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

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
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July 1996 (First Edition)

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For Safety

WARNING ⚠

![!](alert triangle)

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.

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.

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.

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	SAMPLE
(for analog communication systems)	
• Occupied frequency bandwidth, adjacent-channel leakage power	POS PEAK or SAMPLE
(for digital communication systems)	

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

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.

Input signal

Nearby spurious
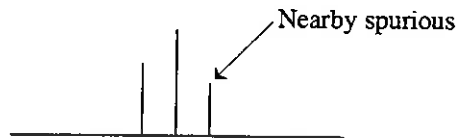
Filter
with better selectivity

Trace waveform
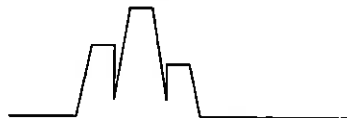
Filter
with worse selectivity
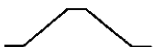
Trace waveform
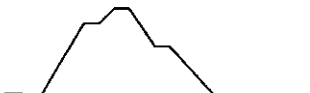
When in the same combination of the RBW and span, the MS2670A auto sweep time in the Hi-Lvl-Acc mode becomes slower than that of the old type, by 3 times.

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.
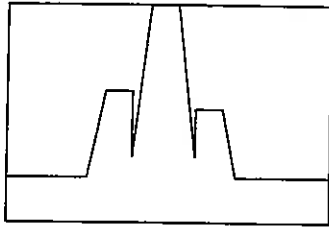
```
RBW = 1 kHzST = 400 ms          RBW = 300 Hz ST = 1.5 s
      SPAN = 50 kHz                    SPAN = 50 kHz
```

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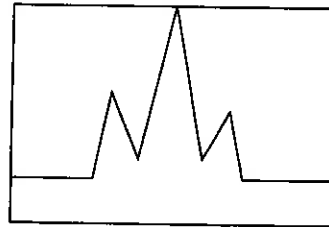
In the same combination of the RBW and span, the MS2670A have the "Fast" auto sweep mode, in which the auto sweep time can be set to the same as that of the old types.

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.

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

$C\epsilon$

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

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.
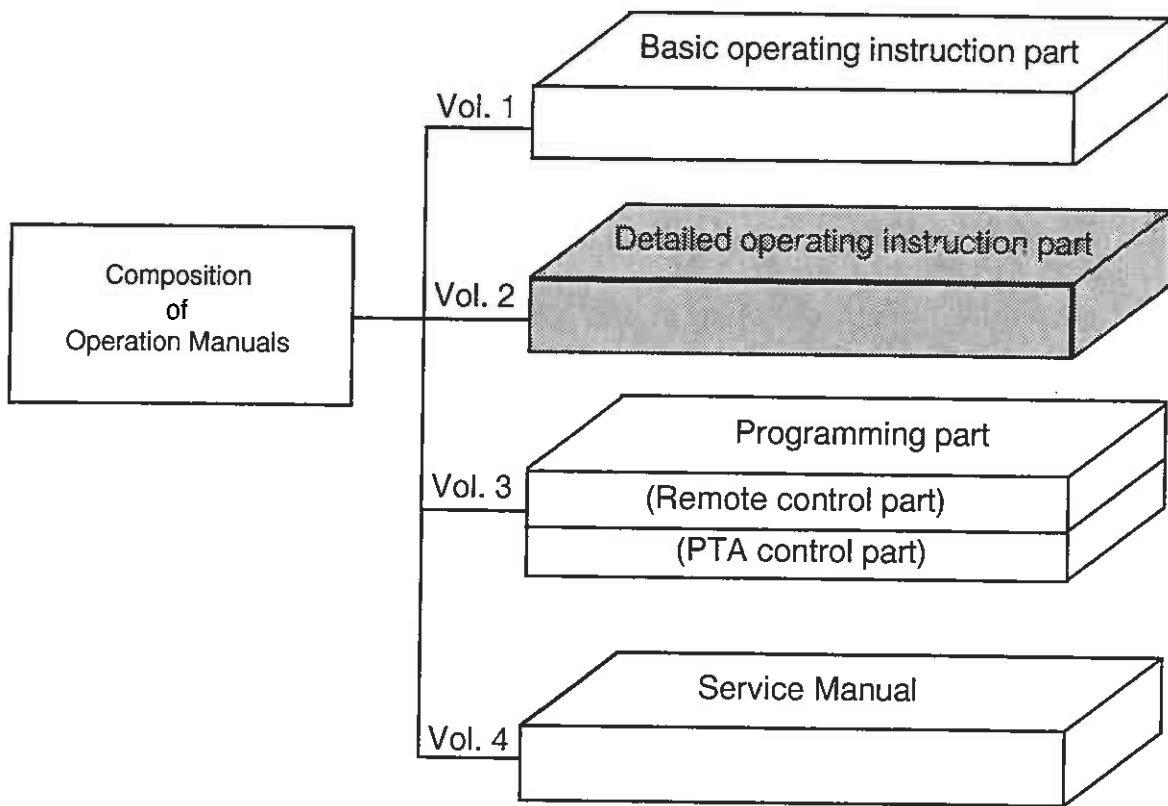
Basic operating instruction part:	Basic Operating Instructions: Provides information on the MS2670A outline, preparation before use, panel description, basic operation, soft-key menu and performance tests.
Detailed operating instruction part:	Detailed Operating Instructions: Provides information on the 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.

I

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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.
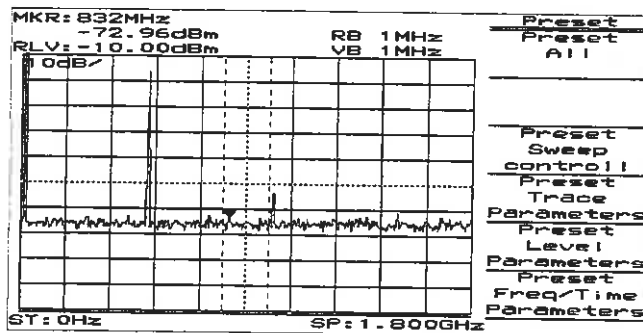
Fig. 1-1

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.

Set the signal to the center of the screen

Press [Frequency] key.
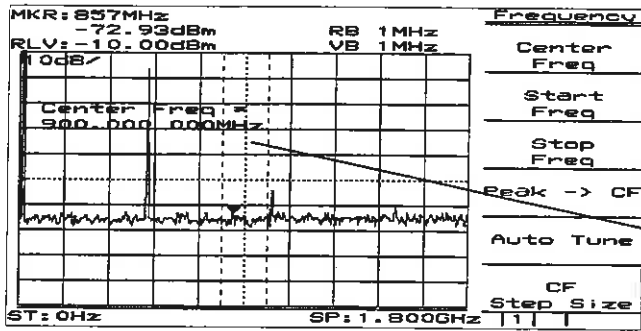
Fig. 1-2

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
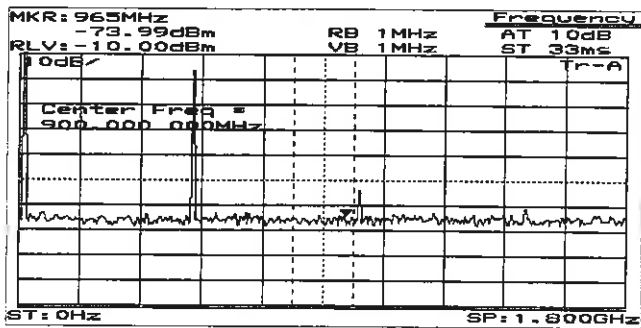
Fig. 1-3

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.
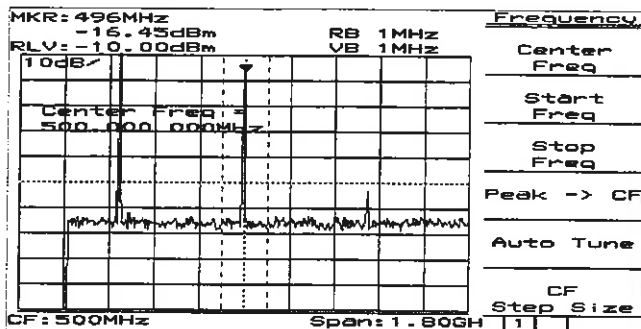
Fig. 1-4

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.

Enlarge and display the signal

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

```
MKR:500MHz
   -16.62dBm          RB  1MHz          Span
RLV:-10.00dBm         VB  1MHz          Span
10dB/
                                       Full Span
Freq Span =
1.800 000 000GHz                        Zero Span

                                        Scroll ->

                                        <-Scroll

CF:500MHz              Span:1.80GH
```
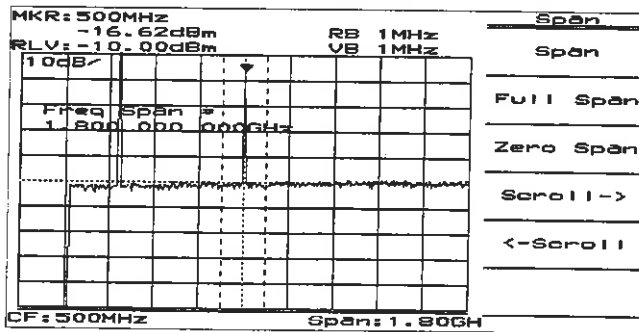
Fig. 1-5

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.
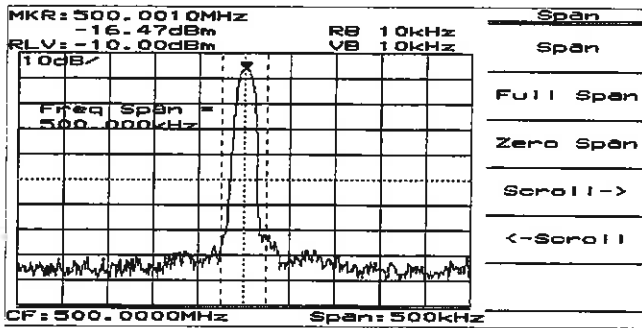
Fig. 1-6

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.
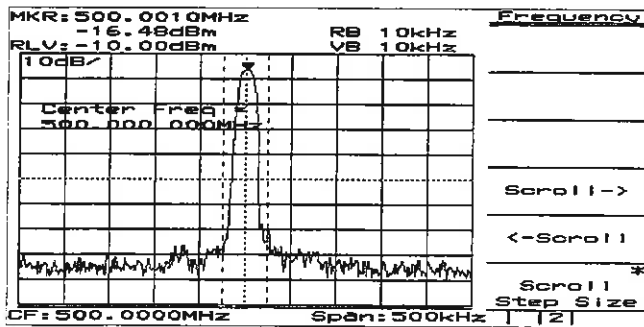
Fig. 1-7

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.

Press <u>Peak Search</u> key.
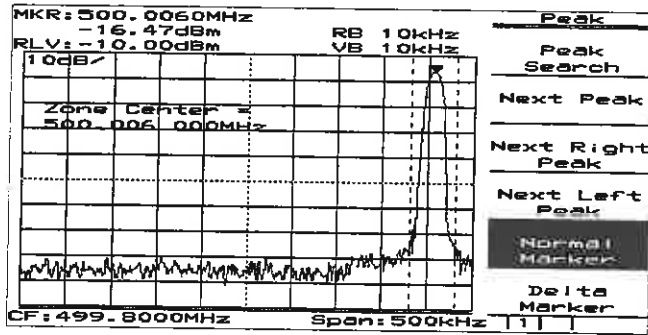
Fig. 5-8

> *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 <u>Marker →</u> key.
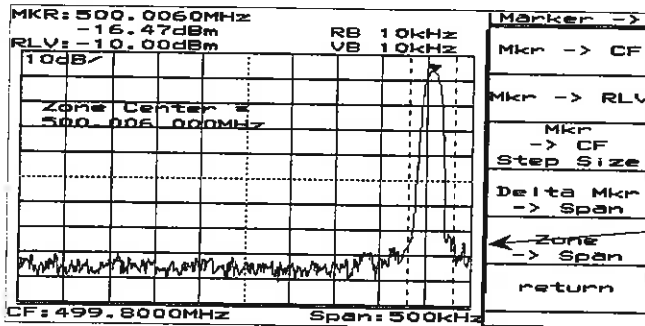
Fig. 5-9

> 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 <u>marker →</u> CF key.
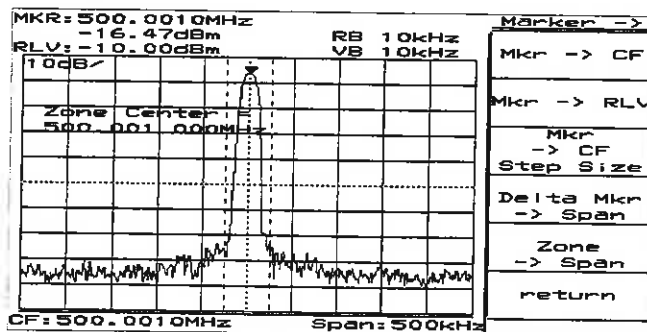
Fig. 1-10

> The page opened by pressing the soft key can return to the preceding page by the <u>return</u> 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.

"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.
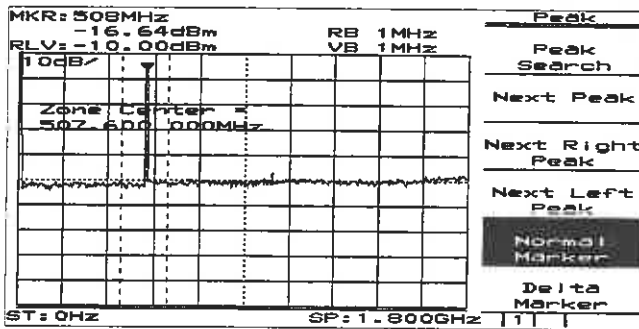
Fig. 1-11

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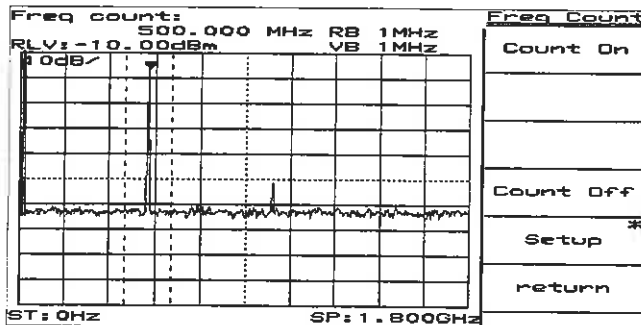
> The soft-key menu display can be switched On/Off by the Menu On/Off key. However, keys that condition setting is not possible unless a menu is On unconditionally make the soft-key menu display On when pressing a panel key.

> 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.

Fig. 1-12

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.

Rear panel
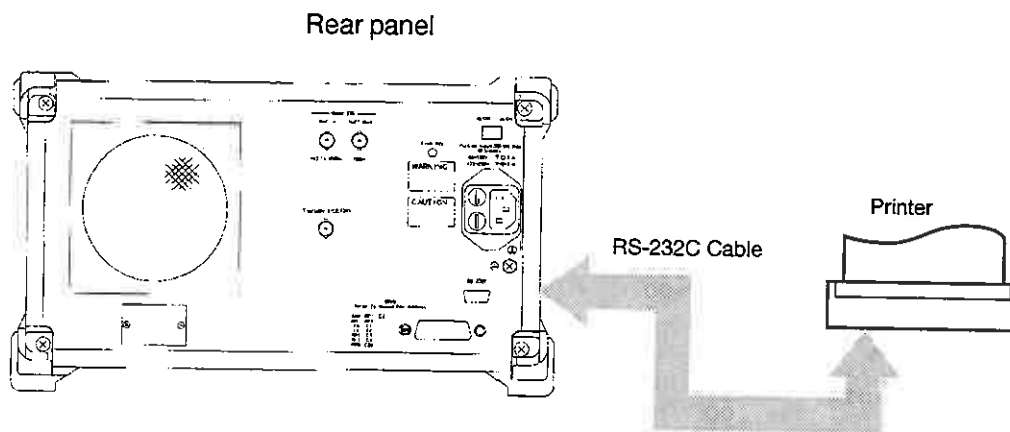
Fig. 1-13

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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.
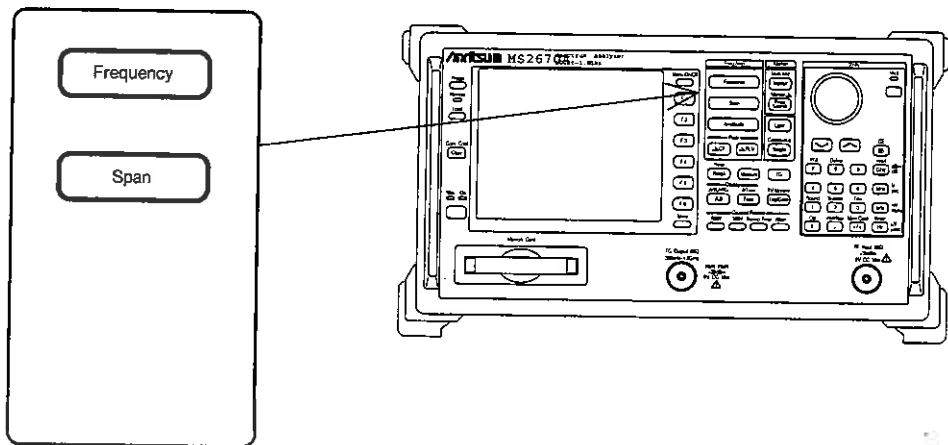
Center-Span Mode

(1) Setting center frequency

Frequency → TEN KEY

→ ⌄ ⌃ Key (Use the <u>CF Step Size</u> key to set the step size.)

(2) Setting frequency span

Span → TEN KEY

→ ⌄ ⌃ Key (1/2/5 sequence)

Tr-A

CF:1.000 000 GHz   Span:1.00 MHz
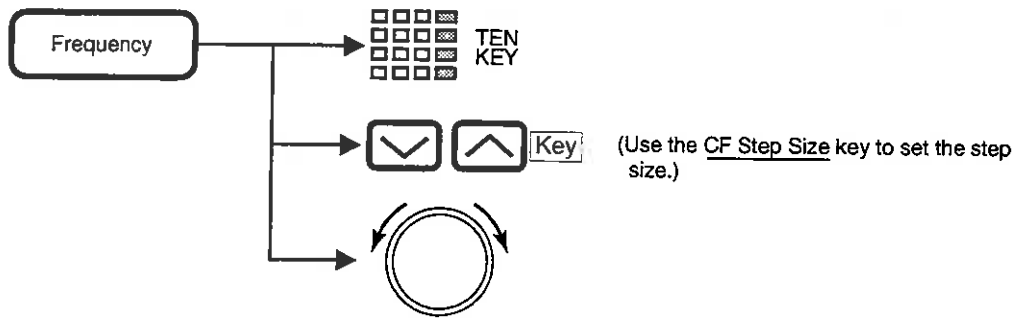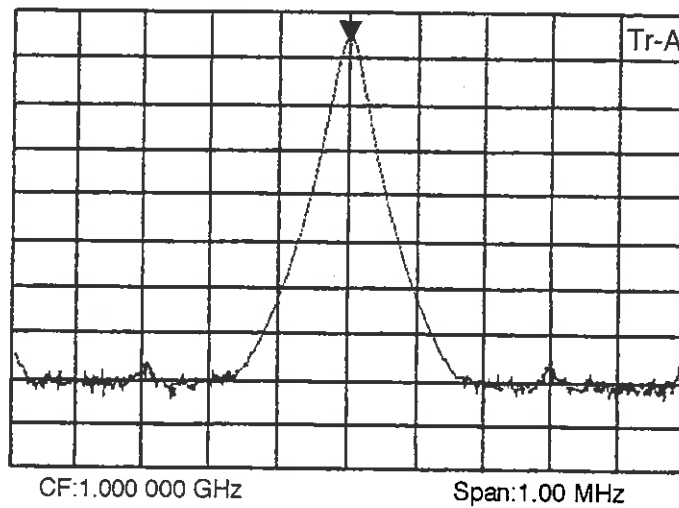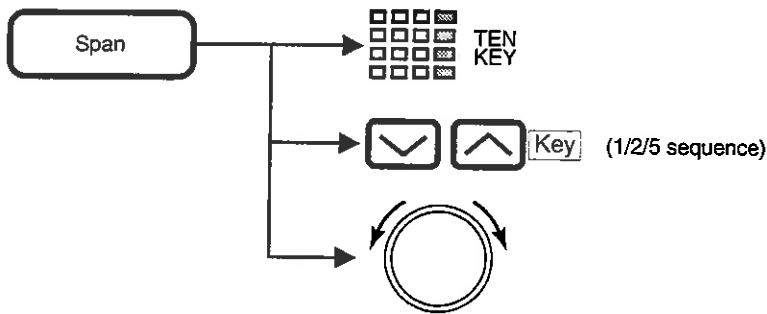
Start-Stop Mode

(1)   Start frequency

```
Frequency  ─────▶  Start Freq  ──────▶  [TEN KEY]
                                    │
                                    └──▶  ( knob )
```

(2)   Stop frequency

```
Frequency  ─────▶  Stop Freq  ──────▶  [TEN KEY]
                                   │
                                   └──▶  ( knob )
```
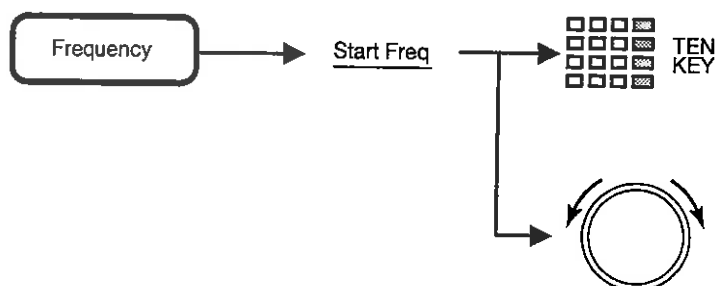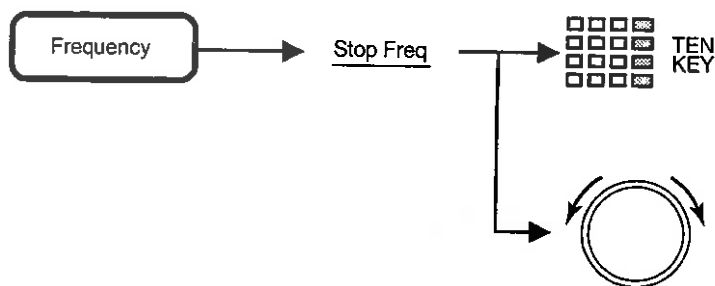
Notes: • Because the $\vee$ and $\wedge$ keys are the step keys for the center frequency, the start and stop frequencies are also changed.

   • The stop frequency may also vary depending on the values of the frequency span setting resolution and start frequency.

ST:0 Hz   SP:1.000 GHz
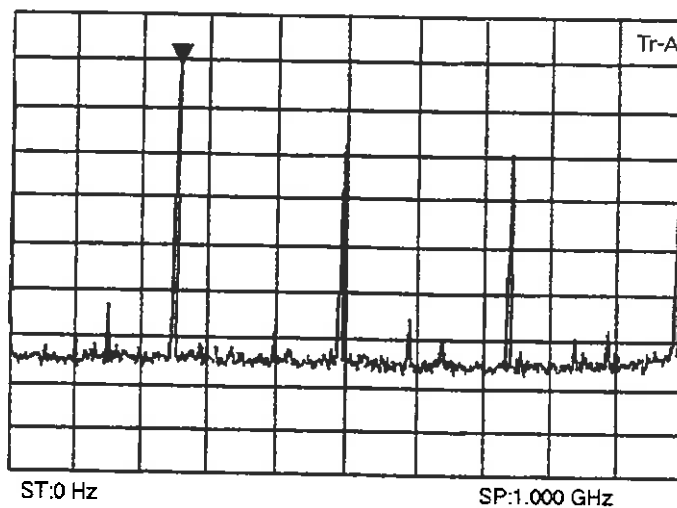
Setting Step Size with Step Keys
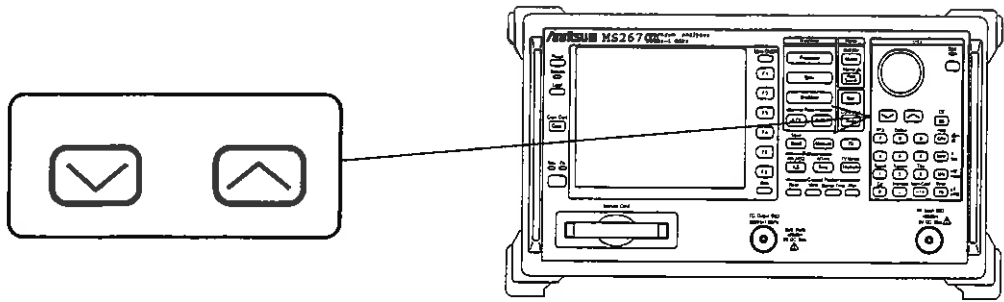
To use the ⌄ ⌃ keys to change the step size of the center frequency, register the step size as follows:

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.

Tr-A

2 div →

Span ⟶ Scroll→
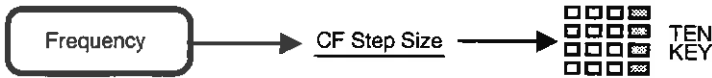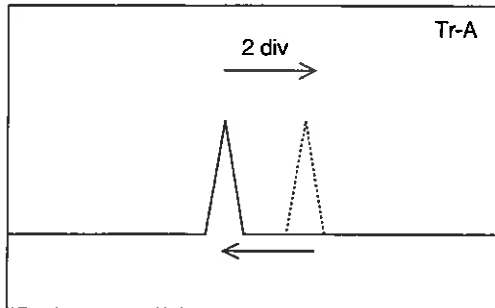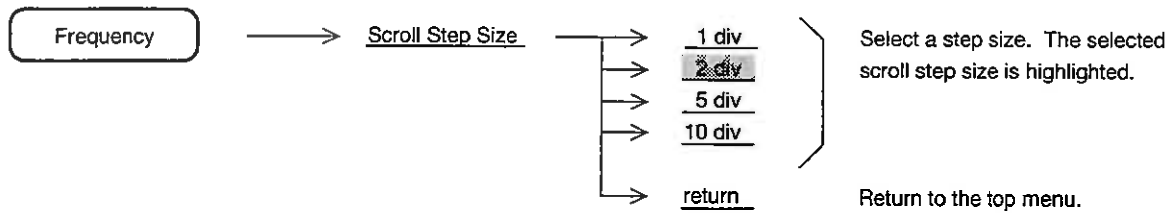
The waveform scrolls 2 divs to the right.

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 <u>Preset All</u> 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) ———⟶ <u>Full Span</u>

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) ———⟶ <u>Zero Span</u>

- (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."

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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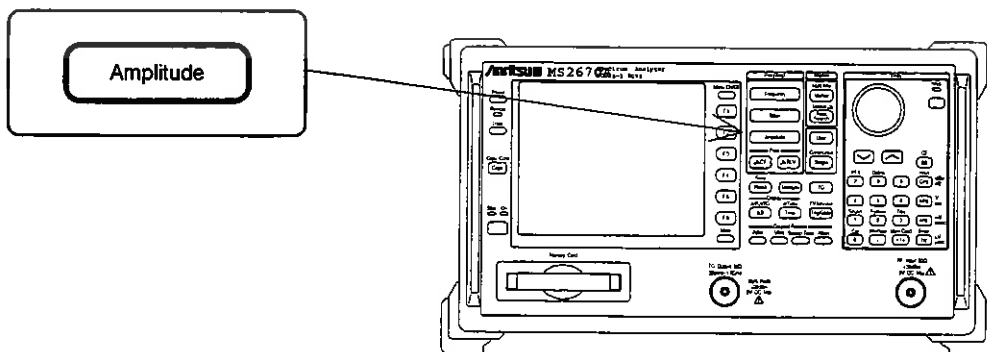
Setting Log/Linear Scale

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

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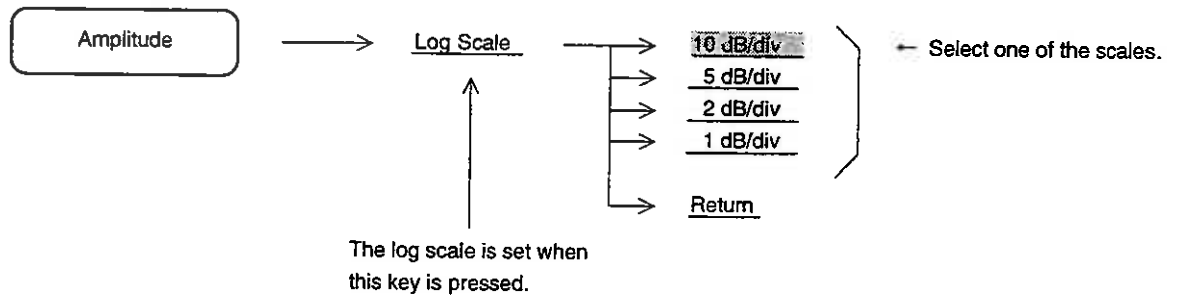
(2) Setting linear scale
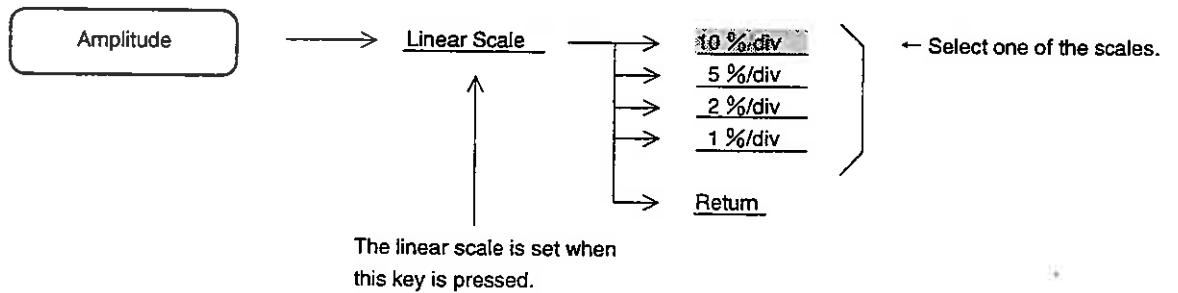
The reference level remains constant, independent of switching between log and linear scales.
When the reference level is set to less than −60 dBm in the log scale mode, the reference level of the linear scale is switched to 224 μV.

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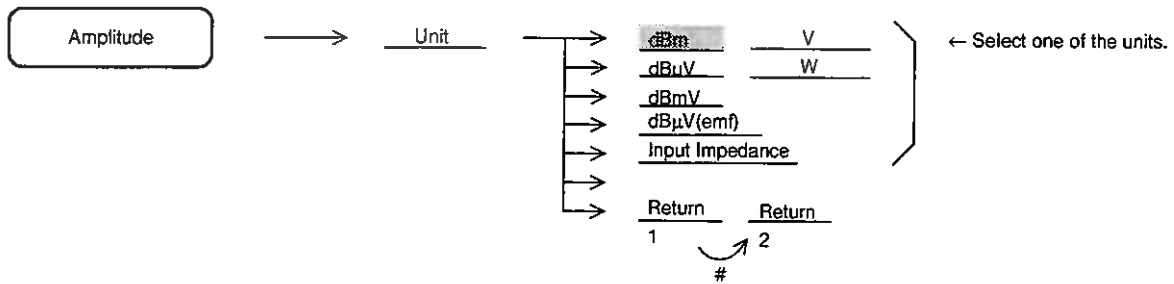
To turn the page, press the [More] key.

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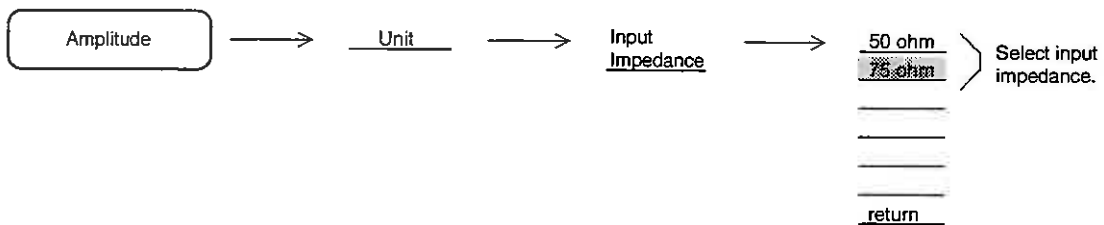
When the input impedance is set to 75 Ω, the level is displayed after adding +1.8 dB to the 50 Ω level, and "75 ohm" is displayed at the top right of the waveform.

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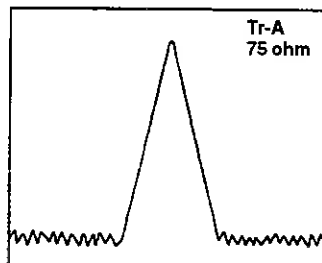
When the MA1621A is used as the 50 Ω→75 Ω Impedance Transformer, the insertion-loss frequency characteristics of the MA1621A must be compensated. The MS2670A has the level-compensation function. (See page 2-15 "Setting 50 Ω→75 Ω Impedance Transformer (MA1621A)".)

Setting Reference Level

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

When the log scale is selected, the value set by Reference Level Step Size is used as the step size. When the linear scale is selected, the step size is fixed at 1 division.
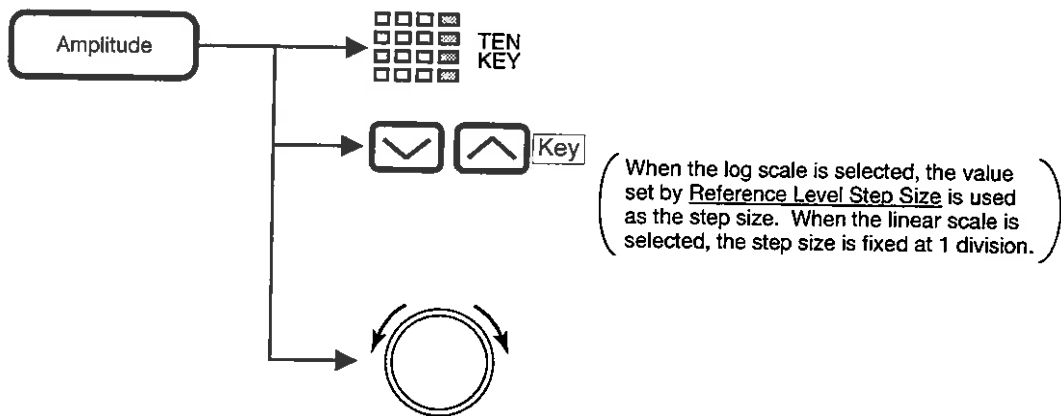
Use the unit key as follows, according to the set reference level unit.

(For W units, read V as W.)
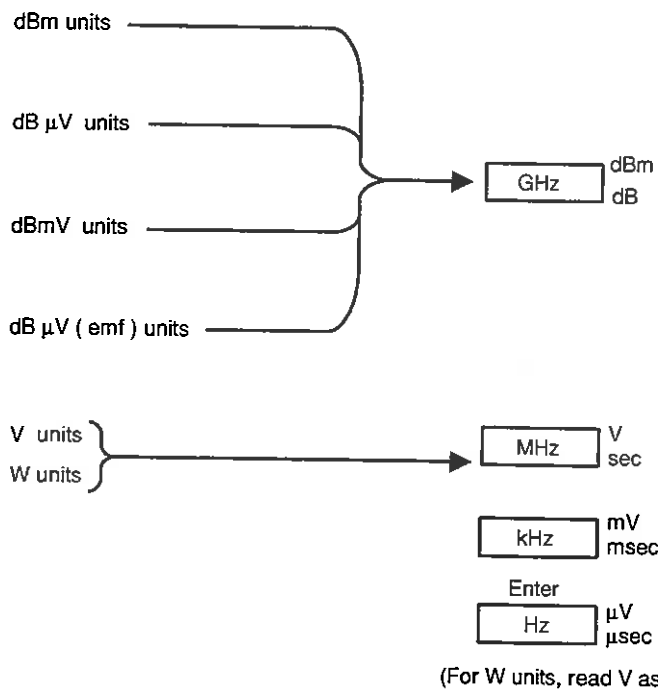
Setting Reference Level Step Size

To change the reference level with the $\boxed{\vee}$ $\boxed{\wedge}$ keys, set the step size by performing the following key operations.

(1) Log scale

Manually enter the step size in dB units from the ten keys.
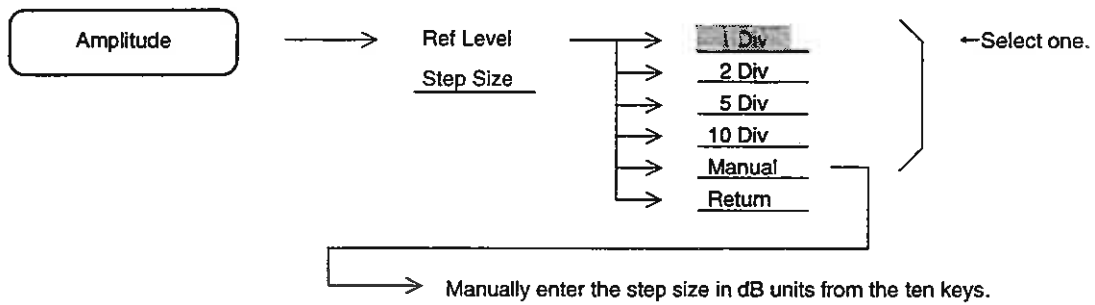
(2) Linear scale

Fixed at 1 division.

Offsetting Reference Level

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

MRK:100.000 MHz
−18.00 dBm
RVL:−10.0 dBm

When the offset
value is set to 30 dB.

When the offset
value is set to −20 dB.

MRK:100.000 MHz
12.00 dBm
RVL: 20.0 dBm #

MRK:100.000 MHz
−38.00 dBm
RVL:−30.0 dBm #
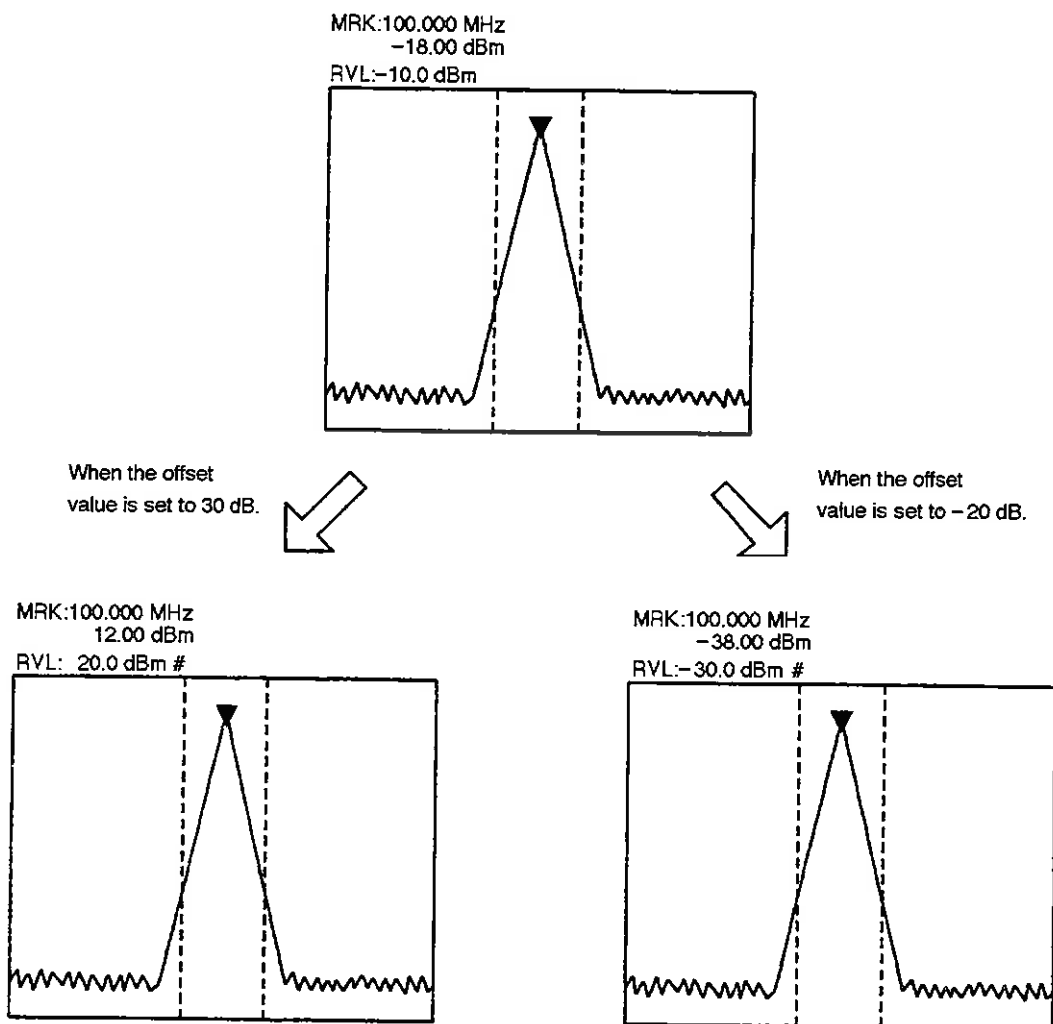
The # is displayed to the right of the reference level display above the scale.

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

```
┌──────────────┐
│  Amplitude   │ ─────────→   Ref Level ──────────┐
└──────────────┘              Offset              │
                                                  │
            ┌─────────────────────────────────────┘
            │
            ├──→   Ref Level         Select reference level offset On or Off.
            │      Offset
            │      On Off
            │
            ├──→   Ref Level    ───→ Set the offset value (dB) with the ten keys, up-down
            │      Offset            keys, or rotary knob.
            │      −10.05 dB
            │
            └──→   Return
```
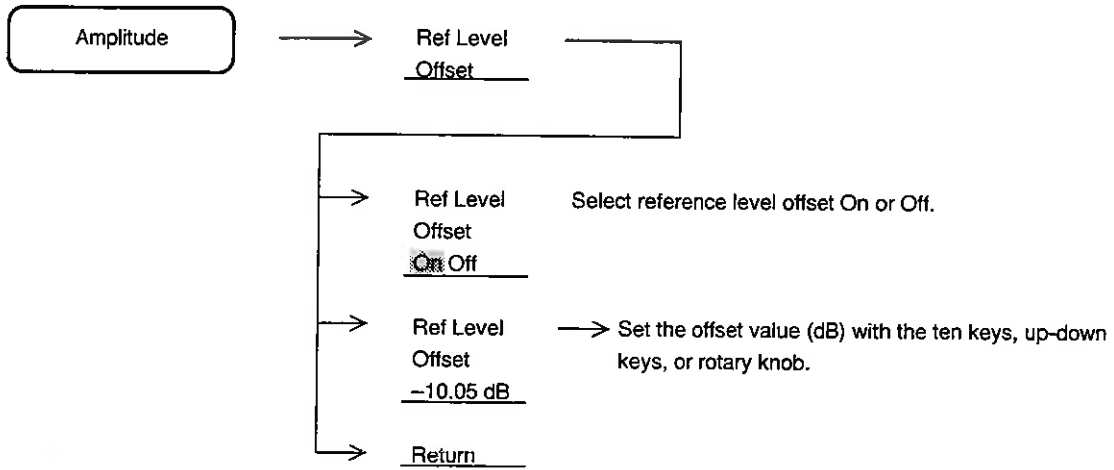
The offset value setting range is from −100 to +100 dB. The offset value resolution is 0.01 dB.

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

Setting Attenuator

Press the | Amplitude | key, then press the <u>Attenuator key</u>.

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 <u>Input Transformer</u> key.

Set the MA1621A to On with the On Off key.

When the input impedance is set to <u>On</u> (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.
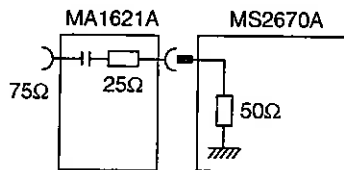
Setting Level Frequency Correction Coefficient

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.

```
 ┌──────────────┐
 │  Amplitude   │ ────────▶   Correction  ──────────┐
 └──────────────┘                                   │
                                                    │
                          Correction        Select correction On or Off by pressing this key.
                    ──▶   On Off

                    ──▶   Select Corr   ──▶ Select the correction table from among the five correction
                                            tables (Corr-1 to 5).
                    ──▶   Setup Corr  ─────────┐
                                               │
                    ──▶   Return               │
                                               │
                                               │
                    ──▶   Load Corr Set    Load the five correction tables from the memory card.

                    ──▶   Display          Display the directory on the screen.
                          Directory        When the entire directory cannot be displayed at one time,
                          /Next            display the remaining directory by holding down the key.

                    ──▶   Dir Disp         Select detailed/outline display by pressing this key.
                          Detail
                          Outline

                    ──▶   Save Corr Set    Save the five correction tables to the memory card.

                    ──▶   Load/Save        Select if memory card 1 or memory card 2 is to be loaded
                          Media            and saved to the media.

                    ──▶   Return
```

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

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).

TABLE OF CONTENTS

SECTION 3
MARKER FUNCTIONS

The inner section keys are used as the header keys for setting the marker functions.
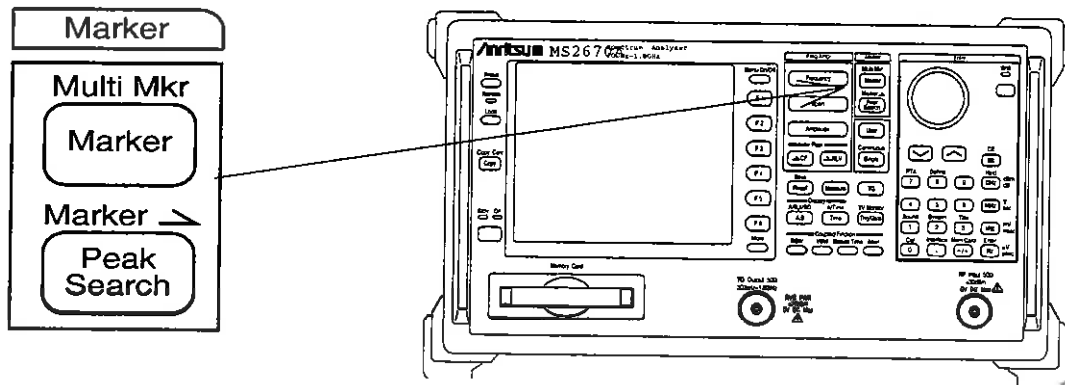
Changing Zone Marker Position and Width

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.
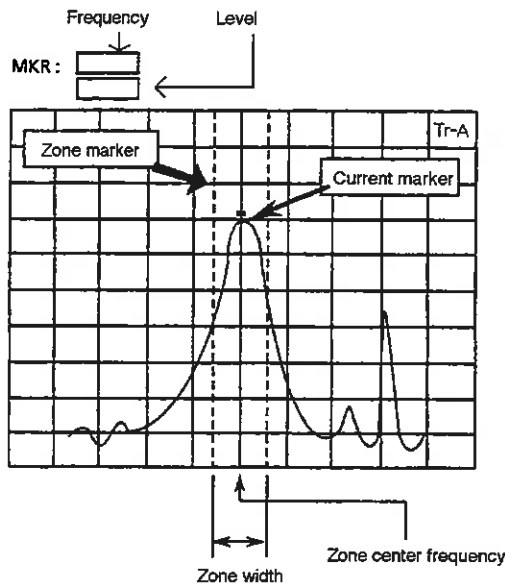
Changing Zone Marker Width

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.
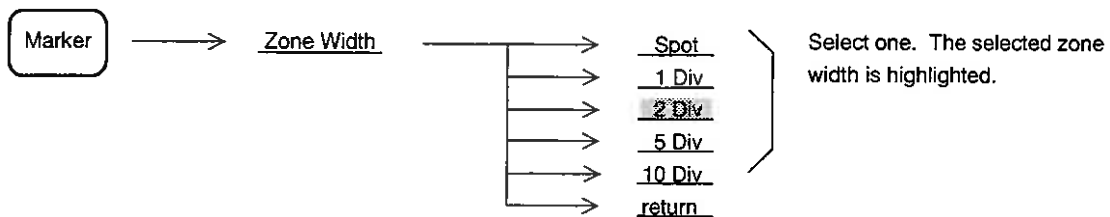
The zone marker width can be arbitrarily set from 1 point to 10 divisions by rotary knob.

The zone marker width can be arbitrarily set from 1 point to 10 divisions by the corresponding frequency input from the ten keys.

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)
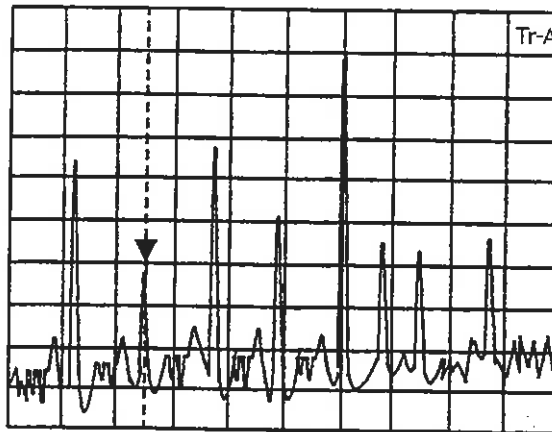
If the zone marker is set to 10 divisions when the zone center frequency is at the center of the frequency axis on the screen, the current marker will always move to the maximum peak level over the entire range of the observation frequency.

Example of Zone Width: 10 Divisions
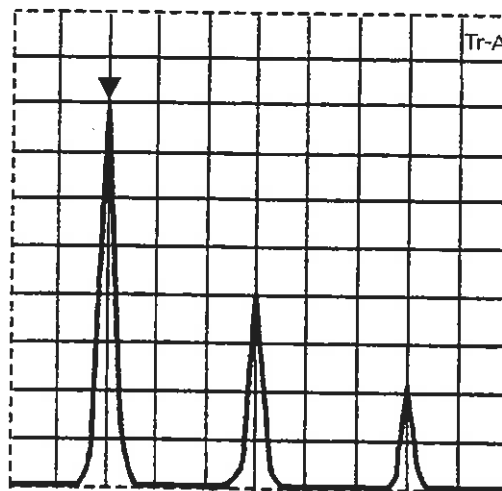
Since the zone width in the time domain mode always becomes 1 (Spot), it cannot be changed.

Changing Zone Marker Position

The center frequency (time) of the zone marker is initially centered on the frequency (time) axis on the screen. By performing the following key operations, the zone marker can be moved from the left end to the right end of the frequency axis (time) on the screen.

(Use the ten keys to set the zone marker position as frequency or time.)

(Use the up-down keys to move the zone marker position in 1 division steps.)
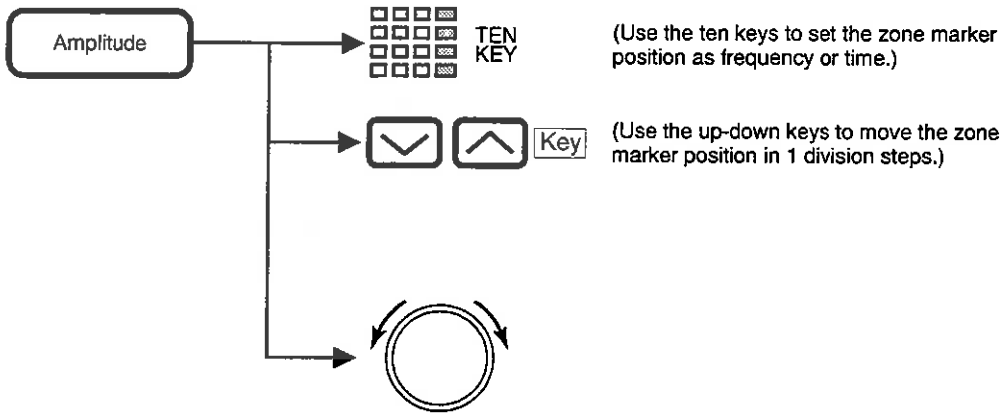
In the delta marker mode, setting the zone marker center frequency (time) with the ten keys results in entry of the delta marker value (difference between reference marker and current marker).

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] ⟶ <u>Normal Marker</u>

MRK : 1.023 GHz
− 32.6 dBm

Current marker

Tr-A
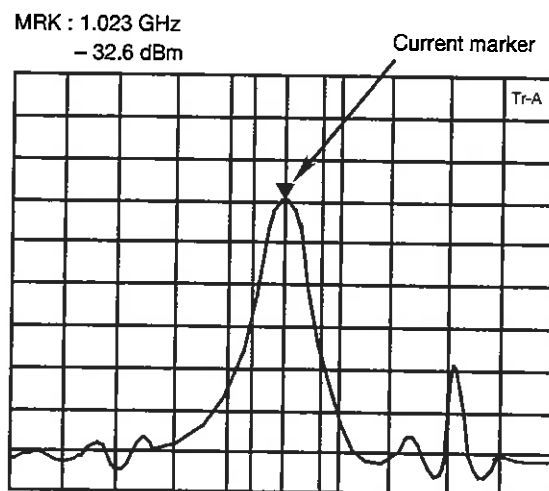
The normal marker displays the absolute level. By setting a display line, the normal marker can also display the level relative to a given level specified as a display line.

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

```
DLT : −9.90 kHz
      −40.3 dB
```
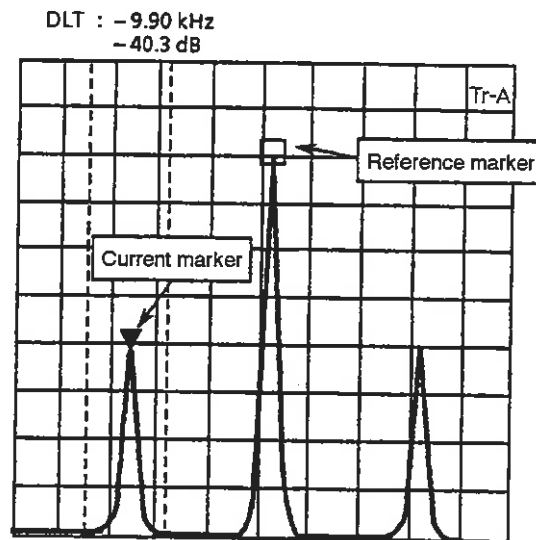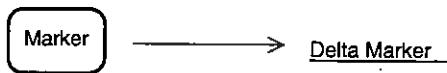

Press the Delta Marker key in the delta maker mode. The reference marker moves to the current marker position and switches to the delta marker mode with that point as the reference point.

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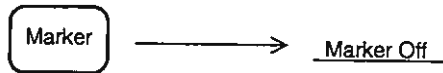
The marker disappears from the screen. When the Normal Marker key is pressed, the marker is displayed.

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.)
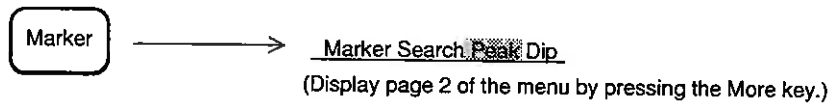
Display Line

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 ———→ <u>Display Line</u>
(Display page 2 of the menu by pressing the More key.)

→ Display Line   Turn the display line On and Off by pressing this key.
  On Off

→ Display Line   Enter the display line level from the ten keys, etc.
  Level
  –50.00 dBm

→ Marker Level   Select if the marker level is set by absolute value or relative
  Abs Rel   value (relative to display line) by pressing this key.

→ <u>Return</u>
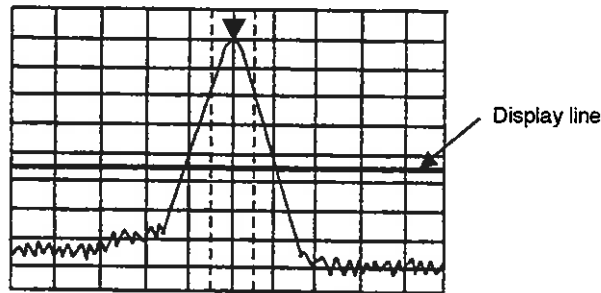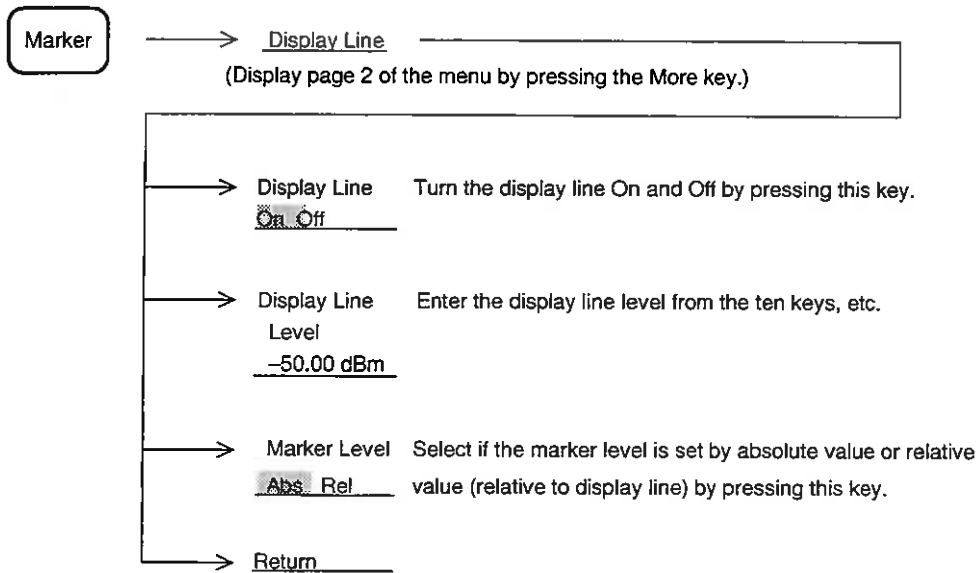
Display line

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.

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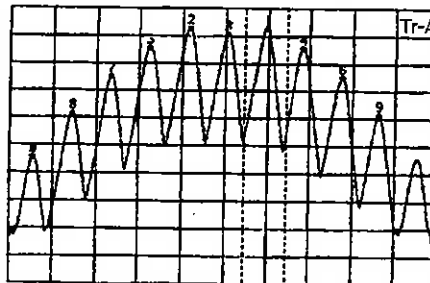
After executing Highest 10, an active marker (with the same functions as the current marker) moves to the peak point of the maximum level signal.

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.

Harmonics Multimarker

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

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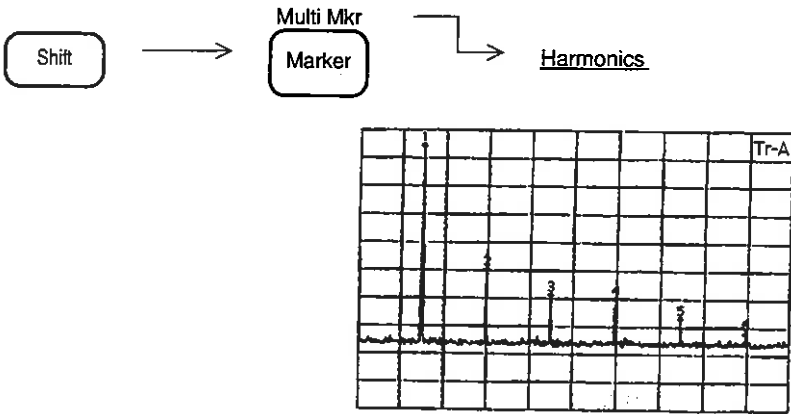
Note: If the fundamental and second harmonic signals are not separated by more than the marker zone width, or when there are larger level signals other than harmonic signals in the frequency range of the marker zone width centered at the harmonic signals, harmonic signals will be incorrectly detected.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

Marker List

Shift ⟶ Marker (Multi Mkr) ⟶ Marker List

→ Marker List
   On Off   Turn the marker list display On and Off by pressing this key.

→ Freq/Time
   Abs Rel   Select frequency/time as absolute value or relative value
                   (relative to frequency/time of active marker) display by pressing this key.

→ Level
   Abs Rel   Select level as absolute value or relative value (relative to
                   active-marker level) display by pressing this key.

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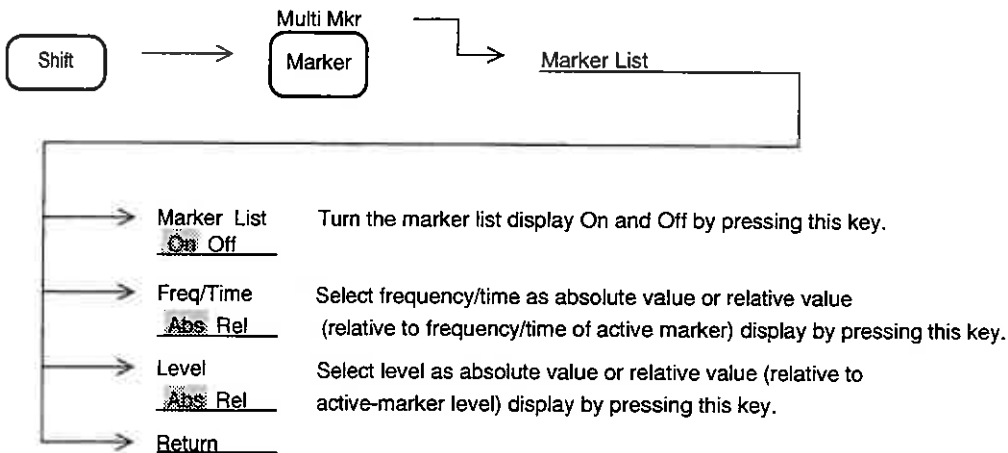
In Freq/Time Rel mode, frequency and time of the markers (except active marker) are displayed in relative values, and "R" marks are appended at the left.

In Level Rel mode, level of the markers (except active marker) are displayed in relative values.
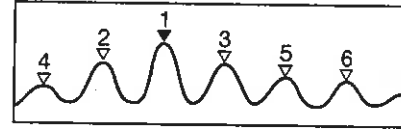

```
                 Marker List

 *  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:
```

Manual Set

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

```
                        Multi Mkr
  ┌────────┐          ┌──────────┐           ┌─────────────┐
  │ Shift  │  ──────► │  Marker  │  ──────►  │ Manual Set  │
  └────────┘          └──────────┘           └─────────────┘
```

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

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

Displays the active marker value.

Mkr : 999.99812MHz
−17.62dBm

RLV: −10.0dBm

Tr-A

*indicates the
active marker.

MARKER LIST

* 1:	999.998 12MHz	− 17.62dBm
2:	1.000 002 12GHz	− 17.62dBm
3:	1.000 000 00GHz	− 17.89dBm
4:	1.000 004 00GHz	− 25.88dBm
5:	999.996 00MHz	− 25.89dBm
6:	999.994 00MHz	− 37.53dBm
7:	1.000 006 04GHz	− 37.53dBm
8:	999.992 00MHz	− 52.45dBm
9:	1.000 008 04GHz	− 52.49dBm
10:		

Undisplayed markers are set to Off.

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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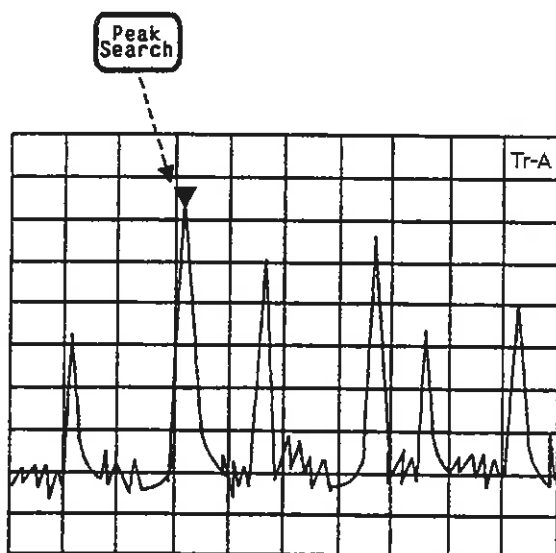
Next Peak Search

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.
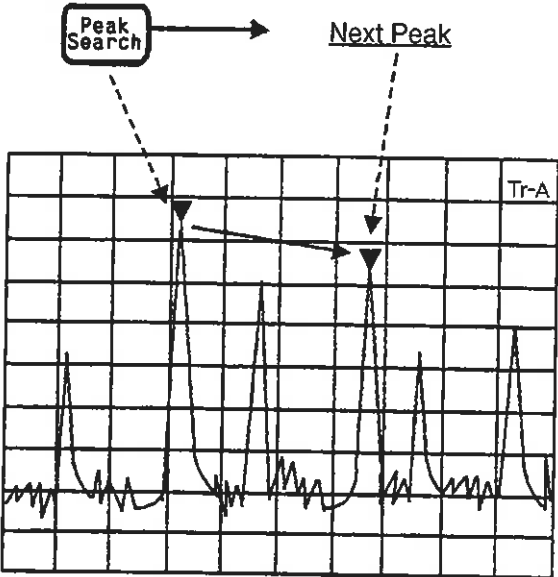
The next largest peaks can be detected and the marker can be moved to those peaks by executing Next Peak Search consecutively.

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.
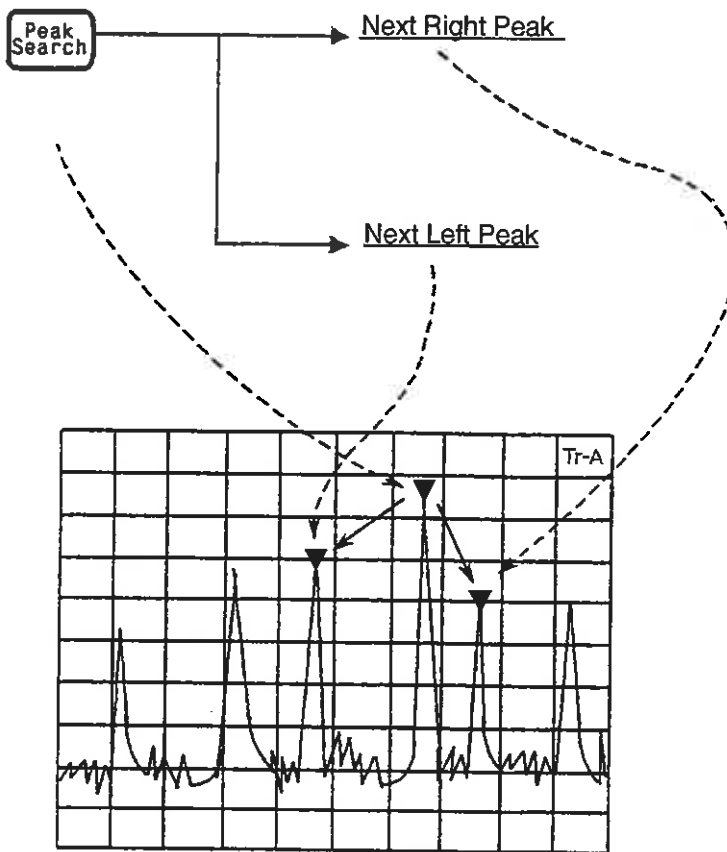
The adjacent peak level to the right or left can be detected and the marker moved to that peak by executing Next Right Peak Search or Next Left Peak Search consecutively.

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.

```
┌─────────┐
│  Peak   │ ──────────→   Dip Search
│ Search  │              ─────────
└─────────┘              (Display page 2 of the menu by pressing the More key.)
```
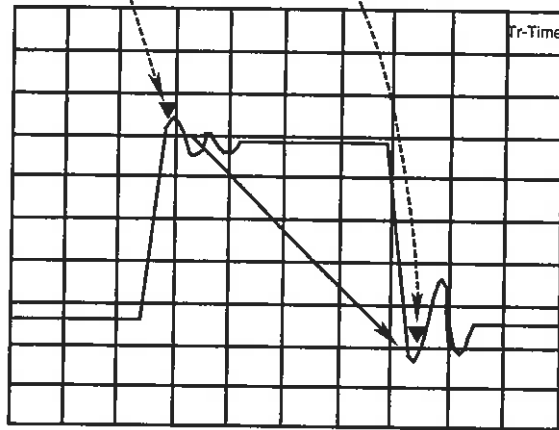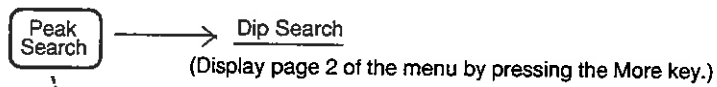
Time domain waveform

Time domain waveform

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.

```
┌────────┐
│ Peak   │ ─────────> __Next Dip__
│ Search │
└────────┘         (Display page 2 of the menu by pressing the MORE key.)
```

Peak   Dip   Next Dip
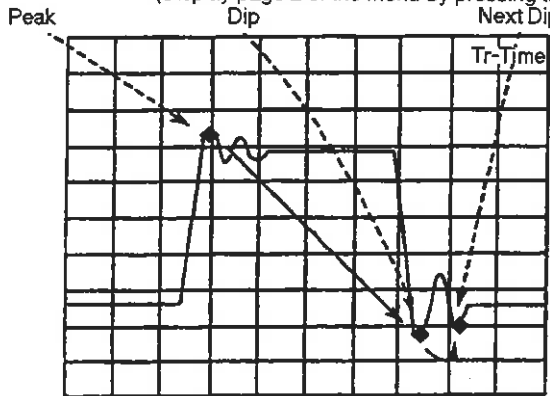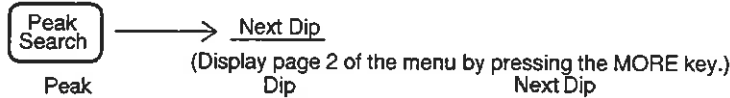
Time domain waveform

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.

```
┌────────┐
│ Peak   │ ─────────> __Resolution 1.23 dB__ ──────────
│ Search │
└────────┘      (Display page 2 of the menu by pressing the More key.)
```

Peak

Resolution

Enter the resolution in dB units from the ten keys.

Next Peak

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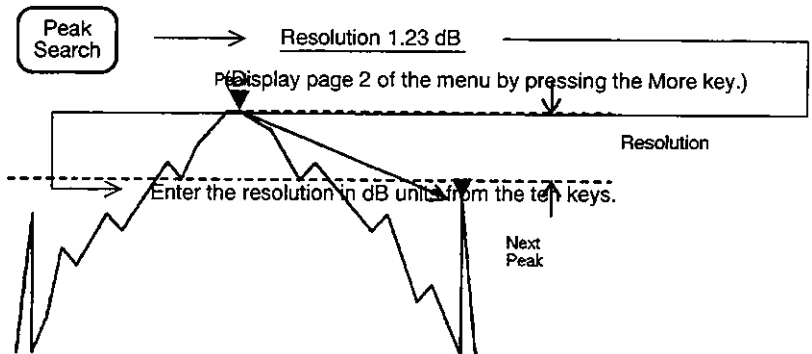
Setting Search Threshold

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

```
┌────────┐
│ Peak   │  ──────→    Threshold  ──────────────────────────────────────┐
│ Search │             (Display page 2 of the menu by pressing the More key.)  │
└────────┘                                                               │
                                                                         │
         ┌───────────────────────────────────────────────────────────────┘
         │
         ├──→   Treshold        Turn threshold On and Off by pressing this key.
         │      On Off
         │
         ├──→   Search          Select search above or below the display line by pressing this
         │      Above           key.
         │      Below
         │
         ├──→   Display         Turn the display line display On and Off by pressing this key.
         │      Line
         │      On Off
         │
         ├──→   Disp Line       Sets the display line level.
         │      Level
         │      –50.00 dBm
         │
         └──→   Return
```

Above ↑

-     Display
                                                                         Line
Below ↓

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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.

Mkr → CF/Mkr → RLV

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

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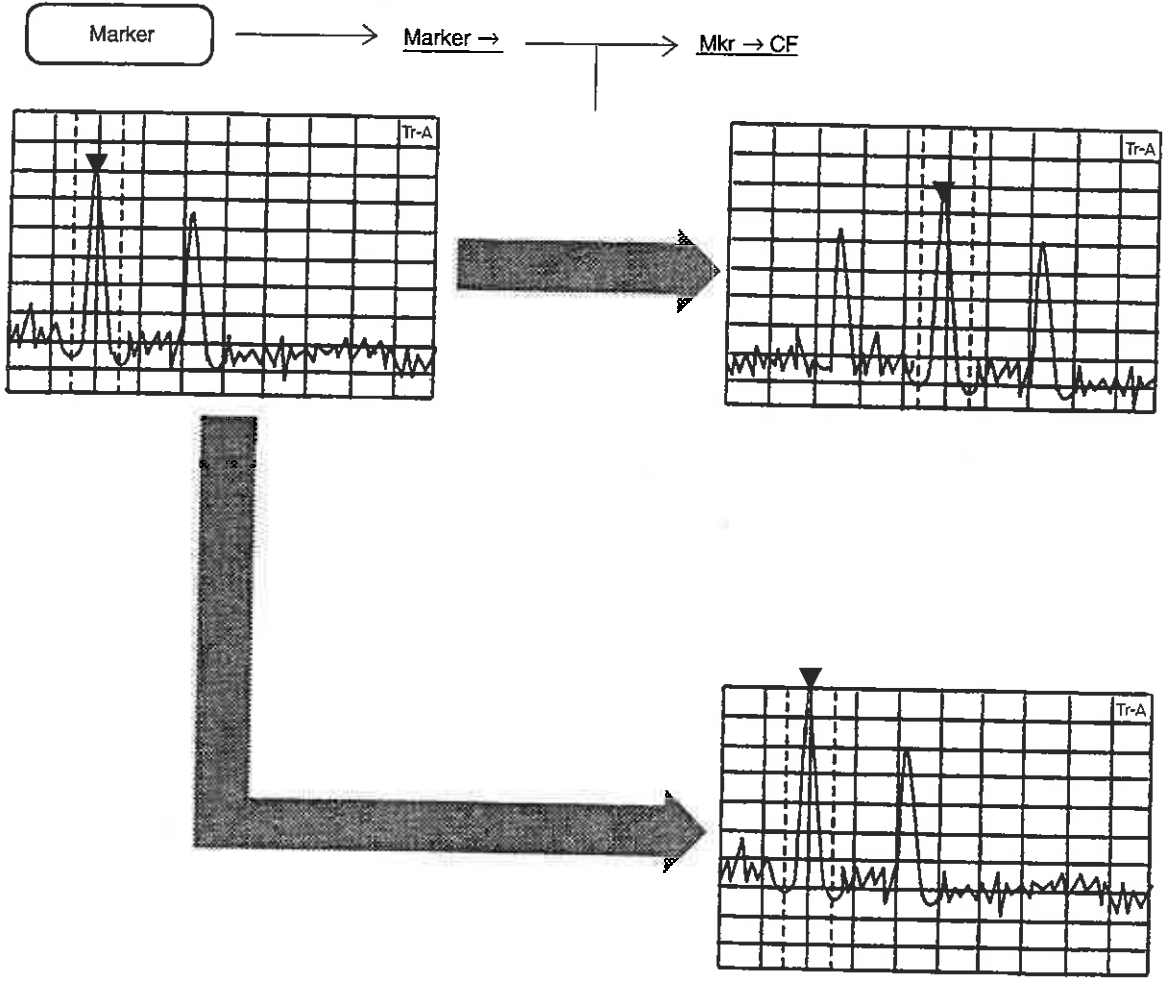
Mkr → CF Step Size

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

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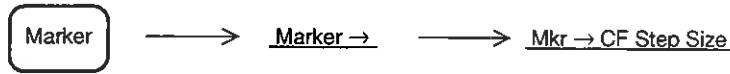
Although this action does not cause any change to appear on the screen, when the center frequency is changed with the up-down keys, the center frequency is changed with the marker frequency as the step size. This facilitates observation of harmonic waves.

fo   2fo   3fo

0 Hz   fo   2fo   3fo   4fo   5fo ···
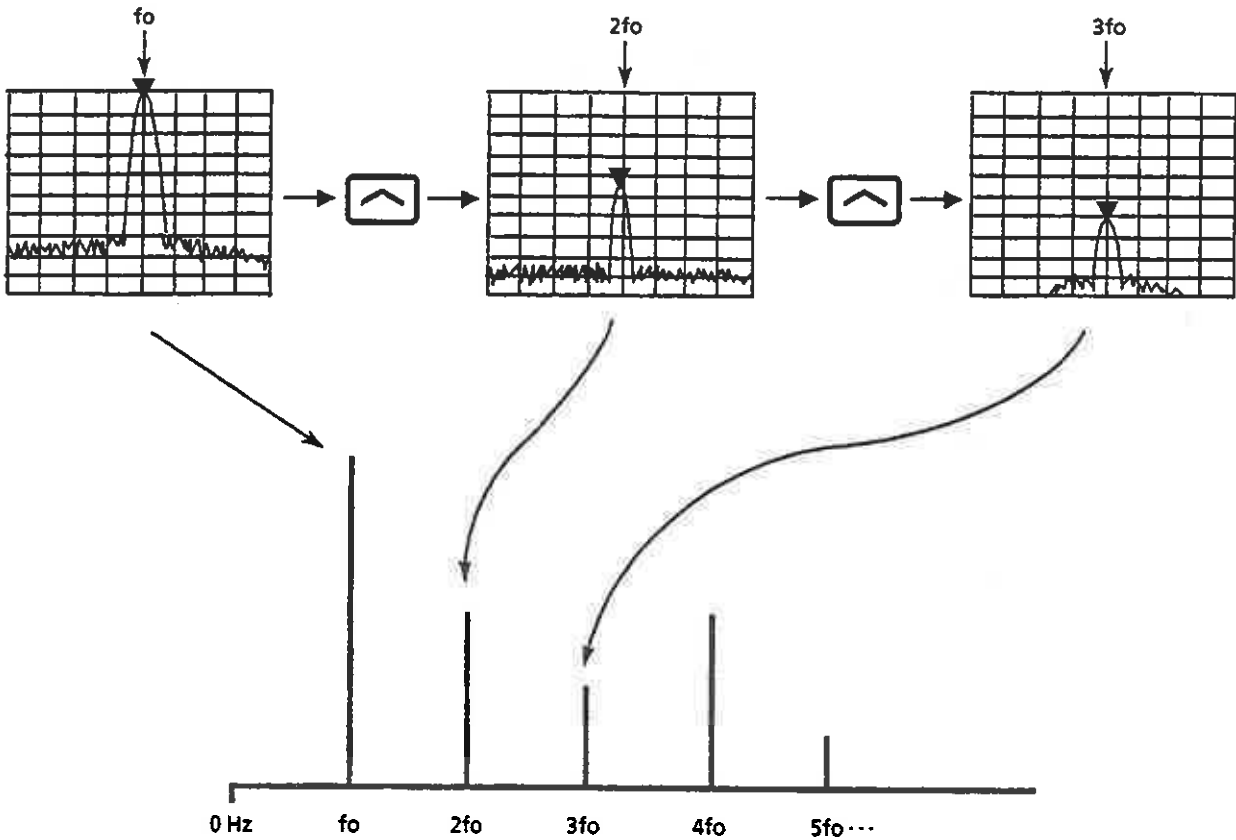
Delta Mkr → Span

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

The normal marker position remains unchanged.

Since the reference marker is fixed relative to the frequency, it moves to the extreme left when the frequency span is changed.

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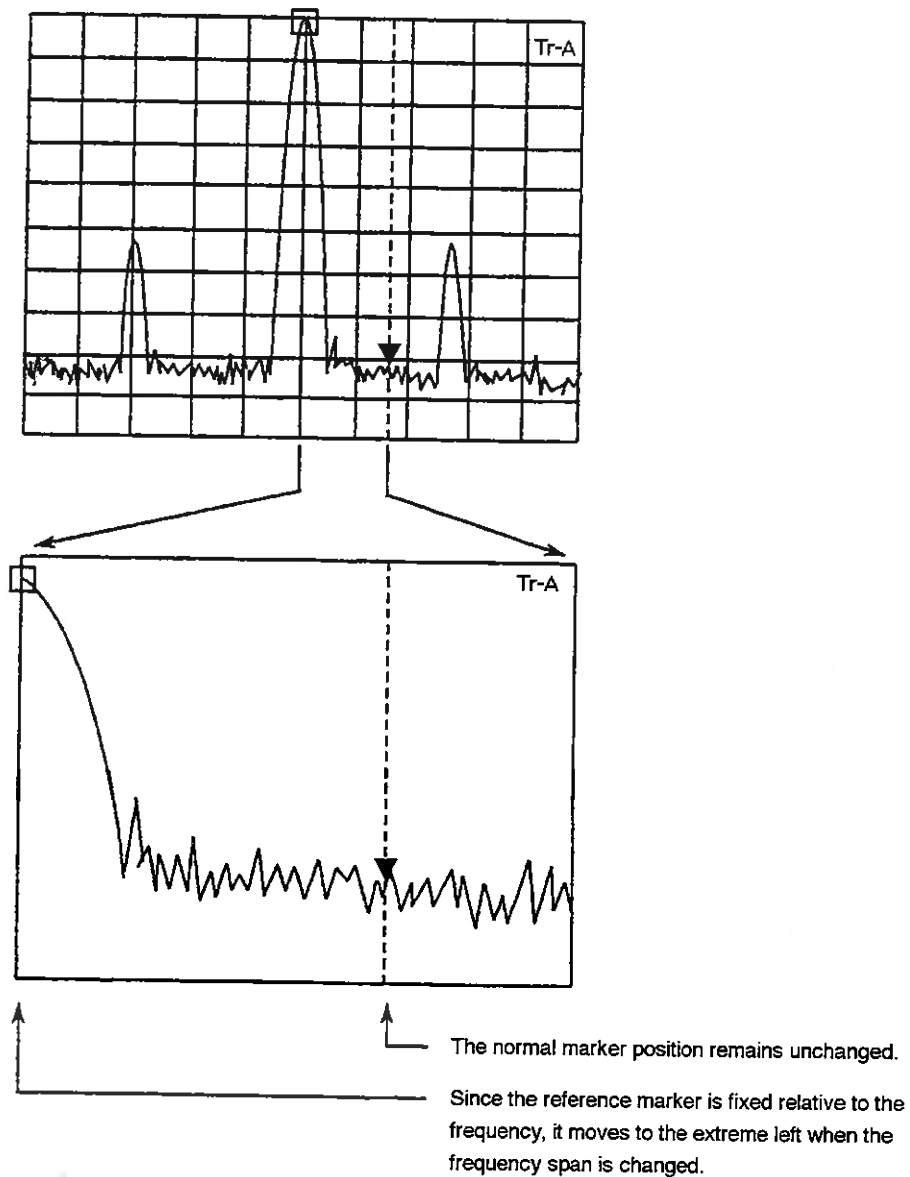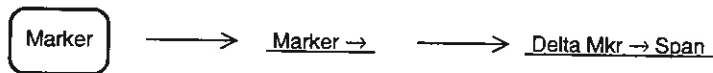
Zone → Span

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

Marker ⟶ <u>Marker →</u> ⟶ <u>Zone → Span</u>
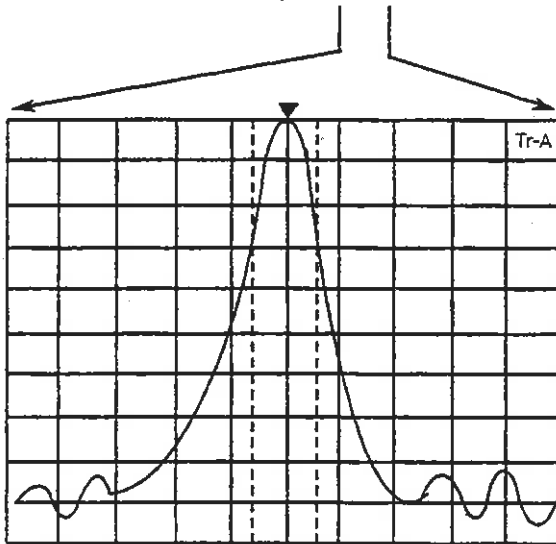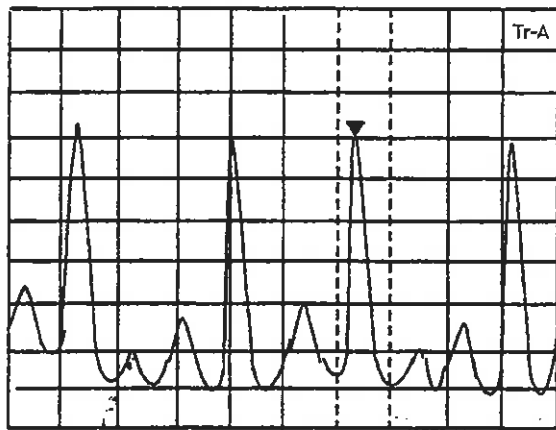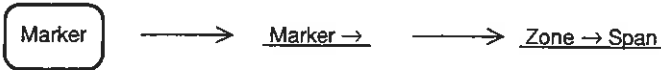
The zone width remains unchanged.

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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.

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.
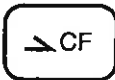
Stop frequency

Stop frequency specified in trace BG.

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.
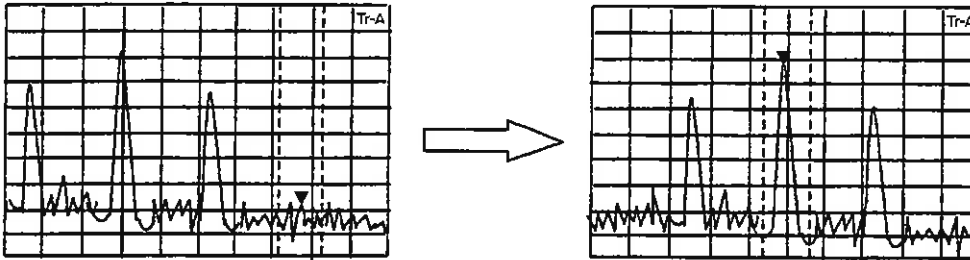
Notes: • When the frequency at the maximum peak point is less than 0 Hz, the center frequency is set to 0 Hz.
• If there are two or more maximum peak points with the same level on the screen, the peak point with the lowest frequency is moved to the center frequency.
• Peak → CF does not operate in the 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.
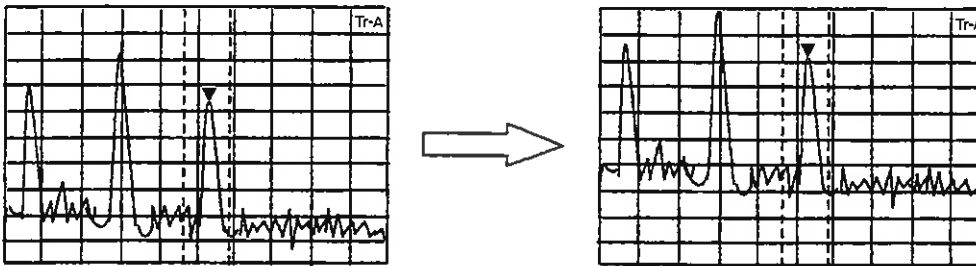
Notes: • If the level at the peak point exceeds the permitted range for the reference level, the reference level is set to the maximum (minimum) reference level that can be set.
• If the level at the peak point exceeds the reference level (scale over), one operation of the Peak→RLV may not be able to 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.
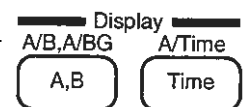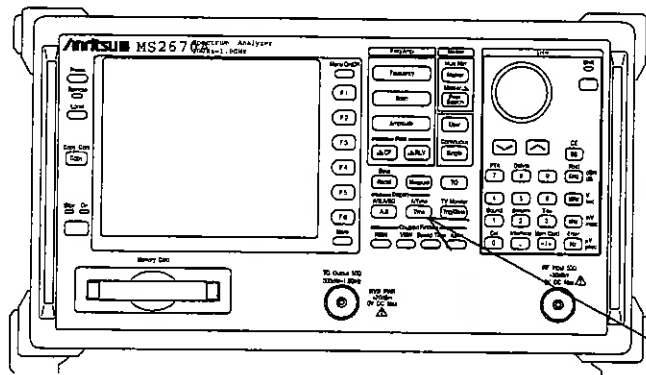
Display Mode

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)

Trace time
(When Expand mode is set to ON)

Time

Trace Time

Time

Trace A or
trace B

Frequency

Expand zone

Level

Time

Frequency

BG zone

Trace BG

Frequency

Frequency range
analyzed
by MS2670A

0

Frequency

3 GHz

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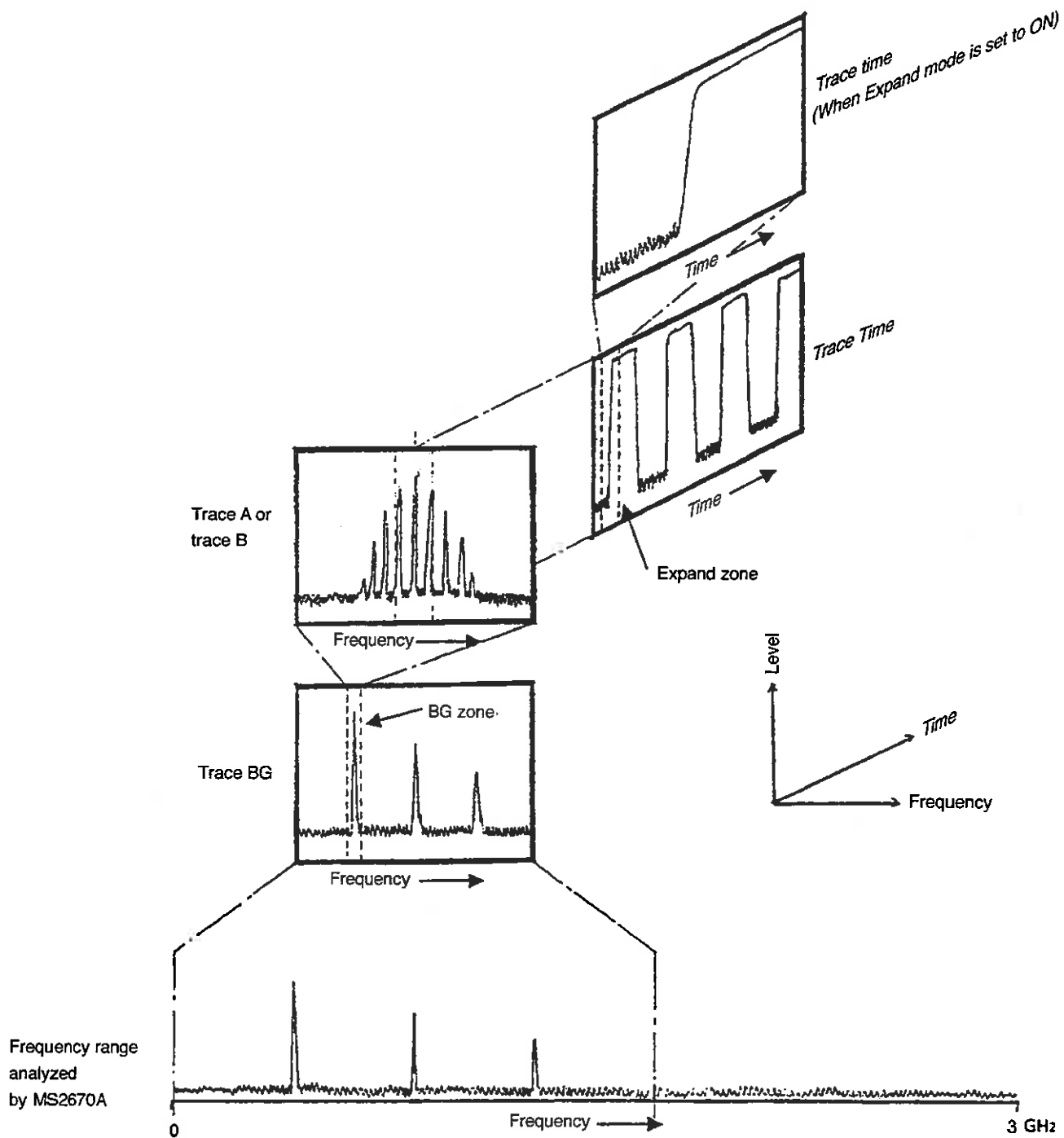
Trace A

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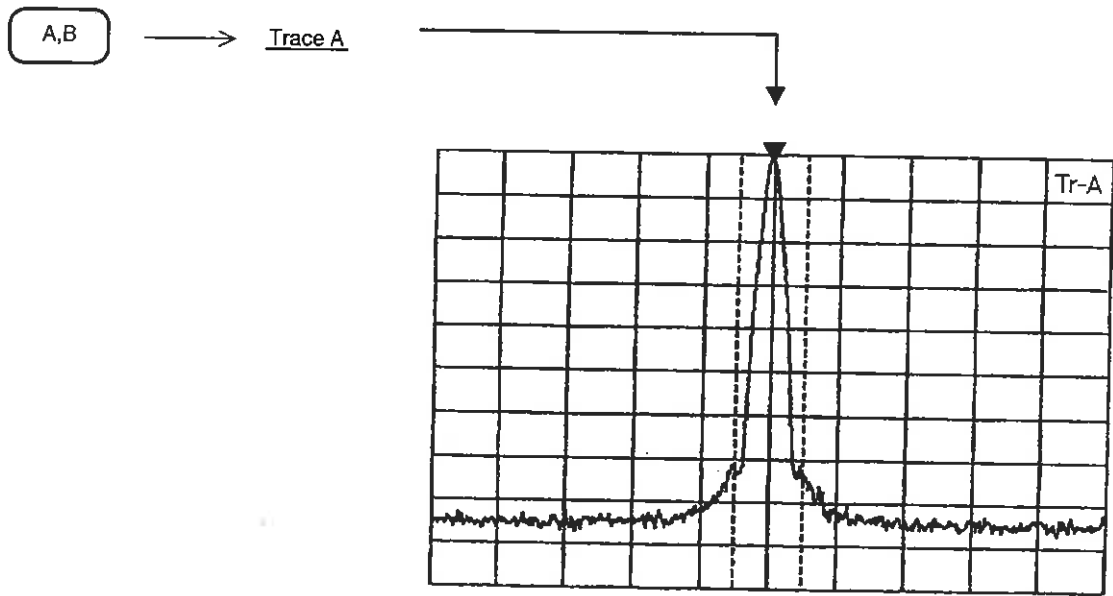
Trace B

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
└─────┘
```
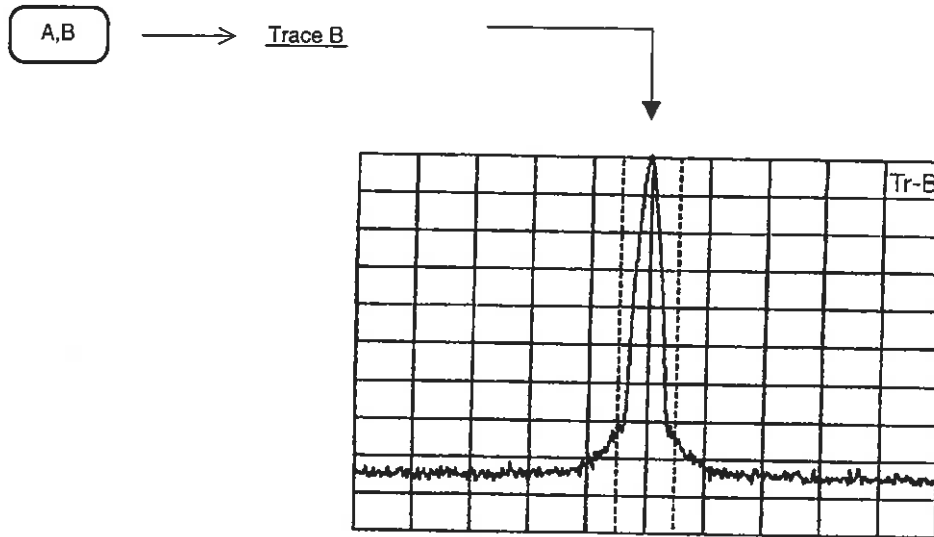

Parameters of the trace A and trace B can be set independently.

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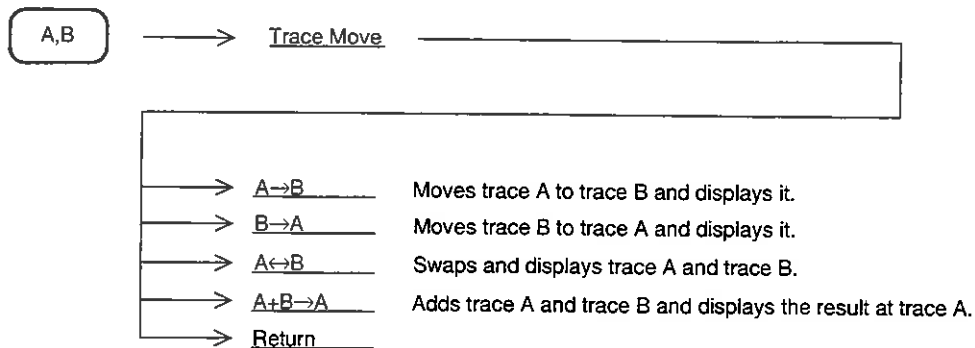
Set the move-destination-trace storage mode to View, and stop the sweeping before moving the trace.
If the trace A or trace B threshold is set to any other mode, the trace data will be displayed once, then updated.

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        Turn the mode that subtracts trace B from trace A and adds the
        │     (A–B+DL)         display line value and continuously displays it at trace A On and
        │     On Off           Off by pressing this key.
        │
        ├──→  A–B→A            Turn the mode that subtracts trace B from trace A and
        │     On Off           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
```



```
┌───────────────────────────┐
│              ⌒            │ Top
│                           │
│          ⌒                │ Middle
│             ⌄             │
│                           │
│         ⌒                │ Bottom
└───────────────────────────┘
```

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.

$\boxed{A,B}$ ———→ Trace A on B

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

Tr-A on B

Trace B
(max hold)
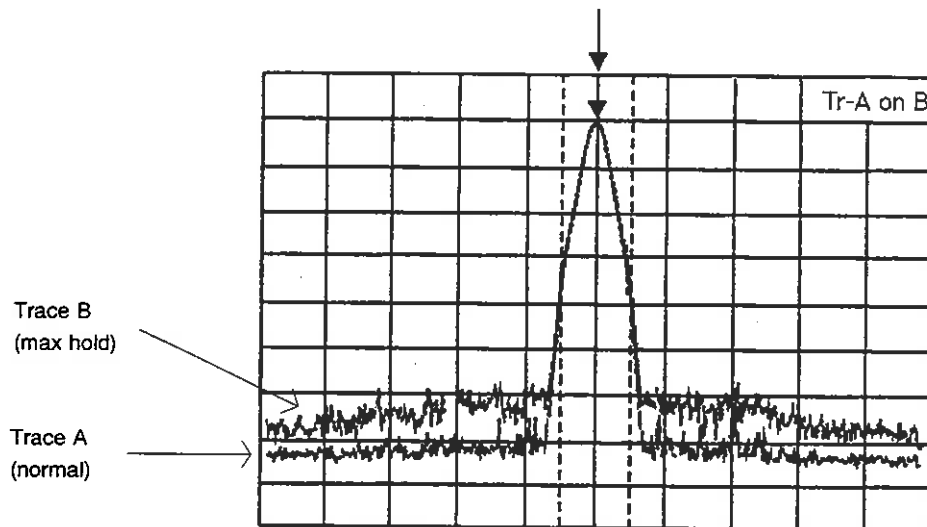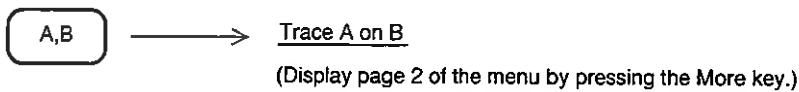
Trace A
(normal)

Setting Active Trace

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

$\boxed{A,B}$ ———→ Active Trace A B

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

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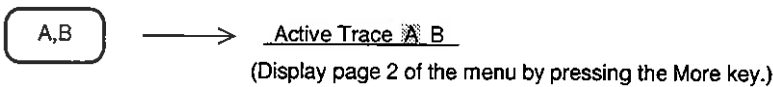
Trace A/Trace B Top and Bottom Split Display

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.

```
                    A/B,A/BG
  ┌─────┐           ┌─────────┐
  │Shift│   ──────▶ │  A,B    │ ─────────────────────────────────────┐
  └─────┘           └─────────┘                                       │
                                                                      │
        ┌─────────────────────────────────────────────────────────────┘
        │
        ├──▶  A/B (A>B)      Simultaneously display trace A and trace B at the top and
        │                    bottom. Display trace B larger than trace A.
        │
        ├──▶  A/B (A>B)      Simultaneously display trace A and trace B at the top and
        │                    bottom. Display trace A larger than trace B.
        │
        ├──▶  A/BG (A<BG)
        │
        ├──▶  A/BG (A>BG)
        │
        └──▶  Swp Contl
```
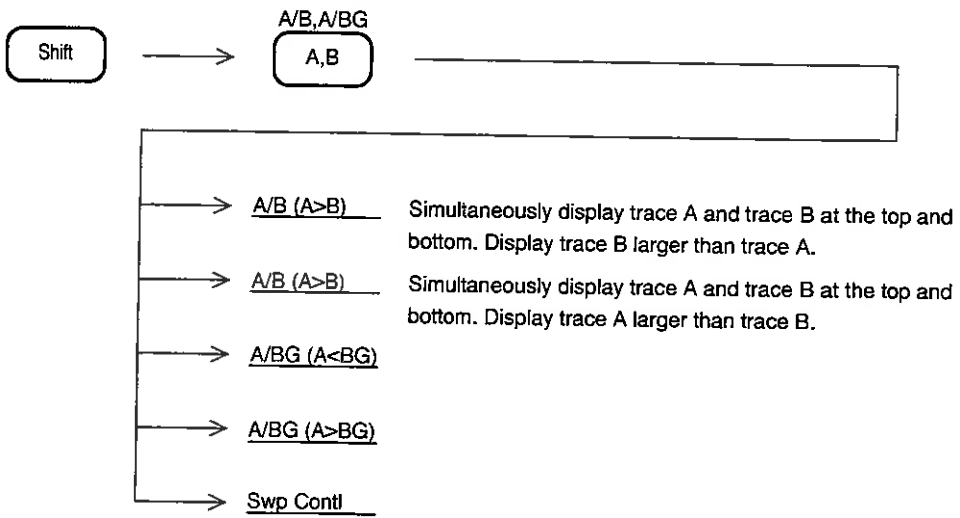
- The large display is called the main trace and the small display is called the sub-trace.

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

Sub-trace

Main trace
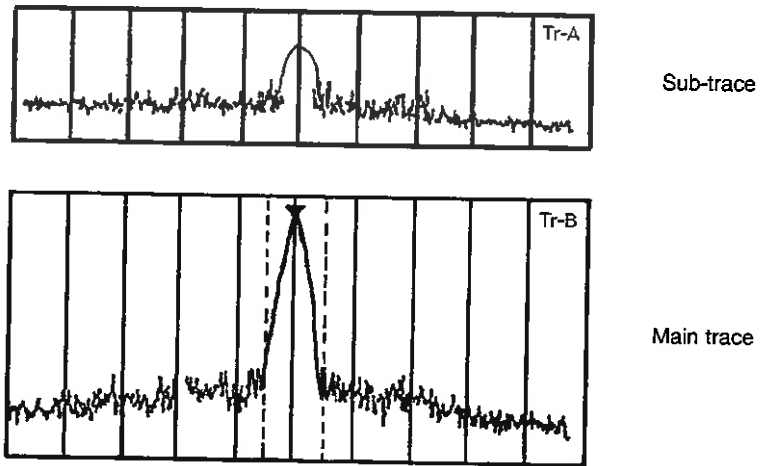
For A/B (A<B)

Setting Sub-trace Sweep

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

```
                         A/B,A/BG
   ┌────────┐          ┌──────────┐
   │ Shift  │ ────────▶│   A,B    │ ──────▶  Swp Contrl ──────────────┐
   └────────┘          └──────────┘                                    │
                                                                       │
        ┌──────────────────────────────────────────────────────────────┘
        │
        ├──────▶  Sub Trace Write    Set the sub-trace to the Over Write mode.
        │
        ├──────▶  Sub Trace View     Set the sub-trace waveform to the View mode (continuously
        │                            displayed without overwriting).
        │
        ├──────▶  Stop               Temporarily stop sweeping without switching the storage
        │                            mode.
        │
        ├──────▶  Continue           Release temporary stop and resume execution.
        │
        ├──────▶  Restart            Erase the trace waveform and restart sweeping.
        │
        └──────▶  Return
```

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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.


```
Shift ──→  A/B,A/BG
           A,B
```

A/B (A<B)

A/B (A>B)

A/BG (A<BG)   Simultaneously display trace A and trace BG at the top and

In this mode, the frequency range of trace A can be specified by moving a marker (BG zone marker) on the BG main trace.

Tr-A
←──Sub-trace

Tr-BG
←── Main trace

A/BG (A>BG)   Simultaneously display trace A and trace B at the top and bottom. Display trace A larger than trace BG.

Swp Contl

In this mode, the frequency range of trace A can be directly set while checking the trace A position (BG zone marker position) within BG.

Tr-A
←──Main trace

Tr-BG
←──Sub-trace

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.

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)

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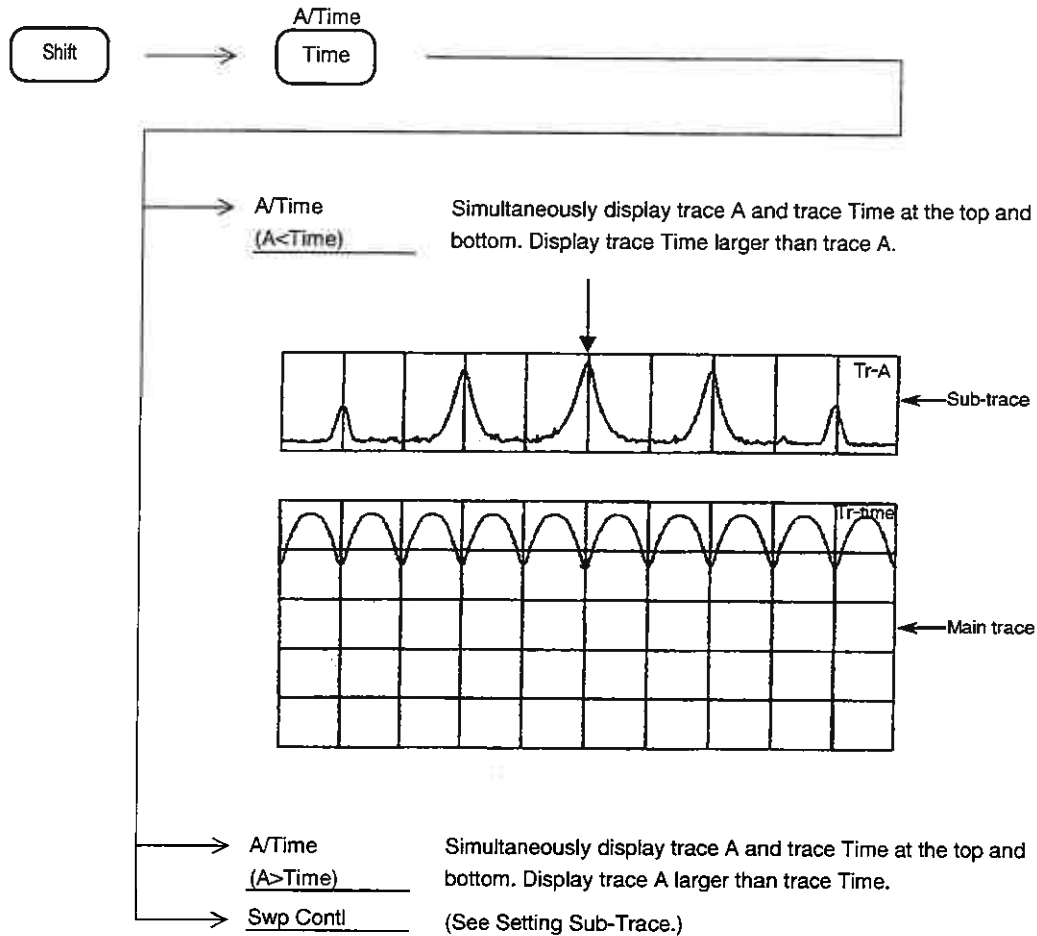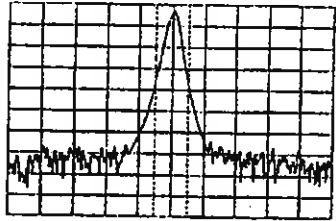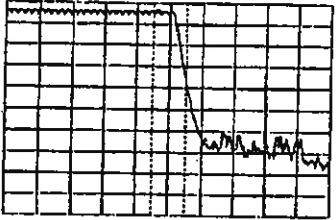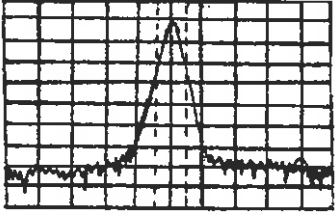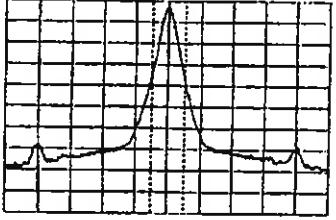
Each parameter can be set in the main trace (larger displayed trace). However, for common parameters (center frequency, reference level, input attenuator, and system setting coupled mode resolution bandwidth, video bandwidth, etc.), the sub-trace parameters can also be converted even when setting is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

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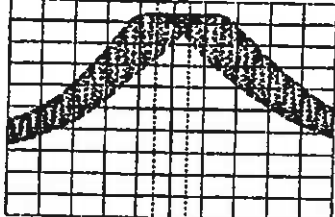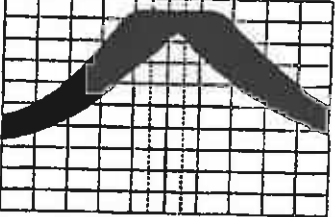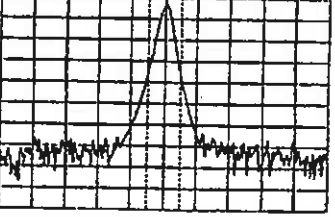
Storage Mode

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.	

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.

```
[ A, B ]────┐
            │
[ Time ]────┴──>  Storage ──────────────────────────────────┐
                                                             │
        ┌──> Normal      ┐                                   │
        ├──> Max Hold     │                                  │
        ├──> Min Hold     ├── Select the storage mode.       │
        ├──> Average      │                                  │
        ├──> View         │                                  │
        └──> Return      ┘                                   │
              1                                              │
                                                             │
        ┌──> Cumulative   ┐                                  │
        │                 ├── Select the storage mode.       │
        ├──> Overwrite    ┘                                  │
        │
        ├──> Stop        Temporarily stop the sweeping without switching the mode.
        │
        ├──> Continue    Restart from temporary stop.
        │
        ├──> Restart     Restart.
        └──> Return
              2
```
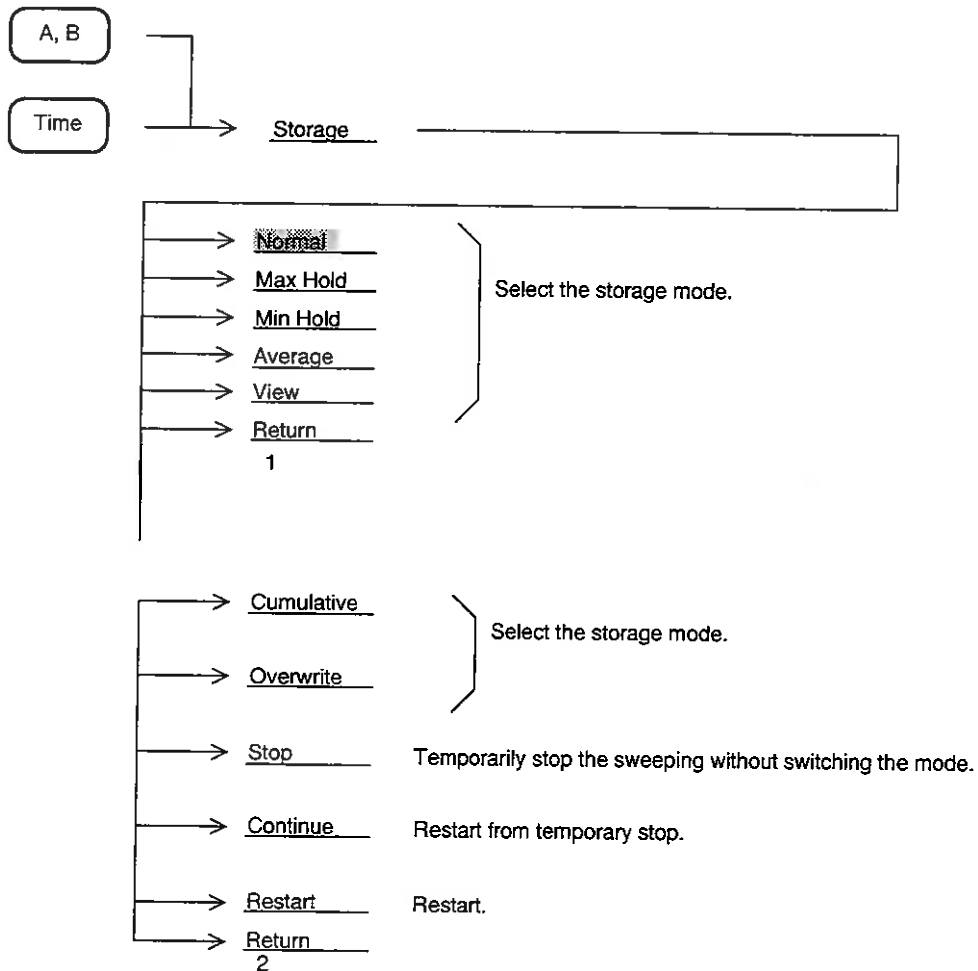
(Display page 2 of the menu by pressing the More key.)

Averaging Function

The digital averaging function calculates the average data at each X axis point at each sweep and displays the results. It is executed by selecting Average in the Trace A, Trace B, and Trace Time display modes.

Averaging Count 256	Set the averaging rate.
Avg Mode Stop Non-Stop	Set averaging Stop/Non-Stop after the number of times of averaging rate by pressing this key.
Stop	Temporarily stop average-sweeping.
Continue	Resume from stop.
Restart	Delete the trace waveform and restart.
Return	
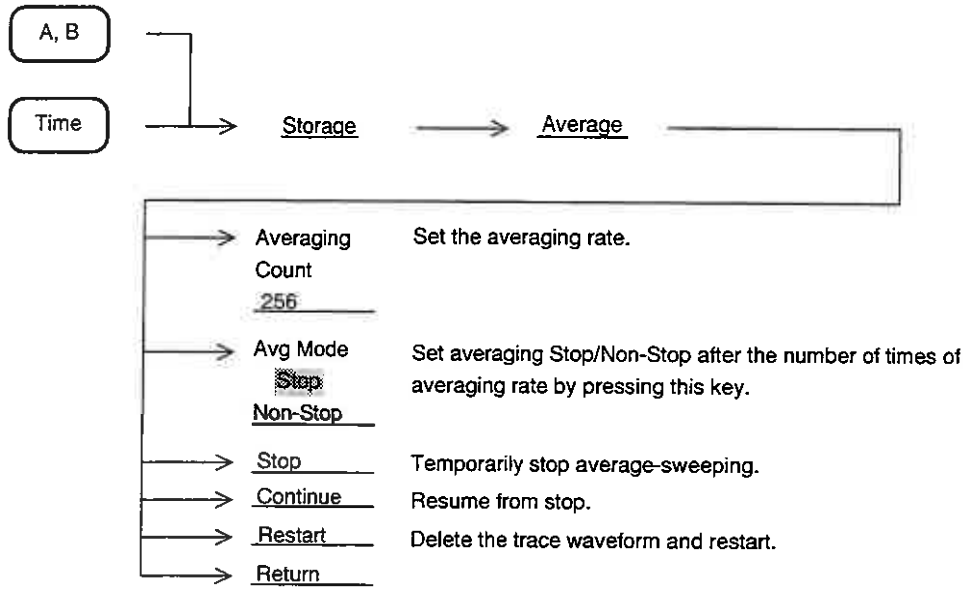
The averaging function improves the S/N ratio depending on the averaging rate and the number of sweep repetitions as shown on the next page.

Digital video averaging is performed by the method shown below.

Averaging Rate = N

Number of sweep repetitions	Measurement value	Displayed value
1	$M(1)$	$Y(1) = M(1)$
2	$M(2)$	$Y(2) = Y(1) + \dfrac{M(2) - Y(1)}{2}$
3	$M(3)$	$Y(3) = Y(2) + \dfrac{M(3) - Y(2)}{3}$
⋮	⋮	⋮
$N-1$	$M(N-1)$	$Y(N-1) = Y(N-2) + \dfrac{M(N-1) - Y(N-2)}{N-1}$
N	$M(N)$	$Y(N) = Y(N-1) + \dfrac{M(N) - Y(N-1)}{N}$
$N+1$	$M(N+1)$	$Y(N+1) = Y(N) + \dfrac{M(N+1) - Y(N)}{N}$
$N+2$	$M(N+2)$	$Y(N+2) = Y(N+1) + \dfrac{M(N+2) - Y(N+1)}{N}$
⋮	⋮	⋮

③ Restart

① Stop

② Continue

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.
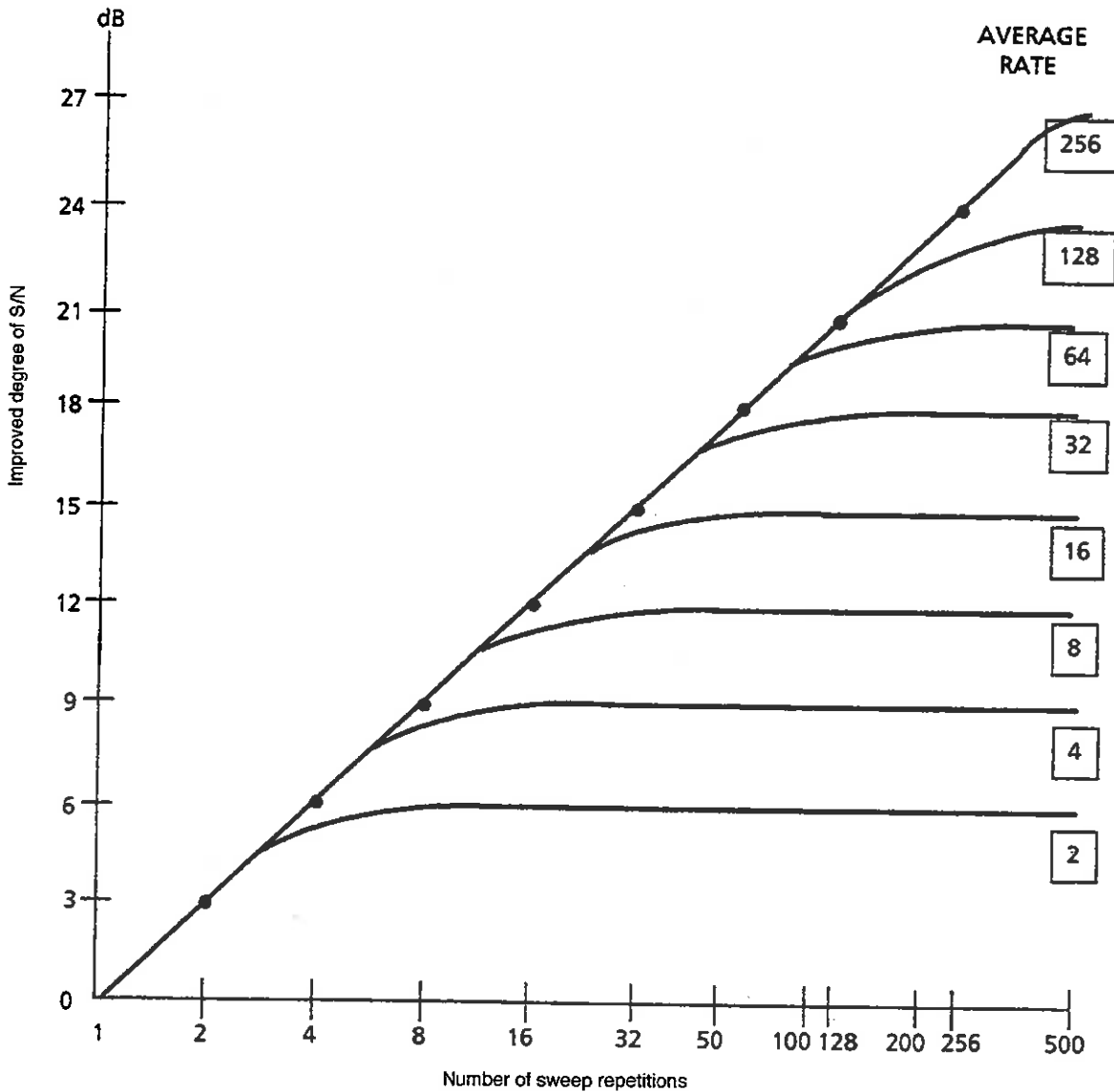
S/N Improvement by Digital Video Averaging

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.

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.

Sweep Count ***	Set the number of sweeping repetitions. After the set number of sweepings, the sweeping stops.	
Endless Sweep	Continue sweeping, endlessly.	
Stop	Stop sweeping, temporarily.	
Continue	Resume sweeping from stop.	
Restart	Delete the trace waveform and restart.	
Return		

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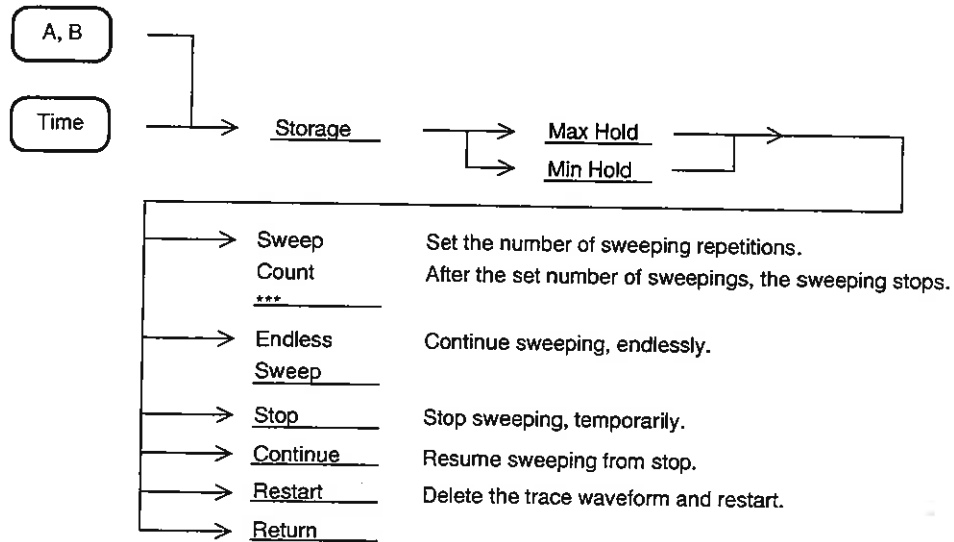
Detection Mode

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.

Selecting Detection Mode

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

```
┌─────────┐
│   A/B   │────────┐
└─────────┘        │
                   │
┌─────────┐        ▼
│  Time   │──────▶ Derection ──────────────────────────────┐
└─────────┘                                                 │
                                                            │
                  ┌──▶ Normal                               │
                  │                        ┐
                  ├──▶ Pos peak            │
                  │                        │  Select the detection mode.
                  ├──▶ Sample              │
                  │                        │
                  ├──▶ Neg Peak            │
                  │                        │
                  ├──▶ _____            ┘
                  │
                  └──▶ Return
```
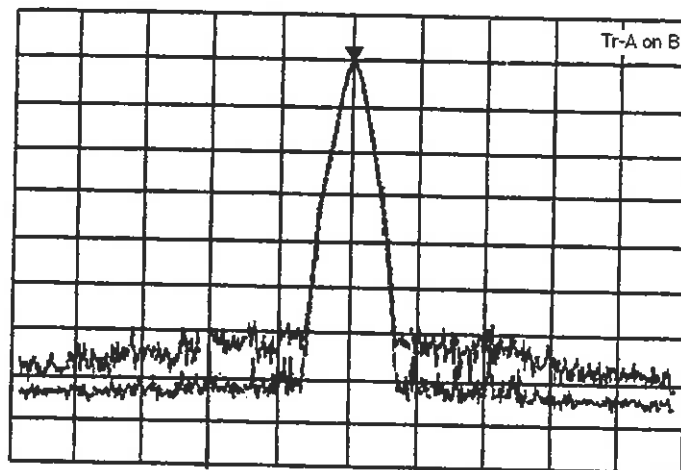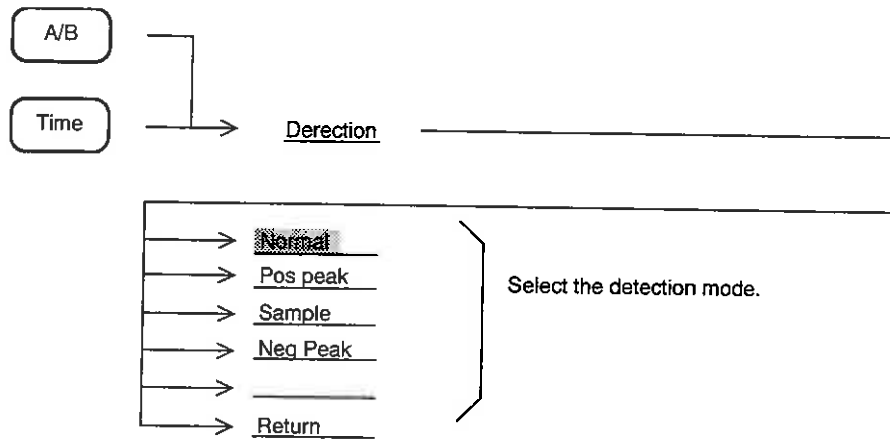
Waveforms when Trace A is in the Pos Peak mode and Trace B is in the Neg Peak mode.

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.

Sample point

Pos Peak

Neg Peak

Sample

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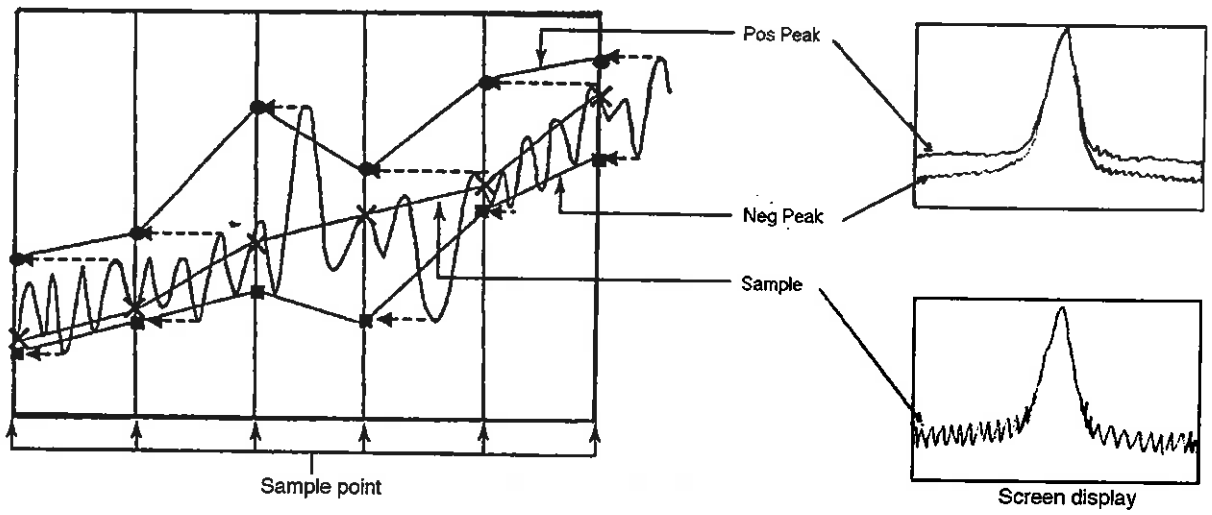
Note: The spectrum peak is incorrectly displayed when the detection mode is set to Sample or Neg Peak while the frequency span and resolution bandwidth are set so that the spectrum is displayed as discrete vertical lines.

Normal

Screen desplay

Sample point
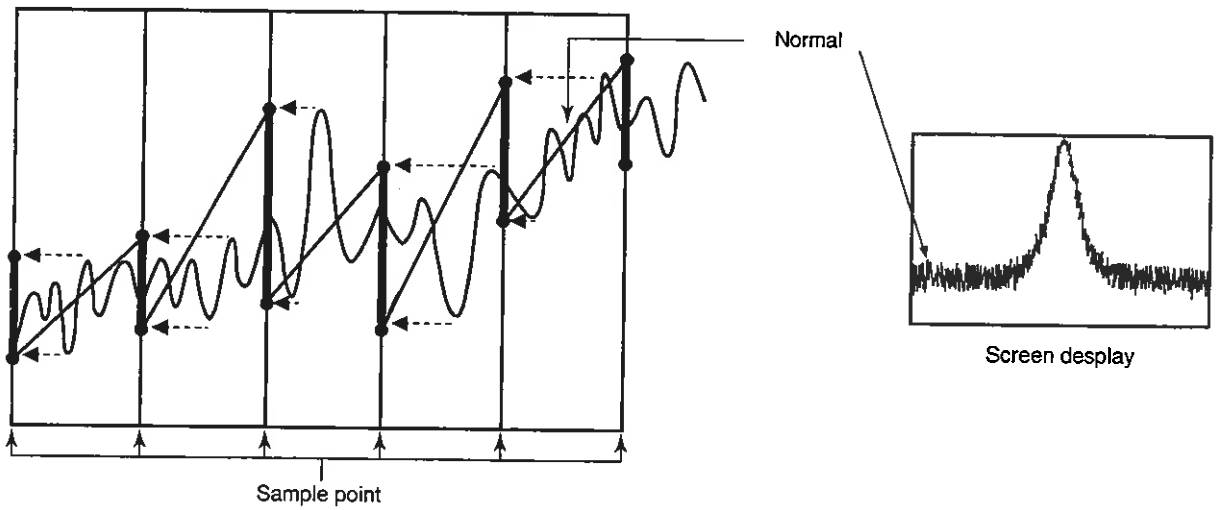
Normal traces and displays both Pos Peak and Neg Peak.

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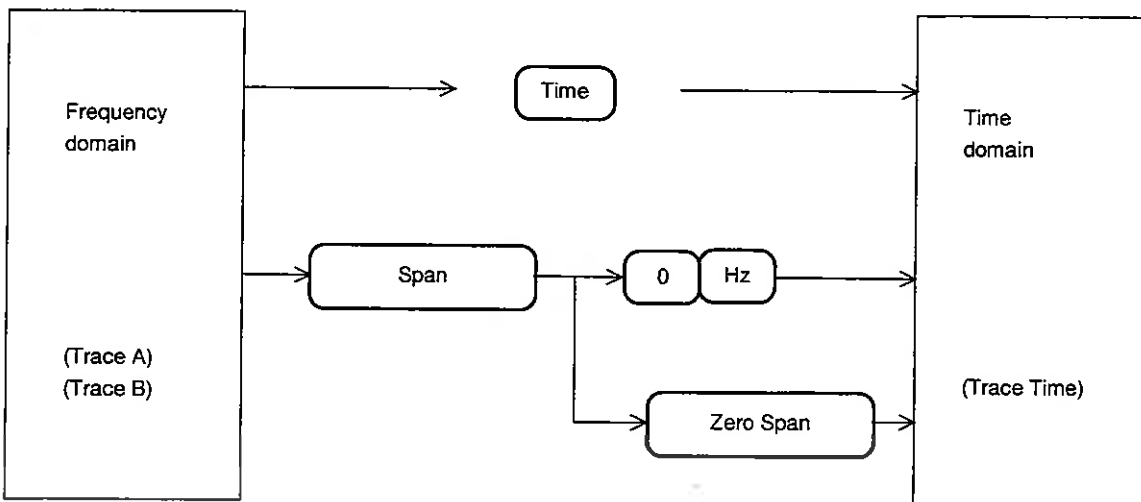
The following parameters can be set independently in the frequency domain or time domain mode:

- 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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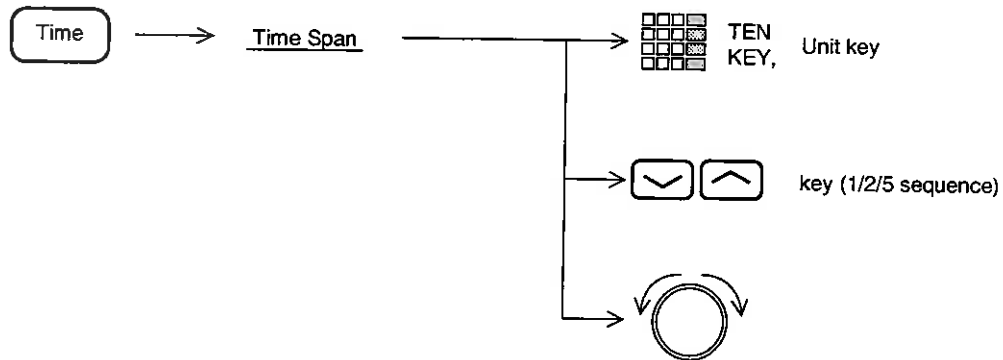
Time Domain Expanded Display

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   Select expansion zone marker display On or Off by pressing this
On Off   key.

Expand   Select expanded display On or Off by pressing this key.
On Off

Return

Zone start

Zone span (zone marker)

Tr-time

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Expand Off

Expand On

Tr-time

Tr-time

Expansion

The Expand mode cannot executed under the following conditions.

*   Trigger mode   .... Freerun

(Blank)

SECTION 6

SELECTING THE SWEEP METHOD

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

TABLE OF CONTENTS

(Blank)

SECTION 6
SELECTING THE SWEEP METHOD

Sweep Mode

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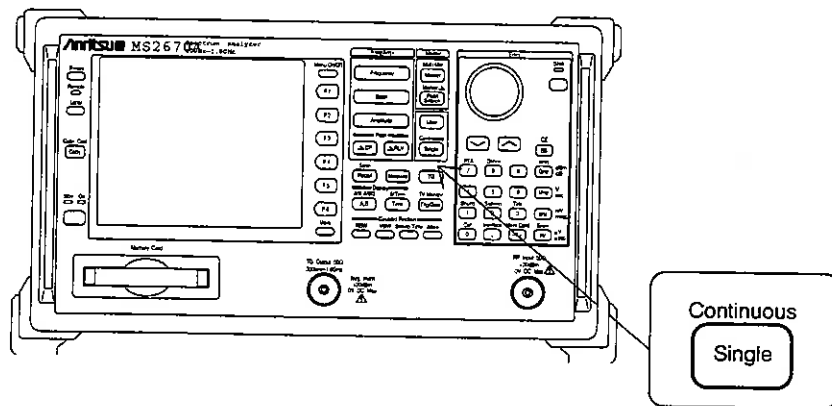
Continuous Sweep Mode

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.)

Single Sweep Mode

When the trigger mode is set to Freerun, sweep is executed once immediately after the $\boxed{\text{Single}}^{\text{Continuous}}$ key is pressed.

When the trigger mode is set to Triggered, sweep is executed only once when the trigger conditions are met after the $\boxed{\text{Single}}^{\text{Continuous}}$ key is pressed.

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

Continuous
$\boxed{\text{Single}}$

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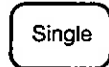
Trigger Mode

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 [Single] key is pressed.

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

[Trig/Gate] ⟶ Trigger   Select Freerun by pressing this key.
              Freerun
              Triggered
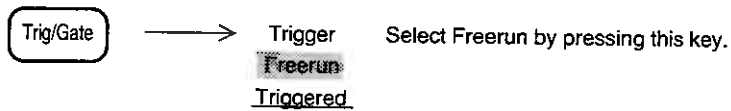
Triggered

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.

Trig/Gate	Trigger Freerun **Triggered**	Select Triggered by pressing this key.
	Trace Time	When this key is pressed, it is highlighted and the MS2670A switches to the time domain mode.
	Delay Time 10.0 ms	Set the delay time from the trigger.
	Time Span 200 us	Set the time span.
	Trigger Source	
	Video	Video trigger
	Wide IF Video	Wide IF video trigger
	External	External trigger
	TV	This function cannot be used in the MS2670A
	Line	Line trigger
	Return	

Select the trigger source.

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.

```
┌─────────┐          Trigger          Video
│ Trig/Gate│ ───────> Source  ───────>
└─────────┘
```

──>	Trig Level −25 dB	Set the trigger level with the ten keys, up-down keys, or rotary knob.
──>	Trig Slope Rise Fall	Select if the positive leading edge (Rise) or negative leading edge (Fall) is made the trigger slope by pressing these keys.
──>	Return	
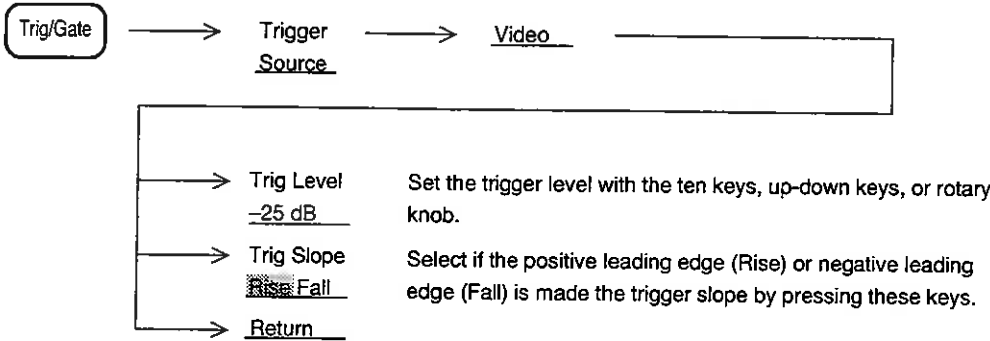
The trigger level is indicated by displaying the trigger level indicator ▶ at the leftmost vertical line of the screen.
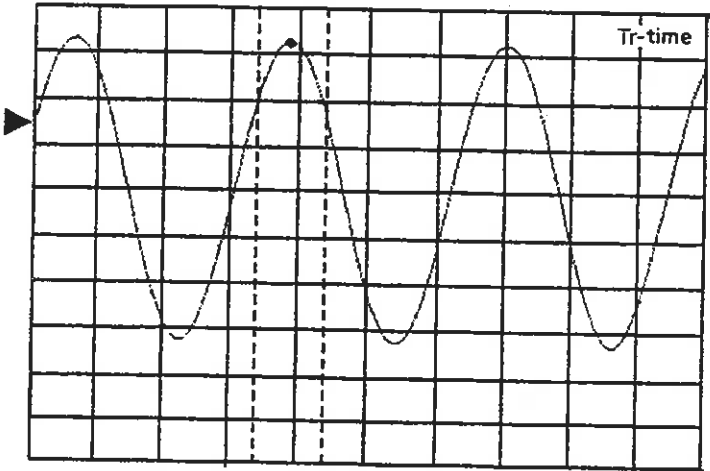
Wide IF Video Trigger

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  ———→  Wide IF Video ————————┐
                  Source                                 │
                                                         │
            ┌────────────────────────────────────────────┘
            │
            ├──→  Trig Level    Select the trigger level from among High, Middle, and Low,
            │     High          according to the input level, by pressing this key.
            │
            ├──→  Trig Slope    Select the positive leading edge (Rise) or negative leading edge
            │     Rise Fall     (Fall) as the trigger slope by pressing this key.
            │
            └──→  Return
```
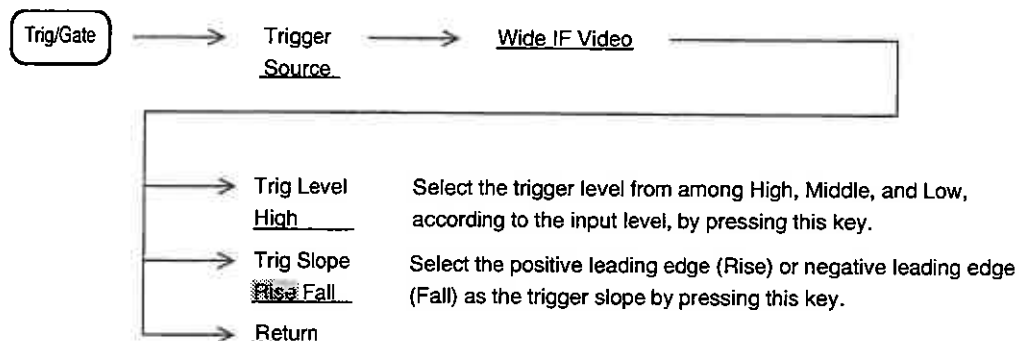
External Trigger

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  ———→  External ————————————┐
                  Source                                │
                                                        │
            ┌───────────────────────────────────────────┘
            │
            ├──→  +10 to 10 V  ┐
            │                   ├─ Select the trigger level from −10 to +10 V and TTL.
            ├──→  TTL          ┘
            │
            ├──→  Trig Level    Set the trigger level when −10 to +10 V was selected.
            │     −5 V
            │
            ├──→  Trig Slope    Select the positive leading edge (Rise) or negative leading edge
            │     Rise Fall     (Fall) as the trigger slope by pressing this key.
            │
            └──→  Return
```

External input

Trigger level
−5 V
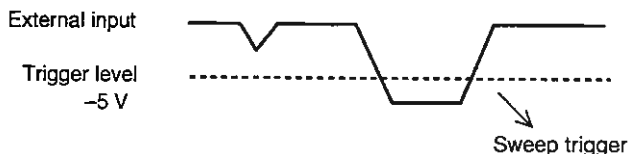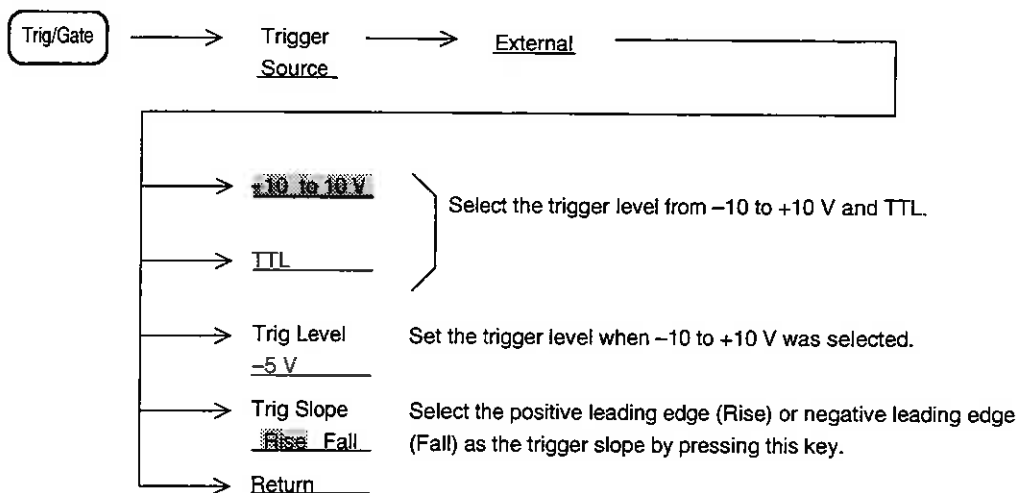
Sweep trigger

(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 $\longrightarrow$ Trigger Source $\longrightarrow$ Line
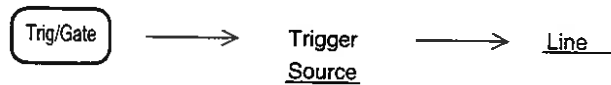
Delay Time

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.

```
┌─────────┐
│ Trig/Gate│ ──────┐──────>   Delay Time   ──────>   Set the delay time with the ten keys, up-down keys,
└─────────┘        │          10.0 ms                or rotary knob.
                   │
┌─────────┐        │
│   Time  │ ───────┘
└─────────┘
```
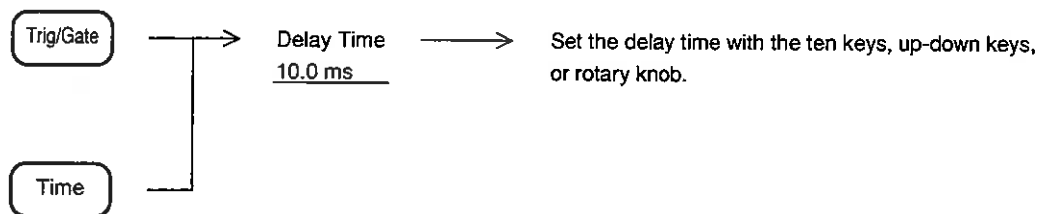
If the trigger point on the time axis screen was set by delay time, the trigger level indicator ▶ is displayed at the bottom of the screen.

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Trigger level ➝

➝ Time

Tr-time

Normal observation waveform

Tr-time

Tr-time

Waveform observed
when the delay time is
set to minus.

Waveform observed
when the delay time is
set to plus.

⊖   Pre-trigger   Post-trigger   ⊕

Up to one screen area   Up to 65.5 msec
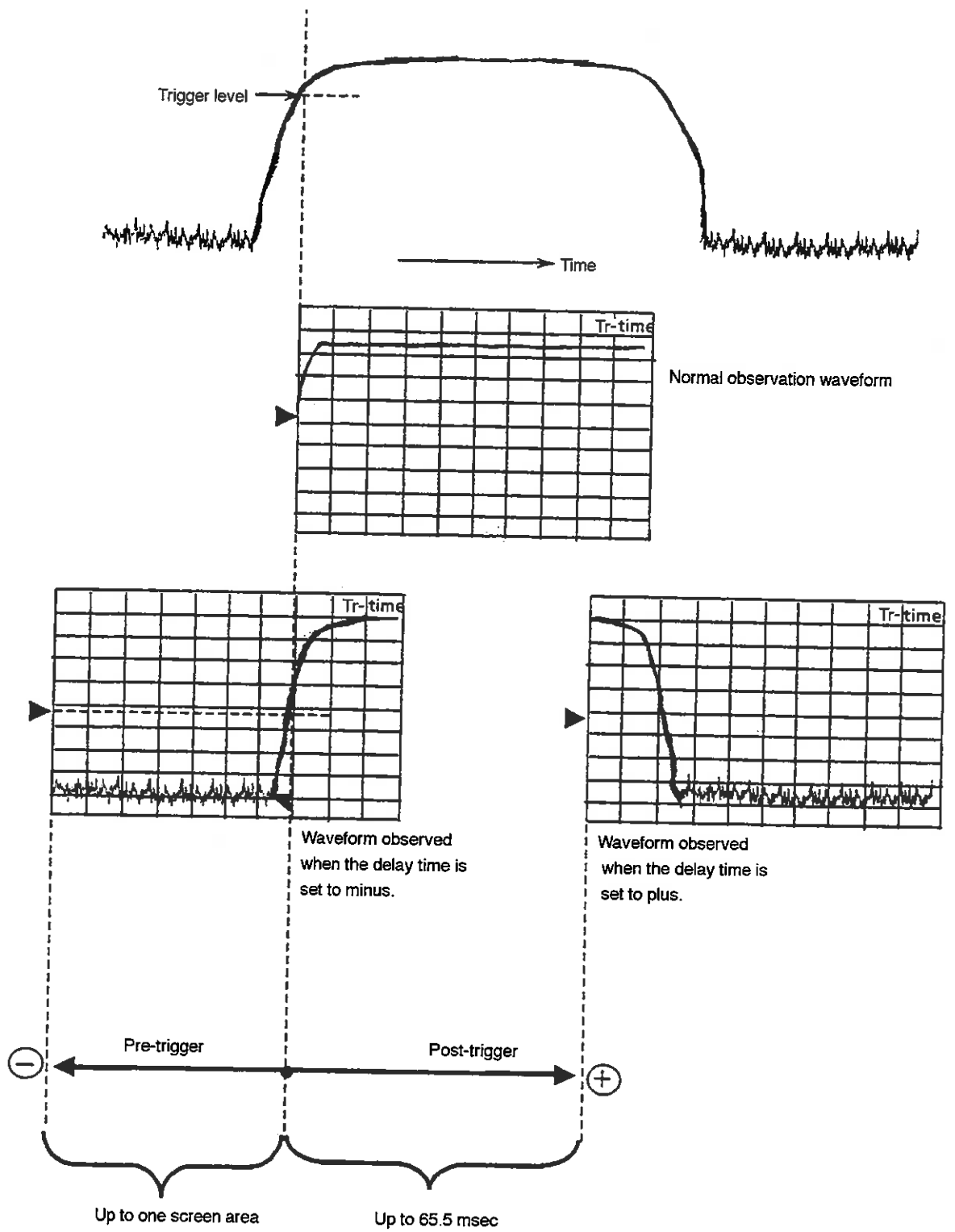
Example of Waveform With Delay Time (when used with video trigger)

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.)
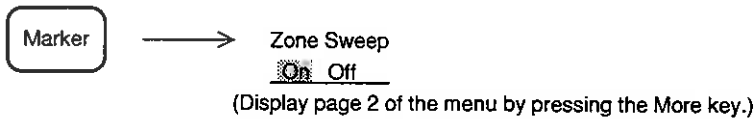
Zone sweep can be conveniently used to closely and quickly analyze part of the whole sweep range on the screen.
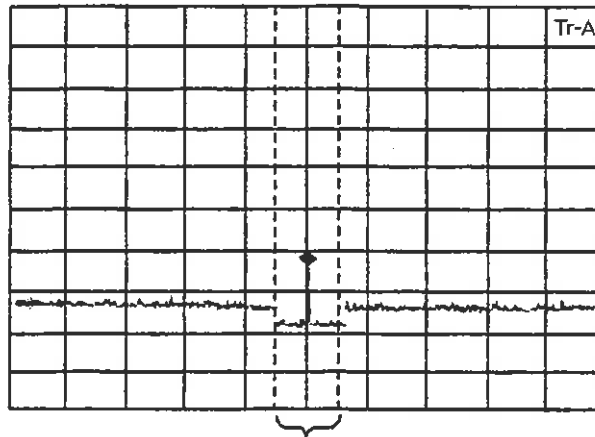
A signal masked by noise can be analyzed at high speed by setting zone sweep to On and adjusting the resolution bandwidth and video bandwidth.

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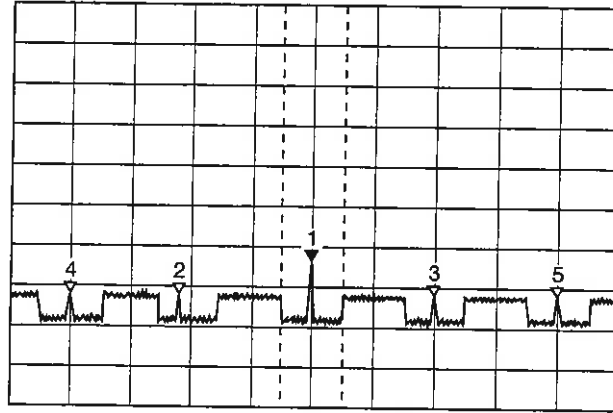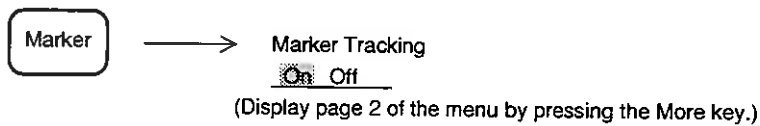
The signal tracking function moves the frequency of the signal of the peak level in the zone marker to the center of the zone marker at each sweep. This is convenient when tracking and analyzing a signal whose frequency drifts.

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

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.

Burst wave input signal
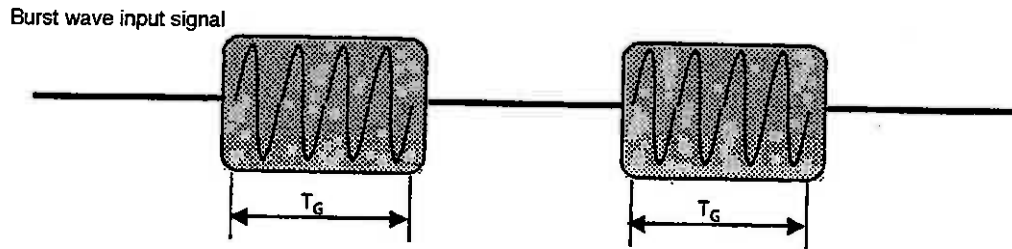
If the spectrum of the burst wave above is analyzed as is, the following graph results:
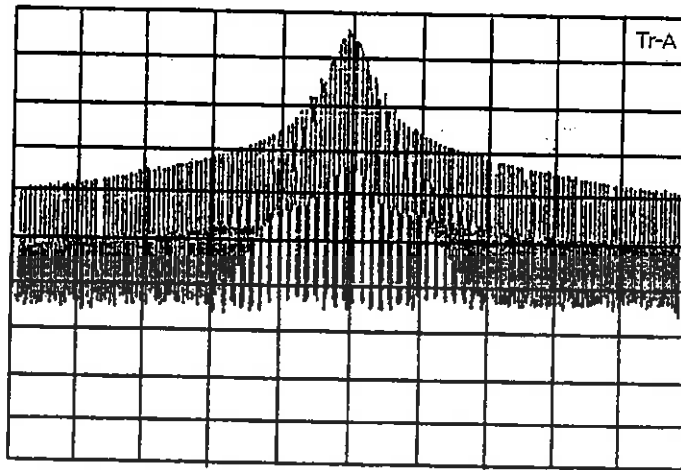
The spectrum spread by the positive or negative leading edge of the burst wave prevents the spectrum from being observed with the burst set to On.

If the spectrum can be analyzed only during the gate time T_G, the following graph results:
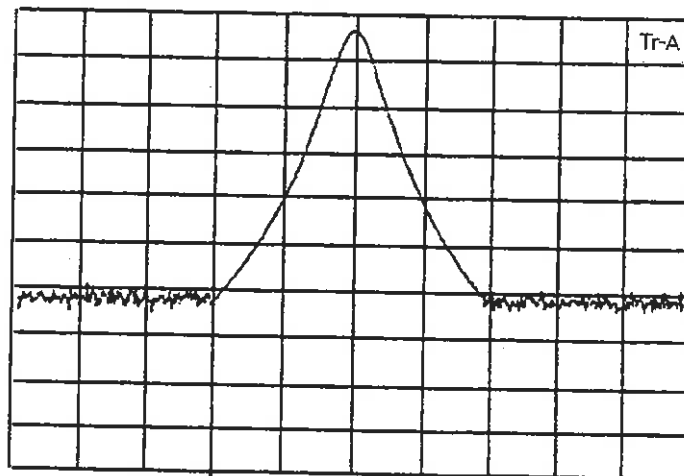
Only the spectrum when the burst is set to On is displayed.

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.
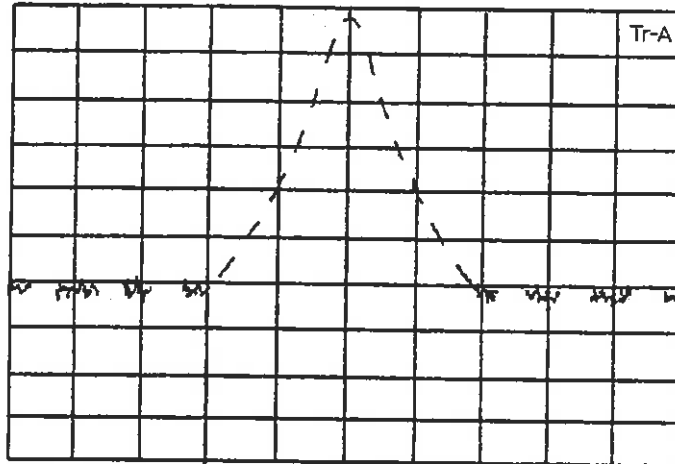
Fewer Sweep Repetitions
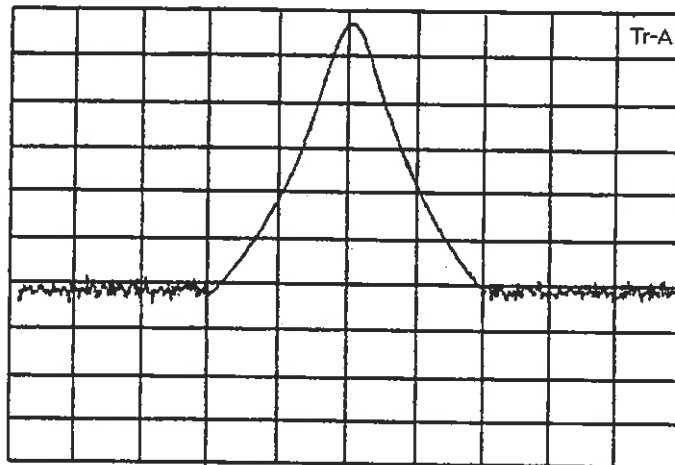
More Sweep Repetitions

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

Trigger point

Trigger signal ----- Trigger level

ON

Gate control signal OFF OFF

Gate Delay | Gate Length

Only this time is displayed.
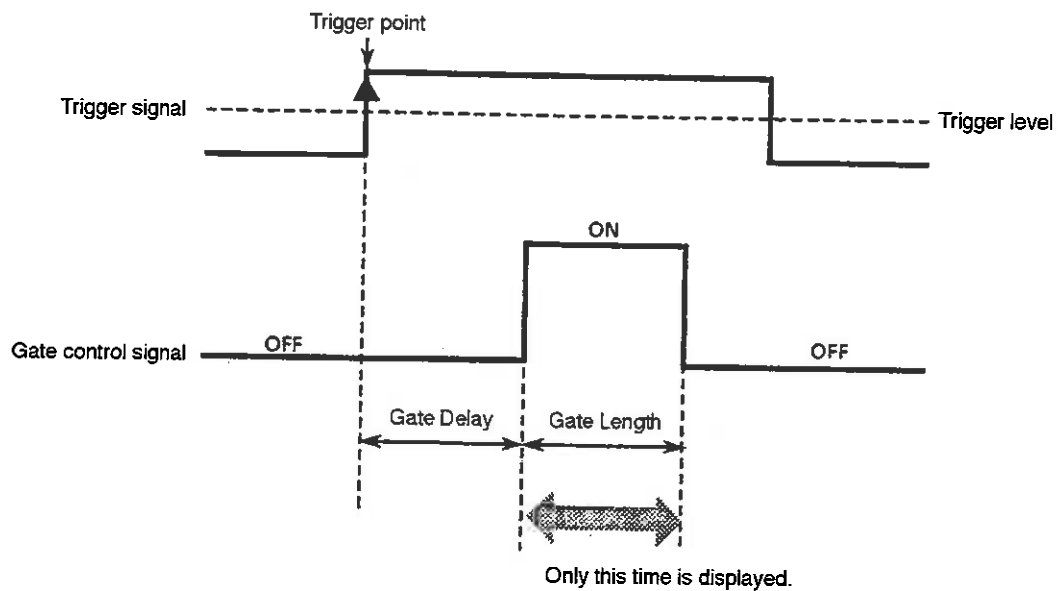
* Gate End: When End selected

Trigger point | Trigger-reset point

Trigger signal ----- Trigger level

ON

Gate control signal OFF OFF

Gate Delay
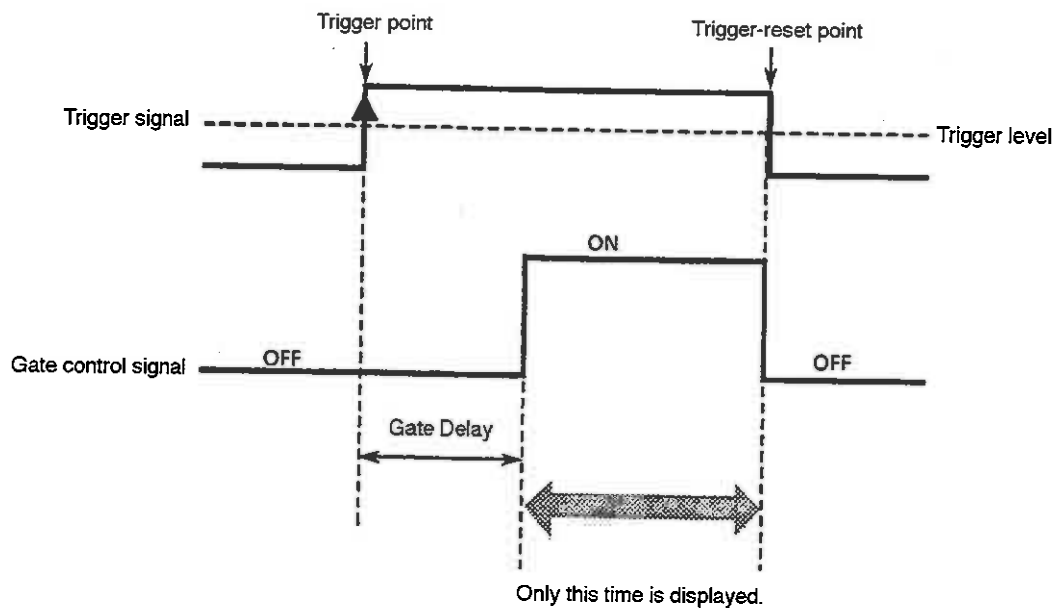
Only this time is displayed.

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

Trig/Gate ———→ (Display page 2 of the menu by pressing the More key.) ———

———→ Gate Sweep   Turn the gate function On and Off by pressing this key.
　　　On Off

———→ Gate Setup   Set the gate function.

———→ Stop   Stop gate operation.

———→ Restart   Restart gate operation.

———→ Trace Time   Set the time domain mode.

———→ Trace A   Set the trace A (frequency domain) mode.

Setting Gate Function

Trig/Gate ———→ Gate Setup ———

———→ Gate Delay   Set the gate delay time.
　　　0 µs

———→ Gate Length   Set the gate time length.
　　　10 ms

———→ Gate End   Select the condition that closes the gate by pressing this key.
　　　Int Ext   When Gate End is set to Int and Gate Length is set to Ext, the
　　　　　　　　　　　gate is closed by an external signal.

———→ Gate Trig   Select the gate trigger source from Wide IF Video and external.
　　　Source

———→ return

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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.
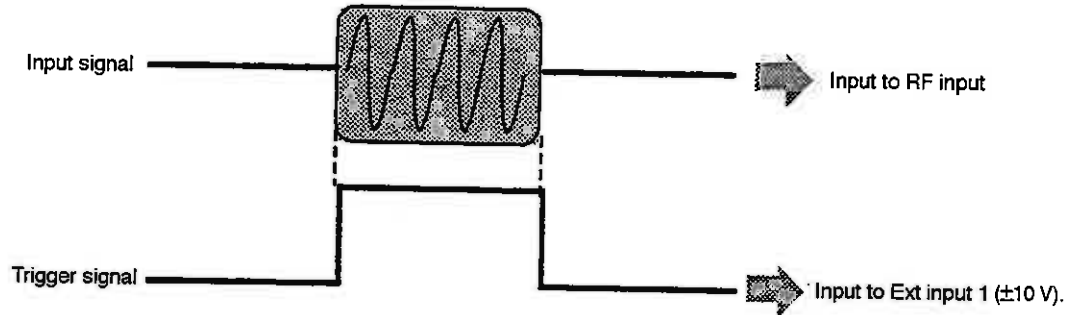
| 2 | Display the waveform in the time domain mode. Synchronize the input signal by setting the trigger mode to Triggered and the trigger source to Ext Input 1 (–10 to 10 V). |

| 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. |
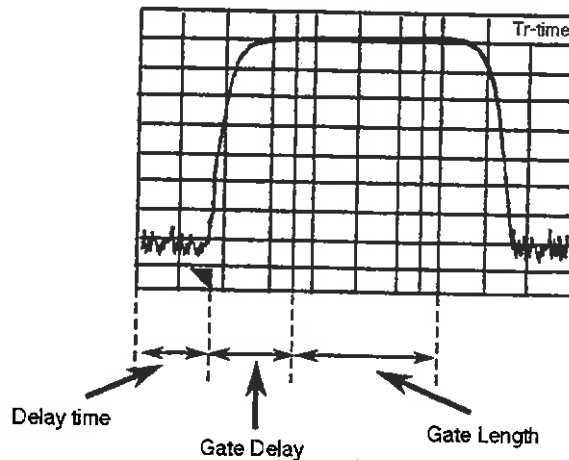
At this time, adjust the resolution bandwidth and video bandwidth in the time domain mode to equal those in the frequency domain mode, then set the gate cursor positions. The influence of spike-like noises independent of the conditions shown in Note (1) described later can be avoided.

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.
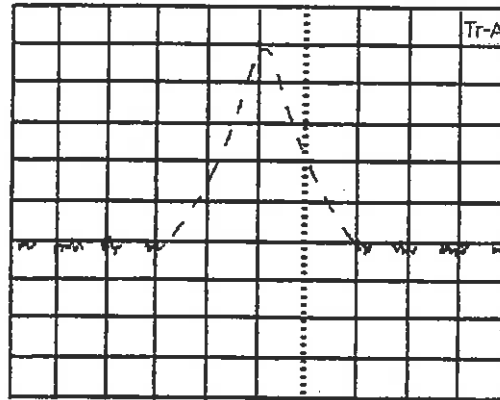
Notes: (1) The detector output is delayed compared to the positive leading edge of the input waveform when the resolution bandwidth (RBW) is narrowed in the frequency domain measurement mode. As a result, spike-like noises may appear on the trace. To prevent this from appearing, set Gate Delay and Gate Length to values that satisfy the following conditions.
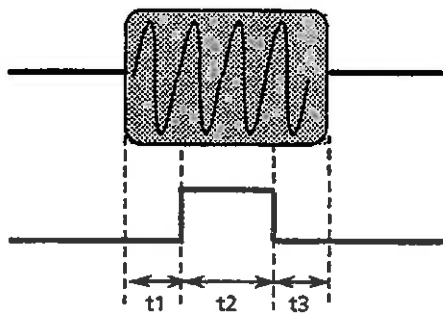
RBW	t1	t2	t3
1 kHz	≥ 3 ms		
3 kHz	≥ 1 ms		
10 kHz	≥ 230 ms		
30 kHz	≥ 200 ms	≥ 20 ms	≥ 1 ms
100 kHz	≥ 20 ms		
300 kHz	≥ 15 ms		
1 MHz 5 MHz	≥ 10 ms		

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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.

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

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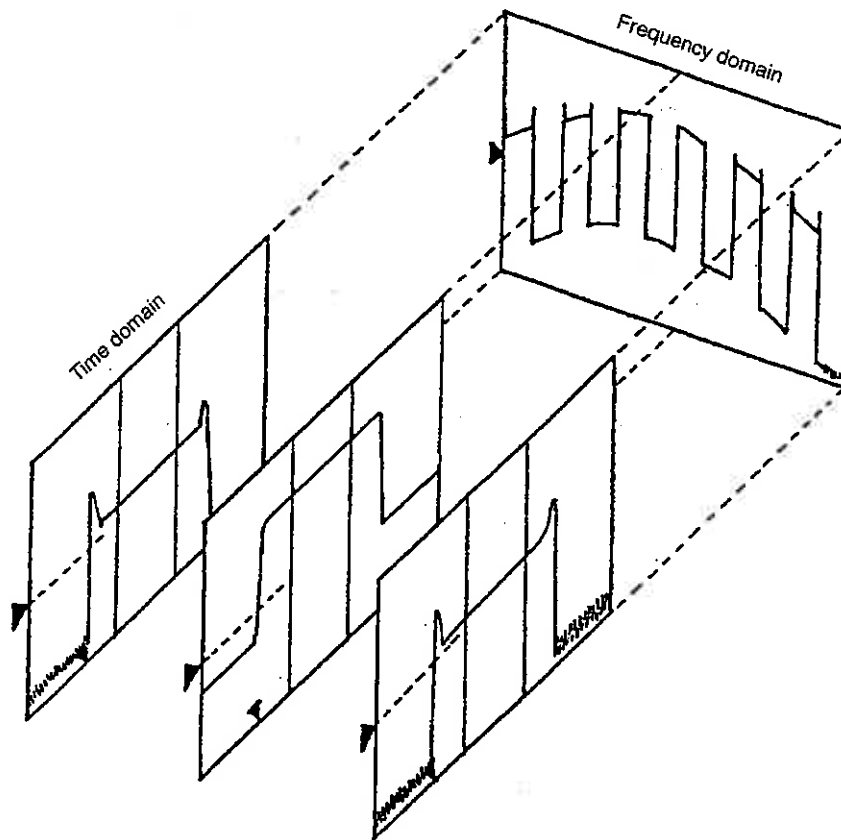
Trigger can be applied by the gate control signal created internally by setting the trigger source to Wide IF Video.

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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.
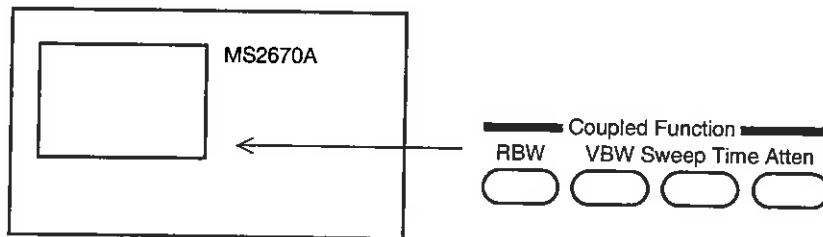
From Auto to Manual Operation

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. |
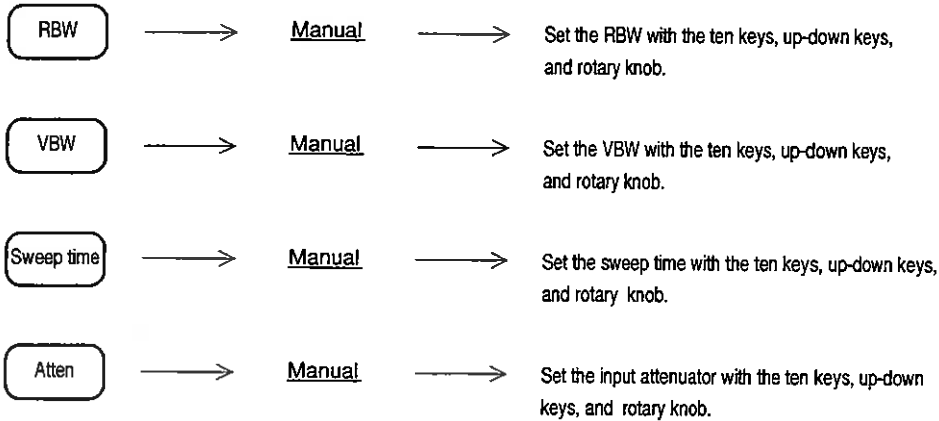
Resolution Bandwidth (RBW) and Sweep Time

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.

(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

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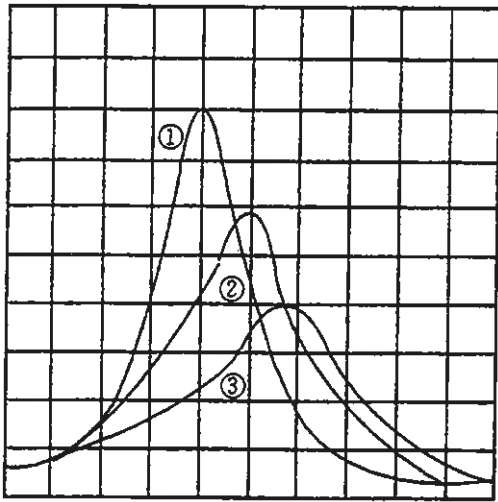
Note: The spectrum traces on the screen are displayed as shown at the left according to the sweep time. The optimum sweep time produces a waveform similar ①. However, a sweep time that is too fast decreases the waveform amplitude on the display as shown in ② and ③ Therefore, as the apparent bandwidth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

Video Bandwidth (VBW)

To set the VBW, perform the following key operations.

```
VBW ─────┬───→ Manual ────────→  Manually set the VBW with the ten keys, up-down keys, and rotary
         │                        knob.
         ├───→ Auto              Automatically set the VBW.
         │
         ├───→ Filter off        Set video filter to Off.
         │
         ├───→ VB/RB Ratio ────→ Set the Auto mode VBR/RBW ratio with the ten keys, up-down keys,
         │      1.0               and rotary knob.
         ├───→ RB, VB, SWT       Automatically set the RBW, VBW, and Sweep Time.
         │      Auto
         └───→ All Auto          Automatically set the RBW, VBW, Sweep Time, and Attn.
```
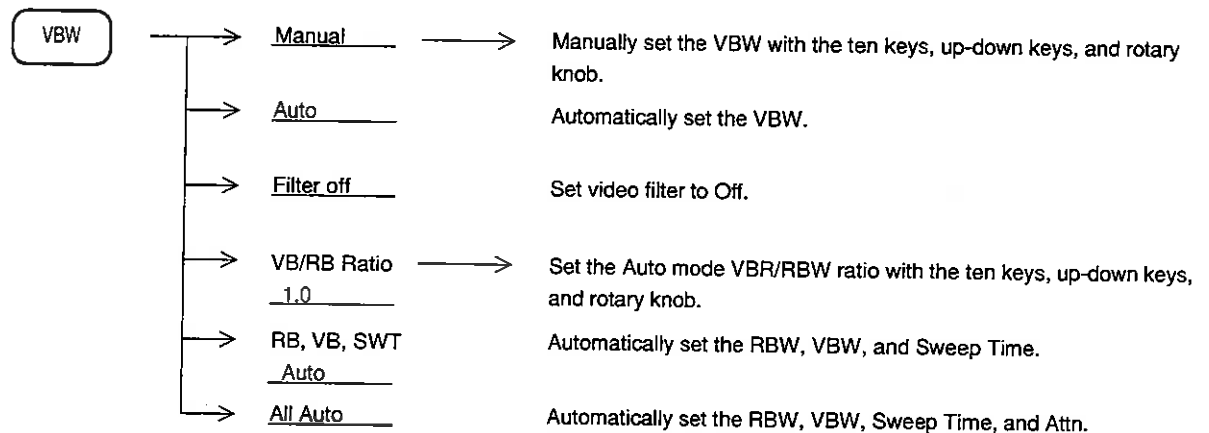
(1) Auto mode

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.

Input Attenuator (Atten)

To set the input attenuator, perform the following key operations.

```
┌────────┐        ┌─────────┐
│ Atten  │───┬──→ │ Manual  │ ─────→ Manually set the input attenuator with the ten keys, up-down
└────────┘   │    └─────────┘        keys, and rotary knob.
             │
             ├──→ Auto               Automatically set the input attenuator.
             │
             ├──→ Pre Ampl   ─────→  This function cannot be used in the MS2670A.
             │    On  Off
             │
             └──→ All Auto           Automatically set the RBW, VBW, Sweep Time, and Atten.
```
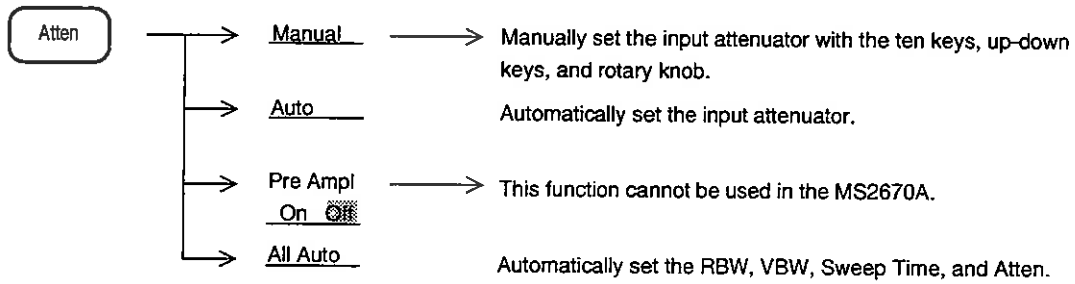
(1) Auto mode

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.
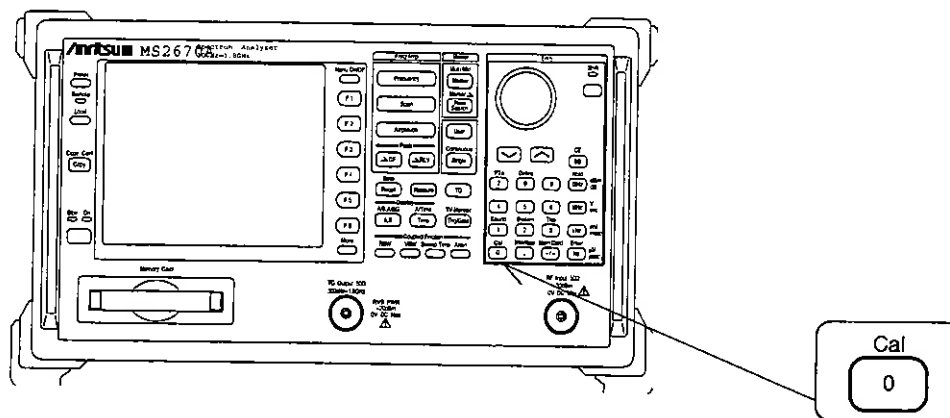
Automatic Calibration

Execute MS2670A automatic calibration by performing the following key operations.

```
                          Cal
  ┌────────┐            ┌──────┐
  │ Shift  │ ──────►    │  0   │ ──────────────────────────────────────┐
  └────────┘            └──────┘                                        │
                    ┌──────────────────────────────────────────────────┘
                    │
                    │ ──────►  All Cal       Automatically calibrate Level, Freq., and FM Cal.
                    │
                    │ ──────►  Level Cal      Automatically calibrate Level.
                    │
                    │ ──────►  Freq Cal       Automatically calibrate frequency reading.
                    │
                    └ ──────►  FM Cal         This function cannot be used in the MS2670A.
```

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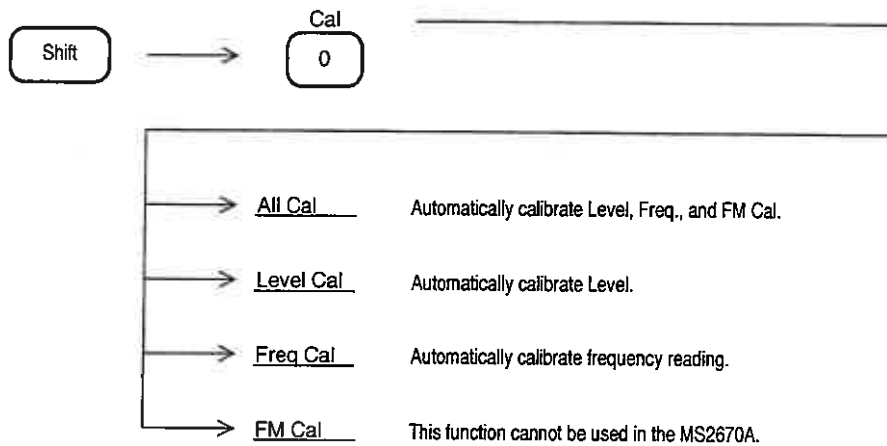
Details of Each Calibration Item

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

A L L C A L	L E V E L C A L	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 calibration	Calibrates the level error when the input-attenuator/pre-amplifier is switched.
	F R E Q C A L	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.

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)

Correction of measurement cable loss, etc.

Correction of pre-amplifier gain and cable loss, etc.

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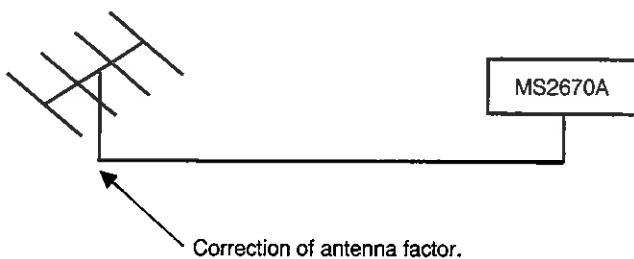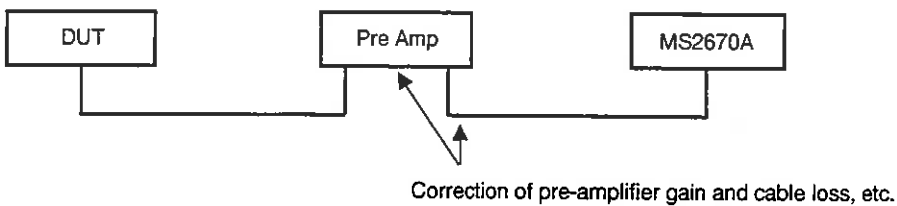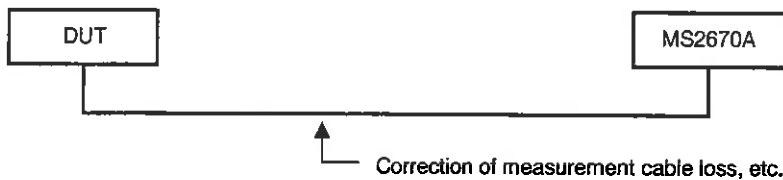
The correction factors for these measurement systems can be stored in the internal memory to add the factor to the measured value and display the spectrum.

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.

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

```
┌──────────┐
│Amplitude │ ────────> (Display page 2 of the menu by pressing the More key.) ──────────┐
└──────────┘                                                                            │
                 ┌──────────────────────────────────────────────────────────────────────┘
                 │
                 └──> Correction ──────> Correction   Turn level correction On and Off by pressing this key.
                                         On  Off

                                   ──> Select Corr   Selects one of the five correction tables.

                                   ──> Setup Corr    Loads and saves the five correction table.
                                                     (For further details, see P.2-16.)                  ┐
                                                                                                          │
                                   ──> return                                                             │
                                                                                                          │
         ┌────────────────────────────────────────────────────────────────────────────────────────────────┘
         │
         └──> Corr-1  ┐
           ──> Corr-2 │
           ──> Corr-3 ├  Select the correction table to be used.
           ──> Corr-4 │
           ──> Corr-5 ┘
           ──> return
```
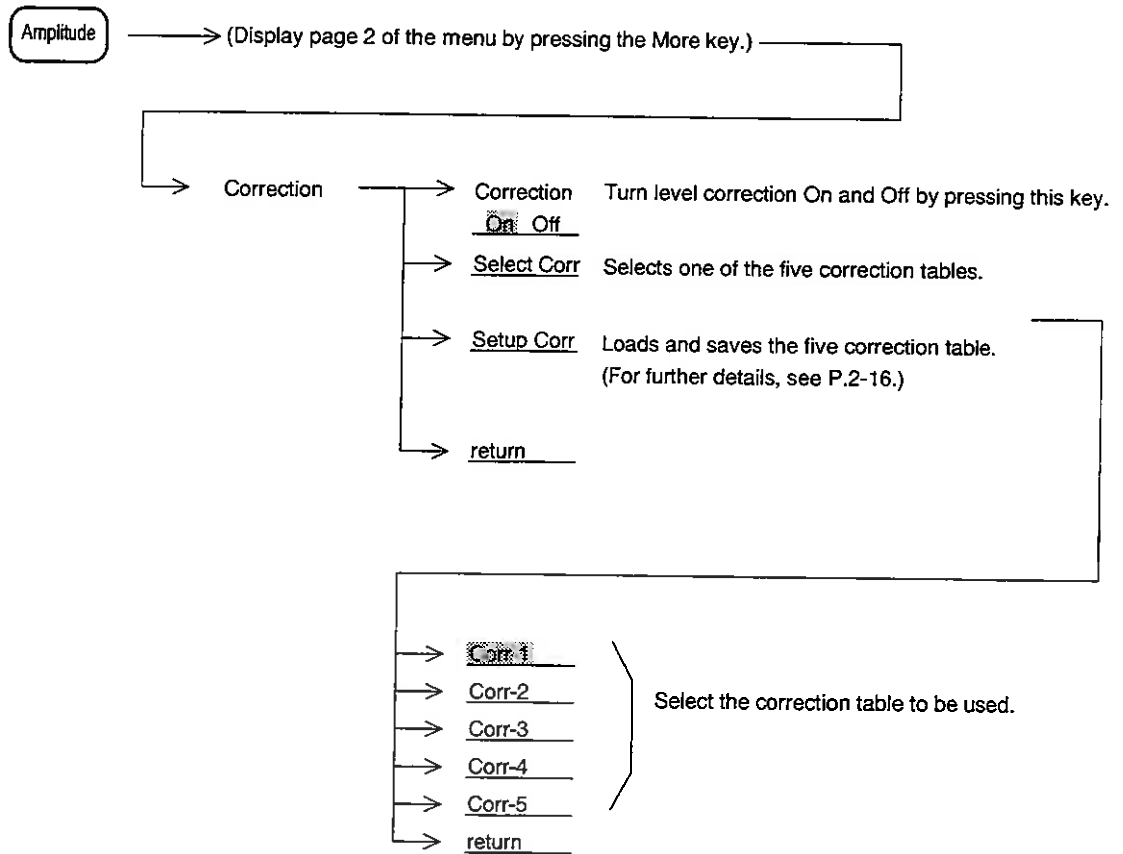
Press one of the Corr-1 to Corr-5 keys. The spectrum data is corrected and displayed by the corresponding correction value.

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.

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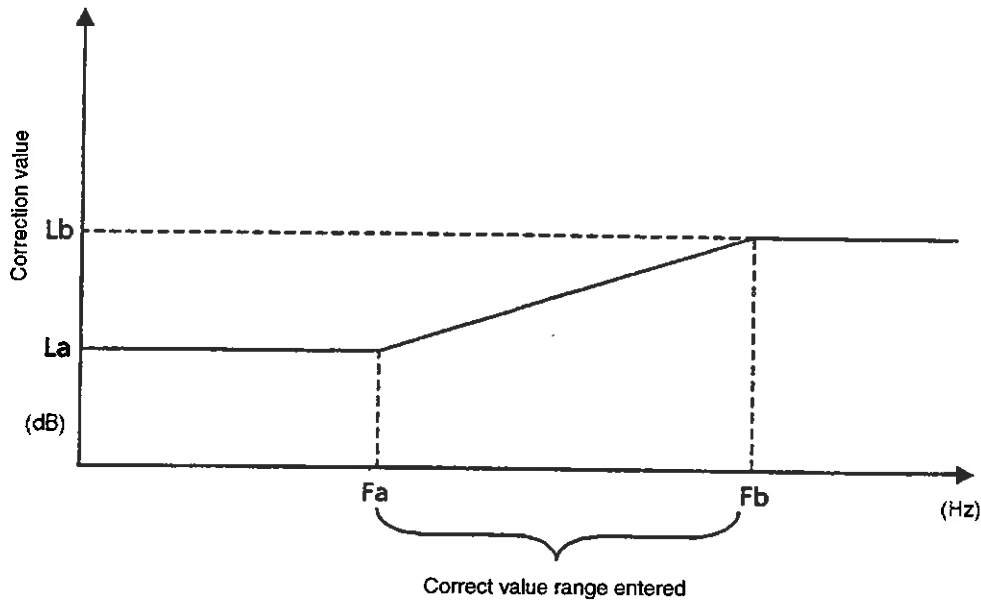
Notes: (1) No correction factor is entered at the factory. The correction values are all 0 dB.

(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.

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.

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.

Shift $\longrightarrow$ System 2 $\longrightarrow$ Coupled Common **Independent**   Set by pressing this key.
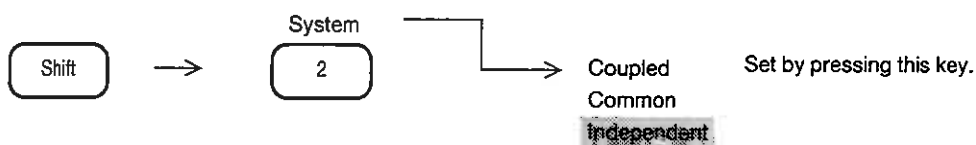
Common ······ The same values are set for both frequency domain and time domain.

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.

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.

Screen Display Type System Setting

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

```
                    System  ┌────────────────┐
  ┌───────┐       ┌───────┐ │                │
  │ Shift │  ──>  │   2   │ └──────> Display ─┤
  └───────┘       └───────┘                   │
                                              │
           ┌──────────────────────────────────┘
           │
           ├──> Parameter        Select the screen display type from the three measurement
           │                     parameters display types by pressing this key repeatedly.
           │    Display  Type-1 :  Display marker value, title, RB, VB, and ST.
           │    Type-1   Type-2 :  Make the marker value large and display RB,
           │                       VB, and ST.  Do not display title.
           │             Type-3 :  Make the marker value large and do not display
           │                       RB, VB, and ST.  Display title.
           ├──> Clock Disp       Select the screen display type from among the three date
           │    YY, MM, DD       display types by pressing this key repeatedly.
           │        YY, MM, DD    :  Digitally display the date in year/month/day order.
           │        DD, MMM,YY   :  Alphanumerically display the date in day/month/year order.
           │        MMM, DD,YY   :  Alphanumerically display the date in month/day/year order.
           │
           │
           └──> return
```

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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.

```
              System
  ┌──────┐           ┌──────────┐
  │ Shift│   ──→     │    2     │ ──→  Change Color
  └──────┘           └──────────┘

              ──→  Color Pattern 1    Standard color pattern at shipment.

              ──→  Color Pattern 2    Color pattern with a slightly higher contrast that the
                                      standard color pattern.

              ──→  Color Pattern 3    Color pattern with a dark background and light waveform.(Note)

              ──→  Color Pattern 4    Monochrome pattern.(Note)

              ──→  Define User        Color pattern that can be defined by the user.
                   Color
              ──→  return
```
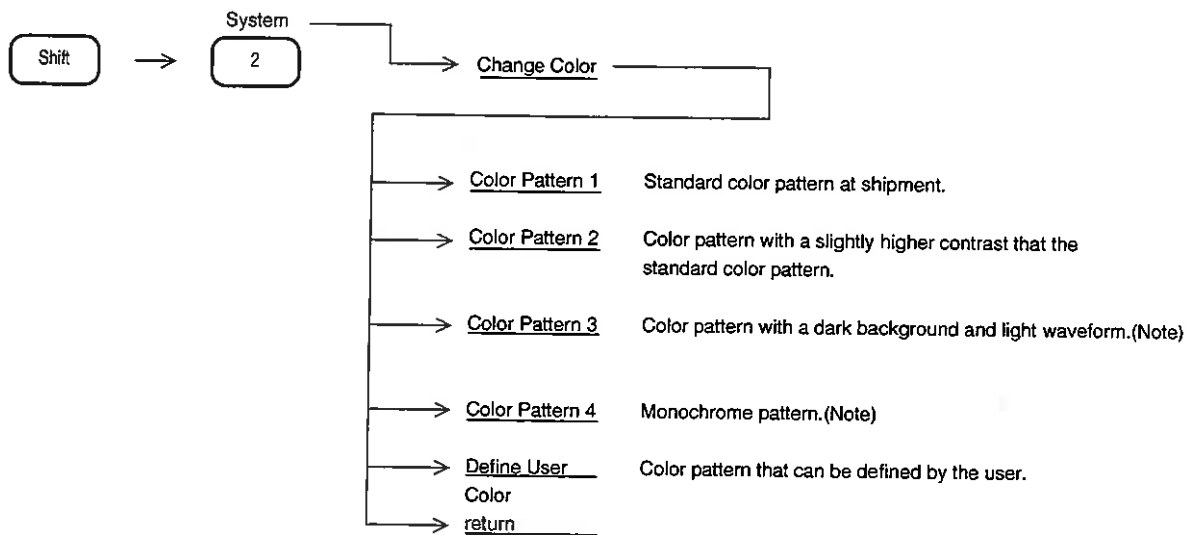
Note: Mainly use color pattern 3 when using in the dark environment.

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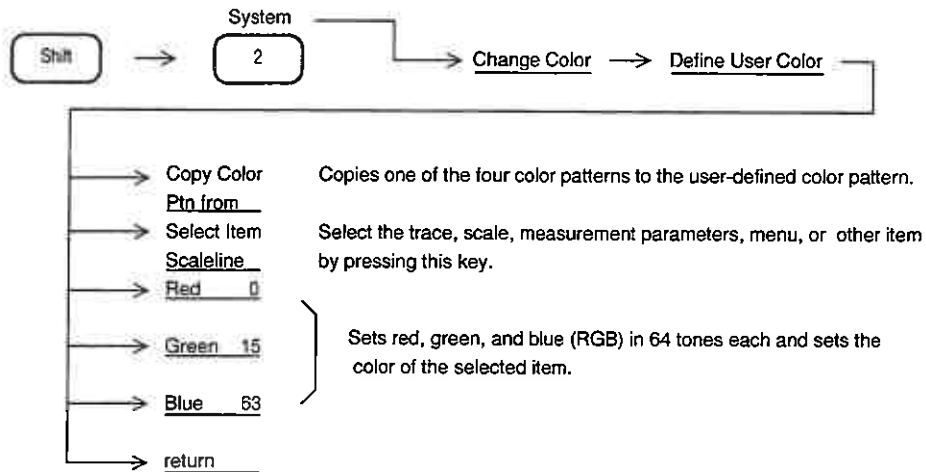
Note: Marker, PTAScreen, Menufield, Menutext, EntryArea, Background, Scalefield, Scaleline, 2ndTrace, 1stTrace, Parameter, Displayline, Trigger, Zone, Temp/Mask, and MultiMarker can be selected.

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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.

Shift → System 2 → Power On State

→ Before Power Off — Settings when the power was turned off.

→ Recall Memory — Recalls and sets the settings from internal memory.

→ Fixed State — Fixed in the reset state.

Select one.

→ Recall Memory No 1 — Specify the number of the internal memory to be recalled.
(For a description of saving to internal register, see SECTION 10.)

→ return
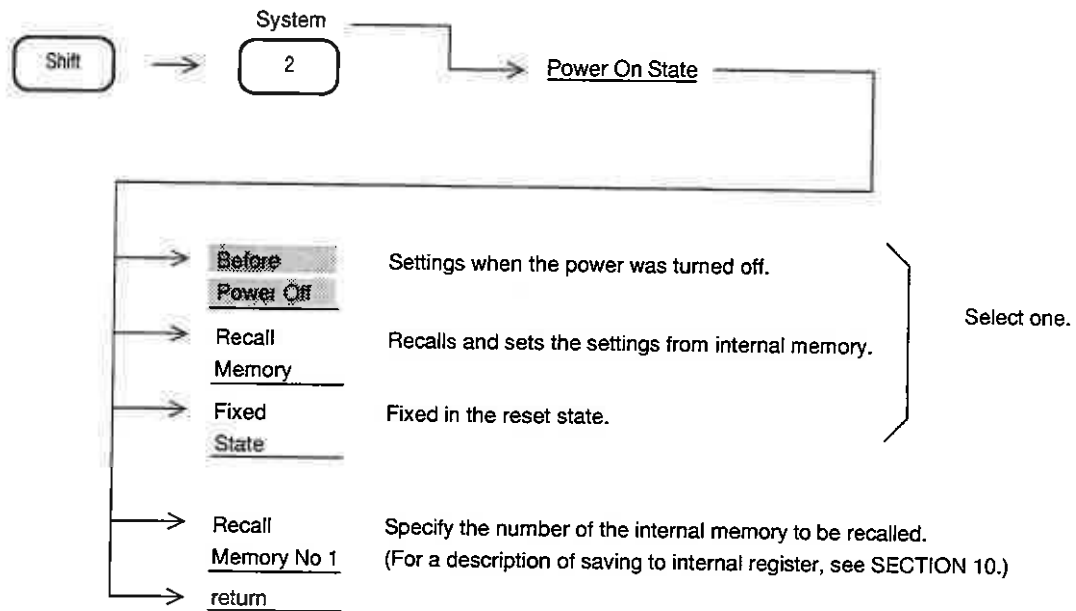
Setting Mode at Auto Sweep Time

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.

Shift → System 2 → Auto SWT Hi-Lvl-Acc Fast — Select sweep time mode by pressing this key when sweep time is AUTO.

In Hi-Lvl-Acc Mode

In Fast Mode

Setting Date/Time

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

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

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

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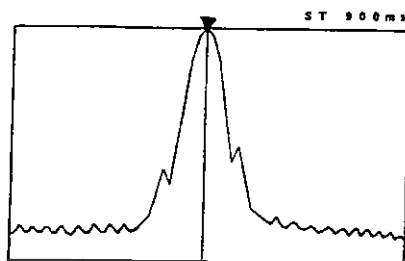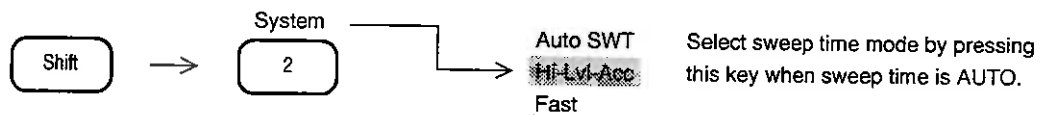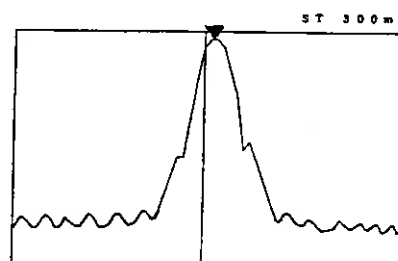
SECTION 10

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.

Memory card slot   Internal register
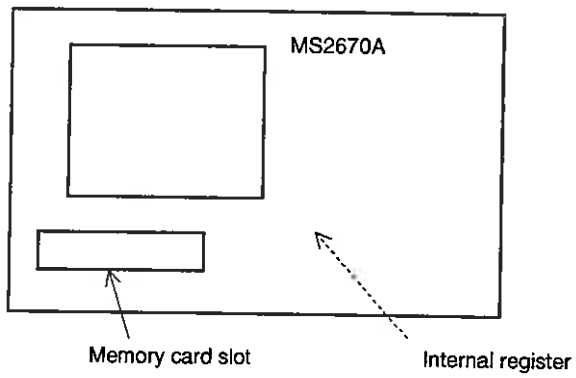
Internal Register

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.

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.)

```
                    Save
  ┌──────┐        ┌──────┐ ──────────────────────┐
  │ Shift│  ───→  │Recall│                        │
  └──────┘        └──────┘                        │
                      │                           │
                      └───────────────────────────┘
```

→ **Save to**   Save to internal register. Enter the register No. from the ten
   Int.Regstr   keys.

→ **Display**   Display the internal register file No., date, and title
   Directory   directory. When the entire directory cannot be displayed on
   /Next   one screen, press this key again to display the next screen.

1

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

→ **Save to**   Save to memory card. Enter the file No. from the ten keys.
   Mem Card

→ **Display**   Display the memory card file No., date, and title directory.
   Directory   When the entire directory cannot be displayed on one screen,
   /Next   press this key again to display the next screen.

→ **Dir Disp**   Select memory card directory detail/outline display by
   Detail   pressing this key.
   Outline

→ **Select Save**   Select save to memory card 1 or to memory card 2.
   Media

2

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

```
┌──────────────────────────────────────────────────┐
│                                                    │
│    <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

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.

Recall

Recall-1 — Select and recall one from the 12 internal register.
Recall-2
:
Recall-12
1,2

Recall from
Int.Regstr — Recall from internal register. Enter the register No. from the ten keys.

Display
Directory
/Next — Display the internal register No., date, and title directory. When the entire directory cannot be displayed on one screen, press this key again to display the next screen.

Recall
Item — Select the item to be recalled.
3

Recall from
Mem Card — Recall from memory card. Enter the file No. from the ten keys.

Display
Directory
/Next — Display the memory card file No., data, and title directory. When the entire directory cannot be displayed on one screen, press this key again to display the next screen.

Dir Disp
Detail
Outline — Select memory card directory detail display/outline display by pressing this key.

Recall
Media — Select recalling to memory card 1 or to memory card 2.

Recall
Item — Select the item to be recalled.
4

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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.

```
Recall  ────►   Recall Item ─────────────────────────────────┐
                                                              │
        ┌─────────────────────────────────────────────────────┘
        │
        ├──►  All Trace &        Recall all the waveform data and parameters.      ╲
        │     Parameter                                                             │
        │                                                                           │
        ├──►  All T & P          Recall all the waveform data and parameters and    │
        │     → View             set the storage mode to the View mode              │
        │                        (do not update the waveform data).                 │   Select the desired item.
        │                                                                           │
        ├──►  Parameter          Recall the parameters.                             │
        │                                                                           │
        ├──►  Parameter except   Recall the parameters other than                   │
        │     Ref Level          the reference level and RF attenuator.            ╱
        │
        └──►  return
```

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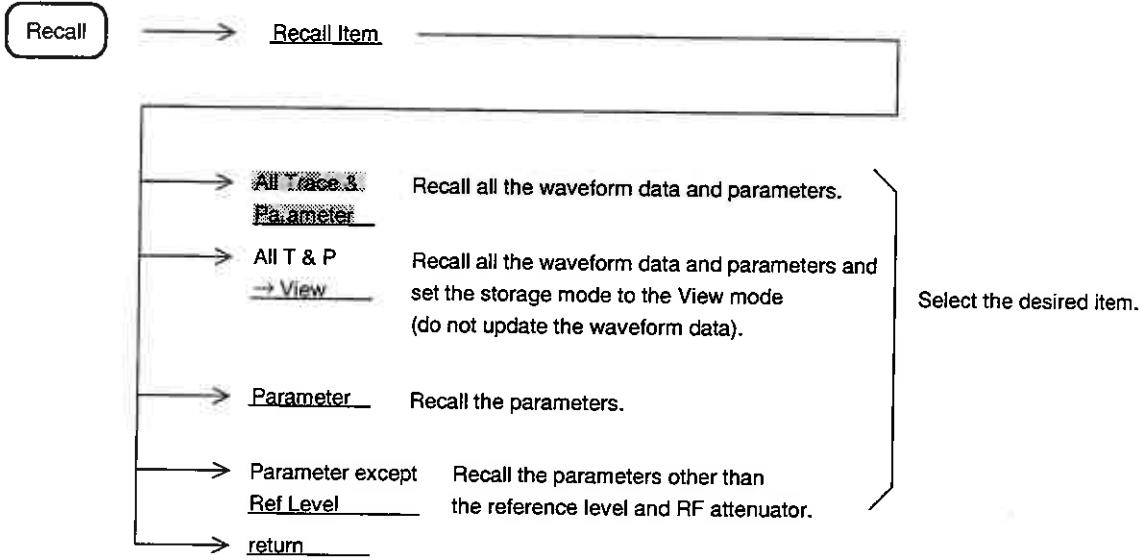
Memory Card File Management

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

```
            Mem Card
  ┌──────┐    ┌──────┐ ┌────────────────────────────────────┐
  │ Shift│──→ │  +/− │ │                                    │
  └──────┘    └──────┘ └──────────────────────────────┐     │
                                                       │     │
        ┌──────────────────────────────────────────────────┘
        │
        ├──→  Directory      Displays the directory, etc.
        │
        ├──→  Format         Format a new memory card in MS-DOS format so that it can be
        │                    used. (Note)
        │
        └──→  Select Media   Select memory card 1 or memory card 2.
```
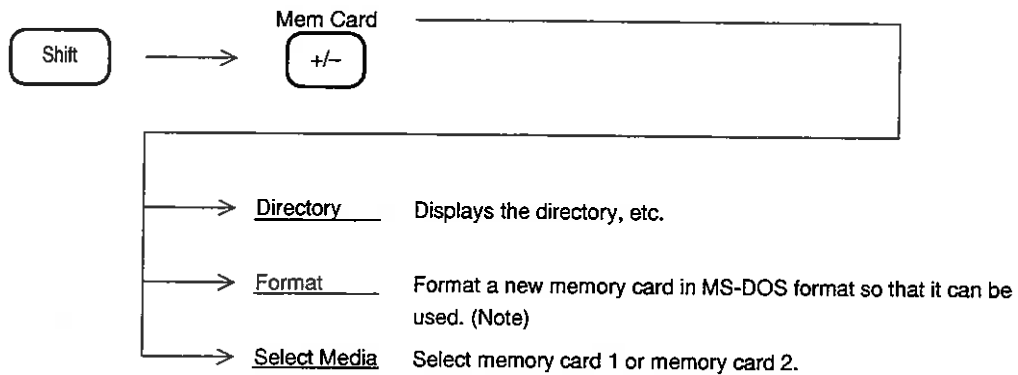
Note: When a memory card is formatted, all the file contents are deleted even if they are write-protected as described below.

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File Deletion and Write Protect

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

Shift	Mem Card +/−	Directory → Trace, Correction, Mask, Template, Define Menus, BMP File

Display
Directory
/Next — Display the memory card file No., date, and title directory. When the entire directory cannot be displayed on one screen, press this key again to display the next screen.

Dir Disp
Detail
Outline — Select memory card directory detail display or outline display.

Delete — Enter the file No. you want to delete from the ten keys.

File
Protection — Write-protect a file. Enter the file No. from the ten keys. (Note)

return

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.

(Blank)

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.

Rear panel

RS-232C cable

Printer or plotter

Do not use as listen-only.

GPIB cable
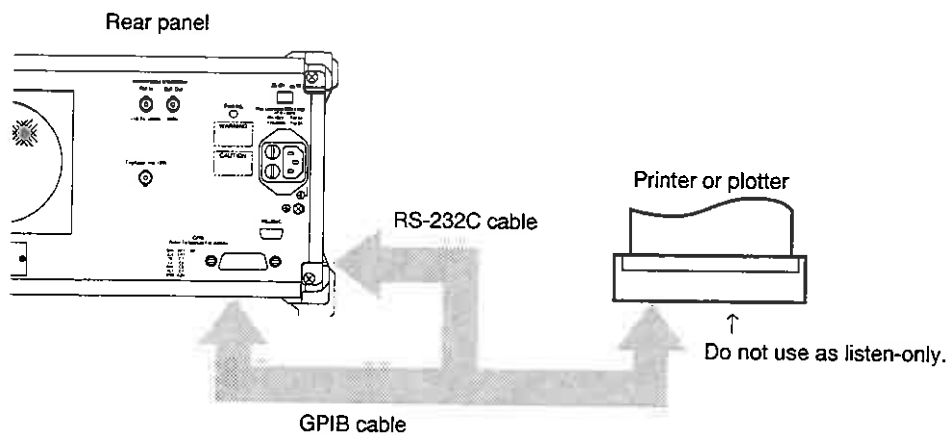
Selecting a Printer/Plotter

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

Copy Cont

(Shift) ───→ (Copy)

Printer	Select printer by pressing this key.
Plotter	Select plotter by pressing this key.
BMP file to Mem Card	Save the screen image data to memory card by pressing this key.
Paper Feed	Feed the printer paper.
Stop Print	Stop printing.
Plot Rocation Reset	Reset the plotter pen position to the initial value.
Printer Setup	Set the printer type, printing size, and GPIB address.
Plotter Setup	Set the Plotter type, chart size, chart position, item and GPIB address.
BMP file Save Media	Select slot of the memory card to which screen image data is saved.

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Selecting a Printer

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

```
                    Copy Cont
  ┌────────┐                ┌────────┐            Printer
  │ Shift  │ ───────────→   │  Copy  │ ─────→     Setup  ──────────────┐
  └────────┘                └────────┘                                 │
  ┌──────────────────────────────────────────────────────────────────┘
  │
  │     ──→  HP2225          Select an HP dot image printer.
  │                          (The HP2225C can be used.)
  │
  │     ──→  VP - 600        Select an EPSON dot image printer.
  │          ESC/P           (The VP-600, VP-800, VP-850, etc. can be used.)
  │
  │     ──→  Magnify         Select the vertical and horizontal magnification from among
  │          1x1             1x1, 1x2, 2x1, 2x2, 2x3, and 2x4 by pressing this key repeatedly.
  │
  │     ──→  Printer         Enter the printer GPIB address with the ten keys or up-
  │          Address         down keys.
  │          18
  │
  └─────→   return
```

```
┌──────────┐        ┌─────────────┐
│          │        │             │
│   1x1    │        │     1x2     │
│          │        │             │
└──────────┘        └─────────────┘

┌────────┐          ┌──────────────┐
│        │          │              │
│        │          │              │
│  2x1   │          │     2x2      │
│        │          │              │
│        │          │              │
└────────┘          └──────────────┘

      ┌──────────────────────┐
      │                      │
      │                      │
      │         2x3          │
      │                      │
      │                      │
      └──────────────────────┘

      ┌──────────────────────┐
      │                      │
      │         2x4          │
      │                      │
      └──────────────────────┘
```

Print Magnification Selection

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   Enter the plotter GPIB address with the ten keys or up-down
 18   keys.

return

When Full Size is SpecifiedforPlotting
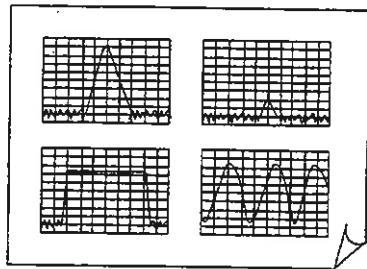
When Quarter Size is Specified for Plotting

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Setting Interface

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

RS232C _Setup_	Set the RS-232C baud rate (1200/2400/4800/9600), parity (Off/Even/Odd), data bit (7 bit/8 bit), and stop bit (1 bit/2 bit).
GPIB My Address 1	Enter the GPIB address of the MS2670A from the ten keys.
Connect to **Controller** _None_	Select the external controller interface from among None, GPIB, and RS-232C by pressing this key repeatedly.
Connect to **Prt/Plt** _RS232C_	Select the printer/plotter interface from among None, GPIB, and RS-232C by pressing this key repeatedly. (Note)
Connect to **Peripheral** _None_	Select the interface of peripherals other than printer/plotter from among None, GPIB, and RS-232C by pressing this key repeatedly.

Shift → Interface

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

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.

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.

Copy Cont

Shift ⟶ Copy

BMP file to Mem Card ⟶ Select the screen-image-data saving function.

Copy Cont

Shift ⟶ Copy ⟶ BMP file Save Media

Mem Card-1 (Upper slot)   Save data to the memory card at the upper slot.

Mem Card-2 (Lower slot)   Save data to the memory card at the lower slot.
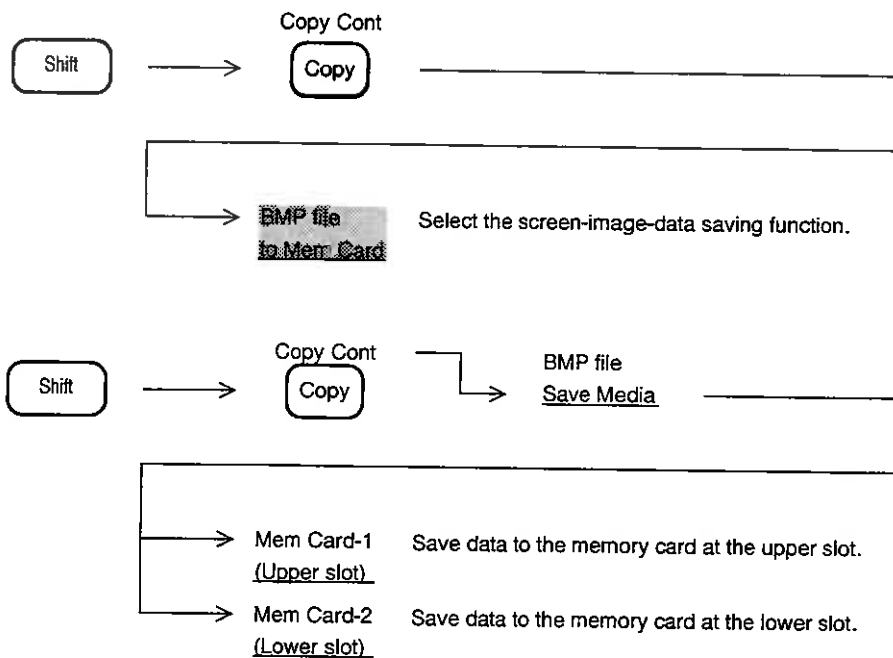
Executing Save

Copy Cont

Saves the screen-image data to a memory card by pressing the [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.

Executing Save by Specifying File Number

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

```
                      Save
  [ Shift ]  ──────▶  [ Recall ]  ┐
                                  └──▶  (Press the More key to display  ──┐
                                         the 3rd page of the menu)        │
  ┌──────────────────────────────────────────────────────────────────────┘
  │
  │       ──▶   Save          Enter the file No. to save from the ten keys.
  │             BMP file
  │             to Mem Card
  │
  │       ──▶   Display       Display the screen-image-data file directory on the memory card.
  │             Directory
  │             /Next
  │
  │       ──▶   Dir Disp      Select memory-card directory detail display or outline display.
  │             Detail
  │             Outline
  │
  └─────▶       Save          Select memory card on which the data is saved.
                Media
```
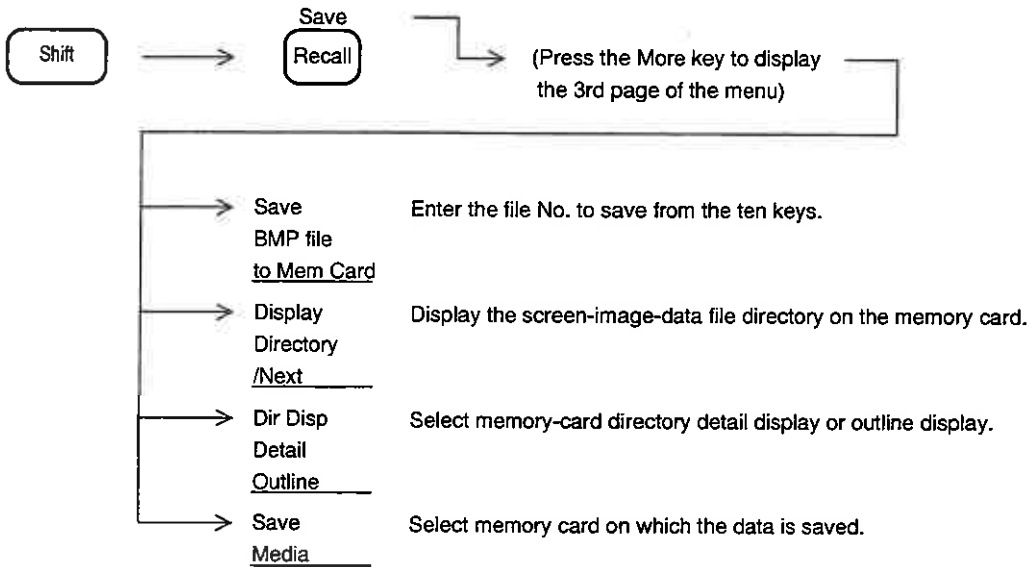
Only the screen-image-data is saved after deleting the menu and data input in this saving mode.
Use the memory card which is formatted by the MS2670A.

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.

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.

```
┌───────┐        Title
│ Shift │  ───→   ┌───┐
└───────┘         │ 3 │
                  └───┘
```

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

Edit Title — 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:Meas Fre

	Edit

```
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9 - + ˙ / ≈ ! " # $ % & ' ( ) — `
/ ¦ @ [ ] { } : ; , . < > ? _
```

Select the charcters by turning the rotary knob, After setting the title, press the [Return] key.

Key	Description
←	Move Title cursor to the left.
→	Move Title cursor to the right.
Insert	Insert one character.
Delete	Delete one character.
Clear	Clear Title.
return	

Title Edit Screen

(Blank)

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.

```
            PTA
  ┌──────┐  ┌──────┐
  │ Shift│→ │  7   │────────┐
  └──────┘  └──────┘        │
     ┌──────────────────────┘
     │
     ├──→ PTA Program    Set the PTA program list display, selection, loading,
     │                   execution, stopping, etc.
     │
     └──→ PTA Library    Set the PTA library (set of program subroutines) file
                         display, selection, loading, library program display, selection,
                         deletion, execution, stopping, etc.
```

Loading and Executing PTA Program

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

Key	Description
Shift → PTA 7 → PTA Program	
Run	Execute PTA program.
Stop	Stop PTA program execution.
Cont	Restart stopped execution.
Reset	Stop PTA program execution and initialize user-defined variables, etc.
Off	Turn off PTA.
1	
Prog List	Display PTA program files list.
Corsor Up	Move list display cursor up.
Cursor Down	Move list display cursor down.
Load	Load PTA program specified by cursor.
Run	Execute PTA program.
2	
F1	Switch 0/1 state of system variable EX1 used by PTA.
F2	Switch 0/1 state of system variable EX2 used by PTA.
F3	Switch 0/1 state of system variable EX3 used by PTA.
F4	Switch 0/1 state of system variable EX4 used by PTA.
F5	Switch 0/1 state of system variable EX5 used by PTA.
3	
Yes	Return character string "YES" for PTA program INPUT statement.
No	Return character string "NO" for PTA program INPUT statement.
4	

Loading and Executing Library Program

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

Shift	→	PTA / 7	PTA Library		

	Library Memory	Open the operation menu for the currently loaded library programs.	
	Library File	Open the operation menu for the library files in the memory card.	
	return		

Corsor Up	Move the list display cursor up.
Cursor Down	Move the list display cursor down.
Load	Load the library file displayed by the cursor.
File/Page	Display a list of library files.
Check File	Display a list of the library programs saved in the specified
return	library file.

Corsor Up	Move the list display cursor up.
Cursor Down	Move the list display cursor down.
Execute	Execute/stop/resume/initialize the library program specified by the cursor.
Library	Display a list of loaded library programs.
Remove	Delete the library program specified by the cursor.
return	

User-Definition Function

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

Shift → Define 8

Define Menus — Set user definition source and destination and delete user definition.

Edit Menu — Edit user key and user menu titles.

Initialize Menus — Reset user-defined menus.

Load/Save Def Files — Load and save user-defined file to specified memory card.

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.

Shift → 8 (Define) → Define Menus

Select Source
Lib Prgm → Select one of the library programs as the user-definition source

Select Source
Menu → Select a normal menu as the user-definition source menu.
Normal key operation can be directly input as the source.

Select Dest
Menu → Select the destination from among the user menus. User key operation can be directly input as the destination.

Set source
into Dest → Define the selected source in the (selected destination) user key.

Delete Dest → Delete the user destination defined in the user key.

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.

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.
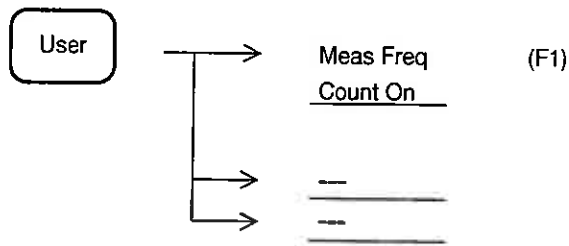
(Blank)

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 1 — Measure the carrier signal and noise power ratio.

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

Frequency Measurement Function

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

Measure	→	Frequency Count	→	Count On	Start frequency measurement.
			→	Count Off	End frequency measurement.
			→	Set Up	Select the measurement resolution from among 1 kHz, 100 Hz, 10 Hz, and 1 Hz.
			→	return	
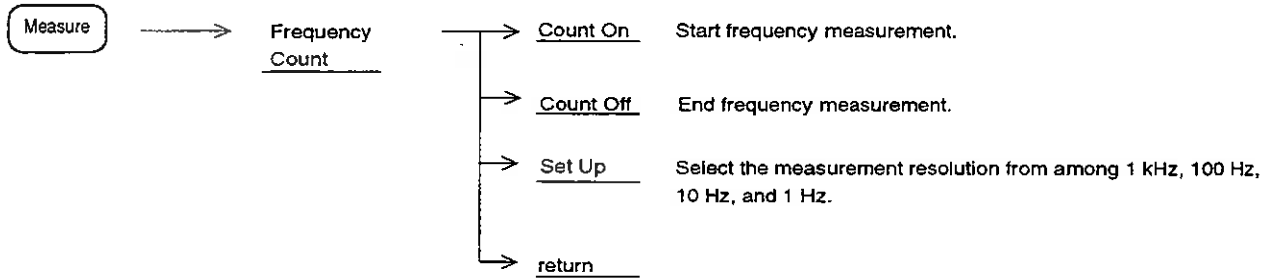
Notes: • If the RBW is too small compared to frequency span, it takes more times to count because of the internal automatic tuning operation.
   • In the following cases, the frequency may not be counted correctly because of the undesired adjacent noise.
   ① Signal level is less than -30 dB from reference 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.

Measure	→	Noise Measure	→	Meas On	Start measurement.
			→	Off	End measurement.
			→	return	
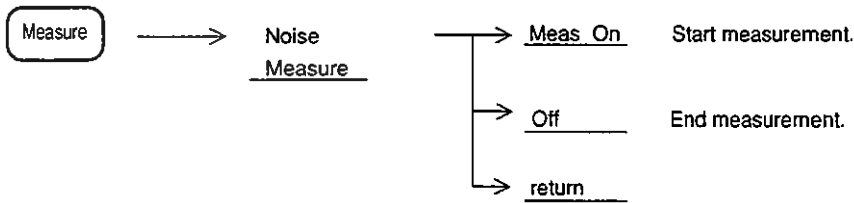
Measuring C/N Ratio

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

Measure	→	C/N Ratio Measure	→	Meas On	Start measurement.
			→	Off	Stop measurement.
			→	return	
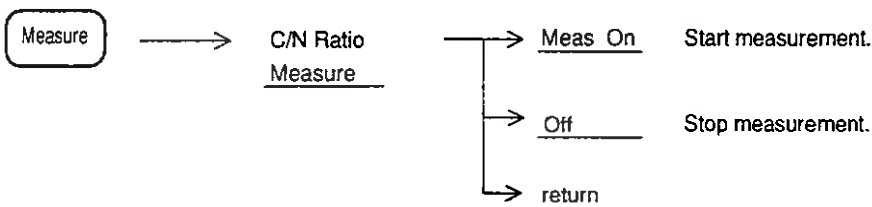
Measuring Occupied Bandwidth

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

Measure	→	Occ BW Measure	→	Execute	Execute measurement.
			→	Setup	Select the XdBDown mode or N% of Power mode.
			→	return	
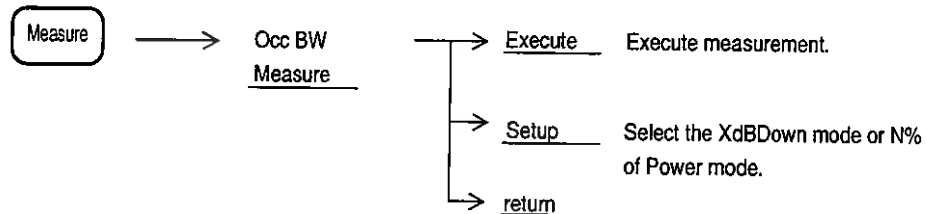
Measuring Adjacent Channel Leakage Power

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

Measure	→	Adj ch pwr Measure	→	Execute	Execute measurement.
			→	Ch Sepa-1 12.5 kHz	Set channel separation to 12.5 kHz.
			→	Ch Sepa-2 25.0 kHz	Set channel separation to 25.0 kHz.
			→	Ch BW 8.5 kHz	Set the channel bandwidth.
			→	Set Up	Select the measurement mode, ACP graph display On/Off, and channel centerline/BW line display On/Off.
			→	return	
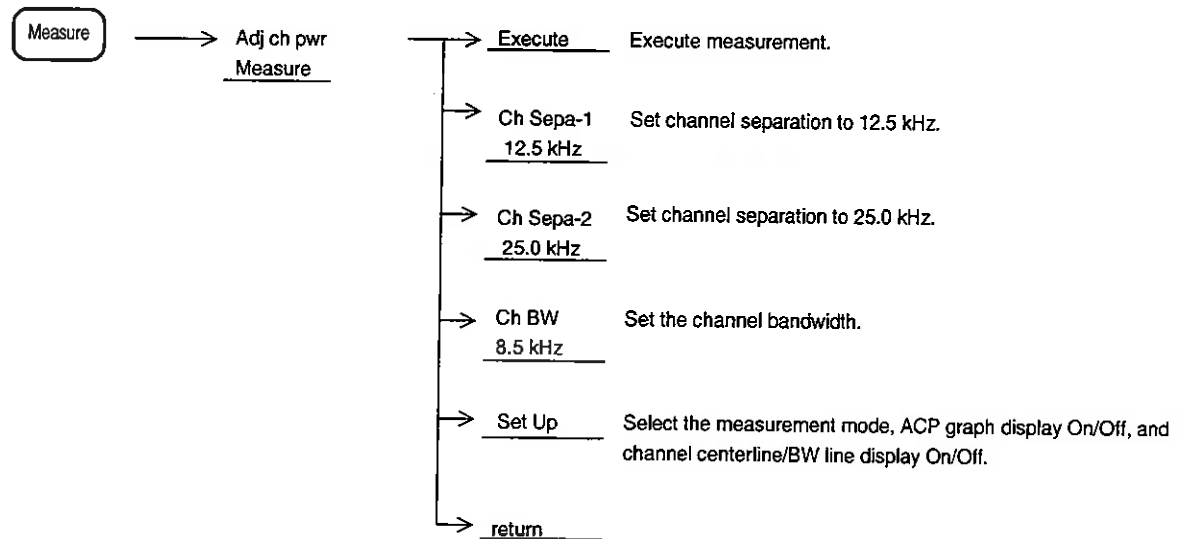
Pass/Fail Judgment by Mask

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

Measure ──────→ Mask ──────┬→ Check | Execute pass/fail judgment relative to the
Pass/Fail | standard line.

├→ Selest | Select one of the five mask tables.
Mask Table

├→ Move Mask | Enter the frequency (Hz) and level (dB) and move
| the current mask.

├→ Sert up | Create a mask table and load and save it from
Mask Table | memory card.

└→ return
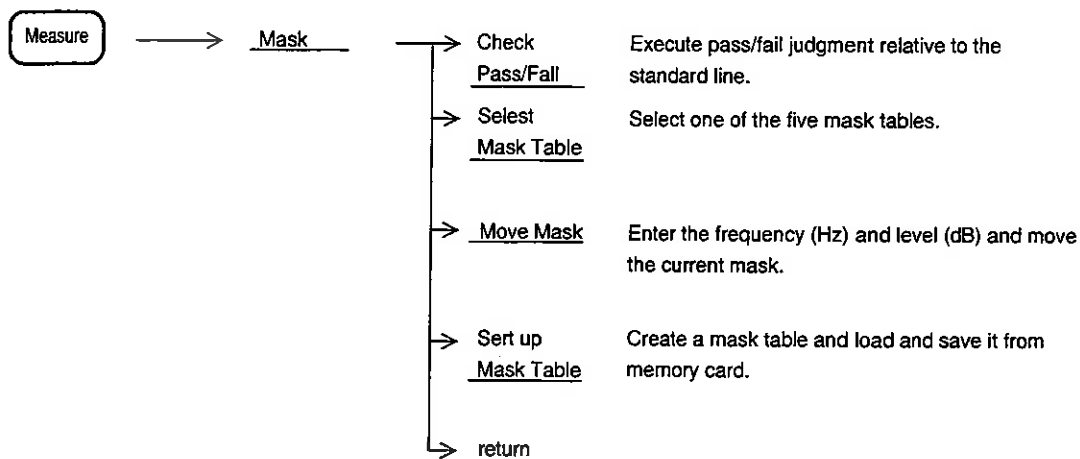
Pass/Fail Judgment by Time Template

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

Measure ──────→ Time ──────┬→ Check | Execute pass/fail judgment by time template.
Template | Pass/Fall

├→ Select | Select one of the five template tables.
Temp Table

├→ Move | Enter the time (msec) and level (dB) and move
Template | the current template.

├→ Set up | Create a template table and load and save it from memory
Temp Tbl | card.

└→ return

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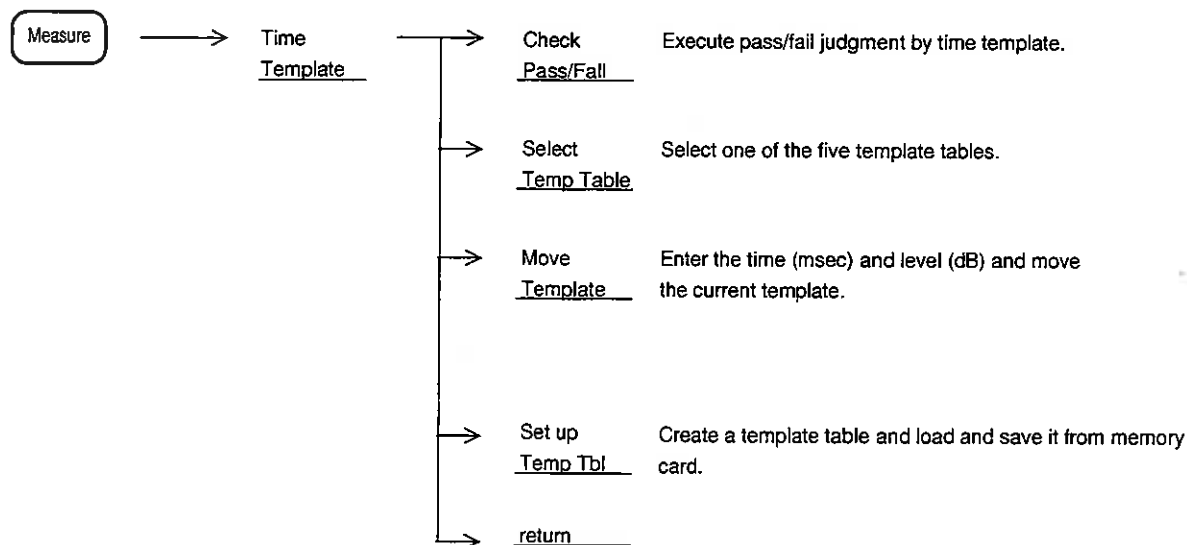
Measuring Burst Average Power

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

```
( Measure ) ——————→   Burst Avg   ┌——→   Execute    Execute measurement.
                      Power        │
                                   ├——→   Start       Set the measurement start point of the burst signal
                                   │      Point        on the screen with the ten keys or the rotary knob.
                                   │      100
                                   │
                                   ├——→   Stop         Set the measurement end point of the burst signal
                                   │      Point        on the screen with the ten keys or the rotary knob.
                                   │      200
                                   │
                                   └——→   return
```
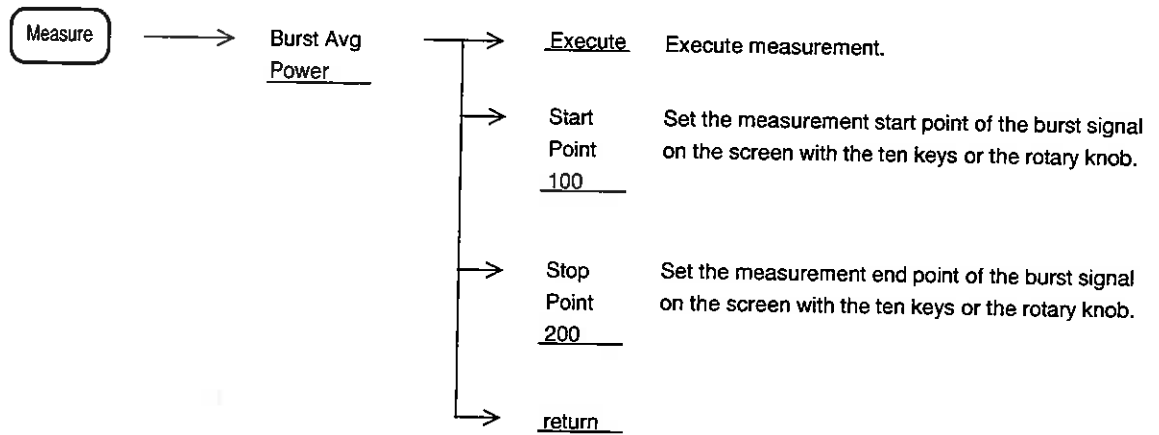
Example of Time Template Creation
(PHS Transmit Signal)

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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MKR:300us
    7.84dBm   RB†1MHz#
RLV: 15.00dBm   VB†1MHz#
20dB/

DT:-200us   TS:1.0ms   F:900.0

| 1 | -200.000us | -65.00 |
| 2 | -4.600us | -65.00 |

Edit
←
→
Insert/
Replace
Delete
Graph/
List
return
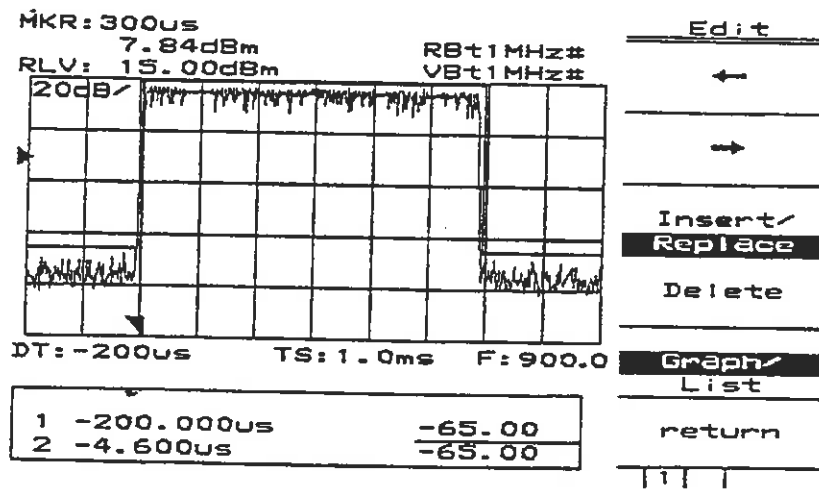
TEMPLATE Creation Screen (Graph)

No.	Time	Level(dB)
1	-200.000us	-65.00
2	-4.600us	-65.00
3	-4.600us	-1.00
4	594.320us	-1.00
5	594.320us	-65.00
6	1.000000ms	-65.00
7		
8		
9		
10		
11		
12		

| 1 | -200.000us | -65.00 |
| 2 | -4.600us | -65.00 |

Edit
←
→
Insert/
Replace
Delete
Graph/
List
return

TEMPLATE Creation Screen (List)

3) Template coordinates (PHS: RCR STD-28)
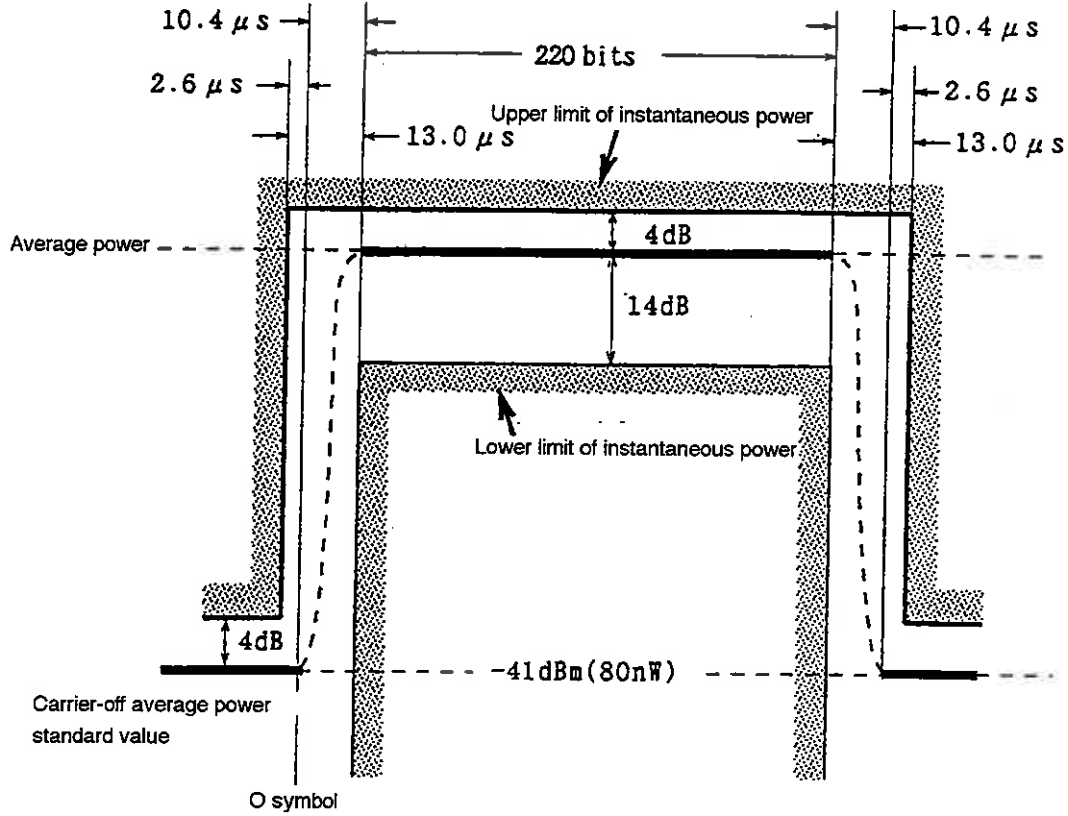
Coordinate reference line (Trigger position → left end of screen: –200 μs)

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

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

5) Template coordinates (GSM, DCS1800)
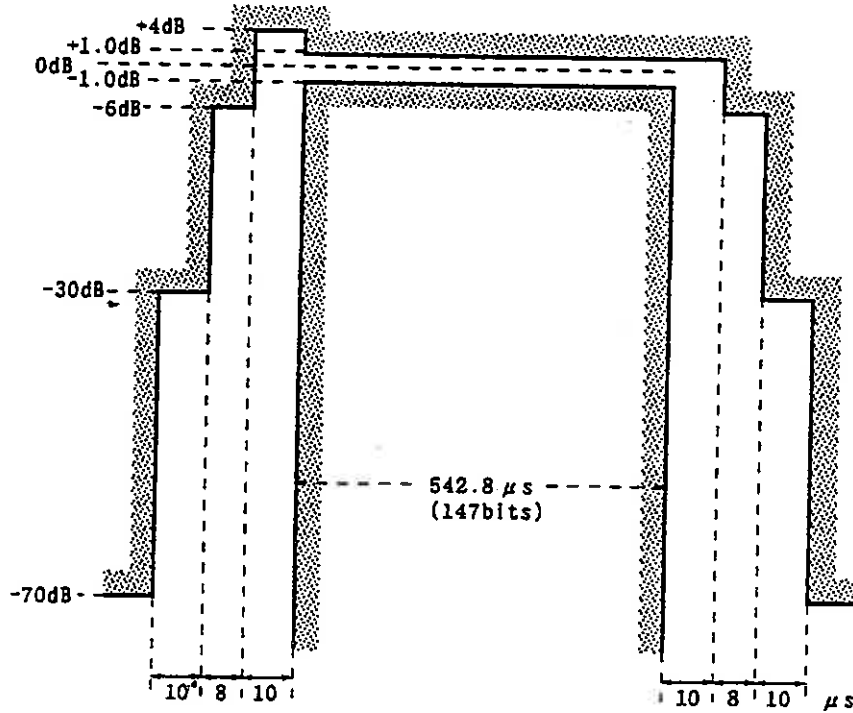
Coordinates standard line (Trigger position → left end of screen: –75.0 μs)

* 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

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.
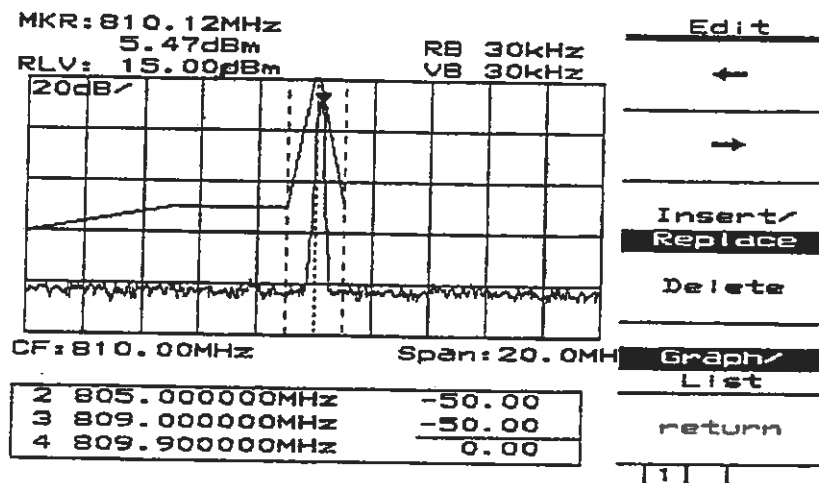
MASK Creation Screen (Graph)

```
┌─────────────────────────────────────┐        ──────Edit──────
│ No. Frequency    Level( dB )         │
│                                      │             ←
│  1  800.000000MHz      -60.00        │        ─────────────────
│  2  805.000000MHz      -50.00        │
│ ▓3▓ 809.000000MHz▓▓▓▓▓▓-50.00▓       │             →
│  4  809.900000MHz       0.00         │
│  5  810.100000MHz       0.00         │        ─────────────────
│  6  811.000000MHz      -50.00        │          Insert/
│  7                                   │          ▓Replace▓
│  8                                   │
│  9                                   │          Delete
│ 1O                                   │
│ 11                                   │        ─────────────────
│ 12                                   │          Graph/
└─────────────────────────────────────┘          ▓List▓
┌─────────────────────────────────────┐
│  2  805.000000MHz      -50.00        │          return
│  3  809.000000MHz      -50.00        │
│  4  809.900000MHz       0.00         │        ───┬─┬─┬───
└─────────────────────────────────────┘           │1│ │
```

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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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.

```
┌─────┐
│ TG  │
└─────┘
   │
   ├──→  TG Out          Turn on the TG output.
   │     On  Off
   │
   ├──→  Output Level    Set the TG output level.
   │     0 dBm
   │
   ├──→  Attenuator      Set the TG output attenuator to fixed or variable state by pressing this key.
   │     Hold      On:   Attenuator fixed
   │     On  Off   Off:  Attenuator varied depending on TG output level
   │
   ├──→  Trace           Display change and move of trace A and B.
   │     A, B
   │
   └──→  Normalize  ──────────────────────────────────────────────────┐
                                                                       │
      ├──→  Instant       By pressing this key, following operations are performed.(Instant-normalize function)
      │     Normalize     Set A→B operation.
      │                   Set the trace-A average level to the display-line level.
      │                   Turn the normalize function On.
      │                   (See the description of the instant-normalize function, below.)
      │
      ├──→  Normalize     Turn the normalize function (A−B+DL) On.    (A−B+DL)
      │     On  Off
      │
      ├──→  Display    Turn the display line On and Off.
      │     line
      │     On  Off
      │
      ├──→  Disp Line     Set the display line level.
      │     Level         − 50.00 dBm
      │
      ├──→  Marker        Select the absolute-value/relative-value of the marker level display.
      │     Level         Relative value is referenced to the display-line level.
      │     Abs Rel       −50.00 dBm
      │
      └──→  Return
```

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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.

```
MKR:952MHz                                      Normalize
    -7.67dBm            RB  1MHz
RLV:-3.00dBm            VB  10kHz#            Instant
 1dB/                                        Normalize
                                             Normalize
                                             (A-B+DL)
                                             On    Off
                                             Display
                                              Line
                                             On    Off
                                             Disp Line
                                              Level
                                             -7.56dBm
                                             Marker
                                              Level
                                             Abs   Rel

                                             return

ST:500MHz                SP:1.500GHz
```
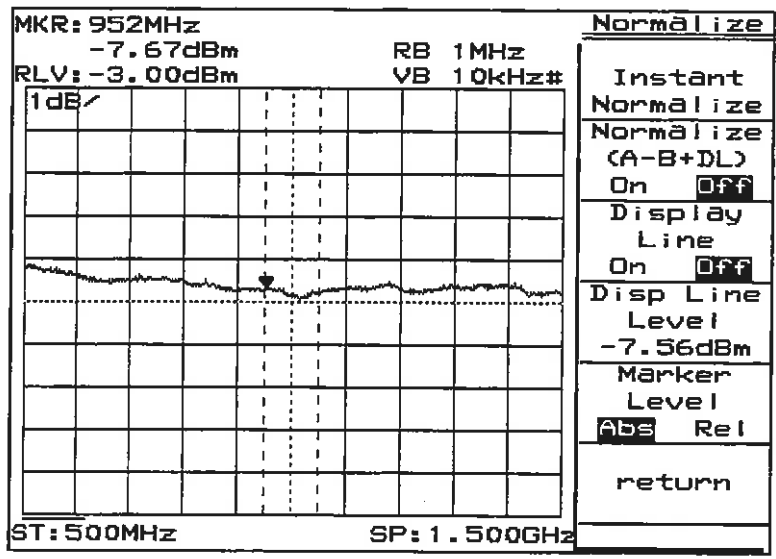
The normalize function compensates this frequency-characteristics ripple.

The following figure shows the frequency characteristics which is compensated by the instant normalize function.

```
MKR:968MHz                                      Normalize
    0.06dB              RB  1MHz
RLV:-3.00dBm            VB  10kHz#            Instant
 1dB/                                        Normalize
                                             Normalize
                                             (A-B+DL)
 DL Level =                                  On    Off
 -7.56dBm                                    Display
                                              Line
                                             On    Off
                                             Disp Line
                                              Level
                                             -7.56dBm
                                             Marker
                                              Level
                                             Abs   Rel

                                             return

ST:500MHz                SP:1.500GHz
```
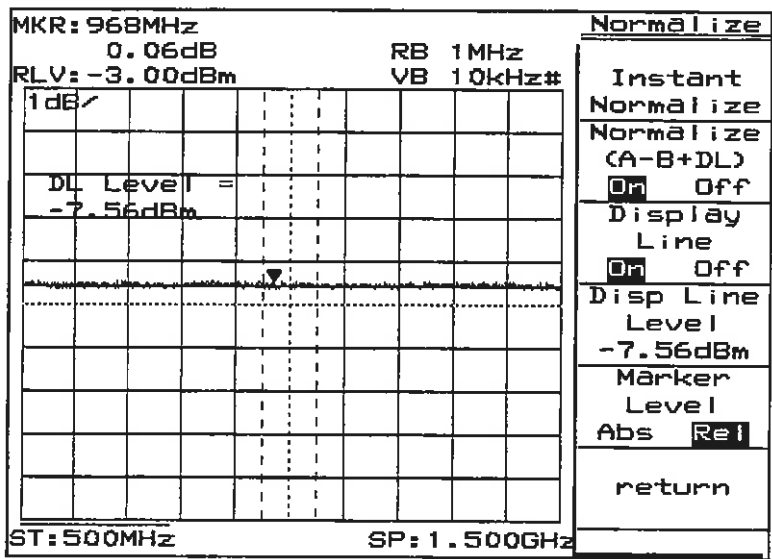
By the instant normalize function, the compensated waveform is displayed at the averaged level of the previous uncompensated waveform. The marker level is displayed with the relative value referenced to the display line level.

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.

```
MKR:960MHz                              | Normalize |
      0.05dB              RB  1MHz       |           |
RLV:-3.00dBm              VB  10kHz#     |  Instant  |
 1dB/                                    | Normalize |
                                         | Normalize |
                                         | (A-B+DL)  |
  DL  Level  =                           | On   Off  |
  -4.00dBm                               | Display   |
                                         |   Line    |
                                         | On   Off  |
                                         | Disp Line |
                                         |   Level   |
                                         | -4.00dBm  |
                                         |  Marker   |
                                         |   Level   |
                                         | Abs  Rel  |
                                         |           |
                                         |  return   |
ST:500MHz              SP:1.500GHz       |           |
```

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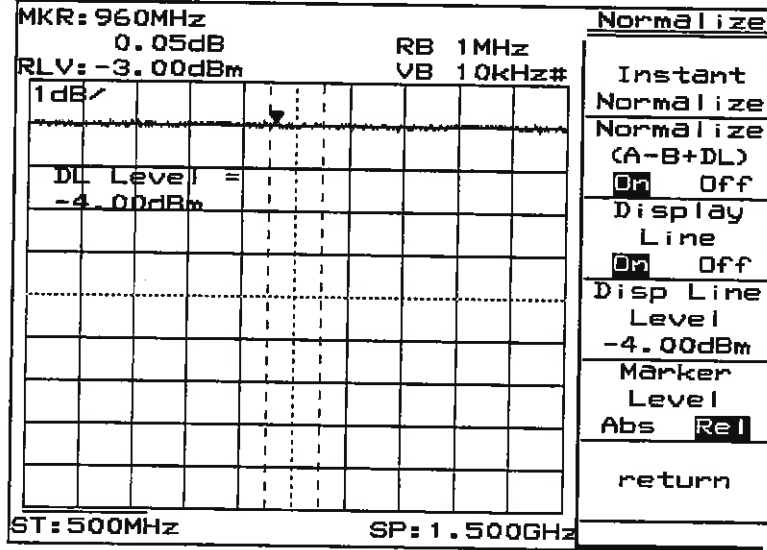
Hereafter, transmission-characteristics/reflection-characteristics measurements of a band-pass filter (BPF) are described below for TG application examples.

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.

(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.

```
MKR:504.0MHz                              TG
     -1.61dBm           RB  300kHz
RLV: 0.00dBm            VB  300kHz      TG Out
 10dB/                                 On    Off
                                       Output
                                       Level
                                       0.0dBm
                                      Attenuator
                                        Hold
                                       On    Off
                                             *
                                       Trace
                                       A,B
                                             *
                                      Normalize

CF:500.0MHz              Span:100MHz
```
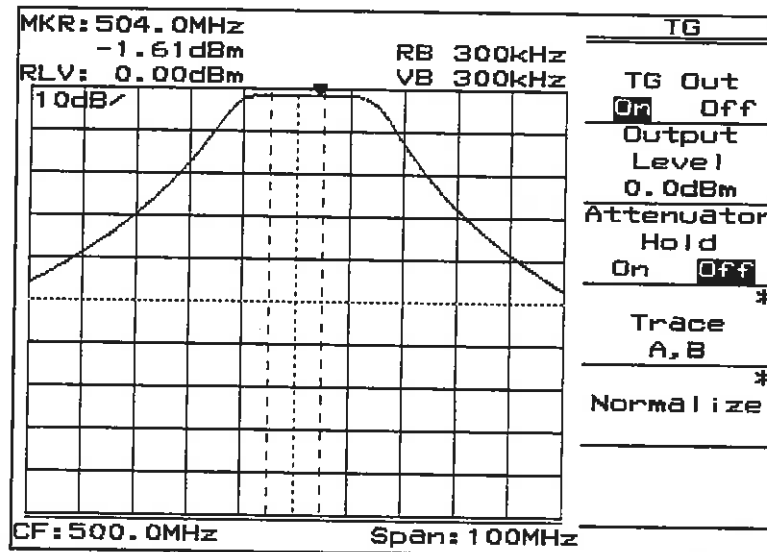
- When the TG output level is set to other than 0 dBm, the insertion loss can be read in dB units by setting the marker level display to the relative value from the reference level, as illustrated in the following procedures.

  - 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>>

14-7

(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.

TG Output   RF Input

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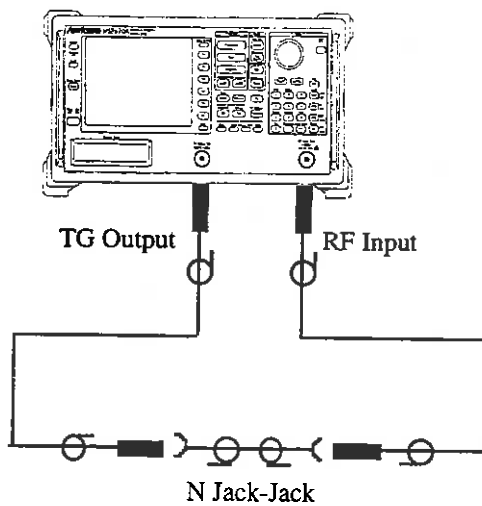
Measuring the compensation factor of the measurement system to calibrate the frequency characteristics as shown below.

- 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>>
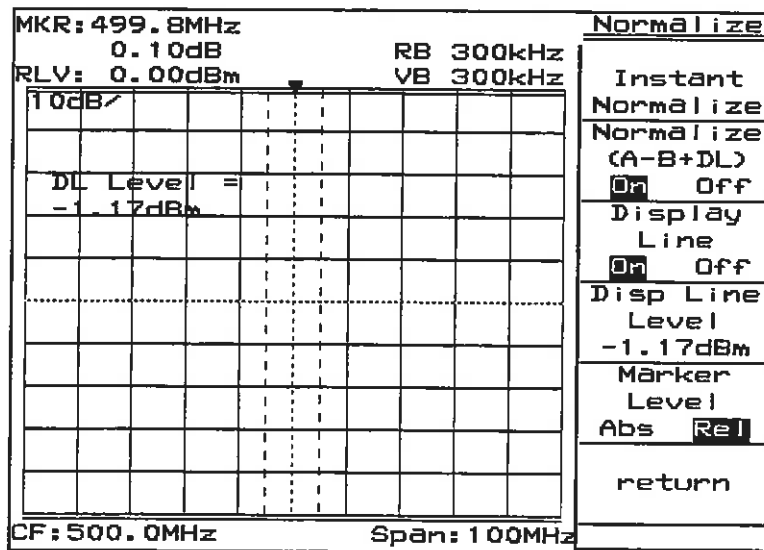
```
MKR:499.8MHz                          Normalize
       0.10dB            RB 300kHz    ┌─────────┐
RLV: 0.00dBm       ▼     VB 300kHz    │ Instant │
┌10dB╱┬───┬───┬───┬───┬───┬───┬───┐   │Normalize│
│     │   │   ┊ ┊ │   │   │   │   │   ├─────────┤
│     │   │   ┊ ┊ │   │   │   │   │   │Normalize│
├─DL─Level──=─┊─┊─┼───┼───┼───┼───┤   │(A-B+DL) │
│ -1.17dBm    ┊ ┊ │   │   │   │   │   │ On  Off │
├─────┼───┼───┊─┊─┼───┼───┼───┼───┤   ├─────────┤
│     │   │   ┊ ┊ │   │   │   │   │   │ Display │
├·····┼···┼···┊·┊·┼···┼···┼···┼····┤   │  Line   │
│     │   │   ┊ ┊ │   │   │   │   │   │ On  Off │
├─────┼───┼───┊─┊─┼───┼───┼───┼───┤   ├─────────┤
│     │   │   ┊ ┊ │   │   │   │   │   │Disp Line│
├─────┼───┼───┊─┊─┼───┼───┼───┼───┤   │  Level  │
│     │   │   ┊ ┊ │   │   │   │   │   │ -1.17dBm│
├─────┼───┼───┊─┊─┼───┼───┼───┼───┤   ├─────────┤
│     │   │   ┊ ┊ │   │   │   │   │   │ Marker  │
├─────┼───┼───┊─┊─┼───┼───┼───┼───┤   │  Level  │
│     │   │   ┊ ┊ │   │   │   │   │   │ Abs Rel │
└─────┴───┴───┴─┴─┴───┴───┴───┴───┘   ├─────────┤
CF:500.OMHz          Span:100MHz      │ return  │
                                      └─────────┘
```

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.

(2) Setup:

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

TG Output   RF Input

BPF
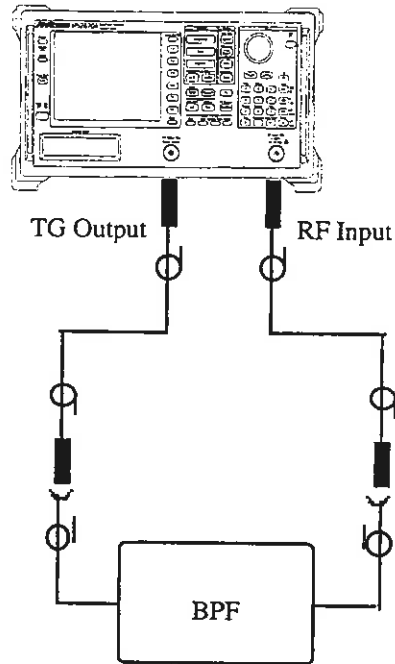
(3) Measuring characteristics:

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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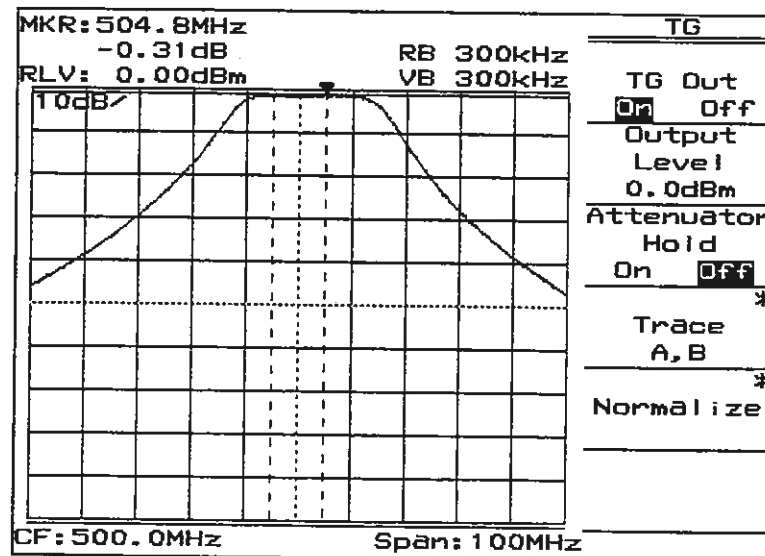
(4) Measuring center frequency and 3dB bandwidth:

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).

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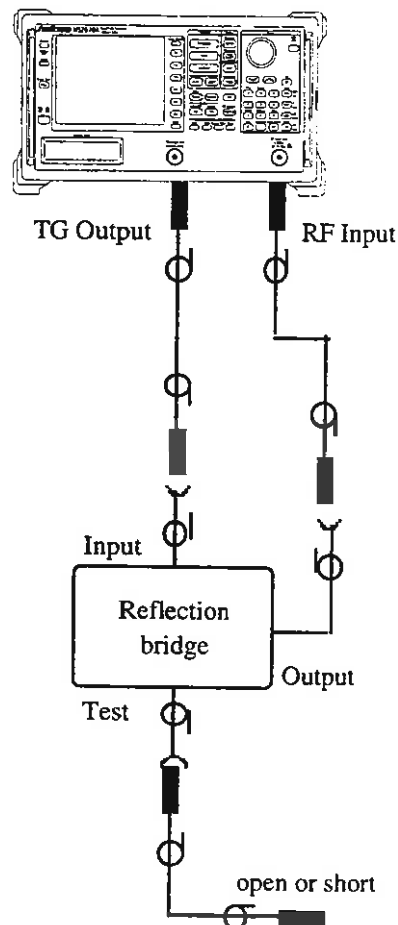
Measure the compensation factor of the measurement system to calibrate the frequency characteristics, as shown below.

- 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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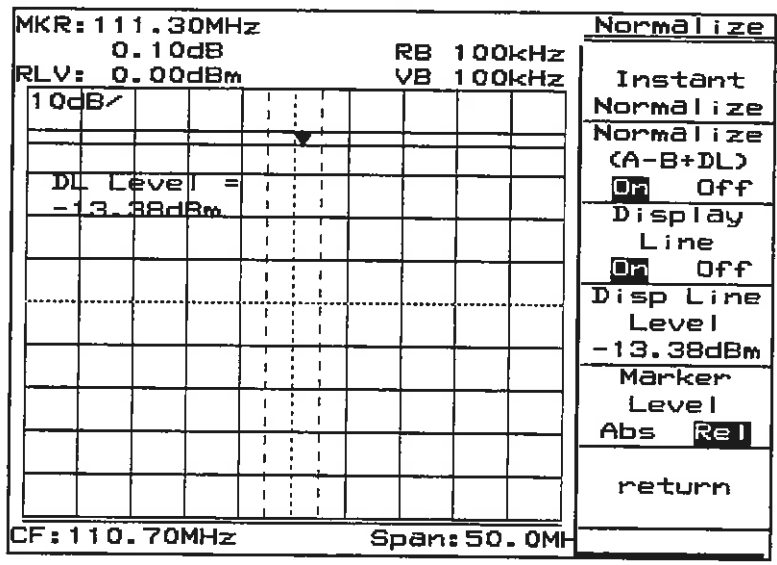
(2) Setup:

Connect the BPF to the Test port of the 60NF50.

TG Output   RF Input

Input

Reflection bridge

Output

Test

BPF   50Ω terminal
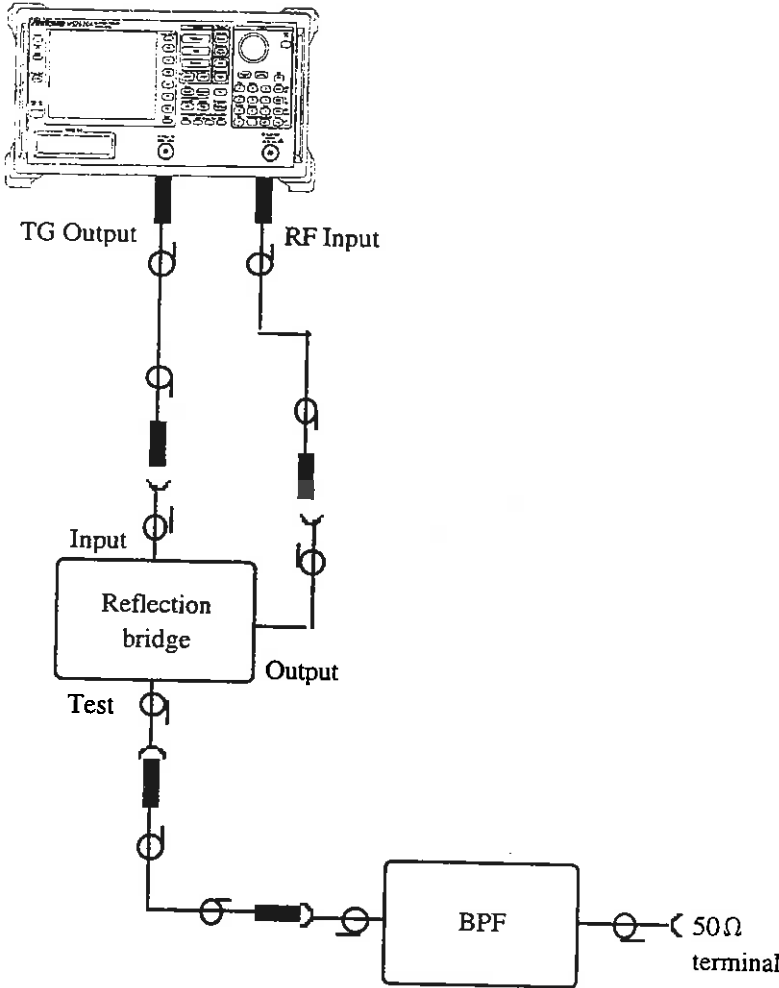
(3) Measuring characteristics:

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.

```
MKR:109.70MHz                        Marker
      -13.51dB          RB 100kHz   AT 10dB
RLV: 0.00dBm            VB 100kHz   ST 25ms
10dB╱                                    Tr-A



Zone Center =
109.700 000MHz




CF:110.70MHz                      Span:50.0MHz
```
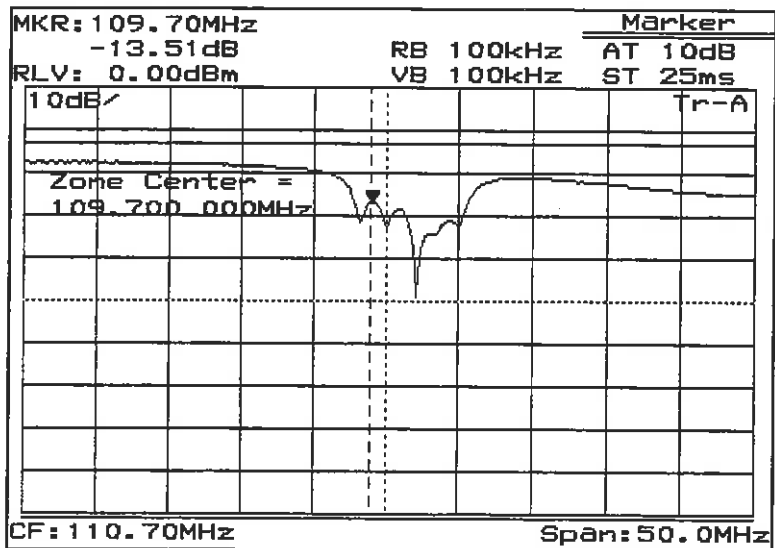
Notes on Active Device Measurement

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.

(Blank)

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

(Blank)

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.

Soft-key Menu List

Menu		Menu Tree(page/27)			Menu		Menu Tree(page/27)		
A)	A/B,A/BG	16			I)	Impedance	2		
	A/Time	17				Initialize	26		
	ACP Setup1	8				Interface	23		
	ACP Setup2	8				Item	12	, 20	
	Ajd ch Pwr	8			L)	Lib Exec	25		
	Amplitude	2				Lib File	25		
	Attenuator	2	,	3		Lib Memory	25		
	Avq Count	15				Lib Prgm	25		
B)	Burst Pwr	11				Lib Remove	25		
C)	C/N Meas	7				Lin Scale	2		
	Cal	22				Line	9	, 10	
	Change Clr	21				Load/Save	9	, 10	
	Check File	25				Location	20		
	Copy Cont	20				Log Scale	2		
	Copy from	21				Lvl Offset	2		
	Correction	2			M)	Manual Set	4		
	CountSetup	7				Marker	4		
D)	Def Files	26				Marker->	4	, 5	
	Def Menues	26				Mask Meas	9		
	Define	26				Measure	7	, 8	, 10
	Define Clr	21				Media	24	, 26	
	Detection	15	, 17			Media	2	, 9	, 10
	Dip	5				Mem Card	24		
	Directory	24				Mkr Func	4		
	Disp Line	2	,	4		Mkr List	4		
	Display	21				Move Mask	9		
E)	Edit Menue	26				Move Temp	10		
	Expand	17				Multi Marker	4		
F)	File Ope	24			N)	Noise Meas	7		
	Format	24				Normalize	14		
	Freq Count	7			O)	OBW Setup	8		
	Frequency	1				Occ BW	8		
G)	Gate	18							
	Gate Setup	18							
H)	Hold Count	15							

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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		

Menu		Menu Tree(page/27)		
	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		

Menu Tree

Menu Tree (1 /27)

── Panel Key ──┼── Top menu ──────────┼── Lower menues ─────────

| Frequency |

```
┌─────────────┐
│ Frequency   │
├─────────────┤
│  Center     │
│  Freq       │
├─────────────┤
│  Start      │
│  Freq       │
├─────────────┤
│  Stop       │
│  Freq       │
├─────────────┤
│  Peak ->CF  │
├─────────────┤
│  Auto Tune  │
├─────────────┤
│    CF       │
│  Step Size  │
├─────────────┤
│|1|  |  |  │
└─────────────┘
```

#1

#2

* 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.

```
┌─────────────┐
│ Frequency   │
├─────────────┤
│             │
├─────────────┤
│             │
├─────────────┤
│             │
├─────────────┤
│  Scroll->   │
├─────────────┤
│ <-Scroll    │
├─────────────┤
│        *    │
│  Scroll     │
│  Step Size  │
├─────────────┤
│ |2| | │
└─────────────┘
```

```
┌─────────────┐
│ ScrollStep  │
├─────────────┤
│   1div      │
├─────────────┤
│   2div      │
├─────────────┤
│   5div      │
├─────────────┤
│  10div      │
├─────────────┤
│             │
├─────────────┤
│  return     │
└─────────────┘
```

```
┌─────────────┐
│ Span        │
├─────────────┤
│             │
├─────────────┤
│             │
├─────────────┤
│             │
├─────────────┤
│             │
├─────────────┤
│             │
├─────────────┤
│ |  |2| | │
└─────────────┘
```

| Span |

```
┌─────────────┐
│ Span        │
├─────────────┤
│  Span       │
├─────────────┤
│ Full Span   │
├─────────────┤
│ Zero Span   │
├─────────────┤
│ Scroll->    │
├─────────────┤
│ <-Scroll    │
├─────────────┤
│ Log Sweep   │
│ On      Off │
├─────────────┤
│|1|          │
└─────────────┘
```

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

Menu Tree (2/27)

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

| Amplitude |

Amplitude
- Reference Level
- Peak-> RLV
- *
- Ref Level Offset
- *
- Unit
- *
- Log Scale
- *
- Linear Scale
- |1| | | |

Lvl Offset
- Ref Level Offset On   Off
- Ref Level Offset -10.05dB
- return

Units
- dBm
- dBuV
- dBmV
- dBuV(emf)
- *
- Input Impedance
- return
- |1| | | |

Units
- dBuV/m
- V
- W
- return
- |2| | |

Log Scale
- 10dB/div
- 5dB/div
- 2dB/div
- 1dB/div
- return

Lin Scale
- 10%/div
- 5%/div
- 2%/div
- 1%/div
- return

Amplitude
- *
- Ref Level Step Size
- *
- Display Line
- *
- Attenuator
- *
- Pre Ampl
- *
- Impedance Trnsformer
- *
- Correction
- | |2| | |

#1

Ref Step
- 1Div
- 2Div
- 5Div
- 10Div
- Manual
- return

Disp Line
- Display Line On   Off
- Disp Line Level -50.00dBm
- Marker Level Abs Rel
- return

Attenuator
- Manual
- Auto
- return

Impedance
- 50 Ohm
- 75 Ohm
- return

Trnsformer
- Trnsformer (MA1621A) On Off
- return

#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.

Correction
- Correction On   Off
- *
- Select Corr
- *
- Setup Corr
- return

Select
- Corr-1
- Corr-2
- Corr-3
- Corr-4
- Corr-5
- return

Setup
- Load Corr Set
- Display Directory /Next
- Dir Disp Detail Outline
- Save Corr Set
- *
- Load/Save Media
- return

Media
- Mem Card-1 (Upper Slot)
- Mem Card-2 (Lower Slot)
- return

Menu Tree (3/27)

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

```
┌──────────┐   ┌──────────┐
│   RBW    │   │RBW       │         • Set the manual/auto of resolution bandwidth, and auto (RBW, VBW and
└──────────┘   ├──────────┤           SWP only) or all auto.
               │ Manual   │
               ├──────────┤
               │ Auto     │
               ├──────────┤
               │          │
               ├──────────┤
               │          │
               ├──────────┤
               │RB,VB,SWT │
               │ Auto     │
          #1   ├──────────┤           #1  Sets RBW, VBW, Sweep Time, Atten all to Auto.
               │ All Auto │
               └──────────┘
```

```
               ┌──────────┐
               │VBW       │          • Set the manual/auto of video bandwidth, and auto (RBW, VBW and SWP
               ├──────────┤            only) or all auto.
               │ Manual   │
┌──────────┐   ├──────────┤              #2  Sets ratio of VBW to RBW when VBW is Auto.
│   VBW    │   │ Auto     │
└──────────┘   ├──────────┤
               │ Filter   │
               │ Off      │
               ├──────────┤
               │ VB/RB    │
               │ Ratio    │
          #2   │ 1.0      │
               ├──────────┤
               │RB,VB,SWT │
               │ Auto     │
               ├──────────┤
               │ All Auto │
               └──────────┘
```

```
┌──────────┐   ┌──────────┐
│  Sweep   │   │Sweep Time│
│  Time    │   ├──────────┤
└──────────┘   │ Manual   │
               ├──────────┤
               │ Auto     │
               ├──────────┤
               │          │
               ├──────────┤
               │          │
               ├──────────┤
               │RB,VB,SWT │          • Set the manual/auto of sweep time, and auto (RBW, VBW and SWP only)
               │ Auto     │            or all auto.
               ├──────────┤
               │ All Auto │
               └──────────┘
```

```
┌──────────┐   ┌──────────┐
│  Atten   │   │Attenuator│
└──────────┘   ├──────────┤
               │ Manual   │
               ├──────────┤
               │ Auto     │          • Set the manual/auto of the input attenuator, On/Off of the pre-amplifier and
               ├──────────┤            all auto.
               │          │
               ├──────────┤
          !    │ Pre Ampl │
               │ On   Off │
               ├──────────┤
               │          │
               ├──────────┤
               │ 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

| Marker |
| Normal Marker |
| Delta Marker |
| Marker Off |
| * Zone Width |
| * Marker -> |
| |1| | | | |

- 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.

| Zone Width |
| Spot |
| 1Div |
| 2Div |
| 5Div |
| 10Div |
| return |

| Mkr Func |
| #1 Marker Search Peak Dip |
| * Display Line |
| Marker Tracking On Off |
| #2 Zone Sweep On Off |
| | |2| | | |

| Marker -> |
| Mkr-> CF |
| Mkr->RLV |
| Mkr -> CF Step Size |
| Delta Mkr -> Span |
| Zone -> Span |
| return |

| Disp Line |
| Display Line On Off |
| Disp Line Level -50.00dBm |
| #6 Marker Level Abs Rel |
| return |

Multi Marker

Marker

| Multi Mkr |
| Multi Marker On Off |
| #3 Highest 10 |
| #4 Harmonics |
| * Marker List |
| * #5 Manual Set |

| Mkr List |
| Marker List On Off |
| Freq/Time Abs Rel |
| Level Abs Rel |
| return |

| Manual Set |
| Change Active Marker No |
| Select Marker No 4 |
| On with Auto Select |
| Off with Auto Select |
| Clear All |
| return |

- 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 |

Peak

Peak Search

Next Peak

Next Right Peak

Next Left Peak

Normal Marker

Delta Marker

|1| |

• 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.

Threshold

Threshold On   Off

Search Above Below

Display Line On   Off

Disp Line Level -50.00dBm

return

Dip

#1 Dip Search

Next Dip

#2 Resolution 1.23 dB

*
Threshold

*
Marker ->

| |2|

#1 Searches for minimum (Dip) level.

#2 Sets peak-search level resolution.

Marker ->

Mkr-> CF

Mkr->RLV

Mkr -> CF Step Size

Delta Mkr -> Span

Zone -> Span

return

| Marker -> |
| Peak Search |

Marker ->

Mkr-> CF

Mkr->RLV

Mkr -> CF Step Size

Delta Mkr -> Span

Zone -> Span

• 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     │
                 │          │   │          │   │          │
                 │          │   │          │   │          │
                 │          │   │          │   │          │
                 │          │   │          │   │          │
                 │          │   │          │   │          │
                 │          │   │          │   │          │
                 │|1|  |  | │   │          │   │          │
                 └──────────┘   │ |2|  |   │   │          │
                                └──────────┘   │ |  |3|   │
                                               └──────────┘
```
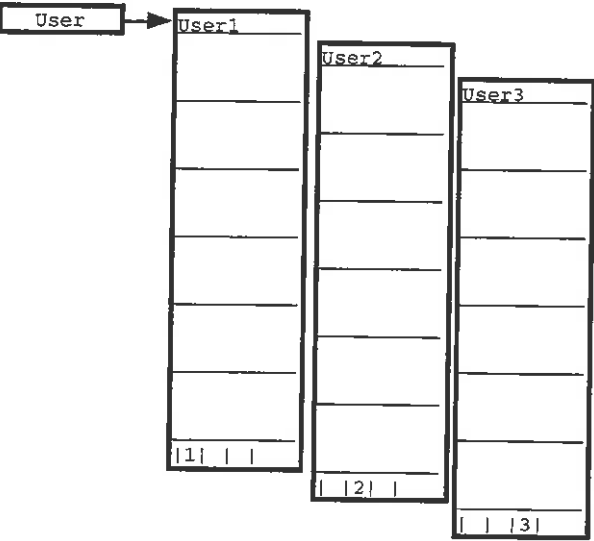
- The soft-key menu defined by the user is displayed. (See "User Define".)

Menu Tree (7/27)

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

| Measure |

Measure
* #1 Frequency Count
* #2 Noise Measure
* #3 C/N Ratio Measure

Off

|1| | |

Freq Count

Count On

Count Off

* Setup

return

CountSetup
Resolution 1kHz

100Hz

10Hz

1Hz

return

Noise Meas

Meas On

Off

return

C/N Meas

Meas On

Off

return
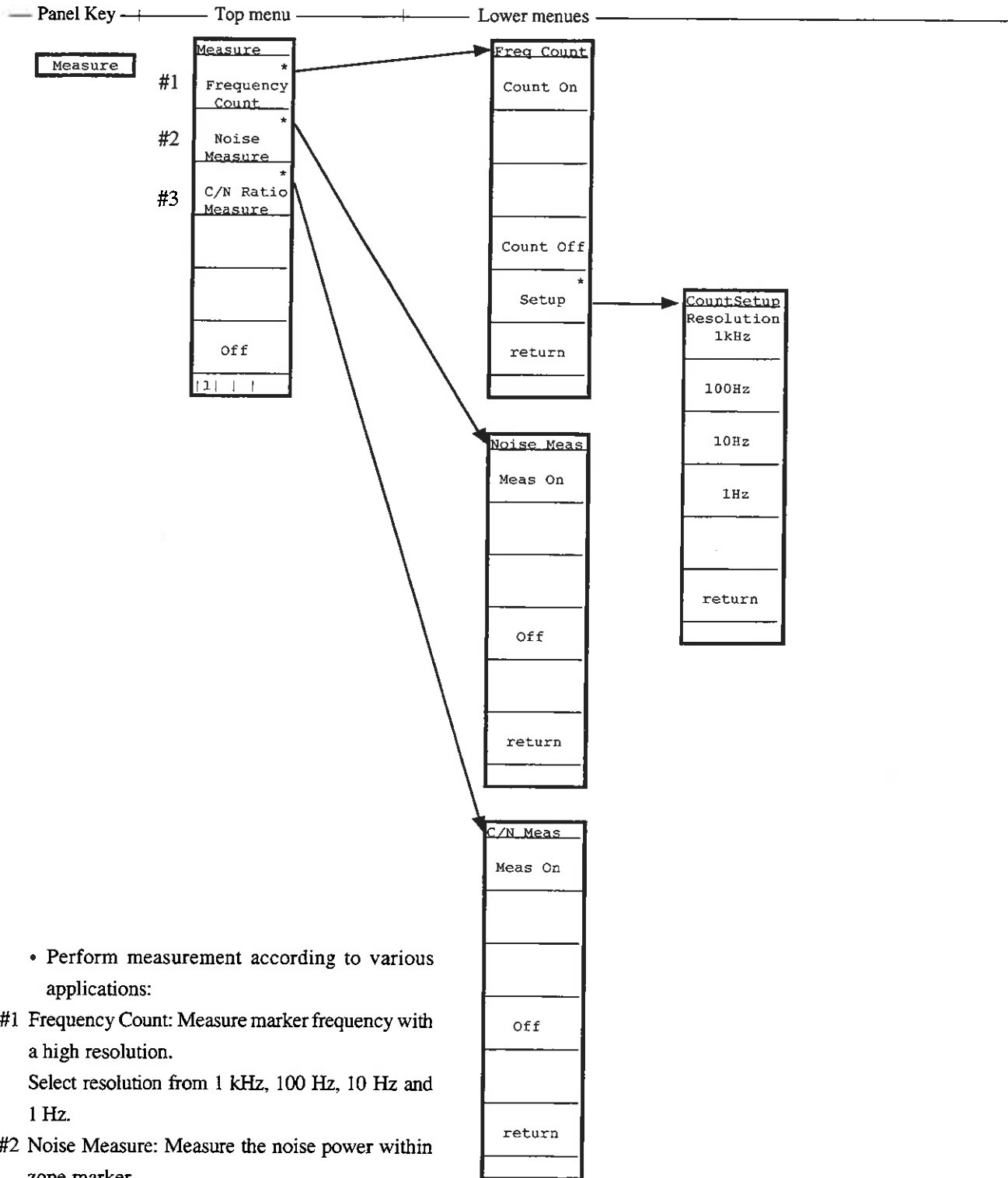
- Perform measurement according to various applications:

#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)

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

```
          ┌──────────┐              ┌──────────┐
          │Measure   │              │Occ BW    │
          │        * │              │          │
    #4    │ Occ BW   │─────────────▶│ Execute  │
          │ Measure  │              │          │
          │        * │              │          │
    #5    │Adj ch pwr│              │          │
          │ Measure  │              │          │
          │        * │              │          │
    #6    │ Mask     │              │          │      ┌──────────┐
          │          │              │        * │      │OBW Setup │
          │          │              │ Setup    │─────▶│ Method   │
          │          │              │          │      │ N% of Pwr│
          │          │              │ return   │      │ xdB Down │
          │ Off      │              └──────────┘      │          │
          │          │                                │ N% Ratio │
          │ |2|      │                                │ 99 %     │
          └──────────┘                                │          │
                                                      │ xdB Value│
                                                      │ 10.0 dB  │
                        (Next                         │          │
                        Page)                         │          │
                                                      │          │
                                                      │ return   │
                                                      └──────────┘
                         ┌──────────┐
                         │Adj ch Pwr│
                         │          │
                         │ Execute  │
                         │          │
                         │ Ch Sepa-1│
                         │ 12.5 kHz │
                         │ Ch Sepa-2│
                         │ 25.0 kHz │
                         │ Ch BW    │
                         │ 8.5 kHz  │
                         │        * │
                         │ Setup    │──────▶
                         │          │
                         │ return   │
                         └──────────┘
```

```
┌──────────┐   ┌──────────┐
│ACP Setup1│   │ACP Setup2│
│ Method   │   │          │
│R:TotalPwr│   │ Both     │
│R:RefLevel│   │ Channel  │
│          │   │          │
│ ACP Graph│   │ Upper    │
│ On   Off │   │ Channel  │
│ Ch Center│   │          │
│ Line     │   │ Lower    │
│ On   Off │   │ Channel  │
│ Ch BW    │   │          │
│ Line     │   │          │
│ On   Off │   │          │
│          │   │          │
│          │   │ Off      │
│ return   │   │          │
│ |1|      │   │ return   │
└──────────┘   │ |2|      │
               └──────────┘
```

#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.

Menu Tree (9/27)

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

```
┌──────────┐   ┌──────────┐        ┌──────────┐
│Mask Meas │   │Select    │        │Line      │
│          │   │         *│        │ Limit 1  │
│ Check    │   │ Mask-1   │   ┌───▶│ Upper    │
│ Pass/Fail│   │         *│   │    │ On   Off │
│          │   │ Mask-2   │   │    │ Limit 1  │
│          │   │         *│   │    │ Lower    │
│        * │   │ Mask-3   │   │    │ On   Off │
│ Select   │   │         *│   │    │ Limit 2  │
│Mask Table│   │ Mask-4   │   │    │ Upper    │
│        * │   │         *│   │    │ On   Off │
│ Move Mask│   │ Mask-5   │   │    │ Limit 2  │
│        * │   │          │   │    │ Lower    │
│ Setup    │   │ return   │   │    │ On   Off │
│Mask Table│   └──────────┘   │    │          │
│ return   │                  │    │ return   │
└──────────┘                  │    └──────────┘
```

```
┌──────────┐                       ┌──────────┐     ┌──────────┐
│Move Mask │                       │Edit      │     │Initiate  │
│          │                       │    ───▶  │     │ Apply    │
│ Move x   │                       │    ◀───  │     │          │
│12.34 kHz │                       │          │     │          │
│          │                       │ Insert/  │     │          │
│ Move y   │                       │ Replace  │     │          │
│ 5.12 dB  │                       │          │     │          │
│          │                       │ Delete   │     │          │
│          │                       │          │     │          │
│ Update   │     ┌──────────┐      │ Graph/   │     │          │
│Mask Table│     │Select    │      │ List     │     │          │
│ Cancel   │     │ Mask-1   │      │ return   │     │ return   │
│          │     │          │      └──────────┘     └──────────┘
│ return   │     │ Mask-2   │      │ |1| |    │
└──────────┘     │          │
                 │ Mask-3   │      ┌──────────┐     ┌──────────┐
                 │          │      │Line      │     │Select    │
                 │ Mask-4   │      │         *│     │ Limit 1  │
                 │          │      │ Initiate │     │ Upper    │
                 │ Mask-5   │      │ Line     │     │          │
                 │          │      │         *│     │ Limit 1  │
                 │ return   │      │ Select   │     │ Lower    │
                 └──────────┘      │ Line     │     │          │
                                   │          │     │ Limit 2  │
┌──────────┐                       │          │     │ Upper    │
│Setup Mask│                       │          │     │          │
│        * │                       │          │     │ Limit 2  │
│ Select   │                       │          │     │ Lower    │
│Mask Table│                       │          │     │          │
│ Level    │                       │ return   │     │ return   │
│ Absolute │                       └──────────┘     └──────────┘
│ Relative │                       │ |2|      │
│        * │
│ Make Up  │
│Mask Table│
│          │      ┌──────────┐     ┌──────────┐
│        * │      │Load/Save │     │Media     │
│ Load/Save│      │          │     │Mem Card-1│
│Mask Table│      │ Load     │     │ (Upper   │
│ return   │      │Mask Table│     │  Slot)   │
└──────────┘      │ Display  │     │Mem Card-2│
                  │Directory │     │ (Lower   │
                  │ /Next    │     │  Slot)   │
                  │ Dir Disp │     │          │
                  │ Detail   │     │          │
                  │ Outline  │     │          │
                  │ Save     │     │          │
                  │Mask Table│     │          │
                  │        * │     │          │
                  │ Load/Save│     │          │
                  │ Media    │     │          │
                  │ return   │     │ return   │
                  └──────────┘     └──────────┘
```

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Menu Tree (10/27)

— Panel Key —┼———— Top menu ————┼———— Lower menues ————————————————

Measure

#7   Time
      Template
      *
#8   Burst
      Avg Power

      Off
| | @|3| |

Temp Meas
Check
Pass/Fail

Select
Temp Table
Move
Template
Setup
Temp Tbl
return

Select
Temp-1
Temp-2
Temp-3
Temp-4
Temp-5
return

Line
Limit 1
Upper
On   Off
Limit 1
Lower
On   Off
Limit 2
Upper
On   Off
Limit 2
Lower
On   Off

return

Edit
→
←
Insert/
Replace
Delete
Graph/
List
return
|1| |

Initiate
Apply

return

(Next Page)

Move Temp
Move x
0.00 msec
Move y
-1.24 dB

Update
Temp Table
Cancel
return

Select
Temp-1
Temp-2
Temp-3
Temp-4
Temp-5
return

Line
Initiate
Line
Select
Line

return
| |2|

Select
Limit 1
Upper
Limit 1
Lower
Limit 2
Upper
Limit 2
Lower

return

Setup Temp
Select
Temp Table
Level
Absolute
Relative
Make Up
Temp Table

Load/Save
Temp Table
return

Load/Save
Load
Temp Table
Display
Directory
/Next
Dir Disp
Detail
Outline
Save
Temp Table
Load/Save
Media
return

Media
Mem Card-1
(Upper
Slot)
Mem Card-2
(Lower
Slot)

return

#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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A-15

Menu Tree (11/27)

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

(Previous
Page)

```
┌──────────┐
│ Burst Pwr│
├──────────┤
│ Execute  │
│          │
├──────────┤
│          │
│          │
├──────────┤
│  Start   │
│  Point   │
│   100    │
├──────────┤
│  Stop    │
│  Point   │
│   100    │
├──────────┤
│          │
│          │
├──────────┤
│  return  │
│          │
└──────────┘
```

Menu Tree (12/27)

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

```
┌──────────┐  ┌──────────┐
│ Recall   │  │Recall    │  ┌──────────┐
└──────────┘  │Reg-1     │  │Recall    │
              │ ABCDEFG  │  │Reg-7     │  ┌──────────┐
              ├──────────┤  │ ABCDEFG  │  │Recall    │
              │Reg-2     │  ├──────────┤  │Recall    │  ┌──────────┐
              ├──────────┤  │Reg-8     │  │ from     │  │Recall    │
              │Reg-3     │  ├──────────┤  │Int.Regstr│  │Recall    │
              ├──────────┤  │Reg-9     │  │Display   │  │ from     │
              │Reg-4     │  ├──────────┤  │Directory │  │Mem Card  │
              ├──────────┤  │Reg-10    │  │/Next     │  │Display   │
              │Reg-5     │  ├──────────┤  ├──────────┤  │Directory │
              ├──────────┤  │Reg-11    │  │          │  │/Next     │
              │Reg-6     │  ├──────────┤  │          │  │Dir Disp  │
              ├──────────┤  │Reg-12    │  │          │  │Detail    │
              │          │  ├──────────┤  │          │  │Outline   │
              │|1|  | |  │  │          │  │          │  │          │
              └──────────┘  │| |2| | | │  │        * │  │        * │
                            └──────────┘  │Recall    │  │Recall    │
                                          │Items     │  │Media     │
                                          │| | |3| | │  │        * │
                                          └──────────┘  │Recall    │
                                                        │Items     │
                                                        │| | | |4| │
                                                        └──────────┘
```

```
                      ┌──────────┐        ┌──────────┐
                      │Item      │        │Recl Media│
                      │All       │        │Mem Card-1│
                      │Trace &   │        │(Upper    │
                      │Parameter │        │ Slot)    │
                      │All T & P │        │Mem Card-2│
                      │->View    │        │(Lower    │
                      │          │        │ Slot)    │
                      │Parameter │        │          │
                      │          │        │          │
                      │Parameter │        │          │
                      │except    │        │          │
                      │Ref Level │        │          │
                      │          │        │          │
                      │          │        │ return   │
                      │ return   │        │          │
                      └──────────┘        └──────────┘
```

• 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.).

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.

```
Save
   Save
    to
  Mem Card
  Display
  Directory
   /Next
  Dir Disp
  Detail
  Outline


  Select *
   Save
   Media

  | |2|
```

```
Save Media
  Mem Card-1
  (Upper
   Slot)
  Mem Card-2
  (Lower
   Slot)




    return
```

```
Save
  Save
  BMP file
  to MemCard
  Display
  Directory
   /Next
  Dir Disp
  Detail
  Outline


         *
   Save
   Media

  | | |3|
```
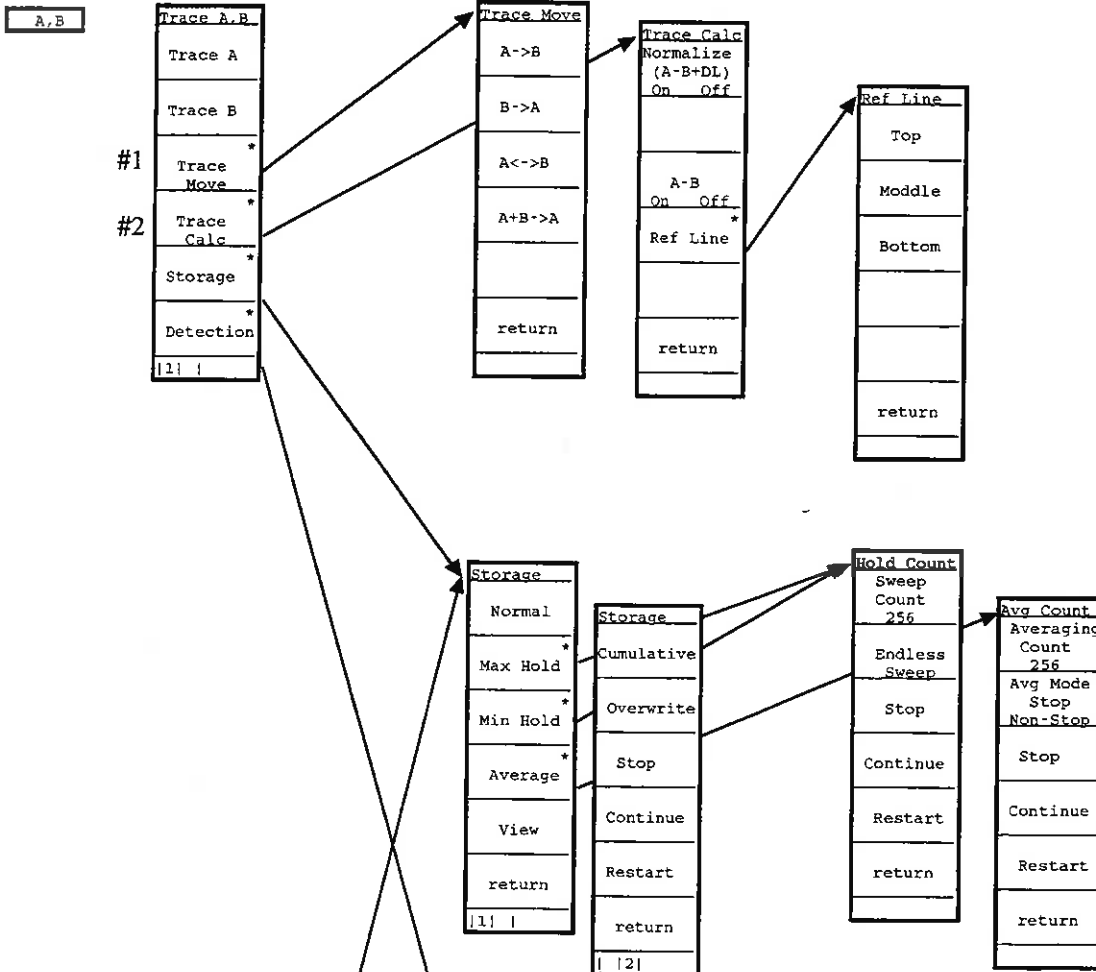
Menu Tree (14 /27)

— Panel Key —| ——— Top menu ——— | ——— Lower menues ———

```
┌─────┐
│  TG │
└─────┘
```

```
┌──────────┐
│TG        │
├──────────┤
│          │
│ TG Out   │
│ On   Off │
├──────────┤
│ Output   │
│ Level    │
│ 0 dBm    │
├──────────┤
│Attenuator│
│ Hold     │
│ On   Off │
├──────────┤
│        * │
│ Trace    │
│ A,B      │
├──────────┤
│        * │
│Normalize │
├──────────┤
│          │
└──────────┘
```

```
┌──────────┐
│Trace A,B │
├──────────┤
│ Trace A  │
├──────────┤
│ Trace B  │
├──────────┤
│  A->B    │
├──────────┤
│  B->A    │
├──────────┤
│  A<->B   │
├──────────┤
│ return   │
└──────────┘
```

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

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

#1

```
┌──────────┐
│Normalize │
├──────────┤
│ Instant  │
│Normalize │
├──────────┤
│Normalize │
│(A-B+DL)  │
│ On   Off │
├──────────┤
│ Display  │
│ Line     │
│ On   Off │
├──────────┤
│Disp Line │
│ Level    │
│-50.00dBm │
├──────────┤
│ Marker   │
│ Level    │
│ Abs  Rel │
├──────────┤
│ return   │
├──────────┤
│          │
└──────────┘
```
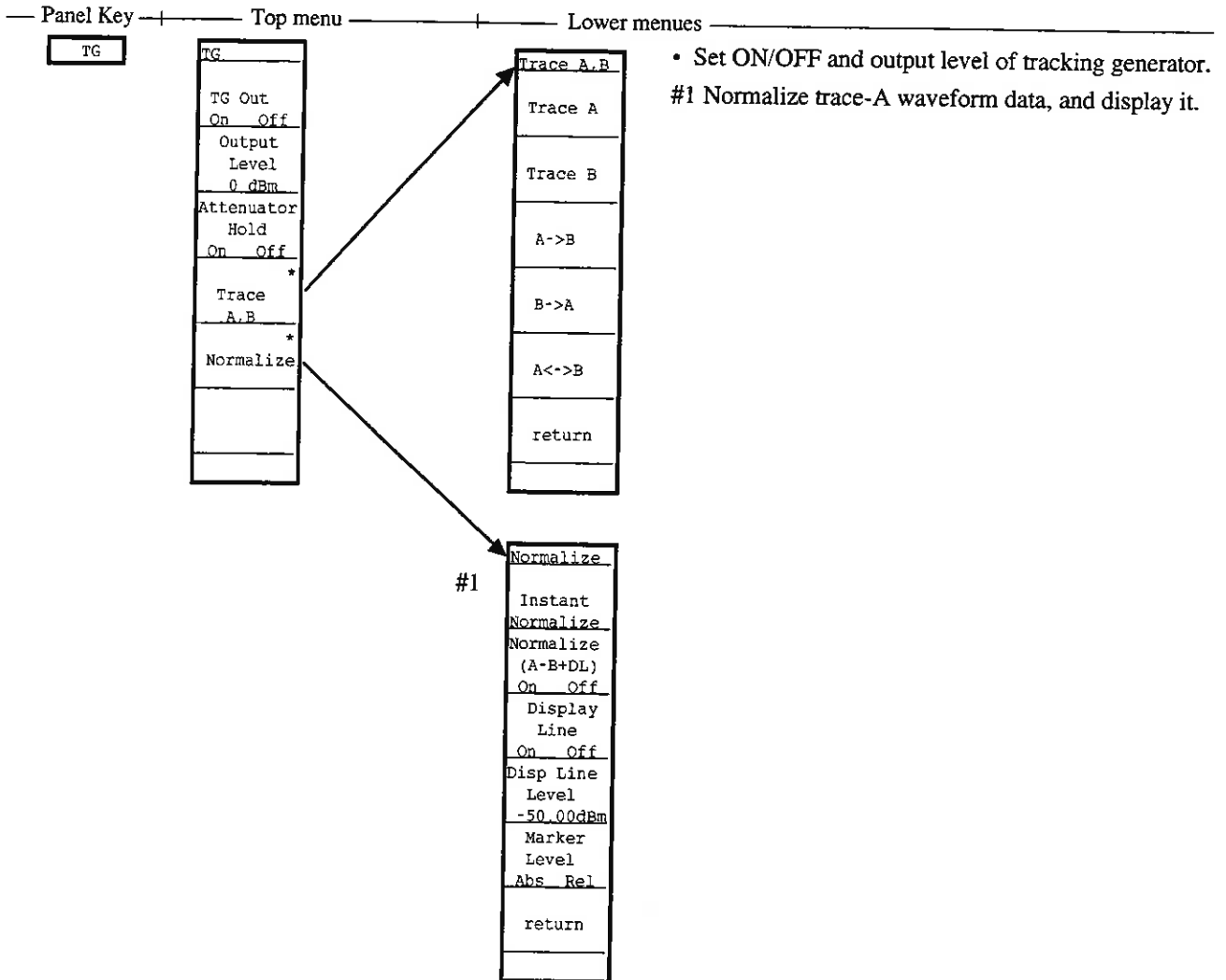
Menu Tree (15/27)

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

A,B

Trace A,B
| Trace A |
| Trace B |
#1 | Trace Move * |
#2 | Trace Calc * |
| Storage * |
| Detection * |
|1| |

Trace Move
| A->B |
| B->A |
| A<->B |
| A+B->A |
| return |

Trace Calc
| Normalize (A-B+DL) On Off |
| A-B On Off |
| Ref Line * |
| return |

Ref Line
| Top |
| Moddle |
| Bottom |
| return |

Storage
| Normal |
| Max Hold * |
| Min Hold * |
| Average * |
| View |
| return |
|1| |

Storage
| Cumulative |
| Overwrite |
| Stop |
| Continue |
| Restart |
| return |
| |2|

Hold Count
| Sweep Count 256 |
| Endless Sweep |
| Stop |
| Continue |
| Restart |
| return |

Avg Count
| Averaging Count 256 |
| Avg Mode Stop Non-Stop |
| Stop |
| Continue |
| Restart |
| return |

Trace A,B
| Trace AonB |
#3 | Storage * |
#4 | Detection * |
| |2|

Detection
| Normal |
| Pos Peak |
| Sample |
| Neg Peak |
| return |

#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.

A-20

Menu Tree (16/27)

— Panel Key —┼——— Top menu ———┼——— Lower menues ————————————————

A/B, A/BG

| A, B |

#1

| A/B, A/BG |
| A/B (A<B) |
| A/B (A>B) |
| A/BG (A<BG) |
| A/BG (A>BG) |
| |
| * Sweep Control |

• 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.

| Swp Contl |
| Sub Trace Write |
| Sub Trace View |
| Stop |
| Continuous |
| Restart |
| return |
| |

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

Menu Tree (17/27)

— Panel Key —┼—— Top menu ————┼—— Lower menues ——————————

| Time |

| Trace Time |
| Delay Time |
| 10.0 ms |
| Time Span |
| 200 us |
| Trigger |
| Freerun |
| Triggered |
| * |
| Trigger |
| Source |
| * |
| Storage |
| * |
| Detection |
| |1| | |

• 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).

| Source | (Same as "Trigger Source" menu in Trig/Gate key)

| Storage | (Same as "Storage Mode" menu in A,B key)

| Detection | (Same as "Det Mode" menu in A,B key)

| Trace Time |
| * |
| FM Monitor |
| |
| |
| * |
| Expand |
| * |
| |
| | |2| |

#1

| Expand |
| Zone Start |
| Point |
| 100 |
| Zone Span |
| Point |
| 50 |
| Expand |
| Zone |
| On   Off |
| Expand |
| On   Off |
| |
| return |

#1   Zooms in time-domain waveform display.

| A/Time |
| Time |

| A/Time |
| A/Time |
| (A<Time) |
| A/Time |
| (A>Time) |
| |
| |
| |
| * |
| Sweep |
| Control |

#2

| Swp Contl |
| Sub Trace |
| Write |
| Sub Trace |
| View |
| Stop |
| Continuous |
| Restart |
| return |

#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.

Menu Tree (18/27)

── Panel Key ──┼── Top menu ──────────┼── Lower menues ──────────────────

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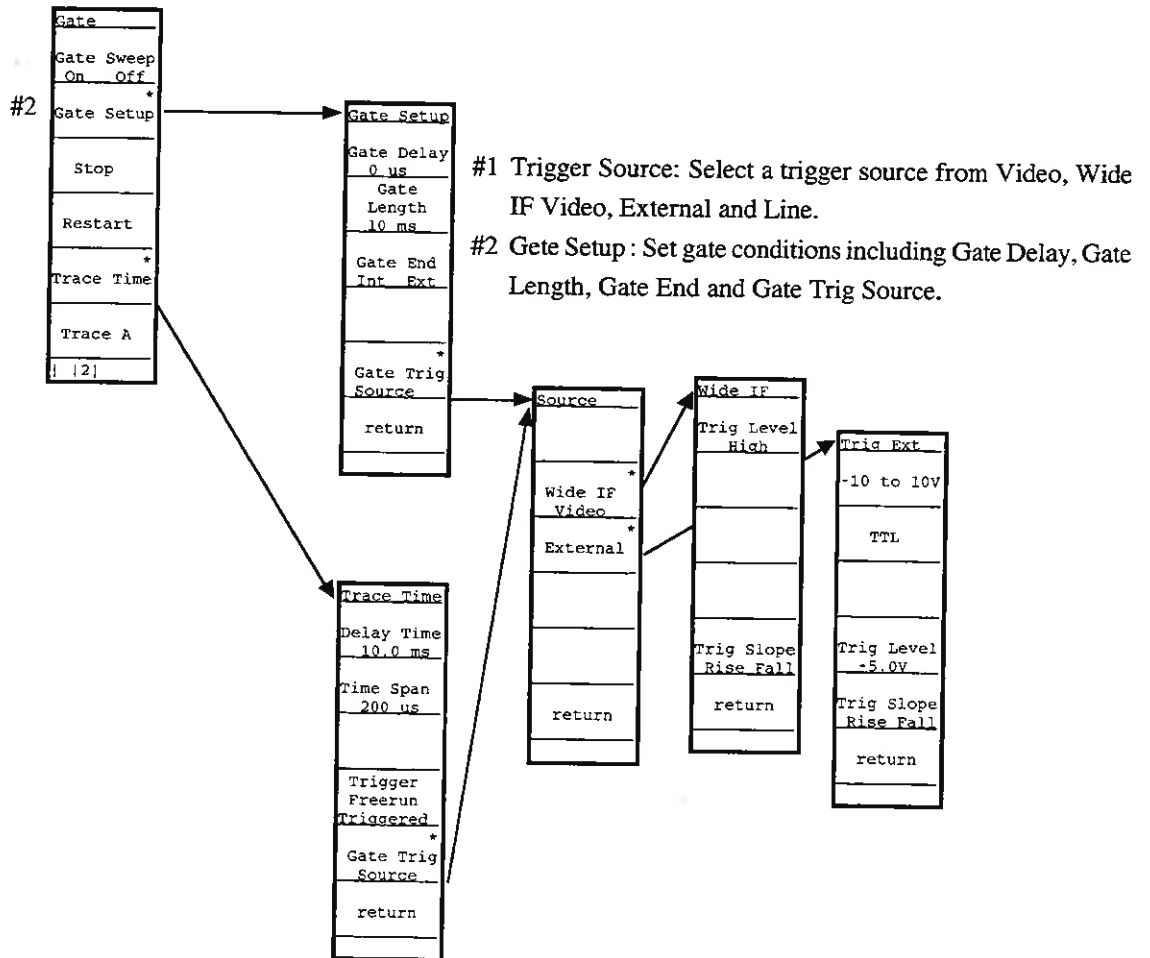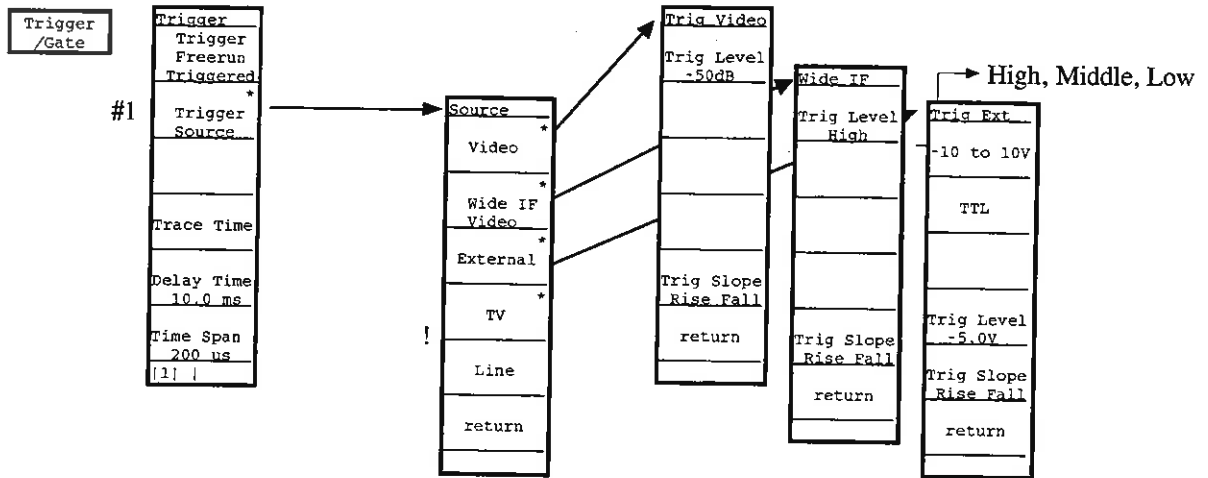
* Set gate functions for controlling the sweep start trigger and the writing of waveform
  data. Set the trigger mode, trigger source, trace time, delay time and time span. Select
  On/Off, Stop and Restart of Gate Sweep.

Menu Tree (19/27)

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

TV Monitor
! Trig/Gate
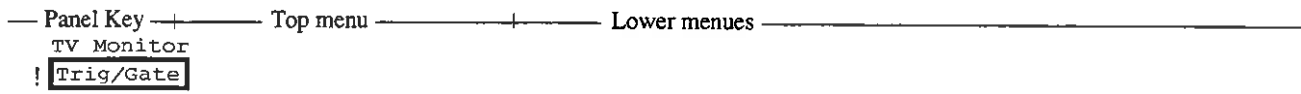
Menu Tree (20/27)

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

Copy

Copy Cont
Copy

Copy Cont
Printer
Plotter
BMP file To MemCard
Paper Feed
Stop Print
Plot Rocation Reset
	1	

#1

Printer
HP2225
VP-600 (ESC/P)
Magnify 1x2
Printer Address 18
return

Plotter
HP-GL GP-GL
* Paper Size
* Location
* Item
Plotter Address 18
return

Paper Size
A4 A3
Full Size
Quarter Size
return

Copy Cont
* Printer Setup
* Plotter Setup
* BMP file Save Media
		2	
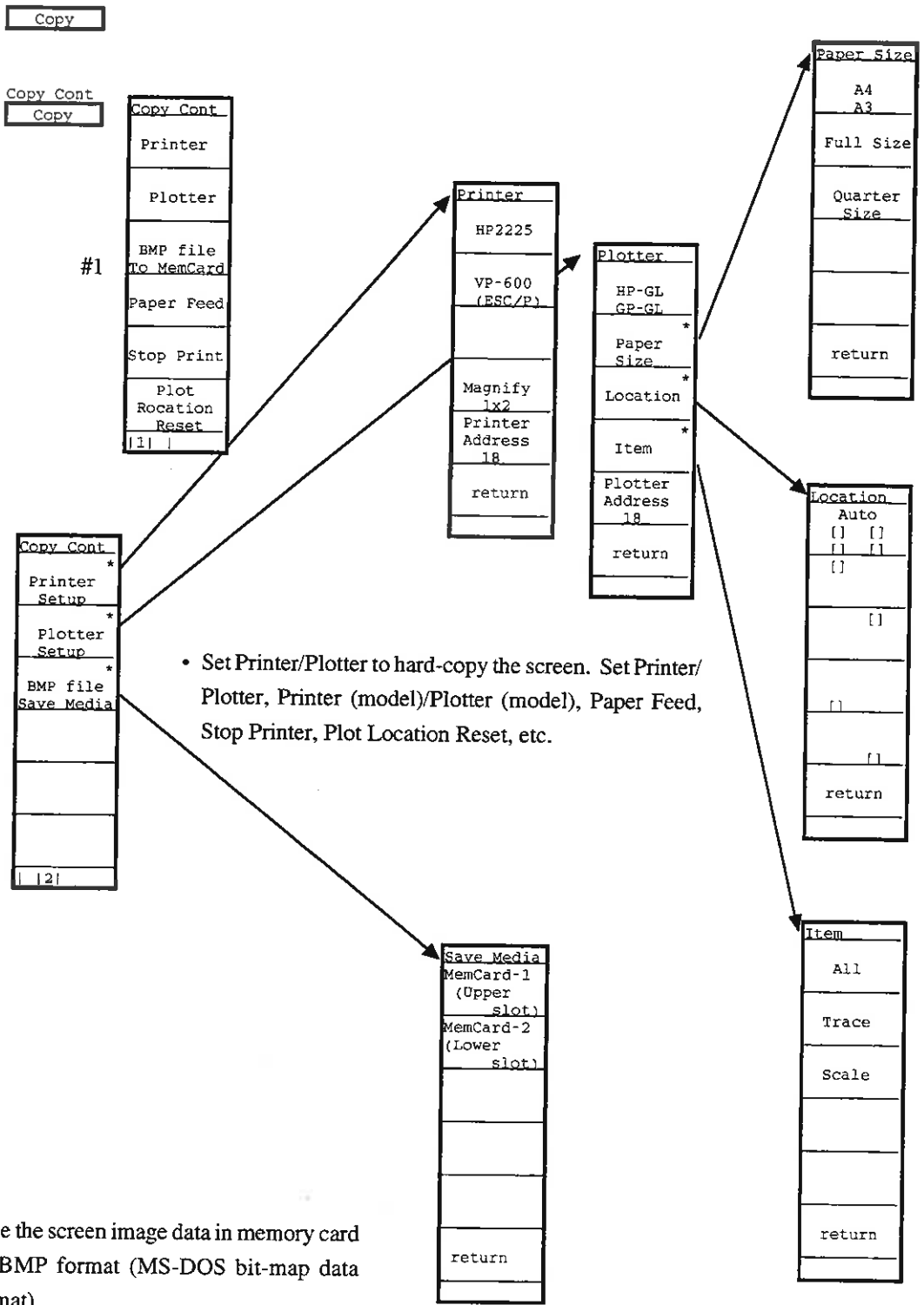
• Set Printer/Plotter to hard-copy the screen. Set Printer/Plotter, Printer (model)/Plotter (model), Paper Feed, Stop Printer, Plot Location Reset, etc.

Location
Auto [] [] [] [] []
[]
[]
[]
return

Save Media
MemCard-1 (Upper slot)
MemCard-2 (Lower slot)
return

Item
All
Trace
Scale
return

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

A-25

Menu Tree (21/27)

— Panel Key —┼— Top menu ——————┼—— Lower menues ————————————

```
    Sound
! [   1   ]
```
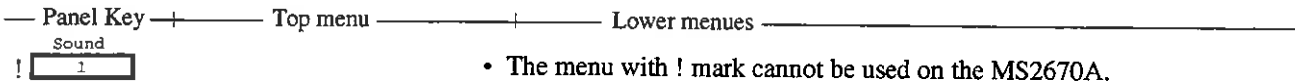
- The menu with ! mark cannot be used on the MS2670A.

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

#2 Changes screen color pattern.

```
   System
  [    2    ]
```

System
- Couple
  Common
  Independnt
- Display
- Change Color
- Auto SWT Hi-Lvl-Acc Fast
- Power On State

|1|

#1 → Couple
#2 → Display

Display
- Parameter Display Type-1
- Clock Disp y/m/d
- return

Change Clr
- Color Pattern 1
- Color Pattern 2
- Color Pattern 3
- Color Pattern 4
- Define User Color
- return

Define Clr
- Copy Color Ptn from
- Select Item BackGround
- Red 15
- Green 15
- Blue 15
- return

Copy from
- Color Pattern 1
- Color Pattern 2
- Color Pattern 3
- Color Pattern 4
- return

System
- Set Date
- Set Time

| |2|

Pon State
- Before Power Off
- Recall Memory
- Fixed State
- Recall Memory No 1
- return

Set Date
- Year
- Month
- Day
- return

Set Time
- Hour
- Minute
- Second
- return

* 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 ———————————————
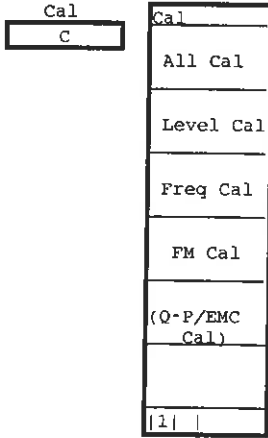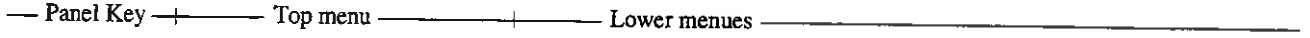
```
  Cal           ┌─────────┐
┌────────┐      │Cal      │
│   C    │      ├─────────┤          • Execute calibration.  Select an item from All Cal, Level Cal and Freq Cal.
└────────┘      │ All Cal │
                ├─────────┤
                │Level Cal│
                ├─────────┤
                │Freq Cal │
                ├─────────┤
                │ FM Cal  │
                ├─────────┤
                │(Q-P/EMC │
                │  Cal)   │
                ├─────────┤
                │         │
                ├─────────┤
                │|1|      │
                └─────────┘


                ┌─────────┐
                │Cal      │
                ├─────────┤
                │Freq Cal │
                │On   Off │
                ├─────────┤
                │         │
                ├─────────┤
                │         │
                ├─────────┤
                │         │
                ├─────────┤
                │       * │
                │Cal Status├──────────────────►  <Calibration status screen>
                ├─────────┤
                │       * │
                │Mainte-  ├──────────────────►  <Screen shows but no sub-menu appears.
                │ nance   │                       Maintenance function is for factory
                │|  |2|   │                       inspection.>
                └─────────┘
```

Menu Tree (23/27)
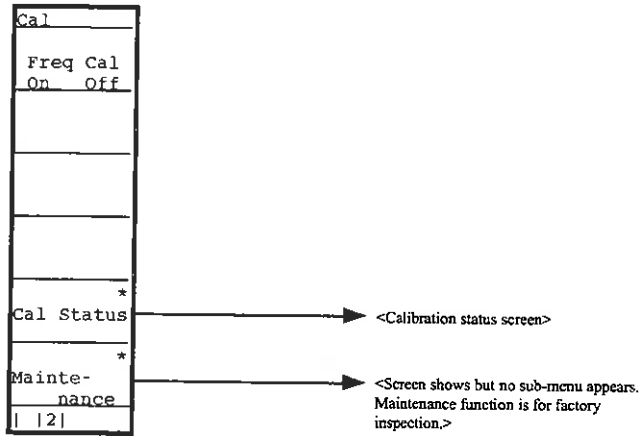
— Panel Key —+———— Top menu —————+——— Lower menues ————————————
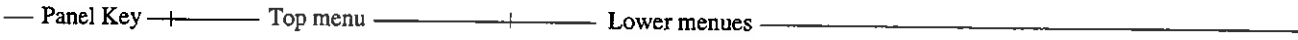
- Set interfaces for external devices to connect. Select RS232C, or GPIB, and set the RS232C interface, GPIB address, etc.

```
  Interface      Interface                         RS232C
 ┌──────────┐   ┌──────────┐ *                    ┌──────────┐
 │    ●     │   │          │ ─────────────────►   │          │
 └──────────┘   │  RS232C  │                      │ Baud Rate│
                │  Setup   │                      │   4800   │
                │  GPIB    │                      │          │
                │My Address│                      │  Parity  │
                │    1     │                      │   Even   │
                │          │                      │          │
                │          │                      │ Data Bits│
                │          │                      │  8bits   │
                │          │                      │          │
                │Connect to│                      │ Stop bit │
                │Controller│                      │   1bit   │
                │  RS232C  │                      │          │
                │Connect to│                      │          │
                │ Prt/Plt  │                      │          │
                │  None    │                      │          │
                │Connect to│                      │          │
                │Peripheral│                      │  return  │
                │  GPIB    │                      │          │
                │          │                      │          │
                └──────────┘                      └──────────┘
```
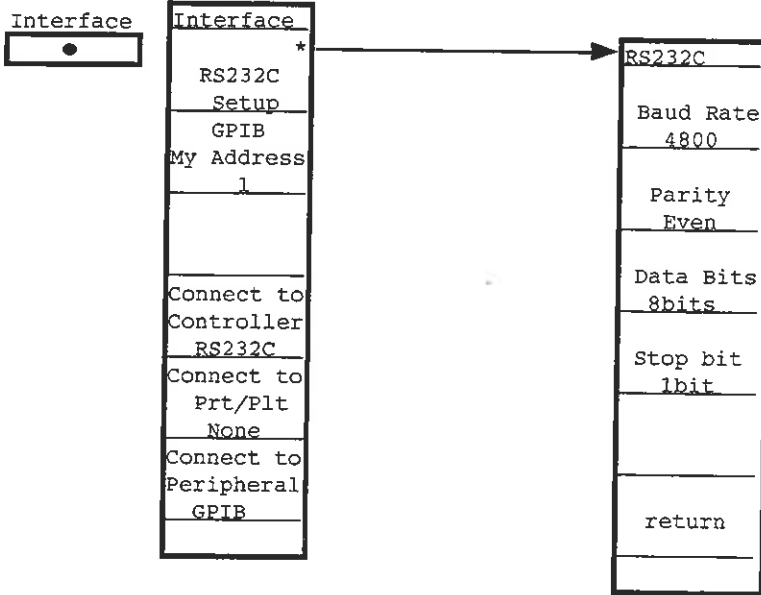
- Input a title to display on the screen.

```
   Title       Title                              Edit
 ┌──────────┐  ┌──────────┐                       ┌──────────┐
 │    3     │  │          │                       │          │
 └──────────┘  │ Comment  │                       │    ──►   │
               │  Title   │                       │          │
               │          │                       │          │
               │          │                       │    ◄──   │
               │          │ *                     │          │
               │Edit Title│ ─────────────────►    │          │
               │          │                       │  Insert  │
               │          │                       │          │
               │          │                       │  Delete  │
               │          │                       │          │
               │          │                       │  Clear   │
               │          │                       │          │
               │          │                       │  return  │
               └──────────┘                       │          │
                                                  └──────────┘
```
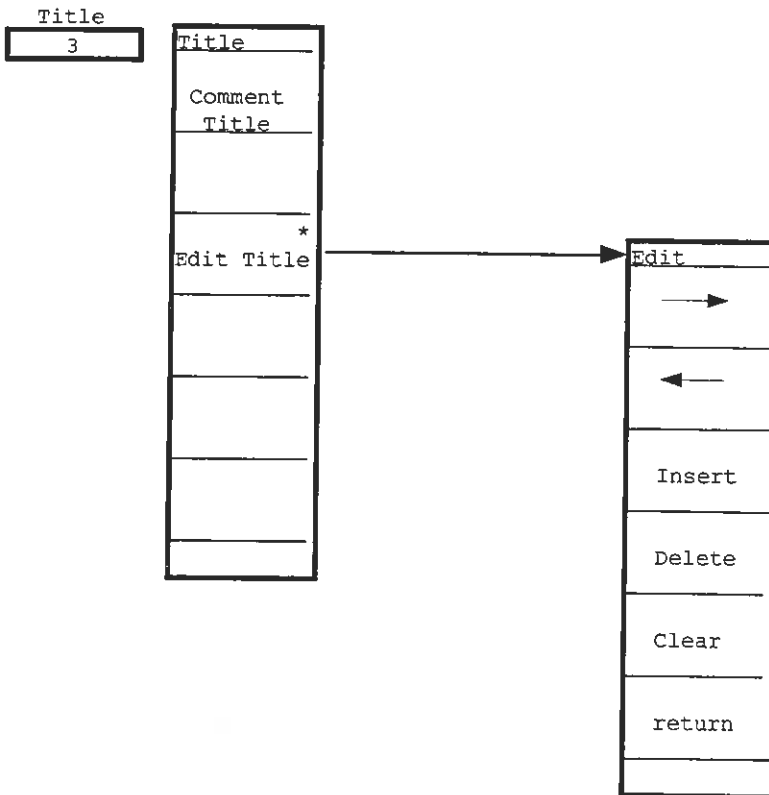
Menu Tree (24/27)

— Panel Key ——|———— Top menu ————————|———— Lower menues ——————————

```
Mem Card          Mem Card *          Directory *          File Ope
  +/-             Directory             Trace *             Display
                                                            Directory
                    #1                Correction *          /Next
                    Format *                                Dir Disp
                                        Mask *              Detail
                                                            Outline
                                        Template *
                                                            Delete
                                        Define *
                                        Menus               File
                    Select *           return               Protection
                    Media                                    return
                                        |1|
```

#1 Formats memory card.

```
                    Directory          Format          Media
                      BMP file *         Apply           Mem Card-1
                                                         (Upper
                                                          Slot)
                                                         Mem Card-2
                                                         (Lower
                                                          Slot)

                      return             return
                      |2|                                 return
```
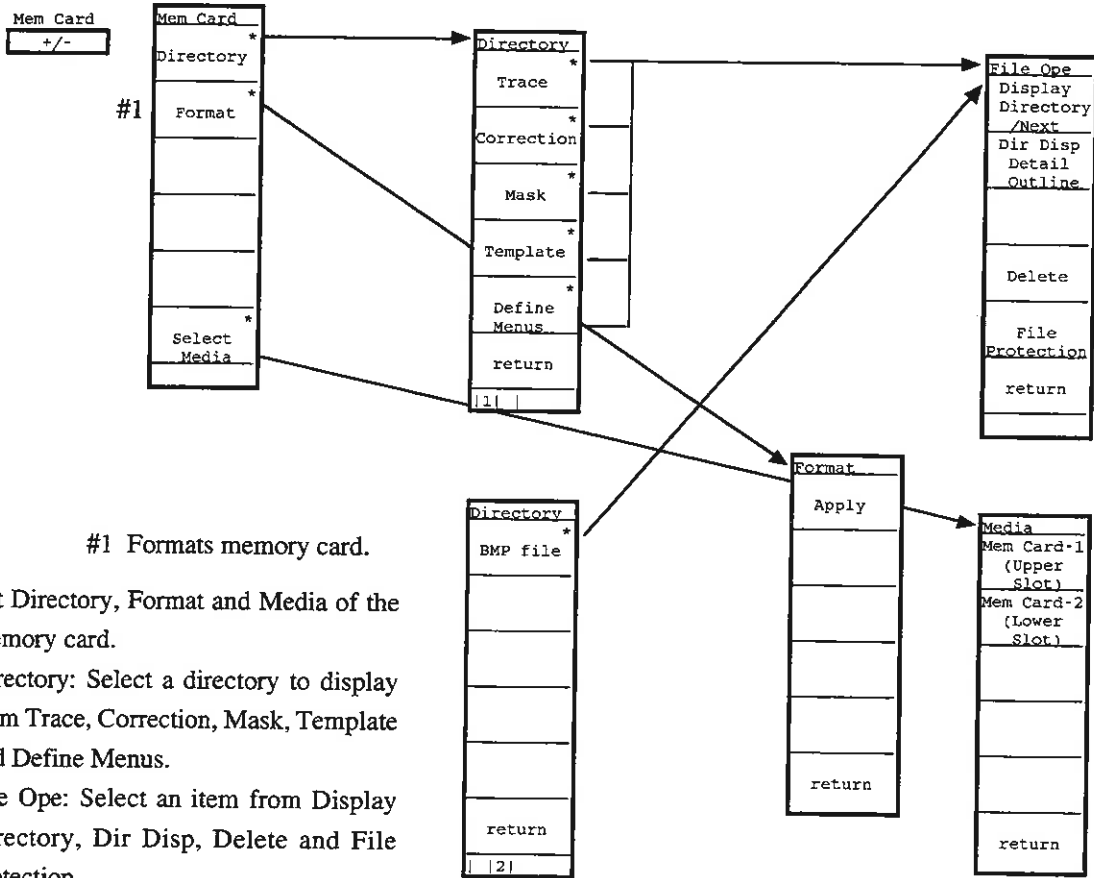
• Set Directory, Format and Media of the memory card.

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.

```
PTA               PTA *               PTA          PTA          PTA          PTA
  7               PTA                   Run          Prog List    F1           Yes
                  Program *
                  PTA *                 Stop         Cursor       F2           No
                  Library                            Up
                                        Cont         Cursor       F3
                                                     Down
                                        Reset        Load         F4
                                        Off          Run          F5
                                        etc.         etc.         etc.         etc.
                                        |1|          |2|          |3|          |4|
```

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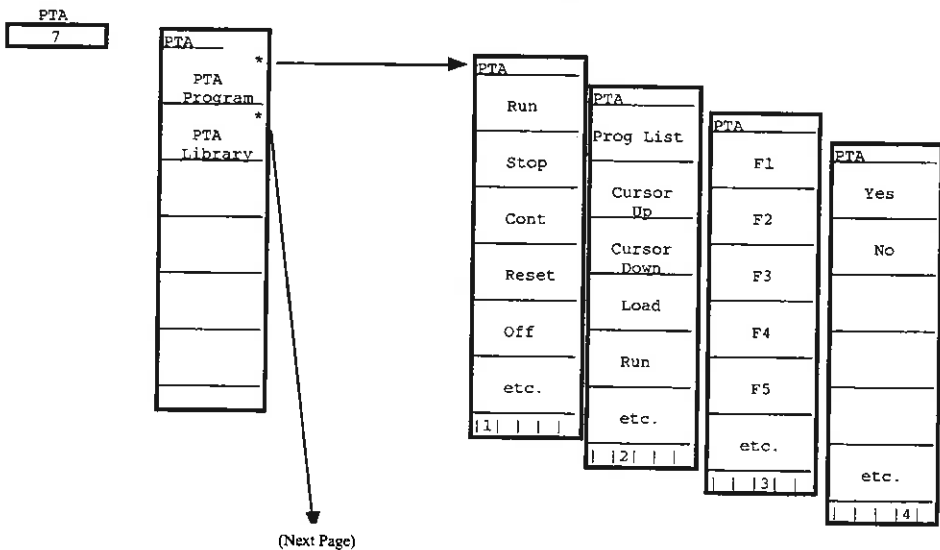
• Set PTA (personal test automation) that can build an auto measurement system without requiring external controllers.
PTA Program: Select one from Run, Stop, Cont Reset, Prog List, Load, etc.
PTA Library: Select one from Display/Run for the library program and Load/Check for the library file.

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Menu Tree (25/27)

— Panel Key —|——— Top menu ———————|——— Lower menues ——————————

(Previous Page)

PTA Lib
* Library Memory
* Library File
return

Lib Memory
Cursor Up
Cursor Down
* Execute
Library /Page
* Remove
return

Lib Exec
Run
Stop
Cont
Reset
return

Lib Remove
Yes
return

Lib File
Cursor Up
Cursor Down
Load
File /Page
* Check File
return

Check File
Library /Page
return

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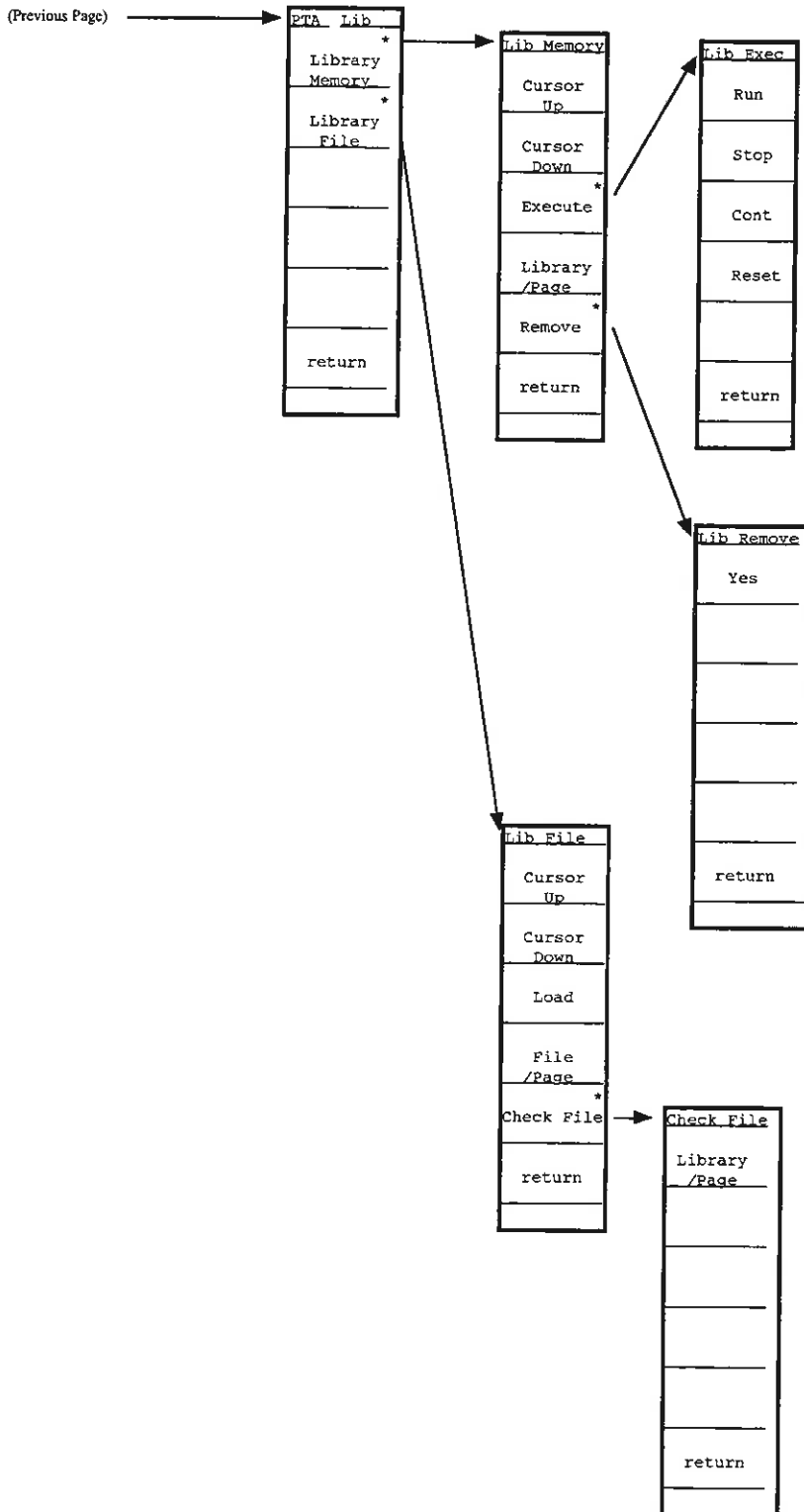
Menu Tree (26/27)

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

```
┌─────────┐
│ Define  │
│    8    │
└─────────┘
```

#1

#2

```
┌──────────────┐
│ Define       │
│           *  │
│  Define      │
│  Menus       │
│           *  │
│  Edit        │
│  Menu        │
│              │
│           *  │
│  Initialize  │
│  Menus       │
│           *  │
│  Load/Save   │
│  Def Files   │
│              │
└──────────────┘
```

```
┌──────────────┐
│ Def Menus    │
│  Select   *  │
│  Source      │
│  Lib Prgm    │
│  Select      │
│  Source      │
│  Menu        │
│  Select      │
│  Dest        │
│  Menu        │
│  Set source  │
│  into Dest   │
│              │
│  Delete      │
│  Dest        │
│              │
│  return      │
└──────────────┘
```

```
┌──────────────┐
│ Lib Prgm     │
│              │
│  Up          │
│              │
│  Down        │
│              │
│  Next Page   │
│              │
│              │
│              │
│  return      │
└──────────────┘
```

```
┌──────────────┐
│ Edit Menu    │
│              │
│  Select      │
│  Source      │
│              │
│           *  │
│  Edit        │
│  F-key Menu  │──────────▶<edit screen>
│           *  │
│  Edit        │
│  Menu Title  │──────────▶<edit screen>
│              │
│  return      │
└──────────────┘
```

```
┌──────────────┐
│ Initialize   │
│              │
│  Yes         │
│              │
│              │
│              │
│              │
│              │
│              │
│  return      │
└──────────────┘
```

```
┌──────────────┐
│ Def Files    │
│  Load        │
│  Def Menu    │
│  File        │
│  Display     │
│  Directory   │
│  /Next       │
│  Dir Disp    │
│  Detail      │
│  Outline     │
│  Save        │
│  Def Menu    │
│  File        │
│           *  │
│  Load/Save   │
│  Media       │
│  return      │
└──────────────┘
```

```
┌──────────────┐
│ Media        │
│  Mem Card-1  │
│  (Upper      │
│   Slot)      │
│  Mem Card-2  │
│  (Lower      │
│   Slot)      │
│              │
│              │
│              │
│              │
│  return      │
└──────────────┘
```

• 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.

Menu Tree (27/27)

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

```
┌─────────────┐        ┌─────────────┐        • Initialize measurement parameters.  Select one from All, Sweep, Trace,
│   Preset    │        │Preset       │          Level and Frequ/Time.
└─────────────┘        │   Preset    │
                       │    All      │
                       │             │
                       │             │
                       │             │
                       │  Preset     │
                       │  Sweep      │
                       │  controll   │
                       │  Preset     │
                       │  Trace      │
                       │ Parameters  │
                       │  Preset     │
                       │  Level      │
                       │ Parameters  │
                       │  Preset     │
                       │  Freq/Time  │
                       │ Parameters  │
                       └─────────────┘
```

```
        Hold
┌─────────────┐
│    GHz      │
└─────────────┘
```

```
┌─────────────┐
│   Local     │
└─────────────┘
```

APPENDIX B

ERROR MESSAGE

This appendix describes the error messages displayed on the screen.

(Blank)

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.
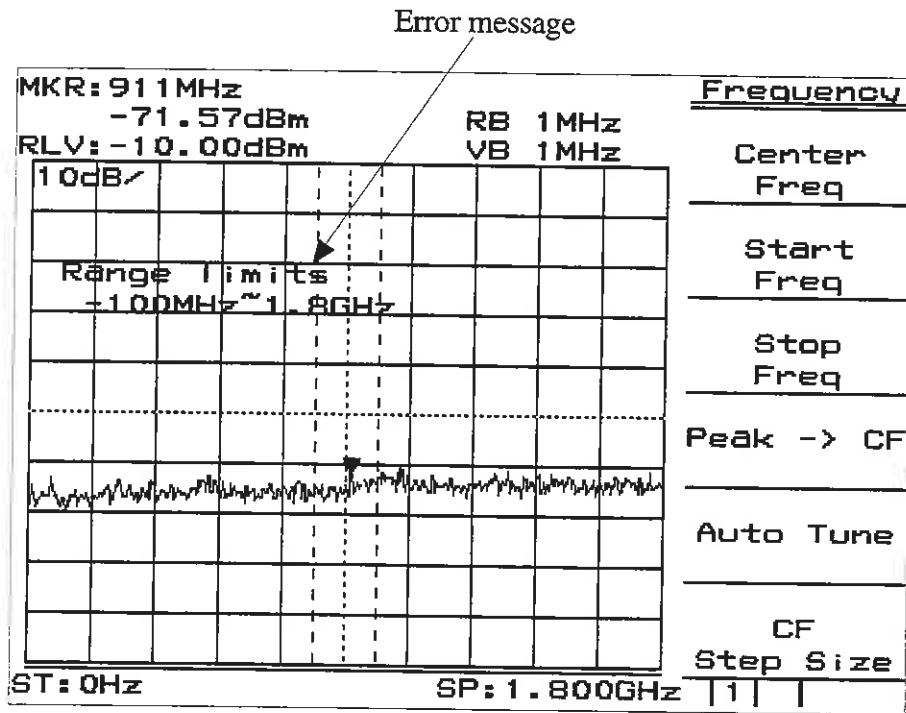
Error message

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.

B-4

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.

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.

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.

(Blank)

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.

[KEYWORDS INDEX]

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