OPERATION MANUAL
(Basic Operating Instructions)
VOLUME I
FOR
SPECTRUM ANALYZER
MODEL MS2670A

NSN: 6625-01-425-2551

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MS2670A
Spectrum Analyzer
Operation Manual
Vol. 1
(Basic Operating Instructions)

First Edition

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

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

Document No.: M-W1033AE-1.0

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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.

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

(Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.)

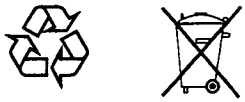
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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.

MS2670A Spectrum Analyzer
Operation Manual Vol. 1 (Basic Operating Instructions)

July 1996 (First Edition)

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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.

Falling Over

3. 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.

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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.

   T5A indicates a time-lag fuse.
   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

Cleaning

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

Check Terminal

3. • Maximum DC voltage ratings:
   RF Input 0 Vdc
   TG Output 0 Vdc
   • Maximum AC power ratings:
   RF Input +30 dBm
   TG Output +20 dBm
   • NEVER input a >+30 dBm and >0 Vdc power to RF Input.
   • NEVER input a >+20 dBm and >0 Vdc reverse power to TG Output.
   • Excessive power may damage the internal circuits.

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For Safety

CAUTION ⚠

Memory Back-up Battery

4. The power for memory back-up is supplied by a Poly-carbonmonofluoride Lithium Battery. This battery should only be replaced by a battery of the same type.

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

Storage Medium

5. This equipment stores data and programs using Memory card. 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 memory card from equipment being accessed.
   - Isolate the card from static electricity.
   - The back-up battery in the SRAM memory card has a limited life; replace the battery periodically.

   For replacing the battery, see page 2-15 of the Operation Manual Vol. 1.

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CAUTION

THIS EQUIPMENT CONTAINS PARTS AND ASSEMBLIES SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSERTING PRINTED CIRCUIT BOARDS.

ESD
CLASS 1

GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

- USE WRIST GROUND STRAPS OR MANUAL GROUNDING PROCEDURES.
- KEEP ESDS ITEMS IN PROTECTIVE COVERING WHEN NOT IN USE.
- GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT.
- PERIODICALLY CHECK CONTINUITY AND RESISTANCE OF GROUNDING SYSTEM.
- USE ONLY METALIZED SOLDER SUCKERS.
- HANDLE ESDS ITEMS ONLY IN PROTECTED AREAS.

MANUAL GROUNDING PROCEDURES

- MAKE CERTAIN EQUIPMENT IS POWERED DOWN.
- TOUCH GROUND BEFORE REMOVING ESDS ITEMS.
- TOUCH PACKAGE OF REPLACEMENT ESDS ITEM TO GROUND BEFORE OPENING.
- TOUCH GROUND BEFORE INSERTING REPLACEMENT ESDS ITEMS.

ESD PROTECTIVE PACKAGING AND LABELING

- PROTECTIVE COVERING OF ANTISTATIC MATERIAL WITH AN OUTER WRAP OF EITHER TYPE 1 ALUMINIZED MATERIAL OR CONDUCTIVE PLASTIC FILM — OR HYBRID LAMINATED BAGS HAVING AN INTERIOR OF ANTISTATIC MATERIAL WITH AN OUTER METALIZED LAYER.
- LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE.

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Quality Guarantee

Anritsu Corporation guarantees that this instrument meets the published specifications at shipping inspection, and that this inspection was performed using measuring instruments calibrated in accordance with the standards of the Japan Electronics Laboratory (JEL) and the Radio Research Laboratory (RRL).

Warranty

Anritsu Corporation warrants this instrument for 1 year after shipment and will, at its own discretion, either repair or replace it free of charge if any fault occurs within 1 year after shipment, provided that the fault is not the result of a natural disaster, misuse, misoperation, or unauthorized alteration or repair. This warranty is valid only for the original purchaser of this instrument and is not transferrable if the instrument is resold.

Anritsu Corporation is not responsible for any losses caused by the malfunctioning of this equipment.

In the unlikely event of a fault occurring, please notify Anritsu Corporation or its Representative Office as soon as possible.

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

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

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

Consequently, if this equipment is built into remote monitoring systems that use MODEMs, the standby function of this equipment must be modified.

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ABOUT DETECTION MODE

This instrument is a spectrum analyzer which uses a digital storage system. The spectrum analyzer makes level measurements in frequency steps obtained by dividing the frequency span by the number of measurement data points (501). This method of measurement cannot detect the signal peak level if the spectrum of a received signal is narrower than these frequency steps.

To resolve this problem, this instrument usually operates in positive peak detection mode and normal detection mode. In the positive peak detection mode, the highest level within the frequency range between the sample points can be held and traced. In the normal detection mode, both the positive peak and the negative peak can be traced.

Positive peak detection mode should be used for almost all measurements including normal signal level measurement, pulsed noise analysis, and others. It is impossible to measure the signal level accurately in sample detection mode or in negative peak detection mode.

Use of sample detection mode is restricted to random noise measurement, occupied frequency bandwidth measurement for analog communication systems, and adjacent-channel leakage power measurement, etc.

Measurement	item
• Normal signal	POS PEAK
• Random noise	SAMPLE
• Pulsed noise	NORMAL (POSI-NEG)
• Occupied frequency bandwidth, adjacent-channel leakage power (for analog communication systems)	SAMPLE
• Occupied frequency bandwidth, adjacent-channel leakage power (for digital communication systems)	POS PEAK or SAMPLE

When a detection mode is specified as one of the measurement methods, make the measurement in the specified detection mode.

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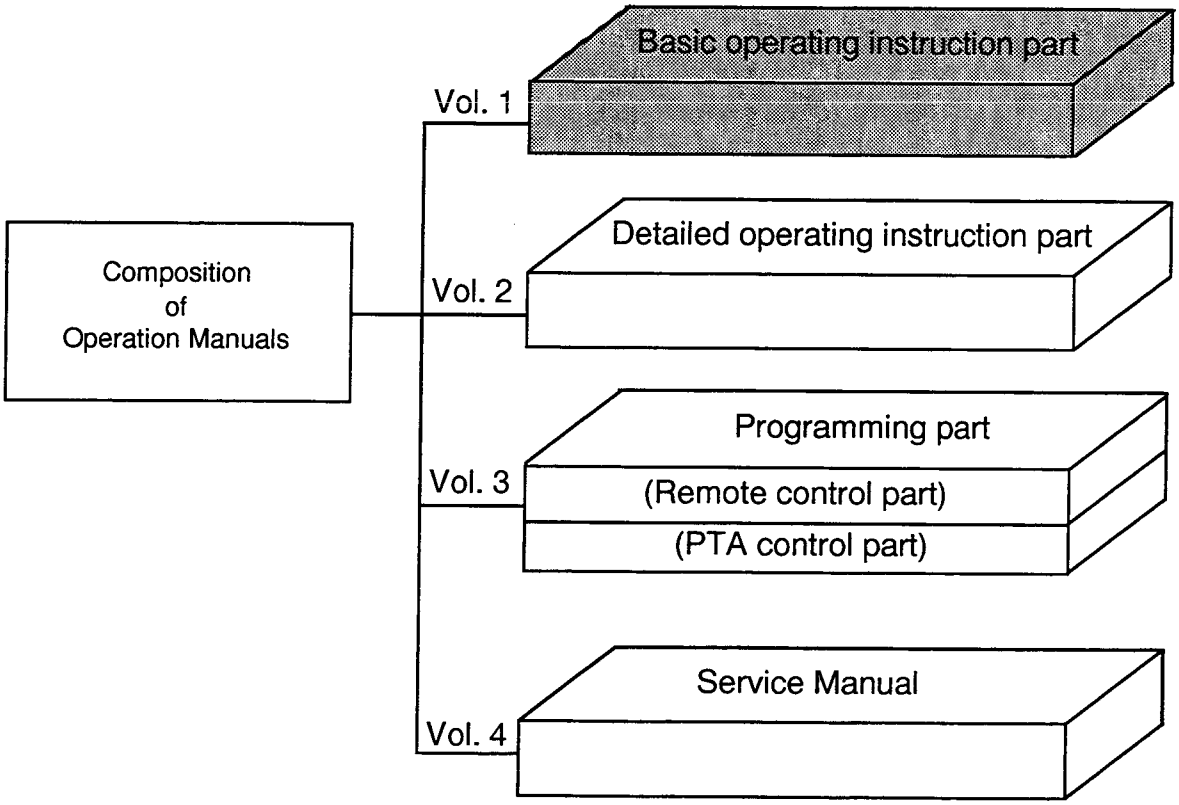
ABOUT THIS MANUAL

(1) Composition of MS2670A Operation Manuals and Service Manual

The MS2670A Spectrum Analyzer operation manuals of the standard type are composed of the following four documents. Use them properly according to the usage purpose.



Basic operating instruction part:	Basic Operating Instructions: Provides information on the MS2670A outline, preparation before use, panel description, basic operation, soft-key menu and performance tests.
Detailed operating instruction part:	Detailed Operating Instructions: Provides information on the detailed panel operating instructions on MS2670A that expand on the basic operation and soft-key menu in the Basic Operating Instruction Part.
Programming part:	Composed of the Remote Control Part and PTA Control Part. The Remote Control Part provides information on RS-232C remote control, GPIB remote control and sample programs, while the PTA Control Part describes about PTA operation and PTL commands.
Service Manual (Vol. 4)	Contains circuit descriptions, troubleshooting and adjustment, mechanical configuration maintenance, and the parts listings.

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SECTION 1

GENERAL

This section outlines the MS2670A Spectrum Analyzer and explains the composition of this manual, the configuration of the MS2670A with the standard accessories, the options, the optional accessories, and peripherals for expanding the MS2670A capabilities, and the MS2670A specifications.

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SECTION 1
GENERAL

Product Outline

The MS2670A (henceforth called "this unit") is a portable type color LCD spectrum analyzer suited for signal analysis of radio equipment where the efficiency of frequency usage is increased and equipment is increasingly speeded and digitized.

Adopts the synthesizer local system and can cover a frequency range of 100 Hz to 1.8 GHz.

Excellent in basic performance such as C/N, distortion, frequency/level accuracy, and easily operable following the display of the soft-key menu screen.

Equipped with high-accuracy calibration signals and an attenuator; it can accurately calibrate switching errors of LOG/LIN scales, resolution bandwidth, reference level, etc. Since frequency response is corrected by built-in calibration data, it allows high-accuracy level measurement for a wide range.

As the switching of waveforms between frequency domain and time domain can be done by a touch and two waveforms are simultaneously displayed, signal analysis of both domains can be done efficiently. Moreover, our original zone marker function and multi-marker function (up to 10 markers) are also special features.

This unit provides the MEASURE function that can perform measurement of various applications without requiring the intervention of external controllers. Therefore, the performance evaluation of radio equipment can be easily done in terms of frequency, noise, occupied frequency bandwidth, adjacent channel leakage power, etc.

In addition, as the template measurement of burst mean power and burst waveform are also available, it is suited for evaluating the performance of digital radio equipment.

■ Applications

The MS2670A Spectrum Analyzer can be used for a wide range of applications such as development, adjustment, inspection, and maintenance of electronic parts and equipment in the following areas:

- AM / FM radio equipment;
- Digital cellular telephone / cordless telephone;
- Satellite broadcasting and TV equipment;
- Small-capacity microwave equipment.

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Composition of Operation Manual

This Operation Manual is composed of 7 sections and appendixes A and B. The profile of each section is shown below.

Section conposition	Explanation
SECTION 1 GENERAL	Product outline, standard configuration, options, applicable parts, peripheral devices, and specifications.
SECTION 2 PREPARATIONS BEFORE USE	Operations to be done before applying power.
SECTION 3 PANEL DESCRIPTION	Description about the front and rear panels.
SECTION 4 SOFT-KEY MENU	Description using a soft-key menu.
SECTION 5 BASIC OPERATION PROCEDURE	Basic operation procedures for operation guide.
SECTION 6 PERFORMANCE TESTS	Tests used for checking performance.
SECTION 7 STORAGE AND TRANSPORTATION	Cautions on storage and transportation.
APPENDIX A	MS2670A FRONT AND REAR PANEL LAYOUT
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Equipment Configuration

This paragraph describes the configuration of the MS2670A Spectrum Analyzer with standard accessories and the various options to expand the functions.

Standard configuration

The table below shows the configuration of the MS2670A with the standard accessories.

Standard Composition

Item	Model / Order NO.	Name	Qty.	Remarks
Main instrument	MS2670A	Spectrum Analyzer	1	
Accessories	J0071	Power cord	1	Approx. 2.5 m
	F0013	Fuse	2	T5 A 250 V
	W1033AE	Operation manual	1	Vol-1, 2, 3
	W1033BE	Service manual	1	Vol-4

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Optional Accessories and Peripherals

The following table shows the optional accessories and peripherals for MS2670A which are all sold separately.

Optional Accesories

Model † - Order No. †	Name	Remarks
J0561	Coaxial cord, 1 m	N-P-5W • E5D-2W • EN-P-5W
J0104A	Coaxial cord, 1 m	BNC-P • ERG-55 / U • EN-P-5W
JS256G3-C-13	256 kB memory card	Meets PCMCIA Ver. 2.0 Type I
JS512G3-C-13	512 kB memory card	Meets PCMCIA Ver. 2.0 Type I
JS1024G3-C-13	1024 kB memory card	Meets PCMCIA Ver. 2.0 Type I
JS2048G3-C-13	2048 kB memory card	Meets PCMCIA Ver. 2.0 Type I
B0329G	Protective cover	3 / 4 MW4U
B0395B	Rack mount kit (IEC)	
B0391A	Carring case (hard type)	With casters
B0391B	Carring case (hard type)	Without casters
MP612A	RF Fuse Holder	DC to 1000 MHz, 50 Ω (N)
MP613A	Fuse Element	For MP612A
MA8601A	DC Block Adaptor	50 Ω
MA1621A	50 Ω →75 Ω Impedance Transformer	9 kHz to 3 GHz, with DC block capacitor (allowable voltage: 100 V)
MP614A	50 Ω ←→ 75 Ω Impedance Transformer	10 to 1200 MHz (transformer type)
J0063	Fixed attenuator for high power	30 dB (10 W, DC to 12.4 GHz)
J0395	Fixed attenuator for high power	30 dB (10 W, DC to 9 GHz)
MP640A	Branch	40 dB, DC to 1700 MHz
MP654A	Branch	30 dB, 0.8 to 3 GHz
MP520C	CM Directional Coupler	25 to 500 MHz, 50 Ω (N)
MP520D	CM Directional Coupler	25 to 1000 MHz, 50 Ω (N)
MP526A	High Pass Filter	60-MHz band
MP526B	High Pass Filter	150-MHz band
MP526C	High Pass Filter	250-MHz band
MP526D	High Pass Filter	400-MHz band
MP526G	High Pass Filter	27-MHz band
J0007	GPIB cable, 1 m	408JE-101
J0008	GPIB cable, 2 m	408JE-102
J0743A	RS-232C cable, 1 m	For IBM PC / AT or compatible, D-sub 9 pins
J0742A	RS-232C cable, 1 m	For Printer, D-sub 25 pins

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

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Specifications

MS2670A specifications are listed in the following table.

Frequency	Frequency range		100 Hz to 1.8 GHz
	Frequency accuracy	Indicated frequency	Resolution: A digit in 5 hundredths of span (1 Hz min.), but fractions are rounded Accuracy: ± ((Indicated frequency X reference frequency accuracy) + resolution band width X 15% + span X 5% + 15 kHz) span ≥ 2 MHz ± ((Indicated frequency X reference frequncy accuracy) + resolution band width X 15% + span X 5% + 25 Hz) span < 2 MHz
		Marker frequency	Resolution: 0.2% of span, fractions are rounded Accuracy: Normal marker is identical to the indicated frequency accuracy. Delta marker is identical to the span accuracy.
	Frequency measurement†		Resolution: 1 Hz, 10 Hz, 100 Hz, and 1 kHz Accuracy: Indicated frequency X reference frequency accuracy ± 1 count (at S/N of > 20 dB)
	Span	Setting range	0 Hz, and 100 Hz to 1.9 GHz
		Accuracy	±5%
	Resolution bandwidth (3 dB BW)	Setting range	10 Hz to 1 MHz, 1/3 sequence and 5 MHz Can be set manually or automatically coupled with span
		Accuracy	±20% (RBW 30 Hz to 300 kHz) ±30% (RBW 10 Hz) ±25% (RBW 1 MHz)
	Video bandwidth (VBW)		1 Hz to 3 MHz, 1/3 sequence and through Can be set manually or automatically coupled with resolution bandwidth
	Signal Purity and stability	Noise sidebands	≤ −100 dBc/Hz (at 1 GHz, 30 kHz offset, RBW 1 kHz)
		Frequency drift	At constant ambient temperature one hour after power-on ≤ 50 Hz/min. (at 100 kHz ≤ span, sweep time ≤ 100 s)
	Reference oscillator	Frequency	10 MHz
		Starting characteristics	≤ 5×10^{-8} (10 minutes after power-on, referred to the frequency after 24-hour warm-up)
		Aging rate	≤ 1×10^{-7}/year (referred to the frequency 24-hour warm-up after power-on) ≤ 2×10^{-8}/day
		Temperature characteristic	± 5×10^{-8} (referred to the frequency at 25°C, in the range of 0° to 50°C)

† Counts the frequency at the peak point in the zone

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Amplitude	Level measurement	Measurement range	Average noise level to +30 dBm
		Residual response	≤ –90 dBm (at 200 kHz to 1.8 GHz, 0 dB input attenuator) ≤ –65 dBm (at 100 Hz to 500 Hz, 0 dB input attenuator) ≤ –85 dBm (at 500 Hz to 200 kHz, 0 dB input attenuator)
	Reference level	Setting range	LOG: –100 to +30 dBm (or equivalent level) LIN: 224 µV to 7.07V
		Unit	LOG: dBm, dBµV, dBmV, V, dBµV (emf), W LIN: V
		Input attenuator setting range	0 to 70 dB, 10 dB step Can be set manually or automatically coupled with reference level
		Input attenuator switching deviation	±2.0 dB (0 to 60 dB referred to the attenuator of 10 dB)
	Frequency response		±1.5 dB At 10 to 60dB input attenuator,
	Screen display	Graticule	10 div (during single scale) LOG (/div): 10 dB, 5 dB, 2 dB, 1 dB LIN (/div): 10%, 5%, 2%, 1%
		Linearity	After calibration LOG: ±0.5 dB (0 to –20 dB, resolution bandwidth ≤ 1 MHz) ±1 dB (0 to –70 dB, resolution bandwidth ≤ 100 kHz) ±1.5 dB (0 to –85 dB, resolution bandwidth ≤ 10 kHz)
		Marker level resolution	LOG: 0.1 dB LIN: 0.2% (compared to reference level)
	Spurious response	Second harmonic distortion	≤ –60 dBc (at 100 Hz to 900 MHz input frequencies, mixer input level –40 dBm †1)
		Two-signal third-intermodulation distortion	At two signal frequency difference of ⊕ 50 kHz and mixer input level of –30 dBm ≤ –64 dBc (at 100 Hz to 10 MHz input frequency) ≤ –70 dBc (at 10 MHz to 1.8 GHz input frequency)
	1 dB gain compression		At input level to mixer, ≥ –5 dBm
Tracking Generator	Frequency range		300 kHz to 1.8GHz
	Output range		0 to –60 dBm resolution : 0.1 dB
	Flatness		±2.25 dB (referenced to the output of 100MHz, 0 dBm setting)
	Residual FM		±50 Hz_{p-p}
	Output impedance		50 ohm nominal Type N VSWR ≤ 2:1
	Spurious outputs		≤ –20dB

†1 Mixer input level = input level (dBm) – input attenuator (dB)

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General electrical specifications	Sweep	Sweep time	Frequency domain	Setting range: 20 msec to 1000 sec Can be set manually or automatically coupled with span, resolution bandwidth, and video bandwidth Accuracy: ±15% (20 msec to 100 sec)
			Time domain	Setting range: 12.5 µsec to 1000 sec Accuracy: ±1% (100 µsec to 100 sec)
		Sweep mode		CONTINUOUS, SINGLE
		Trigger Switch		FREE RUN, TRIGGERED
		Trigger Source	External	Trigger level ±10 V (0.1 V resolution) TTL Trigger slope Rise/Fall Connector BNC Impedance 1 kΩ ±5%
			Video	Trigger level –100 dB to 0 dB (log scale, 1 dB resolution) 0 to 100% (lin scale, 1% resolution) Trigger slope Rise/Fall
			Wide IF Video	High/Mid/Low
			Line	47 to 63 Hz
	Detection mode			POS PEAK, SAMPLE, NEG PEAK, NORMAL (POS-NEG)
	Display			5.7 inch Color TFT-LCD Display items: Graticule, Waveform, Setting parameters, Operation menus, Title
	Display function			Trace A: Displays frequency spectrum Trace B: Displays frequency spectrum Trace Time: Displays the time axis waveform at center frequency Trace A/B: Displays Trace A and B simultaneously, simultaneous sweep of same frequency, alternate sweep of independent frequencies Trace A/BG: Displays simultaneously both the band to be observed (background) and the signal band (foreground) chosen by the Zone marker out of the BG band Trace A/Time: Displays simultaneously both the frequency spectrum and the time axis waveform at the center frequency of the frequency spectrum Trace Move/Calculate: A→B, B→A, A↔B, A+B→A, A–B→A, A–B+DL→A
	Storage function			NORMAL VIEW MAX HOLD (displays the maximum envelope) MIN HOLD (displays the minimum envelope) AVERAGE (displays average value) CUMULATIVE (displays cumulative waveform) OVER WRITE (displays waveform overwritten)
	Input connector			N–J, 50 Ω VSWR ≤ 1.5 (input attenuator Ω 10 dB)
	Auxiliary input/output terminal	REF INPUT		10 MHz ±10 Hz, –10 dBm to +2 dBm, 50 Ω (BNC connector)
		BUFFERED OUTPUT		10 MHz, 0 dBm, 50 Ω (BNC connector)

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Function	Signal search		AUTO TUNE, PEAK→CF, PEAK→REF, SCROLL
	Zone marker		NORMAL, DELTA
	Marker→		MARKER →CF, MARKER→REF MARKER→CF STEP SIZE, Δ MARKER→SPAN ZONE→SPAN
	Peak search		PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK MIN DIP, NEXT DIP
	Multi marker		HIGHEST 10, HARMONICS, MANUAL SET
	Measure (calculation)		Noise level measurement (dBm/Hz, dBm/ch) C/N measurement (dBc/Hz, dBc/ch) Occupied frequency bandwidth measurement Adjacent-channel leakage power measurement Burst-in average power measurement Template (limit lines) comparison measurement Mask (limit lines) comparison measurement
	Memoty card interface		PCM CIA Ver 2.0, 2 slots Saves/recalls setting conditions and waveform data. Uploads/downloads PTA programs. Accesses SRAM, EPROM and flash EEPROM (writes to SRAM only). Supports cards up to 2 Mbytes.
	Save/recall		Can save and recall setting conditions and waveform data to and from internal registers (max. 12) and external memory cards (max. 99).
	Direct plotting		Can hard-copy screen data via RS232C or GPIB (compatible models only).
	GPIB	Functions	Meets IEEE488.2. Can be controlled as device from extemal computer (excluding power switch). Or can control extemal equipment as controller.
		Interface	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C4, C28
Environmental	Temperature		0° to 50°C (operating), –40° to +71°C (not operating)
	Humidity		≤ 85%
	Vibration		MIL-T-28800, Type II, Class 5, Style C
	Pulse shock		MIL-T-28800, Type II, Class 5, Style C
	Drop test		MIL-T-28800, Type II, Class 5, Style C
	Dripproof		MIL-T-28800, Type II, Class 5, Style C
EMC	Conducted interference		Meets MIL.STD461B(Part 4 and 5) with limitations below CE01(Narrowband): For measurement frequency 1 kHz to 15 kHz CE03(Broadband): 20-dB specification relaxation for measurement frequency 15 kHz to 100 kHz
	Radiated interference		Meets MIL.STD461B(Part 4 and 5) with limitations below RE01: 15-dB specification relaxation for measurement frequency upto 30 kHz and limited to 30kHz RE02: For measurement frequency upto 1 GHz
	Radiated susceptibility		Meets MIL.STD461B(Part 4 and 5) with limitations below RS02: Deleted RS03: For measurement frequency 14 kHz to 1 GHz at electric field strength 1 V/m, 20-dB specification reduction for IF frequencies

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Dimension		177 (H), 320 (W), 351 (D) mm
Weight		≤ 15 kg
Power requirements	115 Vac operation	85 to 132 V, 3.0 A rms max, 47.5 to 63Hz, 380Hz to 420Hz
	230 Vac operation	170 to 250 V, 1.5 A rms max, 47.5 to 63 Hz
Maximum power consumption		≤ 250 W

The specifications above are applicable to system settings and auto-sweep time of high level accuracy mode.

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SECTION 2
PREPARATIONS BEFORE USE

This section explains the preparations and safety procedures that should be performed before using the MS2670A Spectrum Analyzer. The safety procedures are to prevent the risk of injury to the operator and damage to the equipment. Insure that you understand the contents of the pre-operation preparations before using the MS2670A.
For connecting the GPIB cable and setting the GPIB address, see the Remote Control part of the separate Operation Manual Vol.3.

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SECTION 2
PREPARATIONS BEFORE USE

Unpacking and Inspection

Remove the MS2670A and accessories after undoing the packing case. Save the packing case and spacers, etc. if it might be reshipped again sometime. The standard MS2670A consists of the following items. If any part is missing or if the MS2670A has been damaged in transport, contact your sales representative immediately.

Table 2-1 List of Parts and Accessories

Item	Model/Order No.	Name	Qty.	Remarks
Main instrument	MS2670A	Spectrum Analyzer	1	
Accessories	J0017	Power cord	1	Approx. 2.5 m
	F0013	Fuse	2	T5A250V
	W1033AE	Operation manual	1	Vol-1, 2, 3
	W1033BE	Service manual	1	Vol-4

Note: Refer to the factory packing lists for the parts and accessories when there are special specifications.

Inspect the equipment for damage incurred during shipment. If the MS2670A has been damaged, report the damage to the closest support and service center (listed on the back of the Service Manual).

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Installation

Locations to be avoided

The MS2670A operates normally at temperatures from 0 to 50°C. However, for the best performance, the following locations should be avoided.

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

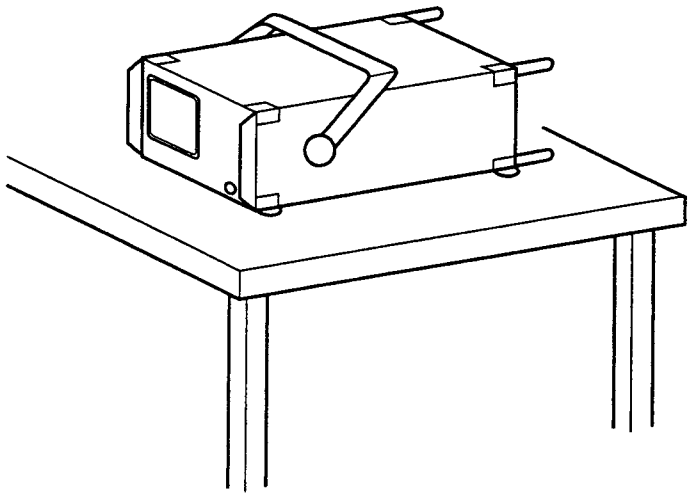
In addition to meeting the above conditions, to insure long-term trouble-free operation, the equipment should be used at room temperature and in a location where the power supply voltage does not fluctuate greatly.

CAUTION ⚠

If the MS2670A is used at normal temperatures after it has been used or stored for a long time at low temperatures, there is a risk of short-circuiting caused by condensation. To prevent this risk, do not turn the MS2670A on until it has been allowed to dry out sufficiently.

Positioning

Position the MS2670A horizontally on a flat surface such as a table.



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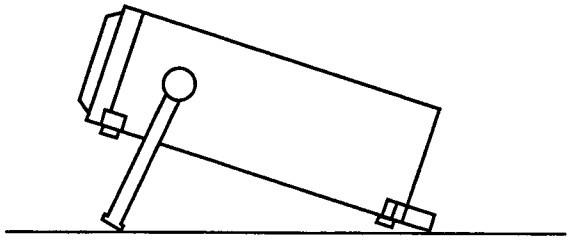
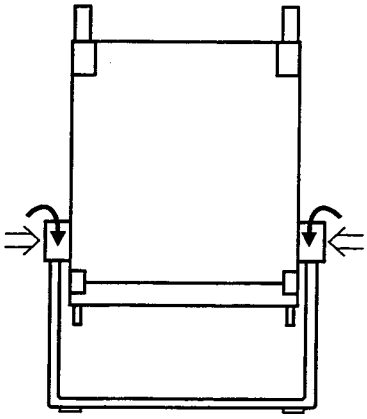
If necessary, use the tilt handle as shown below to improve the viewing angle.

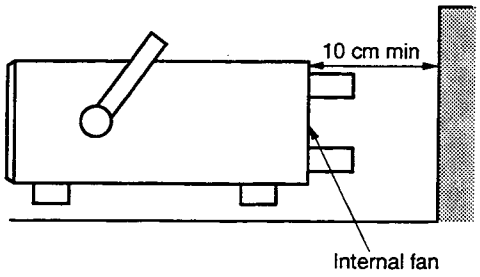


Push the pivots of the handle inward and rotate it until it clicks into the new position.



CAUTION ⚠

To suppress any internal temperature increase, the MS2670A 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.



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Rack mounting

The B0395B Rack Mount Kit (sold separately) is required to mount the MS2670A in a rack. The installation method is included in the rack mount kit diagram.

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Preparation Before Power-on

The MS2670A operates normally when it is connected to an 85 to 132 Vac/47.5 to 63Hz, 380 to 420 Hz, or 170 to 250 Vac (automatic voltage change) 47.5 to 63 Hz AC power supply. To prevent the following problems, take the necessary procedures described on the following pages before power is supplied.

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

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

To protect the operator, the following WARNING and CAUTION notices are attached to the rear panel of the MS2670A.

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

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

WARNING ⚠

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

Always follow the instructions on the following pages.

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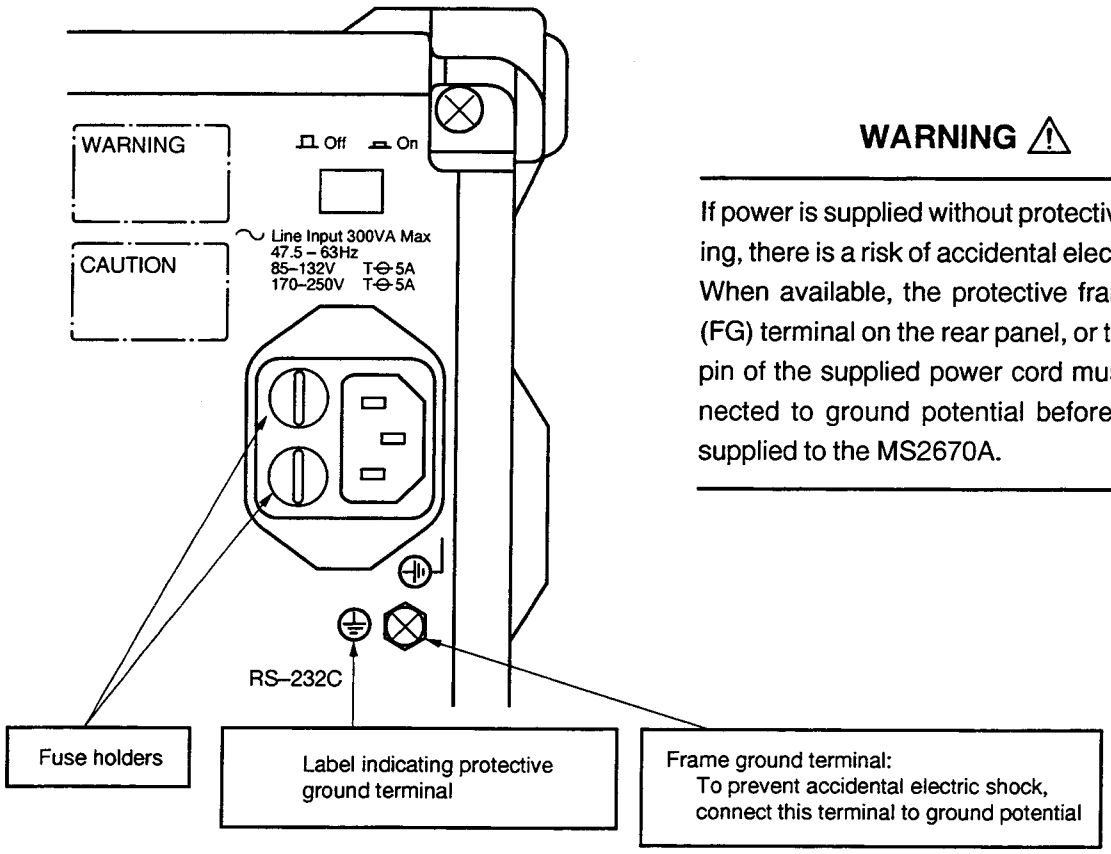
Protective grounding

(1) Grounding with 3-pole power outlet

When connecting to a 3-pole (grounded, 2-pole type) AC power-supply outlet, the frame of the MS2670A is connected to ground potential. As a result, it is not necessary to connect the FG terminal to ground.

(2) Grounding with frame ground (FG) terminal

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



WARNING ⚠

If power is supplied without protective grounding, there is a risk of accidental electric shock. When available, the protective frameground (FG) terminal on the rear panel, or the ground pin of the supplied power cord must be connected to ground potential before power is supplied to the MS2670A.

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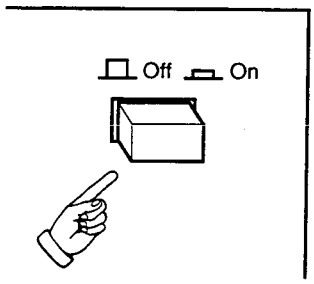
Connecting the power supply

- Make sure that the power switch on the upper-right corner of the rear panel is in the Off position before connecting the power cord to the AC outlet.

  If not Off, push the power switch on the rear panel to Off.



- Connect the attached power cord to the AC power inlet at the rear of the MS2670A, and connect the other end to the AC outlet.

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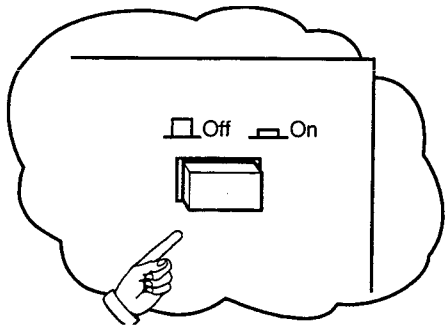
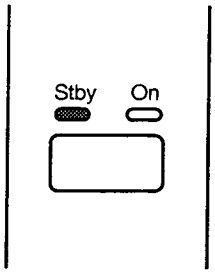
Power On

Standby

- After connecting the MS2670A to the AC outlet, press the power switch on the upper-right corner of the rear panel to turn on the MS2670A.



The MS2670A enters standby mode, and the "stby" indicator (green) on the left side of the front panel comes on.



In standby mode the MS2670A supplies power only to the internal reference oscillator.

The frequency of the reference crystal oscillator is unstable immediately after the power is on. This instability will adversely affect the accuracy of the frequency or narrow-span measurements.

In standby mode after the power is on, power is applied only to the reference crystal oscillator so that the frequency of the reference crystal oscillator stabilizes.

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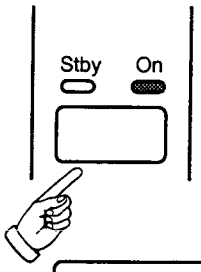
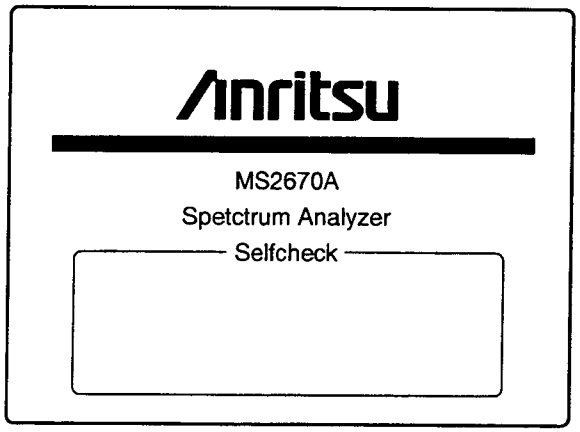
Power-on

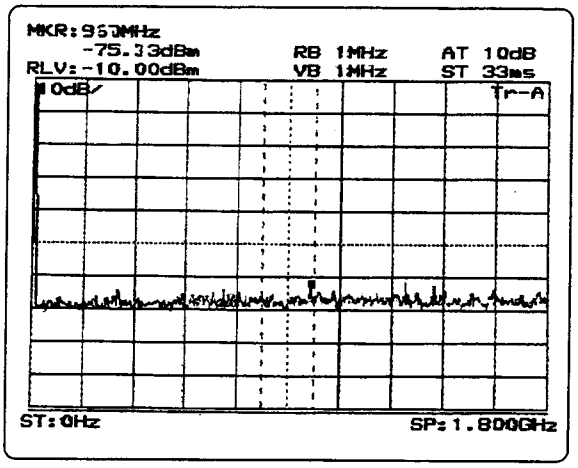
Press the power switch on the left side of the front panel for one second or more in standby mode to turn on the power of the MS2670A.



The "stby" indicator goes off, the "On" indicator (orange) comes on, then power is supplied to the MS2670A.



The power-on screen is displayed for about 40 seconds.



A waveform screen is displayed.

For parameter settings at the factory shipment, see Appendix-A in the Operation Manual Vol.3 "Programming (Remote Control)".

Normally, the parameters immediately after the power-on depend on the state immediately before the last power-off. To turn on the power with other parameter settings, see para. 9.5 "Condition Setting at Power-on" in the Operation Manual Vol.2.

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WARNING ⚠

• During power-on	To maintain the MS2670A, sometimes it is necessary to make internal checks and adjustments with the covers removed while power is supplied. Very-high, dangerous voltages are used in the MS2670A, if insufficient care is taken, there is a risk of a accidential electric shock being received or of damage to the equipment. To maintain the MS2670A, request service by a service personnel who has received the required training.

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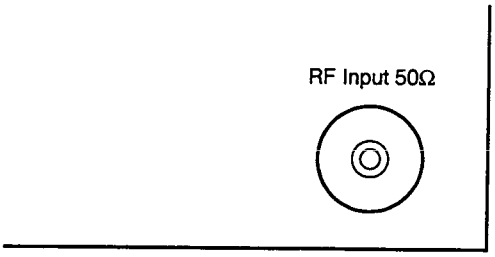
Connecting to Device Under Test

Connect the signals to be measured to the RF connector using a coaxial cable (J0561, N-P-5W•5D2W•N-P-5W).



Fully insert the cable jack into the RF Input connector.

Frequency range: 100 Hz to 1.8 GHz

Measurement level: Apply the measured signal with average noise level of up to + 30 dBm to the N-type connector RF Input of 50Ω input impedance.

CAUTION ⚠

The RF input circuit is not protected against excessive power. If a signal exceeding + 30 dBm and 0V DC between measured terminal and ground is applied, the input attenuator and input mixer may be burned. ⚠ is a warning mark to prevent such damage.

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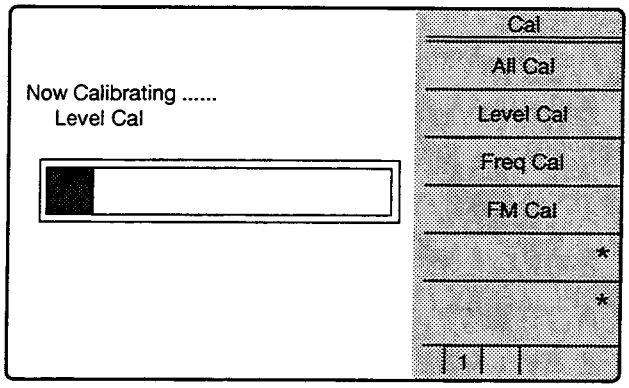
Internal Calibration

Perform internal calibration to maintain the measurement accuracy of the MS2670A within the specifications.

Immediately after the power-on, the performance is unstable due to internal temperature variations. Wait for about 20 minutes or more after the power-on, then perform "All Cal".

Cal

Shift + 0 + All Cal



The Cal screen is displayed during calibration.

Internal calibration takes about four minutes.

If the MS2670A is used in a thermally stable environment such as an office, after the first internal calibration; there is no need to perform internal calibration, repeatedly. If there is a big change in the temperature, perform an internal calibration.

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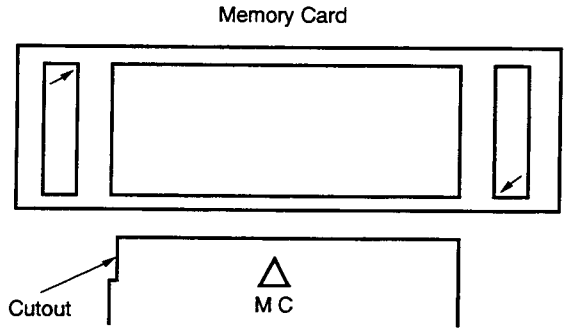
Using the Memory Card

The save/recall functions can be used to save/recall parameter and waveform data to/from the memory card.

When a new memory card used to save any file, format it beforehand to MS-DOS.
When saving data to a memory card; confirm that the write-protect switch of the card is set at the NOT-PROTECTED side, and then install it to the MS2670A. (For the setting method, see the operation manual of the card.)

- Installing Memory Card

  Install the memory card to the MS2670A, with the cutout of the card at the position as shown below. Two card can be installed at the upper and lower sides.



- Removing Memory Card

  Push the left eject button to remove the memory card at the upper side.
  Push the right eject button to remove the memory card at the lower side.

- Replacing Battery of Memory Card

  Memory card has a battery. When the battery life ends, the saved data is erased. Replace the battery before the life end. (For the battery life and replacing method, see the operation manual of the card.)

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Using the RS-232C Interface

See Section 2 in the Operation Manual Vol.3 "Programming (Remote Control)".

Using the GPIB Interface

See Section 2 in the Operation Manual Vol.3 "Programming (Remote Control)".

Reprogramming

The software of the MS2670A is stored in a ROM (read only memory) installed when the MS2670A is shipped from the factory. Therefore, it is unnecessary to load the software in the MS2670A.

Also, the frequency response of each the MS2670A is checked when the equipment is shipped from the factory, and the correction values are written into the ROM. Therefore, it is unnecessary to load the correction values.

The data and program shown below can be set to correct the measured values and perform the automated measurement. For details, refer to the following sections:

- To set the frequency-response correction factor : See Sections 2/3/4 in the Operation Manual Vol.2.
- To set the template/mask limitation line : See Section 13 in the Operation Manual Vol.2.
- To register data in the user defined menu : See Section 12 in the Operation Manual Vol.2.
- To load and execute the PTA (personal test automation) program : See the PTA control part in the Operation Manual Vol.3.

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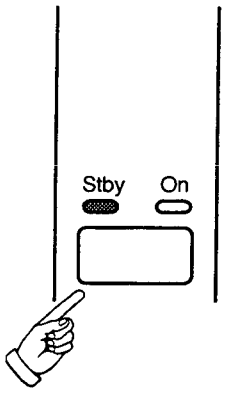
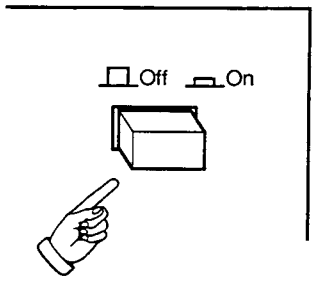
Power-off

Press the power switch on the front panel for one second or more while the power is on to set the MS2670A in standby mode.



The "ON" indicator goes off, the "stby" indicator comes on, and the screen becomes blank.

When the MS2670A will be reused in the same environment, leave the MS2670A in the standby mode. If the MS2670A is not used for a long time or is moved/stored, press the power switch on the rear panel to off.



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Replacing Fuse

The MS2670A with standard accessories has two spare 5 A fuses. The fuses are mounted in the fuse holder and must be replaced if they blow. If the fuses must be replaced, locate and remedy the cause before replacing the blown fuses.

WARNING ⚠

- If the fuses are replaced while power is supplied, there is a serious risk of electric shock. Before replacing the fuses, set the power switch to OFF and remove the power cord from the power outlet.
- If power is supplied without protective grounding, there is a risk of accidental electric shock. In addition, if the AC power supply voltage is unsuitable, there is a risk of the internal circuits of the MS2670A being damaged by the abnormal voltage. Before supplying power again after changing the fuses, check that the protective grounding described previously is still connected, and check that the AC power supply voltage is suitable. Then, set the power switch to ON.

CAUTION ⚠

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

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

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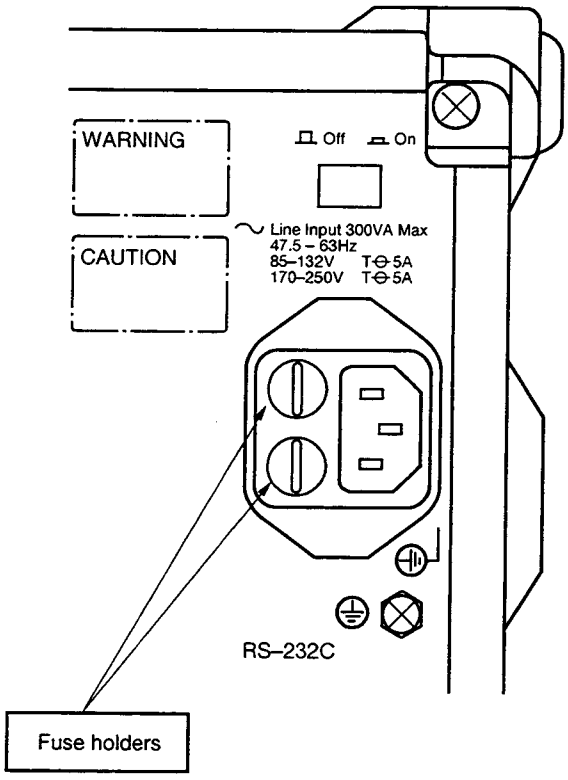
After performing the safety procedures described on the preceding page, replace the fuses according to the following procedure.

Step	Procedure
1	Set the front-panel [Power] switch to Stby and the rear-panel [Line] switch to OFF. Then, remove the power cord from the power-supply outlet.
2	Use a flat-bladed screwdriver to turn the fuse-holder cap counterclockwise. The cap and fuse are removed as a unit from the fuse holder.
3	Remove the fuse from the fuse cap and replace it with a spare fuse. (The direction does not matter.)
4	Return the fuse cap with fuse to the fuse holder and fasten it by turning it clockwise with the flat-bladed screwdriver.



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SECTION 3

PANEL DESCRIPTION

In this section, the front and rear panel functions and interfaces are explained.

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SECTION 3
PANEL DESCRIPTION

In this section, the front and rear panel functions (Figs. 3-1 and 3-2) and interfaces are explained.

Table of Front Panel Features

NOTE: All blue key designations are accessed by first pressing the shift key.

No.	Panel Making	Explanation of Function
1	(LCD)	This is a 5.7 " color TFT liquid crystal display (LCD). It displays the trace waveforms, the parameter settings, the values of marker, and the soft menu keys, etc.
2	Menu On / Off	This toggles the soft-key menu display On / Off.
3	F 1 - F 6	These are the soft keys for selecting the soft-key menus linked to the panel key operation.
4	More	This displays the next page of soft-key menus.
5	Freq / Ampl	This is the frequency and level parameter data input section. [Frequency] Sets frequency. [Span] Sets frequency span. [Amplitude] Sets reference level. [– > CF] Sets peak level signal frequency on screen to center frequency. [– > RLV] Sets peak level on screen to reference level.
6	Marker	This section is related to operation of marker functions. [Marker] Sets marker. [Multi Mkr] Sets multimarkers. [Peak Search] Moves marker to currently-displayed peak level. [Marker – >] Sets paramater according to marker value.
7	User	This is a user-dedicated key which users can specify.

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No.	Panel Making	Explanation of Function
8	Single	This sets the sweep mode. [Single] Executes single sweep. [Continuous] Executes continuous sweeping. The initial default is continuous sweeping.
9	Recall	This executes recall / save. [Recall] Reads measurement parameters and waveform data from internal memory or memory card. [Save] Saves measurement parameters and waveform data to internal memory or memory card.
10	Measure	This menu is for performing the various application measurements including frequency measurement, noise measurement, adjacent-channel leakage power measurement, etc.
11	TG	This sets the tracking generator function.)
12	Display	This section is for selecting the trace waveform. Normally in the frequency domain, up to two trace waveforms can be displayed. The zero-span (Time Domain) mode is selected simply by pressing the [Time] key. [A, B] Displays trace A or B waveform in frequency domain. [A/B, A/BG] Displays trace A and B waveforms simultaneously, or displays trace A and BG (background frequency spectrum including trace A) simultaneously. [Time] Switches to zero span (Time domain) mode to display time domain waveforms. [A/Time] Displays trace A and the time domain waveform simultaneously.
13	Trig / Gate	This sets the trigger/gate and TV-image monitoring functions. [Trig/Gate] Sets the sweep-start trigger and gate(to control wave-form-data write timing) functions. [TV Monitor] Don't use in MS2670A.
14	Coupled Function	This sets the RBW, VBW, sweep time and input attenuator.
15	Entry	These keys set the numeric data, units and special functions. [Rotary knob] Used for moving marker and inputting data.

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No.	Panel Making	Explanation of Function
		[∧ ,∨] Increments and decrements input data.
		[Shift] To execute panel functions indicated by blue letters, press this key and then press the blue-lettered key.
		[BS] Backspace key for correcting input mistakes.
		[0-9, . , +/–] Numeric-data setting keys.
		[GHz, MHz, kHz, Hz] Units keys for frequency, level, time, etc.
		[PTA] Used to edit, load and execute the PTA Program and Library.
		[DEFINE] Used to allow definition of library program execution.
		[CE] Used to clear last entry.
		[HOLD] Press to hold current settings.
		[SOUND] Option not available on this model.
		[SYSTEM] Use this key to set system parameters.
		[TITLE] Use this key to set the title display field at the top of the screen.
		[CAL] This key is used for full system calibration.
		[INTERFACE] Used to set the RS-232C baud rate and interface with external devices.
		[MEM CARD] Used to format a new memory card, select memory card and display directory.
16	Preset	This sets the measurement parameters to the default values.
17	Local	This changes the remote status to the local status.
18	Copy	This outputs a hard copy of the screen to a printer or plotter.
		[COPY CONT] Used to select printer/plotter, feed paper, stop printing, etc.
19	Stby / On	This is the power switch. It can be used when the back-panel power switch is on. The power-on condition is fetched from the Stby condition when the key is pressed for about 1 second. The equipment is returned to the Stby condition from the power-on condition when the key is

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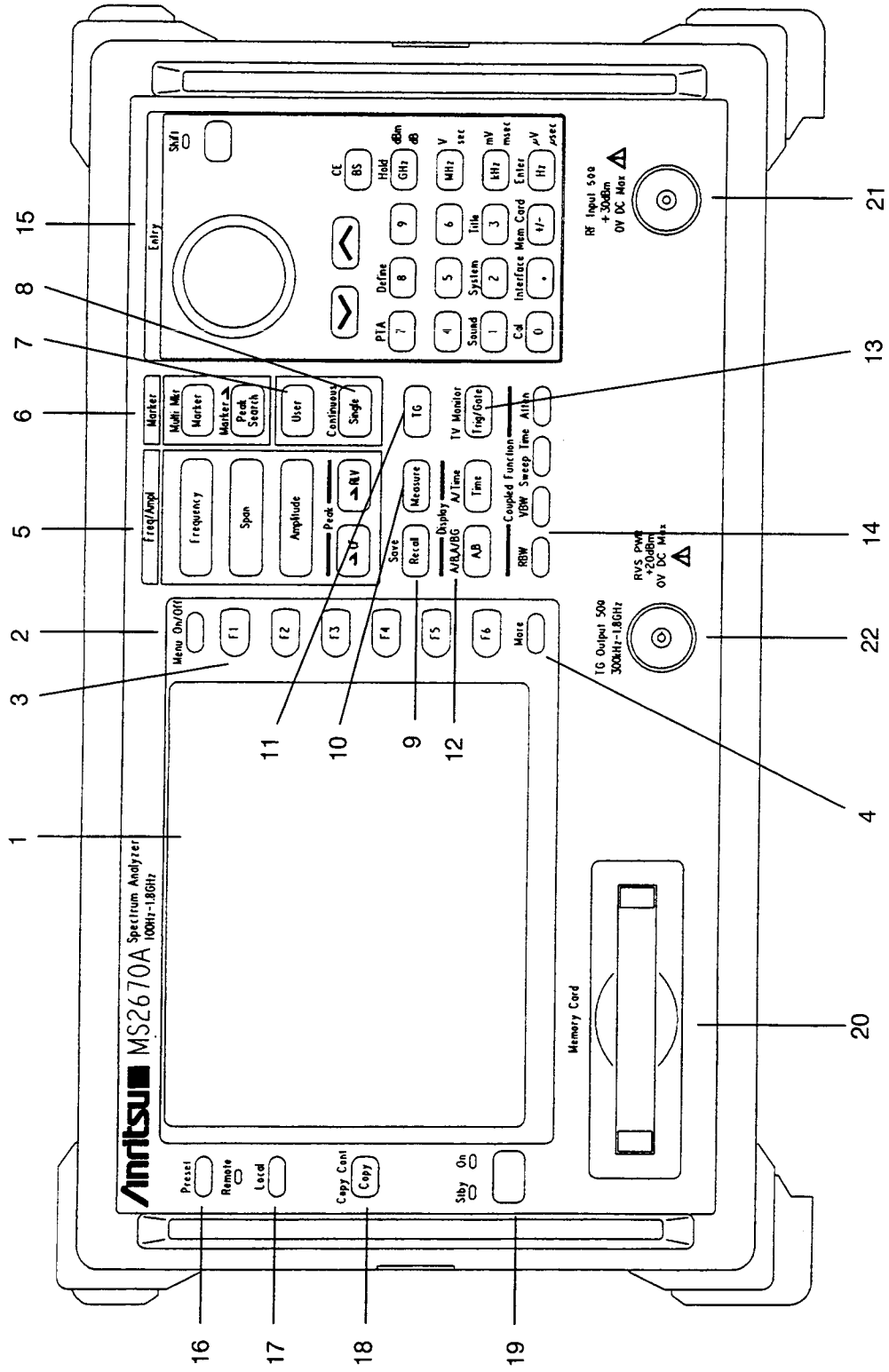

Fig. 3-1 Front Panel

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No.	Panel Making	Explanation of Function
20	Memory Card	This is the slot to set memory cards which save/load the waveform data and measurement parameters, etc. Up to two plug-in memory card can be used.
21	RF Inout	This is the RF input connector.
22	TG Output	This is the tracking generator output connector.
50	(Fan)	This is the cooling fan for ventilating internally-generated heat. Maintain a clearance of at least 10 cm around the fan.
51	10 MHz STD	This is the input connector for an external reference crystal oscillator. When an external reference signal is input, the equipment switches automatically from the internal signal to the external signal.
	BUFF OUT	
55	Off / On	This is the AC line power switch.
56	(Inlet)	This is the fused AC power inlet to which the supplied power cord is connected. It contains two time-lag fuses.
57	(Ground Terminal)	Connect this frame ground terminal to ground to prevent risk of an accidental electric shock.
58	RS-232C	This is the RS-232C connector. Connect it to an external system controller or printer, etc.
59	GPIB	This connector is for use with a GPIB interface. It is connected to an external system controller or a printer, etc.
60	Trig/Gate In (±10 V)	This is an input connector for external trigger/gate signal.

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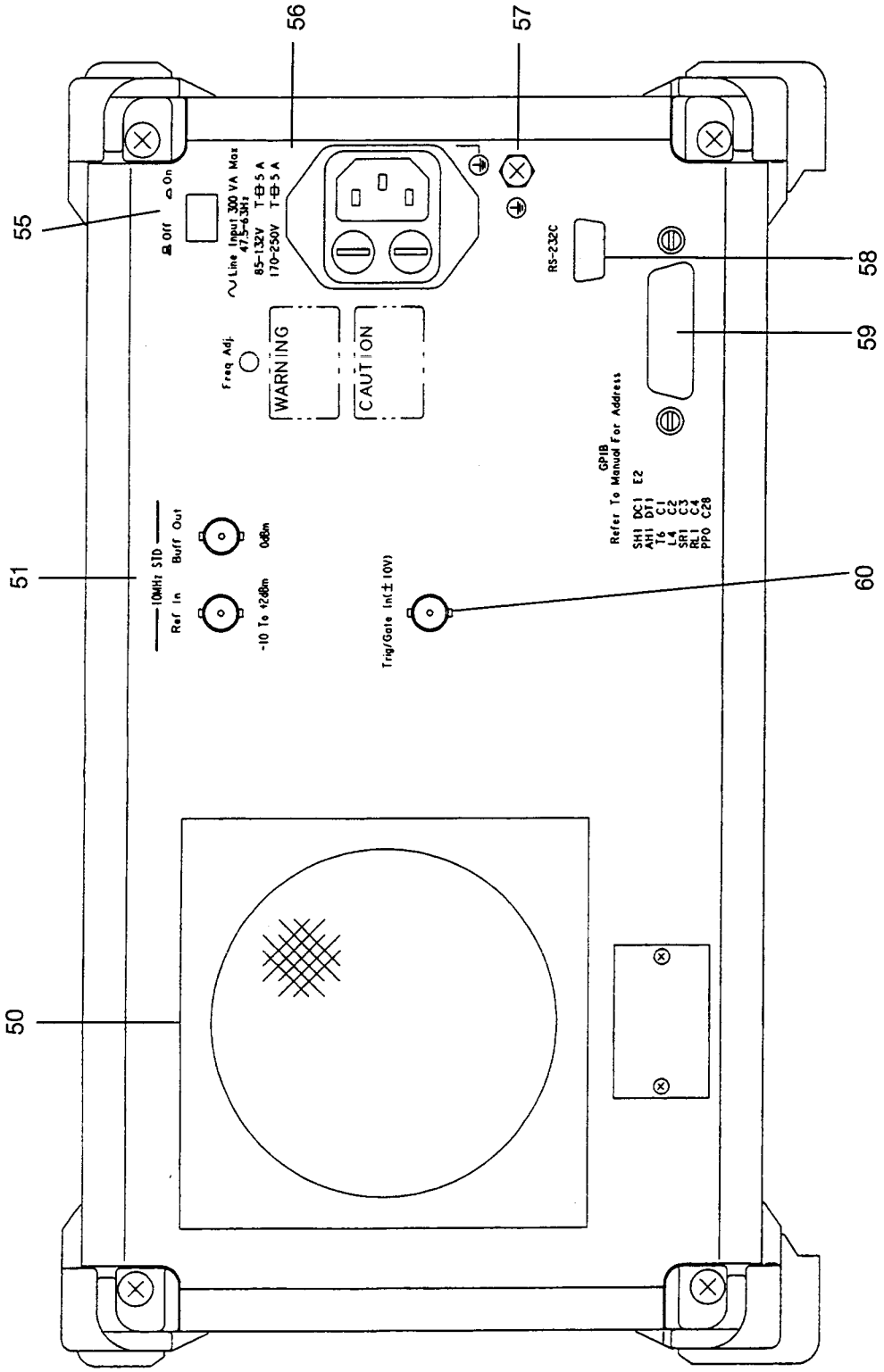

Fig. 3-2 Rear Panel

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Description of Screen Display

Display items on the screen are explained in the 4 types:

1. Common display item --- commonly displayed items
2. Frequency-domain display item --- displayed items in frequency domain trace
3. Time-domain display item --- displayed items in time domain trace (zero span mode)
4. Menu display items --- displayed items at soft-key menus

- Common display item
  1. Marker value
  2. Reference level
     When the reference level offset is on, # is appended.
  3. Resolution band width (RBW)
     When the RBW is Manual, # is appended.
     When the Couple mode is Independent, t is appended in time domain mode.
  4. Video band width (VBW)
     When the VBW is Manual, # is appended.
     When the Couple mode is Independent, t is appended in time domain mode.
  5. Attenuator
     When the Attenuator is Manual, # is appended.
  6. Sweep time
     When the Sweep time is Manual, # is appended.
  7. Time or title
     Time is updated in 1-sec period.
  8. Trace name
  9. Input impedance
     When the input impedance is 75Ω, 75Ohm is displayed.
     When the input impedance is 50Ω, nothing is displayed.
  10. Trace
  11. Y-scale range
      Displays the setting contents of the Y-axis scale range.
  12. UNCAL indicator
      When the relation among Span/RBW/VBW/Sweep-time is UNCAL(the measurement error of the level and frequency is large because of too short sweep time), UNCAL is displayed.
      When it is not in UNCAL state, nothing is displayed.
  13. Average/hold count
      Displays the current sweep time when Storage mode is Averaging and Max-hold/Min-hold.
      When the Storage mode is others, nothing is displayed.

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14. Current marker
    Displays ▼ at maximum or minimum point within the Marker zone. The frequency is in the frequency domain (time in time domain) and level is displayed at the item of the 1 Marker above.
15. Marker zone
    Displays the Marker zone with a dotted rectangle. When the Zone width is spot, it becomes a dotted line.
16. Reference marker
    In the Delta marker mode, the Reference marker is displayed with □.
17. Sweep marker
    Real-time displays the point where the sweep is complete.

- Frequency-domain display item
  21. Center frequency
      In Start/Stop frequency mode, Start frequency is displayed.
  22. Frequency span
      In Start/Stop frequency mode, Stop frequency is displayed.

- Time-domain display item
  31. Trigger level indicator
      When the Trigger source is Video, the set Trigger level is displayed on the screen.
  32. Trigger point indicator
      When the Delay time is a minus value, the Trigger-signal input point(0) is displayed on the screen.
  33. Delay time
      When the Trigger function is not used, 0 is displayed.
  34. Time span
  35. Tuned frequency

- Menu display items
  41. Menu set (or group of menus) title
  42. Menu title
  43. Menu page number
      When a few Menus exist on the same layer, the Menu page is displayed with a tag.
  44. Lower menu mark
      The current Menu is not on top: this mark(vertical line along the side of the Menu display) is displayed and F6 soft-key menu becomes "return".
  45. Lower-menu existing mark
      When the lower menu exists below the current menu, "*" is appended at the top right of the current menu label.

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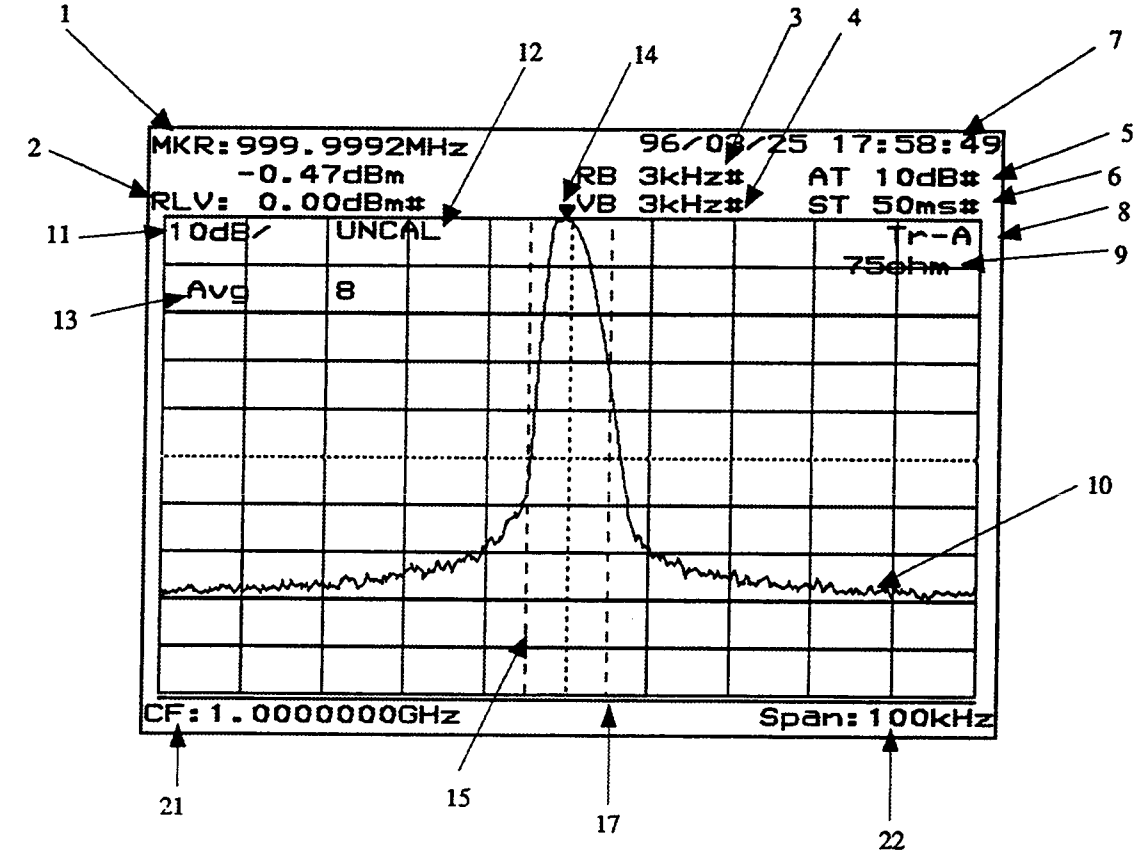

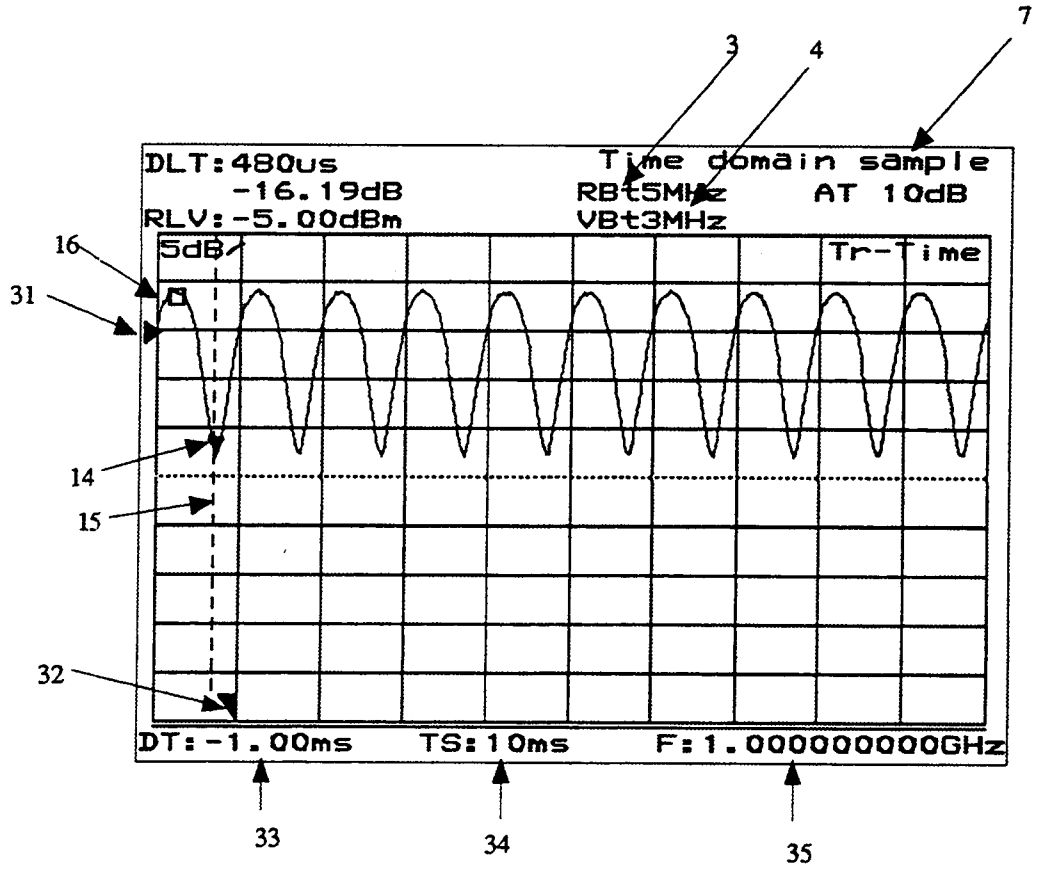

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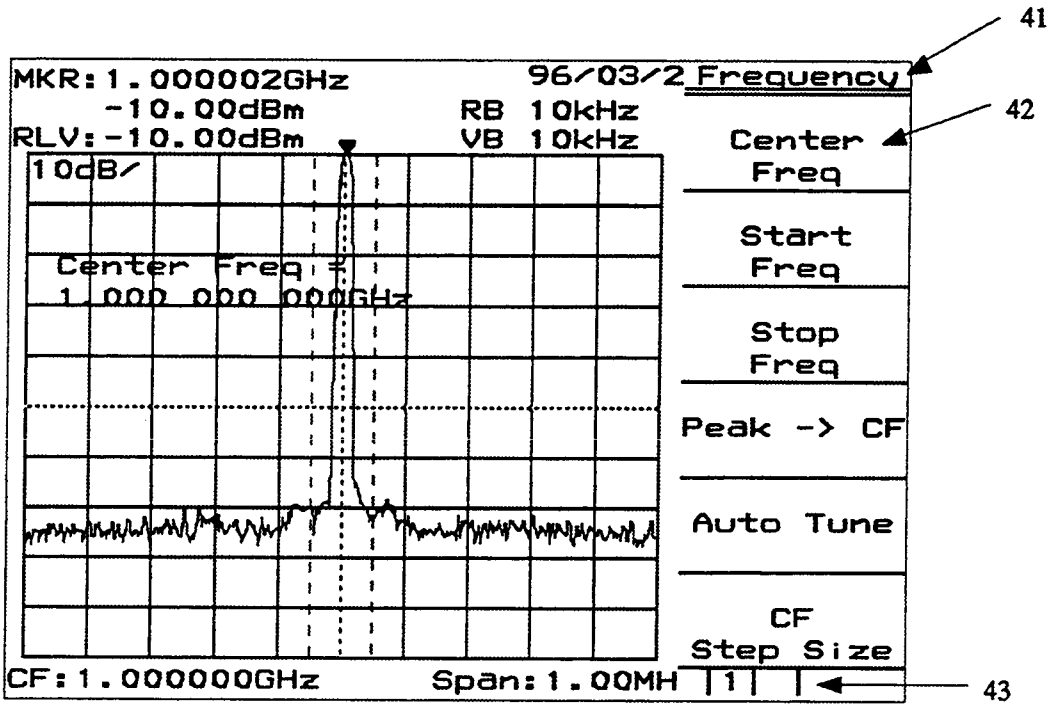

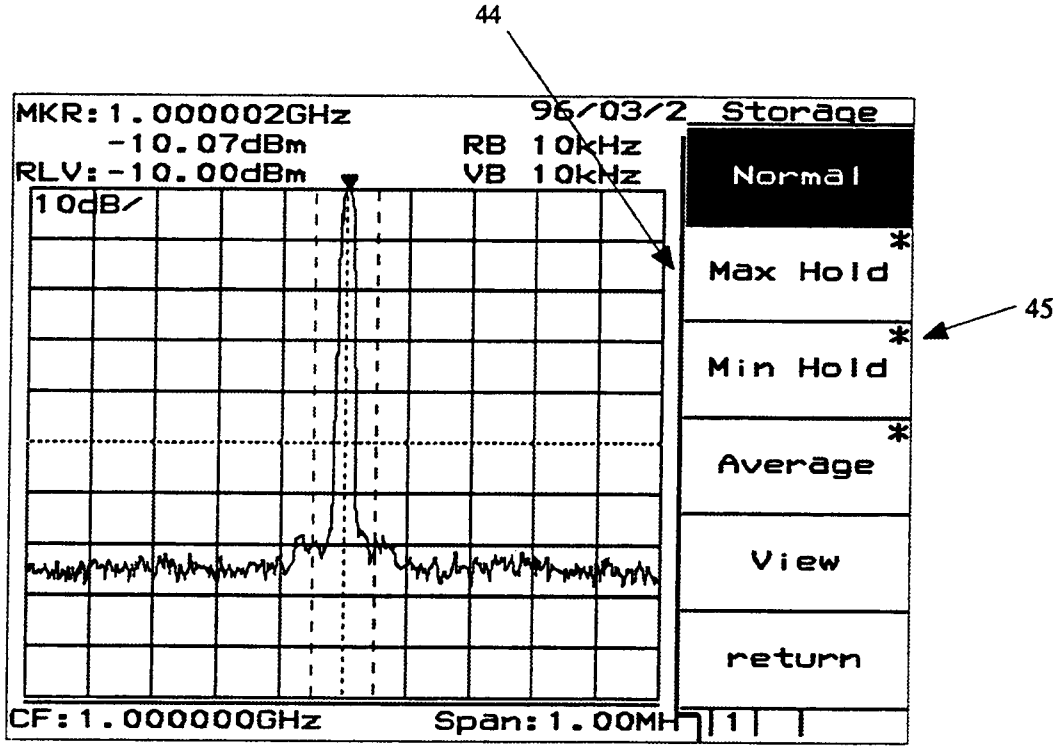

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SECTION 4

SOFT-KEY MENU

In this section, soft-key menu functions and and its hierarchical system are described using a tree structure.

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Soft-key Menu List 4-4

Menu Tree 4-6

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SECTION 4
SOFT-KEY MENU

In this section, soft-key menu functions and its hierarchical system are described using a tree structure. Matters to be noted about the tree are as follows:

(1) Panel Key indicates a hard key on the front panel.

(2) Top menus are the menus at the top level which are displayed on the screen when the panel 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 (→). However, if any not-supported-function soft key in an Option is pressed, an error message is displayed.

(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 [More] key.

(7) Panel keys and soft keys prefixed by a sharp symbol (#) at the left of the menu frame give an outline explanation of the function.

(8) The menu with "!" mark cannot be used on the MS2670A.

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Soft-key Menu List

Menu	Menu Tree(page/27)
A) A/B,A/BG	16
A/Time	17
ACP Setup1	8
ACP Setup2	8
Ajd ch Pwr	8
Amplitude	2
Attenuator	2 , 3
Avq Count	15
B) Burst Pwr	11
C) C/N Meas	7
Cal	22
Change Clr	21
Check File	25
Copy Cont	20
Copy from	21
Correction	2
CountSetup	7
D) Def Files	26
Def Menues	26
Define	26
Define Clr	21
Detection	15 , 17
Dip	5
Directory	24
Disp Line	2 , 4
Display	21
E) Edit	9 , 10 , 23
Edit Menu	26
Expand	17
F) File Ope	24
Format	24
Freq Count	7
Frequency	1
G) Gate	18
Gate Setup	18

Menu	Menu Tree(page/27)
H) Hold Count	15
I) Impedance	2
Initialize	26
Initiate	9 , 10
Interface	23
Item	12 , 20
L) Lib Exec	25
Lib File	25
Lib Memory	25
Lib Prgm	26
Lib Remove	25
Lin Scale	2
Line	9 , 10
Load/Save	9 , 10
Location	20
Log Scale	2
Lvl Offset	2
M) Manual Set	4
Marker	4
Marker->	4 , 5
Mask Meas	9
Measure	7 , 8 , 10
Media	24 , 26
Media	2 , 9 , 10
Mem Card	24
Mkr Func	4
Mkr List	4
Move Mask	9
Move Temp	10
Multi Marker	4
N) Noise Meas	7
Normalize	14
O) OBW Setup	8
Occ BW	8

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Menu	Menu Tree(page/27)
P) Paper Size	20
Peak	5
Plotter	20
Pon State	21
Preset	27
Printer	20
PTA	24
PTA Lib	25
R) RBW	3
Recal Media	12
Recall	12
Ref Line	15
Ref Step	2
RS232C	23
S) Save	13
Save Media	13 , 20
ScrollStep	1
Select	2 , 9 , 10
Set Date	21
Set Time	21
Setup	2
Setup Mask	9
Setup Temp	10
Source	17 , 18
Span	1
Storage	15 , 17
Sweep Time	3
Swp Contl	16 , 17
System	21
T) Temp Meas	10
TG	14
Threshold	5
Title	23
Trace A,B	14 , 15
Trace Calc	15
Trace Move	15
Trace Time	17 , 18
Trnsformer	2
Trig Ext	18
Trig Video	18
Trigger	18
U) Units	2
User1	6
User2	6
User3	6
V) VBW	3
W) Wide IF	18
Z) Zone Width	4

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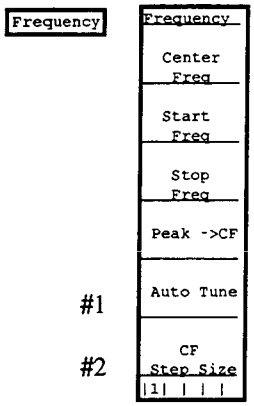
Menu Tree

Menu Tree (1 /27)

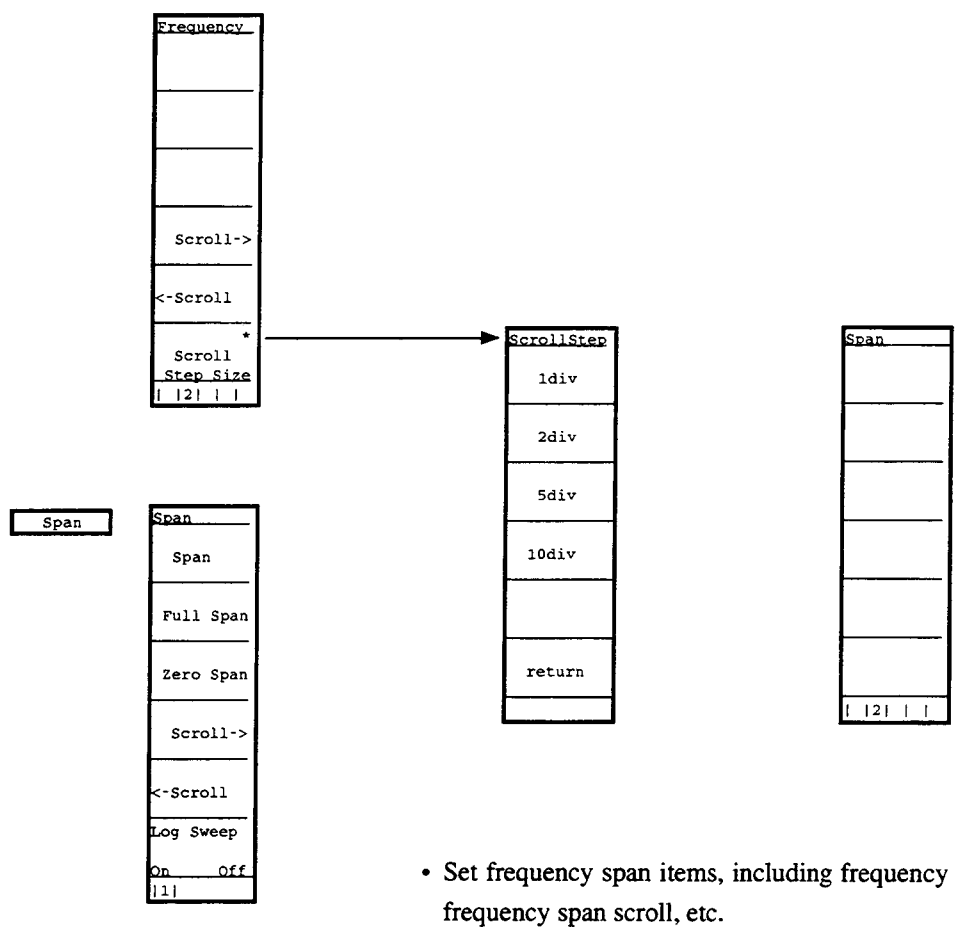
— Panel Key —+— Top menu —+— Lower menues —



- Set items related to frequency, including the center frequency, start/stop frequency, peak->CF, auto synchronization, frequency step size and scroll step size, etc.

#1 Detects peak point in pre-specified (in BG range) span and automatically tunes the peak signal to the specified span.

#2 Sets frequency step size for changing center frequency.



- Set frequency span items, including frequency span, full span, zero span, frequency span scroll, etc.

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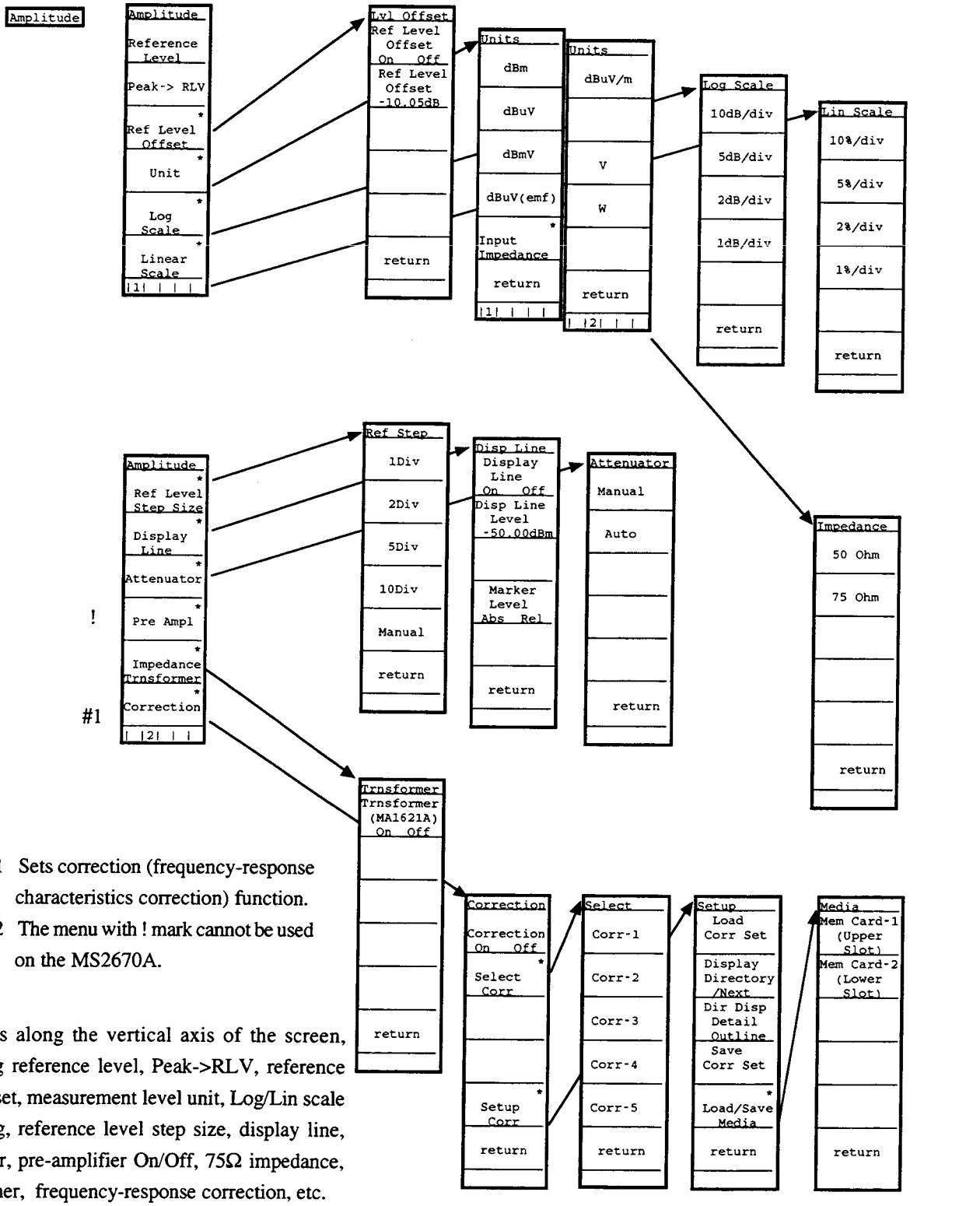
Menu Tree (2/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————



#1 Sets correction (frequency-response characteristics correction) function.

#2 The menu with ! mark cannot be used on the MS2670A.

- Set items along the vertical axis of the screen, including reference level, Peak->RLV, reference level offset, measurement level unit, Log/Lin scale switching, reference level step size, display line, attenuator, pre-amplifier On/Off, 75Ω impedance, transformer, frequency-response correction, etc.

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Menu Tree (3/27)

— Panel Key —+— Top menu —+— Lower menues —

RBW

RBW
Manual
Auto
RB,VB,SWT Auto
#1 All Auto

- Set the manual/auto of resolution bandwidth, and auto (RBW, VBW and SWP only) or all auto.

#1 Sets RBW, VBW, Sweep Time, Atten all to Auto.

VBW

VBW
Manual
Auto
Filter Off
#2 VB/RB Ratio 1.0
RB,VB,SWT Auto
All Auto

- Set the manual/auto of video bandwidth, and auto (RBW, VBW and SWP only) or all auto.

#2 Sets ratio of VBW to RBW when VBW is Auto.

Sweep Time

Sweep Time
Manual
Auto
RB,VB,SWT Auto
All Auto

- Set the manual/auto of sweep time, and auto (RBW, VBW and SWP only) or all auto.

Atten

Attenuator
Manual
Auto
! Pre Ampl On Off
All Auto

- Set the manual/auto of the input attenuator, On/Off of the pre-amplifier and all auto.
- The menu with ! mark cannot be used on the MS2670A.

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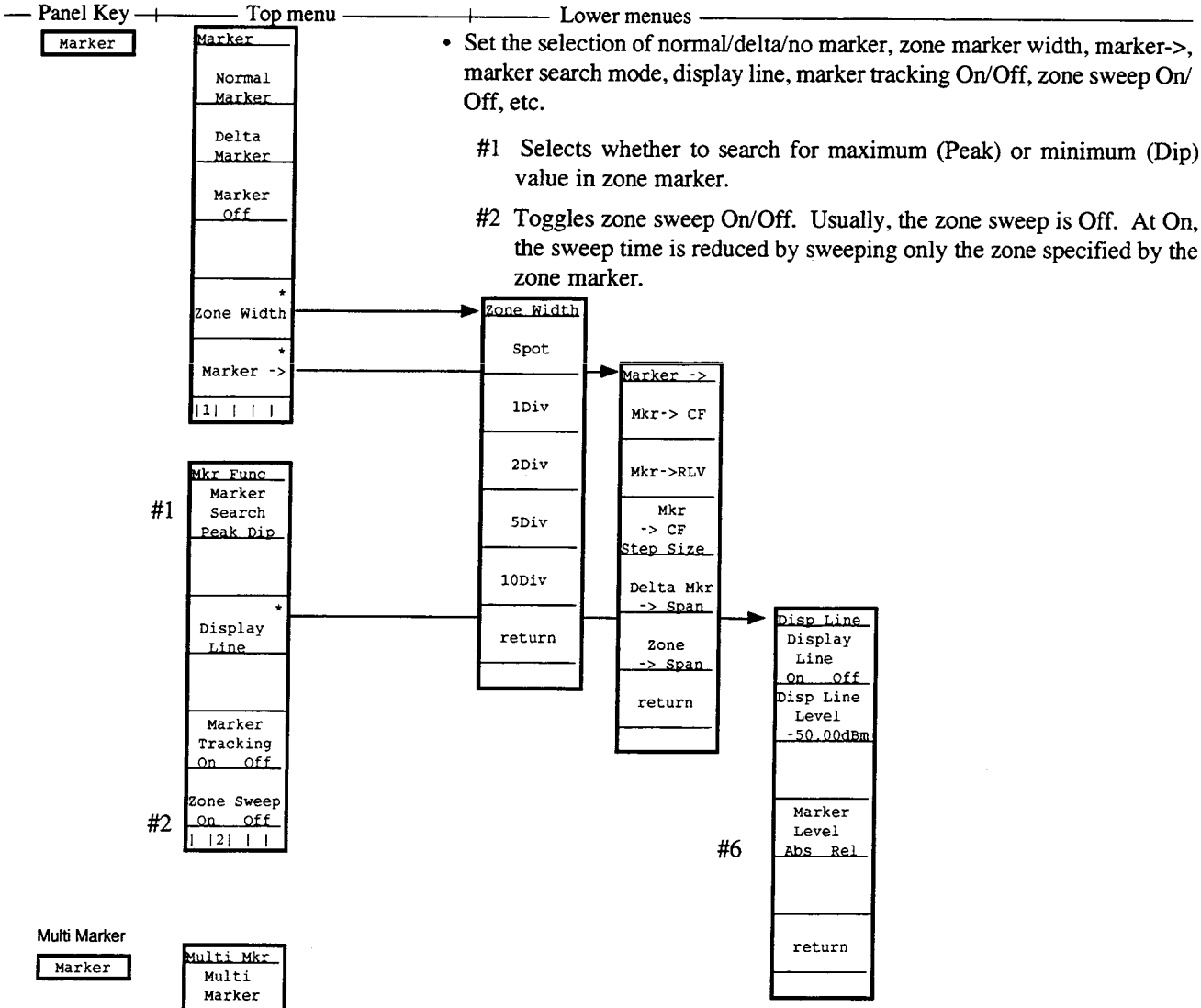
Menu Tree (4/27)



- Set the selection of normal/delta/no marker, zone marker width, marker->, marker search mode, display line, marker tracking On/Off, zone sweep On/Off, etc.

  #1 Selects whether to search for maximum (Peak) or minimum (Dip) value in zone marker.

  #2 Toggles zone sweep On/Off. Usually, the zone sweep is Off. At On, the sweep time is reduced by sweeping only the zone specified by the zone marker.

- Set multi-marker On/Off, 10 multi-marker, harmonic multi-marker, listing of multi-marker values, selection of necessary markers, etc.

  #3 Allocates up to 10 multi-markers sequentially from the peak level of the signal displayed on screen.

  #4 Allocates multi-markers to the harmonic signals of frequency indicated by current marker.

  #5 Function allowing user to select only multi-markers necessary for measurement.

  #6 Select "absolute value" or "relative value (display line)" to display marker level.

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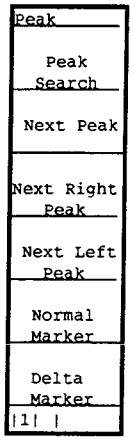
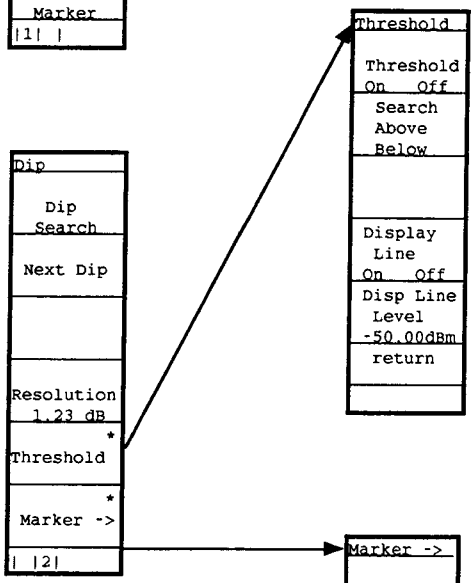
Menu Tree (5/27)

— Panel Key —+— Top menu —+— Lower menues —

Peak Search



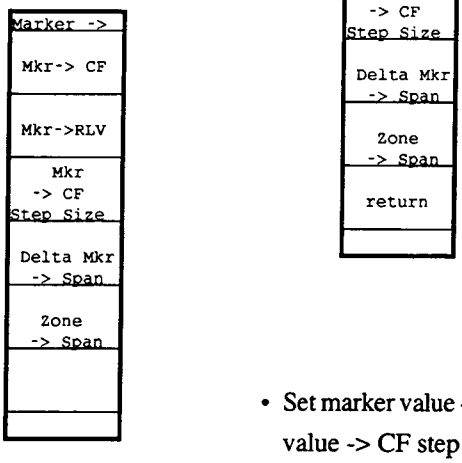
- Set maximum level search, next peak, next right peak, next left peak, Marker->, minimum level search, next minimum level, search level resolution, threshold level On/Off, etc.



#1 Searches for minimum (Dip) level.

#2 Sets peak-search level resolution.

Marker ->
Peak Search



- Set marker value -> center frequency, marker value -> reference level, marker value -> CF step size, delta marker-> span, zone marker -> span, etc.

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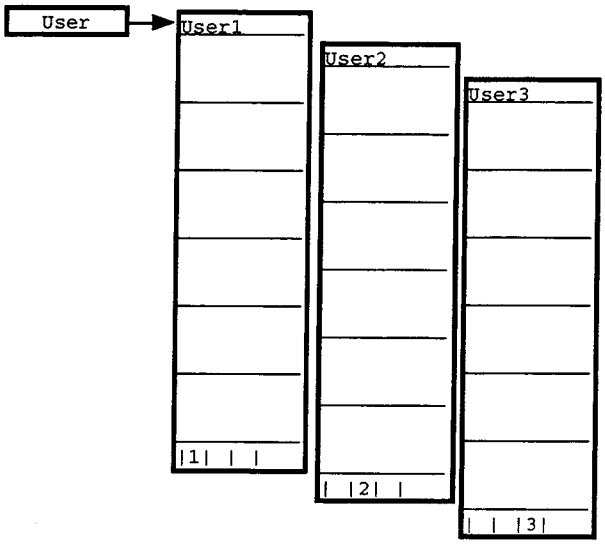
Menu Tree (6/27)

Panel Key	Top menu	Lower menues
Peak →CF		
Peak →RLV		
Single		
Continuous Single		
User	User1	
	User2	
	User3	



- The soft-key menu defined by the user is displayed. (See "User Define".)

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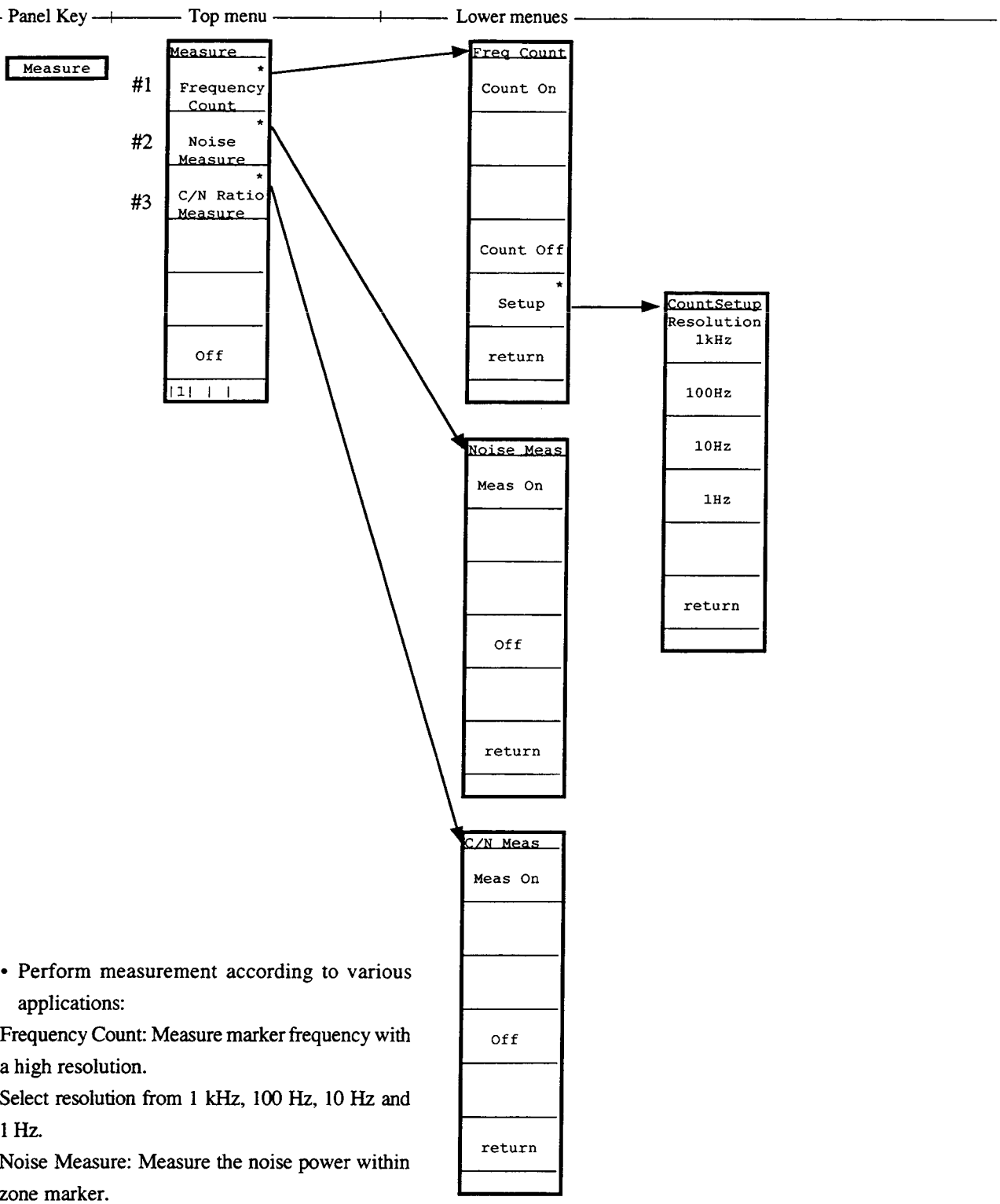
Menu Tree (7/27)



- Perform measurement according to various applications:

#1 Frequency Count: Measure marker frequency with a high resolution.
Select resolution from 1 kHz, 100 Hz, 10 Hz and 1 Hz.

#2 Noise Measure: Measure the noise power within zone marker.

#3 C/N Ratio Measure: Measure the ratio of carrier signal and noise power. Reference marker of the delta marker shall be set to the carrier, and marker's zone width specifies the power measured.

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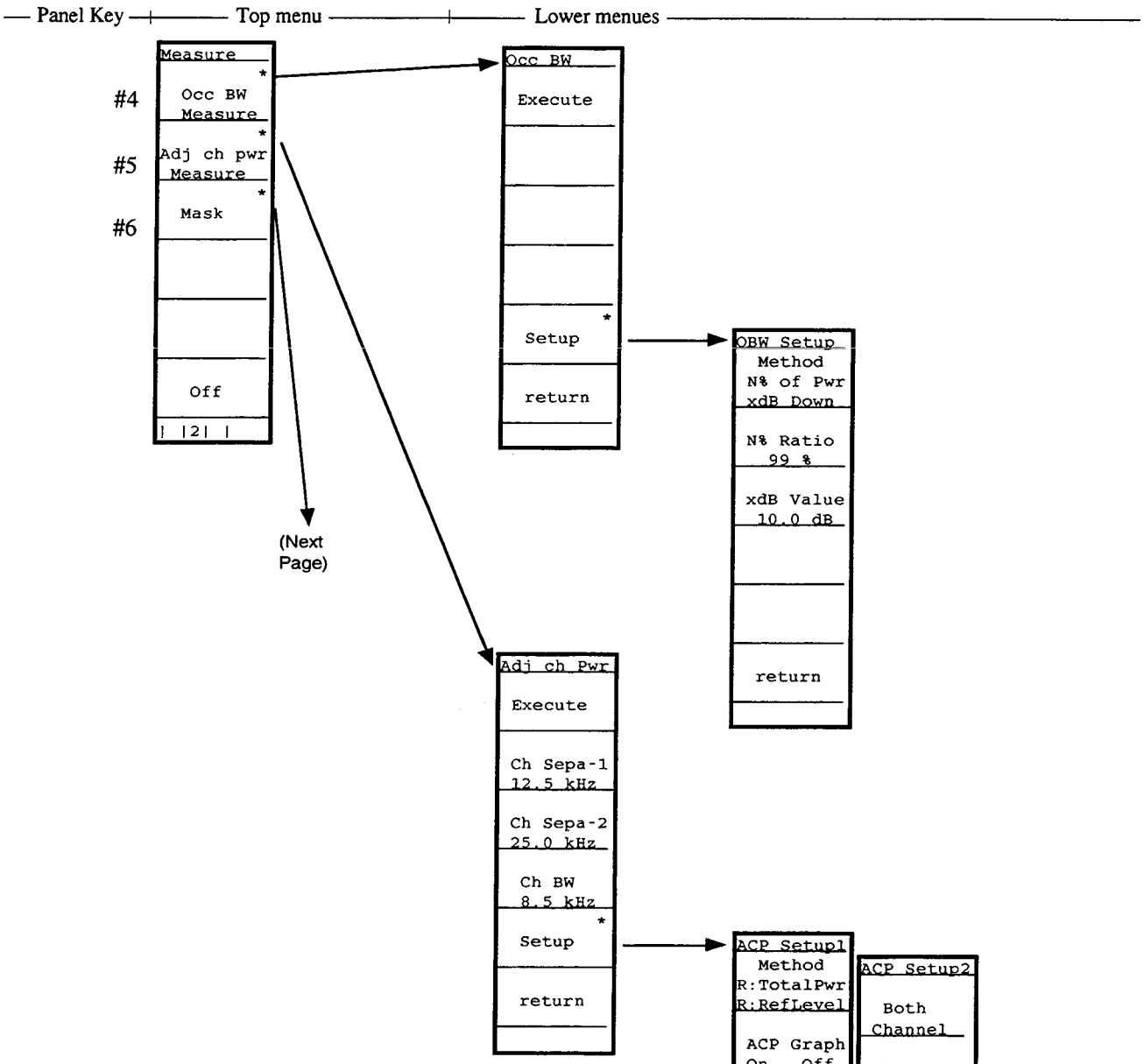
Menu Tree (8/27)



#4 Occ BW Measure: Measure the occupied bandwidth. Select the XdB DOWN or N% of POWER mode.

#5 Adj ch pwr Measure: Measure leak power from adjacent channels. Select Channel Separate, Channel Bandwidth and Measurement Mode (Method), On/Off of ACP Graph, On/Off of Channel Center Line and On/Off of Channel BW Line, Upper Channel, Lower Channel or Both Channel, etc.

#6 Mask: Set Standard Line of the frequency domain and judge Good/NG in relation to the standard line. Select Mask Table, Mask Movement, Measurement Mode, Mask Table Preparation, Load/Save of Mask Table, etc.

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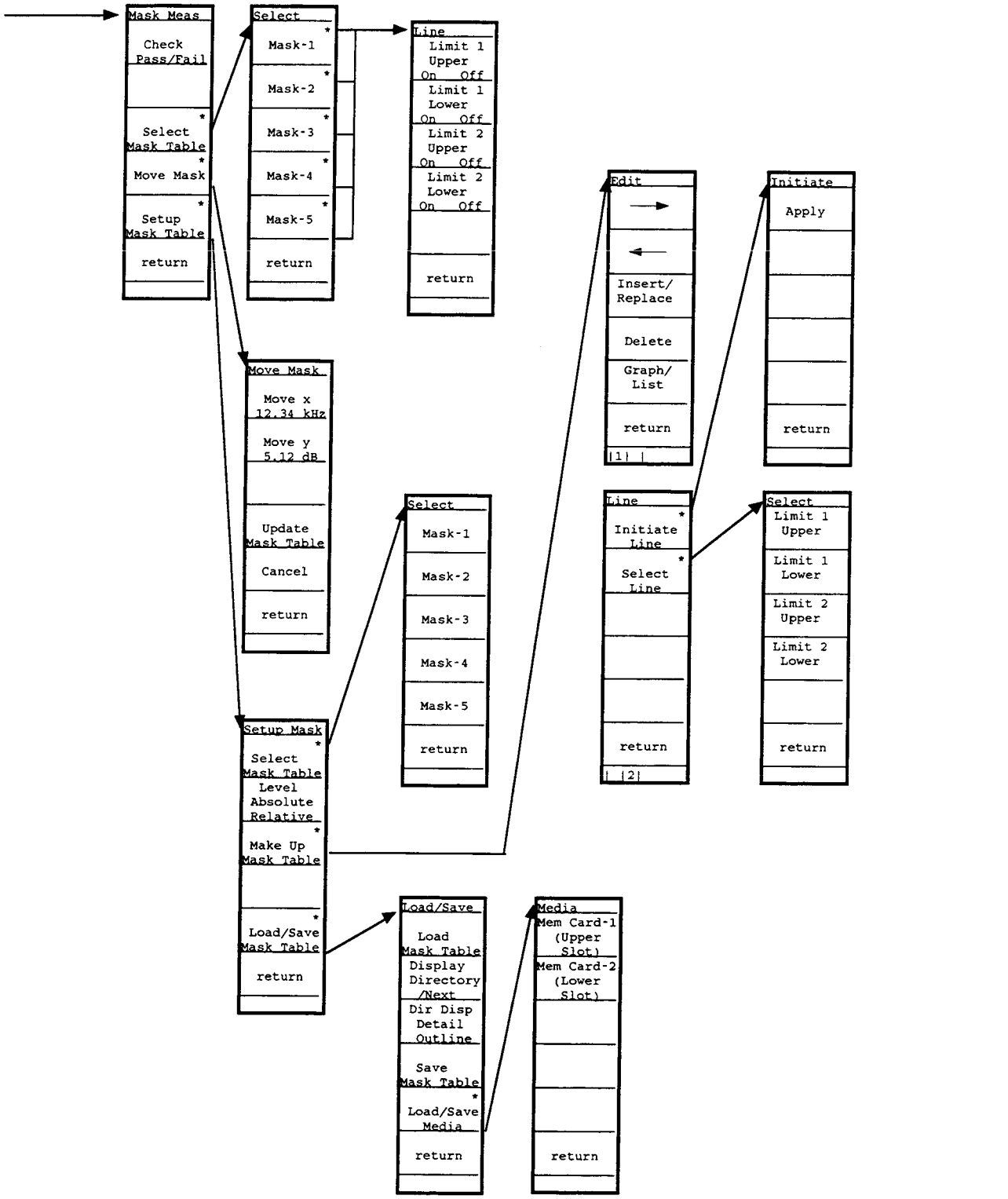
Menu Tree (9/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————



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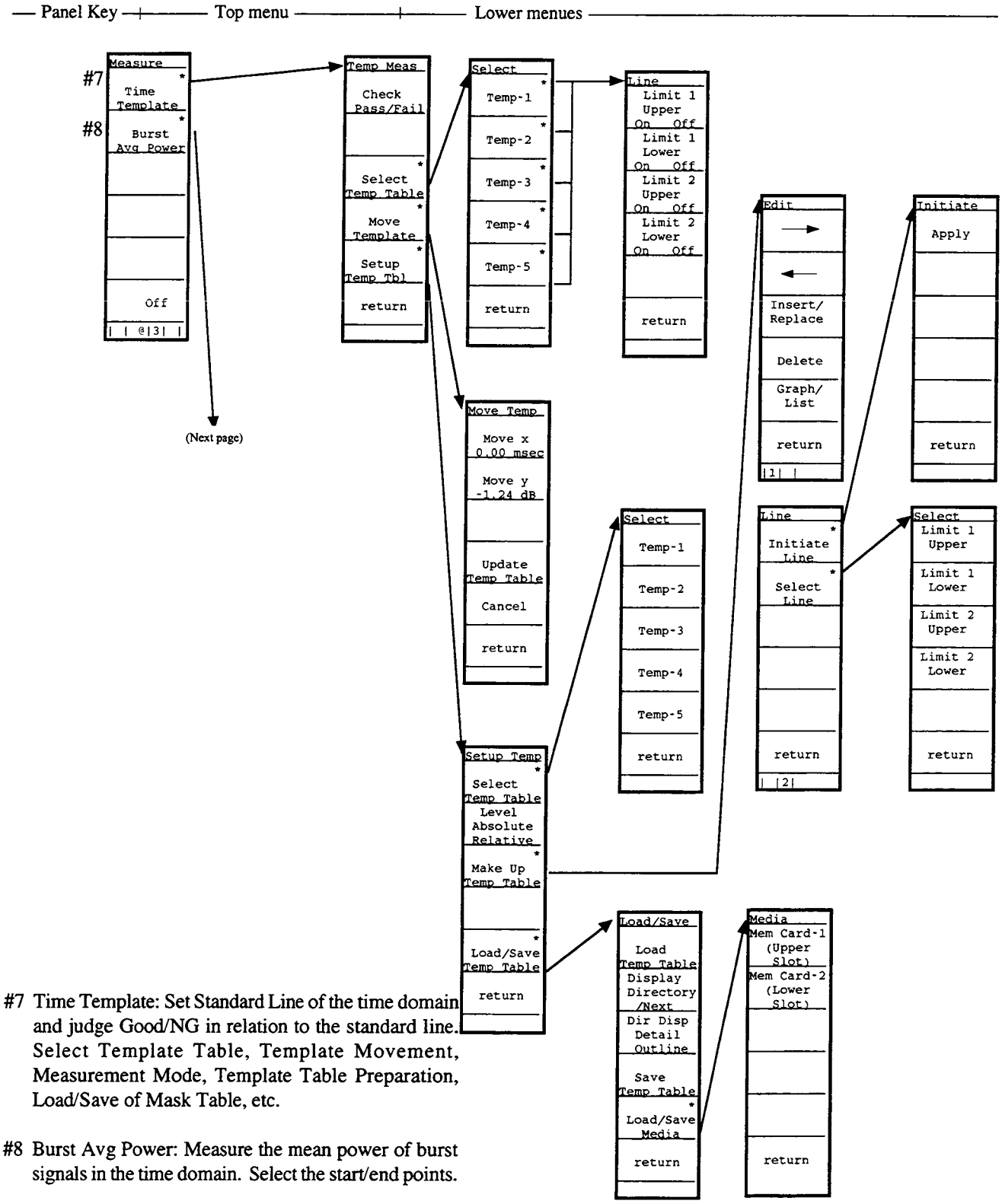
Menu Tree (10/27)



#7 Time Template: Set Standard Line of the time domain and judge Good/NG in relation to the standard line. Select Template Table, Template Movement, Measurement Mode, Template Table Preparation, Load/Save of Mask Table, etc.

#8 Burst Avg Power: Measure the mean power of burst signals in the time domain. Select the start/end points.

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Menu Tree (11/27)

Panel Key	Top menu	Lower menues
	(Previous Page) →	Burst Pwr
		Execute
		Start Point 100
		Stop Point 100
		return

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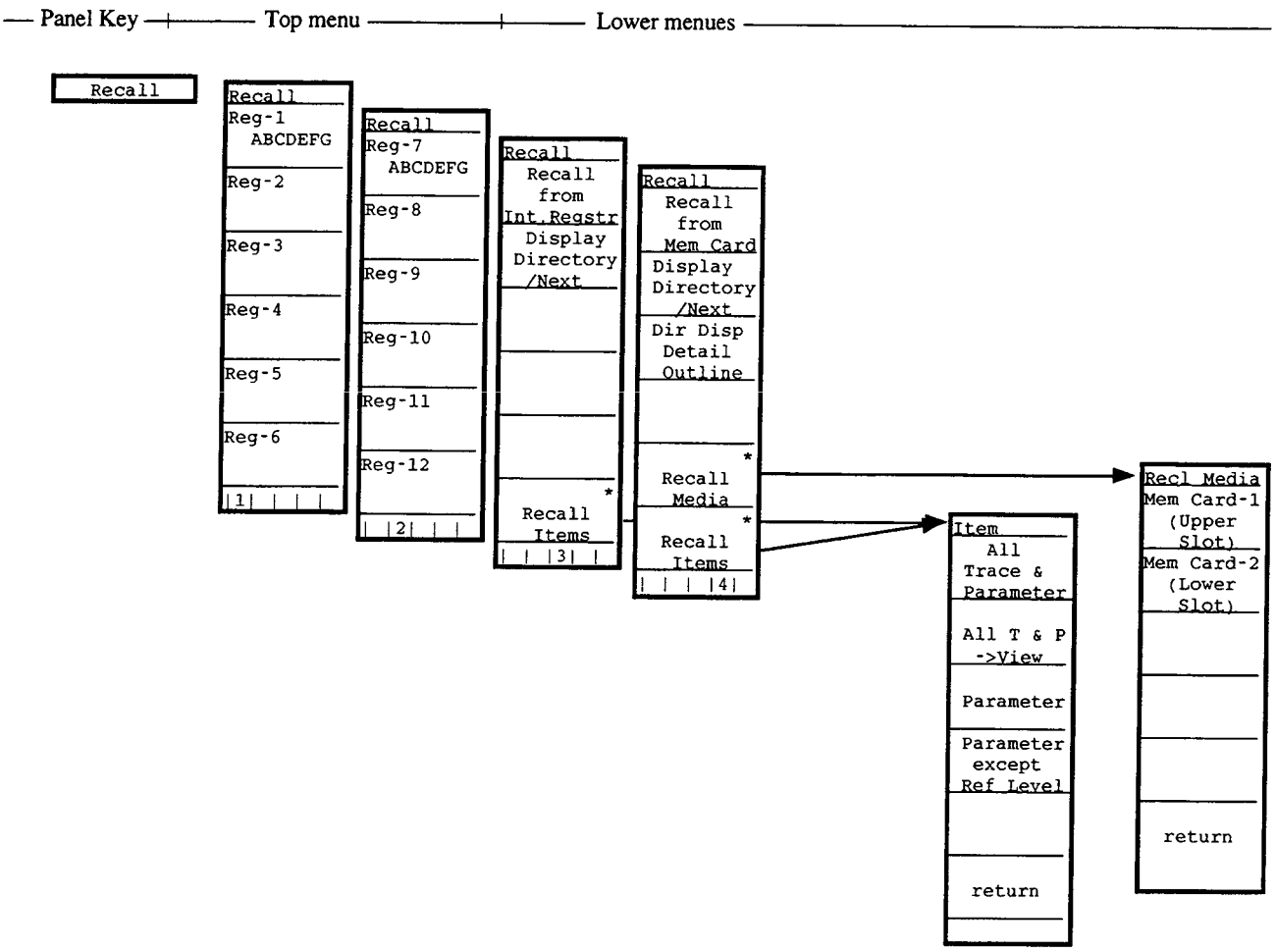
Menu Tree (12/27)



- Read out trace waveform/parameters from the internal memory or memory card. Select recall addresses and media/items, and display file directories.

  #1 Displays list of internal-register directories.

  #2 Specifies items to be recalled (trace waveform, parameter, etc.).

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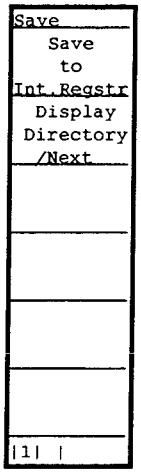
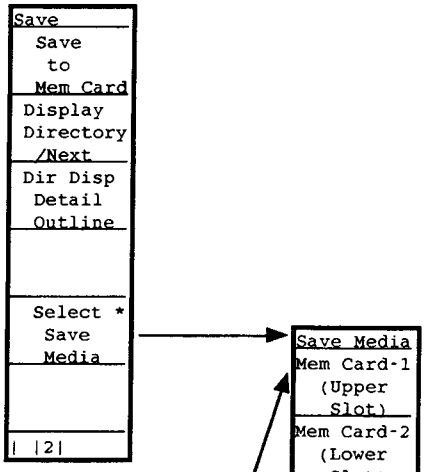
Menu Tree (13/27)

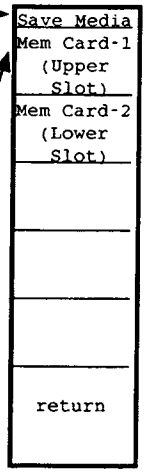
— Panel Key —+— Top menu —+— Lower menues —

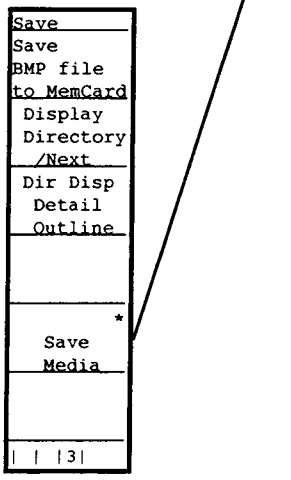
Save
Recall



- Save trace waveform/parameters to the internal memory or memory card. Select saved media, and display file directories.







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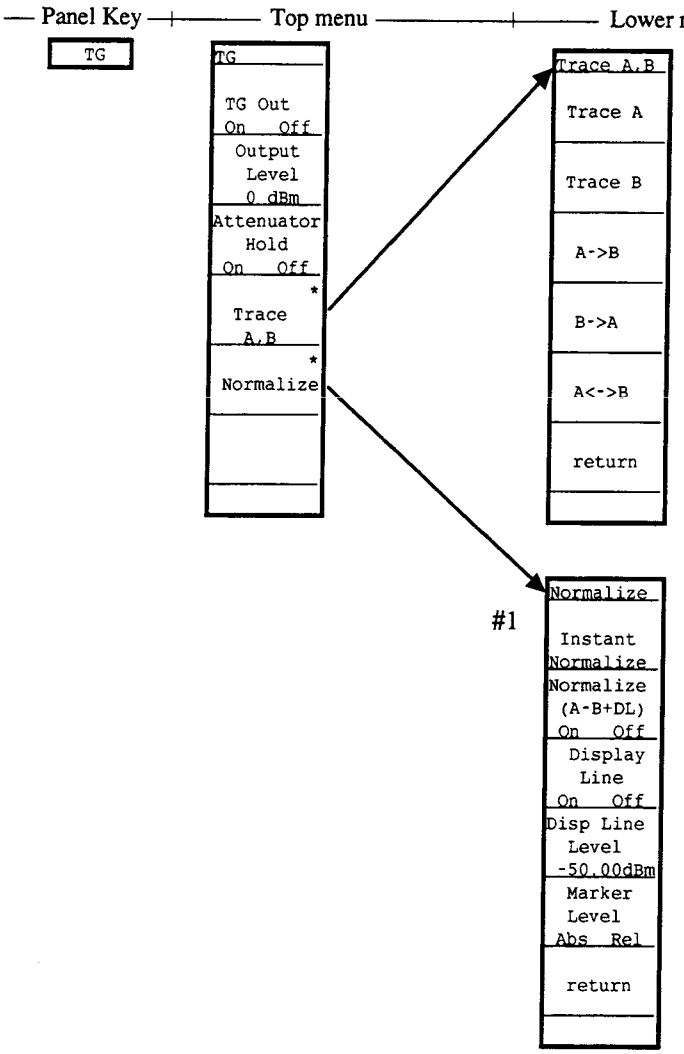
Menu Tree (14/27)



- Set ON/OFF and output level of tracking generator.

#1 Normalize trace-A waveform data, and display it.

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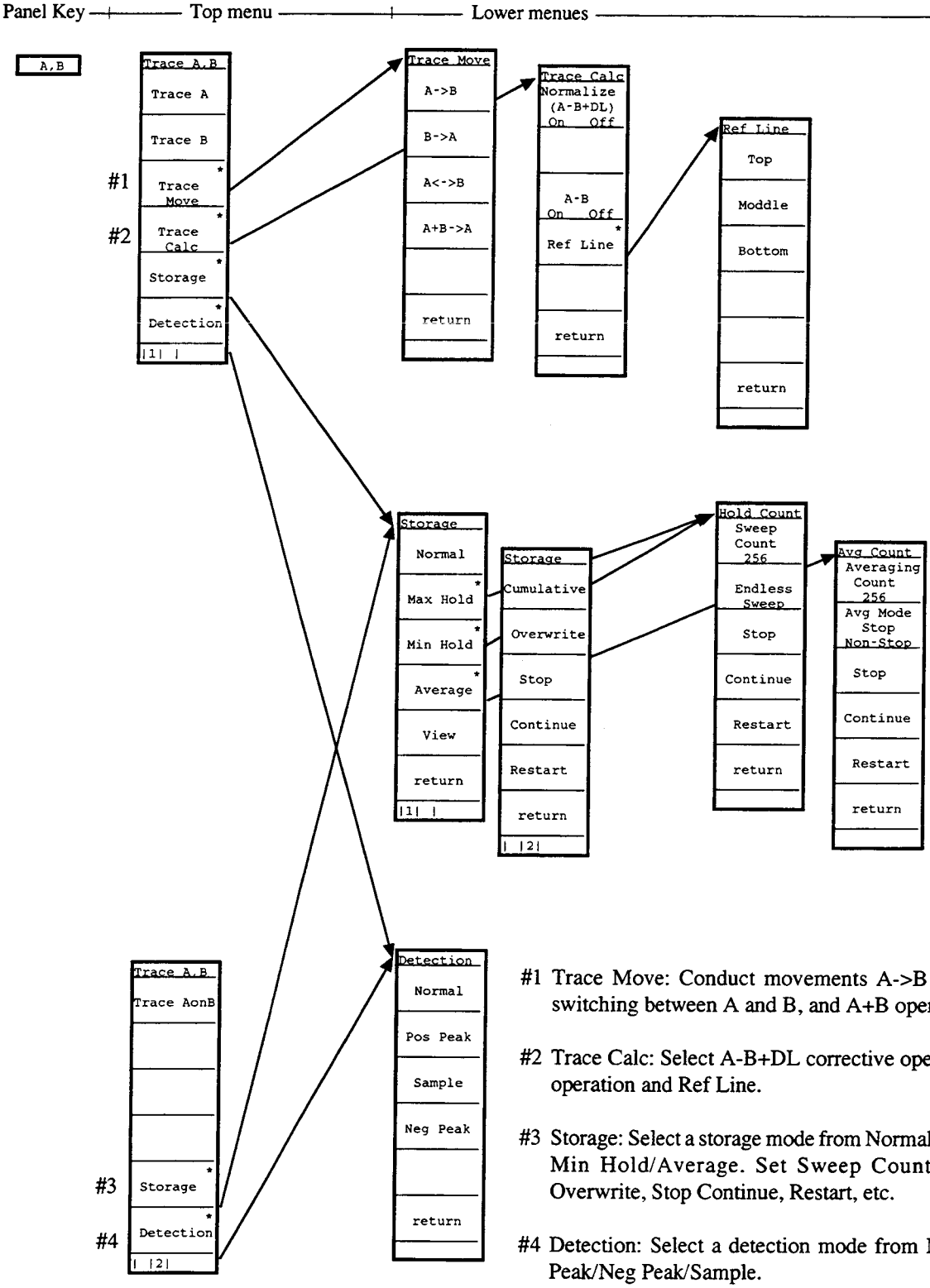
Menu Tree (15/27)



#1 Trace Move: Conduct movements A->B and B->A, switching between A and B, and A+B operation.

#2 Trace Calc: Select A-B+DL corrective operation, A-B operation and Ref Line.

#3 Storage: Select a storage mode from Normal/Max Hold/ Min Hold/Average. Set Sweep Count, Rewrite/ Overwrite, Stop Continue, Restart, etc.

#4 Detection: Select a detection mode from Normal/Pos Peak/Neg Peak/Sample.

- Select Trace A/B, movement between Trace A/B, sum/difference operation between Trace A/B and Ref Line, and designate the storage and detection modes and Active Trace.

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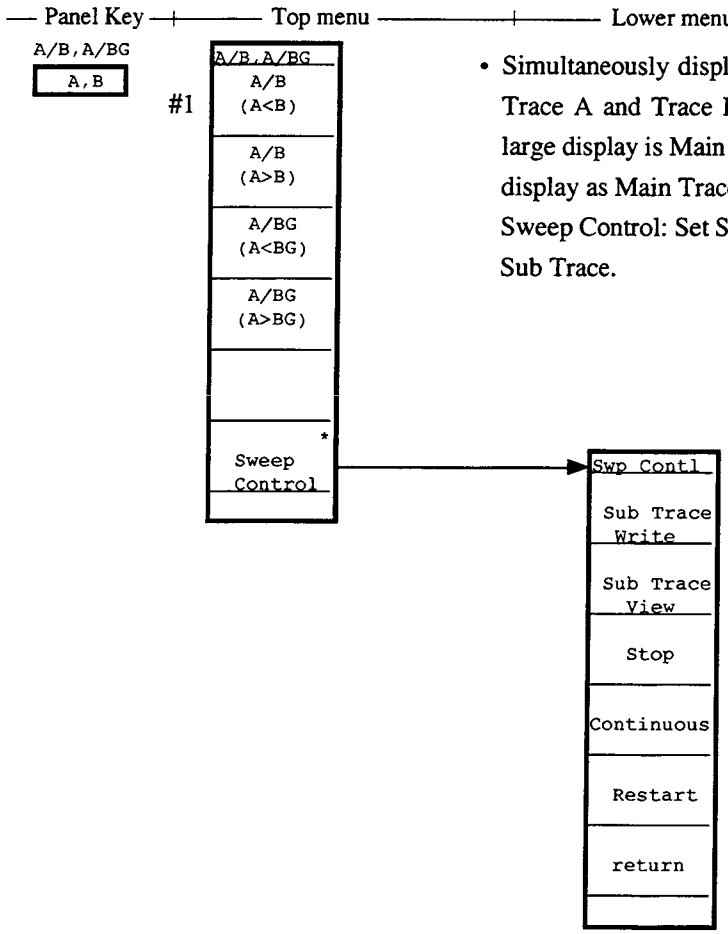
Menu Tree (16/27)



- Simultaneously display two waveforms, namely Trace A and Trace B or Trace A and Trace BG (peripheral spectrum containing Trace A). The large display is Main Trace and the small one is Sub Trace; select which to display as Main Trace (or Sub Trace).
  Sweep Control: Set Stop/Continuous/Restart for sweep and Stop/Write for Sub Trace.

#1 Displays two traces A and B simultaneously at top and bottom of screen. The trace-B display is the larger at this time.

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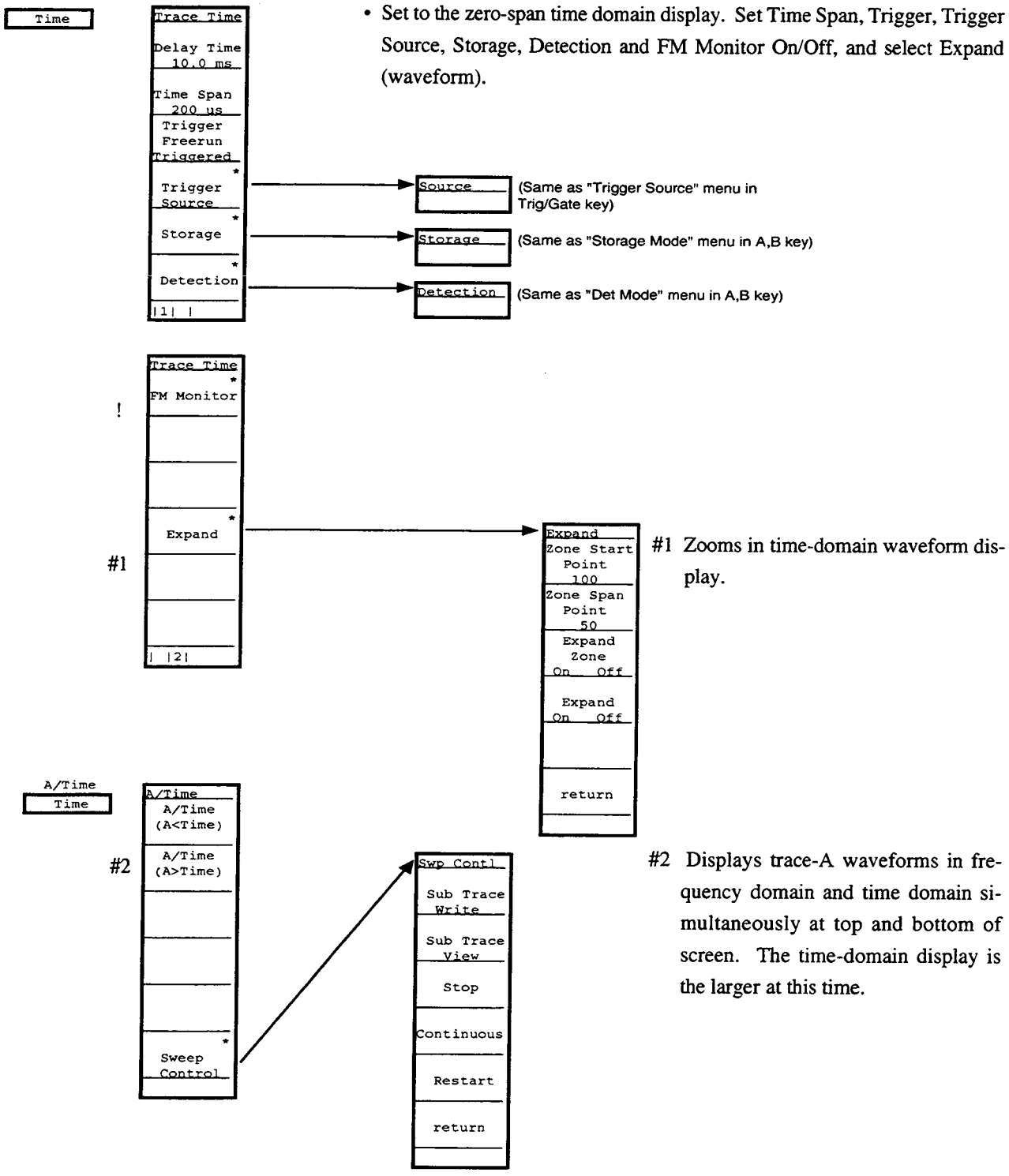
Menu Tree (17/27)

— Panel Key —+— Top menu —+— Lower menues —



- Set to the zero-span time domain display. Set Time Span, Trigger, Trigger Source, Storage, Detection and FM Monitor On/Off, and select Expand (waveform).

#1 Zooms in time-domain waveform display.

#2 Displays trace-A waveforms in frequency domain and time domain simultaneously at top and bottom of screen. The time-domain display is the larger at this time.

- Simultaneously display waveforms of Trace a and Time Domain. Which to display as Main Trace (or Sub Trace) can be selected.

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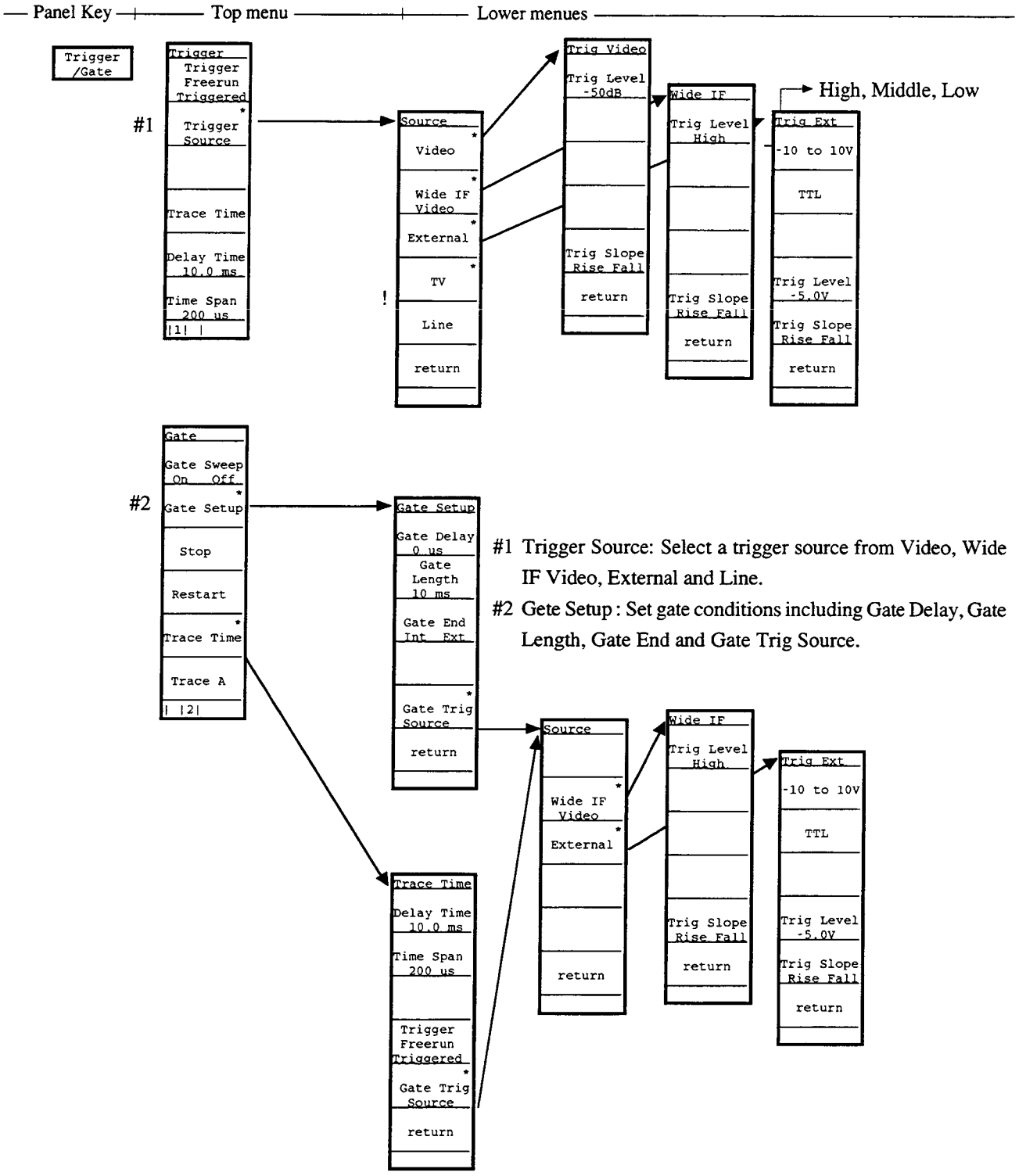
Menu Tree (18/27)



#1 Trigger Source: Select a trigger source from Video, Wide IF Video, External and Line.

#2 Gete Setup : Set gate conditions including Gate Delay, Gate Length, Gate End and Gate Trig Source.

- Set gate functions for controlling the sweep start trigger and the writing of waveform data. Set the trigger mode, trigger source, trace time, delay time and time span. Select On/Off, Stop and Restart of Gate Sweep.

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Menu Tree (19/27)

Panel Key	Top menu	Lower menues
TV Monitor		
Trig/Gate		

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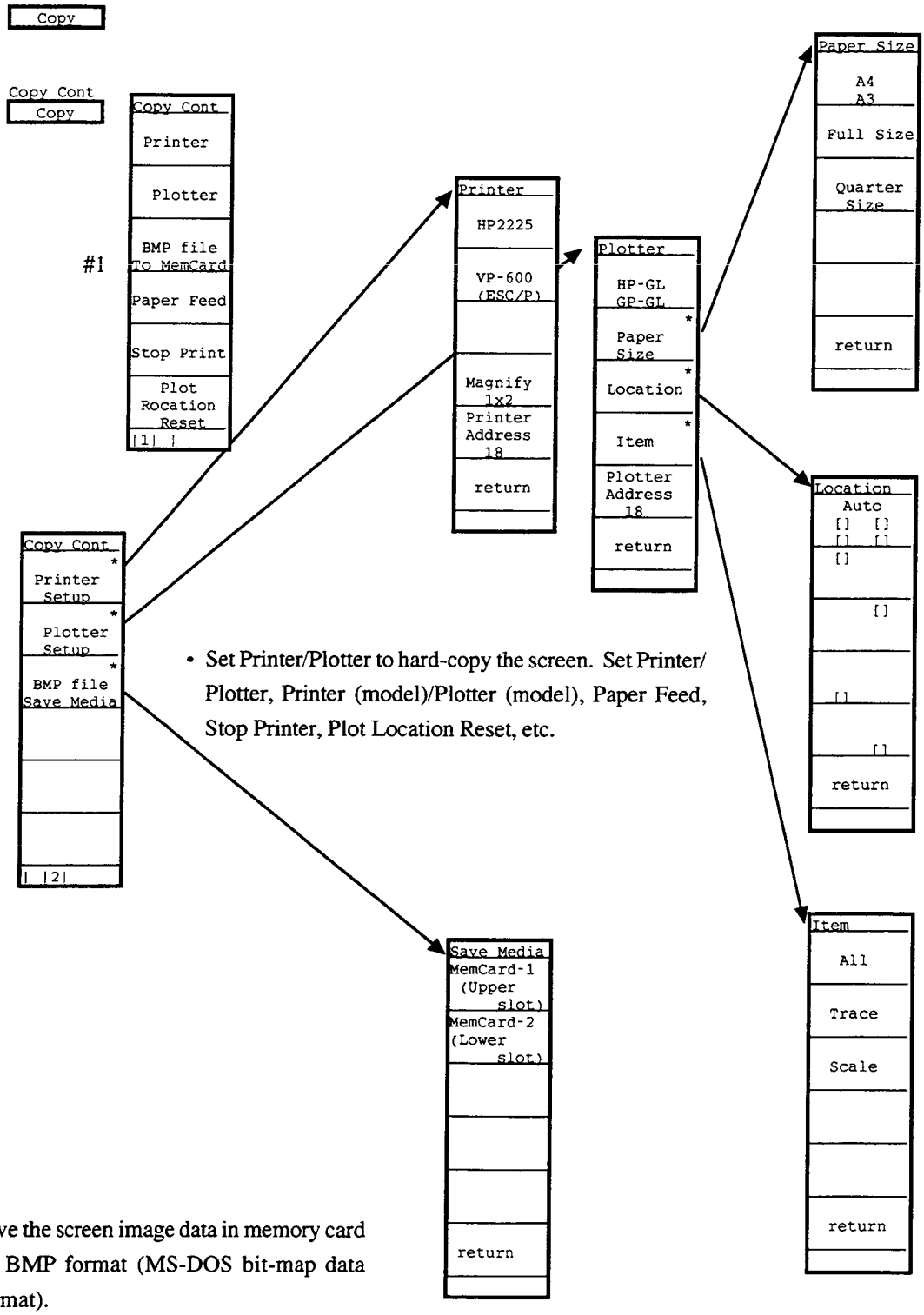
Menu Tree (20/27)

— Panel Key —+— Top menu —+— Lower menues —



- Set Printer/Plotter to hard-copy the screen. Set Printer/Plotter, Printer (model)/Plotter (model), Paper Feed, Stop Printer, Plot Location Reset, etc.

#1 Save the screen image data in memory card by BMP format (MS-DOS bit-map data format).

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Menu Tree (21/27)

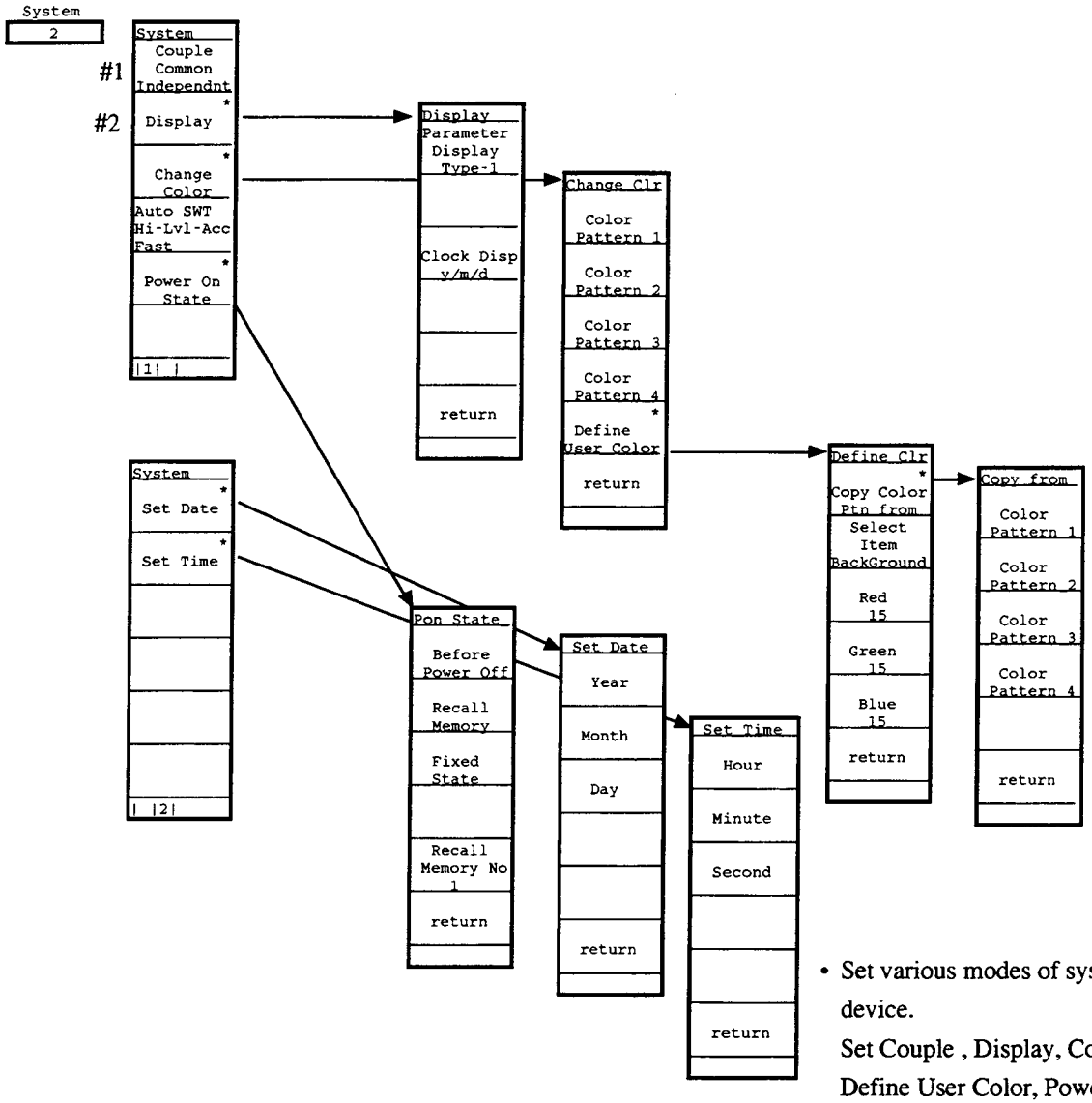
— Panel Key —+— Top menu —————+— Lower menues ————————————————————

Sound
! 1

• The menu with ! mark cannot be used on the MS2670A.

#1 Sets whether the coupled settings for RBW, VBW, etc., in frequency and time domain, independent or common.

#2 Changes screen color pattern.



• Set various modes of systems of this device.
Set Couple , Display, Color Pattern, Define User Color, Power On State, etc.

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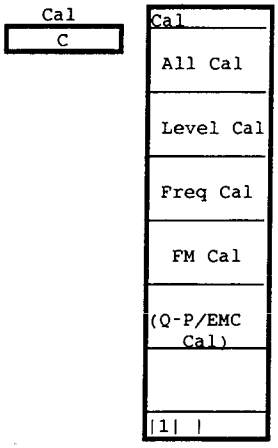
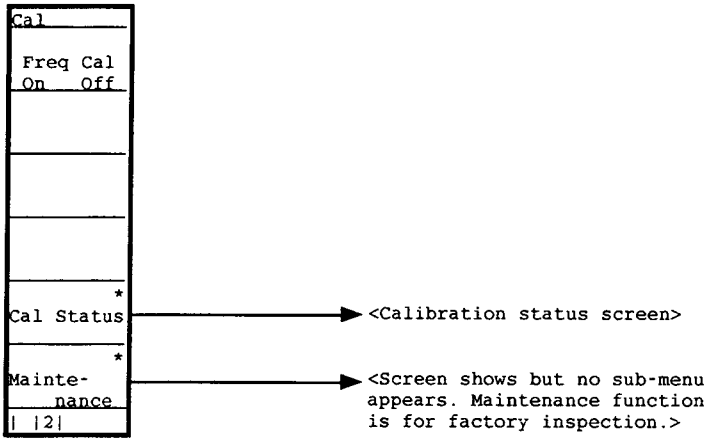
Menu Tree (22/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————————

• Execute calibration. Select an item from All Cal, Level Cal and Freq Cal.





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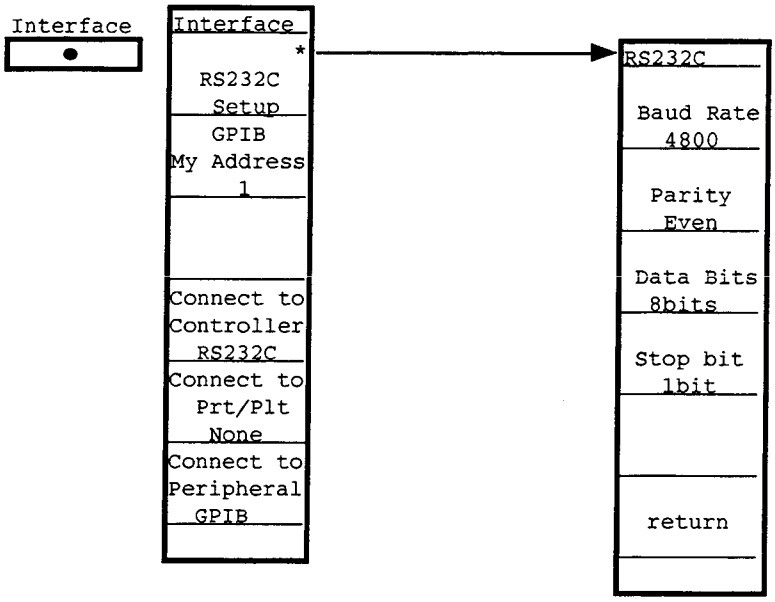
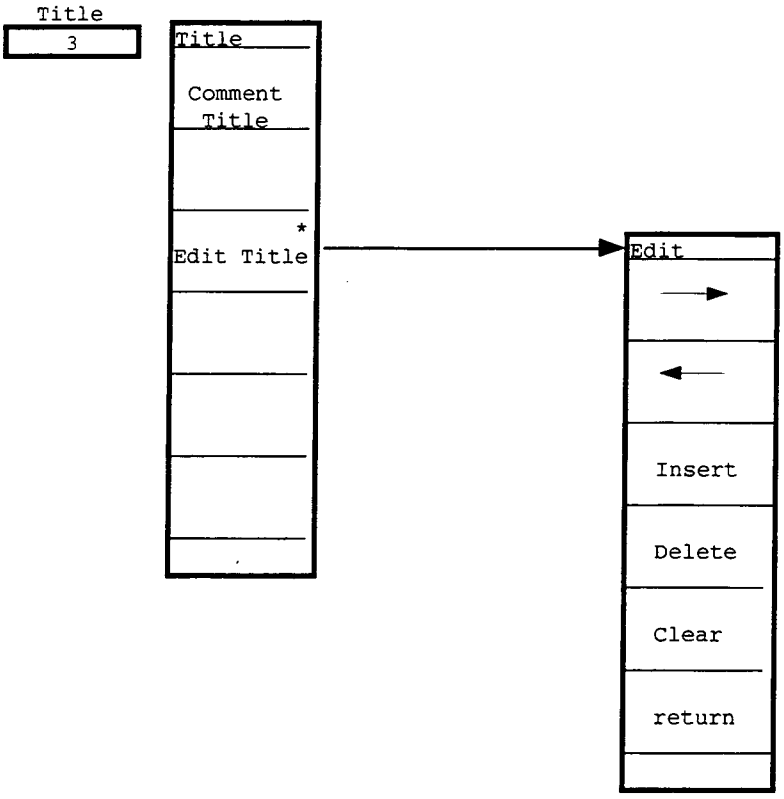
Menu Tree (23/27)

— Panel Key —+— Top menu —+— Lower menues —

- Set interfaces for external devices to connect. Select RS232C, or GPIB, and set the RS232C interface, GPIB address, etc.



- Input a title to display on the screen.



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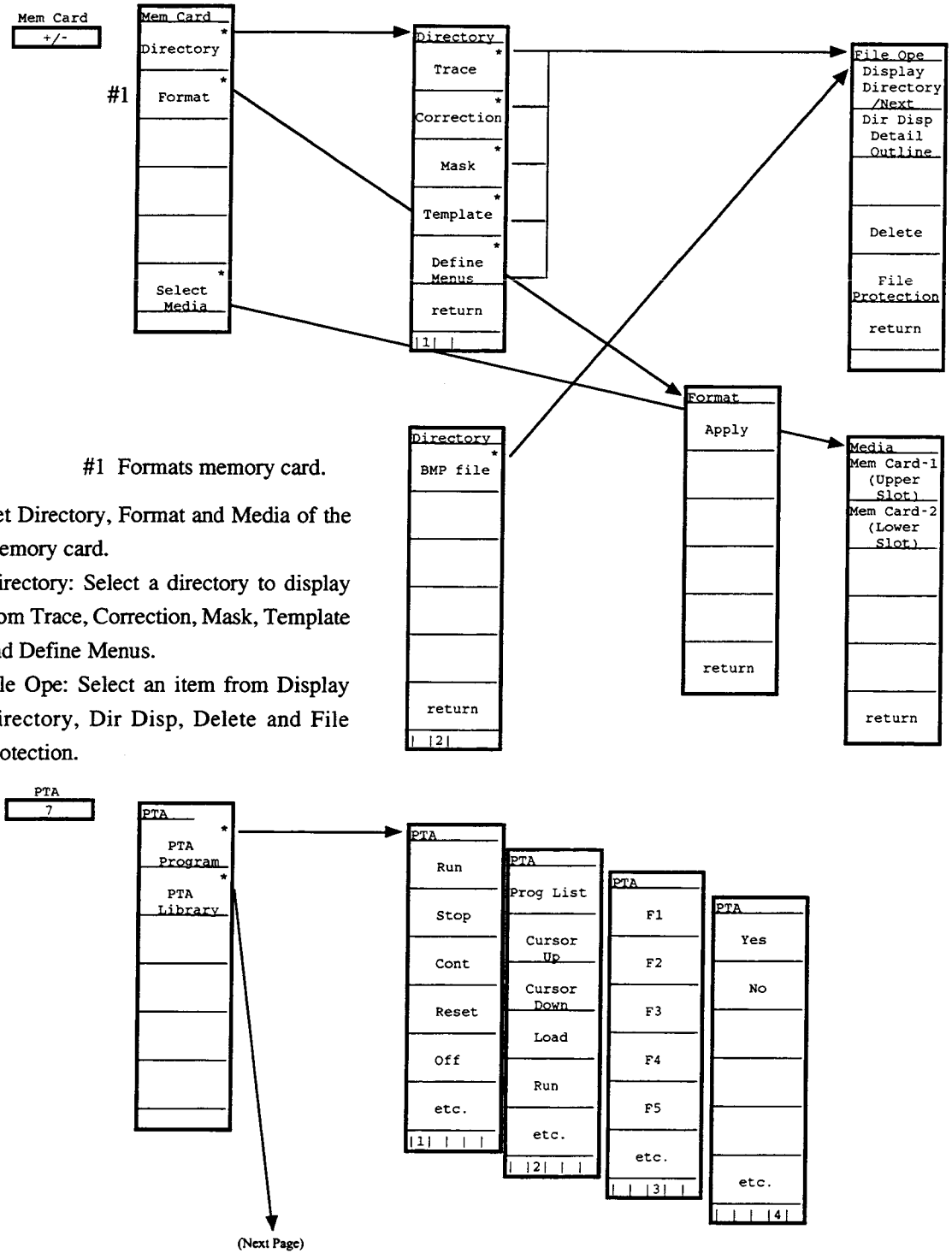
Menu Tree (24/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————



#1 Formats memory card.

- Set Directory, Format and Media of the memory card.
  Directory: Select a directory to display from Trace, Correction, Mask, Template and Define Menus.
  File Ope: Select an item from Display Directory, Dir Disp, Delete and File Protection.

- Set PTA (personal test automation) that can build an auto measurement system without requiring external controllers.
  PTA Program: Select one from Run, Stop, Cont Reset, Prog List, Load, etc.
  PTA Library: Select one from Display/Run for the library program and Load/Check for the library file.

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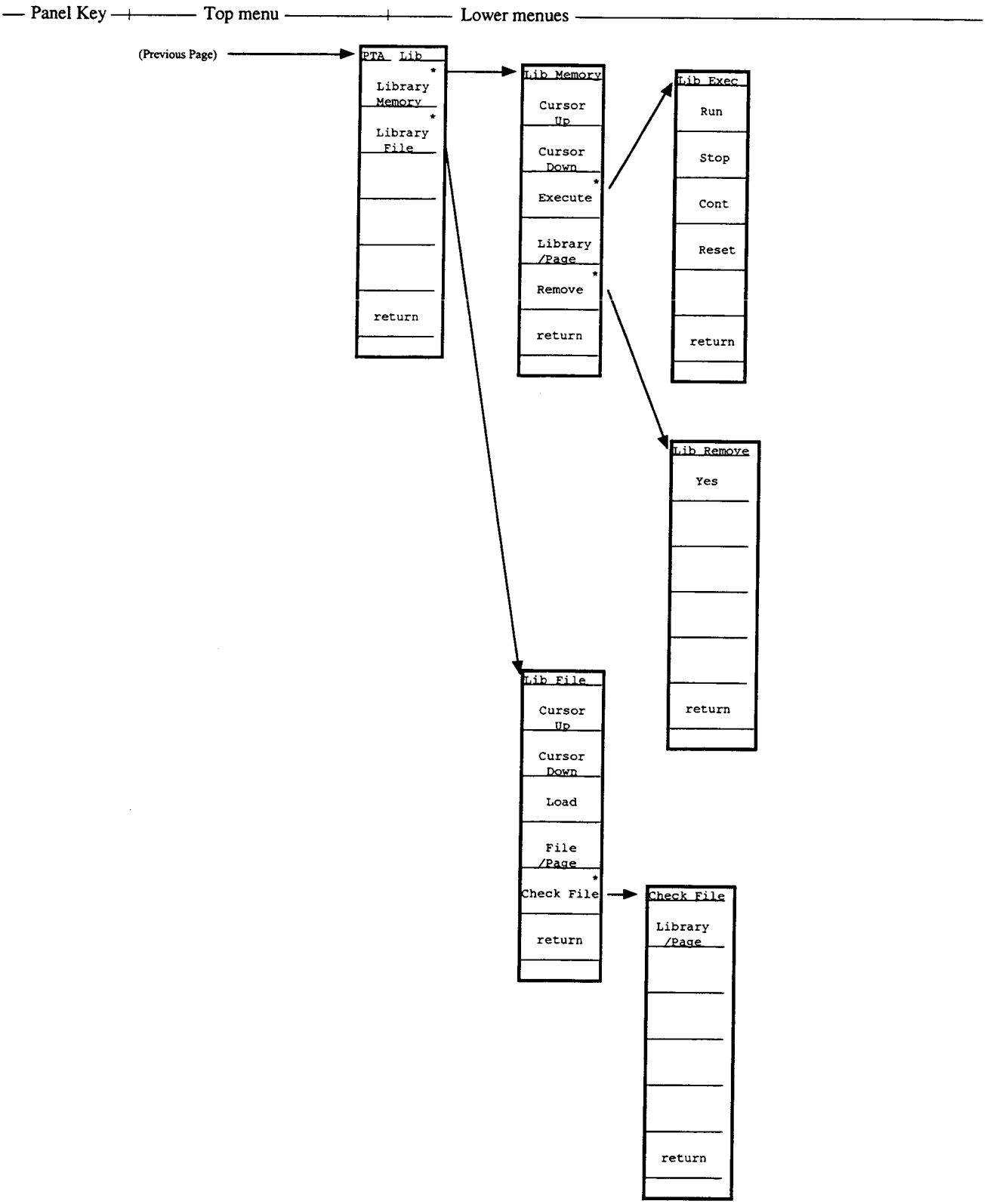
Menu Tree (25/27)



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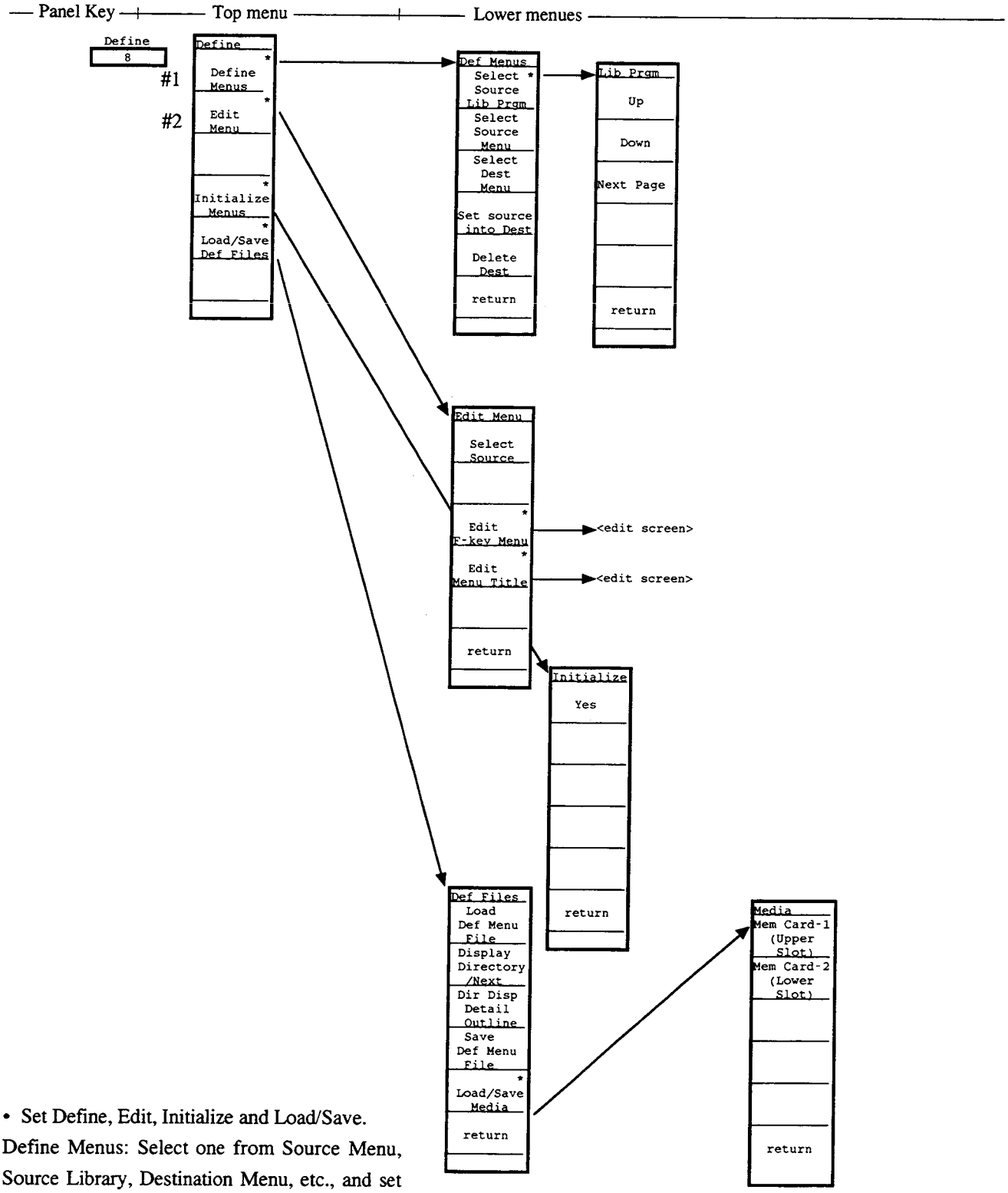
Menu Tree (26/27)



- Set Define, Edit, Initialize and Load/Save.

#1 Define Menus: Select one from Source Menu, Source Library, Destination Menu, etc., and set Definition/Delete for the user menu.

#2 Edit Menu: Select a source and edit Menu Title.

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Menu Tree (27/27)

Panel Key	Top menu	Lower menues
Preset	Preset	• Initialize measurement parameters. Select one from All, Sweep, Trace, Level and Frequ/Time.
Hold GHz		
Local		

Preset
Preset All
Preset Sweep controll
Preset Trace Parameters
Preset Level Parameters
Preset Freq/Time Parameters

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SECTION 5

BASIC OPERATION PROCEDURE

TABLE OF CONTENTS

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SECTION 5
BASIC OPERATION PROCEDURE

The basic operation procedure of this equipment are explained here. The operations are listed on the right. Also, the explanation willl advance assuming that a 500 MHz signal is applied to the input connector. Please read this manual while operating this equipment.

([ ] : Panel key, ___ : Soft key)

<Actual operations>

(1) Signal display
   1) Turn the power on,
   2) set the signal to the center of the screen, and
   3) enlarge and display the signal.

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

(3) "Measure" function check.

(4) Screen hard copy.

Signal Display

Turn the power on

Press the AC line power switch on the rear panel, then press the power switch (0) on the front panel. In this case, continue pressing the power switch for one second or more.

Press [Preset] key.

Press Preset All Parameters key in the menu.

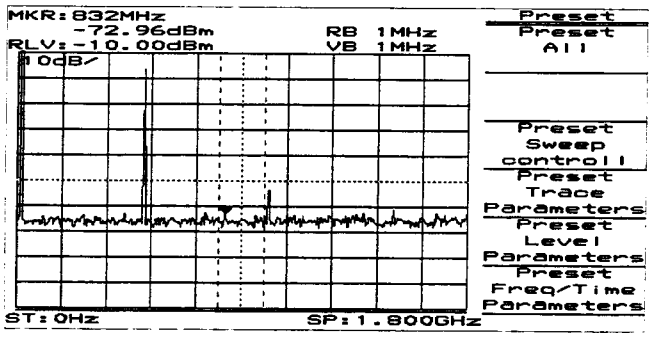

Fig. 5-1

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

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

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

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Set the signal to the center of the screen

Press [Frequency] key.

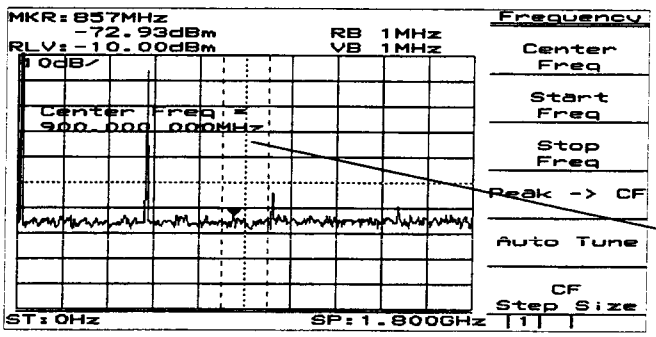

Fig. 5-2

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

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

Press [Menu On/Off] key

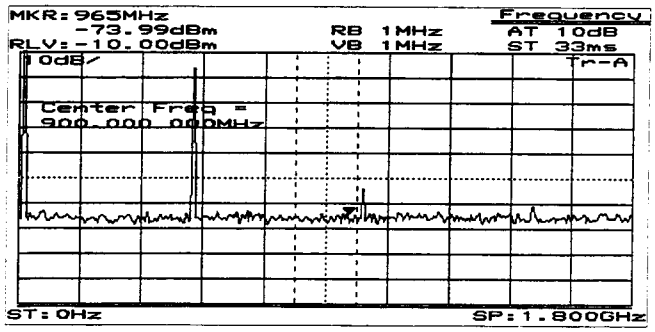

Fig. 5-3

The display of the soft key menu can be switched on/off using [Menu On/Off] key. When the menu disappears, the scale is enlarged. Also, when the menu is displayed, the scale is reduced.

Press [Menu On/Off] key to return to previous screen.
Use the ten-key pad (numeric keys) to enter 500 MHz.

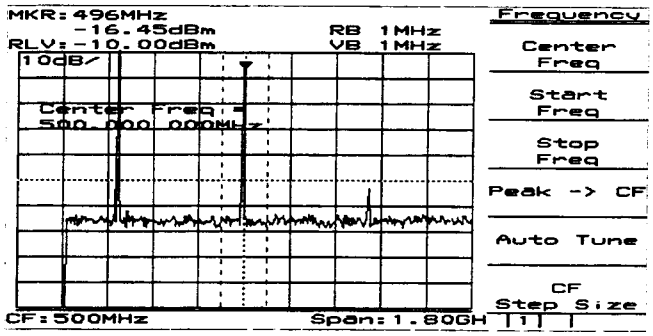

Fig. 5-4

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

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Enlarge and display the signal

Press [Span] key , then press the [V] down key several times to enlarge the signal display.

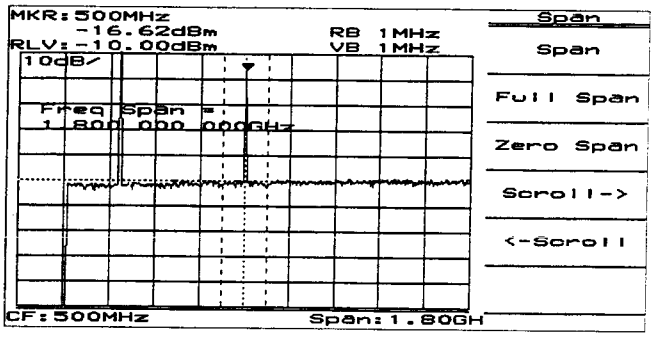

Fig. 5-5

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Marker Operation

Check the zone marker function

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

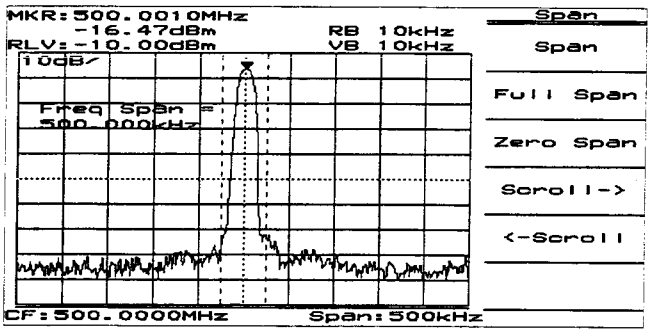

Fig. 5-6

The "marker → CF" function check

To check Marker → CF function, shift the signal from the center intentionally.
Press [Frequency] key and [More] key in order, and then Scroll → key two times.

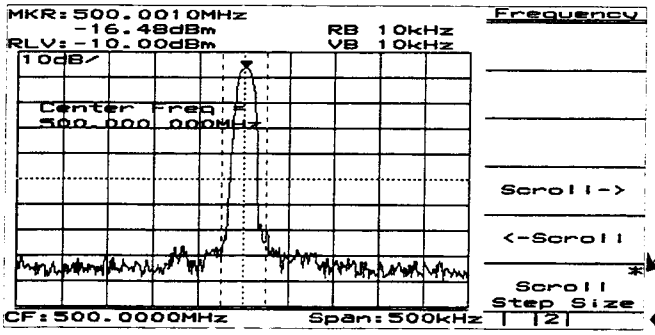

Fig. 5-7

The soft key menu marked by an asterisk (*) on the upper right indicates that the menu can further be opened by pressing the key. Conversely, the soft key menu not marked indicates that the menu cannot be opened further.

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

To turn over the page, press [More] key.

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Press Peak Search key.

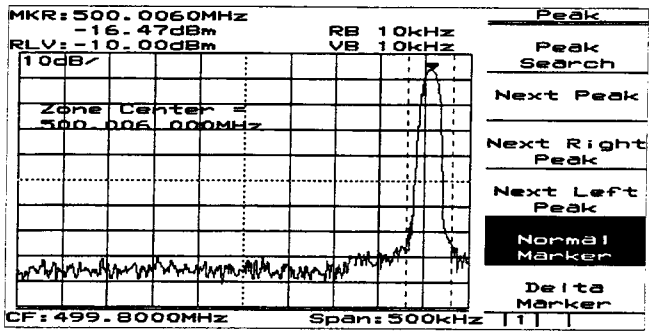

Fig. 5-8

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

The marker fetches the signal.

Press [More] key.

Press Marker → key.

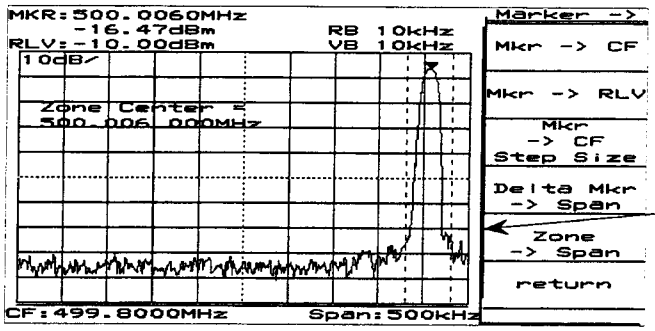

Fig. 5-9

When the soft key menu with "*" is pressed, the lower menu of function related to the menu is further displayed.
In this case, as shown in the figure on the left, the thick line is displayed at the left of the soft key menu. This indicates that the lower menu is displayed.

Press marker → CF key.

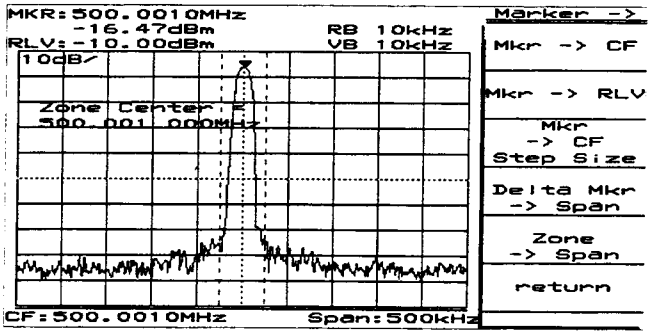

Fig. 5-10

The page opened by pressing the soft key can return to the preceding page by the return key. It can also check which soft key menu was previously pressed to open the current menu, as the menu title is displayed on the upper row of the soft key.

Return to the screen of Fig. 5-7 and ensure that the screen changes to that of Fig. 5-10 only by pressing the [→CF] key.

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"Measure" Function Check

Press [Preset] key and Preset All Parameters key in order.
Press [Peak Search] key.
If the zero beat signal level (local feed though) is larger than the signal level and the marker fetches the zero beat level, press "Next peak" key and put the marker on the signal.

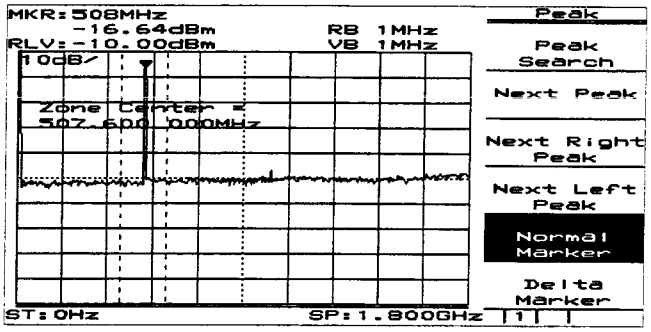

Fig. 5-11

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

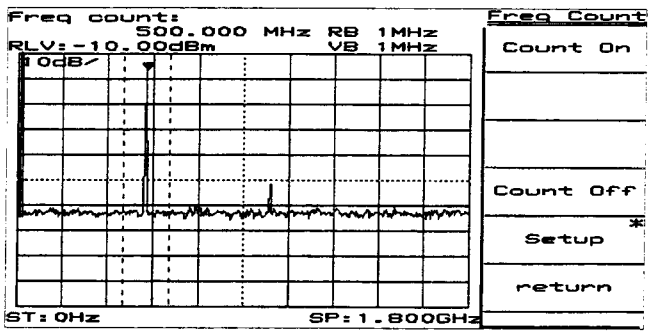

Fig. 5-12

The soft-key menu display can be switched On/Off by the [Menu On/Off] key.
However, keys that condition setting is not possible unless a menu is On unconditionally make the soft-key menu display On when pressing a panel key.

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

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

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Screen Hard Copy

The screen can be hard-copied with the VP-600 printer (Epson) via an RS-232C interface with the procedures described below:

1) As illustrated below, connect the RS-232C connector and printer with an attached RS-232C cable.

2) Press the [Copy] key and the currently displayed screen is hard-copied.
If the printed copy is improper, check if the RS-232C interface is correctly set by performing the following sequence.

3) Press the [Shift] key and then the [Interface] key.

4) Press the Connect to Controller key several times to get None on the display and press the Connect to Prt/Plt key several times to get RS-232C on the display.
Now the printer can be operated with the RS-232C interface.

5) Press the RS-232C Setup key to set (or check if) the the setting of RS-232C interface is the same between the main body and printer.
(For the setting/checking of the RS-232C interface on the printer side, refer to the instruction manual of the printer.)

6) Press the [Shift] key and then the [Copy Cont] key.

7) Press the Printer/Plotter key and select Printer.

8) Press the Printer Setup key and then press the VP-600 key.

9) Press the Magnify key several times and make the display 1 X 1.

10) Press the [Copy] key to print the currently displayed screen.

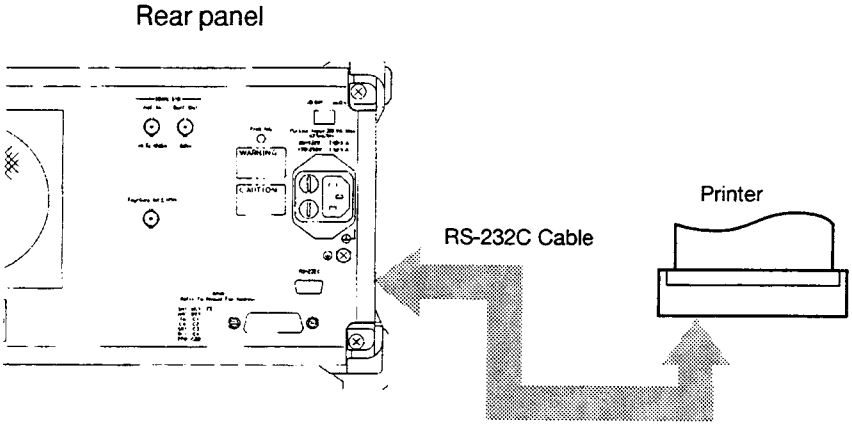

Fig. 5-13

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SECTION 6
PERFORMANCE TESTS

In this chapter, measuring instruments, setup and operations necessary for conducting performance tests of MS2670A are described.

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SECTION 6
PERFORMANCE TESTS

Requirement for Performance Tests

Performance tests are used as preventive maintenance to prevent degradation of the MS2670A performance before it occurs.

Use the performance tests whenever necessary such as at acceptance and periodic inspection of the MS2670A and to verify performance after repair. Execute the performance tests listed below to verify the MS2670A performance at acceptance inspection, periodic inspection, and after repair.

- Reference oscillator frequency stability
- Center frequency display accuracy
- Frequency span display accuracy
- Resolution bandwidth and selectivity
- Sideband noise level
- Frequency measurement accuracy
- Amplitude display linearity
- Frequency response
- Second harmonic distortion
- Input attenuator switching error
- Sweep time and time span accuracy
- TG output level

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

If the specifications are not met at the performance tests, reference Volume 4 Service Manual for maintenance and adjustment procedures.

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Instruments Required for Performance Test

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

Instruments Required for Performance Test (1/2)

Recommended instrument name (Model name)	Required Performance †	Test item
Synthesized signal generator (MG3633A)	• Frequency range 10 MHz to 1.8 GHz Resolution of 1 Hz possible. • Output level range — 20 to 0 dBm. Resolution of 0.1 dB possible. • SSB phase noise ≦130 dBc / Hz (at 10 kHz offset). • Second harmonic ≦30 dBc. • Amplitude modulation (0% to 100%, 0.1 to 400 Hz) possible. • External reference input (10 MHz) possible.	Frequency-span display accuracy. Resolution bandwidth, selectivity. Sideband noise. Amplitude display linearity. Second-harmonic distortion. Input-attenuator switching error. Sweep-time and time-span accuracy.
Attenuator (MN510C)	• Frequency 100 MHz. • Maximum attenuation 70 dB (resolution 0.1 dB) possible with calibrated data.	Amplitude display linearity Input-attenuator switching error.

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

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Instruments Required for Performance Test (2/2)

Recommended instrument name (Model name)	Required Performance †	Test item
Power meter (ML4803A)	• Main instrument accuracy ±0.02 dB. • Frequency range 100 kHz to 1.8 GHz (depending on the power sensor type).	Frequency response. Input-attenuator switching error. TG output level.
Power sensor (MA4601A)	• Frequency range 100 kHz to 1.8 GHz. • Measurement power range — 30 to +10 dBm. • Input connector N type.	Frequency response. Input-attenuator switching error. TG output level.
Low-pass filter (M-238C) (SAGE L20CA072)	• Attenuation ≧ 70 dB (at frequency: 2 X (10 MHz and 1 GHz)).	Second-harmonic distortion.
Frequency counter (MF1601A)	10 MHz measurement possible. Number of display digits: 10. • External reference input (10 MHz) possible.	Reference-oscillator frequency stability.
Frequency standard	• Frequency 10 MHz. • Stability ≦ 1 X 10^{-9}/day.	Reference-oscillator frequency stability.

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

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Performance Test

The warm-up time depends on the test item. For test item other than oscillator frequency, warm-up the equipment for at least for thirty minutes. Test the performance after the MS2670A stabilizes completely. Also, begin measurement after taking the warm-up time of the calibration instrument into full consideration. In addition, the test must be conducted at room temperature; there must be little AC power supply voltage fluctuation, and no noise, vibration, dust, humidity, etc.

Reference oscillator frequency stability

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

(1) Specifications

n Reference oscillator

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

(2) Test instruments

- Frequency counter: MF1601A
- Frequency standard: with stability of $\leq \pm 1 \times 10^{-9}$ / day

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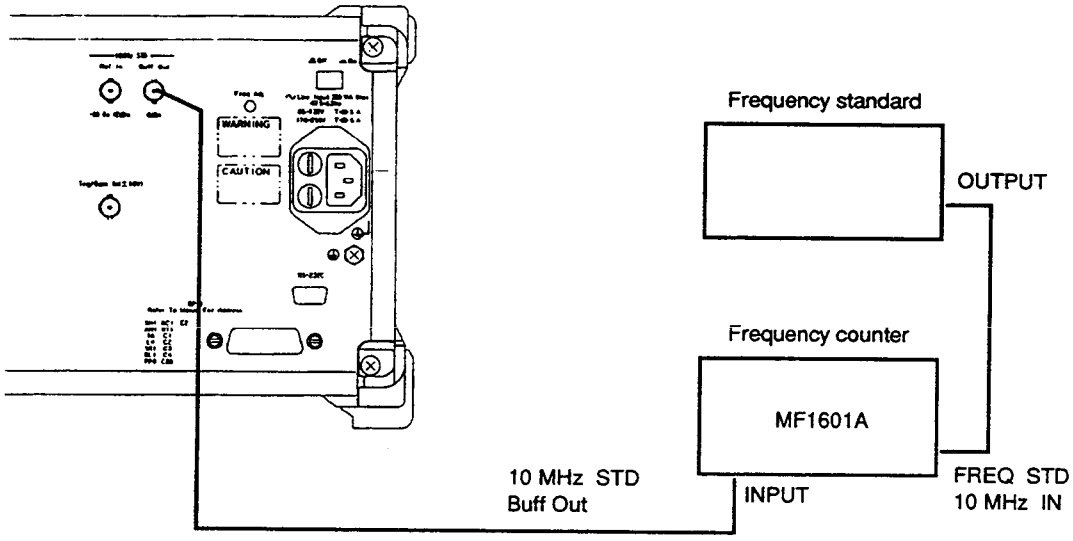
(3) Setup



Reference Oscillator Frequency Stability Test

(4) Procedure

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

Step	Procedure
1	Set the changeover switch (FREQ STD: INT / EXT) on the MF1601A counter rear panel to EXT.
2	Set the AC line power supply switch on the MS2670A rear panel to On and then the Power switch on the MS2670A front panel to On.
3	Measure the frequency using the counter with 0.1 Hz resolution after 24 hours have passed after turning the power ON.
4	Measure the frequency using the counter after 24 more hours have passed from the step 3 measurement.
5	Calculate the stability by using the following equation. $\text{Frequency stability} = \frac{\text{(2nd reading of the counter)} - \text{(1st reading of the counter)}}{\text{(1st reading of the counter)}}$

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

Step	Procedure
1	Set up the MS2670A in a constant-temperature chamber at 25°C in the same setup.
2	Set the LINE and Power switches on the MS2670A to On and wait until the MS2670A internal temperature stabilizes (approx. 1.5 hours after the chamber temperature stabilizes).
3	When the internal temperature stabilizes, measure the frequency by using the counter with 0.1 Hz resolution.
4	Change the chamber temperature to 50°C.
5	When the chamber temperature and the MS2670A internal temperature re-stabilize, measure the frequency by using the counter.
6	Calculate the stability by using the following equation. $\text{Frequency stability} = \frac{(\text{counter reading at } 50℃) - (\text{counter reading at } 25℃)}{(\text{counter reading at } 25℃)}$
7	Change the chamber temperature to 0°C and repeat steps 5 and 6.

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Center frequency readout accuracy

Add the known frequency which serves as the center frequency reference to the MS2670A as shown in the figure below and set CF (same value as the known reference frequency) and SPAN. At this time, check that the difference between the reading of the marker readout frequency (thick arrow in the figure) of the center frequency peak point and the CF set value is ≦ ± (Center frequency accuracy).

As shown in the figure, the Synthesized Signal Generator uses the signal source phase-locked with the same accuracy as the 10 MHz reference oscillator of the MS2670A.

(1) Specifications

- Center frequency accuracy: ± (Indicated frequency x reference frequency accuracy + resolution band width x 15% + span x 5% + 15 kHz) ; ♦Span ≧ 2 MHz.

  ± (Indicated frequency x reference frequency accuracy + resolution band width x 15% + span x 5% + 25 Hz) ; ♦Span ≧ 2 MHz.

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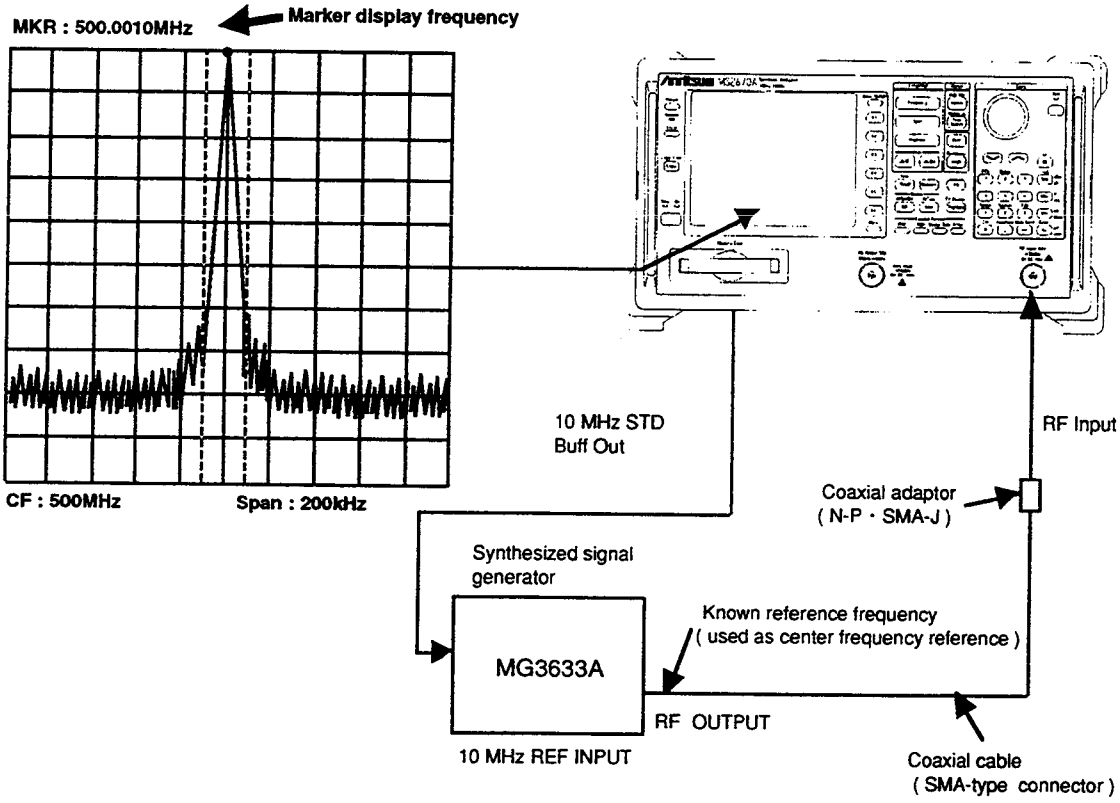
(2) Test instruments

- Synthesized signal generator: MG3633A

(3) Setup



Center-Frequency Readout-Accuracy Test

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(4) Precautions

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

(5) Procedure

Step	Procedure
1	Press the MS2670A [Preset] key, and then Preset All key.
2	Operate Freq Cal.
3	Set the signal generator output frequency equal to the center frequency (500 MHz) in the following table.
4	Set the MS2670A to the center frequency in the following table.
5	Set the span (10 kHz) that corresponds to the center frequency (500 MHz) in the table by using the numeric/unit keys.
6	Read the marker frequency (indicated by thick arrow in the figure on the previous page) and check that the value is within the range between the maximum and minimum values shown in the following table.
7	Repeat steps 3 to 6 for other combination of the center frequency and span according to the combinations shown in the following table.

Center frequency display accuracy test

Signal generator	Center frequency	Span frequency	Center frequency		
			Minimum value	Maker value	Maximam value
500 MHz	500 MHz	10 kHz (RBW:100 Hz)	499.999 46		500.000 54
		200 kHz (RBW:3 kHz)	499.989 525		500.010 475
		100 MHz (RBW:300 kHz)	494.940 00		505.060 00

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Frequency span readout accuracy

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

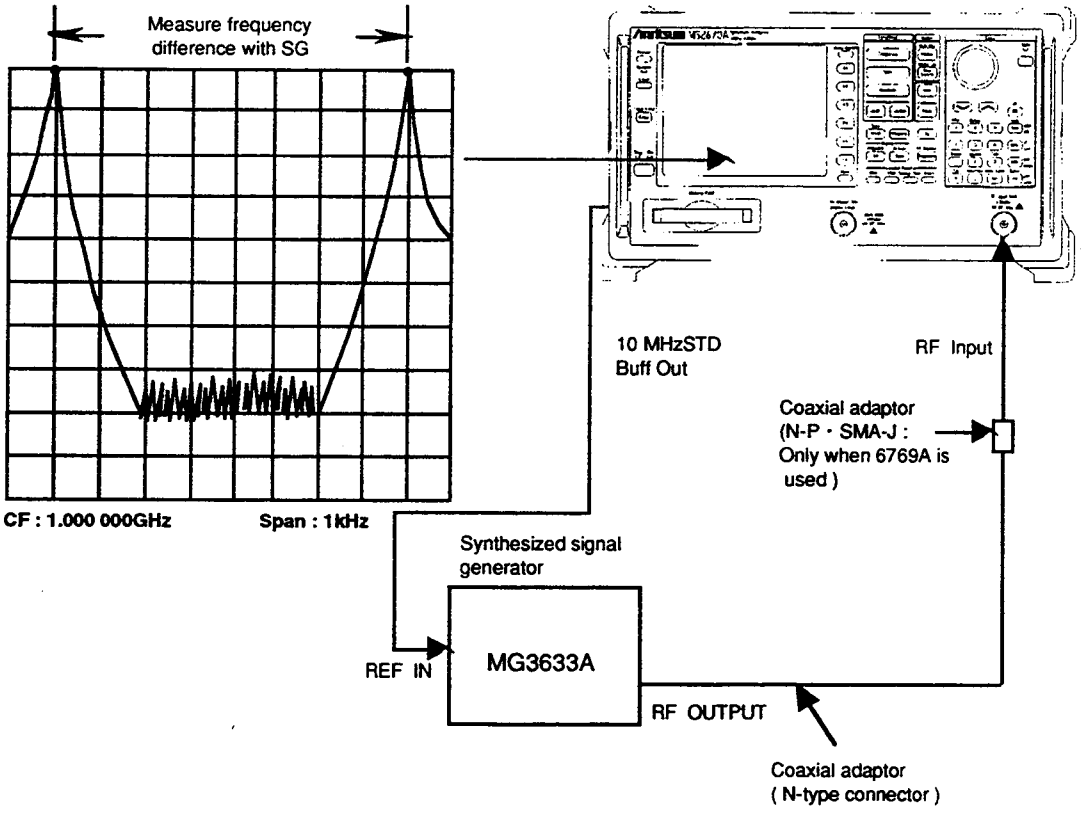
(1) Specifications

- Frequency span accuracy: ± 5%

(2) Test instrument

- Synthesized signal generator: MG3633A

(3) Setup



Frequency Readout Accuracy Test

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(4) Precautions

Set the signal generator output level to approx. 0 to – 10 dBm.

(5) Procedure

Step	Procedure
1	Press the [Preset] key, and then Preset All key.
2	Operate Freq Cal.
3	Connect the MG3633A output to the MS2670A RF Input.
4	Set the MS2670A as shown below: Span ..... 2 kHz Center Freq ..... 1000 MHz
5	Set the MG3633A output frequency to the f_1 frequency (999.9992 MHz) shown in the table on the next page.
6	Adjust the MG3633A output frequency to set the spectrum peak at the 1st division from the left end of the screen scale. Remember the frequency as f_1' .
7	After setting the MG3633A output frequency to the f_2 frequency (1000.0008 MHz), adjust it to set the spectrum peak at the 9th division. Remember the frequency as f_2'.
8	Calculate ($f_2' - f_1'$) / 0.8 and check that the value is within the specified range (minimum to maximum values) shown in the table on the next page.
9	Repeat steps 4 through 8 for each frequency span with 1 GHz center frequency shown in the table on the next page.

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Frequency-Span Readout-Accuracy Test

MS2670A		Signal generator		Span		
Center frequency	Span	f_1	f_2	Minimum value	$\frac{f_2' - f_1'}{8}$	Maximum value
1 GHz	2 kHz	999.9992 MHz	1000.0008 MHz	1.9 kHz		2.1 kHz
	20 kHz	999.992 MHz	1000.008 MHz	19 kHz		21 kHz
	200 kHz	999.92 MHz	1000.08 MHz	190 kHz		210 kHz
	2 MHz	999.2 MHz	1000.8 MHz	1.9 MHz		2.1 MHz
	10 MHz	996 MHz	1004 MHz	9.5 MHz		10.5 MHz
	100 MHz	960 MHz	1040 MHz	95 MHz		105 MHz
	1.8 GHz	280 MHz	1.72 GHz	1.71 GHz		1.89 GHz

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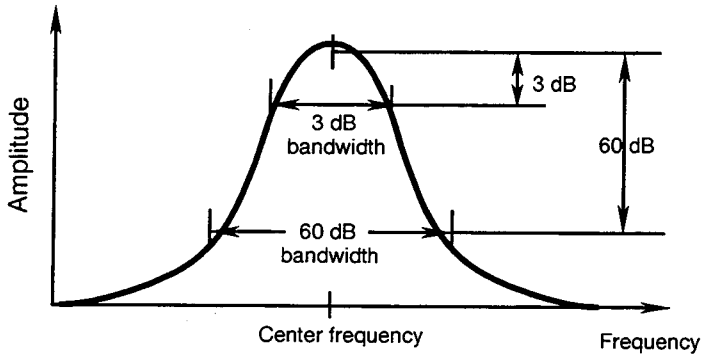
Resolution bandwidth (RBW) and selectivity

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

This is called the resolution bandwidth.

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

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



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

(1) Specifications

- Selectivity (60 dB / 3 dB bandwidth): ≦15:1 (10 Hz, 1 MHz)
  ≦10:1 (30, 100, 300 Hz, 1, 3, 10, 30, 100, 300 kHz)

(2) Test instrument

- Synthesized signal generator: MG3633A

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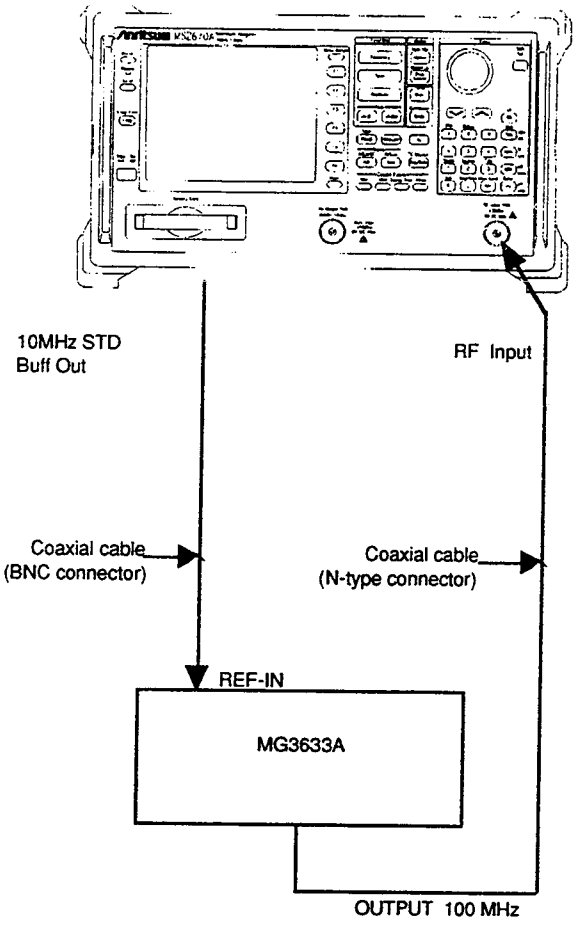
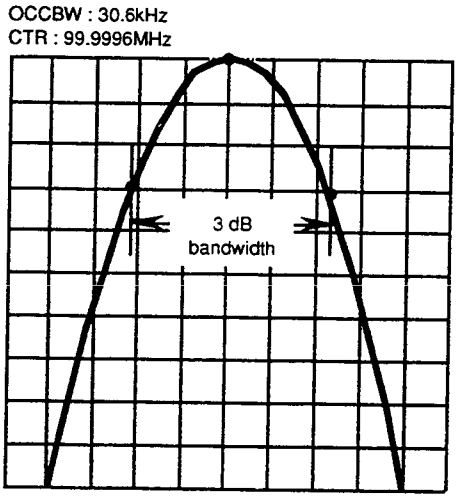
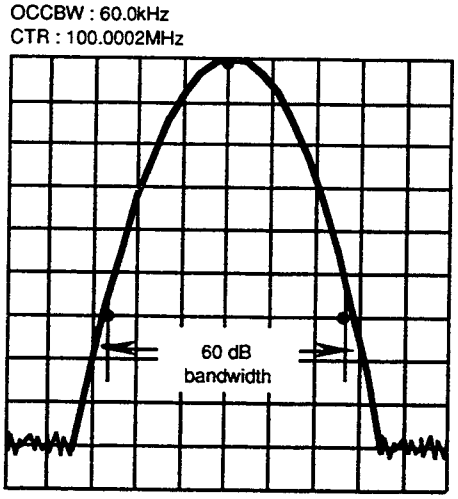
(3) Setup





(a) Resolution bandwidth



(b) 60 dB dropped bandwidth

Resolution Bandwidth / Selectivity Test

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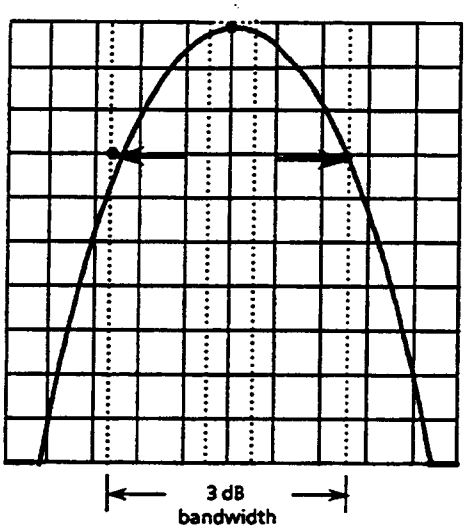
(4) Procedure

(a) Resolution bandwidth accuracy

Step	Procedure
1	Press the [Preset] key, and then Preset All key.
2	Perform all calibration (ALL CAL: Refer to SECTION 8 in the Detailed Operating Instruction Part of the separate operation manual).
3	Set the MS2670A as shown below: Center Freq ..... 100 MHz Span ..... 5 MHz RBW (MANUAL) ..... 1 MHz Scale ..... LOG 1 dB / div
4	Press the [→ RLV] key and match the peak of the signal trace to the top line (REF LEVEL) on the screen.
5	Press the [Single] key to execute a single sweep, then check that the single sweep has been completed.
6	After pressing the Measure key, operate Occ BW Measure and Setup and display the setup menu of occupied frequency bandwidth measurement.
7	Select XdB Down and set it to 3 dB.
8	Press Return to return to the Occ BW Measure menu, and then press Execute.
9	The 3 dB resolution bandwidth value is displayed in the upper left-hand corner of the screen. Fill in this value in the table on the next page.
10	Repeat steps 3 to 9 for the frequencies other than the resolution bandwidth 1 MHz and the frequency span 5 MHz according to the combinations of resolution bandwidth and frequency span shown in the table on the next page.



Bandwidth Measurement

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Resolution Bandwidth (3 dB)

Resolution bandwidth	Frequency span	3 dB bandwidth
1 MHz	5 MHz	_____
300 kHz	500 kHz	_____
100 kHz	200 kHz	_____
30 kHz	50 kHz	_____
10 kHz	20 kHz	_____
3 kHz	5 kHz	_____
1 kHz	2 kHz	_____
300 Hz	500 Hz	_____
100 Hz	200 Hz	_____
30 Hz	100 Hz	_____
10 Hz	100 Hz	_____

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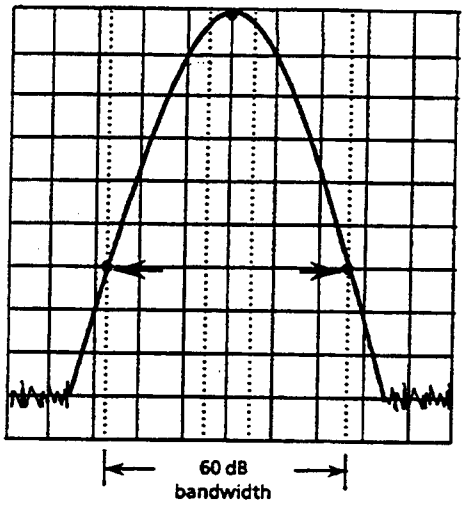
(b) Resolution bandwidth selectivity

Step	Procedure
1	Set the MS2670A as shown below: Center Freq ..... 100 MHz Span ..... 50 MHz RBW (MANUAL) ..... 1 MHz Scale ..... LOG 10 dB / div VBW ..... 100 Hz Marker ..... NORMAL
2	Press the [→RLV] key to match the peak of the signal trace to the top line (REF LEVEL) on the screen.
3	Press the [Single] key to execute a single sweep, then check that the single sweep has been completed.
4	After pressing the Measure key, operate Occ BW Measure and Setup and display the setup menu of occupied frequency bandwidth measurement.
5	Select XdB Down and set it to 60 dB.
6	Press Return to return to the Occ BW Measure menu, and then press Execute.
7	The 60 dB resolution bandwidth value is displayed in the upper left-hand corner of the screen. Fill in this value in the table on the next page.
8	Repeat steps 1 to 7 for the frequencies other than the resolution bandwidth 1 MHz and the frequency span 50 MHz according to the combinations of resolution bandwidth and frequency span shown in the table on the next page.
9	For the 3 dB bandwidth, write the value of the Resolution Bandwidth (3 dB) table on the preceding page in the table on the next page.
10	For each resolution bandwidth in the table on the next page, confirm that the value calculated from (60 dB BW / 3 dB BW) is ≦ 15 or ≦ 10.



60 dB Bandwidth Measurement

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Selectivity Test (60 dB / 3 dB Bandwidth Ratio)

Resolution bandwidth	Frequency span	Video BW	60 dB resolution band width	3 dB resolution band width	Selectivity (60 dB BW ÷ 3 dB BW)
1 MHz	50 MHz	100 Hz			
300 kHz	20 MHz	100 Hz			
100 kHz	10 MHz	100 Hz			
30 kHz	200 kHz	100 Hz			
10 kHz	100 kHz	100 Hz			
3 kHz	20 kHz	100 Hz			
1 kHz	10 kHz	10 Hz			
300 Hz	5 kHz	10 Hz			
100 Hz	2 kHz	10 Hz			
30 Hz	500 Hz	3 Hz			
10 Hz	200 Hz	3 Hz			

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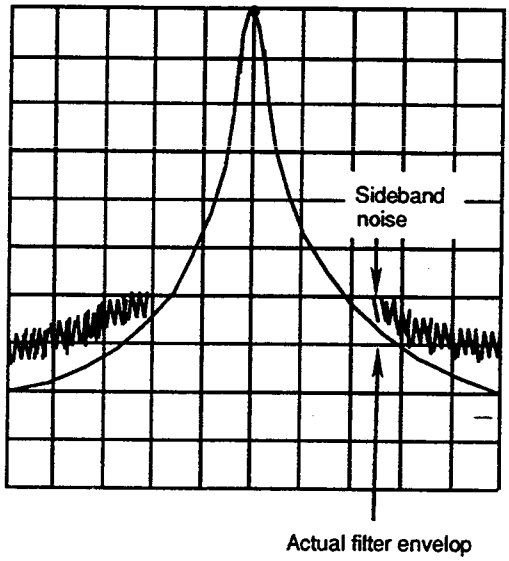
Sideband noise

When the resolution bandwidth is set to a fixed value and a signal that has far less sideband-noise level than the equipment to be tested (MS2670A) is input, check the level of the noise as compared to the peak signal (dBc) at the specified frequency away from the peak.



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

This sideband noise is a spectrum response which is modulated by the internal noise of the MS2670A. If this response is large, the actual filter envelope is masked by the noise as shown, which makes measurement impossible.

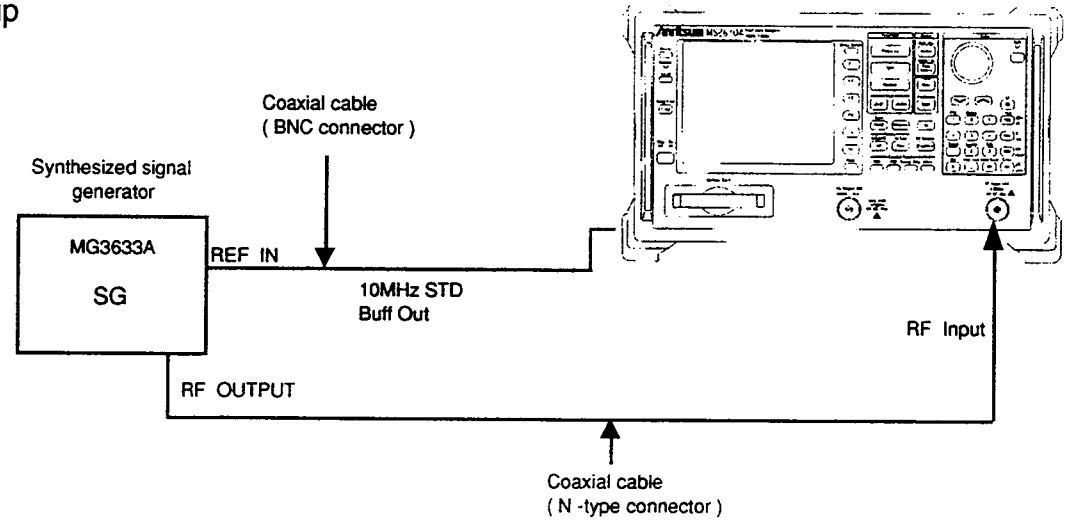
(1) Specifications

- Sideband noise: ≦ − 100 dBc / Hz (Frequency: 1 GHz, 30 kHz offset, RBW: 1 kHz)

(2) Test instruments

- Signal generator: MG3633A Synthesized Signal Generator

(3) Setup



Sideband Noise Test

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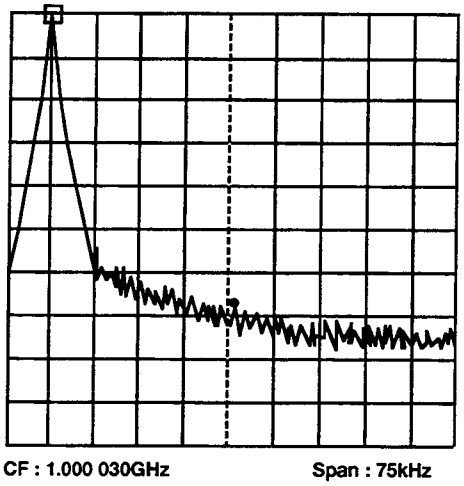
(4) Procedure

Step	Procedure
1	Press the [Preset] key, and then Preset All key.
2	Operate All Cal.
3	Set the MG3633A output to 1000 MHz and 0 dBm.
4	Set the MS2651A/MS2661A as shown below: Center Freq ..... 1.000 030 GHz Span ..... 75 kHz Reference Level ..... 0 dBm Attenuator ..... 10 dB RBW ..... 1 kHz VBW ..... 10 Hz DET MODE ..... SAMPLE
5	Press the [Peak Search] key to search for a peak point so that the peak point on the signal trace is included in the zone marker.
6	Press the [→ RLV] key to match the peak of the signal trace to the top line (REF LEVEL) on the screen.
7	After pressing the Measure key, select C/N Ratio Measure.
8	Press the Meas On key to start C/N measurement.
9	Set Zone Width of Marker to Spot.
10	Press the [Marker] key, then turn the rotary knob to move the zone marker to the right so that the zone center frequency is 30.0 kHz.
11	Make sure that the C/N value is – 100 dBc/Hz or less.



Sideband Noise Measurement

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Frequency measurement accuracy

Set the marker point to the position at least 20 dB higher than the noise (or adjacent interference signal) to operate the built-in counter (Option 03) with the higher-S/N signal, and test the frequency measurement accuracy using Count On mode. (This test cannot be performed without Option 03.)

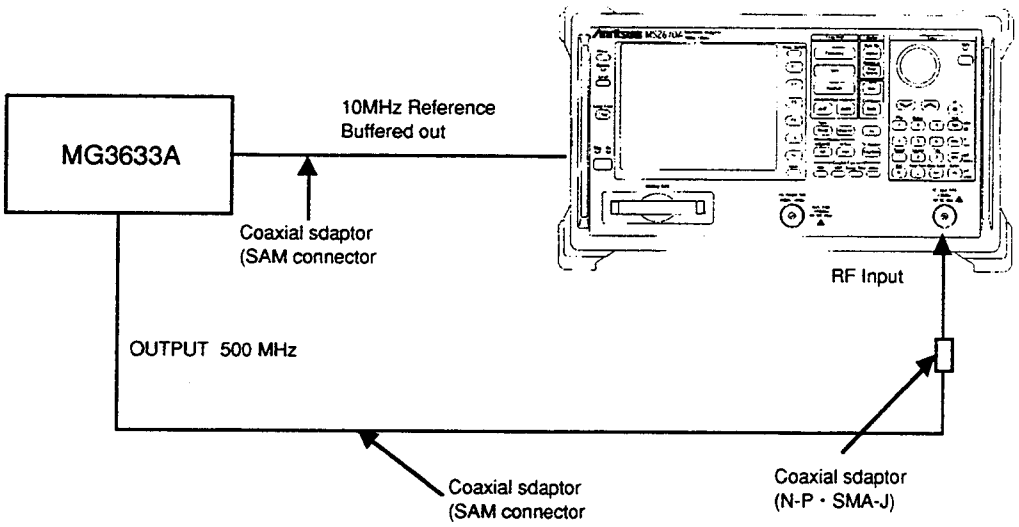
(1) Specifications

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

(2) Test instrument

- Signal generator: MG3633A

(3) Setup



Frequency Measurement Accuracy Test

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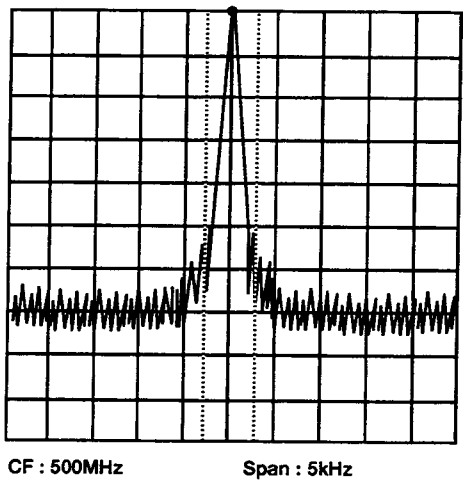
(4) Procedure

Step	Procedure
1	Press the [Preset] key, and then Pseset All key.
2	Set the MG3633A to 500 MHz and -10 dBm.
3	Set the MS2670A as shown below: Center Freq ..... 500 MHz Span ..... 5 kHz
4	Press the [Measure] key and set to Frequency Count. Press Setup and set Resolution to 1 Hz. Then, press the Return key and set to Count On.
5	Confirm that the FREQ reading at the upper-left of the screen is the RF INPUT frequency 500 MHz ± 1 Hz or less.
6	Change the counter resolution to 10 Hz and confirm that the Freq reading is 500 MHz ± 10 Hz or less.
7	• Change the counter resolution to 100 Hz and confirm that the Freq reading is 500 MHz ± 100 Hz or less. • Change the counter resolution to 1 kHz and confirm that the Freq reading is 500 MHz ± 1 kHz or less.



Frequency Measurement

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Amplitude display linearity

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

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

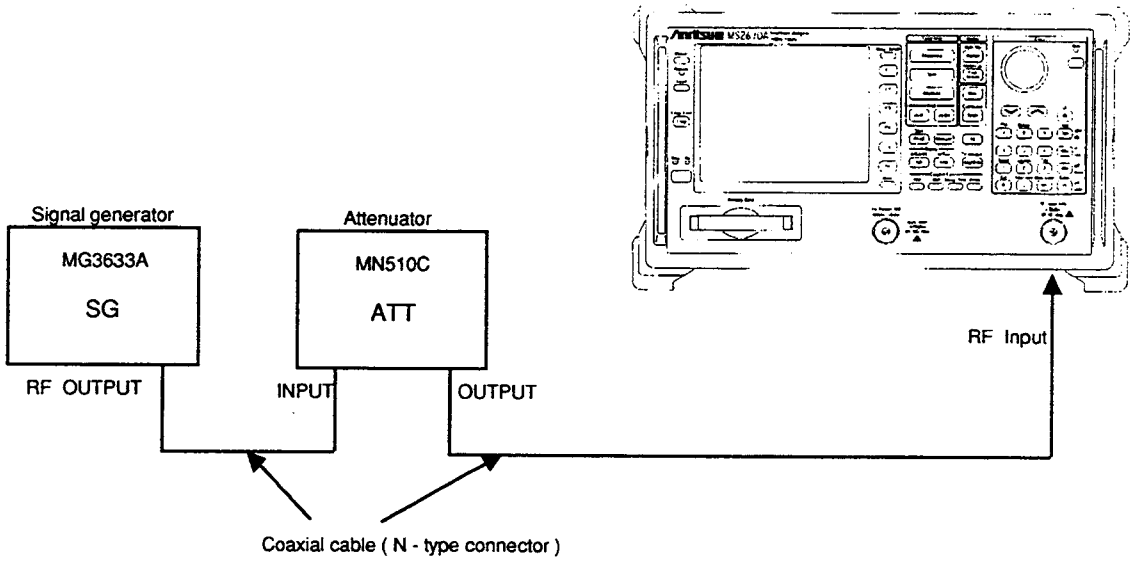
(1) Specifications

- Amplitude display linearity: After automatic calibration
  LOG: ± 1.5 dB for 0 to − 85 dB (RBW ≤ 10 kHz)
  ± 1 dB for 0 to − 70 dB (RBW ≤ 100 kHz)
  ± 0.5 dB for 0 to − 20 (RBW ≤ 1 MHz)

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C

(3) Setup



Amplitude Display Linearity Test

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(4) Procedure

LOG display linearity

Step	Procedure
1	Press the [Preset] key.
2	Operate All Cal.
3	Set the MG3633A to 100 MHz and 0 dBm.
4	Set the MN510C to 0 dB.
5	Set the MS2670A as shown below: Center Freq ..... 100 MHz Span ..... 10 kHz Reference Level ..... 0 dBm Attenuator ..... 10 dB RBW ..... 3 kHz VBW ..... 300 Hz
6	Press the [→ CF] key to set the spectrum waveform peak to the center of the screen.
7	Adjust the MG3633A output level so that the marker level reading is 0.0 dBm.
8	Press the [Marker] key sequentially to set the marker to Δ marker after the sweep is completed.

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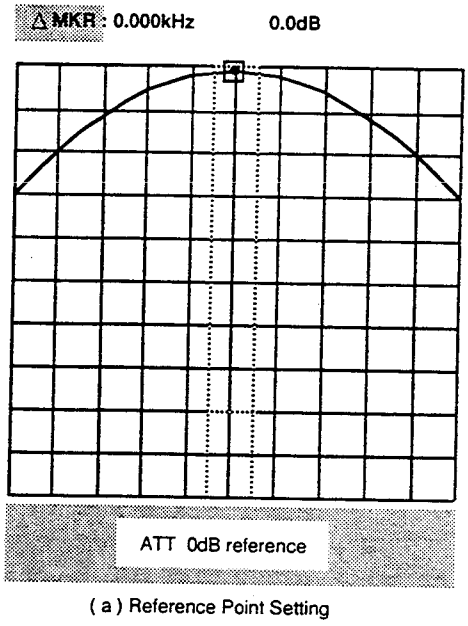
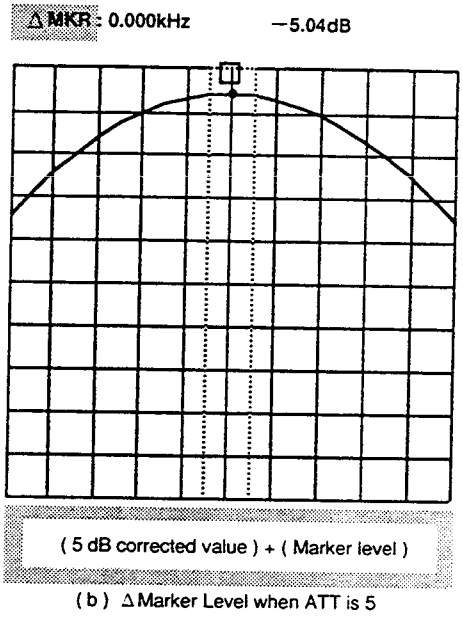
Step	Procedure
9	As shown on Fig. (b), read the level of the current marker when the MN510C is set at 5dB. An error is determined as calibrated ATT 5 dB value + Δ marker level.
10	Add a marker level corresponding to the calibrated ATT value when the MN510C is set as 10 to 90 DB (with 5 dB steps) and determine the error.



(a) Reference Point Setting



(b) ΔMarker Level when ATT is 5

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Log Display Linearity (10 dB / div)

MN510C setting (dB)	A	B	Error (dB)=A+B
	MN510C calibration value (dB)	Δmarker 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	———	———	———
85	———	———	———

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Frequency response

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

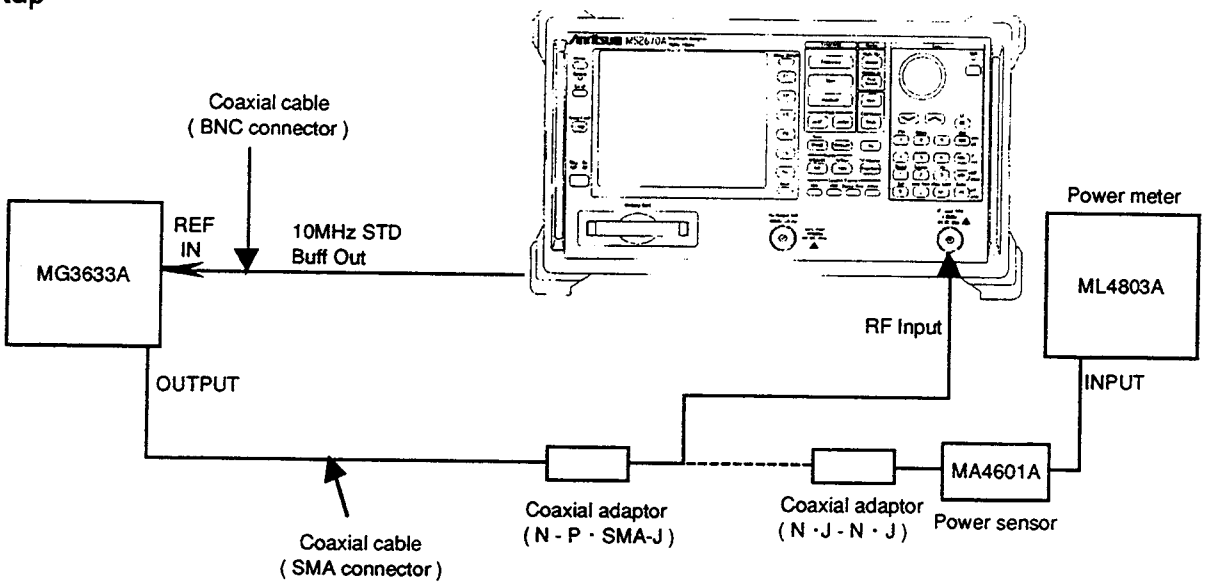
(1) Specifications

- Frequency response: At 100 MHz, input ATT 10 dB to 60 dB
  ± 1.5 dB (100 Hz to 1.8 GHz)

(2) Test instruments

- Signal generator: MG3633A
- Power meter: ML4803A
- Power sensor: MA4601A

(3) Setup



Frequency Response Test

(4) Precautions

This test should be performed after allowing the instrument to warm up for 60 minutes or more.

(5) Procedure

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(5) Procedure

(a) Calibration of signal-generator MG3633A

Step	Procedure
1	Set the MG3633A as shown below: OUTPUT FREQ ..... 100 MHz OUTPUT LEVEL ..... – 10 dBm
2	Connect the MG3633A output to the power sensor input with a coaxial cable.
3	Read the power meter display.
4	Change the MG3633A output frequency as shown in the tables on the next page and read the power meter display with level at 100 MHz as reference. This is the calibration data.

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

Step	Procedure
1	Connect the MG3633A OUTPUT to MS2670A RF Input with a coaxial cable.
2	Press the MS2670A [Preset] key, and then Preset All key.
3	Perform all calibration.
4	Set the MS2670A as shown below: Center Freq ..... 100 MHz Span ..... 200 kHz Reference Level ..... – 10 dBm
5	Press the [→ CF] key.
6	Set the marker mode to delta marker.
7	Set the MS2670A center frequency as shown in the tables on the next page, then obtain the deviation from the formula below by reading the delta marker level at each frequency. Deviation = Delta marker level reading – Measurement frequency calibration value

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Frequency Response

Frequency	Calibration value (dBm)	Marker level (dB)	Deviation (dB)
100 MHz	0 dB (reference)	0 dB (reference)	0 dB (reference)
200 MHz	_____	_____	_____
500 MHz	_____	_____	_____
1 GHz	_____	_____	_____
1.5 GHz			

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Second harmonic distortion

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

The second harmonic level is the highest harmonic displayed on the MS2670A. The main point of the test is to apply a signal (with a distortion that is lower than the MS2670A internal harmonic distortion [at least 20 dB below]) to the MS2670A and measure the level difference between the fundamental wave and the second harmonic. If a low-distortion signal source cannot be obtained, apply a low-distortion signal to the MS2670A after passing the signal through a low-pass filter (LPF).

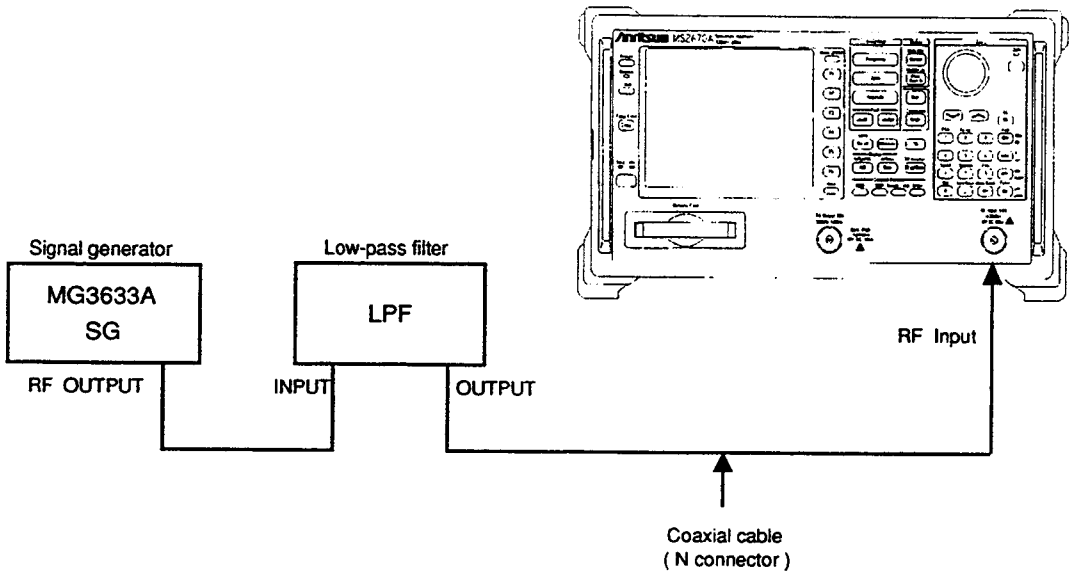
(1) Specifications

- Second harmonic distortion: At mixer input level − 40 dBm:
  ≤− 60 dBc (input frequency 100 Hz to 900 MHz)

(2) Test instruments

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

(3) Setup



Second Harmonic Distortion Test

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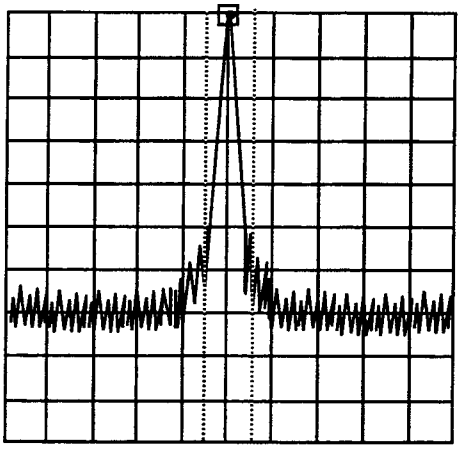
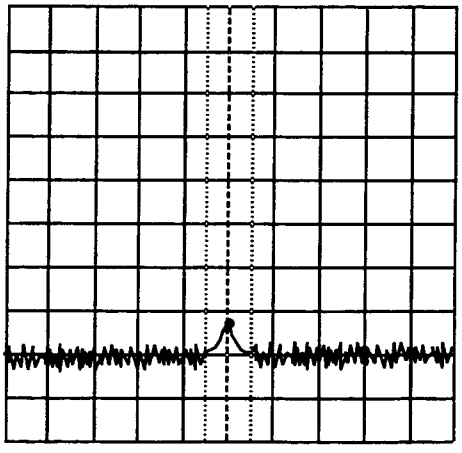
(4) Procedure

Step	Procedure
1	Press the [Preset] key, and then Preset All key.
2	Operate All Cal.
3	Set the LPF cut-off frequency to approx. 12.8 MHz.
4	Set the SG output frequency to 10 MHz and the output level to – 40 dBm.
5	Set the MS2670A as shown below: Center Freq ..... 10 MHz Span ..... 10 kHz Reference Level ..... – 40 dBm Attenator ..... 0 dB
6	Adjust the SG output level so that peak of the spectrum waveform is at the REF LEVEL (the top horizontal line of the screen).
7	Move the marker to the peak of the spectrum waveform and make the marker the delta marker.



8	Set the center frequency to twice the fundamental wave frequency to display the second harmonic on the screen. The delta marker reading indicates the level difference betweeen the fundamental wave and the second harmonic. If the level difference is 80 dB or more,set the REF LEVEL to – 60 dBm. Confirm that the ATT set value is 0 dB.



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Step	Procedure
9	Set the LPF cut-off frequency to approx. 1.2 GHz.
10	Set the SG as follows: OUTPUT FREQ ..... 900 GHz OUTPUT LEVEL .....– 40 dBm
11	Set the MS2670A as follows: Center Freq ..... 900 GHz Span ..... 10 kHz Reference Level .....– 40 dBm Attenutor ..... 0 dB
12	Repeats steps 6 to 8.

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Input attenuator switching error

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

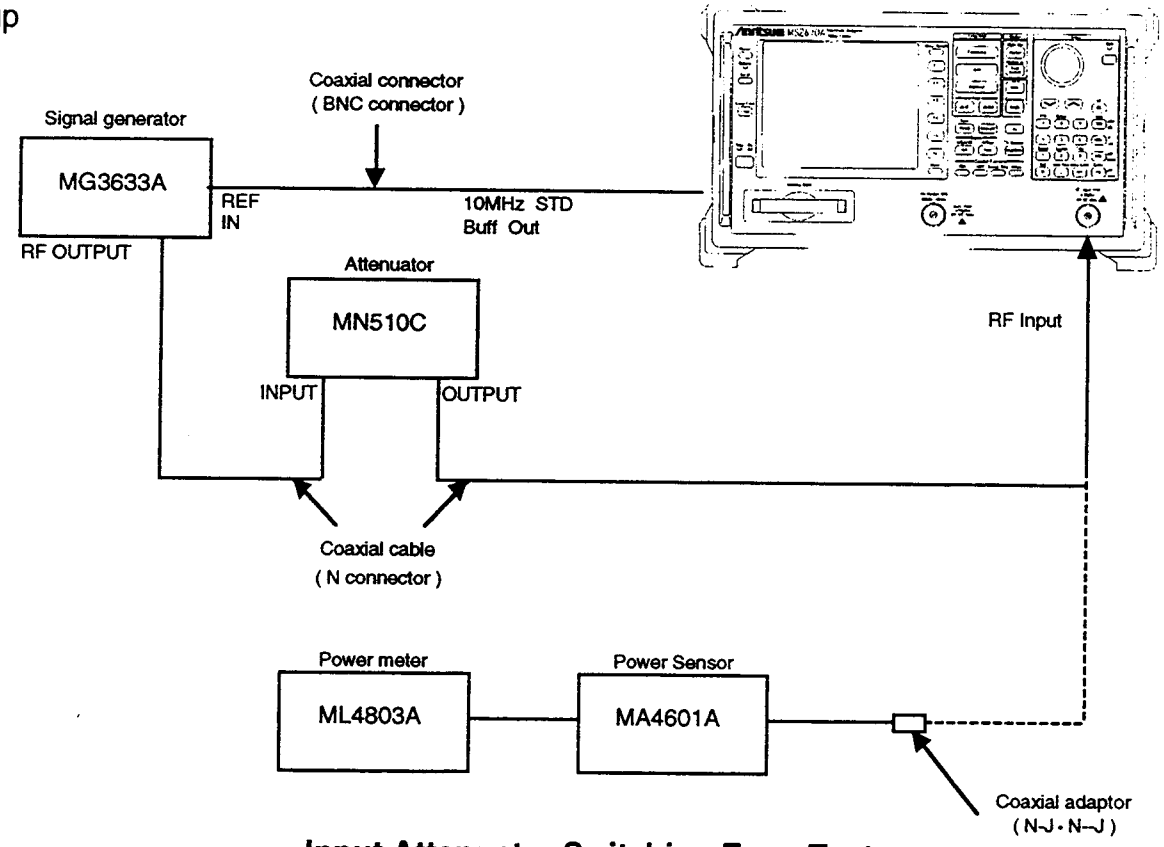
(1) Specifications

- Input attenuator switching error: ± 2.0 dB (at 0 to 60 dB, frequency 100 MHz and input ATT 10 dB)

(2) Test instruments

- Signal generator: MG3633A
- Attenuator: MN510C
- Power meter: ML4803A
- Power sensor: MA4601A

(3) Setup



Input Attenuator Switching Error Test

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(4) Procedure

Step	Procedure
1	Press the MS2670A [Preset] key, and then Preset All key.
2	Operate All Cal.
3	Set the MS2670A as shown below: Center Freq ..... 100 MHz Span ..... 200 kHz
4	Set the signal generator MG3633A as shown below: OUTPUT FREQ ..... 100 MHz OUTPUT LEVEL ..... -10 dBm
5	Set the amount of attenuation of the attenuator MN510C to 0 dB.
6	Connect the output of the attenuator MN510C to the power meter via coaxial cable.
7	Adjust the signal-generator output level so that the indicated value of the power meter is – 10.0 dBm.
8	Connect the coaxial cable of the attenuator output to the MS2670A RF Input.
9	Press the MS2670A [→ CF] key.
10	Set the MS2670A reference level to –10 dBm and attenuation to 60 dB.
11	Read the marker level.
12	Set Reference Level, ATT of this device and the external ATT as shown in the table on the next page, and read the level of each marker.
13	Find the error by the formula below: Error = marker level value – Reference Level – attenuator calibration value
14	Find the deviation by the formula below: Deviation = Error - error when ATT at 10 dB Confirm that the deviation is within ≤ 2.0 dB.

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MS2670A setting		MN510C setting	Calibration value of attenuator	Marker level value	Error	Deviation
REF LEVEL	ATT					
– 10 dBm	60 dB	0 dB	dB	dBm	dB	dB
– 20 dBm	50 dB	10 dB	dB	dBm	dB	dB
– 30 dBm	40 dB	20 dB	dB	dBm	dB	dB
– 40 dBm	30 dB	30 dB	dB	dBm	dB	dB
– 50 dBm	20 dB	40 dB	dB	dBm	dB	dB
– 60 dBm	10 dB	50 dB	dB	dBm	dB	0 dB (reference)
– 70 dBm	0 dB	60 dB	dB	dBm	dB	dB

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Sweep time and time span accuracy

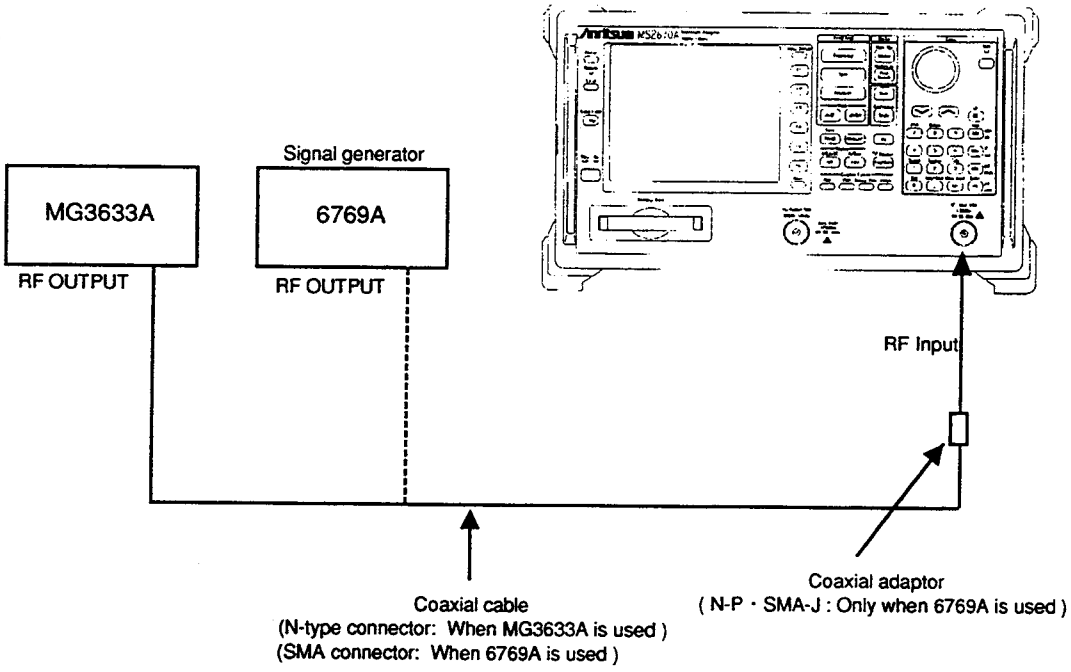
(1) Specifications

- Sweep time accuracy: ± 15% (20 msec to 100 sec)
- Time span accuracy: ± 1% (100µsec to 100sec)

(2) Test instruments

- Signal generator: MG3633A
  Wiltron 6769A

(3) Setup



Sweep Time and Time Span Accuracy

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(4) Procedure

(a) Sweep Time

Step	Procedure
1	Press the MS2670A [Preset] key, and then Preset All key.
2	Operate All Cal.
3	Connect the MG3633A signal generator with the MS2670A as shown in the setup diagram.
4	Set the MS2670A as shown below: CENTER FREQ ..... 100 MHz SPAN ..... 100 Hz SWP TIME ..... 20 msec RBW ..... 1 MHz VBW ..... 1 MHz
5	Set the MG3633A as shown below: OUTPUT FREQ ..... 100 MHz OUTPUT LEVEL ..... — 16 dBm MODULATION ..... AM (INT) 90% MODULATION FREQ ..... 1 kHz
6	Press the [→ RLV] key.
7	Set the MS2670A scale to Linear.
8	Press the [Single] key, then wait until a single sweep execution is completed.
9	Set the MS2670A marker zone width to 5 Hz (Zone Width = 5 Hz).
10	Move the MS2670A marker to the left of the screen using the knob and set the zone marker on the leftmost peak of the sine wave.
11	Setting the MS2670A marker mode to delta marker, move the current marker to the right using the knob. Then set the zone marker to the 18th peak from the leftmost sine wave peak on the screen.
12	Read the time display of the delta marker, which corresponds to 90% of the Sweep Time. Obtain the SWP TIME by the following equation. $\text{SWP TIME} = \text{Setting SWP TIME} \times \frac{\text{delta maker reading}}{1000\ (\text{Hz})}$

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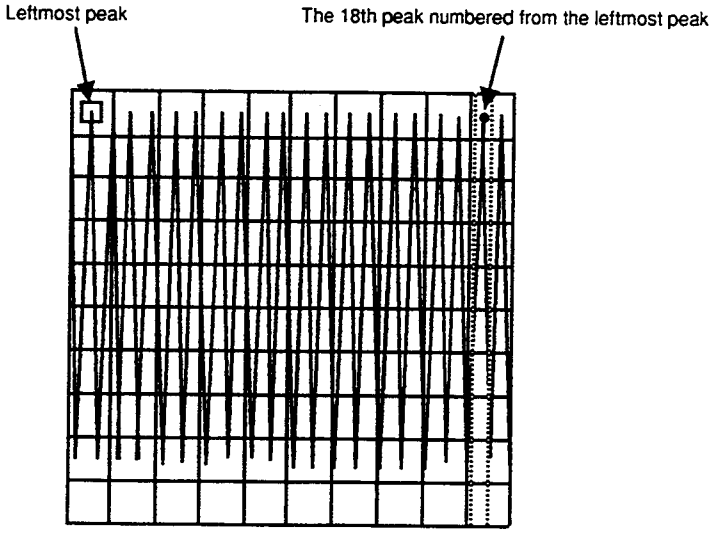
Step	Procedure

13 Measure at each setting shown in the table below according to steps 8 to 12.

MS2670A Setting SWP TIME	MG3633A AM modulation frequency	MS2670A SWP TIME	90% of specification min / max
20 msec	1 kHz		15.3 msec / 20.7 msec
200 msec	100 Hz		153 msec / 207 msec
2 sec	10 Hz		1.53 sec / 2.07 sec
20 sec	1 Hz		15.3 sec / 20.7 sec



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(b) Time span

Step	Procedure
1	Perform test procedure steps 1 to 8 on the preceding paragraph (a). However, set MODULATION FREQ of the MG3633A to 100 Hz.
2	Set the MS2670A display mode to Time.
3	Set Time Span to 20 msec.
4	Perform steps 8 to 13 of the test procedure on the preceding paragraph (a).

MS2670A time span	MG3633A AM modulation frequency	MS2670A delta marker reading	90% of specification min / max
20 msec	1 kHz		17.82 msec / 18.18 msec
200 msec	100 Hz		178.2 msec / 181.8 msec
2 sec	10 Hz		1.782 sec / 1.818 sec
20 sec	1 Hz		17.82 sec / 18.18 sec

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Tracking generator(TG) output level flatness

The output level of the Tracking Generator can be easily tested by inputting the TG output signal to the RF Input connector of the MS2670A.

An accurate method to test the TG output level by using a power meter is described below.

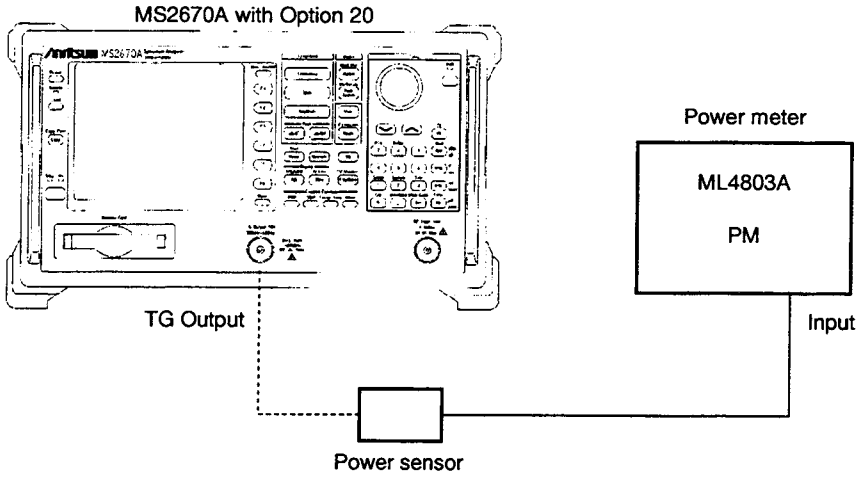
(1) Specifications

Output level flatness: ≤ ±2.25 dB(at output level 0 dBm, referenced to 100 MHz)

(2) Test instrument

- Power meter: ML4803A
- Power sensor: MA4601A

(3) Setup



TG Output Level flatness Test

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(4) Procedure

(a) Calibrating ML4803A Power Meter

Step	Procedure
1	Warm-up the ML4803A, then zero-adjust the ML4803A. (Note: Don't connect anything to the power sensor.)
2	Connect the power sensor to the CAL OUTPUT of the ML4803A. Press the [ON] key. After conforming the measured value to be stabilized, press the [ADJ] key for calibration.

(b) Measuring TG output level accuracy

Step	Procedure
1	Press the [Preset] key, and then Preset All key.
2	Connect the power sensor to the TG Output.
3	Set the MS2670A as shown below: Center Freq ---------- 100 MHz Span ---------- 10 MHz
4	Set the TG output level to 0 dBm, and ON.
5	Measure the TG output level with the power meter.
6	Repeat the steps 3 to 5 above while changing the Center Freq of the MS2670A as shown in the table on the next page.

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TG Output Level Accuracy Test

Output level (dBm)	Frequency(Hz)						
	100k	1M	10M	50M	100M	1G	1.8G
0							
Error					0dB (reference)		

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Service

If the MS2670A is damaged or does not operate as specified, refer to the Service Manual (Volume 4). For additional service, contact your nearest Anritsu dealer or business office for repair. When you request repair, provide the following information:

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

(b) Fault description;

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

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SECTION 7

STORAGE AND TRANSPORTATION

This section describes the long-term storage, repacking and transportation of the MS2670A as well as the regular care procedures and the timing.

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Storage Precautions 7-4

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- Recommended storage precautions 7-4
- Saving the setting parameter and data before storage 7-4

Repacking and Transportation 7-5

- Repacking 7-5
- Transportation 7-5

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SECTION 7
STORAGE AND TRANSPORTATION

Cleaning Cabinet

Always turn the MS2670A POWER switch OFF and disconnect the power plug from the ac power inlet before cleaning the cabinet. To clean the external cabinet:

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

CAUTION ⚠

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

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Storage Precautions

This paragraph describes the precautions to take for long-term storage of the MS2670A SPECTRUM ANALYZER.

Precautions before storage

(1) Before storage, wipe dust, finger-marks, and other dirt off the MS2670A.

(2) Avoid storing the MS2670A where:

1) It may be exposed to direct sunlight or high dust levels,
2) It may be exposed to high humidity,
3) It may be exposed to active gases,
4) It may be exposed to extreme temperatures ($< -40°C$ or $> 71°C$) or high humidity ($\geq 85\%$).

(3) Remove the memory card from the slot, and store it separately from the main body.

Recommended storage precautions

The recommended storage conditions are as follows:

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

Saving the setting parameter and data before storage

The MS2670A back-ups the internal (data such as setting parameters) with a built-in battery.
The battery life is about 7 years after shipment. If it is feared that the data may be lost because of battery depletion, save the setting parameter to the memory card or record them for re-use after storage.
Early battery replacement is recommended.

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Repacking and Transportation

The following precautions should be taken if the MS2670A must be returned to Anritsu Corporation for servicing.

Repacking

Use the original packing materials. If the MS2670A is packed in other materials, observe the following packing procedure:

(1) When repacking, remove all the cables and unplug the memory card from the slot.
(2) Wrap the MS2670A in a plastic sheet or similar material.
(3) Use a cardboard, wooden box, or aluminum case which allows shock-absorbent material to be inserted on all sides of the equipment.
(4) Use enough shock-absorbent material to protect the MS2670A from shock during transportation and to prevent it from moving in the container.
(5) Secure the container with packing straps, adhesive tape, or bands.

Transportation

Do not subject the MS2670A to severe vibration during transport. It should be transported under the storage conditions recommended on the previous page.

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APPENDIX A
FRONT AND REAR PANEL LAYOUT

This appendix shows the front and rear panel layouts.

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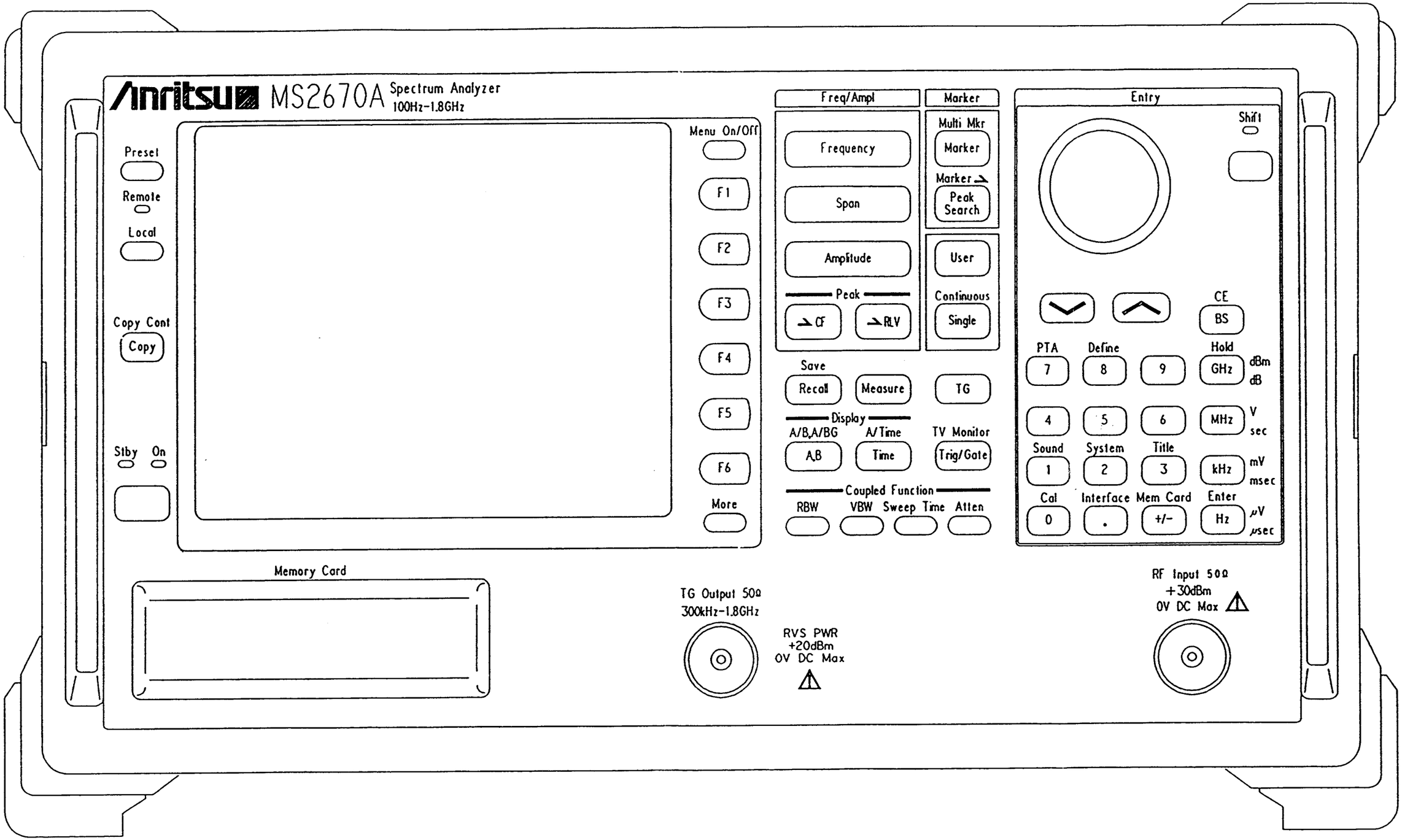

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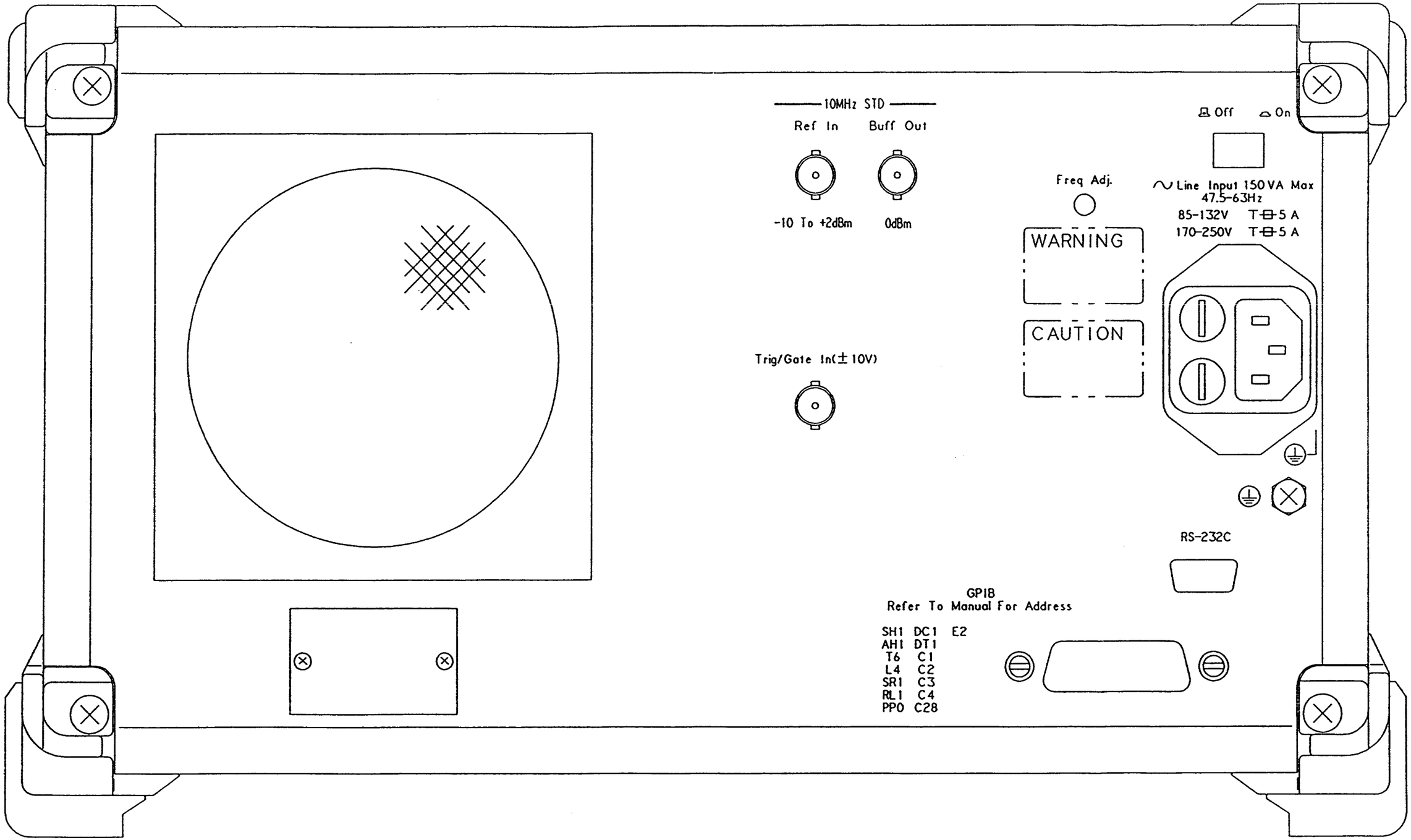

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APPENDIX B
BLOCK DIAGRAM

This appendix shows the Block Diagram of the MS2670A.

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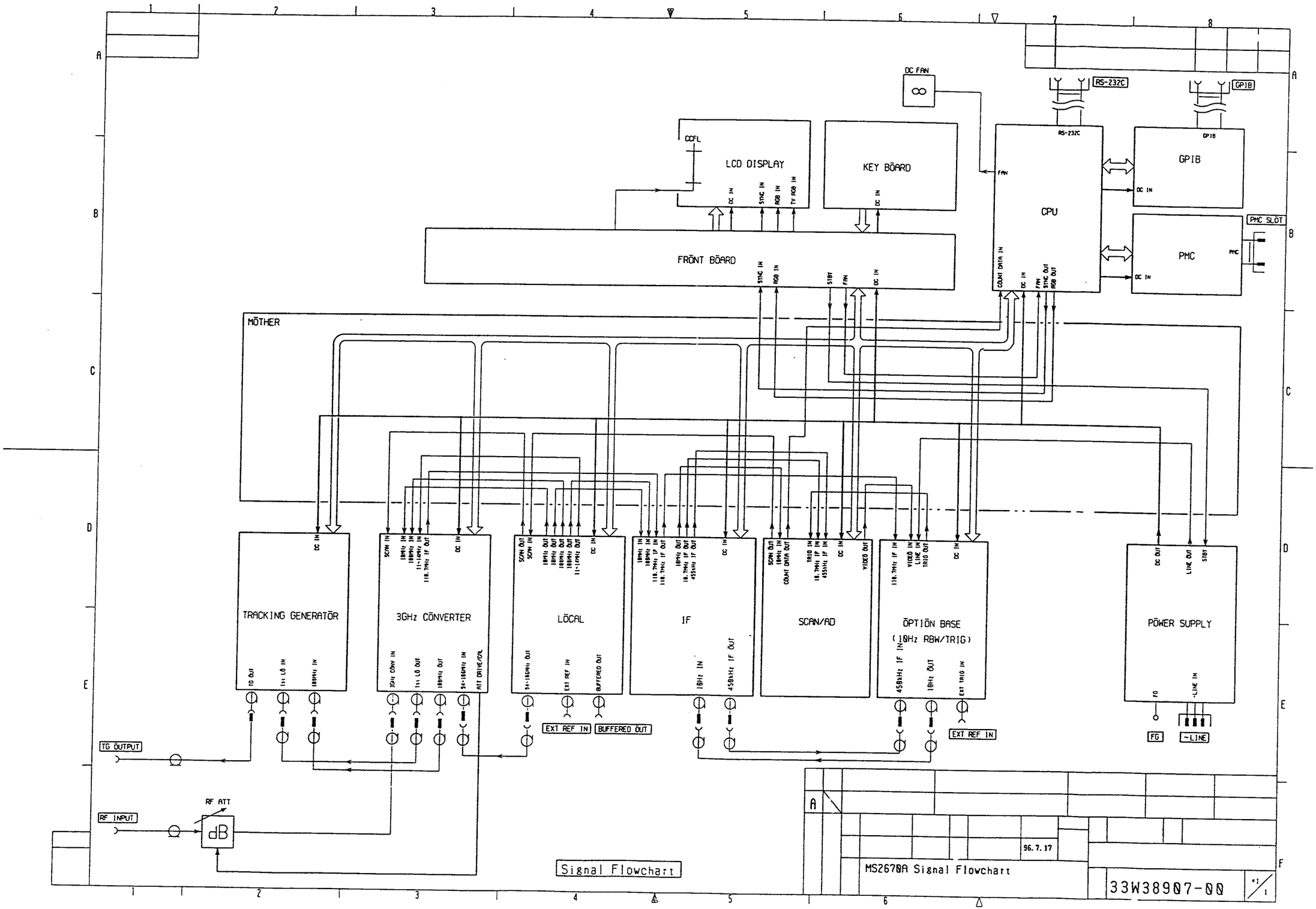

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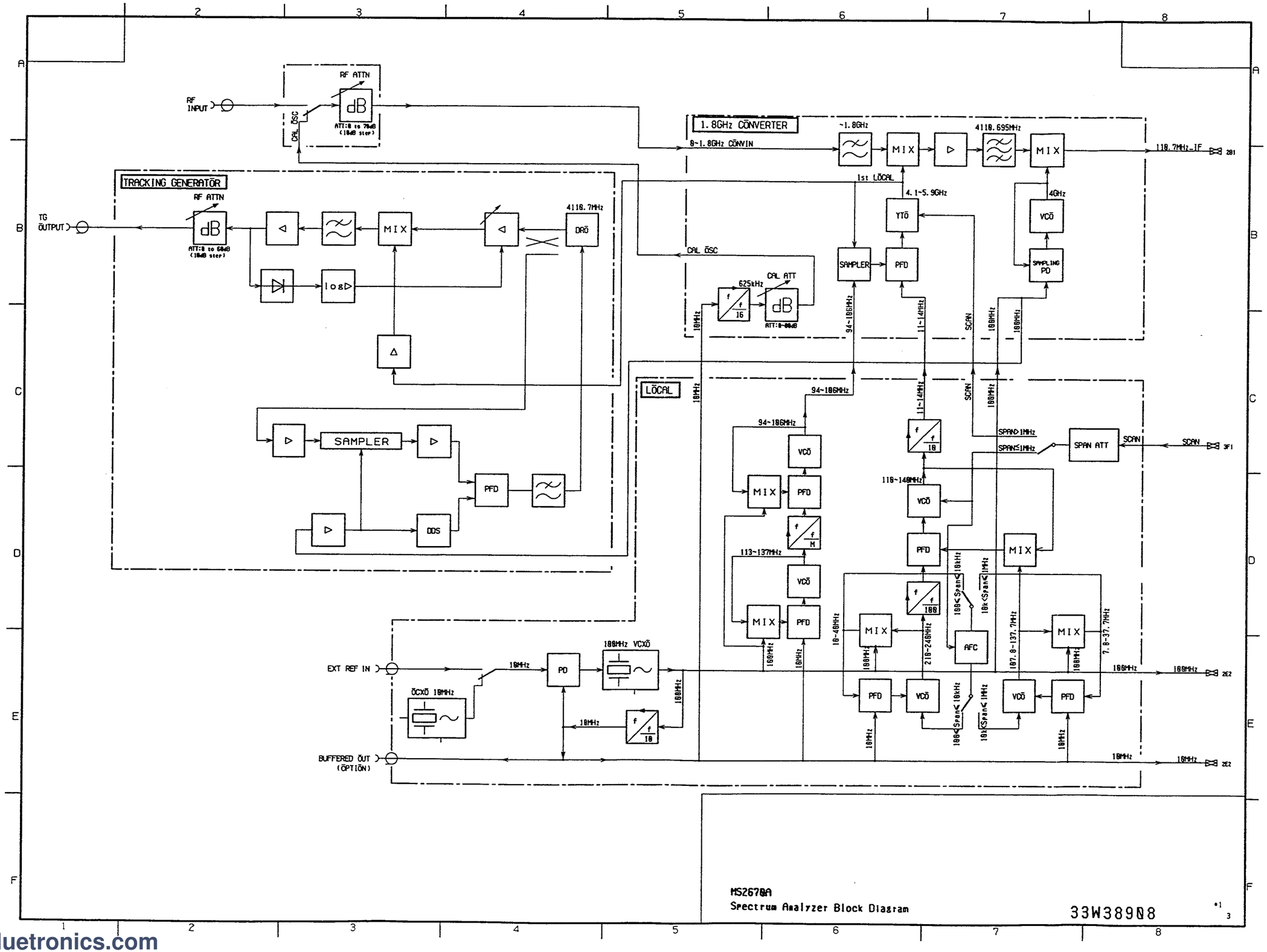

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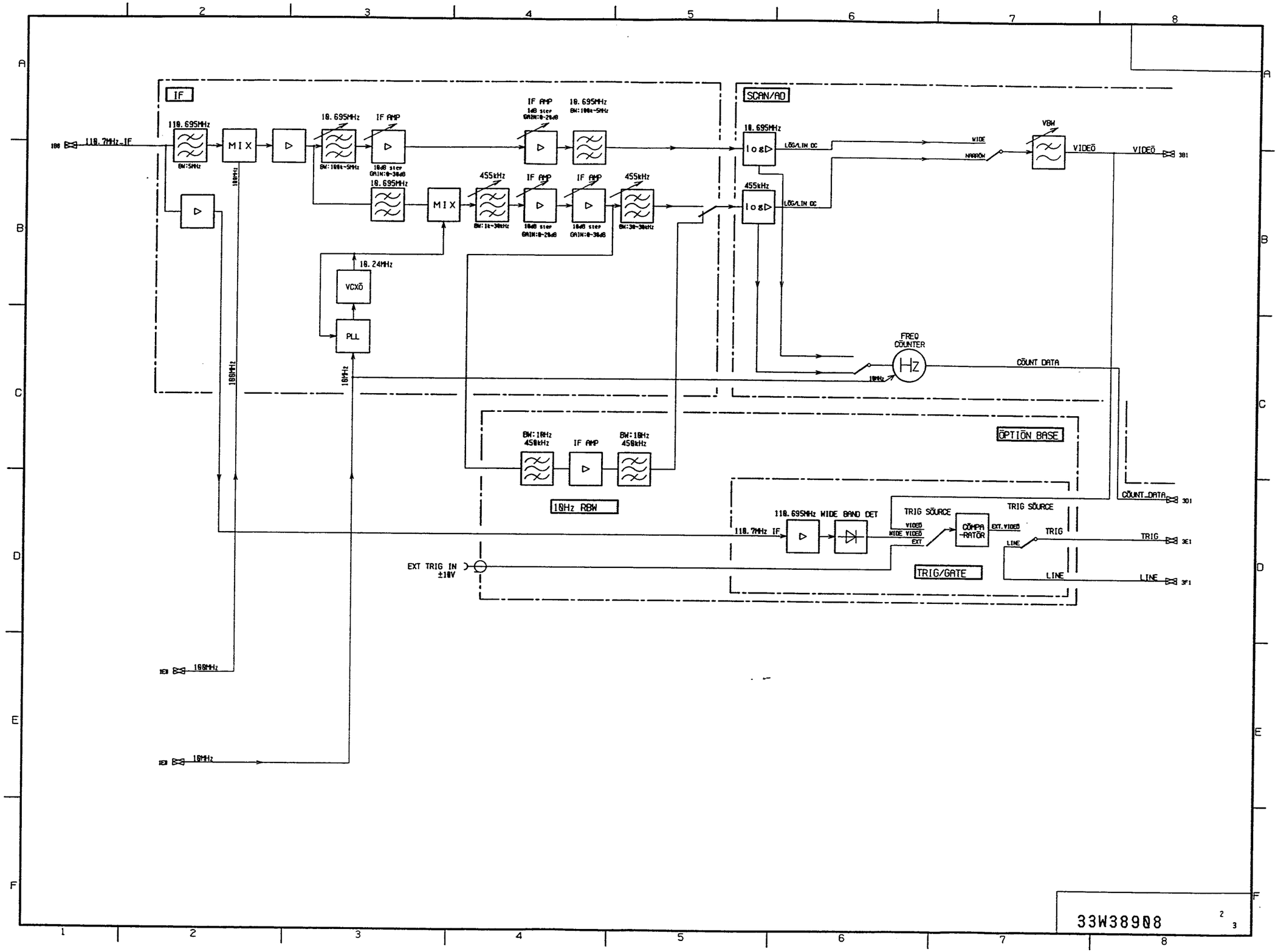

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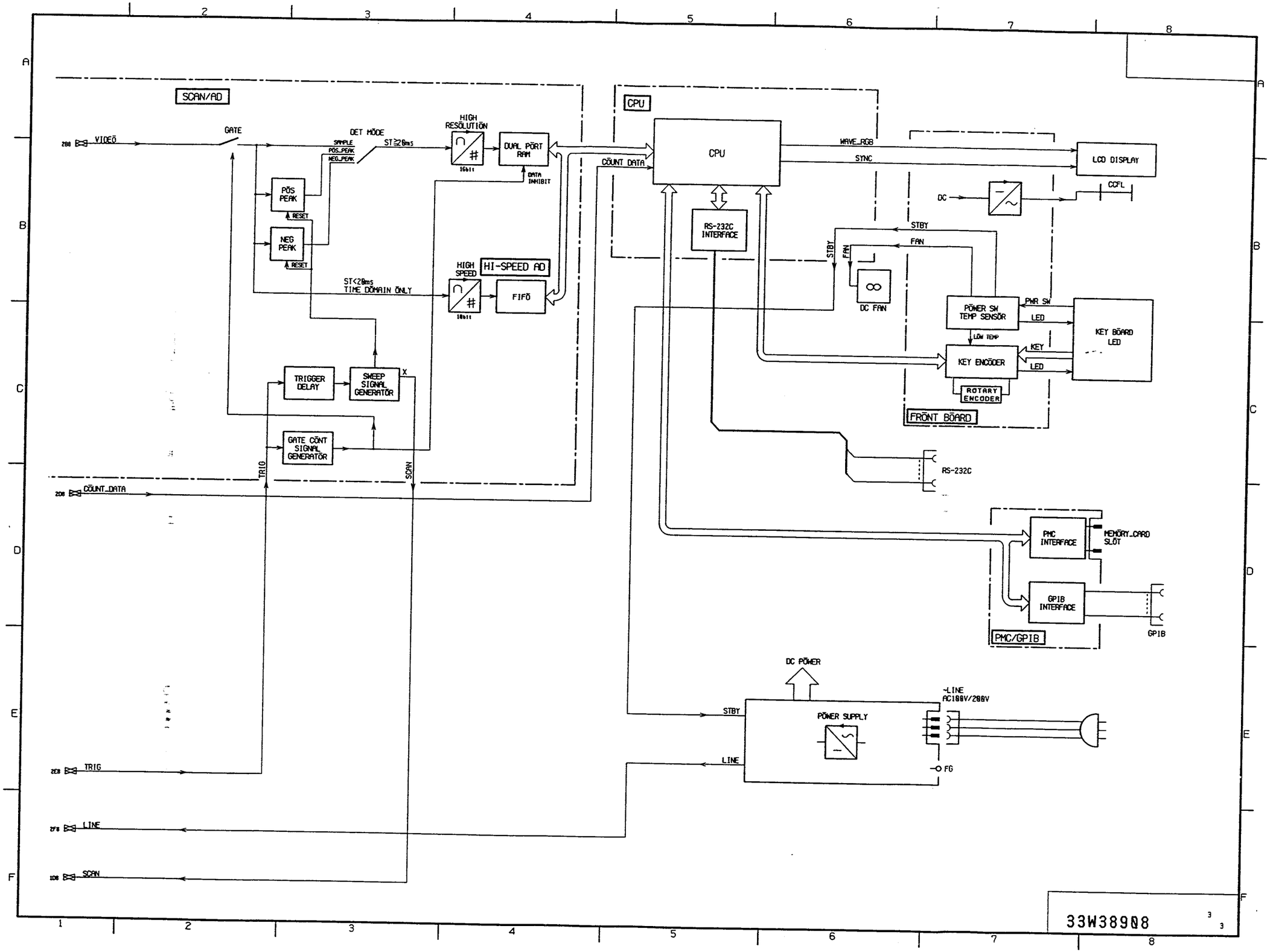

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U.S. NAVY TECHNICAL MANUAL

OPERATION MANUAL
(Detailed Operating Instructions)
VOLUME II
FOR
SPECTRUM ANALYZER
MODEL MS2670A

NSN: 6625-01-425-2551

CONTRACTOR: ANRITSU WILTRON SALES COMPANY
19630 Club House Rd., Ste 710
Gaithersburg, MD 20879
CONTRACT NO.: N00104-96-D-N011

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MS2670A
Spectrum Analyzer
Operation Manual
Vol. 2

(Detailed Operating Instructions)

First Edition

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

Measuring Instruments Division
Measurement Group
ANRITSU CORPORATION

Document No.: M-W1033AE-1.0

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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.

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

(Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.)

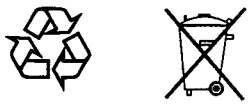
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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.

MS2670A Spectrum Analyzer
Operation Manual Vol. 2 (Detailed Operating Instructions)

July 1996 (First Edition)

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Printed in Japan

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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.

Falling Over

3. 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.

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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.

   T5A indicates a time-lag fuse.

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

Cleaning

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

Check Terminal

3. • Maximum DC voltage ratings:

     RF Input 0 Vdc

     TG Output 0 Vdc

   • Maximum AC power ratings:

     RF Input +30 dBm

     TG Output +20 dBm

   • NEVER input a >+30 dBm and >0 Vdc power to RF Input.

   • NEVER input a >+20 dBm and >0 Vdc reverse power to TG Output.

   • Excessive power may damage the internal circuits.

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For Safety

CAUTION ⚠

Memory Back-up Battery

4. The power for memory back-up is supplied by a Poly-carbonmonofluoride Lithium Battery. This battery should only be replaced by a battery of the same type.

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

Storage Medium

5. This equipment stores data and programs using Memory card 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 memory card from equipment being accessed.
   - Isolate the card from static electricity.
   - The back-up battery in the SRAM memory card has a limited life; replace the battery periodically.

   For replacing the battery, see page 2-15 of the Operation Manual Vol. 1.

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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.

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

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

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

Consequently, if this equipment is built into remote monitoring systems that use MODEMs, the standby function of this equipment must be modified.

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ABOUT DETECTION MODE

This instrument is a spectrum analyzer which uses a digital storage system. The spectrum analyzer makes level measurements in frequency steps obtained by dividing the frequency span by the number of measurement data points (501). This method of measurement cannot detect the signal peak level if the spectrum of a received signal is narrower than these frequency steps.

To resolve this problem, this instrument usually operates in positive peak detection mode and normal detection mode. In the positive peak detection mode, the highest level within the frequency range between the sample points can be held and traced. In the normal detection mode, both the positive peak and the negative peak can be traced.

Positive peak detection mode should be used for almost all measurements including normal signal level measurement, pulsed noise analysis, and others. It is impossible to measure the signal level accurately in sample detection mode or in negative peak detection mode.

Use of sample detection mode is restricted to random noise measurement, occupied frequency bandwidth measurement for analog communication systems, and adjacent-channel leakage power measurement, etc.

Measurement	item
• Normal signal	POS PEAK
• Random noise	SAMPLE
• Pulsed noise	NORMAL (POSI-NEG)
• Occupied frequency bandwidth, adjacent-channel leakage power (for analog communication systems)	SAMPLE
• Occupied frequency bandwidth, adjacent-channel leakage power (for digital communication systems)	POS PEAK or SAMPLE

When a detection mode is specified as one of the measurement methods, make the measurement in the specified detection mode.

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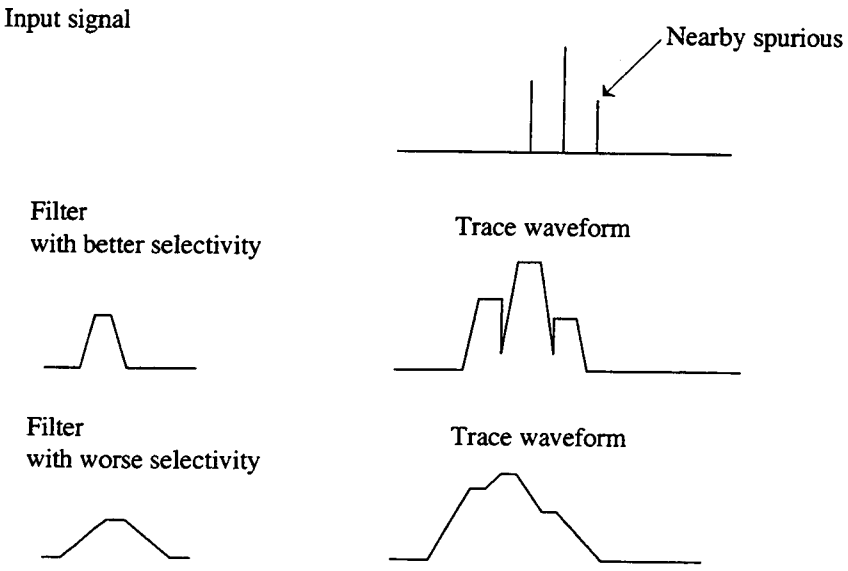
RBW Filter Characteristics and Auto Sweep Mode

The MS2670A use the filter with better selectivity (sharp skirt characteristics) than that of the old Anritsu spectrum analyzers.
As shown below, when filters have the same RBW (3 dB bandwidth), the filter with better selectivity can more accurately analyze the nearby spurious signal.
For example, the RBW 1 kHz of the MS2670A corresponds to the RBW 300 Hz of the old types.
Moreover, in the low frequency, the decrease of the level-measurement dynamic range by the zero-beat effect (caused by the filter skirt characteristics) is also improved.



When in the same combination of the RBW and span, the MS2670A auto sweep time in the Hi-Lvl-Acc mode becomes slower than that of the old type, by 3 times.
However, since the MS2670A use the filter with better selectivity (sharp skirt characteristics), the wider RBW by 3 times can be set in the same span, and conversely, the sweep time can be set faster by 3 times for the high-accurate level measurement.

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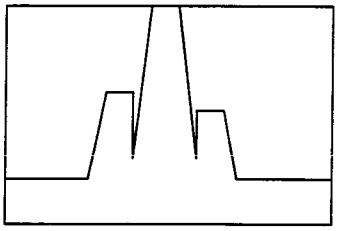
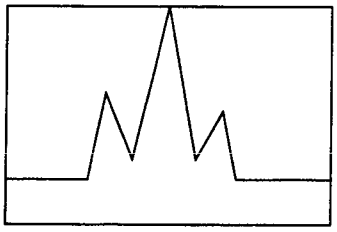
RBW = 1 kHzST = 400 ms
SPAN = 50 kHz



MS2670A
in Hi-Lvl-Acc mode

RBW = 300 Hz ST = 1.5 s
SPAN = 50 kHz



Old types

In the same combination of the RBW and span, the MS2670A have the "Fast" auto sweep mode, in which the auto sweep time can be set to the same as that of the old types.

However, the level measurement accuracy becomes worse by 1 dB in this mode. So, use this Fast mode in the relative-level measurement such as the adjacent channel leakage power, harmonic distortion, and occupied frequency bandwidth, in which this effect can be neglected.
In the burst-wave relative-level measurement of the adjacent channel leakage power, note that the measurement value may fluctuate by 1 or 2 dB. In that case, compare the value to that in the Hi-Lvl-Acc mode.

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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/ModelName

Product Name: Spectrum Analyzer
Model Name: MS2670A

2. Applied Directive

EMC : Council Directive 89/336/EEC

3. Applied Standards

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

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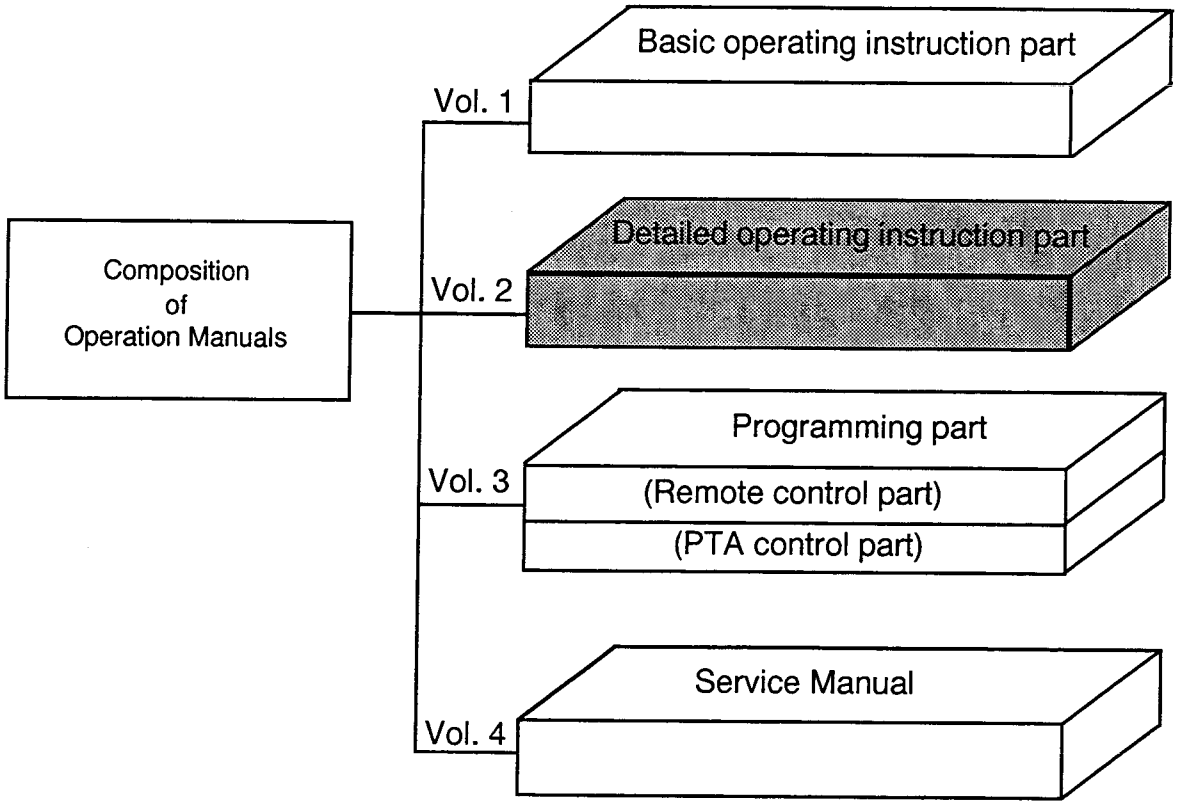
ABOUT THIS MANUAL

(1) Composition of MS2670A Operation Manuals and Service Manual

The MS2670A Spectrum Analyzer operation manuals of the standard type are composed of the following four documents. Use them properly according to the usage purpose.



Basic operating instruction part:	Basic Operating Instructions: Provides information on the MS2670A outline, preparation before use, panel description, basic operation, soft-key menu and performance tests.
Detailed operating instruction part:	Detailed Operating Instructions: Provides information on the detailed panel operating instructions on MS2670A that expand on the basic operation and soft-key menu in the Basic Operating Instruction Part.
Programming part:	Composed of the Remote Control Part and PTA Control Part. The Remote Control Part provides information on RS-232C remote control, GPIB remote control and sample programs, while the PTA Control Part describes about PTA operation and PTL commands.
Service Manual (Vol. 4)	Contains circuit descriptions, troubleshooting and adjustment, mechanical configuration maintenance, and the parts listings.

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SECTION 1

BASIC OPERATION PROCEDURE

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SECTION 1
BASIC OPERATION PROCEDURE

The basic operational procedures of this equipment is explained here. The operations are listed on the right. Also, the explanations assume that a 500 MHz signal is applied to the input connector. Please read this manual while operating this equipment.
([ ]: Panel key, ___ : Soft key)

<Acutual operations>
(1) Signal display
   1) Turn the power on,
   2) set the signal to the center of the screen, and
   3) enlarge and display the signal.
(2) Marker operation
   Check of the zone marker function.
   The "marker →" function check.
(3) "Measure" function check.
(4) Screen hard copy.

Signal Display

Turn the power on

Press the AC line power switch on the rear panel, then press the power switch (0) on the front panel. In this case, continue pressing the power switch for one second or more.

Press [Preset] key.

Press Preset All Parameters key in the menu.

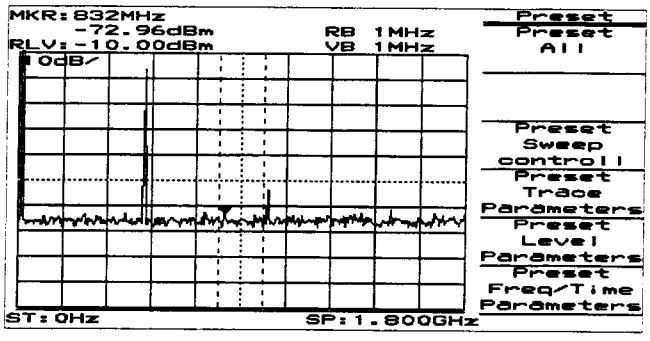

Fig. 1-1

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

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

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

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Set the signal to the center of the screen

Press [Frequency] key.

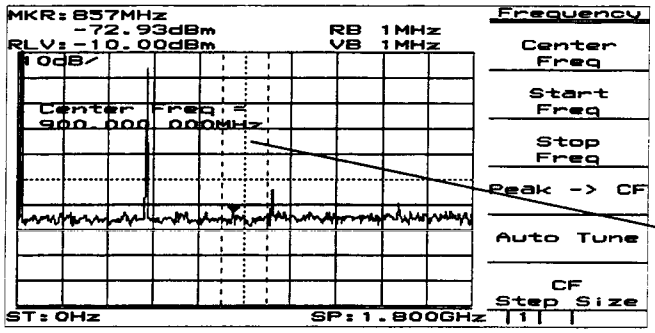

Fig. 1-2

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

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

Press [Menu On/Off] key

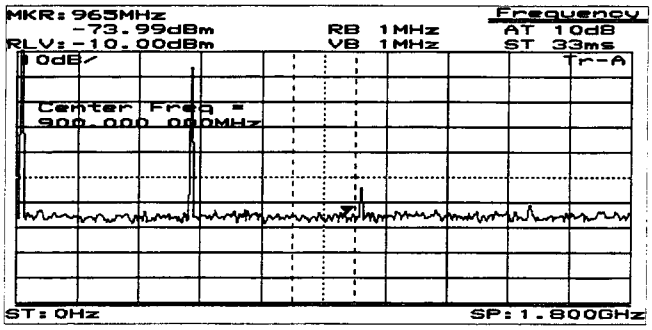

Fig. 1-3

The display of the soft key menu can be switched on/off using [Menu On/Off] key. When the menu disappears, the scale is enlarged. Also, when the menu is displayed, the scale is reduced.

Press [Menu On/Off] key to return to previous screen.
Use the ten-key pad (numeric keys) to enter 500 MHz.

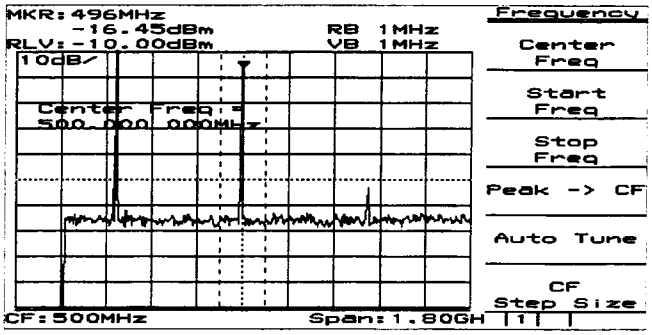

Fig. 1-4

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

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Enlarge and display the signal

Press [Span] key , then press the [V] down key several times to enlarge the signal display.

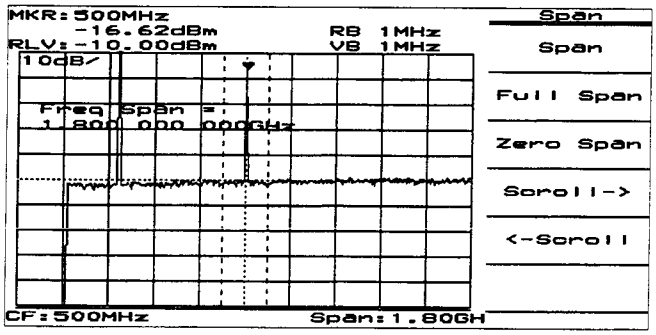

Fig. 1-5

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Marker Operation

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

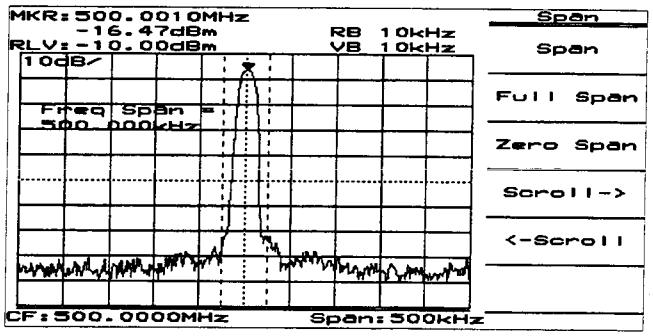

Fig. 1-6

To check Marker $\rightarrow$ CF function, shift the signal from the center intentionally.
Press [Frequency] key and [More] key in order, and then Scroll $\rightarrow$ key two times.

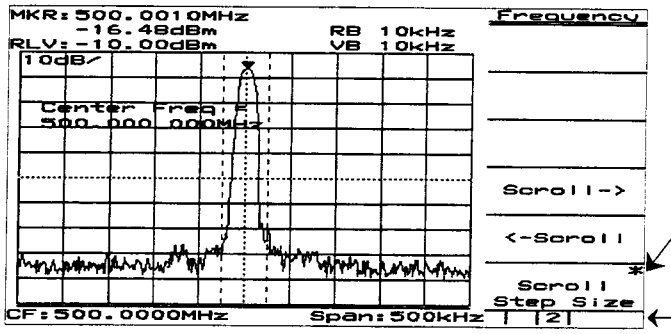

Fig. 1-7

The soft key menu marked by an asterisk (*) on the upper right indicates that the menu can further be opened by pressing the key. Conversely, the soft key menu not marked indicates that the menu cannot be opened further.

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

To turn over the page, press [More] key.

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Press Peak Search key.

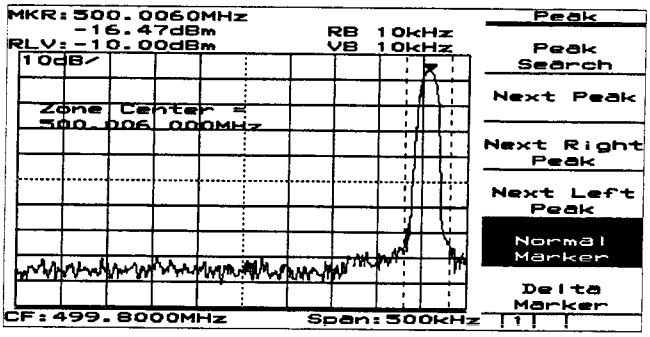

Fig. 5-8

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

The marker fetches the signal.

Press [More] key.

Press Marker → key.

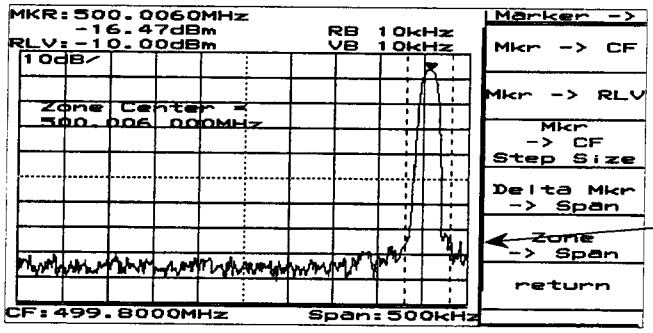

Fig. 5-9

When the soft key menu with * is pressed, the lower menu of function related to the menu is further displayed.
In this case, as shown in the figure on the left, the thick line is displayed at the left of the soft key menu. This indicates that the lower menu is displayed.

Press marker → CF key.

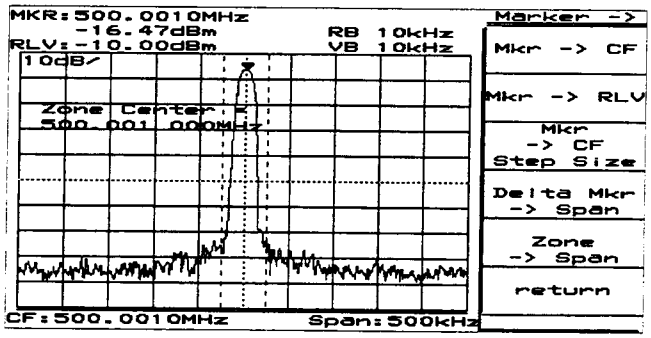

Fig. 1-10

The page opened by pressing the soft key can return to the preceding page by the return key. It can check which soft key menu was previously pressed to open the current menu, as the menu title is displayed on the upper row of the soft key.

Here, return to the screen of Fig. 1-7 and ensure that the screen changes to that of Fig. 1-10 only by pressing the [→CF] key.

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"Measure" Function Check

Press [Preset] key and Preset All Parameters key in order.
Press [Peak Search] key.
If the zero beat signal level (local feed though) is larger than the signal level and the marker fetches the zero beat level, press "Next peak" key and put the marker on the signal.

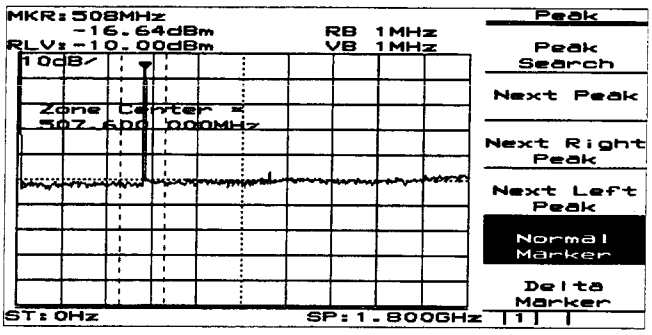

Fig. 1-11

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

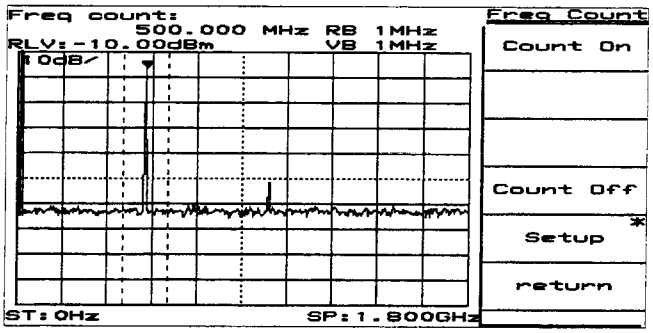

Fig. 1-12

The soft-key menu display can be switched On/Off by the [Menu On/Off] key. However, keys that condition setting is not possible unless a menu is On unconditionally make the soft-key menu display On when pressing a panel key.

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

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

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Screen Hard Copy

The screen can be hard-copied with the VP-600 printer (Epson) via an RS-232C interface, and the procedures are described below:

1) As illustrated below, connect the RS-232C connector and printer with an attached RS-232C cable.

2) Press the [Copy] key, and the currently displayed screen is hard-copied.
If the printed copy is improper, check if the RS-232C interface is correctly set by performing the following sequence.

3) Press the [Shift] key and then the [Interface] key.

4) Press the Connect to Controller key several times to get None on the display, and press the Connect to Prt/Plt key several times to get RS-232C on the display.
Now the printer can be operated with RS-232C interface.

5) Press the RS-232C Setup key to set so that (or check if) the the setting of RS-232C interface is the same between the main body and printer.
(For the setting/checking of the RS-232C interface on the printer side, refer to the instruction manual of the printer.)

6) Press the [Shift] key and then the [Copy Cont] key.

7) Press the Printer/Plotter key and select Printer.

8) Press the Printer Setup key, and then press the VP-600 key.

9) Press the Magnify key several times and make the display 1 X 1.

10) Press the [Copy] key to print the currently displayed screen.

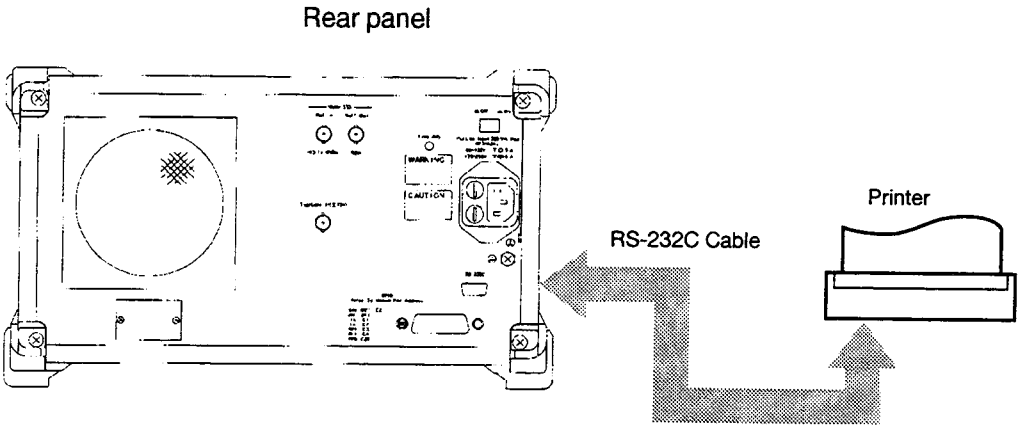

Fig. 1-13

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SECTION 2

FREQUENCY/AMPLITUDE DATA ENTRY

This section describes the front panel data entry functions relating to frequency and amplitude.

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SECTION 2
FREQUENCY/AMPLITUDE DATA ENTRY

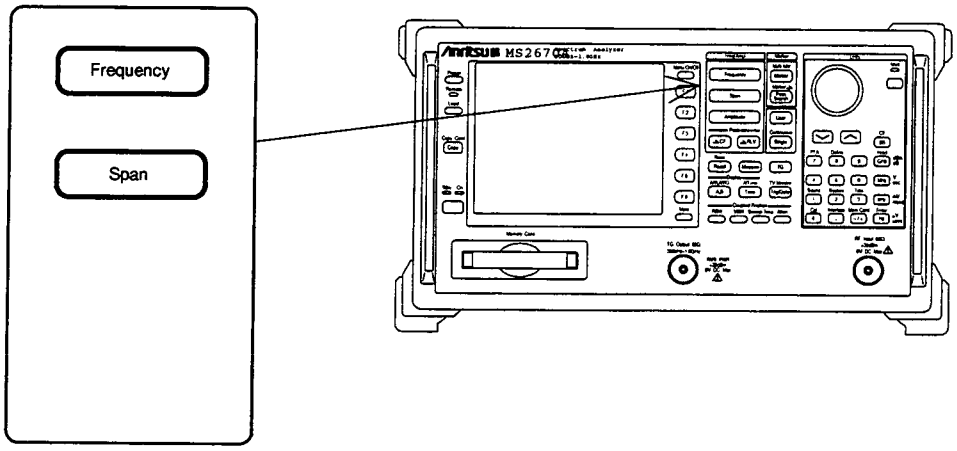
Setting Observation Frequency

The observation frequency of the MS2670A is set in the following two modes:

- Center-Span
- Start-Stop

The frequency setting upper and lower limits are –100 MHz and 1.8 GHz, respectively.

The Frequency key is used as the header key for setting the frequency, and the Span key is used as the header key for setting the frequency span.



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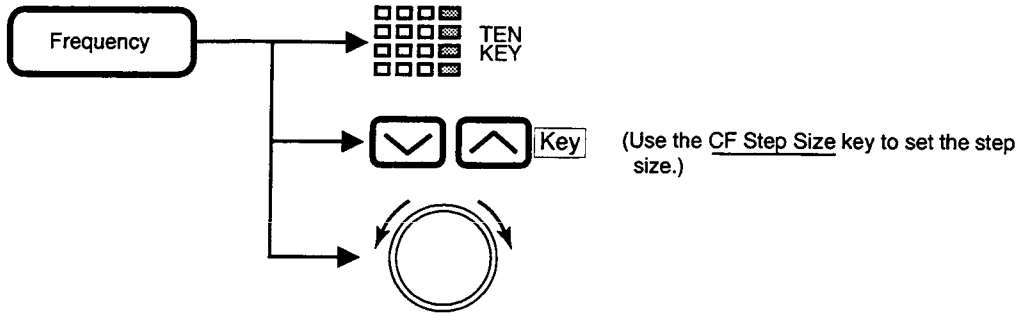
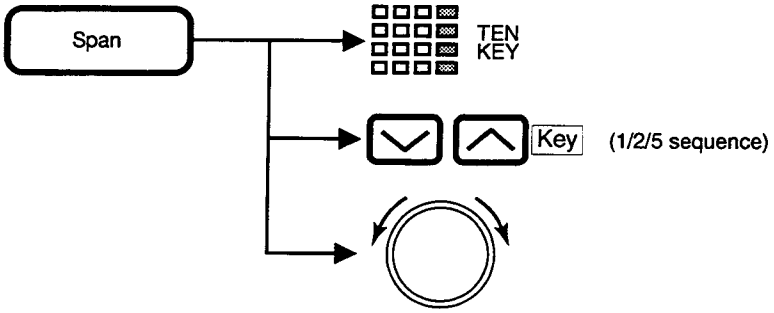
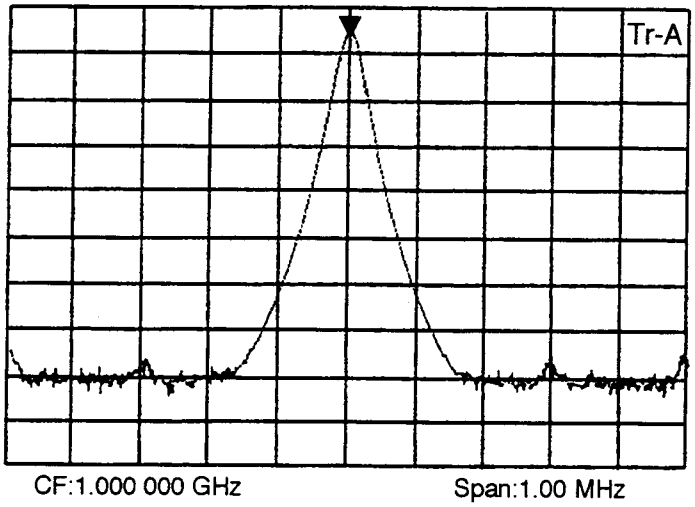
Center-Span Mode

(1) Setting center frequency



(2) Setting frequency span





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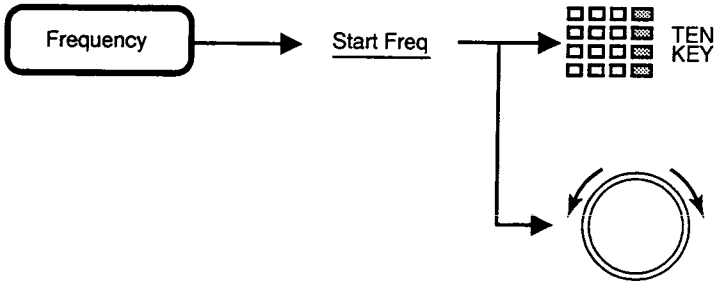
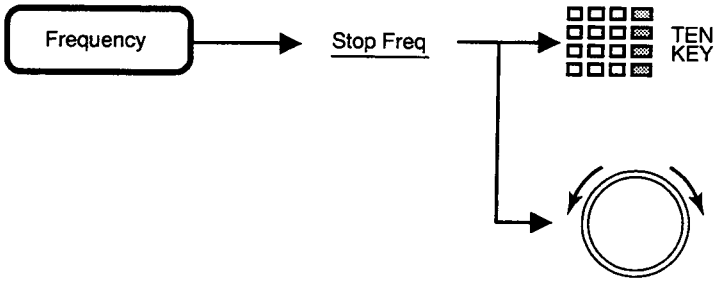
Start-Stop Mode

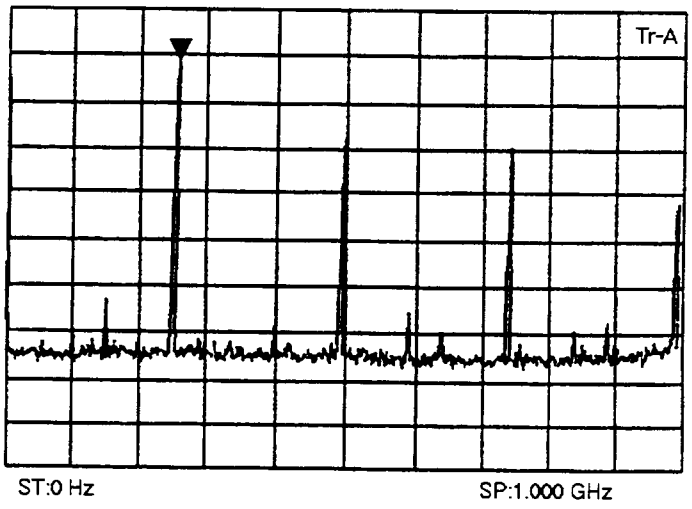
(1) Start frequency



(2) Stop frequency



Notes:
- Because the ∨ and ∧ 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.



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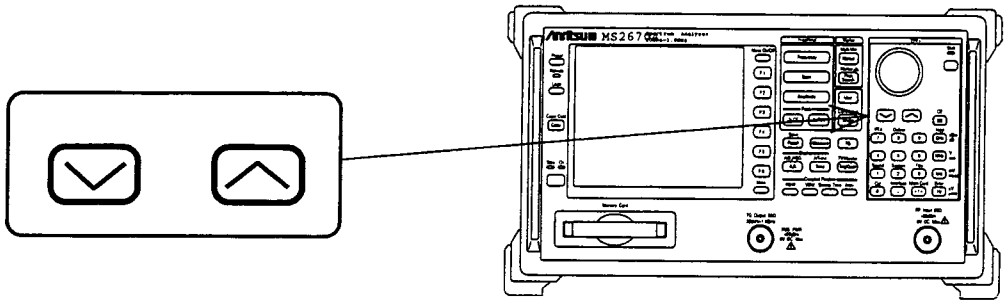
Setting Step Size with Step Keys



To use the ▽ △ keys to change the step size of the center frequency, register the step size as follows:

Frequency → CF Step Size → TEN KEY

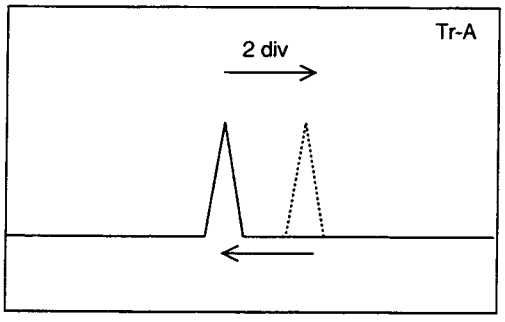
Setting Frequency Scroll Step Size

Frequency → Scroll Step Size →
- 1 div
- 2 div
- 5 div
- 10 div

Select a step size. The selected scroll step size is highlighted.

- return

Return to the top menu.



Span → Scroll→

The waveform scrolls 2 divs to the right.

Span → ←Scroll

The waveform scrolls 2 divs to the left.

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Setting Full Scan

In the normal operating state, pressing the Preset key and Preset All key allows the entire frequency range of the MS2670A 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

Setting Zero Span

The MS2670A 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 MS2670A to operate in the zero span (time domain) mode.

- Span → 0 → Hz
- Span → Zero Span
- Time

For further details on the zero span (time domain) mode, see SECTION 5, "SELECTING THE DISPLAY METHOD."

In the frequency and time domains, the RBW, VBW, Sweep time and other coupling functions time can be set to different values. For further details, see CHAPTER 9, "SETTING MEASURING SYSTEM."

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Setting Level Range

The table below shows the types of MS2670A level display modes and the ranges of the reference level (top graticule of the amplitude scale) for the different modes.

Display mode	Units	Reference level range
Log scale	dBm	−100 to +30 dBm
	dBμV	+7 to +137 dBμV
	dBmV	−53 to +77 dBmV
	V	2.24 μV to 7.07 V
	dBμV (emf)	+13 to +143 dBμV (emf)
	W	100 fW to 1.00 W
Linear scale	V	224 μV to 7.07 V

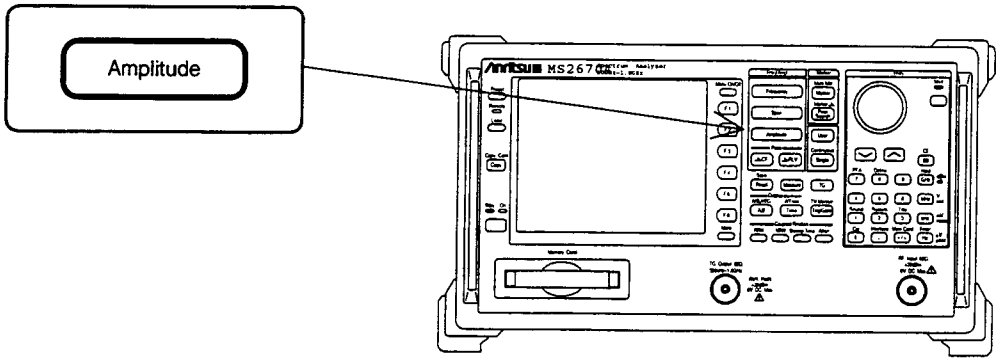
dBm: dBm unit system where 1 mW/50 Ω is defined as 0 dBm.

dBμV: dBμV unit system where 1 V is defined as 0 dBμV, and the terminal voltage display is terminated into 50 Ω.

dBmV: dBmV unit system where 1 mV is defined as 0 dBmV, and the terminal voltage display is terminated into 50 Ω.

dBμV (emf): dBμV (emf) unit system based on the open-voltage display, and dBμV +6 dB is fed as the output value.

The Amplitude key is used as the header key for setting the amplitude level.



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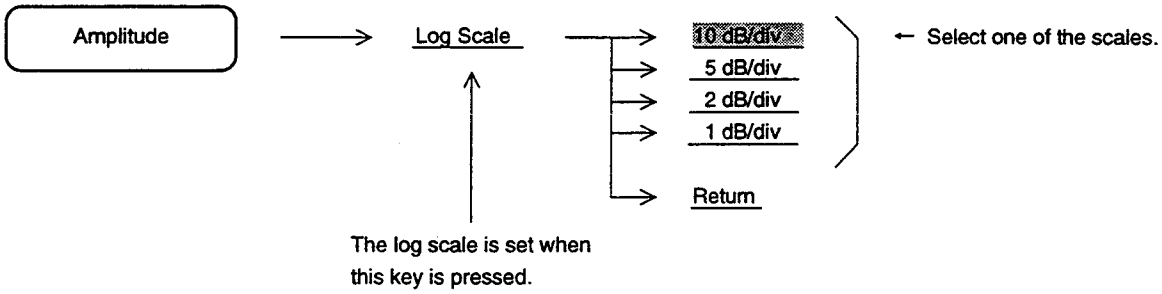
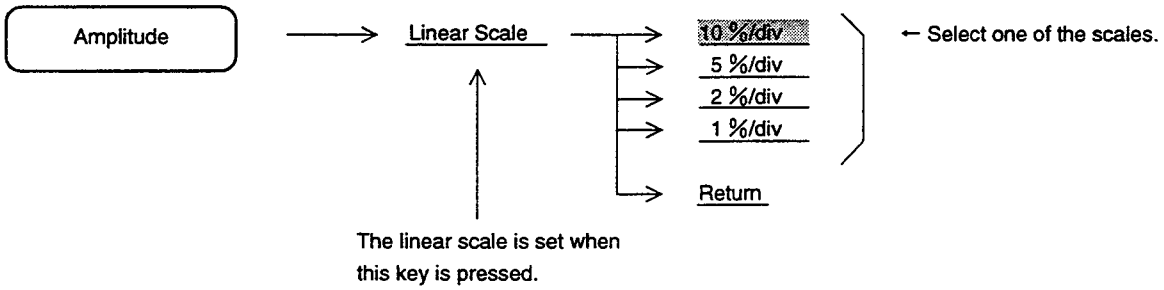
Setting Log/Linear Scale

To set the amplitude scale to log scale or linear scale, perform the following key operations.

(1) Setting log scale



(2) Setting linear scale



The reference level remains constant, independent of switching between log and linear scales.
When the reference level is set to less than –60 dBm in the log scale mode, the reference level of the linear scale is switched to 224 μV.

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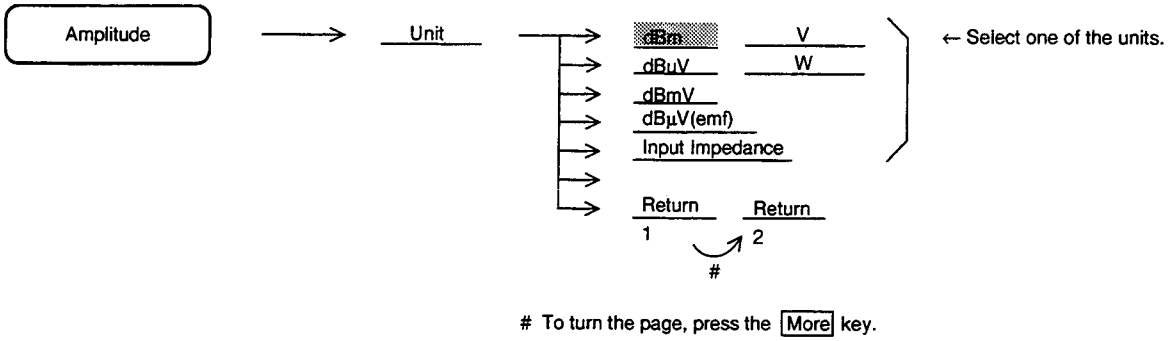
Selecting Reference Level Units

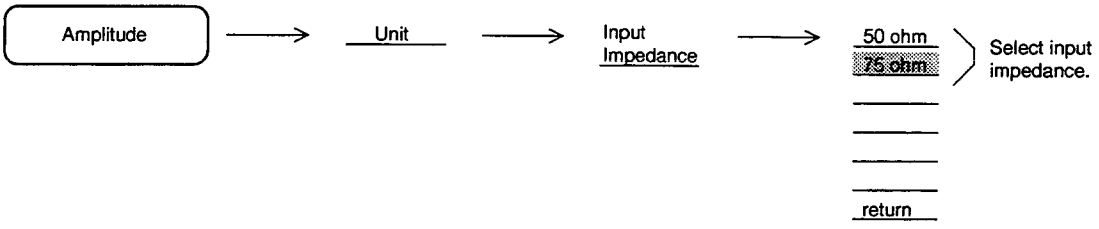
In the log scale mode, the MS2670A provides six types of reference level units: dBm, dBμV, dBmV, V, dBμV (emf), and W. To select one of the reference level units, perform the following key operations.



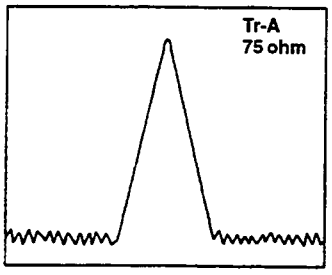
Because the reference level unit used for the linear scale is only V, there is nothing to select.

Selecting Input Impedance

The input impedance of the MS2670A is 50 Ω. Measurement with 75 Ω can be enabled by using 50 Ω→75 Ω Impedance Transformer. In this case, measured value is level converted.
When the input impedance is set to 75 Ω as shown in the figure below; measured value is level converted, and displayed according to the level unit of the dBμV/dBmV/dBμV(emf)/V.



When the input impedance is set to 75 Ω, the level is displayed after adding +1.8 dB to the 50 Ω level, and "75 ohm" is displayed at the top right of the waveform.



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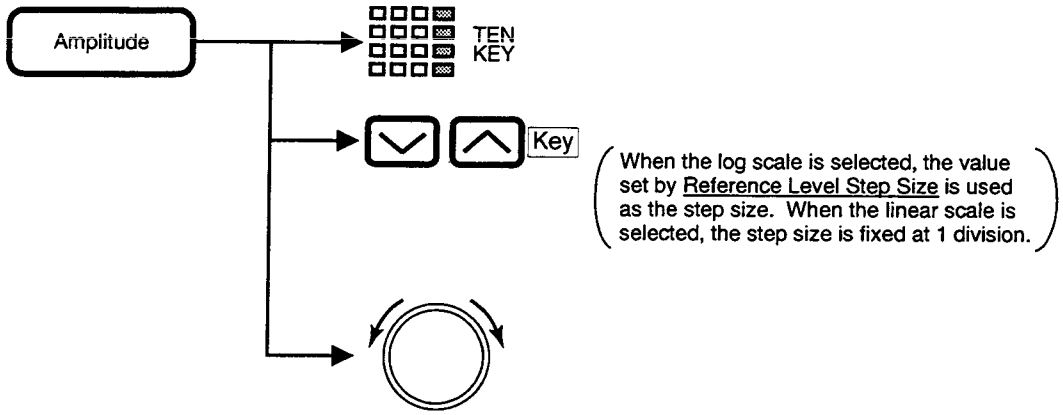
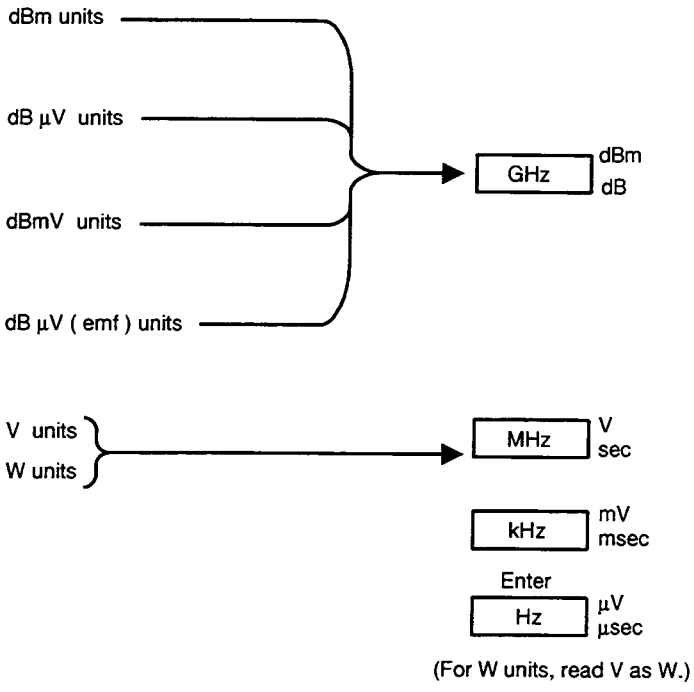
When the MA1621A is used as the 50 Ω→75 Ω Impedance Transformer, the insertion-loss frequency characteristics of the MA1621A must be compensated. The MS2670A has the level-compensation function. (See page 2-15 "Setting 50 Ω→75 Ω Impedance Transformer (MA1621A)".)

Setting Reference Level

Select the reference level (top graticule of the amplitude scale) by performing the following key operations.



Use the unit key as follows, according to the set reference level unit.



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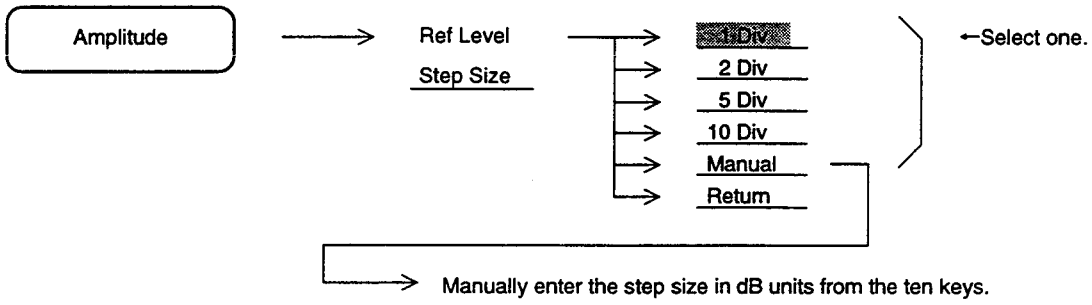
Setting Reference Level Step Size

To change the reference level with the ∨ ∧ keys, set the step size by performing the following key operations.

(1) Log scale



(2) Linear scale

Fixed at 1 division.

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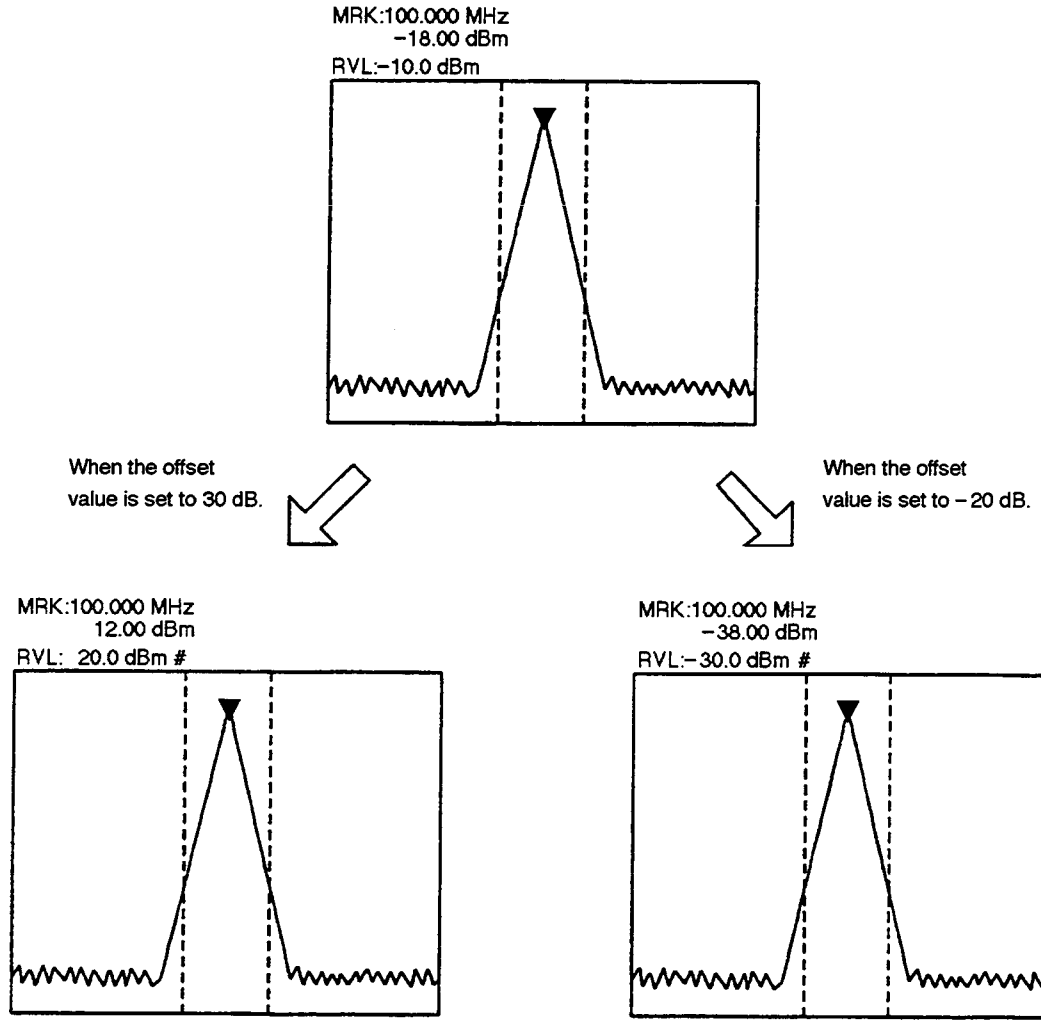
Offsetting Reference Level

The reference level and waveform trace can be displayed by adding a given offset.



The # is displayed to the right of the reference level display above the scale.

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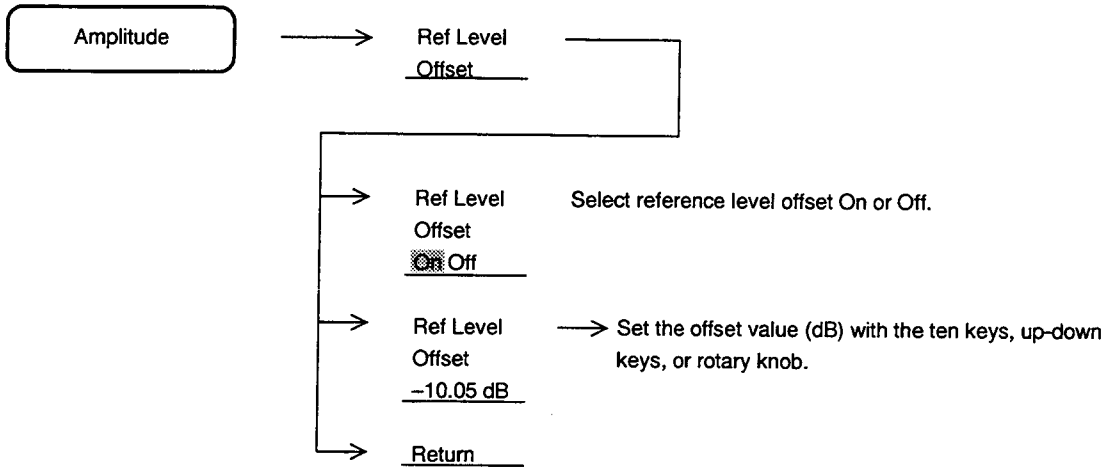
Turn the offset display On/Off and set its offset value by performing the following key operations.



The offset value setting range is from –100 to +100 dB. The offset value resolution is 0.01 dB.

The offset can be applied to each trace (A, B, BG, Time), but it cannot be applied when using A–B→A function.

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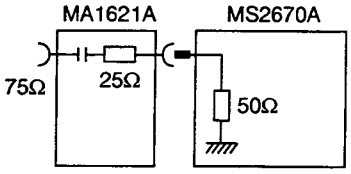
Setting Attenuator

Press the Amplitude key, then press the Attenuator key.
Select manual setting or automatic setting.
For manual setting, enter the attenuator setting in dB units from the ten keys.

Setting 50Ω→75 Ω Impedance Transformer

When the optional MA1621A (75 Ω → 50 Ω) impedance transformer is installed to the RF input attenuator (see the figure below), set the input impedance to 75 Ω.
Press the Amplitude key, then press the Input Transformer key.
Set the MA1621A to On with the On Off key.
When the input impedance is set to On (it is assumed that a 25 Ω resistor is connected in series with the input), the level is converted for 75 Ω, the insertion-loss frequency characteristic is corrected, and then the measured result is displayed.



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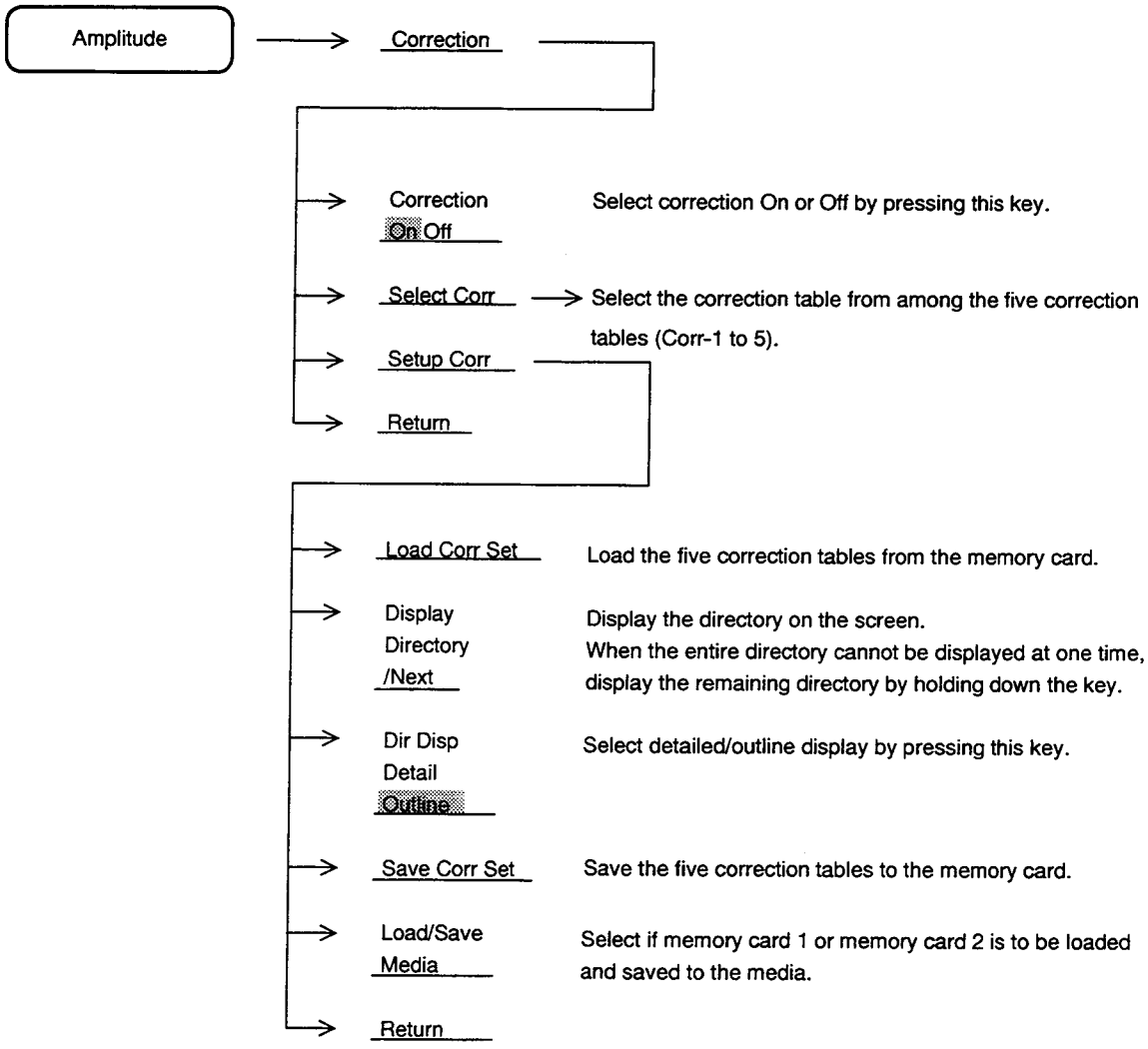
Setting Level Frequency Correction Coefficient

This function corrects the level-frequency characteristics of the cables and pads (connected to the front end of the RF Input connector) so that the level becomes flat. Correction tables are written via the RS-232C or GPIB interface.



For further details, see SECTION 8 (AUTOMATIC CALIBRATION AND LEVEL CORRECTIONS FUNCTIONS).

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SECTION 3

MARKER FUNCTIONS

This section describes the marker functions for improving the measurement efficiency, such as the zone marker, marker mode menu, marker search, and the parameters set by marker value.
For a description of marker tracking and zone sweep setting, see SECTION 6 (SELECTING THE SWEEP METHOD).

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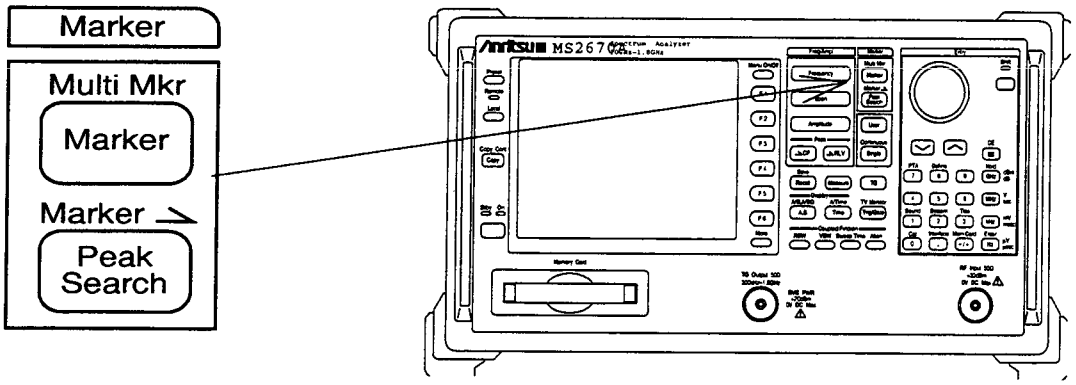
SECTION 3
MARKER FUNCTIONS

The inner section keys are used as the header keys for setting the marker functions.



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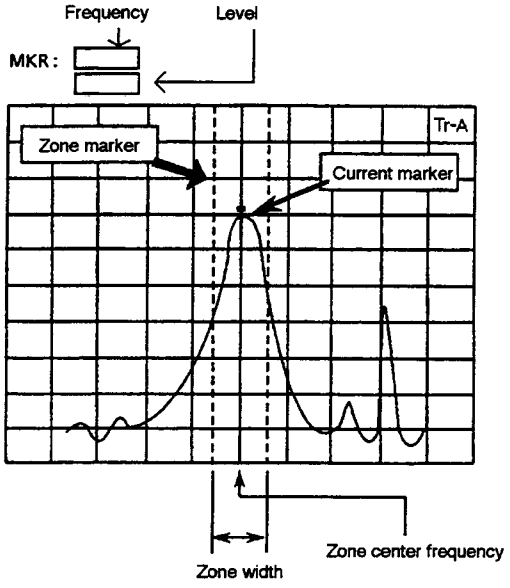
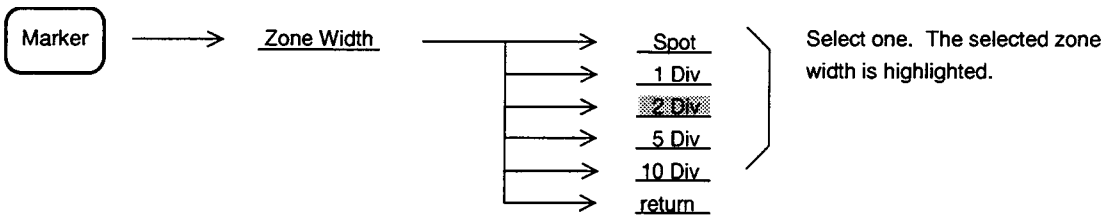
Changing Zone Marker Position and Width

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.



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.

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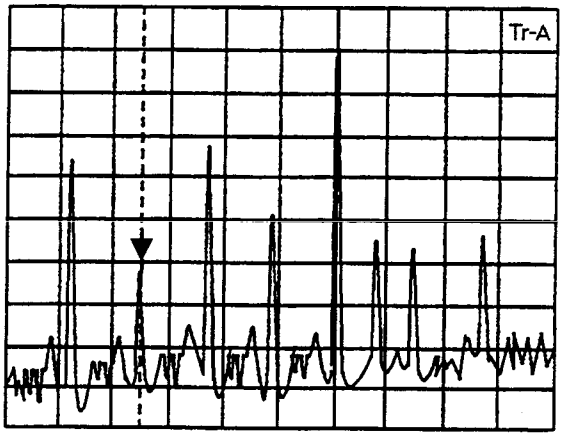
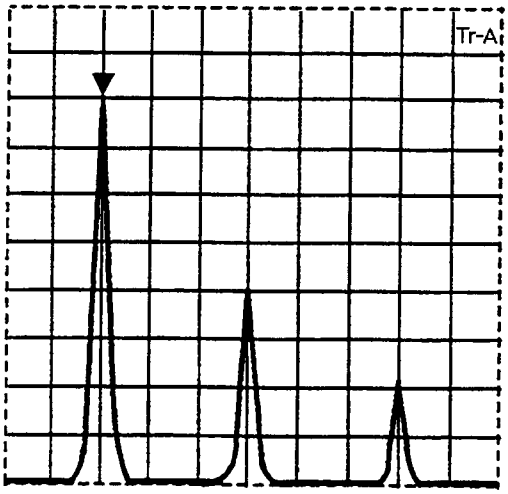
When the zone marker width is set to 1 point (Spot), the zone marker becomes a vertical line. This is called a spot marker. Since the marker center frequency and the current marker frequency coincide, the level at the desired frequency can be measured.

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.

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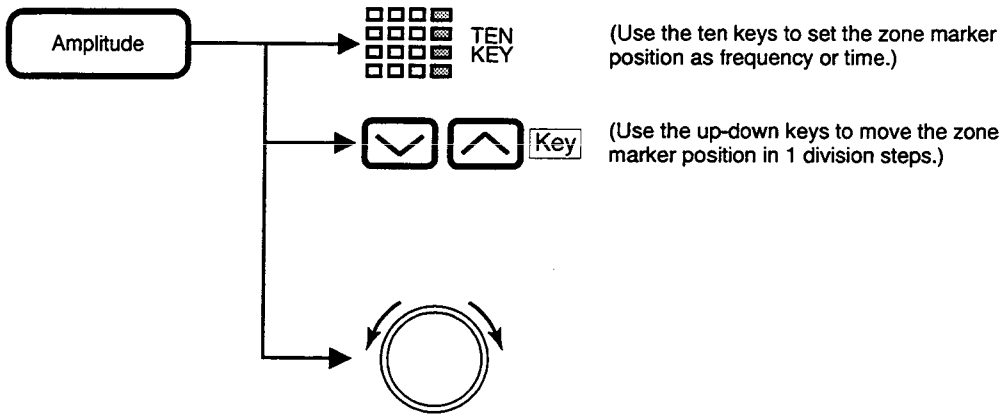
Changing Zone Marker Position

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.



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).

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Marker Mode

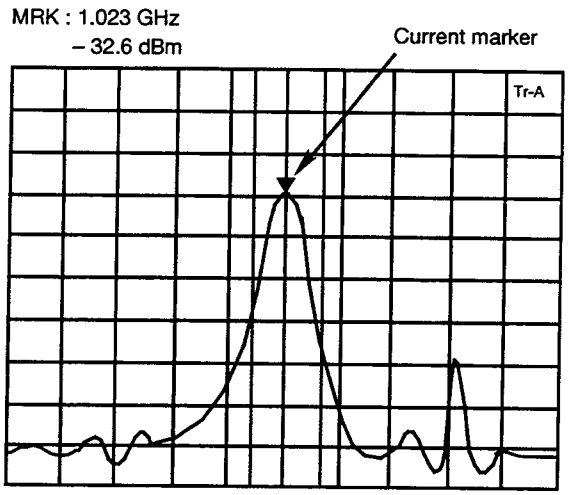
Three types of markers can be used with the MS2670A: normal marker, delta marker, and multimarker.

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 by default. 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.

Marker → Normal Marker



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 display line.

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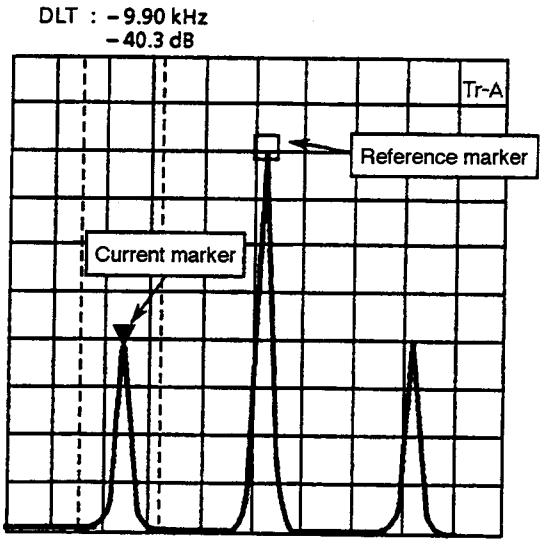
Delta Marker

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 a delta marker value.

In the delta marker mode, the reference marker is indicated by a □ .

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 either changing the observation frequency, level, or range, it is at the edge of the scale lines.

The marker mode at delta marker-ON becomes the normal mode when the scale mode is changed from log scale to linear scale and vice-versa. If the scale mode was changed, set the delta marker again.

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Marker Off

Marker → Marker Off

The marker disappears from the screen. When the Normal Marker key is pressed, the marker is displayed.

Switching Marker Search Mode

Searching the maximum value (Peak) or minimum value (Dip) in the zone marker is selected by pressing this key. Usually select Peak.

Marker → Marker Search Peak Dip

(Display page 2 of the menu by pressing the More key.)

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Display Line

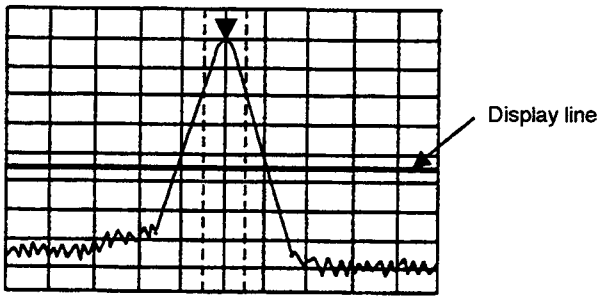
If a horizontal line, which indicates a given level, is displayed on the scale, the display line can be used as the frequency response measurement guideline, or as the reference line of the marker level measurement, or pass/fail judgement with a standard line.

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 More 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, BG, Time). Also, the display-line level is common.

The display-line level and Abs/Rel can be selected independently for each trace.

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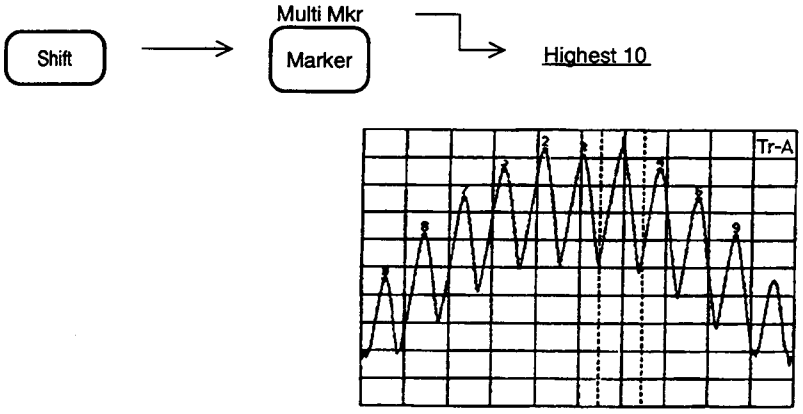
Multimarker

The MS2670A has a marker function which displays up to ten markers simultaneously. Multimarker can be set by the following four methods:

- Highest 10
- Harmonics
- Marker List
- Manual Set

Highest 10 Multimarker

Allocates up to 10 multimarkers in descending order of signal peak level displayed on the screen.



After executing Highest 10, an active marker (with the same functions as the current marker) moves to the peak point of the maximum level signal.

Note: Each multimarker has a zone the same as the current marker and is positioned at the maximum level point. When the next sweep is done after Highest 10 operation, each multimarker position may be changed. To prevent this, execute the Highest 10 after stopping the sweeping or after narrowing the zone width.

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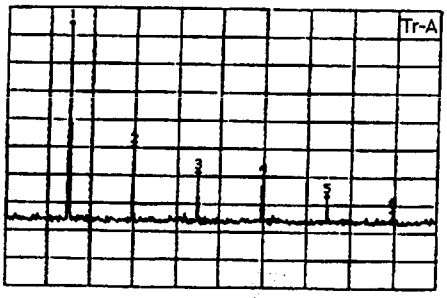
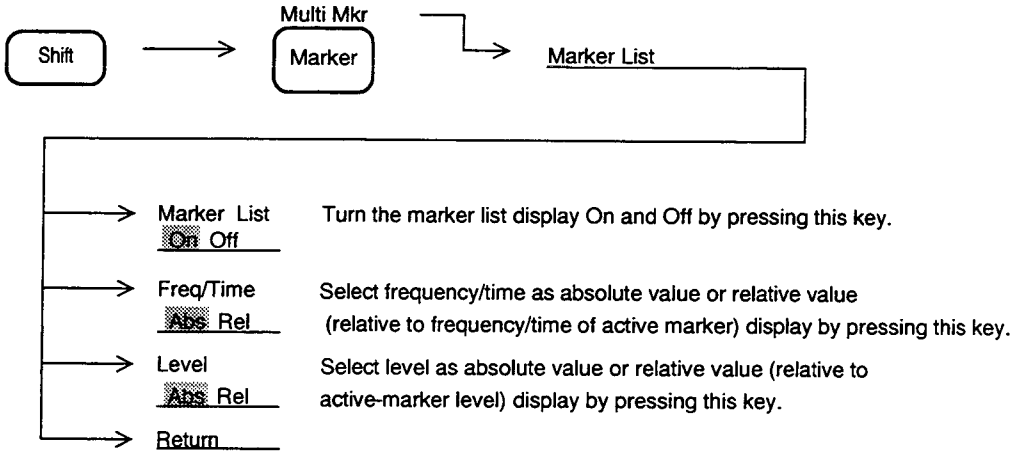
Harmonics Multimarker

Allocates multimarkers to the 2nd to the 10th harmonic signals of the active marker signal as the fundamental signal.



Note: If the fundamental and second harmonic signals are not separated by more than the marker zone width, or when there are larger level signals other than harmonic signals in the frequency range of the marker zone width centered at the harmonic signals, harmonic signals will be incorrectly detected. In this case, narrow the marker zone width.

Marker List



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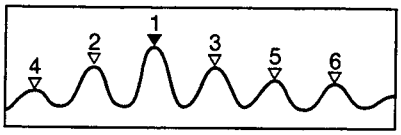
In Freq/Time Rel mode, frequency and time of the markers (except active marker) are displayed in relative values, and "R" marks are appended at the left.
In Level Rel mode, level of the markers (except active marker) are displayed in relative values.



Marker List

*	1:	1.00000GHz	-15.12dBm
	2:R	-1.31MHz	-3.55dB
	3:R	1.41MHz	-3.61dB
	4:R	-2.00MHz	-5.96dB
	5:R	1.89MHz	-6.21dB
	6:R	2.20MHz	-6.76dB
	7:		
	8:		
	9:		
	10:		

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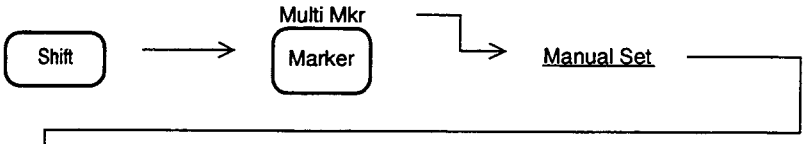
Manual Set

Allocates up to 10 multimarkers to arbitrary frequencies or time points.



Change Active Maker No

Selects the active marker from among the markers that are currently On. Each time this key is pressed, the markers are scrolled and selected. #

Select Marker No 4

Specifies the marker number to be set to On or Off.

On with Auto Select

At the same time the marker number selected above is set to On, the selected marker is made the active marker. If the selected marker is already On, the next higher marker number of the markers set to Off is set to On. By holding this key down, the multimarkers are set to On one by one in ascending order of number.

<Example> When marker No.4 is selected when marker Nos. 3, 4, 5, 8, and 9 are On, the markers are turned On in No., 6, 7, 10, 1, 2 order.

Off with Auto Select

Sets the marker of the selected No. to Off. If the selected marker is already Off, the next smaller marker No. of the markers set to On is set to Off. By holding down this key, the multimarkers are set to Off one by one in descending order of number. When the active marker is set to Off, the marker with the next smaller number is made the active marker.

<Example> When marker No. 7 is selected to be set to Off when marker Nos. 3, 4, 5, 8 and 9 are On and marker No. 5 is made the active marker, the markers are set to Off in No. 6, 5, 4, 3, 9 order, then marker No. 8 becomes the active marker.

The active marker is indicated by the ▼ mark. The other marker Nos. are indicated by the ▽ mark. The active marker can be moved by using the ten keys, up-down keys, or rotary knob.

Continued

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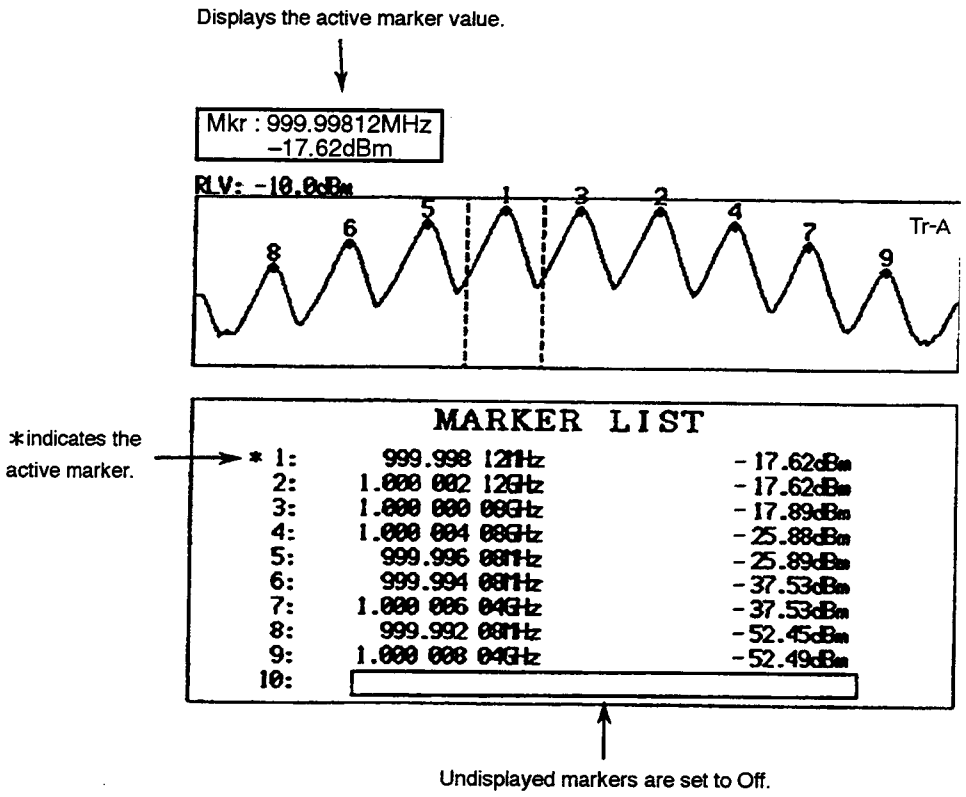
Clear All — Leaves only the marker number currently made the active marker and sets all the other multimarkers to Off. The active marker



Multimarker Off

To return from multimarker to normal marker, perform the following key operations.

Shift → Multi Mkr / Marker → Multi Marker On Off

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Marker Search

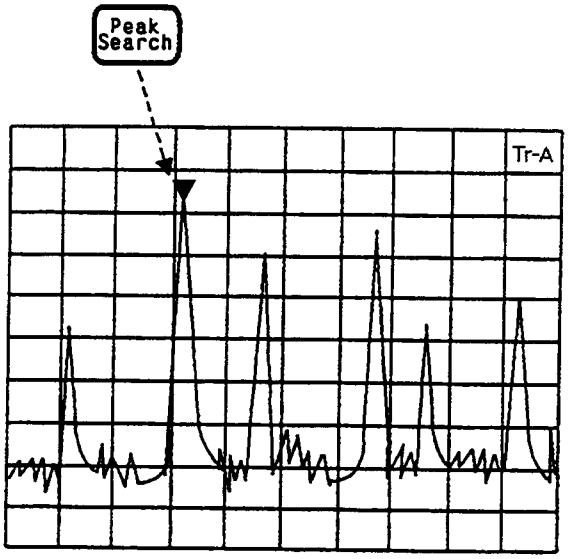
The MS2670A has the following six marker search functions:

- Peak search
- Next Peak search
- Next Right Peak search
- Next Left Peak search
- Dip search
- Next Dip search

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.



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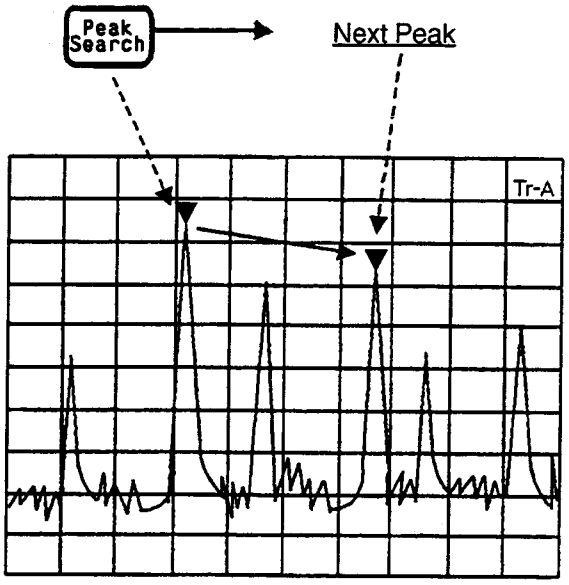
Next Peak Search

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.

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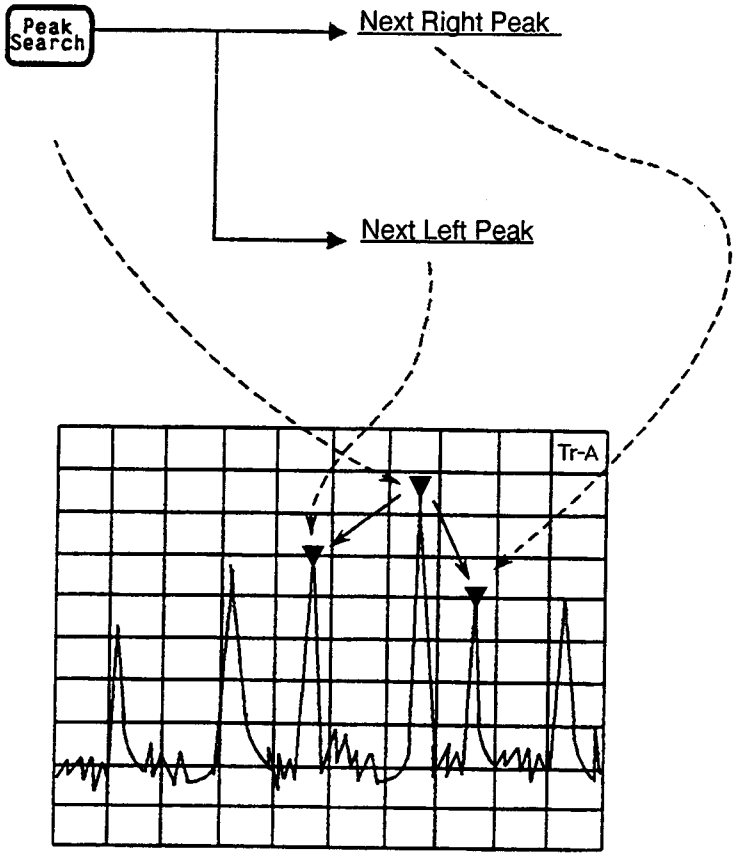
Next Right Peak Search/Next Left Peak Search

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).

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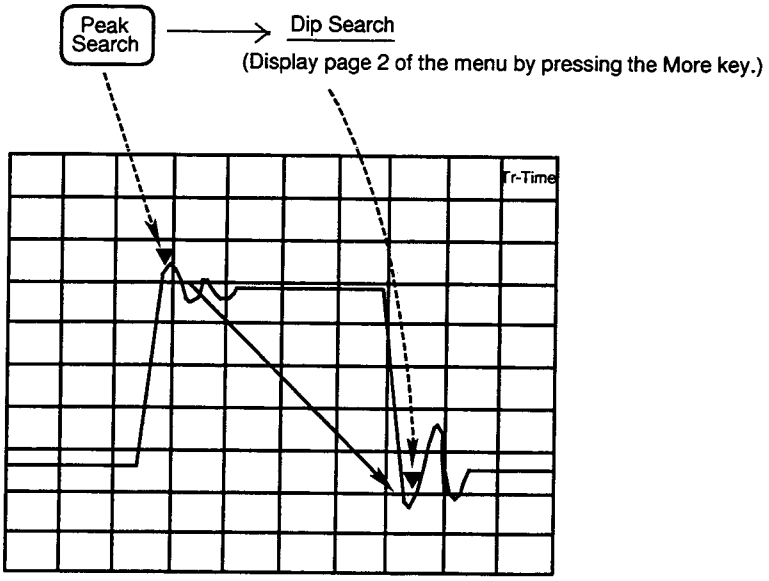
Dip Search

Dip search detects the minimum level point from the entire trace in which a marker is displayed and moves the marker to that point.

Execute Dip search by the performing the following key operations.



Time domain waveform

Time domain waveform

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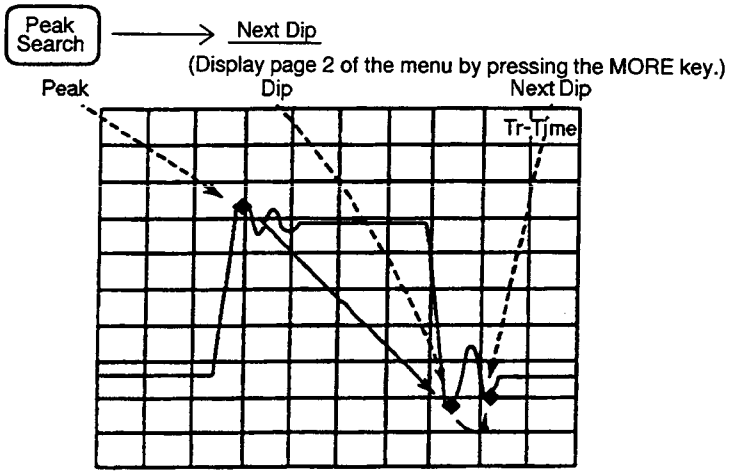
Next Dip Search

Next Dip Search detects the next smallest dip relative to the current marker level and moves the marker to that point. (When there are two or more dips with the same level on the screen, the leftmost dip is detected.) Execute Next Dip Search by performing the following key operations.

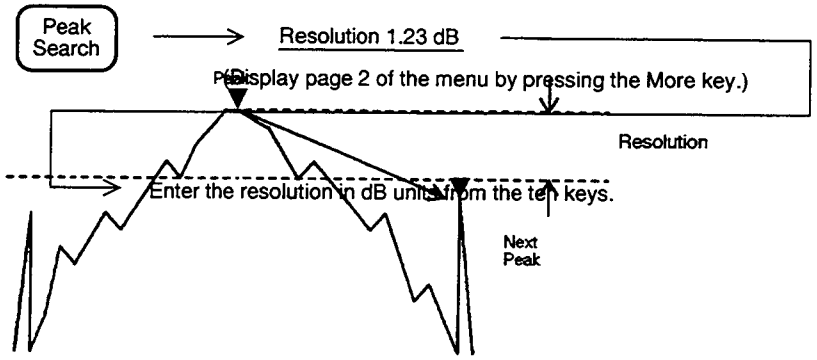


Time domain waveform

The next smallest peaks can be detected one by one and the marker moved to the detected peaks by executing Next Dip Search consecutively.

Setting Search Resolution

Sets the Peak and Dip search resolution. When searching for the next peak, etc., the marker moves to the point of the set resolution or higher.



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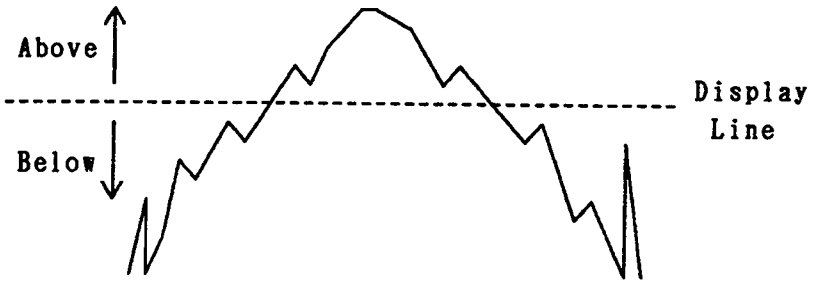
Setting Search Threshold

Sets the display line to the threshold and searches for the level above or below the display line.

Peak Search → Threshold

(Display page 2 of the menu by pressing the More 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



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Setting Parameters Using Marker Values

The marker value can b set as the parameter value of the observation frequency, reference level, and so on. This facilities observation of the desired waveform.

To set parameters using the marker value, the following settings are possible:

- Mkr → CF Sets the marker frequency to the center frequency.
- Mkr → RLV Sets the marker level to the reference level.
- Mkr → CF Step Size Sets the marker frequency to the center frequency step size.
- Delta Mkr →Span Sets the reference marker and current marker frequency to the start frequency and stop frequency, respectively.
- Zone → Span Sets the zone marker center frequency and zone width to the center frequency and frequency span, respectively.

In the time domain mode, only Mkr → RLV is valid.

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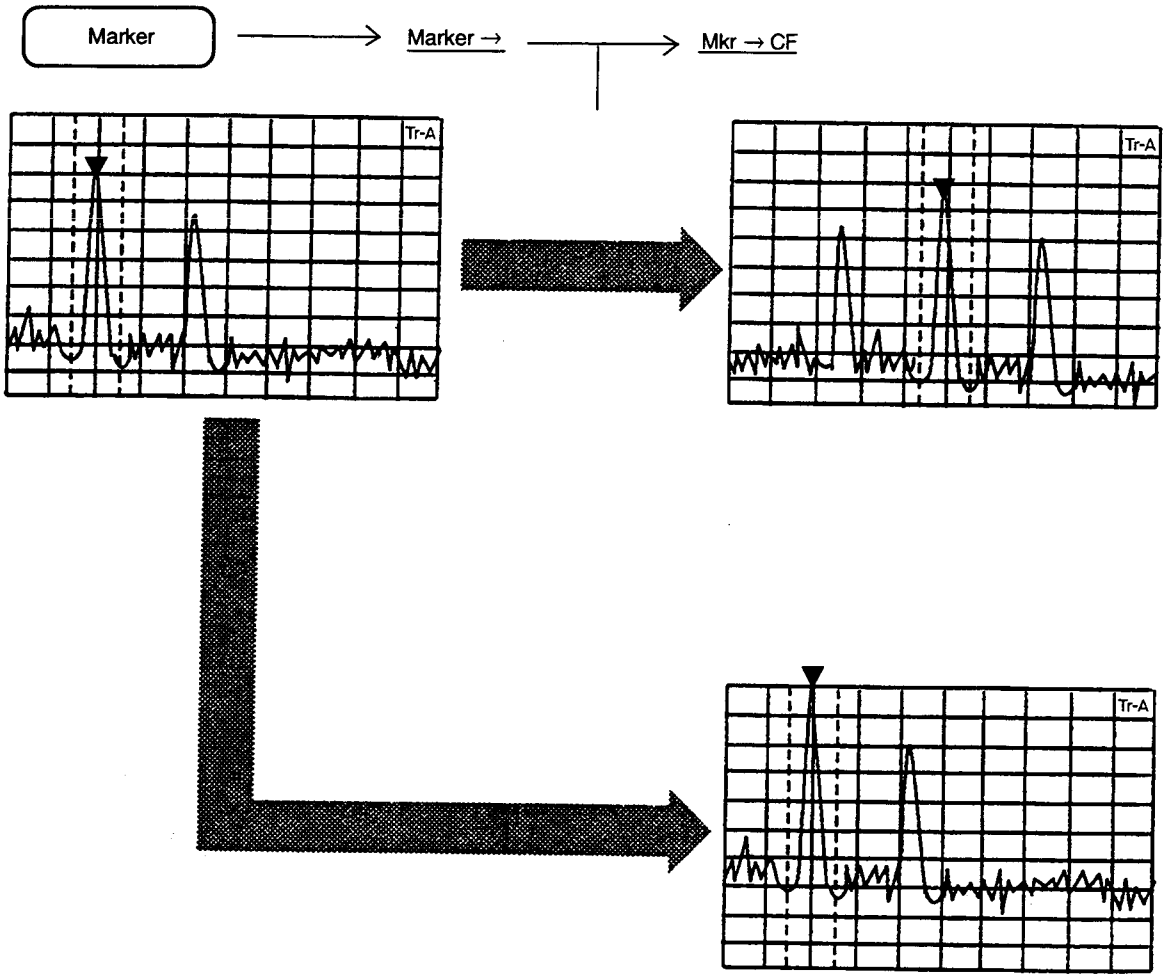
Mkr → CF/Mkr → RLV

Sets the current marker frequency or level to the center frequency or reference level.



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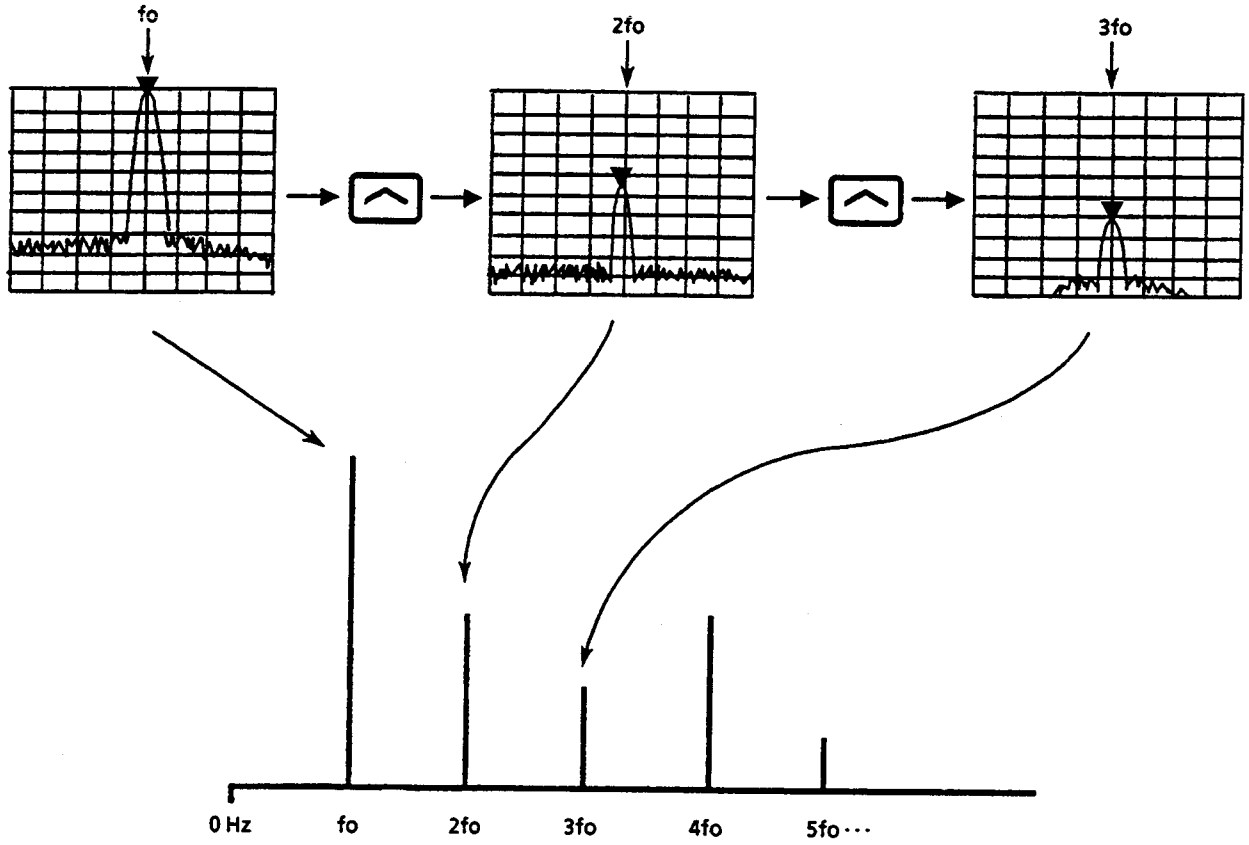
Mkr → CF Step Size

Sets the marker frequency to the center frequency step size (up-down keys resolution).

Marker → Marker → → Mkr → CF Step Size

Although this action does not cause any change to appear on the screen, when the center frequency is changed with the up-down keys, the center frequency is changed with the marker frequency as the step size. This facilitates observation of harmonic waves.



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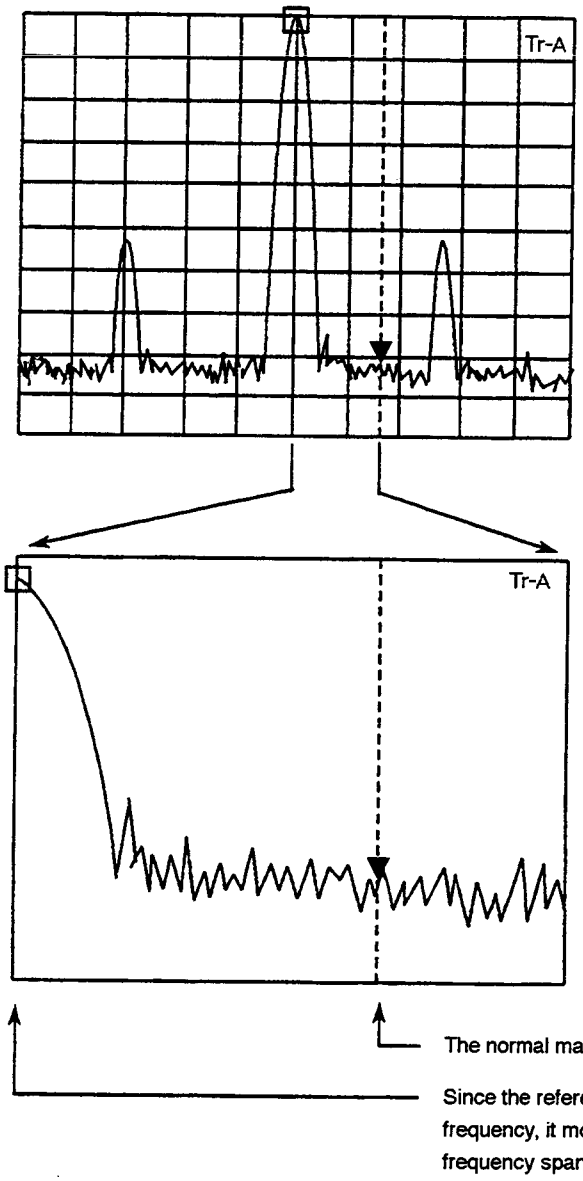
Delta Mkr → Span

In the delta marker mode, this operation sets the delta marker mode current marker frequency and reference marker frequency to the start frequency and stop frequency, respectively.

Marker → Marker → → Delta Mkr → Span



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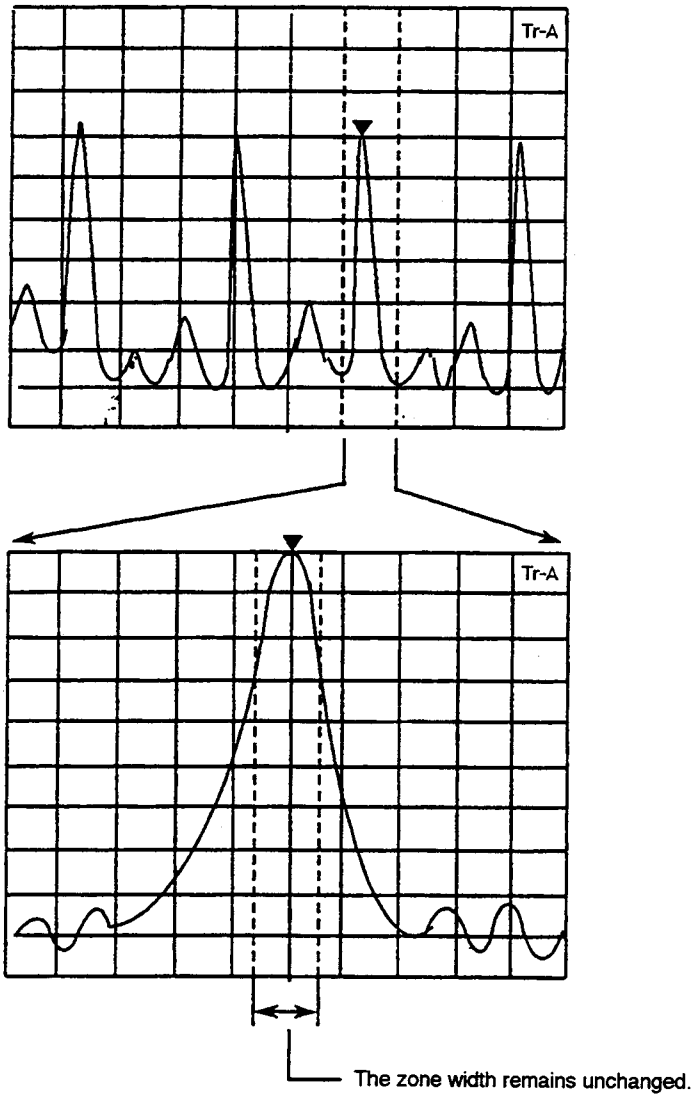
Zone → Span

To set the zone marker center frequency and width to the center frequency and frequency span, respectively, perform the following key operations.

Marker ⟶ Marker → ⟶ Zone → Span



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SECTION 4

SIGNAL SEARCH FUNCTION

Signal search facilitates extraction of the objective signal. Although the functions of signal search are similar to the marker function, this section only describes the Signal Search function.

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SECTION 4
SIGNAL SEARCH FUNCTION

Detecting Peaks

The MS2670A has the following three peak detection functions:

- Auto Tune
- Zone Marker
- Marker Tracking

SECTION 3 (MARKER FUNCTION) describes the Zone Marker function and SECTION 6 (SELECTING THE SWEEP METHOD) describes the Marker Tracking function.

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Detecting the Maximum Peak Signal by Automatic Tuning

Frequency → Auto True

Pressing the Auto Tune key detects the maximum peak signal within the Back Ground (BG) and sets that signal frequency and level to the center frequency and reference level, respectively.

Notes:
- When executed at a frequency span of more than 100 MHz, the frequency span is set to 100 MHz. When executed at a frequency span of less than 100 MHz, that value is retained.
- When the Display mode was executed by trace Time, the instrument switches to trace A/Time and trace Time becomes the main trace. Also the Expand mode is set to Off.
- The input attenuator is set to Auto.
- In the initial state, the Auto Tune frequency range is set to 54 MHz to 1.8 GHz. By changing the trace BG frequency range, the Auto Tune frequency range can also be set as follows:

  Start frequency

  Start frequency specified in trace BG
  Exclude the 0 Hz to 3/100 frequency span range.

  Stop frequency

  Stop frequency specified in trace BG.

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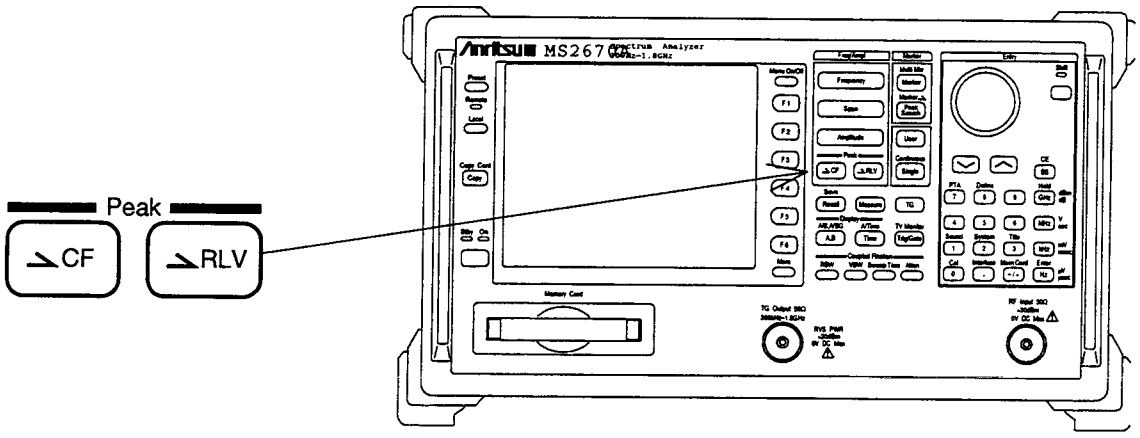
Moving the Measurement Point

This function moves the spectrum on the screen to the center to make the measurement easier. The following five functions can be used.

- Mkr → CF — Sets the marker frequency to the center frequency.
- Mkr → RLV — RLV sets the marker level to the reference level.
- Peak → CF — Sets the frequency of the maximum point on the screen to the center frequency.
- Peak → RLV — Sets the level of the maximum level point on the screen to the reference level.
- Scroll→, Scroll← — Scroll the observation frequency.

SECTION 3 (MARKER FUNCTIONS) describes the Mkr → CF and Mkr → RLV functions. SECTION 2 (FREQUENCY/AMPLITUDE DATA ENTRY) describes the scroll function.

This section describes the Peak → CF and Peak → RLV functions.



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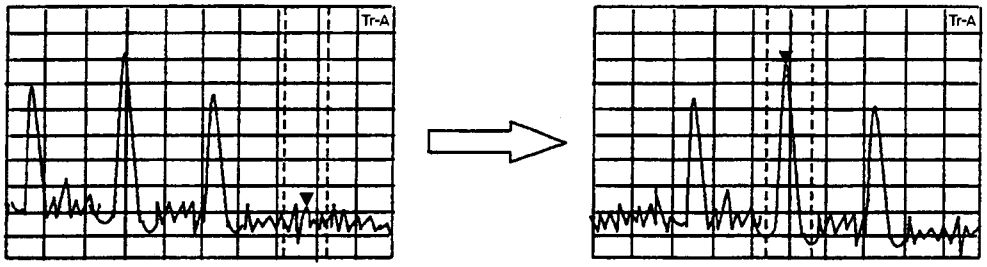
Peak → CF and Peak → RLV

The Peak → CF and Peak → RLV functions set the maximum level value displayed on the screen to the center frequency and reference level, respectively, and move the peak point to the center of the frequency axis on the screen and to the top level axis, respectively.

(1) Peak→ CF

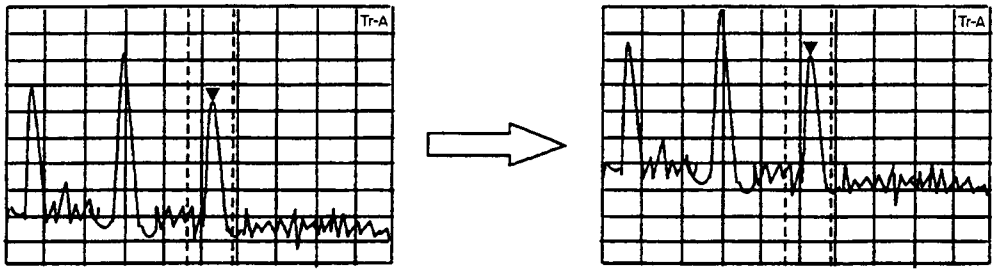
[→CF] Sets the maximum peak point and the zone marker to the center frequency.



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 following cases:
  (1) When zone sweep is On
  (2) In the time domain mode
  (3) When A<Time is specified in the A/Time mode

(2) Peak → RLV

[→RLV] Sets the maximum peak level to the reference level.



Notes:
- 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.

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SECTION 5

SELECTING THE DISPLAY METHOD

This sections gives a detailed description of the display modes (Trace A/B, A/B, A/BG, Trace Time, A/Time), storage modes (Normal, Max Hold, Min Hold, Average, View, Cumulative, Overwrite), detection modes (Normal, Pos Peak, Sample, Neg Peak) and time domain analysis.

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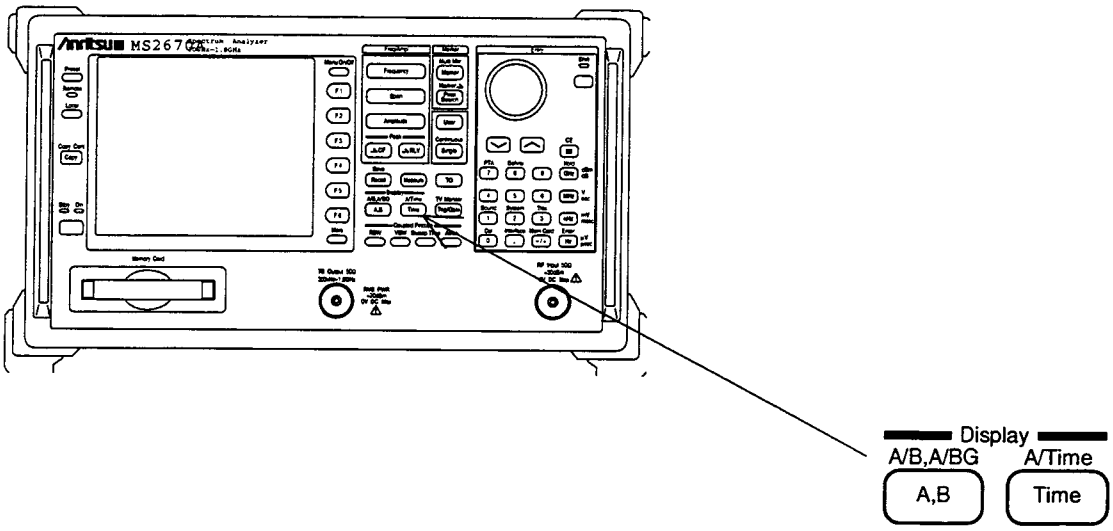
SECTION 5
SELECTING THE DISPLAY METHOD

The MS2670A can display four trace modes (BG †, A, B, Time) in six Display modes (A, B, Time, A/B, A/BG, A/Time).
In the Display mode, the two keys of the Display section shown below are used.



Display Mode

The following description outlines the trace modes. The figures on the following pages shows the correlation between the available trace modes.

- Trace BG ..... When the objective signal is measured in the trace A, B, or Time mode, the trace BG mode allows the frequency range to be observed to be pre-set to a wide band. The BG band is initially set to full span (0 to 1.8 GHz).
- Trace A, trace B ..... Used to analyze signals in the normal frequency domain. The BG zone within trace BG is expanded and displayed.
  Different frequency range can be observed by trace A and trace B.
- Trace Time ..... Displays the time axis waveform at the center frequency of trace A.

† BG (Back Ground)

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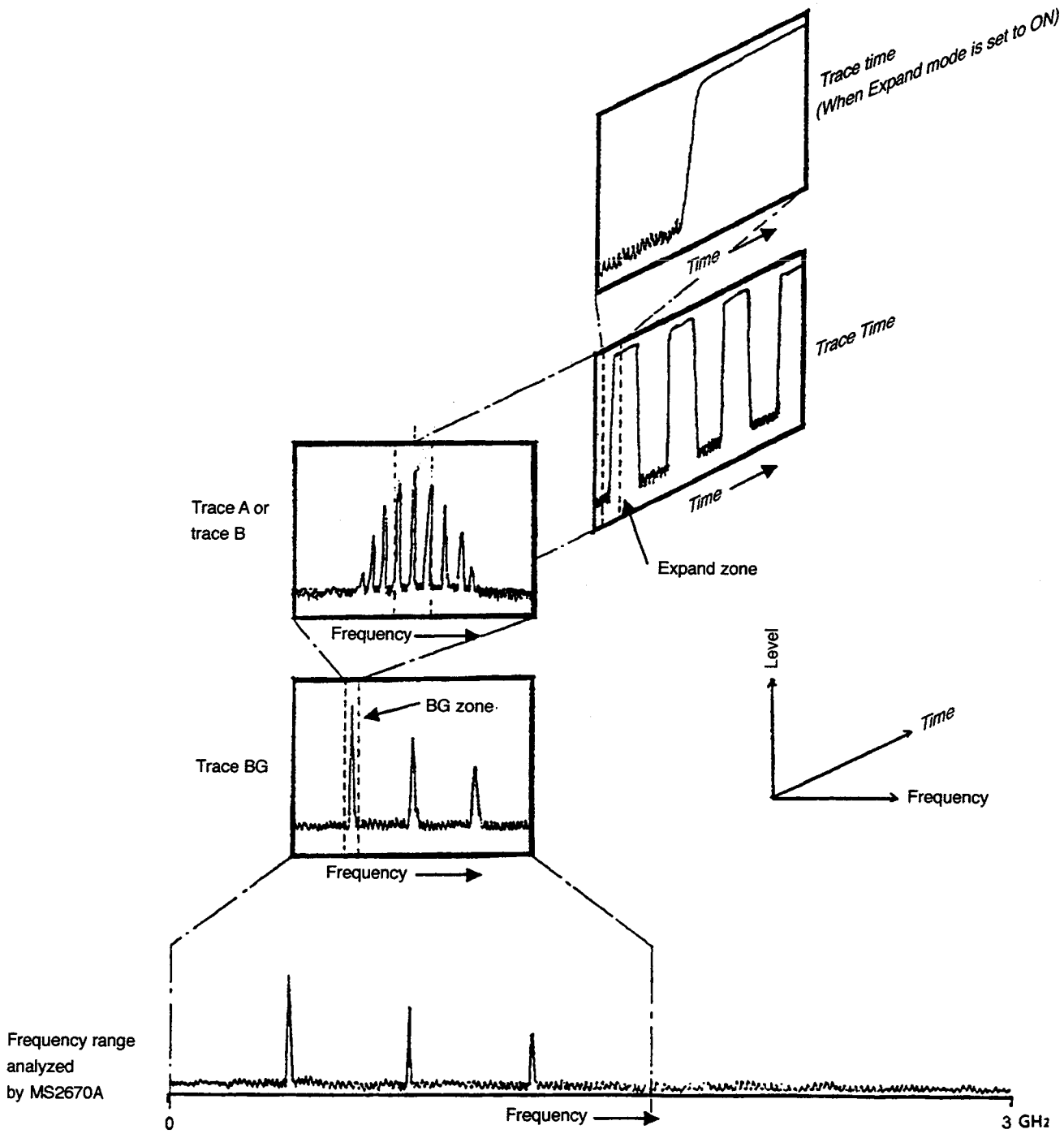

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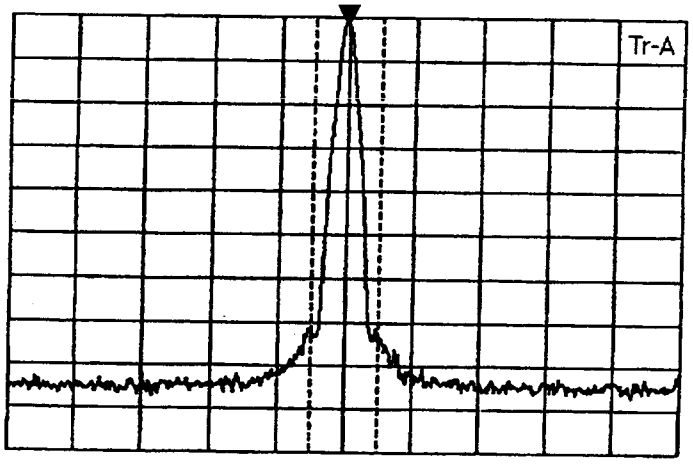
Trace A

Trace A is used to analyze signals in the normal frequency domain.

A,B → Trace A



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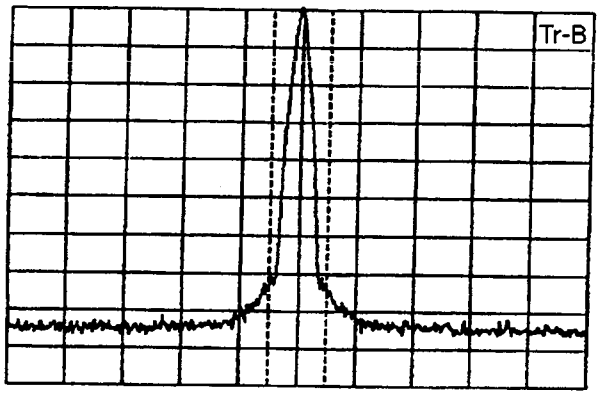
Trace B

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.

A,B → Trace B



Parameters of the trace A and trace B can be set independently.

Moving the Trace

This function moves and adds the trace A and trace B displays once.

A,B → Trace Move

A→B	Moves trace A to trace B and displays it.
B→A	Moves trace B to trace A and displays it.
A↔B	Swaps and displays trace A and trace B.
A+B→A	Adds trace A and trace B and displays the result at trace A.
Return	

Set the move-destination-trace storage mode to View, and stop the sweeping before moving the trace.
If the trace A or trace B threshold is set to any other mode, the trace data will be displayed once, then updated.

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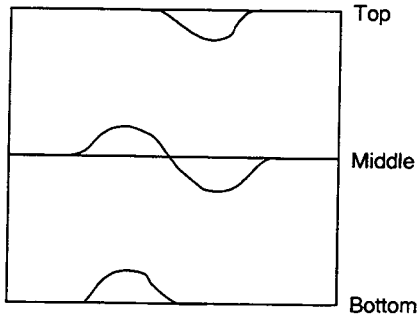
Trace Computation

This function continuously displays the difference between trace A and trace B. Normally set trace B to the View mode before executing this function.

A,B → Trace Calc

- Normalize (A–B+DL) On Off — Turn the mode that subtracts trace B from trace A and adds the display line value and continuously displays it at trace A On and Off by pressing this key.
- A–B→A On Off — Turn the mode that subtracts trace B from trace A and continuously displays it at trace A On and Off by pressing this key.
- Ref Line — Selects if the A–B computed value=0 line is to be displayed at the top, middle, or bottom of the screen.
- Return



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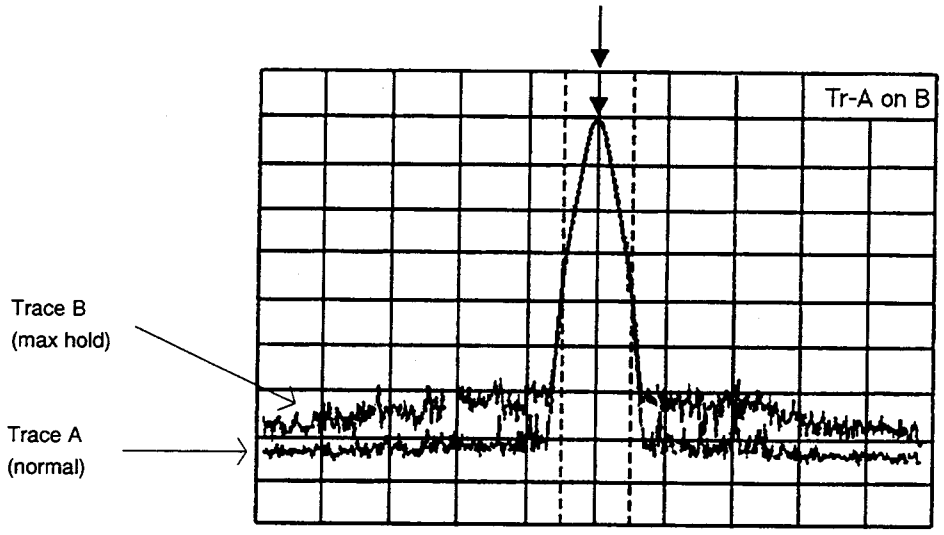
Trace A and Trace B Overwrite Display

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 storage 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.

A,B ⟶ Trace A on B

(Display page 2 of the menu by pressing the More key.)



Setting Active Trace

When trace A and trace B were overwritten on the same screen, select the marker trace by pressing this key.

A,B ⟶ Active Trace A B

(Display page 2 of the menu by pressing the More key.)

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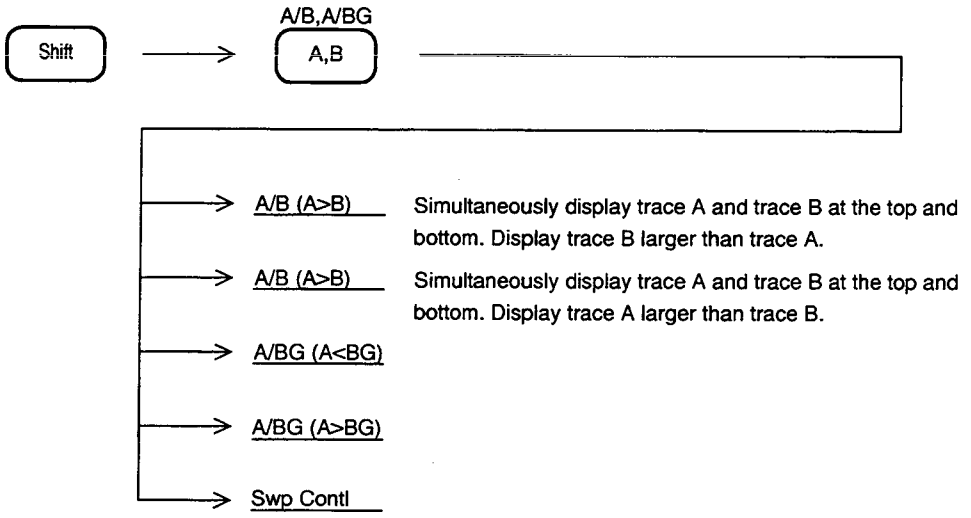
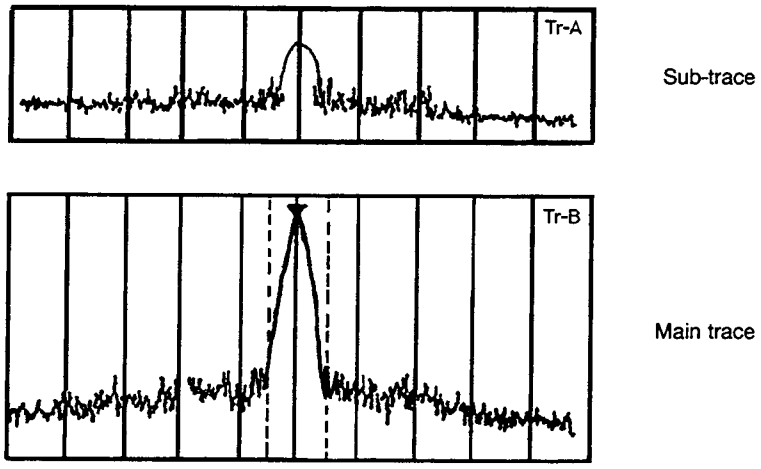
Trace A/Trace B Top and Bottom Split Display

When trace A and trace B are overwritten and displayed, the setup parameters are common. In this mode, however, the frequency and other parameters can be set independently.
For instance, the reference wave can be observed at trace A and harmonics can be simultaneously observed at trace B.
When examining interference, the interference source frequency and its harmonics can be simultaneously observed.



- The large display is called the main trace and the small display is called the sub-trace.

Trace A and trace B are displayed at the top and bottom, respectively.



For A/B (A<B)

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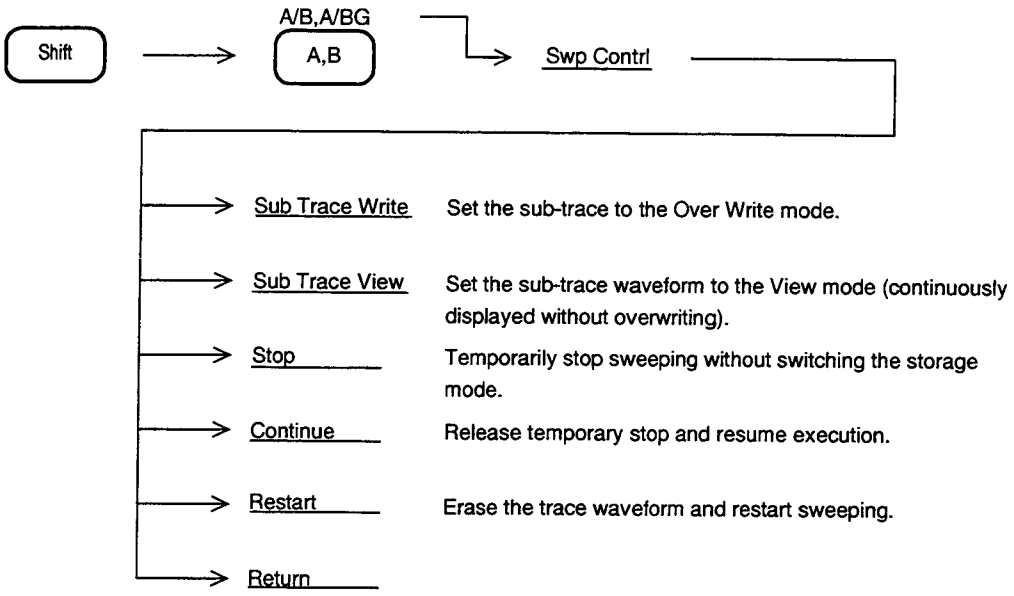
Setting Sub-trace Sweep

To set the sub-trace storage mode, perform the following key operations.



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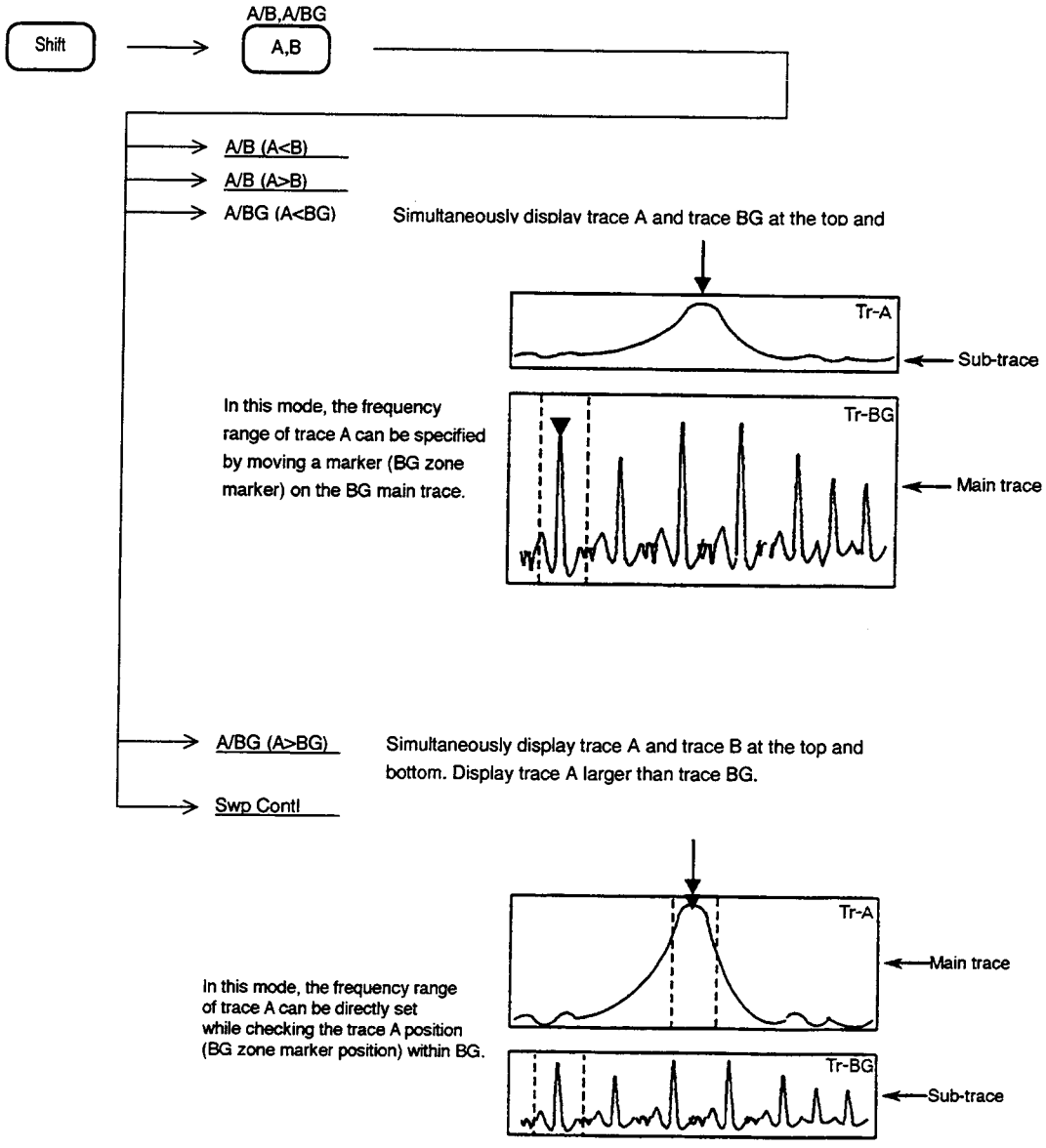
Trace A/Trace BG Top and Bottom Split Display

This mode simultaneously displays Trace A and Trace BG. It is used to extract a specific signal from a wide frequency range.

The surrounding conditions over a wide frequency range can be monitored while simultaneously observing the selected signal in detail.



Trace A and Trace BG parameters other than reference level, vertical axis scale, and input attenuator settings are used independently. Each parameter can be set in the main trace (larger displayed side).
Marker operation is available only for the main trace.

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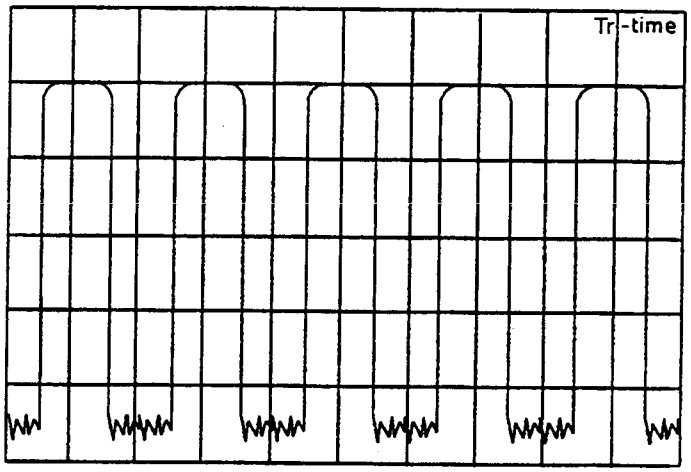
Trace Time

Trace Time displays the time axis waveform at the center frequency of Trace A or Trace B. To display trace Time, press the [Time] key.



[Time]

- Delay Time 10.0 ms — Sets the delay time from trigger to sweep. When a negative value is input, the waveform before the trigger is displayed up to one screen. (See paragraph 6.12 of SECTION 6.)
- 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 1 — Selects the detection mode.
- FM Monitor — This function cannot be used in the MS2670A.
- Expand 2 — Expands and displays part of the time domain waveform.

(Display page 2 of the menu by pressing the More key.)

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Trace-A center frequency and Trace-Time tuning frequency is always common. Other parameters can be set independently. However, the following parameters can be used commonly by "Coupled function common/ independent setting mode" of SECTION 9.

- Resolution bandwidth (RBW)
- Video bandwidth (VBW)
- Sweep time (Sweep Time/Time Span)

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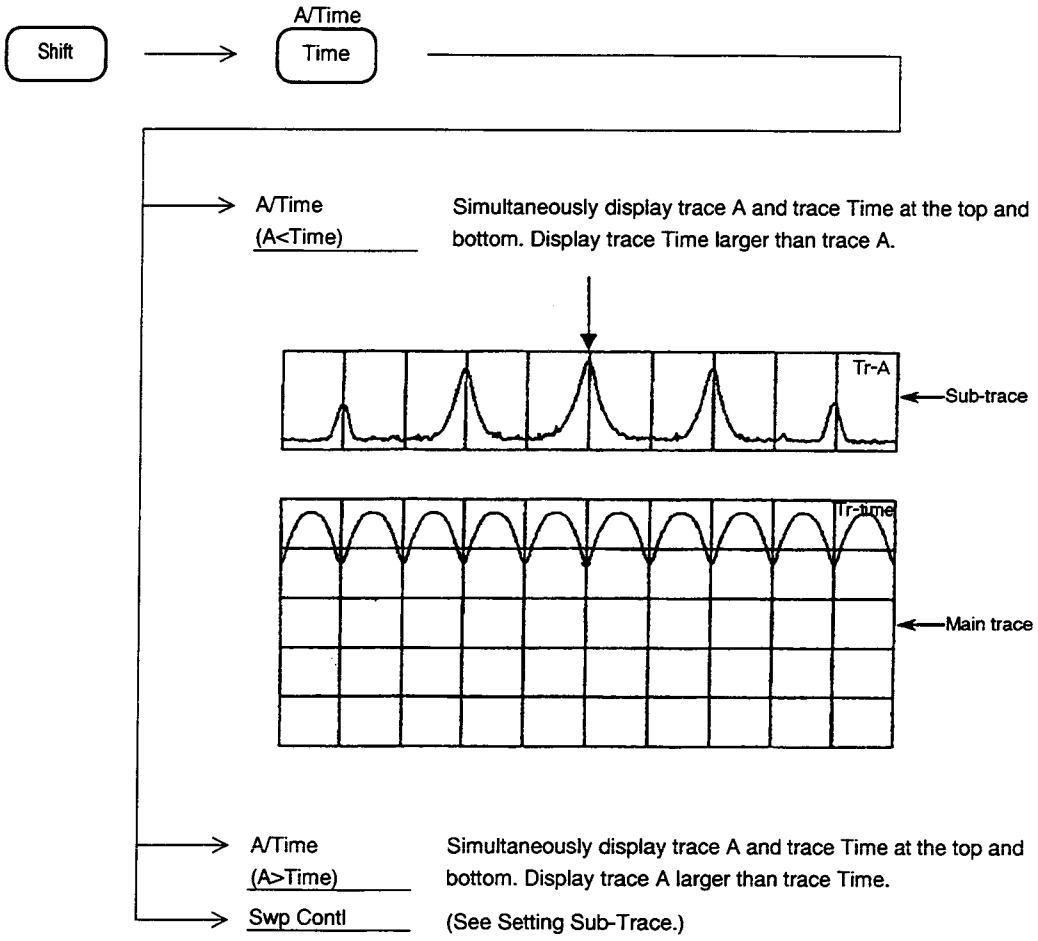
Trace A/Trace Time Top and Bottom Split Display

Trace A/Trace Time top and bottom split display simultaneously displays Trace A and Trace Time.



Each parameter can be set in the main trace (larger displayed trace). However, for common parameters (center frequency, reference level, input attenuator, and system setting coupled mode resolution bandwidth, video bandwidth, etc.), the sub-trace parameters can also be converted even when setting is performed at the main trace. Marker operation is only available for the main trace.

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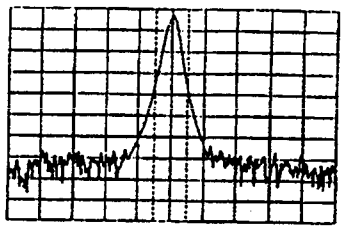
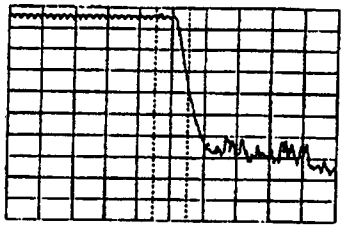
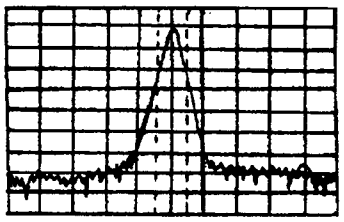
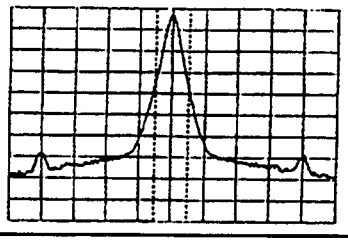
Storage Mode

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 5-18.	

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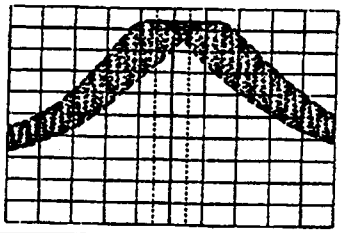
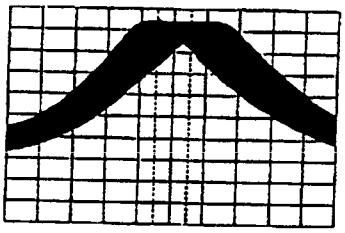
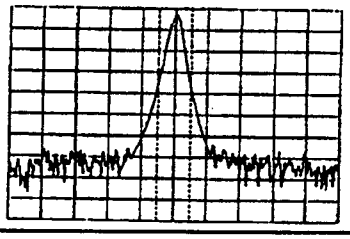
NO.	Mode	Explanation	Display example
5	Cumulative	Displays the cumulative waveform at each sweep. The waveform data, which are not connected by lines, are displayed by plotting the data.	
6	Over write	Displays the waveform overwritten without deleting the old trace data.	
7	View	Continues displaying 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.	

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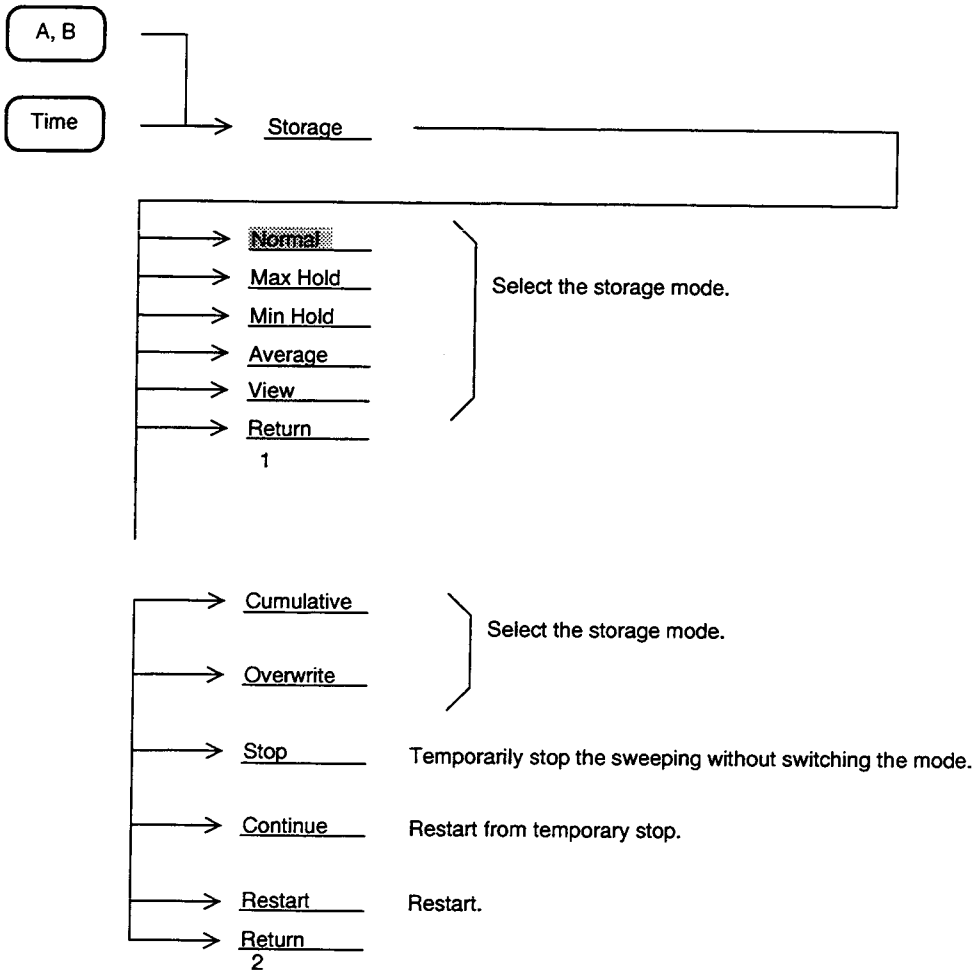
Setting Storage Mode

The storage mode can be selected by operating the function keys shown below while the MS2670A is operating in the Trace A, Trace B, or Trace Time mode.



(Display page 2 of the menu by pressing the More key.)

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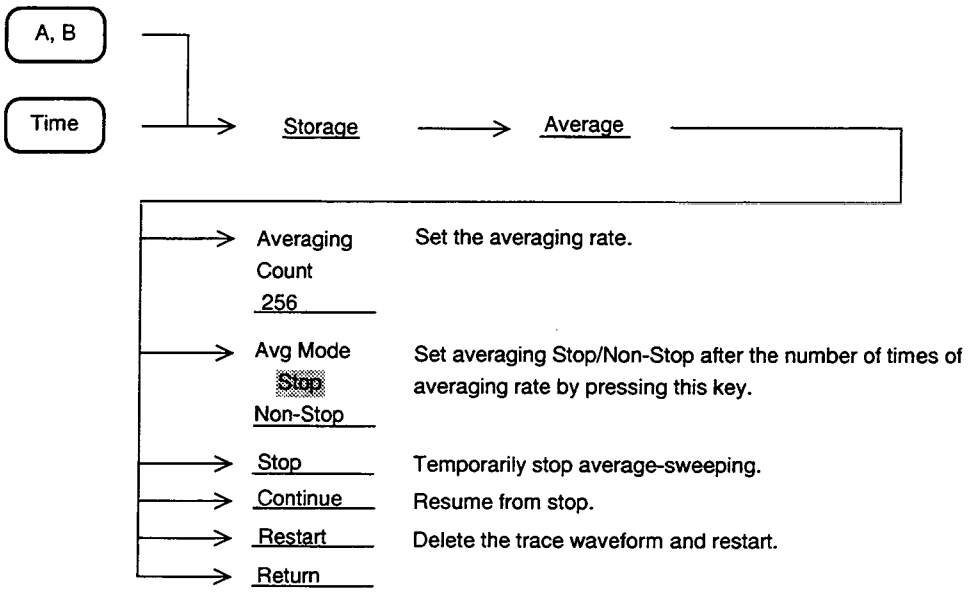
Averaging Function

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.



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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
③ Restart	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	$M(N-1)$	$Y(N-1)=Y(N-2)+\frac{M(N-1)-Y(N-2)}{N-1}$
① Stop	N	$M(N)$	$Y(N)=Y(N-1)+\frac{M(N)-Y(N-1)}{N}$
② Continue	N + 1	$M(N+1)$	$Y(N+1)=Y(N)+\frac{M(N+1)-Y(N)}{N}$
	N + 2	$M(N+2)$	$Y(N+2)=Y(N+1)+\frac{M(N+2)-Y(N+1)}{N}$
	⋮	⋮	⋮

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.

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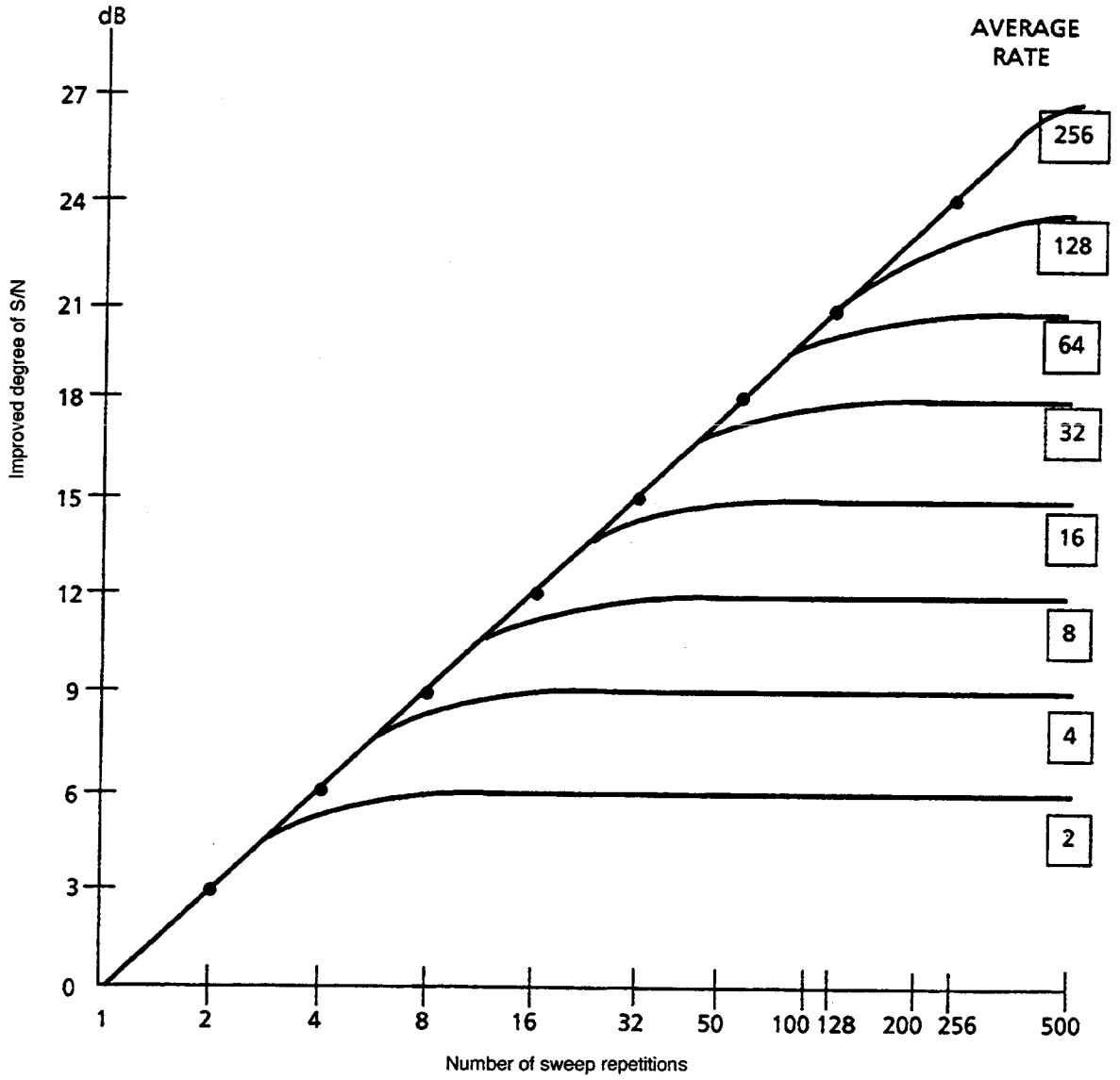

S/N Improvement by Digital Video Averaging

Averaging by video filter has a disadvantage in 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 both the time required for each sweep and verification of the entire spectrum image becomes longer.

Since the averaging rate is initially eight, the above figure shows than an S/N improvement of 9 dB is obtained with eight sweeps.

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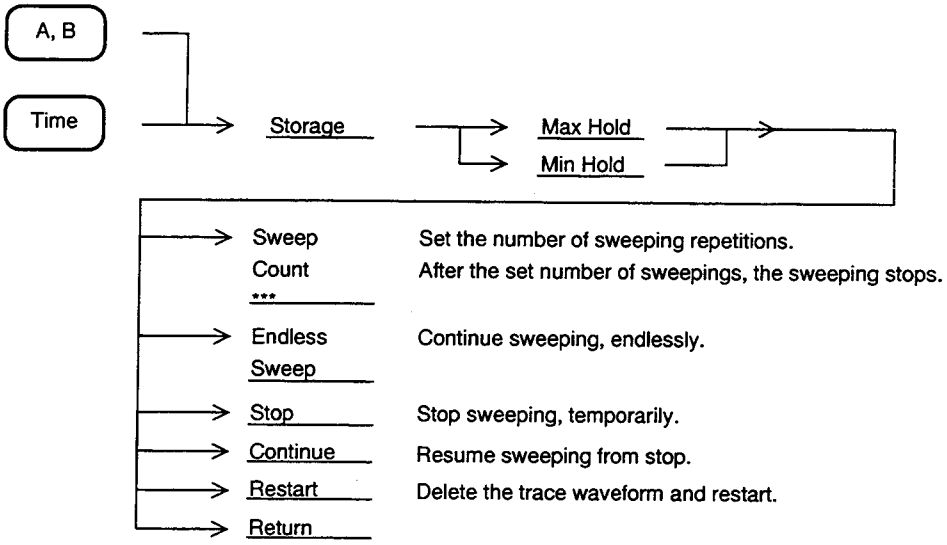
Max Hold and Min Hold Functions

When Max Hold or Min Hold is selected, the sweep can be performed by the specified number of repetitions, and then stop.



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Detection Mode

The detection mode can be selected from Normal, Pos Peak, Sample, and Neg Peak for Trace A and Trace B and Trace Time.

Normal	Traces the maximum value and minimum value between sample points.
Pos Peak	Traces the maximum value between sample points.
Sample	Traces the instantaneous value between sample points.
Neg Peak	Traces the minimum value between sample points.

However, Trace BG is fixed at Pos Peak.
When the time span is under 20 ms at Trace Time, only Sample is available.

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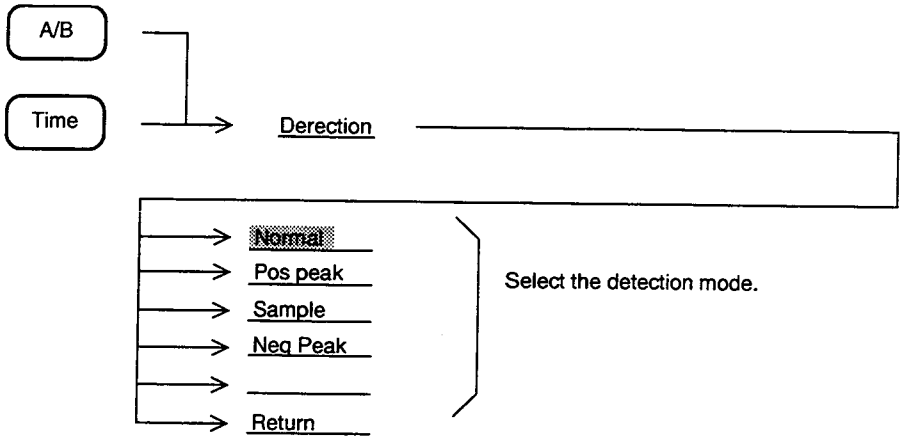
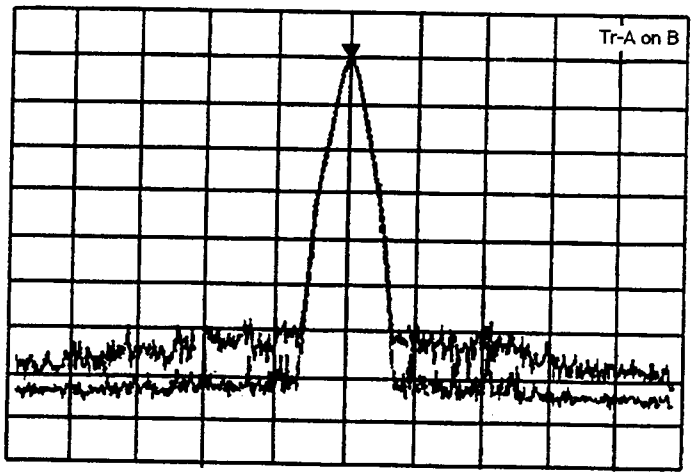
Selecting Detection Mode

Select the detection mode for Trace A, Trace B, or Trace Time by performing the following key operations.





Waveforms when Trace A is in the Pos Peak mode and Trace B is in the Neg Peak mode.

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Selecting Measured Level by Detection Mode

The MS2670A 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
Normal	Stores both the maximum level and the minimum level present between the current sample point and the next sample point and displays them on the screen. This mode is used in normal measurement.
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.

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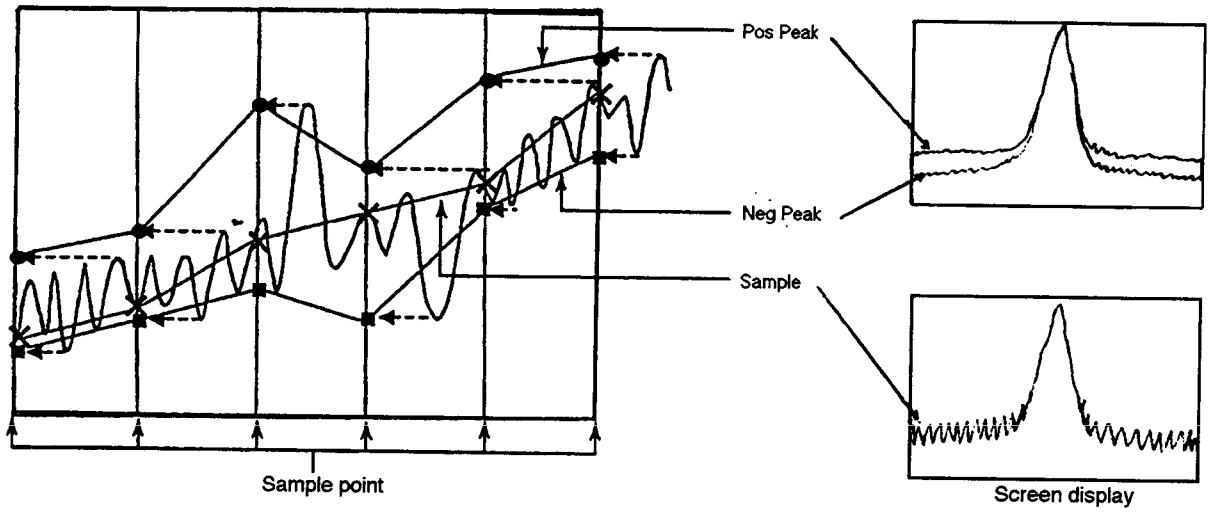
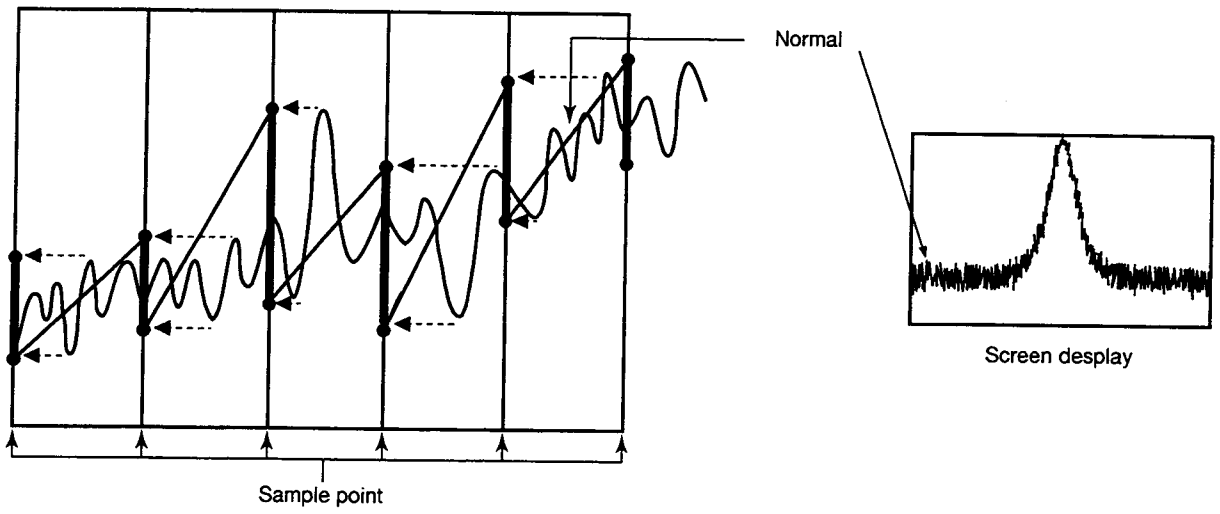


Note: The spectrum peak is incorrectly displayed when the detection mode is set to Sample or Neg Peak while the frequency span and resolution bandwidth are set so that the spectrum is displayed as discrete vertical lines.



Normal traces and displays both Pos Peak and Neg Peak.

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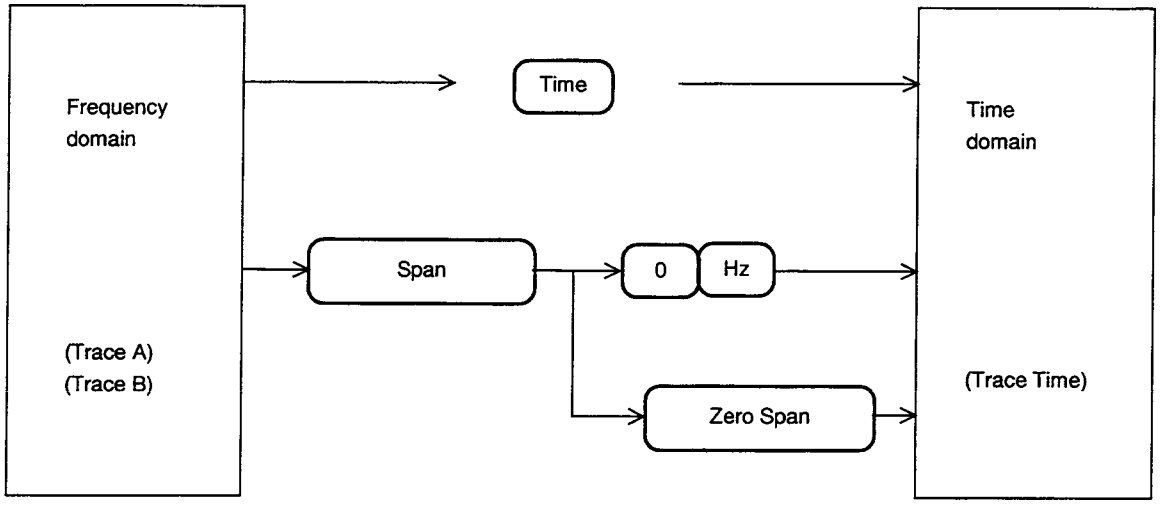
Time Domain

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".
MS2670A time domain display has an Expand function for expanding the waveform time axis to create a more convenient display.

Setting Time Domain

The time domain can normally be set by pressing the [Time] key in the Display section. It can also be set by setting the frequency span to 0 Hz in the frequency domain mode.



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The following parameters can be set independently in the frequency domain or time domain mode:

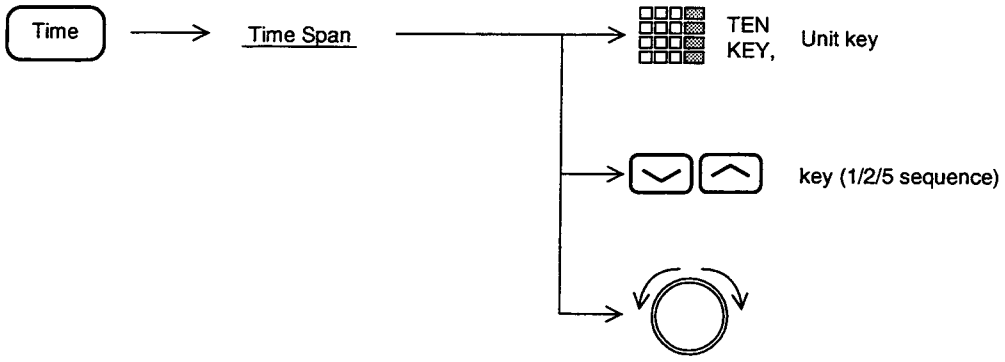
- Vertical scale mode (Log/Lin)
- Vertical scale range (10 dB/div, 10 %/div, etc.)
- Storage mode (Normal, Max Hold, Average, etc.)
- Detection mode (Pos Peak, Sample, Neg Peak, Normal)
- Resolution bandwidth (RBW)
- Video bandwidth (VBW)
- Sweep time (Sweep Time/Time Span)
- Trigger switch (Freerun/Triggered)

The three parameters resolution bandwidth, video bandwidth, and sweep time can be selected in common or independently in the frequency or time domain mode when setting the system.

Note: The time domain mode marker function uses a spot marker. A zone marker cannot be used.

Setting Time Span

In the time domain mode, the measurement range on the horizontal axis sets the time span, not the frequency span. To set the time span, perform the following key operations.



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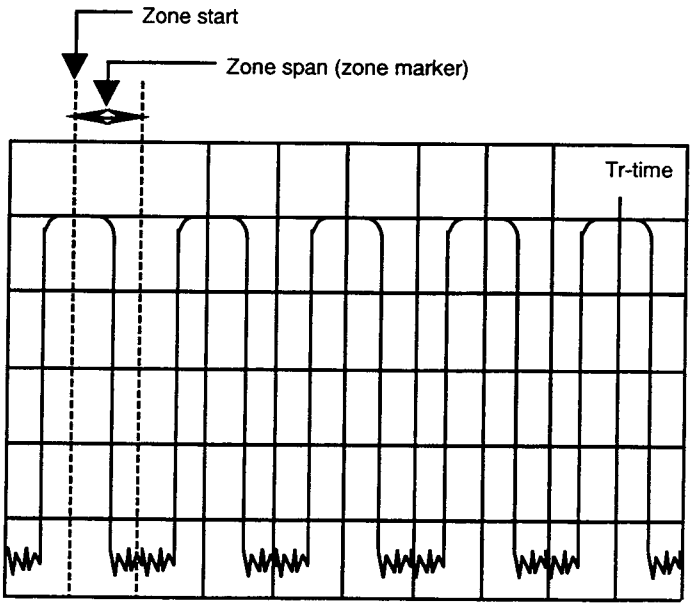
Time Domain Expanded Display

Part of the time domain time axis can be expanded and displayed.

Time → Expand

- Zone Start Point 50 — Set the expansion zone start point.
- Zone Span Point 50 — Set the expansion zone width.
- Expand Zone On Off — Select expansion zone marker display On or Off by pressing this key.
- Expand On Off — Select expanded display On or Off by pressing this key.
- Return



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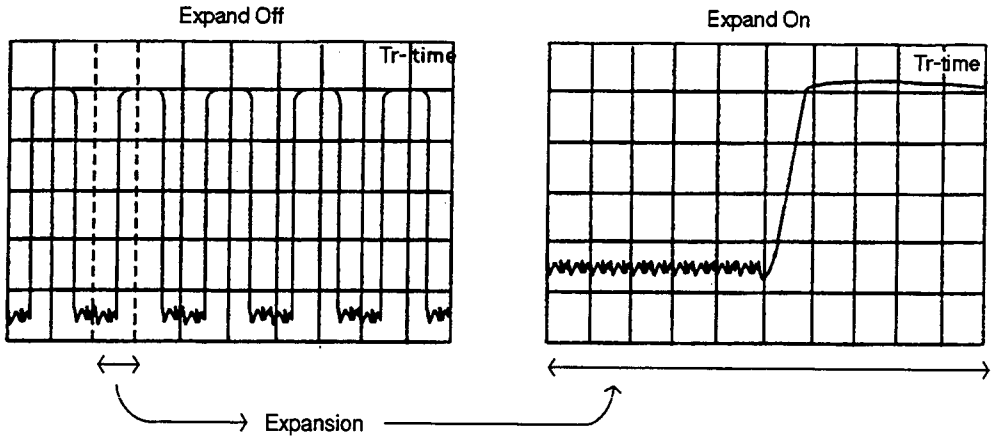

The Expand mode cannot executed under the following conditions.

- Trigger mode ..... Freerun

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SECTION 6

SELECTING THE SWEEP METHOD

This section describes the sweep mode, trigger sweep mode, zone sweep, and signal tracking and time gate functions.

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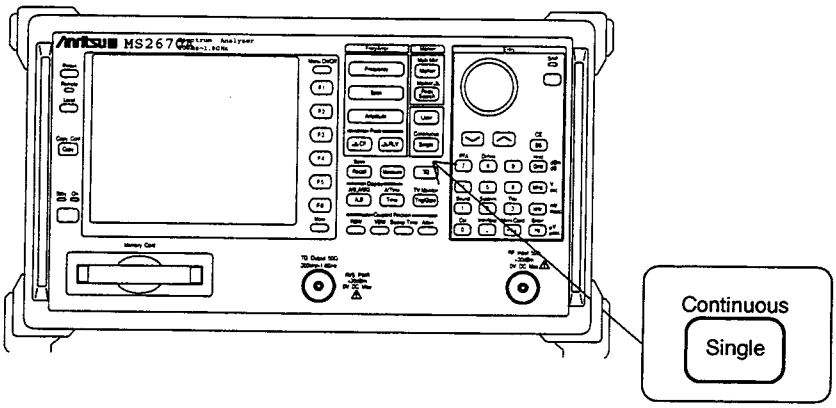
SECTION 6
SELECTING THE SWEEP METHOD

Sweep Mode

The MS2670A sweep mode is set by using the following key.



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.)

Shift → Continuous Single

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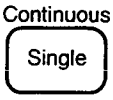
Single Sweep Mode

When the trigger mode is set to Freerun, sweep is executed once immediately after the Continuous 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 Continuous Single key is pressed.

To set (sweep start) the single sweep mode, press the following key.



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Trigger Mode

The MS2670A trigger mode can be divided into Freerun and Triggered.
In the Triggered mode, Video, Wide IF Video, External, or Line can be selected as the trigger source.

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 Continuous/Single key is pressed.

To set the Freerun mode, perform the following key operations. (The Freerun mode is initially set.)

Trig/Gate → Trigger → Freerun / Triggered — Select Freerun by pressing this key.

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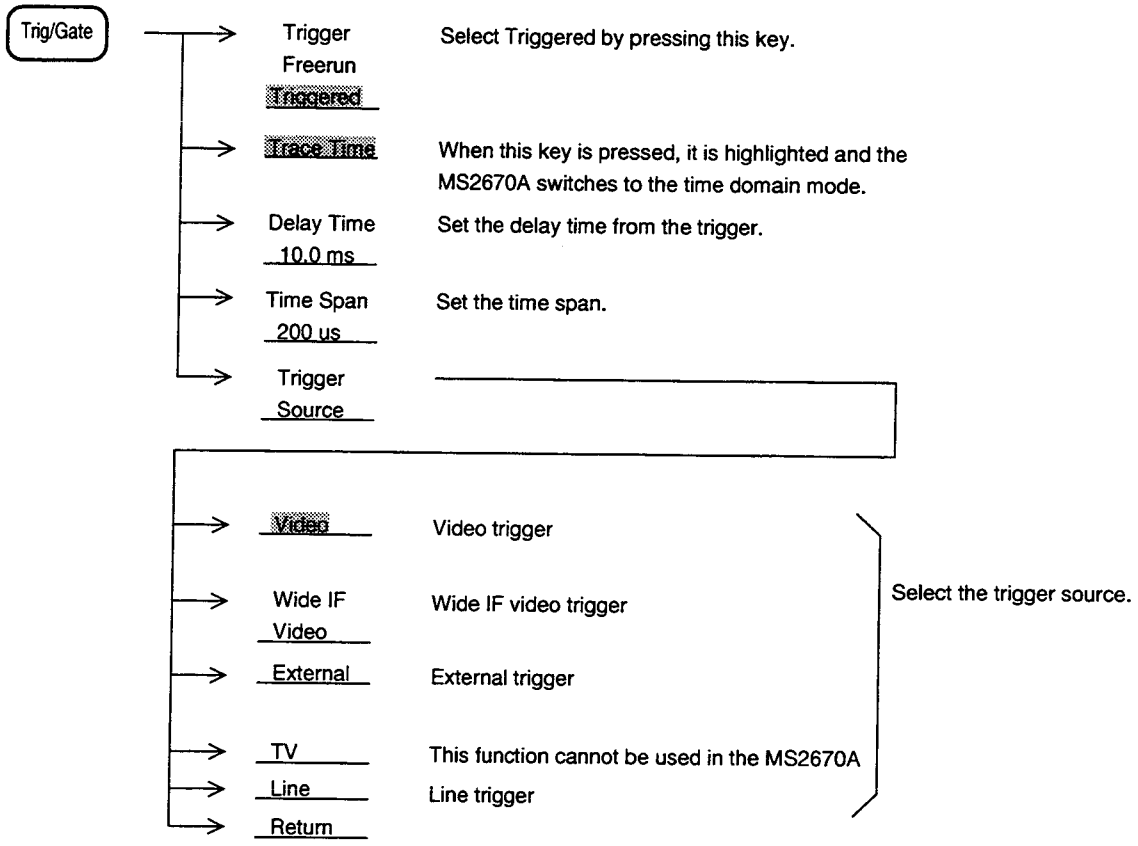
Triggered

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.



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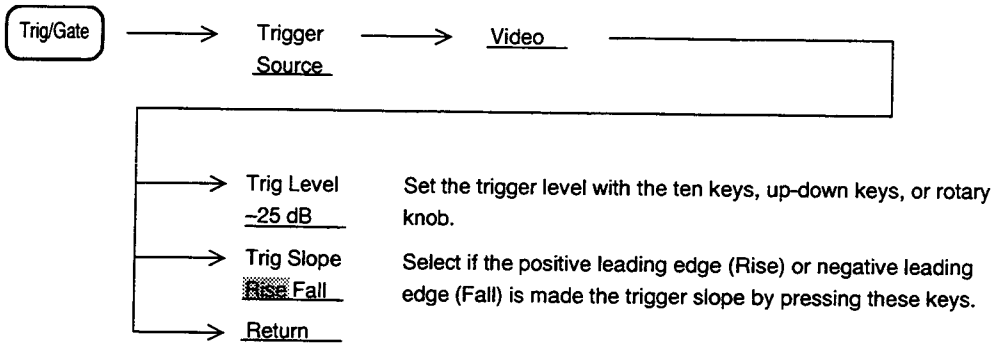
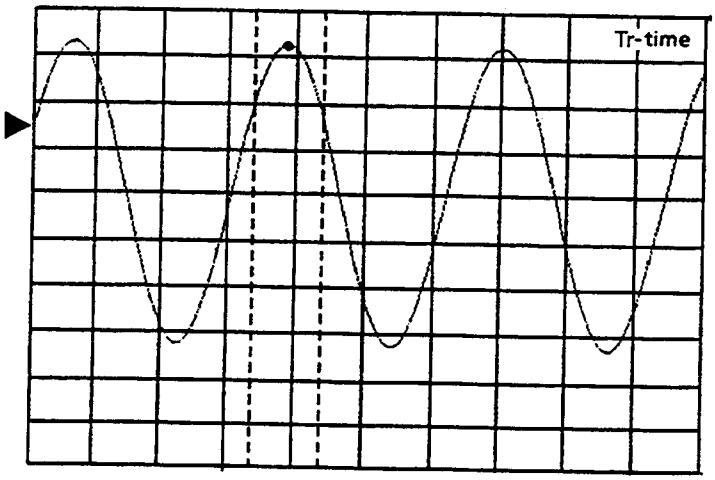
Video Trigger

Sweep is started in synchronization with the positive edge or negative leading edge of the detected waveform. To select the trigger level and trigger slope, perform the following key operations.



The trigger level is indicated by displaying the trigger level indicator ▶ at the leftmost vertical line of the screen.



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Wide IF Video Trigger

A wide bandwidth IF signal of at least 5 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.

Trig/Gate → Trigger Source → Wide IF Video

- Trig Level High — Select the trigger level from among High, Middle, and Low, according to the input level, by pressing this key.
- Trig Slope Rise Fall — Select the positive leading edge (Rise) or negative leading edge (Fall) as the trigger slope by pressing this key.
- Return

External Trigger

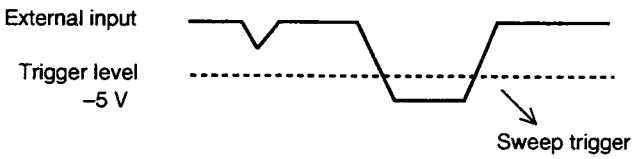
Sweep is started in synchronization with the positive leading edge or negative leading edge of the signal waveform input to the Ext Input connector on the rear panel. To select the trigger level and trigger slope, perform the following key operations.

Trig/Gate → Trigger Source → External

- −10 to 10 V
- TTL

Select the trigger level from −10 to +10 V and TTL.

- Trig Level −5 V — Set the trigger level when −10 to +10 V was selected.
- Trig Slope Rise Fall — Select the positive leading edge (Rise) or negative leading edge (Fall) as the trigger slope by pressing this key.
- Return



(Example) When trigger level is −5 V and trigger slope is Rise.

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Line Trigger

This function starts sweep in synchronization with the AC power line frequency. Line trigger is conveniently used to observe power line-related hum waveform. With the line trigger function, the trigger level and trigger slope are not selected.

Trig/Gate → Trigger Source → Line

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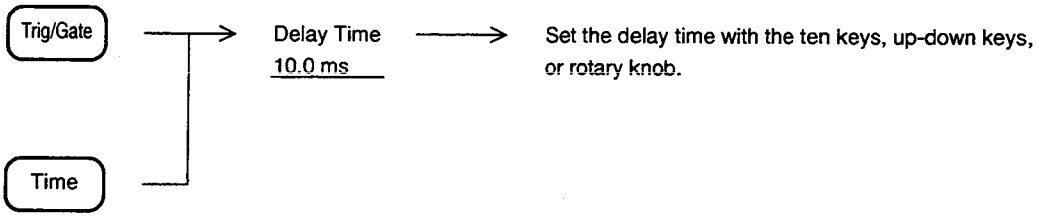
Delay Time

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 MS2670A, 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.



If the trigger point on the time axis screen was set by delay time, the trigger level indicator ▶ is displayed at the bottom of the screen.

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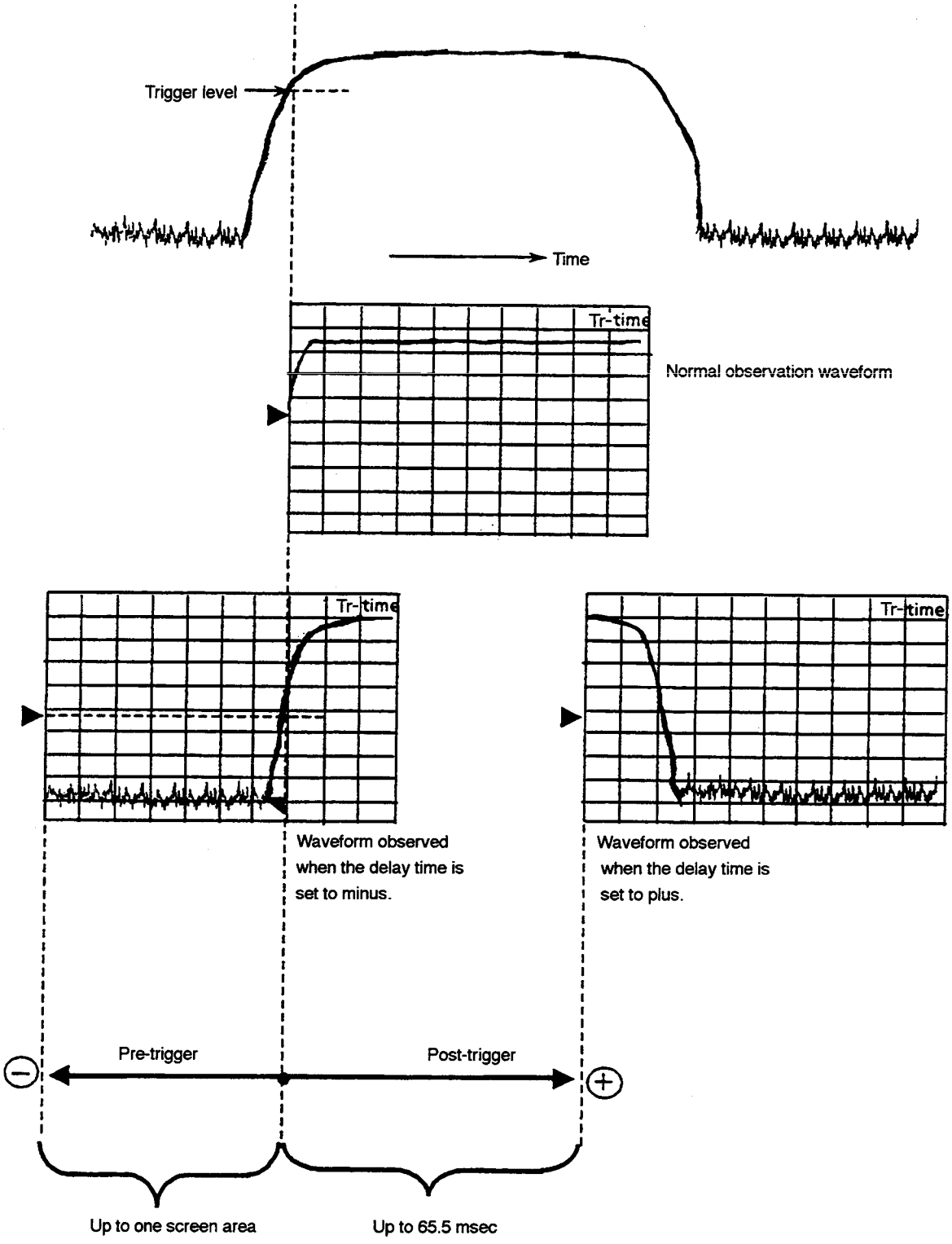

Example of Waveform With Delay Time (when used with video trigger)

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Zone Sweep and Signal Tracking

The MS2670A has two sweep methods:

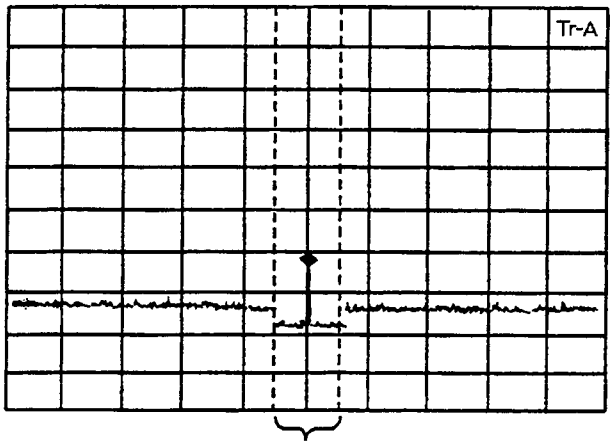
(1) Zone sweep which sweeps only within the zone marker and

(2) Signal tracking function which detects the peak level frequency at each sweep, then moves it to the center of the zone marker.

Zone Sweep

Marker → Zone Sweep
On Off
(Display page 2 of the menu by pressing the More key.)

Zone sweep can be conveniently used to closely and quickly analyze part of the whole sweep range on the screen.



A signal masked by noise can be analyzed at high speed by setting zone sweep to On and adjusting the resolution bandwidth and video bandwidth.

Note: Zone sweep cannot be executed while the marker is Off or when the instrument is in the time domain mode.

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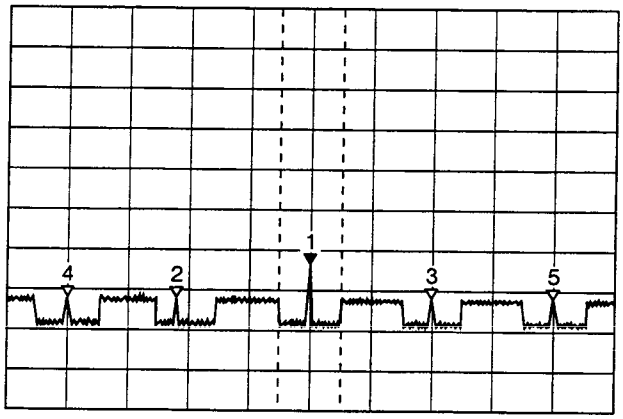
When the multimarker function is on, each multimarker on state is sequentially zone-sweeped (multi-zone sweep).



Signal Tracking

Marker → Marker Tracking
On Off
(Display page 2 of the menu by pressing the More key.)

The signal tracking function moves the frequency of the signal of the peak level in the zone marker to the center of the zone marker at each sweep. This is convenient when tracking and analyzing a signal whose frequency drifts.

Note: The signal tracking function cannot be executed while the marker is Off or when the instrument is in the time domain mode.

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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 MS2670A 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.

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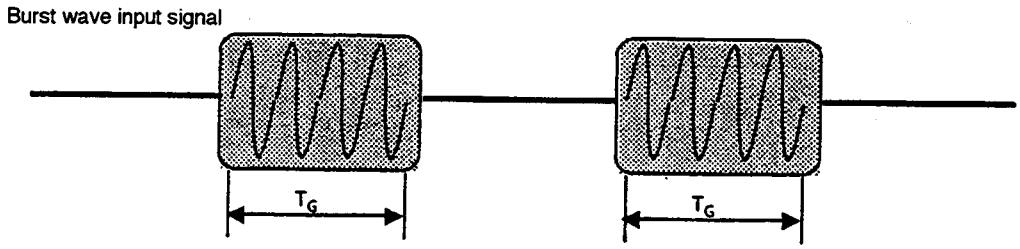
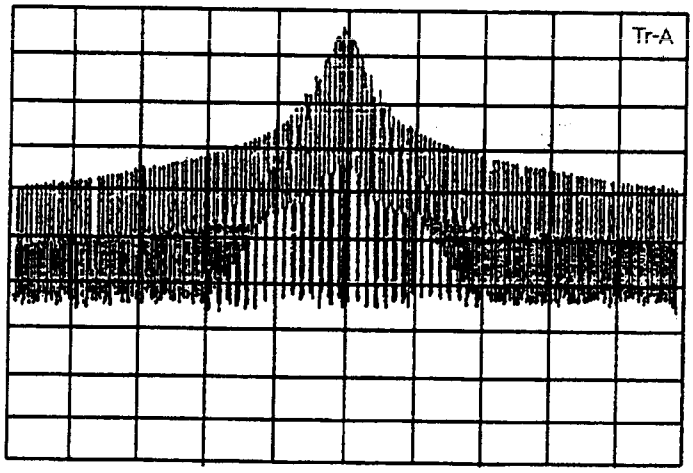
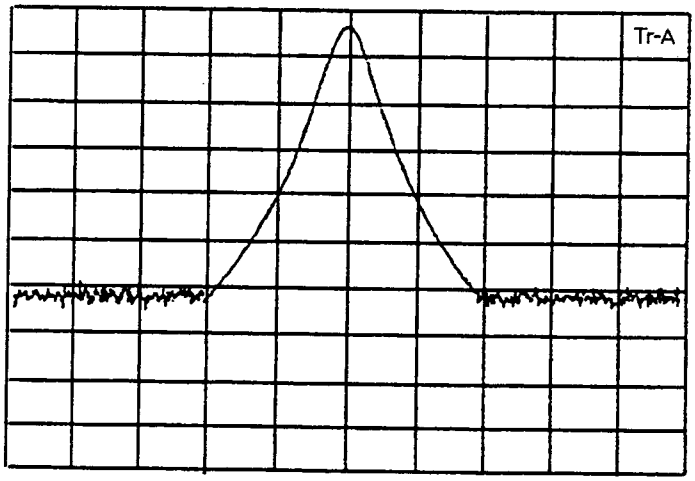


If the spectrum of the burst wave above is analyzed as is, the following graph results:



The spectrum spread by the positive or negative leading edge of the burst wave prevents the spectrum from being observed with the burst set to On.

If the spectrum can be analyzed only during the gate time T_G, the following graph results:



Only the spectrum when the burst is set to On is displayed.

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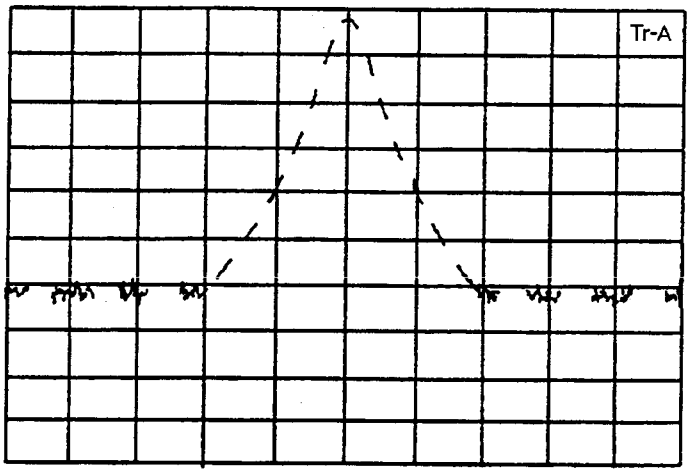
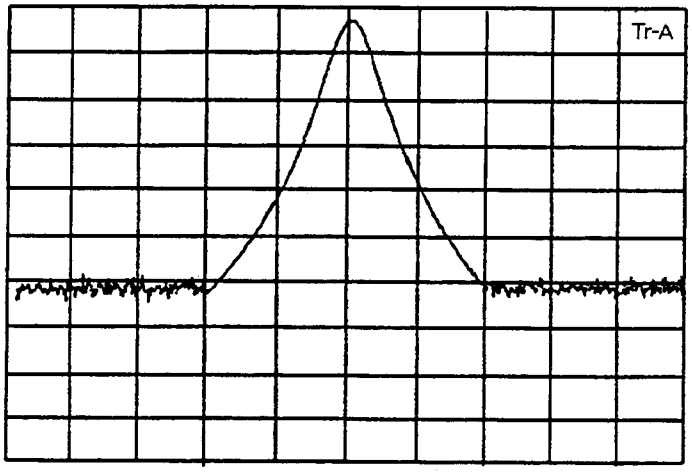
When the time gate function is executed, sweep runs in the Freerun mode and only the waveform data validated by the gate control signal is refreshed. If the sweep period is not synchronized with the gate control signal, a perfectly shaped trace can be obtained by increasing the number of sweep repetitions.



Fewer Sweep Repetitions



More Sweep Repetitions

Example of Frequency Spectrum Measurement on Burst Signal

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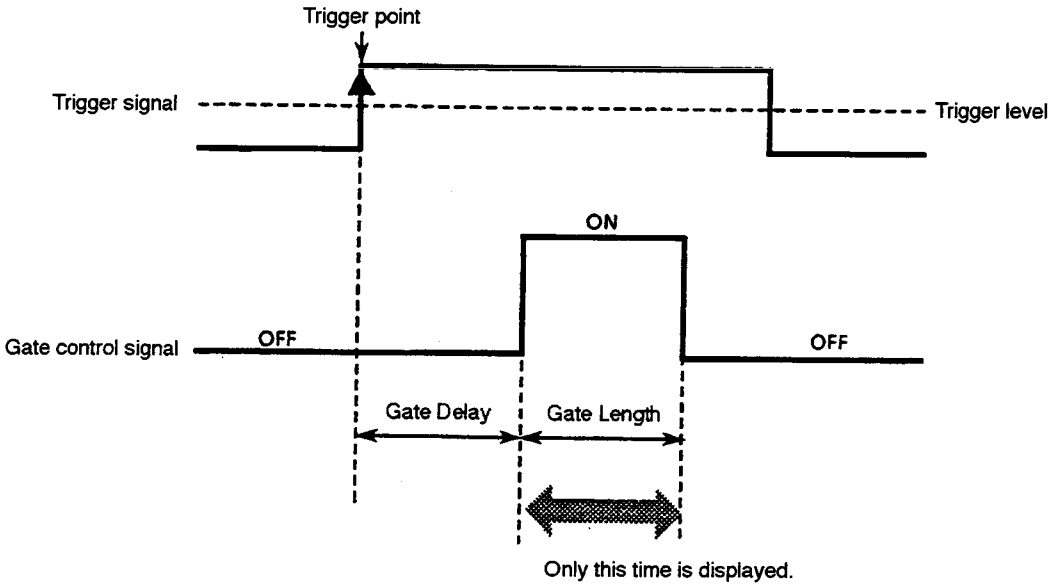
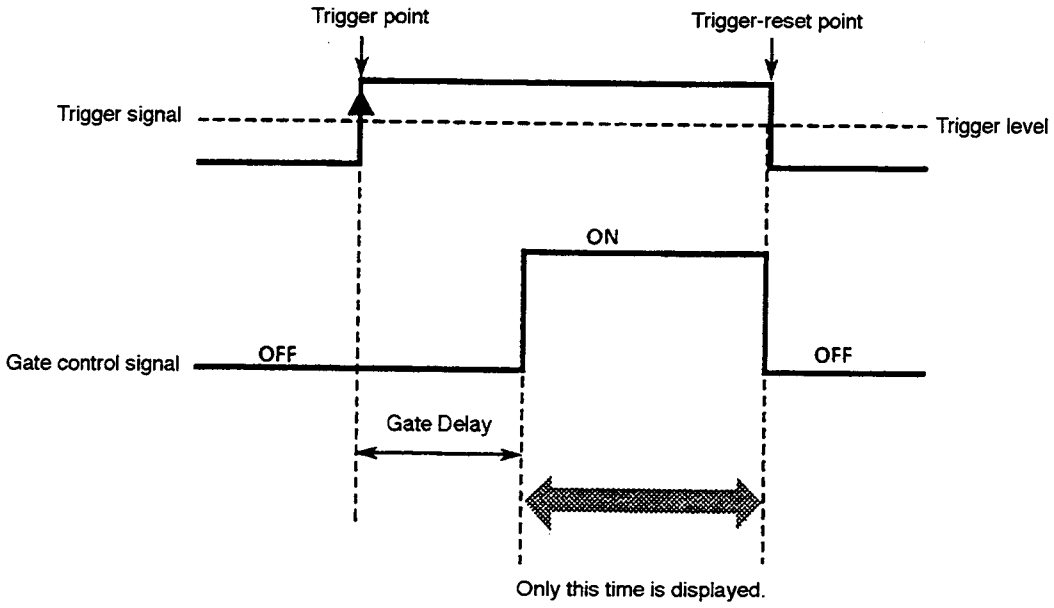
Creating a Gate Control Signal

If the point where an external trigger signal (Ext Input only) 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, or to the time reset by a trigger signal.

- Gate End: When Int selected



- Gate End: When End selected



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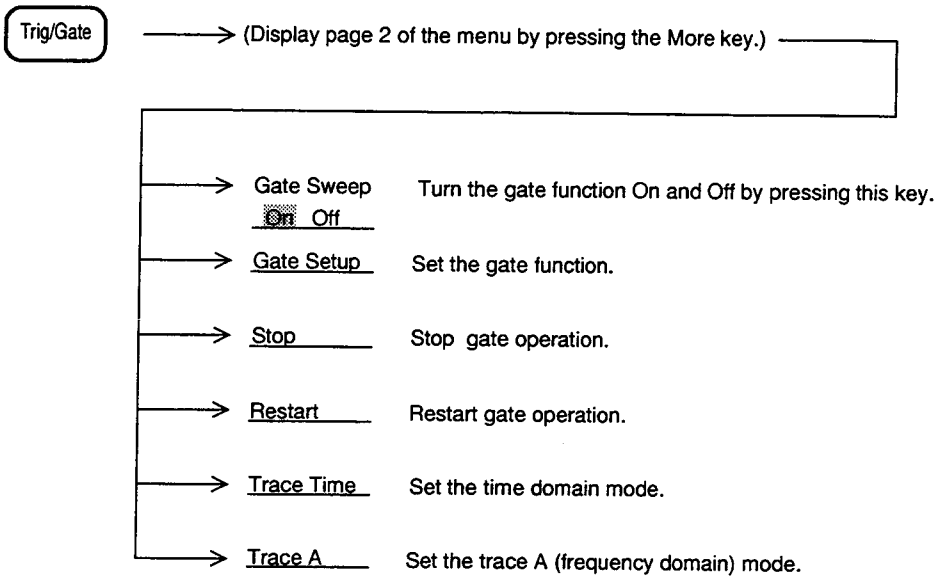
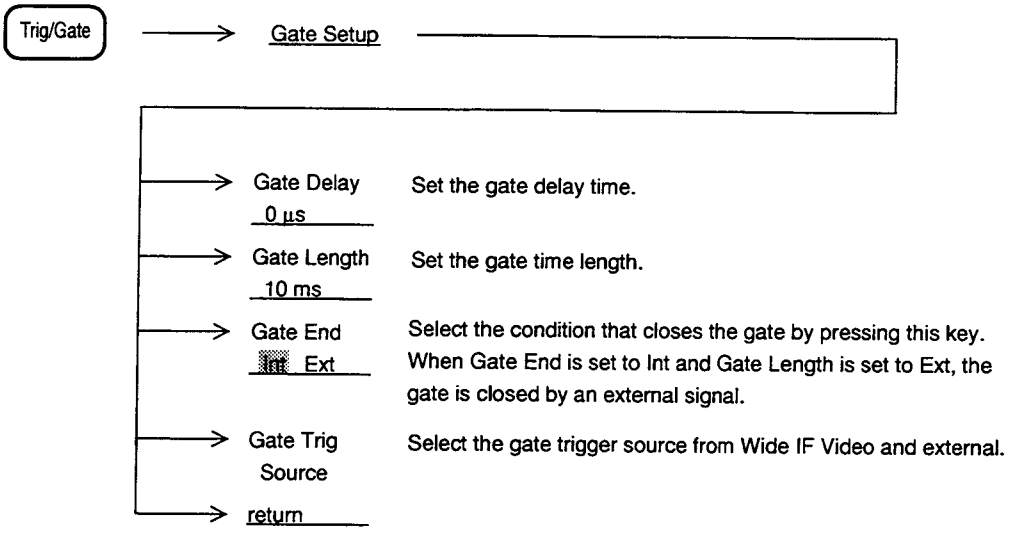
To turn the gate time analysis function On and Off and to create the gate control signal, perform the following key operations.



Setting Gate Function



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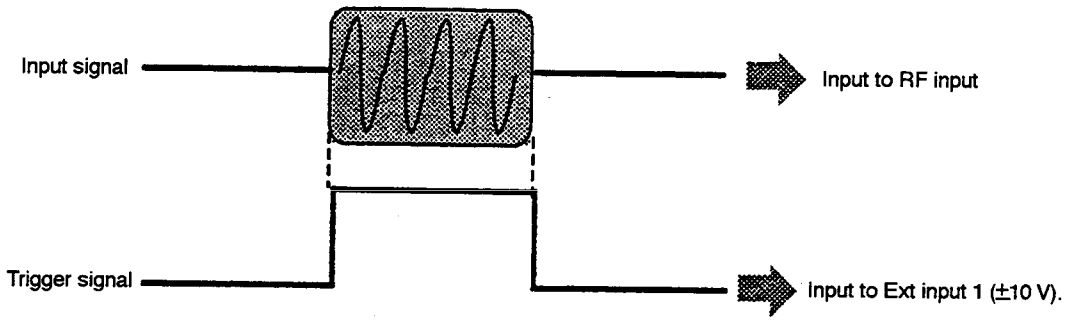
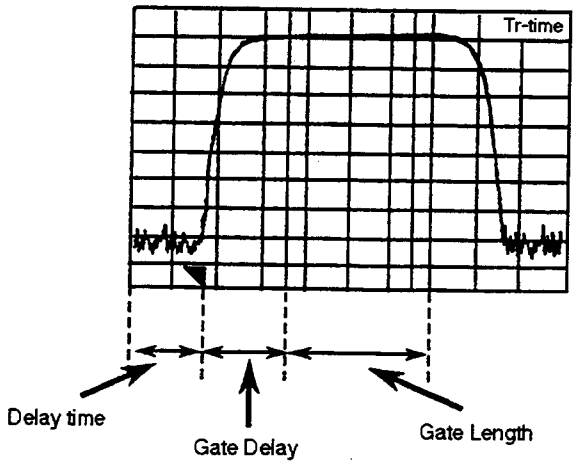
The time domain mode facilitates setting the gate control signal time. The following shows an example of how to use the Time Gate function that uses the time domain mode.

Step	Procedure
1	Input the following signals to the MS2670A.



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 10 V).



3 Set Gate to On. Vertical lines (gate cursor) should appear at the Gate Delay and Gate Length positions. Set Gate Delay 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.

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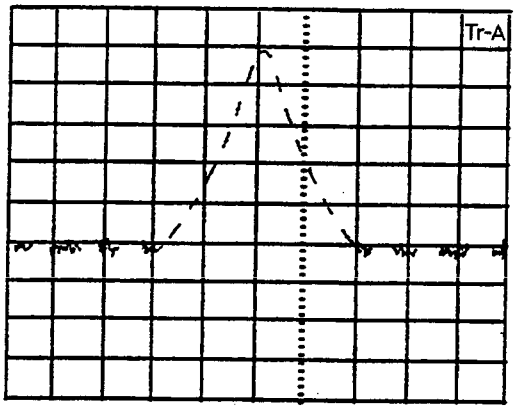
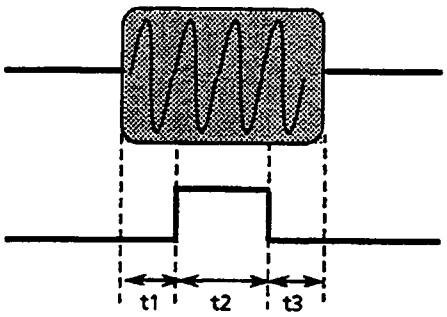
Step	Procedure
4	Set the frequency domain mode. The trigger mode becomes Freerun and the waveform data is displayed only for the time set by Gate Length.



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 ms	≥ 1 ms
3 kHz	≥ 1 ms		
10 kHz	≥ 230 ms		
30 kHz	≥ 200 ms		
100 kHz	≥ 20 ms		
300 kHz	≥ 15 ms		
1 MHz 5 MHz	≥ 10 ms		

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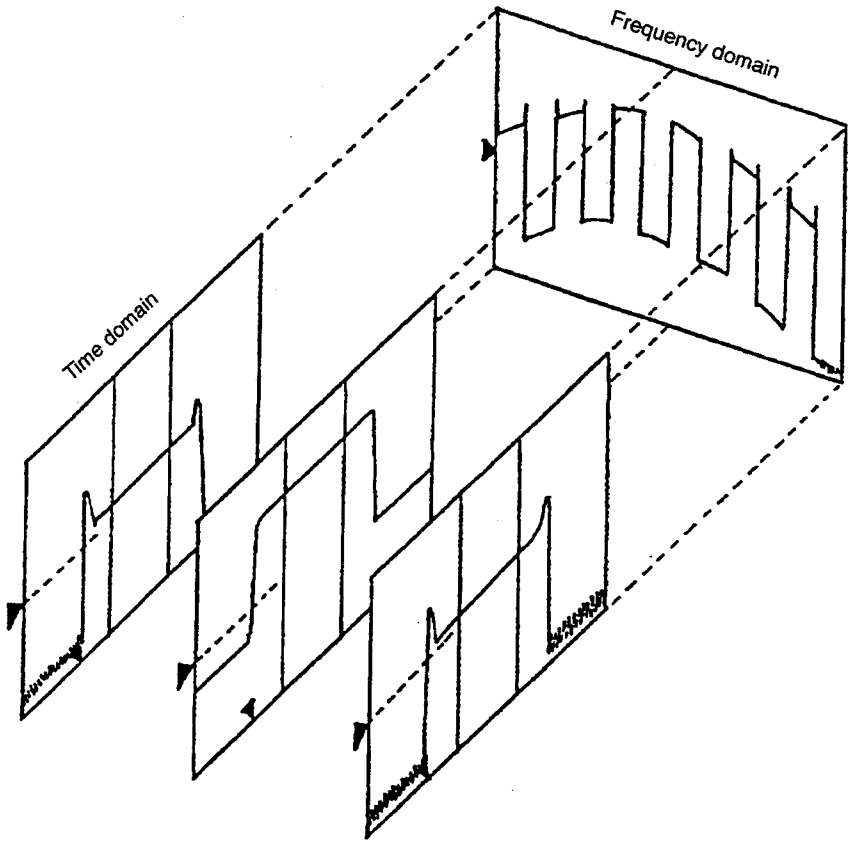
(2) When the resolution bandwidth (RBW) is extremely narrow for the frequency span, some waveforms cannot be displayed correctly. Set each parameter so that the following conditions are satisfied.

$$RBW \geq \frac{Span}{\text{Number of data points (501)}} \times 5$$

(3) The Time Gate function can use a video trigger as the gate control signal. In this case, the gate control signal must be generated correctly so that a trigger can be normally set with the same RBW, VBW, and trigger level conditions at all frequencies within the frequency span observed in the frequency domain. (See the figure below.)



Trigger can be applied by the gate control signal created internally by setting the trigger source to Wide IF Video.

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SECTION 7

COUPLED FUNCTION

This section describes the coupled function. Generally, the MS2670A automatically selects the optimum values of the coupled function so that both the correct level and correct frequency values can be measured. This is called the Auto Coupled Function.

This section describes manual settings that are used to set the coupled function according to the application.

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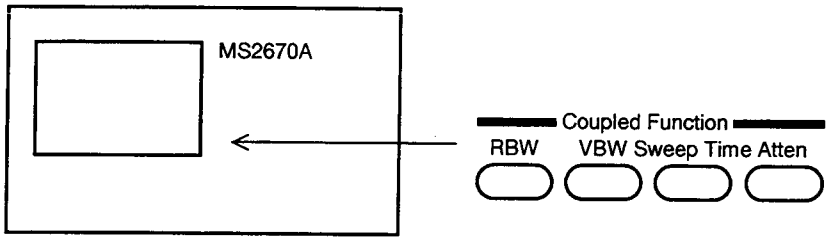
SECTION 7
COUPLED FUNCTION

The coupled function of the four functions (Resolution Bandwidth (RBW), Video Bandwidth (VBW), Sweep Time, and Attenuation (Atten)) is initially set to Auto so that the MS2670A can automatically select the optimum setting.



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From Auto to Manual Operation

Perform manual setting as follows:

RBW	→	Manual	→ Set the RBW with the ten keys, up-down keys, and rotary knob.
VBW	→	Manual	→ Set the VBW with the ten keys, up-down keys, and rotary knob.
Sweep time	→	Manual	→ Set the sweep time with the ten keys, up-down keys, and rotary knob.
Atten	→	Manual	→ Set the input attenuator with the ten keys, up-down keys, and rotary knob.

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, up-down 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, up-down 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.

Note: Either of the two automatic set modes (Auto SWT: Hi-Lvl-Acc and Fast) can be selected. Normally, select the Hi-Lvl-Acc mode. See Section 9 for details.

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(1) Auto mode

The RBW, Sweep Time, and VBW parameters are set to Auto so that if the frequency span is varied, the respective parameters are automatically set to the optimum values to ensure that frequency and level measurement errors do not occur.

The following shows the Swp Time Auto setting range:

- Lower limit value

  20 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.

A 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.

B 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:

10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 5 MHz

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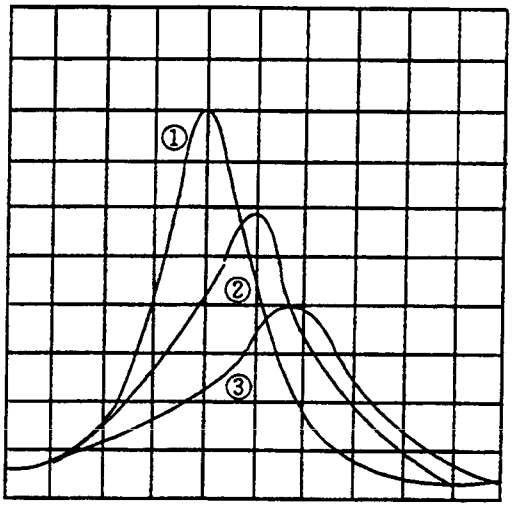

① Optimum trace waveform
② ③ UNCAL trace waveforms

Note: The spectrum traces on the screen are displayed as shown at the left according to the sweep time. The optimum sweep time produces a waveform similar ①. However, a sweep time that is too fast decreases the waveform amplitude on the display as shown in ② and ③ Therefore, as the apparent bandwidth gets wider, and the requency also shifts. When waveform ① cannot be maintained, "UNCAL" is displayed.

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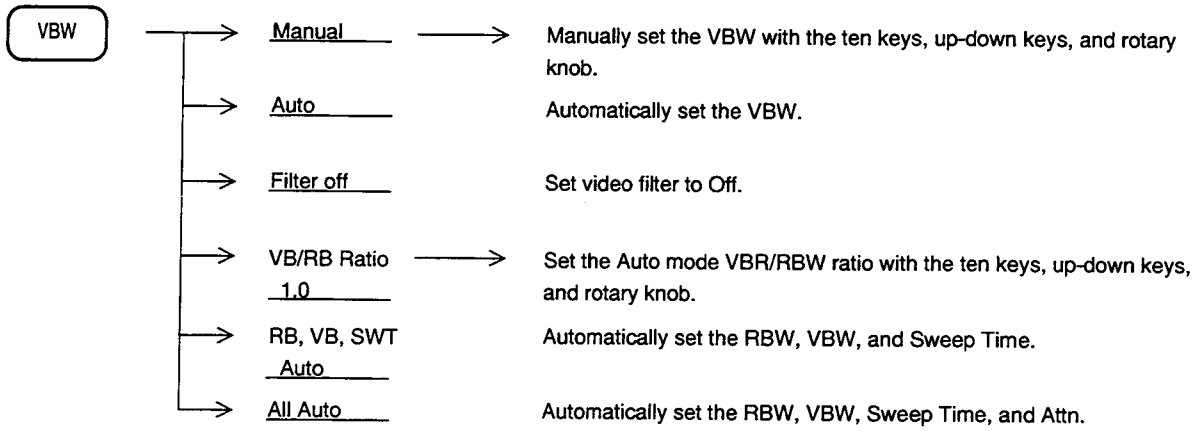
Video Bandwidth (VBW)

To set the VBW, perform the following key operations.



(1) Auto mode

When VBW is set to Auto, the product of the RBW set value multiplied by the VB/RB Ratio is set. Since VB/RB Ratio is initially set to 1, RBW and VBW are set to the same value.

By setting the VB/RB Ratio to a small value (since VBW is set to a narrow value according to the RBW setting), noise can be efficiently averaged.

Note: The VBW setting range is 1 Hz to 3 MHz. If an attempt is made to exceed this range, the VBW is set to 1 Hz or 3 MHz.

(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:

1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, OFF

Notes:
- 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 SECTION 5.

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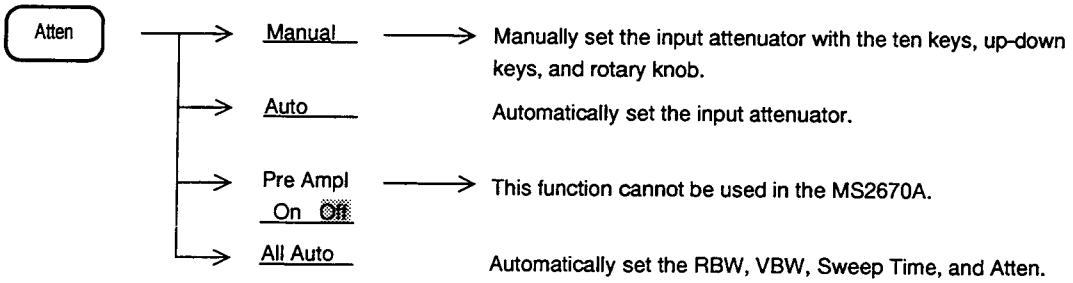
Input Attenuator (Atten)

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.

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(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, For second and third harmonic measurements, the influence of internal distortion must be eliminated by decreasing the mixer input level. Because the internal distortion is –60 dBm when the mixer input level is –40 dBm, when wanting to measure spurious harmonics up to –60 dB, the mixer input level must be made –40 dBm or less. In this case, set the input attenuator manually because the Atten value in the Auto mode is too small.

Reference Level and Input Attenuator (Manual)

Reference Level effective range (dBm)	Atten Manual (dB)
+30 ~ –30	70
+30 ~ –40	60
+30 ~ –50	50
+30 ~ –60	40
+20 ~ –70	30
+10 ~ –80	20
0 ~ –90	10
–10 ~ –100	0

A small input attenuator value can be set within the range at which internal mixer level = {(same input level as reference level) – (input attenuator set value)} is –10 dBm or less.

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SECTION 8

AUTOMATIC CALIBRATION AND LEVEL CORRECTION FUNCTIONS

This section describes the internal calibration function and measuring system level correction function which minimize the MS2670A measurement error.

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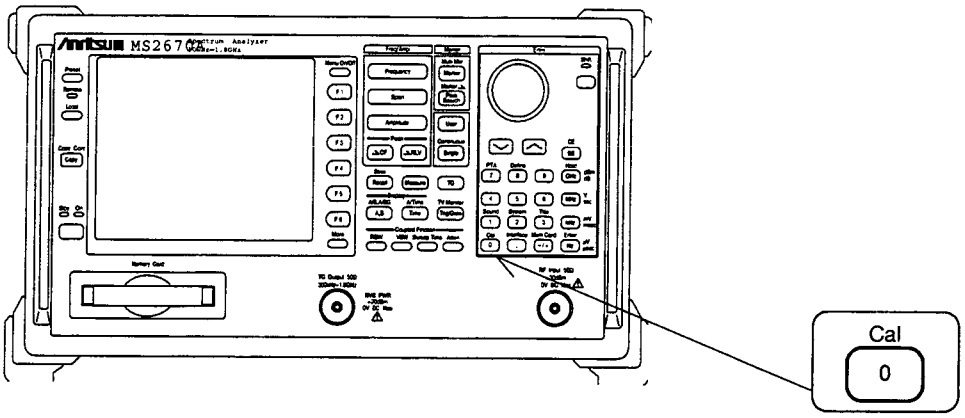
SECTION 8
AUTOMATIC CALIBRATION AND LEVEL CORRECTION FUNCTIONS

Automatic Calibration Function .....CAL

The MS2670A incorporates a 625 kHz calibration oscillator and a calibration attenuator, which perform automatic calibration so that the MS2670A can minimize measurement errors and make high accuracy measurements.

WARNING

If calibration is executed with an external signal applied to the RF input, the correct calibration value cannot be obtained. Perform calibration without applying a signal to the RF input connector.



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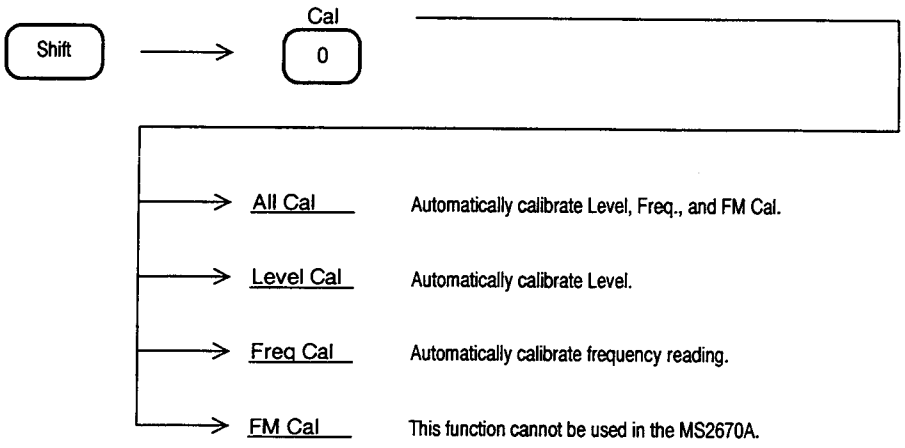
Automatic Calibration

Execute MS2670A automatic calibration by performing the following key operations.



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Details of Each Calibration Item

The following describes the items that are calibrated by the automatic calibration function and the items that are calibrated at the factory.

ALL CAL	LEVEL CAL	Reference level error calibration	Calibrates the absolute-value levels on the LOG/LIN scale.
		LOG-scale linearity calibration	Calibrates the LOG-scale linearity.
		IF Gain switching error correction	Calibrates the error caused by the IF gain from among the level errors when the reference level is switched.
		RBW switching error calibration	Calibrates the error when the resolution bandwidth (RBW) is switched.
		Detection-mode switching error calibration	Calibrates the level error when the detection mode (Pos Peak, Sample, Neg Peak) is switched.
		Input-attenuator/pre-amplifier switching error	Calibrates the level error when the input-attenuator/pre-amplifier is switched.
	FREQ CAL	calibration RBW center frequency calibration	Calibrates the center frequency error when the resolution bandwidth (RBW) is switched.
		RBW bandwidth measurement	Measures the RBW bandwidth used for noise measurement bandwidth conversion.
Frequency response calibration		Factory Calibration	Calibrates the amplitude frequency response over the entire band.

When ALL CAL is executed, the calibration data is retained by the built-in battery back-up even when the MS2670A power is turned off. Therefore, it is not always necessary to execute automatic calibration each time the power is turned on. However, when a particularly high accuracy measurement is required, when the specifications are not met, or when the set-up circumstances have changed greatly (such as ambient temperature), execute automatic calibration again.

Notes:
- Since the built-in calibration oscillator is automatically connected internally when automatic calibration is executed, external connection is unnecessary.
- Unless the frequency span is taken into account, the measurement frequency error depends on the local oscillator frequency error and the IF center frequency error. The local oscillator is a synthesizer system and its frequency error depends on the frequency accuracy of the reference crystal oscillator or external reference signal input. Frequency-related automatic calibration calibrates the IF center frequency error.

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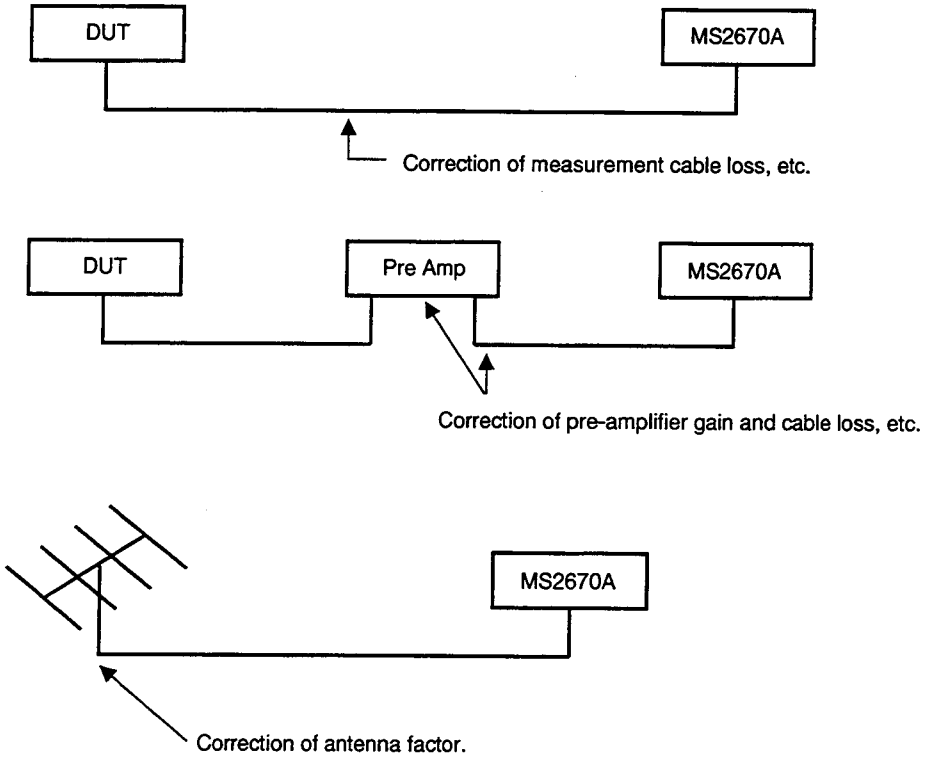
Measurement System Level Correction

When making measurements with a spectrum analyzer, it may be necessary to correct the error and gain of the measurement system. The following are examples of this.

(1) Frequency characteristics and loss of measurement cables
(2) Frequency characteristics and loss of pre-amplifier, etc. connected to RF input connector
(3) When wanting to measure the field strength with an antenna or near-field probe connected (antenna factor correction)



The correction factors for these measurement systems can be stored in the internal memory to add the factor to the measured value and display the spectrum.

Up to five correction factors (maximum 150 points each) can be stored in the internal memory by storage from an external computer via an external interface or by using the internal PTA. For a more detailed explanation of these methods, refer to the Remote Control part of the separate operation manual.

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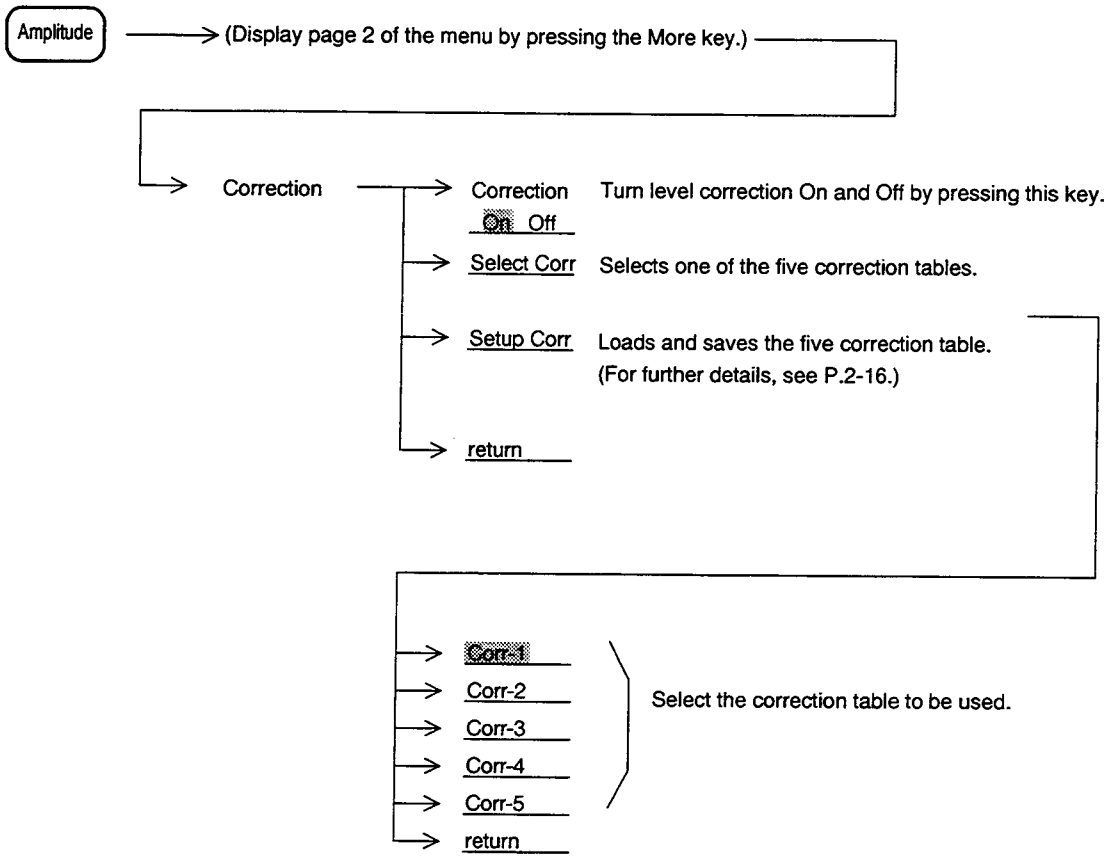
The following shows the procedure for adding the correction factor to the measured value by using the correction data saved in advance.



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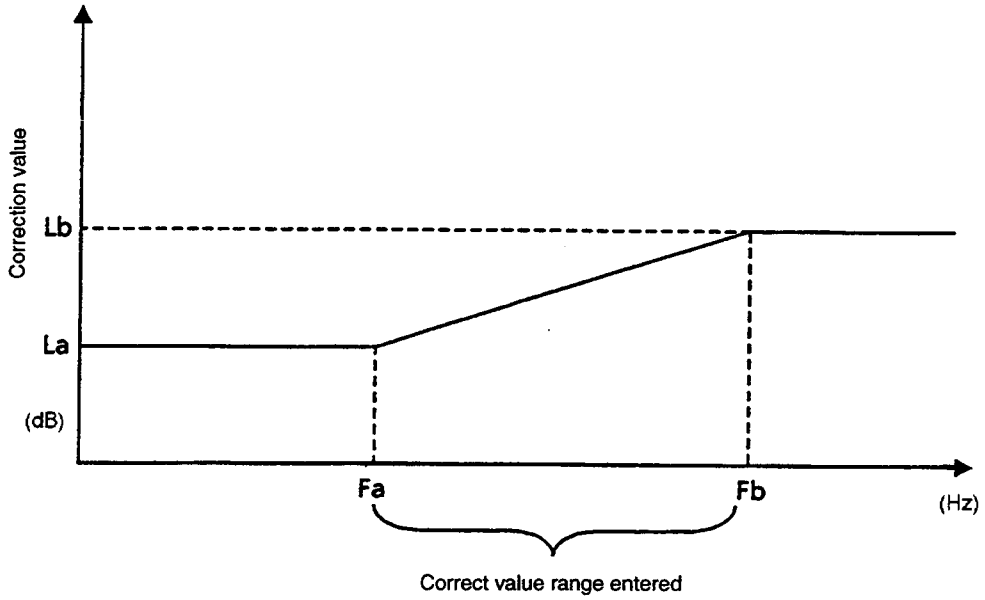
Press one of the Corr-1 to Corr-5 keys. The spectrum data is corrected and displayed by the corresponding correction value.

If the frequency range over which the correction values are entered is from Fa to Fb, displayed frequency ranges lower than Fa or higher than Fb have correction values applied as shown in the figure below. The correction value for frequencies lower than Fa is the same as that (La) for Fa and the correction value for frequencies higher than Fb is the same as that (Lb) for Fb.



Notes: (1) No correction factor is entered at the factory. The correction values are all 0 dB.

(2) The correction value is backed-up by a battery. Therefore, once the value has been entered, it is not lost even after the power is turned off.

(3) The Corr-1 to Corr-5 soft keys allow each menu label to contain up to 20 characters. The labels can be entered from the remote control command only. For further details, refer to the Remote Control part of the separate Vol. 3 operation manual.

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SECTION 9

SYSTEM SETTING AND PRESET FUNCTION

This section describes the MS2670A system setting method and the measurement parameters preset function.

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SECTION 9
SYSTEM SETTING AND PRESET FUNCTION

The following system parameters of the MS2670A can be set depending on the usage objective.

- Frequency domain and time domain coupled function value common/independent setting ..... Coupled Common Independent
- Measurement parameters and date display type setting ..... Display
- Screen display color (color pattern) setting ..... Change Color
- Setting Mode at Auto Sweep Time ..... Auto SET
- Setting Date/Time ..... Set Date/Set Time
- Power on state setting ..... Power On State

These system settings are independent from, and are not affected by, the preset function. However, they are included in the Save parameters described in SECTION 10, so the system settings may have changed when recalled.

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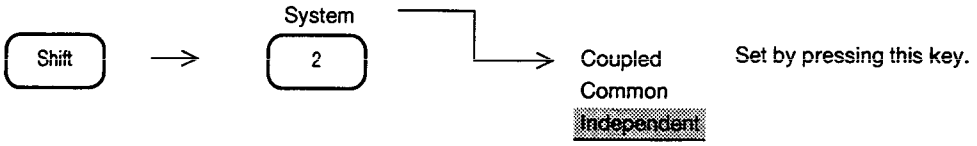
Coupled Function Common/Independent Setting Mode

At factory shipment, the four coupled functions RBW, VBW, Sweep time (Time Span), and Atten are set to have the independent value for frequency domain and time domain.

When these coupling functions are desired to be used with the same sense of operation as zero span of a traditional spectrum analyzer, they can be set commonly by making the following system settings.



Common ..... The same values are set for both frequency domain and time domain.

Indepenent ... Different values are set for frequency domain and time domain.

The Atten value cannot be set independently. When the coupled mode is set to Independent, "RB" and "VB" displayed at the top of the screen change to "RBt" and "VBt", respectively.

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Note: The sweep time (time span) setting range and resolution in the frequency domain and the time domain differ as shown below. In some cases, the same values cannot be obtained even if the coupled mode is sent to Common.

Frequency domain

20 msec to 1000 sec
Resolution: High-order 2 digits

Time domain

12.5 µs, 25 µs, 50 µs, 100 µs to 1000 sec
Resolution: High-order 1 digit (100 µsec to 900 µsec)
High-order 2 digits (1 msec to 1000 sec)

Example: After switching to the time domain mode to set the time span to 100 µsec when the sweep time is 300 msec in the frequency domain mode, the display mode returns to the frequency domain mode.

↓

Since the lower limit value of the sweep time that can be set in the frequency domain mode is 20 msec, the sweep time is set to the 20 msec nearest to 100 µsec. Then, when the display mode switches to the time domain mode, the time span is renewed to 20 msec.

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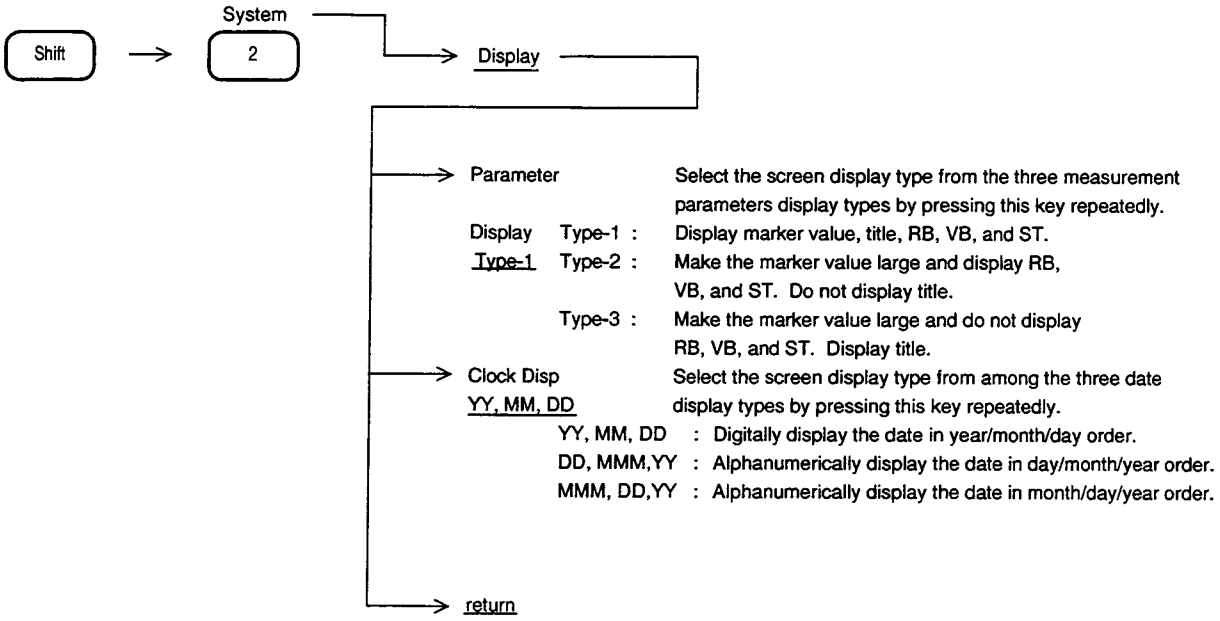
Screen Display Type System Setting

This function selects the measurement parameters display type and date display time that are displayed on the screen.



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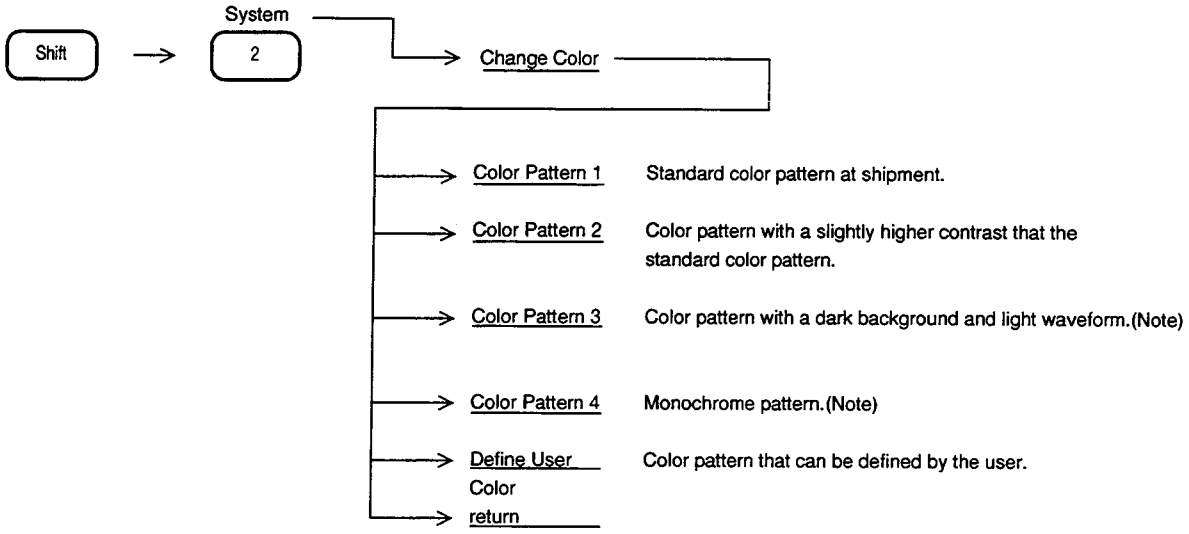
Modifying Display Color (Change Color)

This function changes the color of the trace waveform, scale, measurement parameters, menu, and other items displayed on the screen. The color pattern can be selected from among four color patterns, or defined by the user.



Note: Mainly use color pattern 3 when using in the dark environment.
Mainly use color pattern 4 when photographing the display screen.

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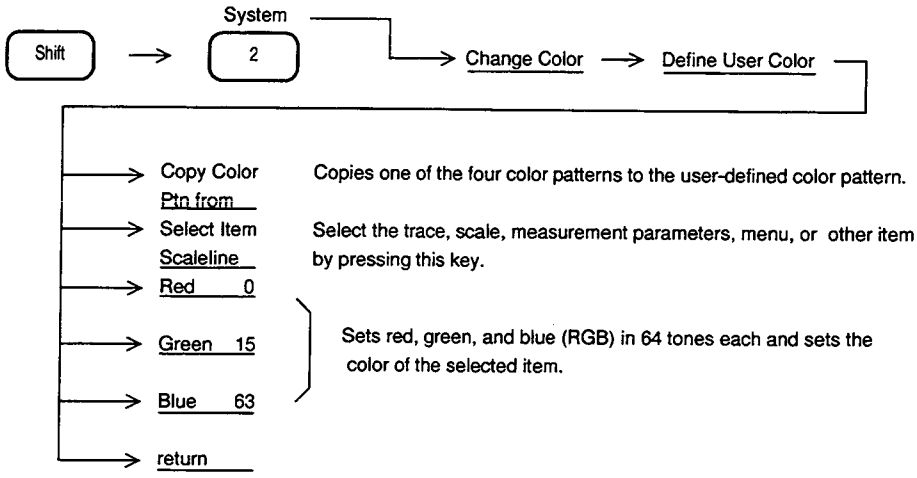
User Definition of Display Color

The MS2670A has a color pattern function that allows the user to define the color of the trace waveform, scale, measurement parameters, menu, and other items displayed on the screen.



Note: Marker, PTAScreen, Menufield, Menutext, EntryArea, Background, Scalefield, Scaleline, 2ndTrace, 1stTrace, Parameter, Displayline, Trigger, Zone, Temp/Mask, and MultiMarker can be selected.

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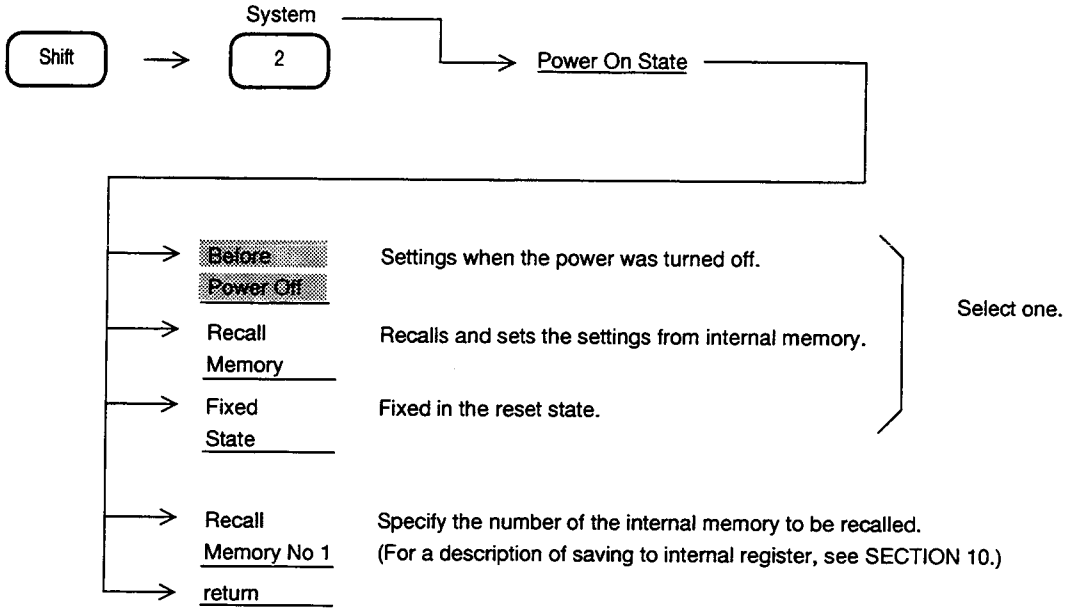
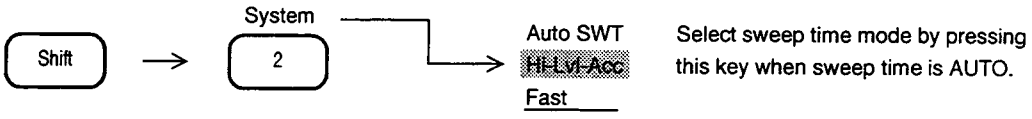
Conditions Setting at Power-on

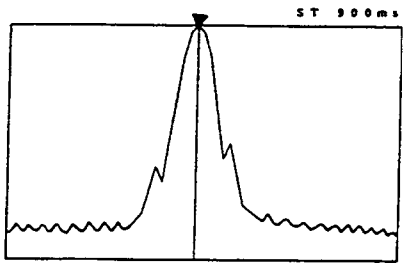
Set the state of the screen display when the power is turned on by performing the following key operations.



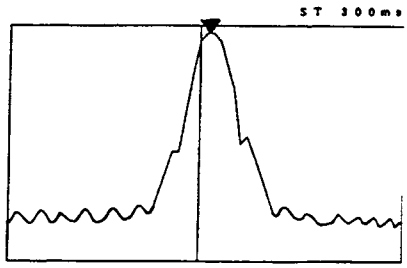
Setting Mode at Auto Sweep Time

Set the sweep time mode when sweep time is Auto.
Normally, select the Hi-Lvl-Acc mode.
In Fast mode, the sweep time becomes fast, but level-measurement error may increase by approx. 1 dB.
Use this Fast mode in the relative-level measurement such as the adjacent channel leakage power, harmonic distortion, and occupied frequency bandwidth.





In Hi-Lvl-Acc Mode



In Fast Mode

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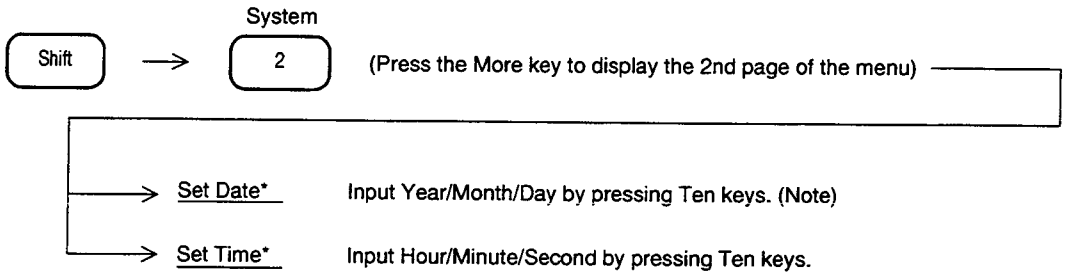
Setting Date/Time

Set the date and time by performing the following key operations.



Note: For an example, when inputting 1st January 1996,

Input Year 9 6 Enter Hz
Month 1 Enter Hz
Day 1 Enter Hz .

For an example, when inputting 15:35:00 (3:35:00 PM),

Input hour 1 5 Enter Hz
minute 3 5 Enter Hz
second 0 Enter Hz .

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SECTION 10

SAVE/RECALL FUNCTION

This section describes saving and recalling of the waveform and parameter data to and from the internal register and memory card.

It also describes memory card file management.

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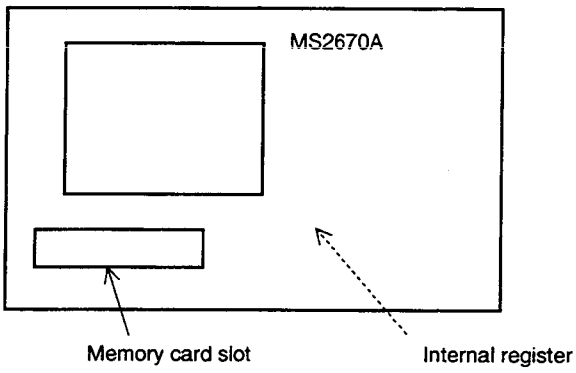
SECTION 10
SAVE/RECALL FUNCTION

The MS2670A can save the setting conditions (Parameter) and waveform data (Trace) to the internal register and memory card. This data can be recalled and used later.



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Internal Register

The internal register uses RAM backed-up by a battery in the MS2670A.
Up to 12 parameters and waveform data can be saved. Parameters and waveform data, or parameters only, can be recalled.

Memory Card

The memory card is an interface that corresponds to PCMCIA Ver.2 type 2 and contains 2 slots.
Memory capacity can be selected from among 256 kB, 512 kB, 1024 kB, and 2048 kB.
Parameters and waveform data can be saved. Parameter and waveform data, or parameters only, can be recalled.
(A 256 kB memory can save more than 50 files.)
PTA programs created by an external controller, etc. can also be uploaded and downloaded.

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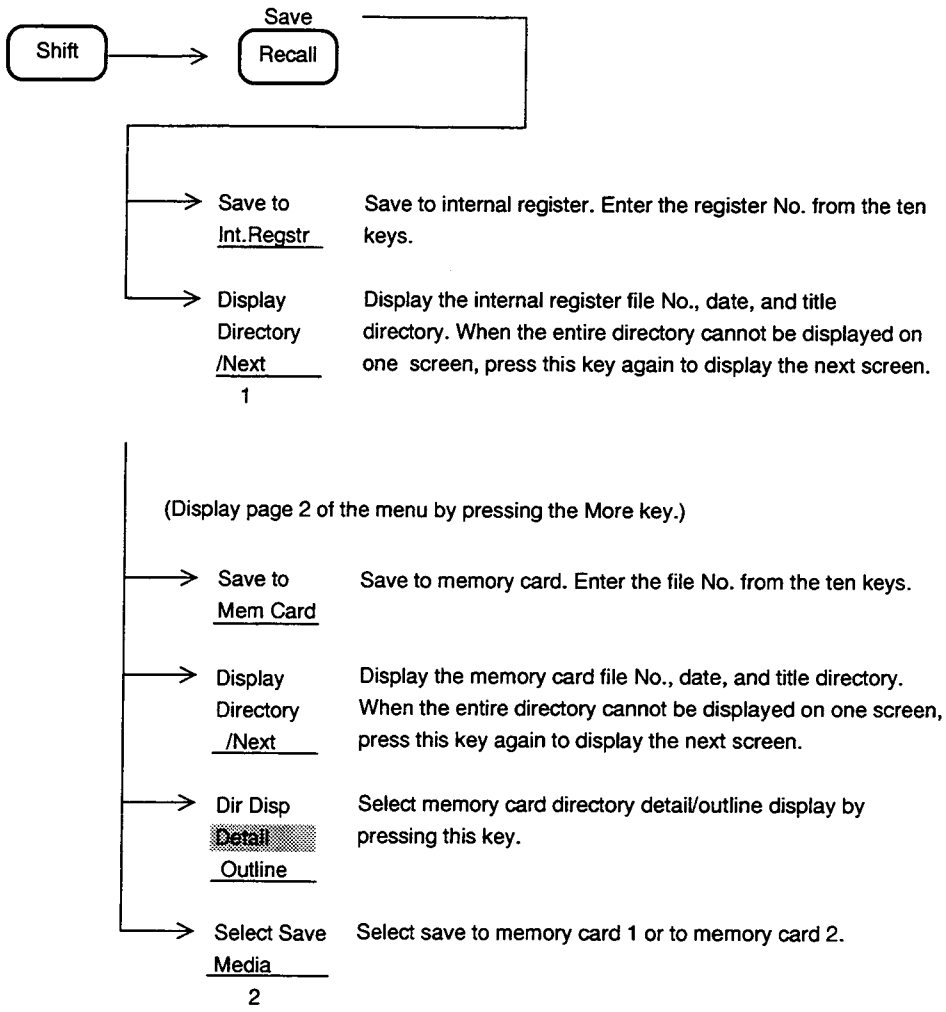
Saving Parameter and Waveform Data

To save the current parameters, waveform data, and title to internal register or memory card, perform the following key operations.
When a title is necessary, enter it in advance. (See SECTION 12.)



Note: Since the Save operation overwrites the data written using the same register/file number, check the directory before saving.

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<Memory Directory> save

No.	Date	Title
01	95-09-15	Noize Level Measument
02	95-09-23	FALL 0923
10	95-10-10	SPRT 1010
12	95-11-03	CLTR

Save Int. Reg. NO=

Internal Register Directory Display Screen

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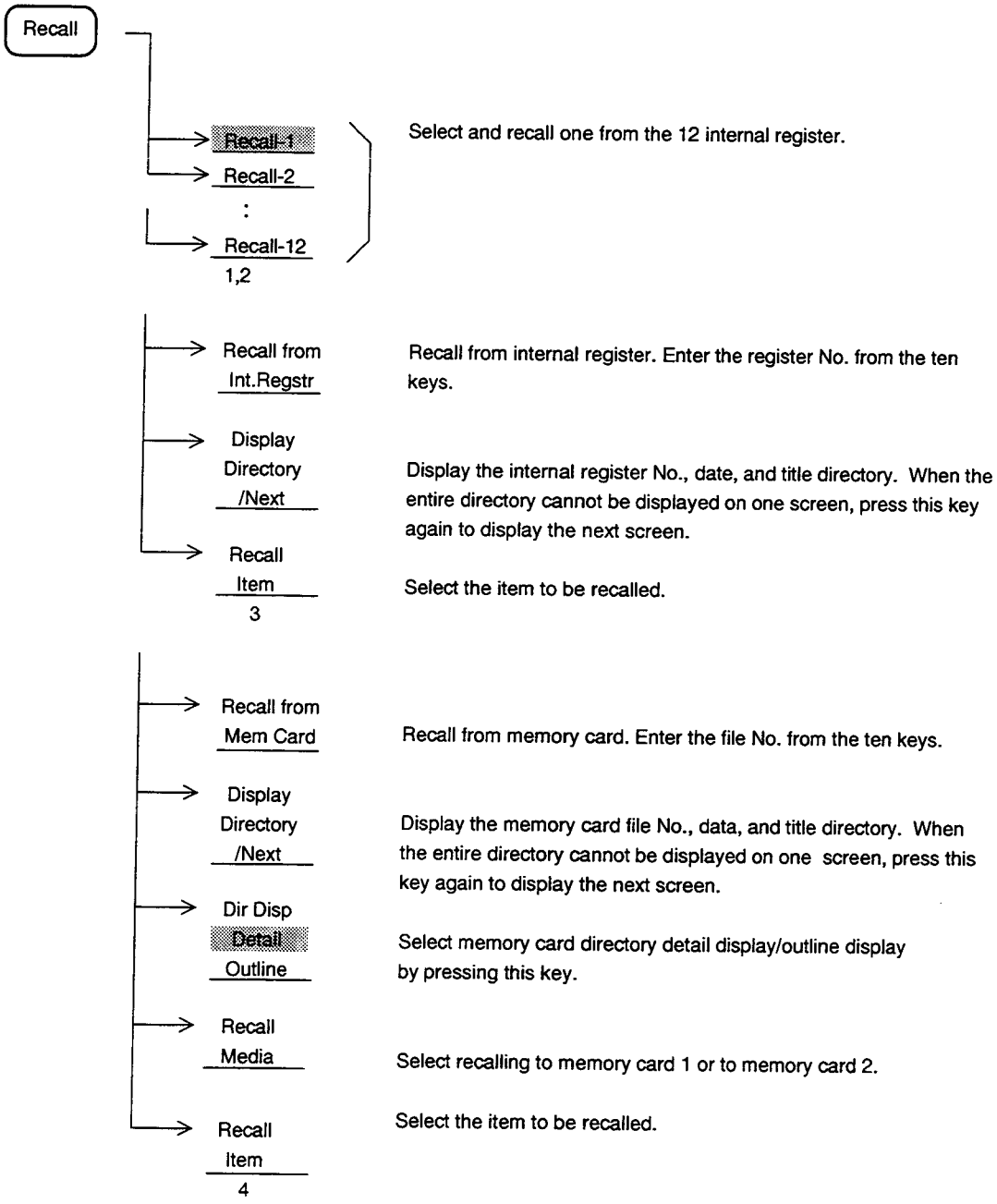
Recalling Parameter and Waveform Data

To recall the saved parameters and waveform data or parameters only from internal register or memory card, perform the following key operations.



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Notes: (1) Waveform data should be saved in the View storage mode or in the state while stopped after a single sweep. Resweep immediately after recall clears from the screen display the data saves during continuous sweep.

(2) The Cumulative and Overwrite storage modes allow the last-swept waveform data to be saved.

(3) Since the system settings described in SECTION 9 MEASUREMENT SYSTEM SETTING (Coupled Mode) are included in the parameters to be saved, they may have changed when recalled.

<File Directory> Recall

Media: Mem Card-1
Unused Area: 205 824 byte
31 Files in \P-2110\TRACE

Name Title Bytes Date Protect
TRACE001 DAT Carrier Power Measure
2608 96-05-16 09:04 Off
TRACE002 DAT Power steps Measure
2608 96-05-16 09:04 Off
TRACE003 DAT PvsT full frame Measure
2608 96-05-16 09:04 Off
TRACE004 DAT PvsT full slot Measure
2608 96-05-16 09:04 Off
TRACE005 DAT PvsT top 10dB Measure
2608 96-05-16 09:04 Off

Recall File No =

(Detail)

<File Directory> Recall

Media: Mem Card-1
Unused Area: 205 824 byte
31 Files in \P-2110\TRACE

No. Date Title
001 96-05-16 Carrier Power Measure
002 96-05-16 Power steps Measure
003 96-05-16 PvsT full frame Measure
004 96-05-16 PvsT full slot Measure
005 96-05-16 PvsT top 10dB Measure
006 96-05-16 PvsT Rising edge Measure
007 96-05-16 PvsT Falling edge Measur
008 96-05-16 Intermod measure (carr
009 96-05-16 BS Tx band(800kHz abov
010 96-05-16 BS Tx band(800kHz belo
011 96-05-16 BS Rx band(3rd) measure
Recall File No =

(Outline)

Memory Card Directory Display Screen

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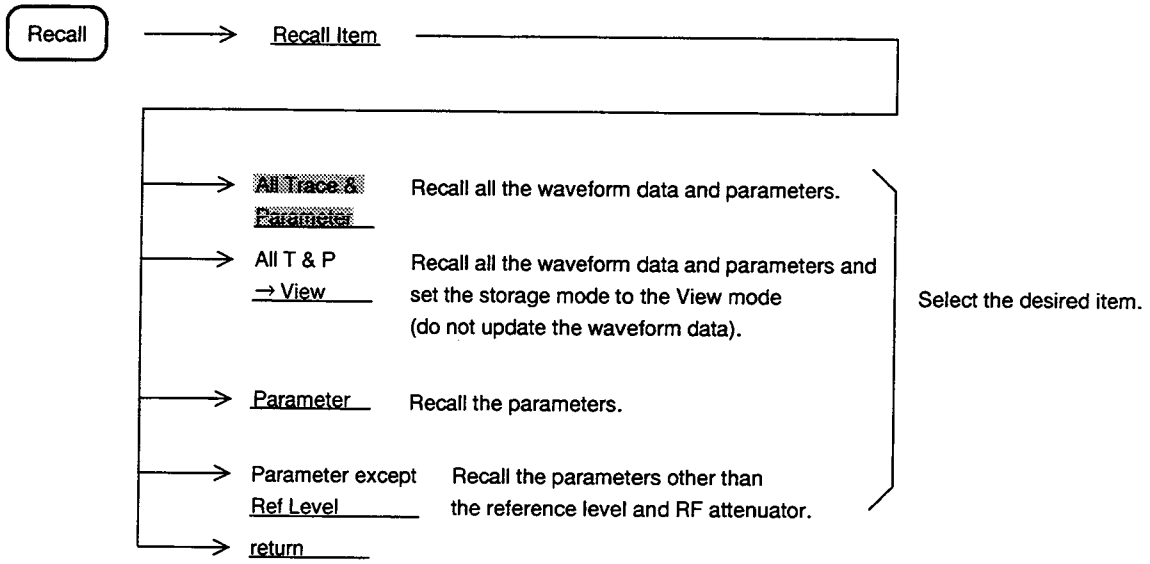
Selecting Recall Item

Select the item to be recalled by performing the following key operations.



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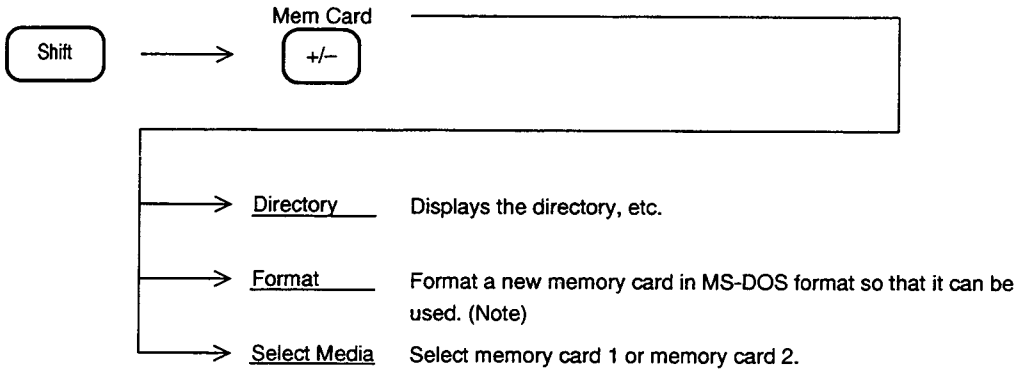
Memory Card File Management

This parameter describes the memory card format, file deletion, and write protect key operation.



Note: When a memory card is formatted, all the file contents are deleted even if they are write-protected as described below.

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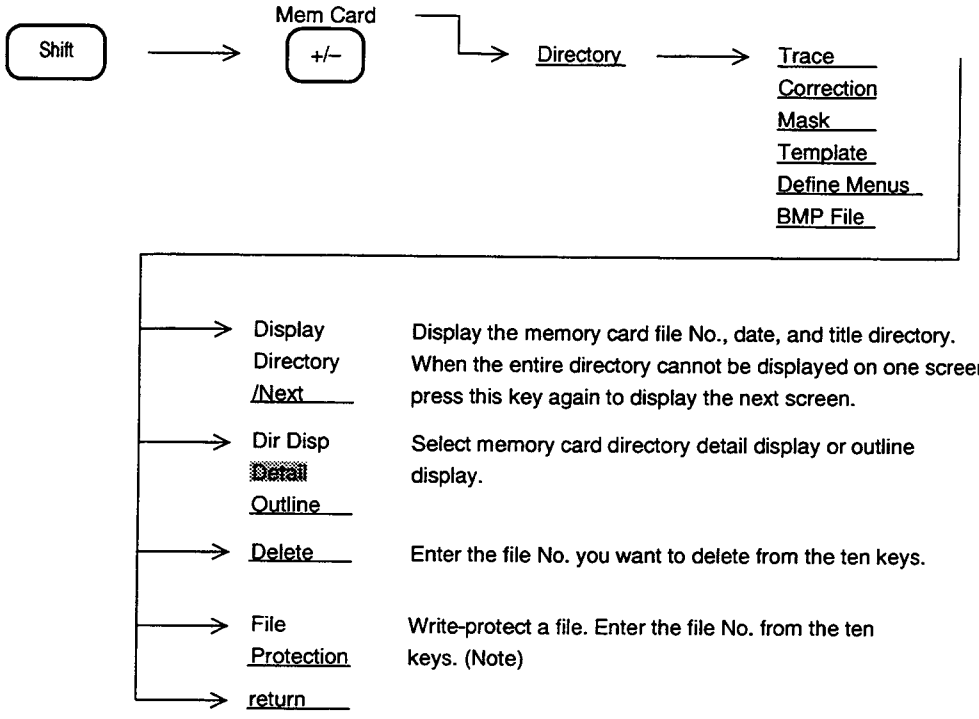
File Deletion and Write Protect

To delete a file and set write protect, perform the following key operations.



Note: The operation above releases write protection of the protected file.
Write-protected files are displayed with "protect" in the memory card directory displayed set to "on" and cannot be saved or deleted.
Note that the formatting deletes the protected file.

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SECTION 11

COPY

This sections describes the COPY function for hard-copying the contents displayed on the screen.

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SECTION 11
COPY/TV IMAGE MONITOR

Direct Plotting

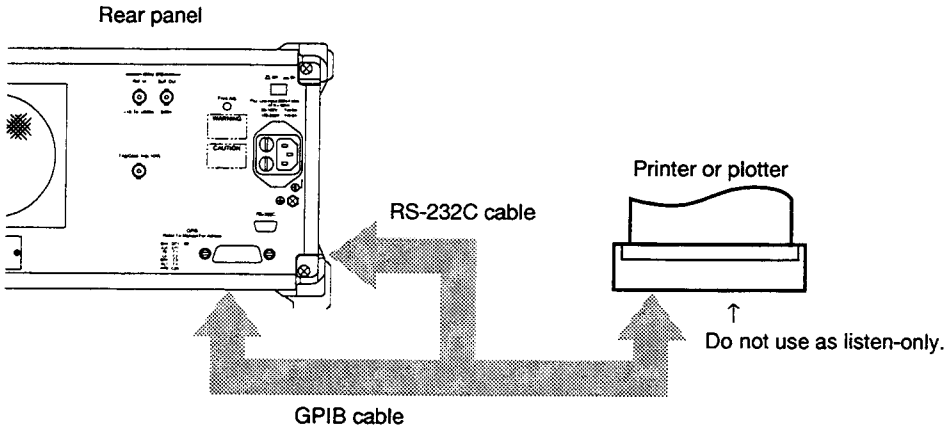
The MS2670A can output a hard copy of the screen as follows:

- Using a printer via RS-232C interface.
- Using a printer via GPIB (Option) interface.
- Output to a plotter in the specified format via RS-232C interface.
- Output to a plotter in the specified format via GPIB (Option) interface.

However, the printer is limited to HP dot image and EPSON dot image types.
The plotter is limited to HPGL and GPGL types.

Connecting to Printer and Plotter

Connect the MS2670A and printer/plotter as shown below.



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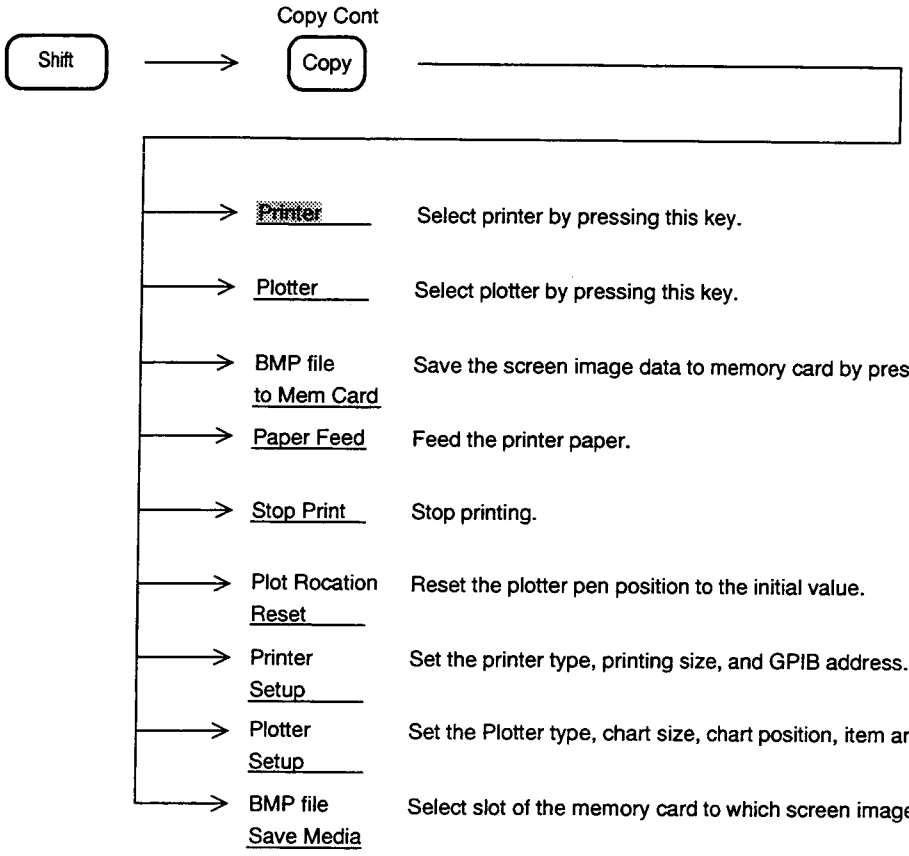
Selecting a Printer/Plotter

To select printer/plotter, set-up the printer/plotter, feed the paper, stop printing, etc., perform the following key operations.



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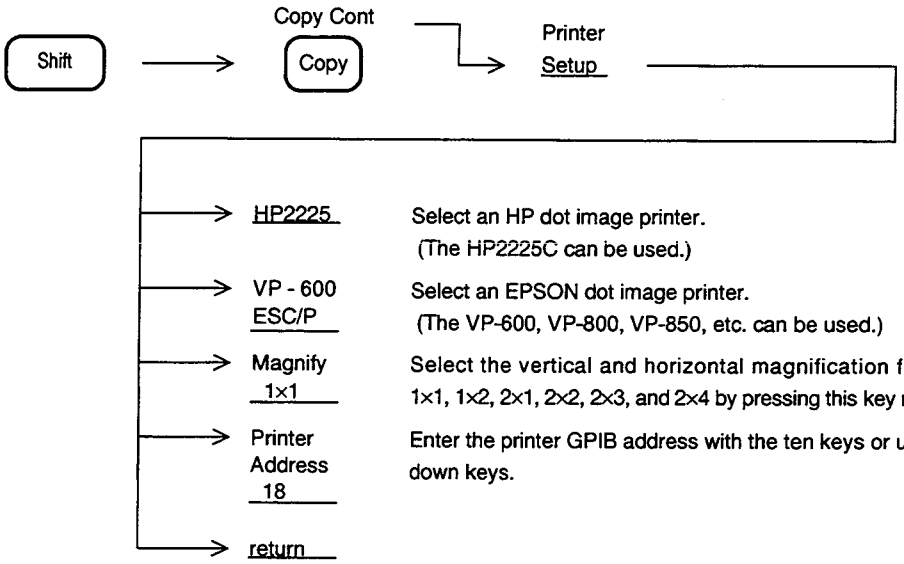
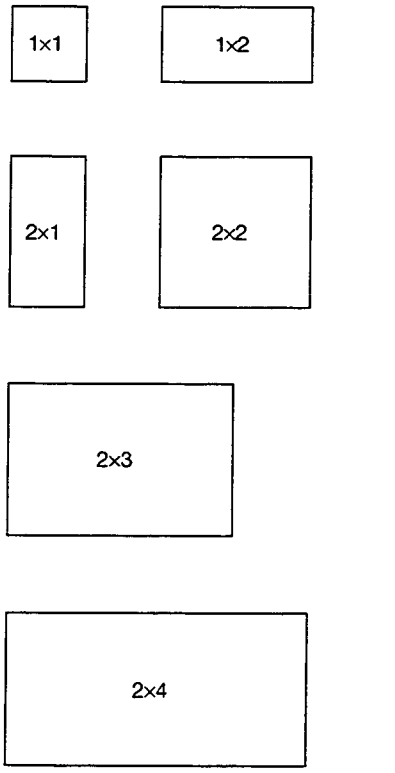
Selecting a Printer

To select the printer to use and to set its GPIB address, perform the following key operations.





Print Magnification Selection

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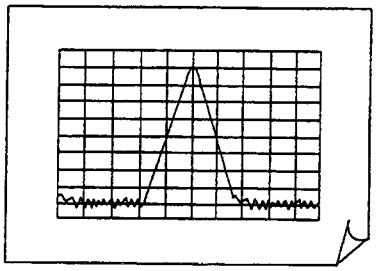
Setting the Plotter

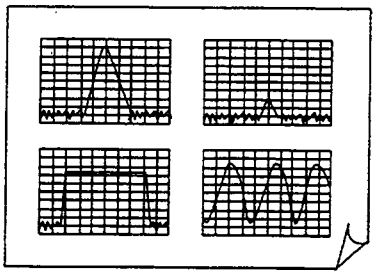
To select the plotter to use and to set its GPIB address, perform the following key operations.

Shift → Copy Cont → Copy → Plotter Setup

HP - GL / GP - GL	Select HP-GL or GP-GL type plotter by pressing this key.
Paper Size	Set the plotting chart size (A4/A3) and plotting size (full/Quarter).
Location	Select the plotting position (automatic/top left/top right/bottom left/bottom right) when plotting size was set to 1/4 (Quarter).
Item	Select the plotting item (all/trace/scale).
Plotter Address 18	Enter the plotter GPIB address with the ten keys or up-down keys.
return	



When Full Size is SpecifiedforPlotting



When Quarter Size is Specified for Plotting

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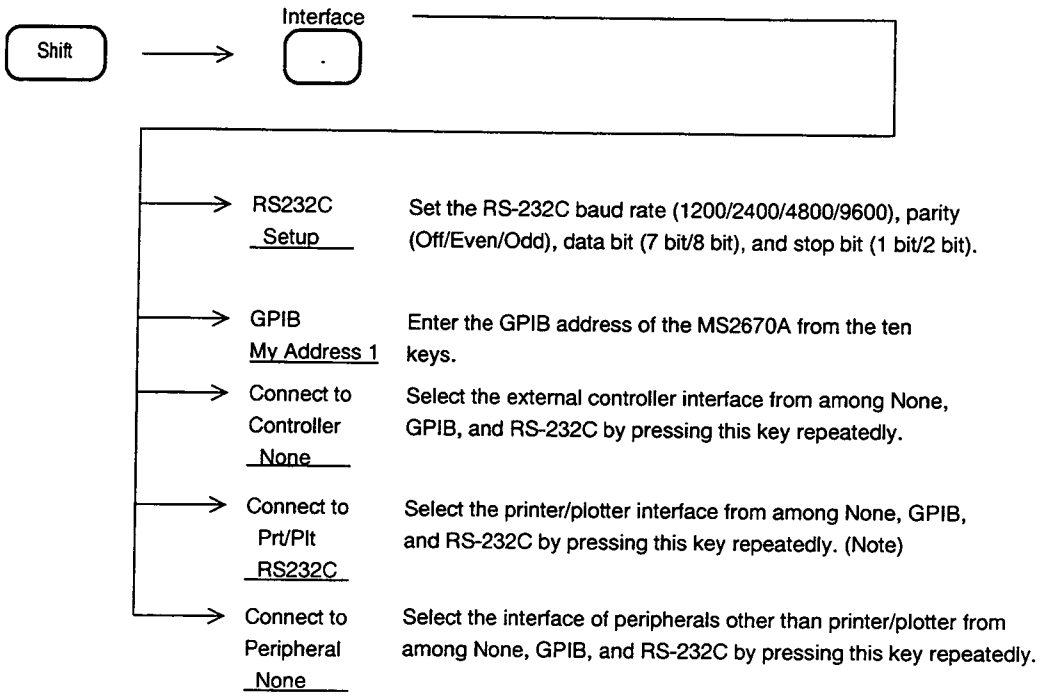
Setting Interface

To set the RS-232C baud rate and interface with external devices, perform the following key operations.



Note: When GPIB is selected as the external controller, for Prt/Plt, select from None and RS-232C.

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Executing Hard Copy

Copy Cont

Start hard copy by pressing the [Copy] key. When the screen-image data saving is selected, saves the data to the memory card.

Note: Set the printer or plotter to the ON LINE mode.

Notes:
- Some printer and plotter models take a considerable time to output a hard copy. This may cause a time-out error in the MS2670A and the hard copy operation may be interrupted.
  In this case, modify the time-out setting value via GPIB using an external controller.
  N88-BASIC ..... `PRINT Δ@1;"GTOUT Δ60"`
  PTL ..... `PUT Δ"GTOUT Δ 60"`

  Integer represented in units of second (s)

- Immediately after setting the copy execution, the sweep stops for a few seconds for data processing. After restarting the sweep, and beginning the printing at printer/plotter, the parameters can be set. After completion of the current copying, perform the next copying command.

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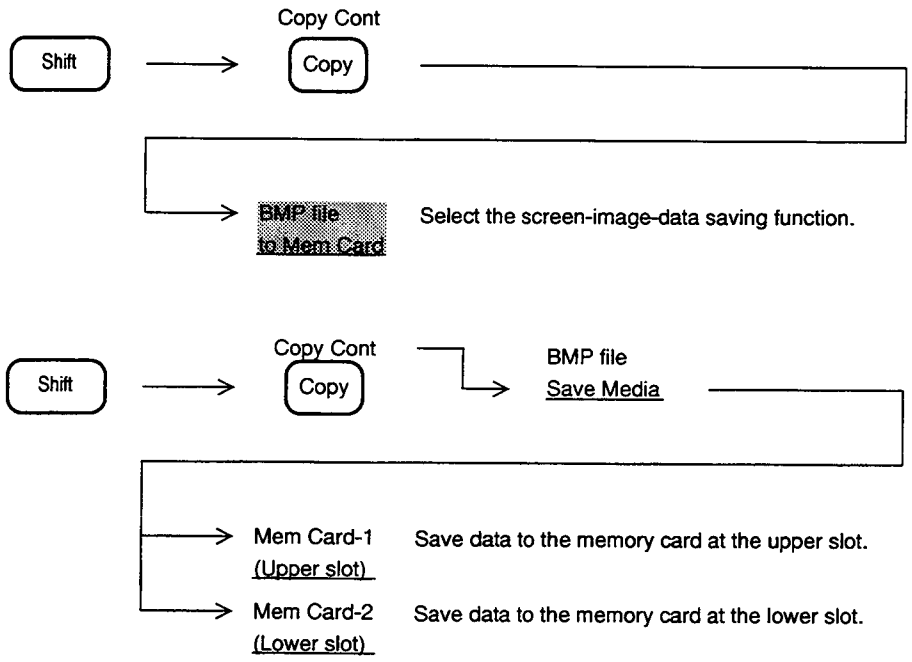
Saving Screen Image Data to Memory Card

The screen display contents can be saved to a memory card as a BMP-format (standard image data format of the Windows) file. After saving, the file in the memory card can be opened on any Windows-based PC.

Selecting Memory Card

To select the screen-image-data saving function and the memory-card slot at the front panel, perform the following key operations.



Executing Save

Saves the screen-image data to a memory card by pressing the Copy Cont / Copy key.
File name to be saved is automatically numbered.
When the menu is displayed in this saving mode, it is also saved as it is.
Use the memory card which is formatted by the MS2670A.

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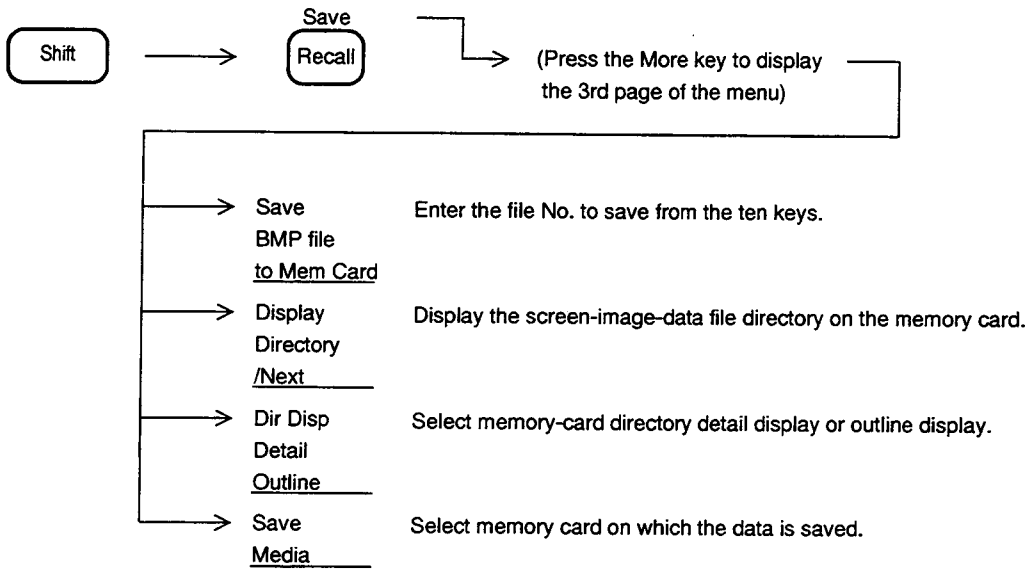
Executing Save by Specifying File Number

To save the screen image data to a memory card, perform the following key operations.



Only the screen-image-data is saved after deleting the menu and data input in this saving mode.
Use the memory card which is formatted by the MS2670A.

Displaying the Screen Image Data on PC

The saved screen image data can be displayed on a personal computer (PC) using the appropriate Windows software.
The saved files on a memory card are in the directory as shown below.

¥P-2110¥COPY¥COPY001.BMP
↑
File No.

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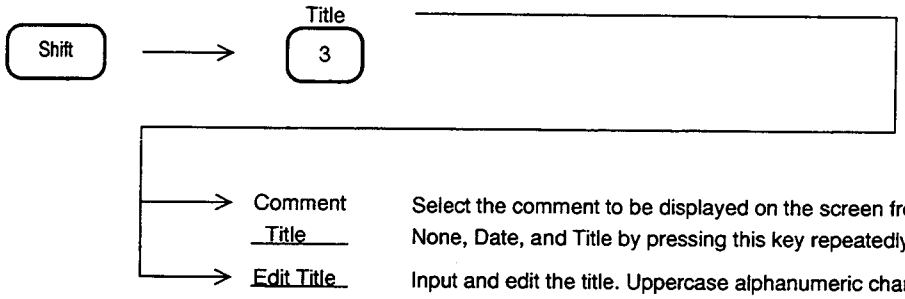
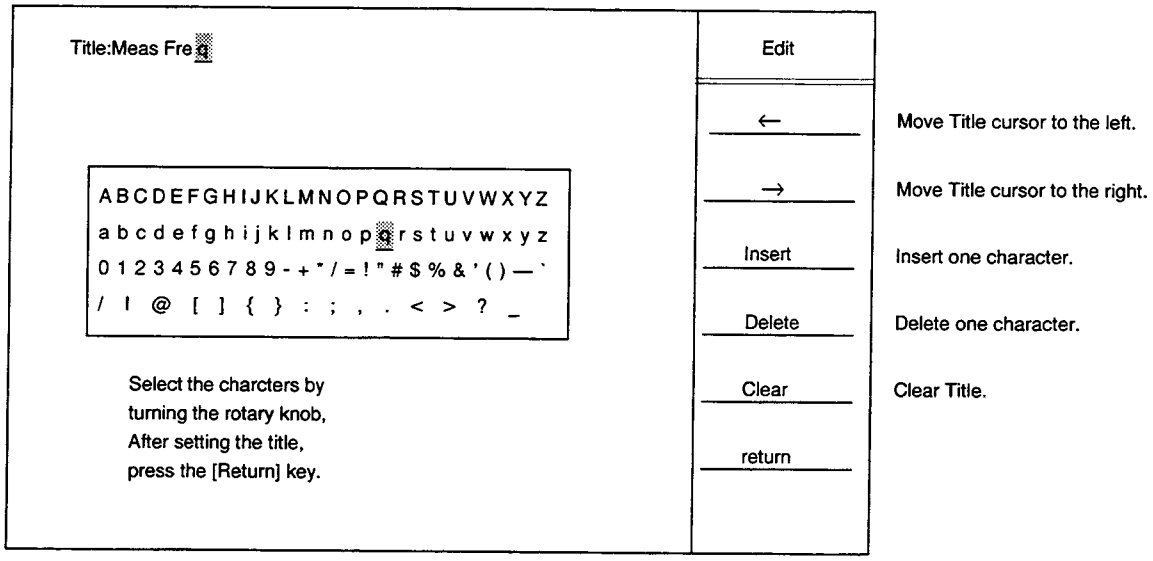
Displaying a Title

A character string of up to 19 letters can be displayed in the title display field at the top of the screen. To display a title character string, perform the following key operations.



Select the comment to be displayed on the screen from among None, Date, and Title by pressing this key repeatedly.

Input and edit the title. Uppercase alphanumeric characters, lower-case alphanumeric characters, numeric characters, and symbols can be used. Enter the characters with the rotary knob or up-down keys.



Title Edit Screen

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SECTION 12
PTA/DEFINE FUNCTIONS

This section describes the PTA function which uses the spectrum analyzer as the controller and the define function. This allows definition of PTA automatic measurement program execution by user input.

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SECTION 12
PTA/DEFINE FUNCTIONS

PTA Program Editing and Loading

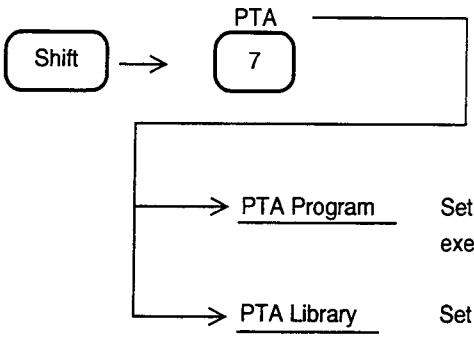
Input and edit the PTA program by utilizing an external computer editor such as PTL language (BASIC-like interpreter). For further details refer to the operating instructions of the PTA Control part.

Load the edited program to a memory card or the MS2670A program memory (192 kilobytes) via the RS-232C or GPIB interface.

The measurement data can be directly accessed as variables by system variable, system subroutine, and system function.

Setting PTA Program

To set a PTA program and library, perform the following key operations.



Set the PTA program list display, selection, loading, execution, stopping, etc.

Set the PTA library (set of program subroutines) file display, selection, loading, library program display, selection, deletion, execution, stopping, etc.

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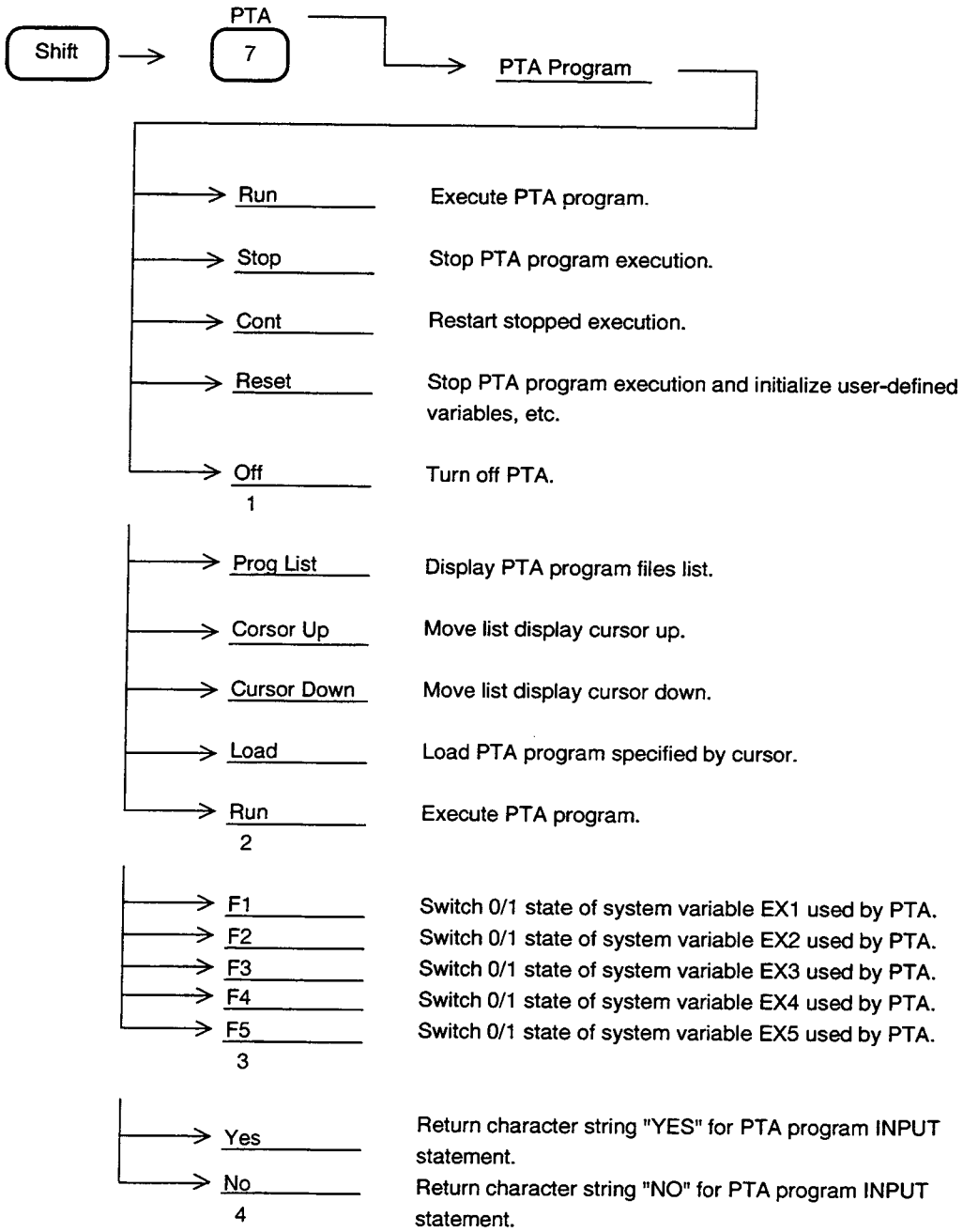
Loading and Executing PTA Program

To load and execute a PTA program, perform the following key operations.



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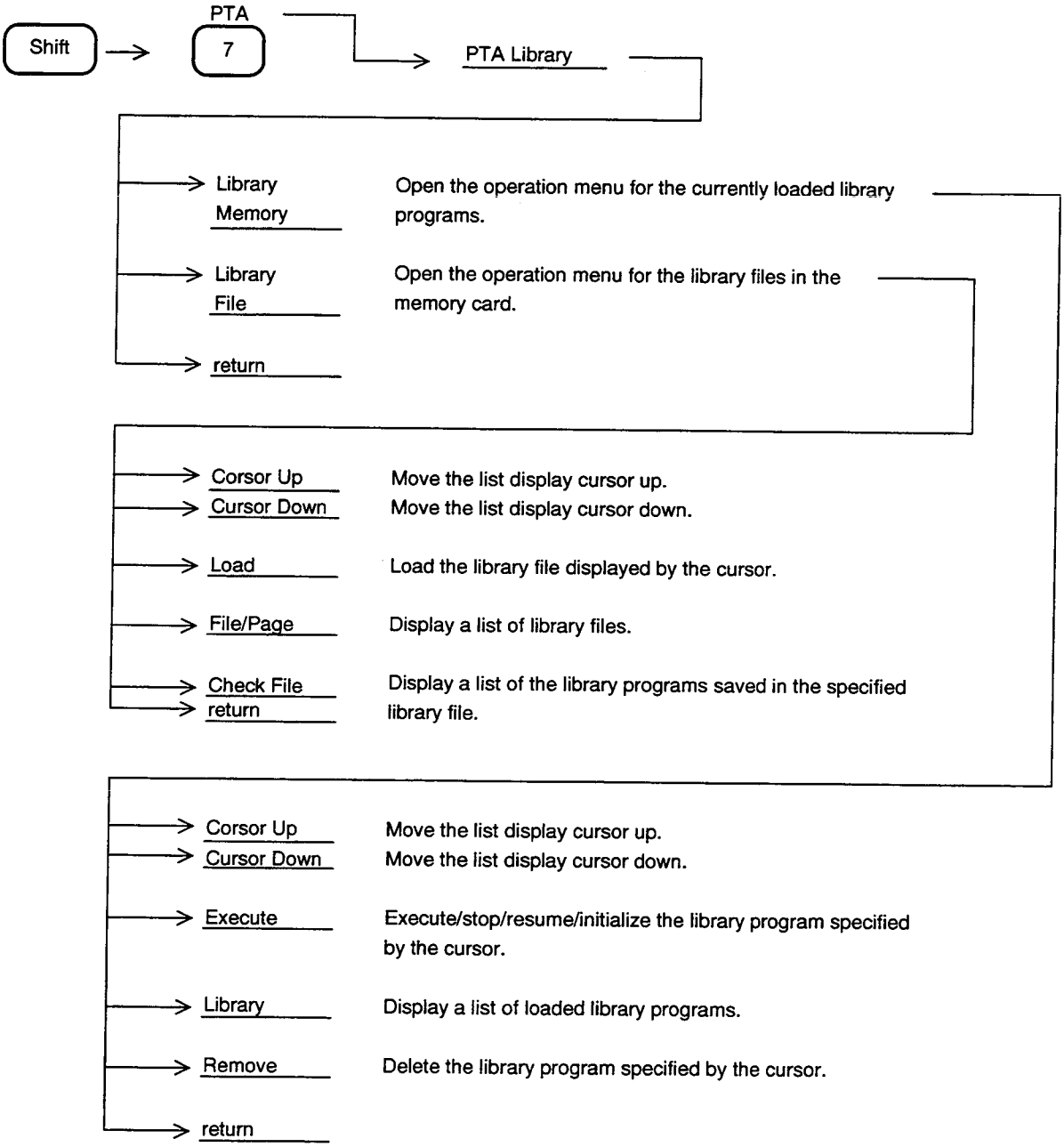
Loading and Executing Library Program

To load and execute a library program, perform the following key operations.



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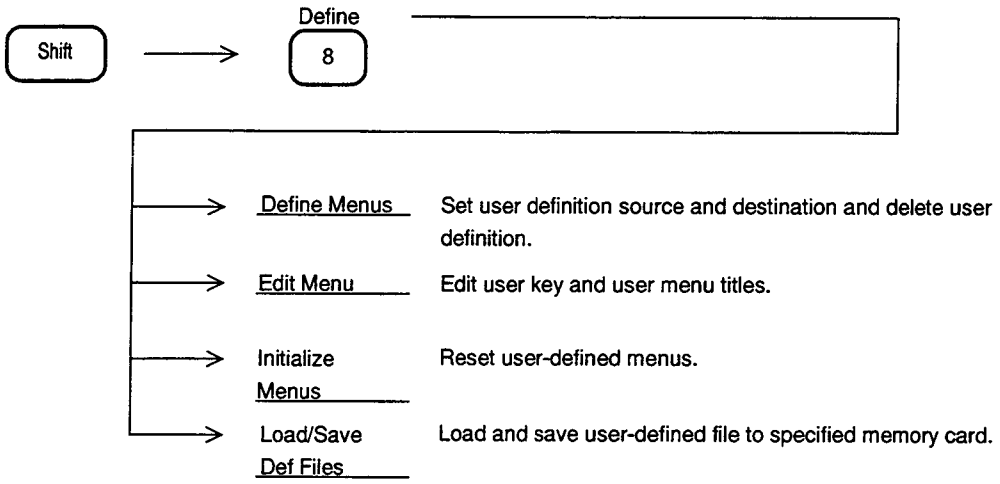
User-Definition Function

This paragraph describes the define function that allows definition of library program execution or normal key operation by user input.



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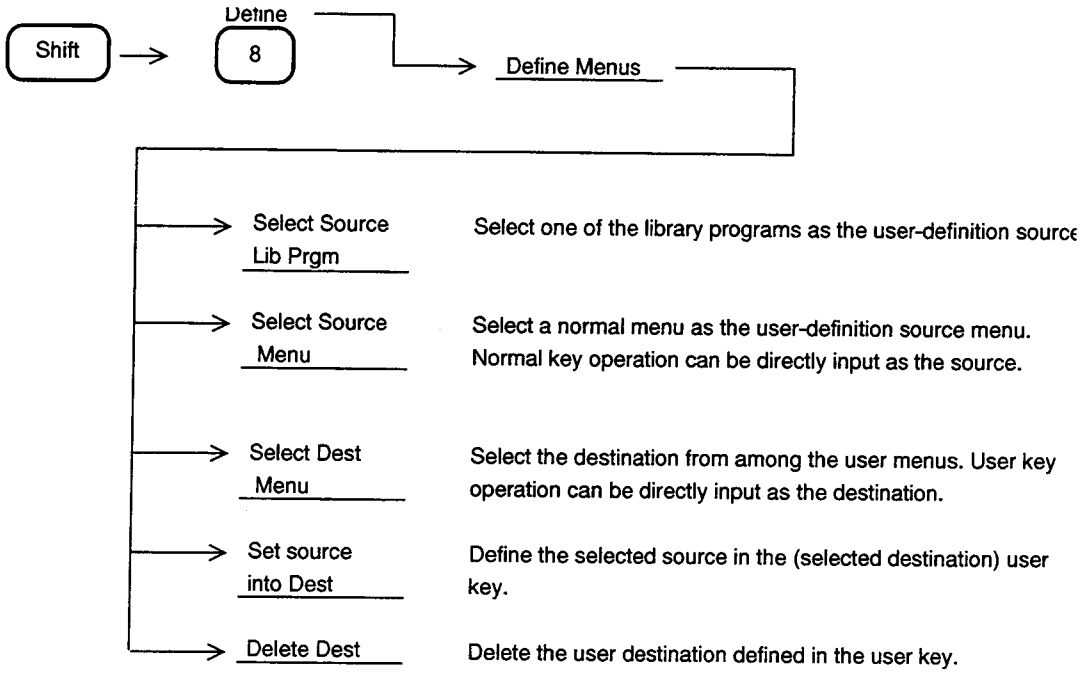
Defining User Menu

To select the library programs or normal key operations that are frequently used and define their function in the user keys, perform the following key operations.



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Example of User-Definition Operation

To define the frequency count measurement function in the User1 F1 key, perform the following key operations.

The following section also explains an example of key operations which define the title of the key "Meas Freq".

1. Select the source by " [Shift] [Define] Define Menus Select Source Menu" key operation.
2. Set frequency count measurement start at the source by " [Measure] Frequency Count Count On" key operation.
3. Select the destination by " [Shift] [Define] Define Menus Select Dest Menu" key operation.
4. Set the User1 F1 key as the destination by " [User] [F1] " key operation.

Source	Destination
F1-Key	F1-Key
Freq Count	User-1
Count On	—

User Definition Screen Display

5. Execute user key definition by " [Shift] [Define] Define Menus Set source into Dest" key operation.
6. Perform " [Shift] [Define] Edit Menu Select Source" key operation and select the User1 F1 key by " [User] [F1] " key operation.

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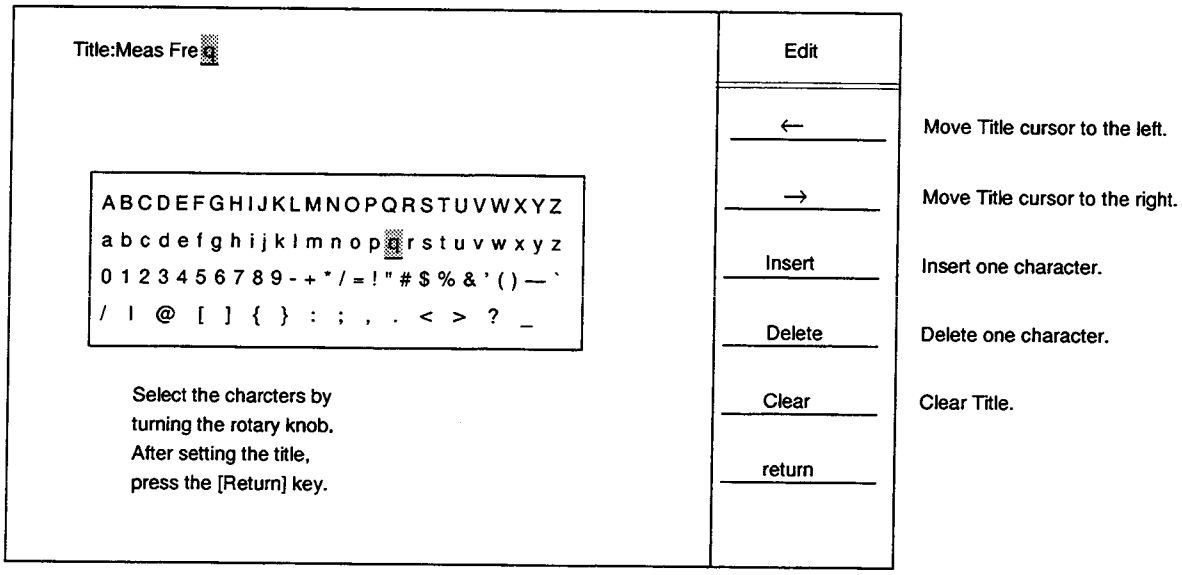
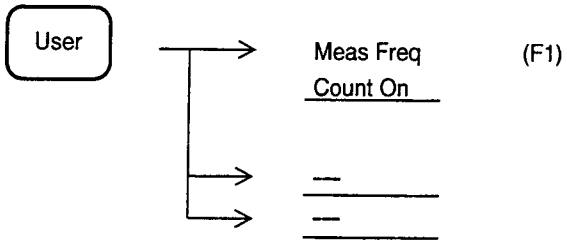
7 . Perform [Shift] [Define] Edit Menus Edit F-key menu key operation and enter "Meas Freq" at the title edit screen shown below by rotary knob and soft key operation.



Title Edit Screen

8 . Press the [User] key and check if the following is displayed at the F1 function key. Also, press the User1 [F1] key and check if frequency measurement is performed.



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SECTION 13

MEASUREMENT

This section describes the Measure key and the operating procedure for actual measurement examples.

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SECTION 13
MEASUREMENT

Measure Measurement Function

Various application measurements can be selected by performing the following key operations.

- **Noise Measure** — Measure the absolute value of the total noise power of the zone marker range.
- **C/N Ratio Measure** — Measure the carrier signal and noise power ratio.
  1
- **Occ BW Measure** — Measure the occupied bandwidth. Select the XdBDOWN mode or N% of POWER mode.
- **AdJ ch pwr Measure** — Measure the adjacent channel leakage power.
  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.
- **Mask**
  2 — Set the frequency domain standard line and judge quality relative to the standard. Select the mask table, mask movement, measurement mode, mask table creation, mask table load/save, etc.
- **Time Template** — Set the time domain standard line and judge quality relative to the standard. Select the template table, template movement, measurement mode, table creation, table load/save, etc.
- **Burst AvgPower** — Measure the average power of a burst signal in the time domain. Select the start/end points.
- **Off**
  3

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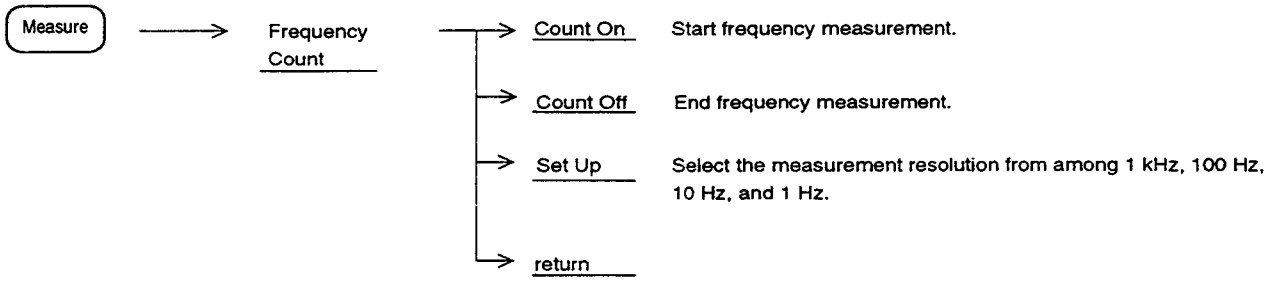
Frequency Measurement Function

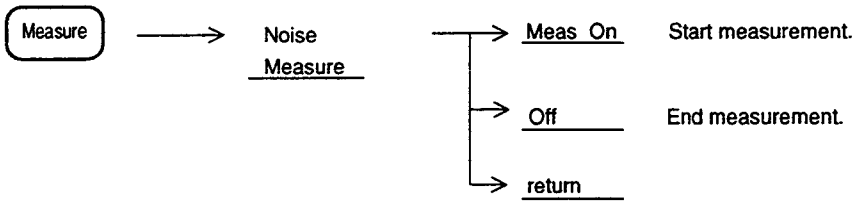
To measure the marker frequency at high resolution, perform the following key operations.



Notes:
- If the RBW is too small compared to frequency span, it takes more times to count because of the internal automatic tuning operation.
- In the following cases, the frequency may not be counted correctly because of the undesired adjacent noise.
  ① Signal level is less than -30 dB from reference level.
  ② Level difference between signal and noise is less than 20 dB.

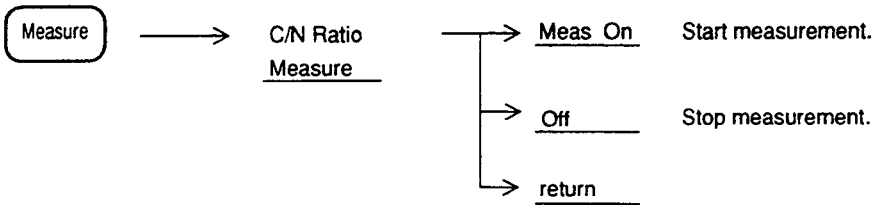
Measuring Noise Power

To measure the total noise power of the zone marker range, perform the following key operations.



Measuring C/N Ratio

To measure the C/N ratio, perform the following key operations.



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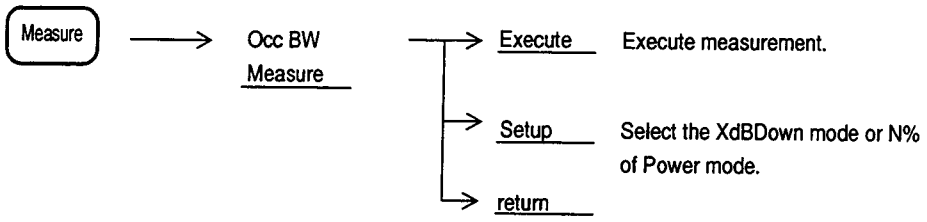
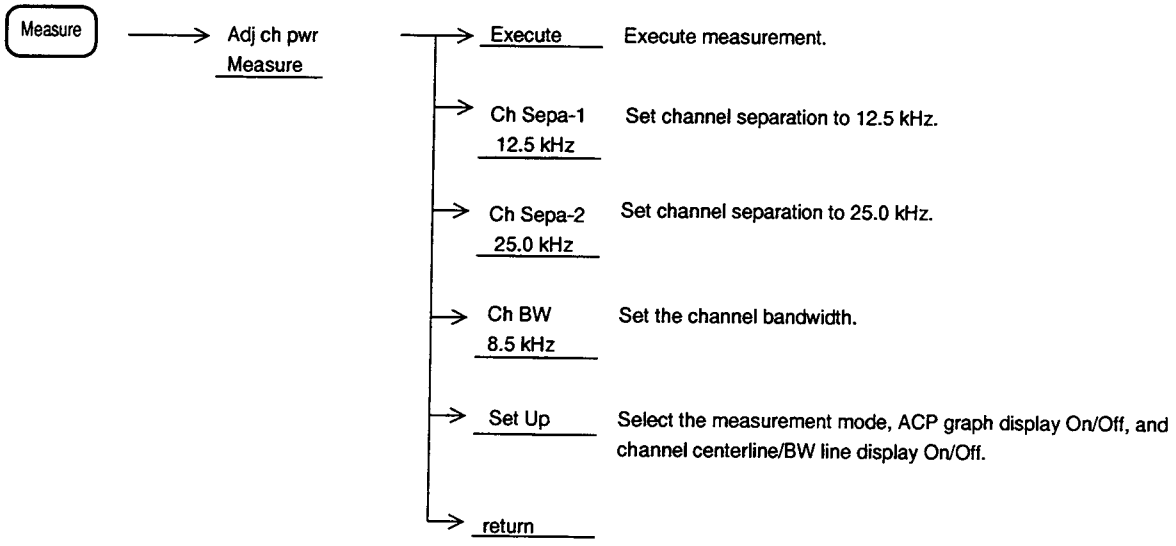
Measuring Occupied Bandwidth

To measure the occupied bandwidth, perform the following key operations.



Measuring Adjacent Channel Leakage Power

To measure the adjacent channel leakage power, perform the following key operations.



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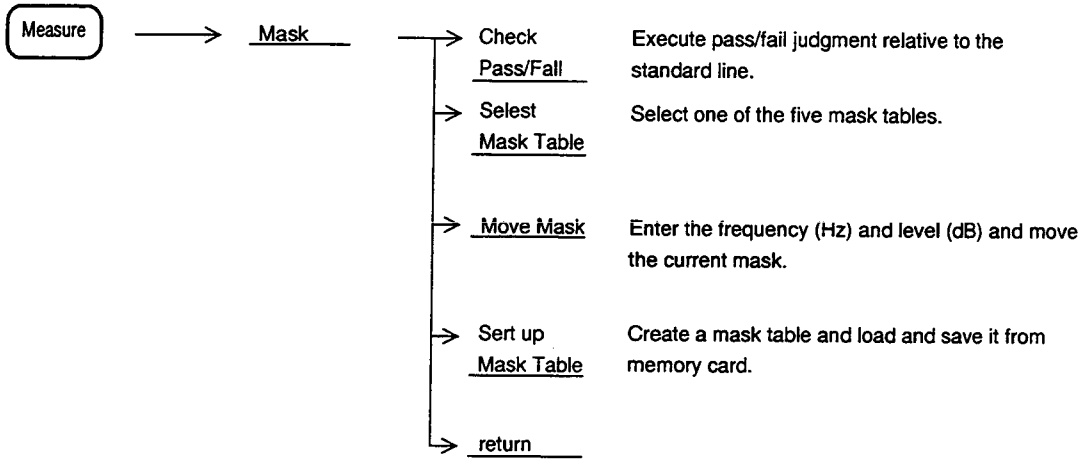
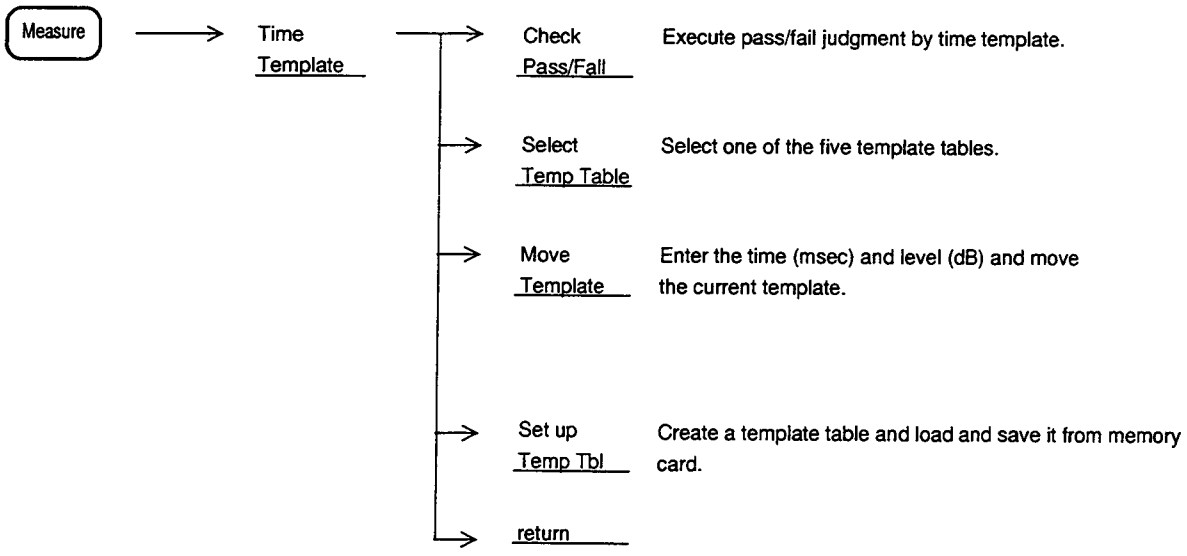
Pass/Fail Judgment by Mask

To perform pass/fail judgment relative to the frequency domain standard line (mask), perform the following key operations.



Pass/Fail Judgment by Time Template

To perform pass/fail judgment by time domain template, perform the following key operations.



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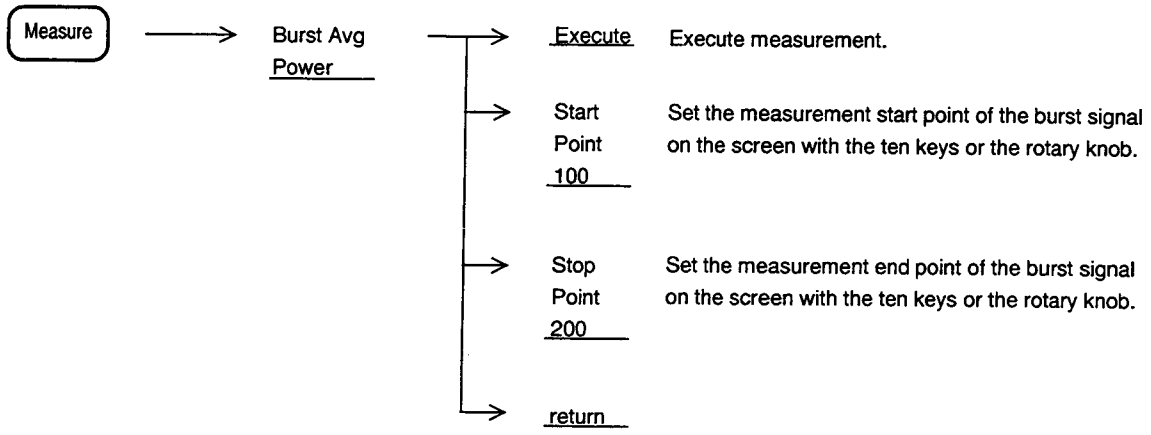
Measuring Burst Average Power

To measure the average power of a burst wave in the time domain mode, perform the following key operations.



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Example of Time Template Creation (PHS Transmit Signal)

1) Burst wave screen setting (time domain):

Time span : 1 ms
Trigger : –200 us
RBW : 1 MHz
VBW : 1 MHz
RLV : +15 dBm

2) Template data overwrite method:

- Template scale number setting (No. 1 here):
  Press [Time], [Measure] until F1: <<Time Template>> is displayed, then press F1: <<Time Template>>, F5: <<Setup Temp Table>>, F1: <<Select Temp Table>>, F1: <<Temp-1>>, F6: <<return>>.
- Data write preparation: Select Relative with F2: <<Level>>.
  F3: <<Make Up Temp Table>>, [More], F2: <<Select Line>>, F1: <<Limit1 Upper>>, F6: <<return>>, [More] (Here, Limit1 Upper is specified.)
- Data write: Sequentially write the coordinates (time, level) of the template to be created in ascending order of time value.
  Write data by alternately repeating time setting and level setting.
  * Time setting (example: –200 us) : [+/–], [2], [0], [0], [us]
  * Level setting (example: –65 dB) : [+/–], [6], [5], [dB]
- Limit1 Lower write: Press [More], F2: <<Select Line>>, F2: <<Limit 1 Lower>>, F6: <<return>>, [More], then write the template coordinate data.

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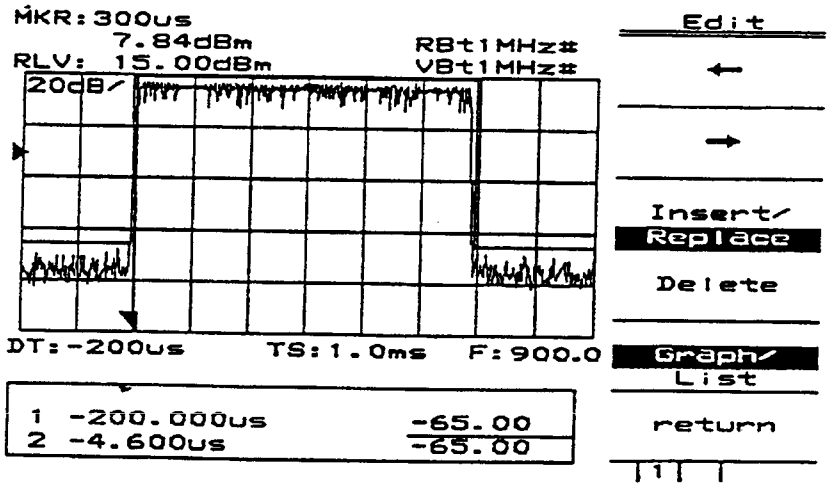
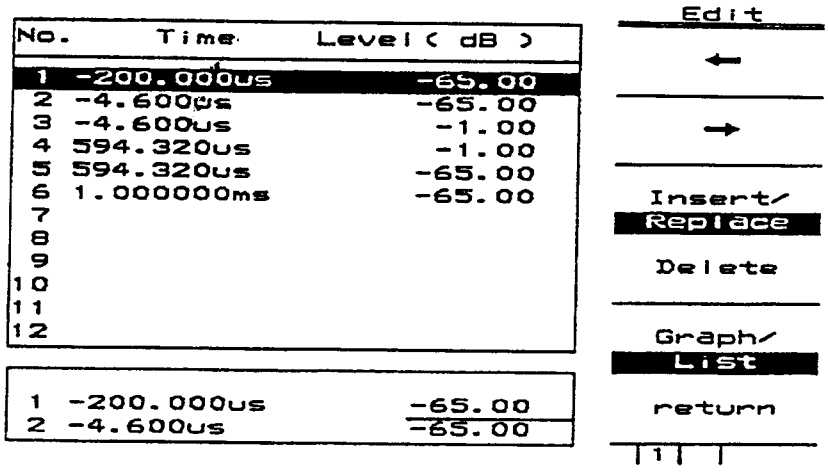


TEMPLATE Creation Screen (Graph)



TEMPLATE Creation Screen (List)

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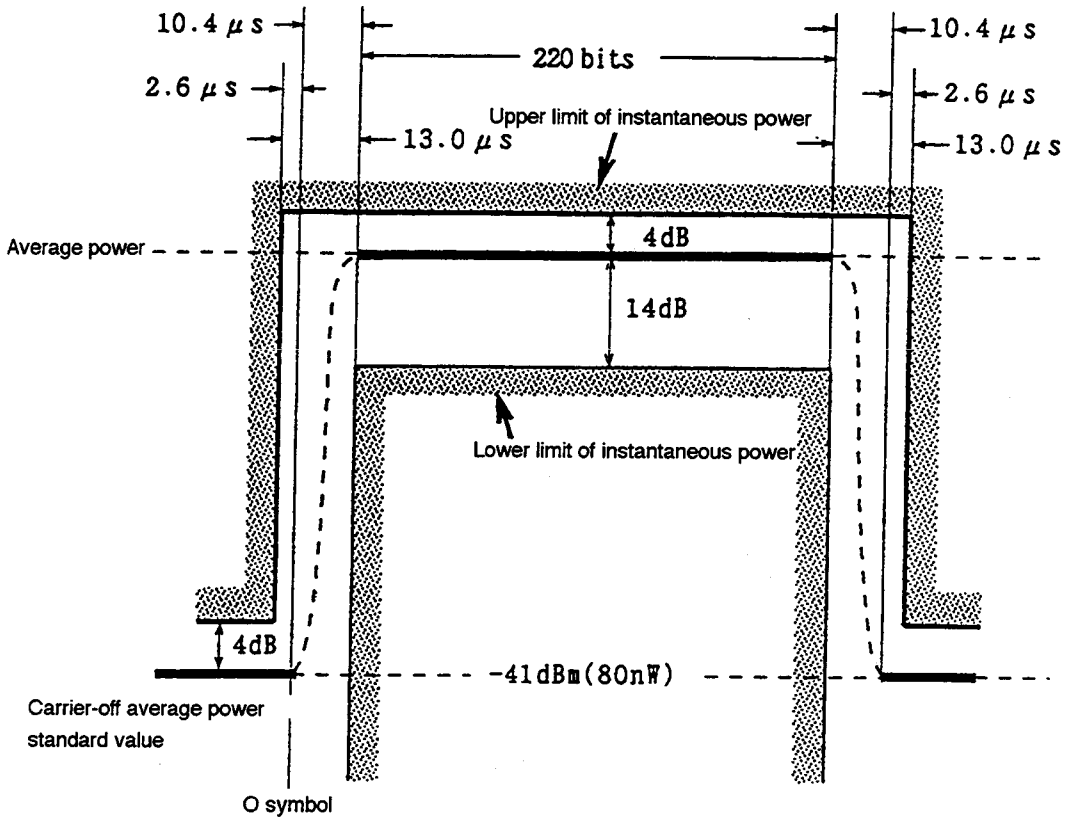
3) Template coordinates (PHS: RCR STD-28)



Coordinate reference line (Trigger position → left end of screen: –200 μs)

When average power in burst of input signal is 19 dBm and SPA REF LEVEL is 24 dBm

- Limit1 Upper coordinates

(1)	–200 μs,	–65 dB
(2)	–4.6 μs,	–65 dB
(3)	–4.6 μs,	–1 dB
(4)	594.32 μs,	–1 dB
(5)	594.32 μs,	–65 dB
(6)	1 ms,	–65 dB

- Limit1 Lower coordinates

(1)	8.40 μs,	–100 dB
(2)	8.40 μs,	–19 dB
(3)	581.32 μs,	–19 dB
(4)	581.32 μs,	–100 dB

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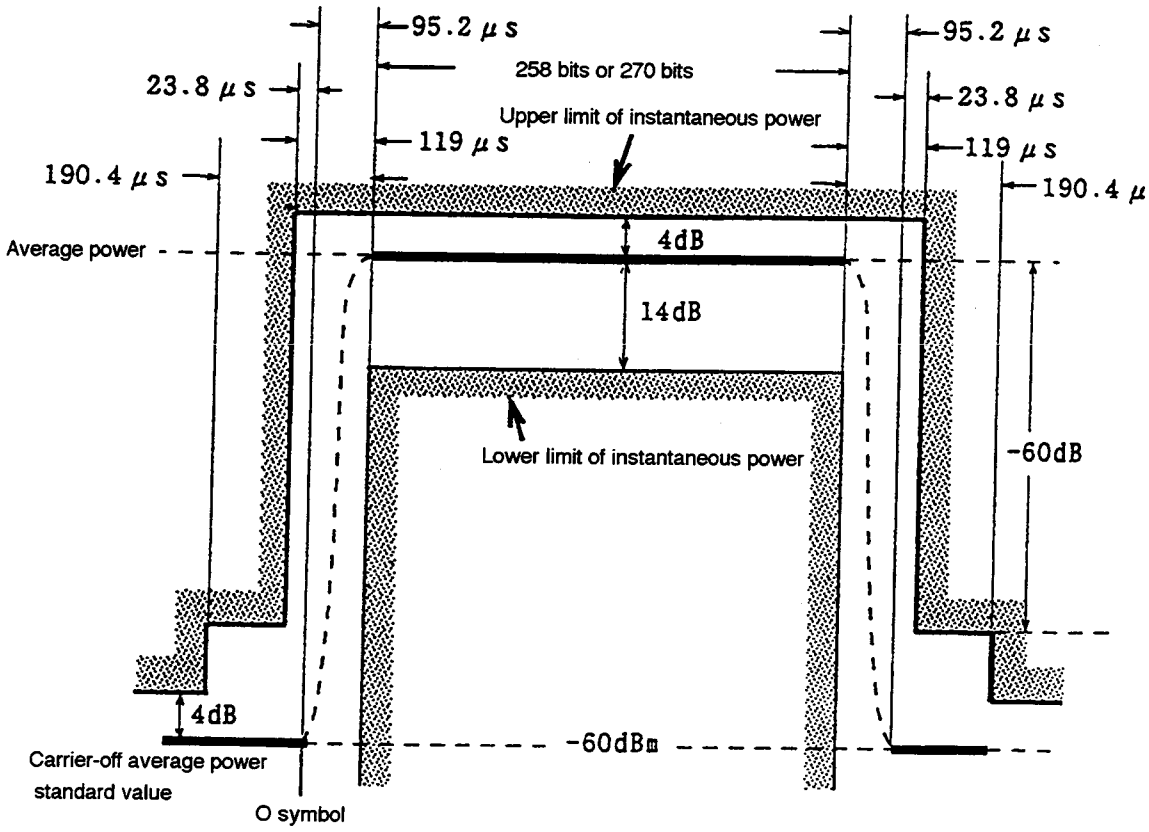
4) Template coordinates (PDC-RCR STD-27B)



Coordinates standard line (Trigger position → screen left end: –1 ms)

When average power in burst of input signal is 10 dBm and SPA REF LEVEL is 15 dBm

- Limit1 Upper coordinates

(1)	–1.7 ms,	–71 dB
(2)	–114.21 μs,	–71 dB
(3)	–114.21 μs,	–65 dB
(4)	42.81 μs,	–65 dB
(5)	42.81 μs,	–1 dB
(6)	6.6238 ms,	–1 dB
(7)	6.6238 ms,	–65 dB
(8)	6.6952 ms,	–65 dB
(9)	6.6952 ms,	–71 dB
(10)	8.3 ms,	–71 dB

- Limit1 Lower coordinates

(1)	76.19 μs,	–100 dB
(2)	76.19 μs,	–19 dB
(3)	6.5048 ms,	–19 dB
(4)	6.5048 ms,	–100 dB

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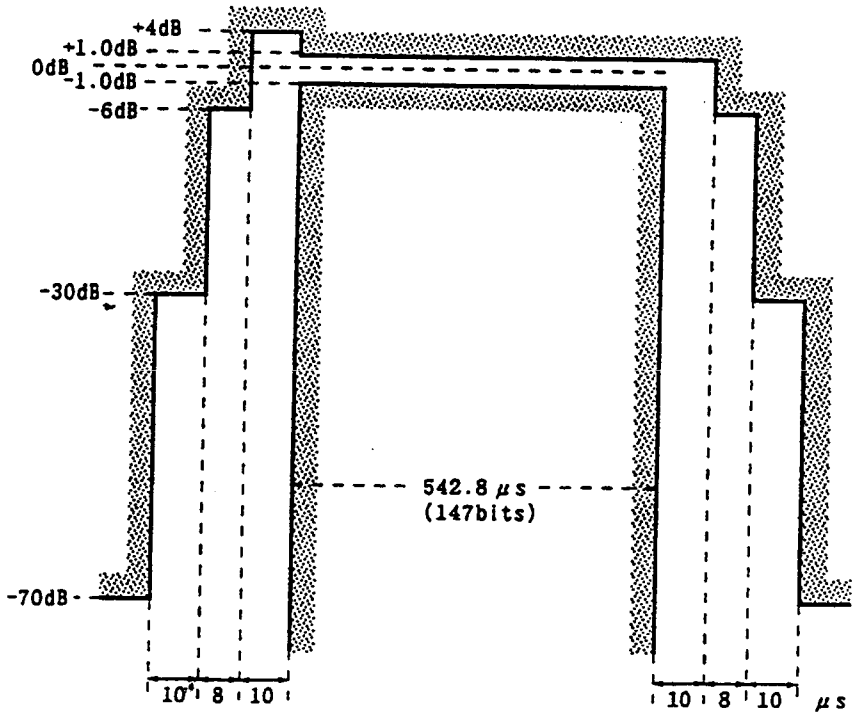
5) Template coordinates (GSM, DCS1800)



Coordinates standard line (Trigger position → left end of screen: –75.0 μs)

- Limit1 Upper coordinates

(1)	–75.0 μs,	–75 dB
(2)	–25.0 μs,	–75 dB
(3)	–25.0 μs,	–35 dB
(4)	–150 μs,	–35 dB
(5)	–150 μs,	–11 dB
(6)	–7.0 μs,	–11 dB
(7)	–7.0 μs,	–1 dB
(8)	3.0 μs,	–1 dB
(9)	3.0 μs,	–4 dB
(10)	555.8 μs,	–4 dB
(11)	555.8 μs,	–11dB
(12)	563.8 μs,	–11dB
(13)	563 8 μs,	–35dB
(14)	573 8 μs,	–35dB
(15)	573 8 μs,	–75dB
(16)	625.0 μs,	–75dB

- Limit1 Lower coordinates

(1)	3 0 μs,	–100 dB
(2)	3.0 μs,	–6 dB
(3)	545.8 μs,	–6 dB
(4)	545.8 μs,	–100 dB

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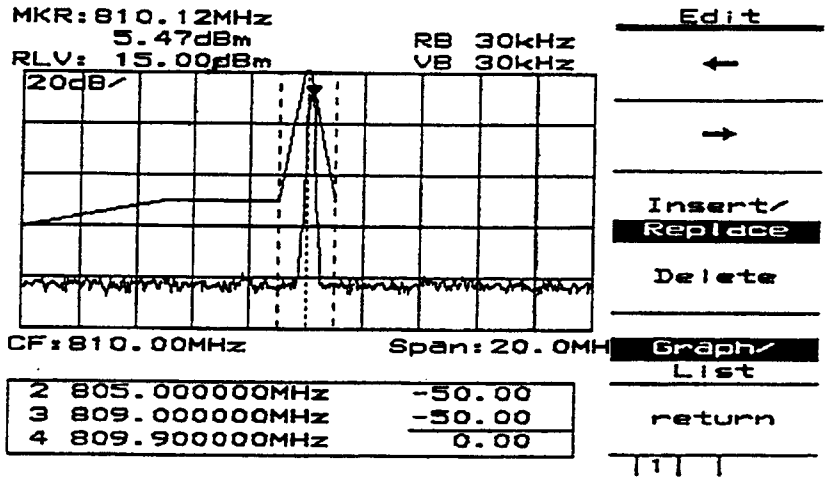
MASK Creation in Frequency Domain Mode

1) Mask data write method:

- Template scale number setting (Here it is 1.):
  Press [A, B] and F1: <<Trace A>> and press [Measure] until F3: <<Mask>> is displayed, then press F3: <<Mask>>, F5: <<Setup Mask Table>>, F1: <<Select Mask Table>>, F1: <<Mask-1>>, F6: <<return>>.
- Data write preparation: Select Relative with F2: <<Level>>.
  F3: <<Make Up Mask Table>>, [More], F2: <<Select Line>>, F1: <<Limit1 Upper>>, F6: <<return>>, [More] (Here, Limit1 Upper is specified.)
- Data write: Write the coordinates (frequency, level) of the template to be created in ascending order of time value.
  Write the data by alternately repeating time setting and level setting.
  Frequency setting (example: 800 MHz): [8], [0], [0], [MHz]
  Level setting (example: –60 dB): [+/–], [6], [0], [dB]
- Limit1 Lower write: Press [More], F2: <<Select Line>>, F2: <<Limit1 Lower>>, F6: <<return>>, [More], then write the mask data coordinates data.



MASK Creation Screen (Graph)

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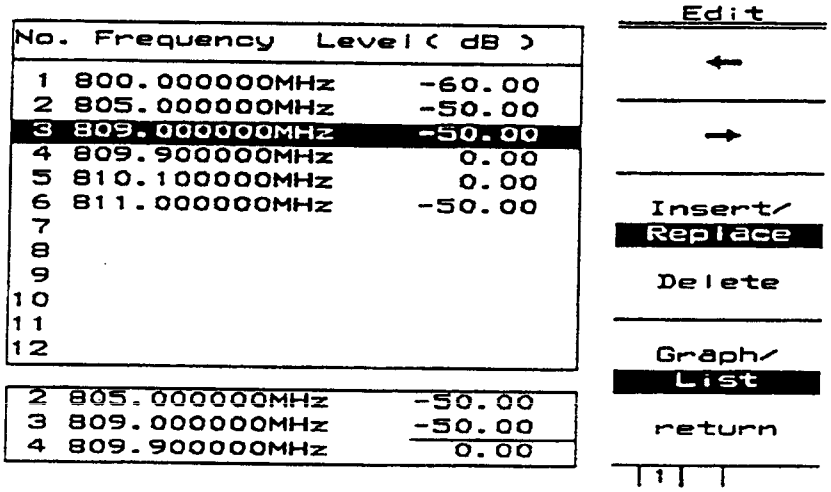

MASK Creation Screen (List)

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SECTION 14

TRACKING GENERATOR

This section describes the Tracking Generator's function-key menus, Normalize/Instant-Normalize functions, measurement example of band-pass-filter transmission-characteristics/reflection-characteristics, and notes on active-device (including amplifier) measurement.

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Transmission Characteristics Measurement 14-6

- Characteristics Outline Measurement 14-6
- 3dB-Bandwidth and Insertion-Loss Accurate Measurement 14-9

Reflection Characteristics Measurement 14-13

Notes on Active Device Measurement 14-17

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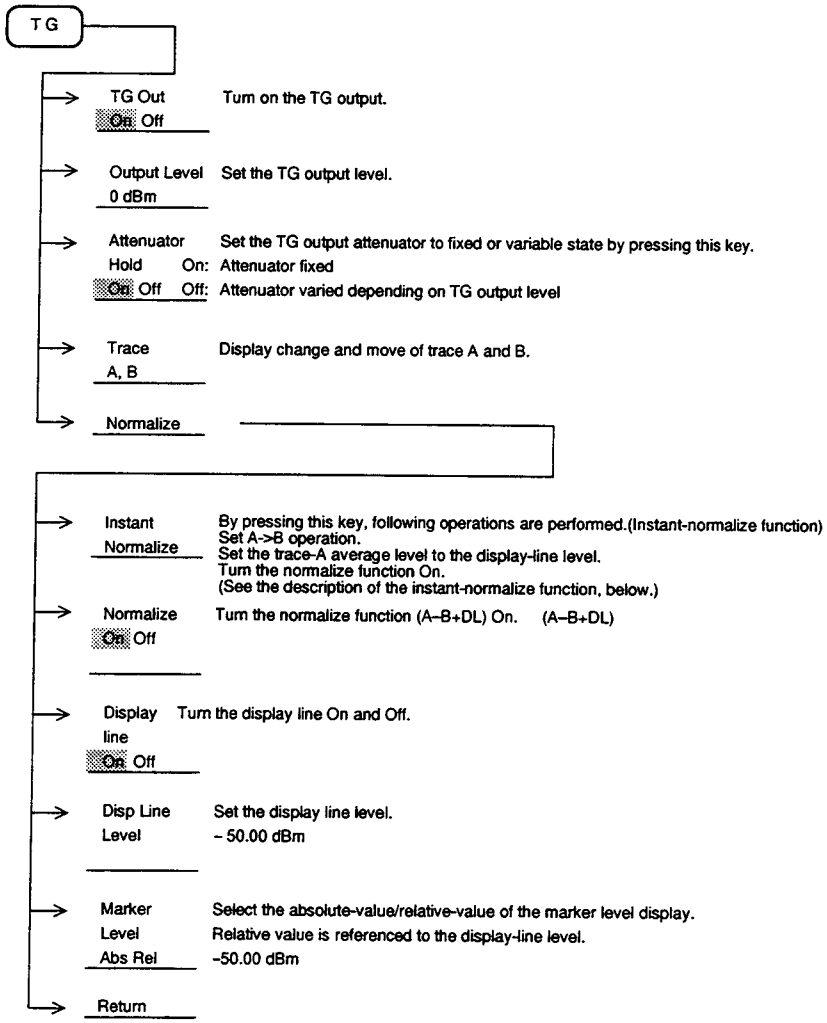
SECTION 14
TRACKING GENERATOR

Tracking Generator Menus

The Tracking Generator is installed in the MS2670A to measure the transmission characteristics and reflection characteristics of the passive devices (filters, etc.) and active devices (amplifier, etc.).

To turn the output On/Off, set the output level, and compensate the insertion loss of the cables/bridges, etc (normalizing function), perform the following key operations.



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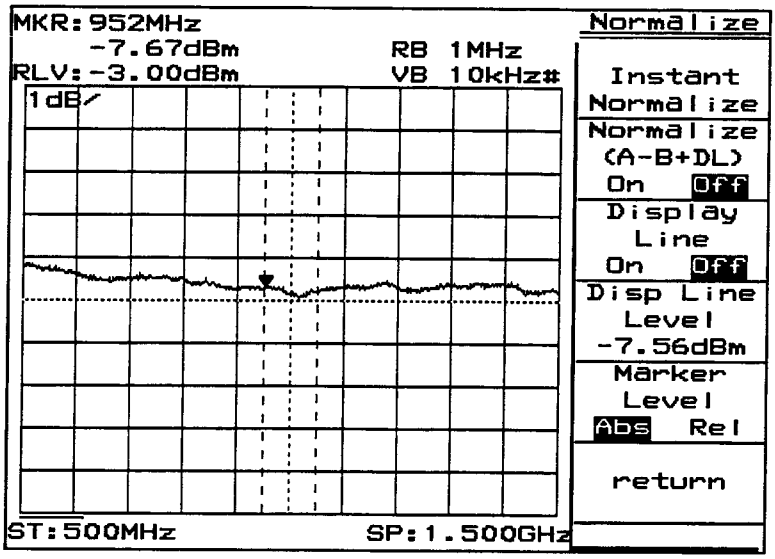
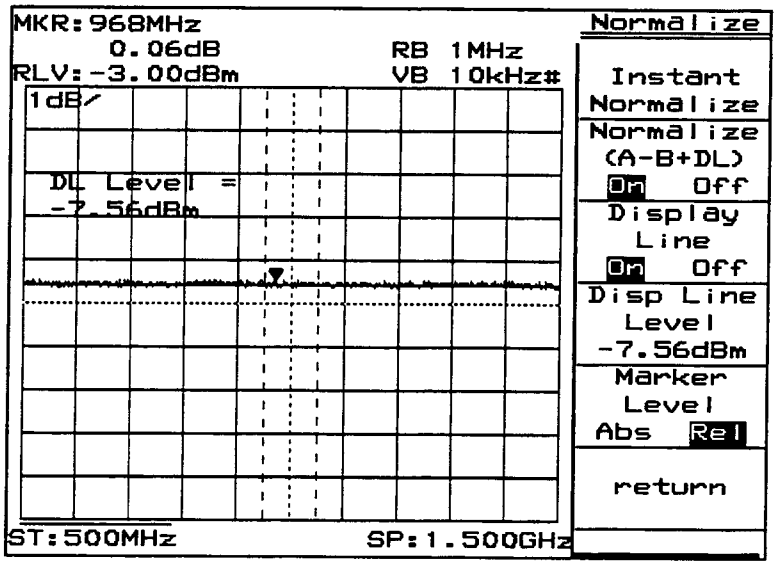
Normalize/Instant-Normalize Function

For accurate measurement of the transmission characteristics and reflection characteristics by using TG, the insertion-loss frequency characteristics of the cables/bridges must be compensated.
The normalize function is used for this purpose.

The following figure shows the frequency characteristics which is not compensated for the coaxial cable connected from the TG Output to RF Input. The figure shows approximately one dB frequency-characteristics ripple.



The normalize function compensates this frequency-characteristics ripple.
The following figure shows the frequency characteristics which is compensated by the instant normalize function.



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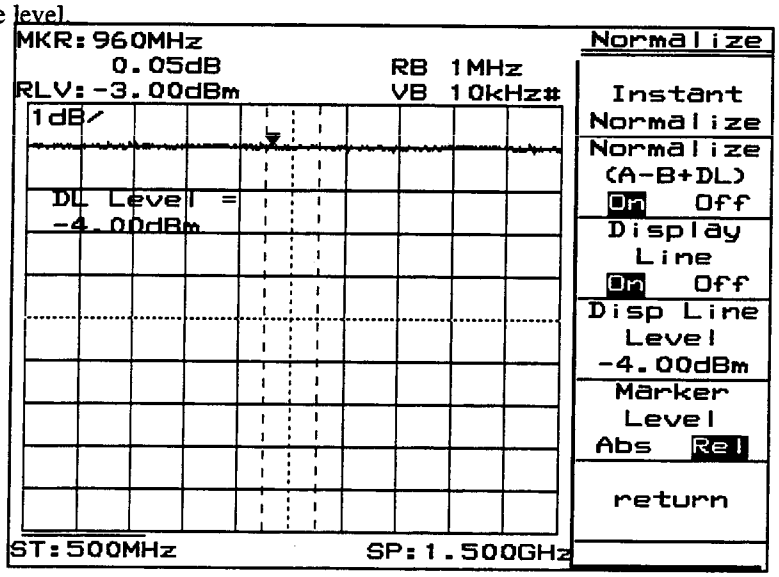
By the instant normalize function, the compensated waveform is displayed at the averaged level of the previous uncompensated waveform. The marker level is displayed with the relative value referenced to the display line level.

When using the normalize function, the waveform is displayed with reference to the display line. By changing the display line level, the compensated waveform can be displayed at any position.
The following figure shows the waveform moved by one scale division below the top line by changing the display-line level.



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Hereafter, transmission-characteristics/reflection-characteristics measurements of a band-pass filter (BPF) are described below for TG application examples.

Transmission Characteristics Measurement

Typical transmission characteristics measurement of a BPF is described below.
BPF characteristics:

- Center frequency: 500 MHz
- 3dB bandwidth: 27 MHz
- Insertion loss: -0.4 dB
- Input/Output connector: N jack

Characteristics Outline Measurement

(1) Setup:

Connect the TG Output to BPF input, and BPF output to RF Input with a coaxial cable, respectively.

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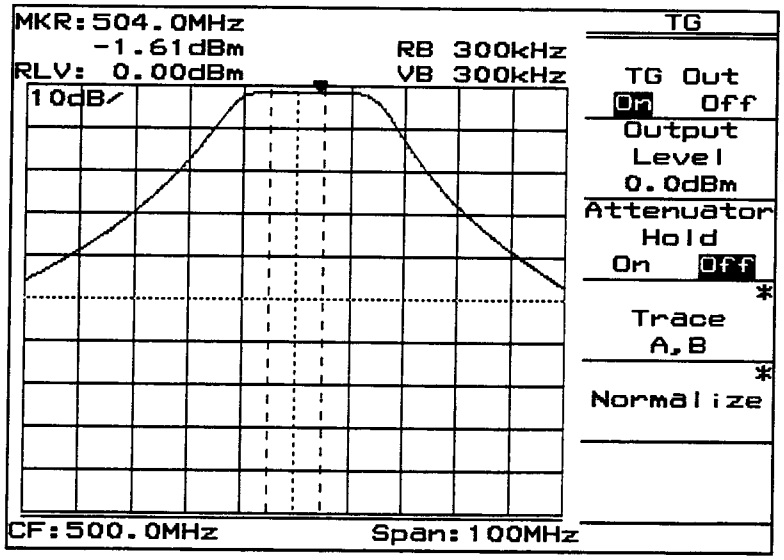
(2) Setting parameters and measuring characteristics outline:

- Setting parameters
  - Initializing the MS2670A
    [Preset], F1: << Preset All >>
  - Setting center frequency to 500 MHz
    [Frequency], [5], [0], [0], [MHz]
  - Setting span to 100 MHz
    [Span], [1], [0], [0], [MHz]
  - Setting reference level to 0 dBm
    [Amplitude], [0], [dBm]
  - Setting TG to On
    [TG], F1:<<TG On Off>>

The following figure shows the measurement results.
When accurate results are not required, each frequency and level can be read using a marker. In this case, the marker unit is dBm and TG output level is 0 dBm. The marker level indicates the insertion loss, directly.



- When the TG output level is set to other than 0 dBm, the insertion loss can be read in dB units by setting the marker level display to the relative value from the reference level, as illustrated in the following procedures.
  - Setting the display-line to On. Setting the display-line level to the same as the TG output level. Setting the marker level display mode to the relative value.
    Displaying the 2nd page of the TG menu: [TG], [More]
    F3: <<Display Line On Off>>
    F4: <<Display Line Level>>, (Setting the display-line level to the same as the TG output level)
    F5: <<Marker Level Abs Rel>>

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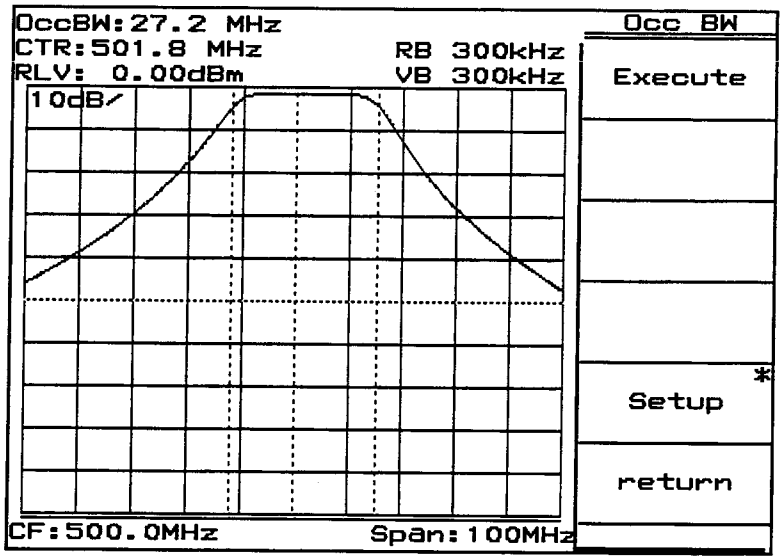
(3) Measuring center frequency and 3dB bandwidth:

Using the measurement function of the occupied bandwidth, measure the center frequency and 3dB bandwidth of the BPF.

- Setting xdB method and 3dB Down of the Occ BW measurement.
  Displaying the 2nd page of the Measure menu : [Measure], [More], F1:<<Occ BW>>, F5:<<Setup>>, F1:<<Method N% of Pwr xdB Down>>, F3:<<xdB Value>>, [3], [dBm]
- Executing the Occ BW measurement.
  Displaying the 2nd page of the Measure menu : [Measure], [More], F1:<<Occ BW>>, F1:<<Execute>>



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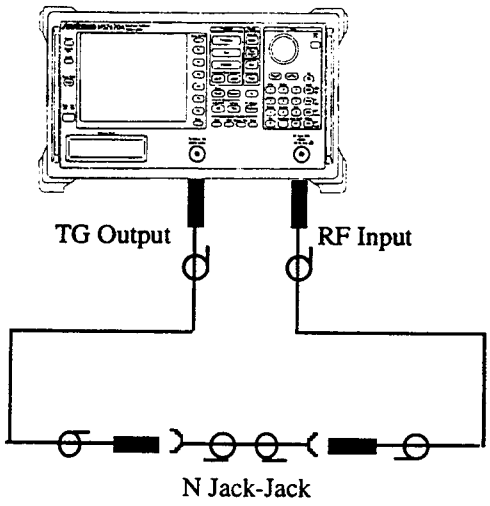
3dB-Bandwidth and Insertion-Loss Accurate Measurement

When accurate measurement is required, the measurement level accuracy of the spectrum analyzer and insertion loss of the connecting cables must be considered. In this case, use the normalize function to calibrate these error factors.

An accurate 3dB bandwidth/insertion loss measurement procedure utilizing the normalize function, is shown below.

(1) Measuring and calibrating (normalizing) the compensation factor of measurement system.
Remove the BPF and connect only the coaxial cables.



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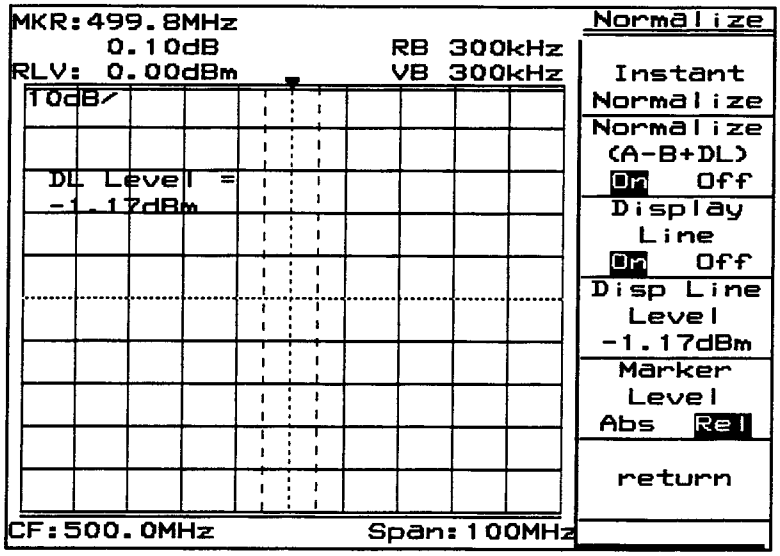
Measuring the compensation factor of the measurement system to calibrate the frequency characteristics as shown below.

- Initializing the MS2670A:
  [Preset], F1: << Preset All >>
- Setting center frequency to 500 MHz:
  [Frequency], [5], [0], [0], [MHz]
- Setting span to 100 MHz:
  [Span], [1], [0], [0], [MHz]
- Setting reference level to 0 dBm:
  [Amplitude], [0], [dBm]
- Setting TG to On:
  [TG], F1:<<TG On Off>>
- Executing the instant normalize function:
  [More], Displaying the 2nd page of the TG menu : F1:<<Instant Normalize>>



Note: Before executing the instant normalize function, turn the Normalize (A-B+DL) to Off, as shown below.

Displaying the 2nd page of the TG menu: [TG], [More], Turning the normalize (A-B+DL) function to Off : F2:<<Normalize (A-B+DL) On Off>>

The instant normalize function normalizes the current displaying Trace-A waveform.

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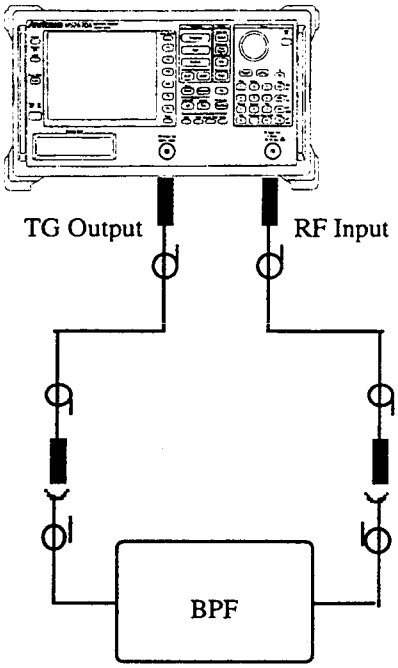
(2) Setup:

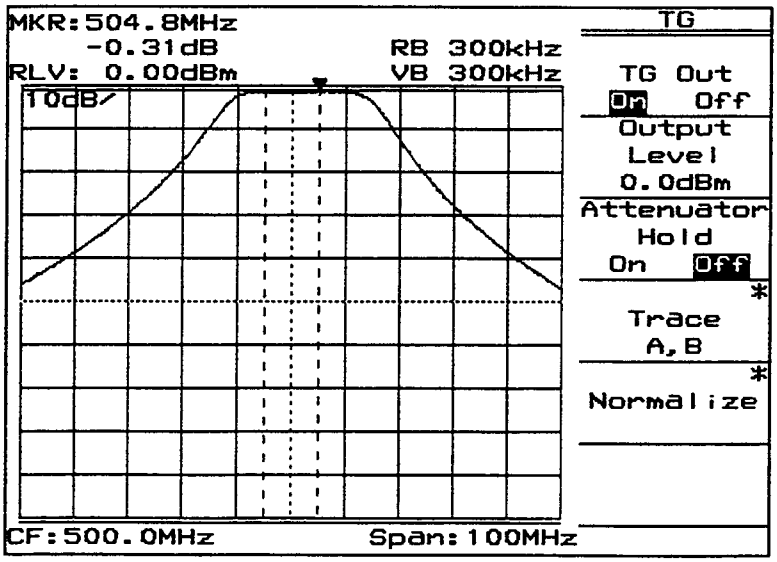
Connect the TG Output to BPF input, and the BPF output to RF Input with a coaxial cable, respectively.



(3) Measuring characteristics:

The following figure is obtained as the measurement results.

The marker level is displayed in the relative mode by setting the display-line level (normalized flat level) to the reference value. The marker level indicates the insertion loss directly.



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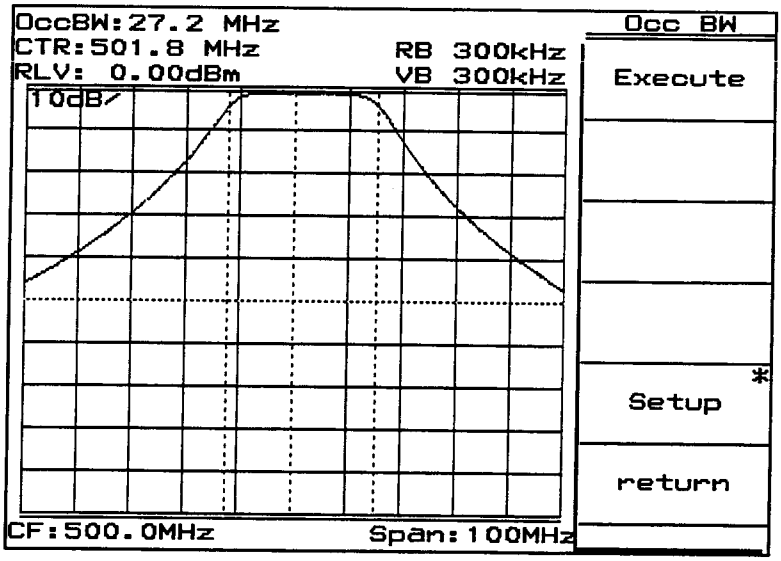
(4) Measuring center frequency and 3dB bandwidth:

Using the measurement function of the occupied bandwidth, measure the center frequency and 3dB bandwidth of the BPF.

- Settinging xdB method and 3dB Down of the Occ BW measurement:
  Displaying the 2nd page of the Measure menu : [Measure], [More], F1:<<Occ BW>>, F5:<<Setup>>, F1:<<Method N% of Pwr xdB DOWN>>, F3:<<xdB Value>>, [3], [dBm]
- Executing the Occ BW measurement:
  Displaying the 2nd page of the Measure menu : [Measure], [More], F1:<<Occ BW>>, F1:<<Execute>>



Note: Use the impedance-matched coaxial cables between the MS2670A and the device under test (BPF).

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Reflection Characteristics Measurement

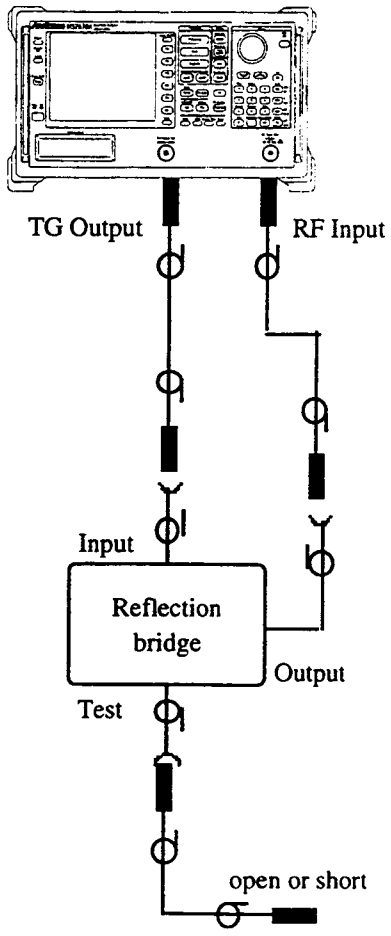
Reflection characteristics can be measured with a TG and a reflection bridge.
In this paragraph, reflection characteristics measurement of a BPF is described using the reflection bridge of the Wiltron 60NF50.

BPF characteristics:

- Center frequency: 110.7 MHz
- 3dB bandwidth: 6 MHz
- Input/Output connector: N plug

Due to the large insertion loss of the reflection bridge, use the normalize function in the reflection characteristics measurement.

(1) Measuring and calibrating (normalizing) the compensation factor of measurement system:
As shown below, connect the TG Output to the Input port of the 60NF50, and the RF Input to the Output port of the 60NF50 with a coaxial cable, respectively. Open or short the Test port of the 60NF50.



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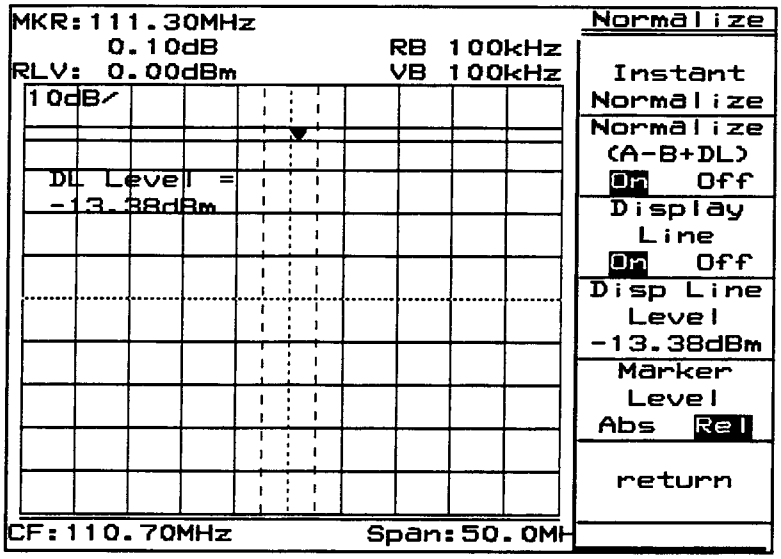
Measure the compensation factor of the measurement system to calibrate the frequency characteristics, as shown below.

- Initializing the MS2670A:
  [Preset], F1: << Preset All >>
- Setting center frequency to 110.7 MHz:
  [Frequency], [1], [1], [0], [.], [7], [MHz]
- Setting span to 50 MHz:
  [Span], [5], [0], [MHz]
- Setting reference level to 0 dBm:
  [Amplitude], [0], [dBm]
- Setting TG to On:
  [TG], F1:<<TG On Off>>
- Executing the instant normalize function:
  Displaying the 2nd page of the TG menu: [More], F1:<<Instant Normalize>>

Note: Before executing the instant normalize function, turn the Normalize (A-B+DL) to Off as shown below.

Displaying the 2nd page of the TG menu : [TG], [More], Turning the normalize (A-B+DL) function to Off: F2:<<Normalize (A-B+DL) On Off>>

The instant normalize function normalizes the current displaying Trace-A waveform.



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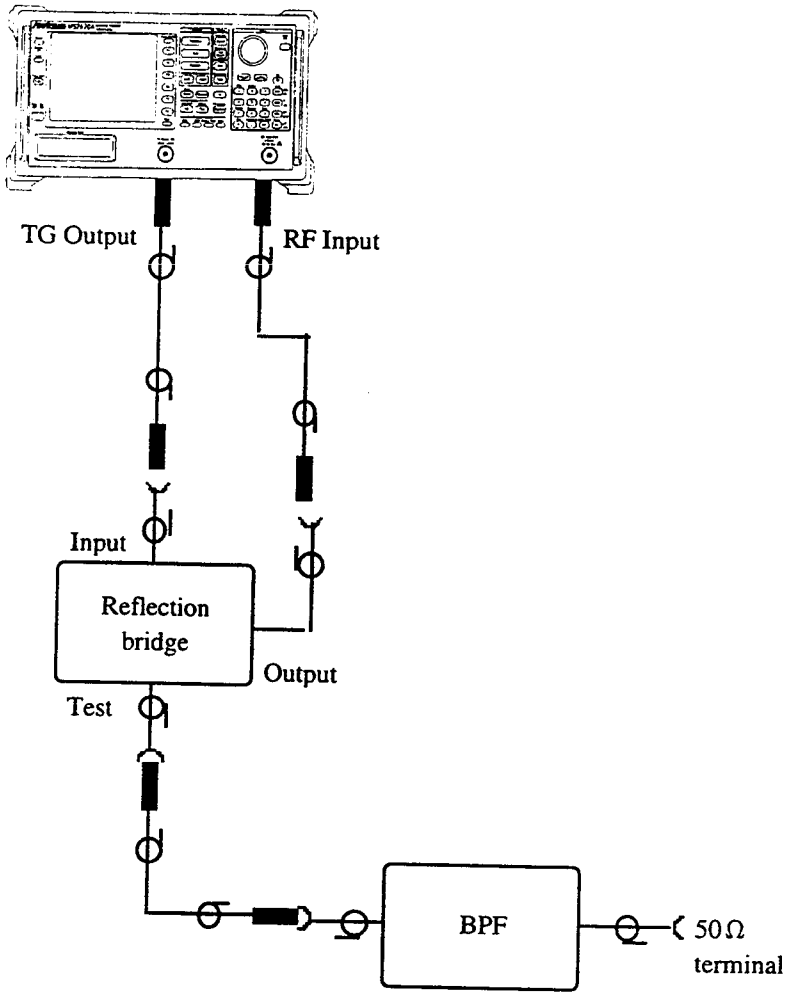
(2) Setup:

Connect the BPF to the Test port of the 60NF50.



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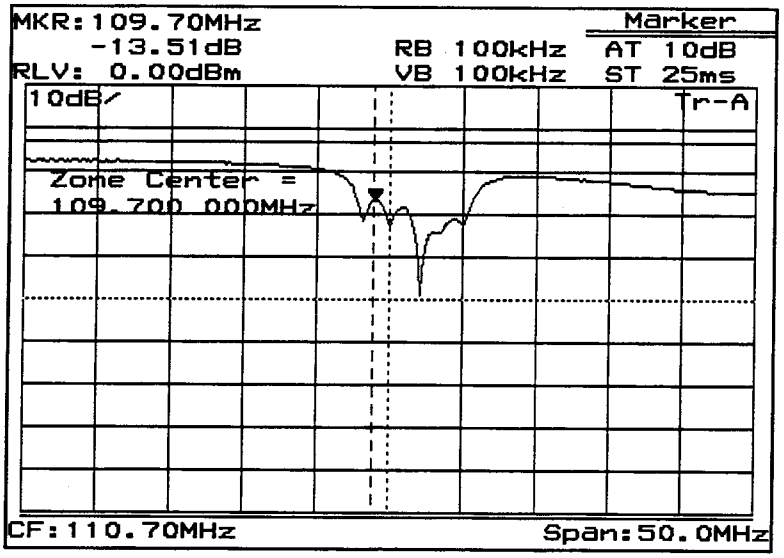
(3) Measuring characteristics:

The figure displayed is obtained as the measurement results.

The marker level is displayed in the relative mode by setting the display-line level (normalized flat level) to the reference value. The marker level indicates the refrection loss directly.

Perform the following procedure.

- Turning the marker function to On (Normal mode):
  [Marker]
- Sets the marker zone width to Spot:
  [Marker], F5:<<Marker Width>>, F1:<<Spot>>, F6:<<Return>>
- Moving the marker to the desired point to be measured by rotary knob.



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Notes on Active Device Measurement

When measuring any active device (including an amplifier, etc.), note the following cautions.

CAUTION ⚠

- Maximum DC voltage ratings: RF Input ±0 Vdc, TG Output 0 Vdc.
- Maximum AC power ratings: RF Input ±30 dBm, TG Output ±20 dBm.
- NEVER input a >+30 dBm and >0 Vdc power to RF Input.
- NEVER input a >+20 dBm and >0 Vdc reverse power (reflected power from DUT/power-splitter/directional-coupler) to TG Output.
- Excessive power may damage the internal circuits.

When measuring the transmission characteristics of any active device, including an amplifier, decrease the TG output level by the amount of the amplifier gain. The procedures and notes are the same for the BPF, described earlier.

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APPENDIX A

SOFT-KEY MENU

In this section, soft-key menu functions and and its hierarchical system are described using a tree structure.

TABLE OF CONTENTS

Soft-key Menu List A-4

Menu Tree A-6

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SECTION 4
SOFT-KEY MENU

In this section, soft-key menu functions and its hierarchical system are described using a tree structure. Matters to be noted about the tree are as follows:

(1) Panel Key indicates a hard key on the front panel.

(2) Top menus are the menus at the top level which are displayed on the screen when the panel 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 (→). However, if any not-supported-function soft key in an Option is pressed, an error message is displayed.

(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 [More] key.

(7) Panel keys and soft keys prefixed by a sharp symbol (#) at the left of the menu frame give an outline explanation of the function.

(8) The menu with "!" mark cannot be used on the MS2670A.

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Soft-key Menu List

Menu	Menu Tree(page/27)
A) A/B,A/BG	16
A/Time	17
ACP Setup1	8
ACP Setup2	8
Ajd ch Pwr	8
Amplitude	2
Attenuator	2 , 3
Avq Count	15
B) Burst Pwr	11
C) C/N Meas	7
Cal	22
Change Clr	21
Check File	25
Copy Cont	20
Copy from	21
Correction	2
CountSetup	7
D) Def Files	26
Def Menues	26
Define	26
Define Clr	21
Detection	15 , 17
Dip	5
Directory	24
Disp Line	2 , 4
Display	21
E) Edit Menue	26
Expand	17
F) File Ope	24
Format	24
Freq Count	7
Frequency	1
G) Gate	18
Gate Setup	18
H) Hold Count	15
I) Impedance	2
Initialize	26
Interface	23
Item	12 , 20
L) Lib Exec	25
Lib File	25
Lib Memory	25
Lib Prgm	25
Lib Remove	25
Lin Scale	2
Line	9 , 10
Load/Save	9 , 10
Location	20
Log Scale	2
Lvl Offset	2
M) Manual Set	4
Marker	4
Marker->	4 , 5
Mask Meas	9
Measure	7 , 8 , 10
Media	24 , 26
Media	2 , 9 , 10
Mem Card	24
Mkr Func	4
Mkr List	4
Move Mask	9
Move Temp	10
Multi Marker	4
N) Noise Meas	7
Normalize	14
O) OBW Setup	8
Occ BW	8

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Menu	Menu Tree(page/27)
P) Paper Size	20
Peak	5
Plotter	20
Pon State	21
Preset	27
Printer	20
PTA	24
PTA Lib	25
R) RBW	3
Recal Media	12
Recall	12
Ref Line	15
Ref Step	2
RS232C	23
S) Save	13
Save Media	13 , 20
ScrollStep	1
Select	2 , 9 , 10
Set Date	21
Set Time	21
Setup	2
Setup Mask	9
Setup Temp	10
Source	17 , 18
Span	1
Storage	15 , 17
Sweep Time	3
Swp Contl	16 , 17
System	21
T) Temp Meas	10
TG	14
Threshold	5
Title	23
Trace A,B	14 , 15
Trace Calc	15
Trace Move	15
Trace Time	17 , 18
Trnsformer	2
Trig Ext	18
Trig Video	18
Trigger	18
U) Units	2
User1	6
User2	6
User3	6
V) VBW	3
W) Wide IF	18
Z) Zone Width	4

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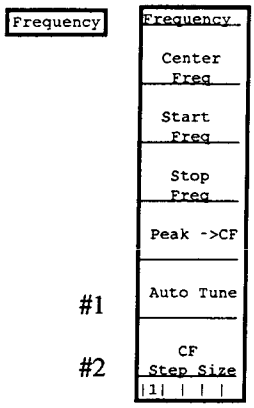
Menu Tree

Menu Tree (1 /27)

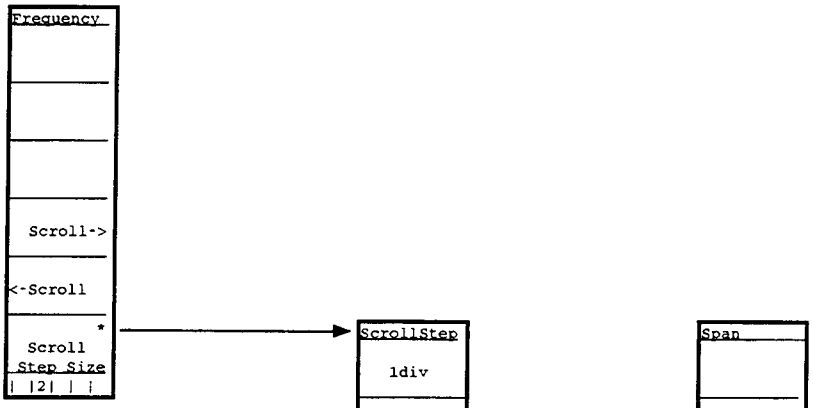
— Panel Key —+— Top menu —+— Lower menues —

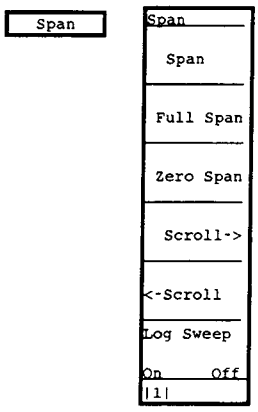


- Set items related to frequency, including the center frequency, start/stop frequency, peak->CF, auto synchronization, frequency step size and scroll step size, etc.

#1 Detects peak point in pre-specified (in BG range) span and automatically tunes the peak signal to the specified span.

#2 Sets frequency step size for changing center frequency.





- Set frequency span items, including frequency span, full span, zero span, frequency span scroll, etc.

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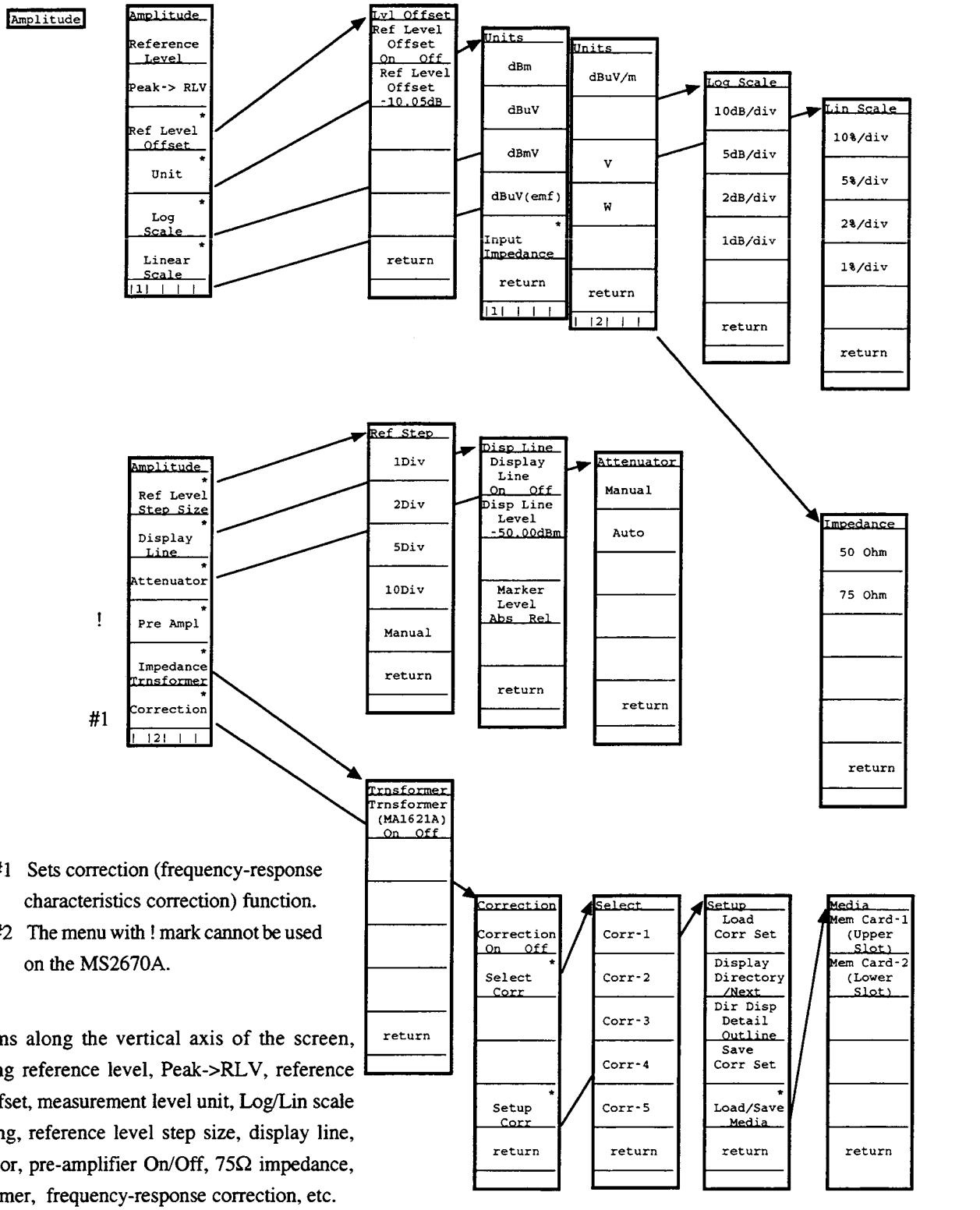
Menu Tree (2/27)

— Panel Key —+— Top menu —+— Lower menues —



!

#1

#1 Sets correction (frequency-response characteristics correction) function.

#2 The menu with ! mark cannot be used on the MS2670A.

- Set items along the vertical axis of the screen, including reference level, Peak->RLV, reference level offset, measurement level unit, Log/Lin scale switching, reference level step size, display line, attenuator, pre-amplifier On/Off, 75Ω impedance, transformer, frequency-response correction, etc.

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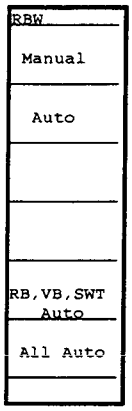
Menu Tree (3/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————

RBW

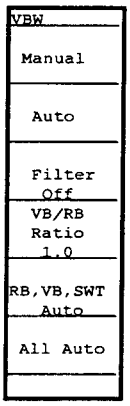


#1

- Set the manual/auto of resolution bandwidth, and auto (RBW, VBW and SWP only) or all auto.

#1 Sets RBW, VBW, Sweep Time, Atten all to Auto.

VBW

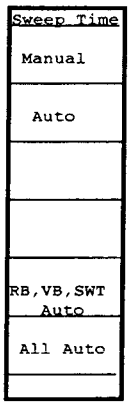


#2

- Set the manual/auto of video bandwidth, and auto (RBW, VBW and SWP only) or all auto.

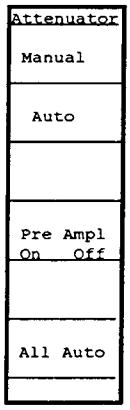
#2 Sets ratio of VBW to RBW when VBW is Auto.

Sweep Time



- Set the manual/auto of sweep time, and auto (RBW, VBW and SWP only) or all auto.

Atten



- Set the manual/auto of the input attenuator, On/Off of the pre-amplifier and all auto.

! The menu with ! mark cannot be used on the MS2670A.

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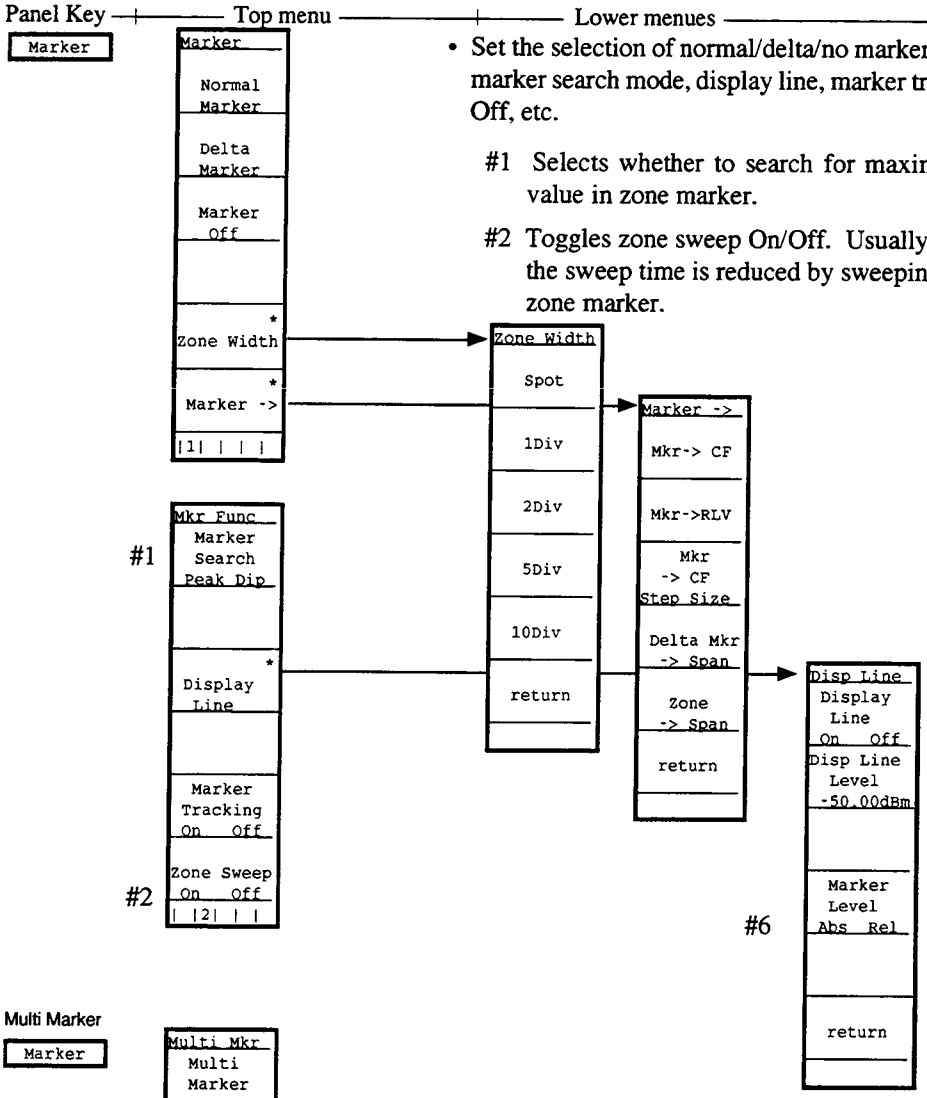
Menu Tree (4/27)

— Panel Key —+— Top menu —+— Lower menues —

Marker



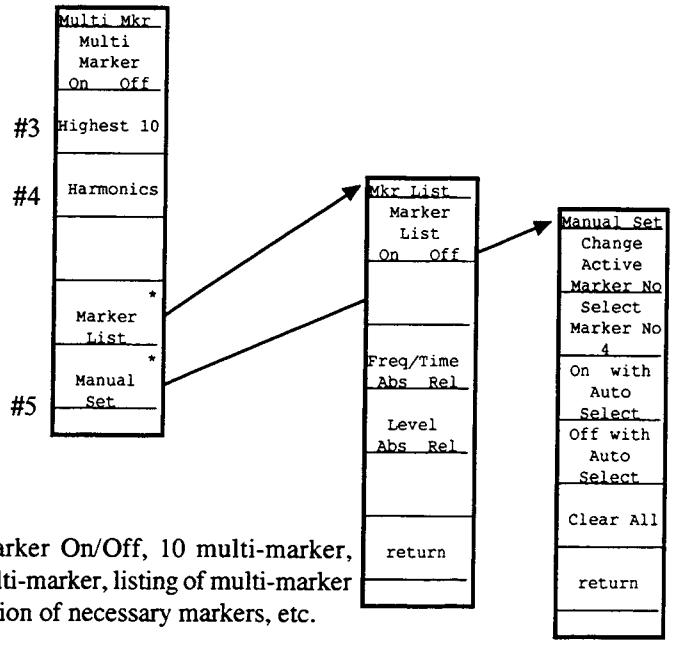
- Set the selection of normal/delta/no marker, zone marker width, marker->, marker search mode, display line, marker tracking On/Off, zone sweep On/Off, etc.

#1 Selects whether to search for maximum (Peak) or minimum (Dip) value in zone marker.

#2 Toggles zone sweep On/Off. Usually, the zone sweep is Off. At On, the sweep time is reduced by sweeping only the zone specified by the zone marker.

Multi Marker

Marker



- Set multi-marker On/Off, 10 multi-marker, harmonic multi-marker, listing of multi-marker values, selection of necessary markers, etc.

#3 Allocates up to 10 multi-markers sequentially from the peak level of the signal displayed on screen.

#4 Allocates multi-markers to the harmonic signals of frequency indicated by current marker.

#5 Function allowing user to select only multi-markers necessary for measurement.

#6 Select "absolute value" or "relative value (display line)" to display marker level.

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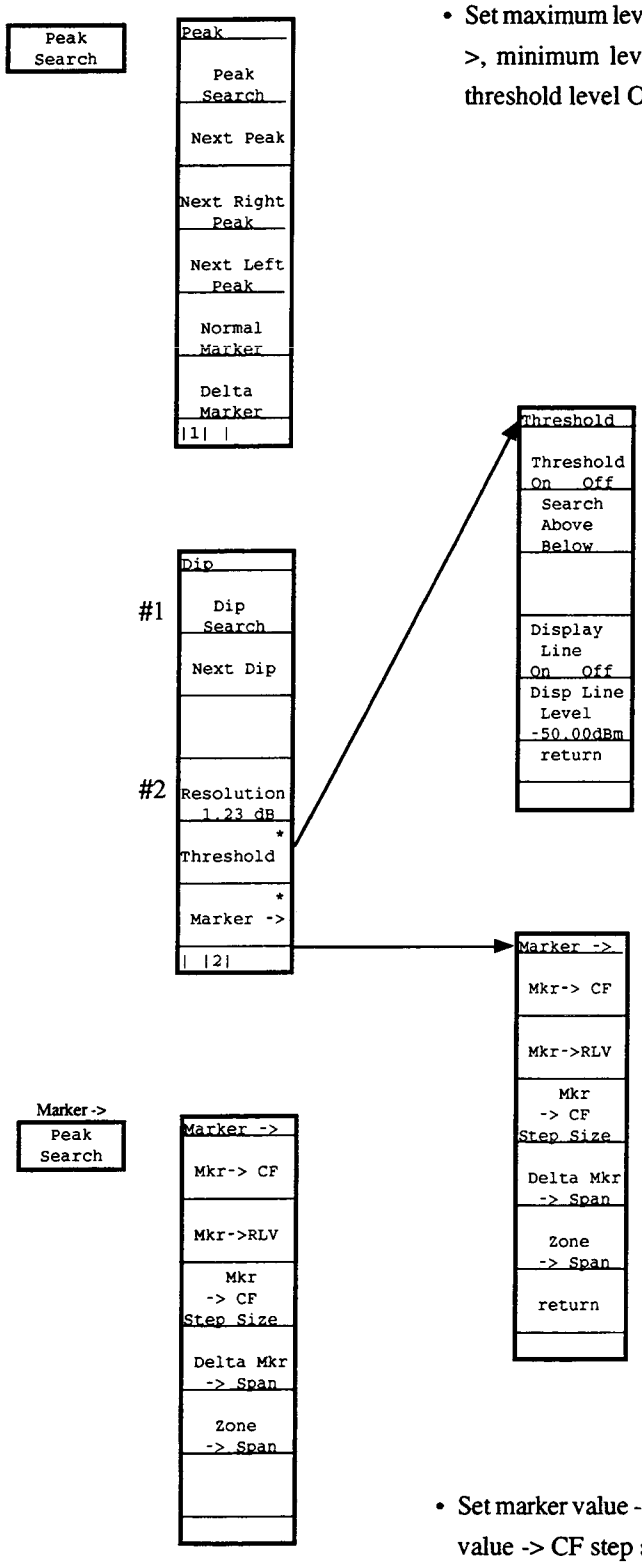
Menu Tree (5/27)

— Panel Key —+— Top menu —+— Lower menues —



- Set maximum level search, next peak, next right peak, next left peak, Marker->, minimum level search, next minimum level, search level resolution, threshold level On/Off, etc.

#1 Searches for minimum (Dip) level.

#2 Sets peak-search level resolution.

- Set marker value -> center frequency, marker value -> reference level, marker value -> CF step size, delta marker-> span, zone marker -> span, etc.

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Menu Tree (6/27)

Panel Key	Top menu	Lower menues
Peak →CF		
Peak →RLV		
Single		
Continuous Single		
User	User1	|1| | |
	User2	| |2| |
	User3	| | |3|

- The soft-key menu defined by the user is displayed. (See "User Define".)

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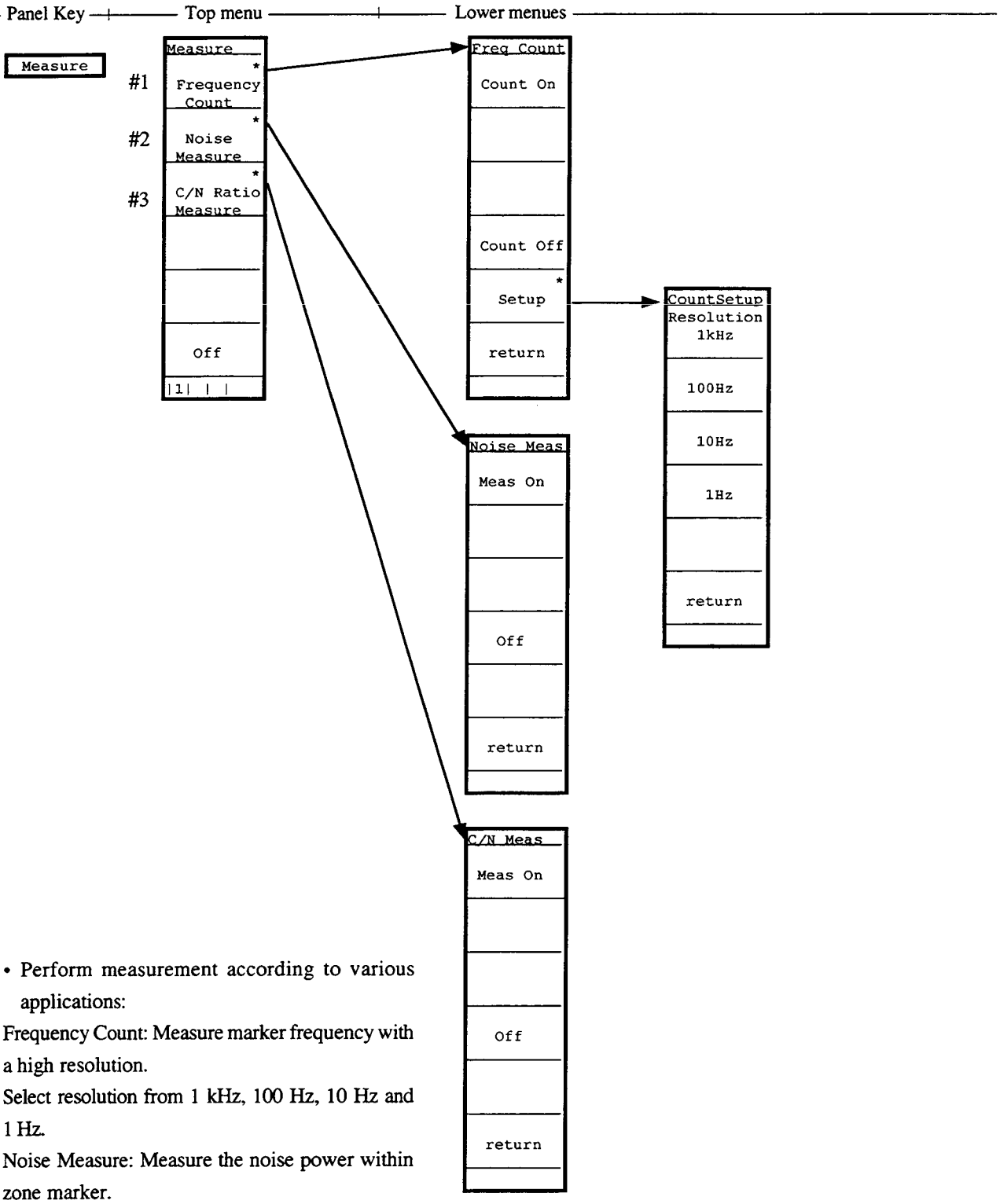
Menu Tree (7/27)



- Perform measurement according to various applications:

#1 Frequency Count: Measure marker frequency with a high resolution.
Select resolution from 1 kHz, 100 Hz, 10 Hz and 1 Hz.

#2 Noise Measure: Measure the noise power within zone marker.

#3 C/N Ratio Measure: Measure the ratio of carrier signal and noise power. Reference marker of the delta marker shall be set to the carrier, and marker's zone width specifies the power measured.

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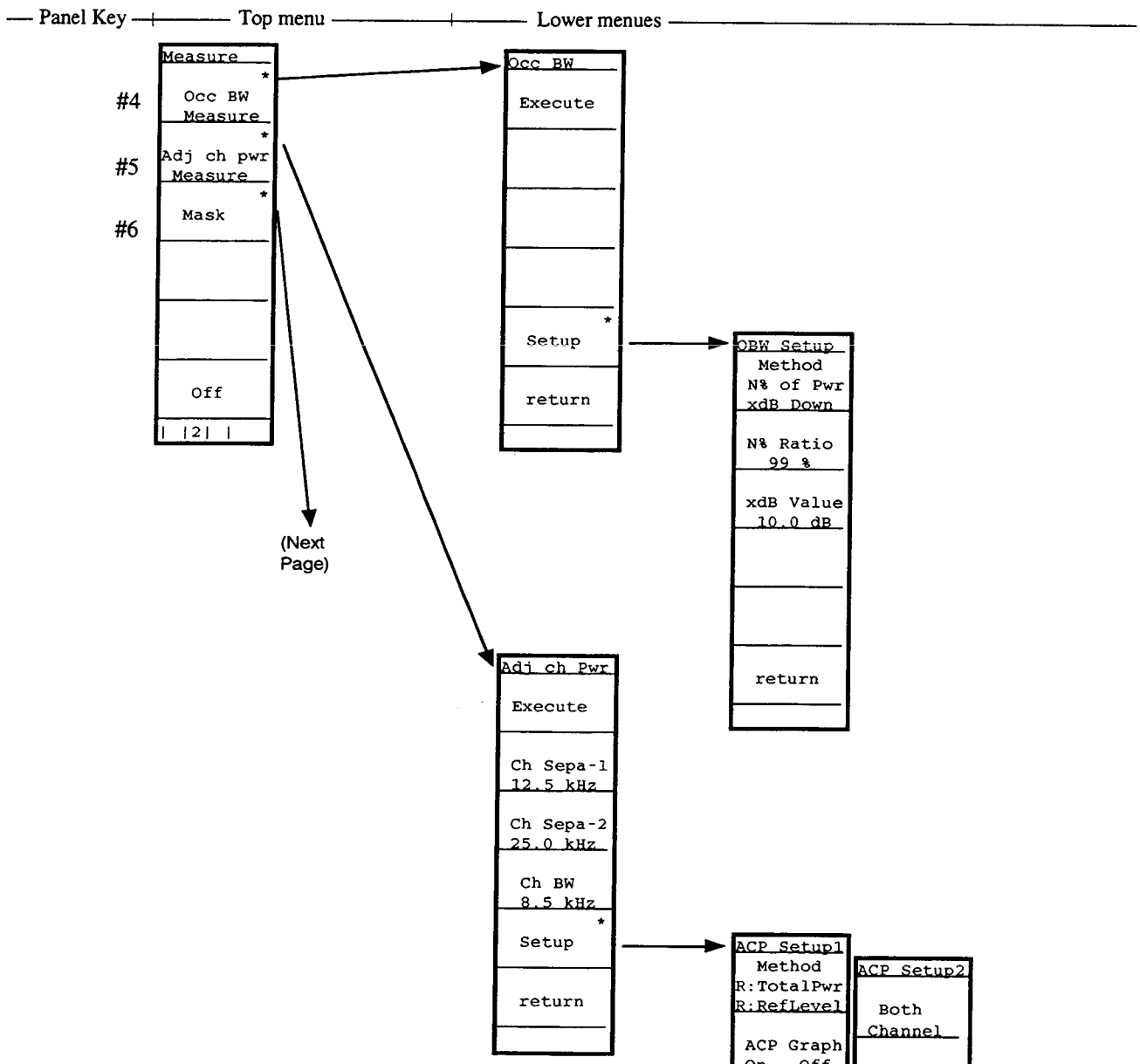
Menu Tree (8/27)



#4 Occ BW Measure: Measure the occupied bandwidth. Select the XdB DOWN or N% of POWER mode.

#5 Adj ch pwr Measure: Measure leak power from adjacent channels. Select Channel Separate, Channel Bandwidth and Measurement Mode (Method), On/Off of ACP Graph, On/Off of Channel Center Line and On/Off of Channel BW Line, Upper Channel, Lower Channel or Both Channel, etc.

#6 Mask: Set Standard Line of the frequency domain and judge Good/NG in relation to the standard line. Select Mask Table, Mask Movement, Measurement Mode, Mask Table Preparation, Load/Save of Mask Table, etc.

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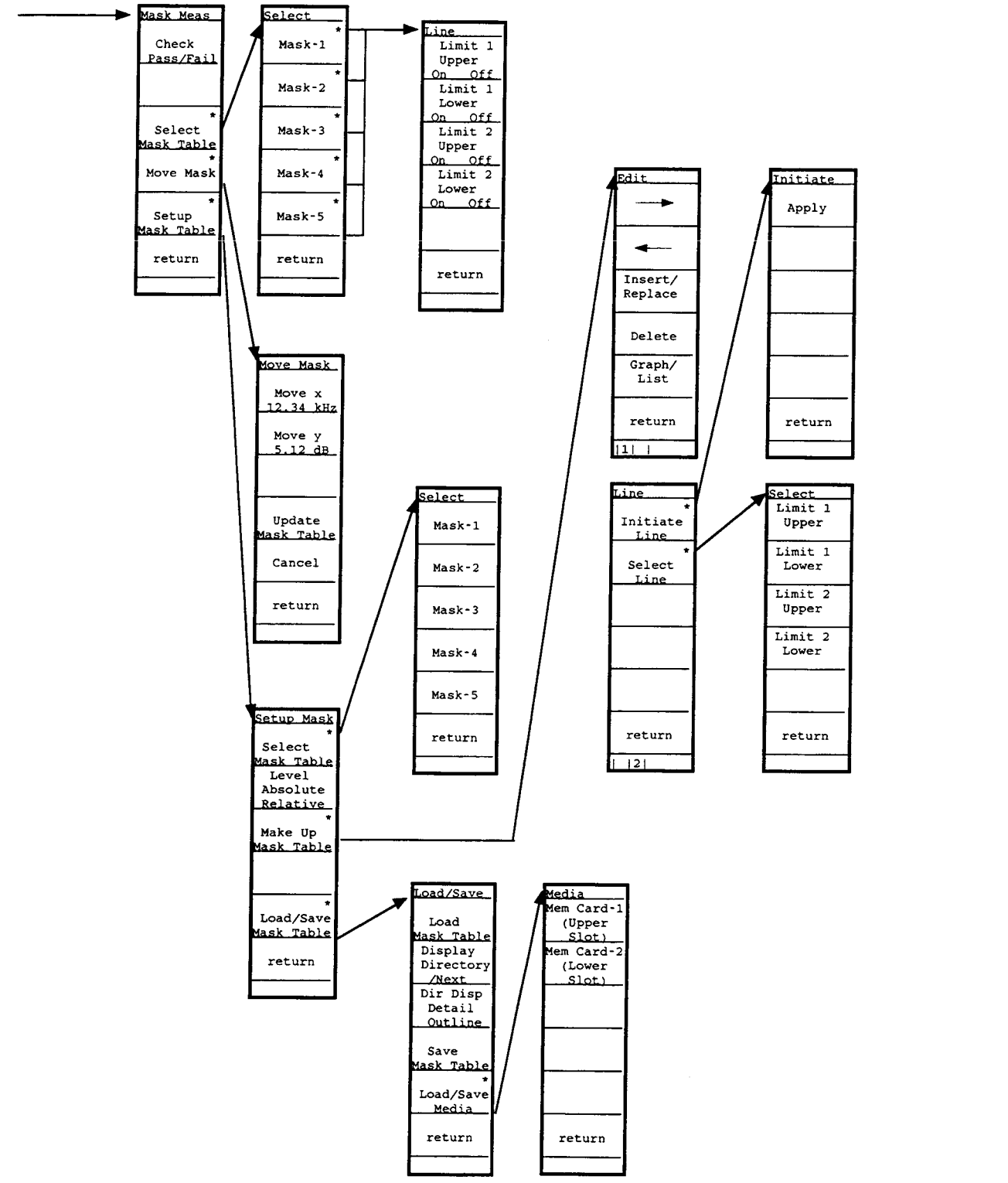
Menu Tree (9/27)



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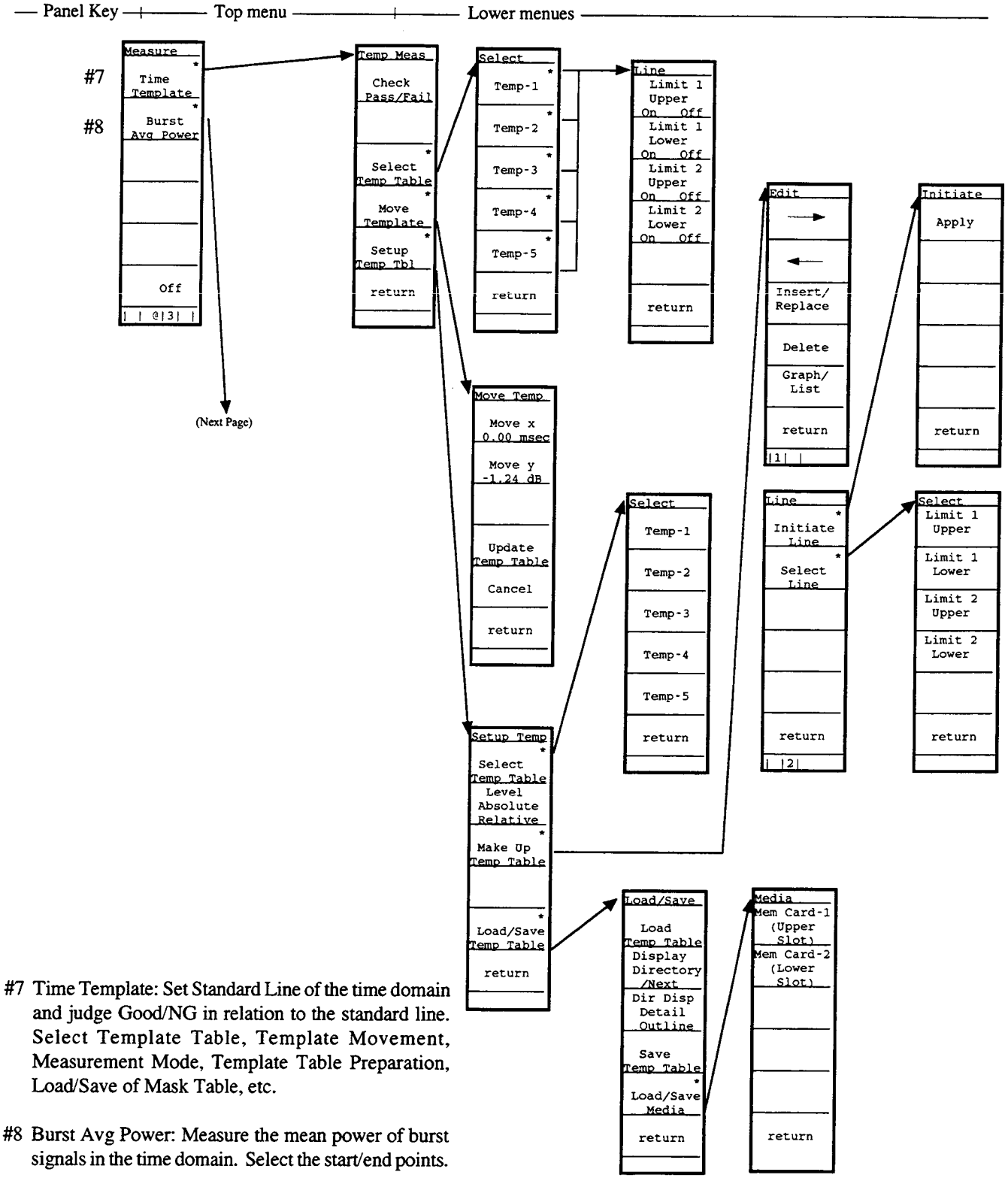
Menu Tree (10/27)



#7 Time Template: Set Standard Line of the time domain and judge Good/NG in relation to the standard line. Select Template Table, Template Movement, Measurement Mode, Template Table Preparation, Load/Save of Mask Table, etc.

#8 Burst Avg Power: Measure the mean power of burst signals in the time domain. Select the start/end points.

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Menu Tree (11/27)

Panel Key	Top menu	Lower menues
(Previous Page)		Burst Pwr
		Execute
		Start Point 100
		Stop Point 100
		return

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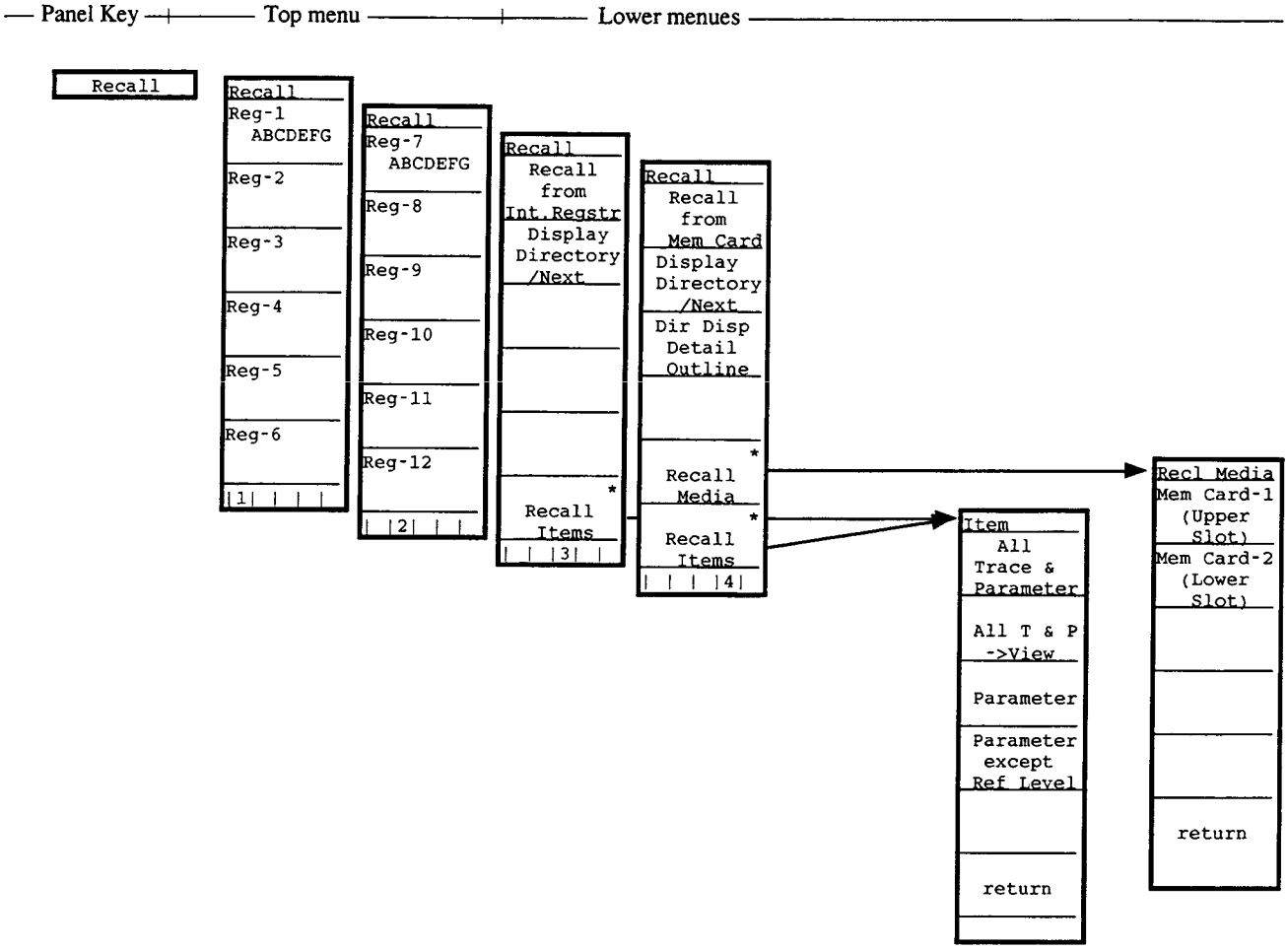
Menu Tree (12/27)



- Read out trace waveform/parameters from the internal memory or memory card. Select recall addresses and media/items, and display file directories.

  #1 Displays list of internal-register directories.

  #2 Specifies items to be recalled (trace waveform, parameter, etc.).

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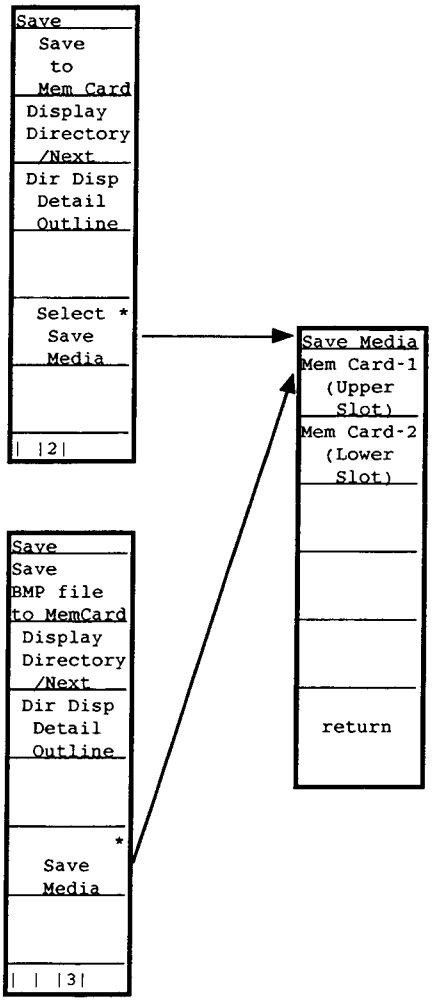
Menu Tree (13/27)

Panel Key	Top menu	Lower menues
Save Recall	Save Save to Int.Regstr Display Directory /Next |1| |	• Save trace waveform/parameters to the internal memory or memory card. Select saved media, and display file directories.



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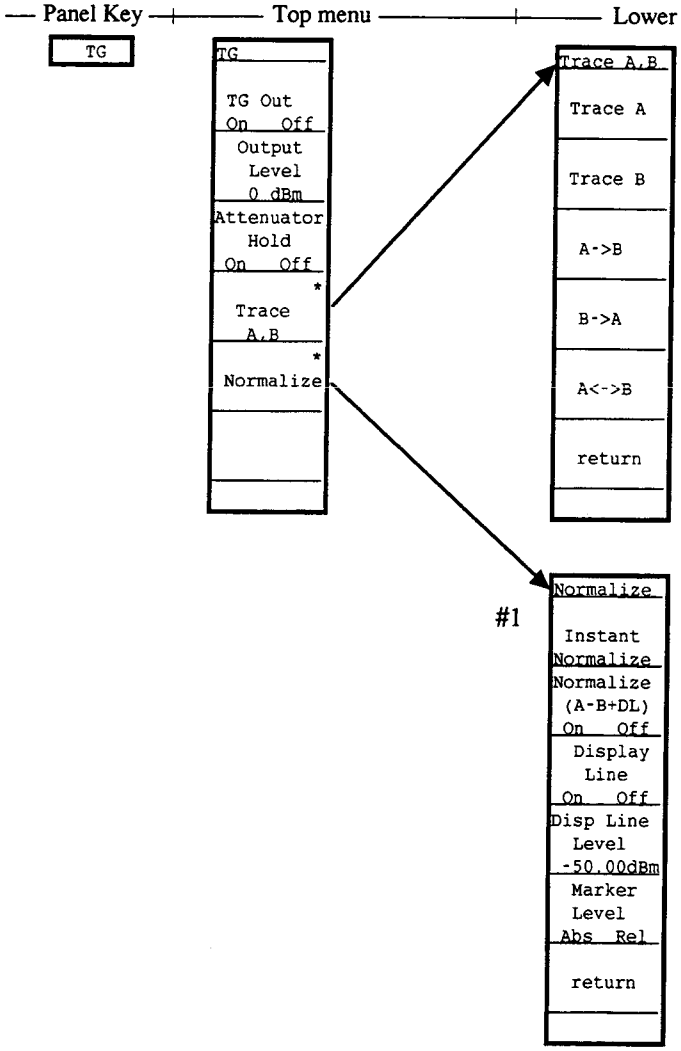
Menu Tree (14/27)



- Set ON/OFF and output level of tracking generator.

#1 Normalize trace-A waveform data, and display it.

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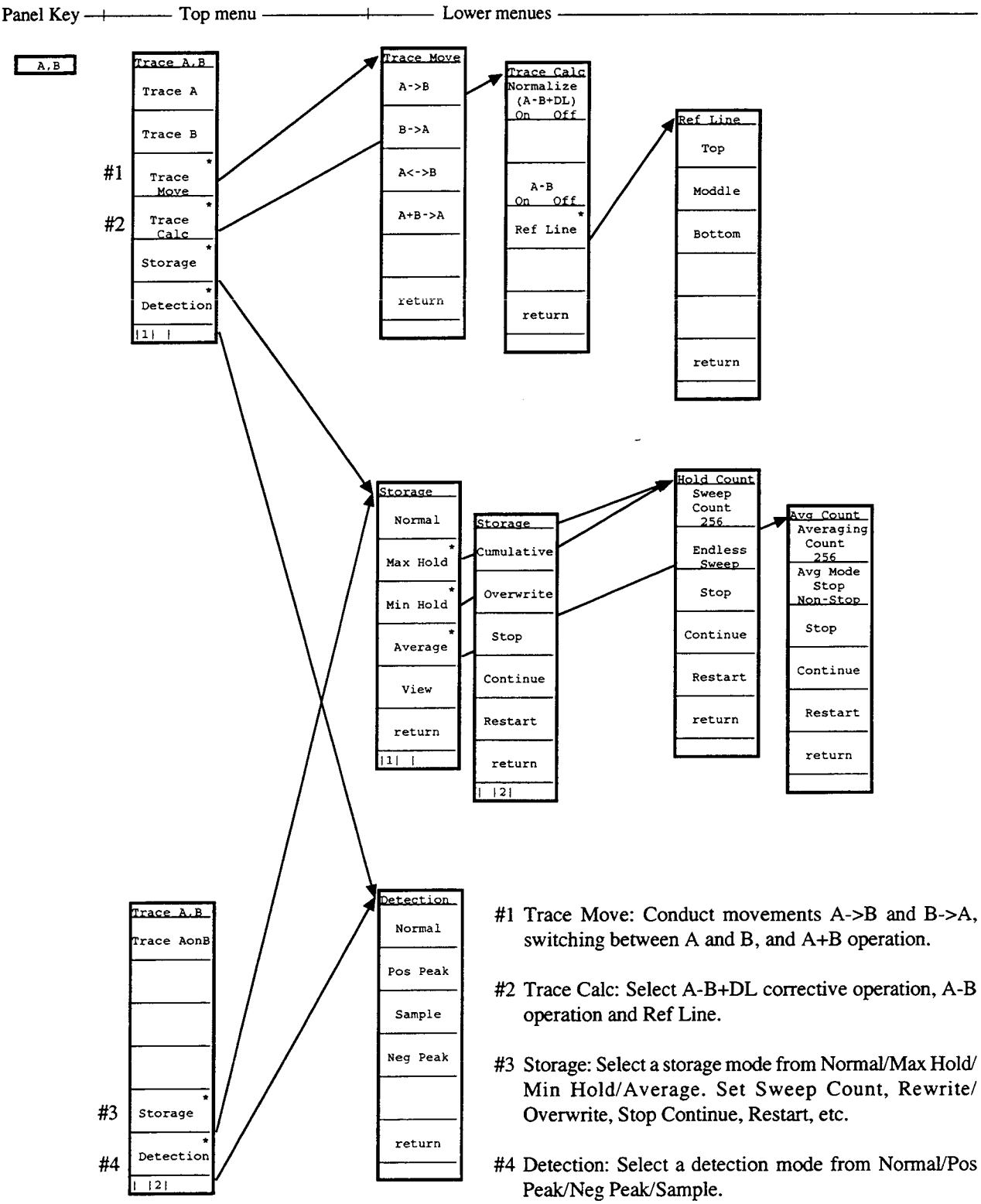
Menu Tree (15/27)



#1 Trace Move: Conduct movements A->B and B->A, switching between A and B, and A+B operation.

#2 Trace Calc: Select A-B+DL corrective operation, A-B operation and Ref Line.

#3 Storage: Select a storage mode from Normal/Max Hold/ Min Hold/Average. Set Sweep Count, Rewrite/ Overwrite, Stop Continue, Restart, etc.

#4 Detection: Select a detection mode from Normal/Pos Peak/Neg Peak/Sample.

- Select Trace A/B, movement between Trace A/B, sum/difference operation between Trace A/B and Ref Line, and designate the storage and detection modes and Active Trace.

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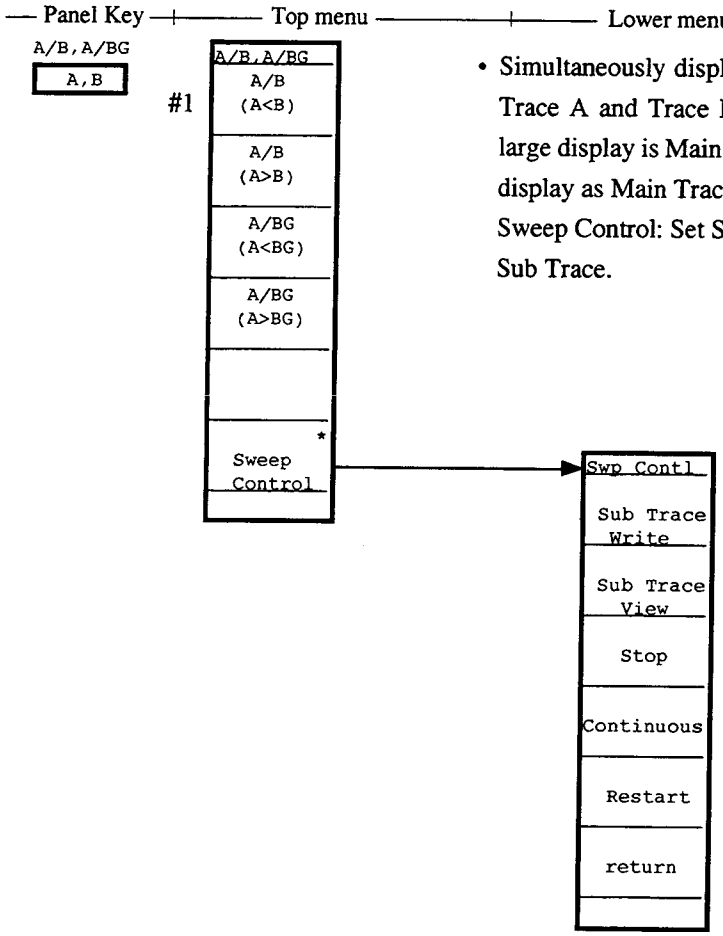
Menu Tree (16/27)



- Simultaneously display two waveforms, namely Trace A and Trace B or Trace A and Trace BG (peripheral spectrum containing Trace A). The large display is Main Trace and the small one is Sub Trace; select which to display as Main Trace (or Sub Trace).
  Sweep Control: Set Stop/Continuous/Restart for sweep and Stop/Write for Sub Trace.

#1 Displays two traces A and B simultaneously at top and bottom of screen. The trace-B display is the larger at this time.

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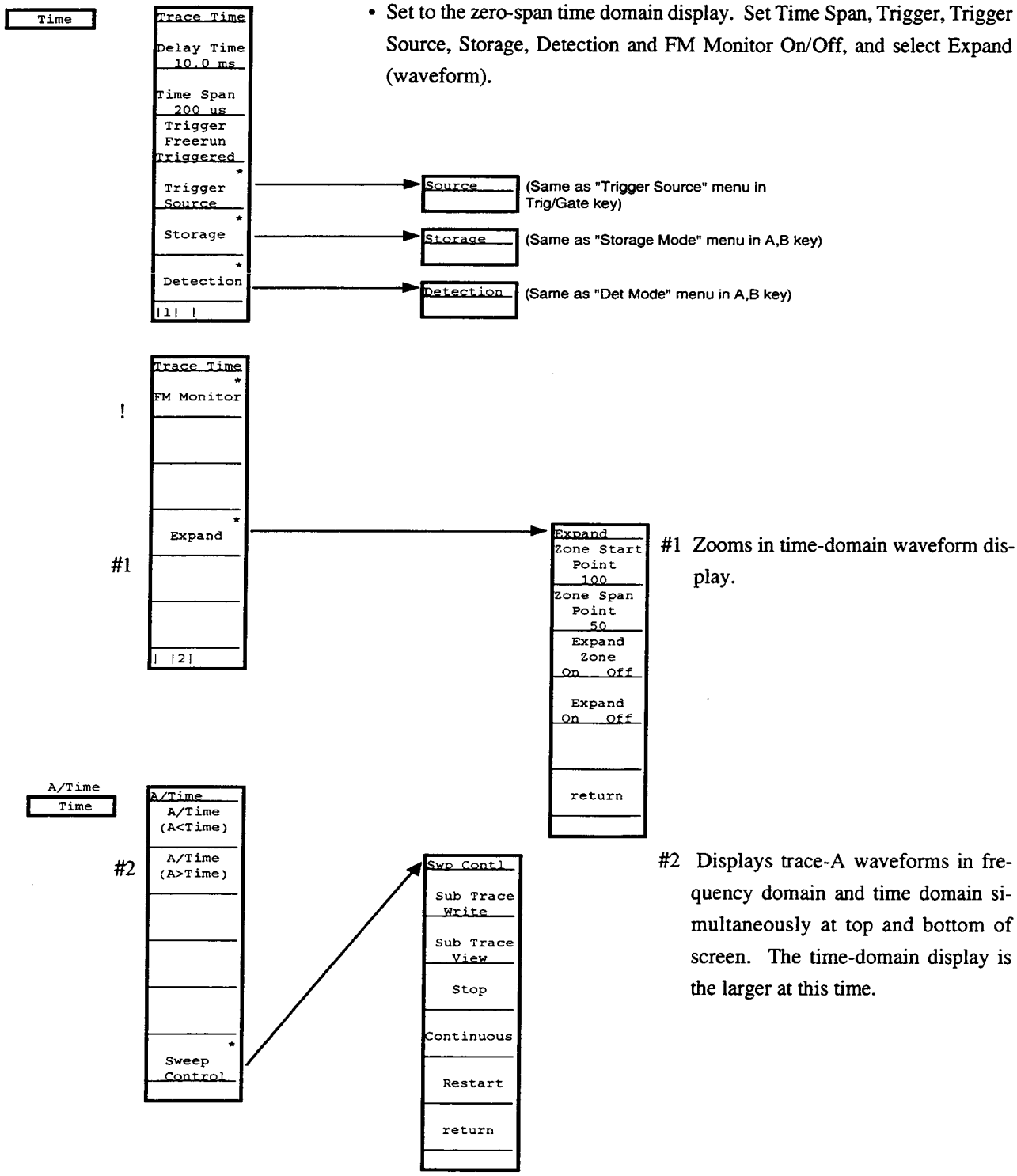
Menu Tree (17/27)

— Panel Key —+— Top menu —+— Lower menues —



- Set to the zero-span time domain display. Set Time Span, Trigger, Trigger Source, Storage, Detection and FM Monitor On/Off, and select Expand (waveform).

#1 Zooms in time-domain waveform display.

#2 Displays trace-A waveforms in frequency domain and time domain simultaneously at top and bottom of screen. The time-domain display is the larger at this time.

- Simultaneously display waveforms of Trace a and Time Domain. Which to display as Main Trace (or Sub Trace) can be selected.

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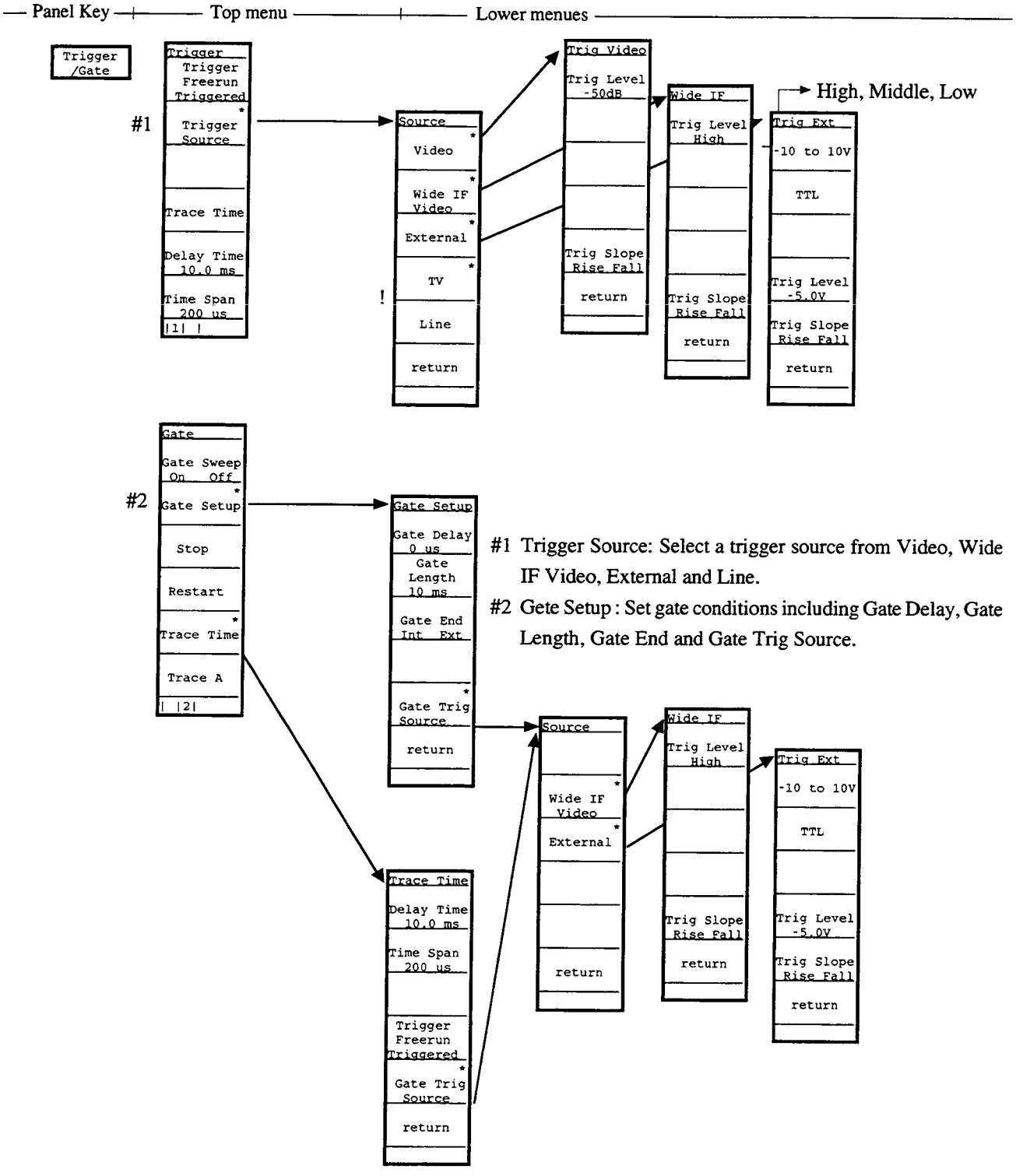
Menu Tree (18/27)



#1 Trigger Source: Select a trigger source from Video, Wide IF Video, External and Line.

#2 Gete Setup : Set gate conditions including Gate Delay, Gate Length, Gate End and Gate Trig Source.

- Set gate functions for controlling the sweep start trigger and the writing of waveform data. Set the trigger mode, trigger source, trace time, delay time and time span. Select On/Off, Stop and Restart of Gate Sweep.

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Menu Tree (19/27)

Panel Key	Top menu	Lower menues
TV Monitor		
Trig/Gate		

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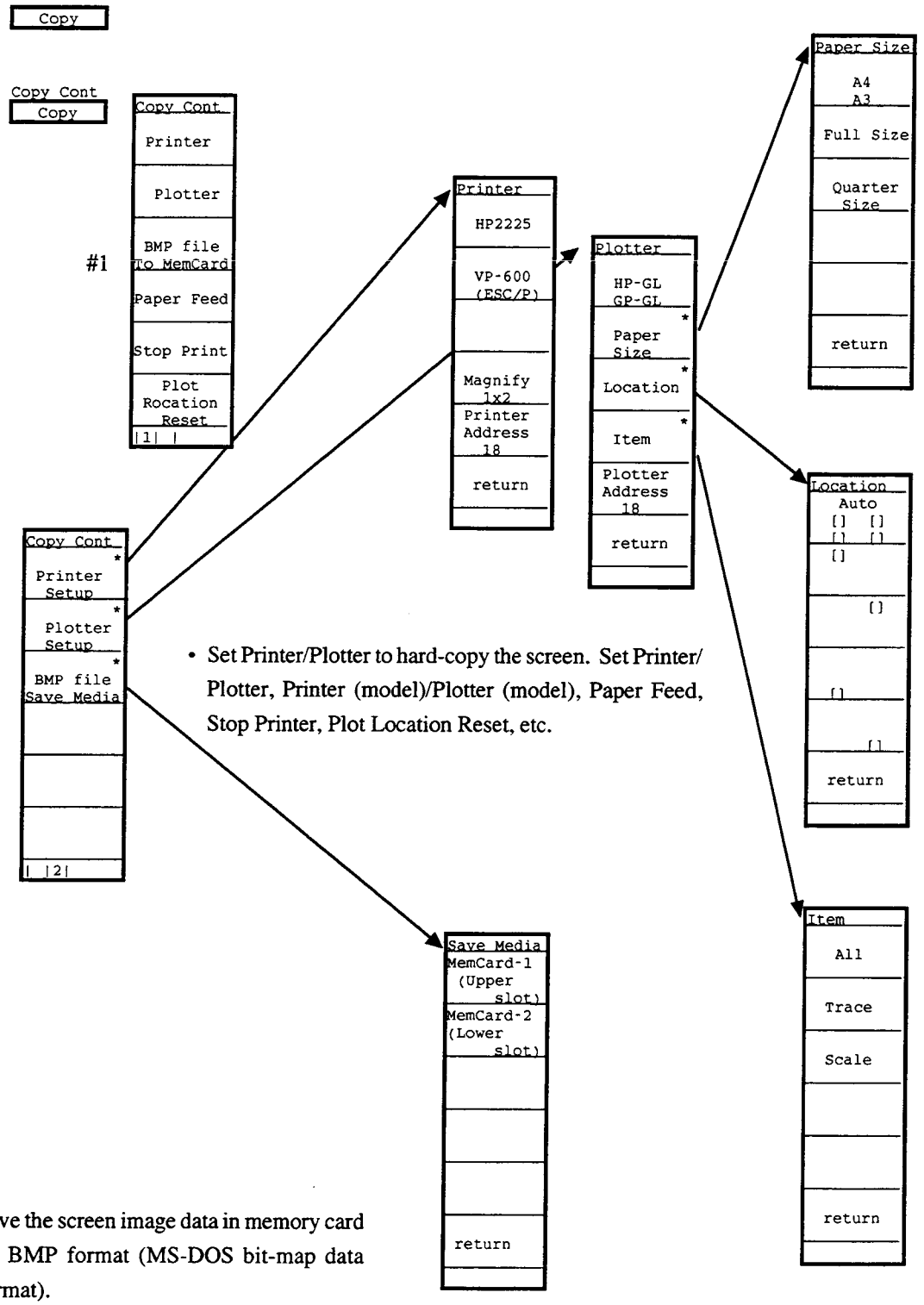
Menu Tree (20/27)

— Panel Key —+— Top menu —+— Lower menues —



- Set Printer/Plotter to hard-copy the screen. Set Printer/Plotter, Printer (model)/Plotter (model), Paper Feed, Stop Printer, Plot Location Reset, etc.

#1 Save the screen image data in memory card by BMP format (MS-DOS bit-map data format).

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Menu Tree (21/27)

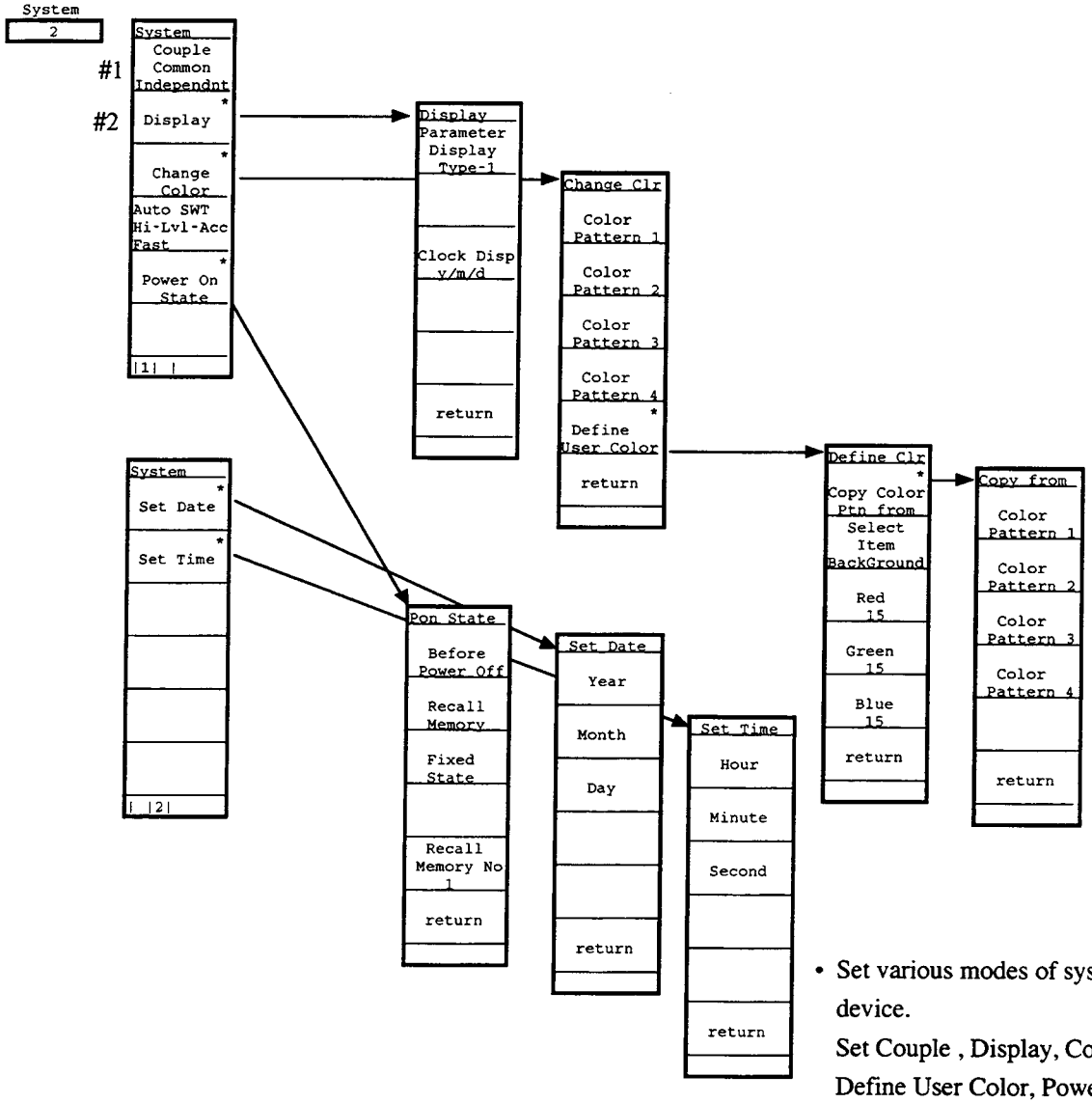
— Panel Key —+— Top menu —+— Lower menues —

Sound
! 1

• The menu with ! mark cannot be used on the MS2670A.

#1 Sets whether the coupled settings for RBW, VBW, etc., in frequency and time domain, independent or common.

#2 Changes screen color pattern.



• Set various modes of systems of this device.
Set Couple , Display, Color Pattern, Define User Color, Power On State, etc.

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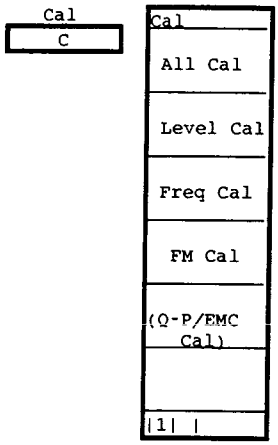
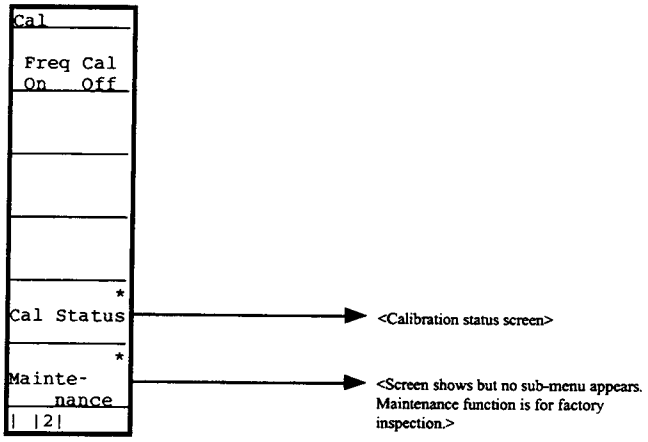
Menu Tree (22/27)

— Panel Key —+— Top menu —+— Lower menues —



• Execute calibration. Select an item from All Cal, Level Cal and Freq Cal.



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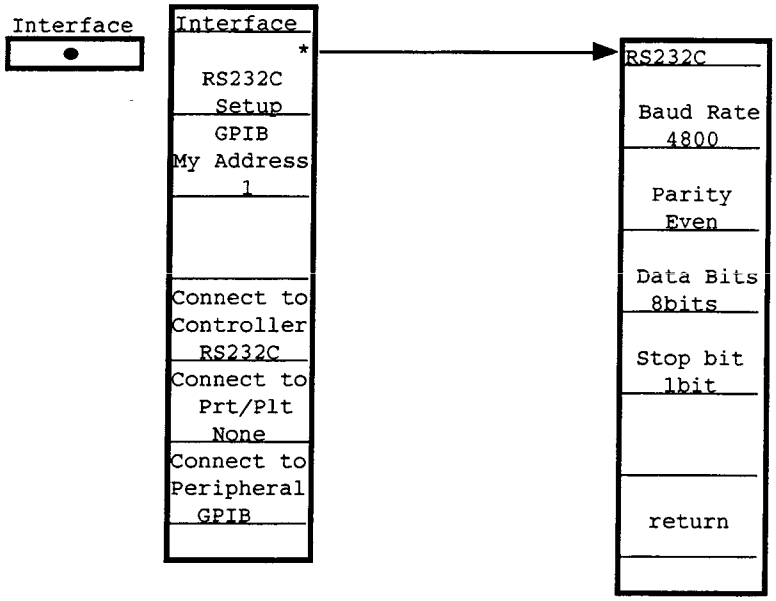
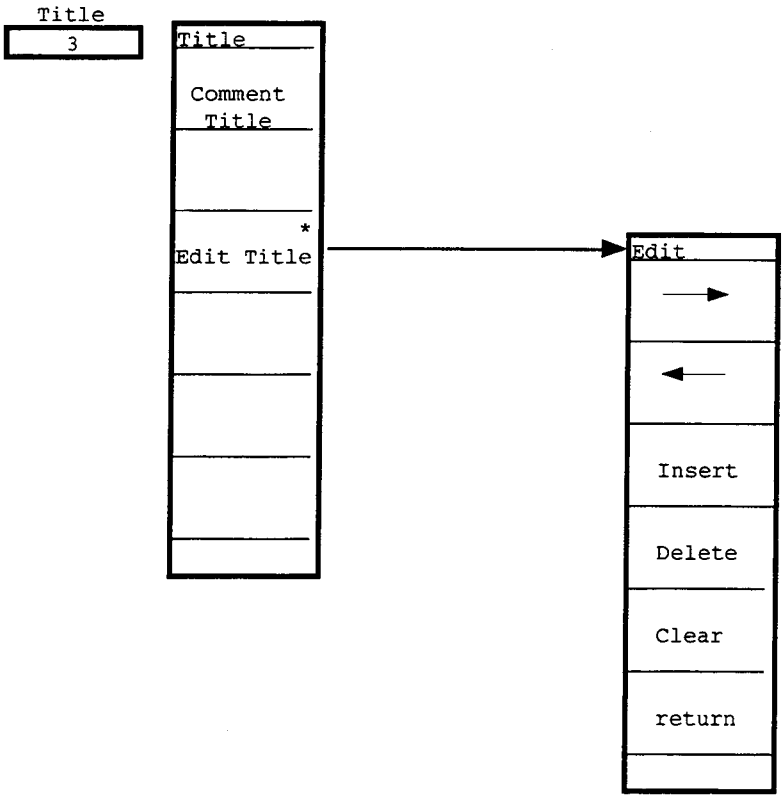
Menu Tree (23/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————————

- Set interfaces for external devices to connect. Select RS232C, or GPIB, and set the RS232C interface, GPIB address, etc.



- Input a title to display on the screen.



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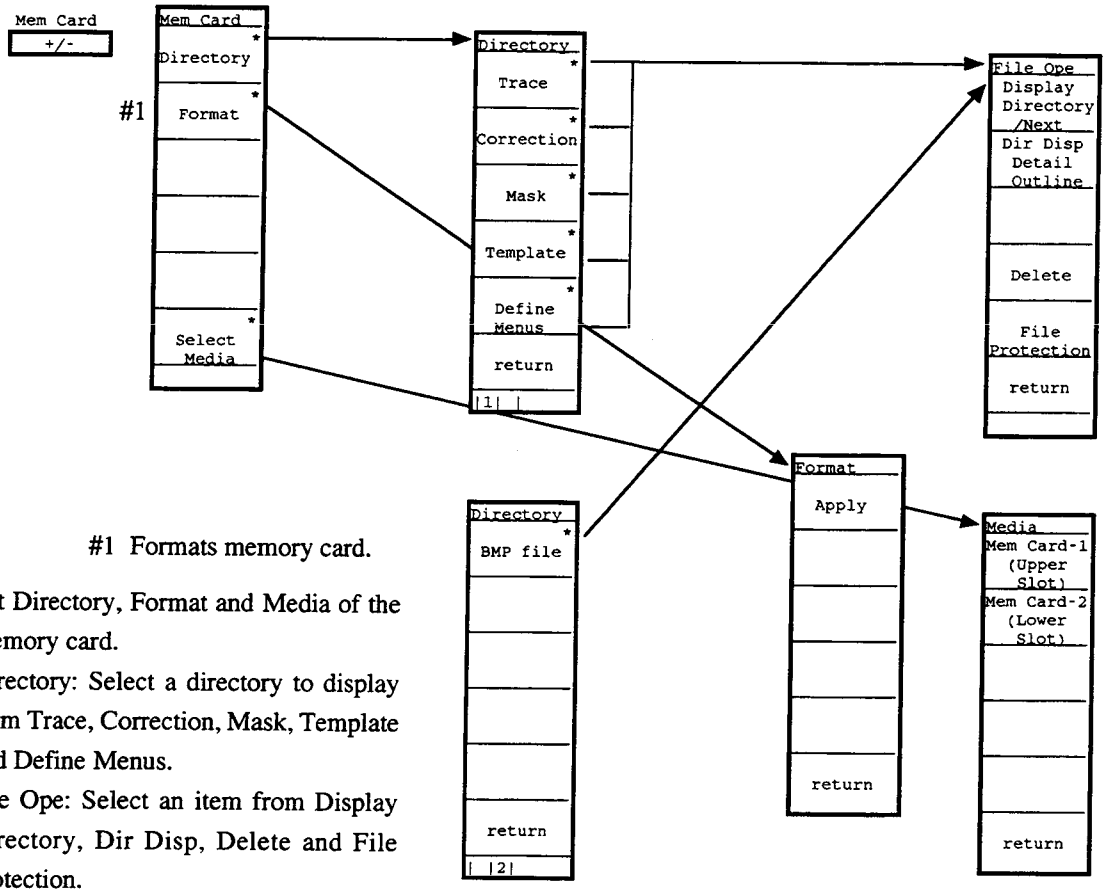
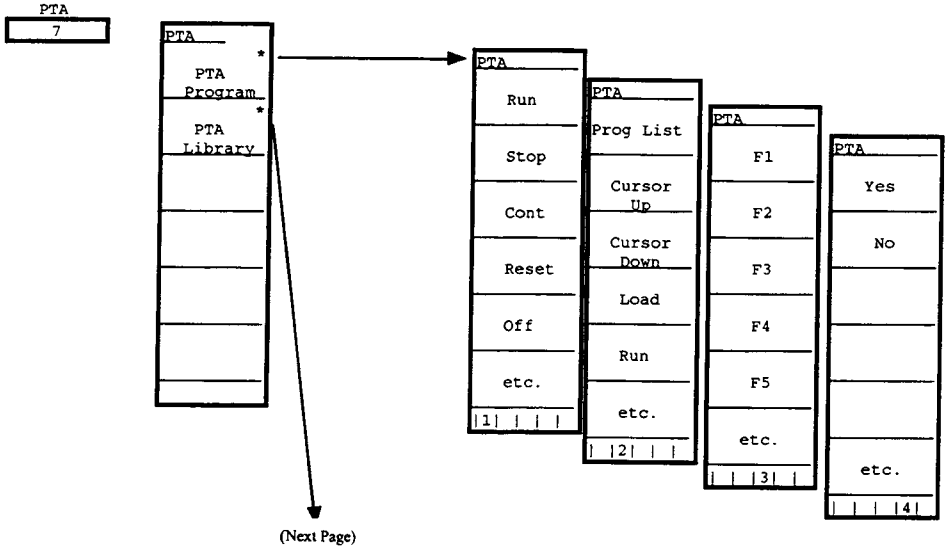
Menu Tree (24/27)

— Panel Key —+— Top menu —————+— Lower menues ————————————————



#1 Formats memory card.

- Set Directory, Format and Media of the memory card.
  Directory: Select a directory to display from Trace, Correction, Mask, Template and Define Menus.
  File Ope: Select an item from Display Directory, Dir Disp, Delete and File Protection.



- Set PTA (personal test automation) that can build an auto measurement system without requiring external controllers.
  PTA Program: Select one from Run, Stop, Cont Reset, Prog List, Load, etc.
  PTA Library: Select one from Display/Run for the library program and Load/Check for the library file.

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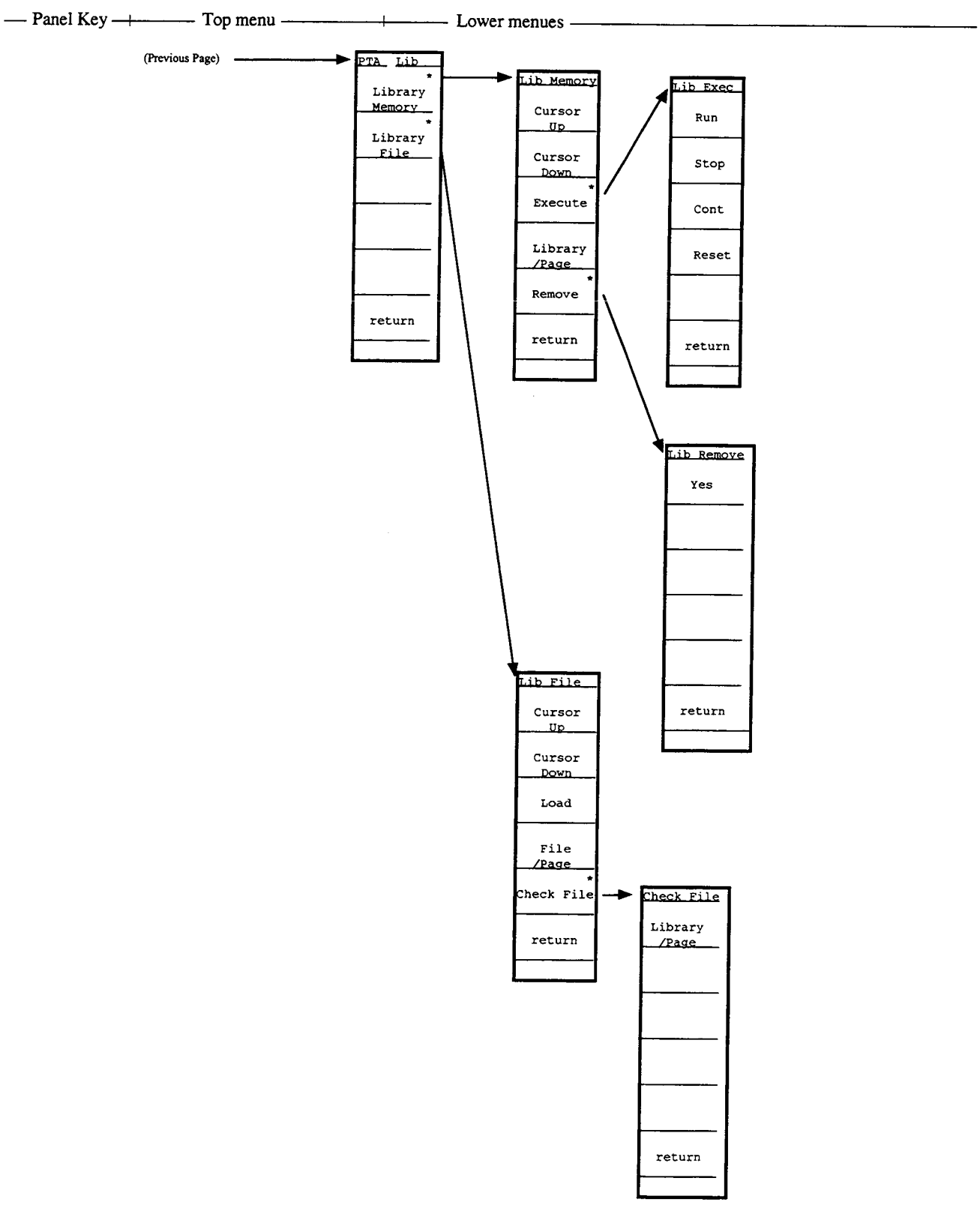
Menu Tree (25/27)



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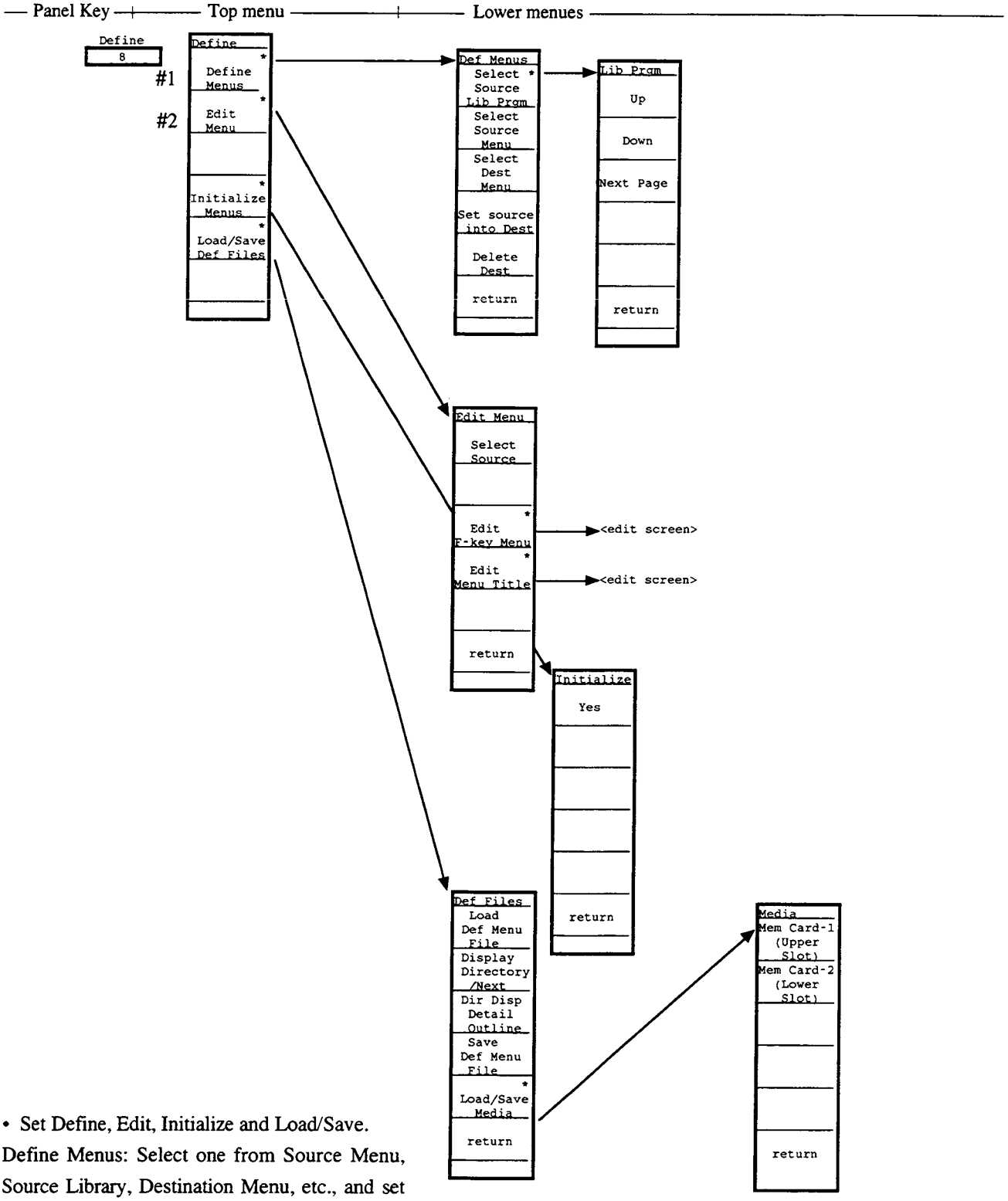
Menu Tree (26/27)



- Set Define, Edit, Initialize and Load/Save.

#1 Define Menus: Select one from Source Menu, Source Library, Destination Menu, etc., and set Definition/Delete for the user menu.

#2 Edit Menu: Select a source and edit Menu Title.

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Menu Tree (27/27)

Panel Key	Top menu	Lower menues
Preset	Preset	• Initialize measurement parameters. Select one from All, Sweep, Trace, Level and Frequ/Time.

Preset
Preset All
Preset Sweep controll
Preset Trace Parameters
Preset Level Parameters
Preset Freq/Time Parameters

Hold
GHz

Local

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APPENDIX B

ERROR MESSAGE

This appendix describes the error messages displayed on the screen.

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APPENDIX B
ERROR MESSAGE

When operating or controlling the MS2670A with RS-232C/GPIB, if any setting error or execution error occurs, an error message is displayed at the left center of the screen.
If an error message is displayed, confirm the setting contents and current measurement-conditions/setup-conditions according to the message, and re-operate/re-set them to the correct ones.

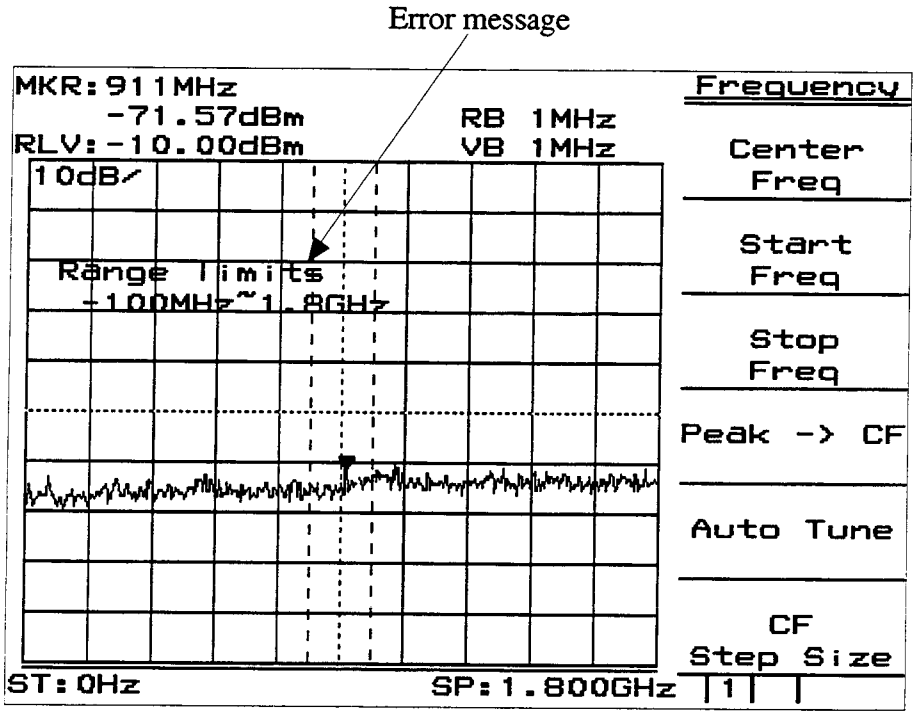

Fig. B-1 Error Message

Error messages are listed below. in the alphabetical order.

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All markers are on
Operation of the "Multi marker on" cannot be used because all markers are on.

Argument count is not correct
Argument count of the external control command is not correct.
See the Operation manual Vol.3 (Remote comtrol) to confirm the argument count.

Can not define into this key
The selected key cannot be registered by the "User define" operation.

Can not edit this key
The selected F-key menu cannot be edited.

Can not edit this menu
The selected menu title cannot be edited.

Can not search
The peak point or dip point cannot be serched by the search function for Peakpoint etc.
Confirm the setting contents of the search resolution and threshold.

Data is not sequent
The specified data is not in ascending order.
Confirm the setting data.

Data not found
Peak point cannot be found.
Confirm the setting contents of the search resolution and threshold.

Dest has not been selected yet
Destination menu is not selected in the User-define function.
Select destination menu, and operate the registration.

Det. mode changed
Detection Mode is changed internally.

Det. Mode changed to Sample
Detection Mode is changed internally.

Device not connected
Device is not connected to the RS-232C/GPIB interface port.
Confirm them.

Error occurred .....
Processing error is occurred during internal calculation.

Error occurred .....
Processing error is occurred during internal calculation.

Execution error .....
Processing error is occurred during internal calculation.

File is not found
Specified file cannot be found.
Confirm the memory card slot, memory card, file name etc.

File write protected
Specified file is write-protected.
Confirm the memory card slot, memory card, file mane etc.

FM monitor option is needed
This function cannot be used because the FM Monitor option is not installed.

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GPIB error
Error occurred in GPIB interface.
Confirm the connection and GPIB address etc.

Invalid active marker No
Multi-marker active No. is incorrect.
Confirm the setting contents.

Invalid Code
The set code or number is incorrect.

Invalid condition
The specified function cannot be executed under the current setting parameters.

Invalid DATE
The data of date is incorrect.
Confirm the setting contents.

Invalid input
The input data is incorrect.
Confirm the setting contents.

Invalid input data
The input data is incorrect.
Confirm the setting contents.

Invalid numeric data (Integer part)
The integer part of the input numeric data is incorrect.
Confirm the setting contents.

Invalid numeric data (Fraction part)
The decimal part of the input numeric data is incorrect.
Confirm the setting contents.

Invalid numeric data (Exponent part)
The exponent part of the input numeric data is incorrect.
Confirm the setting contents.

Invalid numeric data
The input numeric data is incorrect.
Confirm the setting contents.

Invalid point No.
The data cannot be set at the specified point.
Confirm the set data and current setting conditions.

Invalid string data
The input string data is incorrect.
Confirm the setting contents.

Invalid TIME
The input time data is incorrect.
Confirm the setting contents.

Invalid unit
The unit of the input data is incorrect.
Confirm the setting contents.

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Invalid unit data
The unit of the input data is incorrect.
Confirm the setting contents.

Listener device not connected
Listener device is not connected
Confirm the RS-232C/GPIB connection and interface conditon settings.

Marker changed to Off
Marker is changed to Off, internally.

Marker value is invalid
Marker level value is invalid.

Media error
Memory-card access error is occurred.
Confirm the memory card.

Media full
Memory card is full. Saving cannot be executed.

Media is not installed
Memory card is not installed at the specified slot.
Insert the memory card at the specified slot, correctly, and re-operate.

Media is not formatted
Memory card is not formatted in the specified format.
After confirming that the saved data in the memory card is no use, execute the formatting of the memory card.

Media type is different
The inserted memory card cannot be handled in the MS2670A.

Media write protected
Memory card is write-protected. Saving cannot be executed.

No more menu can be added
User defined menu can be no more added.

Not Available .....
The specified function cannot be executed under the current setting conditions.

Not in device mode
GPIB of the MS2670A is not in device mode.
Confirm the interface connection condition.

Not in system controller mode
GPIB of the MS2670A is not in system controller mode.
Confirm the interface connection condition.

Only one marker is on
One or more multi markers must be set to On.
So, the specified operation cannot be executed.

Out of lower limit
Input numeric data is out of the lower limit.
Confirm the set value and the setting range.

Out Of Range .....
Input numeric data is out of the setting range.
Confirm the set value and the setting range.

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Out of upper limit
Input numeric data is out of the upper limit.
Confirm the set value and the setting range.

Quote(¥") is not pair
Input string data has not the either of the pair.
Confirm the setting data.

Range limit .....
Input data is out of the setting range.
Confirm the set value and the setting range.

Read/Write error
Error is occurred in the read/write operation of the memory card.
Confirm the memory card.

Reference level changed
Reference level value is rounded in the internal processing.

RS232C error
Error is occurred in the RS-232C operation.
Confirm the RS-232C connection and interface condition settings.

Source has not been selected yet
Source of the user-define function is not selected.
Select the Source, and re-operate.

Storage mode changed
Storage Mode is changed in the internal processing.

String too long .....
Length of the input string is out of the upper limit.
Confirm the setting data.

Sweep time changed to lowest value
Sweep Time is rounded to the lowest value in the internal processing.

Sweeping was suspended
Sweeping was suspended.

The memory has not been saved
Recalled internal register is not saved(existed).
Confirm the register No. to be recalled.

Time out error
Time-out error is occurred.
Confirm the connected devices and connection conditions.

Unavailable to set Marker to Normal
The specified function cannot be performed, because the marker cannot be set to Normal.
Set the marker to Normal, and re-execute the function.

Unavailable to set Marker to Delta
The specified function cannot be performed, because the marker cannot be set to Delta.
Set the marker to Delta, and re-execute the function.

Undefined command
The specified external control command is undefined in the MS2670A, and cannot be used.

Unit Exchange Error (Overflow)
Error(overflow) is occurred in the internal conversion processing.

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APPENDIX C

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.

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