Caution

Do not exceed the operating input power level, voltage level, current level, and signal type that is appropriate for the instrument being used. Refer to your instrument's operation manual for safe operating practices and device limitations.

Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument's front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the instrument's front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.

Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.

MS462XX

VECTOR NETWORK MEASUREMENT SYSTEM

OPERATION MANUAL

Software Version: 1.17

TIP TO GET STARTED QUICKLY

Read the companion MS462XX Measurement Guide (PN 10410-00213) for a system overview along with detailed help for calibration, applications, features, and software system support.

490 JARVIS DRIVE | MORGAN HILL, CA 95037-2809

P/N: 10410-00203
REVISION: L
PRINTED: AUGUST 2003

WARRANTY

The Anritsu product(s) listed on the title page is (are) warranted against defects in materials and workmanship for three years from the date of shipment.

Anritsu's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Anritsu for warranty repairs. Obligation is limited to the original purchaser. Anritsu is not liable for consequential damages.

LIMITATION OF WARRANTY

The foregoing warranty does not apply to Anritsu connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

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NOTICE

DECLARATION OF CONFORMITY

Manufacturer's Name: ANRITSU COMPANY

Manufacturer's Address: Microwave Measurements Division
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

declares that the product specified below:

Product Name: Vector Network Measurement System

Model Number: MS4622A; MS4622B; MS4622C; MS4623A; MS4623B; MS4623C; MS4622D; MS4623D, MS4624D

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 73/23/EEC as amended by Council directive 93/68/EEC

Electromagnetic Interference:

Emissions:	CISPR 11:1990/EN55011: 1991 Group 1 Class A EN 61000-3-2:1995 Class A EN 61000-3-3:1995 Class A
Immunity:	EN 61000-4-2:1995/EN50082-1: 1997 - 4kV CD, 8kV AD EN 61000-4-3:1997/EN50082-1: 1997 - 3V/m ENV 50204/EN50082-1: 1997 – 3V/m EN 61000-4-4:1995/EN50082-1: 1997 - 0.5kV SL, 1kV PL EN 61000-4-5:1995/EN50082-1: 1997 - 1kV L-L, 2kV L-E EN 61000-4-6:1994/EN61326: 1998 – 3V EN 61000-4-8:1994/EN61326: 1998 – 3A/m EN 61000-4-11:1994/EN61326: 1998 – 100% @ 20msec

Electrical Safety Requirement:

Product Safety: IEC 1010-1:1990 + A1/EN61010-1: 1993

Director of Corporate Quality

Morgan Hill, CA

13-MAR-02
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close, Stevenage Herts, SG1 2EF UK, (FAX 44-1438-740202)

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully BEFORE operating the equipment.

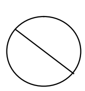
Symbols Used in Manuals

DANGER	This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
WARNING	This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
CAUTION	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

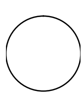
Safety Symbols Used on Equipment and in Manuals

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

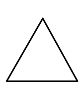
Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.



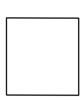
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



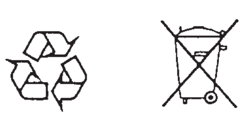
This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.



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



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



These indicate that the marked part should be recycled.

For Safety

WARNING

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

WARNING

or

When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric

WARNING

Repair

This equipment can not be repaired by the operator. DO NOT attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

WARNING

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

Static Safety

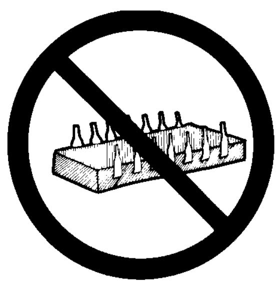
Anritsu products comply with the immunity requirements defined by the European Immunity Standard EN 61000-4-2:1995/EN50082-1:1997-4kV CD, 8kV AD for static discharge. This standard requires that the products survive air discharge static levels of 8 kV, and direct contact discharge static levels of 4 kV. The standard also states, "the static electricity discharges shall be applied only to such points and surfaces of the equipment which are accessible to personnel during normal usage."

Anritsu, as well as most other manufacturers of VNA test equipment, interpret this standard to mean immunity that excludes direct static discharge to the test port center conductor. To prevent direct contact under normal usage, the test port connectors are designed with recessed center conductor pins. The following warning is also affixed near the test ports:

CAUTION
+27 dBm Max
40 VDC Max
Avoid Static
Discharge

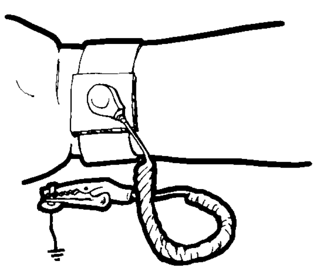
Proper static prevention techniques should always be followed when operating this equipment. These precautions will minimize the possibility of static-shock damage to the equipment.

1. Do not touch exposed contacts on any static sensitive component.



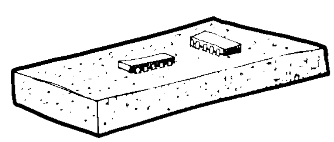
2. Do not slide static sensitive component across any surface.

3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.



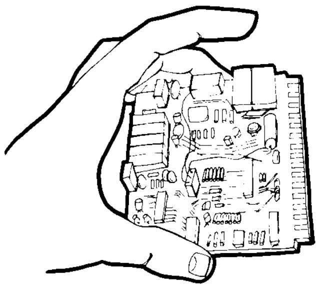
4. Wear a static-discharge wristband when working with static sensitive components.

5. Label all static sensitive devices.

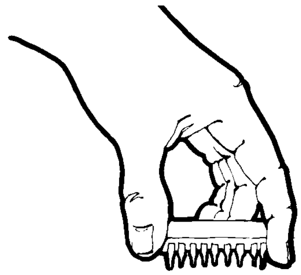


6. Keep component leads shorted together whenever possible.

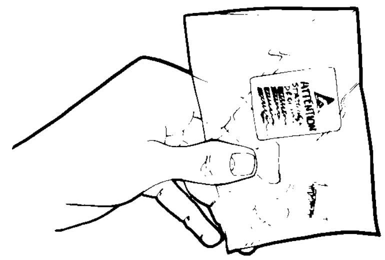
Static Safety



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift & handle solid state devices by their bodies—never by their leads.



9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

ADDITIONAL PRECAUTIONS

Keep work spaces clean and free of any objects capable of holding or storing a static charge.
Connect soldering tools to an earth ground.
Use only special anti-static suction or wick-type desoldering tools.

CAUTION

Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the MS462XX VNMS. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument's front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the intrument's front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.

Repair of damage that is found to be caused by ESD is not covered under warranty.

Narrative Table of Contents

Narrative Table of Contents (Continued)

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Table of Contents (Continued)

Table of Contents (Continued)

Chapter 1
General Information

Table of Contents

Figure 1-1. *Model MS462XX Vector Network Measurement System*

Chapter 1
General Information

1-1 SCOPE OF MANUAL

This manual provides general information, installation, and operating information for the MS4622, MS4623, and MS4624 A, B, C, and D models Vector Network Measurement System (VNMS). (Throughout this manual, the terms *MS462XX VNMS* and *MS462XX* will be used interchangeably to refer to the system.) Manual organization is shown in the table of contents.

1-2 INTRODUCTION

This section provides general information about the MS462X VNMS system and its precision-component calibration kits.

1-3 SERIAL NUMBER

All Anritsu instruments are assigned a unique six-digit serial number, such as "940101." This number is affixed to a decal on the rear panel of each unit. In any correspondence with Anritsu Customer Service, please use this number.

1-4 ONLINE MANUALS

Updates to this manual are available at the Anritsu Internet site (http://www.anritsu.com) as an Adobe Acrobat™ (*.pdf) file. The file can be viewed using Adobe Acrobat Reader™, a free program that is available from the Adobe web site. This file is "linked" such that the viewer can choose a topic to view from the displayed "bookmark" list and "jump" to the manual page on which the topic resides. The text can also be word-searched.

1-5 RELATED MANUALS AND LITERATURE

This manual is one of a three-manual set that covers the operation, programming, and maintenance of the MS462XX. There is also a body of other literature that provides applications-oriented help in understanding and using this product. These manuals and literature are listed in Table 1-1 (following page).

Table 1-1. *Related Manuals, Literature, and Software for MS462XX*

Literature	Part Number	Literature	Part Number
Manuals and User Guides		AutoCal	11410-00258
MS462XX Operation Manual	10410-00203	***Software***	
MS462XX Programming Manual	10410-00204	Scorpion Command Encyclopedia	2300-364
MS462XX Maintenance Manual	10410-00205	Power Tools	2300-218
MS462XX GPIB Quick Reference Guide	10410-00206	LabView Drivers	2300-358
MS462XX Measurement Guide	10410-00213	Exact Uncertainty	2300-361
Application Guide	10410-00214	Mixer Measurement Assistant (NxN)	2300-232
Brochures		***Demonstration Kits***	
Scorpion Brochure	11410-00288	Scorpion Demo Kit	SC6287
AutoCal Brochure	11410-00189	***Allied Equipment Manuals and Literature***	
Power Meter Brochure	11410-00207	ME7840A Power Amplifier Test System (PATS) Operation Manual	10410-00224
Application Notes		ME7840A Power Amplifier Test System (PATS) Brochure	11410-00239
Noise Figure	11410-00210	***Article Reprints***	
Noise Figure Accuracy	11410-00227	*Microwaves & RF*: PATS Reprint	11410-00241
Intermodulation Distortion	11410-00213	*Microwaves Journal*: NF Reprint	
Harmonics	11410-00222	*RF Design*: Mixer Reprint	
Frequency Translated Group Delay	11410-00236	***CDs***	
Global Power Sweep	11410-00243	Scorpion Literature CD	10920-00040
Multiple Source Control	11410-00244	MS462XX Operation Manual and MS462XX Programming Manual	10920-00033
Reflectometer Measurements-Revisited	11410-00214		
Time Domain	11410-00206		
Frequency Accuracy	11410-00208		

1-6 SYSTEM DESCRIPTION

The MS462XX Vector Network Measurement System (VNMS) (Figure 1-1) is a single-instrument system that contains a built-in source, test set, and analyzer. It is produced in six models that cover a range 10 MHz to 9 GHz. It provides up to 1601 measurement data points, non-volatile memory for storing and recalling front panel setups and measurement and calibration data. It provides an on-screen display of total operational time and date of last system calibrations, and the number of power-off cycles since the last calibration. It supports operation over the IEEE 488.2 General Purpose Interface Bus (GPIB). It also uses the same GPIB command set to support operations over an Ethernet.

NOTES

The MS462XC VNMS- Direct Receiver Access version cannot make system measurements without an external test set that couples power into the reference and test channels, such as the Anritsu MS4782A. This manual will discuss calibration and system measurements for the MS462XX assuming the user understands the need for the external test set for the MS462XC.

For the MS462XC, the a_1, a_2, b_1, b_2 connectors on the rear panel are inputs and normally connected to a MS4782X Test Set, when used with the ME7840A Power Amplifier Test System. If a test set is not connected, 50 Ohm terminations must be used with these connectors.

1-7 EXTERNAL INTERFACES

In addition to the visible external interfaces—keyboard, LCD, and floppy disk drive—the MS462XX provides the following interfaces:

- *IEEE488.2 GPIB*: Connects MS462XX to an external controller for remote programming. Connections provides support for the 37XXX Series GPIB command set (as applicable to MS462XX hardware). It also provides partial support for the Hewlett Packard 8753D command set. This interface is described in the MS462XX Programming Manual, Part Number: 10410-00204
- *Dedicated GPIB*: Connects external peripherals for network measurement system controlled operations (such as, GPIB plotters, frequency synthesizers, and power meters)
- *Printer:* Provides support for the Think Jet, HPQuietJet, HP DeskJet, HP LaserJet II, III, & IV Series, and some Epson compatible printers with Parallel (Centronics) interfaces. Requires a DB25 male to Centronics male printer cable, APN: 2225-6
- *External I/O:* Provides input/output (I/O) access for Channel 1 through Channel 4 limits, including pass and fail indications. It is also used for TTL Out and TTL In (for Sequence feature)
- *Ethernet:* Provides network control of the MS462XX using the native GPIB command set. This interface is also described in the MS462XX Programming Manual, Part Number: 10410-00204
- SCSI Interface
- VGA Output
- Serial Port for AutoCal
- *Probe:* Provides an interface for a high-frequency probe, HP85024A

1-8 PRECISION COMPONENT KITS

Two types of precision-component kits are available: calibration and verification. Calibration kits contain components used to identify and separate error sources inherent in microwave test setups. Details of these kits are described in the following paragraphs.

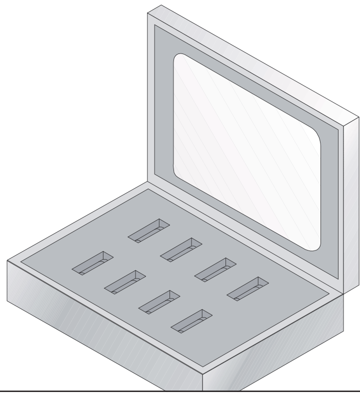


Figure 1-2. *Model 3750R Calibration Kit*

3750R Calibration Kit

The 3750R Calibration Kit (Figure 1-2) contains precision 3.5 mm components with characteristics that are traceable to the NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining system accuracy. The kit is available as Option 1 or 3, as described below:

- *Option 1:* A set of five phase equal insertables
- *Option 3:* Includes two additional terminations required for four-port calibration. In the case of 3.5 mm or N, a male and female termination would be added

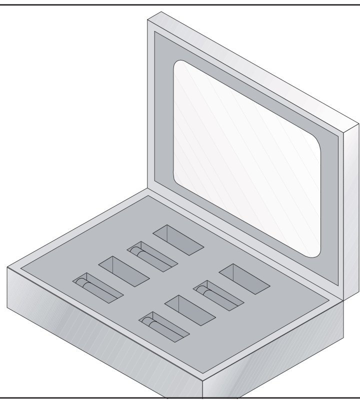


Figure 1-3. *Model 3751R Calibration Kit*

3751R Calibration Kit

The 3751R Calibration Kit (Figure 1-3) contains precision GPC-7 components with characteristics that are traceable to the NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining system accuracy. The kit is available as Option 2 or 3, as described below:

- *Option 2:* A third termination required for three-port calibrations
- *Option 3:* Includes two additional terminations required for four-port calibration. In the case of 3.5 mm or N, a male and female termination would be added

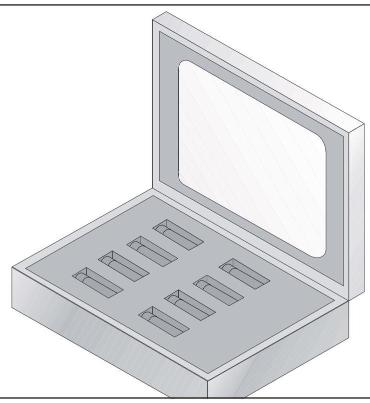


Figure 1-4. Model 3753R Calibration Kit

3753R Calibration Kit

The 3753R Calibration Kit (Figure 1-4) contains precision Type N components with characteristics that are traceable to the NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining system accuracy. The kit is available as Option 1 or 3, as described below:

- *Option 1:* A set of five phase equal insertables
- *Option 3:* Includes two additional terminations required for four-port calibration. In the case of 3.5 mm or N, a male and female termination would be added

1-9 OPTIONS

The following options are available.

- **Option 1:** Rack Mount Kit
- **Option 1A:** Rack Mount Kit for use with System Console
- **Option 2:** Time (Distance) Domain Measurement Capability
- **Option 3A:** For the MS4622B, adds an internal 3 GHz second source, 3rd test port, and a step attenuator
- **Option 3B:** For the MS4623B, adds an internal 6 GHz second source, 3rd test port, and a step attenuator
- **Option 3C:** For the MS4622C, adds an internal 3 GHz second source, 3rd test port, and a step attenuator
- **Option 3D:** For the MS4623C, adds an internal 6 GHz second source, 3rd test port, and a step attenuator
- **Option 3E:** For the MS4624B, adds an internal 9 GHz second source, 3rd test port, and a step attenuator
- **Option 3F:** For the MS4624C, adds an internal 9 GHz second source, 3rd test port, and a step attenuator
- **Option 4:** Noise Figure, 50 MHz to 3 GHz
- **Option 4B:** Noise Figure, 50 MHz to 6 GHz
- **Option 5:** Frequency Translation Group Delay
- **Option 6:** Third Test Port
- **Option 7:** Transmission and Reflection Step Attenuator
- **Option 8:** Harmonic Measurements
- **Option 10:** Internal Control of AutoCal
- **Option 11x:** Replacement of Type N (female) connectors with other connector types (Type N (male), GPC-7, 3.5 mm (male) or 3.5 mm (female)
- **Option 13:** Intermodulation Distortion (IMD)
- **Option 24:** For the MS462XB and MS462XC, adds processing upgrades (standard on the MS462XD)

1-10 PERFORMANCE SPECIFICATIONS

System performance specifications are provided in Appendix C.

1-11 PREVENTIVE MAINTENANCE

The MS462XX VNMS requires periodic cleaning of the cooling fan screen to prevent an obstruction that could facilitate overheating. Additional maintenance that may be required includes replacing a blown fuse, replacing the CPU backup battery, and replacing the LCD backlight. This additional maintenance is outlined below:

Fuses

The MS462XX contains three fuses, two internal and one external. The external, rear-panel-mounted fuse is rated at 5A, 250V, F (quick acting). It is designed to blow first in the event of an over-current condition. Of the two internal fuses, one is rated at 6.3A, 250V, F (quick acting), and the other at 15A, 32Vdc (automotive type). Neither of the internal fuses are replaceable at the field level. They are mounted within the field-replaceable power supply module. Internal fuse information is provided for reference only.

CPU Backup Battery

The MS462XX CPU module contains a lithium battery that powers the instrument's hard drive. When this battery becomes discharged, you may observe the following:

- ❑ Inability to view the contents of the hard drive
- ❑ Inability to save or recall hard drive files (Error 7172 Hard Disk Read Error)
- ❑ GPIB address changes after cycling the instrument power
- ❑ Self test fails and displays a battery failure message

The life of the CPU battery is dependant on instrument use. For example, the maximum life expectancy of the CPU battery is 2.8 years when the instrument is stored in an unused state (always powered off), and 5 years when the instrument is in continual use (always powered on). Anritsu service centers recommend a proactive approach to maintaining the CPU battery by replacing it every three years. Refer this maintenance to a qualified Anritsu service center.

LCD Backlight

The MS462XX LCD display contains a backlight flourescent lamp that has a rated life span of 50,000-hours. The LCD backlight may need to be replaced after this life span has elapsed. Refer this maintenance to a qualified Anritsu service center.

1-12 CONVENTIONS

Throughout this manual, path names may be used to represent the keystrokes for a desired action or procedure. The pathname begins with a front panel key selection, followed by additional front panel or softkey selections, each separated by a forward slash (/). Front panel key names and soft keys are presented in the manual as they are on the system, that is, in initial caps or all uppercase letters as appropriate. For additional clarity, soft keys are shown in boldface type. For example, the following pathname representation displays the system model number, serial number, current software version, and installed options:

Utility/**INSTRUMENT STATE PARAMETERS/SYSTEM**

Following the path above, the user would press the Utility front panel key, followed by the **INSTRUMENT STATE PARAMETERS** soft key, then the **SYSTEM** soft key to display the system information.

Individual steps within a procedure may also be presented as sequentially numbered steps for clarity. Again, front panel key names and soft keys are presented in the manual as they are on the system. For example, the following procedure displays the system model number, serial number, current software version, and installed options:

Press Utility then the following soft keys:
INSTRUMENT STATE PARAMETERS
SYSTEM

Chapter 2
Installation

Table of Contents

Chapter 2
Installation

2-1 INTRODUCTION

This chapter provides information for the initial inspection and preparation for use of the MS462XX Vector Network Measurement System. Information for interfacing the MS462XX to the IEEE-488 General Purpose Interface Bus and reshipment and storage information is also included.

2-2 INITIAL INSPECTION

Inspect the shipping container for damage. If the container or cushioning material is damaged, retain until the contents of the shipment have been checked against the packing list and the instrument has been checked for mechanical and electrical operation.

If the MS462XX is damaged mechanically, notify your local sales representative or Anritsu Customer Service. If either the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as Anritsu. Keep the shipping materials for the carrier's inspection.

WARNING

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

2-3 PREPARATION FOR USE

No initial setup is required. After unpacking, the MS462XX is ready for use. The MS462XX is equipped with automatic line-power sensing, and will operate with any of the following line voltages: 100V, 120V, 220V, 240V +5%, –10%, 48–63 Hz, 350 VA. The MS462XX is intended for Installation Category (Overvoltage Category) II.

or

WARNING

When supplying power to this equipment, always use a three-wire power cable connected to a three-wire power line outlet. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

2-4 GPIB SETUP AND INTERCONNECTION

All functions of the MS462XX (except power on/off and initialization of the hard disk) can be controlled remotely by an external computer/controller via the IEEE-488.2 GPIB. The information in this section pertains to interface connections and cable requirements for the rear panel GPIB connector. Refer to the MS462XX Programming Manual, Anritsu part number 10410-00204, for information about remote operation of the MS462XX using the GPIB and Ethernet.

The MS462XX GPIB operates with any IBM PC compatible computer/controller equipped with a National Instruments GPIB-PCII/IIA interface card and software.

Interface Connector Interface between the MS462XX and other devices on the GPIB is via a standard 24-wire GPIB interface cable. For proper operation, order APN 2100-1, -2, -4, or -5 (1, 2, 4, or 0.5 meter length) cables through your local sales representative. This cable uses a double-sided connector; one connector face is a plug, the other a receptacle. These double-function connectors allow parallel connection of two or more cables to a single instrument connector. The pin assignments for the rear panel GPIB connector are shown in Figure B-3 located in Appendix B.

Cable Length Restrictions The GPIB system can accommodate up to 15 instruments at any one time. To achieve design performance on the bus, proper timing and voltage level relationships must be maintained. If either the cable length between separate instruments or the accumulated cable length between all instruments is too long, the data and control lines cannot be driven properly and the system may fail to perform. Cable length restrictions are as follows:

- ❑ No more than 15 instruments may be installed on the bus
- ❑ Total accumulative cable length in meters may not exceed two times the number of bus instruments or 20 meters—whichever is less

NOTE

For low EMI applications, the GPIB cable should be a fully shielded type with well-grounded metal-shell connectors. Use Anritsu Model 2100-series cables.

2-5 SYSTEM GPIB INTERCONNECTION

There are two rear panel GPIB IEEE-488 connectors. The IEEE 488.2 connector is used to interface the MS462XX to an external computer/controller via a standard GPIB cable. The dedicated GPIB connector is used to interface to plotters and an external source for multiple source operation via a standard GPIB cable.

GPIB Interface to an External Plotter The MS462XX GPIB interface can be configured to control a suitable external plotter (refer to Chapter 6—Data Displays). In this mode of operation, the GPIB is dedicated to this application and only the MS462XX and the plotter are connected to the GPIB. Standard GPIB cables are used to interconnect to the plotter.

GPIB Addresses The MS462XX leaves the factory with the default GPIB address set to 6. This address may be changed using the Utility key and **REMOTE INTERFACE/GPIB SETUP** soft keys.

2-6 ETHERNET SETUP AND INTERCONNECTION

The MS462XX can be remotely controlled via a network server and an Ethernet connection. The MS462XX software supports the TCP/IP network protocol. The TCP/IP protocol setup requires the following:

- **IP Address:** Every computer/electronic device in a TCP/IP network requires an IP address. An IP address has four numbers (each between 0 and 255) separated by periods. For example: 128.111.122.42 is a valid IP address
- **Subnet Mask:** The subnet mask distinguishes the portion of the IP address that is the network ID from the portion that is the station ID. The subnet mask 255.255.0.0, when applied to the IP address given above, would identify the network ID as 128.111 and the station ID as 122.42. All stations in the same Local Area Network (LAN) should have the same network ID but different station IDs
- **Default Gateway:** A TCP/IP network can have a gateway to communicate beyond the LAN identified by the network ID. A gateway is a computer or electronic device that is connected to two different networks and can move TCP/IP data from one network to the other. A single LAN that is not connected to other LANs requires a default gateway setting of 0.0.0.0. This (0.0.0.0) is Scorpion’s default gateway setting. If you have a gateway, then the default gateway would be set to the appropriate value of your gateway
- **Ethernet Address:** An Ethernet address is a unique 48-bit value that identifies a network interface card to the rest of the network. Every network card has a unique ethernet address permanently stored into its memory

Inappropriate setting of the Default Gateway IP Address will cause the Scorpion system to appear to be locked up at start up. The instrument will appear to stop working at the following message:

Application loaded successfully, starting system…

Once the Default Gateway IP Address has been inappropriately set, the only way to restore the system is to use the debugger loader utility program on the 2300-246 Boot Utility Diskette and the Hyper Terminal Utility program (supplied with Microsoft Windows) connected via the serial port on the rear panel. A null modem cable, part number 800-441, is also required.

Procedures found in Chapter 3 of the MS462XX Programming Manual, part number 10410-00204, guide you through the Ethernet setup and configuration process.

2-7 EXTERNAL MONITOR CONNECTOR

The rear panel VGA connector allows the internal display information of the MS462XX to be connected to an external VGA monitor (either color or monochrome). The pinout of this 15-pin Type D connector is shown in Appendix B, Page B-10.

2-8 RACK MOUNT INSTALLATION

To install the Option 1 Rack Mount rails, refer to the procedure below.

Step 1. Disconnect the line cord and any other attachments from the instrument.

Step 2. Carefully place the instrument on a secure and stable work surface.

Step 3. Using a Phillips screwdriver, remove the two handles or four bumper assemblies (and tilt bail, if installed) from the front of the unit, and the four feet at the rear. Save the screws for later use.

NOTES

- The green-headed screws are metric threads and must be used only in the appropriately tapped holes
- The feet, handles, and bumpers are not reused in this application

Step 4. Remove the side carrying handle screws and remove the handle.

Step 5. For Option 1A (System Console), install the two Rack Mount Handles using the green-headed screws removed earlier (or use the ones from the kit). Orient the handles such that the slotted opening in the handle mounting plate (Figure 2-1) is toward the bottom of the unit.

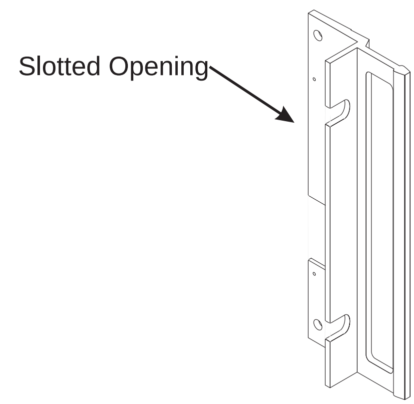


Figure 2-1. *Rack Mount Handle Showing Slotted Opening*

Step 6. For Option 1, install the rack mount assembly to the front and rear using the green-headed screws removed earlier (or use the ones from the kit). Orient the assemblies such that the slotted opening in the handle mounting plate (Figure 2-1) is toward the bottom of the unit.

This completes the installation of the slide assembly.

2-9 PREPARATION FOR STORAGE AND/OR SHIPMENT

The following paragraphs describe the procedure for preparing the MS462XX for storage or shipment.

Preparation for Storage Preparing the MS462XX for storage consists of cleaning the unit, packing the inside with moisture-absorbing desiccant crystals, and storing the unit in a temperature environment that is maintained between –40 and +70 degrees centigrade (–40 to 156 degrees Fahrenheit).

Preparation for Shipment To provide maximum protection against damage in transit, the MS462XX should be repackaged in the original shipping container. If this container is no longer available and the MS462XX is being returned to Anritsu for repair, advise Anritsu Customer Service; they will send a new shipping container free of charge. In the event neither of these two options is possible, instructions for packaging and shipment are given on the following page.

Use a Suitable Container
Obtain a corrugated cardboard carton with a 275-pound test strength. This carton should have inside dimensions of no less than six inches larger than the instrument dimensions to allow for cushioning.

Protect the Instrument
Surround the instrument with polyethylene sheeting to protect the finish.

Cushion the Instrument
Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument. Provide at least three inches of dunnage on all sides.

Seal the Container
Seal the carton by using either shipping tape or an industrial stapler.

Address the Container
If the instrument is being returned to Anritsu for service, mark the Anritsu address and your return address on the carton in one or more prominent locations. For international customers, use the address of your local representative (Table 2-1). For U.S.A. customers, use an Anritsu address shown below:

Anritsu Company
ATTN: Customer Service
685 Jarvis Drive
Morgan Hill, CA 95037-2809

10 New Maple Avenue
Unit 305
Pine Brook, NJ 07058

1155 E. Collins Blvd.
Richardson, TX 75081

NOTE

Contact Anritsu Call Center at 1-800-ANRITSU (1-800-267-4878) for return instruction prior to shipping the instrument (for U.S.A. Customers).

2-10 SERVICE CENTERS

A list of Anritsu worldwide Service Centers is provided in Table 2-1.

Table 2-1. *Anritsu Service Centers*

UNITED STATES
ANRITSU COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408) 776-8300
1-800-ANRITSU
FAX: 408-776-1744

ANRITSU COMPANY
10 New Maple Ave., Unit 305
Pine Brook, NJ 07058
Telephone: (973) 227-8999
1-800-ANRITSU
FAX: 973-575-0092

ANRITSU COMPANY
1155 E. Collins Blvd
Richardson, TX 75081
Telephone: 1-800-ANRITSU
FAX: 972-671-1877

AUSTRALIA
ANRITSU PTY. LTD.
Unit 3, 170 Foster Road
Mt Waverley, VIC 3149
Australia
Telephone: 03-9558-8177
FAX: 03-9558-8255

BRAZIL
ANRITSU ELECTRONICA LTDA.
Praia de Botafogo, 440, Sala 2401
CEP22250-040, Rio de Janeiro, RJ, Brasil
Telephone: 021-527-6922
FAX: 021-53-71-456

CANADA
ANRITSU INSTRUMENTS LTD.
700 Silver Seven Road, Suite 120
Kanata, Ontario K2V 1C3
Telephone: (613) 591-2003
FAX: (613) 591-1006

CHINA
ANRITSU ELECTRONICS (SHANGHAI) CO. LTD.
2F, Rm B, 52 Section Factory Building
No. 516 Fu Te Rd (N)
Shanghai 200131 P.R. China
Telephone:21-58680226, 58680227, 58680228
FAX: 21-58680588

FRANCE
ANRITSU S.A
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
Telephone: 016-09-21-550
FAX: 016-44-61-065

GERMANY
ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf, Germany
Telephone: 0211-968550
FAX: 0211-9685555

INDIA
MEERA AGENCIES PVT. LTD.
23 Community Centre
Zamroodpur, Kailash Colony Extension,
New Delhi, India 110 048
Phone: 011-2-6442700/6442800
FAX : 011-2-644250023

ISRAEL
TECH-CENT, LTD.
4 Raul Valenberg St
Tel-Aviv 69719
Telephone: (03) 64-78-563
FAX: (03) 64-78-334

ITALY
ANRITSU Sp.A
Roma Office
Via E. Vittorini, 129
00144 Roma EUR
Telephone: (06) 50-99-711
FAX: (06) 50-22-4252

KOREA
ANRITSU CORPORATION LTD.
Head Office:
14F, Hyunjuk Building 832-41
Yeoksam-Dong, Kangnam-Ku
Seoul 135-080, South Korea
Telephone: 02-553-6603
FAX: 02-553-6604

Service Center:
8F Hyunjuk Building
832-41, Yeoksam Dong
Kangnam-Gu
Seoul, South Korea 135-080
Telephone: 82-2-553-6603
FAX: 82-2-553-6605

JAPAN
ANRITSU CUSTOMER SERVICE LTD.
1800 Onna Atsugi-shi
Kanagawa-Prf. 243 Japan
Telephone: 0462-96-6688
FAX: 0462-25-8379

SINGAPORE
ANRITSU (SINGAPORE) PTE LTD.
10, Hoe Chiang Road
#07-01/02 Keppel Towers
Singapore 089315
Telephone: 282-2400
FAX: 282-2533

SOUTH AFRICA
ETECSA
12 Surrey Square Office Park
330 Surrey Avenue
Ferndale, Randburt, 2194
South Africa
Telephone: 011-27-11-787-7200
FAX: 011-27-11-787-0446

SWEDEN
ANRITSU AB
Botivid Center
Fittja Backe 13A
145 84 Stockholmn
Telephone: (08) 534-707-00
FAX: (08) 534-707-30

TAIWAN
ANRITSU CO., INC.
7F, No. 316, Section 1
NeiHu Road
Taipei, Taiwan, R.O.C.
Telephone: 886-2-8751-1816
FAX: 886-2-8751-2126

UNITED KINGDOM
ANRITSU LTD.
200 Capability Green
Luton, Bedfordshire
LU1 3LU, England
Telephone: 015-82-433200
FAX: 015-82-731303

Chapter 3 Network Analyzers, A Primer

Table of Contents

Chapter 3
Network Analyzers, A Primer

3-1 INTRODUCTION

This section provides front panel operating and measurement application information and data. It includes discussions on the following topics:

- System description
- General discussion about network analyzers
- Basic measurements and how to make measurements
- Error correction

3-2 GENERAL DESCRIPTION

The Model MS462XX Vector Network Measurement System measures the magnitude and phase characteristics of networks that include passives (e.g., diplexers, cables, filters, antennas, SAWS, balanced and unbalanced); Integrated amplifiers, ICs, LNAs; mixers; power amplifiers; and tower mounted amplifiers. It compares the incident signal that leaves the analyzer with either the signal that is transmitted through the test device or the signal that is reflected from its input. Figures 3-1 and 3-2 illustrate the types of measurements that the MS462XX can make.

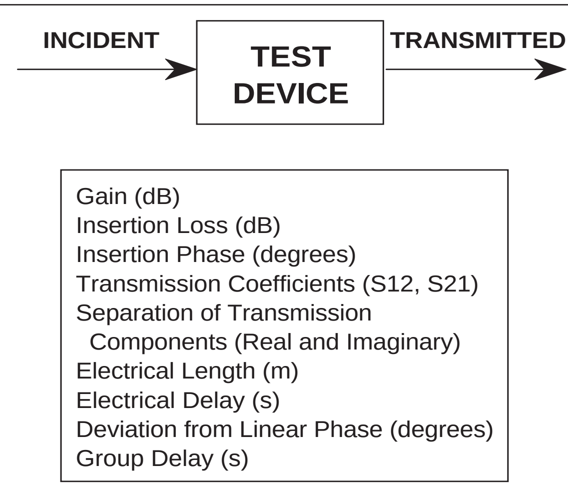


Figure 3-1. *Transmission Measurements*

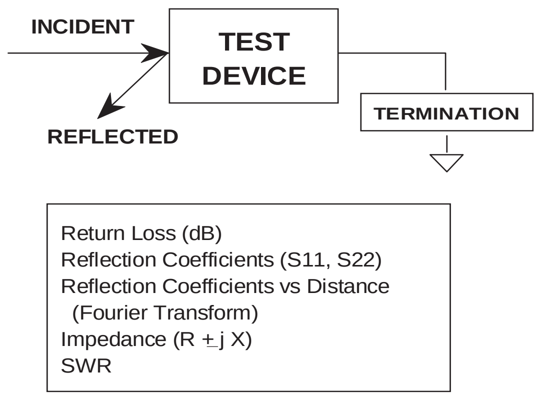


Figure 3-2. *Reflection Measurements*

The MS462XX is a self-contained, fully integrated measurement system that includes an optional time domain capability. The system hardware consists of the following:

- Analyzer
- Precision components required for calibration and performance verification
- Optional use of Anritsu 67XXB, 68X/ 69X or MG369X series synthesizers as additional sources

The MS462XX internal system modules perform the following functions:

Source Module or Modules This module provides the stimulus to the device under test (DUT). The frequency range of the source and test set modules establish the frequency range of the system. The frequency stability of the source is an important factor in the accuracy (especially phase accuracy) of the network analyzer. Hence, the MS462XX always phase locks the source to an internal (or optional external) 10MHz crystal reference.

Test Set Module The test set module routes the stimulus signal to the DUT and samples the reflected and transmitted signals. The type of connector used is important, as is the “Auto Reversing” feature (462XB only). Auto Reversing means that it applies the stimulus signal in both the forward and reverse direction. The direction is reversed automatically. This saves you from having to reverse the test device physically to measure all four scattering parameters (S-parameters). Frequency conversion occurs in the analyzer.

Analyzer Module

The analyzer module down-converts, receives, and interprets the IF signal for phase and magnitude data. It then displays the results of this analysis on a color display. This display can show all four S-parameters simultaneously. In addition to the installed display, you can also view the measurement results on an external color monitor.

3-3 NETWORK ANALYZERS

We will begin this discussion with a subject familiar to most Anritsu customers: scalar network analysis. After showing comparisons, we will proceed to the fundamentals of network analyzer terminology and techniques. This discussion serves as an introduction to topics presented in greater detail later in this section. This discussion will touch on new concepts that include the following:

- Reference Delay
- S-parameters: what they are and how they are displayed
- Complex Impedance and Smith Charts

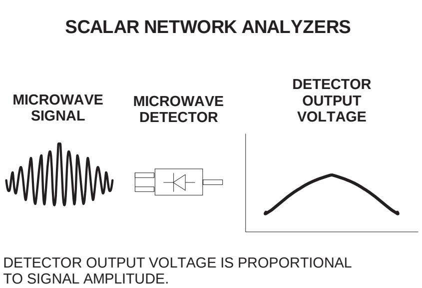


Figure 3-3. *Scalar Analyzer Detection*

Scalar Analyzer Comparison

Network Analyzers do everything that scalar analyzers do except display absolute power. In addition, they add the ability to measure the phase characteristics of microwave devices and allow greater dynamic range.

If all a Network Analyzer added was the capability for measuring phase characteristics, its usefulness would be limited. While phase measurements are important in themselves, it is the availability of this phase information that unlocks many new features for complex measurements. These features include Smith Charts, Time Domain, and Group Delay. Phase information also allows greater accuracy through *vector error correction* of the measured signal.

First, let us look at scalar network analyzers (SNAs). SNAs measure microwave signals by converting them to a DC voltage using a diode detector (Figure 3-3). This DC voltage is proportional to the magnitude of the incoming signal. The detection process, however, ignores any information regarding the phase of the microwave signal.

In a network analyzer, access is needed to both the magnitude and phase of a microwave signal. There are several different ways to perform the measurement. The method Anritsu employs is to down-convert the signal to a lower intermediate frequency (IF). This signal can then be measured directly by a tuned receiver. The tuned receiver approach gives the system greater dynamic range. The system is also much less sensitive to interfering signals, including harmonics.

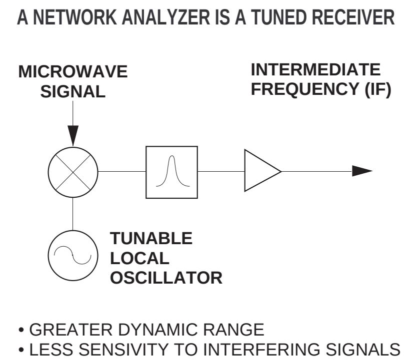


Figure 3-5. *Network Analyzer is a Tuned Receiver*

Vector Network Measurement System Basics

The network measurement system is a tuned receiver (Figure 3-5, left). The microwave signal is down converted into the passband of the IF.

This phase reference can be obtained by splitting off some of the microwave signal before the measurement (Figure 3-4, below).

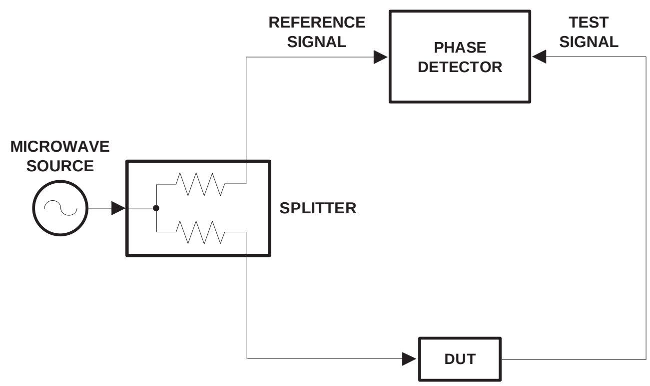


Figure 3-4. *Splitting the Microwave Signal*

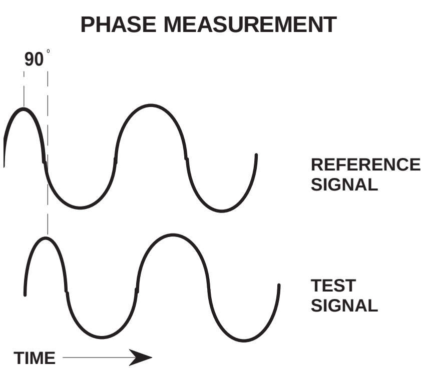


Figure 3-6. *Signals with a 90 Degree Phase Difference*

The phase of the microwave signal after it has passed through the device under test (DUT) is then compared with the reference signal. The network analyzer automatically samples the reference signal, so no external hardware is needed.

Let us consider for a moment that you remove the DUT and substitute a length of transmission line (Figure 3-7, left). Note that the path length of the test signal is longer than that of the reference signal. Now let us see how this affects our measurement.

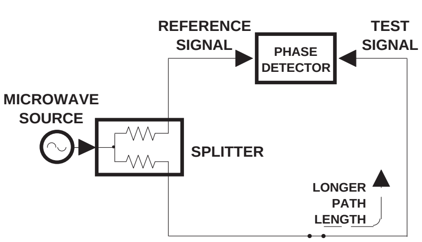


Figure 3-7. *Split Signal where a Length of Line Replaces the DUT*

Assume that we are making a measurement at 1 GHz and that the difference in path-length between the two signals is exactly 1 wavelength. This means that test signal is lagging the reference signal by 360 degrees (Figure 3-8). We cannot really tell the difference between one sine wave maxima and the next (they are all identical), so the network

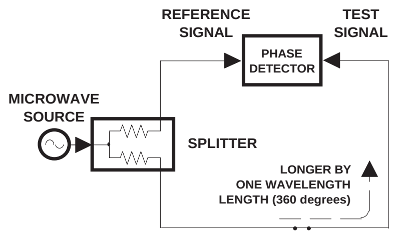


Figure 3-8. *Split Signal where Path Length Differs by Exactly One Wavelength*

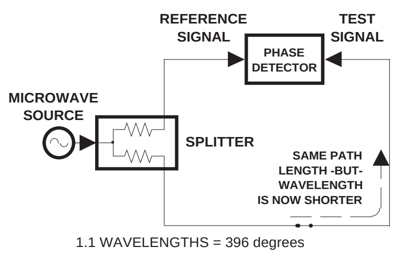


Figure 3-9. *Split Signal where Path Length is Longer than One Wavelength*

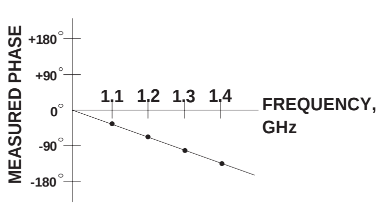


Figure 3-10. *Electrical Delay*

analyzer would measure a phase difference of 0 degrees.

Now consider that we make this same measurement at 1.1 GHz. The frequency is higher by 10 percent so therefore the wavelength is shorter by 10 percent. The test signal path length is now 0.1 wavelength longer than that of the reference signal (Figure 3-9). This test signal is:

$$1.1 \times 360 = 396 \text{ degrees}$$

This is 36 degrees different from the phase measurement at 1 GHz. The network analyzer will display this phase difference as –36 degrees.

The test signal at 1.1 GHz is delayed by 36 degrees more than the test signal at 1 GHz.

You can see that if the measurement frequency is 1.2 GHz, we will get a reading of –72 degrees, –108 degrees for 1.3 GHz, etc. (Figure 3-10). There is an electrical delay between the reference and test signals. For this delay we will use the common industry term of reference delay. You also may hear it called phase delay. In older network analyzers you had to equalize the length of the reference arm with that of the test arm to make an appropriate measurement of phase vs. frequency.

To measure phase on a DUT, we want to remove this phase-change-vs.-frequency-due-to changes in the electrical length. This will allow us to view the actual phase characteristics. These characteristics may be much smaller than the phase-change-due-to-electrical-length difference.

There are two ways of accomplishing this. The most obvious way is to insert a length of line into the reference signal path to make both paths of equal length (Figure 3-11, below). With perfect transmission lines and a perfect splitter, we would then measure a constant phase as we change the frequency. The problem using this approach is that we must change the line length with each measurement setup.

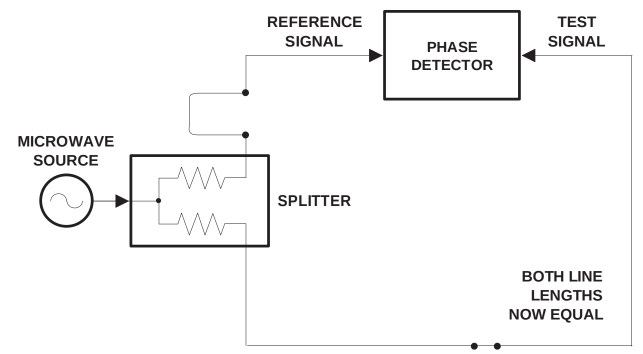


Figure 3-11. *Split Signal where Paths are of Equal Length*

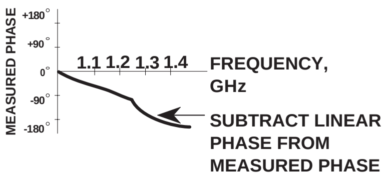


Figure 3-12. *Phase Difference Increases Linearly with Frequency*

Another approach is to handle the path length difference in software. Figure 3-12 (left) displays the phase-vs.-frequency of a device. This device has different effects on the output phase at different frequencies. Because of these differences, we do not have a perfectly linear phase response. We can easily detect this phase deviation by compensating for the linear phase. The size of the phase difference increases linearly with frequency so we can modify the phase display to eliminate this delay.

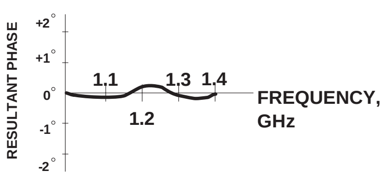


Figure 3-13. *Resultant Phase with Path Length Compensation in Place*

The MS462XX offers automatic reference delay compensation with the push of a button. Figure 3-13 (left) shows the resultant measurement when we compensate path length. In a system application you can usually correct for length differences; however, the residual phase characteristics are critical.

Network Analyzer Measurements

Now let us consider measuring the DUT. Consider a two port device; that is, a device with a connector on each end. What measurements would be of interest?

First, we could measure the reflection characteristics at either end with the other end terminated into 50 ohms. If we designate one end as the normal place for the input that gives a reference. We can then define the reflection characteristics from the reference end as forward reflection, and those from the other end as reverse reflection (Figure 3-14).

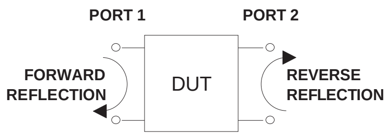


Figure 3-14. *Forward and Reverse Measurements*

Second, we can measure the forward and reverse transmission characteristics. However, instead of saying “forward,” “reverse,” “reflection,” and “transmission” all the time, we use a shorthand. That is all that S-parameters are, a shorthand! The “S” stands for scattering. The second number is the network analyzer port that the signal is being injected into, while the first is the network analyzer port that the signal is leaving. S_{11}, therefore, is the signal being injected into port 1 relative to the signal leaving port 1. The four scattering parameters (Figure 3-15):

- ❑ S_{11} Forward Reflection
- ❑ S_{21} Forward Transmission
- ❑ S_{22} Reverse Reflection
- ❑ S_{12} Reverse Transmission

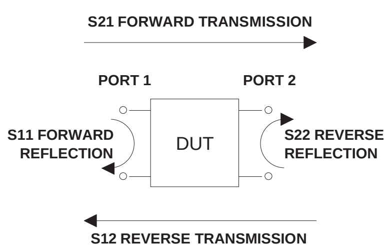


Figure 3-15. *S-Parameters*

S-parameters can be displayed in many ways. An S-parameter consists of a magnitude and a phase. We can display the magnitude in dB, just like a scalar network analyzer. We often call this term *log magnitude*.

We can display phase as “linear phase” (Figure 3-16). As discussed earlier, we can’t tell the difference between one cycle and the next. Therefore, after going through 360 degrees we are back to where we began. We can display the measurement from –180 to +180 degrees. The –180 to +180 approach is more common. It keeps the display discontinuity removed from the important 0 degree area used as the phase reference.

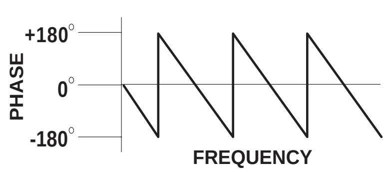


Figure 3-16. *Linear Phase-with-Frequency Waveform*

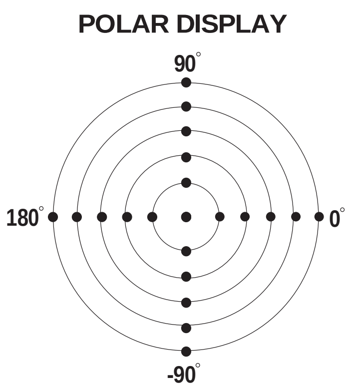


Figure 3-17. *Polar Display*

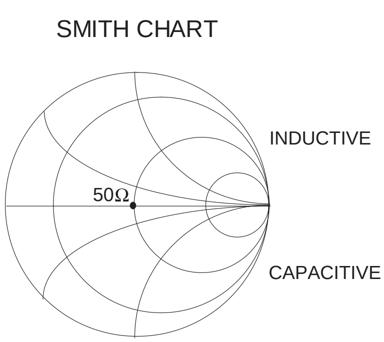


Figure 3-18. *Smith Chart*

There are several ways in which all the information can be displayed on one trace. One method is a polar display (Figure 3-17). The radial parameter (distance from the center) is magnitude. The rotation around the circle is phase. We sometimes use polar displays to view transmission measurements, especially on cascaded devices (devices in series). The transmission result is the addition of the phase and log magnitude (dB) information of each device's polar display.

As we have discussed, the signal reflected from a DUT has both magnitude and phase. This is because the impedance of the device has both a resistive and a reactive term of the form $r+jx$. We refer to the r as the real or resistive term, while we call x the imaginary or reactive term. The j, which we sometimes denote as i, is an imaginary number. It is the square root of –1. If x is positive, the impedance is inductive, if x is negative the impedance is capacitive.

The size and polarity of the reactive component x is important in impedance matching. The best match to a complex impedance is the complex conjugate. This complex-sounding term simply means an impedance with the same value of r and x, but with x of opposite polarity. This term is best analyzed using a Smith Chart (Figure 3-18), which is a plot of r and x.

To display all the information on a single S-parameter requires one or two traces, depending upon the format we want. A very common requirement is to view forward reflection on a Smith Chart (one trace) while observing forward transmission in Log Magnitude and Phase (two traces). Let us see how to accomplish this in the MS462XX.

The MS462XX has four channels. Each channel can display a complete S-parameter in any format on either one or two traces. All four S-parameters can be seen simultaneously in any desired format. A total of eight traces can be viewed at the same time. While this is a lot of information to digest, the MS462XX's large LCD color display makes recognizing and analyzing the data surprisingly easy.

Another important parameter we can measure when phase information is available is group delay. In linear devices, the phase change through the DUT is linear-with-frequency. Thus, doubling the frequency also doubles the phase change. An important measurement, especially for communications system users, is the rate of change-of-phase-vs.-frequency (group delay). If the rate of phase-change-vs.-frequency is not constant, the DUT is nonlinear. This nonlinearity can create distortion in communications systems.

Measurement Error Correction

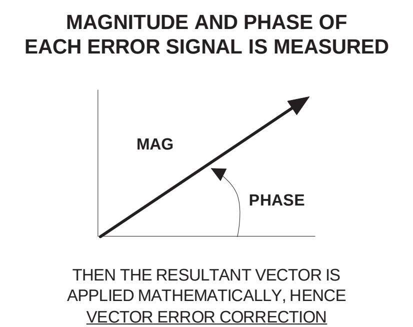


Figure 3-19. *Magnitude and Phase Measurements*

Since we can measure microwave signals in both magnitude and phase, it is possible to correct for six major error terms:

- ❑ Source Test Port Match
- ❑ Load Test Port Match
- ❑ Directivity
- ❑ Isolation
- ❑ Transmission Frequency Response
- ❑ Reflection Frequency Response

We can correct for each of these six error terms in both the forward and reverse directions, hence the name 12-term error correction. Since 12-term error correction requires both forward and reverse measurement information, the test set must be *reversing.* “Reversing” means that it must be able to apply the measurement signal in either the forward or reverse direction.

To accomplish this error correction, we measure the magnitude and phase of each error signal (Figure 3-19). Magnitude and phase information appear as a vector that is mathematically applied to the stimulus signal. This process is termed *vector error correction*.

Summary

A network analyzer is similar to a scalar network analyzer. The major difference it that it adds the capability for measuring phase as well as amplitude. With phase measurements comes scattering, or S-parameters, which are a shorthand method for identifying forward and reverse transmission and reflection characteristics. The ability to measure phase introduces two new displays, polar and Smith Chart. It also adds vector error correction to the measurement trace. With vector error correction, errors introduced by the measurement system are compensated for and measurement uncertainty is minimized. Phase measurements also add the capability for measuring group delay, which is the rate of change-of-phase-vs.-frequency (group delay). All in all, using a network analyzer provides for making a more complete analysis of your test device.

Chapter 4
Front Panel Operation

Table of Contents

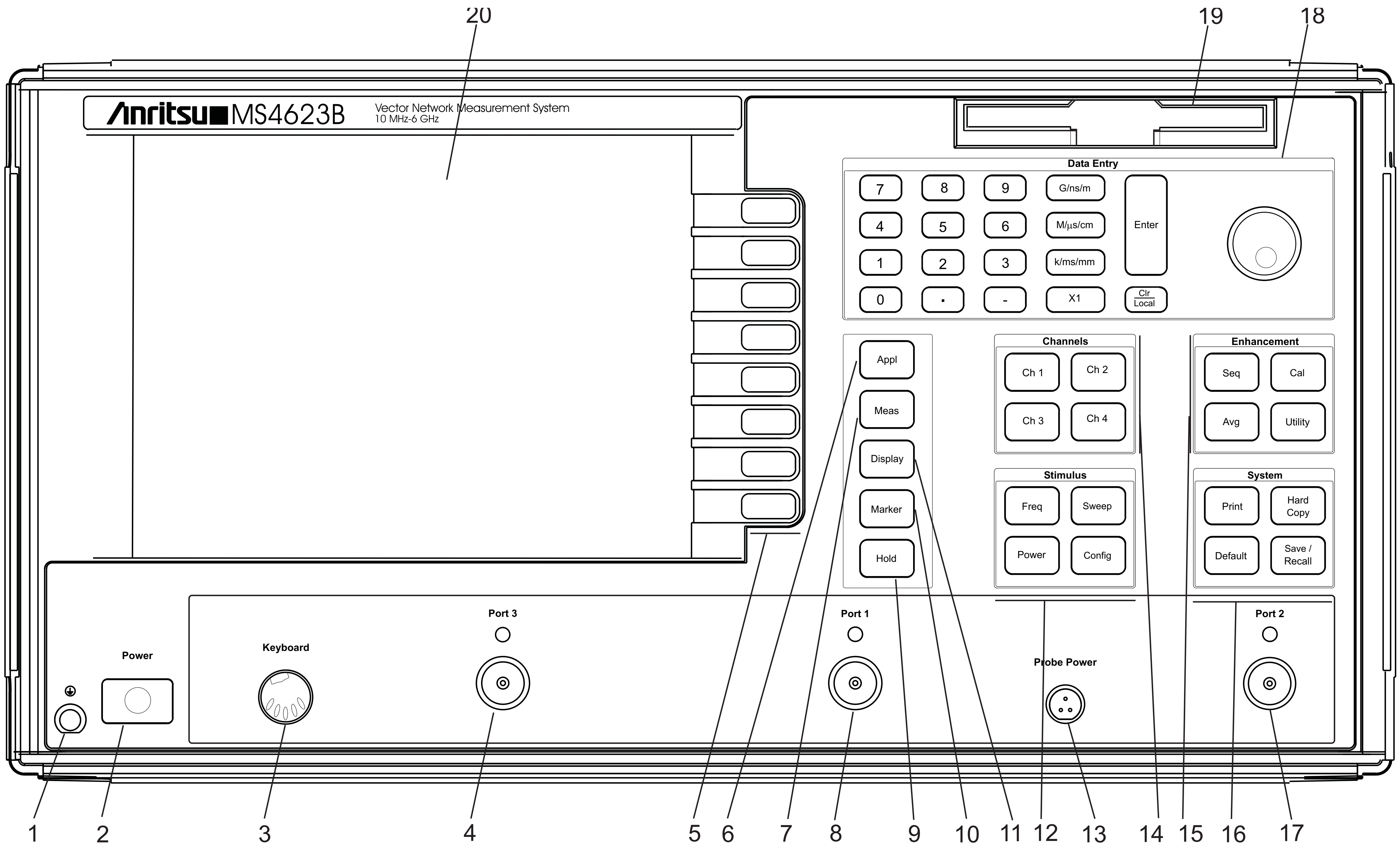


Figure 4-1. *MS4623B Network Analyzer Front Panel Controls and Connector*

Chapter 4
Front Panel Operation

4-1 INTRODUCTION

This chapter describes the front panel keys, controls, menus, and related GPIB mnemonics. The chapter is organized into an overall description of the front panel key-groups and detailed descriptions of individual keys within the key-groups.

4-2 FRONT PANEL KEY DESCRIPTIONS

The following pages provide descriptions of the front panel key-groups indexed in Figure 4-1.

Index 1 **Ground connector:** Provides ground connection.

Index 2 **Power:** Turns the MS462XX on and off. When on, the operating program runs a self test then recalls the parameters and functions in effect when powered down last.

Index 3 **Keyboard connector:** Provides for connecting an external IBM-AT-type keyboard. All alphanumeric field entries can be input from this keyboard. These inputs include Device ID, Model, Date, Operator Identification, frequencies, filenames, as well as comment-type entries. The analog knob and keypad input for these entries remains active. The F1 thru F12 function keys can be used to access certain key and menu functions. A template is provided and a copy of an actual-size template can be found in a foldout page at the end of this chapter.

Index 4 **Port 3 Connector:** Provides an output test connector for the device-under-test (DUT).

Index 5 **Soft Keys:** Provides functions that are based on changeable menu options.

Index 6 **Appl Key:** Displays the first in a series of menus that provide functions for measurement applications. See page 4-7.

Index 7 **Meas Key:** Displays the first in a series of menus that let you select S-parameters. See page 4-19.

Index 8 **Port 1 Connector:** Provides a test connection for the device-under-test (DUT).

Index 9 **Hold:** Toggles the instrument in and out of the hold modes; or it triggers a sweep.

Index 10 **Marker Key:** Displays the first in a series of menus that let you set and manipulate marker frequencies, powers, times, and distances. See page 4-46.

Index 11 **Display Key:** Displays the first in a series of menus that let you choose graph types, set scales, set reference plane, store trace memory and manipulate limit lines. See page 4-24.

Index 12

Stimulus Keys

Freq: Displays the first in a series of menus that provide frequency-sweep control and let you trigger I.F. calibration measurements. See page 4-57.

Sweep: Displays the first in a series of soft-key menus that provide frequency-sweep control. See page 4-60.

Power: Displays the first in a series of menus that provide RF power control. See page 4-64.

Config: Displays the first in a series of soft-key menus that provide control over measurement configuration. See page 4-69.

Index 13

Probe Power Connector: Provides bias voltages of +15 or -12 Vdc (Figure 4-2) for an external high-impedance probe.

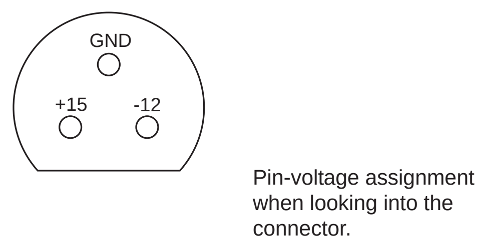


Figure 4-2. *Probe Power Connector Pinout*

Index 14

Channel Keys

Ch 1: Makes Channel 1 the active channel. The active channel is the one acted on by the keys in the Display section. Only one channel can be active at any one time.

Ch 2: Makes Channel 2 the active channel.

Ch 3: Makes Channel 3 the active channel.

Ch 4: Makes Channel 4 the active channel.

Index 15

Enhancement Keys

Seq: Displays a series of sequencing menus that allow you to create, modify, and store up to seven sequences that can be executed automatically. See page 4-111.

Cal: Calls up the first in a sequence of menus that guide you through a measurement calibration. See page 4-119.

Avg: Displays a menu that lets you control the Average, Smoothing, and IF Bandwidth functions. See page 4-164.

Utility: Displays the first in a series of menus that let your perform network, diskette, auto cal characterization and assurance, trouble shooting and other utility functions. See page 4-80.

Index 16

System Keys

Print: Tells the printers, plotters or disk files to start output based on the current selections.

Hard Copy: Displays the first in a series of menus that let you define and perform hard-copy output functions to printers, plotters or disk files. See page 4-100.

Default: Displays a menu that lets you return the MS462XX front panel to its default settings. See page 4-106.

NOTE

Use of this key will destroy front panel and calibration setup data, unless they have been saved to disk.

Save/Recall: Displays the first of several menus that let you save the current calibration or front panel setup or recall a previously saved calibration or setup. See page 4-107.

Index 17

Port 2 Connector: Provides an input test connection for the device-under-test (DUT).

Index 18

Data Entry Keys

Rotary Knob: Used to alter measurement values for the *active parameter* (Start Frequency, Stop Frequency, Offset, etc.). It is also used to scroll up or down in a sequencing editor box.

Keypad: Provides for entering values for the *active parameter*. The active parameter is the one to which the menu cursor is pointing.

G/ns/m: Terminates a value entered on the keypad in the units shown —that is; gigahertz for frequency, nanoseconds for time, or meters for length.

M/us/cm: Terminates a value entered on the keypad in the units shown—that is; megahertz for frequency, microseconds for time, or centimeters for length.

k/ms/mm: Terminates a value entered on the keypad in the units shown—that is; kilohertz for frequency, milliseconds for time, or millimeters for length.

X1: Terminates a value entered on the keypad in the units shown—times 1 or unity for power, angle, or dimension less entries.

Clr/Local:

a. Local (Non-GPIB) Mode: (1) The key clears entries not yet terminated by one of the terminator keys above, which allows the previously displayed values to redisplay. Or (2) the key turns off the displayed menu and expands the data area to fill the entire screen, if you have not made any keypad entries needing termination. Or (3) the key terminates any calibration, sequencing, and certain editing functions that are in progress.

b. GPIB Mode: The key returns the instrument to local (front panel) control, unless the controller has sent a local lockout message (LLO) over the bus.

Index 19 **Diskette Drive:** Provides for the 3.5-inch, high-density (1.44 MB) floppy diskette used to store selected front panel setups and calibrations.

Index 20 **CRT Display:** Displays any or all of the four measurement channels, plus soft-key menus.

4-3 SOFT-KEY MENUS, GENERAL

The eight soft keys adjacent to the screen provide sets of variable functions based on other front panel keys, such as Appl, Markers, Freq, etc. The name of each soft-key menu appears on the MS462XX LCD at the menu top. The tabulations that appear on the following pages provide alphabetical listings of each soft-key menu groups, along with a description and related GPIB mnemonic for each soft-key function. Menu maps showing the hierarchical structure are provided in Appendix D.

4-4 APPL KEY MENUS

This key provides entry to measurement application functions.

Menu Name	Function	Description	GPIB Mnemonic
APPLICATIONS	MEASUREMENT TYPE XXXX	Changes the soft-key display to the MEASUREMENT TYPE menu.	APPX?
	DEVICE TYPE		APPDEVX?
	STANDARD	Selects device type to be non-mixer.	APPDEVS
	MIXER	Selects device type to be mixer.	APPDEVM
	ENTRY STATE CURRENT/PREVIOUS	Switches between current and previous application entry states.	APPENTC; APPENTP
BANDPASS DISTANCE DISPLAY SETUP	START XXX.XXX mm/cm	Sets the start distance of the display.	ZST; ZST?
	STOP XXX.XXX mm/cm	Sets the stop distance of the display	ZSP; ZSP?
	CENTER XXX.XXX mm/cm	Sets the center distance of the display.	ZCT; ZCT?
	SPAN XXX.XXX mm/cm	Sets the span (Stop - Start) distance of the display	ZSN; ZSN?
	PHASOR IMPULSE ON/OFF	Switches Phasor Impulse processing on or off.	TDPI1; TDPI0; TDPIX?
	MORE	Changes the soft-key display to the BANDPASS TIME DOMAIN SETUP2 menu.	None
	HELP ON/OFF	Displays an informational help menu.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
	REL. VELOCITY X.X	Indicates the relative velocity of light, as set by the dielectric constant in the SET DIELECTRIC menu (Display key).	None
BANDPASS TIME DOMAIN SETUP	START XXX.XXX ps/ns	Sets the start time of the display.	ZST; ZST?
	STOP XXX.XXX ps/ns	Sets the stop time of the display.	ZSP; ZSP?
	CENTER XXX.XXX ps/ns	Sets the center time of the display.	ZCT; ZCT?
	SPAN XXX.XXX ps/ns	Sets the span (Stop - Start) time of the display.	ZSN; ZSN?
	PHASOR ON/OFF IMPULSE	Switches Phasor Impulse processing on or off.	TDPI1; TDPI0; TDPIX?
	MORE	Changes the soft-key display to the BANDPASS TIME DOMAIN SETUP2 menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
	MARKER RANGE	Changes the soft-key display to the TIME MARKER SWEEP or DISTANCE MARKER SWEEP menu.	None
	WINDOW SHAPE XXXXXXXXX	Changes the soft-key display to the WINDOW SHAPE SETUP menu.	None
	GATE SETUP	Changes the soft-key display to the GATE SETUP menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
D.C. TERM SETUP FOR LOWPASS PROCESSING	AUTO EXTRAPOLATE	Sets the D.C. term to a value determined by extrapolating the data points near the zero frequency.	DCA; DCX?
	LINE IMPEDANCE	Sets the D.C. term to the characteristic impedance of the transmission medium (Z0).	DCZ
	OPEN	Sets the D.C. term to correspond to an open circuit.	DCO
	SHORT	Sets the D.C. term to correspond to a short circuit.	DCS
	OTHER XXX.XXX	Sets the D.C. term to the value entered.	DCV
	(REFLECTION COEFFICIENT X.XXX pU)	Displays the reflection coefficient value.	DCX?
	RETURN	Returns to the previous soft-key menu.	None
DISTANCE MARKER SWEEP	START MARKER ( ) XX.XXXX cm	Sets the start distance to the value of the selected marker.	M1S thru M12S
	STOP MARKER ( ) XX.XXXXcm	Sets the stop distance to the value of the selected marker.	M1E thru M12E
	RESTORE ORGINAL RANGE	Returns the display to the original distance range that was in effect before the marker range was selected.	MRR
	RETURN	Returns to the previous soft-key menu.	None
DOMAIN	SELECT DOMAIN		None
	FREQUENCY, NO TIME GATE	Displays the data in the frequency domain, with no time gate.	FQD; TDX?
	FREQUENCY, WITH TIME GATE	Displays the data in the frequency domain, after a specific time range has been sampled by the gate function.	FGT
	TIME, LOWPASS	Displays the data in the time (distance) domain, using true lowpass processing. Data must be taken using a harmonic series calibration and sweep.	TLP
	TIME, BANDPASS	Displays the data in the time (distance) domain using bandpass processing. Any data sweep range using normal calibration can be used.	TBP
	DISPLAY TIME/DISTANCE	Toggles between TIME and DISTANCE display when TIME LOWPASS or TIME BANDPASS mode is selected.	TDDIST; TDTIME; TDDIST?
	SETUP	Changes the soft-key display to the DOMAIN 2 menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?

Menu Name	Function	Description	GPIB Mnemonic
DOMAIN2	RANGE SETUP	Changes the soft-key display to a DISPLAY SETUP menu.	None
	GATE SETUP	Changes the soft-key display to the GATE SETUP menu.	None
	SELECT GATE FUNCTION		None
	OFF	Switches gate function Off.	GOF
	DISPLAY	Switches gate function to Display.	GDS
	ON	Switches gate function ON.	GON
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
ENR TABLE OPERATION	SAVE ENR TABLE	Changes the soft-key display to the SAVE ENR TABLE menu	None
	LOAD ENR TABLE	Changes the soft-key display to the LOAD ENR TABLE menu	None
	EXTERNAL EXTENSION/ TABLE ON/OFF	Turns the external extension table on or off	NFXENR0; NFXSWR1; NFXENRX?
	DISPLAY ENR TABLE	Changes the soft-key display to the DISPLAY ENR TABLE menu.	None
	RETURN	Returns to the previous soft-key menu.	None
FREQUENCY TRANSLATION GROUP DELAY	ABSOLUTE PHASE ON/OFF (PHASE SHIFT DOES NOT APPLY IN ABS PHASE)	Turns ABSOLUTE PHASE mode on or off.	ABSPHASE0; ABSPHASE1; ABSPHASE?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
GATE SETUP	START XXX.XXX ns	Sets the start time of the gate.	GST; GST?
	STOP XXX.XXX ns	Sets the stop time of the gate.	GSP; GSP?
	CENTER XXX.XXX ns	Sets the center time of the gate.	GCT; GCT?
	SPAN XXX.XXX ns	Sets the span (Stop - Start) of the gate. It also provides for an anti-gate if a negative value is entered. Refer to Chapter 8, paragraphs 8-6 and 8-7 for additional information.	GSN; GSN?
	GATE SHAPE XXXXXXXXX	Changes the soft-key display to the GATE SHAPE SETUP menu.	GSX?
	GATE ON/OFF/DISP	Selects the gate display mode.	GOF; GON; GDS; GOF?
	RANGE SETUP	Changes the soft-key display to the LOWPASS DISTANCE DISPLAY SETUP, LOWPASS TIME DOMAIN SETUP, BANDPASS DISTANCE DISPLAY SETUP, or BANDPASS TIME DOMAIN SETUP menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
HARMONIC	SWEEP MODE SOURCE/CW RCVR	Sweeps the source frequency or receiver frequency.	APPSWPC; APPSWPS; APPSWPX?
	PORT 1,2/1,3	Selects Port 1, Port 2, or Port 3 as the second port.	HARP12; HARP13; HARPX?
	HARMONIC SETUP	Changes the soft-key display to the HARMONIC SETUP menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
HARMONIC SETUP	HARMONIC (1-9)	Selects the harmonic to be measured.	HAR1 thru HAR9; HARX?
	DISPLAY OUTPUT RELATIVE TO:		None
	SOURCE HARMONIC	Selects display of harmonic output power relative to source harmonic power.	HARDSH; HARDX?
	SOURCE FUNDAMENTAL	Selects display of harmonic output power relative to source fundamental power.	HARDSF; HARDX?
	OUTPUT FUNDAMENTAL	Selects display of harmonic output power relative to output fundamental power.	HARDOF; HARDX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
IMD DISPLAY SELECTION	THIRD ORDER INTERMODULATION		None
	INTERCEPT/PRODUCT	Selects Intercept/Product TOI display.	IMDDI; IMDDP; IMDDX?
	MEASURE RELATIVE TO:		None
	TONE1 *(UPPER PRODUCT)	Selects measurement relative to Tone 1. *Non-mixer mode only	IMDRT1; IMDRTX?
	TONE2 *(LOWER PRODUCT)	Selects measurement relative to Tone 2. *Non-mixer mode only	IMDRT2; IMDRTX?
	MEAS REFERENCE INPUT/OUTPUT	Toggles measurement reference between input and output.	IMDMRI; IMDMRO; IMDMRX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
IMD SOURCE SELECTION	SELECTOR MODE DEFINE/APPLY	Switches between DEFINE and APPLY setup modes. The parameter changes selected below are not applied to the hardware while in DEFINE mode.	IMDSSMD; IMDSSMA; IMDSSMX?
	TONE 1 IS SOURCE (1-4)X	Selects Tone 1 source.	IMDT1S1-IMDT1S4; IMDT1SX?
	TONE 2 IS SOURCE (1-4)X	Selects Tone 2 source.	IMDT2S1-IMDT2S4
	LO IS SOURCE (2-4)X	Selects local oscillator source. (Mixer mode only)	APPLORS2-APPLORS4; APPLORSX?
	SOURCE 2 USING PORT3/PORT4	Selects source 2 to drive port 3 or port 4 ** For 4 port model	MIXP3; MIXP4; MIXPORT?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
INTER-MODULATION DISTORTION	SWEEP MODE SOURCE/CW RCVR	Sweeps either the source frequency or receiver frequency.	APPSWPC; APPSWPS; APPSWPX?
	DISPLAY SELECTION XXX	Changes the soft-key display to the IMD DISPLAY SELECTION menu.	IMDDX?
	TONE 2 OFFSET +/-XX.XXXXXXXX GHz	Sets offset of Tone 2 from Tone 1.	IMDT2OFF; IMDT2OFF?
	SOURCE SELECTION	Changes the soft-key display to the TOI SOURCE SELECTION menu.	None
	IMD ORDER 3/5/7/9	Selects intermodulation products.	IMD3; IMD5; IMD7; IMD9; IMDOX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
LOAD ENR TABLE	FROM HARD DISK	Changes the soft-key display to the SELECT FILE TO READ.	None
	VENDOR ENR TABLE	Load ENR table of Noise Source	NFLENRH
	INTERNAL ENR EXTENSION TABLE	Load ENR extension between INT Noise Src and Port1	None
	EXTERNAL ENR EXTENSION TABLE	Load ENR extension between Port 1 and DUT	NFLNFXH
	FROM FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ.	None
	VENDOR ENR TABLE	Load ENR table of Noise Source	NFLENR
	INTERNAL ENR EXTENSION TABLE	Load ENR extension between INT Noise Src and Port1	None
	EXTERNAL ENR EXTENSION TABLE	Load ENR extension between Port 1 and DUT	NFLNFX
	RETURN	Returns to the previous soft-key menu.	None
LOWPASS DISTANCE DISPLAY SETUP	START XXX.XXX mm	Sets the start distance of the display.	GST; GST?
	STOP XXX.XXX mm	Sets the stop distance of the display.	GSP; GSP?
	CENTER XXX.XXX mm	Sets the center distance of the display.	GCT; GCT?
	SPAN XXX.XXX mm	Sets the span (Stop - Start) distance of the display.	GSN; GSN?
	RESPONSE IMPULSE/STEP	Switches between Impulse and Step response.	LPI; LPS; LPSPX?
	MORE	Changes the soft-key display to the LOW PASS TIME DOMAIN SETUP2 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
	RELATIVE VELOCITY X.X	Indicates the relative velocity of light, as set by the dielectric constant in the SET DIELECTRIC menu (Display key).	VELO?

Menu Name	Function	Description	GPIB Mnemonic
LOWPASS TIME DOMAIN SETUP	START XXX.XXX ps	Sets the sweep start time.	GST; GST?
	STOP XXX.XXX ps	Sets the sweep stop time.	GSP; GSP?
	CENTER XXX.XXX ps	Sets the sweep center time.	GCT; GCT?
	RESPONSE IMPULSE/STEP	Switches between Impulse and Step response.	LPI; LPS; LPSX?
	MORE	Changes the soft-key display to the LOW PASS TIME DOMAIN SETUP2 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
LOWPASS TIME DOMAIN SETUP2	MARKER RANGE	Changes the soft-key display to the TIME MARKER SWEEP menu.	None
	WINDOWS SHAPE XXXXXXXXXXXX	Changes the soft-key display to the WINDOW SHAPE SETUP menu.	None
	GATE SETUP	Changes the soft-key display to the GATE SETUP menu.	None
	D.C. TERM XXXX XXXXXXXX	Changes the soft-key display to the D.C. TERM SETUP FOR LOWPASS PROCESSING menu.	None
	RETURN	Returns to the previous soft-key menu.	None
MEASUREMENT TYPE	TRANSMISSION AND REFLECTION	Changes the soft-key display to the TRANSMISSION AND REFLECTION menu or to the MIXER TRANSMISSION AND REFLECTION menu, if MIXER is the measurement type.	APPTR
	NOISE FIGURE	Changes the soft-key display to the NOISE FIGURE menu or to MIXER NOISE FIGURE menu, if MIXER is the measurement type.	APPNF
	HARMONIC (NON-MIXER ONLY)	Changes the soft-key display to the HARMONIC menu.	APPHAR
	IMD	Changes the soft-key display to the INTERMODULATION DISTORTION menu or to MIXER INTERMODULATION DISTORTION menu, if MIXER is the measurement type.	APPIMD
	FREQUENCY TRANSLATION GROUP DELAY	Changes the soft-key display to the FREQ TRANS GRP DLY	APPFTGD
MIXER FREQUENCY TRANSLATION GROUP DELAY	LO/RECEIVER SETUP	Changes the soft-key display to the MIXER LO/RECEIVER SETUP menu.	None
	ABSOLUTE PHASE ON/OFF (PHASE SHIFT DOES NOT APPLY IN ABS PHASE)	Toggles the ABSOLUTE PHASE mode on or off.	ABSPHASE0; ABSPHASE1; ABSPHASE?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
MIXER INTER-MODULATION DISTORTION	SWEEP MODE SOURCE/CW RCVR	Selects between sweeping the source frequency or receiver frequency.	APPSWPC; APPSWPS; APPSWPX?
	DISPLAY SELECTOR XXX	Changes the soft-key display to the IMD DISPLAY SELECTION menu.	None
	TONE 2 OFFSET +/1XX.XXXXXXXX GHz	Sets offset of Tone 2 from Tone 1.	IMDT2OFF; IMDT2OFF?
	LO RECEIVER SETUP	Changes the soft-key display to the MIXER LO/RECEIVER SETUP menu. * Not allowed in multiple source mode	None
	SOURCE SELECTION	Changes the soft-key display to the IMD SOURCE SELECTION menu.	None
	IMD ORDER 3/5/7/9	Selects intermodulation products.	IMD3; IMD5; IMD7; IMD9; IMDOX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
MIXER LO/RECEIVER SETUP	LO IS SOURCE (2 - 4) X	Selects the LO source.	APPLORS2-APPLORS4; APPLORSX?
	LO OFFSET FROM RF * +/- XXX.XXXXXXXX GHz	Sets the offset of LO from RF frequency, which is set in the FREQUENCY menu.	APPLOROFF; APPLOROFF?
	*LO CW ON/OFF MODE	Toggles the LO CW mode on or off. * If LO MODE is on, LO OFFSET is not displayed.	APPLORCW1; APPLORCW0; APPLORCWX?
	LO CW FREQUENCY * XXX.XXXXXXXX GHz	Sets the LO CW frequency. * If LO CW MODE is off, LO CW FREQUENCY is not displayed.	APPLORCWF; APPLORCWF?
	RCVR CONVERSION XXXX	Changes the soft-key display to the SELECT RECEIVER CONVERSION menu.	None
	**SOURCE 2 USING PORT 3/PORT 4	Selects source 2 to drive port 3 or port 4 ** For 4 port model	MIXP3; MIXP4; MIXPORT?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
MIXER NOISE FIGURE	DUT BANDWIDTH NARROW/WIDE	Toggles between narrow and wide bandwidth.	NFDBWW; NFDBWN; NFDBWX?
	NOISE FIGURE SETUP	Changes the soft-key display to the NOISE FIGURE SETUP menu.	None
	DISPLAY SELECTION	Changes the soft-key display to the NOISE FIGURE DISPLAY SELECTION menu.	None
	LO/RECEIVER SETUP	Changes the soft-key display to the MIXER LO/RECEIVER SETUP menu.	None
	INSERT LOSS	Enable to account for loss before or after DUT	None
	BEFORE DUT XXXXXX dB	Sets the insertion loss before the DUT in NF meas.	NFLB; NFLB?
	AFTER DUT XXXXXX dB	Sets the insertion loss after the DUT in NF meas.	NFLA; NFLA?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
MIXER TRANSMISSION AND REFLECTION	DOMAIN	Changes the soft-key display to the DOMAIN menu.	None
	LO/RECEIVER SETUP	Changes the soft-key display to the LO/RECEIVER SETUP menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
MULTIPLE FREQUENCY GAIN COMPRESSION	TEST AUT	Changes the soft-key display to the MULTIPLE FREQUENCY GAIN COMPRESSION2 menu.	None
	TEXT DATA TO HARD DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	None
	TEXT DATA TO FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	None
	FIXED SCALE ON/OFF	Toggles the FIXED SCALE mode on or off.	GCFSON; GCFSOFF; GCFS?
	Y START XX.XX DBM	Enter the Y start power level for multiple frequency gain compression.	GCYST; GCYST?
	Y STOP XX.XX DBM	Enter the Y stop power level for multiple frequency gain compression.	GCYSP; GCYSP?
	RETURN TO T/R MODE	Changes the soft-key display to the TRANSMISSION AND REFLECTION menu.	UNDOGC
	RETURN	Returns to the previous soft-key menu.	None
MULTIPLE FREQUENCY GAIN COMPRESSION2	TESTING AUT	Changes the soft-key display to the MULTIPLE FREQUENCY GAIN COMPRESSION2 menu.	None
	ABORT	Aborts Multiple Frequency Gain Compression testing.	None

Menu Name	Function	Description	GPIB Mnemonic
NOISE FIGURE	DUT BANDWIDTH NARROW/WIDE	Toggles between narrow and wide bandwidth.	NFDBWN; NFDBWW; NFDBWX?
	NOISE FIGURE SETUP	Changes the soft-key display to the NOISE FIGURE SETUP menu.	None
	DISPLAY SELECTION	Changes the soft-key display to the NOISE FIGURE DISPLAY SELECTION menu.	None
	INSERT LOSS BEFORE DUT XXXXXX dB	Selects the insertion loss before the DUT	NFLB; NFLB?
	AFTER DUT XXXXXX dB	Selects the insertion loss after the DUT	NFLA; NFLA?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
NOISE FIGURE DISPLAY SELECTION	NOISE FIGURE	Selects Noise Figure for data display.	NFDNF; NFDX?
	INSERTION GAIN	Selects Insertion Gain Noise Figure for data display.	NFDIG; NFDX?
	AVAILABLE GAIN	Selects Available Gain Noise Figure for data display.	NFDAG; NFDX?
	Y FACTOR	Selects Y Factor Noise Figure for data display.	NFDYF; NFDX?
	EQUIVALENT NOISE TEMPERATURE	Selects equivalent noise temperature for data display.	NFDENT; NFDX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
NOISE FIGURE SETUP	NOISE SOURCE INTERNAL/EXTERNAL	Toggles noise source between Internal and External.	NFSRCI; SFSRCE; NFSRCE; NFSRCX?
	COLD TEMPERATURE XXX.XXX K	Selects Noise Figure Cold Temperature.	NFCT; NFCT?
	*WIDEBAND BW CORR FREQ XXXXXXXX MHz	Displays wideband correction frequency. *Appears if wideband is on.	NFBW; NFBW?
	*WIDEBAND BW CORR MODE ON/OFF	Turns wideband correction mode feature on/off. *Appears if wideband is on.	NFBWC1; NFBWC0; NFBWCX?
	ENR TABLE OPERATION	Changes the soft-key display to the ENR TABLE OPERATION menu	None
	SSB CORRECTION ON/OFF	Toggles SSB (single sideband) correction on or off.	NFSSBC1; NFSSBC0; NFSSBCX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SAVE ENR TABLE	TO HARD DISK	Saves Vendor ENR table into the Floppy Disk	None
	VENDOR ENR TABLE	Saves Vendor ENR table into the Hard Disk	None
	INTERNAL ENR EXTENSION TABLE	Saves the Int ENR table into the Hard Disk	None
	EXTERNAL ENR EXTENSION TABLE	Saves the Ext ENR table into the Hard Disk	None
	TO FLOPPY DISK	Saves the Int ENR table into the Floppy Disk	None
	VENDOR ENR TABLE	Saves Vendor ENR table into the Hard Disk	None
	INTERNAL ENR EXTENSION TABLE	Saves the Int ENR table into the Hard Disk	None
	EXTERNAL ENR EXTENSION TABLE	Saves the Ext ENR table into the Hard Disk	None
	RETURN	Returns to the previous soft-key menu.	None
SELECT RECEIVER CONVERSION	UP	Selects mixer conversion directions and hence the receiver (IF) frequency. Up implies IF=RF+LO. Down implies IF=RF-LO.	APPLORRCU; APPLORRCX?
	DOWN	Selects mixer conversion directions and hence the receiver (IF) frequency. Up implies IF=RF+LO. Down implies IF=RF-LO.	APPLORRCD; APPLORRCX?
	NONE	Selects mixer conversion directions and hence the receiver (IF) frequency. Up implies IF=RF+LO. Down implies IF=RF-LO.	APPLORRCN; APPLORRCX?
	RETURN	Returns to the previous soft-key menu.	None
SWEPT FREQUENCY GAIN COMPRESSION	NOMINAL OFFSET XXX dB	Sets nominal offset.	NOFST; NOFST?
	GAIN COMPRESSION POINT (XXX.XX dB)	Sets gain compression point.	GCMP; GCMP?
	TEST AUT	Changes the soft-key display to the TEST SIGNALS menu.	SFGCT
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN TO T/R MODE	Changes the soft-key display to the TRANSMISSION AND REFLECTION menu.	UNDOGC
SWEPT POWER GAIN COMPRESSION	SET FREQUENCIES	Changes the soft-key display to the SWEPT POWER GAIN COMPRESSION2 menu.	IFV
	SET ATTENUATION	Changes the soft-key display to the SWEPT POWER GAIN COMPRESSION4 menu.	None
	SET POWER	Changes the soft-key display to the SWEPT POWER GAIN COMPRESSION3 menu.	None
	SWEPT NORMALIZATION OF S21 ON/OFF	Changes the soft-key display to the SWEPT POWER SETUP menu.	
	TEST AUT	Changes the soft-key display to the SWEPT POWER SETUP menu.	SPGCT
	MULTIPLE FREQ GAIN COMPRESSION	Changes the soft-key display to the MULTIPLE FREQUENCY GAIN COMPRESSION menu.	MFGCT
	RETURN TO T/R MODE	Changes the soft-key display to the TRANSMISSION AND REFLECTION menu.	UNDOGC
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?

Menu Name	Function	Description	GPIB Mnemonic
SWEPT POWER GAIN COMPRESSION 2	NEXT FREQUENCY XXX.XXXXXXX GHz	Sets the next frequency to be imported in the frequency list.	DFQ; DFQ?
	INSERT NEXT FREQUENCY	Inserts the NEXT FREQUENCY into the frequency list.	IFV
	FREQUENCY NUMBER TO BE CLEARED XX	Selects the frequency number to be cleared.	IFV
	CLEAR SELECTED FREQUENCY	Clears the selected frequency.	IFV
	CLEAR ALL FREQUENCIES	Clears all frequencies in the list.	IFV
	RETURN	Returns to the previous soft-key menu.	None
SWEPT POWER GAIN COMPRESSION3	P START XX.XX dBm	Sets the sweep start frequency.	PSTRT; PSTRT?
	P STOP XX.XX dBm	Sets the sweep stop frequency.	PSTOP; PSTOP?
	STEP SIZE XX.XX dB	Sets the power sweep step size.	PSTEP; PSTEP?
	P SET XX.XX dBm	Enter target power for gain compression receiver calibration.	PSET; PSET?
	GAIN COMPRESSION POINT (MAX REF) XX.XX dBm	Sets gain compression point.	GCMP; GCMP?
	NOMINAL OFFSET XXX dB	Sets nominal offset.	NOFST; NOFST?
	RETURN	Returns to the previous soft-key menu.	None
SWEPT POWER GAIN COMPRESSION4	PORT 1 ATTN 0*10dB (0-70)	Sets Port 1 attenuator.	SA1; SA1?
	PORT 3 ATTN 0*10dB (0-70)	Sets Port 3 attenuator.	SA3; SA3?
	RETURN	Returns to the previous soft-key menu.	None
SWEPT POWER SETUP	SWEPT POWER FREQUENCY XXX.XXXXXX GHz	Sets the power sweep frequency.	PSF; PSF?
	P START XX.XX dBm	Displays the sweep start power.	PSTRT?
	P STOP XX.XX dBm	Displays the sweep stop power.	PSTOP?
	STEP SIZE XX.XX dB	Displays the power sweep step size.	PSTEP?
	POWER SWEEP ON/OFF	Toggles the power sweep on or off.	PSWP1; PSWP0; PSWPX?
	MULTIPLE FREQ GAIN COMPRESSION	Changes the soft-key display to the MULTIPLE FREQUENCY GAIN COMPRESSION menu.	None
	RETURN TO T/R MODE	Changes the soft-key display to the TRANSMISSION AND REFLECTION menu.	UNDOGC
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TEST SIGNALS	SOURCE 1 POWER XX.XX dBm (XX TO YY)	Sets the Source 1 power level.	PWR; PWR?
	PORT 1 ATTN 0*10 dB (0-70)	Sets Port 1 attenuation in 10 dB steps.	SA1
	PORT 1 POWER XX.XX dBm	Displays resulting output power level of Port 1.	P1P?
	SOURCE 2 POWER XX.XX dBm	Sets the Source 2 power level.	PW2
	PORT 3 ATTN 0*10 dB (0-70)	Sets Port 3 attenuation in 10 dB steps.	SA3
	PORT 3 POWER XX.XX dBm	Displays resulting output power level of Port 3.	P3P?
	RETURN TO T/R MODE	Changes the soft-key display to the top-level APPLICATIONS menu.	UNDOGC
TIME MARKER SWEEP	START MARKER ( ) XXX.XXX ns	Sets the start time to the value of the selected marker.	M1S thru M12S
	STOP MARKER ( ) XXX.XXX ns	Sets the stop time to the value of the selected marker.	M1E thru M12E
	RESTORE ORIGINAL RANGE	Returns the display to the original time range that was in effect before the marker range was selected.	MRR
	RETURN	Returns to the previous soft-key menu.	None
TRANSMISSION AND REFLECTION	DOMAIN	Changes the soft-key display to the DOMAIN menu.	
	SWEPT POWER GAIN COMPRESSION	Changes the soft-key display to the SWEPT POWER GAIN COMPRESSION menu.	APPGCP
	SWEPT FREQUENCY GAIN COMPRESSION	Changes the soft-key display to the SWEPT FREQUENCY GAIN COMPRESSION menu.	APPGCF
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	CHANGE APPLICATION SETUP	Changes the soft-key display to the top-level APPLICATIONS menu.	None
WINDOW/GATE SHAPE SETUP	RECTANGULAR	Selects a Rectangular (one-term) shape.	WRT; GRT
	NOMINAL	Selects a two-term Hamming shape.	WNM; GNM
	LOW SIDELOBE	Selects a three-term Blackman-Harris shape.	WLS; GLS
	MIN SIDELOBE	Selects a four-term Blackman-Harris shape.	WMS; GMS
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

4-5 MEAS KEY MENUS

This key provides entry to measurement functions.

Menu Name	Function	Description	GPIB Mnemonic
SELECT MIXED MODE S-PARAMETER	S1D DIFF. MODE	Selects S1D to be the active S-parameter.	MS1D
	SD1 DIFF. MODE	Selects SD1 to be the active S-parameter.	MSD1
	SDD DIFF. MODE	Selects SDD to be the active S-parameter.	MSDD
	S1C COMMON MODE	Selects S1C to be the active S-parameter.	MS1C
	SC1 COMMON MODE	Selects SC1 to be the active S-parameter.	MSC1
	SCC COMMON MODE	Selects SCC to be the active S-parameter.	MSCC
	MORE	Changes the soft-key display to the next SELECT MIXED MODE S-PARAMETER menu.	None
SELECT MIXED MODE S-PARAMETER	SDC MODE CONVERSION	Selects SDC to be the active S-parameter.	MSDC
	SCD MODE CONVERSION	Selects SCD to be the active S-parameter.	MSCD
	MORE	Changes the soft-key display to the SELECT S-PARAMETER menu.	None
SELECT MIXED MODE S-PARAMETER (4 PORT MODELS)	SDC MODE CONVERSION	Selects SDC to be the active S-parameter.	MSDC
	SCD MODE CONVERSION	Selects SCD to be the active S-parameter.	MSCD
	SD1D1 DIFF. MODE	Selects SD1D1 to be the active S-parameter.	MSD1D1
	SD1D2 DIFF. MODE	Selects SD1D2 to be the active S-parameter.	MSD1D2
	SD2D1 DIFF. MODE	Selects SD2D1 to be the active S-parameter.	MSD2D1
	SD2D2 DIFF. MODE	Selects SD2D2 to be the active S-parameter.	MSD2D2
	MORE	Changes the soft-key display to the next SELECT MIXED MODE S-PARAMETER menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT MIXED MODE S-PARAMETER (4 PORT MODELS)	SC1C1 COMMON MODE	Selects SC1C1 to be the active S-parameter.	MSC1C1
	SC1C2 COMMON MODE	Selects SC1C2 to be the active S-parameter.	MSC1C2
	SC2C1 COMMON MODE	Selects SC2C1 to be the active S-parameter.	MSC2C1
	SC2C2 COMMON MODE	Selects SC2C21 to be the active S-parameter.	MSC2C2
	SD1C1 MODE CONVERSION	Selects SD1C1 to be the active S-parameter.	MSD1C1
	SD1C2 MODE CONVERSION	Selects SD1C2 to be the active S-parameter.	MSD1C2
	MORE	Changes the soft-key display to the next SELECT MIXED MODE S-PARAMETER menu.	None
SELECT MIXED MODE S-PARAMETER (4 PORT MODELS)	SD2C1 MODE CONVERSION	Selects SD2C1 to be the active S-parameter.	MSD2C1
	SD2C2 MODE CONVERSION	Selects SD2C2 to be the active S-parameter.	MSD2C2
	SC1D1 MODE CONVERSION	Selects SC1D1 to be the active S-parameter.	MSC1D1
	SC1D2 MODE CONVERSION	Selects SC1D2 to be the active S-parameter.	MSC1D2
	SC2D1 MODE CONVERSION	Selects SC2D1 to be the active S-parameter.	MSC2D1
	SC2D2 MODE CONVERSION	Selects SC2D2 to be the active S-parameter.	MSC2D2
	MORE	Changes the soft-key display to the SELECT S-PARAMETER menu.	None
SELECT S-PARAMETER	USER DEFINED	Changes the soft-key display to the USER DEFINED S-PARAMETER menu.	None
	S21, TRANS/USER 1 b2/a1	Selects S21 to be the active S-parameter.	S21
	S11, REFL/USER 2 b1/a1	Selects S11 to be the active S-parameter.	S11
	S12, TRANS/USER 3 a1/a2	Selects S12 to be the active S-parameter.	S12
	S22, REFL/USER 4 b2/a2	Selects S22 to be the active S-parameter.	S22
	EXT ANALOG IN	Selects the external analog input to be read in volts	EANAIN
	MIXED MODE S-PARAMETERS	Changes the soft-key display to the SELECT MIXED MODE S-PARAMETER menu.	None
	MORE	Changes the soft-key display to the next SELECT S-PARAMETER menu, if Port 3 options is installed.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT S-PARAMETER	S13, TRANS/USER 5 b1/a3	Selects S13 to be the active S-parameter.	S13
	S23, TRANS/USER 6 b2/a3	Selects S23 to be the active S-parameter.	S23
	S31, TRANS/USER 7 b3/a1	Selects S31 to be the active S-parameter.	S31
	S32, TRANS/USER 8 b3/a2	Selects S32 to be the active S-parameter.	S32
	S33, REFL/USER 9 b3/a3	Selects S33 to be the active S-parameter.	S33
	MORE	Changes the soft-key display to the SELECT MIXED MODE S-PARAMETER menu.	None
SELECT S-PARAMETER (4 PORT MODELS)	S14, TRANS/USER 10 b1/a4	Selects S14 to be the active S-parameter.	S14
	S24, TRANS/USER 11 b2/a4	Selects S24 to be the active S-parameter.	S24
	S41, TRANS/USER 12 B4/a1	Selects S41 to be the active S-parameter.	S41
	S42, TRANS/USER 13 B3/a2	Selects S42 to be the active S-parameter.	S42
	S34, REFL/USER 14 B4/a4	Selects S34 to be the active S-parameter.	S34
	S43, REFL/USER 15 B4/a3	Selects S43 to be the active S-parameter.	S43
	S44, REFL/USER 16 B4/a4	Selects S44 to be the active S-parameter.	S44
	MORE	Changes the soft-key display to the SELECT S-PARAMETER menu.	None
USER DEFINED S-PARAMETER	Sxx/USERx	Toggles between Sxx and User S-parameter.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	USER RATIO X/X	Displays current User Parameter ratio.	UDPX?
	USER LABEL XXX	Displays current User Parameter label.	USL; USL?
	CHANGE RATIO	Changes the soft-key display to the USER DEFINED S-PARAMETER NUMERATOR.	None
	CHANGE LABEL	Changes the soft-key display to the SELECT LABEL menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
USER DEFINED S-PARAMETER DENOMINATOR	Sxx/USERx x/y	Displays the active S-parameter and its ratio.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	a1 (Ra)	Selects denominator a1 for user defined S-parameter.	DA1
	a2 (Rb)	Selects denominator a2 for user defined S-parameter.	DA2
	a3 (Rc)	Selects denominator a3 for user defined S-parameter.	DA3
	b1 (Ta)	Selects denominator b1 for user defined S-parameter.	DB1
	b2 (Tb)	Selects denominator b2 for user defined S-parameter.	DB2
	b3 (Tc)	Selects denominator b3 for user defined S-parameter.	DB3
	1 (UNITY)	Selects unity denominator for user defined S-parameter.	DE1
USER DEFINED S-PARAMETER DENOMINATOR (4 PORT MODELS)	Sxx/USERx x/y	Displays the active S-parameter and its ratio.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	a1 (Ra)	Selects denominator a1 for user defined S-parameter.	DA1
	a2 (Rb)	Selects denominator a2 for user defined S-parameter.	DA2
	a3 (Rc)	Selects denominator a3 for user defined S-parameter.	DA3
	a4 (Rd)	Selects denominator a4 for user defined S-parameter.	DA4
	1 (UNITY)	Selects unity denominator for user defined S-parameter.	DE1
	MORE	Changes the soft-key display to the next USER DEFINED S-PARAMETER DENOMINATOR menu.	None
USER DEFINED S-PARAMETER DENOMINATOR (4 PORT MODELS)	Sxx/USERx x/y	Displays the active S-parameter and its ratio.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	b1 (Ta)	Selects denominator b1 for user defined S-parameter.	DB1
	b2 (Tb)	Selects denominator b2 for user defined S-parameter.	DB2
	b3 (Tc)	Selects denominator b3 for user defined S-parameter.	DB3
	b4 (Rd)	Selects denominator b4 for user defined S-parameter.	DB4
	1 (UNITY)	Selects unity denominator for user defined S-parameter.	DE1
	MORE	Changes the soft-key display to the previous USER DEFINED S-PARAMETER DENOMINATOR menu.	None

Menu Name	Function	Description	GPIB Mnemonic
USER DEFINED S-PARAMETER NUMERATOR	Sxx/USERx x/y	Displays the active S-parameter and its ratio.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	a1 (Ra)	Selects numerator a1 for user defined S-parameter.	NA1
	a2 (Rb)	Selects numerator a2 for user defined S-parameter.	NA2
	a3 (Rc)	Selects numerator a3 for user defined S-parameter.	NA3
	b1 (Ta)	Selects numerator b1 for user defined S-parameter.	NB1
	b2 (Tb)	Selects numerator b2 for user defined S-parameter.	NB2
	b3 (Tc)	Selects numerator b3 for user defined S-parameter.	NB3
	1 (UNITY)	Selects unity numerator for user defined S-parameter.	NU1
USER DEFINED S-PARAMETER NUMERATOR (4 PORT MODELS)	Sxx/USERx x/y	Displays the active S-parameter and its ratio.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	a1 (Ra)	Selects numerator a1 for user defined S-parameter.	NA1
	a2 (Rb)	Selects numerator a2 for user defined S-parameter.	NA2
	a3 (Rc)	Selects numerator a3 for user defined S-parameter.	NA3
	a4 (Rd)	Selects numerator a4 for user defined S-parameter.	NA4
	1 (UNITY)	Selects unity numerator for user defined S-parameter.	NU1
	MORE	Changes the soft-key display to the next USER DEFINED S-PARAMETER DENOMINATOR menu.	None
USER DEFINED S-PARAMETER NUMERATOR (4 PORT MODELS)	Sxx/USERx x/y	Displays the active S-parameter and its ratio.	USR1 to USR9; UDP11; UDP12; UDP21; UDP22; UDP31; UDP32; UDP33; UDP13; UDP23
	b1 (Ta)	Selects numerator b1 for user defined S-parameter.	NB1
	b2 (Tb)	Selects numerator b2 for user defined S-parameter.	NB2
	b3 (Tc)	Selects numerator b3 for user defined S-parameter.	NB3
	b4 (Td)	Selects numerator a4 for user defined S-parameter.	NB4
	1 (UNITY)	Selects unity numerator for user defined S-parameter.	NU1
	MORE	Changes the soft-key display to the previous USER DEFINED S-PARAMETER DENOMINATOR menu.	None

4-6 DISPLAY KEY MENUS

This key provides entry to display functions.

Menu Name	Function	Description	GPIB Mnemonic
DISPLAY	DISPLAY MODE	Changes the soft-key display to the DISPLAY MODE menu.	None
	GRAPH TYPE	Changes the soft-key display to the GRAPH TYPE menu.	None
	SCALE	Changes the soft-key display to the appropriate SCALE menu.	None
	LIMITS	Changes the soft-key display to the appropriate LIMITS menu.	None
	TRACE MEMORY	Changes the soft-key display to the TRACE MEMORY menu.	None
	INTERCHANNEL MATH	Changes the soft-key display to the INTERCHANNEL MATH menu.	DD1; DD0; DD1?
	REFERENCE PLANE	Changes the soft-key display to the REFERENCE PLANE menu.	None
	AUTO SCALE	Automatically scales the active channel for optimum viewing.	ASC
DISPLAY	DISPLAY MODE	Changes the soft-key display to the DISPLAY MODE menu.	None
	GRAPH TYPE	Changes the soft-key display to the GRAPH TYPE menu.	None
	SCALE	Changes the soft-key display to the appropriate SCALE menu.	None
	AUTO SCALE	Automatically scales the active channel for optimum viewing.	ASC
	RESUME CAL	Resumes the calibration.	None
DISPLAY GROUP	SELECT DISPLAY GROUP		
	GROUP 1	Select Group 1 to be the active group.	GROUP1; GROUP?
	GROUP 2	Select Group 2 to be the active group.	GROUP2; GROUP?
	GROUP 3	Select Group 3 to be the active group.	GROUP3; GROUP?
	GROUP 4	Select Group 4 to be the active group.	GROUP4; GROUP?
	REDEFINE CHANNEL KEYS		
	CHANNEL/GROUP	Redefine CHANNEL keys to select active channel or active group.	SETCHANKEY; SETGRPKEY; SETCHANKEY?
	SETUP S-PARAMS IN ALL CHANNELS	Changes the soft-key display to the S-PARAMS IN ALL CHANNELS menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
DISPLAY MODE	SINGLE CHANNEL	Selects a single channel for display. You select the type of display in menu GRAPH TYPE.	DSP; DSP?
	DUAL CHANNELS 1&3	Selects channels 1 and 3 for display.	D13
	DUAL CHANNELS 2&4	Selects channels 2 and 4 for display.	D24
	OVERLAY DUAL CHANNELS 1&3	Simultaneously displays the Channel 1 data superimposed over the Channel 3 data on a single display. Channel 1 trace displays in red and Channel 3 in yellow.	T13
	OVERLAY DUAL CHANNELS 2&4	Simultaneously displays the Channel 2 data superimposed over the Channel 4 data on a single display. Channel 2 trace displays in red and Channel 4 in yellow.	T24
	FOUR CHANNELS	Selects all four channels for display.	D14
	OVERLAY ALL FOUR CHANNELS	Simultaneously displays the Channels 1 through 4 data on a single display. Channel 1 displays in red, 2 in yellow, 3 in green, and 4 in blue.	T14
	*SETUP DISPLAY GROUP	Changes the soft-key display to the DISPLAY GROUP menu. *4-Port instrument in TR mode	None
	RETURN	Returns to the previous soft-key menu.	None
EDIT LOWER LIMIT SEGMENTS GRAPH TYPE	SEGMENT X ON/OFF	Enter the segment number that you want to define, and turn it on or off.	LS1-LS10; LSX?
	START POSITION HORIZONTAL XX.XXXXXXXX GHz	Enter the start horizontal value in GHz, seconds, meters, or points (domain dependent).	STH; STH?
	VERTICAL XX.XXXXXXXX dB	Enter the start vertical value in dB, degree, units, or seconds (graph type dependent).	STV; STV?
	STOP POSITION HORIZONTAL XX.XXXXXXXX GHz	Enter the stop horizontal value in GHz, seconds, meters, or points(domain dependent).	SPH; SPH?
	VERTICAL XX.XXXXXXXX dB	Enter the stop vertical value in dB, degree, units, or seconds (graph type dependent).	SPV; SPV?
	BEGIN NEXT	Turns the next segment on and sets its start and stop position to the previous segment stop position.	BEGN
	ATTACH NEXT	Turns the next segment on and sets its start position to the previous segment stop position.	ATTN
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
EDIT UPPER LIMIT SEGMENTS GRAPH TYPE	SEGMENT X ON/OFF	Enter the segment number that you want to define, and turn it on or off.	US1-US10; LSX?
	START POSITION HORIZONTAL XX.XXXXXXXX GHz	Enter the start horizontal value in GHz, seconds, meters, or points (domain dependent).	STH; STH?
	VERTICAL XX.XXXXXXXX dB	Enter the start vertical value in dB, degrees, units, or seconds (graph-type dependent).	STV; STV?
	STOP POSITION HORIZONTAL XX.XXXXXXXX GHz	Enter the stop horizontal value in GHz, seconds, meters, or points (domain dependent).	SPH; SPH?
	VERTICAL XX.XXXXXXXX dB	Enter the stop vertical value in dB, degrees, units, or seconds (graph-type dependent).	SPV; STV?
	BEGIN NEXT	Turns the next segment on and sets its start and stop positions to the previous segment stop position.	BEGN
	ATTACH NEXT	Turns the next segment on and sets its start position to the previous segment stop position.	ATTN
	RETURN	Returns to the previous soft-key menu.	None
EDIT UPPER/LOWER LIMIT SEGMENTS GRAPH TYPE	EDIT UPPER LIMITS	Changes the soft-key display to the EDIT UPPER LIMITS menu.	None
	EDIT LOWER LIMITS	Changes the soft-key display to the EDIT LOWER LIMITS menu.	None
	CLEAR SEGMENT	Turns the current segment-to-define off and sets its start equal to its stop.	CAS
	RETURN	Returns to the previous soft-key menu.	None
GRAPH TYPE	LOG MAGNITUDE	Selects a log magnitude graph for display on the active channel selected S-parameter. The active channel is indicated by its key (CH1, CH2, CH3, CH4) being lit.	MAG
	PHASE	Selects a phase graph for display on the active channel.	PHA
	LOG MAGNITUDE AND PHASE	Selects log magnitude and phase graphs for display on the active channel.	MPH
	SMITH CHART (IMPEDANCE)	Selects a Smith chart for display on the active channel.	SMI; SME; SMC
	SWR	Selects an SWR display for the active channel.	SWR
	GROUP DELAY	Selects a Group Delay display for the active channel.	DLA
	MORE	Changes the soft-key display to the GRAPH TYPES 2 menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
GRAPH TYPES 2	POWER OUT	Provides for measuring output power. The measurement of output power is accomplished by using the b2 (or Tb) measured value normalized to the power supplied to the AUT at Test Port 1. While the b2 parameter is the most meaningful for this graph type, you may use any other parameter.	POW
	SMITH CHART (ADMITTANCE)	Selects an Admittance Smith chart for display on the active channel S-parameter.	ISM; ISE; ISC
	LINEAR POLAR	Selects a Linear Polar graph for display on the active channel S-parameter.	PLR
	LOG POLAR	Selects a Log Polar graph for display on the active channel S-parameter.	PLG
	LINEAR MAGNITUDE	Selects a Linear Magnitude graph for display on the active channel S-parameter.	LIN
	LINEAR MAGNITUDE AND PHASE	Selects Linear Magnitude and Phase graphs for display on the active channel S-parameter.	LPH
	MORE	Changes the soft-key display to the GRAPH TYPES 3 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
GRAPH TYPES 3	REAL	Selects Real data for display on the active channel S-parameter.	REL
	IMAGINARY	Selects Imaginary data for display on the active channel S-parameter.	IMG
	REAL AND IMAGINARY	Selects both Real and Imaginary data for display on the active channel S-parameter.	RIM
	MORE	Changes the soft-key display to the GRAPH TYPES-menu.	None
	RETURN	Returns to the previous soft-key menu.	None
INTERCHANNEL MATH	INTERCHANNEL MATH ON/OFF	Turns Interchannel Math on or off.	ICM0; ICM1; ICMX?
	CHANNEL NUM FOR		
	OPERATND 1 X	Enter channel number for the first operand.	ICOP1; ICOP1?
	OPERATND 2 X	Enter channel number for the second operand.	ICOP2; ICOP2?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
READOUT LIMIT	-GRAPH TYPE-	Displays the currently selected graph type.	None
	UPPER LIMIT (REF) XX.XX dB	Sets the UPPER LIMIT (REF) limit line. Changing this value also moves the lower limit line by the LIMIT DIFFERENCE amount.	LUP; LUP?
	LOWER LIMIT (REF) XX.XX dB	Sets the LOWER LIMIT dB limit line. Changing this value also changes the LIMIT DIFFERENCE amount relative to the UPPER LIMIT (REF) value.	LLO; LLO?
	LIMIT DIFFERENCE Δ (UPPER-LOWER) XXX.XXXX dB	Sets the LIMIT DIFFERENCE amount. Changing this value also changes the lower limit value relative to the UPPER LIMIT (REF) value.	LFD; LFD?; LFD2; LFD2?
	INTERCEPTS AT LOWER LIMIT: XXX.XXXXXXXXXGHz: XXX.XXXXXXXXXGHz: XXX.XXXXXXXXXGHz: XXX.XXXXXXXXXGHz	Displays at which frequencies the data intercepts the lower limit. May be interpolated.	None
	RETURN	Returns to the previous soft-key menu.	None
REFERENCE PLANE Ch x	AUTO	Automatically sets the reference delay such that the cumulative phase shift is zero. This selection unwinds the phase in a Smith chart display or reduces the phase revolutions in a rectilinear display to less than one.	RDA
	DISTANCE XX.XXX mm	Electrically repositions the measurement reference plane, as displayed on the active channel, by a distance value entered in millimeters. This selection lets you compensate for the phase reversals inherent in a length of transmission line connected betwee	RDD
	TIME XX.XXX ps	Electrically repositions the measurement reference plane by a distance value that corresponds to the time in picoseconds.	RDT
	SET DIELECTRIC XXXXX	Changes the soft-key display to the SET DIELECTRIC menu.	DIE
	PHASE OFFSET XXXXXX	Add a constant phase offset to the display data.	POSET; POSET?
	PER CHANNEL/PORT	Changes the soft-key display to the REFERENCE PLANE PER PORT menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
REFERENCE PLANE PER PORT	PORT X	Select the port number.	RPPORTNUM; RPPORTNUM?
	AUTO	Changes the S-parameter being measured on the active channel to the reflection S-parameter that corresponds to the port number. Automatically sets the reference delay such that the cumulative phase shift is zero. This selection unwinds the phase in a Smith chart display or reduces the phase revolutions in a rectilinear display to less than one.	RDA
	DISTANCE XX.XXX mm	Electrically repositions the measurement reference plane in all measurements as specified in “PORT X” (above) by a distance value entered in millimeters. This selection lets you compensate for the phase reversals inherent in a length of transmission line connected between.	RDD
	TIME XX.XXX ps	Electrically repositions the measurement reference plane by a distance value that corresponds to the time in picoseconds.	RDT
	SET DIELECTRIC XXXXX	Changes the soft-key display to the SET DIELECTRIC menu.	DIE
	PER CHANNEL/PORT	Changes the soft-key display to the REFERENCE PLANE CHx menu.	None
	RETURN	Returns to the previous soft-key menu.	None
S-PARAMS SETUP IN ALL CHANNELS	SINGLE ENDED S-PARAMS	Sets all the groups to SINGLE ENDED S-parameters.	SETSE
	BALANCED DIFFERENTIAL	Sets all the groups to BALANCED DIFFERENTIAL S-parameters.	SETBD
	SINGLE ENDED/ BALANCED DIFFERENTIAL	Sets all the groups to 3 PORTS MIXED MODE S-parameters.	SETSB
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
SCALE GROUP DELAY	RESOLUTION XXX.XXX uS/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX fS	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	APERTURE X.X PERCENT OF SWEEP	Sets the percent of frequency span over which group delay is calculated.	APR; APR?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE IMAGINARY	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2
	REFERENCE VALUE XXX.XXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2
	RETURN	Returns to the previous soft-key menu.	None
SCALE LINEAR MAG & PHASE	-LINEAR MAG-		None
	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX PU	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	-PHASE-		None
	RESOLUTION XX.XX DEG/DIV	Sets the resolution for the vertical axis of the active channel displayed phase graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX DEG	Sets the value by which the active channel phase measurement is offset on the phase graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel phase measurement on the phase graph. This is the line about which the phase expands with different resolution values.	REF; REF2; REF?; REF2?
	PHASE SHIFT X.XX	Sets the value by which the active channel phase measurement is shifted on the phase graph.	PHO; PHO?
	RETURN	Returns to the previous menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE LINEAR MAG & PHASE (CAL)	-LINEAR MAG-		None
	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed phase graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX PU	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	-PHASE-		None
	RESOLUTION XX.XX DEG/DIV	Sets the resolution for the vertical axis of the active channel displayed phase graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX DEG	Sets the value by which the active channel phase measurement is offset on the phase graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel phase measurement on the phase graph. This is the line about which the phase expands with different resolution values.	REF; REF2; REF?; REF2?
	PHASE SHIFT X.XX	Sets the value by which the active channel phase measurement is shifted on the phase graph.	PHO; PHO?
	RESUME CAL	Resumes calibration.	None
SCALE LINEAR MAGNITUDE	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX pU	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RETURN	Returns to the previous soft-key menu.	None
SCALE LINEAR POLAR	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph. Resolution can be set incrementally using the keypad or rotary knob. The center is fixed at 0 units; therefore, changing the resolution also changes the reference value and	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	FIXED REFERENCE LINE		None
	SELECT POLAR CHART MODE XXXXXXXX	Changes the soft-key display to the SELECT POLAR CHART MODE menu.	PCP
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE LOG MAG & PHASE	-LOG MAG-		None
	RESOLUTION XX.XX dB/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XX.XX dBc/dBm	Sets the value at the reference line for the active channel amplitude measurement on the log-magnitude graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement on the log-magnitude graph. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	-PHASE-		None
	RESOLUTION XX.XX DEG/DIV	Sets the resolution for the vertical axis of the active channel displayed phase graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX DEG	Sets the value at the reference line for the active channel amplitude measurement on the phase graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel phase measurement on the phase graph. This is the line about which the phase expands with different resolution values.	REF; REF2; REF?; REF2?
	PHASE SHIFT X.XX DEG	Sets the value by which the active channel phase measurement is shifted on the phase graph.	PHO; PHO?
	RETURN	Returns to the previous soft-key menu.	None
SCALE LOG MAG & PHASE(CAL)	-LOG MAG-		None
	RESOLUTION XX.XX dB/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XX.XX dBc/dBm	Sets the value at the reference line for the active channel amplitude measurement on the log-magnitude graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement on the log-magnitude graph. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	-PHASE-		None
	RESOLUTION XX.XX DEG/DIV	Sets the resolution for the vertical axis of the active channel displayed phase graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX DEG	Sets the value at the reference line for the active channel amplitude measurement on the phase graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel phase measurement on the phase graph. This is the line about which the phase expands with different resolution values.	REF; REF2; REF?; REF2?
	PHASE SHIFT X.XX DEG	Sets the value by which the active channel phase measurement is shifted on the phase graph.	PHO; PHO?
	RESUME CAL	Resumes the calibration.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE LOG MAGNITUDE	RESOLUTION XX.XX dB/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XX.XX dB	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement on the log-magnitude graph. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RETURN	Returns to the previous soft-key menu.	None
SCALE LOG POLAR	RESOLUTION XX.XX dB/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XX.XX dB	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	FIXED REFERENCE LINE		None
	SELECT POLAR CHART MODE	Changes the soft-key display to the SELECT POLAR CHART MODE menu.	PCP
	RETURN	Returns to the previous soft-key menu.	None
SCALE PHASE	RESOLUTION XX.XXX DEG/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX DEG	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	PHASE SHIFT X.XX DEG	Sets the value by which the active channel phase measurement is shifted on the phase graph.	PHO; PHO?
	RETURN	Returns to the previous soft-key menu.	None
SCALE POWER OUT	RESOLUTION XX.XX dB/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XX.XX dBc/dBm	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE POWER OUT (CAL)	RESOLUTION XX.XX dB/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XX.XX dBc/dBm	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RESUME CAL	Resumes the calibration.	None
SCALE REAL	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RETURN	Returns to the previous soft-key menu.	None
SCALE REAL & IMAGINARY	-REAL-		None
	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	-IMAGINARY-		None
	RESOLUTION XX.XX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel phase measurement on the phase graph. This is the line about which the phase expands with different resolution values.	REF; REF2; REF?; REF2?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE REAL & IMAGINARY CAL)	-REAL-		None
	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	-IMAGINARY-		None
	RESOLUTION XX.XX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel phase measurement on the phase graph. This is the line about which the phase expands with different resolution values.	REF; REF2; REF?; REF2?
	RESUME CAL	Resumes the calibration.	None
SCALE ADMITTANCE SMITH CHART	NORMAL SMITH (REF=1.0000000)	Selects a normal Smith chart for display in the active channel.	ISM
	EXPAND 10 dB (REF=0.3162278)	Selects a 10 dB expansion of the Smith chart being displayed for the active channel.	ISE10 DB
	EXPAND 20 dB (REF=0.1000000)	Selects a 20 dB expansion of the Smith chart being displayed for the active channel.	ISE 20 DB
	EXPAND 30 dB (REF=0.0316228)	Selects a 30 dB expansion of the Smith chart being displayed for the active channel.	ISE 30 DB
	COMPRESS 3dB (REF=1.4125375)	Selects a 3 dB compression of the Smith chart being displayed for the active channel.	ISC 3 DB
	RETURN	Returns to the previous soft-key menu.	None
SCALE IMPEDANCE SMITH CHART	NORMAL SMITH (REF=1.0000000)	Selects a normal Smith chart for display in the active channel.	SMI
	EXPAND 10 dB (REF=0.3162278)	Selects a 10 dB expansion of the Smith chart being displayed for the active channel.	SME 10 DB
	EXPAND 20 dB F=0.1000000)	Selects a 20 dB expansion of the Smith chart being displayed for the active channel.	SME 20 DB
	EXPAND 30 dB (REF=0.0316228)	Selects a 30 dB expansion of the Smith chart being displayed for the active channel.	SME 30 DB
	COMPRESS 3dB (REF=1.4125375)	Selects a 3 dB compression of the Smith chart being displayed for the active channel.	SMC 3 DB
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SCALE SWR	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RETURN	Returns to the previous soft-key menu.	None
SCALE SWR (CAL)	RESOLUTION XX.XXX U/DIV	Sets the resolution for the vertical axis of the active channel displayed graph.	SCL; SCL2; SCL?; SCL2?
	REFERENCE VALUE XXX.XXX U	Sets the value at the reference line for the active channel amplitude measurement on the displayed graph.	OFF; OFF2; OFF?; OFF2?
	REFERENCE LINE X	Sets the reference line for the active channel amplitude measurement. This is the line about which the amplitude expands with different resolution values.	REF; REF2; REF?; REF2?
	RESUME CAL	Resumes the calibration.	None
SEGMENTED LIMITS	-GRAPH TYPE-		None
	DISPLAY LIMITS ON/OFF	Toggle between on and off to display the active channel limits.	LON; LOF; LON?
	UPPER LIMIT ON/OFF	Turns the Upper Limit line on or off for the active channel.	SLU1; SLU0; SLUX?
	LOWER LIMIT ON/OFF	Turns the Lower Limit line on or off for the active channel.	SLU0; SLU0; SLUX?
	EDIT SEGMENTS	Changes the soft-key display to the EDIT UPPER/LOWER LIMIT SEGMENTS menu.	None
	SET SEGMENT OFFSETS	Changes the soft-key display to the SET SEGMENT OFFSET menu.	None
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	None
	CLEAR ALL SEGMENT	Clears all segments.	SLC
	SINGLE LIMITS	Returns to the appropriate single limits menu.	None
SELECT FILE TO OVERWRITE	CREATE NEW FILE	Changes the soft-key display to the SELECT LABEL menu.	None
	FILE 1	Select file number 1 to be overwritten with new data.	None
	FILE 2	Select file number 2 to be overwritten with new data.	None
	FILE 3	Select file number 3 to be overwritten with new data.	None
	FILE 4	Select file number 4 to be overwritten with new data.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT FILE TO READ	FILE 1	Recalls the data stored in file number 1	None
	FILE 2	Recalls the data stored in file number 2	None
	FILE 3	Recalls the data stored in file number 3	None
	FILE 4	Recalls the data stored in file number 4	None
	PREVIOUS PAGE	Returns to the previous menu of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None
SELECT LABEL	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%&'@^_'{}-	Enter the label using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number. You are allowed up to twelve cha	None
	* ? : \. SP	For keyboard command line entry.	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the label displayed above. Selecting CLR deletes the entire label. Selecting DONE signals that you have finished writing the label.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key enters the selected letter/number in the label.	None
	NUMBERS MAY BE SELECTED USING KEYPAD	You may also select numbers and decimals using the keypad.	None
	PRESS <CLEAR> TO ABORT	Press the Clr/Local key to abort the process.	None
SELECT POLAR CHART MODE	MAGNITUDE, PHASE	Selects Polar Chart Display to show magnitude and phase for the full frequency range-from start frequency to stop frequency.	PCP
	MAGNITUDE, SWEEP POSITION	Selects Polar Chart Display to show magnitude information only for the phase data that falls between the start and stop angles selected below.	PCS
	SET SWEEP POSITION BOUNDARIES		None
	START ANGLE X.XXDEG	Sets the start angle for the data display.	AST; AST?
	STOP ANGLE X.XXDEG	Sets the stop angle for the data display.	ASP; ASP?
	RETURN	Returns to the previous soft-key menu.	None
SELECT TRACE MATH	ADD (+)	Selects DATA + MEMORY as the math function.	ADD
	SUBTRACT (-)	Selects DATA - MEMORY as the math function.	MIN
	MULTIPLY (*)	Selects DATA x MEMORY as the math function.	MUL
	DIVIDE (/)	Selects DATA / MEMORY as the math function.	DIV
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SET DIELECTRIC	AIR (1.000649)	Calculates reference delay based on the dielectric constant of air (1.000649).	DIA
	POLYETHYLENE (2.26)	Calculates reference delay based on the dielectric constant of polyethylene (2.26).	DIP
	TEFLON (2.10)	Calculates reference delay based on the dielectric constant of teflon (2.1).	DIT
	MICROPOROUS TEFLON (1.69)	Calculates reference delay based on the dielectric constant of microporous Teflon (1.69).	DIM
	OTHER XXXX.XX	Calculates reference delay based on the value you enter.	DIE
	RETURN	Returns to the previous soft-key menu.	None
SET SEGMENT OFFSETS	-GRAPH TYPE-		None
	HORIZONTAL XXX.XXXXXXX GHz	Sets the horizontal segment offset.	SLH; SLH?
	VERTICAL XX.XXXXXXXX dB	Sets the vertical segment offset.	SLV; SLV?
SINGLE LIMIT	-GRAPH TYPE-		None
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	None
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	MORE	Changes the soft-key display to the appropriate SINGLE LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SINGLE LIMITS GROUP DELAY	-GROUP DELAY-		None
	UPPER LIMIT XX.XXXXXX s ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Group Delay display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX s ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SINGLE LIMITS IMAGINARY	-IMAGINARY-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line in your Imaginary display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SINGLE LIMITS LINEAR MAGNITUDE	-LINEAR MAGNITUDE-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Linear Mag display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SINGLE LIMITS LINEAR MAG & PHASE	-LINEAR MAG-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate go/no go line on your Linear Mag display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	-PHASE-		None
	UPPER LIMIT XX.XXDEG ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your polar display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXDEG ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	MORE	Change soft-key to an appropriate SINGLE LIMITS menu.	None
SINGLE LIMITS LINEAR POLAR	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the upper limit on or off for the active channel, and sets its value.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the lower limit on or off for the active channel, and sets its value.	LOL1; LOL0
	DISPLAY LIMITS ON/OFF	Enables both limit lines for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SINGLE LIMITS LOG MAGNITUDE	UPPER LIMIT XX.XXXXXX dB ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Log Mag display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX dB ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets it value.	LOL1; LOL0
	READOUT LIMITS	Changes the soft-key display to the READOUT LIMITS menu.	None
	DISPLAY LIMITS ON/OFF	Enables both limit lines for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SINGLE LIMITS LOG MAG & PHASE	-LOG MAG-		None
	UPPER LIMIT XX.XXX dB ON/OFF	Turns the Upper Limit line on or off for the active channel. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on our Log Mag display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXX dB ON/OFF	Turns the Lower Limit line on or off for the active channel on your Log Mag display.	LOL1; LOL0
	READOUT LIMITS	Changes the soft-key display to the READOUT LIMITS menu.	None
	-PHASE-		None
	UPPER LIMIT XX.XXXDEG ON/OFF	Turns the Upper Limit line on or off for the active channel on your Phase display.	UPL1; UPL0
	LOWER LIMIT XX.XXXDEG ON/OFF	Turns the Lower Limit line on or off for the active channel on your Phase display.	LOL1; LOL0
	READOUT LIMITS	Changes the soft-key display to the READOUT LIMITS menu.	None
	DISPLAY LIMITS ON/OFF	Enables both limit lines for the active channel on both the Log-Mag and Phase graphs.	LON; LOF; LON?
	MORE	Change soft-key to an appropriate SINGLE LIMITS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SINGLE LIMITS LOG POLAR	-LOG POLAR-		None
	UPPER LIMIT XX.XXXXXX dB ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Log Polar display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX dB ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel on your Log Polar display.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	RETURN	Returns to the previous soft-key menu.	None
SINGLE LIMITS PHASE	-PHASE-		None
	UPPER LIMIT XX.XXXDEG ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Phase display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXDEG ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	LT1; LT0
	DISPLAY LIMITS ON/OFF	Enables both limit lines for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
SINGLE LIMITS POWER OUT	POWER OUT		None
	UPPER LIMIT XX.XXXXXX dBm ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your power display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX dBm ON/OFF	Turns the Lower Limit line on or off for the active channel.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SINGLE LIMITS REAL	-REAL-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Real display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel, and sets its value.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SINGLE LIMITS REAL & IMAGINARY	-REAL-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Real display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	-IMAGINARY-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your Imaginary display beyond which the measured values are unacceptable.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	MORE	Change soft-key to an appropriate SINGLE LIMITS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SINGLE LIMITS SMITH CHART	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the upper limit on or off for the active channel, and sets its value.	UPL1; UPL0
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the lower limit on or off for the active channel, and sets its value.	LOL1; LOL0
	DISPLAY LIMITS ON/OFF	Enables both limit lines for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	RETURN	Returns to the previous soft-key menu.	None
SINGLE LIMITS SWR	-SWR-		None
	UPPER LIMIT XX.XXXXXX U ON/OFF	Turns the Upper Limit line on or off for the active channel, and sets its value. For your convenience, the arbitrarily set limit lines allow you to delineate a go/no go line on your SWR display beyond which the measured values are unacceptable.	UPL1; UPL0?
	LOWER LIMIT XX.XXXXXX U ON/OFF	Turns the Lower Limit line on or off for the active channel.	LOL1; LOL0
	READOUT LIMIT	Changes the soft-key display to the READOUT LIMIT menu.	None
	DISPLAY LIMITS ON/OFF	Enables both previously set limit lines to appear for the active channel.	LON; LOF; LON?
	TEST LIMITS	Changes the soft-key display to the TEST LIMITS menu.	LTST
	SEGMENTED LIMITS	Changes the soft-key display to the SEGMENTED LIMITS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
TEST LIMITS	LIMIT TESTING ON/OFF	Toggles limit testing on or off.	LT1; LT0; LTX?
	BEEP ON FAILURE ON/OFF	Toggles Beep on Failure mode on or off.	LB1; LB0; LBX?
	LIMIT TEST TTL FAIL CONDITION: TTL LOW/TTL HIGH	Toggles limit test fail conditions high or low.	LVH; LVL; LVX?
	TEST RESULT: CHANNEL 1 PASS/FAIL CHANNEL 2 PASS/FAIL CHANNEL 3 PASS/FAIL CHANNEL 4 PASS/FAIL	Displays test results.	LTST
	EXT I/O OUTPUT ON/OFF	Enable/disable external output.	EXTIO0, EXTIO1, EXTIOX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TRACE MEMORY CHANNEL X	VIEW:		None
	DATA	Displays measured data; that is, the data presently being taken.	DAT
	MEMORY	Displays stored data; that is, data that was previously taken and stored in memory.	MEM
	DATA AND MEMORY	Displays measured data superimposed over stored data.	DTM
	DATA (x) MEMORY	Displays measured data combined with stored data using selected math (x=+, -, *, /).	DNM
	SELECT TRACE MATH	Changes the soft-key display to the SELECT TRACE MATH menu.	None
	STORE DATA TO MEMORY (STORED/NOT STORED)	Stores the measured data to internal memory.	STD
	DISK OPERATIONS	Changes the soft-key display to the TRACE MEMORY DISK OPERATIONS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
TRACE MEMORY DISK OPERATIONS	CHANNEL X	Indicates the active channel number.	CH1; CH2; CH3; CH4; CHX?
	SAVE MEMORY TO HARD DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu. Trace memory only.	SAVE “C:*.NRM”
	SAVE MEMORY TO FLOPPY DISK	Changes the soft-key display to the DSK3 menu, which lets you save memory to the floppy disk.	SAVE “A:*.NRM”
	RECALL MEMORY FROM HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu. Trace memory only.	RECALL “C:*.NRM”
	RECALL MEMORY FROM FLOPPY	Changes the soft-key display to the DSK2 menu, which lets you recall memory from the floppy disk.	RECALL “A:*.NRM”
	RETURN	Returns to the previous soft-key menu.	None

4-7 MARKER KEY MENUS

This key provides entry to marker functions.

Menu Name	Function	Description	GPIB Mnemonic
ALL DISPLAYED CHANNELS	ACTIVE MARKER XX	Selects the active marker on all channels	
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	CH1 - Sxx XXX.XXXXXXXXXGHz XXX.XXX dB XXX.XX °	Sets the marker value and displays the measure values for channel 1. The active channel is displayed in green others are in blue.	OAM1
	CH2 - Sxx XXX.XXXXXXXXXGHz XXX.XXX dB XXX.XX °	Sets the marker value and displays the measure values for channel 2. The active channel is displayed in green others are in blue.	OAM2
	CH3 - Sxx XXX.XXXXXXXXXGHz XXX.XXX dB XXX.XX °	Sets the marker value and displays the measure values for channel 3. The active channel is displayed in green others are in blue.	OAM3
	CH4 - Sxx XXX.XXXXXXXXXGHz XXX.XXX dB XXX.XX °	Sets the marker value and displays the measure values for channel 4. The active channel is displayed in green others are in blue.	OAM4
	MARKER READOUT FUNCTIONS	Changes the soft-key display to the MARKER READOUT FUNCTIONS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
ALL DISPLAYED CHANNELS (Power Sweep)	ACTIVE MARKER XX	Selects the active marker on all channels	
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	CH1 - Sxx	Sets the marker value and displays the measure values for channel 1. The active channel is displayed in green others are in blue.	OAM1
	XXX.XXXXXXXXXdBm		
	XXX.XXX dB		
	XXX.XX °		
	CH2 - Sxx	Sets the marker value and displays the measure values for channel 2. The active channel is displayed in green others are in blue.	OAM2
	XXX.XXXXXXXXXdBm		
	XXX.XXX dB		
	XXX.XX °		
	CH3 - Sxx	Sets the marker value and displays the measure values for channel 3. The active channel is displayed in green others are in blue.	OAM3
	XXX.XXXXXXXXXdBm		
	XXX.XXX dB		
	XXX.XX °		
	CH4 - Sxx	Sets the marker value and displays the measure values for channel 4. The active channel is displayed in green others are in blue.	OAM4
	XXX.XXXXXXXXXdBm		
	XXX.XXX dB		
	XXX.XX °		
	MARKER READOUT FUNCTIONS	Changes the soft-key display to the MARKER READOUT FUNCTIONS menu.	None
CH x - S XX REFERENCE PLANE X.XXXX mm	SELECT ∆REF XX	Selects the reference marker (1-12)	
	∆REF FREQ XXX.XXXXXXXXXGHz	Selects the frequency of the reference marker	DR1 - DR12
	∆(X-1) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 1	MK1?; OM1
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	∆(X-2) XXX.XXX dB ON/OFF	Selects the marker value, displays the measure values and toggles the delta marker 2	MK2?; OM2
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	∆(X-3) XXX.XXX dB ON/OFF	Selects the marker value, displays the measure values and toggles the delta marker 3	MK3?; OM3
	XXX.XX°		
	XXX.XXXXXXXXXGHz		
	∆(X-4) XXX.XXX dB ON/OFF	Selects the marker value, displays the measure values and toggles the delta marker 4	MK4?; OM4
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 2 menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CH x - S XX REFERENCE PLANE X.XXXX mm (Power Sweep)	SELECT ΔREF XX	Selects the reference marker (1-12)	
	ΔREF FREQ XXX.XXXXXXXXXdBm	Selects the frequency of the reference marker	DR1 - DR12
	Δ(X-1) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 1	MK1?; OM1
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	Δ(X-2) XXX.XXX dB ON/OFF	Selects the marker value, displays the measure values and toggles the delta marker 2	MK2?; OM2
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	Δ(X-3) XXX.XXX dB ON/OFF	Selects the marker value, displays the measure values and toggles the delta marker 3	MK3?; OM3
	XXX.XX°		
	XXX.XXXXXXXXXdBm		
	Δ(X-4) XXX.XXX dB ON/OFF	Selects the marker value, displays the measure values and toggles the delta marker 4	MK4?; OM4
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 2 menu.	None
CH x - S XX REFERENCE PLANE X.XXXX mm	SELECT ΔREF XX	Selects the reference marker (1-12)	
	ΔREF FREQ XXX.XXXXXXXXXGHz	Selects the frequency of the reference marker	DR1 - DR12
	Δ(X-5) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 5	MK5?; OM5
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	Δ(X-6) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 6	MK6?; OM6
	XXX.XX°		
	XXX.XXXXXXXXXGHz		
	Δ(X-7) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 7	MK7?; OM7
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	Δ(X-8) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 8	MK8?; OM8
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 32 menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CH x - S XX REFERENCE PLANE X.XXXX mm (Power Sweep)	SELECT ΔREF XX	Selects the reference marker (1-12)	
	ΔREF FREQ XXX.XXXXXXXXXdBm	Selects the frequency of the reference marker	DR1 - DR12
	Δ(X-5) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 5	MK5?; OM5
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	Δ(X-6) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 6	MK6?; OM6
	XXX.XX°		
	XXX.XXXXXXXXXdBm		
	Δ(X-7) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 7	MK7?; OM7
	XXX.XX °		
	XXX.XXXXXXXXXdBmz		
	Δ(X-8) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 8	MK8?; OM8
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 32 menu.	None
CH x - S XX REFERENCE PLANE X.XXXX mm	SELECT ΔREF XX	Selects the reference marker (1-12)	
	ΔREF FREQ XXX.XXXXXXXXXGHz	Selects the frequency of the reference marker	DR1 - DR12
	Δ(X-9) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 9	MK9?; OM9
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	Δ(X-10) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 10	MK10?; OM10
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	Δ(X-11) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the deltat marker 11	MK11?; OM11
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	Δ(X-12) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 12	MK12?; OM12
	XXX.XX °		
	XXX.XXXXXXXXXGHz		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 1 menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CH x - S XX REFERENCE PLANE X.XXXX mm (Power Sweep)	SELECT ΔREF XX	Selects the reference marker (1-12)	
	ΔREF FREQ XXX.XXXXXXXXXdBm	Selects the frequency of the reference marker	DR1 - DR12
	Δ(X-9) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 9	MK9?; OM9
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	Δ(X-10) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 10	MK10?; OM10
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	Δ(X-11) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the deltat marker 11	MK11?; OM11
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	Δ(X-12) XXX.XXX dB ON/OFF	Sets the marker value, displays the measure values and toggles the delta marker 12	MK12?; OM12
	XXX.XX °		
	XXX.XXXXXXXXXdBm		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 1 menu.	None
CH x - S XX REFERENCE PLANE X.XXXX mm	REFERENCE PLANE X.XXXX mm	Displays the reference plane distance	RDD?
	1: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 1. Values are not displayed when the marker is turn off	MR1; MK1?; OM1
	XXX.XXX dB		
	XXX.XX °		
	2: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 2. Values are not displayed when the marker is turn off	MR2; MK2?; OM2
	XXX.XXX Db		
	XXX.XX °		
	3: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 3. Values are not displayed when the marker is turn off	MR3; MK3?; OM3
	XXX.XXX dB		
	XXX.XX °		
	4: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 4. Values are not displayed when the marker is turn off	MR4; MK4?; OM4
	XXX.XXX dB		
	XXX.XX °		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 5 menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CH x - S XX REFERENCE PLANE X.XXXX mm	REFERENCE PLANE X.XXXX mm	Displays the reference plane distance	RDD?
	5: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 5. Values are not displayed when the marker is turn off	MR5; MK5?; OM5
	XXX.XXX dB		
	XXX.XX °		
	6: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 6. Values are not displayed when the marker is turn off.	MR6; MK6?; OM6
	XXX.XXX dB		
	XXX.XX °		
	7: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 7. Values are not displayed when the marker is turn off.	MR7; MK7?; OM7
	XXX.XXX dB		
	XXX.XX °		
	8: XXX.XXXXXXXXXGHz ON/OFF	Sets the marker value and displays the measure values for marker 8. Values are not displayed when the marker is turn off.	MR8; MK8?; OM8
	XXX.XXX dB		
	XXX.XX °		
	MARKER TO PEAK	Changes the soft-key display to the MARKER TO PEAK menu	None
	MORE	Change soft-key to an CH x - S XX etc. 6 menu.	None

<table>
<tr><th>Menu Name</th><th>Function</th><th>Description</th><th>GPIB Mnemonic</th></tr>
<tr><td rowspan="17">CH x - S XX REFERENCE PLANE X.XXXX mm 6</td><td>REFERENCE PLANE X.XXXX mm</td><td>Displays the reference plane distance</td><td>RDD?</td></tr>
<tr><td>9: XXX.XXXXXXXXXGHz ON/OFF</td><td rowspan="3">Sets the marker value and displays the measure values for marker 9. Values are not displayed when the marker is turn off</td><td rowspan="3">MR9; MK9?; OM9</td></tr>
<tr><td>XXX.XXX dB</td></tr>
<tr><td>XXX.XX °</td></tr>
<tr><td>10: XXX.XXXXXXXXXGHz ON/OFF</td><td rowspan="3">Sets the marker value and displays the measure values for marker 10. Values are not displayed when the marker is turn off</td><td rowspan="3">MR10; MK10?; OM10</td></tr>
<tr><td>XXX.XXX dB</td></tr>
<tr><td>XXX.XX °</td></tr>
<tr><td>11: XXX.XXXXXXXXXGHz ON/OFF</td><td rowspan="3">Sets the marker value and displays the measure values for marker 11. Values are not displayed when the marker is turn off</td><td rowspan="3">MR11; MK11?; OM11</td></tr>
<tr><td>XXX.XXX dB</td></tr>
<tr><td>XXX.XX °</td></tr>
<tr><td>12: XXX.XXXXXXXXXGHz ON/OFF</td><td rowspan="3">Sets the marker value and displays the measure values for marker 12. Values are not displayed when the marker is turn off</td><td rowspan="3">MR12; MK12?; om12</td></tr>
<tr><td>XXX.XXX dB</td></tr>
<tr><td>XXX.XX °</td></tr>
<tr><td>MARKER TO PEAK</td><td>Changes the soft-key display to the MARKER TO PEAK menu</td><td>None</td></tr>
<tr><td>MORE</td><td>Change soft-key to an CH x - S XX etc. 4 menu.</td><td>None</td></tr>
<tr style="display:none"></tr>
<tr style="display:none"></tr>
<tr><td rowspan="8">FILTER PARAMETERS</td><td>CENTER FREQ XX.XXXXXXXX GHz</td><td>Displays the value of Marker 2. Marker 1 displays the reference value (maximum filter response, or its set value if delta ref).</td><td>FLTC?</td></tr>
<tr><td>BANDWIDTH -XX.XXX dB</td><td>Displays the difference between Markers 3 and 4.</td><td>FLTBW?</td></tr>
<tr><td>SEARCH REFERENCE XXX.XXX GHz</td><td>Maximum value, ΔREF MARKER or 0 dB.</td><td>MSRX?</td></tr>
<tr><td>LOSS AT REF -XXX.XXX dB</td><td>Displays the difference between the reference value and 0 dB.</td><td>FLTL?</td></tr>
<tr><td>Q XXXX.XXX</td><td>Displays the Q value, if Q readout is on.</td><td>FLTQ?</td></tr>
<tr><td>SHAPE FACTOR XXXX.XXX</td><td>Displays the Shape Factor value, if Shape Factor is on.</td><td>FLTS?</td></tr>
<tr><td>FILTER SETUP</td><td>Change soft-key to FILTER SETUP menu.</td><td>None</td></tr>
<tr><td>MARKER READOUT FUNCTIONS</td><td>Changes the soft-key display to the MARKER READOUT FUNCTIONS menu.</td><td>None</td></tr>
</table>

Menu Name	Function	Description	GPIB Mnemonic
FILTER SETUP	BANDWIDTH LOSS VALUE XX.XXX dB	A loss is a positive number. A value of 0 to 999.999 dB may be entered. The search value for bandwidth will be REF minus (-) LOSS. By default the loss value is set to 3 dB.	BWLS
	SETUP SEARCH	Change soft-key to SETUP SEARCH menu.	None
	SHAPE FACTOR		None
	HIGH XXX.XXX dB	Enter high value for the Shape Factor.	MSFH
	LOW XXX.XXX dB	Enter low value for the Shape Factor The LOW entry must be less than the HIGH entry. A value of 0 to 999.999 dB may be entered. The defaults are +6 dB for the HIGH, and +60 dB for the LOW value.	MSFL
	READOUTS		None
	Q ON/OFF	Toggles Q on or off.	DSQ1; DSQ0; DSQX?
	SHAPE FACTOR ON/OFF	Toggles the Shape Factor on or off.	DSF1; DSF0; DSF?
	RETURN	Returns to the previous soft-key menu.	None
MARKERS	READOUT MARKERS	Changes the soft-key display to one of the READOUT MARKER menu.	None
	MARKER READOUT FUNCTIONS	Changes the soft-key display to the MARKER READOUT FUNCTION menu.	None
	DISPLAY MARKERS ON/OFF	Toggles marker display on or off.	MON; MOF
	ΔREF MODE ON/OFF	Toggles Delta Reference mode on or off.	DRF; DRO; DRO?
	SCREEN DISPLAY ON/OFF		
	MARKER MODE CONTINUOUS	Marker values are interpolated between data points. Interpolated markers are allowed only when the horizontal axis of the display is FREQUENCY. Interpolated markers are not allowed in CW, Time Domain, or Power sweep. If a channel has been set to interpola	MKRC
	DISCRETE	Markers are displayed only at actual measured data point values.	MKRD

Menu Name	Function	Description	GPIB Mnemonic
MARKERS (Power Sweep)	READOUT MARKERS	Changes the soft-key display to one of the READOUT MARKER menu.	None
	MARKER READOUT FUNCTIONS	Changes the soft-key display to the MARKER READOUT FUNCTION menu.	None
	DISPLAY MARKERS ON/OFF	Toggles marker display on or off.	None
	ΔREF MODE ON/OFF	Toggles Delta Reference mode on or off.	None
	SCREEN DISPLAY ON/OFF	Toggles screen display on or off.	None
	STATISTIC DISPLAY ON/OFF	Toggles statistic display on or off.	None
	MARKER MODE CONTINUOUS	Marker values are interpolated between data points. Interpolated markers are allowed only when the horizontal axis of the display is FREQUENCY. Interpolated markers are not allowed in CW, Time Domain, or Power sweep. If a channel has been set to interpola	None
	DISCRETE	Markers are displayed only at actual measured data point values.	None
MARKER READOUT FUNCTIONS	MARKERS ON ACTIVE CHANNEL	Selects normal markers on active channel marker mode and changes the soft-key display to one of the REFERENCE PLANE menus.	NMKR; XMKR?
	ACTIVE MARKER ON ALL CHANNELS	Selects active marker on all channels marker mode and changes the soft-key display to the Marker X on all displayed channel menus.	AMKR; XMKR?
	SEARCH	Selects marker search marker mode and changes the soft-key display to the SEARCH menu.	SMKR; XMKR?
	FILTER PARAMETERS	Selects filter parameters marker mode and changes the soft-key display to the FILTER PARAMETERS menu.	FMKR; XMKR?
	SEARCH (X-AXIS)	Selects marker search x-axis marker mode and changes the soft-key display to the SEARCH (X-AXIS) menu.	SMKRX; XMKR?
	RETURN	Returns to the previous soft-key menu.	None
MARKER READOUT FUNCTIONS (Power Sweep)	MARKERS ON ACTIVE CHANNEL	Selects normal markers on active channel marker mode and changes the soft-key display to one of the REFERENCE PLANE menus.	NMKR; XMKR?
	ACTIVE MARKER ON ALL CHANNELS	Selects active marker on all channels marker mode and changes the soft-key display to the Marker X on all displayed channel menus.	AMKR; XMKR?
	SEARCH	Selects marker search marker mode and changes the soft-key display to the SEARCH menu.	SMKR; XMKR?
	FILTER PARAMETERS	Not allowed in power sweep mode.	None
	SEARCH (X-AXIS)	Selects marker search x-axis marker mode and changes the soft-key display to the SEARCH (X-AXIS) menu.	SMKRX; XMKR?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
MARKER TO PEAK	MARKER TO MAX	Moves the active marker to the maximum readout value.	MMX
	MARKER TO MIN	Moves the active marker to the minimum readout value.	MMN
MAXIMUM RETURN	SELECT MODE AUTO/MANUAL XXXX MHz	Toggles the maximum returm mode between auto or manual. When manual mode is selected, enter the frequency for the maximum return mode.	MSRMRA; MSRMRM; MSRMRX?; MSRMRV; MSRMRV?
	RETURN	Chnages the soft-key display to the SETUP SEARCH menu.	
SEARCH	VALUE XX.XX dB	Target search value. A value from -999.999 to 999.999 dB may be entered.	SRCH
	SETUP SEARCH	Changes the soft-key display to the SETUP SEARCH menu.	None
	VALUE AT REFERENCE -81.767	Displays the frequency, time, or distance of the search marker.	OM1
	SEARCH LEFT XXX.XXXXXXXX GHz	Searches for the next data point to the left of the search marker (Marker 2), where value is VALUE above.	MKSL; MK2?
	SEARCH RIGHT XXX.XXXXXXXX GHz	Searches for the next data point to the right of the search marker (Marker 2), where value is VALUE above.	MKSR
	SEARCH MRKR VALUES		None
	CH1: XX.XXX dB	Displays the Channel 1 value at the SEARCH marker.	None
	CH2: XX.XXX dB	Displays the Channel 2 value at the SEARCH marker.	None
	CH3: XX.XXX dB	Displays the Channel 3 value at the SEARCH marker.	None
	CH4: XX.XXX dB	Displays the Channel 4 value at the SEARCH marker.	None
	MARKER READOUT FUNCTIONS	Changes the soft-key display to the MARKER READOUT FUNCTIONS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SEARCH (Power Sweep)	VALUE XX.XX dB	Target search value. A value from -999.999 to 999.999 dB may be entered.	SRCH
	SETUP SEARCH	Changes the soft-key display to the SETUP SEARCH menu.	None
	VALUE AT REFERENCE -81.767	Displays the frequency, time, or distance of the search marker.	OM1
	SEARCH LEFT XXX.XXXXXXXX dBm	Searches for the next data point to the left of the search marker (Marker 2), where value is VALUE above.	MKSL; MK2?
	SEARCH RIGHT XXX.XXXXXXXX dBm	Searches for the next data point to the right of the search marker (Marker 2), where value is VALUE above.	MKSR
	SEARCH MRKR VALUES		None
	CH1: XX.XXX dB	Displays the Channel 1 value at the SEARCH marker.	None
	CH2: XX.XXX dB	Displays the Channel 2 value at the SEARCH marker.	None
	CH3: XX.XXX dB	Displays the Channel 3 value at the SEARCH marker.	None
	CH4: XX.XXX dB	Displays the Channel 4 value at the SEARCH marker.	None
	MARKER READOUT FUNCTIONS	Changes the soft-key display to the MARKER READOUT FUNCTIONS menu.	None
SEARCH (X-AXIS)	Y VALUE XX.XXX DB	Enters the marker search Y-value.	SRCH; SRCH?
	X VALUE XX.XXX DBM	Displays the marker search X-value.	SRCHX?; SRCHFX?
	MARKER READOUT FUNCTION	Returns to the previous soft-key menu.	None
SEARCH (X-AXIS)	In Power Sweep Mode.		
	Y VALUE XX.XXX DB	Enters the marker search Y-value.	SRCHP; SRCHP?
	X VALUE XXX.XXXXXXXX MHZ	Displays the marker search X-value.	SRCHXP?; SRCHFXP?
	MARKER READOUT FUNCTION	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SETUP SEARCH	SELECT REFERENCE		
	MAXIMUM VALUE	Selects maximum readout value as the reference.	MSRM; MSRX?
	ΔREF MARKER	SelectsΔRef Marker (Marker 1) as the reference.	MSRD; MSRX?
	0 dB	Selects 0 dB as the reference.	MSR0; MSRX?
	TRACKING ON/OFF	When ON the active marker will change its frequency value after every sweep to maintain the user entered loss value. When OFF the marker stays at the same frequency and reads out the magnitude value at that frequency, except when a search is triggered.	MKT1; MKT0; MSRX?
	MAXIMUM RETURN	Selects maximum return as the reference for the marker search and bandwidth calculation. Changes the soft-key display to the MAXIMUM RETURN menu.	MSRMR
	RETURN	Returns to the previous soft-key menu.	None
SETUP SEARCH (Power Sweep)	SELECT REFERENCE		
	MAXIMUM VALUE	Selects maximum readout value as the reference.	None
	ΔREF MARKER	SelectsΔRef Marker (Marker 1) as the reference.	None
	0 dB	Selects 0 dB as the reference.	None
	TRACKING ON/OFF	When ON the active marker will change its frequency value after every sweep to maintain the user entered loss value. When OFF the marker stays at the same frequency and reads out the magnitude value at that frequency, except when a search is triggered.	None
	RETURN	Returns to the previous soft-key menu.	None

4-8 FREQ KEY MENUS

This key provides entry to frequency functions.

Menu Name	Function	Description	GPIB Mnemonic
DISCRETE FILL	START FREQ XXX.XXXXXXXX GHz	Enter the first frequency of the range.	FRS; FRS?
	INCREMENT XXX.XXXXXXXX GHz	Enter the increment (step size) between one frequency and the next.	FRI; FRI?
	NUMBER OF POINTS XX POINT(S)	Enter the number of frequency points in the range.	FRP; FRP?
	STOP FREQ XXX.XXXXXXXX GHz	Displays the stop frequency, in GHz.	None
	FILL THE RANGE (XXX ENTERED)	Fills the range and shows the total number of frequencies entered.	FIL
	INDIVIDUAL FREQ INSERT	Changes the soft-key display to the INDIVIDUAL FREQUENCY INSERT menu.	None
	CLEAR ALL	Clears all entries displayed above.	FRC
	RETURN	Returns to the previous soft-key menu.	DFD
FREQUENCY	START XXX.XXXXXXXX GHz	Enter the sweep-start frequency in GHz. The start frequency must be lower than the stop frequency.	SRT; MxS(x=1-12) SRT?
	STOP XXX.XXXXXXXX GHz	Enter the sweep-stop frequency in GHz. The stop frequency must be higher than the start frequency.	STP; MxE(x=1-12) STP?
	SET CENTER/SPAN	Changes the soft-key display to the FREQUENCY 2 menu.	None
	C.W. MODE XXX.XXXXXXXX GHz ON/OFF	Enables the CW mode. Enter CW frequency for measurements.	CWF; MxC(x=1-12); CWON; SWP; SWP?; CWON?
	MARKER SWEEP	Changes the soft-key display to the FREQUENCY MARKER-SWEEP menu.	None
	DISCRETE FILL	Changes the soft-key display to the DISCRETE FILL menu.	None
	XXX.XXXXXXXX GHz STEP SIZE XXX DATA POINT(S)	Displays the number of frequency points and the spacing between points for the start and stop frequencies selected above. The number of points shown provides the finest frequency resolution possible, based on the number of data points.	None
FREQUENCY (Power Sweep)	START XXX.XXXXXXXX GHz	Enter the sweep-start frequency in GHz. The start frequency must be lower than the stop frequency.	MxS(x=1-12) SRT?
	STOP XXX.XXXXXXXX GHz	Enter the sweep-stop frequency in GHz. The stop frequency must be higher than the start frequency.	MxE(x=1-12) STP?
	C.W. MODE XXX.XXXXXXXX GHz ON/OFF	Enables the CW mode. Enter CW frequency for measurements.	CWF; MxC(x=1-12); CWON; SWP; SWP?; CWON?

Menu Name	Function	Description	GPIB Mnemonic
FREQUENCY (In Segmented Sweep Frequency Mode)	START XXX.XXXXXXXX MHZ	Enter the start frequency of the active defined segment for the segmented sweep.	DSGSRT; DSGSRT?
	STOP XXX.XXXXXXXX MHZ	Enter the stop frequency of the active defined segment for the segmented sweep.	DSGSTP; DSGSTP?
	STEP SIZE VARIABLE FOR SEGMENTED SWEEP		None
	XXX POINT(S)	Enter the number of points for the active defined segment for the segmented sweep.	DSGPTS; DSGPTS?
FREQUENCY 2	CENTER XXX.XXXXXXXX GHz	Enter the center frequency in GHz.	CNTR; CNTR?
	SPAN XXX.XXXXXXXX GHz	Enter the span frequency in GHz.	SPAN: SPAN?
	SET START/STOP	Changes the soft-key display to the FREQUENCY menu.	None
	C.W. MODE XXX.XXXXXXXX GHz ON/OFF	Enables the CW mode. Enter CW frequency for measurements.	CWF; MxC(x=1-12); CWON; SWP; SWP?; CWON?
	MARKER SWEEP	Changes the soft-key display to the FREQUENCY MARKER-SWEEP menu.	None
	DISCRETE FILL	Changes the soft-key display to the DISCRETE FILL menu.	None
	XXX.XXXXXXXX GHz STEP SIZE XXX DATA POINT(S)	Displays the number of frequency points and the spacing between points for the center and span frequencies selected above. The number of points shown provides the finest frequency resolution possible, based the number of data points.	None
FREQUENCY MARKER - C.W.	C.W. FREQ MARKER(n) XXX.XXXXXXXX GHz	Selecting a number on the keypad causes the associated marker to be the C.W. frequency.	M1C-M12C
	USE KEYPAD TO SELECT MARKER (1-12).	Use the keypad to select markers 1 through 12.	None
	RETURN	Returns to the previous soft-key menu.	None
FREQUENCY MARKER - SWEEP	START SWEEP MARKER(n) XXX.XXXXXXXX GHz	Selecting a number on the keypad causes the associated marker to be the start frequency of the sweep.	M1S-M12S
	STOP SWEEP MARKER(n) XXX.XXXXXXXX GHz	Selecting a number on the keypad causes the associated marker to be the stop frequency of the sweep.	M1E-M12E
	RESTORE FULL SWEEP	Sets START and STOP frequencies to the full range of the instrument.	None
	USE KEYPAD TO SELECT MARKER (1-12).	Use the keypad to select markers 1 through 12.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
INDIVIDUAL FREQ INSERT	NEXT FREQUENCY XXX.XXXXXXXX GHz	Enter the individual frequency, in GHz.	DFQ; DFQ?
	INSERT NEXT FREQUENCY	Inserts the NEXT FREQUENCY (above) into the list of individual frequencies.	None
	XX FREQS ENTERED	Displays the number of frequencies in the list.	None
	LAST FREQ WAS XXX.XXXXXXXX GHz	Displays the last frequency entered.	None
	AUTO INCR XXX.XXXXXXXX GHz ON/OFF	Toggles Auto Increment mode on or off, and sets the increment value.	None
	RETURN	Returns to the previous soft-key menu.	None

4-9 SWEEP KEY MENUS

This key provides entry to frequency sweep functions.

Menu Name	Function	Description	GPIB Mnemonic
APPLY SEGMENTED SWEEP	CONTINUE	Applies the currently defined definition of the segmented sweep and changes the soft-key display to the previous menu.	SGAPL
	REVERT TO CAL SETUP	Changes the soft-key display to a previous menu.	None
	ABORT	Changes the soft-key display to a previous menu.	None
	WARNING CONTINUING WILL CLEAR RF CAL!!!!!!		None
CLEAR ALL DEFINED SEGMENTS	CONTINUE	Clears all the defined segments of segmented sweep and changes the soft-key display to the previous menu.	CLRDSG
	ABORT	Changes the soft-key display to the previous soft-key menu.	None
	WARNING CONTINUING WILL CLEAR ALL DEFINED SEGMENTS!!!!!!		None
DEFINE SEGMENTED SWEEP 1	SEGMENT ON/OFF 1	Toggles the sweep segment on or off.	DSGON; DSGOFF; DSG
	ADD NEXT SEGMENT	Adds the next defined segment to the segmented sweep.	ADDNDSG
	START XXX.XXXXXXXX GHZ	Enters the start frequency of the segmented sweep.	DSGSTRT; DSGSTRT?; SGSTRT?
	STOP XXX.XXXXXXXX GHZ	Enters the stop frequency of the segmented sweep.	DSGSTP; DSGSTP?; SGSTP?
	DATA POINTS XXX POINTS	Selects the segmented sweep calibration data points.	DGSPTS; SGPTS?
	SEGMENTED ON/OFF SWEEP LOG	Displays the segmented sweep log and changes the soft-key display to the SEGMENTED SWEEP LOG menu.	OSGLOG
	MORE	Changes the soft-key display to the DEFINE SEGMENTED SWEEP 2 menu.	None
	RETURN	Changes the soft-key display to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
DEFINE SEGMENTED SWEEP 2	SEGMENT ON/OFF 1	Toggles the define sweep segment on or off.	DSGON; DSGOFF; DSG?
	DISCRETE FILL	Changes the soft-key display to the SEGMENTED SWEEP DISCRETE FILL menu.	None
	SELECT IFBW (1 KHZ)	Changes the soft-key display to the SEGMENTED SWEEP I.F. BANDWIDTH menu.	None
	DATA AVERAGE 1 MEAS./POINT	Enters the averaging count for the active defined segment.	DSGAVG; DSGAVG?
	SOURCE 1 POWER XX.XXXX DBM	Enters the Source 1 power level for the active segment.	DSGPWR1; DSGPWR1?
	SOURCE 2 POWER XX.XXXX DBM	Enters the Source 2 power level for the active segment.	DSGPWR2; DSGPWR2?
	MORE	Changes the soft-key display to the previous soft-key menu.	None
	RETURN	Changes the soft-key display to the previous soft-key menu.	None
MEASUREMENT ENHANCEMENT	CHOP SWEEP ON/OFF	Toggles Chop Sweep mode on or off.	SWPC1; SWPC0; SWPCX?
	CHOP MODE TYPE		
	PER PORT	Sets Chop Mode to PER PORT.	PERPORT; CHOPMODE?
	ALL PARAMS	Sets Chop Mode to MEASURE ALL S-PARAMS	SPARAM CHOPMODE?
	SPUR AVOIDANCE		None
	OFF	Turns Spur Avoidance mode off.	SPA0; SPAX?
	ON	Turns Spur Avoidance mode on.	SPA1; SPAX?
	RETURN	Returns to the previous soft-key menu.	None
SEGMENTED SWEEP	SEGMENTED ON/OFF SWEEP	Turns the Segmented Sweep Flag on or off.	SGON; SGOFF; SG?
	SEGMENTED SWEEP MODE APPLY	Applies the currently defined definition of the segmented sweep and changes the soft-key display to the APPLY SEGMENTED SWEEP menu.	SGAPL
	DEFINE	Changes the soft-key display to the DEFINE SEGMENTED SWEEP 1 menu.	None
	CLEAR ALL SEGMENTS	Changes the soft-key display to the CLEAR ALL DEFINED SEGMENTS menu.	None
	DELETE LAST SEGMENT	Deletes the last defined segment of the segmented sweep.	DELLDSG
	SEGMENTED SWEEP LOG	Displays the segmented sweep log.	OSGLOG
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	

Menu Name	Function	Description	GPIB Mnemonic
SEGMENTED SWEEP DISCRETE FILL	START FREQ XXX.XXXXXXXX MHZ	Enters the discrete fill start frequency for the active discrete segment.	DSGFRS; DSGFRS?
	INCREMENT XXX.XXXXXXXX MHZ	Enters the segmented sweep discrete fill increment frequency for the active discrete segment.	DSGFRI; DSGFRI?
	NUMBER OF POINTS 1 POINT(S)	Enters the segmented sweep discrete fill number of points for the active discrete segment.	DSGFRP; DSGFRP?
	STOP FREQ XXX.XXXXXXXX MHZ	Displays the discrete fill stop frequency for the active discrete segment.	None
	FILL THE RANGE (0 ENTERED)	Fills the defined discrete frequency range for the active discrete segment.	DSGFIL
	INDIVIDUAL FREQ INSERT	Changes the soft-key display to the SEGMENTED SWEEP INDIVIDUAL FREQ INSERT menu.	None
	CLEAR ALL	Clears all of the defined discrete frequency ranges for the active discrete segment.	DSGFRC
	RETURN	Changes the soft-key display to the previous soft-key menu.	DSGDFD
SEGMENTED SWEEP I.F. BANDWIDTH	I.F.BW 30 KHZ	Sets the IFBW to 30 kHz for the active defined segment in segmented sweep.	DSGIFBW30K; DSGIFBWX?
	I.F.BW 10 KHZ	Sets the IFBW to 10 kHz for the active defined segment in segmented sweep.	DSGIFBW10K; DSGIFBWX?
	I.F.BW 3 KHZ	Sets the IFBW to 3 kHz for the active defined segment in segmented sweep.	DSGIFBW3K; DSGIFBWX?
	I.F.BW 1 KHZ	Sets the IFBW to 1 kHz for the active defined segment in segmented sweep.	DSGIFBW1K; DSGIFBWX?
	I.F.BW 300 HZ	Sets the IFBW to 300 Hz for the active defined segment in segmented sweep.	DSGIFBW300; DSGIFBWX?
	I.F.BW 100 HZ	Sets the IFBW to 100 Hz for the active defined segment in segmented sweep.	DSGIFBW100; DSGIFBWX?
	I.F.BW 30 HZ	Sets the IFBW to 30 Hz for the active defined segment in segmented sweep.	DSGIFBW30; DSGIFBWX?
	I.F.BW 10 HZ	Sets the IFBW to 10 Hz for the active defined segment in segmented sweep.	DSGIFBW10; DSGIFBWX?
SEGMENTED SWEEP INDIVIDUAL FREQ INSERT	NEXT FREQUENCY XXX.XXXXXXXX MHZ	Enters the next single discrete frequency for the active discrete segment.	DSGDFQ; DSGDFQ?
	INSERT NEXT FREQ 0 FREQ ENTERED	Enters a single discrete frequency for the active discrete segment.	DSGDFQ; DSGDFQ?
	LAST FREQ WAS XXX.XXXXXXXX MHZ	Displays the last inserted frequency.	None
	AUTO INCREMENT XXX.XXXXXXXX MHZ	Displays the auto-increment frequency.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SEGMENTED SWEEP LOG	PRINT LOG	Sends the segmented sweep log to a printer.	PSGLOG
	SAVE SEG SWP LOG TO FLOPPY DISK	Saves the segmented sweep log to a floppy disk.	SAVE
	FIRST PAGE	Displays the first page of the segmented sweep log.	None
	PREVIOUS PAGE	Displays the previous page of the segmented sweep log.	None
	NEXT PAGE	Displays the next page of the segmented sweep log.	None
	RETURN	Returns to the previous soft-key menu.	None
SWEEP	ALTERNATE SWEEP ON/OFF	Toggles Alternate Sweep mode on or off.	ALTS0; ALTS1; ALTSX?
	SWEEP TYPE FREQUENCY SWEEP/POWER SWEEP	Select sweep type.	FSWP; PSWP; SWPX?
	TUNE MODE ON/OFF	Toggles Tune mode on or off.	TUNE1; TUNE0; TUNEX?
	TUNE MODE COUNT XXXX SWEEPS (XXXX REMAINING)	Sets the Tune mode count.	TUNESWP; TUNESWP?
	SWEEP TIME ON/OFF	Toggles sweep time measurement on/off	SWPT0; SWPT1; SWPTX?
	SWEEP TIME X.XX S	Sets sweep time, if mode is manual. Displays sweep time, if mode is auto.	SWPT; SWPT?
	SWEEP TIME MODE AUTO/MANUAL	Toggles between auto and manual Sweep Time mode.	SWPTMA; SWPTMM; SWPMX?
	MORE	Changes the soft-key display to the SWEEP 2 menu.	None
SWEEP 2	TRIGGERS	Changes the soft-key display to the TRIGGERS menu.	None
	MEASUREMENT ENHANCEMENT	Changes the soft-key display to the MEASUREMENT ENHANCEMENT menu.	None
	FLICKERING ON/OFF	Slows down sweep to eliminate flickering.	FLICK0; FLICK1; FLICKX?
	DATA DRAWING ON/OFF	Toggles Data Drawing mode on or off.	None
	SEGMENTED SWEEP	Changes the soft-key display to the SEGMENTED SWEEP menu.	None
	RETURN	Returns to the previous soft-key menu.	None
TRIGGERS	MEASUREMENT		None
	INTERNAL	Selects internal sweep trigger.	TIN; TXX?
	EXTERNAL	Selects external sweep trigger.	TEX; TXX?
	I.F. CALIBRATION		None
	AUTOMATIC I.F. CAL ON/OFF	Toggles automatic IF calibration on or off.	HC1; HC0; HCX?
	TRIGGER I.F. CAL	Triggers an IF calibration.	HCT
	RETURN	Returns to the previous soft-key menu.	None

4-10 POWER KEY MENUS

This key provides entry to power functions.

Menu Name	Function	Description	GPIB Mnemonic
FLAT TEST PORT POWER CALIBRATION	FLAT POWER CALIBRATION		None
	CALIBRATING TEST PORT		None
	PRESS <CLEAR> TO ABORT	Aborts the calibration.	ABORTCAL
POWER	SOURCE 1 SETUP	Changes the soft-key display to the Source 1 SETUP menu.	None
	SOURCE 2 SETUP	Changes the soft-key display to the Source 2 SETUP menu.	None
	SOURCE 3 SETUP	Changes the soft-key display to the Source 3 SETUP menu.	None
	SOURCE 4 SETUP	Changes the soft-key display to the Source 4 SETUP menu.	None
	RECEIVER CAL	Changes the soft-key display to the Receiver SETUP menu.	None
POWER (Power Sweep)	SELECT SOURCE X		PSRC; PSRC?
	START XXX.XXXXXXXX dBm	Enter the sweep-start power in dBm. The start power must be lower than the stop power.	STRTP; STRTP?
	STOP XXX.XXXXXXXX dBm	Enter the sweep-stop power in dBmz. The stop power must be higher than the start power.	STOPP; STOPP?
	SET CENTER/SPAN	Changes the soft-key display to the POWER 2 menu.	None
	STEP SIZE XXX.XXXXXXXX dBm	Displays the number of frequency points and the spacing between points for the start and stop power levels selected above. The number of points shown provides the finest power-sweep resolution possible, based on the number of data points.	STEPP; STEPP?
	SINGLE POWER ON/OFF XXX.XXXXXXXX dBm	Toggles single power on or off.	SINP0; SINP2; SINPX?
	SOURCE SETUP	Change soft-key display to the SOURCE SETUP menu.	None
	xxx DATA POINTS	Indicates the number of data points selected (For display only)	None
POWER (Power Sweep)	MARKER SWEEP		None
	RECEIVER CAL (WARNING: SYSTEM IS SWITCHED TO FREQ SWP MODE RECEIVER CAL)		None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
POWER 2 (Power Sweep)	SELECT SOURCE X	Select source.	PSRC; PSRC?
	CENTER XXX.XXXXXXXX dBm	Enter the center power in dBm. The start frequency must be lower than the stop frequency.	None
	SPAN XXX.XXXXXXXX dBm	Enter the span power range in dBm. The stop frequency must be higher than the start frequency.	None
	SET START/STOP	Changes the soft-key display to the FREQUENCY 2 menu.	None
	XXX.XXXXXXXX dBm STEP SIZE	Displays the number of frequency points and the spacing between points for the start and stop frequencies selected above. The number of points shown provides the finest frequency resolution possible, based on the number of data points.	STEPP; STEPP?
	SINGLE POWER ON/OFF xxx.xxxxxxxx dBm	Toggles single power on or off.	SINP0; SINP1; SINPX?; SINP; SINP?
	SOURCE SETUP	Change soft-key display to the SOURCE SETUP menu.	None
	XXX DATA POINT(S)	Indicates the number of data points selected (For display only)	None
POWER MARKER - SINGLE POWER	SINGLE POWER MARKER(n) XX.XX dBm	Selecting a number on the keypad causes the associated marker to be a single power level.	None
	USE KEYPAD TO SELECT MARKER (1-12).	Use the keypad to select markers 1 through 12.	None
	RETURN	Returns to the previous soft-key menu.	None
POWER MARKER - SWEEP	START SWEEP MARKER(n) XX.XX dBm	Selecting a number on the keypad causes the associated marker to be the start power of the sweep.	None
	STOP SWEEP MARKER(n) XX.XX dBm	Selecting a number on the keypad causes the associated marker to be the stop power of the sweep.	None
	RESTORE FULL SWEEP	Sets START and STOP frequencies to the full power range of the instrument.	None
	USE KEYPAD TO SELECT MARKER (1-12).	Use the keypad to select markers 1 through 12.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
RECEIVER CALIBRATION	CONNECT A THROUGHLINE BETWEEN TEST PORTS		None
	RECEIVER PORT: PORT1/PORT2/ PORT3	Select Receiver port. Port 3 is not offered unless it is installed.	RCALRP1; RCALRP2; RCALRP3; RCALRPX?
	SOURCE PORT: PORT1/PORT2/ PORT3	Select Source port. Port 3 is not offered unless it is installed.	RCALSP1; RCALSP2; RCALSP3
	BEGIN CAL	Initiates Receiver calibration.	BEGR
	RETURN	Returns to the previous soft-key menu.	None
RECEIVER CALIBRATION (Power Sweep)	CONNECT A THROUGHLINE BETWEEN TEST PORTS		None
	RECEIVER PORT: PORT1/PORT2/ PORT3	Select Receiver port. Port 3 is not offered unless it is installed.	RCALRP1; RCALRP2; RCALRP3; RCALRPX?
	SOURCE PORT: PORT1/PORT2/ PORT3	Select Source port. Port 3 is not offered unless it is installed.	RCALSP1; RCALSP2; RCALSP3; RCALSPX?
	BEGIN CAL	Initiates Receiver calibration.	BEGR
	RETURN	Returns to the previous soft-key menu.	None
RECEIVER CALIBRATION 2	MEASURING		None
	ABORT	Aborts calibration.	ABORTCAL
RECEIVER CALIBRATION 2 (Power Sweep)	MEASURING		None
	ABORT	Aborts calibration.	ABORTCAL
RECEIVER SETUP	RECEIVER CAL	Changes the soft-key display to the RECEIVER CALIBRATION menu.	None
	RECEIVER CAL ON/OFF FOR PORT 1 ((NO) CAL EXISTS)	Toggles Receiver calibration for Port 1 on or off.	RCALP11; RCALP10; RCALP1X?; RCALP1DONE?
	RECEIVER CAL ON/OFF FOR PORT2 ((NO) CAL EXISTS)	Toggles Receiver calibration for Port 2 on or off.	RCALP21; RCALP20; RCALP2X?; RCALP2DONE?
	RECEIVER CAL ON/OFF FOR PORT3 ((NO) CAL EXISTS)	Toggles Receiver calibration for Port 3 on or off.	RCALP31; RCALP30; RCALP3X?; RCALP3DONE?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
RECEIVER SETUP (Power Sweep)	RECEIVER CAL	Changes the soft-key display to the RECEIVER CALIBRATION menu.	None
	RECEIVER CAL ON/OFF FOR PORT 1 ((NO) CAL EXISTS)	Toggles Receiver calibration for Port 1 on or off.	RCALP11; RCALP10; RCALP1X?; RCALP1DONE?
	RECEIVER CAL ON/OFF FOR PORT2 ((NO) CAL EXISTS)	Toggles Receiver calibration for Port 2 on or off.	RCALP21; RCALP20; RCALP2X?; RCALP2DONE?
	RECEIVER CAL ON/OFF FOR PORT3 ((NO) CAL EXISTS)	Toggles Receiver calibration for Port 3 on or off.	RCALP31; RCALP30; RCALP3X?; RCALP3DONE?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 1 FLAT TEST PORT POWER CALIBRATION	XXX POINTS MEASURE 1 PWR POINT EVERY XX POINT(S)	Number of points between measurement of power taken during flat test port power calibration, and displays net port power if correction is on.	PTS; PTS?
	POWER TARGET XX.XX dBm	Power level at which calibration will try to level.	PTP; PTP?
	BEGIN CAL	Changes the soft-key display to the FLAT TEST PORT POWER CALIBRATION menu.	TP1; SFC; TPX?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 1 SETUP	SOURCE 1 POWER XX.XX dBm (5 TO -15 dB)	Enter and display the power level, in dBm, of the Source 1 Power Level.	PWR; PWR?
	PORT1 ATTN: 0*10 dB (0-70 dB)	Attenuates the microwave source power at Port 1 from 0 to 70 dB, in 10 dB steps. The power is attenuated before being applied to Port 1 for a forward transmission or reflection test (S21 or S11, respectively).	SA1; SA1?
	PORT1 POWER XX.XX dBm	Displays the net port power: Sum of Source 1 power and attenuator settings.	P1P?
	FLAT TEST PORT POWER CAL ((NO) CAL EXISTS)	Changes the soft-key display to the FLAT TEST PORT POWER CAL menu.	(FP1DONE?)
	FLATNESS CORRECTION ON/OFF AT XX.XX dBm	Toggles power flatness correction on or off and displays the correction level.	FP1; FP0; FPX?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 2 FLAT TEST PORT POWER CALIBRATION	XXX POINTS MEASURE 1 PWR POINT EVERY XX POINT(S)	Number of points between measurement of power taken during flat test port power calibration.	PTS3; PTS3?
	POWER TARGET XX.XX dBm	Power level at which calibration will try to level.	PTP3; PTP3?
	BEGIN CAL	Starts the calibration.	TP3; SFC; TPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SOURCE 2 SETUP EXTERNAL SOURCE	SOURCE 2 POWER XX.XX dBm	Sets external Source 2 power level.	PW2; PW2?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 2 SETUP INTERNAL SOURCE	SOURCE 2 POWER XX.XX dBm (5 TO -15 dB)	Sets Source 2 power level.	PW2; PW2?
	PORT 3 ATTN 0*10 dB (0 TO -70 dB)	Sets Port 3 attenuator in 10 dB increments.	SA3; SA3?
	PORT3 POWER XX.XX dBm	Displays the net port power: Sum of Source 2 power and attenuator settings.	P3P?
	FLAT TEST PORT POWER CAL ((NO) CAL EXISTS)	Changes the soft-key display to the SOURCE 2 FLAT TEST PORT POWER CALIBRATION menu.	None FP3DONE?
	FLATNESS CORRECTION ON/OFF AT XX.XX dBm	Toggles power flatness correction on or off.	FP30; FP31; FP3X?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 3 SETUP	SOURCE 3 POWER XX.XX dBm	Sets external Source 3 power level.	PW3; PW3?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 4 SETUP	SOURCE 4 POWER XX.XX dBm	Sets external Source 4 power level.	PW4; PW4?
	RETURN	Returns to the previous soft-key menu.	None

4-11 CONFIG KEY MENUS

This key provides entry to configuration functions.

Menu Name	Function	Description	GPIB Mnemonic
2 PORT DUT EMBEDDING DE-EMBEDDING	SELECT PORT P1/P2	Select Port 1 or Port 2 for embedding/de-embedding.	EDEPORT1; EDEPORT2
	ADD ON TO NTWK	Adds network to composite for embedding.	EDADD
	MODIFY LAST NTWK	Modify last input into composite for embedding.	EDEMODIFY
	SELECT METHOD		
	EMBEDDING/ DE-EMBEDDING	Select EMBEDDING or DE-EMBEDDING.	EDEE; EDED; EDEED?
	SELECT NTWK GENERATION METHOD	Changes the soft-key display to the SELECT NTWK GENERATION METHOD menu.	None
	EMBEDDING DE-EMBEDDING LOG	Changes the soft-key display to the EMBEDDING DE-EMBEDDING LOG (PORT x) menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
3 PORT DUT EMBEDDING DE-EMBEDDING	SELECT PORT OR PAIR OF PORTS P1/P2 P3/P2-P3	Selects P1, P2, P3 or pair P2/P3 for embedding/de-embedding.	EDEPORT1; EDEPORT2; EDEPORT3; EDEPORT23
	ADD ON TO NTWK	Adds network to composite for embedding.	EDADD
	MODIFY LAST NTWK	Modify last input into composite for embedding.	EDEMODIFY
	SELECT METHOD		None
	SELECT NTWK GENERATION METHOD	Changes the soft-key display to the SELECT NTWK GENERATION METHOD menu.	None
	EMBEDDING DE-EMBEDDING LOG	Changes the soft-key display to the EMBEDDING DE-EMBEDDING LOG (PORT x) menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
4 PORT DUT EMBEDDING DE-EMBEDDING	SELECT PORT OR PAIR OF PORTS P1/P2/P3/P4/ P1-P2/P3-P4	Selects Port 1, 2, 3, 4 or pair of Ports 1-2 or 3-4 for embedding/de-embedding.	EDEPORTX (X=1,2,3,4); EDEPORTY (Y=1-2, 3-4)
	ADD ON TO NTWK	Adds network to composite for embedding.	EDADD
	MODIFY LAST NTWK	Modify last input into composite for embedding.	EDEMODIFY
	SELECT METHOD		
	SELECT NTWK GENERATION METHOD	Changes the soft-key display to the SELECT NTWK GENERATION METHOD menu.	None
	EMBEDDING DE-EMBEDDING LOG	Changes the soft-key display to the EMBEDDING DE-EMBEDDING LOG (PORT x) menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
(ADDON/MODIFY)	ADDON/MODIFY	Informational text	None
	EMBEDDING/ DE-EMBEDDING		
	LC CKT TYPE		
CIRCUIT TOPOLOGY (ADDON/MODIFY)	INDUCTANCE XXXXXXXXXXXXnH	Sets the inductance value for the 4 Port network.	EDEIND4P; EDEIND4P?
	CAPACITANCE 1 XXXXXXXXXXXXnF	Sets the capacitance value for the 4 Port network.	EDECAP4P1; EDECAP4P1?
	CAPACITANCE 2 XXXXXXXXXXXXpF	Sets the capacitance 2 value for the 4 Port network.	EDECAP4P2; EDECAP4P2?
	APPLY/DEFINE	Changes the soft-key display to the APPLY/DEFINE menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
CLEAR COMPOSITE NTWK	CONTINUE	Changes the soft-key display to the 2 PORT (3 PORT or 4 PORT) EMBEDDING DE-EMBEDDING menu.	None
	ABORT	Aborts the operation and returns soft-key display to the NTWK EMBEDDING DE-EMBEDDING menu.	None
	WARNING CONTINUE WILL CLEAR ALL COMPOSITE NETWORKS!!!!!		None
CONFIGURATION	SOURCE	Changes the soft-key display to the SOURCE CONFIGURATION menu.	None
	MULTIPLE SOURCE	Changes the soft-key display to the MULTIPLE SOURCE CONFIGURATION menu.	None
	DATA POINTS	Changes the soft-key display to the DATA POINTS menu.	None
	HOLD	Changes the soft-key display to the HOLD menu.	None
	BLANK FREQUENCY INFO ON/OFF	Blanks all frequency-identifier information from the displays, if such information is presently being displayed. Hides the frequency value with X's, such as XXX.XXXXXXXXX GHz.	FOF; FON; FOX?
	SIMULTANEOUS INTERNAL SOURCES		None
	*ENABLED INTERNAL SOURCES ON/OFF	* Appears if Source 2 Option is installed and Option Type is not mixer.	SIS1; SIS0; SISX?
	MORE	Changes the soft-key display to the next CONFIGURATION menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CONFIGURATION	IMPEDANCE TRANSFORMATION	Changes the soft-key display to the next IMPEDANCE CONFIGURATION menu.	None
	NTWK EMBEDDING/ DE-EMBEDDING	Changes the soft-key display to the NTWK EMBEDDING/DE-EMBEDDING menu.	None
	RIPPLE TEST	Changes the soft-key display to the RIPPLE TEST menu.	None
	RETURN	Returns to the previous soft-key menu.	None
DATA POINTS	1601 MAX POINTS	Selects measurement data points to be 1601.	NP1601; FHI; ONP
	801 MAX POINTS	Selects measurement data points to be 801.	NP801; ONP
	401 MAX POINTS	Selects measurement data points to be 401.	NP401; FME; ONP
	201 MAX POINTS	Selects measurement data points to be 201.	NP201; ONP
	101 MAX POINTS	Selects measurement data points to be 101.	NP101; FLO; ONP
	51 MAX POINTS	Selects measurement data points to be 51.	NP51; ONP
	15 MAX POINTS	Selects measurement data points to be 15.	NP15; ONP
	3 MAX POINTS	Selects measurement data points to be 3.	NP3; ONP
DATA POINTS 2	POINTS DRAWN IN C.W. XXXX POINT(S)	Displays the number of data points, when in the CW mode. This number can be between 1 and 1601.	CWP; CWP?
DEFINE BANDS	BAND X	Selects frequency band to be defined.	BD1-BD5
	BAND START FREQ XX.XXXXXXXX GHz	Selects band start frequency.	BST; BNDSRT?; BST?
	BAND STOP FREQ XX.XXXXXXXX GHz	Selects band stop frequency.	BSP; BNDSTP?; BSP?
	EDIT SYSTEM EQUATIONS	Changes the soft-key display to the EQUATION TO EDIT menu.	None
	STORE BAND X BANDS STORED: (X X X X X)	Stores the set values in the selected band.	SVB
	CLEAR ALL DEFINITIONS	Clears all definitions.	CLB
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
EDIT SYSTEM EQUATION	BAND X	Displays the current band.	BD1-BD5
	SOURCE X/ RECEIVER	Displays the current Source or Receiver.	ED1-ED4; EDR EDX?
	C.W. ON/OFF	Toggles C.W. MODE on or off.	ESW; ECW; EXW?; BNDxCW?y (x=1-4); R; X=S1-S4; R; NF; y=1-5 (Band Number))
	MULTIPLIER X	Sets the equation multiplier.	EML; BNDxMUL?y (x=1-4); R; X=S1-S4; R; NF; y=1-5; EML?
	DIVISOR X	Sets the equation divisor.	BNDxDIV? y; X=S1-S4; R; NF; y=1-5 EDV; EDV?
	OFFSET FREQ XXX.XXXXXXXX GHz	Sets the equation offset.	EOS; EOS?
	RETURN	Returns to the previous soft-key menu.	None
EMBEDDING DE-EMBEDDING LOG (PORT X)	PRINT LOG	Prints the embedding/de-embedding log.	OEDELOG
	SAVE LOG TO FLOPPY DISK	Saves the embedding/de-embedding composite network to floppy disk.	PEDELOG
	FIRST PAGE	Goes to the first page of Service Log entries.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None
EQUATION TO EDIT	SOURCE 1	Changes the soft-key display to the EDIT SYSTEM EQUATION menu for Source 1.	ED1; EDX?
	SOURCE 2	Changes the soft-key display to the EDIT SYSTEM EQUATION menu for Source 2.	ED2; EDX?
	SOURCE 3	Changes the soft-key display to the EDIT SYSTEM EQUATION menu for Source 3.	ED3; EDX?
	SOURCE 4	Changes the soft-key display to the EDIT SYSTEM EQUATION menu for Source 4.	ED4; EDX?
	RECEIVER	Changes the soft-key display to the EDIT SYSTEM EQUATION menu for the Receiver.	EDR; EDX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
HOLD	HOLD FUNCTION		
	HOLD/	Causes the hold key (button) to alternately stop and continue the sweep from the stopped point.	HLD; HLD?
	CONTINUE	Causes the hold key (button) to alternately stop and continue the sweep from the stopped point.	CTN
	HOLD/RESTART	Causes the hold key to alternately stop and restart the sweep.	None
	SINGLE SWEEP AND HOLD	Causes the hold key to trigger a single sweep and hold when finished. (Two sweeps, one from Port 1 to 2 and another from Port 2 to 1, are accomplished for a 12-Term measurement.)	HLD; TRS
	HOLD CONDITIONS		None
	BIAS ON/OFF	Causes the hold key to trigger a single sweep and hold when finished. (Two sweeps, one from Port 1 to 2 and another from Port 2 to 1, are accomplished for a 12-Term measurement.)	BH0; BH1; BHX?
	RF ON/OFF	Selects RF to be on or off while system is in hold.	RH0; RH1; RHX?
	DUT/AUT PROTECTION ON/OFF	When on, a default reset places the system in hold with RF and bias turned off. This choice is initialized to OFF when the software version changes or after a Default Program key press, so that the system comes up in the sweep mode.	AH1; AH0; AHX?
	WITH DUT/AUT PROTECTION ON, A DEFAULT RESET TURNS ON HOLD WITH BIAS AND RF TURNED OFF		None
IMPEDANCE CONFIGURATION	IMPEDANCE TRANSFORMATION ON/OFF	Turns IMPEDANCE TRANSFORMATION On or Off.	IMPTS0; IMPTS1; IMPTS?
	PORT X	Selects port on which to set up impedance.	IMPPORT; IMPPORT?
	RESISTIVE TERM XXXXXXXX	Sets the resistance value of the impedance for the impedance transformation.	IMPRESIST; IMPRESIST?
	REACTIVE TERM XXXXXXXX	Sets the reactive value of the impedance for the impedance transformation.	IMPREACT; IMPREACT?
	COMPUTATION METHOD		
	POWER--WAVE	Selects POWER--WAVE as a computation method for impedance.	IMPPOWER; IMPCOMPU?
	PSEUDO--WAVE	Selects PSEUDO--WAVE as a computation method for impedance.	IMPPSEUDO; IMPCOMPU?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
LC CIRCUIT (ADDON/MODIFY)	For 2-port device.		
	SELECT LC CIRCUIT TYPE (XXXX)	Changes the soft-key display to the SELECT LC CIRCUIT TYPE menu.	None
	INDUCTANCE XXXXXXXXXXXX nH	Sets the inductance value for the 2-port LC circuit.	EDEIND; ENEIND?
	CAPACITANCE XXXXXXXXXXpF	Sets the capacitance value for the 2-port LC circuit.	EDECAP; EDECAP?
	APPLY/DEFINE	Changes the soft-key display to the ADDON/MODIFY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
LC CIRCUIT (ADD ON TO NTWK) 1	For 3 and 4-port device.		
	SELECT LC CIRCUIT TYPE (XXXX)	Changes the soft-key display to the SELECT LC CIRCUIT TYPE menu.	None
	INDUCTANCE XXXXXXXXXXXX nH	Sets the inductance value for the 2-port LC circuit.	EDEIND; ENEIND?
	CAPACITANCE 1 XXXXXXXXXXXX pF	Sets the capacitance 1 value for the 2-port LC circuit.	EDECAP; EDECAP?
	CAPACITANCE 2 XXXXXXXXXXXX pF	Sets the capacitance 2 value for the 2-port LC circuit.	EDECAP4P2; EDECAP4P2?
	APPLY/DEFINE	Changes the soft-key display to the ADDON/MODIFY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
LC CIRCUIT (ADD ON TO NTWK) 2	For 3 and 4-port device.		
	SELECT LC CIRCUIT TYPE (XXXX)	Changes the soft-key display to the SELECT LC CIRCUIT TYPE menu.	None
	CAPACITANCE XXXXXXXXXXXX pF	Sets the capacitance value for the 2-port LC circuit.	EDECAP; EDECAP?
	INDUCTANCE 1 XXXXXXXXXXXX nH	Sets the inductance 1 value for the 2-port LC circuit.	EDEIND; EDEIND?
	INDUCTANCE 2 XXXXXXXXXXXX nH	Sets the inductance 2 value for the 2-port LC circuit.	EDEIND4P; EDEIND4P?
	APPLY/DEFINE	Changes the soft-key display to the ADDON/MODIFY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
MULTIPLE SOURCE CONFIGURATION	DEFINE BANDS	Changes the soft-key display to the DEFINE BAND menu.	None
	MULTIPLE SOURCE MODE		None
	OFF	Sets Multiple Source mode to off.	MS0; MSX?
	DEFINE	Sets Multiple Source mode to define.	MSD
	ON	Sets Multiple Source mode to on.	MS1
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
NTWK EMBEDDING DE-EMBEDDING	EMBEDDING/ DE-EMBEDDING ON/OFF	Turns EMBEDDING/DE-IMPEDDING On or Off.	EDE0; EDE1; EDE?
	SAVE/RECALL SETUP	Changes the soft-key display to the SAVE/RECALL SETUP menu.	NP801; ONP
	SELECT DEVICE TYPE		
	2 PORT	Changes the soft-key display to the CLEAR COMPOSITE NTWK menu	None
	3 PORT		None
	4 PORT		None
	CLEAR ALL COMPOSITE NTWKS	Changes the soft-key display to the CLEAR COMPOSITE NTWK menu.	NP15; ONP
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
RIPPLE TEST	RIPPLE TESTING ON/OFF	Turns Ripple Testing on or off.	RT0; RT1; RT?; RTVAL; RTVAL?
	LIMIT TESTING ON/OFF	Turns Limit Testing on or off.	LT0; LT1; LT?
	LIMIT TEST RESULT		
	CHANNEL 1 PASS/FAIL/NA	Displays result for Channel 1	None
	CHANNEL 2 PASS/FAIL/NA	Displays result for Channel 2	None
	CHANNEL 3 PASS/FAIL/NA	Displays result for Channel 3	None
	CHANNEL 4 PASS/FAIL/NA	Displays result for Channel 4	None
	RIPPLE TEST RESULT		
	CHANNEL 1 PASS/FAIL/NA	Displays result for Channel 1	None
	CHANNEL 2 PASS/FAIL/NA	Displays result for Channel 2	None
	CHANNEL 3 PASS/FAIL/NA	Displays result for Channel 3	None
	CHANNEL 4 PASS/FAIL/NA	Displays result for Channel 4	None
	ΔREF MODE ON/OFF	Turns ΔRef Model on or off.	DRF; DR0; DR0?
	RETURN	Returns to the previous soft-key menu.	None
SAVE/RECALL SETUP	SAVE SETUP ON		
	HARD DISK	Saves setup to hard drive.	None
	FLOPPY DISK	Saves setup to floppy drive.	None
	RECALL SETUP FROM		
	HARD DISK	Loads file from hard drive.	None
	FLOPPY DISK	Loads file from floppy drive.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT LC CIRCUIT TYPE	For 2-port devices.		
	L(S)-C(P)	Selects L(S)-C(P) as LC circuit type.	EDELSCP
	C(S)-L(P)	Selects C(S)-L(P) as LC circuit type.	EDECSCP
	C(P)-L(S)	Selects C(P)-L(S) as LC circuit type.	EDECPLS
	L(P)-C(S)	Selects L(P)-C(S) as LC circuit type.	EDELPCS
	HELP ON/OFF	Displays an informational help menu.	HELP1; HELP0; HELPX?
SELECT LC CIRCUIT TYPE	For 3 and 4-port devices.		
	L(S)-C(P)	Selects L(S)-C(P) as LC circuit type.	EDELSCP4P; EDELC4P?
	C(S)-L(P)	Selects C(S)-L(P) as LC circuit type.	EDECSLP4P; EDELC4P?
	HELP ON/OFF	Displays an informational help menu.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
SELECT NTWK GENERATION METHOD (2 PORT NTWK)	CIRCUIT TOPOLOGY		
	LC CIRCUIT	Changes the soft-key display to the LC CIRCUIT (ADDON/MODIFY) menu.	None
	T-LINE SECTION	Changes the soft-key display to the T-LINE (ADDON/MODIFY) menu.	None
	LOAD S2P FILE FROM		
	HARD DISK	Load file from hard drive	None
	FLOPPY DISK	Load file from floppy drive	None
	RETURN	Returns to the previous soft-key menu.	None
SELECT NTWK GENERATION METHOD (4 PORT NTWK)	CIRCUIT TOPOLOGY	Changes the soft-key display to the CIRCUIT TOPOLOGY (ADDON/MODIFY) menu.	None
	LOAD S2P FILE FROM		
	HARD DISK	Load file from hard drive	None
	FLOPPY DISK	Load file from floppy drive	None
	RETURN	Returns to the previous soft-key menu.	None
SET DIELECTRIC CONSTANT	AIR (1.000649)	Calculates reference delay based on the dielectric constant of air (1.000649).	DIA
	POLYETHYLENE (2.26)	Calculates reference delay based on the dielectric constant of polyethylene (2.26).	DIP
	TEFLON (2.10)	Calculates reference delay based on the dielectric constant of teflon (2.1).	DIT
	MICROPOROUS TEFLON (1.69)	Calculates reference delay based on the dielectric constant of microporous Teflon (1.69).	DIM
	OTHER (1.00)	Calculates reference delay based on the value you enter.	DIE
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SOURCE CONFIGURATION	SOURCE 1	Changes the soft-key display to the SOURCE 1 CONFIGURATION menu.	None
	SOURCE 2	Changes the soft-key display to the SOURCE 2 CONFIGURATION menu.	None
	SOURCE 3	Changes the soft-key display to the SOURCE 3 CONFIGURATION menu.	None
	SOURCE 4	Changes the soft-key display to the SOURCE 4 CONFIGURATION menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 2 SETUP	INTERNAL SOURCES BOTH ENABLED ON/OFF	Toggles the simulaneous enabling of both internal sources to be on or off.	SIS1; SIS0; SISX?
	*SOURCE 2 OFFSET FROM SOURCE 1 +/-XXX.XXXXXX GHz	Sets Source 2 offset from Source 1. If Source 2 CW Mode is on, Source 2 Offset is not displayed. * Appears if Source 2 CW mode is on, Source 2 offset is not displayed.	None
	SOURCE 2 CW MODE ON/OFF	Toggles Source 2 CW Mode on or off.	None
	**SOURCE 2 CW FREQUENCY XXX.XXXXXX GHz	Sets Source 2 CW frequency. If Source 2 CW Mode is off, Source 2 C.W. Frequency is not displayed. ** Appears if Source 2 CW mode is off, Source 2 CW frequency is not displayed.	None
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 1 CONFIGURATION	ACTIVE	Displays status of Source 1.	None
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 2 CONFIGURATION	ACTIVE	Displays status of Source 2.	SRC2AC ; SRC2NA; SRC2AC?
	RETURN	Returns to the previous soft-key menu.	None
	ACTIVE/INACTIVE	Toggles source 2 state between active and inactive.	SRC2AC; SRC2NA; SRC2AC?
	GPIB ADDRESS X	Sets the GPIB address of external source.	ADDSRC2; ADDSRC2?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 3 CONFIGURATION	ACTIVE/INACTIVE	Toggles source 3 state between active and inactive.	SRC3AC ; SRC3NA; SRC3AC?
	GPIB ADDRESS X	Sets the GPIB address of external source.	ADDSRC3; ADDSRC3?
	RETURN	Returns to the previous soft-key menu.	None
SOURCE 4 CONFIGURATION	ACTIVE/INACTIVE	Toggles source 4 state between active and inactive.	SRC4AC ; SRC4NA; SRC4AC?
	GPIB ADDRESS X	Sets the GPIB address of external source.	ADDSRC4; ADDSRC4?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
T-LINE SECTION (ADDON/MODIFY)	IMPEDANCE XXXXXXXXXXXX	Sets the impedance of the T-line section.	EDEIMP; EDEIMP?
	LENGTH XXXXXXXXXXXX	Sets the length of the T-line section.	EDELEN; EDELEN?
	TIME XXXXXXXXps	Sets the time of the T-line section.	EDETIME; EDETIME?
	LOSS XXXXXX dBm	Sets the insertion loss of the T-line section.	EDELOS; EDELOS?
	SET DIELECTRIC XXXXX	Changes the soft-key display to the SET DIELECTRIC CONSTANT menu.	None
	APPLY/DEFINE	Changes the soft-key display to the ADDON/MODIFY menu.	None
	RETURN	Returns to the previous soft-key menu.	None

4-15 START PRINT KEY MENUS

This key provides entry to printer, plotter, or disk file functions.

Menu Name	Function	Description	GPIB Mnemonic
SELECT FILE TO OVERWRITE	CREATE NEW FILE	Changes the soft-key display to the SELECT FILENAME menu.	None
	FILE 1	Selects disk file 1 for write.	None
	FILE 2	Selects disk file 2 for write.	None
	ILE 3	Selects disk file 3 for write.	None
	FILE 4	Selects disk file 4 for write.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None
SELECT FILENAME	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%'@^_'{}~ * ?: \. SP	Name your file using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number. You are allowed up to eight characters.	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the name displayed above. Selecting CLR deletes the entire name. Selecting DONE signals that you have finished writing the name.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection.	None
	NUMBERS MAY BE SELECTED USING KEYPAD	You may also select numbers and decimals using the keypad.	None

4-16 UTILITY KEY MENUS

This key provides entry to utility functions.

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL ASSURANCE	PORT CONFIG (1X2A3B4C OR 1L2R)	Displays the selected port configuration. This display is based on last connection of current cal.	
	ASSURANCE LIMITS SETUP	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS menu.	None
	MEASURE DEVICE(S)	Start assurance measurement and changes the soft-key display to the AUTOCAL ASSURANCE 2 menu.	BEGACA
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE MANUAL CONTROL menu.	None
AUTOCAL ASSURANCE 2	MEASURING...		None
	ABORT	Aborts measurement.	ABORTCAL
AUTOCAL ASSURANCE 3	ASSURANCE FAILS A FULL 2-PORT RECALIBRATION IS REQUIRED. A BRIEF SUMMARY OF FAILURE FOR THE FIRST 5 FREQUENCY DATA POINTS IS IN THE SERVICE LOG.		None
	CONTINUE	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None
AUTOCAL ASSURANCE 4	EXIT	Exits AutoCal assurance and changes the soft-key display to the FREQUENCY menu.	None
	ASSURANCE PASSED!		None
AUTOCAL ASSURANCE LIMITS	Displays with a 2-port AutoCal box.		
	DIRECTIVITY DC - 2 GHZ 36.0 DB 2 - 6 GHZ 36.0 DB	Changes the values of AutoCal directivity limits. The values are defaulted to 36.0 dB.	ACADIR1; ACADIR1?; ACADIR2; ACADIR2?
	SOURCE MATCH DC - 2 GHZ 34.0 DB 2 - 6 GHZ 34.0 DB	Changes the values of AutoCal source match limits. The values are defaulted to 34.0 dB.	ACASRC1; ACASRC1?; ACASRC2; ACASRC2?
	REFLECTION TRACKING DC - 2 GHZ 0.150 DB 2 - 6 GHZ 0.200 DB	Changes the values of AutoCal reflection tracking limits. The values are defaulted to 0.150 dB for DC to 2 GHz and 0.200 dB for 2 to 6 GHz.	ACARET1; ACARET1?; ACARET2; ACARET2?
	MORE	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS 2 menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL ASSURANCE LIMITS 2	Displays with a 2-port AutoCal box.		
	LOAD MATCH DC - 2 GHZ 37.0 DB 2-6 GHZ 37.0 DB	Changes the values of AutoCal load match limits. The values are defaulted to 37.0 dB.	ACALM1; ACALM1?; ACALM2; ACALM2?
	TRANSMISSION TRACKING DC - 2 GHZ 0.150 DB 2 - 6 GHZ 0.200 DB	Changes the values of AutoCal transmission tracking limits. The values are defaulted to 0.150 dB for DC to 2 GHz and 0.200 dB for 2 to 6 GHz.	ACATRT1; ACATRT1?; ACATRT2; ACATRT2?
	MORE	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None
AUTOCAL ASSURANCE LIMITS	Displays in MS4622X with a 4-port AutoCal box.		
	DIRECTIVITY DC - 3 GHZ 40.0 DB	Changes the value of AutoCal directivity limits. The value is defaulted to 40.0 dB.	ACADIR1; ACADIR1?
	SOURCE MATCH DC - 3 GHZ 38.0 DB	Changes the value of AutoCal source match limits. The value is defaulted to 38.0 dB.	ACASRC1; ACASRC1?
	REFLECTION TRACKING DC - 3 GHZ 0.150 DB	Changes the value of AutoCal reflection tracking limits. The value is defaulted to 0.150 dB.	ACARET1; ACARET1?
	LOAD MATCH DC - 3 GHZ 40.0 DB	Changes the value of AutoCal load match limits. The value is defaulted to 40.0 dB.	ACALM1; ACALM1?
	TRANSMISSION TRACKING DC - 3 GHZ 0.150 DB	Changes the value of AutoCal transmission tracking limits. The value is defaulted to 0.150 dB.	ACATRT1; ACATRT1?
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL ASSURANCE LIMITS	Displays in MS4623X with a 4-port AutoCal box.		
	DIRECTIVITY DC - 3 GHZ 40.0 DB 3 - 6 GHZ 35.0 DB	Changes the value of AutoCal directivity limits. The values are defaulted to 40.0 dB for DC to 3 GHz and 35.0 dB for 3 to 6 GHz.	ACADIR1; ACADIR1?; ACADIR2; ACADIR2?
	SOURCE MATCH DC - 3 GHZ 38.0 DB 3 - 6 GHZ 35.0 DB	Changes the value of AutoCal source match limits. The values are defaulted to 38.0 dB for DC to 3 GHz and 35.0 dB for 3 to 6 GHz.	ACASRC1; ACASRC1?; ACASRC2; ACASRC2?
	REFLECTION TRACKING DC - 3 GHZ 0.150 DB 3 - 6 GHZ 0.200 DB	Changes the value of AutoCal reflection tracking limits. The values are defaulted to 0.150 dB for DC to 3 GHz and 0.200 dB for 3 to 6 GHz.	ACARET1; ACARET1?; ACARET2; ACARET2?
	MORE	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS 2 menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None
AUTOCAL ASSURANCE LIMITS 2	Displays in MS4623X with a 4-port AutoCal box.		
	LOAD MATCH DC - 3 GHZ 40.0 DB 3 - 6 GHZ 35.0 DB	Changes the values of AutoCal load match limits. The values are defaulted to 40.0 dB for DC to 3 GHz and 35.0 dB for 3 to 6 GHz.	ACALM1; ACALM1?; ACALM2; ACALM2?
	TRANSMISSION TRACKING DC - 3 GHZ 0.150 DB 3 - 6 GHZ 0.200 DB	Changes the values of AutoCal transmission tracking limits. The values are defaulted to 0.150 dB for DC to 3 GHz and 0.200 dB for 3 to 6 GHz.	ACATRT1; ACATRT1?; ACATRT2; ACATRT2?
	MORE	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL ASSURANCE LIMITS	Displays in MS4624X with a 4-port AutoCal box.		
	DIRECTIVITY DC - 3 GHZ 40.0 DB 3 - 6 GHZ 35.0 DB 6 - 9 GHZ 33.0 DB	Changes the values of AutoCal directivity limits. The values are defaulted to 40.0 dB for DC to 3 GHz and 35.0 dB for 3 to 6 GHz and 33.0 dB for 6 to 9 GHz.	ACADIR1; ACADIR1?; ACADIR2; ACADIR2?; ACADIR3; ACADIR3?
	SOURCE MATCH DC - 3 GHZ 38.0 DB 3 - 6 GHZ 35.0 DB 6 - 9 GHZ 33.0 DB	Changes the values of AutoCal source match limits. The values are defaulted to 38.0 dB for DC to 3 GHz and 35.0 dB for 3 to 6 GHz and 33.0 dB for 6 to 9 GHz.	ACASRC1; ACASRC1?; ACASRC2; ACASRC2?; ACASRC3; ACASRC3?
	MORE	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS 2 menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None
AUTOCAL ASSURANCE LIMITS 2	Displays in MS4624X with a 4-port AutoCal box.		
	REFLECTION TRACKING DC - 3 GHZ 0.150 DB 3 - 9 GHZ 0.200 DB	Changes the values of AutoCal reflection tracking limits. The values are defaulted to 0.150 dB for DC to 3 GHz and 0.200 dB for 3 to 9 GHz.	ACARET1; ACARET1?; ACARET2; ACARET2?
	LOAD MATCH DC - 3 GHZ 40.0 DB 3 - 6 GHZ 35.0 DB 6 - 9 GHZ 33.0 DB	Changes the values of AutoCal load match limits. The values are defaulted to 40.0 dB for DC to 3 GHz and 35.0 dB for 3 to 6 GHz and 33.0 dB for 6 to 9 GHz.	ACALM1; ACALM1?; ACALM2; ACALM2?; ACALM3; ACALM3?
	MORE	Changes the soft-key display to the AUTOCAL ASSURANCE LIMITS 3 menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None
AUTOCAL ASSURANCE LIMITS 3	Displays in MS4624X with a 4-port AutoCal box.		
	TRANSMISSION TRACKING DC - 3 GHZ 0.150 DB 3 - 9 GHZ 0.200 DB	Changes the values of AutoCal transmission tracking limits. The values are defaulted to 0.150 dB for DC to 3 GHz and 0.200 dB for 3 to 9 GHz.	ACARET1; ACARET1?; ACARET2; ACARET2?
	MORE	Changes the soft-key display to the appropriate AUTOCAL ASSURANCE LIMITS menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL ASSURANCE MANUAL CONTROL	SELECT BOX TYPE 2 PORT/4 PORT	Toggles between AutoCal box types, 2 or 4-port.	AC2PBTYPE; AC4PBTYPE; ACBTYPE?
	SELECT PATH (FOR 4 PORT AC BOX) PORT X-A PORT X-B PORT X-C	Sets the AutoCal connected path to X-A, X-B, or X-C.	ACPXA; ACPXB; ACPXC; ACPATH?
	SELECT CAL STANDARD	Changes the soft-key display to the SELECT CAL STANDARD menu.	None
	PERFORM ASSURANCE	Starts measurement and changes the soft-key display to the AUTOCAL ASSURANCE menu.	BEGACA
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Changes the soft-key display to the DIAGNOSITCS menu.	None
AUTOCAL CHAR-ACTERIZATION	SELECT BOX TYPE 2 PORT/4 PORT	Toggles between AutoCal box types 2-port or 4-port.	AC2PBTYPE; AC4PBTYPE; ACBTYPE?
	PORT CONFIG. 1L2R/1R2L OR (1X2A2B2C) OR (1X2A3B2C) OR (1X2A3B4C)	Toggles between port configurations. Displayed for any model using a 2-port AutoCal box. Displayed for a 2-port model using a 4-port AutoCal box. Displayed for a 3-port model using a 4-port AutoCal box. Displayed for a 4-port model using a 4-port AutoCal box.	ACL1R2; ACR1L2; ACF2P?
	AVERAGING	Changes the soft-key display to the AUTOCAL AVERAGING 3 menu in the CAL KEY menus section.	None
	CONTINUE	Changes the soft-key display to the AUTOCAL CHARACTERIZATION 2 or 3 menu, as appropriate.	BEGCH
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Changes the soft-key display to the UTILITY menu.	None
AUTOCAL CHAR-ACTERIZATION 2	Displayed for a model MS4622X with a 4-port AutoCal.		
	(1X2B) CONNECT AUTOCAL PORT B TO VNA PORT 2 LEAVE AUTOCAL PORT X CONNECTED TO PORT 1 OF VNA		
	MEASURE DEVICE(S)	Changes the soft-key display to the AUTOCAL CHARACTERIZATION 3 menu.	BEGCH
	RETURN	Aborts the characterization.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL CHAR-ACTERIZATION	Displayed for a model MS4622X with a 4-port AutoCal.		
	(1X2C) CONNECT AUTOCAL PORT C TO VNA PORT 2 LEAVE AUTOCAL PORT X CONNECTED TO PORT 1 OF VNA		
	MEASURE DEVICE(S)	Changes the soft-key display to the AUTOCAL CHARACTERIZATION 3 menu.	BEGCH
	RETURN	Changes the soft-key display to the previous menu.	None
AUTOCAL CHAR-ACTERIZATION 2	Displayed for a model MS4623X with a 4-port AutoCal.		
	(1X2C3B) CONNECT AUTOCAL PORT C TO VNA PORT 2 LEAVE AUTOCAL PORT X CONNECTED TO PORT 1 OF VNA		
	MEASURE DEVICE(S)	Changes the soft-key display to the AUTOCAL CHARACTERIZATION 3 menu.	BEGCH
	RETURN	Changes the soft-key display to the previous menu.	None
AUTOCAL CHAR-ACTERIZATION 3	MEASURING ...	After measurement is complete, soft-key display changes to AUTO CAL CHARACTERIZATION 4 menu.	None
	ABORT	Changes the soft-key display to the UTILITY menu.	ABORTCAL
AUTOCAL CHAR-ACTERIZATION 4	SAVE TO HARD DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	
	SAVE TO FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	
	EXIT	Changes the soft-key display to the FREQUENCY menu.	None
BACKEND ATTENUATOR CALIBRATION	CALIBRATING BACKEND ATTENUATOR	Perform backend attenuator calibration.	BAC
	PRESS <CLEAR> TO ABORT	Pressing the Clear key aborts the calibration and returns to the previous soft-key menu.	None
CAUTION: ALL FLOPPY DISK DATA WILL BE ERASED	INSERT DISK TO FORMAT	Ensure that you have the correct floppy diskette for formatting.	None
	FORMAT DISK	Starts formatting floppy diskette.	INT
	ABORT	Changes the soft-key display to the FLOPPY DISK UTILITIES menu.	None
CAUTION: ALL HARD DISK DATA WILL BE ERASED	ASSUME HARD DISK READY TO FORMAT	Assumes that the hard disk is ready to be formatted; press the Enter key to begin the formatting process.	None
	FORMAT DISK	Starts formatting hard disk.	None
	ABORT	Changes the soft-key display to the HARD DISK UTILITIES menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CLOCK SETUP	YEAR XXXX	Sets the YEAR.	DATE; DATE?
	MONTH XX	Sets the MONTH.	DATE; DATE?
	DAY XX	Sets the DAY.	DATE; DATE?
	HOUR XX	Sets the HOUR.	TIME
	MINUTE XX	Sets the MINUTE.	TIME
	DONE (SET DATE/TIME)	Returns to the previous soft-key menu.	None
	RETURN	Returns to the previous soft-key menu.	None
COLOR SETUP	DATA XX COLOR NAME	Sets the color for the data.	DATCOL; DATCOL?
	ALTERNATE SWEEP & OVERLAY DATA XX COLOR NAME	Sets the color for the alternate sweep and overlay data.	LAYCOL; LAYCOL?
	MEMORY DATA XX COLOR NAME	Sets the color for the trace memory data.	TRCCOL; TRCCOL?
	MARKERS & LIMITS XX COLOR NAME	Sets the color for the markers and limits.	MKRCOL; MKRCOL?
	GRATICULE XX COLOR NAME	Sets the color for the CRT graticule.	GRTCOL; GRTCOL?
	ANNOTATION & MENU XX COLOR NAME	Sets the color for the annotation and menu text.	ANNCOL; ANNCOL?
	MORE	Change the soft-key display to the COLOR SETUP 2 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
COLOR SETUP 2	BACKGROUND XX COLOR NAME	Sets the color for the background.	BCKCOL; BCKCOL?
	MENU TITLE & INFO XX COLOR NAME	Sets the color for the menu titles and informational displays.	MNUCOL; MNUCOL?
	RESET COLORS	Resets colors to the default values.	RSTCOL
	MORE	Change soft-key display to the COLOR SETUP menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
COMMAND LINE	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%'@^_'{}~ * ?: \. SP	Enter a DOS command line using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number.	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the command line. Selecting CLR deletes the entire command line. Selecting DONE signals that you have finished writing the command line.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection.	None
	NUMBERS MAY BE SELECTED USING KEYPAD	You may also select numbers and decimals using the keypad.	None
	PRESS <CLEAR> TO ABORT	Pressing the Clear key changes the soft-key display to the HARD/FLOPPY DISK UTILITIES menu.	None
DIAGNOSTICS	START SELF TEST	Starts a self test of the system, and changes the soft-key display to the DIAGNOSTICS 2 menu.	*TST?; TST
	SERVICE LOG	Changes the soft-key display to the SERVICE LOG menu.	None
	INSTALLED OPTIONS	Displays the fitted options.	*OPT?
	PERIPHERAL TEST	Changes the soft-key display to the PERIPHERAL TEST menu.	None
	HARDWARE CAL (SERVICE USE ONLY)	Changes the soft-key display to the HARDWARE CAL menu, which provides for invoking calibration routines for use by a qualified service technician.	None
	TROUBLE SHOOTING (SERVICE USE ONLY)	Changes the soft-key display to the TROUBLESHOOTING menu.	TSBEG; SDG
	AUTO CAL ASSURANCE or NOISE FIGURE ASSURANCE	Changes the soft-key display to the AUTOCAL ASSURANCE menu. If in Noise Figure mode, NOISE FIGURE VERIFICATION appears. This selection changes the soft-key display to the NOISE FIGURE VERIFICATION menu.	None
	RETURN	Returns to the previous soft-key menu.	None
DIAGNOSTICS 2	SELF TEST	After self test completes, soft-key display changes to the DIAGNOSTICS menu.	TST; *TST?
	TESTING SYSTEM...		None

Menu Name	Function	Description	GPIB Mnemonic
FLOPPY DISK UTILITIES	DISPLAY DIRECTORY	Directory displays in the screen data area.	DIR
	DELETE FILES	Change the soft-key display to the TYPE OF FILES TO DELETE menu.	DEL
	COPY FILES TO HARD DISK	Change the soft-key display to the TYPE OF FILES TO COPY menu.	COPY
	FORMAT FLOPPY DISK	Change the soft-key display to the CAUTION: ALL FLOPPY DISK DATA WILL BE ERASED menu.	None
	COMMAND LINE	Changes the soft-key display to the COMMAND LINE menu.	None
	HARD DISK UTILITIES	Change the soft-key display to the HARD DISK UTILITIES menu.	None
	RETURN	Returns to the previous soft-key menu.	None
GPIB SETUP	IEEE 488.2 XX	Sets GPIB address.	ADDGP;
	DEDICATED GPIB		
	EXTERNAL SOURCE 1 XX	Sets GPIB address of External Source 1.	None
	EXTERNAL SOURCE 3 XX	Sets GPIB address of External Source 3.	ADDSRC3; ADDSRC3?
	EXTERNAL SOURCE 4 XX	Sets GPIB address of External Source 4.	ADDSRC4; ADDSRC4?
	PLOTTER: XX	Sets GPIB address of the external Plotter.	ADDPLT; ADDPLT?
	POWER METER: XX	Sets GPIB address of the external Power Meter.	ADDPM; ADDPM?
	RETURN	Returns to the previous soft-key menu.	None
HARD DISK UTILITIES	DISPLAY DIRECTORY	Directory displays in the screen data area.	DIR
	DELETE FILES	Changes the soft-key display to the TYPE OF FILES TO DELETE menu.	DEL
	COPY FILES TO FLOPPY DISK	Changes the soft-key display to the TYPE OF FILES TO COPY menu.	COPY
	FORMAT HARD DISK	Changes the soft-key display to the CAUTION: ALL HARD DISK DATA WILL BE ERASED menu.	None
	COMMAND LINE	Changes the soft-key display to the COMMAND LINE menu.	None
	FLOPPY DISK UTILITIES	Changes the soft-key display to the FLOPPY DISK UTILITIES menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
H/W CALIBRATION DISK OPERATIONS	RECALL FROM HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	RECALL FROM FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	DELETE FROM HARD DISK	Changes the soft-key display to the SELECT FILE TO DELETE menu.	DEL
	DELETE FROM FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO DELETE menu.	DEL
	COPY FROM HARD DISK TO FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO COPY menu.	COPY
	COPY FROM FLOPPY DISK TO HARD DISK	Changes the soft-key display to the SELECT FILE TO COPY menu.	COPY
	SAVE DATA	Changes the soft-key display to the H/W CALIBRATIONS DISK OPERATIONS 2 menu.	SAVE
	RETURN	Returns to the previous soft-key menu.	None
H/W CALIBRATIONS DISK OPERATIONS 2	SAVE TO HARD DISK	Changes the soft-key display to the SAVE H/W CALIBRATIONS menu.	SAVE
	SAVE TO FLOPPY DISK	Changes the soft-key display to the SAVE H/W CALIBRATIONS menu.	SAVE
	RETURN	Returns to the previous soft-key menu.	None
HARDWARE CAL (SERVICE USE ONLY)	SELECT SOURCE 1/2		None
	START CAL	Change soft-key to an appropriate BACKEND ATTENUATOR CALIBRATION menu.	None
HARDWARE CAL2 (SERVICE USE ONLY)	SOURCE ALC CAL	Changes the soft-key display to the SOURCE ALC CALIBRATION menu.	None
	BACK END ATTENUATOR CAL	Changes the soft-key display to the next HARDWARE CALIBRATION menu.	None
	DISK OPERATIONS	Changes the soft-key display to the HARDWARE CALIBRATION DISK OPERATIONS menu.	None
	RETURN	Returns to the previous soft-key menu.	None
HARDWARE CALIBRATION (SERVICE USE ONLY)	CONNECT FREQUENCY COUNTER TO PORT 1		None
	DAC NUMBER XXX	Enter a DAC number (0-255) to adjust the frequency within 3 GHz ±400 Hz.	DAC; DAC?
	SAVE		
	RETURN	Returns to the previous soft-key menu.	None
HARDWARE CALIBRATION (SERVICE USE ONLY)	SAVE TO HARD DISK	Changes the soft-key display to the SAVE H/W CALIBRATIONS menu.	SAVE
	SAVE TO FLOPPY DISK	Changes the soft-key display to the SAVE H/W CALIBRATIONS menu.	SAVE
	EXIT CAL	Changes the soft-key display to the FREQUENCY menu.	None

Menu Name	Function	Description	GPIB Mnemonic
INSTRUMENT STATE PARAMETERS	SYSTEM	Displays all of the system parameters.	DGS
	CALIBRATION	Displays the calibration parameters.	DCP
	OPERATION	Displays the global operating parameters.	DFP
	CHANNEL 1 & 2	Displays the Channel 1-2 operating parameters.	DC1
	CHANNEL 3 & 4	Displays the Channel 3-4 operating parameters.	DC3
	NEXT PARAM PAGE	Cycles through the above list.	None
	RETURN	Returns to the previous soft-key menu.	None
NETWORK SETUP	INSTRUMENT IP XXX.XXX.XXX.XXX	Set the network IP address by entering numbers.	ADDIP; ADDIP?
	DEFAULT GATEWAY IP XXX.XXX.XXX.XXX	Set the default gateway IP address by entering numbers.	None
	SUBNET MASK XXX.XXX.XXX.XX	Set the network subnet mask address by entering numbers.	None
	ETHERNET ADDRESS XXXXXXXXXXXX	Displays the Ethernet Address.	None
	RETURN	Returns to the previous soft-key menu.	None
NOISE FIGURE ASSURANCE	CONNECT A THROUGHLINE BETWEEN PORTS 1 AND 2		None
	VERIFY	Changes the soft-key display to the NOISE FIGURE VERIFICATION 2 menu.	NFV
	RETURN	Returns to the previous soft-key menu.	None
NOISE FIGURE ASSURANCE 2	MEASURING...		None
	ABORT	Changes the soft-key display to the DIAGNOSTICS menu.	None
NOISE FIGURE ASSURANCE 3	NB=XX.XX dB	Displays NB results of noise figure verification.	NFVNB?
	NC=XX.XX dB	Displays NC results of noise figure verification.	NFVNC?
	ND=XX.XX dB	Displays ND results of noise figure verification.	NFVND?
	SB=XX.XX dB	Displays SB results of noise figure verification.	NFVSB?
	SC=XX.XX dB	Displays SC results of noise figure verification.	NFVSC?
	SD=XX.XX dB	Displays SD results of noise figure verification.	NFVSD?
	EXIT	Exits the Noise Figure Verification process and changes soft-key display to the FREQUENCY menu.	None
NOISE FIGURE ASSURANCE 4	VERIFICATION FAILED CANNOT SET NECESSARY POWER LEVEL		None
	EXIT	Exits the Noise Figure Verification process and changes soft-key display to the FREQUENCYmenu.	None

Menu Name	Function	Description	GPIB Mnemonic
PERIPHERAL TESTS	LCD DISPLAY	Provides a graphic display for evaluating screen colors and linearity.	DGT1; DGT2; DGT3
	FRONT PANEL	Provides for testing the front panel keys.	FPT
	EXTERNAL KEYBOARD	Provides for testing the external keyboard connected to the Keyboard connector on the front panel.	EKT
	PRINTER INTERFACE	Provides for testing the printer interface.	PRT?
	GPIB INTERFACE	Provides for testing the GPIB interface.	None
	RETURN	Returns to the previous soft-key menu.	None
REAR PANEL	OUTPUT VOLTAGE ON/OFF	Toggles Output Voltage on or off.	RV1; RV0; RV1?
	SELECT OUTPUT MODE (XXX)	Displays selected output mode.	RPO; RVD; RVX?
	HORIZONTAL	Changes the soft-key display to the REAR PANEL SCALING menu.	RVH; RVX?
	VERTICAL	Changes the soft-key display to the REAR PANEL SCALING menu.	RVV; RVX?
	DRIVEN PORT	Changes the soft-key display to the REAR PANEL DRIVEN PORT menu.	RVP; RVX?; RVL
	TTL OUTPUT	Changes the soft-key display to the REAR PANEL TTL OUTPUT menu.	RVT; RVX?
	REFERENCE FREQUENCY INTERNAL/EXTERNAL	Toggles frequency reference between Internal and External.	FREFI; FREFG; FREFX?
	RETURN	Returns to the previous soft-key menu.	None
REAR PANEL DRIVEN PORT SETUP	SET OUTPUT VOLTAGES		None
	PORT 1 XX.XX V	Sets the Port 1 output voltage.	RVA1; RVA1?
	PORT 2 XX.XX V	Sets the Port 2 output voltage.	RVA2; RVA2?
	PORT 3 XX.XX V	Sets the Port 3 output voltage.	RVA3; RVA3?
	*PORT 4 XX.XX V	Sets the Port 4 output voltage. * 4-Port models only	RVA4; RVA4?
	RETURN	Returns to the previous soft-key menu.	None
REAR PANEL SCALING	HORIZONTAL		None
	START XX.XX V	Sets Start voltage.	VST; RVST; VST?; RVST?
	STOP XX.XX V	Sets Stop voltage.	VSP; RVSP; VSP?; RVSP?
	VERTICAL RESOLUTION 1.00 V/DIV	Displays vertical scaling resolution value.	None
	REFERENCE VALUE 0.00 v	Displays the reference value.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
REAR PANEL TTL OUTPUT MODE	SELECT PORT		None
	1	Selects Port 1.	RVTP1; RVTPX?
	2	Selects Port 2.	RVTP2; RVTPX?
	3	Selects Port 3.	RVTP3; RVTPX?
	SELECT LEVEL		None
	HIGH	Selects a high TTL output.	RVTPxHL (x=1-3); RVTPxX? (x=1-3)
	LOW	Selects a low TTL output.	RVTPxLL (x=1-3)
	HIGH PULSE	Selects a high pulse TTL output.	RVTPxHP (x=1-3)
	LOW PULSE	Selects a low pulse TTL output.	RVTPxLP LP(x=1-3)
	RETURN	Returns to the previous soft-key menu.	None
REMOTE INTERFACE	GPIB SETUP	Changes the soft-key display to the GPIB SETUP menu.	None
	NETWORK SETUP	Changes the soft-key display to the NETWORK SETUP menu.	None
	SELECT LANGUAGE		None
	8753D	Selects the HP8753 language.	LANG “8753D”
	NATIVE	Selects the native MS462XX language.	LANG “NATIVE”
	RETURN	Returns to the previous soft-key menu.	None
SAVE H/W CALIBRATIONS	HW_CAL ALC	Saves ALC calibration data.	SAVE
	HW_CAL BNF	Saves BNF calibration data.	SAVE
	HW_CAL ALL	Saves ALL calibration data.	SAVE
	RETURN	Returns to the previous soft-key menu.	None
SELECT CAL STANDARD	OPEN	Set AutoCal standard to OPEN.	ACOPEN; ACSTD?
	SHORT	Set AutoCal standard to SHORT.	ACSHORT; ACSTD?
	LOAD	Set AutoCal standard to LOAD.	ACLOAD; ACSTD?
	THRU	Set AutoCal standard to THRU.	ACTHRU; ACSTD?
	ASSURANCE	Set AutoCal standard to ASSURANCE.	ACAA; ACSTD?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Changes the soft-key display to the AUTOCAL ASSURANCE MANUAL CONTROL menu.	None
SELECT FILE TO COPY	FILE 1	Selects FILE 1 data to be copied.	None
	FILE 2	Selects FILE 2 data to be copied.	None
	FILE 3	Selects FILE 3 data to be copied.	None
	FILE 4	Selects FILE 4 data to be copied.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT FILE TO DELETE	FILE 1	Selects FILE 1 data to be deleted.	None
	FILE 2	Selects FILE 2 data to be deleted.	None
	FILE 3	Selects FILE 3 data to be deleted.	None
	FILE 4	Selects FILE 4 data to be deleted.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None
SERVICE LOG	DISPLAY LOG	Displays the Service Log.	OSL
	PRINT LOG	Prints the Service Log.	PSL; PEL
	SAVE LOG TO DISK	Saves the Service Log.	SAVE “*.LOG”; SAVE
	CLEAR LOG	Clears the Service Log.	CSL
	FIRST PAGE	Goes to the first page of Service Log entries.	None
	PREVIOUS PAGE	Returns to the previous page of Service Log entries.	None
	NEXT PAGE	Advances to the next page of Service Log entries.	None
	RETURN	Returns to the previous soft-key menu.	None
SOURCE ALC CALIBRATION	SELECT SOURCE 1/2	Toggles between Source 1 and 2.	TSALCS1; TSALCS2
	START CAL	Start ALC calibration.	ALC
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING (SERVICE USE ONLY)	EXTERNAL A/D INPUT	Selects external A/D input.	TSEXTI
	DVM CHANNEL XXXX (CHANNEL NAME)	Sets DVM Channel and displays channel name.	DVM; TSDVMC
	LATCH ADDRESS XXXX ADDRESS NAME)	Sets latch address and displays address name.	DWL; TSLATW
	TRIGGER READ READ DATA= XXXX	Triggers a read, and displays the resulting data.	DRL; TSLATR?
	WRITE DATA=XXXX	Sets the write data.	DWL; TSLATW
	TRIGGER WRITE	Triggers a write.	DWL; TSLATW
	MORE	Changes the soft-key display to the appropriate TROUBLE SHOOTING 2 menu.	None
	FINISHED, RECOVER FROM TROUBLESHOOTING	Exits troubleshooting mode and changes soft-key display to the DIAGNOSTICS menu.	TSEND; EDG

Menu Name	Function	Description	GPIB Mnemonic
TROUBLE SHOOTING 2 (SERVICE USE ONLY)	HET OSCILLATOR VOLTAGE	Selects HET OSCILLATOR VOLTAGE.	TSHETO
	SOURCE 1	Changes the soft-key display to TROUBLE SHOOTING SOURCE 1 menu.	None
	SOURCE 2	Changes the soft-key display to the TROUBLE SHOOTING SOURCE 2 menu.	None
	LO1	Changes the soft-key display to the TROUBLE SHOOTING LO 1 menu.	None
	SELECT MODES	Changes the soft-key display to the TROUBLE SHOOTING MODE SELECTION menu.	None
	MEASURE RECEIVER NOISE FIGURE	Changes the soft-key display to the TROUBLE SHOOTING RECEIVER NOISE FIGURE menu.	None
	MORE	Changes the soft-key display to the TROUBLE SHOOTING 3 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING 3 (SERVICE USE ONLY)	VERIFY ALC CALIBRATION	Changes the soft-key display to the TROUBLE SHOOTING ALC VERIFICATION menu.	TSALCV
	SRAM	Changes the soft-key display to the TROUBLE SHOOTING SRAM menu.	TSSRAM
	SRAM DISK	Changes the soft-key display to the TROUBLE SHOOTING SRAM (DISK) menu.	TSSRAMD
	FLASH MEMORY	Changes the soft-key display to the TROUBLE SHOOTING FLASH MEMORY menu.	TSFMEM
	EXTENDED FLASH MEMORY	Changes the soft-key display to the TROUBLE SHOOTING (EXTENDED) FLASH MEMORY menu.	TSEFMEM
	MORE	Changes the soft-key display to the TROUBLE SHOOTING 4 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING 4 (SERVICE USE ONLY)	DRAM	Change soft-key to TROUBLE SHOOTING xRAM menu.	TSDRAM
	GRAPHICS VRAM	Changes the soft-key display to the TROUBLE SHOOTING xRAM menu.	TSGVRAM
	GRAPHICS DRAM	Changes the soft-key display to the TROUBLE SHOOTING xRAM menu.	TSGDRAM
	DSP SRAM	Changes the soft-key display to the TROUBLE SHOOTING xRAM menu.	TSDSPSRAM
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE-SHOOTING ALC VERIFICATION	SELECT SOURCE 1/2	Toggles between Source 1 and 2.	TSALCS1; TSALCS2
	START VERIFICATION	Starts ALC verification.	TSALCV
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TROUBLE-SHOOTING EXTENDED FLASH MEMORY	!!!WARNING!!! THIS TEST TAKES ABOUT 4 MINUTES AND DESTROYS THE INSTRUMENT'S CONTROL SOFTWARE. AFTER THE TEST COMPLETES AND THE INSTRUMENT IS POWERED OFF, THE SOFTWARE MUST BE RELOADED USING THE FLOPPY BOOT PROCEDURE.	None	None
	START TEST	Start troubleshooting flash memory.	TSFMEM (Regular); TSEFMEM (Extended)
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE-SHOOTING EXTENDED FLASH MEMORY 2	TEST PASSED / FAILED		None
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE-SHOOTING LO 1	OFFSET VCO VOLTAGE	Selects OFFSET VCO VOLTAGE for LO 1.	TSOFFVLO1
	MAIN VCO VOLTAGE	Selects MAIN VCO VOLTAGE for LO 1.	TSMAIVLO1
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE-SHOOTING MODE SELECTION	HARMONIC MODE ON/OFF	Toggles harmonic mode on or off.	TSMHAR1; TSMHAR0
	COMMON OFFSET MODE ON/OFF	Toggles common offset mode on or off.	TSMCOO1; TSMCOO0
	SPEED UP CIRCUIT ON/OFF	Toggles speed up circuit mode on or off.	TSMSPU1; TSMSPU0
	SPUR AVOIDANCE MODE ON/OFF	Toggles spur avoidance mode on or off.	TSMSPA1; TSMSPA0
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE-SHOOTING RECEIVER NOISE FIGURE	CONNECT A THROUGH LINE BETWEEN A NOISE SOURCE AND PORT 2		None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TROUBLE SHOOTING SOURCE 1	DDS REFERENCE CLOCK VOLTAGE	Selects DDS REFERENCE CLOCK VOLTAGE for SOURCE 1.	TSDDSS1
	OFFSET VCO VOLTAGE	Selects OFFSET VCO VOLTAGE for SOURCE 1.	TSOFFVS1
	MAIN VCO VOLTAGE	Selects MAIN VCO VOLTAGES for SOURCE 1.	TSMAIVS1
	LEVEL AMPLIFIER VOLTAGE	Selects LEVEL AMPLIFIER VOLTAGE for SOURCE 1.	TSLEVAS1
	LOG AMPLIFIER VOLTAGE	Selects LOG AMPLIFIER VOLTAGE for SOURCE 1.	TSLOGAS1
	POWER LEVEL DAC VOLTAGE	Selects POWER LEVEL DAC VOLTAGE for SOURCE 1.	TSPWRLS1
	ALC MODULATOR DRIVE VOLTAGE	Selects ALC MODULATOR DRIVE VOLTAGE for SOURCE 1.	TSALCMS1
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING SOURCE 2	DDS REFERENCE CLOCK VOLTAGE	Selects DDS REFERENCE CLOCK VOLTAGE for SOURCE 2.	TSDDSS2
	OFFSET VCO VOLTAGE	Selects OFFSET VCO VOLTAGE for SOURCE 1.	TSOFFVS2
	MAIN VCO VOLTAGE	Selects MAIN VCO VOLTAGES for SOURCE 1.	TSMAIVS2
	LEVEL AMPLIFIER VOLTAGES	Selects LEVEL AMPLIFIER VOLTAGES for SOURCE 2.	TSLEVAS2
	LOG AMPLIFIER VOLTAGE	Selects LOG AMPLIFIER VOLTAGE for SOURCE 2.	TSLOGAS2
	POWER LEVEL DAC VOLTAGE	Selects ALC MODULATOR DRIVE VOLTAGE for SOURCE 2.	TSPWRS2
	ALC MODULATOR DRIVE VOLTAGE	Selects POWER LEVEL DAC VOLTAGE for SOURCE 2.	TSALCMS2
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING SRAM	WARNING THIS TEST DESTROYS ALL FRONT PANEL SETUPS (INCLUDING INTERNAL), AND CAL COEFFICIENTS AND SERVICE LOG.ON FAILURE, THE UNIT BEEPS AND THE LEDs FLASH THE INSTRUMENT WILL AUTOMATICALLY REBOOT AFTER TEST COMPLETION.	None	None
	START TEST	Starts troubleshooting SRAM(DISK) and changes soft-key display to the TROUBLE SHOOTING SRAM (DISK) RESULTS menu.	TSSRAM
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TROUBLE SHOOTING SRAM DISK	!!!WARNING!!! THIS TEST DESTROYS THE HARMONIC CAL COEFFICIENTS THE HARD DISK IS CORRUPTED AND MUST BE REFORMATTED AFTER TEST COMPLETION. ON FAILURE, THE UNIT BEEPS AND THE LED's FLASH		None
	START TEST	Starts SRAM DISK test.	TSSRAMD
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING SRAM DISK2	TEST PASSED / FAILED		None
	RETURN	Returns to the previous soft-key menu.	None
TROUBLE SHOOTING Xram x = DRAM GRAPHICS VRAM GRAPHICS DRAM DSP SRAM	!!!WARNING!!! THE DISPLAY WILL GO BLANK WHEN THIS TEST BEGINS. AFTER TEST COMPLETION, 4 BEEPS AND FLASHING LEDs INDICATE A FAILURE, AND THE INSTRUMENT AUTOMATICALLY RE-BOOTS	None	None
	START TEST	Starts the testing.	TSDRAM; TSGVRAM; TSGDRAM; TSDSPSRAM
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TYPE OF FILES TO COPY	FRONT PANEL SETUP AND CAL DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of front panel setup and cal data files on the source disk.	COPY
	TRACE DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of trace data files on the source disk.	COPY
	TABULAR DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of tabular data files on the source disk.	COPY
	TEXT DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of text files on the source disk.	COPY
	SNP DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of S2P files on the source disk.	COPY
	BITMAP DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of bitmap files on the source disk.	COPY
	HPGL DATA	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of HPGL files on the source disk.	COPY
	ALL TYPES(*.*)	Changes the soft-key display to the SELECT FILE TO COPY menu, which provides a list of all files on the source disk.	COPY
	PRESS UTILITY KEY TO RETURN	Returns to the previous soft-key menu.	None
TYPE OF FILES TO DELETE	FRONT PANEL SETUP AND CAL DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of front panel and calibration data files.	DEL
	TRACE DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of trace data files.	DEL
	TABULAR DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of tabular data files.	DEL
	TEXT DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of text files.	DEL
	SNP DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of S2P data files.	DEL
	BITMAP DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of bitmap files.	DEL
	HPGL DATA	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of HPGL files.	DEL
	ALL TYPES(*.*)	Changes the soft-key display to the SELECT FILE TO DELETE menu, which provides a list of all.	DEL
	PRESS UTILITY KEY TO RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
UTILITY	INSTRUMENT STATE PARAMETERS	Changes the soft-key display to the INSTRUMENT STATE PARAMETERS menu.	None
	REMOTE INTERFACE	Changes the soft-key display to the REMOTE INTERFACE menu.	None
	REAR PANEL	Changes the soft-key display to the REAR PANEL menu.	None
	COLOR SETUP	Changes the soft-key display to the COLOR SETUP menu.	None
	CLOCK SETUP	Changes the soft-key display to the CLOCK SETUP menu.	None
	DIAGNOSTICS	Changes the soft-key display to the DIAGNOSTICS menu.	None
	GENERAL DISK UTILITIES	Changes the soft-key display to the HARD DISK UTILITIES menu.	None
	AUTO CAL CHARACTERIZATION	Changes the soft-key display to the AUTO CAL CHARACTERIZATION menu. Only appears in Transmission and Reflection mode.	None

4-17 HARD COPY KEY MENUS

This key provides entry to hard copy functions.

Menu Name	Function	Description	GPIB Mnemonic
DISK FILE OPTIONS	DESTINATION		None
	HARD DISK	Selects hard disk file destination.	None
	FLOPPY DISK	Selects floppy disk file destination.	None
	FORMAT:		None
	TEXT	Selects file format TEXT.	SAVE “*.TXT”
	SNP OPTIONS	Changes the soft-key display to the SNP OPTIONS menu.	SAVE “*.S2P”
	TABULAR DATA	Selects file format TABULAR DATA.	SAVE “*.DAT”
	BITMAP	Selects file format BITMAP.	SAVE “*.BMP”
	HPGL	Selects file format HPGL.	SAVE “*.HGL”
	RETURN USES <PRINT> TO CAPTURE DATA	Returns to the previous soft-key menu.	None
HARD COPY	OUTPUT DEVICE XXXX	Changes the soft-key display to the OUTPUT DEVICE menu.	None
	OUTPUT SETUP	Changes the soft-key display to the PRINTER SETUP menu, DISK FILE OPTIONS menu, or PLOT SETUP menu; based on selected output device.	None
	OUTPUT HEADERS SETUP	Changes the soft-key display to the OUTPUT HEADERS SETUP menu.	None
	OUTPUT OPTIONS	Changes the soft-key display to the OUTPUT OPTIONS menu.	None
	PAGE ORIENTATION PORTRAIT/ LANDSCAPE	Toggles page orientation between portrait and landscape.	PORT; LAND; PLO?
	STOP PRINT	Tells the printer, plotter, or disk files to terminate output that is in process.	FFD
LOGO SETUP	LOGO ON/OFF	Turns the logo on and off.	LOGO1; LOGO0; LOGOX?
	LOGO TYPE STANDARD/USER LOGO	Toggles between the standard Anritsu and a user-defined logo.	LOGOS; LOGOU; LOGO?
	INSTALL USER LOGO		None
	FLOPPY TO PRINTER	Defines logo for plotting.	None
	FLOPPY TO PLOTTER	Defines logo for plotting.	None
	RETURN	Returns to the previous soft-key menu.	None
OUTPUT DEVICE	PRINTER	Selects the output device to be the printer.	None
	PLOTTER	Selects the output device to be the plotter.	None
	DISK FILE	Selects the output device to be a disk file.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
OUTPUT HEADERS SETUP	MODEL ON/OFF XXX	Toggles header model number on or off.	LMS; LMS?; LMD0; LMD1
	DEVICE ID ON/OFF XXX	Toggles header device identification number on or off.	LID; LID?; LDV0; LDV1
	OPERATOR ON/OFF XXX	Toggles header operator name on or off.	LNM; LNM?; LOP0; LOP1
	COMMENT ON/OFF XXX	Toggles header comments on or off.	LOC; LOC?; LCM0; LCM1
	LOGO SETUP	Changes the soft-key display to the LOGO SETUP menu.	None
	EDIT	Changes the soft-key display to the OUTPUT HEADERS SETUP 2 menu.	None
	MORE	Changes the soft-key display to the OUTPUT HEADERS SETUP 3 menu.	None
	RETURN	Changes the soft-key display to the HARD COPY menu.	None
OUTPUT HEADERS SETUP 2	MODEL XXXXXXXXXXXX	Changes the soft-key display to the SELECT LABEL menu.	LMS
	DEVICE ID XXXXXXXXXXX	Changes the soft-key display to the SELECT LABEL menu.	LID
	OPERATOR XXXXXXXXXXXX	Changes the soft-key display to the SELECT LABEL menu.	LNM
	COMMENT XXXXXXXXXXXX	Changes the soft-key display to the SELECT COMMENT menu.	LOC
	RETURN	Returns to the previous soft-key menu.	None
OUTPUT HEADERS SETUP 3	DATE ON/OFF	Toggles date on or off.	LDT1; LDT0
	SEQ HELP MESSAGE ON/OFF	Toggles the Sequence Help message on or off.	SEQHELP0; SEQHELP1; SEQHELP?
	SEQ OPERATOR MESSAGE ON/OFF	Toggles the Sequence Operator message on or off.	SEQOP1; SSEQOP0; SEQOP?
	MORE	Changes the soft-key display to the OUTPUT HEADERS SETUP menu.	None
	RETURN	Changes the soft-key display to the HARD COPY menu.	None
OUTPUT OPTIONS	TABULAR DATA FROM HARD DISK TO PRINTER	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL “C:*.DAT”
	TABULAR DATA FROM FLOPPY DISK TO PRINTER	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL “C:*.DAT”
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
PEN COLORS	DATA XX	Selects the color (pen number) in which the data will be plotted. The number of the pen displays where the “n” is shown.	DPN; DPN?
	DATA TRACE OVERLAY XX	Selects the color (pen number) in which the 2nd trace in a dual trace overlay plot will be plotted. The number of the pen displays where the “n” is shown.	TPN; TPN?
	GRATICULE XX	Selects the color (pen number) in which the graticule will be plotted. The number of the pen displays where the “n” is shown.	GPN; GPN?
	MARKERS AND LIMITS XX	Selects the color (pen number) in which the markers and limits will be plotted. The number of the pen displays where the “n” is shown.	MPN; MPN?
	HEADER XX	Selects the color (pen number) in which the header information will be plotted. The number of the pen displays where the “n” is shown.	HPN; HPN?
	PEN SPEED XXX PERCENT OF MAXIMUM	Selects the pen’s speed as a percentage of the plotter’s maximum speed. (Used to optimize plots on transparencies or with worn pens.)	SPD; SPD?
	RETURN	Changes the soft-key display to the PLOT SETUP menu.	None
PLOT SETUP	FULL PLOT	The plotter will plot everything displayed on the screen (data traces, graticule, menu text) when START PRINT is pressed.	PLS
	OBJECTS TO PLOT		None
	HEADER ON/OFF	The plot will include an information header if this option is on and START PRINT is pressed.	PLH; PLD
	MENU ON/OFF	The plot will include the menu text if this option is on and START PRINT is pressed.	PMN
	LIMITS ON/OFF	The plot will include any limit lines if this option is on and START PRINT is pressed.	PLM; PLD
	GRATICULE ON/OFF	The plot will include the graticule and annotation if this option is on and START PRINT is pressed.	PGT; PLD
	DATA TRACES AND MARKERS ON/OFF	The plot will include the data and any markers that are present if this option is on and START PRINT is pressed.	PLT; PLD
	PLOT FORMAT	Changes the soft-key display to the PLOT SIZE menu.	None
	RETURN	Returns to the previous soft-key menu.	None
PLOT SIZE	FULL SIZE	Selects a full size (page) plot.	PFL; PXX?
	QUARTER OF PLOT		None
	UPPER LEFT	Selects a quarter-size plot, upper-left quadrant.	PTL; PXX?
	UPPER RIGHT	Selects a quarter-size plot, upper-right quadrant.	PTR; PXX?
	LOWER LEFT	Selects a quarter-size plot, lower-left quadrant.	PBL; PXX?
	LOWER RIGHT	Selects a quarter-size plot, lower-right quadrant.	PBR; PXX?
	PEN COLORS	Changes the soft-key display to the PEN COLORS menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
PRINTER SETUP	PRINTER TYPE		None
	THINKJET	Selects HP QuietJet or HP ThinkJet printer.	PRNTYPTJ; PRNTYPX?
	DESKJET	Selects HP DeskJet (B/W) or HP LaserJet II and III series printer.	PRNTYPDJ; PRNTYPLJ; PRNTYPX?
	EPSON	Selects Epson FX, Epson MX, or Epson 9—pin compatible printer.	PRNTYPEP; PRNTYPX?
	OUTPUT FORMAT		None
	GRAPHICAL DATA	Changes the soft-key display to the PRINTER SETUP GRAPHICAL DATA menu.	None
	TABULAR DATA	Changes the soft-key display to the PRINTER SETUP TABULAR DATA menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
PRINTER SETUP GRAPHICAL DATA	HEADER ON/OFF	Toggles printing of header on or off.	HD1; HD0; HDX?
	SCREEN AREA TO OUTPUT		None
	FULL SCREEN	Prints the full-screen data, including the menus.	PFS
	GRAPH ONLY	Prints only the graph area of the screen.	PGR
	BITMAP FILE OUTPUT OPTIONS		None
	TRUE COLOR	Selects true color bitmap.	BMPT; BMPX?; BBMP
	COLOR ON WHITE BACKGROUND	Selects color on white background.	BMPC; BMPX?
	BLACK ON WHITE BACKGROUND	Selects black on white background.	BMPB; BMPX?
	RETURN	Returns to the previous soft-key menu.	None
PRINTER SETUP TABULAR DATA	MARKER DATA ON/OFF	Toggles printing of marker data on or off.	PMK; PMT
	SWEEP DATA ON/OFF	Toggles printing of sweep data on or off. If you choose to print the sweep data, you can choose the print density below.	PTB; PMT
	HEADER AND PAGE BREAK ON/OFF	Toggles printing of header and page—break data on or off.	HD1; HD0; HDX?
	PRINTER DENSITY 1 POINT EVERY XXX PRINT PT(S) XXX POINT(S)	Outputs one point every X points. Use the rotary knob to select total number of points to output. Skipping points will reduce the total number of printed points.	PT0-PT9
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT LABEL*	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%&'@^_'{}- * ? : \. SP	Enter the model number, device, and operator name or comment using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the lette	None
	BKSP CLR DONE	Selecting BKSP" deletes the last letter in the entry. Selecting "CLR" deletes the entire entry. Selecting "DONE" signals that you have finished writing the entry."	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the enternal keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection.	None
	NUMBERS MAY BE SELECTED USING KEYPAD	You may also select numbers and decimals using the keypad.	None
	PRESS <CLEAR> TO ABORT	Press the Clr/Local key to abort the process.	None
* Names of files must begin with an alphabetical character--not a numeric character.			
SNP OPTIONS	PORT 1	Select S1P format for Port 1.	OS1P1
	PORT 2	Select S1P format for Port 2.	OS1P2
	PORT 3	Select S1P format for Port 3.	OS1P3
	PORT 4	Select S1P format for Port 4.	OS1P4
	RETURN	Returns to the previous soft-key menu.	None
SNP OPTIONS	S1P PORT 1 PORT 2 PORT 3	 Select S1P format for Port 1. Select S1P format for Port 2. Select S1P format for Port 3.	 OS1P1 OS1P2 OS1P3
	S2P	Select S2P format.	OS2P
	S3P	Select S3P format.	OS3P
	S4P	Select S4P format.	OS4P
	M3P	Select mixed mode, S3P format.	OM3P
	M4P	Select mixed mode, S4P format.	OM4P
	SETUP	Changes the soft-key display to the SNP SETUP menu.	None
	RETURN	Returns to the previous soft-key menu.	None
	USE <PRINT> TO CAPTURE DATA	Press the Print key to capture data.	None

Menu Name	Function	Description	GPIB Mnemonic
SNP SETUP	FREQ UNITS GHz/MHz/kHz	Select frequency units.	
	OUTPUT FORMAT		
	LOG MAG	Select Log Magnitude and Phase as output format.	SNPDB
	LIN-MAG	Select Linear Magnitude and Phase as output format.	SNPMA; SNPFMTX?
	REAL-IMAG	Select Real and Imaginary as output format.	SNPRI
	RETURN	Returns to the previous soft-key menu.	None

4-18 DEFAULT KEY MENUS

This key provides entry to default functions.

Menu Name	Function	Description	GPIB Mnemonic
DEFAULT	CONTINUE	Erases current instrument state and loads a default state.	RST; *RST; RST1; RST0
	ABORT	Returns to the previous soft-key menu.	None
	WARNING: DEFAULT PROGRAM SELECTED. CONTINUING WILL ERASE CURRENT SETUP & CALIBRATION.		None

4-19 SAVE/RECALL KEY MENUS

This key provides entry to save and recall functions.

Menu Name	Function	Description	GPIB Mnemonic
RECALL	FRONT PANEL SETUP IN INTERNAL MEMORY	Changes the soft-key display to the RECALL FRONT PANEL SETUP FROM INTERNAL MEMORY menu.	None
	FRONT PANEL SETUP AND CAL DATA		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	AUTOCAL CHARACTERIZATION		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	LINEAR CAL		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	CAL DATA IN INTERNAL MEMORY	Changes the soft-key display to the RECALL CAL DATA IN INTERNAL MEMORY menu.	
	RETURN	Returns to the previous soft-key menu.	None
RECALL	LINEAR CAL		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	RECALL
	RETURN	Returns to the previous soft-key menu.	None
RECALL CAL DATA IN INTERNAL MEMORY	CAL 1 *	Causes the calibration data to be recalled from memory location 1. An asterisk indicates calibration data are stored in this memory location.	RCCM1
	CAL 2 *	Same as above, except memory location 2.	RCCM2
	CAL 3 *	Same as above, except memory location 3.	RCCM3
	CAL 4 *	Same as above, except memory location 4.	RCCM4
	CAL 5 *	Same as above, except memory location 5.	RCCM5
	CAL 6 *	Same as above, except memory location 6.	RCCM6
	CAL 7 *	Same as above, except memory location 7.	RCCM7
	CAL 8 *	Same as above, except memory location 8.	RCCM8

Menu Name	Function	Description	GPIB Mnemonic
RECALL FRONT PANEL SETUP FROM INTERNAL MEMORY	MEMORY 1 *	Causes the current front panel setup to be recalled from memory location 1. An asterisk indicates setup data are stored in this memory location.	RC1
	MEMORY 2 *	Same as above, except memory location 2.	RC2
	MEMORY 3 *	Same as above, except memory location 3.	RC3
	MEMORY 4 *	Same as above, except memory location 4.	RC4
	MEMORY 5 *	Same as above, except memory location 5.	RC5
	MEMORY 6 *	Same as above, memory location 6.	RC6
	MORE	Changes the soft-key display to the RECALL FRONT PANEL SETUP INTERNAL MEMORY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
RECALL FRONT PANEL SETUP FROM INTERNAL MEMORY	MEMORY 7 *	Same as above, except memory location 7.	RC7
	MEMORY 8 *	Same as above, except memory location 8.	RC8
	MEMORY 9 *	Same as above, except memory location 9.	RC9
	MEMORY 10 *	Same as above, except memory location 10.	RC10
	MORE	Changes the soft-key display to the RECALL FRONT PANEL SETUP INTERNAL MEMORY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SAVE	FRONT PANEL SETUP IN INTERNAL MEMORY	Changes the soft-key display to the SAVE FRONT PANEL SETUP TO INTERNAL MEMORY menu.	None
	FRONT PANEL SETUP AND CAL DATA		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	SAVE
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	SAVE
	AUTOCAL CHARACTERIZATION		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	SAVE
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO OVERWRITE menu.	SAVE
	CAL DATA IN INTERNAL MEMORY	Changes the soft-key display to the SAVE CAL DATA IN INTERNAL MEMORY menu.	None
	MORE	Changes the soft-key display to the next SAVE menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SAVE	LINEAR CAL		None
	ON HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	SAVE
	ON FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	SAVE
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SAVE CAL DATA IN INTERNAL MEMORY	CAL 1 *	Causes the current front panel setup to be saved to memory location 1. An asterisk indicates setup data are stored in this memory location.	SVCM1
	CAL 2 *	Same as above, except memory location 2.	SVCM2
	CAL 3 *	Same as above, except memory location 3.	SVCM3
	CAL 4 *	Same as above, except memory location 4.	SVCM4
	CAL 5 *	Same as above, except memory location 5.	SVCM5
	CAL 6 *	Same as above, except memory location 6.	SVCM6
	CAL 7 *	Same as above, except memory location 7.	SVCM7
	CAL 8 *	Same as above, except memory location 8.	SVCM8
SAVE FRONT PANEL SETUP TO INTERNAL MEMORY	MEMORY 1 *	Causes the current front panel setup to be saved to memory location 1. If an asterisk appears beside the selection, the memory is full. Select a different memory location.	SV1
	MEMORY 2 *	Same as above, except the setup saves to memory location 2.	SV2
	MEMORY 3 *	Same as above, except the setup saves to memory location 3.	SV3
	MEMORY 4 *	Same as above, except the setup saves to memory location 4.	SV4
	MEMORY 5 *	Same as above, except the setup saves to memory location 5.	SV5
	MEMORY 6 *	Same as above, except the setup saves to memory location 6.	SV6
	MORE	Changes the soft-key display to the SAVE FRONT PANEL SETUP TO INTERNAL MEMORY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SAVE FRONT PANEL SETUP TO INTERNAL MEMORY	MEMORY 7 *	Same as above, except the setup saves to memory location 7.	SV7
	MEMORY 8 *	Same as above, except the setup saves to memory location 8.	SV8
	MEMORY 9 *	Same as above, except the setup saves to memory location 9.	SV9
	MEMORY 10 *	Same as above, except the setup saves to memory location 10.	SV10
	MORE	Changes the soft-key display to the appropriate SAVE FRONT PANEL SETUP TO INTERNAL MEMORY menu.	None
	RETURN	Returns to the previous soft-key menu.	None
SAVE/RECALL FRONT PANEL AND CAL DATA	SAVE	Changes the soft-key display to the SAVE menu.	SAVE
	RECALL	Changes the soft-key display to the RECALL menu.	RECALL

Menu Name	Function	Description	GPIB Mnemonic
SELECT FILE TO OVERWRITE	CREATE NEW FILE	Changes the soft-key display to the SELECT FILENAME menu.	None
	FILE 1	Select file number 1 to be overwritten with new data.	None
	FILE 2	Select file number 2 to be overwritten with new data.	None
	FILE 3	Select file number 3 to be overwritten with new data.	None
	FILE 4	Select file number 4 to be overwritten with new data.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None
SELECT FILE TO READ	FILE 1	Recalls the data stored in file number 1.	None
	FILE 2	Recalls the data stored in file number 2.	None
	FILE 3	Recalls the data stored in file number 3.	None
	FILE 4	Recalls the data stored in file number 4.	None
	PREVIOUS PAGE	Returns to the previous menu.	None
	NEXT PAGE		None
	RETURN	Returns to the previous soft-key menu.	None
SELECT FILE-NAME	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%'@^_'{}~ * ?: \. SP	Name your filename using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been has been chosen for selection. Pressing the Enter key selects the letter or number. You are allowed	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the name displayed above. Selecting CLR deletes the entire name. Selecting DONE signals that you have finished writing the name.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key enters the selected letter/number in the name.	None
	NUMBERS MAY BE SELECTED USING KEYPAD	You may also select numbers and decimals using the keypad.	None
	PRESS <CLEAR> TO ABORT	Press the Clr/Local key to abort the process.	None

4-12 SEQ KEY MENUS

This key provides entry to sequence functions.

Menu Name	Function	Description	GPIB Mnemonic
CONDITION STATEMENT	IF LIMIT TEST PASS	Changes the soft-key display to the SELECT LIMIT TEST PASS SEQUENCE menu.	None
	IF LIMIT TEST FAIL	Changes the soft-key display to the SELECT LIMIT TEST FAIL SEQUENCE menu.	None
	LOOP COUNTER XXX	Sets the value of the loop counter and adds the statement to the sequence editor. The range value is 0 to 65535.	None
	LOOP COUNTER +1	Adds a statement LOOP COUNTER +1 to the sequence being edited.	None
	LOOP COUNTER -1	Adds the statement LOOP COUNTER -1 to the sequence being edited.	None
	IF LOOP COUNTER=0	Changes the soft-key display to the SELECT LOOP IF ZERO SEQUENCE menu.	None
	IF LOOP COUNTER<>0	Changes the soft-key display to the SELECT LOOP IF NOT ZERO SEQUENCE menu.	None
	RETURN	Returns to the CONTROL STATEMENT menu.	None
CONTROL STATEMENT	CONDITION STATEMENT	Changes the soft-key display to the CONDITION STATEMENT menu.	None
	WAIT FOR SWEEP COMPLETE	Adds a wait-for-sweep-complete statement to the sequence being edited.	None
	ENTER WAIT TIME XX SEC	Enters a number of seconds to wait in the sequence being edited.	None
	PAUSE	Adds a pause statement to the sequence being edited.	None
	EMBEDDED FILE NAME ON/OFF	Toggles the embedded file name on or off and adds a corresponding statement to the sequence editor.	None
	MESSAGE	Changes the soft-key display to the MESSAGE menu.	None
	SHOW MENU ON/OFF	Toggles the show menu on or off. If on, each menu name will add to the sequence editor; otherwise, the menu name will not be in the sequence editor.	None
	RETURN	Returns to the SEQUENCE menu.	None

Menu Name	Function	Description	GPIB Mnemonic
DELETE SEQUENCE	SEQUENCE 1 XXXXX	Remove sequence 1 from SRAM.	SEQDEL1
	SEQUENCE 2 XXXXX	Removes sequence 2 from SRAM.	SEQDEL2
	SEQUENCE 3 XXXXX	Removes sequence 3 from SRAM.	SEQDEL3
	SEQUENCE 4 XXXXX	Removes sequence 4 from SRAM.	SEQDEL4
	SEQUENCE 5 XXXXX	Removes sequence 5 from SRAM.	SEQDEL5
	SEQUENCE 6 XXXXX	Removes sequence 6 from SRAM.	SEQDEL6
	SEQUENCE 7 XXXXX	Removes sequence 7 from SRAM.	SEQDEL7
	RETURN	Returns to the previous soft-key menu.	None
EDIT SEQUENCE	SEQUENCE 1 XXXXX	Edits sequence 1.	None
	SEQUENCE 2 XXXXX	Edits sequence 2.	None
	SEQUENCE 3 XXXXX	Edits sequence 3.	None
	SEQUENCE 4 XXXXX	Edits sequence 4.	None
	SEQUENCE 5 XXXXX	Edits sequence 5.	None
	SEQUENCE 6 XXXXX	Edits sequence 6.	None
	SEQUENCE 7 XXXXX	Edits sequence 7.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
ENTER A SEQUENCE OPERATOR MESSAGE or (ENTER A SEQUENCE COMMENT)	(Message or comment)	Display the message text.	None
	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%&'@^_'{}- * ? : \. SP	Enter the message or comment using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number.	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the name displayed above. Selecting CLR deletes the entire name. Selecting DONE signals that you have finished writing the name.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection. The menu remains on the screen until another menu is selected for display or until the CLEAR/RET LOC key is pressed.	None
	NUMBERS MAY BE SELECTED USING KEYPAD		None
EXECUTE SEQUENCE	SEQUENCE 1 XXXXX	Runs sequence 1.	SEQEXE1
	SEQUENCE 2 XXXXX	Runs sequence 2.	SEQEXE2
	SEQUENCE 3 XXXXX	Runs sequence 3.	SEQEXE3
	SEQUENCE 4 XXXXX	Runs sequence 4.	SEQEXE4
	SEQUENCE 5 XXXXX	Runs sequence 5.	SEQEXE5
	SEQUENCE 6 XXXXX	Runs sequence 6.	SEQEXE6
	SEQUENCE 7 XXXXX	Runs sequence 7.	SEQEXE7
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
GOSUB SEQUENCE	SEQUENCE 1 XXXXX	Selects sequence 1 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	SEQUENCE 2 XXXXX	Selects sequence 2 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	SEQUENCE 3 XXXXX	Selects sequence 3 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	SEQUENCE 4 XXXXX	Selects sequence 4 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	SEQUENCE 5 XXXXX	Selects sequence 5 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	SEQUENCE 6 XXXXX	Selects sequence 6 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	SEQUENCE 7 XXXXX	Selects sequence 7 to be called during sequence execution; the corresponding statement will be added to the sequence editor.	None
	RETURN	Returns to the previous soft-key menu.	None
LOAD SEQUENCE	TO SEQUENCE NUMBER X	Sets a sequence # to load.	None
	FROM HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu to select a hard disk file to load.	SEQLOAH1 thru SEQLOAH7
	FROM FLOPPY DISK	Changes the soft-key display to the SELECT FILE TO READ menu to select a floppy disk file to load.	SEQLOA1 thru SEQLOA7
	RETURN	Returns to the previous soft-key menu.	None
MESSAGE	MESSAGE TO OPERATOR	Changes the soft-key display to the ENTER A SEQUENCE OPERATOR MESSAGE menu.	None
	SEQUENCE COMMENT	Changes the soft-key display to the ENTER A SEQUENCE COMMENT menu.	None
	RETURN	Returns to the previous soft-key menu.	None
PARALLEL OUT SETUP	SET PARALLEL OUT PORT (0-255) X	Sets the value of the parallel out port (pins 7 through 13 and 15, of rear panel Ext I/O connector).	POP; POP?
	SET PARALLEL OUT BIT (0-7) X	Sets the selected bit of the parallel out port to a 1.	POPBS0 thru POPBS7
	CLEAR PARALLEL OUT BIT (0-7) X	Sets the selected bit of the parallel out port to a 0.	POPBC0 thru POPBC7
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
RENAME SEQUENCE	SEQUENCE 1 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM1; SEQNAM1?
	SEQUENCE 2 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM2; SEQNAM2?
	SEQUENCE 3 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM3; SEQNAM3?
	SEQUENCE 4 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM4; SEQNAM4?
	SEQUENCE 5 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM5; SEQNAM5?
	SEQUENCE 6 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM6; SEQNAM6?
	SEQUENCE 7 XXXXX	Changes the soft-key display to the RENAME A SEQUENCE menu.	SEQNAM7; SEQNAM7?
	RETURN	Returns to the previous soft-key menu.	None
RENAME A SEQUENCE	(Name)	Display the name.	None
	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%&'@^_'{}- * ? : \. SP	Name your sequence using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number. You are allowed up to nine ch	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the name displayed above. Selecting CLR deletes the entire name. Selecting DONE signals that you save finished writing the name.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection. The menu remains on the screen until another menu is selected for display or until the CLEAR/RET LOC keys pressed.	None
	NUMBERS MAY BE SELECTED USING KEYPAD		None
	PRESS <CLEAR> TO ABORT	Press the Data Entry Clear key to abort the process.	None

Menu Name	Function	Description	GPIB Mnemonic
SAVE SEQUENCE	SEQUENCE 1 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV1 (FDD) SEQSAVH1 (HDD)
	SEQUENCE 2 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV2 (FDD) SEQSAVH2 (HDD)
	SEQUENCE 3 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV3 (FDD) SEQSAVH3 (HDD)
	SEQUENCE 4 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV4 (FDD) SEQSAVH4 (HDD)
	SEQUENCE 5 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV5 (FDD) SEQSAVH5 (HDD)
	EQUENCE 6 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV6 (FDD) SEQSAVH6 (HDD)
	SEQUENCE 7 XXXXX	Selects sequence 1 to save on hard/floppy disk; a statement is added to the sequence editor.	SEQSAV7 (FDD) SEQSAVH7 (HDD)
	RETURN	Returns to the previous soft-key menu.	None
SELECT FILENAME	(Name)	Display the name.	None
	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%&'@^_'{}- * ? : \. SP	Name your file using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number. You are allowed up to eight characters.	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the name displayed above. Selecting CLR deletes the entire name. Selecting DONE signals that you save finished writing the name.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection. The menu remains on the screen until another menu is selected for display or until the CLEAR/RET LOC key is pressed.	None
	NUMBERS MAY BE SELECTED USING KEYPAD		None
	PRESS <CLEAR> TO ABORT	Press the Data Entry Clear key to abort the process.	None
SELECT FILE TO OVERWRITE	CREATE NEW FILE	Changes the soft-key display to the SELECT FILENAME menu.	None
	FILE 1	Select file number 1 to be overwritten with new data.	None
	FILE 2	Select file number 2 to be overwritten with new data.	None
	FILE 3	Select file number 3 to be overwritten with new data.	None
	FILE 4	Select file number 4 to be overwritten with new data.	None
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT FILE TO READ	FILE 1 SEQ	Displays the data stored in file number 1.	None
	FILE 2 SEQ	Displays the data stored in file number 2.	None
	FILE 3 SEQ	Displays the data stored in file number 3.	None
	FILE 4 SEQ	Displays the data stored in file number 4.	None
	PREVIOUS PAGE	Returns to the previous menu of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to the previous soft-key menu.	None
SELECT GOSUB SEQUENCE	SELECT EXISTING SEQUENCE		
	ENTER A SEQUENCE NAME		
	RETURN	Returns to the previous soft-key menu.	None
SEQUENCE	EXECUTE SEQUENCE	Changes the soft-key display to the EXECUTE SEQUENCE menu.	None
	EDIT SEQUENCE	Changes the soft-key display to the EDIT SEQUENCE menu.	None
	GOSUB SEQUENCE	Changes the soft-key display to the SELECT GOSUB SEQUENCE menu.	None
	CONTROL STATEMENT	Changes the soft-key display to the CONTROL STATEMENT menu.	None
	DONE SEQUENCE EDIT	Closes sequence editor and saves the sequence in memory.	None
	TTL I/O	Changes the soft-key display to the TTL I/O menu.	None
	UTILITY	Changes the soft-key display to the SEQUENCE UTILITY menu.	None
	EDITING FUNCTIONS	Changes the soft-key display to the SEQUENCE EDITING FUNCTIONS menu.	None
SEQUENCE EDITING FUNCTIONS	TO SEQUENCE BEGIN	Moves cursor to the first statement of a sequence.	None
	TO SEQUENCE END	Moves cursor past the last statement of a sequence.	None
	CLEAR EDITING WINDOW	Hides the sequence editing window to allow viewing of the data display area of the screen.	None
	RESTORE EDITING WINDOW	Restores the hidden editing window to the screen.	None
	SAVE TO MEMORY		None
	CURRENT SEQUENCE	Saves the top editing sequence to memory.	None
	ALL SEQUENCES	Saves all sequences to memory.	None
	CANCEL SEQUENCE EDIT	Discards all modifications, and the old contents replace the modifications.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SEQUENCE NAME	(Name)	Display the name.	None
	ABCDEFGHIJKLM NOPQRSTUVWXYZ 0123456789()- !#$%&'@^_'{}- * ? : \. SP	Name your sequence using the rotary knob to select letters, numbers, or both. A letter or number turns red to indicate that the letter/number has been chosen for selection. Pressing the Enter key selects the letter or number. You are allowed up to 15 char	None
	BKSP CLR DONE	Selecting BKSP deletes the last letter in the name displayed above. Selecting CLR deletes the entire name. Selecting DONE signals that you have finished writing the name.	None
	TURN KNOB TO INDICATE CHARACTER OR FUNCTION	Use the rotary knob to indicate the letter or number you wish to select. You can use the external keyboard up-arrow and down-arrow keys to move between rows.	None
	PRESS <ENTER> TO SELECT	Pressing the Enter key implements your menu selection. The menu remains on the screen until another menu is selected for display or until the CLEAR/RET LOC key is pressed.	None
	NUMBERS MAY BE SELECTED USING KEYPAD	You may also select numbers and decimals using the keypad.	None
SEQUENCE UTILITY	LOAD SEQUENCE	Changes the soft-key display to the LOAD SEQUENCE menu.	None
	SAVE MESSAGE TO SERVER LOG ON/OFF	When on, saves sequence message to the Service Log.	SEQDGMSG0; SEQDGMSG1; SEQDGMSG?
	SAVE SEQUENCE		None
	DELETE SEQUENCE	Changes the soft-key display to the DELETE SEQUENCE menu.	None
	RENAME SEQUENCE	Changes the soft-key display to the RENAME SEQUENCE menu.	None
	RETURN	Returns to the previous soft-key menu.	None
TTL I/O	REAR PANEL SETUP	Changes the soft-key display to the REAR PANEL menu.	None
	PARALLEL OUT SETUP	Changes the soft-key display to the PARALLEL OUT SETUP menu.	None
	PARALLEL IN BIT (0-4)	Sets up which parallel-in bit is to be used and adds the corresponding statement to the sequence editor.	None
	IF PARALLEL IN BIT HIGH	Changes the soft-key display to the SELECT BIT HIGH SEQUENCE menu. (This entry only appears in sequence editing mode.)	None
	IF PARALLEL IN BIT LOW	Changes the soft-key display to the SELECT BIT LOW SEQUENCE menu. (This entry only appears in sequence editing mode.)	None
	RETURN	Returns to the previous soft-key menu. (This entry only appears in sequence editing mode.)	None

4-13 CAL KEY MENUS

This key provides entry to calibration functions.

Menu Name	Function	Description	GPIB Mnemonic
3 PORT CALIBRATION	CONNECT A THROUGH LINE BETWEEN PORTS 1 AND 3		None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 3 PORT CALIBRATION menu.	TCD
3 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 3: OPEN/SHORT/ BROADBAND	Connect specified open, short, or broadband load to Port 3, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 3 PORT CALIBRATION menu.	TCD
3 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 3: SLIDE LOAD SLIDE LOAD TO POSITION 1	Connect a sliding load to Port 3, and slide the load to position 1. Then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 3 PORT CALIBRATION menu.	TCD
3 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	SLIDE LOAD TO POSITION x	Slide the load to the indicated position, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 3 PORT CALIBRATION menu.	TCD
3 PORT CALIBRATION	MEASURING...		None
	RESTART MEASUREMENT	Changes the soft-key display to the beginning 3 PORT CALIBRATION menu.	None
3 PORT CALIBRATION	REMEASURE	Changes the soft-key display to the previous 3 PORT CALIBRATION menu.	None
	NEXT CAL STEP	Changes the soft-key display to next 3 PORT CALIBRATION menu.	NCS
3 PORT CALIBRATION	CONNECT ISOLATION DEVICES TO ALL PORTS	Connect appropriate isolation devices to all test ports.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 3 PORT CALIBRATION menu.	TCD

Menu Name	Function	Description	GPIB Mnemonic
4 PORT BEGIN 4 PORT CALIBRATION (40 TERMS)	KEEP EXISTING CAL DATA	Changes the soft-key display to the FREQUENCY menu, in the Freq key group.	KEC
	REPEAT PREVIOUS CAL	Changes the soft-key display to the beginning 4 PORT CALIBRATION menu.	RPC
	CAL METHOD XXXX	Displays the current calibration method.	CM4PX?
	LINE TYPE XXXX	Displays the current line type.	LTX?
	CHANGE CAL METHOD	Changes the soft-key display to the SELECT 4 PORT CAL METHOD menu.	None
	USE EXISTING 3 PORT CAL? YES/NO	Selects if the existing 3 Port Cal is used in the 4 Port Cal.	US3P; NUS39; US3P?
	NEXT CAL STEP	Changes the soft-key display to the 4 PORT CONFIRM CALIBRATION PARAMETERS menu.	None
4 PORT CONFIRM CALIBRATION PARAMETERS	*PORT 3 CONN XXX	Displays current connector type and changes soft-key display to one of the SELECT PORT X CONNECTOR TYPE menus. * Omitted if 24 Term Cal exists.	P3C; P3C?
	PORT 4 CONN XXX	Displays current connector type and changes soft-key display to one of the 4 PORT SELECT PORT 4 CONNECTOR TYPE menus.	P4C; P4C?
	LOAD TYPE XXXX	Changes the soft-key display to the 4 PORT SELECT TYPE OF LOAD menu.	None
	DO PORT 2, 4 THROUGH? YES/NO	Selects Port 2, 4 THROUGH measurement during 4 port calibration.	THRU24; THRU24N; THRU23?
	DO PORT 3, 4 THROUGH? YES/NO	Selects Port 2, 3 THROUGH measurement during 4 port calibration.	THRU34; THRU34N; THRU34?
	DO PORT 2, 3 THROUGH? YES/NO	Selects Port 2, 3 THROUGH measurement during 4 port calibration.	THRU23; THRU23N; THRU23?
	THROUGHLINE OFFSET LENGTH	Changes the soft-key display to the 4 PORT THROUGHLINE OFFSET LENGTH menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG

Menu Name	Function	Description	GPIB Mnemonic
4 PORT CONFIRM CALIBRATION PARAMETERS	*PORT 3 SHORT OFFSET LENGTH XXX mm	Sets reflective device offset length for 3 port TRX calibration. * Omitted if 24 Term Cal exists.	ROLP3; ROLP3?
	PORT 4 SHORT OFFSET LENGTH XXX mm	Sets reflective device offset length for 4 port TRX calibration.	ROLP4; ROLP4?
	LOAD TYPE XXXX	Changes the soft-key display to the 4 PORT SELECT TYPE OF LOAD menu.	None
	DO PORT 2, 4 THROUGH? YES/NO	Selects Port 2, 4 THROUGH measurement during 4 port calibration.	THRU24; THRU24N; THRU23?
	DO PORT 3, 4 THROUGH? YES/NO	Selects Port 2, 3 THROUGH measurement during 4 port calibration.	THRU34; THRU34N; THRU34?
	DO PORT 2, 3 THROUGH? YES/NO	Selects Port 2, 3 THROUGH measurement during 4 port calibration.	THRU23; THRU23N; THRU23?
	THROUGHLILNE OFFSET LENGTH	Changes the soft-key display to the 4 PORT THROUGHLINE OFFSET LENGTH menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
4 PORT SELECT 4 PORT CAL METHOD	40-TERM CAL		
	SOLT (NOT FOR WAVEGUIDE)	Selects a Short-Open-Load-Thru (SOLT) calibration of 4 ports.	SOLT4P
	TRX	Selects TRX method for 4 ports.	TRX4P
	NEXT CAL STEP	Changes the soft-key display to the next 4 PORT CALIBRATION menu.	NCS
4 PORT THROUGHLINE OFFSET LENGTH	PORT 1, 3 XXX mm	Enter Port 1, 3 THROUGH offset length for 4 port calibration.	TOLP3; TOLP3?
	PORT 1, 4 XXX mm	Enter Port 1, 4 THROUGH offset length for 4 port calibration.	TOLP14; TOLP14?
	PORT 2, 4 XXX mm	Enter Port 2, 4 THROUGH offset length for 4 port calibration.	TOLP24; TOLP24?
	PORT 3, 4 XXX mm	Enter Port 3, 4 THROUGH offset length for 4 port calibration.	TOLP34; TOLP34?
	PORT 2, 3 XXX mm	Enter Port 2, 3 THROUGH offset length for 4 port calibration.	TOLP23; TOLP23?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
4 PORT PORT 4 OPEN DEVICE	ENTER THE CAPACITANCE COEFFICIENTS		None
	TERM 1-C0 P/MXXX.XX e - 15	Enter the term 1 coefficient value (x 10^{-15} F).	CC0; CC0?
	TERM 2-C1 P/MXXX.XX e - 27	Enter the term 2 coefficient value (x 10^{-27}F/Hz).	CC1; CC1?
	TERM 3-C2 P/MXXX.XX e - 36	Enter the term 3 coefficient value (x 10^{-36}F/Hz^2).	CC2; CC2?
	TERM 4-C3 P/MXXX.XX e - 45	Enter the term 4 coefficient value (x 10^{-45}F/Hz^3).	CC3; CC3?
	ENTER THE OFFSET LENGTH		None
	OFFSET LENGTH P/MXXX.XXX mm	Enter and display offset length of Open.	COO; COO?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
4 PORT PORT 4 SHORT DEVICE	ENTER THE INDUCTANCE COEFFICIENTS		None
	TERM 1-L0 P/MXXX.XX e - 12	Enter the term 1 coefficient value (x 10^{-12} H).	CC0; CC0?
	TERM 2-L1 P/MXXX.XXe - 24	Enter the term 2 coefficient value (x 10^{-24} H/Hz).	CC1; CC1?
	TERM 3-L2 P/MXXX.XX e - 33	Enter the term 3 coefficient value (x 10^{-33}H/Hz^2).	CC2; CC2?
	TERM 4-L3 P/MXXX.XX e - 42	Enter the term 4 coefficient value (x 10^{-42}H/Hz^3).	CC3; CC3?
	ENTER THE OFFSET LENGTH		None
	OFFSET LENGTH P/MXXX.XXX mm	Enter and display offset length of Short.	COS; COS?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
4 PORT SELECT TYPE OF LOAD	BROADBAND FIXED LOAD	Selects a broadband load for calibration and changes soft-key display to the BROADBAND LOAD PARAMETERS menu.	BBL; BBX?
	SLIDING LOAD (MAY ALSO REQUIRE A BROADBAND FIXED LOAD)	Selects sliding load for calibration. If low-end frequency is below 2 GHz (4 GHz for V Connector), a fixed broadband load is also required.	SLD; BBX?

Menu Name	Function	Description	GPIB Mnemonic
4 PORT SELECT CONNECTOR TYPE	SMA (M)	Sets port 4 to be male SMA connector.	CMS; P1C?; P2C?
	SMA (F)	Sets port 4 to be female SMA connector.	CFS; P1C?; P2C?
	K-CONN (M)	Sets port 4 to be male K connector.	CMK; P1C?; P2C?
	K-CONN (F)	Sets port 4 to be female K connector.	CFK; P1C?; P2C?
	TYPE N (M)	Sets port 4to be male N connector.	CMN; P1C?; P2C?
	TYPE N (F)	Sets port 4 to be female N connector.	CFN; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the 4 PORT OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next 4 PORT SELECT CONNECTOR TYPE menu.	None
4 PORT SELECT CONNECTOR TYPE	GPC-3.5 (M)	Sets port 4 to be male GPC 3.5 connector.	CM3; P1C?; P2C?
	GPC-3.5 (F)	Sets port 4 to be female GPC 3.5 connector.	CF3; P1C?; P2C?
	GPC-7	Sets port 4 to be GPC-7 connector.	CNG; P1C?; P2C?
	V-CONN (M)	Sets port 4 to be male V connector.	CMV; P1C?; P2C?
	V-CONN (F)	Sets port 4 to be female V connector.	CFV; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the 4 PORT OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next 4 PORT SELECT CONNECTOR TYPE menu.	None
4 PORT SELECT CONNECTOR TYPE	TNC (M)	Sets port 4 to be male TNC connector.	CMC; P1C?; P2C?
	TNC (F)	Sets port 4 to be female TNC connector.	CFC; P1C?; P2C?
	2.4 mm (M)	Sets port 4 to be male 2.4 mm connector.	CM2; P1C?; P2C?
	2.4 mm (F)	Sets port 4 to be female 2.4 mm connector.	CF2; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the 4 PORT OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next 4 PORT SELECT CONNECTOR TYPE menu.	None
4 PORT SELECT CONNECTOR TYPE	TYPE N (M) 75 Ohm	Sets port 4 to be male Type N 75 Ohm connector.	CMN75; P1C?; P2C?
	TYPE N (F) 75 Ohm	Sets port 4 to be female Type N 75 Ohm connector.	CFN75; P1C?; P2C?
	7/16 (M)	Sets port 4 to be male 7/16 connector.	CM716
	7/16 (F)	Sets port 4 to be female 7/16 connector.	CF716
	SPECIAL (M)	Sets port 4 to be male Special connector.	CMSP; P1C?; P2C?
	SPECIAL (F)	Sets port 4 to be female Special connector.	CFSP; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the 4 PORT OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next 4 PORT SELECT CONNECTOR TYPE menu.	None
4 PORT CALIBRATION	CONNECT A THROUGH LINE BETWEEN PORTS 1 AND 4		None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 4 PORT CALIBRATION menu.	TCD

Menu Name	Function	Description	GPIB Mnemonic
4 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 3: OPEN/SHORT/ BROADBAND	Connect specified open, short, or broadband load to Port 3, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 4 PORT CALIBRATION menu.	TCD
4 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 3: OPEN PORT 4: SHORT	Connect specified open to Port 3 and short to Port 4, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 4 PORT CALIBRATION menu.	TCD
4 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 3: SHORT PORT 4: OPEN	Connect specified short to Port 3 and open to Port 4, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes4 PO soft-key display to the next 4 PORT CALIBRATION menu.	TCD
4 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 3: BROADBAND PORT 4: BROADBAND	Connect specified broadband load to Ports 3 and 4, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes4 PO soft-key display to the next 4 PORT CALIBRATION menu.	TCD
4 PORT CALIBRATION	CONNECT CALIBRATION DEVICE		None
	PORT 4: OPEN/SHORT/ BROADBAND	Connect specified open, short, or broadband load to Port 4, then press the MEASURE DEVICES soft-key.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 4 PORT CALIBRATION menu.	TCD
4 PORT CALIBRATION	MEASURING...		None
	RESTART MEASUREMENT	Changes the soft-key display to the beginning 4 PORT CALIBRATION menu.	None
4 PORT CALIBRATION	REMEASURE	Changes the soft-key display to the previous 4 PORT CALIBRATION menu.	None
	NEXT CAL STEP	Changes the soft-key display to next 4 PORT CALIBRATION menu.	NCS
4 PORT CALIBRATION	CONNECT ISOLATION DEVICES TO ALL PORTS	Connect appropriate isolation devices to all test ports.	None
	MEASURE DEVICE(S)	Changes the soft-key display to the next 4 PORT CALIBRATION menu.	TCD

Menu Name	Function	Description	GPIB Mnemonic
ADAPTER REMOVAL	12-TERM CAL X AND Y MUST EXIST IN THE CURRENT DIRECTORY		None
	ELECTRICAL LENGTH OF THE ADAPTER XXX.XXX ps	Displays the electrical length of the adapter. The value of the electrical length is used when the two calibrations are merged. It has the same range as the time delay for reference plane extension and a default value of 0.0000 ps.	ADPL; ADPL?
	REMOVE ADAPTER	Changes the soft-key display to the next ADAPTER REMOVAL menu.	LDARF; IARF
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
ADAPTER REMOVAL 2	RECALL FROM DISK THE CALIBRATION FILE OF THE X TEST PORT (ADAPTER ON PORT2)		None
	HARD DISK	Changes the soft-key display to the next SELECT FILE TO READ menu.	LDARF; IARF
	FLOPPY DISK		LDARF; IARF
	RETURN	Returns to the previous soft-key menu.	None
ADAPTER REMOVAL 3	RECALL FROM DISK THE CALIBRATION FILE OF THE Y TEST PORT (ADAPTER ON PORT1)		None
	HARD DISK	Changes the soft-key display to the next SELECT FILE TO READ menu.	LDARF; IARF
	FLOPPY DISK		LDARF; IARF
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL	PLEASE CONNECT THE AUTOCAL MODULE.		None
	MEASURE DEVICE(S)	Start processing the measurement and changes soft-key display to the AUTOCAL 2 menu.	BEGAC
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL 2	MEASURING...		None
	RETURN	Aborts the calibration. Changes the soft-key display to the PERFORM AUTOCAL menu.	ABORTCAL
AUTOCAL 3	SAVE	Changes the soft-key display to the SAVE menu.	SAVE
	EXIT CAL	Exit AutoCal without saving calibration data to disk.	ABORTCAL

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL 4	SELECT CALIBRATION TYPE		None
	FULL 2 PORT	Selects a traditional 2-port Short-Open-Load-Thru(SOLT) calibration.	ACSF2P; ACX?
	FULL 3 PORT	Selects a traditional 3-port Short-Open-Load-Thru(SOLT) calibration.	ACSF3P; ACX?
	FULL 4 PORT	Selects a traditional 4-port Short-Open-Load-Thru(SOLT) calibration.	ACSF4P; ACX?
	REFLECTION ONLY		None
	S11 REFL.	Selects S11 1-port calibration of port 1.	ACS11; ACX?
	S22 REFL.	Selects S22 1-port calibration of port 2.	ACS22; ACX?
	2 PORT REFL. (S11, S22)	Selects S11 and S22 2-port calibration and changes soft-key display to the AUTOCAL menu.	ACS11S22; ACX?
	ADAPTER REMOVAL	Selects calibrations on male-male or female-female test port cables. In addition to the calibrator module, an adapter is needed for this kind of calibration.	ACADR; ACX?
	RETURN	Returns to the PERFORM AUTOCAL menu.	None
AUTOCAL 5	Displayed only when performing and AutoCal adapter removal.		
	REVERSE THE VNMS CONNECTIONS TO THE AUTO-CAL MODULE		None
	LEAVE THE ADAPTER ON THE SAME PORT OF AUTO-CAL MODULE		None
	MEASURE DEVICE(S)	Starts processing the measurement and changes soft-key display to the AUTOCAL 2 menu.	BEGAC
	RETURN	Aborts the adapter removal calibration. Changes the soft-key display to the PERFORM AUTOCAL menu.	None
AUTOCAL 6	CONNECT ISOLATION STANDARDS TO VNA		None
	OR		None
	DISCONNECT ONE CABLE FROM THE AUTO-CAL MODULE		None
	MEASURE DEVICE(S)	Starts processing the measurement and changes soft-key display to the AUTOCAL 2 menu.	BEGAC
	RETURN	Aborts the adapter removal calibration. Changes the soft-key display to the PERFORM AUTOCAL menu.	None
AUTOCAL 7	CONNECT A THRU LINE BETWEEN PORT 1 AND 2		None
	MEASURE DEVICE(S)	Starts processing the measurement and changes soft-key display to the AUTOCAL 2 menu.	BEGAC
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL PORT CONFIGURATION (FULL 2 PORT CAL /2 PORT REFLEC-TION/ADAPTER REMOVAL)	PORT CONFIG. 1L2R/1R2L	Toggles between port configurations 1L2R and 1R2L.	ACR1L2; ACL1R2; ACF2P?; ACAP?
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 2 PORT CAL /2 PORT REFLEC-TION/ ADAPTER REMOVAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1 or 2.	
	PORT CONFIG. 1X2A 1X2B 1X2C	Menu display for VNA port assignment 1.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 2 PORT CAL /2 PORT REFLEC-TION/ ADAPTER REMOVAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1 or 2.	
	PORT CONFIG. 1A2X 1B2X 1C2X	Menu display for VNA port assignment 2.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 3 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, or 3.	
	PORT CONFIG. 1X2A3B 1X2A3C 1X2B3A 1X2B3C 1X2C3A 1X2C3B	Menu display for VNA port assignment 1.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 3 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, or 3.	
	PORT CONFIG. 1A2X3B 1A2X3C 1B2X3A 1B2X3C 1C2X3A 1C2X3B	Menu display for VNA port assignment 2.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL PORT CONFIGURATION (FULL 3 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, or 3.	
	PORT CONFIG. 1A2B3X 1A2C3X 1B2A3X 1B2C3X 1C2A3X 1C2B3X	Menu display for VNA port assignment 3.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 4 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3/4	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, 3, or 4.	
	PORT CONFIG. 1X2A3B4C 1X2A3C4B 1X2B3A4C 1X2B3C4A 1X2C3A4B 1X2C3B4A	Menu display for VNA port assignment 1.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 4 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3/4	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, 3, or 4.	
	PORT CONFIG. 1A2X3B4C 1A2X3C4B 1B2X3A4C 1B2X3C4A 1C2X3A4B 1C2X3B4A	Menu display for VNA port assignment 2.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (FULL 4 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3/4	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, 3, or 4.	
	PORT CONFIG. 1A2B3X4C 1A2C3X4B 1B2A3X4C 1B2C3X4A 1C2A3X4B 1C2B3X4A	Menu display for VNA port assignment 3.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL PORT CONFIGURATION (FULL 4 PORT CAL)	SELECT VNA PORT FOR AUTOCAL PORT X 1/2/3/4	This menu displays for a 4-port AutoCal box only. Toggles between VNA port selection 1, 2, 3, or 4.	
	PORT CONFIG. 1A2B3C4X 1A2C3B4X 1B2A3C4X 1B2C3A4X 1C2A3B4X 1C2B3A4X	Menu display for VNA port assignment 4.	ACPCFG
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (S11 REFLECTION OR S22 REFLECTION)	SELECT AUTOCAL PORT FOR VNA PORT (Displays 1 or 2 depending on calibration type) LEFT/RIGHT	Toggles between AutoCal port left or right.	ACPL; ACPR; ACP1?; ACP2?; ACP2L; ACP2R
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL PORT CONFIGURATION (S11 REFLECTION OR S22 REFLECTION)	SELECT AUTOCAL PORT FOR VNA PORT (Displays 1 or 2 depending on calibration type) X/A/B/C	Toggles between AutoCal ports X, A, B, or C.	ACPX; ACPA; ACPB; ACPC; ACPX?
	RETURN	Returns to the previous soft-key menu.	
AUTOCAL SETUP (FULL 2 PORT CAL)	PORT CONFIG. (XXXX)	Changes the menu soft-key display to the appropriate AUTOCAL PORT CONFIGURATIONS menu.	None
	THRU ASSIGNMENT	Changes the menu soft-key display to the appropriate THRU ASSIGNMENT menu.	None
	AVERAGING	Changes the menu soft-key display to the appropriate AUTOCAL AVERAGING menu.	None
	START CAL	Starts the calibration.	BEGAC
	HELP	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL SETUP (FULL 3 PORT CAL)	PORT CONFIG. (1X2A3B)	Displays only if connected to a 4-port AutoCal box. Changes the menu soft-key display to the appropriate AUTOCAL PORT CONFIGURATIONS menu.	None
	THRU ASSIGNMENT	Changes the menu soft-key display to the appropriate THRU ASSIGNMENT menu.	None
	AVERAGING	Changes the menu soft-key display to the appropriate AUTOCAL AVERAGING menu.	None
	START CAL	Starts the calibration.	BEGAC
	HELP	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL SETUP (FULL 4 PORT CAL)	PORT CONFIG. (1X2A3B4C)	Displays only if connected to a 4-port AutoCal box. Changes the menu soft-key display to the appropriate AUTOCAL PORT CONFIGURATIONS menu.	None
	THRU ASSIGNMENT	Changes the menu soft-key display to the appropriate THRU ASSIGNMENT menu.	None
	AVERAGING	Changes the menu soft-key display to the appropriate AUTOCAL AVERAGING menu.	None
	START CAL	Starts the calibration.	BEGAC
	HELP	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL SETUP (REFLECTION ONLY)	PORT CONFIG. (XXXX)	Changes the menu soft-key display to the appropriate AUTOCAL PORT CONFIGURATIONS menu.	None
	AVERAGING	Changes the menu soft-key display to the appropriate AUTOCAL AVERAGING menu.	None
	START CAL	Starts the calibration.	BEGAC
	HELP	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL SETUP (ADAPTER REMOVAL)	PORT CONFIG. (1L2R)	Displays if selected box type is a 2-port AutoCal. Changes the menu soft-key display to the appropriate AUTOCAL PORT CONFIGURATIONS menu.	None
	ADAPTER CONNECTED TO AUTOCAL PORT LEFT/RIGHT	Toggles between the adapter connection left or right.	ACADTL; ACADTR; ACADTX?
	AVERAGING	Changes the menu soft-key display to the appropriate AUTOCAL AVERAGING menu.	None
	START CAL	Starts the calibration.	BEGAC
	HELP	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL SETUP (ADAPTER REMOVAL)	PORT CONFIG. (1X2A)	Displays if selected box type is a 4-port AutoCal. Changes the menu soft-key display to the appropriate AUTOCAL PORT CONFIGURATIONS menu.	None
	ADAPTER CONNECTED TO VNA PORT 1/2	Toggles between the adapter connection to VNA port 1 or VNA port 2..	ACAVNA1; ACAVNA2; ACAVNAPX?
	AVERAGING	Changes the menu soft-key display to the appropriate AUTOCAL AVERAGING menu.	None
	START CAL	Starts the calibration.	BEGAC
	HELP	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
AUTOCAL THRU UPDATE	MEASURING...	Changes the soft-key display to the AUTOCAL THRU UPDATE 2 menu when the measurement is complete.	None
	ABORT CAL	Aborts the thru update measurement.	ABORTCAL

Menu Name	Function	Description	GPIB Mnemonic
AUTOCAL THRU UPDATE 2	SAVE	Changes the soft-key display to the SAVE menu.	SAVE
	EXIT	Exits AutoCal thru update without saving data.	None
AVERAGING	REFLECTION XXXX	Sets the number of averages for a reflection measurement.	ACRFL; ACRFL?
	LOAD XXXX	Sets the number of averages for a load measurement.	ACLO; ACLO?
	THRU XXXX	Sets the number of averages for a thru measurement.	ACTUAVG; ACTUAVG?
	ISOLATION XXXX	Sets the number of averages for an isolation measurement. (not performed with 4-port AutoCal)	ACISO; ACISO?
	INCLUDE ISOLATION YES/NO	Select to perform the isolation measurement or not.	ACDEF; ACIAX?
	RETURN	Returns to the previous soft-key menu.	None
AVERAGING 2	REFLECTION XXXX	Sets the number of averages for a reflection measurement.	ACRFL; ACRFL?
	LOAD XXXX	Sets the number of averages for a load measurement.	ACLO; ACLO?
	RETURN	Returns to the previous soft-key menu.	None
AVERAGING 3	REFLECTION XXXX	Sets the number of averages for a reflection measurement.	ACRFL; ACRFL?
	LOAD XXXX	Sets the number of averages for a load measurement.	ACLO; ACLO?
	THRU XXXX	Sets the number of averages for a thru measurement.	ACTUAVG; ACTUAVG?
	RETURN	Returns to the previous soft-key menu.	None
BEGIN 2 PORT CALIBRATION (12-TERMS)	KEEP EXISTING CAL DATA	Changes the soft-key display to the FREQUENCY menu.	KEC
	REPEAT PREVIOUS CAL	Changes the soft-key display to the CALIBRATION SEQUENCE menu.	RPC
	CAL METHOD XXXX	Displays the current calibration method.	CMX?
	LINE TYPE XXXX	Displays the current line type.	LTX?
	CHANGE CAL METHOD AND LINE TYPE	Changes the soft-key display to the CHANGE CAL METHOD AND LINE TYPE menu.	None
	NEXT CAL STEP	Changes the soft-key display to the SELECT CALIBRATION TYPE menu. Or, it changes to SELECT USE OF ISOLATION IN CALIBRATION menu, if calibration method is LRL/LRM.	None

Menu Name	Function	Description	GPIB Mnemonic
BEGIN 3 PORT CALIBRATION (24-TERMS)	KEEP EXISTING CAL DATA	Changes the soft-key display to the FREQUENCY menu, in the Freq key group.	KEC
	REPEAT PREVIOUS CAL	Changes the soft-key display to the beginning 3 PORT CALIBRATION menu.	RPC
	CAL METHOD XXXX	Displays the current calibration method.	CM3PX?
	LINE TYPE XXXX	Displays the current line type.	LTX?
	CHANGE CAL METHOD	Changes the soft-key display to the CHANGE 3 PORT CAL METHOD menu.	None
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
BROADBAND LOAD PARAMETERS	IMPEDANCE XX.XXX{SYM}W	Sets the broadband load impedance value.	BBZ; BBZ?
	INDUCTANCE XX.XXX e-12	Sets the broadband load inductance value.	BBZL; BBZL?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
CALIBRATION	MEASURING		None
	ABORT	Aborts the calibration and changes the soft-key display to the IMD CALIBRATION menu.	ABORTCAL
CAL FREQ RANGE	START XXX.XXXXXXXXXGHz	Enter the sweep-start frequency for calibration. If desired; frequency can be changed using the Freq key. The only restriction is that the start measurement frequency be greater than or equal to the start calibration frequency.	SRT; SRT?
	STOP XXX.XXXXXXXXXGHz	Enter the sweep-stop frequency for calibration. If desired; frequency can be changed using the Freq key. The stop frequency must be lower than or equal to the stop calibration frequency.	STP; STP?
	SET CENTER/SPAN	Changes the soft-key display to the CAL FREQ RANGE 2 menu.	None
	DATA POINTS XXX DATA POINT(S) XXXXXXXXXXXX GHz STEP SIZE	Displays data points and step size values and changes soft-key display to the DATA POINTS menu.	NPX?; ONP
	NEXT CAL STEP	Changes the soft-key display to a CONFIRM CALIBRATION PARAMETERS menu, based on the Calibration Method and/or Line Type selections made using an earlier soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CAL FREQ RANGE 2	CENTER XXX.XXXXXXXXXGHz	Enter the center frequency for calibration. If desired; frequency can be changed using the Freq key.	CNTR; CNTR?
	SPAN XXX.XXXXXXXXXGHz	Enter the span width for calibration. Like the start frequency, this too can be changed for the measurement.	SPAN; SPAN?
	SET START/STOP	Changes the soft-key display to the CAL FREQ RANGE menu.	None
	DATA POINTS XXX DATA POINT(S) XXXXXXXXXXXX GHz STEP SIZE	Displays data points and step-size values and changes soft-key display to the DATA POINTS menu.	NPX?; ONP
	NEXT CAL STEP	Changes the soft-key display to a CONFIRM CALIBRATION PARAMETERS menu, based on the Calibration Method and/or Line Type selections made using an earlier soft-key menu.	None
CAL FREQ RANGE 3	START XXX.XXXXXXXXX MHZ	Displays the start frequency of the first apply segment.	SGSTRT?
	STOP XXX.XXXXXXXXX MHZ	Displays the stop frequency of the last apply segment.	SGSTP?
	DATA POINTS XXX DATA POINTS STEP SIZE VARIABLE FOR SEGMENTED SWEEP	Displays the total number of points of all of the apply segments.	SGPTS?
CALIBRATION COMPONENT UTILITIES	INSTALL KIT INFO FROM FLOPPY DISK	Installs the information from the calibration components kit.	LKT
	DISPLAY COAXIAL INFORMATION	Changes the soft-key display to the INSTALLED TEST PORT CONNECTOR INFO menu.	None
	DISPLAY WAVEGUIDE INFORMATION	Displays waveguide parameters in the data area of the screen.	DWG
	DISPLAY AUTOCAL CHARACTERIZATION INFORMATION	Displays AutoCal characterization information in the data area of the screen.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CALIBRATION RANGE	HARMONIC CAL FOR TIME DOMAIN		None
	START (STEP) XXX.XXXXXXXXXGHz	Enter the desired start frequency. This frequency also will be used as the frequency increment.	SRT
	APPROXIMATE STOP XXX.XXXXXXXXXGHz	Enter the approximate desired stop frequency. The frequency will be adjusted to the nearest harmonic multiple of the start frequency.	APRXSTP?
	USING ABOVE START AND STOP WILL RESULT IN XXX DATA POINTS XXX.XXXXXXXXXGHz TRUE STOP FREQ	Indicates the number of data points and the true (harmonic) stop frequency.	ONP; STP?
	NEXT CAL STEP	Changes the soft-key display to a CONFIRM CALIBRATION PARAMETERS menu, based on the Calibration Method and/or Line Type selections made using an earlier soft-key menu.	None
CALIBRATION SEQUENCE	CONNECT CALIBRATION DEVICE(S)	Soft-key set provides options for completing the calibration started earlier.	None
	PORT 1 XXXXXXXXXXXXXXX	Displays the device connected to Port 1 for this calibration step.	None
	PORT 2 XXXXXXXXXXXXXXX	Displays the device connected to Port 2 for this calibration step.	None
	MEASURE PORT 1 ((NO) CAL EXISTS)	Measure calibration data for Port 1 then displays the CALIBRATION SEQUENCE CONTINUED menu.	TC1
	MEASURE PORT 2 ((NO) CAL EXISTS)	Measure calibration data for Port 2 then displays the CALIBRATION SEQUENCE CONTINUED menu.	TC2
	MEASURE BOTH PORTS	Measure calibration data for Port 1 and Port 2 then displays the CALIBRATION SEQUENCE CONTINUED menu.	TCD
CALIBRATION SEQUENCE CONTINUED	NEXT CALIBRATION STEP	Changes the soft-key display to the next CALIBRATION SEQUENCE menu.	NCS
	REMEASURE	Changes the soft-key display to the previous CALIBRATION SEQUENCE menu.	None
CALIBRATION SEQUENCE COMPLETED	PRESS <SAVE/RECALL> TO STORE CAL DATA ON DISK OR PRESS <ENTER> TO PROCEED	Press the Save/Recall key to store the calibration data on the hard or a floppy disk. Alternatively, press the Enter key to proceed.	SAVE “C:*.CAL” SAVE “A:*.CAL”

Menu Name	Function	Description	GPIB Mnemonic
CHANGE 3 PORT CAL METHOD	24-TERM		
	SOLT (NOT FOR WAVEGUIDE)	This option and the ones below provide for selecting the method (procedure) to be used to calibrate. This method is independent of the calibration type, which may be 12 term, reflection only etc.	SOLT
	TRX	Selects TRX method.	TRX
	2-PATH 3-PORT (S11, S21, S31)	Selects 2-Path, 3-Port method.	
	NEXT CAL STEP	Changes the soft-key display to the BEGIN 3 PORT CALIBRATION menu.	None
CHANGE CAL METHOD AND LINE TYPE	CAL METHOD		None
	STANDARD (NOT USED FOR WAVEGUIDE)	This option and the ones below provide for selecting the method (procedure) to be used to calibrate. This method is independent of the calibration type, which may be 12 term, reflection only etc.	SCM; CMX?
	OFFSET SHORT	Selects offset-short method.	OCM; CMX?
	LRL/LRM	Selects LRL or LRM method.	LCM; CMX?
	TRM	Selects TRM method.	TCM; CMX?
	LINE TYPE		None
	COAXIAL	Selects coaxial cable as the transmission line type.	LTC; LTX?
	WAVEGUIDE	Selects waveguide as the transmission line type.	LTW; LTX?
	MICROSTRIP	Selects microstrip as the transmission line type.	LTU; LTU?
	NEXT CAL STEP	Changes the soft-key display to the BEGIN 2 PORT CALIBRATION (12 TERMS) menu.	None
CHANGE LRL/LRM PARAMETERS	NUMBER OF BANDS USED		None
	ONE BAND	Selects a one-band LRL or LRM calibration.	LR2; LRX?
	TWO BANDS	Selects a two-band LRL or LRM calibration (that is, a three-line LRL or concatenated LRL and LRM calibrations).	LR3; LRX?
	LOCATION OF REFERENCE PLANES		None
	MIDDLE OF LINE 1 (REF)	Select reference planes to be at middle of line 1.	RM1; RMX?
	ENDS OF LINE 1 (REF)	Select reference planes to be at end of line 1.	RRP; RMX?
	NEXT CAL STEP	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	None

Menu Name	Function	Description	GPIB Mnemonic
CHANGE LRL/LRM PARAMETERS2	CHARACTERIZE CAL DEVICES		None
	DEVICE 1 LINE 1 (REF) X.XXXX mm	Enter length of line 1.	LL1; LL1?
	DEVICE 2 LINE/MATCH X.XXXX mm/FULLBAND	Select device 2—LINE or MATCH; if line is selected, enter length.	LL2; LM2; LX2?; LL2?
	DEVICE 3 LINE/MATCH X.XXXX mm/HIGHBAND Only if two bands	Select device 3—LINE or MATCH; if line is selected, enter length.	LL3; LM3; LX3?; LL3?
	FREQ AFTER WHICH THE USE OF DEVICE 2 AND DEVICE 3 IS EXCHANGED		None
	BREAKPOINT XXX.XXXXXXXX GHz	Enter breakpoint frequency: end of band 1, beginning of band 2.	BPF; BPF?
	NEXT CAL STEP	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	None
CHANGE LRL/LRM PARAMETERS3	OFFSET LENGTH OF REFLECTIVE DEVICE		None
	OFFSET LENGTH X.XXXX mm	Enter the offset length of the reflective device.	ROL; ROL?
	TYPE OF REFLECTION		None
	OPEN (GREATER THAN Zo)	Specifies the reflection to have an impedance value greater than the reference impedance (Zo). This is typically an open device.	RGZ; RXZ?
	SHORT (LESS THAN Zo)	Selects the reflection to have an impedance value less than the reference impedance (Zo). This is typically a short device.	RLZ; RXZ?
	NEXT CAL STEP	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	None
CHANGE PARAMETERS	CHARACTERIZE CAL DEVICES		None
	DEVICE 1 LINE 1 (REF) X.XX mm	Enter length of line 1.	LL1; LL1?
	DEVICE 2 LINE MATCH X.XX mm/FULLBAND	Select device 2—LINE or MATCH; if line is selected, enter length.	LL2; LL2?
	NEXT CAL STEP	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	None

Menu Name	Function	Description	GPIB Mnemonic
CHANGE PARAMETERS2	CHARACTERIZE CAL DEVICES		None
	DEVICE 1 P3-P1 LINE LENGTH X.XX mm	Sets device 1 line length.	LL1P3; LL1P3?
	DEVICE 3 P3-P2 LINE LENGTH X.XX mm	Sets device 3 line length.	LL2P3; LL2P3?
	NEXT CAL STEP	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	None
CHANGE PARAMETERS3	OFFSET LENGTH OF REFLECTIVE DEVICE		None
	OFFSET LENGTH X.XX mm	Enter reflection device offset length for 3-port TRX calibration.	ROLP3; ROLP3?
	NEXT CAL STEP	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	None
CONFIRM CALIBRATION PARAMETERS	PORT 1 CONN XXXXXXXXXXX	Displays current connector type and changes soft-key display to one of the SELECT PORT X CONNECTOR TYPE menus.	P1C; P1C?
	PORT 2 CONN XXXXXXXXXXX	Displays current connector type and changes soft-key display to one of the SELECT PORT X CONNECTOR TYPE menus.	P2C; P2C?
	REFLECTION PAIRING XXXX	Changes the soft-key display to the SELECT REFLECTION PAIRING menu.	MIX; MAT; MIX?
	LOAD TYPE XXXX	Changes the soft-key display to the SELECT TYPE OF LOAD menu.	BBL; SLD; BBX?
	THROUGH LINE PARAMETERS	Changes the soft-key display to the ENTER THE THROUGH LINE PARAMETERS menu.	None
	REFERENCE IMPEDANCE	Changes the soft-key display to the ENTER REFERENCE IMPEDANCE menu.	None
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG

Menu Name	Function	Description	GPIB Mnemonic
CONFIRM CALIBRATION PARAMETERS2	PORT 1 OPEN/SHORT	Changes the soft-key display to the PORT X OPEN DEVICE menu.	None
	PORT 2 OPEN/SHORT	Changes the soft-key display to the PORT X OPEN DEVICE menu.	None
	REFLECTION PAIRING	Changes the soft-key display to the SELECT REFLECTION PAIRING menu.	MIX; MAT; MIX?
	LOAD IMPEDANCE	Changes the soft-key display to the BROADBAND LOAD PARAMETERS menu.	None
	THROUGH LINE PARAMETERS	Changes the soft-key display to the ENTER THROUGH LINE PARAMETERS menu.	None
	MICROSTRIP PARAMETERS XXXXXXXXXXX	Changes the soft-key display to the SELECT MICROSTRIP KIT TO USE menu.	U10; U15; U25; UTFD; UTFX?
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
CONFIRM CALIBRATION PARAMETERS3	OFFSET LENGTHS OF SHORTS	Changes the soft-key display to the ENTER OFFSET LENGTHS OF SHORTS menu.	None
	LOAD TYPE	Changes the soft-key display to the SELECT TYPE OF LOAD menu.	BBL; SLD; BBX?
	THROUGH LINE PARAMETERS	Changes the soft-key display to the ENTER THROUGH LINE PARAMETERS menu.	None
	REFERENCE IMPEDANCE	Changes the soft-key display to the ENTER REFERENCE IMPEDANCE menu.	None
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
CONFIRM CALIBRATION PARAMETERS4	OFFSET LENGTHS OF SHORTS	Changes the soft-key display to the ENTER OFFSET LENGTHS OF SHORTS menu.	None
	LOAD IMPEDANCE	Changes the soft-key display to the BROADBAND LOAD PARAMETERS menu.	None
	THROUGH LINE PARAMETERS	Changes the soft-key display to the ENTER THROUGH LINE PARAMETERS menu.	None
	MICROSTRIP PARAMETERS XXXXXXXXXXX	Changes the soft-key display to the SELECT MICROSTRIP KIT TO USE menu.	U10; U15; U25; UTFD; UTFX?
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG

Menu Name	Function	Description	GPIB Mnemonic
CONFIRM CALIBRATION PARAMETERS5	LOAD TYPE XXXX	Changes the soft-key display to the SELECT TYPE OF LOAD menu.	BBL; SLD; BBX?
	THROUGH LINE PARAMETERS	Changes the soft-key display to the ENTER THROUGH LINE PARAMETERS menu.	None
	WAVEGUIDE PARAMETERS XXXXXXXXXXX	Changes the soft-key display to the SELECT WAVEGUIDE KIT TO USE menu.	WKI; WKD; WKX?
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
CONFIRM CALIBRATION PARAMETERS6	LRL/LRM PARAMETERS	Changes the soft-key display to the CHANGE LRL/LRM PARAMETERS menu.	None
	REFERENCE IMPEDANCE	Changes the soft-key display to the ENTER REFERENCE IMPEDANCE menu.	None
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
CONFIRM CALIBRATION PARAMETERS7	LRL/LRM PARAMETERS	Changes the soft-key display to the CHANGE LRL/LRM PARAMETERS menu.	None
	MICROSTRIP PARAMETERS XXXXXXXXXXX	Changes the soft-key display to the SELECT MICROSTRIP KIT TO USE menu.	U10; U15; U25; UTFD; UTFX?
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
CONFIRM CALIBRATION PARAMETERS8	LRL/LRM PARAMETERS	Changes the soft-key display to the CHANGE LRL/LRM PARAMETERS menu.	None
	WAVEGUIDE CUTOFF FREQ	Changes the soft-key display to the ENTER WAVEGUIDE FREQUENCY menu.	None
	TEST SIGNALS	Changes the soft-key display to the TEST SIGNALS menu.	None
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG
CONFIRM CALIBRATION PARAMETERS9	CHANGE PARAMETERS	Changes the soft-key display to the CHANGE PARAMETERS menu.	None
	START CAL	Changes the soft-key display to the first 3 PORT CALIBRATION menu.	BEG

Menu Name	Function	Description	GPIB Mnemonic
CONFIRM CALIBRATION PARAMETERS10	PORT 3 CONN XXX	Changes the soft-key display to the SELECT PORT 3 CONNECTOR TYPE menu.	P3C; P3C?
	LOAD TYPE XXX	Changes the soft-key display to the SELECT TYPE OF LOAD menu.	BBLD3; SLDP3; BBXP3?
	DO PORT 2, 3 THROUGH YES/NO	Select to do or not do Port 2, 3 Through.	
	PORT 1, 3 THROUGHLINE OFFSET LENGTH XXX mm	Sets the offset length of the throughline.	TOLP3; TOLP3?
	PORT 2, 4 THROUGHLINE OFFSET LENGTH XXX mm	Sets the offset length of the throughline.	**<MNEMONIC?>**
	START CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEG3P
CUSTOMIZE CAL (FULL 2 PORT CAL)	SET ALL ON	Toggles all S-parameter selections on.	FXSON
	SET ALL OFF	Toggles all S-parameter selections off.	FXSOFF
	S11, REFL ON/OFF	Toggles the S11 selection on or off.	FXS11T0; FXS11T1; FXS11T?
	S12, TRANS ON/OFF	Toggles the S12 selection on or off.	FXS12T0; FXS12T1; FXS12T?
	S21, TRANS ON/OFF	Toggles the S21 selection on or off.	FXS21T0; FXS21T1; FXS21T?
	S22, REFL ON/OFF	Toggles the S22 selection on or off.	FXS22T0; FXS22T1; FXS22T?
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None
CUSTOMIZE CAL (FULL 3 PORT CAL OR FULL 4 PORT CAL)	SET ALL ON	Toggles all S-parameter selections on.	FXSON
	SET ALL OFF	Toggles all S-parameter selections off.	FXSOFF
	S11, REFL ON/OFF	Toggles the S11 selection on or off.	FXS11T0; FXS11T1; FXS11T?
	S12, TRANS ON/OFF	Toggles the S12 selection on or off.	FXS12T0; FXS12T1; FXS12T?
	S21, TRANS ON/OFF	Toggles the S21 selection on or off.	FXS21T0; FXS21T1; FXS21T?
	S22, REFL ON/OFF	Toggles the S22 selection on or off.	FXS22T0; FXS22T1; FXS22T?
	MORE	Changes the soft-key the next appropriate CUSTOMIZE CAL 2 menu.	None
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None

Menu Name	Function	Description	GPIB Mnemonic
CUSTOMIZE CAL 2 (FULL 3 PORT CAL)	S13, TRANS ON/OFF	Toggles the S13 selection on or off.	FXS13T0; FXS13T1; FXS13T?
	S23, TRANS ON/OFF	Toggles the S23 selection on or off.	FXS23T0; FXS23T1; FXS23T?
	S31, TRANS ON/OFF	Toggles the S31 selection on or off.	FXS31T0; FXS31T1; FXS31T?
	S32,TRANS ON/OFF	Toggles the S32 selection on or off.	FXS32T0; FXS32T1; FXS32T?
	S33, REFL ON/OFF	Toggles the S33 selection on or off.	FXS33T0; FXS33T1; FXS33T?
	MORE	Changes the soft-key display to the previous menu.	None
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None
CUSTOMIZE CAL 2 (FULL 4 PORT CAL)	S13, TRANS ON/OFF	Toggles the S13 selection on or off.	FXS13T0; FXS13T1; FXS13T?
	S23, TRANS ON/OFF	Toggles the S23 selection on or off.	FXS23T0; FXS23T1; FXS23T?
	S31, TRANS ON/OFF	Toggles the S31 selection on or off.	FXS31T0; FXS31T1; FXS31T?
	S32,TRANS ON/OFF	Toggles the S32 selection on or off.	FXS32T0; FXS32T1; FXS32T?
	S33, REFL ON/OFF	Toggles the S33 selection on or off.	FXS33T0; FXS33T1; FXS33T?
	MORE	Changes the soft-key display to the next CUSTOMIZE CAL 3 menu.	None
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None
CUSTOMIZE CAL 3 (FULL 4 PORT CAL)	S14, TRANS ON/OFF	Toggles the S14 selection on or off.	FXS14T0; FXS14T1; FXS14T?
	S24, TRANS ON/OFF	Toggles the S24 selection on or off.	FXS24T0; FXS24T1; FXS24T?
	S34, TRANS ON/OFF	Toggles the S34 selection on or off.	FXS34T0; FXS34T1; FXS34T?
	S41, TRANS ON/OFF	Toggles the S41 selection on or off.	FXS41T0; FXS41T1; FXS41T?
	S42, TRANS ON/OFF	Toggles the S42 selection on or off.	FXS42T0; FXS42T1; FXS42T?
	S43, TRANS ON/OFF	Toggles the S43 selection on or off.	FXS43T0; FXS43T1; FXS43T?
	MORE	Changes the soft-key display to the CUSTOMIZE CAL 4 menu.	None
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None
CUSTOMIZE CAL 4 (FULL 4 PORT CAL)	S44, REFL ON/OFF	Toggles the S44 selection on or off.	FXS44T0; FXS44T1; FXS44T?
	MORE	Changes the soft-key display to the initial CUSTOMIZE CAL menu.	None
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None

Menu Name	Function	Description	GPIB Mnemonic
DATA POINTS	1601 MAX POINTS	Provides 1601 data points across selected frequency range.	FHI; NP1601; ONP
	801 MAX POINTS	Provides 801 data points across selected frequency range.	NP801; ONP
	401 MAX POINTS	Provides 401 data points across selected frequency range..	NP401; FME; ONP
	201 MAX POINTS	Provides 201 data points across selected frequency range.	NP201; ONP
	101 MAX POINTS	Provides 101 data points across selected frequency range.	NP101; FLO; ONP
	51 MAX POINTS	Provides 51 data points across selected frequency range.	NP51; ONP
	15 MAX POINTS	Provides 15 data points across selected frequency range.	NP15; ONP
	3 MAX POINTS	Provides 3 data points across selected frequency range.	NP3; ONP
DISCRETE FILL	START FREQ XXX.XXXXXXXXX GHz	Enter the first frequency of the range.	FRS; FRS?
	INCREMENT XXX.XXXXXXXXX GHz	Enter the increment (step size) between one frequency and the next.	FRI; FRI?
	NUMBER OF POINTS XX POINT(S)	Enter the number of frequency points in the range.	FRP; FRP?
	STOP FREQ XXX.XXXXXXXXX GH	Displays the highest frequency in the range.	None
	FILL THE RANGE (XXX ENTERED)	Fills the frequency range.	FIL
	INDIVIDUAL FREQ INSERT	Changes the soft-key display to the INDIVIDUAL FREQUENCY INSERT menu.	DFQ; DFQ?
	CLEAR ALL	Clears all entries displayed above.	FRC
	NEXT CAL STEP	Changes the soft-key display to a CONFIRM CALIBRATION PARAMETERS menu, based on the Calibration Method and/or Line Type selections made using an earlier soft-key menu.	None
DISPLAY INSTALLED TEST PORT CONNECTOR INFO	SMA (M)	Displays coefficient data for the SMA male components.	DMS
	SMA (F)	Displays coefficient data for the SMA female components.	DFS
	K - CONN (M)	Displays coefficient data for the K connector male components.	DMK
	K - CONN (F)	Displays coefficient data for the K connector female components.	DFK
	TYPE N (M)	Displays coefficient data for the Type N male components.	DMN
	TYPE N (F)	Displays coefficient data for the Type N female components.	DFN
	MORE	Changes the soft-key display to the DISPLAY INSTALLED TEST PORT CONNECTOR INFO 2 menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
DISPLAY INSTALLED TEST PORT CONNECTOR INFO 2	GPC - 3.5 (M)	Displays coefficient data for the GPC-3.5 male components.	DM3
	GPC - 3.5 (F)	Displays coefficient data for the GPC-3.5 female components.	DF3
	GPC - 7	Displays coefficient data for the sexless GPC-7 components.	DG7
	V - CONN (M)	Displays coefficient data for the V Connector male components.	DMV
	V - CONN (F)	Displays coefficient data for the V Connector female components.	DFV
	NEXT CONNECTOR	Cycle through selections GPC-3.5 (M) to V_CONN (F).	None
	MORE	Changes the soft-key display to the DISPLAY INSTALLED TEST PORT CONNECTOR INFO 3 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
DISPLAY INSTALLED TEST PORT CONNECTOR INFO 3	TNC (M)	Displays coefficient data for the TNC male components.	DMT
	TNC (F)	Displays coefficient data for the TNC female components.	DFT
	2.4 mm (M)	Displays coefficient data for the 2.4 mm male components.	DM2
	2.4 mm (F)	Displays coefficient data for the 2.4 mm female components.	DF2
	NEXT CONNECTOR	Cycle through selections TNC (M) to 2.4 mm (F).	None
	MORE	Changes the soft-key display to the DISPLAY INSTALLED TEST PORT CONNECTOR INFO 4 menu.	None
	RETURN	Returns to the previous soft-key menu.	None
DISPLAY INSTALLED TEST PORT CONNECTOR INFO 4	TYPE N (M) 75Ω	Displays coefficient data for the TYPE N 75Ω male components.	DMN75
	TYPE N (F) 75Ω	Displays coefficient data for the TYPE N 75Ω female components.	DFN75
	7/16 (M)	Displays coefficient data for the SPECIAL connector male components.	DMSP
	7/16 (F)	Displays coefficient data for the SPECIAL connector female components.	DFSP
	NEXT CONNECTOR	Cycle through selections TYPE N (M) 75{SYM}W to 7/16 (F).	None
	MORE	Changes the soft-key display to the DISPLAY INSTALLED TEST PORT CONNECTOR INFO menu.	None
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
DISPLAY INSTALLED TEST PORT CONNECTOR INFO 5	SPECIAL (M)	Displays coefficient data for the SPECIAL connector male components.	DMSP
	SPECIAL (F)	Displays coefficient data for the SPECIAL connector female components.	DFSP
	NEXT CONNECTOR	Cycle through selections SPECIAL (M) to SPECIAL (F).	None
	MORE	Changes the soft-key display to the DISPLAY INSTALLED TEST PORT CONNECTOR INFO menu.	None
	RETURN	Returns to the previous soft-key menu.	None
ENTER MICROSTRIP PARAMETERS	WIDTH OF STRIP XX.XXXX mm	Enter the width of the microstrip.	USW; USW?
	THICKNESS OF SUBSTRATE XXXX.XXXX mm	Enter the thickness of the substrate.	SBT; SBT?
	Zc XXX.XXX {SYM}W	Enter the characteristic impedance of the microstrip.	USZ; USZ?
	SUBSTRATE DIELECTRIC XX.XX	Enter the relative dielectric constant of the substrate.	SBD; SBD?
	EFFECTIVE DIELECTRIC XX.XX (RECOMMENDED 1.01)	Enter the effective dielectric constant of the microstrip. A recommended value will also be displayed.	USE; USE?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
ENTER OFFSET LENGTHS OF SHORTS	IF USING ONLY TWO SHORTS, PORT 2 OFFSETS SHOULD EQUAL PORT 1 OFFSETS		None
	PORT 1 SHORTS		None
	SHORT 1 XX.XXXX mm	Enter the length that Short 1 is offset from the reference plane.	SH1; SH1?
	SHORT 2 XX.XXXX mm	Enter the length that Short 2 is offset from the reference plane.	SH2; SH2?
	PORT 2 SHORTS		None
	SHORT 1 XX.XXXX mm	Enter the length that Short 1 is offset from the reference plane.	SH1; SH1?
	SHORT 2 XX.XXXX mm	Enter the length that Short 2 is offset from the reference plane.	SH2; SH2?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
ENTER REFERENCE IMPEDANCE	REFERENCE IMPEDANCE XXXX{SYM}W	Enter the reference impedance.	LLZ; LLZ?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
ENTER THE THROUGH LINE PARAMETERS	OFFSET LENGTH XX.XX mm	Enter offset length of throughline device.	TOL; TOL?
	THROUGHLINE IMPEDANCE XX.XXX{SYM}W	Enter the impedance of the throughline device.	TLZ; TLZ?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
ENTER WAVEGUIDE CUTOFF FREQUENCY	WAVEGUIDE CUTOFF FREQ XXX.XXXXXXXXXGHz	Enter the waveguide cutoff frequency.	WCO; WCO?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
ENTER WAVEGUIDE PARAMETERS	WAVEGUIDE CUTOFF FREQ XXX.XXXXXXXXXGHz	Enter waveguide cutoff frequency.	WCO; WCO?
	OFFSET LENGTH OF SHORT 1 X.XXXmm	Enter the offset length of Short 1.	WSH1; WSH1?
	OFFSET LENGTH OF SHORT 2 X.XXXmm	Enter the offset length of Short 2.	WSH2; WSH2?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
FLEXIBLE CAL	SELECT INPUT METHOD		None
	(BY PORT)		None
	FULL TERM CALS	Changes the soft-key display to the FULL TERM CAL menu.	CFXIFU; CFXI?
	REFLECTION ONLY	Changes the soft-key display to the REFLECTION ONLY CAL menu.	CFXIRF; CFXI?
	(BY S-PARAM)		None
	CUSTOMIZE CAL	Changes the soft-key display to the appropriate CUSTOMIZE CAL menu.	CFXICU; CFXI?
	FLEXIBLE CAL MODE		
	APPLY	Apply the current flexible cal selections.	FXAPL; CFFX?
	DEFINE	Define the new flexible cal selections.	CFFX?
	HELP ON/OFF	Displays an informational help screen.	HELP0; HELP1; HELPX?
	RETURN	Changes the soft-key display to the TRANSMISSION AND REFLECTION CALIBRATION menu.	None

Menu Name	Function	Description	GPIB Mnemonic
FULL TERM CAL (FULL -PORT CAL)	PORT 1 ON PORT 2 ON	Displayed when a 12-term cal exists. Toggles port 1 selection on or off. Toggles port 2 selection on or off.	FXP1T0; FXP1T1; FXP1T?; FXP2T0; FXP2T1; FXP2T?
	PORT 1 ON PORT 2 ON PORT 3 ON	Displayed when a 24-term cal exists. Toggles port 1 selection on or off. Toggles port 2 selection on or off. Toggles port 3 selection on or off.	FXP1T0; FXP1T1; FXP1T?; FXP2T0; FXP2T1; FXP2T?; FXP3T0; FXP3T1; FXP3T?
	PORT 1 ON PORT 2 ON PORT 3 ON PORT 4 ON	Displayed when a 40-term cal exists. Toggles port 1 selection on or off. Toggles port 2 selection on or off. Toggles port 3 selection on or off. Toggles port 4 selection on or off.	FXP1T0; FXP1T1; FXP1T?; FXP2T0; FXP2T1; FXP2T?; FXP3T0; FXP3T1; FXP3T?; FXP4T0; FXP4T1; FXP4T?
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None
FREQUENCY TRANSLATION GROUP DELAY CALIBRATION	APPLY CAL ON/OFF (CAL EXIST/NO CAL EXIST)	Turn on or off Frequency Translation Group Delay correction.	FTGDC0; FTGDC1, FTGDCX?; FTGDCDONE?
	PERFORM CAL	Changes the soft-key display to the next soft-key menu in calibration sequence. Refer to Appendix D for menu flow.	BEGFTGD
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
FREQUENCY TRANSLATION GROUP DELAY CALIBRATION 2	CONNECT A THROUGHLINE BETWEEN PORTS 1 AND 2		None
	ABORT CAL	Aborts the calibration.	ABORTCAL
	MEASURE DEVICE(S)	Measures the device(s).	None
FREQUENCY TRANSLATION GROUP DELAY CALIBRATION 3	RESTART MEASUREMENT	Restarts the measurement.	
	ABORT CAL	Aborts the calibration.	ABORTCAL
	MEASURING THROUGHLINE BETWEEN PORTS 1 AND 2 ...		None
FREQUENCY TRANSLATION GROUP DELAY CALIBRATION 4	SAVE CAL DATA	Changes the soft-key display to the SAVE menu.	SAVE “*.cal”
	RESTART MEASUREMENT	Restarts the measurement.	None
	EXIT	Exit calibration menu.	None

Menu Name	Function	Description	GPIB Mnemonic
GAIN COMPRESSION CALIBRATION	CALIBRATE FOR FLATNESS ((NO) CAL EXISTS)	Changes the soft-key display to the SOURCE X FLAT TEST PORT POWER CALIBRATION menu.	None
	CALIBRATE RECEIVER ((NO) CAL EXISTS)	Changes the soft-key display to the RECEIVER CALIBRATION menu.	None
	NORMALIZE S21 ((NOT) STORED)	Changes the soft-key display to the NORMALIZE S21 menu.	None
	FLATNESS CORRECTION AT XX.XX dBm ON/OFF	Toggles the flatness correction on or off, and displays the correction power level.	FP1; FP0; FPX?
	RETURN TO T/R MODE	Changes the soft-key display to the TRANSMISSION AND REFLECTION menu (Appl key group).	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
GAIN COMPRESSION CALIBRATION2	LINEAR POWER ((NO) CAL EXISTS)	Changes the soft-key display to the LINEAR POWER CALIBRATION.	PSWC
	LINEAR POWER CORRECTION ON/OFF	Toggles the linear power correction on or off.	PSWC1; PSWC0; PSWCX?
	CALIBRATE RECEIVER ((NO) CAL EXISTS)	Changes the soft-key display to the RECEIVER CALIBRATION menu.	CALR
	NORMALIZE S21 ((NOT) STORED)	Changes the soft-key display to the NORMALIZE S21 menu.	NRMS
HARMONIC CALIBRATION	SOURCE 1 SETUP	Changes the soft-key display to the SOURCE 1 SETUP menu.	None
	SOURCE 2 SETUP	Changes the soft-key display to the SOURCE 2 SETUP menu.	None
	RECEIVER SETUP	Changes the soft-key display to the RECEIVER SETUP menu.	None
	CALIBRATE	Changes the soft-key display to the START HARMONIC CALIBRATION menu.	None
	APPLY CAL	This selection only appears if Sweep Mode is source.	None
	ENHANCEMENT ONLY ((NO) CAL EXISTS)	Applies an existing Enhancement calibration. This selection only appears if Sweep Mode is source.	HARCE; HARCX?
	ENHANCEMENT AND PHASE ((NO) CAL EXISTS)	Applies an existing Enhancement and Phase calibration. This selection only appears if Sweep Mode is source.	HARCEP; HARCX?
	NONE	This selection only appears if Sweep Mode is source.	HARCN; HARCX?
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?

Menu Name	Function	Description	GPIB Mnemonic
HARMONIC ENHANCEMENT CALIBRATION	CONNECT A THROUGHLINE BETWEEN TEST PORTS		None
	ABORT CAL	Changes the soft-key display to the HARMONIC CALIBRATION menu.	ABORTCAL
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	MEASURE DEVICE(S)	Starts measuring through line and changes soft-key display to the HARMONIC ENHANCEMENT CALIBRATION 2 menu.	TCD
HARMONIC ENHANCEMENT CALIBRATION 2	RESTART MEASUREMENT	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	None
	ABORT CAL	Aborts the entire measurement and changes soft-key display to the HARMONIC CALIBRATION menu.	ABORTCAL
	MEASURING THROUGHLINE BETWEEN PORTS 1 AND 2 / 1 AND 3 ...	After measurements complete, soft-key display changes to HARMONIC ENHANCEMENT CALIBRATION 3 menu.	None
HARMONIC ENHANCEMENT CALIBRATION 3	RESTART MEASUREMENT	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	None
	ABORT CAL	Changes the soft-key display to the START HARMONIC CALIBRATION menu.	ABORTCAL
	NEXT CAL STEP	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION4 menu.	None
HARMONIC ENHANCEMENT CALIBRATION 4	CONNECT A SHORT BETWEEN TEST PORTS		None
	ABORT CAL	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	ABORTCAL
	MEASURING DEVICES	Starts measuring shorts and changes soft-key display to the HARMONIC ENHANCEMENT CALIBRATION 5 menu.	TCD
HARMONIC ENHANCEMENT CALIBRATION 5	RESTART MEASUREMENT	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION 4 menu.	None
	ABORT CAL	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	ABORTCAL
	MEASURING SHORT FOR PORT 1 AND 2 / 1 AND 3...	After measurements complete, soft-key display changes to HARMONIC ENHANCEMENT CALIBRATION 6 menu.	None
HARMONIC ENHANCEMENT CALIBRATION 6	SAVE CAL DATA	Changes the soft-key display to the SAVE menu.	SAVE “*.CAL”
	RESTART MEASUREMENT	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION 4 menu.	None
	ABORT CAL	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	ABORTCAL
	NEXT CAL STEP	Changes the soft-key display to the START HARMONIC CALIBRATION menu.	None

Menu Name	Function	Description	GPIB Mnemonic
HARMONIC PHASE CALIBRATION	CONNECT STANDARD EXTERNAL DEVICE BETWEEN TEST PORTS		None
	ABORT CAL	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	ABORTCAL
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	MEASURE DEVICE(S)	Changes the soft-key display to the HARMONIC PHASE CALIBRATION 2 menu.	TCD
HARMONIC PHASE CALIBRATION 2	RESTART MEASUREMENT	Changes the soft-key display to the HARMONIC PHASE CALIBRATION menu.	None
	ABORT CAL	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	ABORTCAL
	MEASURING STANDARD EXTERNAL DEVICE BETWEEN TEST PORTS 1 AND 2/1 AND 3	After measurements complete, soft-key display changes to HARMONIC PHASE CALIBRATION 3 menu.	None
HARMONIC PHASE CALIBRATION 3	SAVE CAL DATA	Changes the soft-key display to the SAVE menu.	SAVE “*.CAL”
	RESTART MEASUREMENT	Changes the soft-key display to the HARMONIC PHASE CALIBRATION menu.	None
	ABORT CAL	Changes the soft-key display to the HARMONIC CALIBRATION menu.	ABORTCAL
	NEXT CAL STEP	Changes the soft-key display to the START HARMONIC CALIBRATION menu.	None
IMD CALIBRATION	APPLY CAL		
	RECEIVER CAL ON/OFF FOR PORT 2 ((NO) CAL EXISTS)	Toggles the receiver on or off and shows whether a calibration exists.	RCALP21; RCALP20; RCALP2DONE?; (RCALPX2?)
	SOURCE 1 FLATNESS CORRECTION ((NO) CAL EXISTS) AT XX.XX dBm	Toggles Source 1 flatness calibration on or off, shows whether a calibration exist, and shows its power level.	FP0; FP1; FPX?; (FP1DONE?)
	SOURCE 2 FLATNESS CORRECTION ((NO) CAL EXISTS) AT XX.XX dBm	Toggles Source 2 flatness calibration on or off, shows whether a calibration exist, and shows its power level.	FP30; FP31; FPX?; (FP3DONE?)
	IMD CORRECTION ON/OFF ((NO) CAL EXISTS)	Toggles IMD Correction on or off and shows whether a calibration exists.	IMDC1; IMDC0; IMDCX?; IMDCDONE?
	PERFORM CAL	Changes the soft-key display to the INTERMODULATION DISTORTION CALIBRATION menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?

Menu Name	Function	Description	GPIB Mnemonic
IMD CALIBRATION 2	CONNECT A THROUGHLINE BETWEEN SOURCE PORT AND RECEIVER PORT (PORT 2)		None
	ABORT CAL	Aborts the calibration and changes soft-key display to the IMD CALIBRATION menu.	ABORTCAL
	MEASURE DEVICE(S)	Changes the soft-key display to the CALIBRATION menu.	None
IMD RECEIVER CALIBRATION	CONNECT A THROUGHLINE BETWEEN SOURCE PORT AND RECEIVER PORT (PORT 2)		None
	SOURCE PORT: PORT 1/PORT 3	Selects Port 1 or 3 for IMD Receiver calibration source port.	RCALSP1; RCALSP3; RCALPX?
	BEGIN CAL	Changes the soft-key display to the IMD RECEIVER CALIBRATION 2 menu.	BEGR
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous menu.	None
IMD RECEIVER CALIBRATION 2	MEASURING...		None
	ABORT CAL	Aborts the calibration and changes soft-key display to the IMD CALIBRATION menu.	ABORTCAL
INDIVIDUAL FREQUENCY INSERT	NEXT FREQUENCY XXX.XXXXXXXXXGHz	Enter next frequency for which calibration data is to be taken. If the AUTO INCR option is ON, pressing Enter automatically increments the calibration frequency by the interval in GHz that appears below the option.	None
	INSERT NEXT FREQUENCY	Enter next frequency.	None
	XX FREQS ENTERED	Displays the number of frequencies that have been entered.	None
	LAST FREQ WAS XXX.XXXXXXXXXGHz	Displays the value of the last frequency entered.	None
	AUTO INCR ON/OFF XXX.XXXXXXXXXGHz	Toggles Automatic frequency increment mode on or off, and sets the increment.	None
	RETURN	Returns to the previous menu.	None
INTER-MODULATION DISTORTION CALIBRATION	RECEIVER CAL	Changes the soft-key display to the IMD RECEIVER CALIBRATION menu.	None
	TONE1 SETUP	Changes the soft-key display to the SOURCE 1 SETUP menu.	None
	TONE 2 SETUP	Changes the soft-key display to the SOURCE 2 SETUP INTERNAL SOURCE menu (Power key group).	None
	IMD CAL	Changes the soft-key display to the IMD CALIBRATION 2 menu.	BEGIMD
	EXIT	Changes the soft-key display to the FREQUENCY menu.	None

Menu Name	Function	Description	GPIB Mnemonic
NETWORK EXTRACTION	THE “OUTER” AND “INNER” CALIBRATION FILES MUST EXIST IN THE CURRENT DIRECTORY		
	CALIBRATE S2P FILE	Changes the soft-key display to the next NETWORK EXTRACTION menu.	None
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None
NETWORK EXTRACTION	RECALL FROM DISK THE CALIBRATION FILE FOR THE “OUTER” (”INNER) CAL FROM		
	HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	None
	FLOPPY DISK		None
	RETURN	Returns to the first NETWORK EXTRACTION menu.	None
NETWORK EXTRACTION	RECALL FROM DISK THE CALIBRATION FILE FOR THE “OUTER” (”INNER) CAL FROM		
	HARD DISK	Changes the soft-key display to the SELECT FILE TO READ menu.	None
	FLOPPY DISK		None
	RETURN	Returns to the first NETWORK EXTRACTION menu.	None
NOISE FIGURE CALIBRATION	APPLY CAL		
	NOISE FIGURE ONLY ((NO) CAL EXISTS)	Applies the existing noise figure calibration.	NFC1; NFCX?; NFCDONE?
	*NOISE FIGURE WITH 12 TERM (NO CAL EXISTS)	Applies the existing 12-term noise figure calibration. Not allowed unless Noises Figure calibration was done with 12-term calibration. * Not allowed unless Noise Figurer Cal was done with 12-Term Cal.	NFC2; NFC12TDONE?; NFCX?
	NONE	Applies no Noise Figure calibration.	NFC0; NFCX?
	PERFORM CAL		None
	NOISE FIGURE ONLY	Starts calibration and changes soft-key display to the NOISE FIGURE CALIBRATION 2 menu. Not allowed without a valid 12-term calibration.	BEGNF
	**NOISE FIGURE WITH 12-TERM	Starts calibration and changes soft-key display to the NOISE FIGURE CALIBRATION 2 menu. Not allowed without a valid 12-term calibration. ** Not allowed without a valid 12-Term Cal in 50 MHz to 3 GHz range.	BEGNFRF
	HELP ON/OFF	Displays an informational help screen.	HELP1; HELP0; HELPX?

Menu Name	Function	Description	GPIB Mnemonic
NOISE FIGURE CALIBRATION2	CONNECT A THROUGH LINE BETWEEN A NOISE SOURCE AND PORT 2		None
	ABORT CAL	Changes the soft-key display to the NOISE FIGURE CALIBRATION menu.	ABORTCAL
	MEASURE DEVICE(S)	Restarts measurement without going through all steps again.	None
NOISE FIGURE CALIBRATION3	RESTART MEASUREMENT	Changes the soft-key display to the NOISE FIGURE CALIBRATION 2 menu.	None
	ABORT CAL	Changes the soft-key display to the NOISE FIGURE CALIBRATION menu.	ABORTCAL
	MEASURING THROUGH LINE BETWEEN THE NOISE SOURCE AND PORT 2...	After measurements complete, soft-key display changes to NOISE FIGURE CALIBRATION4 menu.	None
NOISE FIGURE CALIBRATION4	SAVE CAL DATA	Changes the soft-key display to the SAVE menu.	SAVE “*.CAL”
	RESTART MEASUREMENT	Changes the soft-key display to the NOISE FIGURE CALIBRATION 2 menu.	None
	EXIT	Changes the soft-key display to the FREQUENCY menu.	None
NORMALIZE S21	CONNECT AUT AND APPLY BIAS WAIT FOR ONE COMPLETE SWEEP BEFORE STORING	Checks for a good throughline connection.	None
	STORE	Stores data and changes soft-key display to the GAIN COMPRESSION CALIBRATION menu.	None
	ABORT	Changes the soft-key display to the GAIN COMPRESSION CALIBRATION menu.	ABORTCAL
PERFORM AUTOCAL	THRU UPDATE	Changes the soft-key display to the appropriate THRU UPDATE menu.	BEGTU
	SELECT BOX TYPE 2 PORT/4 PORT	Sets the AutoCal box type 2-port or 4-port.	AC2PBTYPE; AC4PBTYPE; ACBTYPE?
	SELECT CAL TYPE (FULL 4 PORT)	Changes the soft-key display to the AUTOCAL 4 menu.	None
	CHANGE SETUP (1X2A3C4D or 1L2R)	Changes the soft-key display to the appropriate AUTOCAL SETUP menu.	None
	START CAL	Changes the soft-key display to the AUTOCAL menu or the AUTOCAL 6 menu if an isolation measurement is needed.	BEGAC
	HELP	Displays an informational help screen.	HELP1; HELP0; HELPX?
	RETURN	Returns to the previous soft-key menu.	None

Menu Name	Function	Description	GPIB Mnemonic
PERFORM MANUAL CAL	2-PORT (CAL EXISTS)	Changes the soft-key display to the BEGIN 2 PORT CALIBRATION (12 TERMS) menu.	None
	3-PORT (CAL EXISTS)	Changes the soft-key display to the BEGIN 3 PORT CALIBRATION (24 TERMS) menu.	None
	4-PORT (CAL EXISTS)	Changes the soft-key display to the BEGIN 4 PORT CALIBRATION (40 TERMS) menu.	None
	ADAPTER REMOVAL	Changes the soft-key display to the ADAPTER REMOVAL menu.	None
	RETURN	Returns to the previous soft-key menu.	None
PORT X OPEN DEVICE	ENTER THE CAPACITANCE COEFFICIENTS		None
	TERM 1-C0 P/MXXX.XX e - 15	Enter the term 1 coefficient value (x 10^{-15} F).	CC0; CC0?
	TERM 2-C1 P/MXXX.XX e - 27	Enter the term 2 coefficient value (x 10^{-27}F/Hz).	CC1; CC1?
	TERM 3-C2 P/MXXX.XX e - 36	Enter the term 3 coefficient value (x 10^{-36}F/Hz^2).	CC2; CC2?
	TERM 4-C3 P/MXXX.XX e - 45	Enter the term 4 coefficient value (x 10^{-45}F/Hz^3).	CC3; CC3?
	ENTER THE OFFSET LENGTH		None
	OFFSET LENGTH P/MXXX.XXX mm	Enter and display offset length of Open.	COO; COO?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None
PORT X SHORT DEVICE	ENTER THE INDUCTANCE COEFFICIENTS		None
	TERM 1- P/MXXX.XX e - 12	Enter the term 1 coefficient value (x 10^{-12} H).	CC0; CC0?
	TERM 2 P/MXXX.XXe - 24	Enter the term 2 coefficient value (x 10^{-24} H/Hz).	CC1; CC1?
	TERM 3 P/MXXX.XX e - 33	Enter the term 3 coefficient value (x 10^{-33}H/Hz^2).	CC2; CC2?
	TERM 4 P/MXXX.XX e - 42	Enter the term 4 coefficient value (x 10^{-42}H/Hz^3).	CC3; CC3?
	ENTER THE OFFSET LENGTH		None
	OFFSET LENGTH P/MXXX.XXX mm	Enter and display offset length of Short.	COS; COS?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None

Menu Name	Function	Description	GPIB Mnemonic
RECEIVER CALIBRATION	CONNECT THROUGHLINE BETWEEN TEST PORTS.	Checks for a good throughline connection.	None
	RECEIVER PORT PORT 1/ PORT 2/ PORT 3	Selects Receiver port to be calibrated.	RCALRP1; RCALRP2; RCALRP3; RCALRPX?
	SOURCE PORT PORT 1/ PORT 2/ PORT 3	Selects Source port to be calibrated.	RCALSP1; RCALSP2; RCALSP3; RCALSPX
	BEGIN CAL	Starts measurement and changes soft-key display to the RECEIVER CALIBRATION 2 menu.	BEGR
	RETURN	Returns to the previous soft-key menu.	None
RECEIVER CALIBRATION 2	MEASURING...		None
	ABORT	Aborts calibration and changes soft-key display to the IMD RECEIVER CALIBRATION menu.	ABORTCAL
RECEIVER SETUP	RECEIVER CAL	Changes the soft-key display to the RECEIVER CALIBRATION menu.	None
	RECEIVER CAL FOR PORT 1 ON/OFF ((NO) CAL EXISTS)	Toggles Port 1 Receiver calibration on or off.	RCALPP11; RCALP10; RCALP1X?; RCALP2DONE?
	RECEIVER CAL FOR PORT 2 ON/OFF ((NO) CAL EXISTS)	Toggles Port 2 Receiver calibration on or off.	RCALPP21; RCALP20; RCALP2X?; RCALP3DONE?
	RECEIVER CAL FOR PORT 3 ON/OFF ((NO) CAL EXISTS)	Toggles Port 3 Receiver calibration on or off.	RCALP31; RCALP30; RCALP3X?; RCALP3DONE?
	RETURN	Returns to the previous soft-key menu.	None
REFLECTION ONLY (FULL -PORT CAL)	PORT 1 ON PORT 2 ON	Displayed when a 12-term cal exists. Reflection only will be applied to the port that is on if the input method selected is REFLECTION ONLY and APPLY mode is selected.	FXP1T0; FXP1T1; FXP1T?; FXP2T0; FXP2T1; FXP2T?
	PORT 1 ON PORT 2 ON PORT 3 ON	Displayed when a 24-term cal exists. Reflection only will be applied to the port that is on if the input method selected is REFLECTION ONLY and APPLY mode is selected.	FXP1T0; FXP1T1; FXP1T?; FXP2T0; FXP2T1; FXP2T?; FXP3T0; FXP3T1; FXP3T?
	PORT 1 ON PORT 2 ON PORT 3 ON PORT 4 ON	Displayed when a 40-term cal exists. Reflection only will be applied to the port that is on if the input method selected is REFLECTION ONLY and APPLY mode is selected.	FXP1T0; FXP1T1; FXP1T?; FXP2T0; FXP2T1; FXP2T?; FXP3T0; FXP3T1; FXP3T?; FXP4T0; FXP4T1; FXP4T?
	RETURN	Changes the soft-key display to the FLEXIBLE CAL menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT 1 PATH 2 PORT CALIBRATION TYPE	FORWARD PATH (S11, S21)	Corrects the forward transmission and reflection error terms, ETF, EDF, ESF, ERF, (EXF) and changes soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	C8T; CXX?
	REVERSE PATH (S22, S12)	Corrects the reverse transmission and reflection error term, EDR, ESR, ERR, ETR, (EXR) and changes soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	C8R; CXX?
SELECT CALIBRATION TYPE	FULL 12 TERM	Corrects for all 12 error terms and changes soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	C12; CXX?
	1 PATH, 2 PORT	Corrects for the 1 path, 2 port error terms and changes soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	None
	TRANSMISSION FREQ RESPONSE	Corrects for the reflection only error terms and changes soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	None
	REFLECTION ONLY	Corrects for the reflection-only error terms and changes soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	None
SELECT CALIBRATION DATA POINTS	NORMAL (1601 POINTS MAXIMUM)	Selects the standard calibration using a start-to-stop frequency that provides for up to 1601 equally spaced (except the last) points of data for the defined frequency range. Changes the soft-key display to the CAL FREQ RANGE menu.	NOC; SWP?
	C.W. (1 POINT)	Selects the single frequency (C.W.) calibration sequence that provides for 1 data point at a selected frequency. Changes the soft-key display to the SINGLE POINT C.W. CALIBRATION menu.	CWC; SWP?
	N-DISCRETE FREQUENCIES (2 TO 1601 POINTS)	Selects the discrete frequency calibration mode that allows inputting a list of from 2 to 1601 individual data point frequencies. Changes the soft-key display to the DISCRETE FILL menu.	DFC; SWP?
	TIME DOMAIN (HARMONIC)	Selects time domain harmonic frequency calibration data points and changes the soft-key display to the CALIBRATION RANGE menu.	TDC; SWP?
	SEGMENTED SWEEP (1601 POINTS MAXIMUM)	Selects segmented sweep calibration data points and changes the soft-key display to the CAL FREQ RANGE 3 menu.	SSC; SWP?
SELECT PORT X CONNECTOR TYPE	SMA (M)	Sets port x to be male SMA connector.	CMS; P1C?; P2C?
	SMA (F)	Sets port x to be female SMA connector.	CFS; P1C?; P2C?
	K-CONN (M)	Sets port x to be male K connector.	CMK; P1C?; P2C?
	K-CONN (F)	Sets port x to be female K connector.	CFK; P1C?; P2C?
	TYPE N (M)	Sets port x to be male N connector.	CMN; P1C?; P2C?
	TYPE N (F)	Sets port x to be female N connector.	CFN; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the PORT X OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next SELECT PORT X CONNECTOR TYPE menu.	None

Menu Name	Function	Description	GPIB Mnemonic
SELECT PORT X CONNECTOR TYPE2	GPC-3.5 (M)	Sets port x to be male GPC 3.5 connector.	CM3; P1C?; P2C?
	GPC-3.5 (F)	Sets port x to be female GPC 3.5 connector.	CF3; P1C?; P2C?
	GPC-7	Sets port x to be GPC-7 connector.	CNG; P1C?; P2C?
	V-CONN (M)	Sets port x to be male V connector.	CMV; P1C?; P2C?
	V-CONN (F)	Sets port x to be female V connector.	CFV; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the PORT X OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next SELECT PORT X CONNECTOR TYPE menu.	None
SELECT PORT X CONNECTOR TYPE3	TNC (M)	Sets port x to be male TNC connector.	CMC; P1C?; P2C?
	TNC (F)	Sets port x to be female TNC connector.	CFC; P1C?; P2C?
	2.4 mm (M)	Sets port x to be male 2.4 mm connector.	CM2; P1C?; P2C?
	2.4 mm (F)	Sets port x to be female 2.4 mm connector.	CF2; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the PORT X OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next SELECT PORT X CONNECTOR TYPE menu.	None
SELECT PORT X CONNECTOR TYPE4	TYPE N (M) 75 Ohm	Sets port x to be male Type N 75 Ohm connector.	CMN75; P1C?; P2C?
	TYPE N (F) 75 Ohm	Sets port x to be female Type N 75 Ohm connector.	CFN75; P1C?; P2C?
	7/16 (M)	Sets port x to be male 7/16 connector.	CM716
	7/16 (F)	Sets port x to be female 7/16 connector.	CF716
	SPECIAL (M)	Sets port x to be male Special connector.	CMSP; P1C?; P2C?
	SPECIAL (F)	Sets port x to be female Special connector.	CFSP; P1C?; P2C?
	USER DEFINED	Changes the soft-key display to the PORT X OPEN DEVICE menu.	CND; P1C?; P2C?
	MORE	Changes the soft-key display to the next SELECT PORT X CONNECTOR TYPE menu.	None
SELECT FILE TO READ	FILE 1	Sets port x to be male Type N 75 Ohm connector.	CMN75; P1C?; P2C?
	FILE 2	Sets port x to be female Type N 75 Ohm connector.	CFN75; P1C?; P2C?
	FILE 3	Sets port x to be male Special connector.	CMSP; P1C?; P2C?
	FILE 4	Sets port x to be female Special connector.	CFSP; P1C?; P2C?
	PREVIOUS PAGE	Returns to the previous page of file names.	None
	NEXT PAGE	Advances to the next page of file names.	None
	RETURN	Returns to first NETWORK EXTRACTION menu.	None
SELECT MICROSTRIP KIT TO USE	10 MIL KIT	Selects parameters for 10 mil UTF kit.	U10; UTFX?
	15 MIL KIT	Selects parameters for 15 mil UTF kit.	U15; UTFX?
	25 MIL KIT	Selects parameters for 25 mil UTF kit.	U25; UTFX?
	USER DEFINED	Changes the soft-key display to the ENTER MICROSTRIP PARAMETERS menu.	UTFD; UTFF?

Menu Name	Function	Description	GPIB Mnemonic
SELECT REFLECTION ONLY CALIBRATION TYPE	PORT 1 ONLY (S11)	Changes the soft-key display to the SELECT CALIBRATION DATA POINTS menu.	CRF; CXX?
	PORT 2 ONLY (S22)	Changes the soft-key display to the SELECT CALIBRATION DATA POINTS menu.	CRR; CXX?
	BOTH PATHS (S11, S22)	Changes the soft-key display to the SELECT CALIBRATION DATA POINTS menu.	CRB; CXX?
SELECT REFLECTION PAIRING	MIXED (OPEN-SHORT SHORT-OPEN)	Selects different reflection devices (open/short or short/open) to be connected to Ports 1 and 2 for the calibration sequencing.	MIX; MIX?
	MATCHED (OPEN-OPEN SHORT-SHORT)	Selects the same type of reflection device (open/open or short/short) to be connected to Ports 1 and 2 for the calibration sequencing.	MAT; MIX?
SELECT TRANSMISSION FREQ RESPONSE CALIBRATION TYPE	FORWARD PATH (S21)	Changes the soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	CFT; CXX?
	REVERSE PATH (S12)	Changes the soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	CRT; CXX?
	BOTH PATHS (S21, S12)	Changes the soft-key display to the SELECT USE OF ISOLATION IN CALIBRATION menu.	CBT; CXX?
SELECT TYPE OF LOAD	BROADBAND FIXED LOAD	Selects a broadband load for calibration and changes soft-key display to the BROADBAND LOAD PARAMETERS menu.	BBL; BBX?
	SLIDING LOAD (MAY ALSO REQUIRE A BROADBAND FIXED LOAD)	Selects sliding load for calibration. If low-end frequency is below 2 GHz (4 GHz for V Connector), a fixed broadband load is also required.	SLD; BBX?
SELECT USE OF ISOLATION IN CALIBRATION	INCLUDE ISOLATION (STANDARD)	Includes isolation in calibration setup and changes soft-key display to the SELECT CALIBRATION POINTS menu.	ISN; ISX?
	EXCLUDE ISOLATION	Excludes isolation from calibration setup and changes soft-key display to the SELECT CALIBRATION POINTS menu.	ISF; ISX?
SELECT WAVEGUIDE KIT TO USE	INSTALLED KIT	The lines below indicate the characteristics of the installed waveguide calibration kit, if applicable.	None
	IDENTIFIER XXXX	Displays the type of waveguide used.	WGSER?
	CUTOFF FREQ XXX.XXXXXXXXXGHz	Displays the cutoff frequency of the waveguide.	WGCUTOFF?
	SHORT 1 XX.XXXXmm	Displays the offset length of the first calibration short.	WGSHOFF1?
	SHORT 2 XX.XXXXmm	Displays the offset length of the second calibration short.	WGSHOFF2?
	USE INSTALLED WAVEGUIDE KIT	Selects installed waveguide kit and changes soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	WKI; WKX?
	USER DEFINED	Changes the soft-key display to the ENTER WAVEGUIDE PARAMETERS menu.	WKD; WKX?

Menu Name	Function	Description	GPIB Mnemonic
SINGLE POINT C.W. CALIBRATION	C.W. FREQ XXX.XXXXXXXXXGHz	Sets the C.W. Frequency.	CWF; CWF?
	NEXT CAL STEP	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu, based on the Calibration Method and/or Line Type selections made using an earlier soft-key menu.	None
SOURCE 1 FLAT TEST PORT POWER CALIBRATION	XXXX POINTS MEASURE 1 PWR POINT EVERY XX POINT(S)	Displays the number of power points (0-50) to be skipped during the power sweep. The points not measured are interpolated to provide a flat sweep. The VNMS uses Port 1 power for source 1 and Port 3 power for source 2.	PTS; PTS?
	POWER TARGET XX.XX dBm	Sets a flat output-power value.	PTP; PTP?
	BEGIN CAL	Changes the soft-key display to the FLAT TEST PORT POWER CALIBRATION menu.	SFC
	RETURN	Returns to the previous soft-key menu.	None
	PORT 1 CAL WILL BE APPLIED TO PORT 2		None
START HARMONIC CALIBRATION	ENHANCEMENT CAL ((NO) CAL EXISTS)	Changes the soft-key display to the HARMONIC ENHANCEMENT CALIBRATION menu.	BEGEN; HARCEDONE?
	PHASE CAL ((NO) CAL EXISTS)	Changes the soft-key display to the HARMONIC PHASE CALIBRATION menu.	BEGPH; HARCPDONE?
	ENHANCEMENT & PHASE CAL	Changes the soft-key display to the HARMONIC ENHANCEMENT CAL menu, then on to HARMONIC PHASE CAL menu.	BEGHAR; HARCEPDONE?
	EXIT	Changes the soft-key display to the FREQUENCY menu.	None
TEST SIGNALS	SOURCE 1 POWER XX.XX dBm (20 TO - 15 dB)	Enter the power level, in dBm, of the internal source.	PWR; PWR?
	PORT 1 ATTN 0*10 dB (0 - 70 dB)	Attenuates from 0 to 70 dB (10 dB steps) the microwave power being output at Port 1.	SA1; SA1?
	PORT 1 POWER XX.XX dBm	Displays the Port 1 power, in dBm.	P1P?
	CALIBRATE FOR FLATNESS ((NO) CAL EXISTS)	Changes the soft-key display to the SOURCE 1 FLAT TEST PORT POWER CALIBRATION menu.	None
	FLATNESS ON/OFF CORRECTION	Toggles flatness correction on or off.	FP1; FP0; FPX?
	SOURCE 2 POWER X.XX dBm	Enter the power level, in dBm, of the 2nd frequency source.	PW2; PW2?
	RESUME CAL	Changes the soft-key display to the CONFIRM CALIBRATION PARAMETERS menu.	None

<table>
<tr><th>Menu Name</th><th>Function</th><th>Description</th><th>GPIB Mnemonic</th></tr>
<tr><td rowspan="2">THRU ASSIGNMENT (FULL 2 PORT CAL)</td><td>THRU (1-2)
AUTOCAL/THRU
LINE LENGTH
0.000 mm</td><td>Select thru type for port 1-2. Enter the line length offset if true thru is selected.</td><td>ACF2TC; ACF2TT;
ACF2TX?;
ACTHRU12T0;
ACTHRU12T1;
ACTHRU12TX?;
ACTOLP12;
ACTOLP12?</td></tr>
<tr><td>RETURN</td><td>Changes the soft-key display to the AUTOCAL SETUP (FULL 2-PORT CAL) menu.</td><td>None</td></tr>
<tr><td rowspan="4">THRU ASSIGNMENT (FULL 3 PORT CAL)</td><td>THRU (1-2)*
AUTOCAL/THRU
LINE LENGTH
0.000 mm</td><td>Select thru type for port 1-2. Enter the line length offset if true thru is selected.

* When port assignment X = 1 or X = 2 is selected or THRU (1-3) for port assignment X = 3.</td><td>ACF2TC; ACF2TT;
ACF2TX?;
ACTHRU12T0;
ACTHRU12T1;
ACTHRU12TX?;
ACTOLP12;
ACTOLP12?</td></tr>
<tr><td>THRU (1-3)*
AUTOCAL/THRU
LINE LENGTH
0.000 mm</td><td>Select thru type for port 1-3. Enter the line length offset if true thru is selected.

* When port assignment X = 1 is selected or THRU (2-3) for port assignment X = 2 or X = 3.</td><td>ACTHRU13T0;
ACTHRU13T1;
ACTHRU13TX?;
ACTOLP13;
ACTOLP13?</td></tr>
<tr><td>THRU (2-3)*
OMIT/THRU
LINE LENGTH
0.000 mm</td><td>Select whether to omit the thru or to select a true thru. Enter the line length offset if a thru is selected.

* When port assignment X = 1 is selected,
THRU (1-3) for port assignment X = 2, or
THRU (1-2) for port assignment X = 3.</td><td>ACTHRU23T0;
ACTHRU23T1;
ACTHRU23TX?;
ACTOLP23;
ACTOLP23?</td></tr>
<tr><td>RETURN</td><td>Changes the soft-key display to the AUTOCAL SETUP (FULL 3-PORT CAL) menu.</td><td>None</td></tr>
<tr><td rowspan="5">THRU ASSIGNMENT (FULL 4 PORT CAL)</td><td>THRU (1-2)*
AUTOCAL/THRU
LINE LENGTH
0.000 mm</td><td>Select thru type for port 1-2. Enter the line length offset if true thru is selected.

* When port assignment X = 1 is selected,
THRU (1-2) for port assignment X = 2,
THRU (1-3) for port assignment X = 3, or
THRU (1-4) for port assignment X = 4.</td><td>ACF2TC; ACF2TT;
ACF2TX?;
ACTHRU12T0;
ACTHRU12T1;
ACTHRU12TX?;
ACTOLP12;
ACTOLP12?</td></tr>
<tr><td>THRU (1-3)*
AUTOCAL/THRU
LINE LENGTH
0.000 mm</td><td>Select thru type for port 1-3. Enter the line length offset if true thru is selected.

* When port assignment X = 1 is selected,
THRU (2-3) for port assignment X = 2 or X = 3, or
THRU (2-4) for port assignment X = 4.</td><td>ACTHRU13T0;
ACTHRU13T1;
ACTHRU13TX?;
ACTOLP13;
ACTOLP13?</td></tr>
<tr><td>THRU (1-4)*
AUTOCAL/THRU
LINE LENGTH
0.000 mm</td><td>Select thru type for port 1-4. Enter the line length offset if true thru is selected.

* When port assignment X = 1 is selected,
THRU (2-4) for port assignment X = 2, or
THRU (3-4) for port assignment X = 3 or X = 4.</td><td>ACTHRU14T0;
ACTHRU14T1;
ACTHRU14TX?;
ACTOLP14;
ACTOLP14?</td></tr>
<tr><td>MORE</td><td>Changes the soft-key display to the THRU ASSIGNMENT2 (FULL 4-PORT CAL) menu.</td><td>None</td></tr>
<tr><td>RETURN</td><td>Changes the soft-key display to the AUTOCAL SETUP (FULL 4-PORT CAL) menu.</td><td>None</td></tr>
</table>

Menu Name	Function	Description	GPIB Mnemonic
THRU ASSIGNMENT2 (FULL 4 PORT CAL)	THRU (2-3)* OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected. * When port assignment X = 1 is selected, THRU (1-3) for port assignment X = 2, or THRU (1-2) for port assignment X = 3 or X = 4.	ACTHRU23T0; ACTHRU23T1; ACTHRU23TX?; ACTOLP23; ACTOLP23?
	THRU (2-4)* OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected. * When port assignment X = 1 is selected, THRU (1-4) for port assignment X = 2 or X = 3, or THRU (1-3) for port assignment X = 4.	ACTHRU24T0; ACTHRU24T1; ACTHRU24TX?; ACTOLP24; ACTOLP24?
	THRU (3-4)* OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected. * When port assignment X = 1 is selected, THRU (3-4) for port assignment X = 2, THRU (2-4) for port assignment X = 3, or THRU (2-3) for port assignment X = 4.	ACTHRU34T0; ACTHRU34T1; ACTHRU34TX?; ACTOLP34; ACTOLP34?
	MORE	Changes the soft-key display to the previous menu.	None
	RETURN	Changes the soft-key display to the AUTOCAL SETUP (FULL 4-PORT CAL) menu.	None
THRU UPDATE (FULL 2 PORT CAL)	THRU (1-2) LINE LENGTH 0.000 mm	Set the line length offset for the true thru between port 1 and port 2.	ACTHRU12T0; ACTHRU12T1; ACTHRU12TX?; ACTOLP12; ACTOLP12?
	NUMBER OF THRU AVERAGES XX	Set the number of averages for the true thru measurement.	ACTUAVG; ACTUAVG?
	CONNECT A THRU LINE BETWEEN PORT 1 AND 2		None
	START THRU UPDATE	Changes the sof-key display to the AUTOCAL THRU UPDATE menu.	BEGTU
	RETURN	Changes the sof-key display to the PERFORM AUTOCAL menu.	None

Menu Name	Function	Description	GPIB Mnemonic
THRU UPDATE (FULL 3 PORT CAL)	THRU (1-2) LINE LENGTH 0.000 mm	Set the line length offset for the true thru between port 1 and port 2.	ACTHRU12T0; ACTHRU12T1; ACTHRU12TX?; ACTOLP12; ACTOLP12?
	THRU (1-3) LINE LENGTH 0.000 mm	Set the line length offset for the true thru between port 1 and port 3.	ACTHRU13T0; ACTHRU13T1; ACTHRU13TX?; ACTOLP13; ACTOLP13?
	THRU (2-3) OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected.	ACTHRU23T0; ACTHRU23T1; ACTHRU23TX?; ACTOLP23; ACTOLP23?
	NUMBER OF THRU AVERAGES XX	Set the number of averages for the true thru measurement.	ACTUAVG; ACTUAVG?
	CONNECT A THRU LINE BETWEEN PORT 1 AND 2		
	START THRU UPDATE	Changes the sof-key display to the AUTOCAL THRU UPDATE menu.	BEGTU
	RETURN	Changes sof-key display to the PERFORM AUTOCAL menu.	None
THRU UPDATE (FULL 4 PORT CAL)	THRU (1-2) LINE LENGTH 0.000 mm	Set the line length offset for the true thru between port 1 and port 2.	ACTHRU12T0; ACTHRU12T1; ACTHRU12TX?; ACTOLP12; ACTOLP12?
	THRU (1-3) LINE LENGTH 0.000 mm	Set the line length offset for the true thru between port 1 and port 3.	ACTHRU13T0; ACTHRU13T1; ACTHRU13TX?; ACTOLP13; ACTOLP13?
	THRU (1-4) LINE LENGTH 0.000 mm	Set the line length offset for the true thru between port 1 and port 4.	ACTHRU14T0; ACTHRU14T1; ACTHRU14TX?; ACTOLP14; ACTOLP14?
	NUMBER OF THRU AVERAGES XX	Set the number of averages for the true thru measurement.	ACTUAVG; ACTUAVG?
	MORE	Changes the soft-key display to the THRU UPDATE 2 (FULL 4-PORT CAL) menu.	None
	RETURN	Changes sof-key display to the PERFORM AUTOCAL menu.	None

Menu Name	Function	Description	GPIB Mnemonic
THRU UPDATE 2 (FULL 4 PORT CAL)	THRU (2-3) OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected.	ACTHRU23T0; ACTHRU23T1; ACTHRU23TX?; ACTOLP23; ACTOLP23?
	THRU (2-4) OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected.	ACTHRU24T0; ACTHRU24T1; ACTHRU24TX?; ACTOLP24; ACTOLP24?
	THRU (3-4) OMIT/THRU LINE LENGTH 0.000 mm	Select whether to omit the thru or select a true thru. Enter the line length offset if a thru is selected.	ACTHRU34T0; ACTHRU34T1; ACTHRU34TX?; ACTOLP34; ACTOLP34?
	CONNECT A THRU LINE BETWEEN PORT 1 AND 2		None
	START THRU UPDATE	Changes the sof-key display to the AUTOCAL THRU UPDATE menu.	BEGTU
	RETURN	Changes sof-key display to the PERFORM AUTOCAL menu.	None
TRANSMISSION AND REFLECTION CALIBRATION	Displayed for MS4622X and MS4623X models		
	APPLY CAL		
	2-PORT (CAL EXISTS)	Selects a 2-port transmission and reflection calibration.	CON; APPC12T?; CON?; CXX?
	3-PORT (CAL EXISTS)	Selects a 3-port transmission and reflection calibration.	CON3P; APPC3P?; CON3P?; CDP3CALTP?; CXX?
	FLEXIBLE CAL (CAL EXISTS)	Selects flexible calibration and changes the soft-key display to the FLEXIBLE CAL menu.	CFXICU; CDFXCALTP?; CONFX; CONFX?
	NONE	Selects no transmission and reflection calibration.	COF
	PERFORM CAL		
	2-PORT (CAL EXISTS)	Changes the soft-key display to the BEGIN 2 PORT CALIBRATION (12 TERMS) menu.	None
	3-PORT (CAL EXISTS)	Changes the soft-key display to the BEGIN 3 PORT CALIBRATION (24 TERMS) menu.	None
	AUTOCAL	Changes the soft-key display to the PERFORM AUTOCAL menu.	None
	MORE	Changes the soft-key display to the TRANSMISSION AND REFLECTION CALIBRATION 2 menu.	None

Menu Name	Function	Description	GPIB Mnemonic
TRANSMISSION AND REFLECTION CALIBRATION	Displayed for MS4624X models		
	APPLY CAL		
	2-PORT (CAL EXISTS)	Selects a 2-port transmission and reflection calibration.	CON; APPC12T?; CON?; CXX?
	3-PORT (CAL EXISTS)	Selects a 3-port transmission and reflection calibration.	CON3P; APPC3P?; CON3P?; CDP3CALTP?; CXX?
	4-PORT (CAL EXISTS)	Selects a 4-port transmission and reflection calibration.	CON4P; APPC4P?; CON4P?; CDP3CALTP?; CXX?
	FLEXIBLE CAL (CAL EXISTS)	Selects a flexible calibration and changes the soft-key display to the FLEXIBLE CAL menu.	CFXICU; CDFXCALTP?; CONFX; CONFX?
	NONE	Selects no transmission and reflection calibration.	COF
	PERFORM CAL		
	MANUAL CAL	Changes the soft-key display to the 4-PORT PERFORM MANUAL CAL menu.	None
	AUTOCAL	Changes the soft-key display to the AUTOCAL menu.	None
	MORE	Changes the soft-key display to the TRANSMISSION AND REFLECTION CALIBRATION 2 menu.	None
TRANSMISSION AND REFLECTION CALIBRATION 2	PERFORM ADAPTER REMOVAL	Changes the soft-key display to the ADAPTER REMOVAL menu.	None
	NETWORK EXTRACTION	Changes the soft-key display to the NETWORK EXTRACTION menu.	None
	COMPONENT UTILITY	Changes the soft-key display to the CALIBRATION COMPONENT UTILITIES menu.	None
	RETURN	Returns to the previous soft-key menu.	None

4-14 AVG KEY MENUS

This key provides entry to averaging and IF bandwidth functions.

Menu Name	Function	Description	GPIB Mnemonic
AVERAGE 1	AVERAGE ON/OFF	Toggles data averaging on or off.	AON; AOF; AOF?
	DATA AVERAGE: XX MEA./POINT	Sets the number of measurements to be averaged.	AVG; AVG?
	TRACE SMOOTHING ON/OFF	Toggles TRACE SMOOTHING on or off.	SOF; SOF?
	SMOOTHING 0-20% OF SWEEP	Sets trace smoothing percentage.	SON; SON?
	NOISE FIGURE AVERAGE ON/OFF	Toggles NOISE FIGURE AVERAGE on or off.	NFAON; NFAOF; NFAON?
	NOISE FIGURE AVERAGE XX	Sets the number of noise figure measurements to be averaged.	NFAVEC; NFAVEC?
	SELECT I.F. BANDWIDTH	Changes the soft-key display to the I.F. BANDWIDTH menu.	None
AVERAGE 2	Displays in the Frequency Translation Group Delay or the Transmission/Reflection Modes Only.		
	AVERAGE ON/OFF	Toggles the averaging mode on or off.	AON; AOF; AOF?
	DATA AVERAGE 1 MEAS.	Enters the averaging count and turn it on.	AVG; AVG?
	AVERAGING TYPE POINT-BY-POINT SWEEP-BY-SWEEP	Selects the averaging type of Point-by-Point or Sweep-by-Sweep.	SWAVG; PTAVG; SWAVG?; AVGCNT?
	RESET AVG. COUNT (X SWEEP(S))	Resets the Sweep-by-Sweep averaging sweep count.	RSTAVG
	TRACE SMOOTHING ON/OFF	Toggles trace smoothing on or off.	SON; SOF; SOF?
	SMOOTHING X.XX% OF SWEEP X POINTS	Displays the number of smoothing points.	SON; SON?; SPTS?
	SELECT I.F. BANDWIDTH	Changes the soft-key display to the I.F. BANDWIDTH menu.	None

Menu Name	Function	Description	GPIB Mnemonic
AVERAGE 3	Displays in the Transmission/Reflection Calibration Mode Only.		
	AVERAGE ON/OFF	Toggles the averaging mode on or off.	AON; AOF; AOF?
	DATA AVERAGE 1 MEAS.	Enters the averaging count and turn it on.	AVG; AVG?
	AVERAGING TYPE POINT-BY-POINT SWEEP-BY-SWEEP	Selects the averaging type of Point-by-Point or Sweep-by-Sweep.	SWAVG; PTAVG; SWAVG?; AVGCNT?
	RESET AVG. COUNT (X SWEEP(S))	Resets the Sweep-by-Sweep averaging sweep count.	RSTAVG
	TRACE ON/OFF SMOOTHING	Toggles trace smoothing on or off.	SON; SOF; SOF?
	SMOOTHING X.XX% OF SWEEP X POINTS	Sets the number of smoothing points.	SON; SON?; SPTS?
	SELECT I.F. BANDWIDTH	Changes the soft-key display to the I.F. BANDWIDTH menu.	None
	RESUME CAL	Changes the soft-key display to the ? menu.	
I.F. BANDWIDTH	I.F.BW 30 kHz	Selects IF bandwidth of 30 kHz.	IFA; IFBW30K; IFBWX?; IFX?
	I.F.BW 10 kHz	Selects IF bandwidth of 10 kHz.	IF4; IFBW10K; IFBWX?; IFX?
	I.F.BW 3 kHz	Selects IF bandwidth of 3 kHz.	IFBW3K; IFBWX?; IFX?
	I.F.BW 1kHz	Selects IF bandwidth of 1 kHz.	IF3; IFN; IFBW1K; IFBWX?; IFX?
	I.F.BW 300 Hz	Selects IF bandwidth of 300 Hz.	IFBW300; IFBWX?; IFX?
	I.F.BW 100 Hz	Selects IF bandwidth of 100 Hz.	IF2; IFR; IFBW100; IFBWX?; IFX?
	I.F.BW 30 Hz	Selects IF bandwidth of 30 Hz.	IFBW30; IFBWX?; IFX?
	I.F.BW 10 Hz	Selects IF bandwidth of 10 Hz.	IF1; IFM; IFBW10; IFBWX?; IFX?

Anritsu	Default	Appl	Meas	Display	Ctrl	Marker	Hold	Rdout Mkr	Cmd Line	Ctrl	Gr Type	Store Mem	Seq	Cal
Vector Network Analyzer	Exe Seq 1	Exe Seq 2	Exe Seq 3	Exe Seq 4	Alt	Exe Seq 5	Exe Seq 6	Exe Seq 7	IF BW	Alt	Limits	Trace Mem	Avg	Utility
Clear/Ret Loc _____ Esc Start Print _______ Print Screen, F12 Hold ___________ Pause	Softkey 1	Softkey 2	Softkey 3	Softkey 4	Shift	Softkey 5	Softkey 6	Softkey 7	Softkey 8	Shift	Scale	Domain	Data Pts	Hardcopy
Copyright (c) 1998 by Anritsu Company	Ch 1	Ch 2	Ch 3	Ch 4		Freq	Sweep	Power	Config		Auto Scale	Save	Recall	Start Print

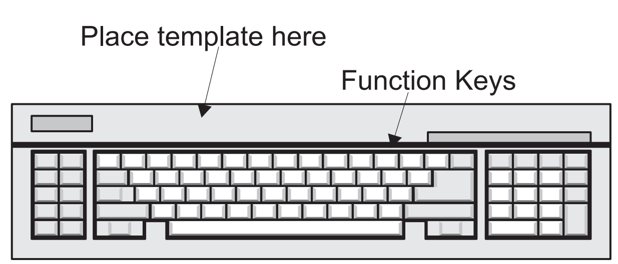


Figure 4-3. *Function Keys Template, Actual Size*

Chapter 5 Error and Status Messages

Table of Contents

Chapter 5
Error and Status Messages

5-1 INTRODUCTION

This chapter lists, describes, and provides corrective action for the error messages that appear on the display. Any error messages that appear on the display but do not appear in this chapter will require action by a qualified service representative.

5-2 ERROR MESSAGES

Error messages are provided in Tables 5-1 through 5-4.

Table 5-1. *General Error Messages (1 of 7)*

Code	Message	Description	Corrective Action
	Troubleshooting Error Codes		
	ALC SHAPER DAC CAL FAIL	ALC CAL fail	Contact factory
	DSP NMI ERROR		Contact factory
	DSP ST ERROR	DSP self-test fail	Contact factory
	FLASH WRITE ERROR	FLASH memory write fail	Contact factory
	FLASH ERASE ERROR	FLASH memory erase fail	Contact factory
	MEMORY TEST ERROR		
	NCR ACC1 ERROR	Hard drive controller test fail	Contact factory
	NCR ACC2 ERROR	Hard drive controller test fail	Contact factory
	NCR SFIFO ERROR	Hard drive controller test fail	Contact factory
	NCR DFIFO ERROR	Hard drive controller test fail	Contact factory
	NCR LPBK ERROR	Hard drive controller test fail	Contact factory
	NCR SCRIPT ERROR	Hard drive controller test fail	Contact factory
	NCR IRQ ERROR	Hard drive controller test fail	Contact factory
	LANC SELF TEST_ERROR	LANC controller test fail	Contact factory
	LANC IRQ ERROR	LANC controller test fail	Contact factory
	LANC REG STATE ERROR	LANC controller test fail	Contact factory
	LANC DUMP TEST ERROR	LANC controller test fail	Contact factory
	LANC DIAG ERROR	LANC controller test fail	Contact factory
	LANC SCB ERROR	LANC controller test fail	Contact factory
	LANC CANT IDLE ERROR	LANC controller test fail	Contact factory
	LANC IRQ PENDING ERROR	LANC controller test fail	Contact factory
	LANC IDLE ERROR	LANC controller test fail	Contact factory
	LANC TIMEOUT ERROR	LANC controller test fail	Contact factory
	LANC CONFIGURE ERROR	LANC controller test fail	Contact factory
	LANC SETUP ERROR	LANC controller test fail	Contact factory

Table 5-1. *General Error Messages (2 of 7)*

Code	Message	Description	Corrective Action
	LANC BCMP ERROR	LANC controller test fail	Contact factory
	LANC TRANSMIT ERROR	LANC controller test fail	Contact factory
	LANC DATA ERROR	LANC controller test fail	Contact factory
	RTC BATT LOW ERROR	Timerkeeper RAM test fail	Contact factory
	RTC NOT RUN ERROR	Timerkeeper RAM test fail	Contact factory
	RTC NOT FREEZE ERROR	Timerkeeper RAM test fail	Contact factory
	RTC CLK ERROR	Timerkeeper RAM test fail	Contact factory
	RTC DATA MISCOMPARE	Timerkeeper RAM test fail	Contact factory
	RTC RAM ERROR	Timerkeeper RAM test fail	Contact factory
	RTC ADDR ERROR	Timerkeeper RAM test fail	Contact factory
	RTC DATA VERIFY ERROR	Timerkeeper RAM test fail	Contact factory
	SCC RW ERROR	Serial port self-test fail	Contact factory
	SCC INTERRUPT ERROR	Serial port self-test fail	Contact factory
	SCSI INIT ERROR	Hard drive controller test fail	Contact factory
	SCSI ISTAT ERROR	Hard drive controller test fail	Contact factory
	SCSI SSTAT0 ERROR	Hard drive controller test fail	Contact factory
	SCSI SSTAT1 ERROR	Hard drive controller test fail	Contact factory
	SCSI SSTAT2 ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO NOT EMPTY ERROR	Hard drive controller test fail	Contact factory
	SCSI NCR LOOPBACK ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO BIT SET ERROR	Hard drive controller test fail	Contact factory
	SCSI SHIFT ERROR	Hard drive controller test fail	Contact factory
	SCSI INTERRUPT ENABLE ERROR	Hard drive controller test fail	Contact factory
	SCSI DEST ID ERROR	Hard drive controller test fail	Contact factory
	SCSI OUTPUT DATA LTCH REG ERROR	Hard drive controller test fail	Contact factory
	SCSI TRANSFER REG ERROR	Hard drive controller test fail	Contact factory
	SCSI CHIP ID REG ERROR	Hard drive controller test fail	Contact factory
	SCSI DATA STRUCT REG ERROR	Hard drive controller test fail	Contact factory
	SCSI TEMP STACK REG ERROR	Hard drive controller test fail	Contact factory
	SCSI DMA BYTE COUNTER REG ERROR	Hard drive controller test fail	Contact factory
	SCSI DMA NEXT DATA REG ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO WALK THRU ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO READ ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO READ WRITE ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO READ EMPTY ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO EMPTY ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO SET DMA ENABLE ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO CLR BITS ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO CLR PARITY BIT ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO LANE FULL ERROR	Hard drive controller test fail	Contact factory

Table 5-1. *General Error Messages (3 of 7)*

Code	Message	Description	Corrective Action
	SCSI FIFO DMA PARITY BIT ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO DMA READ WRITE ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO DMA LANE FULL ERROR	Hard drive controller test fail	Contact factory
	SCSI FIFO DMA LANE EMPTY ERROR	Hard drive controller test fail	Contact factory
	SCSI BUS DATA LINES SETUP ERROR	Hard drive controller test fail	Contact factory
	SCSI DMA NEXT DATA INIT ERROR	Hard drive controller test fail	Contact factory
	SCSI DMA LOOPPBACK RW ERROR	Hard drive controller test fail	Contact factory
	SCSI DMA BYTE COUNT REG ERROR	Hard drive controller test fail	Contact factory
	SCSI GEN SGE SSTAT0 ERROR	Hard drive controller test fail	Contact factory
	SCSI GEN SGE ISTAT ERROR	Hard drive controller test fail	Contact factory
	SCSI CLR SGE SSTA0 ERROR	Hard drive controller test fail	Contact factory
	SCSI CLR SGE ISTAT ERROR	Hard drive controller test fail	Contact factory
	Sequence Error Codes		
	SEQ FILE NOT FOUND	Sequence file is not on disk	Correct file name
	SEQ ERROR ON STATEMENT	A statement can't be used	Recreate the statement
	SEQ EDIT BUSY	Sequence is busy in editing	Terminate sequence edit
	SEQ EXECUTE BUSY	Sequence is in execution mode	Terminate sequence execute
	SEQ UNKNOWN ERROR	An unknown error occurs	Contact factory
	Ethernet Error Codes		
	SKT BUFF OVERWITTEN ERROR	Network buffer error	Contact factory
	SKT REGION DLTD ERROR	Network buffer error	Contact factory
	SKT REGION ID INCORRECT	Network buffer error	Contact factory
	SKT SEG NOT BELONG TO REGION	Network buffer error	Contact factory
	SKT WRONG REGION BEGIN ADDR	Network buffer error	Contact factory
	SKT SEQ DISALLOCATED ALREADY	Network buffer error	Contact factory
	SKT WRONG BUFF BEGIN ADDR	Network buffer error	Contact factory
	SKT BUFFER FREED ALREADY	Network buffer error	Contact factory
	SKT NODE SPECIFIER OUT OF RANGE	Network addressing error	Contact factory
	SKT INIT NOT COMPLETED	Network start up error	Contact factory
	SKT NO SUCH ADDRESS	Network addressing error	Contact factory
	SKT INVALID DESCRIPTOR	Network socket description error	Contact factory
	SKT NO BROADCAST ON SOCKET	Network socket error	Contact factory
	SKT ENTRY DUPLICATED	Network table error	Contact factory
	SKT INVALID ARGUMENT	Network table error	Contact factory
	SKT OUT OF INTERNAL TABLE SPACE	Network table error	Contact factory
	SKT SOCKET DISCONNECTED	Socket has been removed from table	
	SKT BLOCK ON NON-BLOCK SOCKET	Network transmission is blocked	Receive all output

Table 5-1. *General Error Messages (4 of 7)*

Code	Message	Description	Corrective Action
	SKT INVALID DESCRIPTOR	Socket has been removed	
	SKT INCOMPLETED CONN ON NON-SKT	Network connection error	
	SKT INVALID DESTINATION ADDR	Unreachable destination	Clear table
	SKT DATA TRANSMITTED NOT IN UNIT	Fragmental transmission	
	SKT INVALID OPTNAME/LEVEL	Invalid socket number	
	SKT INVALID OPERATION ON SOCKET	Invalid operation on socket	
	SKT MEMBER NOT IN AF_INET	Invalid protocol	
	SKT SPECIFIED ADDR IN USE	Invalid network addressing	
	SKT ADDRESS NOT AVAILABLE	Invalid network addressing	
	SKT NOT REACHABLE DESTINATION	Unreachable destination	
	SKT PEER ABORTED CONNECTION	Peer networked unit may be power down	
	SKT PEER RESET CONNECTION	Peer networked unit resets connection	
	SKT ALLOCATION ON INTERNAL BUFF		
	SKT SOCKET ALREADY CONNECTED	Duplicate in connection	
	SKT SOCKET NOT CONNECTED	Connection is broken	
	SKT CONNECTION REQUEST REFUSED	A connection request is rejected	
	SKT ROUTE NOT FOUND	A routing address is not found	
	SKT COLLISION IN SELECT	An error on select a socket	
	SKT INVALID TASK ID	An invalid task ID	
	SKT INQUE NULL ERROR	Buffering error	Contact factory
	SKT INQUE ERROR	Buffering error	Contact factory
	SKT INQUE NO MEMORY ERROR	Buffering error	Contact factory
	SKT SOCKET NOT FOUND ERROR	Socket doesn't exist	Contact factory
	SKT UNKNOWN ERROR		Contact factory
	General Error Codes		
	AUTOCAL ASSURANCE FAIL SUMMARY	Cal done with AutoCal failed assurance test	None
	LC VERIFY FAIL	Hardware cal verification for accuracy of power level failed	
	SRC PWR CHANGED AFTER CAL	Cal maybe invalid because SRC pwr changed	
	ATTEN CHANGED AFTER CAL	Cal maybe invalid because SRC pwr changed	
	CAL DATE TOO OLD	Calibration data is too old to use	Redo a calibration
	CAL COEFF NOT INSTALLED	Calibration coefficient data is not installed	Install the data
	TEMP TOO HIGH	Temperature is too high to accept	Decrease temperature

Table 5-1. General Error Messages (5 of 7)

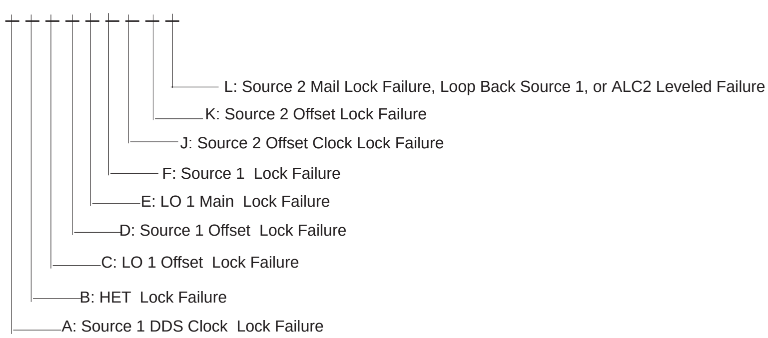
Code	Message	Description	Corrective Action
	TOO HIGH TEMP CHANGE	Temperature is too high to change to	Decrease the need temperature
	H/W RETUNED SINCE CAL		
	BAD FILENAME	File name is not acceptable	Re-enter the file name according to the rule
	CAL MAY BE INVALID	Calibration data may not be applicable for the current application	Check the needed cal
	FLAT CAL MAY BE INVALID	Flat calibration data invalid	Redo a flat calibration
	FLAT PWR TURNED OFF	Flat power is off	
	HARD COPY OUTPUT ABORTED	An abort of hardcopy out is performed	
	CORRECTION UNAVAILABLE	A corrective action is not supported	
	TIME DOMAIN INVALID	Time domain value is not valid	
	GATE MUST BE ON	Gating must be on in Time Domain for this function	
	SMOOTHING INVALID		
	MEMORY DATA INVALID	Memory may be corrupted	Contact manufacturer
	NEED HARMONIC SWEEP	RF Cal needs to be done in Harmonic Sweep in order to be applied in Time Domain	Perform RF Cal in Harmonic Sweep
	PARAMETER INVALID	Input parameter is out of range	Perform new cal
	CORRUPT OR INCOMPATIBLE FILE	File parameter data structure is not recognized	Contact factory
	NOT ALLOWED AT THIS TIME	This function is not allowed under the current setup	
	STORED SWP FREQS CLEARED	The frequency list in Power Sweep Gain Compression has been cleared	
	HARD COPY DATA CAPTURE FAILED	A hardcopy of data can't be made	
	PRINTER BUSY	Printer is busy in performing other task	Check connection or wait
	VALUE NOT FOUND	The need value is not found in the system	
	OUT OF SOURCE CONTROL RANGE	The value is not in the control range	Correct the value
	ABORTED: INCOMPATIBLE FILES	Not an acceptable file type	
	POWER OUT OF CALIBRATED RANGE	Power is not in the range of CAL	
	LOGO FILE NOT FOUND	LOGO file is not on the disk	Create a LOGO file and reload

Table 5-1. *General Error Messages (6 of 7)*

Code	Message	Description	Corrective Action
	POWER RESTORED TO CAL RANGE	Power restored is within cal range	
	FREQUENCIES NOT SET	Frequencies did not set in swept power gain compression	
	MULTIPLE SOURCE MODE ACTIVE	Multiple source mode is inactive	
	SYSTEM IMPEDANCES CHANGED	User changed to connector type having a different characteristic impedance	
	NON-STD CONNECTOR IMPEDANCE	Impedance does not match connection	
	NOT ALLOWED DURING IF CAL	Not allowed in IF cal	
	TRACE MATH APPLIED	Trace match applied	
	THREE PORT CORRECTION	Three port cal applied	
	NOISE FIGURE OVERLOAD	Receiver overloaded	
	LO FREQ OUT OF H/W RANGE	Low frequency in mixer mode is out of range	Change to different low frequency

Message displays as:

6100 PHS LCK FAIL



The phase lock message can include any or all of the letter codes, a sample message may resemble the following:
6100 PHS LCK FAIL A C

Figure 5-1. *6100 Phase Lock Error Message*

Table 5-1. General Error Messages (7 of 7)

Code	Message	Description	Corrective Action
	Source Error Codes		
6129	EXT SRC ERROR		
6130	EXT SRC LIST ERROR		
6131	EXT SRC POWER ERROR		
6132	EXT SRC START FREQ ERROR		
6133	EXT SRC NEXT FREQ ERROR		

Table 5-2. *Peripherals (Hard and Floppy Disks and GPIB) Error Messages (1 of 2)*

Code	Message	Description	Corrective Action
7100	FILE MARKED READ ONLY	Can't perform a write	Mark the file to write accessible if needed
7140	GENERAL FLOPPY DRIVE FAIL	Invalid disk media or format	Reformat disk in the MS462XX
7142	FLOPPY DISK READ ERROR	Can't perform a read	Reformat disk in the MS462XX
7143	FLOPPY DISK WRITE ERROR	Can't perform a write	Reformat disk in the MS462XX
7146	FLOPPY DISK CHANGED	Not the same disk	Insert the same disk
7147	FLOPPY DISK UNAVAILABLE	Can't access floppy disk	Check the MX462X supports floppy disk
7169	FLOPPY INIT FAIL	Can't initial floppy disk	Check if it is a bad disk
7170	GENERAL HARD DISK FAIL	Can't access hard disk	Check if there is a hard disk or bad connection
7172	HARD DISK READ ERROR	Can't perform a read	Check if the disk is compatible
7173	HARD DISK WRITE ERROR	Can't perform a write	Check if the disk is compatible
7177	HARD DISK UNAVAILABLE	Can't access hard disk	Check if there is a hard disk or bad connection
7199	HARD DISK INIT FAIL	Can't initialize hard disk	Check if the disk is compatible or bad connection
7200	IEEE 488.2 GPIB BUS ERROR	GPIB bus error	
7203	NO LISTENER ON BUS	No listener on GPIB bus	
7204	GPIB COMMAND ERROR	GPIB command error	Check Service Log for detail
7205	GPIB EXECUTION ERROR	GPIB execution error	Check Service Log for detail
7206	GPIB DEVICE SPECIFIC ERROR	GPIB device error	Check Service Log for detail
7207	GPIB QUERY ERROR	GPIB query error	Check Service Log for detail
7210	DEDICATED GPIB BUS ERROR	Dedicated GPIB bus error	Check Service Log for detail
7220	PLOTTER NOT RESPONDING	Plotter doesn't respond to the operation	Check if bad connection occurred or power off
7221	PLOTTER NOT READY	Plotter is not ready	Wait until it is not busy or check if bad connection occurred
7222	PLOTTER OUT OF PAPER	There is no paper	Place paper
7223	PLOTTER PEN UP	Pen is not ready	Place pen in right position
7230	POWER METER NOT RESPONDING	Power meter is not ready	Check if bad connection occurred
7250	EXT SOURCE NOT RESPONDING	External source is not ready	Check if bad connection occurred
7310	PRINTER NOT RESPONDING	Printer is not ready	Check if bad connection or power off
7311	PRINTER NOT READY	Printer is not ready	Check if bad connection
7312	PRINTER OUT OF PAPER	Printer is out of paper	Place paper
7330	SERIAL PORT ERROR		
7340	ETHERNET PORT ERROR		

Table 5-2. *Peripherals (Hard and Floppy Disks and GPIB) Error Messages (2 of 2)*

Code	Message	Description	Corrective Action
7350	EXT TRIG RATE TOO FAST	Pulse rate of the external trigger is faster than the maximum rate	
7410	EXT KYBD ERROR	External keyboard error	Check connection
8120	GENERAL MEMORY FAIL	Data might be lost because of memory failure	
8121	NON-VOLATILE MEMORY FAIL	System configuration might be lost because of NVRAM failure	
8140	GENERAL DISK BUFFER ERR	Error messages that suggest the floppy drive needs service	

Table 5-3. *Self Test Error Messages (1 of 2)*

Code	Message	Code	Message
0002	SRC1 COMM FAIL	0121	SERIAL PORT FAIL
0003	SRC2 COMM FAIL	0125	DSP SRAM FAIL
0005	PWR SUPPLY UP +5V	0126	DSP FAIL
0006	PWR SUPPLY UP +15V	0127	REAL TIME CLOCK TEST FAIL
0007	PWR SUPPLY UP -15V	0128	ST RTC FAIL
0008	PWR SUPPLY UP +12V	0201	FTGD REFERENCE FAIL
0009	PWR SUPPLY UP -125V	0300	SRC2 COMM FAIL
0010	PWR SUPPLY UP +10V	0302	SRC2 OFST LCK IND FAIL
0011	PWR SUPPLY BB +28V	0303-1	SRC2 OFST TUNE VOL FAIL 850MHZ
0012	PWR SUPPLY BB +5V	0303-2	SRC2 OFST TUNE VOL FAIL 120MHZ
0013	PWR SUPPLY BB +6.5V	0303-3	SRC2 OFST TUNE VOL FAIL 1550MHZ
0014	PWR SUPPLY BB -13.4V	0304	SRC2 MCOM LCK IND FAIL
0015	PWR SUPPLY BB -10V	0305-1	SRC2 MCOM TUNE VOL FAIL 850MHZ
0016	PWR SUPPLY BB +28VN	0305-2	SRC2 MCOM TUNE VOL FAIL 1200MHZ
0017	OPTIONS BOARD PWR SUPPLY +12V	0305-3	SRC2 MCOM TUNE VOL FAIL 1550MHZ
0018	OPTIONS BOARD PWR SUPPLY -12V	0306	SRC2 M NOCOM LCK IND FAIL
0019	OPTIONS BOARD PWR SUPPLY -5V	0307-1	SRC2 M NOCOM TUNE VOL FAIL 850MHZ
0020	OPTIONS BOARD PWR SUPPLY +5V	0307-2	SRC2 M NOCOM TUNE VOL FAIL 1200MHZ
0021	FTGD SYNTH LOCK DET PWR SUPPLY	0307-3	SRC2 M NOCOM TUNE VOL FAIL 1550MHZ
0022	PWR SUPPLY UP -5V	0308	SRC2 FREQ PATH BAND1 FAIL
0092	ETHERNET TEST FAILED	0309	SRC2 FREQ PATH BAND2 FAIL
0095	PRNT INTERFACE TEST FAILED	0310	SRC2 FREQ PATH BAND3 FAIL
0097	GPIB INTERFACE TEST FAILED	0311	SRC2 FREQ PATH BAND4 FAIL
0099	SELF TEST FAILED	0312	SRC2 FREQ PATH BAND5 FAIL
0101	BBRAM CHECK FAIL	0313	SRC2 FREQ PATH BAND6 FAIL
0102	SRAM CHECK FAIL	0314	SRC2 FREQ PATH BAND7 FAIL
0106	CLOCK NOT RUNNING	0315	SRC2 FREQ PATH BAND8 FAIL
0107	EXT KEYB CNTRL FAIL	0316	SRC2 FREQ PATH BAND9 FAIL
0108	FLOPPY DISK CNTRL FAIL	0317	SRC2 FREQ PATH BAND10 FAIL
0109	VRAM CHECK FAIL	0318-1	SRC2 PWR LEVEL DAC FAIL -10V
0110	FRONT PANEL CNTRL FAIL	0318-2	SRC2 PWR LEVEL DAC FAIL -5V
0111	ROTARY KNOB FAIL	0318-3	SRC2 PWR LEVEL DAC FAIL 0V
0114-1	A TO D EXT ANA OUTP FAIL -10V	0320	SRC2 FREQ PATH BAND1 FAIL
0114-2	A TO D EXT ANA OUTP FAIL 0V	0321	SRC2 FREQ PATH BAND2 FAIL
0114-3	A TO D EXT ANA OUTP FAIL +10V	0322	SRC2 FREQ PATH BAND3 FAIL
0116	BATTERY TEST FAIL	0323	SRC2 FREQ PATH BAND4 FAIL
0117	SRAM DISK CHECK FAIL	0324	SRC2 FREQ PATH BAND5 FAIL
0119	SCSI CHECK FAIL	0325	SRC2 FREQ PATH BAND6 FAIL
0120	ETHERNET CHECK FAIL	0326	SRC2 FREQ PATH BAND7 FAIL

Table 5-3. *Self Test Error Messages (2 of 2)*

Code	Message
0327	SRC2 FREQ PATH BAND8 FAIL
0328	SRC2 FREQ PATH BAND9 FAIL
0329	SRC2 FREQ PATH BAND10 FAIL
0400	SRC1 COMM FAIL
0401	HET PHS LCK IND FAIL
0402-1	HET TUNE VOL FAIL 850MHZ
0402-2	HET TUNE VOL FAIL 1200MHZ
0402-3	HET TUNE VOL FAIL 1550MHZ
0404	SRC1 OFST LCK IND FAIL
0405-1	SRC1 OFST TUNE VOL FAIL 850MHZ
0405-2	SRC1 OFST TUNE VOL FAIL 120MHZ
0405-3	SRC1 OFST TUNE VOL FAIL 1550MHZ
0406	SRC1 MCOM LCK IND FAIL
0407-1	SRC1 MCOM TUNE VOL FAIL 850MHZ
0407-2	SRC1 MCOM TUNE VOL FAIL 1200MHZ
0407-3	SRC1 MCOM TUNE VOL FAIL 1550MHZ
0408	SRC1 M NOCOM LCK IND FAIL
0409-1	SRC1 M NOCOM TUNE VOL FAIL 850MHZ
0409-2	SRC1 M NOCOM TUNE VOL FAIL 1200MHZ
0409-3	SRC1 M NOCOM TUNE VOL FAIL 1550MHZ
0410	LO1 OFST LCK IND FAIL
0411-1	LO1 OFST TUNE VOL FAIL 850MHZ
0411-2	LO1 OFST TUNE VOL FAIL 1200MHZ
0411-3	LO1 OFST TUNE VOL FAIL 1550MHZ
412	LO1 MAIN LCK IND FAIL
0413-1	LO1 MAIN TUNE VOL FAIL 850MHZ
0413-2	LO1 MAIN TUNE VOL FAIL 1200MHZ
0413-3	LO1 MAIN TUNE VOL FAIL 1550MHZ
0414	SRC1 FREQ PATH BAND1 FAIL
0415	SRC1 FREQ PATH BAND2 FAIL
0416	SRC1 FREQ PATH BAND3 FAIL
0417	SRC1 FREQ PATH BAND4 FAIL
0418	SRC1 FREQ PATH BAND5 FAIL
0419	SRC1 FREQ PATH BAND6 FAIL
0420	SRC1 FREQ PATH BAND7 FAIL
0421	SRC1 FREQ PATH BAND8 FAIL
0422	SRC1 FREQ PATH BAND9 FAIL
0423	SRC1 FREQ PATH BAND10 FAIL
0424-1	SRC1 PWR LEVEL DAC FAIL -10V
0424-2	SRC1 PWR LEVEL DAC FAIL -5V
0424-3	SRC1 PWR LEVEL DAC FAIL 0V
0426	SRC1 ALC CAL BAND1 FAIL
0427	SRC1 ALC CAL BAND2 FAIL
0428	SRC1 ALC CAL BAND3 FAIL
0429	SRC1 ALC CAL BAND4 FAIL
0430	SRC1 ALC CAL BAND5 FAIL
0431	SRC1 ALC CAL BAND6 FAIL
0432	SRC1 ALC CAL BAND7 FAIL
0433	SRC1 ALC CAL BAND8 FAIL
0434	SRC1 ALC CAL BAND9 FAIL
0435	SRC1 ALC CAL BAND10 FAIL
0501	INTERNAL 10MHZ FAIL
0502	REFERENCE CHANNEL FAIL
0503	TEST CHANNEL FAIL
0504	TEST GAIN RANGING FAIL
0505	REFERENCE GAIN RANGING FAIL

Chapter 6
Data Displays

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Chapter 6
Data Displays

6-1 INTRODUCTION

This chapter provides discussion and examples of the various types of data displays.

6-2 DISPLAY MODES AND TYPES

The MS462XX displays measurement data using a “Channel Concept.” This means that each channel can display both a different S-Parameter (or another specialty parameter) and a different graph type. As you select each channel the graph type, scaling, reference delay, S-Parameter, etc. associated with that channel appear on the screen. You can display the same S-Parameter on two or more channels.

Several graph-types are possible: polar, rectilinear, or Smith chart. The rectilinear graph-type may be magnitude, phase, magnitude and phase, SWR, group delay, real, imaginary, and real and imaginary. The Smith chart graph-type is specifically designed to plot complex impedances or admittances.

Single Channel Display— Ch 1, 2, 3, 4

You select this display type (Figures 6-1 and 6-2) by pressing the Display key, then selecting the **DISPLAY MODE** and **SINGLE CHANNEL** soft-keys. Possible graph types include Smith, polar, rectilinear, or dual (split) rectilinear (magnitude and phase).

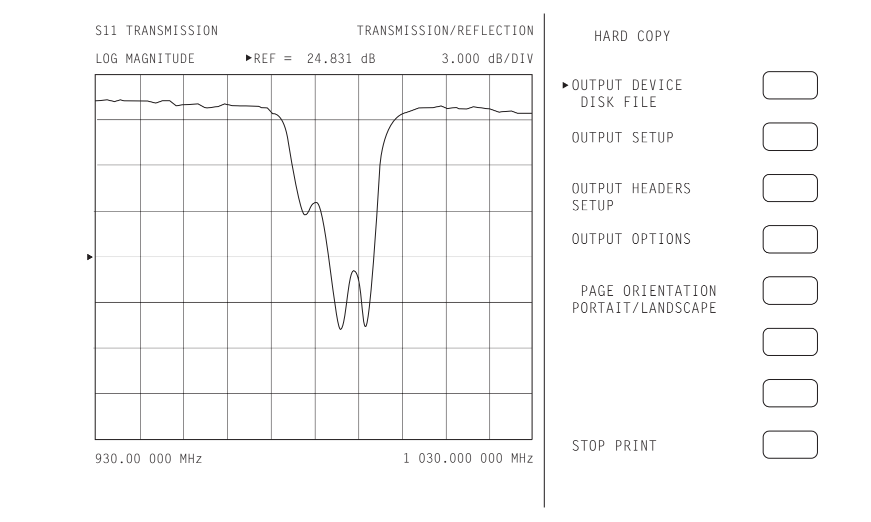


Figure 6-1. *Single Channel Display, Log Magnitude*

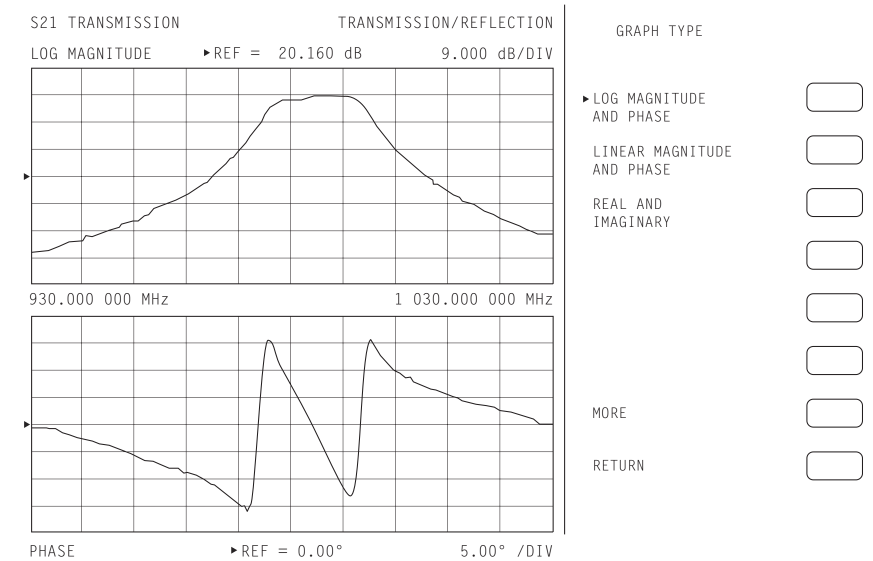


Figure 6-2. *Single Channel Display, Log Magnitude and Phase*

Dual Channel Display— Ch 1 and 3 or Ch 2 and 4

If you have chosen a dual display of magnitude and phase, the affected area of the LCD screen is subdivided into two smaller portions (Figure 6-3). You select this display type by pressing the Display key, then selecting **DISPLAY MODE** and **DUAL CHANNEL 1&3** or **DUAL CHANNEL 2&4** soft-keys.

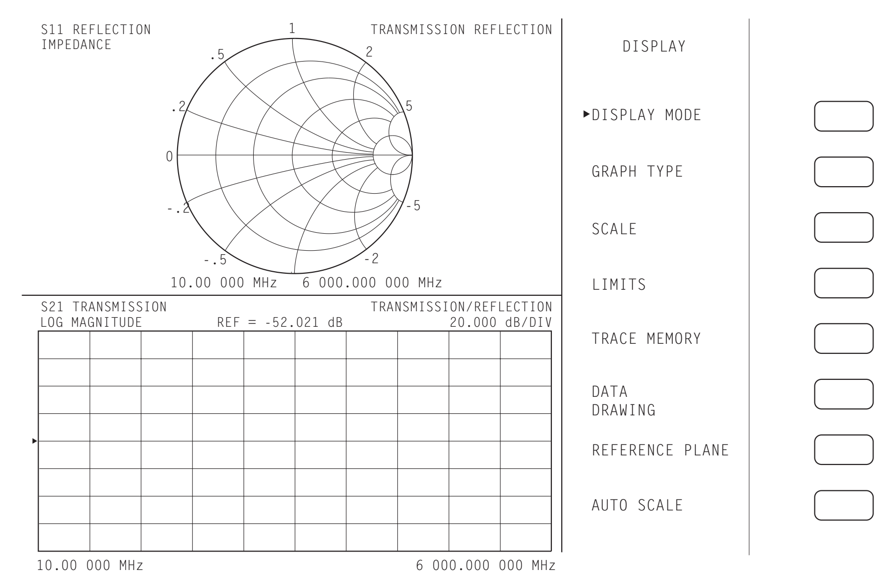


Figure 6-3. *Dual Channel Display*

Four Channel Display— Ch 1, 2, 3, 4

From four-to-eight graph types are displayed. In each quadrant, the graph type can be any of the possible choices listed in the "Graph Types" soft-key selections (Chapter 4). If you have chosen to display magnitude and phase on a channel, the quadrant displaying that channel is further subdivided as described above. You select this display type by Display key, then selecting **DISPLAY MODE** and **FOUR CHANNELS** soft-keys. An example of a four-channel display appears in Figure 6-4, below.

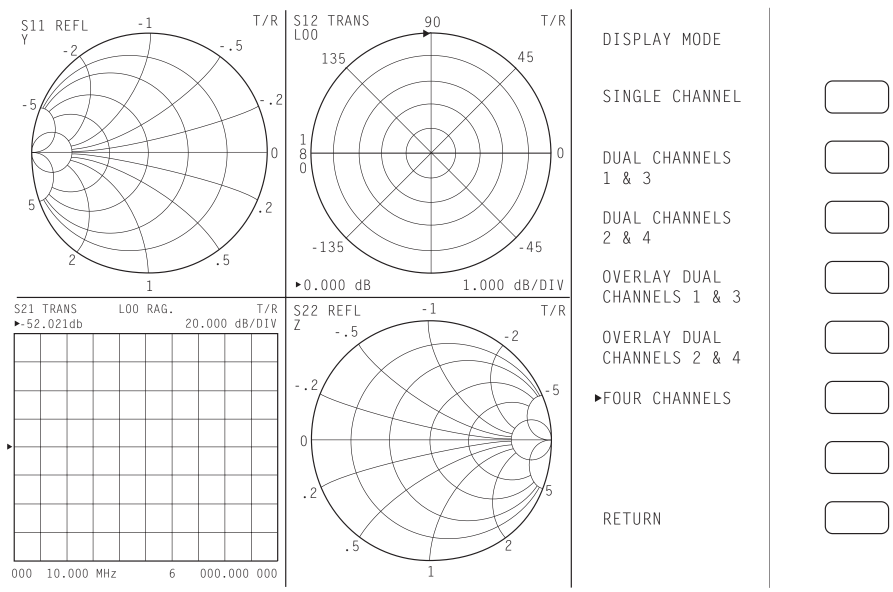


Figure 6-4. *Four Channel Display*

Dual Trace Overlay

For rectilinear graph types, two traces can be displayed, one overlaid (superimposed) on the other (Figure 6-5). By soft-key selection, the two traces can be Channel 1 overlaid on Channel 3 or Channel 2 overlaid on Channel 4. Each trace is in a different color. Channels 1 and 2 are displayed in red, while Channels 3 and 4 are displayed in yellow.

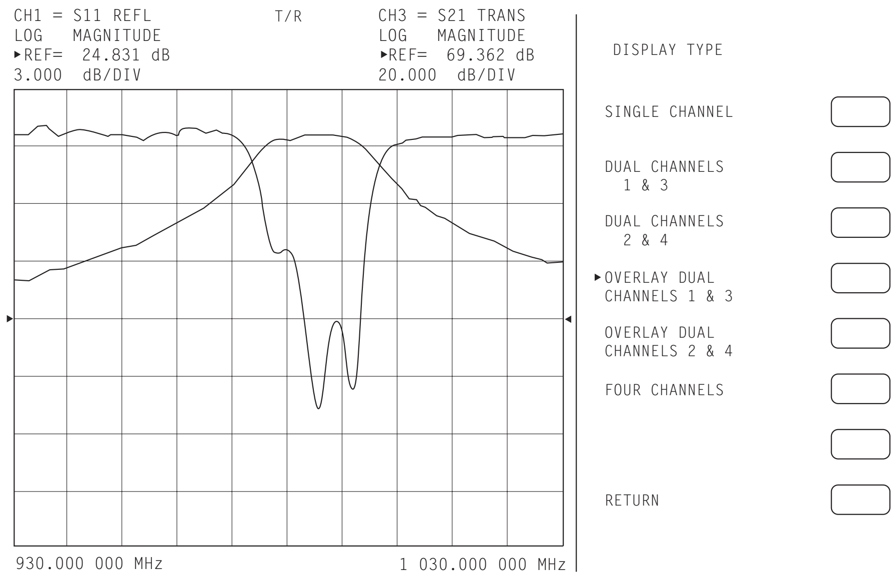


Figure 6-5. *Dual Trace Overlay*

Four Channel Overlay For rectilinear graph types, four traces can be displayed, each one overlaid (superimposed) on another (Figure 6-6). Each trace is in a different color. Channels 1 is red, Channel 2 is yellow, Channel 3 is Green, and Channel 4 is blue.

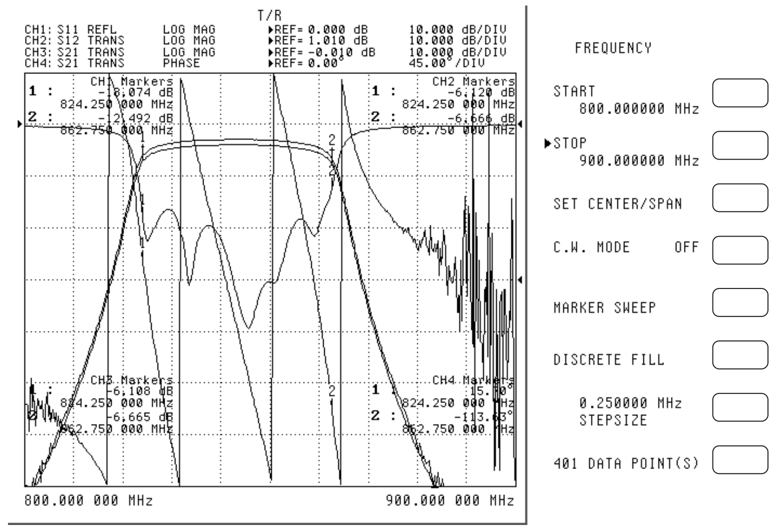


Figure 6-6. *Four Channel Trace Overlay*

Graph Data Types

The data types (real, imaginary, magnitude, phase) used in the displayed graph-types reflect the possible ways in which S-Parameter data can be represented in polar, Smith, or rectilinear graphs. For example: Complex data—that is, data in which both phase and magnitude are graphed—may be represented and displayed in any of the ways described below:

- ❑ Complex Impedance; displayed on a Smith chart graph
- ❑ Real and imaginary; displayed on a real and imaginary graph
- ❑ Phase and magnitude components; displayed on a rectilinear (Cartesian)
- ❑ In addition to the above, the MS462XX can display the data as a group delay plot. In this graph-type, the group-delay measurement units are time. Those of the associated aperture are frequency in the form of a percentage of the sweep

The quantity group delay is displayed using a modified rectilinear-magnitude format. In this format the vertical scale is in linear units of time (ps-ns-μs). With one exception, the reference value and reference line functions operate the same as they do with a normal magnitude display. The exception is that they appear in units of time instead of magnitude.

Examples of graph-data types are shown in Figure 6-7 through 6-12, on the following pages.

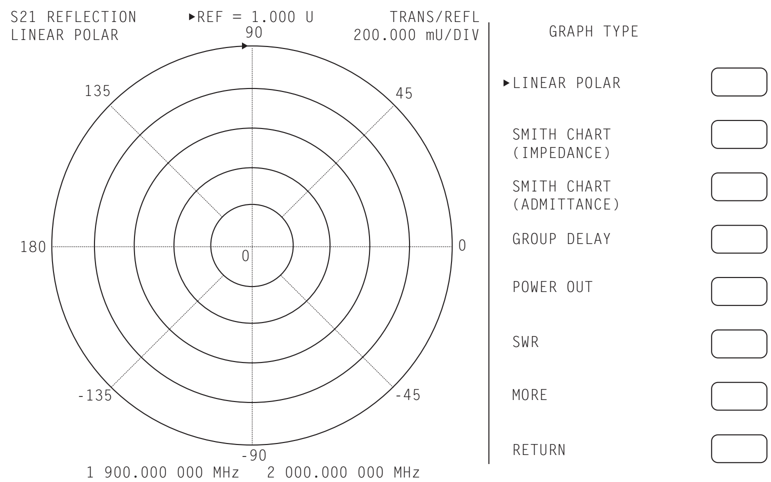


Figure 6-7. *Linear Polar Graticule*

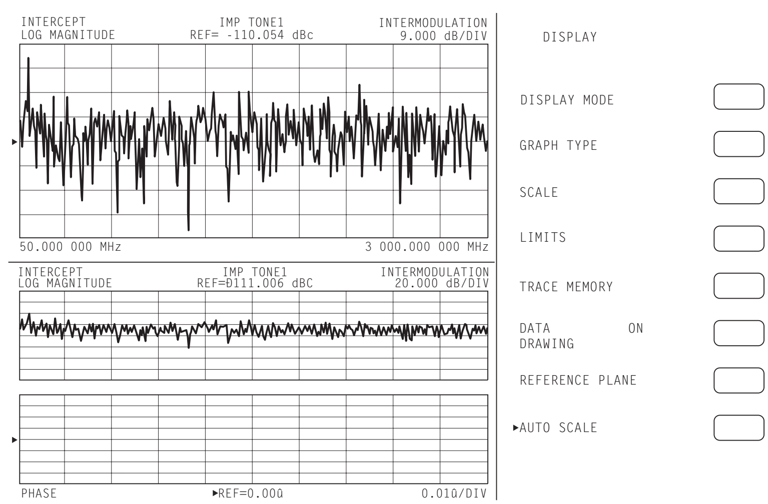


Figure 6-8. *Dual Channel Rectilinear Graticule*

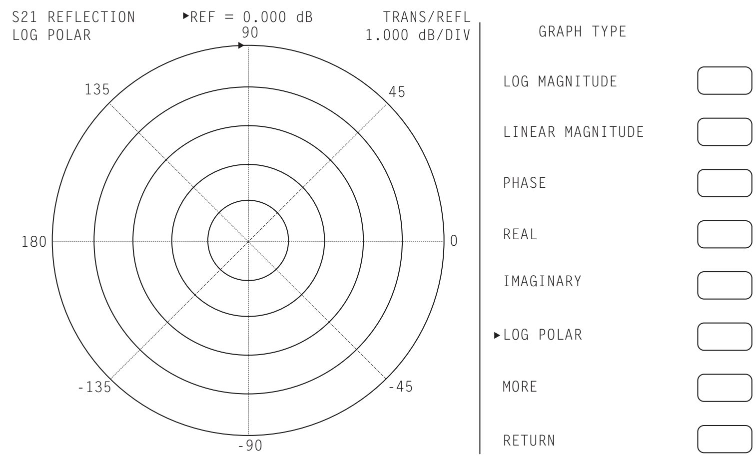


Figure 6-9. *Log Polar Graticule*

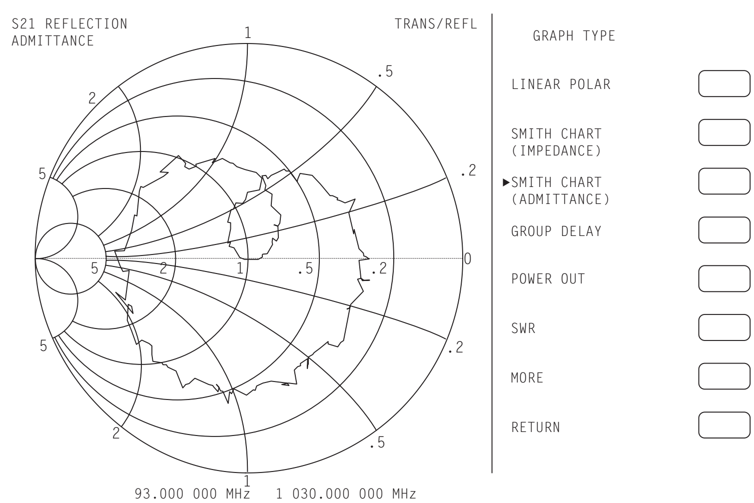


Figure 6-10. *Smith Chart, Admittance*

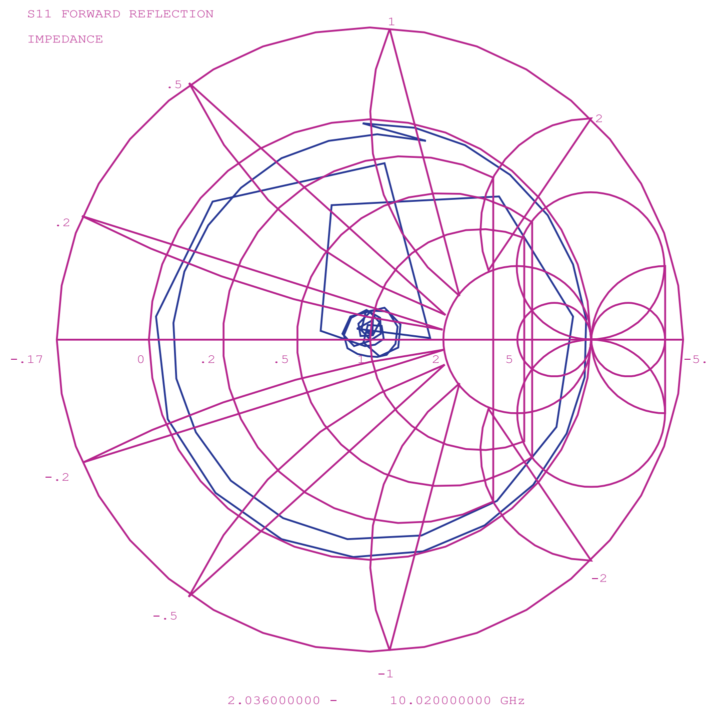


Figure 6-11. *3 dB Compressed Smith Chart*

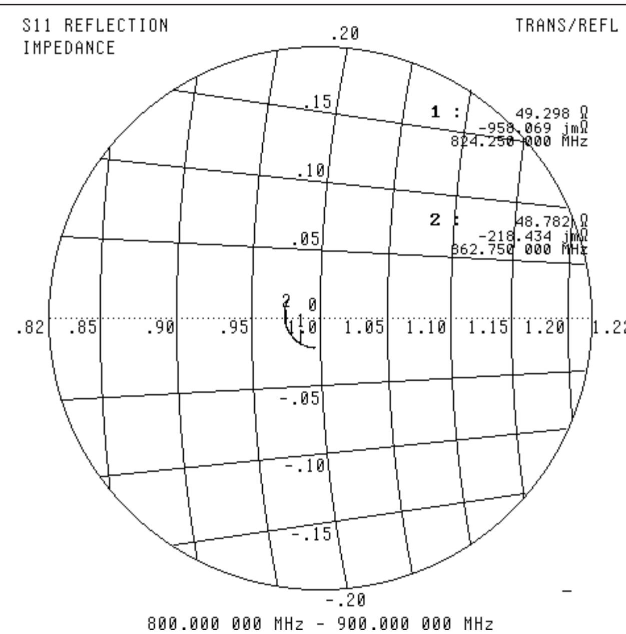


Figure 6-12. *20 dB Expanded Smith Chart*

6-3 FREQUENCY MARKERS

Frequency markers are described below.

Marker Annotation Figure 6-13 shows how the MS462XX annotates markers for the different graph-types. Each marker is identified with its own number. When a marker reaches the top of its graticule, it will flip over and its number will appear below the symbol. When markers approach the same frequency, they will overlap. Their number will appear as close to the marker as possible without overlapping.

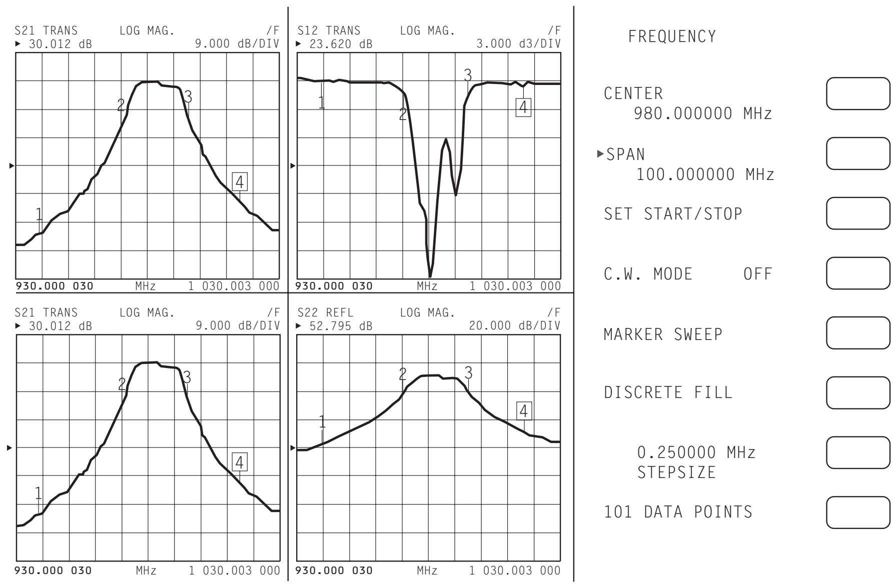


Figure 6-13. *Marker Annotation*

Marker Designation Depending on menu selection, you may designate a marker as the “active” or the “delta reference” marker. If you choose a marker to be active—indicated by its number being enclosed in a square box—you may change its frequency or time (distance) (or point number in CW Draw) with the Data Entry keypad or knob. If you have chosen it to be the delta-reference marker, a delta symbol (Δ) appears one character space above the marker number (or one character space below a “flipped” marker). If the marker is both active and the delta reference marker, the number and the delta symbol appear above (below) the marker. The delta symbol appears above (below) the number.

Marker Statistics

The marker statistics available in the marker menu calculates and displays mean, peak to peak and standard deviation on screen. Two mode selections are available: one calculates the statistics between the reference marker and the active marker (Figure 6-14) and the other calculates them for the entire display (Figure 6-15, on next page).

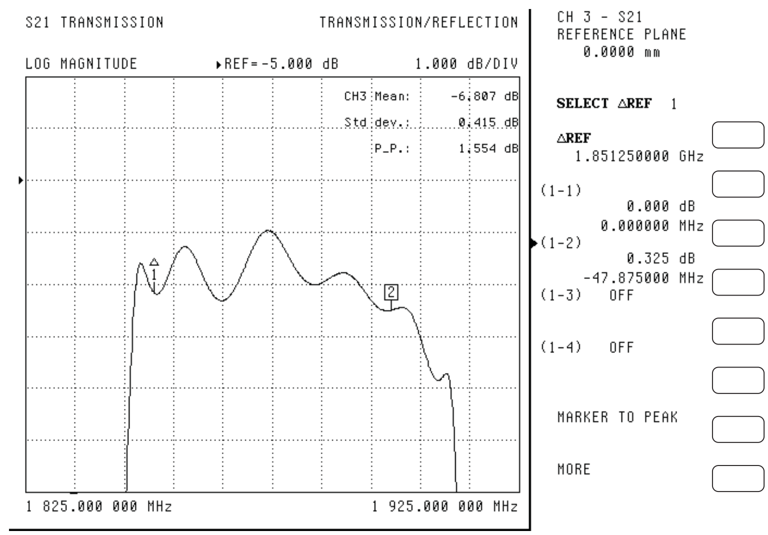


Figure 6-14. *Marker Statistics, Between Reference Markers*

6-4 LIMITS

Limit lines function as settable maximum and minimum indicators for the value of displayed data. These lines are settable in the basic units of the measurement on a channel-by-channel basis. If the display is rescaled, the limit line(s) will move automatically and thereby maintain their correct value(s).

Each channel has two limit lines (four for dual displays), each of which may take on any value. Limit lines are either horizontal lines in rectilinear displays or concentric circles around the origin in Smith and polar displays.

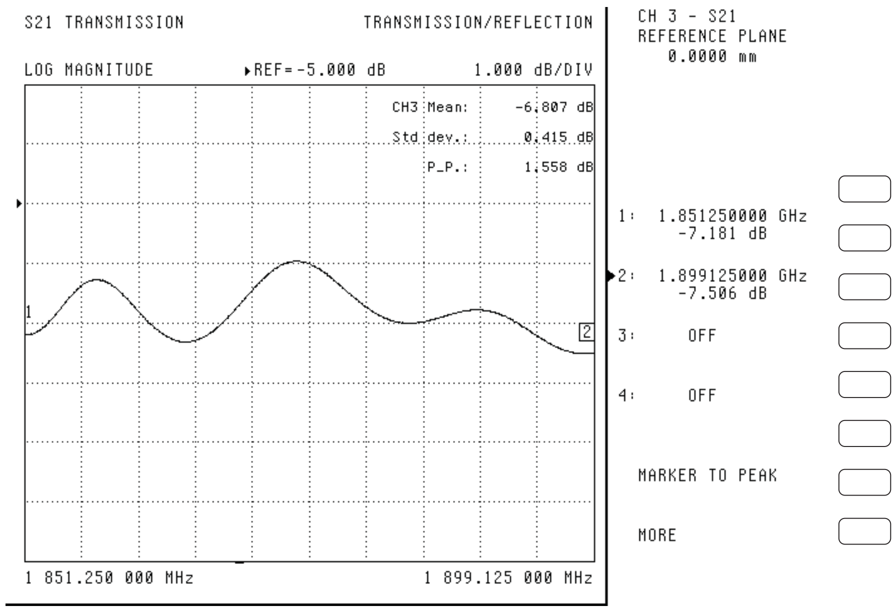


Figure 6-15. *Marker Statistics, Full Band*

Each channel can produce segmented limits. They allow different upper and lower limit values to be set at up to ten segments across the measurement range.

6-5 STATUS DISPLAY

In addition to graticules, data, markers, and marker annotations, the MS462XX displays certain instrument status information in the data display area. This information is described below.

Reference Position Marker The Reference Position Marker indicates the location of the reference value. It is displayed at the left edge of each rectilinear graph-type. It consists of a green triangular symbol similar to the cursor displayed in the menu area. You can center this symbol on one of the vertical graticule divisions and move it up or down using the "Reference Position" option. When you do this, the data trace moves accordingly. If you also select the reference value option, the marker will remain stationary and the trace will move with the maximum allowable resolution. When changing from a full-screen display to half- or quarter-screen display, the marker will stay as close to the same position as possible.

Scale Resolution Each measurement display is annotated with the scale resolution. For log-magnitude displays resolution ranges from 0.001 to 50 dB per division. Linear displays of magnitude range from 0.001 to 50 units per division. Cartesian phase displays can range from 0.01 to 90 degrees per division. The polar display is 45 degrees per display graticule.

Frequency Range Each measurement display is annotated with the frequency range of the measurement.

Analog Instrument Status The MS462XX displays analog-instrument-status messages (in red when appropriate) in the upper right corner of the LCD.

Measurement Status The MS462XX displays measurement-status messages (in red when appropriate) in the upper-right corner of the graticule (channel) to which they apply.

Sweep Indicator Marker A blue sweep-indicator marker appears at the bottom of each displayed graph-type under certain sweep conditions (<500 ms, none; 500 ms to <1 sec, flashing bar; >1 sec, sweeping bar). It indicates the progress of the current sweep. When measuring quiet data—that is, data having few or no perturbations—this indicator assures that the instrument is indeed sweeping. Its position is proportional to the number of data points measured in the current sweep. If the sweep should stop for any reason, the position of the indicator will stop changing until the sweep resumes.

6-6 DATA DISPLAY CONTROL

Data display control is described below.

Active Channel Figure 6-16 shows the algorithm that the MS462XX uses to display the active channel.

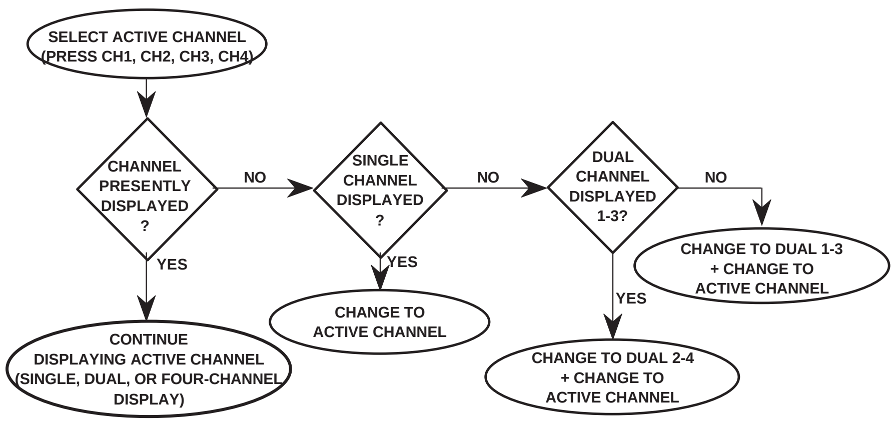


Figure 6-16. *Active Channel Algorithm*

Selection

S-Parameter Selection If you select a new S-Parameter using the Meas key it appears on the then-active channel with the current. The following table shows the displayable S-Parameters based on the correction type you have in place. If you attempt to display other S-Parameters, an error message displays. In cases when there is no last-displayed S-Parameter stored, the display will default as shown. If an S-Parameter is selected for which there was no last-displayed graph-type, the display defaults to S_{21} and S_{12} Log Magnitude and Phase and S_{11} and S_{22} Smith Chart.

Correction Type	Displayable S-Param, MS462B	Displayable S-Param MS462A	Default Display Position, MS462XB				Default Display Position, MS462XA			
			CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
None	All	S_{11}, S_{21}	S_{11}	S_{12}	S_{21}	S_{22}	S_{11}	S_{21}	S_{21}	S_{11}
Frequency Response										
Reverse Transmission	S_{12}	NA		S_{12}						
Forward Transmission	S_{21}	S_{21}			S_{21}		S_{21}	S_{21}		
Both	S_{12}, S_{21}	NA		S_{12}	S_{21}					
Port 1 Reflection Only	S_{11}	S_{11}	S_{11}				S_{11}			
Port 2Reflection Only	S_{22}	NA				S_{22}				
Reflection Only, Both	S_{11}, S_{22}	NA	S_{11}			S_{22}				
Forward 1-Path 2-Port	S_{11}, S_{21}	S_{11}, S_{21}	S_{11}		S_{21}		S_{11}	S_{21}	S_{21}	S_{11}
Reverse 1-Path 2-Port	S_{12}, S_{22}	NA		S_{12}		S_{22}				
12-Term	S_{11}, S_{21}, S_{12}, S_{22}	NA	S_{11}	S_{12}	S_{21}	S_{22}				S_{22}
Full 3-Port Calibration	All	NA	S_{11}	S_{12}	S_{21}	S_{22}				
2-Path, 3-Port Calibration	S_{11}, $S_{21,}$ S_{31}	NA	S_{11}	S_{12}	S_{21}	S_{22}				
Full 4-Port Calibration	S_{11}, $S_{21,}$ S_{31}, S_{41}	NA	S_{11}	S_{12}	S_{21}	S_{22}				

Data Display Update

When you change a control panel parameter that affects the appearance of the display, the entire display changes immediately to reflect that change. For example, if you press Autoscale, the entire display rescales immediately. You do not have to wait for the next sweep to see the results of the change. The following parameters are supported for this feature: Reference Delay, Offset, Scaling, Auto Scale, Auto Reference Delay, Trace Math, IF BW, and Smoothing. In the case of Averaging or I.F. BW, the sweep restarts.

If the knob is used to vary any of the above parameters, the change occurs as the measurement progresses–that is, the continuing trace will reflect the new setting(s).

When you change a marker frequency or time (distance), the readout parameters will change. This change reflects the changes in measurement data at the marker's new frequency, using data stored from the previous sweep.

Display of Markers

Once you have selected a marker to display, it will appear on the screen. It does not matter what resolution you have selected. When you set a marker to another calibrated frequency and then lower the resolution, that frequency and the marker will continue to display. It will display even if its frequency is not consistent with the data points in the lower-resolution sweep.

6-7 HARD COPY AND DISK OUTPUT

In addition to the LCD display, the Model MS462XX is capable of outputting measured data as a

- Tabular Printout
- Screen-Image Printout
- Pen Plot
- Disk Image of the Tabular Data Values

The selection and initiation of this output is controlled by the Hard Copy keys.

Tabular Printout

The tabular formats are used as follows:

- *Tabular Printout Format:* Used when printing three or four channels
- *Alternate Data Format:* Used when printing one or two channels

In tabular printouts, the MS462XX shifts the data columns to the left when an S-Parameter is omitted. Leading zeroes are always suppressed. The heading (Model, Device ID, Date, Operator, Page) appears on each page.

Screen-Image Printout

In a Screen-Image Printout, the exact data displayed on the screen is dumped to the printer. The dump is in the graphics mode, on a pixel-by-pixel basis.

Plotter Output The protocol used to control plotters is HP-GL (Hewlett-Packard Graphics Language). HP-GL contains a comprehensive set of vector graphics type commands. These commands are explained in the Interfacing and Programming Manual for any current model Hewlett-Packard plotter, such as the 7470A.

When the plotter is selected as the output device, it is capable of drawing the graph shown on the screen or of drawing only the data trace(s), so that multiple traces may be drawn on a single sheet of paper (in different colors, if needed). Examples of a plotter output are shown in Figures 6-17 and 6-18.

Disk Output The MS462XX can write-to or read-from the disk all measured data. This data is stored as an ASCII file in the exact same format as fora tabular printout. If read back from the disk, the data is output to the printer. There, it prints as tabular data.

/inritsu

MS4622B

MODEL: DATE: 07/30/98 16:55 Page 1
DEVICE ID: OPERATOR:

START:	0.010000000 GHz	GATE START:	-	ERROR CORR:	NONE
STOP:	3.000000000 GHz	GATE STOP:	-	AVERAGING:	1 PT
STEP:	0.007475000 GHz	GATE:	-	IF BNDWDTH:	1 KHz
		WINDOW:	-		

	-----------CH1-----------
PARAMETER:	-S23-
NORMALIZATION:	DATA / MEMORY
REFERENCE PLANE:	0.0000 mm
SMOOTHING:	0.0 PERCENT
DELAY APERTURE:	-

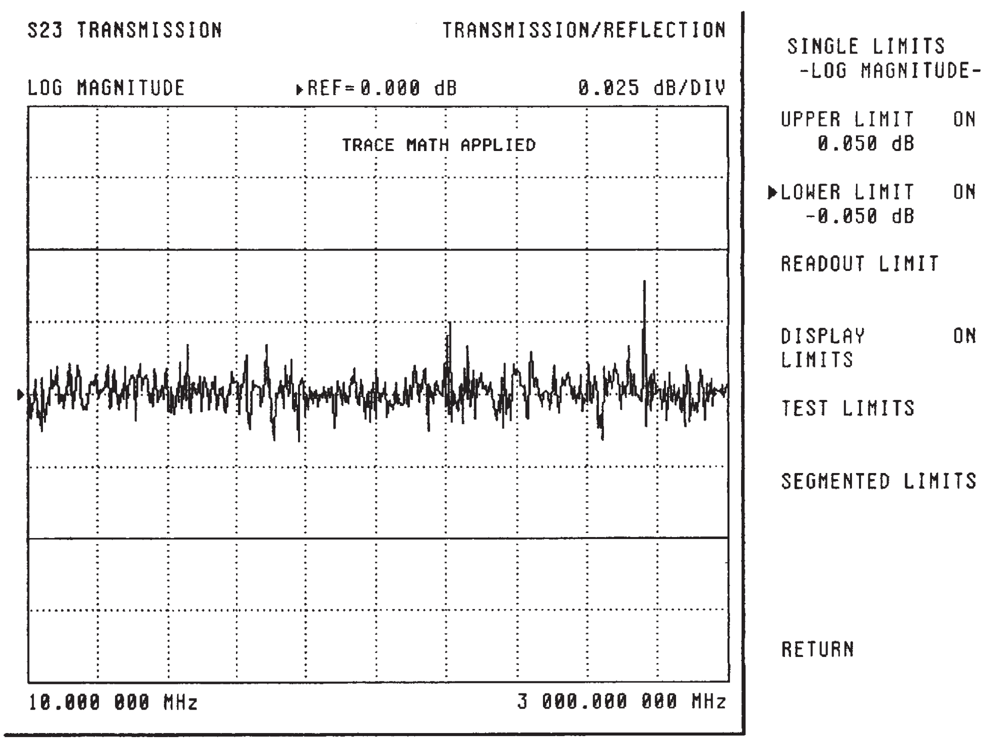


Figure 6-17. *Example of a Plot (MS4622B)*

Anritsu

MS4623A

MODEL:		DATE:	08/03/98	10:27	Page	1
DEVICE ID:		OPERATOR:				

START:	0.010000000 GHz	GATE START:	-	ERROR CORR:	NONE
STOP:	6.000000000 GHz	GATE STOP:	-	AVERAGING:	1 PT
STEP:	0.014975000 GHz	GATE:	-	IF BNDWDTH:	1 KHz
		WINDOW:	-		

	CH1	CH3
PARAMETER:	a1/1	b2/1
NORMALIZATION:	OFF	OFF
REFERENCE PLANE:	0.0000 mm	0.0000 mm
SMOOTHING:	0.0 PERCENT	0.0 PERCENT
DELAY APERTURE:	-	-

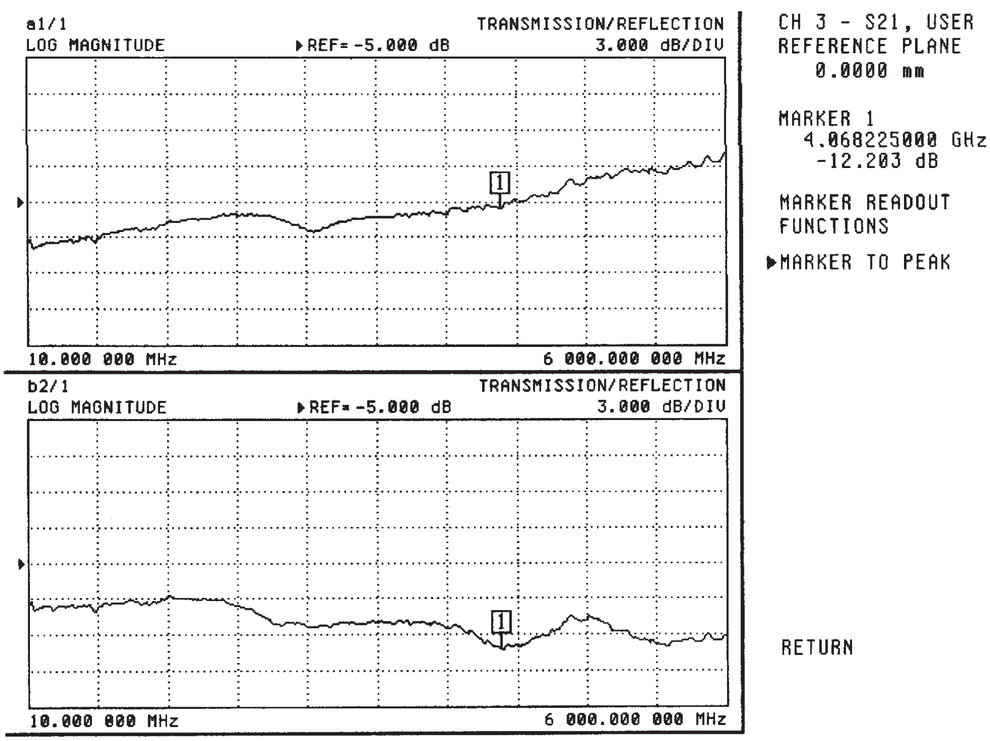


Figure 6-18. *Example of a Plot (MS4623A)*

Chapter 7
Measurement Calibration

Table of Contents

NOTE

The MS462XC VNMS- Direct Receiver Access version cannot make system measurements without an external test set that couples power into the reference and test channels, such as the Anritsu MS4782A. This manual will discuss calibration and system measurements for the MS462XX assuming the user understands the need for the external test set for the MS462XC.

Chapter 7
Measurement Calibration

7-1 INTRODUCTION

This section provides discussion and examples for performing a measurement calibration. It also provides a detailed procedure for calibrating with a sliding termination.

7-2 CONVENTIONS

Refer to Chapter 1, paragraph 1-13, for an explanation of the typographic conventions used to document the procedures.

7-3 MEASUREMENT CALIBRATION—DISCUSSION

Measurements always include a degree of uncertainty due to imperfections in the measurement system. The measured value is always a combination of the actual value plus the systematic measurement errors. Calibration, as it applies to network analysis, characterizes the systematic measurement errors and subtracts them from the measured value to obtain the actual value.

The calibration process requires that you establish the test ports, perform the calibration, and confirm its quality. Let us examine each of these steps.

Establishing the Test Ports Figures 7-1 and 7-2 are two of the most common approaches used to make measurements on two-port devices. In many cases, you may need adapters to change between connector types (N, SMA, GPC-7, etc.) or between genders (male [M] or female [F]).

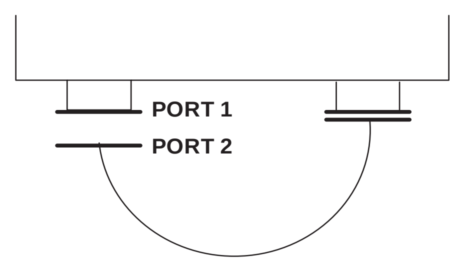


Figure 7-1. *Establishing the Test Port*

The use of cables and/or adapters does not effect the final measurement result, if they were in place for the calibration process. The vector error corrections established during the calibration process eliminates cable and/or adapter effects as long as the ports used are stable and exhibit good repeatability, which is the case if good quality components are used. Figure 7-2 shows such a configuration.

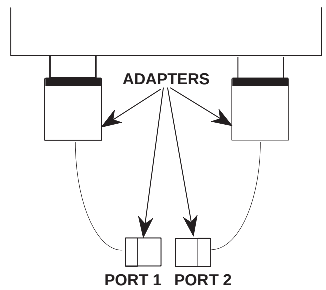


Figure 7-2. *Using Adapters on the Test Ports*

Many calibration kits include adapters that are designed to have equal phase length. These parts are called phase equal adapters (PEA). Anritsu designs in-series adapters (e.g., K Connector M-M, M-F, F-F) to be phase insertable when technically possible.

When available, it is good practice to use PEAs to establish test ports (Figure 7-3).

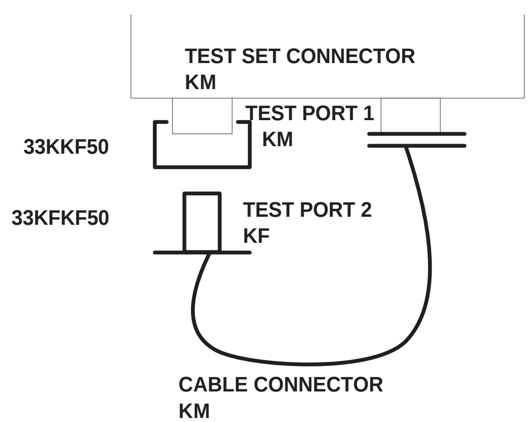


Figure 7-3. *Use of PEAs to Establish Test Ports*

This approach offers two advantages:

- ❑ It minimizes wear on the more expensive test set and cable connectors
- ❑ It provides a simple solution to measuring non-insertable devices (e.g., a filter with K female input and output connectors) by merely swapping the PEA after calibration. See Figure 7-4

NOTE

In this and other discussions, we will talk about “insertable” and “non-insertable” devices. Insertable devices have an insertable connector pair (i.e., male input and female output connectors) and can be measured after a through calibration. A non-insertable device has a non-insertable pair of connectors. This would be the case if it included female connectors on both ports or different connector types on each port. Therefore, “non-insertables” cannot be connected directly into the measurement path without an adapter.

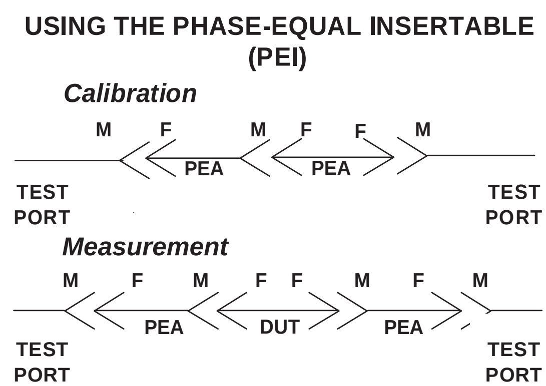


Figure 7-4. *Using Phase-Equal Insertables*

ERRORS REDUCED BY CALIBRATION

- Directivity
- Source Match
- Load Match
- Frequency Sensitivity (Tracking)
- Isolation

INTERNAL SYSTEM ERRORS

- RF Leakage
- IF Leakage
- System Interaction

RANDOM ERRORS

- Frequency
- Repeatability
- Noise
- Connector Repeatability
- Temperature/Environmental Changes
- Calibration Variables

TRANSMISSION MEASUREMENT ERRORS

- Source Match
- Load Match
- Tracking

Understanding the Calibration System

Measurement errors must be reduced by a process that uses calibration standards. The standards most commonly used are Opens, Shorts, and Z_0 (Characteristic Impedance) Loads. In conjunction with a through connection, these standards can correct for the major errors in a microwave test system. These errors are Directivity, Source Match, Load Match, Isolation, and Frequency Tracking (reflection and transmission).

Calibration also corrects for many internal system errors, such as RF leakage, IF leakage, and system component interaction.

Random errors such as noise, temperature, connector repeatability, DUT sensitive leakages, frequency repeatability, and calibration variables are not completely correctable. However, some of them can be minimized by careful control. For instance: temperature effects can be reduced by room temperature control, calibration variables can be reduced through improved technique and training, and frequency errors can be virtually eliminated by the fully synthesized internal source.

We know that adapters and cables degrade the basic directivity of the system, but these errors are compensated by vector error correction.

In general, transmission measurement errors are source match, load match, and tracking; while reflection measurement errors are source match, directivity, and tracking.

REFLECTION MEASUREMENT ERRORS

- Source Match
- Directivity
- Tracking

Error modeling and flowgraphs are techniques used to analyze the errors in a system. Error models describe the errors, while flowgraphs show how these errors influence the system. Error models (Figure 7-5, below) can become quite complex.

DIRECTIVITY, SOURCE MATCH, AND TRACKING ERRORS

DISTORTED MEASUREMENT

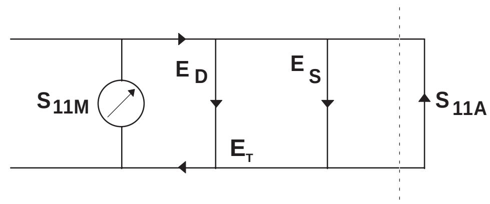


Figure 7-5. *Example of Error Modeling*

CALIBRATION TYPES

- Frequency Response
- Reflection Only—1 Port
- 1 Path, 2 Port
- 12 Term—2 Port, Both Directions

The MS462XX offers a selection of calibration possibilities depending on the user's needs. These possibilities are as follows:

- ❑ Frequency Response
- ❑ Reflection Only—1 Port
- ❑ 1 Path, 2 Port
- ❑ 12 Term—2 Port, Both Directions

These calibration types are described below.

Frequency Response: Corrects for one or both of the transmission error terms associated with measurements of S_{21}, S_{12} or both.

Reflection Only: Corrects for the three error terms associated with an S11 measurement (EDF, ESF, and ETF), an S22 measurement (EDR, ESR, and ETR), or both.

1 Path, 2 Port: Corrects for the four forward-direction error terms (EDF, ESF, ERF, and ETF), or the four reverse-direction error terms (EDR, ESR, ERR, and ETR).

Full 12 Term: Corrects for all twelve error terms associated with a two-port measurement. A 12-Term error model is shown in Figure 7-6.

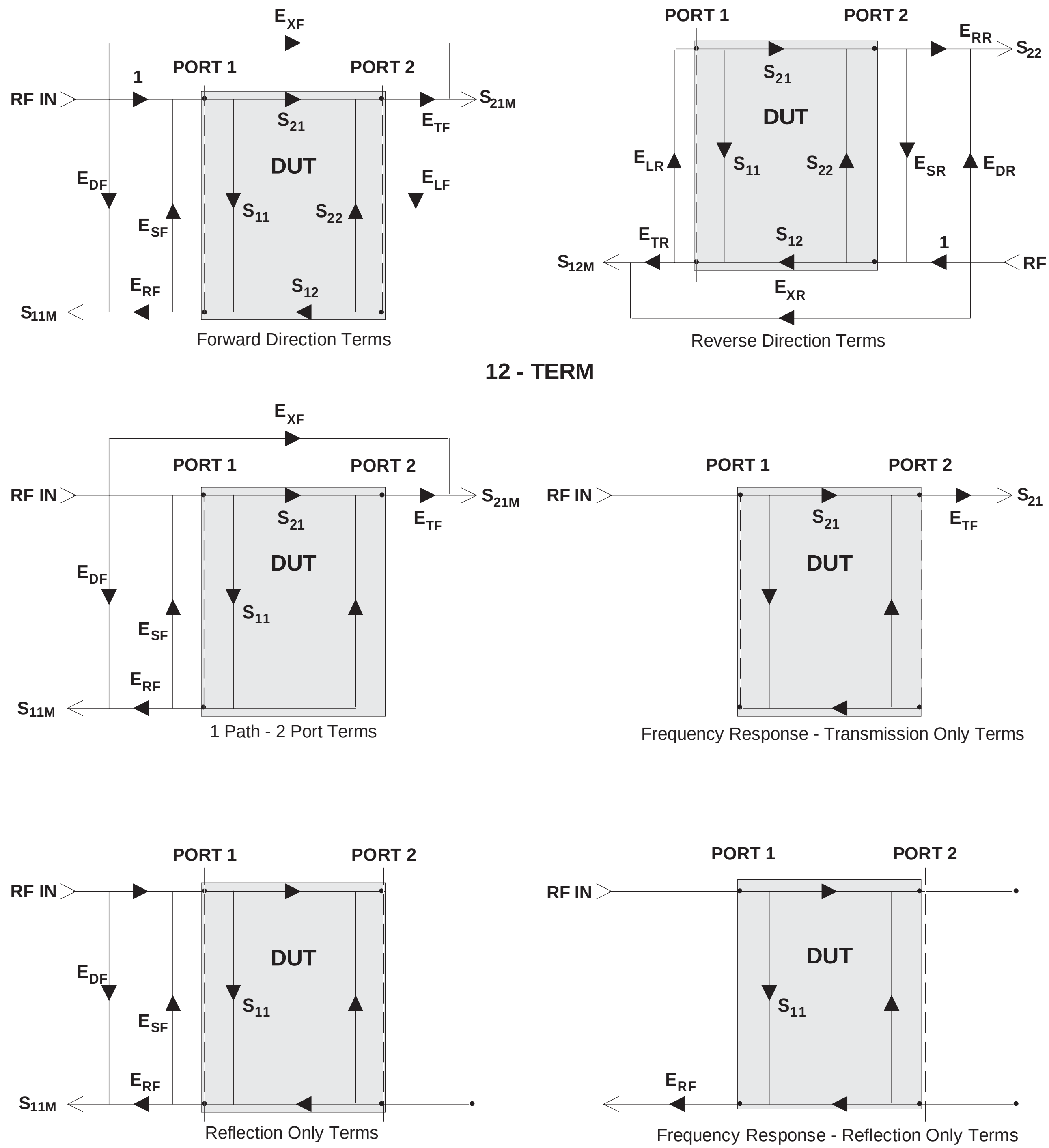


Figure 7-6. *Error Models*

Measurement calibration using the MS462XX is straightforward and menu directed. A short time spent in preparation and preplanning will make the process simple and routine. (Example: Adjusting the coaxial cables used in the measurement setup such that insertion of the DUT causes minimal flexing of these cables).

The screen prompts on the MS462XX guide you through the calibration process—a process that consists of connecting and disconnecting connectors and moving the slide on a sliding load (if one is used).

The most critical part of the calibration process is properly seating and torquing the connectors. Also, you will notice that the calibration takes longer when the ports are terminated with a load. This is intentional. It allows for more averaging during the isolation measurement.

CALIBRATING FOR A REFLECTION MEASUREMENT USES THREE STANDARDS:

- Short
- Open
- Termination

Calibrating for a Measurement

Let us assume that we want to correct for three errors in the reflection measurement: source match, directivity, and tracking. We accomplish this using three standards.

Shorts are the easiest to visualize. They totally reflect all of the incident RF energy output at a precise phase. The terms zero-ohms impedance, voltage null, and 180° phase all define an RF Short.

Opens are similar to Shorts, but their response is more complex. The terms voltage maximum, infinite impedance, and 0° phase all define a perfect Open. A perfect Open, however, is only a concept. In reality Opens always have a small fringing capacitance.

To account for the fact that the Open will not predictably reflect impedance at an exact 0° phase reference, we alter its response using coefficients that accurately characterize the fringing capacitance. The coefficients are different for each coaxial line size, since each size has a different fringing capacitance. To maximize accuracy, ensure that these coefficients are installed prior to the calibration (Menu U3).

As Opens and Shorts provide two references for a full reflection, Z_0 terminations provide a zero-reflection reference.

IDEAL TERMINATIONS

- Reflectionless
- Perfect Connector
- Infinite-Length, Dimensionally Exact, Reflectionless Transmission Line

Ideal Z_0 terminations must consist of two parts, a perfect connector and an infinite-length perfect transmission line that absorbs all of the RF energy that enters it (no reflections).

PRACTICAL Z_O TERMINATIONS

- Broadband Load
- Sliding Termination

Infinite length transmission lines are unwieldy at best, so you must use less-than-ideal terminations. For calibration purposes there are two common types: broadband loads and sliding terminations.

BROADBAND LOAD

- Easy to Use
- Inexpensive
- Adequate for Most Applications

Broadband loads are widely used. An example is the Anritsu 28 Series Termination. These terminations are easy to use as calibration tools, and they are adequate for most applications.

SLIDING LOAD

- Connector
- Long Transmission Line
- Movable Microwave Load

Sliding Loads are the traditional Vector Network Measurement System Z_0 calibration reference. They provide the best performance when the application requires high-precision return loss measurements. Sliding loads consist of a connector, a long section of precision transmission line, and a microwave load that is movable within the transmission line. One thing to remember with sliding loads is that they have a low-frequency limit and must be used with a fixed load below this cutoff frequency for full frequency coverage. Anritsu sliding loads cut off at 2 GHz. (V-connector sliding loads cut off at 4 GHz).

Pin depth—the relationship between the interface positions of the outer and center conductors—is the most critical parameter under your control in a sliding load. An example of its criticality is that an incorrect pin depth of 0.001 inch can cause a reflection return loss of 44 dB. And, since we are trying to calibrate to accurately measure a 40 dB return loss, correct pin depth makes a *big difference!*

Cables in the measurement system are another cause for concern. The main criteria for a cable are stability and repeatability. Anritsu offers two types of cables that meet these criteria: semi-rigid and flexible. Our semi-rigid cables provide maximum stability with limited flexibility of movement. Our flexible cables allow more freedom of movement and provide good phase stability.

Evaluating the Calibration

The MS462XX provides an accurate representation of complex data. However, it can only provide accuracy to the extent of the supplied calibration data. For this reason, it is necessary to periodically verify the calibration data and the MS462XX system performance.

Calibration verification reveals problems such as a poor contact with one of the calibration components, improper torquing, or a test port out of specification. Problems like these can easily occur during a calibration procedure. Anyone who has experienced one of these problems and stored bad data—after having performed a complete calibration procedure—knows the frustration it can cause. Additionally, it can be very costly to use incorrectly taken measurement data for design or quality assurance purposes.

The best way to confirm a calibration is to measure a precision, known-good device and confirm its specifications.

Verification Kits

Anritsu has developed several precision-component kits: for N, 3.5 mm, and for GPC-7 connectors. These are, respectively, Models 3663R, 3666R, and 3667R.

Typically, these verification kits will be used by calibration or metrology labs. Each of the kits contain several precision components, all of which have been characterized at specified frequencies. The data on these components is stored on a disk provided with the verification kit.

VERIFICATION KIT

- Used by Calibration and Metrology Labs
- Contains Components That Have Been Completely Characterized

The verification of the kit components is straight forward. The components are first measured with the MS462XX, then they are compared with the data recorded on the disk. If the measured data compares favorably with the recorded data (taking tolerances into consideration), then the system is known to be operating properly and providing accurate data.

There is one caution that you need to observe when using Verification Kits. Because the verification components have been characterized, you must handle them carefully so that you do not change their known characteristics. Consequently, you should not have them available for daily use. Rather, you should only use them for the accuracy verification checks taken every 6-to-12 months (or at any other time the system's integrity is in doubt).

This completes the discussion on calibration. Refer to paragraph 7-4 for a procedure showing how to calibrate the sliding load.

7-4 MEASUREMENT CALIBRATION—SLIDING TERMINATION

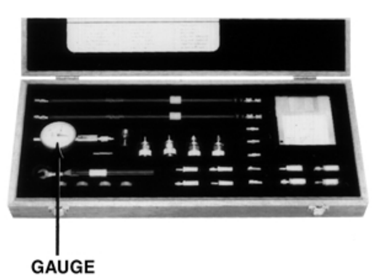
Sliding terminations (loads) are the traditional Z_0 calibration-reference devices for Vector Network Measurement System calibration. When correctly used and perfectly aligned, they can be more accurate than precision fixed loads. However, sliding terminations have a 2 GHz (4 GHz for V-Connector sliding loads) low-frequency limit and must be used with a fixed load for full frequency-range coverage.

Sliding terminations consist of a connector, a long section of precision transmission line, and a microwave load that is movable within the transmission line. Pin depth—the relationship between the interface positions of the outer and center conductors—is the most critical parameter that you can control in a sliding termination. An example of its criticality is that an incorrect pin depth of 0.001 inch can cause a reflection return loss of 44 dB. Since you are usually calibrating to accurately measure a greater than 40 dB return loss, correct pin depth is essential.

Since setting an accurate pin depth is so important, this discussion centers on describing how to set the pin depth for male and female sliding terminations. Calibration with the sliding termination is essentially the same as described below for the broadband load.

The procedure below uses the Model 3652 Calibration Kit and its 17KF50 and 17K50 Sliding Terminations. Calibration is similar for the Model 3650 SMA/3.5mm, Model 3651 GPC-7 and Model 3654B V-connector kits. For the 3651, the procedure is simpler because the GPC-7 connector is sexless, there is only one sliding termination.

Procedure

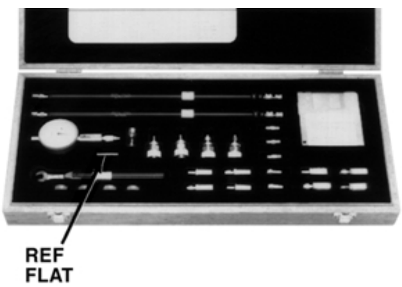


Step 1. Remove the Pin Depth Gauge from the kit, place it on the bench top.

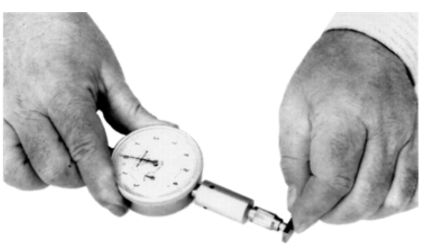
NOTE

The meter is convertible between male and female. The following procedure describes the zeroing process for the female fitting. The procedure for the male fitting begins with step 16.

Step 2. Push the outer locking ring towards the gauge to expose the center pin.



Step 3. Take the 01-210 Ref Flat from the kit.



Step 4. While holding the gauge as shown, press the Ref Flat firmly against the end of the exposed center pin.

Step 5.

While pressing the Ref Flat against the center pin, check that the pointer aligns with the "0" mark. If it does not, loosen the bezel lockscrew and rotate the bezel to align the pointer with the "0" mark. Tighten the bezel lock screw.

NOTE

Gently rock the Ref Flat against the center pin to ensure that it is fully depressed and you have accurately set the gauge for zero.

Step 6.

Remove the sliding termination with the female-connector (17KF50, for this example) from the kit, and slide the load all the way toward the end closest to the connector.

Step 7.

With either hand, pick up the sliding termination near its connector end.

Step 8.

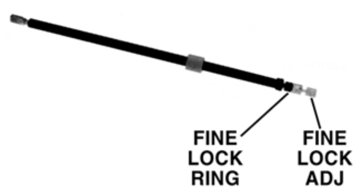
Cup the sliding termination in your palm, and support the barrel between your body and crooked elbow.

Step 9. Remove the flush short by holding its body and unscrewing its connector.

Step 10. Install the gauge onto the end of the sliding termination.

Step 11. If the COARSE SET adjustment—which has been set at the factory—has not moved, the inner dial on the gauge will read “0.” If it doesn’t, perform the Coarse Set Adjustment in step 15.

Step 12. Place the sliding termination, with the gauge attached, on the bench top.

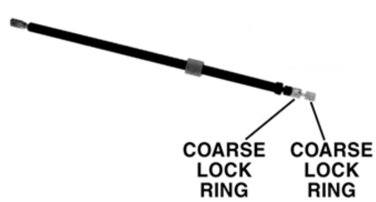


Step 13. Loosen the FINE LOCK ring and turn the FINE ADJ ring to position the gauge pointer 2-3 small divisions on the "–" side of zero.

Step 14. Turn the FINE LOCK ring clockwise to both tighten the adjustment and place the pointer exactly to "0." The Sliding Termination is now ready to use.

NOTES

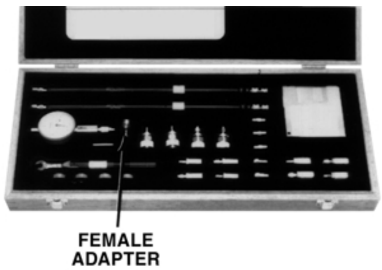
- Ensure that the inner dial reads "0"
- The following step is not normally necessary. It needs to be done only if the adjustment has changed since it was set at the factory



Step 15. With the 01-211 Flush Short installed, loosen the COARSE LOCK and gently push the COARSE SET adjustment rod in as far as it will go. This coarsely sets the center conductor to be flush against the attached short. Return to Step 2.

Step 16. The procedure for adjusting the male-connector sliding termination is essentially the same as that described above. The only difference is that you must install the female adapter on the end of the gauge shaft, over the center conductor. To install this adapter, proceed as follows:

- ❑ Zero-set the gauge as described in Step 2
- ❑ Push the outer locking ring back toward the gauge and turn it clockwise onto the exposed threads
- ❑ Loosen the lock ring one turn in a counterclockwise direction



Step 17. Remove the 01-223 Female Adapter (“F ADAPTER FOR PIN GAUGE”) from the kit.

Step 18. Install the female adapter over the center pin and screw it into the locking ring, and tighten the outer ring until it is snug against the housing.

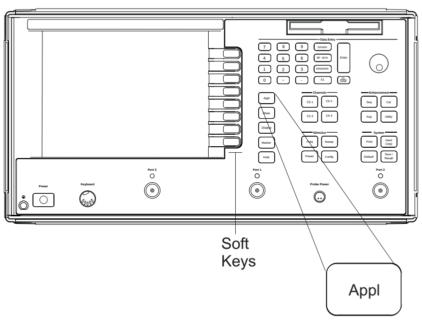
Step 19. Inspect the end of the adapter, you should see no more than two exposed threads. If so, repeat Steps 7 through 10.

Step 20. Connect the gauge to the sliding termination and zero set the center pin using the FINE ADJ as previously described in Step 2.

7-5 STANDARD 2-PORT (OSL) CALIBRATION PROCEDURE

The standard 2-port calibration for the MS462XX Vector Network Measurement System uses an Open, a Short, a Broadband and/or Sliding Load, and a throughline connection to categorize the inherent errors in the measurement system. These errors include those caused by connectors as well as internal system errors such as RF leakage, IF leakage, and component interaction. For maximum accuracy, install the capacitive coefficients (for the open device) using the CALIBRATION COMPONENTS UTILITIES menu (page D-27).

Calibration Procedure A detailed, step-by-step procedure for performing a Open-Short-Load calibration is given below.

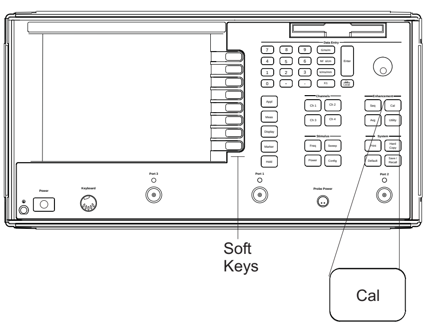


Step 1. Press Appl (top left) then **TRANSMISSION AND REFLECTION**.

Step 2. Press Cal (bottom left) then PERFORM CAL 2-PORT CAL.

Pressing this key starts a linked set of soft-key choices that guide you through a measurement calibration.

Step 3. Observe the **CAL METHOD** and **LINE TYPE** soft-key options. If they read STANDARD and COAXIAL, respectively, go to step 5.



Step 4. Press the following soft keys in sequence:
CHANGE CAL METHOD AND LINE TYPE
CAL METHOD STANDARD
LINE TYPE COAXIAL
NEXT CAL STEP

Step 5. Press **NEXT CAL STEP** then **FULL 12-TERM.**

This soft key calibrates for the twelve error terms associated with a two-port calibration.

Step 6. Press **INCLUDE ISOLATION (STANDARD).**

This soft-key set lets you choose whether to include or exclude the error terms associated with leakage between measurement channels. For a normal calibration, you would choose to include these error terms.

Step 7. Press **NORMAL (1601 POINTS MAXIMUM).**

This soft-key set lets you select the number of frequency points at which calibration data is to be taken. The choices: NORMAL: Data is taken at up to 1601 equally spaced frequencies across the calibra-

tion frequency range. C.W.: Data is taken at one point. N-DISCRETE FREQUENCIES (2 TO 1601 POINTS): This selection lets you specify a discrete number of frequency points, from 2 to 1601. TIME DOMAIN (HARMONIC): This selection is the calibration mode for low-pass time-domain or for Harmonic processing. It lets you select frequencies at integer (harmonic) multiples of the start frequency.

Step 8. Press **START**, then enter 10 MHz, using either the rotary knob or keypad and terminator keys.

Step 9. Press **STOP**, then enter 3 GHz (MS4622X) or 6 GHz (MS4623X), using either the rotary knob or keypad and terminator keys.

The above 2 steps let you set your start and stop frequencies. For this example, press START, press 10 on keypad, and hit the M/μs/cm terminator key. Perform like operations for STOP, except make entry read 3 GHz or 6 GHz.

Step 10. Press **NEXT CAL STEP**.

In this soft-key set, current settings for all parameters appear in blue. If you do not need to make any changes, you would press the START CAL soft key. However, for this example, we will change them all.

Step 11. Press the following soft keys in sequence:
PORT 1 CONN
TYPE N (M)
PORT 2 CONN
TYPE N (F)
REFLECTION PAIRING
MIXED

Reflection Pairing lets you mix or match the Open and Short reflection devices in the Calibration Sequence menus. The MIXED choice lets you calibrate using first an Open on one port and a Short on the other, then a Short on one port and an Open on the other. Conversely, MATCHED lets you calibrate first using an Open on both ports then using a Short on both ports.

Step 12. Press **LOAD TYPE**.

The next soft-key set lets you select either of two load types, broadband or sliding. Broadband loads are adequate for all but the most demanding reflection measurements. They are easier to use and less expensive than sliding loads. If you choose a sliding load, refer to paragraph 7-3 for a procedure on setting pin depth. For this example, we will select BROADBAND FIXED LOAD.

Step 13. Press **BROADBAND FIXED LOAD**.

The next soft-key set, prompts you to enter impedance and inductance values. For this example, we will use the rotary knob to change the displayed value to 50 Ω. Alternatively, you can key in 50 Ohms. That is, press 50 on the keypad and the X1 terminator key.

Step 14. Press **IMPEDANCE** and set for 50Ω, using the rotary knob.

Step 15. Press **NEXT CAL STEP**.

Step 16. Press **THROUGH LINE PARAMETERS.**

The next soft-key set lets you define the length of the offset and the impedance of the throughline. For this example, enter 0 mm for length and 50Ω for impedance.

Step 17. Press **OFFSET LENGTH** and set for 0.0 mm, using the rotary knob.

Step 18. Press **THROUGH LINE IMPEDANCE** and set for 50 Ohms, using the rotary knob.

Step 19. Press **NEXT CAL STEP**.

Step 20. Press **REFERENCE IMPEDANCE/REFERENCE IMPEDANCE** and set for 50Ω.

Step 21. Press **TEST SIGNALS**.

The next soft-key set lets you define the power level of the signals at the two test ports.

(If you needed to calibrate the test port for power flatness, you would press the FLATNESS CORRECTION soft key to ON.)

Step 22. Press **RESUME CAL**.

Step 23. Press **START CAL**.

Step 24. Continue the calibration sequence by following the prompts as they appear. Connect the appropriate Isolation Devices, Broadband Loads, Opens, Shorts, and Throughlines, when requested in the calibration sequence.

7-6 TRANSMISSION AND REFLECTION 3-PORT CALIBRATION

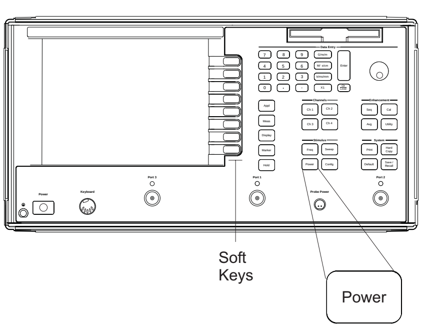
Once the two port calibration has been successfully performed, the user may select one of presently two varieties of *three port calibration completion* steps.

(1) SOLT is very similar to the standard two port method and will require connecting an open, a short, and a load to port 3 as well as a thru line between port 1 and 3 (and possibly between 2 and 3). The connector type on port 3 must also be specified since open standard coefficients must be applied. The connector type need not be the same as for port 1 or for port 2. The SOLT calibration is quite stable for coaxial systems and will almost always perform adequately.

(2) TRX is very similar to the LRL/LRM/TRM family of calibrations and will require connecting a short to port 3 (presently not allowed to be an ambiguous reflection) and a thru line between port 1 and port 3. The offset of the short plane must be specified as in LRL/LRM/TRM and the length of the thru must be specified as well. Fewer connections are required for this cal and it is more amenable to on-wafer calibrations. The required care and quality of calibration is somewhat higher as is the case with the LRL/LRM/TRM family.

Once the calibration method is selected, some attention must be paid to where the reference planes are located. With larger DUTs, cables are commonly connected to all three ports and the reference planes are established at each of the cable ends. The only important requirement is if the port 3 reference plane is not connected to the port 1 reference plane (that defined during the two port calibration) during the 3 port thru step, then the appropriate length of the thru line must be entered. The scenario just described does not fall into the common 'zero-length-thru' category.

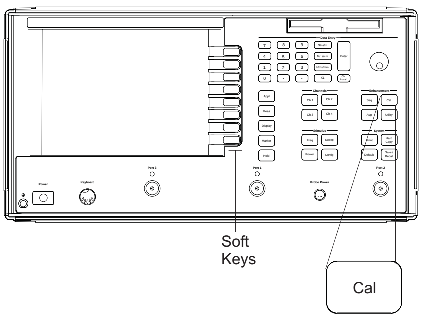
The 3-port feature is an option and is only available for the MS4622B and MS4623B.



3-Port Calibration
The following procedure calibrates the MS462XX using the 3-port technique. A 2-port calibration must be performed first.

Step 1. Press Power (left) then the following soft keys in sequence:
SOURCE 2 SETUP
SOURCE 2 POWER

Step 2. Set the power level for 7 dB, using the Data Entry keypad and X1 key.



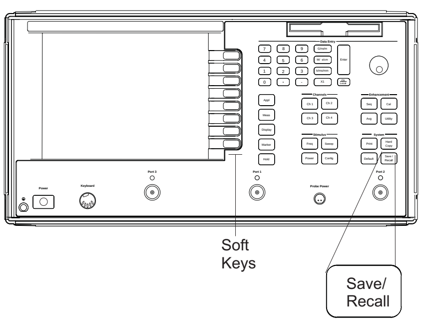
Step 3. Press the Cal (top left) then the following soft keys in sequence:
PERFORM 3 PORT CAL
CHANGE CAL METHOD
TRX
NEXT CAL STEP
NEXT CAL STEP
CHANGE PARAMETERS
NEXT CAL STEP

Step 4. Specify offset length for the reflective device, press **OFFSET LENGTH**.

Step 5. Enter 5 mm, using the Data Entry keypad and k/ms/mm key.

Step 6. Press **NEXT CAL STEP/START CAL**.

Step 7. Continue the calibration sequence by following the prompts as they appear.



Step 8. Press Save/Recall (bottom left.)

Step 9. Press the following soft keys in sequence:
SAVE
FRONT PANEL SETUP AND CAL DATA ON HARD DISK
CREATE NEW FILE

Step 10. Specify a name using the front panel knob. When complete, select **DONE.**

3-Port Calibration Method Details

The basic error model for two port calibrations consists of 12 error coefficients that correct for non-idealities in the VNA test set. Both of the three port calibrations discussed expand this set of coefficients to 24, which can be grouped as follows:

Basic two port cal	12 terms
Port 3 directivity and matches	3 terms
Port 3 tracking	5 terms (to and from the other ports + reflection tracking)
Additional isolation terms	4 terms

The model illustrated in Figure 7-7 shows the error boxes that embody the error terms. The isolation and transmission tracking terms (12 out of the 24) involve paths between ports and are not shown directly in the figure. The 12 other terms (source and load match, directivity, and reflection tracking) are associated with each individual error box.

Both three port completion steps will start with a two port calibration (first 12 terms) and will use the same isolation measurement steps to get the last 4 terms. The two methods differ in how they find the middle 8 terms in the above list

As one might expect, the SOLT version first proceeds by performing a one port cal on port 3 by measuring an open, a short and a load. These measurements allow the computation of source match, directivity and reflection tracking terms. The remaining thru line measurement(s) allows the computation of load match and the required transmission tracking terms to complete the model.

The TRX method follows in the path of the LRL/LRM/TRM methods and exploits some of the data redundancy in the standard SOLT approach. The thru line measurement allows the direct computation of directivity, load match and some of the transmission tracking terms. The short measurement allows direct computation of the source match and the completion of calculation of the remaining tracking terms.

Since the 24-term model is shared between the two methods, the calibration will be applied in the same way for both via a matrix equation system. Figure 7-7 illustrates the three port error model. An error box is associated with each port that contains the coefficients describing that port's non-idealities.

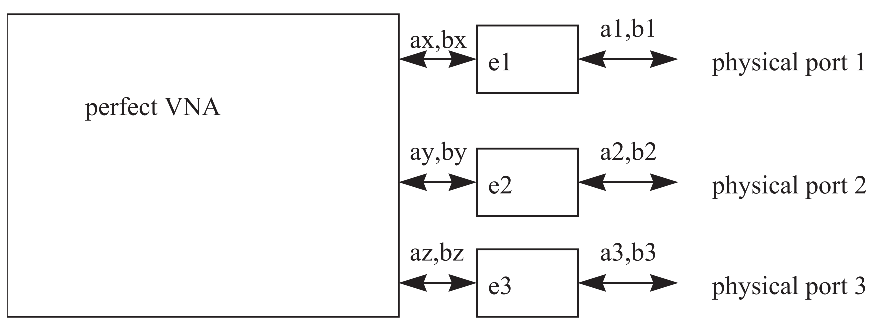


Figure 7-7. *Three-Port Error Model*

7-7 FOUR-PORT CALIBRATION

Calibration using the Four-Port Calibration technique is available for 4-Port D models only. The following procedure calibrates the MS462xD using the four-port technique.

A Two-Port calibration must be performed before proceeding with a Four-Port Calibration. A Two-Port calibration can be one of the preceding Transmission & Reflection calibrations. The frequency range and data points of the two-port calibration dictate the calibration configuration for the Four-Port calibration.

Step 1. Perform an OSLT calibration or an AutoCal calibration (Section 9-3, page 9-4).

Step 2. Specify Test Signal Power Levels:

Power/**SOURCE 2 SETUP/SOURCE 2 POWER = 7 dB**
Cal/**PERFORM MANUAL CAL/4 PORT CAL/CHANGE CAL METHOD/SOLT**
NEXT CAL STEP
NEXT CAL STEP
PORT 3 CONN = GPC-3.5 (M)
PORT 4 CONN = GPC-3.5 (M)
START CAL

Step 3. Follow the directions for connecting calibration devices.

Step 4. Save the setup and cal data:

Save/Recall/**SAVE/FRONT PANEL SETUP AND CAL DATA ON HARD DISK/CREATE NEW FILE**

Step 5. Specify a name using the front panel knob. When complete, select DONE.

This completes the procedure for calibrating the MS462xD using the four-port calibration technique.

NOTE

To verify that the calibration is good, connect a through between Ports 1 and 2, 1 and 3 and 1 and 4 in consecutive order and check that S11, S22, S33 and S44 have a RL of 15 or better. Also verify transmission S-Parameters are close to 0 dBm.

7-8 LRL/LRM CALIBRATION PROCEDURE

The LRL/LRM (line-reflect-line/line-reflect-match) calibration* feature provides an enhanced capability for error compensation when making measurements in coaxial, microstrip and waveguide transmission media. Instead of using the standard Open, Short, and Load, the LRL/LRM calibration method uses two lines and a reflection or match. The difference in length between line 1 and line 2 creates the measurements necessary for the error solutions.

The LRL/LRM calibration technique uses the characteristic impedance of a length of transmission line or a precision match as the calibration standard. A full LRL/LRM calibration consists of two transmission line measurements, a high reflection measurement, and an isolation measurement. Using this technique full 12-term error correction can be performed with the MS462XX.

Three line LRL/LRM calibration can also be selected. In a two-line LRL measurement, the difference in length between line 1 and line 2 is necessary for calibration but limits the frequency range to a 9:1 span. The use of three lines in the calibration extends the frequency range to an 81:1 span. A combination of LRL and LRM can accommodate any broadband measurement.

1. Through the use of LRL/LRM calibration and an external computer, in conjunction with ANACAT software, multiple-level de-embedding is possible. This calibration allows you to make semi-conductor chip measurements up to 40 GHz with a single test fixture.

2. In addition, any non-coaxial transmission media, including mixed media interconnects, can be accommodated. For example, a test device with a waveguide input and a coplanar microstrip output can be measured. Software automatically compensates for the microstrip dispersion.

Three detailed procedures (microstrip, coaxial, waveguide) for calibrating for a measurement using the LRL/LRM method are provided below and on the following pages.

LRL/LRM Calibration (Microstrip)

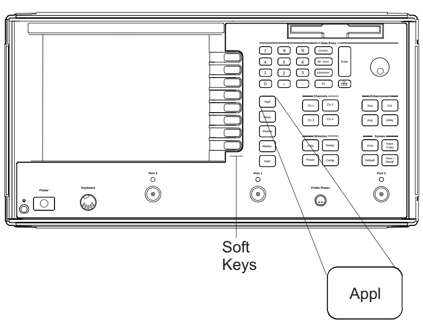
Microstrip is a dispersive media. The MS462XX applies dispersion compensation during calibration for microstrip measurements. Because the MS462XX must know the specific microstrip parameters during calibration, soft keys are provide for entering the following:

- ❑ width of the strip
- ❑ thickness of the substrate
- ❑ substrate dielectric constant
- ❑ effective dielectric constant Zc
- ❑ characteristic impedance (reference)

*LRM Calibration Method of Rhode & Scharwz, Germany

When testing microstrip devices it is necessary to launch from coax to microstrip. In production testing this launching must be temporary, so that the device can easily be installed in and be removed from the fixture. The requirement for launching is met by the Anritsu Universal Test Fixture (UTF). The UTF provides accurate, repeatable launch to substrates from 5 to 70 mils thick, and from 0.15 to 2 inches long. Offset connections and right angles can be configured. DC bias probes can be mounted to the UTF to inject bias onto the substrate. UTF calibration/verification kits are available for alumina in 10 mil, 15 mil, and 25 mil microstrip, and for 25 mil coplanar waveguide. Although a UTF is not essential, the following calibration procedures presume its use.

Step 1. Select the desired LRL line substrates from the appropriate microstrip calibration kit. When called for in the calibration sequence, mount the LRL line substrates on the UTF following the procedure given in the 3680 OMM.

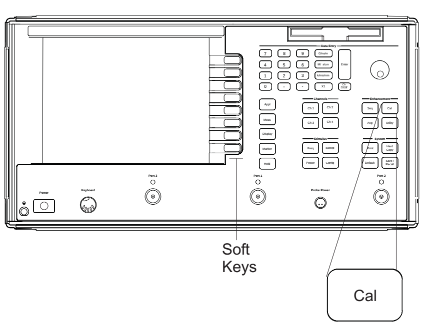


Step 2. Press Appl (top left) then **TRANSMISSION AND REFLECTION.**

Step 3. Press Cal (bottom left) then **PERFORM CAL 2-PORT CAL.**

Pressing this key starts a linked set of soft-key choices that guide you through a measurement calibration.

Step 4. Observe the **CAL METHOD** and **LINE TYPE** soft-key options. If they read LRL/LRM and MICROSTRIP, respectively, go to step 6.



Step 5. Press the following soft keys in sequence:
CHANGE CAL METHOD AND LINE TYPE
CAL METHOD LRL/LRM
LINE TYPE MICROSTRIP
NEXT CAL STEP

Step 6. Press the following soft keys in sequence:
NEXT CAL STEP
INCLUDE ISOLATION (STANDARD)

This soft-key set lets you choose whether to include or exclude the error terms associated with leakage between measurement channels. For a normal calibration, you would choose to include these error terms.

Step 7. Press **NORMAL (1601 POINTS MAXIMUM)**.

This soft-key set lets you select the number of frequency points at which calibration data is to be taken. The choices: NORMAL: Data is taken at up to 1601 equally spaced frequencies across the calibration frequency range. C.W.: Data is taken at one point. N-DISCRETE FREQUENCIES (2 TO 1601 POINTS): This selection lets you specify a discrete number of frequency points, from 2 to 1601. TIME DOMAIN (HARMONIC): This selection is the calibration mode for low-pass time-domain or for Harmonic processing. It lets you select frequencies at integer (harmonic) multiples of the start frequency.

Step 8. Press **START,** then enter 10 MHz, using either the rotary knob or keypad and terminator keys.

Step 9. Press **STOP,** then enter 3 GHz (MS4622X) or 6 GHz (MS4623X), using either the rotary knob or keypad and terminator keys.

The above 2 steps let you set your start and stop frequencies. For this example, press START, press 10 on keypad, and hit the M/µs/cm terminator key. Perform like operations for STOP, except make entry read 3 GHz or 6 GHz.

Step 10. Press **NEXT CAL STEP**.

Step 11. Press **LRL/LRM PARAMETER.**

Step 12. Press the applicable reference plane soft key: **MIDDLE OF LINE 1 (REF)** or **ENDS OF LINE 1 (REF).**

Step 13. Press **ONE BAND** for a two-line calibration (Step 15), or **TWO BANDS** (Step 16) for a three-line calibration.

As mentioned earlier, in a two-line measurement, the difference in length between line 1 and line 2 is necessary for calibration but limits the frequency range to a 9:1 span. By using three lines in the calibration, you extend the frequency range to an 81:1 span.

Step 14. Press **NEXT CAL STEP.**

Step 15. If **ONE BAND** was chosen in Step 13, perform the following:

a. Press **DEVICE 1 LINE 1 (REF)** and enter the value.

b. Press **DEVICE 2 LINE/MATCH**.

Here you have another decision to make: whether your calibration is to be LRL or LRM. The soft key acts as a toggle.

c. If you toggle such that **LINE** turns red, then enter the value for line 2.

This value depends on your frequency range.

d. If you toggle **MATCH** red, observe that FULLBAND appears.

This indicates that your reflective device covers the full calibration range.

e. When you have made both selections, press **NEXT CAL STEP** and go to Step 17.

Step 16. If **TWO BANDS** was selected in Step 13, perform the following:

a. Press **DEVICE 1 LINE 1 (REF)** and enter the value (typically 1.00 cm).

b. Press **DEVICE 2 LINE/MATCH**.

Both here, and for the next choice, you have another decision to make: whether your calibration is to be LRL or LRM. For this selection, the soft key acts as a toggle.

c. If you toggle such that **LINE** turns red, then enter the value for line 2.

This value depends on your frequency range.

d. If you toggle **MATCH** red, observe that LOWBAND appears.

This indicates that your reflection device is a low-band load. This load must have a passband such that it passes all frequencies from the start to the breakpoint (see below).

e. Press **DEVICE 3 LINE/MATCH.** If device 3 is a line, key in the value. If it is a match, the term HIGHBAND will appear.

This indicates that your match is a high-band load. This load must have a passband such that it passes all frequencies from the breakpoint to the stop frequency.

f. Press **BREAKPOINT** and enter your breakpoint frequency.

For two-line LRL calibrations, select a breakpoint equal to the upper frequency of the low frequency LRL line. For a combined LRL and LRM calibration, select a breakpoint equal to the top frequency of the calibration divided by six; for instance, to cover the frequency range 0.01 to 6 GHz, select 1 GHz as the breakpoint.

g. When you have made all selections, press **NEXT CAL STEP.**

Step 17. Press **OFFSET LENGTH** enter a value (typically 0.0000 mm).

Step 18. Press **GREATER THAN Zo** or **LESS THAN Zo,** depending on whether your reflective device is an Open or a Short.

Choose GREATER THAN Zo for an Open and LESS THAN Zo for a Short.

Step 19. Press **NEXT CAL STEP**.

Step 20. Press **MICROSTRIP PARAMETERS**.

This soft-key lets you change the microstrip parameters. The current setting appears in blue. Pressing it provides for selecting the following 3680 Connection Substrate Kits:
10 MIL KIT—36804B-10M
15 MIL KIT—36804B-15M
25 MIL KIT—36804B-25M

If you choose USER DEFINED, press USER DEFINED, and review the current microstrip parameter settings; change any that do not apply.

Step 21. Press **NEXT CAL STEP/TEST SIGNALS**.

The TEST SIGNALS soft-key set lets you define the power level of the signals at the two test ports.

(If you needed to calibrate the test port for power flatness, you would press the FLATNESS CORRECTION soft key to ON.)

Step 22. Press **RESUME CAL**.

Step 23. Press **START CAL**.

Step 24. Continue the calibration sequence by following the prompts as they appear. Mount the appropriate LRL line substrates when requested in the calibration sequence.

For the REFLECTIVE DEVICE and BROADBAND LOAD prompts, remove all substrates from the UTF and allow the lower jaws to short the center conductor. Separate the connector blocks by at least an inch. (The BROADBAND LOAD prompt only appears if you selected to include isolation.)

Step 25. Store the calibration.

LRL/LRM Calibration (Coaxial)

An LRL cal kit is necessary to perform the coaxial calibration. Calibration kits for GPC-7 are available from Maury Microwave and Hewlett Packard.

Two line lengths are used as the impedance standard. The calibration frequency range is limited by the difference in the lengths of the two lines. Their length must be different by approximately 90 degrees at the mid-band frequency. A good calibration can be achieved over the range of 18 degrees to 162 degrees making it possible to calibrate LRL over a 9:1 frequency range.

LRL calibration is very sensitive to uncalibrated source match. If some padding is placed at the test ports, the directivity and source match will be improved. If the goal is high level measurements, then padding should be included. If low level measurements are being performed, then the padding must be left out.

The coaxial procedure is the same as the Microstrip Procedure, except chose **COAXIAL** as the line type and use the **REFERENCE IMPEDANCE** soft key (when it become available) to select or change the line impedance.

In the coaxial, three-line calibration there are factors you need to be aware of. Note that it is the line length *differences* that are important to the LRL calibration, namely (L2–L1) and (L3–L1) where L1 is the length of line 1, L2 is the length of line 2, and L3 is the length of line 3.

Longer length differences are used for longer wavelengths (lower frequencies). For frequencies up to and including the breakpoint frequency, the larger absolute value of the (L2–L1) and (L3–L1) differences is used. At frequencies above the breakpoint, the smaller absolute value of the (L2–L1) and (L3–L1) differences is used.

Consideration must also be given to selecting the breakpoint frequency. Divide the frequency range to satisfy the 9:1 rule for any given pair of lines. The range is thus divided by the frequency breakpoint into the intervals [f1, f2] and [f2, f3]. Based on these intervals, next determine the appropriate length differences; the longer difference is associated with the lower interval [f1, f2]. Note that if the differences are equal to each other, concurrent frequency ranges are implied and only two lines need be used.

Select a line 1 reference (L1) around which to place these two differences. Use any combination of positive or negative differences around line 1. The software selects which interval is associated with either of line 2 or line 3 by comparing the absolute values of the differences with line 1. Data from the two lines, which make up the larger absolute difference, are used for the interval [f1, f2]. Data from the two lines, which make up the smaller absolute difference, are used for the interval [f2, f3].

LRL/LRM Calibration (Waveguide)

The waveguide procedure is the same as the Microstrip procedure, except chose WAVEGUIDE as the line type and use the **WAVEGUIDE CUTOFF FREQ** soft key (Appendix D, page D-32) to select or change its value.

7-9 TRM CALIBRATION PROCEDURE

The TRM Calibration procedure is the same as the LRL/LRM procedure, except that certain parameters have been set by default so that the calibration is simpler to perform (e.g., the L parameter in the LRM calibration has been set to equal a length of 0 mm for a through, and the R parameter is set for a short)

7-10 BALANCED CALIBRATION TECHNIQUE

Balanced calibration and measurement techniques are covered in the companion MS462XX Measurement Guide, Anritsu Part Number: 10410-00213.

7-11 FLEXIBLE CALIBRATION

Flexible Calibration mode allows an existing 2, 3 or 4-port calibration to be quickly subdivided so that only the required measurements are used. This is accomplished by having all error coefficients available, but just enabling those that are needed. The configuration can be changed so that calibration setups do not need to be recalled from memory or disk.

Using Flexible Calibration

Flexible Calibration requires that a single N-port (2, 3 or 4-port) calibration be performed (see application notes *AutoCal*, 11410-00258, or *4-Port AutoCal*, 11410-00298, for more information). Then, when a given measurement is to be performed, the user selects what portion of the calibration is to be used. The simplest case is when a full M-port calibration is enabled ($M \leq N$).

For example, a 4-port VNA is used to measure a pair of 2-port DUTs. While one DUT is being measured, the second DUT is being loaded on the remaining two ports. The user has two options:

- Use two 2-port calibrations and recall the setup between each measurement
- Use a 4-port calibration

FLEXIBLE CAL
SELECT INPUT METHOD
(BY PORT)
FULL TERM CALS
REFLECTION ONLY
(BY S-PARAM)
▶ CUSTOMIZE CAL
FLEXIBLE CAL MODE
APPLY
DEFINE
HELP OFF
RETURN

In each case, considerable time is lost due to reloading a 2-port calibration between measurements or due to measuring 16 parameters each time when only four are needed.

With Flexible Calibration, you can perform a full 4-port calibration (parent calibration) to start and then enable a 2-port calibration for each of the measurement groups. Once the parent calibration has been performed, the Flexible Cal menu (left) can be used to select the appropriate measurement subsets as follows:

- FULL TERM CALS—If the parent calibration is a 4-port calibration, use this to select a full 2 or 3-port calibration or to re-enable the full 4-port calibration; if the parent calibration is a 3-port calibration, use this to select any 2-port calibration or to re-enable the 3-port calibration
- REFLECTION ONLY CALS—Use this to select one, or up to four, reflection-only one-port calibrations
- CUSTOMIZE CALS—Use this to select different combinations other than full-term or 1-port calibrations

An important point is that the system will automatically determine which error terms must be included to perform the correction as best as possible within the constraints supplied. The rules for the system's decisions can be described as follows:

- If a reflection term (S_{ii}) is activated, include all reflectometer coefficients for that port. If S_{ii} is isolated, the calibration is treated like a 1-port reflection-only calibration
- For each transmission term (S_{ji}), activate its tracking term. If done alone, the calibration is treated like a normalization calibration (similar to frequency response)
- If a transmission term is activated along with its matching reflection terms (e.g., S_{12}, S_{11} and S_{22}), activate the load match terms

The net effect is, if all four parameters associated with a 2-port calibration are specified, a full 2-port correction will be enabled. If only S_{ii} and S_{ji} are activated, then a 1-path 2-port calibration will be enabled.

NOTE

Although the system can be fairly intelligent in which terms it uses, it knows little about the DUT. You can help by specifying not only the measurements that are needed, but also the ones that are tightly connected to the desired measurement and are not on the measurement's list.

Example Using Flexible Calibration

Figure 7-8 shows a 3-port device consisting of a 1-port resonator/antenna and a 2-port sub-DUT. If leakage is not of interest, you would really want to measure only five parameters instead of nine. The idea is to avoid measuring more than is needed.

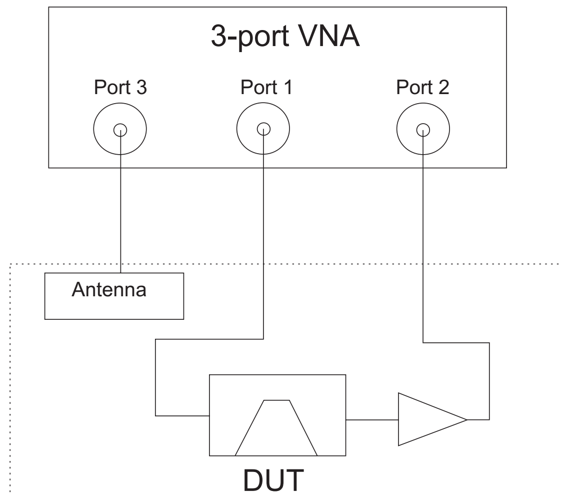


Figure 7-8. *3-Port VNA Measuring a 3-Port Device*

The 3-port DUT has an integrated antenna, to be treated as a single port, and an amplifier path, to be treated as a separate 2-port device. The following will illustrate that in partially connected DUTs, such as this, there is no accuracy penalty in using the Flexible Calibration mode.

A full 3-port calibration and measurements over the 700 MHz to 1000 MHz frequency range were performed. Both the full 3-port calibration results and the Flexible Calibration results, defined as CUSTOM CAL with the S11, S12, S21, S22, and S33 parameters enabled, are compared on an overlay in Figure 7-9 on the following page.

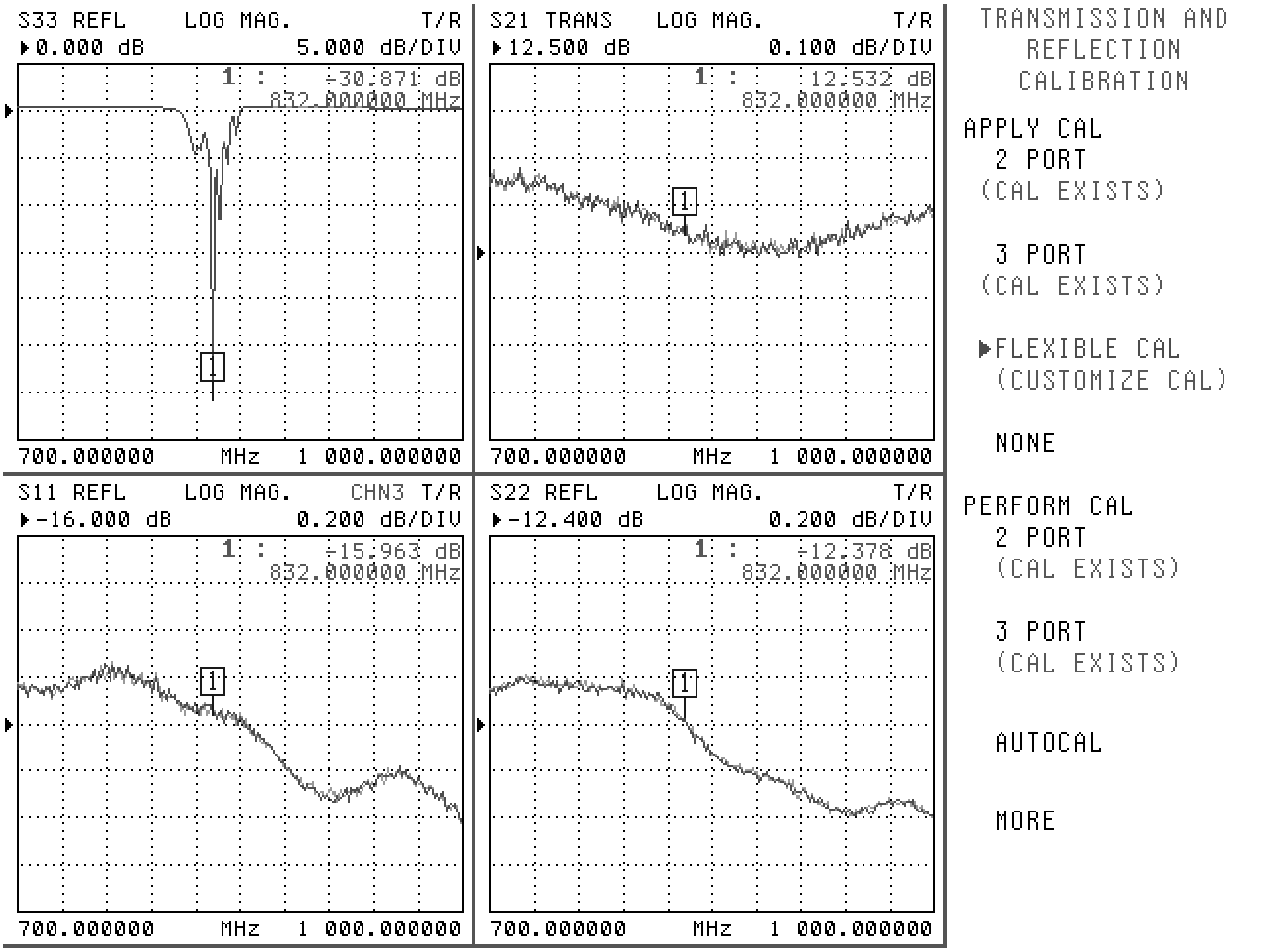


Figure 7-9. *Example Comparing Flexible Calibration Results with Full 3-Port Calibration Results*

The light trace is the full 3-port calibration result while the dark trace uses the Flexible Calibration method. Aside from some minor differences due to trace noise (measurement done with a very wid IFBW with no averaging), the traces overlay completely. As expected there is no difference, but only five parameters were measured per cycle instead of nine. This method works for partially connected DUTs, such as those discussed previously.

Other application notes (e.g., *Three and Four Port S-parameter Measurements*, 11410-00279) or Anritsu customer service can be consulted for more information on the various types of calibrations possible.

Chapter 8
Time Domain

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Chapter 8
Time Domain

8-1 INTRODUCTION

This chapter describes the optional Time Domain feature.

8-2 TIME DOMAIN MEASUREMENTS

The Option 2, Time Domain feature provides a useful measurement tool for determining the location of impedance discontinuities. Some typical applications are identifying and analyzing circuit elements, isolating and analyzing a desired response, locating faults in cables, and measuring antennas.

**TIME DOMAIN
A USEFUL TOOL FOR:**

- Identifying and Analyzing Circuit Elements
- Isolating a Desired Response
- Locating Faults
- Making Antenna Measurements

The relationship between the frequency-domain response and the time-domain response of a network is described mathematically by the Fourier transform.

The MS462XX makes measurements in the frequency domain then calculates the inverse Fourier transform to give the time-domain response. The time-domain response is displayed as a function of time (or distance). This computational technique benefits from the wide dynamic range and the error correction of the frequency-domain data.

Let us examine the time-domain capabilities. Two measurement modes are available: lowpass and bandpass.

MS462XX TIME DOMAIN MODES

- Lowpass Mode
- Bandpass Mode

We use the lowpass mode with devices that have a dc or low-frequency response. In the lowpass mode two responses to the device-under-test (DUT) are available: impulse or step response.

LOWPASS MODE

- Either Impulse or Step Response Available
- Displays Impedance Information
- Requires Harmonically Related Frequencies
- Used When Device Has a DC or Low Frequency Path

The frequencies used for the test must be harmonically related (integer multiples) to the start frequency. The simplest way to calculate this relationship is to divide the highest frequency in the calibration by 1600 (the default number-of-points available); this is the start frequency. For example if the highest frequency is 6 GHz, the calculated start frequency is 3.75MHz (6/1600).

LOWPASS IMPULSE RESPONSE

- Location of Discontinuities
- Information on Type of Discontinu-ities

The lowpass impulse response displays the location of discontinuities as well as information useful in determining the impedance (R, L, or C) of each discontinuity.

The impulse response is a peak that goes positive for $R>Z_0$ and negative for $R<Z_0$. The height of the response is equal to the reflection coefficient

$$r = \frac{R - Z_0}{R + Z_0}$$

The impulse response for a shunt capacitance is a negative-then-positive peak and for a series inductance is a positive-then-negative peak (Figure 8-1).

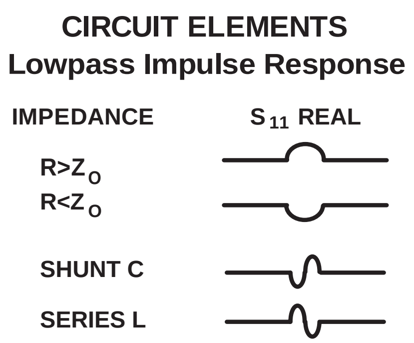


Figure 8-1. *Lowpass Impulse Response*

An example of using impulse response is circuit impedance analysis. With an impulse response, we can observe the circuit response of a passive device, such as a multi-element step attenuator (Figure 8-2), and make final, realtime adjustments during the test.

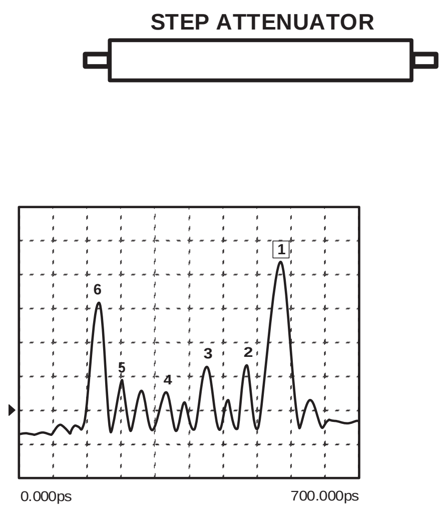


Figure 8-2. *Example of Lowpass Impulse Response*

In the above example, the connectors at each end have been gated out (page 8-13), which lets you better observe the internal circuit response. Each displayed marker has been manually set to the peak of the response at each adjustable circuit element. In this way, the data display lets you make the adjustment in realtime, while the marker menu shows the magnitude of the response at each marker.

The lowpass-step response displays the location of discontinuities as well as information useful in determining the impedance (R, L, or C) of each discontinuity. If you are familiar with time-domain reflectometry

LOWPASS STEP RESPONSE

- TDR Measurement
- Location of Discontinuities
- Information on Type of Discontinuities

(TDR) you may feel more comfortable with step response, as the displays are similar.

The lowpass-step response for a resistive impedance is a positive level shift for $R>Z_0$ and a negative level shift for $R<Z_0$. The height of the response is equal to the reflection coefficient

$$r = \frac{R - Z_0}{R + Z_0}$$

The step response for a shunt capacitance is a negative peak, and for a series inductance it is a positive peak (Figure 8-3).

An example of using the lowpass-step response is cable-fault location. In the frequency domain, a cable with a fault exhibits a much worse match than a good cable. Using lowpass-step response, both the location of the discontinuity and the information about its type are available (Figure 8-4).

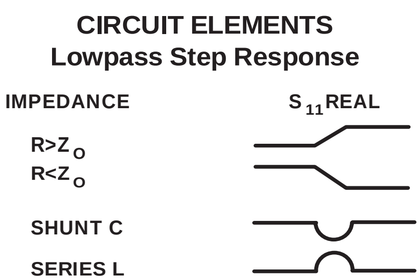


Figure 8-3. *Lowpass-Step Response*

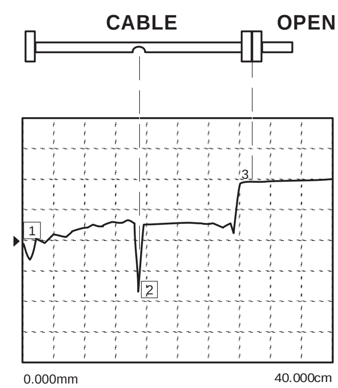


Figure 8-4. *Example of Lowpass-Step Response*

In the above example, the dip in the display shows the shunt-capacitive response caused by a crimp in the cable. The response at the end of the cable shows the step-up that is typical of an open (Figure 8-3).

BANDPASS MODE

- Calculates Impulse or Phasor-Impulse Response
- Uses Any Frequency Range
- Used When Device Does Not Have a DC or Low-Frequency Path

The MS462XX bandpass mode gives the response of the DUT to an RF-burst stimulus. Two types of response are available: impulse and phasor-impulse. An advantage of the bandpass mode is that any frequency range can be used. Use this mode with devices that do not have a dc or low-frequency path.

BANDPASS IMPULSE RESPONSE

- Magnitude Measurement Only
- Location of Discontinuities
- No Information on Type of Discontinuities

Use the bandpass-impulse response to show the location of a discontinuity in time or distance, as indicated by changes in its magnitude. Unlike the lowpass mode, no information as to the type of the discontinuity is available. A typical use for this mode is to measure devices—such as, filters, waveguide, high-pass networks, bandpass networks—where a low-frequency response is not available.

The bandpass-impulse response for various impedance discontinuities is shown in Figure 8-5. As we can see, no information about the type of discontinuity is available.

An example of using the bandpass-impulse response is the pulse height, ringing, and pulse envelope of a bandpass filter (Figure 8-6). Use the phasor-impulse response with bandpass response to determine the type of an isolated impedance discontinuity.

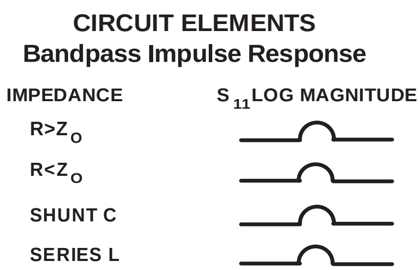


Figure 8-5. *Bandpass Impulse Response*

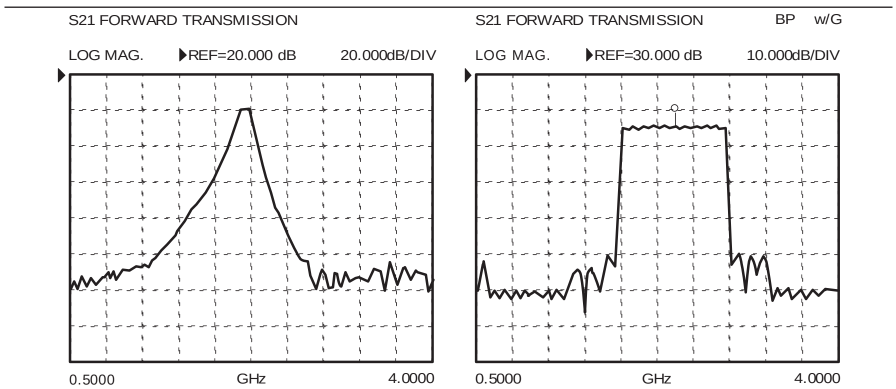


Figure 8-6. *Example of Bandpass-Impulse Response*

PHASOR IMPULSE BANDPASS RESPONSE

- Real and Imaginary Measurement
- Information On Type of Discontinuity

After the bandpass-impulse response has been isolated, the phasor-impulse response for a resistive-impedance-level change is a peak that goes positive ($R>Z_0$) for the real part of S_{11} and negative for $R<Z_0$. The imaginary part remains relatively constant. In each case the peak is proportional to the reflection coefficient. The phasor-impulse response for a shunt capacitance is a negative-going peak in the imaginary part of S_{11}. For a series inductance, it is a positive going peak.

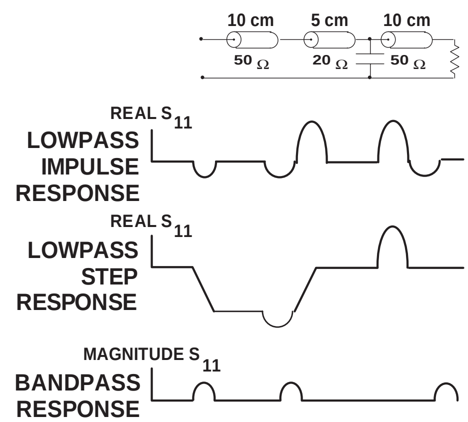


Figure 8-7. *Complex Impedances*

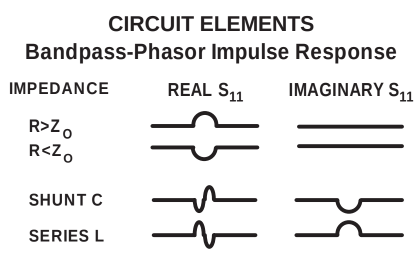


Figure 8-8. *Bandpass Phasor Response*

Next, let us look at a complex circuit. A resistive impedance change $R<Z_0$ and a shunt capacitance and series inductance. These impedance changes are shown in the time domain for the lowpass-impulse response, lowpass-step response, and bandpass-impulse response (Figure 8-7).

The MS462XX processes bandpass-impulse-response data to obtain phasor-impulse response. This becomes most advantageous where both a reactive reflection and an impedance change occur at the same location. The real part of the time-domain response shows the location of impedance level changes, while the imaginary part shows the type of reactive discontinuity. Phasor-impulse response displays one discontinuity at a time (Figure 8-9).

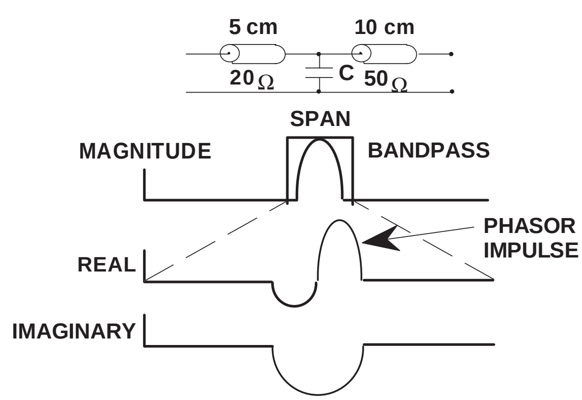
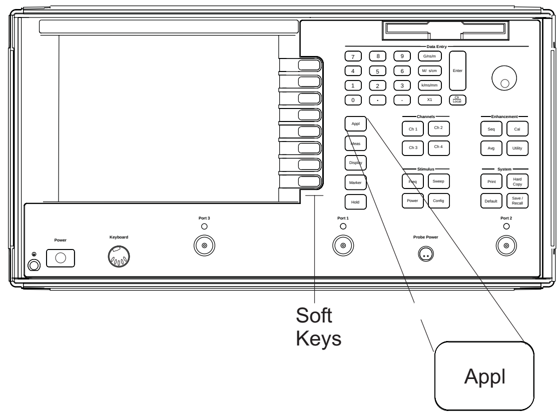


Figure 8-9. *Phasor-Impulse Response Data*

8-3 OPERATING TIME DOMAIN

To operate in the time domain mode, press the Appl key (below), then the **TRANSMISSION AND REFLECTION** and **DOMAIN** soft keys.. The “DOMAIN” menu soft keys let you select the frequency- or time-domain modes (Figure 8-10). The MS462XX defaults to the frequency domain.



Select time or distance for the horizontal axis. The MS462XXdefaults to time axis.

NOTE

If you select distance, be sure to set the dielectric constant Display key, **REFERENCE PLANE**, and **SET DIELECTRIC** soft keys (Figure 8-11).

SET DIELECTRIC
AIR
(1.000649)
POLYETHYLENE
(2.26)
TEFLON
(2.10)
MICROPOROUS
TEFLON
(1.69)
OTHER
XXXX.XX
RETURN

Figure 8-11. *Reference Delay Soft-Key Menu*

DOMAIN
SELECT DOMAIN
FREQUENCY
NO TIME GATE
FREQUENCY
WITH TIMEGATE
TIME
LOWPASS
TIME
BANDPASS
DISPLAY
TIME/DISTANCE
SETUP
HELP ON/OFF

Figure 8-10. *Domain Soft-Key Menu*

Select **SETUP** then **RANGE SETUP AND** and use the START/STOP selections to set the range (Figure 8-12). Alternatively, you can use **GATE SETUP** and **SPAN**.

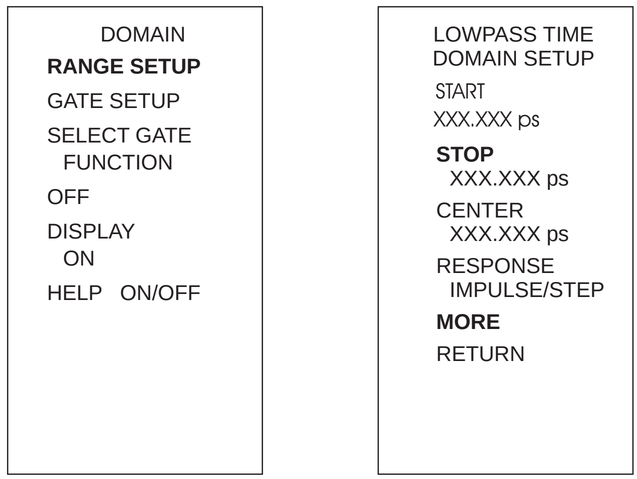


Figure 8-12. *Set Range Soft-Key Menu*

For the lowpass mode select either **IMPULSE** or **STEP** Response and set the DC term. The MS462XXdefaults to the **IMPULSE** Response and the **AUTO EXTRAPOLATE** mode for the DC term (Figure 8-13).

NOTE

The bandpass mode displays Bandpass Impulse Response unless we select Phasor Impulse Response.

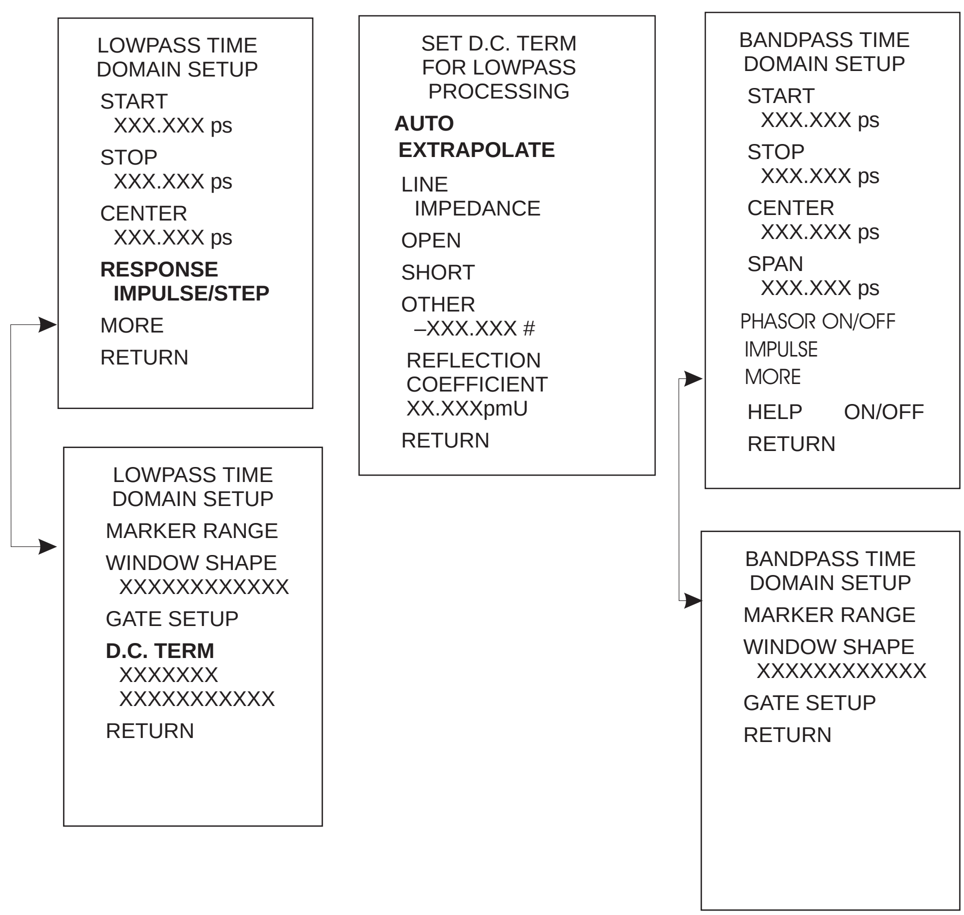


Figure 8-13. *Response Soft-Key Menus*

The Marker Range menu allows us to zoom in and display the range between two selected markers (Figure 8-14).

TIME MARKER SWEEP	DISTANCE MARKER SWEEP
START MARKER XXX.XXX ps	START MARKER XXX.XXX ps
STOP MARKER XXX.XXX ps	STOP MARKER XXX.XXX ps
RESTORE ORIGINAL RANGE	RESTORE ORIGINAL RANGE
RETURN	RETURN

Figure 8-14. *Marker Range Soft-Key Menus*

8-4 WINDOWING

Windowing is a frequency filter that we apply to the frequency-domain data when we convert it to time-domain data. This filtering rolls off the abrupt transition at F1 and F2. This effectively produces a time-domain response with lower sidelobes. Windowing allows a limited degree of control over the pulse shape, trading off ringing (sidelobes) for pulse width (Figure 8-15).

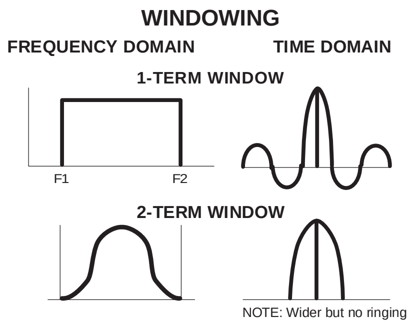


Figure 8-15. *Windowing*

We select windowing from the Time Domain Setup soft-key menu. Four different windows are available: RECTANGLE, NOMINAL, LOW SIDELOBE, and MINIMUM SIDELOBE. The RECTANGLE option provides the narrowest pulse width, while the MINIMUM SIDELOBE option provides the least ringing (fewest sidelobes). The MS462XX defaults to the NOMINAL option, which is acceptable for most measurements. Windowing menus are shown in Figure 8-16.

LOWPASS TIME DOMAIN SETUP	LOWPASS TIME DOMAIN SETUP	WINDOW/GATE SHAPE
START XXX.XXX ps	MARKER RANGE	RECTANGULAR
STOP XXX.XXX ps	**WINDOW SHAPE** XXXXXXXXXXX X	NOMINAL
CENTER XXX.XXX ps	GATE SETUP	LOW SIDELOBE
RESPONSE IMPULSE/STEP	D.C. TERM XXXXXXX XXXXXXXXXXX	MIN SIDELOBE
MORE	RETURN	HELP ON/OFF
		RETURN

Figure 8-16. *Window Shape Soft-Key Menus*

8-5 GATING

Gating is a time filter that allows for removing unwanted time-domain responses by gating the desired response. We can view the isolated response in both time domain—and in the frequency domain—using the FREQUENCY WITH TIME GATE selection (Figure 8-17).

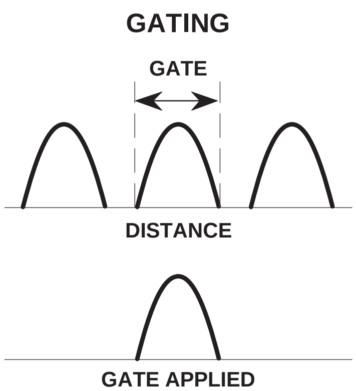


Figure 8-17. *Gating*

There are four different gate shapes available: MINIMUM, NOMINAL, WIDE, and MAXIMUM (Figure 8-18). The MS462XX defaults to the NOMINAL gate. To specify a different shape simply enter the Gate menu and select the desired gating shape. The MINIMUM has the sharpest roll off and some frequency domain ripple, while MAXIMUM has the least roll off and best residual ripple. Figures 8-19 through 8-22, on the next page, show gating shapes.

The combinations of gate/window shapes will be restricted. For the MINIMUM gate shape, the LOW and MIN SIDELOBE window shape will not be allowed. For the NOMINAL gate shape, the MIN SIDELOBE window will not be allowed. If the user has set the window shape to MIN or LOW SIDELOBE and changes the-gate shape to MINIMUM, the window will be reset to NOMINAL. If the user has set the window to MIN SIDELOBE and changes the gate shape to NOMINAL, the window will be reset to LOW SIDELOBE. Gate shapes will be adjusted in a similar manner.

LOWPASS TIME
DOMAIN SETUP
START
XXX.XXX ps
STOP
XXX.XXX ps
CENTER
XXX.XXX ps
RESPONSE
IMPULSE/STEP
MORE

LOWPASS TIME
DOMAIN SETUP
MARKER RANGE
WINDOW SHAPE
XXXXXXXXXXXX
GATE SETUP
D.C. TERM
XXXXXXX
XXXXXXXXXXX
RETURN

WINDOW/GATE
SHAPE
RECTANGULAR
NOMINAL
LOW SIDELOBE
MIN SIDELOBE
HELP ON/OFF
RETURN

Figure 8-18. *Gating Soft-Key Menus*

An informational message will be displayed in the data area when the window or gate shape is reset in this way. The message will last 2 sweeps, and will say:

“GATE SHAPE ADJUSTED” or “WINDOW SHAPE ADJUSTED” depending on which was changed by the software.

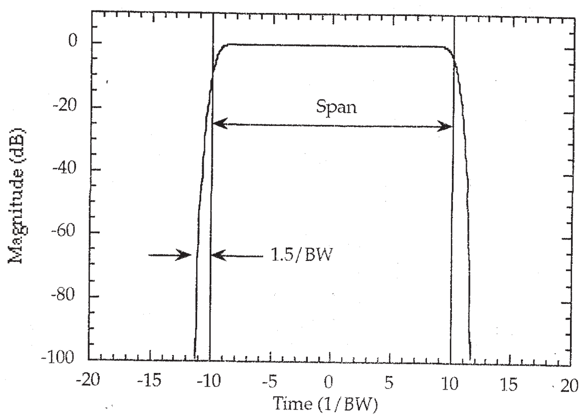


Figure 8-19. *Minimum Gate Shape*

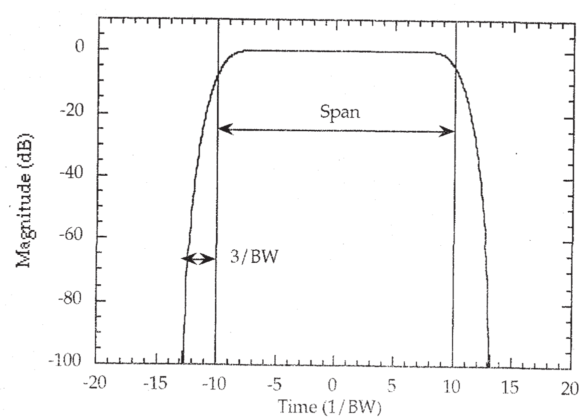


Figure 8-20. *Nominal Gate Shape*

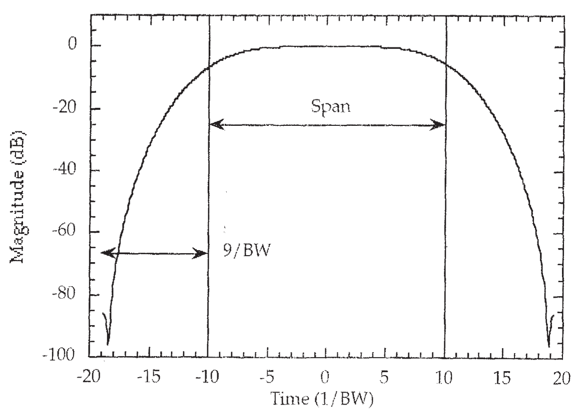


Figure 8-21. *Wide Gate Shape*

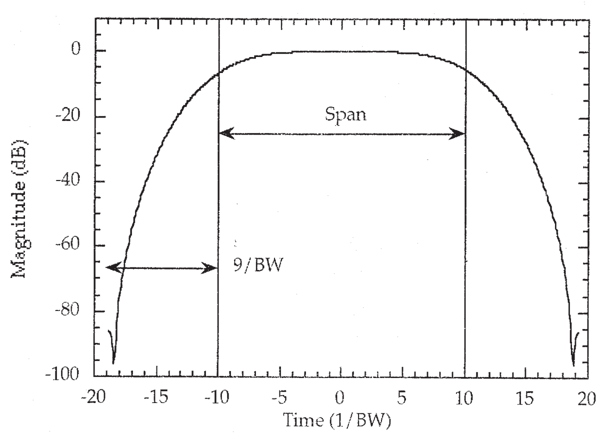


Figure 8-22. *Maximum Gate Shape*

8-6 ANTI-GATING

Anti-gating is the opposite of gating. Whereby, gating provides for removing all but the desired response, anti-gating displays all but the desired response. To provide anti-gating, gate in the normal manner, except use a minus value for the SPAN width.

Chapter 9
AutoCal

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NOTE

The MS462XC VNMS- Direct Receiver Access version cannot make system measurements without an external test set that couples power into the reference and test channels, such as the Anritsu MS4782A. This manual will discuss calibration and system measurements for the MS462XX assuming the user understands the need for the external test set for the MS462XC.

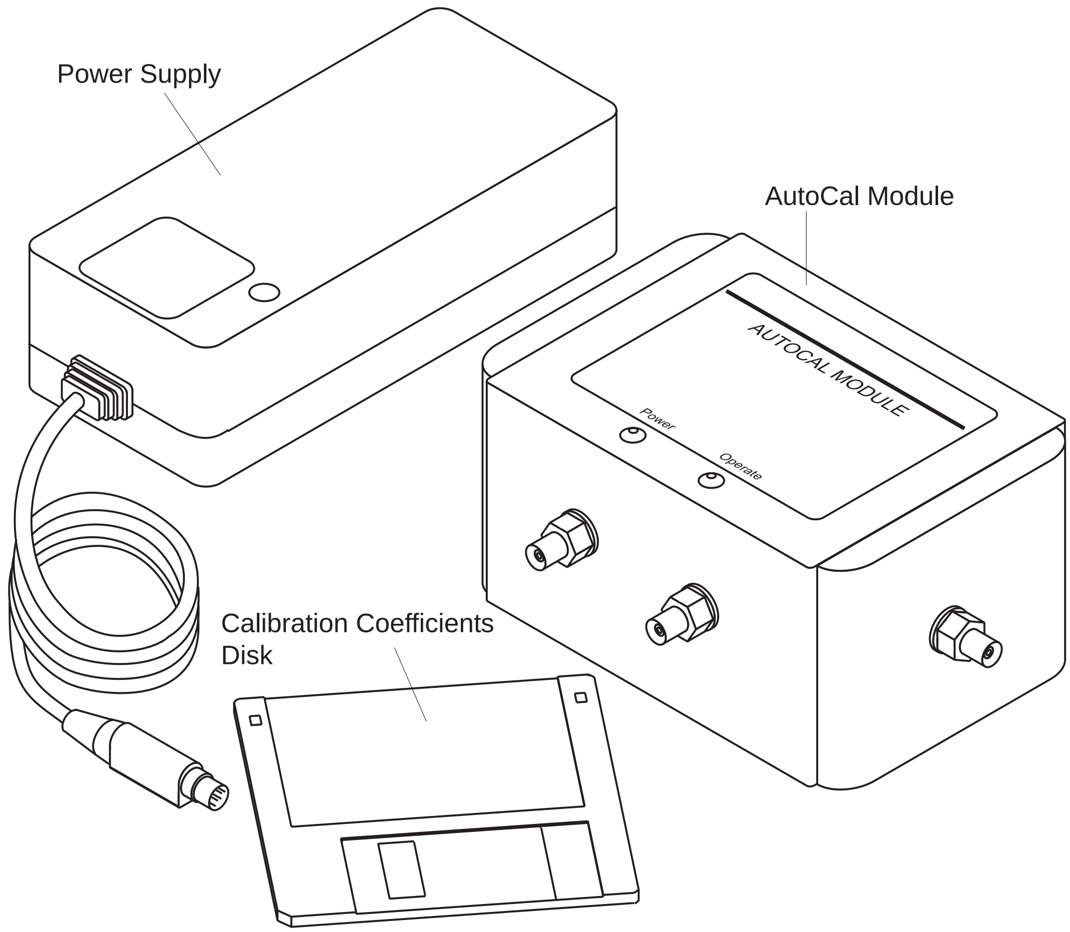


Figure 9-1. *AutoCal Module, Power Supply, and Cables*

Chapter 9
AutoCal

9-1 INTRODUCTION

This chapter provides a general description of the **AutoCal** calibrators, including specifications, setup, and the use of the associated software and on-line documentation. The RF series members are shown below. Throughout this manual, the term **AutoCal** will refer to the series. Individual models will be referred to by model number. Figure 9-1 shows the **AutoCal** module and all of its attaching parts.

Model	Switch	Freq. Range	Connector
36581NNF/1	Electronic	10MHz-6 GHz	N (Male)-N(Fem)
36581NNF/2	Electronic	10MHz-9 GHz	N (Male)-N(Fem)
36581KKF/1	Electronic	10MHz-6 GHz	K(Male)-K(Fem)
36581KKF/2	Electronic	10MHz-9 GHz	K(Male)-K(Fem)

9-2 DESCRIPTION

The **AutoCal** module provides an automatic system for fast, repeatable high-quality calibrations of a Vector Network Measurement System (VNMS). The **AutoCal** module is inserted between the VNMS test ports to perform the calibration. The **AutoCal** module is connected between Ports 1 and 2 (3-Port and 4-Port **AutoCal** procedures are found in Section 9-8). Refer to Figure 9-2 (page 9-6) for a diagram of the **AutoCal** connections.

The **AutoCal** module use solid-state electronic switches to exchange the internal calibration standards. The module does NOT contain isolation standards and requires a manual operation to perform this measurement.

A standard serial RS-232 interface cable is used to connect the **AutoCal** module to the MS462XX. Power is supplied by a connecting cable from a Universal power supply (+5V, +15V, -15V for the electronic modules; +5V, +24V for the mechanical modules). A power on-off switch is not provided. It is important to connect the power supply connecting cable to the **AutoCal** module **BEFORE** the power supply is connected to the wall outlet.

Test Port Cable Converters (Anritsu series 36583) are used during and after the calibration process to establish the desired test port connector type.

9-3 CALIBRATIONS

Four types of calibration can be performed using **AutoCal**:

One-Port: S_{11} 1-Port and S_{22} 1-Port are 1-port calibrations performed on the indicated port of the VNMS and are equivalent to the traditional Open-Short-Load calibrations.

Full 2-Port: This type is equivalent to the traditional Open-Short-Load-Thru (OSLT) calibration.

Thru Update: This type is a new form of calibration which is used to update an existing 12-term calibration in the VNMS. This calibration could have been performed using any method of calibration which yields 12 terms (LRL, LRM, **AutoCal,** or OSLT). Due to cable movement and aging, the calibration may have degraded over time. The Thru Update refreshes the calibration by measuring a Thru connection and updating the Transmission Tracking and Load Match calibration constants.

Adapter Removal: This calibration measures the characteristics of male-male or female-female test port cables for subsequent measurement of non-insertable devices. An adapter is required for this calibration. Adapter Removal requires two calibration procedures in order to calculate the parameters and electrical length of the adapter.

NOTE

If a full frequency range calibration is not required, modify the VNMS Setup Menu to reflect only the needed range. This will be useful when calibrating a 6 GHz or 9 GHz VNMS below 6 GHz or 9 GHz, respectively.

9-4 DEFINITIONS

The following terms are used in explaining the calibration procedure using the **AutoCal** module:

Thru: A *thru* is a connection of the two test ports. Two kinds of thru connections are defined for the **AutoCal** calibration: (1) a *Calibrator* thru is an internal path through the calibrator. (2) a *True* thru is a direct cable connection between the test ports, with no intervening connectors. The calibrator thru is not as accurate as a true thru, so the user has the option during a calibration to use the more accurate method, if necessary.

Isolation: For certain measurements which require accurate S_{21} or S_{12} readings for very small values of those parameters, an *isolation* step is required to characterize the leakage of the VNMS and test setup. The isolation step requires a manual operation for the **AutoCal** module. In order to achieve high accuracy for the characterization of the leakage, a high averaging factor is needed.

VNMS Measurement Averaging Factor: This factor is the averaging factor used by the VNMS when making measurements.

VNMS Video IF Bandwidth: This setting is the same as the value which can be set using the Avg key and **SELECT IF BANDWIDTH** soft key.

Characterization File: Each calibrator module has a file containing data which characterizes each standard in the calibrator. This file also contains information (identification number, start and stop frequencies) concerning the capabilities of the calibrator. Each characterization file has the extension ".acd". When modules are changed, the user must install the appropriate new characterization file. This file can be installed using the Save/Recall key to recall the characterization file from a disk.

9-5 PHYSICAL SETUP

See Figure 9-2 for an illustration of the connections necessary to perform an automatic calibration using the **AutoCal** module.

There is no on-off switch. When power is connected to the **AutoCal** module, the LED labeled POWER should come on immediately. The second LED, labeled OPERATE, should come on in about five minutes, after the internal temperature control oven has stabilized. (Internal temperature is held within a 5 ^{o}C window.)

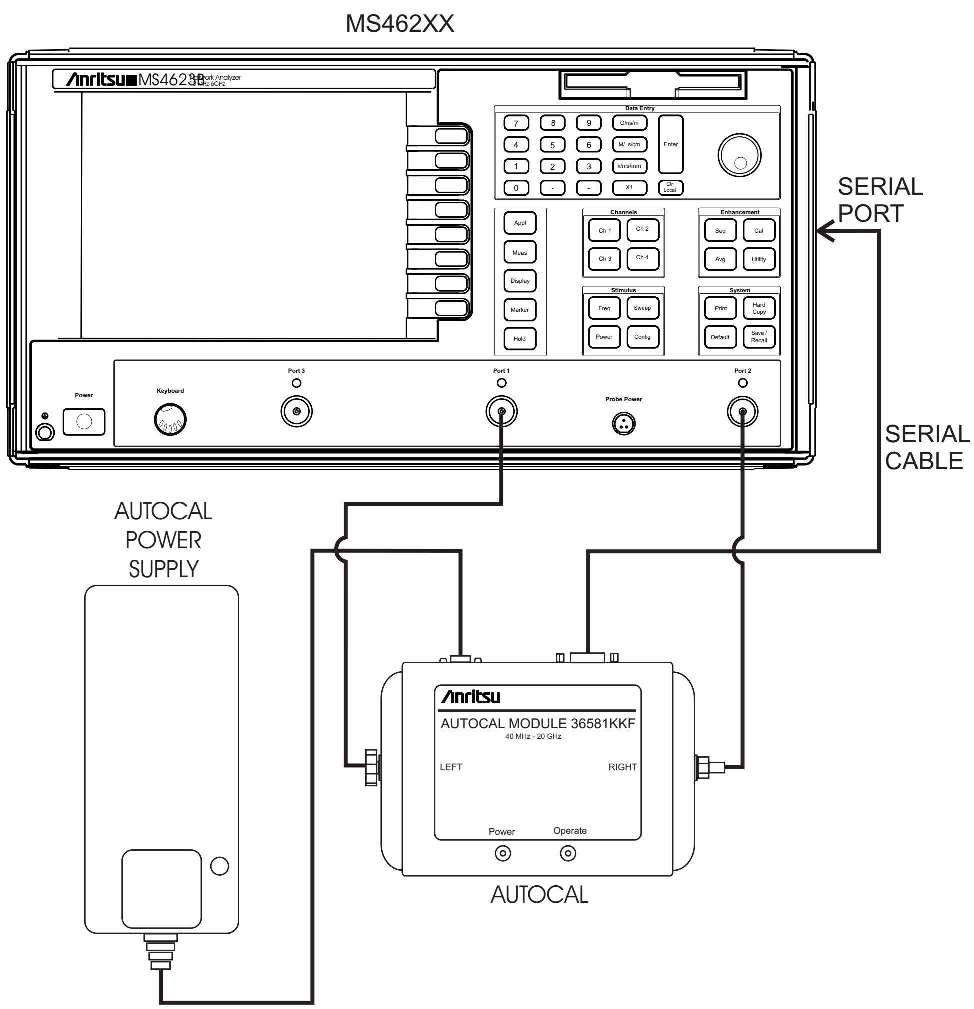


Figure 9-2. *AutoCal Equipment Setup*

9-6 CHARACTERIZATION FILES

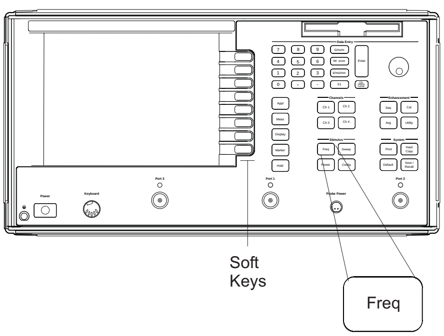
Before performing an **AutoCal** on a MS462XX, the Characterization File for the **AutoCal** Module must be loaded.

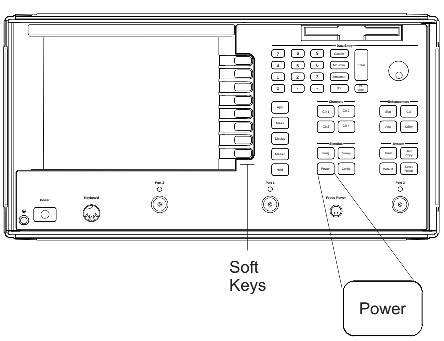
Insert the **AutoCal Module Characterization Disk** into the floppy drive. Press the Save/Recall key, then select **RECALL\AUTOCAL CHARACTERIZATION ON FLOPPY DISK**. Select the file "Sxxxxxx.ACD, where xxxxxx is the serial number of the **AutoCal** module.

If a copy of the Characterization File is in the hard-disk, you can recall it by choosing **RECALL\AUTOCAL CHARACTERIZATION ON HARD DISK** instead. Select the same file **"Sxxxxxx.ACD**".

9-7 USING AUTOCAL

An example procedure for using the **AutoCal** module is given below. This example assumes a frequency range of 10 MHz to 6 GHz, a power level of +0 dB, use of a Series 36581 **AutoCal** module. Refer to the menu key illustrations at left.





Step 1. Press the Freq key.

Step 2. Press the **START** soft key; enter "10" from the keypad and press the M/μs/cm Data Entry key.

Step 3. Press the **STOP** soft key; enter "6" from the keypad and press the G/ns/m Data Entry key.

Step 4. Press the Power key.

Step 5. Press the **SOURCE 1 SETUP, SOURCE 1 POWER** soft keys; enter "0" from the keypad and press the X1 Data Entry key.

Step 6. Press the Cal key.

Step 7. Press the **AUTOCAL** soft key.

Step 8. Press the **HELP** soft key to ON.

This activates a context-sensitive help screen that will appear for each **AutoCal** *function.*

The next selection depends on current instrument conditions: **THRU UPDATE** *lets you update the Thru calibration of an active 12-term Calibration. This updates the transmission frequency response and load match coefficients.*
APPLY LAST CAL SETUP *lets you to repeat the last calibration setup without going through all the*

menus again.
CHANGE CAL SETUP *lets you set up a new calibration, which is what we will do for this example.*

Step 9. Press the **CHANGE CAL SETUP** then **FULL 2-PORT** soft keys.

You could also have selected **S11 1-PORT, S22 1-PORT** *or* **ADAPTER REMOVAL** *soft keys (paragraph 9-3). The latter lets you remove the effect of an adapter used in the calibration.*

If a more accurate calibration is required, you can increase the number of averages for each impedance standard by pressing the **NUMBER OF AVERAGES** *soft key.*

Step 10. Press the **SELECT PORTS** soft key and a configuration that matches the physical setup (R=1, L=2 for this example).

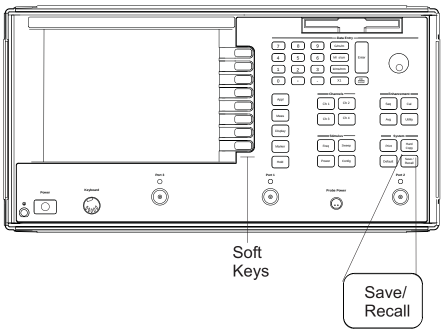
It is critical to ensure the correct module orientation is established; each side (left and right) of the module is labeled.

Step 11. Observe that **CALIBRATOR** is shown for the **SELECT THRU TYPE** soft key.

By default, the internal thru standard is used for the Thru Calibration. The transmission response of the calibration may be improved by selecting a True Thru. This will result in a manual step, however.

Step 12. Observe that **OMIT** is shown for the **ISOLATION AVERAGING** soft key.

Isolation may be omitted (default), or included. If included, the Select Isolation Averaging soft key menu lets you set the **AVERAGING FACTOR** *or use the* **DEFAULT** *value during the isolation step. Including isolation involves a manual step for the 36581 models.*



Step 13. Ensure the **AutoCal** module is properly connected between Ports 1 and 2, then press the **START CAL** soft key (**AutoCal** main menu).

Follow the instructions and do not disturb the setup during the calibration. A typical Full 2-Port Cal with 401 data points should take about one minute. Please note that you should not start a calibration until the yellow LED on the **AutoCal** *Module is lit. This will ensure accurate calibration of the VNMS.*

*After the Calibration, select **Save/Recall** to save the calibration data, as shown in the following steps. Alternatively, you could press **Enter** to apply the calibration.*

Step 14. Press the Save/Recall key.

Step 15. Press the **SAVE\FRONT PANEL SETUP AND CAL DATA ON HARD DISK** (or **ON FLOPPY DISK**) soft keys.

Step 16. Enter a file name using the name editor or an external keyboard.

9-8 4-PORT AUTOCAL

This section describes how to setup and use the 4-Port **AutoCal** module. Once setup, the use of the module is illustrated through discussion of the MS462XX firmware and associated help screens. This section covers two models:

- 36584KF 10 MHz to 9 GHz K female connectors, 4-Ports
- 36584NF 10 MHz to 9 GHz N female connectors, 4-Ports

4-Port AutoCal Description

The 4-Port **AutoCal** module provides an automatic system for fast, repeatable, high-quality calibrations of a multiport Vector Network Measurement System (VNMS), such as the MS462XX. The 4-Port **AutoCal** module can be used to perform 1, 2, 3 and 4-Port calibrations on any MS462XX VNMS. 4-Port calibrations can only be performed on a 4-Port VNMS.

The 4-Port **AutoCal** module uses electronic switches to exchange the internal calibration standards. Isolation standards are not included in the module; however, isolation calibration steps can be performed using external terminations.

Like the 2-Port **AutoCal** module, a standard RS-232 serial cable is used to connect the 4-Port **AutoCal** module to the MS462XX. Power is supplied by a connecting cable from a universal power supply (+5V, +15V, -15V). A power on/off switch is not provided. The power supply cable should be connected to the **AutoCal** module **BEFORE** connecting the line cord to the wall outlet.

The 4-Port **AutoCal** module ships with a power supply and attached cable, a serial interface cable, and a disk containing a characterization file.

As with the 2-Port **AutoCal** version, software operation falls into three broad categories:

Calibration Calibration is the process of calibrating the instrument using the **AutoCal** module. The **AutoCal** module is connected between the VNMS test ports to perform the calibration. The **AutoCal** port connectors are all female since this matches the configurations used most often during measurements. If other connector matings are needed, phase equal insertables (PEIs) can be used and are available as 375XR/1 in sets of 5. Contact the factory for more details or for information on different connector types.

NOTE

MS462XX firmware version 1.15 or later is required for automatic operation.

Assurance

Assurance is the process of validating a calibration. This is done by comparing the measurement of a standard within the **AutoCal** module with previously stored measurement results.

A standard of intermediate match and insertion loss is built into the **AutoCal** module and measured at the time of characterization. Assurance is invoked under:

Utility/Diagnostics/**AutoCal** Assurance

The item is then measured again and the results are compared to those of the original measurement. If they agree within computed uncertainties, then the assurance test will pass. If the test has not passed, the module may not be properly connected or the characterization has drifted out of specification. If checking connections/cables does not help, then a re-characterization (either by the user or by the factory) may be required.

The issue of calibration uncertainties in general and **AutoCal** uncertainties specifically are addressed in separate application notes. Consult the factory or your sales representative for more information.

Assurance may or may not be available depending on the firmware version, see the latest application guide or consult the factory.

Characterization

Characterization is the process of characterizing the **AutoCal** module based on a good calibration obtained by other means. The characterization is performed by the factory at the time of manufacture and then typically re-characterized every 6 months. You may also perform a re-characterization if the module is operated in a harsh environment or if you desire a higher characterization point density in a given frequency range.

To help understand the last point, note that factory characterization must be done over the full frequency range of the module (10 MHz- 9 GHz) using the maximum calibration point count (1601). As a result, Auto Calibrations performed over smaller frequency ranges will have a lower point density than may be desired. The resulting interpolation error is typically very small but if an issue, you can perform a characterization over a smaller frequency range (or ranges) with a desired point count.

Remember that the **AutoCal** is a transfer standard and the resulting calibration will only be as good as the original characterization. Depending on connector types, use PEIs or non-zero length thrus (consult *Three and Four Port S-parameters*). Consider using sliding loads (in the 365X series of calibration kits) or the higher performance fixed loads of the 375XR calibration kits.

The characterization process is performed by measuring the various standards in the module sequentially and is accessed under:

Utility/**AutoCal** Characterization

The **AutoCal** module must be connected as indicated by the port assignment. When completed, the characterization file can be saved to hard disk or floppy disk. The file name must be of the form Sxxxxxx.ACD where the .ACD extension will automatically be added.

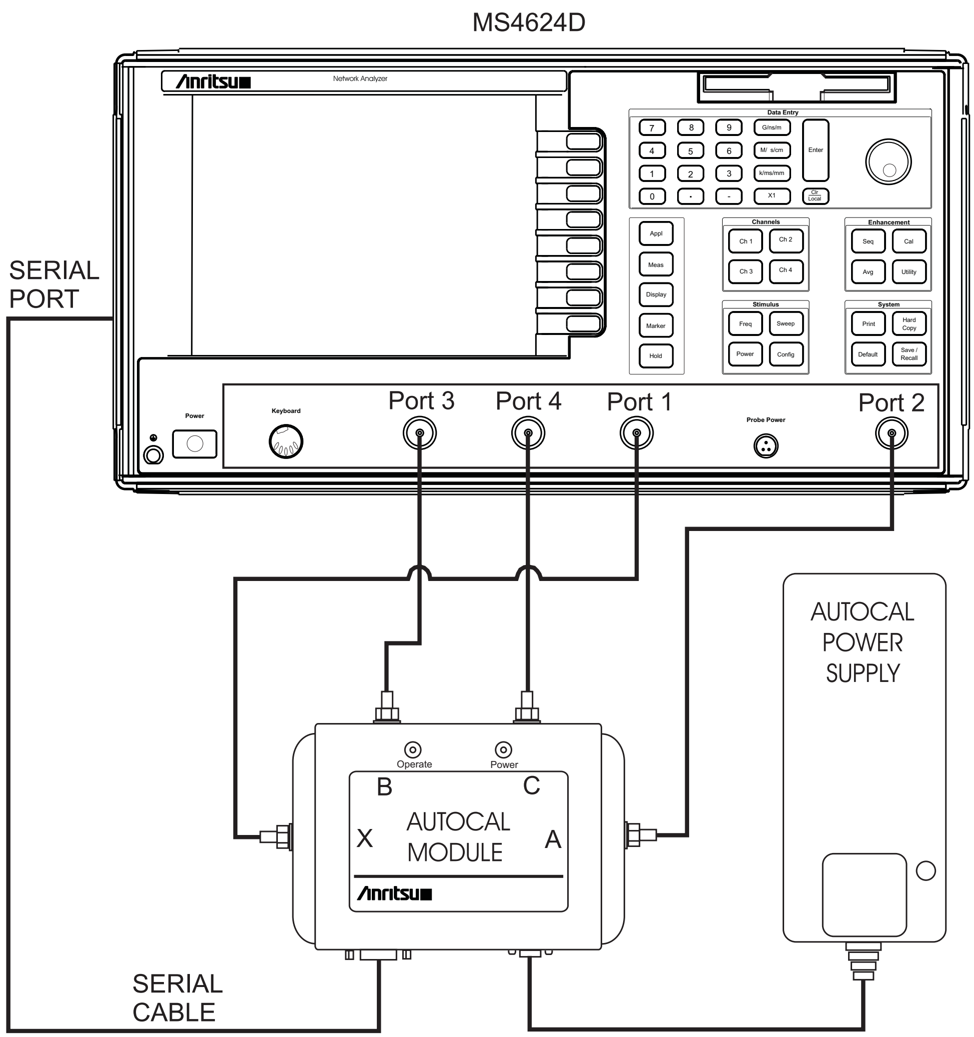


Figure 9-3. *4-Port AutoCal Equipment Setup*

4-Port AutoCal Setup

Figure 9-3 shows the connections necessary for the operation of the 4-Port **AutoCal** module. These include:

- ❑ Power supply (connect the cord to the **AutoCal** module first, then to the wall outlet)
- ❑ Serial cable connected from the **AutoCal** module to the rear panel of the VNMS
- ❑ RF cables connected from the VNMS Port connectors to the **AutoCal** module (unused RF connections may remain disconnected)

The RF cable connections will be dependent on the type of calibration being done and on the port assignments. By default, the connections are done as follows:

AutoCal Port X to VNMS Port 1

AutoCal Port A to VNMS Port 2

AutoCal Port B to VNMS Port 3 (used for 3 or 4-Port calibrations)

AutoCal Port C to VNMS Port 4 (used only for 4-Port calibrations)

Only some of these port combinations may be used with a 2 or 3-Port VNMS. If a reflection-only cal is being performed, then only one port combination is required. If a port is not being used (on either the VNMS or **AutoCal** module), nothing needs to be connected to the open port.

Additional port assignments may be possible. Consult the help screens on the instrument or the latest application notes/application guide for details.

4-Port AutoCal Operation

When power is first applied, the POWER LED on the **AutoCal** module will illuminate. The OPERATE LED will only come on after the module has warmed up (typically 2-5 minutes). DO NOT perform an auto calibration (or characterization or assurance) until the OPERATE LED is on.

The characterization file for the **AutoCal** module must first be loaded. This typically comes on a floppy from the factory. The characterization file may be loaded from:

Save-Recall/Recall/**AutoCal** Characterization.

Once connected (and the OPERATE LED is illuminated), the calibration can be started by proceeding to the calibration menu and selecting **AutoCal** and the appropriate calibration type. The number of averages may be adjusted if necessary (see specifications section for definitions), but the default values are usually adequate. Isolation averaging may also be selected here or the isolation step may be omitted (this is the default). Note the port assignment on these menus/help screens to be sure the module is connected correctly. When prompted, hit ENTER and the various standards within the module will be sequentially measured and the calibration coefficients computed. For more information on the calibration computation process, consult the application notes *Three and Four Port S-parameters* and *AutoCal*. Once completed, the calibration can be saved to hard disk or floppy disk for later recall.

AUTOCAL ASSURANCE
MANUAL CONTROL

CONNECT PATH
▶PORT X-A

PORT X-B

PORT X-C

SELECT
CAL STANDARD

PERFORM
ASSURANCE

HELP OFF

RETURN

SELECT CAL
STANDARD

OPEN

SHORT

▶LOAD

THRU

ASSURANCE

HELP OFF

RETURN

Manual Control

While rarely needed, the standards within the **AutoCal** module can be manually selected under:

Utility/Diagnostics/**AutoCal** Assurance

The individual paths and standards can then be selected. Refer to the menu illustrations to the left. Figure 9-4 shows the internal connections within the **AutoCal** module and what the standards selection mean. The reflection standards are labeled:

Load (L)

Short (S)

Open (O)

These are just convenient designators for three distinct complex impedances. Since the **AutoCal** module is a transfer standard, the exact impedances are not important as long as they are stable and distinct. An error message will appear if the **AutoCal** module is not connected and powered when selecting these standards/paths. The calibration standard type will always be the same for the 2 ports of the selected path.

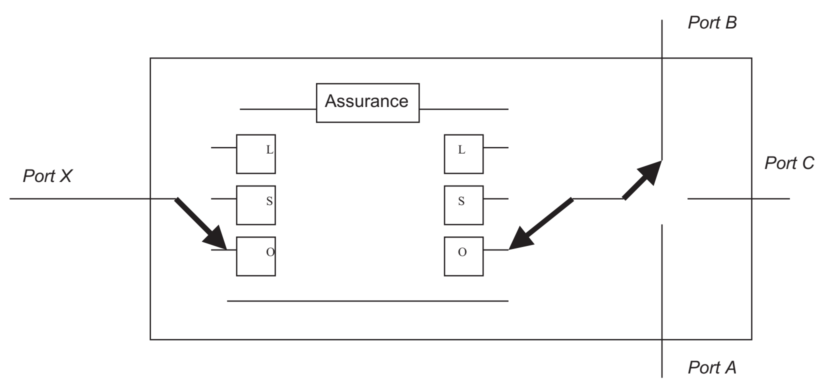


Figure 9-4. *4-Port AutoCal Block Diagram*

9-9 PIN DEPTH SPECIFICATIONS

The depth of the center pin on connectors is a critical specification, which if not met, can cause damage to mating connectors. Table 9-1 provides pin-depth specifications for associated **AutoCal** connectors and Table 9-2 provides pin depth examples.

Table 9-1. *AutoCal Module Connector Pin Depth Specifications*

Device	Connector	Pin Depth (inches)
3658XXX	K-Female	+0.0000 to -0.005
3658XXX	K-Male	+0.0000 to -0.005
3658XXX	N-Female	*[0.207](+0.000, -0.005)
3658XXX	K-Female	*[0.207](+0.000, -0.005)
32K50 32KF50	K-Male (cable side)	**Negative Indication
	K-Female	+0.0000 to -0.0005
	K-Male (DUT side)	+0.0000 to -0.0005
32L50 32LF50	K-Male (cable side)	**Negative Indication
	3.5mm-Female (DUT side)	+0.006 to -0.008
	3.5mm-Male (DUT side)	+0.006 to -0.008
32S50 32SF50	K-Male (cable side)	**Negative Indication
	SMA-Female (DUT side)	+0.0005 to -0.0015
	SMA-Male (DUT side)	+0.0005 to -0.0015

Gauging Type N Connectors:* The actual value of a Type N master gauge block will always vary to some degree from the desired nominal value. The recorded measured value of the master gauge must be observed when calibrating the Pin Depth Gauge to the desired nominal value. Although the **AutoCal Module Pin Depths are not critical, this information may be helpful in the measurement of Type N mating components. Examples are shown in Table 9-2, on the following page.

Table 9-2. *Checking Connector Pin Depth (Example)*

Example 1:		
FEMALE MASTER GAUGE BLOCK (protrusion)		
	Desired nominal value:	0.2070
Case1	Actual value of master gauge	0.2071 (protrusions 0.0001 more than desired)
	Gauge should be set to indicate:	+0.0001
Case2	Actual value of master gauge	0.2069 (protrusions 0.0001 less than desired)
	Gauge should be set to indicate:	-0.0001
Example 2:		
MALE MASTER GAUGE BLOCK (cavity)		
	Desired nominal value:	0.2070
Case1	Actual value of master gauge	0.2071 (cavity 0.0001 deeper than desired)
	Gauge should be set to indicate:	-0.0001
Case2	Actual value of master gauge	0.2069 (cavity 0.0001 shallower than desired)
	Gauge should be set to indicate:	+0.0001

Chapter 10
Operational Checkout Procedures

Table of Contents

Repair

WARNING ⚠

WARNING

This equipment can not be repaired by the operator. DO NOT attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

Chapter 10
Operational Checkout Procedures

10-1 INTRODUCTION

This chapter provides quick operational checkout procedures that may be used to ensure that the Model MS462XX Vector Network Measurement System is operational. For the full performance verification procedure, refer to the Series MS462XX Maintenance Manual, Anritsu Part Number 10410-00205.

10-2 CONVENTIONS

Refer to Chapter 1, paragraph 1-13, for an explanation of the typographic conventions used to document the procedures.

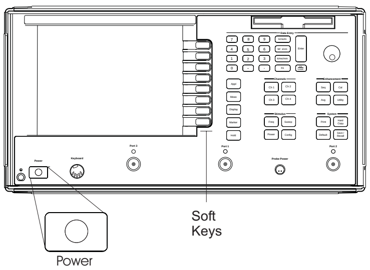
10-3 REQUIRED EQUIPMENT

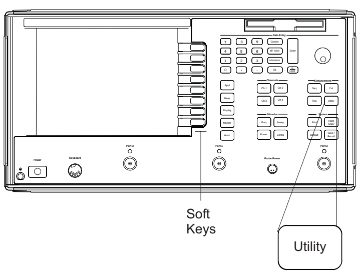
The following items are needed to perform the tests in this chapter:

- ❑ Flexible microwave cable (through line)
- ❑ Short and Open

10-4 SELF TEST

Perform an instrument self test to ensure that the MS462XX is operating properly.





Step 1. Press Power (top left) to On.

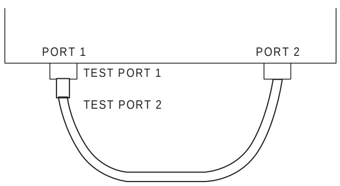
Step 2. Press Utility (bottom left).

Step 3. Press **DIAGNOSTICS/START SELF TEST** to begin the self test.

Step 4. Verify that the unit passes self test.

10-5 MS462XA/B NON-RATIO PARAMETERS TEST

This test verifies that each individual receiver channel operates properly. Measurement calibration of the system is *not* required for this test.

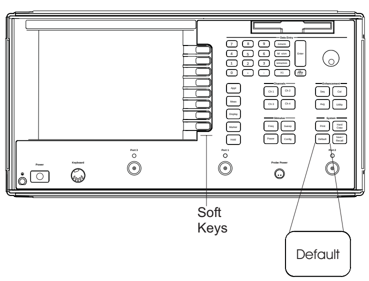


Preliminary Perform the steps in paragraph 10-4.

Test Setup Setup MS462XX as described below:

Step 1. Connect Ports 1 and 2 together using a high-quality through line (top left).

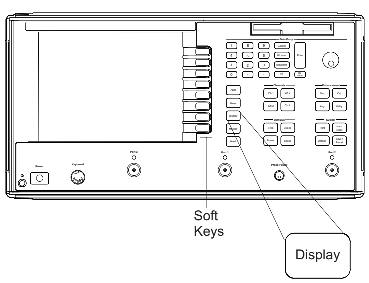
Step 2. Press Default (middle left) then **CONTINUE** to re-set the MS462XX to its factory-default settings.



Test Procedure Perform the test as described below:

Step 3. Observe the displayed FREQUENCY menu and note that the **START** and **STOP** values are the low- and high-end frequencies.

Step 4. Press Display (middle left).

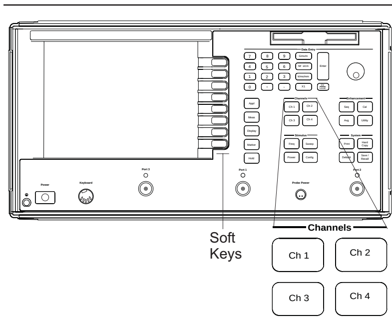


Step 5. Press **DISPLAY MODE**/**DUAL CHANNEL 1 & 3** (MS462XXA) or **FOUR CHANNELS** (MS462XXB).

Step 6. Press **RETURN.**

Step 7. Press **GRAPH TYPE.**

Step 8. *For MS462XA:* Press **MORE** twice then **LOG MAGNITUDE**, Ch 3 (bottom left), **MORE**, then **LOG MAGNITUDE.**
F*or MS462XB:* Press Ch 1, **MORE** twice then **LOG MAGNITUDE**, Ch 2, **MORE** then **LOG MAGNITUDE**, Ch 3, **MORE** then **LOG MAGNITUDE**, Ch 4, **MORE** twice then **LOG MAGNITUDE**.



Step 9. Press **RETURN**.

Step 10. Press **SCALE**/**RESOLUTION**

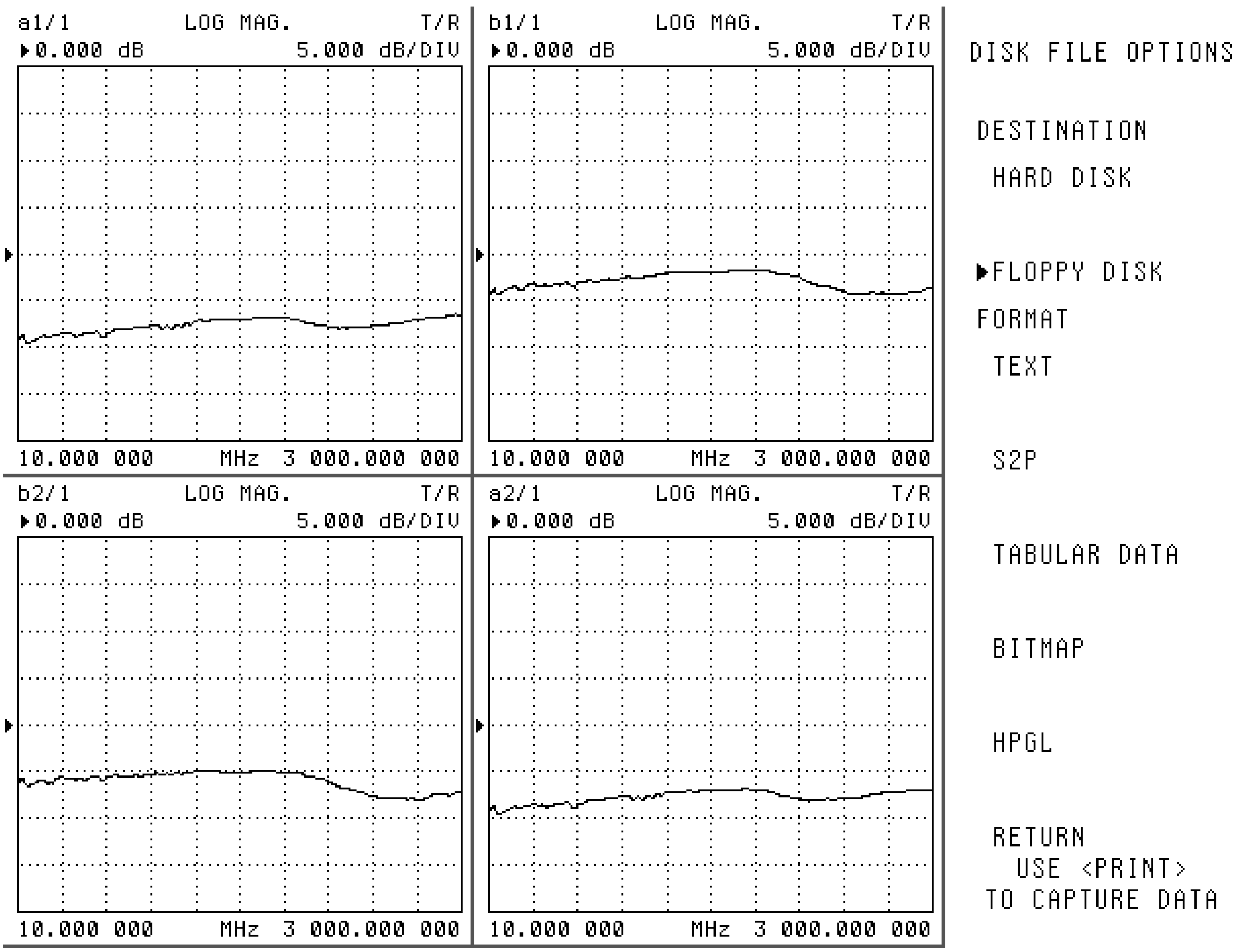
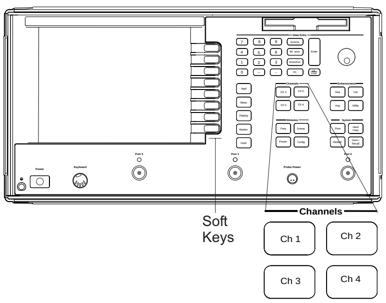
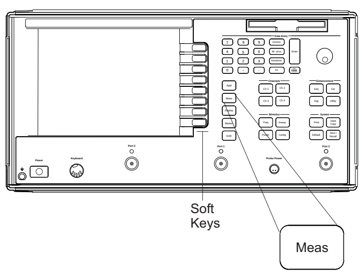


Figure 10-1. *Non-Ratioed Parameter Waveform*





Step 11. *For MS462XA:* Press Ch1 (top left) and set resolution for 5 dB (use "5" and "X1" Data Entry keys); press Ch3 and set resolution for 5 dB.
For MS462XB: Press Ch 1 and set resolution for 3 dB, press Ch 2 and set resolution for 3 dB; press Ch 3 and set resolution for 3 dB, press Ch 4 and set resolution for 3 dB.

Step 12. Set **REFERENCE VALUE** to –5 dB on all channels.

Step 13. Press Ch 1 (top left), then Meas (middle left).

Step 14. Press **USER DEFINED/USER 2/CHANGE RATIO**, then make **a1** (numerator) and **1** (denominator).

Step 15. Press Ch 3 (top left), **USER 1/CHANGE RATIO,** then make **b2** (numerator) and **1** (denominator).

Step 16. Press Ch 2 (top left), **USER 3, CHANGE RATIO,** then make **b1** (numerator) and **1** (denominator).

Step 17. Press Ch 4 (top left). Select **USER 4/CHANGE RATIO,** then make **a2** (numerator) and **1** (denominator).

Step 18. After at least one sweep has occurred, verify that the maximum-value to minimum-value amplitude slope (Figure 10-1, page 10-6) meets the specifications shown below.

Model	High-End Frequency	Test Channel Slope (b1/1 & b2/1)	Reference Channel Slope (a1/1 & a2/1)
MS4622A	3 GHz	5 dB	5 dB
MS4622B	3 GHz	5 dB	6 dB
MS4623A	6 GHz	7 dB	10 dB
MS4623B	6 GHz	7 dB	10 dB

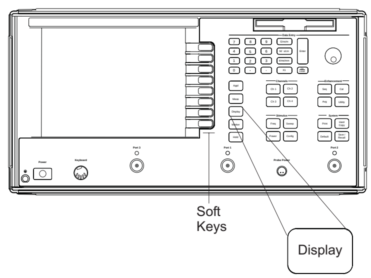
Step 19. Verify that the minimum amplitude meets the specifications shown below.

NOTE
If desired, use the Readout Markers function (Marker key (left) and Readout Marker soft key) to obtain precise frequency and amplitude values.

Model	Test Channel (b1/1 & b2/1)	Reference Channel (a1/1 & a2/1)
MS4622A	–12 dB	–11 dB
MS4622B	–10 dB	–13 dB
MS4623A	–14 dB	–11 dB
MS4623B	–11 dB	–14 dB

3-Port VNMSs

Step 20. Connect a Short to Port 3.



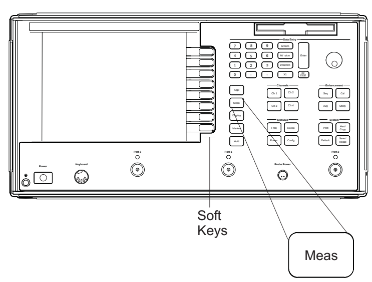
Step 21. Press Display (top left).

Step 22. Press **DISPLAY MODE/DUAL CHANNELS 1&3**.

Step 23. Press Meas (middle left).

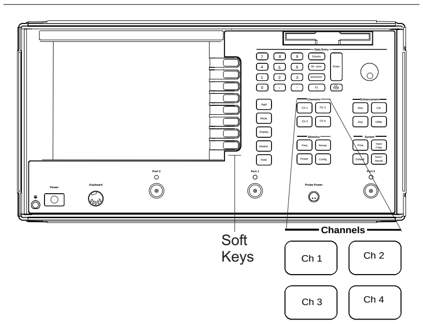
Step 24. Press Ch1 (bottom left).

Step 25. Press the following soft keys in sequence.
MORE
S33
MORE
USER DEFINED
CHANGE RATIO, then make **a3** (numerator) and **1** (denominator).



Step 26. Press Ch3.

Step 27. Press the following soft keys in sequence.
RETURN
MORE
S23
MORE
USER DEFINED

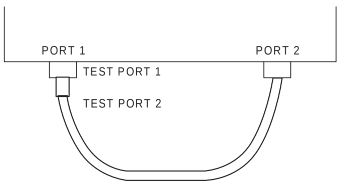


Step 28. Press **USER 6/CHANGE RATIO,** then make b3 (numerator) and 1 (denominator).

Step 29. Verify that slope and minimum amplitude are within the specifications given in Step 16 and Figure 10-1.

10-6 MS462XA/B HIGH LEVEL NOISE TEST

The following test verifies that the high-level signal noise in the MS462XX will not significantly affect the accuracy of subsequent measurements. Calibration of the system is *not* required for this test.

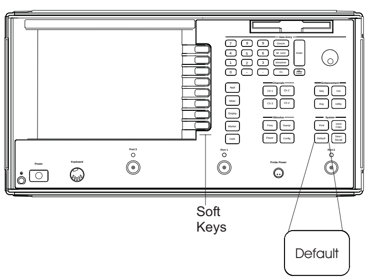


Preliminary Perform the steps in paragraph 10-4.

Test Setup Setup the MS462XX as described below:

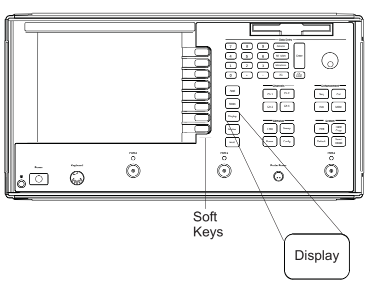
Step 1. If instrument is a MS4623A or MS4623B, change **STOP** frequency to 3 GHz.

Step 2. Press Default (middle left) then the **"0"** key to reset the MS462XX to its factory-default settings.



Test Procedure Perform the test as described below:

Step 3. Press Display (middle left).



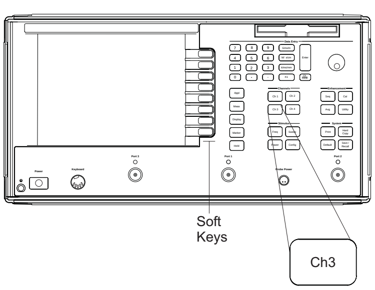
Step 4. Press **DISPLAY MODE**, **SINGLE CHANNEL** (MS462XA) or **DUAL CHANNEL 1 & 3** (MS462XB).

Step 5. Press **RETURN.**

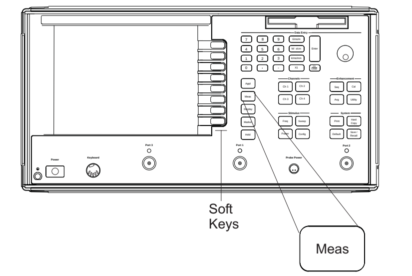
Step 6. Press **GRAPH TYPE.**

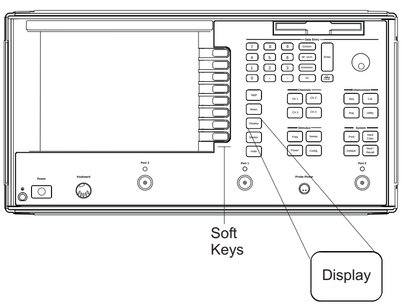
Step 7. *For MS462XA:* Press **MORE** twice then **LOG MAGNITUDE**,
F*or MS462XB:* Press **MORE** twice then **LOG MAGNITUDE**.

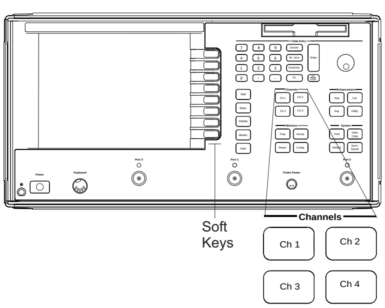
Step 8. Press Ch 3 (bottom left), **MORE** then **LOG MAGNITUDE.**

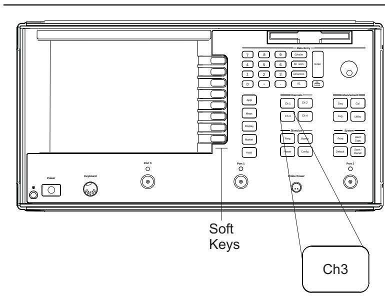


Step 9. Press **RETURN**.









Step 10. For MS462XB, press Meas (top left) then Ch 1 (middle left). Select **S12**.

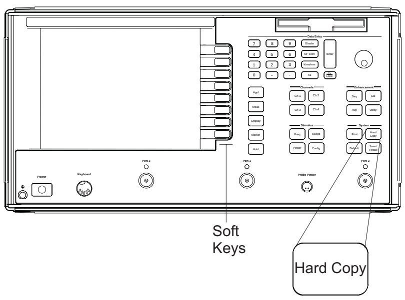
Step 11. Press Display (middle left), **TRACE MEMORY/ VIEW DATA**.

Step 12. After at least one sweep has occurred, press **STORE DATA TO MEMORY/VIEW DATA (/) MEMORY.**

Step 13. *For MS462XB*, perform steps 13 and 30; for MS462XA, skip to step 31.

Step 14. Press Ch 3 key (bottom left).

Step 15. Repeat steps 9 and 10.



Step 16. Press Hard Copy key (top left).

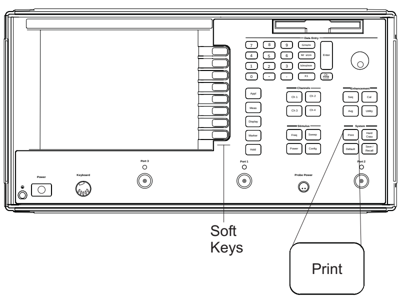
Step 17. Select **OUTPUT DEVICE** then **DISK FILE**.

Step 18. Press **RETURN**.

Step 19. Select **OUTPUT SETUP** then **FLOPPY DISK**.

Step 20. Press **RETURN**.

Step 21. Insert a formatted 1.44 MB floppy disk into the MS462XX floppy disk drive; then press Print (bottom left).



Step 22. Select **CREATE NEW FILE**.

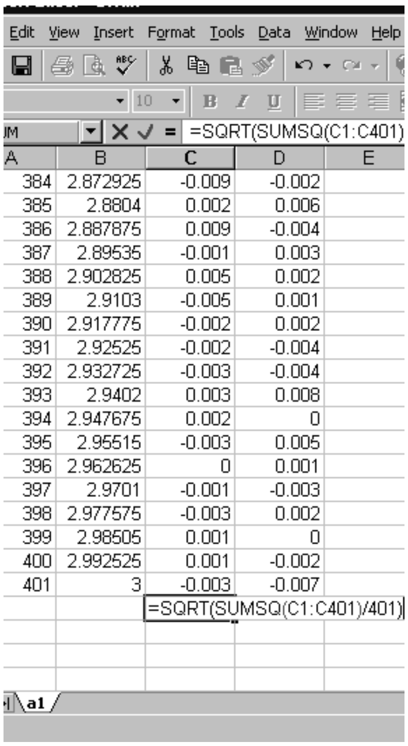
Step 23. Enter an appropriate filename and save the data to floppy disk.

Step 24. Open this text file using the *Notepad*[1] text editor.

Step 25. Delete all header information and resave the file. (See Figure 10-2 on page 10-14. This figure shows the *Notepad* file before and after the header lines are deleted.)

Step 26. Open the text file using the *Excel*[2] spreadsheet program. (See Figure 10-3 on page 10-15 and follow the steps shown to open this file.)

1, 2 *Notepad* and *Excel* are registers trademarks of Microsoft Corp.



A	B	C	D	E
384	2.872925	-0.009	-0.002	
385	2.8804	0.002	0.006	
386	2.887875	0.009	-0.004	
387	2.89535	-0.001	0.003	
388	2.902825	0.005	0.002	
389	2.9103	-0.005	0.001	
390	2.917775	-0.002	0.002	
391	2.92525	-0.002	-0.004	
392	2.932725	-0.003	-0.004	
393	2.9402	0.003	0.008	
394	2.947675	0.002	0	
395	2.95515	-0.003	0.005	
396	2.962625	0	0.001	
397	2.9701	-0.001	-0.003	
398	2.977575	-0.003	0.002	
399	2.98505	0.001	0	
400	2.992525	0.001	-0.002	
401	3	-0.003	-0.007	
		=SQRT(SUMSQ(C1:C401)/401)		

Step 27. Enter the following formula in the cell that follows the last data point (top left).

SORT(SUMSQ(X1:X401)/401)
Where X is the column letter in the spreadsheet

Step 28. Observe that the calculated result is as follows:

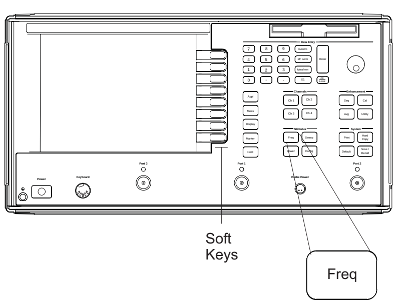
10 to 3000 MHz	<0.008
3000 to 6000 MHz	<0.018

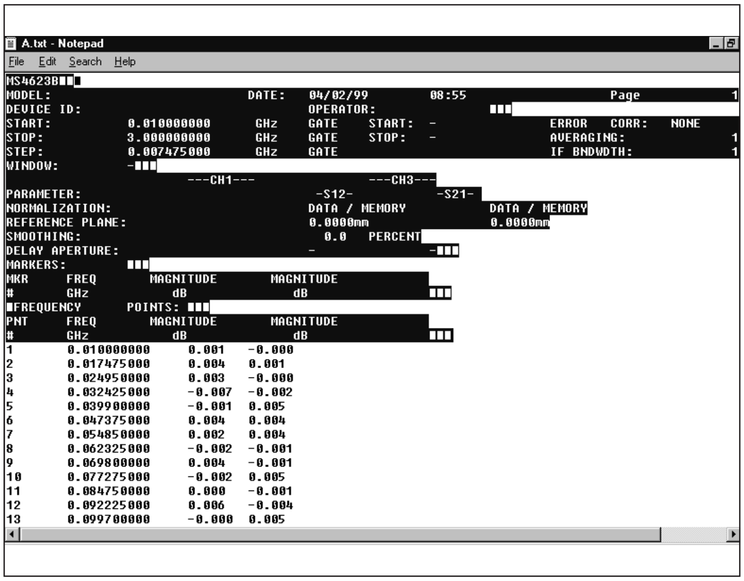
Step 29. For MS4623A and MS4623B, perform steps 28 and 29; for MS4622A or MS4622B, skip to step 31.

Step 30. Press Freq key (bottom left).

Step 31. Change **STOP** frequency to 6 GHz and **START** frequency to 3 GHz.

Step 32. Repeat steps 12 through 26.





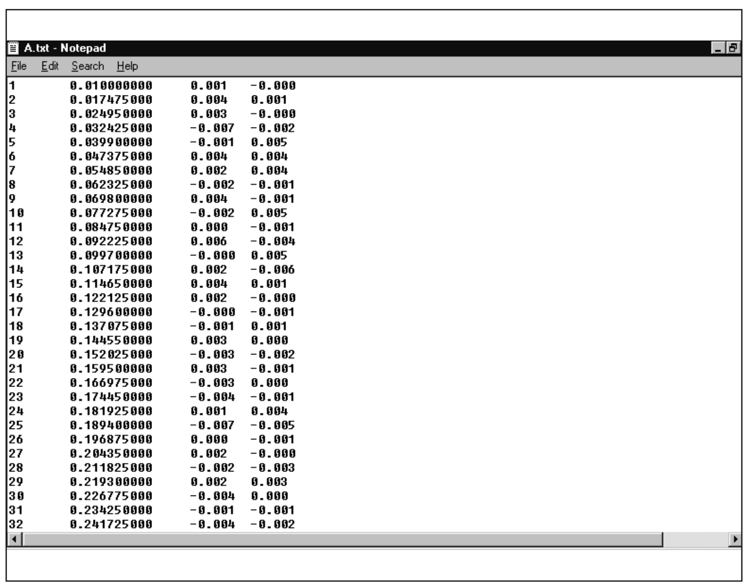
A.txt - Notepad

File Edit Search Help

```
MS4623B
MODEL:                          DATE:   04/02/99        08:55                   Page        1
DEVICE ID:                              OPERATOR:
START:          0.010000000     GHz     GATE    START:  -               ERROR   CORR:   NONE
STOP:           3.000000000     GHz     GATE    STOP:   -               AVERAGING:          1
STEP:           0.007475000     GHz     GATE                            IF BNDWDTH:         1
WINDOW:         -
                        ---CH1---               ---CH3---
PARAMETER:                               -S12-          -S21-
NORMALIZATION:                          DATA / MEMORY           DATA / MEMORY
REFERENCE PLANE:                        0.0000mm                0.0000mm
SMOOTHING:                                0.0   PERCENT
DELAY APERTURE:                         -               -
MARKERS:
MKR     FREQ        MAGNITUDE       MAGNITUDE
#       GHz            dB              dB
FREQUENCY       POINTS:
PNT     FREQ        MAGNITUDE       MAGNITUDE
#       GHz            dB              dB
1       0.010000000     0.001   -0.000
2       0.017475000     0.004   0.001
3       0.024950000     0.003   -0.000
4       0.032425000     -0.007  -0.002
5       0.039900000     -0.001  0.005
6       0.047375000     0.004   0.004
7       0.054850000     0.002   0.004
8       0.062325000     -0.002  -0.001
9       0.069800000     0.004   -0.001
10      0.077275000     -0.002  0.005
11      0.084750000     0.000   -0.001
12      0.092225000     0.006   -0.004
13      0.099700000     -0.000  0.005
```

Header text is shown highlighted.

Header text has been deleted.

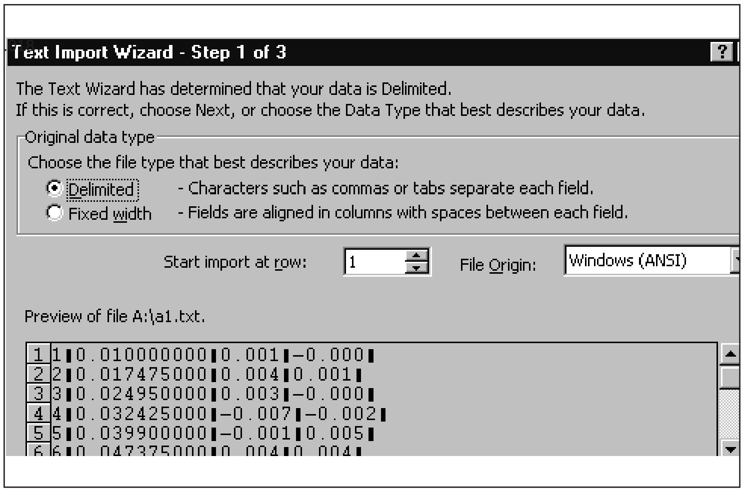


A.txt - Notepad

File Edit Search Help

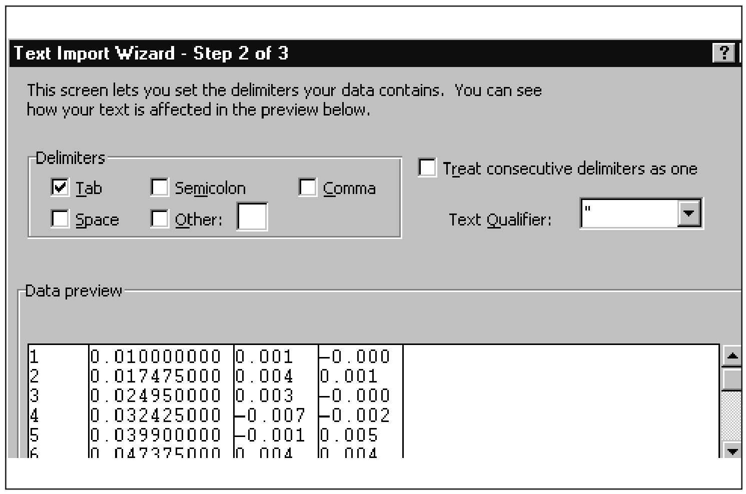
```
1       0.010000000     0.001   -0.000
2       0.017475000     0.004   0.001
3       0.024950000     0.003   -0.000
4       0.032425000     -0.007  -0.002
5       0.039900000     -0.001  0.005
6       0.047375000     0.004   0.004
7       0.054850000     0.002   0.004
8       0.062325000     -0.002  -0.001
9       0.069800000     0.004   -0.001
10      0.077275000     -0.002  0.005
11      0.084750000     0.000   -0.001
12      0.092225000     0.006   -0.004
13      0.099700000     -0.000  0.005
14      0.107175000     0.002   -0.006
15      0.114650000     0.004   0.001
16      0.122125000     0.002   -0.000
17      0.129600000     -0.000  -0.001
18      0.137075000     -0.001  0.001
19      0.144550000     0.003   0.000
20      0.152025000     -0.003  -0.002
21      0.159500000     0.003   -0.001
22      0.166975000     -0.003  0.000
23      0.174450000     -0.004  -0.001
24      0.181925000     0.001   0.004
25      0.189400000     -0.007  -0.005
26      0.196875000     0.000   -0.001
27      0.204350000     0.002   -0.000
28      0.211825000     -0.002  -0.003
29      0.219300000     0.002   0.003
30      0.226775000     -0.004  0.000
31      0.234250000     -0.001  -0.001
32      0.241725000     -0.004  -0.002
```

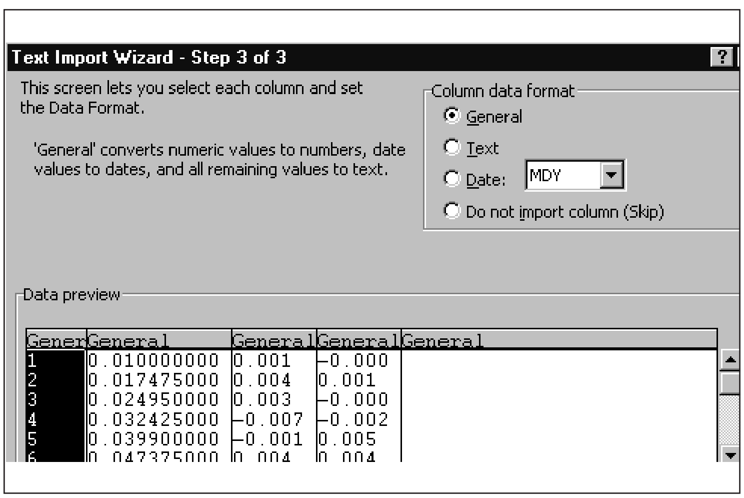
Figure 10-2. *Notepad File Examples*



Select “Delimited” in the first Excel dialog box (left)

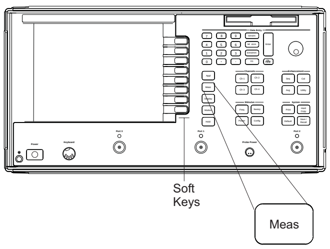
Select “Tab” as the delimiter in the second Excel dialog box (right)





Select “General” for the data format in the third Excel dialog box (left)

Figure 10-3. *Excel Dialog Boxes*

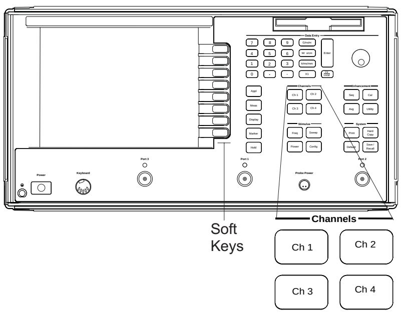


Step 33. Press Meas (top left).

Step 34. *For MS462XA*, press **S11**.
For MS462XB, press Ch 1 then **S11;** press Ch 3 then **S22** (middle left).

Step 35. Connect a Short to Test Port 1 and an Open to Test Port 2.

Step 36. Repeat steps 12 thru 30.



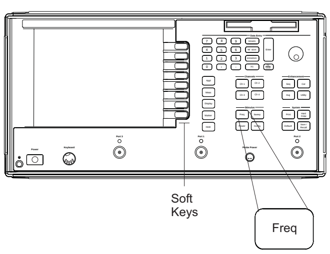
For MS462XB with Option 3A or 3B installed.

Step 37. Press Freq key (middle left).

Step 38. For MS4623B, change **START** frequency to 10 GHz and **STOP** frequency to 3 GHz.

Step 39. Press Ch 1 key (middle left).

Step 40. Press Meas key (top left) then **MORE/S33**.

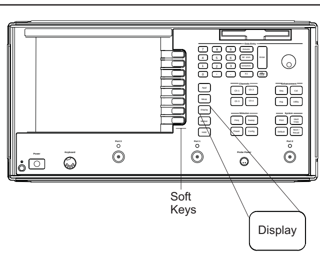


Step 41. Connect a Short to Test Port 3.

Step 42. Press Display key (bottom left) then **DISPLAY MODE/SINGLE CHANNEL**.

Step 43. Repeat steps 9 and 10.

Step 44. Repeat Steps 19 through 26.



Step 45. For MS4623B, change **STOP** frequency to 6 GHz and **START** frequency to 3 GHz. For MS4622B, High Level Noise Test is complete.

Step 46. Repeat steps 10 and 11.

Step 47. Repeat steps 20 through 26.

10-7 MS462XC SYSTEM DYNAMIC RANGE TEST

This test verifies the System Dynamic Range of the test channels of the MS462XC receiver.

Test Setup Set up the equipment as shown below and allow them to warm up for at least 60 minutes.

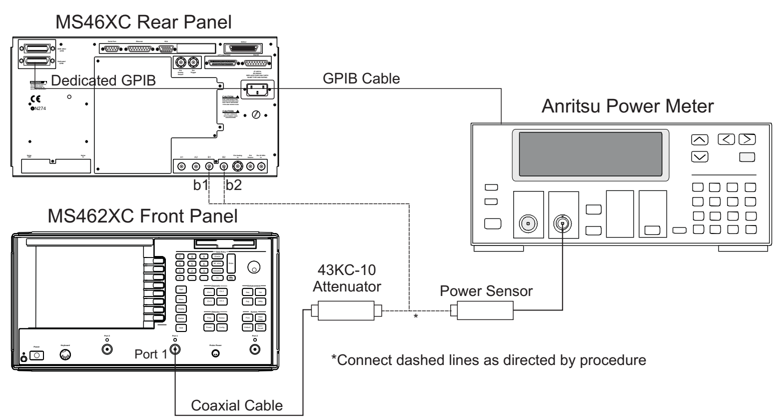


Figure 10-4. *Test Equipment Setup for System Dynamic Range Test*

Test Procedure Perform test as described below:

Step 1. Press Default key and then 0 key to reset the MS462XC.

Step 2. Press Ch 3 key and then Display key.

Step 3. Select:
DISPLAY MODE
SINGLE CHANNEL
RETURN
GRAPH TYPE
LOG MAGNITUDE

Step 4. Press Config key.

Step 5. Select DATA POINTS and change the value to 51MAX PTS.

Step 6. Press Power key.

Step 7. Select:
SOURCE 1 SETUP
FLAT TEST PORT POWER CAL

Step 8. Change POWER TARGET to –10 dBm.

Step 9. Zero and calibrate the power meter. Then connect the power sensor to the unterminated end of the model 43KC-10 fixed attenuator.

Step 10. Press BEGIN CAL soft key to start calibration.

Step 11. After the Flat Test Port Power Cal is completed, disconnect the power sensor from the unterminated end of the 43KC-10 attenuator and connect the attenuator with the coaxial cable to b1 input on the rear panel of MS462XC.

Step 12. Press Avg key.

Step 13. Select:
SELECT I.F. BANDWIDTH
I.F. BW 10 Hz

Step 14. Press Meas key and select USER DEFINED.

Step 15. Select:
CHANGE RATIO
b1 (Ta)
1 (UNITY)

Step 16. Press S21/USER 1 soft key to select USER 1.

Step 17. Press Display key and select TRACE MEMORY soft key.

Step 18. Allow two complete sweeps to occur.

Step 19. Select:
STORE DATA TO MEMORY
DATA (/) MEMORY
RETURN
SCALE

Step 20. Disconnect the 43KC-10 attenuator with the cable from the receiver input. Then connect a termination to the receiver input.

Step 21. Change the REFERENCE VALUE to – 97 dB.

Step 22. Allow one full sweep to occur, then press Hold key.

Step 23. Verify that the trace is below the REFERENCE VALUE.

Step 24. Press Meas key and select USER DEFINED.

Step 25. Select:
CHANGE RATIO
b2 (Tb)
1 (UNITY)

Step 26. Remove the 43K-10 Attenuator with the coaxial cable from b1 input and connect to b2 input.

Step 27. Repeat Step 17 to Step 23.

Chapter 11
Calibration Kits

Table of Contents

Chapter 11
Calibration Kits

11-1 INTRODUCTION

This chapter provides illustrations and contents for the Models 3750R, 3751R, and 3753R Calibration Kits.

11-2 PURPOSE

The calibration kits contain all of the precision components and tools required to calibrate the MS462XX Vector Network Measurement System for an 11-term error-corrected measurement.

11-3 KIT CONTENTS

Contents of the calibration kits are listed on the following pages.

Model 3750R 3.5 mm Calibration Kit

The 3.5 mm Connector kit (Figure 11-1) includes the following items:

Index 1.	23LF50 Female Short
Index 2.	23L50 Male Short
Index 3.	24LF50 Female Open
Index 4.	24L50 Male Open
Index 5.	28L50R Male Termination
Index 6.	28L50R Male Termination
Index 7.	28LF50R Female Termination
Index 8.	28LF50R Female Termination

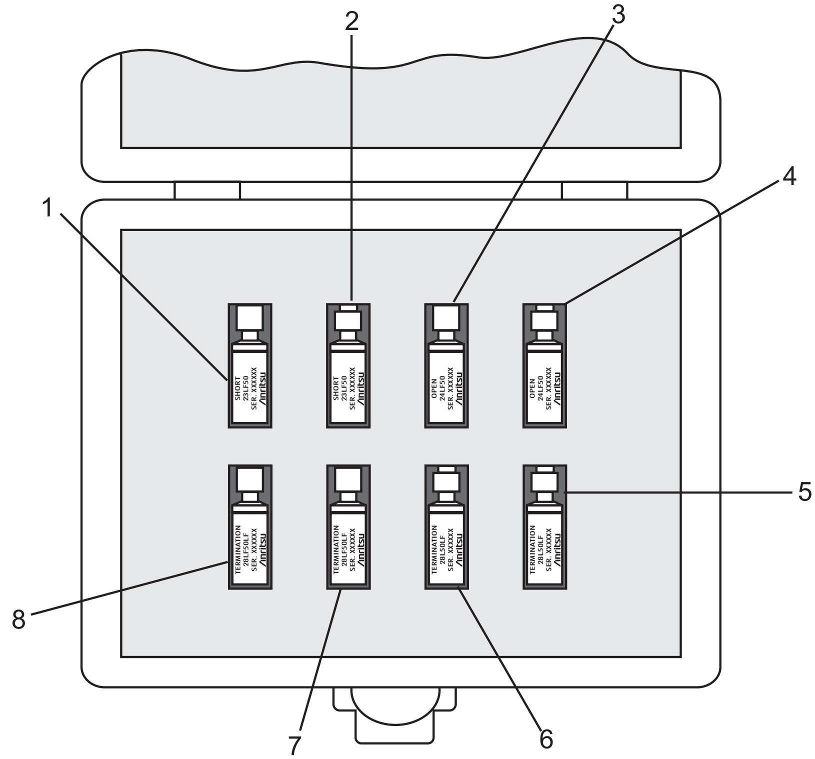


Figure 11-1. *Model 3750R 3.5 mm Calibration Kit*

Model 3751R GPC-7 Calibration Kit

The GPC-7 Connector kit (Figure 11-2) includes the following items:

Index 1. 23A50 Male Short

Index 2. 24A50 Female Open

Index 3. 28A50R Male Termination

Index 4. 28A50R Male Termination

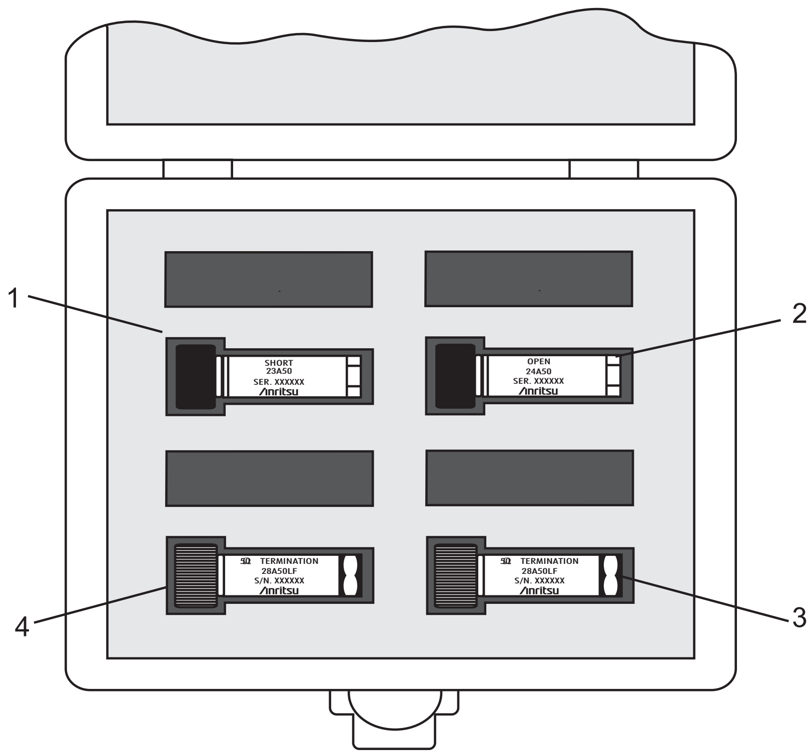


Figure 11-2. *Model 3751R GPC-7 Calibration Kit*

Model 3753R Type N Calibration Kit

The Type N connector kit (Figure 11-3) includes the following items:

Index 1.	23NF50 Female Short
Index 2.	24NF50 Female Open
Index 3.	24N50 Male Open
Index 4.	28NF50R Female Termination
Index 5.	28N50R Male Termination
Index 6.	28N50R Male Termination
Index 7.	28NF50R Female Termination
Index 8.	23N50 Male Short

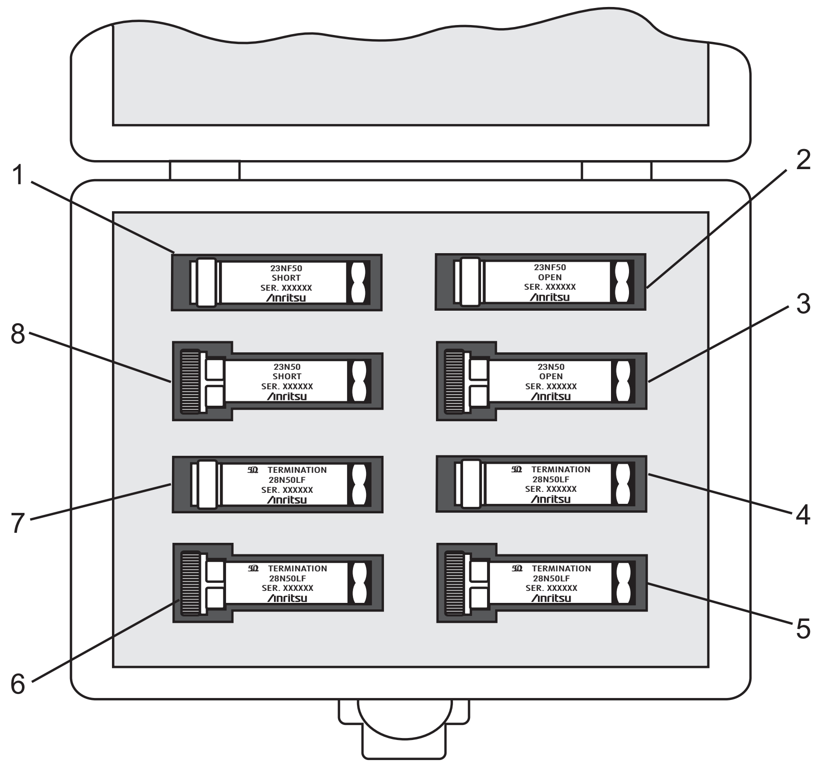


Figure 11-3. *Model 3753R Type N Calibration Kit*

11-4 PRECAUTIONS FOR USING CONNECTORS

The following are precautionary notes related to the use of connectors. For specific information on setting pin depths on sliding terminations, refer to Chapter 8, paragraph 8-3.

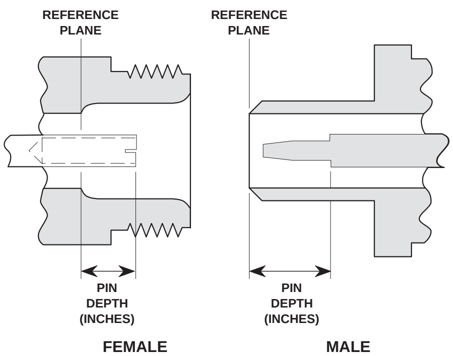


Figure 11-4. *N Connector Pin Depth*

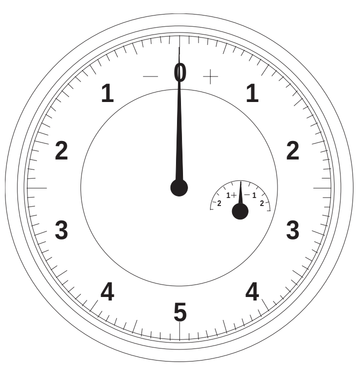


Figure 11-5. *Pin Depth Gauge*

Pin Depth Before mating, measure the pin depth (Figure 11-4) of the device that will mate with the RF component, using a Anritsu Pin Depth Gauge or equivalent (Figure 11-5). Based on RF components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When an RF component is mated with a connector having a destructive pin depth, damage will likely occur to the RF component connector. (A destructive pin depth has a center pin that is too long in respect to the connector's reference plane.)

Pin Depth Tolerance The center pin of RF component connectors has a precision tolerance measured in mils (1/1000 inch). Connectors on test devices that mate with RF components may not be precision types and may not have the proper depth. They must be measured before mating to ensure suitability. When gauging pin depth, if the test device connector measures out of tolerance (Table 11-1) in the "+" region of the gauge (Figure 11-5), the center pin is too long. Mating under this condition will likely damage the termination connector. On the other hand, if the test device connector measures out of tolerance in the "–" region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

Over Torquing Connectors Over torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient, especially on Type N connectors. *Never* use pliers to tighten connectors.

Teflon Tuning Washers The center conductor on most RF components contains a small teflon tuning washer located near the point of mating (interface). This washer compensates for minor impedance discontinuities at the interface. The washer's location is critical to the RF component's performance. *Do not disturb it.*

Mechanical Shock RF components are designed to withstand years of normal bench handling. However, do not drop or otherwise treat them roughly. They are laboratory-quality devices, and like other such devices, they require careful handling.

Table 11-1. *Pin Dept Tolerances*

Port/Connector Type	Pin Depth (mils)	Anritsu Gauge Setting
GPC-7	–0.0002 –0.0007	Same as pin depth
N Male	0.207 –0.000 +0.001	0.207 +0.000 –0.001
N Female	0.207 +0.000 –0.001	Same as pin depth
3.5 mm Male 3.5 mm Male	–0.0002 –0.0007	Same as pin depth
K Male K Female	–0.0002 –0.0007	Same as pin depth
V Male V Female	–0.0002 –0.0010	Same as pin depth

11-5 CLEANING INSTRUCTIONS

Connector interfaces—especially the outer conductors on the GPC-7 and SMA connectors—should be kept clean and free of dirt and other debris.

NOTE

Most cotton swabs are too large to fit in the smaller connector types. It is necessary to peal off most of the cotton and then twist the remaining cotton tight. Be sure that the remaining cotton does not get stuck in the connector.

The following are some important tips on cleaning connectors:

- Use only denatured alcohol as a solvent
- Always use an appropriate size of cotton swab
- Gently move the cotton swab around the center conductor
- Never put lateral pressure on the connector's center pin
- Verify that no cotton or other foreign material remains in the connector after cleaning
- Only dampen the cotton swab. Do NOT saturate it
- Compressed air can be used to remove foreign particles and to dry the connector
- Verify that the center pin has not been bent or damaged

Figure 11-6, following page, illustrates how to clean connectors.

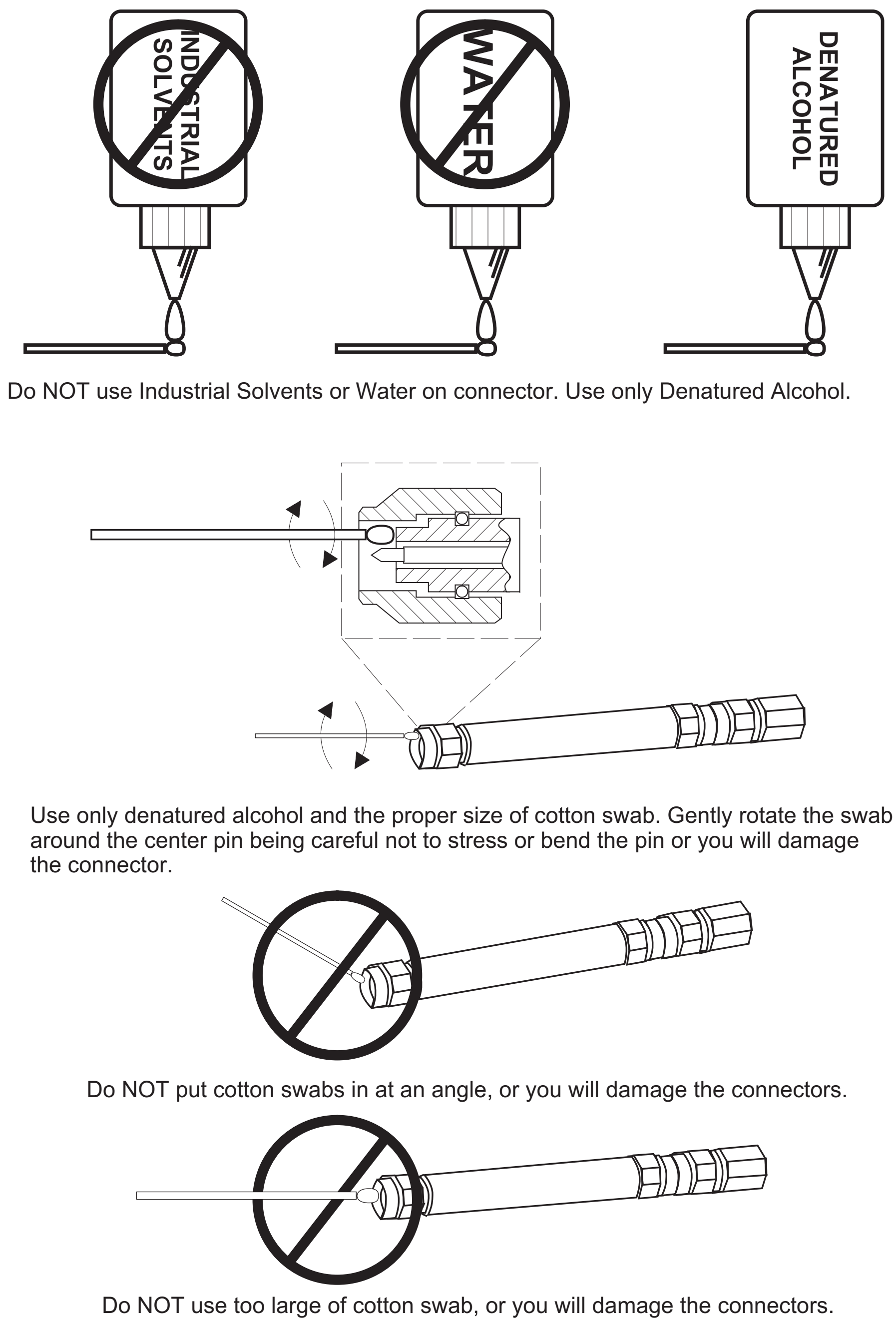


Figure 11-6. *How to Clean Connectors*

Appendix A
Sequence Operation

Table of Contents

Appendix A
Sequence Operation

A-1 INTRODUCTION

This appendix provides description of the Seq (Sequence) key function and procedures for its use.

A-2 DESCRIPTION

Sequence enables users to automate a repetitive testing task. A sequence is created by recording a series of keystrokes. After a sequence is created, users can execute these keystrokes by pressing a single key. Sequence also offers subroutine and sequence flow control mechanisms to increase the flexibility of test sequences.

The program listing for a sequence appears in a 2-5/8 x 1-3/4 inch box in the middle of the display. The box appears after pressing the Seq key and the EDIT SEQUENCE, SEQUENCE X soft keys (Figure A-1).

Up to seven independent sequences may be active at any given time. Sequences are saved in non-volatile memory. The size of a sequence is

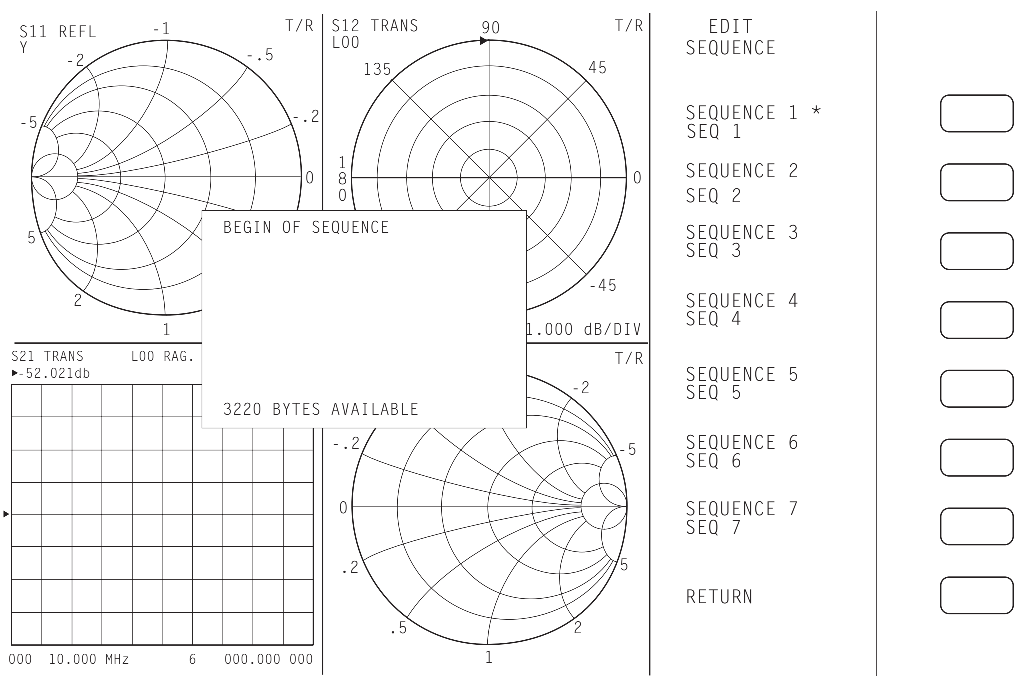


Figure A-1. *EDIT SEQUENCE Program Listing Box* limited to approximately 500 statements. A statement consists of a keyword (such as, SAVE AUTOCAL), or a keyword and a value (such as, START 1.2 GHz), and each statement represents the set of keystrokes required to perform the statement function. The effective size of a sequence can be increased by cascading multiple sequences.

A-3 BASIC FUNCTIONS

Basic functions are described in Table A-1.

A-4 CONTROL STATEMENT

A set of control conditions provides the capability to modify the sequence of executed statements based on a set of realtime conditions. Control Statement capabilities are described in Table A-2 (page A-5).

A-5 KEYS OPERATE DIFFERENTLY

Some keys on the front panel operate differently during editing or executing a sequence. During editing, the Clear/Local key deletes a statement in a sequence, and the rotary knob moves the editing cursor to a different statement. When a sequence is executing, all keys are disabled except the Enter and Clear/Local keys. The Clear /Local key terminates executions; the Enter key releases a pause.

A-6 CONVENTIONS

Refer to Chapter 1, paragraph 1-13, for an explanation of the typographic conventions used to document the procedures.

Table A-1. *Sequence Basic Functions (1 of 2)*

Function	Description
Create	Uses the EDIT SEQUENCE soft key function to create a new sequence. After a sequence is selected, all subsequent keystrokes are recorded and placed in the selected sequence memory area.
Save	Uses the DONE SEQUENCE soft key function. The current sequence recording is terminated and saved in a designated memory area. Using the SAVE SEQUENCE function under the Sequence utility, a sequence can be saved on a floppy disk or on the hard disk.
Display	During a sequence edit, the content of the sequence is displayed on the screen. Display of menu transitions may be enabled and disabled by the user. The display window is 30 character wide and 11 lines long. The last line of the display window is to display the availability of characters.
Execute	After a sequence is selected for execution, that sequence is executed automatically. Also supported over the GPIB.
Modify	The modify function works as follows: *To delete a statement:* Move the cursor to the statement and press the clear key. *To insert a statement:* Move the cursor to the line above the new statement and insert the new statement. *To add a statement:* Move the cursor to the last statement in the sequence and enter the new statement.

Table A-1. *Sequence Basic Functions (2 of 2)*

Function	Description
Load	A sequence may be loaded to memory from a floppy disk or hard disk.
Delete	A sequence may be removed from memory. To delete a sequence from disk, use the disk operations utility. Also supported over the GPIB.
Terminate	Terminate a sequence execution.
Step Through	To step through a sequence, enter the EDIT SEQUENCE mode and move the cursor down the list of statements. Except for inactive statements; a statement is executed when the cursor is moved from the statement to the statement below it.
Dump	Dumps a sequence in ASCII format to floppy disk or hard disk. This option is not supported during sequence editing, execution, or step through. Also supported over the GPIB.
Name	Each sequence can be assigned a user-defined name. Also supported over the GPIB.
Edit Functions	GO TOP (to Sequence begin), GO END (to Sequence end), HIDE WINDOW, RESTORE WINDOW, SAVE CURRENT, SAVE ALL, and CANCEL SEQUENCE EDIT.

Table A-2. *Control Statement Capabilities*

Capability	Description
Condition	Conditions are as follows: *Loop counter:* A loop counter value may be defined, incremented and decremented; and execution of a sub-sequence may be conditioned on the loop counter value being zero or not zero. *Limit test:* Execution of a sub-sequence may be conditioned on whether a limit test passes or fails. *Wait:* Sequence execution may be suspended for a specified time. *Pause:* Sequence execution may be suspended until the operator presses the continue key (Enter key). *External Trigger:* Sequence execution may be suspended until an external trigger occurs. *Sweep Complete:* Sequence execution may be suspended until completion of a sweep.
Message String	A message to the operator may be defined (such as, to prompt for equipment setup), after which a pause statement may be used to enable the operator to control the continuation of sequence execution.
Embedded File	The output file will be concatenated with the value of loop counter when embedded file name is set to ON.
Show Menu	Every menu keyword is added to sequence editing buffer when show menu is set to ON.

A-7 SEQUENCE CREATION

For this example, you will create a program for Sequence 1. You will be instructed to enter the parameters to setup the measurement environment that you wish to make. For this example, the sequence sets up start and stop frequency, and graph type.

BEGIN OF SEQUENCE
START 1.0 G/ns/m
STOP 2.0 G/ns/m
LOG MAGNITUDE
AUTOSCALE

Step 1. Press Seq/**EDIT SEQUENCE.**

As shown in Figure A-2 (following page), a list of instructions appears on the display to help you create or edit a sequence.

Step 2. Press **SEQUENCE 1/SEQ 1.**

Step 3. Press Freq/ **START 1.0 GHZ /STOP 2.0 GHZ.**

Step 4. Press Display/**GRAPH TYPE/LOG MAGNITUDE.**

Step 5. Press Display/**AUTO SCALE.**

Step 6. Observe that the screen displays the box and text shown at left.

Step 7. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 1/NAME 1.

A SEQUENCE OF KEYSTROKES CAN BE STORED IN MEMORY OR DISK FOR LATER PLAYBACK, THUS SAVING TIME ON REPETITIVE FRONT PANEL OPERATIONS.

- INSTRUCTIONS -

1. TO CREATE A SEQUENCE, SELECT <EDIT -> SEQn>, AND PERFORM THE FRONT PANEL OPERATIONS.
2. THE KNOB ALLOWS SCROLLING UP AND DOWN DURING SEQUENCE EDITING. SCROLLING DOWN PAST A STATEMENT CAUSES EXECUTION OF THE STATEMENT.
3. A SEQUENCE CAN JUMP TO ANOTHER SEQUENCE, OR INVOKE ANOTHER SEQUENCE AS A SUBROUTINE BY NAME OR NUMBER.
4. MULTIPLE SEQUENCES CAN BE EDITED SIMULTANEOUSLY.
5. TO TERMINATE EDITING, SELECT <DONE SEQUENCE EDIT>.
6. TO EXECUTE A SEQUENCE, SELECT <EXECUTE -> SEQn>.
7. TO STOP AN EXECUTING SEQUENCE, PRESS <CLR/LOCAL>.
8. TO LOAD, SAVE, DELETE OR RENAME A SEQUENCE, SELECT <UTILITY>.

Figure A-2. *Sequence Help Screen Text*

A-8 SEQUENCE MODIFICATION

Modifying a sequence is described below.

Delete a Statement

Step 1. Press Seq/EDIT SEQUENCE/SEQUENCE 1.

Step 2. Using the rotary knob, move the cursor to the AUTOCAL statement, which will be deleted.

Turn the knob to the right for upward direction and to the left for downward direction.

Step 3. Press Clear/Local.

Step 4. After deletion, the sequence display is as shown as top left.

Step 5. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 1/NAME 1.

BEGIN OF SEQUENCE
START 1.0 G/ns/m
STOP 2.0 G/ns/m
LOG MAGNITUDE

Insert a Statement

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1**.

Step 2. Using the rotary knob, move the cursor to the statement before the new statement; in this example, **LOG MAGNITUDE.**

Step 3. Press Avg/**AVERAGE ON**.

Step 4. After insertion, the sequence display is as shown as bottom left.

Step 5. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 1/NAME 1.

BEGIN OF SEQUENCE
START 1.0 G/ns/m
STOP 2.0 G/ns/m
AVERAGE ON
LOG MAGNITUDE

A-9 *SEQUENCE EXECUTION*

There are two types of sequence execution: regular and auto. A regular execution is initiated by pressing the Seq key and choosing **EXECUTE SEQUENCE**. An auto execution of **SEQUENCE 7** is initiated automatically after power up, if SEQUENCE 7 exists and is named **"AUTO."**

Regular Execution

Step 1. Press Seq/**EXECUTE SEQUENCE/SEQUENCE1.**

Auto Execution

Step 2. Press Seq then the following soft keys:
UTILITY
RENAME SEQUENCE
SEQUENCE 7

Step 3. Using the rotary knob, turn the knob and select the characters "AUTO" and DONE; using an external keyboard, type "Auto."

Step 4. Reboot the system and **SEQUENCE/AUTO** will execute.

Termination of a Sequence Execution

Step 5. Press the Clr/Local key to terminate the execution.

Execution Through GPIB

An execution of a sequence can be activated by GPIB mnemonics. Please refer to the MS462XX Programming Manual for details.

A-10 *DISPLAY MENU DURING A SEQUENCE EXECUTION*

This function turns on the display of menu transitions in the sequence list, and also causes menu transitions to occur during sequence execution. For example, the start frequency is set under the FREQUENCY menu. When show menu is on, the name of the frequency menu will be added to the content of the displayed sequence list, and the menu will be displayed on the instrument during sequence execution. For this example, Sequence 2 is new and will contain start frequency 1.2 GHz, stop frequency 1.8 GHz, and display phase for graph type. The creation steps are:

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 2**.

Step 2. Press Seq/**CONTROL STATEMENT/SHOW MENU ON.**

Step 3. Press Freq/**START 1.2 GHZ/STOP 1.8 GHZ**.

Step 4. Press Display/**GRAPH TYPE/PHASE**.

Step 5. After creation, the sequence display is as shown at left.

BEGIN OF SEQUENCE
SHOW MENU ON
FREQUENCY MENU
START 1.2 G/ns/m
STOP 1.8 G/ns/m
DISPLAY MENU
GRAPH TYPE MENU1
PHASE

Step 6. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 2/NAME 2.

A-11 SEQUENCE REMOVAL

This example illustrates a sequence being removed from memory.

Step 1. Press Seq/UTILITY.

Step 2. Press DELETE SEQUENCE/SEQUENCE 2.

NOTE

If the system is "booted" by Default 0, all sequences are removed from memory.

The GPIB supports this function. Please refer to the MS462XX Programming Manual.

A-12 SEQUENCE NAMING

Each sequence is assigned a default name, but names can be changed, as follows:

Step 1. Press Seq then the following soft keys:
UTILITY
RENAME SEQUENCE
SEQUENCE 1

Step 2. Using the keyboard or DEFINE SEQUENCE NAME screen, rename the sequence.

NOTE

The GPIB supports this function. Please refer to the MS462XX Remote Programming Manual, Part Number 10410-00204.

A-13 SEQUENCE LOAD

This function enable user to restore a sequence file from either the hard disk or a floppy disk to a selected sequence in memory.

Step 1. Press Seq then the following soft keys:
UTILITY
LOAD SEQUENCE
TO SEQUENCE NUMBER

Step 2. Enter "1" from the keypad.

Step 3. Continue by pressing **FROM FLOPPY (or FROM HARD DISK).**

Step 4. Select one of the listed disk files.

NOTE
The GPIB supports this function. Please refer to the MS462XX Programming Manual, Part Number 10410-00204.

A-14 MULTIPLE SEQUENCE CASCADING

Cascading multiple sequences is done by entering an EXECUTE SEQUENCE statement in a sequence. The following steps illustrate the creation of cascaded sequences.

```
BEGIN OF SEQUENCE
START 1.2 G/ns/m
STOP 2.5 G/ns/m
LOG MAGNITUDE
EXEC SEQ 2
```

Sequence 1

```
BEGIN OF SEQUENCE
AVERAGE ON
MEASURE T&R
S-PARAMETER/ S21/USER1
```

Sequence 2

Create Sequence 1 (See listing, left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1**.

Step 2. Press Freq/**START 1.2 GHZ/STOP 2.5 GHZ**.

Step 3. Press Display/**GRAPH TYPE/LOG MAGNITUDE**.

Step 4. Press Seq/**EXECUTE SEQUENCE/SEQUENCE 2**.

Step 5. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 1/NAME 1.

Create Sequence 2 (See listing, left)

Step 6. Press Seq/**EDIT SEQUENCE/SEQUENCE 2**.

Step 7. Press Avg/**AVERAGE ON**.

Step 8. Press Appl then the following soft keys:
CHANGE APPLICATION SETUP
MEASUREMENT TYPE
TRANSMISSION AND REFLECTION

Step 9. Press Meas/**S21**.

Step 10. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 2/NAME 2.

Execute Both Sequences

Step 11. Press Seq/**EXECUTE SEQUENCE/SEQUENCE 1**.

A-15 SUB-SEQUENCE CALLING BY LOOP COUNTER

The loop counter enables repetition of a sequence multiple times. This example creates a sequence that sets the initial value of the loop counter, and then it calls another sequence repetitively.

```
BEGIN OF SEQUENCE
LOOP COUNTER 4 X1
EXEC SEQ2
```

Sequence 1

Create the Calling Sequence (See listing, left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1**.

Step 2. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
LOOP COUNTER

Step 3. Enter “4” from the keypad and press the X1 key.

Step 4. Press Seq/**EXECUTE SEQUENCE/SEQUENCE2**.

Step 5. Press Seq/**DONE SEQUENCE EDIT**.

This sequence replaces the one stored in memory as SEQUENCE 1/NAME 1.

NOTE
The loop counter is a global value available to all sequences.

```
BEGIN OF SEQUENCE
START 1.1 G/ns/m
STOP    1.5 G/ns/m
AVERAGE ON
WAIT FOR SWEEP COMPLETE
LOOP COUNTER - 1
IF LOOP COUNTER <> 0 SEQ 2
```

Sequence 2

Create the Called Sequence (See listing, left)

Step 6. Press Seq/**EDIT SEQUENCE/SEQUENCE 2**.

Step 7. Press Freq/**START 1.1 GHZ/STOP 1.5 GHZ**.

Step 8. Press Avg/**AVERAGE ON**.

Step 9. Press Seq/**CONTROL STATEMENT/WAIT FOR SWEEP COMPLETE.**

Step 10. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
LOOP COUNTER - 1
IF LOOP COUNTER <> 0
SEQUENCE 2.

Step 11. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 2/NAME 2.

Execute Sequence 1 once and Sequence 2 four times

Step 12. Press Seq/**EXECUTE SEQUENCE/SEQUENCE1**.

A-16 SUB-SEQUENCE CALLING BY LIMIT TESTING

A sequence can use the result of a limit test to jump to another sequence or to restart itself. A designated sequence has to be entered after the statement IF LIMIT PASS or IF LIMIT FAIL. The limit test setup environment (predefined limit setup) can be recalled from memory, or it can be created within the sequence (in-line limit setup). These two methods are illustrated as below.

```
BEGIN OF SEQUENCE
RECALL MEMORY 1
IF LIMIT PASS SEQ 2
IF LIMIT FAIL SEQ 3
```

Predefined Limit Setup (See listing, left)

A limit test setup environment was saved in memory X . The limit testing sequence uses Save/Recall to recall this limit test setup environment. For this example, the setup environment was saved in memory 1.

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Save/Recall then the following soft keys:
RECALL
FRONT PANEL SETUP IN INTERNAL MEMORY
MEMORY 1

Step 3. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
LIMIT PASS
SEQUENCE 2

Step 4. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
IF LIMIT FAIL
SEQUENCE 3

Step 5. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 1/NAME 1. Note Sequences 2 and 3 must exist prior to execution of Sequence 1.

In-line Limit Testing Setup Sequence (See listing, next page)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Display/**GRAPH TYPE/LOG MAGNITUDE**.

Step 3. Press Display/**LIMITS/UPPER LIMIT ON.**

Step 4. Enter “3” from the keypad and press the X1 key.

Step 5. Press **LOWER LIMIT ON.**

BEGIN OF SEQUENCE
LOG MAGNITUDE
LOG MAG UPPER LIMIT ON
LOG MAG UPPER LIMIT 3X1
LOG MAG LOWER LIMIT .1X1
BEEP ON FAILURE ON
LIMIT TEST ON
IF LIMIT PASS SEQ x
IF LIMIT FAIL SEQ y

Step 6. Enter "1" from the keypad and press the X1 key.

Step 7. Press then the following soft keys:
TEST LIMITS
BEEP ON FAILURE ON
LIMIT TESTING ON

Step 8. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
IF LIMIT PASS
SELECT EXISTING SEQUENCE
SEQUENCE x
RETURN
CONTROL STATEMENT
CONDITION STATEMENT
IF LIMIT FAIL
SELECT EXISTING SEQUENCE
SEQUENCE y.

Step 9. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 1/NAME 1. Note that Sequences x and y must exist prior to execution of Sequence 1.

A-17 LOOP COUNTER EMBEDDED IN A DATA FILE NAME

In a sequence, the loop counter value may be embedded in a data file name. This feature allows separate data files to be created for each repetition of a loop. Each file name will consist of a fixed string of up to three character, with the loop counter value (0 - 65535) appended.

```
BEGIN OF SEQUENCE
LOOP COUNTER 2 X1
EXEC SEQ2
```

Sequence 1

Create the Calling Sequence (listing appears at left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
LOOP COUNTER

Step 3. Enter "2" from the keypad and press the X1 key.

Step 4. Press Seq/**EXECUTE SEQUENCE/SEQUENCE 2.**

Step 5. Press Seq/**DONE SEQUENCE EDIT.**

Create the Called Sequence (listing appears at left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 2.**

Step 2. Press Seq then the following soft keys:
CONTROL STATEMENT
EMBEDDED FILE NAME ON
CONDITION STATEMENT
LOOP COUNTER - 1

Step 3. Press Freq/**START 1.0 GHZ /STOP 2.5 GHZ.**

Step 4. Press Seq/**CONTROL STATEMENT/WAIT FOR SWEEP COMPLETE.**

Step 5. Press Hard Copy then the following soft keys:
OUTPUT DEVICE
DISK FILE
RETURN
OUTPUT SETUP
FLOPPY DISK
TABULAR DATA
RETURN.

Step 6. Press Start Print, then enter the name using an external keyboard or the name editor.

```
BEGIN OF SEQUENCE
FILE NAME W/LOOP COUNTER
ON
LOOP COUNTER -1
START 1.0 G/ns/m
STOP 2.5 G/ns/m
WAIT FOR SWEEP COMPLETE
OUTPUT TO DISK FILE
FLOPPY DISK
TABULAR DATA
SAVE  TABULAR(FD):A:XYZ.TAB
LOOP COUNTER - 1
IF LOOP COUNTER <> 0 SEQ 2
```

Sequence 2

Step 7. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
LOOP COUNTER - 1
IF LOOP COUNTER<>0
SELECT EXISTING SEQUENCE
SEQUENCE 2

Step 8. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is also stored in memory as SEQUENCE 2/ NAME 2.

In the above example, Sequence 2 will save two measured data files on floppy disk: xyz00002.tab and xyz00001.tab. Note that a file name may be embedded without a loop counter. In the above example, this would result in the data file xyz being overwritten the second time through the loop.

A-18 TTL OUTPUT FOR CONTROLLING PERIPHERALS

On the parallel port, there are eight TTL compatible output lines that can be used for controlling external peripheral equipment. Each bit may be set or cleared individually, or all eight bits may be set with one TTL I/O statement, in which the range of values is 0 to 255.

```
BEGIN OF SEQUENCE
LOG MAGNITUDE
SET BIT 0 X 1
```

Sequence 2

Set an Individual Bit (listing appears at left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 2.**

Step 2. Press Display/**GRAPH TYPE/LOG MAGNITUDE**.

Step 3. Press Seq then the following soft keys:
TTL I/O
PARALLEL OUT SETUP
SET PARALLEL OUT BIT

Step 4. Enter " 0" from the keypad and press the X1 key.

Step 5. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 2/NAME 2.

```
BEGIN OF SEQUENCE
LOG MAGNITUDE
SET PORT 170 X 1
```

Sequence 3

Set the Port to 170 (listing appears at left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 3.**

Step 2. Press Display/**GRAPH TYPE/LOG MAGNITUDE.**

Step 3. Press Seq then the following soft keys:
TTL I/O
PARALLEL OUT SETUP
PARALLEL OUT PORT

Step 4. Enter "170" from the keypad and press the X1 key.

Step 5. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 3/NAME 3.

A-19 TTL INPUT CONTROL STATEMENT

On the parallel port, there are five TTL compatible input lines that can be used for controlling the flow of a sequence. When an external device connected to the parallel port has a switch needing activation, the sequence has to check the TTL state of the input line corresponding to that switch. The sequence can then jump to other sequences depending on whether the line is high or low.

```
BEGIN OF SEQUENCE
LOG MAGNITUDE
TTL IN BIT 0
IF BIT HIGH  SEQ 3
IF BIT LOW  SEQ 4
```

Sequence 2

Create a Sequence with TTL Input Control (listing appears at left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 2.**

Step 2. Press Display/**GRAPH TYPE/LOG MAGNITUDE**.

Step 3. Press Seq then the following soft keys:
TTL I/O
PARALLEL IN BIT

Step 4. Enter "0" from the keypad.

Step 5. Press then the following soft keys:
IF PARALLEL IN BIT HIGH
SELECT EXISTING SEQUENCE
SEQUENCE 3

Step 6. Press Seq then the following soft keys:
SEQ
TTL I/O
IF PARALLEL IN BIT LOW
SELECT EXISTING SEQUENCE
SEQUENCE 4

Step 7. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 2/NAME 2.

Sequences 3 and 4 must exist prior to execution of Sequence 1.

A-20 BNC TTL OUTPUT CONTROL STATEMENT

A BNC TTL output signal can be used to control the test environment. On a two-port instrument, the driven port has to be specified either 1 or 2 according to the output of TTL HIGH or LOW, or pulse high or low at the end of sweep. On a three-port instrument, the test set has to specify the driven port 1, 2, or 3. (Listing appears at left.)

```
BEGIN OF SEQUENCE
START 1.0 G/ns/m
STOP 2.0 G/ns/m
SELECT TTL OUT PORT1
PORT 1: HIGH PULSE
SELECT TTL OUT PORT 2
PORT 2: LOW PULSE
SELECT TTL OUT PORT3
PORT 3: TTL  HIGH
```

Sequence 1

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Freq/**START 1.0 GHZ/STOP 2.0 GHZ.**

Step 3. Press Seq then the following soft keys:
TTL I/O
REAR PANEL SETUP
TTL OUT PORT 1
HIGH PULSE
PORT 2
LOW PULSE
PORT 3
TTL HIGH

Step 4. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is also stored in memory as SEQUENCE 1/ NAME 1.

A-21 GOSUB SEQUENCE

The GOSUB sequence capability allows treatment of a sequence as a subroutine. After the subroutine sequence has completed, execution continues after the GOSUB SEQUENCE statement. (Listing appears at left.)

BEGIN OF SEQUENCE
LOG MAGNITUDE
AVERAGE ON
GOSUB SEQ 2
OUTPUT FORMAT TABULAR
OUTPUT TO DISK FILE

Sequence 1

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Display/**GRAPH TYPE/LOG MAGNITUDE.**

Step 3. Press Avg/**AVERAGE ON.**

Step 4. Press Seq then the following soft keys:
GOSUB SEQUENCE
SELECT EXISTING SEQUENCE
SEQUENCE 2

Step 5. Press Hard Copy then the following soft keys:
OUTPUT SETUP
TABULAR DATA
RETURN
OUTPUT DEVICE
DISK

Step 6. Observe that content of Sequence 1 is as shown at top left.

Step 7. Press Seq/**DONE SEQUENCE EDIT**.

This sequence is stored in memory as SEQUENCE 1/NAME 1.

A-22 NESTING GOSUB SEQUENCES

Nesting sub-sequences is another method of cascading sequences. The following example illustrates this.

Create Sequence 1 to Call Sequence 2 (listing appears at left)

BEGIN OF SEQUENCE
START 1.5 G/ns/m
STOP 2.0 G/ns/m
LOG MAGNITUDE
GOSUB SEQ 2
OUTPUT TO DISK FILE

Sequence 1

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Freq/**START 1.5 GHZ/STOP 2.0 GHZ.**

Step 3. Press Display/**GRAPH TYPE/LOG MAGNITUDE.**

Step 4. Press Seq then the following soft keys:
GOSUB SEQUENCE
SELECT EXISTING SEQUENCE
SEQUENCE 2

Step 5. Press Hard Copy/**OUTPUT DEVICE/DISK.**

Step 6. Press Seq/**DONE SEQUENCE EDIT.**

Create Sequence 2 to Call Sequence 3 (listing appears at left)

BEGIN OF SEQUENCE
AUTOSCALE
WAIT FOR SWEEP TO COMPLETE
OUTPUT FORMAT TABULAR
OUTPUT TO DISK FILE
SAVE TABULAR (HD):C:XYZ.DAT
GOSUB SEQ 3

Sequence 2

Step 7. Press Seq/**EDIT SEQUENCE/SEQUENCE 2.**

Step 8. Press Display/**AUTOSCALE.**

Step 9. Press Seq**/CONTROL STATEMENT/WAIT FOR SWEEP COMPLETE.**

Step 10. Press Hard Copy then the following soft keys:
OUTPUT SETUP
TABULAR DATA
RETURN
OUTPUT DEVICE
DISK
START PRINT
CREATE NEW FILE

Step 11. Press Print/**CREATE NEW FILE.**

Step 12. Enter the name using an external keyboard or the name editor.

Step 13. Press Seq then the following soft keys:
GOSUB SEQ
SELECT EXISTING SEQUENCE
SEQUENCE 3

Step 14. Press Seq/**DONE SEQUENCE EDIT.**

```
BEGIN OF SEQUENCE
AUTOSCALE
WAIT FOR SWEEP TO COMPLETE
OUTPUT FORMAT TABULAR
OUTPUT TO DISK FILE
SAVE TABULAR (HD):C:XYZ.DAT
```

Sequence 3

Create Sequence 3 (listing appears at left)

Step 15. Press Seq/**EDIT SEQUENCE/SEQUENCE 3**.

Step 16. Press Display/**AUTOSCALE**.

Step 17. Press Seq/**CONTROL STATEMENT/WAIT FOR SWEEP COMPLETE**.

Step 18. Press Hard Copy then the following soft keys:
OUTPUT SETUP
TABULAR DATA
RETURN
OUTPUT DEVICE
DISK

Step 19. Press Start Print, then enter the name “XYZ” using an external keyboard or the name editor.

Step 20. Seq/**DONE SEQUENCE EDIT.**

Execute Sequences 1, 2, and 3

Step 21. Press Seq/**EXECUTE SEQUENCE/SEQUENCE1.**

NOTES

Maximum GOSUB sequence nesting level is 6. Attempts to nest more than 6 will terminate sequence execution and display an error message.

A-23 OPERATOR MESSAGES

An operator message can be embedded in a sequence to inform the instrument's operator to take certain actions. An operator message is limited to 50 characters. Since the display width of the sequence buffer is 30 characters, the message may wrap to the next line.

```
BEGIN OF SEQUENCE
LOG MAGNITUDE
START 1.0 GHZ
STOP  3.0 GHZ
AVERAGE ON
DISPLAY  xxxxxxxxx
PAUSE
```

Sequence 1

Create a Sequence (listing appears at left)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1.**

Step 2. Press Display/**GRAPH TYPE/LOG MAGNITUDE.**

Step 3. Press Freq/**START 1.0 GHZ /STOP 3.0 GHZ.**

Step 4. Press Avg/**AVERAGE ON.**

Add an Operator Message

Step 5. Press Seq then the following soft keys:
CONTROL STATEMENT
MESSAGE
MESSAGE TO OPERATOR

Step 6. Using an external keyboard or the message editing menu, create a message string.

Step 7. Press **RETURN/PAUSE.**

NOTE

During execution, a message "PLEASE PRESS THE ENTER KEY TO CONTINUE SEQUENCE" will be displayed.

Step 8. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 1/ NAME 1.

Comment Message in a Sequence (listing appears next page)

Step 1. Press Seq/**EDIT SEQUENCE/SEQUENCE 1**.

BEGIN OF SEQUENCE
xxxxx
LOG MAGNITUDE
START 1.0 G/ns/m
STOP 3.0 G/ns/m
AVERAGE ON
yyyyy
RECALL MEMORY 1
IF LIMIT PASS SEQ x
IF LIMIT FAIL SEQ y

Sequence 1

Step 2. Press Seq then the following soft keys:
CONTROL STATEMENT
MESSAGE
SEQUENCE COMMENT

Step 3. Using an external keyboard or the message editing menu, create a comment string.

Step 4. Press Display/**GRAPH TYPE/LOG MAGNITUDE.**

Step 5. Press Freq/**START 1.0 GHZ /STOP 3.0 GHZ.**

Step 6. Press Avg/**AVERAGE ON.**

Step 7. Press Seq then the following soft keys:
CONTROL STATEMENT
MESSAGE
SEQUENCE COMMENT

Step 8. Using an external keyboard or the message editing menu, create a comment string.

Step 9. Press Save/Recall then the following soft keys:
RECALL
FRONT PANEL SETUP IN INTERNAL MEMORY
MEMORY 1.

Step 10. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
IF LIMIT PASS
SELECT EXISTING SEQUENCE
SEQUENCE x.

Step 11. Press Seq then the following soft keys:
CONTROL STATEMENT
CONDITION STATEMENT
IF LIMIT FAIL
SELECT EXISTING SEQUENCE
SEQUENCE y.

Step 12. Press Seq/**DONE SEQUENCE EDIT.**

This sequence is stored in memory as SEQUENCE 1/ NAME 1. Note that sequence x and y should be in memory before executing Sequence 1.

A-24 *DUMP A SEQUENCE IN ASCII TO DISK*

To dump a sequence in a readable ASCII code to disk, proceed as follows:

Step 1. Press Seq then the following soft keys:
UTILITY
DUMP SEQ IN ASCII TO FLOPPY DISK
SEQUENCE x
CREATE NEW FILE

Step 2. Enter the name using an external keyboard or the name editor.

This will result sequence x being saved on a floppy disk in ASCII format with a file name SEQX.SQT.

A-25 *SAVING A SEQUENCE IN ITS ORIGINAL FORMAT*

To save a sequence in its original format to disk, proceed as shown below.

Step 1. Press Seq then the following soft keys:
UTILITY
SAVE SEQUENCE TO FLOPPY DISK
SEQUENCE x
CREATE NEW FILE

Step 2. Enter the name using an external keyboard or the name editor.

This will result sequence x being saved on a floppy disk in its original format with a file name SEQX.SEQ. Note that the original format is not readable.

Appendix B
Rear Panel Connectors

Table of Contents

Appendix B
Rear Panel Connectors

B-1 INTRODUCTION

This appendix provides descriptions and pinout diagrams for the MS462XX rear panel connectors .

B-2 MS462XX REAR PANEL

The MS462XX rear panel connectors are described on page B-5 and B-6.

B-3 CONNECTOR PINOUT DIAGRAMS

Figures B-1 through B-7 provide pinout diagrams for the rear panel connectors.

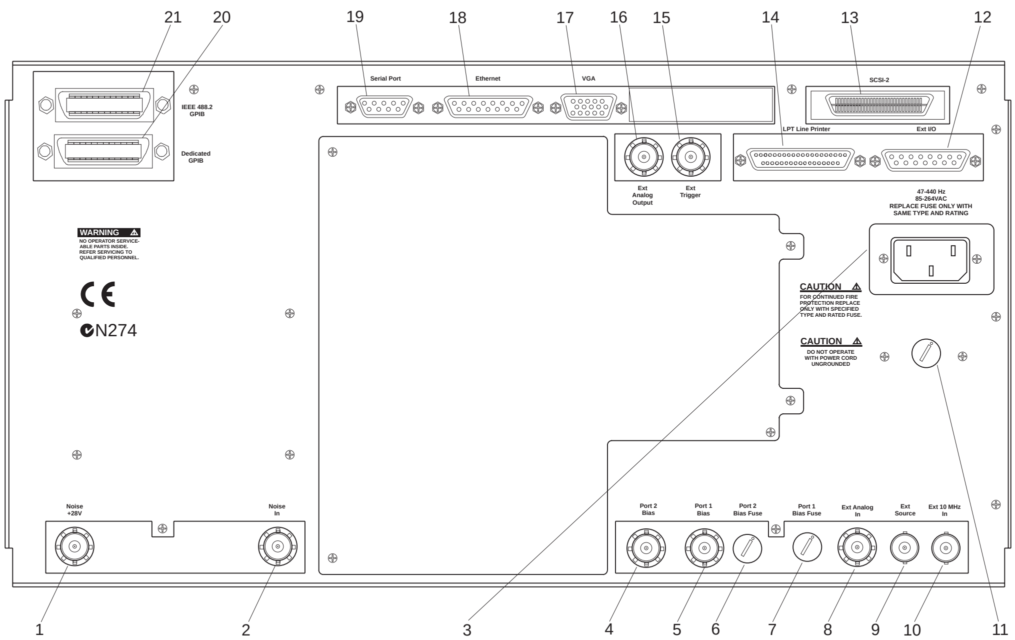


Figure B-1. *Rear Panel, MS462XA and MS462XB*

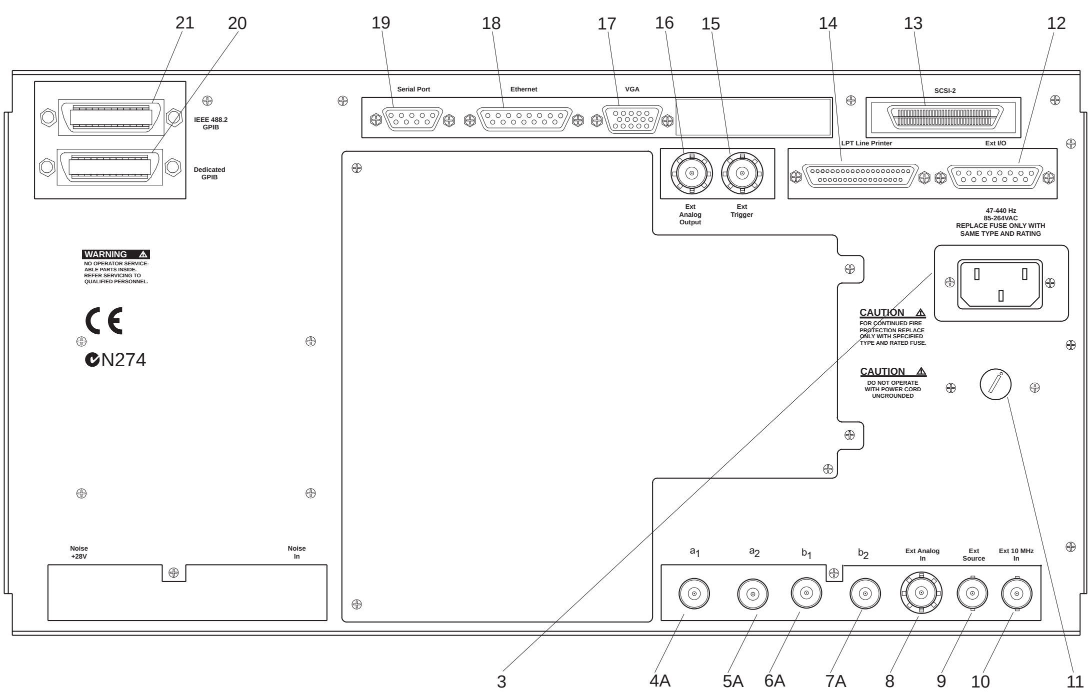


Figure B-2. *Rear Panel, MS462XC*

1. **Noise +28:** Outputs pulsed 28V supply to drive the noise source.

2. **Noise In:** Routes Noise Source energy to the test set.

3. **Line Voltage Input:** Three-prong ac plug that provides input for the input-line power. The line voltage must be between 85 and 264 Vac RMS, 43 to 63 Hz.

4. **Port 2 Bias:** Provides DC input for Bias Tee on Port 2. Not available on MS462XA models.

4A. **a_1:** Reference channel 1 input. Port match: –12 dB (uncorrected). Port power: –10 dBm for 0.1 dB compression. Must be terminated in 50 Ohms, when not used.

5. **Port 1 Bias:** Provides input for Bias Tee on Port 1.

5A. **a_2:** Reference channel 2 input. Port match: –12 dB (uncorrected). Port power: –10 dBm for 0.1 dB compression. Must be terminated in 50 Ohms, when not used

6. **Bias Fuse, Port 2:** Fuse, 0.5A, 3AG, 250V, provides protection for external bias being applied to the active device connected to test port 2 without disturbing the accuracy of the MS462XX measurement.

6A. **b_1:** Test channel 1 input. Port match: –12 dB (uncorrected). Port power: –10 dBm for 0.1 dB compression. Must be terminated in 50 Ohms, when not used

7. **Bias Fuse, Port 1:** Fuse, 0.5A, 3AG, 250V, provides protection for external bias being applied to the active device connected to test port 1 without disturbing the accuracy of the MS462XX measurement.

7A. **b_2:** Test channel 2 input. Port match: –12 dB (uncorrected). Port power: –10 dBm for 0.1 dB compression. Must be terminated in 50 Ohms, when not used

8. **Ext Analog In:** Provides input to the A5 A/D Converter PCB. BNC connector allows an external dc voltage to be measured by the internal analog-to-digital converter circuit. The output could be displayed in one of the measurement channels.

9. **Ext Source:** Provides input for an external frequency source to drive Port 3 on models equipped with Option 6.

10. **Ext 10MHz In**: BNC connector that allows an external 10MHz signal (–5 to +5 dBm) to be used as the frequency reference for phase locking the source frequency.

11. **Line Fuse:** 3 AG fuse cartridge that protects for an input over-current condition. The fuse is slow blow, 8A, 250V.

12. **Ext I/O:** Provide I/O access for Channel 1 through 4 limit and Port 1 and 2 bias voltages. Figure B-3 provides a pinout diagram.

13. **SCSI-2**: Provides for connecting an external SCSI-2 hard disk drive (Option 4). Figure B-7 provides a pinout diagram.

14. **LPT Line Printer:** 25-pin connector that provides a parallel interface to the companion printer. Figure B-2 describes the signal lines and shows the connector pinout.

15. **Ext Trigger:** Allows an external signal to sync the MS462XX measurements; ±1V trigger.

16. **Ext Analog Output:** Provides a 0 to ±10V signal for use in driving an external plotter or antenna (CW draw).

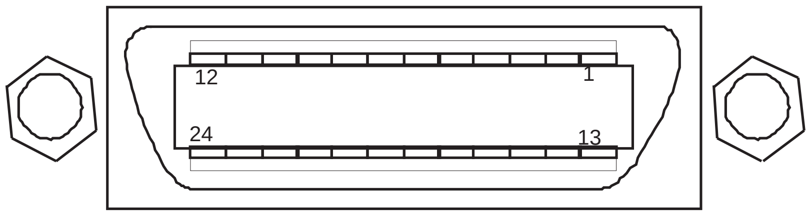
17. **VGA:** 15-pin connector provides VGA output of MS462XX video display. Figure B-4 provides a pinout diagram.

18. **Ethernet:** Provides for connecting the MS462XX to a network using an Ethernet-type connector. Figure B-5 provides a pinout diagram.

19. **Serial Port**: Provides control for AutoCal module. Figure B-6 provides a pinout diagram.

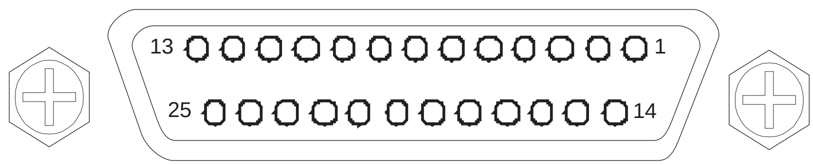
20. **Dedicated GPIB:** IEEE 488 standard 24-pin connector that allows the MS462XX to remotely control a second, third, and up-to-a-fourth frequency source, an external plotter, analyzer, or other peripheral. Figure B-1 provides a pinout diagram.

21. **IEEE 488.2 GPIB:** IEEE 488 standard 24-pin connector that provides for remotely controlling the MS462XXX from an external computer/controller via the IEEE-488 bus (GPIB). Figure B-1 provides a pinout diagram.



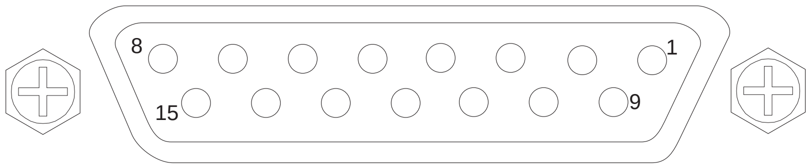
PIN	NAME	DESCRIPTION
1-4	DIO 1 thru DIO 4	*Data Input/Output.* Bits are HIGH with the data is logical 0 and LOW when the data is logical 1.
5	EOI	*End Or Identify.* A low-true state indicates that the last byte of a multibyte message has been placed on the line.
6	DAV	*Data Valid.* A low-true state indicates that the talker has (1) sensed that NRFD is LOW, (2) placed a byte of data on the bus, and (3) waited an appropriate length of time for the data to settle.
7	NRFD	*Not Ready For Data.* A high-true state indicates that valid data has not yet been accepted by a listener.
8	NDAC	*Not Data Accepted.* A high-false state indicates that the current data byte has been accepted for internal processing by a listener.
9	IFC	*Interface Clear.* A low-true state places all bus instruments in a known state—such as, unaddressed to talk, unaddressed to listen, and service request idle.
10	SRQ	*Service Request.* A low-true state indicates that a bus instrument needs service from the controller.
11	ATN	*Attention.* A low-true state enables the controller to respond to both it's own listen/talk address and to appropriate interface messages — such as, device clear and serial poll.
12	Shield	Chassis ground.
13-16	DIO 5 thru DIO 8	*Data Input/Output.* Bits are high with the data is logical 0 and LOW when the data is logical 1.
17	REN	*Remote Enable.* A low-true state enables bus instruments to be operated remotely, when addressed.
18-24	GND	Logic ground.

Figure B-3. *Pinout Diagram, GPIB and Dedicated GPIB Connectors*



PIN	NAME	DESCRIPTION
1	$\overline{\text{STROBE}}$	*Printer Strobe.* A low-true pulse that tells the printer valid data has been placed on the bus.
2-9	DATA1 thru DATA8	*Data Lines.* Bits are HIGH when the data is logical 1 and LOW when the data is a logical 0.
10	$\overline{\text{ACK NLG}}$	*Printer Acknowledgment.* A low-true (it varies from printer to printer) pulse sent back by the printer to acknowledge that the data has been accepted and the printer is ready to accept more data.
11	BUSY	*Printer Busy.* High-true level sent by the printer to indicate that it is not available. This line is HIGH at the following times: (1) During data entry. (2) While printing. (3) When off-line. (4) When a printer-error has been signaled.
12	PE	*Printer Error.* High-true level sent by the printer to indicate that it is out of paper.
13	SLCT	*Select.* A high-true logic level.
14	$\overline{\text{AUTO FEED XT}}$	*Automatic Paper Feed.* A low-true level that tells the printer to feed the paper automatically.
15	$\overline{\text{ERR}}$	*Printer Error.* A low-true signal that indicates the printer is (1) out of paper, (2) off-line, or (3) in an error state.
16	$\overline{\text{INIT}}$	*Printer Initial State.* A low-true pulse that tells the printer to assume its initial state and clear its print buffer.
17	$\overline{\text{SLCT IN}}$	*Printer Select Input.* A low-true level that permits the printer to accept data.
18–25	DATA RTN	Return lines for DATA 1 thru DATA 8 lines.

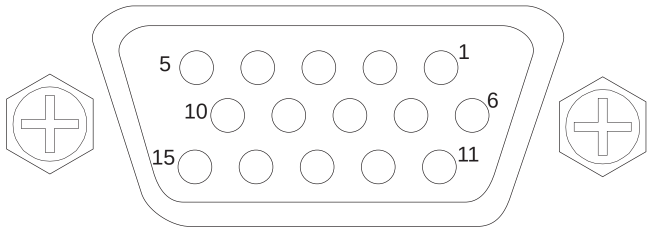
Figure B-4. *Pinout Diagram, LPT Line Printer Connector*



PIN	NAME	DESCRIPTION
1	Limit 1-4 Rtn	Return for the Channel 1-4 limit signal
2 (TTL Out 0)*	Channel 1 Limit	Signal indicating results of Channel 1 limit testing. User selectable TTL-high = Fail or TTL-low = Fail.
3 (TTL Out 1)*	Channel 2 Limit	Signal indicating results of Channel 2 limit testing. User selectable TTL-high = Fail or TTL-low = Fail.
4 (TTL Out 2)*	Channel 3 Limit	Signal indicating results of Channel 3 limit testing. User selectable TTL-high = Fail or TTL-low = Fail.
5 (TTL Out 3)*	Channel 4Limit	Signal indicating results of Channel 4 limit testing. User selectable TTL-high = Fail or TTL-low = Fail.
6 (TTL Out 4)*	Limit Fail	Signal indicating failure in any channel limit testing. User selectable TTL-high = Fail or TTL-low = Fail.
7 (TTL Out 5)	Spare	
8 (TTL Out 6)	Spare	
9 (TTL Out 7)	Spare	
10	TTL IN 0	
11	TTL IN 1	
12	TTL IN 2	
13	TTL IN 3	
14	Limit Fail Rtn	Return for the Limit Fail signal
15	TTL IN 4	

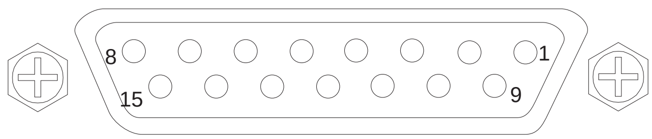
* Note: Pins 2,3,4,5, and 6 are shared between limit lines and TTL output. Only one functionality can be used at the same time.

Figure B-5. *Pinout Diagram, Ext I/O Connector*



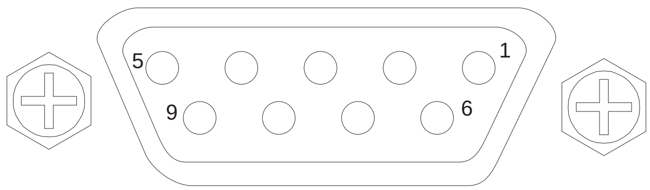
PIN	NAME	DESCRIPTION
1	Red	Red signal
2	Green	Green signal
3	Blue	Blue signal
4	Not Used	
5	Not Used	
6	Red Return	Red return
7	Green Return	Green return
8	Blue Return	Blue return
9	Not Used	
10	Digital Ground	Sync ground
11	Not Used	
12	Not Used	
13	Hsync	Horizontal sync
14	Vsync	Vertical sync
15	Not Used	

Figure B-6. *Pinout Diagram, VGA Connector*



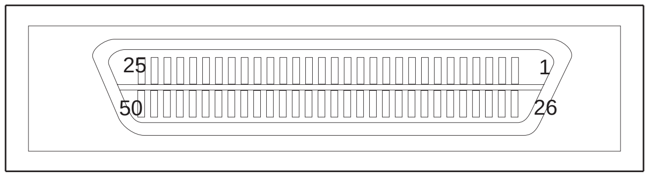
PIN	DESCRIPTION
1	Gnd
2	Collision +
3	Transmit +
4	Ground
5	Receive +
6	Gnd
7	N.C.
8	Gnd
9	Collision -
10	Transmit -
11	Gnd
12	Receive -
13	+12V
14	Gnd
15	*N.C.*

Figure B-7. *Pinout Diagram, Ethernet Connector*



PIN	DESCRIPTION
1	CD
2	RXD
3	TXD
4	DTR
5	N.C.
6	N.C.
7	RTS
8	CTS
9	N.C.

Figure B-8. *Pinout Diagram, Serial Port Connector*



PIN	DESCRIPTION
1 thru 25	GND
26	DATA 1
27	DATA 2
28	DATA 3
29	DATA 4
30	DATA 5
31	DATA 6
32	DATA 7
33	DATA 8
34	Data Parity
35	Ground
36	Ground
37	N.C.
38	Termination Power
39	N.C.
40	GND
41	$\overline{\text{ATN}}$
42	GND
43	$\overline{\text{BSY}}$
44	$\overline{\text{ACK}}$
45	$\overline{\text{RST}}$
46	$\overline{\text{MSG}}$
47	$\overline{\text{SEL}}$
48	$\overline{\text{CD}}$
49	$\overline{\text{REQ}}$
50	$\overline{\text{I/O}}$

Figure B-9. *Pinout Diagram, SCSI-2 Connector*

Appendix C Performance Specifications

This appendix contains a copy of the MS4622A/B, MS4623A/B Vector Network Measurement System Technical Data Sheet, Anritsu Part Number 11410-00288.

Anritsu

MS4622 A/B/C/D
MS4623 A/B/C/D
MS4624 A/B/C/D
Vector Network Measurement Systems

10 MHz - 9 GHz

Technical Specifications & Configuration Guide

Versatility to Completely Characterize
Wireless Components and Systems

MS462xx TYPICAL SPECIFICATIONS OVERVIEW

	MS4622x	MS4623x	MS4624x
Frequency Range	10 MHz to 3 GHz	10 MHz to 6 GHz	10 MHz to 9 GHz
■ MS462xA T/R[1]	■	■	■
■ MS462xB S-Parameter	■	■	■
■ MS462xC DRA[2]	■	■	■
■ MS462xD 4-Port	■	■	■
Source Summary			
■ Power Range (No Options)	+10 to –85 dBm	+7 to –85 dBm	+7 to –85 dBm
■ Level Accuracy	±1 dB	±1 dB	±1.5 dB[4]
■ Sweep Range	20 dB Minimum	20 dB Minimum	20 dB Minimum
■ Harmonics	–30 dBc	–30 dBc	–25 dBc
■ Stability	<5 ppm / year	<5 ppm / year	<5 ppm / year
Receiver Summary			
■ Average Noise, 10 Hz			
• <3 GHz[5]	–115 dBm	–115 dBm	–115 dBm
• 3 to 6 GHz		–105 dBm	–115 dBm
• 6 to 9 GHz			–105 dBm
■ 0.1 dB Compression	+7 dBm	+7 dBm	+7 dBm
■ Maximum Input	+27 dBm	+27 dBm	+27 dBm
■ Damage Level	+30 dBm	+30 dBm	+30 dBm
System Dynamic Range (Terminated)			
■ 10 to 3000 MHz	125 dB	125 dB	125 dB
■ 3000 to 6000 MHz		110 dB	120 dB
■ 6000 to 9000 MHz			110 dB
High Level Noise			
■ 10 to 3000 MHz	<0.008 dB rms	<0.008 dB rms	<0.008 dB rms
■ 3000 to 6000 MHz		<0.018 dB rms	<0.018 dB rms
■ 6000 to 9000 MHz			<0.018 dB rms
Standard Features			
■ Mixed-Mode S-Parameters	■	■	■
■ Embedding/De-embedding	■	■	■
■ Arbitrary Impedance	■	■	■
■ Power Sweep/Gain Compression	■	■	■
■ Mixer Measurements	■	■	■
■ Pass/Fail, Limit Lines	■	■	■
■ 12 Independent Markers	■	■	■
■ AutoCal® Calibration	■	■	■
■ Multiple Source Control	■	■	■
Optional Features			
■ Time Domain	■	■	■
■ Noise Figure[3]	■	■	■
■ Intermodulation Distortion	■	■	■
■ Harmonics	■	■	■
■ Mixer Group Delay	■	■	■
■ Processing Upgrade	■	■	■
Measurement Speed	150 µsec/point	150 µsec/point	150 µsec/point

[1]T/R is economical Transmission/Reflection (or one-path, two-port) configuration that measures S_{11}, S_{21}.
[2]DRA is Direct Receiver Access configuration for use in developing custom solutions.
[3]Noise Figure measurements start at 50 MHz. Options available for 3 or 6 GHz.
[4]Level Accuracy is ±1 dB to 6 GHz, ±1.5 dB to 9 GHz.
[5]Some degradation below 50 MHz.

Other Notes

IF Bandwidth Range: 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, and 30 kHz
Data Points: 1, 3, 15, 51, 101, 201, 401, 801, and 1601; Arbitrarily use Discrete Fill for 2 to 1601 points
Impedance: 50 Ohms; Frequency Resolution: 1 Hz
Standard Connector Type: N-female; Optionally 3.5mm female, 3.5mm male, GPC-7, and N-male
Dimensions: 224H x 425W x 450D mm (8.75 x 16.75 x 17.75 in.)
Weight: Ranges between 16 kg (35 lb.) and 23 kg (52 lb.) depending upon model and options
Power Requirements: 85-240V, 48-63Hz, 540 VA maximum

SYSTEM DESCRIPTION

The foundation of the Scorpion® MS462xx Vector Network Measurement System (VNMS) is a high performance 2-port S-parameter measurement engine consisting of a single flexible source and ultra-linear receiver. This vector network analyzer (VNA) engine provides all the necessary features to thoroughly characterize your RF components versus time, frequency and power. Simply upgrade your Scorpion, as shown in the following table, to further apply this powerful engine towards performing 3 and 4-Port S-parameter measurements…

S-PARAMETER MODEL CONFIGURATION OVERVIEW

Configuration	10 MHz -3 GHz	10 MHz - 6 GHz	10 MHz - 9 GHz
2-Port T/R[1]	MS4622A	MS4623A	MS4624A
2-Port	MS4622B	MS4623B	MS4624B
3-Port	MS4622B + MS4600/3A	MS4623B + MS4600/3B	MS4624B + MS4600/3E
3-Port T/R[2]	MS4622B + MS4600/6	MS4623B + MS4600/6	MS4624B + MS4600/6
4-Port	MS4622D	MS4623D	MS4624D
2-Port DRA[3]	MS4622C	MS4623C	MS4624C
3-Port DRA[3]	MS4622C + MS4600/3C	MS4623C + MS4600/3D	MS4624C + MS4600/3F

[1]T/R is economical Transmission/Reflection (or one-path, two-port) configuration that measures S_{11}, S_{21}.
[2]3-Port T/R measures 2-port S-parameters plus two-path, three-port measurements.
[3]DRA is Direct Receiver Access configuration for use in developing custom solutions.

…And, Scorpion is NOT limited to just S-parameters.

A single connection to Scorpion reveals the true performance of your RF device especially as your passive devices are integrated with active devices. This single instrument, consisting of both flexible models and powerful options, means you can design and manufacture all of your passive, active, mixer, power amplifier, and custom RF devices! For example, you can also add any or all of the following options to your 2, 3, or 4-Port S-parameter engine: Time Domain, Noise Figure, Frequency Translating Group Delay (FTGD), Harmonics and Intermodulation Distortion (IMD). This integrated and compact measurement solution provides unparalleled performance, versatility and value for all of your RF measurement requirements.

SCORPION MS462xx VECTOR NETWORK MEASUREMENT SYSTEM PRODUCT OVERVIEW

Model / Option	"A" Passive T/R[1]	"B" Active / Mixer Bal / Diff, 3-Port	"C" Antenna / Custom DRA[2]	"D" Bal / Diff 4-Port
10 MHz - 3 GHz (MS4622x)	■	■	■	■
10 MHz - 6 GHz (MS4623x)	■	■	■	■
10 MHz - 9 GHz (MS4624x)	■	■	■	■
Time Domain	■	■	■	■
Internal Second Source		■	■	Standard
50 MHz - 3 GHz NF 50 MHz - 6 GHz NF	Contact Factory	■ ■	■ ■	■ ■
Mixer Group Delay		■	■	■
Third Port (No Source)	Contact Factory	■		
Step Attenuator	■	Standard	Standard	Standard
Harmonics	■	■	■	■
AutoCal Control	■	■	■	■
Connector Designation	■	■	■	■
Intermodulation Distortion	■	■	■	■
Processing Upgrade		■	■	Standard

[1]T/R is economical Transmission/Reflection (or one-path, two-port) configuration that measures S_{11}, S_{21}.
[2]DRA is Direct Receiver Access configuration for use in developing custom solutions.

TECHNICAL SPECIFICATIONS

Technical Specifications and Configuration Guide for Scorpion are detailed in the following pages.

TEST CONDITIONS

The specifications in the following pages describe the warranted performance of the instrument at 23 ± 3° C when the unit is calibrated with the appropriate AutoCal module or coaxial calibration kit. A warm-up time of ninety (90) minutes should be allowed prior to verifying system specifications. Performance parameters denoted as "typical" indicate non-warranted specifications.

Test Port Corrected Characteristics

Standard Connector Type: N female
Optional Connector Types: 3.5mm female (MS4600/11SF), 3.5mm male (MS4600/11S), GPC-7 (MS4600/11A) and N male (MS4600/11NM)

Connector	Configuration	Frequency (MHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)
3.5mm (MS4600/11S) (MS4600/11SF)	Ports 1 & 2 MS462xB MS462xD	10-1000	>46	>44	>46
		1000-3000	>44	>41	>44
		3000-6000	>38	>39	>38
		6000-9000	>37	>36	>37
	Ports 3 & 4 MS462xB/Opt3x MS462xD	10-1000	>44	>42	>44
		1000-3000	>42	>40	>42
		3000-6000	>37	>37	>37
		6000-9000	>36	>35	>36
N-Type Standard N(F) (MS4600/11NM)	Ports 1 & 2 MS462xB MS462xD	10-1000	>46	>44	>46
		1000-3000	>44	>41	>44
		3000-6000	>38	>39	>38
		6000-9000	>37	>36	>37
	Port 3 & 4 MS462xB/Opt3x MS462xD	10-1000	>44	>42	>44
		1000-3000	>42	>40	>42
		3000-6000	>37	>37	>37
		6000-9000	>36	>35	>36
GPC-7 (MS4600/11A)	Ports 1 & 2 MS462xB MS462xD	10-1000	>46	>44	>46
		1000-3000	>44	>41	>44
		3000-6000	>38	>39	>38
		6000-9000	>37	>36	>37
	Port 3 & 4 MS462xB/Opt3x MS462xD	10-1000	>44	>42	>44
		1000-3000	>42	>40	>42
		3000-6000	>37	>37	>37
		6000-9000	>36	>35	>36

(12-term error correction applied; 24-term error correction applied for Port 3; 40-term error correction applied for Port 4)

TEST PORT RAW CHARACTERISTICS

Frequency Range	Raw Directivity (All Models)	Raw Port Match (All Models)
10 MHz - 3 GHz	23 dB	15 dB*
3 GHz - 6 GHz	20 dB	15 dB
6 GHz - 9 GHz	15 dB	9 dB

*MS462xD models with Option 4F or 4G degraded below 100 MHz

DYNAMIC RANGE

System Dynamic Range is defined as the differential between the power available at Port 1 and the system noise floor. The noise floor of the system is defined as the peak of the noise trace under the following conditions; terminating all test ports with broadband coaxial loads, applying full 12-term error correction and minimum (10 Hz) IF bandwidth with one average applied.

TYPICAL SYSTEM DYNAMIC RANGE: For Nominal Receiver Compression (Option 4 not installed)

Models	Frequency (MHz)	Typical Port Power (dBm)	Noise Floor dBm	System Dynamic Range (dB)
MS4622A 3 GHz 2-Port T/R[1]	50	14	–100	114
	800	14	–115	129
	1900	14	–115	129
	3000	13	–115	128
MS4622B 3 GHz 2, 3-Port	50	12	–100	112
	800	12	–115	127
	1900	12	–115	127
	3000	11	–115	126
NEW MS4622D 3 GHz 4-Port	50	12	–100	112
	800	12	–115	127
	1900	12	–115	127
	3000	11	–115	126
MS4623A 6 GHz 2-Port T/R[1]	50	13	–100	113
	1900	13	–115	128
	3000	13	–115	128
	6000	11	–105	116
MS4623B 6 GHz 2, 3-Port	50	11	–100	111
	1900	11	–115	126
	3000	11	–115	126
	6000	10	–105	115
NEW MS4623D 6 GHz 4-Port	50	11	–100	111
	1900	11	–115	126
	3000	11	–115	126
	6000	10	–105	115
NEW MS4624A 9 GHz 2, 3-Port T/R[1]	50	14	–100	114
	1900	14	–115	129
	3000	13	–115	128
	6000	12	–115	127
	9000	12	–105	117
NEW MS4624B 9 GHz 2, 3-Port	50	12	–100	112
	1900	12	–115	127
	3000	11	–115	126
	6000	11	–115	126
	9000	11	–105	116
NEW MS4624D 9 GHz 4-Port	50	12	–100	112
	1900	12	–115	127
	3000	11	–115	126
	6000	11	–115	126
	9000	11	–105	116

[1]T/R is economical Transmission/Reflection (or one-path, two-port) configuration that measures S_{11}, S_{21}.

SOURCE SPECIFICATIONS

The following source specifications apply to both the standard (Source 1) and optional (Source 2, reference Option 3x) sources within Scorpion.

Power Output Range:

Standard source output power ranges are summarized in the following table. Note that the source output power range is primarily affected in the 4-port configuration or when adding the option for Noise Figure (MS4600/4 or MS4600/4B).

Configuration	Model/Option	Frequency Range	Source 1	Source 2
2-Ports No Options	MS4622X[1] MS4623X[1] MS4624X[1]	10 MHz to 3 GHz 10 MHz to 6 GHz 10 MHz to 9 GHz	+10 to –85 dBm +7 to –85 dBm +7 to –85 dBm	N/A N/A N/A
3-Ports Without Noise Figure	MS4622B + MS4600/3B or 3D (2nd Internal Source)	10 MHz to 3 GHz	+10 to –85 dBm	+10 to –85 dBm
	MS4623B + MS4600/3E or 3F (2nd Internal Source)	10 MHz to 6 GHz	+7 to –85 dBm	+7 to –85 dBm
	MS4624B + MS4600/3E or 3F (2nd Internal Source)	10 MHz to 9 GHz	+7 to –85 dBm	+7 to –85 dBm
2, 3. or 4-Ports Add Noise Figure	MS4622B + MS4600/4 MS4623B + MS4600/4(B) MS4624B + MS4600/4(B) MS462xD + MS4600F MS462xD + MS4600G	Add 3 GHz NF[2] Add 3 or 6 GHz NF[2] Add 3 or 6 GHz NF[2] Add 3 GHz NF[2] Add 6 GHz NF[2]	+7 to –85 dBm +5 to –85 dBm +5 to –85 dBm +5 to –85 dBm +5 to –85 dBm	No Change No Change No Change No Change No Change
4-Ports	MS4622D MS4623D MS4624D	10 MHz to 3 GHz 10 MHz to 6 GHz 10 MHz to 9 GHz	+10 to –85 dBm +7 to –85 dBm +7 to –85 dBm	+10 to –15 dBm +7 to –15 dBm +7 to –15 dBm

[1]MS4622A and MS4623A source power includes optional step attenuator; otherwise lowest port power is –15 dBm.
[2]Noise Figure measurements start at 50 MHz.

Frequency Resolution: 1 Hz

Frequency Stability - Aging: < 5×10^{-6} / year

Temperature: < 5×10^{-6} over +15° C to +50° C

Power Control Range: > 20 dB. The minimum absolute level for power sweep is -15 dBm while the maximum power output for a unit is typically +10 dBm, depending upon configuration.

Source Power Level: The source power (dBm) may be set from the front panel menu or via GPIB. Port 1 power level is settable from +10 dBm (on the simpler test sets, ranging to +5 dBm on the most complex) to -15 dBm with 0.01 dB resolution. In addition, the Port 1 (& Port 3) power may be attenuated in 10 dB steps using the internal 70 dB step attenuator. Port 3 step attenuator is not available in D models. Port 1 step attenuator is optional in A models.

Power Level Accuracy: ±1 dB to 6 GHz, ±1.5 dB to 9 GHz (no flat power calibration applied; full-band frequency sweep at -15 dBm, 0 dBm, and maximum rated power).

Level Test Port Power: The power, at all sweep frequencies, is leveled to within ±1dB to 6 GHz (±1.5 dB to 9 GHz). Only Port 1 and Port 3 (if installed) can be leveled.

Harmonics and Spurious (at Maximum Rated Power): <–25 dBc for MS4624x, <–30 dBc for all other models.

Sweep Type: Linear, CW, Marker, or N-Discrete point sweep.

Power Sweep Range: 20 dB (minimum)

Power Meter Correction: The MS462xx offers a user-selectable feature that corrects for test port power variations and slope on Port 1 (or Port 3 when the optional internal source is installed) using an external Anritsu ML2437A or ML2438A power meter. Power meter correction is available at a user-selectable power level, if it is within the power adjustment range of the internal source. Once the test port power has been flattened, its level may be changed within the remaining power adjustment range of the signal source.

Multiple Source Control Capability:

Multiple Source Control capability allows a user to independently control the frequencies of up to four sources (two internal and two external or one internal and three external) and the receiver without the need for an external controller. The frequency ranges and output powers of each source may be independently specified. A frequency sweep may be comprised of up to five separate bands, each with independent source and receiver settings, for convenient testing of frequency translation devices such as mixers. Up to five sub-bands may be tested in one sweep. This feature enables users to easily test mixers, up/down converters, multipliers, and other frequency conversion devices. For more information, see Multiple Source Mode application note (p.n. 11410-00244).

RECEIVER SPECIFICATIONS

The following receiver specifications apply to standard receivers within Scorpion when terminating all test ports with broadband coaxial loads (excluding spurs and degradation below 50 MHz).

3 GHz (MS4622x) Models, Average Noise Level (I.F. Bandwidth = 10 Hz):

Frequency Range	MS4622A[1,2]	MS4622B[1,2]	MS4622C[1,3]	MS4622D[1,2]
10 MHz to 3 GHz (Typical)	–100 dBm (–115 dBm)	–100 dBm (–115 dBm)	–110 dBm (–120 dBm)	–100 dBm (–115 dBm)

[1]**Damage Level:** > +30 dBm, > +23 dBm noise figure mode
[2]**Maximum Input Level:** +27 dBm, +20 dBm noise figure mode
[3]**Maximum Input Level:** +20 dBm

6 GHz (MS4623x) Models, Average Noise Level (I.F. Bandwidth = 10 Hz):

Frequency Range	MS4623A[1,2]	MS4623B[1,2]	MS4623C[1,3]	MS4623D[1,2]
10 MHz to 3 GHz (Typical)	–100 dBm (–115 dBm)	–100 dBm (–115 dBm)	–110 dBm (–120 dBm)	–100 dBm (–110 dBm)
3 GHz to 6 GHz (Typical)	–90 dBm (–105 dBm)	–90 dBm (–100 dBm)	–100 dBm (–110 dBm)	–90 dBm (–100 dBm)

[1]**Damage Level:** > +30 dBm, > +23 dBm noise figure mode
[2]**Maximum Input Level:** +27 dBm, +20 dBm noise figure mode
[3]**Maximum Input Level:** +20 dBm

9 GHz (MS4624x) Models, Average Noise Level (I.F. Bandwidth = 10 Hz):

Frequency Range	MS4624A[1,2]	MS4624B[1,2]	MS4624C[1,2]	MS4624D[1,2]
10 MHz to 3 GHz (Typical)	–100 dBm (–115 dBm)	–100 dBm (–115 dBm)	–110 dBm (–120 dBm)	–100 dBm (–115 dBm)
3 GHz to 6 GHz (Typical)	–100 dBm (–115 dBm)	–100 dBm (–115 dBm)	–110 dBm (–120 dBm)	–100 dBm (–115 dBm)
6 GHz to 9 GHz (Typical)	–90 dBm (–105 dBm)	–90 dBm (–105 dBm)	–100 dBm (–110 dBm)	–90 dBm (–105 dBm)

[1]**Damage Level:** > +30 dBm, > +23 dBm noise figure mode
[2]**Maximum Input Level:** +27 dBm, +20 dBm noise figure mode
[3]**Maximum Input Level:** +20 dBm

MEASUREMENT ENHANCEMENT

Data Averaging: Averaging of 1 to 4096 averages can be selected. The data averaging function is performed at each data point during the frequency sweep. Averaging can be toggled on/off via the front panel and a front panel LED indicates that the data averaging function is enabled.

IF Bandwidth: Soft Key selection of IF bandwidth; selections shown in the following table.

30 kHz	10 kHz	3 kHz	1 kHz	300 Hz	100 Hz	30 Hz	10 Hz

Trace Smoothing: Computes an average over a percentage range of the data trace. The percentage of trace to be smoothed can be selected from 0 to 20% of trace.

MEASUREMENT CAPABILITIES

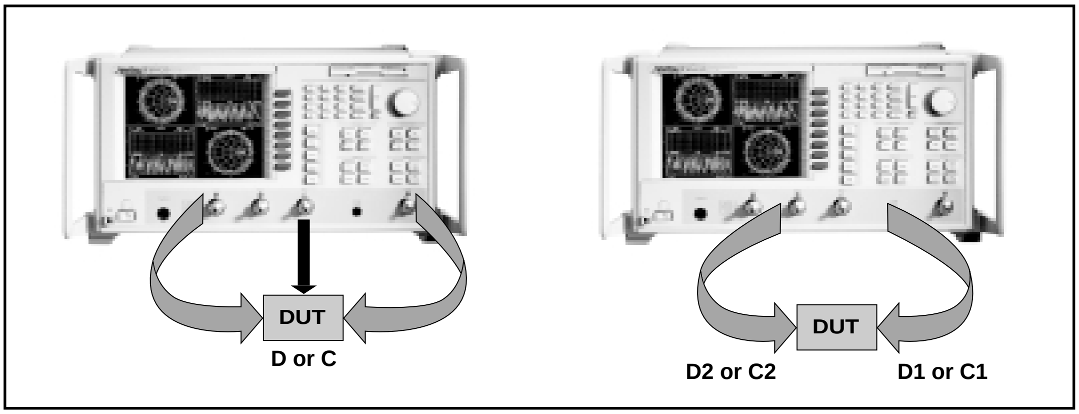
Parameters: S-Parameters (including Mixed-Mode on 3 and 4-port configurations) , Harmonics, Noise Figure, Intermodulation Distortion (IMD), Frequency Translating Group Delay and user-defined combinations of a_1 , a_2 , a_3 , a_4, b_1 , b_2 , b_3 and b_4.

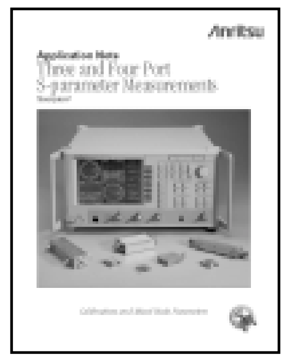
Balanced/Differential Measurement Configuration: NEW

Depending upon the configuration, S-Parameters (including Mixed-Mode) that can be chosen from the front panel are shown in the following table.

Standard				Single Ended Balanced			Balanced \ Balanced			
S_{11}	S_{12}	S_{13}	S_{14}	S_{11}	S_{1D}	S_{1C}	S_{D1D1}	S_{D1D2}	S_{D1C1}	S_{D1C2}
S_{21}	S_{22}	S_{23}	S_{24}	S_{D1}	S_{DD}	S_{DC}	S_{D2D1}	S_{D2D2}	S_{D2C1}	S_{D2C2}
S_{31}	S_{32}	S_{33}	S_{34}	S_{C1}	S_{CD}	S_{CC}	S_{C1D1}	S_{C1D2}	S_{C1C1}	S_{C1C2}
S_{41}	S_{42}	S_{43}	S_{44}				S_{C2D1}	S_{C2D2}	S_{C2C1}	S_{C2C2}

The following pictures illustrate how 3 and 4-port devices are connected to Scorpion for balanced / differential measurements and the relationship to the virtual ports for mixed-mode S-Parameters.





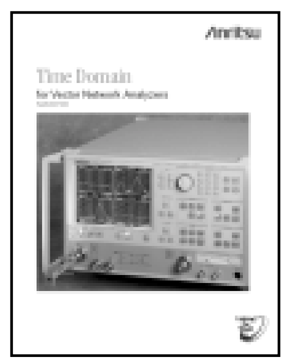
Measurement of 3 and 4-port single ended S-parameters are required in order to perform the mixed-mode conversion, which generates results as if the ports were being driven in pairs.

For more information, see Three and Four Port S-Parameter Measurements application note (p.n. 11410-00279).

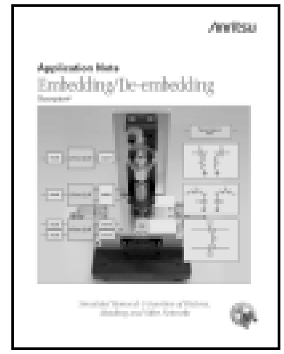
Time Domain (MS4600/2):

High Speed Time (Distance) Domain software allows the conversion of reflection or transmission measurements from the frequency domain to the time domain. Time domain analysis can also be performed utilizing Lowpass, Bandpass or Phasor Impulse processing techniques. Windows and Gating support additional conditioning to further enhance time domain processing.

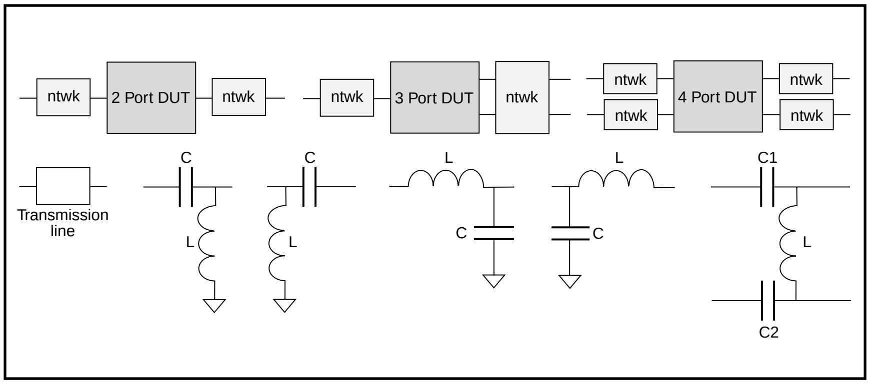
For more information, see Time Domain application note (p.n. 11410-00206).



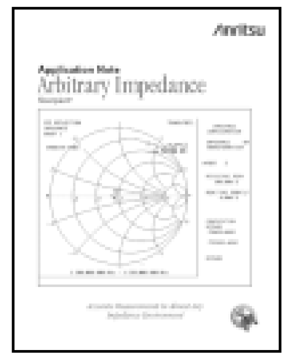
Embedding/De-Embedding: The MS462xx incorporates a variety of standard embedding and de-embedding functions and some utilities to make this task easier. As shown in the following simplified block diagrams, the MS462xx can (depending upon the configuration) remove the effects of networks (ntwk) or virtually add in the effects of other networks (e.g., matching) for 2, 3 or 4-port devices. Network elements can consist of transmission lines, L-C circuit primatives and SnP data files (some examples are shown). Multiple cascading of network elements is supported. For 3-port models, the option for Processing Upgrade (MS4600/24) increases maximum data points (from 401 to 1601) and enables the use of S4P files when matching.



For more information, see Embedding/De-Embedding application note (p.n. 11410-00278).



Arbitrary Impedance Transformations: Standard firmware feature to perform the calibration in a 50 ohm world (using conventional calibration kits) and then transform the resulting measurement data to what it would look like if calibrated in some other arbitrary impedance environment.This feature allows measurements to be presented as if performed in the desired impedance (typically between a few ohms and 1000 ohms). Impedance can be specified in both real and imaginary terms for every port. Impedances can be specified as complex numbers.



For more information, see Arbitrary Impedance application note (p.n. 11410-00284).

Network Extraction: Standard firmware utility that determines S-parameters of a test fixture from a pair of calibrations: one calibration at the coaxial plane and the other calibration at the DUT plane with the fixture in place. Output is a *.S2P file for every port.

For more information, see Embedding/De-Embedding application note (p.n. 11410-00278).

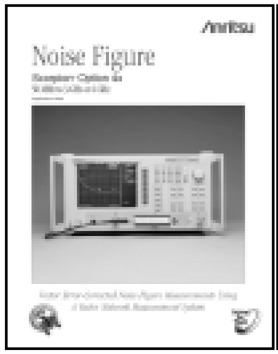
Interchannel Math: Calculations (primarily division) can be performed between two channels. These calculations are typically used to calculate amplitude and phase imbalance of balanced/differential structures.

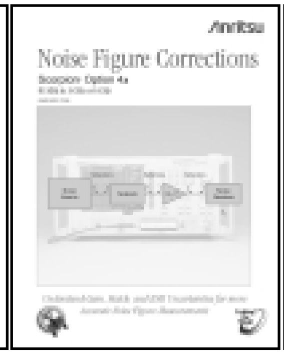
For more information, see Three and Four Port S-Parameter Measurements application note (p.n. 11410-00279).

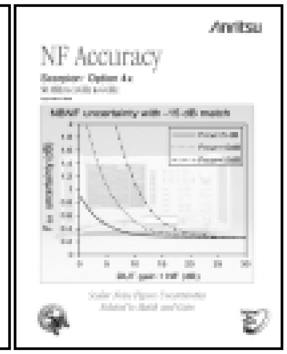
INNOVATIVE MEASUREMENT CAPABILITIES:

NOISE FIGURE (MS4600/4x)

Frequency Range	Part Number
50 MHz – 3 GHz	MS4600/4, 4D, 4F
50 MHz – 6 GHz	MS4600/4B, 4E, 4G







Bandwidth: Selections are provided between Wide (>4 MHz) and Narrow (<250 kHz).

Display Selections: Noise Figure, Y-Factor, Insertion Gain, Available Gain and Equivalent Noise Temperature.

Loss Compensation: Loss Before DUT, Loss After DUT and various S2P data files are supported.

Noise Source Locations: Noise Source (not included) can be connected either externally or internally, where the rear panel connection provides a path to Port 1 of Scorpion. Factory created EXT file (consisting of S2P and S1P data) for this path is provided.

Noise +28V: Rear panel BNC female connector supplying pulsed drive for noise diode.

Instrumentation Uncertainty: ±0.15 dB

For more information, see the following Noise Figure application notes:

Noise Figure (p.n. 11410-00210)
Noise Figure Corrections (p.n. 11410-00256)
Noise Figure Accuracy (p.n. 11410-00227)

INTERMODULATION DISTORTION (IMD, MS4600/3x, MS4600/13)

Frequency	Model / Option	Source 1 (dBm)	Source 2 (dBm)
10 MHz to 3 GHz	MS4622B + MS4600/3A + MS4600/13 MS4622C + MS4600/3C + MS4600/13 MS4622D + MS4600/13[1]	+10 to –85[2]	+10 to –85
10 MHz to 6 GHz	MS4623B + MS4600/3B + MS4600/13 MS4623C + MS4600/3D + MS4600/13 MS4623D + MS4600/13[1]	+7 to –85[2]	+7 to –85
10 MHz to 9 GHz	MS4624B + MS4600/3E + MS4600/13 MS4624C + MS4600/3F + MS4600/13 MS4624D + MS4600/13[1]	+7 to –85[2]	+7 to –85

NEW

[1]Source 2 step attenuator not available in D models; port 3 lowest power is –15 dBm.
[2]When using Noise Figure (MS4600/4 or MS4600/4B), Source 1 power is reduced to +5 dBm.

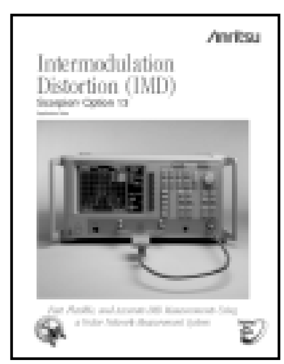
Display Selections: Intermodulation Distortion Products (IMD, dBc) and Third Order Intercept Calculations (TOI, dBm) for 3rd, 5th, 7th and 9th order products. Selections are also provided for: Upper and/or Lower Products, Input or Output Referred and CW, Swept Frequency or Swept Power. Second Order Intercept measurements can be performed using Multiple Source Control.

Accuracy: ±1 dB (levels > –60dBm, 10 Hz BW)

Dynamic Range: (receiver main tones = –10 dBm, 10 Hz BW)
Offset > 300 kHz.............................–80 dBc

Typical Dynamic Range (with combiner network of sufficient isolation):
–85 to –100 dBc for tone-spacing of 500 kHz
–100 dBc or lower for tone-spacing of 2 MHz

For more information, see Intermodulation Distortion (IMD) application note (p.n. 11410-00213).



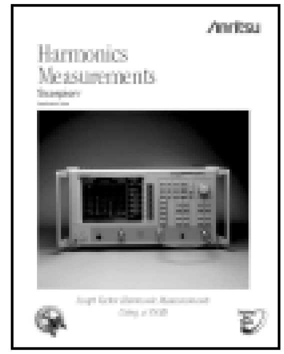
HARMONIC MEASUREMENT (MS4600/8)

Frequency Range	Model / Option	Source 1 (dBm)	Harmonic Number
10 MHz – 3 GHz	MS4622x + MS4600/8	+10 to –85[1]	Fundamental, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, and 9th. Frequency Limited by Model
10 MHz – 6 GHz	MS4623x + MS4600/8	+7 to –85[1]	
10 MHz – 9 GHz	MS4624x + MS4600/8	+7 to –85[1]	

[1]When using Noise Figure (MS4600/4 or MS4600/4B), Source 1 power is reduced to +5 dBm.

Display Selections: For harmonics (Fundamental, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th and 9th), select relative to (dBc) Output Harmonic or Source Harmonic. Selections are also provided for CW, Swept Frequency or Swept Power measurements.

Correction: Enhancement calibration enables measurement of magnitude and phase for 2nd and 3rd harmonics.

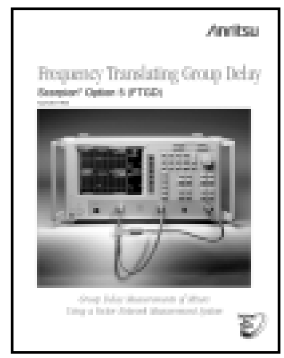


Accuracy (level of harmonic at receiver above -40 dBm):

Scalar Accuracy and Setup	Dynamic Range
Scalar ±1 dB source power @ DUT <–10 dBm fundamental power @ receiver <0 dBm	30 dB Typical
Vector Enhancement and Setup Vector ±1 dB fundamental power @ receiver <+10 dBm	50 dB Typical

For more information, see Harmonic Measurements application note (p.n. 11410-00222).

FREQUENCY TRANSLATING GROUP DELAY (FTGD), (MS4600/5)



FTGD allows the measurement of group delay of mixers and other translating devices by analyzing the phase shift experienced by a modulated signal (generated internally). The Group Delay is measured by computing the phase change across a frequency interval using the formula, τ_g = –(phase (deg.))/ {360 · (frequency (Hz))} applies except the phase change is measured across the modulating bandwidth of the test signal instead of across frequency points. The aperture is fixed at about 900 kHz and the range is limited to about 1µs. The use of angle modulation keeps the measurement relatively immune from compression and other non-linearities.

Frequency Range	Model / Option
10 MHz to 3 GHz	MS4622x + MS4600/5
10 MHz to 6 GHz	MS4623x + MS4600/5
NEW 10 MHz to 9 GHz	MS4624x + MS4600/5

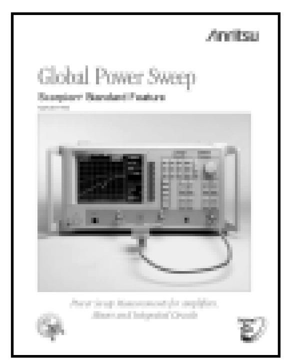
Display Selections: Conversion Loss (or Gain), Group Delay and Phase.

For more information, see Frequency Translating Group Delay application note (p.n. 11410-00236).

POWER SWEEP MEASUREMENTS

Standard, easy-to-use Swept Power Gain Compression (SPGC) and Swept Frequency Gain Compression (SFGC) modes are available. Additional standard power sweep features are available for S-parameters, Intermodulation Distortion, Harmonics and mixer measurements.

For more information, see Global Power Sweep application note (p.n. 11410-00243).



MEASUREMENT SWEEP SPEED SUMMARY

Measurement times are measured using a single trace (S21) display and one average (no correction is applied). The measurement speeds for the communications band are measured in a 25 MHz band from 824 - 849 MHz. The typical measurement times observed are as follows:

Data Points	IF Bandwidth (Hz)	10 MHz - 3 GHz (ms)	10 MHz - 6 GHz (ms)	10 MHz - 9 GHz (ms)	Communications Band (ms)
51	30 kHz	16	18	31	11
	10 kHz	21	23	35	16
	3 kHz	32	35	46	27
	1 kHz	66	69	76	61
	300 Hz	187	189	203	184
101	30 kHz	26	28	40	20
	10 kHz	35	38	48	28
	3 kHz	57	60	71	50
	1 kHz	126	129	138	120
	300 Hz	366	370	380	368
201	30 kHz	44	48	64	37
	10 kHz	61	65	81	52
	3 kHz	106	110	126	98
	1 kHz	242	246	262	234
	300 Hz	716	720	740	712
401	30 kHz	80	87	110	70
	10 kHz	114	121	146	104
	3 kHz	206	212	236	196
	1 kHz	480	484	508	468
	300 Hz	1424	1432	1448	1408
801	30 kHz	150	161	202	130
	10 kHz	218	230	270	198
	3 kHz	400	412	456	380
	1 kHz	952	960	1000	928
	300 Hz	2820	2840	2900	2800

Corrected Sweep Speed Performance

Corrected Measurement times are measured using a single trace (S21) display and one average in the communications band, which is measured in a 25 MHz band from 824 - 849 MHz. The typical measurement times for the various n-port configurations are as follows:

Data Points	IF Bandwidth (Hz)	2-Port (ms)	3-Port (ms)	4-Port (ms)
401	30 kHz	308	752	1640
	10 kHz	432	1040	2040
	3 kHz	796	1840	3480

GPIB DATA COLLECTION SUMMARY

This section summarizes typical data collection times for automated measurements using the MS462xx's IEEE 488.2 GPIB bus. Throughput measurement times for both tables include triggering and waiting for a full sweep and transferring data across the GPIB bus. Data throughput times are shown separately for measurements made without calibration and with full two-port, 12-term calibration.

Byte Transfer Rate: >100 Kbytes/second

Single Marker Readout: <15 msec

201 Point Real/Imaginary Data Pair Readout: <(15 msec + sweep time)

Measurement Conditions: Instrument setup is 10 MHz to 3 GHz sweep, single channel, single graph (log mag) display, 30 kHz IF bandwidth, no averaging, no markers, no limit lines.

Data Transfer Conditions: Data Pair Format ON (mag and phase pairs), Most Significant Byte First (MSB) order, and Final (displayed) Data.

Typical Throughput Times (ms) without Correction

Data Format	3 Points	51 Points	101 Points	201 Points	401 Points	1601 Points
32 Bit	10	20	40	50	111	381
64 Bit	10	20	30	60	110	391
ASCII	10	61	90	180	361	1382

Typical Throughput Times (ms) with 12-term Correction

Data Format	3 Points	51 Points	101 Points	201 Points	401 Points	1601 Points
32 Bit	10	80	141	250	450	1582
64 Bit	10	80	140	241	460	1582
ASCII	20	111	200	371	701	2574

GPIB INTERFACE - Two Connectors

System GPIB (IEEE-488.2): Connects to an external controller for use in remote programming of the network analyzer. Address can be set from the front panel and can range from 1 to 30.

Dedicated GPIB: Connects to external peripherals for network analyzer controlled operations (e.g. GPIB plotters, frequency counters, frequency synthesizers, and power meters).

GPIB Pass Thru Mode: Allows users to control equipment that is connected to Scorpion via the Dedicated GPIB interface.

Interface Function Codes: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC0, and C0.

GPIB Data Transfer Formats: ASCII, 32-bit floating point, or 64-bit floating point. 32-bit and 64-bit floating point data can be transferred with LSB or MSB first. When using Language Support Mode, most of the output formats of the 8753 will be supported, except for the hp internal binary data array format.

VECTOR ERROR CORRECTION

There are four methods of calibration:

1) Open-Short-Load (OSL) calibration method using short circuits, open circuits, and terminations (fixed or sliding)

2) Offset-Short (waveguide) calibration,

3) LRL/LRM - Line-Reflect-Line or Line-Reflect-Match calibration, and

4) TRM - Thru-Reflect-Match calibration.

There are seven vector error correction models available:

1) Full 12-Term (2 Ports)

2) Full 24-Term (3 Ports)

3) Full 40-Term (4-Ports)

4) One Path/Two Port

5) Two Path/Three Port

6) Frequency Response (Transmission/Reflection)

7) Reflection Only

Full 12-term can be used on the fully reversing models MS462xB, MS462xC (depending on the test set) and MS462xD only. Full 24-Term can be used on the 3-port models (MS462xB with MS4600/3x). Full 40-Term can be used on the 4-port models (MS462xD). Front-panel display indicates the type of calibration stored in memory. Front-panel button selects whether calibration is to be applied, and the Cal LED illuminates when error correction is being applied.

Flexible Cal™: Optimize throughput by performing only the sweeps required to characterize mult-port devices. Also enables convenient switching between 2, 3 and 4-port calibrations without re-calibration.

Calibration Sequence: Prompts the user to connect the appropriate calibration standard to Port 1 and/or Port 2 and/or Port 3 and/or Port 4.

Calibration Standards: For coaxial calibrations the user selects SMA, GPC-3.5, GPC-7, Type N, 2.4 mm, TNC, 7/16, N-75 or K Connector from a calibration menu. Use of fixed or sliding loads can be selected for each connector type. Open circuit capacitance coefficients can be modified. Short circuit offset length may be modified. Inductance values for the shorts and terminations may be modified. In general, all calibration parameters may be modified manually or through the GPIB interface.

Reference Impedance: Modify the reference impedance of the measurement to other than 50 ohms (but positive).

LRL/LRM Calibration Capability: The LRL calibration technique uses the characteristic impedance of a length of transmission line as the calibration standard. A full LRL calibration consists merely of two transmission line measurements, a high reflection measurement, and an isolation measurement. The LRM calibration technique is a variation of the LRL technique that utilizes a precision termination rather that a second length of transmission line. A third optional standard, either Line or Match, may be measured in order to extend the frequency range of the calibration. This extended calibration is achieved by mathematically concatenating either two LRL, two LRM, or one LRL and one LRM calibration(s). Using these techniques, full 12-term error correction can be performed on the MS462xB, MS62xC, or MS462xD, refer to B, C, and D.

Dispersion Compensation: Selectable as Coaxial (non-dispersive), Waveguide, or Microstrip (dispersive).

Reference Plane: Selectable as Middle of line 1 or Ends of line 1.

NEW

AutoCal: The MS462xx incorporates internal control of the 3658x-series AutoCal modules, including the new 4-port module, as a standard feature. For 4-Port AutoCal use with 2 and 3-port models, the option for processing upgrade (MS4600/24) enables the use of more than 401 data points.

For more information, see the following AutoCal related literature:

3658 Series AutoCal VNA 2-Port Automatic Calibrators Brochure (p/n: 11410-00189)
AutoCal Automatic Calibrator Application Note (p/n: 11410-00258)
3658 Series AutoCal VNA 4-Port Automatic Calbrators Brochure (p/n: 11410-00294)
4-Port AutoCal Automatic Calibrator Application Note (p/n: 11410-00298)

Measurement Frequency Range: Frequency range of measurement can be narrowed within the calibration range without recalibration. CW mode permits single frequency measurements, also without recalibration. In addition, the system accepts N discrete frequency points where 2 < N < 1601.

Domains: Frequency Domain, CW Draw, and optional High Speed Time (Distance) Domain.

Formats: Log Magnitude, Phase, Log Magnitude & Phase, Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, Log Polar, Group Delay, Linear Magnitude, Linear Magnitude and Phase, Real, Imaginary, Real & Imaginary, SWR, and Power.

Group Delay: Group Delay is measured by computing the phase change across a frequency interval using the formula, $\tau_g = -(\text{phase (deg.)}) / \{360 \cdot (\text{frequency (Hz)})\}$

> **Aperture:** Defined as the frequency interval over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency span divided by the number of points while the maximum is 20% of the span. A larger aperture can be considered equivalent to increased smoothing.
>
> **Range:** The maximum delay range corresponds to ±180 degrees of phase change over a frequency step. A step of 100 kHz corresponds to a maximum delay of 10 µs.

Data Points: 1601 maximum. Number of data points can be switched to a value of 801, 401, 201, 101, 51, 15, or 3 points without recalibration (if 1601 points were used in the calibration).

Standard Measurements	1	3	15	51	101	201	401	801	1601	2 < Discrete < 1601
3-Port Balanced/Differential	1	3	15	51	101	201	401	801	1601	2 < Discrete < 401
With MS4600/24 Processing Upgrade	1	3	15	51	101	201	401	801	1601	2 < Discrete < 1601
4-Port Balanced/Differential	1	3	15	51	101	201	401	801	1601	2 < Discrete < 1601

In addition, the system accepts an arbitrary set of N discrete data points where: 2 < N < 1601. CW mode permits selection of a single data point without recalibration.

NEW

Reference Delay: Can be entered in time or in distance (when the dielectric constant is entered). Automatic reference delay feature adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between reference and test is always accurate and stable since measurement frequencies are always synthesized. In addition, the system compensates reference phase delay for dispersive transmission media such as microstrip. Delay information can be saved to output file types.

Alternate Sweep: Allows the capability to decouple channel 1 and 2 from channel 3 and 4 for the following parameters: correction type, start and stop frequencies, number of data points, markers, sweep time, averaging, smoothing and IF bandwidth. Operation of alternate sweep is not compatible with the following modes: Multiple source, power sweep, gain compression, time domain, and adapter removal.

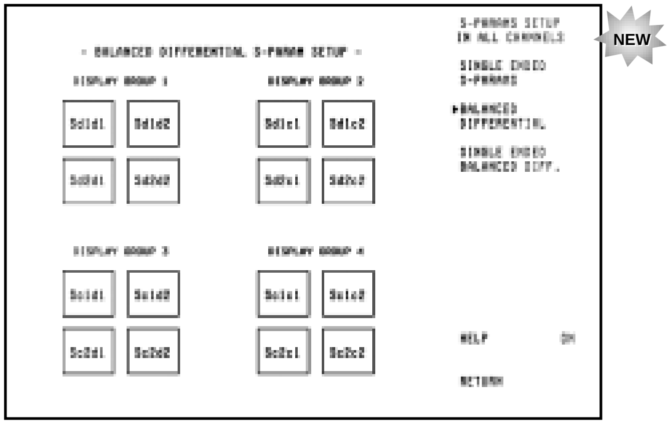
Tune Mode: Tune Mode optimizes sweep speed in tuning applications by updating forward S-parameters more frequently than reverse ones. This mode allows the user to select the ratio of forward sweeps to reverse sweeps after a full 12-term calibration. The ratio of forward sweeps to reverse sweeps can be set anywhere between 1:1 to 10,000:1.

Sequencing: Up to seven measurement sequences can be created, stored, edited, and run from the front panel. Sequences can include front panel functions as well as user definable control statements. Sequences can be run from either the unit front panel, via GPIB, or from an AT-style keyboard plugged into the front panel.

DISPLAY CAPABILITIES

Display Channels: Four, each of which can display any S-parameter or user defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously. Each channel is also capable of displaying harmonics, noise figure, intermodulation distortion, or time domain trace. A single channel, two channels (1 and 3, or 2 and 4), or all four channels can be displayed simultaneously. Channels 1 and 3, or channels 2 and 4 can be overlaid for rectilinear graph types.

Display Groups (For MS462xD Models only): Four groups of four channels for a total of sixteen displays, with only four channels displayed at a time. Each channel can display any S-parameter or user-defined parameter in any format as described in Display Channels previously.   Display groups are selected with front panel channel-selection keys (Ch 1, Ch 2, Ch 3, and Ch 4).



Liquid Crystal Display: A Color 8.4" Thin Film Transistor (TFT) LCD display is standard on all units. The default color configuration is as follows: graticules are displayed in green, measurement data in red, background in black, markers and limits in blue, and overlaid trace data in yellow. Trace data stored in memory are displayed in green.

Trace Color: The color of display traces, memory, text, markers, background color, and limit lines are all user definable.

Trace Overlay: Displays two data traces on the active channel's graticule simultaneously. The overlaid trace is displayed in yellow and the primary trace is displayed in red.

Trace Memory: A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data.

Markers: Twelve independent markers can be used to read out simultaneous measurement data. In alternate sweep mode there are sets of markers for each frequency sweep. In delta-reference marker mode, any one marker can be selected as the reference for the other eleven. Markers can be directed automatically to the minimum or maximum of a data trace.

Enhanced Markers: Marker search for a level or bandwidth, displaying an active marker for each channel, and discrete or continuous (interpolated) markers. Identifies the X dB bandwidth and ripple of amplifiers, filters and other frequency sensitive devices.

Marker Sweep: Sweeps upward in frequency between any two markers. Recalibration is not required during the marker sweep.

Limit Lines: Either single or segmented limit lines can be displayed. Two limit lines are available for each trace.

Single Limit Readouts: Interpolation algorithm determines the exact intersection frequencies of data traces and limit lines.

Segmented Limit Lines: A total of 20 segments (10 upper and 10 lower) can be generated per data trace. Complete segmented traces can be offset in both frequency and amplitude.

Test Limits:
Both single and segmented limits can be used for PASS/FAIL testing. PASS or FAIL status is indicated on the display after each sweep. In addition, PASS/FAIL status is output through the rear panel I/O connector as selectable TTL levels (PASS=0V, FAIL=+5V, or PASS=+5V, FAIL=0V).

Scale Resolution (minimum):

Log Magnitude: 0.001 dB/div Linear Magnitude: 1 pU

Phase: 0.01° **Group Delay:** 0.001 ps

Time: 0.001 ms **Distance:** 0.1 mm

SWR: 1 pU **Power:** 0.01 dB

Autoscale: Automatically sets resolution and offset to fully display measurement data

Reference Position: Can be set at any graticule line.

Annotation: Type of measurement, vertical and horizontal scale resolution, start/stop or center/span frequencies, and reference position.

Blank Frequency Information: Blanking function removes all references to displayed frequencies on the LCD. Frequency blanking can only be restored through a system reset or GPIB command.

HARD COPY

Printer: Menu selects full screen graphical, tabular data, *.SnP (S1P, S2P, S3P, or S4P), *.MnP (M3P or M4P consisting of mixed-mode S-parameters), or *.txt output, and printer type. The number of data points of tabular data can be selected as well as data at markers only.

The MS462XX series will support the same printers as the Anritsu 37000 family of network analyzers, which currently include the HP 2225C InkJet, HP QuietJet, HP DeskJet, HP LaserJet II, III, IV, & V Series, and Epson compatible printers with Parallel (Centronics) interfaces. Compatible with ANRITSU "CAP3700" program (outputs bitmap file over GPIB) and provide bitmap output over front panel to disk.

GPIB Plotters: The MS462xx series will support the same plotters as the Anritsu 37000 family of network analyzers, which currently include HP Models 7440A, 7470A, and 7475A, and Tektronix Model HC100 plotters. Menu selects plotting of full or user-selected portions of

graphical data. The plotter is connected to the dedicated GPIB bus.

Performance: After selecting the Start Print button, front panel operation and measurement capability is restored to the user within 2 seconds.

STORAGE

Internal Memory: Ten front panel states (setup/calibration) can be stored and recalled from non-volatile memory locations. The current front panel setup is automatically stored in non-volatile memory at instrument power-down. When power is applied, the instrument returns to its last front panel setup. The system will be able to exchange two stored calibrations in less than 0.5 seconds.

Internal Non-Volatile Memory: Used to store and recall measurement and calibration data and front-panel setups. All files are MS-DOS compatible. File names can be 1 to 8 characters long, and must begin with a character, not a number. Extensions are automatically assigned.

Internal Floppy Disk Drive: A 3.5-inch diskette drive with 1.44 Mbytes formatted capacity is used to load measurement programs and to store and recall measurement and calibration data and front panel setups. All files are MS-DOS compatible. File names can be 1 to 8 characters long, and must begin with a character, not a number. Extensions are automatically assigned.

Measurement Data Size: 102.8 kbytes per 1601 point S-parameter data file.

Calibration Data Size: 187.3 kbytes per 1601 point S-parameter data file (12-term cal plus setup).

Trace Memory File Size: 12.8 kbytes per 1601 point channel.

External SCSI-2 Drive Support: Additional storage space is permitted through the use of an external SCSI-2 drive. When attached, the internal storage space is removed when using the external storage. Exchanging two stored calibrations becomes dependent on the performance of the external drive.

GENERAL

Front Panel Connectors and Controls:

Standard Test Port: N female

Optional Connector Types: 3.5mm female (MS4600/11SF), 3.5mm male (MS4600/11S), GPC-7 (MS4600/11A) and N male (MS4600/11NM)

Probe Power: –12, +15V, & GND; resettable fuse protected; HP 85024 compatible connector

External Keyboard: An IBM-AT compatible keyboard can be connected to the front panel for navigating through front panel menus, annotation of data files and display labels, printing displays and pausing instrument sweeps.

Rear Panel Connectors and Controls:

Printer: Standard 25-pin IBM PC interface for an external parallel port printer.

Line Selection: Power supply automatically senses 85V, 120V, 220V or 240V lines.

IEEE 488.2 GPIB: Standard IEEE488.2 GPIB interface. Connection for instrument controller

Dedicated GPIB: Standard IEEE488.2 GPIB interface. Connection for external source(s), plotters, or power meter

Serial Port: 15-pin male RS232 interface; connection for AutoCal module

SCSI-2: 50-pin female "D" Type Micro-Miniature interface

Ethernet: 15-pin female IEEE802.3 interface (Contact factory for RJ-45 Adapter)

VGA: Standard 15-pin female VGA interface

Noise +28V: BNC female connector supplying pulsed drive for noise diode

Noise Input: K female input connector from noise diode output

External Source Input: K female

External I/O: 15-pin D-sub connector to support Limits (pass/fail) information

P1 Bias T Fuse: 0.5A fuseholder for Port 1 Bias T

P2 Bias T Fuse (Not Available on MS462xA Models): 0.5A fuseholder for Port 1 Bias T

The following connectors are all BNC female:

External Trigger: External triggering for MS462XX measurement, ±1V trigger 10k ohm input impedance.

External Analog Out: –10V to +10V with 5 mV resolution, varying in proportion to user-selected data (e.g., frequency, amplitude).

External Analog In: ±50 volt input for displaying external signals on the LCD display in Diagnostics mode.

10 MHz Ref In: Connects to external reference frequency standard, 10 MHz, +5 to -5 dBm, 50 ohms.

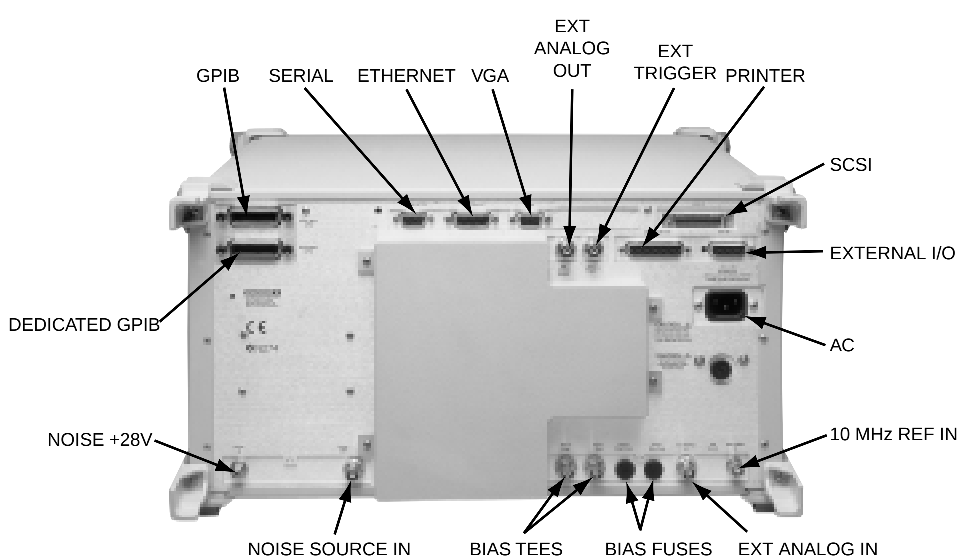
P1 Bias T: 0.5A maximum, 40V DC maximum

P2 Bias T (Not Available on MS462xA Models): 0.5A maximum, 40V DC maximum

Power Requirements: 85-240V, 48-63Hz, 540 VA maximum

Dimensions: 222H x 425W x 450D mm (8.75 x 16.75 x 17.75 in.)

Weight: Ranges between 16 kg (35 lb.) for a MS4622A with no options installed and 23 kg (52 lb.) for a **MS4624D** with all options installed.



ENVIRONMENT

Storage Temperature Range: –40˚ to +75˚C
Operating Temperature Range: 0˚C to +50˚C (specifications apply at 23 ± 3˚ C)
Relative Humidty: 5% to 95% at +40˚C

EMC

Meets the emissions and immunity requirements of:
EMC Directive - 89/336/EEC per EN61326

Emissions Standard:
EN55011:1991
IEC 61000-3-2
IEC 61000-3-3

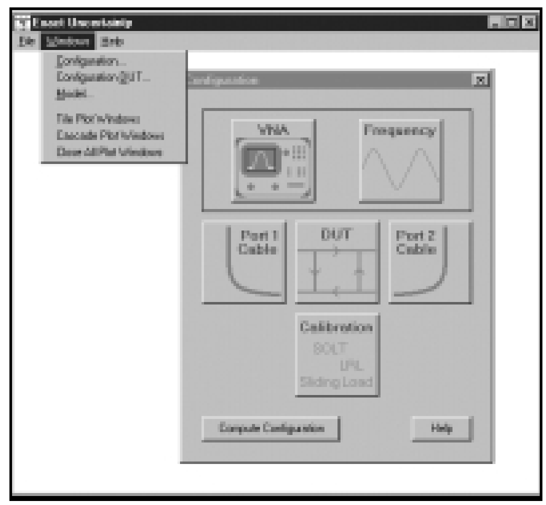
Immunity Standard:
IEC 1000-4-2:1995
IEC 1000-4-3:1995
IEC 1000-4-4:1995
IEC 1000-4-5:1995
IEC 1000-4-6:1995
IEC 1000-4-8:1995
IEC 1000-4-11:1995

SAFETY

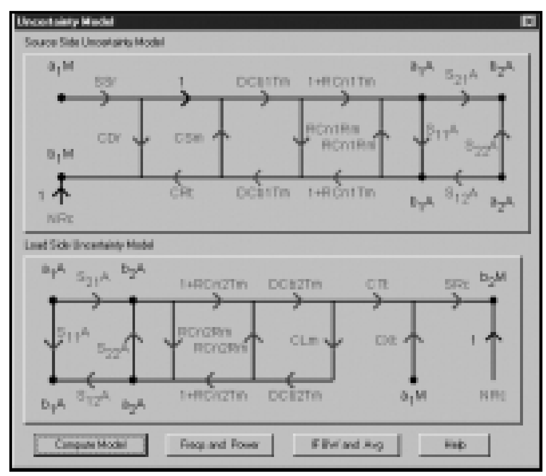
Meets safety requirements of Low Voltage/Safety Standard:
72/23/EEC - EN61010-1:1993

MEASUREMENT UNCERTAINTY

Exact Uncertainty is a Windows based program (Model No. 2300-361) that is available to help you obtain the uncertainty data that is appropriate for your specific setup conditions. An example of the basic configuration window is shown here to illustrate the intuitive graphical user interface. You can select the Anritsu VNA and the calibration kit being used as well as the frequency range of interest. Specified performance parameters are automatically included to simplify the calculations. This utility enables users to meet the uncertainty analysis requirements of the ISO standards.

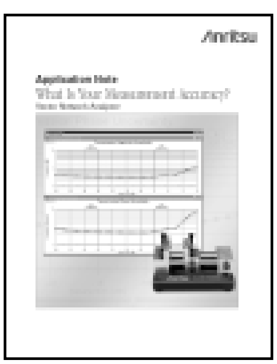


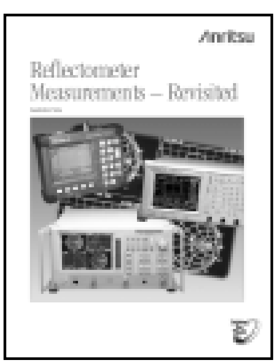
The uncertainty curves in the following pages were generated using the utility.



Uncertainty Models includes the important VNA effective parameters, test configuration parameters such as connector and cable performance and Device Under Test (DUT) parameters. The model leads to equations that are quite elaborate. For more explanation of uncertainties, models and Exact Uncertainty, see the following application notes:

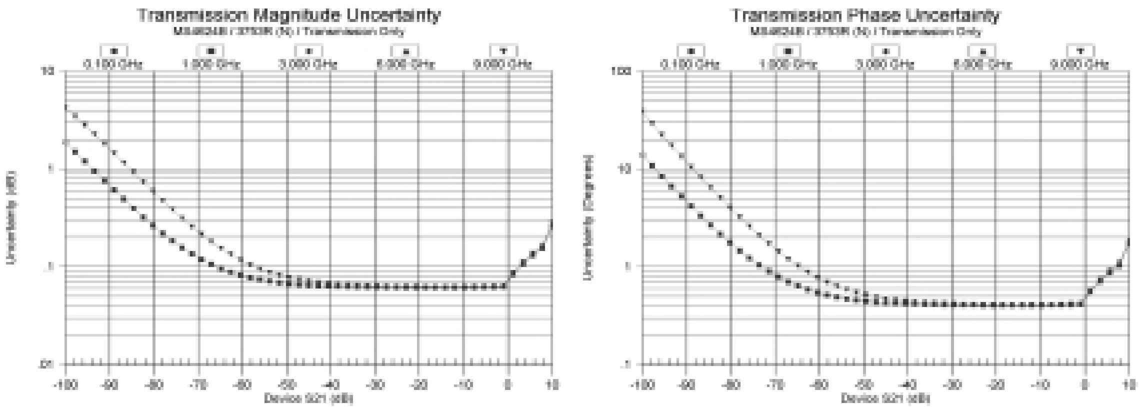
What is Your Measurement Accuracy (p/n: 11410-00270)
Reflectometer Measurements-Revisited (p/n: 11410-00214).



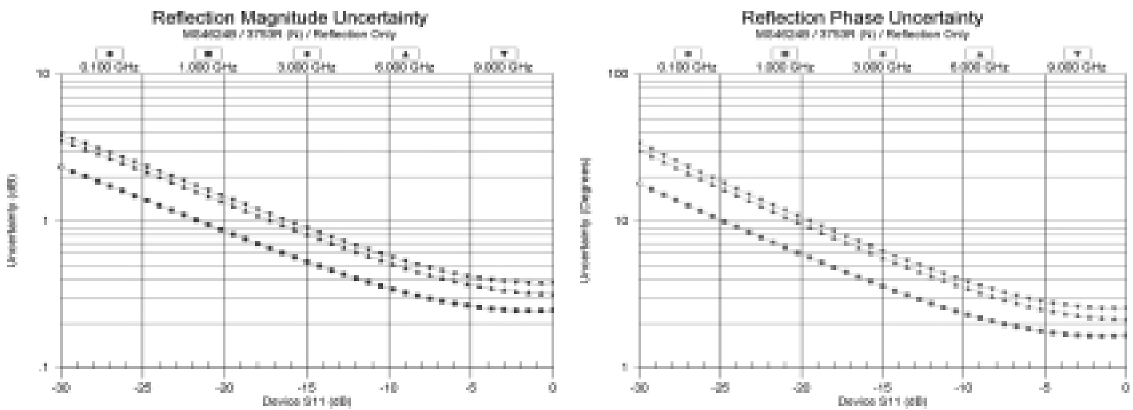


UNCERTAINTY GRAPHS

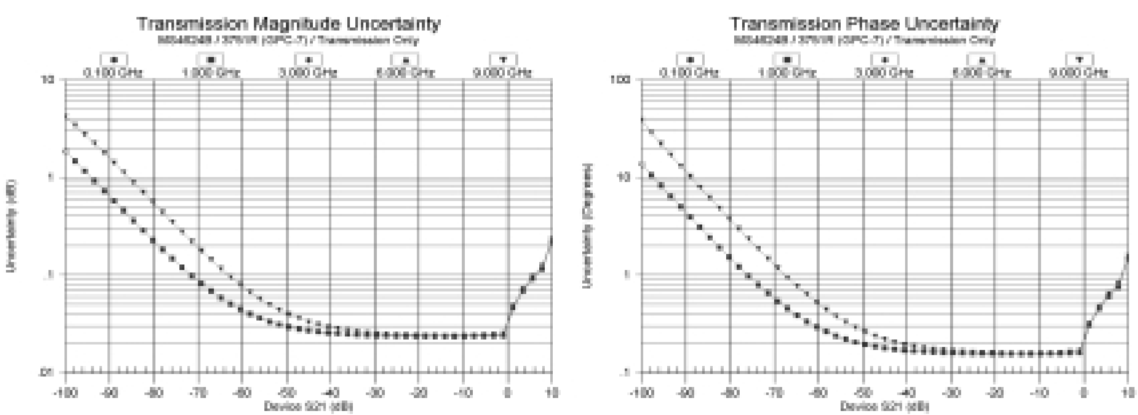
The following graphs give measurement accuracy after 12-term vector error correction for N, 3.5mm and GPC-7 connector types. The errors are worst case contributions of residual directivity, load and source match, frequency response, isolation, network analyzer dynamic accuracy, and connector repeatability.



Transmission Measurements: N Connectors



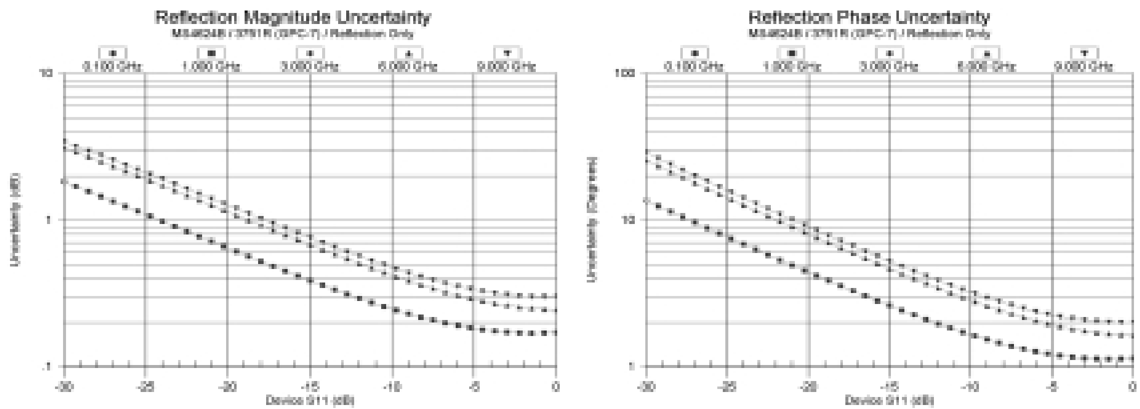
Reflection Measurements: N Connectors



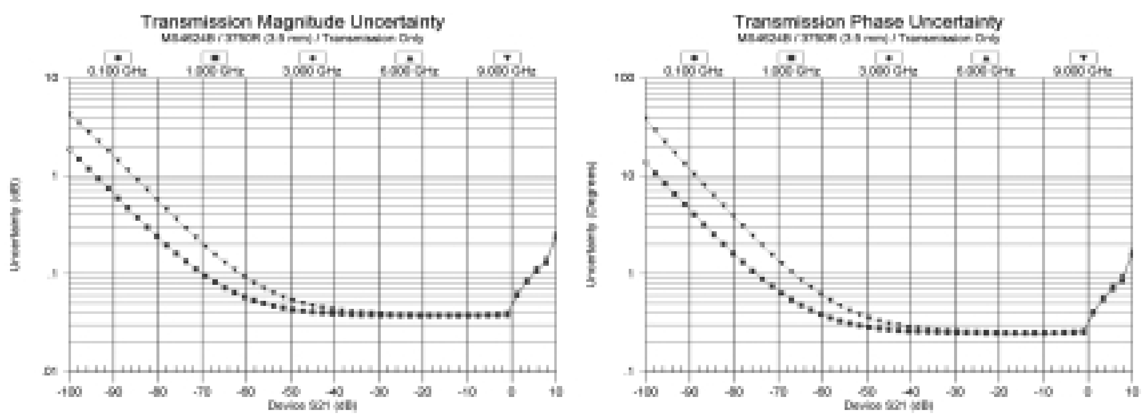
Transmission Measurements: GPC-7 Connectors

UNCERTAINTY GRAPHS

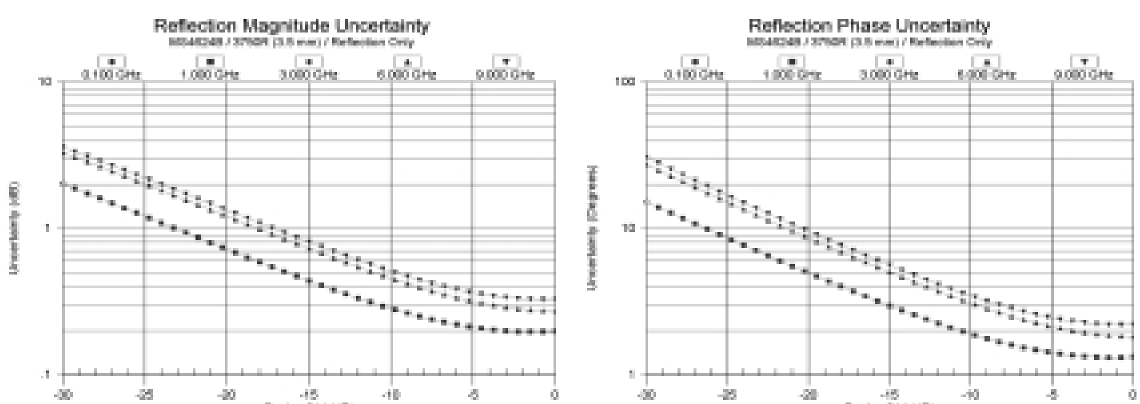
In preparing the graphs on these two pages, a 10 Hz IF bandwidth and one averaging point were used following a calibration using 0 dBm Port Power. A 375xR series cal kit was used to obtain this data, which was generated using the Exact Uncertainty utility. Changes in the IF bandwidth or averaging can result in variations at low levels.



Reflection Measurements: GPC-7 Connectors



Transmission Measurements: 3.5 mm Connectors



Reflection Measurements: 3.5 mm Connectors

CONFIGURATION OVERVIEW

Scorpion is available in many powerful configurations to satisfy all of your RF measurement requirements; furthermore, Scorpion is easy to upgrade as your measurement requirements expand. Configuring your Scorpion is as easy as following this three-step process:

(1) Choose the desired S-parameter measurement configuration

(2) If required, specify the 2nd Source part number according to this selected configuration

(3) If required, add additional options and specify connector type

The latest manufacturing techniques enable you to preserve your investment. With the modular and compartmentalized infrastructure, Scorpion is easy to manufacture, maintain, and upgrade.

(1) Choose the desired S-parameter measurement configuration

NEW

	10 MHz - 3 GHz	10 MHz - 6 GHz	10 MHz - 9 GHz
2-Port T/R[1]	MS4622A	MS4623A	MS4624A
2-Port	MS4622B	MS4623B	MS4624B
3-Port	MS4622B + MS4600/3A	MS4623B + MS4600/3B	MS4624B + MS4600/3E
3-Port T/R[2]	MS4622B + MS4600/6	MS4623B + MS4600/6	MS4624B + MS4600/6
4-Port	MS4622D	MS4623D	MS4624D
2-Port DRA[3]	MS4622C	MS4623C	MS4624C
3-Port DRA[3]	MS4622C + MS4600/3C	MS4623C + MS4600/3D	MS4624C + MS4600/3F

[1]T/R is economical Transmission/Reflection (or one-path, two-port) configuration that measures S_{11}, S_{21}.
[2]3-Port T/R measures 2-port S-parameters plus two-path, three-port measurements.
[3]DRA is Direct Receiver Access configuration for use in developing custom solutions.

2) For IMD and/or Mixer configurations, make sure to include the second source part number

Option MS4600/3x, as shown in the following table, adds an additional integrated source to support S-parameter measurements of 3-port devices. This integrated source also supports mixer measurements and intermodulation distortion (MS4600/13 provides integrated application software to simplify IMD testing) measurements.

Option Description	Part Number
3 GHz 2nd Source for MS4622B	MS4600/3A
6 GHz 2nd Source for MS4623B	MS4600/3B
9 GHz 2nd Source for MS4624B	MS4600/3E
3 GHz 2nd Source for MS4622C	MS4600/3C
6 GHz 2nd Source for MS4623C	MS4600/3D
9 GHz 2nd Source for MS4624C	MS4600/3F

This additional source (Option 3x) is standard in the 4-port network analyzer (i.e. "D" Models) and supports true S-Parameter measurements of 4-port devices.

(3) Finally, specify any additional options to complete your configuration

Scorpion can be further upgraded to include the following options:

Option Description	Part Number	Availablity
Time Domain	MS4600/2	All Models
3 GHz Noise Figure[1]	MS4600/4, 4D, 4F	B, C and D Models respectively
6 GHz Noise Figure[1]	MS4600/4B, 4E, 4G	B, C and D Models respectively
Frequency Translating Group Delay (FTGD)	MS4600/5	B and D Models Only
T/R Step Atten	MS4600/7	A Models Only
Harmonic Measurement	MS4600/8	All Models
Test Port Connector[2]	MS4600/11	All Models
Intermodulation Distortion[3]	MS4600/13	All Models
Processing Upgrade	MS4600/24	B and C Models Only

[1]Noise Figure measurements start at 50 MHz
[2]Standard Connector is N-female, also available is N male (MS4600/11NM), 3.5mm male (MS4600/11S), 3.5mm female (MS4600/11SF), and GPC-7 male (MS4600/A)
[3]Intermodulation Distortion requires an additional source (external source or reference MS4600/3x)

MODELS

A flexible choice of models from "economical" to "fully-loaded, deadly accurate" ensures you can configure a system to satisfy your requirements. You can upgrade the model between frequency ranges and configurations as your requirements change for additional value.

Configuration Summary	MS462x 10 MHz to 3 GHz	MS4623x 10 MHz to 6 GHz	MS4624x 10 MHz to 9 GHz
MS462xA T/R[1]	■	■	■
MS462xB S-Parameter	■	■	■
MS462xC DRA[2]	■	■	■
MS462xD 4-Port	■	■	■

[1]T/R is economical Transmission/Reflection (or one-path, two-port) configuration that measures S_{11}, S_{21}.
[2]DRA is Direct Receiver Access configuration for use in developing custom solutions.

MS462xA Transmission/Reflection Analyzer

These economical analyzers are one path, two port network analyzers that satisfies high volume passive RF production requirements for stability, reliability, speed, dynamic range and accuracy.

❏ **MS4622A,** 10 MHz to 3 GHz, 2-Port, T\R
❏ **MS4623A,** 10 MHz to 6 GHz, 2-Port, T\R
❏ **MS4624A,** 10 MHz to 9 GHz, 2-Port, T\R

MS462xB Vector Network Measurement System (VNMS)

For passive, active, and frequency translating devices, these powerful S-parameter configurations offer the performance, ease-of-use and versatility of a vector network analyzer (VNA) with an amazing twist: integrated options that allow 3-Port, Noise Figure, Harmonic, Frequency Translating Group Delay and Intermodulation Distortion (IMD) measurements. The 3-port configuration includes mixed-mode S-parameters, arbitrary impedance and powerful embedding/de-embedding routines, too.

❏ **MS4622B,** 10 MHz to 3 GHz, 2-Port
❏ **MS4623B,** 10 MHz to 6 GHz, 2-Port
❏ **MS4624B,** 10 MHz to 9 GHz, 2-Port

MS462xC VNMS / Direct Receiver Access

With direct access to the receivers (i.e. without an integrated test set), these vector network analyzers offer the ultimate flexibility for power amplifiers, frequency translating, and multiple output device requirements.

❏ **MS4622C,** 10 MHz to 3 GHz, 2-Port
❏ **MS4623C,** 10 MHz to 6 GHz, 2-Port
❏ **MS4624C,** 10 MHz to 9 GHz, 2-Port

MS462xD VNMS / 4-Port, Balanced Differential Measurements

This newest 4-port measurement solution includes mixed-mode S-Parameters, aribtrary impedance, powerful embedding/de-embedding routines and the second internal source to tame your toughest RF device requirements. Many of these new features are available in the existing model configurations, too.

❏ **MS4622D,** 10 MHz to 3 GHz, 4-Port
❏ **MS4623D,** 10 MHz to 6 GHz, 4-Port
❏ **MS4624D,** 10 MHz to 9 GHz, 4-Port

OPTIONS

Rack Mount

❏ **MS4600/1,** Rack Mount Kit with Slides
For all models, rack mount kit containing a set of track slides (90Υ tilt capability), mounting ears, and front panel handles for mounting the instrument in a standard 19-inch equipment rack.

❏ **MS4600/1A,** Rack Mount Kit with Handles
For all models, rack mount kit containing a set of mounting ears and hardware to permanently mount instrument in a standard 19-inch equipment rack. Slides are not provided.

Time Domain

❏ **MS4600/2**, Time (Distance) Domain
For all models, Time domain analysis can also be performed utilizing Lowpass, Bandpass or Phasor Impulse processing techniques. Windows and Gating support additional conditioning to further enhance time domain processing.

Second Internal Source, Third Test Port

The following options add internal second source, third test port and test attenuator. The appropriate models are also shown.

❏ **MS4600/3A,** MS4622B, 3 GHz

❏ **MS4600/3B,** MS4623B, 6 GHz

❏ **MS4600/3C,** MS4622C, 3 GHz

❏ **MS4600/3D,** MS4623C, 6 GHz

❏ **MS4600/3E,** MS4624B, 9 GHz

❏ **MS4600/3F,** MS4624C, 9 GHz

Noise Figure

The following options add integrated Noise Figure measurements. Noise Source not included. The appropriate models are also shown.

NF Options, 50 to 3000 MHz

❏ **MS4600/4,** MS4622B, MS4623B, MS2624B

❏ **MS4600/4D,** MS4622C, MS4623C, MS4624D

❏ **MS4600/4F,** MS4622D, MS4623D, MS4624D

NF Options, 50 to 6000 MHz,

❏ **MS4600/4B,** MS4623B, MS4623B

❏ **MS4600/4E,** MS4623C, MS4624C

❏ **MS4600/4G,** MS4623D, MS4624D

Noise Sources

❏ **NC346A**, 3.5mm, 5 dB ENR Noise Source

❏ **NC346B**, 3.5mm, 15 dB ENR Noise Source

Frequency Translating Group Delay

❏ **MS4600/5,** Frequency Translating Group Delay
For MS462xB and MS462xD, adds mixer group delay measurement.

Third Test Port Without Second Internal Source

❏ **MS4600/6,** Third Test Port
For MS462xB and MS462xC, adds third test port on front panel with routing to rear panel for external source (3.5mm rear panel connector). Configuration supports 12-term (2-port) vector correction plus vector correction of S_{11}, S_{21} and S_{31} on 3-port devices. With external source, 3-port (24-term) calibrations can be performed.

Source Step Attenuator

❏ **MS4600/7,** T/R Step Attenuator
For MS462xA, adds internal step attenuator to internal source.

Harmonic Measurements

❏ **MS4600/8,** Harmonic Measurements
For all models, adds firmware to orchestrate harmonics measurements.

Connector Designation

Standard front panel connector type is N female. Use the following options to specify optional connector types. Connector type is the same for all ports.

❏ **MS4600/11NM,** Replaces N female with N male Test Port Adapters

❏ **MS4600/11S,** Replaces N female with 3.5mm male Test Port Adapters

❏ **MS4600/11SF,** Replaces N female with 3.5mm female Test Port Adapters

❏ **MS4600/11A,** Replaces N female with GPC-7 male Test Port Adapters

Intermodulation Distortion Measurements

❏ **MS4600/13,** Intermodulation Distortion Measurements

For all models, adds firmware to orchestrate CW, swept frequency and swept power IMD measurements. Second source is required (reference MS4600/3x) or external source can be used.

Processing Upgrade

❏ **MS4600/24**, Processing Upgrade
For MS462xB and MS462xC (standard in MS462xD), adds processing upgrades for (1) additional data points (from 401 to 1601) when performing balanced/differential measurements on 3-port devices, (2) S4P file use in embedding/de-embedding matching circuits, (3) additional throughput enhancements, and (4) enables the use of more than 401 data points when using 4-Port AutoCals with 2 and 3-port models.

Calibration Options

❏ **MS4600/98,** Z540/Guide 25 Calibration

❏ **MS4600/99,** Premium Calibration

CALIBRATION KITS

Using Anritsu's precision coaxial OSLT calibration kits ensures accurate operation of your MS462xx series VNMS. These kits include precision components required to perform the requisite calibrations.

Standard (10 MHz to 9 GHz)

- ❏ **3750R**, SMA/3.5 mm Calibration Kit
- ❏ **3750R/1**, Adds a set of five Phase Equal Insertables (PEIs).
- ❏ **3750R/3**, Adds additional 3.5 mm (female) and 3.5 mm (male) terminations required for four port calibrations.
- ❏ **3751R**, GPC-7 Calibration Kit
- ❏ **3751R/2**, Adds a third GPC-7 termination required for three port calibrations.
- ❏ **3751R/3**, Adds two additional GPC-7 terminations required for four port calibrations.
- ❏ **3753R**, N (50 Ohms) Connector Calibration Kit
- ❏ **3753R/1**, Adds a set of five Phase Equal Insertables (PEIs).
- ❏ **3753R/3**, Adds additional N (female) and N (male) terminations required for four port calibrations.
- ❏ **3753-75R**, N (75 Ohms) Calibration Kit, Specified to 3 GHz
- ❏ **3753-75R/3**, Adds additional N (75 Ohm female) and N (75 Ohm male) terminations required for four port calibrations.

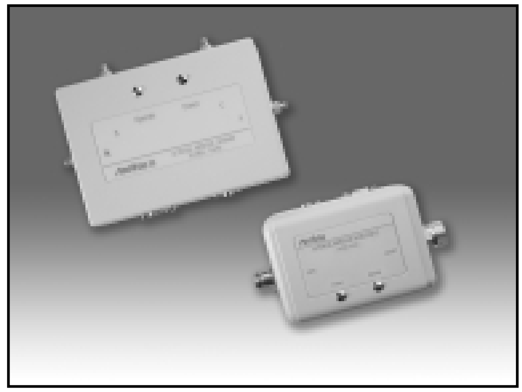
VERIFICATION KITS

Anritsu offers a complete line of coaxial verification kits to confirm your system's performance. All verification kits contain precision components with characteristics traceable to the US National Institute of Standards and Technology (NIST).

- ❏ **3663R**, Type N Verification Kit
- ❏ **3666R**, SMA/3.5 mm Verification Kit
- ❏ **3667R**, GPC-7 Verification Kit

AutoCal®

The AutoCal modules are automatic precision calibrators that provide fast, repeatable, and accurate coaxial calibrations up to 9 GHz. The AutoCal system includes the module, serial cable, power supply, power cord, characterization disk, and operational manual. Scorpion has standard firmware to control AutoCal so no further options are required for auto-calibrations.



- ❏ **36581NNF/2**, N(m) to N(f), 10 MHz to 9 GHz
- ❏ **36581KKF/2**, K(m) to K(f), 10 MHz to 9 GHz
- ❏ **36584KF,** 4-Port K(f), 10 MHz to 9 GHz
- ❏ **36584NF,** 4-Port N(f), 10 MHz to 9 GHz
- ❏ **36583S**, Test Port Cable Converter Set, SMA type
- ❏ **36583L**, Test Port Cable Converter Set, 3.5mm type
- ❏ **36583K**, Test Port Cable Converter Set, K type
- ❏ **760-208**, Transit Case for AutoCal

TEST PORT CABLES

High Performance, Flexible

- ❏ **15LL50-0.3A**, 3.5 mm Cable, Male to Male, 30 cm (11.8 in.)
- ❏ **15LL50-0.6A**, 3.5 mm Cable, Male to Male, 60 cm (23.6 in.)
- ❏ **15LLF50-0.3A**, 3.5 mm Cable, Male to Female, 30 cm (11.8 in.)
- ❏ **15LLF50-0.6A**, 3.5 mm Cable, Male to Female, 60 cm (23.6 in.)
- ❏ **15NN50-0.3A**, Type N Cable, Male to Male, 30 cm (11.8 in.)
- ❏ **15NN50-0.6A**, Type N Cable, Male to Male, 60 cm (23.6 in.)
- ❏ **15NNF50-0.3A**, Type N Cable, Male to Female, 30 cm (11.8 in.)
- ❏ **15NNF50-0.6A**, Type N Cable, Male to Female, 60 cm (23.6 in.)

Economy, Armored Semi-Rigid

- ❑ **3670A50-1**, GPC-7 Cable, 30.5 cm (1 ft.)
- ❑ **3670A50-2**, GPC-7 Cable, 61 cm (2 ft.)
- ❑ **3670K50-1**, K(f)-K(m) Cable, 30.5 cm (1 ft.)
- ❑ **3670K50-2**, K(f)-K(m) Cable, 61 cm (2 ft.)
- ❑ **3670KF50-1**, K(f)-K(f) Cable, 30.5 cm (1 ft.)
- ❑ **3670KF50-2**, K(f)-K(f) Cable, 61 cm (2 ft.)
- ❑ **3670N50-1**, N(f)-N(m) Cable, 30.5 cm (1 ft.)
- ❑ **3670N50-2**, N(f)-N(m) Cable, 61 cm (2 ft.)
- ❑ **3670NN50-1**, N(m)-N(m) Cable, 30.5 cm (1 ft.)
- ❑ **3670NN50-2**, N(m)-N(m) Cable, 61 cm (2 ft.)

GPIB CABLES

- ❑ **2100-5**, GPIB Cable, 0.5 m (1.6 ft.)
- ❑ **2100-1**, GPIB Cable, 1 m (3.3 ft.)
- ❑ **2100-2**, GPIB Cable, 2 m (6.6 ft.)
- ❑ **2100-4**, GPIB Cable, 4 m (13.2 ft.)

PRECISION ADAPTERS

Coaxial

- ❑ **34NK50**, Adapter, DC to 18 GHz, 50 Ω, N(m)-K(m)
- ❑ **34NKF50**, Adapter, DC to 18 GHz, 50 Ω, N(m)-K(f)
- ❑ **34NFK50**, Adapter, DC to 18 GHz, 50 Ω, N(f)-K(m)
- ❑ **34NFKF50**, Adapter, DC to 18 GHz, 50 Ω, N(f)-K(f)

FIXED ATTENUATORS

- ❑ **43KB-3**, Fixed Attenuator,3 dB, DC to 26.5 GHz, 50 W, K(m) to K(f)
- ❑ **43KB-6,** Fixed Attenuator,6 dB, DC to 26.5 GHz, 50 W, K(m) to K(f)
- ❑ **43KB-10,** Fixed Attenuator,10 dB, DC to 26.5 GHz, 50 W, K(m) to K(f)
- ❑ **43KB-20,** Fixed Attenuator, 20 dB, DC to 26.5 GHz, 50 W, K(m) to K(f)

75 Ω ACCESSORIES

- ❑ **34NN75B,** Precision Adapter, DC to 3 GHz, 75 W, N(m)-N(m)
- ❑ **34NFNF75B,** Precision Adapter, DC to 3 GHz, 75 W, N(f)-N(f)
- ❑ **1091-137**, Adapter, DC to 1500 MHz, 75 W, N(f)-F(m)
- ❑ **1091-168**, Adapter, DC to 1500 MHz, 75 W, N(m)-F(m)
- ❑ **1091-169,** Adapter, DC to 1500 MHz, 75 W, N(m) F(f)
- ❑ **1091-170,** Adapter, DC to 1500 MHz, 75 W, N(f)-F(f)
- ❑ **11N75B,** Power Divider, 1 MHz to 3 GHz, 75 W, N(f) input, N(f) output

SOFTWARE

- ❑ **2300-218,** Anritsu Power Tools, Windows® Instrument Drivers
- ❑ **2300-232,** Mixer Measurement Assistant (NxN)
- ❑ **2300-361,** Exact Uncertainty
- ❑ **2300-364,** Scorpion Command Encyclopedia

PRINTER

- ❑ **2000-1214,** HP Desk Jet Printer, Model 450
- ❑ **2000-1216,** Black Printer Cartridge, Model 450
- ❑ **2000-1217,** Rechargeable Battery, Model 450
- ❑ **2000-1218,** Desk Jet Power Cord (UK)
- ❑ **2000-663**, Desk Jet Power Cord (Europe)
- ❑ **2000-664**, Desk Jet Power Cord (Australia)
- ❑ **2000-666,** Desk Jet Power Cord (Japan)
- ❑ **2000-667,** Desk Jet Power Cord (South Africa)
- ❑ **2225-6,** Parallel Interface Printer Cable

OTHER ACCESSORIES AND TOOLS

- ❑ **01-201,** 5/16" Torque Wrench, 8 ft-lbs, for SMA, 3.5 mm, and K Connectors
- ❑ **01-204,** Anritsu Stainless Steel Connector Wrench
- ❑ **760-216,** Scorpion (MS462xx) Transit Case
- ❑ **2000-1064,** 250 MB Iomega SCSI Zip Drive (U.S. 100V Line Voltage only)
- ❑ **2000-1065,** 0.9 m SCSI Cable (SCSI-2 - DB25 Male)
- ❑ **2000-1066,** 104 Key AT Connector Keyboard
- ❑ **2000-1208,** Ethernet Transceiver
- ❑ **2000-1209,** Crossover Ethernet Cable

EXTENDED SERVICE OPTIONS

Standard Warranty is for 3 years, which covers the Scorpion mainframe, options, noise sources, and harmonic phase standard.

On-Site Support Plans

- ❑ **Option ES31,** 3 Year On-Site Repair
- ❑ **Option ES37**, 3 Year On-Site Standard Calibration
- ❑ **Option ES38,** 3 Year On-Site Premium Calibration

Return-to-Service Center Support Plans

- ❑ **Option ES32,** 3 Year Return-to-Service Center Standard Calibration
- ❑ **Option ES34,** 3 Year Return-to-Service Center Premium Calibration
- ❑ **Option ES50,** 5 Year Return-to-Service Center Repair Only
- ❑ **Option ES52,** 5 Year Return-to-Service Center Standard Calibration
- ❑ **Option ES54,** 5 Year Return-to-Service Center Premium Calibration
- ❑ **Option ES55,** 5 Year Return-to-Service Center Repair plus Standard Calibration
- ❑ **Option ES56,** 5 Year Return-to-Service Center Repair plus Premium Calibration

UPGRADE OPTIONS*

- ❑ MS4622x to MS4623x or MS4624x*
- ❑ MS4623x to MS4624x*
- ❑ Add Additional Options*

*Please contact your Anritsu representative for pricing and delivery.

Related Literature	Part Number
Brochures	
Scorpion Family Brochure	11410-00289
Scorpion Technical Specifications	11410-00288
Synthesizer MG3690A Brochure	11410-00262
PATS Brochure	11410-00263
TMATS Brochure	11410-00292
2-Port AutoCal Brochure	11410-00189
4-Port AutoCal Brochure	11410-00294
Power Meter Brochure	15000-00004
Application Notes	
CDROM, Scorpion Literature	10920-00040
2-Port AutoCal Automatic Calibrator	11410-00258
4-Port AutoCal Automatic Calibrator	11410-00298
Noise Figure	11410-00210
Noise Figure Accuracy	11410-00227
Noise Figure Corrections	11410-00256
Intermodulation Distortion	11410-00213
Harmonics	11410-00222
Frequency Translated Group Delay	11410-00236
Global Power Sweep	11410-00243
Multiple Source Control	11410-00244
Reflectometer Measurements-Revisited	11410-00214
Time Domain	11410-00206
Frequency Accuracy	11410-00208
Adjacent Channel Power Ratio (ACPR)	11410-00264
What is Your Measurement Accuracy?	11410-00270
Embedding/De-embedding	11410-00278
Three and Four Port S-parameter Measurements	11410-00279
Arbitrary Impedance	11410-00284
Hot S_{22} and Hot K-factor Measurements	11410-00295
Pulse S-parameters Measurements	11410-00300
Manuals	
MS462XX Operation Manual	10410-00203
MS462XX Programming Manual	10410-00204
MS462XX Maintenance Manual	10410-00205
MS462XX GPIB Quick Reference Guide	10410-00206
Measurement Guide	10410-00213
Application Guide	10410-00214
PATS Operation Manual	10410-00225
TMATS Operation Manual	10410-00244
MN4790A Maintenance Manual	10410-00245
ME7840/4 Operation Manual	10410-00247
MN4783A Maintenance Manual	10410-00248
Scorpion Navigator Software User's Guide	10410-00249
Software Utilities and Drivers	
Scorpion Command Encyclopedia	2300-364
Power Tools	2300-218
Exact Uncertainty	2300-361
Mixer Measurements Assistant (NxN)	2300-232

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Appendix D
Soft-Key Menu Maps

Table of Contents

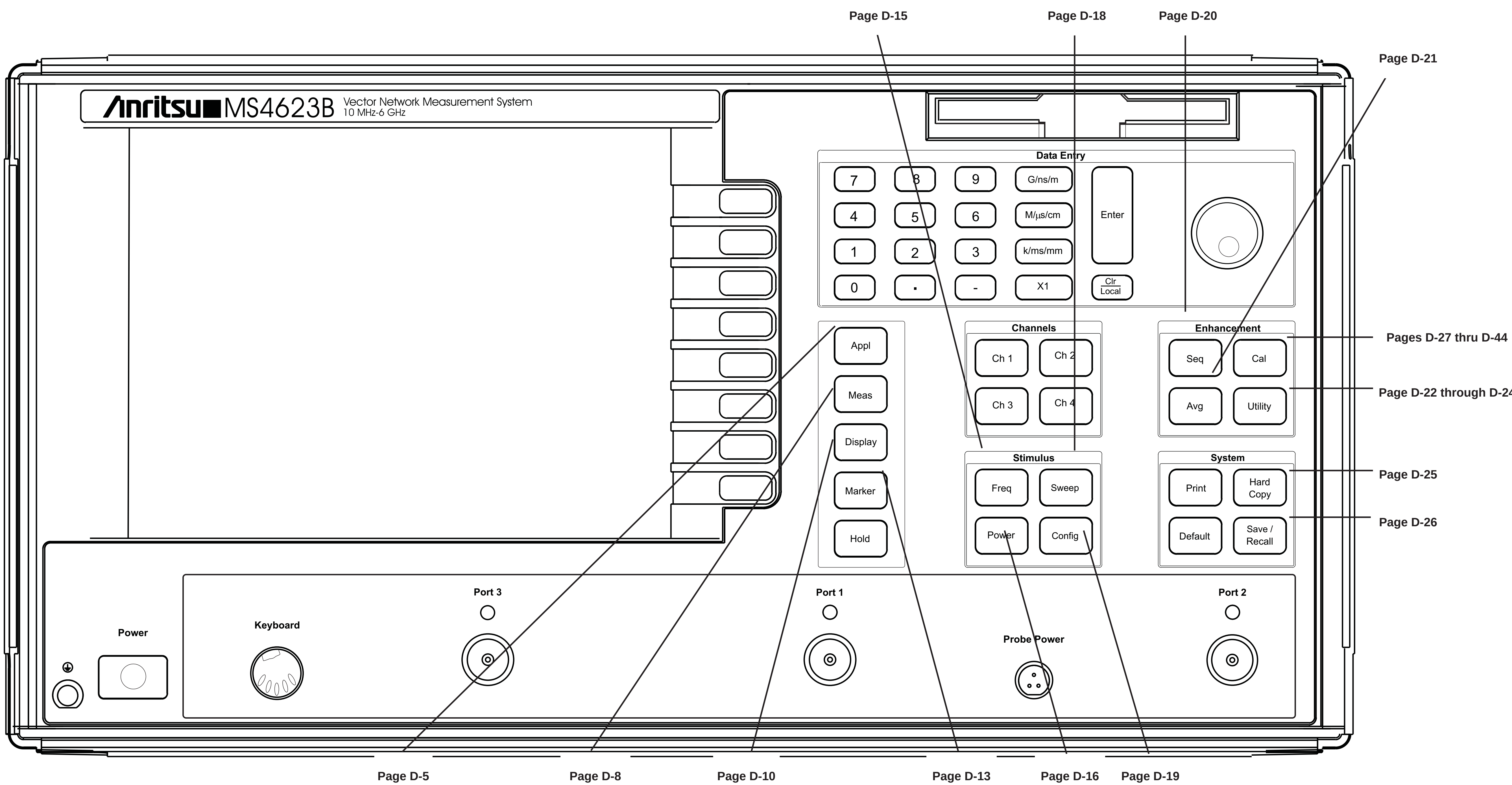

Figure D-1. *MS462XXX Front Panel Keys With Index to Associated Menu Map(s)*

Appendix D
Soft-Key Menu Maps

D-1 INTRODUCTION

This appendix provides menu maps that document the flow of the front panel soft-key menus.

D-2 ORGANIZATION

The menu maps are organized by front panel key, as shown in Figure D-1 on the facing page. An index of maps is provided below.

D-3 CONVENTIONS

The menu maps in the following pages use the following conventions:

Appl — Indicates a front panel key

A — Indicates a connection to a like-lettered circle on the same page.

To A Sheet 3 — Indicates a connection to a like-lettered small circle on the indicated sheet within the same menu set.

A D-14 — Indicates a connection to a like-lettered small circle on the indicated page (different menu set).

D-4 MENU MAPS

The menu maps begin with Figure D-2, on the next page

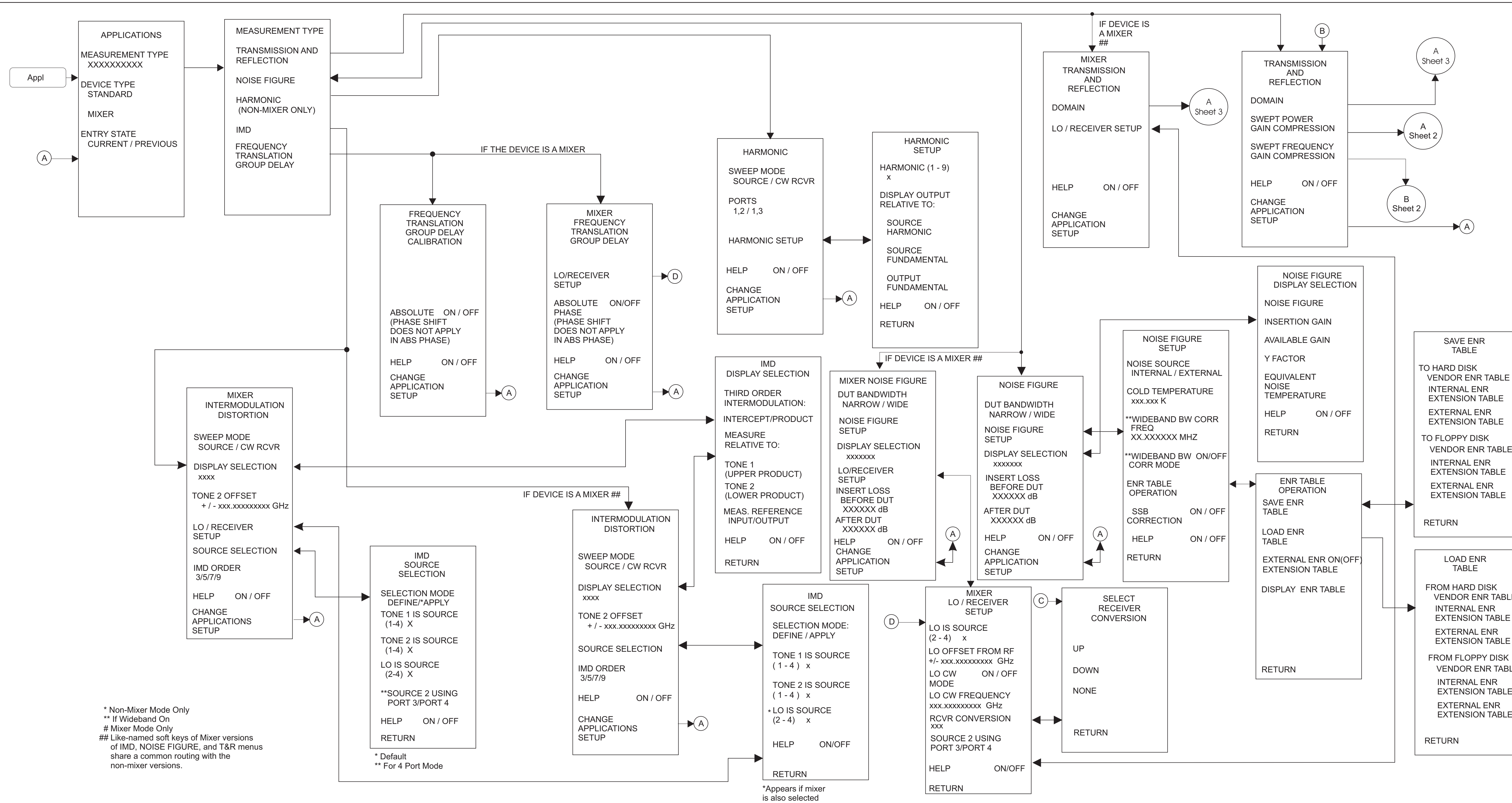

Figure D-2. *Appl Key Soft-Key Menu Map (1 of 3)*

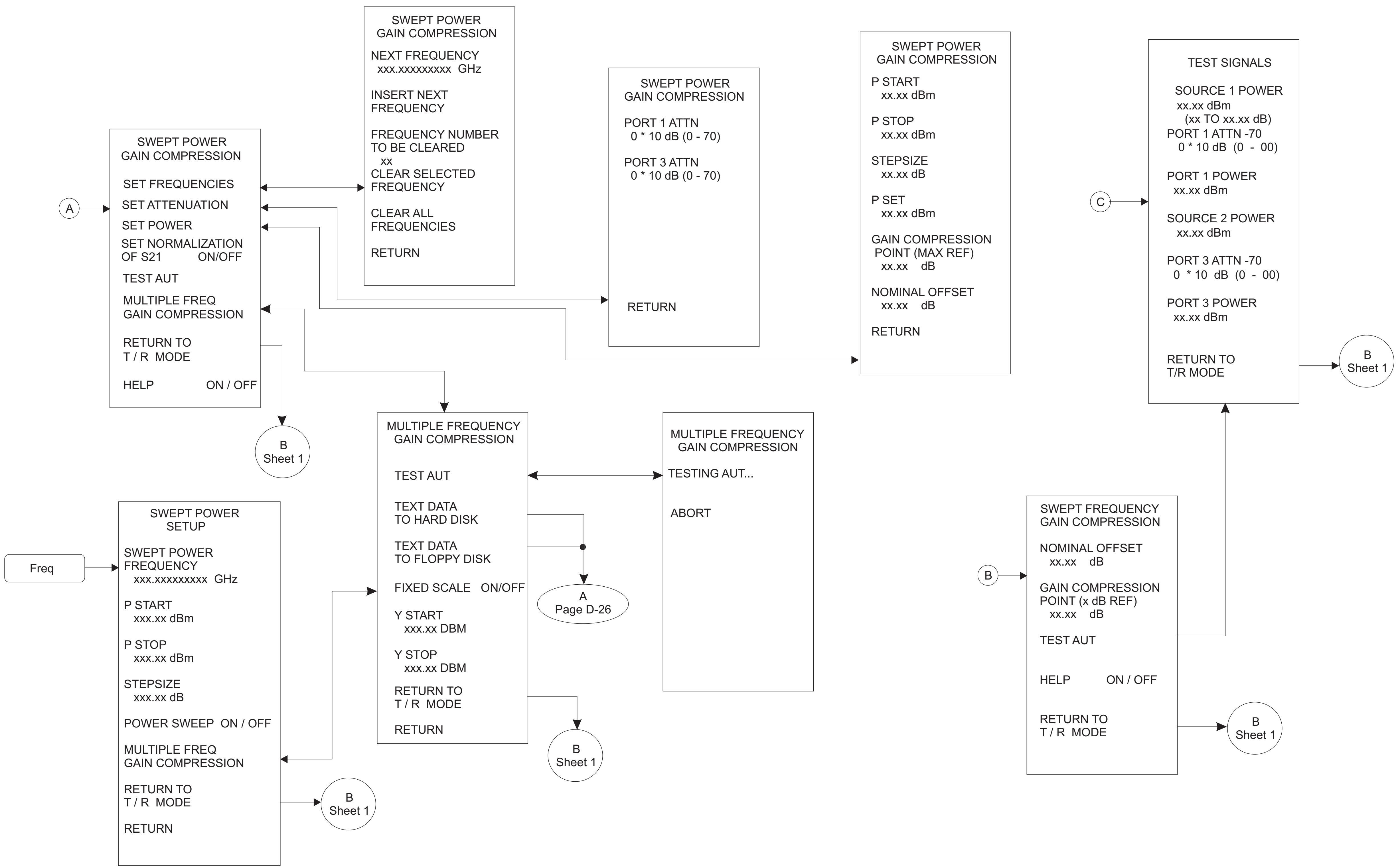

Figure D-2. *Appl Key Soft-Key Menu Map (2 of 3)*

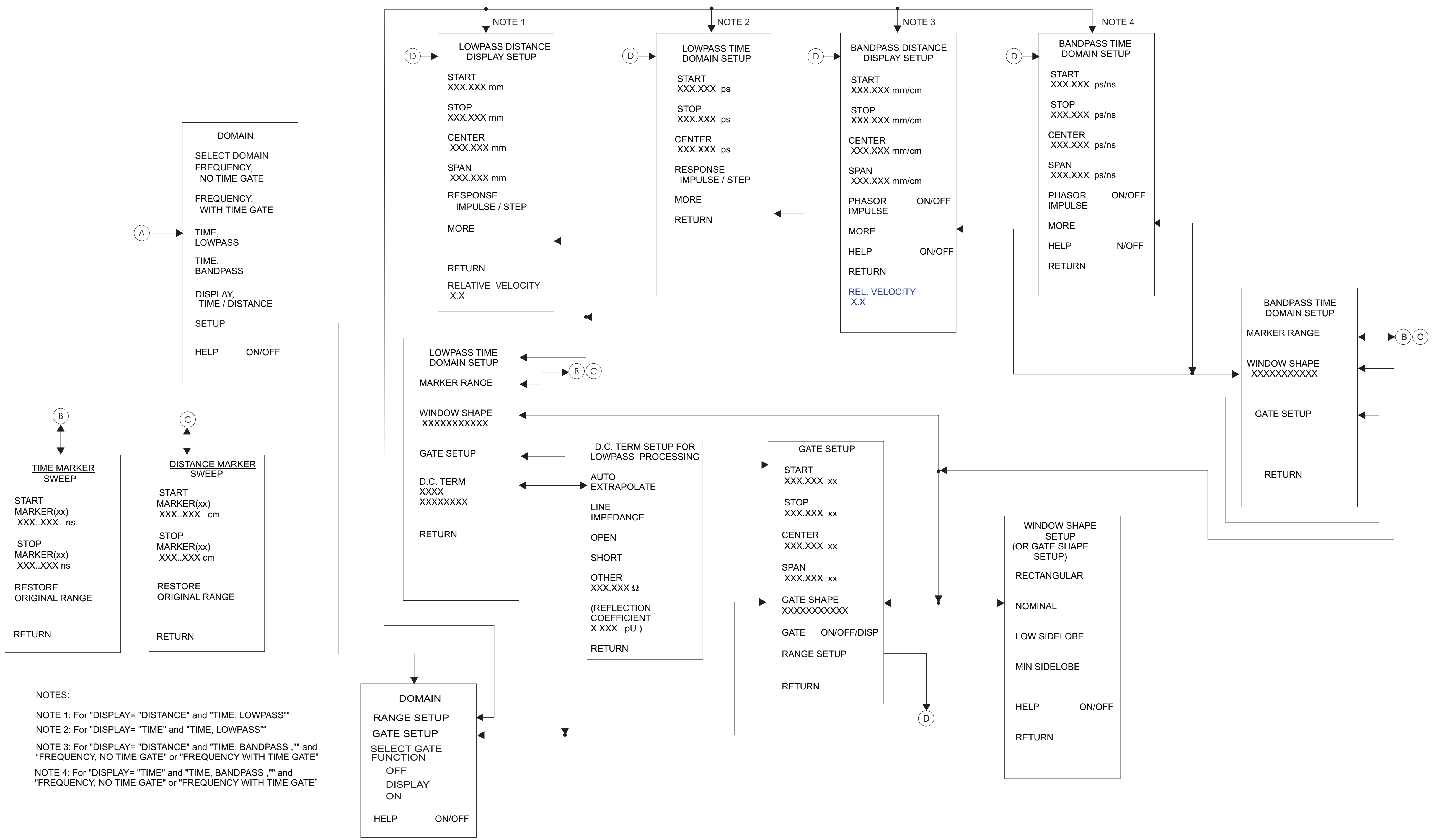

Figure D-2. *Appl Key Soft-Key Menu Map (3 of 3)*

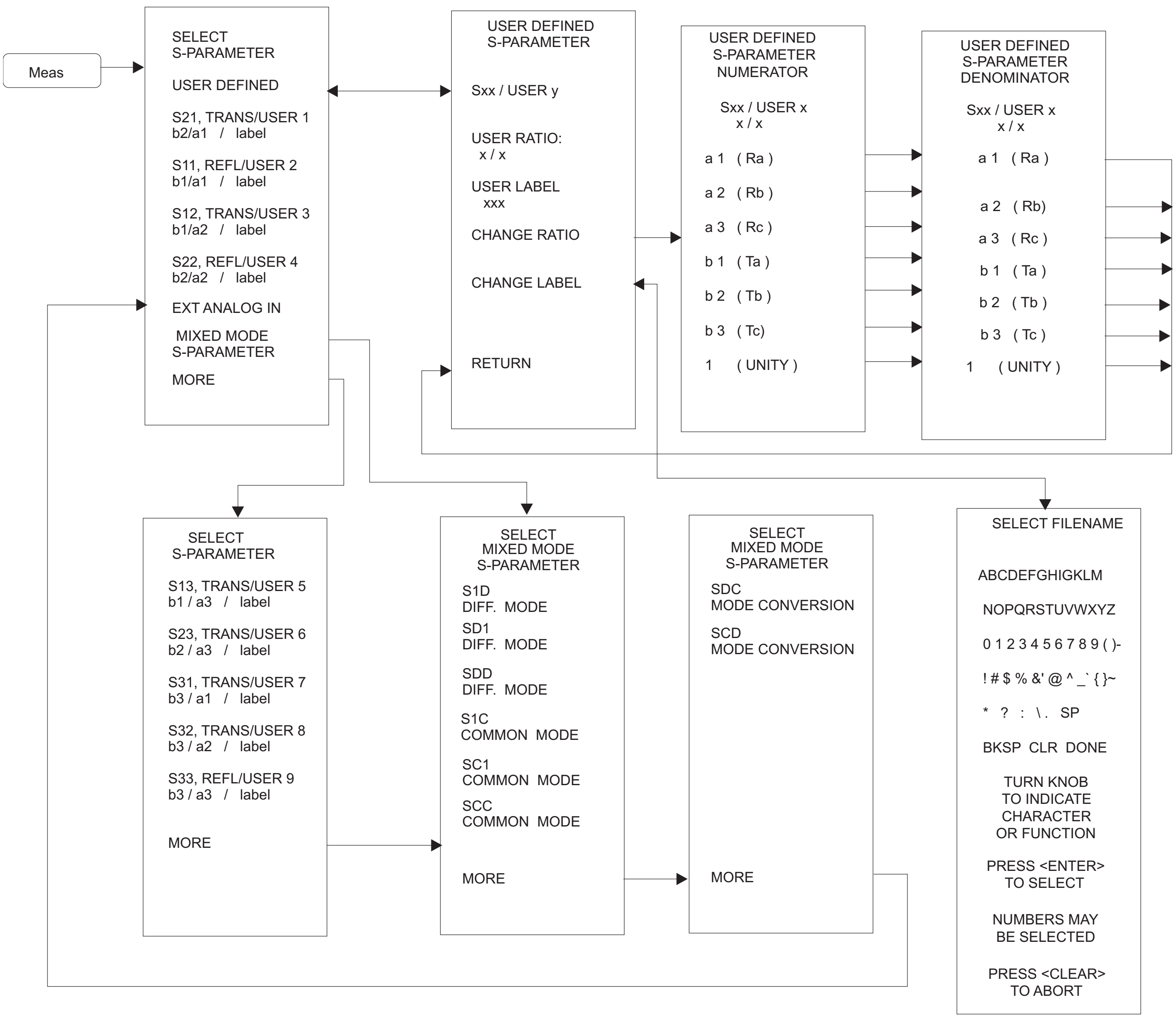

Figure D-3. *Meas Key Soft-Key Menu Map (1 of 2)*

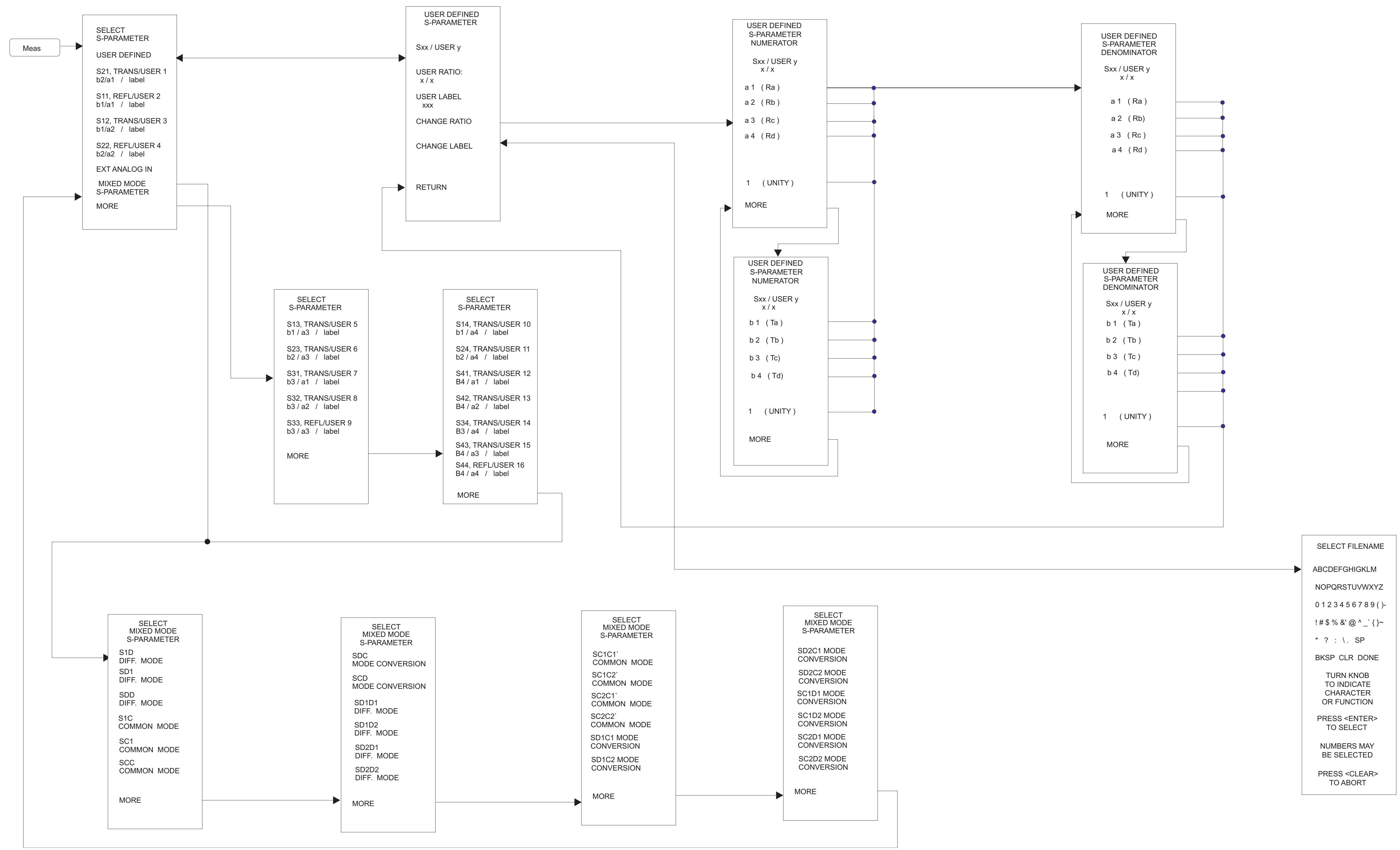

Figure D-3. *Meas Key Soft-Key Menu Map (2 of 2)*

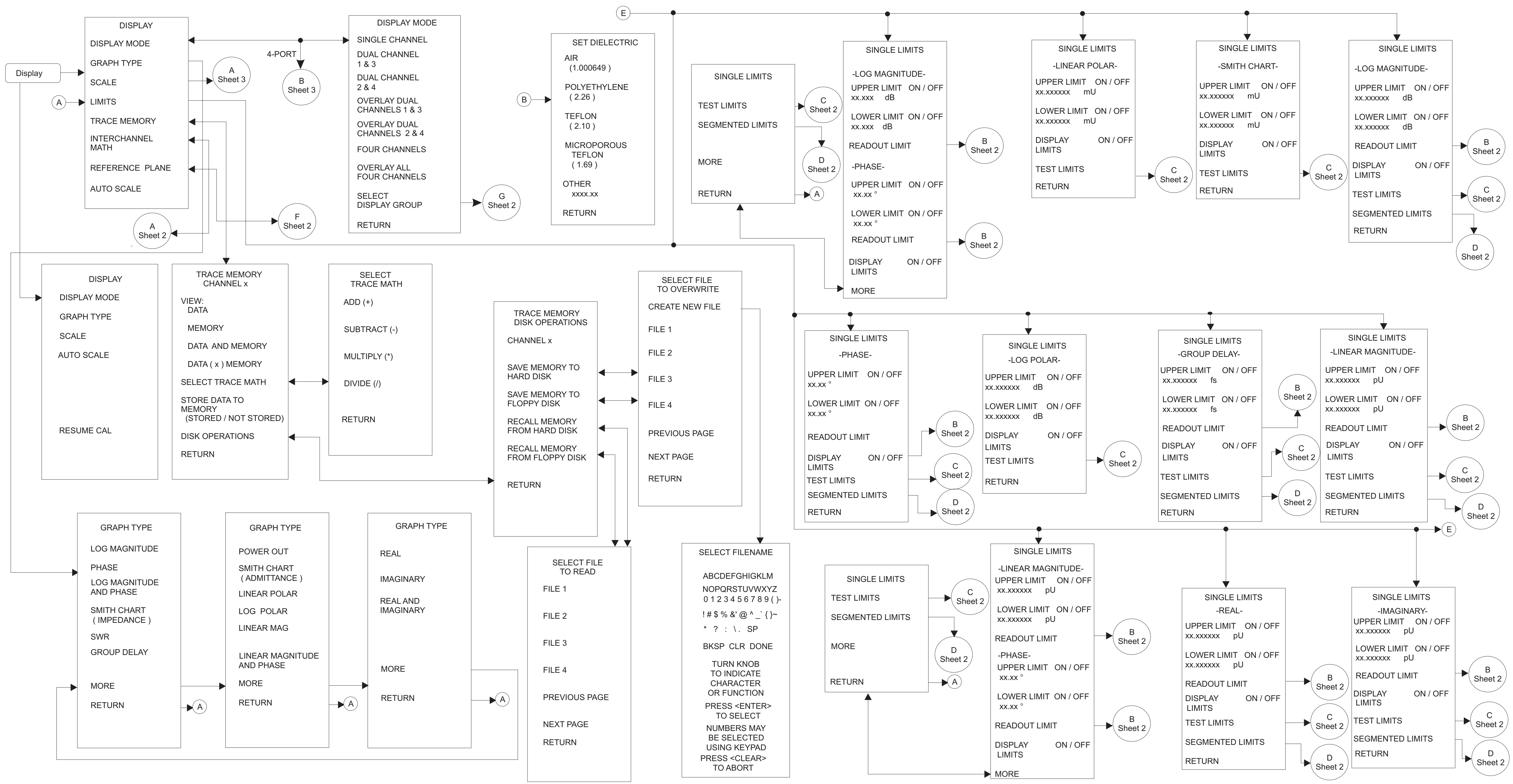

Figure D-4. *Display Key Soft-Key Menu Map (1 of 3)*

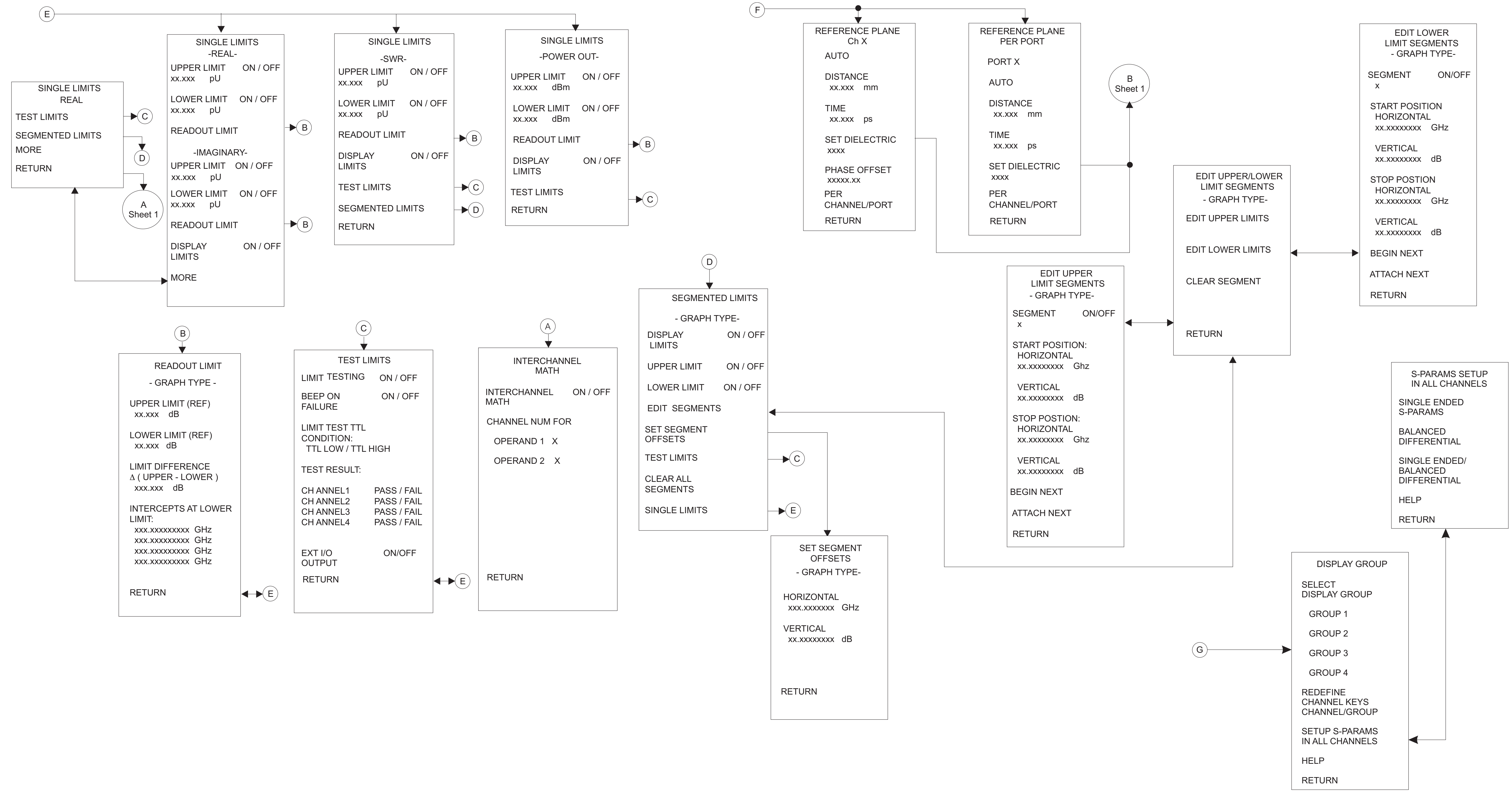

Figure D-4. *Display Key Soft-Key Menu Map (2 of 3)*

Figure D-4. *Display Key Soft-Key Menu Map (3 of 3)*

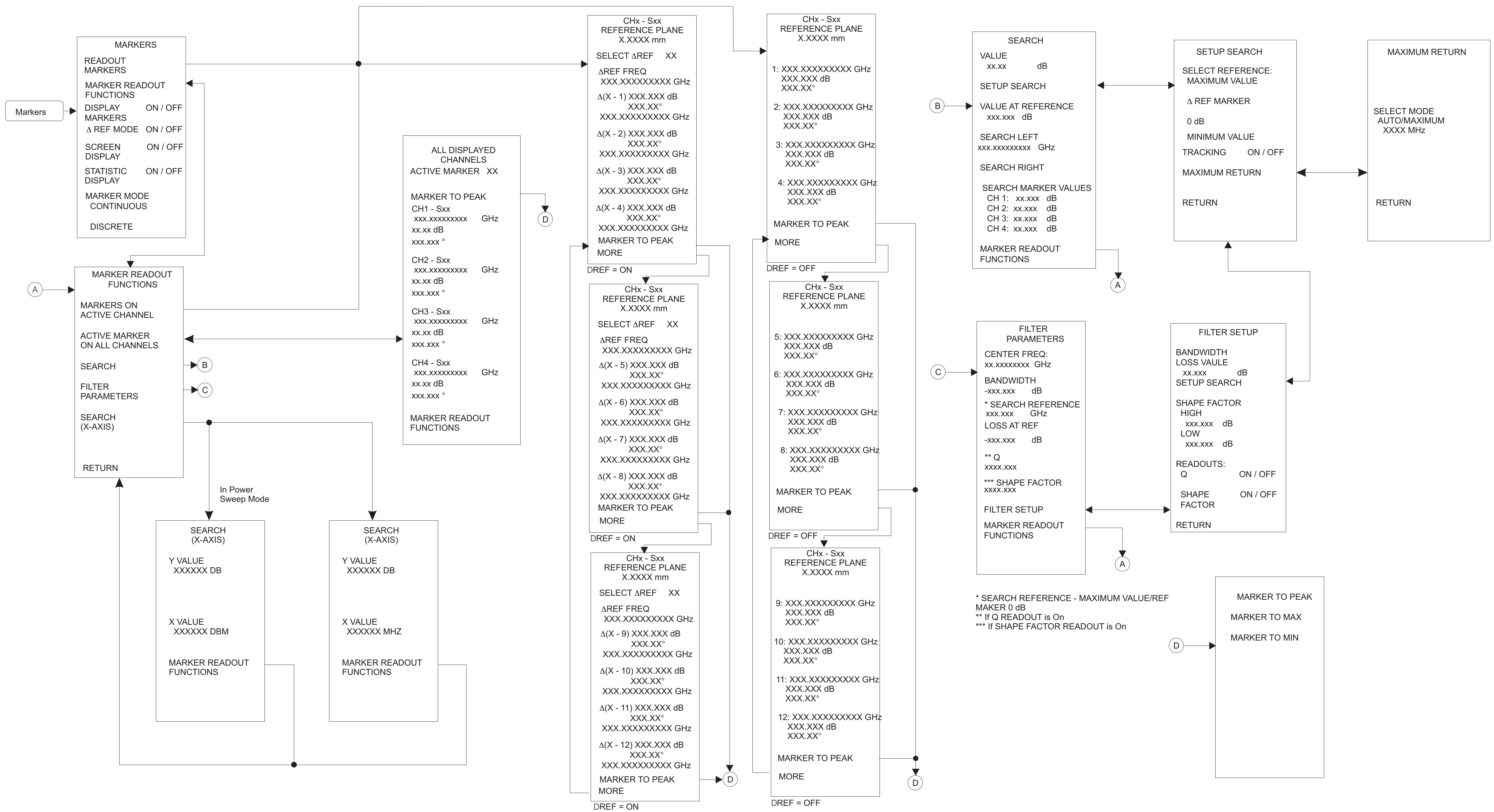

Figure D-5. *Marker Key Soft-Key Menu Map (1 of 2)*

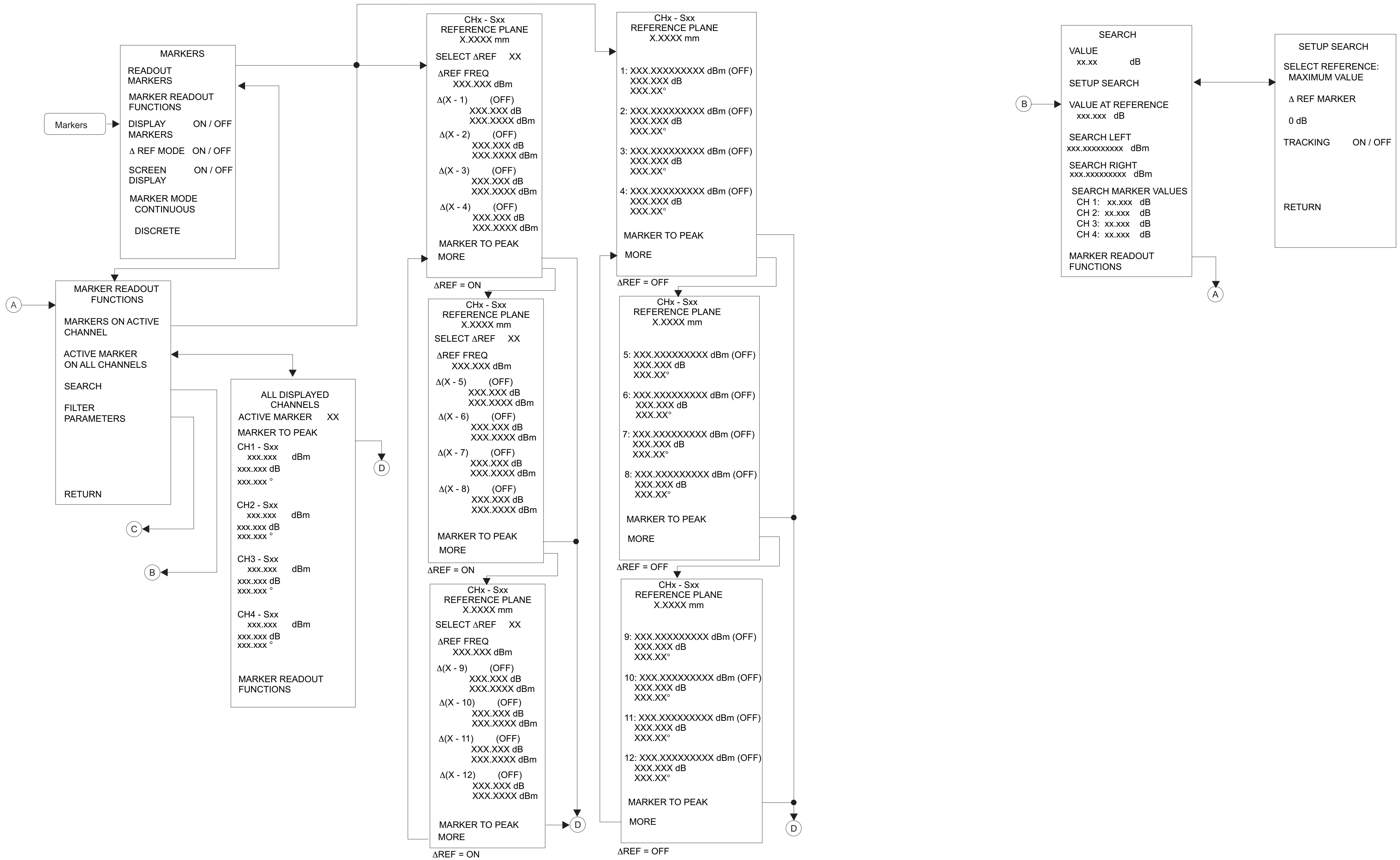

Figure D-5. Marker Key Soft-Key Menu Map (2 of 2)

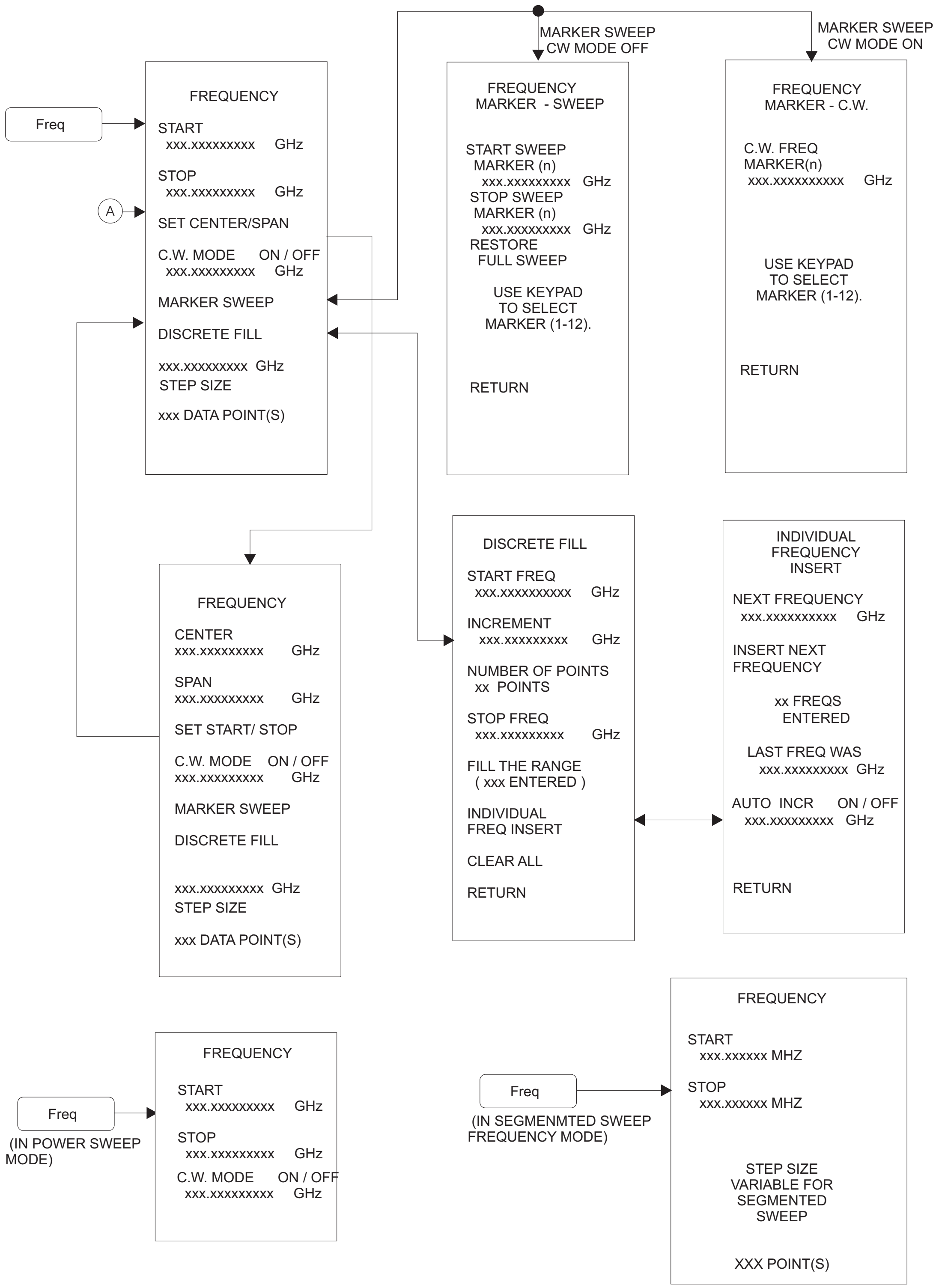

Figure D-6. *Freq Key Soft-Key Menu Map (1 of 1)*

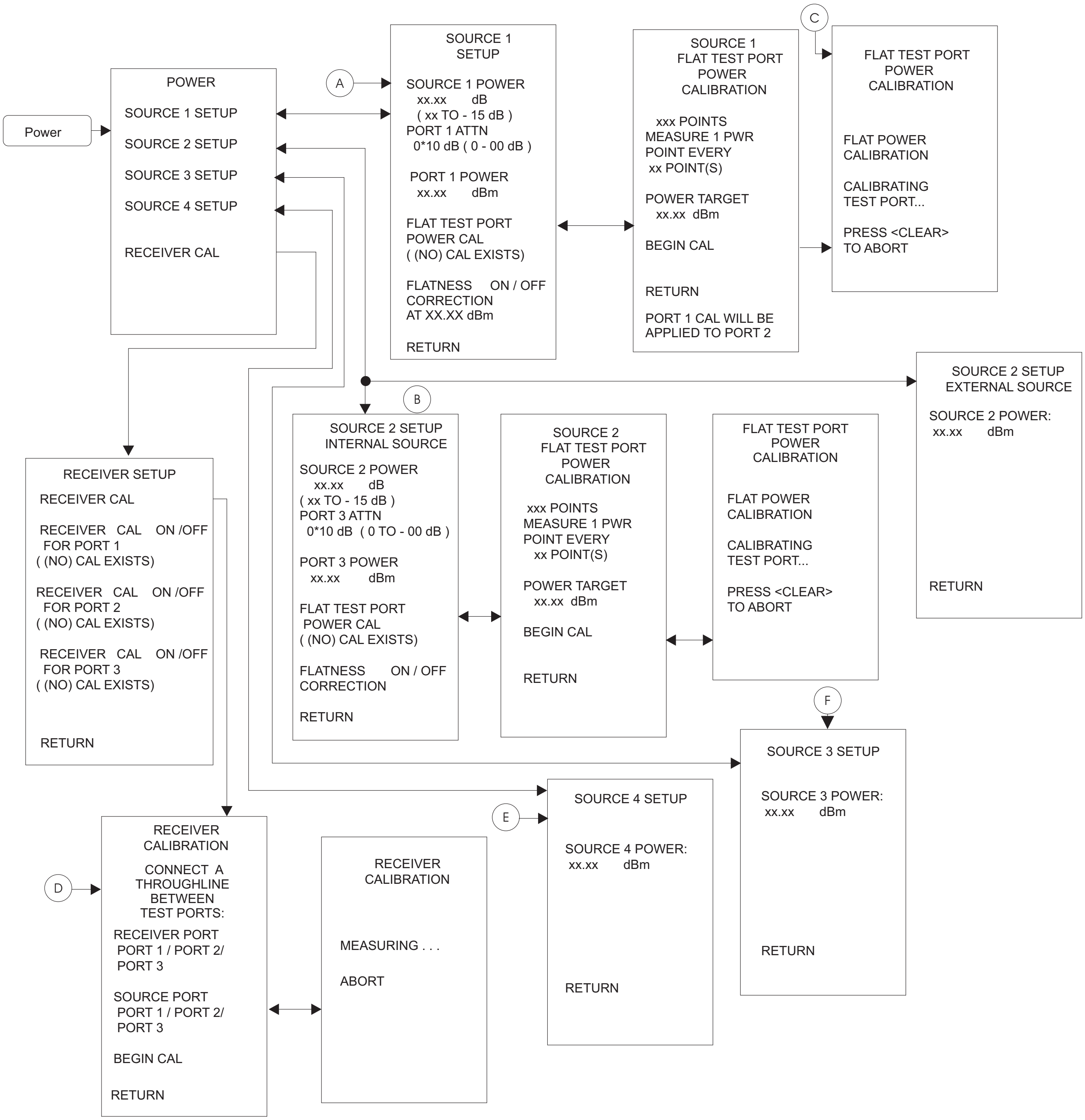

Figure D-7. *Power Key Soft-Key Menu Map (1 of 2)*

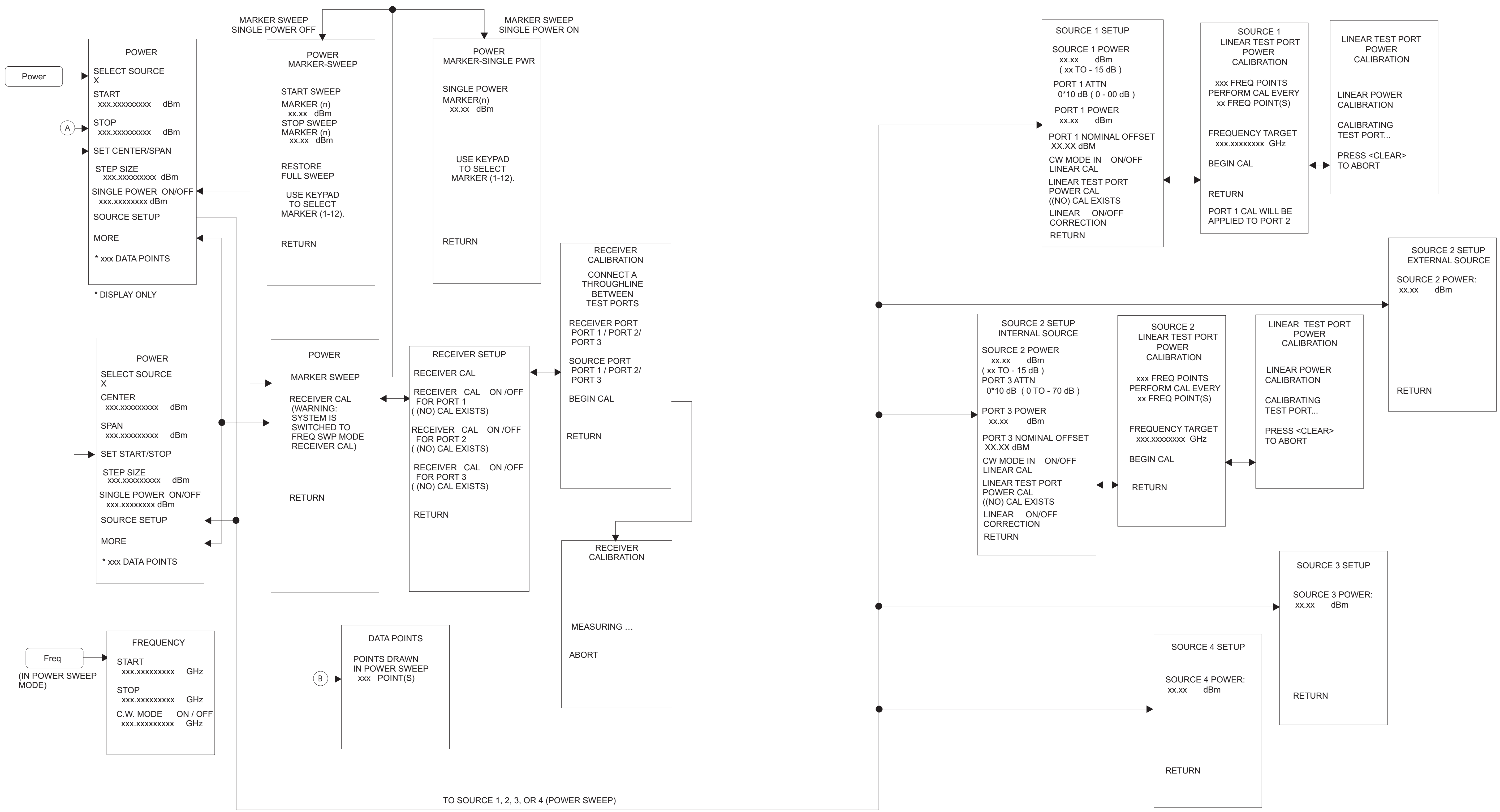

Figure D-7. *Power Key (Power Sweep) Soft-Key Menu Map (2 of 2)*

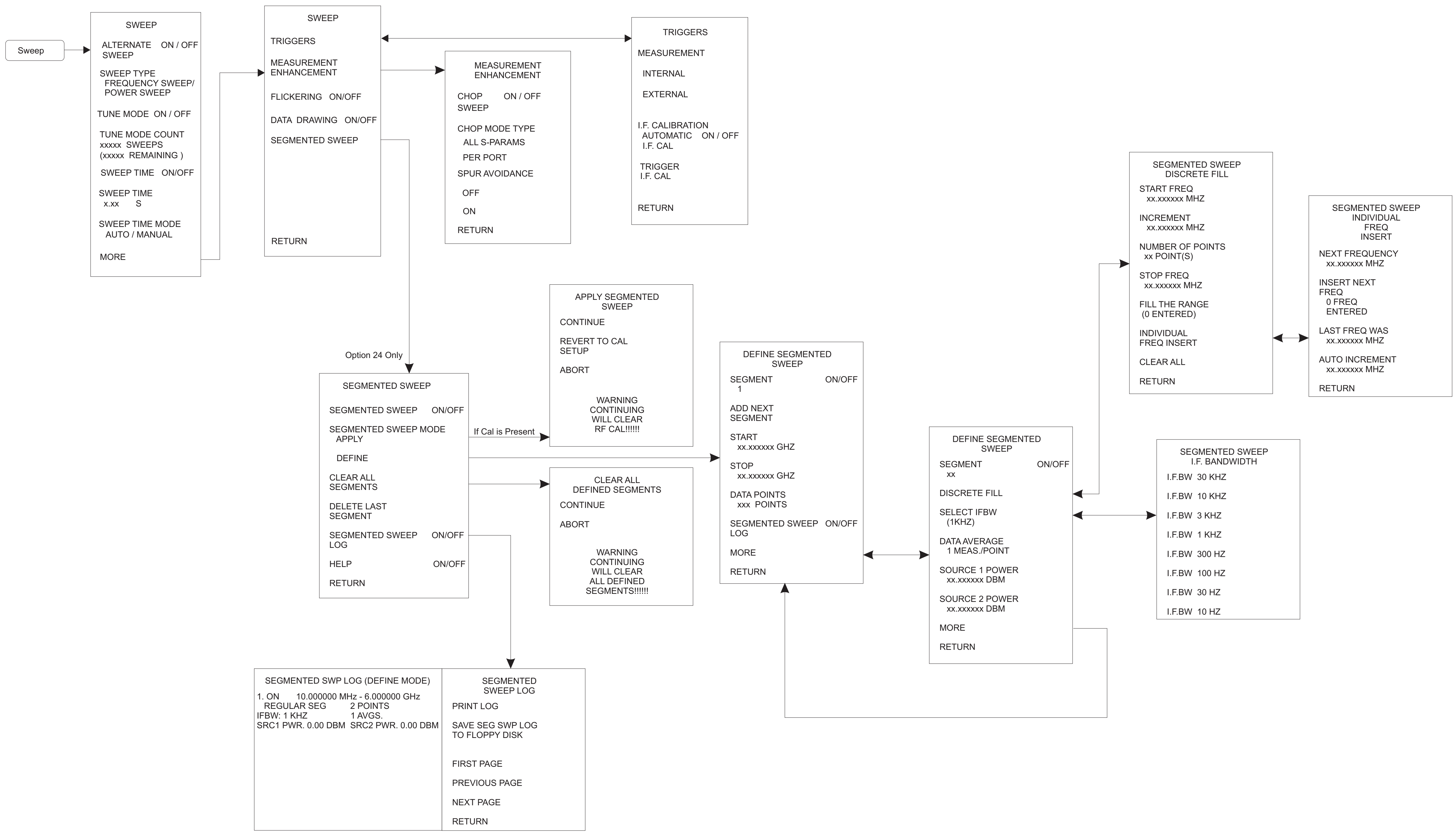

Figure D-8. Sweep Key Soft-Key Menu Map (1 of 1)

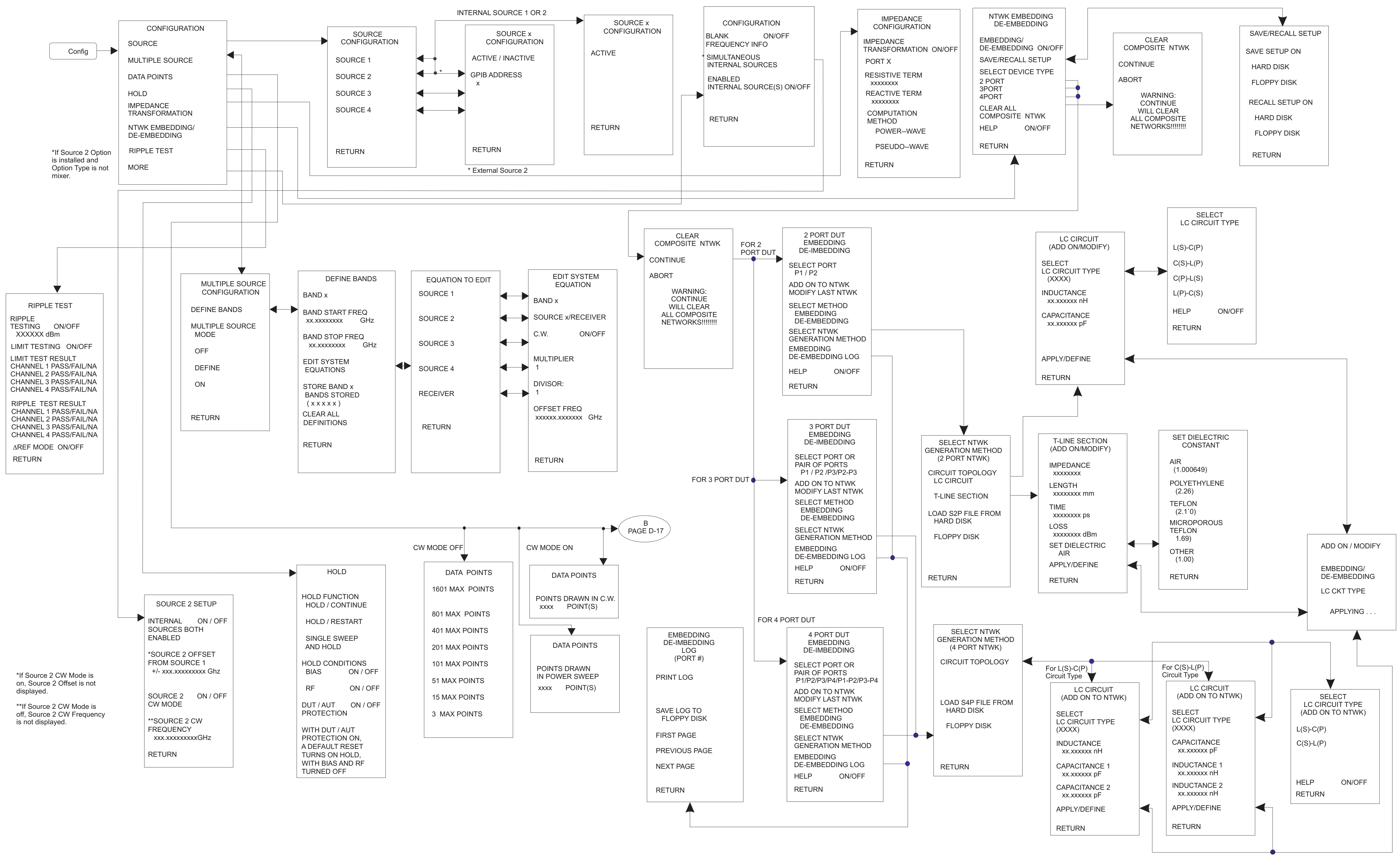

Figure D-9. *Config Key Soft-Key Menu Map (1 of 1)*

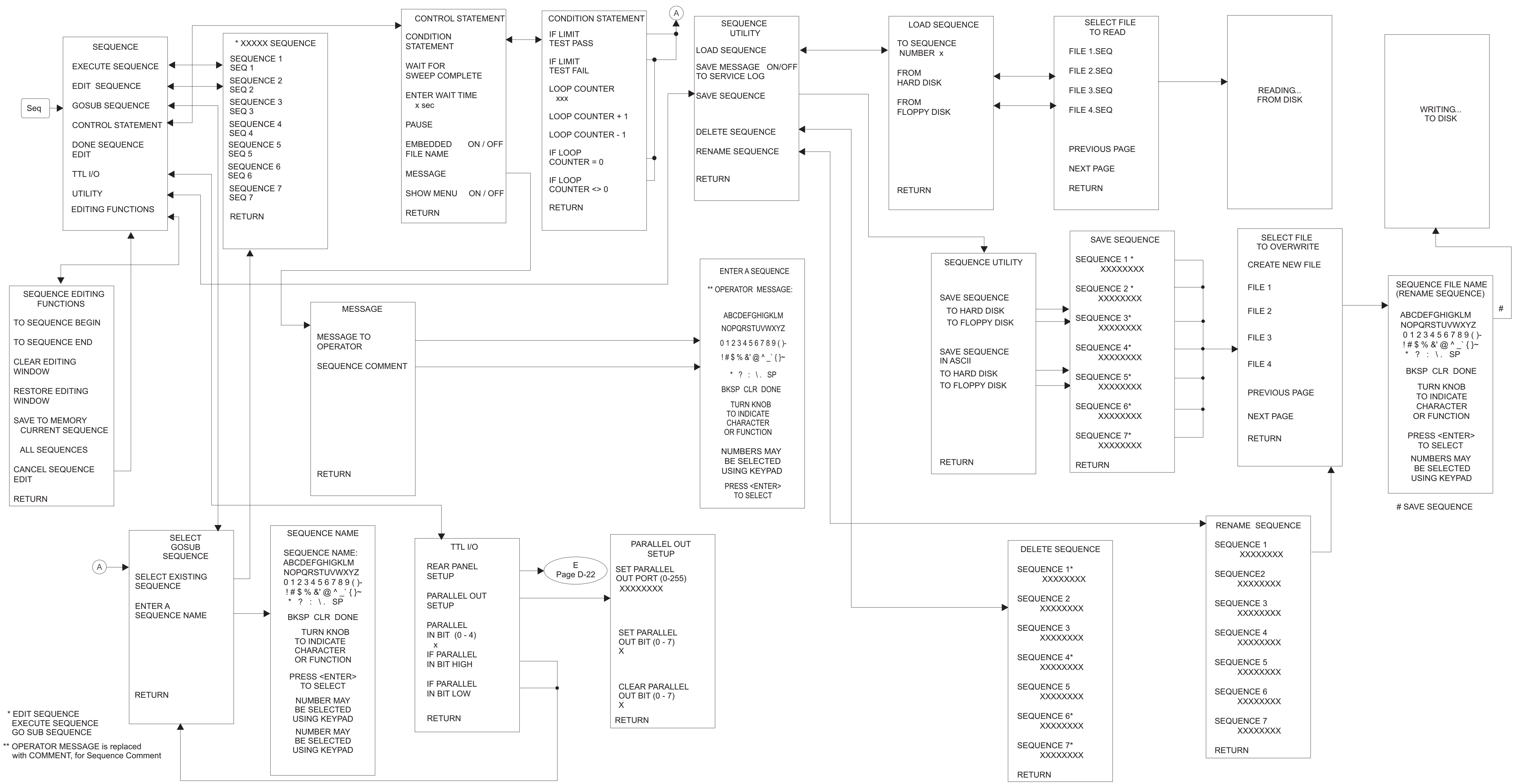

Figure D-10. *Sequence Key Soft-Key Menu Map (1 of 1)*

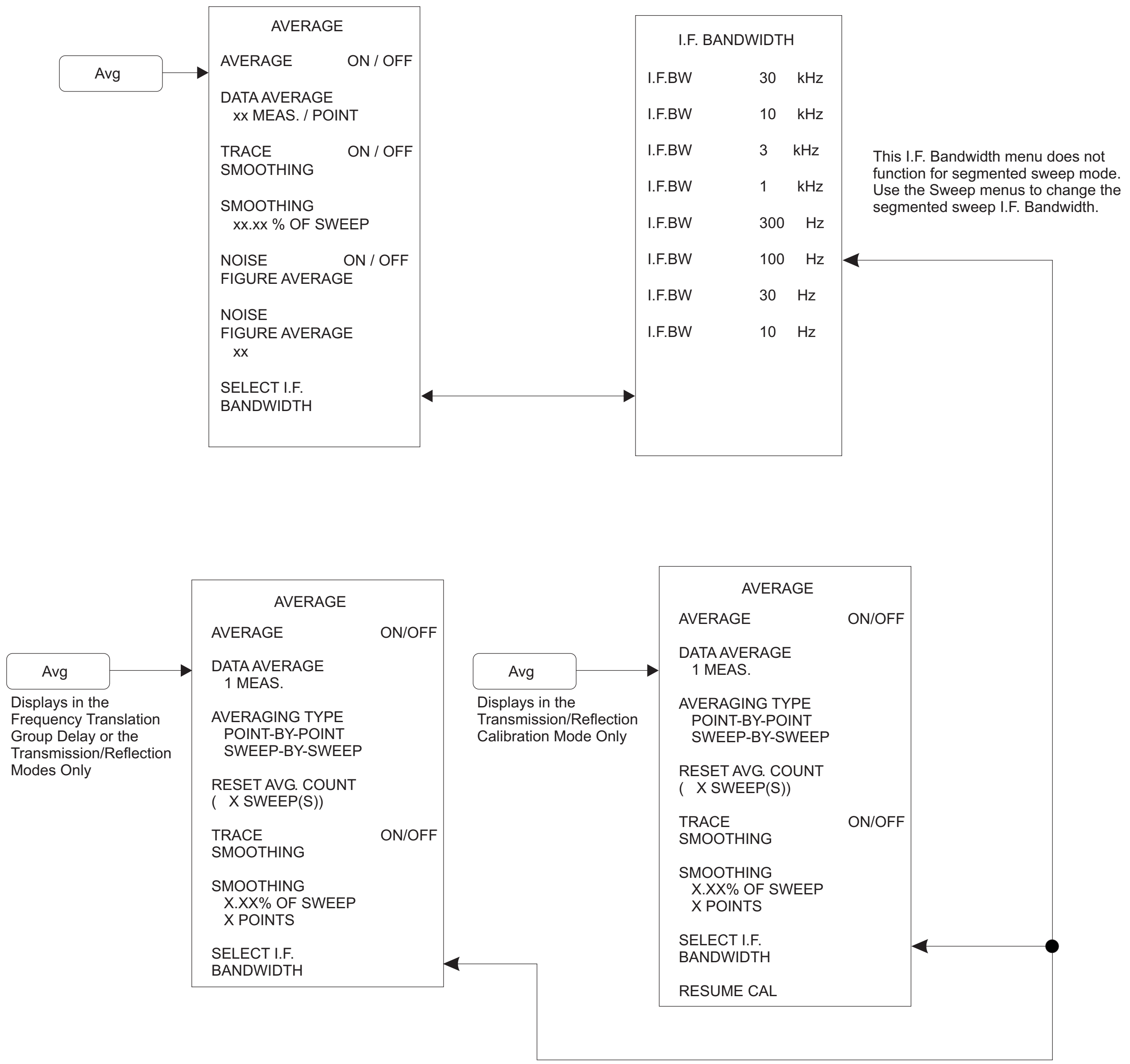

Figure D-11. *Avg Key Soft-Key Menu Map (1 of 1)*

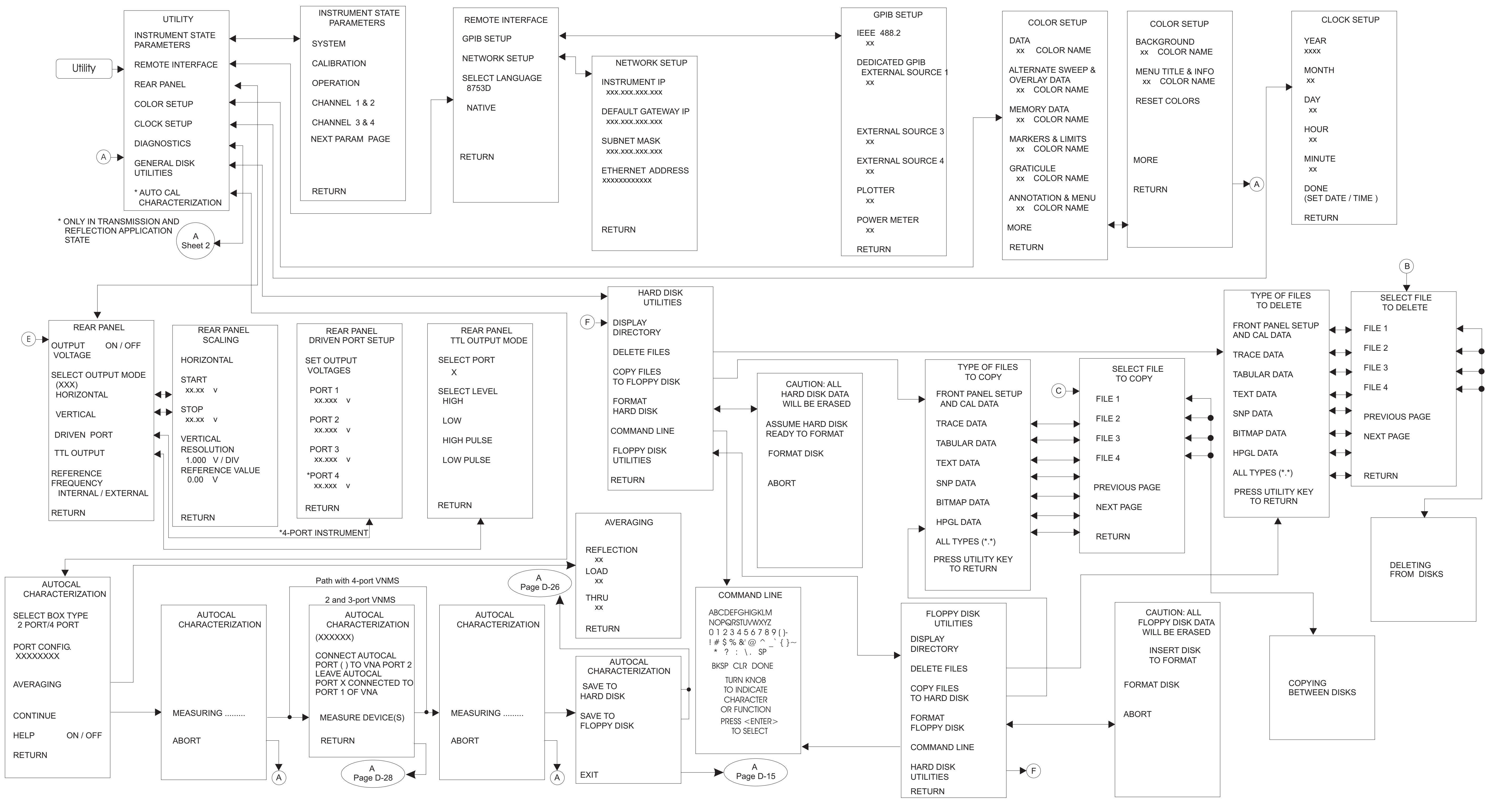

Figure D-12. Utility Key Soft-Key Menu Map (1 of 3)

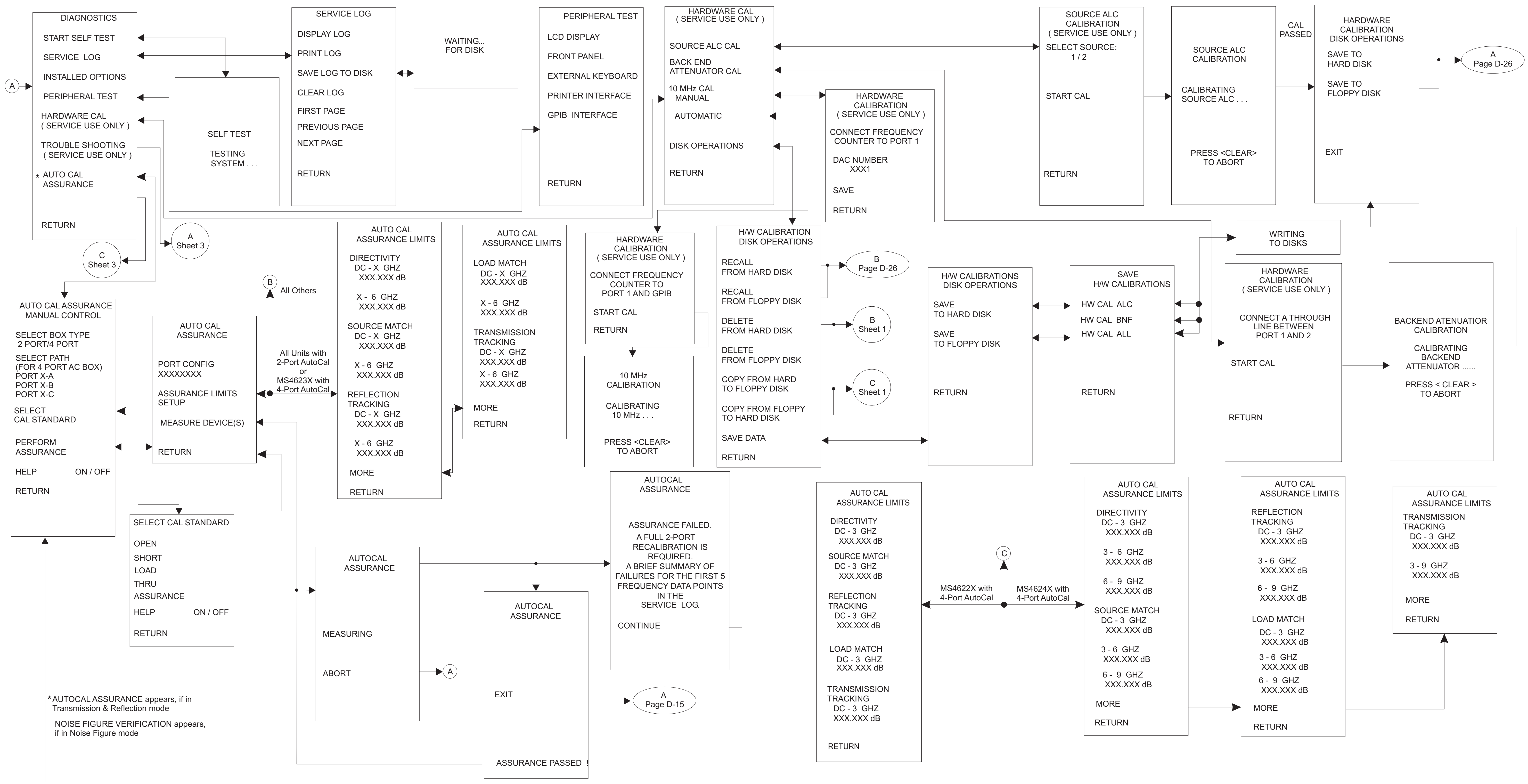

Figure D-12. *Utility Key Soft-Key Menu Map (2 of 3)*

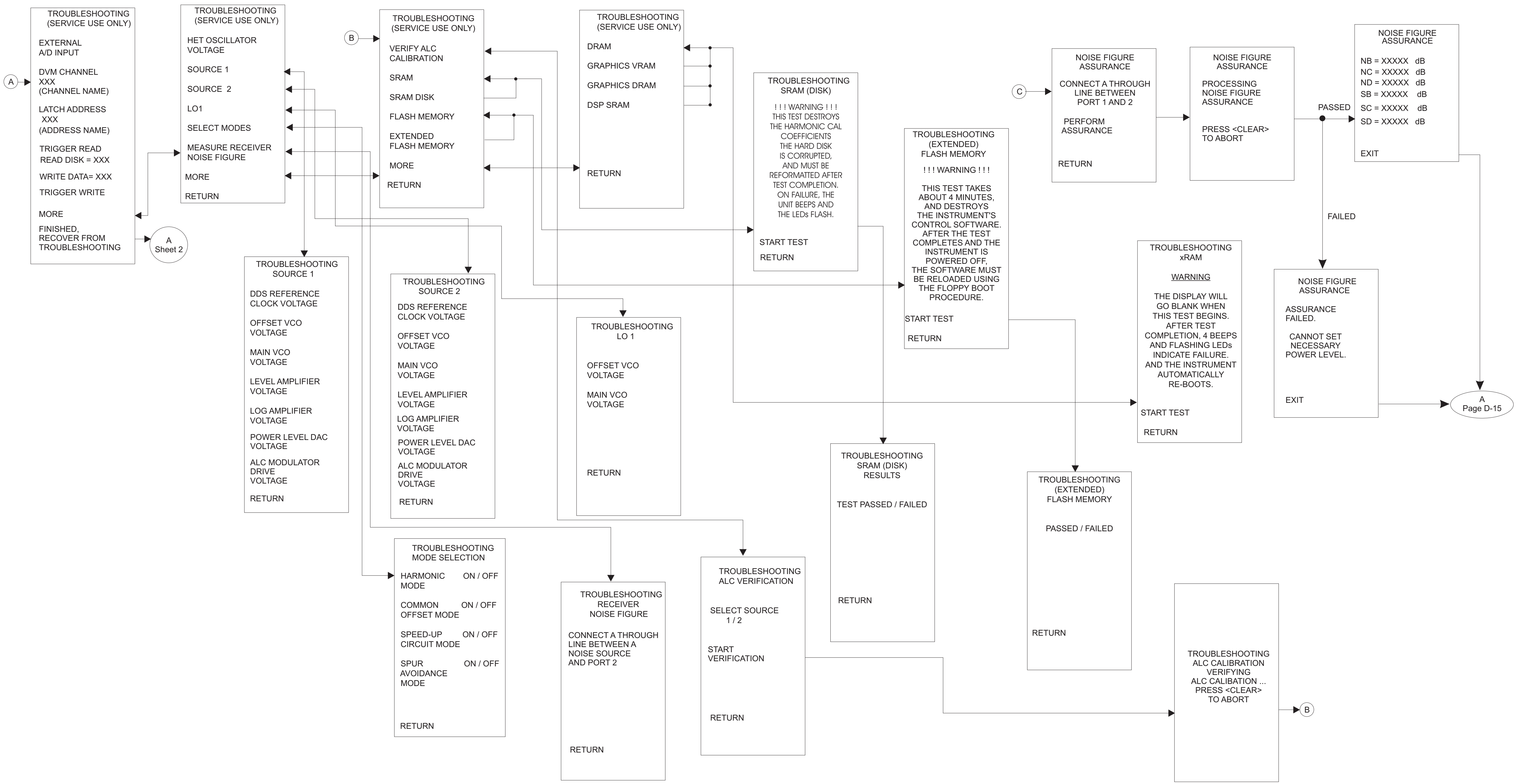

Figure D-12. *Utility Key Soft-Key Menu Map (3 of 3)*

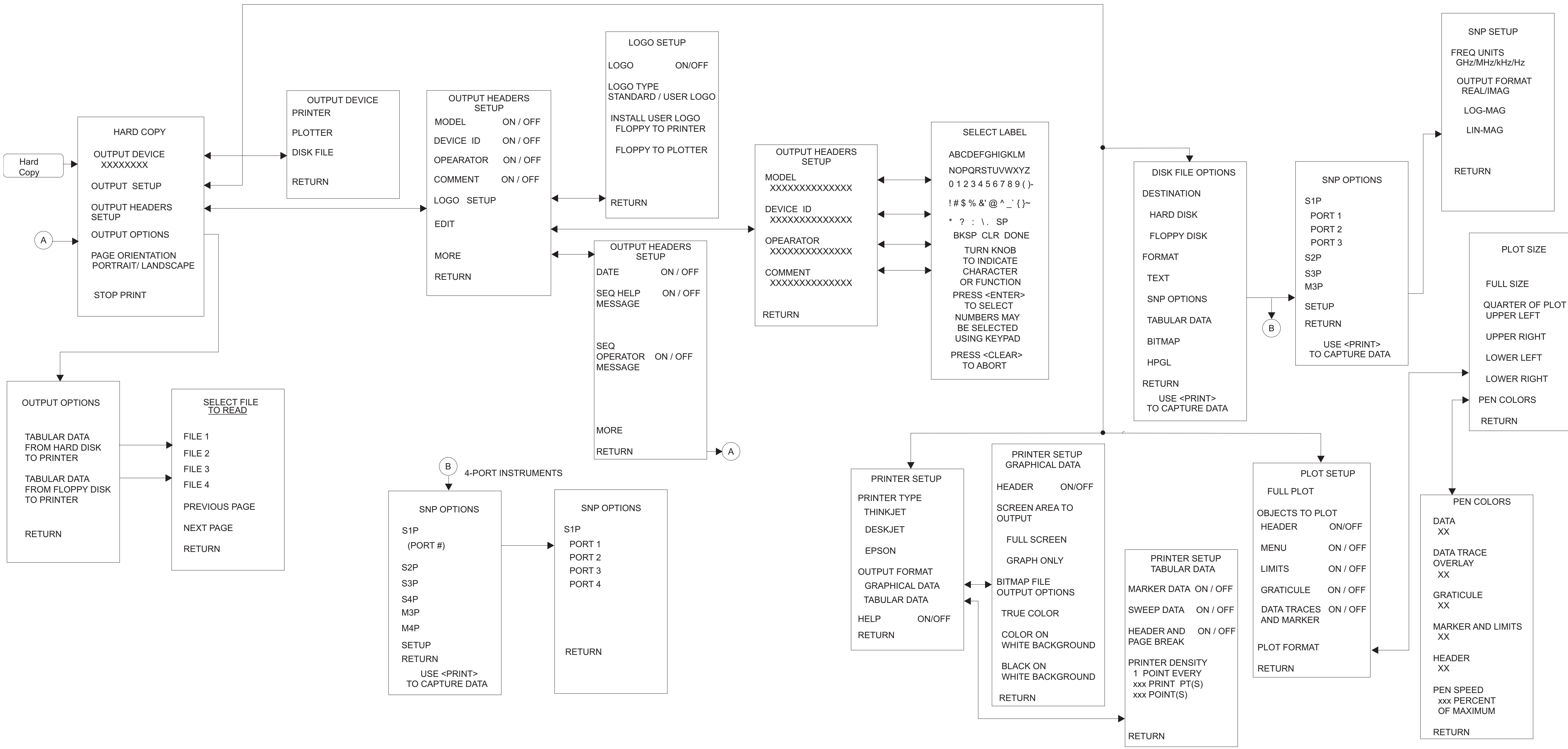

Figure D-13. *Hard Copy Key Soft-Key Menu Map (1 of 1)*

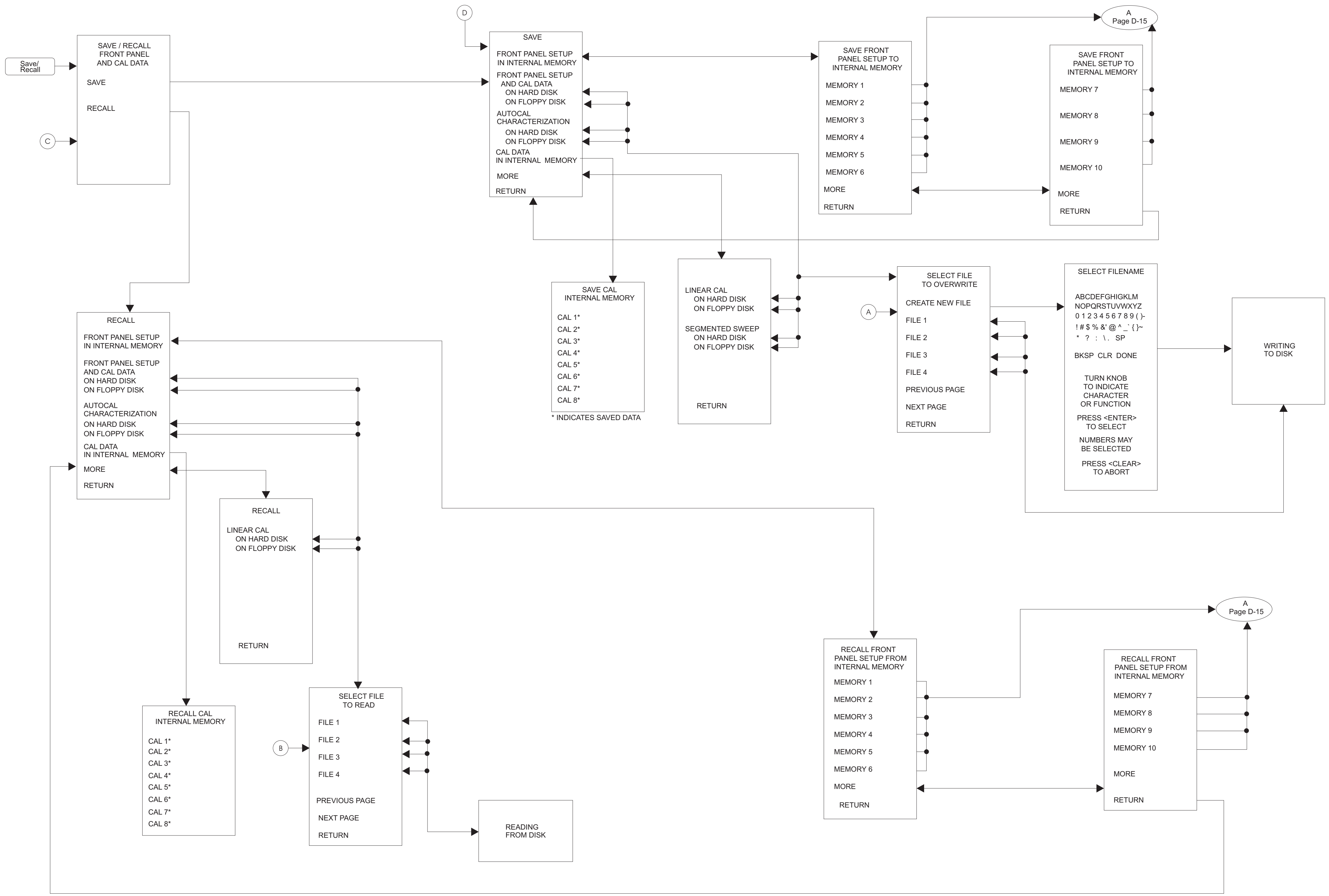

Figure D-14. *Save-Recall Key Soft-Key Menu Map (1 of 1)*

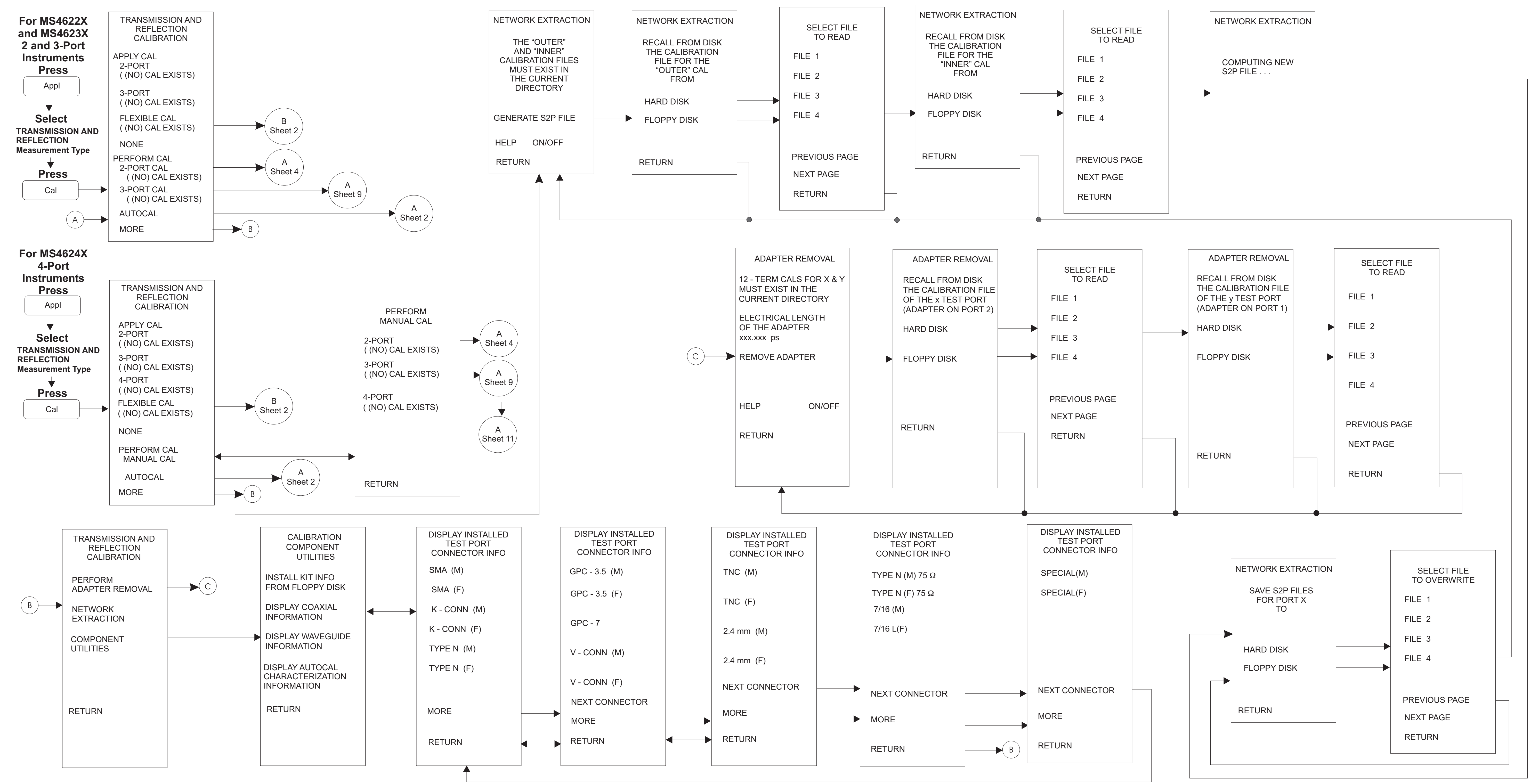

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(1 of 13)*

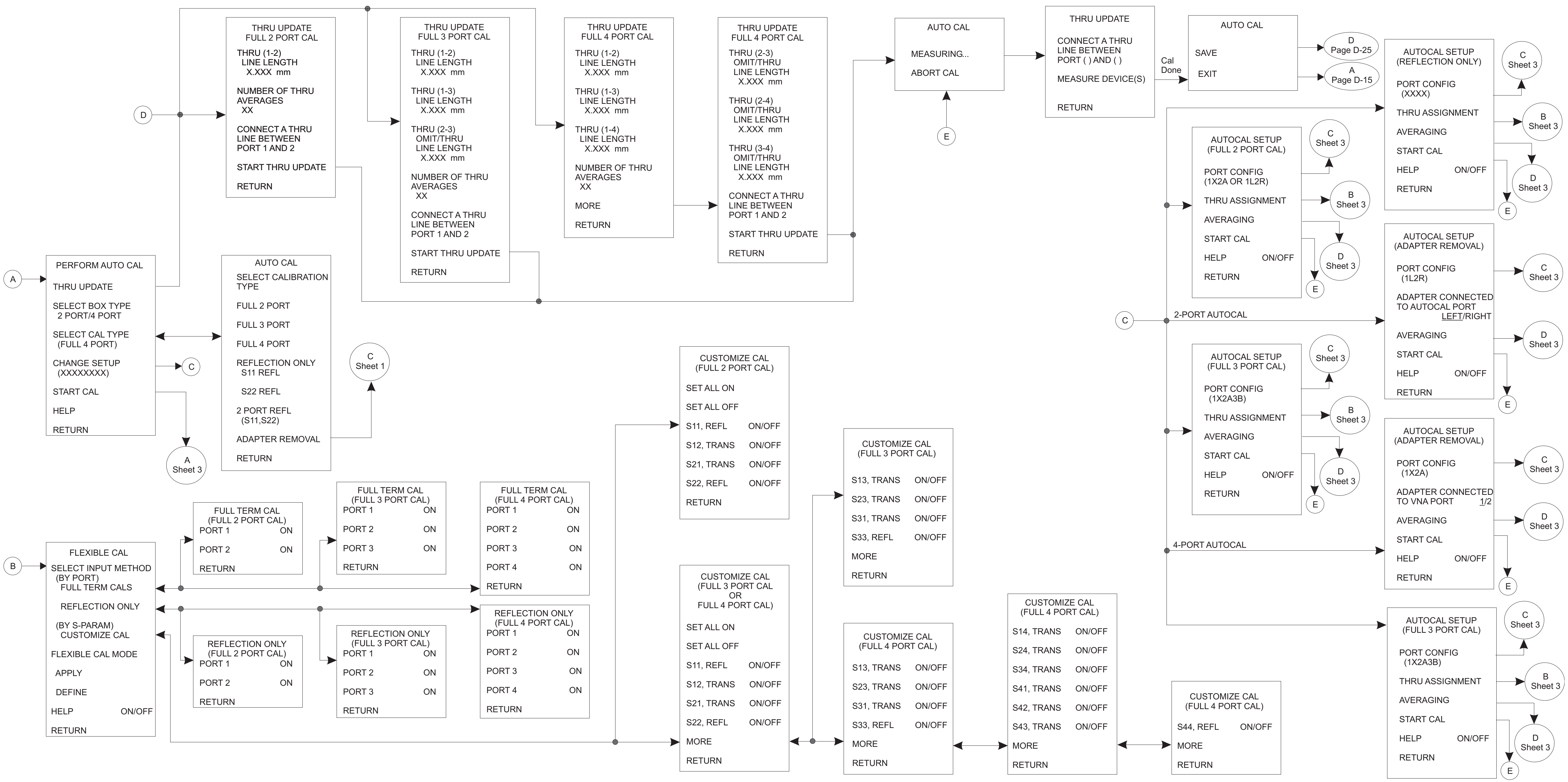

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(2 of 13)*

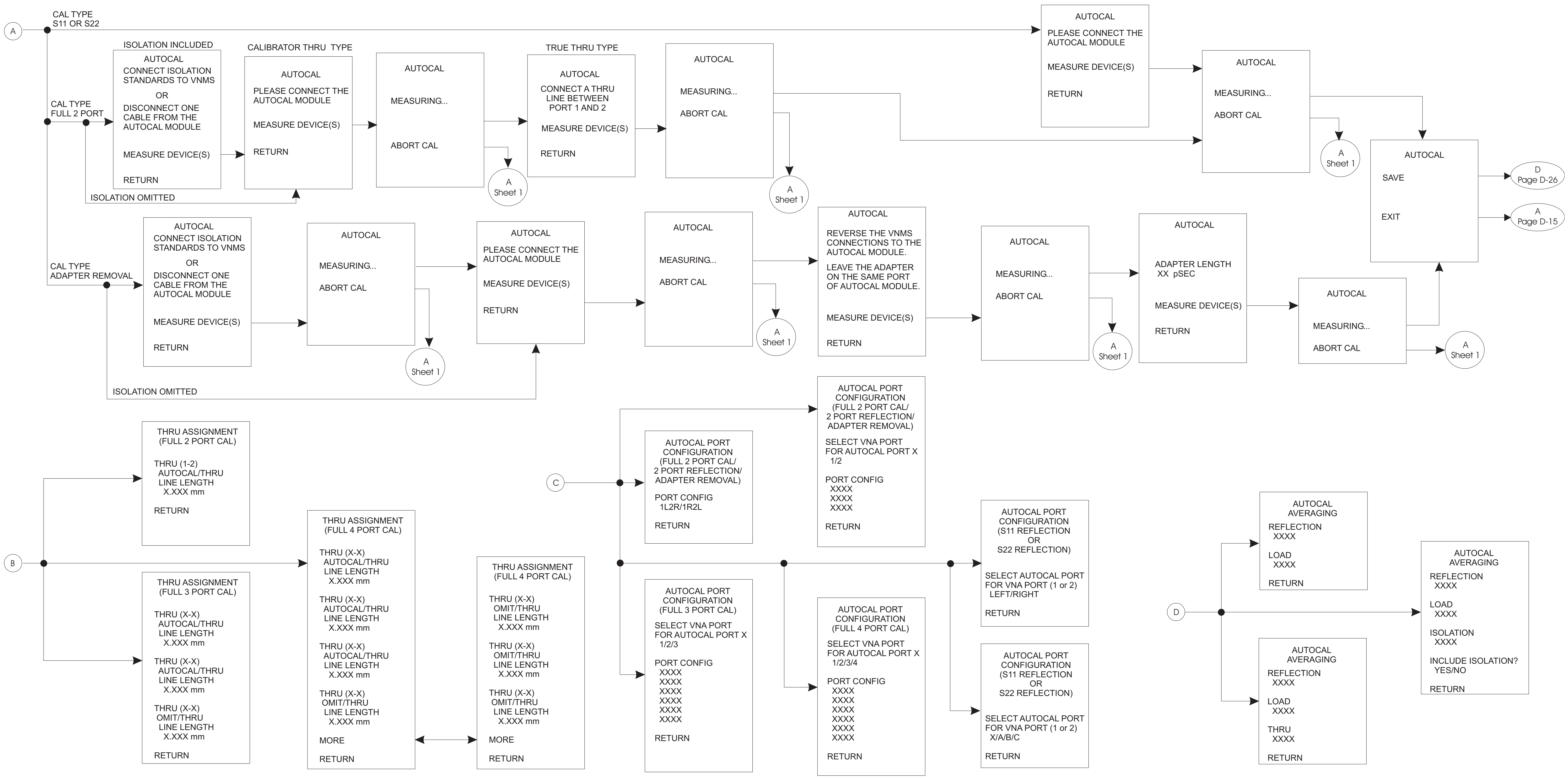

Figure D-15. Calibration Key Soft-Key Menu Map (Transmission & Reflection)(3 of 13)

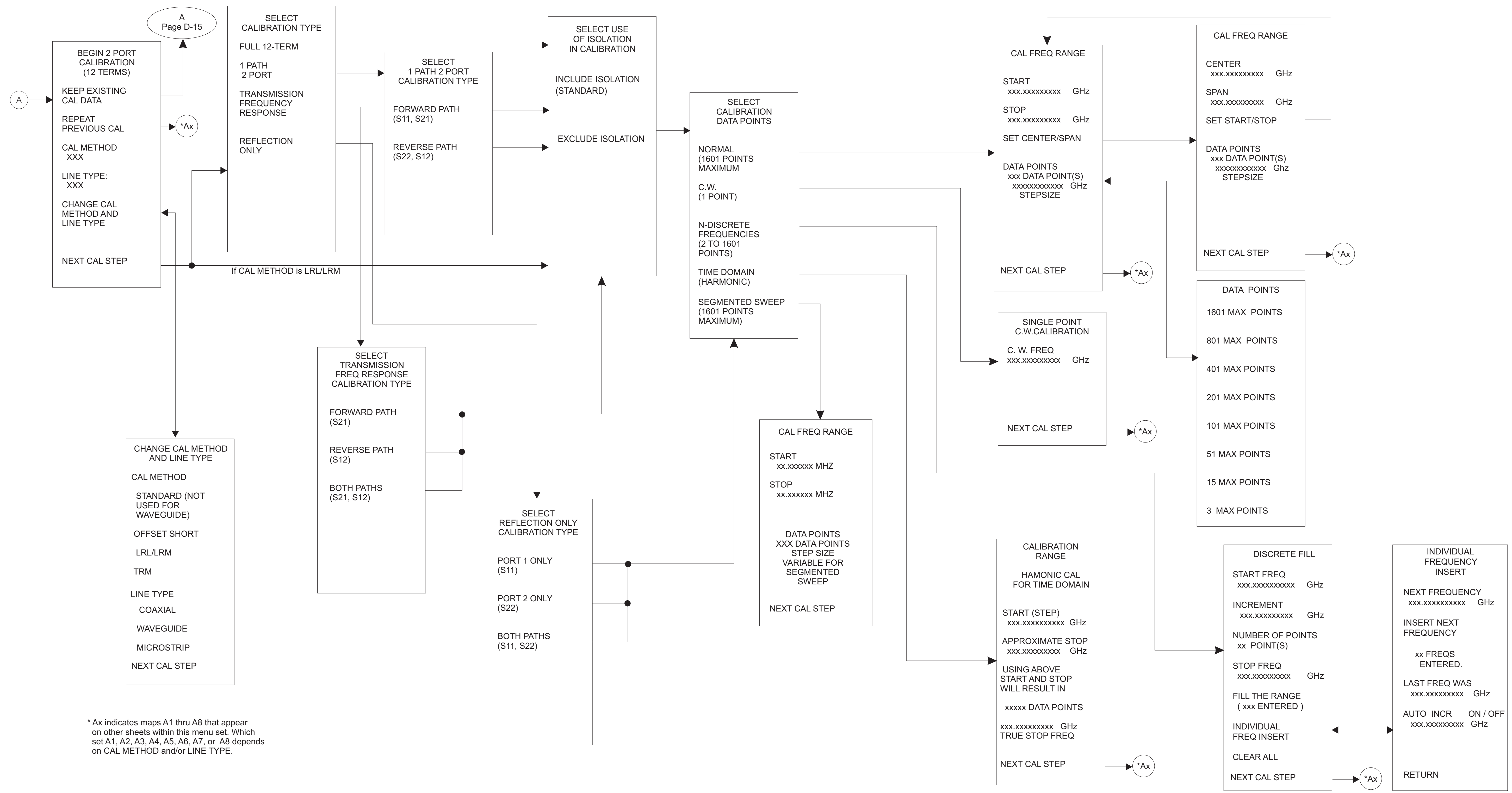

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(4 of 13)*

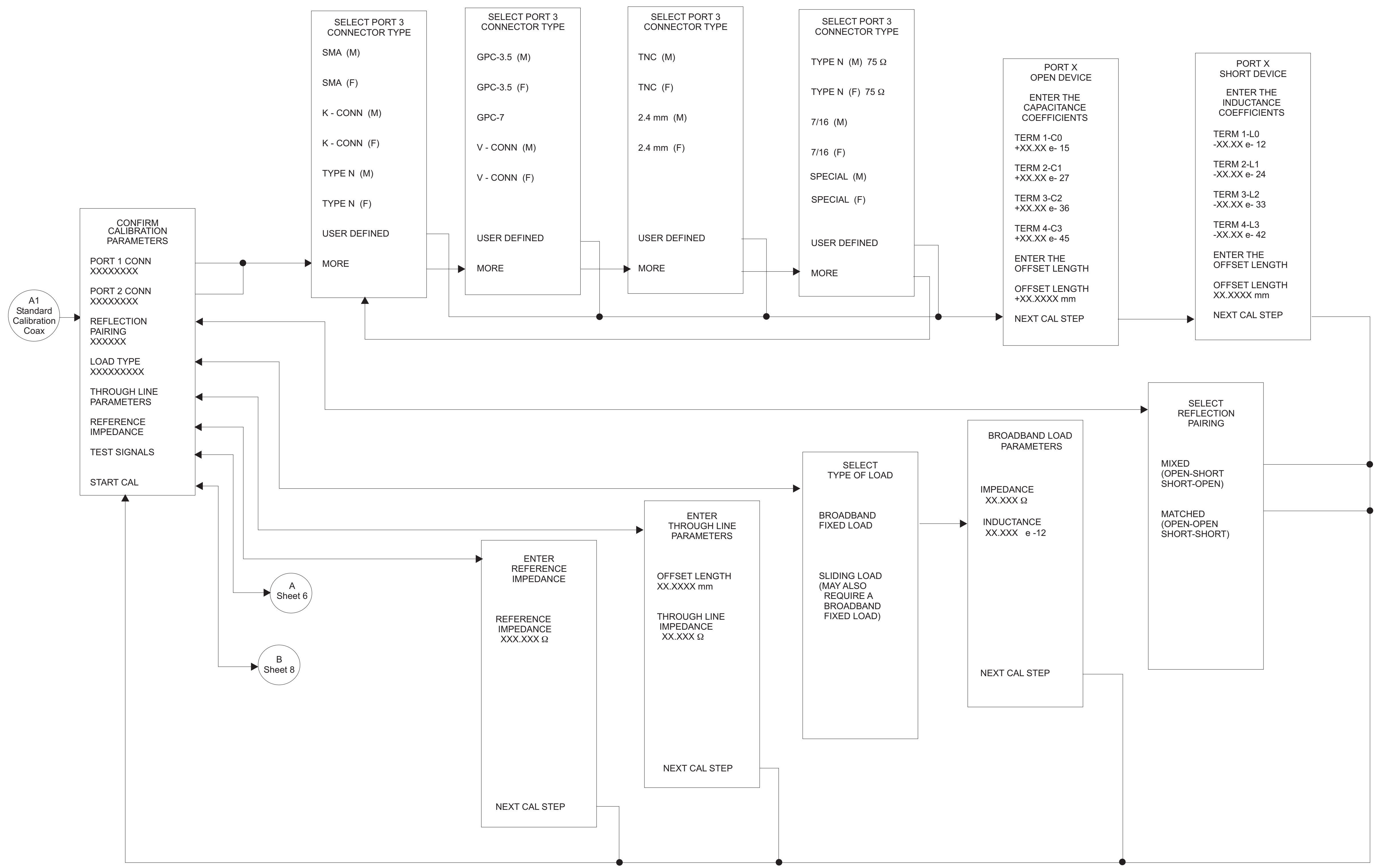

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(5of 13)*

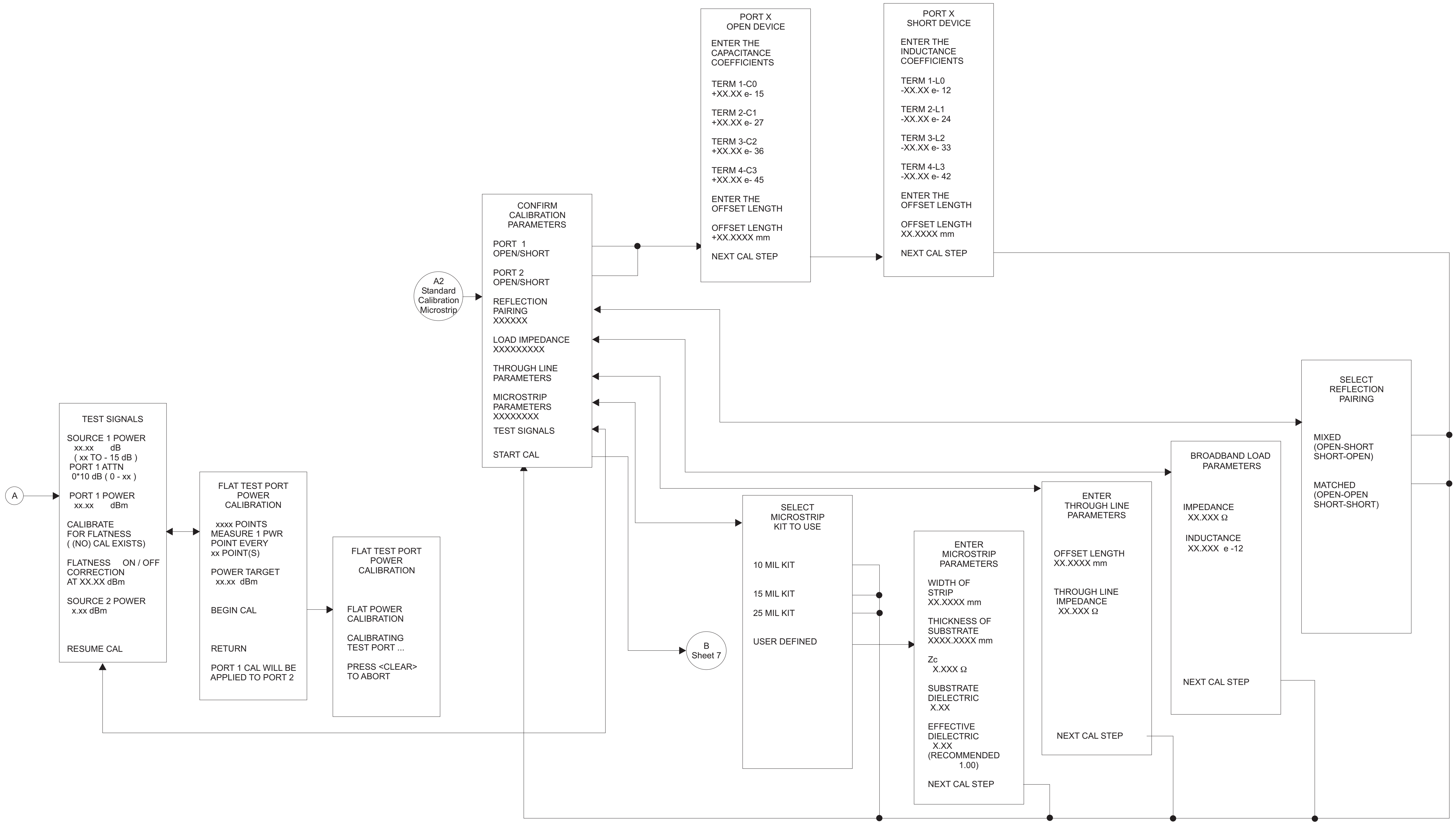

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(6 of 13)*

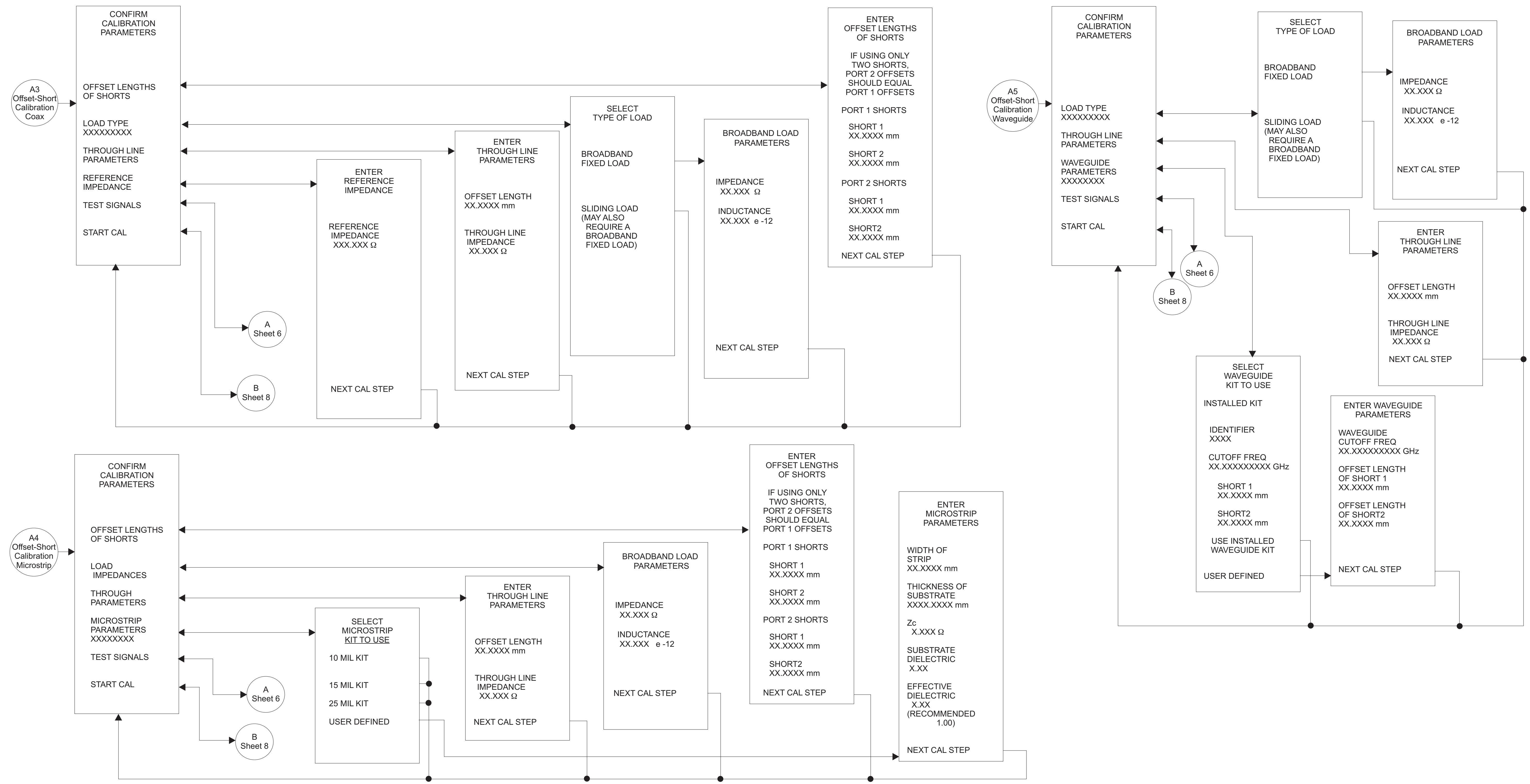

Figure D-15. Calibration Key Soft-Key Menu Map (Transmission & Reflection)(7 of 13)

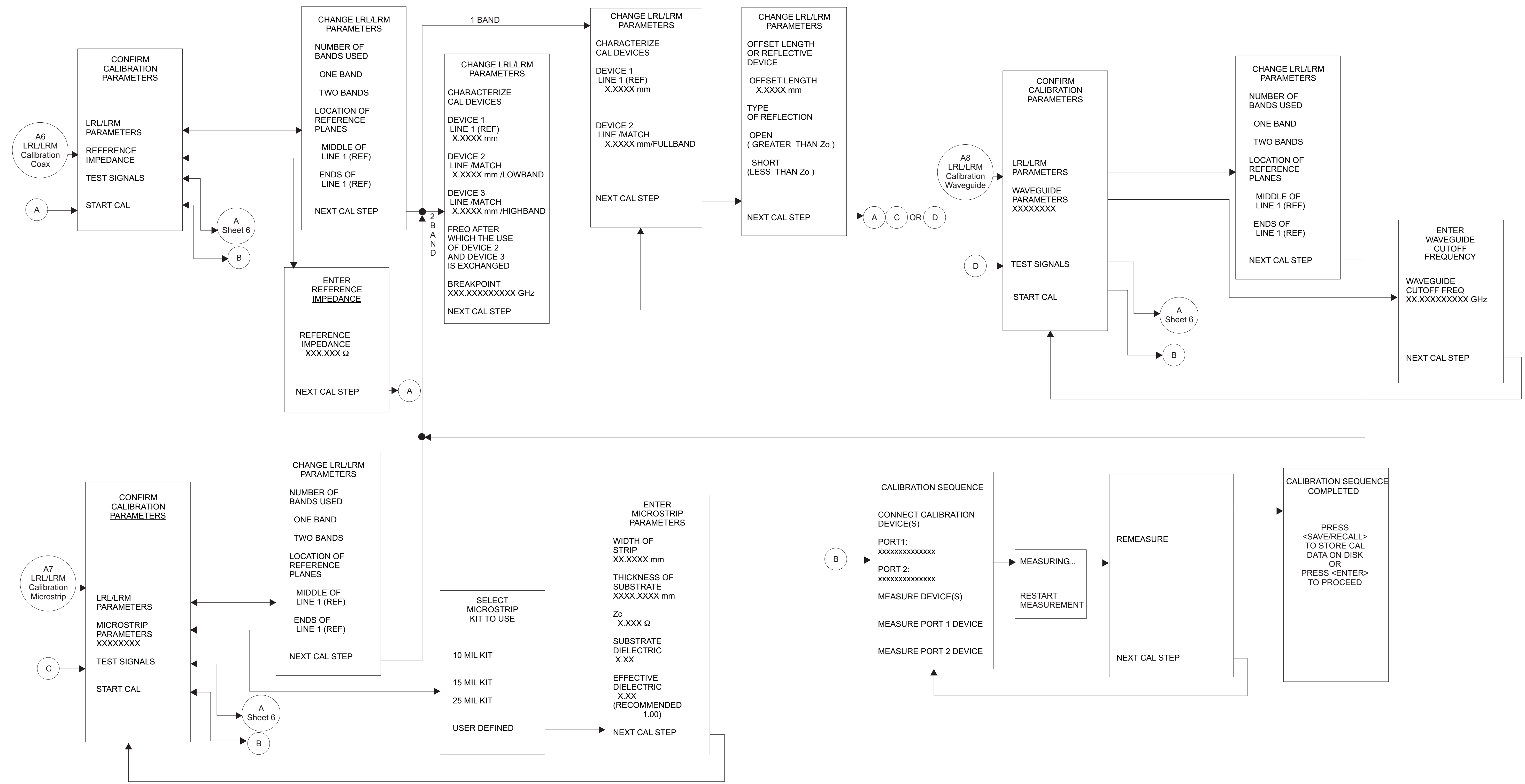

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(8 of 13)*

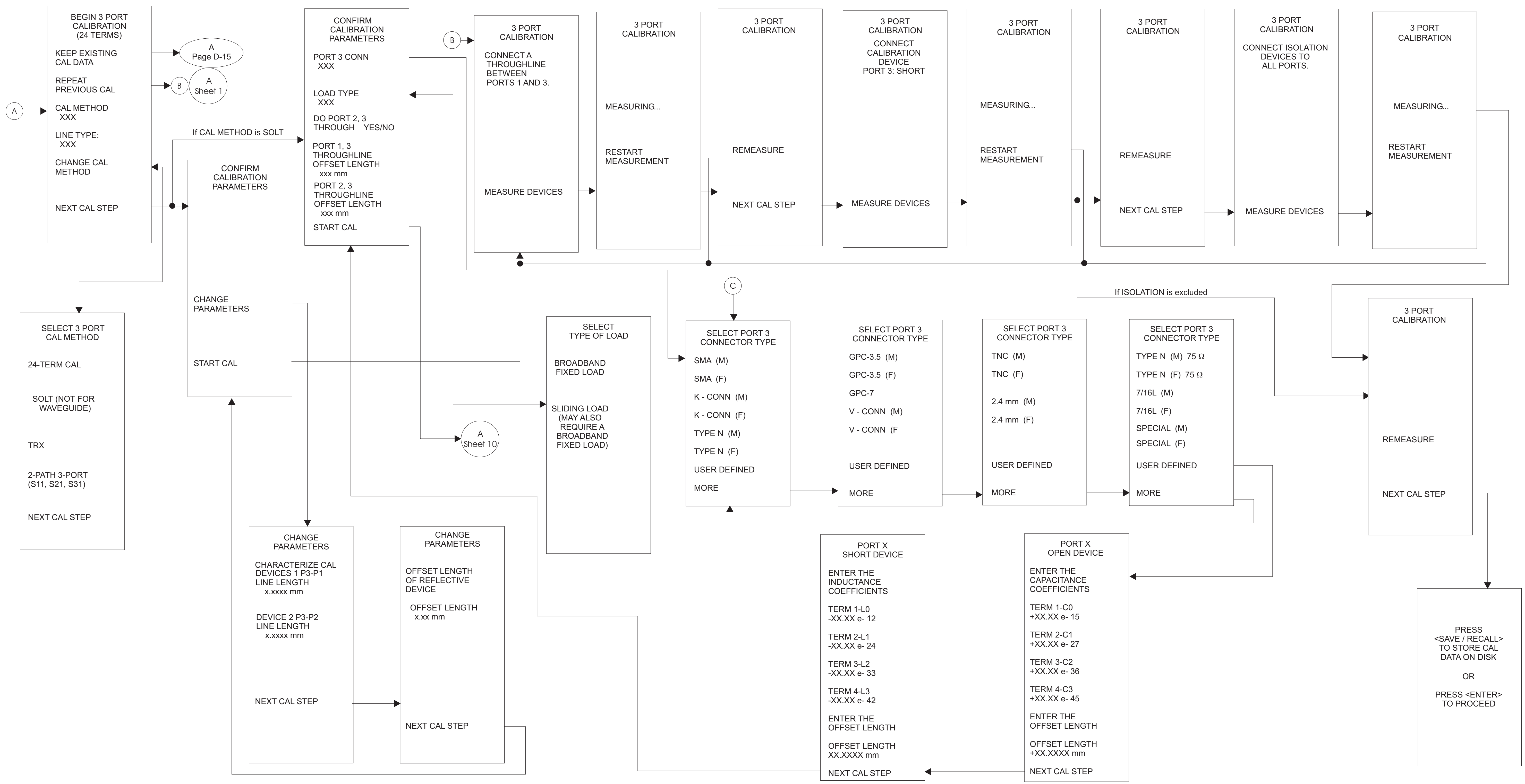

Figure D-15. Calibration Key Soft-Key Menu Map (Transmission & Reflection)(9 of 13)

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(10 of 13)*

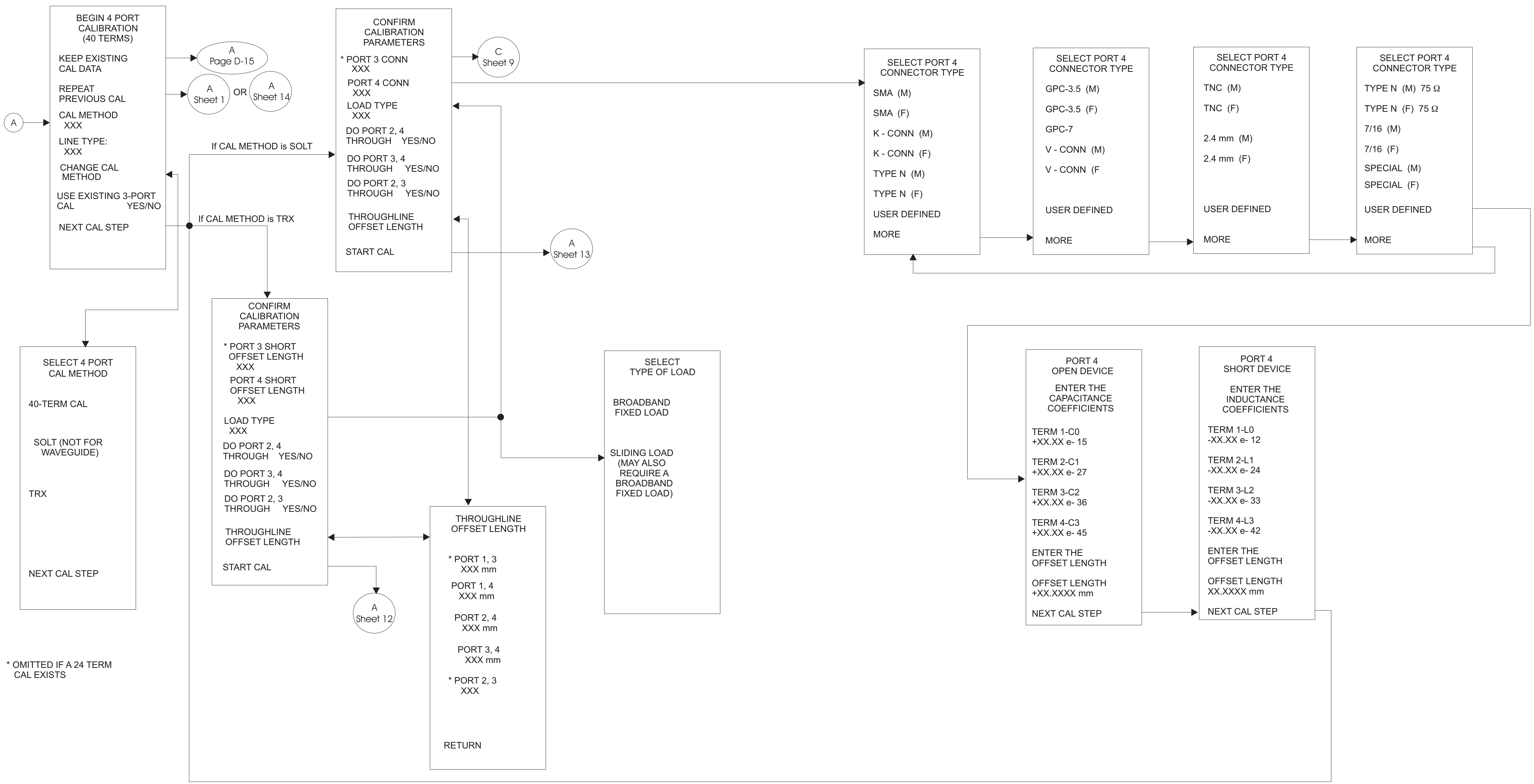

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(11 of 13)*

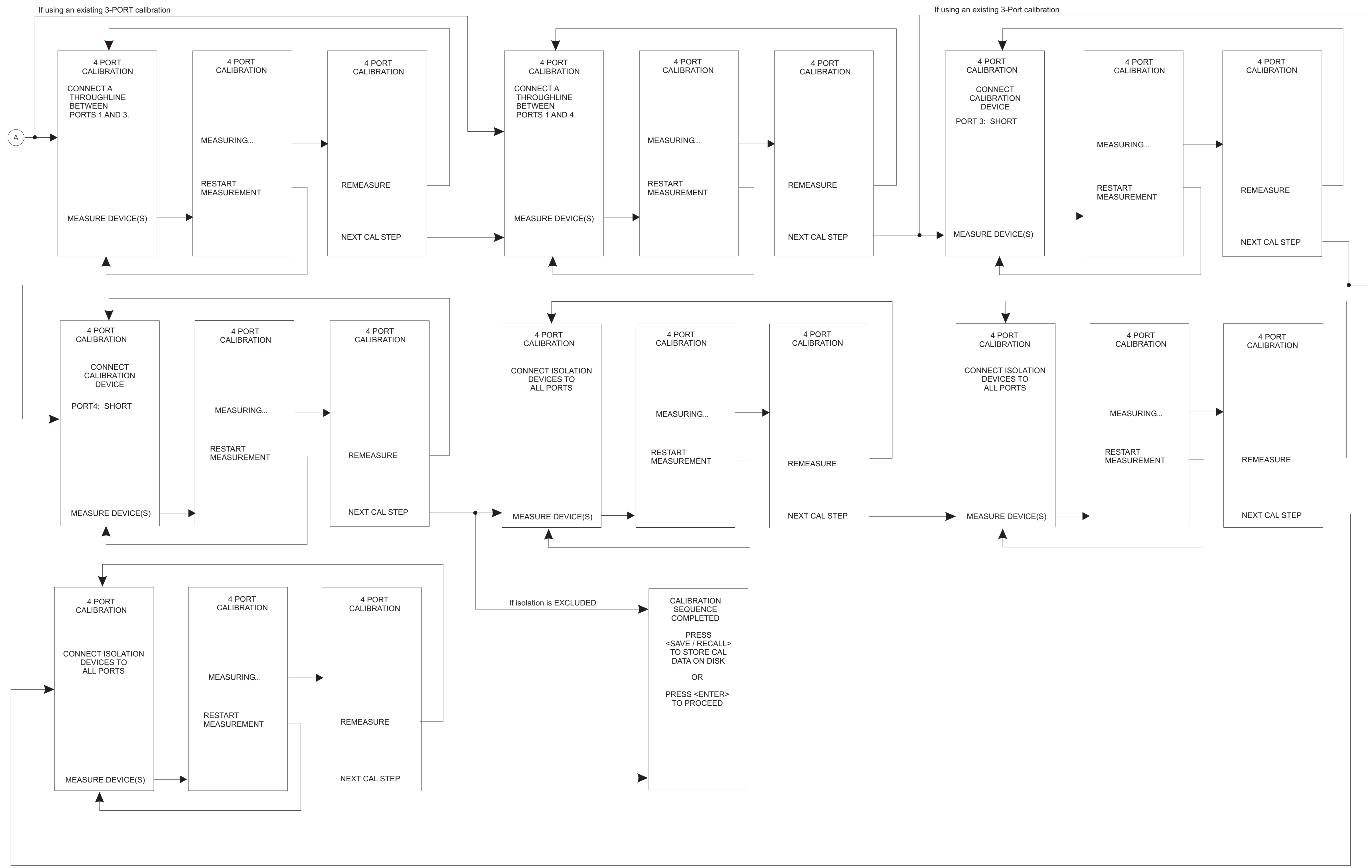

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(12 of 13)*

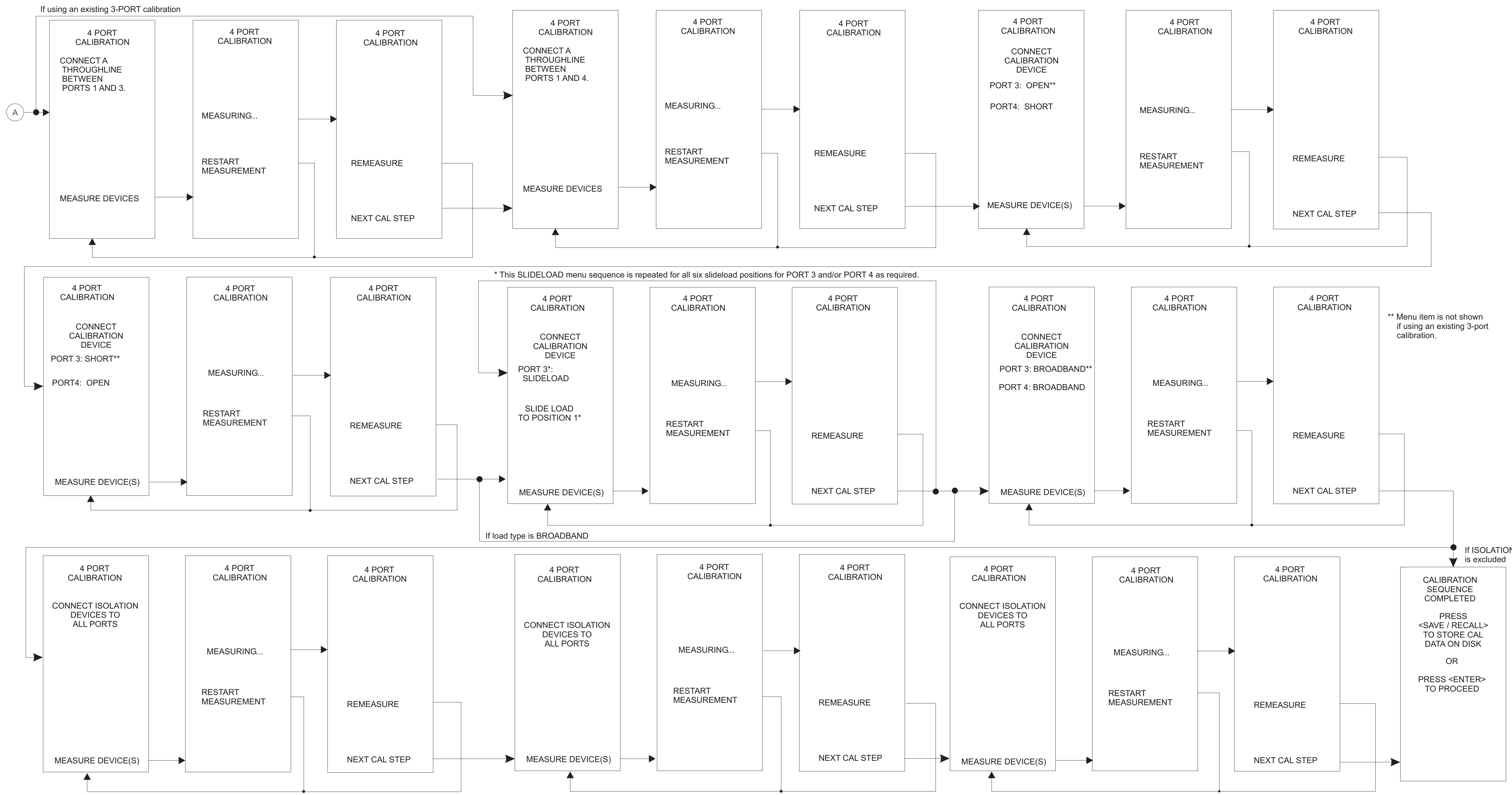

Figure D-15. *Calibration Key Soft-Key Menu Map (Transmission & Reflection)(13 of 13)*

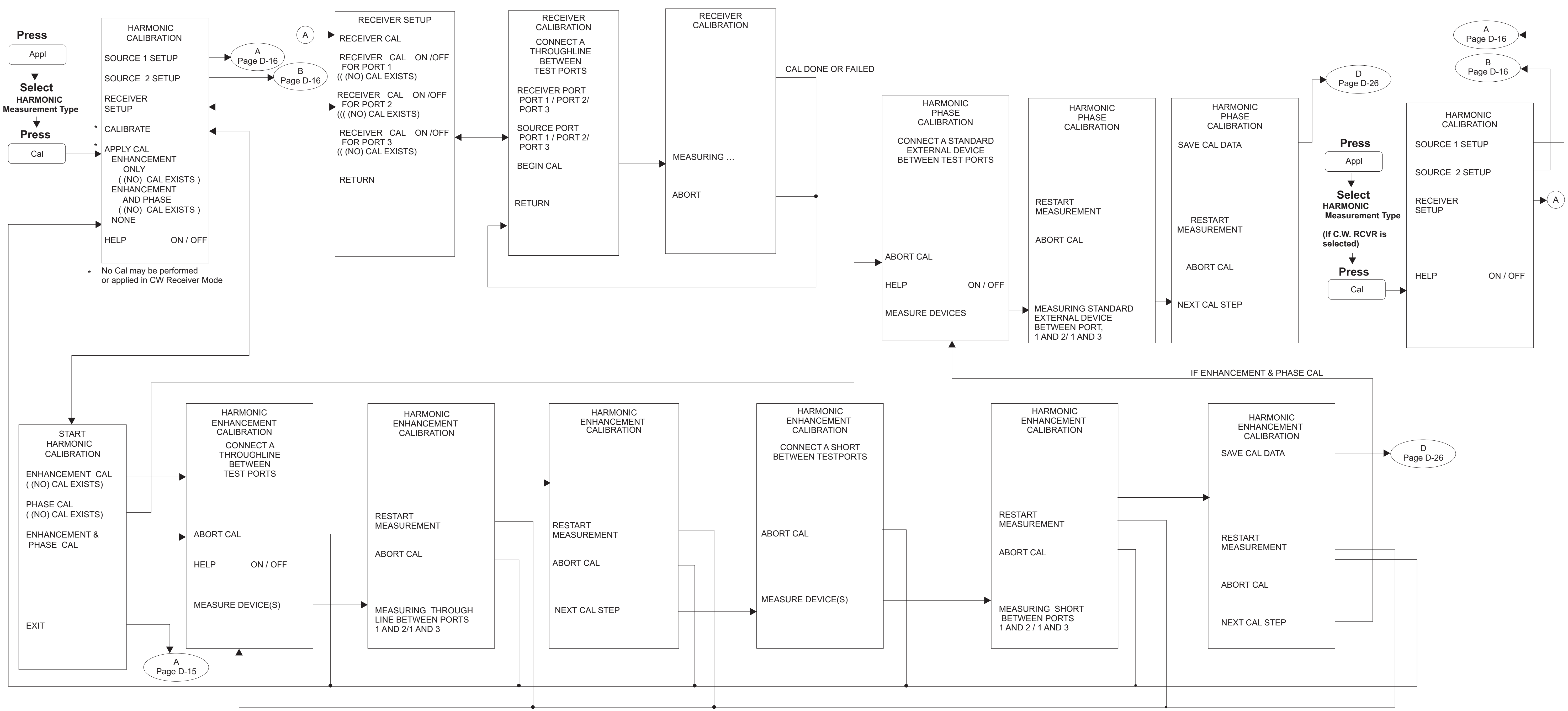

Figure D-16. Calibration Key Soft-Key Menu Map (Harmonic)(1 of 1)

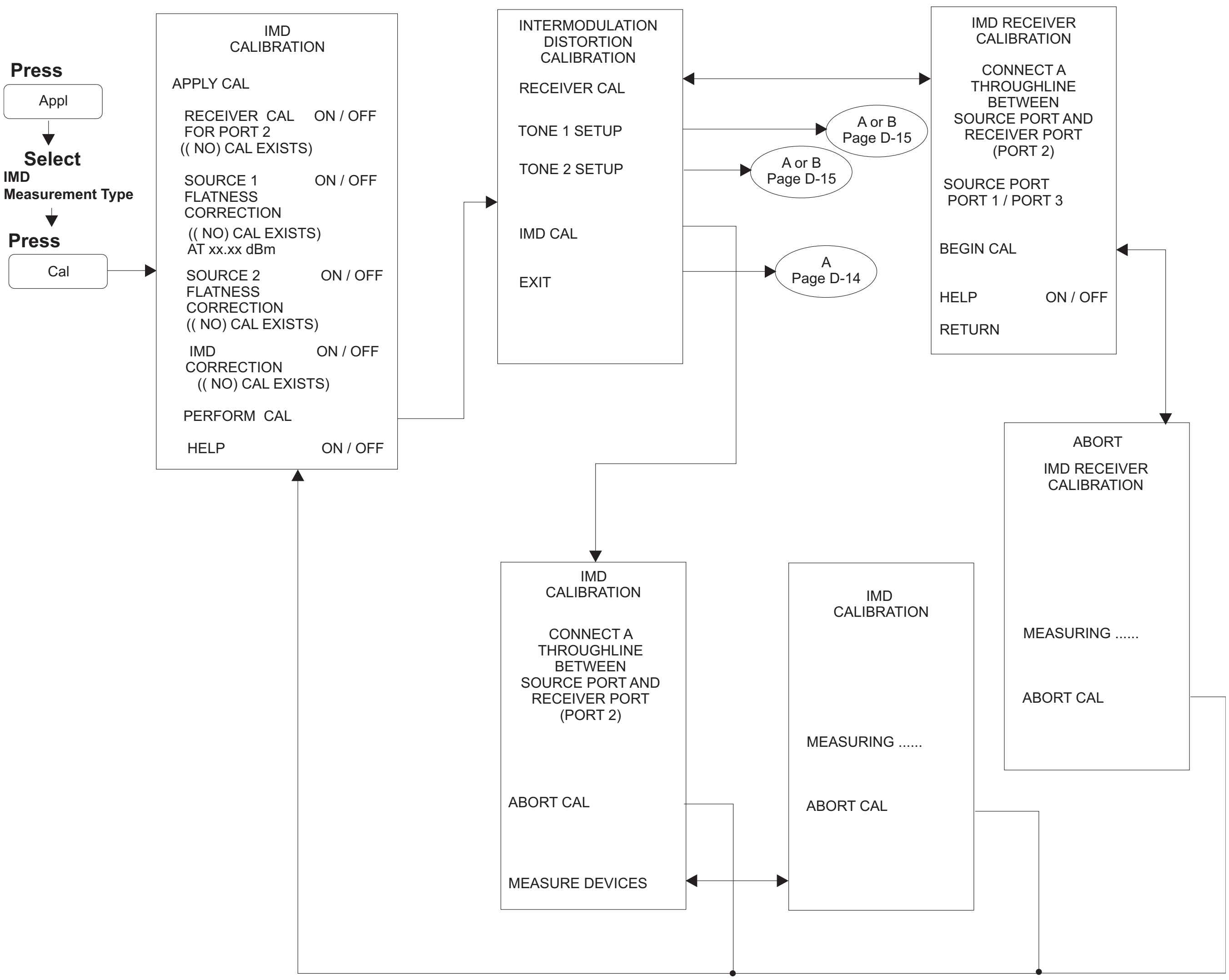

Figure D-17. *Calibration Key Soft-Key Menu Map (IMD)(1 of 1)*

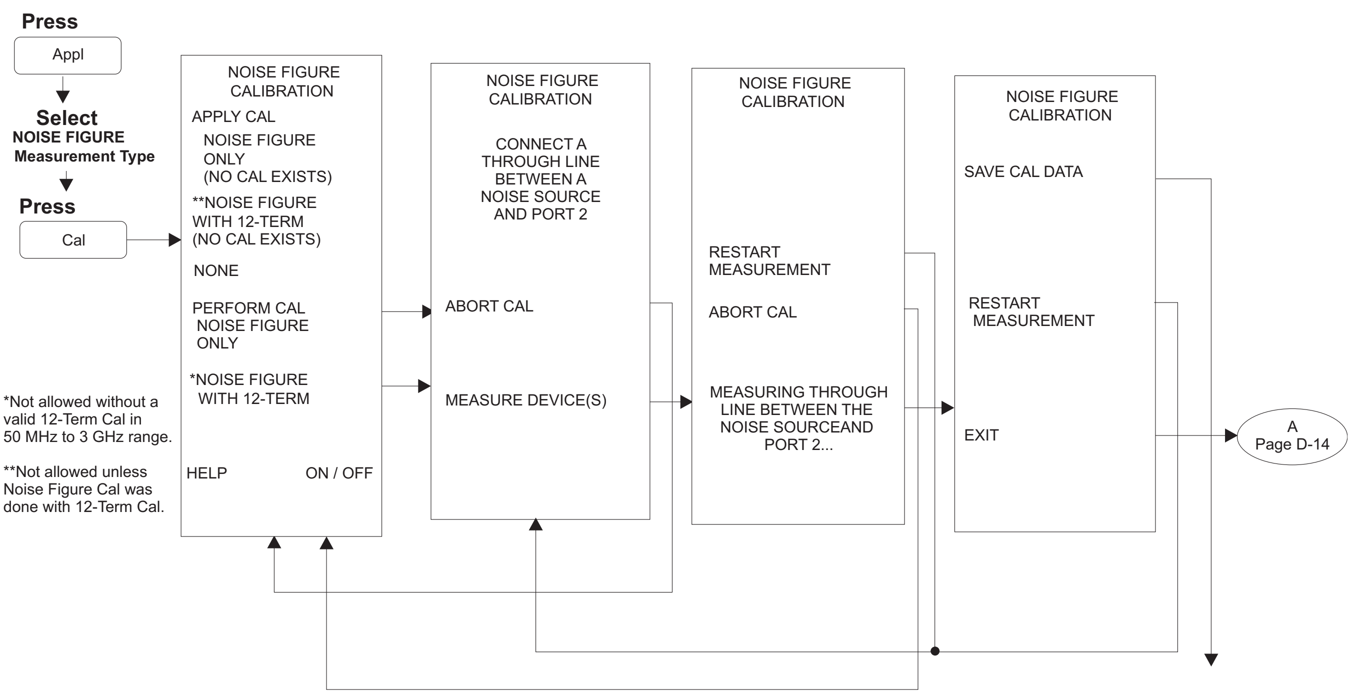

Figure D-18. *Calibration Key Soft-Key Menu Map (Noise Figure)(1 of 1)*

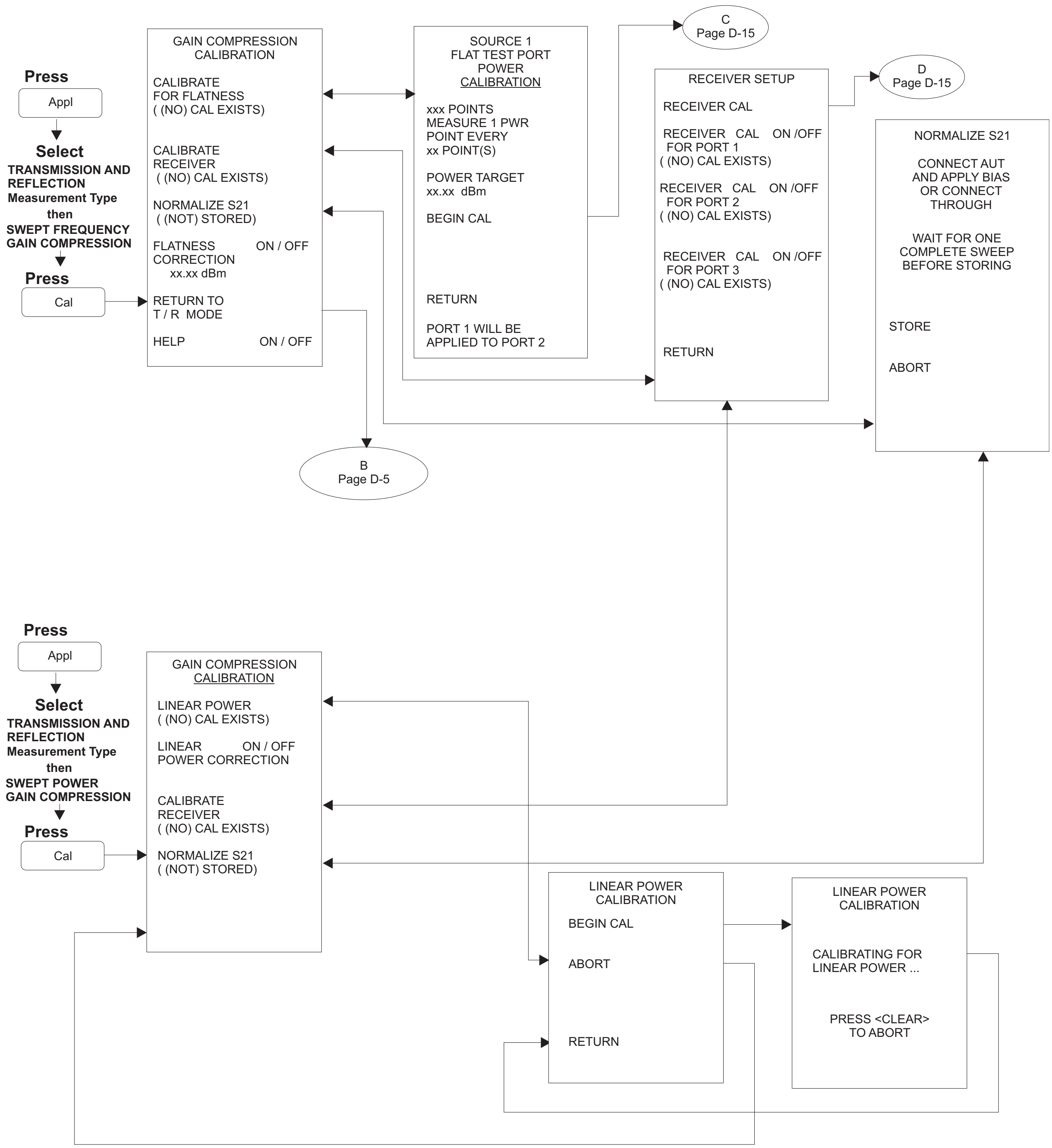

Figure D-19. Calibration Key Soft-Key Menu Map (Gain Compression)(1 of 1)

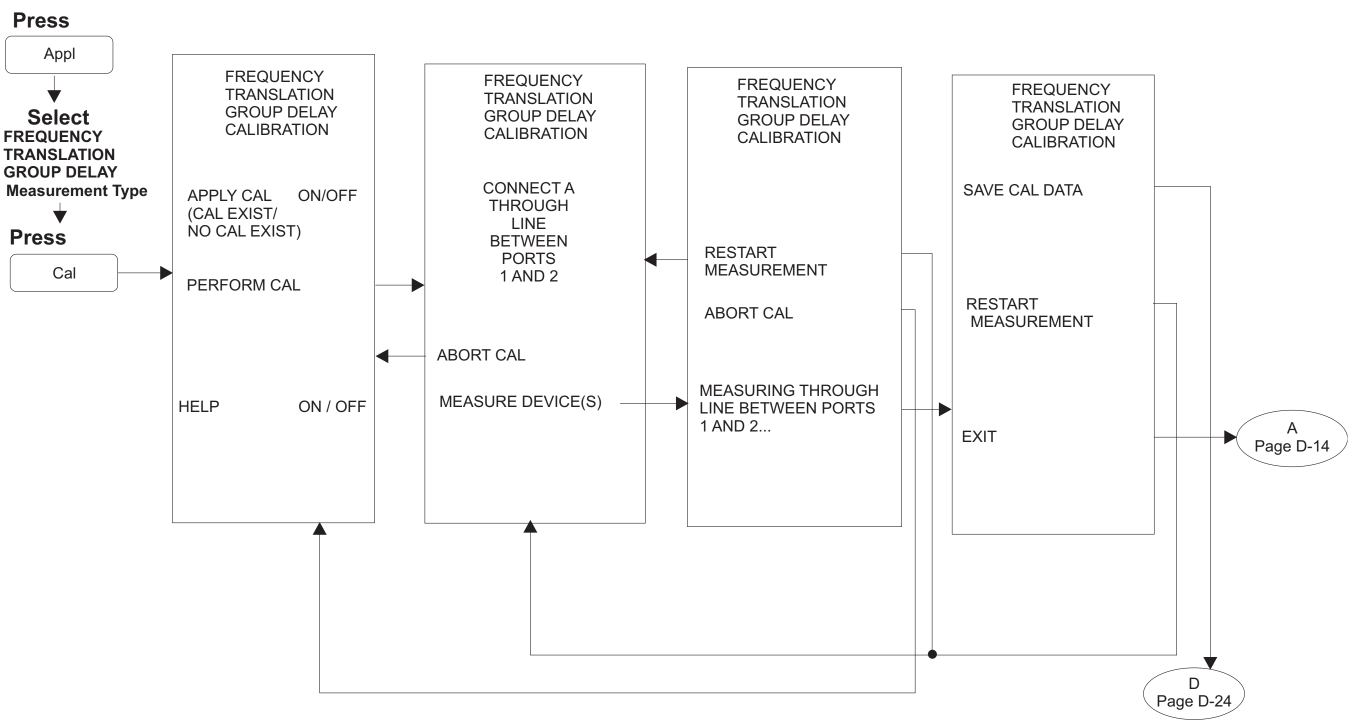

Figure D-20. *Calibration Key Soft-Key Menu Map (Frequency Group Delay)(1 of 1)*

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