'   Sample program
'   <<Burst power measure>>
'++++++++++++++++++++++++++++++++++++++
'
' Setup parameter of PC Com. port
'
OPEN "COM1:2400,N,8,1,CD500,DS0,LF" FOR RANDOM AS #1
'
PRINT #1, "INI"'          Initialize Spectrum Analizer
'
PRINT #1, "CF 500MHZ"'          Center fequency :500MHz
PRINT #1, "DFMT TIME"'          Display         :Trace-Time(Zero span mode)
PRINT #1, "TRGSOURCE WIDEVID"'  Trigger source  :Wide IF video
PRINT #1, "TRGS TRGD"'          Trigger sweep On
PRINT #1, "TDLY -60US"'         Delay time      :-60 usec
PRINT #1, "TSP 12MS"'                     Time span       :12 msec
PRINT #1, "TS"'                 Take a sweep
'
GOSUB MEASPWR'                  Call burst power measure subroutine
'
END
'
'[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[[
' Burst power measure SUBROUTINE
']]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]]
MEASPWR:
'
PRINT #1, "PWRSTART 50"'        Power measure start point :50 point(1 div)
PRINT #1, "PWRSTOP 450"'        Power measure stop point  :450 point(9 div)
'
PRINT #1, "MEAS POWER,EXE"'      Perform power measure
'
PRINT #1, "RES?"'               Query the result
INPUT #1, PWRDB, PWRW'          Read out the result
'
PRINT USING "####.##dBm ####.##mW"; PWRDB; PWRW / 1E+09
RETURN
```

This program is a subroutine that measures the burst wave average power.

Lines 29 and 30 set the measurement start and stop points on the screen display.

The average power is measured at line 32.

Data can be obtained as a value with dBm units or pW UNITS.



When a waveform is displayed on the screen as shown in the left diagram (TIME domain), the average power between 50 point and 450 point is measured

Before calling the subroutine, lines 12 to 18 set the center frequency, time delay, etc. to execute the sweep.

3.3 Precautions on Creating the GPIB Program

Note the following points when writing remote control programs.

No.	Precaution	Description
1	Be sure to initialize each device.	There may be a number of the state in which each device is not proper to be actually used due to operation on its own panel or execution of other programs. It is necessary to using individual devices with a prescribed condition resulting from initializing them. Execute the following. ① Initializing the interface functions (Send IFC) ② Initializing message exchange functions of each device (DevClear) ③ Initializing the functions proper to each device (INI or *RTS)
2	Do not send any command (related to the device) other than the Receive @ statement immediately after sending a query.	If MLA is received when a command other than the Receive @ statement is sent to the controller before the response to a query is read, the output buffer is cleared, and the response message disappears. For this reason, write the Receive @ statement in immediate succession to a query.
3	Create a program that avoids the exception processing of the protocol.	Avoid stoppage of execution (caused by an error) by means of providing a program with exception-processing section against exceptions that can be foreseen.
4	Confirm the interface function of each device (subset).	Execution of program does not advance if necessary subset (s) has (have) not been prepared in the device. Be sure to confirm the subset (s) of each device. Also confirm that each device complies with IEEE488.2.

3.4 Sample Program (GPIB)

3.4.1 Initializing (GPIB)

<Example 9>   Initializes the MS8606A

```
 1 '++++++++++++++++++++++++++++++++++++++++
 2 '  GPIB control sample program
 3 '  <<Initialize GPIB bus & MS8606A>>
 4 '++++++++++++++++++++++++++++++++++++++++
 5 REM $INCLUDE: 'C:¥YAT-GPIB¥QBASIC¥QBEDECL.BAS'
 6 DECLARE SUB gpiberr (msg&)
 7 '
 8 SPA% = 1'  Set SPA GPIB adress
 9 CALL SendIFC(0)'     Send GPIB bus interface clear
10 CALL DevClear(0, SPA%)'  Send DeviceClear to MS8606A
11 CALL Send(0, SPA%, "IP", NLend)'   Send Initialize comand "IP"
12 END
13 '
```

Line 9: Interface-clears GPIB bus.

Line 10: Specifies Spectrum Analyzer address, and sends device-clear.

Line 11: Sends "IP" command to for initialization.

There is a '*RST' command in another GPIB command for executing initialization. The '*RST' command is used to execute initialization over a winder range. The usage of the 'IP' command is identical to the 'INI' command.

For general usage of INI and *RST, first initialize the Spectrum Analyzer device functions with the IP or INI command, then use the program commands to set only the functions to be changed. This prevents the Spectrum Analyzer from being controlled while unnecessary functions are set.

3.4.2 Reading trace data (GPIB)

<Example 10> Performs the same operation as Example 3-1, using GPIB.

```
 1 ' ++++++++++++++++++++++++++++++++++++++++
 2 '  GPIB control sample program i
 3 ' <<Read out Trace data>>
 4 ' ++++++++++++++++++++++++++++++++++++++++
 5 REM $INCLUDE: 'C : ¥AT-GPIB¥QBASIC¥QBDECL.BAS'
 6 DECLARE SUB gpiberr (msg$)
 7 '
 8 SPA% = 1'                              Set SPA GPIB address
 9 '
10 '        Initialize GPIB bus & MS8606A
11 CALL SendIFC(0)
12 CALL DevClear(0, SPA%)
13 CALL Send(0, SPA%, "IP", NLend)
14 '
15 '
16 CALL Send(0, SPA% "CF 500MHZ", NLend)'  Center frequnecy :500MHz
17 CALL Send(0, SPA%, "SP 10MHZ", NLend)'  Span frequnecy :10MHz
18 CALL Send(0, SPA%, "TS", NLend)         Take a sweep
19 '
20 DIM TRACE(501)'                         Define read data area
21 CALL Send(0, SPA%, "BIN 0", NLend)'     Set read out data type to
ASCII
22 '
23 FOR I = 0 TO 500'                       Repeat trace(0) to
trace(500):501 points
24 CMD$ = "XMA?" + STR$(I) + ",1"
25 CALL Send(0, SPA%, CMD$, NLend)'        Query trace data
26 '
27 DATA$ = SPACE$(100)
28 CALL Receive(0, SPA%, DATA$, NLend)'    Read out trace data
29 '
30 TRACE(I) = VAL(DATA$)'                  Store readout data to trace
data area
31 '                                       Print out trace data
32 PRINT USING "Trace-A(###) ####.##"; I; TRACE(I)/100
33 NEXT I
34 '
35 '
36 END
```

Lines 11 to 13: Initializes GPIB bus and the Spectrum Analyzer.

CALL Send( ) statements after line 13: Sends the Spectrum Analyzer commands.
Command termination code is specified toNLend (line-feed code, New-Line or LF).

CALL Receive( ) statements at line 28: Reads out trace data from the Spectrum Analyzer.
Termination code of the read data is specified to NLend.

Line 30: Converts the read character-string data to numeric data, and stores it at trace-data store area.

APPENDIXES

TABLE OF CONTENTS

APPENDIX A
TABLE OF SPECTRUM ANALYZER DEVICE DEPENDENT INITIAL SETTINGS

Table A Device-Dependent Initial Settings (1/2)

Group	Outline	Control item	Initial setting data	
			TRACE-A,B	TRACE-TIME
Frequency	Selects the mode for setting a frequency band.	FREQUENCY MODE	START-STOP	
	Sets the start frequency	START FREQUENCY	10 MHz	---------
	Sets the center frequency	CENTER FREQUENCY	1.505 GHz	
	Sets the stop frequency	STOP FREQUENCY	3 GHz	---------
	Sets the frequency span	FREQUENCY SPAN	2.99 GHz	*0 Hz
	Sets the center-frequency s tep size	CENTER FREQ STEP SIZE	1 GHz	
	Select Band	BAND SELECT	Band1	
Level	Sets the reference level	REFERENCE LEVEL	– 10 dBm	
	Set the reference level s tep size	REF LEVEL STEP SOZE	AUTO:1div	
	Sets the display line	DISPLAY LINE	OFF	
	Sets the display line level	DISPLAY LINE LEVEL	– 60 dBm	
	Selects the ABS or REL marker level	MARKER LEVEL ABS/REL	A:ABS B:ABS	ABS
Display mode	Selects the display mode	DISPLAY MODE	TRACE-A	
	Selects the mode for processing a waveform	TRACE STORAGE MODE	NORMAL	NORMAL
	Number of traces averaged	AVERAGE No.	8 times	
	Selects the detection mode	DETECTION MODE	PEAK	SAMPLE
	Sets the delay time	DELAY TIME	---------	0 sec
	Sets the time span	TIME SPAN	---------	100 msec
	Sets the active marker when display mode is trace A/B	TRACE-A/B ACTIVE MKR	TRACE-A	---------
	Selects the marker mode	MARKER MODE	NORMAL	
	Specifies the zone-marker center	ZONE MAKER CENTER	250 point	250 point
	Specifies the zone-marker width	ZONE MAKER WIDTH	51 point(1 div)	*1 point
	Search resolution	SEARCH RESOLUTION	5 dB	
	Search threshold	THRESHOLD	OFF	
Sweep function	Sets the sweep mode	SWEEP MODE	CONTINUOUS	
	Sets the gate sweep function to ON/OFF	GATE SWEEP	OFF	
	Sets the gate delay time	GATE DELAY	0 sec	
	Sets the gate length	GATE LENGTH	1 msec	
	Sets the trigger switch mode	TRIGGER SWITCH	FREE RUN	FREE RUN
	Sets the trigger source	TRIGGER SOURCE	Wide IF Video	
	Selects the trigger slope	TRIGGER SLOPE	RISE	

Table A Device-Dependent Initial Settings (2/2)

Group	Outline	Control item	Initial setting data	
			TRACE-A,B	TRACE-TIME
Waveform writing/reading	Sets the trace write switch to ON/OFF	TRACE WRITE SWITCH	ON	ON
	Sets the trace read switch to ON/OFF	TRACE READ SWITCH	ON	ON
Coupled function	Selects the mode for setting the resolution bandwidth	RESOLUTION BANDWIDTH	AUTO	AUTO
	Selects the mode for setting the video bandwidth	VIDEO BAND WIDTH	AUTO	AUTO
	Selects the mode for setting the sweep time	SWEEP TIME	AUTO	AUTO
	Selects the mode for setting the RF attenuator	RF ATTENUATOR	AUTO	
Measure function	Selects the item to be measured	MEAURE ITEM	OFF	
	Selects the occupied frequency bandwidth measurement method	OBW MEASURE METHOD	Not initialized *RST: N%	
	Sets the occupied frequency bandwidth to N%	OBW N% VALUE	Not initialized *RST: 99%	
	Sets the occupied frequency to X dB	OBW XdB VALUE	Not initialized *RST: 25dB	
	Selects the adjacent channel leakage power measurement method	ADJ-CH MEASURE METHOD	Not initialized *RST: R:TOTAL POWER	
	Selects the adjacent channel leakage power measurement method	ADJ-CH GRAPH	Not initialized *RST: ON	
	Selects the adjacent channel	ADJACENT CH SELECT	Not initialized *RST: BOTH SIDES	
	Sets the adjacent separation 1	ADJACENT CH SEPARATION1	Not initialized *RST: 12.5 kHz	
	Sets the adjacent separation 2	ADJACENT CH SEPARATION2	Not initialized *RST: 25.0 kHz	
	Sets the adjacent channel bandwidth	ADJACENT CH BANDWIDTH	Not initialized *RST: 8.5 kHz	
	Sets the adjacent channel center line display	ADJ-CH CENTER LINE	Not initialized *RST: ON	
	Sets the adjacent channel band line display	ADJ-CH BAND LINE	Not initialized *RST: OFF	
	Selects the noise measurement method	NOISE MEASURE METHOD	Not initialized *RST: ABS	
	BURST POWER START POINT	BURST POWER MEASURE START POINT	100 point	
	BURST POWER STOP POINT	BURST POWER MEASURE STOP POINT	400 point	
Calibration	Automatical calibration	CAL	ON	
CAL/ UNCAL	Displays couple failure	UNCAL DISPLAY	Not initialized. Initialized to ON at power-on.	

Note: • In the above table, in place of the parameters not initialized by the INIT command or P+reset key, the initial settings (indicated by *RST) initialized by the *RST command are listed. In place of the parameters not initialized by the *RST command, the values at the shipment are listed.

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