Safety Summary

When you notice any of the unusual conditions listed below, immediately terminate operation and disconnect the power cable.
Contact your local Agilent Technologies sales representative or authorized service company for repair of the instrument. If you continue to operate without repairing the instrument, there is a potential fire or shock hazard for the operator.

- Instrument operates abnormally.
- Instrument emits abnormal noise, smell, smoke or a spark-like light during the operation.
- Instrument generates high temperature or electrical shock during operation.
- Power cable, plug, or receptacle on instrument is damaged.
- Foreign substance or liquid has fallen into the instrument.

Caution

Do not exceed the operating input power, voltage, and current level and signal type appropriate for the instrument being used, refer to your instrument's Function Reference.

Electrostatic discharge(ESD) can damage the highly sensitive microcircuits in your instrument. ESD damage is most likely to occur as the test fixtures are being connected or disconnected. Protect them from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any static charge built-up by touching the outer shell of any grounded instrument chassis before touching the test port connectors..

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

Manufacturer's Name: Agilent Technologies Japan, Ltd.

Manufacturer's Address: 1-3-2, Murotani, Nishi-ku, Kobe-shi, Hyogo, 651-2241 Japan

Declares, that the product:

Product Name: VCO / PLL Signal Analyzer

Model Number: 4352B

Product Options: This declaration covers all options of the above product

Conforms with the following product standards:

EMC:	Standard	Limit
	IEC 61326-1:1997 +A1:1998 / EN 61326-1:1997 +A1:1998	
	CISPR 11:1997 / EN 55011:1998 / AS/NZS 2064.1/2	Group 1, Class A [1]
	IEC 61000-4-2:1995 / EN 61000-4-2:1995 +A1:1998	4 kV CD, 4 kV AD
	IEC 61000-4-3:1995 / EN 61000-4-3:1996 +A1:1998	3 V/m 80% AM 80 - 1000 MHz
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV signal lines, 1 kV power lines
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5 kV line-line, 1 kV line-ground
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	3 V 80% AM 0.15 - 80 MHz
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	1 cycle, 100%
	Canada: ICES-001	

Safety: IEC 61010-1:1990 +A1:1992 +A2:1995 / EN 61010-1:1993 +A2:1995
CAN / CSA C22.2 No. 1010.1-92

Conformity / Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE-marking accordingly (European Union).

LEDs in this product are Class 1 in accordance with EN 60825-1:1994.

[1] The product was tested in a typical configuration with Agilent Technologies test systems.

Kobe, Japan Dec. 15, 2000 Koichi Yanagawa

Date Name Koichi Yanagawa / Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Herstellerbescheinigung

GERÄUSCHEMISSION

LpA < 70 dB
am Arbeitsplatz
normaler Betrieb
nach DIN 45635 T. 19

Manufacturer's Declaration

ACOUSTIC NOISE EMISSION

LpA < 70 dB
operator position
normal operation
per ISO 7779

Agilent 4352B VCO/PLL Signal Analyzer

Function Reference

SERIAL NUMBERS

This manual applies directly to instruments that have the firmware revision 2.x. For additional information about firmware revisions, see in Appendix A.

Agilent Technologies

Agilent Part No. 04352-90090
Printed in JAPAN July 2003

Eighth Edition

Notice

The information contained in this document is subject to change without notice.

Agilent Technologies Japan, Ltd.
Component Test PGU-Kobe
1-3-2, Murotani, Nishi-ku, Kobe-shi,
Hyogo, 651-2241 Japan

Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

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July 1999 .... Fourth Edition (part number: 04352-90070)

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January 2001 .... Sixth Edition (part number: 04352-90070)

December 2001 .... Seventh Edition (part number: 04352-90080)

July 2003 .... Eighth Edition (part number: 04352-90090)

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Note 4352B comply with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. 4352B are INDOOR USE product.

Note LEDs in 4352B are Class 1 in accordance with IEC825-1.
CLASS 1 LED PRODUCT

Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

Warnings , such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Warning **Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.**

Typeface Conventions

Bold	Boldface type is used when a term is defined. For example: **icons** are symbols.
Italics	Italic type is used for emphasis and for titles of manuals and other publications.
	Italic type is also used for keyboard entries when a name or a variable must be typed in place of the words in italics. For example: `copy` *filename* means to type the word `copy`, to type a space, and then to type the name of a file such as `file1`.
`Computer`	Computer font is used for on-screen prompts and messages.
(HARDKEYS)	Labeled keys on the instrument front panel are enclosed in ( ).
SOFTKEYS	Softkeys located to the right of the LCD are enclosed in .

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Documentation Warranty

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Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

Safety Symbols

General definitions of safety symbols used on equipment or in manuals are listed below.

Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual.

Alternating current.

Direct current.

On (Supply).

Off (Supply).

In position of push-button switch.

Out position of push-button switch.

Frame (or chassis) terminal. A connection to the frame (chassis) of the equipment which normally include all exposed metal structures.

Warning This **Warning** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

Caution This **Caution** sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

Note This **Note** sigh denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Affixed to product containing static sensitive devices use anti-static handling procedures to prevent electrostatic discharge damage to component.

In This Book

This reference is organized as follows:

- Chapter 1
  Gives you an overview of the analyzer (4352B VCO/PLL Signal Analyzer).
- Chapter 2
  Illustrates the front and rear panels of 4352B.
- Chapter 3
  Describes what to verify when opening the package and how to install your 4352B.
- Chapter 4
  Provides a tutorial guide for measuring VCOs and PLLs with the 4352B.
- Chapter 5
  Explains basic procedures to measure VCOs and PLLs using the 4352B and the 43521A (Downconverter Unit).
- Chapter 6
  Explains the functions accessible via the ENTRY block.
- Chapter 7
  Explains the functions accessible via the MEASUREMENT block when the analyzer operates in the tester mode.
- Chapter 8
  Explains the functions accessible via the MEASUREMENT block when the analyzer operates in the analyzer mode.
- Chapter 9
  Explains the functions accessible via the CONTROL block.
- Chapter 10
  Explains the functions accessible via the INSTRUMENT STATE block.
- Chapter 11
  Lists the specifications of the 4352B.
- Appendix A
  Contains the information required to adapt this manual to earlier versions or configurations of the analyzer than the current printing date of this manual.
- Appendix B
  Provides an overview of GPIB and its functions available with the 4352B.
- Appendix C
  Provides additional information on the phase noise vs. offset frequency measurements and frequency transient measurements.
- Appendix D
  Contains an overview of the save/recall function and the information required when you use a data file stored with the save function.
- Appendix E
  Lists input ranges, preset values, and power ON default settings.
- Appendix F
  Helps you perform a quick guide diagnosis of your 4352B.

Document Guide

Please utilize the following manuals when using the analyzer:

Function Reference

Describes basic operations of this instrument and the 43521A (Downconverter Unit) and all the functions called from the front panel keys and softkeys. It also provides information on options and accessories available, specifications, system performance, and conceptual information about the analyzer's features.

GPIB Programming Manual

Describes basic programming to remote-control this instrument and the 43521A (Downconverter Unit) using GPIB. Also, contains information on the usage of all GPIB commands, the status report mechanism, and the data transmission format.

Manual Supplement for Instrument BASIC Users Handbook

Describes how Instrument BASIC works with the analyzer.

Instrument BASIC User's Handbook

Explains the usage of Instrument BASIC including general programming examples and hints. Also, explains all Instrument BASIC commands. This manual consists of the following three parts: "Instrument BASIC Programming Technique," "Instrument BASIC Interface Technique," and "Instrument BASIC Language Reference."

43521A Operation Manual

Describes the accessories of the 43521A (Downconverter Unit), connection to the 4352B (VCO/PLL signal analyzer), configuration of the front and rear panels, and specifications. Details on how to operate the 43521A are described in the 4352B Function Reference.

If A Problem Is Suspected

If any kind of failure is observed in the operation of the analyzer, or in the operation of a measurement system that includes the analyzer, please see Appendix F. Appendix F is a quick fault diagnosis guide for the analyzer. By performing the diagnostics according to the instructions provided, the faulty instrument can be pinpointed in a short time.

Also, when an error message is displayed on the analyzer's LCD screen, please see "Error Messages" at the back of the manual.

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1

Introduction

This chapter provides an overview of the analyzer (4352B VCO/PLL Signal Analyzer). The "Analyzer's Features" section shows the name and describes the functions available with each part of the front panel, the rear panel, and the 4 key blocks. The section "Front and Rear Panel" explains the input and output connectors, the LCD, and so on. The four "Key Block" sections provide description of keys, introduce the menus available with these keys, and show how to use them (for example, how to set measurement conditions end enter values). The hardkeys on the front panel are grouped by block, and the menus available with each of the hardkeys are selected using the softkeys that appear on the right-hand side of the LCD. The 4352B has 2 measurement modes; tester and analyzer modes.
The following list shows the measurement items available with each mode:

- Tester Mode (Target device: VCO)

  RF Power
  Frequency
  DC Power Current
  FM Deviation
  C/N Ratio (Carrier/Noise)

- Analyzer Mode (Target device: PLL or VCO)

  RF Power Characteristics vs. DC Control Voltage
  Frequency/Tuning Sensitivity Characteristics vs. DC Control Voltage
  Phase Noise Characteristics vs. Offset Frequency
  Frequency Transient
  Spectrum

Analyzer's Features

The following paragraphs provide an outline of each part of the analyzer. Detailed information on the features in each block is provided in the corresponding chapter of this manual.

Front and Rear Panel

Functions are activated by pressing the hardkeys or softkeys provided on the front panel. Measurement results are displayed on the LCD (which also displays the measurement conditions and the instrument status). The front panel has input and output ports to connect to the device under test (DUT) or the test signal source. A flexible disk drive is also provided to store and retrieve data and instrument status.

The rear panel has input and output connector ports to control the analyzer from external equipment or to control external equipment from the analyzer.

For more information, see Chapter 2.

ENTRY Block

This block provides the numerical and units keypad, the rotary knob, and the step keys. These controls are used in combination with other keys to enter or change numeric data.

For more information, see Chapter 6.

MEASUREMENT Block

This block is used to select the measurement parameters, display the measured value, and specify the measurement conditions. When a key on this block is pressed, a softkey menu is displayed.

(Meas) provides menus used to select the measurement item, and also provides the measurement mode menu used to switch between the tester and analyzer modes. This key also lets you select a frequency band and a carrier signal search used when the 43521A (Downconverter Unit) is connected.

(Sense Range), in the tester mode, lets you set the attenuator for the input signal from the DUT, the resolution of the frequency counter, the built-in attenuator used in the C/N ratio measurement, and the measurement range for FM deviation. In the analyzer mode, it lets you set the built-in attenuator, the gradient of a device (df/dv), the resolution of the frequency measurement, the noise attenuator in the phase noise measurement, the reference frequency and frequency span for the frequency transient measurement range, and so on.

(Bw/Avg) displays menus used to average the measurement data for noise reduction. In the tester mode it is used to specify the measurement conditions for C/N ratio measurements and the detection bandwidth for FM deviation measurements.
In the analyzer mode it is used to specify the video bandwidth, the resolution bandwidth, the noise bandwidth for phase noise measurements, and the aperture for tuning sensitivity measurements.

(Format) in the tester mode displays a menu used to select the unit in which to display measurement data for RF power or FM deviation measurements.
In the analyzer mode it displays a menu used to select the display unit for RF power measurements and spectrum measurements.

(Display) displays menus used to specify the 4352B display settings. In the tester mode it provides menus for adjusting the color of on-screen information and displaying titles.
In the analyzer mode it provides menus for not only adjusting/selecting the on-screen

information color and displaying titles, but also for selecting the trace to be displayed, storing the data trace with the memory trace function, and so on.

(Menu) displays menus used to perform advanced measurements functions. In the tester mode it provides menus for the automatic frequency control, cable loss compensation, and FM deviation calibration function. The analyzer mode provides, in addition to the automatic frequency control function and the measurement cable loss compensation function, the sweep function (linear sweep and log sweep) and the marker function. Switching ON/OFF the noise integration measurement is also included in the marker function.

See Chapter 7 and Chapter 8 for details.

CONTROL Block

This block is used to select the signal and trigger type for a measurement. When a key on the block is pressed, a softkey menu is displayed.

(Mod) displays a menu to control the modulation signal applied to the DUT.

(RF/LO) displays menus to select the external signal generator and to control the input signal from the external signal generator. This key also lets you switch ON/OFF the converter and set the upper limit of the measurement frequency used when the 43521A (Downconverter Unit) is connected.

(Trigger) displays menus to select the trigger mode and trigger source. In the analyzer mode, the value trigger is added as a new choice for trigger mode in frequency transient measurements.

(DC Control) displays a menu to specify the level of control voltage applied to the DUT. In the analyzer mode, it provides a softkey to set the control voltage level to the X-coordinate values at the current marker position.

(DC Power) displays a menu to specify the level of power voltage (V_{cc}) applied to the DUT.

See Chapter 9 for details.

INSTRUMENT STATE Block

This block is used to control system functions. The following system functions are available: GPIB controller mode, real time clock, Instrument BASIC, printer output, and saving the 4352B settings and measurement data to the floppy disk or RAM disk memory.

(System) can be used to access menus to control the Instrument BASIC programming, the real time clock, and the alarm beep. In addition, In the analyzer mode it provides menus for specifying the upper and lower limits and storing the data trace as an upper or lower limit trace.

(Local) is used to return control to the user from an external controller and displays a series of menus used to select the HP-B mode and modify the GPIB addresses.

(Preset) resets the 4352B settings to defaults. See Appendix E for a list of defaults.

(Copy) provides access to the menus used for controlling external printers.

(Save/Recall) is used to access a menu to save/read the instrument settings and data to/from disk or memory.
In addition, in the analyzer mode it provides a menu to specify the limit traces.

See Chapter 10 for details.

2

Front and Rear Panel

This chapter describes the features of the front and rear panels of the 4352B. It provides illustrations and descriptions of the front panel features, the LCD display and its labels, and the rear panel connectors.

Front Panel

The functions available with the 4352B are activated from the front panel (Figure 2-1) by using the front panel hardkeys or softkeys. In this manual, all front panel hardkeys and softkey labels are shown as (Hardkey) and Softkey, respectively.

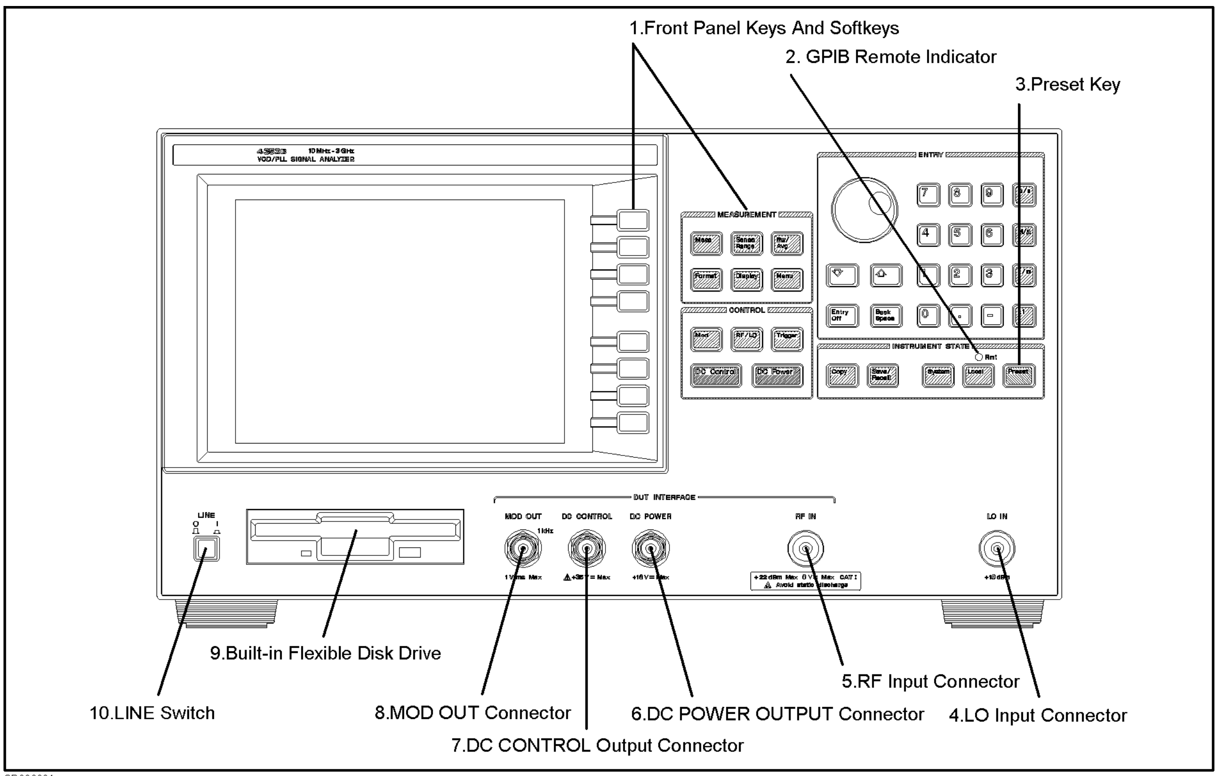


Figure 2-1. 4352B Front Panel

1. Front Panel Keys and Softkeys

Some of the front panel keys change instrument functions directly, and others provide access to additional functions available in softkey menus. Softkey menus are lists of up to eight related functions that can be displayed in the softkey label area at the right-hand side of the display. The eight keys to the right of the LCD are the softkeys. Pressing one of the softkeys selects the adjacent menu function. This either executes the labeled function, makes it active to select the status and to entry numeric value, displays 4352B status information, or presents another softkey menu. There are two types of menus: those that are directly displayed with the front panel keys, and those that are displayed from within other menus. For example, in the Averaging Menu that is displayed with (Bw/Avg), all functions related to averaging are displayed, such as the averaging factor, the averaging restart, etc. If AVERAGING FACTOR is pressed on that menu, the averaging factor can be entered directly with numeric keys. If RETURN is pressed, the previous menu is displayed. If DONE is pressed, the specified function will be executed, then the initial menu is displayed.

Usually, the present active function is aborted at menu change.

Softkeys that are Connected with Vertical Lines

When several possible choices are available for a function, the softkeys connected with a vertical line represents these choices. For example, in the menu for (Meas) in the tester mode, the measured values that may be displayed (RF POWER, FREQUENCY, DC POWER CURRENT, FM DEVIATION, and CARRIER/NOISE), are connected by a vertical line. Only one softkey can be selected at a time. When a selection has been made from the listed alternatives, that selection is underlined until another selection is made.

Softkeys That Toggle On or Off

Some softkey functions can be toggled on or off. This is indicated in the softkey label. The current state, on or off, is capitalized in the softkey label.

Example:

AVERAGING ON off	The word on is capitalized, showing that averaging is currently ON.
AVERAGING on OFF	The word off is capitalized, showing that averaging is currently OFF.

Softkeys that Show Status Indications in Brackets

Some softkey labels show the current status of a function in brackets. These softkeys only display status. For example, the type of the data holding function is indicated in the brackets of DATA HOLD[ ].

2. GPIB REMOTE Indicator

Lights when the 4352B is in the remote state.

3. Preset key

Returns the 4352B to a known standard preset state. A complete listing of the 4352B preset conditions is provided in Appendix E.

4. LO IN (LO Input) Connector

Receives the output signal from the external signal generator. If you use this instrument by connecting it to the 43521A (Downconverter Unit), use this connector for connection to the LO OUT terminal of the 43521A.

5. RF IN (RF Input) Connector

Receives the RF output signal from the device under test (DUT). If you use this instrument by connecting it to the 43521A (Downconverter Unit), use this connector for connection to the RF OUT terminal of the 43521A.

INSTALLATION CATEGORY I

Caution

Do not exceed the operating input power, voltage, and current level and signal type appropriate for the instrument being used, refer to your instrument's function reference.

6. DC POWER (Power Voltage) Output Connector

Provides the DC Power voltage to the DUT.

7. DC CONTROL (Control Voltage) Output Connector

Provides the DC Control voltage to the DUT.

Output voltage range

Without option 001	0 to +20 Vdc
With Option 001	−15 to +35 Vdc

8. MOD OUT (Modulation Signal Output) Connector

Provides the modulation signal to the DUT.

9. Built-In Flexible Disk Drive

Stores the measurement data, instrument status, and Instrument BASIC programs. The applicable disk formats are LIF (logical interchange format) and DOS (disk operating system) format.

10. LINE Switch

Controls ac power to the 4352B. | is ON, ○ is OFF.

Screen Display (Tester Mode)

The measured value and measurement information for the current selected parameter is displayed on the LCD. For each item of information displayed on the LCD, its display location is indicated with a label in Figure 2-2, and each item is explained below.

The screen can also be used as the Instrument BASIC display. Instrument BASIC uses either a full-screen display or a half-screen display below the measurement display as a text screen. When the graphic function is used in Instrument BASIC, select the full-screen display.

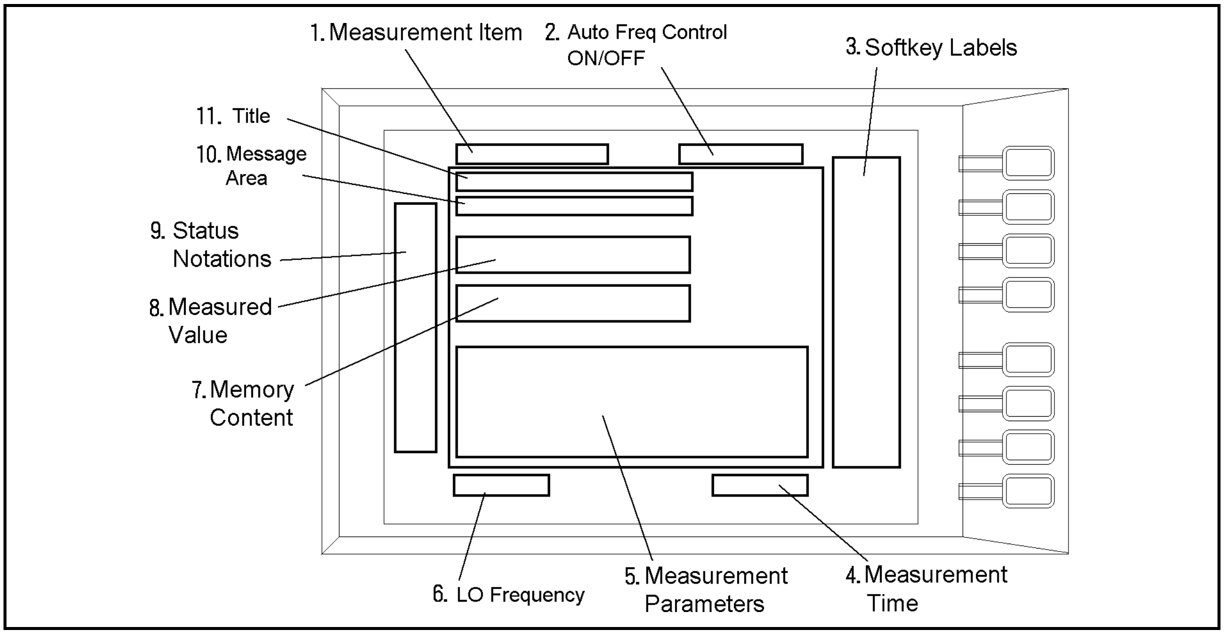


Figure 2-2. LCD Display (Tester Mode)

1. Measurement Item

Displays the measurement item selected by (Meas).

2. Automatic Frequency Control ON/OFF

The AFC display and frequency is displayed when the automatic frequency control function is ON. In this mode, the 4352B keeps controlling the tuning voltage (DC control output) to maintain the DUT's output frequency at your specified target frequency.

3. Softkey Labels

Displays the menu labels that define the function of the softkeys immediately to the right of the label.

4. Measurement Time

The measurement time under the current measurement conditions is displayed. However, the time required for the automatic frequency control function and display is not included.

5. Measurement Parameters

The measurement conditions for the measurement item are displayed. The left side shows the conditions common to each measurement item, and the right side shows the conditions peculiar to the present displayed measurement item.

6. LO Frequency

The frequency of the reference signal that should be input to the 4352B LO IN connector from the external signal generator is displayed. When `LO <Frequency>` is displayed, the external signal generator is automatically controlled by the 4352B, and the signal of the displayed frequency is actually being input. When `LO# < frequency >` is displayed, the external signal generator is not automatically controlled by the 4352B. In this case, the displayed frequency is not the actual input frequency, but the frequency that the 4352B is requesting to the external signal generator.

7. Memory Content

The measured value saved in internal memory is displayed.

8. Measured Value

The measured value in the selected measurement item is displayed.

9. Status Notations

Displays the current status of various functions. The following notations are used:

`DwC`	The 43521A(Downconverter Unit) is connected and (RF/LO), `DOWNCONV ON off` is set to ON.
*	Measurement condition change. Measurement data in doubt under the current conditions.
`ExR`	Displayed when the external reference signal is being input to the external reference input connector on the rear panel. (Even if the phase is not locked in the external reference signal, this is displayed when a signal is being input from the outside.)
`Avg`	Averaging function is ON. The averaging factor is displayed below `Avg`.
`Max`	Maximum hold function is ON.
`Min`	Minimum hold function is ON.
`G*`	Data math operation gain is ON.
`-O`	Data math operation offset is ON.
`G&O`	Data math operation gain ON, data operation offset ON.
`D-M`	Data math operation (data - memory) is ON.
`D+M`	Data math operation (data + memory) is ON.
`D/M`	Data math operation (data ÷ memory) is ON.
`Hld`	Trigger hold.
↑	Measurement in progress.
`Ext`	Waiting for external trigger (rear panel BNC).
`Man`	Waiting for manual trigger.
`Bus`	Waiting for GPIB trigger.
`Svc`	In service mode. In this mode, the measured data is out of the specification. For details, please see the *Service Manual*.
`Cor`	FM deviation calibration function is ON.

10. Message Area

Displays prompts or error messages. See "Error Messages" for more information on error messages.

11. Title

Displays a descriptive alpha-numeric string title defined by you according to the procedures described in "(Display)" in Chapter 7.

Screen Display (Analyzer Mode)

The measured value and measurement information for the currently selected parameter is displayed on the LCD. For each item of information displayed on the LCD, its display location is indicated with a label in Figure 2-2, and the item is explained below.

The screen can also be used as the Instrument BASIC display. Instrument BASIC uses either a full-screen display or a half-screen display below the measurement display as a text screen. When the graphic function is used in Instrument BASIC, select a full-screen display.

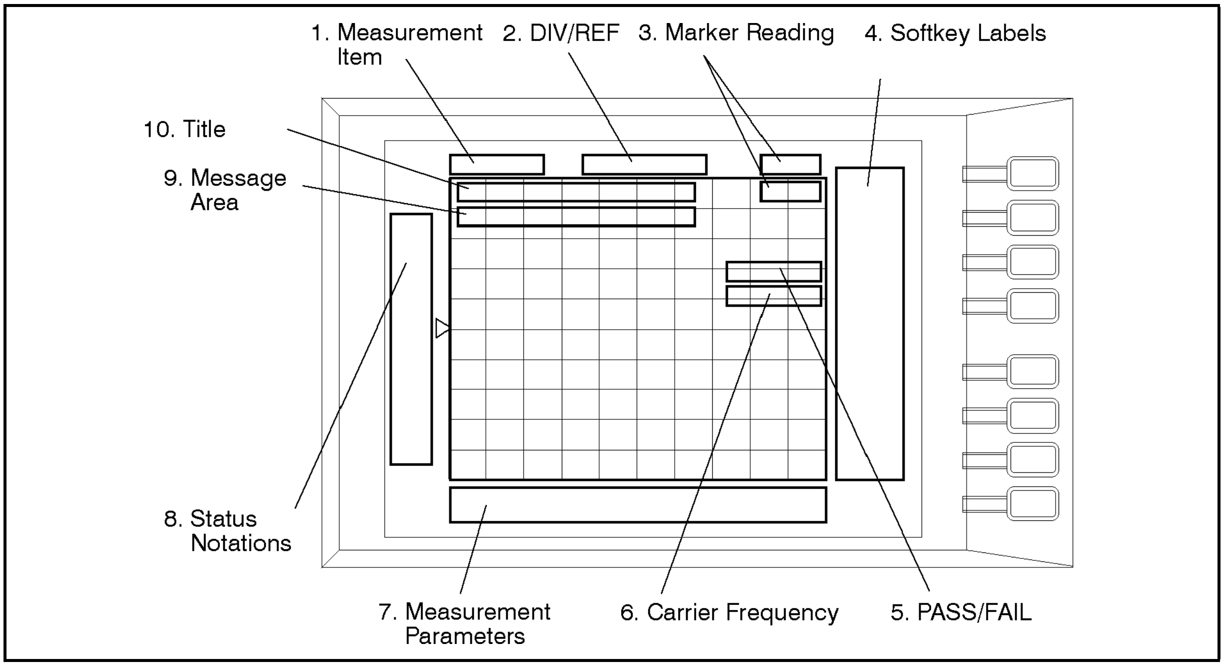


Figure 2-3. LCD Display (Analyzer Mode)

1. Measurement Item

Displays the measurement item selected by (Meas).

2. DIV/REF

Displays the value per division (`DIV`) on the trace along the Y-axis and the value (`REF`) pointed to by the small triangle shown on the left-hand side of the scale.

3. Marker Reading

Displays the marker reading in units appropriate to the current measurement. The value on top represents the Y-coordinate reading value. The value below the Y-coordinate reading value represents the X-coordinate reading value.

4. Softkey Labels

Displays the menu labels that define the function of the softkeys close to the right of the label.

5. PASS/FAIL

Displays the limit test result (pass/fail) using limit lines.

6. Carrier Frequency

Displays the carrier frequency. This frequency is displayed only when phase noise is selected as the measurement item.

7. Measurement Parameters

The measurement conditions for the measurement item are displayed.

8. Status Notations

Displays the current status of various functions. The following notations are used:

`DwC`	The 43521A (Downconverter Unit) is connected and (RF/LO), `DOWNCONV ON off` is set to ON.
*	Measurement condition change. Measurement data in doubt under the current conditions.
`DC↓`	DC power and control voltages are not output.
`ExR`	Displayed when the external reference signal is being input to the external reference input connector on the rear panel. (Even if the phase is not locked in the external reference signal, this is displayed when a signal is being input from the outside.)
`Avg`	Averaging function is ON. The averaging factor is displayed below `Avg`.
`Max`	Maximum hold function is ON.
`Min`	Minimum hold function is ON.
`G*`	Data math operation gain is ON.
`-O`	Data math operation offset is ON.
`G&O`	Data math operation gain is ON, data math operation offset is ON.
`D-M`	Data math operation (data - memory) is ON.
`D+M`	Data math operation (data + memory) is ON.
`D/M`	Data math operation (data ÷ memory) is ON.
`Hld`	Trigger hold.
↑	Measurement in progress.
`Ext`	Waiting for external trigger (rear panel BNC).
`Man`	Waiting for manual trigger.
`Bus`	Waiting for GPIB trigger.
`Svc`	In service mode. In this mode, the measured data is out of the specification. For details, please see the *Service Manual*.
`afc`	AFC function is ON.

9. Message Area

Displays prompts or error messages. See "Error Messages" for more information on error messages.

10. Title

Displays a descriptive alpha-numeric string title defined by you according to the procedures described in "(Display)" in Chapter 7.

Rear Panel

Figure 2-4 provides a brief review of the rear panel. Requirements for the input signals to the rear panel connectors are provided in Chapter 11.

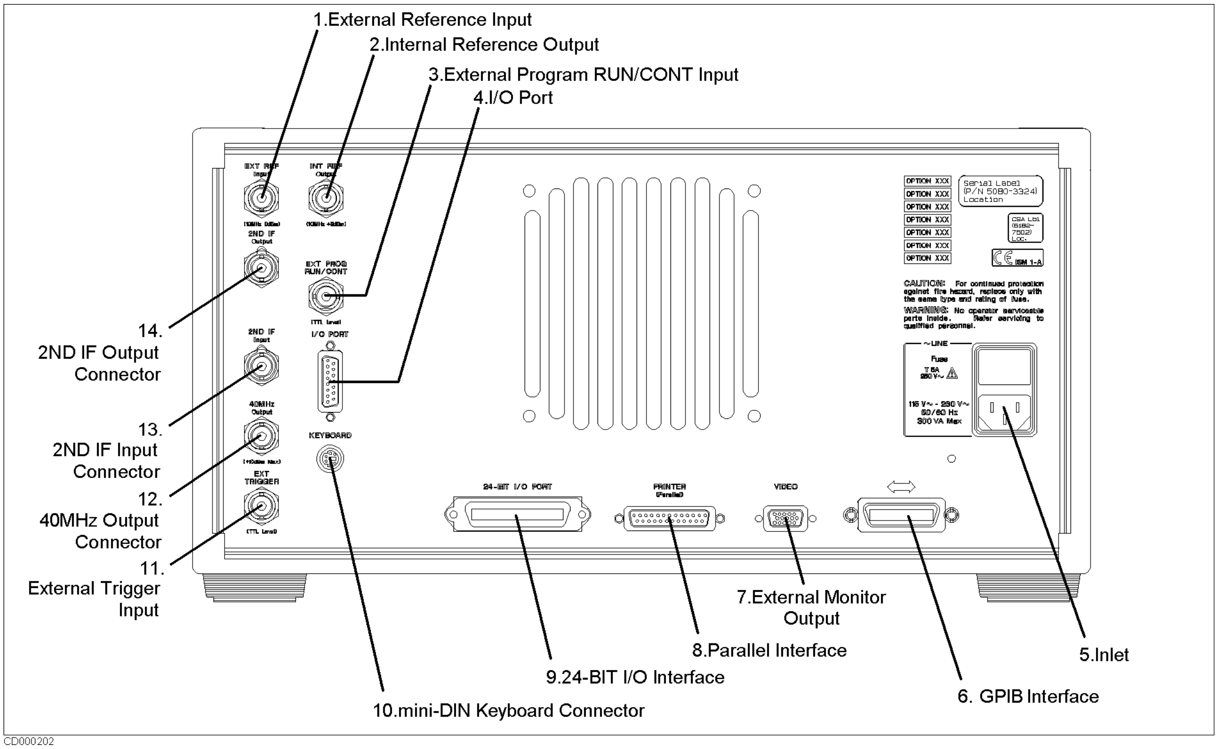


Figure 2-4. 4352B Rear Panel

1. External Reference Input

Connects an external frequency reference signal to the 4352B. The 4352B is phase locked to the external frequency reference signal for improvement of frequency accuracy.

The external frequency reference function is automatically enabled when an external signal is input to this connector. When the external frequency reference signal is no longer present, the 4352B automatically switches back to the internal reference frequency.

2. Internal Reference Output

Connects to the frequency reference input terminal of an external instrument to phase lock it to the 4352B.

3. External Program RUN/CONT Input

Externally triggers execution of RUN or CONT of the Instrument BASIC program. The trailing edge of a pulse more than 20 μs wide in the HIGH state triggers RUN or CONT. The signal is TTL-compatible.

4. I/O Port

When you use this instrument by connecting it to the 43521A (Downconverter Unit), use this port for connection to I/O PORT on the 43521A's rear panel. This port is also used for connection to external equipment, such as handlers in production lines. See *4352B GPIB Programming Manual* also for details.

5. Inlet (with fuse box)

Connects the power cable to this inlet. To replace the fuse, please see "Replacing the Fuse" in Chapter 3.

6. GPIB Interface

Connects the 4352B to an external controller and other instruments in an automated system. This connector is also used when the 4352B itself is the controller of compatible peripherals. See "What is GPIB?" in Appendix B.

7. External Monitor Terminal

This terminal outputs measurement results to an external color monitor. Color monitors supporting VGA (scan speed of 31.5 kHz) can be connected to this terminal.

8. Parallel Interface Connector

This interface enables the output of displayed results to a printer. It complies with the Centronics parallel interface standard. See Table 11-3 for supported printers.

9. 24 Bit I/O Interface

Connects to external equipment such as a handler on a production line. See *4352B GPIB Programming Manual* for additional information.

10. mini-DIN Keyboard Connector

Connects to the mini-DIN keyboard that is usually used with Instrument BASIC.

11. External Trigger Input

Triggers a measurement sweep when the external trigger mode is selected in the trigger mode (see "(Trigger)" in Chapter 9). The leading (or trailing) edge of a pulse more than 20 μs wide in the LOW (or HIGH) state starts a measurement. The signal is TTL-compatible.

12. 40 MHz Output Connector

When you use this instrument by connecting it to the 43521A (Downconverter Unit), use this connector for connection to the 40 MHz Input BNC connector on the 43521A's rear panel with the BNC-BNC cable. It is also used in the service mode.

13 and 14. Second IF Input/Output Connectors

Each is connected respectively to the 4352B's internal second IF amplification stage's input/output. Connect a furnished BNC-BNC adapter between these connectors when you make normal measurements.

3

Installation and Setup Guide

This chapter provides installation and setup instructions. It contains the following information. For information on the 43521A (Downconverter Unit), see the User's Manual of the 43521A.

- Incoming Inspection
- Power Requirements
- Replacing Fuse
- Connecting the BNC-BNC connector
- Operation Environment
- Ventilation Requirements
- Instruction for Cleaning
- Rack/Handle Installation

Incoming Inspection

Warning **To avoid hazardous electrical shock, do not turn on the 4352B when there are signs of shipping damage to any portion of the outer enclosure (for example, covers, panel, or display)**

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the 4352B has been checked mechanically and electrically. The contents of the shipment should be as listed in Table 3-1. If the contents are incomplete, if there is mechanical damage or defect, or if the analyzer does not pass the power-on selftests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of unusual stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

Contents

Table 3-1. Contents

Name	Agilent Parts No.
VCO/PLL Signal Analyzer	4352B
BNC Cable (60 cm)	8120-1839
N-N Cable	41951-61602
GPIB Cable	8120-3445(10833A)
Power Cable	8120-4753
BNC-BNC Connector	1250-1859
Sasmple Program Disk	04352-18520
CD-ROM (for manuals)[1]	04352-9050x[2]
Option ABA only	
Documents	
Function Reference	04352-900x0
GPIB Programming Manual	04352-900x7
Manual Supplement for Instrument BASIC Users Handbook	04352-900x5
Instrument BASIC Users Handbook	04155-90151
Option 810 only	
mini-DIN Keyboard	1150-7970

1 CD-ROM contains the contents of the Function Reference, GPIB Programming Manual, Instrument BASIC Users Handbook, Manual Supplement, Manual Supplement for Instrument BASIC Users Handbook.

2 The number indicated by “x” in the part number of each manual, is allocated for numbers increased by one each time a revision is made. The latest edition comes with the product.

Power Requirements

The 4352B requires the following power source:

Voltage : 90 to 132 Vac, 198 to 264 Vac

Frequency : 47 to 63 Hz

Power : 300 VA maximum

Power Cable

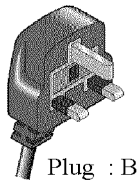
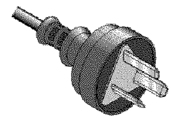
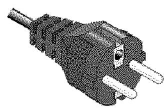
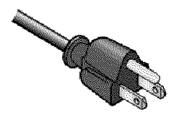
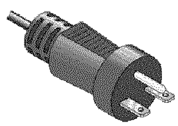
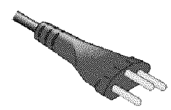
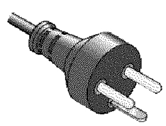
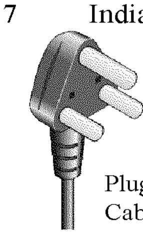
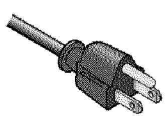
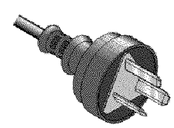
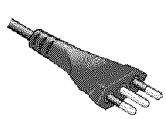
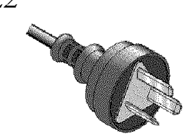
In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power outlet, this cable grounds the instrument frame.

The type of power cable shipped with each instrument depends on the country of destination. Refer to Figure 3-1 for the part numbers of the power cables available.

Warning

For protection from electrical shock, the power cable ground must not be defeated.

The power plug must be plugged into an outlet that provides a protective earth ground connection.

OPTION 900 United Kingdom  Plug : BS 1363/A, 250V, 10A Cable: 8120-1351	OPTION 901 Australia/ New Zealand  Plug : AS 3112, 250V, 10A Cable: 8120-1369
OPTION 902 Continental Europe  Plug : CEE 7 Standard Sheet VII, 250V, 10A Cable: 8120-1689	OPTION 903 U.S./ Canada  Plug : NEMA 5-15P, 125V, 10A Cable: 8120-1378
OPTION 904 U.S./ Canada  Plug : NEMA 6-15P, 250V, 6A Cable: 8120-0698	OPTION 906 Switzerland  Plug : SEV Type 12, 250V, 10A Cable: 8120-2104
OPTION 912 Denmark  Plug : SR 107-2-D, 250V, 10A Cable: 8120-2956	OPTION 917 India/ Republic of S.Africa  Plug : IEC 83-B1, 250V, 10A Cable: 8120-4211
OPTION 918 Japan  Plug : JIS C 8303, 125V, 12A Cable: 8120-4753	OPTION 920 Argentina  Plug : Argentine Resolution 63, Annex IV, 250V, 10A Cable: 8120-6870
OPTION 921 Chile  Plug : CEI 23-16, 250V, 10A Cable: 8120-6978	OPTION 922 China  Plug : GB 1002, 250V, 10A Cable: 8120-8376

NOTE: Each option number includes a 'family' of cords and connectors of various materials and plug body configurations (straight, 90° etc.).

OPT9XXE

Figure 3-1. Power Cable Supplied

Replacing Fuse

Fuse Selection

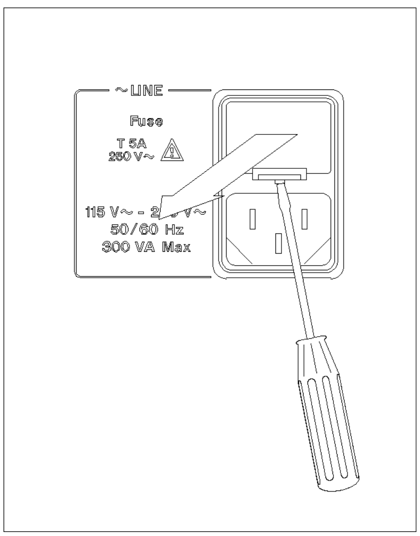
Select proper fuse according to the Table 3-2.

Table 3-2. Fuse Selection

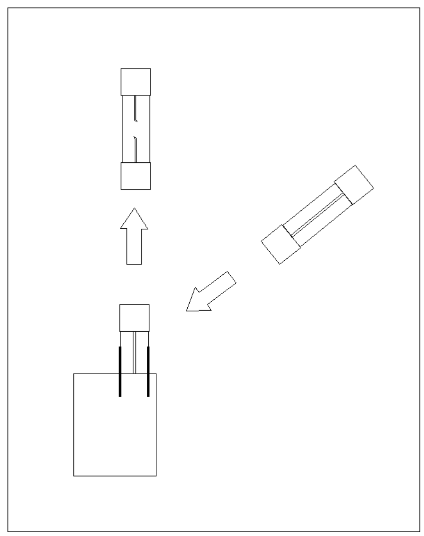
Fuse Rating/Type	Fuse Part Number
5A 250Vac	
UL/CSA type	2110-0030
Time Delay	

For ordering the fuse,contact your nearest Hewlett-Packard Sales and Service Office.

Replacing Fuse



Lever a small minus screwdriver to dismount the fuse holder above the AC line receptacle on the rear panel.



To check or replace the fuse, pull the fuse holder and remove the fuse. To reinstall the fuse, insert a fuse with the proper rating into the fuse holder.

Caution Use the proper fuse for the line voltage selected. Use only fuses with the required current rating and of the specified type as replacements. DO NOT use a mended fuse or short-circuit the fuse-holder in order to by-pass a blown fuse.

Connecting the BNC-BNC connector

Connect a furnished BNC-BNC Connector (Agilent Parts No. 1250-1859) between Second IF Input Connector and Second IF Output Connector in the rear panel when you make normal measurements.

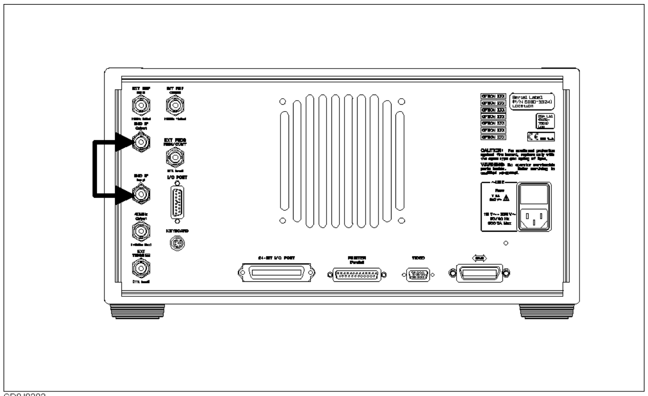


Figure 3-2. Connecting the BNC-BNC connector

Operation Environment

The 4352B must be operated under within the following environment conditions, and sufficient space must be kept behind the 4352B to avoid obstructing the air flow of the cooling fans.

Temperature: 0°C to 40°C

Humidity: less than 95% RH at 40°C

Note The 4352B must be protected from temperature extremes which could cause condensation within the instrument.

Providing clearance to dissipate heat at installation site

To ensure the specifications and measurement accuracy of the product, you must keep ambient temperature around the product within the specified range by providing appropriate cooling clearance around the product or, for the rackmount type, by forcefully air-cooling inside the rack housing. For information on ambient temperature to satisfy the specifications and measurement accuracy of the product, refer to Chapter 11, Specifications.

When the ambient temperature around the product is kept within the temperature range of the operating environment specification (refer to "Operation Conditions" in Chapter 11), the product conforms to the requirements of the safety standard. Furthermore, under that temperature environment, it has been confirmed that the product still conforms to the requirements of the safety standard when it is enclosed with cooling clearance as follows:

Table 3-3.

	Conditions
Rear	180 mm
Side	60 mm

Instruction for Cleaning

To prevent electrical shock, disconnect the 4352B power cable from the receptacle before cleaning. Wipe with a dry cloth or a soft cloth that is soaked with water and wrung tightly without undeue pressure to clean the casing. Do not attempt to clean the 4352B internally.

Rack/Handle Installation

The analyzer can be rack mounted and used as a component in a measurement system. Figure 3-3 shows how to rack mount the analyzer.

Table 3-4. Rack Mount Kits

Option	Description	Agilent Part Number
1CN	Handle Kit	5062-3991
1CM	Rack Mount Kit	5062-3979
1CP	Rack Mount & Handle Kit	5062-3985

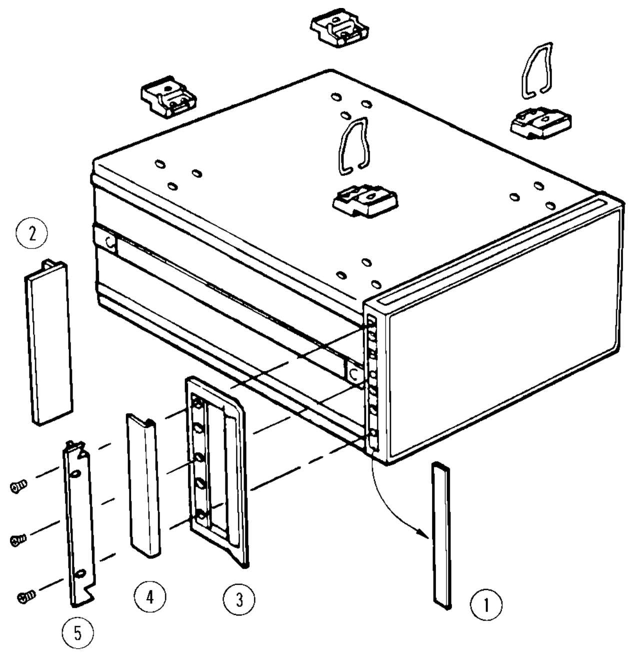


Figure 3-3. Rack Mount Kits Installation

Option 1CN Handle Kit

Option 1CN is a handle kit containing a pair of handles and the necessary hardware to attach them to the instrument.

Installing the Handle

1. Remove the adhesive-backed trim strips ① from the left and right front sides of the analyzer.
2. Attach the front handles ③ to the sides using the screws provided.
3. Attach the trim strips ④ to the handles.

Option 1CM Rack Mount Kit

Option 1CM is a rack mount kit containing a pair of flanges and the necessary hardware to mount them to the instrument in an equipment rack with 482.6 mm (19 inches) horizontal spacing.

Mounting the Rack

1. Remove the adhesive-backed trim strips ① from the left and right front sides of the analyzer.
2. Attach the rack mount flange ② to the left and right front sides of the analyzer using the screws provided.
3. Remove all four feet (lift bar on the inner side of the foot, and slide the foot toward the bar).

Option 1CP Rack Mount & Handle Kit

Option 1CP is a rack mount kit containing a pair of flanges and the necessary hardware to mount them to an instrument which has handles attached, in an equipment rack with 482.6 mm (19 inches) spacing.

Mounting the Handle and Rack

1. Remove the adhesive-backed trim strips ① from the left and right front sides of the analyzer.
2. Attach the front handle ③ and the rack mount flange ⑤ together on the left and right front sides of the analyzer using the screws provided.
3. Remove all four feet (lift bar on the inner side of the foot, and slide the foot toward the bar).

4

Basic Measurement Procedures

Introduction

This chapter describes the basic VCO and PLL measurement procedures available with the 4352B. The 4352B offers 2 measurement modes; tester and analyzer modes. Each mode allows you to make measurements of different measurement items. Select the measurement mode required for your measurement needs.

You can quickly become familiar with the 4352B operations by performing the procedures in this chapter. Figure 4-1 shows the basic measurement flow for these procedures.

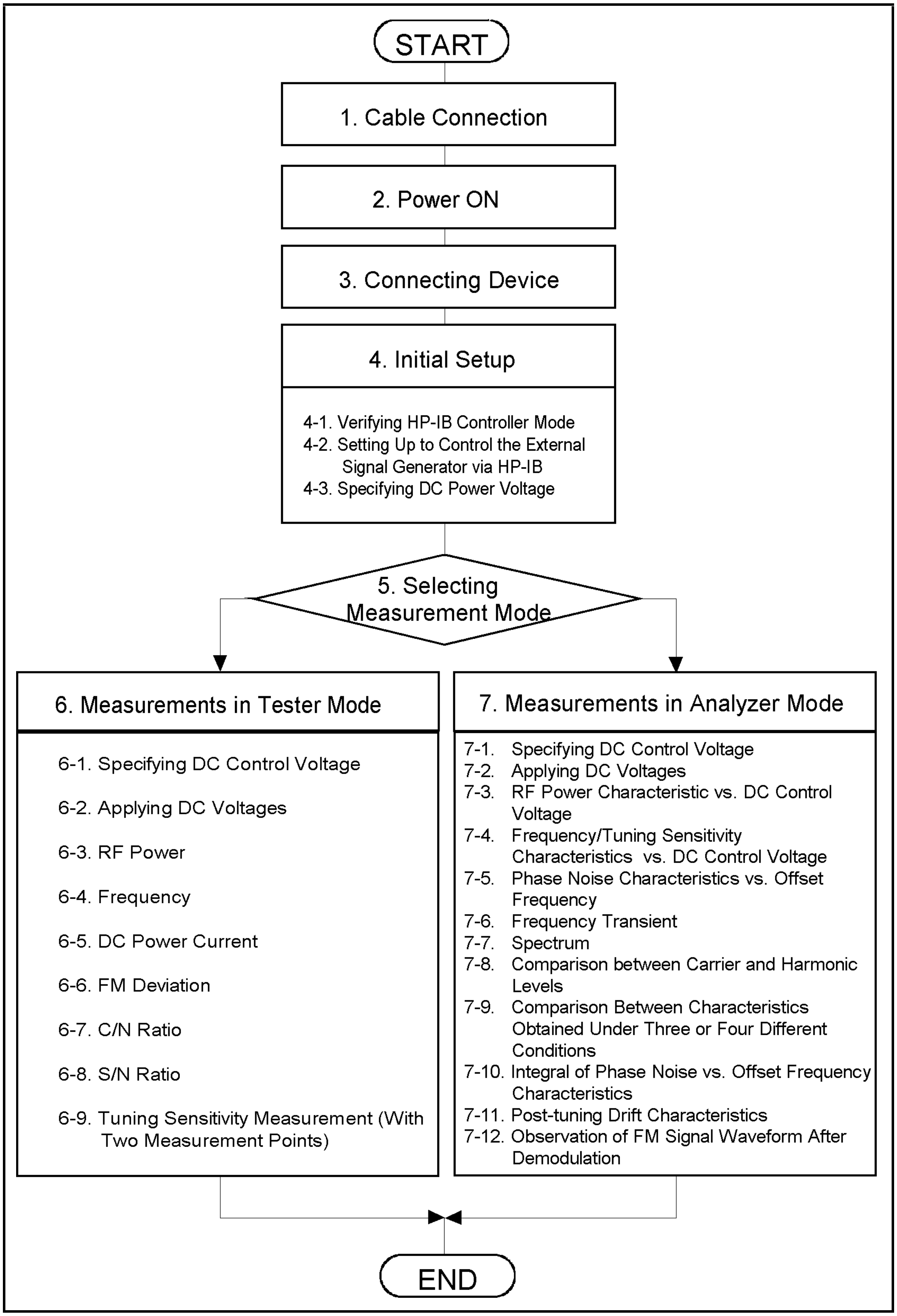


Figure 4-1. Basic Measurement Flow

- Basic Measurement Items Available in Tester Mode
  - **RF Power**
    Measures the level of the carrier signal generated by the VCO.
  - **Frequency**
    Measures the frequency of the carrier signal generated by the VCO.
  - **DC Power Current**
    Measures the DC current provided to the VCO's power voltage (V_{cc}) terminal.
  - **FM Deviation**
    Measures the VCO's FM deviation caused by the FM modulation signal.
  - **C/N Ratio**
    Measures the ratio of the VCO's carrier power to the noise power at your specified offset frequency.
- Advanced Measurement Items in Tester Mode
  See "Advanced Measurement Items in Tester Mode" for more details.
  - **S/N Ratio**
    Is expressed as the ratio of the FM deviation under a specific condition and a measured residual FM.
  - **Tuning Sensitivity**
    Is expressed as the ratio of difference in the carrier frequenciy to difference in tuning voltage level. Those difference values are obtained through the measurement of the carrier frequencies $f_n(n = 1, 2)$ at specified tuning (control) voltage levels $E_n(n = 1, 2)$.
- Basic Measurement Items Available in Analyzer Mode
  - **RF Power Characteristics vs. DC Control Voltage**
    Measures RF power characteristics by sweeping the DC control voltage.
  - **Frequency/Tuning Sensitivity Characteristics vs. DC Control Voltage**
    Measures output carrier frequency and tuning sensitivity characteristics by sweeping the DC control voltage.
  - **Phase Noise Characteristics vs. Offset Frequency**
    Measures phase noise characteristics at your specified offset frequency range from the carrier frequency.
  - **Frequency Transient**
    Measures frequency fluctuation characteristic over time.
  - **Spectrum**
    Measures spectrum characteristics. Carrier, spurious, and harmonics levels can be obtained.
- Advanced Measurement Items in Analyzer Mode
  See "Advanced Measurement Items in Analyzer Mode" for more details.
  - **Comparison between Carrier and Harmonic Levels**
    Compares the carrier level with the harmonic level using markers.
  - **Comparison between Characteristics Obtained under three or four Different Conditions**
    Compares the measurement results under three or four different conditions on the same display format.
  - **Integral of phase noise vs. offset frequency characteristics**
    Obtains a power ratio of the phase noise within any range.
  - **Post-tuning drift characteristics**
    Measures the long-term change characteristics of the carrier frequency after the change of the DC control voltage.
  - **Observation of FM signal waveform after demodulation**
    Observes the waveform of an FM signal after demodulation.

You should also be familiar with the following operations:

- How to specify DC power voltage
- How to specify DC control voltage
- How to use the automatic frequency control function
- How to set up the external signal generator
- How to use the cable loss compensation function

Note

The measurement procedures described in this chapter assumes that the continuous trigger mode is selected.
Perform the following steps to select the continuous trigger mode, if required:

1. Press (Trigger).
2. Press CONTINUOUS.

Measurement Overview

This chapter uses a stand alone system in the examples use to explain the measurement procedures. This system consists of the 4352B and an external signal generator. In this system, the 4352B controls the external signal generator via GPIB.

Note

The 4352B can also be used as a part of the measurement system controlled by an external controller such as a PC. In such a system, you can perform measurement automatically by running a program written in BASIC.

See the *4352B GPIB Programming Manual* for more details.

Device Characteristics

In this measurement example, a device under test (DUT) that has the following characteristics is used:

Voltage Control Oscillator (VCO):

Power Voltage	5 V
Control Voltage	4 V
Maximum Allowable Control Voltage Level	12 V
Response Time for Change in Control Voltage	20 msec
Carrier Frequency	800 MHz

Phase Locked Loop (PLL):

Control voltage	12 V
Carrier frequency	180 MHz to 200 MHz

If you are measuring a device that has characteristics other than those listed above, change the settings given in the description accordingly.

The modulation signal frequency is fixed at 1 kHz at all times.

Required Equipment

The following equipment is required for the procedures in this chapter:

- 4352B VCO/PLL Signal Analyzer
- External Signal Generator
  The recommended external signal generators for this system are listed below:
  - 8664A (with Option 004) 3GHz Hi-Performance RF Singal Source
  - 8644B (with Option 002) 2GHz Hi-Performance RF Singal Source
- Cables connecting the device to the 4352B
  Prepare these cables by yourself.

Note

The cables that connect between the 4352B and the external signal generator are furnished with the 4352B.
Signal generators other then those listed above can also be used. See "SG TYPE (SGTYPE <Value>)" in Chapter 9 for more details.

Note

System performance with regard to measurable frequency range is restricted by the frequency range of the signal genrator you use. Note that the phase noise characteristics of the signal generator restricts the minimum measurable value in the phase noise measurement.

---

1. Cable Connection

Connect the cables to so that the correct reference signal is output from the external signal generator.

Note Cables and connectors required for the following connections are furnished with the 4352B.

- Rear Panel
  - Connect the BNC-BNC connector between the 2nd IF Output Connector and 2nd IF Input Connector.
  - Connect the GPIB cable between 4352B and External Signal Generator GPIB connectors.
  - Connect the BNC-BNC cable between the EXT REF Input Connector (4352B) and EXT REF Output Connector (External Signal Generator).
- Front Panel
  - Connect the N-N cable between LO IN Connector (4352B) and RF Connector (External Signal Generator).

After all cables/adapter connections have been completed, connect the power cable according to the following steps.

Warning **For protection from electrical shock, the power cable ground must not be defeated.**

The power plug must be plugged into an outlet that provides a protective earth ground connection.

1. Connect the power cable to the power connector on the rear panel of the 4352B.
2. Connect the power cable to the outlet.

2. Power ON

1. Turn the external signal generator power ON.
2. Press the 4352B LINE switch.
   When the power-on self test is completed (about 10 seconds), information about the installed options is displayed.

Note

- The following message is displayed on the LCD just after the power on sequence is completed:

  `CAUTION: Insufficient RF Level`

  This will no longer be displayed when the DUT is connected, and the proper DC power voltage and DC control voltage are applied to the DUT.
- To make a measurement that meets the accuracy specifications of the 4352B, a warm up of 30 minutes is required after turning the 4352B power on.

3. Connecting Device

Connect the device under test (DUT) to the 4352B as shown in Figure 4-2 or Figure 4-3.

Caution

Do not exceed the operating input power, voltage, and current level and signal type appropriate for the instrument being used, refer to your instrument's function reference.

Note

Inserting a low-pass filter

In phase noise measurement, a low-cutoff low-pass filter is sometimes inserted into the DC control voltage input terminal to attenuate the noise of the DC control voltage source. This kind of low-pass filter has a longer time constant, making the measurement time longer. The DC control voltage source of the 4352B provides a lower noise level of 1nV/$\sqrt{Hz}$. If you use the low-noise DC control voltage source of the 4352B, you need no low-cutoff low-pass filter as described above for almost all VCO measurements. However, an oscillation frequency component may leak to the DC control voltage input terminal of the VCO, which adversely affects the measurement result of RF power or frequencies. Insert a low-pass filter (cutoff frequency: 100 kHz to 1 MHz) to the DC control voltage input terminal of the VCO in order to attenuate the oscillation frequency component.

Using coaxial cables

To avoid effects of external noise, use coaxial cables to connect the DC power voltage terminal and the DC control voltage terminal of the 4352B to a DUT.

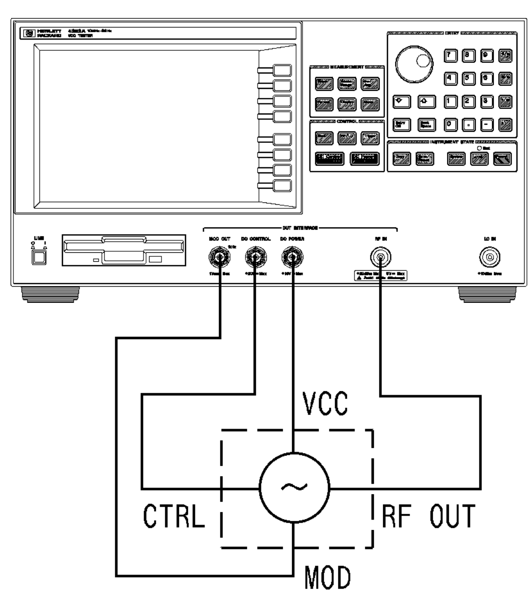


Figure 4-2. Connecting Device (VCO)

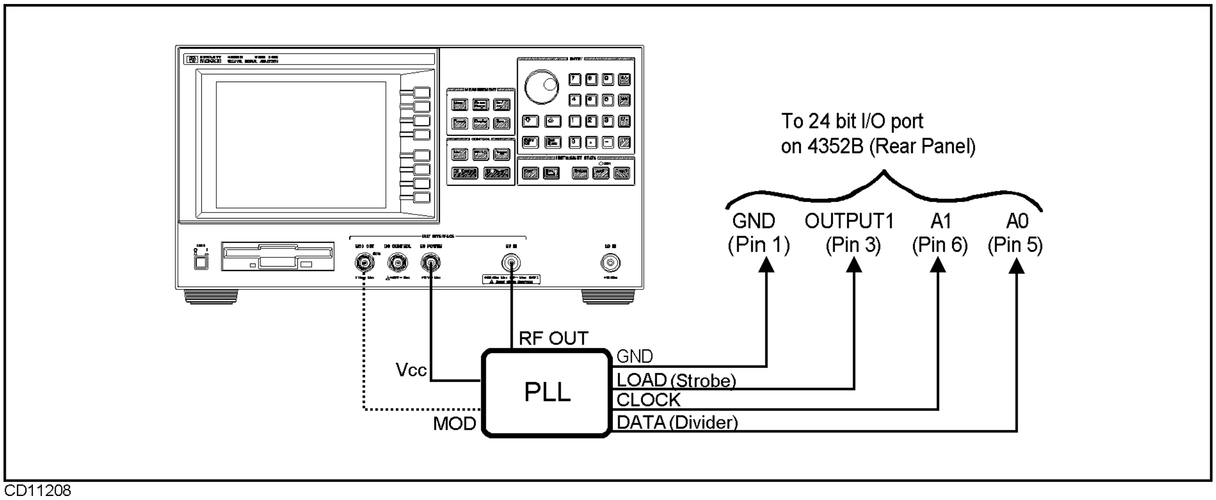


Figure 4-3. Connecting Device (PLL)

4. Initial Setup

Before starting the measurement, the initial setup of the 4352B must be performed.

Perform the following steps to setup the 4352B. The keys used in this initial setup are located in the CONTROL block and the INSTRUMENT STATE block.

4-1. Verifying GPIB Controller Mode

Make sure that the 4352B is the system controller.

1. Press [Local].
2. Make sure that SYSTEM CONTROLLER is displayed with an underline.

4-2. Setting Up to Control the External Signal Generator via GPIB

Note

When using this function, make sure that the external signal generator is controlled properly by the 4352B via GPIB.

The VCO/PLL test system consists of the 4352B and the external signal generator. The 4352B can automatically control the external signal generator via GPIB in accordance with the change of VCO carrier frequency.

Perform the following steps for the 4352B to control the external signal generator via GPIB.

- External Signal Generator Type
  Select one of the following values according to your external signal generator.

External Signal Generator	Set Value
8664A	1
8644B	1
8665B	1
8657B	2
8648B	3
8648C	3
Other than the above†	4

†See the note below.

Note

The cables that connect between the 4352B and the external signal generator are furnished with the 4352B. Note that external signal generators other than those given above can also be used. See "SG TYPE (SGTYPE <Value>)" in Chapter 9 for more details.
If the external signal generator does not respond properly when LO CONTROL AUTO man is selected, check if the GPIB address for the external signal generator in the 4352B is correct. Press [Local], SET ADDRESSES, and ADDRESS:SG to display the current GPIB address setting for the external signal generator. Enter the correct address and press [x1] if the GPIB address for the external signal generator is incorrect.

- Frequency Change Wait Time
  This is the wait time required for stabilization of the changed output frequency from the

external signal generator after the external signal generator frequency setting is changed by the 4352B automatic control function. This wait time varies depending on your external signal generator.

When this wait time is specified, the 4352B waits the specified time after the external signal generator frequency setting is changed by the 4352B automatic control function. Then the 4352B starts making a measurement.

1. Press (RF/LO).
2. Specify the type of the external signal generator.

   Press SG TYPE.
   Enter the value that corresponds to the external signal generator used, and press (x1).
3. Set the frequency change wait time.

   Press LO SWTCH TIME.
   Press (1), (0), (0), and (k/m).
   100 msec is specified as the frequency switching wait time.
4. Turn ON the automatic control function for the external signal generator.

   Press LO CONTROL auto MAN to toggle it LO CONTROL AUTO man.

Note

In the tester mode, the external signal generator is not automatically controlled during a measurement. That is, the automatic control of the external signal generator completes when the measurement starts, and the signal frequency of the external signal generator is kept constant during the entire measurement. Thus, setting LO CONTROL AUTO man does not guarantee that the frequency specified in the external signal generator is appropriate for all through the measurement under way, when a measured frequency may greatly change due to the change of driving and/or control voltage and measurement time is relatively long using averaging technique.

In the analyzer mode, on the other hand, the signal generator can be reset to change a frequency of the generated signal so that the signal should follow any change of the frequency under measurement.

4-3. Specifying DC Power Voltage

Specify the required DC power voltage for the device.

1. Press (DC Power).
   The current DC power voltage setting is displayed.
2. Press POWER VOLTAGE.
3. Press (5) and (x1).
   The DC power voltage is specified as 5 V.

5. Selecting Measurement Mode

Select the tester or analyzer mode.

1. Press (Meas), INST TYPE .
2. Press INST TYPE:VCO TESTER to select the tester mode, or press VCO ANALY to select the analyzer mode.

See "6. Measurements in Tester Mode" and "7. Measurements in Analyzer Mode" when you select the tester and analyzer modes, respectively.

6. Measurements in Tester Mode

This section describes measurement procedures for the VCO in the tester mode.

Note When you enter your desired value, be sure to press [x1], [K/m], [M/μ], or [G/n] to specify the proper unit after entering the value. Also, when you wish to specify a non-physical value such as an averaging factor, be sure to press [x1] after entering the value. See Chapter 6 for more details.

6-1. Specifying DC Control Voltage

Specify the DC control voltage that is applied to the device under test (DUT) from the 4352B, and its related values to protect the DUT and to perform stable measurement.

In the 4352B, the maximum and minimum acceptable level for the DC control voltage can be specified. This will prevent excessive DC control voltage from being applied to the DUT.

Also, when the output signal from the DUT has transient fluctuations after the change in the DC control voltage, the wait time required for the stabilization of the output can be specified in the 4352B. If this wait time is specified, the 4352B waits until the specified time elapses after the DC control voltage is changed before it starts making a measurement. This can eliminate the effect of the DUT transient response.

1. Press [DC Control].
2. Press MAX CTRL VOLTAGE.
3. Press [1], [2], [x1].
   The maximum acceptable level for the DC control voltage is set to 12 V.
4. Press MIN CTRL VOLTAGE.
5. Press [1], [x1].
   The minimum acceptable level for the DC control voltage is set to 1 V.

Next, set the wait time to eliminate the DUT transient responses caused by changing the DC control voltage.

6. Press CTRL DELAY.
7. Press [2], [0], [k/m].
   The wait time is set to 20 msec.

Next, specify the DC control voltage.

8. Press CTRL VOLTAGE.
9. Press [4], [x1].
   The DC control voltage is set to 4 V.

6-2. Applying DC Voltages

Apply the DC power voltage and DC control voltage to the DUT.

1. Press (DC Power) or (DC Control).
   If the above keys have already been pressed in the setup, you do not need to press them again.
2. Press OUTPUT on OFF to toggle it OUTPUT ON off.
   The DC power voltage and DC control voltage are applied to the DUT.

Note

- OUTPUT on OFF can be selected in either (DC Control) or (DC Power).
  No matter which key is used, the DC control voltage and DC power voltage are *both simultaneously* applied to the device.
- A message that reads as follows may be displayed on the LCD. In this case, press (Sense Range), RF ATTEN, and the entry keys to set the RF attenuation value according to the instruction.

  `Example:`

  If the following message is displayed, use RF ATTEN to set the attenuation 5 dB less than its current value:

  `CAUTION: Set RF ATT 5 dB Less`

6-3. RF Power Measurement

The level of the carrier signal from the VCO is measured.

1. Make sure that the modulation signal output is OFF.
   Look at the measurement setting parameters on the screen, and confirm that OFF is displayed in the MOD column. If the modulation output value is displayed in MOD, perform the following steps to turn the modulation signal output OFF.

   Press (Mod).

   Press MOD OUT ON off to toggle it to MOD OUT on OFF.
2. Select RF power measurement as the measurement item.

   Press (Meas), RF POWER.
   The measured RF power value is displayed on the screen.

The unit in the RF power measurement can be changed. For details, see Chapter 7.

Note

If a DC voltage component (TTL output, etc.) is included in the device output signal, the measurement will not be performed accurately. In this case, insert the high-pass filter between the DUT's output and the 4352B to eliminate the DC component.

6-4. Frequency Measurement

The frequency of the carrier signal from the VCO is measured.

1. Make sure that the modulation output is OFF.
   Look at the measurement setting parameters on the screen, and confirm that `OFF` is displayed in the `MOD` column. If the modulation output value is displayed in `MOD`, perform the procedure in "6-3. RF Power Measurement" to turn the modulation output OFF.
2. Select frequency measurement as the measurement item.

   Press (Meas), `FREQUENCY`.
   The measured frequency value is displayed on the screen.

The frequency measurement resolution can be changed. For details, see Chapter 7.

6-5. DC Power Current Measurement

The DC current through the VCO power voltage (V_{cc}) terminal is measured.

1. Make sure that the modulation output is OFF.
   Look at the measurement setting parameter on the screen, and confirm that `OFF` is displayed in the `MOD` column. If the modulation output value is displayed in `MOD`, perform the procedure in "6-3. RF Power Measurement" to turn modulation output OFF.
2. Select DC power current measurement as the measurement item.

   Press (Meas), `DC POWER CURRENT`.
   The DC power current measured value is displayed on the screen.

6-6. FM Deviation Measurement

This is the deviation (variation width) of VCO carrier frequency caused by the modulation signal. When the DUT is a VCO that has an FM modulation function, the 4352B inputs the modulation signal, and measures the deviation of the carrier frequency. The frequency of the modulation signal from the 4352B is constantly fixed at 1 kHz.

1. Set the amplitude of the modulation signal.

   Press (Mod).

   Press `MOD AMPLITUDE`.

   Press (1), (x1). The modulation signal amplitude is set to 1 [Vrms].
2. Output the modulation signal.

   Press `MOD OUT on OFF` to toggle it `MOD OUT ON off`.
3. Select FM deviation measurement mode.

   Press (Meas), `FM DEVIATION`.
   The FM deviation measured value is displayed on the screen.
4. Set the detection bandwidth.
   Specify the cutoff frequency for high-pass and low-pass filters (HPF and LPF) to pass the demodulated signal input to the 4352B. Determine the cutoff frequencies by evaluating the VCO characteristics and applications.

   Press (Bw/Avg).

   Press `FM DETECTION`.

The softkey menu used to set the cutoff frequencies for HPF and LPF is displayed.

For both HPF and LPF, press the softkey that corresponds to the cutoff frequency that you want to use.

Press RETURN.

5. Select the FM deviation measurement range.

   Press (Sense Range).

   Press FM DEV RANGE. The softkey menu used to select the measurement range is displayed.

   Press the softkey that corresponds to the measurement range to be selected.

   Press RETURN. The measured value is displayed in rms. Press (Format), PEAK CONV on OFF to toggle it PEAK CONV ON off, if you need to display this value with its units converted from rms to peak.

6. When you need even higher accuracy (±0.8% (typical) under the conditions given in the specification), perform FM deviation calibration.

   Press (Menu).

   Press FM DEV CAL.

   Press EXECUTE DEV CAL. The calibration factor is stored in the 4352B.

   Press DEV CORR on OFF to toggle it DEV CORR ON off.

Note

- If the ambient temperature changes by more than ±5° after FM deviation calibration, or if the detection bandwidth is changed, you need to perform FM deviation calibration again.
- The calibration factor obtained by the FM deviation calibration is canceled if the 4352B is turned OFF or if (Preset) is pressed.

6-7. C/N Ratio (Carrier/Noise)

The ratio of the carrier power to the noise power at the specified offset frequency is measured.

1. Make sure that the modulation output is OFF.
   Look at the measurement setting parameter on the screen, and confirm that `OFF` is displayed in the `MOD` column. If the modulation output value is displayed in `MOD`, perform the procedure in "6-3. RF Power Measurement" to turn the modulation signal output OFF.
2. Select C/N ratio measurement as the measurement item.

   Press (Meas), `CARRIER/NOISE`.
3. Specify offset frequency.

   Press (Bw/Avg).

   Press `OFFSET FREQ`.

   Enter the offset frequency using the entry keys.

   A large offset frequency selected for `OFFSET FREQ` in C/N ratio measurement can result in large fluctuations of the measurement data. This occurs because the noise measurement bandwidth used in the 4352B increases due to the large offset frequency. In this case, specify a proper averaging factor to minimize the measurement fluctuations.
4. Set the converted noise bandwidth for the noise measurement.

   Press `NOISE BW`.

   Enter the converted noise bandwidth using the entry keys.

   For the noise measurement internally performed in the 4352B, the resolution band width is automatically determined based on the offset frequency specified with `OFFSET FREQ`, and cannot be changed by the user. The noise level used for C/N ratio measurement is derived by converting the noise bandwidth which you set with `NOISE BW`.
5. Set the averaging factor for the noise measurement.

   Press `AVERAGING FACTOR`.

   Enter the averaging factor using the entry keys.

   Press `AVERAGING on OFF` to toggle it `AVERAGING ON off`.

Note

- If the message saying that *the noise attenuator should be set properly* is displayed, perform the following steps:

  Press (Sense Range).
  Press `NOISE ATTEN`.
  Enter the attenuation using the entry keys.

  This can help prevent spurious in the bandwidth for the noise measurement from substantially affecting measurement data.

  `Example:`

  Suppose that the following message is displayed:

  `CAUTION: Set Noise ATT 10 dB More`

  Set the noise attenuation at a level at least 10 dB higher than the current value.

Note

When measuring phase noise using the C/N ratio measurement function in the tester mode, a measurement around a spurious component may show a larger value than an actual phase noise. This occurs because the level of the spurious component is significant enough to affect the measurement. In this case, the value differs from the measurement at the same offset frequency obtained through the phase noise measurement function in the analyzer mode. Refer to the first section of Appendix C for how differs phase noise measurement in each mode.

Note

The minimum measurable value in a C/N ratio measurement is restricted by the phase noise characteristics and spurious characteristics of the signal generator you use.

Note

When the message **CAUTION: 2nd PLL Unlocked** appears on the LCD, follow the steps below to alter the bandwidth of the 2nd PLL in the 4352B to `WIDE`.

1. Press (Bw/Avg).
2. Press `NOISE PLL AUTO wide` to toggle it `NOISE PLL auto WIDE`.

See "(Bw/Avg)" in Chapter 7 where `AUTO` and `WIDE` are compared in their usage.

Advanced Measurement Items in Tester Mode

This section describes the advanced measurement items in Tester mode. The advanced measurement items can be obtained by calculation based on frequency or FM deviation measurement results. You can also use Instrument BASIC to automatically calculate their specific items from results obtained by basic measurement procedures.

See the corresponding section for detailed basic measurement procedures.

6-8. S/N Ratio

The S/N ratio for FM modulation is defined as the ratio of the FM deviation caused by the modulating signal (S) to the residual FM (N).

Residual FM represents FM deviation caused by noise, and it is equivalent to the value of FM deviation measured when there is no modulation input.

The measurement method for the S/N ratio varies depending on the definition of FM deviation caused by the modulation signal (S).

- **When S is defined as the FM peak deviation ΔF**

1. Turn the modulation signal output OFF.
2. Set FM deviation range to 2 kHz.
   Press (Sense Range), FM DEV RANGE, FM DEV RANGE: 2kHz.
3. Set the display format to a peak value.
   Press (Format), PEAK CONV ON off.
4. Measure FM deviation.
   Record the value displayed on the screen as the residual FM (Nmeas).
5. Calculate the S/N ratio using: S/N(dB)=20 * LOG(ΔF/Nmeas)

- **When S is defined as the modulation signal level**

1. Set the modulation signal output to the prescribed level.
2. Set the FM deviation's measurement range (press (Sense Range), FM DEV RANGE, and select the proper range) in accordance with the level of S.
3. Measure FM deviation.
   Record the value displayed on the screen as Smeas.
4. Turn the modulating signal output OFF.
5. Set FM deviation range to 2 kHz.
   Press (Sense Range), FM DEV RANGE, FM DEV RANGE: 2kHz.
6. Measure FM deviation.
   Record the value displayed on the screen as residual FM (Nmeas).
7. Calculate the S/N ratio using: S/N(dB)=20*LOG(Smeas/Nmeas)

6-9. Tuning Sensitivity Measurement (With Two Measurement Points)

Tuning sensitivity is defined by the following formula:

$$S_c = \frac{\Delta f}{\Delta E}$$

Where,

S_c	Tuning Sensitivity [MHz/V]
ΔE	DC Control Voltage Variation [V]
Δf	Carrier Frequency Variation [MHz]

Actually, the carrier frequency $f_n(n = 1, 2)$ at the prescribed DC control voltage level $E_n(n = 1, 2)$ is measured, and the tuning sensitivity is calculated by the following formula:

$$S_c = \frac{f_2 - f_1}{E_2 - E_1}$$

1. Set the DC control voltage (E1).
2. Measure the RF frequency, and record the measured value as f1.
3. Change the DC control voltage (E2), and measure the RF frequency. Record the measured value as f2.
4. Calculate the tuning sensitivity using the measured values in the formula above.

Note

Only follow the steps given above if you wish to quickly evaluate VCO performance in the tester mode. Otherwise, measure the frequency/tuning sensitivity characteristics vs. DC control voltage in the analyzer mode. This measurement provides you with more detailed information on VCO performance.

7. Measurements in Analyzer Mode

This section describes the measurement procedures for VCO or PLL measurements in the analyzer mode.

Note

When you enter a value, be sure to press [x1], [K/m], [M/μ], or [G/n] to specify the proper unit after entering the value. Also, when you wish to enter an integer, be sure to press [x1] after entering your desired value. See Chapter 6 for more details.

7-1. Specifying DC Control Voltage

Specify the DC control voltage that is applied to the DUT from the 4352B, and its related values to protect the DUT and to perform stable measurement.

In the 4352B, the maximum and minimum allowable level for the DC control voltage applied to the device can be specified. This will prevent excessive DC control voltage from being applied to the device.

When the signal generated by the DUT has transient fluctuations after the DC control voltage is changed, specify the wait time required for the stabilization of the DUT output. If this wait time is specified, the 4352B waits until the specified time elapses after the DC control voltage is changed before it starts making a measurement. This can eliminate the effect of the DUT transient responses.

1. Press [DC Control].
2. Press MAX CTRL VOLTAGE.
3. Press [1], [2], [x1].
   The maximum allowable level for the DC control voltage is set to 12 V.
4. Press MIN CTRL VOLTAGE.
5. Press [1], [x1].
   The minimum allowable level for the DC control voltage is set to 1 V.

Next, set the wait time to eliminate the DUT transient response by changing the DC control voltage.

6. Press CTRL DELAY.
7. Press [2], [0], [k/m].
   The wait time is set to 20 msec.

When the phase noise measurement or the spectrum measurement is performed, specify the DC control voltage. (When the other measurement is performed, this DC control voltage setting is not used, and the DC control voltage is specified as the sweep parameter in described later.)

8. Press CTRL VOLTAGE.
9. Press [4], [x1].
   The DC control voltage is set to 4 V.

7-2. Applying DC Voltages

Apply the DC power voltage and DC control voltage to the DUT.

1. Press (DC Power) or (DC Control).
   If the above keys have already been pressed in the setup, you do not need to press them again.
2. Press OUTPUT on OFF to toggle it OUTPUT ON off .
   The DC power voltage and DC control voltage is applied to the DUT.

Note

- OUTPUT on OFF can be selected in either (DC Control) or (DC Power).
  No matter which key is used, the DC control voltage and DC power voltage are *both simultaneously* applied to the device.
- A message saying that *the attenuation for the input signal from the DUT will be adjusted* may be displayed on the LCD. In this case, press (Sense Range), RF ATTEN , and adjust the RF attenuation value according to the instruction in the message.

  `Example:`

  If the following message is displayed, use RF ATTEN to reduce the attenuation by 5 dB smaller than it is:

  `CAUTION: Set RF ATT 5 dB Less`

Note

- The DC control voltage level specified in the analyzer mode at Step 7-1 is applicable when the phase noise measurement or the spectrum measurement is performed.
  In other measurement items, the DC control voltage specified within the range defined with SWEEP as the sweep parameter is used, and it is applied to the DUT. (See the description on later pages.) Note that if the maximum and minimum acceptable voltage levels are specified using MAX CTRL VOLTAGE and MIN CTRL VOLTAGE , any DC control voltage without the allowable range is not applied to the DUT.
- In the analyzer mode, you can specify the DC control voltage level for phase noise or spectrum measurements using the automatic frequency control function. See "Setting the Automatic Frequency Control Function" for details.

7-3. RF Power Characteristic vs. DC Control Voltage (Target Device: VCO)

The RF power characteristic vs. the DC control voltage is measured.

1. Check that the modulation output is OFF.

   Press Mod, and confirm that MOD OUT on OFF is selected.

2. Select the RF Power Characteristic vs. DC Control Voltage as the measurement item.

   Press Meas, RF POWER.

3. Specify the DC control voltage sweep range.

   Press Menu.

   Press SWEEP.

   Perform one of the following two procedures to enter the sweep range.

   - Press START and entry keys to enter the sweep start value. Then, press STOP and entry keys to enter the sweep stop value.
   - Press CENTER and entry keys to enter the sweep center value. Then, press SPAN and entry keys to enter the sweep span value.

4. Specify the number of measurement points per sweep.

   Press NUMBER of POINTS.

   Use entry keys to enter the number of measurement points.

5. Specify the sweep time.

   Press SWEEP TIME.

   Alternately press h:m:s and entry keys to specify the hour, minute, and second, respectively. You can also specify the sweep time in seconds. In the case of the sweep time setting in seconds, press SWEEP TIME, enter the time in seconds, and press x1. The allowable minimum sweep time varies depending on the specified number of measurement points. The allowable maximum sweep time is 1 hour.

6. Perform display scale optimization for the measurement data after the first sweep is completed.

   Press Display.
   Press AUTO SCALE to optimize the display scale for the measurement data.

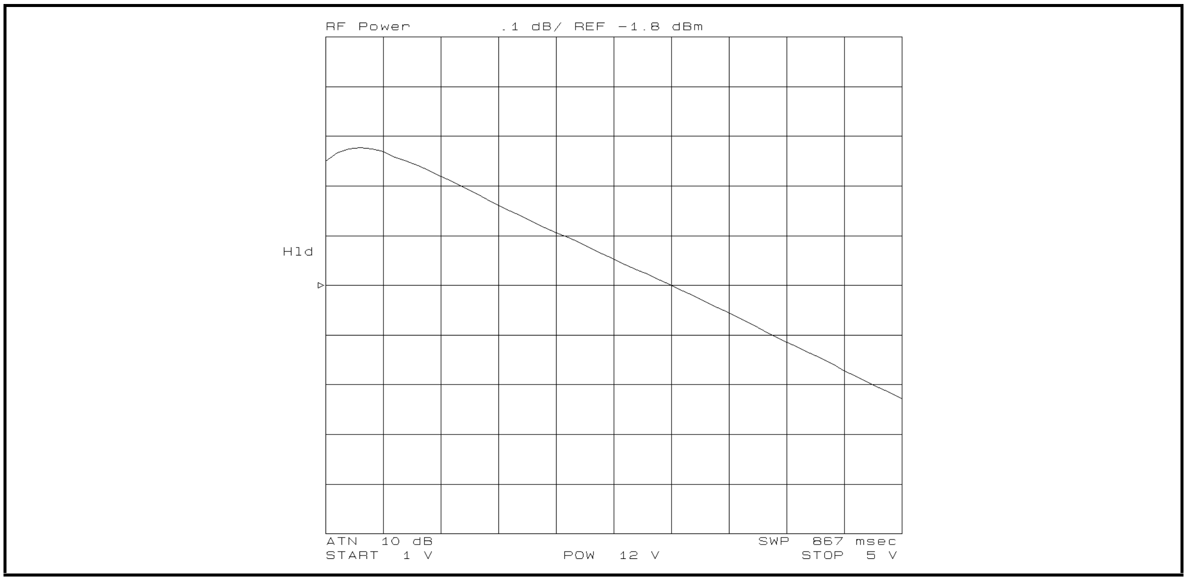


Figure 4-4.
Example of Measurement Screen (RF Power Characteristics vs. DC Control Voltage)

7. Read the measurement value.

   Press (Menu), MARKER to display the marker. The measurement value at the marker is displayed on the screen.
   If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF.), and that the modulation output is OFF.

   For more information about the additional features for this measurement, see "Setting Cable Loss Compensation Function" for the cable loss compensation function. See Chapter 8 for the power level unit selection, averaging, and marker functions.

Note Sweep starts after the time specified with CTRL DELAY under (DC Control) elapses. This delay time is intended to wait until the DC control voltage becomes stable before sweep. The delay time is not included in the sweep time and is applicable only to the first measurement point. To provide delay time for the other points, you need to specify a proper sweep time.

7-4. Frequency/Tuning Sensitivity Characteristics vs. DC Control Voltage (Target Device: VCO)

Carrier frequency and tuning sensitivity characteristics vs. the DC control voltage are measured.
The tuning sensitivity is a differential curve of the F-V (carrier frequency vs. DC control voltage) characteristics.

1. Check that the modulation output is OFF.

   Press (Mod), and confirm that MOD OUT on OFF is selected.

2. Select the Frequency/Tuning Sensitivity Characteristics vs. DC Control Voltage as the measurement item.

   Press (Meas), FREQUENCY .

3. Specify the DC control voltage sweep range.

   Press (Menu).

   Press SWEEP .

   Perform one of the following two procedures to enter the sweep range.

   - Press START and entry keys to enter the sweep start value. Then, press STOP and entry keys to enter the sweep stop value.

   - Press CENTER and entry keys to enter the sweep center value. Then, press SPAN and entry keys to enter the sweep span value.

4. Specify the number of measurement points per sweep.

   Use NUMBER of POINTS and entry keys to enter the number of measurement points.

5. Specify the sweep time.

   Use SWEEP TIME and h:m:s to specify the sweep time per sweep. You can also specify the sweep time in seconds. In the case of the sweep time setting in seconds, press SWEEP TIME , enter the time in seconds, and press (x1).
   The specified number of measurement points limit the allowable minimum sweep time. On the other hand, any time span up to 1 hour can be specified for the allowable maximum sweep time.

6. Select the frequency resolution.

   Press (Sense Range).
   Press FREQ RES: 1kHz or 64 kHz .

7. When 1 kHz frequency resolution is selected, select either the positive (upward to the right) or negative (downward to the right) slope (df/dv) of the frequency vs. DC control voltage characteristics suitable for the DUT.

   Press either SENS PLRTY pos NEG for the positive slope or SENS PLRTY POS neg for the negative slope.
   When the slope is correctly selected, the output frequency setting of the external signal generator is controlled by the 4352B every time the change in the measured frequency exceeds about 30 MHz. If the slope is incorrectly selected, it may take an excessively

long time for the sweep because the external signal generator needs to be controlled frequently by the 4352B.

8. Perform display scale optimization for the measurement data after the first sweep is completed.

   Press (Display).

   Press AUTO SCALE to optimize the display scale for the measurement data.

9. Specify the aperture for tuning sensitivity measurement.

   Only specify the aperture when you need to make an uneven trace flatter. See "Definition of Tuning Sensitivity and Specifying Aperture" in Chapter 8 for details. Perform the following steps to specify aperture for tuning sensitivity. Enter the aperture value in percentage of span.
   Press (Bw/Avg).
   Use SENS APERTURE and entry keys to enter aperture.

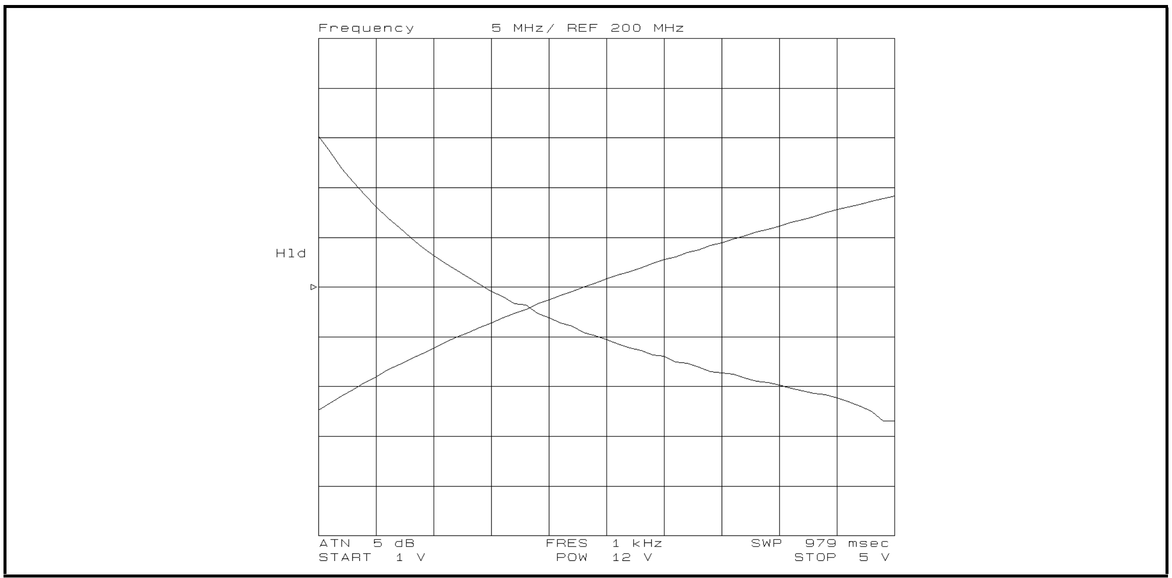


Figure 4-5.
Example of Measurement Screen (Frequency/Tuning Sensitivity Characteristics vs. DC Control Voltage)

10. Read the measurement value.

    Press (Menu), MARKER to display the marker. The measurement value at the marker is displayed on the screen.
    The tuning sensitivity is displayed using the memory trace. Press MKR ON [DATA] to toggle it MKR ON [MEMORY] to check the value of the tuning sensitivity using the marker.
    If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF.), and that the modulation output is OFF.

    For more information about the additional features for this measurement, see Chapter 8 for the frequency resolution selection, averaging, marker, and tuning sensitivity aperture functions.

Note

The sweep starts when the time specified with CTRL DELAY under [DC Control] elapses. This delay time is intended to wait until the DC control voltage becomes stable before sweep. This delay time is not included in the sweep time and is applicable only to the first measurement point. To provide delay time for the other points, you need to specify a proper sweep time.

7-5. Phase Noise Characteristics vs. Offset Frequency (Target Device: VCO or PLL)

The phase noise characteristic at an offset frequency from the carrier is measured. The measurement value is negative, though the measurement value of the C/N (Carrier/Noise) ratio in the tester mode is positive.

1. Check that the modulation output is OFF.

   Press (Mod) and confirm that MOD OUT on OFF is selected.

2. Select the Phase Noise Characteristics vs. Offset Frequency as the measurement item.

   Press (Meas), PHASE NOISE.

3. Specify the offset frequency sweep range.

   Press (Menu).

   Press SWEEP.

   Press START and entry keys to enter the sweep start value. Then, press STOP and entry keys to enter the sweep stop value. (The center or span value entry method cannot be used because the 4352B only employs the logarithm sweep of an offset frequency for this measurement.)
   Allowable value you can specify is one of the values 100 Hz,1 kHz,10 kHz,100 kHz,1 MHz, and 10 MHz.

4. Specify the converted noise bandwidth for noise measurement.

   Press (Bw/Avg).

   Use NOISE BW and entry keys to specify the converted noise bandwidth. Generally, use 1 Hz (preset value of this instrument).

5. Specify the averaging factor for noise measurement.

   Press AVERAGING FACTOR.

   Use entry keys to enter the averaging factor.

   Press AVERAGING on OFF to toggle it to AVERAGING ON off.

6. Optimize the display scale for the measurement data.

   Press (Display).

   Press AUTO SCALE to optimize the display scale for the measurement data.

Note

The minimum measurable value in a phase noise measurement is restricted by the phase noise characteristics and spurious characteristics of the signal generator you use.

Note

When the message **CAUTION: 2nd PLL Unlocked** appears on the LCD, follow the steps below to alter the bandwidth of the 2nd PLL in the 4352B to WIDE.

a. Press (Bw/Avg).

b. Press NOISE PLL AUTO wide to toggle it NOISE PLL auto WIDE.

See "(Bw/Avg)" in Chapter 7 where AUTO and WIDE are compared in their usage.

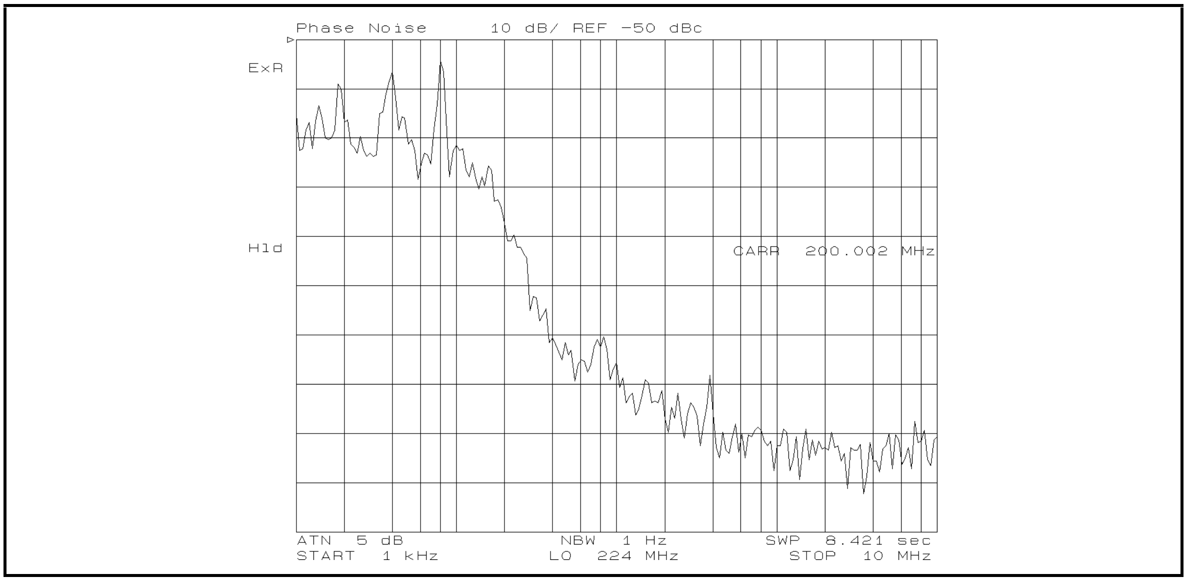


Figure 4-6.
Example of Measurement Screen (Phase Noise Characteristics vs. Offset Frequency)

7. Read the measurement value.

   Press (Menu), MARKER to display the marker. The measurement value at the marker is displayed on the screen.

   If the measured value does not match your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF.), and that the modulation output is OFF.

   For more information about the additional features for this measurement, see Chapter 8 for the automatic frequency control, averaging, marker, and noise attenuator functions.

Note

In this measurement, the sweep time can not be specified. Only the query for the sweep time is available.
When the automatic frequency control function is ON, the carrier frequency is automatically set to the target frequency before the sweep starts. The time required to set the carrier frequency to the target frequency is not included in the sweep time. Also, when the external signal generator needs to change its output frequency for a correct measurement, the external signal generator changes the frequency, and a certain time elapses before the sweep. The time required for the frequency change of the external signal generator is not included in the sweep time.

7-6. Frequency Transient (Target Device: PLL)

The PLL output frequency transients that occur after a change in the PLL frequency setting are measured. This measurement requires a program in order to send the DUT, PLL sythesizer, data containing a request to change its frequency. The program is detailed in Appendix C of this manual and "Frequency Transient Measurement" in Chapter 12 of the 4352B GPIB Programming Manual.

1. Check that the modulation output is OFF.

   Press (Mod) and confirm that MOD OUT on OFF is selected.

2. Select the Frequency Transient as the measurement item.

   Press (Meas), RF TRANSIENT .

3. Set the trigger mode to HOLD.

   Press (Trigger).

   Press HOLD .

4. Specify the measurement range for the frequency transient.

   Press (Sense Range), TARGET FREQ .

   Use the numeric entry keys to enter the target frequency.

   Press TARGET POSITION .

   Use the numeric entry keys to enter the target position value.

   Select a frequency span from 2 MHz, 20 MHz, or MAX.

5. Specify the sweep start time and the sweep time.

   Press (Menu).

   Press SWEEP .

   Use START and the entry keys to set the delay time from the measurement trigger to the start of sweeping.

   Use SPAN and entry keys to specify the sweep time.

   Allowable range you can specify for the delay time is 0 to 800 msec, for the sweep time 12.5 μsec to 10 sec.

6. Send divider data to the PLL.

   See "2-5. Sending divider data to a serial-input PLL" in Appendix C to learn how to send the divider data to the PLL via the 24 bit I/O port.

7. Send a load (strobe) signal to the PLL.

   See "2-5. Sending divider data to a serial-input PLL" in Appendix C to know how to generate a measurement trigger and send a load signal to the PLL.

8. Optimize the display scale for the measurement data.

   Press (Display).

   Press AUTO SCALE to optimize the display scale for the measurement data.

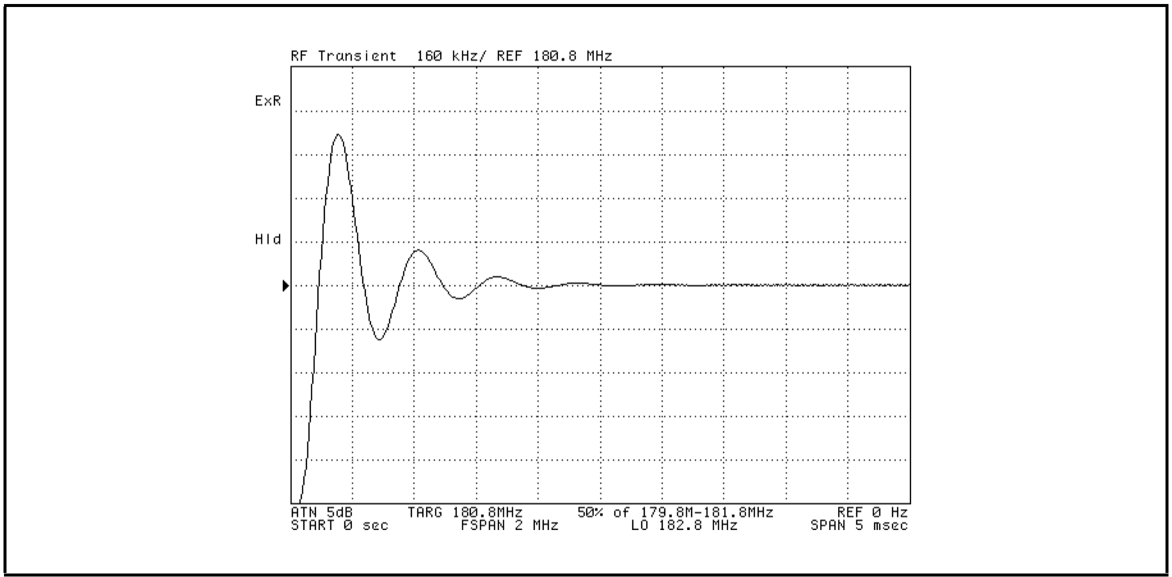


Figure 4-7. Example of Measurement Screen (Frequency Transient Characteristics)

9. Read the measurement value.

   Press (Menu), MARKER to display the marker. The measurement value at the marker is displayed on the screen.
   If the measurement value does not match your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF.), and that the modulation output is OFF.

   For more information about other useful features for this measurement, see Chapter 8 for the averaging and marker functions.

10. Specify the reference frequency (RF REF) if you need more digits to display the measurement value.

    Press (Sense Range).
    Use REF FREQ FOR SCALE and entry keys to enter the reference frequency.

Note For more detailed information about frequency transient measurements, see "Frequency Transient Measurements (Analyzer Mode)" in Appendix C.

7-7. Spectrum (Target Device: VCO or PLL)

A spectrum measurement is performed.

1. Check that the modulation output is OFF.

   Press (Mod) and confirm that MOD OUT on OFF is selected.

2. Select Spectrum as the measurement item.

   Press (Meas), SPECTRUM.

3. Specify the frequency sweep range.

   Press (Menu).

   Press SWEEP.

   Perform one of the following two procedures to enter the sweep range.

   - Press START and entry keys to enter the sweep start value. Then, press STOP and entry keys to enter the sweep stop value.

   - Press CENTER and entry keys to enter the sweep center value. Then, press SPAN and entry keys to enter the sweep span value.

4. Specify the resolution bandwidth.

   Press (Bw/Avg).

   Press RES BW and entry keys to enter the resolution bandwidth.

5. Move the carrier frequency to the center of the full span.

   Press (Menu).

   Press CARRIER MENU.

   Press CARRIER→CENTER.
   The carrier frequency is set to the center frequency, and the carrier signal is on the center of the full sweep range.

6. Optimize the display scale for the measurement data.

   Press (Display).

   Press AUTO SCALE to optimize the display scale for the measurement data.

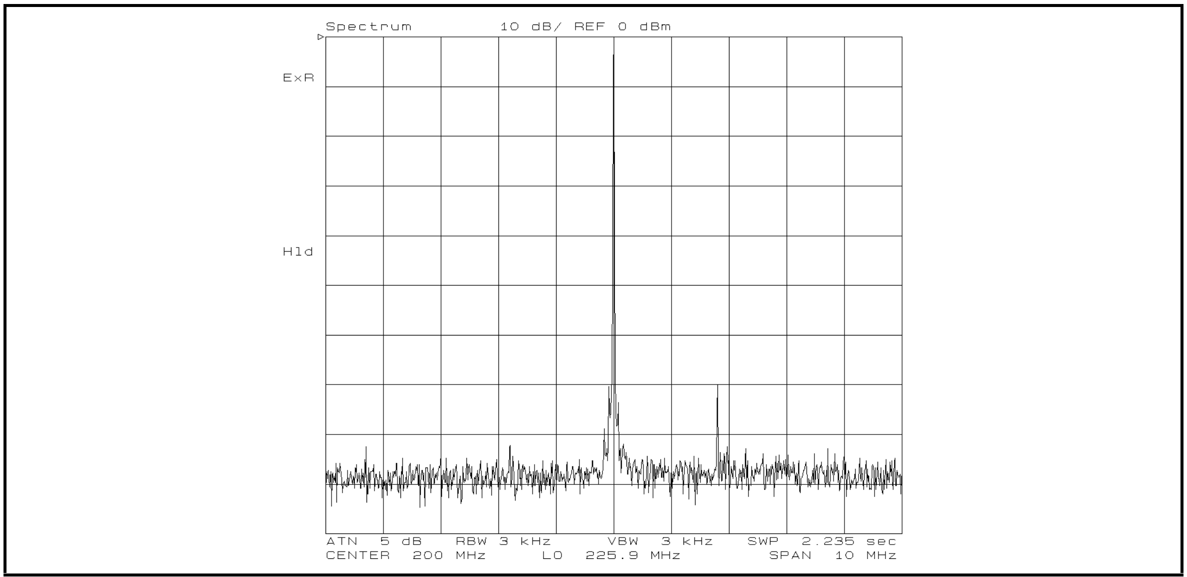


Figure 4-8. Example of Measurement Screen (Spectrum)

7. Read the measurement value.

   Press (Menu), MARKER to display the marker. The measurement value at the marker is displayed on the screen.

   If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF.), and that the modulation output is OFF.

   For more information about other features for this measurement, see Chapter 8 for the automatic frequency control, video bandwidth, averaging, power level unit switching, and marker functions.

Note

In this measurement, the sweep time can not be specified. Only the query for the sweep time is available.

Advanced Measurement Items in Analyzer Mode

This section provides advanced measurement items based on basic measurement steps in the analyzer mode.

7-8. Comparison between Carrier and Harmonic Levels

Carrier level is compared with third harmonics level by using the marker.

1. Measure the carrier level.

   See "7-7. Spectrum (Target Device: VCO or PLL)" in Chapter 4 for how to measure the carrier level.

2. Stop the sweep. (Set the trigger mode to HOLD.)

   Press (Trigger) and `HOLD`.

3. Store the measurement trace using the memory trace function.

   Press (Display), `DEF TRACE`.

   Press `DATA→MEMORY`.
   The carrier measurement trace is stored in the memory trace.

4. Display the data and memory traces.

   Press `DATA and MEMORY`.
   Two traces are displayed.

5. Change the center stimulus value to the third harmonics frequency.

   Press (Menu), `CARRIER MENU`.

   Press `3×CARR→CENTER`.

6. Measure the third harmonics level.

   Press (Trigger), `SINGLE`.

7. Select a memory trace (carrier) to be applied for the marker value.

   Press (Menu), `MARKER`.

   Press `MKR ON [DATA]` to toggle it `MKT ON [MEMORY]`.

8. Use the marker to search the trace for the carrier level.
   (In this case, the carrier level must be maximum in full span.)

   Press `RETURN`.

   Press `MKR SEARCH`.

   Press `MAX`.

9. Display the Δ marker at the marker reading position and fix it in position.

   Press `RETURN`.

   Press `MARKER`.

   Press `ΔMKR MENU`.

   Press `FIXED ΔMKR`.

10. Select the data trace (third harmonics) to be applied for the marker value.

Press RETURN.

Press MKR ON [MEMORY] to toggle it MKR ON [DATA].

11. Use the marker to search the trace for the third harmonics level. (In this case, the third harmonic level must be maximum in full span.)

    Press RETURN.

    Press MKR SEARCH.

    Press MAX.
    At this time, the difference in level between the carrier and the third harmonics is displayed at the upper right corner of the screen. Also, perform the following steps to check the absolute level of the third harmonics.
    Press RETURN.

    Press MARKER.

    Press ΔMKR MENU.

    Press ΔMODE OFF.

7-9. Comparison Between Characteristics Obtained Under Three or Four Different Conditions

Measurement results obtained under different conditions are compared on the same display format.

In this section, we compare the phase noise characteristics obtained at the three different carrier frequencies (fundamental frequency, frequency above the fundamental frequency, and frequency below the fundamental frequency) as an example.

First, measure the phase noise at the fundamental frequency. See "7-5. Phase Noise Characteristics vs. Offset Frequency (Target Device: VCO or PLL)" for details.

1. Stop the sweep.

   Press (Trigger), `HOLD`.

2. Store the measurement data at the fundamental frequency in the memory trace.

   Press (Display), `DEF TRACE`.

   Press `DATA→MEMORY`.

3. Display the data and memory traces.

   Press `DATA and MEMORY`.

4. Set the DUT output frequency to the frequency above the fundamental frequency.

   (Be sure to change the target frequency when measuring the VCO phase noise characteristics using the automatic frequency control function.)

5. Measure the phase noise characteristics.

   Press (Trigger), `SINGLE`.

6. Store the measurement data at the frequency above the fundamental frequency in the upper limit trace.

   Press (Display), `DEF TRACE`.

   Press `DATA→LIMIT MENU`.

   Press `LIMIT LINE on OFF` to toggle it `LIMIT LINE ON off`.

   Press `DATA→UPPER`.

7. Set the DUT output frequency to the frequency below the fundamental frequency.

8. Measure the phase noise characteristics.

   Press (Trigger), `SINGLE`.

9. Compare three measurement results.

   The memory trace for the measurement data at the fundamental frequency is displayed. The upper limit memory trace for the measurement data at the frequency above the fundamental frequency is displayed, and the data trace for the measurement data at the frequency below the fundamental frequency is displayed.

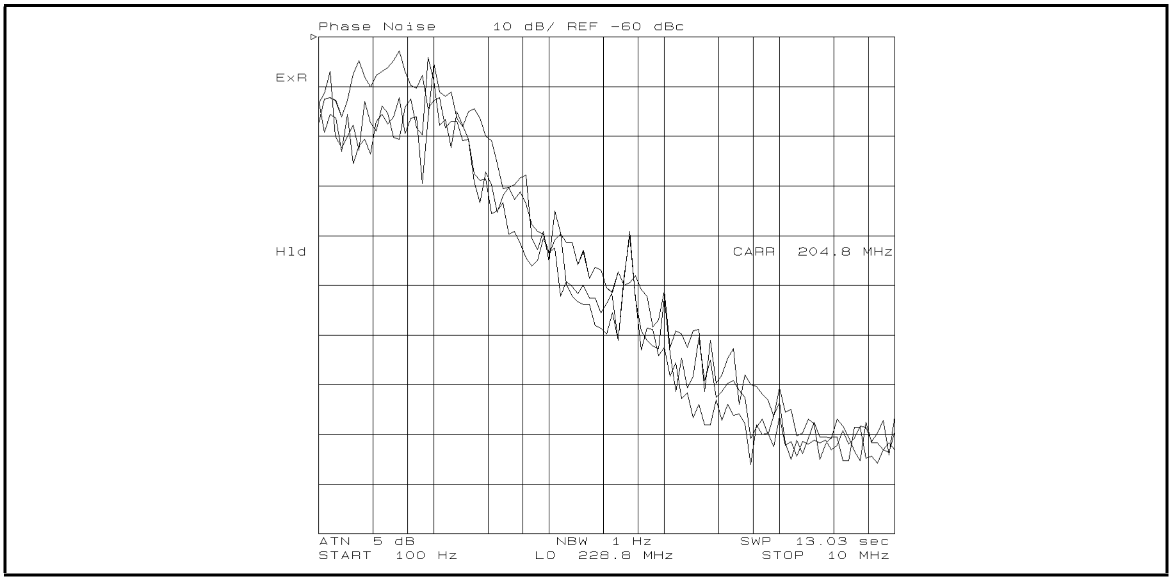


Figure 4-9.
Example of the Measurement Screen (Comparison between Characteristics Obtained Under Three Different Conditions)

10. Read the measurement value by using the marker function.
    All markers are designed for use on either the data or memory trace. To analyze measurement data on the upper limit memory trace, therefore, you need to switch between the upper limit trace and the data trace. To switch between traces, follow the steps below:

    Press (Display), DEF TRACE.

    Press DATA→LIMIT MENU.

    Press DATA↔UPPER.

When the fourth carrier frequency is compared with the other three traces, perform the following steps.

1. Press (Display), DEF TRACE.
2. Press DATA→LIMIT MENU.
3. Press DATA→LOWER to store the third measurement data as the lower limit memory trace.
4. Change the device frequency setting.
5. Measure the phase noise characteristics.

   Press (Trigger), SINGLE.
6. To check the measurement values using the marker function, press DATA↔LOWER to switch between the lower limit trace and the data trace.

See Chapter 8 for additional information about the marker function.

7-10. Integral of Phase Noise vs. Offset Frequency Characteristics (Target Device: VCO or PLL)

In this section, you integrates the result of the phase noise characteristic of the device with respect to the offset frequency from the carrier of the DUT (VCO).

1. Check that the modulation output is OFF.

   Press (Mod), and confirm that MOD OUT on OFF is selected.

2. Select the measurement mode. Select the analyzer mode.

   Press (Meas), INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.

3. Select the phase noise vs. offset frequency characteristics measurement mode.

   Press PHASE NOISE.

4. Select the linear sweep.

   Press (Menu).

   Press SWEEP TYPE [xxx FREQ] to toggle it SWEEP TYPE [LIN FREQ].

5. Set the offset frequency sweep range.

   Press (Menu).

   Press SWEEP.

   Press CENTER and use the numeric entry keys to enter the sweep center value. Then, press SPAN and use the numeric entry keys to enter the sweep span value.

6. Select the resolution bandwidth.

   Press (Bw/Avg).

   Press RES BW and use the numeric entry keys to enter the resolution bandwidth value.

7. Set the averaging factor for the phase noise measurement.

   Press AVERAGING FACTOR.

   Use the numeric entry keys to enter the averaging factor.

   Press AVERAGING on OFF to toggle it AVERAGING ON off.

8. Adjust the scale for measurement trace.

   Press (Display).

   Press AUTO SCALE. The scale is adjusted automatically.

9. Set the noise integration measurement.

   Press (Menu) and MARKER.

   Press INTG NOISE on OFF to toggle it INTG NOISE ON off.

As shown in Figure 4-10, the measurement result is displayed on the screen and, at the lower left of the screen, the result of the noise integration is displayed (Intg Noise -xxxx dBc). This value is the integral of the entire span (trace).

Note

The minimum measurable value in a phase noise measurement is restricted by the phase noise characteristics and spurious characteristics of the external signal source you use.

Note

When the **CAUTION: 2nd PLL Unlocked** appears on the LCD screen, follow the steps below to alter the bandwidth of the 2nd PLL inside the 4352B to WIDE.

a. Press (Bw/Avg).

b. Press NOISE PLL AUTO wide to toggle it NOISE PLL auto WIDE.

For the difference between AUTO and WIDE, see the (Bw/Avg) section in Chapter 7.

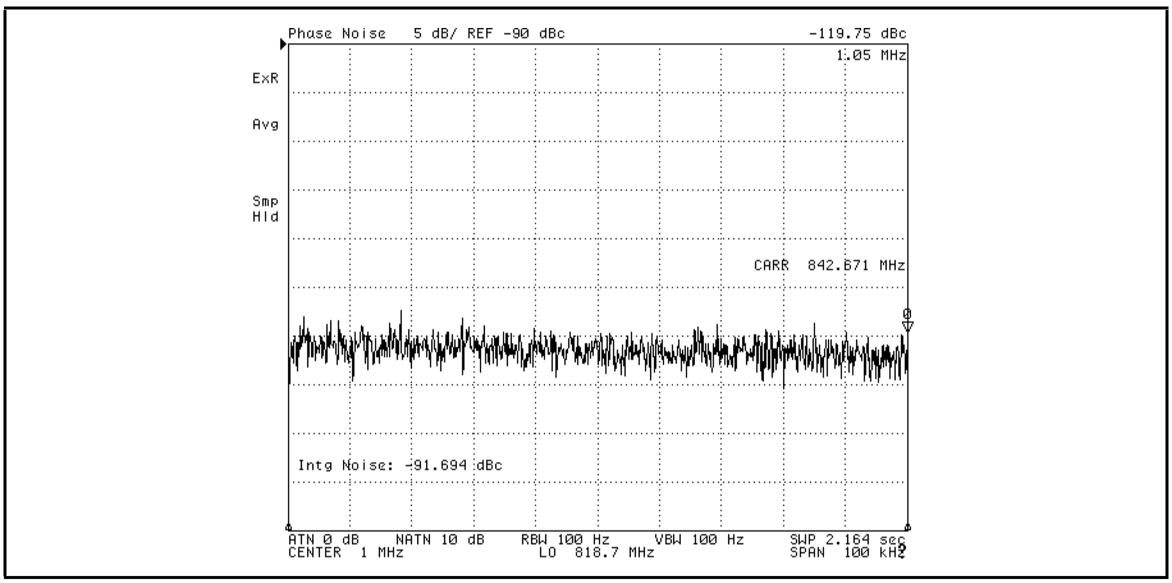


Figure 4-10.
Sample measurement screen (integral of phase noise vs. offset frequency characteristics)

10. Read the values of measurement points.

Press (Menu) and MARKER to display the marker. You can read the value of each measurement point using the marker.

Note

If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF), and that the modulation output is OFF.

Note

For the automatic frequency control function, the averaging function, the marker function, and the noise attenuator function, see Chapter 8.

Note

In this measurement, the sweep time can not be specified. Only the query is available.
When the automatic frequency control function is ON, the carrier frequency is automatically adjusted before the sweep. The time required for the adjustment is not included in the sweep time. If the external signal source needs to be set again, the setting is first made and, after the frequency change time elapses, the sweep starts. This time is not included in the sweep time also.

Partial integration

You can specify a portion of the span (trace) and view the integral of that part.

1. Press (Menu) and `MKR SEARCH`. The current marker position is displayed on the screen, as MARKER xxx kHz.
2. Press `SEARCH RANGE`.
3. Press `PART SRCH on OFF` to toggle it `PART SRCH ON off`. Small triangles are displayed at the lower left and lower right of the screen.
4. There are 2 methods to set the noise integration range as follows. In this section, the method using the rotary knob is described.
   - Using the numeric entry keys to enter the integration start (or end) frequency and pressing `MKR -> LEFT RNG` (or `MKR -> RIGHT RNG`)
   - Using the rotary knob to move the marker to the integration start (or end) frequency and pressing `MKR -> LEFT RNG` (or `MKR -> RIGHT RNG`)
5. Turn the rotary knob to move the marker to the frequency of 0.970 MHz (integration start frequency). Press `MKR -> LEFT RNG`. A vertical line appears at the frequency of 0.970 MHz. (At this time, the noise integration value displayed at the lower left of the screen is the integral of the range to the right of the vertical line.)
6. Turn the rotary knob to move the marker to the frequency of 1.03 MHz (integration end frequency). Press `MKR -> RIGHT RNG`. A vertical line appears at the frequency of 1.03 MHz.
7. The measurement result as shown in Figure 4-11 is displayed, and the lower left of the screen shows the value of the noise partial integration for the frequency range between 0.97 MHz to 1.03 MHz, as `Intg Noise: -xx dBc`.

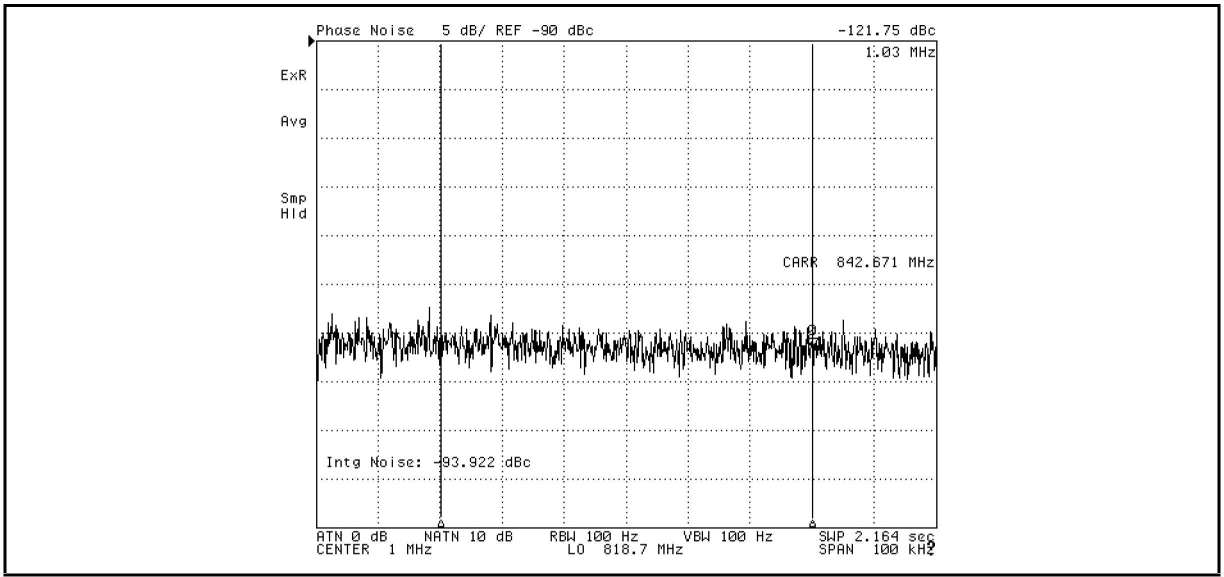


Figure 4-11.
Sample measurement screen (partial integration of phase noise vs. offset frequency characteristics)

7-11. Post-tuning Drift Characteristics

This is a parameter specified as part of the total RF transient characteristics. It is expressed as the frequency deviation versus the time characteristics in a given time window after a step change in frequency. To make this measurement, the zero-span measurement function is used in the Frequency/Tuning Sensitivity mode.

Note

The 4352B offers the following three ways to measure the post-tuning drift characteristics of the DUT oscillation frequency. Select the method suitable for your measurement requirements based on the required observation time.

Observation time	Measurement Item	Reference section
10 sec or shorter	Frequency transient	"7-6. Frequency Transient (Target Device: PLL)"
10 sec to 1 hour	Frequency/Tuning Sensitivity (Zero Span)	This section (7-10)
1 hour or longer	Frequency in Tester Mode by program	GPIB Programming Guide, Chapter 12

1. Check that the modulation output is OFF.

   Press (Mod) and confirm that MOD OUT on OFF is selected.

2. Stop the sweep.

   Press (Trigger), HOLD .

3. Select the Frequency/Tuning Sensitivity vs. DC Control Voltage as the measurement item.

   Press (Meas), FREQUENCY .

4. Specify the DC control voltage level.

Press Menu, SWEEP.

Use CENTER and entry keys to enter the DC control voltage level.

Press SPAN, 0, x1 to set the span to 0 V.

5. Specify the sweep time.

   Use SWEEP TIME, h:m:s, and entry keys to specify the sweep time per sweep. You can also specify the sweep time in seconds. To do this, press SWEEP TIME, enter the time in seconds, and press x1.
   The allowable minimum sweep time varies depending on the specified number of measurement points, but it should not be shorter than 10 msec. The allowable maximum sweep time is 1 hour.

6. Specify the number of measurement points per sweep.

   Press NUMBER of POINTS.

   Use entry keys to enter your desired number.

7. Display the data trace.

   Press Display.
   Press DEF TRACE and select DISPLAY:DATA.

8. Select 1 kHz for frequency resolution.

   Press Sense Range.
   Select FREQ RES: 1 kHz.

9. Start the sweep.

   Press Trigger, SINGLE.

10. Optimize the display scale for the measurement data.

    Press Display.
    Press AUTO SCALE to optimize the display scale for the measurement data.

11. Read the measurement value.

    Press Menu, MARKER to display the marker. The measurement value at the marker is displayed on the screen.

If the measurement value is not your expected value, check that the DC outputs are ON, and that the modulation output is OFF.

For more information about the additional features available for this measurement, see Chapter 8 for the frequency resolution change, averaging, and marker functions.

7-12. Observation of FM Signal Waveform After Demodulation

FM signal waveform after demodulation can be observed on the frequency transient measurement screen using the 4352B built-in F-V converter.

The observation is made in the continuous trigger mode.

1. Select frequency transient as the measurement item.

   Press (Meas), RF TRANSIENT.

2. Specify the sweep start time and the sweep time.

   Press (Menu).

   Press SWEEP.

   Use START and entry keys to specify the sweep start time.

   Use SPAN and entry keys to specify the sweep time.

   See "(Menu)" in Appendix E for the allowable ranges for sweep start time and sweep time.

3. Select the continuous trigger mode.

   Press (Trigger), CONTINUOUS.

4. Optimize the display for the measurement data.

   Press (Display).
   Press AUTO SCALE to optimize the display scale for the measurement data.

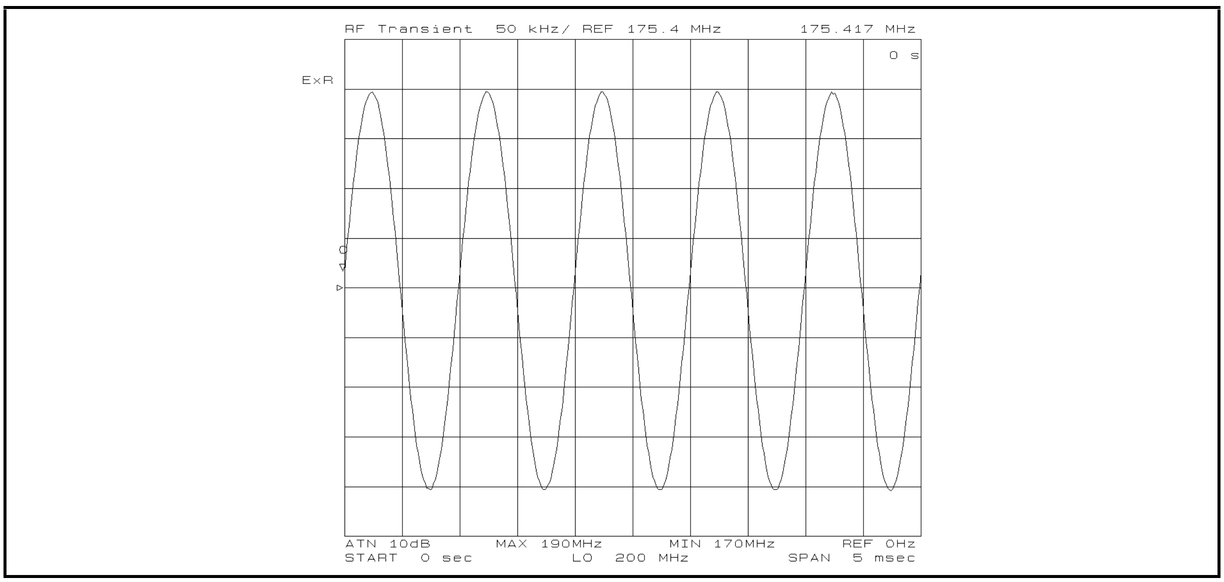


Figure 4-12.
Example of Measurement Screen (Observation of FM Signal Waveform After Demodulation)

Note Demodulated waveforms cannot be obtained if the modulated signal frequency is beyond 5 kHz.

Measurement Technique

This section explains how to perform more stable and precise measurements using the advanced functions of the 4352B.

Setting the Automatic Frequency Control Function

The 4352B can automatically adjust the control voltage so that the VCO carrier frequency is maintained at your specified frequency.

Repeat the following steps (the control voltage setting loop) to reach/maintain the VCO carrier frequency at your specified frequency.

Control voltage change → Frequency measurement → Calculation of a more proper control voltage from the measurement results

This function is used to evaluate the characteristics of the VCO with the carrier frequency held constant.

Caution

When using the automatic frequency control function, use AFC MAX CTRL VOLT and AFC MIN CTRL VOLT to specify the maximum and minimum level of control voltage that can be applied to the DUT.

If the automatic frequency control function is used without an appropriate control voltage specified as the maximum and minimum level, an unexpectedly high voltage may be applied to the DUT, eventually damaging or destroying the DUT.

Note

Minimum and maximum values of the control voltage can be controlled in two ways:by setting AFC MAX CTRL VOLT and AFC MIN CTRL VOLT, and setting MAX CTRL VOLTAGE and MIN CTRL VOLTAGE. If controlled in both ways, the maximum value is set to the lower value of AFC MAX CTRL VOLT and MAX CTRL VOLTAGE. Likewise, the minimum value is set to the higher value of AFC MIN CTRL VOLT and MIN CTRL VOLTAGE.

The following conditions must be specified in the 4352B to use the automatic frequency control function:

- Target Frequency
  The frequency of the carrier signal to be maintained
- Allowable Frequency Tolerance
  Allowable tolerance limit between the target frequency (F_T) and the actual frequency (F_M). The VCO's control voltage is automatically adjusted until $|F_M - F_T|$ is equal to or less than this value.
- DUT's Tuning Sensitivity (Hz/V)
  Specify a value close to the actual DUT tuning sensitivity. If a value as close as possible is entered, the control voltage setting loop cycles required will be smaller to reach/maintain your specified frequency.
  If the actual DUT tuning sensitivity is 5 or more times larger than your entered tuning sensitivity value, the actual frequency may not be reached to your specified target frequency to within the allowable frequency tolerance.
  For the definition and measurement method for tuning sensitivity in the tester mode, see

"6-9. Tuning Sensitivity Measurement (With Two Measurement Points)". For the same information in the analyzer mode, see "7-4. Frequency/Tuning Sensitivity Characteristics vs. DC Control Voltage (Target Device: VCO)".

- Maximum Iteration of the Control Voltage Setting Loop Cycles
  The measurement and calculation is repeated to determine the optimum control voltage level until the number of this loop cycles reaches the value specified here. A value from 1 to 999 can be entered.

To enter these conditions, perform the following steps:

1. Press (Menu).
2. Press AUTO FREQ CONTROL.
3. Set the target frequency.

   Press TARGET.

   Press (8), (0), (0), (M/μ).
   The target frequency is set to 800 MHz.
4. Set the allowable frequency tolerance.

   Press TOLERANCE.

   Press (1), (0), (0), (k/m).
   The allowable frequency tolerance is set to 100 kHz.
5. Set the DUT tuning sensitivity.

   Press SENSITIVITY.

   Press (5), (M/μ).
   The tuning sensitivity is set to 5 MHz/V.
6. Set the maximum iteration for the control voltage setting loop cycles.

   Press MAX ITERATION.

   Press (2), (0), (x1).
   The maximum iteration for the control voltage setting loop cycles is set to 20.
7. Specify the upper and lower limits of the control voltage levels for the automatic frequency control function.

   Press AFC MAX CTRL VOLT.
   Press (5), (x1).
   The maximum control voltage level is set to 5 V. Next, set the lower limit.
   Press AFC MIN CTRL VOLT.
   Press (1), (x1).
   The minimum control voltage level is set to 1 V.
8. Turn ON the automatic frequency control function.

   Press AFC on OFF to toggle it AFC ON off.
9. Press RETURN.

Note

The automatic frequency control function is performed immediately before the sweep or measurement starts. During the entire measurement, the DC control voltage is kept constant. Therefore, the DC control voltage level is not changed even if the actual frequency is shifted or changed during the entire measurement.

Be sure to take this into consideration for measurements that have long measurement time conditions. For example, the specified averaging factor might be a problem due to the DC power/control voltage fluctuations.

Setting Cable Loss Compensation Function

The 4352B can compensate for he RF power level loss of the cable connecting the DUT output terminal and the 4352B RF IN connector when measuring RF power.

The following conditions must be set in the 4352B to use the cable loss compensation function:

- Frequency Characteristics of the Cable Level Loss
  Slope of curve (loss/frequency) in dB/GHz
- Level Loss at DC (0 Hz)

To enter these conditions, perform the following steps:

1. Press (Menu).
2. Press SLOPE and entry keys to enter the frequency characteristics of the level loss.
3. Press LOSS and entry keys to enter the level loss at DC (0 Hz).
4. Press COMPEN on OFF to toggle it COMPEN ON off.
5. Press Return.

See "Cable Loss Compensation Menu" in Chapter 7 for more information on cable loss compensation.

5

Basic Measurements Using the 43521A

Introduction

This chapter introduces basic VCO and PLL measurement procedures at higher frequencies available with the system in which the 43521A (Downconverter Unit) is combined with the 4352B and the external signal source. The overall flow of the description is almost the same as that of Chapter 4 (previous chapter). This instrument offers 2 measurement modes: tester and analyzer modes. Each mode allows you to make measurements of different measurement items. This chapter introduces the measurement procedures listed below.

Measurement Items Available in Tester Mode

- **RF power measurement (DUT: VCO)**
  Measures the level of the carrier signal outputted from the VCO.
- **Frequency measurement (DUT: VCO)**
  Measures the frequency of the carrier signal outputted from the VCO.
- **C/N ratio measurement (DUT: VCO)**
  Measures the ratio of the level of the carrier signal outputted from the VCO to the phase noise level at the specified offset frequency.

Measurement Items Available in Analyzer Mode

- **RF power vs. DC control voltage characteristics measurement (DUT: VCO)**
  Measures RF power characteristics with respect to the DC control voltage.
- **Frequency/tuning sensitivity vs. DC control voltage characteristics measurement (DUT: VCO)**
  Measures output carrier frequency and tuning sensitivity characteristics with respect to the DC control voltage.
- **Phase noise vs. offset frequency characteristics measurement (DUT: VCO)**
  Measures phase noise characteristics with respect to the offset frequency relative to the carrier frequency.
- **Integral of phase noise vs. offset frequency characteristics measurement (DUT: VCO)**
  Integrates the result of the phase noise characteristics measurement. Integration within a specified range is also available.
- **Frequency transient measurement (DUT: PLL)**
  Measures frequency fluctuation characteristic over time.
- **Spectrum measurement (DUT: PLL)**
  Measures spectrum characteristics. Carrier, spurious, and harmonics levels can be obtained.

1. Preparations for Measurements

This chapter uses a stand alone system as an example to explain the measurement procedures. This system consists of the 4352B, 43521A (Downconverter Unit), and an external signal generator only. In this system, the 4352B controls the external signal generator (8664A) via GPIB.

Note

The 4352B can also be used as a part of the measurement system controlled by an external controller such as a PC. In such a system, you can perform measurement automatically by running a program written in BASIC.

See the *4352B GPIB Programming Manual* for more details.

1-1. Connecting Devices

1. The following equipment is required for the procedures in this chapter:
   - 4352B VCO/PLL Signal Analyzer
   - 43521A Downconverter Unit
   - External signal source (The 8664A is used in this chapter.)
     There are 3 types of recommended external signal sources as listed below:
     - 8664A (with Option 004) 3-GHz Hi-Performance RF Signal Generator
     - 8665A (with Option 004) 4.2-GHz Hi-Performance RF Signal Generator
     - 8665B (with Option 004) 6-GHz Hi-Performance RF Signal Generator

Note

If no recommended signal sources are available, refer to SG TYPE in the (RF/LO) menu described in Chapter 9.

Note

System performance with regard to measurable frequency range is restricted by the oscillation frequency range of the signal source you use.

2. Make connections between the devices both on the front panel and on the rear panel as shown in Figure 5-1 and Figure 5-2. The cables that connect between the 4352B and the 43521A and the external signal source are furnished with this instrument and the 43521A.

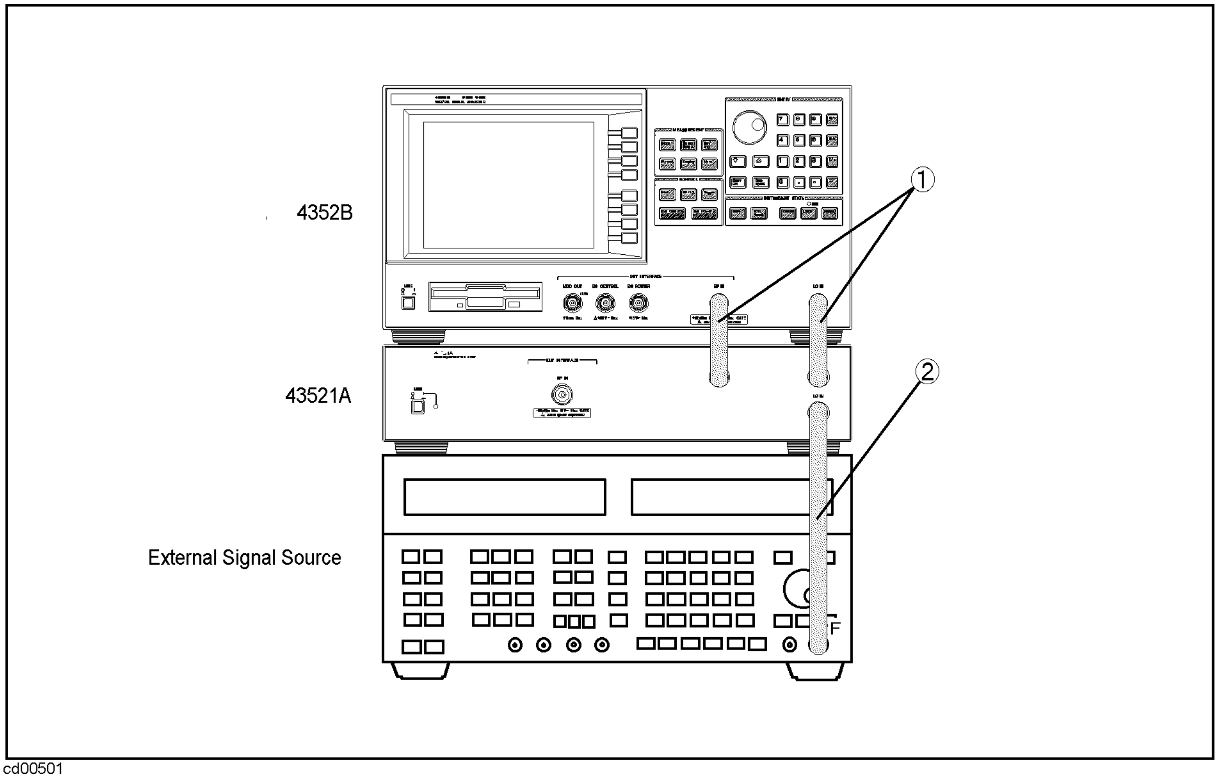


Figure 5-1. Connections on the Front Panel

Table 5-1. Parts Used on the Front Panel

Number	Name	Agilent Part Number	Connection Locations
1	N-N cable (18 cm x 2ea.)	8120-4387 (attached to the 43521A)	The RF IN connector of the 4352B and the RF OUT connector of the 43521A, the LO IN connector of the 4352B and the LO OUT connector of the 43521A
2	N-N cable	04195-61602	The RF output connector of the external signal source and the LO IN connector of the 43521A

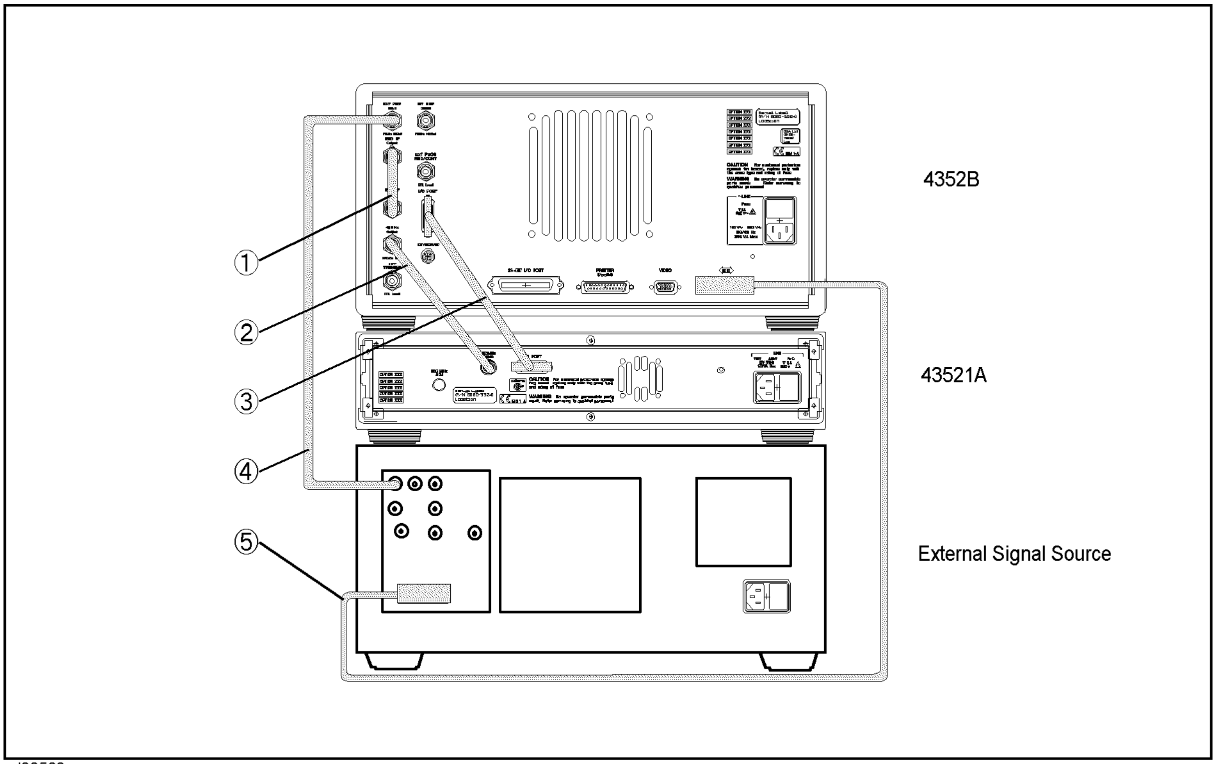


Figure 5-2. Connections on the Rear Panel

Table 5-2. Parts Used on the Rear Panel

Number	Name	Agilent Part Number	Connection Locations
①	BNC-BNC connector	1250-1859	The 2ND IF Output connector and the 2ND IF Input connector of the 4352B
②	BNC-BNC cable (30 cm)	8120-1838 (attached to the 43521A)	The 40MHz Output connector of the 4352B and the 40MHz Input connector of the 43521A
③	15-pin D-Sub cable	04380-61601 (attached to the 43521A)	The I/O PORT connector of the 4352B and the I/O PORT connector of the 43521A
④	BNC-BNC cable (60 cm)	8120-1839	The EXT REF Input connector of the 4352B and the 10MHz OUT connector of the external signal source
⑤	GPIB cable	10833A	The GPIB connector of the 4352B and the GPIB connector of the external signal source

3. Connect the power cables to each device and plug them into outlets.

Warning **For protection from electrical shock, the power cable ground must not be defeated.**

The power plug must be plugged into an outlet that provides a protective earth ground connection.

1-2. Power ON

1. Turn on the external signal source.
2. Press the LINE switch of the 43521A.
3. Press the LINE switch of the 4352B.
   `Internal test in progress` is displayed, and the selftest is performed approximately 10 seconds. Then, the Tester Mode RF Power Measurement Screen appears.

Note

- The following message is displayed on the LCD at power-on. However, this will no longer be displayed when a DUT is connected, and the proper DC power voltage and DC control voltage are applied.

  `CAUTION: Insufficient RF Level`

- To make a measurement that meets the accuracy specifications, a warm up of 30 minutes is required after turning on the power.

1-3. Connecting a DUT

This chapter uses VCO and PLL as measurement samples. The characteristics of each sample are as follows. If you are measuring a sample that has characteristics other than those listed below, change the settings given in this chapter accordingly.

- Voltage Control Oscillator (VCO)

Power voltage	5 V
Control voltage	2 V
Maximum allowable control voltage	8 V
Carrier frequency	5.8 GHz

- Phase-Locked Loop (PLL)

Power voltage	5 V
Carrier frequency	5.8 GHz

1. Before connecting a DUT, check that the DC power voltage and the DC control voltage are not supplied to avoid damage due to excess input.

   Press (DC POWER) or (DC CONTROL) and check that `OUTPUT on OFF` is OFF.

2. Connect a DUT as shown in Figure 5-3 for VCO or Figure 5-4 for PLL. Prepare cables required for the connection by yourself. In this chapter, the FM deviation measurement is not performed, and therefore you need not to connect a cable to the FM OUT connector.

Note

Inserting a low-pass filter

In phase noise measurement, a low-cutoff low-pass filter is sometimes inserted into the DC control voltage input terminal to attenuate the noise of the DC control voltage source. This kind of low-pass filter has a longer time constant, making the measurement time longer. The DC control voltage source of the 4352B provides a lower noise level of $1\text{nV}/\sqrt{Hz}$. If you use the low-noise DC control voltage source of the 4352B, you need no low-cutoff low-pass filter as described above for almost all VCO measurements. However, an oscillation frequency component may leak to the DC control voltage input terminal of the VCO, which adversely affects the measurement result of RF power or frequencies. Insert a low-pass filter (cutoff frequency: 100 kHz to 1 MHz) to the DC control voltage input terminal of the VCO in order to attenuate the oscillation frequency component.

Using coaxial cables

To avoid effects of external noise, use coaxial cables to connect the DC power voltage terminal and the DC control voltage terminal of the 4352B to a DUT.

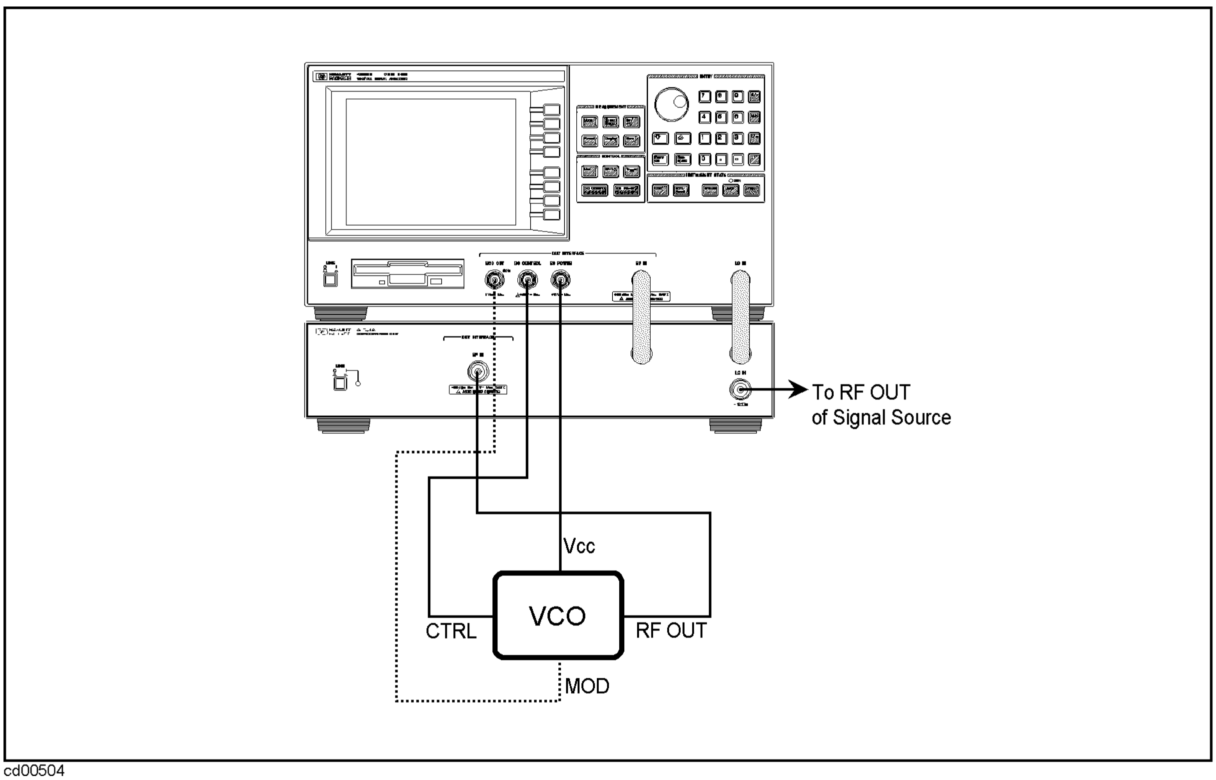
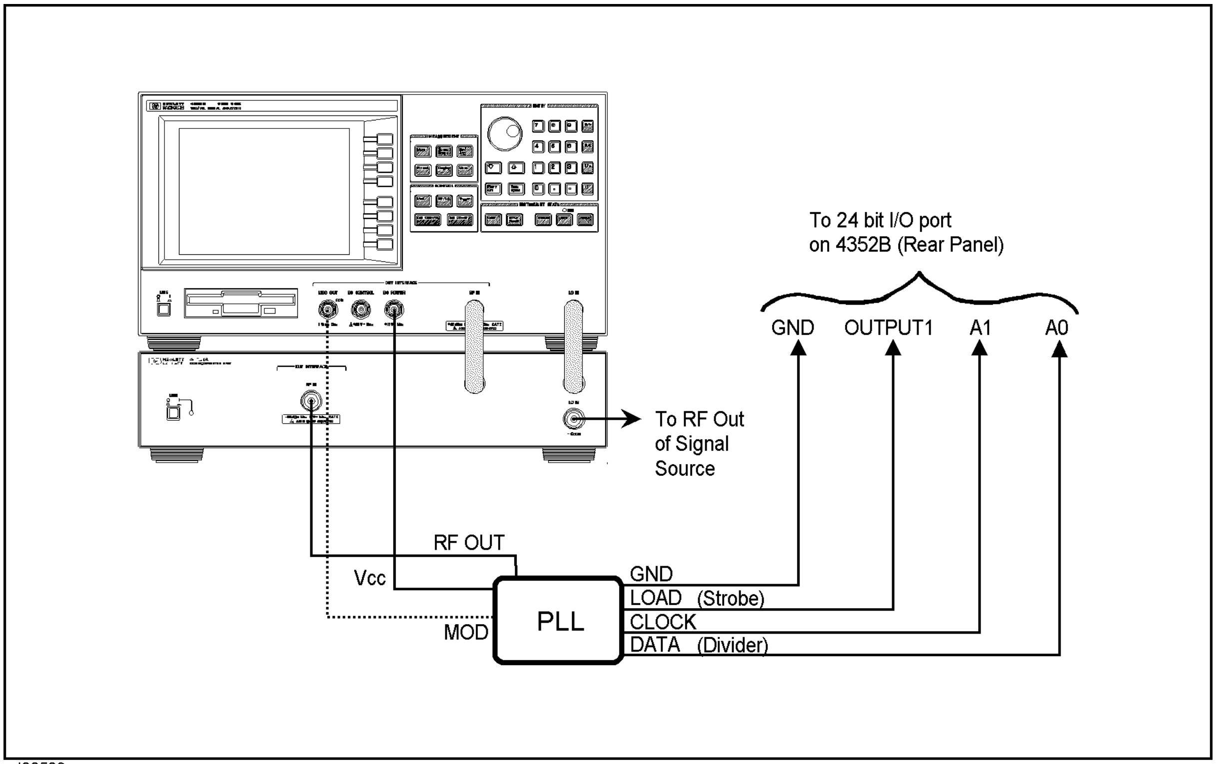


Figure 5-3. Connecting a VCO DUT



cd00503

Figure 5-4. Connecting a PLL DUT

Note For information on the pin numbers of the 24-bit I/O port, refer to Chapter 11 Specifications.

1-4. Initial Setup

This section describes how to perform the initial setup of the 4352B and the 43521A (Downconverter Unit).

Verifying GPIB Controller Mode

Make sure that the 4352B is the GPIB system controller.

1. Press the (Local) key.
2. Make sure that the SYSTEM CONTROLLER softkey menu is displayed with an underline.

Setting the Trigger Mode

The measurement procedures described in this chapter assume that the continuous trigger mode is selected. Perform the following steps to select the continuous trigger mode.

1. Press (Trigger).
2. Press CONTINUOUS. CONTINUOUS is underlined.

1-5. Setting the Downconverter Unit

On the (RF/LO) menu, change DOWNCONV on OFF to DOWNCONV ON off. DwC appears at the upper left of the LCD screen.

Note

If the 43521A is not connected (the 12-Bit I/O Port on the rear panel is not connected) or the 43521A is turned off, trying to set to DOWNCONV ON off causes an error (61 No Downconverter Unit Connected) to be displayed.

1-6. Setting the External Signal Source and Frequency Band

Note

The phrase "**Use the numeric entry keys to enter** " implies that, after entering your desired value, you have to press (x1), (k/m), (M/μ), or (G/n) to specify the proper unit. Notice that, when you wish to specify a non-physical value such as an averaging factor, press (x1) after entering the value. See Chapter 6 for more details.

Setting the GPIB Address

Press (Local), SET ADDRESSES, and ADDRESS:SG in this order. The current address value for the external signal source registered in the 4352B is displayed as SG GPIB ADDRESS xx . Check that it matches with the address setting in the external signal source. If it is incorrect, enter the address value of the external signal source again, and press (x1).

Setting the External Signal Source Automatic Setting Function

Press (RF/LO) and LO CONTROL auto MAN to toggle it LO CONTROL AUTO man.

Note

If no response (for example, the GPIB REM lamp on the external signal source lights up) is obtained when setting to LO CONTROL AUTO man, the external signal source address value registered in the 4352B may be different from the address setting in the external signal source. Check them.

Note

In the tester mode, the automatic setting of the external signal source is performed only immediately before measurement and does not operate during measurement. Therefore, for example, when relatively long measurement time is required due to averaging, even if a frequency changes due to the variation of the power voltage or control voltage, the automatic setting of the external signal source does not operate, and as a result, the frequency of the external signal source may not be an appropriate value for the measurement. On the other hand, in the analyzer mode, even if the averaging function is used, the automatic setting function of the external signal source operates depending on the variation of the frequency, and therefore the frequency of the external signal source is always set to an appropriate value.

Setting the Type of the External Signal Source and the Frequency Change Wait Time

Some period of time is required between when the 4352B commands the external signal source to change the oscillation frequency and when the external signal source actually changes the frequency. The 4352B must perform measurement after the frequency change time elapses.

This time varies depending on the external signal source. In the following example, you set the frequency change wait time of the 8664A to 200 msec.

1. Press RF/LO.
2. Specify the type of the external signal source.

   Press SG TYPE. The current setting is displayed on the screen, as SG TYPE x. Enter the value that corresponds to the external signal source used, and press x1. For the 8664A, press 1 and x1.
3. Set the frequency change wait time.

   Press LO SWTCH TIME. The current setting is displayed on the screen, as LO SWITCHING TIME xxx msec. Press 2, 0, 0, and k/m in this order.

Setting the Maximum Frequency of the External Signal Source

Enter the maximum frequency of the connected external signal source (in this chapter, the 8664A) using the numeric entry keys. The frequency band menu corresponding to the entered maximum frequency appears. The relationship between the maximum frequency and the frequency band is as follows. You can make measurement within the frequency band.

Entered Frequency	Frequency Band Menu
Less than 4.2 GHz	10 MHz to 6.6 GHz (3 steps)
Equal to or greater than 4.2 GHz and less than 6.0 GHz	10 MHz to 9.0 GHz (4 steps)
Equal to or greater than 6.0 GHz	10 MHz to 12.6 GHz (3 steps)

For example, the maximum frequency of the 8664A is 3 GHz. When you enter 3 GHz, the frequency band between 10 MHz and 6.6 GHz is displayed. Now, you can make measurement with the range of 10 MHz to 6.6 GHz.

1. Press RF/LO and SG MAX FREQ. The current setting is displayed on the screen, as SG MAX FREQUENCY xx GHz.
2. Enter 3 and G/n.

Note

If the display of SG MAX FREQ is faint and you cannot enter a frequency, check that DOWNCONV ON off is set to ON. You can enter SG MAX FREQ only when DOWNCONV ON off is ON.

Setting the Frequency Band

Select a frequency band. The frequency band menu that has appeared in the previous section has 3 to 4 steps of frequency bands. In this section, you select a frequency band from the frequency band menu. You can perform measurement within the frequency band you select. Select a band containing the carrier frequency of your DUT.

1. Press Meas and FREQ BAND [xx-xx]. The frequency band menu shown below appears.

   - FREQ BAND 10M-3G
   - 2.5-3.6G
   - 3.1-6.6G

2. The carrier frequency of the DUT measured in this chapter is 5.8 GHz. Therefore, select `3.1-6.6G`. `3.1-6.6G` is underlined.

3. Pressing `RETURN` displays the immediate previous softkey menu of `FREQ BAND [3.1-6.6G]`, which means that `3.1-6.6G` has been selected.

Setting NOMINAL FREQ

Enter the carrier frequency of the DUT as the nominal frequency, with the accuracy of ±200 MHz.

1. Press (Meas), `FREQ BAND`, and `NOMINAL FREQ`. The current setting is displayed on the screen, as `NOMINAL FREQUENCY xxx GHz`.
2. Use the numeric entry keys to enter the carrier frequency of the DUT. For this DUT, press (5), (.), (8), and (G/n).

Note

By entering the nominal frequency, measurement is performed accurately. If you do not know the carrier frequency of the DUT, do not enter it in this step. Instead, find it out using the signal search (`SIGNAL SEARCH`) function during measurement. The signal search function detects the carrier frequency and automatically stores (sets) it as the nominal frequency. In this chapter, the signal search is also performed during measurement, for reference purpose.

1-7. Specifying DC Power Voltage

Specify the DC power voltage required for the DUT. The power voltage of the DUT (VCO and PLL) is 5 V, and therefore set the DC POWER to 5 V. This setting does not actually supply the power voltage. The power will be supplied in "1-9. Applying Power Voltage and Control Voltage" described later.

1. Press (DC Power).
2. Check that `OUTPUT on OFF` is set to OFF.
3. Press `POWER VOLTAGE`. The current setting is displayed on the screen, as `POWER VOLTAGE xx V`.
4. Press (5) and (x1) in this order. The DC power voltage is set to 5 V.

1-8. Specifying DC Control Voltage and Wait Time

You can specify the maximum and minimum acceptable levels for the DC control voltage applied to the DUT, which prevents excessive control voltage from being applied to the DUT. The supplied DC control voltage can be set only within the range between the maximum and minimum acceptable levels. In addition, when the output signal from the DUT has transient fluctuations after the change in the DC control voltage, the wait time required for the stabilization of the output can be specified in the 4352B. If this wait time is specified, the 4352B waits until the specified time elapses after the DC control voltage is changed before it starts making a measurement. This can eliminate the effect of the DUT transient response. The characteristics of the DUT (VCO and PLL) are as follows:

Maximum allowable control voltage level: 8 V
Control voltage: 2 V

This setting does not actually supply the control voltage. The power will be supplied in "Applying DC Voltages" described later.

1. Press [DC Control].
2. Press MAX CTRL VOLTAGE. The current setting is displayed on the screen, as MAX CONTROL VOLTAGE xx V.
3. Press [8] and [x1] in this order. The maximum allowable level of the DC control voltage is set to 8 V.
4. Press MIN CTRL VOLTAGE. The current setting is displayed on the screen, as MIN CONTROL VOLTAGE xx V.
5. Press [1] and [x1] in this order. The minimum allowable level of the DC control voltage is set to 1 V.

Next, set the wait time used when the control voltage is changed.

6. Press CTRL DELAY. The current setting is displayed on the screen, as CONTROL DELAY xx msec.
7. Press [2], [0], and [k/m] in this order.
   The wait time after the change of the control voltage is set to 20 msec.

Then, set the DC control voltage to be supplied.

8. Press CTRL VOLTAGE. The current setting is displayed on the screen, as CONTROL VOLTAGE xx V.
9. Press [2] and [x1] in this order. The DC control voltage is set to 2 V.

1-9. Applying Power Voltage and Control Voltage

Apply the DC power voltage and DC control voltage to the DUT.

1. Press [DC Power] or [DC Control].
2. Press OUTPUT on OFF to toggle it OUTPUT ON off. The DC power voltage and DC control voltage are applied to the DUT.
3. Check that CAUTION: Insufficient RF Level disappears from the screen.

Note

The OUTPUT on OFF softkey can be accessed from either [DC Control] or [DC Power]. No matter which key is used, the DC control voltage and DC power voltage are both simultaneously applied to the DUT.

Note

If the CAUTION: Set RF ATT 5dB Less (or CAUTION: Set RF ATT 5dB More) message appears on the screen, use one of the following methods to change the attenuator value of the 43521A until the CAUTION display disappears.

- Press [Sense Range] and RF ATTEN. The current attenuator value is displayed like RF ATTEN xx dB. Press the [⇓] key or the [⇑] key to change the attenuator value.
- Press [Sense Range] and RF ATTEN. The current attenuator value is displayed like RF ATTEN xx dB. Use the numeric entry keys to change the attenuator value in steps of 5 dB.

You can change the ATT of the 43521A from 0 dB to 35 dB in steps of 5 dB.

2. Measurements in Tester Mode

In this section, you measure the characteristics of the VCO in the tester mode.

Note

The phrase "**Use the numeric entry keys to enter** " implies that, after entering your desired value, you have to press (x1), (k/m), (M/μ), or (G/n) to specify the proper unit. Notice that, when you wish to specify a non-physical value such as an averaging factor, press (x1) after entering the value. See Chapter 6 for more details.

2-1. RF Power Measurement (DUT: VCO)

In this section, you measure the level of the carrier signal outputted from the VCO.

1. Preparing for the measurement
   Perform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter. Connect a VCO as the DUT.
2. Making sure that the modulation output is OFF
   Look at the parameters displayed on the LCD screen, and check that `OFF` is displayed in the `MOD` column. If the modulation output value is displayed in `MOD`, perform the following steps to turn the modulation output OFF.

   Press (Mod).

   Press `MOD OUT ON off` to toggle it `MOD OUT on OFF` .
3. Performing signal search
   Press (Meas), `FREQ BAND [xx-xx]` , and `SIGNAL SEARCH` . `SIGNAL FOUND x.xxx GHz` appears on the screen. Press `NOMINAL FREQUENCY` and check that the value displayed on the screen is the same as the frequency of the signal search result (`NOMINAL FREQUENCY x.xxx GHz`).
4. Selecting the measurement mode
   Select the tester mode. Press (Meas), `INST TYPE` , and `VCO TESTER` in this order. The menu whose top item is `MEAS:RF POWER` appears.
5. Selecting the RF power measurement mode
   Press `MEAS:RF POWER` . The measured value of the RF power is displayed on the LCD screen as shown in Figure 5-5.

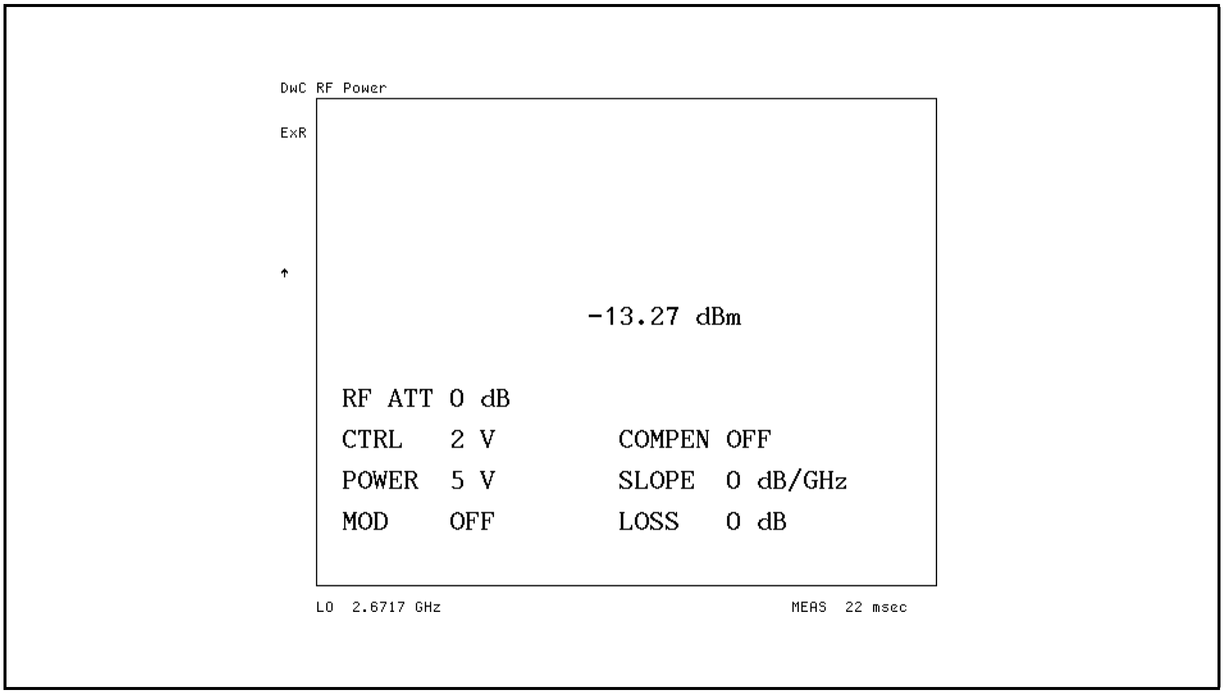


Figure 5-5. Sample Measurement Screen: RF Power Measurement (DUT: VCO)

Note

The unit to display the RF power can be changed. For details, see (Format) in Chapter 7.

2-2. Frequency Measurement (DUT: VCO)

In this section , you measure the frequency of the carrier signal outputted from the VCO.

1. Preparing for the measurement
   Perform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter. Connect a VCO as the DUT.
2. Making sure that the modulation output is OFF
   Look at the parameters displayed on the LCD screen, and check that `OFF` is displayed in the `MOD` column. If the modulation output value is displayed in `MOD`, perform the following steps to turn the modulation output OFF.

   Press (Mod).

   Press `MOD OUT ON off` to toggle it `MOD OUT on OFF`.
3. Performing signal search
   Press (Meas), `FREQ BAND [xx-xx]`, and `SIGNAL SEARCH`. `SIGNAL FOUND x.xxx GHz` appears on the screen. Press `NOMINAL FREQUENCY` and check that the value displayed on the screen is the same as the frequency of the signal search result (`NOMINAL FREQUENCY x.xxx GHz`).
4. Selecting the measurement mode
   Select the tester mode. Press (Meas), `INST TYPE`, and `VCO TESTER` in this order. The menu whose top item is `MEAS:RF POWER` appears.
5. Select the frequency measurement mode.
   Press `FREQUENCY`. The measured value of the frequency is displayed on the LCD screen as shown in Figure 5-6.

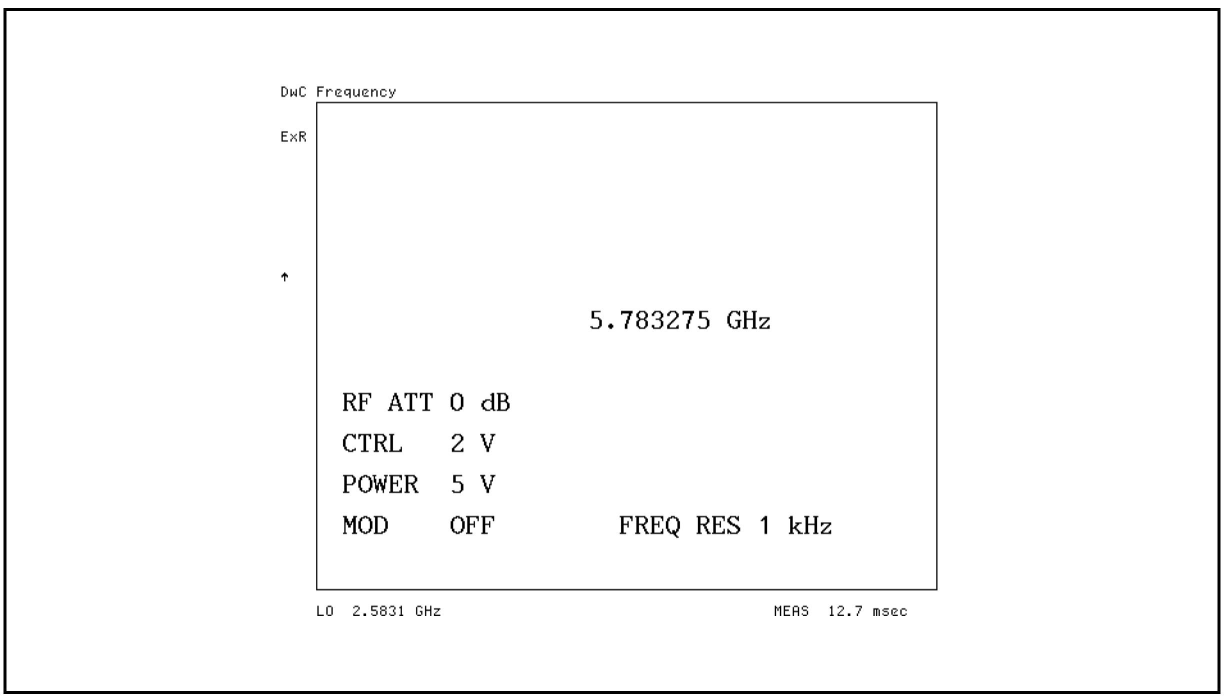


Figure 5-6. Sample Measurement Screen: Frequency Measurement (DUT: VCO)

Note

The frequency measurement resolution can be changed. For details, see (Sens Range) in Chapter 7.

2-3. C/N (Carrier/Noise) Ratio Measurement (DUT: VCO)

In this section, you measure the ratio of the carrier signal level to the phase noise at the specified offset frequency.

1. Preparing for the measurement
   Perform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter. Connect a VCO as the DUT.
2. Making sure that the modulation output is OFF
   Look at the parameters displayed on the LCD screen, and check that `OFF` is displayed in the `MOD` column. If the modulation output value is displayed in `MOD`, perform the following steps to turn the modulation output OFF.

   Press (Mod) and `MOD OUT ON off` to toggle it `MOD OUT on OFF`.
3. Performing signal search
   Press (Meas), `FREQ BAND [xx-xx]`, and `SIGNAL SEARCH`. `SIGNAL FOUND x.xxx GHz` appears on the screen. Press `NOMINAL FREQUENCY` and check that the value displayed on the screen is the same as the frequency of the signal search result (`NOMINAL FREQUENCY x.xxx GHz`) is displayed.
4. Selecting the measurement mode
   Select the tester mode. Press (Meas), `INST TYPE`, and `VCO TESTER` in this order. The menu whose top item is `MEAS:RF POWER` appears.
5. Select the C/N ratio measurement mode.
   Press `CARRIER/NOISE`.
6. Specifying an offset frequency
   Press (Bw/Avg) and `OFFSET FREQ` in this order. The current setting is displayed on the screen, as `OFFSET FREQUENCY xx kHz`. Use the numeric entry keys to enter an offset frequency. (Example: To specify 100 kHz, press (1), (0), (0), and (k/m).)

Note

A large offset frequency used in the C/N ratio measurement can result in large fluctuations of the measurement data. This occurs because the noise measurement resolution bandwidth used inside the 4352B increases due to the large offset frequency. In this case, specify a proper averaging factor to minimize the measurement fluctuations.

7. Setting the converted bandwidth for the noise measurement
   Press (Bw/Avg) and `NOISE BW`. The current setting is displayed on the screen, as `NOISE BAND WIDTH xx Hz`. Use the numeric entry keys to enter noise bandwidth. (Example: To specify 1 Hz, press (1) and (x1).)

Note

For the noise measurement internally performed in the 4352B, the resolution bandwidth is uniquely determined based on the setting of `OFFSET FREQ`, and cannot be changed by the user. The noise level used for C/N ratio measurement is the value converted to the noise bandwidth which you set with `NOISE BW`.

8. Setting the averaging factor
   Press (Bw/Avg) and `AVERAGING FACTOR`. The current setting is displayed on the screen, as `AVERAGE FACTOR xx`. Use the numeric entry keys to enter the averaging factor. (Example: Press (8) and (x1).)

9. Setting the averaging to ON

   Press (Bw/Avg) and AVERAGING on OFF to toggle it AVERAGING ON off. The measured value of the C/N ratio is displayed on the LCD screen as shown in Figure 5-7.

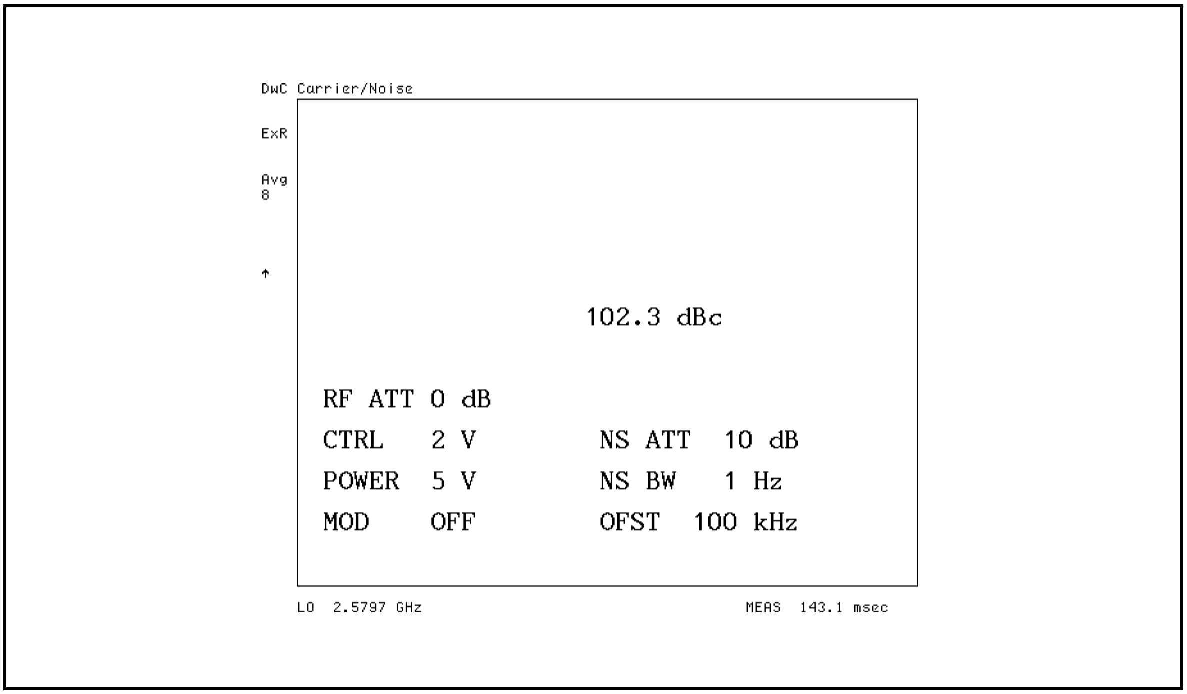


Figure 5-7.
Sample Measurement Screen: Carrier/Noise Ratio Measurement (DUT: VCO)

Note

If the `CAUTION: Set Noise ATT 10 dB Less` (or `CAUTION: Set Noise ATT 10 dB More`) message appears on the screen, use one of the following methods to change the ATT value until the CAUTION display disappears. You can change the ATT from 0 dB to 40 dB in steps of 10 dB.

- Press (Sense Range) and NOISE ATTEN. The current ATT value is displayed on the screen, as `NOISE ATTEN xx dB`. Press the (⇩) key or the (⇧) key to change the ATT value.
- Press (Sense Range) and NOISE ATTEN. The current ATT value is displayed on the screen, as `NOISE ATTEN xx dB`. Use the numeric entry keys to change the ATT value in steps of 10 dB.

Note

When measuring phase noise using the C/N ratio measurement function in the tester mode, a measurement around a spurious component may show a larger value than an actual phase noise. This occurs because the level of the spurious component is significant enough to affect the measurement. In this case, the value differs from the measurement at the same offset frequency obtained through the phase noise measurement function in the analyzer mode. Refer to the first section of Appendix C "Technical Information" for how phase noise measurement in each mode differs.

Note

The minimum measurable value in a C/N ratio measurement is restricted by the phase noise characteristics and spurious characteristics of the external signal source you use.

Note

When the `CAUTION: 2nd PLL Unlocked` message appears on the LCD screen, follow the steps below to alter the bandwidth of the 2nd PLL inside the 4352B to `WIDE`.

a. Press (Bw/Avg).
b. Press `NOISE PLL AUTO wide` to toggle it `NOISE PLL auto WIDE`.

3. Measurements in Analyzer Mode

In this section, you measure the characteristics of VCO or PLL in the analyzer mode.

Note

The phrase "**Use the numeric entry keys to enter** " implies that, after entering your desired value, you have to press x1, k/m, M/μ, or G/n to specify the proper unit. Notice that, when you wish to specify a non-physical value such as an averaging factor, press x1 after entering the value. See Chapter 6 for more details.

Note

The DC control voltage level specified in the analyzer mode is applicable only when the phase noise measurement or the spectrum measurement for VCO is performed. In other measurement items, the DC control voltage within the range defined with SWEEP described later is applied. Note that if the maximum and minimum acceptable voltage levels are specified using MAX CTRL VOLTAGE and MIN CTRL VOLTAGE, the DC control voltage applied to the DUT is restricted by the allowable range.

3-1. RF Power vs. DC Control Voltage Characteristics Measurement (DUT: VCO)

In this section, you measure the RF power characteristic vs. the DC control voltage applied to the DUT (VCO).

1. Preparing for the measurement
   Preform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter.
2. Selecting the measurement mode
   Select the analyzer mode. Press Meas, INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.
3. Selecting the RF power vs. DC control voltage characteristic measurement mode
   Press ANALY:RF POWER. ANALY:RF POWER is underlined.
4. Making sure that the modulation output is OFF
   Press Mod, and check that MOD OUT on OFF is selected.
5. Specify the DC control voltage sweep range.
   Press Menu and SWEEP in this order. Perform one of the following two setting procedures.
   - Press START and use the numeric entry keys to enter the sweep start value. (Example: Press 1 and x1.) Then, press STOP and use the numeric entry keys to enter the sweep stop value. (Example: Press 5 and x1.)
   - Press CENTER and use the numeric entry keys to enter the sweep center value. Then, press SPAN and use the numeric entry keys to enter the sweep span value.

Note

In "1. Preparations for Measurements" in this chapter, the minimum and maximum allowable levels of the DC control voltage have been set to 1 V and 8 V, respectively. Therefore, you cannot enter a value out of the range between 1 V and 8 V.

6. Specifying the number of measurement points per sweep

   Press (Menu), SWEEP, and NUMBER of POINTS in this order. The current setting is displayed on the screen, as NUMBER OF POINTS xx. Use the numeric entry keys to set the number of measurement points. (Example: Press (5), (1), and (x1).)

7. Specifying the sweep time per sweep

   Press (Menu), SWEEP, and SWEEP TIME in this order. : h:m:s is displayed. Alternately press numeric entry keys and : h:m:s to specify the hour, minute, and second, respectively. (Example: To specify 1 minute and 23 seconds, press (0), : h:m:s, (1), : h:m:s, (2), (3), and (x1)).

Note

You can also specify the sweep time in seconds. In the case of the sweep time setting in seconds, press SWEEP TIME, use the numeric entry keys to enter the time in seconds, and then press (x1). The minimum setting time varies depending on the specified number of measurement points. The maximum setting time is 1 hour.

8. Performing signal search

   Press (Meas), FREQ BAND [xx-xx], and SIGNAL SEARCH in this order. SIGNAL FOUND x.xxx GHz appears on the screen. Press NOMINAL FREQUENCY and check that the value displayed on the screen is the same as the frequency of the signal search result (NOMINAL FREQUENCY x.xxx GHz).

9. Adjusting the scale for measurement trace

   Press (Display) and AUTO SCALE in this order. The scale is adjusted automatically, and the measurement result of the RF power vs. DC control voltage characteristics is displayed on the screen as shown in Figure 5-8.

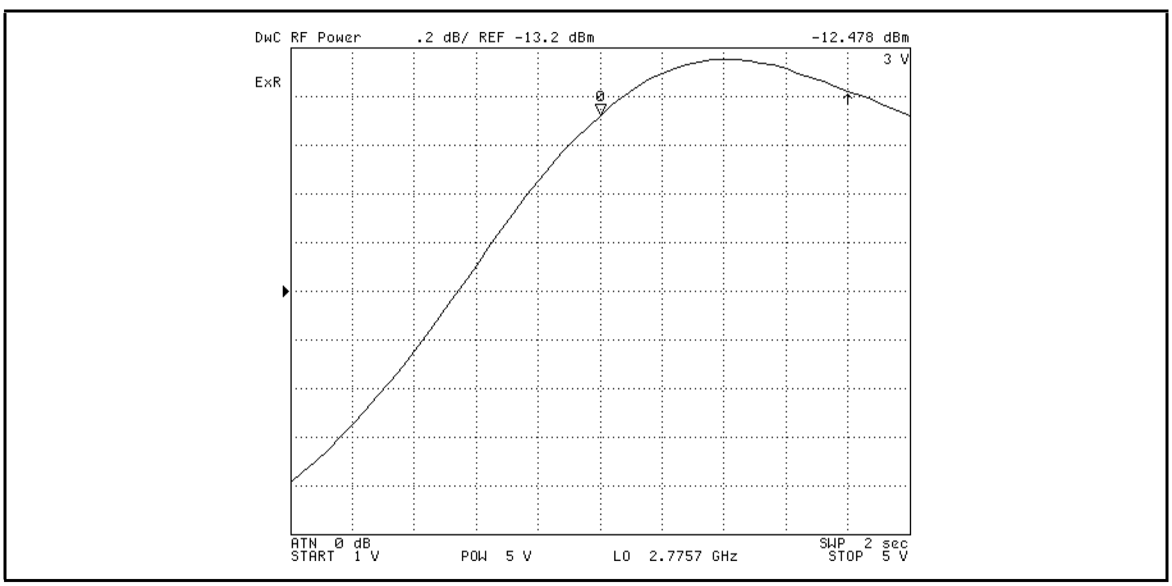


Figure 5-8.
Sample Measurement Screen: RF Power vs. DC Control Voltage Characteristics Measurement (DUT: VCO)

10. Reading the measurement values
    Press (Menu) and MARKER to display the marker. You can read the value of each measurement point using the marker.

Note

If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF), and that the modulation output is OFF.
For the cable loss compensation function, see "Setting Cable Loss Compensation Function" in Chapter 4. For the power level unit selection function, the averaging function, and the marker function, see Chapter 8.

Note

To eliminate the effect of the transient of the DC control voltage, sweep starts after the time specified with CTRL DELAY under (DC Control) elapses. The delay time is not included in the sweep time and is applicable only to the 1st measurement point. To provide delay time for 2nd and later measurement points, you need to specify a proper sweep time.

3-2. Frequency/Tuning Sensitivity vs. DC Control Voltage Characteristics Measurement (DUT: VCO)

In this section, you measure the output carrier frequency and tuning sensitivity characteristics vs. the DC control voltage of the DUT (VCO). The tuning sensitivity is a characteristic obtained by differentiating the output carrier frequency with respect to the DC control voltage.

1. Preparing for the measurement
   Preform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter.
2. Selecting the measurement mode
   Select the analyzer mode. Press (Meas), INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.
3. Selecting the frequency/tuning sensitivity vs. DC control voltage characteristics measurement mode
   Press FREQUENCY. FREQUENCY is underlined.
4. Making sure that the modulation output is OFF
   Press (Mod), and check that MOD OUT on OFF is selected.
5. Specify the DC control voltage sweep range.
   Press (Menu) and SWEEP in this order. Perform one of the following two setting procedures.
   - Press START and use the numeric entry keys to enter the sweep start value. (Example: Press (1) and (x1).) Then, press STOP and use the numeric entry keys to enter the sweep stop value. (Example: Press (5) and (x1).)
   - Press CENTER and use the numeric entry keys to enter the sweep center value. Then, press SPAN and use the numeric entry keys to enter the sweep span value.

Note

In "1. Preparations for Measurements" in this chapter, the minimum and maximum allowable levels of the DC control voltage have been set to 1 V and 8 V, respectively. Therefore, you cannot enter a value out of the range between 1 V and 8 V.

6. Specifying the number of measurement points per sweep
   Press (Menu), SWEEP, and NUMBER of POINTS. The current setting is displayed on the screen, as NUMBER OF POINTS xx. Use the numeric entry keys to set the number of measurement points. (Example: Press (5), (1), and (x1).)
7. Specifying the sweep time per sweep
   Press (Menu), SWEEP, and SWEEP TIME. : h:m:s is displayed. Alternately press numeric entry keys and : h:m:s to specify the hour, minute, and second, respectively. (Example: To specify 1 minute and 23 seconds, press (0), : h:m:s, (1), : h:m:s, (2), (3), and (x1).)

Note

You can also specify the sweep time in seconds. In the case of the sweep time setting in seconds, press SWEEP TIME, use the numeric entry keys to enter the time in seconds, and then press (x1). The minimum setting time varies depending on the specified number of measurement points. The maximum setting time is 1 hour.

8. Selecting the frequency resolution

   Press (Sense Range). Select FREQ RES: 1kHz or 64 kHz. The selected softkey is underlined. In this example, select FREQ RES: 1kHz.

9. Setting the polarity of the frequency vs. control voltage characteristic of the DUT

   Press (Sense Range) and SENS PLRTY POS neg in this order. If the frequency increases as the control voltage increases, select POS; if it decreases, select NEG.

10. Performing signal search

    Press (Meas), FREQ BAND [xx-xx], and SIGNAL SEARCH in this order. SIGNAL FOUND x.xxx GHz appears on the screen. Press NOMINAL FREQUENCY and check that the value displayed on the screen is the same as the frequency of the signal search result (NOMINAL FREQUENCY x.xxx GHz).

11. Adjusting the scale for measurement trace

    Press (Display) and AUTO SCALE in this order. The scale is adjusted automatically. The measurement result is displayed on the screen as shown in Figure 5-9.

12. Specifying the aperture for tuning sensitivity measurement

    Press (Bw/Avg) and SENS APERTURE in this order. Use the numeric entry keys to enter an aperture. Enter the aperture value in percentage of span.

Note

Specify the aperture only when you need to make an uneven trace flatter. See "Definition of Tuning Sensitivity and Specifying Aperture" in Chapter 8 for details.

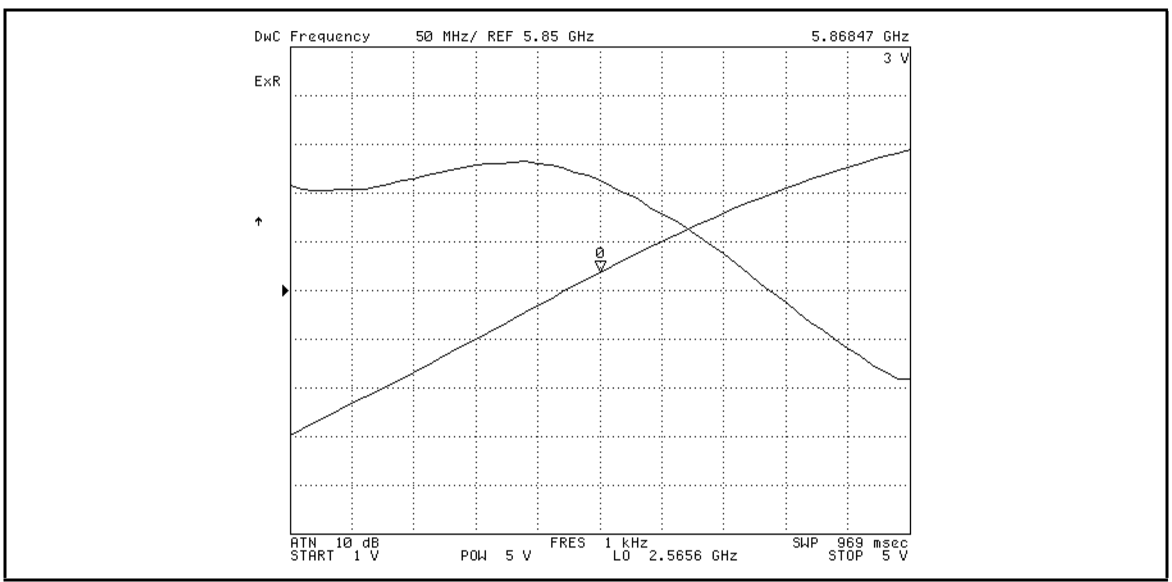


Figure 5-9.
Sample Measurement Screen: Frequency/Tuning Sensitivity vs. DC Control Voltage Characteristics Measurement (DUT: VCO)

13. Reading the measurement values

    Press (Menu) and MARKER to display the marker. You can read the value of each measurement point using the marker. The tuning sensitivity characteristic is displayed on the memory trace. Therefore, to read tuning sensitivity values at measurement points using the marker, press (Menu) and press MKR ON [xxx] to toggle it MKR ON [MEMORY] .

Note

If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF), and that the modulation output is OFF.

Note

For the frequency resolution selection function, the averaging function, the marker function, and the tuning sensitivity aperture function, see Chapter 8.

Note

To eliminate the effect of the transient of the DC control voltage before sweep, sweep starts after the time specified with CTRL DELAY under (DC Control) elapses. The delay time is not included in the sweep time and is applicable only to the 1st measurement point. To provide delay time for 2nd and later measurement points, you need to specify a proper sweep time.

3-3. Phase Noise vs. Offset Frequency Characteristics Measurement (DUT: VCO)

In this section, you measure the phase noise characteristic with respect to the offset frequency from the carrier of the DUT (VCO). Unlike the C/N (Carrier Noise) ratio measurement in the tester mode, the measurement value is negative.

1. Preparations for measurement
   Preform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter. Connect a VCO as the DUT.
2. Selecting the measurement mode
   Select the analyzer mode. Press (Meas), INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.
3. Selecting the phase noise vs. offset frequency characteristics measurement mode.
   Press PHASE NOISE. PHASE NOISE is underlined.
4. Making sure that the modulation output is OFF
   Press (Mod), and check that MOD OUT on OFF is selected.
5. Performing signal search
   Press (Meas), FREQ BAND [xx-xx], and SIGNAL SEARCH in this order. SIGNAL FOUND x.xxx GHz appears on the screen. Press NOMINAL FREQUENCY and check that the value displayed on the screen is the same as the frequency of the signal search result (NOMINAL FREQUENCY x.xxx GHz).
6. Selecting the log sweep
   Press (Menu) and SWEEP TYPE to select SWEEP TYPE [LOG FREQ].
7. Specifying the offset frequency sweep range
   Press (Menu) and SWEEP in this order. Press START and use the numeric entry keys to enter the sweep start value. (Example: Press (1), (0), (0), and (x1).) Then, press STOP and use the numeric entry keys to enter the sweep stop value. (Example: Press (1), (0), and (M/μ).)

Note The allowable value you can specify as the offset frequency sweep range is one of the following values: 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, or 10 MHz. In this example, the log sweep has been selected. Therefore, CENTER and SPAN are not available.

8. Specifying the converted bandwidth
   Press (Bw/Avg) and NOISE BW in this order. The current setting is displayed on the screen, as NOISE BAND WIDTH x Hz. Use the numeric entry keys to change the value. (Example: Press (1) and (x1).) Generally, use 1 Hz (preset value of this instrument).
9. Setting the averaging factor
   Press (Bw/Avg) and AVERAGING FACTOR in this order. The current setting is displayed on the screen, as AVERAGE FACTOR xx. Use the numeric entry keys to enter averaging factor. (Example: Press (8) and (x1).)
10. Setting the averaging to ON
    Press AVERAGING on OFF to toggle it AVERAGING ON off.

11. Adjusting the scale for measurement trace

    Press (Display) and AUTO SCALE in this order. The scale is adjusted automatically. The measurement result is displayed on the screen as shown in Figure 5-10.

Note The minimum measurable value in a phase noise measurement is restricted by the phase noise characteristics and spurious characteristics of the external signal source you use.

Note When the CAUTION: 2nd PLL Unlocked message appears on the LCD screen, follow the steps below to alter the bandwidth of the 2nd PLL inside the 4352B to WIDE.

1. Press (Bw/Avg).
2. Press NOISE PLL AUTO wide to toggle it NOISE PLL auto WIDE.

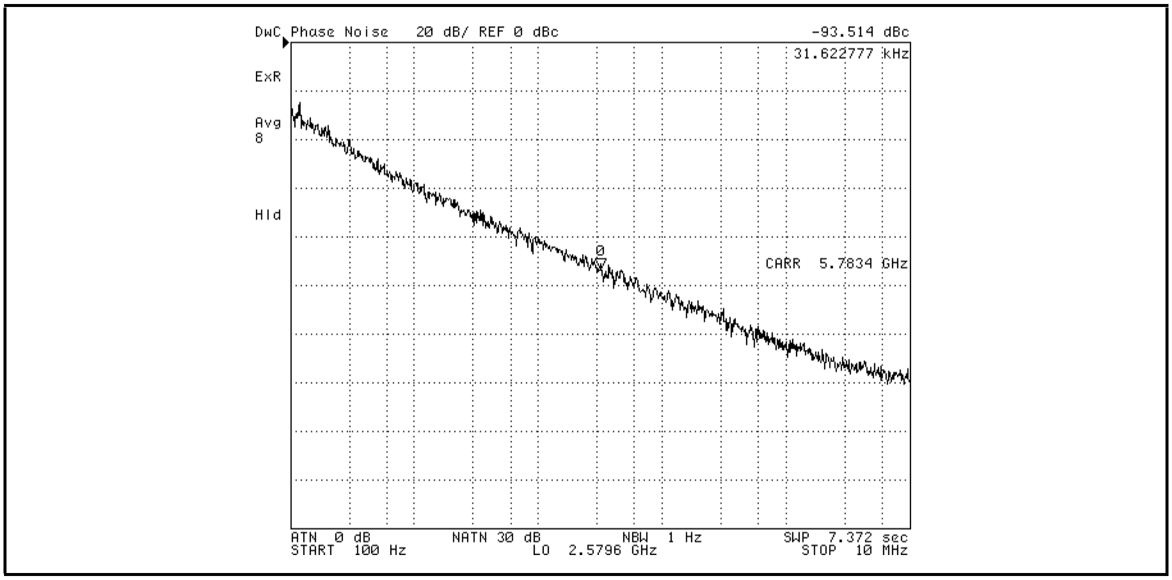


Figure 5-10.
Sample Measurement Screen: Phase Noise vs. Offset Frequency Characteristics Measurement (DUT: VCO)

12. Reading the measurement values

    Press (Menu) and MARKER to display the marker. You can read the value of each measurement point using the marker.

Note If the measurement value is not your expected value, check that the DC outputs are ON (DC↓ appears if the DC outputs are OFF), and that the modulation output is OFF.

Note

For the automatic frequency control function, the averaging function, the marker function, and the noise attenuator function, see Chapter 8.

Note

In this measurement, the sweep time can not be specified. Only the query is available. When the automatic frequency control function is ON, the carrier frequency is automatically adjusted before the sweep. The time required for the adjustment is not included in the sweep time. If the external signal source needs to be set again, the setting is first made and, after the frequency change time elapses, the sweep starts. This time is not included in the sweep time also.

Note

you can set the DC control voltage level for phase noise or spectrum measurement using the automatic frequency control function. See "Setting the Automatic Frequency Control Function" in Chapter 4 for details.

3-4. Integral of Phase Noise vs. Offset Frequency Characteristics Measurement (DUT: VCO)

In this section, you integrates the phase noise characteristic of the device with respect to the offset frequency from the carrier of the DUT (VCO).

1. Preparing for the measurement
   Preform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter. Connect a VCO as the DUT.
2. Selecting the measurement mode
   Select the analyzer mode. Press (Meas), INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.
3. Selecting the phase noise vs. offset frequency characteristics measurement mode
   Press PHASE NOISE. PHASE NOISE is underlined.
4. Making sure that the modulation output is OFF
   Press (Mod), and check that MOD OUT on OFF is selected.
5. Performing signal search
   Press (Meas), FREQ BAND [xx-xx], and SIGNAL SEARCH in this order. SIGNAL FOUND x.xxx GHz appears on the screen. Press NOMINAL FREQUENCY and check that the value displayed on the screen is the same as the frequency of the signal search result (NOMINAL FREQUENCY x.xxx GHz).
6. Selecting the linear sweep
   Press (Menu) and SWEEP TYPE to select SWEEP TYPE [LIN FREQ].
7. Specifying the offset frequency sweep range
   Press (Menu) and SWEEP in this order. The current setting is displayed on the screen, as CENTER xxx MHz. Press CENTER and use the numeric entry keys to enter the sweep center value. (Example: To specify 1 MHz, press (1) and (M/μ).) Then, press SPAN and use the numeric entry keys to enter the sweep span value. (Example: To specify 100 kHz, press (1), (0), (0), and (k/m).)
8. Setting the resolution bandwidth
   Press (Bw/Avg) and RES BW in this order. The current setting is displayed on the screen, as RES BANDWIDTH x kHz. Use the numeric entry keys to change the value. (Example: To specify 100 Hz, press (1), (0), (0), and (x1).)
9. Setting the video bandwidth
   Press (Bw/Avg) and VIDEO BW in this order. The current setting is displayed on the screen, as VIDEO BAND WIDTH x kHz. Use the numeric entry keys to change the value. (Example: To specify 100 Hz, press (1), (0), (0), (x1).)
10. Setting the averaging factor
    Press (Bw/Avg) and AVERAGING FACTOR in this order. The current setting is displayed on the screen, as AVERAGE FACTOR xx. Use the numeric entry keys to change the value. (Example: To specify 8 times, press (8) and (x1).)
11. Setting the averaging to ON
    Press AVERAGING on OFF to toggle it AVERAGING ON off.

12. Setting the noise integration

    Press (Menu) and MARKER in this order. Press INTG NOISE on OFF to toggle it INTG NOISE ON off.

13. Adjusting the scale for measurement trace

    Press (Display) and AUTO SCALE. The scale is adjusted automatically. The measurement result is displayed on the screen as shown in Figure 5-11.

14. Reading the measurement values

    At the lower left of the screen, the result of the noise integration is displayed (`Intg Noise -xxxx dBc`). This value is the integral of the entire trace (950 kHz to 1050 kHz).

Note

The minimum measurable value in a phase noise measurement is restricted by the phase noise characteristics and spurious characteristics of the external signal source you use.

Note

When the `CAUTION: 2nd PLL Unlocked` message appears on the LCD screen, follow the steps below to alter the bandwidth of the 2nd PLL inside the 4352B to WIDE.

1. Press (Bw/Avg).
2. Press NOISE PLL AUTO wide to toggle it NOISE PLL auto WIDE.

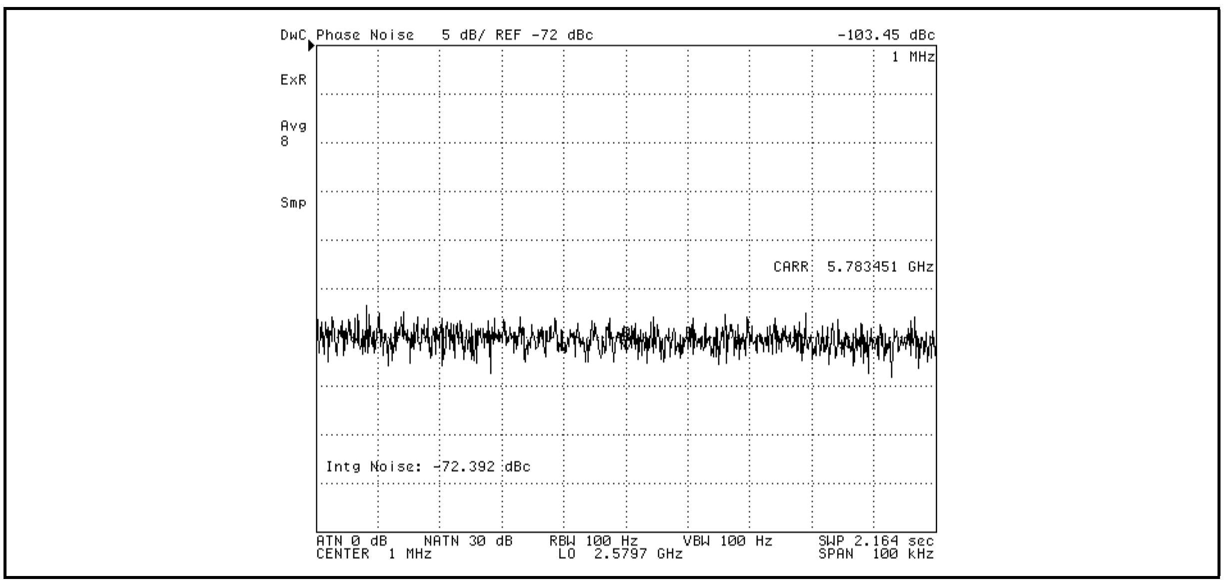


Figure 5-11.
Sample Measurement Screen: Integral of Phase Noise vs. Offset Frequency Characteristics Measurement (DUT: VCO)

Partial Integration of the Phase Noise vs. Offset Frequency Characteristics Measurement

The result of the noise integration shown in Figure 5-11 (Intg Noise -72.392 dBc) is the integral of the entire trace (950 kHz to 1050 kHz). Next, using the partial integration function, you integrate the trace range between 975 kHz and 1025 kHz.

1. Setting the partial integration to ON
   Press Menu, MKR SEARCH, and SEARCH RANGE. Press PART SRCH on OFF to toggle it PART SRCH ON off. Small triangles are displayed at the lower left and lower right of the screen.
2. Entering the partial integration start frequency
   Enter the frequency from which you want to start the integration using the numeric entry keys. (Example: To specify 975 kHz, press 9, 7, 5, and k/m.) The display changes to MARKER 975 kHz.
3. Setting the partial integration start frequency
   Press MKR LEFT RNG. A vertical line appears in the left half of the screen, and the measured noise value at 975 kHz is displayed at the upper right of the screen. (At this time, the noise integration value displayed at the lower left of the screen is the integral of the range to the right of the vertical line.)
4. Entering the partial integration stop frequency
   Enter the frequency at which you want to stop the integration using the numeric entry keys. (Example: To specify 1.025 MHz, press 1, ., 0, 2, 5, and M/μ.) The display changes to MARKER 1.025 MHz.
5. Setting the partial integration stop frequency
   Press MKR RIGHT RNG. A vertical line appears in the right half of the screen. The measured noise value at 1.025 MHz is displayed at the upper right of the screen.
6. Reading the value of the partial integration
   The measurement result as shown in Figure 5-12 is displayed, and the lower left of the screen shows the result of the partial noise integration for the frequency range between 975 kHz and 1.025 MHz, like Intg Noise: -75.515 dBc.

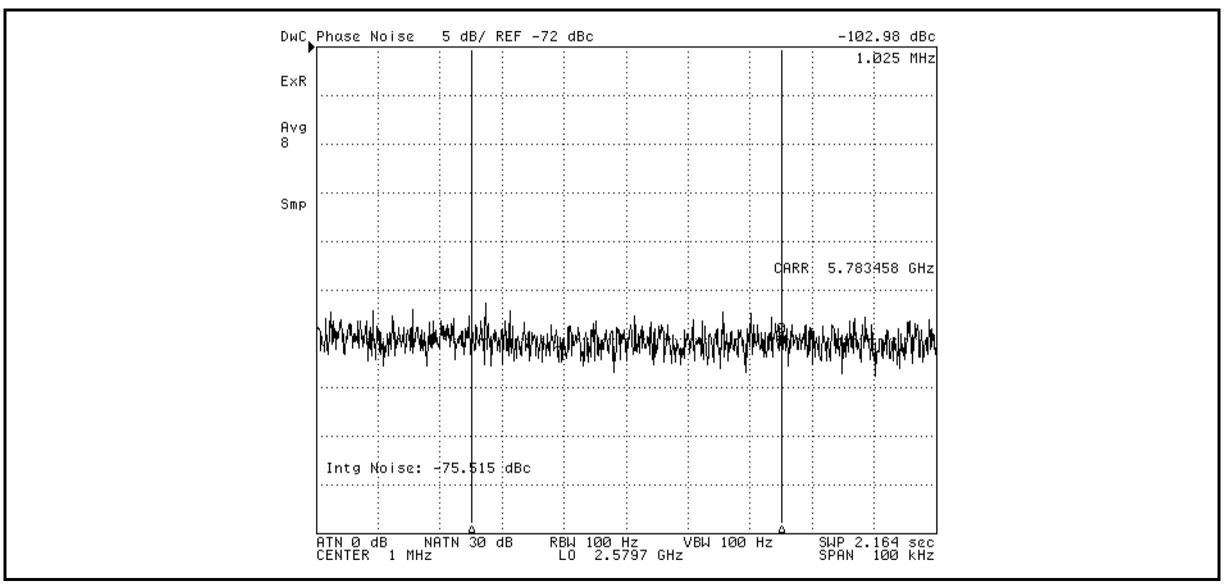


Figure 5-12.
Sample Measurement Screen: Partial Integration of Phase Noise vs. Offset Frequency Characteristics Measurement (DUT: VCO)

Note

Alternatively, you can set the position of the vertical line by moving the marker to the desired frequency with the rotary knob and pressing `MKR LEFT RNG` (or `MKR RIGHT RNG`).

Note

For information on the auto frequency control function, the averaging function, the marker function, and the noise attenuator function, see Chapter 8.

Note

In this measurement, the sweep time can not be specified. Only the query is available.
When the automatic frequency control function is ON, the carrier frequency is automatically adjusted before the sweep. The time required for the adjustment is not included in the sweep time. If the external signal source needs to be set again, the setting is first made and, after the frequency change time elapses, the sweep starts. This time is not included in the sweep time also.

Note

You can set the DC control voltage level for phase noise or spectrum measurement using the auto frequency control function. For details, see "Setting the Automatic Frequency Control Function" in Chapter 4 in Chapter 4 Measurement Technique.

3-5. Frequency Transient Measurement (DUT: PLL)

In this section, you measure the transient of the output frequency when changing the frequency setting of the DUT (PLL). This measurement requires a program in order to send the DUT, PLL sythesizer, data containing a request to change its frequency. The program is detailed in Appendix C of this manual and “Frequency Transient Measurement” in Chapter 12 of the 4352B GPIB Programming Manual.

1. Preparing for the measurement
   Preform “1. Preparations for Measurements” (1-1 to 1-9) in this chapter. In this example, connect a PLL as the DUT.
2. Selecting the measurement mode
   Select the analyzer mode. Press (Meas), INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.
3. Selecting the frequency transient measurement mode
   Press RF TRANSIENT. RF TRANSIENT is underlined.
4. Making sure that the modulation output is OFF
   Press (Mod), and check that MOD OUT on OFF is selected.
5. Setting the measurement trigger to the HOLD mode
   Press (Trigger) and HOLD in this order. At the left of the screen (status indication area), Hld is displayed.
6. Setting the target frequency
   Press (Sense Range) and TARGET FREQ in this order. The current value is displayed on the screen, as TARGET FREQUENCY xx MHz. Use the numeric entry keys to enter the target frequency. (Example: To specify 5.85 GHz, press (5), (.), (8), (5), and (G/n).)
7. Setting the target position
   Press TARGET POSITION. The current value is displayed on the screen, as TARGET POSITION RATIO xx% FREQ SPAN. Use the numeric entry keys to enter the target position value. (Example: To specify 50%, press (5), (0), and (x1).)
8. Setting the frequency span
   Press MAX 512MHz. MAX 512MHz is underlined.
9. Setting the sweep start time
   Press (Menu), SWEEP, and START. The current value is displayed on the screen, as START TIME xx sec. Use the numeric entry keys to enter the delay time between the measurement trigger and the sweep start. (Example: To specify 0 sec, press (0) and (x1).)

Note The setting range of the delay time is 0 to 800 milliseconds.

10. Setting the sweep time
    Press SPAN and use the numeric entry keys to enter the sweep time. (Example: To specify 5 msec, press (5) and (k/m).)

Note	The setting range of the sweep time is 12.5 microseconds to 10 seconds.

11. Sending divider data to the PLL
See "2-4. Setting the measurement trigger" in Appendix C and "2-5. Sending divider data to a serial-input PLL" in Appendix C to learn how to set the divider data to the PLL via the 24-bit I/O port.

12. Sending a load (strobe) signal to the PLL
See "2-4. Setting the measurement trigger" in Appendix C and "2-5. Sending divider data to a serial-input PLL" in Appendix C to learn how to generate a measurement trigger and send a load signal to the PLL.

13. Adjusting the scale for measurement trace
Press (Display) and AUTO SCALE. The scale is adjusted automatically. The measurement result is displayed on the screen as shown in Figure 5-13.

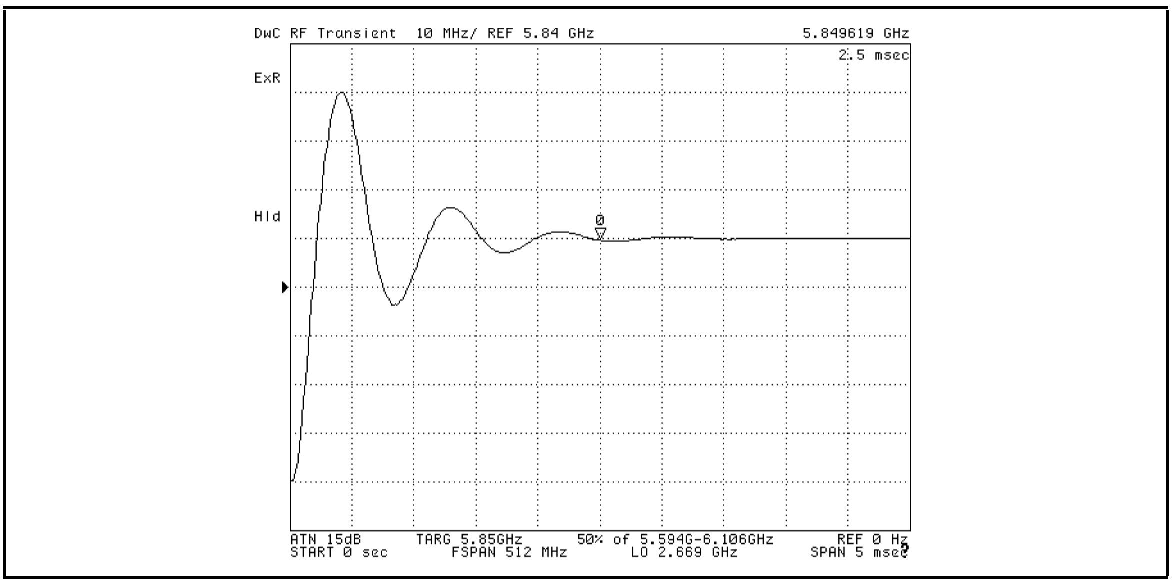


Figure 5-13.
Sample Measurement Screen: Frequency Transient Measurement (DUT: PLL)

14. Reading the measurement values
Press (Menu) and MARKER. The marker appears. You can read the value of each measurement point using the marker.

15. Specifying the reference frequency
If you need more digits to display the measurement value, specify the reference frequency.

    Press (Sense Range) and REF FREQ FOR SCALE in this order. The current setting is displayed on the screen, as REFERENCE FREQUENCY xx. Use the numeric entry keys to enter the frequency transient reference frequency. (Example: To specify 5 GHz, press (5), and (G/n).) At the lower right of the screen, 5 GHz is displayed and the REF frequency value displayed above decreases by 5 GHz. See "2-3. Setting a reference frequency (REF FREQ FOR SCALE)" in Appendix C for details.

Note

If the measurement value is not your expected value, check that the DC outputs are ON (`DC↓` appears if the DC outputs are OFF), and that the modulation output is OFF.

Note

For information on the averaging function and the marker function, see Chapter 8.

3-6. Spectrum Measurement (DUT: PLL)

In this section, you perform the spectrum measurement for the oscillation signal of the DUT (PLL).

1. Preparing for the measurement
   Preform "1. Preparations for Measurements" (1-1 to 1-9) in this chapter. Connect a PLL as the DUT.
2. Selecting the measurement mode
   Select the analyzer mode. Press (Meas), INST TYPE, and VCO ANALY in this order. The menu whose top item is ANALY:RF POWER appears.
3. Selecting the spectrum measurement mode
   Press SPECTRUM. SPECTRUM is underlined.
4. Making sure that the modulation output is OFF
   Press (Mod), and check that MOD OUT on OFF is selected.
5. Setting the frequency sweep range
   Press (Menu) and SWEEP. Perform one of the following two setting procedures.
   - Press CENTER and use the numeric entry keys to enter the sweep center value. (Example: To specify 5.8 GHz, press (5), (.), (8), and (G/n).) Then, press SPAN and use the numeric entry keys to enter the sweep span value. (Example: To specify 20 kHz, press (2), (0), and (k/m).)
   - Press START and use the numeric entry keys to enter the sweep start value. Then, press STOP and use the numeric entry keys to enter the sweep stop value.
6. Setting the measurement resolution bandwidth
   Press (Bw/Avg) and RES BW in this order. The current setting is displayed on the screen, as RES BANDWIDTH xx. Use the numeric entry keys to enter the measurement resolution bandwidth. (Example: To specify 3 Hz, press (3) and (x1).)
7. Performing signal search
   Press (Meas), FREQ BAND [xx-xx], and SIGNAL SEARCH. SIGNAL FOUND x.xxx GHz appears on the screen. Press NOMINAL FREQUENCY and check that the value displayed on the screen is the same as the frequency of the signal search result (NOMINAL FREQUENCY x.xxx GHz).
8. Moving the carrier frequency
   Press (Menu), CARRIER MENU, and CARRIER→CENTER in this order. The frequency at which the carrier exists moves to the center of the screen (sweep range).
9. Automatically setting the scale for the measurement trace
   Press (Display) and AUTO SCALE. The scale is adjusted automatically. The measurement result is displayed on the screen as shown in Figure 5-14.

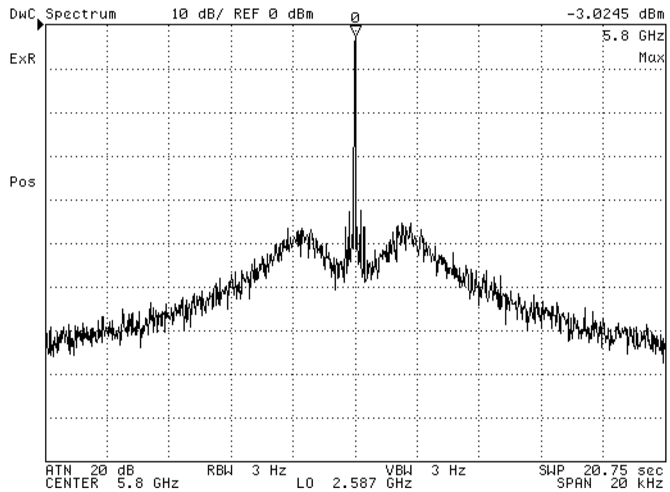


Figure 5-14.
Sample Measurement Screen: Spectrum Measurement in the Analyzer Mode (DUT: PLL)

10. Reading the measurement values

    Press (Menu) and MARKER. The marker appears. You can read the value of each measurement point using the marker.

Note If the measurement value is not your expected value, check that the DC outputs are ON (DC ↓ appears if the DC outputs are OFF), and that the modulation output is OFF.

Note For more information about the auto frequency control function, the video bandwidth function, the averaging function, the power level display unit function, and the marker function, see Chapter 8.

Note In this measurement, the sweep time can not be specified. Only the query is available.

Note you can set the DC control voltage level for phase noise or spectrum measurement using the automatic frequency control function. See “Setting the Automatic Frequency Control Function” in Chapter 4 for details.

6

Entry Block

The Entry Block (Figure 6-1) contains the numeric and unit's keypad, the knob, and the step keys. These controls are used in combination with other front panel keys and softkeys to modify the active entry, to enter or change numeric data, and to change the value of the marker. In most cases, the keypad, knob, and step keys can be used interchangeably.

Before a function is modified, it must be made the active function by pressing a front panel key or softkey. It can then be modified directly with the knob, the step keys, or the digits' keys and a terminator.

In the following section, GPIB commands corresponding to the various front panel key functions or softkeys are given in parentheses that follow the keys.

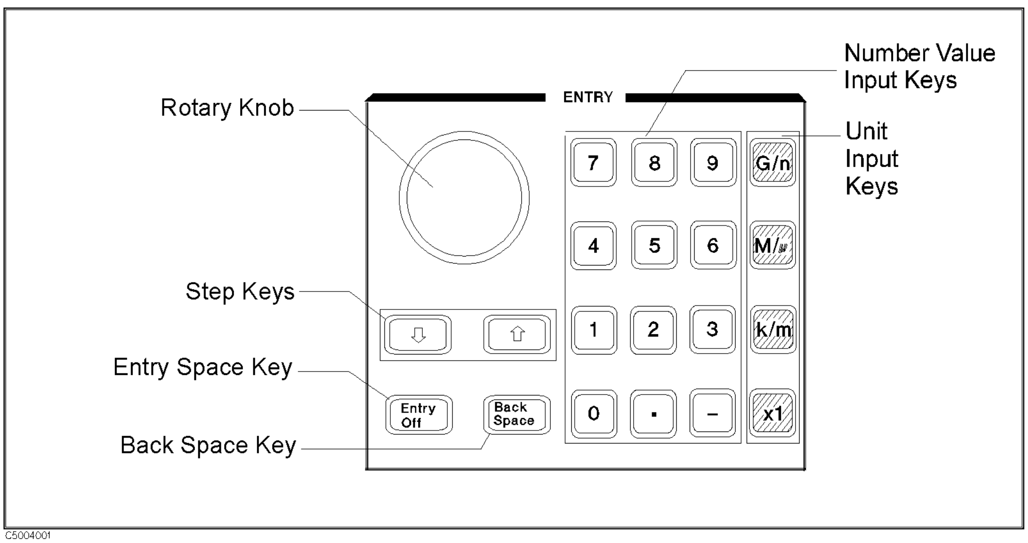


Figure 6-1. Entry Block

Numeric Keypad

The numeric keypad selects digits, decimal point, and minus sign for numerical entries. A unit's terminator is required to complete the entry.

Terminator Keys

The unit's terminator keys are the four keys in the right-hand column of the keypad. These specify units of numerical entries from the keypad and also terminate the entries. A numerical entry is incomplete until a terminator is entered. When a terminator is required, the data entry arrow "←" points at the last entered digit in the active entry area. When the unit's terminator key is pressed, the arrow is replaced by the units selected. The units are abbreviated on the terminator keys as follows:

(G/n) (G, N, KEY 35)	Giga/nano (10^9 / 10^{-9})
(M/μ) (MA, U, KEY 34)	Mega/micro (10^6 / 10^{-6})
(k/m) (K, M, KEY 33)	Kilo/milli (10^3 / 10^{-3})
(x1) (KEY 32)	Basic Units: dB, second, Hz, dB/GHz, Hz/V (Also used in cases where the value has no units, such as the averaging factor.) Not required for GPIB commands.

Knob

The knob adjusts the current values continuously for functions such as scale, reference level, and others. Values changed by the knob are effective immediately and require no terminator.

(⇧) and (⇩)

The (⇩) (KEY 16) and (⇧) (KEY 17) keys step the current value of the active function up or down. The step size is predetermined, and cannot be changed. Also, when the step key is used, input termination by the unit's key is not required.

(Entry Off)

Clears and turns off the active entry area and any displayed prompts, error messages, or warnings. Because this key prevents active values from being changed by accidentally moving the knob, use (Entry Off) to clear the active entry area. The next function selected turns the active entry area back on.

(Back Space)

Deletes the last entry (or the last digit) entered from the numeric keypad.

7

Measurement Block (Tester Mode)

This chapter describes each softkey, which is called from its corresponding hardkey in the MEASUREMENT block, when the tester mode is selected. The keys in the MEASUREMENT block control the functions including: measurement parameters, control of input ports, control of display, averaging, and compensation. The block also includes keys available when using the 43521A (Downconverter Unit). The following show the function of each key in the MEASUREMENT block in the tester mode.

(Meas)	Selects measurement item. Switches between instrument types.
(Sense Range)	Specifies the attenuation for input signal from the DUT. Specifies the resolution for frequency measurements. Specifies the internal attenuation for C/N ratio measurements. Specifies the measurement range for FM deviation measurements.
(Bw/Avg)	Specifies the averaging function. Specifies the measurement conditions for C/N ratio measurements. Specifies the detection bandwidth for FM deviation measurements.
(Format)	Selects the display unit for the RF power measurement data. Selects the display unit for the FM deviation measurement data.
(Display)	Selects the data (current measurement value and data stored in the memory) to be displayed. Stores measurement value into the memory. Splits the display into the measurement and IBASIC screens. Selects whether to display measurement conditions. Displays title. Adjusts on-screen information colors.
(Menu)	Specifies the automatic frequency control function. Performs/Activates the cable loss compensation. Performs/Activates the FM deviation calibration.

In this chapter, an GPIB command that corresponds to the hardkey or softkey is given in parenthesis ( ). Characters following the program code that are separated by a space are parameters of the command.

Example:
`ON|OFF` indicates that `ON` or `OFF` can be used as the parameter. That is, `AVER ON|OFF` means that this command can take the form of `AVER ON` or `AVER OFF`.

See the *4352B GPIB Programming Manual* for details on GPIB commands.

Meas

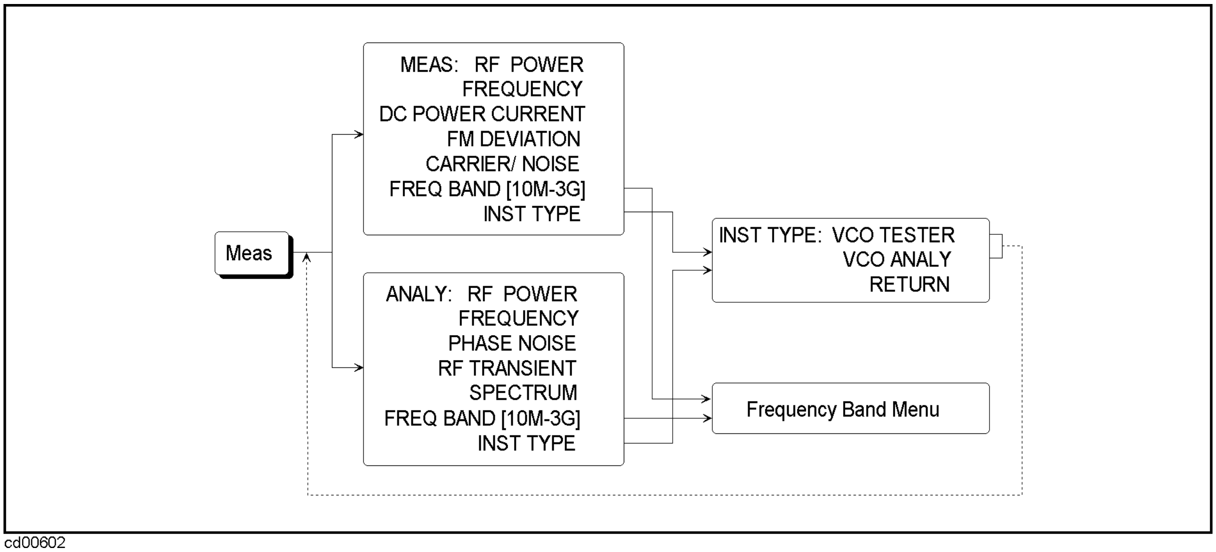


Figure 7-1. Softkey Menus Accessed from Meas Key (Tester Mode)

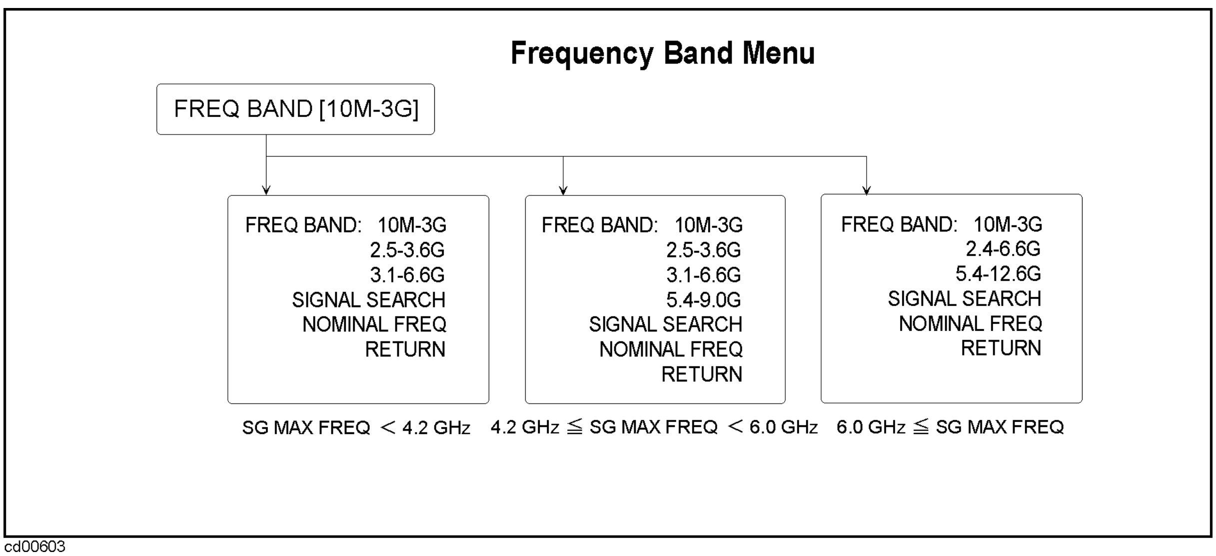


Figure 7-2. Frequency band menu

(Meas) Menu

VCO Tester Menu

MEAS:RF POWER (MEAS POWE)

Selects RF power as the measurement item.

FREQUENCY (MEAS FREQ)

Selects frequency as the measurement item.

DC POWER CURRENT (MEAS CURR)

Selects DC power current as the measurement item.

FM DEVIATION (MEAS FMDEV)

Selects FM deviation as the measurement item.

CARRIER/NOISE (MEAS CN)

Selects C/N ratio as the measurement item.

FREQ BAND [10M-3G] (FBAND <value>)

Lets you select the frequency band when you use the 43521A (Downconverter Unit) and have set DOWNCONV ON off under (RF/LO) to ON. Pressing this FREQ BAND [xx-xx] key displays the frequency band menu that lets you select the frequency band used for your measurement (example: 3.1-6.6G). When you have selected a frequency band, it becomes underlined. Pressing RETURN displays the 1-level upper menu, in which this key is displayed together with the selected frequency band, as FREQ BAND [3.1-6.6G]. There are 3 kinds of frequency band menus. The displayed menu is determined depending on the maximum frequency of the external signal source entered with SG MAX FREQ on the (RF/LO) menu. If DOWNCONV on OFF under (RF/LO) is set to OFF, this key is displayed in a faint color as FREQ BAND [10M-3G] and the frequency band is always set to 10 MHz to 3 GHz automatically.

INST TYPE

Displays the Instrument Type menu.

Instrument Type Menu

INST TYPE: VCO TESTER (VT)

Selects the tester mode and displays the VCO Tester menu.

VCO ANALY (VA)

Selects the analyzer mode and displays the VCO Analyzer menu. See Chapter 8 for more information on this menu.

Meas (Tester Mode)

SIGNAL SEARCH (SIGSRCH)

Searches for (finds out) the carrier signal from the DUT. The search is performed within the frequency band (Meas, FREQ BAND [xx-xx]) that has been selected. If the carrier is found out, SIGNAL FOUND x.xxxx GHz is displayed and the frequency is automatically set as the nominal frequency. By setting the nominal frequency, the frequency of the external signal source and the input attenuator are set to proper values, which realizes correct measurements. If the carrier signal cannot be detected within the frequency band, an error (66 No Signal Found) is displayed. Check the setting of the frequency band (Meas, FREQ BAND [xx-xx]) again. If you cannot enter the nominal frequency (NOMINAL FREQ) (for example, you do not know the oscillation frequency of the DUT), you can find out the nominal frequency using this search function. In the following cases, this function is not required and therefore invalid.

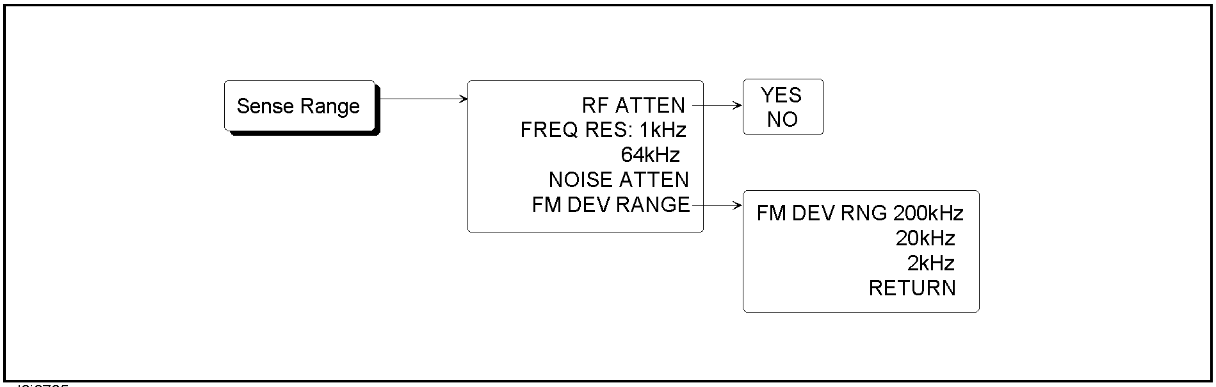
- When using the 4352B alone (without connecting the 43521A)
- When the 43521A (Downconverter Unit) is connected, DOWNCONV ON off is set to ON, and the frequency band is set to 10 MHz to 3 GHz

NOMINAL FREQ (NOMFREQ <value>)

Pressing this key displays the current setting, as NOMINAL FREQUENCY x.xxxxx GHz. Enter an approximate oscillation frequency (nominal frequency) of the DUT using the numeric entry keys. Enter the value with a resolution of ±200 MHz. You can enter the nominal frequency within the specified frequency band (Meas, FREQ BAND [xx-xx]). Setting the nominal frequency realizes correct measurements. If you cannot enter the nominal frequency (for example, you do not know an approximate oscillation frequency of the DUT), use the signal search function (SIGNAL SEARCH) described above to find out the nominal frequency. The carrier frequency detected by the signal search is automatically set as the nominal frequency. In the following cases, this function is not required and therefore invalid.

- When using the 4352B alone (without connecting the 43521A)
- When the 43521A (Downconverter Unit) is connected, DOWNCONV ON off is set to ON, and the frequency band is set to 10 MHz to 3 GHz

Sense Range



cd0j0705

Figure 7-3. Softkey Menus Accessed from Sense Range Key (Tester Mode)

Sense Range Menu

RF ATTEN (RFATT <Value>)

Sets the input attenuator of the 4352B or the 43521A (Downconverter Unit). During measurement, `CAUTION: Set RF ATT 5dB Less` (or `CAUTION: Set RF ATT 5dB More`) may appear. In this case, use one of the following methods to change the input attenuator value until the CAUTION display disappears.

- Press Sense Range and RF ATTEN. The current input attenuator value is displayed as `RF ATTEN xx dB`. Press the ⇩ key or the ⇧ key to change the input attenuator value.
- Press Sense Range and RF ATTEN. The current input attenuator value is displayed as `RF ATTEN xx dB`. Use the numeric entry keys to change the input attenuator value in steps of 5 dB.

The input attenuator of the 4352B and that of the 43521A provide 0 dB to 25 dB and 0 dB to 35 dB, respectively in steps of 5 dB. Therefore, you cannot specify a value that is not a multiple of 5 dB.
In the following cases, the setting is applied to the input attenuator of the 4352B.

- When using the 4352B alone (without connecting the 43521A)
- When the 43521A (Downconverter Unit) is connected, DOWNCONV ON off is set to ON, and the frequency band is set to 10 MHz to 3 GHz

If DOWNCONV ON off is set to ON and the frequency band is set to a range other than 10 MHz to 3 GHz, the setting is applied to the input attenuator of the 43521A.
If you try to make a setting of 0 dB, the message `MAXIMUM RF INPUT POWER IS 19dBm FOR 0dB ATTEN, CONTINUE?` may appear. After checking that the RF input is 19 dBm or less, press Yes.

If it is greater than 19 dBm, press no. If you enter a value larger than 19 dBm when the input attenuator is set 0 dB, the 4352B or the 43521A may be damaged.

FREQ RES:1kHz (FCOUN RES1KHZ)

Sets the frequency resolution to 1 kHz for frequency measurements.

Sense Range (Tester Mode)

64kHz (FCOUN RES64KHZ)

Sets the frequency resolution to 64 kHz for frequency measurements.

NOISE ATTEN (NATT <Value>)

Specifies the noise attenuation for C/N measurements. The attenuation level can be selected as 0, 10, 20, 30, or 40 dB. The purpose of this noise attenuator is to adjust the input level to the A/D converter when the power of the noise component is measured. This prevents range saturation that may occur due to the presence of spurious (peak component) within the noise measurement bandwidth.

```
Example:
```

When the following message is displayed:

```
CAUTION: Set Noise ATT 10 dB More
```

Press NOISE ATTEN, and set the noise attenuation to a level at least 10 dB higher than the current level.

FM DEV RANGE

Displays the *FM Deviation Range menu*.

FM Deviation Range Menu

FM DEV RNG:200kHz (DEVRNG DV200KHZ)

Sets the FM deviation range to 200 kHz (peak value).

FM DEV RNG:20kHz (DEVRNG DV20KHZ)

Sets the FM deviation range to 20 kHz (peak value).

FM DEV RNG:2kHz (DEVRNG DV2KHZ)

Sets the FM deviation range to 2 kHz (peak value).

Bw/Avg

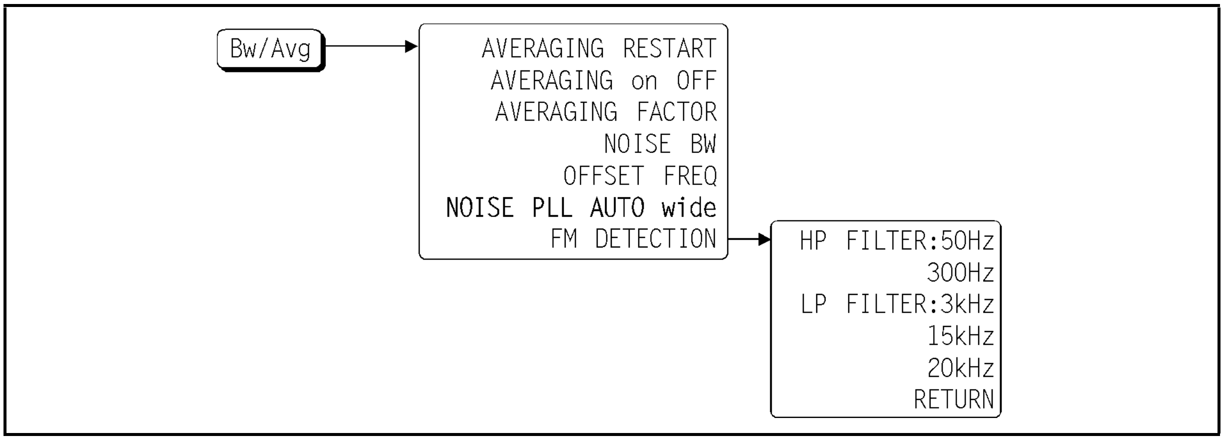


Figure 7-4. Softkey Menus Accessed from Bw/Avg Key (Tester Mode)

Bw/Avg Menu

`AVERAGING RESTART` (AVERREST)

Resets the trigger function so that the trigger count will begin from 1 on the next trigger. The trigger count for averaging is displayed on the left side of the display screen.

`AVERAGING on OFF` (AVER OFF|0|ON|1)

Turns the trace averaging function ON or OFF. When the averaging function is ON, "Avg" appears together with the trigger count in the status display area on the left-hand side of the screen. Whenever an instrument state change affecting the measurement data is made, the trigger for averaging is reset to 1.

Averaging starts at count 1 when you turn ON the averaging function for the first time, or when you restart this function using `AVERAGING RESTART`. Measurement data is averaged and the displayed data is updated each time the measurement is complete, until the count reaches the specified averaging factor. The trigger count appears below "Avg" in the status display area. The trigger count is incremented by 1 before each measurement. When the count reaches the specified averaging factor, the measurement data continues to be updated, weighted by that averaging factor.

`AVERAGING FACTOR` (AVERFACT <Value>)

Specifies the averaging factor (number of times for averaging). The allowable range of values you can specify for this factor varies depending on the measurement item selected.

A large offset frequency selected for `OFFSET FREQ` in C/N ratio measurements can result in large fluctuations of the measurement data. This occurs because the bandwidth for noise measurements used in the 4352B expands with an increase in offset frequency. These fluctuations can be minimized by specifying the proper averaging factor.

`NOISE BW` (CNBW <Value>)

Sets the converted noise bandwidth for C/N measurements.

Bw/Avg (Tester Mode)

For the noise measurement internally performed in the 4352B, the resolution band width is automatically determined based on the offset frequency specified with OFFSET FREQ, and cannot be changed by the user. The noise level used for C/N ratio measurement is derived by converting the noise bandwidth which you set with NOISE BW.

OFFSET FREQ (CNOFREQ <Value>)

Sets the offset from the carrier frequency to make a noise measurement in C/N ratio measurement. The actual bandwidth for noise measurement is determined by the 4352B based on this offset frequency.

NOISE PLL AUTO wide (CNPLL AUTO|WIDE)

Selects AUTO to reduce the bandwidth (200 Hz) automatically or WIDE to maintain the wide bandwidth (1 kHz) if an offset frequency below 5 kHz is used in C/N measurements.

Note

When measuring a DUT with high phase noise and the offset frequency < 5 kHz, the message `2nd PLL Unlocked` might be displayed on the screen. This message indicates that 4352B is unable to make measurements. This condition occurs because the 2nd PLL in the 4352B is designed to automatically set the bandwidth to 1 kHz and 200 Hz respectively when the offset frequency is above and below 5 kHz. However, the 200 Hz bandwidth selected at the offset frequency < 5 kHz is too narrow to cover the high phase noise of the device.

When NOISE PLL auto WIDE is selected, the bandwidth of the built-in 2nd PLL is constantly set at 1 kHz regardless of the variations in the offset frequency. Therefore, the 4352B can make the proper measurement for a device with high phase noise, even when the offset frequency is below 5 kHz. Note, however, that the measurement data at an offset frequency below 5 kHz is only used as reference data if the noise bandwidth is set to WIDE.

FM DETECTION

Displays the *FM Deviation Detection Band menu*.

FM Deviation Detection Band Menu

HP FILTER:50Hz (DTHPF FC50HZ)

Sets the high-pass filter cutoff frequency for the FM deviation detection bandwidth to 50 Hz.

300Hz (DTHPF FC300HZ)

Sets the high-pass filter cutoff frequency for the FM deviation detection bandwidth to 300 Hz.

LP FILTER:3kHz (DTLPF FC3KHZ)

Sets the low-pass filter cutoff frequency for the FM deviation detection bandwidth to 3 kHz.

15kHz (DTLPF FC15KHZ)

Sets the low-pass filter cutoff frequency for the FM deviation detection bandwidth to 15 kHz.

20kHz (DTLPF FC20KHZ)

Sets the low-pass filter cutoff frequency for the FM deviation detection bandwidth to 20 kHz.

Format

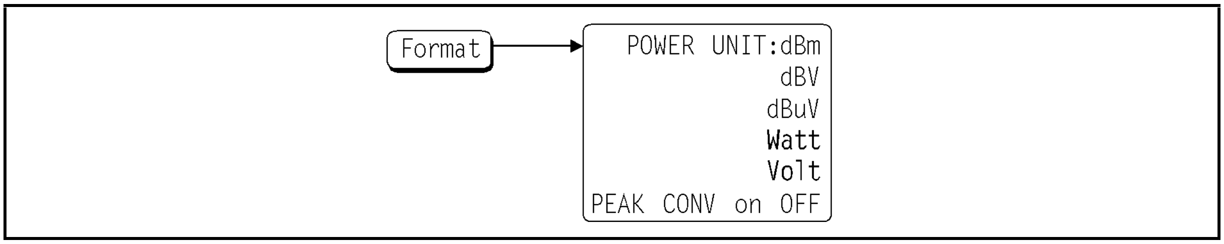


Figure 7-5. Softkey Menus Accessed from Format Key (Tester Mode)

Format Menu

`POWER UNIT:dBm` (POWUNIT DBM)

Selects "dBm" as the unit for RF power measurement data.

`dBV` (POWUNIT DBV)

Selects "dBV" as the unit for RF power measurement data.

`dBuV` (POWUNIT DBUV)

Selects "dBμV " as the unit for RF power measurement data.

`Watt` (POWUNIT W)

Selects "Watt " as the unit for RF power measurement data.

`Volt` (POWUNIT V)

Selects "Volt " as the unit for RF power measurement data.

`PEAK CONV on OFF` (PKCONV OFF|0|ON|1)

Switches between "Hz_{rms}" (root-mean-square value) and "Hz" (peak) to display FM deviation.

Note The 4352B can only measure the root-mean-square value of FM deviation. Selecting `PEAK CONV ON off` allows the root-mean-square value to be converted to the corresponding peak.

Display

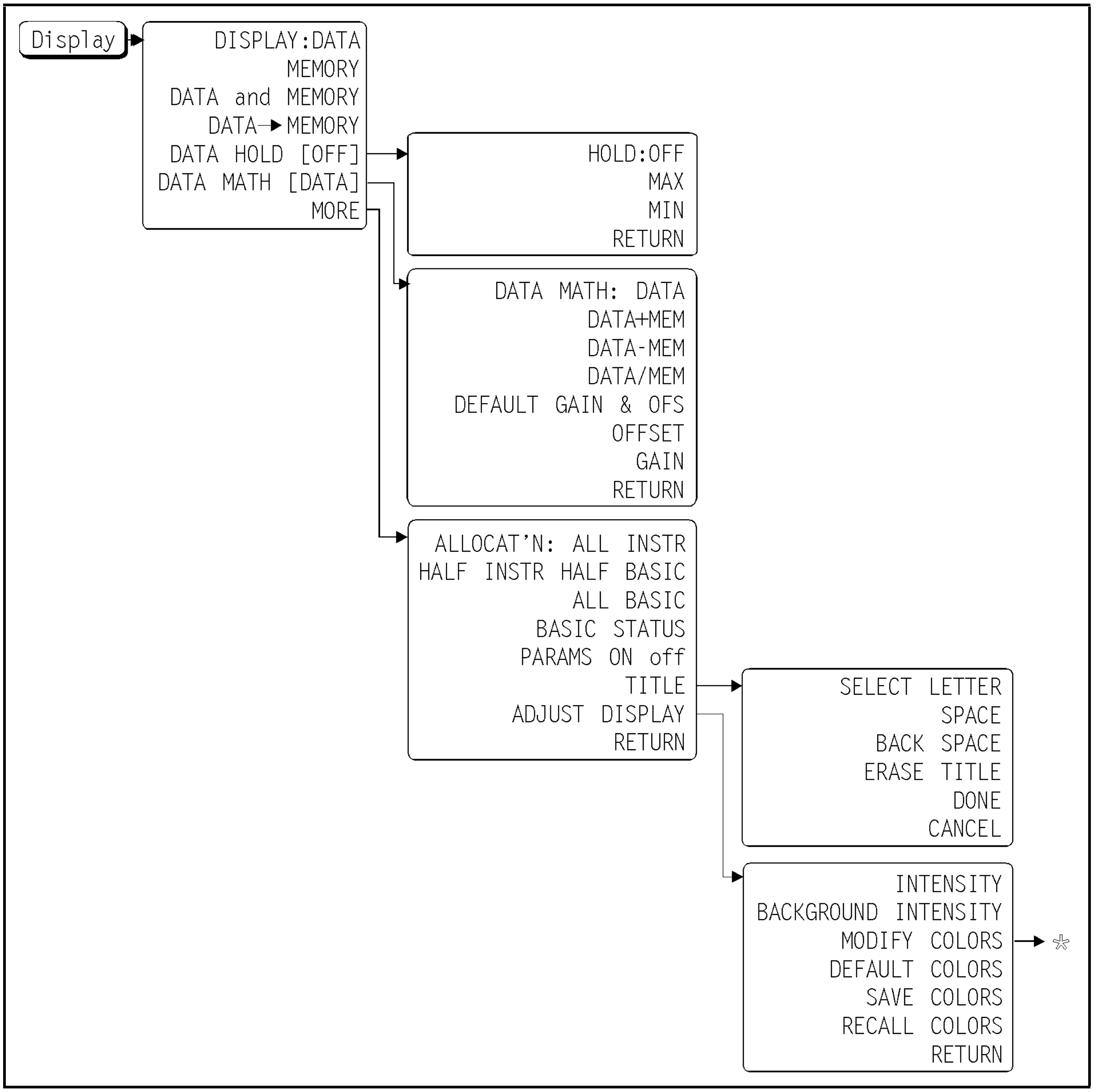


Figure 7-6. Softkey Menus Accessed from Display Key (Tester Mode:1/2)

(Display) (Tester Mode)

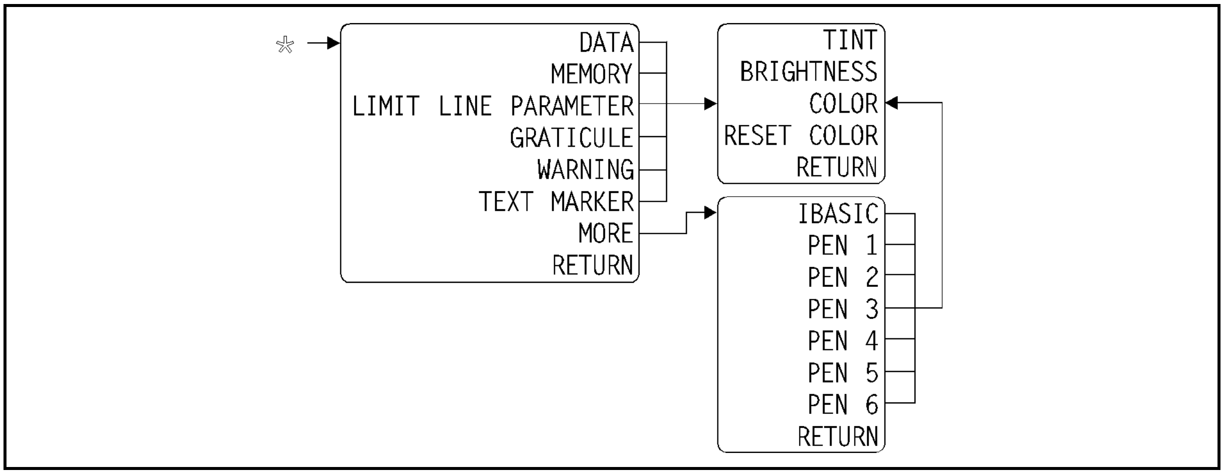


Figure 7-7. Softkey Menus Accessed from (Display) Key (Tester Mode:2/2)

(Display) Menu

DISPLAY:DATA (DISP DATA)

Displays the current measurement data when the data math function OFF is turned off. The calculation result is displayed (instead of the measurement data) when the data math function is turned ON.

MEMORY (DISP MEMO)

Displays the memory data. When MEMORY is pressed and no data is stored in the memory, a warning message is displayed.

DATA and MEMORY (DISP DATM)

Displays both the measurement data and memory data when the data math function is turned OFF. The calculation result is displayed (instead of the measurement data) when the data math function is turned ON.

DATA→MEMORY (DATMEM)

Stores the current measurement data into the memory. The stored data will be used for calculation. This memory data becomes invalid when you change the measurement items. In this case, only the measurement data is displayed.

DATA HOLD [ ] (DHOLD OFF|MAX|MIN)

The data hold function is used to keep the maximum or minimum value, obtained in the continuous measurement mode, displayed on the screen. The following three softkeys are displayed:

HOLD: OFF	Data hold function OFF.
MAX	Holds the maximum value obtained during measurements.
MIN	Holds the minimum value obtained during measurements.

DATA MATH [ ] (MATH DATA|DPLM|DMNM|DDVM)

Displays the following softkeys used to select the data math type, and also displays the gain & offset definition keys. The selected type appears in the bracket ([ ]) of the softkey label. (For example, [DATA] appears if DATA is selected.)

DATA

Turns OFF all data math functions.

DATA+MEM

Adds the data in the memory to the current measurement data.

DATA-MEM

Subtracts the data in the memory from the current measurement data.

DATA/MEM

Divides the current measurement data by the data in the memory.

DEFAULT GAIN & OFS (DEFGO)

Resets the gain and offset to defaults (gain=1, offset=0).

OFFSET (DATOVAL <Value>)

Defines the offset for the data math function.

GAIN (DATGAIN <Value>)

Defines the gain for the data math function.

The data math function allows you to display the calculation result by using one of these formulas:

- *GAIN* × *DATA* − *OFFSET*
- *GAIN* × *MEMORY* − *OFFSET*
- *GAIN* × *(DATA* + *MEMORY)* − *OFFSET*
- *GAIN* × *(DATA* − *MEMORY)* − *OFFSET*
- *GAIN* × *(DATA / MEMORY)* − *OFFSET*

MORE

Displays the *Display MORE menu*.

Note See figure 6-7 and the text that follows it for a description of the display locations in the following commands.

Display MORE Menu

ALLOCAT'N:ALL INSTR (DISA ALLI)

Displays the measurement screen over the entire display.

HALF INSTR HALF BASIC (DISA HIHB)

Displays the measurement screen on the upper half and the IBASIC screen on the lower half of the display.

ALL BASIC (DISA ALLB)

Displays the IBASIC screen over the entire display. Selecting ALL BASIC reduces the measurement time because the time required for displaying the measurement data is eliminated.

Note also, that you further reduce the measurement time by selecting PARAM on OFF together with ALL BASIC .

BASIC STATUS (DISA BASS)

Displays the IBASIC status information under the measurement screen. (Three status lines are located under the measurement screen.)

PARAMS ON off (PARM OFF|0|ON|1)

Selects whether to display measurement setting parameters. Selecting OFF can reduce the measurement time because the overhead time required for displaying the measurement setting parameters is eliminated.

Note also, that you further reduce the measurement time by selecting ALL BASIC together with PARAMS on OFF .

TITLE (TITL <Character String>)

Displays the *Character Input menu*. The specified title is common, and displayed for all measurement items.

ADJUST DISPLAY

Displays the *Display Adjustment menu*.

RETURN

Returns to the previous menu.

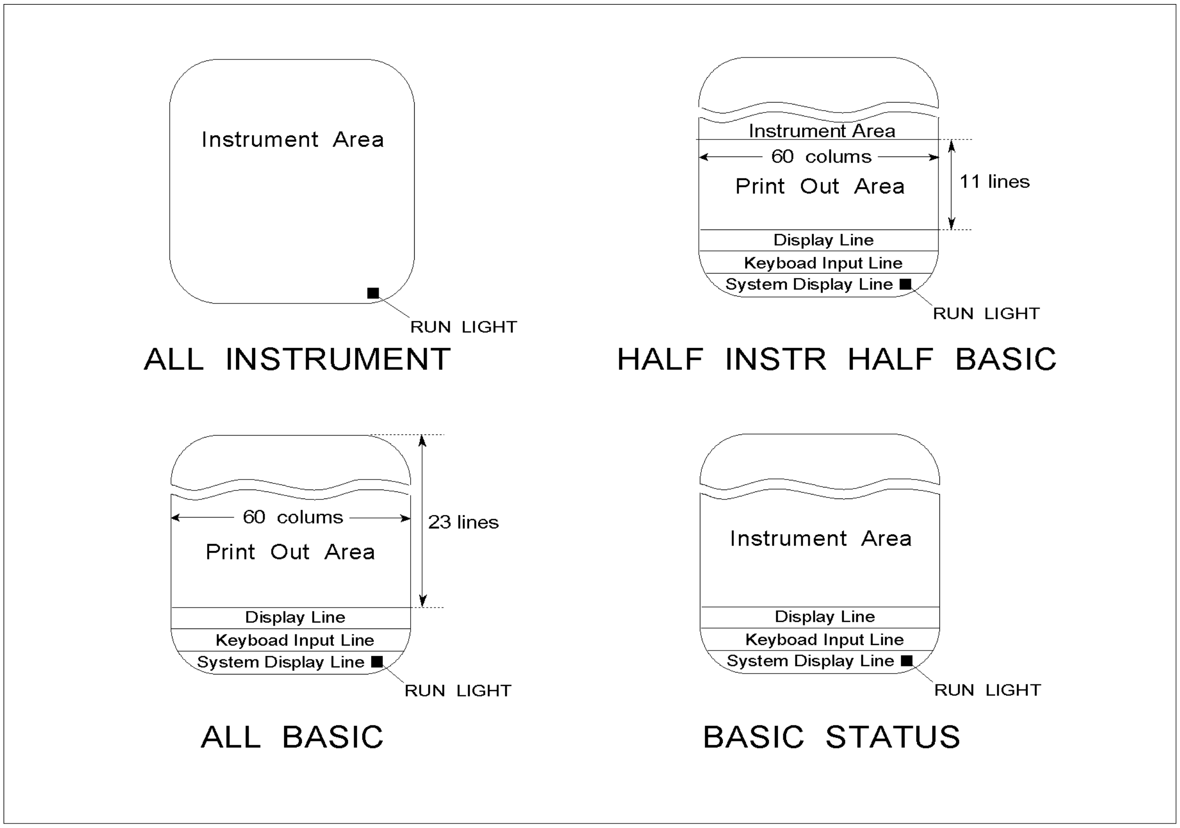


Figure 7-8. Display Location

The list below indicates the row and column numbers of the BASIC print area for each display mode. When the BASIC command line is enabled, BASIC commands can be executed from the keyboard.

Display Location	BASIC Print Area		BASIC Command Line
	Column	Row	
All Instrument	0	0	Not usable
Half Instrument Half BASIC	60	11	Usable
ALL BASIC	60	23	Usable
BASIC Status	0	0	Usable

Status Notation of the Program Execution

␣(blank) Program completion, command executable, `CONTINUE` disabled.

_ Program halt, command executable, `CONTINUE` enabled.

? Program is standing by for input from the keyboard, command not executable.

* This character is displayed under the following 2 conditions.

- Program in execution, command not executable, `CONTINUE` disabled.
- Executing command input from the keyboard, command not executable.

Character Input Menu

SELECT LETTER

Selects the on-screen character pointed to by the arrow (↑). You can use the rotary knob to move the arrow. Use ⇧ and ⇩ to select one of three character sets on the screen.

SPACE

Inserts a space into the title.

BACK SPACE

Deletes the last character entered.

ERASE TITLE

Deletes the entire title.

DONE

Terminates the title entry and returns to the Display MORE menu.

CANCEL

Cancels the title entry and returns to the Display MORE menu without any changes.

Display Adjustment Menu

INTENSITY (INTE <Value>)

Specifies the display intensity as a percentage of the highest brightness level.

BACKGROUND INTENSITY (BACI <Value>)

Specifies the background display intensity as a percentage of white level.

MODIFY COLORS

Displays the *First Color Adjustment menu*.

DEFAULT COLORS (DEFC)

Resets all color settings to the default settings (factory settings).

SAVE COLORS (SVCO)

Stores the modified version of the color settings into the backup memory.

RECALL COLORS (RECC)

Recalls the previously saved modified version of the color settings from the backup memory. RECALL COLORS appears only when a color setting has been saved.

RETURN

Returns to the previous menu.

First Color Adjustment Menu

DATA (COLO DATA)

Selects the measurement data to change its color and displays the *Second Color Adjustment menu*.

MEMORY (COLO MEMO)

Selects the memory data to change its color and displays the *Second Color Adjustment menu*.

LIMIT LINE PARAMETER (COLO PARAM)

Selects the measurement setting parameters to change their color and displays the *Second Color Adjustment menu*.

GRATICULE (COLO GRAT)

Selects the display frame (for measurement data and measurement setting parameters) and some softkey labels (those with ON and OFF options) to change their color and displays the *Second Color Adjustment menu*.

WARNING (COLO WARN)

Selects warning messages to change their color and displays the *Second Color Adjustment menu*.

Note

Select MORE to display a softkey menu for other options if you wish to change the color of on-screen information other than those given above.

TEXT MARKER (COLO TEXT)

Selects text (for example, softkey labels) other than measurement data its color and displays the *Second Color Adjustment menu*.

MORE

Displays the *Color Change MORE menu*.

RETURN

Returns to the previous menu.

Color Change MORE Menu

IBASIC (COLO IBT)

Selects text on the IBASIC screen to change the color and displays the *Second Color Adjustment menu*.

PEN1 (COLO PEN1)

Selects pen 1 to change the color and displays the *Second Color Adjustment menu*.

PEN2 (COLO PEN2)

Selects pen 2 to change the color and displays the *Second Color Adjustment menu*.

PEN3 (COLO PEN3)

Selects pen 3 to change the color and displays the *Second Color Adjustment menu*.

PEN4 (COLO PEN4)

Selects pen 4 to change the color and displays the *Second Color Adjustment menu*.

PEN5 (COLO PEN5)

Selects pen 5 to change the color and displays the *Second Color Adjustment menu*.

PEN6 (COLO PEN6)

Selects pen 6 to change the color and displays the *Second Color Adjustment menu*.

RETURN

Returns to the previous menu.

Second Color Adjustment Menu

TINT (TINT <Value>)

Adjusts the tint of the selected on-screen information.

BRIGHTNESS (CBRI <Value>)

Adjusts the brightness of the color being modified.

COLOR (COLOR <Value>)

Adjusts the whiteness of the color being modified.

RESET COLOR (RSCO)

Resets the color being modified to the default color.

RETURN

Returns to the previous menu.

3 color components	
Tint (TINT)	The continuum of hues on the color wheel, ranging from red through green and blue, and black to red.
Brightness (BRIGHTNESS)	Degree of brightness of color
Color (COLOR)	Whiteness of color (from white to pure color)

Menu

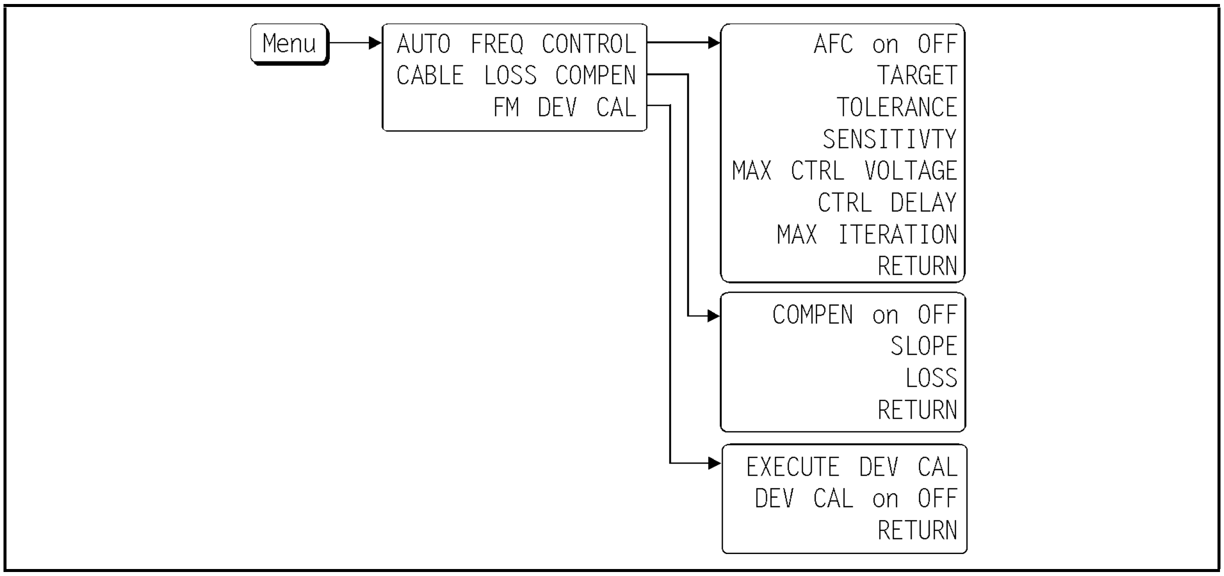


Figure 7-9. Softkey Menus Accessed from Menu Key (Tester Mode)

Menu Menu

AUTO FREQ CONTROL

Displays the *Automatic Frequency Control menu*.

CABLE LOSS COMPEN

Displays the *Cable Loss Compensation menu*.

FM DEV CAL

Displays the *FM Deviation Calibration menu*.

Automatic Frequency Control Menu

This menu controls the settings for the automatic frequency control function. The automatic frequency control function can automatically and quickly set/maintain the DUT output frequency to your specified target frequency. It does this by controlling the internal DC control voltage and using the measurement results obtained by its internal frequency counter.

Note The automatic frequency control function starts immediately before measurement starts. During the entire measurement, the DC control voltage is kept constant. Therefore, the DC control voltage level is not changed even if the actual frequency is shifted or changed during the measurement.
Be sure to take this into consideration for measurements with long measurement time conditions. For example, the specified averaging factor might have problems due to the DC power/control voltage fluctuation.

Menu (Tester Mode)

AFC on OFF (AFC OFF|0|ON|1)

Turns the automatic frequency control function ON or OFF.

TARGET (AFCTARG <Value>)

Specifies the target frequency in Hz.

TOLERANCE (AFCTOL <Value>)

Specifies the tolerance limits between the target frequency and the actual measured frequency in Hz.

SENSITIVTY (AFCSENS <Value>)

Specifies the approximate tuning sensitivity of the DUT in Hz/V.

AFC MAX CTRL VOLT (AFCMAXV <Value>)

AFC MIN CTRL VOLT (AFCMINV <Value>)

These two softkeys specify the maximum and minimum DC control voltage levels for use with the automatic frequency control function. Note that the value specified with MAX CTRL VOLTAGE (available under DC Control) has priority over the value specified with AFC MIN CTRL VOLT.

MAX ITERATION (AFCITER <Value>)

Maximum iteration for the DC control voltage-setting loop cycles. The measurement and calculation is repeated attempting to determine the optimum DC control voltage level for the target frequency until the number of loop cycles reaches the value specified here. A value from 1 to 999 can be entered.

RETURN

Returns to the previous menu.

Cable Loss Compensation Menu

This menu is used to make settings or adjustments associated with the cable loss compensation function. When this function is ON, the 4352B compensates for level loss on a cable using the assumption that the cable characteristics are as shown in Figure 7-10. Level loss on a cable is defined in terms of the frequency domain.

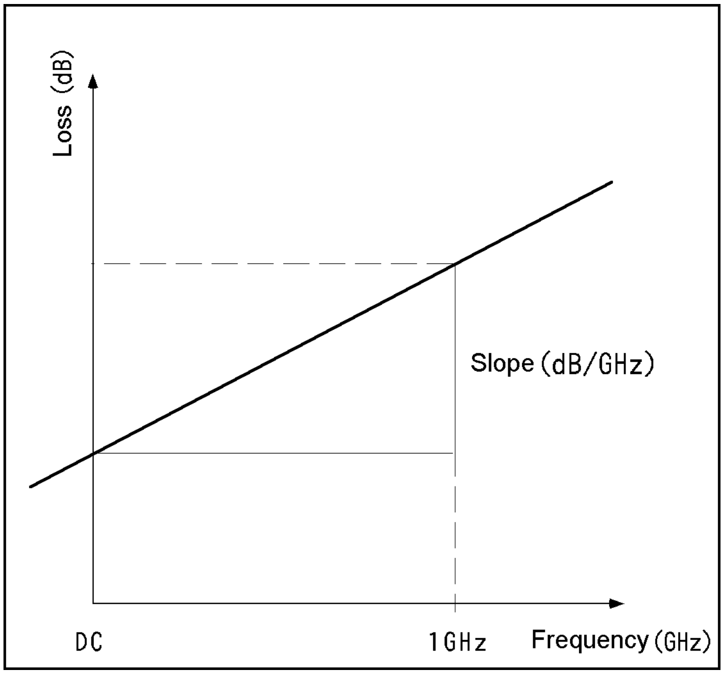


Figure 7-10. Cable Frequency Characteristics for Level Loss Used by the Cable Loss Compensation Function

COMPEN on OFF (LCOMP OFF|0|ON|1)

Turns the cable loss compensation function ON or OFF. This softkey can only be used in RF power measurements.

SLOPE (SLOPE <Value>)

Specifies the slope of the cable level loss frequency characteristics (loss/frequency) in dB/GHz. If the DC loss (value specified with LOSS) is 0, the loss at 1 GHz can be directly entered for SLOPE. (See Figure 7-10.)

LOSS (LOSS <Value>)

Specifies the cable loss at DC (0 Hz) in dB.

RETURN

Returns to the previous menu.

FM Deviation Calibration Menu

This menu is used to perform the FM deviation calibration. Press EXECUTE DEV CAL to obtain a calibration factor for the 4352B. When DEV CORR ON off is selected, the value obtained by multiplying the measurement value by the calibration factor is displayed on the screen.

Note

- This calibration offers measurement accuracy of ±0.8% (typical) under the specified operating conditions.
- Perform calibration after having specified the detection bandwidth.
- Perform calibration again if the temperature changes more than ±5°C or if the detection bandwidth is changed.
- The calibration factor specified in the 4352B becomes invalid if the 4352B is turned OFF or if Preset is pressed.

EXECUTE DEV CAL (DEVCAL)

Obtains and stores a calibration factor in the 4352B. Note that you only need to specify a factor once unless you change measurement conditions.

DEV CORR on OFF (DEVCORR OFF|0|ON|1)

Selects whether to turn the FM deviation calibration ON or OFF.

RETURN

Returns to the previous menu.

8

Measurement Block (Analyzer Mode)

This chapter describes each softkey, which is called from its corresponding hardkey in the MEASUREMENT block, when the analyzer mode is selected. The keys in the MEASUREMENT block control the functions including: measurement parameters, control of input ports, control of display, averaging, and compensation. The block also includes keys available when using the 43521A (Downconverter Unit). The following show the function of each key in the MEASUREMENT block in the analyzer mode.

(Meas)	Selects measurement item. Switches between instrument types.
(Sense Range)	Specifies the attenuation for the input signal from the device. Selects the slope (df/dv) type for the tuning sensitivity characteristics curve. Specifies 1 kHz as the resolution for frequency/tuning sensitivity measurements. Specifies 64 kHz as the resolution for frequency/tuning sensitivity measurements. Sets the attenuation for noise measurement in phase noise measurements. Specifies the maximum frequency for the frequency transient measurement range. Specifies the minimum frequency for the frequency transient measurement range. Specifies the reference frequency for frequency transient data.
(Bw/Avg)	Specifies the averaging function. Specifies the video bandwidth for spectrum measurement. Specifies the resolution bandwidth for spectrum measurement. Specifies the noise bandwidth for phase noise measurement. Specifies the converted noise bandwidth for phase noise measurement. Specifies the aperture for tuning sensitivity measurements.
(Format)	Selects the display unit for the RF power measurement data.
(Display)	Selects the trace to be displayed. Stores the data trace using the memory trace function. Selects the display mode. Splits the display into the measurement and IBASIC screens. Performs data math function. Displays titles. Adjusts on-screen information colors.
(Menu)	Specifies the sweep parameters. Specifies the automatic frequency control function. Controls the marker function. Sets the sweep range based on the carrier frequency. Compensates for cable loss.

Meas

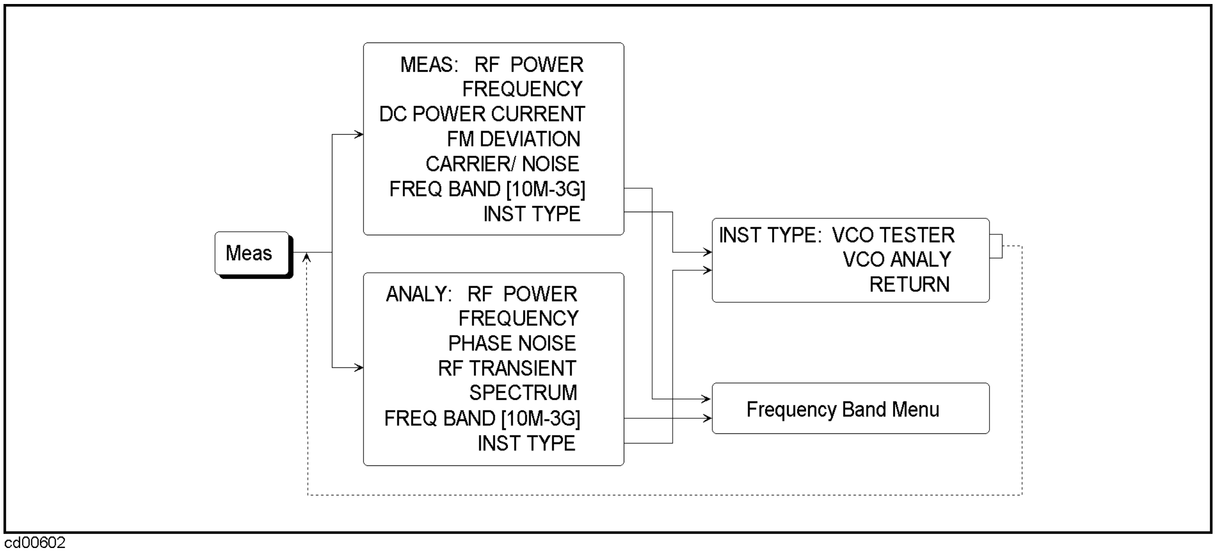


Figure 8-1. Softkey Menus Accessed from Meas Key (Analyzer Mode)

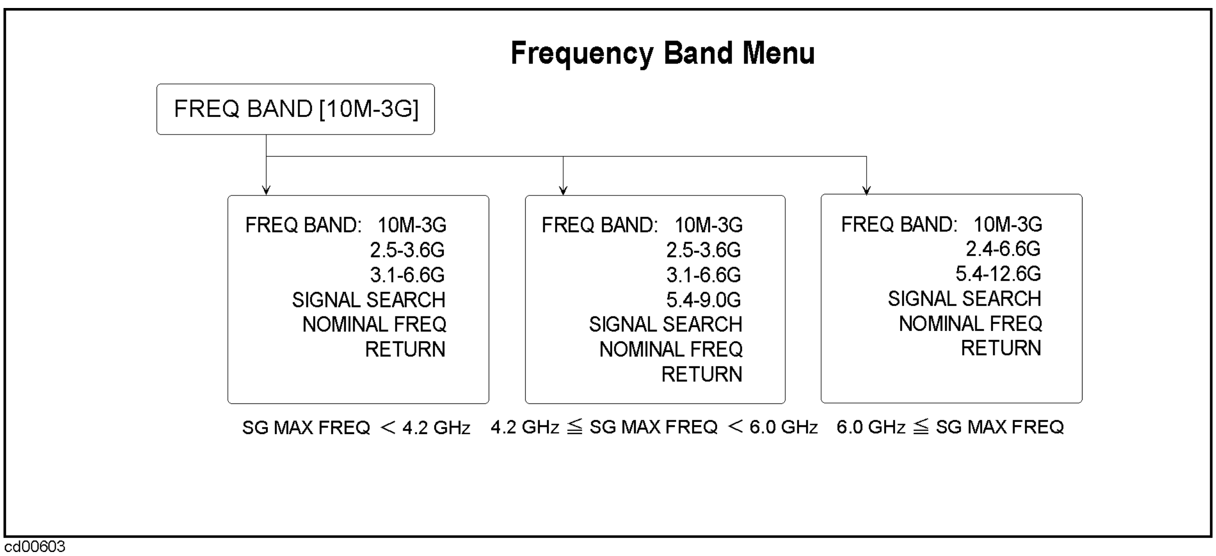


Figure 8-2. Frequency band menu

[Meas] Menu

VCO Analyzer Menu

ANALY:RF POWER (MEAS POWE)

Selects RF power characteristics vs. DC control voltage as the measurement item.

FREQUENCY (MEAS FREQ)

Selects frequency/tuning sensitivity characteristics vs. DC control voltage as the measurement item.

PHASE NOISE (MEAS NOIS)

Selects phase noise characteristics vs. offset frequency as the measurement item.

RF TRANSIENT (MEAS TRAN)

Selects frequency transient as the measurement item.

SPECTRUM (MEAS SPEC)

Selects spectrum as the measurement item.

FREQ BAND [10M-3G] (FBAND <value>)

Lets you select the frequency band when you use the 43521A (Downconverter Unit) and have set DOWNCONV ON off under [RF/LO] to ON. Pressing this FREQ BAND [xx-xx] key displays the frequency band menu that lets you select the frequency band used for your measurement (example: 3.1-6.6G). When you have selected a frequency band, it becomes underlined. Pressing RETURN displays the 1-level upper menu, in which this key is displayed together with the selected frequency band, as FREQ BAND [3.1-6.6G] . There are 3 kinds of frequency band menus. The displayed menu is determined depending on the maximum frequency of the external signal source entered with SG MAX FREQ on the [RF/LO] menu. If DOWNCONV on OFF under [RF/LO] is set to OFF, this key is displayed in a faint color as FREQ BAND [10M-3G] and the frequency band is always set to 10 MHz to 3 GHz automatically.

INST TYPE

Displays the *Instrument Type menu*.

Instrument Type Menu

INST TYPE: VCO TESTER (VT)

Selects the tester mode and displays the *VCO Tester menu*. See Chapter 7 for more information on this menu.

VCO ANALY (VA)

Selects the analyzer mode and displays the *VCO Analyzer menu*.

Meas (Analyzer Mode)

SIGNAL SEARCH (SIGSRCH)

Searches for (finds out) the carrier signal from the DUT. The search is performed within the frequency band (Meas, FREQ BAND [xx-xx]) that has been selected. If the carrier is found out, SIGNAL FOUND x.xxxx GHz is displayed and the frequency is automatically set as the nominal frequency. By setting the nominal frequency, the frequency of the external signal source and the input attenuator are set to proper values, which realizes correct measurements. If the carrier signal cannot be detected within the frequency band, an error (66 No Signal Found) is displayed. Check the setting of the frequency band (Meas, FREQ BAND [xx-xx]) again. If you cannot enter the nominal frequency (NOMINAL FREQ) (for example, you do not know the oscillation frequency of the DUT), you can find out the nominal frequency using this search function. In the following cases, this function is not required and therefore invalid.

- When using the 4352B alone (without connecting the 43521A)
- When the 43521A (Downconverter Unit) is connected, DOWNCONV ON off is set to ON, and the frequency band is set to 10 MHz to 3 GHz

NOMINAL FREQ (NOMFREQ <value>)

Pressing this key displays the current setting, as NOMINAL FREQUENCY x.xxxxx GHz. Enter an approximate oscillation frequency (nominal frequency) of the DUT using the numeric entry keys. Enter the value with a resolution of ±200 MHz. You can enter the nominal frequency within the specified frequency band (Meas, FREQ BAND [xx-xx]). Setting the nominal frequency realizes correct measurements. If you cannot enter the nominal frequency (for example, you do not know an approximate oscillation frequency of the DUT), use the signal search function (SIGNAL SEARCH) described above to find out the nominal frequency. The carrier frequency detected by the signal search is automatically set as the nominal frequency. In the following cases, this function is not required and therefore invalid.

- When using the 4352B alone (without connecting the 43521A)
- When the 43521A (Downconverter Unit) is connected, DOWNCONV ON off is set to ON, and the frequency band is set to 10 MHz to 3 GHz

Sense Range

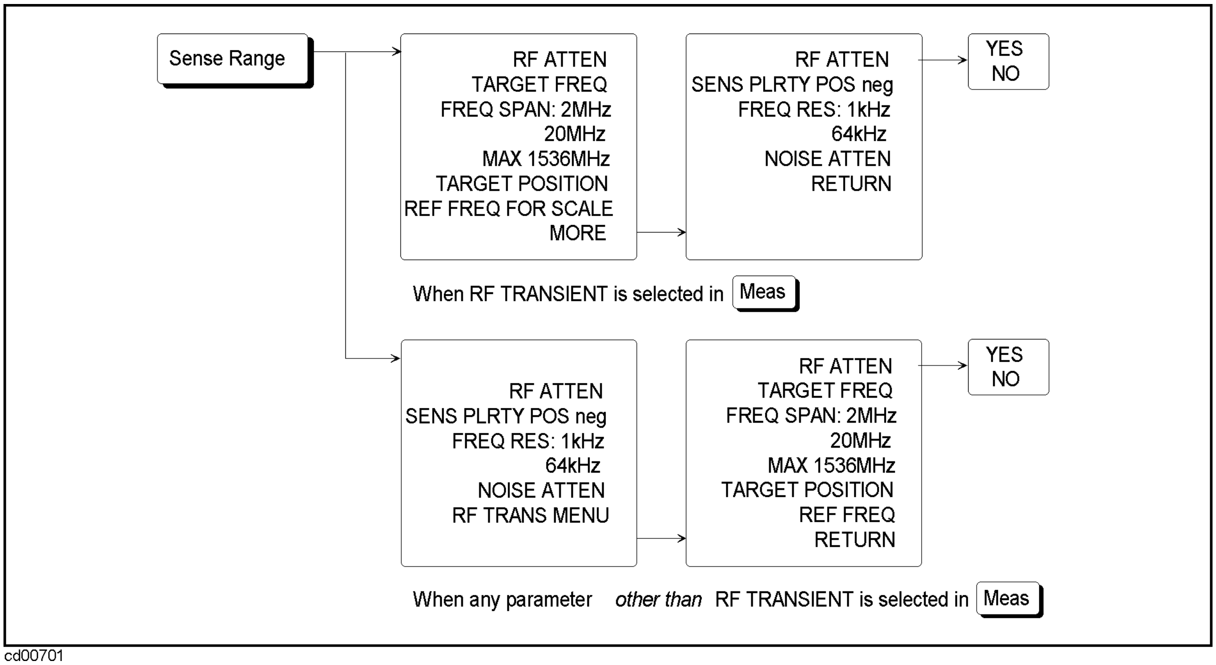


Figure 8-3. Softkey Menus Accessed from Sense Range Key (Analyzer Mode)

Sense Range Menu

RF ATTEN (RFATT <Value>)

Sets the input attenuator of the 4352B or the 43521A (Downconverter Unit). During measurement, `CAUTION: Set RF ATT 5dB Less` (or `CAUTION: Set RF ATT 5dB More`) may appear. In this case, use one of the following methods to change the input attenuator value until the CAUTION display disappears.

- Press Sense Range and RF ATTEN. The current input attenuator value is displayed as `RF ATTEN xx dB`. Press the ⇩ key or the ⇧ key to change the input attenuator value.
- Press Sense Range and RF ATTEN. The current input attenuator value is displayed as `RF ATTEN xx dB`. Use the numeric entry keys to change the input attenuator value in steps of 5 dB.

The input attenuator of the 4352B and that of the 43521A provide 0 dB to 25 dB and 0 dB to 35 dB, respectively in steps of 5 dB. Therefore, you cannot specify a value that is not a multiple of 5 dB.
In the following cases, the setting is applied to the input attenuator of the 4352B.

- When using the 4352B alone (without connecting the 43521A)
- When the 43521A (Downconverter Unit) is connected, DOWNCONV ON off is set to ON, and the frequency band is set to 10 MHz to 3 GHz

If DOWNCONV ON off is set to ON and the frequency band is set to a range other than 10 MHz to 3 GHz, the setting is applied to the input attenuator of the 43521A.
If you try to make a setting of 0 dB, the message `MAXIMUM RF INPUT POWER IS 19dBm FOR 0dB ATTEN, CONTINUE?` may appear. After checking that the RF input is 19 dBm or less, press Yes.

If it is greater than 19 dBm, press `no`. If you enter a value larger than 19 dBm when the input attenuator is set 0 dB, the 4352B or the 43521A may be damaged.

`SENS PLRTY POS neg` (SENSPOL POS|NEG)

Sets the polarity (gradient df/dv) of the frequency vs. control voltage characteristics of the DUT. If the frequency increases as the control voltage increases, select `POS`; if it decreases, select `NEG`. There are 2 purposes of setting the polarity.

- To decrease the number of times the frequency of the external signal source is changed during measurement to shorten the measurement time.
- To grasp the measurement frequency correctly to make correct measurement.

If you use the 4352B alone (not using the 43521A) or if you use the 43521A within the frequency band of 10 MHz to 3 GHz, this polarity setting is valid only when the frequency vs. control voltage characteristics measurement is performed and the frequency resolution (`FREQ RES`) is set to 1 kHz. If the frequency resolution (`FREQ RES`) is set to 64 kHz, this polarity setting is not used. If the 43521A (Downconverter Unit) is used and the frequency band is not the range of 10 MHz to 3 GHz, this polarity setting takes effect, regardless of the frequency resolution setting, for the RF power vs. control voltage characteristics measurement and the frequency vs. control voltage characteristics measurement. The 4352B, if the frequency changes in the direction opposite to this polarity setting, displays an error (65 No Downconverter RF Output; Do Signal Search) to avoid wrong measurement. In this case, check the polarity setting again or perform the signal search (`SIGNAL SEARCH`) to set the nominal frequency (`NOMINAL FREQ`).

`FREQ RES: 1kHz` (FCOUN RES1KHZ)

Selects 1 kHz frequency resolution in frequency/tuning sensitivity measurements.

`64kHz` (FCOUN RES64KHZ)

Selects 64 kHz frequency resolution in frequency/tuning sensitivity measurements.

`NOISE ATTEN` (NATT <Value>)

Specifies the attenuation for noise measurement in phase noise measurements.

`RF TRANS MENU`

Displays the frequency transient measurement menu. If the frequency transient measurement (Meas, `RF TRANSIENT`) has been selected already, pressing Sense Range directly displays the frequency transient measurement menu and this key is not displayed.

`TARGET FREQ` (TRTARG <value>)

Sets the target frequency (frequency that is finally reached) in the frequency transient measurement. Pressing this key displays the current setting value on the screen, as TARGET FREQUENCY x.xx GHz. Use the numeric entry keys to change the value. If a value out of the range of `FREQ BAND [xx-xx]` is entered, it is rounded to a value within the range. Even if the frequency band is the range of 10M to 3 GHz, you cannot specify a value of less than 100 MHz. The setting resolution is 100 kHz. Changing this target frequency may cause the measurement maximum and minimum frequencies to change or cause the frequency span and the frequency resolution to change.

FREQ SPAN 2MHz (TRSPAN TS2MHZ)

Sets the frequency span in the frequency transient measurement to 2 MHz. The frequency resolution is 50 Hz. The difference between the minimum frequency and the maximum frequency to be measured is 2 MHz. Depending on the minimum and maximum frequencies you want to measure, enter the target frequency and the target position value to the 4352B to set the measurement range. If you need more information, see "2-1. Relationship between hardware and setting in transient measurement" in Appendix C.

20MHz (TRSPAN TS20MHZ)

Sets the frequency span in the frequency transient measurement to 20 MHz. The frequency resolution is 500 Hz. The difference between the minimum frequency and the maximum frequency to be measured is 20 MHz. Depending on the minimum and maximum frequencies you want to measure, enter the target frequency and the target position value to the 4352B to set the measurement range. If you need more information, see "2-1. Relationship between hardware and setting in transient measurement" in Appendix C.

MAX xxxxMHz (TRSPAN TSMAX)

If you use the 4352B alone (not using the 43521A) or if you use the 43521A within the frequency band of 10 MHz to 3 GHz, the actual frequency span is determined by the combination of the entered target frequency (TARGET FREQ) and target position (TARGET POSITION). First, select all bands that contain the target frequency from 16 measurement frequency bands in Table 8-1, and calculate the target frequency position (position value %) in each band. Compare these position values [%] with the entered target position value (xx%), and select the band that contains the nearest position. The measurement is performed using the maximum and minimum frequencies, the frequency span, and the frequency resolution of the measurement frequency band (see Table 8-1). Also, the value calculated in the measurement frequency band is used as the target position value (xx%).

Table 8-1.
Available measurement frequency bands when MAX xxxxMHz is selected

Measurement frequency band number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Maximum frequency (MHz)	192	384	576	768	960	1152	1354	1536	1728	1920	2112	2304	2496	2688	2880	3000
Minimum frequency (MHz)	64	128	192	256	320	384	448	512	576	640	704	768	832	896	960	1024
Frequency span (MHz)	128	256	384	512	640	768	896	1024	1152	1280	1408	1536	1664	1792	1920	2048
Frequency resolution (kHz)	3.2	6.4	9.6	12.8	16	19.2	22.4	25.6	28.8	32	35.2	38.4	41.6	44.8	48	51.2

On the other hand, if the 43521A (Downconverter Unit) is connected and the frequency band is set to a range other than 10 MHz to 3 GHz, the frequency span is 512 MHz and the frequency resolution is 12.8 kHz. The measurement maximum and minimum frequencies are automatically calculated from the frequency span of 512 MHz, the entered target frequency, and the target position value.
If you need more information, see "2-1. Relationship between hardware and setting in transient measurement" in Appendix C.

TARGET POSITION (TRTPOS <value>)

Pressing this key displays the current setting value on the screen, as TARGET POSITION RATIO xx% FREQ SPAN. Use the numeric entry keys to change the value. Set the position of the target frequency within the frequency span (minimum frequency to maximum frequency) in %. After selecting the frequency span, determine the minimum frequency and the maximum frequency you want to measure. Assuming that the minimum frequency is 0% and the maximum frequency is 100%, calculate the position value of the target frequency as shown below and enter it. Values you can enter range from 5 to 95% (in steps of 5%).

```
Target position value[%]
 = (target frequency - minimum frequency) / frequency span × 100
```

If you select the frequency span of 2 MHz or 20MHz, the frequency span is 2 MHz or 20 MHz, respectively. If you select frequency span MAX, connect the 43521A (Downconverter Unit), and set the frequency band to a range other than 10 MHz to 3 GHz, the frequency span is 512 MHz. In the following cases, depending on the measurement frequency band used for the measurement, the frequency span is determined. Target position values you can set may be restricted by the frequency span and the target frequency.

- When you use the 4352B alone (not using the 43521A) and select frequency span MAX xxxxMHz.
- When you connect the 43521A (Downconverter Unit) and select the frequency band of 10 MHz to 3 GHz and frequency span MAX xxxxMHz.

If you need more information, see MAX xxxxMHz in this chapter and “2-1. Relationship between hardware and setting in transient measurement” in Appendix C.

REF FREQ FOR SCALE (TRREF <Value>)

Sets the reference frequency to display frequency transient measurement data. Use the numeric entry keys to enter the value.
The number of digits to display the frequency at each measurement point is up to 6.5. Therefore, if you measure frequency transient characteristics in a higher resolution (for example, 50 Hz), the number of frequency display digits may be insufficient. In this case, enter a reference frequency to use the difference between the reference frequency and the actually measured frequency value as trace information at each point, which provides a higher frequency measurement resolution. Specify a reference frequency using digits of 100 MHz or higher. For measurements that do not require reading resolution of 6 digits or higher, you do not need to set this reference frequency. For details, see “2-3. Setting a reference frequency (REF FREQ FOR SCALE)” in Appendix C.

Specifies the reference frequency for frequency transient data. See Appendix C for details.

Bw/Avg

Bw/Avg →	AVERAGING RESTART
	AVERAGING on OFF
	AVERAGING FACTOR
	VIDEO BW
	RES BW
	NOISE BW
	NOISE PLL AUTO wide
	SENSE APERTURE

Figure 8-4. Softkey Menus Accessed from Bw/Avg Key (Analyzer Mode)

Bw/Avg Menu

AVERAGING RESTART (AVERREST)

Resets the sweep-to-sweep averaging function, and restarts the sweep count at 1 at the beginning of the next sweep. The sweep count is displayed at the left-hand side of the screen.

AVERAGING on OFF (AVER OFF|0|ON|1)

Turns the trace averaging function ON or OFF. When the averaging function is ON, "Avg" appears together with the trigger count in the status display area on the left-hand side of the screen. Whenever an instrument state change affecting the measurement data is made, the trigger for averaging is reset to 1.

Averaging starts at count 1 when you turn ON the averaging function for the first time, or when you restart this function using AVERAGING RESTART. Measurement data is averaged and the displayed data is updated each time the measurement is complete, until the count reaches the specified averaging factor. The trigger count appears below "Avg" in the status display area. The trigger count is incremented by 1 before each measurement. When the count reaches the specified averaging factor, the measurement data continues to be updated, weighted by that averaging factor.

AVERAGING FACTOR (AVERFACT <Value>)

Specifies the averaging factor (number of times for averaging). The allowable range of values you can specify for this factor varies depending on the measurement item selected.

VIDEO BW (VBW <Value>)

Changes the setting of the post-detection filter and sets the video bandwidth. This setting is valid only for the linear sweep in the phase noise vs. offset frequency characteristics measurement and the spectrum measurement. Pressing this softkey displays the current setting on the screen, as VIDEO BAND WIDTH xxxHz. Use the ⇩ (or ⇧) key or the numeric entry keys to change the value. Values you can set follow the 1-3 stepping rule, that is, they can be 1/1, 1/3, 1/10, 1/30, 1/100, or 1/300 of the resolution bandwidth (RES BW). If the resolution bandwidth is changed, this value may change automatically. The valid setting ranges from 3 mHz to 3 kHz. When an input value does not follow the 1-3 stepping rule, it is rounded to the nearest valid value.

[Bw/Avg] (Analyzer Mode)

RES BW (BW <Value>)

Sets the resolution bandwidth. This setting is valid only for the linear sweep in the phase noise vs. offset frequency characteristics measurement and the spectrum measurement. Narrowing the resolution bandwidth increases the S/N ratio. Pressing this softkey displays the current setting on the screen, as RES BANDWIDTH xxxHz. Use the [⇓] (or [⇑]) key or the numeric entry keys to change the value. Values you can set follow the 1-3 stepping rule and range from 1 Hz to 3 kHz. When an input value does not follow the rule, it is rounded to the nearest valid value. If this bandwidth is changed, the video bandwidth (VIDEO BW) may change automatically.

NOISE BW (CNBW <Value>)

Specifies the converted noise bandwidth for phase noise measurements.

For the noise measurement internally performed in the 4352B, the resolution band width is automatically determined based on each offset frequency specified with SWEEP menu, and cannot be changed by the user. The noise level used for phase noise measurement is a converted value to the noise level at your specified range, by multiplying the value which you set with NOISE BW.

NOISE PLL AUTO wide (CNPLL AUTO|WIDE)

Selects AUTO to reduce the bandwidth (200 Hz) automatically or WIDE to maintain the wide bandwidth (1 kHz) if an offset frequency below 5 kHz in phase noise measurements.

Note

When measuring a DUT with high phase noise and the offset frequency < 5 kHz, the message 2nd PLL Unlocked might be displayed on the screen. This message indicates that 4352B is unable to make measurements. This condition occurs because the 2nd PLL in the 4352B is designed to automatically set the bandwidth to 1 kHz and 200 Hz respectively when the offset frequency is above and below 5 kHz. However, the 200 Hz bandwidth selected at the offset frequency < 5 kHz is too narrow to cover the high phase noise of the device.

When NOISE PLL auto WIDE is selected, the bandwidth of the built-in 2nd PLL is constantly set at 1 kHz regardless of the variations in the offset frequency. Therefore, the 4352B can make the proper measurement for a device with high phase noise, even when the offset frequency is below 5 kHz. Note, however, that the measurement data at an offset frequency below 5 kHz is only used as reference data if the noise bandwidth is set to WIDE.

SENS APERTURE (SENSAPER <Value>)

Specifies the aperture for tuning sensitivity measurements.

Definition of Tuning Sensitivity and Specifying Aperture

The tuning sensitivity is a differential curve of the F-V (output carrier frequency vs. DC control voltage) characteristic.

The 4352B determines tuning sensitivity based on the slope of the frequency curve. It uses frequency data to calculate frequency deviation (Δf) at the center of the specified DC control voltage aperture (Δv). From this deviation, it obtains the approximate value of a rate of change in frequency as a function of DC control voltage.

This approximate value represents tuning sensitivity on the assumption that the rate of change in frequency within the range of Δv is a linear function.

If the rate of change in frequency is not quite linear, changing DC control voltage steps can change the tuning sensitivity. In this case, increasing the aperture (Δv) can change the calculated slope. With a large aperture, minute changes in tuning sensitivity cannot be obtained. The apertures used in measurements absolutely must be known when you need to compare two or more tuning sensitivity data.

You must consider the trade-off between higher resolution and lower noise when determining a tuning sensitivity aperture. Noise can be reduced with an increase in aperture. However, increased aperture results in elimination of small changes in data for a smooth trace. Reducing the aperture aids detailed observation, but increases noise at the same time, making it difficult to make a proper distinction between noise and actual changes in frequency. Therefore, we recommend that a small value be specified as aperture first to accurately observe small changes and then a larger value be specified next to smooth out the trace. This makes it possible to properly determine the performance characteristics of a device.

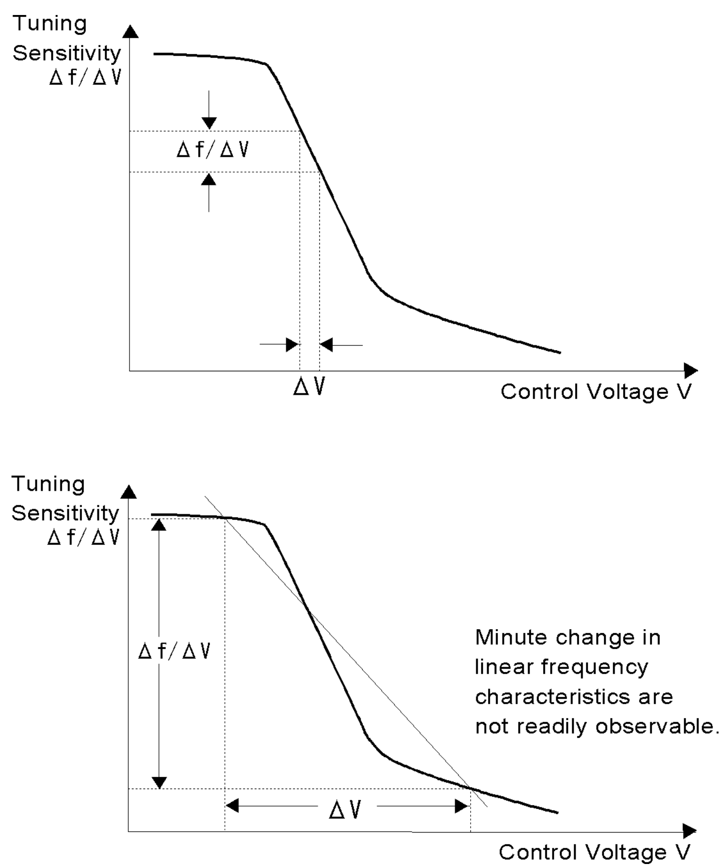


Figure 8-5. Specifying an Appropriate Aperture

Format

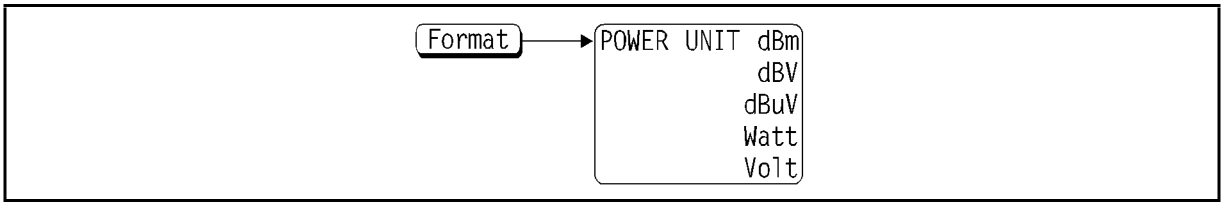


Figure 8-6. Softkey Menus Accessed from Format Key (Analyzer Mode)

Format Menu

Settings in this menu are applicable in RF power and spectrum measurements only.

`POWER UNIT:dBm` (POWUNIT DBM)

Selects "dBm" as the display unit for Power measurement data.

`dBV` (POWUNIT DBV)

Select "dBV" as the display unit for Power measurement data.

`dBuV` (POWUNIT DBUV)

Selects "dBμV" as the display unit for Power measurement data.

`Watt` (POWUNIT W)

Selects "Watt" as the display unit for Power measurement data.

`Volt` (POWUNIT V)

Selects "Volt" as the display unit for Power measurement data.

Display

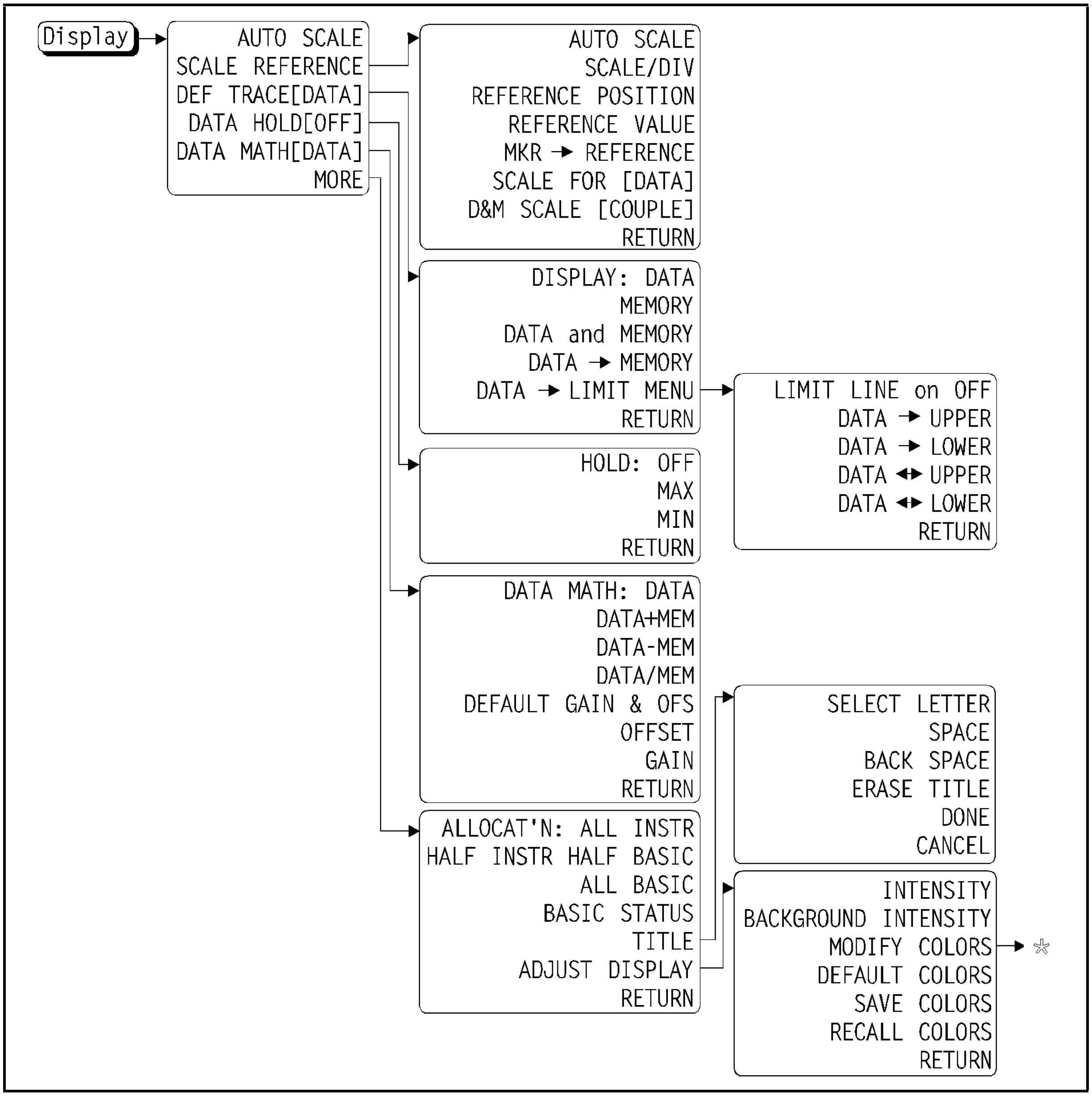


Figure 8-7. Softkey Menus Accessed from Display Key (Analyzer Mode:1/2)

Display (Analyzer Mode)

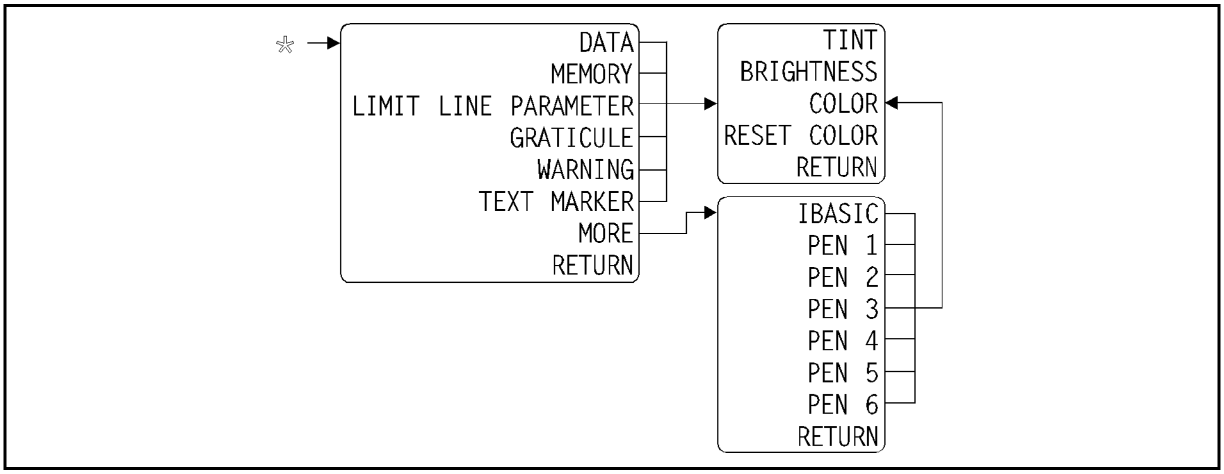


Figure 8-8. Softkey Menus Accessed from Display Key (Analyzer Mode:2/2)

Display Menu

AUTO SCALE (AUTO)

Displays an automatically scaled trace data (defined by SCALE FOR) with one keystroke. Sweep values are not affected, only scale and reference values. The 4352B optimizes the display scale to put all the displayed data onto the vertical GRATICULE.

SCALE REFERENCE

Displays the *Scale menu*.

DEF TRACE[DATA]

Displays the *Define Trace menu*.

DATA HOLD [ ] (DHOLD OFF|MAX|MIN)

The data hold function is used to keep the maximum or minimum value, obtained in the continuous measurement mode, displayed on the screen. The following three softkeys are displayed:

HOLD: OFF	Data hold function OFF.
MAX	Holds the maximum value obtained during the measurement.
MIN	Holds the minimum value obtained during the measurement.

DATA MATH [ ] (MATH DATA|DPLM|DMNM|DDVM)

Displays the following softkeys to select the data math type, and also displays the gain & offset definition keys. The selected type appears in the bracket ([ ]) of the softkey label. (For example, [DATA] appears if DATA is selected.)

DATA \ Turns OFF all data math functions.

DATA+MEM

Adds memory trace values to the measurement data trace values.

DATA-MEM

Subtracts the memory trace values from the measurement data trace values.

DATA/MEM

Divides the measurement data trace values by the memory trace values.

DEFAULT GAIN & OFS (DEFGO)

Resets the gain and offset to defaults (gain=1, offset=0).

OFFSET (DATOVAL <Value>)

Defines the offset for the data math function.

GAIN (DATGAIN <Value>)

Defines the gain for the data math function.

[Display] (Analyzer Mode)

The data math function allows you to display the calculation result by using one of this formula:
■ *GAIN* × *DATA* − *OFFSET*
■ *GAIN* × *MEMORY* − *OFFSET*
■ *GAIN* × (*DATA* + *MEMORY*) − *OFFSET*
■ *GAIN* × (*DATA* − *MEMORY*) − *OFFSET*
■ *GAIN* × (*DATA* / *MEMORY*) − *OFFSET*

MORE

Displays the *Display MORE menu*.

Scale Menu

AUTO SCALE

Displays an automatically scaled trace data (defined by SCALE FOR) with one keystroke. Sweep values are not affected, only scale and reference values. The 4352B optimizes the display scale to put all the displayed data onto the vertical GRATICULE.

SCALE/DIV (SCAL <Value>)

Changes the response value scale per division of the displayed trace.

REFERENCE POSITION (REFP <Value>)

Specifies the reference line position for the rectangular coordinates (with 0 at the bottom line of the GRATICULE and 10 at the tope line).

REFERENCE VALUE (REFV <Value>)

Changes the reference value (reference line position).

MKR→REFERENCE (MKRREF)

Makes the reference value equal to the marker's absolute value (regardless of the delta marker value). As a result, the marker moves to the reference line position.

SCALE FOR [DATA] (SCAF DATA|MEMO)

Selects whether to use the *Scale Reference menu* functions for the data or memory trace. Use the *Display menu* (available under [Display]) to select and display the data or memory trace.

D&M SCALE [COUPLE] (SCAC OFF|0|ON|1)

Selects whether to use the same definition of scale for the data and memory traces (COUPLE) or to use different definitions for these traces (UNCOUPLE). This function can be used for the trace selected and displayed using the *Display menu* (available under [Display]).

RETURN

Returns to the previous menu.

Define Trace Menu

DISPLAY: DATA (DISP DATA)

Displays the measurement data trace.

MEMORY (DISP MEMO)

Displays the memory trace. A warning message appears if no data has been stored.

DATA and MEMORY (DISP DATM)

Displays the data and memory traces.

DATA→MEMORY (DATMEM)

Stores the measurement data into the memory trace. The measurement data trace stored by this softkey can be used for data math function or display. The stored memory trace is automatically canceled if you change the number of measurements (NOP). In this case, only the data trace is displayed.

DATA→LIMIT MENU

Displays the *Data→Limit menu* as with DATA→LIMIT MENU (available under System).

RETURN

Returns to the previous menu.

Data→Limit Menu

LIMIT LINE on OFF (LIMILINE OFF|0|ON|1)

Turns the limit line display ON or OFF. This is the same as LIMIT LINE on OFF included in the *Limit menu*.

DATA→UPPER (DATLIMU)

Stores the data trace as the upper limit trace.

DATA→LOWER (DATLIML)

Stores the data trace as the lower limit trace.

DATA↔UPPER (EXDATLIMU)

Swaps between the current displayed data trace values and the upper limit trace values to check measurement values on the upper limit trace.

DATA↔LOWER (EXDATLIML)

Swaps between the current displayed data trace values and the lower limit trace values to check measurement values on the lower limit trace.

Display MORE Menu

ALLOCAT'N:ALL INSTR (DISA ALLI)

Displays the measurement screen over the entire display.

HALF INSTR HALF BASIC (DISA HIHB)

Displays the measurement screen on the upper half and the IBASIC screen on the lower half of the display.

ALL BASIC (DISA ALLB)

Displays the IBASIC screen over the entire display.

BASIC STATUS (DISA BASS)

Displays the IBASIC status information under the measurement screen. (Three status lines are located under the measurement screen.)

TITLE (TITL <Character String>)

Displays the *Character Input menu*. A title can be specified for each measurement item.

ADJUST DISPLAY

Displays the *Display Adjustment menu*.

RETURN

Returns to the previous menu.

Character Input Menu

SELECT LETTER

Selects the on-screen character pointed to by the arrow (↑). You can use the rotary knob to move the arrow. Use ⇧ and ⇩ to switch character sets on the screen.

SPACE

Inserts a space into the title.

BACK SPACE

Deletes the last character entered.

ERASE TITLE

Deletes the entire title.

DONE

Terminates the title entry and returns to the Display MORE menu.

CANCEL

Cancels the entry of title and returns to the Display MORE menu without any changes.

Display Adjustment Menu

INTENSITY (INTE <Value>)

Specifies the display intensity as a percentage of the highest brightness level.

BACKGROUND INTENSITY (BACI <Value>)

Specifies the background display intensity as a percentage of white level.

MODIFY COLORS

Displays the *First Color Adjustment menu*.

DEFAULT COLORS (DEFC)

Resets all color settings to the default settings (factory settings).

SAVE COLORS (SVCO)

Stores the modified version of the color settings into the backup memory.

RECALL COLORS (RECC)

Recalls the previously saved modified version of the color settings from the backup memory. RECALL COLORS appears only when a color setting has been saved.

RETURN

Returns to the previous menu.

First Color Adjustment Menu

DATA (COLO DATA)

Selects the data trace to change its color and displays the *Second Color Adjustment menu*.

MEMORY (COLO MEM)

Selects the memory trace to change its color and displays the *Second Color Adjustment menu*.

LIMIT LINE PARAMETER (COLO PARAM)

Selects the limit line to change its color and displays the *Second Color Adjustment menu*.

GRATICULE (COLO GRAT)

Selects the GRATICULE and some softkey labels (those with ON and OFF options) to change its color and displays the *Second Color Adjustment menu*.

WARNING (COLO WARN)

Selects warning messages to change their color and displays the *Second Color Adjustment menu*.

TEXT MARKER (COLO TEXT)

Selects texts (for example, softkey labels) other than measurement data to change its color and displays the *Second Color Adjustment menu*.

MORE

Displays the Change Pen Color menu.

RETURN

Returns to the previous menu.

Second Color Adjustment Menu

TINT (TINT <Value>)

Adjusts the tint of the selected on-screen information.

BRIGHTNESS (CBRI <Value>)

Adjusts the brightness of the selected color.

COLOR (COLOR <Value>)

Adjusts the whiteness of the selected color.

RESET COLOR (RSCO)

Resets all parameters of the selected color to defaults.

RETURN

Returns to the previous menu.

Change Pen Color Menu

IBASIC (COLO IBT)

Selects text on the IBASIC screen to change the color.

PEN1 (COLO PEN1)

Selects pen 1 to change the color.

PEN2 (COLO PEN2)

Selects pen 2 to change the color.

PEN3 (COLO PEN3)

Selects pen 3 to change the color.

PEN4 (COLO PEN4)

Selects pen 4 to change the color.

PEN5 (COLO PEN5)

Selects pen 5 to change the color.

PEN6 (COLO PEN6)

Selects pen 6 to change the color.

RETURN

Returns to the previous menu.

Menu

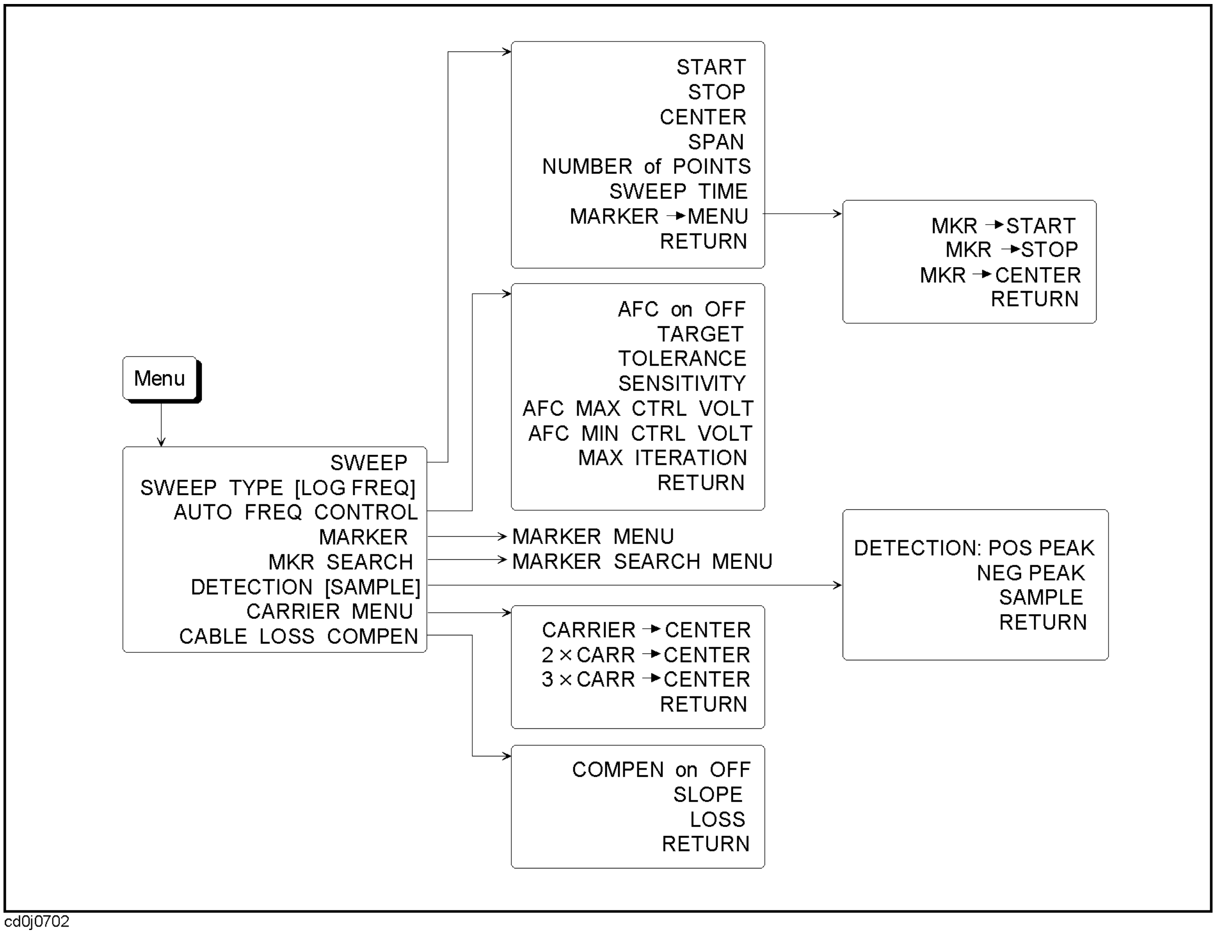


Figure 8-9. Softkey Menus Accessed from Menu Key (Analyzer Mode:1/3)

Menu Menu

SWEEP

Displays the *Sweep menu*.

SWEEP TYPE [ ] (SWPT LOGF|LINF)

Sets the sweep type. You can select the sweep type from log or linear, provided that you have selected the phase noise vs. offset frequency characteristics measurement. When you perform the noise integration measurement or the spurious measurement, select the linear sweep.

- [LOG FREQ] selects the log sweep.
- [LIN FREQ] selects the linear sweep.

AUTO FREQ CONTROL

Displays the *Automatic Frequency Control menu*.

MARKER

Displays the marker and the *Marker menu*.

MKR SEARCH

Displays the *Marker Search menu*.

DETECTION [SAMPLE] (DET POS|NEG|SAM)

Sets the detection mode. Selects it from the positive peak mode, the negative peak mode, or the sample mode.

[POS PEAK] selects the positive peak mode. This mode detects the maximum value from measurement values. Select it for the spurious measurement and the spectrum measurement.
[NEG PEAK] selects the negative peak mode. This mode detects the minimum value from measurement values. Select it for the spurious measurement and the spectrum measurement.
[SAMPLE] must be selected when you perform the linear sweep in the phase noise measurement.

CARRIER MENU

Displays the *Carrier menu*.

CABLE LOSS COMPEN

Displays the *Cable Loss Compensation menu*.

Sweep Menu

Specifies the following x-coordinates in the analyzer mode:

START (STAR <Value>)

Specifies the sweep start value.

STOP (STOP <Value>)

Specifies the sweep stop value. This softkey cannot be used in frequency transient measurements.

CENTER (CENT <Value>)

Specifies the sweep center value. This key is not available when you select the frequency transient measurement or the LOG sweep in the phase noise measurement. Pressing this key displays the current setting, as CENTER xxxGHz. Use the numeric entry keys to enter the value. Changing the sweep start value (START), the sweep stop value (STOP), or the sweep span value (SPAN) causes this value to change.

SPAN (SPAN <Value>)

Sets the sweep time of the linear sweep. This key is not available when you select the LOG sweep in the phase noise measurement. Pressing this key displays the current setting, as SPAN xxxHz. Use the numeric entry keys to enter the value. Changing the sweep start value (START) or the sweep stop value (STOP) causes this value to change.

Menu (Analyzer Mode)

NUMBER of POINTS (POIN <Value>)

Specifies the number of measurement points per sweep. This number can be specified in RF power, frequency/tuning sensitivity measurements. In other measurements, you can only query the 4352B for this number.

SWEEP TIME (SWET <Value>)

Specifies the sweep time. The sweep time can be specified in RF power, frequency/tuning sensitivity, or phase noise measurements. In other measurements, you can only query the 4352B for this time.

MARKER→MENU

Displays the *Marker→ menu*.

RETURN

Returns to the previous menu.

Marker→ Menu

MKR→START (MKRSTAR)

Specifies the X-coordinate value of the marker reading as the sweep parameter start value.

MKR→STOP (MKRSTOP)

Specifies the X-coordinate value of the marker reading as the sweep parameter stop value. This softkey cannot be used in frequency transient measurements.

MKR→CENTER (MKRCENT)

Specifies the X-coordinate value of the marker reading as the sweep parameter center value. This softkey cannot be used in phase noise or frequency transient measurements.

RETURN

Returns to the previous menu.

Automatic Frequency Control Menu

This menu controls the settings for the automatic frequency control function. The automatic frequency control function can automatically and quickly set/maintain the DUT output frequency to your specified target frequency. It does this by controlling the internal DC control voltage and using the measurement results obtained by its internal frequency counter. This function can be used only in phase noise or spectrum measurements.

Note

The automatic frequency control function starts immediately before measurement starts. During the entire measurement, the DC control voltage is kept constant. Therefore, the DC control voltage level is not changed even if the actual frequency is shifted or changed during the measurement.
Be sure to take this into consideration for measurements with long measurement time conditions. For example, the specified averaging factor might have problems due to the DC power/control voltage fluctuation.

AFC on OFF (AFC OFF|0|ON|1)

Turns the automatic frequency control function ON or OFF.

TARGET (AFCTARG <Value>)

Specifies the target frequency in Hz.

TOLERANCE (AFCTOL <Value>)

Specifies the tolerance limits between the target frequency and the actual measured frequency in Hz.

SENSITIVTY (AFCSENS <Value>)

Specifies the approximate tuning sensitivity of the DUT in Hz/V.

AFC MAX CTRL VOLT (AFCMAXV <Value>)

AFC MIN CTRL VOLT (AFCMINV <Value>)

These two softkeys specify the maximum and minimum DC control voltage levels for use with the automatic frequency control function. Note that the value specified with MAX CTRL VOLTAGE , MIN CTRL VOLTAGE (available under DC Control) has priority over the value specified with AFC MIN CTRL VOLT .

MAX ITERATION (AFCITER <Value>)

Maximum iteration for the DC control voltage-setting loop cycles. The measurement and calculation is repeated attempting to determine the optimum control voltage level for the target frequency until the number of this loop cycles reaches the value specified here. A value from 1 to 999 can be entered.

RETURN

Returns to the previous menu.

Menu (Analyzer Mode)

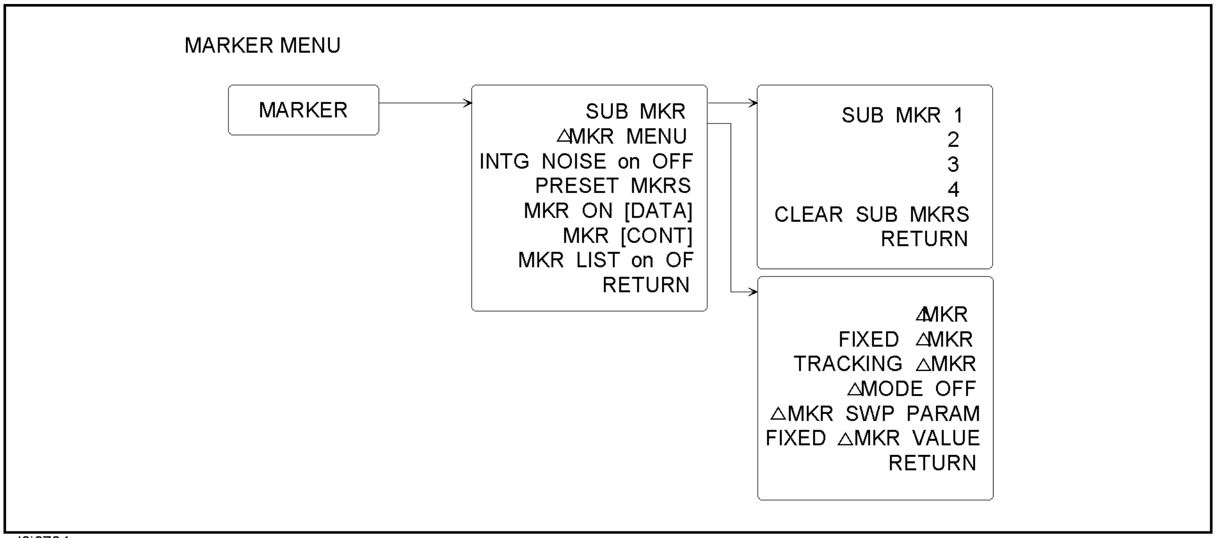


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Figure 8-10. Softkey Menus Accessed from Menu Key (Analyzer Mode:2/3)

Marker Menu

SUB MKR

Displays the *Sub-marker menu* used to turn on the sub-marker.

ΔMKR MENU

Displays the Δ *Marker menu* used to calculate the difference between the marker and Δ marker readings.

INTG NOISE on OFF (MEAINOIS OFF|0|ON|1) (INTGNOIS?)

Sets the noise integration function in the phase noise measurement to ON/OFF. In the ON setting, the measured noise values are integrated and displayed. This function is available only for the linear sweep. If the partial search function (Menu, MKR SEARCH, SEARCH RANGE, PART SEARCH on OFF) is OFF, measured values in the entire screen trace are integrated. If the partial search function is ON, measured values in the marker search range are integrated. The noise integration measurement can be displayed as the measurement data trace (Display, DEF TRACE, DISPLAY:DATA) only. The memory trace (MEMORY or DATA and MEMORY) cannot be displayed. If there is a spurious component within the range to be integrated, the correct value cannot be obtained. For the noise measurement, set the detection mode (Menu, DETECTION [SAMPLE]) to SAMPLE.

PRESET MKRS (PRSMKRS)

Turns all markers OFF.

MKR ON [ ] (MKRO DATA|MEMO)

Selects whether to use the marker on the data or memory trace.

[DATA]	Data trace
[MEM]	Memory trace

MKR [CONT] (MKRCONT OFF|0|ON|1)

Toggles between the continuous and discontinuous maker mode. MKR[CONT] interpolates between the measured points to allow the markers to be placed at any point on the trace. Displayed marker values are also interpolated. This is the default marker mode. MKR[DISCRETE] places markers only on the measured trace points as determined by the stimulus settings.

[DISCRETE]	The marker can only read values at measurement points determined based on x-coordinates.
[CONT]	Interpolates each interval between 2 adjacent measurement points so that the marker can read any value on the trace.

MKR LIST on OFF (MKRL OFF|0|ON|1)

Turns the marker list function ON or OFF. This function is used to display a list of the X- and Y-coordinates of all markers. In the Δ mode, X- and Y-coordinates of the Δ marker are also displayed.

RETURN

Returns to the previous menu.

Sub-marker Menu

SUB MKR 1 (SMKR1 OFF|0|ON|1)

2 (SMKR2 OFF|0|ON|1)

3 (SMKR3 OFF|0|ON|1)

4 (SMKR4 OFF|0|ON|1)

The above keys are used to display the sub-marker where the marker is currently displayed.

CLEAR SUB MKRS (CLRSMKRS)

Turns OFF the sub-marker.

RETURN

Returns to the previous menu.

△ Marker Menu

ΔMKR (DMKR ON)

Puts the Δ marker on the current position of the marker, and activates the Δ marker mode. The Δ marker appears as a small triangle (Δ). The X- and Y-coordinates of the marker and sub-marker readings on the screen are the difference between the actual reading of each marker and the Δ marker. At this time, "ΔMkr" appears at the upper right corner of the screen.

FIXED ΔMKR (DMKR FIX)

Sets a user-specified fixed Δ marker on the current position of the marker, and activates the fixed Δ marker mode. The stimulus and amplitude values can be set arbitrarily and can be anywhere in the display area. Like other markers, the fixed Δ marker is indicated by a small triangle (Δ), and the marker stimulus and measurement values are shown relative to this point. the notation "FxdΔ" is displayed at the top right corner of the GRATICULE.

TRACKING ΔMKR (DMKR TRAC)

Makes the active marker a Δ marker (tracking Δ marker), activates the tracking Δ marker mode. In this mode, the Δ marker automatically moves the active marker position. Thus it is easy to move the Δ marker position by moving the active marker with use of the rotary knob or SEARCH: PEAK. At this time, "TrkΔ" appears at the upper right corner of the screen.

ΔMODE OFF (DMKR OFF)

Turns the Δ marker mode OFF. When this mode is OFF, the marker and sub-marker readings are displayed in absolute values.

ΔMKR SWP PARAM (DMKRPRM <Value>)

Changes the X-coordinate of the fixed Δ marker reading.

FIXEDΔMKR VALUE (DMKRVAL <Value>)

Changes the Y-coordinate of the fixed Δ marker reading.

RETURN

Returns to the previous menu.

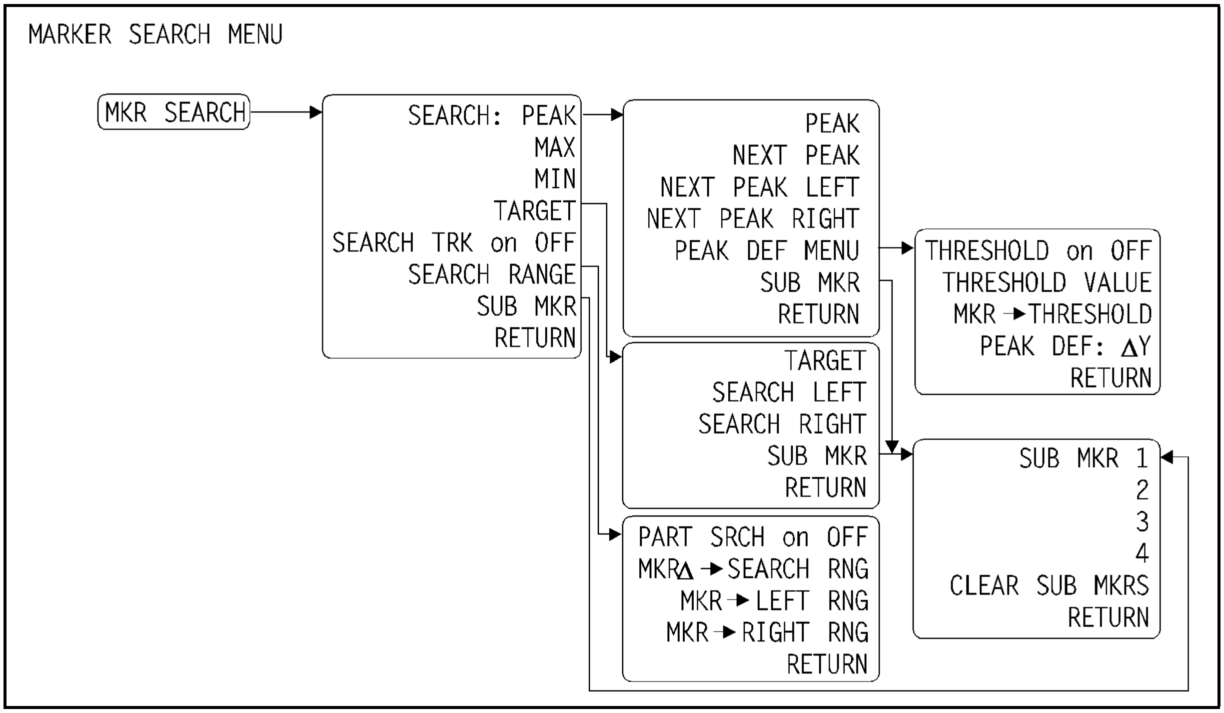


Figure 8-11. Softkey Menus Accessed from Menu Key (Analyzer Mode:3/3)

Marker Search Menu

SEARCH: PEAK (SEAM PEAK)

Moves the marker to the maximum/minimum peak and displays the *Peak menu* used to search for the next peak. The peak search function searches for the peak that matches the definition specified in the *Define Peak menu*. See the *Define Peak menu* for details on peak definitions.

MAX (SEAM MAX)

Moves the marker to the maximum Y-coordinate value on the trace.

MIN (SEAM MIN)

Moves the marker to the minimum Y-coordinate value on the trace.

TARGET (SEAM TARG)

Moves the marker to the specified target point on the trace and displays the *Target menu*. The *Target menu* is used to search to the left or right for other points when two or more target points are available.

SRCH TRACK on OFF (TRACK OFF|0|ON|1)

Turns the search tracking function ON or OFF. This function is used in conjunction with other search functions to search each new sweep.

Menu (Analyzer Mode)

SEARCH RANGE

Displays the *Search Range menu*.

SUB MKR

Displays the *Sub-marker menu* used to turn on the sub-markers.

RETURN

Returns to the previous menu.

Peak Menu

PEAK (SEAM PEAK)

Moves the marker to the maximum peak.

NEXT PEAK (SEANPK)

Moves the marker to the next maximum peak.

NEXT PEAK LEFT (SEANPKL)

Moves the marker to the maximum peak to the left of the present marker position.

NEXT PEAK RIGHT (SEANPKR)

Moves the marker to the maximum peak to the right of the present marker position.

PEAK DEF MENU

Displays the *Define Peak menu*.

SUB MKR

Displays the *Sub-marker menu* used to turn on the sub-markers.

RETURN

Returns to the previous menu.

Target Menu

TARGET (SEATARG <Value>)

The target value is displayed in the appropriate units for the current selected format. The default target value is −3. (The units vary depending on the current measurement item.)

In the Δ marker mode, the target value is displayed as a relative value with respect to the Δ marker. When all Δ makers are OFF, the absolute value of the target value is displayed.

SEARCH LEFT (SEAL)

Searches left for the next target value on the trace.

SEARCH RIGHT (SEAR)

Searches right for the next target value on the trace.

SUB MKR

Displays the *Sub-marker menu* used to put the sub-marker on the present marker position.

RETURN

Returns to the previous menu.

Search Range Menu

PART SRCH on OFF (PARS OFF|0|ON|1)

Turns the partial search function ON or OFF. The search range is defined by two small triangles (△) at the bottom of the GRATICULE. If no search range is defined, the search range is the entire trace.

MKRΔ→SEARCH RNG (SEARSTR)

Specifies the range between the marker and the Δ readings as the partial search range.

MKR→LEFT RNG (SEARSTRL)

Specifies the current marker position as the left-hand boundary of the partial search range.

MKR→RIGHT RNG (SEARSTRR)

Specifies the current marker position as the right-hand boundary of the partial search range.

RETURN

Returns to the previous menu.

Define Peak Menu

THRESHOLD on OFF (PKTHRE OFF|0|ON|1)

Turns the threshold ON or OFF. When the threshold is ON, the 4352B searches only peaks whose levels are higher than the threshold value.

THRESHOLD VALUE (PKTHVAL <Value>)

Specifies the threshold value.

MKR→THRESHOLD (MKRTHRE)

Specifies the Y-coordinate of the current marker position as the threshold value.

PEAK DEF: ΔY (PKDLTY <Value>)

Specifies the peak ΔY value used to define peaks.

(Menu) **(Analyzer Mode)**

RETURN

Returns to the previous menu.

Carrier Menu

This menu can be only used in spectrum measurements.

CARRIER→CENTER (CARRCENT)

Moves the carrier frequency to the center of the X-axis.

2×CARR→CENTER (CARR2CENT)

Moves the 2nd harmonic frequency of the carrier to the center of the X-axis.

3×CARR→CENTER (CARR3CENT)

Moves the 3rd harmonic frequency of the carrier to the center of the X-axis.

RETURN

Returns to the previous menu.

Cable Loss Compensation Menu

This menu is used to make settings or adjustments associated with the cable loss compensation function. When this function is ON, the 4352B compensates for level loss on a cable using the assumption that the cable characteristics are as shown in Figure 8-12. Level loss on a cable is defined in terms of the frequency domain.

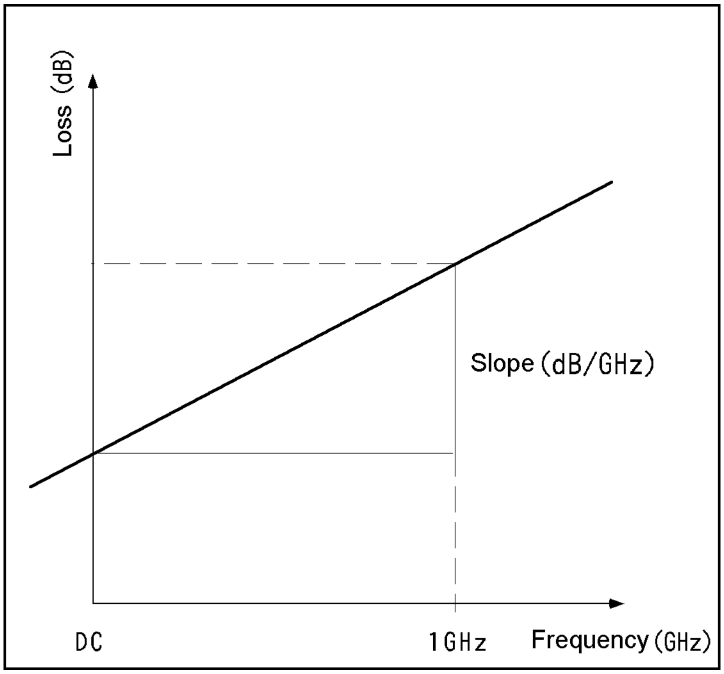


Figure 8-12.
Cable Frequency Characteristics for Level Loss Used by the Cable Loss Compensation Function

COMPEN on OFF (LCOMP OFF|0|ON|1)

Turns the cable loss compensation function ON or OFF. This softkey can be used in RF power measurements and spectrum measurements.

SLOPE (SLOPE <Value>)

Specifies the slope of the cable level loss frequency characteristics (loss/frequency) in dB/GHz. If the DC loss (value specified with LOSS) is 0, the loss at 1 GHz can be directly entered for SLOPE. (See Figure 8-12.)

LOSS (LOSS <Value>)

Specifies the cable loss at DC (0 Hz) in dB.

RETURN

Returns to the previous menu.

9

Control Block

This chapter describes all the functions available with the Control block. Keys provided in this block can be used to select settings associated with signals and triggers used for measurements. The following list describes the function of each key.
In the following menus, softkeys with "Tester Mode" or "Analyzer Mode" shown on their right are displayed only in that mode.

[Mod]	Specifies the modulation signal.
[RF/LO]	Selects settings associated with controlling an external signal generator.
[Trigger]	Selects the trigger mode. Selects the trigger source.
[DC Control]	Specifies the DC control voltage.
[DC Power]	Specifies the DC power voltage.

In the following pages, those keys with "Tester Mode" or "Analyzer Mode" shown on the right of the key label are displayed only in that mode.

Mod

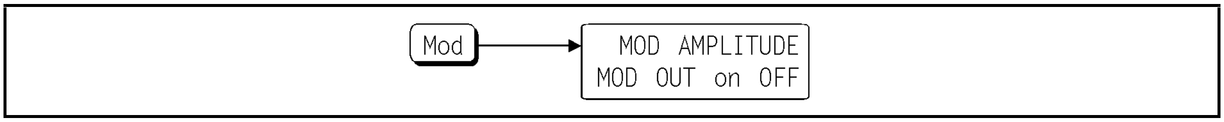


Figure 9-1. Softkey Menus Accessed from Mod Key

Mod Menu

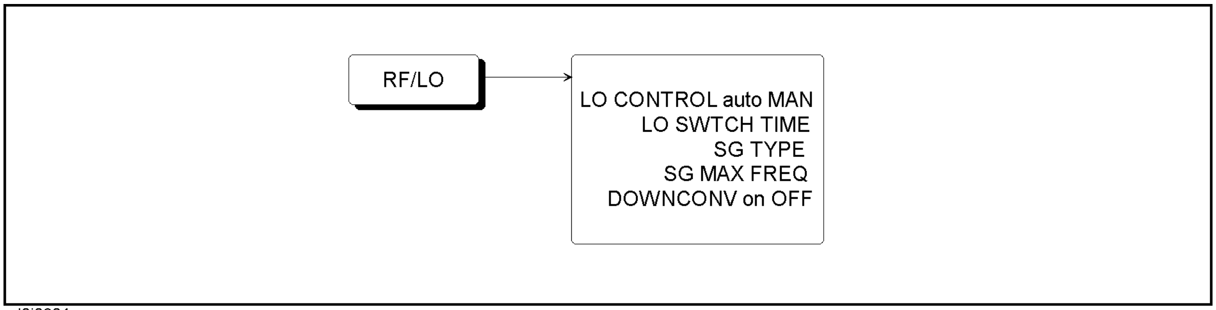
MOD AMPLITUDE (MODAMP <Value>)

Specifies the amplitude of the modulation signal in Vrms.

MOD OUT on OFF (MODO OFF|0|ON|1)

Turns the modulation signal output ON or OFF.

RF/LO



cd0j0804

Figure 9-2. Softkey Menus Accessed from RF/LO Key

RF/LO Menu

Note

All settings selected under RF/LO are stored even when the 4352B is turned OFF. Therefore, you do not need to select the same settings again unless you change the external signal generator integrated with the 4352B.

`LO CONTROL auto MAN` (LOAUTO OFF|0|ON|1)

Turns the external signal generator automatic control function ON or OFF. When `LO CONTROL AUTO man` is selected, the external signal generator is automatically controlled to produce a signal at the frequency required by the 4352B via GPIB. This function can be turned ON when one of the following measurement items is selected:

Tester Mode

- RF frequency (resolution: 1 kHz)
- FM deviation
- C/N ratio

Analyzer Mode

- Frequency/Tuning sensitivity (resolution: 1 kHz)
- Phase noise
- Frequency transient (heterodyne mode)
- Spectrum

When the external signal generator automatic control function is ON, the 4352B functions as follows:

- The external signal generator is reset if Preset is pressed.
- When the SG type is changed with `SG TYPE`, the current connected external signal generator is reset.

Be sure to specify the desired signal generator before selecting `LO CONTROL AUTO man`.

Note The external signal generator is automatically set to a specific frequency immediately before the measurement starts. During the measurement, the external signal generator maintains the specified frequency. Thus, the 4352B automatic control function does not operate the external signal generator during the measurement (Note that this is not the case for the frequency/tuning sensitivity measurements in the analyzer mode).
Be sure to take this into consideration for measurements that have long measurement time conditions. For example, the specified averaging factor might be a problem due to the DC power/control voltage fluctuations.

LO SWTCH TIME (LOSWT <Value>)

Specifies the time that the 4352B waits to elapse for the external signal generator to stabilize at a specific frequency. This softkey can be used when LO CONTROL AUTO man is selected. The duration of the wait time varies depending on the external signal generator.

SG TYPE (SGTYPE <Value>)

Specifies the external signal generator type with a number from 1 to 4.

Type No.	External Signal Generator
1	8643A, 8644B, 8664A, 8665A, 8665B
2	8642A/B, 8656B, 8657B, 8662A, 8663A
3	8648B/C, E8241A, E8244A, E8251A, E8254A
4	See the description on the next page.

Table 9-1 lists GPIB commands used for external signal generators.

Table 9-1.
GPIB Commands Used to Set Up the External Signal Generators

Type No.	Frequency	Amplitude	RF Output ON/OFF	Reset
1	FREQ XXXMHz	AMPL XXXDBM	AMPL:STAT ON	*RST
2	FR XXXMZ	AP XXX DM	R3(ON), R2(OFF)	CLEAR 7XX
3	FREQ:CW XXXMHZ	POW:AMPL XXXDBM	OUTP:STAT ON	*RST

Select 4 for SG TYPE if you wish to use an external signal generator other than those listed above. In this case, use SGCMD, one of the GPIB commands, so that the 4352B stores the GPIB command for setting up the external signal generator. This allows the external signal generator to be automatically controlled by the 4352B. See the *4352B GPIB Programming Manual* for details.
Set the RF output of the external signal generator to +10 dB. This can be done manually or using GPIB commands after power ON.

SG MAX FREQ

Lets you enter the maximum frequency of the connected external signal source using the numeric entry keys. You can enter it only when the 43521A (Downconverter Unit) is connected and the (DOWNCONV ON off) is set to ON. Depending on the entered frequency, a frequency band menu is automatically selected as follows. You can check the selected FREQ BAND menu by pressing (Meas) and FREQ BAND [ ] in this order.

Entered frequency	Selected band menu
Less than 4.2 GHz	10 MHz to 6.6 GHz (3 steps)
Equal to or greater than 4.2 GHz and less than 6.0 GHz	10 MHz to 9.0 GHz (4 steps)
Equal to or greater than 6.0 GHz	10 MHz to 12.6 GHz (3 steps)

Measurements are performed within the selected FREQ BAND range. After you change this maximum frequency, use Meas and `FREQ BAND [ ]` to set FREQ BAND again.

`DOWNCONV ON off` (`DNCONV OFF|0|ON|1`)

Sets the downconverter to ON/OFF. When you make measurements with the 4352B connected to the 43521A (Downconverter Unit), set this setting to ON. If it is set to ON, "DwC" appears in the status indication area at the left of the LCD screen. In the following cases, if you try to set this key to ON, an error (`61 No Downconverter Unit Connected`) is displayed.

- When the 43521A is not connected (when the 12-bit I/O port on the 4352B's rear panel is not connected).
- When the 43521A is turned off.

Check the connection and the power supply. This setting is battery-backed. Therefore, even if you turn off the 4352B, the setting is maintained. However, if you turn on the 4352B with the 43521A not connected or the 43521A turned off, it is automatically set to OFF. If you make measurements using the 43521A with this setting OFF, compensation for frequency characteristics is not performed and, as a result, measured values may be inaccurate. When you make measurements using the 43521A, be sure to set this key to ON.

(Trigger)

(Trigger) Menu

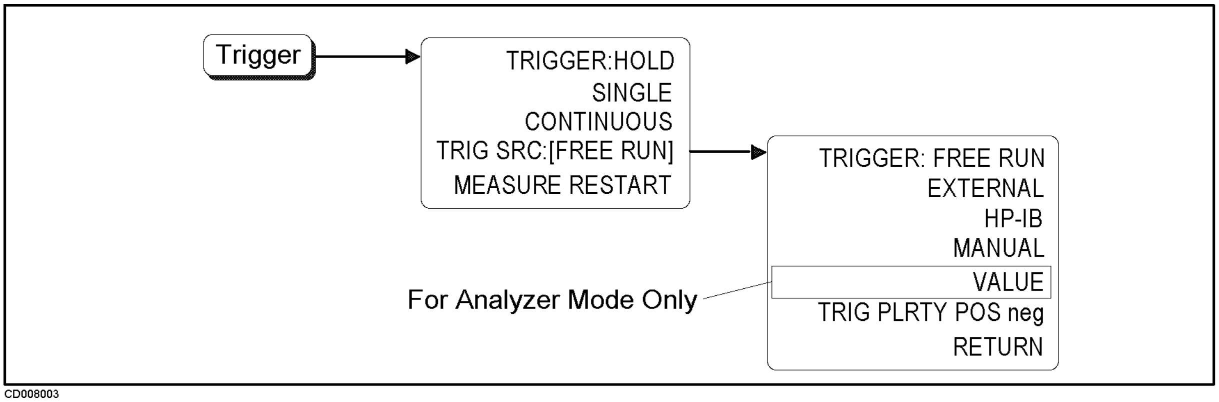


Figure 9-3. Softkey Menus Accessed from (Trigger) Key

TRIGGER:HOLD (HOLD)

Holds the on-screen information and stops the measurement and loading of data. At this time, "Hld" appears at the status display area on the left-hand side of the screen. This mode is called the **hold mode**.

Note

An "*" appearing in the status display area indicates that measurement conditions have been changed. In this case, press SINGLE to make a single measurement.

SINGLE (SING)

Makes a single measurement, and returns to the hold mode.

CONTINUOUS (CONT)

Selects the standard trigger mode in which measurements are continuously performed. Measurement data on the screen is updated with each measurement.

TRIG SRC:[FREE RUN]

Displays the *Trigger Source menu* used to select the trigger source.

MEASURE RESTART (REST)

Aborts the measurement currently in progress and restarts it. Use this softkey to update measurement data after having switched devices or changed measurement conditions.

When the averaging function is ON, MEASURE RESTART is effectively the same as AVERAGING RESTART.

When HOLD is selected as the trigger type, MEASURE RESTART executes a single measurement.

RETURN

Returns to the previous menu.

Trigger Source Menu

The following softkeys are used to specify the trigger source. When a trigger source type other than "FREE RUN" is selected, the 4352B enters the trigger wait state after having made all the necessary settings for the measurement. It starts a measurement when it receives a trigger input signal from the specified trigger source.

TRIGGER:FREE RUN (TRGS INT)

Selects the internal trigger.

EXTERNAL (TRGS EXT)

Selects the external trigger through the BNC on the rear panel.

GPIB (TRGS BUS)

Selects the trigger from GPIB.

MANUAL (TRGS MAN)

Selects the manual trigger.

VALUE (TRGS VAL) **(Analyzer Mode)**

Generates a trigger when the device output frequency reaches the specified frequency in frequency transient measurements. Use TRGVAL␣<*Value*> to specify the frequency at which to generate a trigger. Use TRIG PLRTY POS neg to select whether to generate a trigger when the device output frequency exceeds or falls below the specified frequency. This softkey can be only used in frequency transient measurements.

TRIG PLRTY POS neg (TRGP POS|NEG)

Selects whether to start a measurement at the leading or trailing edge of the input signal. This signal is applied through the external trigger terminal on the rear panel when an external trigger is selected.

POS neg (positive)	Starts measurement at the leading edge of TTL input signal.
pos NEG (negative)	Starts measurement at the trailing edge of TTL input signal.

When the value trigger function is ON in a frequency transient measurement, this softkey is used to select whether to generate a trigger when the device output frequency exceeds (POS) or falls below (NEG) the specified frequency.

DC Control

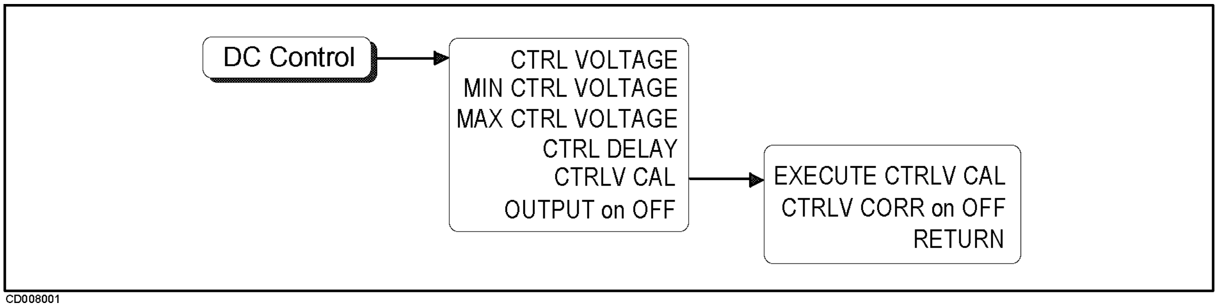


Figure 9-4. Softkey Menus Accessed from DC Control Key (Tester Mode)

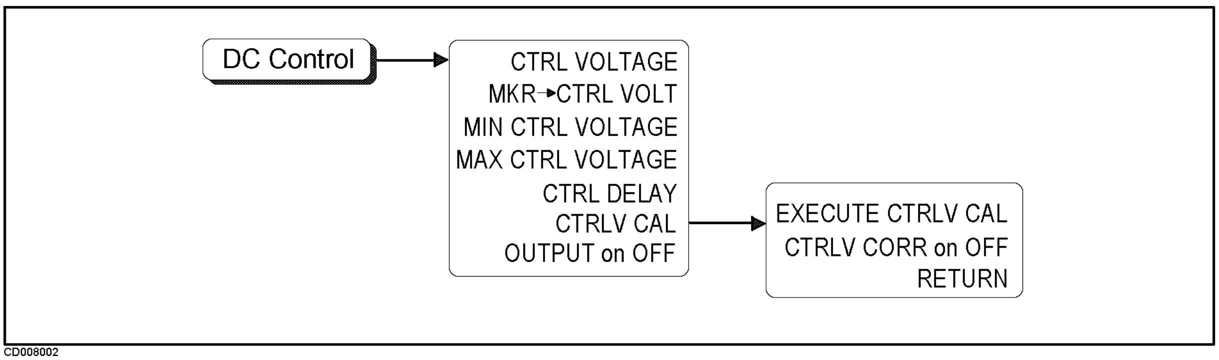


Figure 9-5. Softkey Menus Accessed from DC Control Key (Analyzer Mode)

DC Control Menu

CTRL VOLTAGE (VCTRL <Value>)

Specifies the DC control voltage level in V. This softkey cannot be used in RF power or frequency/Tuning Sensitivity measurements.

MKR → CTRL VOLT (MKRVCTRL) **(Analyzer Mode)**

Specifies the X-coordinate value of the marker reading as the control voltage level. This softkey is useful when you switch measurement items from one (in which the DC control voltage is used for the sweep) over to another (in which the DC control voltage is not used for the sweep). Using this softkey allows measurements to be performed with the DC control voltage set at the level specified by the marker. This softkey can be used in RF power or frequency/Tuning Sensitivity measurements.

MIN CTRL VOLTAGE (MINVCTRL <Value>)

Specifies the minimum DC control voltage level in volts. The DC control voltage level specified with CTRL VOLTAGE is ignored if it is below the level specified with this softkey. In this case, the DC control voltage level is automatically set at the minimum level.

MAX CTRL VOLTAGE (MAXVCTRL <Value>)

Specifies the maximum DC control voltage level in volts. The DC control voltage level specified with CTRL VOLTAGE is ignored if it is beyond the level specified with this softkey. In this case, the DC control voltage level is automatically set at the maximum level.

CTRL DELAY (CTRLDLY <Value>)

Specifies a wait time for the 4352B that corresponds to the response time of the device. The 4352B remains in the wait state until the RF output is stabilized after the DC control voltage is changed.

Caution You cannot use CTRL DELAY to specify a time interval below 10 ms.

CTRLV CAL **(Option 001 only)**

Displays the DC Control Voltage Calibration menu used for calibrating DC control voltage.

OUTPUT on OFF (VOUT OFF|0|ON|1)

Turns the DC control voltage ON or OFF.

Note When OUTPUT ON off is selected, the DC power voltage is also turned ON.

DC Control Voltage Calibration Menu (Option 001 only)

EXECUTE CTRLV CAL (CTRLVCAL)

Performs calibrating DC control voltage calibration. The calibration is applied only to the expanded DC control voltage range with the option 001. You should perform the calibration each time the instrument is powered for it loses effect after powering OFF.

CTRLV CORR on OFF (CTRLVCORR OFF|0|ON|1)

Enables or disables the compensation obtained from the DC control voltage calibration.

RETURN

Returns to the previous menu.

DC Power

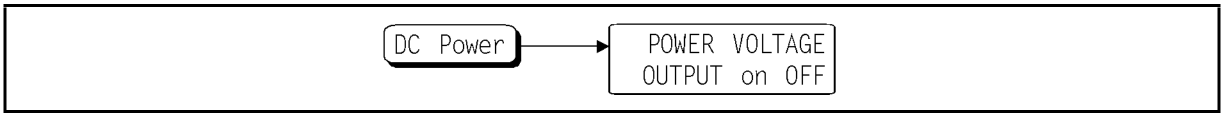


Figure 9-6. Softkey Menus Accessed from DC Power Key

DC Power Menu

POWER VOLTAGE (VPOW <Value>)

Specifies the DC power voltage level in V.

OUTPUT on OFF (VOUT OFF|0|ON|1)

Turns the DC power voltage ON or OFF.

Note When OUTPUT ON off is selected, the DC control voltage is automatically turned ON.

10

Instrument State Block

This chapter describes all the functions available that are not related to measurements. These functions include those used for setting the controller mode, GPIB addresses, real-time clock, Instrument BASIC, beeper, printer outputs, and 4352B status. It also describes functions used for saving measurement data onto disks and resetting the 4352B to defaults. The following list describes the function of each key.

[Copy]	Prints the screen image and displays operating parameters.
[Save/Recall]	Saves the 4352B settings and/or measurement data to and recalls them from the internal RAM disk memory or the floppy disk. It also can initialize the disk.
[System]	Controls Instrument BASIC.
	Changes the internal memory area.
	Adjusts the time on the internal real-time clock. (This clock is used to print the current time and date at the upper section of hard copies.)
	Turns the beeper ON or OFF.
	Specifies limit lines.
	Displays the service menu. (See the *Service Manual* for details.)
[Local]	Selects the GPIB mode and specifies addresses.
[Preset]	Resets the 4352B to the defaults (preset state).

In the following pages, those keys with “Tester Mode” or “Analyzer Mode” shown on the right of the key label are displayed only in that mode.

Copy

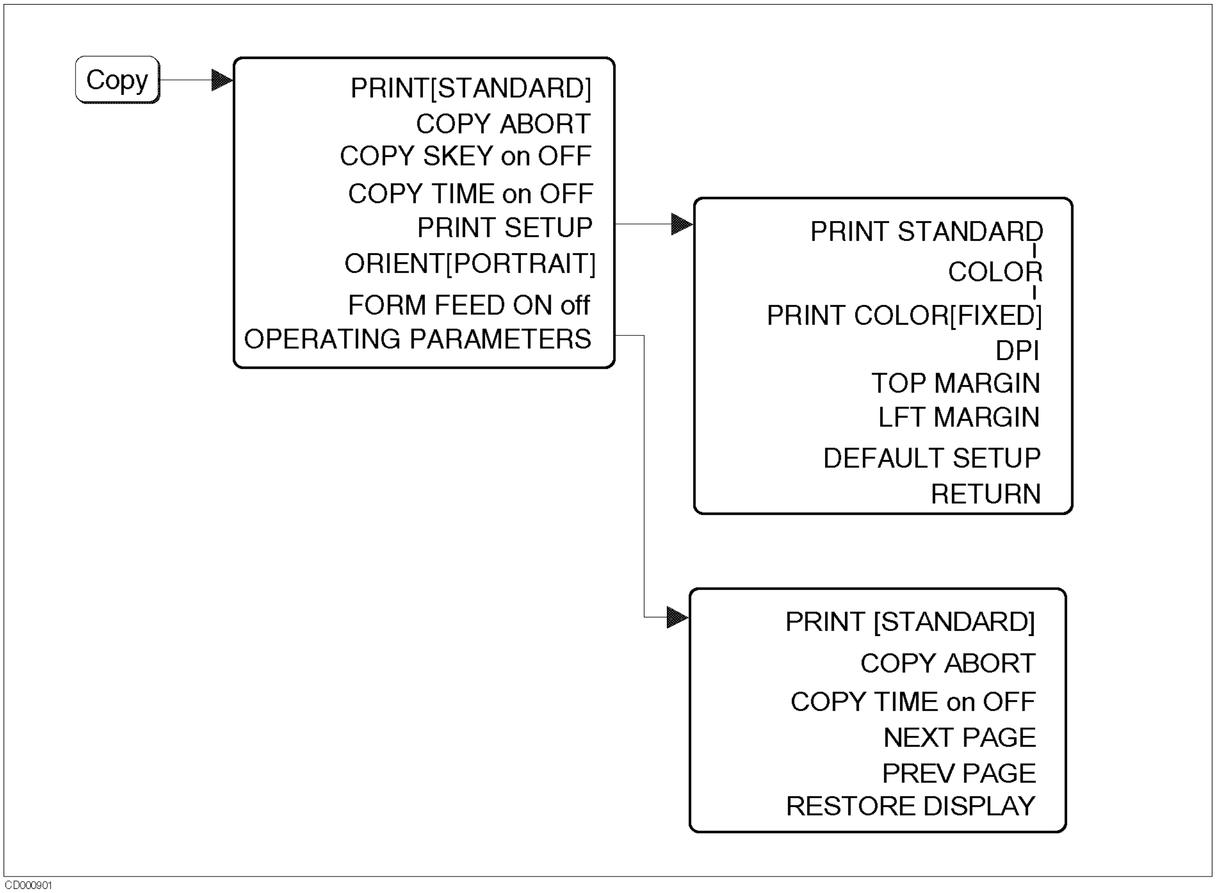


Figure 10-1. Softkey Menus Accessed from Copy Key

Copy Menu

PRINT [STANDARD] (PRINALL)

Prints the screen image. The type of the printer selected on the Print Setup menu is displayed on the softkey label.

STANDARD	The black and white printer is selected.
COLOR	The color printer is selected.

COPY ABORT (COPA)

Aborts the printing currently in progress.

COPY SKEY on OFF (PRSOFT ON|OFF)

Specifies whether to print out softkey labels by switching ON/OFF.

COPY TIME on OFF (COPT OFF|0|ON|1)

Turns the "time stamp" ON or OFF for a print out. When you select print, the time and date are printed out first, then the information on the display is printed. See the *Clock Setup Menu* for how to change the date or time of the internal clock.

PRINT SETUP

Displays the *Print Setup menu*. This menu allows the screen image of on-screen information to be printed in graphical or tabular form.

ORIENT [PORTRAIT] (LANDSCAPE)

Specifies the orientation of printer sheets. If your printer does not support landscape printing, this setting is ignored.

PORTRAIT	Portrait orientation
LANDSCAPE	Landscape orientation

FORM FEED ON off (FORMFEED ON|OFF)

Specifies whether to deliver a sheet after one screen is printed out by switching ON/OFF. When the sheet orientation is specified to LANDSCAPE, the FORMFEED setting is ignored and sheets are always ejected after each screen printout.

OPERATING PARAMETERS (OPEP)

Displays the *Screen Menu*, which displays the current operating parameters and prints them in a tabular form.

Print Setup Menu

PRINT:STANDARD (PRIS)

Selects the default settings for printing.

COLOR (PRIC)

Selects color printing. This setting is only valid when a color printer is used. PRINT [COLOR] does not work with a black and white printer.

PRNT COLOR [FIXED] (PRICFIXE, PRICVARI)

Toggles between [FIXED] and [VARIABLE] for printing color. If FIXED is selected, the information is printed using the default color settings. If VARIABLE is selected, the information is printed with colors as similar as possible to the display colors (that can be adjusted). For details, see "Display" in Chapter 7.

Note

Because of the limited number of printer ink colors, the printed color is not always the same as the displayed color.

Copy

DPI (DPI)

Specifies the resolution of a printer used for printing by dpi. The range of settable resolution is between 75 and 600 dpi.

TOP MARGIN (TMARG)

Specifies the top margin of printing by inch. The settable margin range is between 0 and 5 inches in step of 0.1 inch.

LFT MARGIN (LMARG)

Specifies the left margin of printing by inch. The settable margin range is between 0 and 5 inches in step of 0.1 inch.

DEFAULT SETUP (DFLT)

Resets the printing parameters to the following default settings.

• Printing resolution:	75 dpi
• Form feed:	ON
• Sheet orientation:	Portraint
• Softkey label printing:	OFF
• Top margin:	1.0 inch
• Left margin:	1.0 inch

RETURN

Returns to the previous menu.

Screen Menu

PRINT [STANDARD] (PRINALL)

Prints one page of the screen with the measurement parameter list, using an HP graphic printer (or compatible printer). STANDARD, indicating a black and white printer, or COLOR, indicating a color printer, appears within the brackets ([ ]). This display shows which printer has been selected as the default printer on the Print Setup menu. The power-on default is STANDARD. Also, the default for a color printer is black ink printing.

COPY ABORT (COPA)

Aborts the printing currently in progress.

COPY TIME on OFF (COPT OFF|0|ON|1)

Turns printing time and date ON or OFF. When you select print, the time and date are printed first, then the information on the screen is printed. See the *Clock Setup Menu* for how to change the date or time of the internal clock.

NEXT PAGE (NEXP)

Displays the next page of the measurement parameter list being displayed.

PREV PAGE (PREP)

Displays the previous page of the operating parameter list being displayed.

RESTORE DISPLAY (RESD)

Ends the display of the operating parameter list, and displays the measurement screen.

Save/Recall

Save/Recall Menu

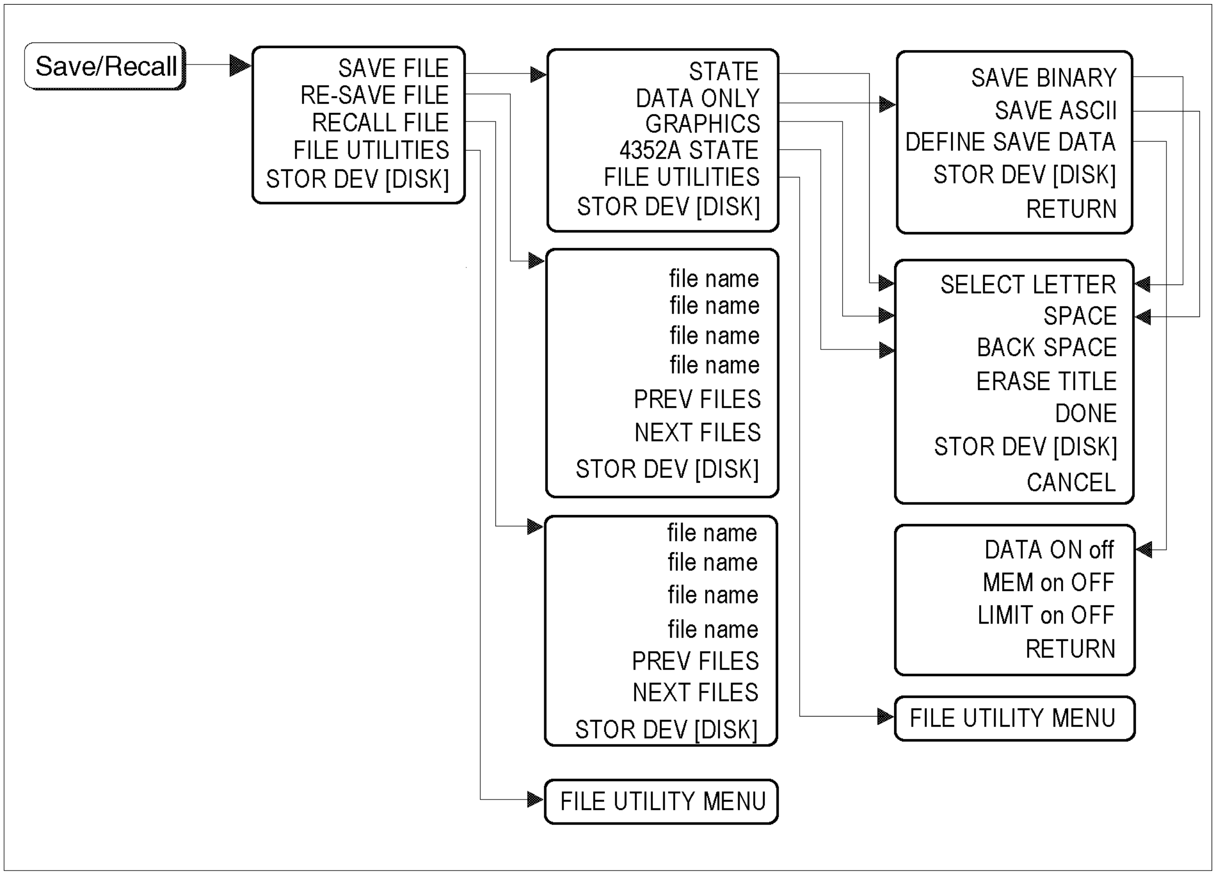


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Figure 10-2. Softkey Menus Accessed from Save/Recall Key (1/3)

SAVE FILE

Displays the *Save File Menu*, which allows the selection of the save format.

RE-SAVE FILE (RESAVD <Character String>)

Displays the *File Select Menu*. Select the file to be re-saved from this menu.

RECALL FILE

Displays the *File Select Menu*. Select the file to be recalled from this menu.

Auto Recall Function
When the 4352B is turned on, it searches for a file named "AUTOREC" in the floppy disk. If it is found, the file is automatically read, recalling the 4352B settings and measurement data.

Notes on Correct Use

To prevent voltage from being erroneously applied to the DUT, the DC power and control voltage levels are recalled as OFF (regardless of their settings before they were saved). Also, the FM deviation calibration data is recalled as OFF (regardless of their settings before they were saved) because there is no guarantee that the operating conditions remained constant.

FILE UTILITIES

Displays the *File Utilities Menu* used to initialize a new disk and delete files from the disk.

STOR DEV [ ] (STODDISK, STODMEMO)

Selects the floppy disk drive or RAM disk memory as the storage device. When [DISK] is displayed, the floppy disk is selected as the storage device. When [MEMORY] is displayed, the internal RAM disk memory is selected as the storage device. This setting does not change if the instrument is turned off, or even if Preset is pressed.

Save File Menu

STATE (SAVDSTA <Character String>)

Stores the 4352B settings and internal data array.

DATA ONLY (SAVDDAT <Character String>)

Displays the Save File Menu

GRAPHICS (SAVDTIFF)

Specifies the file format for saving the screen currently displayed as the TIFF format. The colors to be used in a saved image are controlled by your setting in the *Print Setup Menu*, which provides the options; PRINT:STANDARD , PRNT COLOR [FIXED] or PRNT COLOR [VARIABLE] . Softkeys are also saved.

4352A STATE (SAVDSTAC <string>)

Saves the instrument state in the format so that the 4352A can recall.

FILE UTILITIES

Displays the *File Utilities Menu*, which allows new disks to be initialized and files to be deleted from the disk.

STOR DEV [ ] (STODDISK, STODMEMO)

Selects the floppy disk drive or RAM disk memory as the storage device. When [DISK] is displayed, the floppy disk is selected as the storage device. When [MEMORY] is displayed, the RAM disk memory is selected as the storage device. This setting does not change if the power is turned off, or even if Preset is pressed.

Data Only Menu

SAVE BINARY (SAVDDAT <Character String>)

Specifies saving the internal data arrays as an Binary format file. The arrays saved are defined by the DEFINE SAVE DATA key.

SAVE ASCII (SAVDASC)

Specifies saving the internal data arrays as an ASCII format file. The arrays saved are defined by the DEFINE SAVE DATA key.

DEFINE SAVE DATA

Displays the *Save Data Definition menu* used to select the internal data array to be saved.

STOR DEV [ ] (STODDISK, STODMEMO)

Selects the floppy disk drive or RAM disk memory as the storage device. When [DISK] is displayed, the floppy disk is selected as the storage device. When [MEMORY] is displayed, the internal RAM disk memory is selected as the storage device. This setting does not change if the instrument is turned off, or even if Preset is pressed.

Save Data Definition Menu

DATA ON off (SAVDAT OFF|O|ON|1)

Selects whether to save measurement data. Select (ON) to save or (OFF) not to save data.

MEM on OFF (SAVMEM OFF|O|ON|1)

Selects whether to save the memory data. Select (ON) to save or (OFF) not to save the memory data.

LIMIT on OFF (SAVLIM OFF|O|ON|1) **(Analyzer Mode)**

Selects whether to save the upper (lower) limit value. Select (ON) to save or (OFF) not to save the limit value.

RETURN

Returns to the previous menu.

File Utilities Menu

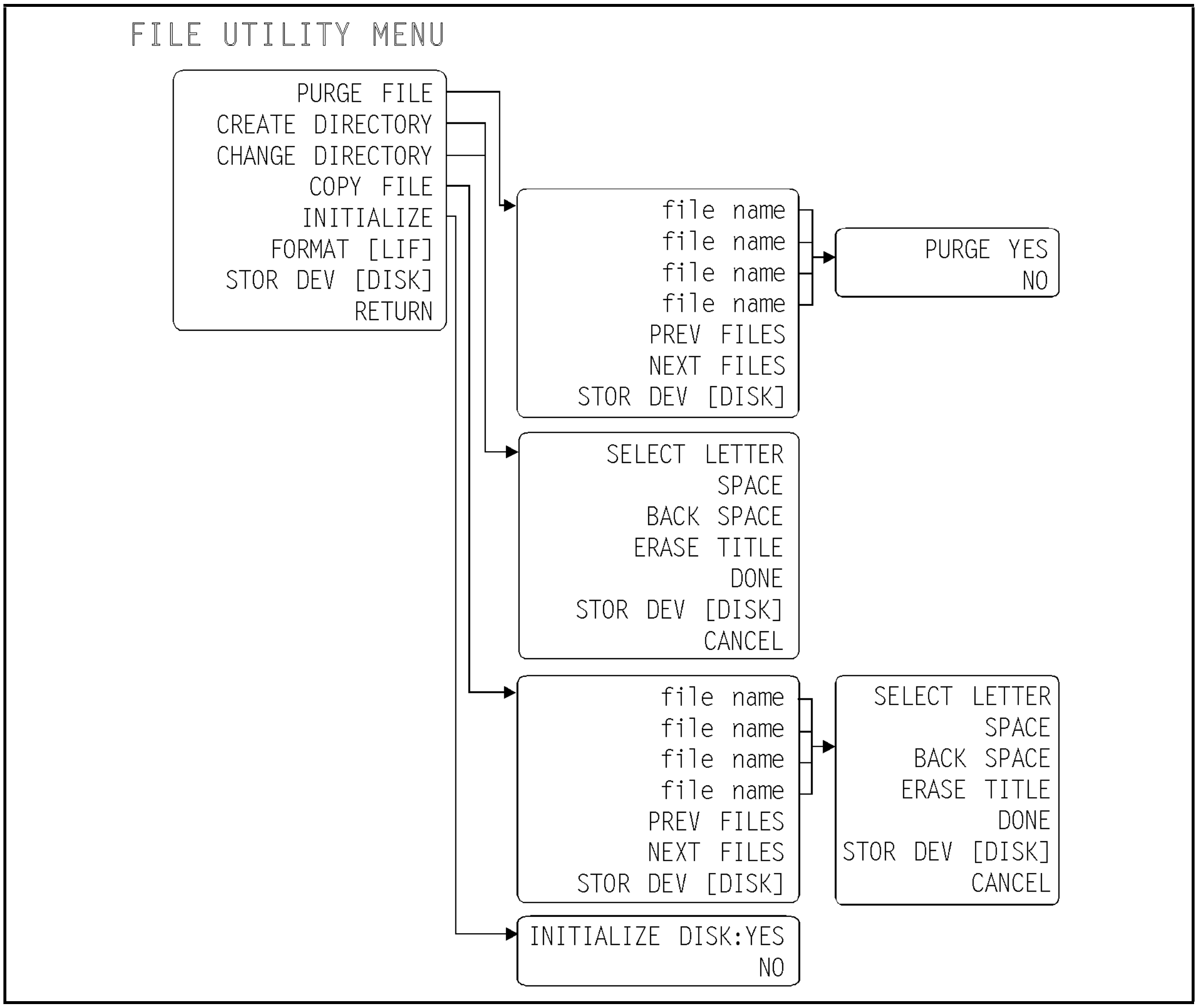


Figure 10-3. Softkey Menus Accessed from Save/Recall Key (3/3)

PURGE FILE (PURG <Character String>)

Displays the *File Select menu*. This softkey is used to select the files to be deleted from among options in this menu. The files to be deleted can be located on the floppy disk or RAM disk memory. If a file is selected and the softkey is pressed, the *Purge YES NO Menu* is displayed.

CREATE DIRECTORY (CRED <Character String>)

Specifies creating a new directory in a DOS format disk. This function is not available for a LIF file. The *Character Input Menu* is displayed.

CHANGE DIRECTORY (CHAD < Character String >)

Selects the current directory on a DOS format disk to be changed. This function is not available for a LIF file. The *Character Input Menu* is displayed.

COPY FILE (FILC)

Displays the *File Select menu*. This softkey is used to select the files to be copied from among options in this menu. When copying files between the floppy disk and RAM disk memory, the disk formats of the disk and the RAM disk memory must be the same format. This copy function cannot copy files when the format of the RAM disk is different from the format of the floppy disk. The *Character Input Menu* is displayed.

INITIALIZE (INID)

Displays the *Initialize YES NO Menu*. When saving data into a new disk, be sure to initialize the disk before saving data. A new disk can be initialized in either LIF format or DOS format.

Note Note that the analyzer can initalize 1.44 Mbyte disks only.

FORMAT [LIF] (DISF LIF, DISF DOS)

Selects the LIF or DOS format for initializing a new disk.

STOR DEV[ ] (STODDISK, STODMEMO)

Selects the floppy disk drive or RAM disk memory as the storage device. When [DISK] is displayed, the floppy disk is selected as the storage device. When [MEMORY] is displayed, the RAM disk memory is selected as the storage device.

Note This setting does not change if the instrument is turned off, or even if Preset is pressed.

RETURN

Returns to the previous menu.

File Select Menu

This menu displays the names of files that can be saved, recalled or deleted. You need to press the softkey that corresponds to the desired file to save, recall, or delete that file.

PREV FILES

Displays the previous page of the file name list (displayed in softkey labels).

NEXT FILES

Displays the next page of the file name list (displayed in softkey labels).

STOR DEV[ ] (STODDISK, STODMEMO)

Selects the floppy disk drive or RAM disk memory as the storage device. When [DISK] is displayed, the floppy disk is selected as the storage device. When [MEMORY] is displayed, the RAM disk memory is selected as the storage device.

Note This setting does not change if the instrument is turned off, or even if Preset is pressed.

Initialize YES/NO Menu

INITIALIZE DISK:YES

Initializes the floppy disk or RAM disk memory. When DISK is displayed in the softkey, the floppy disk is initialized. When MEMORY is displayed in the softkey, the RAM disk memory is initialized.

Note Note that the analyzer can initalize 1.44 Mbyte disks only.

NO

Returns to the previous softkey menu without initializing the floppy disk or RAM disk memory.

Delete YES/NO Menu

PURGE YES

Deletes the selected file.

NO

Returns to the previous menu without purging the file.

Character Input Menu

SELECT LETTER

Selects the characters on the screen pointed to by the arrow (↑). You can use the rotary knob to move the arrow. You can use ⇧ and ⇩ to switch character sets on the screen.

SPACE

Inserts a space.

BACK SPACE

Deletes the last character entered.

ERASE TITLE

Deletes all characters that have been entered.

Save/Recall

DONE

Stop entering characters and return to the previous menu.

STOR DEV [ ] (STODDISK, STODMEMO)

Selects the floppy disk drive or RAM disk memory as the storage device. When [DISK] is displayed, the floppy disk is selected as the storage device. When [MEMORY] is displayed, the RAM disk memory is selected as the storage device. This setting does not change if the instrument is turned off, or even if Preset is pressed.

CANCEL

Cancels the entry of characters and returns to the previous menu.

System

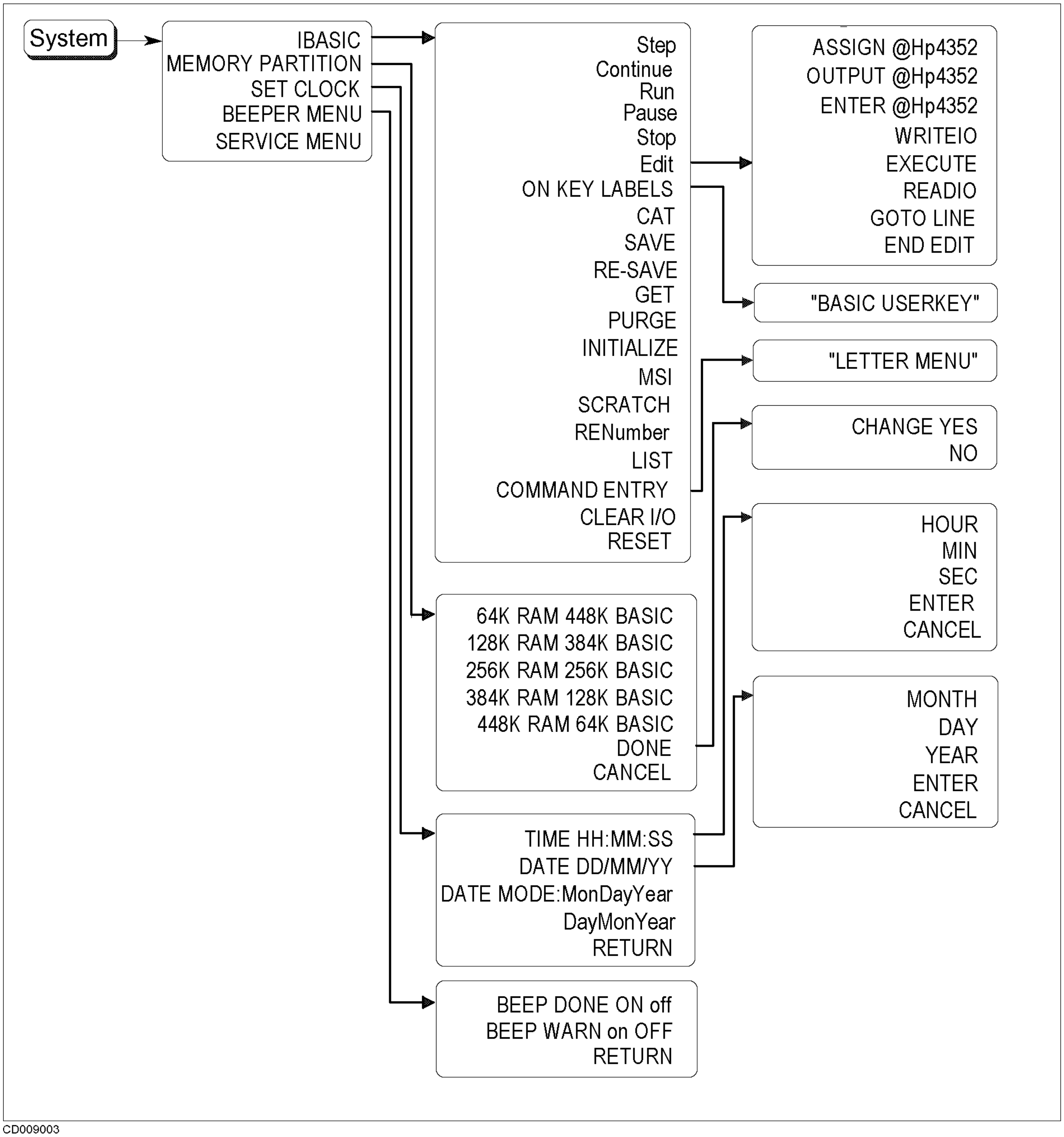


Figure 10-4. Softkey Menus Accessed from System Key (Tester Mode)

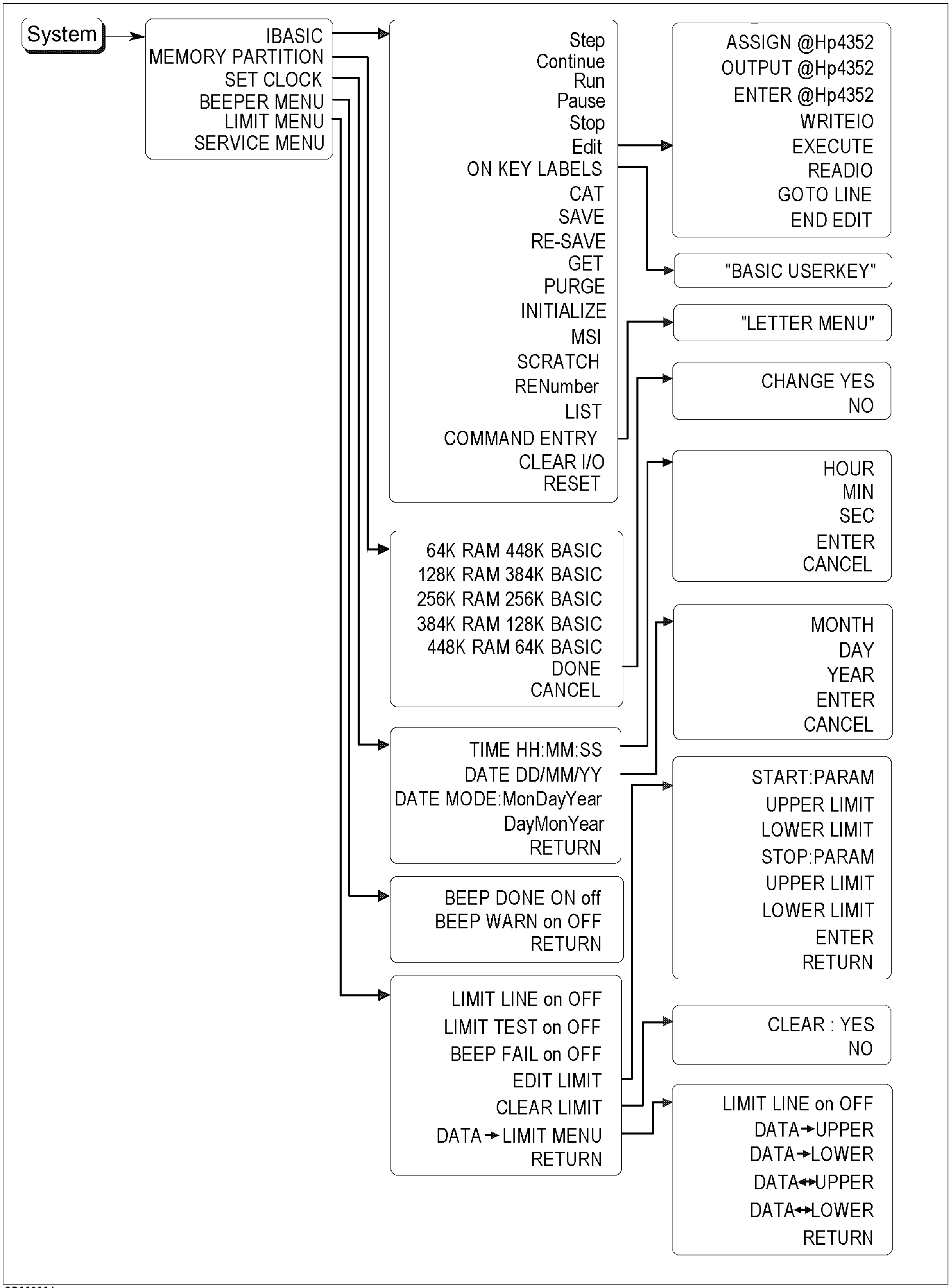


Figure 10-5. Softkey Menus Accessed from System Key (Analyzer Mode)

System Menu

IBASIC

Displays the *Instrument BASIC menu* used to operate Instrument BASIC.

MEMORY PARTITION

Displays the *Memory Partition menu* used to specify the size of the memory areas for Instrument BASIC and the RAM disk.

SET CLOCK

Displays the *Timer Setup menu* used to set the internal real time clock.

BEEPER MENU

Displays the *Beeper menu* used to set the beeper.

LIMIT MENU **(Analyzer Mode)**

Displays the *Limit menu*.

SERVICE MENU

Displays the *Service menu*.

Instrument BASIC Menu

`Step`

Executes one program line at a time. This is very useful during debugging.

`Continue`

Resumes program execution from the point where it paused.

`Run`

Executes a program from the beginning.

`Pause`

Pauses program execution after the current program line is executed.

`Stop`

Stops program execution at the current line.

`Edit`

Enters into the EDIT mode and displays the *BASIC edit menu*.

`ON KEY LABELS`

Displays the user keys defined with BASIC. User key labels are displayed only when an Instrument BASIC program (which defines the user keys) is being executed.

`CAT`

The CAT command displays the list of files on a disk.

`SAVE`

The SAVE command saves a program as an ASCII file.

`RE-SAVE`

The RE-SAVE command overwrites an old file with a new one using the same file name .

`GET`

The GET command loads a specified ASCII file into the editor memory.

`PURGE`

Enters the PURGE command in the BASIC command line. The PURGE command deletes a specified file.

`INITIALIZE`

The INITIALIZE command formats a disk.

`MSI [INTERNAL]`

The MSI [INTERNAL] command specifies a disk device. INTERNAL selects the built-in flexible disk; MEMORY selects the built-in RAM disk.

`SCRATCH`

Pressing the (Return) key after the command deletes a currently edited program from the memory.

`RENumber`

Pressing the (Return) key after the command renumbers the line numbers of a program.

`LIST`

The LIST command outputs the program list to the screen.

`COMMAND ENTRY`

Displays the softkeys that are used to enter BASIC commands. The active entry area displays the letters, digits, and some special characters. Three sets of letters can be scrolled using the step keys, (⇧) and (⇩).

`CLEAR I/O`

The CLEAR I/O command causes the execution of an I/O-related command to pause. Press Continue to resume the execution.

`RESET`

The RESET command terminates program execution without confirmation.

BASIC Edit Menu

`ASSIGN @Hp4352`

Produces the "`ASSIGN @Hp4352 TO 800`" command at the cursor's current position.

`OUTPUT @Hp4352`

Produces the "`OUTPUT @Hp4352;""`" command at the cursor's current position.

`ENTER @Hp4352`

Produces the "`ENTER @Hp4352;`" command at the cursor's current position.

`WRITEIO`

Produces the "`WRITEIO, ;`" command at the cursor's current position.

`EXECUTE`

Produces the "`EXECUTE ""`" command at the cursor's current position.

System

READIO

Produces the "READIO (,)" command at the cursor's current position.

GOTO LINE

Allows you to move the cursor to any line number or to a label. After pressing GOTO LINE, type a line number or a label and then press x1. The cursor moves to the specified line or label.

END EDIT

Exits the edit mode.

Memory Partition Menu

mm K RAM nn K BASIC

Assigns *mm* kBytes to the RAM disk memory and *nn* kBytes to Instrument BASIC as the memory size. The disk size that will be actually assigned is displayed in the softkey in place of *mm* and *nn*.

DONE

Displays the *Partition Change YES/NO menu*, which selects whether to change the assignment of memory size.

CANCEL

Cancels the change in memory size assignment and returns to the previous menu.

Partition Change YES/NO Menu

CHANGE YES

Changes the memory size assignment. When this key is pressed, the 4352B goes to the reset state.

NO

Cancels the change in memory size assignment and returns to the previous softkey menu.

Time Setup Menu

TIME HH:MM:SS (SETCTIME < HH,MM,SS >)

Displays the current time on the active input area, and displays the *Time menu* to set the time.

DATE MM/DD/YY (SETCDATE <MM,DD,YY>)

Displays the current date on the active input area, and displays the Date menu to set the date.

DATE MODE: MonDayYear (MONDYEAR)

Changes the date display format to "month:day:year".

DayMonYear (DAYMYEAR)

Changes the date display format to "day:month:year".

RETURN

Returns to the previous menu.

Time Menu

HOUR

Enables changing the "Hour" setting with the rotary knob or numeric keys. After you change the hour setting, press ENTER to restart the clock.

MIN

Enables changing the "Minute" setting with the rotary knob or numeric keys. After you change the minute setting, press ENTER to restart the clock.

SEC

Enables changing the "Second" setting with the rotary knob or numeric input keys. After you change the second setting, press ENTER to restart the clock.

ENTER (SETCTIME)

Restarts the internal clock.

CANCEL

Returns to the previous menu. Pressing this key does not change the internal clock setting.

Date Menu

MON

Enables changing the "Month" setting with the rotary knob or numeric input keys. After you change the month setting, press ENTER to restart the clock.

DAY

Enables changing the "Day" setting with the rotary knob or numeric input keys. After you change the day setting, press ENTER to restart the clock.

YEAR

Enables changing the "Year" setting with the rotary knob or numeric input keys. After you change the year setting, press ENTER to restart the clock.

System

ENTER (SETCDATE)

Restarts the internal clock.

CANCEL

Returns to the previous menu. Pressing this key does not change the internal clock setting.

Beeper Menu

BEEP DONE ON off (BEEPDONE OFF|0|ON|1)

Turns the beeper function ON or OFF. The beeper sounds to indicate the completion of operation such as instrument state save, or calibration.

BEEP WARN on OFF (BEEPWARN OFF|0|ON|1)

Turns the warning beeper ON or OFF. The beeper sounds to indicate when a warning message is displayed.

Limit Menu (Analyzer Mode)

LIMIT LINE on OFF (LIMILINE OFF|0|ON|1)

Turns the limit line function ON or OFF. If limit line function is turned on, the limit lines are displayed for visual comparison of the measurement data in all rectangular coordinate forms.

Limit line can be saved onto the disk.
When the limit line function is ON, you can specify the limit line and save it into the disk with an instrument state.

LIMIT TEST on OFF (LIMITEST OFF|0|ON|1)

Turns the limit test function ON or OFF. When limit testing is on, the data is compared with the defined limits at each measured point. Limit tests occur at the end of each sweep, whenever the data is updated, and when limit testing is first turned on.

The limit test can be performed for both X- and Y-coordinates on the rectangular coordinate format.

Five Ways to Inform the User of the Test Result

When the limit test function is ON, the 4352B informs the user of the test result as follows:

- PASS or FAIL appears on the left-hand side of the screen.
- Beeper sounds when the measured value is found to be unacceptable. (Only when the fail beep function is ON.)
- When the list is displayed with the copy function, an asterisk (*) appears next to the measurement point for which the measured value is unacceptable.
- A bit in the GPIB status byte is set to 1 if the measured value is unacceptable.
- A bit in 24 bit I/O port is set to 1 (PASS) or 0 (FAIL).

BEEP FAIL on OFF (BEEPFAIL OFF|0|ON|1)

Turns the fail beep function ON or OFF. When the limit test and fail beep functions are ON, the beeper sounds each time a limit test is performed and a failure is detected. This fail beeper is not related to the warning beeper or beeper for completion of operation.

EDIT LIMIT

Displays the *Limit Edit menu* used to define or change limits.

CLEAR LIMIT (LIMCLEL)

Displays the *Limit Clear menu*.

DATA→LIMIT MENU

Displays the *Data→Limit menu*.

Limit Edit Menu (Analyzer Mode)

START:PARAM

Specifies the current X-coordinate as the start point of a limit section.

UPPER LIMIT

Specifies the upper limit for the start point of a limit section.

LOWER LIMIT

Specifies the lower limit for the start point of a limit section.

STOP:PARAM

Specifies the current X-coordinate as the end point of a limit section.

UPPER LIMIT

Specifies the upper limit for the end point of a limit section.

LOWER LIMIT

Specifies the lower limit for the end point of a limit section.

ENTER

Updates the limit line with the information of the specified limit section.

Note

The start and end points as well as the upper and lower limits are fixed at the same time when you press ENTER . Also, entering the sweep start and end points allows all measurement points to be determined. If the X-coordinate value of the start or end point of the limit line does not match any of the measurement points, then the X-coordinate value of the nearest measurement point is automatically selected.

When you use GPIB commands to specify the start and end points, you can specify them as the start and end points of sweep or as specific sweep points. (LIMSECT and LIMSECTN)

If the end point is smaller than the start point, these points are automatically swapped.

When you need to trace a limit line using many straight line segments, use the IBASIC programming function or use an external controller to execute GPIB commands to specify the limit line. See the *4352B GPIB Programming Manual* for details.

Limit Clear Menu (Analyzer Mode)

CLEAR : YES

Clears all limit lines.

NO

Cancels clearing of all limit lines.

Data→Limit Menu (Analyzer Mode)

LIMIT LINE on OFF (LIMILINE OFF|0|ON|1)

Turns the limit line function ON or OFF. If limit line function is turned on, the limit lines are displayed for visual comparison of the measurement data in all rectangular coordinate forms.

Limit line can be saved onto the disk.
When the limit line function is ON, you can specify the limit line and save it into the disk with an instrument state.

DATA→UPPER (DATLIMU)

Stores the data trace as the upper limit line.

DATA→LOWER (DATLIML)

Stores the data trace as the lower limit line.

DATA↔UPPER (EXDATLIMU)

Replaces the current displayed data trace with the upper limit line so that you can check measured values on the upper limit line with the marker.

DATA↔LOWER (EXDATLIML)

Replaces the current displayed data trace with the lower limit line so that you can check measured values on the lower limit line with the marker.

Local

This key has the following two functions:

- One sets the 4352B to the local mode. In this mode, you can control the 4352B from the front panel. On the other hand, in the remote mode, an external controller controls the 4352B. When you wish to set the 4352B back to the local mode, press Local.
- The other displays the *GPIB menu* and the *Address menu*. The *GPIB menu* is used to set the controller mode. The *Address menu* is used to enter GPIB addresses of peripheral equipment. The controller mode determines which device is the system controller and which acts as the master controller. Both the 4352B and the external controller cannot become master controllers at the same time.

Local Menu

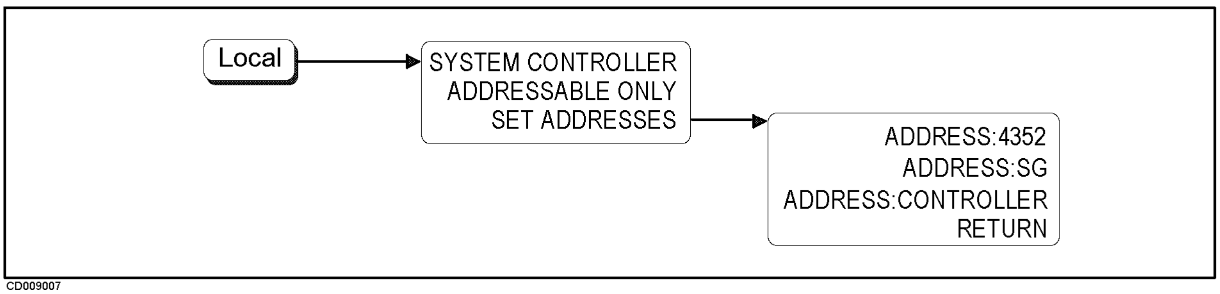


Figure 10-6. Softkey Menus Accessed from Local Key

SYSTEM CONTROLLER

Sets the 4352B as the system controller. This mode is used when peripheral equipment is controlled by the 4352B without an external controller.

This mode can only be selected manually from the 4352B's front panel and can be used only if no active system controller is connected to the system through GPIB. If you try to set the system controller mode when another system controller is present, "CAUTION: CAN'T CHANGE - ANOTHER CONTROLLER ON BUS" is displayed.

ADDRESSABLE ONLY

Sets the 4352B to the addressable only mode in which only addresses can be specified. This mode is used when an external controller controls peripheral devices or the 4352B.

SET ADDRESSES

Displays the *Address Setup menu* used to specify and display not only the 4352B GPIB address but the addresses of peripherals.

Local

Address Setup Menu

ADDRESS:4352

Specifies the GPIB address of the 4352B using the entry keys. There is no physical GPIB address switch available on the 4352B.

ADDRESS:SG (ADDRSG <Value>)

Specifies the GPIB address of the external signal generator.

ADDRESS:CONTROLLER (ADDRCONT <Value>)

Specifies the GPIB address the 4352B will use to communicate with the external controller.

Note The 4352B keeps the settings of GPIB mode and GPIB addresses in the backup memory even if the 4352B is turned OFF.

RETURN

Returns to the previous menu.

Preset

Preset resets the 4352B settings to the preset defaults. The list of preset defaults are given in Appendix E. Note, however, that the Preset has no effect on the following states:

- Display Allocation
- Display Adjustment
- Color Adjustment
- Clock Time/Date
- GPIB addresses
- GPIB mode (system controller/addressable)
- Settings associated with control of external signal generator
- Storage device and initialize disk format
- Extension of file names for measurement data and 4352B settings

11

Specifications

These specifications are the performance standards and operation limits based on which the 4352B is tested. When shipped from the factory, the 4352B meets the specifications listed in this section. For the specifications of the 43521A (Downconverter Unit), see the User's Manual of the 43521A. Specifications list the 4352B's performance guaranteed over the temperature range of 0°C to 40°C (except as noted) and after a warm-up time of at least 30 minutes has elapsed from power-on. Information provided as *typical*, *typically*, *nominal* or *approximate* represents typical characteristics of the 4352B and is intended to serve as reference data for efficient operation of the 4352B.

Measurement Items (Tester Mode)

RF Power

Frequency band .... 10 MHz to 3 GHz
Input level .... −10 dBm to +20 dBm
Resolution .... 0.01 dB
Accuracy
@≤2 GHz, ≤15 dBm, Peak Voltage Response, 23±10°C .... ±0.6dB
@Other than the above, Peak Voltage Response, 23±10°C .... ±1.0dB
@ Peak Voltage Response, 0 to 40°C .... ±2.0dB
@1 GHz, −5 dBm, Peak Voltage Response, 23±10°C .... ±0.2dB(typical)

Frequency

Frequency band .... 10 MHz to 3 GHz

Resolution

When @ 1kHz is selected as resolution .... 1 kHz

Accuracy .... ±(time base accuracy of the external signal source used +1 kHz)

DC Current Consumption

Current range .... 0 to 50 mA
Accuracy
@23±10°C .... ±(0.2% of reading+100 μA)
@0 to 40°C .... ±(0.8% of reading+400 μA)
Resolution 10μA

Measurement Items

FM Deviation

Measurement Range .... 0 to 200 kHz
Deviation Resolution .... 4 digits
Deviation Accuracy
@1 kHz FM, 2kHz range, 23±10°C .... (±2% of reading+0.5% of measurement range)
@1 kHz FM, 2kHz range, 0 to 40°C .... (±8% of reading+2.0% of reading)
@1 kHz FM, 20, 200 kHz range, 23±10°C.... (±2% of reading+0.1% of measurement range)
@1 kHz FM, 20, 200 kHz range, 0 to 40°C .. (±8% of reading+0.4% of measurement range)

Note

- The deviation accuracy obtained after FM deviation calibration is ±0.8% of the reading (typical data, @ ambient temperature during calibration:±5 °C).
- Perform calibration again if the detection band is changed.

Residual FM
@300 Hz to 3 kHz bandwidth .... < 3 Hz_{rms}(typical)
@50 Hz to 20 kHz bandwidth .... < 8 Hz_{rms}(typical)

C/N Ratio

Offset frequency range
@ Carrier ≥ 100 MHz .... 100 Hz to 9 MHz
@ Carrier < 100 MHz .... 100 Hz to 10% of carrier frequency
Phase noise
@100 Hz offset .... 85 dBc/Hz (90 dBc/Hz typical)
@1 kHz offset .... 110 dBc/Hz (117 dBc/Hz typical)
@10 kHz offset .... 130 dBc/Hz (137 dBc/Hz typical)
@100 kHz offset .... 140 dBc/Hz (147 dBc/Hz typical)
@1 M,9 MHz offset .... 150 dBc/Hz (157 dBc/Hz typical)

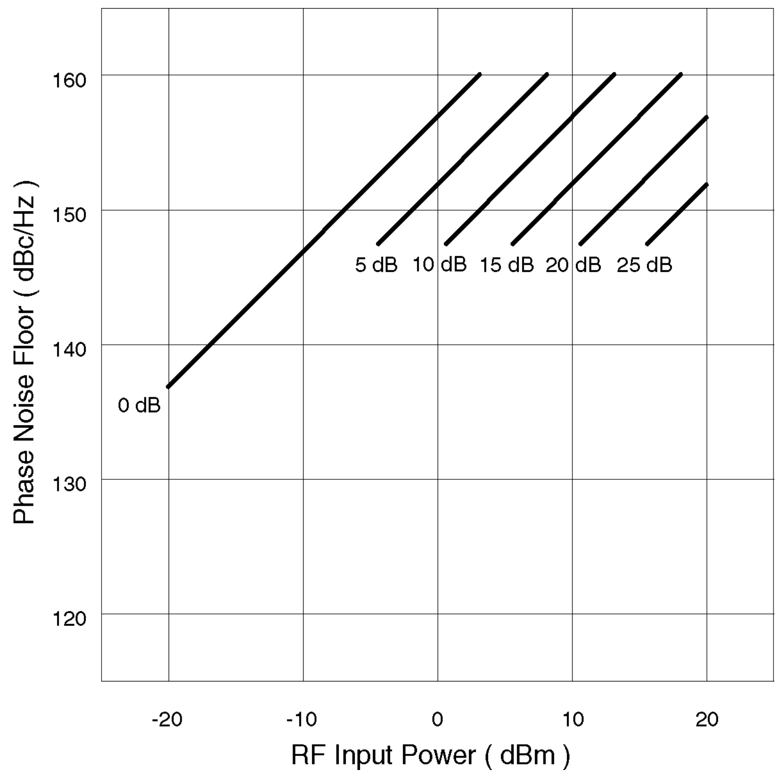
See also the section on **EMC** of “Others” in “General Characteristics”.
Accuracy † ††
@100 Hz to 1 kHz offset .... ±4dB(typical)
@1 kHz to 1 MHz offset .... ±2dB
@1 MHz to 9 MHz offset .... ±4dB

†(Note that if `NOISE PLL auto WIDE` (CNPLL WIDE) is selected, this accuracy is valid at offset frequency above 5 kHz.)

†† (No spurious components should not be assumed around the measurement point (for the tester mode only))

Note

The noise floor at 1 MHz and 9 MHz offsets depends on the input signal level and the RF attenuation setting. The figure shown below illustrates the relationship between them. The value below each line show the RF attenuator setting.



Note

Set the attenuation for noise measurement to 0dB when measuring the phase noise above 150 dBc. Other settings may not guarantee the phase noise specified as a typical value.

Measurement Items (Analyzer Mode)

RF Power Characteristics against DC Control Voltage

Refer to "RF Power" in "Measurement Items (Tester Mode)".

Frequency/Tuning Sensitivity Characteristics against DC Control Voltage

Refer to "Frequency" in "Measurement Items (Tester Mode)".

Phase Noise Characteristics against Offset Frequency

Same as "C/N Ratio" in "Measurement Items (Tester Mode)".

Frequency Transient

Frequency Accuracy

± (frequency span × 0.1% + Time base accuracy of external signal source used)
The frequency span is displayed below the frequency transient measurement screen, as FSPAN xxxMHz. It is selected depending on the setting as follows:

When FREQ SPAN 2MHz is selected: 2 MHz

When 20MHz is selected: 20 MHz

When MAX xxxxMHz is selected: Depending on the entered target frequency and the target position value, one of 16 measurement frequency bands (see Table 11-1) is automatically selected inside the 4352B. The frequency span of that measurement range is used.

Measurement Resolution

The measurement resolution depends on the selected frequency span as follows:

When FREQ SPAN 2MHz is selected: 50 Hz

When 20MHz is selected: 500 Hz

When MAX xxxxMHz is selected: Depending on the entered target frequency and the target position value, one of 16 measurement frequency bands (see Table 11-1) is automatically selected inside the 4352B. The frequency resolution of that measurement band is used.

Table 11-1.
Available measurement frequency bands when MAX xxxxMHz is selected

Measurement frequency band number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Maximum frequency (MHz)	192	384	576	768	960	1152	1354	1536	1728	1920	2112	2304	2496	2688	2880	3000
Minimum frequency (MHz)	64	128	192	256	320	384	448	512	576	640	704	768	832	896	960	1024
Frequency span (MHz)	128	256	384	512	640	768	896	1024	1152	1280	1408	1536	1664	1792	1920	2048
Frequency resolution (kHz)	3.2	6.4	9.6	12.8	16	19.2	22.4	25.6	28.8	32	35.2	38.4	41.6	44.8	48	51.2

Maximum Sweep Time . . . . 20 sec

Minimum Sweep Time Resolution .... 12.5 μsec

Time Base Accuracy

When the 4352B isn't phase locked to the external signal source
.... ±10ppm (typical)
When the 4352B is phase locked to the external signal source
.... Time base accuracy of the external signal source used

Spectrum

When the detection mode (`DETECTION`) is set to the positive peak (`POS PEAK`).

Absolute level accuracy

When @−5 dBm is input, attenuation=0 dB, @23±10°C .... ±2dBm(typical)

Relative level accuracy

Ratio of −10 dBm to −60 dBm during sweep, attenuation=0 dB

.... ±0.5 dB (typical), ±1.5 dB

I/O Signal

VCO Power Voltage Output

Voltage range .... 0 to +15.5 V (50 mA max.), variable in 1-mV steps
Setting accuracy
@23±10°C .... ±(0.2%+2 mV)
@0 to 40°C .... ±(0.6%+6 mV)
Noise
@10 kHz .... 10nV/$\sqrt{Hz}$(typical)
Setup time
@Error: 0.1% .... < 20 msec(typical)
Connector .... BNC female
Output resistance (DC) .... <0.3 Ω(typical)

VCO Control Voltage Output

Voltage range .... 0 to 20 V (20 mA max.), variable in 100-μV steps
.... With option 001, −15 to 35 V (20 mA max.), variable in 100-μV steps
Setting accuracy
@23±10°C
Output voltage range
−15 V to −0.0001 V .... ±{(setting+15 V)×0.1%+5 mV}
0 V to 20 V .... ±(setting×0.1%+2 mV)
20.0001 V to 35 V .... ±{(setting−15 V)×0.1%+5 mV}
@0 to 40°C
Output voltage range
−15 V to −0.0001 V .... ±{(setting+15 V)×0.3%+15 mV}
0 V to 20 V .... ±(setting×0.3%+6 mV)
20.0001 V to 35 V .... ±{(setting−15 V)×0.3%+15 mV}
Noise

I/O Signal

@10 kHz .... $1nV/\sqrt{Hz}$(typical)
@10 kHz, voltage setting −15 to 0 , 20 to 35 V (option 001) .... $1.5nV/\sqrt{Hz}$(typical)
Setup time
@Error: 0.1% .... < 20 msec(typical)
Connector .... BNC female
Output resistance (DC)
0 to 20 V .... <10 Ω(typical)
With option 001, −15 to 0 , 20 to 35 V .... <50 Ω(typical)

Modulation Signal Output

Frequency .... 1 kHz (fixed)
Level
@Open load .... 0 to 1 V_{rms}, variable in 1 mV_{rms} steps
Setting Accuracy
@ Open load, 23±10°C .... ±(0.5% + 1mV_{rms})
@ Open load, 0 to 40°C .... ±(1.5% + 3mV_{rms})
Harmonic Distortion .... <-40 dBc(typical)
Connector .... BNC female
Output impedance
@1 kHz .... Nominal: 50 Ω(typical)
Maximum output current .... 5mA_{rms} (typical)

RF Input

Frequency range .... 10 MHz to 3 GHz
Input level .... −10 dBm to +20 dBm
Connector .... N female
Input impedance .... 50 Ω, SWR < 1.3
@≤ 2 GHz .... SWR < 1.2

Instrument BASIC Related Specifications

Keyboard .... PS/2 style 101 english keyboard
  Connector .... mini-DIN
I/O port
  Connector .... D-SUB (15-pin)
  Level .... TTL level
  I/O .... 4-bit input/8-bit output port

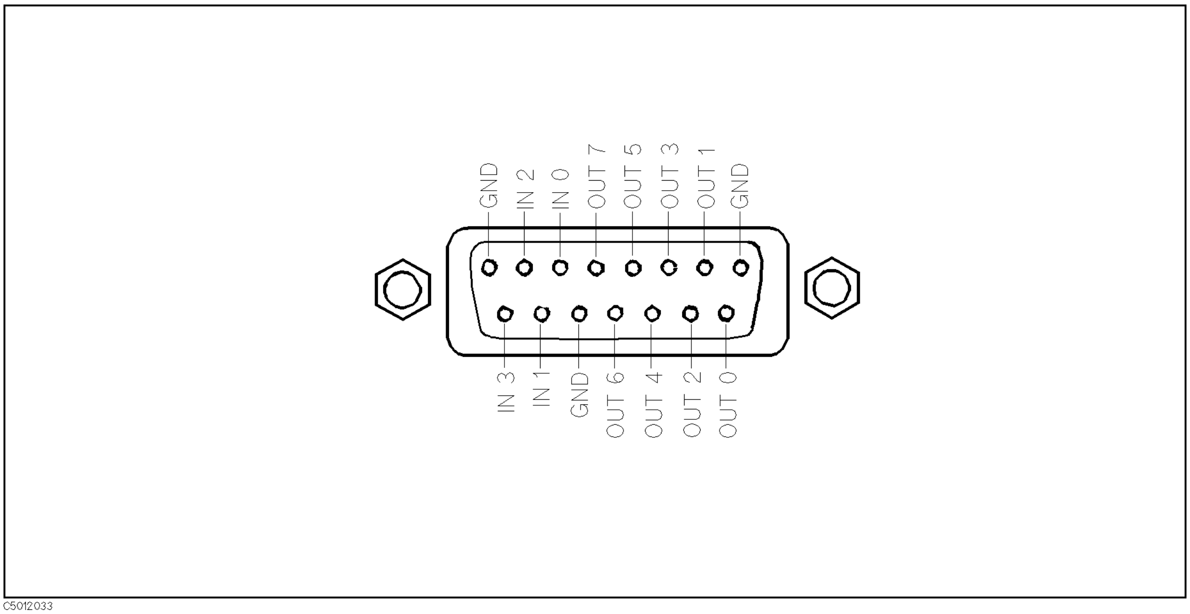


Figure 11-1. I/O Port Pin Assignment

24-bit I/O Interface
  Connector .... D-SUB (36-pin)
  Level .... TTL
  I/O .... 8-bit input/16-bit output

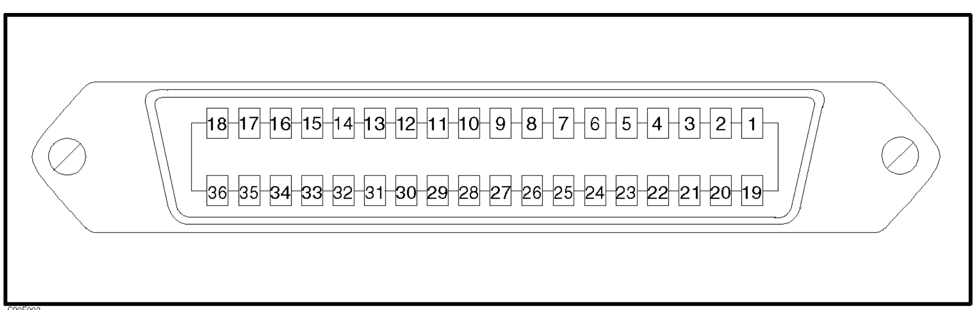


Figure 11-2. 24-bit I/O Interface Pin Assignment

Table 11-2. Signal Source Assignment

Pin No.	Signal Name	Signal Standard
1	GND	0 V
2	INPUT1	TTL level, pulse input (pulse width: 1μs or above)
3	OUTPUT1	TTL level, latch output
4	OUTPUT2	TTL level, latch output
5	OUTPUT PORT A0	TTL level, latch output
6	OUTPUT PORT A1	TTL level, latch output
7	OUTPUT PORT A2	TTL level, latch output
8	OUTPUT PORT A3	TTL level, latch output
9	OUTPUT PORT A4	TTL level, latch output
10	OUTPUT PORT A5	TTL level, latch output
11	OUTPUT PORT A6	TTL level, latch output
12	OUTPUT PORT A7	TTL level, latch output
13	OUTPUT PORT B0	TTL level, latch output
14	OUTPUT PORT B1	TTL level, latch output
15	OUTPUT PORT B2	TTL level, latch output
16	OUTPUT PORT B3	TTL level, latch output
17	OUTPUT PORT B4	TTL level, latch output
18	OUTPUT PORT B5	TTL level, latch output
19	OUTPUT PORT B6	TTL level, latch output
20	OUTPUT PORT B7	TTL level, latch output
21	I/O PORT C0	TTL level, latch output
22	I/O PORT C1	TTL level, latch output
23	I/O PORT C2	TTL level, latch output
24	I/O PORT C3	TTL level, latch output
25	I/O PORT D0	TTL level, latch output
26	I/O PORT D1	TTL level, latch output
27	I/O PORT D2	TTL level, latch output
28	I/O PORT D3	TTL level, latch output
29	PORT C STATUS	TTL level, input mode: LOW, output mode: HIGH
30	PORT D STATUS	TTL level, input mode: LOW, output mode: HIGH
31	WRITE STROBE SIGNAL	TTL level, active low, pulse output (width: 10 μs; typical)
32	+5V PULLUP	
33	SWEEP END SIGNAL	TTL level, active low, pulse output (width: 20 μs; typical)
34	+5V	+5V, 100 mA MAX
35	PASS/FAIL SIGNAL	TTL level, PASS: HIGH, FAIL: LOW, latch output
36	PASS/FAIL WRITE STROBE SIGNAL	TTL level, active low, pulse output (width: 10 μs; typical)

See *4352B GPIB Programming Manual* for details.

General Characteristics

I/O Characteristics

External input (1st LO)
- **Input Level** .... +10 dBm(typical)
- **Connector** .... N female

External reference input
- **Frequency** .... 10 MHz±100 Hz(typical)
- **Level** .... −6 dBm to +16 dBm(typical)
- **Input Impedance** .... 50 Ω(nominal)
- **Connector** .... BNC female

Internal reference output
- **Frequency** .... 10 MHz±100 Hz(typical)
- **Level** .... 2.5 dBm(typical)
- **Output impedance** .... 50 Ω(nominal)
- **Connector** .... BNC female

External trigger input
- **Level** .... TTL level
- **Pulse width (T_p)** .... ≥2 μs (typical)
- **Polarity** .... Positive/negative selectable
- **Connector** .... BNC female

External program RUN/CONT input
- **Connector** .... BNC female
- **Level** .... TTL level

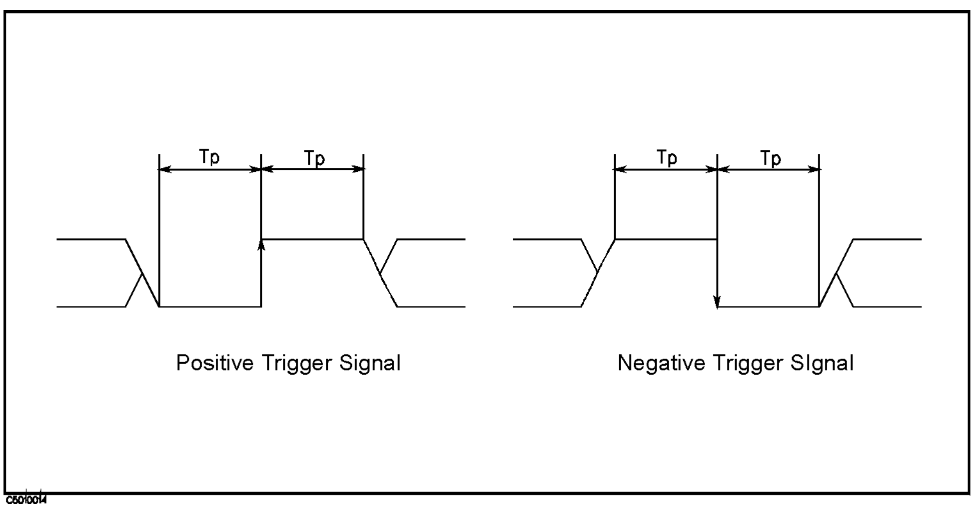


Figure 11-3. Trigger Signal

External monitor output
- **Connector** .... D-SUB 15-pin HD
- **Display resolution** .... 640 × 480 VGA

LCD
- **Size/Type** .... 8.4 inch color LCD
- **Resolution** .... 640 × 480

Effective Display Area .... 160 mm × 115 mm(600 × 430 dots)
Parallel interface
Interface .... Centronics standard compliant
Printer control language .... HP PCL3 Printer Control Language

Table 11-3. Supported Printers and Printing Modes

Printer	Monochrome Printing	Fixed Color Printing	Variable Color Printing
HP DeskJet 340J	√	√	
HP DeskJet 505	√		
HP DeskJet 560C	√	√	
HP DeskJet 850C	√	√	
HP DeskJet 1200	√	√	√
HP DeskJet 1600CM	√	√	√

Operation Conditions

Temperature
Disk drive non-operating condition .... 0°C to 40°C
Disk drive operating condition .... 10°C to 40°C
Humidity
@wet bulb temperature ≤29°C, without condensation
Disk drive non-operating condition .... 15% to 95% RH
Disk drive operating condition .... 15% to 80% RH
Altitude .... 0 to 2000 meters
Warm up time .... 30 minutes

Non-operation Conditions

Temperature .... –20°C to 60°C
Humidity
@wet bulb temperature ≤45°C, without condensation .... 15% to 95% RH
Altitude .... 0 to 4572 meters

Others

EMC ....Complies with CISPR 11 (1990) / EN 55011 (1991) : Group 1, Class A
Complies with IEC 1000-3-2 (1995) / EN 6100-3-2 (1995)
Complies with IEC 1000-3-3 (1994) / EN 6100-3-3 (1995)
Complies with IEC 1000-4-2 (1995) / EN 50082-1 (1992) : 4 kV CD, 8 kV AD
Complies with IEC 801-3 (1984) / EN 50082-1 (1992) : 3 V/m
Complies with IEC 1000-4-4 (1995) / EN 50082-1 (1992) : 1 kV / Main,0.5kV / Signal Line

Note: Note: The 4352B meets the specifications for C/N ratio and phase noise over the entire immunity test frequency range between 27 to 1000 MHz when tested at 3V/m in compliance with IEC 801-3/1984. Note, however, that this does not apply when the frequency to be measured is the same as the test frequency of the interfering signal.

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Power requirements .... 90 V to 132 V, or 198 V to 264 V, 47 to 63 Hz, 300 VA max
Weight ....21.5 kg max
Dimensions ....425(W) × 235(H) × 553(D) mm

A

Manual Changes

Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the 4352B than the current printing date of this manual. The information in this manual applies directly to the 4352B Network/Spectrum Analyzer serial number prefix listed on the title page of this manual.

Manual Changes

To adapt this manual to your 4352B see Table A-1 and Table A-2, and make all the manual changes listed opposite your instrument's serial number and firmware version.

Instruments manufactured after the printing of this manual may be different from those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument's serial number is not listed on the title page of this manual or in Table A-1, it may be documented in a *yellow MANUAL CHANGES* supplement.

In additions to change information, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest *MANUAL CHANGES* supplement.

For information concerning serial number prefixes not listed on the title page or in the *MANUAL CHANGE* supplement, contact the nearest Hewlett-Packard office.

Turn on the line switch or execute the `*IDN?` command by GPIB to confirm the firmware version. See the *GPIB Command Reference* manual for information on the `*IDN?` command.

Table A-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
JP1KE	Change 1

Table A-2. Manual Changes by Firmware Version

Version	Make Manual Changes
Rev 1.xx	Change 1

Serial Number

Hewlett-Packard uses a two-part, nine-character serial number that is stamped on the serial number plate (Refer to Figure A-1) attached to the rear panel. The first five characters are the serial prefix and the last five digits are the suffix.

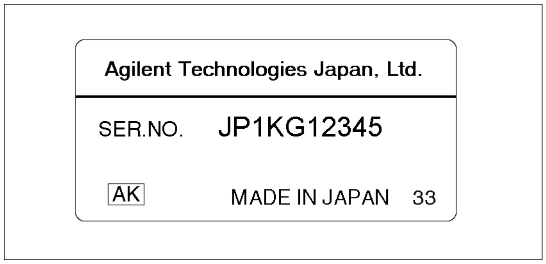


Figure A-1. Serial Number Plate

Change 1

To adapt this manual to the 4352B with serial number JP1KE, make the following changes.

Changes of softkeys under the (Meas) key (common to tester mode and analyzer mode)

Make the following changes in Figure A-3 and Figure A-4 to adapt them to Figure A-2.

Deletion

- FREQ BAND [xx-xx]
- Frequency band menu

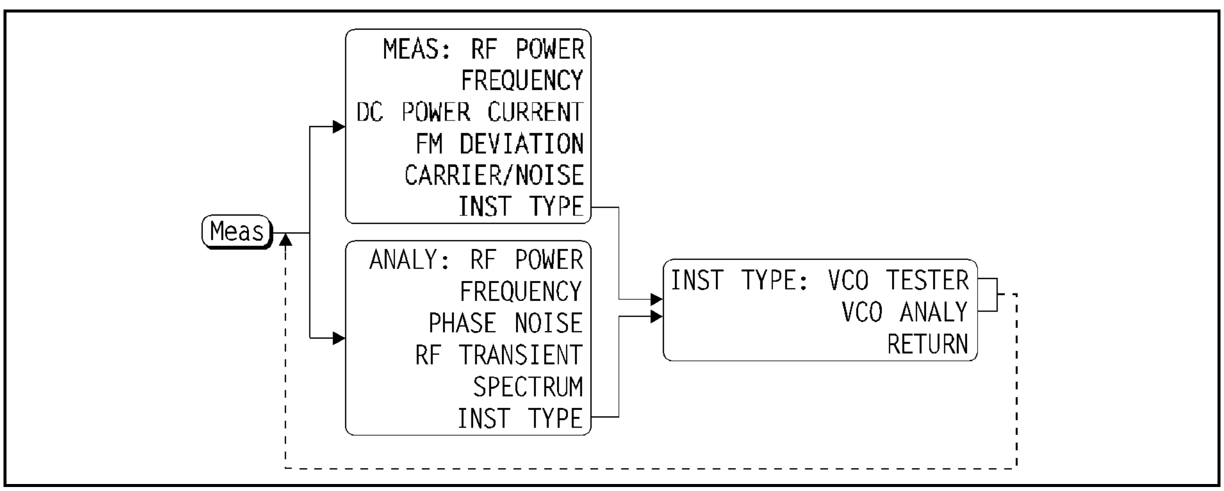


Figure A-2. Softkey menu called from the (Meas) key (for serial number JP1KE)

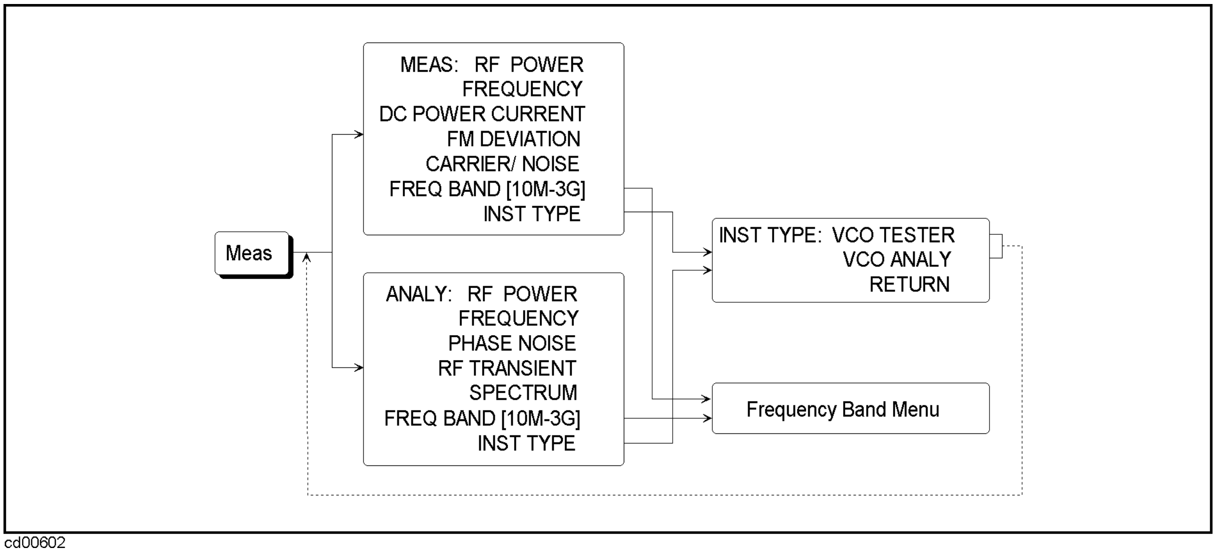


Figure A-3. Softkey menu called from the (Meas) key (current)

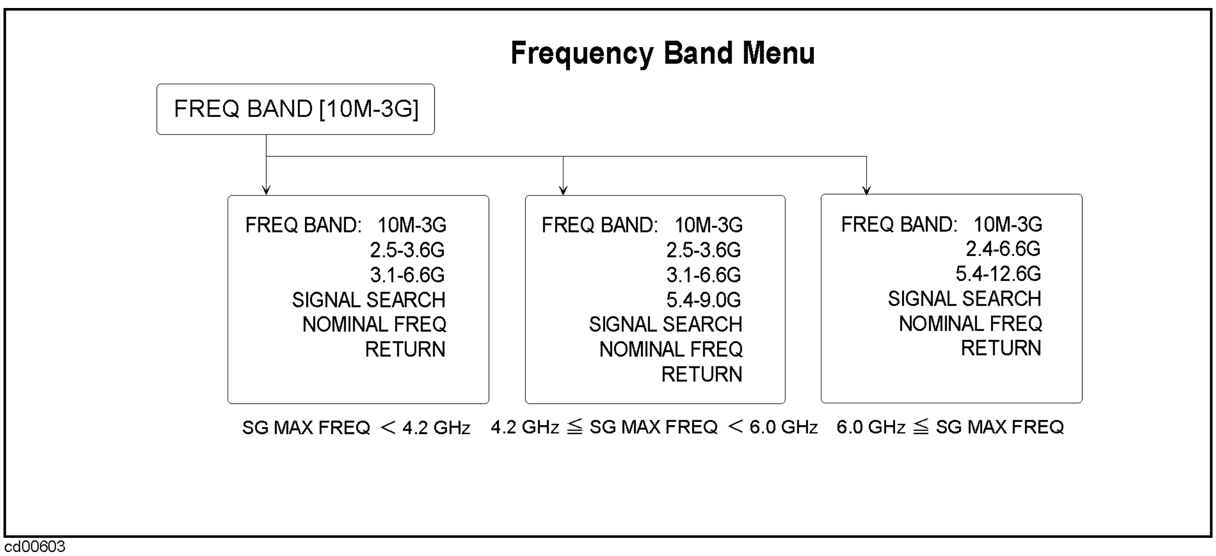


Figure A-4. Frequency band menu (current)

Changes of softkeys under the (Sens Range) key (only for analyzer mode)

Make the following changes in Figure A-6 to adapt it to Figure A-5.

Addition

- `RF TRANS MAX FREQ` (TRMAX <value>)
  Sets the maximum frequency within the frequency transient measurement range.
- `RF TRANS MIN FREQ` (TRMIN <value>)
  Sets the minimum frequency within the frequency transient measurement range.

Renaming

- Rename `REF FREQ FOR SCALE` to `RF TRANS REF FREQ`.

Deletion

- `TARGET FREQ`
- `FREQ SPAN:2MHz`
- `20MHz`
- `MAX xxxMHz`
- `TARGET POSITION`

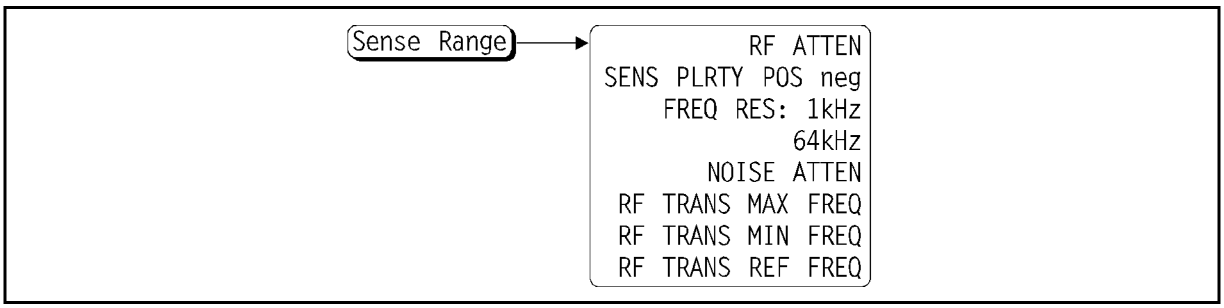


Figure A-5. Softkey menu called from the (Sense Range) key (for serial number JP1KE)

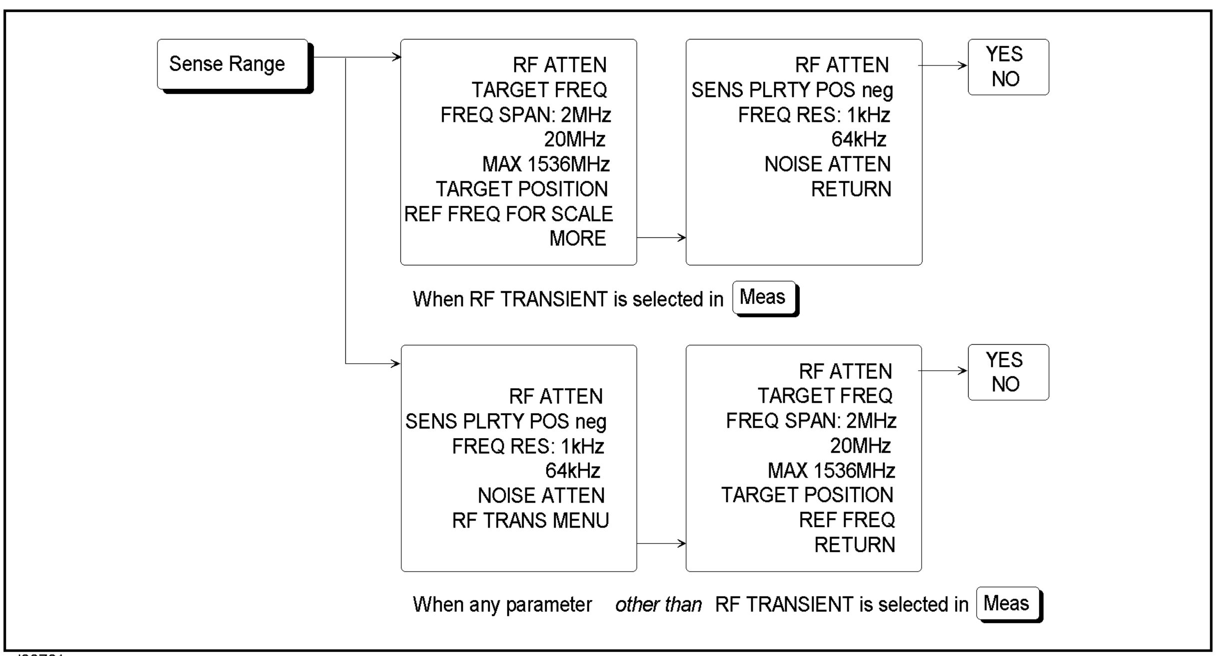


Figure A-6. Softkey menu called from the (Sense Range) key (current)

Changes of softkeys under the Menu key (only for analyzer mode)

Make the following changes in Figure A-8 and Figure A-10 to adapt them to Figure A-7 and Figure A-9.

Deletion

- SWEEP TYPE [LOG FREQ]
- DETECTION [SAMPLE]
- DETECTION:POS PEAK
- NEG PEAK
- SAMPLE
- INTG NOISE on OFF

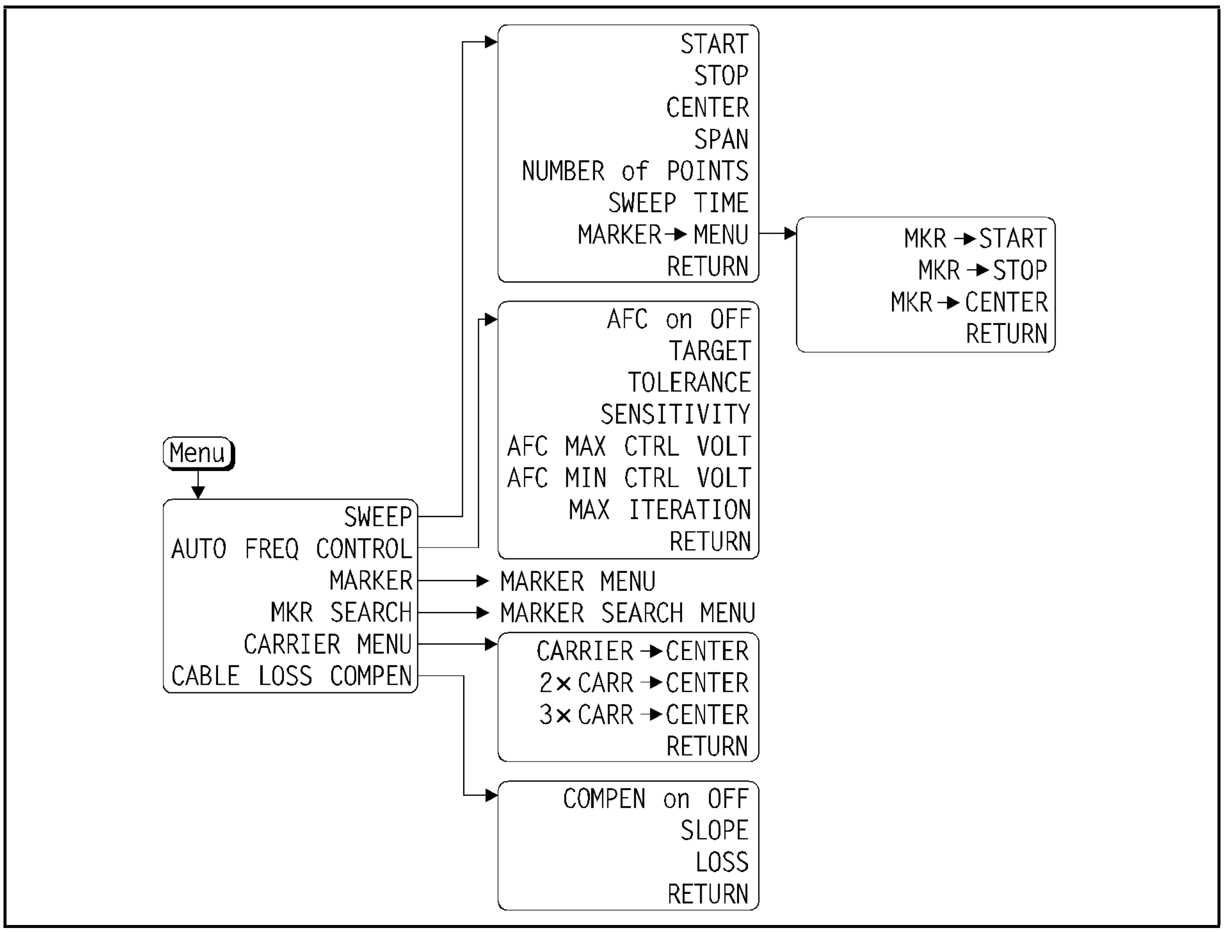


Figure A-7. Softkey menu called from the Menu key (for serial number JP1KE)

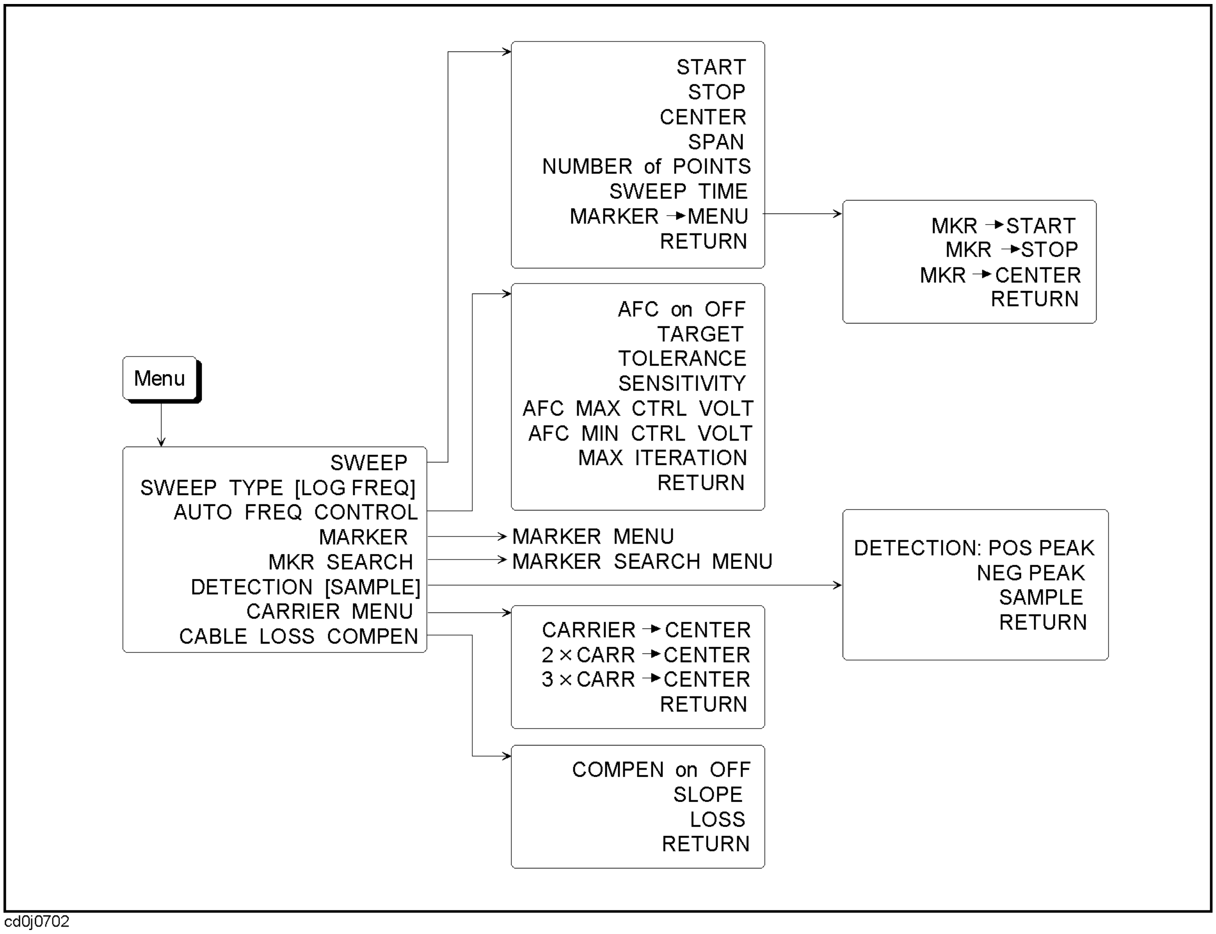


Figure A-8. Softkey menu called from the (Menu) key (current)

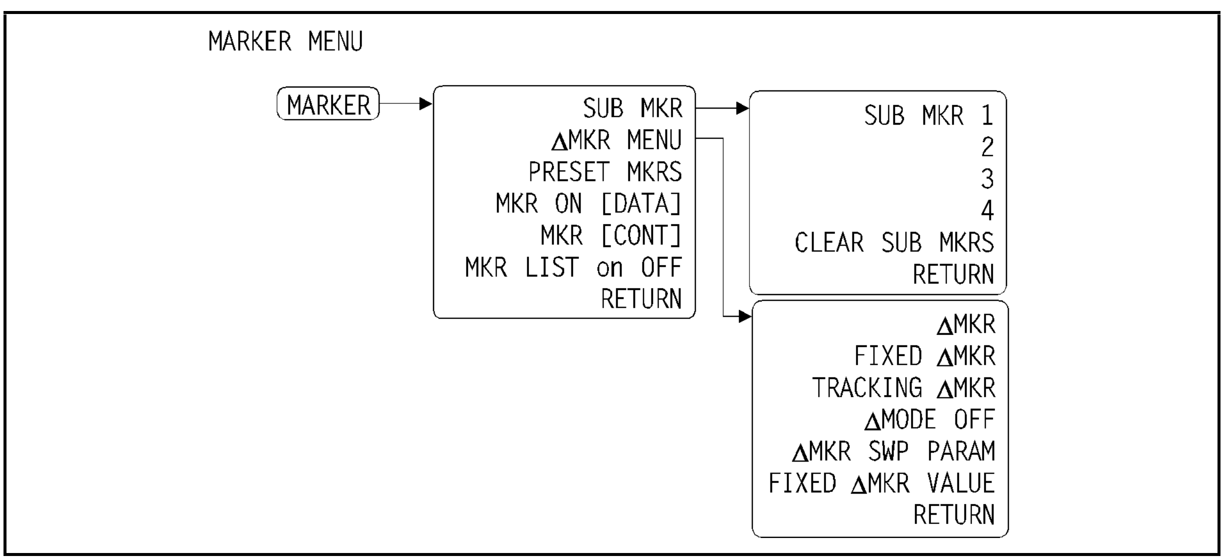
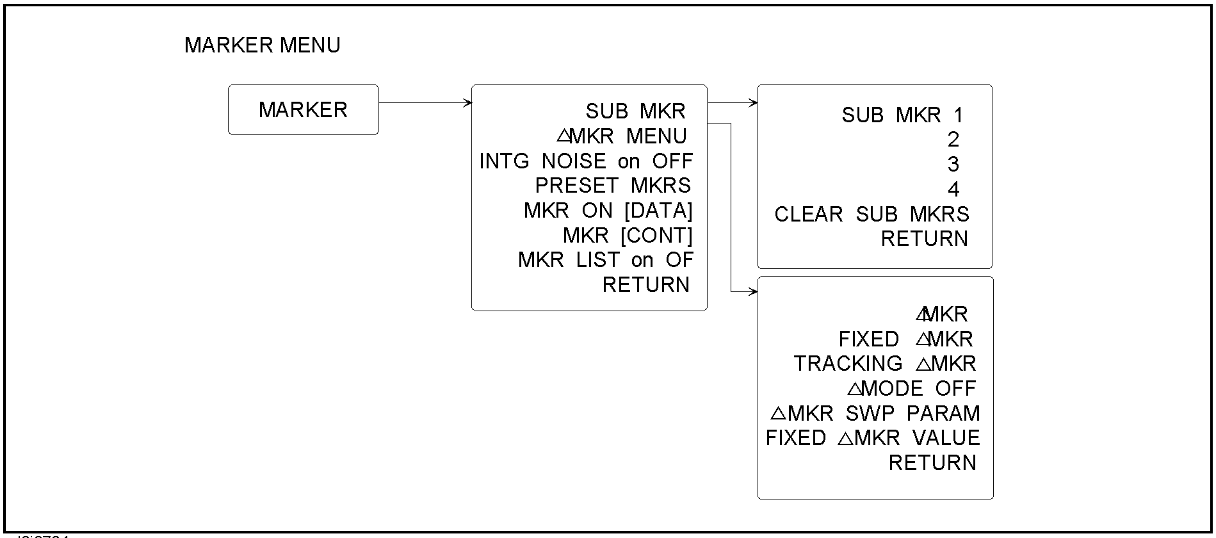


Figure A-9. Softkey menu called from the MARKER key (for serial number JP1KE)



cd0j0704

Figure A-10. Softkey menu called from the MARKER key (current)

Changes of softkeys under the RF/LO key(only for analyzer mode)

Make the following changes in Figure A-12 to adapt it to Figure A-11.

Deletion

- SG MAX FREQ]
- DOWNCONV on OFF

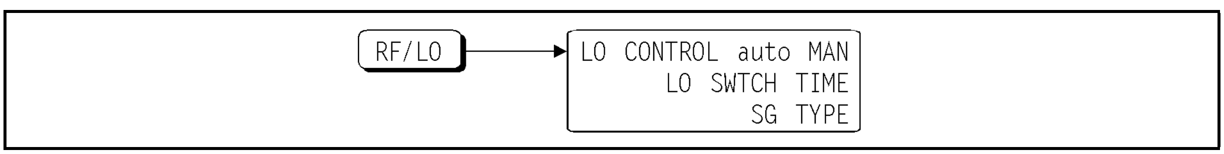
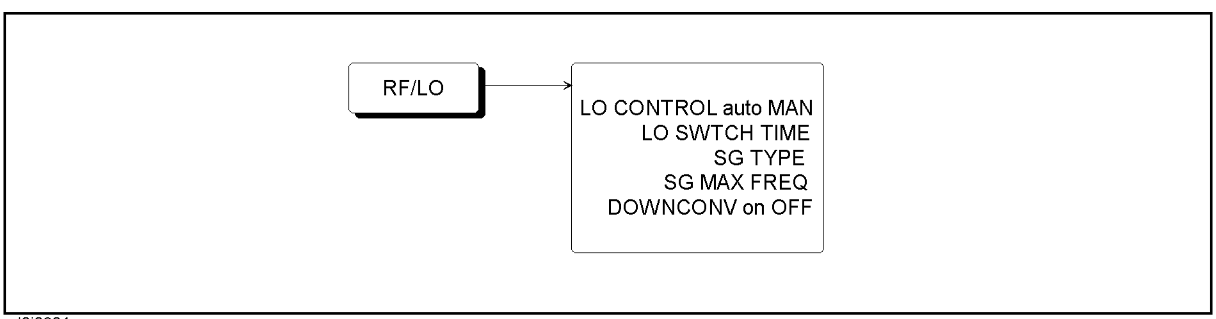


Figure A-11. Softkey menu called from the RF/LO key (for serial number JP1KE)



cd0j0804

Figure A-12. Softkey menu called from the RF/LO key (current)

Adding IBASIC sample programs

To adapt this manual to the 4352B with serial number JP1KE, add the following to Appendix C, Technical Information.

2-6. IBASIC sample programs for frequency transient measurements

The following show two Instrument BASIC sample programs, one using the trigger detection output function and the other using the value trigger function.

The sample program using the trigger detection output function repeats the following procedure for 4 different PLL frequencies: setting divider data, changing the frequency immediately after a measurement trigger, and then measuring the change of the PLL output frequency.
In the sample program using the value trigger function, the following settings are performed first: initial PLL output frequency to 180 MHz, the frequency at which a measurement trigger is generated to 181 MHz, and trigger direction to POS. When all the settings are completed, the PLL output frequency is changed to 200 MHz. The 4352B starts the transient measurement of the PLL output frequency when the frequency reaches 181 MHz.

In each of these programs, the signals are assigned as follows: the load signal to load the PLL divider data to OUTPUT1, serial output of the 8-bit divider data to bit 0 of port A, and the transmission clock to bit 1 of port A.

For details on programming, see *4352B GPIB Programming Manual* also.

Sample program using the trigger detection output function

```
100   ! File Name : FIG12_32.TXT
110   !   IBASIC SAMPLE PROGRAM for Frequency Transient Measurement with
          Trigger Detection Output Function
120   !
130   ASSIGN @Hp4352 TO 800
140   INTEGER Divider(1:4)
150   !
160    Sg_wait_time=.1              ! second
170    Vpower=12                    ! Volt
180    Fmax=2.1E+8                  ! Hz
190    Fmin=1.75E+8                 ! Hz
200   ! Fref=1.8E+8                 ! Hz
210    Start=0                      ! second
220    Sweep_time=.02               ! second
230   !
240    DATA 225,235,245,255  ! Divider
250    FOR I=1 TO 4
260     READ Divider(I)             ! Read Divider Numbers
270    NEXT I
280   !
290    OUTPUT @Hp4352;"PRES"        ! Preset 4352
300    OUTPUT @Hp4352;"HOLD"        ! Trigger HOLD
310    OUTPUT @Hp4352;"SGTYPE 1"    ! Select SG TYPE 1
320    OUTPUT @Hp4352;"LOSWT ";Sg_wait_time ! Set LOCAL SG Wait Time to
       0.1 second
330    OUTPUT @Hp4352;"LOAUTO ON"   ! Automatic Local SG Control
340    WAIT 3
```

Sample program using the trigger detection output function (1/2)

```
350    OUTPUT @Hp4352;"VA"           ! Select Analyzer mode
360    OUTPUT @Hp4352;"MEAS TRAN"    ! Select Frequency Transient Measurement
370    EXECUTE "SING"                ! Perform F-V Converter Calibration
380    OUTPUT @Hp4352;"POSL"         ! Positive Logic
390    OUTPUT @Hp4352;"VPOW ";Vpower  ! Set Power Voltage
400    OUTPUT @Hp4352;"VOUT ON"      ! Supply DC Voltage
410    OUTPUT @Hp4352;"STAR ";Start ! Set Measurement Start Time
420    OUTPUT @Hp4352;"SPAN ";Sweep_time ! Set Sweep Time
430    OUTPUT @Hp4352;"TRMAX ";Fmax ! Set MAX Measurement Frequency
440    OUTPUT @Hp4352;"TRMIN ";Fmin ! Set MIN Measurement Frequency
450   ! OUTPUT @Hp4352;"TRREF ";Fref ! Set Reference Frequency
460    OUTPUT @Hp4352;"TRGOUT ON"    ! Set Trigger Output function ON
470    OUTPUT @Hp4352;"OUT1ENVH"     ! Set OUTPUT 1 to HIGH by Trigger
480    WRITEIO 16,0;0                ! Initialize PORT A
490    OUTPUT @Hp4352;"*OPC?"        ! Verify Operation Completed
500    ENTER @Hp4352;Opc
510   !
520    DISP "CONNECT DEVICE and PRESS CONTINUE"
530    PAUSE
540    DISP "MEASUREMENT"
550    !
560    FOR I=1 TO 4
570     OUTPUT @Hp4352;"OUT1L"       ! Set OUTPUT 1 to LOW
580     X=Divider(I)
590     FOR J=7 TO 0 STEP -1
600      WRITEIO 16,0;BIT(X,J)       ! Send Divider Data via PORT A
610      WRITEIO 16,0;BIT(X,J)+2
620      WRITEIO 16,0;BIT(X,J)
630     NEXT J
640     EXECUTE "SING"               ! Single Sweep
650    NEXT I
660   !
670    DISP "MEAS END"
680   !
690   END
```

Figure A-13. Sample program using the trigger detection output function (2/2)

Sample program using the value trigger function

```
100 ! File Name : FIG12_34.TXT
110 !   IBASIC SAMPLE PROGRAM for Frequency Transient
         Measurement with Value Trigger Function
120 !
130  ASSIGN @Hp4352 TO 800
140 !
150  Sg_wait_time=.1              ! second
160  Vpower=12                    ! Volt
170  Fmax=2.1E+8                  ! Hz
180  Fmin=1.7E+8                  ! Hz
190  ! Fref=1.8E+8                ! Hz
200  Start=0                      ! second
210  Sweep_time=.02               ! second
220 !
230  OUTPUT @Hp4352;"PRES"        ! Preset 4352
240  OUTPUT @Hp4352;"HOLD"        ! Trigger HOLD
250  OUTPUT @Hp4352;"SGTYPE 1"    ! Select SG TYPE 1
260  OUTPUT @Hp4352;"LOSWT ";Sg_wait_time !
                  Set LOCAL SG Wait Time to 0.1 second
270  OUTPUT @Hp4352;"LOAUTO ON"   ! Automatic
                                    Local SG Control
280  WAIT 3
290  OUTPUT @Hp4352;"VA"          ! Select Analyzer mode
300  OUTPUT @Hp4352;"MEAS TRAN"   ! Select Frequency
                                    Transient Measurement
310  EXECUTE "SING"               ! Perform F-V Converter
                                    Calibration
320  OUTPUT @Hp4352;"POSL"        ! Positive Logic
330  OUTPUT @Hp4352;"VPOW ";Vpower  ! Set Power Voltage
340  OUTPUT @Hp4352;"VOUT ON"     ! Supply DC Voltage
350  OUTPUT @Hp4352;"STAR ";Start ! Set Measurement Start Time
360  OUTPUT @Hp4352;"SPAN ";Sweep_time ! Set Sweep Time
370  OUTPUT @Hp4352;"TRMAX ";Fmax ! Set MAX Measurement
                                    Frequency
380  OUTPUT @Hp4352;"TRMIN ";Fmin ! Set MIN Measurement
                                    Frequency
390  !OUTPUT @Hp4352;"TRREF ";Fref ! Set Reference Frequency
400  WRITEIO 16,0;0               ! Initialize PORT A
410  !
420  N=224                        ! Change Frequency
                                    to 180 MHz (@ N=224)
430  GOSUB Set_frequency
440  !
450  DISP "PRESS CONTINUE"
460  PAUSE
470  DISP "MEASUREMENT"
```

Sample program using the value trigger function (1/2)

```
480  !
490  OUTPUT @Hp4352;"TRGS VAL;TRGVAL 181E6"  !
                           Set Value Trigger mode ON
                 and Set Trigger frequency to 181 MHz
500  OUTPUT @Hp4352;"TRGP POS"    ! Select Positive
                                   Trigger Polarity
510  OUTPUT @Hp4352;"CLES"        ! Clear Status Register
520  OUTPUT @Hp4352;"*OPC?"       ! Verify Operation
                                   Completed
530  ENTER @Hp4352;Opc
540  !
550  OUTPUT @Hp4352;"SING"        ! Single Sweep
560  !
570  N=249                        ! Change Frequency
                                   to 200 MHz (@ N=249)
580  GOSUB Set_frequency
590  GOSUB Meas_end
600  !
610  DISP "MEAS END"
620  !
630  STOP
640  !
650  !
660 Set_frequency:!
670  OUTPUT @Hp4352;"OUT1L"       ! Set OUTPUT 1 to LOW
680   FOR I=7 TO 0 STEP -1
690    WRITEIO 16,0;BIT(N,I)      ! Send Divider Data via PORT A
700    WRITEIO 16,0;BIT(N,I)+2
710    WRITEIO 16,0;BIT(N,I)
720   NEXT I
730  OUTPUT @Hp4352;"OUT1H"       ! Set OUTPUT 1 to HIGH
740  RETURN
750  !
760 Meas_end:!
770  REPEAT
780   OUTPUT @Hp4352;"ESB?"       ! Check Event Status Register
790   ENTER @Hp4352;Esb
800  UNTIL BIT(Esb,0)
810  RETURN
820  !
830  END
```

Sample program using the value trigger function (2/2)

Miscellaneous Changes

The option system of the 4352B has changed since July 2003. Apply the following changes.

New Option Number	Old Option Number	Remark
700 (Standard DC control voltage (0 to 20V))	Standard	1
001 (Expand DC control voltage (-15 to 35V))	same as the left one	
810 (Add Keyboard)	-	2
-	1A2 (Delete Keyboard)	
1CM (Rack Mount Kit)	same as the left one	
1CN (Handle Kit)	same as the left one	
1CP (Rackmount and Handle Kit)	same as the left one	
ABA (U.S. - English localization)	-	3
-	ABA (U.S. - English localization)	
ABJ (Japan - Japanese localization)	-	3
-	ABJ (Japan - Japanese localization)	
OBW (Add Service Manual)	same as the left number	
-	OB1 (Add Operation Manual)	4
-	OB0 (Delete Operation Manual)	

1 In the previous system, an option for the Expand DC control voltage was available only for “Add” option. In the new option system, it is available for the “Add” and “No”, requiring the customer to select either of them.

2 In the previous option system, the keyboard comes as one of standard accessories. In the new option system, it will be attached only when you choose option 810.

3 In the previous system, the option number is used to choose the language of the operation manual set (standard accessory). In the new option system, it is used to add an operation manual set (optional accessory) of the language the customer desires.

4 No selection of addition/deletion is required for the operation manual set because it is only available as an optional accessory in the new option system.

B

GPIB Function Specification

This appendix provides an overview of GPIB, and explains the GPIB functions that can be used by the analyzer. This appendix is very useful when constructing a measurement system using the analyzer and peripherals.

This appendix explains the following:

- What is GPIB?
  - GPIB Functions
  - GPIB Specifications
- The Analyzer's GPIB Functions
  - Bus Mode
  - GPIB Address Setup

What is GPIB?

The analyzer is factory-equipped with a remote programming digital interface using the General Purpose Interface Bus (GPIB). GPIB is in compliance with IEEE 488.1, IEC-625, IEEE 488.2, and JIS-C1901.) This allows the analyzer to be controlled by an external computer that sends commands or instructions to and receives data from the analyzer using the GPIB. In this way, a remote operator has the same control of the instrument available to a local operator from the front panel, except for the line power switch.

In addition, the analyzer itself can use GPIB to directly control compatible peripherals, without the use of an external controller. It can output measurement results directly to a compatible printer or plotter.

An overview of GPIB operation is given here. GPIB commands that correspond to front panel functions are indicated with ( ) in this manual. See the *4352B GPIB Programming Manual* for detailed explanations of GPIB commands.

For details of remote programming for the analyzer using the GPIB, see the *4352B GPIB Programming Manual*. The *4352B GPIB Programming Manual* includes examples of remote measurements using an HP 9000 series 200/300 computer with BASIC programming. The *4352B GPIB Programming Manual* assumes familiarity with front panel operation of the instrument. For information regarding the IEEE 488.1 standard, see "IEEE Standard Digital Interface for Programmable Instrumentation" (Published by: Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York 10017, USA).

GPIB Functions

The GPIB uses a party line bus structure in which up to 15 devices can be connected on one contiguous bus. The interface contains 16 signal lines and 6 ground lines. In this connection system, many types of devices such as instruments, computers, plotters, printers, etc. can be connected in parallel.

An GPIB device supports one or more of the following functions.

Talker

A **talker** is a device capable of sending device-dependent data when addressed to talk. There can be only one active talker at any given time. Examples of this type of device are voltmeters, counters, and tape readers. The analyzer is a talker when it sends trace data or marker information over the bus.

Listener

A **listener** is a device capable of receiving device-dependent data when addressed to listen. There can be any number of active listeners at any given time. Examples of this type of device are printers, power supplies, and signal generators. The analyzer is a listener when it is controlled over the bus by a computer.

Controller

A **controller** is a device capable of managing the operation of the bus and addressing talkers and listeners. There can only be one active controller at any time. Examples of controllers include desktop computers and minicomputers. In a multiple-controller system, active control can be passed between controllers, but there can only be one system controller that acts as the master, and can regain active control at any time. The analyzer is an active controller when it plots or prints in the addressable mode. The analyzer is a system controller when it is in the system controller mode.

GPIB Specifications

Number of Devices Connectable	15 maximum.
Cable Length	20 meters maximum or 2 meters per device, whichever is less.
Message Transmission Format	Byte serial/bit parallel asynchronous data transmission using a 3-line handshake system.
Data Rate	Maximum of 1 M byte per second over limited distances with tri-state drivers. Actual data rate depends on the transfer rate of the slowest device involved.
Address Capabilities	Primary Address Specification: 31 talk, 31 listen. Simultaneously, maximum of 1 active talker and 14 active listeners.
Multi-Controller Function	In systems with more than one controller, only one can be active at any given time. The active controller can pass control to another controller, but only one system controller is allowed.

The Analyzer's GPIB Functions

As defined in IEEE 488.1, the analyzer has the following capabilities:

SH1	Full source handshake.
AH1	Full acceptor handshake.
T6	Basic talker, serial poll reply, unaddresses if MLA is issued. No talk only mode.
TE0	No extended talker address
L4	Basic listener, unaddresses if MTA is issued. No listen only mode.
LE0	No extended listener address.
SR1	Complete service request (SRQ) function.
RL1	Complete remote / local function (including local lockout).
PP0	Does not respond to parallel poll.
DC1	Complete device clear.
DT1	Responds to a group execution trigger.
C1, C2, C3, C4	System controller capabilities in system controller mode.
C11	Pass control capabilities in addressable mode.
E2	Tri-stated drivers.

Bus Mode

The analyzer uses a single bus structure. The single bus makes it possible for both the analyzer and the host controller to access the peripherals within the system.

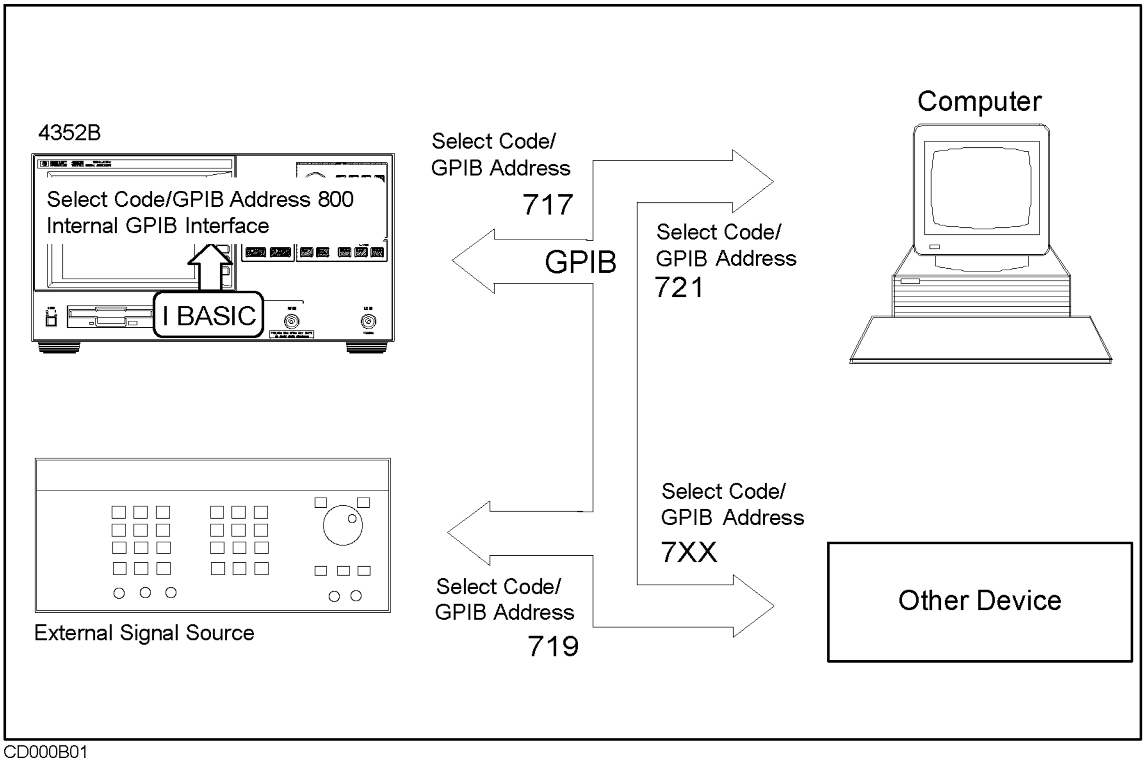


Figure B-1. Single Bus Concept

There are two modes in bus mode: system controller mode and addressable mode.

System Controller
: This mode allows the analyzer to control peripherals directly in a stand-alone environment (without an external controller). This mode can only be selected manually from the analyzer front panel. Use this mode for operation when no computer is connected to the analyzer.

Addressable
: This is the traditional programming mode, in which the external computer is involved in all peripheral access operations. When the external controller is connected to the analyzer through GPIB, this mode allows the external controller to control the analyzer over GPIB in the talker mode in order to send data, and in the listener mode to receive commands. It also allows the analyzer to take or pass control in order to plot and print.

Setting Addresses

In communications over the GPIB, each instrument on the bus is identified by an GPIB address. This address code must be different for each instrument on the bus. These addresses are not affected by (Preset) key or by turning the instrument off.

C

Technical Information

This appendix provides additional information listed below for measurement items described in Chapter 4 and Chapter 5.

1. C/N ratio measurement (tester mode) and phase noise vs. offset frequency characteristics measurement (analyzer mode)

    1-1. Effect of noise of the VCO control voltage source on VCO phase noise
    1-2. Evaluating (estimating) errors in phase noise characteristics measurement
    1-3. Measured values when there is a spurious component

2. Frequency transient measurement

    2-1. Mechanism to determine the measurement frequency band, the frequency span, and the frequency resolution
    2-2. Incorrect measurement during early stages of the transient when high-resolution is selected
    2-3. Setting the reference frequency (REF FREQ FOR SCALE)
    2-4. Setting the measurement trigger
    2-5. Setting divider data of PLL and sending the load signal
    2-6. IBASIC sample program of the frequency transient measurement

3. Notes on measurement

    3-1. Eliminating components that affect measurements

Reading the information in this appendix will help you make accurate measurements.

1. C/N ratio measurement (tester mode) and phase noise vs. offset frequency characteristics measurement (analyzer mode)

1-1. Effect of noise of the VCO control voltage source on VCO phase noise

When noise En is applied to the frequency control terminal of an ideal VCO with no phase noise, the phase noise at the offset frequency Fo from the carrier is expressed as follows:

$$V_{cont} = 20log(Kv\frac{En}{Fo}) - 123[dBc/\sqrt{Hz}]$$

Where,

Kv: Control voltage sensitivity of VCO [MHz/V]

En: Noise applied to the control terminal [nV/$\sqrt{Hz}$]

Fo: Offset frequency from the carrier [kHz]

Assume that the phase noise of VCO when the noise at the control terminal is zero is Vvco, it has no correlation to En, and they are in normal distribution. Total noise Vtotal is expressed as follows:

$$V_{total} = \sqrt{V_{cont}{}^2 + V_{vco}{}^2}$$

Notice that the unit must be converted to dBc before substitution into the expression shown above. For a concrete example, see "1-2. Evaluating (estimating) errors in phase noise measurement".

1-2. Evaluating (estimating) errors in phase noise measurement

Phase noise readings obtained with the 4352B can be expressed in terms of the phase noise of the DUT, the 4352B and the external signal source as follows:

$$V_{reading} = \sqrt{V_{vco}{}^2 + V_{4352A}{}^2 + V_{SG}{}^2}$$

Where

$V_{reading}$	=4352B reading
$V_{VCO}{}^2$	=Phase noise of DUT at offset frequency f_o
$V_{4352A}{}^2$	=4352B phase noise performance at f_o
$V_{SG}{}^2$	=Phase noise performance of external signal source at f_o

Therefore, the measurement error can be estimated as the difference between the reading derived from the above equation and the phase noise.
Usually, the measurement error becomes larger when the difference in phase noise between the DUT and the 4352B (or external signal generator) becomes smaller.

Example

We assume that the phase noise of the DUT, the 4352B, and the external signal source is −135 dBc, −140 dBc, and −145 dBc, respectively. Then, the phase noise measurement error can be determined as follows:

Note that phase noise is normally expressed in [dBc]. Therefore, the unit must be converted to dBc before substitution into the expression shown above.

Procedure

1. Convert each value in [dB] to the equivalent in [V].
2. Calculate the 4352B reading using the expression given above.
3. Convert the 4352B reading in [V] back to the equivalent in [dB].
4. Subtract the DUT phase noise from the 4352B reading to determine the error.

In this example, we obtain 1.51[dB] as the measurement error through the following calculation.

$$V_{VCO}\ [\mathrm{V}] = 10^{-135/20} = 1.778\times10^{-7}$$

$$V_{4352A}\ [\mathrm{V}] = 10^{-140/20} = 1.0\times10^{-7}$$

$$V_{SG}\ [\mathrm{V}] = 10^{-145/20} = 5.623\times10^{-8}$$

$$V_{reading}\ [\mathrm{V}] = 2.12\times10^{-7}$$

$$V_{reading}\ [\mathrm{dB}] = 20log(V_{reading}[V]) = -133.49$$

$$V_{VCO}\ [\mathrm{dB}] = 20log(V_{VCO}[V]) = -135$$

Phase noise measurement error [dB] = (−133.49) − (−135) = 1.51

1-3. Measured values when there is a spurious component

In the tester mode, a measured value is represented by averaging measurement points in the frequency range that is proportional to the offset frequency (approximately ±12% of the offset frequency). This causes a relatively higher measured value than an actual phase noise value, if any spurious component exists around the measurement offset frequency.

2. Technical information on frequency transient measurement (analyzer mode)

The frequency transient measurement function is mainly used to evaluate the oscillation frequency stability of a VCO which stays in a stationary oscillation state. It is also used to characterize the frequency variation of a PLL when it is in a frequency transient state.

The relationship between the frequency span and the minimum and maximum frequencies in the frequency transient measurement depends on the hardware inside the 4352B and the setting of measurement conditions. For more information, see "2-1. Relationship between hardware and setting in transient measurement" described later.

If a narrower frequency span (2 MHz, 20 MHz, or 512 MHz) is selected, frequencies during measurement of a transient may not measured correctly. For more information, see "2-2. Responses out of the measurement range" described later.

When measuring high-frequency signals in high-resolution, the number of digits for displaying the obtained frequency value may be insufficient. In this case, you can gain higher frequency resolution by setting a reference frequency. For more information, see "2-3. Setting a reference frequency (REF FREQ FOR SCALE)" described later.

To measure a frequency transient of a PLL, you need to prepare an IBASIC program which changes divider data setting through the 4352B's built-in 24-bit I/O interface and/or to set 4352B so that it generates a measurement trigger upon a change of the PLL divider data setting. For more information, see "2-4. Setting the measurement trigger" and "2-5. Sending divider data to a serial-input PLL" described later.

2-1. Relationship between hardware and setting in transient measurement

The frequency transient measurement is realized by combining the following hardware devices.

- Mixer for frequency conversion
- Frequency divider
- Frequency-to-voltage converter (hereafter, FV converter) that operates within an input frequency range of 1 MHz to 3 MHz

The relationship between the frequency span and the hardware is described below.

When using the 4352B alone or using the 43521A with the frequency band of 10 MHz to 3 GHz

(a) When selecting the frequency span of 2 MHz

When selecting the frequency span of 2 MHz, set the frequency of the local signal (external signal source) so that the difference from the measured signal frequency is within a range of 1 MHz to 3 MHz. The measured signal and the local signal is inputted to the mixer inside the 4352B and the mixer outputs an IF signal within a range of 1 MHz to 3 MHz. The frequency of this IF signal is measured by the FV converter. As described above, by changing the frequency of the local signal depending on the measured signal frequency, you can specify any frequencies as the minimum and maximum frequencies, while keeping the frequency span of 2 MHz. In this case, the relationship between the measured signal and the local signal is as follows:

- When the measured signal is 550 MHz or less: Measured signal frequency $\leq$ local frequency
- When the measured signal is 550 MHz or more: Measured signal frequency $\geq$ local frequency

(b) When selecting the frequency span of 20 MHz

When selecting the frequency span of 20 MHz, set the frequency of the local signal (external signal source) so that the difference from the measured signal frequency is within a range of 10 MHz to 30 MHz. The measured signal and the local signal is inputted to the mixer inside the 4352B and the mixer outputs an IF signal within a range of 10 MHz to 30 MHz. This IF signal is divided in frequency by 10 and measured by the FV converter. As described above, by changing the frequency of the local signal depending on the measured signal frequency, you can specify any frequencies as the minimum and maximum frequencies, while keeping the frequency span of 20 MHz.

(c) When selecting the maximum frequency span

When selecting the maximum frequency span, the mixer for frequency conversion is not used. Only the frequency divider is used. The measured signal is first inputted to the 64-divide-ratio divider and then its output is inputted to the FV converter through the N-divide-ratio programmable divider. This N is the same as the frequency band number shown in Table C-1. When this N is determined, the minimum and maximum measurement frequencies are automatically determined.

Table C-1. 16 available measurement frequency bands

Frequency band number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Maximum frequency (MHz)	192	384	576	768	960	1152	1354	1536	1728	1920	2112	2304	2496	2688	2880	3000
Minimum frequency (MHz)	64	128	192	256	320	384	448	512	576	640	704	768	832	896	960	1024
Frequency span (MHz)	128	256	384	512	640	768	896	1024	1152	1280	1408	1536	1664	1792	1920	2048
Frequency resolution (kHz)	3.2	6.4	9.6	12.8	16	19.2	22.4	25.6	28.8	32	35.2	38.4	41.6	44.8	48	51.2

When using the 43521A with the frequency band other than 10 MHz to 3 GHz

The measured signal is converted in frequency by the 43521A and inputted to the 4352B. In this case, the local signal of the 4352B is fixed to 600 MHz.

(a) When selecting the frequency span of 2 MHz

When selecting the frequency span of 2 MHz, set the frequency of the local signal (external signal source) of the 43521A so that the difference from the measured signal frequency is within a range of 601 MHz to 603 MHz. The measured signal and the local signal is inputted to the mixer inside the 43521A and the mixer outputs the IF signal within a range of 601 MHz to 603 MHz, which is the frequency difference. This IF signal is converted in frequency again inside the 4352B to produce the IF signal within the range of 1 MHz to 3 MHz. Its frequency is measured by the FV converter. As described above, by changing the frequency of the local signal depending on the measured signal frequency, you can specify any frequencies as the minimum and maximum frequencies, while keeping the frequency span of 2 MHz.

(b) When selecting the frequency span of 20 MHz

When selecting the frequency span of 20 MHz, set the frequency of the local signal (external signal source) so that the difference from the measured signal frequency is within the range of 610 MHz to 630 MHz. The measured signal and the local signal is inputted to the mixer inside the 43521A and the mixer outputs the IF signal within the range of 610 MHz to 630 MHz, which is the difference frequency. This IF signal is converted in frequency again inside the 4352B to produce the IF signal within the range of 10 MHz to 30 MHz. It is converted by the 10-divide-ratio divider, and then measured by the FV converter. As described above, by changing the frequency of the local signal depending on the measured signal frequency, you can specify any frequencies as the minimum and maximum frequencies, while keeping the frequency span of 20 MHz.

(c) When selecting the maximum frequency span (512 MHz)

When selecting the maximum frequency span (512 MHz), set the frequency of the local signal (external signal source) so that the difference from the measured signal frequency is within a range of 256 MHz to 768 MHz. The measured signal and the local signal is inputted to the mixer inside the 43521A and the mixer outputs the IF signal within a range of 256 MHz to 768 MHz, which is the difference frequency. This IF signal is converted by the 64-divide-ratio divider and the 4-divide-ratio divider inside the 4352B. Its frequency is then measured by the FV converter. As described above, by changing the frequency of the local signal of the 43521A depending on the measured signal frequency, you can specify any frequencies as the minimum and maximum frequencies, while keeping the frequency span (512 MHz).

Frequency resolution

The output of the FV converter is read by the 16-bit (resolution of 1/65536) ADC. Including approximately 30 % of overrange, the resolution of 1/40000 is ensured for the output of the FV converter. Inserting a frequency divider before the FV converter expands the measurement range by its ratio, but also increases the frequency resolution. Therefore, in any cases, the frequency resolution is 1/40000 of the frequency span.

Table C-2. Number of frequency conversions

Frequency band	For 10 MHz to 3 GHz	For other frequency bands
Span of 2 MHz	Once	Twice
Span of 20 MHz	Once	Twice
Maximum span	N/A	Once (span of 512 MHz)

2-2. Responses out of the measurement range

Consider the setting in which the frequency conversion by the mixer is performed (see Table C-2). If the measurement signal frequency approaches and then exceeds the local frequency, the same IF frequency is obtained again. In this case, if you observe the IF frequency only, you cannot find out whether the measurement signal frequency is higher or lower than the local frequency. If there is a confusion about this, a contrary calculation, addition or subtraction, is performed, and a wrong frequency is displayed. If the measurement signal frequency goes out of the range between the minimum and maximum measurement frequencies, this problem may occur. When measuring the time required to reach the end frequency (for example, in PLL transient measurement), this problem does not occur, because the end frequency is known. However, for example, when you observe the signal during a transient, you must notice this problem because the measured signal may go out of the range between the minimum and maximum measurement frequencies. To check to see if the frequency measurement is performed accurately, change the target frequency by 100 kHz and perform measurement again. If the measured frequency value does not change, the measurement is performed correctly. If the displayed frequency is shifted by 200 kHz, the measurement is wrong.
The following example explains this phenomenon, assuming that you measure a frequency transient in which the frequency of the DUT changes from 186 MHz to 180 MHz. By selecting

the frequency span of 20 MHz as shown below, you can measure earlier stages of the transient correctly.

- Target frequency : 180 MHz
- Frequency span : 20 MHz
- Target position : 50 %

In this example, the maximum frequency, the minimum frequency, and the local frequency are as follows (when the frequency span is 20 MHz, local frequency = maximum frequency + 10 MHz).

- Maximum frequency: 190 MHz
- Minimum frequency: 170 MHz
- Local frequency: 200 MHz

For example, when the frequency of the RF signal is 183 MHz, the IF signal is the difference between the local frequency (200 MHz) and the frequency of the RF signal, that is 17 MHz. Because the maximum frequency is 550 MHz or less, the 4352B assumes (RF frequency) = (local frequency) -(IF frequency) and calculates the RF frequency correctly, as 200 MHz - 17 MHz = 183 MHz.

On the other hand, assume that, to obtain higher resolution, you set the frequency span to 2 MHz, keeping the target frequency and the target position. In this case, the maximum frequency, the minimum frequency, and the local frequency are as follows. (If the frequency span is 2 MHz, local frequency = maximum frequency + 1 MHz.)

- Maximum frequency: 181 MHz
- Minimum frequency: 179 MHz
- Local frequency: 182 MHz

In the same way as above, when the frequency of the RF signal is 183 MHz, the IF signal is the difference between the local frequency and the frequency of the RF signal, that is 1 MHz. Because the maximum frequency is 550 MHz or less, the 4352B assumes (RF frequency) = (local frequency) - (IF frequency) and calculates a wrong RF frequency, as 182 MHz - 1 MHz = 181 MHz. Because the frequency span is set smaller, the RF frequency becomes greater than the frequency of the local signal. As a result, wrong calculation (incorrect measurement) is performed. A measurement error occurs at early stages of frequency change, and the result waveform is folded over as shown in Figure C-1. You can measure the details of the convergence of the transient, but the frequency measurement at early stages of the transient is inaccurate. You must consider this problem especially when the frequency of the RF signal goes out of the range between the minimum and maximum frequencies.

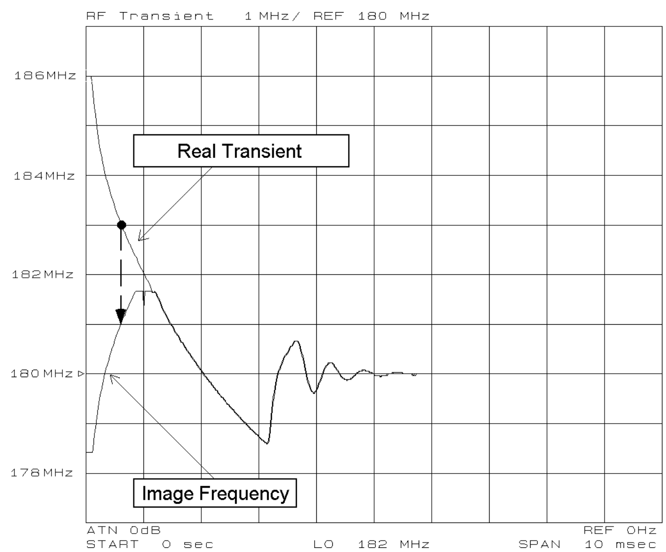


Figure C-1. Example of measuring an image frequency at early stages of transient

2-3. Setting a reference frequency (REF FREQ FOR SCALE)

The 4352B internally uses a 32-bit expression for frequency at each measurement point, and therefore provides 6.5 digit display at maximum. This restriction is also applied to the marker reading.

Therefore, for example, if you need to measure the frequency transient characteristics of a DUT whose oscillation frequency is in the GHz range using the heterodyne mode at 100 Hz resolution, the reading resolution may be insufficient. In this case, use the reference frequency setting function to set a reference frequency and use the difference between the frequency and the actually measured frequency value at each point as trace information, which increases the frequency resolution.

```
Example:
When the measured value is 1.23456789 GHz, the trace data is as follows:
1.23456 GHz (RF REF: 0 Hz)
4.56789 MHz (RF REF: 1.23 GHz)

When the measured value is 850.1234 MHz, the trace data is as follows:
850.1234 MHz (RF REF: 0 Hz)
50.1234 MHz (RF REF: 800 MHz)
```

The following guidelines show how to use the RF REF setting. Be sure to specify a appropriate value, considering the resolution required for your measurement and the measurement resolution available with the 4352B.

- The RF REF setting is not needed when 6 digits or less (reading resolution) is enough in your frequency transient measurement. This is applicable, for example, when you measure a PLL with an output frequency in the GHz range at a 10 MHz resolution.
- Be sure to specify an RF REF value only for digits of 100 MHz and above.

Note The reference frequency setting function is not related to the measurement trigger. Therefore, you can perform this function, when you see an insufficient frequency resolution for a marker value, after the sweep is complete.

2-4. Setting the measurement trigger

To ensure accuracy in determining the transient characteristics of a PLL DUT in response to a request to change its frequency, the following operations must be performed as quickly as possible:

- Sending the request to the PLL to change its frequency (sending a load signal)
- Generating a measurement trigger for the 4352B

The 4352B provides the following functions to synchronize these operations.

- Trigger detection output function
- Value trigger function

The trigger detection output function, immediately after the measurement trigger, changes the logic level of the port on the rear panel. By connecting the port on the rear panel to a PLL, you can supply the load signal to the PLL in order to change its frequency immediately after the measurement trigger.
The value trigger function first sends the load signal to change the frequency to the PLL. The 4352B detects the start of the change of the PLL output frequency and generates a trigger by itself. This function is useful, if the load signal cannot be supplied to PLL immediately after the measurement trigger (for example, when you cannot connect the port on the rear panel to a PLL).

Using the trigger detection output function

This function is designed to send a load signal to the PLL synchronously with the measurement trigger.
When this function is ON, the logic level of the OUTPUT signal in the 24 bit I/O port (in this example, OUTPUT1) changes with a very short delay (85 μsec (typical)) after the generation of a trigger. The signal of this port is supplied to the PLL as the load signal to change its frequency. Figure C-2 and Figure C-3 show the connection diagram when using the trigger detection output function. Depending on whether the PLL has serial data input or parallel data input, the connection to the 24-bit I/O port on the 4352B's rear panel varies.

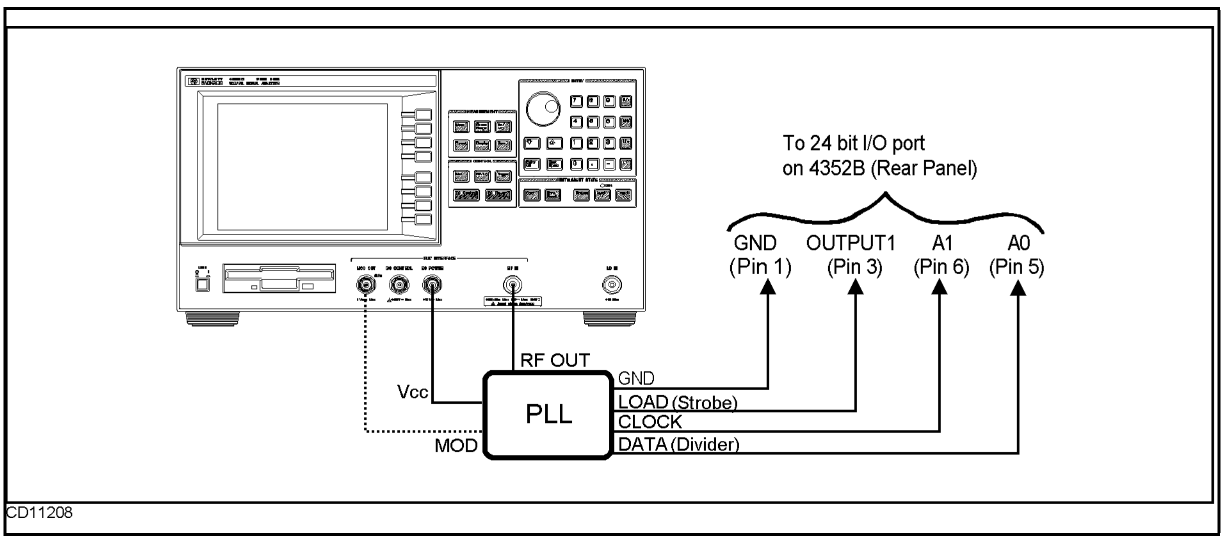


Figure C-2.
Connection diagram when using the trigger detection output function (serial-input PLL)

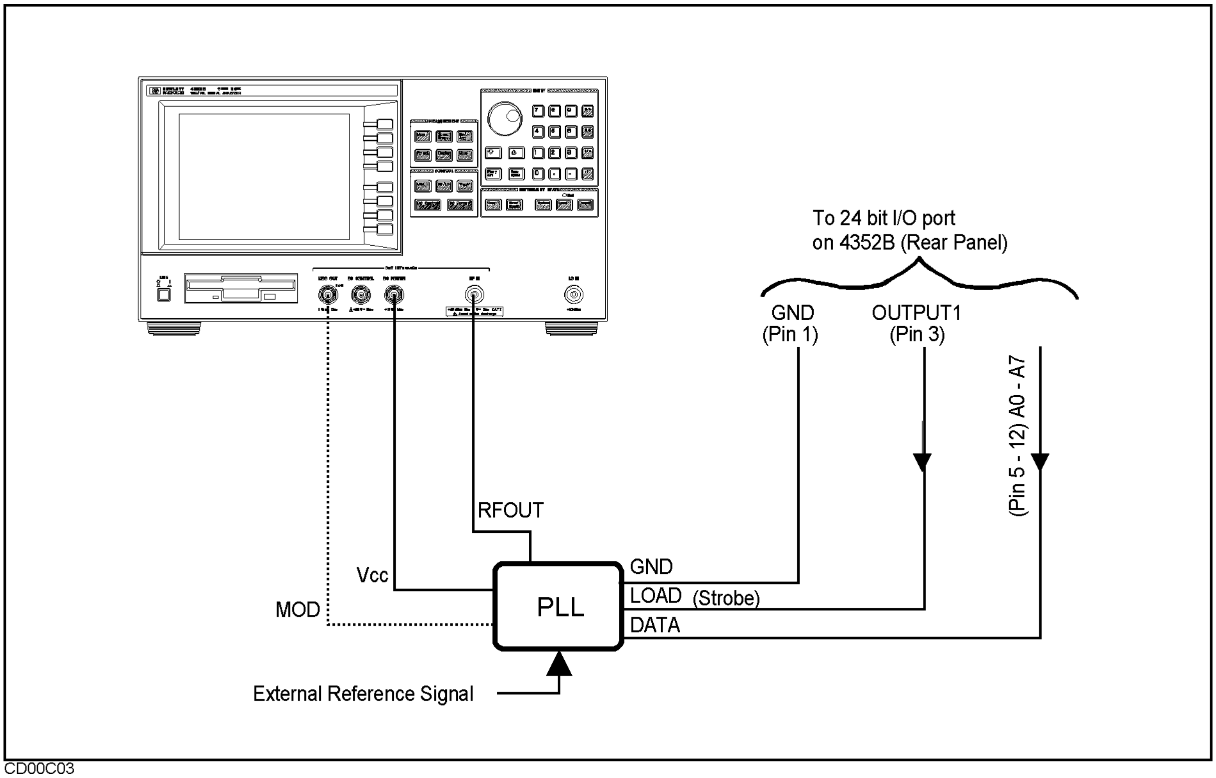


Figure C-3.
Connection diagram when using the trigger detection output function (parallel-input PLL)

The program flow of Figure C-4 shows a concrete procedure. For details on each command, see *4352B GPIB Programming Manual.*

```
100   ASSIGN @Hp4352 TO 800
.
.  (Insert a program to set measurement parameters.)
.
180   OUTPUT @Hp4352;"TRGOUT ON"  ! Turn ON Trigger Detection Output Function
190   OUTPUT @Hp4352;"OUT1ENVH"   ! Perform Setting OUTPUT 1 HIGH
                                  ! Synchronously with Measurement Trigger
.
.  (Insert a program to set the instrument.)
.
350   OUTPUT @Hp4352;"OUT1L"      ! Set OUTPUT1 to LOW
.
.  (Insert program to send PLL divider data (1).)
.
430   OUTPUT @Hp4352;"OUT1H"      ! Set Divider Data (1) to PLL
440   OUTPUT @Hp4352;"OUT1L"      ! Set OUTPUT1 to LOW
.
.  (Insert program to send PLL divider data (2).)
.
490   EXECUTE "SING"              ! Set Divider Data (2) to PLL
                                  ! on Measurement Start
```

Figure C-4. Program flow for the PLL frequency transient measurement

1. `TRGOUT ON` in line 180 sets the trigger detection output function.
2. Line 190 sets `OUT1ENVH` in advance. This command causes OUTPUT1 of the 24-bit I/O port on the 4352B's rear panel to go HIGH when a measurement trigger is generated. This signal is supplied to the load terminal of the PLL.
3. Line 350 causes OUTPUT1 of the 24-bit I/O port on the 4352B's rear panel to LOW. This resets the PLL load terminal. The next HIGH sets the load terminal and causes the divider data (divide ratio) signal that has been sent to the data terminals to be acquired into the PLL.
4. Next, the divider data (divide ratio) signal is sent to the PLL. This divider data is a binary value corresponding to the start frequency. The value must be derived from the specifications of the PLL. This signal is supplied, through the A port of the 24-bit I/O port on the 4352B's rear panel, to the PLL data terminals. If the PLL requires serial data, the signal must be supplied from A0 and A1; if parallel data, it must be supplied from A0 to A7. At this time, the divider data (divide ratio) is not acquired into the PLL yet. For details on the program, see "2-5. Sending divider data to a serial-input PLL" in this appendix.
5. `OUT1H` in line 430 causes the OUTPUT1 of the 24-bit I/O port to go HIGH. This signal sets the PLL load terminal and causes the divider data (divide ratio) that has already sent to the PLL data terminals to be acquired into the PLL. Then, the PLL outputs the start frequency.
6. `OUT1L` in line 440 causes the OUTPUT1 of the 24-bit I/O port to go LOW. This resets the PLL load terminal and prepares for the next set.
7. Then, the divider data (divide ratio) signal is sent to the PLL. This divider data is a binary value corresponding to the target (end) frequency. The value must be derived from the specifications of the PLL. This signal is supplied, through the A port of the 24-bit I/O port on the 4352B's rear panel, to the PLL data terminals. At this time, the divider data (divide ratio) is not acquired into the PLL yet.

8. SING in line 490 generates a measurement trigger, causing the 4352B to start the frequency transient measurement. Upon the measurement trigger, according to OUT1ENVH set in line 190, OUTPUT1 of the 24-bit I/O port goes HIGH. This signal sets the PLL load terminal and causes the divider data (divide ratio) that has already sent to the PLL data terminals to be acquired into the PLL. Then, the output signal of the PLL starts to move to the target frequency. The measurement trigger and the move to the target frequency occur simultaneously and the transient measurement is performed.

Figure C-5 shows the relationship between the measurement trigger and the transient.

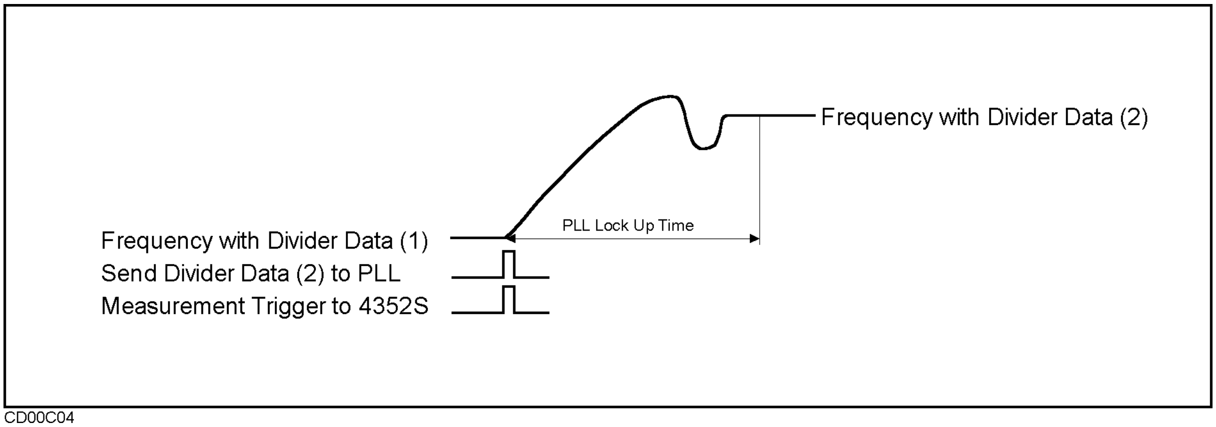


Figure C-5.
Measurement trigger and transient when using the trigger detection output function

Using the value trigger function

This function allows a measurement trigger to be generated when the DUT output frequency reaches your specified frequency in order to start measurement.
When a trigger for the frequency transient measurement is generated with this function turned ON, the 4352B enters the trigger wait state. In this state, the internal circuit of the 4352B measures frequency f until the measured frequency reaches your specified frequency f_T. After that, the actual trigger of frequency transient measurement is generated.

When you switch f from f_L to f_H ($f_L < f_H$), be sure to set f_T at a level slightly higher than that of f_L. This allows a measurement to be initiated immediately after a frequency change request has been sent to the DUT.

Follow the steps below.

1. Turn ON the value trigger function.

   Press (Trigger), VALUE.

2. Specify the frequency f_T to generate the trigger for the frequency transient measurement.

   Use the numeric keys and (x1) to specify f_T.

3. Specify the direction of change for the PLL output frequency.

   Press TRIG PLRTY POS neg.
   Specify the timing to actually generate a trigger for the frequency transient measurement: when PLL output frequency f increases and reaches f_T (TRIG PLRTY POS neg) or when it decreases and reaches f_T (TRIG PLRTY pos NEG).

4. Generate a measurement trigger.
   The 4352B is in the trigger wait state, while measuring the PLL output frequency f, until the frequency f_T specified in step 2 is reached.
5. Send a load signal to the PLL.
   The PLL output frequency is changed, and when it reaches your specified frequency f_T, a frequency transient measurement starts immediately.

Figure C-6 shows the program flow using the value trigger function.

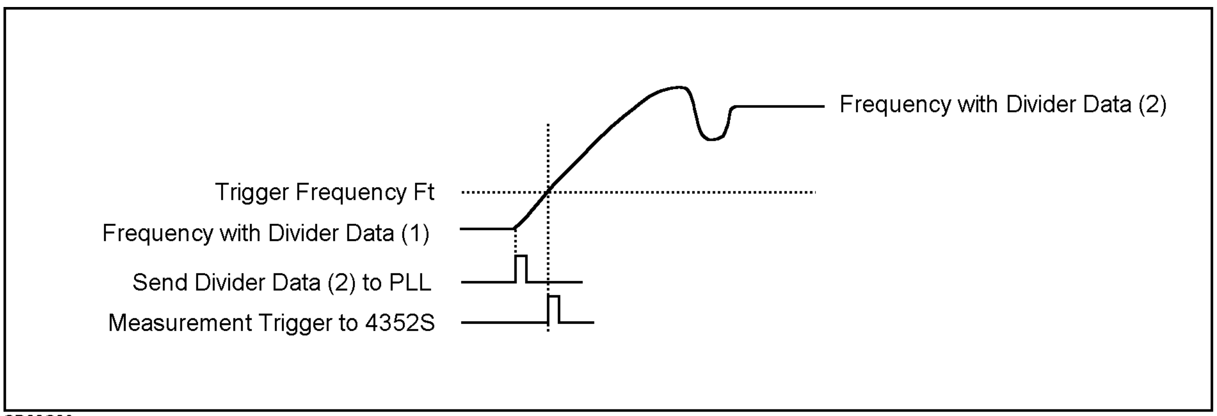
Sample Program for Measuring PLL Lock Up Time with Value Trigger Function

```
 10 ASSIGN  @Hp4352 TO 800
 20 OUTPUT  @Hp4352;"HOLD"          ..........  Trigger HOLD
 30 OUTPUT  @Hp4352;"TRGS VAL"      ..........  Set Value Trigger mode ON
 40 OUTPUT  @Hp4352;"TRGVAL ";Ft    ..........  Set Trigger frequency to Ft
 50 OUTPUT  @Hp4352;"TRGP POS"      ..........  Select Positive Trigger Polarity
 60 OUTPUT  @Hp4352;OUT1L"          ..........  Set OUTPUT 1 to LOW
            (Insert program to send PLL divider data (1).)
 80 OUTPUT  @Hp4352;"OUT1H"         ..........  Set Divider Data (1) to PLL (OUTPUT1 to High)
 90 OUTPUT  @Hp4352;"OUT1L"         ..........  Set OUTPUT 1 to LOW again
100 OUTPUT  @Hp4352;"SING"          ..........  Trigger Wait State
            (Insert program to send PLL divider data (2).)
120 OUTPUT  @Hp4352;"OUT1H"         ..........  Set Divider Data (2) to PLL (OUTPUT1 to High)
130 END
```

CD00C05

Figure C-6. Program flow of the value trigger function

Figure C-7 shows the relationship between the measurement trigger and the transient when using the value trigger function.



CD00C06

Figure C-7. Measurement trigger and transient when using the value trigger function

Note

In the value trigger function, you cannot specify f_T outside the range between the minimum and maximum frequencies.
Notice that, if you measure a DUT in the heterodyne mode that has frequency changes exceeding the above range, an unexpected trigger may be generated because the frequency is folded over.

2-5. Sending divider data to a serial-input PLL

This section describes a program to sent the divider data (divide ratio) to a serial-input PLL. Let us take an example where the data signal, the clock signal, and the load (strobe) signal of the PLL are connected to this instrument as follows:

24-bit I/O port

Pin 5 (output port A0): Data terminal

Pin 6 (output port A1): Clock terminal

Pin 3 (OUTPUT1): Load terminal

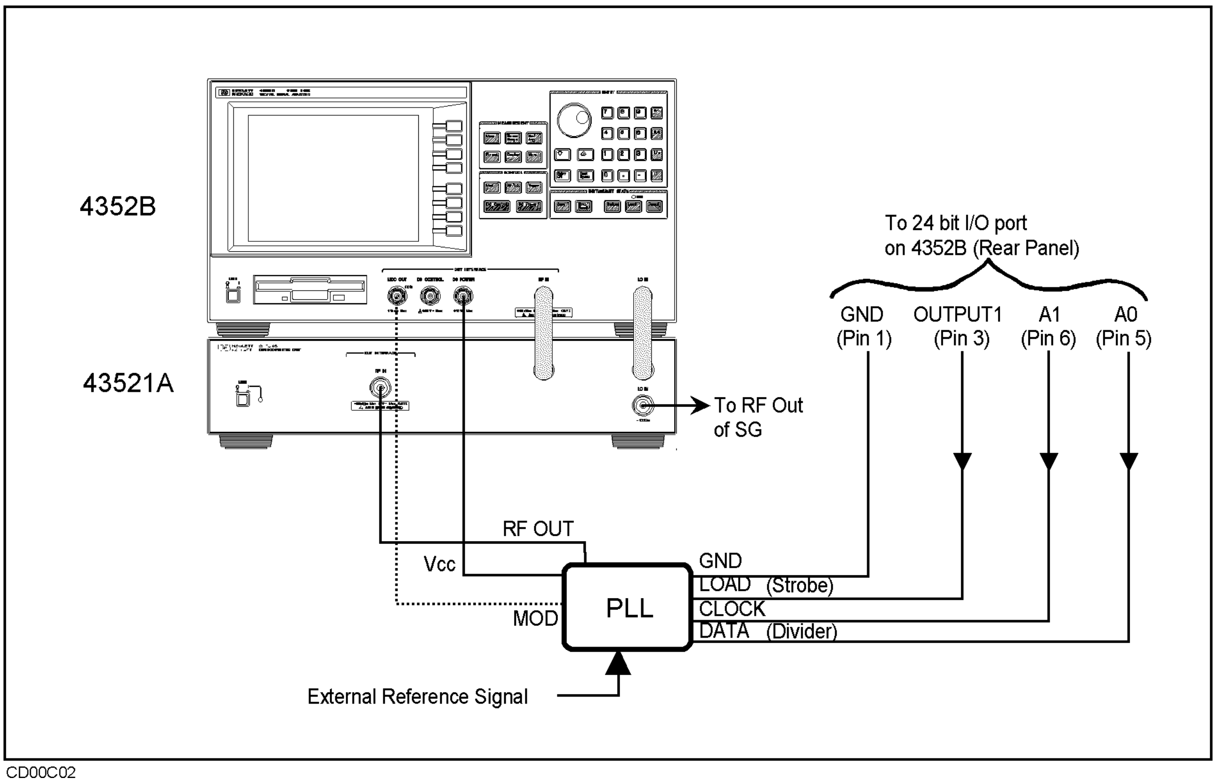


Figure C-8. Connection of serial-input PLL

In this example, port A of the 24-bit I/O port is used to sent divider data. Port A sets the divider data to the PLL by sending it in binary notation through bit A0 bit by bit and sending the clock signal through bit A1.

Figure C-9 shows the program to send divider data to the PLL through the 24-bit I/O port.

```
100   X= Divider
110   FOR I=7 TO 0 STEP -1
120    WRITEIO 16,0;BIT(X,I)  ! Send Value (1 or 0) of Bit I of Value X to
                                ! Port A0
130    WRITEIO 16,0;BIT(X,I)+2 ! Set Output Port A1 to HIGH
140    WRITEIO 16,0;BIT(X,I)  ! Set Output Port A1 to LOW
150   NEXT I
```

Figure C-9. Sample program to send divider data to the PLL

The sample program assumes that the variable name for divider data is Divider and 8-bit serial data is sent starting from MSB.

1. Line 100 calls the divider data that has already set in the variable named Divider. The divider data is 8-bit serial data. In this example, the divider data is 01010010 in binary.
2. Line 110 makes setting so that 8-bit serial data is sent from MSB. First, set I = 7.
3. WRITEIO 16,0; in line 120 is a command to output data to (8-bit) port A of the 24-bit I/O port. BIT(X,I) is a command to specify the (I+1)-th bit of variable X. When I = 7, the 8th bit of variable X, that is 0 (00000000 in binary), is outputted. 0 is outputted to port A0; 0 to port A1.
4. Line 130, by sending +2 (10 in binary notation), causes the output from port A to change to 2, increased by 2 in binary (00000010 in binary notation) compared to that of line 120. 0 is outputted to port A0; 1 to port A1.
5. Line 140 provides the same operation as line 120.
6. Line 150 makes a jump to line 110, which decrements I by -1 resulting in I = 6.
7. Line 120 outputs the 7th bit of variable X, that is 1 (00000001 in binary), to (8-bit) port A. 1 is outputted to port A0; 0 to port A1.
8. Line 130, by sending +2 (10 in binary notation), causes the output from port A to change to 3 (00000011 in binary notation), increased by 2 in binary compared to the previous line. 1 is outputted to port A0; 1 to port A1.

The FOR-NEXT loop in lines from 110 to 150, by decreasing the value of I, outputs variable X from port A0 as serial data and the clock signal to A1. To send variable X starting from LSB, replace line 110 with FOR I= 0 TO 7 STEP 1. To check the binary equivalent of an integer X, you can convert X into binary notation using IVAL$(X,2).

Figure C-10 shows the timing chart for the above description.

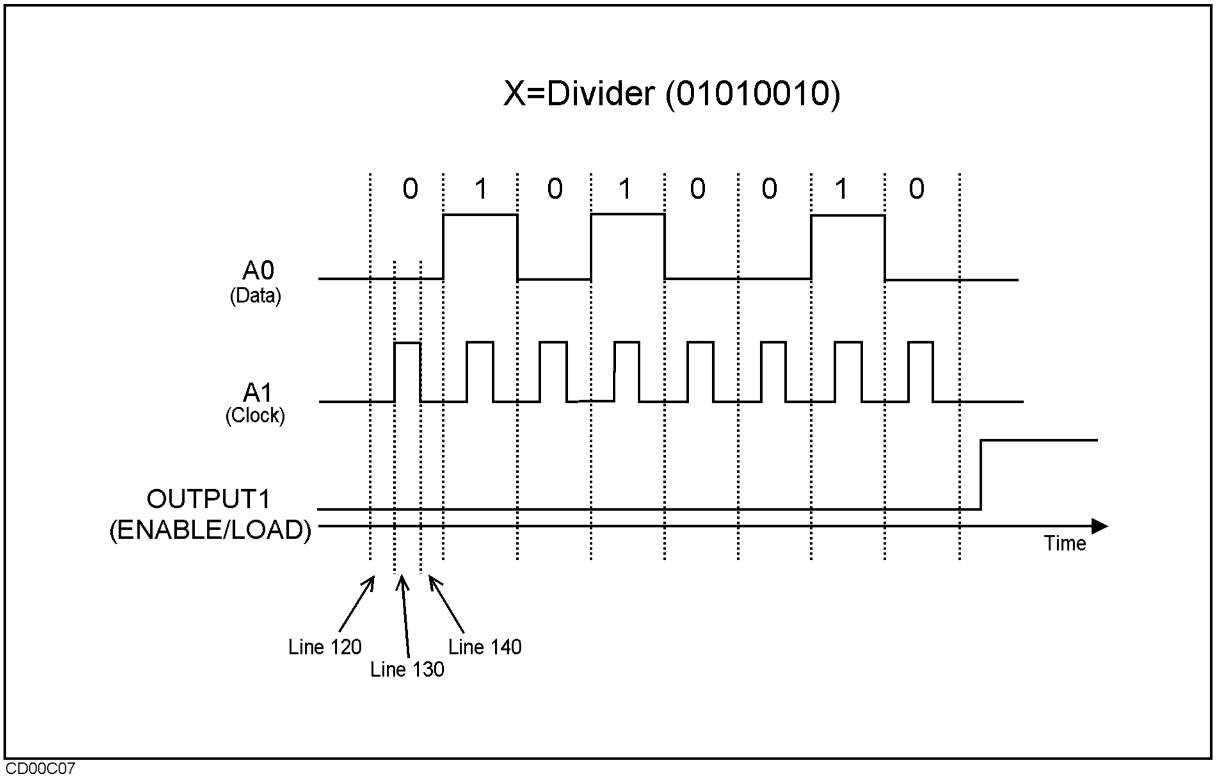


Figure C-10. Timing chart of the trigger detection output function

Note

For information on the specifications of the 24-bit I/O port, see appendix D "Functional Specifications of the I/O Port" in "4352B Programming Manual."

3. Notes on measurements

3-1. Eliminating components that adversely affect measurements

If undesired components come into the connection between a DUT and this instrument, you cannot obtain correct measurement results. When connecting a DUT, take the following measures as necessary.

- This instrument employs the peak detection method to measure RF power. Therefore, the presence of higher harmonics in the measured signal makes it extremely difficult to correctly measure RF power. In such cases, connect a low-pass filter to the RF output terminal of the DUT to eliminate them.
- The output impedance of the DC power and control voltage outputs at RF can affect the output characteristics of the measured DUT (particularly, frequency or RF power). If you think this is possible, insert a low-pass filter (with a cutoff frequency between approximately 100 kHz and 1 MHz) into each of the DC power and control voltage input terminals of the measurement jig.
- If a DC voltage component (TTL output, etc.) is included in the DUT output signal, the measurement will not be performed accurately. In this case, apply a high-pass filter to the DUT's output to eliminate the DC component sufficiently for the measurement.

D

Saving and Recalling Instrument States and Data

This section describes storage devices, and the save and recall function It also provides information on how to use data files you have saved using the save and recall functions.

Additional information on how to save and recall instrument states is provided in Chapter 10.

Note

(Save/Recall) does not access Instrument BASIC programs. Instrument BASIC has its own menus (under (System)) for accessing the built-in disk drive and the RAM disk memory. *See 4352B Using HP Instrument BASIC* for detail.

Storage Devices

The analyzer supports two storage devices, a built-in floppy disk drive and a RAM disk memory. The floppy disk drive is better suited to store a large number of files or to store files over extended periods of time. The RAM disk is better suited for saving data for a short period of time or to quickly save and recall data.

Note

Use the built-in floppy disk drive to store important data that must be retained because the RAM disk data is lost when the power is turned off.

Disk Requirements

The analyzer's disk drive uses either a 720 Kbyte , or 1.44 Mbyte format on 3.5 inch micro-floppy disks.

Disk Formats

The analyzer's built-in disk drive can access both LIF (logical interchange format) and DOS formatted disks. The floppy disk and the RAM disk memory can be initialized in either LIF or DOS format. You need to specify the format type before initializing the disk.

The following shows the applicable DOS formats for the analyzer.

- 720 Kbyte, 80 tracks, double-sided, 9 sectors/track
- 1.44 Mbyte, 80 tracks, double-sided, 18 sectors/track

RAM Disk Memory Capacity

The RAM disk memory capacity can be changed. This capacity includes the directory area. The capacity of data area depends on the disk format type.

Copying Files Between the RAM Disk and the Floppy Disk

A copy function is provided to copy files between the RAM disk and the floppy disk. `FILE UTILITIES` in the SAVE/RECALL menu displays the softkeys used to copy files. The GPIB command `FILC` is also available to copy files.

Note When you copy files using this function, use the same disk format type for both the RAM disk and the floppy disk. This copy function cannot copy files when the format of the RAM disk is different from the format of the floppy disk.

File Types And Data Saved

Binary Files and ASCII Files

The analyzer supports two file formats, binary and ASCII, that are used to save data on a disk. Binary files are used to save measurement conditions and data using the SAVE function and to retrieve binary data using the RECALL function. External controllers and Instrument BASIC can read measurement data from binary data files. ASCII measurement data or screen image files can be read by commonly available IBM PC based software for data analysis or other secondary functions. The RECALL function cannot read ASCII files.

Note When saving internal data arrays, note that ASCII data files cannot be recalled on the analyzer. If you need to recall the data, save the file in binary format. This binary data can be recalled and saved as an ASCII file at any time.

Data Groups

Instrument States and Internal Data (STATE)

This group includes instrument states and measurement data/memory contents (binary files only).

Internal Data (SAVE BINARY)

There are two types of internal data that are saved in the internal memory of the analyzer, as shown below:

- *Data* saves formatted measured values or math results.
- *Memory* saves formatted memory contents.

This internal data can be selected and saved as required.

Graphics Images (GRAPHICS)

Graphics consist of the graphic images on the screen created using HP-GL (Hewlett-Packard Graphics Language). The HP-GL format is supported by most drawing software and is the format used by most plotters.

File Type and Data Group Combinations

You can select and save to a disk one of the following four combinations of the two file types and the four data groups.

- Binary File
  - Instrument state and internal data (STATE)
  - Internal data and memory (SAVE BINARY)
  - Graphics image (GRAPHICS)
- ASCII File
  - Internal data and memory (SAVE ASCII)

Note

Note that if only internal data is saved, the instrument state is not saved. If you wish to recall the instrument state, be sure to save the STATE (by saving the instrument state and internal data in a binary file).

File Names

All data saved using the built-in disk drive and the RAM disk memory has an identifying file name. A file name consists of the lower and upper case alphabet, numbers, and valid symbol characters. Up to 8 characters can be used for a file name. The following table shows the valid characters for LIF and DOS file names.

Table D-1. Valid Characters for File Names

Valid Characters		Description
LIF	DOS Format	
A - Z	A - Z	Upper case alphabet
a - z	a - z	Lower case alphabet
0 - 9	0 - 9	Numeric characters
_	$ & # % ’ ! () - _ @ ^ {} ~	Symbol characters

One of the following suffixes or extensions is automatically added to the file name depending on the data group type stored in the file.

Table D-2. Suffixes and Extensions Added Automatically

Data Groups	Suffixes for LIF	Extensions for DOS
Instrument State and Internal Data (STATE)	_S	.STA
Internal Data Binary File (SAVE BINARY)	_D	.DTA
Internal Data ASCII File (SAVE ASCII)	_I	.TXT
Graphics Image as an HP-GL File (GRAPHICS)	_G	.HPG

Auto Recall Function

When the analyzer is turned on, it looks for a file named "AUTOREC" in the built-in floppy disk. If it finds this file, the analyzer automatically reads the file to retrieve its data.

Note You must save the AUTOREC file in the floppy disk. Do not save it into the RAM disk memory because the RAM disk memory loses data when the power is turned off.

Internal Data (SAVE ASCII) File Structure For ASCII Files

Numbers and strings in an ASCII file are delimited by tab codes. Also, strings are enclosed in double quotation marks (").

Status Block and Data Block

An ASCII data file consists of a status block and data blocks.

The status block consists of two lines, the revision number and the date code.

The data block consists of three parts, the state part, the title line, and the data part.

- State

  The state part consists of the following instrument states:
  - Title (only when set)
  - Measurement Item
  - Measurement Unit
  - `RF ATTEN` Setting
  - DC Control Voltage
  - DC Power Voltage
  - Modulation Signal Amplitude
  - `NOISE BW` Setting (only during C/N or phase noise measurement)
  - Offset Frequency (only during C/N measurement in tester mode)
  - Detection Bandwidth Low Frequency Cutoff Frequency (only during FM deviation measurement in tester mode)
  - Detection Bandwidth High Frequency Cutoff Frequency (only during FM deviation measurement in tester mode)
  - Sweep time (only in analyzer mode)
  - Number of measurement points (only in analyzer mode)
  - Reference frequency (only in frequency transient measurement in analyzer mode)

- **Title Line**

  The title line shows the name of the data saved in an ASCII file. The data name saved is explained in a following section.

- **Data Part**

  The data part includes the values of data or memory.

Table D-3 and Table D-4 shows an example of ASCII data file saved in the tester and analyzer modes, respectively.

ASCII File Structure

Table D-3. Example of ASCII Data File Contents (Tester Mode)

Block Names		Contents
Status Block		"4352B REV1.00" "DATE: Jun 01 1997"[1]
Data Block	State	"TITLE: This is a title."[2] "MEASURE TYPE: Carrier/Noise" "UNIT: dBc" "RF ATT: 10 dB" "CONTROL VOLTAGE: 2 V" "POWER VOLTAGE: 4.3 V" "MOD AMPLITUDE: 0.5 Vrms" "NOISE BAND WIDTH: 1 Hz"(for C/N) or "DETECTION HPF: 300 Hz"(for FM deviation)[3] "C/N OFFSET: 10 kHz"(for C/N) or "DETECTION LPF: 3 kHz"(FM deviation)[4]
	Title Line	"Data"→"Memory"[5,]
	Data Part	1.104020E+02→1.220121E+02[5]

1 This is the date when the file is saved. (mmm dd yyyy format).

2 This line is saved when the title is defined (displayed).

3 This line is saved only when C/N or FM deviation is selected.

4 This line is saved only when C/N or FM deviation is selected.

5 "→" denotes a tab code. Data is delimited by tab codes.

Table D-4. Example of ASCII Data File Contents (Analyzer Mode)

Block Names		Contents
Status Block		"4352B REV.1.00" "DATE: Jun 01 1997"[1]
Data Block	State	"TITLE: This is a title."[2] "MEASURE TYPE: RF Power" "UNIT: dBm" "RF ATT: 10 dB" "CONTROL VOLTAGE: 0 V" "POWER VOLTAGE: 4.3 V" "MOD AMPLITUDE: OFF" "NUMBER of POINTS: 51" "NOISE BAND WIDTH: 1 Hz"(for phase noise) "SWEEP TIME: 867 ms" "REF FREQ: 0 Hz"(for frequency transient)
	Title Line	"Parameter" →"Data" →"Memory" →"Upper" →"Lower"[3,4]
	Data Part[5]	0.000000000000E+00 →7.586498E-01 →6.687014E-01 →9.581785E-01 →5.589128E-01 7.999999821186E-02 →7.775766E-01 →6.874978E-01 →9.772156E-01 →5.77372E-01 1.59999964237E-01 →7.923842E-01 →7.024761E-01 →9.923009E-01 →5.926266E-01[6]

1 This is the date when the file is saved. (mmm dd yyyy format).

2 This line is saved when the title is defined (displayed).

3 "→" denotes a tab code. Data is delimited by tab codes.

4 This line represents types of data saved in the file. Four (4) data types, "Data", "Memory", "Upper", and "Lower" are included in the file. The data name (title) used here is shown in Table D-7.

5 Data is saved in the order shown in the title line.

6 "→" denotes a tab code. Data is delimited by tab codes.

Name Used In Measurement Item

The string corresponding to the measurement item that is saved in`"MEASURE TYPE:"` of the instrument state part. The corresponding strings are shown in Table D-5.

Table D-5. Measurement Item and `"MEASURE TYPE:"` String (Tester Mode)

Measurement Item	`"MEASURE TYPE:"` String
RF Power	`RF Power`
Frequency	`Frequency`
DC Power Current	`DC Power Current`
FM Deviation	`FM Deviation`
C/N Ratio	`Carrier/Noise`

Table D-6. Measurement Item and `"MEASURE TYPE:"` String (Analyzer Mode)

Measurement Item	`"MEASURE TYPE:"` String
RF Power	`RF Power`
Frequency/Tuning Sensitivity	`Frequency`
Phase Noise	`Phase Noise`
Frequency Transient	`RF Transient`
Spectrum	`Spectrum`

Data Name Used In The Title Line

The data name used in the title line of the data block shows which data is saved in the data part. As shown in Table D-7, each internal data has a name.

Table D-7. Data Group and Data Name

Data Group	Data Name	Description
Data	`Data`	Data
Memory	`Memory`	Memory Contents
Upper Limit Trace	`Upper`	Upper Limit Trace
Lower Limit Trace	`Lower`	Lower Limit Trace

The data to be saved is specified on the *Save Data Definition Menu*, which is displayed when `DEFINE SAVE DATA` under (Save/Recall) is pressed. By selecting `DATA ON off` and `MEM ON off`, `Data` and `Memory`, respectively, are saved.

E

Allowable Values and Defaults for Key Functions

The Allowable values and defaults for each function are shown here. There are two types of defaults, "preset values" by pressing (Preset), and "power-on defaults" by turning the instrument power on.

Saved settings are not affected by presetting and turning on/off the instrument. In this chapter, these settings are indicated by "Not Affected." If the battery for the backup memory goes dead, they are initialized to the factory settings shown in "Factory Settings for Backup Memory". The battery for the backup memory lasts 72 hours (typical). It is recharged automatically when you turn on the power. Recharge time is 1 hour (typical).

At power-on, this instrument automatically performs a selftest. When the selftest is completed, it is set to the "power-on defaults" state. If the PRES or *RST GPIB command is executed, it is set to the "preset values" state.

Tester Mode

Measurement Block

Meas

Function	Allowable Values	Preset Value	Power On Default
Measurement Item	RF POWER, FREQUENCY, DC POWER CURRENT, FM DEVIATION, CARRIER/NOISE	RF POWER	RF POWER
Instrument Type	VT, VA	Not Affected	VT
Frequency Band	10M-3G,10M-6.6G,10M-9.0G,10M-12.6G	Not Affected	Not Affected
Nominal Frequency	Range of Frequency Band	Not Affected	Not Affected

Sense Range

Function	Allowable Values	Preset Value	Power On Default
RF Attenuator	0, 5, 10, 15, 20, 25 dB	10 dB	10 dB
Frequency Resolution	1 kHz, 64 kHz	1 kHz	1 kHz
Noise Attenuator	0, 10, 20, 30, 40 dB	10 dB	10 dB
FM Deviation Range	2, 20, 200 kHz	200 kHz	200 kHz

Bw/Avg

Function	Allowable Values	Preset Value	Power On Default
Averaging	On, Off	Off	Off
Averaging Factor	1 to 999 or 1, 2, 4, ... , 4096[1]	16	16
Noise Bandwidth	1 Hz to 1 MHz	1 Hz	1 Hz
Offset Frequency	100 Hz to 10 MHz	10 kHz	10 kHz
HPF Cutoff	50 Hz, 300 Hz	300 Hz	300 Hz
LPF Cutoff	3 kHz, 15 kHz, 20 kHz	3 kHz	3 kHz
2nd PLL Bandwidth	200 Hz, 1 kHz	200 Hz	200 Hz

1 Varies depending on the measurement mode selected.

Format

Function	Allowable Values	Preset Value	Power On Default
Unit	dBm, dBV, dBμV, Watt, Volt	dBm	dBm
Peak Conversion	On, Off	Off	Off

Display

Function	Allowable Values	Preset Value	Power On Default
Display	Data, Memory, Data & Memory	Data	Data
Data Hold	Off, Max, Min	Off	Off
Display Allocation	All Instrument, Half & Half, All BASIC, BASIC Status	Not Affected	All Instrument
Title	Up to 53 characters	No Title	No Title
Data Math	Data, Data+Mem, Data−Mem, Data/Mem	Data	Data
Intensity	0 to 100 %	Not Affected	83 %
Background Intensity	0 to 100 %	Not Affected	0 %
Data color		Not Affected	Yellow
Memory color		Not Affected	Green
Parameter color		Not Affected	Light blue
Graticule color		Not Affected	Gray
Warning color		Not Affected	Red
Text color		Not Affected	White
IBASIC text color		Not Affected	Green
Pen 1 color		Not Affected	White
Pen 2 color		Not Affected	Red
Pen 3 color		Not Affected	Yellow
Pen 4 color		Not Affected	Green
Pen 5 color		Not Affected	Light blue
Pen 6 color		Not Affected	Blue

Menu

Function	Allowable Values	Preset Value	Power ON Default
Auto Frequency Control	On, Off	Off	Off
Target Frequency	10 MHz to 3 GHz	10 MHz	10 MHz
Tolerance	2 kHz to 2 MHz	100 kHz	100 kHz
Sensitivity	-1 GHz/V to -100 Hz/V and 100 Hz/V to 1 GHz/V	10 MHz/V	10 MHz/V
Min.Control Voltage	0 to 20 V (−15 to 35 V with option 001)	0 V	0 V
Max.Control Voltage	0 to 20 V (−15 to 35 V with option 001)	20 V	20 V
Control Delay	10 msec to 1 sec	20 msec	20 msec
Max. Iteration	1 to 999	10	10
Cable Loss Compensation	On, Off	Off	Off
Loss Specification	0 to 20 dB/GHz	0 dB/GHz	0 dB/GHz
Loss at DC	−20 dB to +20 dB	0 dB	0 dB

Control Block

Mod

Function	Allowable Values	Preset Value	Power ON Default
Modulation Output	On, Off	Off	Off
Modulation Amplitude	0 to 1 V_{rms}	0 V_{rms}	0 V_{rms}

RF/LO

Function	Allowable Values	Preset Value	Power ON Default
External Signal Generator Control	Auto, Man	Not Affected	Not Affected
Waiting for LO Switching	0 to 1 s	Not Affected	Not Affected
SG Type	1, 2, 3, 4	Not Affected	Not Affected
SG Max Freq	3 KHz to 20 GHz	Not Affected	Not Affected
Downconverter	On, Off	Not Affected	Not Affected

Trigger

Function	Allowable Values	Preset Value	Power ON Default
Sweep type	Hold, Single, Continuos	Continuous	Continuous
Trigger Source	Free run, External, Manual, GPIB	Free run	Free run

DC Control

Function	Allowable Values	Preset Value	Power ON Default
Control Voltage Output	On, Off	Off	Off
Control Voltage	0 to (Max. Control Voltage)	0 V	0 V
Min.Control Voltage	0 to 20 V (−15 to 35 V with option 001)	0 V	0 V
Max.Control Voltage	0 to 20 V (−15 to 35 V with option 001)	20 V	20 V
Delay to Voltage Change	10 msec to 1 sec	20 msec	20 msec

DC Power

Function	Allowable Values	Preset Value	Power ON Default
Power Voltage Output	On, Off	Off	Off
Power Voltage	0 to 16 V	0 V	0 V

Instrument State Block

Copy

Function	Allowable Values	Preset Value	Power ON Default
Print mode	Standard, Color	Standard	Standard
Copy skey	On, Off	Off	Off
Copy time	On, Off	Off	Off
Print color	Fixed, Variable	Fixed	Fixed
DPI	75 to 600 dpi	75	75
Top margin	0 to 5 inch (0.1 inch steps)	1.0 inch	1.0 inch
Left margin	0 to 5 inch (0.1 inch steps)	1.0 inch	1.0 inch
Orient	Portrait, Landscape	Portrait	Portrait
Formfeed	On, Off	On	On

Save/Recall

Function	Allowable Values	Preset Value	Power ON Default
Storage Device	Disk, Memory	Not Affected	Not Affected
Initialize disk format	LIF, DOS	Not Affected	Not Affected
Define Save:Data	On, Off	On	On
Define Save:Mem	On, Off	Off	Off

System

Function	Allowable Values	Preset Value	Power ON Default
Clock time	0:0:0 to 24:59:59	Not Affected	Not Affected
Clock date	Up to 2099	Not Affected	Not Affected
Date format	Month:Day:Year, Day:Month:Year	Month:Day:Year	Month:Day:Year
Memory Partion	64K/448K, 128K/384K, 256K/256K, 384K/128K, 448K/64K RAM/BASIC	Not Affected	Not Affected
Beeper done	On, Off	On	On
Beeper warning	On, Off	Off	Off

Local

Function	Allowable Values	Preset Value	Power ON Default
GPIB address	0 to 30	Not Affected	Not Affected
GPIB mode	System controller, Addressable	Not Affected	Not Affected

Analyzer Mode

Measurement Block

Meas

Function	Allowable Values	Preset Value	Power ON Default
Measurement Item	RF POWER, FREQUENCY, PHASE NOISE, RF TRANSIENT, SPECTRUM, HARMONICS, ANALYSIS	RF POWER	RF POWER
Instrument Type	VT, VA	VT	VT
Frequency Band	10M-3G,10M-6.6G,10M-9.0G,10M-12.6G	Not Affected	Not Affected
Nominal Frequency	Range of Frequency Band	Not Affected	Not Affected

Sense Range

Function	Allowable Values	Preset Value	Power ON Default
RF Attenuator	0, 5, 10, 15, 20, 25 dB	10 dB	10 dB
Noise Attenuator	0, 10, 20, 30, 40 dB	10 dB	10 dB
Sense Polarity	Positive, Negative	Positive	Positive
Frequency Resolution	1 kHz, 64 kHz	1 kHz	1 kHz
Target Frequency	Same as Freq Band, 100 MHz Min	Midpoint Value of Freq Band. Note: 640 MHz for 10M to 3 GHz	Midpoint Value of Freq Band. Note: 640 MHz for 10M to 3 GHz
Frequency Span	2 MHz,20MHz,Max	Max	Max
Target Position	5,10,15 to 95	50	50
Ref Freq For Scale	0 to Maximum of Freq Band	0MHz	0MHz

Bw/Avg

Function	Allowable Values	Preset Value	Power ON Default
Averaging on OFF	On, Off	Off	Off
Averaging Factor	1 to 999	16	16
Video Bandwidth	3 mHz(RBW = 1) 10 mHz(RBW = 3) 30 mHz(RBW = 10) 100 mHz(RBW = 30) 300 mHz(RBW = 100) 1 Hz(RBW = 300) 3 Hz(RBW = 1k) 10 Hz(RBW = 3k)	3 kHz	
RES Bandwidth	1 Hz, 3 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz	3 kHz	
Noise Bandwidth	1 Hz to 1 MHz	1 Hz	1 Hz
Sensitivity Aperture	0.1 to 20(% of span)	1	1
2nd PLL Bandwidth	200 Hz, 1 kHz	200 Hz	200 Hz

Format

Function	Allowable Values	Preset Value	Power ON Default
Unit	dBm, dBV, dBμV, Volt, Watt	dBm	dBm

Display

Function	Allowable Values	Preset Value	Power ON Default
Define Trace	Data, Memory, Data & Memory	Data	Data
Data Hold	Off, Max, Min	Off	Off
Math Type	Data, D+M, D−M, D/M	Data	Data
Math Gain	−100 to +100	1	1
Math Offset	−10e9 to +10e9	0	0
Disp Allocation	ALLI, HIHB,ALIB, BASS	ALLI	ALLI
Scale/Div(Scale Reference)	0.1 to 20 (RF POWER), 1 kHz to 3 GHz (FREQUENCY/TUNING SENSITIVITY), 1 kHz to 3 GHz (FREQUENCY TRANSIENT), 0.1 to 20 (PHASE NOISE, SPECTRUM)	10, 200kHz, 200kHz, 10, 10	
Reference Value	−150 to 30 (RF POWER), 1 kHz to 15 GHz (FREQUENCY/TUNING SENSITIVITY), 1kHz to 15GHzGHz (FREQUENCY TRANSIENT), −150 to 0 (PHASE NOISE), −150 to 30 (SPECTRUM)	0, 1 GHz, 640 MHz or Midpoint of Frequency Band, 0, 0	
Reference Position	0 to 10 (RF POWER, FREQUENCY/TUNING SENSITIVITY, FREQUENCY TRANSIENT, PHASE NOISE, SPECTRUM)	5, 5, 5, 10, 10	
Scale Couple	On, Off	On (RF POWER, FREQUENCY TRANSIENT, PHASE NOISE, SPECTRUM), Off (FREQUENCY/TUNING SENSITIVITY)	On (RF POWER, FREQUENCY TRANSIENT, PHASE NOISE, SPECTRUM), Off (FREQUENCY/TUNING SENSITIVITY)
Scale For	Data, Memory	Data	Data

Function	Allowable Values	Preset Value	Power ON Default
Sweep Time	Min. sweep time to 1 Hr.(RF POWER, FREQUENCY/TUNING SENSITIVITY)	Min. sweep time	
Number of Points	2 to 801 (RF POWER, FREQUENCY/TUNING SENSITIVITY, FREQUENCY TRANSIENT)	51(RF POWER, FREQUENCY/TUNING SENSITIVITY), 801(PHASE NOISE, FREQUENCY TRANSIENT)	51(RF POWER, FREQUENCY/TUNING SENSITIVITY), 801(PHASE NOISE, FREQUENCY TRANSIENT)
Start	0V to Max. control voltage (RF POWER, FREQUENCY/TUNING SENSITIVITY), 100 Hz to 1 MHz(10˜n, PHASE NOISE), 0 to 800 ms(FREQUENCY TRANSIENT), FREQ BAND MIN to FREQ BAND MAXIMUM (SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 1kHz (PHASE NOISE), 0s (FREQUENCY TRANSIENT), Center-5MHz (SPECTRUM)	
Stop	0V to Max. control voltage (RF POWER, FREQUENCY/TUNING SENSITIVITY), 1 kHz to 10 MHz(10˜n, PHASE NOISE), (FREQ BAND MINIMUM + MINIMUM SPAN) to FREQ BAND MAX(SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 10MHz(PHASE NOISE), Cen- ter+5MHz(SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 10MHz(PHASE NOISE), Cen- ter+5MHz(SPECTRUM)
Center	(Stop+Start)÷2 (RF POWER, FREQUENCY/TUNING SENSITIVITY, PHASE NOISE LINEAR, SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 5.0005MHz(PHASE NOISE LINEAR), FREQ BAND MIDPOINT VALUE (SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 5.0005MHz(PHASE NOISE LINEAR), FREQ BAND MIDPOINT VALUE (SPECTRUM)
Span	Stop−Start(RF POWER, FREQUENCY/TUNING SENSITIVITY, PHASE NOISE LINEAR), 0 to 10s(FREQUENCY TRANSIENT), Stop−Start(SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 10ms (FREQUENCY TRANSIENT), 10MHz (PHASE NOISE LINEAR, SPECTRUM)	0V (RF POWER, FREQUENCY/TUNING SENSITIVITY), 10ms (FREQUENCY TRANSIENT), 10MHz (PHASE NOISE LINEAR, SPECTRUM)
Sweep Type	Log, Linear	Log	Log

Continued

Function	Allowable Values	Preset Value	Power ON Default
Marker	On, Off	Off	Off
Marker On	Data, Mem	Data	Data
Marker List	On, Off	Off	Off
Continuous Marker	On, Off	On	On
Sub Marker[1-4]	On, Off	Off	
Delta Marker	Off, On, Fixed, Tracking	Off	Off
Delta Mkr Swp Prm	−8e9 to 8e9	0	0
Delta Mkr Value	−3e9 to 3e9	0	0
Search Mode	Peak, Max, Min, Target	Peak	Peak
Search Tracking	On, Off	Off	Off
Threshold	On, Off	Off	Off
Threshold Value	−3e9 to 3e9	−100	−100
Peak Delta Value	−3e9 to 3e9	1	1
Search Target	−3e9 to 3e9	−3	−3
Search Range Mode	On, Off	Off	Off
Integ Noise	On, Off	Off	Off
Detection	Positive/Negative for Spectrum, Sample for PHASE NOISE	Sample	Sample

Control Block

Mod

Function	Allowable Values	Preset Value	Power ON Default
Modulation Output	On, Off	Off	Off
Modulation Amplitude	0 to 1 V_{rms}	0 V_{rms}	0 V_{rms}

RF/LO

Function	Allowable Values	Preset Value	Power ON Default
Local Oscillator Control	Auto, Man	(Man)	(Man)
Waiting for LO Switching	0 to 1 s	(100 ms)	(100 ms)
SG Type	1, 2, 3, 4	(1)	(1)
SG Max Freq	3 KHz to 20 GHz	Not Affected	Not Affected
Downconverter	On, Off	Not Affected	Not Affected

Trigger

Function	Allowable Values	Preset Value	Power ON Default
Sweep type	Hold, Single, Continuos	Continuous	Continuous
Trigger Source	Free run, External, Manual, GPIB	Free run	Free run
Trigger:Video	10 MHz to 3 GHz(resolution: 1 Hz)	10 MHz	10 MHz
Trigger Polarity	Positive, Negative	Positive	Positive

DC Control

Function	Allowable Values	Preset Value	Power ON Default
Control Voltage Output	On, Off	Off	Off
Control Voltage	0 to (Max. Control Voltage)	0 V	0 V
Min.Control Voltage	0 to 20 V (−15 to 35 V with option 001)	0 V	0 V
Max.Control Voltage	0 to 20 V (−15 to 35 V with option 001)	20 V	20 V
Delay to Voltage Change	10 msec to 1 sec	20 msec	20 msec

DC Power

Function	Allowable Values	Preset Value	Power ON Default
Power Voltage Output	On, Off	Off	Off
Power Voltage	0 to 16 V	0 V	0 V

Instrument State Block

Copy

Function	Allowable Values	Preset Value	Power ON Default
Print mode	Standard, Color	Standard	Standard
Copy skey	On, Off	Off	Off
Copy time	On, Off	Off	Off
Print color	Fixed, Variable	Fixed	Fixed
DPI	75 to 600 dpi	75	75
Top margin	0 to 5 inch (0.1 inch steps)	1.0 inch	1.0 inch
Left margin	0 to 5 inch (0.1 inch steps)	1.0 inch	1.0 inch
Orient	Portrait, Landscape	Portrait	Portrait
Formfeed	On, Off	On	On

Save/Recall

Function	Allowable Values	Preset Value	Power ON Default
Storage Device	Disk, Memory	Not Affected	Not Affected
Initialize disk format	LIF, DOS	Not Affected	Not Affected
Define Save:Data	On, Off	On	On
Define Save:Mem	On, Off	Off	Off

System

Function	Allowable Values	Preset Value	Power ON Default
Limit Line	On, Off	Off	Off
Limit Test	On, Off	Off	Off
Beeper Fail	On, Off	Off	Off
Limit Test Result	-1: Not Done, 0: Fail, 1: Pass	−1	−1

Local

Function	Allowable Values	Preset Value	Power ON Default
GPIB address	0 to 30	Not Affected	Not Affected
GPIB mode	System controller, Addressable	Not Affected	Not Affected

Factory Settings for Backup Memory

Function	Factory Setting
external signal generator Setting	Manual
Wait time for LO signal change	100 [msec]
External signal generator type	1
GPIB Address of 4352B	17
GPIB Address of external signal generator	19
GPIB Address of external controller	21

F

Fault Diagnosis for the 4352S Measurement System

This appendix provides a simple fault diagnosis guide for this instrument or the measurement system that includes this instrument. By following the diagnostics instructions, you will be able to quickly find out which instrument is faulty in the test system. Also when performing fault diagnosis for the 43521A (Downconverter Unit), see this appendix.

Refer to this information if you notice any failure in the operation of the analyzer or a measurement system that includes the analyzer.

If you find a malfunction using these instructions, adjustments or repair is required. Contact our service office or the company from which you purchased the analyzer.

External Signal Generator Diagnosis

Perform the self test function built into the external signal generator, and verify if there is anything wrong with the external signal generator.

4352B Diagnosis

Diagnosis for Source Functions

Check each output at the MOD OUT, DC CTRL, and DC POWER connectors.

Perform the following steps:

1. Press (DC Power) or (DC Control) to set OUTPUT ON off.
2. Press (DC Power), POWER VOLTAGE, and the entry keys to set the DC Power voltage to your desired value.
3. Measure the output voltage level at the DC POWER connector using a voltmeter, and verify that the measured value is within the specification.
4. Press (DC Control), CTRL VOLTAGE, and the entry keys to set the DC Control voltage to your desired value.
5. Measure the output voltage level at the DC CONTROL connector using a voltmeter, and verify that the measured value is within the specification.
6. Press (Mod), MOD AMPLITUDE, and the entry keys to set the MOD level to your desired level. Then set MOD OUT ON off.
7. Measure the output level at the MOD OUT connector, and verify that the measured level at the MOD OUT connector is within the specification.

Diagnosis for Receiver Functions

Check the receiver functions by using the 4352B's internal signal instead of the external signal generator and DUT.
The diagnosis should be performed with the analyzer in the tester mode.

Perform the following steps:

1. {?Connect between the 2nd IF Output connect and the 2nd IF Input connector (on the rear panel, using U-shape BNC-BNC connectors).?}
2. Connect the BNC-BNC cable between the 40 MHz Output connector (rear panel) and the LO IN connector (front panel).
3. Connect the BNC-BNC cable between the INT REF Output connector (rear panel) and the RF IN connector (front panel).
4. Perform RF Power, RF Frequency, FM Deviation, and C/N Ratio measurements in tester mode, and verify that each measured value is within the following limits.

Measurement Item		Normal Value
RF Power		2.5 dBm ±1 dBm
RF Frequency		10 MHz ±100 kHz
FM Deviation	@ range 2 kHz, detection band 300 Hz – 3 kHz	3 Hz_{rms} or less
C/N Ratio	@ offset 1 kHz	110 dBc or more
	@ offset 10 kHz	130 dBc or more
	@ offset 100 kHz	140 dBc or more

Perform the following steps after the verification above:

5. Set the measurement mode to the tester mode.

   Press (Meas).

   Press INST TYPE, INST TYPE:VCO TESTER.

6. Hold trigger.

   Press (Trigger).

   Press HOLD.

7. Select FM deviation measurement as the measurement item.

   Press (Meas).

   Press FM DEVIATION.

8. Set HPF to 300 Hz.

   Press (Bw/Avg).

   Press FM DETECTION.

   Press HP FILTER:300Hz.

9. Set LPF to 3 kHz.

   Press (Bw/Avg).

   Press FM DETECTION.

   Press LP FILTER:3kHz.

10. Execute FM DEV CAL.

    Press Menu.

    Press FM DEV CAL.

    Press EXECUTE DEV CAL.

Your analyzer is operating correctly if the message FM DEV CAL FACTOR is displayed on the screen. If CAUTION: Invalid Dev Cal is displayed on the screen, your analyzer is probably defective.

Diagnosis for the 43521A Downconverter Unit

Disgnosis of the 600-MHz output

This section describes how to check the frequency and power of the 600-MHz signal outputted from the 43521A. If the frequency is 600 MHz ±30 kHz and the power is 8 dBm or more, the 43521A operates normally. If the values are out of the limits, the 43521A is at fault. Repair it.

1. Connect the attached N-N cable (43521-61638) between the LO OUT connector on the 43521A and the RF IN connector on the 4352B.
2. Connect the attached cable (41951-61602) between the RF output connector on the external signal source and the LO IN connector on the 4352B.
3. Make rear-panel connections between the 4352B and the 43521A as shown in Figure 5-2.
4. Press (RF/LO) and then DOWNCONV on OFF to toggle it DOWNCONV ON off. (The 43521A outputs the 600-MHz signal.)
5. Press (Meas) and FREQ BAND [xx-xx] in this order, and then press a key other than FREQ BAND 10M-3G on the frequency band menu. The selected frequency band softkey is underlined.
6. Press (RF/LO) and then DOWNCONV ON off to toggle it DOWNCONV on OFF. (While keeping the 600-MHz signal from the 43521A, you can use the measurement functions of the 4352B.)
7. Press (Meas), INST TYPE, INST TYPE: VCO TESTER, and FREQUENCY in this order. FREQUENCY is underlined, which indicates that the frequency measurement in the tester mode is selected.
8. Check that the measured value on the 4352B's screen is 600 MHz ±30 kHz.
9. Press MEAS: RF POWER. MEAS: RF POWER is underlined, which indicates that the RF power measurement in the tester mode is selected.
10. Check that the measured value on the 4352B's screen is 8 dBm or more.
11. Record this value as Pb. The difference between this Pb and Pa described later is used to diagnose faults.

Diagnosis of the power measurement function of the 43521A

The 43521A has an internal power measurement function. If this function provides a value close to the measured power value of the 4352B, the measurement function operates normally. If the value is out of the limits, the 43521A is at fault. Repair it.

Use the connection in the previous section.

1. Disconnect the following cables.
   - Between the LO OUT connector of the 43521A and the RF IN connector of the 4352B (43521-61638)
   - Between the RF output connector of the external signal source and the LO IN connector of the 4352B (41951-61602)
2. Connect the attached N-N cable (43521-61638) between the LO OUT connector and the RF IN connector of the 43521A.
3. Press (RF/LO) and then DOWNCONV on OFF to toggle it DOWNCONV ON off.

4. Press (Sens Range) and RF ATTEN in this order. Use (⇧) and (⇩) or the rotary knob to set the attenuator to 20 dB.
5. Press (System), SERVICE MENU, and SERVICE MODES in this order. (The 4352B enters into the service mode and displays the measured power value. The value measured with the power measurement function of the 43521A is displayed.)
6. Use the power value measured with the 4352B as Pa.
7. Check that the difference between Pb recorded in the previous section and Pa is 2 dB or less.

Error Message

This section lists the error messages that are displayed on the 4352B display or transmitted by the instrument over GPIB. Each error message is accompanied by an explanation, and suggestions are provided to help in solving the problem. Where applicable, references are provided to the related chapter of the appropriate manual.

When displayed, error messages are preceded with the word "`CAUTION:`." That part of the error message has been omitted here for the sake or brevity. Some messages without the "`CAUTION:`" are for information only, and do not indicate an error condition. The messages are listed first in alphabetical order because the displayed messages do not contain the message number. The messages are then listed in numerical order to make them easier to find if they are read over the GPIB.

In addition to error messages, The 4352B's status is indicated by status notations in the left margin of the display. Examples are `*`, `Cor`, and `P↓`. Sometimes these appear together with error messages. A complete listing of status notations and their meanings is provided in Chapter 2.

Errors with a negative number are errors that occurred when the 4352B was being controlled with GPIB commands over the GPIB.

Error Messages in Alphabetical Order

45 **1st IF Out Of Range**

The 4352B's 1st IF frequency is outside of the proper range.

Possible problems and the corrective action are shown below:

- The frequency of the external signal generator is not correct.
  The 4352B has not performed automatic control of the external signal generator via GPIB (LO CONTROL MAN and/or ADDRESSABLE ONLY is selected). Verify the frequency of the external signal generator.
- The actual time required for the stabilization of the output frequency from the external signal generator after changing the output frequency exceeds the specified wait time in LOCAL SWTCH TIME.

  Press (RF/LO), LOCAL SWTCH TIME, and the entry keys to increase the 4352B's wait time.
- The DUT output frequency fluctuated largely in a very short time (several hundred kHz in several tens of ms)
  Verify the DUT's frequency stability.
- The automatic frequency control function was ON and the target frequency was 50 MHz or less.
  Set the acceptable frequency deviation to 4% or less of the target frequency.

81 **2nd PLL Unlocked**

The 4352B's internal 2nd PLL cannot be locked. If this message is displayed during a C/N ratio measurement or a phase noise measurement, the following problems and the corrective action are shown below.

- The DUT's noise level is too large, or a large level spurious component exists in the measurement range.
  Verify the spectrum of the DUT's output signal.
- The DUT's output signal is being modulated in frequency.

  Press (Mod), MOD OUT on OFF to stop the frequency modulation.
- In the case of a DUT with an oscillation frequency of 100 MHz or less, a large harmonics component is included in the output signal (effect of TTL output, etc.).

  Insert a low-pass filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the harmonics component.

If this message is displayed any time other than during a C/N measurement, adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

70 **A/D Overload**

The input level to the 4352B's internal A/D converter is too large.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

71 **A/D Overload in Downconverter Unit**

An overflow occurred in the A/D converter of the 43521A (Downconverter Unit). If this error occurs often, the 43521A may be at fault and need repair. Contact our service office or the company from which you purchased this instrument.

48 **AFC Out Of Loop**

The automatic frequency control function could not follow the fluctuation in the measurement condition, and did not converge on the target frequency.

Possible problems and the corrective action are shown below:

- The tuning sensitivity is improperly set.
  Press (Menu), AUTO FREQ CONTROL, SENSITIVITY, and the entry keys to specify a proper tuning sensitivity (the unit is [Hz/V]).
- The maximum value of the control voltage is too small.
  Press (Menu), AUTO FREQ CONTROL, MAX CTRL VOLTAGE, and the entry keys to specify a maximum value larger than the current setting. *Be careful not to set a value that exceeds the DUT's maximum acceptable value.*
- The math/measurement repeat count is too low.
  Press (Menu), AUTO FREQ CONTROL, MAX ITERATION, and the entry keys to specify a value larger than the current setting.
- An effect of the high value capacitor included with the DUT's power voltage (V_{cc}) terminal.
  Press (Menu), AUTO FREQ CONTROL, CTRL DELAY, and the entry keys to specify a value larger than the current setting.

102 **ANALYZER TYPE MISMATCH**

Indicates an invalid function was selected in the present measurement item. Change the measurement item, or select a different function.

13 **BACKUP DATA LOST**

Data checksum error on the battery backup memory has occurred. Wait until the battery is re-charged (approximately 10 minutes after turning the 4352B on).

−160 **Block data error**

The 4352B detected an invalid syntax in a block data element.

−168 **Block data not allowed**

A legal block data element was encountered but was not allowed by the 4352B at this point in parsing.

51 **Calibration Aborted**

The FM deviation calibration in progress was aborted. This was probably caused by changing the measurement parameters during the FM deviation calibration.

Perform the FM deviation calibration again.

Error Messages (Alphabetical Order)

100 CAN'T CHANGE- ANOTHER CONTROLLER ON BUS

The 4352B cannot assume the mode of system controller until the active controller is removed from the bus or relinquishes the bus. See the *4352B GPIB Programming Manual*.

144 CAN'T CHANGE NUMBER OF POINTS

The number of points in the spectrum measurement cannot be changed manually, except in zero span.

132 CAN'T SAVE GRAPHICS WHEN COPY IN PROGRESS

If you attempt to save graphics when a print is in progress, this error message is displayed.

Wait until the print is completed, then save the graphics again.

63 Can't Use 12-Bit I/O Port

This message appears if you execute an IBASIC or GPIB command to operate the 12-Bit I/O Port with `DOWNCONV ON off` set to ON. If `DOWNCONV ON off` is set to ON, the 12-Bit I/O Port is connected to the 43521A. Therefore, you cannot use this kind of commands.

−281 Cannot create program

Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

54 Carrier Overload

The carrier level in a C/N ratio measurement or a phase noise measurement is too large.

The 4352B RF IN connector's input level is too large. Verify the input level to the 4352B RF IN connector.

−140 Character data error

This error, as well as errors −141 through −148, are generated when analyzing the syntax of a character data element. This error message might be displayed if the 4352B detects an unknown problem.

−148 Character data not allowed

A legal character data element was encountered where prohibited by the 4352B.

−144 Character data too long

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

−100 Command error

This is a generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a command error, as defined in IEEE 488.2, 11.5.1.1.4, has occurred.

−110 Command header error

An error was detected in the header. This error message might be displayed if the 4352B detects an unknown problem related to errors −111 through −119.

64 **Command Ignored - Invalid Freq Band**

This message appears if you execute the TRMIN or TRMAX GPIB command when DOWNCONV ON off is set to ON and a frequency band other than 10 MHz to 3 GHz (high frequency band) is selected. The command is ignored. The TRMIN and TRMAX commands are available only in the following cases:

- When you use the 4352B alone (not connecting it to the 43521A)
- When you connect the 4352B and the 43521A (Downconverter Unit), set DOWNCONV ON off to ON, and set the frequency band to 10 MHz to 3 GHz.

62 **Correction Data Lost in Downconverter Unit**

The correction data in the EEPROM of the 43521A (Downconverter Unit) is lost. You cannot use the product. Repair the faulty hardware.

−230 **Data corrupt or stale**

Possibly invalid data. New reading started but not completed since last access.

−225 **Data out of memory**

The 4352B has insufficient memory to perform the requested operation.

−222 **Data out of range**

A legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the 4352B (see IEEE 488.2, 11.5.1.1.5).

−231 **Data questionable**

Indicates that the measurement accuracy is suspect.

−104 **Data type error**

The parser recognized a data element that is not allowed. For example, a numeric or string data was expected but block data was encountered.

77 **DC Control Current Overload**

The current through the DC CONTROL connector is too large (20 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's control current is too large.
  Verify that the DUT is correctly connected to the 4352B RF IN connector.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal.
  This is a transient error. Press (DC Control), CTRL DELAY, and the entry keys to set a sufficiently large value for elimination of this transient error.

52 **DC Output On Required in AFC**

The automatic frequency control function was set on, however, the power or control voltage is not being applied to the DUT.

Verify that the power/control voltages output is set to ON on the LCD information (the measurement setting parameter display or the status notations). If the power/control voltage output is turned to OFF, press (DC Power) or (DC Control), and OUTPUT ON off.

76 **DC Power Current Overload**

The current through the DC POWER connector is too large (50 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's power current is too large.
  Verify that the DUT is correctly connected to the 4352B.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal. This is a transient error. Wait until the DC POWER voltage is stabilized, then perform the measurement.

135 **DUPLICATE FILE EXTENSION**

The extension name entered is already used for other file types. Use a different extension name.

−200 **Execution error**

This is the generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

−123 **Exponent too large**

The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

44 **F-V Input Overflow**

The input frequency to the 4352B's F-V converter is too high.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

43 **F-V Input Underflow**

The input frequency to the 4352B's F-V converter is too low.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

83 **FAN Stopped in Downconverter Unit**

The fan in the 43521A (Downconverter Unit) is stopped. Using it without repair causes the temperature inside the 43521A to increase abnormally, which may result in fatal damage.
It needs repair. Contact our service office or the company from which you purchased this instrument.

−257 **File Name Error**

Indicates that a legal program command or query could not be executed because the file name on the device media was in error. For example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

53 **FM Deviation Range Overload**

The DUT's FM deviation is out of the measurement range.

Press (Sense Range), FM DEV RANGE, and select a measurement range larger than the current setting. (FM deviations over 200 kHz cannot be measured.)

−105 **GET not allowed**

A Group Execute Trigger (GET) was received within a program message (see IEEE 488.2, 7.7).

−240 **Hardware error**

Indicates that a legal program command or query could not be executed because of a hardware problem in the 4352B. Definition of what constitutes a hard ware problem is completely device-specific. This error message might be displayed if the 4352B detects an unknown problem related to errors −241 through −249.

−241 **Hardware missing**

A legal program command or query could not be executed because of missing 4352B hardware. For example, an option was not installed.

−111 **Header separator error**

A character that is not a legal header separator was encountered while parsing the header. For example, no white space followed the header, thus `*SRE4` is an error.

−114 **Header Suffix out of range**

The value of a numeric suffix attached to a program mnemonic makes the header invalid.

−224 **Illegal parameter value**

Used where exact value, from a list of possibilities, was expected.

−282 **Illegal program name**

The name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

−283 **Illegal variable name**

An attempt was made to reference a nonexistent variable in a program.

−213 **Init ignored**

A request for a measurement initiation was ignored as another measurement was already in progress.

159 **INSUFFICIENT Memory**

If a lot of tasks are executed at the same time, memory might be insufficient for a while. (For example, running Instrument BASIC program, printing a screen, and sending or receiving data array by GPIB are requested at the same time.) Wait until finishing some tasks then execute the next task.

40 **Insufficient RF Level**

The input level to the 4352B RF IN connector is too low (less than −20 dBm).

Verify that the DUT is correctly connected to the 4352B. Also, verify that the power/control voltage output is turned ON on the LCD information (the measurement setting parameter display or the status notations). If it is OFF, press [DC Power] or [DC Control], and press `OUTPUT ON off`.

This message is also displayed if a positive DC voltage component (TTL output, etc.) is included in the DUT's output signal. In this case, insert a high-pass filter to sufficiently eliminate the positive DC voltage component.

−161 **Invalid block data**

A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2). For example, an END message was received before the length was satisfied.

−101 **Invalid character**

A syntax element contains a character that is invalid for that type. For example, a header containing an ampersand (SING&).

−141 **Invalid character data**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

−121 **Invalid character in number**

An invalid character for the data type being parsed was encountered. For example, an alpha character in a decimal numeric or a “9” in octal data.

171 **INVALID DATE**

The date entered to set the real time clock is invalid. Re-enter the correct date.

50 **Invalid Dev Cal**

The correction coefficient of the FM deviation calibration is not proper.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

130 **INVALID FILE NAME**

The file name for the RECALL, PURGE, or RE-SAVE function must have a “_D” or “_S” extension for LIF format.

−103 **Invalid separator**

The parser was expecting a separator and encountered an illegal character (semicolon (;), comma (,), etc.).

−151 **Invalid string data**

A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2). For example, an END message was received before the terminal quote character.

−131 **Invalid suffix**

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for the 4352B.

133 **LIF-DOS COPY NOT ALLOWED**

Indicates that you tried to copy a file between the different formatted disks.

For example, if you try to copy a file between the RAM disk and the flexible disk when the format of the RAM disk is different from the format of the flexible disk, this message is displayed.

−250 **Mass Storage Error**

Indicates that a mass storage error occurred. This error message might be displayed if the 4352B detects an unknown problem related to error −257.

−311 **Memory error**

An error was detected in the 4352B's memory.

−109 **Missing parameter**

Fewer parameters were received than required for the header.

116 **NO ACTIVE MARKER**

Indicates that the Marker→ function was executed when no marker is activated. Press (Menu) MARKER to activate a marker.

111 **NO DATA TRACE**

Indicates that MKR ON [DATA] was pressed when no data trace is displayed.

137 **NO DATA TRACE DISPLAYED**

Indicates that SCALE FOR [DATA] was pressed when no data trace is displayed.

65 **No Downconverter RF Output; Do Signal Search**

This message appears when RF OUT of the 43521A (Downconverter Unit) outputs no signal because the frequency setting of the external signal source is inappropriate. Set a correct nominal frequency ((Meas), FREQ BAND [xx-xx] , NOMINAL FREQ), or execute the signal search ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)) to set the nominal frequency to the 4352B. The oscillation frequency of the external signal source is adjusted properly.

61 **No Downconverter Unit Connected**

This message appears in the following cases.

- When you try to set DOWNCONV on OFF to ON with the 43521A (Downconverter Unit) disconnected.
- When you try to set DOWNCONV on OFF to ON with the 43521A turned off.
- When you turn off the 43521A with DOWNCONV ON off set to ON.
- When you recall the setting to use the 43521A with DOWNCONV on OFF set to OFF.

Connect the 43521A correctly, and turn on the power. Notice that, if DOWNCONV on OFF is OFF, you cannot recall the setting to use the 43521A.

118 **NO FIXED DELTA MARKER**

The fixed Δmarker was not turned on. Be sure to turn the fixed Δmarker on before using FIXED ΔMKR VALUE or FIXED ΔMKR AUX VALUE.

114 **NO MARKER DELTA - RANGE NOT SET**

Indicates that MKRΔ→SEARCH RNG was selected when the Δmarker is not turned on.

113 **NO MARKER DELTA - SPAN NOT SET**

Indicates that MKRΔ→SPAN was selected when the Δmarker is not displayed.

112 **NO MEMORY TRACE**

Indicates that MKR ON [MEMORY] was selected when no memory trace is displayed.

138 **NO MEMORY TRACE DISPLAYED**

Indicates that SCALE FOR [MEMORY] was selected when no memory trace is displayed.

66 **No Signal Found**

This message appears when the carrier signal cannot be found out in the signal search function ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)). The frequency of the carrier signal may not be within the specified frequency band ((Meas), FREQ BAND [xx-xxGHz]). Check again to see if the specified range of the frequency band matches with the carrier signal frequency. Generally, if the DUT does not generate the carrier signal, the error message, CAUTION: Insufficient RF Level, appears first. As shown in this example, if another error message has been displayed already, this error message does not appear even if you execute the signal search.

131 **NO STATE/DATA FILES ON DISK**

There are no files with extensions ("_D" or "_S" for LIF format, or "STA" or ".DTA" for DOS format) on the flexible disk.

134 **NO STATE/DATA FILES ON MEMORY**

There are no files with extensions ("_D" or "_S" for LIF format, or ".STA" or ".DTA" for DOS format) in the RAM disk memory.

30 **NO VALID MEMORY STORED**

Indicates that you tried to display memory trace/data when there was no measurement data stored in memory.

0 **(No error)**

The error queue is empty. Every error in the queue has been read (OUTPERRO? query) or the queue was cleared by power-on or the *CLS command.

55 **Noise Overload**

The noise level during a C/N ratio measurement or a phase noise measurement is too large.

This is caused by either the DUT's noise level being too large or by the DUT's spurious component being too large in the measurement range. Verify the spectrum of the DUT's output signal.

91 **NOT ENOUGH DATA**

The amount of data sent to the 4352B is less than that expected when the data transfer format is binary.

−120 **Numeric data error**

This error, as well as errors −121 through −129, are generated when parsing a data element that appears to be numeric, including the nondecimal numeric types. This error message might be displayed if the 4352B detects an unknown problem.

−128 **Numeric data not allowed**

A legal numeric data element was received, but the 4352B does not accept it in this position for a header.

−220 **Parameter error**

Indicates that a program data element related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to −221 through −229.

−108 **Parameter not allowed**

More parameters were received than expected for the header. For example, the `*SRE` command only accepts one parameter, so receiving `*SRE 4,16` is not allowed.

75 **POWER FAILED ON** *nnn*

Serious error. Contact your nearest Hewlett-Packard office. One or more power supply failed. where *nnn* is one of `−5 V`, `−15 V`, `+5 V`, `+15 V`, `+65 V`, and `PostRegHot`. It shows which power line failed. When this error occurs, the system halts so an external controller cannot read this error using GPIB.

22 **PRINTER:not on, not connected, out of paper**

The printer does not respond to control. Verify power to the printer, and check the interface connection between the analyzer and the printer.

−284 **Program currently running**

Certain operations dealing with programs may be illegal while the program is running. For example, deleting a running program might not be possible.

−280 **Program error**

Indicates that a downloaded program-related execution error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −281 through −289.

Error Messages (Alphabetical Order)

−112 **Program mnemonic too long**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

−286 **Program runtime error**

A program runtime error of the Instrument BASIC has occurred. To get more specific error information, use the `ERRM$` or `ERRN` command (Instrument BASIC).

−285 **Program syntax error**

Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

−350 **Queue overflow**

A specific code entered into the queue instead of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.

−400 **Query error**

This is the generic query error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

−410 **Query INTERRUPTED**

A condition causing an interrupted query error occurred (see IEEE 488.2, 6.3.2.3). For example, a query followed by `DAB` or `GET` before a response was completely sent.

−420 **Query UNTERMINATED**

A condition causing an unterminated query error occurred (see IEEE 488.2, 6.3.2.2). For example, the 4352B was addressed to talk and an incomplete program message was received by the controller.

129 **RECALL ERROR: INSTR STATE PRESET**

A serious error, for example corrupted data, is detected on recalling a file, and this forced the 4352B to be PRESET.

49 **RF Freq Out Of Range**

The DUT's output frequency is not within the measurement range of the 4352B (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Downconverter Unit).).

Verify the DUT's output frequency.

58 **RF Input Over Trans Max Freq**

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was beyond the highest possible measurement frequency.

Note, however, that "`RF Input Under Trans Min Freq`" (message No.: 57) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press (Sense Range), MAX TRANS FREQ or MIN TRANS FREQ, and the entry keys to change the detection bandwidth, if required.

57 RF Input Under Trans Min Freq

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was below the lowest possible measurement frequency.

Note, however, that "RF Input Under Trans Max Freq" (message No.: 58) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press (Sense Range), MAX TRANS FREQ or MIN TRANS FREQ, and the entry keys to change the detection bandwidth, if required.

78 RF Level Overload

The input level to the 4352B RF IN connector is too high (+20 dBm or more).

Verify the input level to the 4352B RF IN connector. Also, this message is displayed if a negative DC voltage component is included in the DUT's output signal during RF Power Level measurement. In this case, insert a filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the DC voltage component.

Caution Continuously applying excessive input to the 4352B will cause failures.

128 SAVE ERROR

A serious error occurred when the file was being saved.

For example, this is displayed when the disk surface is physically damaged.

27 SG:not on, not connect, wrong address

Indicates that the external signal generator did not respond when the 4352B tried to control the external signal generator via GPIB.

Verify the external signal generator is turned ON, the GPIB cable connection is proper, the GPIB address setting for the external signal generator is proper, etc.

−330 Self-test failed

The self test failed. Either contact our service office, or see the *Service Manual*.

47 Set Noise ATT 10 dB More

Press (Sense Range), NOISE ATTN, and the entry keys to set a value 10 dB higher than the current setting.

41 **Set RF ATT 5 dB Less**

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB lower than the current setting.

42 **Set RF ATT 5 dB More**

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB higher than the current setting.

−221 **Settings conflict**

A legal program data element was parsed but could not be executed due to the current device state (See IEEE 488.2, 6.4.5.3, and 11.5.1.1.5.).

−150 **String data error**

This error, as well as errors −151 and −158, are generated when analyzing the syntax of a string data element. This error message might be displayed if the 4352B detects an unknown problem.

−158 **String data not allowed**

A string data element was encountered but was not allowed by the 4352B at this point in parsing.

−130 **Suffix error**

This error, as well as errors −131 through −139, are generated when parsing a suffix. This error message might be displayed if the 4352B detects an unknown problem.

−138 **Suffix not allowed**

A suffix was encountered after a numeric element that does not allow suffixes.

−134 **Suffix too long**

The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

−102 **Syntax error**

An unrecognized command or data type was encountered. For example, a string was received when the 4352B was not expecting to receive a string.

−310 **System error**

Some error, termed "system error" by the 4352B, has occurred.

59 **Target Freq Out Of Range**

Indicates the 2nd or 3rd harmonic target frequency is not within the 4352B measurement range (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Downconverter Unit).)) when 2xCARR → CENTER or 3 x CARR → CENTER is selected in spectrum measurements.

At this time, the previous measurement conditions still remain (any of the sweep parameters (start, stop, center, or span values) are not changed).

Check the DUT's output frequency.

82 **Thermometer Out Of Range**

The 4352B's internal thermometer reading is out of the proper range.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

−124 **Too many digits**

The mantissa of a decimal numeric data element contains more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

−223 **Too much data**

A legal program data element of block, expression, or string type was received that contained more data than the 4352B could handle due to memory or related device-specific requirements.

−210 **Trigger error**

A trigger related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −211 through −219.

−211 **Trigger ignored**

A GET, `*TRG`, or triggering signal was received and recognized by the 4352B but was ignored because of the 4352B timing considerations. For example, the 4352B was not ready to respond.

−113 **Undefined header**

The header is syntactically correct, but it is undefined for the 4352B. For example, `*XYZ` is not defined for the 4352B.

160 **WRONG I/O PORT DIRECTION**

The direction setting for the I/O port (input or output) is incorrect.

Verify that a signal from an external instrument is being sent to an input port, and a signal from an output port is being sent to an external instrument.

79 **X-tal PLL Unlocked (40 MHz)**

The 4352B's internal PLL cannot be locked.

Verify the reference frequency input to the EXT REF input connector on the 4352B rear panel is 10 MHz ± 100 Hz.

80 **X-tal PLL Unlocked (85.6 MHz)**

The 4352B's internal PLL cannot be locked.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

Error Messages in Numerical Order

Note The positive number error messages are listed first, and then negative number error messages are listed.

0 **(No error)**

The error queue is empty. Every error in the queue has been read (OUTPERRO? query) or the queue was cleared by power-on or the *CLS command.

13 **BACKUP DATA LOST**

Data checksum error on the battery backup memory has occurred. Wait until the battery is re-charged (approximately 10 minutes after turning the 4352B on).

22 **PRINTER:not on, not connected, out of paper**

The printer does not respond to control. Verify power to the printer, and check the interface connection between the analyzer and the printer.

27 **SG:not on, not connect, wrong address**

Indicates that the external signal generator did not respond when the 4352B tried to control the external signal generator via GPIB.

Verify the external signal generator is turned ON, the GPIB cable connection is proper, the GPIB address setting for the external signal generator is proper, etc.

30 **NO VALID MEMORY STORED**

Indicates that you tried to display the memory trace/data when there was no measurement data stored in memory.

Note Messages with error numbers 40~82 are related to measurement.

40 **Insufficient RF Level**

The input level to the 4352B RF IN connector is too low (less than −20 dBm).

Verify that the DUT is correctly connected to the 4352B. Also, verify that the power/control voltage output is turned ON on the LCD information (the measurement setting parameter display or the status notations). If it is turned OFF, press (DC Power) or (DC Control), and press OUTPUT ON off.

Also, this message is displayed if a positive DC voltage component (TTL output, etc.) is included in the DUT's output signal. In this case, insert a high-pass filter to sufficiently eliminate the positive DC voltage component.

41 **Set RF ATT 5 dB Less**

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB lower than the current setting.

42 **Set RF ATT 5 dB More**

Press (Sense Range), RF ATTN, and the entry keys to set a value 5 dB higher than the current setting.

43 **F-V Input Underflow**

The input frequency to the 4352B's F-V converter is too low.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

44 **F-V Input Overflow**

The input frequency to the 4352B's F-V converter is too high.

This message indicates that the DUT's frequency has fluctuated widely in a very short time (several hundred kHz in several tens of ms). Verify the DUT's output frequency stability.

45 **1st IF Out Of Range**

The 4352B's 1st IF frequency is outside of the proper range.

Possible problems and the corrective action are shown below:

- The frequency of the external signal generator is not correct.
  The 4352B has not performed automatic control of the external signal generator via GPIB (LO CONTROL MAN and/or ADDRESSABLE ONLY is selected). Verify the frequency of the external signal generator.
- The actual time required for the stabilization of the output frequency from the external signal generator after changing the output frequency exceeds the specified wait time in LOCAL SWTCH TIME.

  Press (RF/LO), LOCAL SWTCH TIME, and the entry keys to increase the 4352B's wait time.
- The DUT output frequency fluctuated largely in a very short time (several hundred kHz in several tens of ms)
  Verify the DUT's frequency stability.
- The automatic frequency control function was ON and the target frequency was 50 MHz or less.
  Set the acceptable frequency deviation to 4% or less of the target frequency.

47 **Set Noise ATT 10 dB More**

Press (Sense Range), NOISE ATTN, and the entry keys to set a value 10 dB higher than the current setting.

48 **AFC Out Of Loop**

The automatic frequency control function could not follow the fluctuation in the measurement condition, and did not converge on the target frequency.

Possible causes and countermeasures are shown below:

- The tuning sensitivity is improperly set.
  Press (Menu), AUTO FREQ CONTROL, SENSITIVITY, and the entry keys to specify a proper tuning sensitivity (the unit is [Hz/V]).
- The maximum value of the control voltage is too small.
  Press (Menu), AUTO FREQ CONTROL, MAX CTRL VOLTAGE, and the entry keys to specify a maximum value larger than the current setting. *Be careful not to set a value that exceeds the DUT's maximum acceptable value.*
- The math/measurement repeat count is too low.
  Press (Menu), AUTO FREQ CONTROL, MAX ITERATION, and the entry keys to specify a value larger than the current setting.
- An effect of the high value capacitor included with the DUT's power voltage (V_{cc}) terminal.
  Press (Menu), AUTO FREQ CONTROL, CTRL DELAY, and the entry keys to specify a value larger than the current setting.

49 RF Freq Out Of Range

The DUT's output frequency is not within the measurement range of the 4352B (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Downconverter Unit).).

Verify the DUT's output frequency.

50 Invalid Dev Cal

The correction coefficient of the FM deviation calibration is not proper.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

51 Calibration Aborted

The FM deviation calibration in progress was aborted. This is probably caused by changing the measurement parameters during the FM deviation calibration.

Perform the FM deviation calibration again.

52 DC Output On Required in AFC

The automatic frequency control function was set on, however, power or control voltage is not being applied to the DUT.

Verify that the power/control voltages output is set to ON on the LCD information (the measurement setting parameter display or the status notations). If the power/control voltage output is turned OFF, press (DC Power) or (DC Control), and OUTPUT ON off.

53 FM Deviation Range Overload

The DUT's FM deviation is out of the measurement range.

Press (Sense Range), FM DEV RANGE, and select a measurement range larger than the current setting. (FM deviation over 200 kHz cannot be measured.)

54 **Carrier Overload**

The carrier level in a C/N ratio measurement or a phase noise measurement is too large.

The 4352B RF IN connector's input level is too large. Verify the input level to the 4352B RF IN connector.

55 **Noise Overload**

The noise level during a C/N ratio measurement or a phase noise measurement is too large.

This is caused by either the DUT's noise level being too large or by the DUT's spurious component being too large in the measurement range. Verify the spectrum of the DUT's output signal.

57 **RF Input Under Trans Min Freq**

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was below the lowest possible measurement frequency.

Note, however, that "RF Input Under Trans Max Freq" (message No.: 58) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press (Sense Range), MAX TRANS FREQ or MIN TRANS FREQ, and the entry keys to change the detection bandwidth, if required.

58 **RF Input Over Trans Max Freq**

Indicates that the frequency transient measurement trace was probably inaccurate because the input frequency to the 4352B was beyond the highest possible measurement frequency.

Note, however, that "RF Input Under Trans Min Freq" (message No.: 57) may erroneously appear even when the above problem is present, if the 4352B is operating in the heterodyne mode and if the difference between input signals from the device and the external signal generator is larger than 40 MHz.

Verify that the DUT generates the proper signal, and inputs it to the 4352B RF IN connector. If the signal is generated, check its frequency. Press (Sense Range), MAX TRANS FREQ or MIN TRANS FREQ, and the entry keys to change the detection bandwidth, if required.

59 **Target Freq Out Of Range**

Indicates the 2nd or 3rd harmonic target frequency is not within the 4352B measurement range (The measurement range is set to 10 MHz to 3 GHz when the 4352B is used alone, or set to the selected frequency band when used with 43521A (Downconverter Unit).)) when 2xCARR → CENTER or 3 x CARR → CENTER is selected in spectrum measurements.

At this time, the previous measurement conditions still remain (any of the sweep parameters (start, stop, center, or span values) are not changed).

Check the DUT's output frequency.

Error Messages (Numerical Order)

61 No Downconverter Unit Connected

This message appears in the following cases.

- When you try to set DOWNCONV on OFF to ON with the 43521A (Downconverter Unit) disconnected.
- When you try to set DOWNCONV on OFF to ON with the 43521A turned off.
- When you turn off the 43521A with DOWNCONV ON off set to ON.
- When you recall the setting to use the 43521A with DOWNCONV on OFF set to OFF.

Connect the 43521A correctly, and turn on the power. Notice that, if DOWNCONV on OFF is OFF, you cannot recall the setting to use the 43521A.

62 Correction Data Lost in Downconverter Unit

The correction data in the EEPROM of the 43521A (Downconverter Unit) is lost. You cannot use the product. Repair the faulty hardware.

63 Can't Use 12-Bit I/O Port

This message appears if you execute an IBASIC or GPIB command to operate the 12-Bit I/O Port with DOWNCONV ON off set to ON. If DOWNCONV ON off is set to ON, the 12-Bit I/O Port is connected to the 43521A. Therefore, you cannot use this kind of commands.

64 Command Ignored - Invalid Freq Band

This message appears if you execute the TRMIN or TRMAX GPIB command when DOWNCONV ON off is set to ON and a frequency band other than 10 MHz to 3 GHz (high frequency band) is selected. The command is ignored. The TRMIN and TRMAX commands are available only in the following cases:

- When you use the 4352B alone (not connecting it to the 43521A)
- When you connect the 4352B and the 43521A (Downconverter Unit), set DOWNCONV ON off to ON, and set the frequency band to 10 MHz to 3 GHz.

65 No Downconverter RF Output; Do Signal Search

This message appears when RF OUT of the 43521A (Downconverter Unit) outputs no signal because the frequency setting of the external signal source is inappropriate. Set a correct nominal frequency ((Meas), FREQ BAND [xx-xx] , NOMINAL FREQ), or execute the signal search ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)) to set the nominal frequency to the 4352B. The oscillation frequency of the external signal source is adjusted properly.

66 No Signal Found

This message appears when the carrier signal cannot be found out in the signal search function ((Meas), FREQ BAND [xx-xx] , SIGNAL SEARCH)). The frequency of the carrier signal may not be within the specified frequency band ((Meas), FREQ BAND [xx-xxGHz]). Check again to see if the specified range of the frequency band matches with the carrier signal frequency. Generally, if the DUT does not generate the carrier signal, the error message, CAUTION: Insufficient RF Level, appears first. As shown in this example, if another error message has been displayed already, this error message does not appear even if you execute the signal search.

70 **A/D Overload**

The input level to the 4352B's internal A/D converter is too large.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

71 **A/D Overload in Downconverter Unit**

An overflow occurred in the A/D converter of the 43521A (Downconverter Unit). If this error occurs often, the 43521A may be at fault and need repair. Contact our service office or the company from which you purchased this instrument.

75 **POWER FAILED ON** *nnn*

Serious error. Contact your nearest Hewlett-Packard office. One or more power supply failed. where *nnn* is one of `-5 V`, `-15 V`, `+5 V`, `+15 V`, `+65 V`, and `PostRegHot`. It shows which power line failed. When this error occurs, the system halts so an external controller cannot read this error using GPIB.

76 **DC Power Current Overload**

The current through the DC POWER connector is too large (50 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's power current is too large.
  Verify that the DUT is correctly connected to the 4352B.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal. This is a transient error. Wait until the DC POWER voltage is stabilized, then perform the measurement.

77 **DC Control Current Overload**

The current through the DC CONTROL connector is too large (20 mA or more).

Possible problems and the corrective action are shown below:

- The DUT's control current is too large.
  Verify that the DUT is correctly connected to the 4352B RF IN connector.
- An effect of the high value capacitor connected to the DUT's power voltage (V_{cc}) terminal. This is a transient error. Press [DC Control], `CTRL DELAY`, and the entry keys to set a sufficiently large value for elimination of this transient error.

78 **RF Level Overload**

The input level to the 4352B RF IN connector is too high (+20 dBm or more).

Verify the input level to the 4352B RF IN connector. Also, this message is displayed if a negative DC voltage component is included in the DUT's output signal during RF Power Level measurement. In this case, insert a filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the DC voltage component.

Caution Continuously applying excessive input to the 4352B will cause failures.

79 **X-tal PLL Unlocked (40 MHz)**

The 4352B's internal PLL cannot be locked.

Verify the reference frequency input to the EXT REF input connector on the 4352B rear panel is 10 MHz ± 100 Hz.

80 **X-tal PLL Unlocked (85.6 MHz)**

The 4352B's internal PLL cannot be locked.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

81 **2nd PLL Unlocked**

The 4352B's internal 2nd PLL cannot be locked. If this message is displayed during a C/N ratio measurement or a phase noise measurement, the following problems and the corrective action are shown below.

- The DUT's noise level is too large, or a large level spurious component exists in the measurement range.
  Verify the spectrum of the DUT's output signal.
- The DUT's output signal is being modulated in frequency.
  Press (Mod), `MOD OUT on OFF` to stop the frequency modulation.
- In the case of a DUT with an oscillation frequency of 100 MHz or less, a large harmonics component is included in the output signal (effect of TTL output, etc.).

  Insert a low-pass filter between the DUT's output terminal and the 4352B RF IN connector to eliminate the harmonics component.

If this message is displayed any time other than during a C/N measurement, adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

82 **Thermometer Out Of Range**

The 4352B's internal thermometer reading is out of the proper range.

Adjustment or repair is necessary. Contact our service office or the company from which you purchased the 4352B.

90 **TOO MUCH DATA**

The amount of binary data, sent to this instrument in the FORM2, FORM3, or FORM5 data transfer format, is too much. Or, the number of data items exceeds the number of display points.

91 **NOT ENOUGH DATA**

The amount of data sent to the 4352B is less than that expected when the data transfer format is binary.

100 **CAN'T CHANGE- ANOTHER CONTROLLER ON BUS**

The 4352B cannot assume the mode of system controller until the active controller is removed from the bus or relinquishes the bus. See the *4352B GPIB Programming Manual*.

102 **ANALYZER TYPE MISMATCH**

Indicates the invalid function was selected in the present measurement item. Change the measurement item, or select the different function.

111 **NO DATA TRACE**

Indicates that MKR ON [DATA] was pressed when no data trace is displayed.

112 **NO MEMORY TRACE**

Indicates that MKR ON [MEMORY] was selected when no memory trace is displayed.

113 **NO MARKER DELTA - SPAN NOT SET**

Indicates that MKRΔ→SPAN was selected when the Δmarker is not displayed.

114 **NO MARKER DELTA - RANGE NOT SET**

Indicates that MKRΔ→SEARCH RNG was selected when the Δmarker is not turned on.

116 **NO ACTIVE MARKER**

Indicates that the Marker→ function was executed when no marker is activated. Press (Menu) MARKER to activate a marker.

118 **NO FIXED DELTA MARKER**

The fixed Δmarker was not turned on. Be sure to turn the fixed Δmarker on before using FIXED ΔMKR VALUE or FIXED ΔMKR AUX VALUE.

128 **SAVE ERROR**

A serious error occurred when the file was being saved.

For example, this message is displayed when the disk surface is physically damaged.

129 **RECALL ERROR: INSTR STATE PRESET**

A serious error, for example corrupted data, is detected on recalling a file, and this forced the 4352B to be PRESET.

130 **INVALID FILE NAME**

The file name for the RECALL, PURGE, or RE-SAVE function must have a "_D" or "_S" extension for LIF format.

131 **NO STATE/DATA FILES ON DISK**

There are no files with extensions ("_D" or "_S" for LIF format, or "STA" or ".DTA" for DOS format) on the flexible disk.

132 **CAN'T SAVE GRAPHICS WHEN COPY IN PROGRESS**

If you attempt to save graphics when a print is in progress, this error message is displayed.

Wait until print is completed, then save the graphics again.

133 **LIF-DOS COPY NOT ALLOWED**

Indicates that you tried to copy a file between different formatted disks.

For example, if you try to copy a file between the RAM disk and the flexible disk when the format of the RAM disk is different from the format of the flexible disk, this message is displayed.

134 **NO STATE/DATA FILES ON MEMORY**

There are no files with extensions ("_D" or "_S" for LIF format, or ".STA" or ".DTA" for DOS format) in the RAM disk memory.

135 **DUPLICATE FILE EXTENSION**

The extension name entered is already used for other file types. Use a different extension name.

137 **NO DATA TRACE DISPLAYED**

Indicates that SCALE FOR [DATA] was pressed when no data trace is displayed.

138 **NO MEMORY TRACE DISPLAYED**

Indicates that SCALE FOR [MEMORY] was selected when no memory trace is displayed.

144 **CAN'T CHANGE NUMBER OF POINTS**

The number of points in the spectrum measurement cannot be to change manually, except in zero span.

159 **INSUFFICIENT Memory**

If a lot of tasks are executed at the same time, memory might be insufficient for a while. (For example, running Instrument BASIC program, printing a screen, and sending or receiving data array by GPIB are requested at the same time.) Wait until finishing some tasks then execute the next task.

160 **WRONG I/O PORT DIRECTION**

The direction setting for the I/O port (input or output) is incorrect.

Verify that a signal from an external instrument is being sent to an input port, and a signal from an output port is being sent to an external instrument.

171 **INVALID DATE**

The date entered to set the real time clock is invalid. Re-enter the correct date.

Note

The messages with negative numbers shown below are for errors that occur when the 4352B is being controlled with GPIB commands over the GPIB.

−100 **Command error**

This is a generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a command error, as defined in IEEE 488.2, 11.5.1.1.4, has occurred.

−101 **Invalid character**

A syntax element contains a character that is invalid for that type. For example, a header containing an ampersand (`SING&`).

−102 **Syntax error**

An unrecognized command or data type was encountered. For example, a string was received when the 4352B was not expecting to receive a string.

−103 **Invalid separator**

The parser was expecting a separator and encountered an illegal character (semicolon (;), comma (,), etc.).

−104 **Data type error**

The parser recognized a data element that is not allowed. For example, a numeric or string data was expected but block data was encountered.

−105 **GET not allowed**

A Group Execute Trigger (GET) was received within a program message (see IEEE 488.2, 7.7).

−108 **Parameter not allowed**

More parameters were received than expected for the header. For example, the `*SRE` command only accepts one parameter, so receiving `*SRE 4,16` is not allowed.

−109 **Missing parameter**

Fewer parameters were received than required for the header.

−110 **Command header error**

An error was detected in the header. This error message might be displayed if the 4352B detects an unknown problem related to errors −111 through −119.

−111 **Header separator error**

A character that is not a legal header separator was encountered while parsing the header. For example, no white space followed the header, thus `*SRE4` is an error.

−112 **Program mnemonic too long**

The header contains more than twelve characters (see IEEE 488.2, 7.6.1.4.1).

−113 **Undefined header**

The header is syntactically correct, but it is undefined for the 4352B. For example, `*XYZ` is not defined for the 4352B.

Error Messages (Numerical Order)

−114 **Header Suffix out of range**

The value of a numeric suffix attached to a program mnemonic makes the header invalid.

−120 **Numeric data error**

This error, as well as errors −121 through −129, are generated when parsing a data element that appears to be numeric, including the nondecimal numeric types. This error message might be displayed if the 4352B detects an unknown problem.

−121 **Invalid character in number**

An invalid character for the data type being parsed was encountered. For example, an alpha character in a decimal numeric or a "9" in octal data.

−123 **Exponent too large**

The magnitude of the exponent was larger than 32000 (see IEEE 488.2, 7.7.2.4.1).

−124 **Too many digits**

The mantissa of a decimal numeric data element contains more than 255 digits excluding leading zeros (see IEEE 488.2, 7.7.2.4.1).

−128 **Numeric data not allowed**

A legal numeric data element was received, but the 4352B does not accept it in this position for a header.

−130 **Suffix error**

This error, as well as errors −131 through −139, are generated when parsing a suffix. This error message might be displayed if the 4352B detects an unknown problem.

−131 **Invalid suffix**

The suffix does not follow the syntax described in IEEE 488.2, 7.7.3.2, or the suffix is inappropriate for the 4352B.

−134 **Suffix too long**

The suffix contained more than 12 characters (see IEEE 488.2, 7.7.3.4).

−138 **Suffix not allowed**

A suffix was encountered after a numeric element that does not allow suffixes.

−140 **Character data error**

This error, as well as errors −141 through −148, are generated when analyzing the syntax of a character data element. This error message might be displayed if the 4352B detects an unknown problem.

−141 **Invalid character data**

Either the character data element contains an invalid character or the particular element received is not valid for the header.

−144 **Character data too long**

The character data element contains more than twelve characters (see IEEE 488.2, 7.7.1.4).

−148 **Character data not allowed**

A legal character data element was encountered where prohibited by the 4352B.

−150 **String data error**

This error, as well as errors −151 and −158, are generated when analyzing the syntax of a string data element. This error message might be displayed if the 4352B detects an unknown problem.

−151 **Invalid string data**

A string data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.5.2). For example, an `END` message was received before the terminal quote character.

−158 **String data not allowed**

A string data element was encountered but was not allowed by the 4352B at this point in parsing.

−160 **Block data error**

The 4352B detected the invalid syntax of a block data element.

−161 **Invalid block data**

A block data element was expected, but was invalid for some reason (see IEEE 488.2, 7.7.6.2). For example, an `END` message was received before the length was satisfied.

−168 **Block data not allowed**

A legal block data element was encountered but was not allowed by the 4352B at this point in parsing.

−200 **Execution error**

This is the generic syntax error that the 4352B displays when it cannot detect more specific errors. This code indicates only that an execution error as defined in IEEE 488.2, 11.5.1.1.5 has occurred.

−210 **Trigger error**

A trigger related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −211 through −219.

−211 **Trigger ignored**

A GET, `*TRG`, or triggering signal was received and recognized by the 4352B but was ignored because of the 4352B timing considerations. For example, the 4352B was not ready to respond.

−213 **Init ignored**

A request for a measurement initiation was ignored as another measurement was already in progress.

−220 Parameter error

Indicates that a program data element related error occurred. This error message might be displayed if the 4352B detects an unknown problem related to −221 through −229.

−221 Settings conflict

A legal program data element was parsed but could not be executed due to the current device state (See IEEE 488.2, 6.4.5.3, and 11.5.1.1.5.).

−222 Data out of range

A legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the 4352B (see IEEE 488.2, 11.5.1.1.5).

−223 Too much data

A legal program data element of block, expression, or string type was received that contained more data than the 4352B could handle due to memory or related device-specific requirements.

−224 Illegal parameter value

Used where exact value, from a list of possibilities, was expected.

−225 Data out of memory

The 4352B has insufficient memory to perform the requested operation.

−230 Data corrupt or stale

Possibly invalid data. New reading started but not completed since last access.

−231 Data questionable

Indicates that the measurement accuracy is suspect.

−240 Hardware error

Indicates that a legal program command or query could not be executed because of a hardware problem in the 4352B. Definition of what constitutes a hard ware problem is completely device-specific. This error message might be displayed if the 4352B detects an unknown problem related to errors −241 through −249.

−241 Hardware missing

A legal program command or query could not be executed because of missing 4352B hardware. For example, an option was not installed.

−250 Mass Storage Error

Indicates that a mass storage error occurred. This error message might be displayed if the 4352B detects an unknown problem related to error −257.

−257 File Name Error

Indicates that a legal program command or query could not be executed because the file name on the device media was in error. For example, an attempt was made to copy to a duplicate file name. The definition of what constitutes a file name error is device-specific.

−280 **Program error**

Indicates that a downloaded program-related execution error occurred. This error message might be displayed if the 4352B detects an unknown problem related to errors −281 through −289.

−281 **Cannot create program**

Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.

−282 **Illegal program name**

The name used to reference a program was invalid. For example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program.

−283 **Illegal variable name**

An attempt was made to reference a nonexistent variable in a program.

−284 **Program currently running**

Certain operations dealing with programs may be illegal while the program is running. For example, deleting a running program might not be possible.

−285 **Program syntax error**

Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific.

−286 **Program runtime error**

A program runtime error of the Instrument BASIC has occurred. To get more specific error information, use the `ERRM$` or `ERRN` command (Instrument BASIC).

−310 **System error**

Some error, termed "system error" by the 4352B, has occurred.

−311 **Memory error**

An error was detected in the 4352B's memory.

−330 **Self-test failed**

The self test failed. Either contact our service office, or see the *Service Manual*.

−350 **Queue overflow**

A specific code entered into the queue instead of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.

−400 **Query error**

This is the generic query error that the 4352B displays when it cannot detect more specific errors. This code indicates only that a query error as defined in IEEE 488.2, 11.5.1.1.7 and 6.3 has occurred.

−410 Query INTERRUPTED

A condition causing an interrupted query error occurred (see IEEE 488.2, 6.3.2.3). For example, a query followed by DAB or GET before a response was completely sent.

−420 Query UNTERMINATED

A condition causing an unterminated query error occurred (see IEEE 488.2, 6.3.2.2). For example, the 4352B was addressed to talk and an incomplete program message was received by the controller.

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