MS2661N
Spectrum Analyzer
Operation Manual
Vol. 2
(Detailed Operating instructions)

Fourth Edition

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

ANRITSU CORPORATION

Document No.: M-W1813AE-4.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.

Symbols used in manual

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

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

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

Safety Symbols Used on Equipment and in Manual

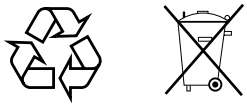
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

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

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

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

MS2661N
Spectrum Analyzer
Operation Manual Vol. 2 (Detailed Operating Insturctions)

1 July 1996 (First Edition)
18 June 2004 (Fourth Edition)

For Safety

WARNING ⚠

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

2. Measurement Categories
   This instrument is designed for Measurement category I (CAT I). Don't use this instrument at the locations of measurement categories from CAT II to CAT IV.
   In order to secure the safety of the user making measurements, IEC 61010 clarifies the range of use of instruments by classifying the location of measurement into measurement categories from I to IV.
   The category outline is as follows:
   Measurement category I (CAT I):
   Secondary circuits of a device connected to an outlet via a power transformer etc.
   Measurement category II (CAT II):
   Primary circuits of a device with a power cord (portable tools, home appliance etc.) connected to an outlet.
   Measurement category III (CAT III):
   Primary circuits of a device (fixed equipment) to which power is directly supplied from the power distribution panel, and circuits from the distribution panel to outlets.
   Measurement category IV (CAT IV):
   All building service-line entrance circuits through the integrating wattmeter and primary circuit breaker (power distribution panel).

or

3. When supplying power to this equipment, connect the accessory 3-pin power cord to a grounded outlet. If a grounded 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.

For Safety

WARNING ⚠

Repair

WARNING ⚠

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

Falling Over

5. 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.
   And also DO NOT use this equipment in the position where the power switch operation is difficult.

For Safety

CAUTION ⚠

Replacing Fuse

CAUTION ⚠

1. Before Replacing 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.

For Safety

CAUTION ⚠

Replacing Memory Back-up Battery

This equipment uses a Poly-carbomonofluoride lithium battery to back-up the memory. This battery must be replaced by a service engineer when it has reached the end of its useful life; contact the Anritsu sales section or your nearest representative.

Note: The battery used in this equipment has a maximum useful life of 7 years. It should be replaced before this period has elapsed.

External Storage Media

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.

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 National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

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

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

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

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

Anritsu Corporation Contact

If this equipment develops a fault, contact Anritsu Service and Sales offices at the address at the end of paper-edition manual or the separate file of CD-edition 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

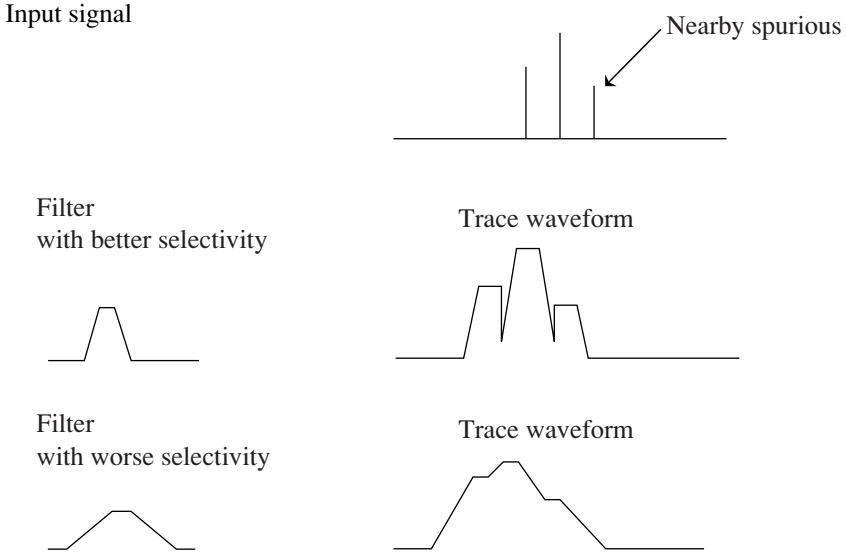
This instrument is a spectrum analyzer which uses a digital storage system. The spectrum analyzer makes level measurements in frequency steps obtained by dividing the frequency span by the number of measurement data points (501). This method of measurement cannot detect the signal peak level if the spectrum 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 (for analog communication systems)	SAMPLE
• Occupied frequency bandwidth, adjacent-channel leakage power (for digital communication systems)	POS PEAK or SAMPLE

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

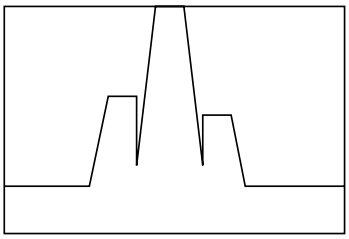
RBW Filter Characteristics and Auto Sweep Mode

The MS2661N 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 MS2661N corresponds to the RBW 300 Hz of the old types.
Moreover, in the low frequency, the decrease of the level-measurement dynamic range by the zero-beat effect (caused by the filter skirt characteristics) is also improved.



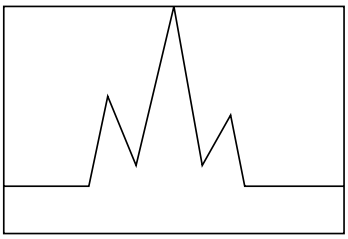
When in the same combination of the RBW and span, the MS2661N auto sweep time in the Hi-Lvl-Acc mode becomes slower than that of the old type, by 3 times.
However, since the MS2661N use the filter with better selectivity (sharp skirt characteristics), the wider RBW by 3 times can be set in the same span, and conversely, the sweep time can be set faster by 3 times for the high-accurate level measurement.

RBW = 1 kHz ST = 400 ms
SPAN = 50 kHz



MS2661N
in Hi-Lvl-Acc mode

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



Old types

In the same combination of the RBW and span, the MS2661N 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.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.
Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.
When you dispose of export-controlled items, the products/manuals are needed to be broken/shredded so as not to be unlawfully used for military purpose.

C-tick Conformity marking

Anritsu affixes the C-tick marking on the following product (s) in accordance with the regulation to indicate that they conform with the EMC framework of Australia/New Zealand.

C-tick marking

1. Product Model

Model: MS2661N Spectrum Analyzer

2. Applied Standards

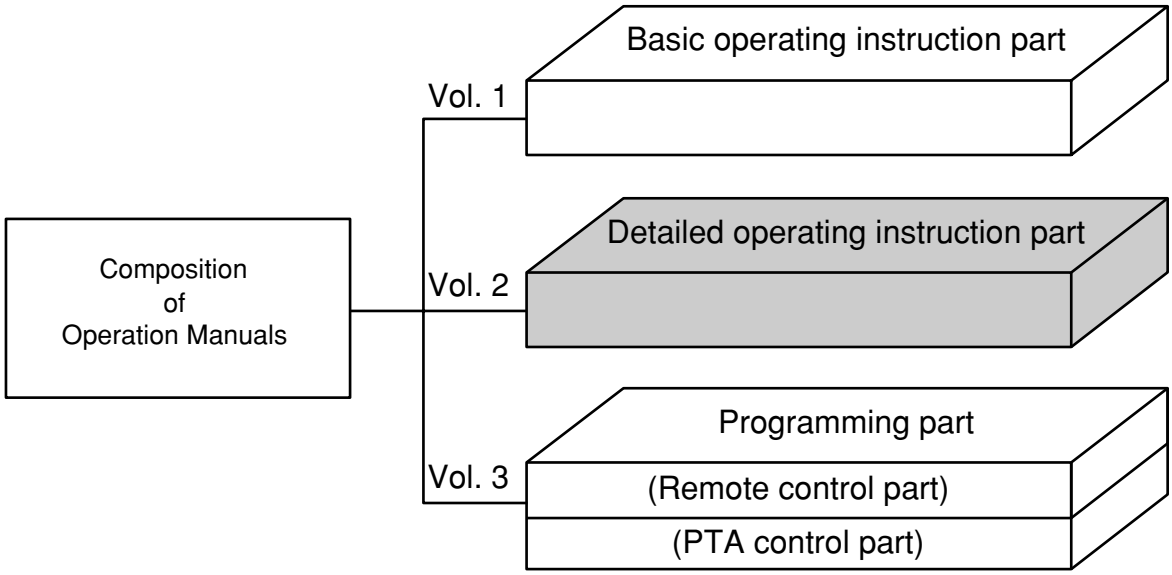
EMC: Emission:

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

ABOUT THIS MANUAL

(1) Composition of MS2661N Operation Manuals

The MS2661N Spectrum Analyzer operation manuals of the standard type are composed of the following three documents. Use them properly according to the usage purpose.



Basic operating instruction part: Basic Operating Instructions: Provides information on the MS2661N 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 MS2661N 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 desctibes about PTA operation and PTL commands.

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SECTION 1

BASIC OPERATION PROCEDURE

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SECTION 1
BASIC OPERATION PROCEDURE

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

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

<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 → CF" function check.

(3) "Measure" function check

(4) Screen hard copy

Signal Display

Turn the power on

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

Press [Preset] key.

Press Preset All Parameters key in the menu.

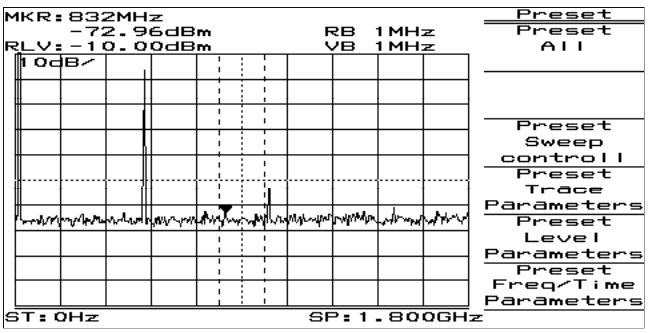

Fig. 1-1

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.

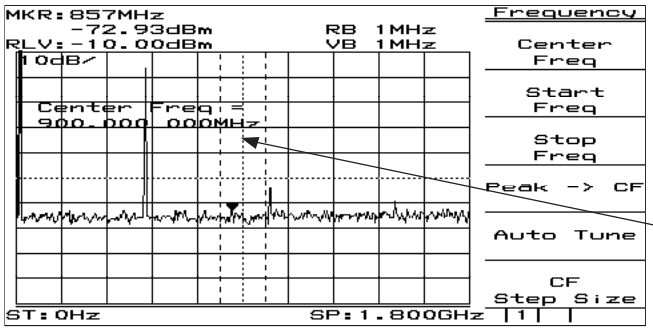

Fig. 1-2

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

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

Press [Menu On/Off] key

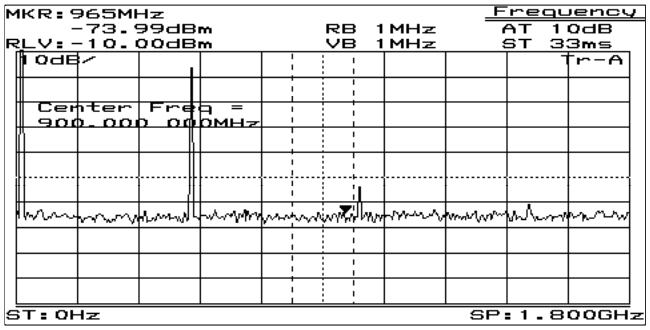

Fig. 1-3

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.

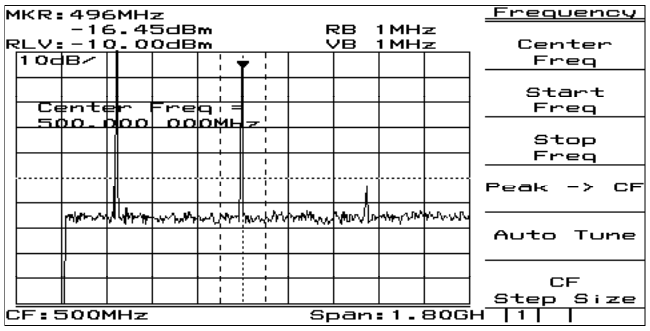

Fig. 1-4

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.

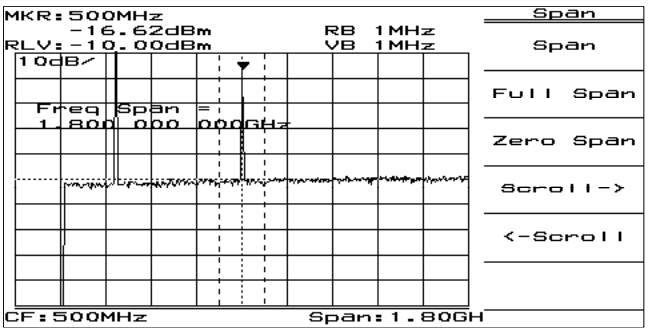

Fig. 1-5

Marker Operation

Here, checks 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.

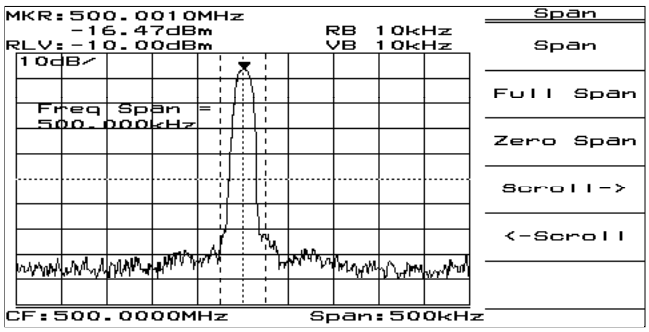

Fig. 1-6

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

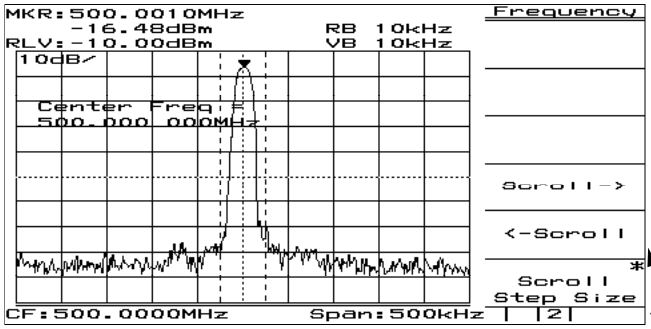

Fig. 1-7

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

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 Peak Search key.

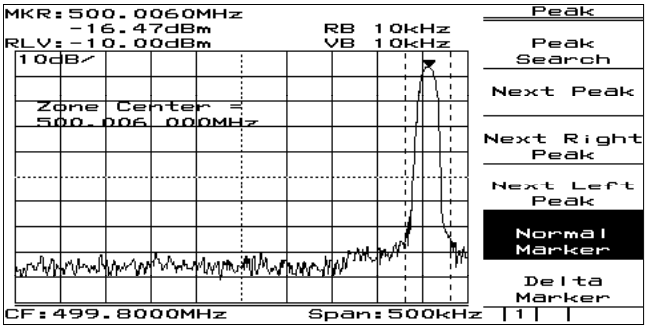

Fig. 5-8

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

The marker fetches the signal.

Press [More] key.

Press Marker → key.

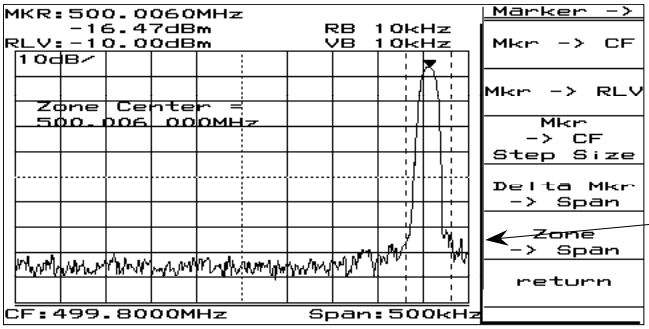

Fig. 5-9

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

Press marker → CF key.

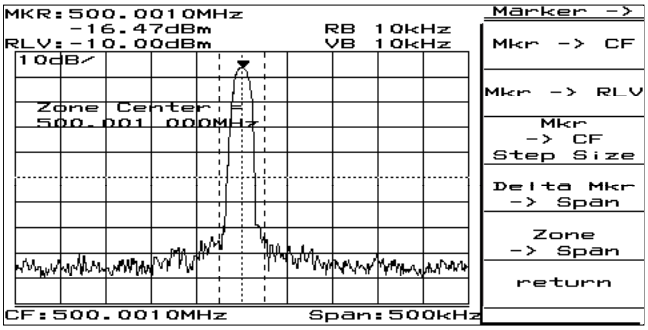

Fig. 1-10

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

Here, return to the screen of Fig. 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.

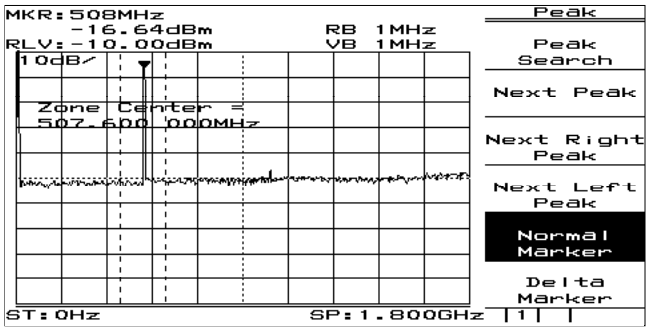

Fig. 1-11

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.

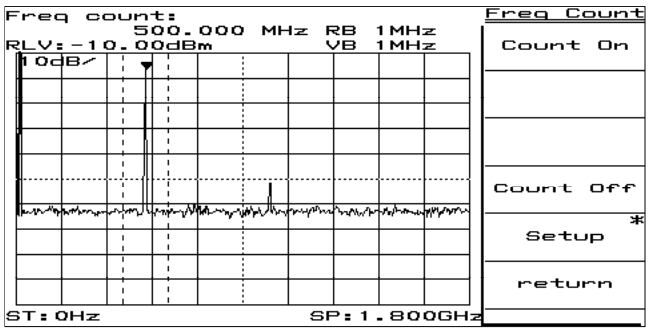

Fig. 1-12

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

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

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

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 in 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 and get RS-232C on the display.
Now the printer can be operated with RS-232C.

5) Press the RS-232C Setup key and 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 × 1.

10) Press the [Copy] key, and the currently displayed screen is hard-copied.

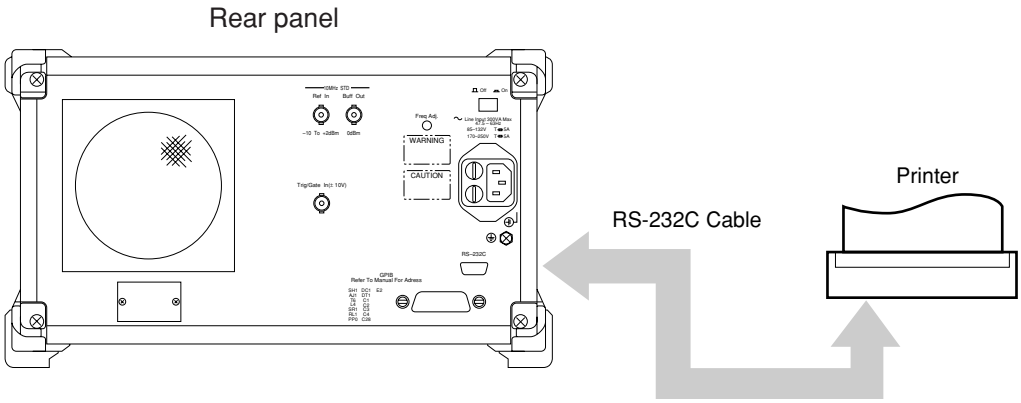

Fig. 1-13

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SECTION 2

FREQUENCY/AMPLITUDE DATA ENTRY

This section describes the data entry function related to frequency and amplitude in the Freq/Ampl section on the front panel.

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SECTION 2 FREQUENCY/AMPLITUDE DATA ENTRY

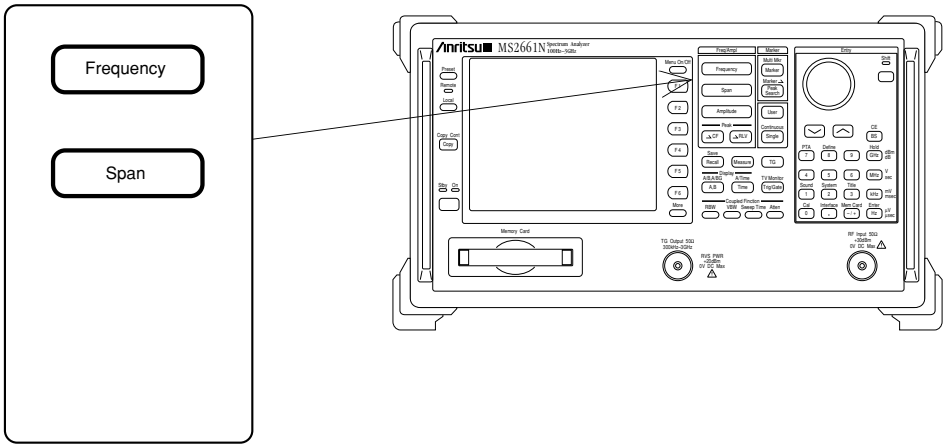
Setting Observation Frequency

The observation frequency of the MS2661N is set in the following two modes:

- Center-Span
- Start-Stop

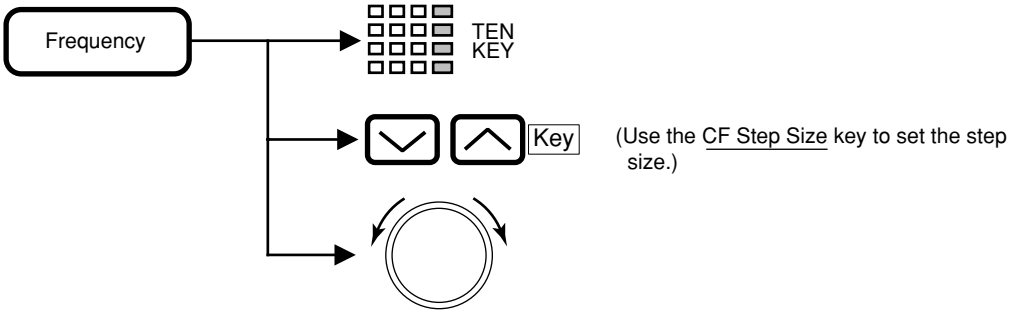
The frequency setting upper and lower limits are –100 MHz and 3 GHz, respectively.

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.

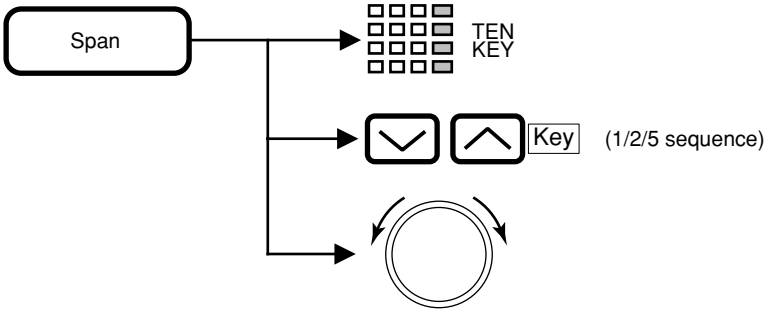


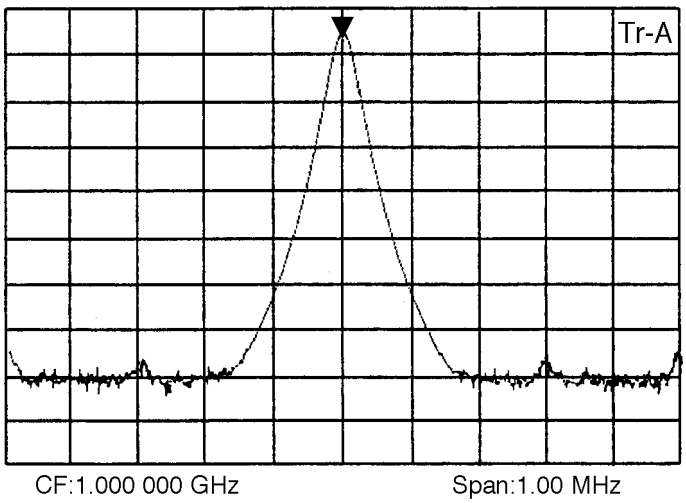
Center-Span Mode

(1) Setting center frequency



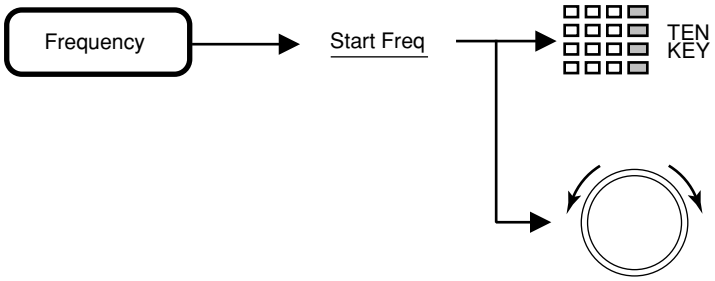
(2) Setting frequency span



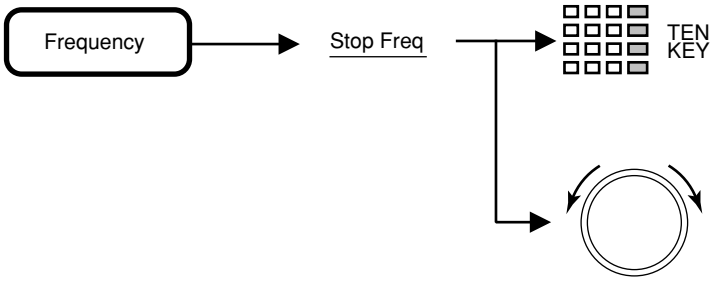


Start-Stop Mode

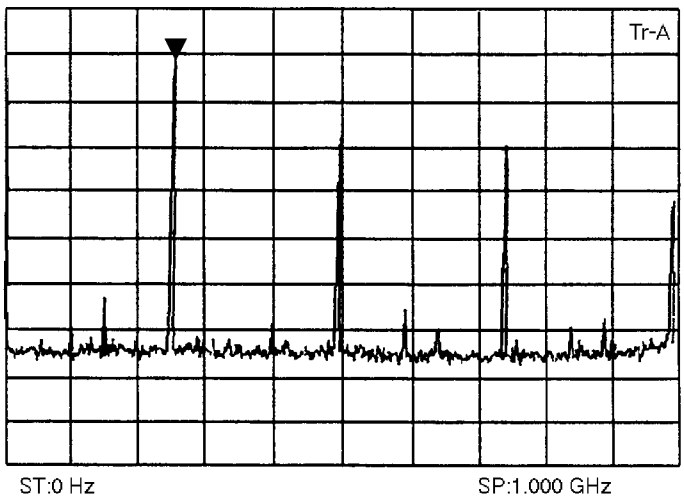
(1) Start frequency



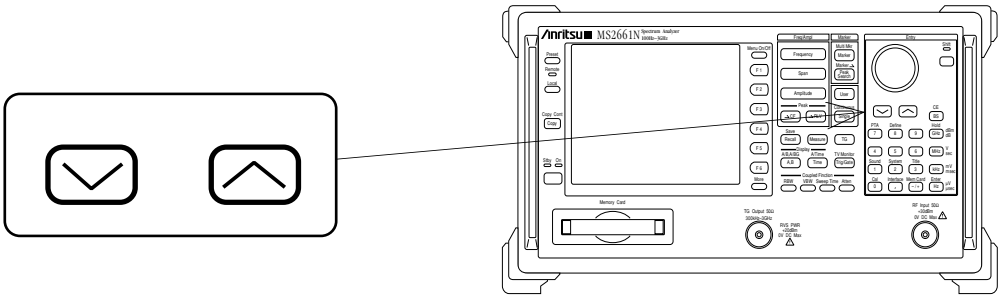
(2) Stop frequency



Notes:
- Because the ∨ and ∧ keys are the step keys for the center frequency, the start and stop frequencies are also changed.
- The stop frequency may also vary depending on the values of the frequency span setting resolution and start frequency.



Setting Step Size with Step Keys



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

Frequency → CF Step Size → TEN KEY

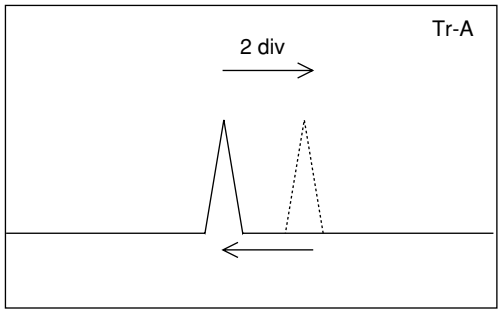
Setting Frequency Scroll Step Size

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

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

- return

Return to the top menu.



Span → Scroll→

The waveform scrolls 2 divs to the right.

Span → ←Scroll

The waveform scrolls 2 divs to the left.

Setting Full Scan

In the normal operating state, pressing the Preset key and Preset All key allows the entire frequency range of the MS2661N to be swept over the full span. However, this setting also initializes the parameters except the frequency range.

To set the full span and leave the other parameters unchanged, perform the following key operations.

Span → Full Span

Setting Zero Span

The MS2661N 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 MS2661N to operate in the zero span (time domain) mode.

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

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

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

Setting Level Range

The table below shows the types of MS2661N 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

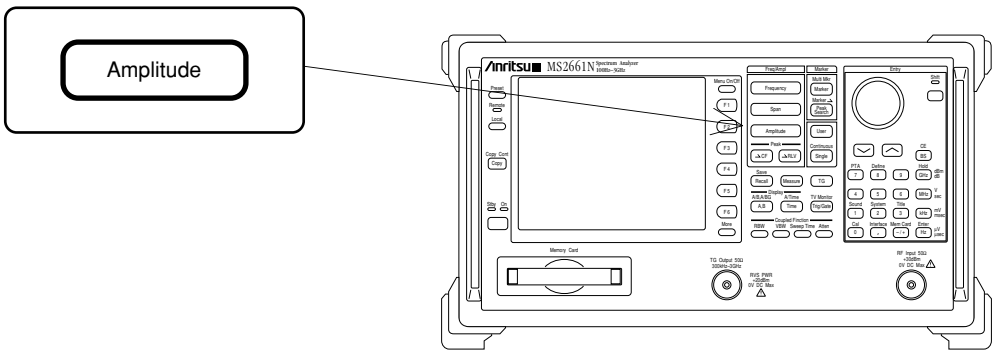
dBm: dBm unit system where 1 mW/50 Ω is defined as 0 dBm.

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.

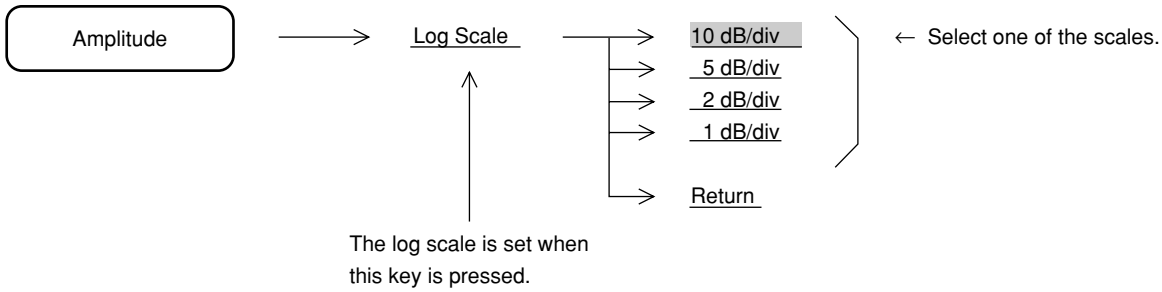
The Amplitude key is used as the header key for setting the amplitude level.



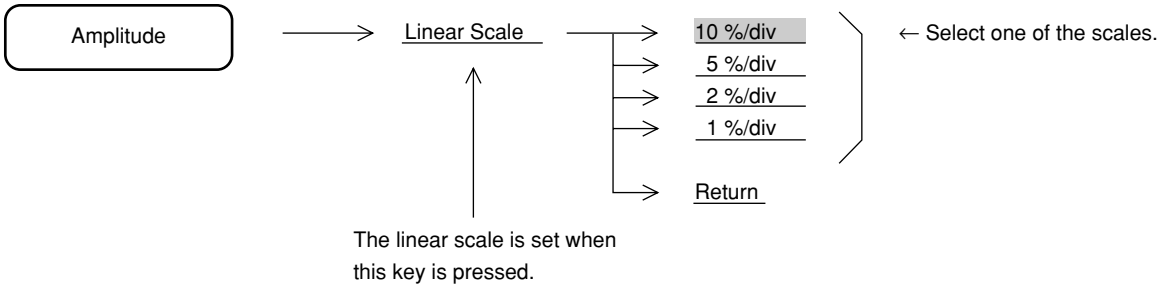
Setting Log/Linear Scale

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

(1) Setting log scale



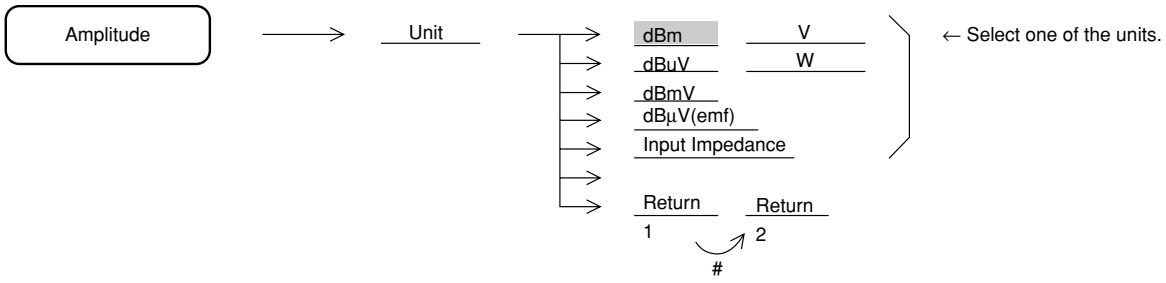
(2) Setting linear scale



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

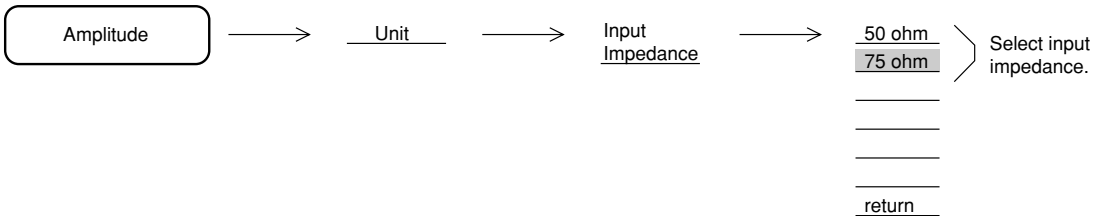
In the log scale mode, the MS2661N provides six types of reference level units: dBm, dBμV, dBmV, V, dBμV (emf), and W. To select one of the reference level units, perform the following key operations.



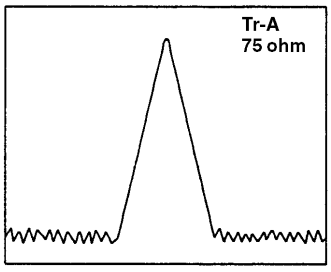
Because the reference level unit used for the linear scale is only V, there is nothing to select.

Selecting Input Impedance

The input impedance of the MS2661N 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.



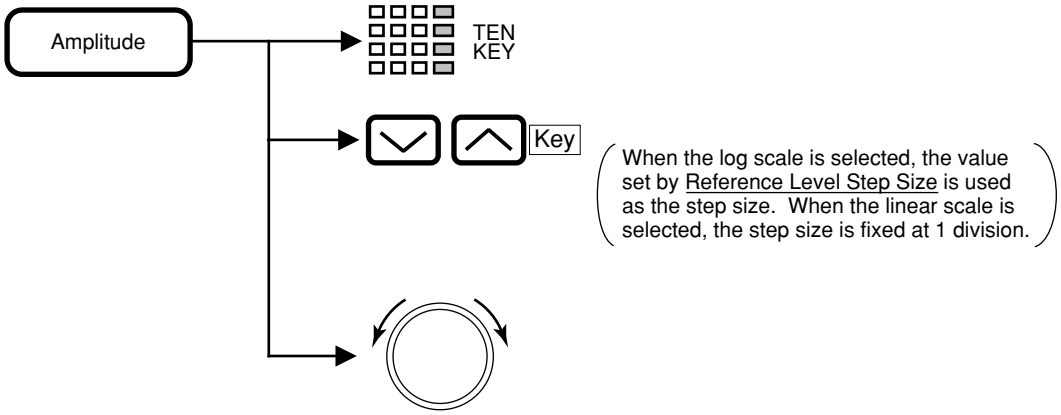
When the input impedance is set to 75 Ω, "75 ohm" is displayed at the top right of the waveform.



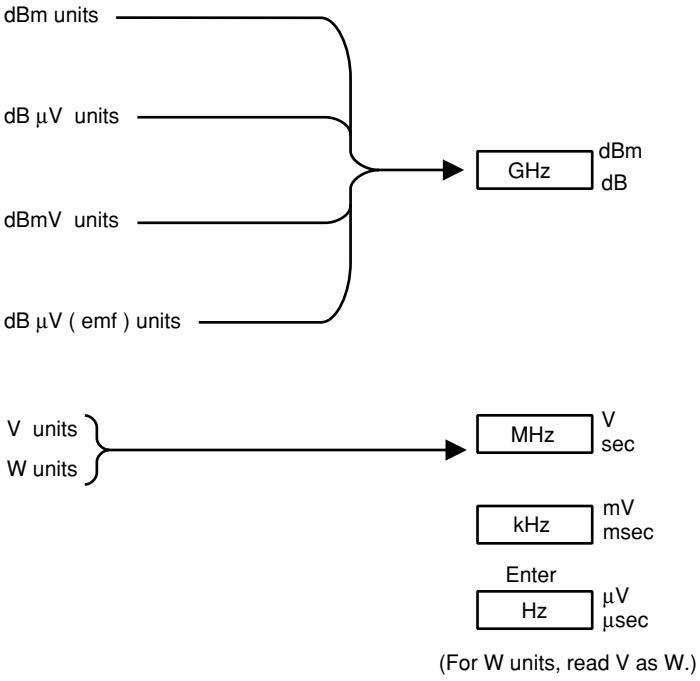
When the MA1621A is used as the 50 Ω→75 Ω Impedance Transformer, the insertion-loss frequency characteristics of the MA1621A must be compensated. The MS2661N has the level-compensation function. (see p.2-15 "Setting 50 Ω→75 Ω Impedance Transformer (MA1621A)".)

Setting Reference Level

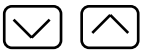
Select the reference level (top graticule of the amplitude scale) by performing the following key operations.



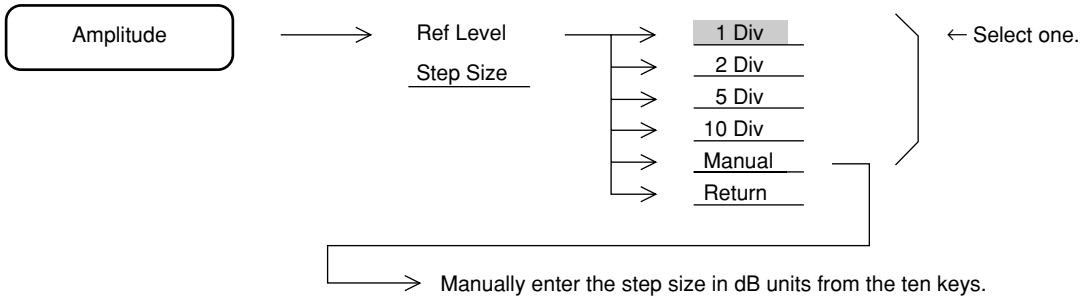
Use the unit key as follows, according to the set reference level unit.



Setting Reference Level Step Size

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

(1) Log scale

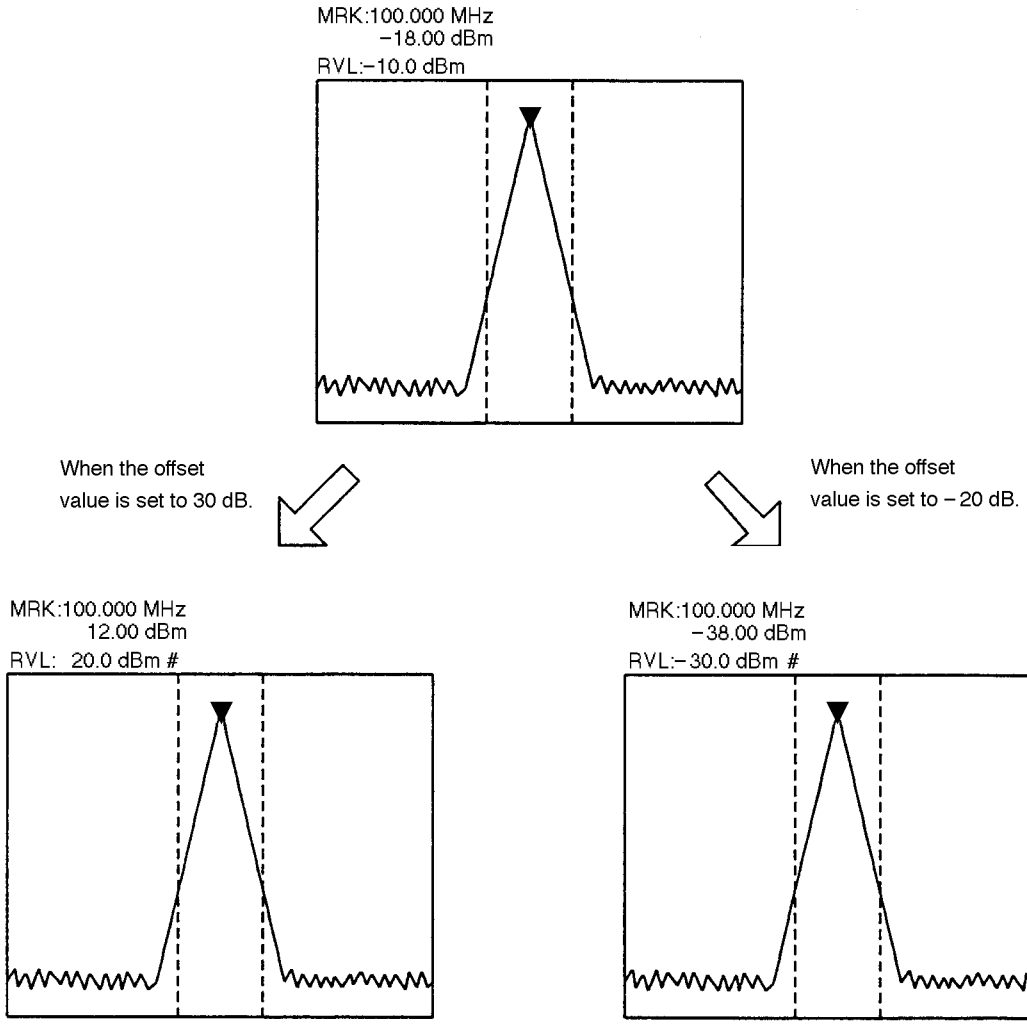


(2) Linear scale

Fixed at 1 division.

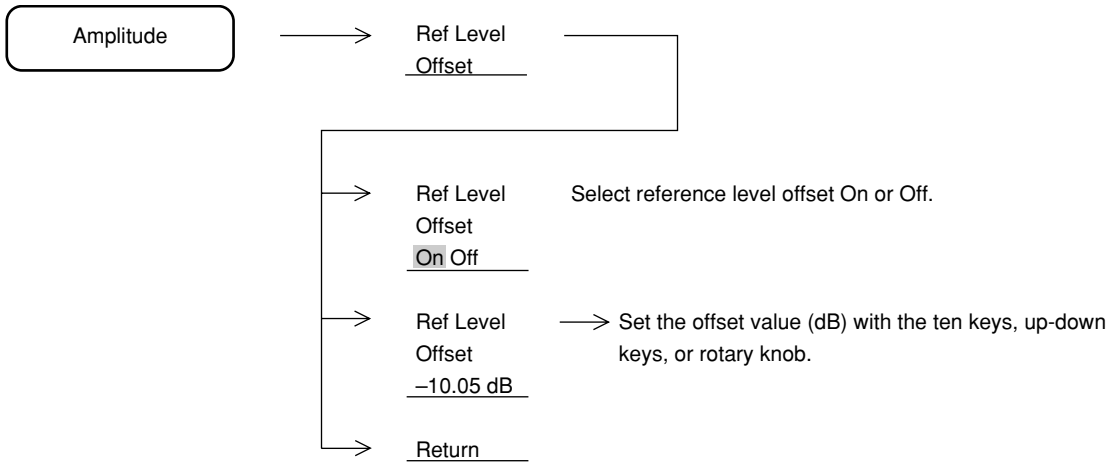
Offsetting Reference Level

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



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

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



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

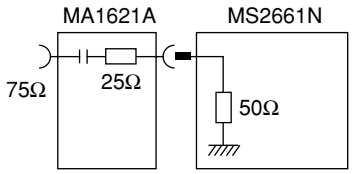
The offset can be applied to each trace (A, B, BG, Time), but it cannot be applied when using A–B→A function.

Setting Attenuator

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

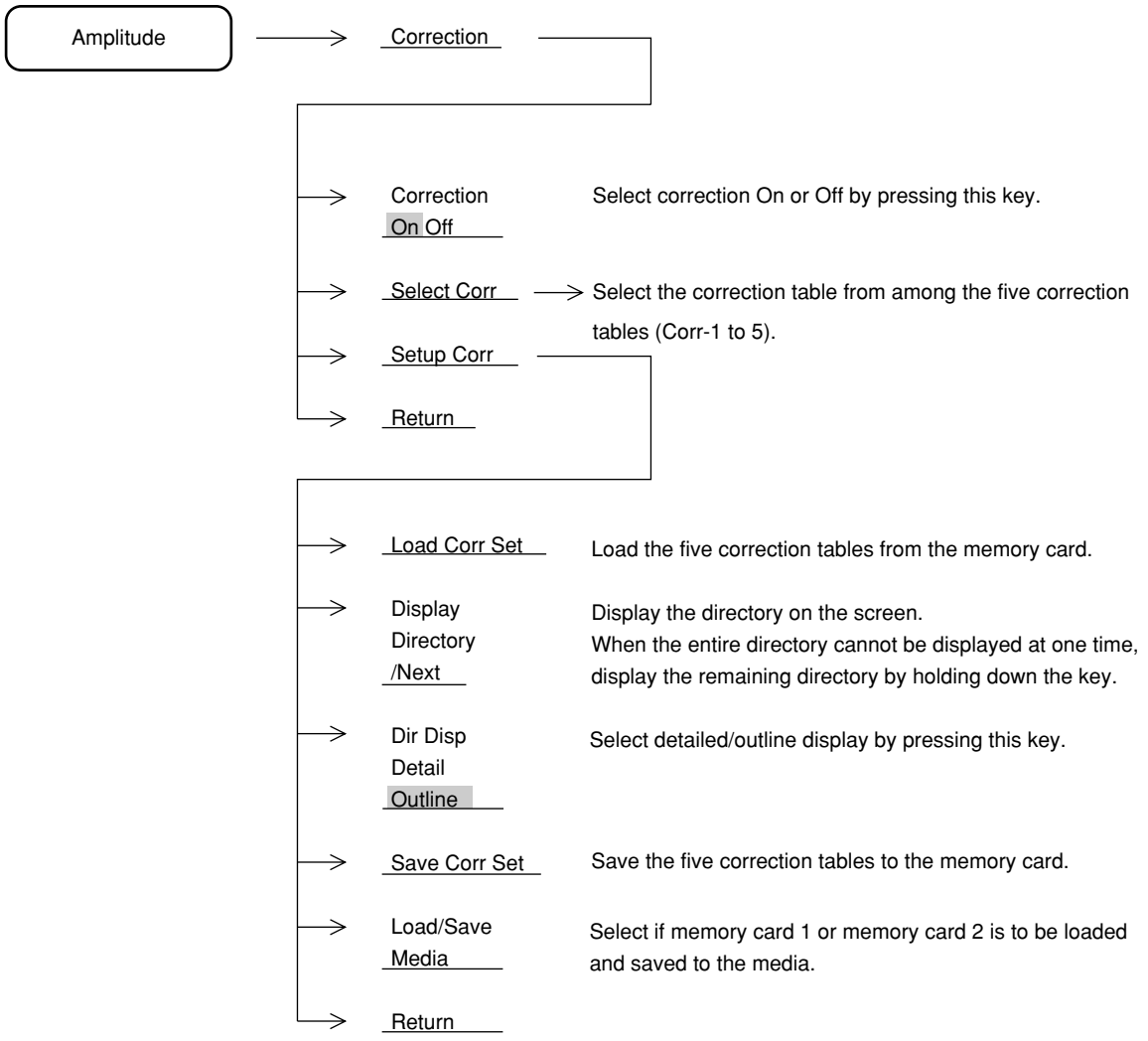
Setting 50 Ω → 75 Ω Impedance Transformer

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



Setting Level Frequency Correction Coefficient

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



For further details, see SECTION 8.

SECTION 3
MARKER FUNCTIONS

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

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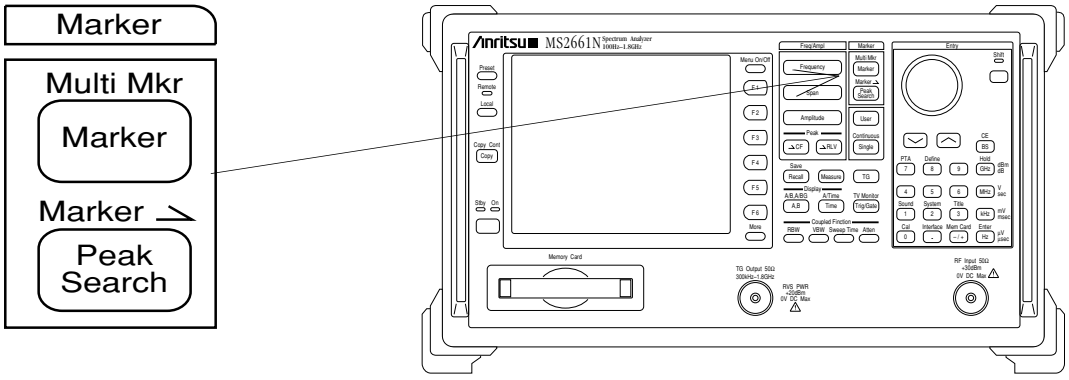
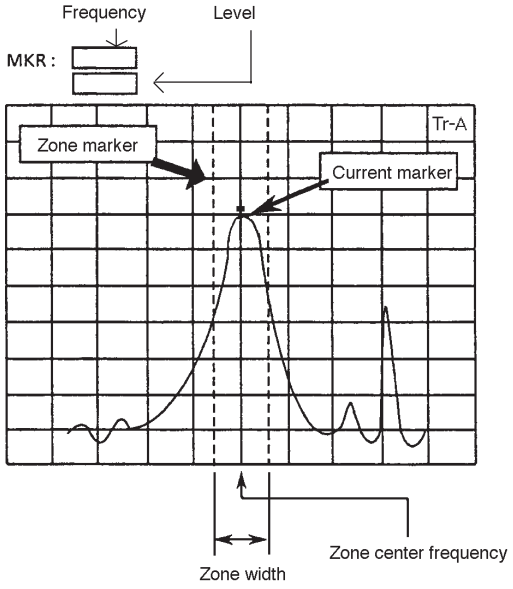
SECTION 3
MARKER FUNCTIONS

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



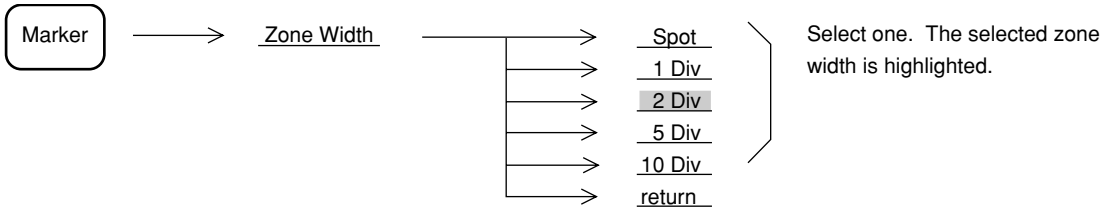
Changing Zone Marker Position and Width

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

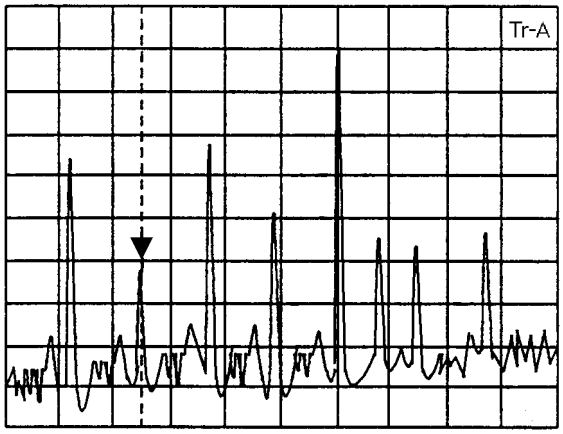
The zone marker width is initially set to 1 division, but can be changed from 1 point to 10 divisions by performing the following key operations.



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.

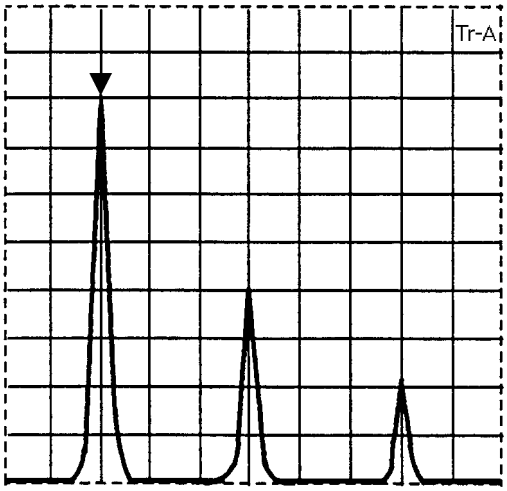
When the zone marker width is set to 1 point (Spot), the zone marker becomes a vertical line. This is called a spot marker. Since the marker center frequency and the current marker frequency coincide, the level at the desired frequency can be measured.

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.

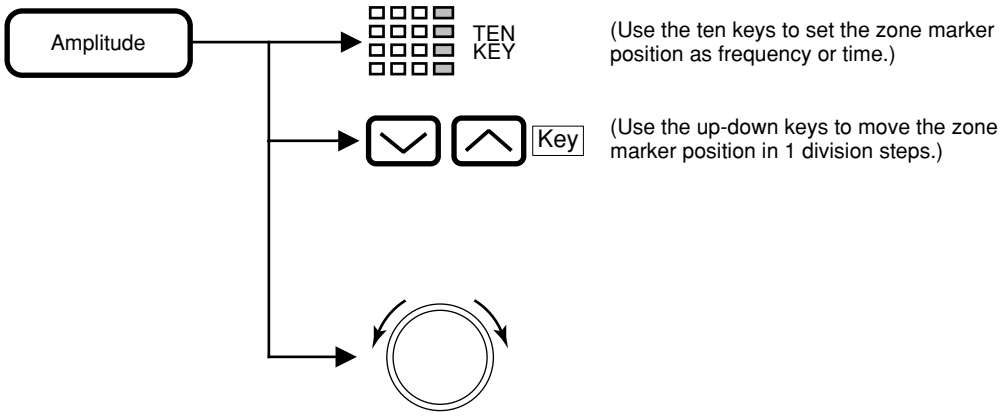
Example of Zone Width: 10 Divisions



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



In the delta marker mode, setting the zone marker center frequency (time) with the ten keys results in entry of the delta marker value (difference between reference marker and current marker).

Marker Mode

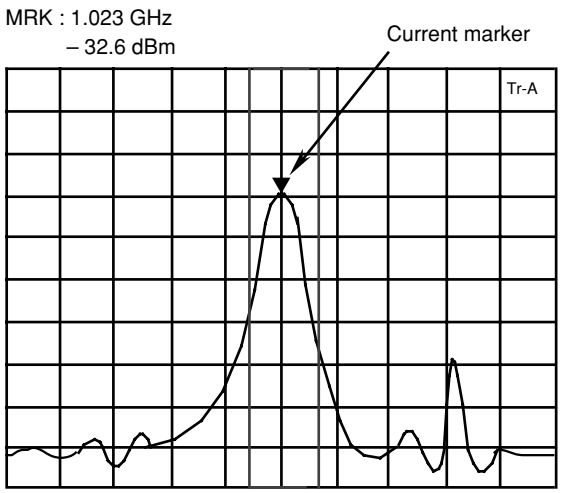
Three types of markers can be used with the MS2661N: normal marker, delta marker, and multimarker.

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. When the current state is another marker mode, or when the normal marker is set to OFF, perform the following key operations to set the normal marker to ON.

Marker → Normal Marker



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

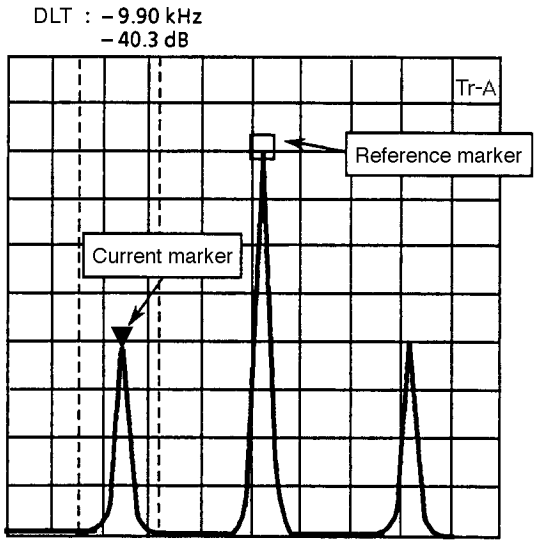
Delta Marker

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 elta marker values.

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

To set the delta marker to On, perform the following key operations.

Marker → Delta Marker



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

Varying the spectrum waveform in the delta marker mode does not change the marker frequency level. The reference marker is not necessarily always on the waveform because it remains unchanged. Also, when the reference marker cannot be positioned on the screen by changing the observation frequency and level and range, it is at the edge of the scale lines.

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.

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

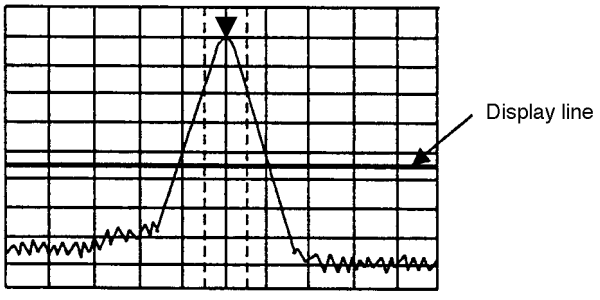
In the state in which a horizontal line which indicates a given level is displayed on the scale, the display line can be used as the frequency response measurement guideline, or as the reference line of the marker level measurement or pass/fail judgement with a standard line.

Setting Display Line

To turn the display-line On and Off and to set the display-line level, perform the following key operations.

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

- Display Line On Off — Turn the display line On and Off by pressing this key.
- Display Line Level –50.00 dBm — Enter the display line level from the ten keys, etc.
- Marker Level Abs Rel — Select if the marker level is set by absolute value or relative value (relative to display line) by pressing this key.
- Return



Display-line On and Off are common to all traces (A, B, BG, Time). Also, the display-line level is common.

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

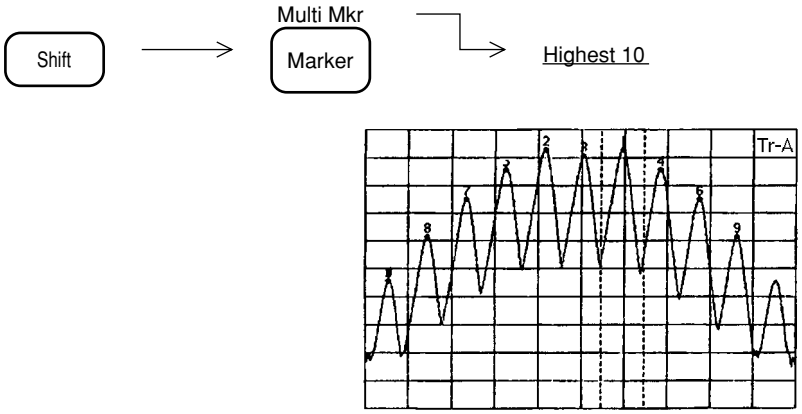
Multimarker

The MS2661N has a marker function which displays up to ten markers displayed 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.

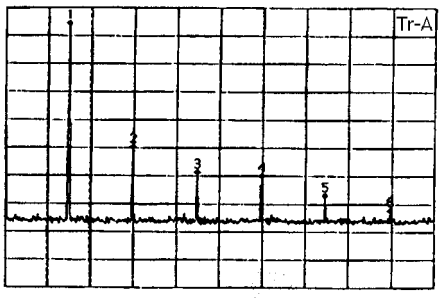


After executing Highest 10, an active marker (with the same functions as the current marker) moves to the peak point of the maximum level signal.

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

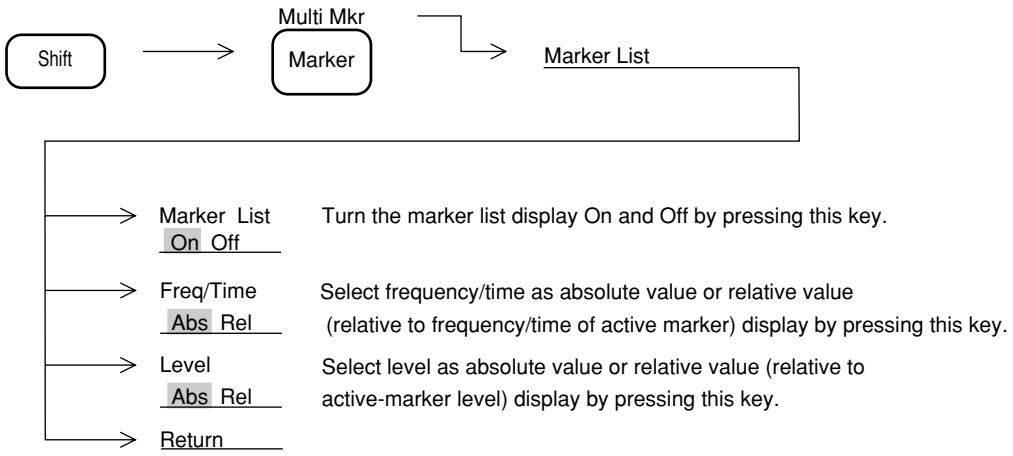
Harmonics Multimarker

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

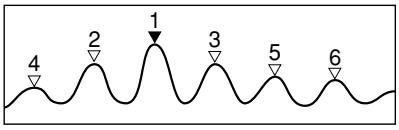


Note: If the fundamental and second harmonic signals are not separated by more than the marker zone width, or when there are larger level signals other than harmonic signals in the frequency range of the marker zone width centered at the harmonic signals, harmonic signals will be incorrectly detected.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

Marker List



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.

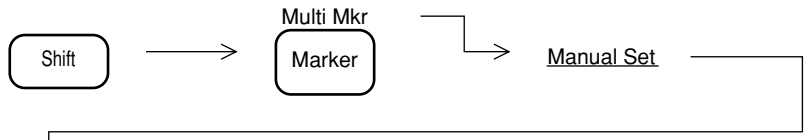


Marker List

*	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.



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

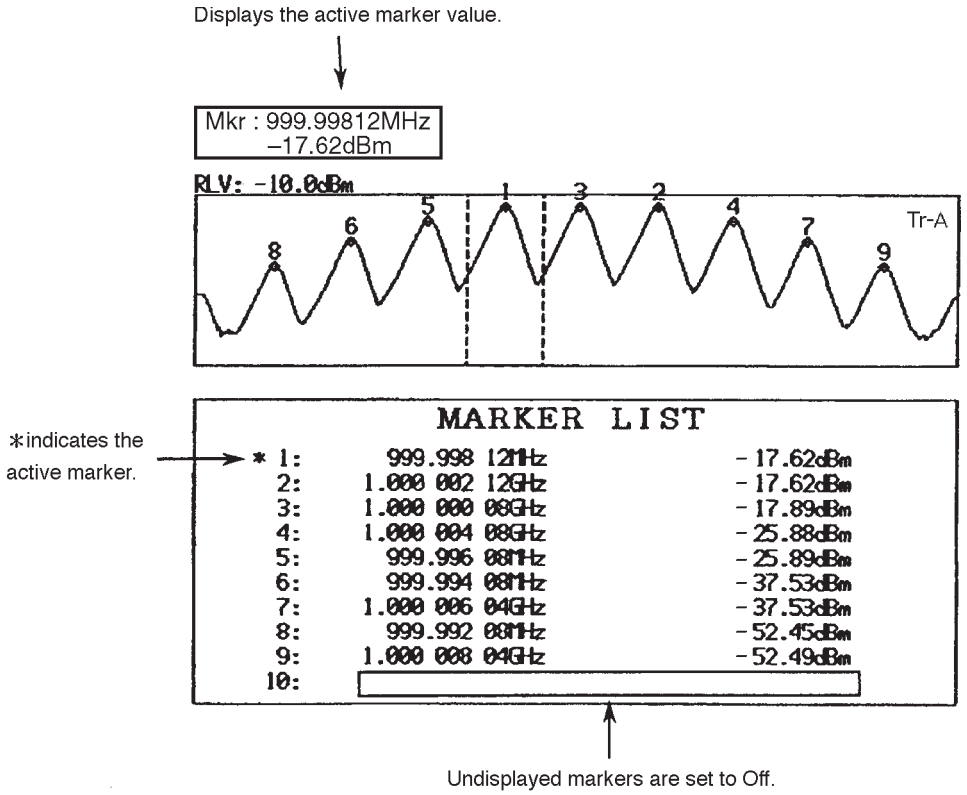
Sets the marker of the selected No. to Off. If the selected marker is already Off, the next smaller marker No. of the markers set to On is set to Off. By holding down this key, the multimarkers are set to Off one by one in descending order of number. When the active marker is set to Off, the marker with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



Multimarker Off

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

Shift → Multi Mkr Marker → Multi Marker On Off

Marker Search

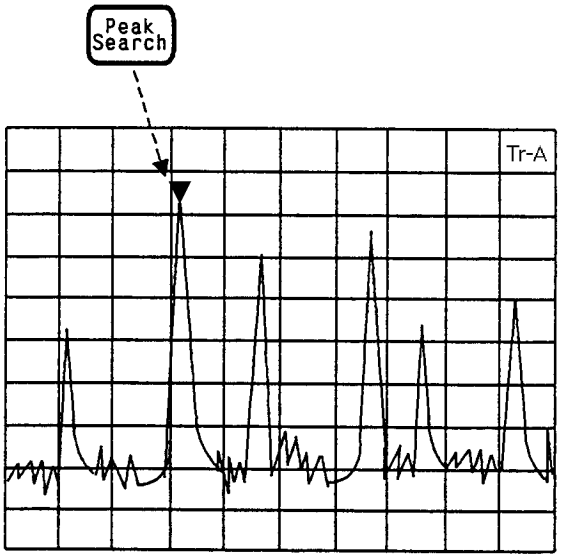
The MS2661N has the following six marker search functions:

- 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.

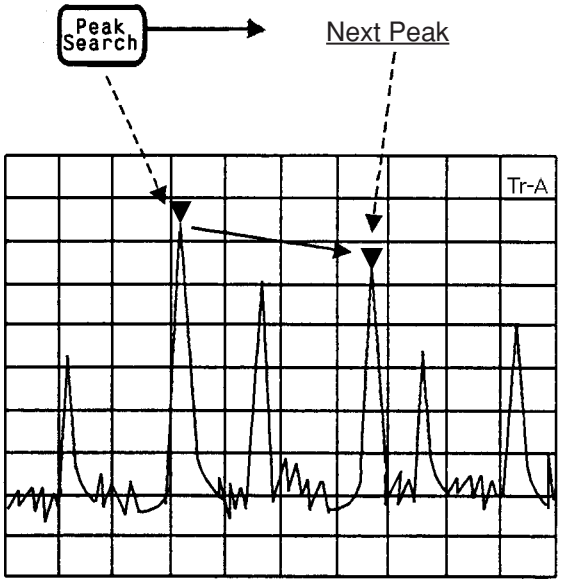
To Execute Peak search, perform the following key operations.



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.

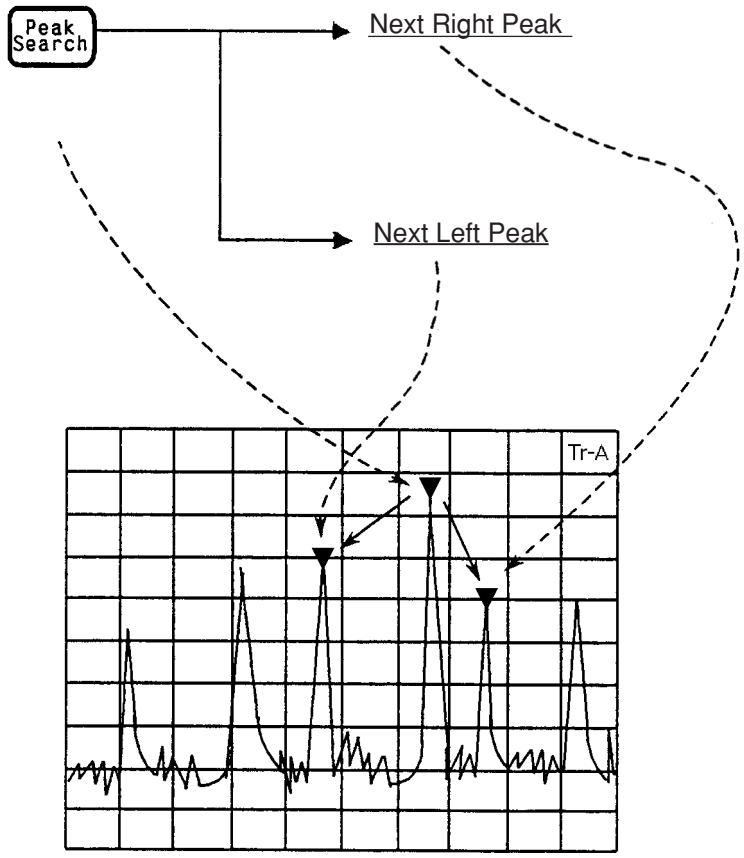


The next largest peaks can be detected and the marker can be moved to those peaks by executing Next Peak Search consecutively.

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.

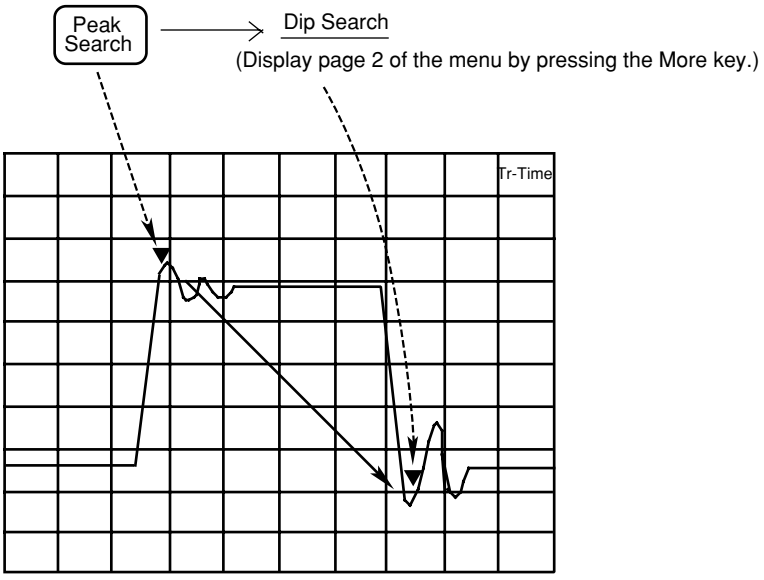


The adjacent peak level to the right or left can be detected and the marker moved to that peak by executing Next Right Peak Search or Next Left Peak Search consecutively.

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 oint 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).

Dip Search

Dip search detects the minimum level point from the entire trace in which a marker is displayed and moves the marker to that point.
Execute Dip search by the performing the following key operations.



Time domain waveform

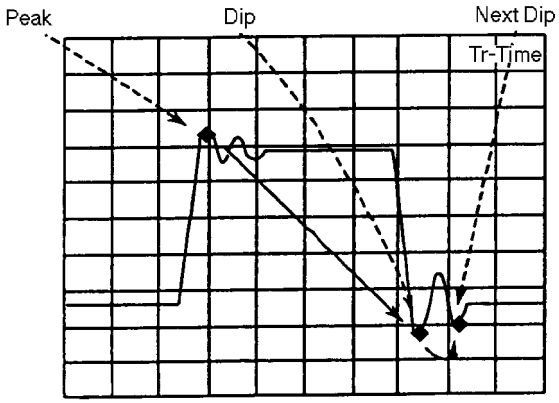
Time domain waveform

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 Search → Next Dip

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



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.

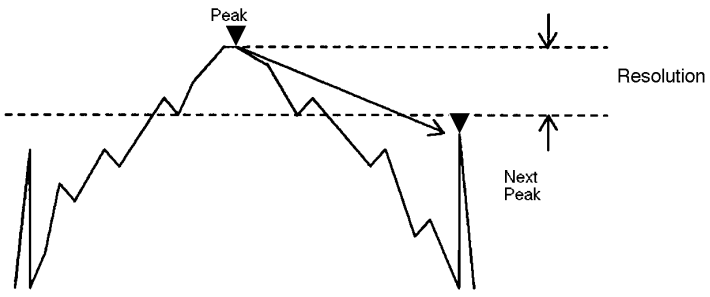
Setting Search Resolution

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 Search → Resolution 1.23 dB

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

→ Enter the resolution in dB units from the ten keys.



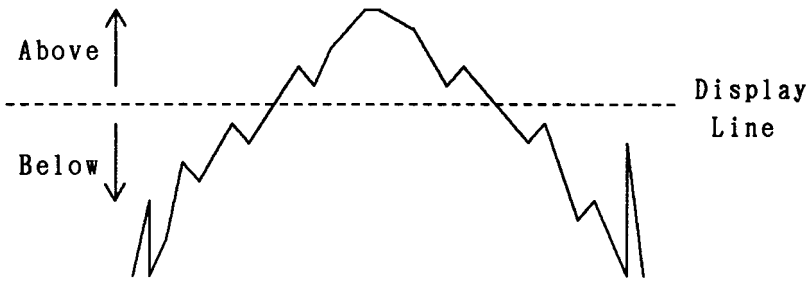
Setting Search Threshold

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

Peak Search → Threshold

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

- Treshold On Off — Turn threshold On and Off by pressing this key.
- Search Above Below — Select search above or below the display line by pressing this key.
- Display Line On Off — Turn the display line display On and Off by pressing this key.
- Disp Line Level –50.00 dBm — Sets the display line level.
- Return



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.

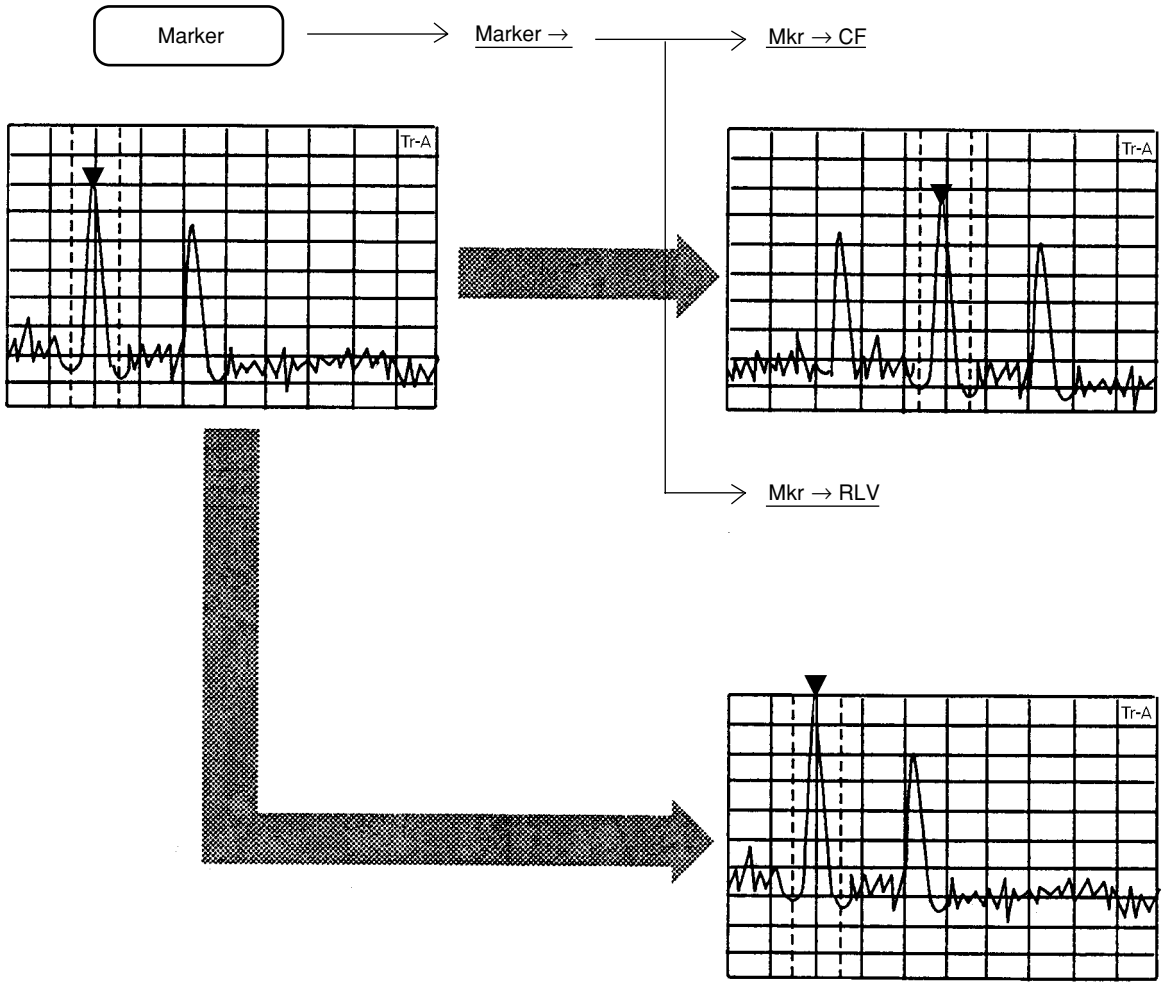
To set parameters using the marker value, the following settings are possible:

- 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.

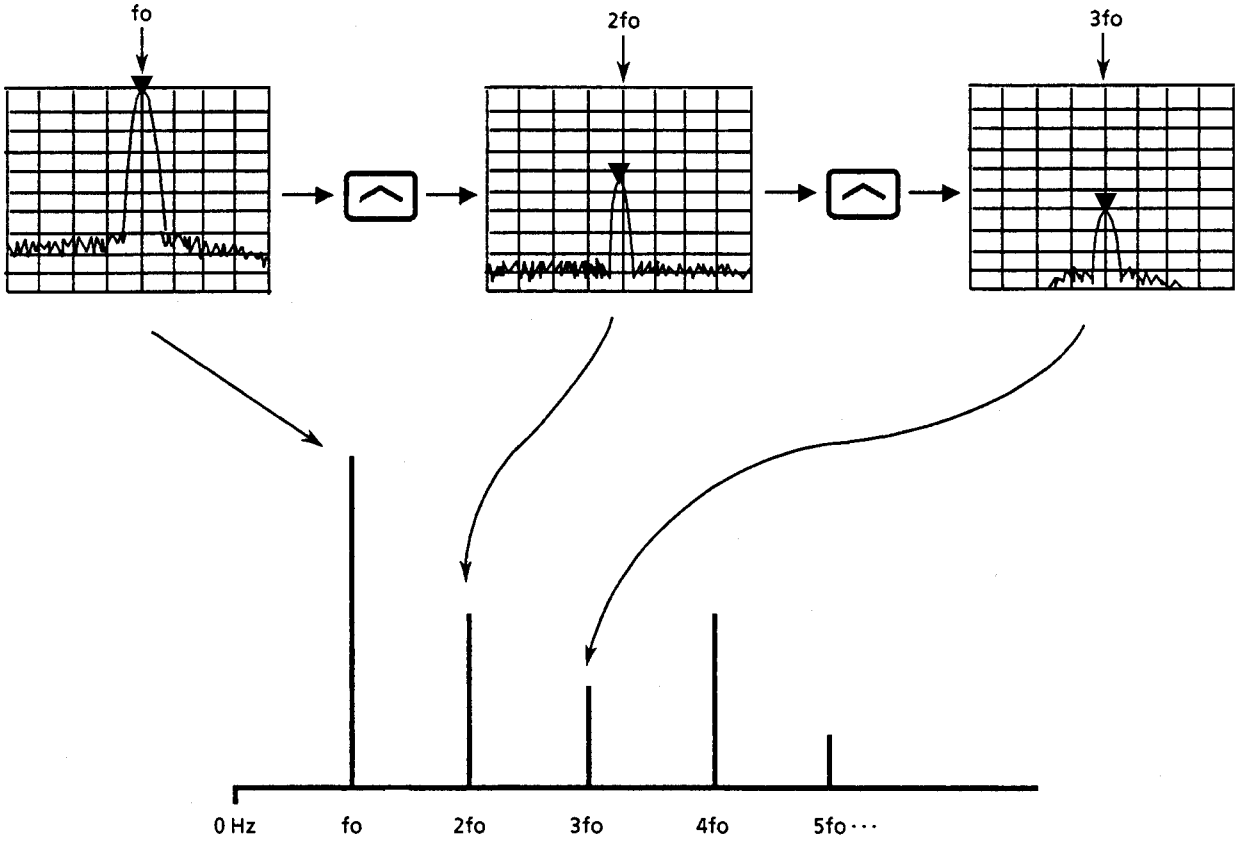


Mkr → CF Step Size

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

Marker → Marker → → Mkr → CF Step Size

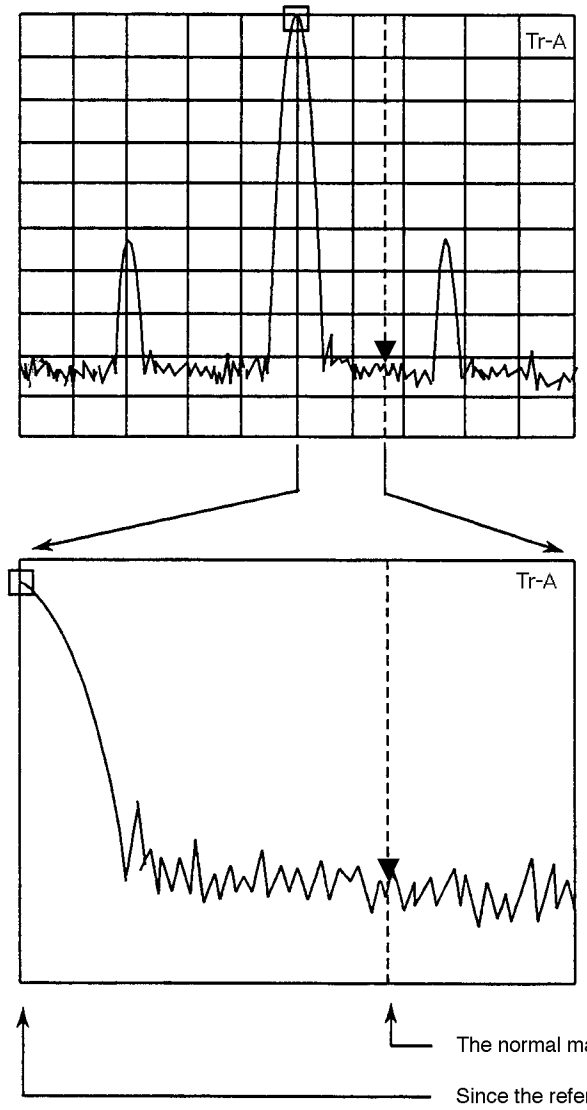
Although this action does not cause any change to appear on the screen, when the center frequency is changed with the up-down keys, the center frequency is changed with the marker frequency as the step size. This facilitates observation of harmonic waves.



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.

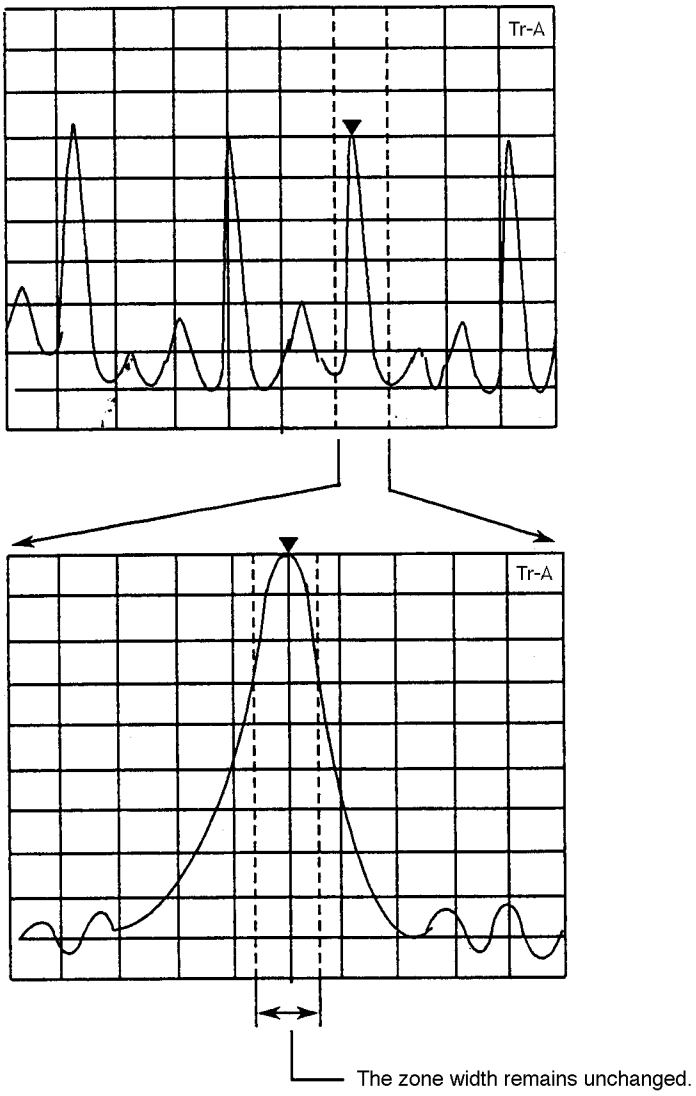
Marker → Marker → → Delta Mkr → Span



Zone → Span

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

Marker ⟶ Marker → ⟶ Zone → Span



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 section

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SECTION 4
SIGNAL SEARCH FUNCTION

Detecting Peaks

The MS2661N 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 3 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

  However, except the 0 Hz to 3/100 frequency span range.

  Stop frequency

  Stop frequency specified in trace BG.

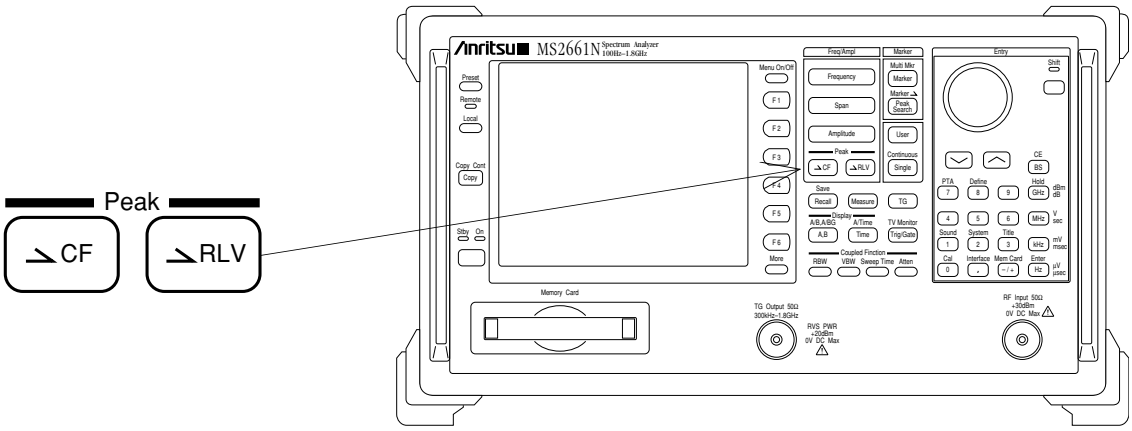
Moving the Measurement Point

This function moves the spectrum on the screen to the center to facilitate measurement. 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.

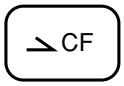
This section describes the Peak → CF and Peak → RLV functions.



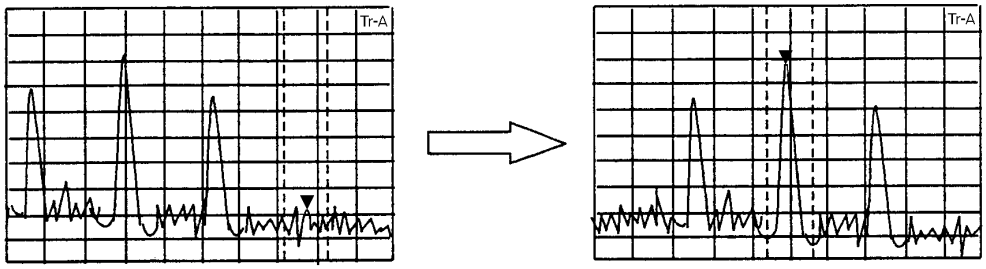
Peak → CF and Peak → RLV

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



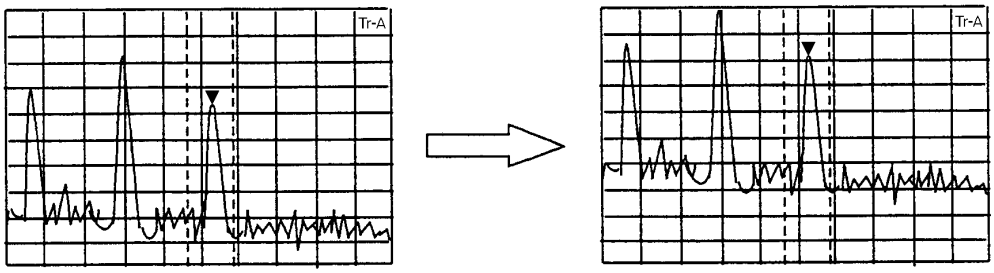
Sets the maximum peak point and the zone marker to the center frequency.



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

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.

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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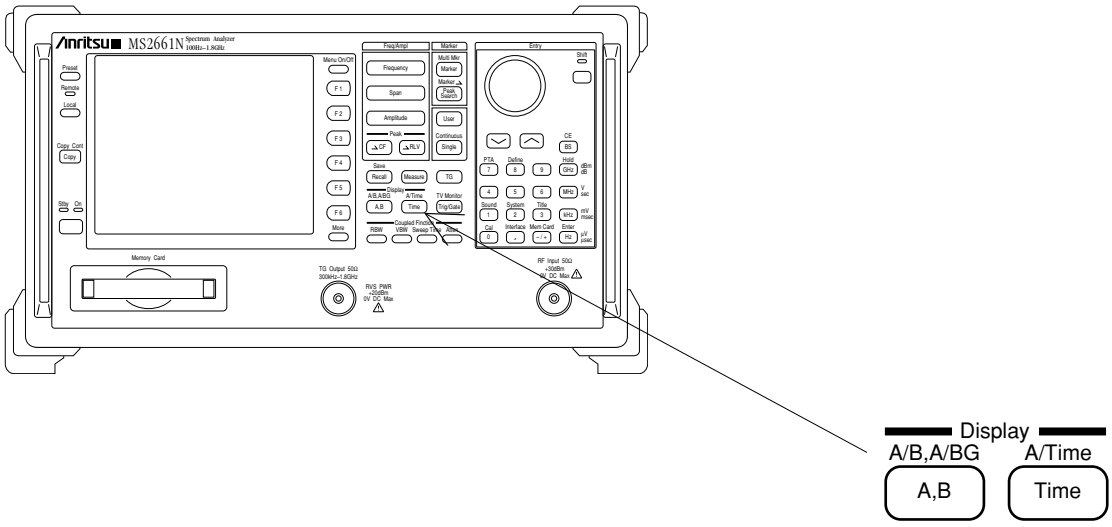
SECTION 5
SELECTING THE DISPLAY METHOD

The MS2661N 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.

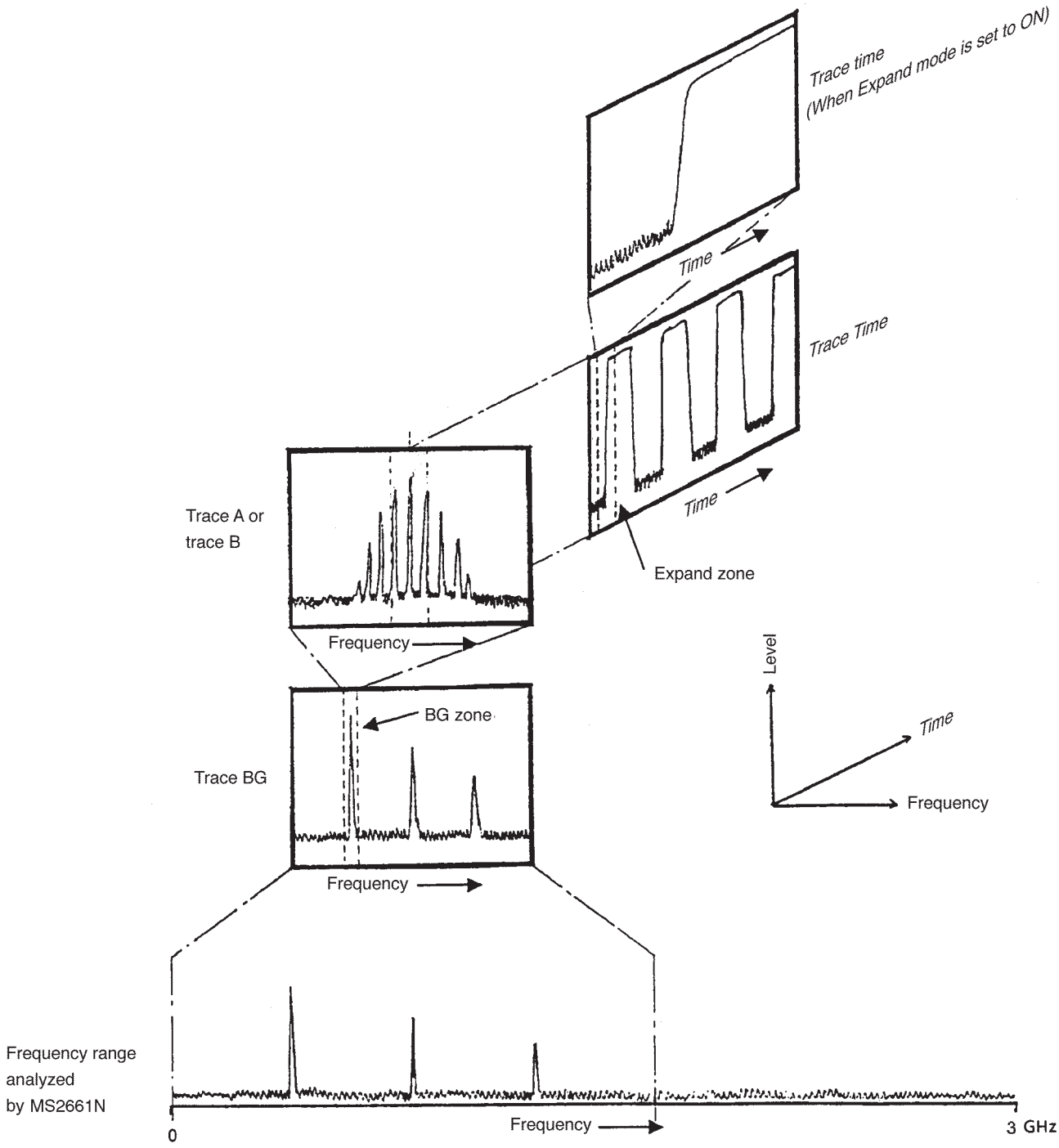


Display Mode

The following outlines the trace modes. The figure on the next pages shows the correlation between trace modes.

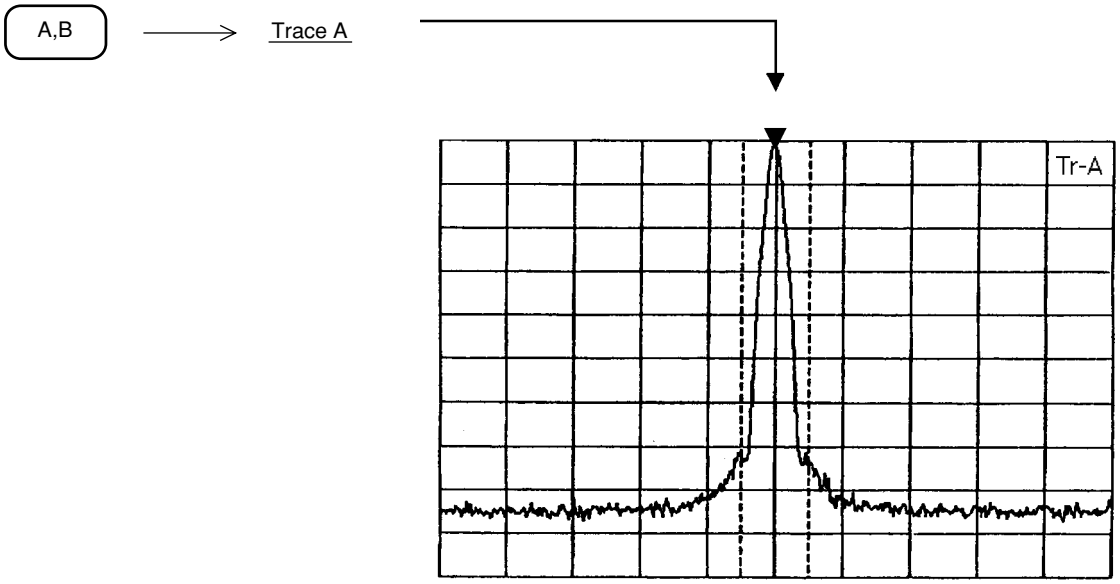
- Trace BG ..... When the objective signal is measured in the trace A, B, or Time mode, the trace BG mode allows the frequency range to be observed to be pre-set to a wide band. The BG band is initially set to full span (0 to 1.8 GHz).
- Trace A, trace B..... Used to analyze signals in the normal frequency 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
Expand zone
Frequency
Level
Time
Frequency
BG zone
Trace BG
Frequency
Frequency range
analyzed
by MS2661N
0
Frequency
3 GHz

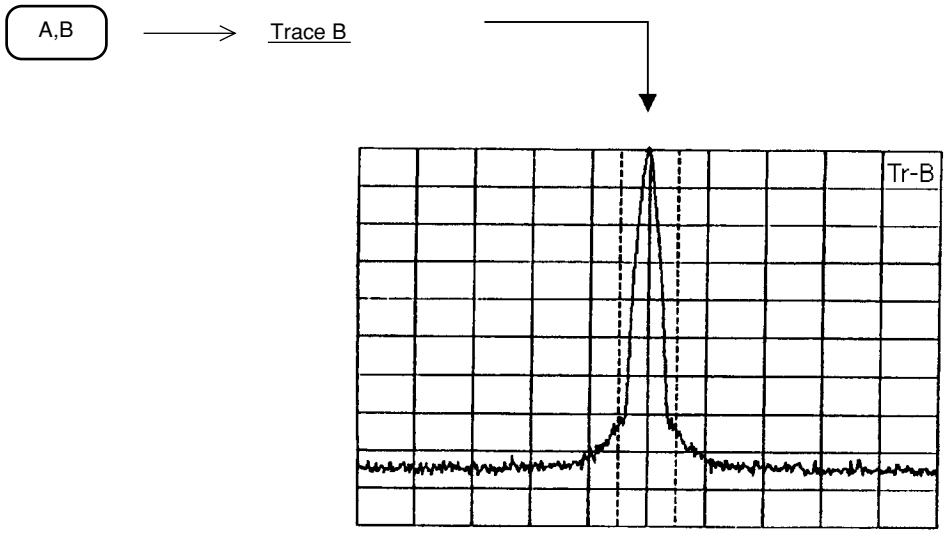
Trace A

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



Trace B

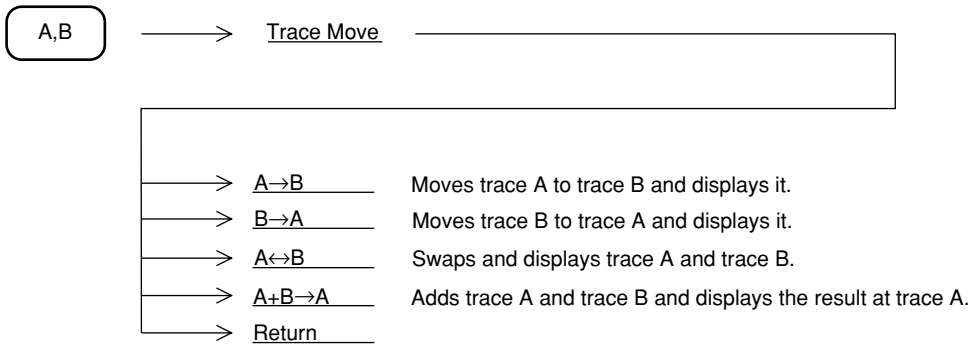
Like trace A, trace B is used to analyze signals in the normal frequency domain.
When used with trace A, it is possible to compare waveform A and waveform B.



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.



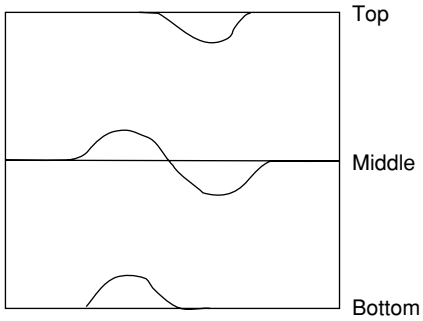
Set the move-destination-trace storage mode to View, and stop the sweeping before moving the trace.
If the trace A or trace B threshold is set to any other mode, the trace data will be displayed once, then updated.

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

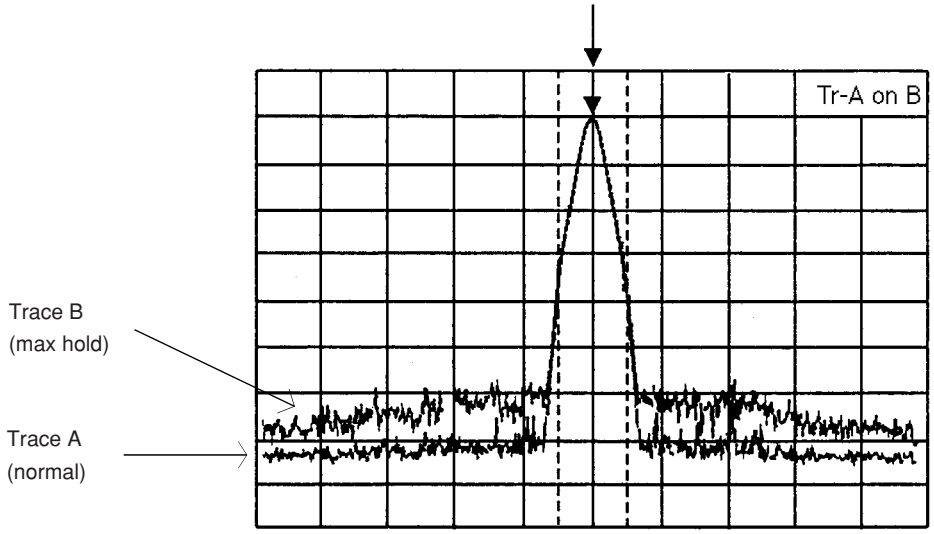
- Normalize (A–B+DL) On Off — Turn the mode that subtracts trace B from trace A and adds the display line value and continuously displays it at trace A On and Off by pressing this key.
- A–B→A On Off — Turn the mode that subtracts trace B from trace A and continuously displays it at trace A On and Off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



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.

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



Setting Active Trace

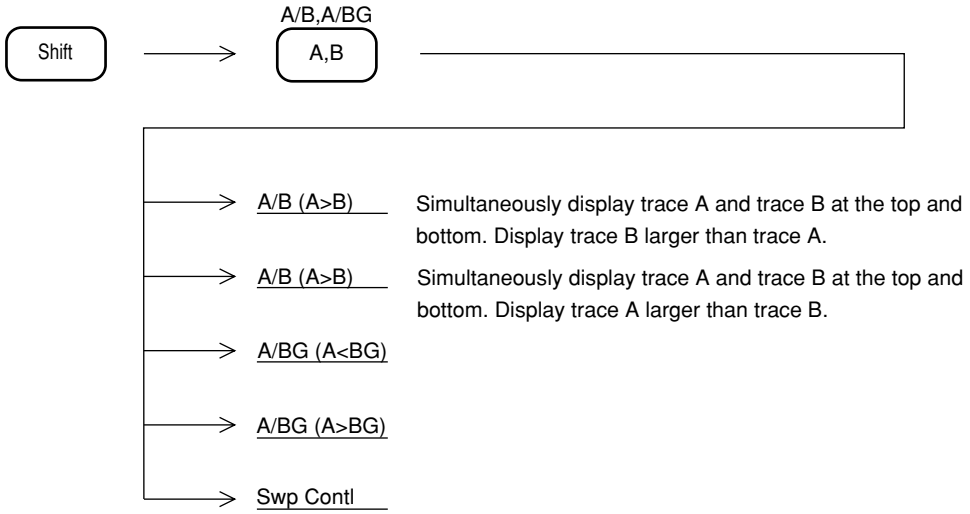
When trace A and trace B were overwritten on the same screen, select the marker trace by pressing this key.

A,B → Active Trace A B

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

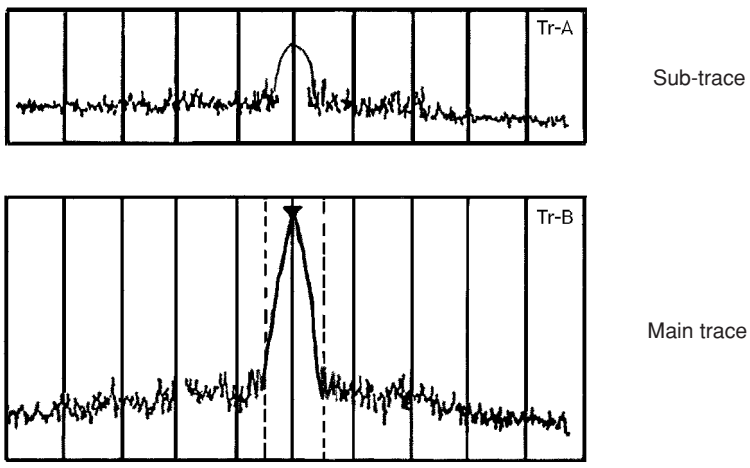
Trace A/Trace B Top and Bottom Split Display

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 frequency that is the source of the interference and interference of a different frequency that is generated by the effect of the source frequency can be simultaneously observed.



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

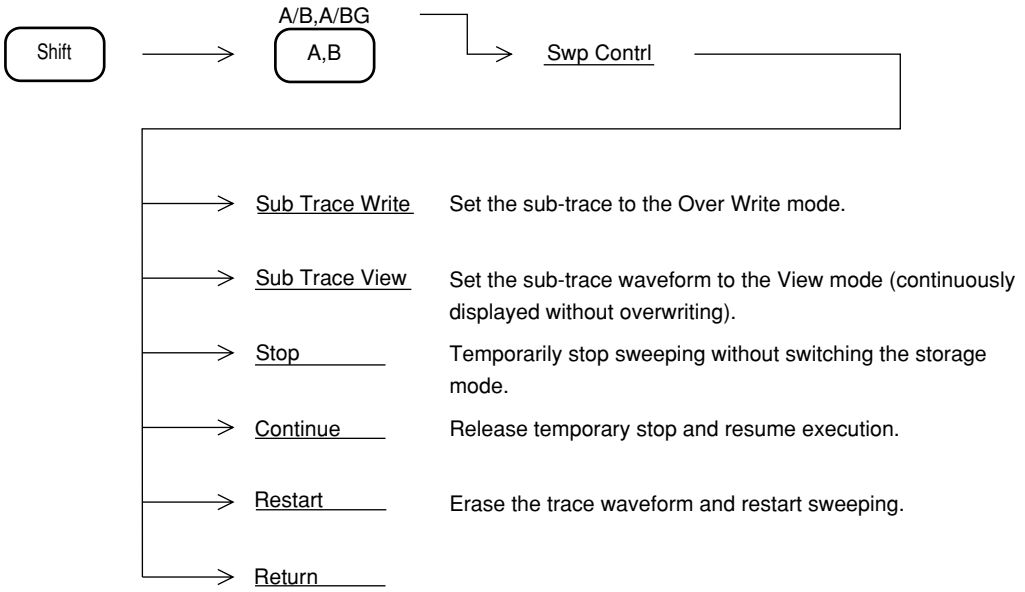
Trace A and trace B are displayed at the top and bottom, respectively.



For A/B (A<B)

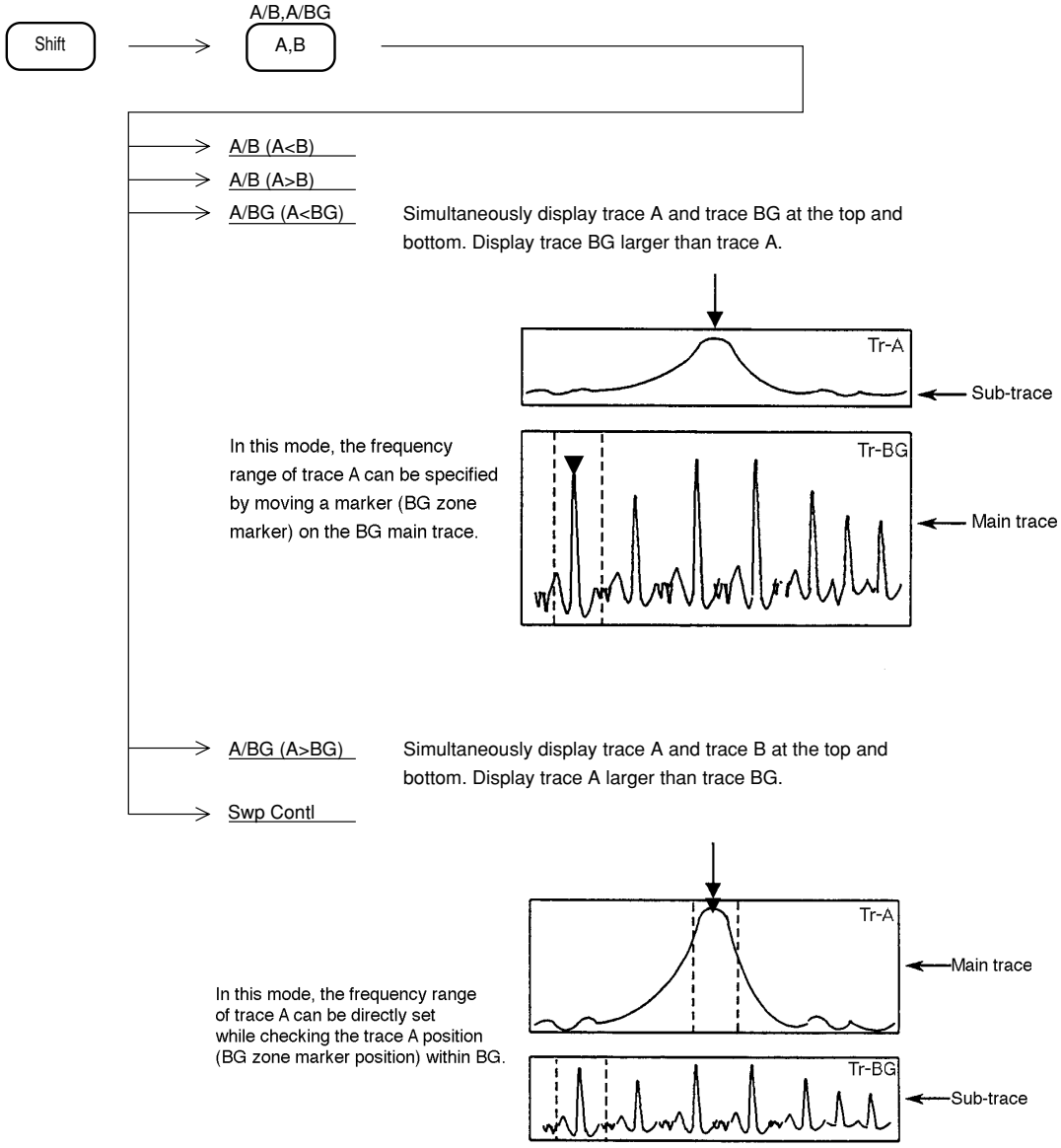
Setting Sub-trace Sweep

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



Trace A/Trace BG Top and Bottom Split Display

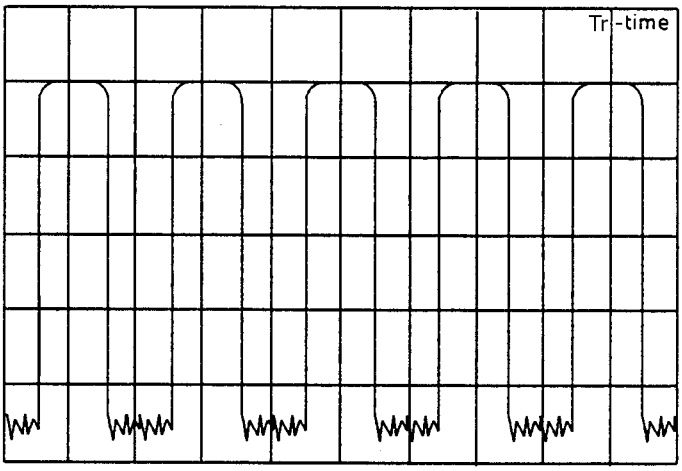
This mode simultaneously displays trace A and trace BG. It is used to extract a specific signal from a wide frequency range.
The conditions over a wide surrounding frequency range can be monitored while simultaneously observing the selected signal in detail.



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

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.

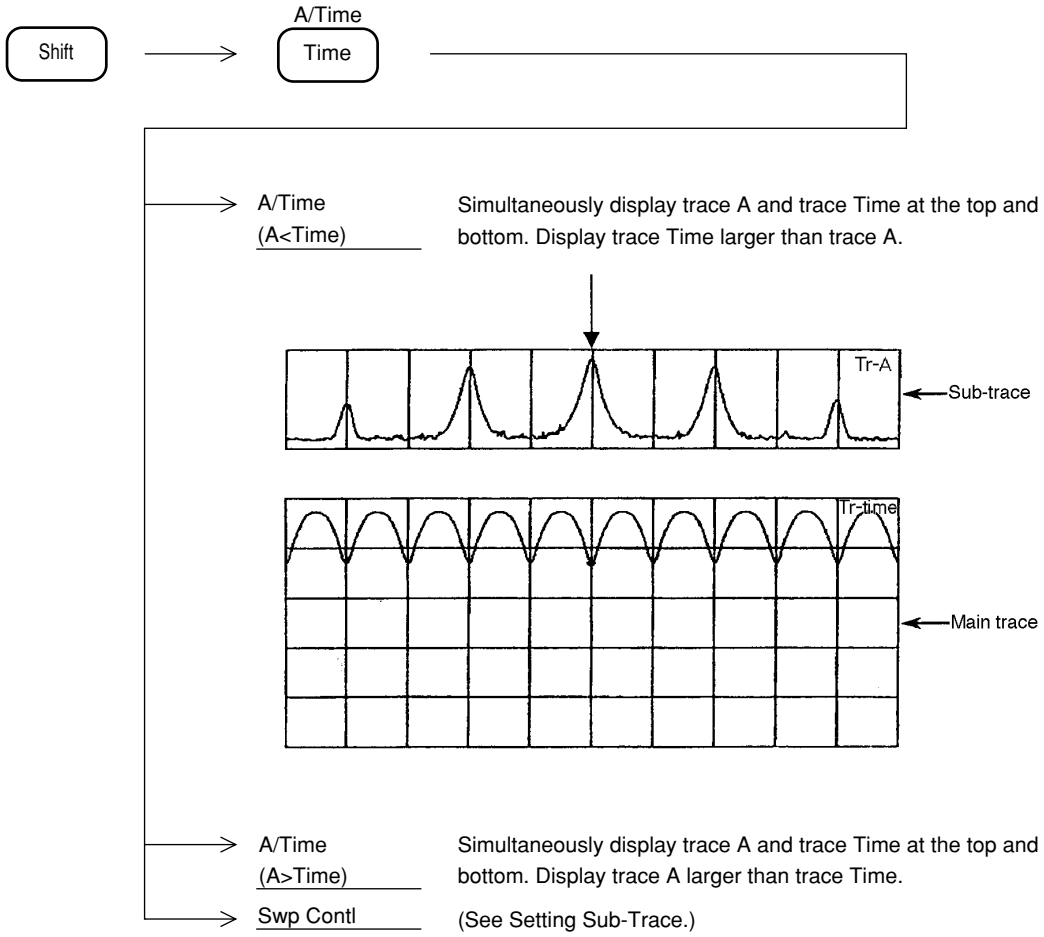
(Display page 2 of the menu by pressing the More key.)

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.

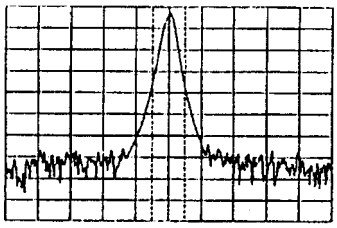
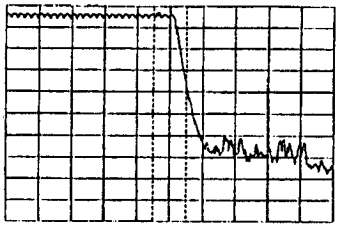
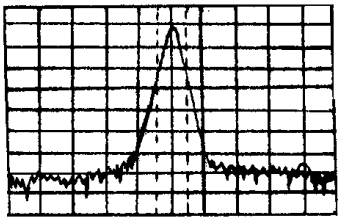
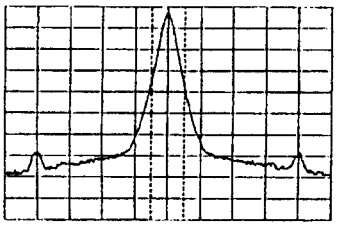


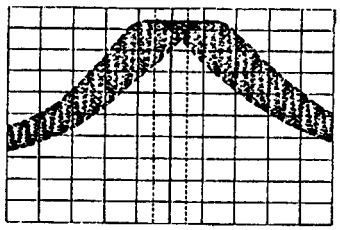
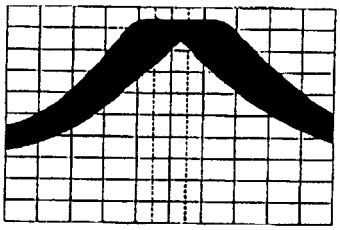
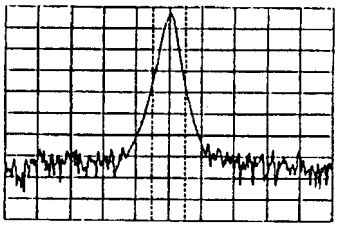
Each parameter can be set in the main trace (larger displayed trace). However, for common parameters (center frequency, reference level, input attenuator, and system setting coupled mode resolution bandwidth, video bandwidth, etc.), the sub-trace parameters can also be converted even when setting is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

Storage Mode

The following seven storage modes can be selected for Display modes trace A, trace B, and trace Time.

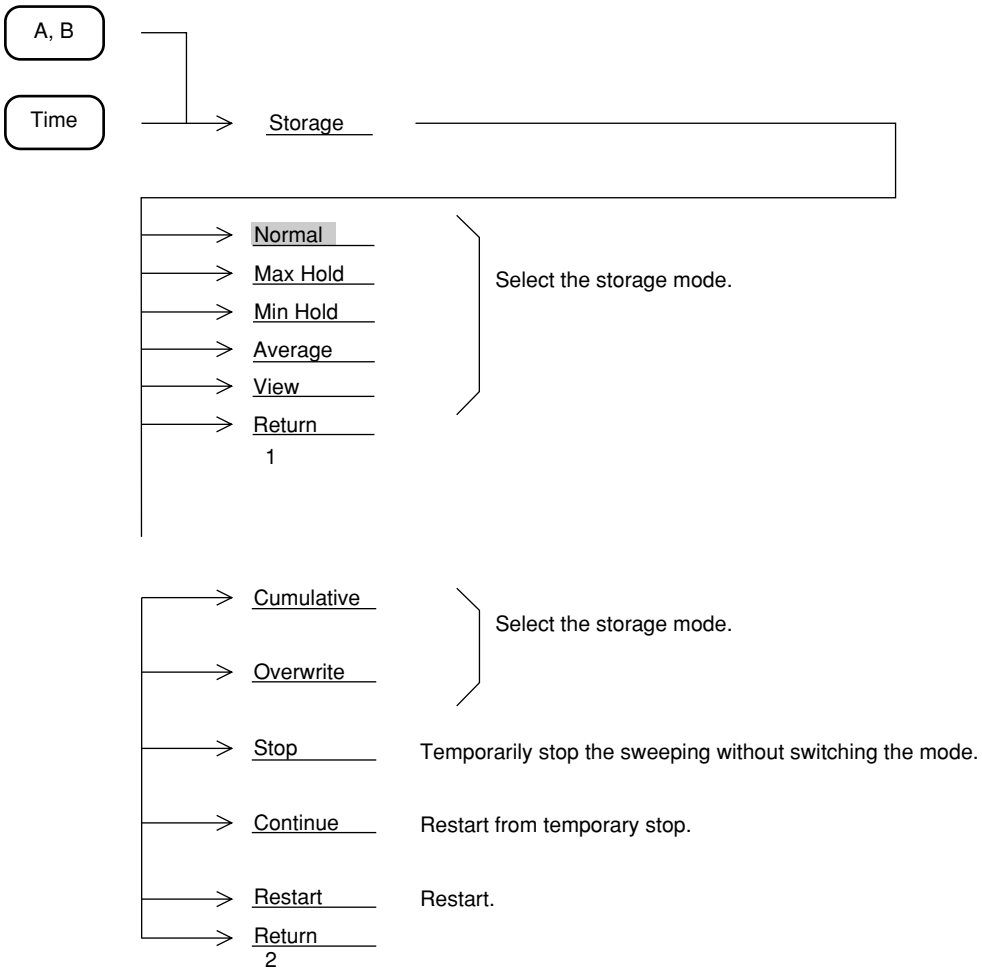
Types of Trace Modes (1/2)

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.	

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

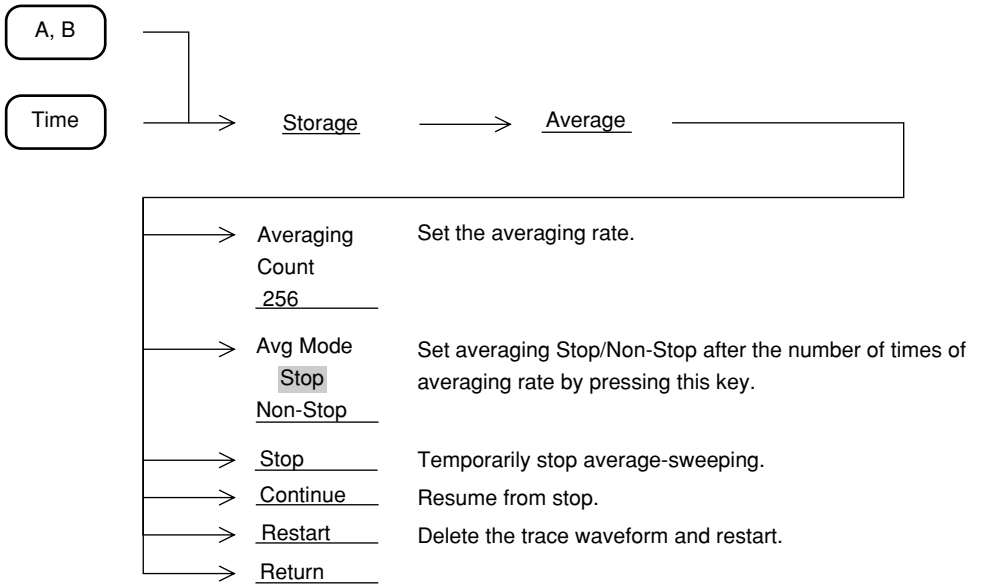
The storage mode can be selected by operating the function keys shown below while the MS2661N is operating in the trace A, trace B, or trace Time mode.



(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.



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.

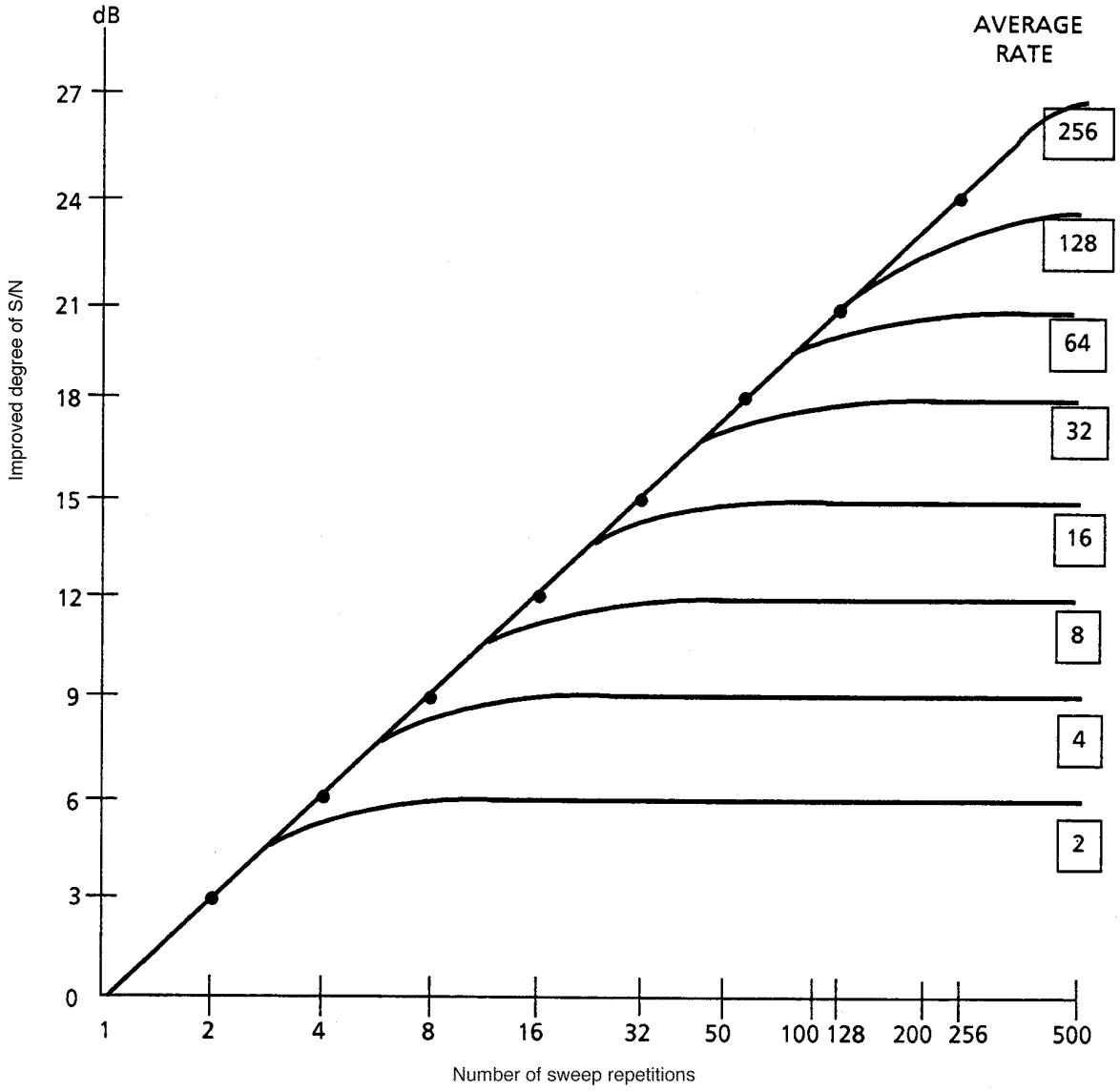
Averaging Rate = N

	Number of sweep repetitions	Measurement value	Displayed value
① Restart	1	M (1)	$Y(1) = M(1)$
	2	M (2)	$Y(2) = Y(1) + \frac{M(2) - Y(1)}{2}$
	3	M (3)	$Y(3) = Y(2) + \frac{M(3) - Y(2)}{3}$
	⋮	⋮	⋮
	N–1	M (N–1)	$Y(N-1) = Y(N-2) + \frac{M(N-1) - Y(N-2)}{N-1}$
① Stop	N	M (N)	$Y(N) = Y(N-1) + \frac{M(N) - Y(N-1)}{N}$
② Continue	N + 1	M (N + 1)	$Y(N+1) = Y(N) + \frac{M(N+1) - Y(N)}{N}$
	N + 2	M (N + 2)	$Y(N+2) = Y(N+1) + \frac{M(N+2) - Y(N+1)}{N}$
	⋮	⋮	⋮

① Sweep stops after N repetitions. (When Avg Mode is Stop)

② The above stop condition is released by restarting sweep by Continue. The averaging operation resumes, while counting the number of sweep repetitions as N+1, N+2....

③ When Restart is performed during sweep or Stop, averaging is repeated from sweep count 1.



S/N Improvement by Digital Video Averaging

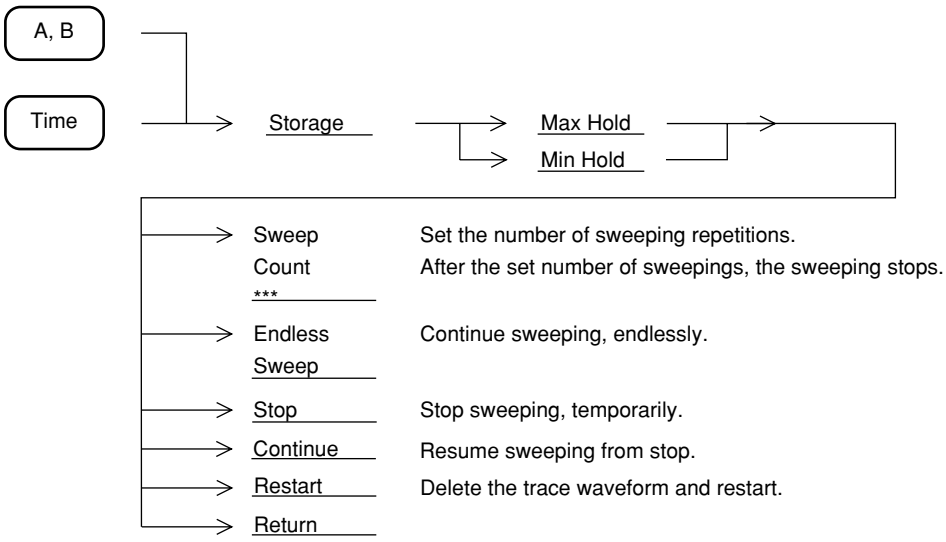
Averaging by video filter has the disadvantage that the sweep time becomes longer when the video bandwidth is narrowed to improve the averaging effect.

On the other hand, digital video averaging smoothes the trace display by averaging the digital data after A/D conversion at each sweep, without narrowing the video bandwidth (VBW). Since the video bandwidth (VBW) gets comparatively wider and the time required for each sweep can be shortened, the entire spectrum image can be verified quickly and the repetitive sweep can be stopped when the required smoothing has been obtained. The problem of averaging with the video filter is that the time required for each sweep becomes longer and it takes a long time to verify the entire spectrum image.

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

Max Hold and Min Hold Functions

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



Detection Mode

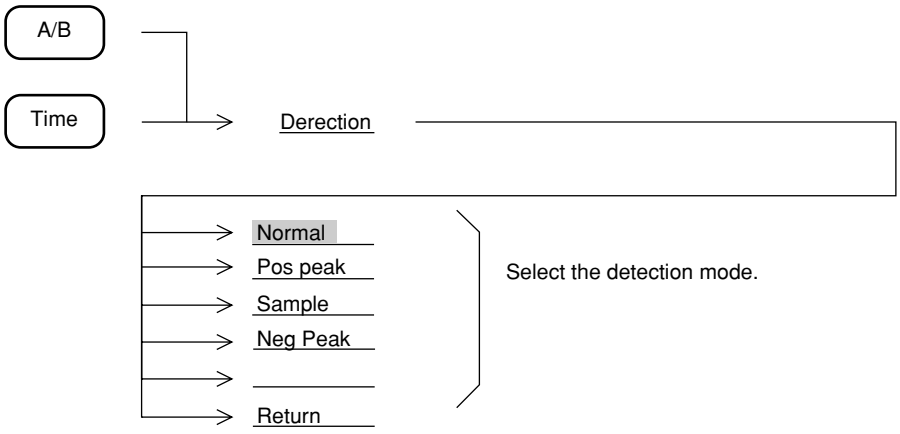
The detection mode can be selected from among Normal, Pos Peak, Sample, and Neg Peak for trace A and trace B and Trace Time.

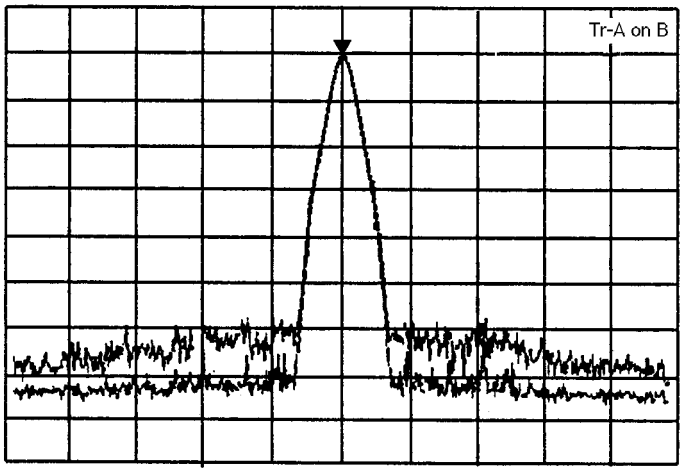
Normal	Traces the maximum value and minimum value between sample points.
Pos Peak	Traces the maximum value between sample points.
Sample	Traces the instantaneous value between sample points.
Neg Peak	Traces the minimum value between sample points.

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.



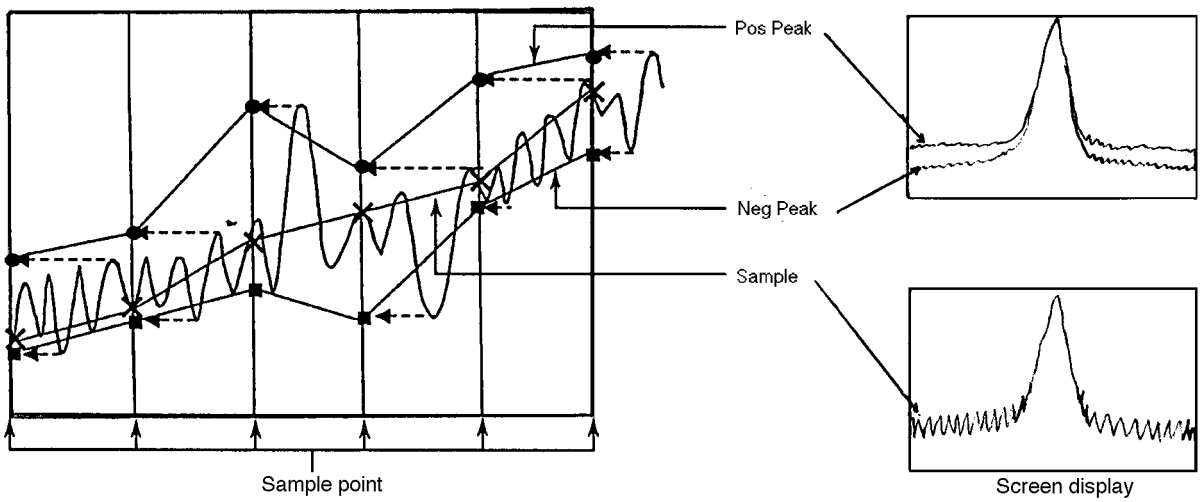


Waveforms when trace A is in the Pos Peak mode and trace B is in the Neg Peak mode

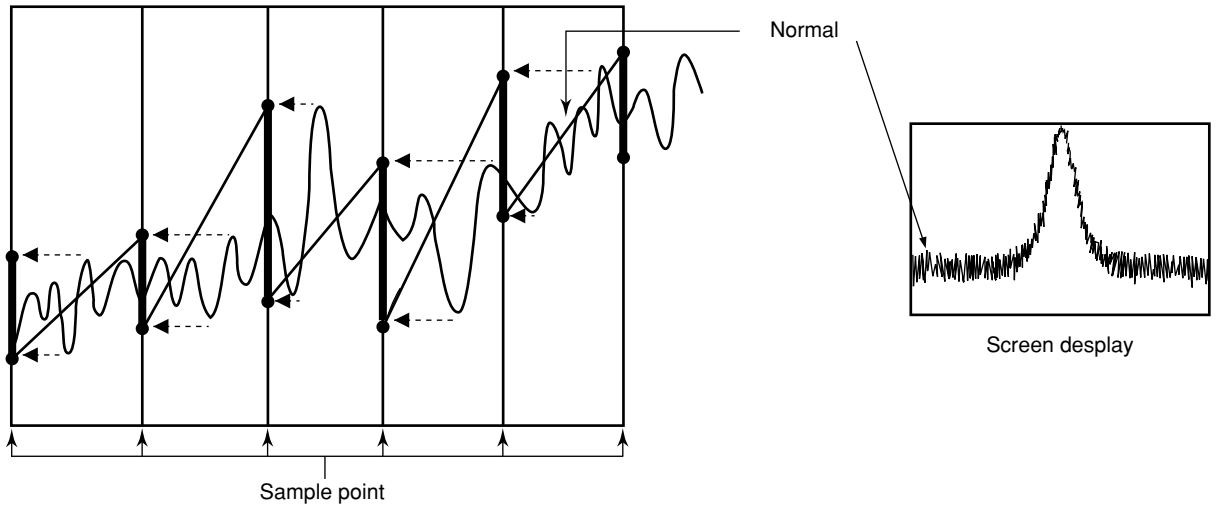
Selecting Measured Level by Detection Mode

The MS2661N 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.



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



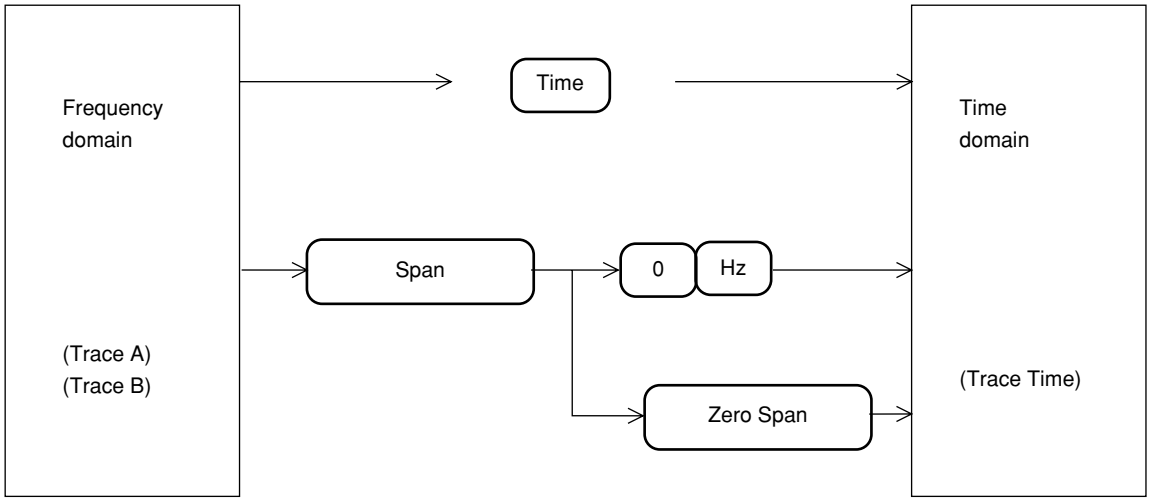
Normal traces and displays both Pos Peak and Neg Peak.

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".
MS2661N 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.



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

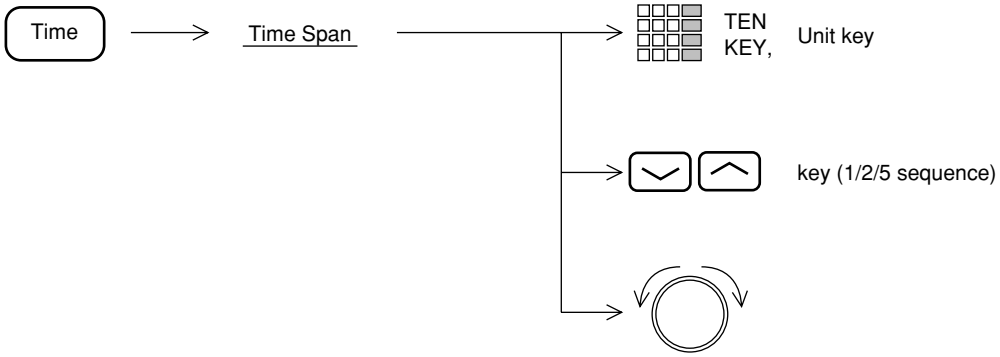
- Vertical scale mode (Log/Lin)
- Vertical scale range (10 dB/div, 10 %/div, etc.)
- Storage mode (Normal, Max Hold, Average, etc.)
- Detection mode (Pos Peak, Sample, Neg Peak, Normal)
- Resolution bandwidth (RBW)
- Video bandwidth (VBW)
- Sweep time (Sweep Time/Time Span)
- Trigger switch (Freerun/Triggered)

The three parameters resolution bandwidth, video bandwidth, and sweep time can be selected in common or independently in the frequency domain 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 does not set the frequency span, but sets the time span. To set the time span, perform the following key operations.

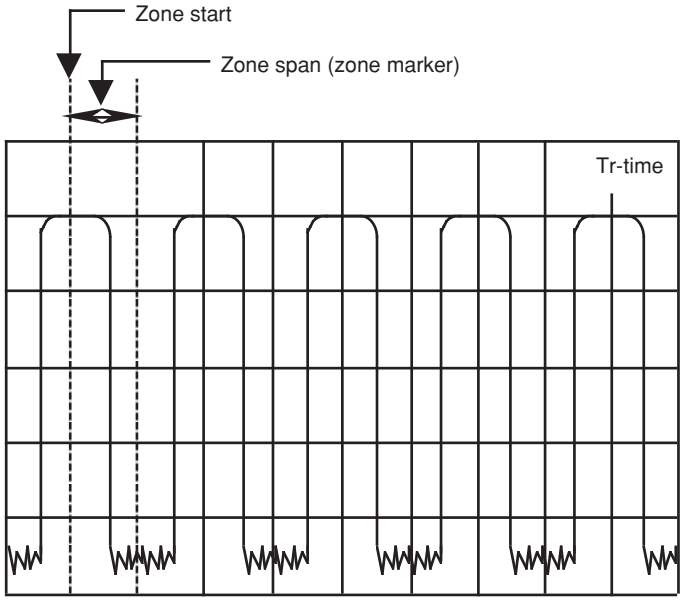


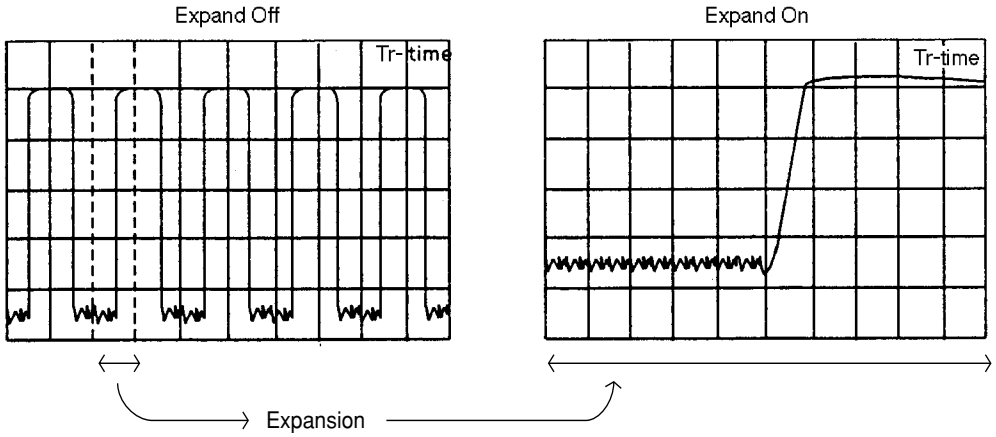
Time Domain Expanded Display

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

Time → Expand

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





The Expand mode cannot executed under the following conditions.

- Trigger mode ..... Freerun

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SECTION 6

SELECTING THE SWEEP METHOD

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

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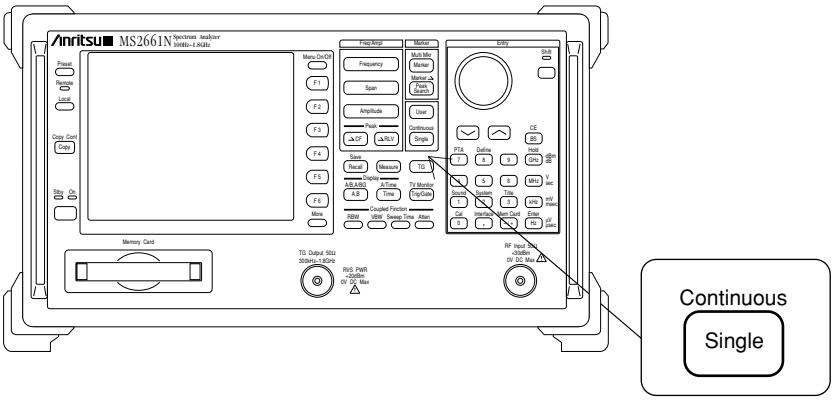
SECTION 6
SELECTING THE SWEEP METHOD

Sweep Mode

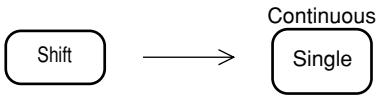
The MS2661N sweep mode is set by using the following key.



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.)

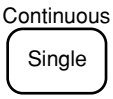


Single Sweep Mode

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

When the trigger mode is set to Triggered, sweep is executed only once when the trigger conditions are met after the Continuous / Single key is pressed.

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



Trigger Mode

The MS2661N trigger mode can be divided into Freerun and Triggered.
In the Triggered mode, Video, Wide IF Video, External, or Line can be selected as the trigger source.

Freerun

When the sweep mode is set to continuous, sweep is repeated continuously. When the sweep mode is set to single sweep, sweep is started immediately after the Continuous / Single key is pressed.

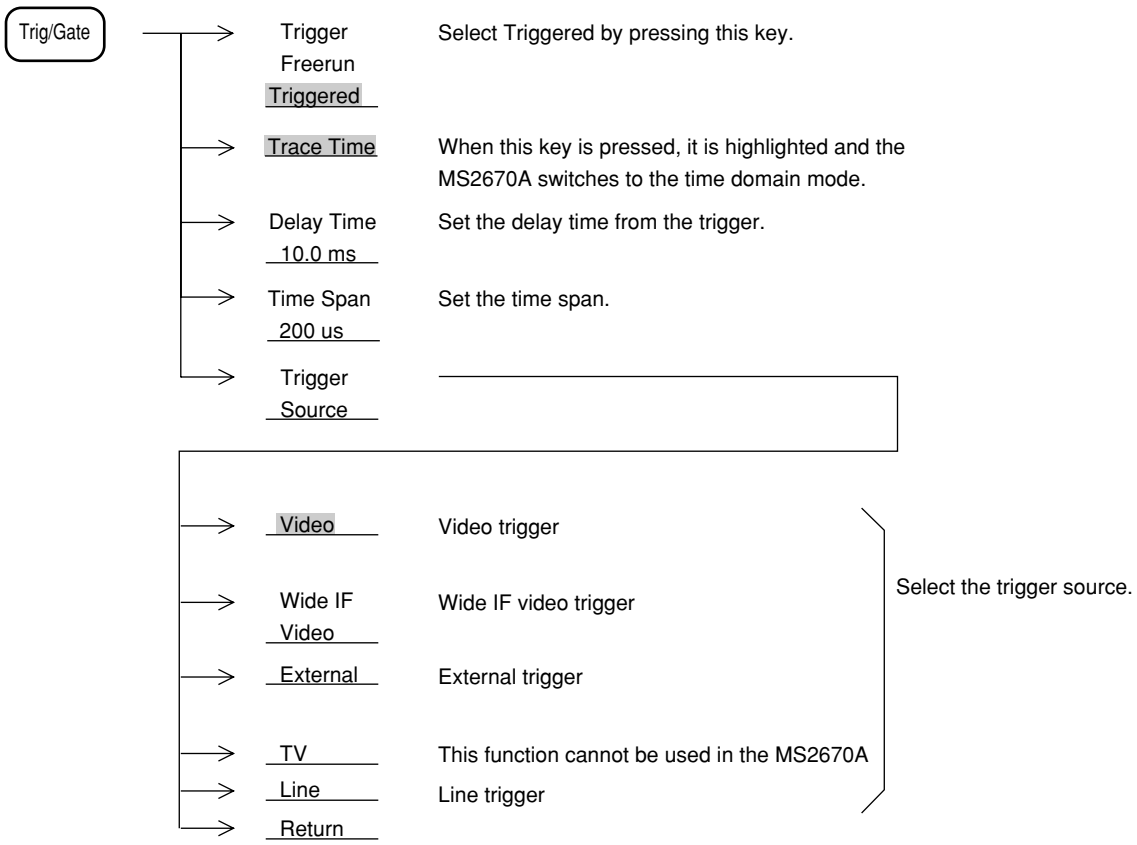
To set the Freerun mode, perform the following key operations. (The Freerun mode is initially set.)

Trig/Gate → Trigger
Freerun
Triggered

Select Freerun by pressing this key.

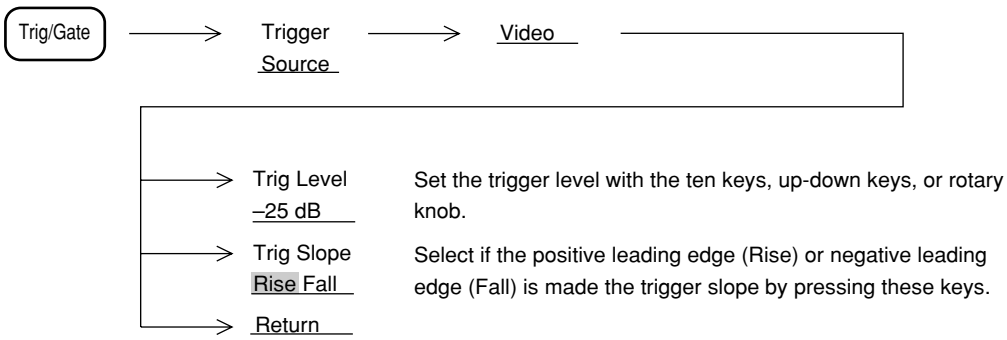
Triggered

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.

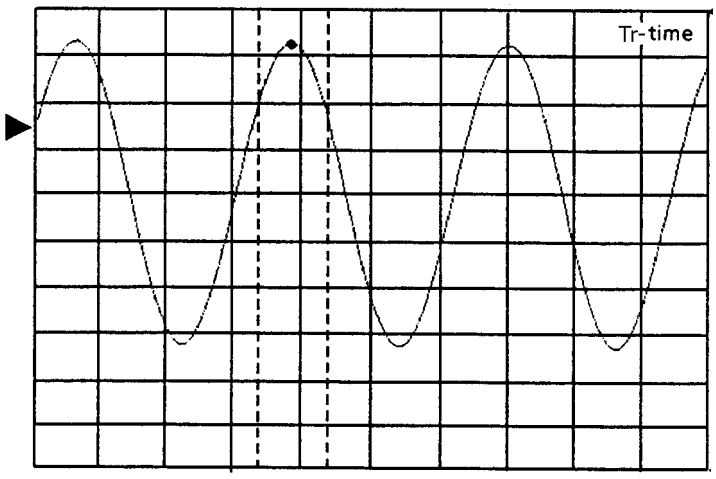


Video Trigger

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

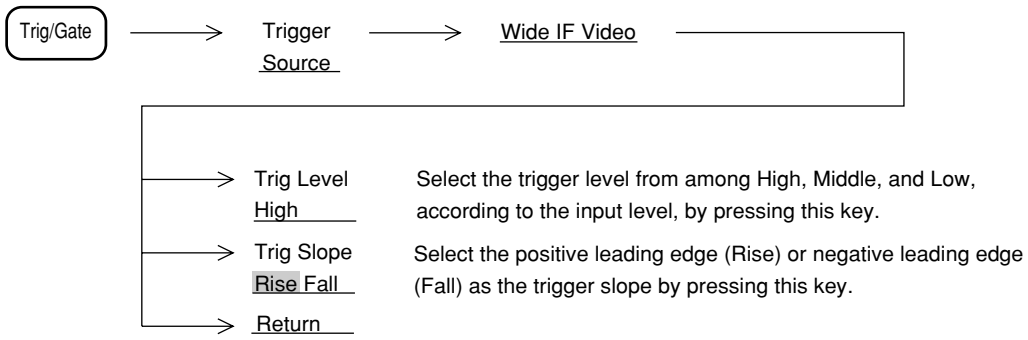


The trigger level is indicated by displaying the trigger level indicator ▶ at the leftmost vertical line of the screen.



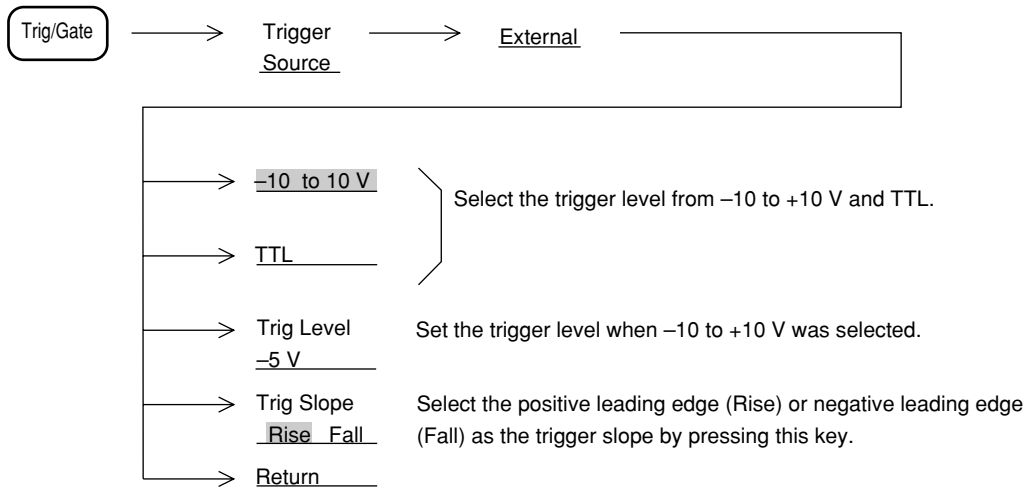
Wide IF Video Trigger

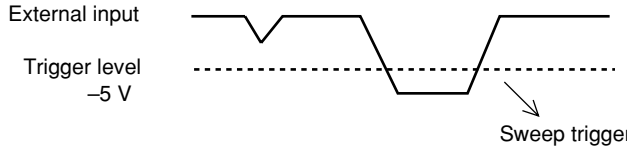
A wide bandwidth IF signal of at least 5 MHz is detected and sweep is started in synchronization with its positive leading edge or negative leading edge.
To select the trigger level and trigger slope, perform the following key operations.
Generally, there is no burst synchronizing signal and this signal is used as a burst wave gate control signal.



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.





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

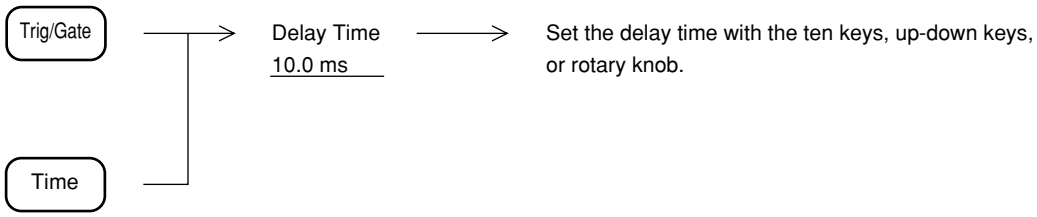
Line Trigger

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

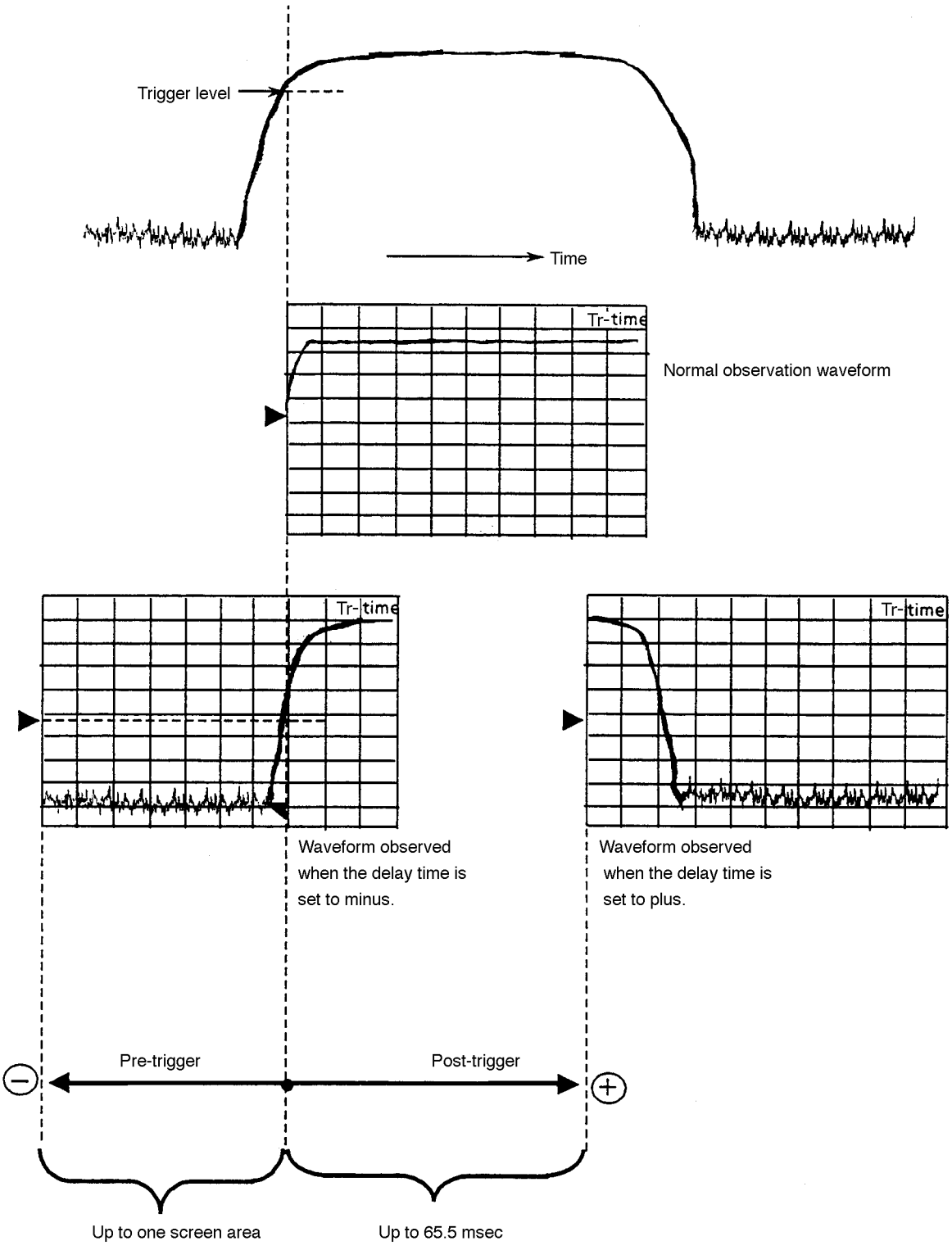
Trig/Gate → Trigger Source → Line

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 MS2661N, a waveform away from the trigger point can be displayed by changing the delay time.
To set the delay time, perform the following key operations.



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



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

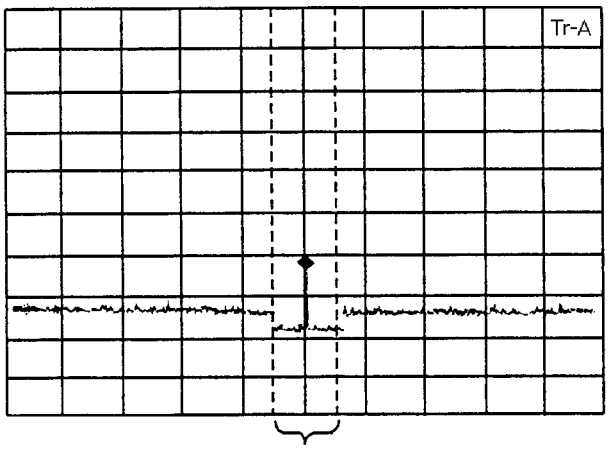
Zone Sweep and Signal Tracking

The MS2661N has two sweep methods-zone sweep which sweeps only within the zone marker and a 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.)

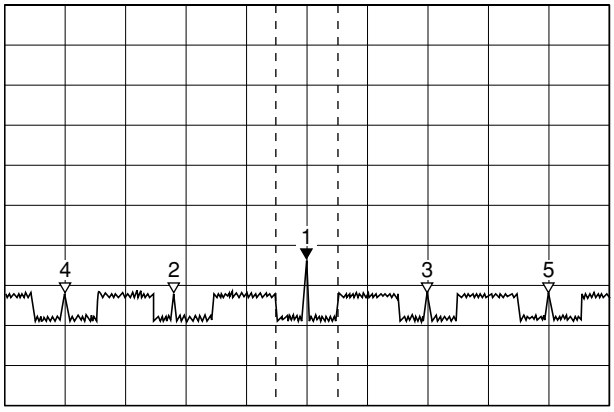
Zone sweep can be conveniently used to closely and quickly analyze part of the whole sweep range on the screen.



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.

When the multimarker function is on, Each multimarker in 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.

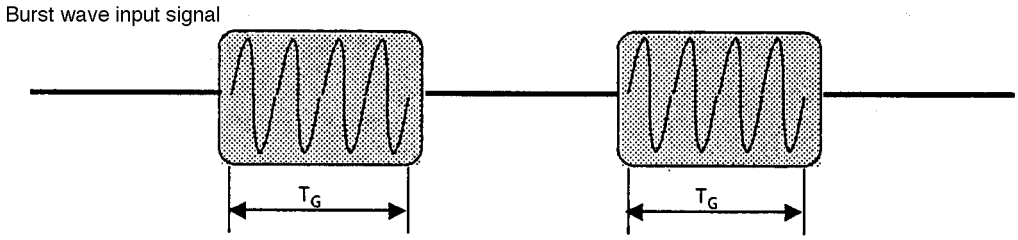
Note: The signal tracking function cannot be executed while the marker is Off or when the instrument is in the time domain mode.

Time Gate Function

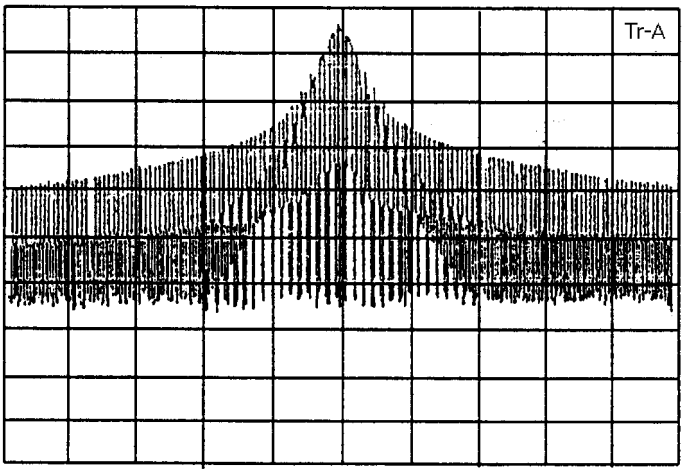
The time gate function is a sweep mode which turns the waveform data display On and Off by the gate control signal generated in the MS2661N based on an external signal or video trigger signal.
Since the timing that displays the spectrum waveform can be set by using this mode, the spectrum when the burst 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.

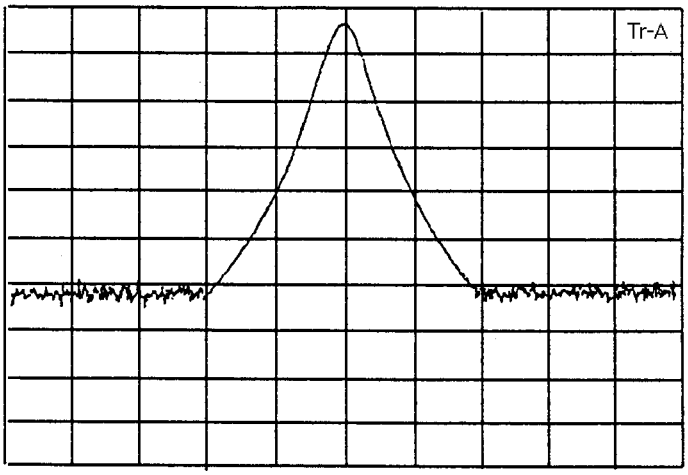


If the spectrum of the burst wave above is analyzed as is,



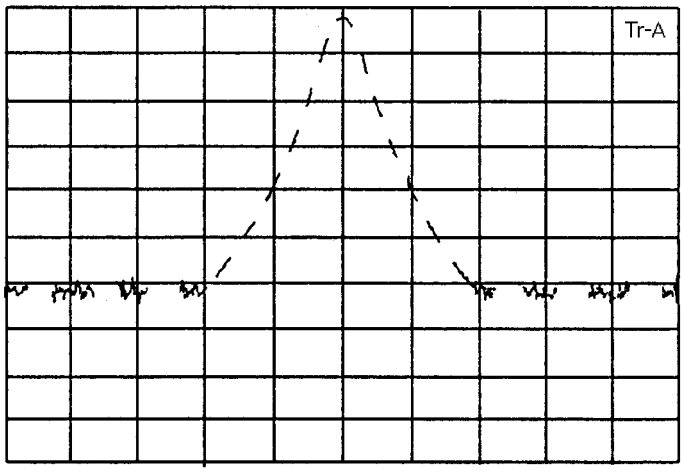
The spectrum spread by the positive leading edge or negative leading edge of the burst wave prevents the spectrum from being observed with the burst set to On.

If the spectrum can be analyzed only during the gate time T_G,

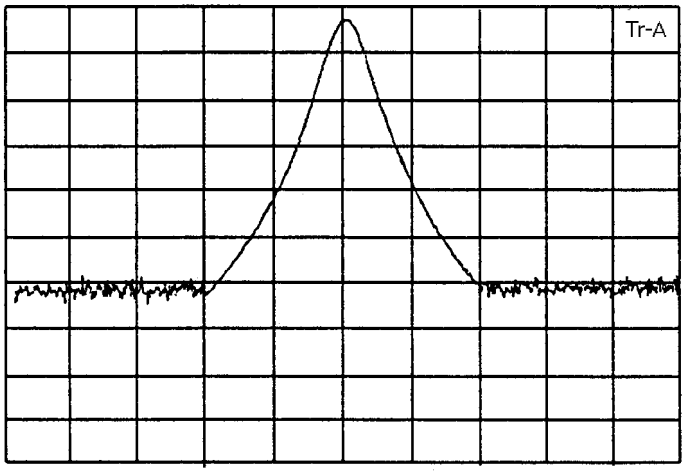


Only the spectrum when the burst is set to On is displayed.

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



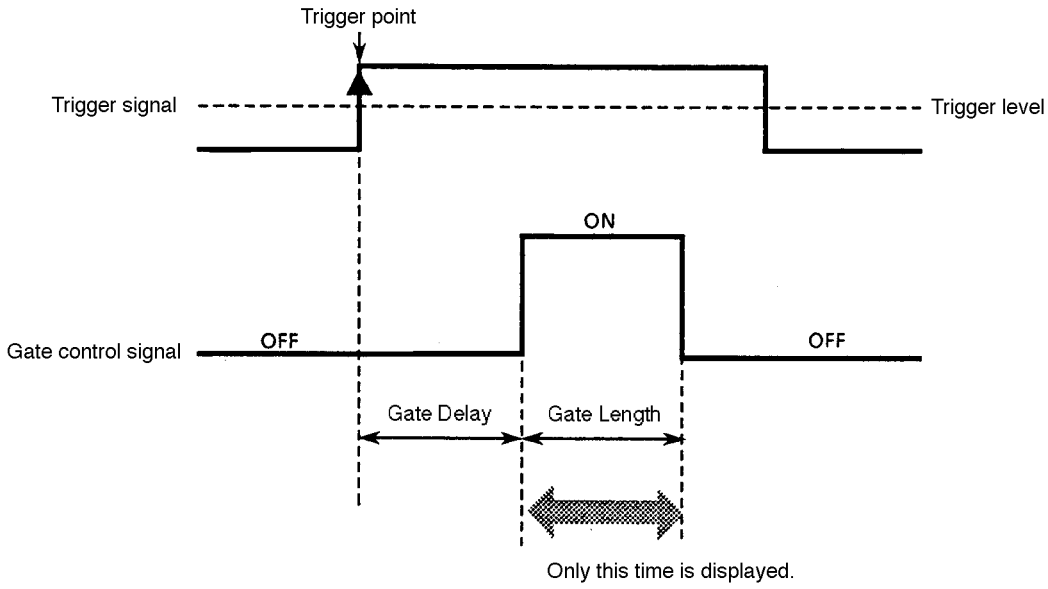
More Sweep Repetitions

Example of Frequency Spectrum Measurement on Burst Signal

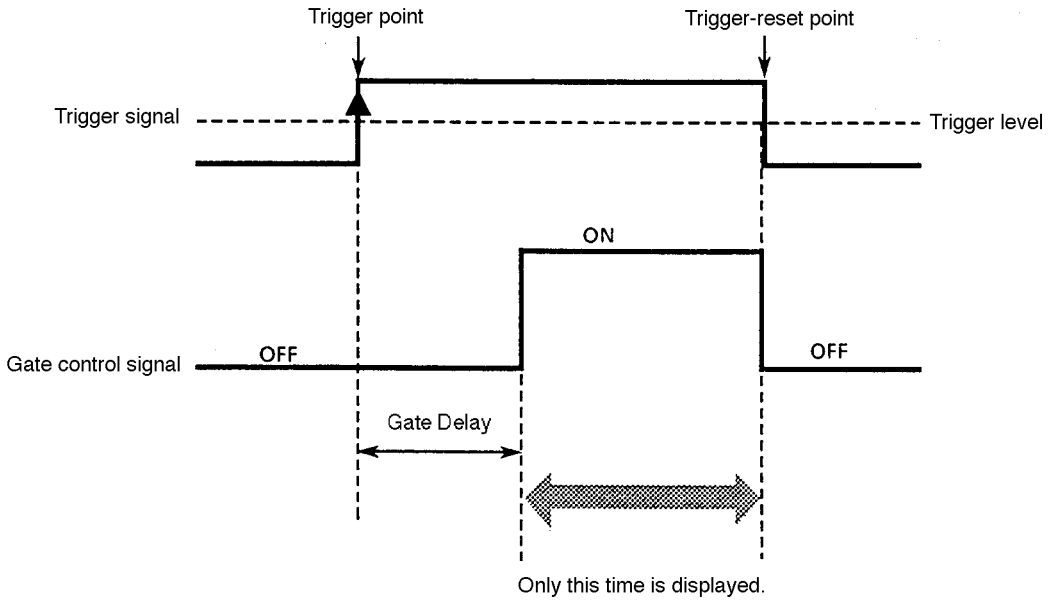
Creating a Gate Control Signal

If the point where an external trigger signal (Ext Input only) or a wide IF video trigger signal is triggered is assumed to be the reference position, the gate control signal remains On over the period from the point immediately after the Gate Delay time has elapsed from the reference position to the time set by Gate Length, or to the time reset by a trigger signal.

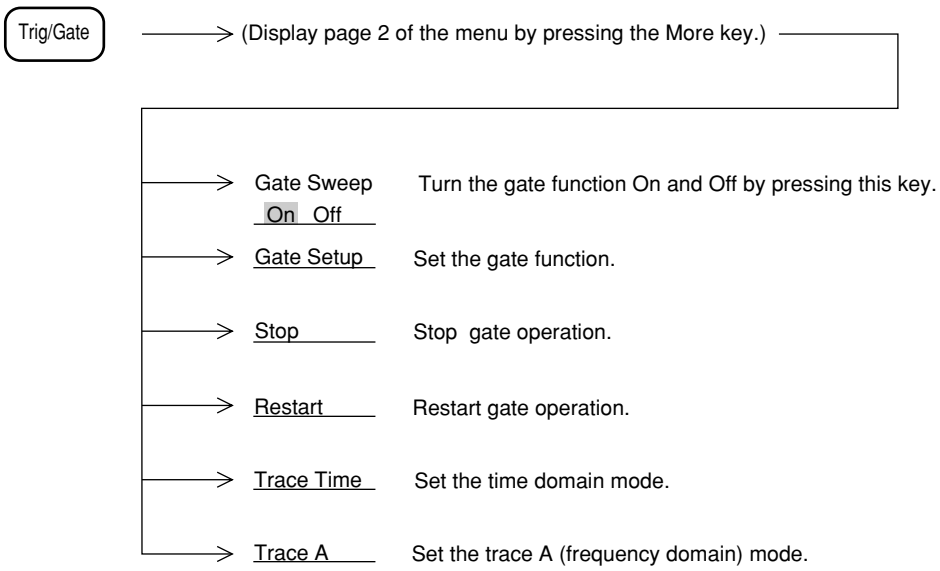
- Gate End: When Int selected



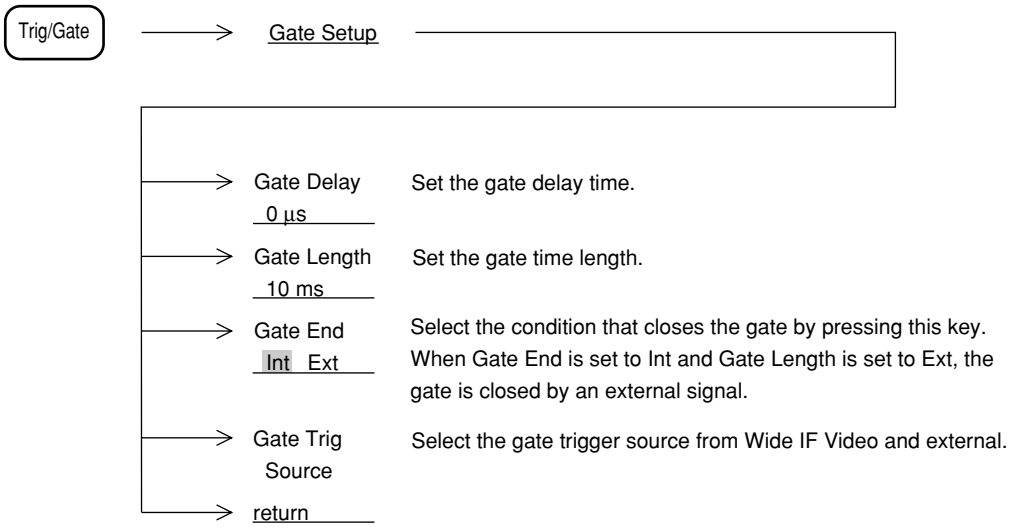
- Gate End: When End selected



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

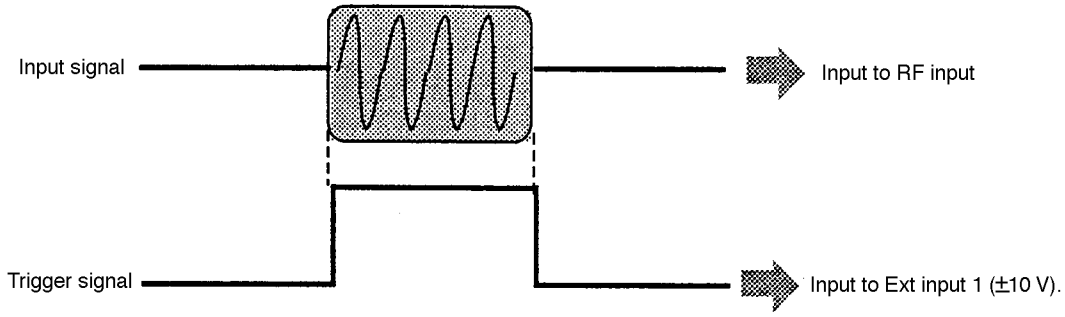


Setting Gate Function

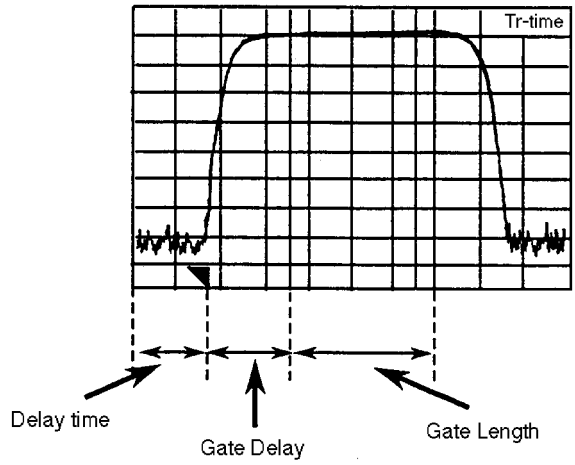


The time domain mode facilitates setting the gate control signal time. The following shows an example of how to use the Time Gate function that uses the time domain mode.

Step	Procedure
1	Input the following signals to the MS2661N.

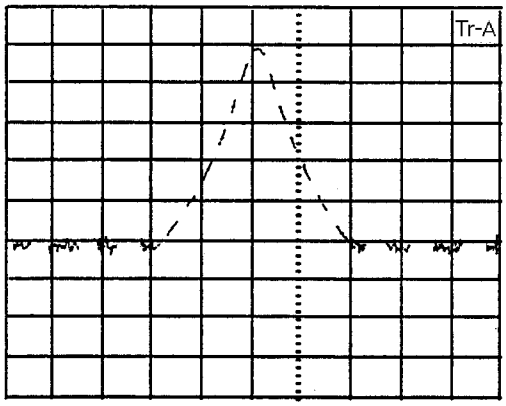


2 Display the waveform in the time domain mode. Synchronize the input signal by setting the trigger mode to Triggered and the trigger source to Ext Input 1 (–10 to 10 V).

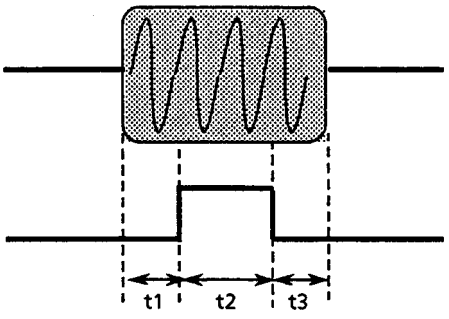


3 Set Gate to On. Vertical lines (gate cursor) should appear at the Gate Delay and Gate Length positions. Set Gate Delay and Gate Length to appropriate positions while observing the waveform.
At this time, adjust the resolution bandwidth and video bandwidth in the time domain mode to equal those in the 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.

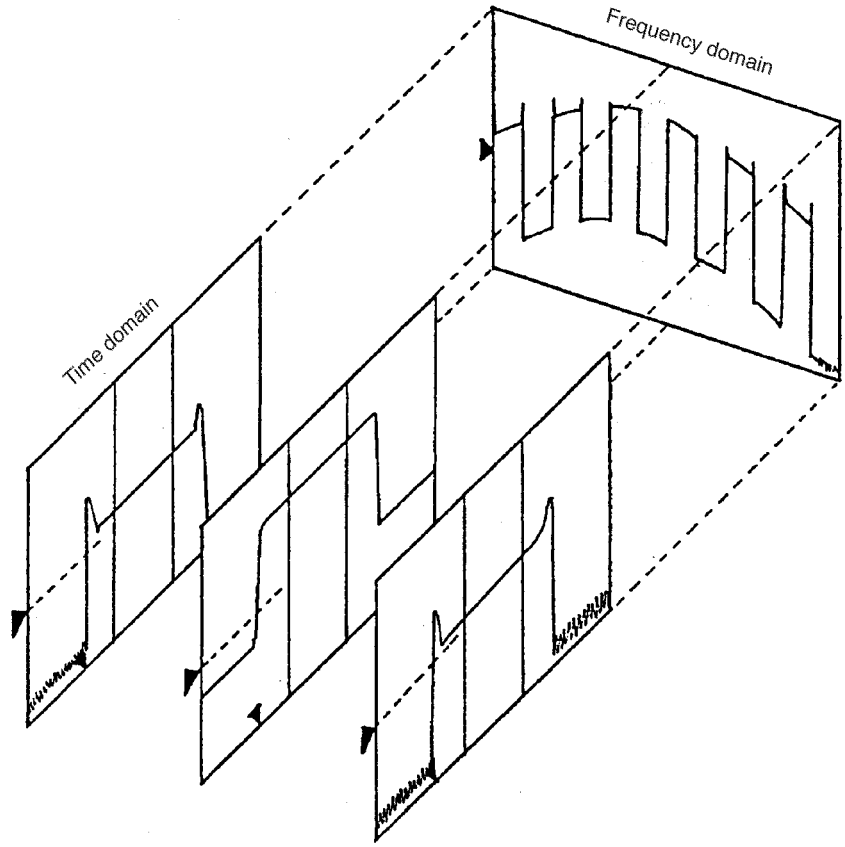


RBW	t1	t2	t3
1 kHz	≥ 3 ms	≥ 20 ms	≥ 1 ms
3 kHz	≥ 1 ms		
10 kHz	≥ 230 ms		
30 kHz	≥ 200 ms		
100 kHz	≥ 20 ms		
300 kHz	≥ 15 ms		
1 MHz 5 MHz	≥ 10 ms		

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

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

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



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

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SECTION 7
COUPLED FUNCTION

This section describes the coupled function. Generally, the MS2661N 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 mainly describes manual settings that are used to set the coupled function according to the application.

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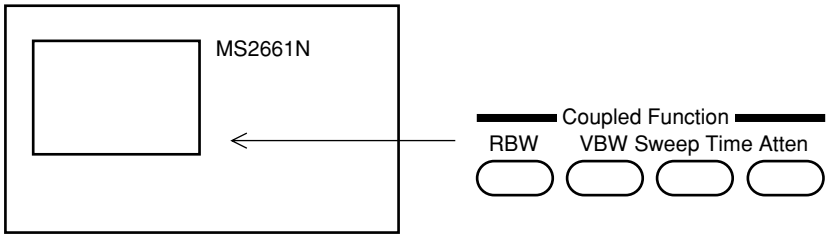
SECTION 7
COUPLED FUNCTION

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 MS2661N 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 even if the frequency span is varied, the respective parameters are automatically set to the optimum values so that frequency and level measurement errors do not occur.

The following shows the Swp Time Auto setting range:

- Lower limit value
  20 msec

- Upper limit value
  1000 sec

(2) Manual setting

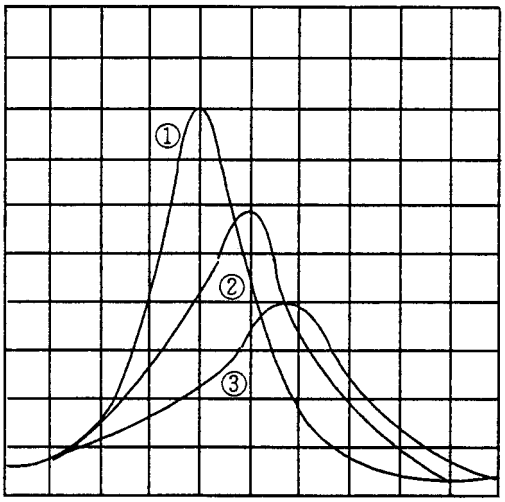
If RBW, VBW, and Sweep Time are set to the Auto mode, normal measurements can be made without considering their settings.
However, in the following cases, RBW should be set to the Manual mode.

① General measurements: When observing two adjacent signals, increasing the frequency by narrowing the RBW can reduce the noise level (a tenth part of the current RBW results in a 10 dB reduction).
However, if the RBW is too narrow, the spectrum waveforms will become too steep, the response characteristics become worse, and the sweep time will also become longer. Therefore, the RBW value should be determined to give a practical sweep speed.

② Intermodulation distortion measurement: When measuring two signal intermodulation distortion with a comparatively wide frequency span and a reduced noise level, the RBW value should be narrowed by manual setting. However, the sweep time increases in inverse proportion to the square of the RBW.

The RBW can be selected from among the following by Manual setting:

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

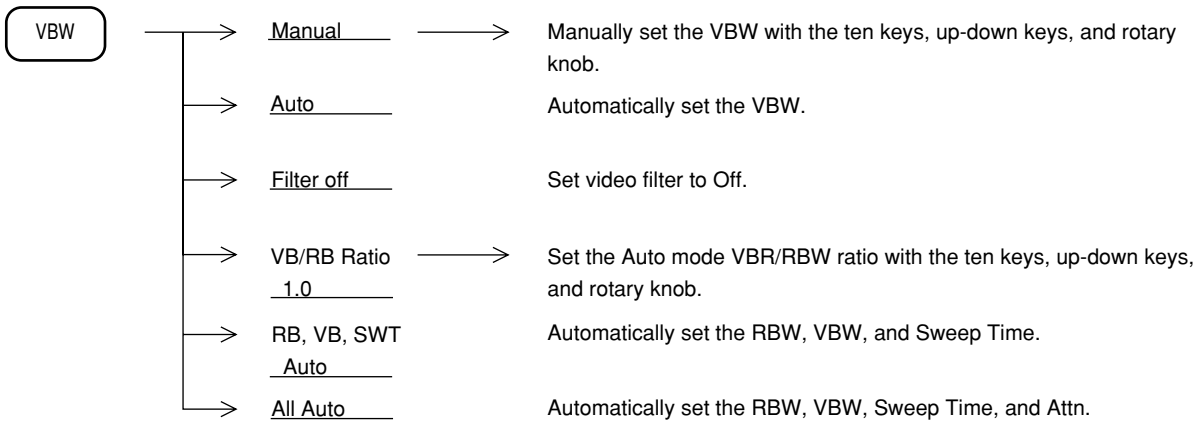


① Optimum trace waveform
②, ③ UNCAL trace waveforms

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

Video Bandwidth (VBW)

To set the VBW, perform the following key operations.



(1) Auto mode

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

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

Note: Since 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.

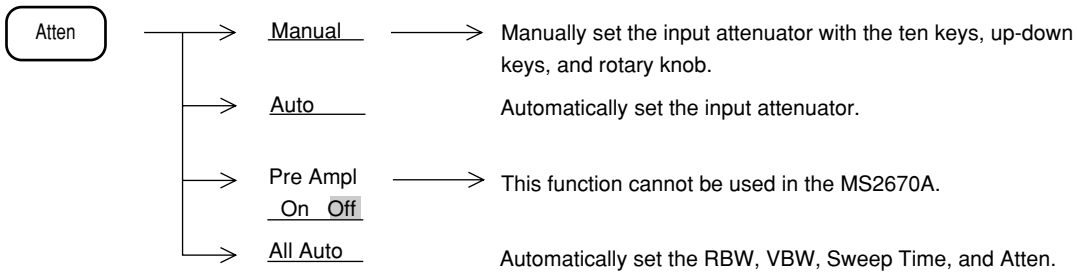
The VBW value can be manually set from among the following values:

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.



(1) Auto mode

When the reference level is set while Auto is selected, the input attenuator is automatically set to the optimum value according to the reference level.

(2) Manual setting

When a signal with the same level as the reference level is input, the input attenuator value in the Auto mode is controlled so that high accuracy measurements can be made without being influenced by gain compression and the noise level can be reduced. However, 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 MS2661N measurement error.

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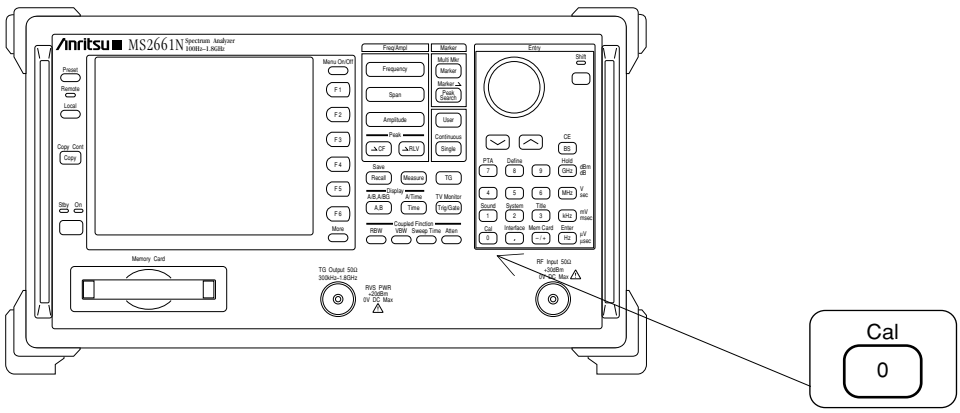
SECTION 8
AUTOMATIC CALIBRATION AND LEVEL CORRECTION FUNCTIONS

Automatic Calibration Function .....CAL

The MS2661N incorporates a 625 kHz calibration oscillator and a calibration attenuator, which perform automatic calibration so that the MS2661N can minimize measurement errors and make high accuracy measurements.

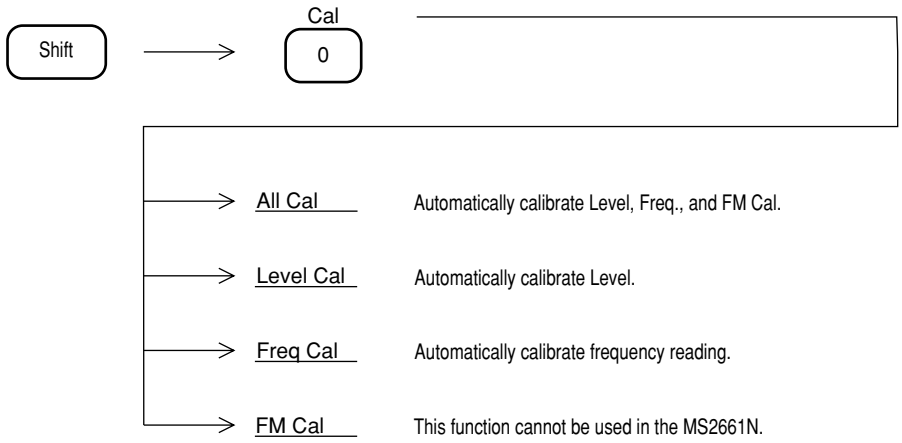
WARNING

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 MS2661N automatic calibration by performing the following key operations.



Details of Each Calibration Item

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

ALL CAL	LEVEL CAL	Reference level error calibration	Calibrates the absolute-value levels on the LOG/LIN scale.
		LOG-scale linearity calibration	Calibrates the LOG-scale linearity.
		IF Gain switching error correction	Calibrates the error caused by the IF gain from among the level errors when the reference level is switched.
		RBW switching error calibration	Calibrates the error when the resolution bandwidth (RBW) is switched.
		Detection-mode switching error calibration	Calibrates the level error when the detection mode (Pos Peak, Sample, Neg Peak) is switched.
		Input-attenuator/pre-amplifier switching error calibration	Calibrates the level error when the input-attenuator/pre-amplifier is switched.
	FREQ CAL	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.

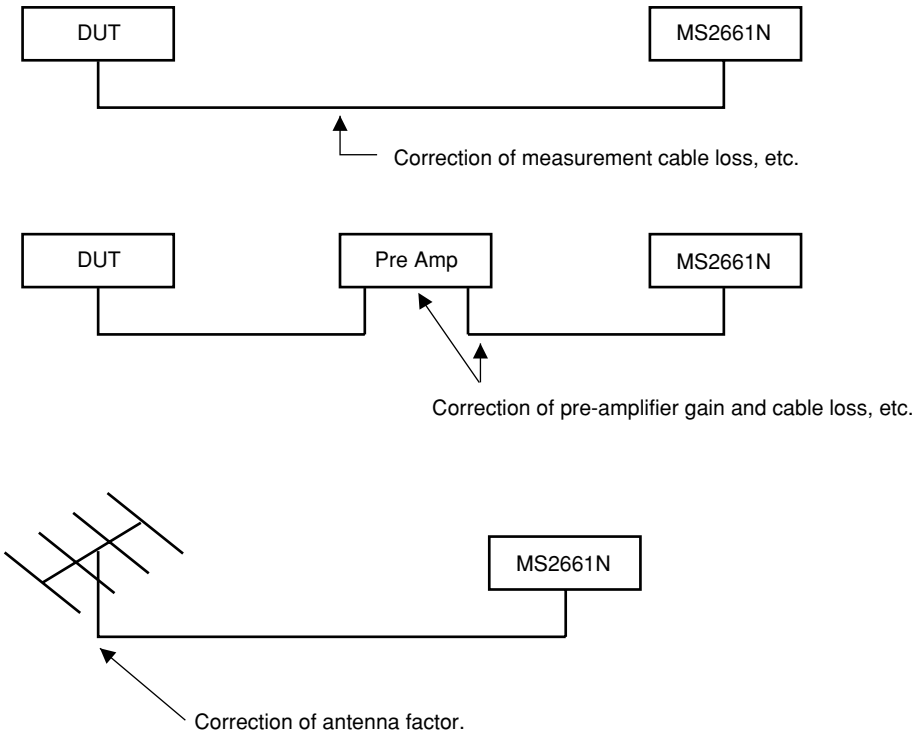
When ALL CAL is executed, the calibration data is retained by the built-in battery back-up even when the MS2661N power is turned off. Therefore, it is not always necessary to execute automatic calibration each time the power is turned on. However, when a particularly high accuracy measurement is required, 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.

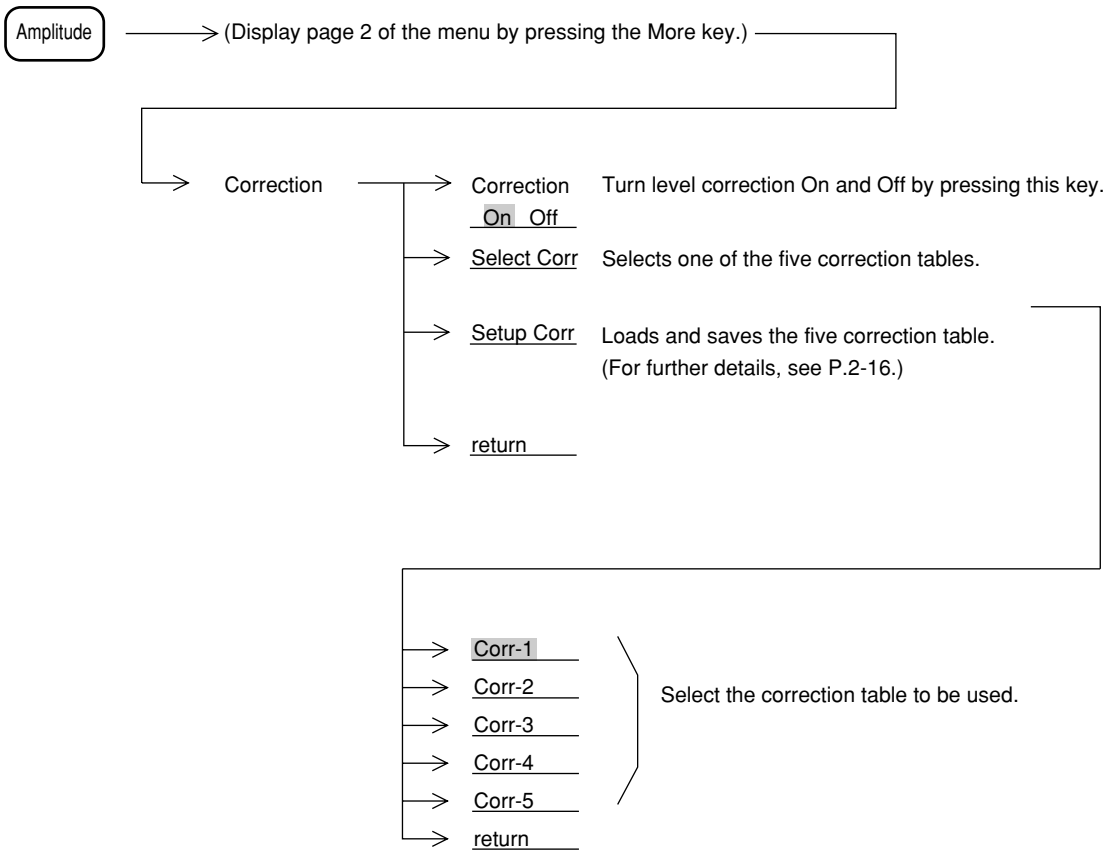
① Frequency characteristics and loss of measurement cables
② Frequency characteristics and loss of pre-amplifier, etc. connected to RF input connector
③ When wanting to measure the field strength with an antenna or near-field probe connected (antenna factor correction)



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.

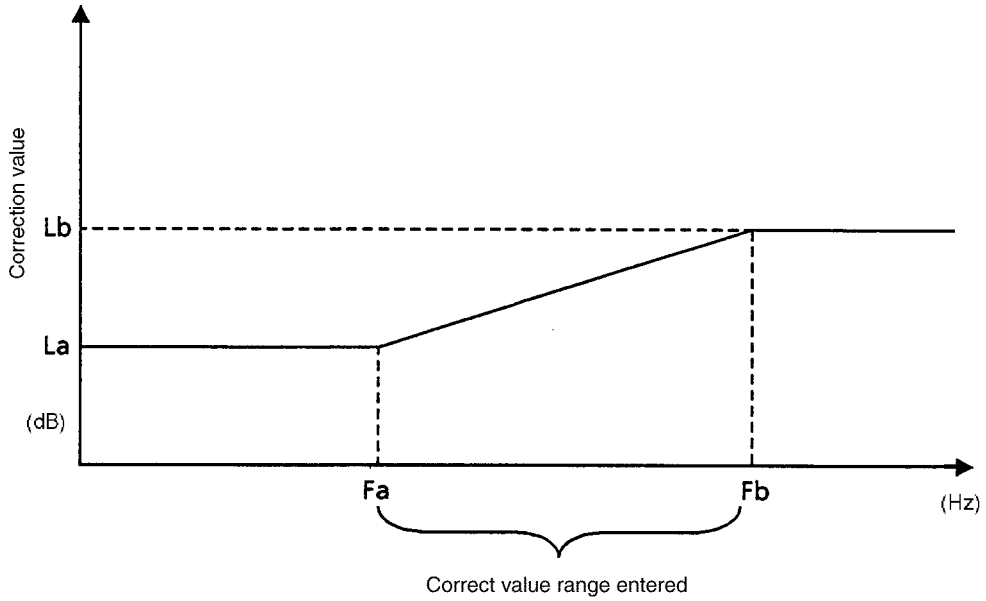
Up to five correction factors (maximum 150 points each) can be stored in the internal memory by storage from an external computer via an external interface or by using the internal PTA. For a more detailed explanation of these methods, refer to the Remote Control part of the separate operation manual.

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



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

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



Notes:
① No correction factor is entered at the factory. The correction values are all 0 dB.
② The correction value is backed-up by a battery. Therefore, once the value has been entered, it is not lost even after the power is turned off.
③ The Corr-1 to Corr-5 soft keys allow each menu label to have 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 MS2661N 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 MS2661N can be set depending on the usage objective.

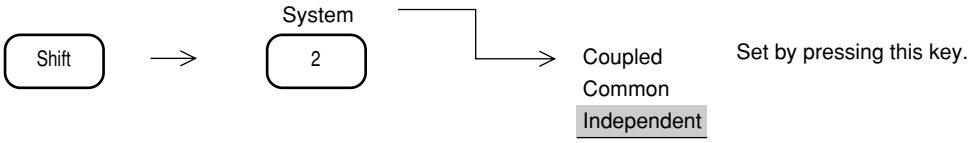
- Frequency domain and time domain coupled function value common/independent setting ..... Coupled Common Independent
- Measurement parameters and date display type setting ..... Display
- Screen display color (color pattern) setting ..... Change Color
- Setting Mode at Auto Sweep Time ..... Auto SET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



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)

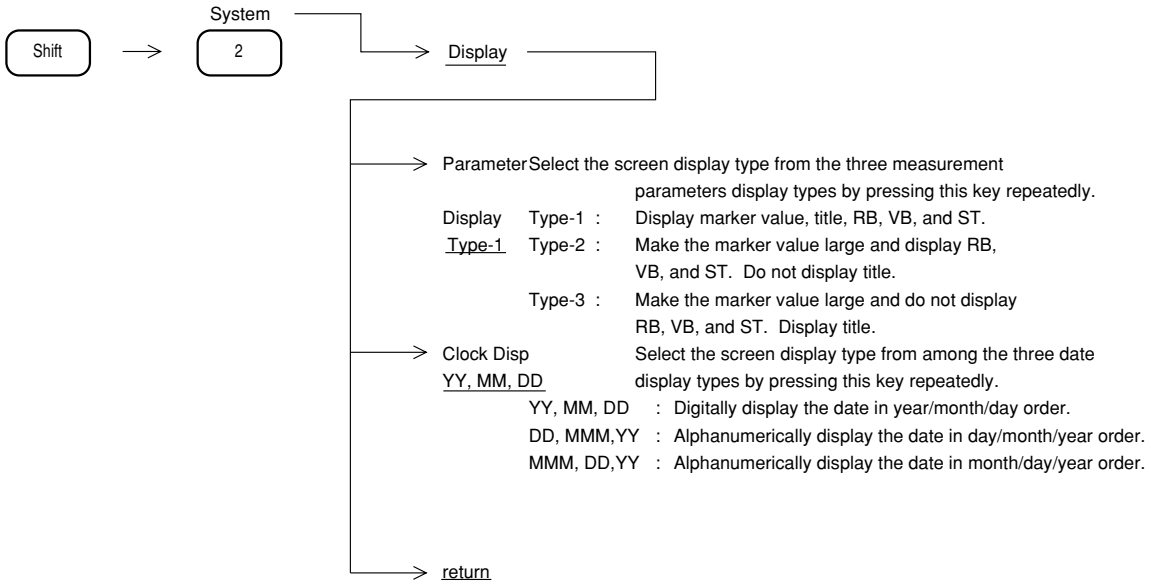
Example: After switching to the time domain mode to set the time span to 100 µsec when the sweep time is 300 msec in the frequency domain mode, the display mode returns to the frequency domain mode.

↓

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.

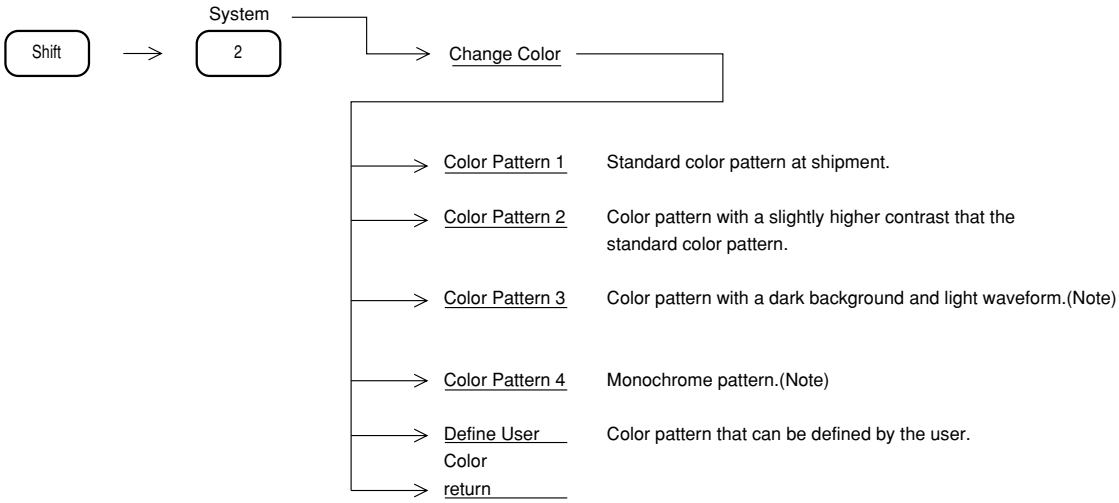
Screen Display Type System Setting

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



Modifying Display Color (Change Color)

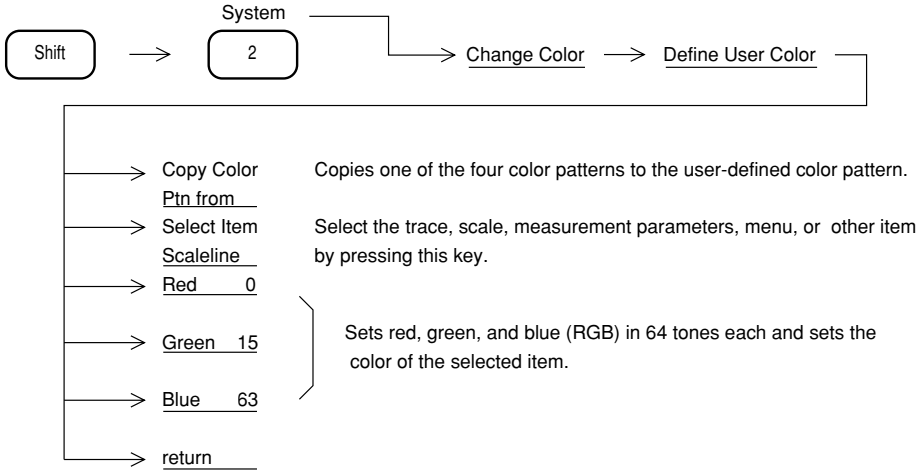
This function changes the color of the trace waveform, scale, measurement parameters, menu, and other items displayed on the screen. The color pattern can be selected from among four color patterns, or defined by the user.



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

User Definition of Display Color

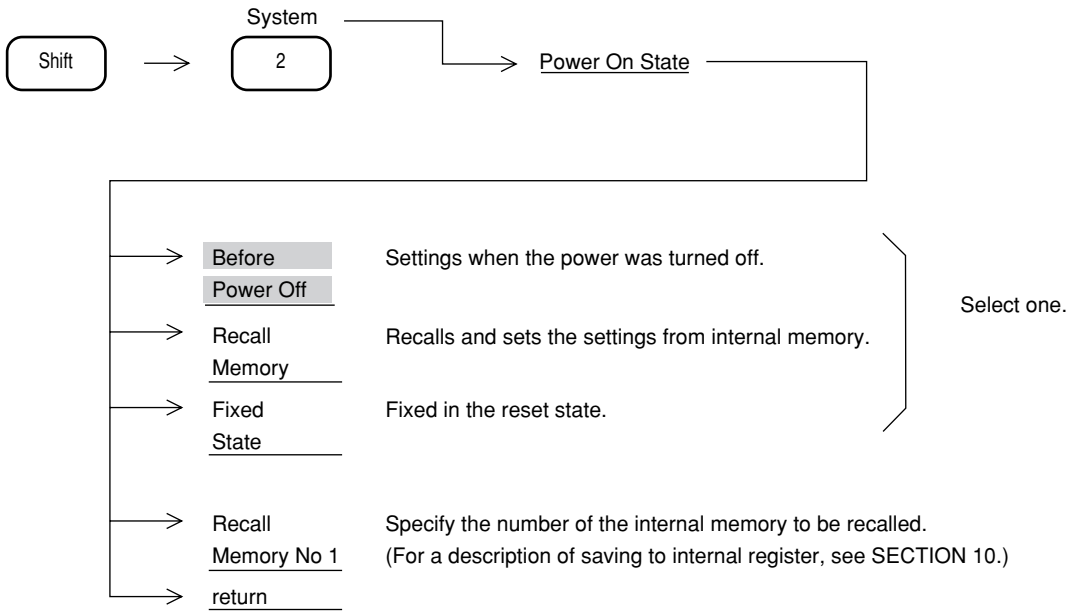
The MS2661N has a color pattern function that allows the user to define the color of the trace waveform, scale, measurement parameters, menu, and other items displayed on the screen.



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

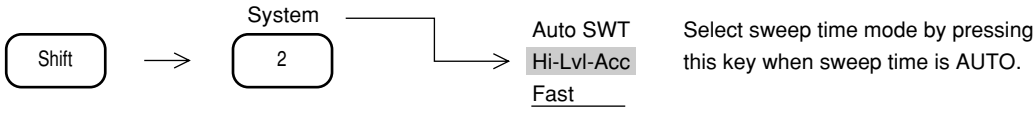
Conditions Setting at Power-on

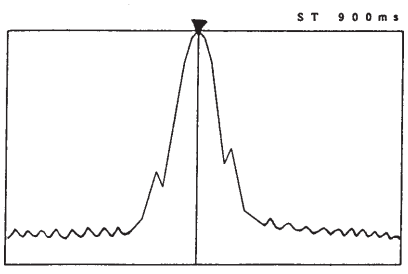
Set the state of the screen display when the power is turned on by performing the following key operations.



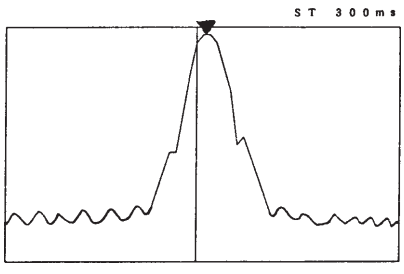
Setting Mode at Auto Sweep Time

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





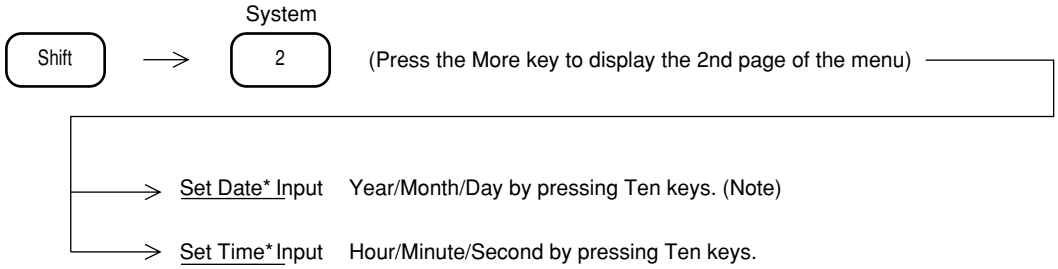
In Hi-Lvl-Acc Mode



In Fast Mode

Setting Date/Time

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



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

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

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

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

SECTION 10
SAVE/RECALL FUNCTION

This section describes saving and recalling of the waveform an parameter data to and from internal register and memory card, respectively.
It also describes memory card file management.

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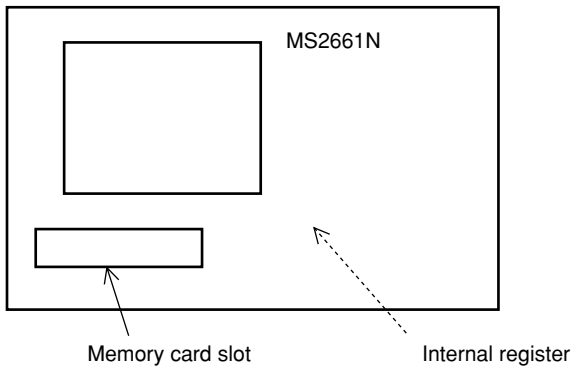
(Blank)

SECTION 10
SAVE/RECALL FUNCTION

The MS2661N can save the setting conditions (Parameter) and waveform data (Trace) to internal register and memory card. These data can be recalled and used later.



Internal Register

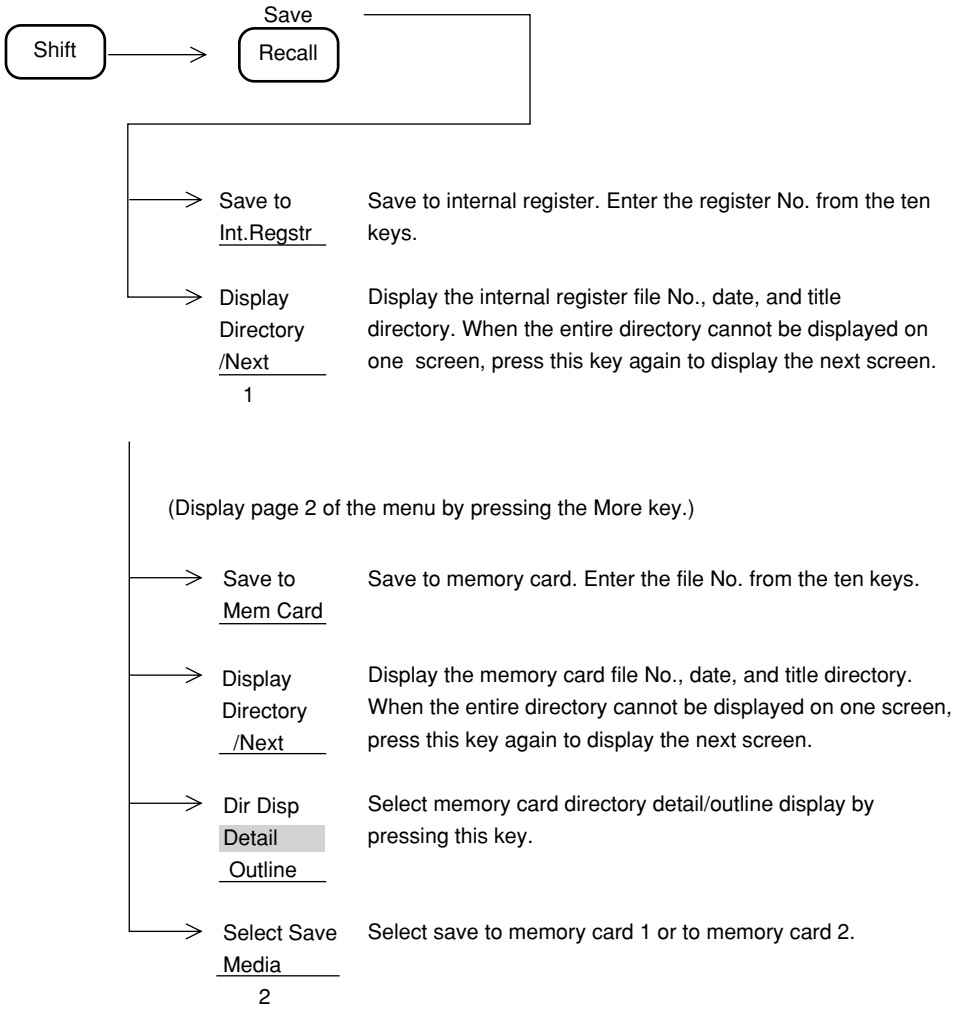
The internal register uses the RAM backed-up by a battery in the MS2661N.
Up to 12 parameters and waveform data can be saved. Parameters and waveform data, or parameters only, can be recalled.

Memory Card

The memory card is an interface that corresponds to PCMCIA Ver.2 type 2, 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 and parameter and waveform data, or parameters only, can be recalled.
(A 256 kB memory can save more than 50 files.)
PTA programs created by external controller, etc. can also be uploaded and downloaded.

Saving Parameter and Waveform Data

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



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

<Memory Directory> save

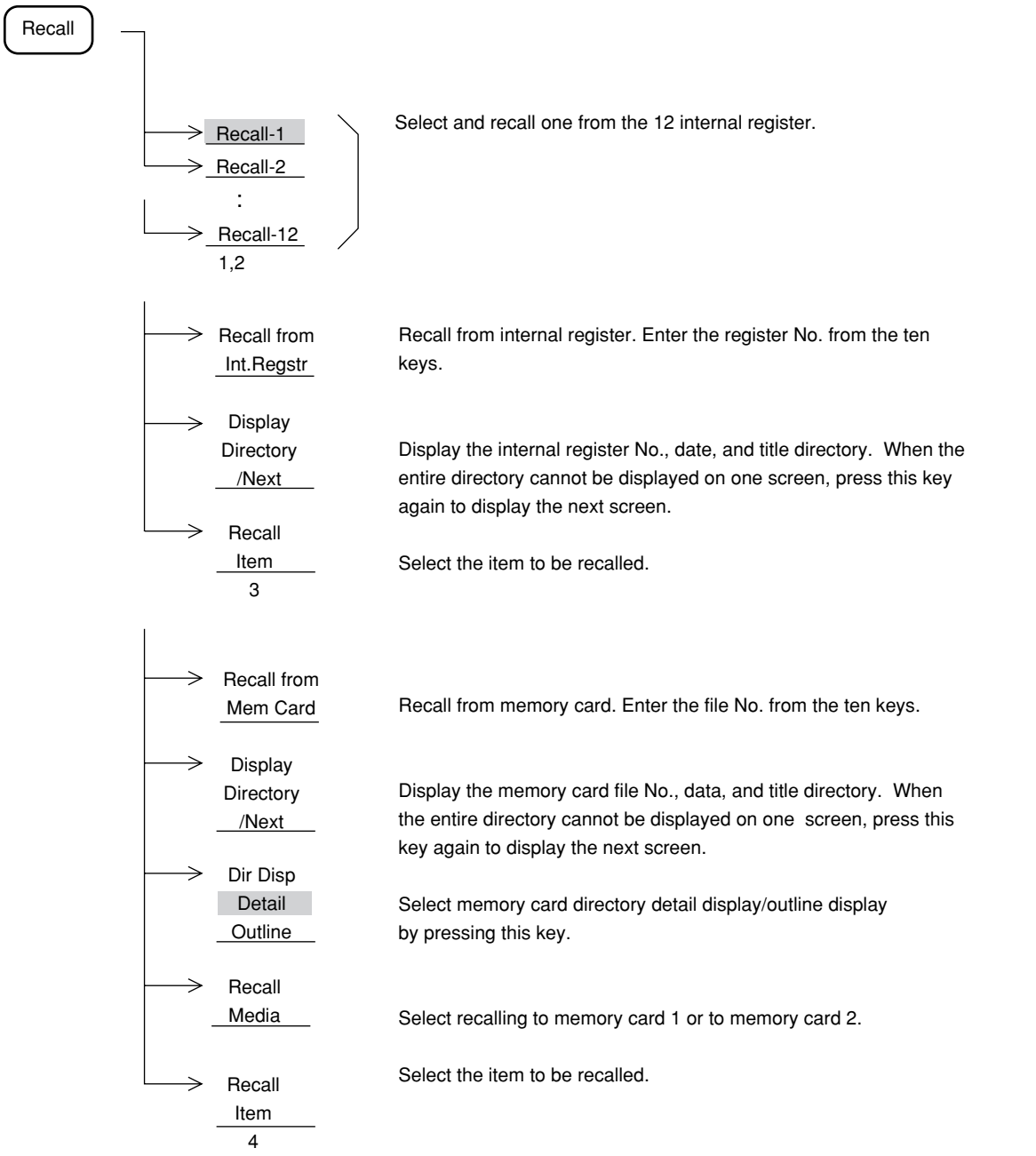
No.	Date	Title
01	95-09-15	Noize Level Measument
02	95-09-23	FALL 0923
10	95-10-10	SPRT 1010
12	95-11-03	CLTR

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.



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)

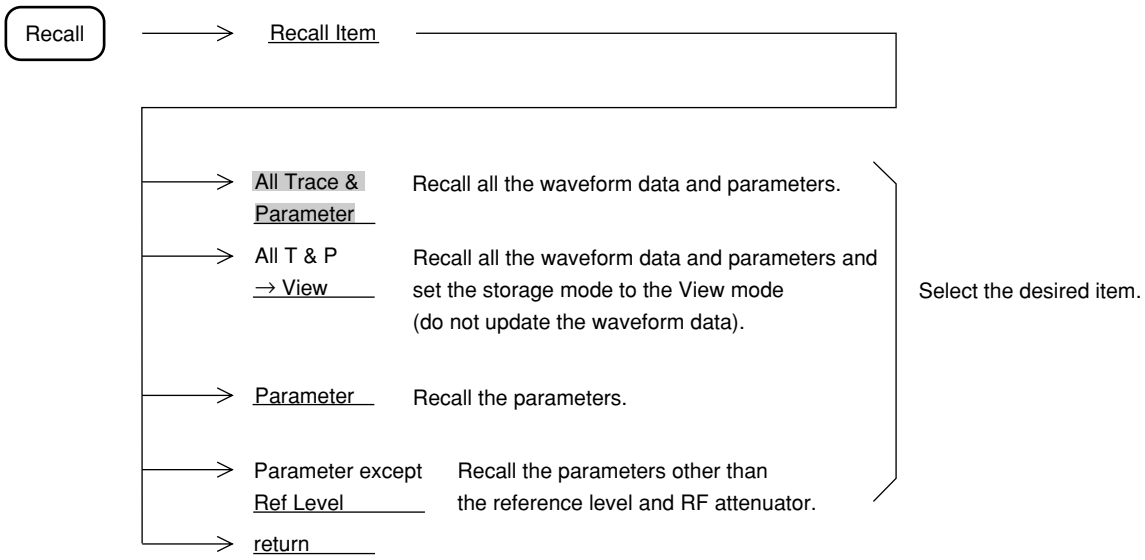
```
                <File Directory>          Recall

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

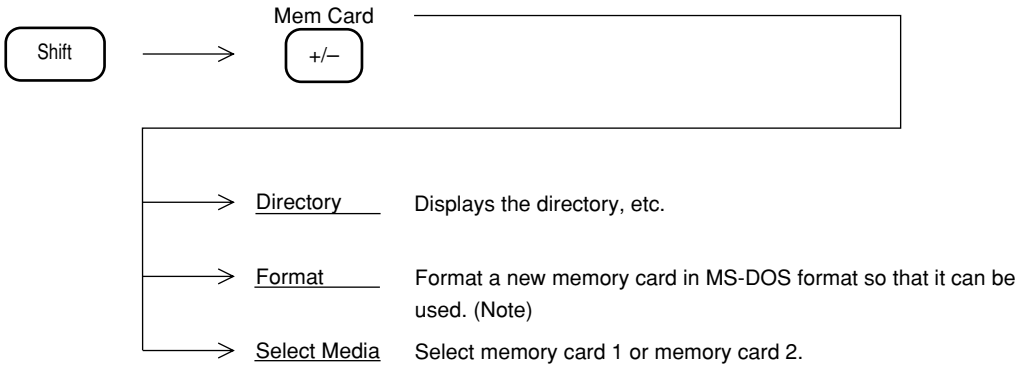
Selecting Recall Item

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



Memory Card File Management

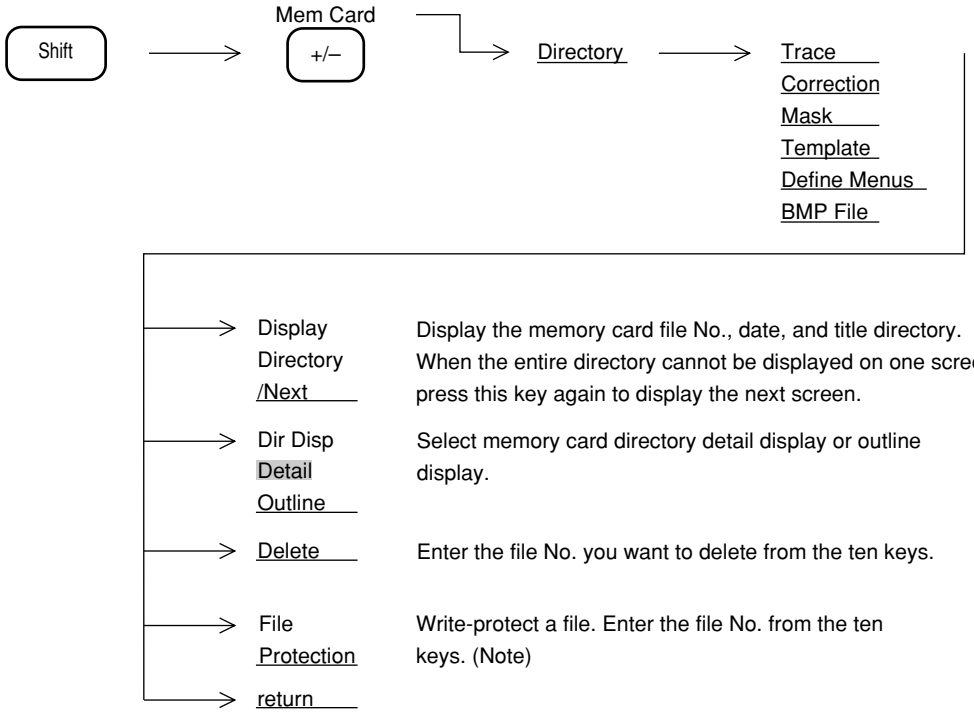
This parameter describes the memory card format, file deletion, and write protect key operation.



Note: When a memory card is formatted, all the file contents are deleted even if they are write-protected as described below.
MS-DOS is a registered trade mark of the Microsoft Corporation.

File Deletion and Write Protect

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



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

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SECTION 11

COPY

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

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SECTION 11
COPY/TV IMAGE MONITOR

Direct Plotting

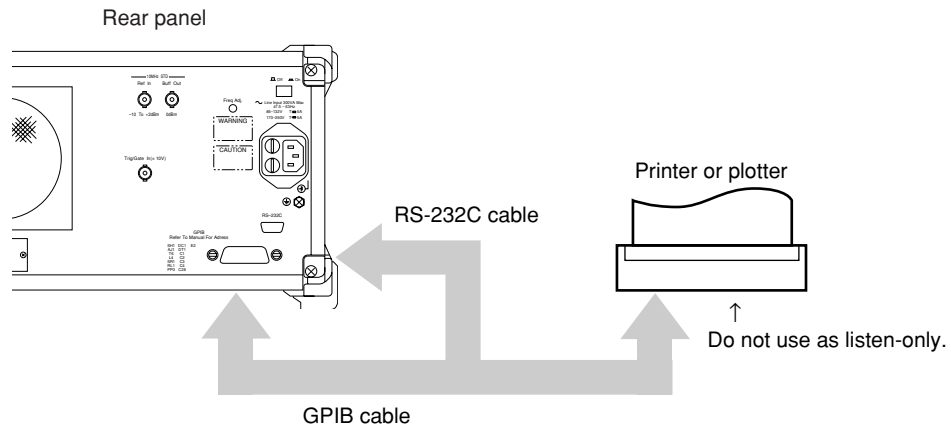
The MS2661N can output a hard copy of the screen as follows:

① Using a printer via RS-232C interface.
② Using a printer via GPIB (Option) interface.
③ Output to a plotter in the specified format via RS-232C interface.
④ 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.

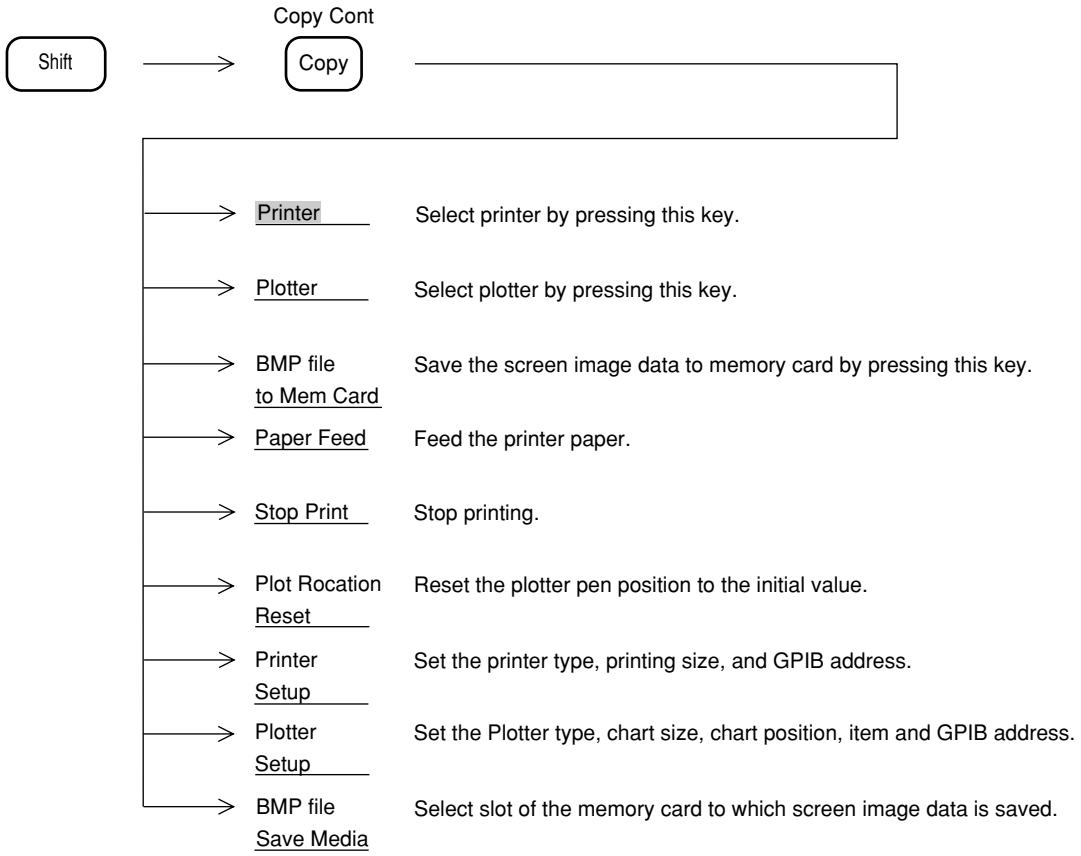
Connecting to Printer and Plotter

Connect the MS2661N and printer/plotter as shown below.



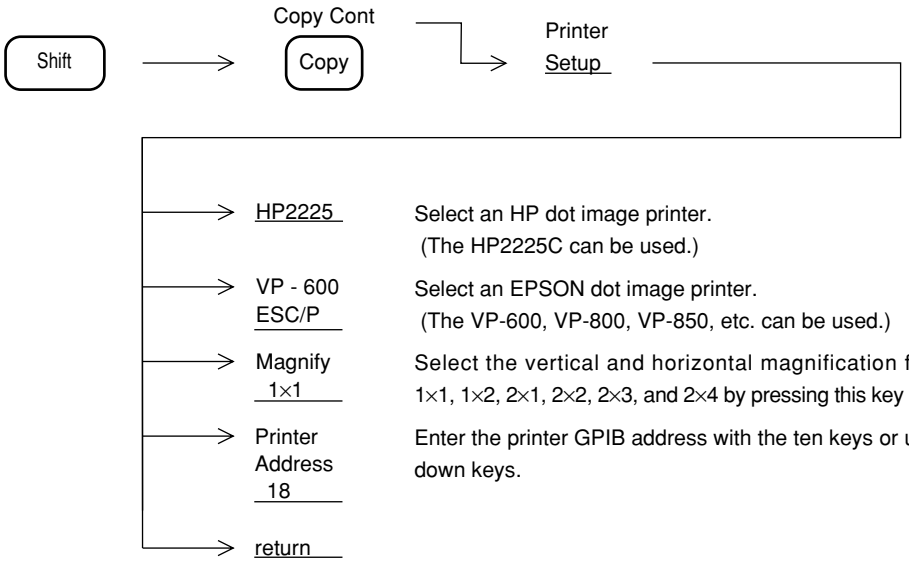
Selecting a Printer/Plotter

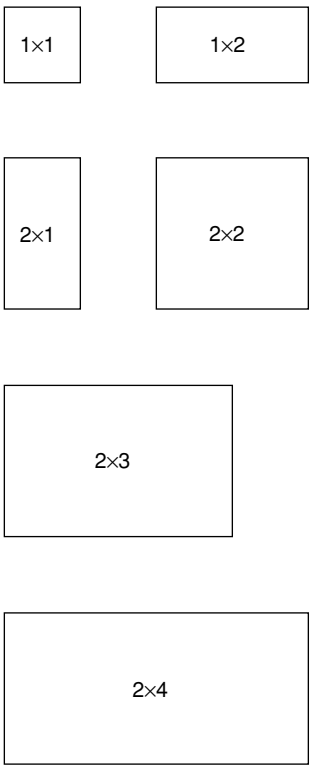
To select printer/plotter, set-up the printer/plotter, feed the paper, stop printing, etc., perform the following key operations.



Selecting a Printer

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





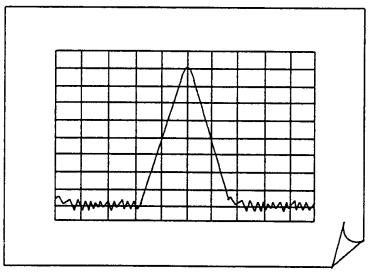
Print Magnification Selection

Setting the Plotter

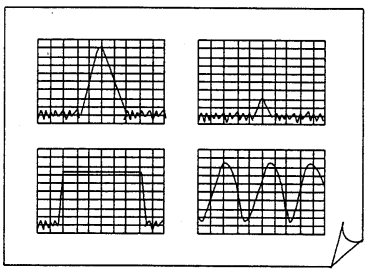
To select the plotter to use and to set its GPIB address, perform the following key operations.

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



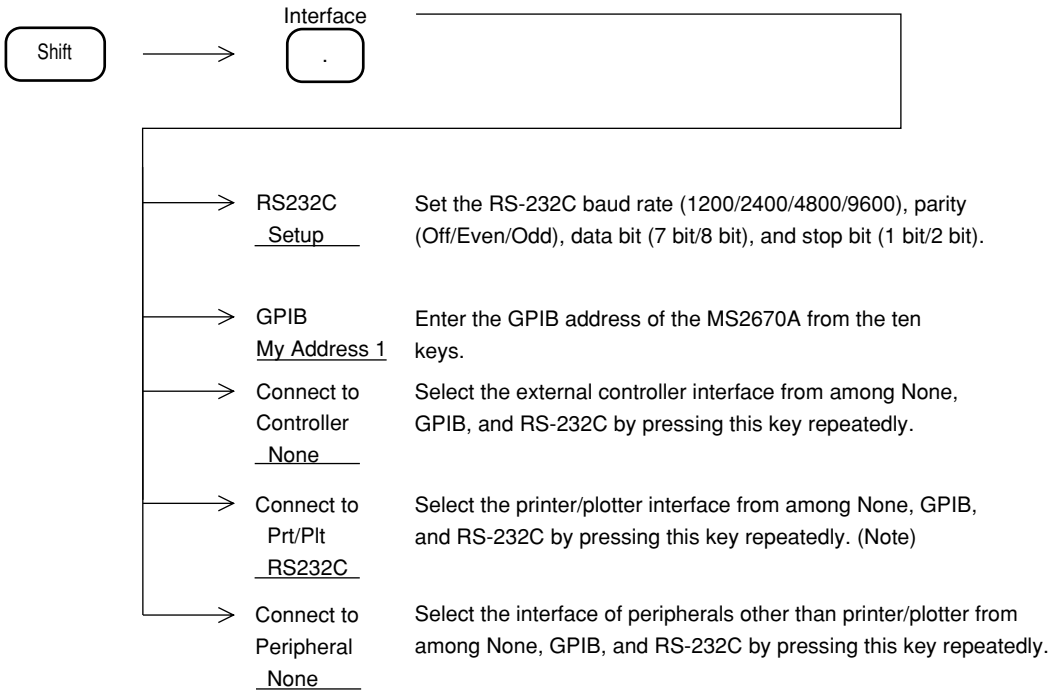
When Full Size is SpecifiedforPlotting



When Quarter Size is Specified for Plotting

Setting Interface

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



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

Executing Hard Copy

Start hard copy by pressing the Copy Cont / 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 MS2661N and the hard copy operation may be interrupted.
  In this case, modify the time-out setting value via GPIB using an external controller.
  N_{88}-BASIC ..... `PRINTΔ@1;"GTOUTΔ 60"`
  PTL ..... `PUT Δ"GTOUTΔ 60"`

  Integer represented in units of second (s)

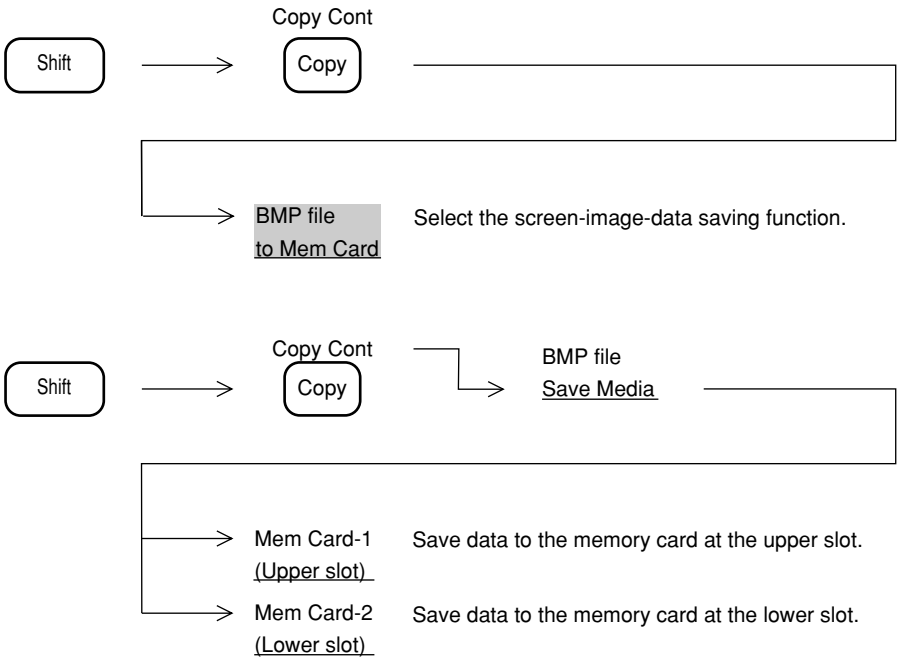
- Immediately after setting the copy execution, the sweep stops for a few seconds because of editting process of the data. After restarting the sweep, and beginning the printing at printer/plotter; the parameters etc. can be set. After completion of the current copying, perform the next copying.

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 the Windows of PC.

Selecting Memory Card

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

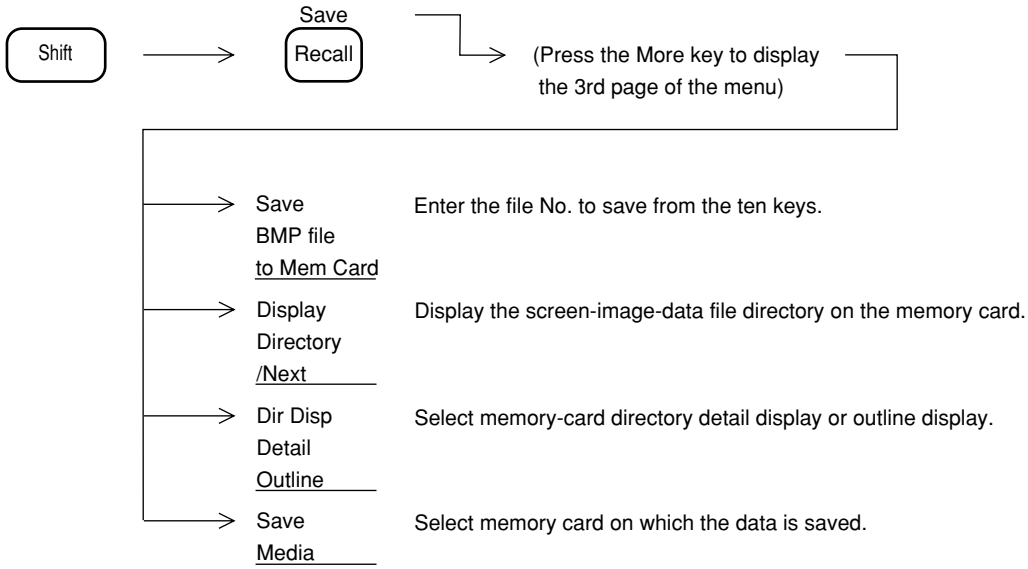


Executing Save

Saves the screen-image data to a memory card by pressing the Copy Cont Copy key.
File name to be saved is automatically numbered.
When the menu is displayed in this saving mode, it is also saved as it is.
Use the memory card which is formatted by the MS2661N.

Executing Save by Specifying File Number

To save the screen-image data to a memory card by specifying a file number to be saved, perform the following key operations..



After deleting the menu and data input in this saving mode, only the screen-image-data is saved.
Use the memory card which is formatted by the MS2661N.

Displaying the Screen Image Data on PC

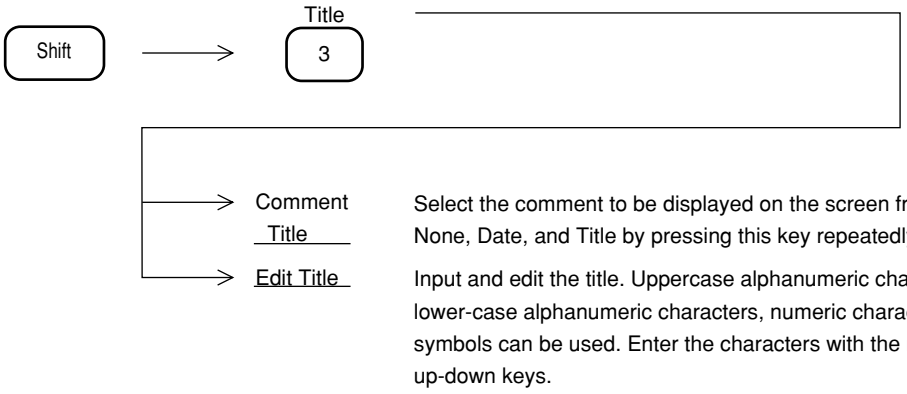
The saved screen image data can be displayed on a personal computer (PC) with a tool on PC (ex. the paint brush of Windows).
The saved files on a memory card are in the directory as shown below.

¥P-2110¥COPY¥COPY001.BMP

File No.

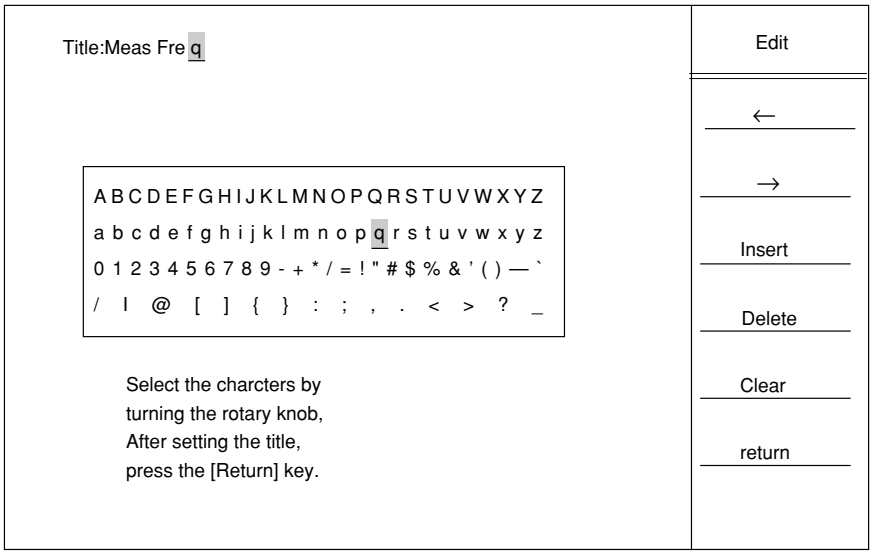
Displaying a Title

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.



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

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



Title Edit Screen

(Blank)

SECTION 12
PTA/DEFINE FUNCTIONS

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

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SECTION 12
PTA/DEFINE FUNCTIONS

PTA Program Editing and Loading

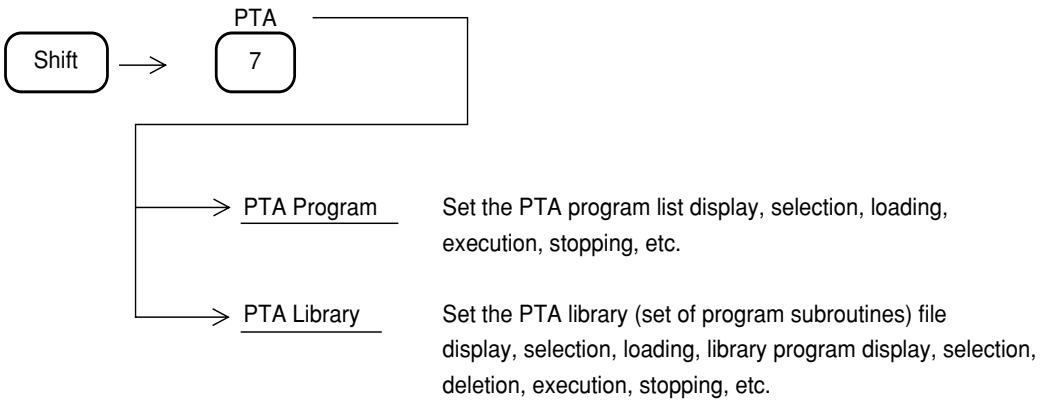
Input and edit the PTA program by external computer editor by PTL language (BASIC-like interpreter). For further details, refer to the operating instructions of the PTA Control part.

Load the edited program to a memory card or the MS2661N 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.

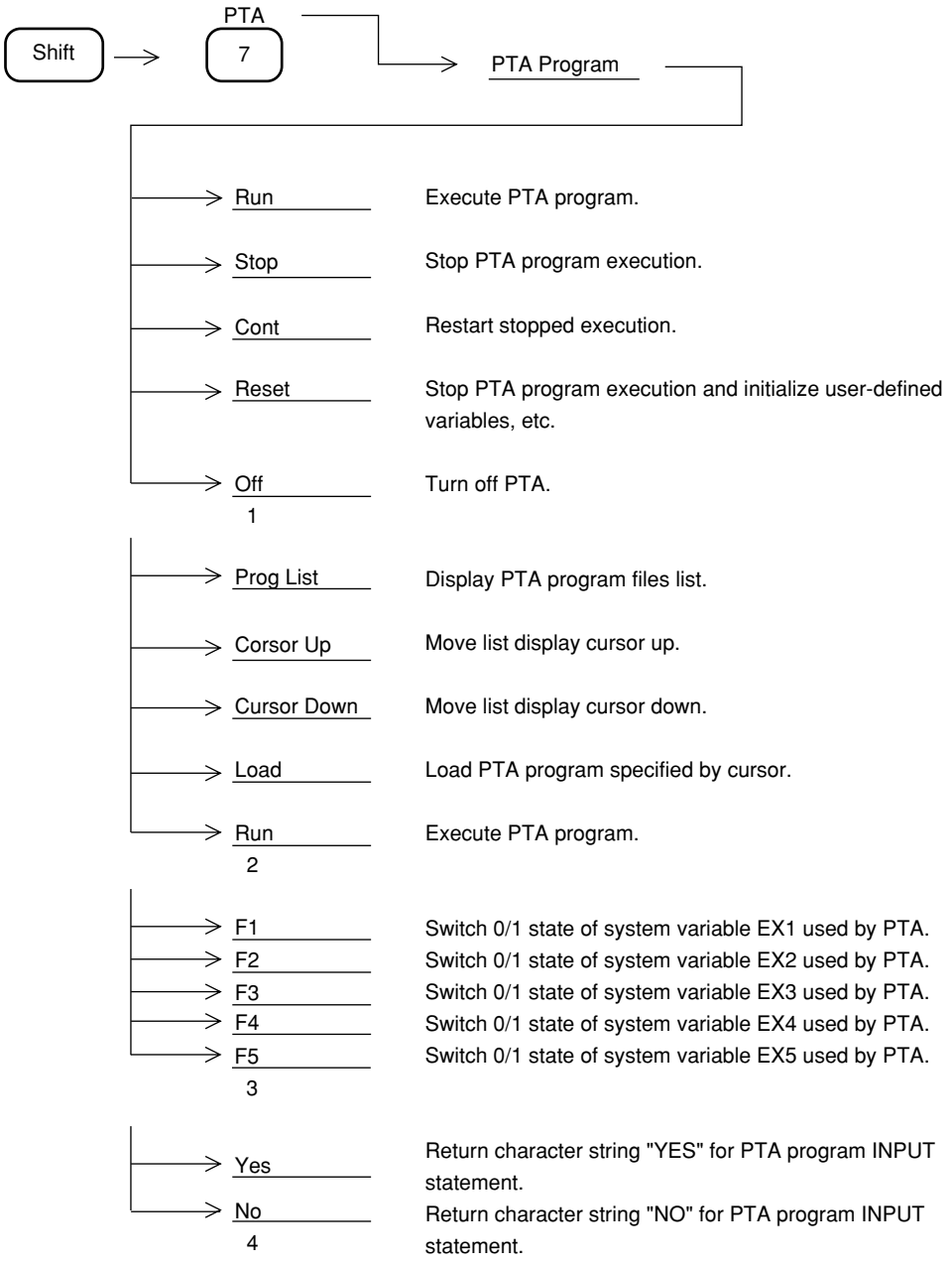
Setting PTA Program

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



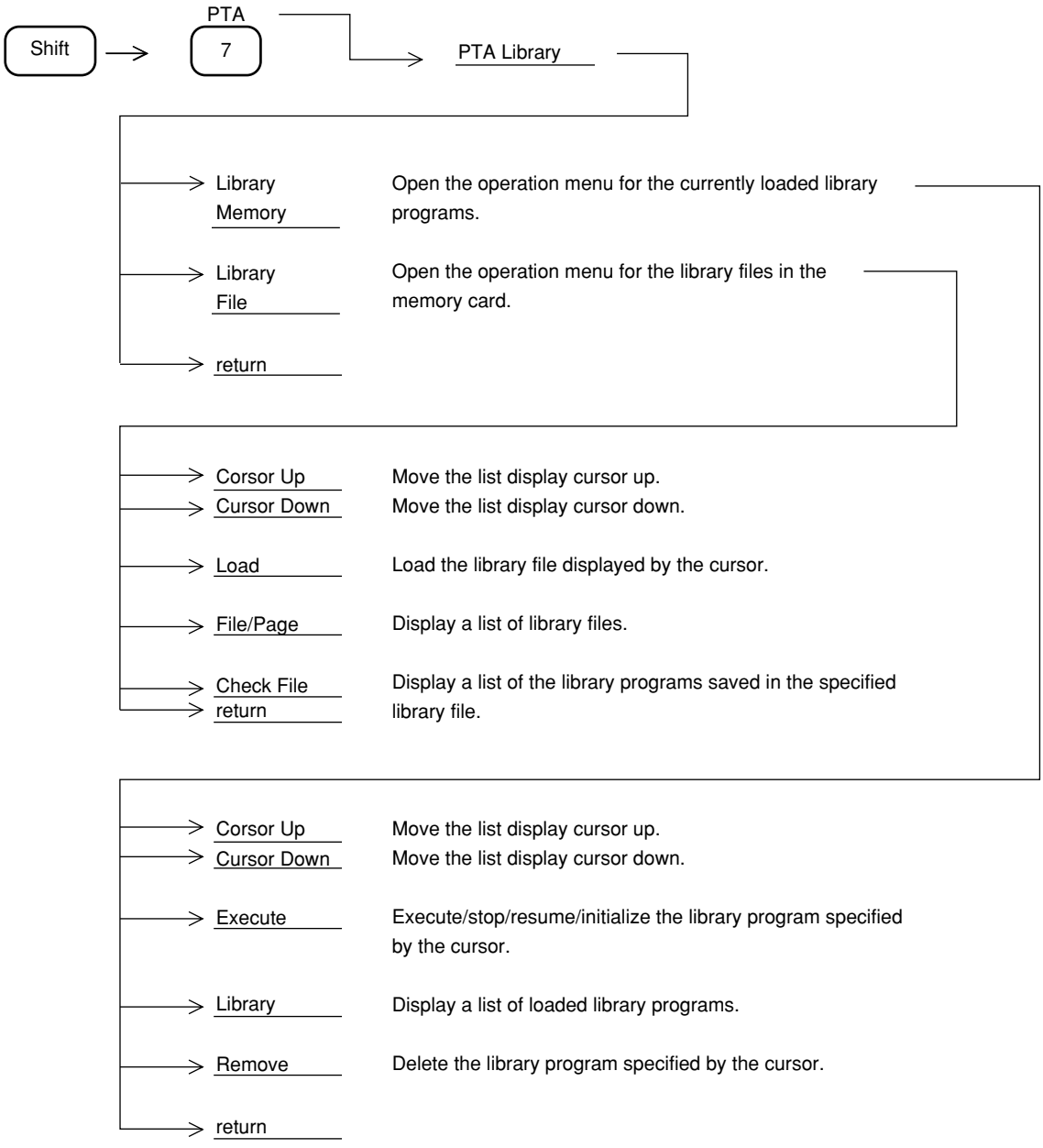
Loading and Executing PTA Program

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



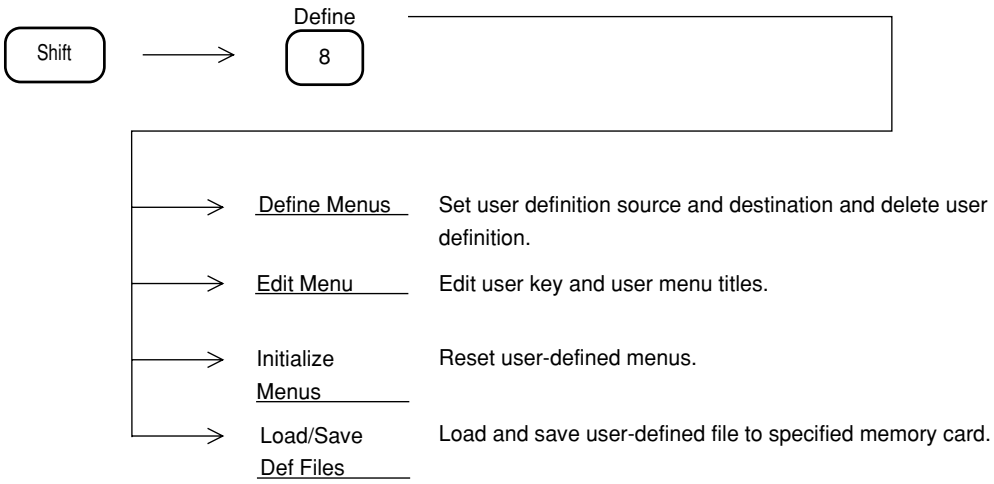
Loading and Executing Library Program

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



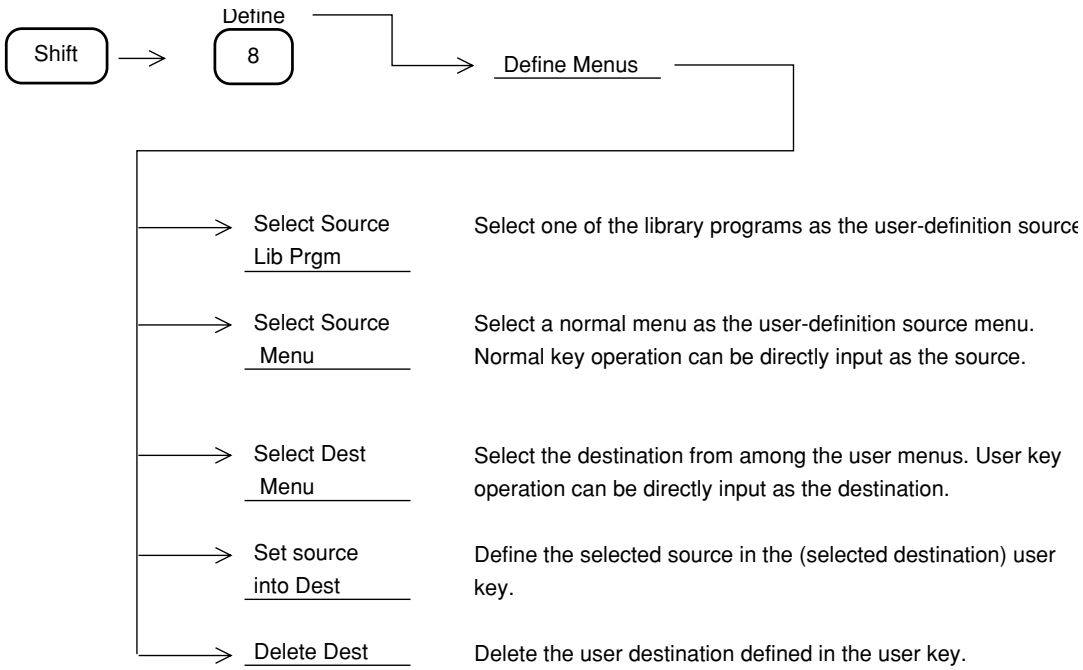
User-Definition Function

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



Defining User Menu

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



Example of User-Definition Operation

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

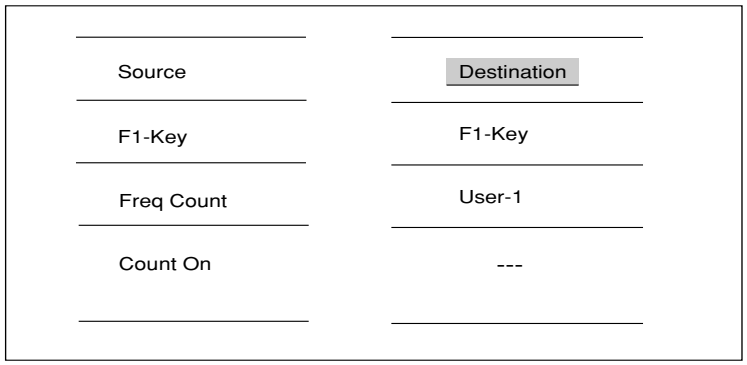
The following also explains an example of key operation which makes the title of that key "Meas Freq".

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.

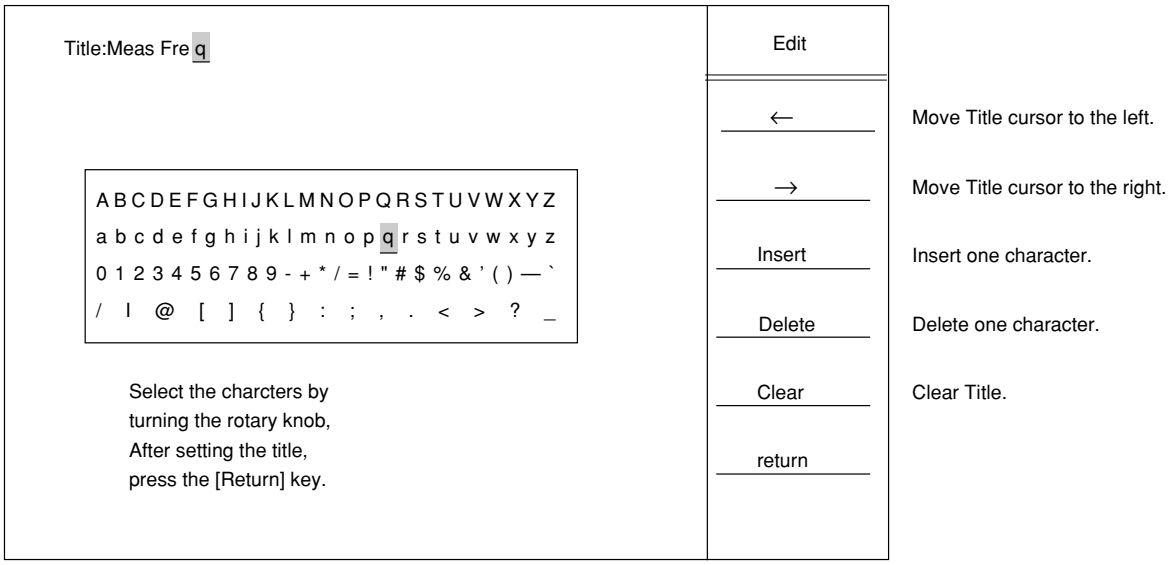


User Definition Screen Display

⑤ Execute user key definition by " Shift | Define Define Menus Set source into Dest" key operation.

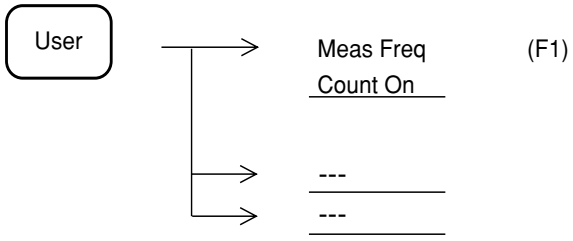
⑥ Perform " Shift | Define Edit Menu Select Source" key operation and select the User1 F1 key by " User | F1 " key operation.

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.



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SECTION 13
MEASUREMENT

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

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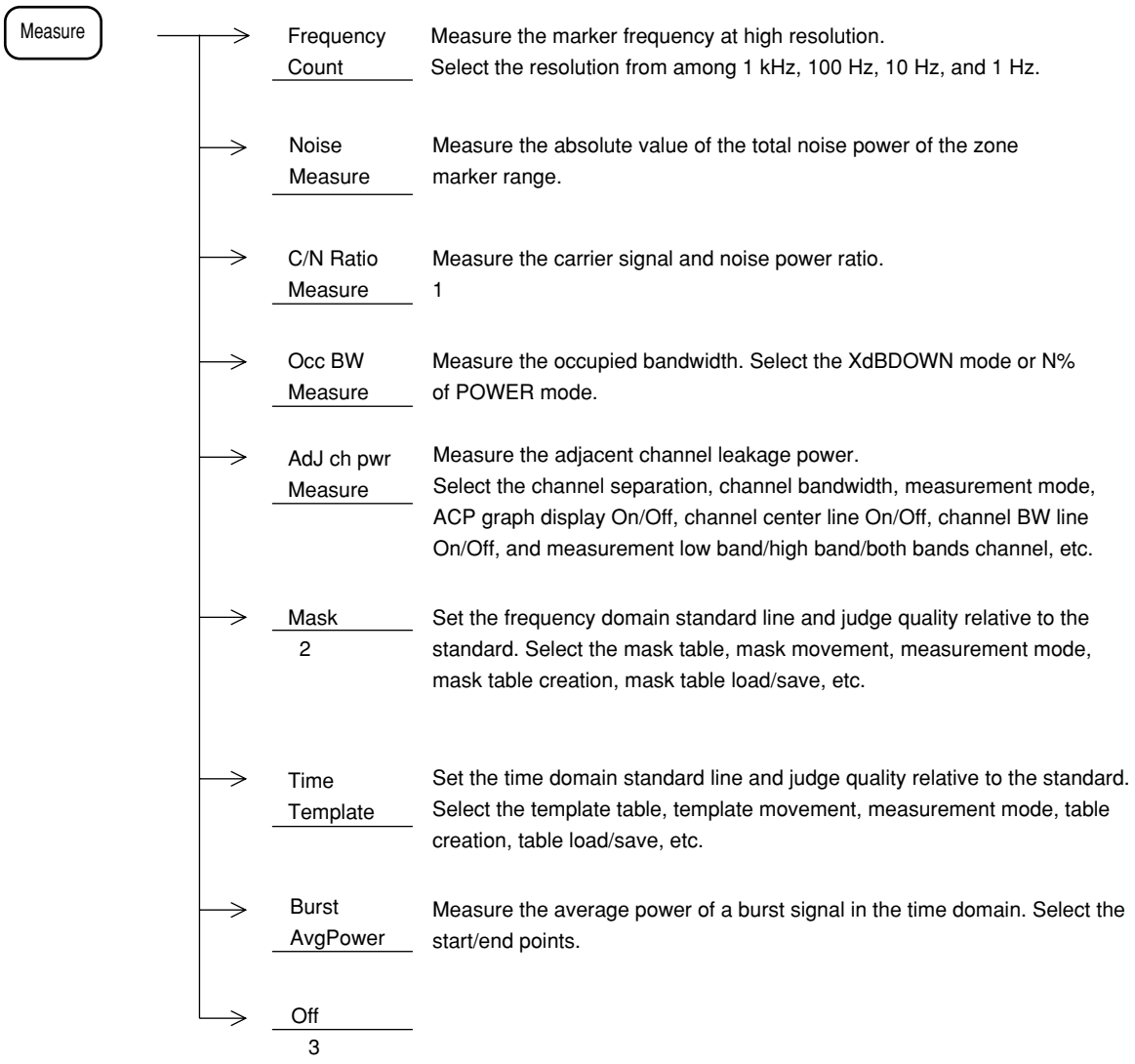
SECTION 13 MEASUREMENT

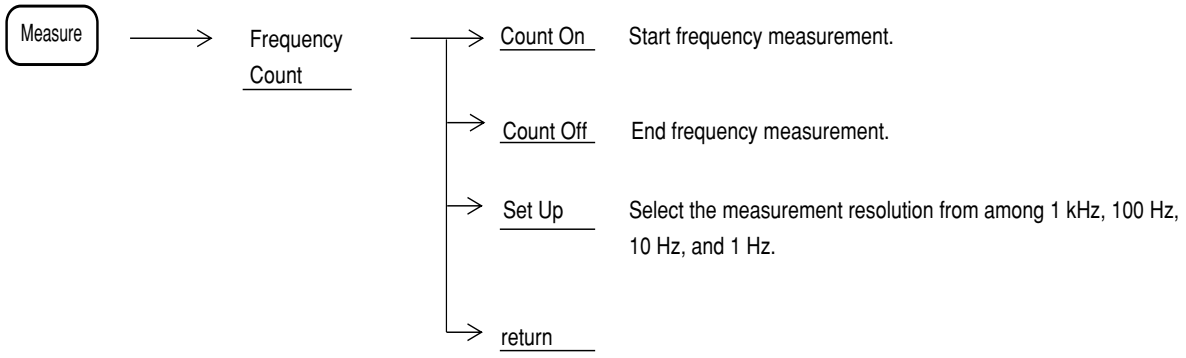
Measure Measurement Function

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



Frequency Measurement Function

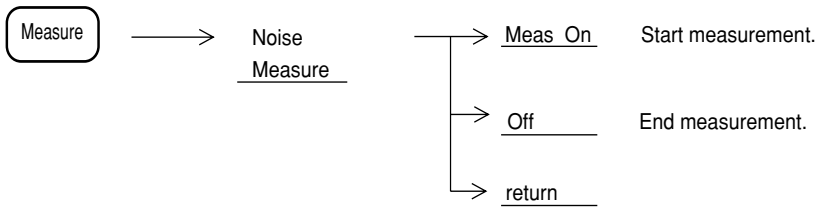
To measure the marker frequency at high resolution, perform the following key operations.



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

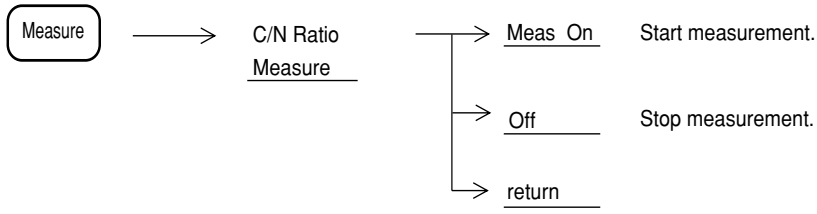
Measuring Noise Power

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



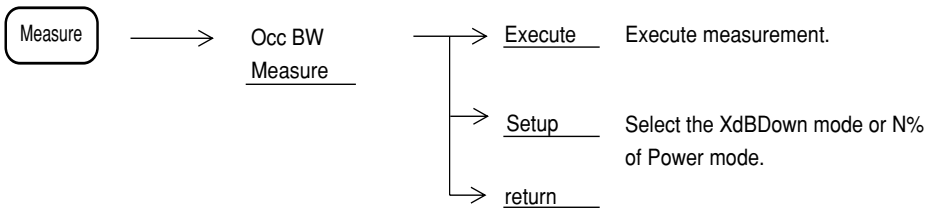
Measuring C/N Ratio

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



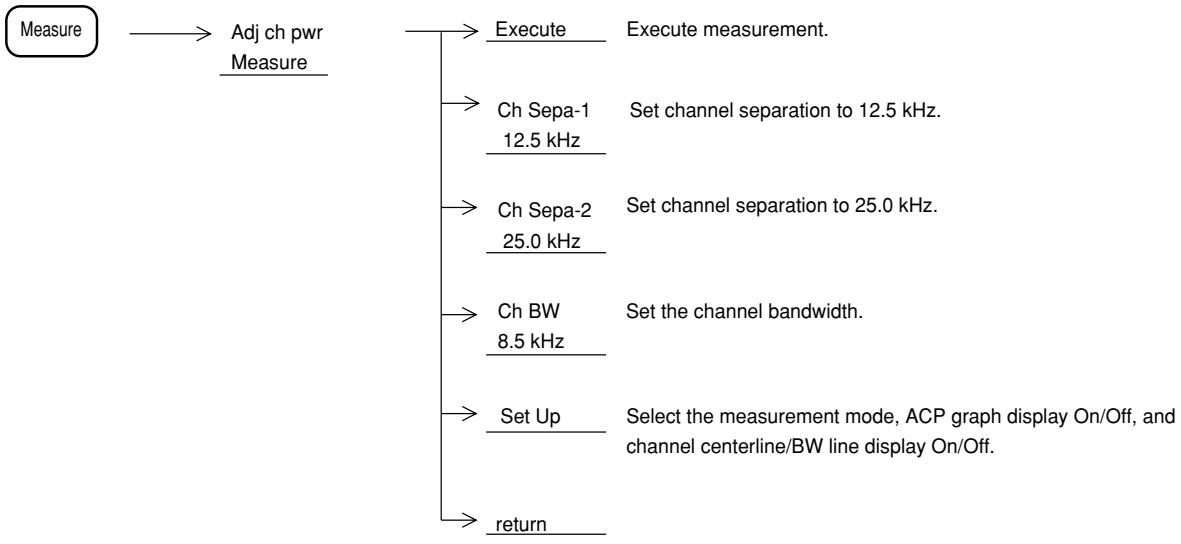
Measuring Occupied Bandwidth

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



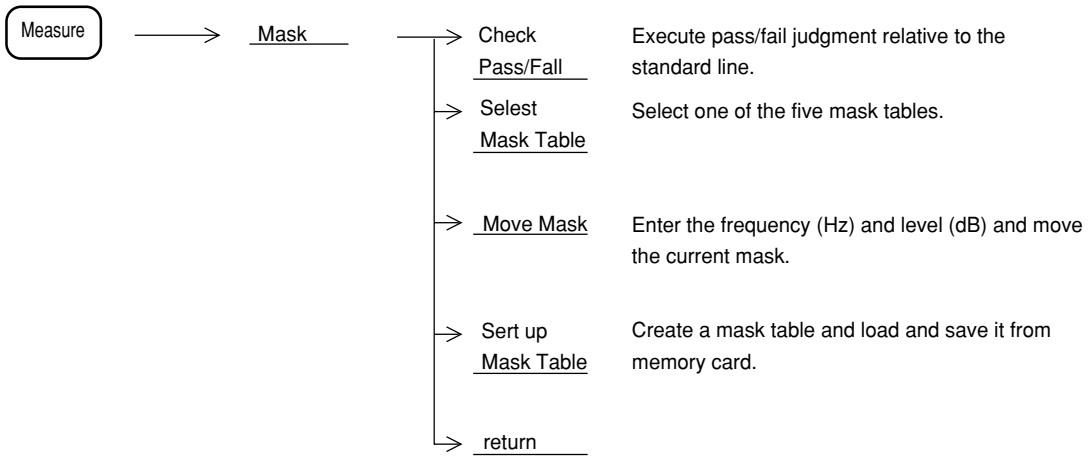
Measuring Adjacent Channel Leakage Power

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



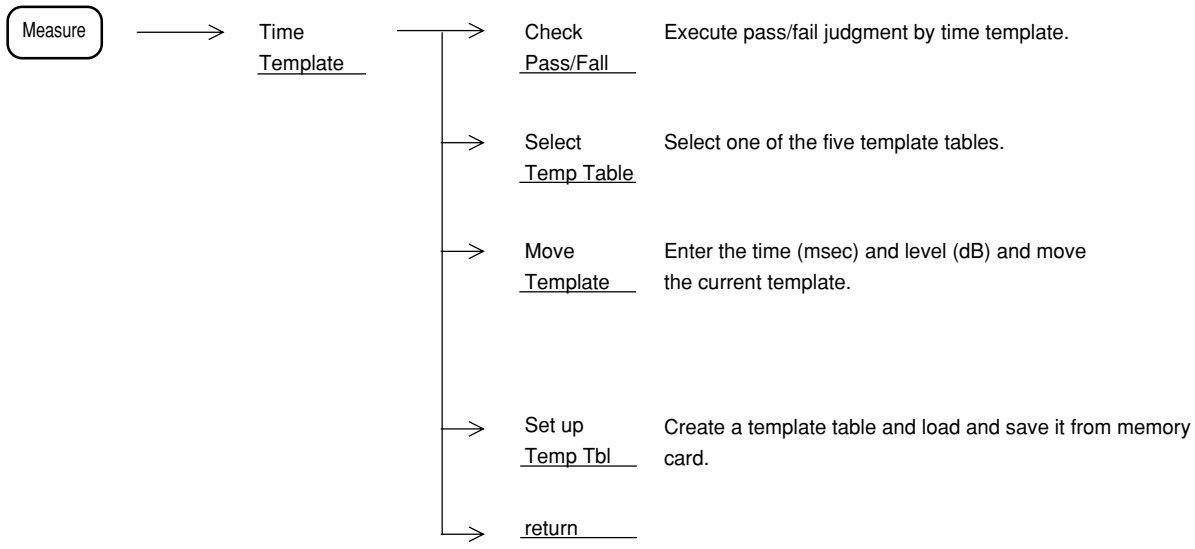
Pass/Fail Judgment by Mask

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



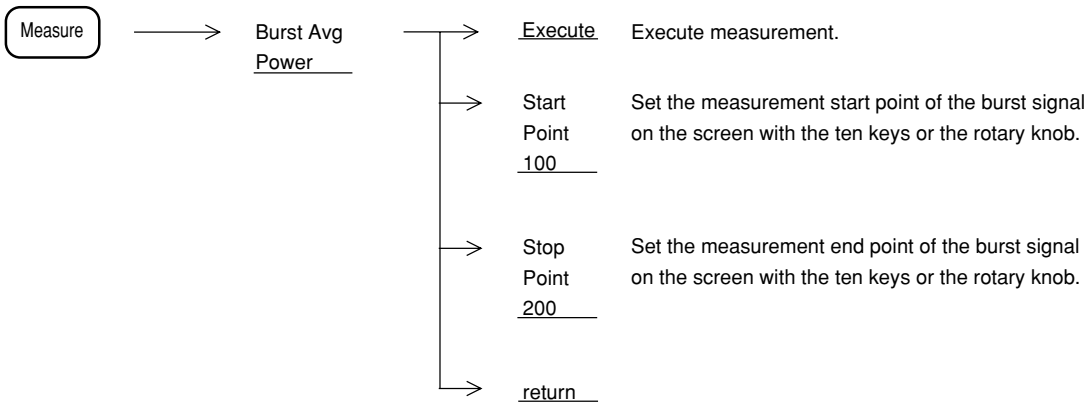
Pass/Fail Judgment by Time Template

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



Measuring Burst Average Power

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



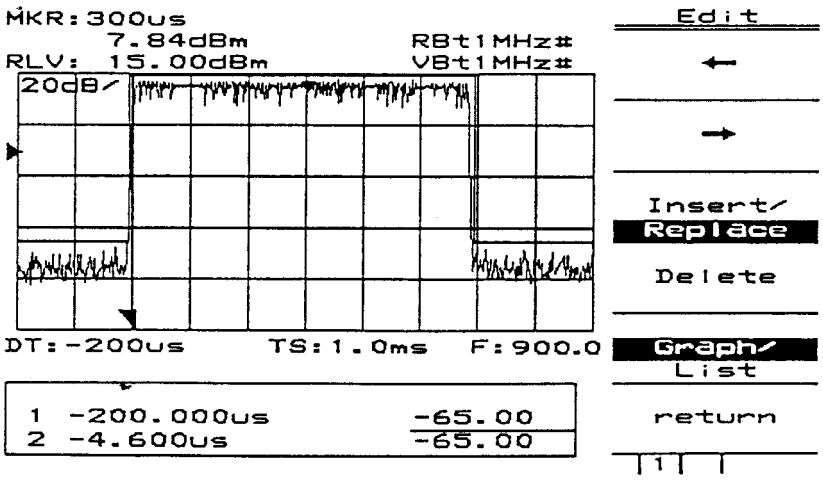
Example of Time Template Creation (PHS Transmit Signal)

1) Burst wave screen setting (time domain)

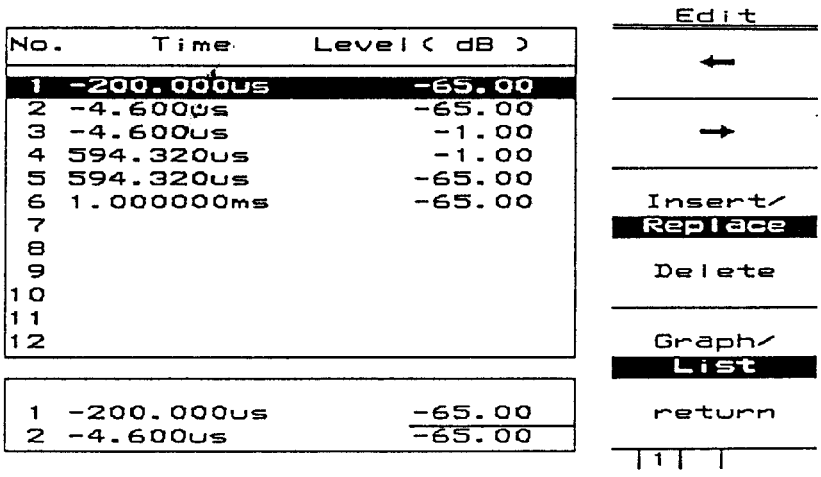
Time span : 1 ms
Trigger : –200 us
RBW : 1 MHz
VBW : 1 MHz
RLV : +15 dBm

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.

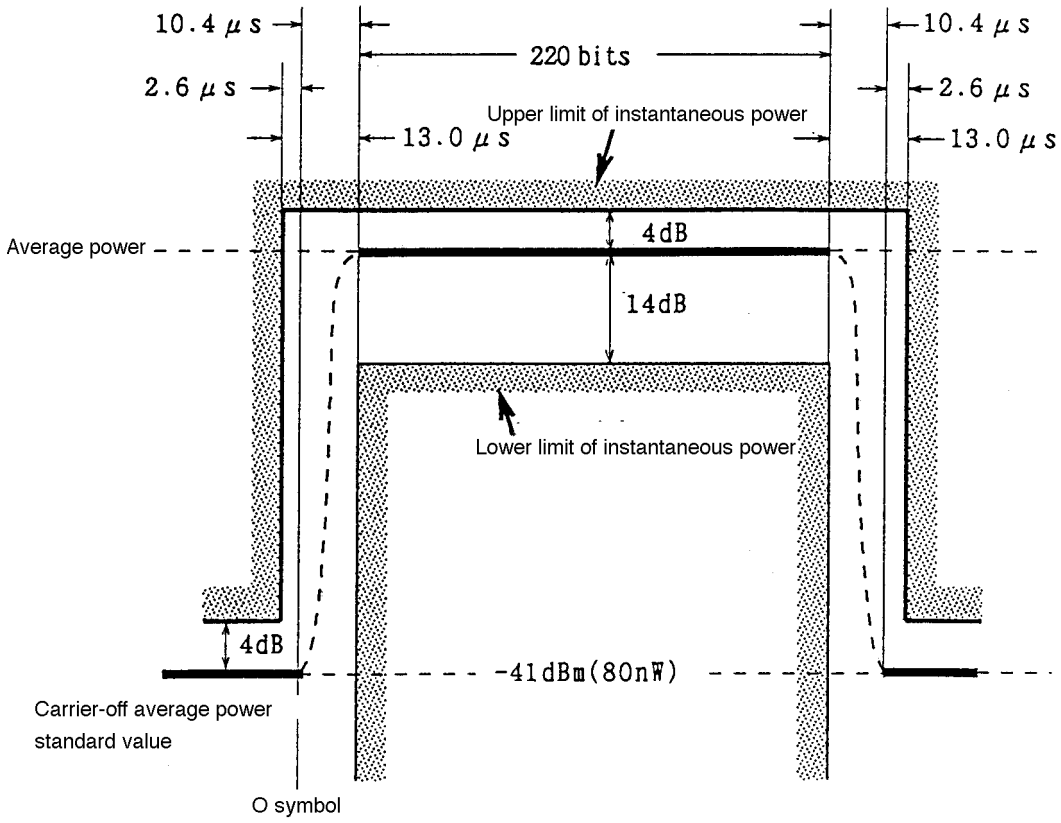


TEMPLATE Creation Screen (Graph)



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

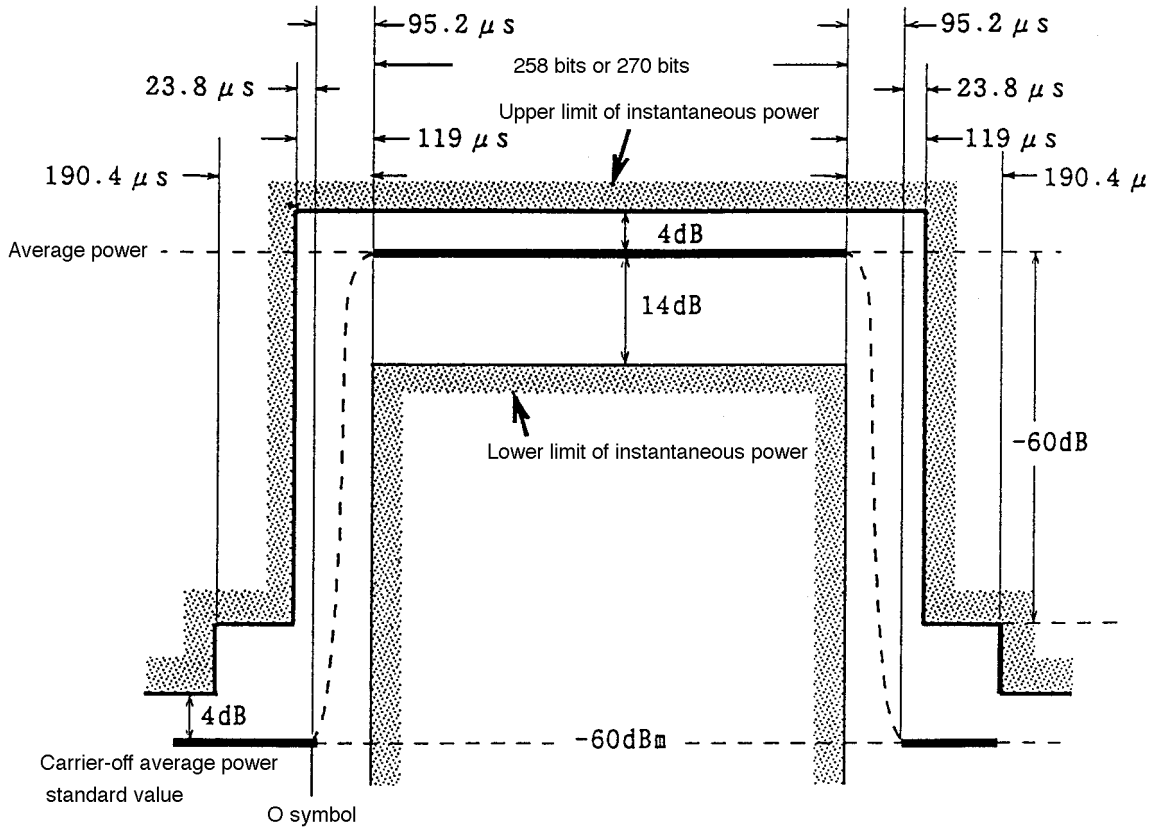
- Limit1 Upper coordinates

(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

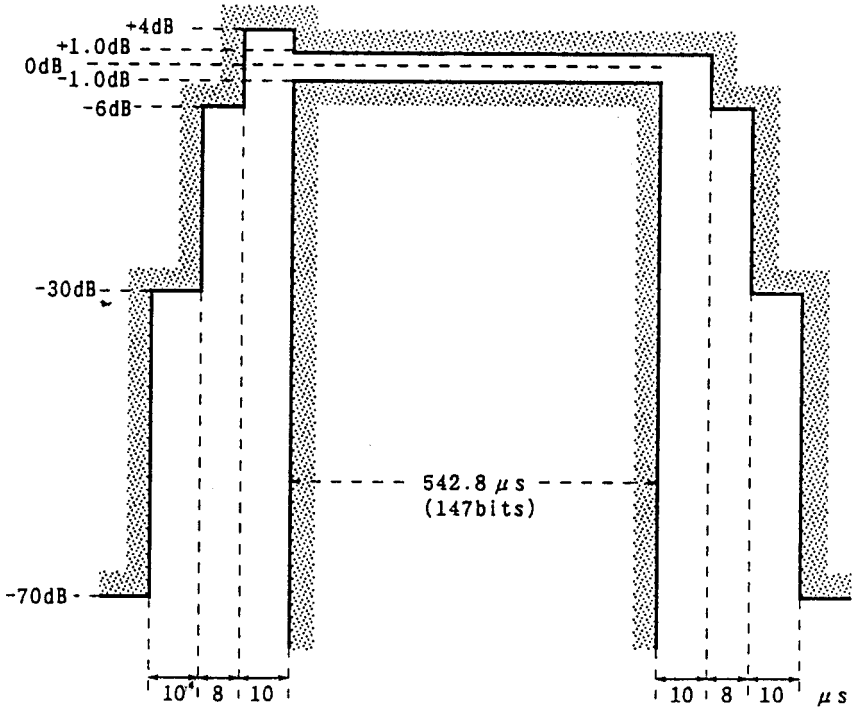
- Limit1 Upper coordinates

(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)	–15.0 µs,	–35 dB
(5)	–15.0 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,	–11 dB
(12)	563.8 µs,	–11 dB
(13)	563.8 µs,	–35 dB
(14)	573.8 µs,	–35 dB
(15)	573.8 µs,	–75 dB
(16)	625.0 µs,	–75 dB

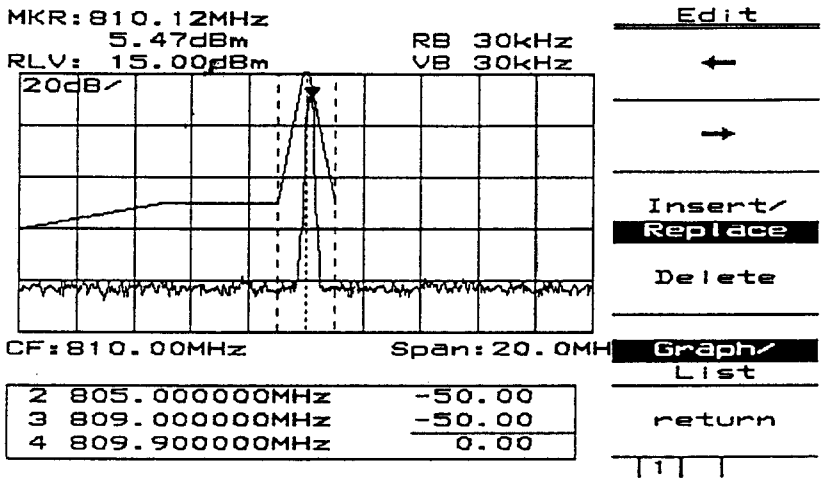
- Limit1 Lower coordinates

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

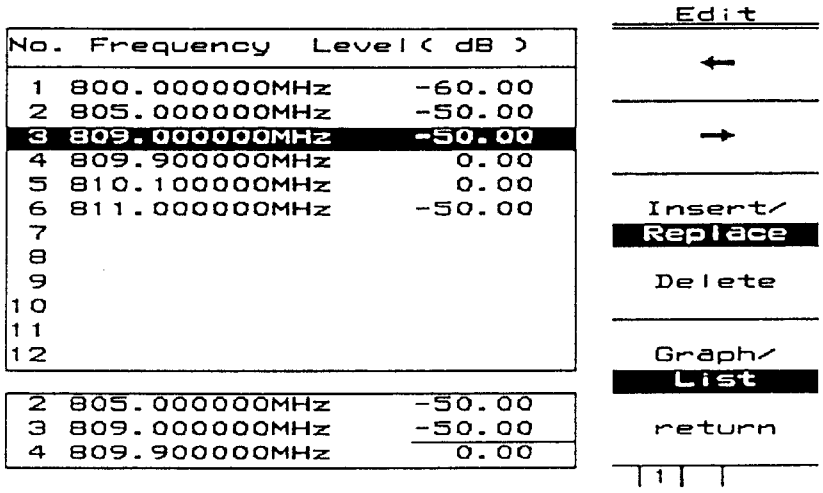
MASK Creation in Frequency Domain Mode

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)



MASK Creation Screen (List)

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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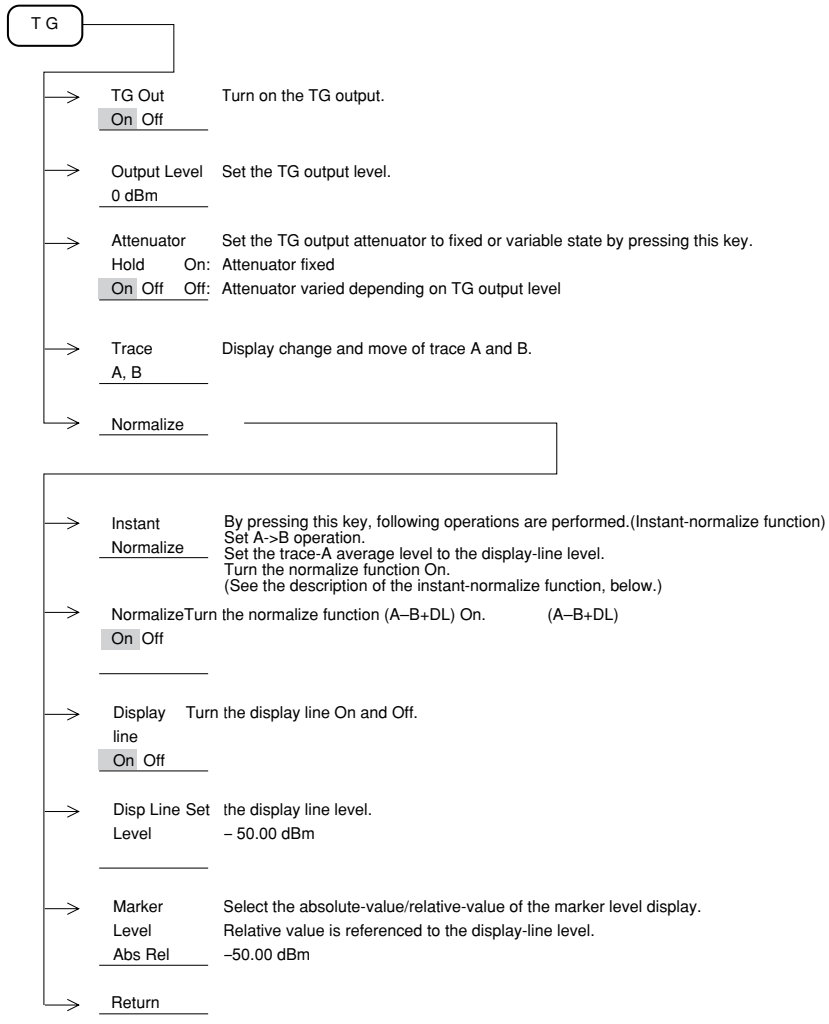
SECTION 14
TRACKING GENERATOR

Tracking Generator Menus

The Tracking Generator is installed to the MS2661N to measure the transmission characteristics and reflection characteristics of the passive devices (filters etc.) and active devices (amplifier etc.).

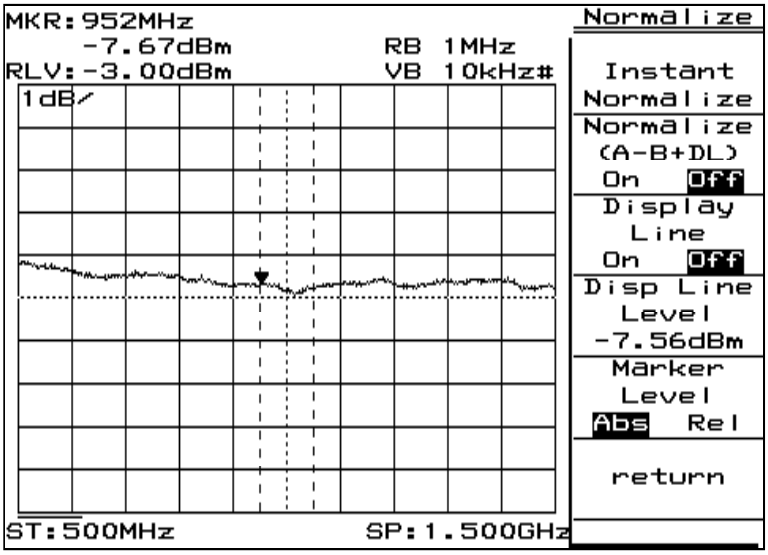
To turn the output On/Off, set the output level, and compensate the insertion loss of the cables/bridges etc. (normalizing function), perform the following key operations.



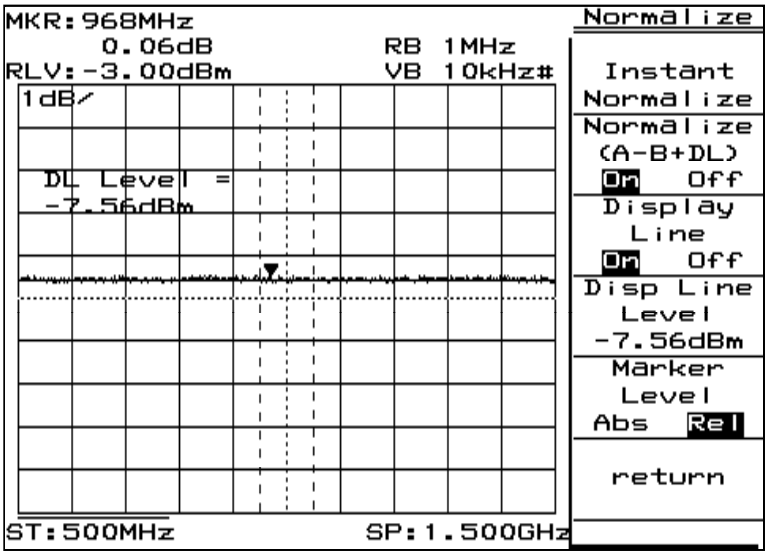
Normalize/Instant-Normalize Function

For accurate measurement of the transmission characteristics and reflection characteristics by using TG, the insertion-loss frequency characteristics of the cables/bridges etc. 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 approx. one dB frequency-characteristics ripple.



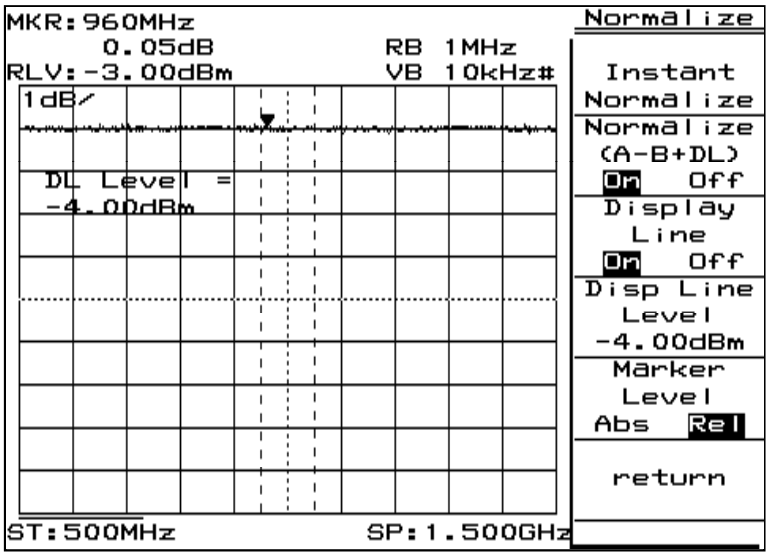
The normalize function compensates this frequency-characteristics ripple.
The following figure shows the frequency characteristics which is compensated by the instant-normalize function.



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. So, 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.



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

Transmission Characteristics Measurement

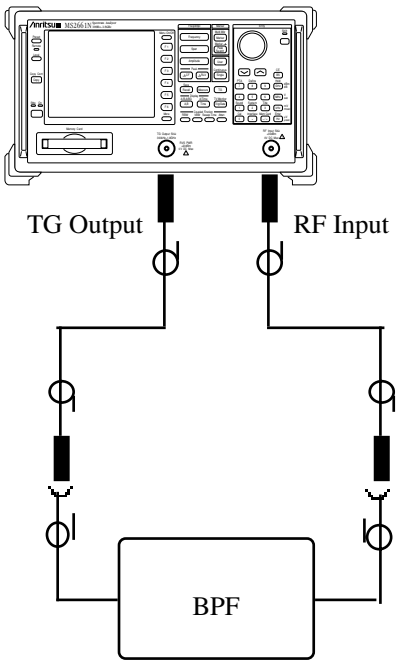
Typical transmission characteristics measurement of a BPF is described below.
BPF characteristics:

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

Characteristics Outline Measurement

(1) Setup

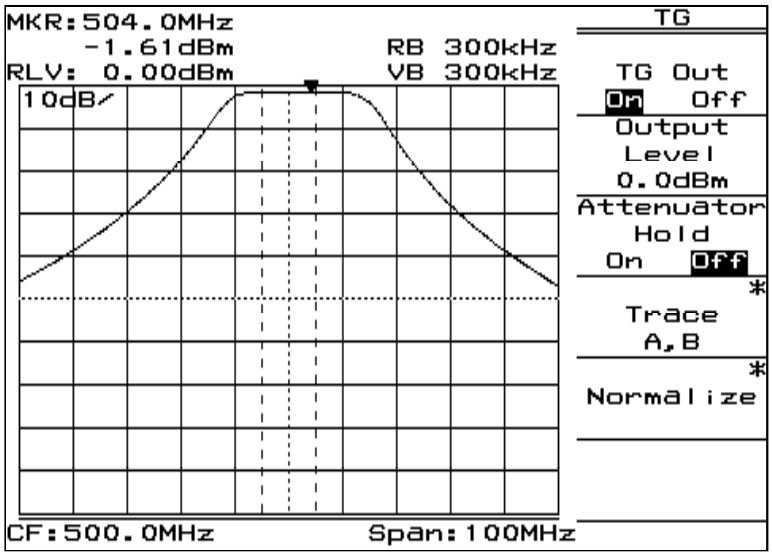
Connect the TG Output to BPF input, and BPF output to RF Input with a coaxial cable, respectively.



(2) Setting parameters and measuring characteristics outline

- Setting parameters
  - Initializing the MS2661N
    [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 is obtained as the measurement results.
When accurate results not required, each frequency and level can be read using marker. In this case, the marker unit is dBm and TG output level is 0 dBm, then the marker level indicates the insertion loss, directly.

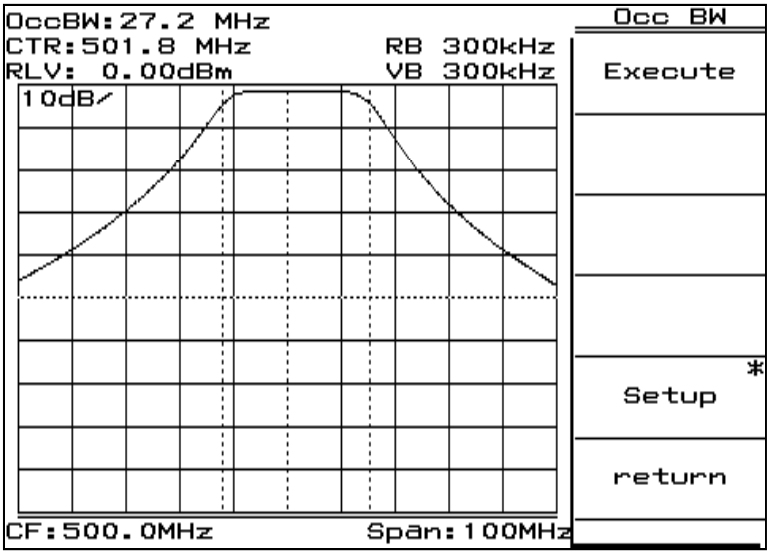


- When the TG output level is set to other than 0 dBm, the insertion loss can be read in dB unit by setting the marker level display to the relative value from the reference level, as the following procedures.
  - Setting the display-line to On. Setting the display-line level to the same as the TG output 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>>

(3) Measuring center frequency and 3dB bandwidth

Using the measurement function of the occupied bandwidth, measures 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>>



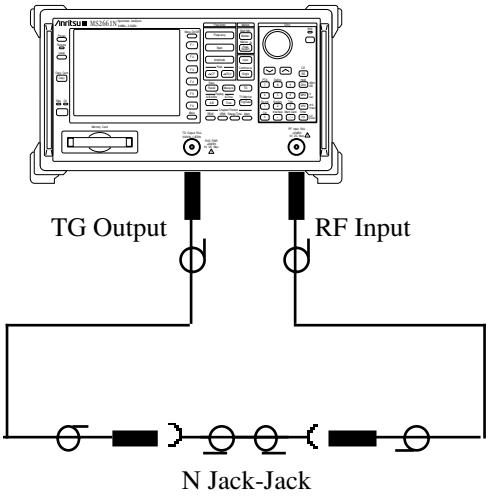
3dB-Bandwidth and Insertion-Loss Accurate Measurement

When accurate measurement 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.

Accurate 3dB-bandwidth/insertion-loss measurement procedure by using the normalize function, is shown below.

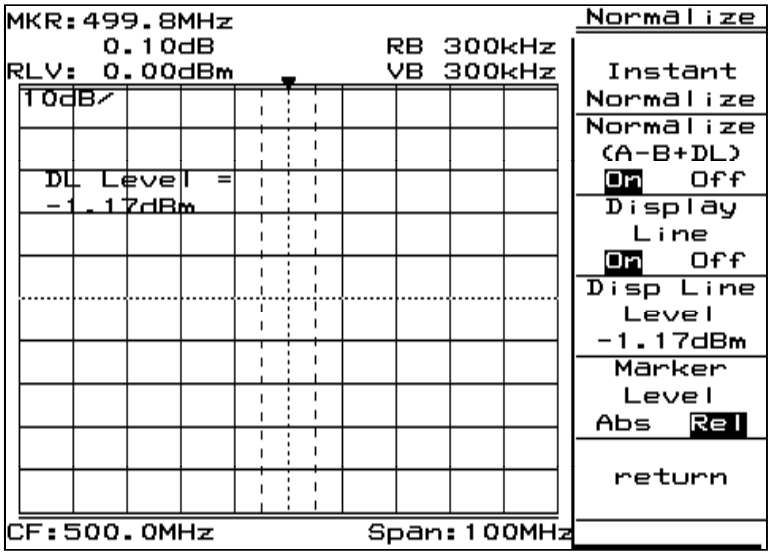
(1) Measuring and calibrating (normalizing) the compensation factor of measurement system

Remove the BPF, and connect only the coaxial cables.



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

- Initializing the MS2661N
  [Preset], F1: << Preset All >>
- Setting center frequency to 500 MHz
  [Frequency], [5], [0], [0], [MHz]
- Setting span to 100 MHz
  [Span], [1], [0], [0], [MHz]
- Setting reference level to 0 dBm
  [Amplitude], [0], [dBm]
- Setting TG to On
  [TG], F1:<<TG On Off>>
- Executing the instant normalize function
  [More], Displaying the 2nd page of the TG menu : F1:<<Instant Normalize>>



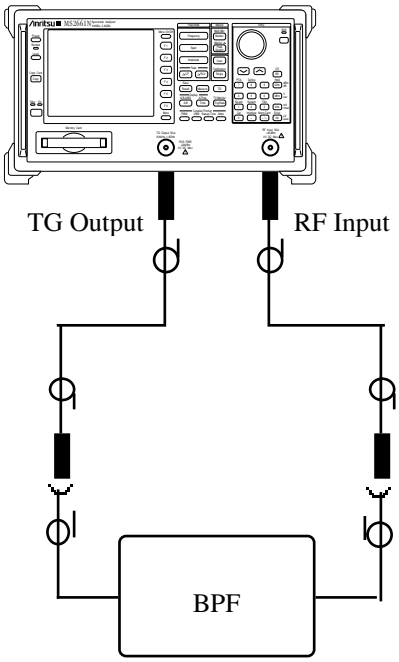
Note: Before executing the instant normalize function, turn the Normalize(A-B+DL) to Off, as shown below.

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

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

(2) Setup

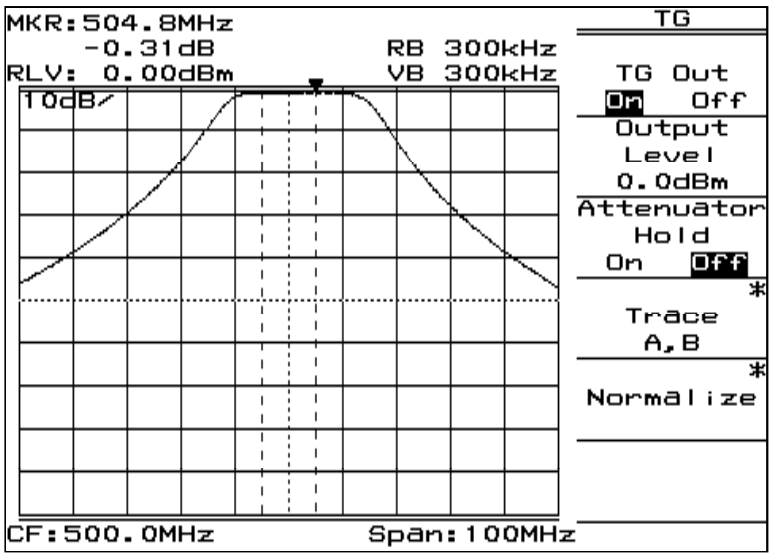
Connect the TG Output to BPF input, and BPF output to RF Input with a coaxial cable, respectively.



(3) Measuring characteristics

The following figure is obtained as the measurement results.

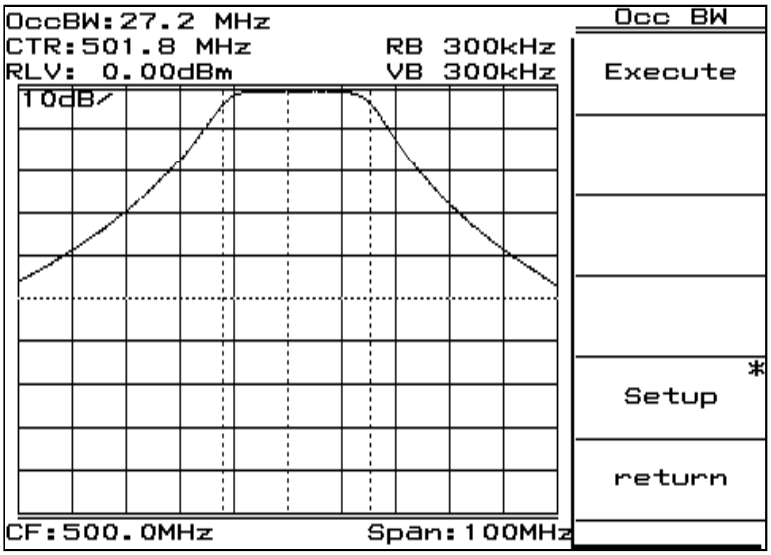
The marker level is displayed in the relative mode by setting the display-line level(normalized flat level) to the reference value. So, the marker level indicates the insertion loss, directly.



(4) Measuring center frequency and 3dB bandwidth

Using the measurement function of the occupied bandwidth, measures 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 well impedance-matched coaxial cables between the MS2661N and the device under test(BPF).

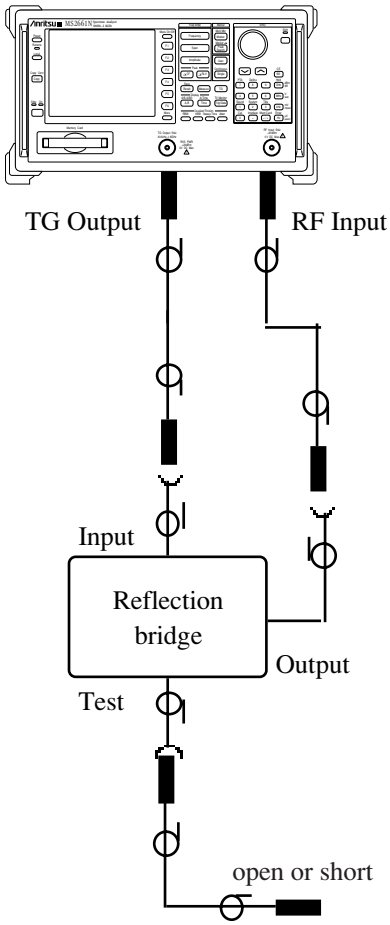
Reflection Characteristics Measurement

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

In the reflection characteristics measurement, since the insertion loss of the reflection bridge is large, use the normalize function.

(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.



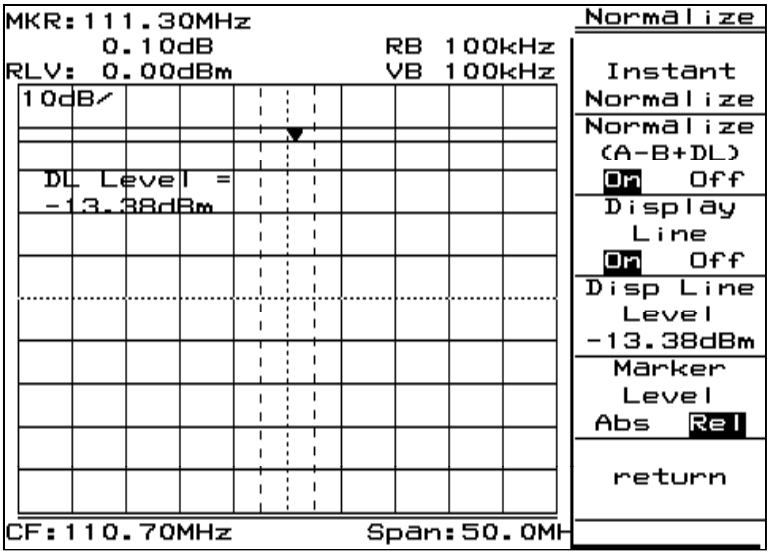
Measuring the compensation factor of the measurement system to calibrate the frequency characteristics, as shown below.

- Initializing the MS2661N
  [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.

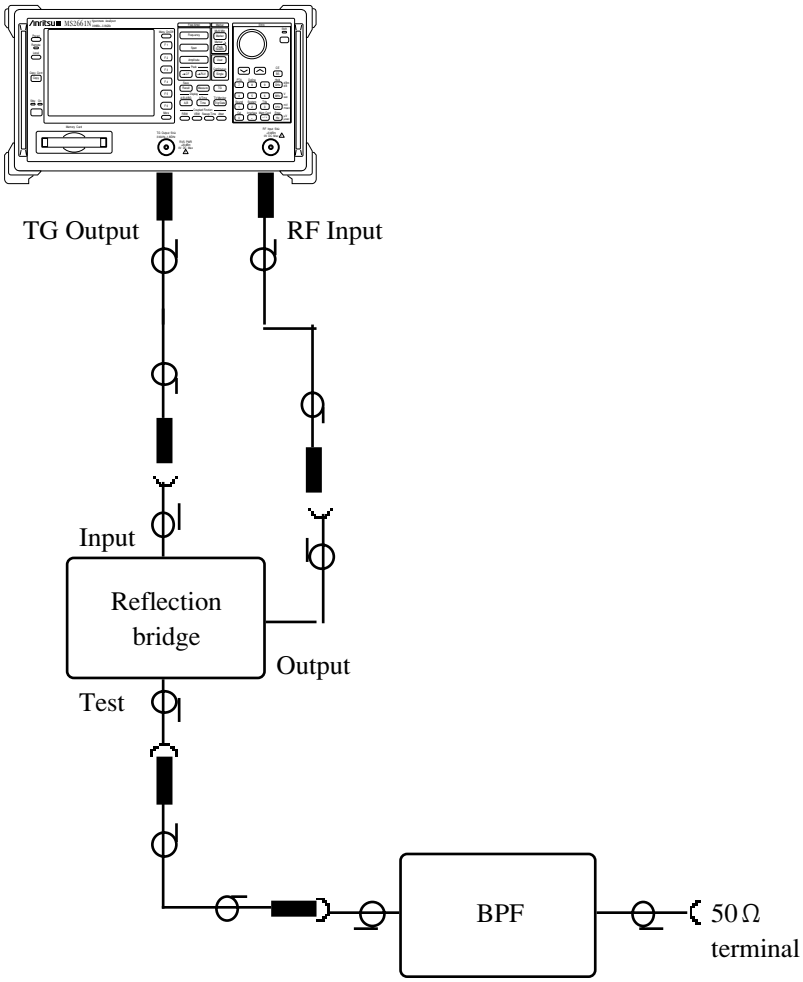
Displaying the 2nd page of the TG menu : [TG], [More], Turning the normalize (A-B+DL) function to Off: F2:<<Normalize (A-B+DL) On Off>>

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



(2) Setup

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



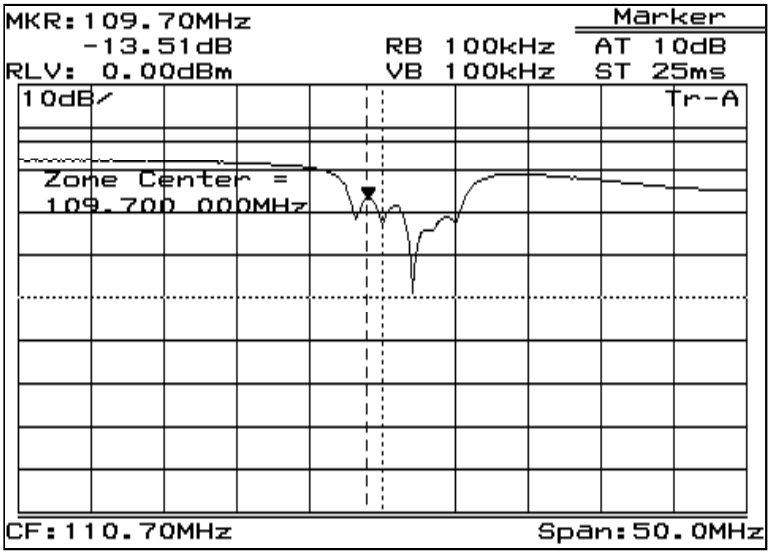
(3) Measuring characteristics

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. So, the marker level indicates the refrection loss, directly.

Take 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



Notes on Active Device Measurement

When measuring any active device(including an amplifier etc.), notes 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 (refrected 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, note to decrease the TG output level by the amount of the amplifier gain. The procedures and notes are the same as the BPF, described in the previous paragraphs.

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APPENDIX A

SOFT-KEY MENU

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

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APPENDIX A
SOFT-KEY MENU

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

(1) 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.

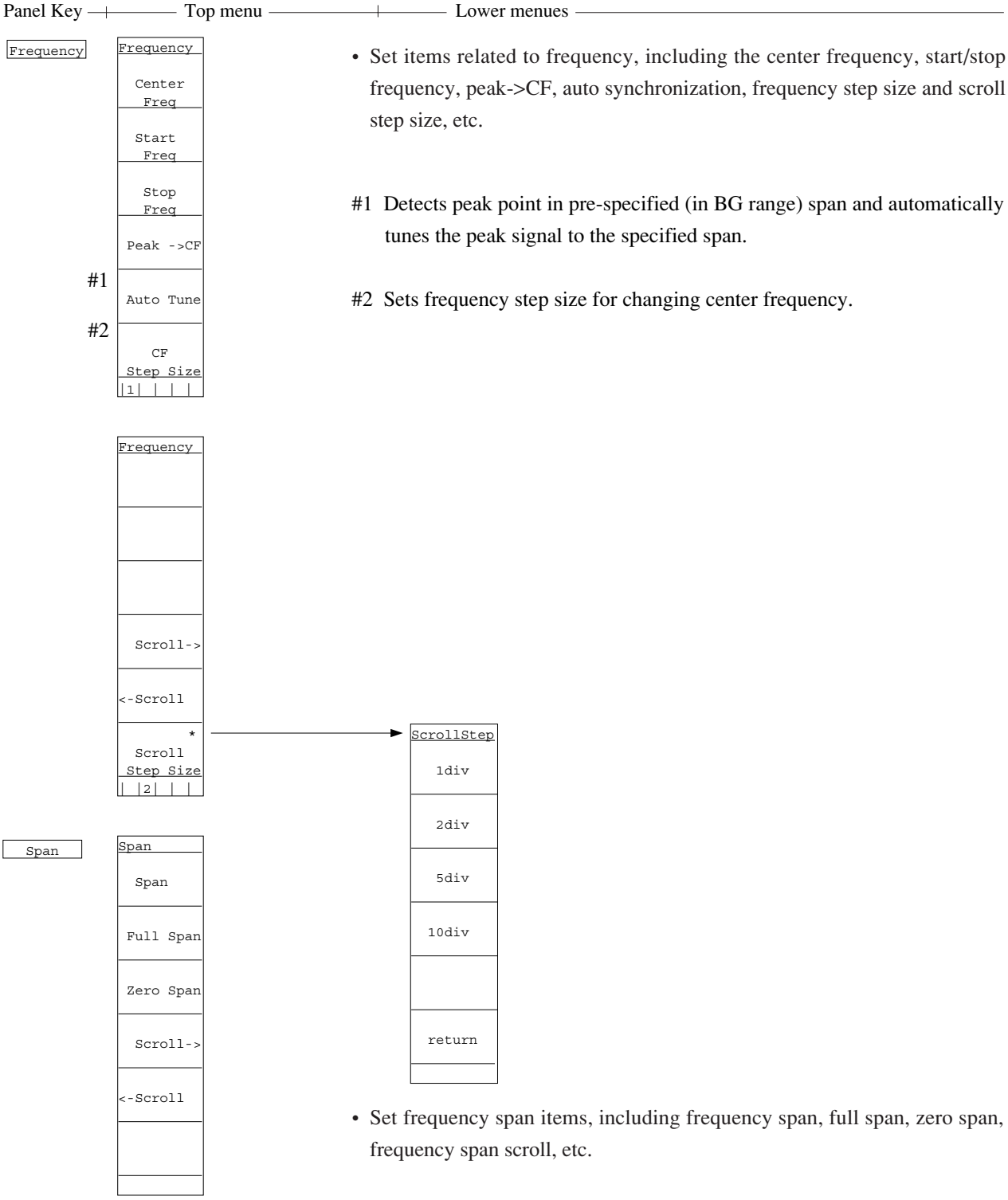
(7) Panel keys and soft keys prefixed by a sharp symbol (#) at the left of the menu frame, give an outline explanation of the function.

(8) The menu with ! mark cannot be used on the MS2661N.

Soft-key Menu List

Menu Tree

Menu Tree (1 /27)



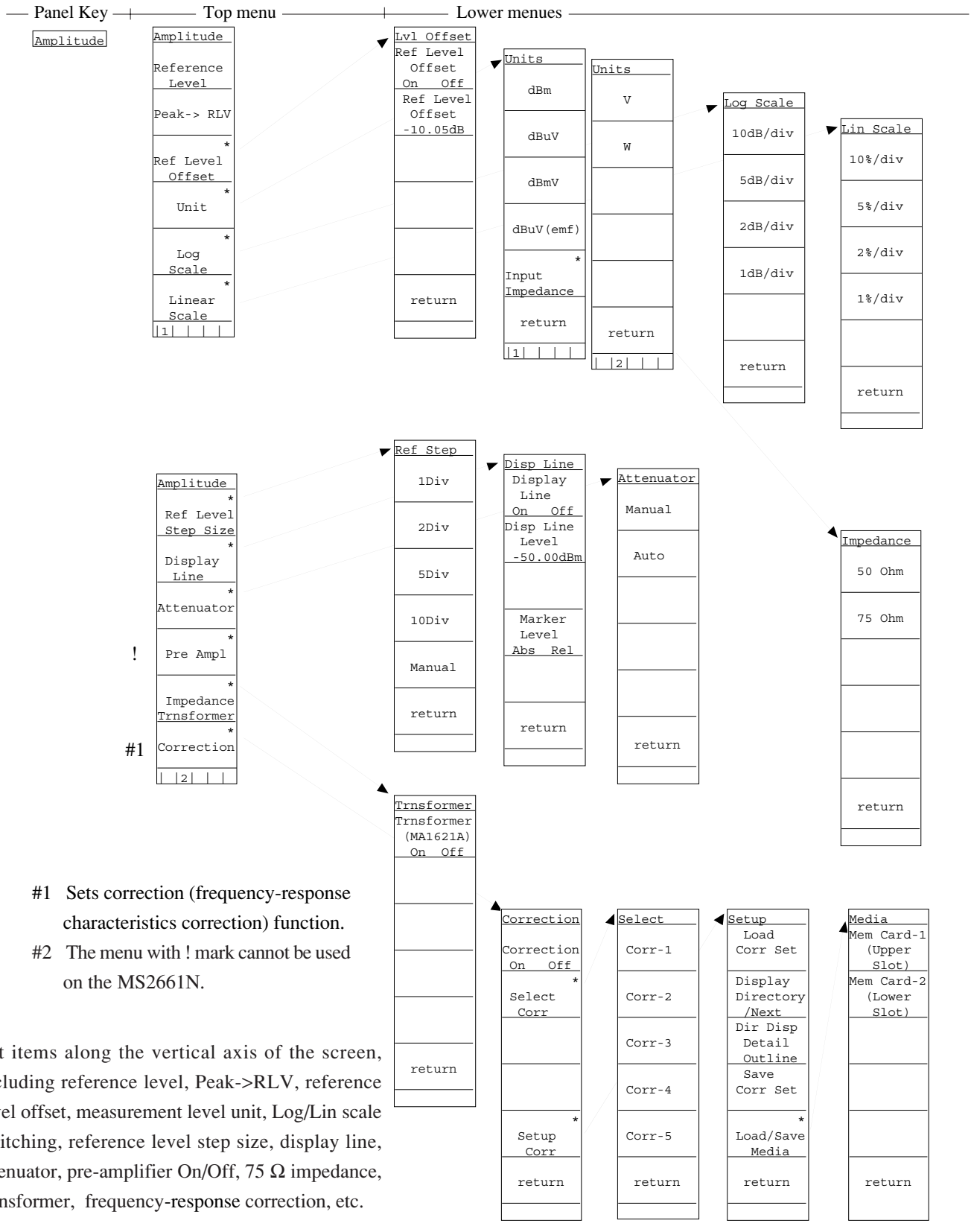
- Set items related to frequency, including the center frequency, start/stop frequency, peak->CF, auto synchronization, frequency step size and scroll step size, etc.

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

#2 Sets frequency step size for changing center frequency.

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

Menu Tree (2/27)



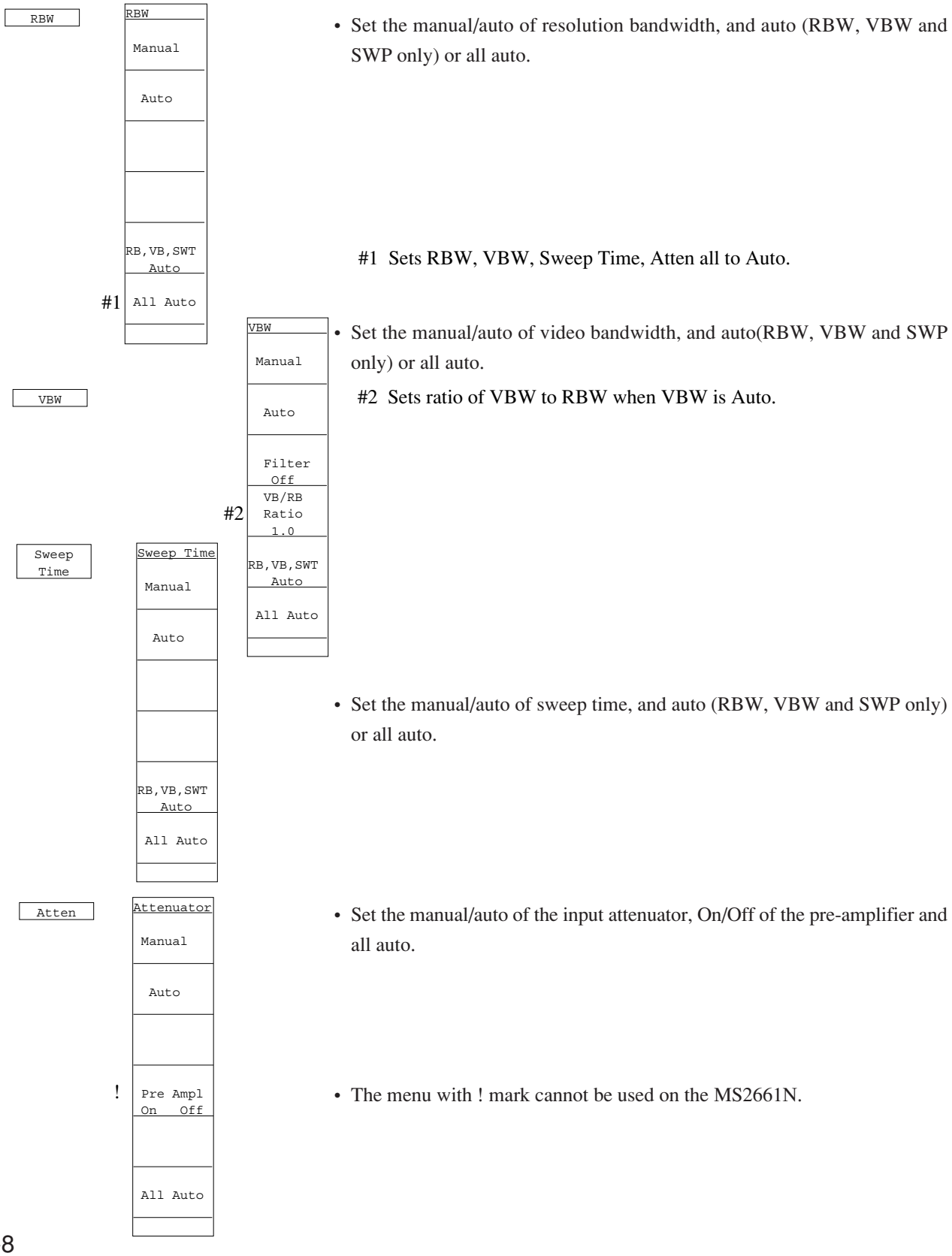
#1 Sets correction (frequency-response characteristics correction) function.

#2 The menu with ! mark cannot be used on the MS2661N.

- 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, 75 Ω impedance, transformer, frequency-response correction, etc.

Menu Tree (3/27)

Panel Key — Top menu — Lower menues



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

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

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

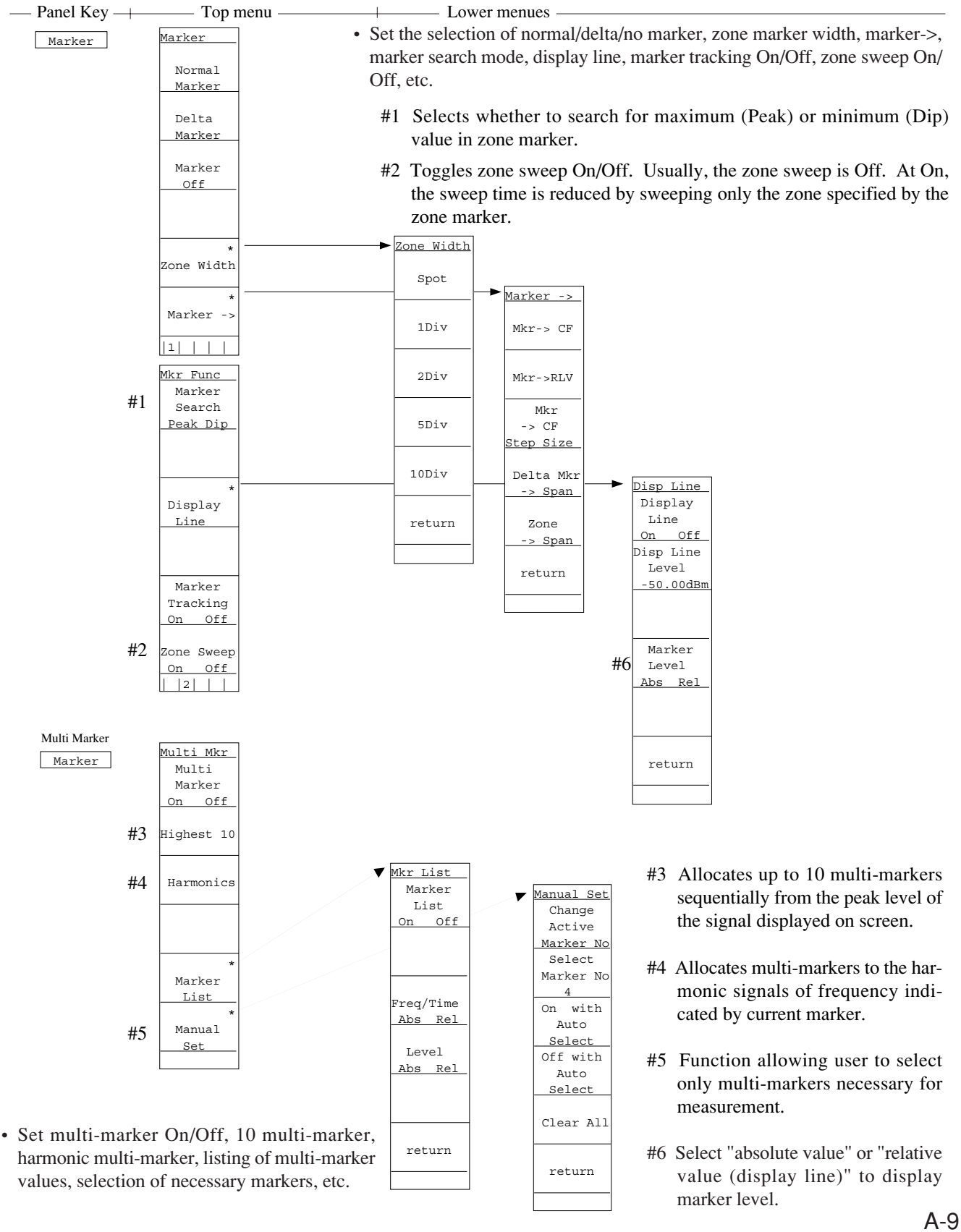
#2 Sets ratio of VBW to RBW when VBW is Auto.

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

- Set the manual/auto of the input attenuator, On/Off of the pre-amplifier and all auto.

- The menu with ! mark cannot be used on the MS2661N.

Menu Tree (4/27)



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

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

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

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

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

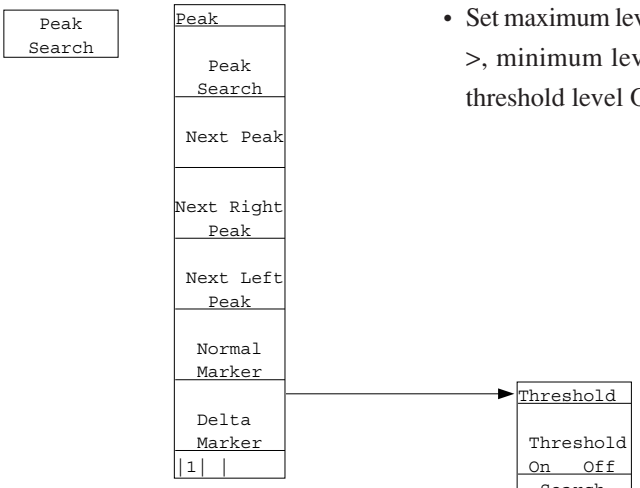
  #4 Allocates multi-markers to the harmonic signals of frequency indicated by current marker.

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

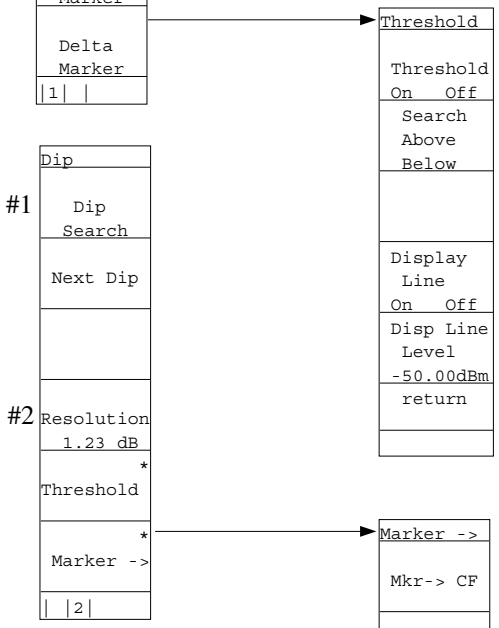
  #6 Select "absolute value" or "relative value (display line)" to display marker level.

Menu Tree (5 /27)

Panel Key — Top menu — Lower menues

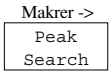


- Set maximum level search, next peak, next right peak, next left peak, Marker->, minimum level search, next minimum level, search level resolution, threshold level On/Off, etc.



#1 Searches for minimum (Dip) level.

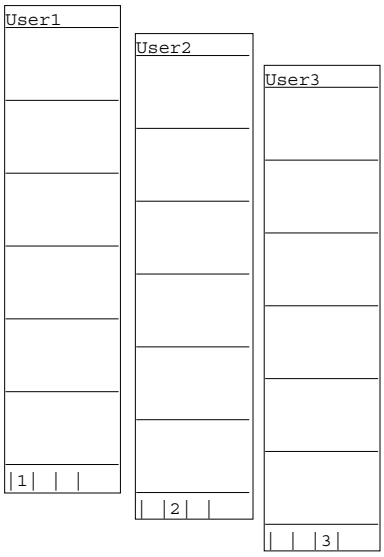
#2 Sets peak-search level resolution.



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

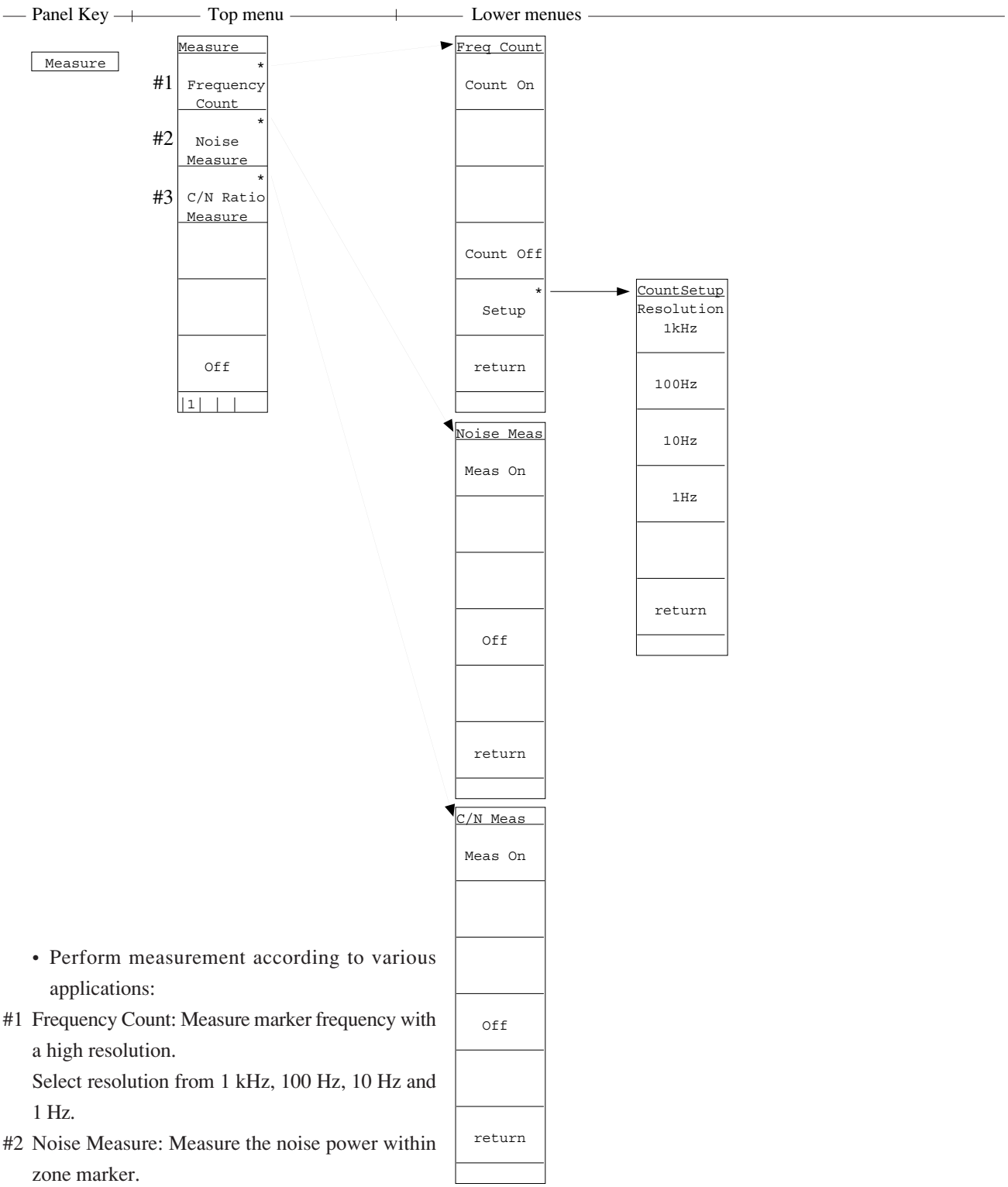
Menu Tree (6/27)

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



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

Menu Tree (7/27)



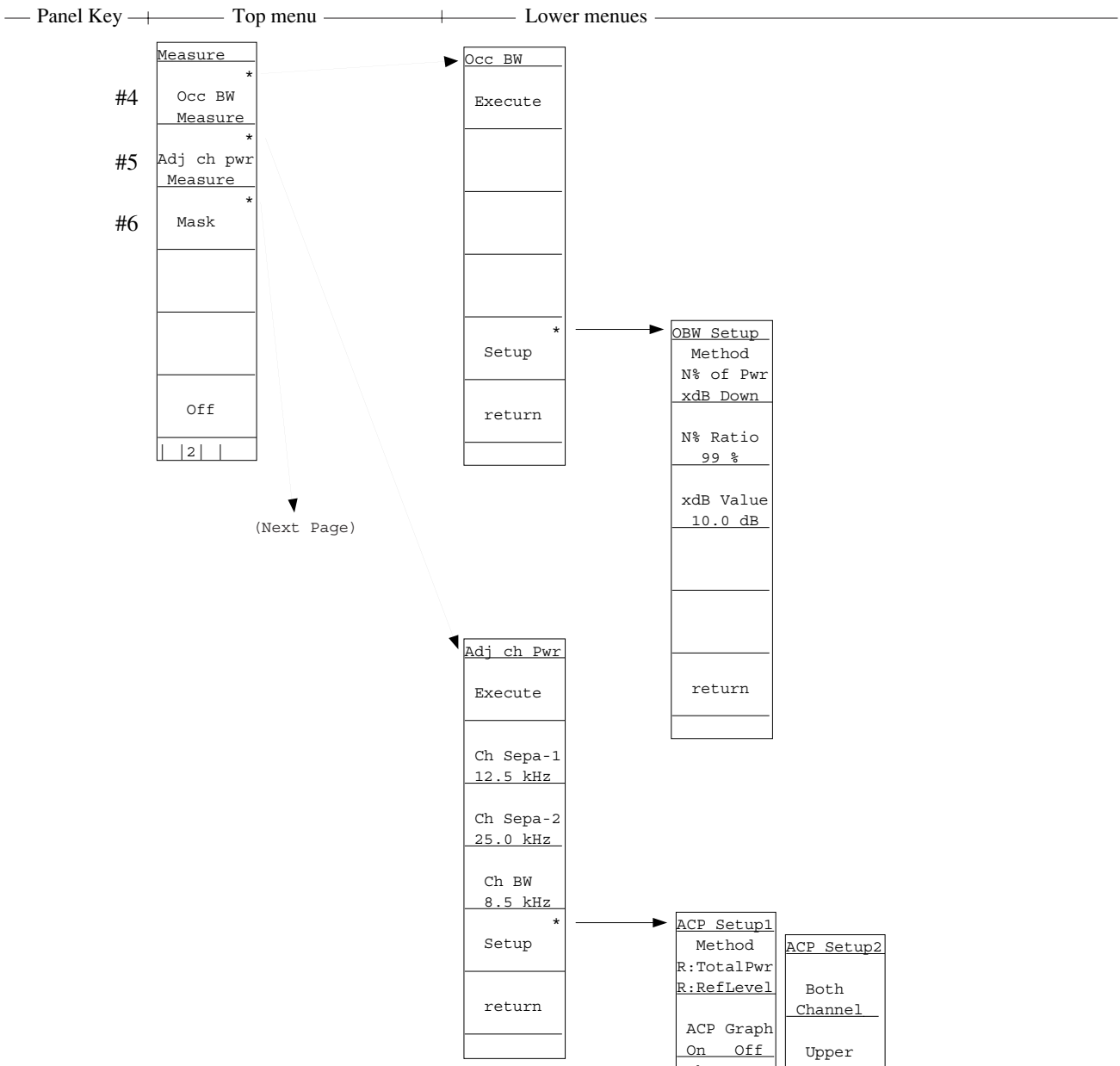
- Perform measurement according to various applications:

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

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

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

Menu Tree (8/27)

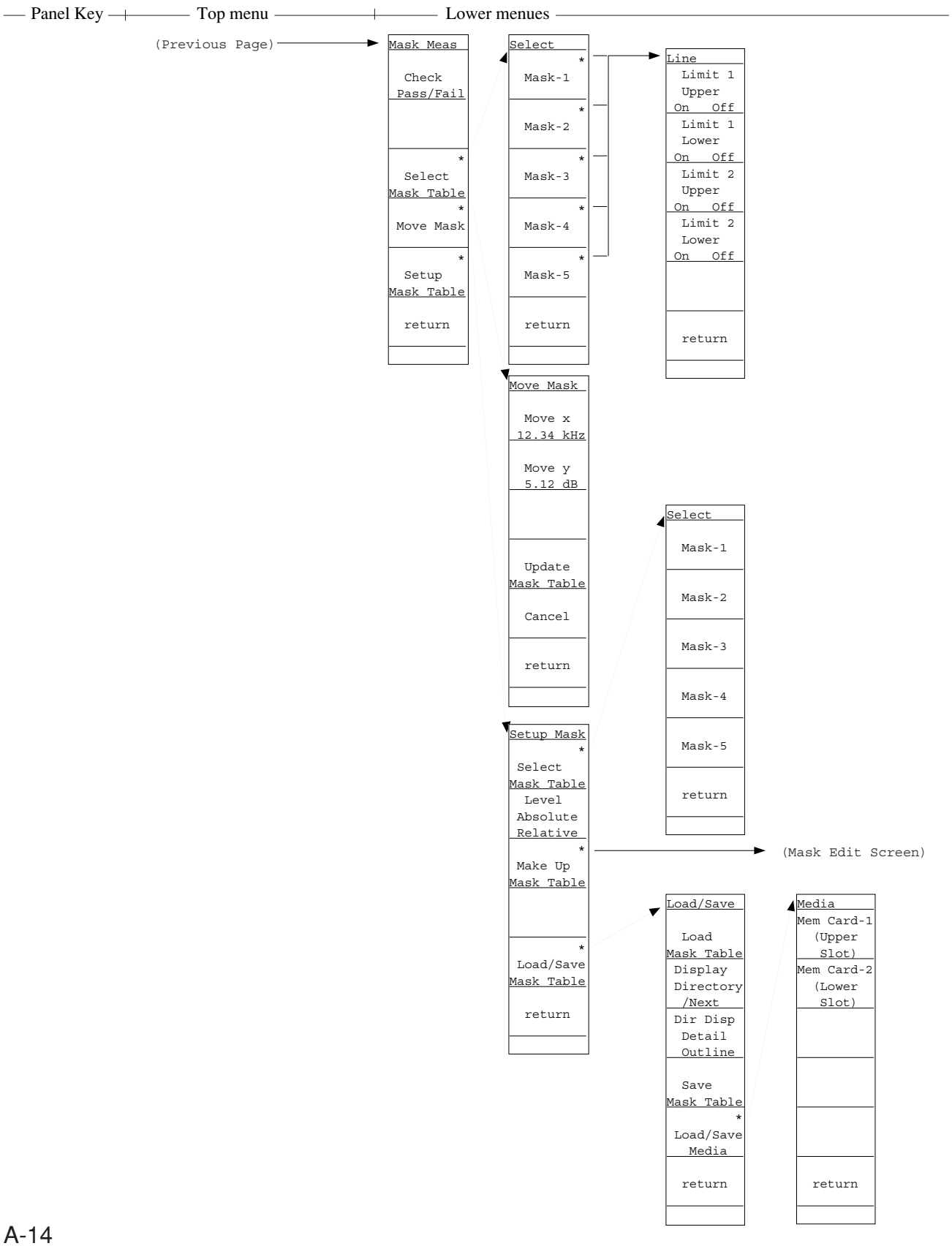


#4 Occ BW Measure: Measure the occupied bandwidth. Select the XdB DOWN or N% of POWER mode.

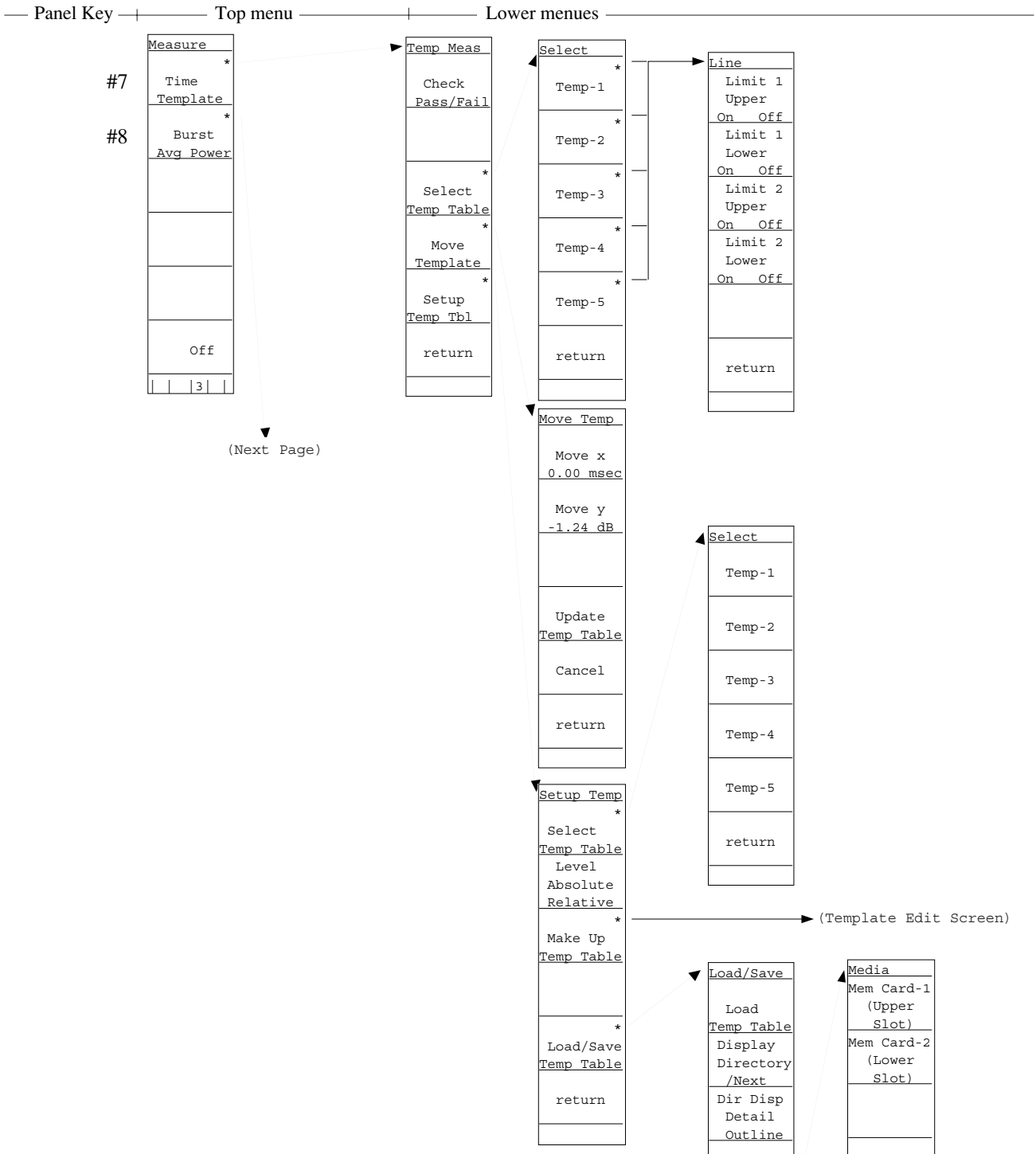
#5 Adj ch pwr Measure: Measure leak power from adjacent channels. Select Channel Separate, Channel Bandwidth and Measurement Mode (Method), On/Off of ACP Graph, On/Off of Channel Center Line and On/Off of Channel BW Line, Upper Channel, Lower Channel or Both Channel, etc.

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

Menu Tree (9/27)



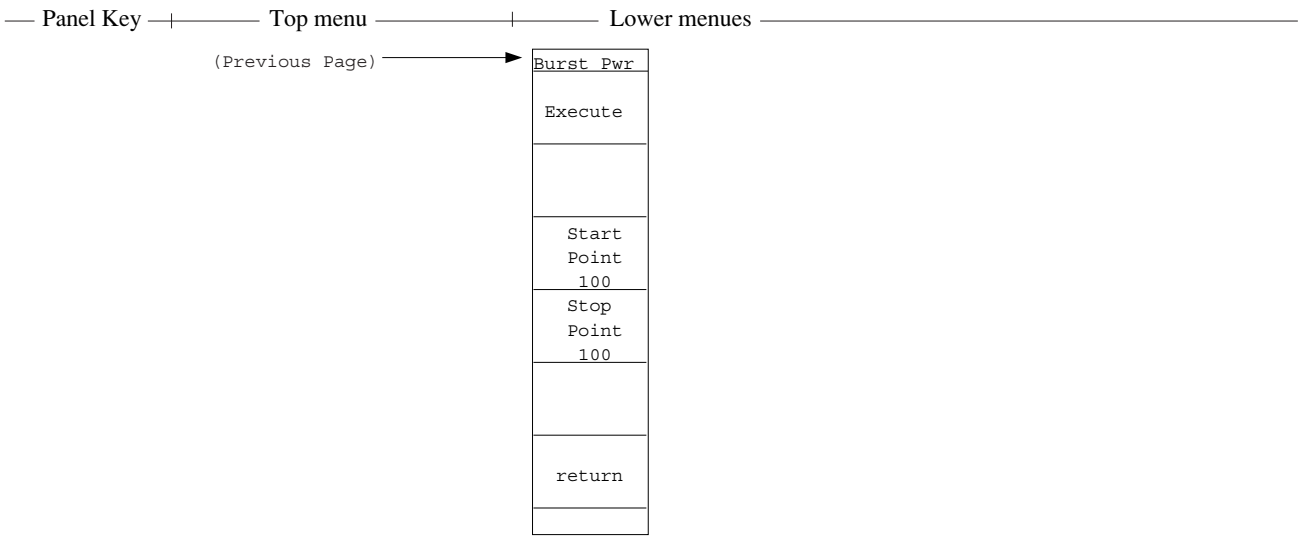
Menu Tree (10/27)



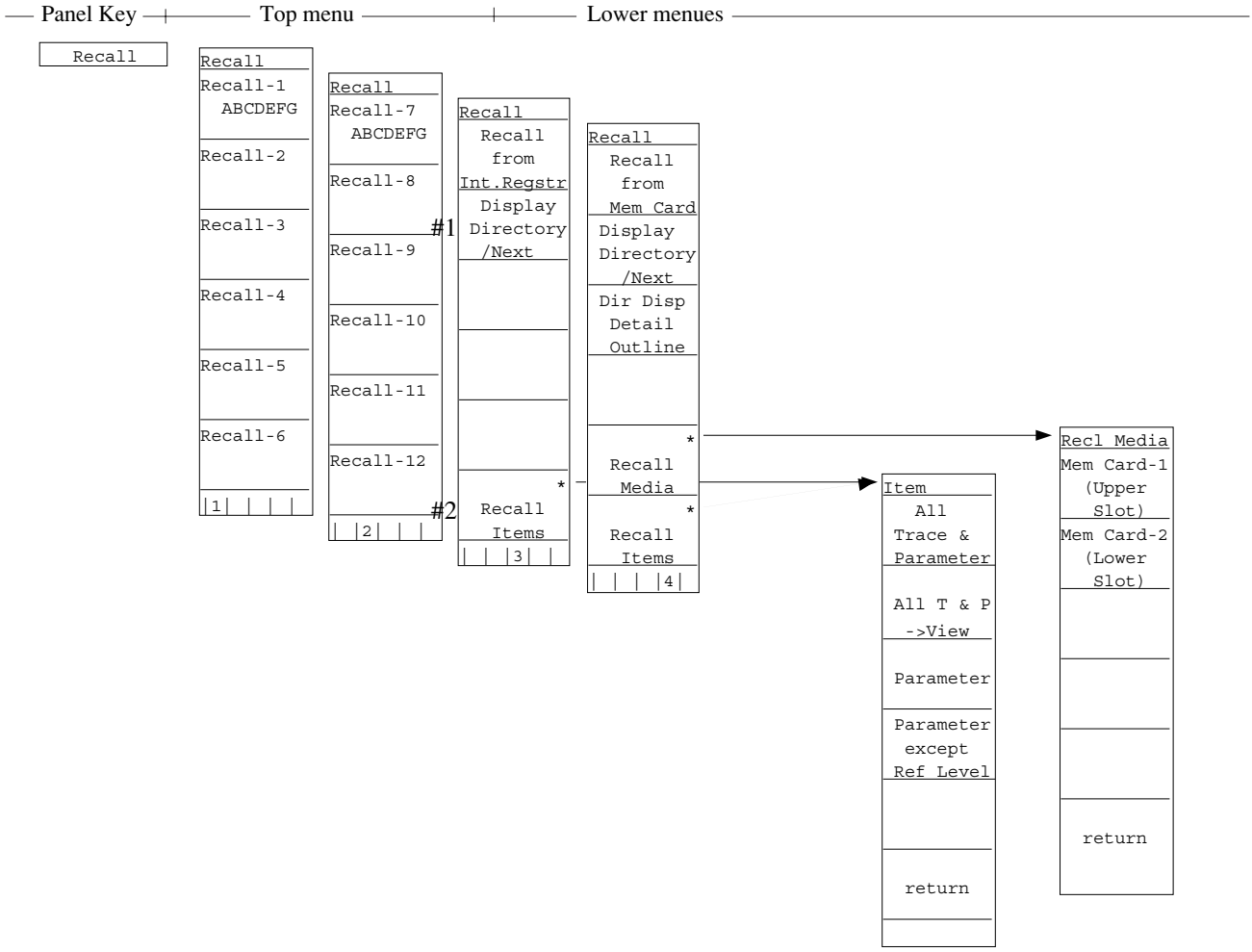
#7 Time Template: Set Standard Line of the time domain and judge Good/NG in relation to the standard line. Select Template Table, Template Movement, Measurement Mode, Template Table Preparation, Load/Save of Mask Table, etc.

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

Menu Tree (11/27)



Menu Tree (12/27)



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

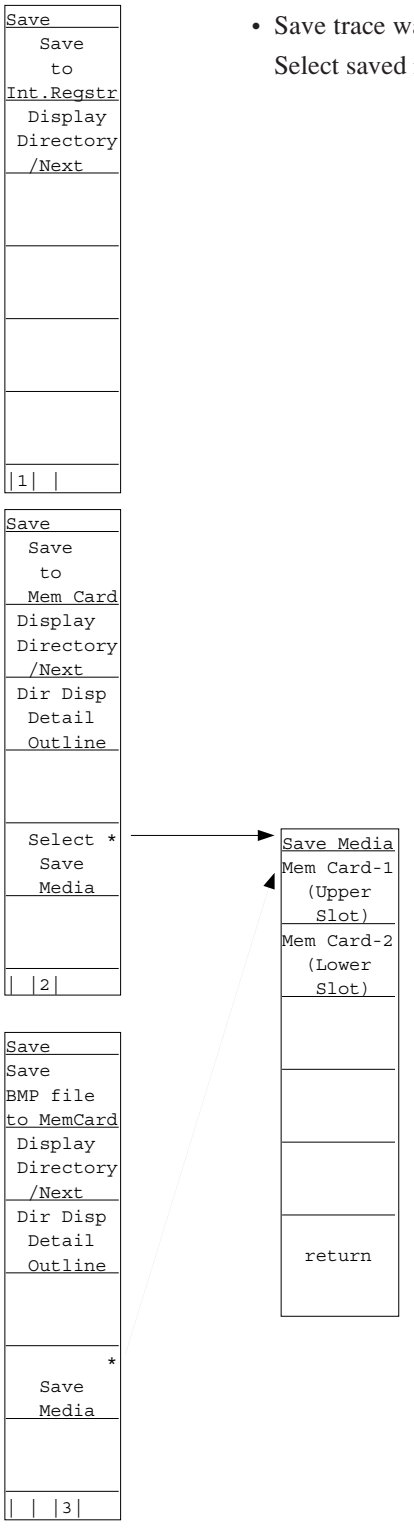
  #1 Displays list of internal-register directories.

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

Menu Tree (13/27)

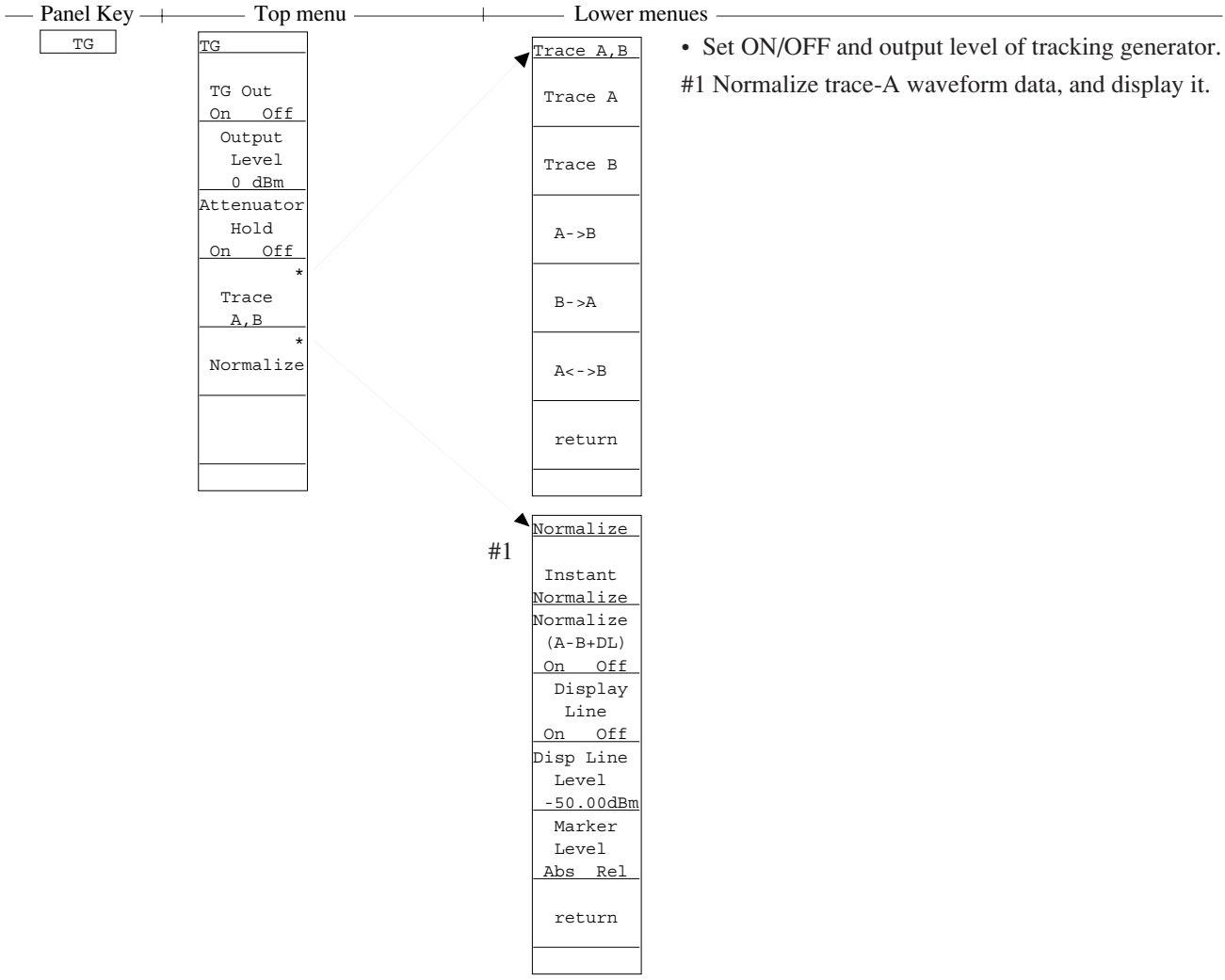
Panel Key — Top menu — Lower menues

Save
Recall



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

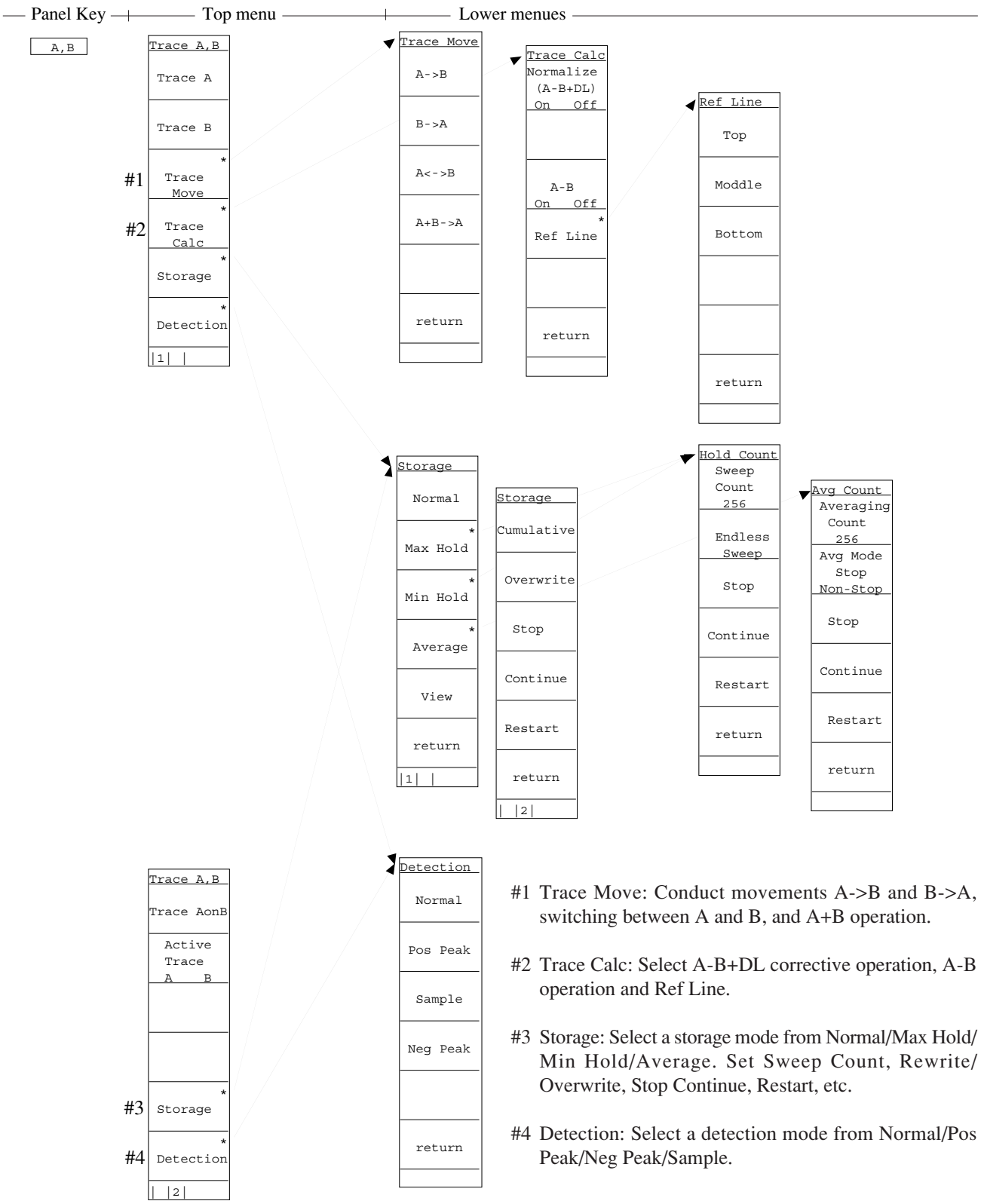
Menu Tree (14/27)



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

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

Menu Tree (15/27)



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

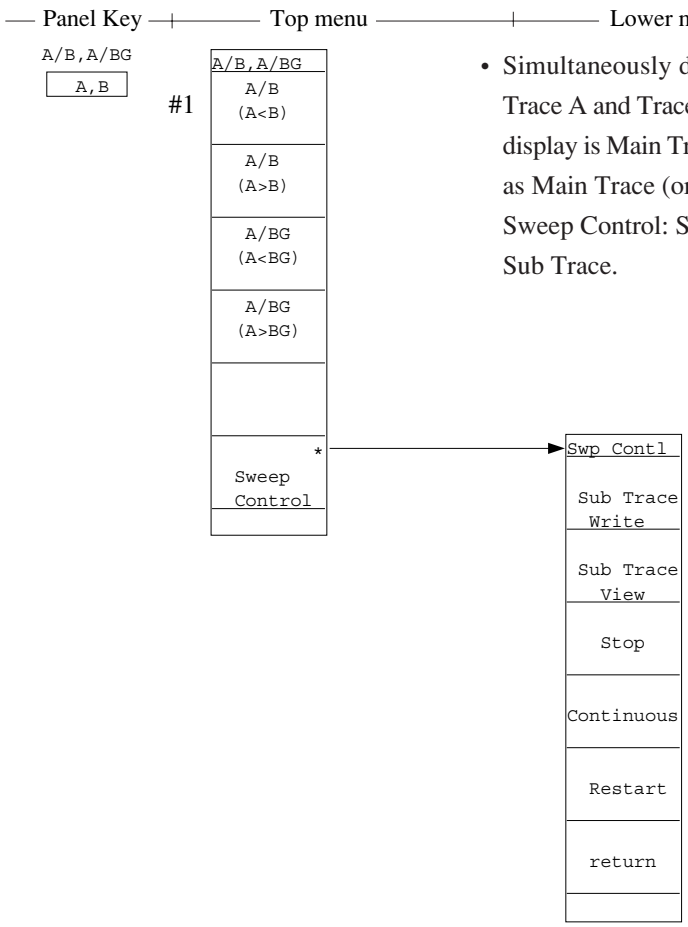
#2 Trace Calc: Select A-B+DL corrective operation, A-B operation and Ref Line.

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

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

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

Menu Tree (16/27)



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

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

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
#1 * Expand
| |2|

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

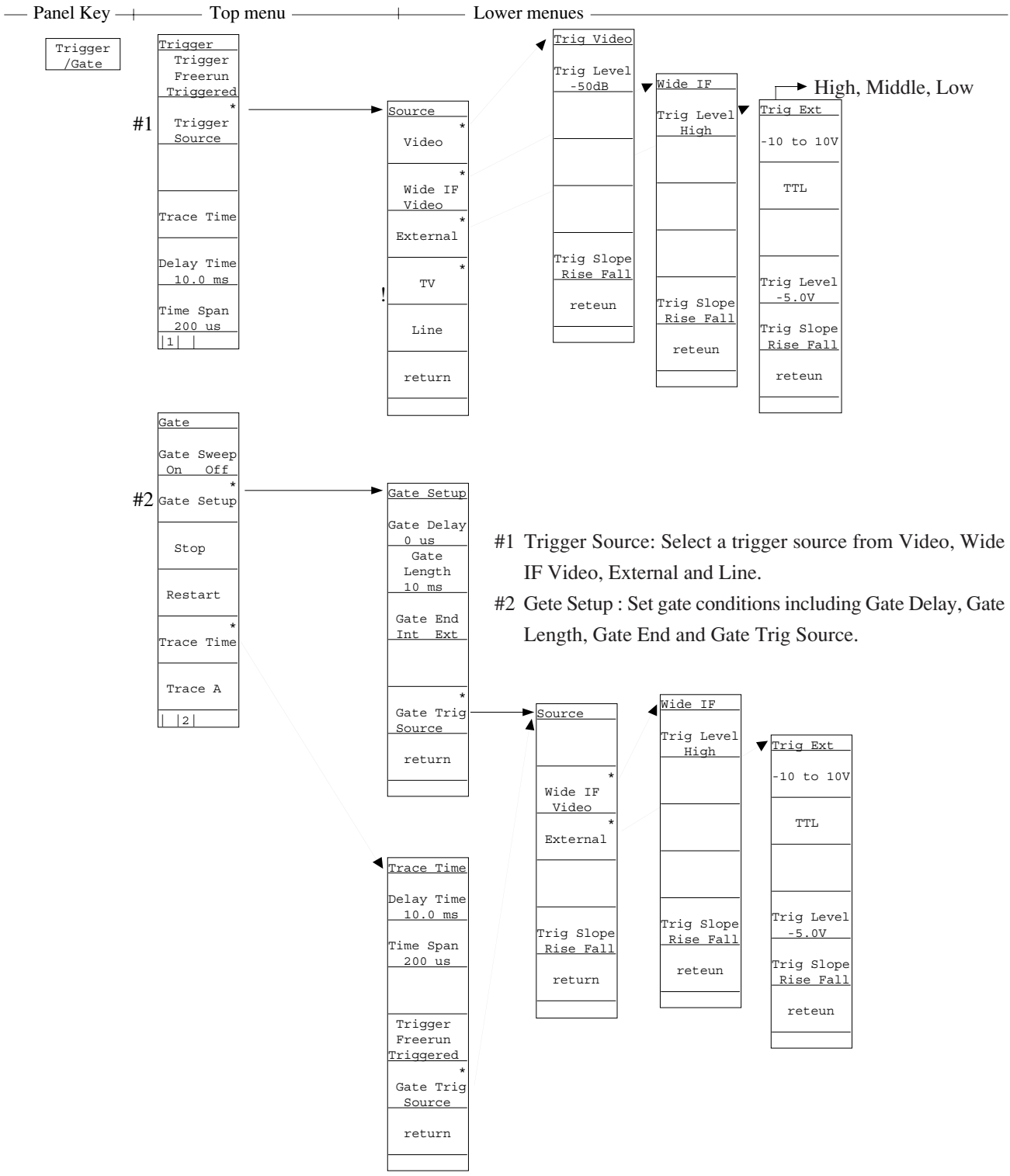
A/Time
#2 A/Time (A<Time)
A/Time (A>Time)
* Sweep Control

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)



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

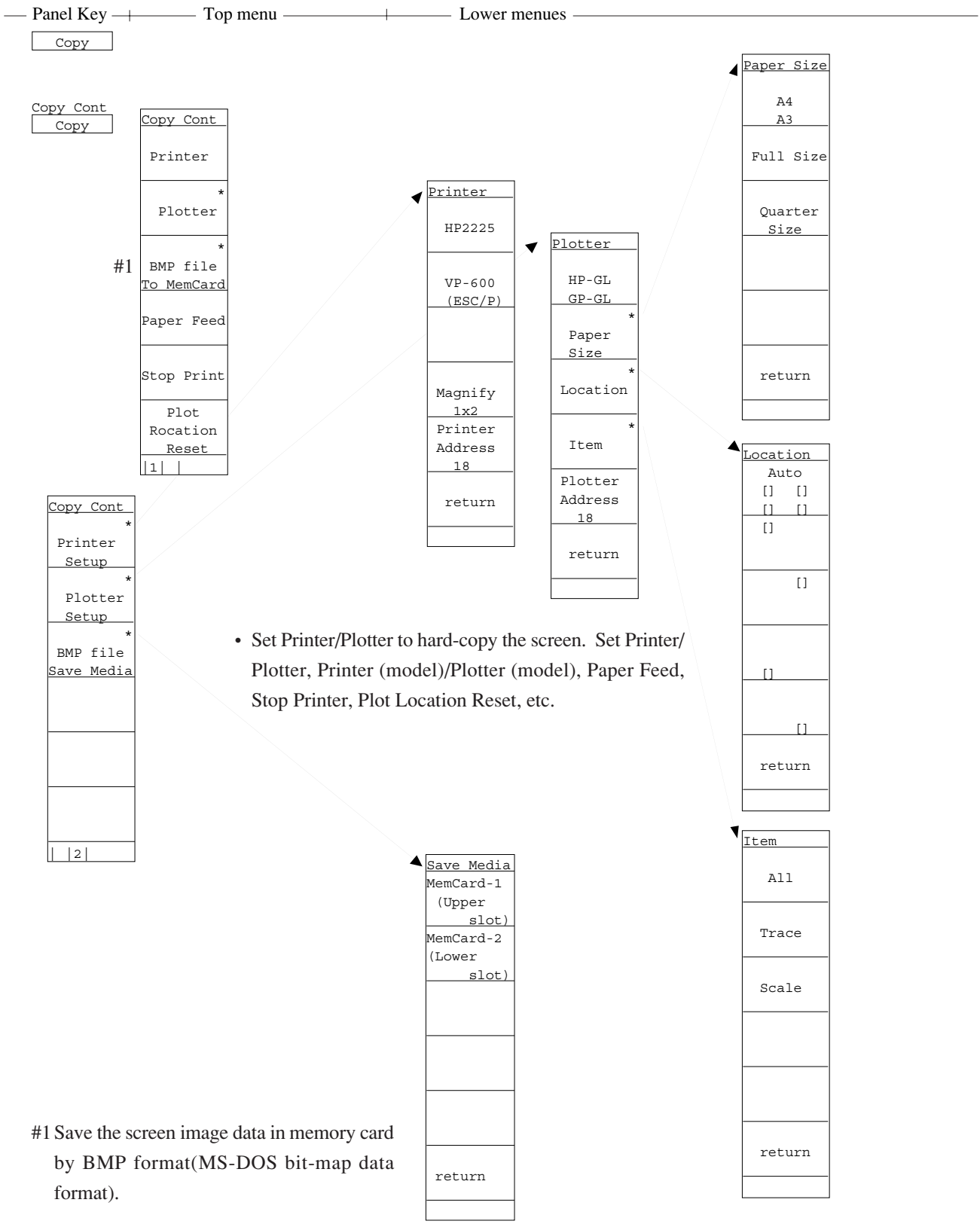
#2 Gete Setup : Set gate conditions including Gate Delay, Gate Length, Gate End and Gate Trig Source.

- 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)



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

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

Menu Tree (21/27)

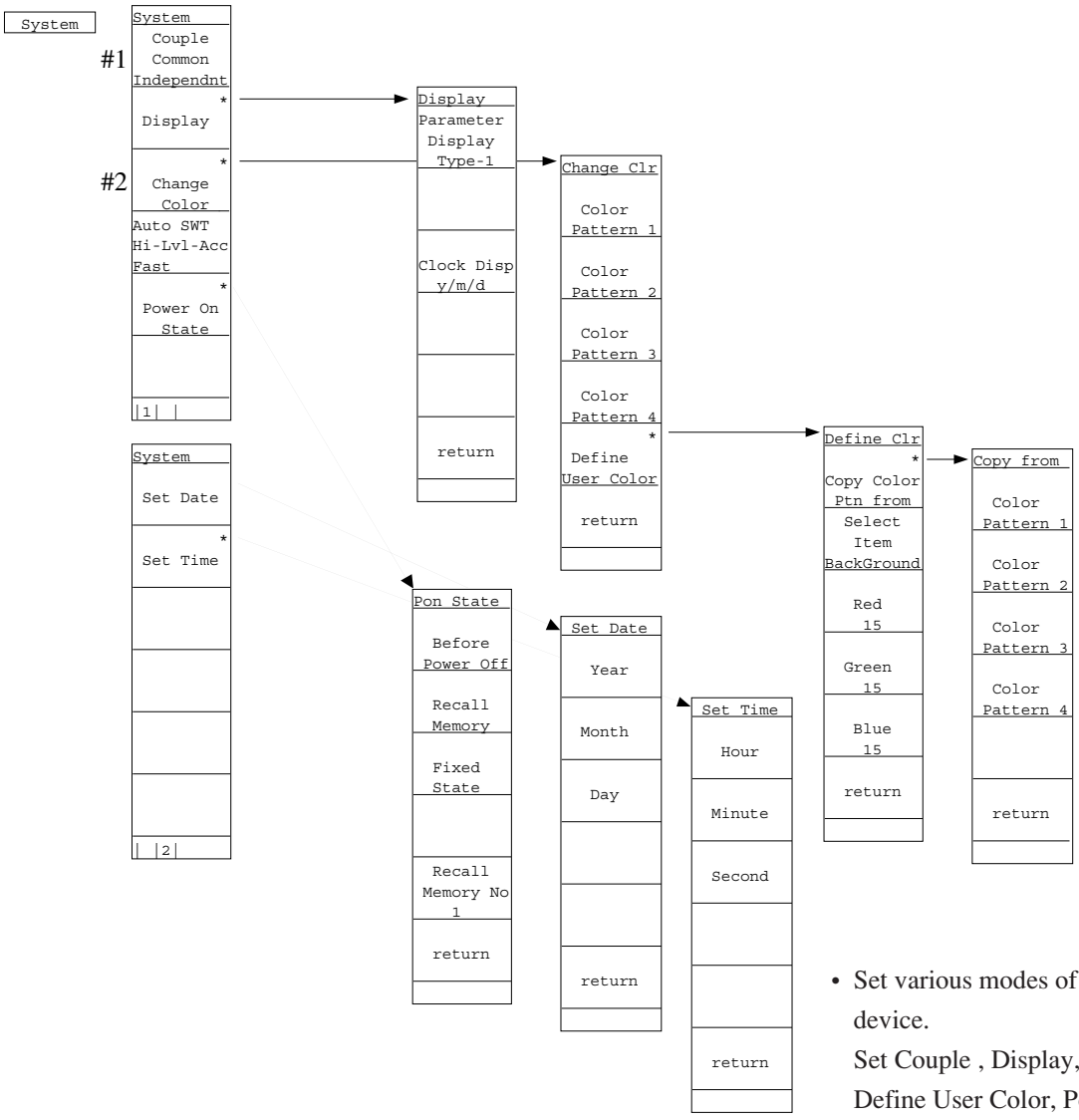
Panel Key — Top menu — Lower menues

! Sound

- The menu with ! mark cannot be used on the MS2661N.

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

#2 Changes screen color pattern.



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

Menu Tree (22/27)

Panel Key	Top menu	Lower menues
Cal	Cal	• Execute calibration. Select an item from All Cal, Level Cal and Freq Cal.

Cal

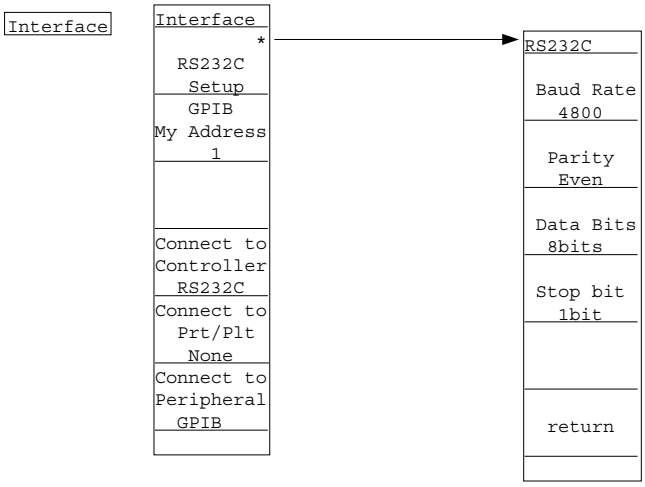
Cal
All Cal
Level Cal
Freq Cal
FM Cal
* Preslctr Tuning

Cal
Freq Cal On Off
* Cal Status → <Calibration status screen>
* Mainte- nance

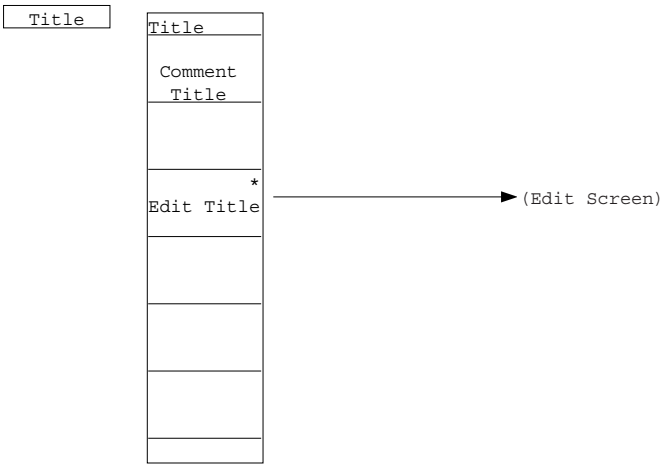
Menu Tree (23/27)

Panel Key — Top menu — Lower menues

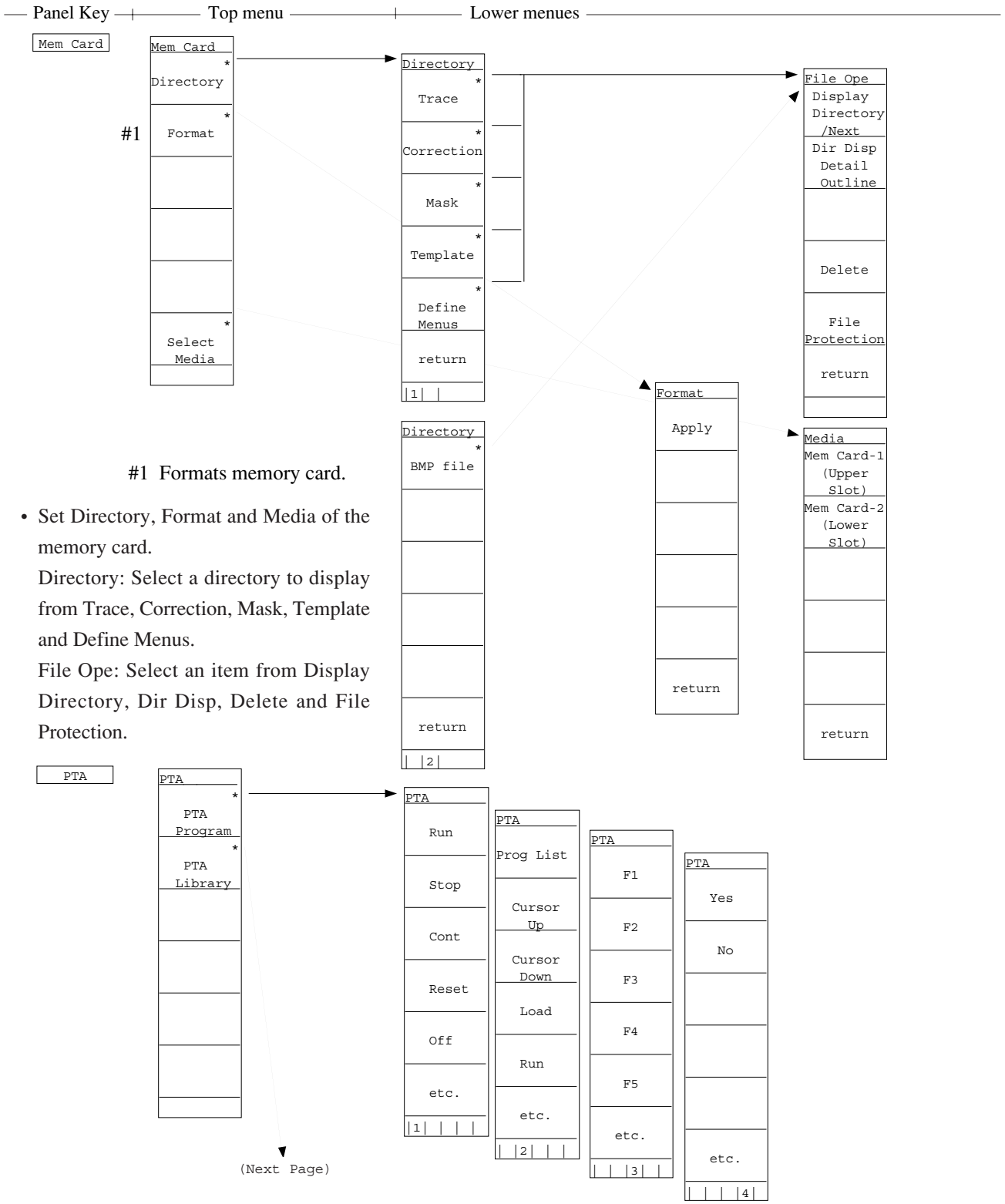
- Set interfaces for external devices to connect. Select RS232C, or GPIB, and set the RS232C interface, GPIB address, etc.



- Input a title to display on the screen.



Menu Tree (24/27)

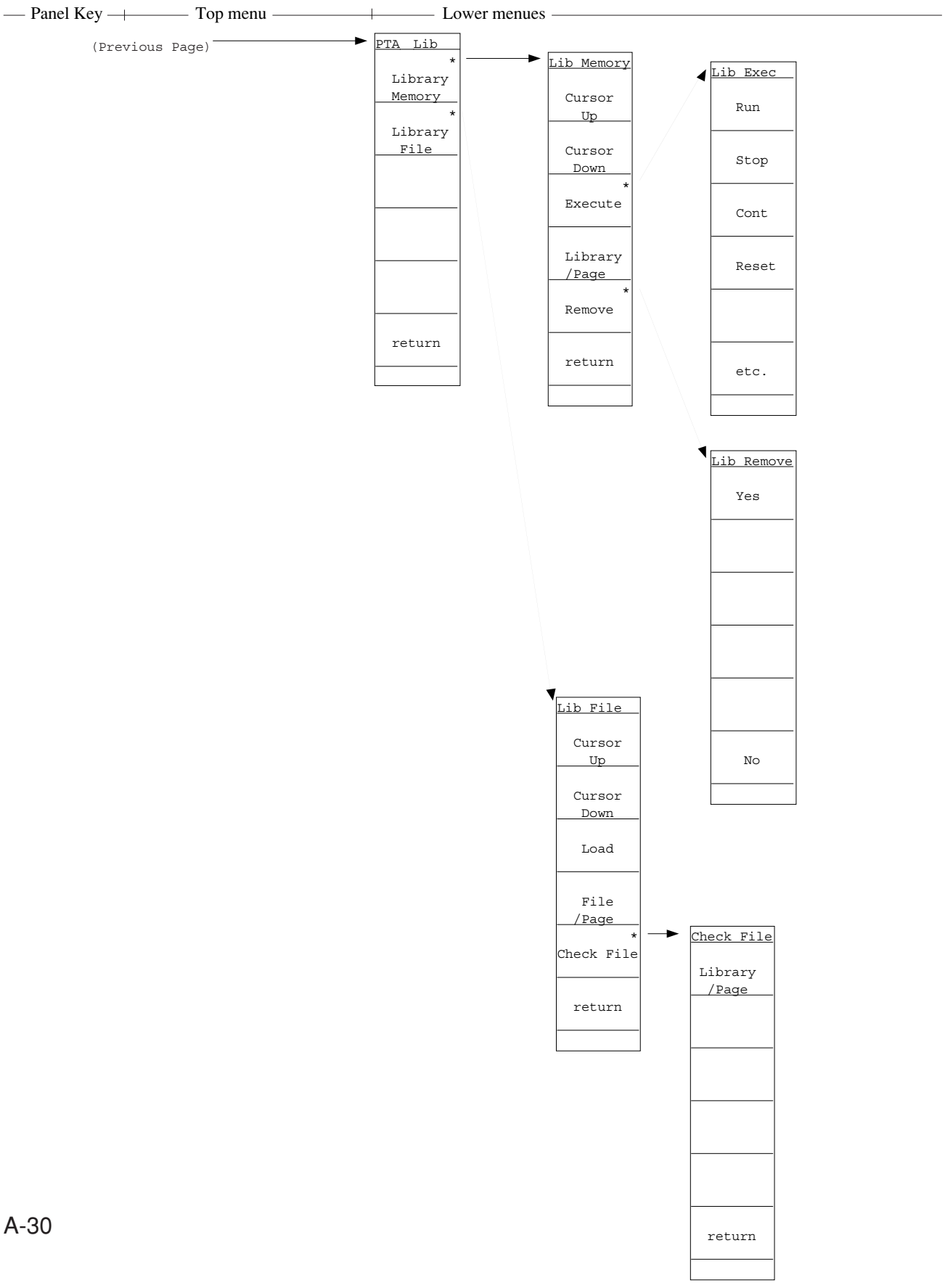


#1 Formats memory card.

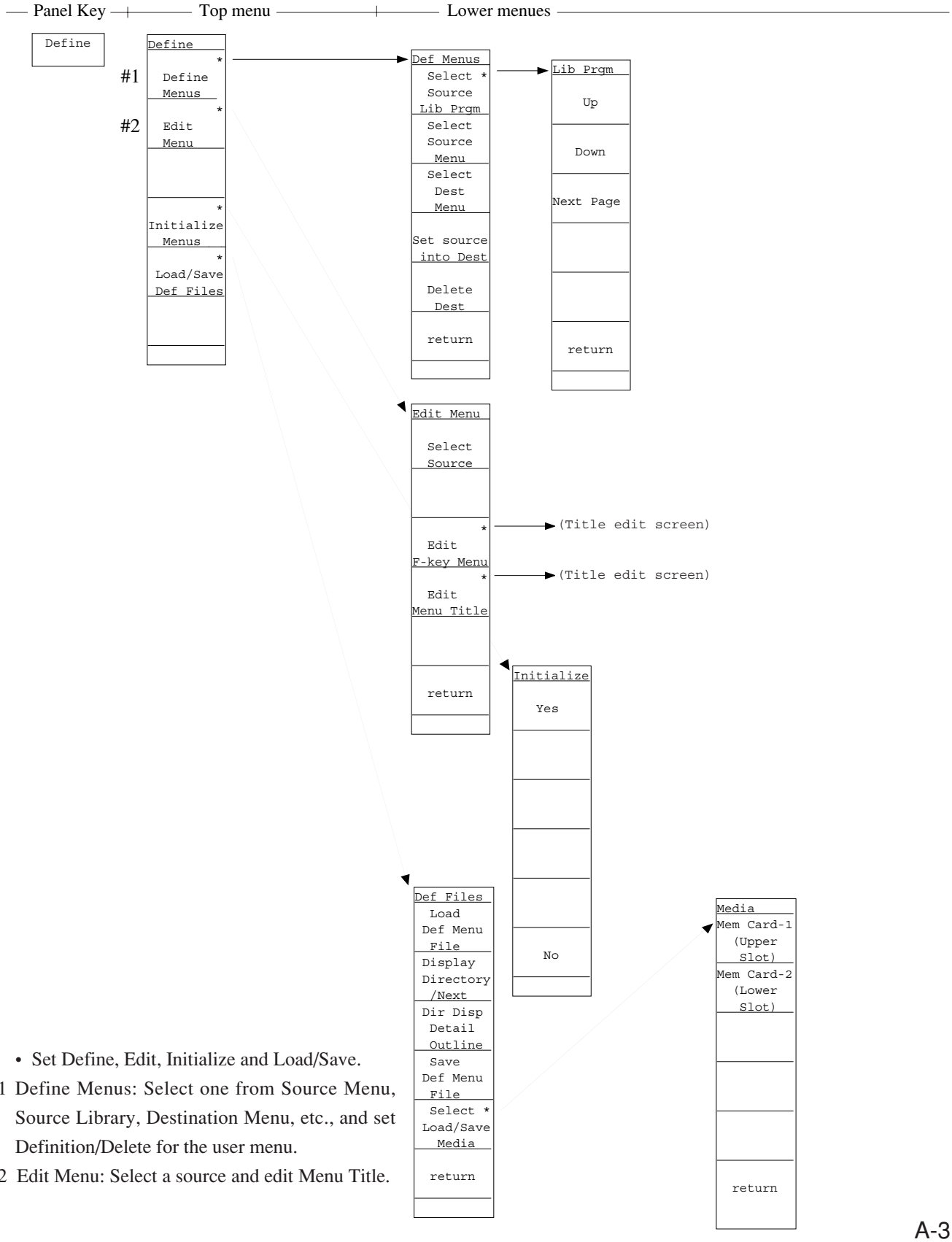
- Set Directory, Format and Media of the memory card.
  Directory: Select a directory to display from Trace, Correction, Mask, Template and Define Menus.
  File Ope: Select an item from Display Directory, Dir Disp, Delete and File Protection.

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

Menu Tree (25/27)



Menu Tree (26/27)



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

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

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

Menu Tree (27/27)

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

APPENDIX B
ERROR MESSAGE

This appendix describes the error messages displayed on the screen.

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APPENDIX B
ERROR MESSAGE

When operating or controlling the MS2661N with RS-232C/GPIB, if any setting error or execution error is occurred; an error message is displayed at the left center of the screen.
If an error message displayed; confirm the setting contents, and current measurement-conditions/setup-conditions according to the message, and re-operate/re-set them to the correct ones.

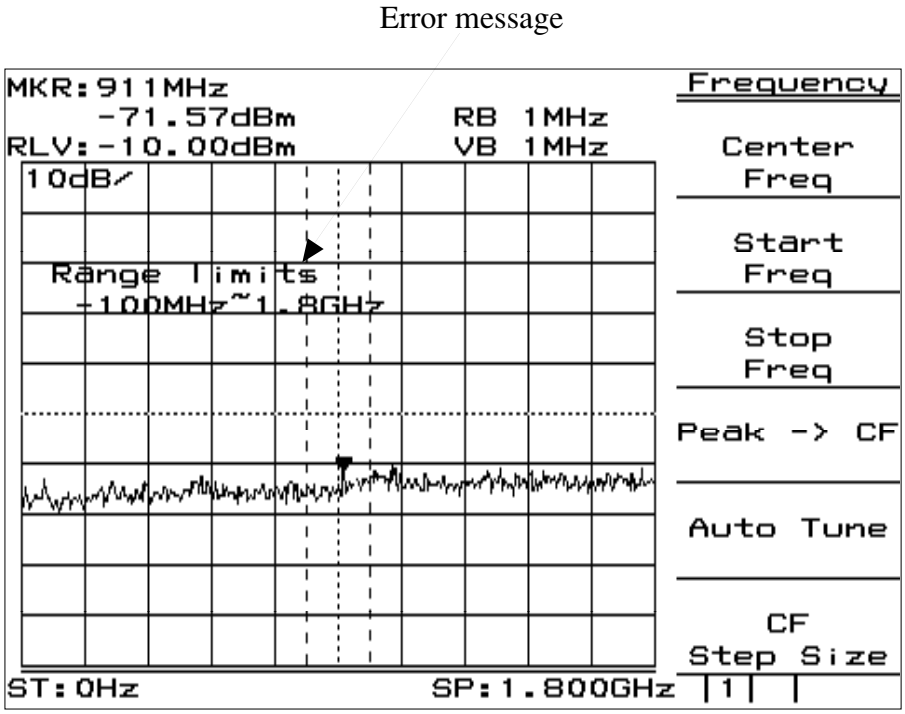

Fig. B-1 Error Message

Error messages are listed below. in the alphabetical order.

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.

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 MS2661N.
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 MS2661N is not in device mode.
Confirm the interface connection condition.
Not in system controller mode
GPIB of the MS2661N 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 MS2661N, 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]