SERIES 541XXA
NETWORK ANALYZER

OPERATION MANUAL

Anritsu

490 JARVIS DRIVE ● MORGAN HILL, CA 95037-2809

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WARRANTY

The ANRITSU product(s) listed on the title page is (are) warranted against defects in materials and workmanship for one year from the date of shipment, except for YIG-tuned oscillators, which are warranted for two years.

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.

NOTICE

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

(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.)

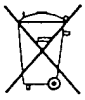
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE operating the equipment.

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 at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.

Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

or

WARNING

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 shock.

Repair

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.

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.

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: Scalar Network Analyzers

Model Number: 540XXA, 541XXA

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
Immunity:	IEC 1000-4-2:1995/prEN50082-1:1995 - 4kV CD, 8kV AD IEC 1000-4-3:1993/ENV50140:1994 - 3V/m IEC 1000-4-4:1995/prEN50082-1:1995 - 0.5kV SL, 1kV PL IEC 1000-4-5:1995/prEN50082-1:1995 - 0.5kV - 1kV LN 0.5kV - 1kV NG 0.5kV - 1kV GL

Electrical Safety Requirement:

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

Jeri Blair
Manager of Corporate Quality

Morgan Hill, CA

5-SEPT-97
Date

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

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Chapter 1
General Information

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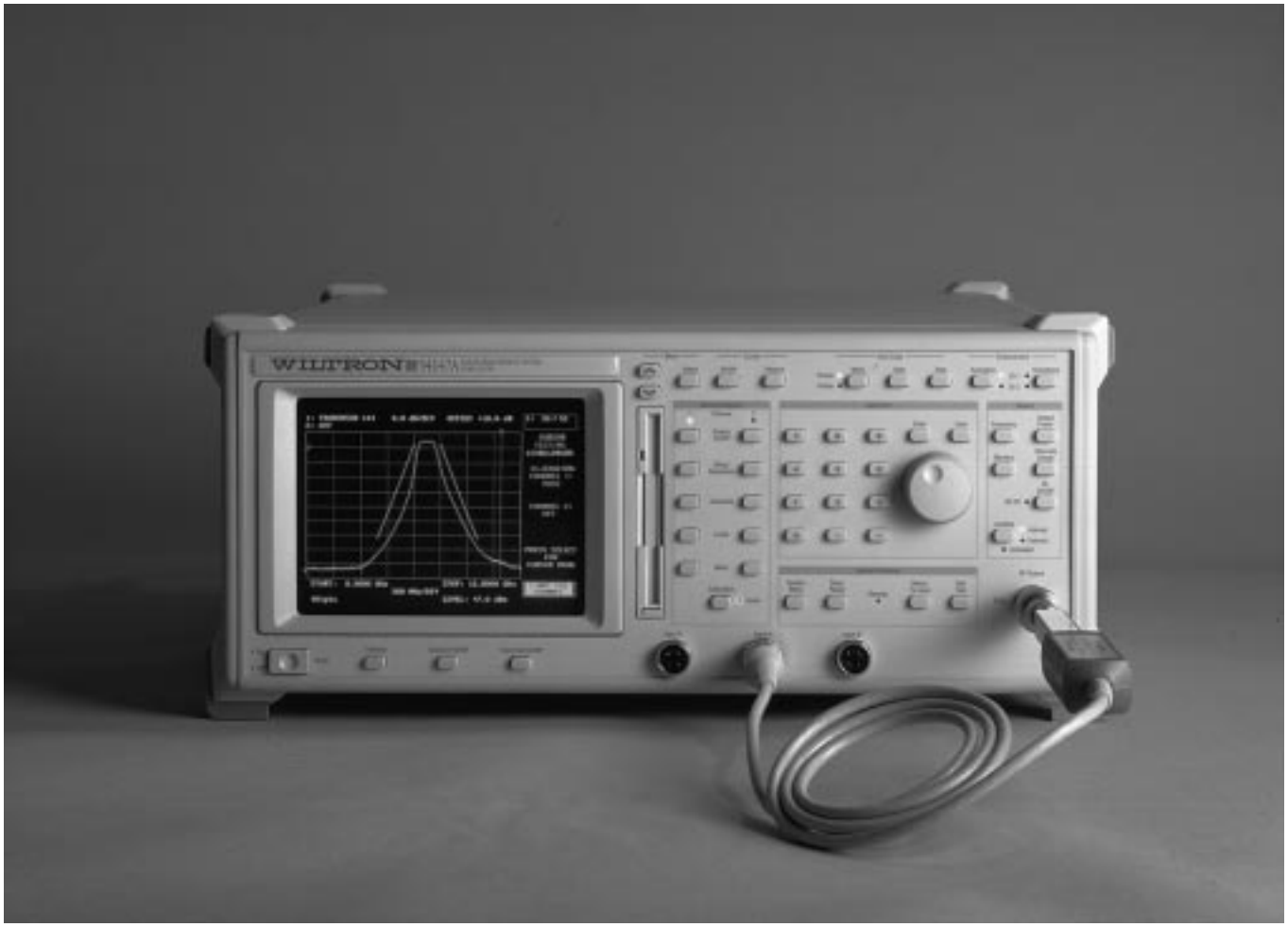


NOTE: ANRITSU Company was formerly known as WILTRON Company.

Figure 1-1. *Model 54147A Network Analyzer*

Chapter 1
General Information

1-1 SCOPE OF THE MANUAL

This manual provides general, installation, and operating information for the Series 541XXA Network Analyzer.

1-2 INTRODUCTION

Chapter 1 provides information about the 541XXA equipment identification number, performance specifications, and options.

1-3 IDENTIFICATION NUMBER

All ANRITSU instruments are assigned a six-digit ID number, such as "401001." This number appears on a decal affixed to the rear panel. Please use this identification number during any correspondence with ANRITSU Customer Service about this instrument.

1-4 ONLINE MANUAL

This manual is available on CD ROM as an Adobe AcrobatTM (*.pdf) file. The file can be viewed using Acrobat ReaderTM, a free program that is also available on the CD ROM. 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. For price and availability, contact ANRITSU Customer Service by phone at 408-778-2000 or via our internet home page at *http://www.anritsuwiltron.com*.

1-5 DESCRIPTION OF 541XXA SYSTEM

The overall 541XXA system consists of sixteen models that span a range of 1 MHz to 50 GHz. The listing of models and the frequency range that each covers is provided in Table 1-1. Each model is a microprocessor controlled network analyzer that is used to make scalar (magnitude) transmission, reflection, Distance-To-Fault (DTF), and absolute power measurements. All measurement functions are selectable by using the front panel keys and controls together with the display screen menus. Chapter 3 describes this mode of operation. A typical 541XXA model is shown in Figure 1-1 (facing page).

All 541XXA front panel control functions (except Power on/off) are programmable via the IEEE–488 interface bus (GPIB). Remote operation of the 541XXA using GPIB commands is described in the 541XXA GPIB User's Guide, which is located at the rear of this manual.

Table 1-1. *Series 541XXA Model Numbers and Frequency Ranges*

Model	Frequency Range	Output Power, dB (Standard)	Output Power, dB (Option 2 Step Attenuator)
54107A	1 MHz to 1.5 GHz	+12	+10
54109A	1 MHz to 2.2 GHz	+12	+10
54111A	1 MHz to 3.0 GHz	+12	+10
54117A	10 MHz to 8.6 GHz	+10	+7
54119A	2 GHz to 8.6 GHz	+10	+7
54128A	8 GHz to 12.4 GHz	+10	+7
54130A	12.4 GHz to 20 GHz	+10	+7
54131A	10 GHz to 16 GHz	+10	+7
54136A	17 GHz to 26.5 GHz	+7	+4
54137A	2 GHz to 20 GHz	+10	+7
54147A	10 MHz to 20 GHz	+10	+7
54154A	2 GHz to 32 GHz	+4	+1
54161A	10 MHz to 32 GHz	+4	+1
54163A	2 GHz to 40 GHz	+4	+1
54169A	10 MHz to 40 GHz	+4	+1
54177A	10 MHz to 50 GHz	+1	–2

1-6 REQUIRED EQUIPMENT

Depending on the test to be performed, an SWR Autotester or one or more detectors are required to complete the test setup; refer to the selection guide in the 54100A Series Technical Data Sheet in Appendix A. These devices produce the detected signals that are processed and displayed by the 541XXA system. These RF components are described in the 54100A Series Network Analyzers Technical Data Sheet contained in Appendix A.

1-7 OPTIONS

The various standard options that are available for the model 541XXA are described below. Contact your ANRITSU representative for further information.

Rack Mount (Option 1) — Adds kit that provides mounting brackets and chassis track slides for 541XXA Network Analyzers. These track slides have 90-degree tilt capability.

70 dB Step Attenuator (Options 2, 2A, 2B, 2C, and 2D) — These options add an internal 70 dB attenuator to the 541XXA signal source. Option 2 is for models 54107A, 54109A and 54111A. Option 2A is for models with upper band edge up to 20 GHz. Option 2B is for models with upper band edge up to 26.5 GHz. Option 2C is for models with upper band edge up to 40 GHz. And Option 2D is for models with upper band edge up to 50 GHz. These attenuators are switchable in 10 dB steps using the front panel keys and menus, or under GPIB control. The specifications for these options are included in Appendix A.

Signal Source 75 Ω Output (Option 4) —Provides 75 Ω signal source output. This option available for models 54107A, 54109A and 54111A only.

Third Input Connector (Option 5) — Adds "Reference" input connector (R) to front panel. This option allows input signal ratios A/R and B/R to be displayed and subsequently printed/plotted. (The ratio mode should be used whenever source power will need to be adjusted during a measurement procedure.)

External Leveling (Option 6) — Adds rear panel EXTERNAL LEVELING connector. The signal applied to this input controls the RF output of the 541XXA internal signal source. (The output power level will be determined by the detector type, detector location, any additional attenuation in leveling loop, and by the Output Power key menu setting.)

This option allows the 541XXA RF output to be leveled from a remote location using standard RF detectors with either a directional coupler or a two-resistor power splitter.

Internal Distance-To-Fault Software (Option 7) – This option enables the 541XXA system to measure the distance to a fault (or faults) in transmission lines, coaxial cables, and waveguides. The return loss of faults—such as open circuits, poor connectors, corroded contacts, and ruptured cable dielectric—is displayed across the x-axis distance in either feet or meters. The amplitude of the Y axis can be displayed in either dB or SWR. These measurement formats can be accessed vis the relevant main menu entry. (i.e., DTF/SWR for SWR units and DTF/DB for dB unit).

Front Panel Cover (Option 12) – This option adds a protective cover for the front panel.

Front Mounted Handles (Option 13) – This option adds front panel mounted handles.

DC Supply for Millimeter Wave Source Modules (Option 16) – This option adds a +15 Vdc supply for use with millimeter-wave-source modules. The +15 Vdc connection is mounted on the rear panel. This option is not available with 541XXA Series instruments having a frequency range greater than 20 GHz.

Maintenance Manual (Option 25) – This option includes a maintenance manual. The 541XXA is shipped with an Operating Manual (OM) that includes a GPIB User's Guide (GPIB-UG). This option also includes a maintenance manual (MM).

Extra Operation and GPIB Programming Manual (Option 26) – This option includes an additional copy of the Operating Manual and GPIB User's Guide.

Portable Printer (Option 33) – This option adds a portable printer.

1-8 MEASUREMENT ACCESSORIES

Measurement accessories include RF cables, power splitters, precision adapters, adapters, matching pads and other accessories. Model numbers and specifications for these accessories are tabulated in the 54100A Series Network Analyzer Technical Data Sheet contained in Appendix A.

1-9 SYSTEM ACCESSORIES

System accessories consist of leveling detectors, power amplifiers, RF limiters, extender cables, GPIB cables, and detector adapter cables. Model numbers and specifications for these accessories are listed in the 54100A Series Network Analyzer Technical Data Sheet contained in Appendix A.

1-10 MILLIMETER WAVE MEASUREMENT SYSTEMS

The ANRITSU 541XXA Millimeter Wave Reflectometers are designed to operate with the 54147A 20 GHz Network Analyzer. This feature, along with associated waveguide test products, is described in the 54100A Series Network Analyzer Technical Data Sheet contained in Appendix A.

1-11 SYSTEM SPECIFICATIONS

Specifications for the 541XXA Network Analyzer models are listed in the 54100A Series Network Analyzer Technical Data Sheet contained in Appendix A.

1-12 SYSTEM RF COMPONENTS

RF Components consists of a precision detector and an SWR Autotester. These components are available for different configurations of frequency and connector type. They are described in the 54100A Series Network Analyzer Technical Data Sheet contained in Appendix A.

1-13 USING SWR AUTOTESTERS AND RF DETECTORS (PRECAUTIONS)

The 560 Series SWR Autotesters and RF Detectors are high-quality, precision laboratory devices that contain General Precision class Connectors (GPC's). Follow the precautions listed below when handling or connecting these devices. Complying with these precautions will guarantee longer component life and less equipment downtime due to connector or device failure. Such compliance will ensure that RF component failures are not due to misuse or abuse (these two failure causes are not covered under the ANRITSU warranty).

Beware of destructive Pin Depth of Mating Connectors

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 connector is mated with a connector having a destructive pin depth, damage will usually occur to the RF component connector. A destructive pin depth is one that is too long in respect to the reference plane of the connector (Figure 1-2).

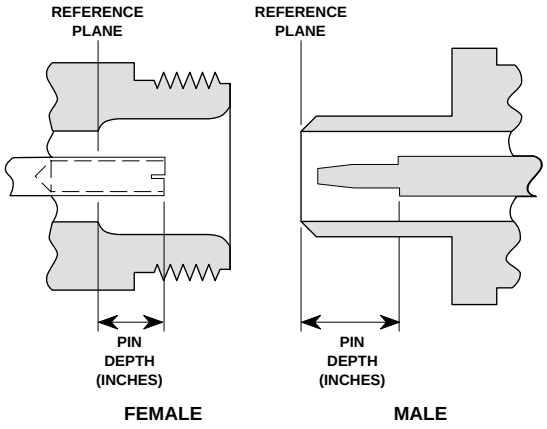


Figure 1-2. *N Connector Pin Depth Definition*

The center pin of a precision RF component connector has a precision tolerance measured in mils (1/1000 inch). The mating connectors of various RF components may not be precision types. Consequently, the center pins of these devices may not have the proper depth. The pin depth of DUT connectors should be measured to assure compatibility before attempting to mate them with SWR Autotester or detector connectors. An ANRITSU Pin Depth Gauge (Figure 1-3), or equivalent, can be used for this purpose. If the measured connector is out of tolerance in the "+" region, the center pin is too long (see Table 1-2). Mating under this condition will probably damage the precision RF component connector. If the test device connector measures out of tolerance in the "–" region, the center pin is too short. This will not cause damage, but it will result in a poor connection and a consequent degradation in performance.

Avoid Over-Torquing Connectors

Over-torquing connectors is destructive; it may damage the connector center pin. Always use a connector torque wrench (8 inch-pounds) when tightening GPC-7, WSMA, K, and V type connectors. (Finger-tight is usually sufficient for Type N connectors). *Never use pliers to tighten connectors.*

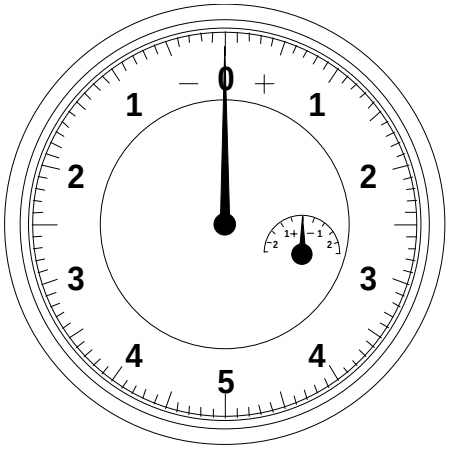


Figure 1-3. *Pin Depth Gauge*

Table 1-2. *Allowable Mating Connector Pin Depth*

Test Port Connector Type	Pin Depth (Inches)	Pin Depth Gauge Reading
N-Male	0.207–0.000 +0.003	0.207 +0.000 –0.003
N-Female	0.207 –0.003 +0.000	Same as Pin Depth
GPC-7	+0.000 –0.003	
WSMA-Male	–0.0025 –0.0035	
WSMA-Female	+0.0003 –0.0007	Same as Pin Depth
K-Male, K-Female	+0.000 –0.002	
V-Male, V-Female	+0.000 –0.003	

Avoid Mechanical Shock

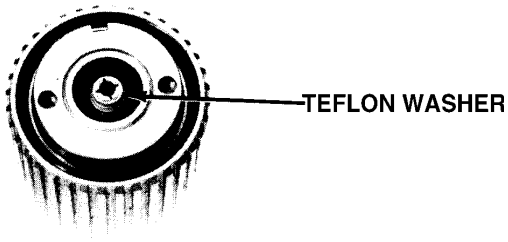
Do not drop or otherwise treat RF components roughly. These devices are designed to withstand years of normal bench handling. However, mechanical shock will significantly reduce their service life.

Avoid Applying Excessive Power

Series 560-9XXXX SWR Autotesters are rated at +27 dBm (0.5 W) maximum input power, and Series 560-7XXX Detectors are rated at +20 dBm maximum input power. Exceeding these input power levels, even for short durations, can permanently damage the internal components of these devices.

Do Not Disturb Teflon Tuning Washers On Connector Center Pins

The center conductor of many RF component connectors contains a small teflon tuning washer that located near the point of mating (Figure 1-4). This washer compensates for minor impedance discontinuities at the interface. *Do not disturb this washer.* The location of this washer is critical to the performance of the component.



NOTE

The teflon washer is shown on a GPC-7 connector. A similar washer may be installed on any ANRITSU precision connectors.

Figure 1-4. *Teflon Tuning Washer*

Compensation Washers (WSMA Connectors)

Compensation washers are needed with some WSMA connections. Washer uses are explained and a typical compensation washer installation procedure is provided in Figure 1-5.

Keep Connectors Clean

The precise geometry that makes possible the RF component's high performance can be easily disturbed by dirt and other contamination adhering to connector interfaces. When not in use, keep the connectors covered.

To clean the connector interfaces, use a clean cotton swab that has been *dampened* with denatured alcohol. Proper techniques for cleaning GPC type connectors are as follows.

- Always use denatured alcohol as cleaning solvent. Never use industrial solvent or water, as damage to the connectors may result.
- Use only a small amount of alcohol; otherwise, prolonged drying of the connector may be required.
- Never put lateral pressure on the center pin of the connector.
- Verify that no cotton or other foreign material remains in the connector after cleaning it.
- If available, use compressed air to remove foreign particles and to dry the connector.
- After cleaning, verify that the center pin has not been bent or damaged.

NOTE

Most cotton swabs are too large to fit into the smaller connector types. In these cases it is necessary to peel 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.

Avoid Static Electricity

Take precautions to avoid acquiring a static charge of electricity. Refer to Figure 1-6 for a listing of precaustions.

WSMA connectors are optimized for connection to standard SMA connectors. Whenever two WSMA connectors are mated, a compensation washer should be inserted between the two connectors near the point of mating (to provide optimum mating depth for this connector combination). The only exceptions are: the WSMA Open/Short, and the RF Output connectors of the 541XXA and other ANRITSU RF signal sources.

Step 1 Separate a single WSMA connector compensation washer and trim away the interconnecting tabs.

Step 2 Connect the 560-98SF50 SWR Autotester input port to the signal source RF output port, and loosely tighten connector. Orient the WSMA female connector (test port) up.

Step 3 Insert the compensation washer into the opening of the WSMA female connector, as shown.

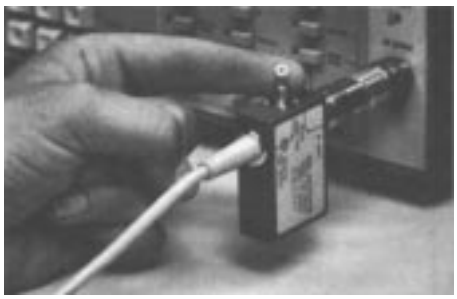


Figure 1-5. *Example for Using Compensation Washer with WSMA Connectors (1 of 2)*

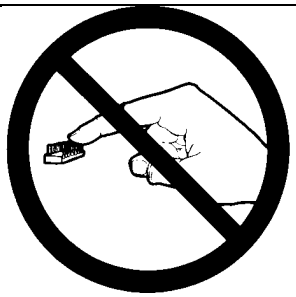
Step 4 Connect beaded end of the air line per application. Tilt the air line horizontally. At unbeaded end, center the inner conductor with the center of the connector opening.

Step 5 Loosen the SWR Autotester input port connector and rotate unit horizontally, as shown at left. Align unbeaded end of Air Line with test port connector and carefully mate connectors. Tighten all connectors carefully.

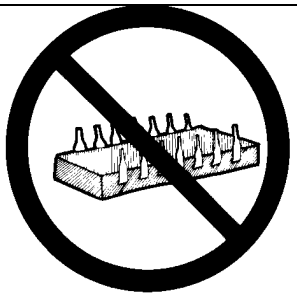
NOTE

For a 560-98S50 SWR Autotester (male WSMA test port) in combination with a 19SF50 Air Line, insert the compensation washer into the female WSMA connector of the air line (beaded end).

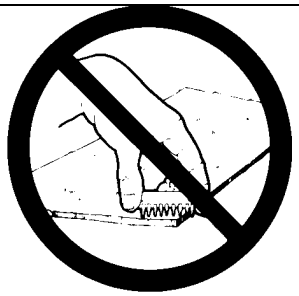
Figure 1-5. *Example for Using Compensation Washer with WSMA Connectors (2 of 2)*



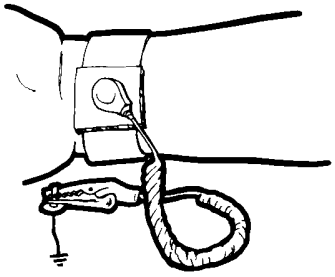
1. Do not touch exposed contacts on any static sensitive component.



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

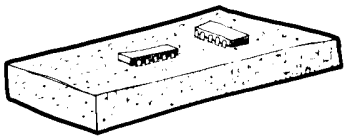


3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.

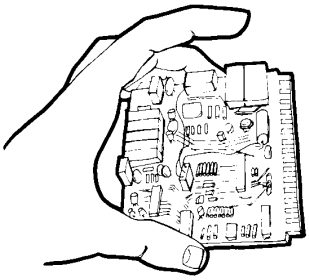


4. Wear a static-discharge wristband when working with static sensitive components.

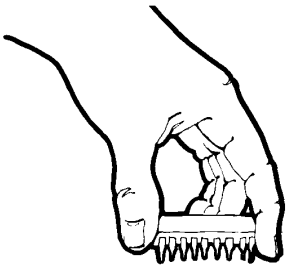
5. Label all static sensitive devices.



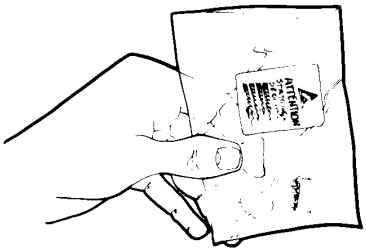
6. Keep component leads shorted together whenever possible.



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.

10. ADDITIONAL PRECAUTIONS:

Keep workspaces clean and free of any objects capable of holding or storing a static charge.

Figure 1-6. *Static Sensitive Component Handling Procedures*

1-14 RECOMMENDED TEST EQUIPMENT

Table 1-3 lists the recommended test equipment required for performance verification and calibration procedures and for troubleshooting Model 541XXA Network Analyzers. Each equipment entry includes a USE code that indicates the type of usage for that piece of equipment. These codes are described below.

Code	Type of Testing
C	Calibration
P	Performance Verification
T	Troubleshooting

Table 1-3. *Recommended Test Equipment (1 of 2)*

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE
Adaptor Cable	Simulates 560-7 Series detectors	ANRITSU Model 560-10BX	P
Computer/Controller	Personal computer, equipped with National PCIIA GPIB interface card	Any IBM compatible (or ANRITSU Model 85, or HP Model 200)	P
RF Detector	1. 50Ω input, 1.0 to 3000 MHz* 2. 75Ω input, 1.0 to 3000 MHz** 3. 0.010 to 18.5 GHz 4. 0.010 to 26.5 GHz#	ANRITSU Model 5400-71N50 ANRITSU Model 5400-71N75 ANRITSU Model 560-7N50 ANRITSU Model 560-7K50	P
Impedance Adapter	Converts from 50Ω To 75Ω	ANRITSU Model 12N75B	P,T
Digital Multimeter	Resolution: 4-1/2 digits (to 20V) *DC Accuracy:* 0.002% + 2 counts *DC Input Impedance:* 10 MΩ *AC Accuracy:* 0.07% + 100 counts (to 20 kHz) AC Input Impedance: 1 MΩ	John Fluke Mfg Co. Inc., Model 8840A, with Option 8840A-09, True RMS AC	T
Frequency Counter	*Frequency:* 0.1 to 26.5 GHz *Input Impedance*: 50Ω	EIP Microwave, Inc., Model 578A	P, C
Modulation Meter	*Bandwidth:* 15 kHz Accuracy: ±3% of FSD at 1 kHz	Anritsu Corp., Model MS-316B	P, C
Oscilloscope	*Bandwidth*: DC to 150 MHz *Sensitivity:* 2 mV *Horiz. Sensitivity:* 50 ns/division	Tektronix, Inc. Model 2445	C, T
Power Meter, with: Power Sensor* 50Ω input Power Sensor** 75Ω input	*Power Range:* +10 to –55 dBm *Other:* 50 MHz Calibrated Output Frequency Range: 1.0 MHz to 2.0 GHz *Power Range:* –30 to +20 dBm Frequency Range: 1.0 MHz to 5.5 GHz *Power Range:* –30 to +20 dBm	Anritsu Corp., Model ML4803A Anritsu Corp., Model MA4601A Anritsu Corp., Model MA4603A with J0365 Conversion Connector	P, T

Table 1-3. *Recommended Test Equipment (2 of 2)*

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE
Power Sensor	Frequency Range: 0.10 to 32.0 GHz *Power Range:* –30 to +20 dBm *Power Range:* –70 to –20 dBm	 Anritsu Corp., Model MA4701A Anritsu Corp., Model MA4702A	P, T
Power Meter	*Frequency: Greater than 32 GHz* *Power Range:* +10 to –70 dBm *Other:* 50 MHz Calibrated Output	Hewlett-Packard 437A	P, T
Power Sensor	Frequency Range: .01 to 40 GHz *(needs adapter HP11904d, 2.4-K)* *Frequency Range: .01 to 50 GHz* *(no adapter needed)*	Hewlett-Packard 8487A Hewlett-Packard 8487D	P, T
Printer	Parallel Interface operation	Cannon Model BJ10SX Bubble-Jet Printer	P
Spectrum Analyzer	*Frequency Range:* 0.01 to 20 GHz *Power Range: +10 dB to –60 dBm*	Anritsu Corp., Model MS2802	P, T
Step Attenuator	*Attenuation Range:* 60 dB, 10 dB/step 0.000 to 18.0 GHz 0.000 to 26.5 GHz	 Hewlett-Packard, Model 8495B Hewlett-Packard, Model 8495D	P, C
Voltage Standard	Range: –1.462V to –1.313 mV Accuracy: 0.002% of set value.	John Fluke Mfg Co. Inc., Model 335D	P, C, T

∗ Required for models 54107A, 54109A, and 54111A with 50Ω output.
∗∗ Required for models 54107A, 54109A, and 54111A with 75Ω output, only.

1-15 PREVENTIVE MAINTENANCE

Cleaning the rear panel fan filter is the only preventive maintenance required. DO NOT REMOVE THE FAN FILTER FROM THE INSTRUMENT. Use a soft brush to remove dust from the fan filter periodically as required to ensure good air flow.

Chapter 2
Installation

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Chapter 2
Installation

2-1 INTRODUCTION

This chapter provides information for the initial inspection and preparation for use of the 541XXA Network Analyzer. Information for interfacing the 541XXA 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.

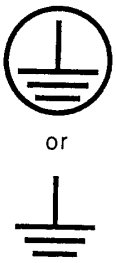
If the 541XXA is damaged mechanically, notify your local sales representative or ANRITSU Customer Service. If either the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as ANRITSU. Keep the shipping materials for the carrier's inspection.

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

Preparation for use consists of checking that the rear panel line voltage module is set for the correct line voltage. The voltage selector switch may be set for either 115 or 230 Vac operation. The fuse size and part number is shown on the following page. The 541XXA is intended for Installation Category (Overvoltage Category) II.



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.

Line Voltage Setting	Area	Fuse Rating	Fuse Size	ANRITSU P/N Fuse	ANRITSU P/N Fuse Holder (Non CE Compliant	ANRITSU P/N Fuse Holder (CE Compliant)
115Vac	USA/Japan	4.0A, Antisurge	3 AG	631-16	553-221	553-387
230 Vac	UK/Europe	2.0A, Antisurge	5 x 20 mm	631-67	553-240	553-386

2-4 GPIB SETUP AND INTERCONNECTION

All functions of the 541XXA (except power on/off) can be controlled remotely by an external computer/controller via the IEEE-488 GPIB. The information in this section pertains to interface connections and cable requirements for the rear panel GPIB connector. Refer to the Model 541XXA Programming Manual, ANRITSU Part Number 10410-00143, for information about remote operation of the 541XXA using the GPIB.

The 541XXA GPIB controller operates with many computer platforms equipped with National Instruments GPIB interface cards and NI-488 software. The procedures for installing GPIB-PCII/IIA interface cards and RS232-GPIB converters is contained in Appendix C. For most GPIB installations, howerver, you should follow the instructions provided in the hardware manufacturer's instructions.

Interface Connector

Interface between the 541XXA and other devices on the GPIB is via a standard 24-wire GPIB interface cable. 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.

2-5 SYSTEM GPIB INTERCONNECTION

The rear panel GPIB IEEE-488 connector is used to interface the 541XXA to an external computer/ controller (or plotter) via a standard GPIB cable. The ANRITSU Part numbers for standard GPIB cables of various lengths are listed in the technical data sheet in Appendix A.

GPIB Interface to an External Plotter The 541XXA GPIB interface can be configured to control a suitable external plotter. In this mode of operation, the GPIB is dedicated to this application and only the 541XXA and the plotter are connected to the GPIB. Standard GPIB cables are used to interconnect to the plotter.

GPIB Addresses The 541XXA leaves the factory with the default GPIB address set to 6 and the external plotter interface default address set to 8. These addresses may be changed using the menus invoked by the front panel System Menu key. This procedure is explained in Chapter 3.

2-6 EXTERNAL MONITOR CONNECTOR

The rear panel EXTERNAL MONITOR connector allows the internal display information of the 541XXA to be connected to an external VGA monitor (either color or monochrome). The pinout of this 15-pin Type D connector is shown in Figure B-2, located in Appendix B.

2-7 PREPARATION FOR STORAGE AND/OR SHIPMENT

The following paragraphs describe the procedure for preparing the 541XXA for storage or shipment.

Preparation for Storage Preparing the 541XXA 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 541XXA should be repackaged in the original shipping container. If this container is no longer available and the 541XXA 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 below.

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 address of the appropriate Anritsu Service Center (Table 2-1) and your return address on the carton in one or more prominent locations.

Table 2-1. ANRITSU *Service Centers*

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

ANRITSU COMPANY
10 Kingsbridge Road
Fairfield, NJ 07004
Telephone: (201) 227-8999
FAX: 201-575-0092

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: 021-28-69-141
Fax: 021-53-71-456

CANADA
ANRITSU INSTRUMENTS LTD.
215 Stafford Road, Unit 102
Nepean, Ontario K2H 9C1
Telephone: (613) 828-4090
FAX: (613) 828-5400

CHINA
ANRITSU BEIJING SERVICE CENTER
Beijing Fortune Building
416W, 5 Dong San Huan Bei Lu
Chaoyang qu
Beijing 100004, China
Telephone: 010-501-7559
FAX: 010-501-7558

FRANCE
ANRITSU S.A
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
Telephone: 016-44-66-546
FAX: 016-44-61-065

GERMANY
ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf
Germany
Telephone: 0211-67 97 60
FAX: 0211-68 33 53

INDIA
MEERA AGENCIES (P) LTD.
A-23 Hauz Khas
New Delhi 110 016
Telephone: 011-685-3959
FAX: 011-686-6720

ISRAEL
TECH-CENT, LTD
Haarad St. No. 7, Ramat Haahayal
Tel-Aviv 69701
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) 50-22-666
FAX: (06) 50-22-4252

JAPAN
ANRITSU CORPORATION
1800 Onna Atsugi-shi
Kanagawa-Prf. 243 Japan
Telephone: 0462-23-1111
FAX: 0462-25-8379

KOREA
ANRITSU KOREA (AWK)
#901 Daeo Bldg. 26-5
Yeoido Dong, Youngdeungpo
Seoul Korea 150 010
Telephone: 02-782-7156
FAX: 02-782-4590

SINGAPORE
ANRITSU (SINGAPORE) PTE LTD
3 Shenton Way #24-03
Shenton House
Singapore 0106
Telephone: 2265206
FAX: 2265207

SOUTH AFRICA
ETESCSA
1st Floor Montrose Place
Waterfall Park
Becker Road
MIDRAND
SOUTH AFRICA
Telephone: 011-315-1366
Fax: 011-315-2175

SWEDEN
ANRITSU AB
Box 247
S-127 25 Skarholmen
Telephone: (08) 74-05-840
FAX: (08) 71-09-960

TAIWAN
ANRITSU CO., LTD.
8F, No. 96, Section 3
Chien Kuo N. Road
Taipei, Taiwan, R.O.C.
Telephone: (02) 515-6050
FAX: (02) 509-5519

UNITED KINGDOM
ANRITSU LTD.
200 Capability Green
Luton, Bedfordshire
LU1 3LU, England
Telephone: 015-82-41-88-53

2-8 RACK MOUNT (OPTION 1) INSTALLATION

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

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

Step 2. Carefully place the instrument on its top (bottom-side up) 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 (Figure 2-1). Save the screws for later use.

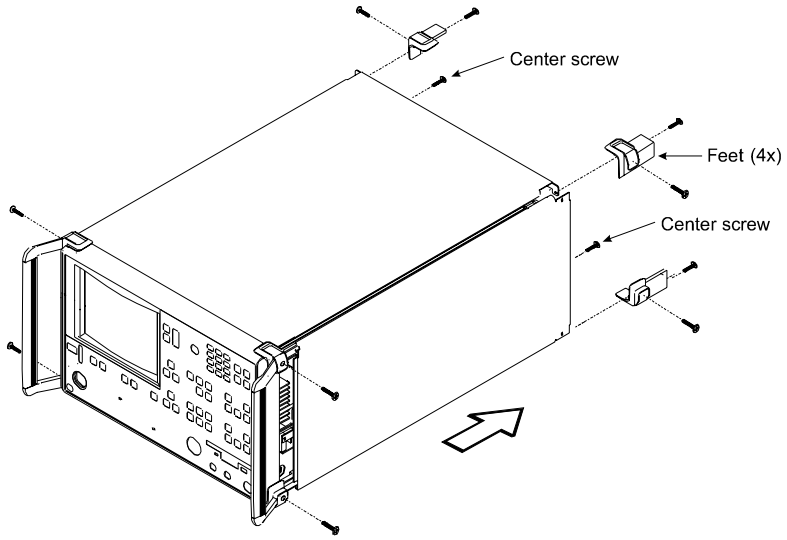


Figure 2-1

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 center screw from the rear of the left side cover.

Step 5. Remove the two carrying handle screws (if so equipped) located under the plastic handle ends.

Step 6. Remove the left side cover. The side covers are not reused in this application.

Step 7. Place the left side slide assembly onto the instrument case with the handle towards the front of the instrument (Figure 2-2).

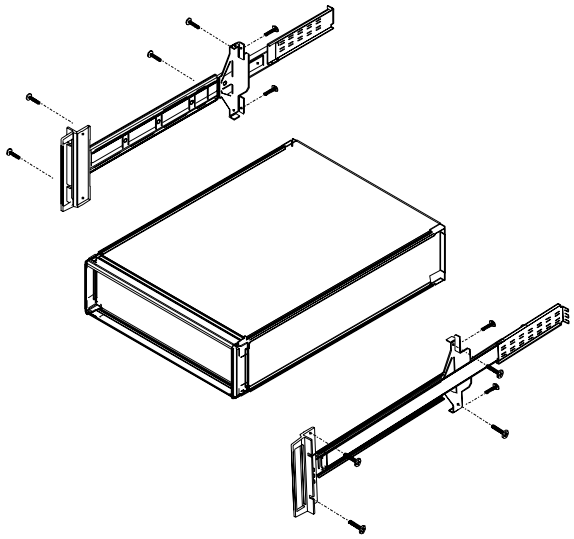


Figure 2-2

Step 8. Insert two green-headed screws through the holes in the slide assembly behind the handle and into the metric tapped holes in the side of the instrument.

Step 9. Insert two green-headed screws through the holes near the rear of the slide assembly and into the metric tapped holes in the side of the instrument.

Step 10. Insert the two SAE thread screws removed from the feet through the 90 degree tabs on the rear of the slide assembly and into the rear panel of the instrument.

Step 11. Remove the center screw from the rear of the right side cover.

Step 12. Remove the right side cover. The side covers are not reused in this application.

Step 13. Place the right side slide assembly onto the instrument case with the handle towards the front of the instrument.

Step 14. Insert two green-headed screws through the holes in the slide assembly behind the handle and into the metric tapped holes in the side of the instrument.

Step 15. Insert two green-headed screws through the holes near the rear of the slide assembly and into the metric tapped holes in the side of the instrument.

Step 16. Insert the two SAE thread screws removed from the feet through the 90 degree tabs on the rear of the slide assembly and into the rear panel of the instrument.

This completes the installation of the slide assembly.

Chapter 3
Front Panel Operation

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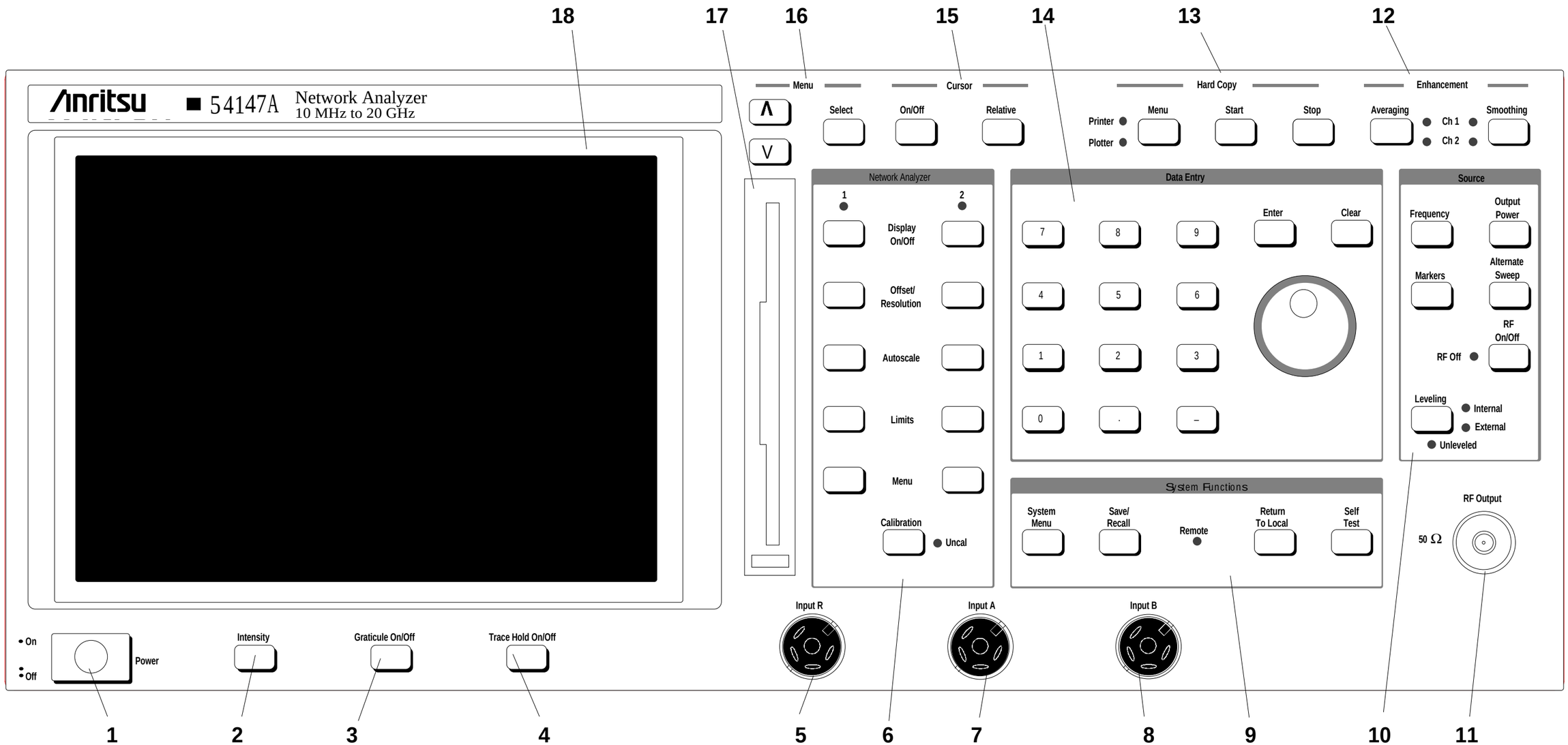


Figure 3-1. *e r nt ne*

Chapter 3
Front Panel Operation

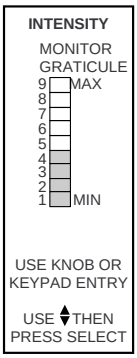
3-1 INTRODUCTION

This section describes the front panel controls and connectors.

3-2 FRONT PANEL KEY-GROUP DESCRIPTION

The 541XXA front panel is organized into individual keys and connectors and key groups. The organization elements are referenced by Index numbers in Figure 3-1. Individual keys and connectors and overall key-groups are described below. The individual keys within each key group are described in separate paragraphs headed with the key-group name.

LED Name	Condition/Fault
Hardcopy Plotter	A6/A7 Personality Change warning
Smoothing Ch1/Ch2	A7 Non-Volatile RAM failed
Unleveled	A7 Power-Down failed
Remote	A2 Keyboard Interface failed
Calibration Uncal	A3 Signal Channel Preset or A5 Signal Channel ADC failed



Index 1 **Power On/Off:** When pressed to On, power is applied to the instrument and a self test is initiated. If the self test passes, the message "**ALL TESTS PASSED**" is displayed on the screen.

If the self test fails, an error message is displayed and one or more of the control panel LED indicators will flash. A different LED indicator will flash for each specific type of fault. The LED indicator fault detection codes are listed at left and in Appendix B, Table B-2 . This coding makes it possible to locate a fault even if the CRT or display circuitry has failed.

Each time power is applied, the control settings for all 541XXA functions are set to those in effect during the last usage of the unit. These settings may be reset to the factory-selected values by using the **RESET** selection from the **SYSTEM** menu. The default settings are listed in Appendix B, Table B-1.

Index 2 **Intensity:** Displays the intensity control menu (left) on the screen. The selections from this menu enable you to adjust the CRT and/or graticule display intensity using either the data entry knob or the keypad.

Index 3 **Graticule On/Off:** Turns the screen display graticule on and off. When off, tick lines are displayed in the margins to show the location of the graticule markings.

Index 4 **Trace Hold On/Off:** Freezes the measurement data, which can then be manipulated by adding or changing limit or marker values, or by changing the offset or resolution values.

Index 5 **Input R:** Input for optional measurement channel R (Option 05.) This connector can be used for ratio type measurements, where the processed Input R signal is logarithmically subtracted from either the Input A signal (Ratio A/R measurement) or the Input B signal (Ratio B/R measurement). These measurement functions are set up via menu selection.

Index 6 **Network Analyzer:** These keys and menus control the network analyzer measurement and display functions. They set measurement type for each measurement trace, turn traces on/off, adjust display scaling and offset, give entry to the DTF (distance to fault) mode, and set measurement limit lines. Refer to page 3-12 for key descriptions.

Index 7 **Input A:** Input for measurement channel A. The signal applied to this connector is processed according to the setup menu selections chosen by you. The resulting signal may then be displayed on either display trace (Channel 1) or (Channel 2) under menu control. The software default measurement mode displays the Input A signal as a transmission type measurement displayed on Channel 1.

Index 8 **Input B:** Input for measurement channel B. The signal applied to this input is processed and displayed in the same manner as for the Input A signal, according to the setup menu selections chosen by you. The software default measurement mode displays the Input B signal as a reflection type measurement displayed on Channel 2.

Index 9 **System Functions:** These keys and menus control overall system operations. They restore front panel controls to factory selected settings, set the number of measurement data points, save and/or recall front panel setups, provide disk utilities, provide clock control, and return the instrument to local operation. The Remote indicator is lit when the analyzer is in the GPIB mode. Refer to page 3-15 for key descriptions. The System Menu key contains several high-level functions for special applications.

Index 10 **Source:** These keys and menus control sweep frequency parameters and they set up frequency markers for screen display. Key functions turn RF output on/off and select internal/external leveling. Refer to page 3-14 for key descriptions.

Index 11 **RF Output:** Provides RF output of the Source frequency.

Index 12 **Enhancement:** Allows set up of data averaging and smoothing parameters. Refer to page 3-25 for key descriptions.

Index 13 **Hard Copy:** Initiates a hard-copy printout of measurement results to a printer or plotter in either graphic or tabular form. The Menu key displays a menu showing the available print and plot options. Refer to page 3-22 for key descriptions.

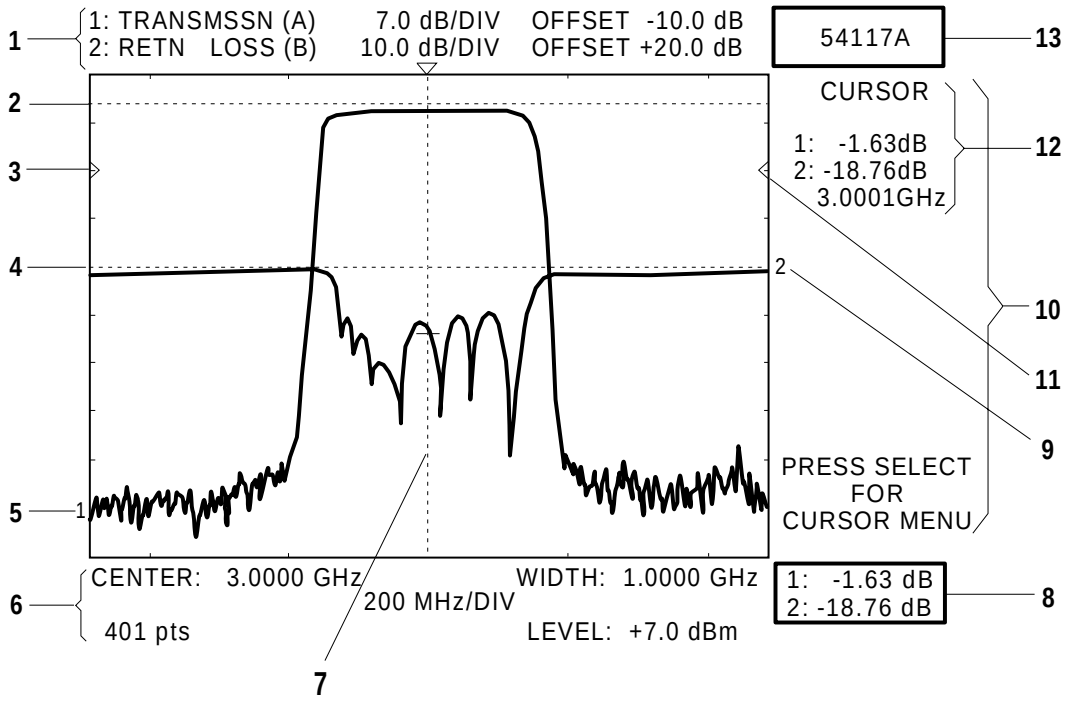
Index 14 **Data Entry:** Used to enter and/or change numerical data in setup menus. When the cursor is on, the knob controls its position. Refer to page 3-11 for key descriptions.

Index 15 **Cursor:** Keys and menus control selection and function of the CRT display's main and relative cursors. Refer to page 3-19 for key descriptions.

Index 16 **Menu:** Moves the menu cursor up or down to indicate menu options on the CRT. Refer to page 3-11 for key descriptions.

Index 17 **Disk Drive:** Provides for using 3.5-inch, 1.44 MB (2HD) floppy disk to save and recall front panel settings and trace data. Refer to page 3-26 for a detailed description.

Index 18 **CRT:** Displays measurement results for selected display channel(s). Displays control and calibration setup menus as selected by front panel control keys. Refer to page 3-9 for a detailed description.



1. **Network Analyzer Setup Parameters:** These two lines display the setup parameters for Channel 1 (and Channel 2, if used).
2. **Upper Limit Line:** Upper test limit line. Menu selectable as complex limit line (up to 10 segments) or simple straight line.
3. **Reference Line Indicator (Channel 1):** Indicates reference point for all channel 1 amplitude values. Position of line on display selectable via menu and Data Entry Knob.
4. **Lower Limit Line:** Lower test limit line (see 2, above).
5. **Channel 1 Measurement Trace:** Display of measured values for Channel 1. Number of measurement points displayed is menu selectable (see below).
6. **Frequency Source Setup Parameters:** Top two lines (below graticule) display the frequency setup parameters for the internal frequency source and screen display. Frequencies are displayed in MHz for models 54107A/54109A/54111A, and in GHz for all other models. Bottom line displays the number of measurement points (i.e., output frequencies) and the source RF output level currently selected.
7. **Cursor Position Indicator:** This dotted vertical line indicates the current frequency location of the cursor. Cursor position continuously variable via Data Entry Knob.
8. **System Message Display Area:** System error/warning messages are displayed in this area. As shown, alternate cursor readout may be displayed here also (menu selectable).
9. **Channel 2 Measurement Trace:** Display of measured values for Channel 2.
10. **Cursor Readout/Menu Display Area:** Cursor readout values or setup menus are displayed in this area of the screen.
11. **Reference Line Indicator (Channel 2):** Indicates reference point for all Channel 2 amplitude values (see 3, above).
12. **Cursor Data Readout Display:** Readout data for main cursor and/or "relative" cursor (if active) displayed here. Frequencies are displayed in MHz for models 54107A/54109A/54111A, and in GHz for all other models.
13. **System Status Display:** System status conditions displayed here, such as: Trace Hold, ALTERNATE SWEEP, etc. Model number is the default display.

Figure 3-2. *Typical Model 541XXA Screen Display*

3-3 CRT DISPLAY

The CRT display shows measurement results and setup information. It also displays menus that are used in conjunction with the front panel control keys to control the instrument measurement parameters.

Measurement Display and Annotation

The measurement screen display (Figure 3-2) includes one or two measurement traces, measurement function settings, cursors, markers, limit lines, and the signal source frequency and output power parameters. The measurement traces are referred to as display channels 1 and 2. They are set up via the display channel menus. If the signal source is programmed for alternating frequency ranges, then trace 1 displays the main setting and trace 2 displays the alternate settings.

Network Analyzer Settings

The two lines labeled "1:" and "2:" across the top of the screen display the type of measurement selected and the offset and vertical resolution values for traces 1, 2, or both. The input connector selected for each trace is also shown. The Network Analyzer menu selections control the vertical axis of the display.

Model/Status Information

The box in the top right side of the screen displays model number and status information. Examples: "ALTERNATE SWEEP" is displayed when an alternate sweep setup has been selected; "TRACE HOLD" is displayed when the instrument is in the Hold mode.

Source Frequency, Power And Horizontal Resolution (graticule) Settings

The three lines along the bottom of the screen display:

- Signal source start/stop frequencies
- Alternate sweep start/stop frequencies
- Horizontal resolution (Graticule values) of the displayed traces
- Power output of the signal source
- Detector Offsets, if used

The 541XXA automatically selects the correct horizontal resolution and graticule divisions for optimum display of the selected frequency-sweep width. In the alternate-setup mode, the graticule is fixed at ten vertical and horizontal divisions. All frequencies are displayed in MHz for models 54107A, 54109A, 54111A, and in GHz for all other models. The Signal source menu selections control the horizontal axis of the display.

3-4 KEY GROUPS, GENERAL

The front panel control keys and knobs are located in the functional groups listed below. With the exception of the Data Entry group, each control key group is used to set the operation of a specific set of 541XXA functions. (The Data Entry keys and knob are used to enter and modify data for many menu selections.) These control key groups and associated menus are further described in the remainder of this section.

Operation of Control Key

Many of the front panel control keys produce setup menus when pressed. These menus appear at the right side of the screen display (Figure 3-2). Other keys, such as Autoscale, Self Test, etc., perform specific functions directly.

Operation of Setup Menu

Setup menu items are selected by using the Menu Up/Down key to position the cursor next to the desired menu selection and pressing the Select key. There are three types of menu selection items:

- Those that perform specific functions directly when selected.
- Those that require data parameter entry before the Enter key is pressed.
- Those that produce submenus when selected.

Menu selections may be cancelled (before the Enter key is pressed) by pressing the Clear key.

NOTE

While reading this section, follow along using the front panel controls and associated menus. Refer to the figures that describe the menus in each group. The annotation for these figures describe each menu selection in detail.

3-5 MENU KEY GROUP

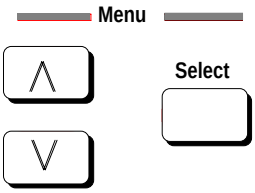


Figure 3-3. Menu *Key Group Keys*

The Menu key group keys (Figure 3-3) select and control the up and down movement of the menu cursor.

Up/Down Keys — Moves the menu cursor up or down to indicate the menu item that can be selected. These keys are active whenever any menu is displayed.

Select *Key* — When pressed, selects the menu item adjacent to the menu cursor. (This key is used in conjunction with the Menu up/down key.)

3-6 DATA ENTRY KEY GROUP

The Data Entry keys and knob (Figure 3-4) are used to enter data into the setup menu selections. The units associated with the entered data are determined by the menu displayed during entry and by the model: levels in dB (or dBr) for all models, frequency in MHz for models 54107A, 54109A and 54111A, and in GHz for all other models. Units are not entered with data.

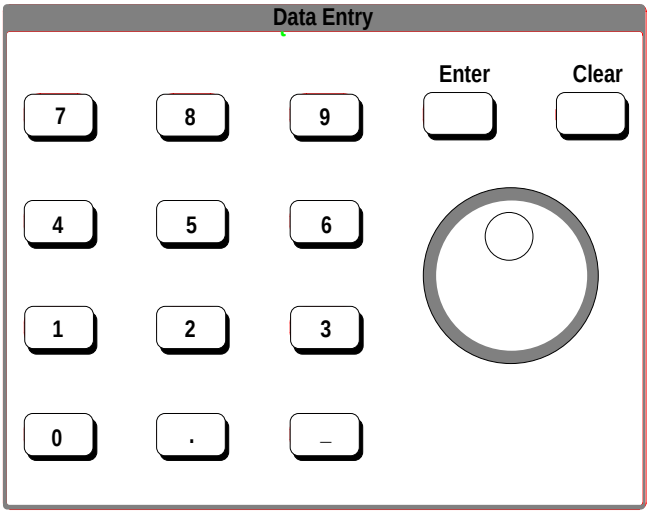


Figure 3-4. Data Entry *Key Group Keys*

Data Entry Keypad — This keypad consists of keys 0–9, "." and "–". These keys are used with the setup menus to enter required operational parameters.

Data Entry Knob — Changes the values of an active parameter during menu entry (cursor position, offset, resolution, etc.). Fast knob movement changes the data in large increments, slow movement allows fine changes to be made.

Enter *Key* Terminates the data entry sequence. When pressed, data entered via the keypad or the data entry knob are input to the 541XXA control logic. This key is also used for other functions, when so specified by a menu function.

Clear *Key* Clears entered value, if pressed before the Enter key. Also clears a displayed menu, entry errors, complex limit segment identifiers, and **CURSOR NOT FOUND** message.

3-7 NETWORK ANALYZER KEY GROUP

This key group consists of two sets of similar control keys (Figure 3-5). One set controls measurement trace 1 and the other controls measurement trace 2. The front panel designations for the two measurement traces are Channel l and Channel 2, respectively. The corresponding key functions for Channel 1 and Channel 2 are identical. The setup menus invoked by the keys in this key group are shown in Chapter 4, Figure 4-2.

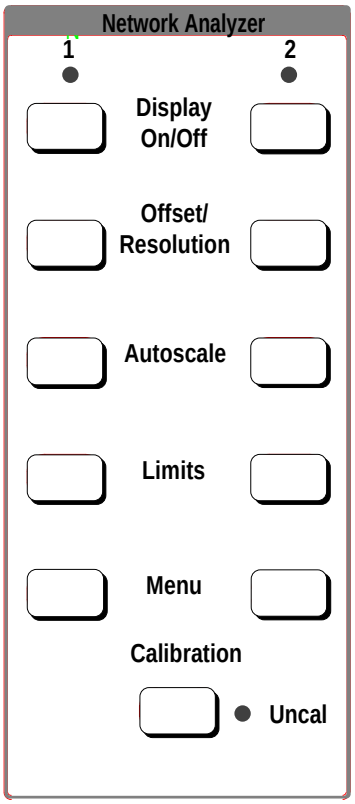


Figure 3-5. Network Analyzer *Key Group Keys*

Display On/Off *Key and Indicator* This key turns on the designated measurement trace (Channel 1 or 2), the reference line indicator, and the limit lines (if used) that are associated with this trace. The LED that is adjacent to the Display key is lit when the trace is on (Figure 3-5).

When both channels are off, the unit is in the CW Mode. In this mode, the internal signal source may be used independently; refer to paragraph 3-8.

Offset/ Resolution Key *and Menus* Displays a menu (Figure 4-2) that allows Offset and Resolution (display scaling) values to be specified for the associated measurement trace. In the normal measurement mode with the cursor displayed on screen, pressing the Select key causes the trace at the cursor to move to the reference line.

Autoscale *Key* Sets the screen display for the designated measurement trace at optimum offset and resolution values for viewing the measured data.

Limits *Key and Menus* Measurement limits are displayed as limit lines on the screen display. Limit lines may be made up of either a single line, or multiple lines (complex). Selection of complex limits allow up to ten different limit values (limit line segments) to be specified across the measurement frequency span (for upper and lower limits.) The Limits key displays a menu (Figure 4-2) that enables/disables testing to limits for the selected

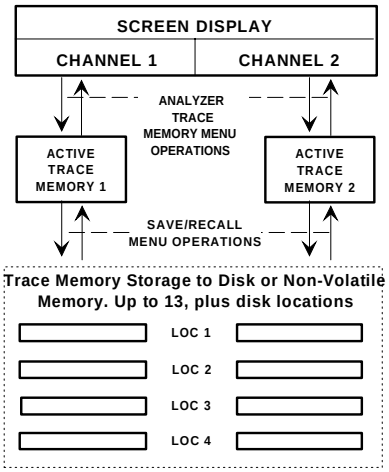


Figure 3-6. *Trace Memory Storage Locations*

NOTE

To store measurement trace data to further *non-volatile* trace memory locations (Figure 3-6) and to retrieve trace data previously stored in these memories, use the Save/Recall key and menu functions, which are described in paragraph 3-9.

NOTE

Service type calibration procedures are described in the 541XXA Network Analyzer Maintenance Manual.

measurement trace. Selections from this menu display submenus that further define the limit parameters. Limits menu also supports trace mask, which is a graticule style mask for visual reference only.

Menu *Key and Menus*

Displays a menu (Figure 4-2) that allows the type of measurement to be specified for the associated measurement trace. Submenus to this menu allow definition of input connector, type of measurement display, and (display) trace memory usage, as well as the main DTF menu.

The **TRACE MEMORY** and **TRACE MEMORY STORAGE** submenus allow two sets of measurement trace data to be stored to "active" trace memory (Figure 3-6). There is one memory for each display channel. Active trace memory is non-volatile; consequently, the stored data remains when the 541XXA is powered down.

The trace data stored in active memory may contain simple or complex limit line data, instead of a trace. This data may be subtracted from subsequent measurement trace data; see **TRACE MEMORY** submenu shown in Figure 4-2.

Calibration *Key and Menus*

This key displays a series of menus that guide you through the appropriate calibration procedure for the current test setup. "Calibration" is an equipment normalization procedure that should be performed whenever the measurement type or the test setup is changed (or as required periodically). Additionally, fixed-value offsets (dB) can be applied for transmission, detector, and power detector scaling to match a standard reference level. Refer to Chapter 5 — Measurement and Calibration Procedures — for an explanation of the Calibration key menus and procedures.

Uncal *Indicator*

This LED indicator is lit when either measurement channel requires re-calibration. This is usually due to a significant change of the front panel control settings for the signal source or either measurement channel.

3-8 SOURCE KEY GROUP

This key group consists of the keys and indicator LEDs shown in Figure 3-7. The menus associated with these keys are shown in Chapter 4, Figure 4-3. The two operating modes of the 541XXA internal signal source are:

- Normal Mode — when either measurement channel is turned on.
- CW Mode — when both measurement channels are turned off. The source operating frequency in this mode is either the **START** frequency, or, for **CENTER/WIDTH** mode:

Frequency = Center freq – 1/2 WIDTH freq.

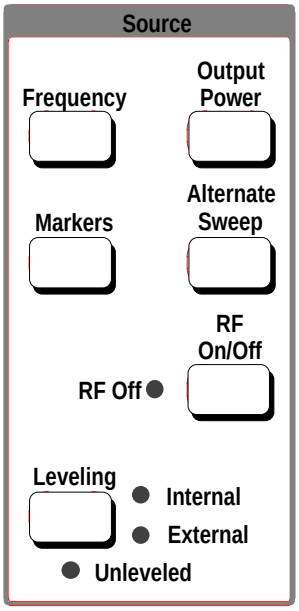


Figure 3-7. Source *Key Group Keys*

Frequency *Key and Menu*

Displays one of two menus that allow you to enter the operating frequency parameters for the signal source (Figure 4-3). The first menu pertains to the Start/Stop Frequency mode of operation; the other pertains to the Center Frequency/Width mode. All frequencies displayed by these menus are in MHz for models 54107A, 54109A, and 54111A, they are displayed in GHz for all other models. Each menu may be accessed from the other. In the DTF mode, the frequency menu can be used to alter the frequency range to accomodate banded devices. The DTF mode frequency will not sweep beyond the start/stop frequency settings.

Alternate Sweep *Key and Menus*

Selects Alternate Sweep mode and displays one of two menus (Figure 4-3) that allow you to enter the operating frequency parameters for the main and alternate sweeps. In this mode, the main sweep parameters apply to display Channel 1 and the alternate sweep parameters apply to Channel 2. Similar to the Frequency key menus, the first menu pertains to the Start/Stop mode of operation; the second to the Center Frequency/Width mode. This function is not available in the DTF mode.

Markers *Key and Menu*

Displays one of two marker frequency input/data readout menus (Figure 4-3). Each menu allows the frequency for each of the four markers to be specified and displays the data readout for both channels at the marker frequencies selected. The selectable frequency range is –999 to +999 MHz for models 54107A, 54109A and 54111A and –999 to +999 GHz for all other models. The marker selected for data entry is referred to as the “Active Marker.” This function is not available in the DTF mode.

NOTE
Negative frequency units (example: –1.500 GHz) may be used when unit is operated in the Frequency Scaling Mode. (Refer to paragraph 3-9 for information about this mode of operation.)

Frequency markers are displayed on the measurement screen as dashed vertical lines with an identifying number at the bottom of the screen (see Figure 3-14, page 3-27). The currently selected marker (Active Marker) is displayed with a box around the marker number. This marker may be toggled off/on by selecting the marker menu and pressing the Select key.

Output Power ***Key***

Allows the RF output level (power) of the signal source to be set (Figure 4-3). The data entry keys or the data entry knob may be used to enter the desired power level. The screen display "**LEVEL**" indicator is highlighted to show the new value.

NOTE
When frequency markers coincide with *displayed* graticule lines, the resultant vertical line approximates a solid line.

RF On/Off ***Key and Indicator***

This key turns the signal source RF output power on or off. The RF Off indicator is lit when the output power is *off*.

CAUTION
Depending on the application, excessive source RF output power may be produced with no input connected to the External ALC Input. Damage to sensitive test devices or sensitive test components may result. Always setup for this mode of operation with the source output off.

Leveling ***Key and Indicators***

This key connects the internal RF output power leveling circuits to either the internal RF output detector signal or the external detector output signal from the rear panel External ALC Input. The Internal and External LEDs indicate the detector selected. The Unleveled LED is lit whenever the source RF output is unleveled. This condition is usually caused by insufficient signal applied to the External ALC Input.

3-9 SYSTEM FUNCTION KEY GROUP

This key group consists of the keys and indicator LED shown in Figure 3-8. The main menus and submenus associated with these keys are described below and in Chapter 4, Figures 4-7.

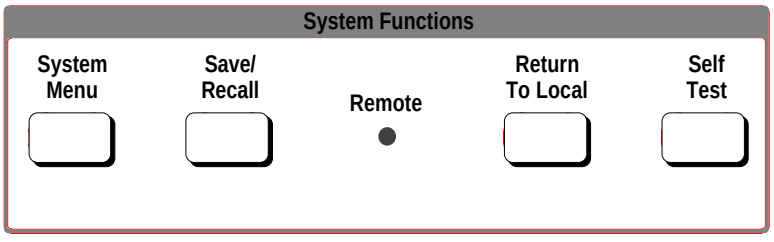


Figure 3-8. SYSTEM FUNCTION *Key Group Keys*

System Functions Menu Key and Menus

Displays the menu shown in Figure 4-7. Submenus from this menu perform the following functions:

- Reset the 541XXA to factory-selected initial front panel control settings.
- Set the configuration of the frequency source and network analyzer portions of the 541XXA.
- Select testing modes for different applications.
- Controls disk operations
- Allows setup of system elements; keyboard, clock, key click

The submenus selected from the main menu enable you to control the system configuration and measurement functions listed below:

Disk Utility
The System Menu key provides control over disk utilities. These utilities allow directory listing, file deletions, and file renaming.

Measurement Data Points
This menu option sets the number of measurement Data Points to 51, 101, 201, or 401. (This also sets the number of frequencies output by the internal signal source for each measurement trace.)

Controls Reset Function
This menu option resets the 541XXA front panel control settings to factory-selected values. Previously saved Calibration, Frequency Marker and Limits data may be selectively retained through the reset function via selections from the RESET submenu (Figure 4-7).

This reset function does not clear any detector offsets in effect. To clear detector offsets, press the Calibration key and select **DETECTOR OFFSETS** from the menu; then enter a zero offset value. (Refer to Chapter 5 — Measurement and Calibration Procedures.)

Configure Source (Also Disk Controls)
This menu option displays a submenu that lets you select the "Secure" operating mode. In this mode of operation, all signal source frequency information is removed from the screen display (including cursor, marker, and limits readouts and menu displays). Likewise, all hard-copy output produced while in this mode will not contain frequency information. It is not possible to change signal source operating frequency parameters, or any other frequency parameters, while

in this operating mode. Likewise, disk functions are not assessible while in the secure mode, including Save/ Recall.

The secure operating mode may be cancelled using the **RESET** menu selection from the **SYSTEM** menu, or, by selecting a saved front panel setup that does not contain this operating mode. When invoked from the secure mode, the RESET function will not save Cal Data, Markers or Limits information. However, the secure operating mode may be saved as part of a front-panel setup through power-down and self-test.

Configure Analyzer
This menu option displays a submenu that

- Selects measurement channel(s) affected by the Trace Hold key.
- Causes the Cursor readout data to be displayed continuously in the lower right portion of the screen. The cursor readout data displayed is identical to that displayed by the Cursor key data readout function (when invoked). This readout will not be present if an Error/Warning message is displayed.
- Selects measurement channels affected by the data smoothing function (refer to Smoothing key menus, Figure 4-6). Channel 1 or 2, or both, may be selected.

Plotter Address
This menu option displays a submenu that allows you to set the GPIB address for the external plotter (Figure 4-7).

System Applications
These menu selections allow you to control the following measurement applications functions listed below. Each is controlled by a separate submenu (Figure 4-7).

- Select trace search functions. These functions find and hold maximum/minimum trace values for measurement.
- Perform amplifier gain compression tests. This mode of operation automatically steps the signal source power output and halts when gain compression (or pre-selected output level) is reached. Limits are used to detect the required compression level.

$$UserFreq = \frac{Int\ Freq * m}{d} + f$$

Where:
m= Frequency Multiplier, an integer value, range 1 – 10;
d = Frequency Divisor, an integer value, range 1 – 10;
f= Frequency Scalilng Offset value, range: ±9999.99 MHz for models 54107A, 54109A, and 54111A and ±99.9999 GHz for all other models.

EXAMPLE:
m = 10, d = 2, and f = 40 will cause model 54128A to display 80 to 102 GHz with a true output of 8 to 12.4 GHz.

- Select titling and labeling functions. These utility functions allow the measurement display titles and labeling to be changed.
- Control the color attributes of an external VGA monitor (if used). The attributes of the display Text, Channel 1/Channel 2 traces, and Graticule may be set individually.
- Set up and invoke the Frequency Scaling function. This function causes the 541XXA to display operating frequency values that are "scaled" from those actually output by the frequency source (see example at left). These scaled values are also used for hard copy output. The relationship between the actual output frequency (Int Freq) and that displayed (User Freq) is as described at left.
- Set Autozero function on or off. The **OFF** selection holds the autozero circuit correction voltage of each active measurement channel at the current value and causes the frequency source output to be on continuously. This function is useful for testing devices that require continuous stimulus during test.

Save/Recall Key and Menus

Displays the main **SAVE/RECALL MENU** shown in Figure 4-7. As shown in the figure, this menu provides three separate functions: save, recall, and preview. The Save menu-set lets you save a setup, a complete instrument state, or a memory trace to any of 13 locations in internal, non-volatile memory and an additional 80 locations are available on 3.5-inch disk.

The Recall menu lets you recall a stored setup, a complete instrument state, or a trace memory. It also lets you turn on a Fast Recall feature. This feature lets you recall stored data by pressing two numbers from the keypad then the <Enter> key. When previewing, you can recall any stored setup. When the Recall mode is in effect, **RECALL ONLY MODE** displays in the System Status Display box in the upper right portion of the screen.

The Preview menu-set lets you review the stored setups and complete instrument states stored in any of the non-volatile or disk memory locations. It also lets you recall the previewed data directly, without having to access the Recall menu.

NOTE
To preserve the trace stored with a complete instrument state, press the Trace Hold On/Off key to On before recalling the stored data. Otherwise, upon recall the trace data will immediately start updating.

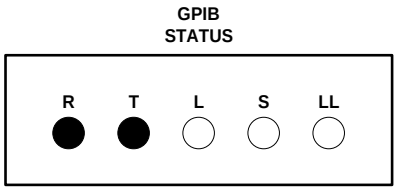


Figure 3-9. *GPIB Indicators*

Remote *Indicator*

This LED is lit when the 541XXA is in the remote (GPIB) mode. In this mode, the GPIB status is also displayed on the screen as shown in Figure 3-9. The abbreviations used are: R (Remote), T (Talk), L (Listen), S (SRQ), and LL (Local Lockout).

Return To Local *Key*

When pressed while in the GPIB mode, this key causes the 541XXA to return to the local mode. The 541XXA will not return to the local mode if the local lockout (LLO) interface function message has been received from the external computer/controller (refer to the 541XXA Programming Manual).

When pressed while in the local mode, the current GPIB address displays on the screen. This address may be changed by entering a new value via the numeric keypad and pressing Enter (Figure 4-7). The GPIB address is saved in non-volatile memory as part of the power-up reset parameters.

Self Test *Key*

This key initiates a self test of the analyzer and signal source. If the unit functions properly, the screen displays **"ALL TESTS PASSED."** If the self test fails, the screen displays a failure message. In addition, one of the front panel LED indicators will flash steadily to indicate a specific fault. The LED coding for Self Test errors are listed in Appendix B, Table B-2.

3-10 CURSOR KEY GROUP

The Cursor keys are shown in Figure 3-10. The menus displayed by these keys are shown in Chapter 4, Figure 4-4.

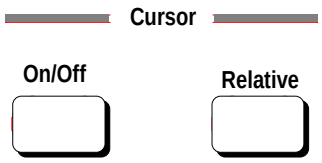


Figure 3-10. Cursor *Key Group Keys*

Cursor Measurements Functions

The 541XXA includes the following cursor search and readout functions:

- Main Cursor Readout
- Main/Relative Cursor Readout
- Maximum (Peak) Search
- Minimum Search
- Next Marker
- Active Marker
- dB Search (Absolute – left, right, or bandwidth)
- dB Search (Relative)

The menu selections for these functions are described in the following paragraphs.

NOTE
If the **NEXT MKR** selection has been previously selected (and if frequency markers have been set up), pressing the Select key will move the cursor to the next frequency marker.

Cursor On/Off *Key*

Turns the main cursor portion of the screen display on/off. When pressed On, the cursor is positioned at the location on the screen display where last used. The frequency and amplitude of the measured data at the cursor trace position are displayed on the right side of the screen (Figure 3-2). The cursor readout display is described in Figure 4-4.

The position of the cursor is continuously variable using the data entry knob.

Cursor* On/Off *Key Menus

Whenever the cursor readout is displayed, pressing the Select key will invoke the cursor function main menu (Figure 4-4). The submenus selected from the main menu are used to set up the cursor functions listed in paragraph 3-10. Using the **SETUP** and **OPTIONS** submenus, searches may be performed using absolute search values (in dB or dBm) or using relative search values (in dBr). Relative searches may also be set up by invoking the search from the Relative cursor key main menu.

USAGE NOTE
Main vs. Relative Cursor
When the main cursor is the only one in use (relative mode OFF), the cursor search functions searches the trace for the value specified in the dB SEARCH VALUE parameter. However, when the RELATIVE cursor is also on, the search looks for a difference between the relative cursor reading and the main cursor reading to match that SEARCH VALUE.
Example:
Enter a –3dB search value, and calibrate for a transmission measurement. When the DUT is inserted, the CURSOR SEARCH (main cursor only) will look for a –3dB transmission measurement. If, however, the relative cursor was also turned ON, then the 541XXA will search for a position where the difference between the reading at the relative cursor (which can be placed anywhere) and that at the main cursor will be –3dB. This allows, for example, a search to be made after a specific cutoff frequency for a 3dB

Relative *Cursor Key*

Turns Relative Cursor mode on/off. When key is pressed, a second (relative) cursor is displayed on the screen at the same position as the main cursor. The "active" (main) cursor will then move away from this position as the data entry knob is varied. (Or it will advance to the next frequency marker position if the Select key is pressed—see note above).

The difference in amplitude and frequency between the "active" (main) cursor position and the relative cursor position are displayed on the right side of the screen. The amplitude difference is displayed in dBr (dB relative to the current active cursor value). The readout display also includes readout data for the active cursor (Figure 4-4). Data for both measurement traces are displayed if both are used.

If the **EXCHANGE REF Cursor** line of the menu is highlighted, pressing the Select key swaps the positions of the main cursor and relative cursor; otherwise, the **CURSOR** menu is selected. This feature may be used to establish the present main cursor position as the new reference frequency point for bandwidth measurements.

Relative *Cursor Key Menu*

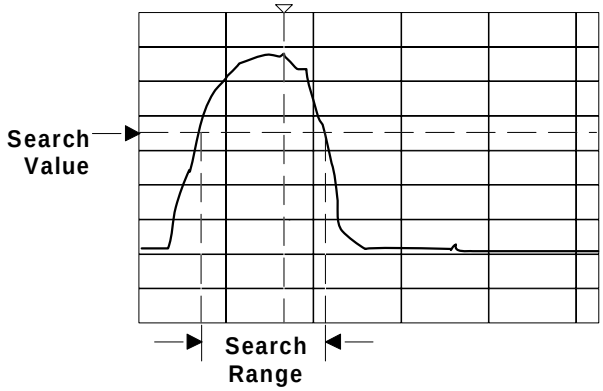
Pressing the Select key with the relative cursor data displayed invokes the main menu for the relative cursor function. This menu is similar to the main menu for the main cursor. All searches initiated from this menu will be performed relative to the value at the current main cursor position, or to the peak value for the channel selected (Figure 4-4). In the DTF mode, MIN and MAX search are operational.

BANDWIDTH Cursor Search Function

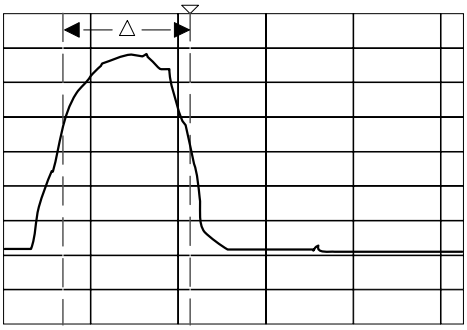
Selecting the **BANDWIDTH** cursor search type from the cursor submenus will set up the 541XXA to perform bandwidth measurements. The search value (absolute or relative) must be specified (in dB) as part of the menu selection. An example of this type of measurement is shown in Figure 3-11.

REPEAT SRCH Cursor Operation

Selecting **REPEAT SRCH EACH SWEEP** from the cursor submenus will cause the 541XXA to reacquire the search position after each frequency sweep. Some front panel keys disable search updates. A CURSOR SRCH ACTIVE display indicator is visible when **REPEAT SRCH EACH SWEEP** is active.



1. Set cursor within the desired Search Range that includes the Search Value.



2. Select Cursor menu options for BANDWIDTH type Search (enter Search Value as indicated). Two cursors will diverge to indicate bandwidth measurement.

Figure 3-11. *dB Search — Bandwidth Measurement*

3-11 HARD COPY KEY GROUP

The Hard Copy key group is shown in Figure 3-12. The main menus and submenus associated with these keys are described in Chapter 4, Figure 4-5.

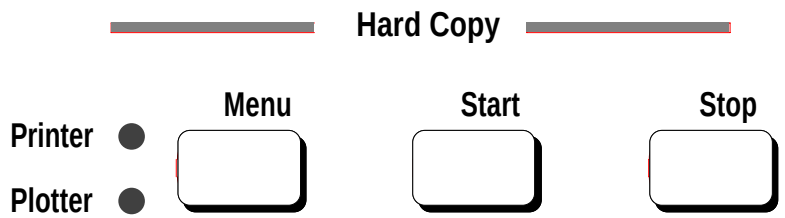


Figure 3-12. *Hard Copy Key Group*

NOTE
Before data can be sent to an external plotter, the 541XXA GPIB interface must be set to the Plotter Mode; see Figure 4-5. (In this mode of operation, only the 541XXA and plotter may be connected to the GPIB; refer to Chapter 2.)

Menu *Key*

Displays one of two main menus that enable you to select the type of hard copy output that is produced from the measurement data. These menus configure the 541XXA to output data to either a printer or a plotter (Figure 4-5). The printer output may be either a tabular printout of the measurement data, a "plot" of the screen display, or both (Figures 3-14 thru 3-17).

Either menu may be accessed from the other; both types of hard copy output may be defined before output begins. The Printer and Plotter LEDs indicate which hard copy output device has been defined. The output options available from these menus are:

- Print the screen measurement display on a printer.
- Print a tabulation of the measurement values (printer only).
- Print measurement data at frequency markers only.
- Print measurement limit values in tabulated form (printer only).
- Plot screen measurement display on a plotter.

- Plot graticule lines, cursor information, titles, or measurement traces, from the screen display separately.

The main menus and submenus are explained in Figure 4-5. Examples of hard copy print outs are shown in Figure 3-14 through 3-17.

Printer/Plotter *Indicators*

When lit, these LED indicators designate which type of hard copy output the 541XXA is set up to produce.

Start *Key*

Freezes the displayed data and loads the printer or plotter buffer with the measurement data. When data transfer is complete, the output device starts printing or plotting and the 541XXA is again usable for measurements. The type of hard copy produced is determined by the last **PRINTER/PLOTTER Menu** options selected.

When plotter output is used, Plot Progress Messages that indicate normal and abnormal plotter conditions are displayed in the menu area at the right side of the screen. Plot progress messages are transient; they are only displayed momentarily. The menu area returns to the previous display when the output data transfer is completed. These messages are listed in Table 3-1, page 3-24.

Stop *Key*

Stops Hard copy output operation. If output is to printer, stop may be delayed, depending on size of printer buffer (if any). If to plotter, the current data string is plotted and the plotter is left in a reset state.

If both hardcopy output devices are active, only the device indicated by the LEDs will be stopped. To stop the other device, select the appropriate hard copy main menu then press Stop.

Table 3-1. *Plot Progress Messages*

Plot Progress Message	Plot Progress	Plotter Condition
PLEASE WAIT LOADING PLOT BUFFER PLOTTER TYPE *{Model No.}*	Normal	Normal
PLOTTER NOT READY	Error	Plotter needs to be re-initialized (on/off or replace paper); or, no paper condition; or, PAPER UNCLAMPED ERROR.
HARDCOPY FAILED	Error	Plot Stop command issued; or, plotter disconnected or plotter stopped during plot
PLEASE WAIT LOADING PLOT BUFFER Then ↓ PLOTTER NOT READY	Error (Error)	Plotter disconnected; or, plotter GPIB interface problem

3-12 ENHANCEMENT KEY GROUP

The Enhancement keys and indicators are shown in Figure 3-13. The menus invoked by the keys in this group are shown in Figure 4-6. The usage and operation of these menus are further described below.

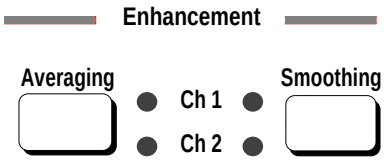


Figure 3-13. Enhancement *Key Group Keys*

Averaging *Key, Indicators and Menu*

Displays a menu that allows you to select data averaging over 2 to 256 successive sweeps. Data averaging can be selected for measurement channel 1 or 2, or both. When a channel selection is made, the Channel 1 and/or Channel 2 LED indicator next to the Averaging key will be lit accordingly.

This form of data smoothing retains measurement bandwidth, but requires more time to generate the measurement data and display. It is an effective method of reducing the effects of random type noise in the measurement data.

Smoothing *Key, Indicators and Menu*

Displays a menu that allows five levels of trace smoothing filtering to be selected for the channel(s) selected (Figure 4-6). This form of data smoothing reduces the effective bandwidth of the measurement display system and requires some extra time; however, the display is correct after just one sweep.

Smoothing Mode Selection

Selection of the measurement channel(s) acted on by the **SMOOTHING** submenu selections is done from the **ANALYZER** configuration submenu, which is invoked from the System Menu Key main menu (Figure 4-7). The **ANALYZER** submenu allows you to set for **COUPLED** smoothing (i.e., measurement Channels 1 and 2, are set to the same data smoothing level), or **INDEPENDENT** smoothing (i.e., measurement channels may be set to different levels). When a channel selection is made, the Channel 1 and/or Channel 2 LED indicator next to the Smoothing key will be lit accordingly.

3-13 DISK DRIVE

The disk drive accomodates 3.5-inch, 2HD (1.44 MB), MS-DOS compatible floppy disks. It provides for saving instrument setups and trace data to disk in a standard spreadsheet format. This will allow data to be read into spreadsheet applications for processing using a standard template.

Data Format Field names or codes do not contain spaces, as some spreadsheet application do not recognize spaces as valid field name characters. The format supports up to two rows of up to 401 data points, together with frequency information. All data is in base units (seconds, Hz, dB or dBm, V, etc.).

Space is provided at the top and left of the spreadsheet for user-formatting — 3 rows and 3 columns. Row 14 contains status information, including date/time, serial number, part number and all other information that currently appears on a hardcopy print. The date in the spreadsheet for trace memory is the *date that the data was saved*. The date that the file was created is attached to the file and can be seen in the DOS directory.

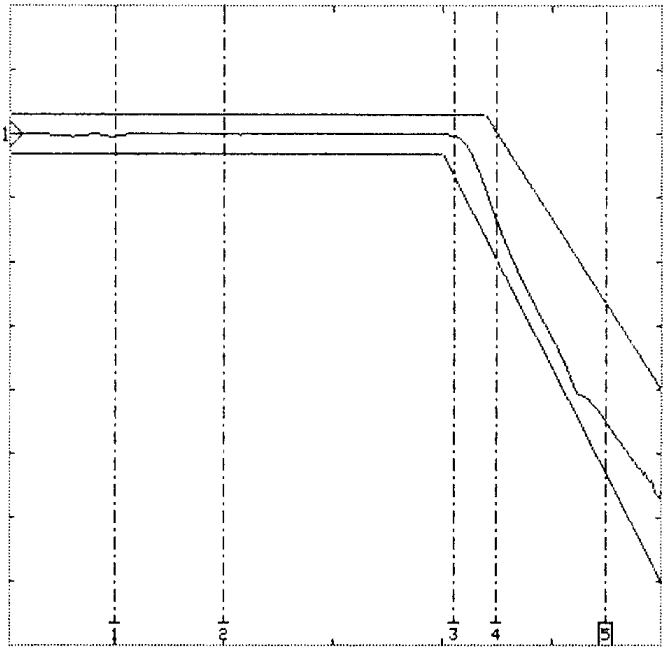
3-14 WARNING/ERROR MESSAGES

If an unusual condition is detected during instrument operation, a warning or error message will be displayed in the lower corner of the screen display. These warning/error messages are listed and described in Appendix B, Table B-3. Suggested remedial action is included for each message.

3-15 REAR PANEL CONNECTORS

The locations of the 541XXA rear panel connectors are shown in Appendix B, Figure B-1. The rear panel contains the line voltage module, multipin GPIB and printer connectors, and additional BNC type input/output connectors. Setup of the line voltage module and connection to the GPIB connector are described in Chapter 2. The characteristics of the Parallel Printer Interface, Horizontal Output, and optional External ALC Input connectors are also described in Figure B-1.

```
Identify    :  DEMO                                  Date : 26/4/94 2:22 pm
Test Device :  FILTER

1: TRANSMSSN (A)   10.0 dB/DIV   OFFSET   0.0 dB
2: OFF
```




```
START:  0.0100 GHz              STOP:  3.0000 GHz      401pts
                  500 MHz/DIV                          LEVEL: +7.0 dBm

                 ----------     System Conditions     ----------
                      Channel 1         Channel 2                    CH1  CH2
High Limit     :       complex          -- off --      Smoothing  :  off  off
Low  Limit     :       complex          -- off --      Averaging  :  off  off
Limit Testing  :        pass            -- off --      Apps Hold  :  off  off

Cursor         :      -- off --         -- off --
         at    :      -- off --         -- off --      (-- off -- ) Bandwidth
Delta Readout  :      -- off --         -- off --       F(min) :  -- off --
         at    :      -- off --         -- off --       F(max) :  -- off --

Detector offsets:  A:   0.00 dB   B:   0.00 dB   R:   0.00 dB

M1:  0.5000 GHz    M2:   1.0000 GHz    M3:   2.0577 GHz    M4:   2.2500 GHz
 1:    -0.45 dB     1:    -0.05 dB     1:    -0.41 dB     1:   -13.94 dB

M5:   2.7500 GHz    M6:   -- off --     M7:   -- off --     M8:   -- off --
 1:   -45.16 dB
```

Figure 3-14. *Example of Hard Copy Printout*

```
Identify    :  DEMO                                  Date : 26/4/94 2:26 pm
Test Device :  FILTER

       FREQUENCY          1:TRANSMISSION    2:OFF
                            (A)

       0.0100 GHz . . . . +0.00 dB
       0.1296 GHz . . . . -0.08 dB
       0.2492 GHz . . . . -0.34 dB
       0.3688 GHz . . . . -0.17 dB
       0.4884 GHz . . . . -0.46 dB
 M1    0.5000 GHz . . . . -0.44 dB . . . . . . . . . . . . . . . . . . . . MARKER
       0.6080 GHz . . . . +0.02 dB
       0.7276 GHz . . . . -0.09 dB
       0.8472 GHz . . . . -0.08 dB
       0.9668 GHz . . . . +0.04 dB

 M2    1.0000 GHz . . . . -0.04 dB . . . . . . . . . . . . . . . . . . . . MARKER
       1.0864 GHz . . . . -0.16 dB
       1.2060 GHz . . . . -0.02 dB
       1.3256 GHz . . . . -0.07 dB
       1.4452 GHz . . . . -0.06 dB
       1.5648 GHz . . . . -0.12 dB
       1.6844 GHz . . . . -0.07 dB
       1.8040 GHz . . . . -0.07 dB
       1.9236 GHz . . . . -0.08 dB
       2.0432 GHz . . . . -0.26 dB

 M3    2.0577 GHz . . . . -0.41 dB . . . . . . . . . . . . . . . . . . . . MARKER
       2.1628 GHz . . . . -5.90 dB
 M4    2.2500 GHz . . .  -13.93 dB . . . . . . . . . . . . . . . . . . . . MARKER
       2.2824 GHz . . .  -16.70 dB
       2.4020 GHz . . .  -25.61 dB
       2.5216 GHz . . .  -33.34 dB
       2.6412 GHz . . .  -40.84 dB
[M5]   2.7500 GHz . . .  -45.22 dB . . . . . . . . . . . . . . . . . . . . ACTIVE
       2.7608 GHz . . .  -45.77 dB
       2.8804 GHz . . .  -51.82 dB

       3.0000 GHz . . .  -56.45 dB


                ----------     System Conditions     ----------

                      Channel 1        Channel 2                    CH1  CH2
High Limit    :       complex          -- off --      Smoothing  :  off  off
Low  Limit    :       complex          -- off --      Averaging  :  off  off
Limit Testing :        pass             -- off --      Apps Hold  :  off  off

Cursor        :      -- off --         -- off --
        at    :      -- off --         -- off --      (-- off -- ) Bandwidth
Delta Readout :      -- off --         -- off --       F(min) :  -- off --
        at    :      -- off --         -- off --       F(max) :  -- off --

Detector offsets:  A:   0.00 dB   B:   0.00 dB   R:   0.00 dB
```

Figure 3-15. *Example of Hard Copy Tabular Data Printout*

```
Identify    :  DEMO                                  Date : 26/4/94 2:26 pm
Test Device :  FILTER

       FREQUENCY          1:TRANSMISSION     2:OFF
                            (A)

 M1    0.5000 GHz . . . . -0.44 dB . . . . . . . . . . . . . . . . . . . MARKER
 M2    1.0000 GHz . . . . -0.04 dB . . . . . . . . . . . . . . . . . . . MARKER
 M3    2.0577 GHz . . . . -0.41 dB . . . . . . . . . . . . . . . . . . . MARKER
 M4    2.2500 GHz . . .  -13.94 dB . . . . . . . . . . . . . . . . . . . MARKER
[M5]   2.7500 GHz . . .  -45.23 dB . . . . . . . . . . . . . . . . . . . ACTIVE
```

```
                ----------     System Conditions     ----------

                       Channel 1         Channel 2                      CH1  CH2
High Limit     :         complex          -- off --       Smoothing   :  off  off
Low  Limit     :         complex          -- off --       Averaging   :  off  off
Limit Testing  :          pass            -- off --       Apps Hold   :  off  off

Cursor         :        -- off --         -- off --
    .    at    :        -- off --         -- off --       (-- off -- ) Bandwidth
Delta Readout  :        -- off --         -- off --        F(min) :  -- off --
         at    :        -- off --         -- off --        F(max) :  -- off --

Detector offsets:  A:   0.00 dB   B:   0.00 dB   R:   0.00 dB
```

Figure 3-16. *Example of Hard Copy Printout of Marker Only Data*

```
Identify     :  DEMO                                  Date : 26/4/94 2:27 pm
Test Device     FILTER

                              Trace 1 High Limits
                             ====================

 Segment          From:-                                  To:-
---------  --------------------------          ----------------------------
    1         0.0100 GHz    +3.00 dB       -       2.2000 GHz    +3.00 dB
    2         2.2000 GHz    +3.00 dB       -       3.0000 GHz   -40.00 dB
 3  - 10   not set

                              Trace 1 Low Limits
                             ====================

 Segment          From:-                                  To:-
---------  --------------------------          ----------------------------
    1         0.0100 GHz    -3.00 dB       -       2.0000 GHz    -3.00 dB
    2         2.0000 GHz    -3.00 dB       -       3.0000 GHz   -70.00 dB
 3  - 10   not set

                              Trace 2 High Limits
                             ====================

 Channel off

                              Trace 2 Low Limits
                             ====================

 Channel off
```

Figure 3-17. *Example of Hard Copy Printout of Limits Only Data*

Chapter 4
Front Panel Menus

Table of Contents

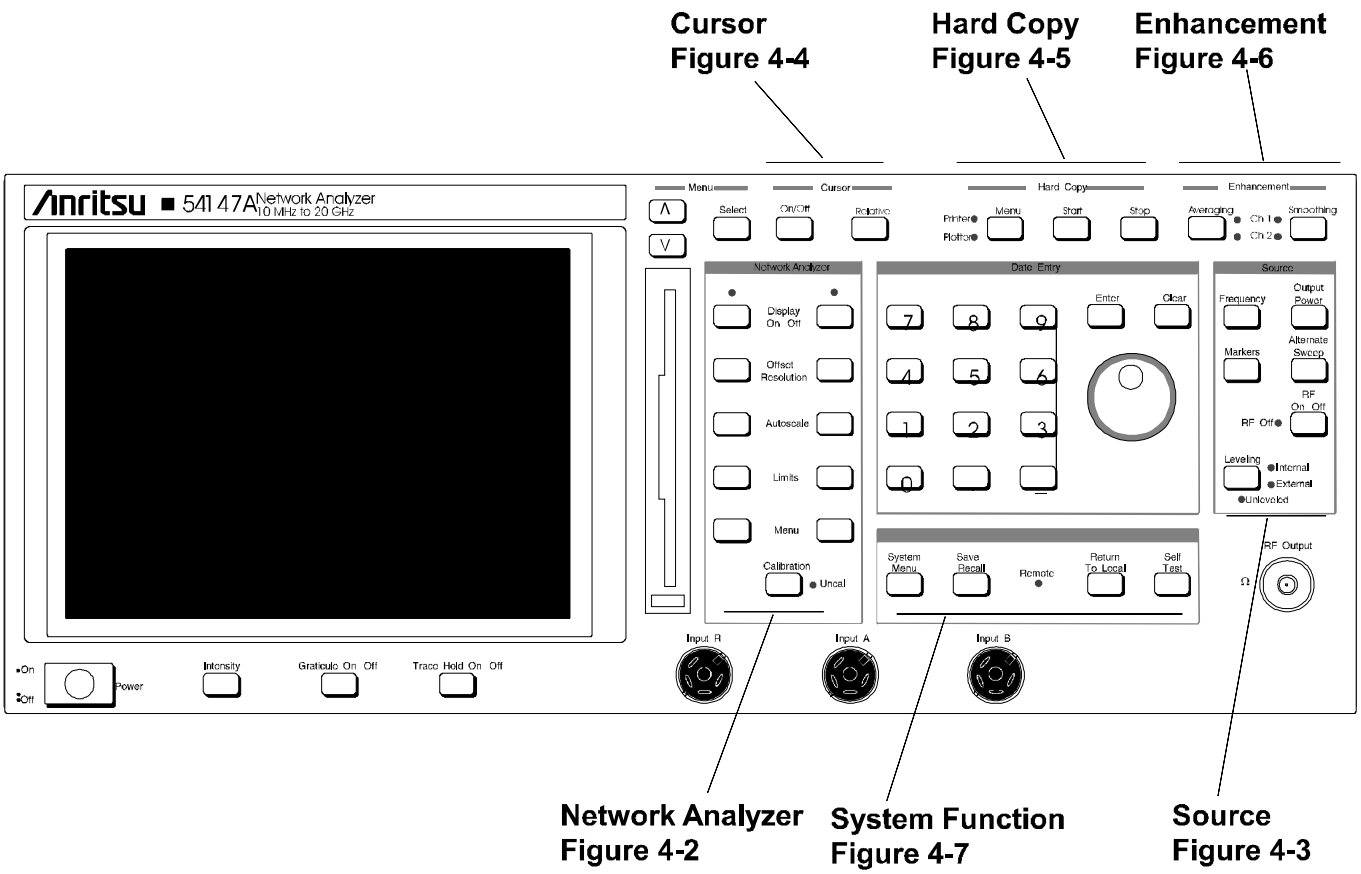


Figure 4-1. *Series r nt ne*

Chapter 4
Front Panel Menus

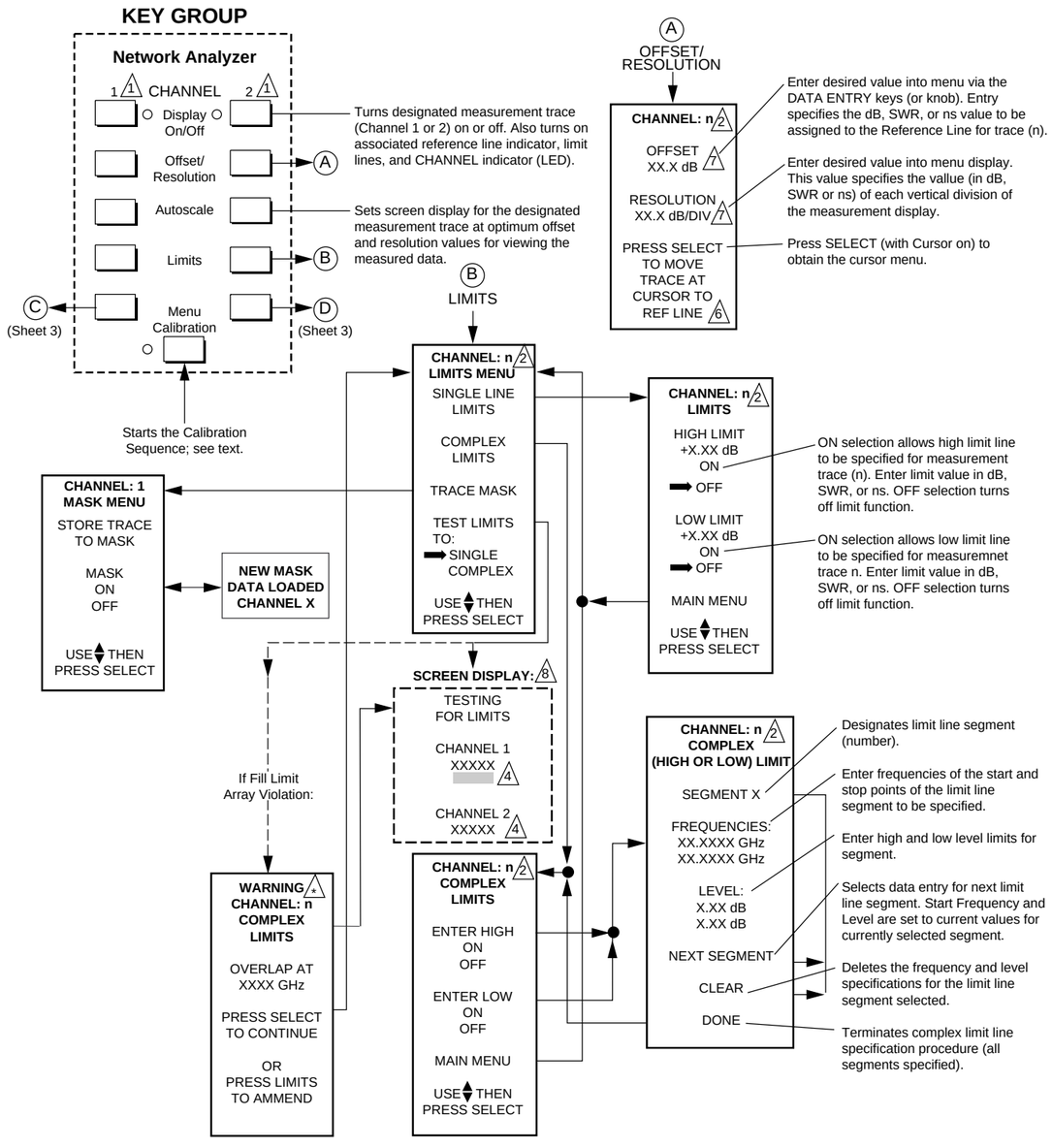
4-1 INTRODUCTION

This chapter provides flowcharts showing the front panel key menu's hierarchical structure, along with descriptive text for menu options.

4-2 ORGANIZATION

Figure 4-1 (facing page), shows the 541XXA front panel indexed to assist in locating the figure numbers in which associated menus are flowcharted and described. The flowcharts are also indexed in the table below.

Key Group Name	Figure Number	Number of Sheets
Network Analyzer	4-2	2
Source	4-3	1
Cursor	4-4	1
Hard Copy	4-5	1
Enhancement	4-6	1
System	4-7	3



NOTES:

1. Corresponding Key functions for Channel 1 and Channel 2 are identical.
2. Displays Selected Measurement Trace (Channel 1 or 2)
3. Displays currently selected Input Connector.
4. PASS/FAIL message displayed here. If fail, frequency is also displayed.
5. Ratio not used for Power measurements.
6. Only displayed when Cursor is on.
7. Or SWR value.
8. Displayed on right side of measurement screen.
9. Alternate presentation: ">" and "<" mark reference line position.
0. These selections will not be presented for 541XXA's without Input R
*. All frequency information displayed by these menus is in MHz for Models 54107/09/11. It is displayed in GHz for all other models.

Figure 4-2. *Network Analyzer Key Group Menus (1 of 3)*

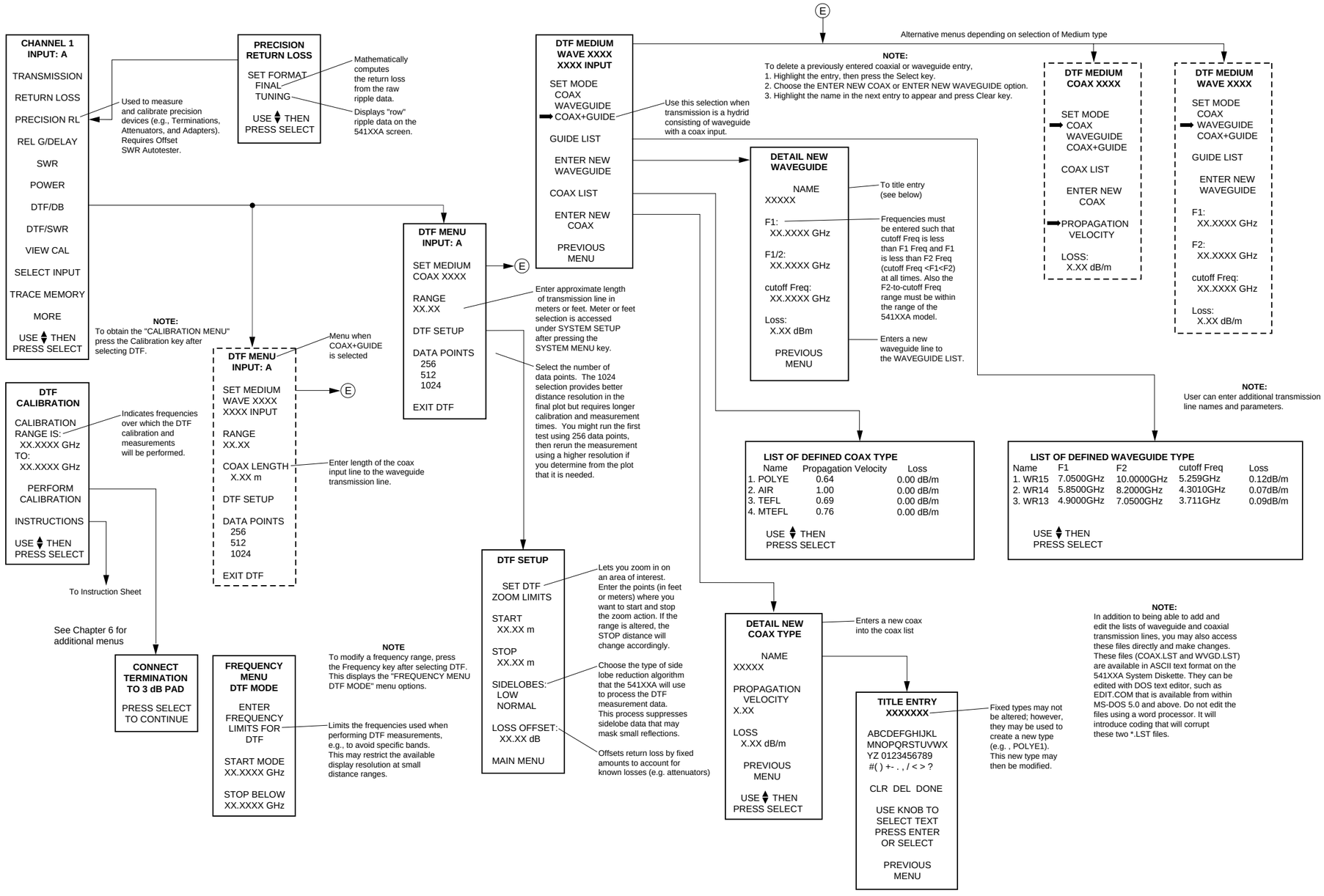
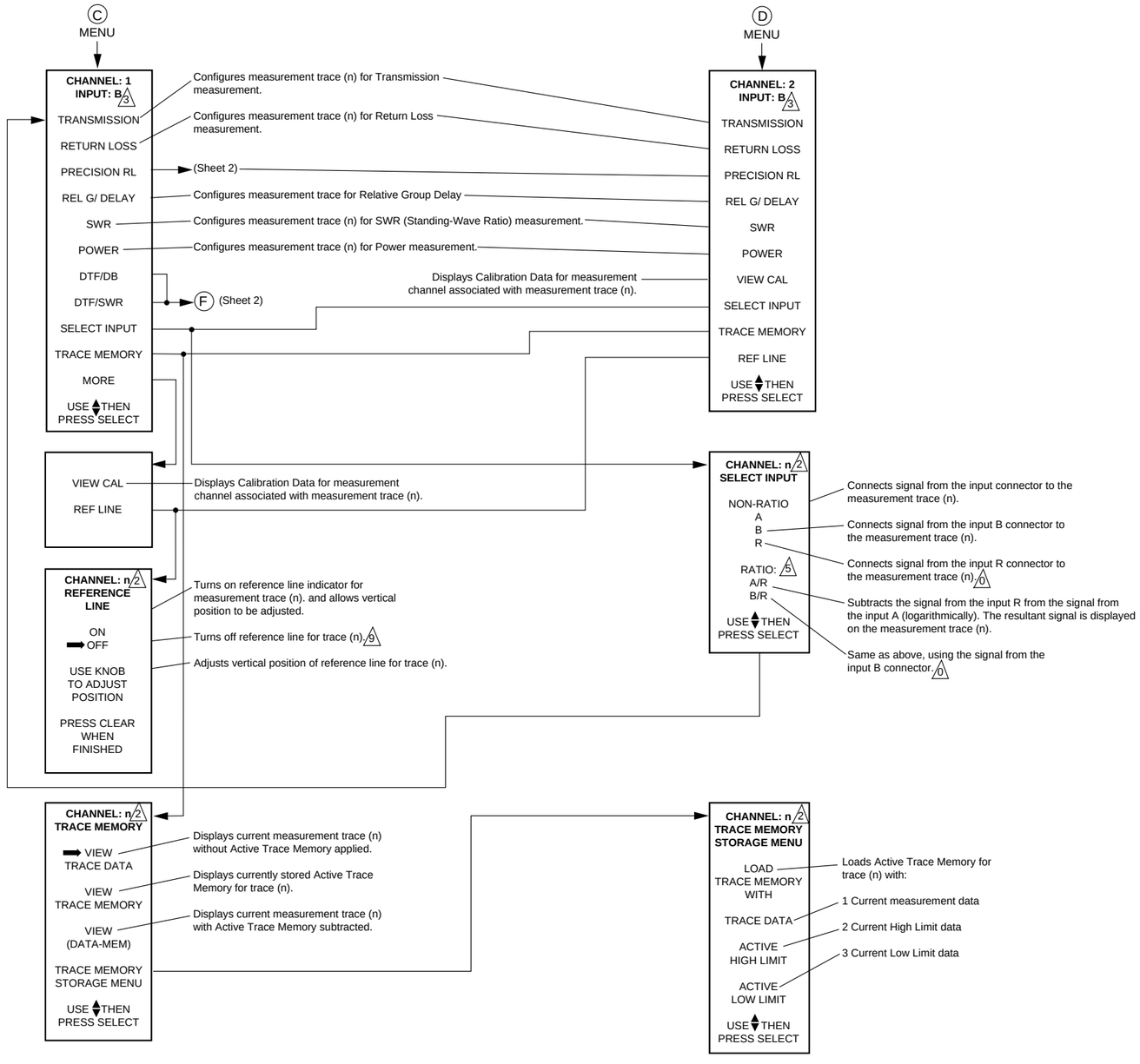


Figure 4-2. *Network Analyzer Key Group Menus 2 of 3)*



NOTES:

1. Corresponding Key functions for Channel 1 and Channel 2 are identical.
2. Displays Selected Measurement Trace (Channel 1 or 2)
3. Displays currently selected Input Connector.
4. PASS/FAIL message displayed here. If fail, frequency is also displayed.
5. Ratio not used for Power measurements.
6. Only displayed when Cursor is on.
7. Or SWR value.
8. Displayed on right side of measurement screen.
9. Alternate presentation: ">" and "<" mark reference line position.
0. These selections will not be presented for 541XXA's without Input R
*. All frequency information displayed by these menus is in MHz for Models 54107/09/11. It is displayed in GHz for all other models.

Figure 4-2. *Network Analyzer Key Group Menus (3 of 3)*

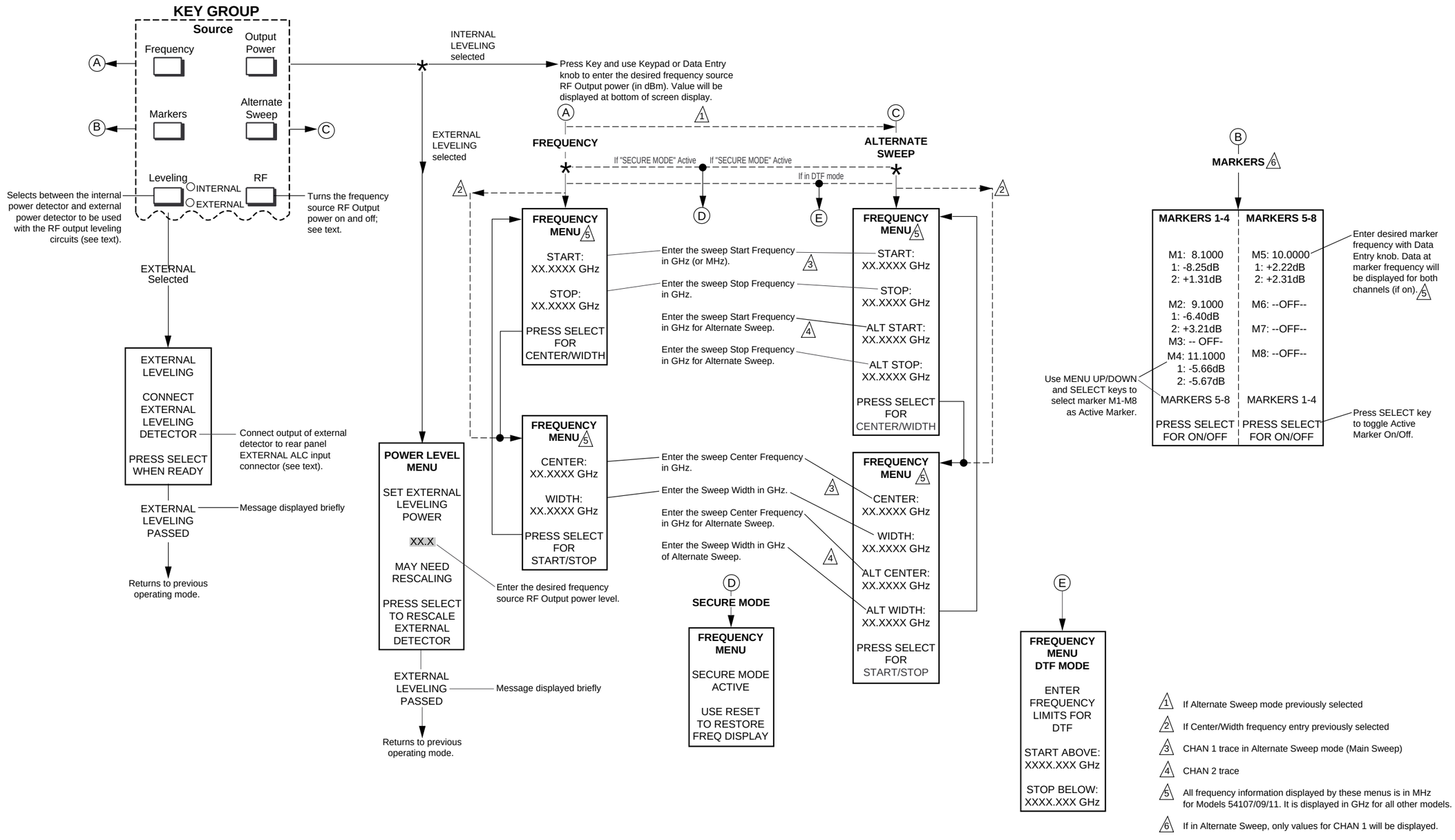
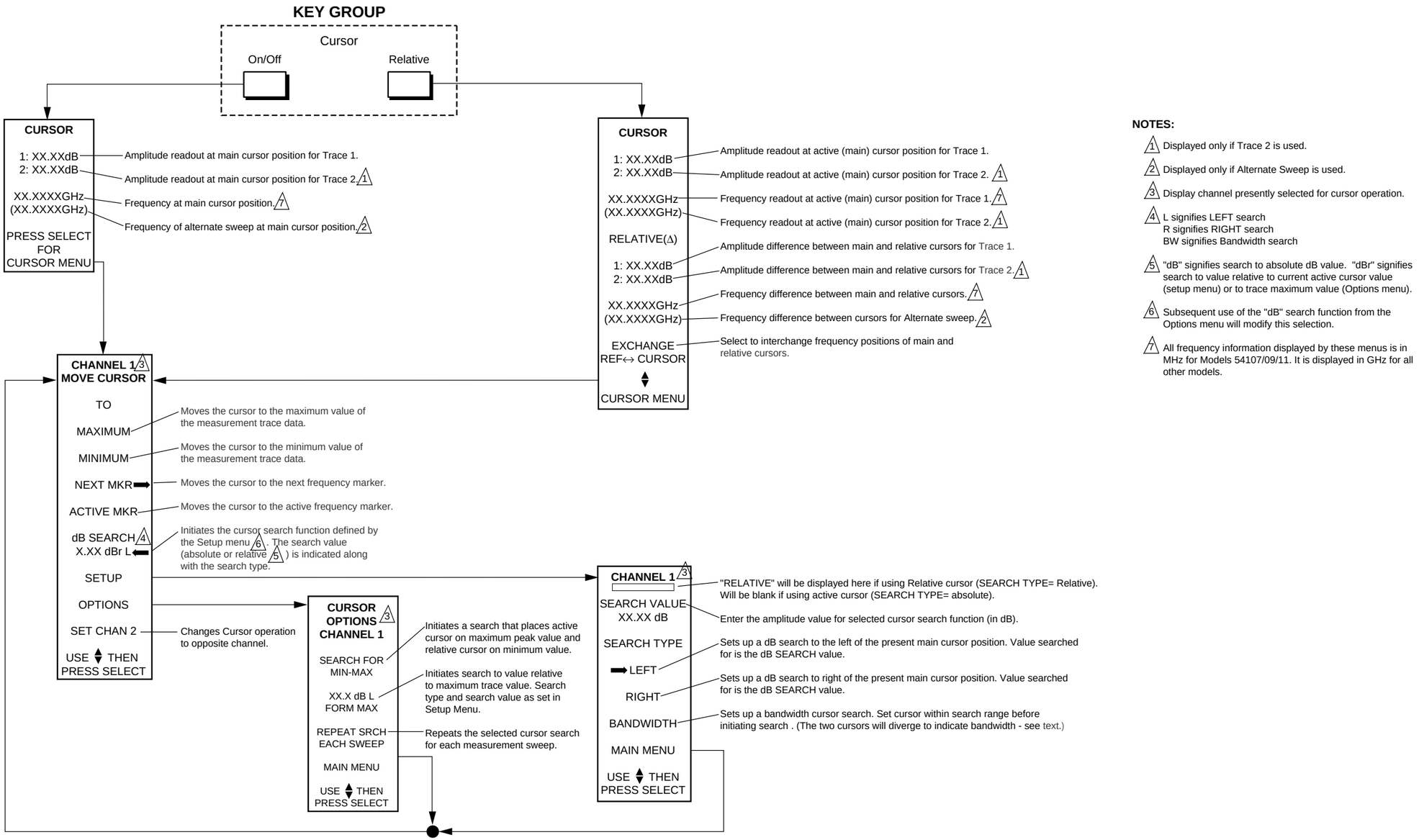


Figure 4-3. *Source Key Group Menus*



NOTES:

1. Displayed only if Trace 2 is used.
2. Displayed only if Alternate Sweep is used.
3. Display channel presently selected for cursor operation.
4. L signifies LEFT search
   R signifies RIGHT search
   BW signifies Bandwidth search
5. "dB" signifies search to absolute dB value. "dBr" signifies search to value relative to current active cursor value (setup menu) or to trace maximum value (Options menu).
6. Subsequent use of the "dB" search function from the Options menu will modify this selection.
7. All frequency information displayed by these menus is in MHz for Models 54107/09/11. It is displayed in GHz for all other models.

Figure 4-4. *Cursor Key Group Menus*

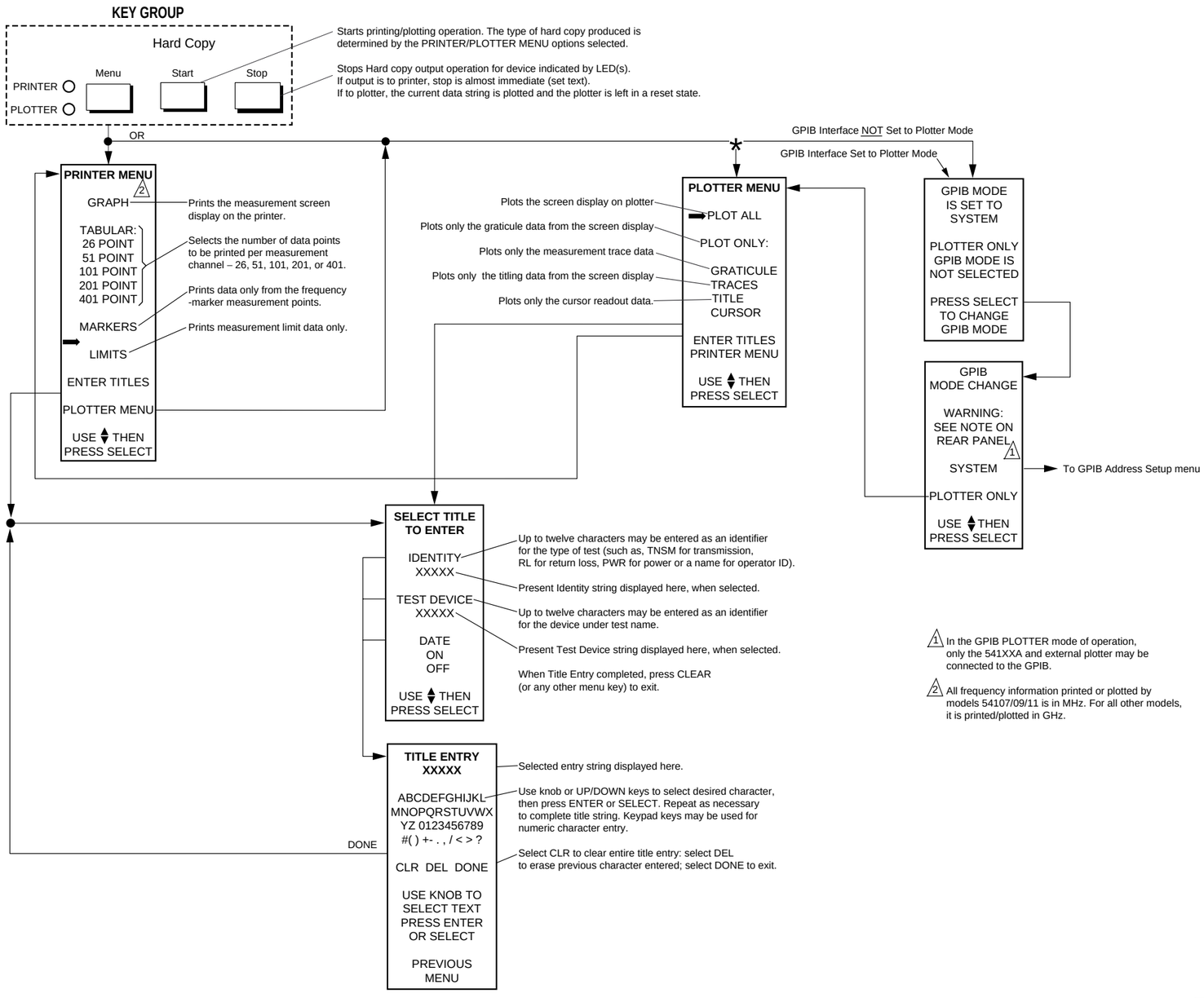


Figure 4-5. *Hard Copy Key Group Menus*

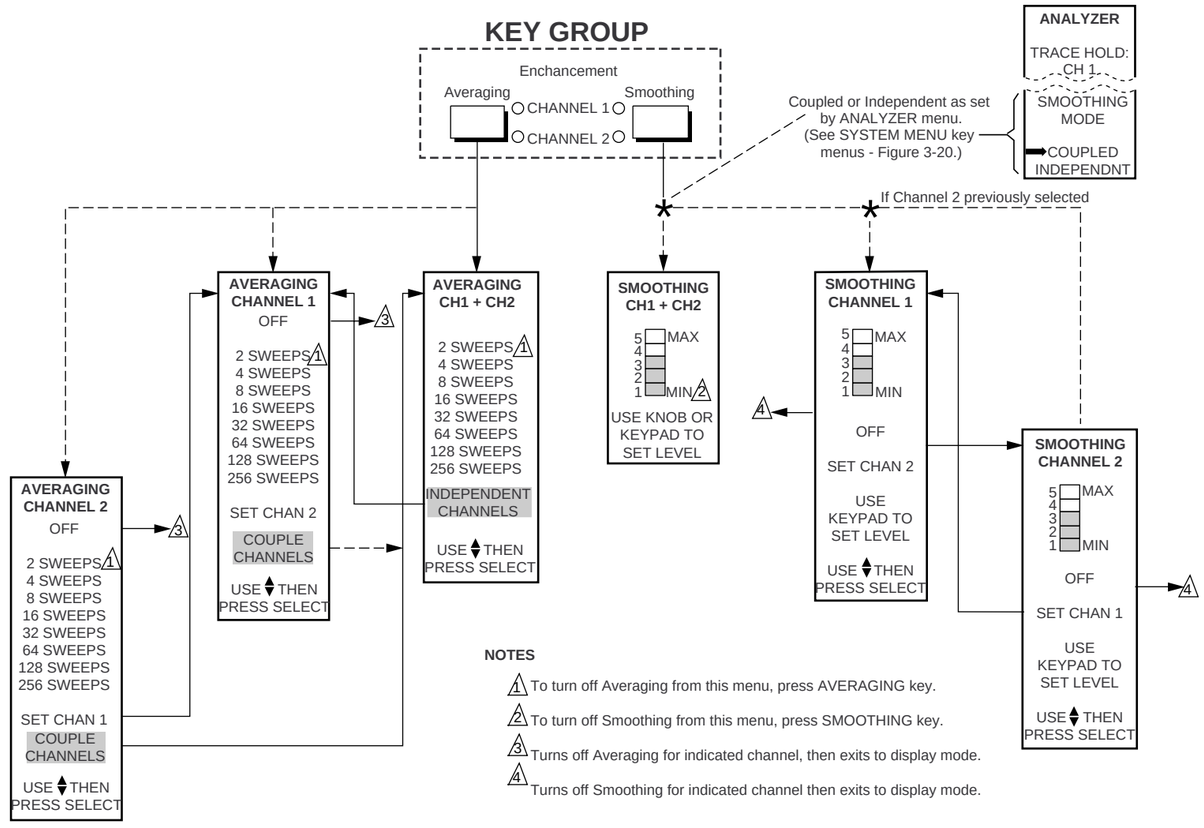


Figure 4-6. *Enhancement Key Group Menus*

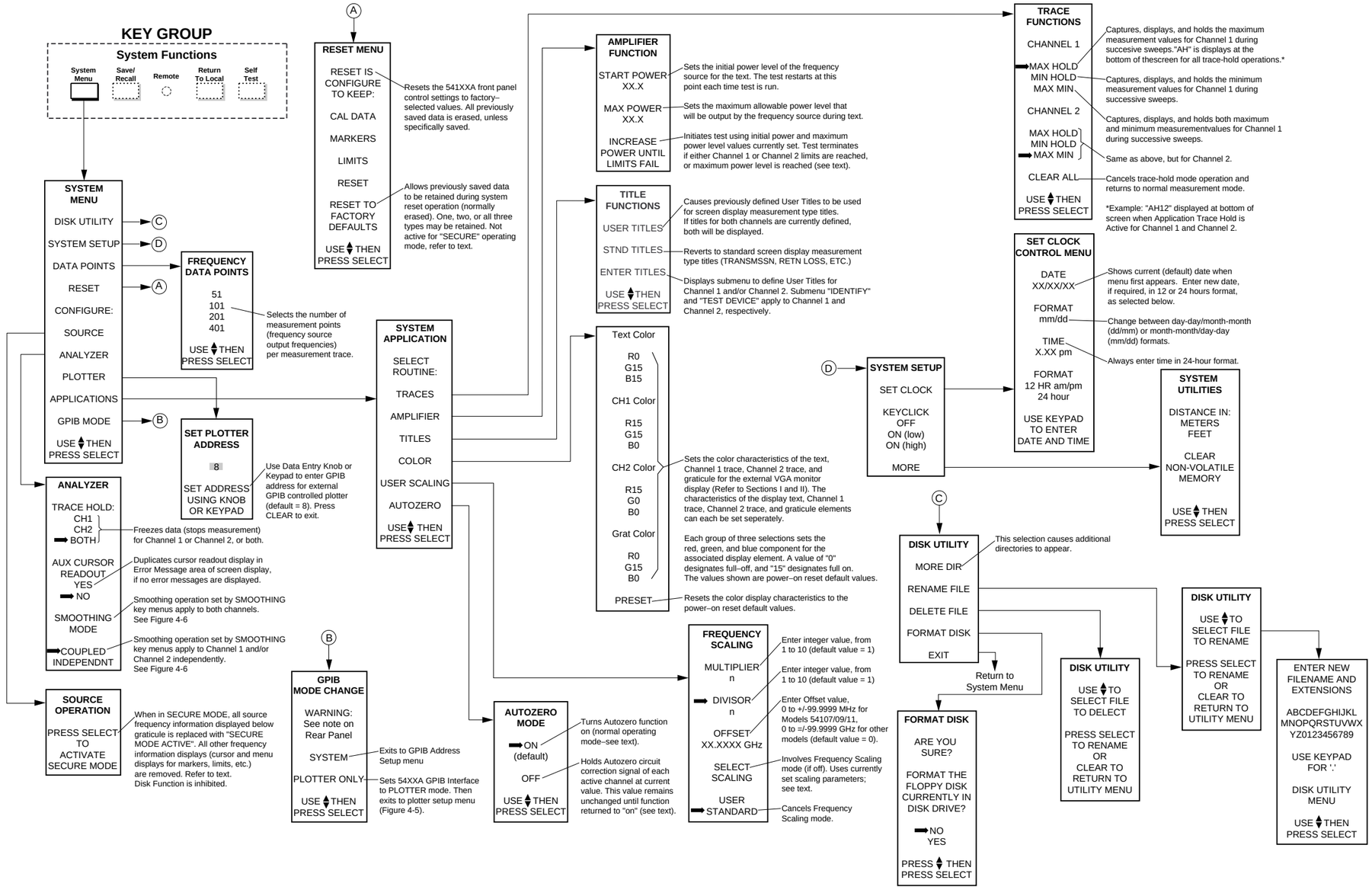


Figure 4-7. *System Functions Key Group Menus (1 of 3)*

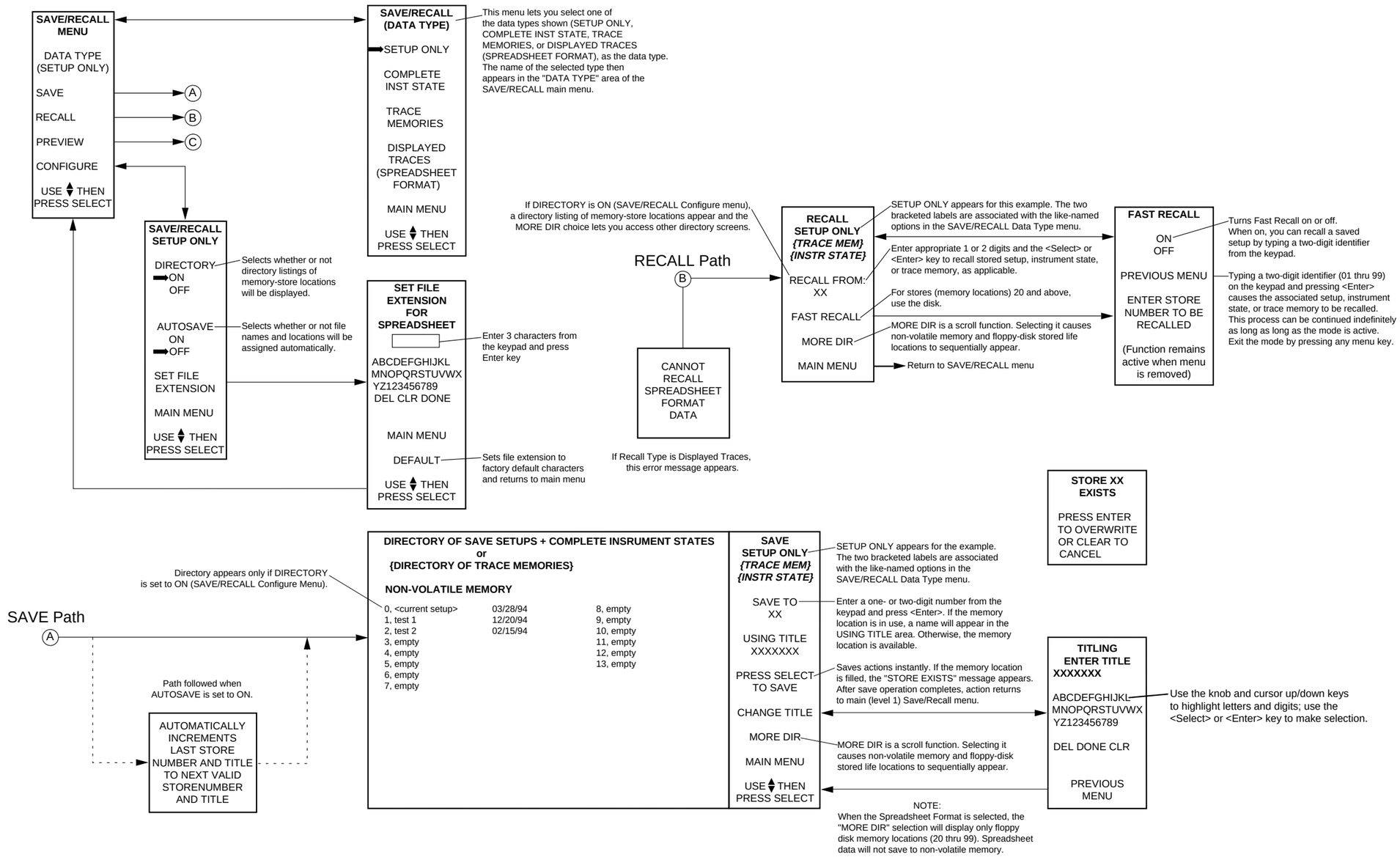


Figure 4-7. *System Functions Key Group Menus (2 of 3)*

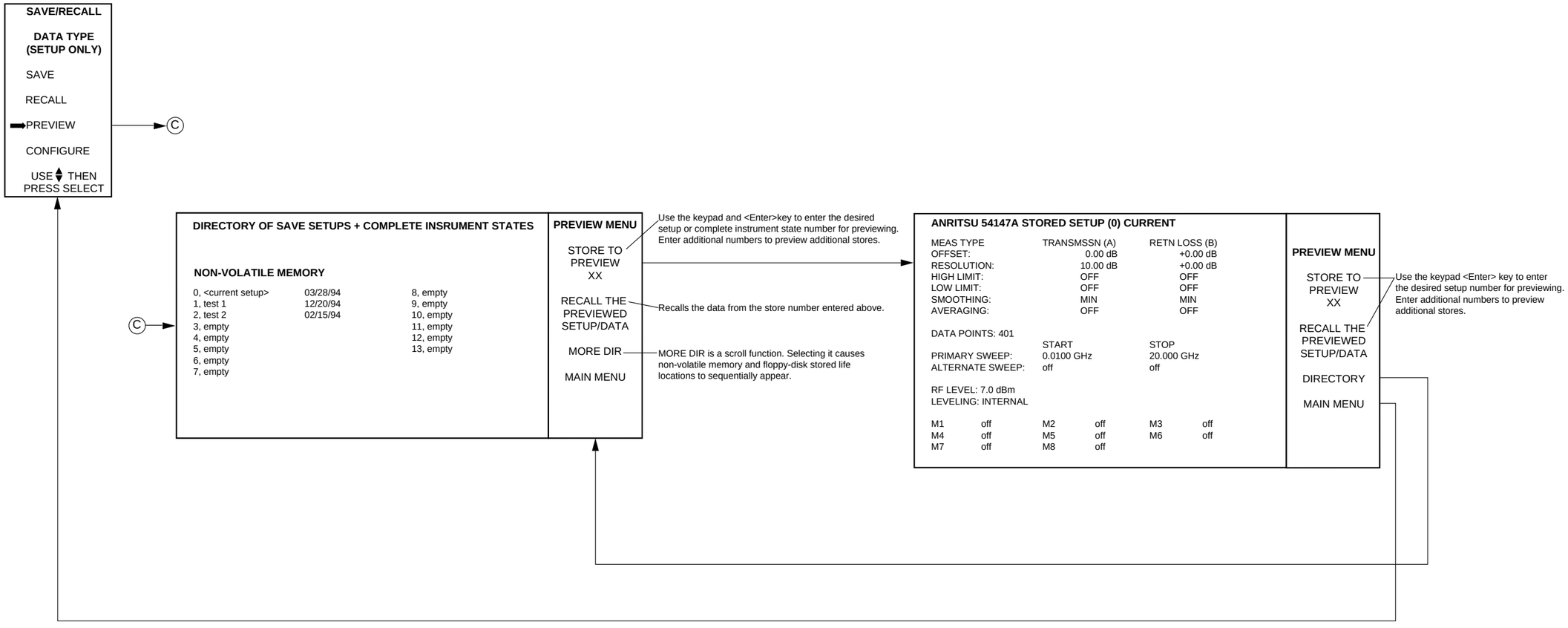


Figure 4-7. *System Functions Key Group Menus (3 of 3)*

Chapter 5
Measurement and Calibration Procedures

Table of Contents

Chapter 5
Measurement and Calibration Procedures

5-1 INTRODUCTION

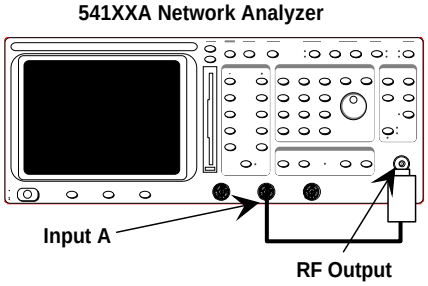
This chapter describes

- How to check that the instrument is operating properly.
- How to perform a measurement setup calibration.
- How to make transmission, return loss, power, and alternate sweep frequency range measurements.

5-2 OPERATIONAL CHECKOUT PROCEDURE

The 541XXA Network Analyzer undergoes a comprehensive self test when turned on, or when the Self Test key is pressed. The **"ALL TESTS PASSED"** message that displays on the screen at the conclusion of the self test signifies that all internal *control* circuits are operating properly.

To perform a simple operational check that confirms that the frequency source and network analyzer circuits are functioning, follow the procedure outlined below.

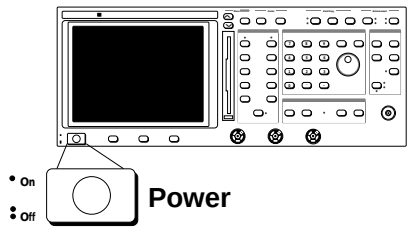


Step 1. Connect an RF detector between the RF Output connector and the Input A connector (top left).

Step 2. Press the 541XXA Power pushbutton (bottom left) to On.

At the conclusion of the self test, **"ALL TESTS PASSED"** *will appear.*

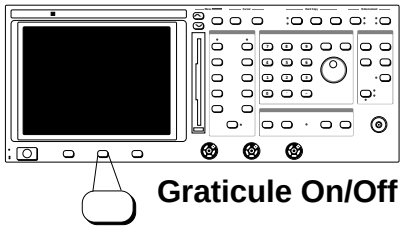
Step 3. Press the System Menu key and select **RESET** from the displayed menu (page 5-4A/54B) using the Menu up/down and Select keys.



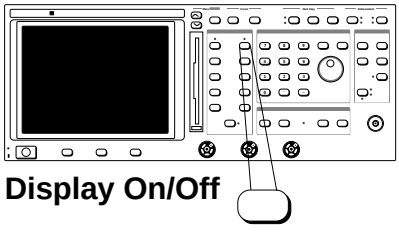
Step 4. From the RESET MENU (below), select **RESET TO FACTORY DEFAULTS.**

SYSTEM MENU
DISK UTILITIES
SYSTEM SETUP
DATA POINTS
RESET
CONFIGURE:
SOURCE
ANALYZER
PLOTTER
APPLICATIONS
GPIB MODE
USE ◆ THEN PRESS SELECT

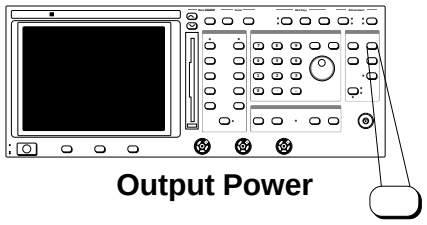
RESET MENU
RESET IS CONFIGURED TO KEEP:
CAL DATA
MARKERS
LIMITS
RESET
RESET TO FACTORY DEFAULTS
USE ◆ THEN PRESS SELECT



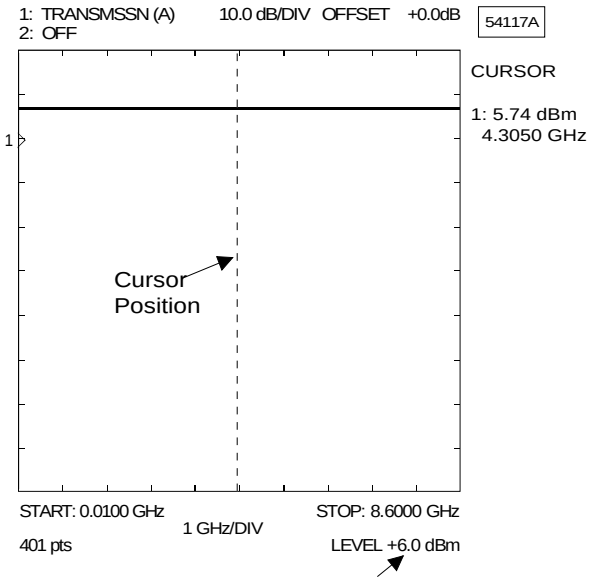
Step 5. Press the Graticule On/Off key (left) to turn on the graticule display.

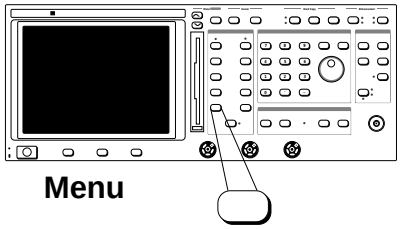


Step 6. Press the Channel 2 Display On/Off key (left) to off to remove trace 2 from the screen display.



Step 7. Press the Output Power key and observe the set power level on the 541XX display."





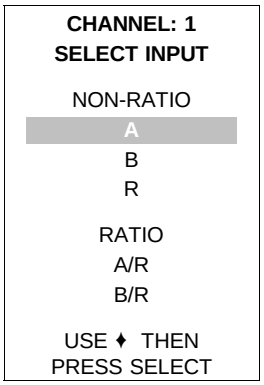
Step 8. Press the Channel 1 Menu key (left).

CHANNEL: 1
INPUT: A

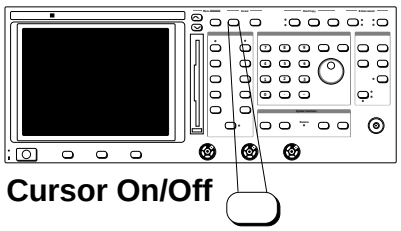
TRANSMISSION
RETURN LOSS
PRECISION RL
REL G/DELAY
SWR
POWER
DTF/DB
DTF/SWR
SELECT INPUT
TRACE MEMORY
MORE

USE ♦ THEN
PRESS SELECT

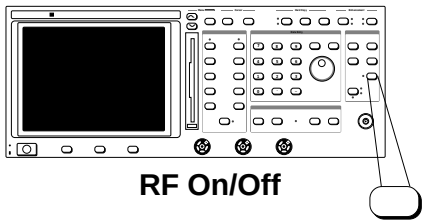
Step 9. Select **POWER** and **SELECT INPUT** from the displayed menu (left).



Step 10. Select **NON-RATIO A** from the displayed menu (left).

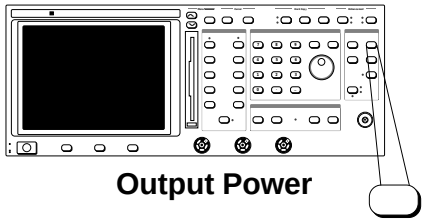


Step 11. Press the Cursor On/Off key (left) to obtain a cursor data readout display.



Step 12. Press the RF On/Off key (left) to off and confirm that the trace moves downward to a noise floor of approximately –60 dBm.

Step 13. Press the RF On/Off key (left) to on and confirm that the cursor readout value is approximately equal to the 541XXA power level noted in step 7.



Step 14. Press the Output Power key and reduce the level by 10 dB. Note the new power level.

Step 15. Confirm that the cursor readout values is approximately that noted in step 14..

NOTE

The measurement display can be offset in dB to match a more accurate power level reference, such as a power meter.

END OF PROCEDURE

5-3 MEASUREMENT CALIBRATION, TRANSMISSION AND RETURN LOSS

Before the 541XXA is used for a transmission or reflection measurement, a test setup normalization procedure must be performed. This procedure is referred to as "calibration." Calibration is the process whereby losses inherent in a transmission or return loss measurement system are measured, stored in internal memory, and later subtracted from the test measurement data. As a result, subsequent screen displays (and test data) reflect the characteristics of the test device only.

NOTE

A calibration is not required before using the 541XXA to perform power measurements.

When the Calibration key is pressed, a series of menus/instructions are displayed that guide the user through the calibration procedure. The calibration procedure should be performed using the same test set up (with the device-under-test removed) that will be used for the actual test. This includes using the same power level and measurement frequencies as for the actual test. A typical setup for transmission and return loss measurements (and calibration) is shown in Figure 5-1.

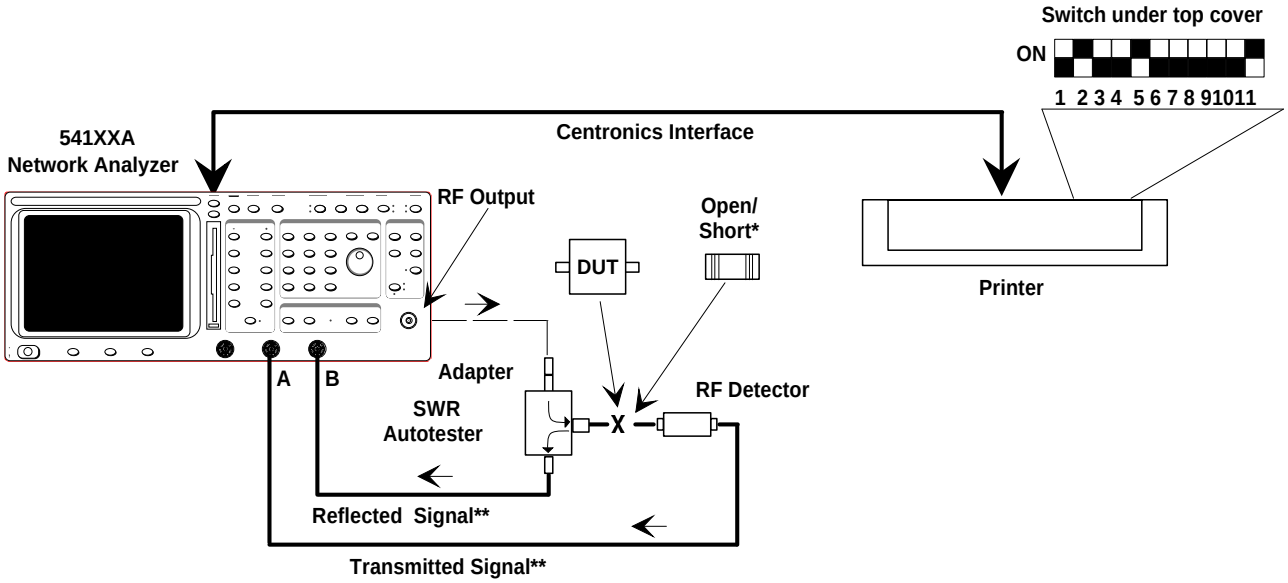


Figure 5-1. *Typical Setup for Transmission And Return Loss Measurements*

Calibration Menu

The main calibration menu has three selections:

START CAL
This selection displays the instructions or menu prompts for the normal calibration sequence for transmission and reflection measurements.

DETECTOR OFFSETS
This selection allows an offset (expressed in dB) to be specified for any detector used with the **A, B,** or **R** inputs. (A typical use is for when an attenuator is placed before the detector to protect it.) These values remain in memory, even after the 541XXA is powered down. The offsets can be cleared by reselecting **DETECTOR OFFSETS** and entering "0 dB." Whenever one or more detector offsets are used, a status message is displayed at the bottom of the screen. *Example*: **"DET OFS ABR"** indicates that non-zero offsets have been entered for each of the three inputs.

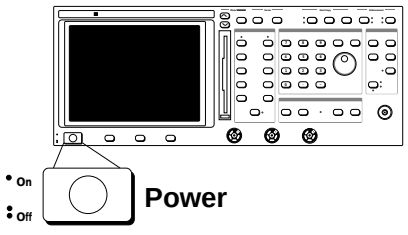
DC CAL MENU
This selection is used in conjunction with the **POWER** selection from the **NETWORK ANALYZER** menus for Channel 1 and/ or Channel 2 to perform absolute power measurements. Refer to paragraph 5-7, page 5-33.

Calibration Procedure

Pressing the Calibration key initiates the sequence of menus shown in Figure 5-2, page 5-10. To obtain these menus, proceed as follows.

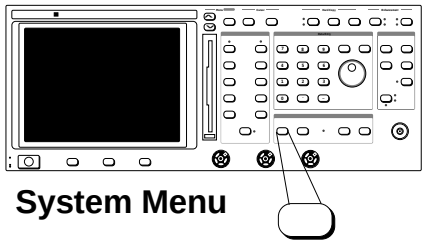
Step 1.

Connect the equipment as shown in Figure 5-1, except do not connect the Open/Short.

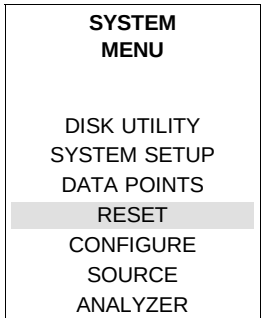


Step 2.

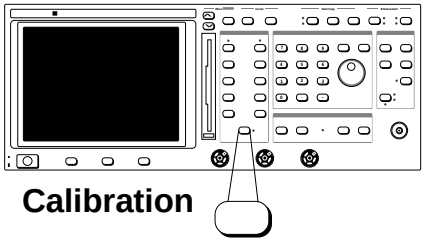
Press the Power key to On.



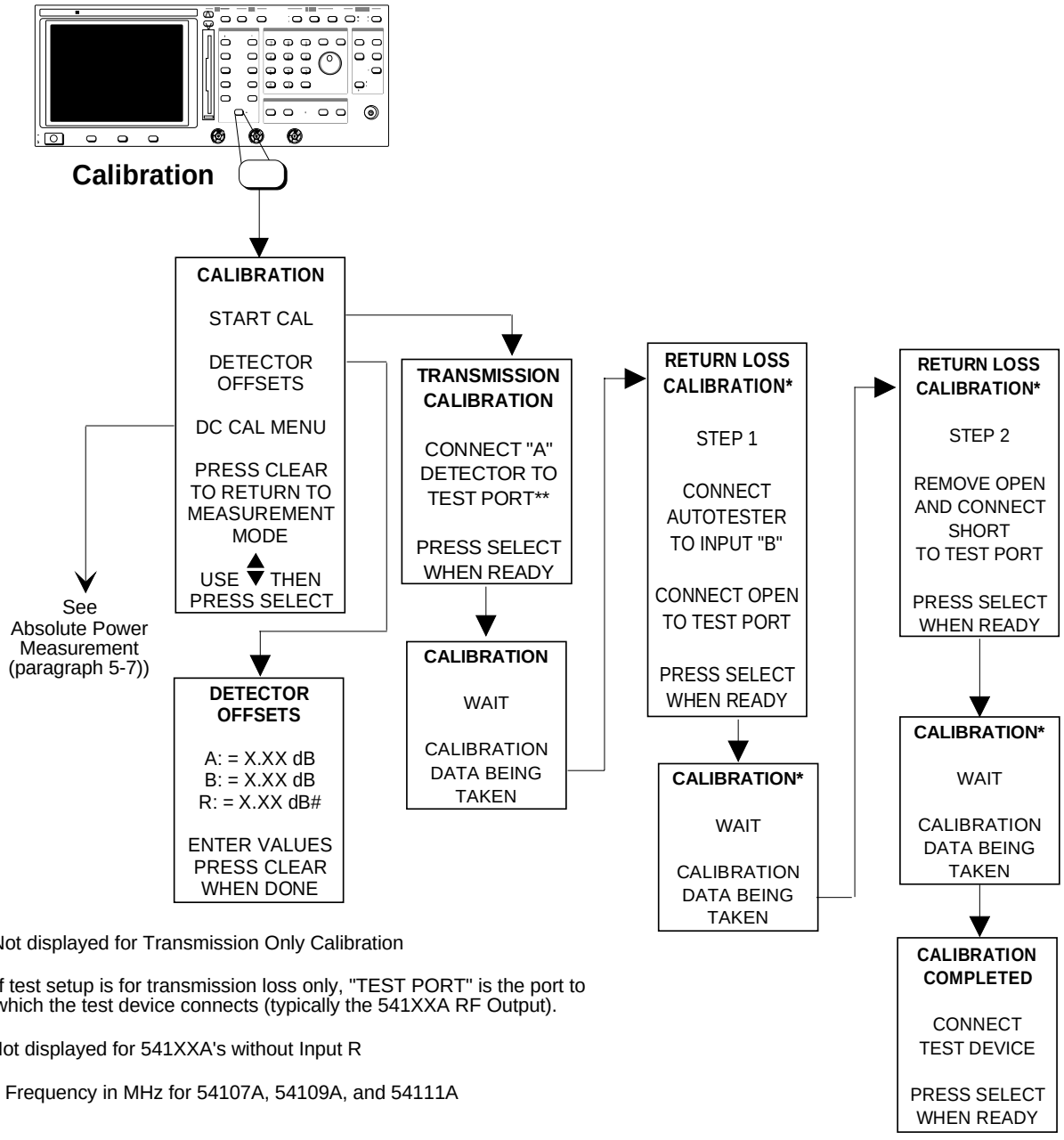
Step 3. Press the System Menu key (left)



Step 4. Select **RESET** from the displayed menu (left) and **RESET TO FACTORY DEFAULTS** from the follow-on menu.



Step 5. Press the Calibration key (left) and follow the instructions in the calibration menus.



*Not displayed for Transmission Only Calibration

**If test setup is for transmission loss only, "TEST PORT" is the port to which the test device connects (typically the 541XXA RF Output).

#Not displayed for 541XXA's without Input R

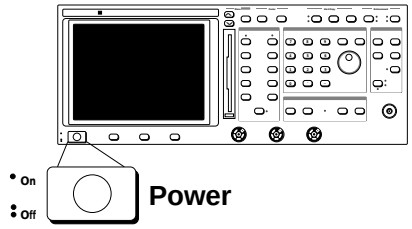
Frequency in MHz for 54107A, 54109A, and 54111A

Figure 5-2. *Calibration Menus Sequencing*

5-4 TRANSMISSION AND RETURN LOSS MEASUREMENT

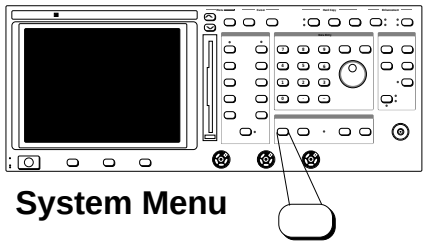
The 541XXA is capable of simultaneous measurements of transmission and return loss. A procedure for performing this measurement is given below.

Step 1. Connect test equipment per Figure 5-1, except do not connect the test device. Turn the printer on.



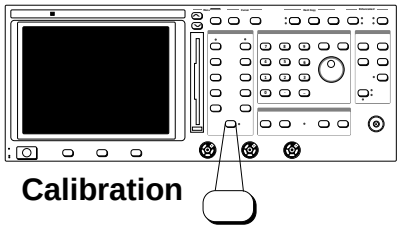
Step 2. Press the Power pushbutton (left) to On.

*At the conclusion of the self test, "**ALL TESTS PASSED**" will be displayed and the screen display should resemble that shown at left. The control settings may differ from those shown, as the 541XXA will come on line with the same control settings as when turned off last. On the accompanying menus, ensure that both channels are turned On and that Channel 1 is set for* **TRANSMISSION** *and Channel 2 for* **RETURN LOSS.**



Step 3. Press the System Menu key (left) and reset the 541XXA to the factory defaults, as described in paragraph 5-3.

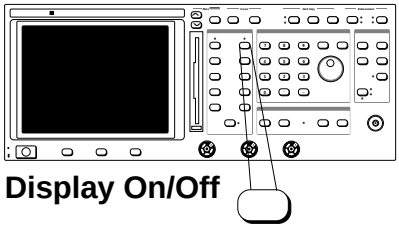
For the example included in this procedure, the start frequency is 2.0 GHz; the stop frequency is 8.6 GHz; and the power output is set to +7.0 dBm.



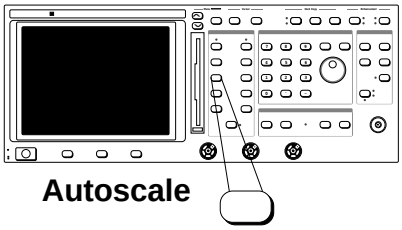
Step 4. Press the Calibration key (left) and follow the directions given in the calibration menu sequence.

(Refer to Paragraph 5-3 for an explanation of the calibration menus.) After finishing the calibration, connect the test device and RF detector as shown in Figure 5-1.

Transmission Loss Measurement



Step 5. Press the Channel 2 Display On/Off key (left) to off.

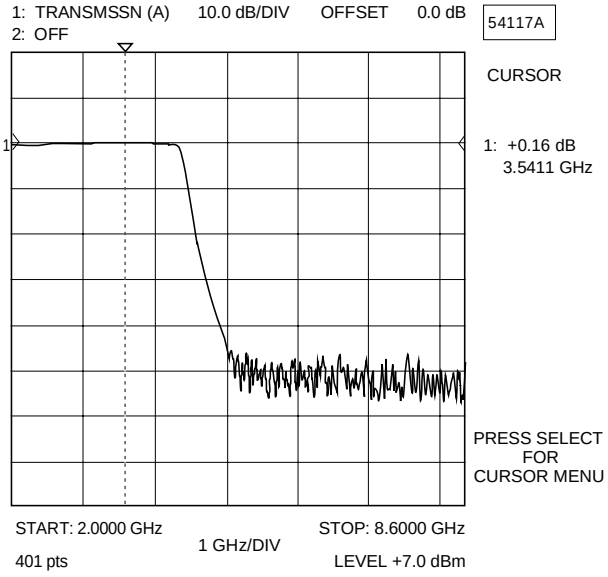


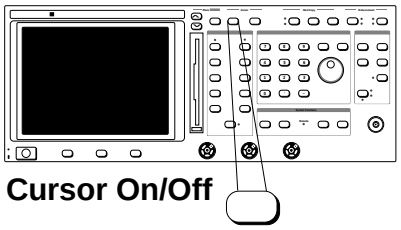
Step 6. Press the Channel 1 Autoscale key (left).

This gives an optimum vertical display of the test data (below).

Read the transmission loss by interpolating the displayed graphic, or read out the measurement data at points of interest by using the cursor functions, as described in Step 7.

*The example below shows a screen display for a transmission measurement of the upper frequency response of a band-pass filter. The model used in this example is a model **54117A**. Models **54107A, 54109A,** and **54111A** do not operate at the frequencies shown, however they perform identically within their own frequency ranges.*



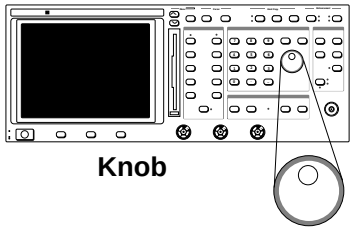


Cursor On/Off

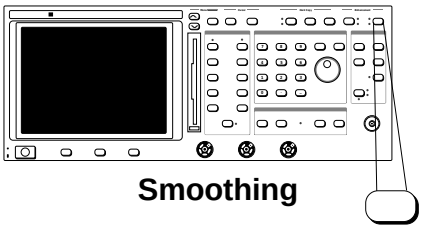
CURSOR

1: 0.16 dBm

PRESS SELEC
FOR
CURSOR MENU



Knob

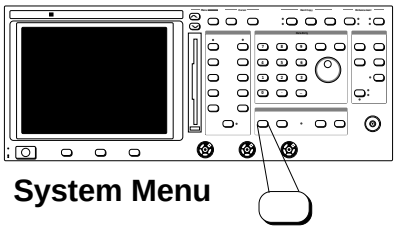


Smoothing

SMOOTHING
CHANNEL 1

5 MAX
4
3
2
1 MIN

USE KNOB OR
KEYPAD TO
SET LEVEL



Step 7. Press the Cursor On/Off key (left).

The cursor readout menu will display the readout data at the present cursor position. Use the Data Entry knob to move the cursor to the desired point on the measurement trace. Then, read the transmission level from the cursor readout display.

For the example shown, the transmission level at 3.5411 GHz is +0.16 dB.

SYSTEM MENU

DISK UTILITY
SYSTEM SETUP
DATA POINTS
RESET
CONFIGURE
SOURCE
ANALYZER
PLOTTER
APPLICATIONS
GPIB MODE

USE ♦ THEN
PRESS SELECT

FREQUENCY DATA POINTS

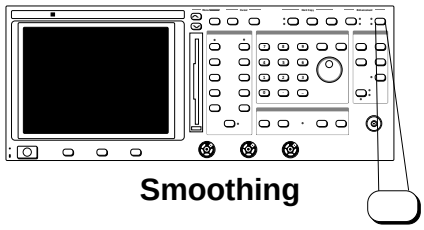
51
101
201
401

USE ♦ THEN
PRESS SELECT

Step 8. Using the Data Entry knob (left), move the cursor to the bottom of the filter skirt and read the frequency and transmission level at the selected point.

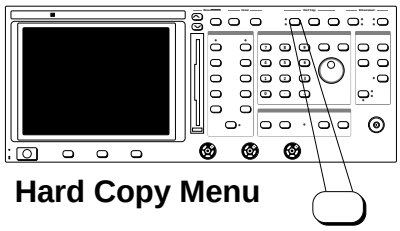
For the example shown at 5.2500 GHz the transmission loss varies between approximately –47dB and –52 dB.

Step 9. Press the Smoothing key (left) and select a smoothing level of 3.



Smoothing

Step 10. Press the System Menu key (left)



Hard Copy Menu

Step 11. Select **DATA POINTS** from the displayed menu (left).

Step 12. Select **401** from the next menu to appear (left)

Step 13. Read the transmission level from the cursor menu readout as before; note that the reading is much steadier.

PRINTER MENU

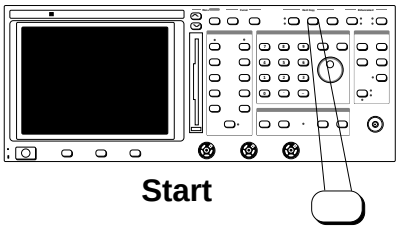
GRAPH

TABULAR

26 POINTS
51 POINTS
101 POINTS
201 POINTS
401 POINTS

MARKERS

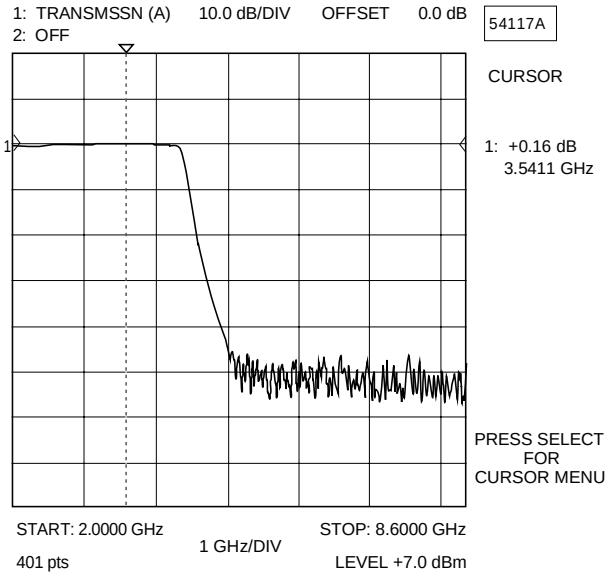
LIMITS



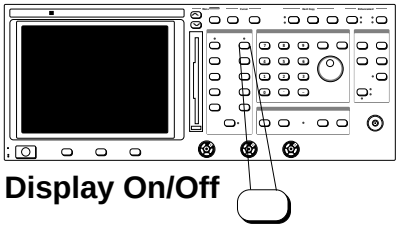
Step 14. Press the Smoothing key (left) to off.

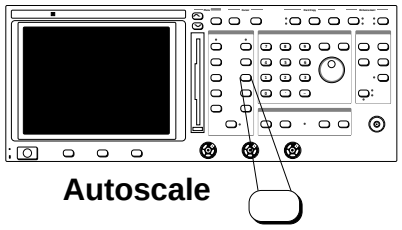
Step 15. Press the Hard Copy Menu key (left).

Step 16. If device identify, date, and test device information is required, then select **"ENTER TITLES"** (refer to Section III – Front Panel Operation, as necessary).

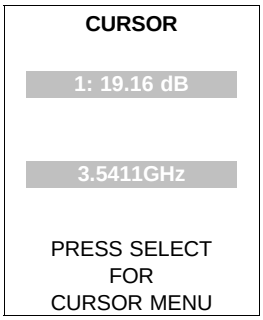


Step 17. Select **GRAPH** to print the displayed graphic, or select **26, 51, 101, 201,** or **401** under **"TABULAR:"** to print a tabulation at the selected number of frequency points. You may also choose to print out a tabulation at only the marker frequencies (if frequency markers have been set up).





Step 18. Press the Hard Copy Start print key (left) to print out the data.



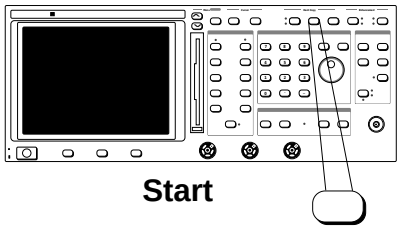
The printout should resemble the example screen display shown below.

NOTE

If a plotter is connected, selecting the **PLOTTER MENU** will allow you to plot either graticules, traces, titling, cursor information, or all of these items (select the **"PLOT ALL"** function — refer to Chapter 3 – Front Panel Operation).

Return Loss Measurement

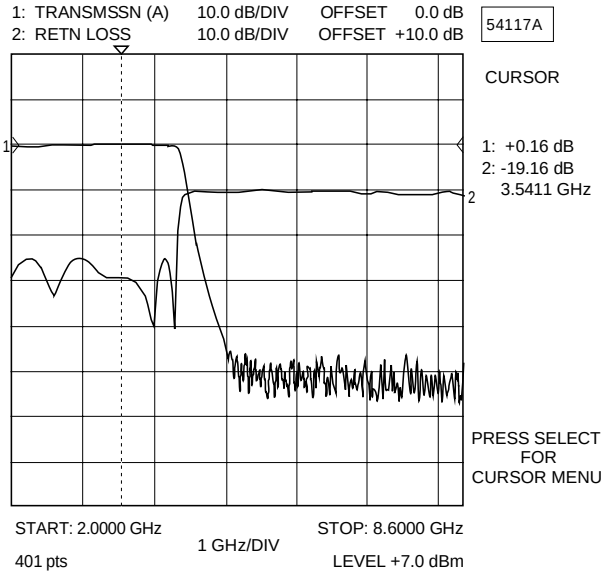
Step 19. Press the Channel 2 Display On/Off key (left) to on.



Step 20. Press Channel 2 Autoscale key (left).

Step 21. Observe the Cursor menu (left).

For the example shown, the transmission level at 3.5411 GHz is –19.16 dB.



Step 22. Press the Hard Copy Start print key (left) to print out the data.

The printout should resemble the example screen display shown below.

NOTE

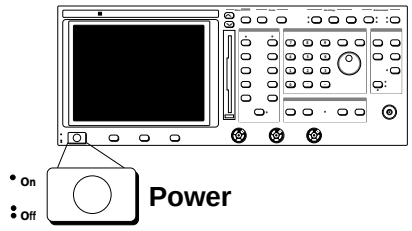
Note that both transmission and return loss measurements are shown.

Step 23. END OF PROCEDURE

5-5 ALTERNATE SWEEP MEASUREMENT

A procedure for making alternate sweep measurements is described below. In this mode, the second (alternate setup) sweep parameters are set differently from the regular sweep — usually with a reduced frequency span. (This produces an expanded measurement display for the second sweep.) The alternate sweep mode is controlled via the menus associated with the Alternate Sweep key. The equipment setup for this type of measurement is generally the same as for transmission and return loss measurements.

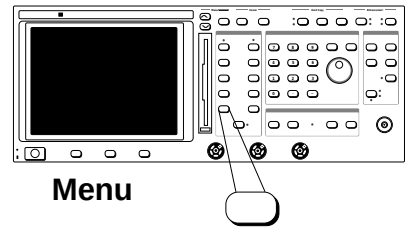
Step 1. Connect test equipment per Figure 5-1, except do not connect the test device. Turn the printer on.



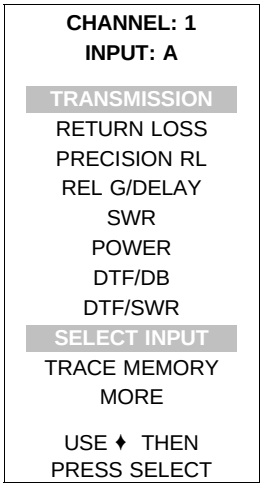
Step 2. Press the Power key (left) to On.

Step 3. At the conclusion of the self test, set up and calibrate the 541XXA with Input A (Channel 1) set for transmission measurement and Input B (Channel 2) set for return loss measurement. Refer to steps in paragraph 5-4 as necessary.

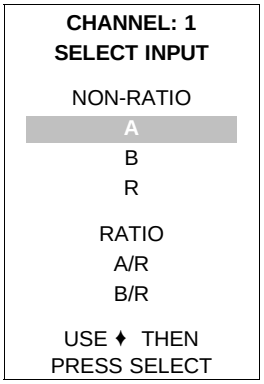
Transmission Loss Measurement



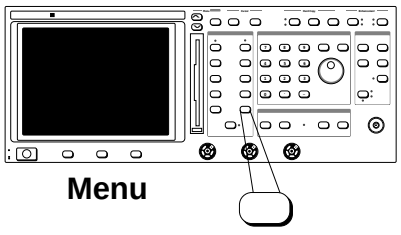
Step 4. Press the Channel 1 Menu key.



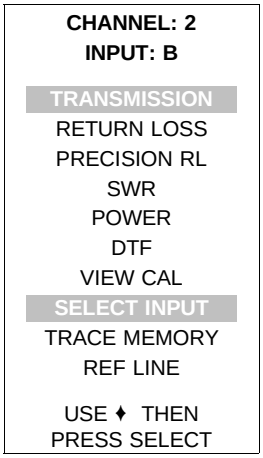
Step 5. Select **TRANSMISSION** and **SELECT INPUT** from the displayed menu..



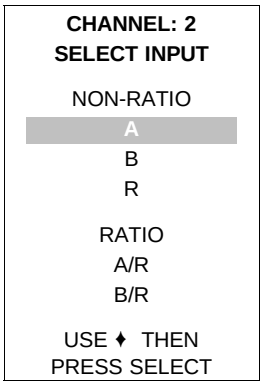
Step 6. Select **NON-RATIO A** from the displayed menu.



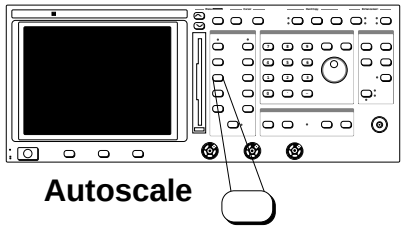
Step 7. Press the Channel 2 Menu key.



Step 8. Select **TRANSMISSION** and **SELECT INPUT** from the displayed menu..

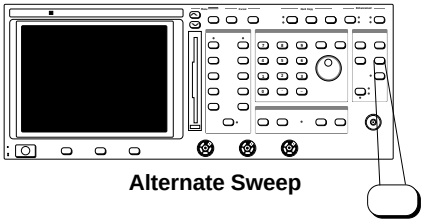


Step 9. Select **NON-RATIO A** from the displayed menu.

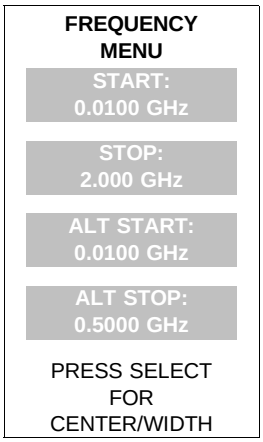


Step 10. Press the Channel 1 Autoscale key. This gives an optimum vertical display of the test data.

Press the Channel 2 Display On/Off key to off, if desired, to view Channel A only.



Step 11. Press Alternate Sweep key.

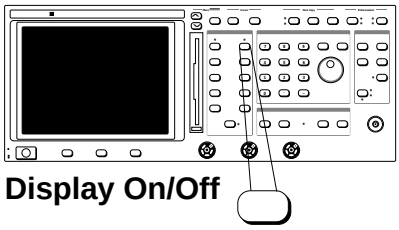


Step 12. Select **START**, from the displayed menu (left) and enter a frequency using the Data Entry keypad or rotary knob. (0.100 GHz is used in this example.)

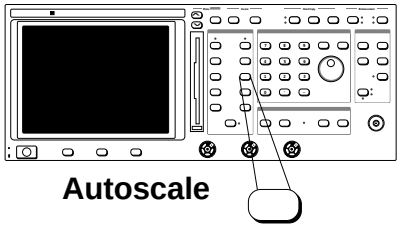
Step 13. Select **STOP** and enter a frequency. using the Data Entry keypad or rotary knob. (2.000 GHz is used in this example.)

Step 14. Select **ALT START**, from the displayed menu (left) and enter a frequency using the Data Entry keypad or rotary knob. (0.100 GHz is used in this example.)

Step 15. Select **ALT STOP** and enter a frequency. using the Data Entry keypad or rotary knob. (0.500 GHz is used in this example.)

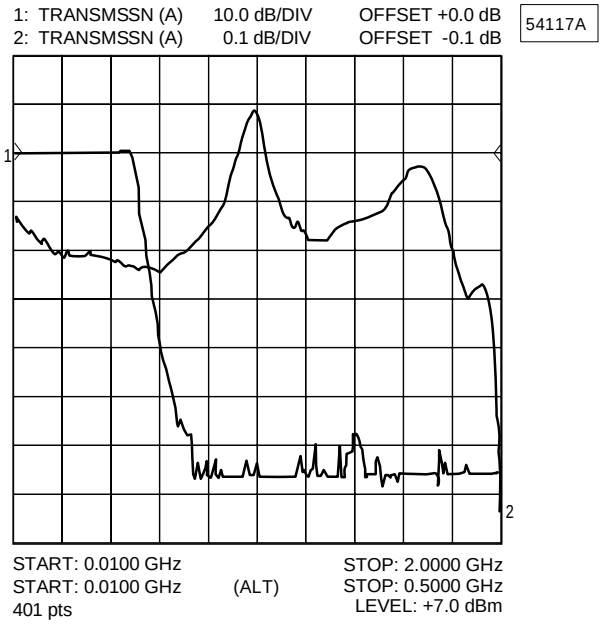


Step 16. Press the Channel 2 Display On/Off key to On.

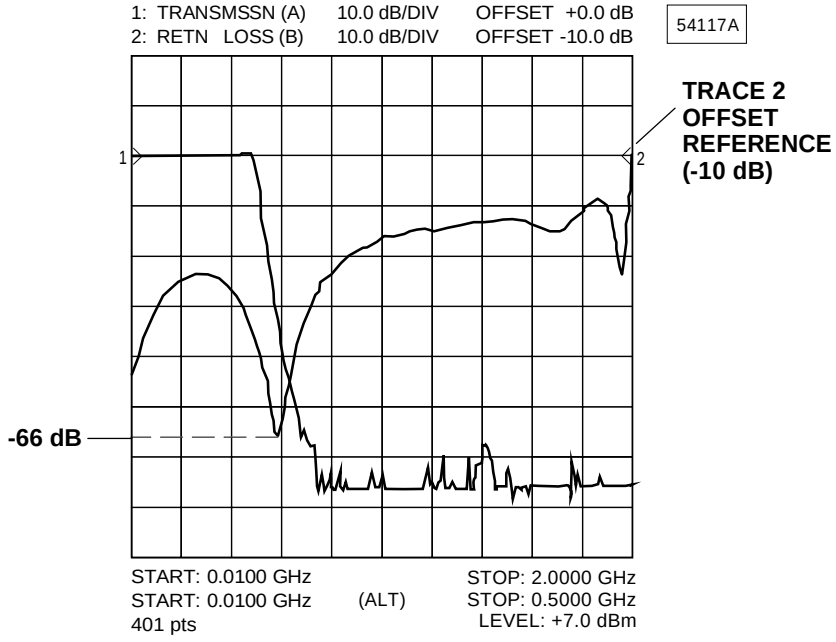


Step 17. Press the Channel 2 Autoscale key.

*Refer to Figure 5-3, part a, which shows an example of a transmission measurement of the frequency response of a **500** MHz filter using the Alternate Sweep Mode.*

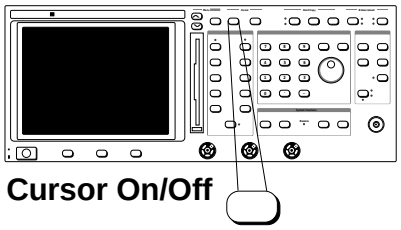


a. Alternating sweep mode measurement display of the transmission characteristics of a 500 MHz filter. The pass band starts at 10 MHz and extends to about 500 MHz. Trace 2 shows an expanded view of the pass band. The start and stop frequencies for trace 2 are marked **"ALT"** in the second frequency parameter line below the graticle display.



b. Alternating sweep mode measurement display of the return loss characteristics of the same 500 MHz filter. Trace 2 shows an expanded view of the return loss characteristics. As shown, the maximum return loss is approximately 66 dB at 500 MHz; the minumum is approximately 10 dB. (Note that the Trace 2 Reference Line is offset by –10 dB.)

Figure 5-3. *Examples of Alternating Sweep Mode Measurements*

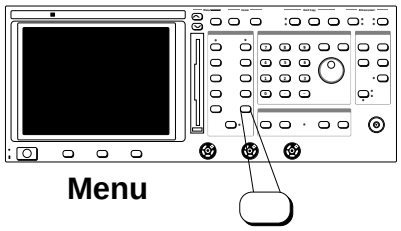


Step 18. Press the Cursor On/Off key (left)

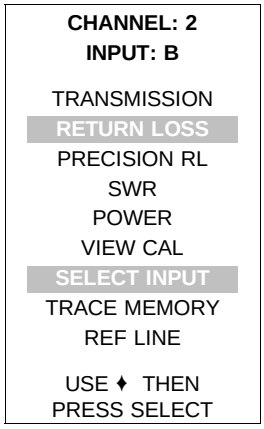
Observe the readout to obtain transmission measurement data at frequencies of interest.

Step 19. If desired, make a hard copy printout of the transmission loss data as described in Step 15 of paragraph 5-4.

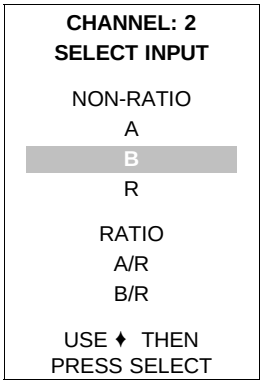
Return Loss Measurement



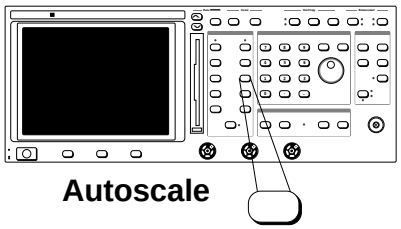
Step 20. Press the Channel 2 Menu key (left).



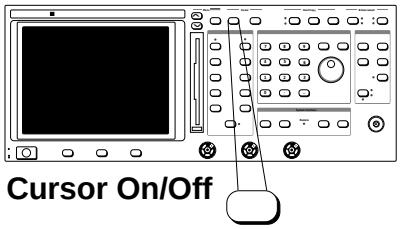
Step 21. Select **RETURN LOSS** and **SELECT INPUT** from the displayed menu.



Step 22. Select **NON-RATIO B** from the displayed menu.



Step 23. Press the Channel 2 Autoscale key.



Step 24. Press the Cursor On/Off key (left).

Step 25. Observe the readout to obtain return loss data at frequencies of interest.

Step 26. An example of a return loss measurement using the Alternate Sweep Mode is shown in Figure 5-3, part b.

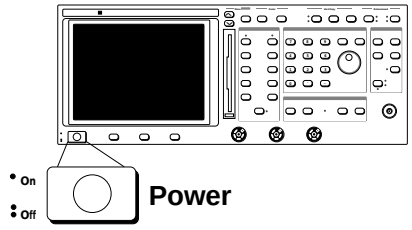
Step 27. Use the cursor readout function to obtain return loss measurement data at frequencies of interest. If desired, make a hard copy printout of the return loss data as described in Step 15 of paragraph 5-4.

END OF PROCEDURE

5-6 RATIO MODE MEASUREMENT

Ratio-mode measurements arithmetically subtract the R input from either the A or B input. This type of measurement is set up by using the Network Analyzer channel setup menus for Channel 1 and/or Channel 2. The procedure for making these measurements is described below. A typical equipment setup for this measurement is shown in Figure 5-4.

The ratio measurement mode has many uses. It can be used to compensate for the effects of a long signal transmission path, such as where the device-under-test (DUT) is located remotely from the 541XXA system. Using extender cables between the Autotester (and/or detector) and the 541XXA, it is possible to locate the DUT more than 200 feet from the 541XXA (refer to Chapter 1). Ratio mode is used to maintain system calibration when the **RF OUTPUT** level is changed during the test.



Step 1. Connect test equipment per Figure 5-4, except do not connect the test device. Turn the printer on.

Step 2. Press the Power key (left) to On. Verify the 541XXA passes the Self Test satisfactorily.

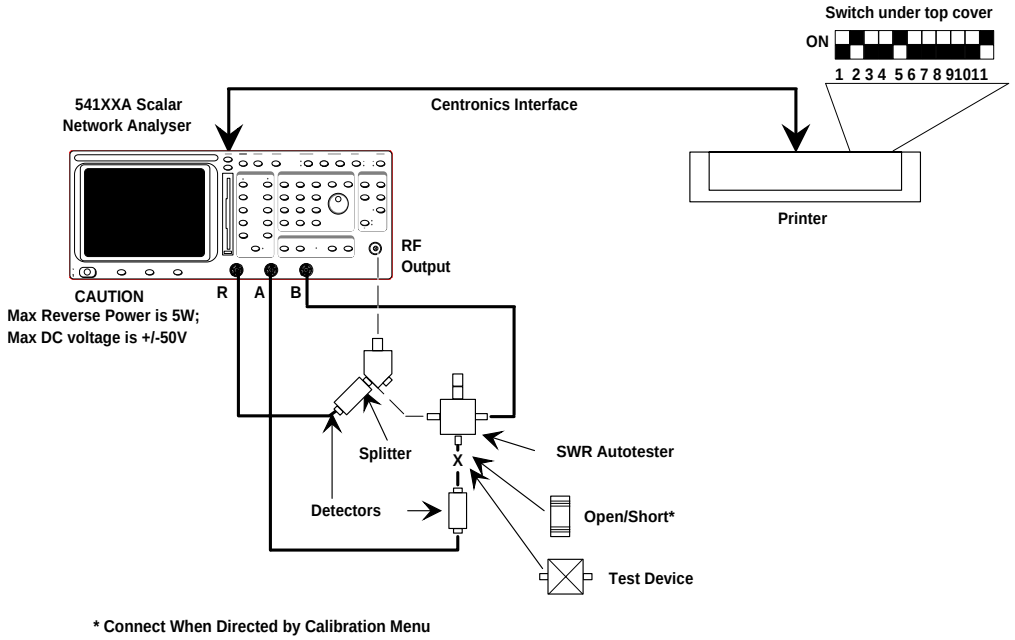
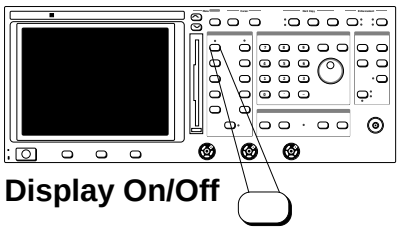
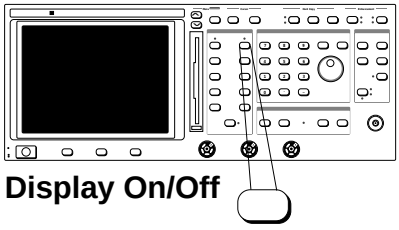


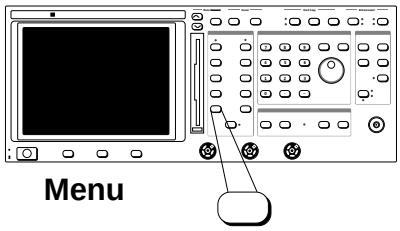
Figure 5-4. *Typical Equipment Test Setup for a Ratio Mode Measurement*



Step 3. Press the Channel 1 Display On/Off key (left) to On.



Step 4. Press the Channel 2 Display On/Off key (left) to On.



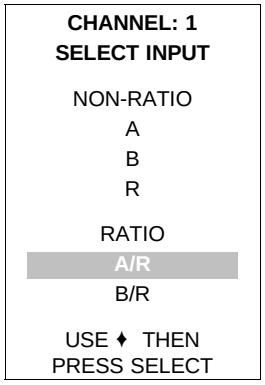
Step 5. Press the Channel 1 Menu key (left).

CHANNEL: 1
INPUT: A

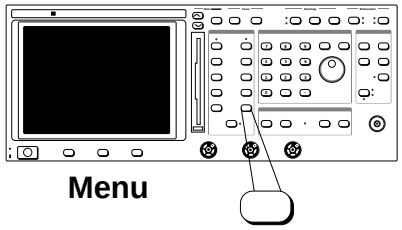
TRANSMISSION
RETURN LOSS
PRECISION RL
REL G/DELAY
SWR
POWER
DTF/DB
DTF/SWR
SELECT INPUT
TRACE MEMORY
MORE

USE ♦ THEN
PRESS SELECT

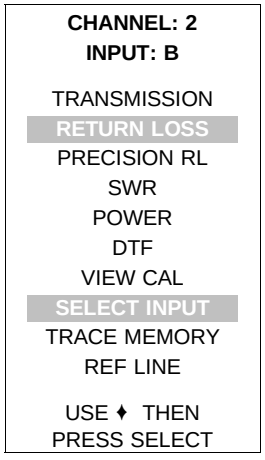
Step 6. Select **TRANSMISSION** then **SELECT INPUT** from the displayed menu (left).



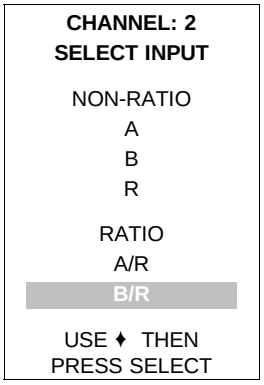
Step 7. Select **RATIO A/R** from the displayed menu (left).



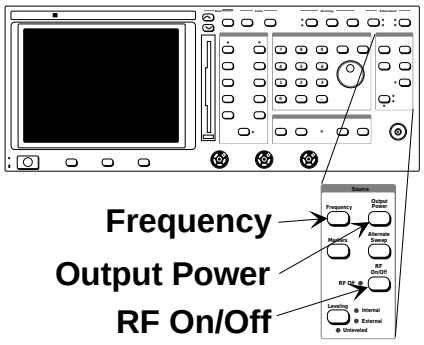
Step 8. Press the Channel 2 Menu key (left).



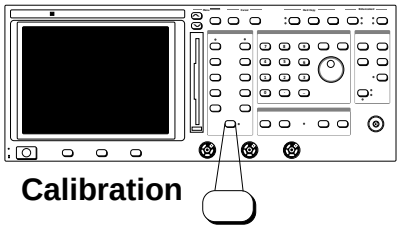
Step 9. Select **RETURN LOSS** then **SELECT INPUT** from the displayed menu (left).



Step 10. Select **RATIO B/R** from the displayed menu (left).

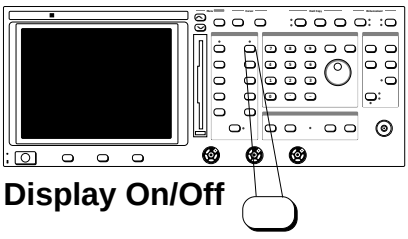


Step 11. Set the Source controls (left) to the desired frequency range and power output level for the test. For the example in Figure 5-4, the start frequency is 0.700 GHz, stop frequency is 3.5 GHz and output power is –10 dBm.

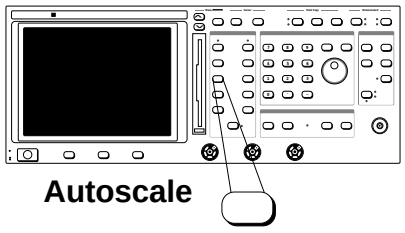


Step 12. Press the Calibration key (left) and follow the instructions displayed in the calibration menus, as shown in Figure 5-2.

Transmission Loss Measurement (Ratio Mode)



Step 13. Press the Channel 2 Display On/Off key (left) to OFF.



Step 14. Press the Channel 1 Autoscale key (left). This gives an optimum vertical display of the test data.

Step 15. Read the transmission loss (ratio A/R) by using the cursor data readout function to obtain measurement data at frequencies of interest (refer to paragraph 5-4, Step 7). An example of a ratio mode measurement display is shown in Figure 5-5. This figure shows both transmission loss (Trace 1) and return loss (Trace 2).

Step 16. If desired, make a hard copy printout of the transmission loss data as described in paragraph 5-4, Step 15.

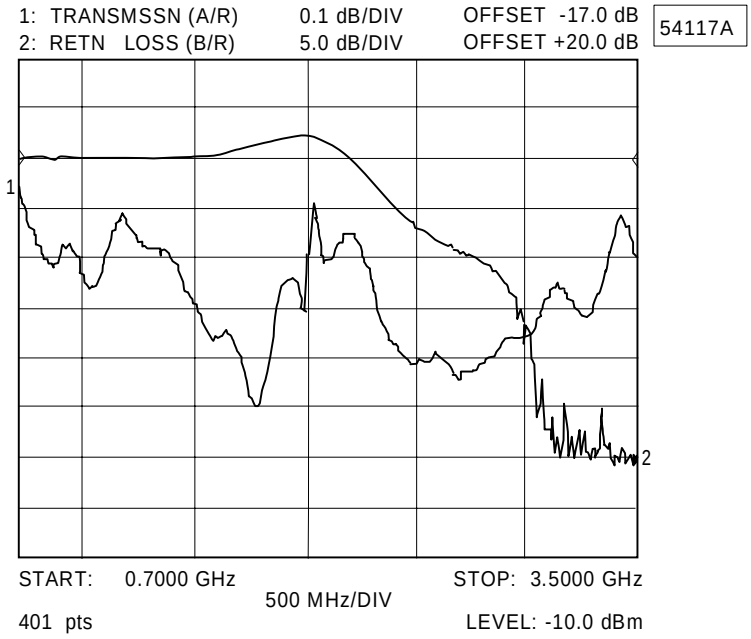
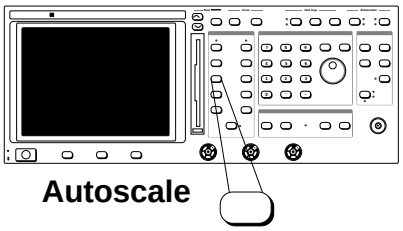


Figure 5-5. *Ratio Mode Measurement Display (Example)*

Return Loss Measurement

Step 17. Press the Channel 2 Display On/Off key to on, and the Channel 1 Display On/Off key to off.

Step 18. Press the Channel 2 Autoscale key (left).



Step 19. Read the return loss (ratio B/R) by using the cursor data readout function.

Step 20. If desired, make a hard copy printout of the return loss data as described in Step 15 of paragraph 5-4.

END OF PROCEDURE

5-7 ABSOLUTE POWER MEASUREMENT

A procedure for using the 541XXA to measure absolute power is given below.

Step 1. Perform the 541XXA Operational Checkout Procedure as described in paragraph 5-1.

Step 2. Verify that the output of the external RF source to be measured is off.

Step 3. Connect the RF detector between the 541XXA Input A connector and the RF source, as shown in Figure 5-6.

For a swept frequency power measurement, the 541XXA and the RF source must be synchronized. The signal from the 541XXA rear panel Horizontal Output *can be used to trigger (or drive) the RF source for this application.*

CAUTION

Before performing the measurement, determine that the power output of the RF source will not exceed the maximum input power limit for the detector and/or matching adaptors used. Use a suitable attenuator, if necessary.

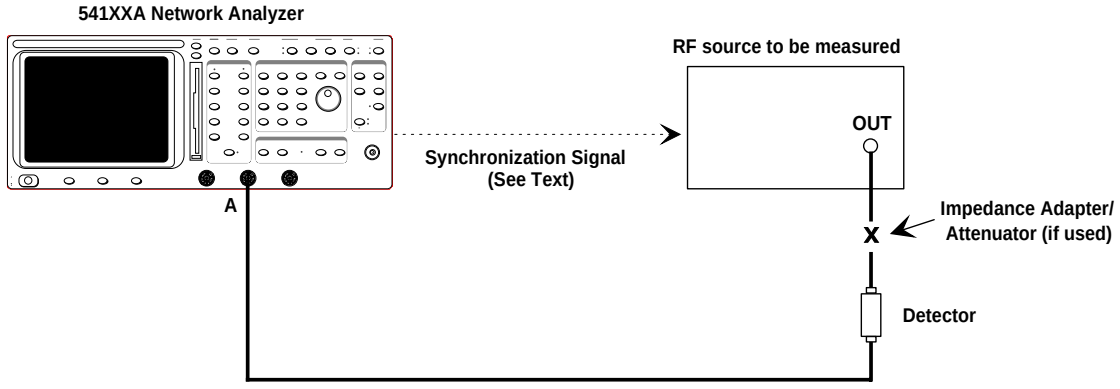
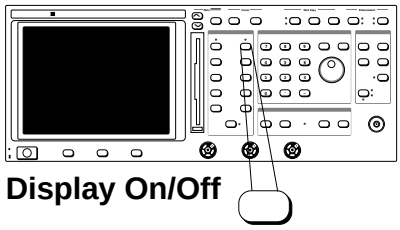
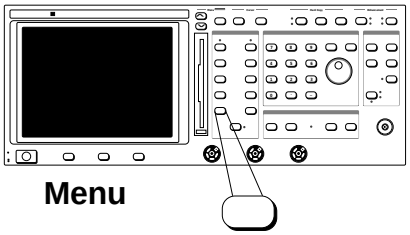


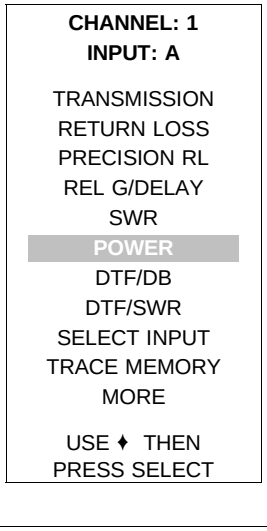
Figure 5-6. *Test Setup for Absolute Power Measurement*



Step 4. Set the Channel 2 Display On/Off key to Off (left).

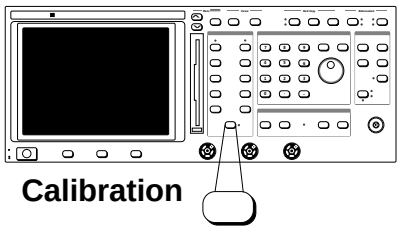


Step 5. Press the Channel 1 Menu key.

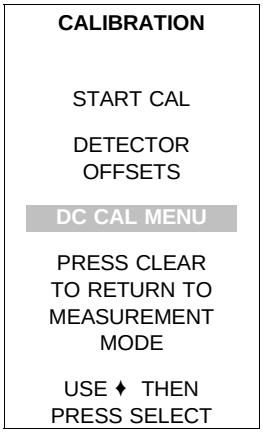


Step 6. Select **POWER** from the displayed menu (left).

Verify that input **"A"** *is selected as the input connector for Channel 1.*



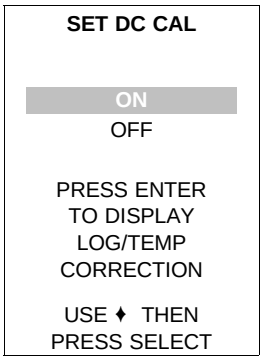
Step 7. Press the Calibration key (left).



Step 8. Select **DC CAL MENU** from the displayed menu (left).

Optional: *Use the DETECTOR OFFSETS selection to match the RF detector's sensitivity to a power meter's measurement.*

1. *Connect a calibration quality (secondary standard) power meter to one arm of a power splitter.*
2. *Connect the 541XXA RF detector to the other arm.*
3. *Apply a **6.0** dBm fixed frequency input signal to the power splitter input.*
4. *Adjust the 541XXA DETECTOR OFFSET value until the 541XXA display is within ±**0.015** dB at the power meter's display.*



Step 9. Select **ON** from the displayed menu (left.

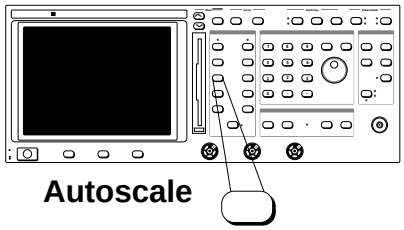
NOTES

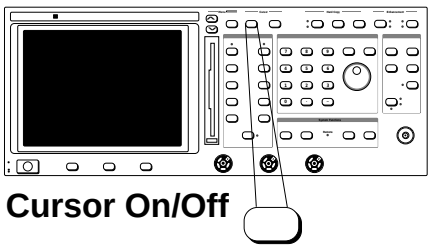
- This mode of operation sets the 541XXA to perform (power) measurements with the autozero function of each active (that is, POWER measurement) channel disabled. The autozero correction voltage for each active channel is held at the value in effect when the **DC CAL** function was enabled.

- While in the **DC CAL** mode, if the measurement input connector is changed (INPUT A, B, R), or a different detector is connected, etc., then a warning message will be displayed. To clear this condition, turn the RF source power off and press SELECT to re-establish the autozero values.

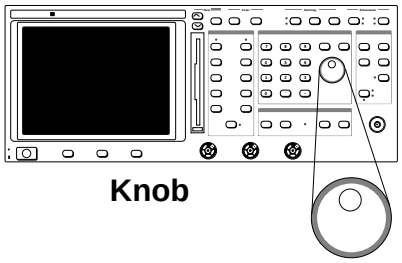
Step 10. Set the output of the external RF source on.

Step 11. Press the Channel 1 Autoscale key (left). This gives an optimum vertical display of the test data.





Step 12. Press the Cursor On/Off key (left), to ON.



Step 13. Using the Data Entry rotary knob (left), move the cursor from the low to the high ends of the trace and read the RF source output power (in dBm) at the frequencies of interest.

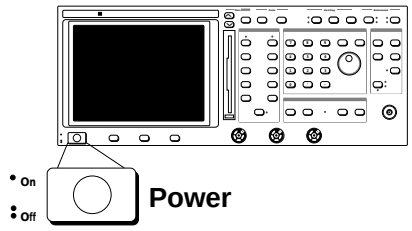
NOTE

If a matching adaptor or attenuator is used, the insertion loss of the added device must be taken into account when reading out the measurement data.

END OF PROCEDURE

5-8 PRECISION RETURN LOSS CALIBRATION AND MEASUREMENT

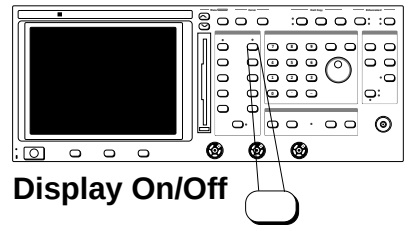
The 541XXA is capable of making precision return loss measurements of adapters, terminations, attenuators, and other high-return-loss components. Measurements require use of a precision air line and an Offset SWR Autotester (Figure 5-7). Measurements made using this mode and the above mentioned components will provide results that are traceable to the NIST (National Institute for Standards and Technology) standards for the precision air line.



Step 1. Connect test equipment per Figure 5-7.

Step 2. Press the Power pushbutton (left) to On.

*At the conclusion of the self test, "**ALL TESTS PASSED**" will be displayed and the 541XXA will be ready to make a measurement.*



Step 3. Press the Channel 2 Display On/Off key (left) to off.

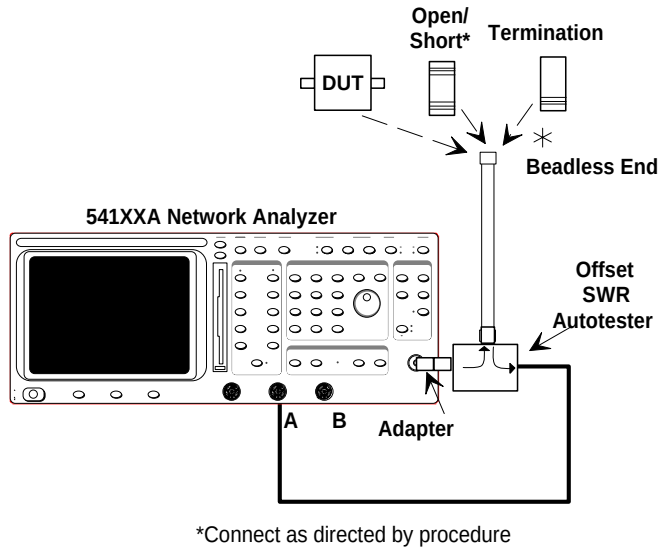
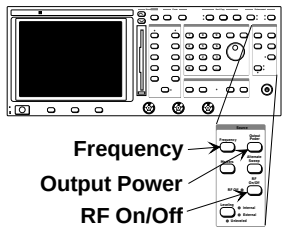
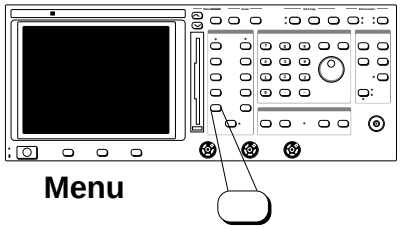


Figure 5-7. *Test Setup for a Precision Return Loss Measurement*



Step 4. Set the 541XXA signal source controls (left) to the desired frequency range and power output level for the test.

*For the example included in this procedure, the start frequency is **0.01** GHz; the stop frequency is **20** GHz; and the power output is set to **+7.0** dBm.*



Step 5. Press the Channel 1 Menu key (left).

CHANNEL: 1
INPUT: A

TRANSMISSION
RETURN LOSS
PRECISION RL
REL G/DELAY
SWR
POWER
DTF/DB
DTF/SWR
SELECT INPUT
TRACE MEMORY
MORE

USE ♦ THEN
PRESS SELECT

Step 6. Select **PRECISION RL** from the displayed menu (left).

PRECISION
RETURN LOSS

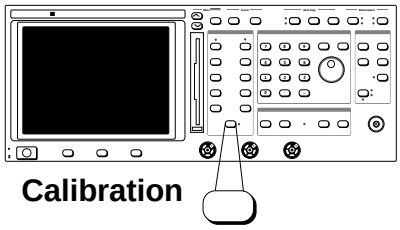
SET FORMAT
FINAL
TUNING

USE ♦ THEN
PRESS Select

Step 7. Select **TUNING** from the displayed menu (left).

The **TUNING** *selection provides a slightly faster response time and can be used to tune the device under test (DUT) for minimum ripple. It also provides an indication of a mis-mating between air line and DUT.*

The **FINAL** *selection provides the measurement signal following the computer's mathematical "ripple-extraction" process. This measurement data is NIST traceable due to the air line's excellent impedance match.*



Step 8. Press the Calibration key (left), then press the Select key to start the calibration process.

PRECISION RETURN LOSS CALIBRATION

CONNECT OFFSET AUTOTESTER AND AIRLINE AS SHOWN TO CHANNEL 'A'

PRESS SELECT WHEN READY

Step 9. Verify that the test setup is connected as shown on the 541XXA CRT (which is the same as shown in Figure 5-7) and described in the associated prompt (left). Then press the Select key to start the calibration process

NOTE

Ensure that the beadless end is connected to the point of measurement.

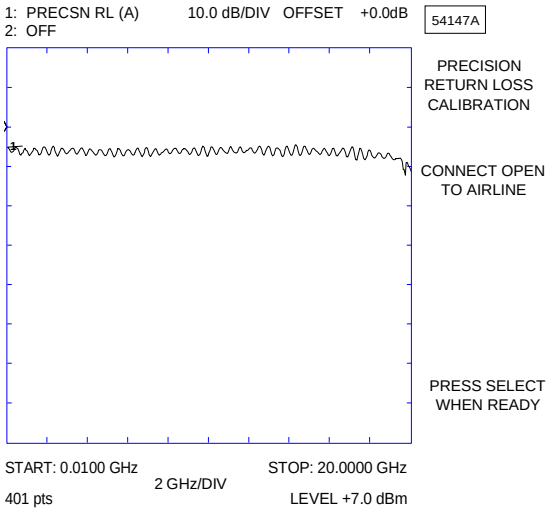
PRECISION RETURN LOSS CALIBRATION

CONNECT OPEN TO AIRLINE

PRESS SELECT WHEN READY

Step 10. At the next prompt (left) connect the Open to the beadless end of the air line. Then press the Select key to start the calibration process.

Step 11. Verify that the display resembles that shown below.



PRECISION RETURN LOSS CALIBRATION

REMOVE OPEN AND CONNECT SHORT

PRESS SELECT WHEN READY

Step 12. At the next prompt (left) remove the Open and connect the Short to the beadless end of the air line. Then press the Select key to start the calibration process.

PRECISION RETURN LOSS CALIBRATION

CONNECT TERMINATION TO AIRLINE

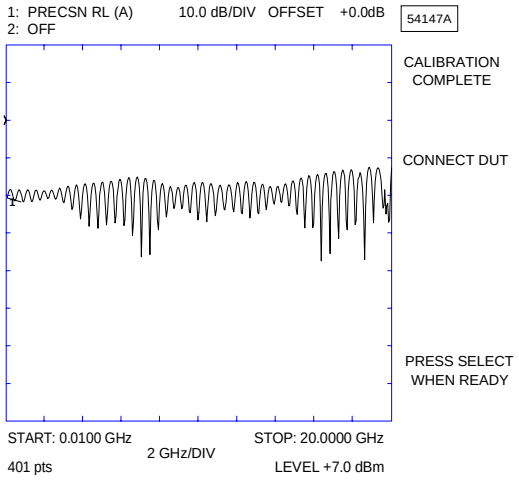
PRESS SELECT WHEN READY

Step 13. Next, remove the Short and connect the Termination to the beadless end of the air line. Then press the Select key to start the calibration process.

Step 14. Remove the Termination. The calibration is complete.

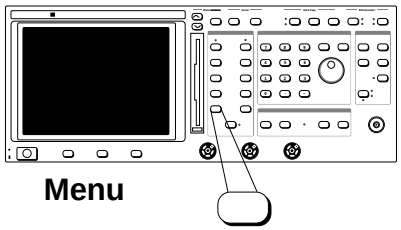
Step 15. Connect the DUT to the beadless end of the air line, and press Select to start the measurement.

Step 16. Observe that the ripple pattern resembles that shown below.

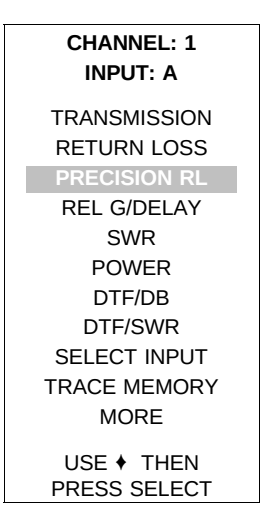


NOTE

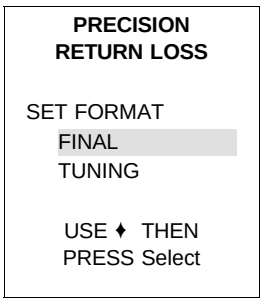
The above waveform is from an adapter terminated with an ANRITSU Termination. Your waveform will have different peak-to-peak magnitudes.



Step 17. Press the Channel 1 Menu key (left).

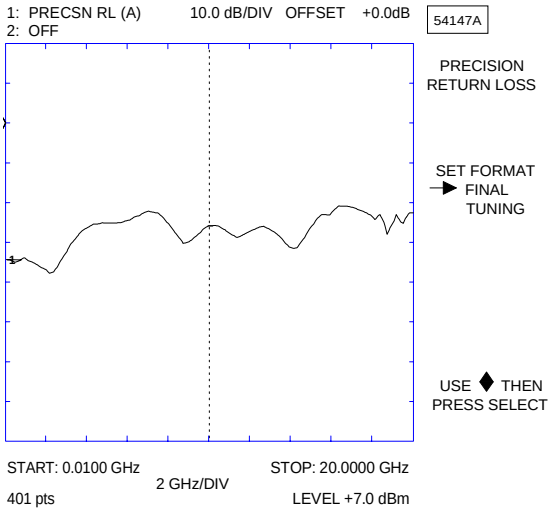


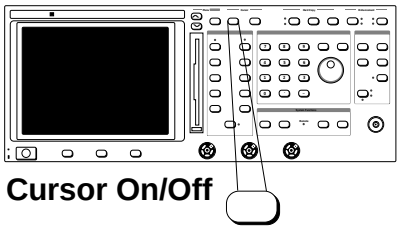
Step 18. Select **PRECISION RL** from the displayed menu (left).



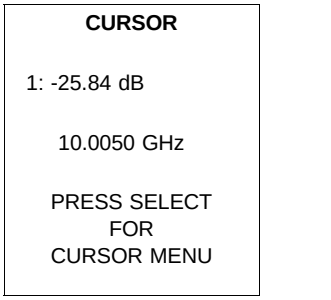
Step 19. Select **FINAL** from the displayed menu (left).

Step 20. Observe that the display changes and now resembles that shown below.





Step 21. Press the Cursor On/Off key (left).



Step 22. Observe the CURSOR MENU readout. This the return loss from the DUT at the frequency shown.

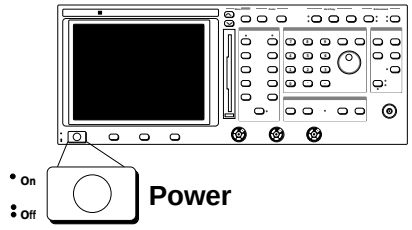
END OF PROCEDURE

5-9 DIRECTIVITY CALIBRATION AND MEASUREMENT

The 541XXA is capable of accurately measuring the directivity of SWR Autotesters using the Precision Return Loss measurement function. This paragraph assumes familiarity with the Precision Return Loss Measurement and Calibration procedures in paragraph 5-8.

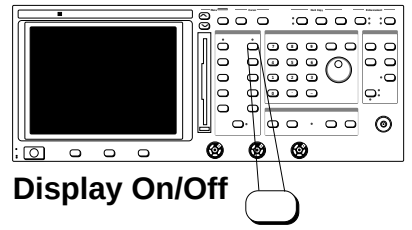
Step 1. Connect test equipment per Figure 5-8.

Note that the difference in the test setup is that the beadless end of the air line connects to the SWR Autotester and that the termination is a 20 dB Offset Termination. Also, the SWR Autotester is a standard model instead of the special offset model used in paragraph 5-8.

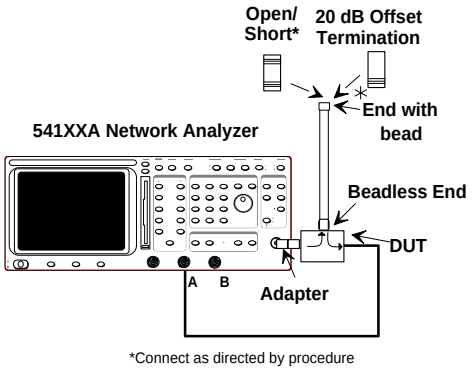


Step 2. Press the Power pushbutton (left) to On.

*At the conclusion of the self test, "**ALL TESTS PASSED**" will be displayed and the 541XXA will be ready to make a measurement.*



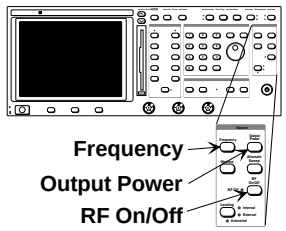
Step 3. Press the Channel 2 Display On/Off key (left) to off.



NOTE

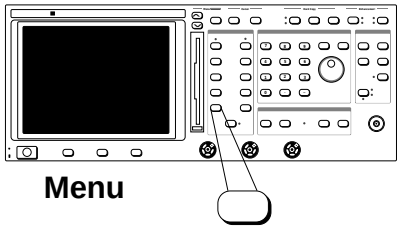
For directivity measurements, the DUT (Device Under Test) is a Coupler, RF Bridge, or SWR Autotester. For Coupler directivity tests, a low return loss attenuator is required between the source output and the Coupler's main line input. For both Couplers and RF Bridges, a ANRITSU RF Detector is required for measuring the ripple response. For Waveguide Coupler tests, substitute a 1/2 wavelength offset short for the Open and a 20 dB mismatch section for the Offset Termination.

Figure 5-8. *Test Setup for a Precision Return Loss Measurement*



Step 4. Set the 541XXA signal source controls (left) to the desired frequency range and power output level for the test.

*For the example included in this procedure, the start frequency is **0.01** GHz; the stop frequency is **20** GHz; and the power output is set to **+7.0** dBm.*



Step 5. Press the Channel 1 Menu key (left).

CHANNEL: 1
INPUT: A

TRANSMISSION
RETURN LOSS
PRECISION RL
REL G/DELAY
SWR
POWER
DTF/DB
DTF/SWR
SELECT INPUT
TRACE MEMORY
MORE

USE ♦ THEN
PRESS SELECT

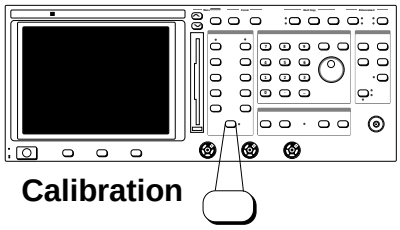
Step 6. Select **PRECISION RL** from the displayed menu (left).

PRECISION
RETURN LOSS

SET FORMAT
FINAL
TUNING

USE ♦ THEN
PRESS SELECT

Step 7. Select **FINAL** from the displayed menu (left).



Step 8. Press the Calibration key (left), then press the Select key to start the calibration process.

Step 9. Verify that the test setup is connected as as shown in Figure 5-8 and described in the associated prompt (left). Then press the Select key to start the calibration process

NOTE

Ensure that the air line's beadless end is connected to the DUT test port.

PRECISION RETURN LOSS CALIBRATION

CONNECT OFFSET AUTOTESTER AND AIRLINE AS SHOWN TO CHANNEL 'A'

PRESS SELECT WHEN READY

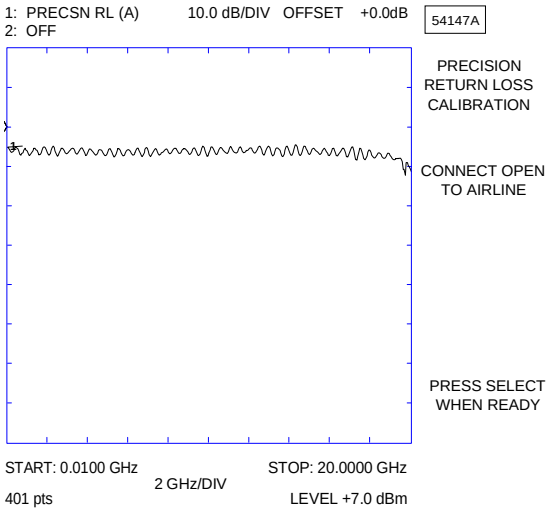
Step 10. At the next prompt (left) connect the Open to the the air line. Then press the Select key to start the calibration process.

Step 11. Verify that the display resembles that shown below.

PRECISION RETURN LOSS CALIBRATION

CONNECT OPEN TO AIRLINE

PRESS SELECT WHEN READY



PRECISION RETURN LOSS CALIBRATION

REMOVE OPEN AND CONNECT SHORT

PRESS SELECT WHEN READY

Step 12. At the next prompt (left) remove the Open and connect the Short to the beaded end of the air line. Then press the Select key to start the calibration process.

PRECISION RETURN LOSS CALIBRATION

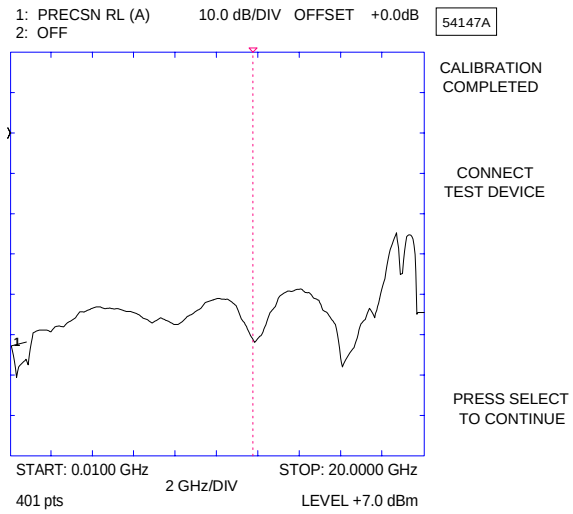
CONNECT TERMINATION TO AIRLINE

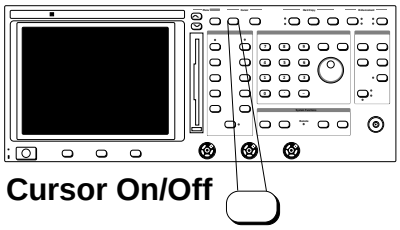
PRESS SELECT WHEN READY

Step 13. Next, remove the Short and connect the Termination to the air line. Then press the Select key to start the calibration process.

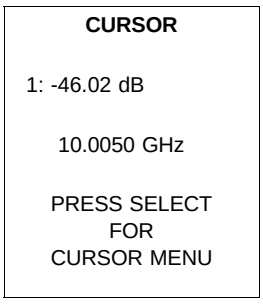
Step 14. Leave the 20 dB Offset Termination in place. The calibration is complete.

Step 15. Press Select to start measurement; observe that the waveform resembles that shown below.





Step 16. Press the Cursor On/Off key (left) to on.



Step 17. Observe the CURSOR MENU readout. This the return loss from the SWR Autotester at the frequency shown.

END OF PROCEDURE

Chapter 6
Distance To Fault (DTF) Measurement and Calibration

Table of Contents

Chapter 6
Distance To Fault (DTF) Measurement and Calibration

6-1 INTRODUCTION

This chapter describes the Distance-To-Fault (DTF) feature. It provides a detailed, step-by-step procedure for performing a DTF measurement and calibration. This chapter also contains charts and tables providing coaxial and waveguide performance data.

6-2 OPERATION

The frequency is set for the main 541XXA operation using the Frequency key in the Source key-group (right side of front panel). When the DTF mode is entered, the frequency previously set is the maximum range of the instrument (default) or the range that was last used in the DTF mode. If this range is very narrow it automatically increases the minimum range over which a DTF measurement is performed. In other words, the sweep must be wide enough to generate sufficient reflective ripples for fault analysis. Being able to alter the frequency range lets you restrict the DTF operation to frequencies that the test device or cable can propagate.

The DTF mode can display in dB or SWR. A dB display is accessed by selecting DTF/DB from the Channel 1 menu. An SWR display is accessed from a separate menu that appears when the Channel 1 Menu key is pressed a second time. When in DTF/SWR display mode the Channel 1 and 2 traces will display SWR values. The cursor and single limits are also in SWR. The Relative cursor is displayed in dBr.

NOTE

If a trace is stored to Channel 2 memory and the DTF/SWR mode is exited, the relative dBr cursor value is invalid until new trace memory data is stored.

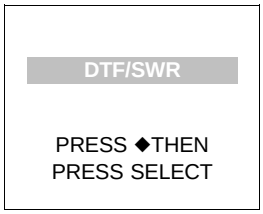
All other operator parameters are accessed using the DTF menus that appear when DTF is selected from the Channel 1 or 2 Menu key.

6-3 DTF/SWR MEASUREMENT MODE

The DTF/SWR measurement mode is described in the following paragraphs.

Access to DTF/SWR Measurement Mode

Press the Channel 1 “Menu” key until the DTF/SWR menu (left) appears.



DTF/SWR Measurement Mode Operational Description

Normal DTF measurements display trace data in dB. The DTF/SWR mode translates the dB trace information into SWR values. The trace offset, resolution, cursor and single limits are also displayed in SWR. The relative cursor is displayed in relative dB (i.e. dBr). All other operational parameters are the same as normal DTF dB mode. If a dB trace is required when operating in the DTF/SWR mode or an SWR trace is required when operating in the DTF/DB mode, exit the DTF mode and re-enter the other DTF/SWR or DTF/DB mode and the new trace will display as required. Recalibration is not required when changing between DTF/SWR and DTF/DB modes. The plotter and printer outputs will be in SWR units if DTF/SWR mode is active. Front-panel-setup memories may be used to store a DTF/SWR set up. The DTF/SWR mode may be entered via the GPIB by sending the "SM 1 W" command.

Measurement Exclusion

The dBr relative cursor readout for the DTF/SWR trace memory Channel 2 remains valid while in the DTF/SWR mode. If the DTF/SWR mode is exited and re-entered the DTF/SWR trace memory will be displayed correctly but the Channell 2 dBr value will be invalid.

6-4 TEST SETUPS

When using the DTF feature, the 541XXA can be operated in two modes. Best use depends on the accessibility of the transmission line to be tested. When the test equipment and the line-to-be-tested can be located close to each other, the standard mode setup (Figure 6-1) is preferred because of its simplicity.

When the transmission line must be tested in place and the test equipment cannot be located near it, the ratio mode setup (Figure 6-2) should be used.

The ratio mode setup requires an additional detector and a power splitter. The detectors and their connecting hardware should be located as close as possible to the line being tested. Extender cables may then used to connect to the 541XXA. The RF extender cable should be a low loss type with high-quality connectors.

NOTE

Figures 6-1 and 6-2 show part numbers for K-type connector transmission lines. Refer to the "54100A Series Network Analyzer Configuration Chart" tabulation on page 8 of the 54100A Technical Data Sheet in Appendix A.

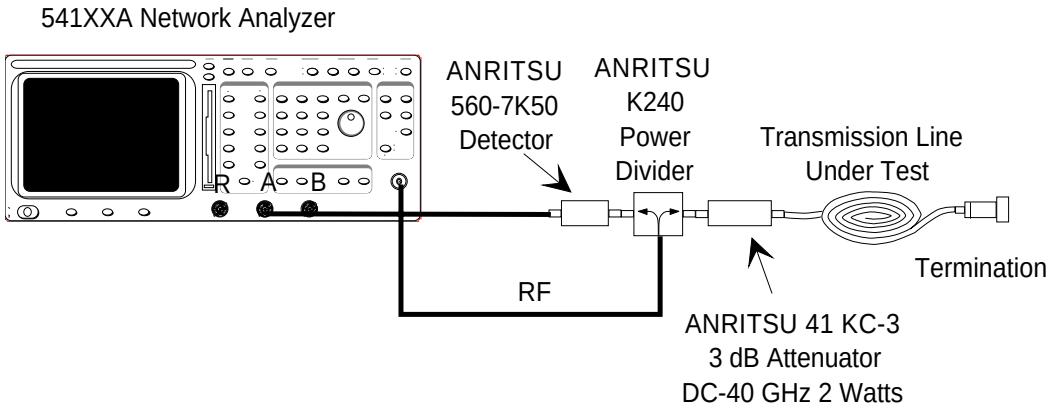


Figure 6-1. *Standard Mode 541XXA DTF Test Setup*

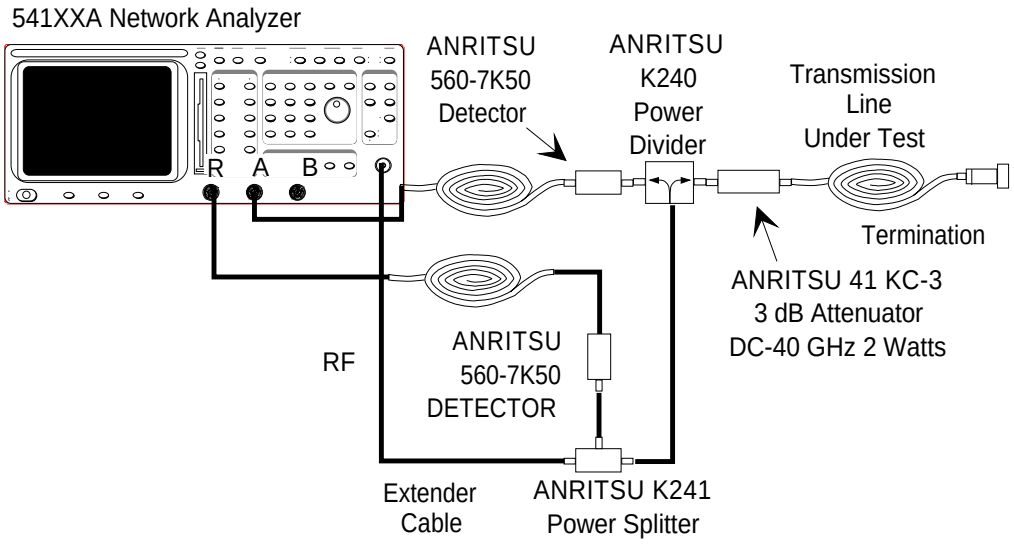


Figure 6-2. *Ratio Mode 541XXA DTF Test Setup*

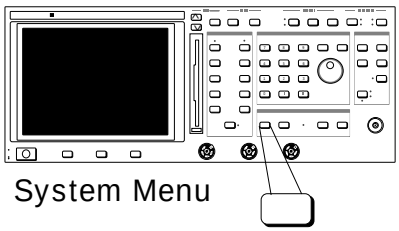
6-5 DISTANCE-TO-FAULT MEASUREMENT AND CALIBRATION

A procedure for using the 541XXA to make a distance to fault (DTF), standard mode measurement is given below.

Key Assumptions: DTF measurement of a coaxial transmission line using a 54117A or 54147A. Maximum frequency range of the transmission line is 2 to 8 GHz, distance scale is in meters, and display resolution is 512 data points.

Step 1. Connect the test setup for a ratio mode measurement per Figure 6-1.

Step 2. Press the System Menu key (left).



Step 3. Select **SYSTEM SETUP** from the displayed menu (left).

SYSTEM MENU

DISK UTILITIES

SYSTEM SETUP

DATA POINTS

RESET

CONFIGURE
SOURCE
ANALYZER
PLOTTER
APPLICATIONS
GPIB MODE

PRESS ◆THEN
PRESS SELECT

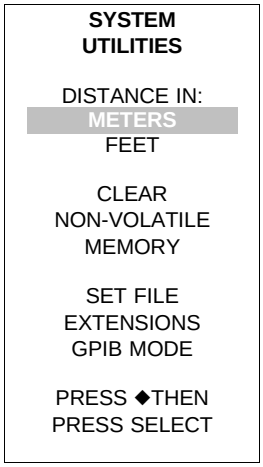
Step 4. Select **MORE** from the displayed menu (left).

SYSTEM SETUP

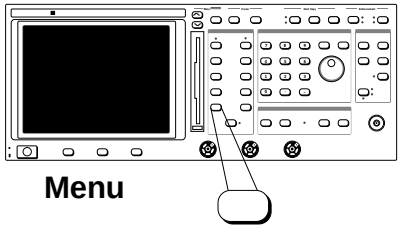
SET CLOCK

KEYCLICK
OFF
ON (low)
ON (high)

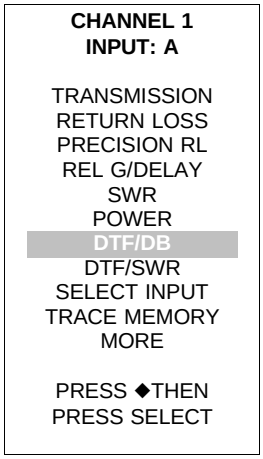
MORE



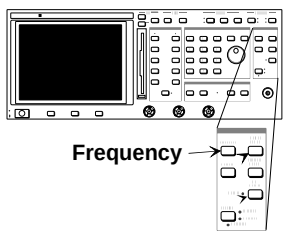
Step 5. Select **DISTANCE IN METERS** from the displayed menu (left).



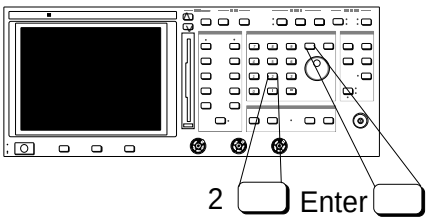
Step 6. Press the Channel 1 Menu key (left).



Step 7. Select **DTF/DB** from the displayed menu (left).



Step 8. Press the Frequency key (left).



Step 9. Press <2> on the keypad, then the <Enter> key (left)

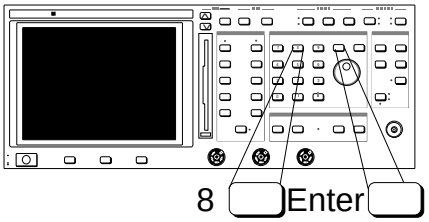
Observe that the frequency menu appears, that the **START ABOVE***: selection is highlighted, and that it shows 2.0000 GHz.*

FREQUENCY MENU DTF MODE

ENTER FREQUENCY LIMITS FOR DTF

START ABOVE: 2.0000 GHz

STOP BELOW: 8.0000 GHz



Step 10. Move the cursor to **STOP BELOW:**, using the <Select> key.

Step 11. Press <8> on the keypad, then the <Enter> key (left).

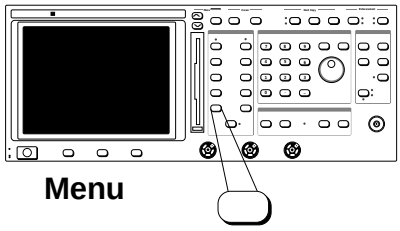
Observe that the **STOP BELOW***: selection shows 8.0000 GHz.*

FREQUENCY MENU DTF MODE

ENTER FREQUENCY LIMITS FOR DTF

START ABOVE: 2.0000 GHz

STOP BELOW: 8.0000 GHz



Step 12. Press the Channel 1 Menu key (left) to return to the DTF menu.

DTF MENU
INPUT: A

SET MEDIUM
COAX POLYE

RANGE
xxxxxx

DTF SETUP

DATA POINTS
256
512
1024

EXIT DTF

Step 13. Choose **SET MEDIUM** from the displayed menu (left).

DTF MEDIUM
COAX POLYE

SET MODE
COAX
WAVEGUIDE
COAX+GUIDE

COAX LIST

ENTER NEW
COAX

PROPAGATION
VELOCITY
X.XX

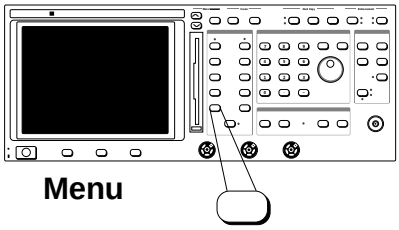
LOSS
X.XX dB/m

Step 14. Select **COAX** then **COAX LIST** from the displayed menu.

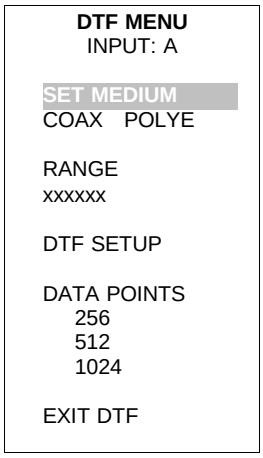
This selection displays a listing that lets you choose a type from a predefined list. An example:
POLYE is a polyethelene dielectric
AIR is an air dielectric
TEFL is a teflon dielectric
MTEFL is a microporous teflon dielectric

Step 15. Select **POLYE** from the list.

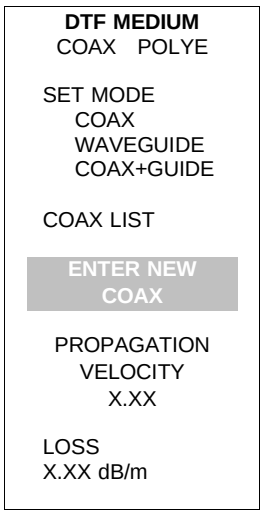
As an alternative to selecting from the predefined list, assume that you wish to add a new coaxial type to the list. Proceed as follows:



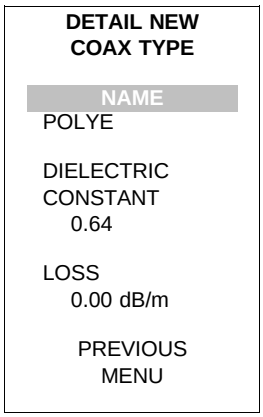
Step 16. Press the Channel 1 Menu key (left) to return to the DTF menu.



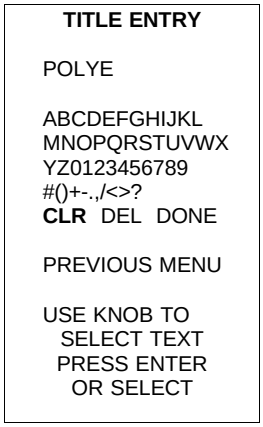
Step 17. Choose **SET MEDIUM** from the displayed menu (left) and press the <Select> key.



Step 18. Select **ENTER NEW COAX** from the displayed menu.



Step 19. With **NAME** hightlighted, press the <Select> key.



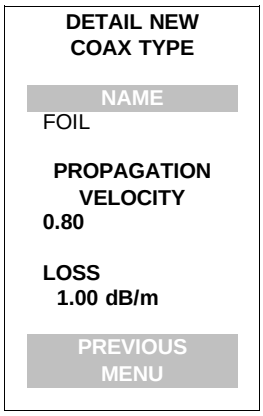
Step 20. Select **CLR** from the displayed menu, and press the <Select> key to clear the previous entry.

For this example we will create a new type named "FOIL." It will have a dielectric constant of .8 and a loss-per-meter of 1 dB.

Step 21. Use the <^>, <v>, and <Select> or <Enter> keys to spell-out **FOIL**.

Step 22. Move the cursor to **DONE** and press <Select> or <Enter>.

Step 23. Move the cursor to **PREVIOUS MENU** and press <Select> or <Enter>.



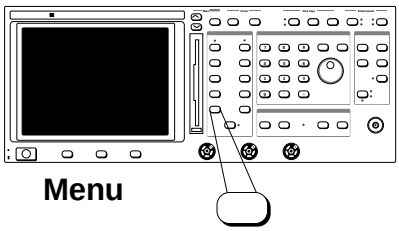
Step 24. Select **PROPAGATION VELOCITY**, from the displayed menu.

Step 25. Press the <.>. <8> then <Enter> keys on the keypad.

Step 26. Move the cursor to **LOSS**.

Step 27. Press the <1> then <Enter> keys on the keypad.

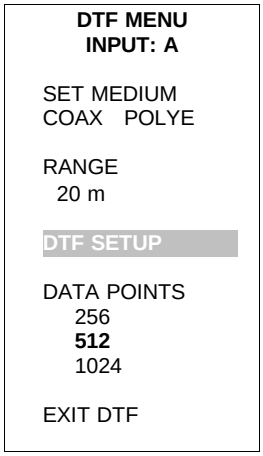
Step 28. Move the cursor to **PREVIOUS MENU** and press <Select> or <Enter>.



Step 29. Press the Channel 1 Menu key (left) to return to the DTF menu.

Step 30. Select **512** from the data-point listing in the displayed menu (left)

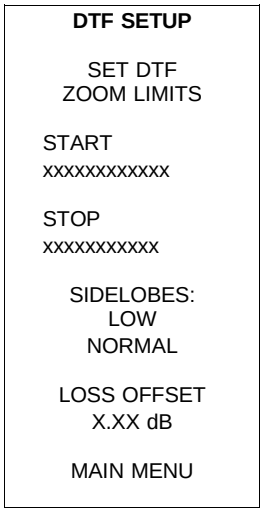
*The **1024** selection provides better distance resolution in the final plot but requires longer calibration and measurement times. For the fastest data plot, you might run the first test using **256** data points, then re-run the measurement using a higher resolution if you determine from the plot that it is needed. For this example, we'll use the middle value.*



Step 31. Enter a value for the **RANGE** option (left). This value is the length of the transmission line under test. For this example, enter 20 from the keypad.

*The 541XXA incorporates automated, high performance anti-aliasing software. For best results, set the RANGE value to about **1.5** times the length of the transmission line under test.*

Step 32. Select **DTF SETUP** from the displayed menu (left).



Step 33. In the DTF SETUP menu (left), observe that the **SET DTF ZOOM LIMITS, START** and **STOP** options have distance values.

These values are automatically entered, based on the frequency range and may be altered later to focus on new areas of the transmission-line-under-test. The total range allowed may be restricted by any of the setup parameters.

The **ZOOM LIMITS** *option lets you zoom in on an area of interest. Enter the points (in feet or meters) where you want to start and stop the zoom action. If the range is altered, the STOP distance will change accordingly.*

Step 34. If necessary enter a value for **LOSS OFFSET** (left). For this example, enter 10 from the keypad.

This menu option lets you compensate for an in-line attenuator (or other loss source). If not compensated for, the presence of such a device will distort the return loss indication.

Alternative Measurement Options

The procedure thus far has detailed menu options for a coax measurement. However, there are two additional options: **WAVEGUIDE** and **COAX+GUIDE**. The next several steps provide details for these menu choices.

Waveguide

*The waveguide menu (left) lets you select from a list or enter new waveguide in the same manner as described for coax. When a waveguide has been selected, the key frequency values—**F1, F2,** and cutoff, along with the loss value—will appear in the menu.*

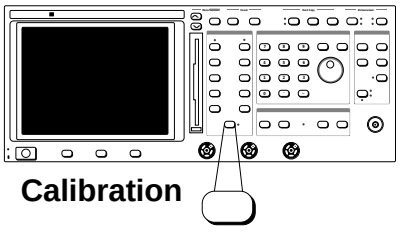
```
DTF MEDIUM
WAVE  WR15
POLY  INPUT

SET MODE
   COAX
   WAVEGUIDE
   COAX+GUIDE

GUIDE LIST

   ENTER NEW
   WAVEGUIDE

COAX LIST

   ENTER NEW
      COAX

   PREVIOUS
      MENU
```

Coax+Guide

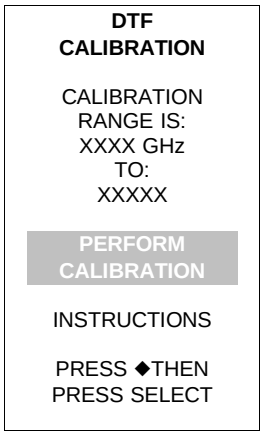
The coax+guide menu (left) lets you select from a list or enter new waveguide or coax types in the same manner as described for coax. This menu choice is intended for use with hybrid transmission lines where a length of waveguide has a coax line on its input.

*After making the appropriate choices in the DTF MEDIUM menu, choose PREVIOUS MENU to return to the DTF MENU. Here, you tell the program how long the input length of coax is. In this example, we'll say that it is **20** meters.*

```
DTF MENU
INPUT: A

SET MEDIUM
WAVE   WR15
COAX   POLYE

RANGE
xxxxxx

COAX LENGTH
  20.00 m

DTF SETUP

DATA POINTS
   256
   512
   1024

EXIT DTF
```



Step 35. Press the Calibration key (left).



Step 36. Select **PERFORM CALIBRATION** from the displayed menu (left).

Step 37. Follow the menu prompts (Figure 6-3) and step through the calibration sequence.

Step 38. After the calibration completes, remove the termination and connect the transmission line to be tested.

NOTE

For COAX + GUIDE, the cursor should be placed at the distance where the coax-to-waveguide transition is located. The mismatch reflection creates an easily recognized spike on the calibration screen display.

END OF PROCEDURE

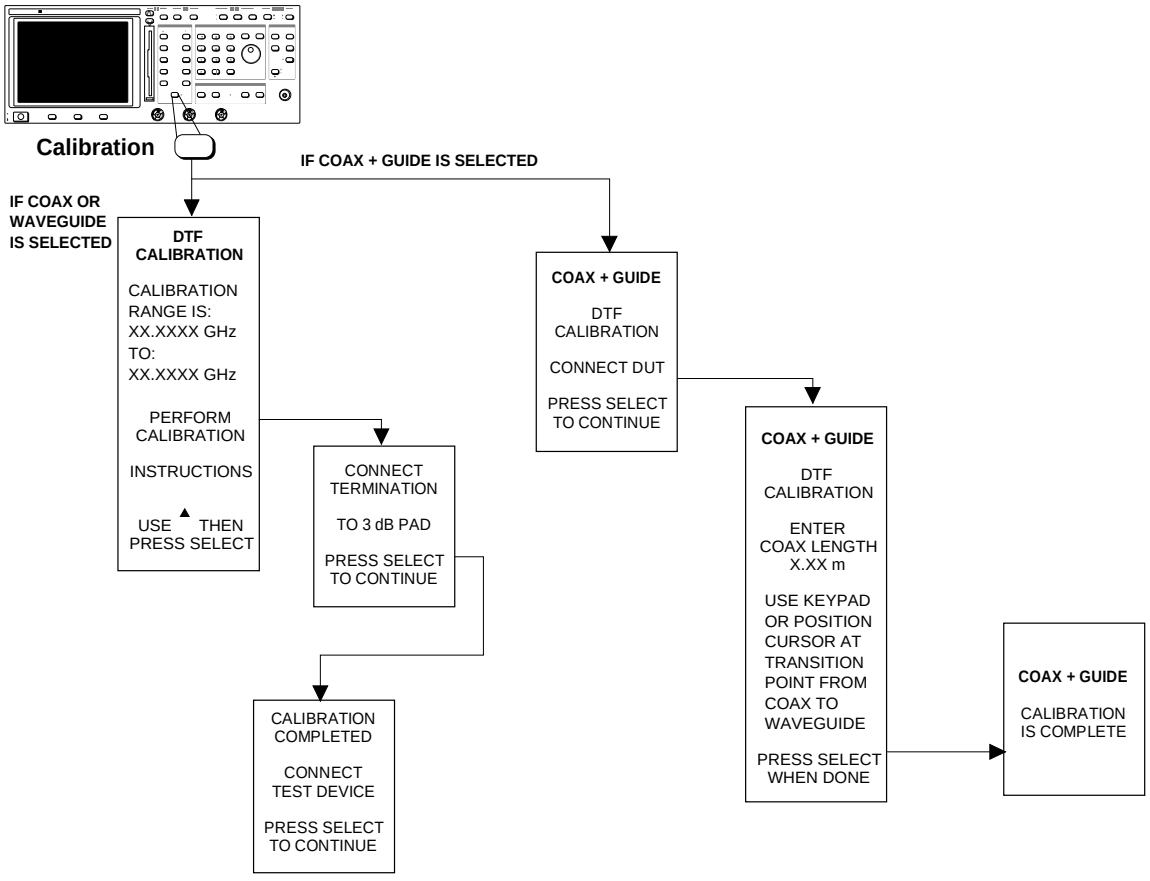


Figure 6-3. *Distance-to-Fault Calibration Menu Sequencing*

6-6 DETERMINING PROPAGATION VELOCITY AND LOSS

This paragraph describe how to determine the relative propagation velocity and dB/meter loss of a transmission line when its length is known

NOTE

Table 6-2 lists the relative propagation velocities of some common waveguide types and Table 6-3 lists the dB/meter loss of the more common coaxial cable types.

The relative propagation velocity of a transmission line and its dB/meter loss can be determined with the DTF system if the line's mechanical length is known. Use the following procedure.

Step 1. Short the end of the transmission line and make a DTF measurement using a propagation velocity of 1.0 and a 0 dB/meter loss.

Step 2. If you are using type N components in the test setup (power divider, attenuator, etc.), subtract 0.13m from the distance measurement to account for the test setup.

The DTF distance is from the middle of the power divider to the end of the transmission line. You can measure the test setup length for other component types by shorting the end and using the DTF system.

Calculate the propagation velocity as follows:

$K = L_m/d_m$

where
K = the propagation velocity,
L_m = the mechanical length of the line, and
d_m = the measured distance to the end of the line minus the test setup distance.

Calculate the dB/meter loss as follows:

$l = l_m/(2 \times L_m)$

where
l = loss in dB/meter,
l_m = the measured loss at the end of the line, and
L_m = the mechanical length of the line.

Step 3. Repeat the DTF measurement on the line using the new calculated values.

If the corrected measured distance to the end of the line does not equal its mechanical length, repeat the entire procedure until it does.

NOTE

The estimates made by this method may not always agree with the theoretical values in Table 6-2 since the DTF program does not correct for mismatch losses. The estimated values should be close, however, and they can be verified by measuring a known offset (mismatch) whose value is at least 10 dB worse than the value at the end of the transmission line. Also, most common cable grades only specify nominal values for dielectric constant. It is normal for both the dielectric properties and center conductor's concentricity to vary by about 10% along the length of the cable. These normal cable properties cause the propagation velocity and the impedance (return loss) to vary at different distances.

If you know the propagation velocity but not the dB/meter loss, you can calculate the loss by making a DTF measurement on the shorted line with the correct velocity and 0 dB/meter, measuring the loss at the short, and then applying the above loss formula.

6-7 LOCATING FAULTS IN A MULTI-TYPE LINE

When you are testing a line with different types of coax or a mixture of different waveguides with different propagation velocities, the Distance-To-Fault scale is not accurate because you can input only one velocity value. Consider the following situations.

You are trying to determine which section contains the fault and you know the lengths and characteristics of each of the sections. Use an average propagation velocity for the DTF measurement and use the distance scale as a relative indication of the locations of the ends of the sections and the location of the fault.

You know which section contains the fault and you would like to locate it in that section without disconnecting the section. Make a DTF measurement using the propagation velocity for that section.

The distance scale will then be accurate as a percentage of the length of that section. For example, if the fault is 20% of the total length of the section away from the nearest end and the section is 10 meters long, the fault is 2 meters from the end.

6-8 SUPPLEMENTAL DATA

This paragraph provides tables and charts to supplement DTF measurements. Table 6-1 contains a chart that converts between SWR, Reflection Coefficient, and Return Loss. Table 6-2 provides transmission line data. And Table 6-3 provides a tabulation of coaxial cable characteristics.

Table 6-1. *Microwave Conversion Chart*

SWR	Reflection Coefficient	Return Loss (dB)
17.3910	0.8913	1
8.7242	0.7943	2
5.8480	0.7079	3
4.4194	0.6310	4
3.5698	0.5623	5
3.0095	0.5012	6
2.6146	0.4467	7
2.3229	0.3981	8
2.0999	0.3548	9
1.9250	0.3162	10
1.7849	0.2818	11
1.6709	0.2512	12
1.5769	0.2239	13
1.4935	0.1995	14
1.4326	0.1778	15
1.3767	0.1585	16
1.3290	0.1413	17
1.2880	0.1259	18
1.2528	0.1122	19
1.2222	0.1000	20
1.1957	0.0891	21
1.1726	0.0794	22
1.1524	0.0708	23
1.1347	0.0631	24
1.1192	0.0562	25
1.1055	0.0501	26
1.0935	0.0447	27
1.0829	0.0398	28
1.0736	0.0355	29
1.0653	0.0316	30

SWR	Reflection Coefficient	Return Loss (dB)
1.0580	0.0282	31
1.0515	0.0251	32
1.0458	0.0224	33
1.0407	0.0200	34
1.0362	0.0178	35
1.0322	0.0158	36
1.0287	0.0141	37
1.0255	0.0126	38
1.0227	0.0112	39
1.0202	0.0100	40
1.0180	0.0089	41
1.0160	0.0079	42
1.0143	0.0071	43
1.0127	0.0063	44
1.0113	0.0056	45
1.0101	0.0050	46
1.0090	0.0045	47
1.0080	0.0040	48
1.0071	0.0035	49
1.0063	0.0032	50
1.0057	0.0028	51
1.0050	0.0025	52
1.0045	0.0022	53
1.0040	0.0020	54
1.0036	0.0018	55
1.0032	0.0016	56
1.0028	0.0014	57
1.0025	0.0013	58
1.0022	0.0011	59
1.0020	0.0010	60

Table 6-2. *Waveguide Technical Data*

Waveguide Type	Low Frequency (GHz)	K at Low Frequency	K at Center Frequency	High Frequency (GHz)	K at High Frequency	Cutoff Frequency (fc) (GHz)
WR-284	2.60	0.6010	0.7648	3.95	0.8504	2.078
WR-187	3.95	0.6025	0.7656	5.85	0.8424	3.152
WR-137	5.85	0.6778	0.7923	8.20	0.8514	4.301
WR-90	8.20	0.6005	0.7712	12.4	0.8488	6.557
WR-62	12.4	0.6439	0.7813	18.0	0.8498	9.486
WR-42	18.0	0.6250	0.7742	26.5	0.8479	14.047
WR-28	26.5	0.6062	0.7734	40.0	0.8499	21.081
WR-22	33.0	0.6020	0.7726	50.0	0.8499	26.350
WR-15	50.0	0.6027	0.7702	75.0	0.8467	39.860

Table 6-3. *Coaxial Cable Technical Data*

Cable RG	Dialectric	Relative Velocity (Vf)	Dielectric Constant (ε_r)	Nominal Atten. dB/m @ 1,000 MHz
8, 8A,10,10A	P	0.659	2.303	0.262
9, 9A	P	0.659	2.303	0.289
14,14A	P	0.659	2.303	0.256
17, 17A	P	0.659	2.303	0.180
18A	P	0.659	2.303	0.144
19A	P	0.659	2.303	0.118
20A	P	0.659	2.303	0.118
21, 21A	P	0.659	2.303	1.411
29A	P	0.659	2.303	0.531
55,55A, 55B	P	0.659	2.303	0.541
58, 58B	P	0.659	2.303	1.574
58A, 58C	P	0.659	2.303	0.787
71, 71A, 71B	P	0.659	2.303	0.394
87A	T	0.840	1.417	0.249
94A, 115, 115A	T	0.710	1.984	0.230
117, 118	T	0.659	2.303	0.115
119, 120, 126	T	0.659	2.303	0.180
140	T	0.659	2.303	0.197
141	T	0.659	2.303	0.427
142	T	0.659	2.303	0.443
143	T	0.659	2.303	0.312
144	T	0.659	2.303	0.030
178B	T	0.659	2.303	1.509
179B	T	0.659	2.303	0.787
187, 188	T	0.659	2.303	1.017
FSJ1-50A	P	0.840	1.417	0.197

Chapter 7
Relative Group Delay Measurement and Calibration

Table of Contents

Chapter 7
Relative Group Delay Measurement and Calibration

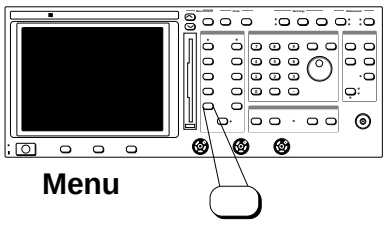
7-1 INTRODUCTION

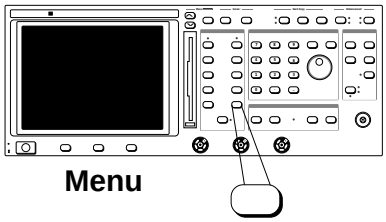
This chapter describes the Relative Group Delay feature. It provides a detailed, step by step procedure for performing a Relative Group Delay measurement and calibration.

7-2 OPERATION

Relative Group Delay is selected from the Channel 1 Menu key (top left) or Channel 2 Menu key (bottom left). Pressing the key displays the appropriate Channel 1 or Channel 2 menu (below).

Relative Group Delay may be viewed simultaneously with transmission or return loss.





CHANNEL 1
INPUT: A (or B)

TRANSMISSION
RETURN LOSS
PRECISION RL
REL G/DELAY
SWR
POWER
DTF/DB
DTF/SWR
SELECT INPUT
TRACE MEMORY
MORE

PRESS ◆THEN
PRESS SELECT

CHANNEL 2
INPUT: A (or B)

TRANSMISSION
RETURN LOSS
PRECISION RL
REL G/DELAY
SWR
POWER
VIEW CAL
SELECT INPUT
TRACE MEMORY
REF LINE

PRESS ◆THEN
PRESS SELECT

7-3 TEST SET-UPS

Test setups for relative group delay measurements are shown in Figures 6A-1 and 6A-2

NOTE:

Figures 1 and 2 show part numbers for N-type connectors. Refer to the "54100A Series Network Analyzer Configuration Chart" tabulation on page 8 of the 54100A Technical Data Sheet in Appendix A for other connector type part numbers.

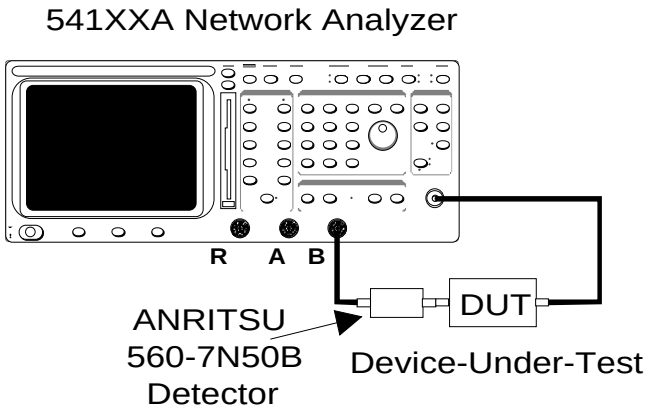


Figure 6A-1. *Relative Group Delay and Transmission Loss Measurement*

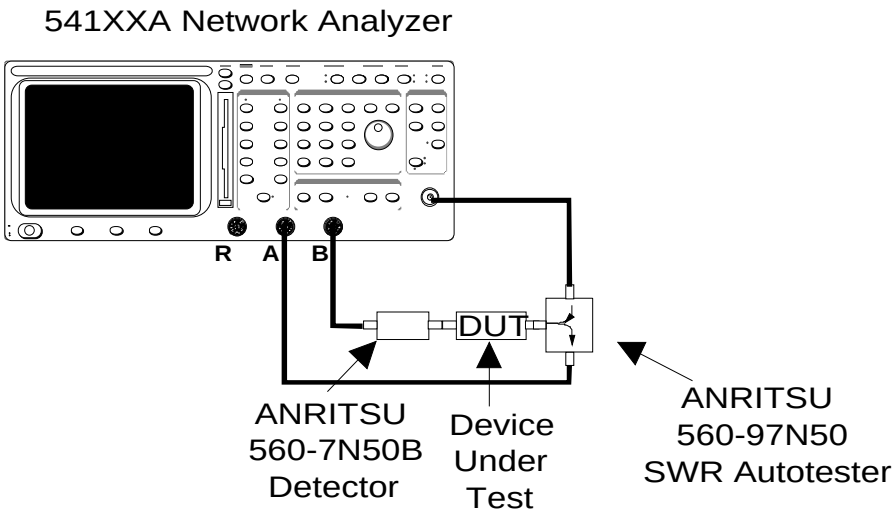
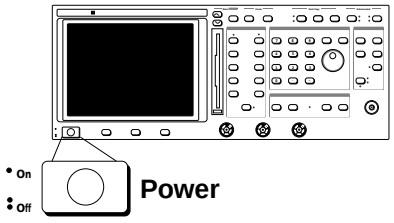


Figure 6A-2. *Relative Group Delay and Return Loss Measurement*

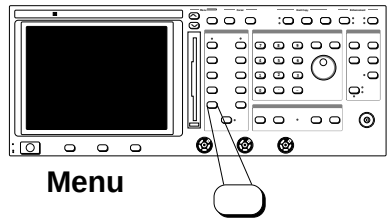
7-4 RELATIVE GROUP DELAY MEASUREMENT CALIBRATION

A procedure to calibrate the measurement test setup for making a relative group delay measurement is given below.

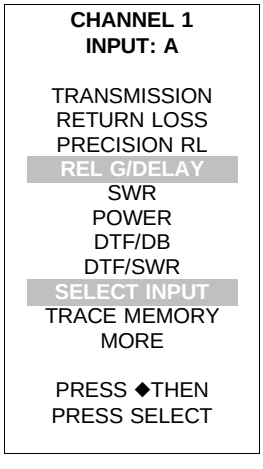
Step 1. Connect the test set up per Figure 6A-1, except do not connect the DUT.



Step 2. Press the Power key to on.



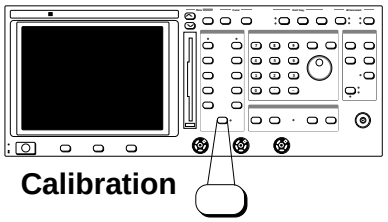
Step 3. Press the Channel 1 Menu key.



Step 4. Select **REL G/DELAY** from the displayed menu.

Step 5. Select **SELECT INPUT** and then **SELECT B** from the next menu to appear.

Step 6. Turn Channel 2 off.



Step 7. Press Calibration key and **START CAL** to begin the calibration. Follow the menu prompts through the end of the calibration.

Step 8. Connect the DUT between the RF Detector and the RF Output connector as directed by the prompts and as shown in Figure 6A-1.

NOTE

Press the Autoscale key as necessary to scale the displayed waveform for optimal viewing.

Step 9. Observe that the displayed waveform resembles the plotted image shown in Figure 6A-3.

NOTE

The displayed trace in Figure 6A-3 is plotted over a frequency range that exceeds the –3 dBr bandwidth of the filter. For best accuracy, sweep a minimum of –20 dBr about the filter's frequency response rolloff.

Step 10. To perform a transmission loss measurement, proceed to paragraph 6A-5. To perform a return loss measurement, proceed to paragraph 6A-6.

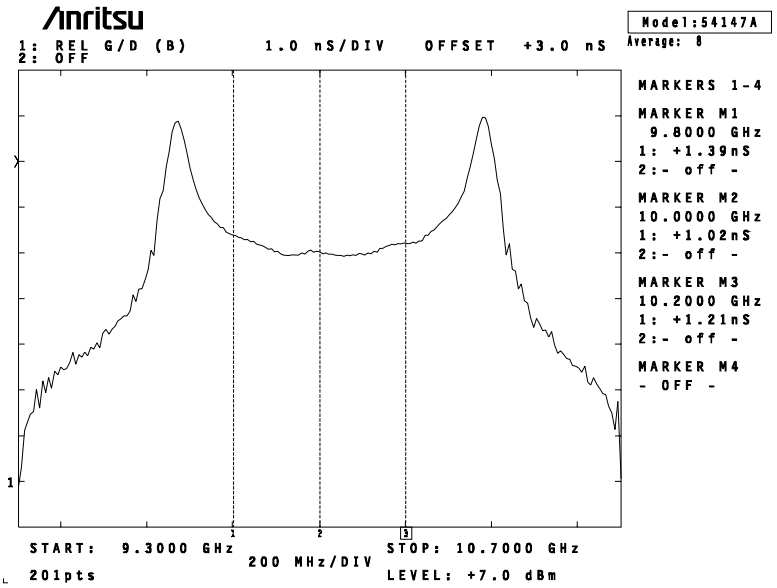
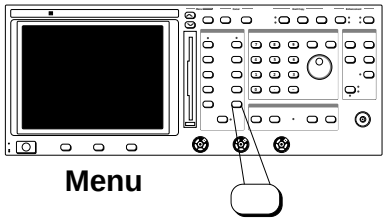


Figure 6A-3. *Relative Group Delay Measurement Trace*

7-5 RELATIVE GROUP DELAY AND TRANSMISSION MEASUREMENT

A procedure for using the 541XXA to make a relative group delay and transmission measurement is given below.

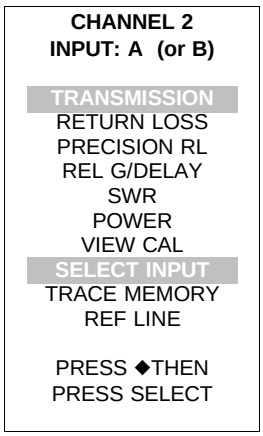
Step 1. Perform Steps 1 through 6 per the procedure in paragraph 6A-4.



Step 2. Turn on Channel 2.

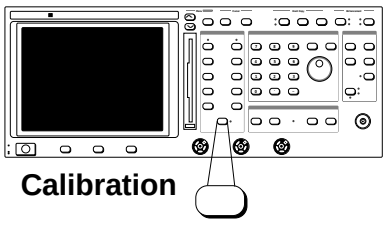
Step 3. Press the Channel 2 Menu key.

Step 4. Select **TRANSMISSION** from the displayed menu.



Step 5. Select **SELECT INPUT** then **SELECT B** from the next menu to appear.

Step 6. Press the Calibration key and **START CAL** to begin the calibration.



Step 7. Follow the menu prompts; connect the DUT between the RF Detector and the RF Output connector as directed by the prompts and as shown in Figure 6A-1.

Step 8. Observe that the meaured transmission loss trace is similar to the plotted image shown in Figure 6A-4.

NOTE

The displayed trace is plotted over a relatively narrow frequency range and has three markers activated.

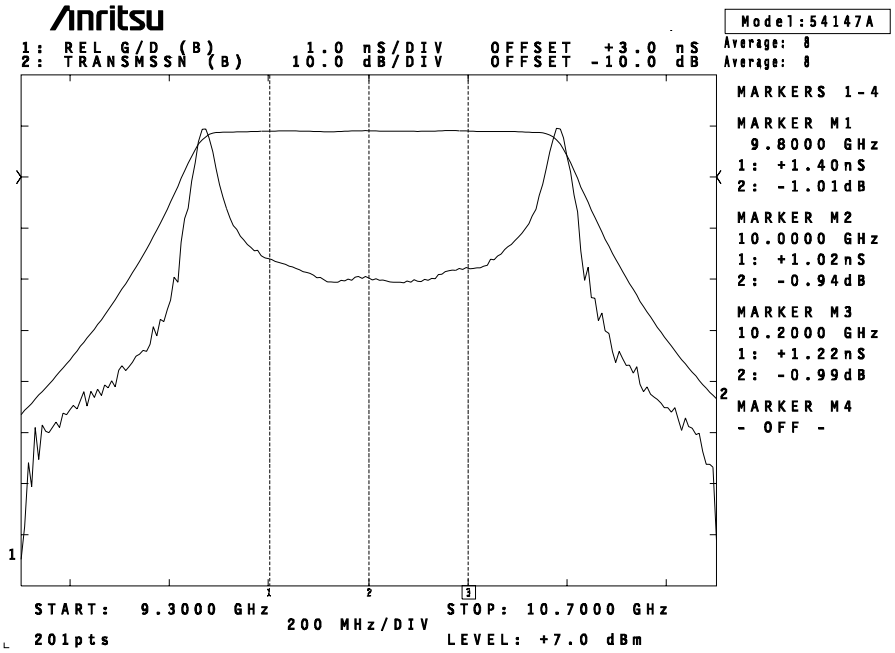


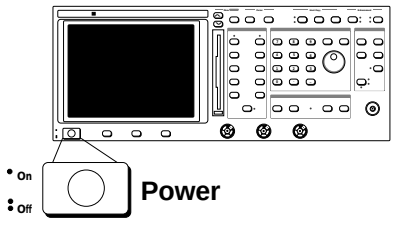
Figure 6A-4. *Relative Group Delay and Transmission Loss Measurement Traces*

7-6 RELATIVE GROUP DELAY AND RETURN LOSS MEASUREMENT

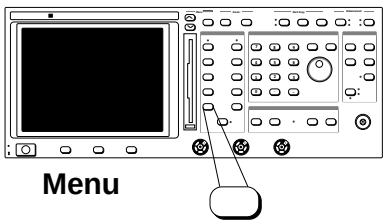
A procedure for using the 541XXA to make a relative group delay and return loss measurement is given below.

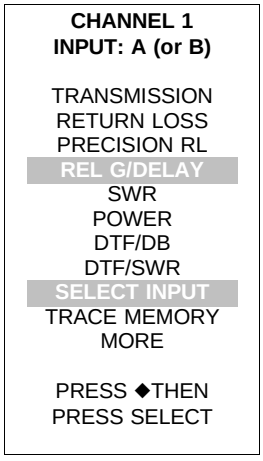
Step 1. Connect the test set up per Figure 6A-2, except do not connect the DUT.

Step 2. Press the Power key to on.



Step 3. Press the Channel 1 Menu key.

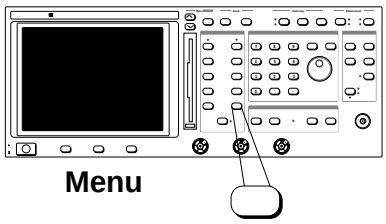




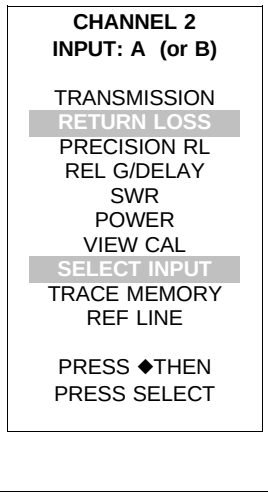
Step 4. Select **REL G/DELAY** from the displayed menu.

Step 5. Select **SELECT INPUT** and then **SELECT B** from the next menu to appear.

Step 6. Turn on Channel 2.

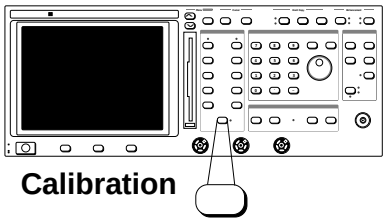


Step 7. Press the Channel 2 Menu key.



Step 8. Select **RETURN LOSS** from the displayed menu (left).

Step 9. Select **SELECT INPUT** then **SELECT A** from the next menu to appear.



Step 10. Press the Calibration key and **START CAL** to begin the calibration.

Step 11. Follow the menu prompts; connect the DUT between the RF Detector and the SWR Autotester test port connector as directed by the prompts and as shown in Figure 6A-2.

Step 12. Observe that the measured return loss trace is similar to the plotted image shown in Figure 6A-5.

NOTE

The displayed trace is plotted over a relatively narrow frequency range and has three markers activated.

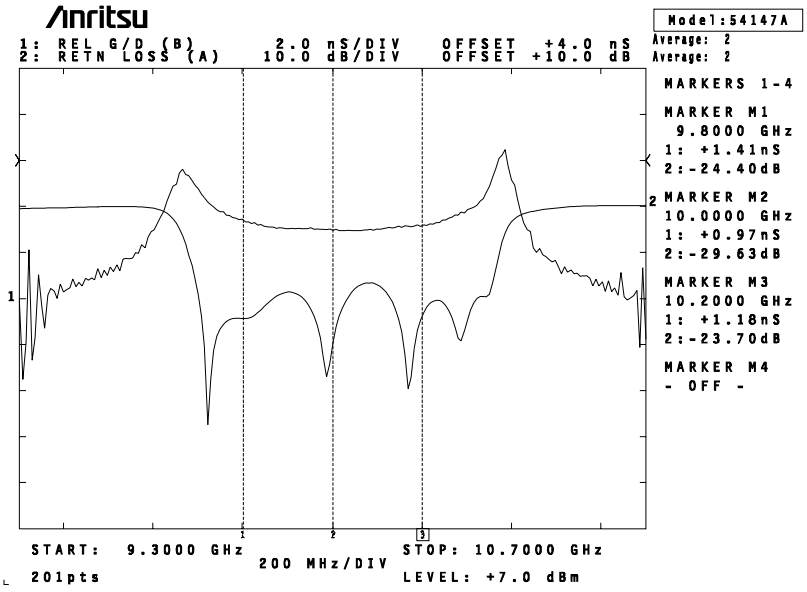


Figure 6A-5. *Relative Group Delay and Return Loss Measurement Traces*

Chapter 8
Operational Checkout Procedures

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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 8
Operational Checkout Procedures

8-1 INTRODUCTION

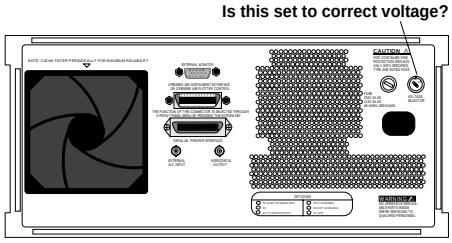
This section is common to all standard models of 541XXA Network Analyzers. The tests provided are designed to disclose damage that may have occurred in transit.

8-2 FRONT PANEL OPERATION TEST

This test verifies that all the front panel switches and LED's are operational. The test involves pressing each key of each key group and checking that the 541XXA responds correctly.

Equipment Required 541XXA under test.

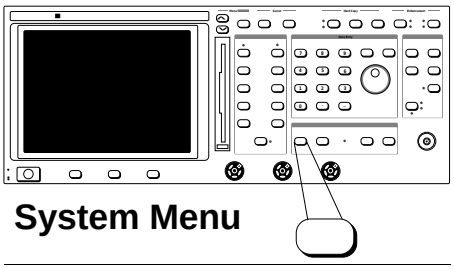
Procedure



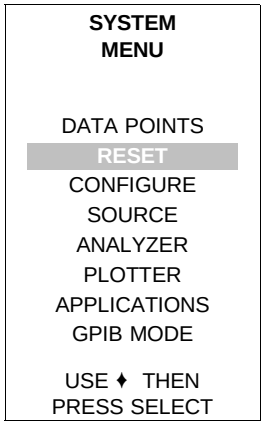
Step 1. Verify that the 541XXA rear panel voltage selector switch is set to the correct value. Connect the power cable to the 541XXA and switch the unit on.

Observe that during power-up all of the front panel LED's are first turned on and then off again and that the speaker produces a short beep. This verifies that all LED's are functioning and the main CPU is running.

The 541XXA will display **"ALL TESTS PASSED"** *at the end of the self test if no defects are found.*



Step 2. Press the System Menu key.



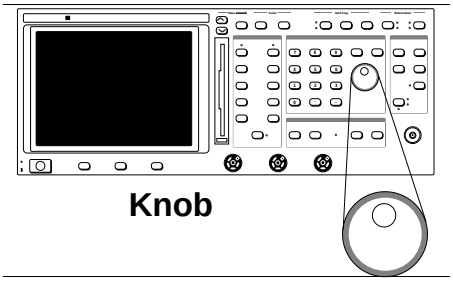
Step 3. Select **RESET** (left).

Use the Menu up/down and Select keys to select options for all menus that appear in this procedure.

Step 4. Select **RESET TO FACTORY DEFAULTS** (left).

This sets the 541XXA to its initial factory settings.

Step 5. Press each key of each key group and verify that the 541XXA responds correctly.



Step 6. To test the Data Entry knob, press the Intensity key and turn the knob counter-clockwise to decrease the intensity and then clockwise to increase it.

NOTE
When testing the Network Analyzer key group keys, ensure that Channels 1 and 2 are switched on.

End of Procedure

8-3 BASIC MEASUREMENT TEST

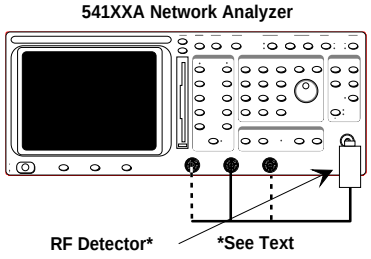
This test verifies the ability of the 541XXA to perform basic measurements. This exercises Channel 1 and Input A, B, & R (Option 5). If Channel 1 passes this test, the test infers that Channel 2 will also pass. If you wish to verify the Channel 2 condition, repeat this test using Channel 2 is place of Channel 1.

Equipment: Select one of the following detectors to match the frequency range, output connector and impedance of the 541XXA under test.

ANRITSU Model	Frequency Range	Connector Type
5400-71N50	1 MHz to 3 GHz	Type N male
5400-71N75	1 MHz to 3 GHz	Type N male, 75 Ohm
560-7N50B	10 MHz to 20 GHz	Type N male
560-7K50	10 MHz to 40 GHz	Type K male
560-7VA50	10 MHz to 50 GHz	Type V male

Procedure: *INPUT A*

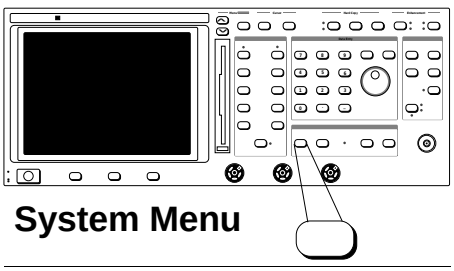
Step 1. Connect the detector between Input A and RF Output, as shown at left, and turn the 541XXA on.

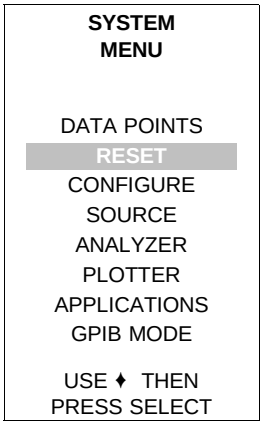


CAUTION

Do not exceed 5W maximum reverse power or ±50 Vdc input signal voltage on the RF Output connector. Levels above these value may cause equipment damage.

Step 2. Press the System Menu key.



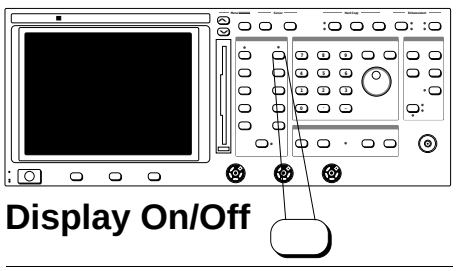


Step 3. Select **RESET** (left).

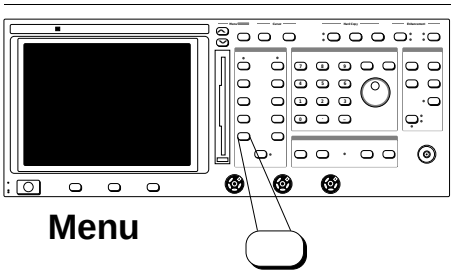
Use the Menu up/down and Select keys to select options for all menus that appear in this procedure.

Step 4. Select **RESET TO FACTORY DEFAULTS** (left).

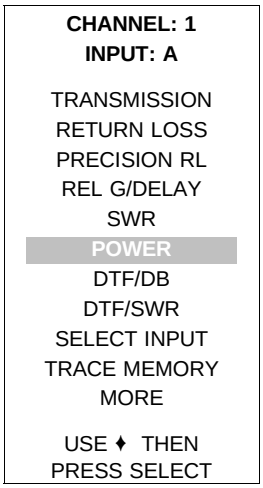
This sets the 541XXA to its initial factory settings.



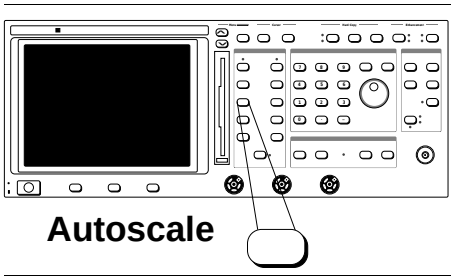
Step 5. Press Channel 2, Display On/Off key to turn off the Channel 2 indicator.



Step 6. Press Channel 1 Menu key.



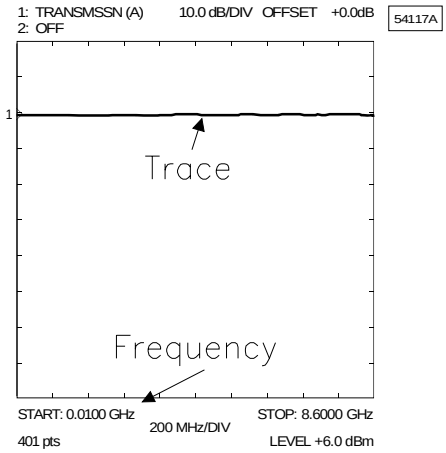
Step 7. Select **POWER** from the displayed menu (left)



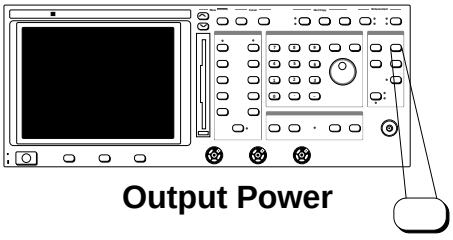
Step 8. Press Channel 1Autoscale key (left).

This optimizes the display resolution.

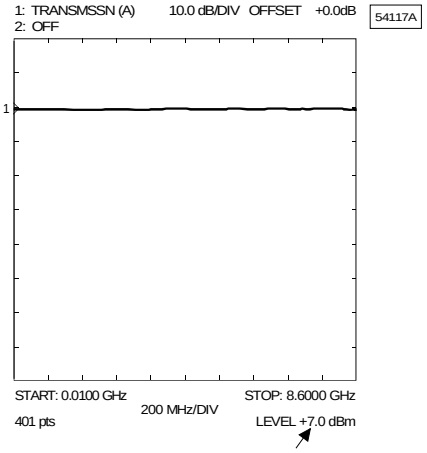
Step 9. Observe the display (below) and verify that the trace is continuous and varies with the frequency shown along the horizontal axis.

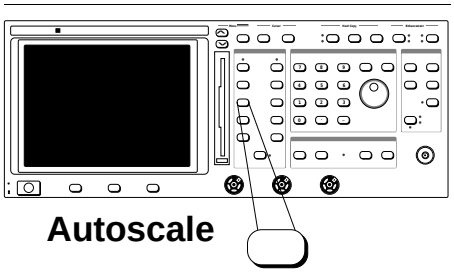


Step 10. Press the Output Power key.



Step 11. Observe the highlighted value of LEVEL (below). Using Data Entry knob, reduce the displayed value by 10.0 dB.

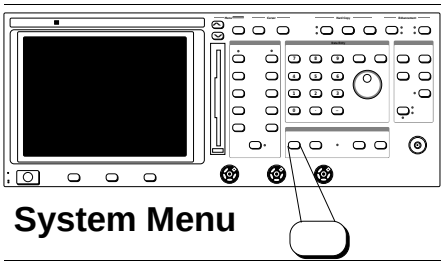




Step 12. Press the Channel 1 Autoscale key.

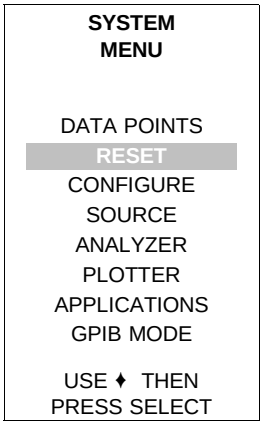
Step 13. Observe that the displayed trace is continuous and varies with the frequency, and that it has moved by approximately 10 dB.

Procedure: *INPUT B*



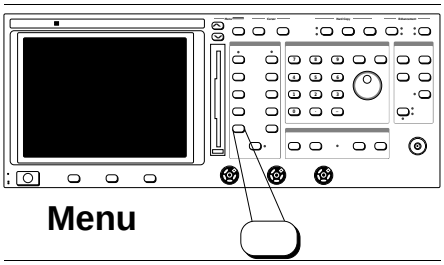
Step 1. Move the detector to Input B.

Step 2. Press the System Menu key.

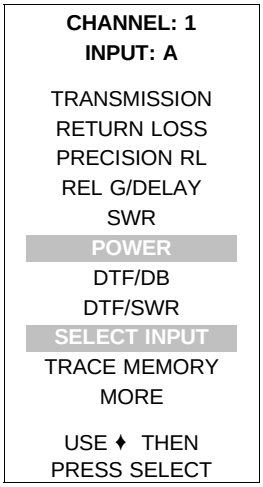


Step 3. Select **RESET** (left).

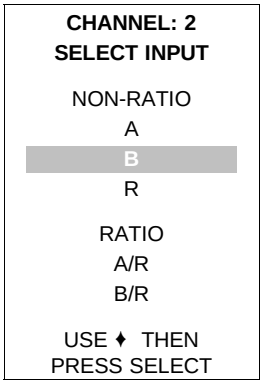
Step 4. Select **RESET TO FACTORY DEFAULTS** (left).



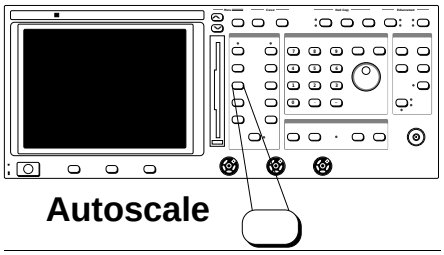
Step 5. Press Channel 1 Menu key.



Step 6. Select **POWER** and **SELECT INPUT** from the displayed menu (left).

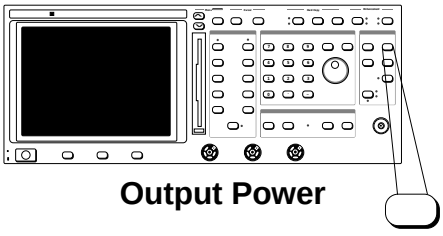


Step 7. Select **NON-RATIO B** from the displayed menu (left).

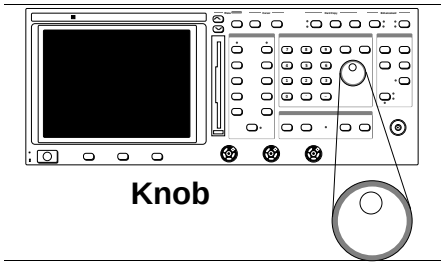


Step 8. Press Channel 1Autoscale key (left).

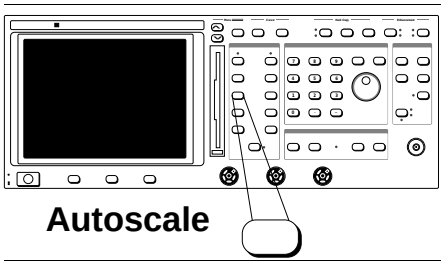
Step 9. Observe that the displayed trace is continuous and varies with the frequency, as discussed in Step 9 of the INPUT A procedure.



Step 10. Press the Output Power key.



Step 11. Using Data Entry knob, reduce the LEVEL value by 10.0 dB.



Step 12. Press the Channel 1 Autoscale key.

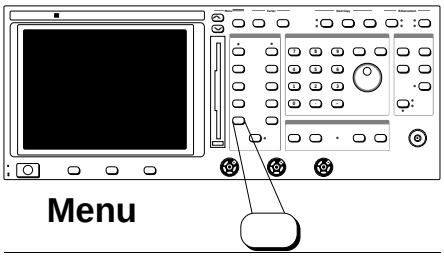
Step 13. Observe that the displayed trace is continuous and varies with the frequency, as discussed in Step 9 of the INPUT A procedure.

Step 14. If 541XXA is not equipped with an INPUT R connector (Option 5) , this procedures is finished. Proceed to paragraph 5-4.

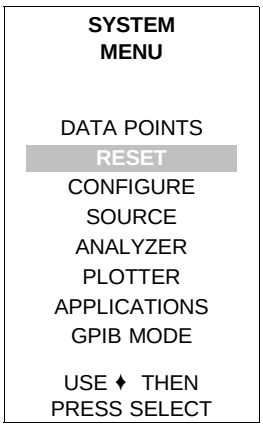
Procedure: *INPUT R (If Option 5 is installed.)*

Step 1. Move the detector to Input R.

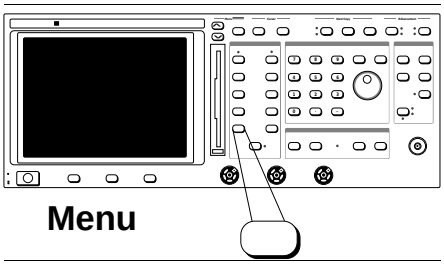
Step 2. Press the System Menu key.



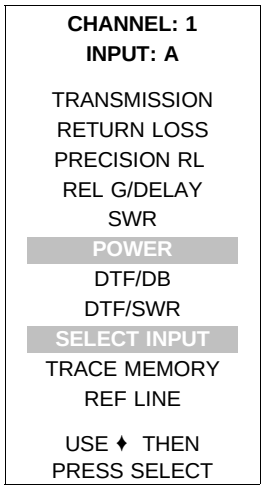
Step 3. Select **RESET** (left).



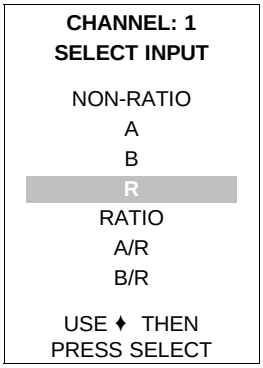
Step 4. Select **RESET TO FACTORY DEFAULTS** (left).



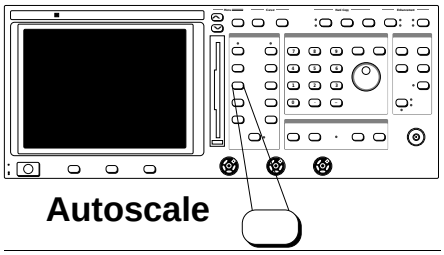
Step 5. Press Channel 1 Menu key.



Step 6. Select **POWER** and **SELECT INPUT** from the displayed menu (left).

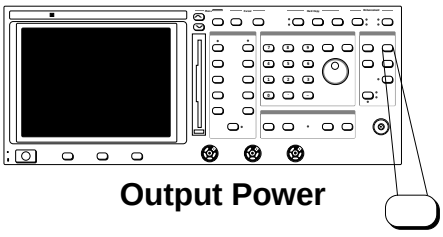


Step 7. Select **NON-RATIO R** from the displayed menu (left).

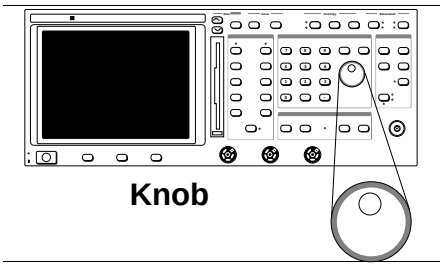


Step 8. Press Channel 1Autoscale key (left).

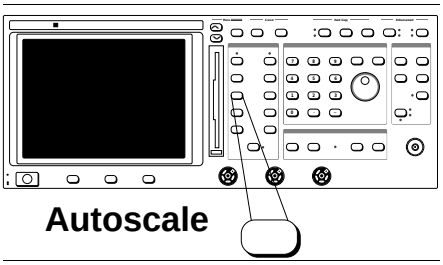
Step 9. Observe that the displayed trace is continuous and varies with the frequency, as discussed in Step 9 of the INPUT A procedure.



Step 10. Press the Output Power key.



Step 11. Using Data Entry knob, reduce the LEVEL value by 10.0 dB.



Step 12. Press the Channel 1 Autoscale key.

Step 13. Observe that the displayed trace is continuous and varies with the frequency, as discussed in Step 9.

End of Procedure

8-4 PRINTER OPERATION TEST

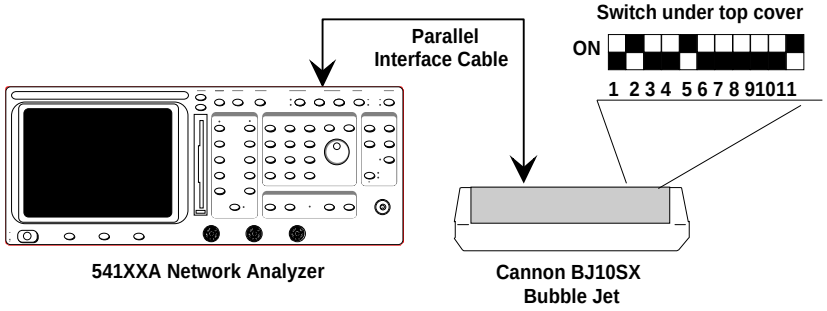
This test confirms that the centronics printer interface is operational. The test involves connecting a centronics interface printer to the 541XXA and confirming that a graphics dump can be performed.

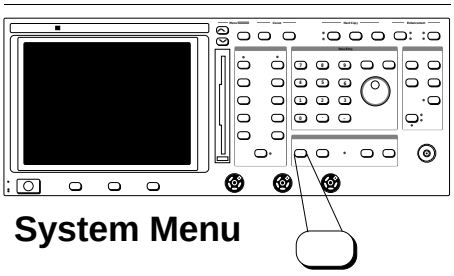
Equipment

- Cannon model BJ10SX Bubble-Jet Printer set to Epson LQ emulator mode.
- Parallel interface cable.

Procedure

Step 1. Connect the test equipment as shown below, and turn it on. Connect the interface cable to the rear panel PARALLEL PRINTER INTERFACE connector.





Step 2. Press the System Menu key.

SYSTEM MENU

DATA POINTS
RESET
CONFIGURE
SOURCE
ANALYZER
PLOTTER
APPLICATIONS
GPIB MODE

USE ♦ THEN PRESS SELECT

Step 3. Select **RESET** (left).

RESET MENU

RESET IS CONFIGURED TO KEEP
CAL DATA
MARKERS
LIMITS

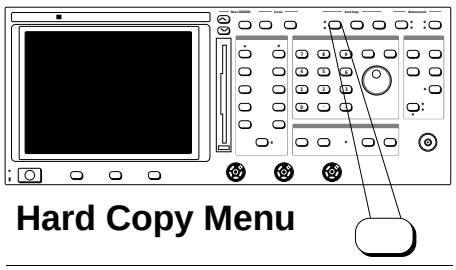
RESET

RESET TO FACTORY DEFAULTS

USE ♦ THEN PRESS SELECT

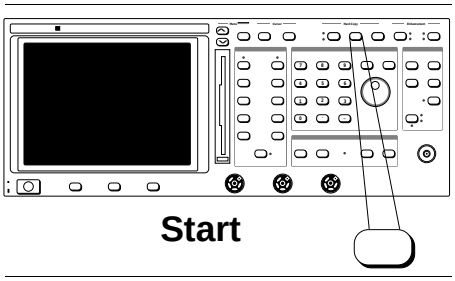
Step 4. Select **RESET TO FACTORY DEFAULTS** (left).

Step 5. Check that the printer has sufficient paper and is "on line."



Hard Copy Menu

Step 6. Press the Hard Copy Menu key.



Step 7. Press the Start key.

The printer should print a copy of the 541XXA screen display. This will take approximately one minute to complete.

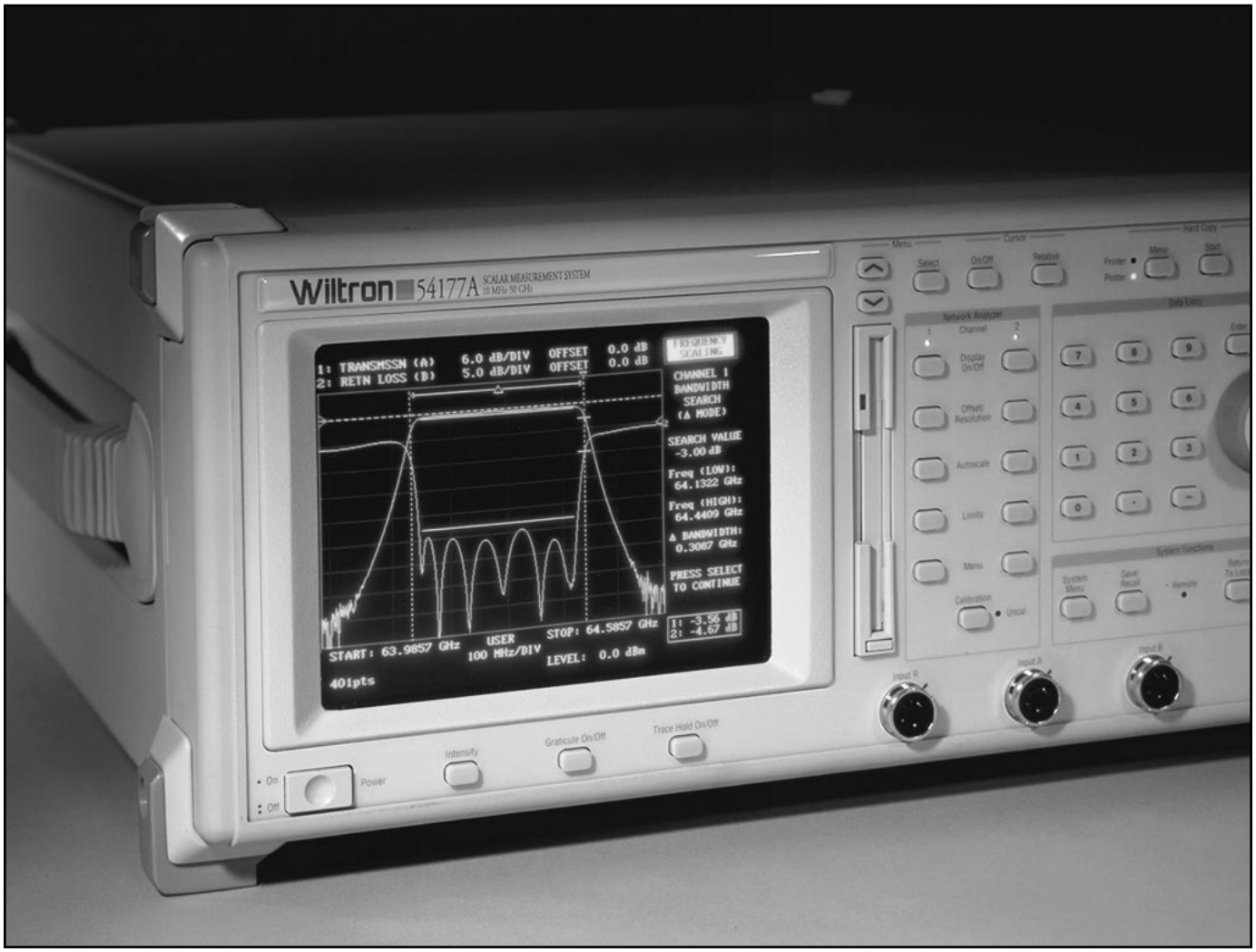
End of Procedure

Appendix A
54100A Series
Technical Data Sheet

Anritsu
Wiltron

54100A Series
Network Analyzers
1 MHz to 110 GHz

Technical Data Sheet



High Performance Solutions in an Economical Network Analyzer

MEASUREMENTS

The 54100A Series Network Analyzer include models and measurement components from 1 MHz to 110 GHz.

Measurement Modes: Transmission (dB), Relative Group Delay (ns), Return Loss (dB), Precision Return Loss (dB), SWR (linear SWR), Power (dBm), and optional Distance-To-Fault (feet or meters).

ANALYZER

Dynamic Range:

−55 dBm to +16 dBm, Autozeroing implements AC detection on a single cycle per sweep basis using Wiltron 560 Series or 5400 Series Detectors and SWR Autotesters. DC detection is used during the sweep to improve accuracy and avoid disturbing automatic leveling controls in the device under test. Auto-zeroing can be disabled.

Inputs: Three. Two standard inputs, A and B, with an optional third reference channel, R (Option 5). Wiltron 560 Series and 5400 Series Detectors and Autotesters are designed to operate with the 54100A Network Analyzer. For millimeter wave applications, the 5400 Series Multiplier/Reflectometers provide integrated reference and return loss detection.

Channels: Two channels are used to select and simultaneously display any two inputs from A, B, or R. The inputs can also be displayed as ratios A/R or B/R.

Display Resolution:

Horizontal: 51, 101, 201, or 401 points.
Vertical: 0.025 dB, 0.0025 ns

Graticule: Ten vertical divisions. Horizontal axis automatically scales in frequency increments of 1, 2, 5. Graticule On/Off button turns all graticule lines off. Tick marks remain on axis to indicate graticule position.

Vertical Scaling:

Resolution: 0.1 dB(m) to 10 dB(m) per division. Independent control for each channel 0.1 to 100 ns per division.
Offset range: −99.9 dB to +99.9 dB, −99.9 to +99.9 ns.
Autoscale: Automatically selects offset and resolution to provide optimum display of test data.

External VGA Monitor Output: Rear panel connection is provided to drive a VGA color display. Trace colors are menu selectable.

Cursor: The numerical amplitude of the test data and frequency are displayed for both channels. Display range −99.9 to +99.9 dB or ns.

Relative Cursor: Displays the amplitude and frequency differences between the Cursor and Relative Cursor for both channels.

Cursor Functions: Automatic cursor searches for trace Maximum, Minimum, dB Level, dB Bandwidth, Next Marker, and Active Marker may be performed.

Display Data Correction: System frequency response errors are removed from measurements with a through-line transmission calibration and an open-short reflection calibration. Calibration data is stored at 0.002 dB resolution over the selected frequency range. Interpolation is used to maintain calibration as frequency sweep range is decreased.

Smoothing: Filtering, adjustable in five levels, to reduce noise and interference on low-level traces. Channels may be independently set.

Averaging: 2, 4, 8, 16, 32, 64, 128, or 256 successive traces may be averaged together to remove unwanted noise. Channels may be independently set.

Limit Lines: Two limit lines, either single value or multi-level segmented, for each trace. Complex lines may be made from up to 10 individually-editable segments.

Trace Mask: A swept measurement can be stored to a graticule Trace Mask for visual comparison to later measurements.

Save/Recall: Thirteen sets of front-panel set-ups and thirteen sets of trace memory can be stored in non-volatile instrument memory. Stored set-ups may be previewed on the CRT or printed prior to selection. Non-volatile memory can be erased for security purposes.

3.5 Inch DOS Disk Drive: Instrument configurations and trace data can be stored on a MS-DOS® compatible 3.5 inch, 1.44 MB floppy disk. Trace Data can be stored in a standardized ASCII format which easily reads into common PC spread sheets and word processing software.

SOURCE

Frequency Range: 1 MHz to 110 GHz. Contact Factory for special frequency range requirements.

Start-Stop: Sweeps from start frequency to stop frequency.

Center-Width: Sweeps from *center* − (*width/2*) to *center* + (*width/2*)

Alternate Sweep: Sweeps alternately between frequency ranges set differently for Channel 1 and Channel 2.

CW: Provides single frequency output (both channels turned off).

Frequency Resolution:

RF Models (54107A, 54109A, 54111A): ±10 kHz
Microwave Models: ±100 kHz

Start Frequency Accuracy:

RF Models (54107A, 54109A, 54111A): ±100 kHz
Microwave Models to 20 GHz: ±200 kHz
Microwave Models, 20 to 40 GHz: ±400 kHz
Microwave Models, 40 to 50 GHz: ±800 kHz

Sweep Time, Single Band: Typically less than 70 ms for single channel with 101 point horizontal resolution, depending on frequency, averaging, and smoothing settings. Trace update time is typically 130 ms with similar system settings.

Residual FM:

1 MHz to 20 GHz	< 10 kHz Peak
20 GHz to 40 GHz	< 20 kHz Peak
40 GHz to 50 GHz	< 40 kHz Peak

Measured in 30 Hz to 15 kHz post-detection BW.

Output Power: Maximum guaranteed leveled output power is model dependent. Typical unleveled output power exceeds the specified leveled output power. Operation with unleveled output power degrades rated specifications and is not recommended.

Reverse Power Protection: Up to 1 Watt.

Power Level Accuracy: ±1 dB, leveled. ±3.0 dB for models above 20 GHz, and ±4.0 dB for 50 GHz models. Add ±0.2 dB for Option 4−75 Ω output.

Power Level Accuracy, Attenuator: Optional 70 dB Step Attenuator (10 dB steps). Leveled power accuracy degrades by ±1.5 dB for models below 20 GHz and ±1.9 dB for 20 GHz models.

Power Level Control, Internally Leveled: Front panel control adjusts power over a 10 dB range (up to 20 dB in some models) or from −70.0 dBm to maximum leveled power when Option 2, 2A, 2B, 2C or 2D 70 dB Step Attenuator is installed.

Power Level Control, Externally Leveled (Option 6): Front panel control adjusts power range determined by external leveling detector output. Flatness determined by leveling detector and coupler characteristics.

Leveling (With External Detector): Levels output power at DUT input positions other than near the 54100A source output. A leveling detector tracks the RF power level by providing a positive or negative polarity detected signal of 30 to 200 mV to a rear panel BNC connector.

Leveled Power Variation:

1.0 MHz to 1.0 GHz	±0.3 dB	±1.0 dB, Opt 2
1.0 MHz to 2.0 GHz	±0.4 dB	±1.1 dB, Opt 2
1.0 MHz to 3.0 GHz	±0.6 dB	±1.3 dB, Opt 2
10.0 MHz to 20 GHz	±0.8 dB	±1.0 dB, Opt 2A
10.0 MHz to 26.5 GHz	±1.0 dB	±2.5 dB, Opt 2B
10.0 MHz to 32 GHz	±2.0 dB	±2.0 dB, Opt 2C
10.0 MHz to 40 GHz	±2.0 dB	±2.0 dB, Opt 2C
10.0 MHz to 50 GHz	±3.0 dB	±3.0 dB, Opt 2D

Add ±0.2 for 75 Ω sources

Markers: The numerical amplitude of the test data and frequency are displayed. Markers remain fixed at the set frequency, independent of displayed sweep frequency range.

APPLICATION FUNCTIONS

Application functions speed and ease the task of characterizing antennas, filters, amplifiers, and other microwave devices.

Min/Max Hold: Save the minimum and maximum values of successive sweeps or the combination of the two. Ideal for acquiring data on drift or gain variation against temperature.

Cursor Functions: Automatic cursor search updates the bandwidth, minimum, or maximum levels of the displayed trace, “X” dB above or below the min/max point, or a selected bandwidth. This function can be set to repeat continuously.

Compression Test Automation: Determines the gain compression point over the operating frequency range of an amplifier by successively incrementing the source power and measuring the amount of compression until a preset “X” dB limit is exceeded.

GPIB

Interface: IEEE-488.2 compliant interface with integrated GPIB Plotter Control is standard on all 54100A instruments. All front panel controls are GPIB-controllable except power on/off. Front panel configurable for instrument control or for control of GPIB plotter.

GPIB Indicators:

Remote: Operating on GPIB
Talk: Talking on GPIB
Listen: Listening on GPIB
SRQ: Sending a service request
Local Lockout: Indicates the front panel RETURN TO LOCAL pushbutton is disabled. The instrument is returned to local mode via GPIB.

PRINTER/PLOTTER

Plotter: The GPIB interface is compatible with HP 7440A, HP 7550, HP 7470A, and HP 7475A plotters. Display traces, markers, cursor, and graticule information can be plotted.

Printer: Parallel printer interface is compatible with the Canon BJ10-SX, BJ30 and most Epson FX-compatible printers.

Internal Print and Plot Buffer: A new test can be conducted while previously taken test data are being printed or plotted from the internal printer buffer.

PRINTERS & ACCESSORIES

Portable printers may be purchased locally or through Anritsu Wiltron. When purchased separately, a Centronics-to-Centronics Printer Interface Cable will be needed for operation with the 54100A.

Canon BJ10-SX Printer	2000-668
Extra Ink Cartridge	2000-669
Extra Battery	633-16
Extra Printer Interface Cable	800-430

PRINTER POWER SUPPLIES

UK - AD150, 240V	40-65
USA - AD150/120, 120V	40-66
Europe - AD150/220, 220V	40-67
Japan - AD150/100, 100V	40-68

INPUT/OUTPUT CONNECTIONS

Horizontal Sweep Ramp Output: 0 to +10 V nominal

GPIB: Connects 54100A to controller or plotter. Rear panel GPIB connector.

Parallel Printer (Centronics): Connects 54100A to printer. Rear panel.

VGA Output: Connects 54100A to external VGA color display (not supplied). Rear panel 15 pin “D” connector.

External Leveling: Option 6 adds external leveling capability. Levels output power at remote test position. (Rear panel BNC female connector).

GENERAL

Self Test: Performs a self test every time power is applied or when SELF TEST pushbutton is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.

Temperature Range:

Operating: 0°C to +50°C
Storage: -40°C to +70°C

Electromagnetic Compatiblity: Complies with European Community requirements for CE marking

Power: 115V +10%/-20%, 230V +10%/−20%, 48-440 Hz, 300 VA maximum

Dimensions: 177 H x 426 W x 476 D mm + 51 mm for feet
(7 H x 16.75 W x 18.75 D in. + 2.0 in. for feet)

Weight: Less than 18 kg (39 lb.), 54147A

TRANSIT CASE

760–183 Transit Case: Hard shell case with custom foam inserts and carrying handle for maximum protection of the 54100A.

54100A SERIES NETWORK ANALYZERS

Model	Frequency Range	Harmonic[2]	Non Harmonic	Source SWR[1] (Leveled)	Output Power[1]	Connector
54107A	0.001 to 1.5 GHz	–40 dBc	–60 dBc	< 1.5	12 dBm, 50 Ω 10 dBm, 75 Ω	N (f)
54109A	0.001 to 2.2 GHz	–40 dBc	–60 dBc	< 1.5	12 dBm, 50 Ω 10 dBm, 75 Ω	N (f)
54111A	0.001 to 3 GHz	–40 dBc	–60 dBc	< 1.5	12 dBm, 50 Ω 10 dBm, 75 Ω	N (f)
54117A	0.01 to 8.6 GHz	–60 dBc, > 2 GHz –40 dBc, ≤ 2 GHz	–60 dBc, > 2 GHz –50 dBc, ≤ 2 GHz	< 1.5	10 dBm, 50 Ω	N (f)
54147A	0.01 to 20 GHz	–60 dBc, > 2 GHz –40 dBc, ≤ 2 GHz	–60 dBc, > 2 GHz –50 dBc, ≤ 2 GHz	< 1.8	10 dBm, 50 Ω	N (f)
54161A	0.01 to 32 GHz	–60 dBc, 2-20 GHz –40 dBc, > 20 GHz –40 dBc, ≤ 2 GHz	–50 dBc, > 2 GHz –50 dBc, ≤ 2 GHz	< 1.8	4.0 dBm, 50 Ω	K (f)
54169A	0.01 to 40 GHz	–60 dBc, 2-20 GHz –40 dBc, > 20 GHz –40 dBc, ≤ 2 GHz	–50 dBc, > 2 GHz –50 dBc, ≤ 2 GHz	< 1.8	4.0 dBm, 50 Ω	K (f)
54177A	0.01 to 50 GHz	–60 dBc, 2-20 GHz –40 dBc, > 20 GHz –40 dBc, ≤ 2 GHz	–50 dBc, > 2 GHz –50 dBc, ≤ 2 GHz	< 2.0	1.0 dBm, 50 Ω	V (f)

[1] At 25° C, internally leveled. Attenuator Options 2 through 2C reduce output power specification by 3.0 dB; 2D, 4.0 dB. [2] Loaded at 50 Ω

Additional Models

54119A	2 to 8.6 GHz	N(f)
54128A	8 to 12.4 GHz	N(f)
54130A	12.4 to 20 GHz	N(f)
54131A	10 to 16 GHz	N(f)
54136A	17 to 26.5 GHz	K(f)
54137A	2 to 20 GHz	N(f)
54154A	2 to 32 GHz	K(f)
54163A	2 to 40 GHz	K(f)

Measurement System Options

Option 1	Rack Mounting with Slides
Option 2	70 dB RF Step Attenuator
Option 2A	70 dB, 20 GHz Step Attenuator
Option 2B	70 dB, 26.5 GHz Step Attenuator
Option 2C	70 dB, 40 GHz Step Attenuator
Option 2D	70 dB, 50 GHz Step Attenuator
Option 4	75 ohm source output. (Available to 3.0 GHz)
Option 5	Add Reference Channel
Option 6	Add External Leveling
Option 7	Internal Distance-To-Fault Software
Option 8	Relative Group Delay Software
Option 12	Add Front Panel Cover
Option 13	Add Front Mounted Handles
Option 16	+15 V DC Supply for Millimeter Wave Source Modules (Available with ≤ 20 GHz Models only)
Option 25	Maintenance Manual
Option 26	Extra Operation and GPIB Programming Manual
Option 33	Canon BJ10-SX Bubble Jet Printer

SWR AUTOTESTERS

The 5400 and 560 Series SWR Autotesters integrate a high directivity bridge, a detector, a low reflection stainless steel test port, a reference termination, and a connecting cable. The detected output signal is proportional to reflections from the test device connected to the test port.

RF Extender cables with moderate insertion loss used between the source output to the SWR Autotester input do not degrade Return Loss (SWR) measurement performance. A mating Open/Short is shipped with each SWR Autotester except 5400-67FF75. WSMA test port connectors are precision connections for improved measurement accuracy when testing devices with SMA connectors.

Maximum Input Power: +27 dBm

The 560-98C50 Convertible SWR Autotester improves test accuracy and reduces maintenance cost without using error prone test port adapters or connector savers.

SWR AUTOTESTERS

Model	Frequency Range	Directivity	Test Port			Input Connector
			Impedance	SWR	Connector	
5400-67FF75	0.01 to 1 GHz	40 dB	75 Ω	< 1.22	F (f)	BNC (f)
5400-6B50B	0.001 to 1.5 GHz	40 dB	50 Ω	< 1.13	BNC (m)	N (f)
5400-6BF50B	0.001 to 1.5 GHz	40 dB	50 Ω	< 1.13	BNC (f)	N (f)
5400-6B75B	0.001 to 1.5 GHz	40 dB	75 Ω	< 1.22	BNC (m)	N (f)
5400-6BF75B	0.001 to 1.5 GHz	40 dB	75 Ω	< 1.22	BNC (f)	N (f)
5400-6N50	0.001 to 3 GHz	40 dBc, < 3 GHz	50 Ω	< 1.08, ≤ 2 GHz < 1.11, > 2 GHz	N (m)	N (f)
5400-6NF50	0.001 to 3 GHz	40 dBc, < 3 GHz		< 1.08, ≤ 2 GHz < 1.11, > 2 GHz	N (f)	N (f)
5400-6N75	0.001 to 3 GHz	40 dBc, < 3 GHz	75 Ω	< 1.10, ≤ 2 GHz < 1.17, > 2 GHz	N (m)	N (f)
5400-6NF75	0.001 to 3 GHz	40 dBc, < 3 GHz		< 1.10, ≤ 2 GHz < 1.17, > 2 GHz	N (f)	N (f)
560-97A50	0.01 to 18 GHz	36 dB	50 Ω	< 1.10, ≤ 2 GHz	GPC-7	N (f)
560-97A50-1		40 dB		< 1.17, > 2 GHz		
560-97N50	0.01 to 18 GHz	35 dB	50 Ω	< 1.17, ≤ 8 GHz	N (m)	N (f)
560-97N50-1		38 dB		< 1.27, > 8 GHz		
560-97NF50		35 dB		< 1.17, ≤ 8 GHz	N (f)	
560-97NF50-1		38 dB		< 1.27, > 8 GHz		
560-98S50	0.01 to 26.5 GHz	37 dB, < 18 GHz 36 dB, < 26.5 GHz	50 Ω	< 1.14, ≤ 8 GHz < 1.22, ≤18 GHz < 1.27, ≤ 26 GHz	WSMA (m)	Ruggedized K (f)
560-98S50-1		40 dB, < 18 GHz 38 dB, < 26.5 GHz				
560-98SF50		37 dB, < 18 GHz 36 dB, < 26.5 GHz		< 1.14, ≤ 8 GHz < 1.22, ≤18 GHz < 1.27, ≤ 26 GHz	WSMA (f)	
560-98SF50-1		40 dB, < 18 GHz 38 dB, < 26.5 GHz				
560-98K50	0.01 to 40 GHz	35 dB, < 18 GHz 32 dB, < 32 GHz 30 dB, < 40 GHz	50 Ω	< 1.14, ≤ 8 GHz < 1.26, ≤18 GHz < 1.29, ≤ 26.5 GHz < 1.33, ≤ 32 GHz < 1.38, ≤ 40 GHz	K (m)	Ruggedized K (f)
560-98KF50		35 dB, < 18 GHz 32 dB, < 32 GHz 30 dB, < 40 GHz			K (f)	
560-98VA50	0.01 to 50 GHz	30 dB, < 40 GHz 30 dB, < 50 GHz	50 Ω	< 1.25, ≤ 40 GHz < 1.25, ≤ 50 GHz	V (m)	Ruggedized V (f)
560-98VFA50		30 dB, < 40 GHz 30 dB, < 50 GHz		< 1.25, ≤ 40 GHz < 1.25, ≤ 50 GHz	V (f)	
560-98C50	0.01 to 40 GHz	34 dB, ≤ 20 GHz 32 dB, ≤ 26.5 GHz 29 dB, ≤ 40 GHz	50 Ω	< 1.20, ≤ 20 GHz < 1.30, ≤ 40 GHz	SMA (m and f) 3.5 mm (m and f) K (m and f)	Ruggedized K (f)

DETECTORS

Model	Frequency Range	Impedance	Return Loss	Input Connector	Frequency Response
5400-71B50	0.001 to 1.5 GHz	50 Ω	20 dB	BNC(m)	± 0.2 dB, < 1.5 GHz
5400-71B75	0.001 to 1.5 GHz	75 Ω	20 dB	BNC(m)	± 0.2 dB, < 1.5 GHz
5400-71N50	0.001 to 3 GHz	50 Ω	26 dB	N(m)	± 0.2 dB, < 1 GHz ± 0.3 dB, < 3 GHz
5400-71N75	0.001 to 3 GHz	75 Ω	26 dB, ≤ 2 GHz 20 dB, ≤ 3 GHz	N(m)	± 0.2 dB, < 1 GHz ± 0.5 dB, < 3 GHz
560-7A50	0.01 to 18 GHz	50 Ω	16 dB, < 0.04 GHz 22 dB, < 8 GHz 17 dB, < 18 GHz	GPC-7	± 0.5 dB, < 3 GHz
560-7N50B	0.01 to 20 GHz	50 Ω	16 dB, < 0.04 GHz 22 dB, < 8 GHz 17 dB, < 18 GHz 14 dB, < 20 GHz	N(m)	± 0.5 dB, < 18 GHz ± 2.0 dB, < 20 GHz
560-7S50B	0.01 to 20 GHz	50 Ω	16 dB, < 0.04 GHz 22 dB, < 8 GHz 17 dB, < 18 GHz 14 dB, < 20 GHz	WSMA(m)	± 0.5 dB, < 18 GHz ± 2.0 dB, < 20 GHz
560-7S50-2	0.01 to 26.5 GHz	50 Ω	16 dB, < 0.04 GHz 22 dB, < 8 GHz 17 dB, < 18 GHz 14 dB, < 26.5 GHz	WSMA(m)	± 0.5 dB, < 18 GHz ± 2.0 dB, < 26.5 GHz
560-7K50	0.01 to 40 GHz	50 Ω	13 dB, < 0.04 GHz 22 dB, < 8 GHz 17 dB, < 18 GHz 16 dB, < 26.5 GHz 15 dB, < 32 GHz 13 dB, < 40 GHz	K(m)	± 0.5 dB, < 18 GHz ±1.25 dB, < 26.5 GHz ± 2.2 dB, < 32 GHz ± 2.5 dB, < 40 GHz
560-7VA50	0.01 to 50 GHz	50 Ω	19 dB, < 20 GHz 15 dB, < 40 GHz 10 dB, < 50 GHz	V(m)	± 0.5 dB, < 18 GHz ±1.25 dB, < 26.5 GHz ± 2.5 dB, < 40 GHz ± 3.0 dB, < 50 GHz

DETECTORS

The 5400 and 560 Series Detectors use zero-biased Schottky diodes. Measurement range is –55 dBm to +16 dBm using single cycle per sweep AC detection, Auto-zeroing with DC detection during the frequency sweep. Optional extender cables of over 3000 feet can be used with the 54100A Series. Contact local sales representative for special cables.

Maximum Input Power: +20 dBm

Standard Cable Length: 122 cm (4 ft.)

Dimensions: 7.6 x 2.9 x 2.2 cm (3 x 1-1/8 x 7/8 in.)

Weight: 170 g (6 oz.)

MEASUREMENT ACCESSORIES

RF CABLES

Model	Frequency Range (GHz)	Impedance (Ohms)	Length	Connectors
10B75-1	DC to 1.5 GHz	75	30.5 cm (1 ft.)	BNC (m)
10N50-1	DC to 1.5 GHz	50	30.5 cm (1 ft.)	N (m)
10N75-1	DC to 1.5 GHz	75	30.5 cm (1 ft.)	N (m)
N120-6	DC to 18 GHz	50	15.25 cm (6 in)	N (m)
N120-12	DC to 18 GHz	50	30.5 cm (1 ft.)	N (m)
NS120MF-6	DC to 18 GHz	50	15.25 cm (6 in)	N (m)-SMA (f)
K120MF-6	DC to 40 GHz	50	15.25 cm (6 in)	K (m)-K (f)
V120MF-6	DC to 67 GHz	50	15.25 cm (6 in)	V (m)-V (f)

These RF Cables are used to extend the source RF Output to the device-under-test input port.

POWER SPLITTERS

Power Model	Frequency Range	Connectors	
		Input	Outputs
N241A50	DC to 3.0 GHz	N (f)	N (f)
N241A75	DC to 3.0 GHz	N (f)	N (f)
1091-28	DC to 18 GHz	N (f)	N (f)
K241B	DC to 26.5 GHz	K (m)	K (f)
K241C	DC to 40 GHz	K (m)	K (f)
V241C	DC to 60 GHz	V (m)	V (f)

These power splitters are symmetrical, two-resistor tee designs that can be used in applications where signals must be accurately divided for ratio measurements. They provide excellent flatness and effective output SWR. K Connectors are compatible with 3.5 mm and SMA.

PRECISION ADAPTERS

Part Number	Frequency Range	Impedance	SWR	Connectors
34NN75B	DC to 3 GHz	75 Ω	1.1	N (m) to N (m)
34NFNF75B	DC to 3 GHz	75 Ω	1.1	N (f) to N (f)
34NN50A	DC to 18 GHz	50 Ω	1.1	N (m) to N (m)
34NFNF50	DC to 18 GHz	50 Ω	1.1	N (f) to N (f)
K220	DC to 40 GHz	50 Ω	1.22	K (m) to K (m)
K222	DC to 40 GHz	50 Ω	1.22	K (f) to K (f)
34VK50	DC to 46 GHz	50 Ω	1.3	V (m) to K (m)
34VKF50	DC to 46 GHz	50 Ω	1.3	V (m) to K (f)
34VFK50	DC to 46 GHz	50 Ω	1.3	V (f) to K (m)
34VFKF50	DC to 46 GHz	50 Ω	1.3	V (f) to K (f)
34VV50	DC to 60 GHz	50 Ω	1.4	V (m) to V (m)
34VFVF50	DC to 60 GHz	50 Ω	1.4	V (f) to V (f)

MATCHING PAD AND MINIMUM LOSS ADAPTER

Model	Frequency Range (MHz)	SWR	Insertion Loss (dB)	Connectors
12N50-75B	DC to 3000	1.25	7.5 max.	N (m) 50 Ω to N (f) 75 Ω
12N75B	DC to 3000	1.25	3.0 max.	N (m) 50 Ω to N (m) 75 Ω

The 12N50-75B pad matches 50 Ω to 75 Ω or 75 Ω to 50 Ω circuits. The 12N75B converts 50 Ω to 75 Ω with less than 3 dB loss.

ADAPTERS

Part Number	Frequency Range	Impedance	SWR	Connectors
1091-136	DC to 1.5 GHz	75 Ω	1.1	F (f) to F (f)
1091-137	DC to 1.5 GHz	75 Ω	1.1	N (f) to F (m)
1091-168	DC to 1.5 GHz	75 Ω	1.06	N (m) to F (m)
1091-169	DC to 1.5 GHz	75 Ω	1.06	N (m) to F (f)
1091-170	DC to 1.5 GHz	75 Ω	1.06	N (f) to F (f)
1091-171	DC to 1.3 GHz	50 Ω	1.03	N (m) BNC (m)
1091-172	DC to 1.3 GHz	50 Ω	1.03	N (m) BNC (f)
1091-173	DC to 1.3 GHz	50 Ω	1.03	N (f) BNC (m)
1091-174	DC to 1.3 GHz	50 Ω	1.03	N (f) BNC (f)
1091-175	DC to 1.3 GHz	75 Ω	1.03	N (m) BNC (m)
1091-176	DC to 1.3 GHz	75 Ω	1.03	N (m) BNC (f)
1091-177	DC to 1.3 GHz	75 Ω	1.03	N (f) BNC (m)
1091-178	DC to 1.3 GHz	75 Ω	1.03	N (f) BNC (f)
1091-26	DC to 18 GHz	50 Ω	1.3	N (m) SMA (m)
1091-27	DC to 18 GHz	50 Ω	1.3	N (m) SMA (f)
1091-80	DC to 18 GHz	50 Ω	1.3	N (f) SMA (m)
1091-81	DC to 18 GHz	50 Ω	1.3	N (f) SMA (f)

CONVERTIBLE SWR AUTOTESTER TEST PORT HEADS

DUT Connector	Test Head Model	Frequency Range	Open/Short Model
SMA (f)	25S50	DC to 26.5 GHz	22KF50
SMA (m)	25SF50	DC to 26.5 GHz	22K50
3.5 mm (f)	25L50	DC to 30 GHz	22KF50
3.5 mm (m)	25LF50	DC to 30 GHz	22K50
K (f)	25K50	DC to 40 GHz	22KF50
K (m)	25KF50	DC to 40 GHz	22K50
SMA (f), SMA (m) K (f), K (m)	25SK50 (Set of Four)	DC to 26.5 GHz DC to 40 GHz	22KF50 22K50

54100A SERIES NETWORK ANALYZER CONFIGURATION G

Model Number	Source Frequency	DUT's Input Connector	SWR Autotester	Detector	Power Splitter	Splitter Adapter	Ext. Leveling Detector	Source Cable
Connection Diagram Reference Letter			A	B	C	D	E	F
54107A	0.001 to 1.5 GHz	75 Ω F (m)	5400-67FF75	5400-71N75	N241A75	1091-175	73N75	10N75-1
		50 Ω BNC (f)	5400-6B50	5400-71B50	N241A50	34NN50A	73N50	10N50-1
		50 Ω BNC (m)	5400-6BF50	5400-71B50	N241A50	34NN50A	73N50	10N50-1
54109A	0.001 to 2.2 GHz	75 Ω BNC (f)	5400-6B75	5400-71B75	N241A75	34NN75B	73N75	10N75-1
		75 Ω BNC (m)	5400-6BF75	5400-71B75	N241A75	34NN75B	73N75	10N75-1
54111A	0.001 to 3.0 GHz	50 Ω N (f)	5400-6N50	5400-71N50	N241A50	34NN50A	73N50	N120-6
		50 Ω N (m)	5400-6NF50	5400-71N50	N241A50	34NN50A	73N50	N120-6
		75 Ω N (f)	5400-6N75	5400-71N75	N241A75	34NN75B	73N75	10N75B-1
		75 Ω N (m)	5400-6NF75	5400-71N75	N241A75	34NN75B	73N75	10N75B-1
54117A	0.01 to 8.6 GHz	50 Ω APC-7	560-97A50-1	560-7A50	1091-28	34NN50A	75N50B	N120-6
		50 Ω N (f)	560-97N50-1	560-7N50B	1091-28	34NN50A	75N50B	N120-6
54147A	0.01 to 20 GHz	50 Ω N (m	560-97NF50-1	560-7N50B	1091-28	34NN50A	75N50B	N120-6
		50 Ω SMA (f)	560-98C50[3]	560-7S50B	K241B	1091-27	75KB50	NS120MF-6
		50 Ω SMA (m)	560-98C50[3]	560-7S50B	K241B	1091-27	75KB50	NS120MF-6
54161A	0.01 to 32 GHz	50 Ω SMA (f)	560-98C50[3]	560-7S50-2	K241C	K220	75KC50	K120MF-6
		50 Ω SMA (m)	560-98C50[3]	560-7S50-2	K241C	K220	75KC50	K120MF-6
54169A	0.01 to 40 GHz	50 Ω K (f)	560-98C50[3]	560-7K50	K241C	K220	75KC50	K120MF-6
		50 Ω K (m)	560-98C50[3]	560-7K50	K241C	K220	75KC50	K120MF-6
		50 Ω V (f)	560-98VA50	560-7VA50	V241C[1]	34VV50	70VC50	K120MF-6
		50 Ω V (m)	560-98VFA50	560-7VA50	V241C[1]	34VV50	70VC50	K120MF-6
54177A	0.01 to 50 GHz	50 Ω K (f)	560-98C50[3]	560-7K50	K241C[1]	K220	75KC50	V120MF-6
		50 Ω K (m)	560-98C50[3]	560-7K50	K241C[1]	K220	75KC50	V120MF-6
		50 Ω V (f)	560-98VA50	560-7VA50	V241C	34VV50	70VC50	V120MF-6
		50 Ω V (m)	560-98VFA50	560-7VA50	V241C	34VV50	70VC50	V120MF-6

[1] V to K interconnections require male (source) to female power splitter adapters. [2] Also requires a source adapter. [3] See page 7 (bottom right) to select appropriate test port heads.

(A) SWR Autotesters

For optimum accuracy, the SWR Autotester test port must mate to the DUT's input connector. If you must use an adapter at the SWR Autotester test port, use a precision low SWR adapter to minimize degradation of directivity.

(B) Detectors

One detector is required for transmission or DTF measurements in non-ratio configurations. Ratio measurements (monitors source output power) require a second detector. BNC type detectors will not mate directly to the N-type power splitter output (for use as the Reference of a Ratio Measurement) or power divider output (for use in Distance-To-Fault Measurements). For these applications, use a 1091-172 adapter or an N(m) detector such as 5400-71N50, 5400-71N75, or 560-7N50B.

(C) Power Splitter

Two resistor power splitters are used for ratio measurements and external leveling.

(D) Splitter Adapter

Adapter mates the power splitter output to the SWR Autotester input for Ratio and/or externally leveled measurements.

(F) Source Cable

In manufacturing applications, using the source cable from the source output to the power splitter input (or, in Non-Ratio applications to the SWR Autotester input) helps minimize long term wear of the SWR Autotester's test port connector. The cable mates directly to power splitter's input. Connection directly to SWR Autotesters requires a male-male adapter for WSMA, K, and V type SWR Autotesters.

RT

rce ter	Power Divider	3 dB Attenuator	DUT Adapter	Precision Termination
	H	I	J	K
175	11N75B	1010-53	1091-169	1015-29
50A	11N50B	1010-31	1091-171	1015-35
50A	11N50B	1010-31	1091-172	1015-34
75B	11N75B	1010-53	1091-175	1015-37
75B	11N75B	1010-53	1091-176	1015-36
50A	11N50B	1010-31	34NN50A	26NF50
50A	11N50B	1010-31	n/a	26N50
75B	11N75B	1010-53	34NN75B	26NF75
75B	11N75B	1010-53	n/a	26N75
50A	1091-29	1010-31	34AN50	28A50-1
50A	1091-29	1010-31	34NN50A	26NF50
50A	1091-29	1010-31	n/a	26N50
N50	K240B	43KB-3	K220	28SF50
N50	K240B	43KB-3	n/a	28S50
20	K240C	43KB-3	K220	28SF50
20	K240C	43KB-3	n/a	28S50
20	K240C	43KC-3	K220	28KF50
20	K240C	43KC-3	n/a	28K50
RK50	V240C [2]	41V-3	34VV50	28VF50B
RK50	V240C [2]	41V-3	n/a	28V50B
RK50	K240C [2]	43KC-3	K220	28KF50
RK50	K240C [2]	43KC-3	n/a	28K50
RV50	V240C	41V-3	34VV50	28VF50B
RV50	V240C	41V-3	n/a	28V50B

(G) Source Adapter

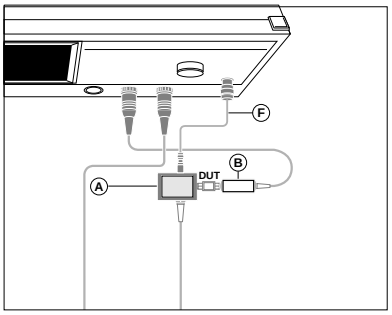
This adapter mates the source output directly to the SWR Autotester input.

(H) Power Divider

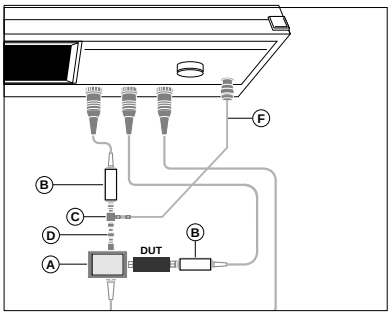
Distance-To-Fault testing procedures recommend use of a three resistor power divider. Except for the 1091-29, the power divider connection to the source output requires a male-male adapter or an RF extension cable with male connectors.

(I) 3 dB Attenuators, (J) DUT Adapters, (K) Terminations

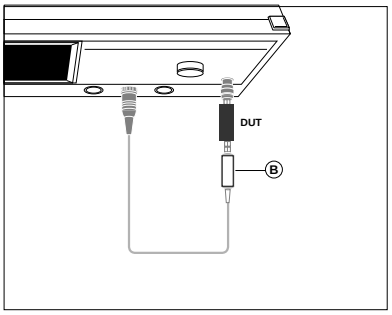
These components are used during coaxial Distance-To-Fault applications. Waveguide DTF applications may require a coaxial to waveguide adapter. Integrated DTF divider/detector modules are available in WR-22, WR-15, and WR-10.



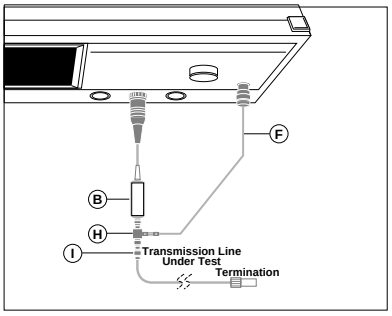
Non-Ratio Measurements: Eliminate one detector and the power splitter for measurements which do not need a source power reference detector.



Ratio Measurements: Use ratio techniques whenever source amplitude is adjusted during the measurement process.



Gain (or Loss), Group Delay and Output Power: An RF detector measures transmission characteristics. Group Delay measurement quality improves when a RF splitter and a second RF detector are used in a ratio configuration.



Distance-To-Fault: Faulty antenna systems and transmission lines are easily diagnosed with the 54100A Series optional Distance-To-Fault mode.

SYSTEM ACCESSORIES

LEVELING DETECTORS

Negative output polarity microwave detectors can be used to externally level 54100A power by sampling power at a remote test position. Connection is made to the 54100A rear panel (Option 6) via a BNC cable. For 70KC50 and 70VC50, an SMC (m) to BNC (m) cable is provided.

Max. Input: +20 dBm

Low Level Sensitivity at -30 dBm: 0.35 mV/μW

High Level Sensitivity at +13 dBm: 1V, minimum

Model	Frequency Range	Impedance	SWR (max.)	Flatness (dB)	Connectors
71B50	0.0001 to 3 GHz	50 Ω	1.2	± 0.5	Input: BNC (m) Output: BNC (f)
73N50	0.0001 to 4 GHz	50 Ω	1.2	± 0.5	Input: N (m) Output: BNC (f)
73N75	0.0001 to 2 GHz	75 Ω	1.2	± 0.5	Input: N (m) Output: BNC (f)
75N50B	0.01 to 18 GHz	50 Ω	1.39	± 0.6	Input: N (m) Output: BNC (f)
75KB50	0.01 to 26.5 GHz	50 Ω	1.5	± 1.0	Input: K (m) Output: BNC (f)
75VC50	0.01 to 40 GHz	50 Ω	1.5	± 1.5	Input: V (m) Output: SMC (f)
	40 to 50 GHz		2.1	± 3.0	

PRECISION TERMINATIONS

These precision, metrology–grade terminations are used in measurement systems where achieving the smallest possible reflections is critical.

Maximum Input Power: 0.5 W

Model	Frequency Range (GHz)	Test Port Connector	Input Impedance	SWR (F in GHz)
26N75	DC to 4	N (m)	75 Ω	1.004 + 0.0025F
26NF75		N (f)		
26N50	DC to 18	N (m)	50 Ω	1.004 + 0.0026F
26NF50		N (f)		
28A50	DC to 18	GPC-7	50 Ω	1.010 + 0.001F (1.020 Max.)
28A50-1				
28S50	DC to 26.5	WSMA (m)	50 Ω	1.036 to 18.5 GHz
28SF50		WSMA (f)		1.173 to 26.5 GHz
28S50-1	DC to 26.5	WSMA (m)	50 Ω	1.020 to 18.5 GHz
28SF50-1		WSMA (f)		1.135 to 26.5 GHz
28K50	DC to 40	K (m)	50 Ω	1.040 to 18.5 GHz
28KF50		K (f)		1.070 to 26.5 GHz 1.135 to 40 GHz
28V50B	DC to 65	V (m)	50 Ω	1.070 to 40 GHz
28VF50B		V (f)		1.110 to 60 GHz 1.230 to 65 GHz

RF LIMITERS

Return Loss: >11 dB, ≤ 20 GHz
>10 dB, ≤ 26 GHz

Insertion Loss: < 2.2 dB, ≤ 20 GHz, 0.0 dBm
< 3.2 dB, ≤ 26 GHz, 0.0 dBm

Turn-On Power: 10-14 dBm typ., ≤ 18 GHz
15-19 dBm typ., ≤ 26 GHz

RF limiters protect RF detectors against damage from:

1) DC Voltage — blocks up to 50 Vdc
2) AC Voltage — filters 50/60 Hz up to 100 Vac and impulse currents of >1.0 A.
3) RF Power — provides protection up to 3.0 W for frequencies range

Model	Frequency Range	Maximum Input Power	Impedance	Connectors
1N75C	0.01-3.0 GHz,	5 W	75 Ω	N (m) to N (f)
1N50C	0.01-18.0 GHz	5 W	50 Ω	N (m) to N (f)
1K50A	0.01-20.0 GHz	5 W	50 Ω	K (m) to K (f)
1K50B	0.01-26.0 GHz	3 W	50 Ω	K (m) to K (f)

DETECTOR EXTENDER CABLES

These cables can be installed between the SWR Autotester or Detectors and the 54100A. The 54100A is operational with cables up to 3000 feet.

Model	Cable Length
800-109	7.6 m (25 ft.)
800-110	15.2 m (50 ft.)
800-111	30.5 m (100 ft.)
800-112	61 m (200 ft.)
SC 5372	100 m (328 ft.)
Contact Factory	1000 ft.

GPIB CABLES

These cables connect the 54100A to a GPIB plotter or controller on the GPIB (IEEE–488 bus)

Model	Cable Length
2100-1	1 m (3.3 ft.)
2100-2	2 m (6.6 ft.)
2100-4	4 m (13.2 ft.)
2100-5	0.5 m (1.65 ft.)

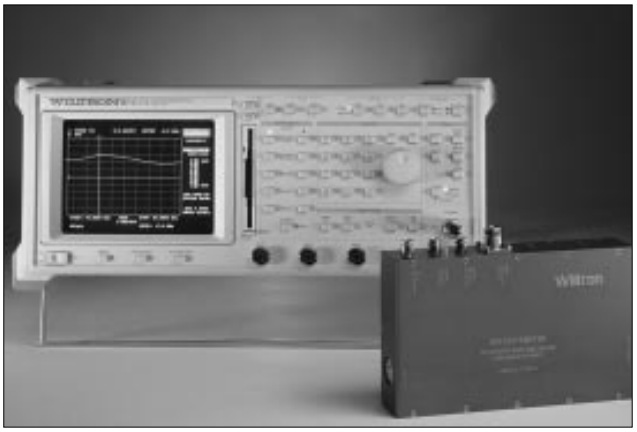
DETECTOR ADAPTER CABLES

These adapter cables allow the 54100A to be used with waveguide or other detectors. The model 560-10BX can be used with Leveling Detectors. The 560-10BX-1 and -2 models are used with millimeter wave detectors.

Model	Cable Length	Connector Type
560-10BX	122 cm (4 ft.)	BNC (f)
560-10BX-1	122 cm (4 ft.)	SMA (m)
560-10BX-2	122 cm (4 ft.)	BNC (m)

MILLIMETER WAVE MEASUREMENT SYSTEMS

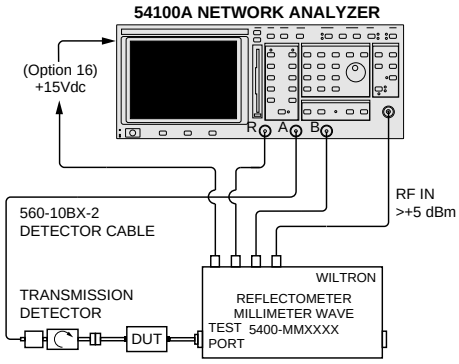
The Wiltron's Millimeter Wave Reflectometers are designed to operate with the 54147A 20 GHz Network Analyzer. The millimeter wave multiplier includes subharmonic filters and an isolator, to dramatically improve reflection accuracy.



The 54000 Series millimeter wave reflectometers integrate the measurement components within the multiplier/amplifier housing.

Excellent multiplier source match provided by the internal isolators and the improved detector return loss allow accurate, simultaneous return loss and transmission measurements.

Millimeter Wave Reflectometer Configuration



REFLECTION ACCURACY CHARACTERISTICS

Source Match: < 1.9 (< 1.7 Typical)

Directivity: 35 dB (> 40 dB Typical)

Dynamic Range: > 56 dB

Channel Accuracy:
Channel Accuracy is degraded by ± 0.4 dB from standard 54100A specifications

Output Power, Minimum: Leveled or Unleveled
V-band: 0.0 dBm min. (+ 4.0 dBm Typ.)
W-band: –5.0 dBm min. (+1.0 dBm Typ.)

Power Flatness, Unleveled: ± 3.0 dB Typ.

Required Input Frequency:
V-band: 12.75 to 18.75 GHz
W-band: 12.75 GHz to 18.33 GHz

Required Input Harmonics: < –60 dBc

Spurious Signals:
Harmonic: < –55 dBc (< –60 dBc Typical)
Nonharmonic: < –55 dBc (< –60 dBc Typical)

Frequency Accuracy: Source Dependent

Frequency Resolution: Source Dependent

MILLIMETER REFLECTOMETER ACCESSORIES

12" N (m) to N (m) RF input cable: PN: N120-12
Precision Attenuators: 1.08:1.0 SWR

Precision loads and attenuators allow low insertion loss devices such as couplers and wavequide sections to be accurately tested.
V band 3 dB: SM4784; 6 dB, SM4786
W band 3 dB: SM4785; 6 dB, SM4787

Precision Loads: 1.06: 1.0 SWR
V band, SM4782
W band, SM4783

DC Power Connections: SM4819 Twinax (m) – Twinax (m) cable
SM4816 Twinax to Dual Banana Plug
SM4818 Twinax to Dual EZ Hooks

PHYSICAL CHARACTERISTICS

Size: 9.5 x 4.5 x 1.5 inches

MILLIMETER WAVE DETECTORS

Maximum Input Power, Damage Level: +21 dBm

Special Waveguide Reflectometers Reflectometers have integrated multipliers/amplifiers. Input frequency is < 20 GHz

Model	Frequency Range	Directivity	Test Port		Input Connector
			SWR	Flange	
54000-6WR15	50 to 75 GHz	35 dB, 40 dB typ.	<1.9 (<1.7 typ.)	WR-15	N (f)
54000-6WR10	75 to 110 GHz	35 dB, 40 dB typ	<1.9 (<1.7 typ.)	WR-10	N (f)

Millimeter Wave Detectors

Model	Frequency Range	Dynamic Range	Input Port		Output Connector
			Return Loss	Flange	
54000-7WR15	50 to 75 GHz	> 56 dB typ.	17 dB	WR-15	BNC (f)
54000-7WR10	75 to 110 GHz	> 56 dB typ	17 dB	WR-10	BNC (f)

Return Loss Measurement Accuracy

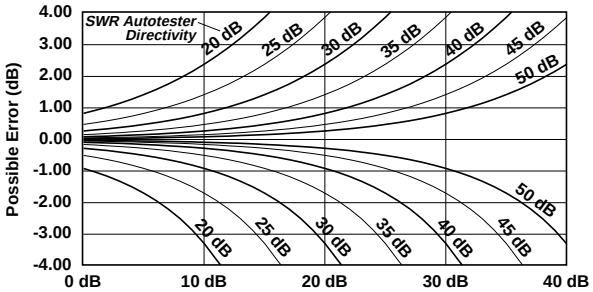
Uncertainties resulting from SWR Autotester and source frequency response and from system open and short characteristics are subtracted automatically from test data. Overall accuracy is then:

Channel Accuracy
+ Autotester Accuracy
+ Distortion From Source Harmonics
Return Loss Measurement Accuracy

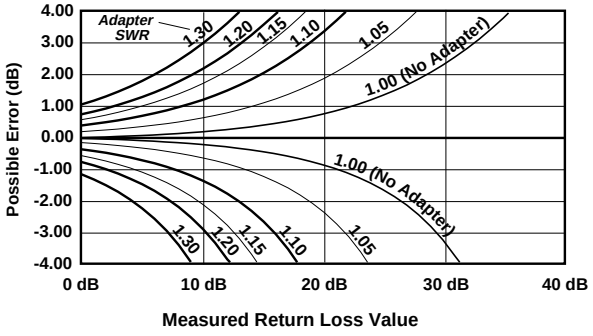
Autotester accuracy is composed of error due to directivity and error due to test port match. Unless the DUT has very poor return loss (high SWR), directivity will be largest source of error. When an adapter is used at the test port, use Effective Directivity to determine possible errors.

NOTE: Return loss errors due to source harmonics will be significant when the harmonic level is within 10 dB of the DUT's measured return loss.

RETURN LOSS ACCURACY DUE TO DIRECTIVITY

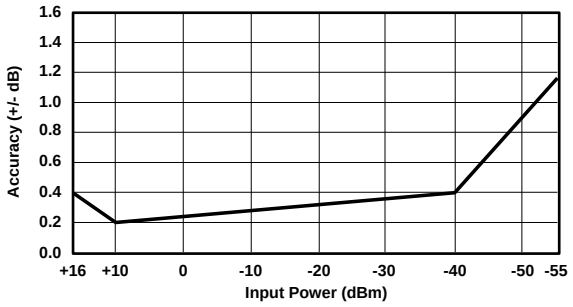


RETURN LOSS ACCURACY DUE TO EFFECTIVE DIRECTIVITY

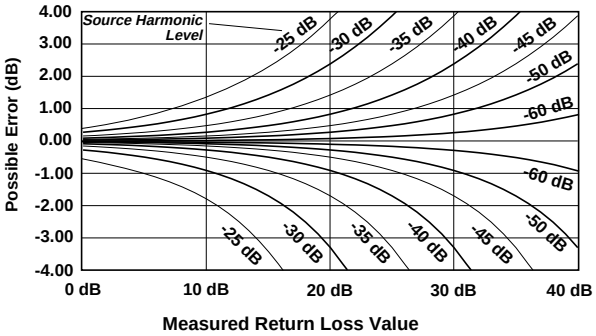


Effective Directivity is the reduction to Directivity due to the adapter's SWR performance. The chart above assumes a 40 dB directivity SWR Autotester.

CHANNEL ACCURACY (25°C)



RETURN LOSS ACCURACY DUE TO SOURCE HARMONICS



This chart assumes full reflections of a single source harmonic at the DUT input. Multiple harmonics can cause additional measurement uncertainty.

Source harmonics are a significant source of return loss measurement uncertainty when testing banded devices such as filters, receivers, transmitters, power amplifiers, and antennas. With the source output frequency in the DUT passband, the source harmonics are in the reject band. Thus, the total signal power of the harmonic is reflected into the SWR Autotester's internal broadband detector.

RELATIVE GROUP DELAY

Optional relative group delay software identifies signal distortion caused by bandpass devices such as filters, receivers, power amplifiers, and up/down converters. Group delay is a key cause of high Bit Error Rate (BER). Group delay is important for 1) CDMA and spread spectrum communications 2) phase radars 3) high capacity satellite and terrestrial microwave links 4) PAL and HDTV television components and other RF systems sensitive to phase distortion.

The 54100A saves time and expense by eliminating several pieces of expensive test equipment – combining the capabilities into a single, low cost test station. Manufacturing processes save re-test/re-tuning time by utilizing a single 54100A instead of two separate tuning stations – one for transmission and return loss and the other for relative phase group delay. The 54100A's other convenient features for Distance-To-Fault analysis, Convertible SWR Autotesters, rugged construction, low cost and wide frequency range make it an ideal field service analyzer.

In many manufacturing applications, the 54100A can replace expensive vector network analyzers. Furthermore, the 54100A can accurately test frequency conversion devices without the wideband reference converters required with vector network analyzers or microwave system analyzers.

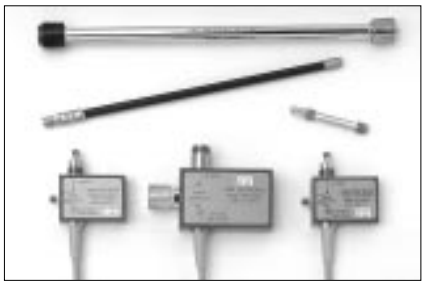
Calibration requires only an RF path normalization with a standard RF detector. Relative group delay specifications assume measurement of bandpass devices. Frequency sweep must include at minimum 20 dBr of transmission rolloff from mid-band response. For best results, set the frequency sweep to cover more than 20 dBr rolloff is suggested.

Relative Group Delay Accuracy: Typically < 1ns, < 5.0% of peak-to-valley range with noise averaged. Assumes the band limiting device within the DUT meets minimum phase shift design. Devices such as SAW filters, microwave phase equalizers, and branch line couplers will have additional uncertainty.

Calibration: A transmission path normalization is required.

PRECISION RETURN LOSS MODE

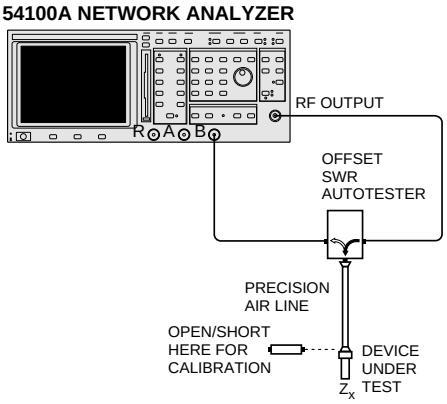
Terminations, adapters, and connectors have return loss values that are difficult of measure directly with a standard SWR Autotester. Without proper care, test bench components can be easily damaged without showing significant physical changes.



Offset SWR Autotesters and Precision Airlines measure high return loss values from 20 dB to 60 dB.

Precision Return Loss Mode automatically verifies the specified performance of these common test components using an Offset SWR Autotester, Airline, Open/Short, and a Termination.

Component Connections for Precision Return Loss Mode



SELECTION GUIDE

DUT Connector	Offset SWR Autotester	Airline	Open Short	Precision Terminations[1]
GPC-7	560-97A50-20	18A50	22A50	28A50 28A50-1
N male N female	560-97A50-20 560-97A50-20	18NF50 18N50	22N50 22NF50	26N50 26NF50
SMA male	560-98KF50-15	19SF50	22S50	28S50 28S50-1
SMA female	560-98KF50-15	19S50	22SF50	28SF50 28SF50-1
3.5mm male	560-98KF50-15	19LF50 (SC4127)	22K50	28K50
3.5mm female	560-98KF50-15	19L50 (SC3588)	22KF50	28KF50
K male K female	560-98KF50-15 560-98KF50-15	19KF50 19K50	22K50 22KF50	28K50 28KF50

[1]Terminations are needed for adapter verification tests and other two port device testing.

PRECISION AIRLINE SPECIFICATIONS

Model	Freq. Range (GHz)	Test Port Connector	Beaded Port Connector	SWR	Dia. (mm)	Length (cm)
18A50	0.5 to 18	GPC-7	GPC-7	1.003 (Test Port) 1.020 (Beaded End)	7	30
18N50	0.5 to 18	N (m)	GPC-7	1.006	7	30
18NF50		N (f)				
19S50	0.8 to 26.5	WSMA (m)	WSMA male	1.006 to 18 GHz 1.010 to 26.5 GHz	3.5	25
19SF50		WSMA (f)				
19K50	0.8 to 40	K (m)	1.020	1.020	2.9	15
19KF50		K (f)				

Waveguide SWR Autotesters					
Model	Frequency Range	Directivity	Test Port		Input Connector
			Return Loss	Flange	
560-WR229	3.6 to 4.2 GHz, WR229	40 dB	22 dB	UG-1350/U	N (f)
560-WR137	5.9 to 6.5 GHz, WR137	40 dB	22 dB	UG-1356/U	N (f)
SC5302	6.5 to 7.1 GHz, WR137	38 dB	22 dB	UG-1356/U	N (f)
SC5121	7.1 to 7.9 GHz, WR137	38 dB	22 dB	UG-1356/U	N (f)
SC5125	7.3 to 7.7 GHz, WR112	40 dB	22 dB	UG-1358/U	N (f)
560-WR90	10.7 to 11.7 GHz, WR90	40 dB	19 dB	UG-1360/U	N (f)
SC5122	12.7 to 13.3 GHz, WR75	40 dB	19 dB	UDR120	N (f)
SC5123	14.0 to 14.5 GHz, WR62	40 dB	19 dB	UG-419/U	N (f)
SC5137	14.5 to 15.5 GHz, WR62	40 dB	19 dB	UG-419/U	N (f)
560-WR42	18 to 19 GHz, WR42	40 dB	19 dB	UG-595/U	N (f)
SC5124	21.2 to 23.6 GHz, WR42	38 dB	19 dB	UG-595/U	Ruggedized K (f)
560-WRXX	Customer Specified	Contact AW	Contact AW	Customer Specified	N (f)

WAVEGUIDE SWR AUTOTESTERS

New Waveguide SWR Autotesters are tuned for unequaled high directivity performance with a coaxial to waveguide flange installed on the test port. The result is a small package that is a) more rugged, b) easier-to-use, c) more accurate, and d) more reliable than precision waveguide couplers.

WAVEGUIDE SWR ADAPTERS

A wide variety of standard waveguide sizes are designed for field testing of installed waveguide within:

- Microwave Communications Towers
- Cellular Base Stations
- Aircraft Radar Transmission Lines
- Ship-board Radar Transmission Lines

When ordering, please alert your Anritsu Wiltron sales representative to request special flange types.

SPECIAL WAVEGUIDE ADAPTERS

Wiltron markets some of the worlds rarest – and most useful – coaxial to waveguide transitions. For example, the 26 GHz to 40 GHz waveguide to 40 GHz K-type coaxial is the only precision instrumentation grade transition available for Ka band.

Model	Frequency Range (GHz)	Connectors	W/G Flange UG-(_)U	SWR
35WR42K 35WR42KF	18 to 26.5	WRD42 to K Male WRD42 to K Female	595	1.25
35WR180K 35WR180KF	18 to 40	WRD180 to K Male WRD180 to K Female	N/A	1.25
35WR28K 35WR28KF	26.5 to 40	WR28 to K Male WR28 to K Female	599	1.25
35WR22K 35WR22KF	33 to 40	WR22 to K Male WR22 to K Female	383	1.30
35WR22V 35WR22VF	33 to 50	WR22 to V Male WR22 to V Female	383	1.30
35WR19K 35WR19KF	40 to 50 Usable to 54	WR19 to K Male WR19 to K Female	383	1.30
35WR19V 35WR19VF	40 to 60	WR19 to V Male WR19 to V Female	383	1.30
35WR15V 35WR15VF	50 to 67	WR15 to V Male WR15 to V Female	385	1.30

Wiltron manufactures a wide variety of high frequency waveguide to coaxial adapters.

Customer requests for new standards supporting millimeter wave applications in wireless LANs, vehicle collision avoidance, and wafer probing have lead to the development of coaxial to waveguide transitions to 67 GHz (V connectors) and 110 GHz (W connectors).

DISTANCE-TO-FAULT

The optional Distance-To-Fault software displays impedance discontinuities versus distance based on a swept frequency measurement of transmission line mismatch. The software is available by ordering Option 7 with 54100A Series Network Analyzers.

Measurements: Distance-To-Fault (meters or feet), Return loss or SWR of fault.

Frequency Sampling: 256, 512, or 1024 frequency points.

Window Functions: Hamming, 2-term, –42 dB sidelobes;

Blackman-Harris, 3-term, –67 dB sidelobes.

Anti-aliasing: Filtering of post detected data rejects indications of false faults caused by signal re-reflections during high reflection fault conditions or out of band sweep on antenna systems.

Distance Accuracy: < 0.01% of range or 2 mm dependent upon knowledge of the propagation velocity for the device under test and the frequency sweep range.

Dynamic Range: > 80 dB, depending upon calibration component return loss and operating frequency range.

Return Loss Amplitude Accuracy: Effective Directivity is dependent upon the return loss of the precision termination used during calibration.

Distance Range: 1 to 5000 meters depending on measurement frequency range and hardware configuration.

Distance Resolution (of one fault):
0.4% of total distance (256 frequency measurement points),
0.2% of total distance (512 frequency measurement points),
0.1% of total distance (1024 frequency measurement points).

Transmission Lines Supported:

- Coaxial Cable
- Waveguide
- Waveguide with Coaxial Cable Input

Transmission line loss and velocity factor are corrected by the software. Waveguide dispersion is corrected based on the cutoff frequency, f_c. For waveguide with coaxial cable input, a special operating mode is utilized to automatically compensate for the length of non-dispersive coaxial cable in front of the waveguide transmission line.

Distance-To-Fault Measurement Accessories:

Wiltron Distance-To-Fault test systems utilize standard diode detectors and measurement accessories.

POWER DIVIDERS

Power Divider Model	Frequency Range	Connectors	
		Input	Output
11N50B	DC to 3 GHz	N (f)	N (f)
11N75B	DC to 3 GHz	N (f)	N (f)
1091-29	DC to 18 GHz	N (m)	N (f)
K240B	DC to 26.5 GHz	K (f)	K (f)
K240C	DC to 40 GHz	K (f)	K (f)
V240C	DC to 60 GHz	V (f)	V (f)

These signal dividers are symmetrical, three-resistor tee designs that are used with the Distance-To-Fault option and other applications requiring two inputs to be combined into a single output.

Maximum Input Power: +30 dBm

3 dB ATTENUATORS

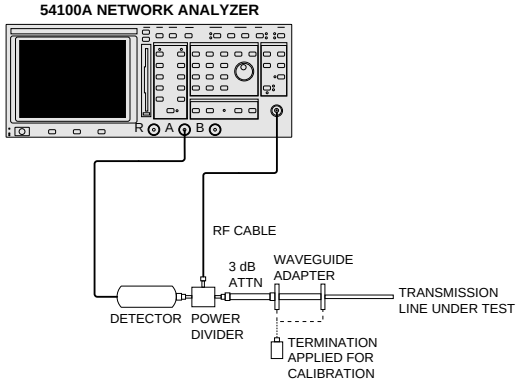
3 dB Attenuator Model	Frequency Range	Connectors	
		Input	Output
1010-31	0.01 to 18 GHz	N (m)	N (f)
43KB-3	0.01 to 26.5 GHz	K (m)	K (f)
43KC-3	0.01 to 40 GHz	K (m)	K (f)
41V-3	0.01 to 60 GHz	V (m)	V (f)

RECOMMENDED TERMINATIONS

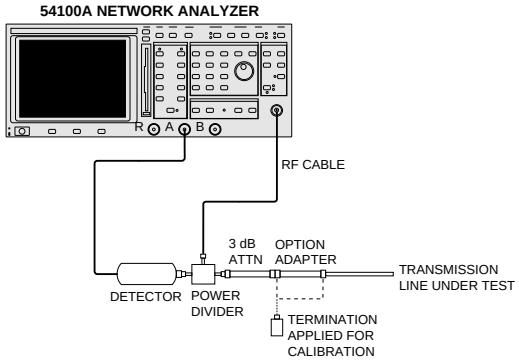
Model	Impedance	Frequency Range	Connector
1015-29	75 Ω	DC to 1.5 GHz	F (f)
1015-34	50 Ω	DC to 2 GHz	BNC (m)
1015-35	50 Ω	DC to 2 GHz	BNC (f)
1015-36	75 Ω	DC to 1 GHz	BNC (m)
1015-37	75 Ω	DC to 1 GHz	BNC (f)
26N75	75 Ω	DC to 4 GHz	N (m)
26N50	50 Ω	DC to 18 GHz	N (m)
28S50	50 Ω	DC to 26.5 GHz	WSMA (m)
28S50-1	50 Ω	DC to 26.5 GHz	WSMA (m)
28K50	50 Ω	DC to 40 GHz	K (m)
28V50	50 Ω	DC to 65 GHz	V (m)

Terminations are required for calibration and are occasionally used for terminating the output of the coaxial cable under test. Contact your local sales representative for additional precision termination models.

Non-Ratio Operation, Waveguide



Non-Ratio Operation, Coaxial



Ordering Information

54100A SERIES MODELS

54107A Network Analyzer, 1 MHz to 1.5 GHz
54109A Network Analyzer, 1 MHz to 2.2 GHz
54111A Network Analyzer, 1 MHz to 3 GHz
54117A Network Analyzer, 10 MHz to 8.6 GHz
54147A Network Analyzer, 10 MHz to 20 GHz
54161A Network Analyzer, 10 MHz to 32 GHz
54169A Network Analyzer, 10 MHz to 40 GHz
54177A Network Analyzer, 10 MHz to 50 GHz

OPTIONS

Option 1	**Rack Mounting with Slides**
Option 2	**70 dB RF Step Attenuator**
Option 2A	**70 dB 20 GHz Step Attenuator**
Option 2B	**70 dB 26.5 GHz Step Attenuator**
Option 2C	**70 dB 40 GHz Step Attenuator**
Option 2D	**70 dB 50 GHz Step Attenuator**
Option 4	**75 ohm Source Output** (Available to 3.0 GHz)
Option 5	**Add Reference Channel**
Option 6	**Add External Leveling**
Option 7	**Internal Distance-To-Fault Software**
Option 8	**Internal Relative Group Delay Software**
Option 12	**Add Front Panel Cover**
Option 13	**Add Front Mounted Handles**
Option 16	**+15 V DC Supply for Millimeter Wave Source Modules.** (Available with ≤20 GHz Models Only)
Option 25	**Maintenance Manual**
Option 26	**Extra Operation and GPIB Programming Manual**
Option 33	**Canon BJ30 Bubble Jet Printer**

DETECTORS

5400-71N50L	**5 MHz to 1 GHz**	N (m)
5400-71N50	**1 MHz to 3 GHz**	N (m)
5400-71N75	**1 MHz to 3 GHz**	N (m)
560-7A50	**10 MHz to 18 GHz**	GPC-7
560-7N50B	**10 MHz to 20 GHz**	N (m)
560-7S50B	**10 MHz to 20 GHz**	WSMA (m)
560-7S50-2	**10 MHz to 26.5 GHz**	WSMA (m)
560-7K50	**10 MHz to 40 GHz**	K (m)
560-7VA50	**10 MHz to 50 GHz**	V (m)

SWR AUTOTESTERS

5400-6N50	**1 MHz to 3 GHz**	N (m)
5400-6NF50	**1 MHz to 3 GHz**	N (f)
5400-6N75	**1 MHz to 3 GHz**	N (m)
5400-6NF75	**1 MHz to 3 GHz**	N (f)
560-97A50	**10 MHz to 18 GHz**	GPC-7
560-97A50-1	**10 MHz to 18 GHz**	GPC-7
560-97N50	**10 MHz to 18 GHz**	N (m)
560-97N50-1	**10 MHz to 18 GHz**	N (m)
560-97NF50	**10 MHz to 18 GHz**	N (f)
560-97NF50-1	**10 MHz to 18 GHz**	N (f)
560-98S50	**10 MHz to 26.5 GHz**	WSMA (m)
560-98S50-1	**10 MHz to 26.5 GHz**	WSMA (m)
560-98SF50	**10 MHz to 26.5 GHz**	WSMA (f)
560-98SF50-1	**10 MHz to 26.5 GHz**	WSMA (f)
560-98K50	**10 MHz to 40 GHz**	K (m)
560-98KF50	**10 MHz to 40 GHz**	K (f)
560-98C50	**10 MHz to 40 GHz**	SMA (m,f), K (m,f)
560-98VA50	**10 MHz to 50 GHz**	V (m)
560-98VFA50	**10 MHz to 50 GHz**	V (f)

WAVEGUIDE SWR AUTOTESTERS

560-WR229	**3.6 to 4.2 GHz**	N (f)
560-WR137	**5.9 to 6.5 GHz**	N (f)
560-WR90	**10.7 to 11.7 GHz**	N (f)
560-WR42	**18 to 19 GHz**	N (f)
560-WRXX	**Customer Specified**	

UPGRADES

54107A-to-54109A	ND41000
54107A-to-54111A	ND41001
54109A-to-54111A	ND41002
54147A-to-54161A	ND41009
54147A-to-54169A	ND41010
54147A-to-54177A	ND41011
54169A-to-54177A	ND41012

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Anritsu Wiltron

Microwave Measurements Division • 490 Jarvis Drive • Morgan Hill, CA 95037-2809
http://www.anritsuwiltron.com • FAX (408) 778-0239

International Sales Centers:
Europe Intl. 44 (1582) 418853
Japan (03) 3446-1111
Canada (613) 828-4090
Asia-Pacific Intl. 81 (3) 3440-2770

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Appendix B
Operating Data

Table of Contents

Appendix B
Operating Data

B-1 INTRODUCTION

This appendix provides default control settings, error codes and warning messages, and rear panel connector information and pinout data.

B-2 DEFAULT CONTROL SETTINGS

Table B-1 provides a listing of the power-up default control settings for the Model 541XXA Network Analyzer.

B-3 FRONT PANEL LED ERROR CODES

Table B-2 provides a listing of the front panel LED error codes.

B-4 ERROR/WARNING MESSAGES

Tables B-3 and B-4 provide listings for error and warning messages that may occur at start-up and/or during operation.

B-5 REAR PANEL CONNECTORS

Figure B-1 shows the rear panel and describes the connectors.

B-6 CONNECTOR PINOUT LISTINGS

Figures B-2 and B-3 provide a pinout listing for the respective External Monitor and GPIB Interface connectors.

Table B-1. *Power-up Default Control Settings*

Control Setting	Default	Control Setting	Default
Alternate Frequency Mode	Off	Width Frequency	HBEF – LBEF
Averaging Mode	Off	Power Output Level:	W/O Atten. With Atten.
Current Sweep Mode	Start/Stop Mode	Models 54107/109/11, 50Ω:	+12 dbm +10 dbm
Cursor	Off	Models 51407/109/111, 75Ω:	+10 dbm +8 dbm
Graticule	Off	Model 54136:	+ 7dBm +4 dBm
Hardcopy Plot Type	Plot All	All Other Models:	+10 dBm +7 dBm
Hardcopy Print Type	Print All	Limits	Off
Leveling Mode	Internal	Markers	Off
Printer Select	On	Measurement Mode, Ch 1	Transmission, Input A
RF Power	On	Measurement Mode, Ch 2	Return Loss, Input B
Frequency Information	Displayed	Reference Line	Off
Smoothing Mode	Off	Offset	0 dB
Trace Hold	Off	Resolution	10 dB
Number of Data Points	401	Print Text String Length	12 Spaces
Start Frequency	Low Band Edge Freq (LBEF)*	User Title String Length	12 Spaces
Stop Frequency	High Band Edge Freq (HBEF)*	GPIB	System, Main Address 6
Center Frequency	LBEF + ((HBEF – LBEF) ÷ 2)		System, Plotter Address 8

∗ Model Dependent

Table B-2 *Front Panel LED Error Codes*

LED Name	Condition/Fault	LED Name	Condition/Fault
HARDCOPY PLOTTER	A6/A7 PERSONALITY CHANGE warning	UNLEVELED	A7 POWER-DOWN fail
SMOOTHING CHANNELS 1 & 2	A7 NON-VOLATILE RAM fail	REMOTE	A2 KEYBOARD INTERFACE fail
CALIBRATION UNCAL*	A3 SIGNAL CHANNEL PRESET fail or A5 SIGNAL CHANNEL ADC fail	DISPLAY CHAN'S 1 & 2	Self Test Finished

* This LED designates one of two failures

ERROR/WARNING MESSAGES

Error/warning messages are displayed by the 541XXA for the conditions described below. These messages warn that some unusual instrument condition exists. In some cases, the user may elect to continue to use the 541XXA without taking the suggested remedial action included with the error message description below. (This is not possible with Error Warning Message #14 — see below.) Use caution when interpreting the measurement results when operating the 541XXA with an error warning message displayed. Some (or all) of the data may be in error.

The error warning message is displayed in a warning message box located in the lower right corner of the screen display. This message box displays an error/warning number (XXX) along with the error message. If the screen display error message box also contains a "1:" or "2:" before the error message, the error message relates to measurement channel 1 or 2, respectively. The error/warning number will also be returned as part of the 541XXA response to a Return Status (RS) GPIB command issued during these conditions.

Hardcopy output from the 541XXA under these conditions will include a warning message box (shown below) that will be located at the bottom right of the printout or plot. Note that this box also shows the error/warning number.

Instrument Warning: XXX Displayed

Table B-3. *Warning/Error Messages (1 of 4)*

Error / Warning Number	Type	Description	Screen Display Warning Box Message
000	O	No error or warning A null value is returned as part of the 541XXA response to a 'RS' GPIB command issued during normal operation.	(None)
001 002	W W	Calibration Start Error, Channel 1 Calibration Start Error, Channel 2	n*: CAL START XX.XXXX GHz
003 004	W W	Calibration Stop Error, Channel 1 Calibration Stop Error, Channel 2 Problem: The new frequency range includes frequencies outside the current calibrated range for the indicated channel. If a start error, the new start frequency is below the calibration start frequency. If a stop error, the new stop frequency is above the calibration stop frequency. Remedy: Re-calibrate using the new start/stop frequency values or adjust new current frequency range to fall within existing calibration range.	n*: CAL STOP XX.XXXX GHz

Table B-3. *Warning/Error Messages (2 of 4)*

Error / Warning Number	Type	Description	Screen Display Warning Box Message
005 006	W W	Not Calibrated, Channel 1 Not Calibrated, Channel 2 Problem: The 541XXA was calibrated with a different input connector selected for channel. Remedy: Re-calibrate the 54XXA with current settings, or proceed with caution: measurement results must be interpreted to compensate for the problem.	n*: NOT CAL CHANNEL
007	W	Invalid Calibration Data Problem: Subtract Trace Memory feature presently selected. Remedy: Re-calibrate, or de-select Subtract Trace Memory from measurement setup.	INVALID CAL DATA
008 009 010 011	W W W W	Trace Memory Start Error, Channel 1 Trace Memory Start Error, Channel 2 Trace Memory Stop Error, Channel 1 Trace Memory Stop Error, Channel 2 Problem: The current frequency range includes frequencies outside of the range covered by the specified Trace Memory. Remedy: Adjust current frequency range or cancel use of the specified Trace Memory.	n*: MEM START XX.XXXX GHz n*: MEM STOP XX.XXXX GHz
012 013	W W	Calibration Power Error, Channel 1 Calibration Power Error, Channel 2 Problem: The current output power is different from the power value used during the last calibration. Remedy: Re-calibrate using new power level or adjust current power level to calibration value.	CAL POWER n*: XX.XX dBm
014	U	Keypad Entry Error Problem: The last keypad input is not within credible limits for the current data parameter.	ENTRY ERROR RE-ENTER

* n = Channel Number
F = Hardware Fault
O = OK information message (GPIB)
U = User Error, keyboard input, etc.
W = Warning Only

Table B-3. *Warning/Error Messages (3 of 4)*

Error / Warning Number	Type	Description	Screen Display Warning Box Message
		Remedy: Re-enter valid data value via keypad or spinwheel. ***NOTE:*** This is an *ERROR* condition. Further use of the instrument is not possible until the condition causing the error has been corrected.	
015 016	W W	No Calibration Data, Channel 1 No Calibration Data, Channel 2 Problem: No calibration data exists for the indicated channel. Remedy: Perform calibration including designated channel or change measurement type for the channel.	n*: NO CAL DATA
017 018	W W	Calibration Data Only for Transmission, Channel 1 Calibration Data Only for Transmission, Channel 2 Problem: Channel set to measure Return Loss or SWR, but the calibration data for channel is for Transmission. Remedy: Perform calibration for current measurement type or change channel measurement type.	n*: CAL IS TRANSMSSN
019 020	W W	Calibration Data Only for Return Loss or SWR, Channel 1 Calibration Data Only for Return Loss or SWR, Channel 2 Problem: Channel set to measure Transmission, but the calibration data for channel is for Return Loss or SWR. Remedy: Perform calibration for current measurement type or change channel measurement type.	n*: CAL IS RET LOSS
021	W	Cursor Search Failed Problem: The last cursor search command was unable to find the requested value(s) on the current trace. Remedy: Amend search targets, search type, or cursor mode. (Reminder: if Relative ModeCursor is enabled, target values are interpreted as relative to the value at the current cursor.)	NOT FOUND

* n = Channel Number
F = Hardware Fault
O = OK information message (GPIB)
U = User Error, keyboard input, etc.
W = Warning Only

Table B-3. *Warning/Error Messages (4 of 4)*

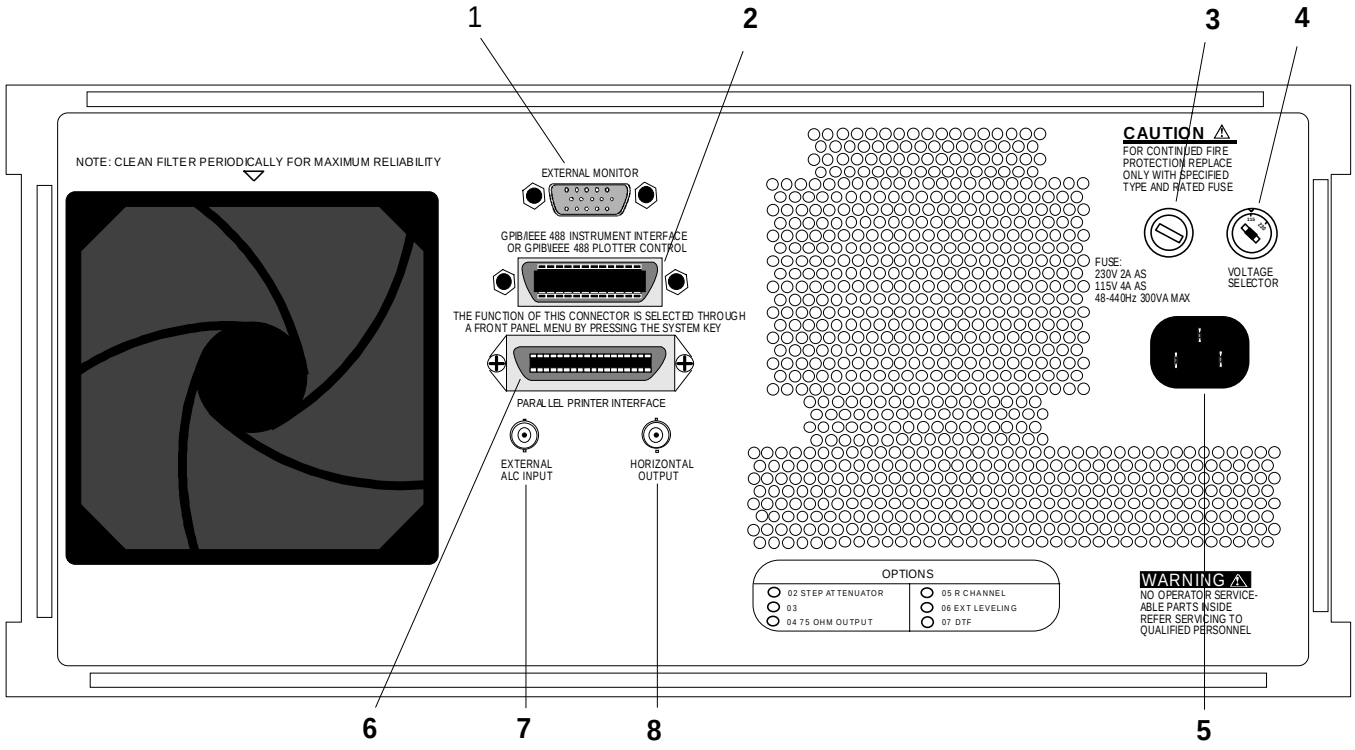
Error / Warning Number	Type	Description	Screen Display Warning Box Message
022 023	W W	Trace Memory Invalid Display Resolution, Channel 1 Trace Memory Invalid Display Resolution, Channel 2	TRACE MEM 101 pts
		Problem: The requested trace memory was captured with a resolution inconsistent with current settings. Remedy: Recall a different trace memory, change resolution, or disable trace memory subtraction.	
024	W	External ALC Uncalibrated Problem: External ALC selected , but has not yet been rescaled. Remedy: Perform External ALC calibration.	EXT ALC UNCAL
025	W	N/A (Reserved)	N/A (Reserved)
026	F	Frequency Calibration Fault Problem: A serious fault condition has been detected during the frequency calibration process. The error codes (nnn) that are displayed with the Frequency Calibration Fault warning message are listed in Table B-4. Remedy: Report the problem to your ANRITSU Service Center (refer to Table 2-1).	FREQUENCY LOCK nnn
027	W	Invalid Calibration Mode Problem: Attempting to use Frequency Scaling mode with standard calibration data. Remedy : Perform a new calibration, or cancel Frequency Scaling mode.	NOT CAL MODE

* n = Channel Number
F = Hardware Fault
O = OK information message (GPIB)
U = User Error, keyboard input, etc.
W = Warning Only

Table B-4. *Frequency Calibration Fault Warning Message Error Codes*

The following is a list of calibration error codes that are displayed along with the Frequency Calibration Fault warning message (see Error/Warning Number 26 in Table B-3).

Calibration Error Code	Error Description
201	General, no 500 MHz markers
202	Start DAC main band, 500 MHz marker(s) missing; or, top or bottom frequency(s) not correctly set
203	Start DAC main band, 1st MHz markers (top) wrong
204	Start DAC main band, 500 MHz marker size error
205	Error DAC, 25 MHz marker spacing wrong
206	Width DAC main band, 500 MHz marker(s) missing
207	Width DAC main band, 1st MHz markers (top) wrong
208	Width DAC main band, 500 MHz marker size error
209	Width DAC fm, 25 MHz marker spacing wrong
210	HET band, 500 MHz marker missing
211	HET band, 25 MHz and 500 MHz marker spacing wrong
212	HET band, 25 MHz marker spacing wrong



1. **EXTERNAL MONITOR:** Connects internal display information to an external VGA-type monitor via a standard VGA interface cable. The pinout for this connector is shown in Figure B-2.

2. **GPIB/IEEE-488 INSTRUMENT INTERFACE:** General Purpose Interface bus connector. Connects 541XXA to external system controller or external GPIB controlled plotter via standard GPIB interface cable. Refer to Chapter 2, Installation. The pinout for this connector is shown in Figure B-3.

3. **LINE FUSE:** Provides overvoltage/current protection for the 540XXA circuits. Unit requires a 4A, antisurge fuse for 115 Vac line voltage or a 2A, antisurge fuse for 230 Vac line voltage.

4. **VOLTAGE SELECTOR;** Provides selection of 115 or 230 Vac line voltages. When 115 Vac is selected, the 541XXA accepts 90-132 Vac, 48-400Hz line voltage; when 230 Vac is selected, the 541XXA accepts 180-265 Vac, 48-400Hz line voltage.

5. **INPUT LINE VOLTAGE RECEPTACLE:** Provides for connecting line voltage to the 541XXA SMS.

6. **PARALLEL PRINTER INTERFACE:** Provides standard Centronics® parallel interface to external printer.

7. **EXTERNAL ALC INPUT (Option 06):** Connects external detector signal to internal RF output leveling circuits for signal source. Selection of internal or external ALC detectors is made via the LEVELING key located in the SOURCE key group. External level detector signal output requirements: positive or negative polarity signal, 5 to 200mV amplitude.

8. **HORIZONTAL OUTPUT:** Sweep Ramp output signal, 0 to +10V (nominal). Instantaneous voltage proportional to present position of sweep within sweep range.

Figure B-1. *Model 541XXA Rear Panel Layout*

Pin No.	Pin Name/Function	
	Monochrome	Color
1	not used	Red Signal
2	Mono Dots	Green Signal
3	not used	Blue Signal
4	not used	not used
5	not used	not used
6	Key Pin	Red Return
7	Mono Return	Green Return
8	not used	Blue Return
9	no pin	no pin
10	Digital Ground	Digital Ground
11	not used	Digital Ground
12	not used	not used
13	H Sync	H Sync
14	V Sync	V Sync
15	not used	not used

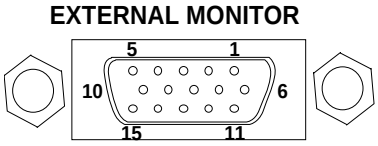


Figure B-2. *Pinout of* EXTERNAL MONITOR *Rear Panel Connector*

GPIB IEEE - 488

Pin No.	Function/Description	Pin No.	Function/Description
1	$\overline{\text{DIO1}}$	13	$\overline{\text{DIO5}}$
2	$\overline{\text{DIO2}}$	14	$\overline{\text{DIO6}}$
3	$\overline{\text{DIO3}}$	15	$\overline{\text{DIO7}}$
4	$\overline{\text{DIO4}}$	16	$\overline{\text{DIO8}}$
5	$\overline{\text{EOI}}$	17	$\overline{\text{REN}}$
6	$\overline{\text{DAV}}$	18	Logic Ground
7	$\overline{\text{NRFD}}$	19	Logic Ground
8	$\overline{\text{NDAC}}$	20	Logic Ground
9	$\overline{\text{IFC}}$	21	Logic Ground
10	$\overline{\text{SRQ}}$	22	Logic Ground
11	$\overline{\text{ATN}}$	23	Logic Ground
12	Chassis Ground	24	Logic Ground

Figure B-3. *Pinout for Rear Panel* GPIB *Connector*

Appendix C
National Instruments Cards Installation and Data
(GPIB-PCII/IIA Card and GPIB-232CR-A Converter)

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Appendix C
National Instruments Cards Installation and Data
(GPIB-PCII/IIA Card and GPIB-232CR-A Converter)

C-1 GENERAL

This appendix provides installation and configuration instructions for the National Instruments GPIB-PCII/IIA Card, NI-488 MS-DOS Handler Software, and GPIB-232CT-A RS-232 IEEE 488 Controller.

C-2 GPIB-232CT-A RS-232 IEEE 488 CONTROLLER, INSTALLATION INSTRUCTIONS

The following is a procedure for the installing the National Instruments GPIB-232CT-A RS-232 IEEE 488 Controller box.

NOTE

Verify that the GPIB-232CT-A input line-voltage requirements, as shown on the label, are met.

Step 1. Insert the National Instruments "NI-488.2 Distribution Disk for GPIB-232CT-A" into the A or B floppy drive.

Step 2. Change to that floppy drive.
Example: Type **B:**

Step 3. Choose *DOS GPIB Installation*, from the available options, and press <ENTER>.

Step 4. Choose *Partial GPIB Installation*, from the available options, and press <ENTER>.

Step 5. Choose *Driver and Support Files*, from the available options, and press <ENTER>. (Note: Although not required, you can also choose to install language interfaces.

Step 6. Accept the default directory, C:\ GPIB-CT, and press <ENTER>.

Step 7. Let the program modify your CONFIG.SYS file; press <ENTER>.

Step 8. Set switches on the GPIB-232CT-A as shown in Figure C-1.

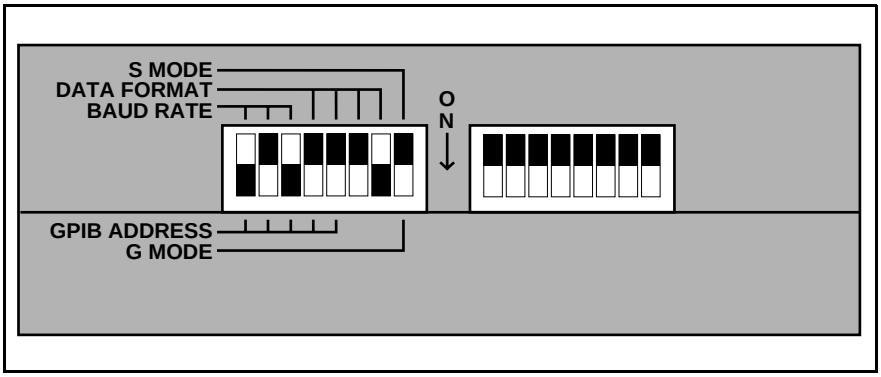

Figure C-1. *GPIB-232CT-A Switch Settings*

Step 9. Using a 9-pin cable, connect the GPIB-232CT-A to the controller's COM1. See Figure C-2 for a pinout diagram of the GPIB-232CT-A 9-pin connector, female-female, null modem cable.

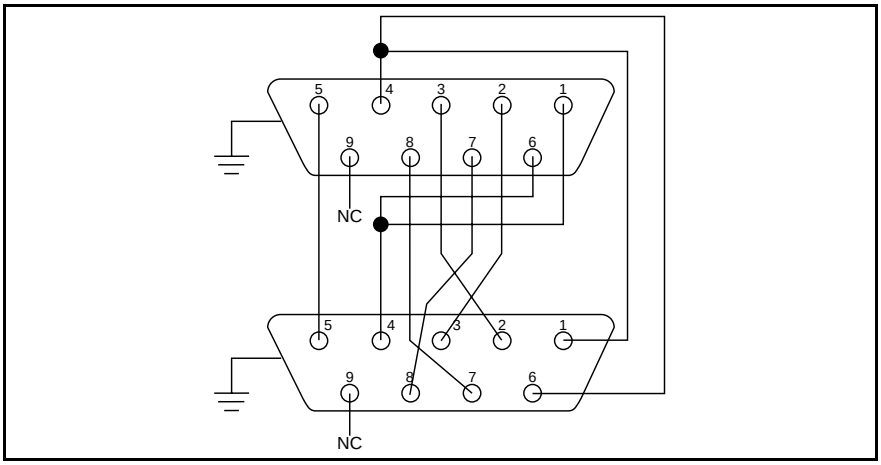

Figure C-2. *Pinout Diagram of GPIB-232CT-A 9-Pin Connector, female-female, null modem cable*

Step 10. Press the GPIB-232CT-A 1-0 rocker switch to the "1" position. Wait for the POWER and READY indicators to light.

Step 11. Remove the floppy disk and reboot your computer.

C-3 GPIB-PCII/IIA CARD, INSTALLATION AND CONFIGURATION INSTRUCTIONS

The following steps provide detailed instructions for installing the National Instruments GPIB-PCII/IIA Interface Card (P/N 181065-02) into a personal computer.

Step 1. Before installation, set the switches and jumpers on the GPIB-PCII/ IIA card as shown in the Figure C-3.

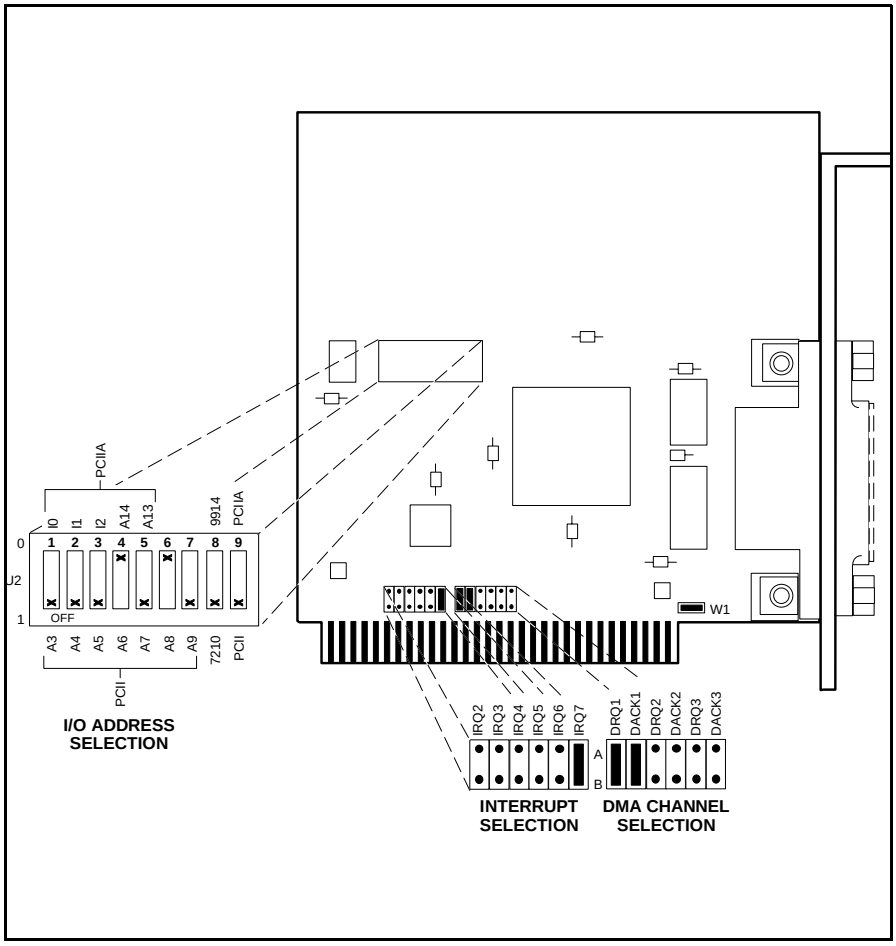

Figure C-3. *GPIB-PCII/IIA Hardware Configuration*

Step 2. Turn off the computer and unplug the power cord from the power source.

Step 3. Remove the top cover from the computer and install the GPIB-PCII/ IIA card into any unused slot. Install the card with the IEEE-488 connector protruding out of the back panel.

Step 4. Secure the card by fastening the GPIB-PCII/ IIA mounting bracket to the back panel rail with a screw, then replace the computer cover.

Step 5. Plug the power cord into the power source and power up (boot) the computer.

C-4 INSTALLING AND CONFIGURING THE NI-488 MS-DOS HANDLER SOFTWARE

The following steps provide detailed instructions for installing the NI-488 MS-DOS Handler software in support of the GPIB-PCII/IIA card and for changing the default software configuration options of the handler.

NOTE

When installing the MS-DOS Handler software, use ***only*** the National Instruments NI-488 Distribution Disk for GPIB-PCII/PCIIA MS-DOS Handler, P/N 420039-09, Revision C.11. Use of any other versions of the GPIB handler software can cause interfacing problems between the handler and the devices on the bus.

Step 1. Insert the NI-488 Distribution Disk for the GPIB-PCII/ IIA MS-DOS Handler into the disk drive. At the DOS prompt:
Type: A:
Press: <ENTER> (The A:\ DOS prompt will appear.)

Step 2. Run the installation program IBSTART and specify the start up (boot) drive. For example, if C: is the boot drive, at the DOS prompt:
Type: IBSTART C:
Press: < ENTER>

Step 3. Follow the instructions on the display.

The installation program first copies the files, GPIB.COM and IBCONF.EXE, from the distribution disk to the root directory of the boot drive, then it creates the directory GPIB-PC on the boot drive and copies all the files on the distribution disk into this directory.

Next the program adds the line, DEVICE = GPIB.COM, to the computer's CONFIG.SYS file so that DOS will load the handler whenever the computer is booted.

The program then prompts you to run the hardware diagnostic program (IBDIAG) to insure the GPIB-PCII/IIA card is installed and working properly.

Step 4. Run the software program (IBCONF) to change the default software configuration options of the GPIB handler. At the DOS prompt:
Type: IBCONF
Press: <ENTER>

Step 5. Follow the instructions on the display.

The program firsts displays a device map for the GPIB card (Figure C-4).

Select the GPIB-PCII/IIA Card or device whose parameters you wish to display, then press the function key, F8.

Change the configuration of the GPIB-PC-II/IIA card to that shown in Figure C-4 and verify that the configuration of the devices DEV6 and DEV8 match Figures C-5 and C-6.

Step 6. Reboot your computer to install the GPIB handler software and the software configuration changes.

Step 7. Run the software diagnostic program (IBTEST) to verify that the GPIB handler software is installed correctly. To do this, at the DOS prompt:
Type: CD\ GPIB-PC
Press: <ENTER>
Type: IBTEST
Press: <ENTER>
If errors are encountered, refer to Appendix B of the GPIB-PC User Manual for an explanation of the errors and their solutions.

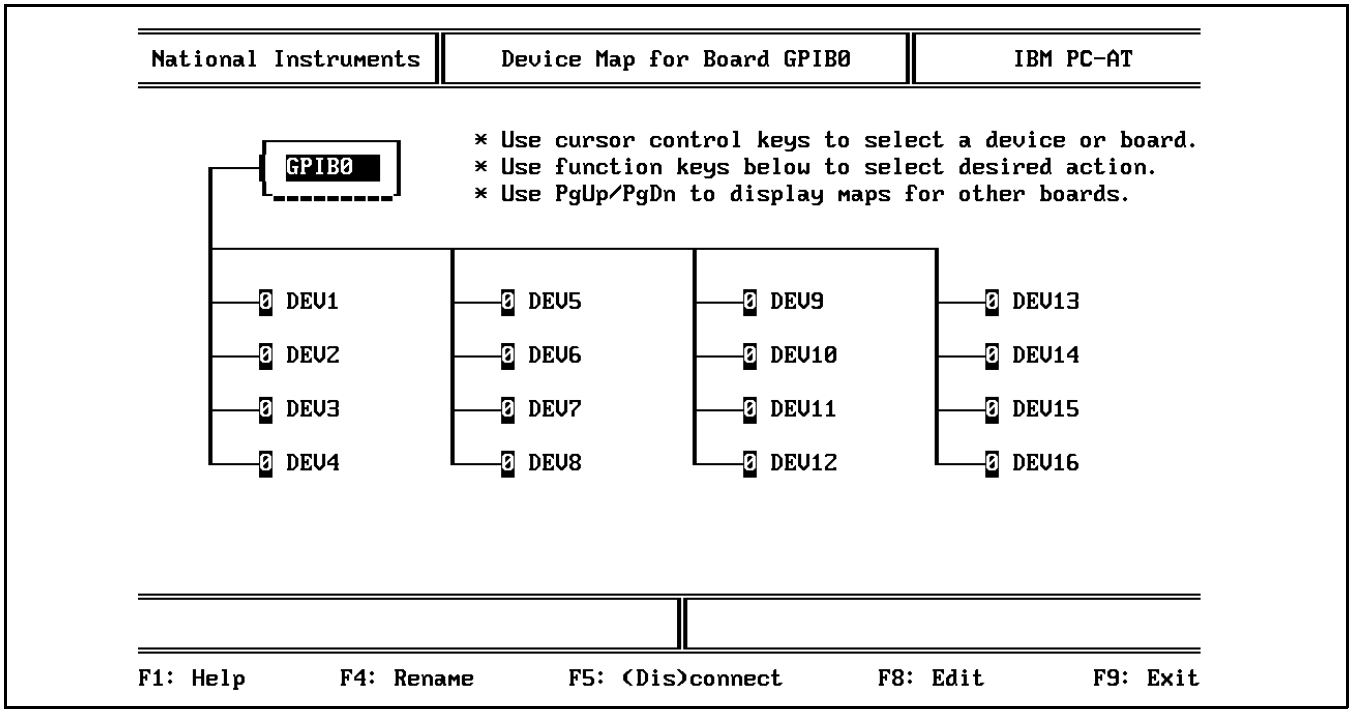

Figure C-4.. *Device Map for the GPIB-PCII/IIA Card*

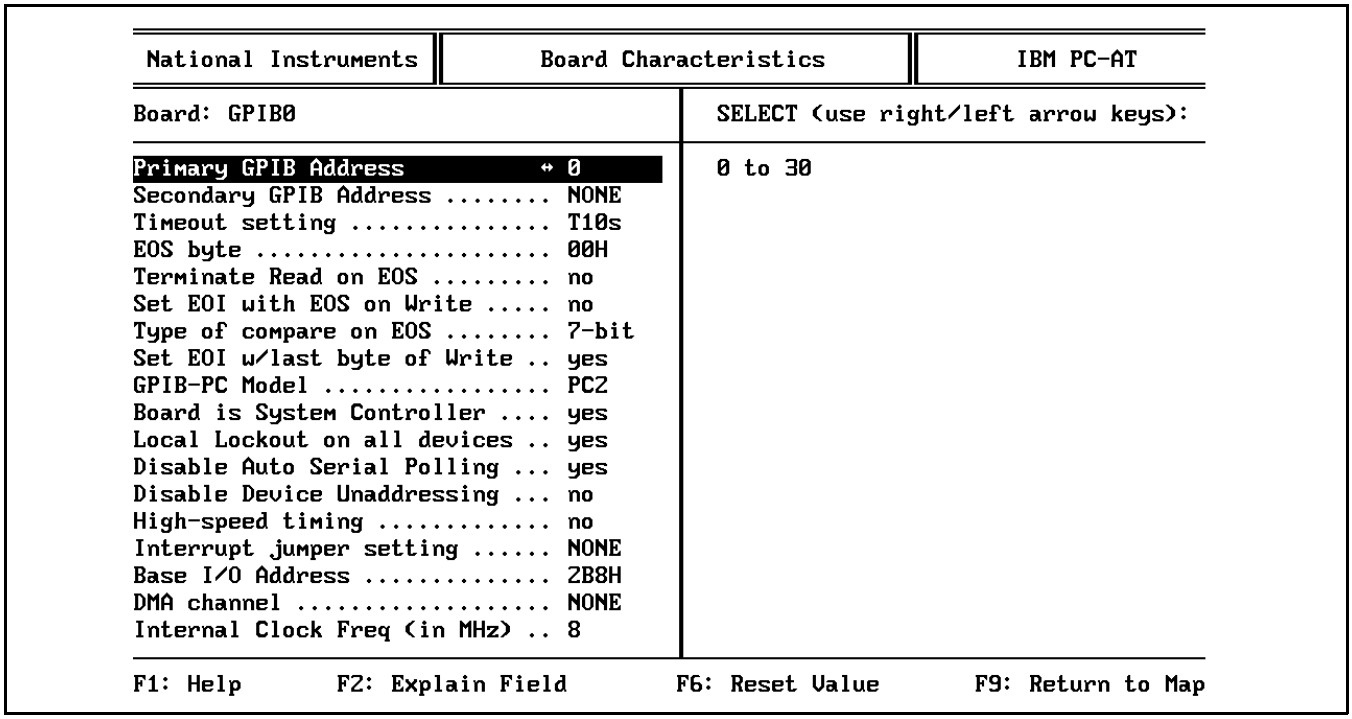

Figure C-5. *GPIB-PCII/IIA Card Configuration Parameters*

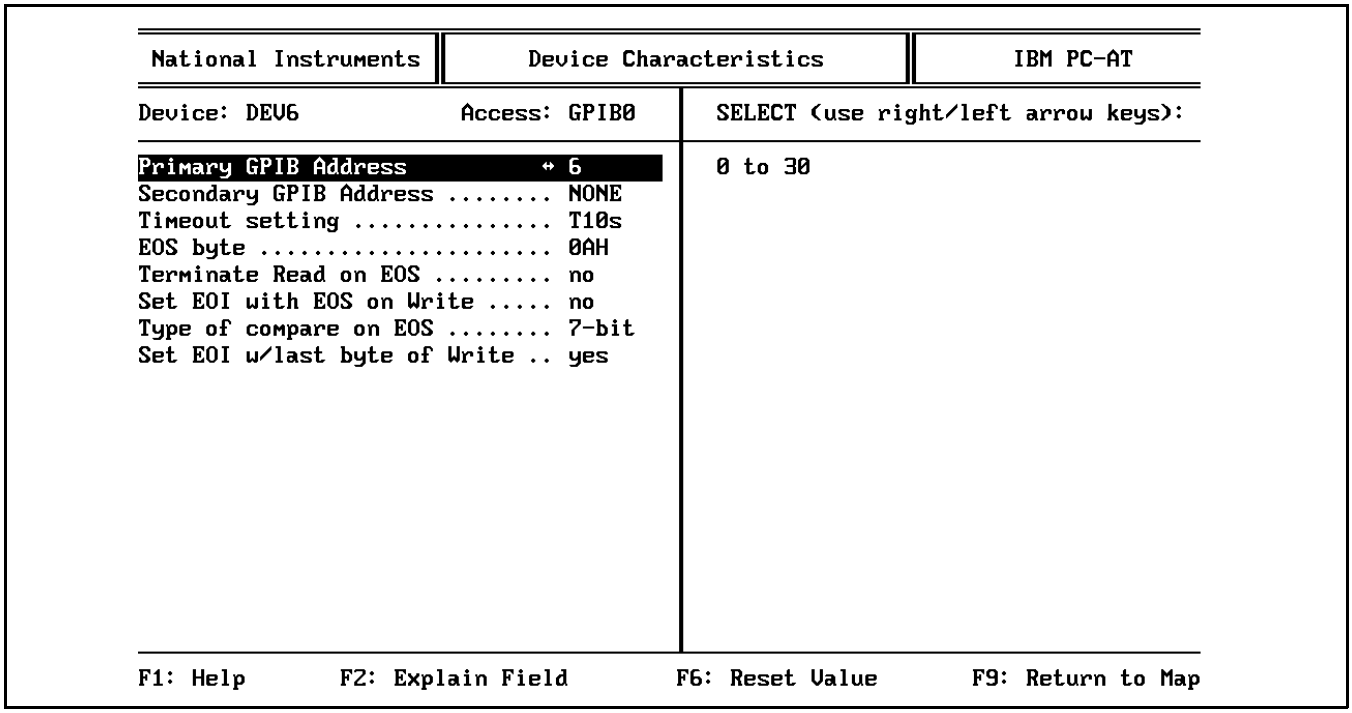

Figure C-6. *GPIB Device 6 (541XX/562) Configuration Parameters*

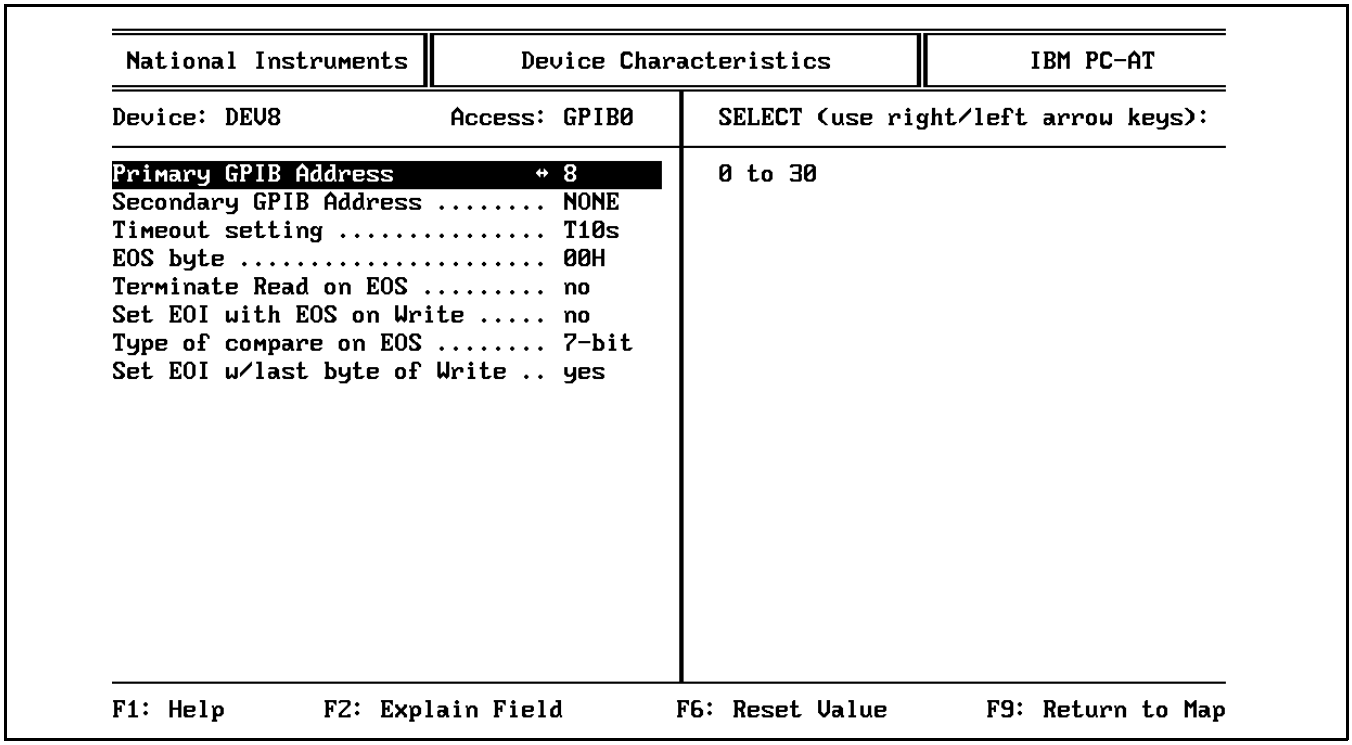

Figure C-7. *GPIB Device 8 (Plotter) Configuration Parameters*

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