Model
ME7842B
Tower Mounted Amplifier Test System

Operation Manual

Anritsu

490 JARVIS DRIVE - MORGAN HILL, CA 95037-2809

P/N: 10410-00244
REVISION: A
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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: Tower Mounted Amplifier Test Set

Model Number: MN4790A

conforms to the requirement of:

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

Electromagnetic Interference:

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

Electrical Safety Requirement:

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

Corporate Quality Director

Morgan Hill, CA

24 SEPT 02
Date

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

Safety Symbols

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

Symbols used in manuals

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

Safety Symbols Used on Equipment and in Manuals

(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.

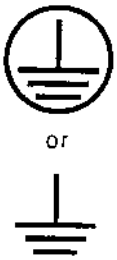
This indicates a note. The contents are described in the box.

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.



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.

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Chapter 4 Operations, Calibration

Chapter 5 Operations, Measurement

Chapter 6 Performance Verification Procedures

Chapter 7 Maintenance

Appendix A Programming the MN4790A

Chapter 1
General Information

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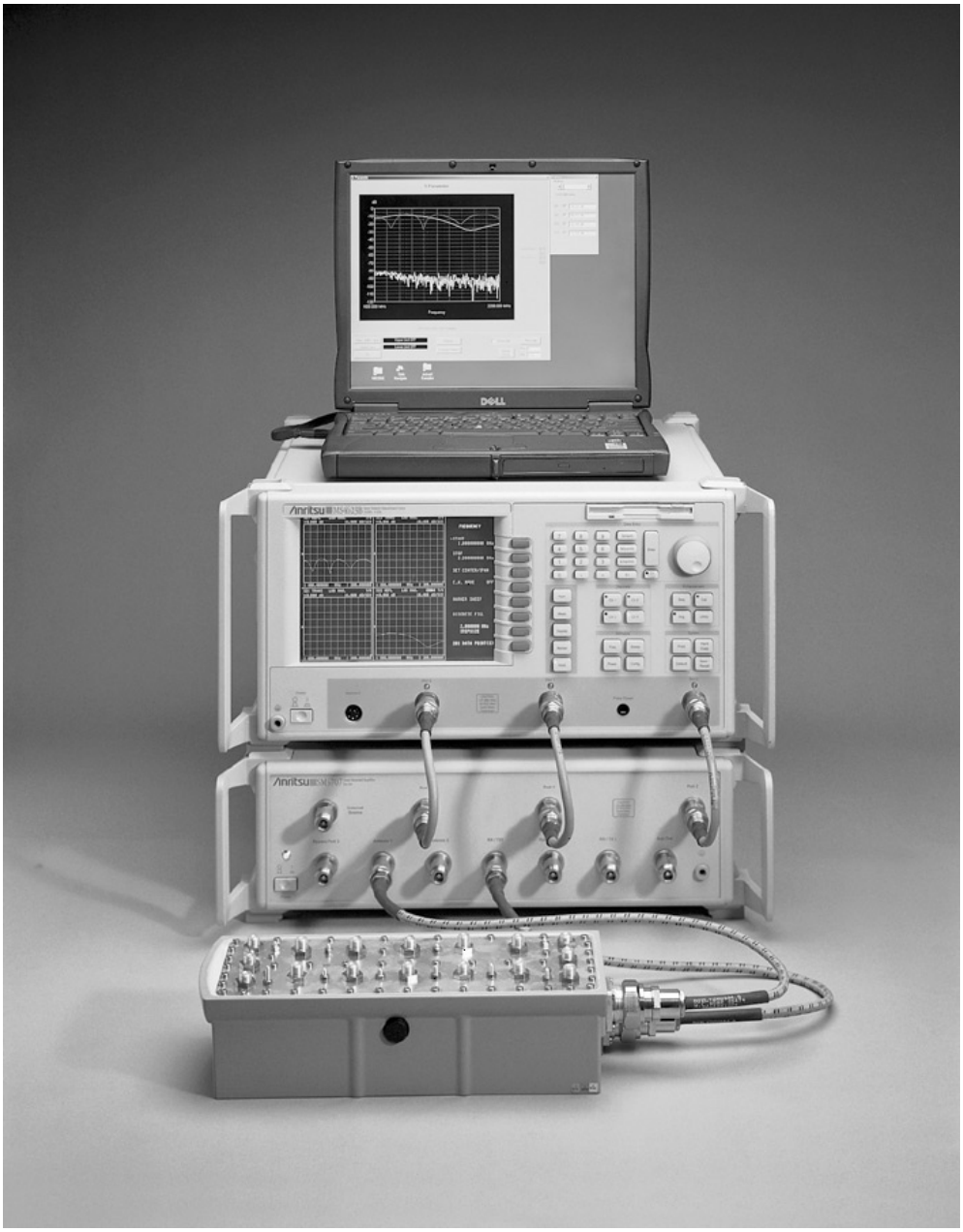

Figure 1-1. *Model ME7842B Tower Mounted Amplifier Test System (TMATS)*

Chapter 1
General Information

1-1 Scope of Manual

This manual provides general information, installation, operating, and maintenance information for the Anritsu ME7842B Tower Mounted Amplifier Test System (TMATS). Manual organization is shown in the table of contents. The following topics are discussed:

- Equipment Description
- Equipment Installation and Connection
- Software Description
- Software Installation
- Calibration
- System Operation
- Test Procedures and Test Results Interpretation
- System Performance Verification

Refer to the other manuals supplied with the ME7842B (see below) for more detailed explanations of the system equipment and procedures.

1-2 Introduction

This chapter provides information to familiarize the user with the basic ME7842B Tower Mounted Amplifier Test System. It includes a general description of the test system, technical specifications, related manuals, and the available models and options.

1-3 Related Manuals

The ME7842B manual set consists of the following manuals:

Manual Description	Anritsu Part Number
ME7842B Operation Manual (OM)	10410-00244
MN4790A Maintenance Manual	10410-00245 (Optional)
MS462XX Operating Manual (OM)	10410-00203
MS462XX Programming Manual (PM)	10410-00204
MS462XX Maintenance Manual (MM)	10410-00205 (Optional)

The operating and programming manuals are supplied with the equipment; the maintenance manuals are optional items that may be purchased.

1-4 Related Literature

There are a number of marketing brochures and related application notes available for the Tower Mounted Amplifier Test System and the MS462XX VNMS. Refer to Table 1-1 for a listing and part numbers. Most of these items are available from our Internet site (*www.anritsu.com*).

Table 1-1. *Related Manuals, Literature, and Software for MS462XB/ME7842B*

Literature	Part Number
Brochures and Data Sheets	
Scorpion Data Sheet/Brochure	11410-00212
AutoCal Brochure	11410-00189
TMATS Data sheet	11410-00292
Application Notes	
Adjacent Channel Power Ratio (ACPR)	11410-00264
Scorpion Noise Figure	11410-00210
Scorpion Noise Figure Accuracy	11410-00227
Scorpion Intermodulation Distortion	11410-00213
Scorpion Harmonics	11410-00222
Scorpion Frequency Translated Group Delay	11410-00236
Scorpion Global Power Sweep	11410-00243
Scorpion Multiple Source Control	11410-00244
Reflectometer Measurements-Revisited	11410-00214
Time Domain for VNAs	11410-00206
AutoCal	11410-00258
Software	
Scorpion Command Encyclopedia	2300-364
Scorpion Navigator	2300-353
LabView Drivers	2300-358
Exact Uncertainty	2300-361
Demonstration Kits	
Scorpion Demo Kit	SC6287

1-5 Conventions

Throughout this manual, the terms *ME7842B*, *TMATS*, and *test system* will be used interchangeably to refer to the instrument. The *MS4623B* may be referenced as *Scorpion* or *MS4623B* and the *MN4790A* test set may be referenced as *test set* or *MN4790A*.

1-6 Serial Number

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

1-7 Online Manuals

This manual is available online as an Adobe Acrobat™ (*.pdf) file and can be downloaded from *www.anritsu.com*. The file can be viewed using Acrobat Reader™, a free program that is available from Adobe. This file is “linked” such that the viewer can choose a topic to view from the displayed “bookmark” list and “jump” to the manual page on which the topic resides. The text can also be word-searched.

1-8 ME7842B System Overview

The Anritsu ME7842B Tower Mounted Amplifier Test System (TMATS) is intended for the measurement and real-time graphical display of the following amplifier parameters in the frequency range of 10 to 6000 MHz:

- S-Parameters including Hot S22
- K-Factor
- Gain Compression and Phase Distortion
- Intermodulation Distortion (500 MHz to 6 GHz)
- Harmonics
- Noise Figure
- Drain Current and Power Added Efficiency (PAE)
- Adjacent Channel Power Ratio (ACPR)

TMATS is designed to facilitate alignment, tuning and pass/fail testing of the components, modules and subassemblies of a tower-mounted amplifier.

1-9 Hardware Description

The ME7842B hardware (Figure 1-1) consists of a MS4623B Vector Network Measurement System (VNMS), a MN4790A Test Set, and a customer supplied Personal Computer (PC). A basic functional block diagram is provided in Figure 1-2 on the following page.

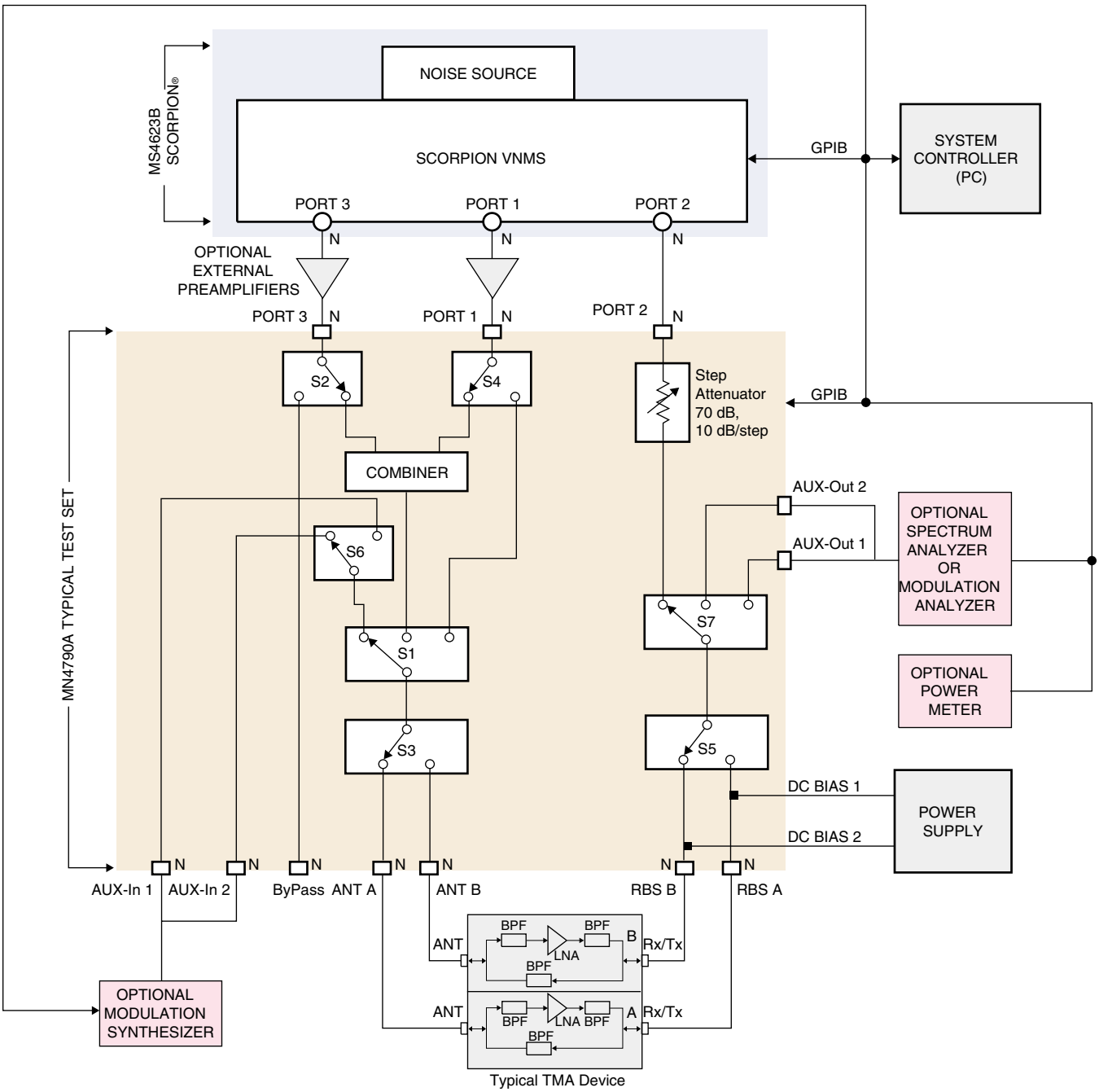

Figure 1-2. *Basic Functional Block Diagram of the Tower Mounted Amplifier Test System (TMATS) with the MN4790A Test Set*

1-10 System Description

The ME7842 Tower Mounted Amplifier Test System (TMATS) consists of the MS4623B VNMS, the MN4790A Test Set, and the ND57610 Accessory Kit. ND57610 is an accessory kit containing cables and Scorpion Navigator™ software. Scorpion Navigator is a Windows based program which orchestrates the system calibration and performs measurements on Tower Mounted Amplifiers. Software modules exist in Scorpion Navigator for measuring:

- S-Parameters
- Swept Power 2-Tone Measurements
- Swept Power 1-Tone Measurements
- IMD (500 MHz to 6 GHz)
- Noise Figure
- Harmonics
- Hot S22
- ACPR

TMATS software runs best on Windows 95/98/NT/2000/XP and requires a National Instruments GPIB controller (NI-488.2 software version 1.7 or higher and NI VISA version 2.5 or higher preferred), and Scorpion firmware version 1.14 or higher.

MN4790A Test Set

The Series MN4790A Test Set is a programable multi-port TMA signal router that contains a Wilkinson type combiner. The test set combines the two RF signals from Ports 1 and 3 of the Scorpion VNMS. Optional preamplifiers may be externally provided at the combiner input to boost the input RF power to the device-under-test (DUT).

CAUTION

The test set has a maximum power input rating of 20 dBm.

The output of the combiner is fed to a source selection switch that enables one of the following to be applied to the DUT:

- The combined signal from the Scorpion Port 1 and Port 3 sources
- The signal from the Scorpion Port 1 source
- A modulated signal from an optional external modulation synthesizer

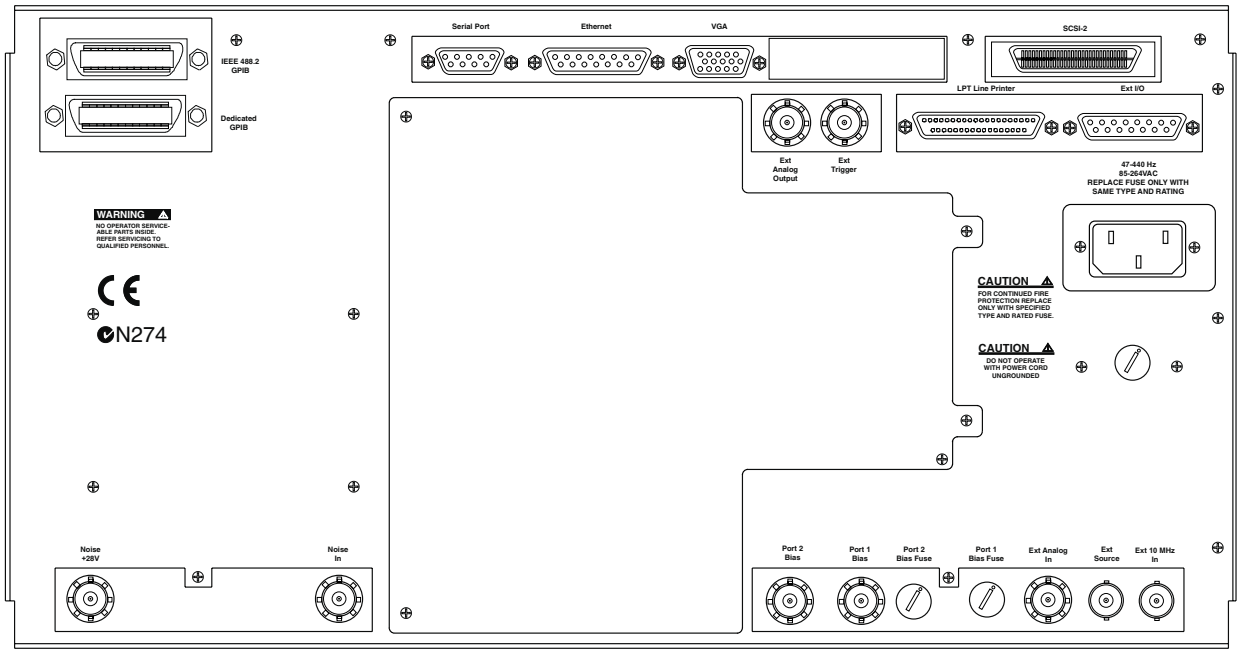

Figure 1-3. *MS4623B Rear Panel*

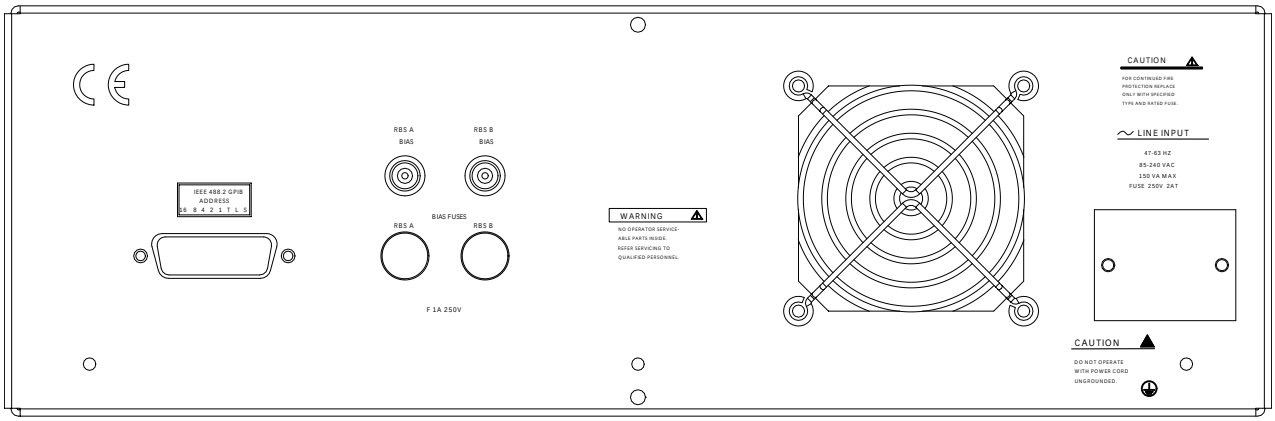

Figure 1-4. *MN4790A Rear Panel*

1-11 Scorpion Navigator Features

Scorpion Navigator Version 2.0 software supports the following measurements and features.

- ACPR measurements
  - CW and swept power ACPR
  - GPIB control of Agilent ESG for CDMA and WCDMA
  - GPIB control of Anritsu MG3681A for WCDMA
  - GPIB control of R&S FSIQ spectrum analyzer for verification
- Simplified calibration
  - Added calibration wizard
  - Eliminated use of calibration specification files
- Additional Measurements
  - Multifrequency Gain Compression in 1-Tone power sweep
  - Multifrequency Gain Compression in 2-Tone power sweep
  - Swept offset measurements in 2-Tone power sweep
  - Power Swept measurements displayed as a function of power out
- Calibration File manager
  - Save and recall sets of calibration files that correspond to a particular part or test set variation

The software works with a Scorpion VNMS and Anritsu test sets including the Handset Amplifier Test Set (HATS), Power Amplifier Test Set (PATS), and the Tower Mounted Amplifier Test Set (TMATS).

1-12 Preventive Maintenance

The MN4790A test set does not require any preventive maintenance. Refer to the MS462XX Operation Manual (P/N: 10410-00203) for preventative maintenance for the Scorpion VNMS.

1-13 Performance Specifications

Specifications for the ME7842B Tower Mounted Amplifier Test System are provided on the following page in Table 1-2.

Table 1-2. *Performance Specifications for the ME7842B Tower Mounted Amplifier Test System*

Characteristic	Value	Notes
Bandwidth through Test Set	10 MHz to 6.0 GHZ	With MN4790A Test Set (Note 1)
	500 MHz to 6.0 GHZ	For IMD Measurements
Maximum Power Level	20 dBm	At DUT Input
Input Power Range	0 dBm to -85 dBm	To DUT Input
IMD Third Order Dynamic Range	70 dB min	With 10 Hz IF Bandwidth at 300 KHz tone separation and -20 dBm tone levels
IMD Accuracy	±1 dB maximum	For levels greater than -60 dBc
Port Power Accuracy	±0.1 dB maximum	With flat power calibration
	±1 dB maximum	Without flat power calibration
Dynamic Range	80 dB typical	Overall system, including test set
Source Match	35 dB	Corrected value 10 MHz to 6 GHz
Directivity	40 dB	Corrected value 10 MHz to 3 GHz
	35 dB	Corrected value 3 GHz to 6 GHz
Isolation Between DUTPports ANTA ↔ ANTB RBSA ↔ RBSB ANTn ↔ RBSn	 60 dB 60 dB 100 dB	
Power Requirements	255 VA maximum	85-240 Vac, 47-63 Hz
Bias Tee Rating	35 Vdc, 1.0 Amps	
Impedance	50Ω	
Environmental	-40° C to +75° C	Storage Temperature Range
	0° C to +50° C	Operating Temperature Range
	23 ±3° C	Range Over Which Specifications Apply
	5% to 95% at +40° C	Relative Humidity
Physical, MN4790A Test Set	152.4 mm (6 in.)	Height
	443.6 mm (17.5 in.)	Width
	500 mm (19.7 in.)	Depth
	8 kg (17.5 pounds)	Weight

Note 1: This frequency range does not take into account any restricting effects of the external circulator (if one is used for reverse measurements).

1-14 Recommended Items

Table 1-3 provides a list of test equipment and other items needed for calibration and performance verification.

Table 1-3. *Recommended Test Equipment*

Item	Critical Specification	Anritsu Model
Power Meter	GPIB capable	ML243XA
Power Sensor	10 MHz to 6 GHz	MA247XA
N connector Calibration Kit	Type N Open, Short, Broadband Load	3753R
Offset Termination	6 dB	SC5237
Offset Termination	20 dB	SC5270
Power Divider	None	11N50B
Cables	50 Ohm, N-male to N-male	3670NN50-2
	50 Ohm, BNC-male to BNC-male	
Adapter	50 Ohm, N-male to N-male	34NN50A
GPIB Cable	IEEE 488	2100-2

1-15 User Supplied Items

The following items required for the operation of the ME7842B Tower Mounted Amplifier Test System must be supplied by the user.

Item	Critical Specification
Personal Computer (PC)	Pentium II or better, 200 MHz or faster, with the Windows® 95/98/NT/2000 or XP operating system and a National Instruments GPIB card installed.
GPIB Cables (2)	IEEE 488

Chapter 2
Installation

Table of Contents

Chapter 2
Installation

2-1 Introduction

This chapter describes the installation, connection and set-up of the equipment that comprises the ME7842B Tower Mounted Amplifier Test System.

2-2 Equipment Complement

The ME7842B is made up of the following equipment:

- MS4623B Scorpion Vector Network Measurement System(VNMS)
- Model MN4790A Tower Mounted Amplifier Test Set
- Scorpion Navigator™ system measurement software

Optional Items:

- Current probe(s)
- For ACPR measurements: Anritsu MG3691A Signal Generator for W-CDMA or Agilent ESG E4423B Signal Generator for CDMA.

2-3 Unpacking and Inspection

The ME7842B equipment has been securely packaged. The packaging material and container should be retained in case the equipment must be re-shipped or placed into storage.

The MS4623B Scorpion® VNMS and the MN4790A Test Set are each packed within heavy cardboard boxes.

Step 1. Carefully cut the sealing tape on the top box surface with a packing knife.

Step 2. Open the box lids, and remove the upper layer of foam material.

Step 3. Lift the equipment from the boxes. Two persons should do this, as the equipment is heavy and bulky.

2-4 Hardware Installation

The MN4790A is intended for Installation Category (Overvoltage Category) II. Follow the steps below in sequence to ensure a trouble free installation.

Step 1. Place the MS4623B on top of the MN4790A Test Set. Figure 2-1 shows how the green colored feet on the case of each unit stack on each other.

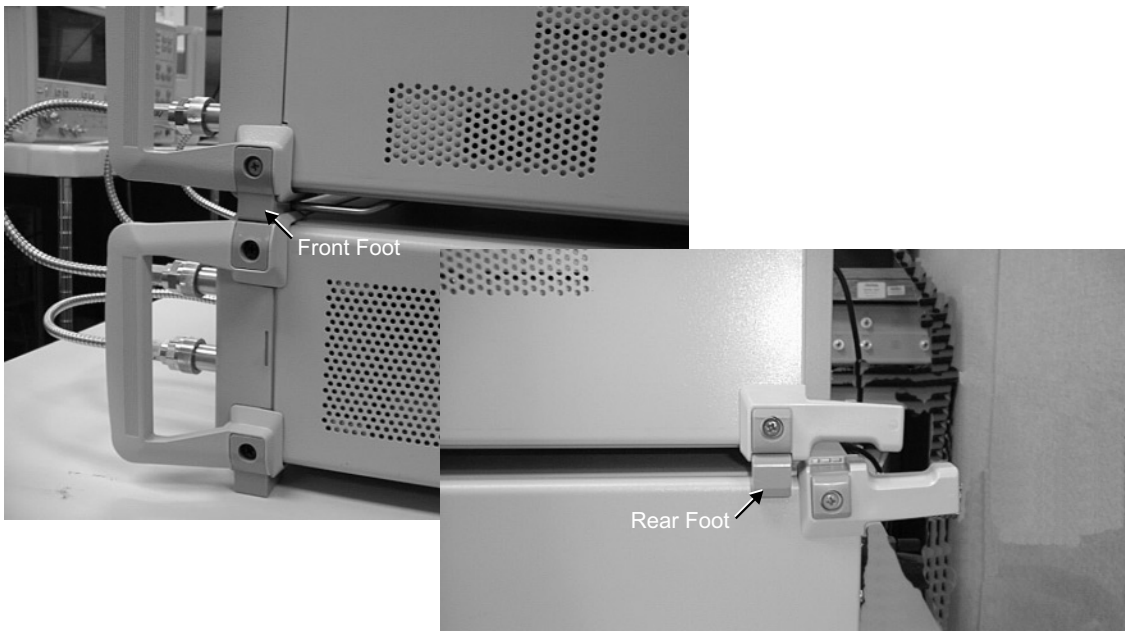

Figure 2-1. *ME7842B Component Assembly*

Step 2. Install the three front RF coaxial cables. Figure 2-2 (following page) shows the installation of the RF interconnect cables between the front panel of the MS4623B and the front panel of the Test Set.

Step 3. Connect a GPIB cable from IEEE-488.2 connector on the rear panel of the MS4623B to the PC GPIB Controller, then connect a GPIB cable from the PC GPIB Controller to the MN4790A Test set. Note: The GPIB cable is not supplied with the ME7842B TMATS.

Step 4. (Optional for Noise Figure only) Install the noise source to the Noise In connector on the rear panel of the MS4623B, then connect a BNC (m) to BNC (m) coaxial cable between the Noise +28V connector on the rear panel of the MS4623B and the noise source bias input. Note: The Noise Source is not supplied with the ME7842B TMATS.

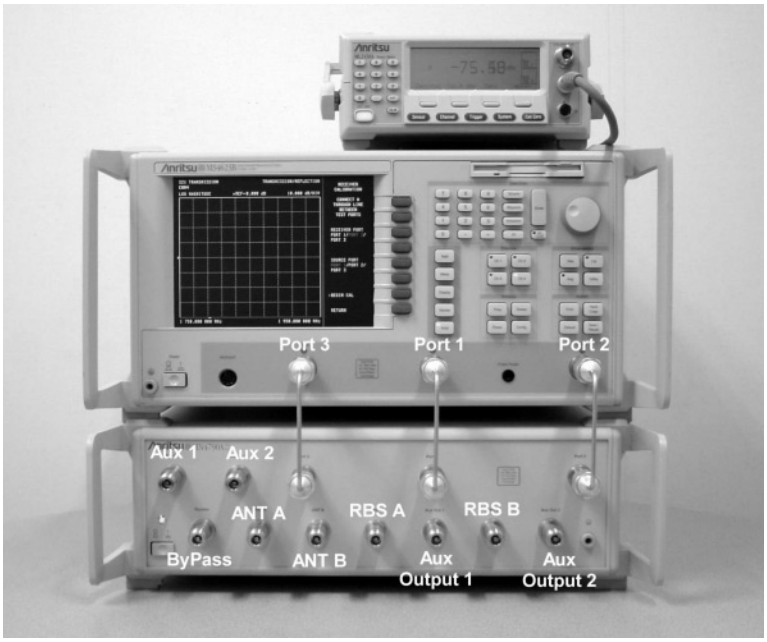

Figure 2-2. *ME7842B Front RF Cable Connections*

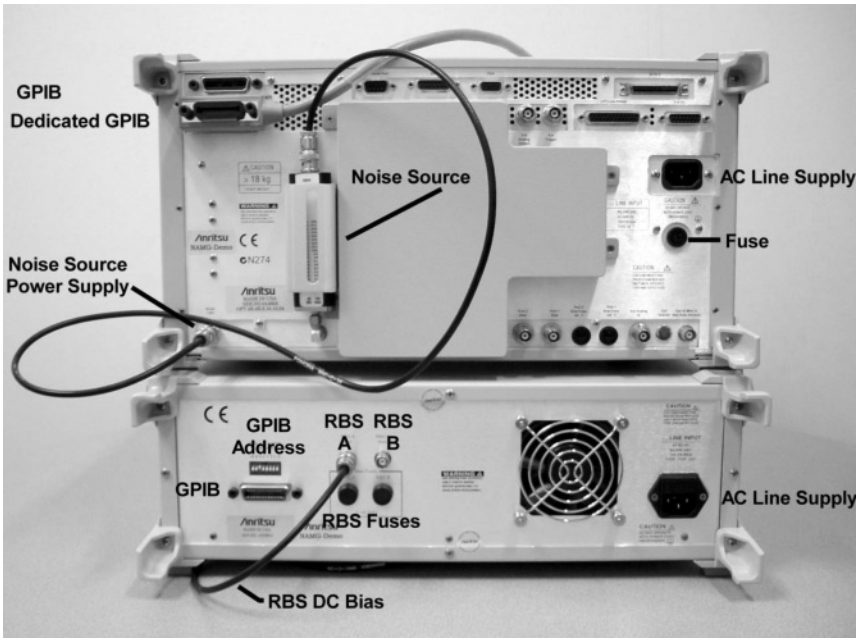

Figure 2-3. *ME7842B Rear Cable Connections*

Step 5. Connect an AC power cord to each of the three-prong connectors on the rear panel of the MN4790A and the MS4623B.

Step 6. (Optional, for drain current PAE measurements) Connect a current probe cable BNC connector to the Ext. Analog In connector on the rear of the MS4623B as shown in Figure 2-4 below.

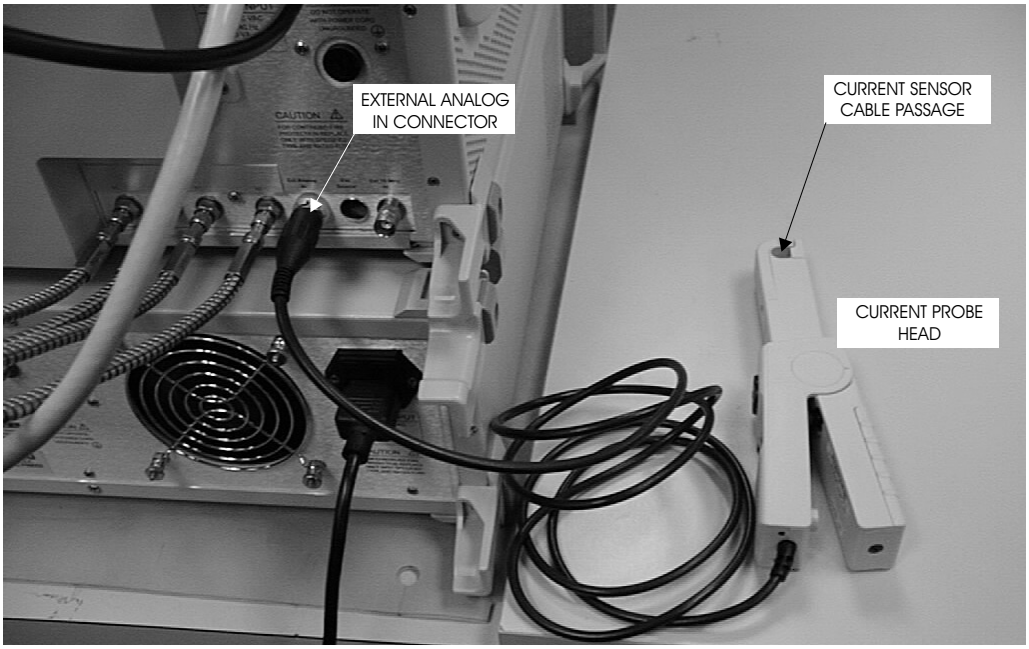

Figure 2-4. *Current Probe Connection*

2-5 Software Installation

The ME7842B software is delivered on a CD ROM which contains the Anritsu Scorpion Navigator library and is required to be installed on the target system (the PC which is receiving the installation of the ME7842B software). Scorpion Navigator is also included in the ME7842B Software CD ROM.

Installation

Run the *Setup.exe* file to install Scorpion Navigator and the ME7842B software (Figure 2-5). During installation, the system may indicate that some files being installed already exist. In general it is best to accept copying newer versions of the files and reject copying older versions. If in doubt, cancel the installation, backup the files in question, and try again. The Readme.txt file lists the files and versions copied to the target system during installation of ME7842B Software.

CD ROM Contents

The CD ROM includes a Readme.txt file in the root directory and several folders. The readme file contains specific updated instructions for installing the software and a listing of the features in the version being installed. The folders are as follows:

- Scorpion Navigator Version 4.0 Installation files
- TMATS Installation Files
- Programming Examples

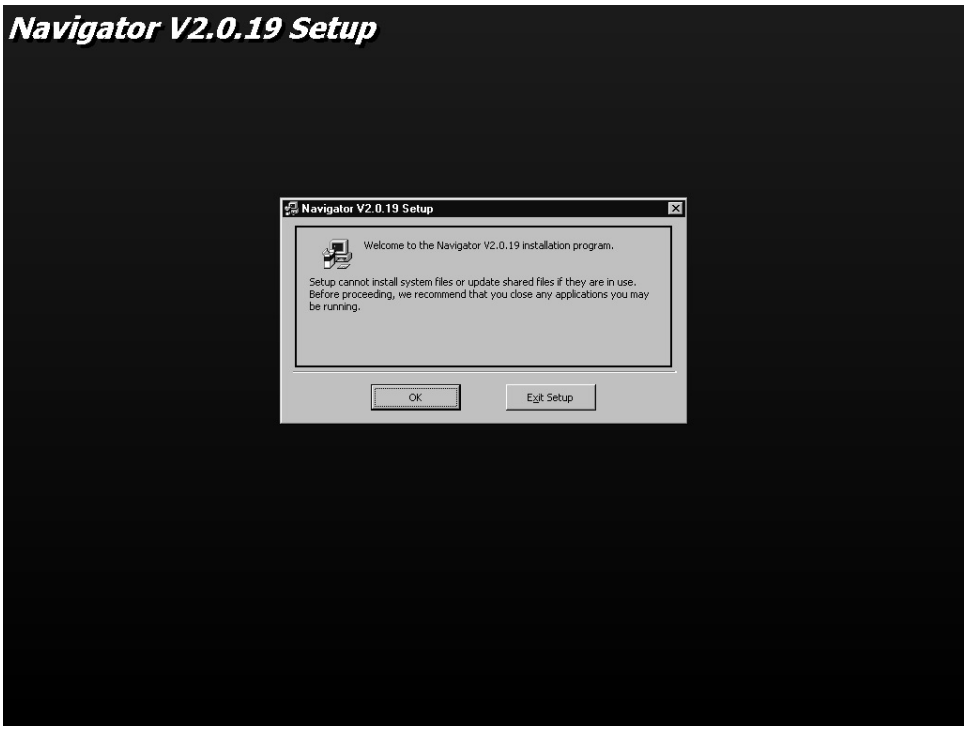

Figure 2-5. *Software Installation Window*

Uninstalling the Software

To uninstall the ME7842B software or Scorpion Navigator, go to the Windows Control Panel and click on “Add/Remove Programs.” Select the programs you would like to remove and follow the instructions.

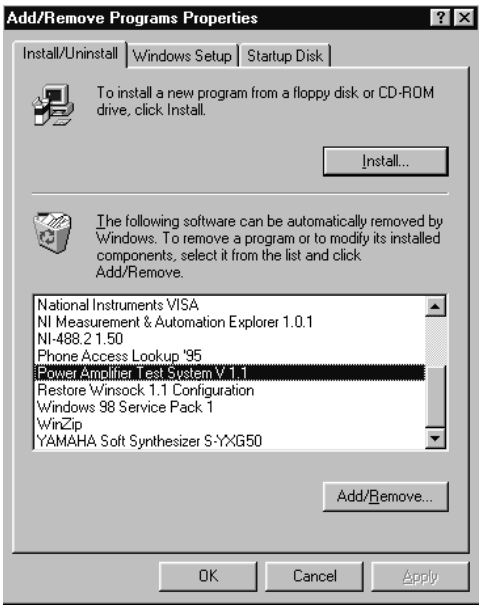

Figure 2-6. *Software Uninstall Window*

2-6 Service Centers

Anritsu Service Centers are listed in Table 2-1.

Table 2-1. *Anritsu Service Centers*

UNITED STATES

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

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

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

AUSTRALIA

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

BRAZIL

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

CANADA

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

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

FRANCE

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

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D-40237 Dusseldorf, Germany
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FAX: 0211-9685555

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FAX : 011-644250023

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Seoul 135-080, South Korea
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FAX: 02-553-6604

Service Center:
8F Samwon Building
1329-8, Seocho-Dong
Seocho-Ku
Seoul, South Korea 137-070
Telephone: 02-581-6603
FAX: 02-582-6603

JAPAN

ANRITSU CUSTOMER SERVICE LTD.
1800 Onna Atsugi-shi
Kanagawa-Prf. 243 Japan
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Chapter 3
Operations, General

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Chapter 3
Operations, General

3-1 Introduction

The basic operation of the Model ME7842B Tower Mounted Amplifier Test System is described in this and the following two chapters: Calibration Operations and Measurement Operations. “Calibration Operations” describes the software measurement calibration function and “Measurement Operations” describes the software measurement function. This chapter describes the setup and general operation of the software.

3-2 Preparing the System

Refer to Figure 3-1 on page 3-5 to identify the equipment named in the recommended power-up sequence for the ME7842B.

Step 1. Connect the output of the DUT to Test Port 2 of the MN4790A.

Step 2. Connect the input of the DUT to Test Port 1 of the MN4790A.

Step 3. Ensure that the power rating of the cables is suitable for the test, and that the connections are tightened.

Step 4. Turn on the MS4623B then the MN4790A Test Set.

Step 5. Set the output of the MS4623B so that the DUT output power does not exceed the maximum test port input level of 20 dBm.

CAUTION

The maximum DUT RF power output level should be no more than 20 dBm. Otherwise, damage to the equipment will occur.

Step 6. When ready for measurements, cautiously apply DC power to the DUT.

Step 7. If drain current or PAE measurements are desired, the optional current probe (Anritsu part number 2000-1067 or 2000-1085) can be used. Ensure the probe (Figure 3-1) has a fresh battery, and set the zero offset using the MS4623B as follows:

a. Press the Domain softkey, set to **Transmission & Reflection**.

b. Press the Display soft key, set for **Single Channel**.

c. Press the Graph Type softkey, set for **Real**.

d. Press the Scale softkey and Data Entry keys, set for 1 mU/Division.

e. Press the Avg key and associated softkeys to set **Averaging** for 10 and **IF Bandwidth** for 300 Hz.

f. Press the Config key, **DATA POINTS** and associated softkeys to set for 101 **Max Data Points**.

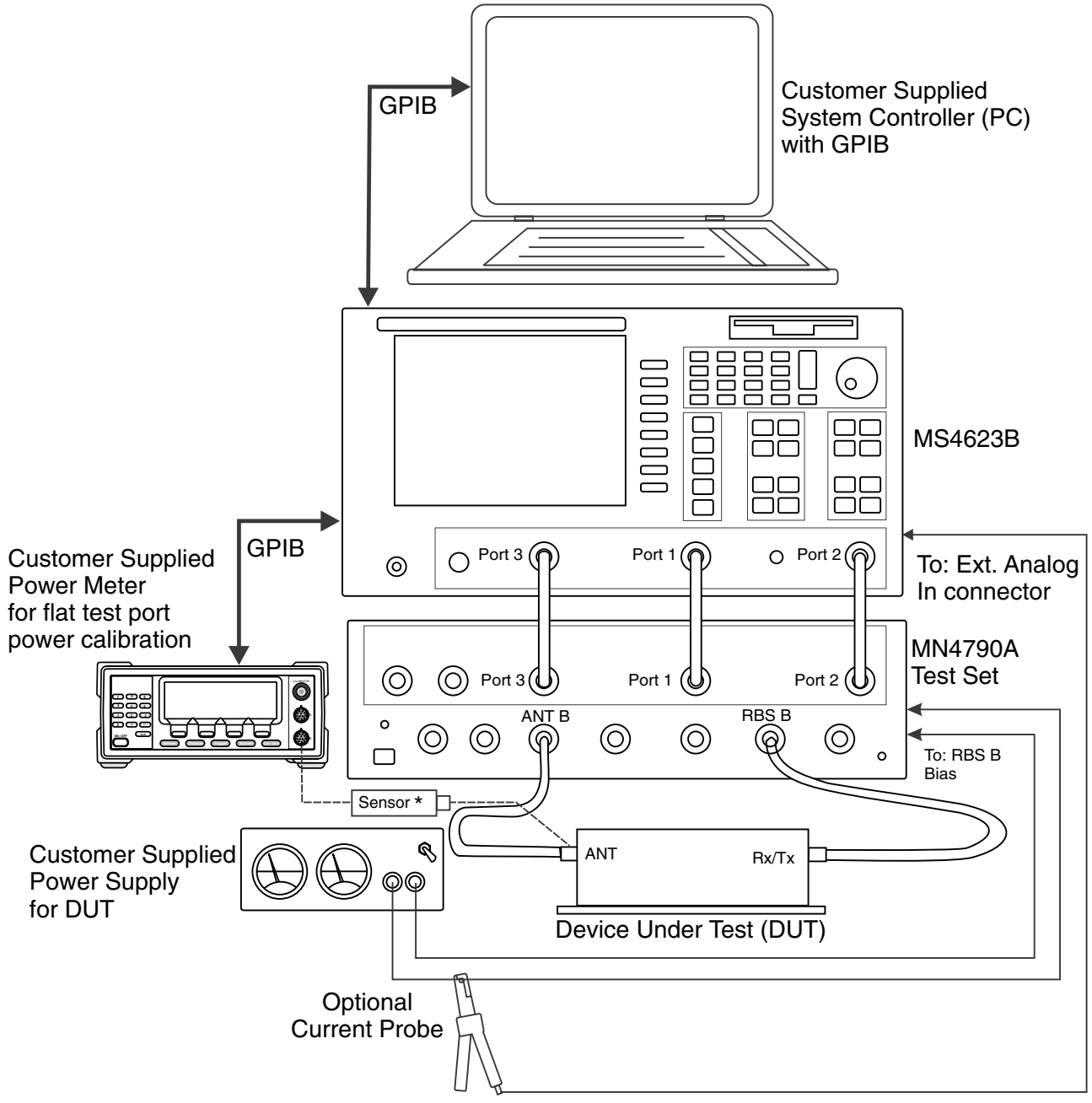
g. Use the Measure softkey and select **Ext. Analog In**.

h. Turn on the current probe and set it for the desired range.

i. Adjust the “Zero Adjustment” thumb wheel until the reading is minimum (typically 0 ±100 μU).

On the current probe:

Orient the probe such that the “Current Direction” arrow points away from the power supply, then place the jaws over the DC wire only (not both wires).



* Connect when directed by procedure for power calibrations

Figure 3-1. *TMATS Power On Sequence*

3-3 Using Scorpion Navigator Software

Scorpion Navigator software requires a computer with GPIB capability running Windows 95 or higher (NT/2000). The software is started by selecting the Start button, then Programs, Navigator V2.0, then Navigator 2.0 (Figure 3-2).

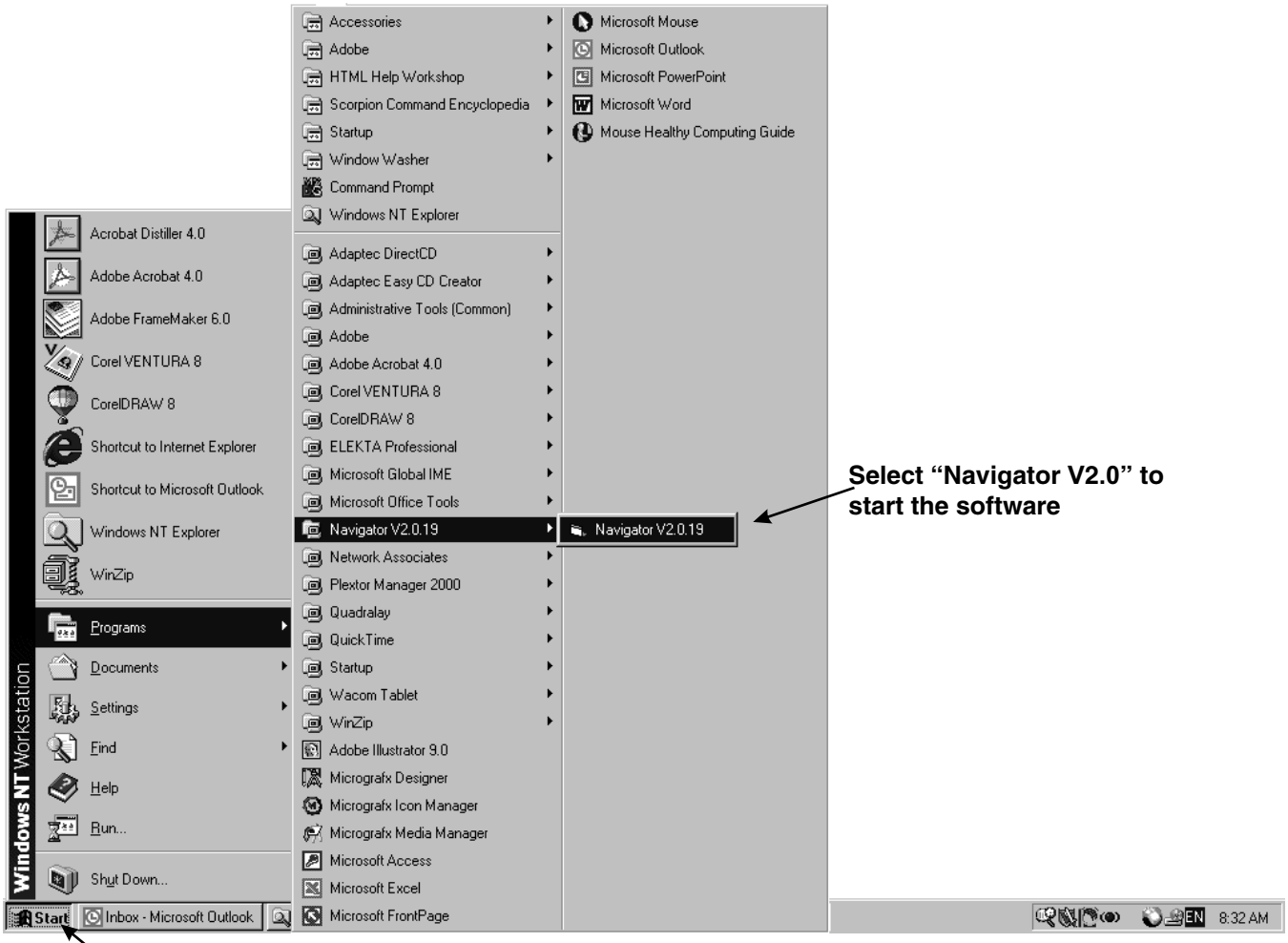


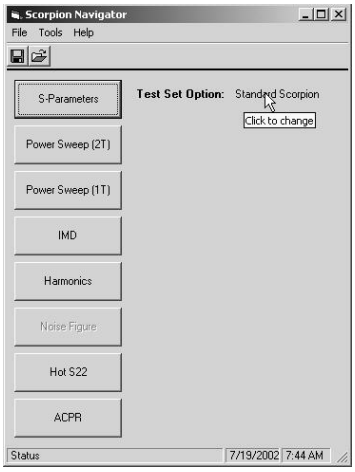
Figure 3-2. *Starting the Scorpion Navigator Software*

Software Organization

The Scorpion Navigator software has two main and three collateral functions. The two main functions, calibration and measurement, are described in Chapters 5 and 6, respectively. The collateral functions, accessed from the TMATS program's top menu, are described in Section 3-4.

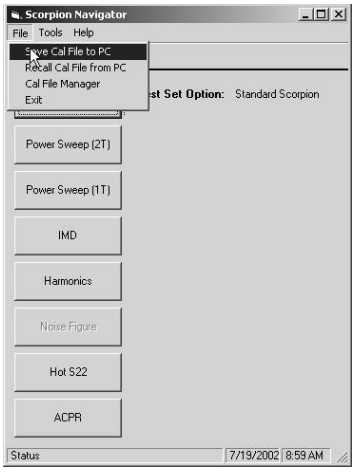
3-4 Collateral Functions

The Scorpion Navigator software collateral functions are found on the top menu (below). The Test Set Options can be changed by clicking the selected test set or changed under Tools and Test Set Option.



File

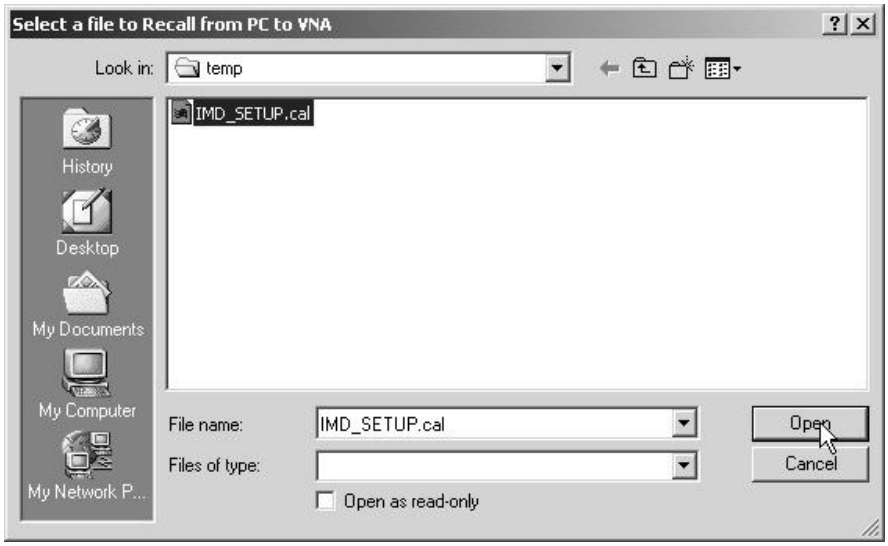
The file menu (below) provides for saving files from the PC to the MS4623B, recalling files from the MS4623B to the PC, and for exiting the system.



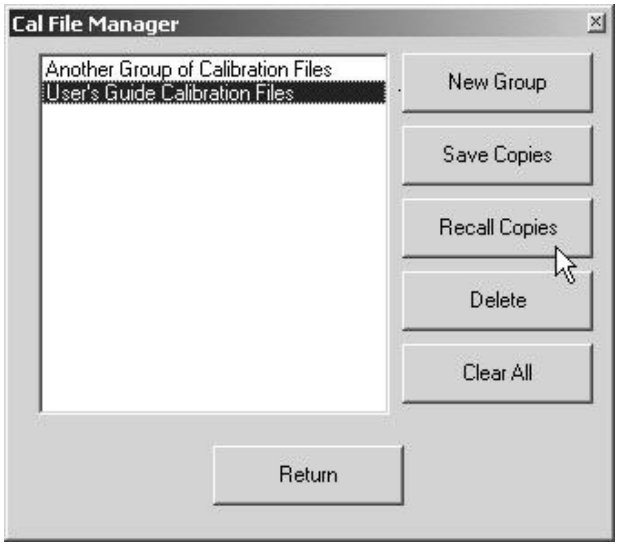
Click on File to display a drop-down list (above) that provides the four options described on the following pages. TMATS Save and Recall functions have the exact same behaviors as the Save/Recall button on the Scorpion. However, instead of saving to the Scorpion hard disk or recalling from the

hard disk, the Scorpion Navigator software allows you to save to the PC hard disk and recall from the PC hard disk.

- Save Cal Files to PC: Displays a dialog box (similar to that shown for Recall Cal Files from PC, below) showing the cal files stored in the default folder (Temp). This function is useful for saving the front panel setup and calibration data to a file on the PC. The user has the option of overwriting an existing file by selecting an existing file from the file listing or creating a new file by typing in a file name. The user must type in a ".cal" extension or the program will report an error. The calibration procedure automatically saves cal files to the PC. The file names of these files is specified in the calibration specification file (*.txt file).
- Recall Cal Files from PC: Displays a dialog box similar to that shown below with the listing of file name. This function transfers a .cal file from the PC to the Scorpion over the GPIB bus (and names the file a.cal on the Scorpion's hard disk) and then recalls the front panel setup and cal data from a.cal.



- Cal File Manager: Lets users save and recall sets of calibration files under a logical name (see below). For example, a manufacturer may have two different parts which require two different calibrations. With this utility the user can acquire a complete calibration for part "1234" and then save the complete calibration to "MANF X PART 1234." A complete calibration is actually a set of 8 ".CAL" files and they are copied to a directory under C:\temp on the user's PC. Then, the user can acquire a complete calibration for part "5678" and then save the complete calibration to "MANF Y PART 5678." The "Active" calibration is the most recently acquired calibration. The user can replace the "Active" calibration by "Recalling" a calibration set that was previously "Saved."



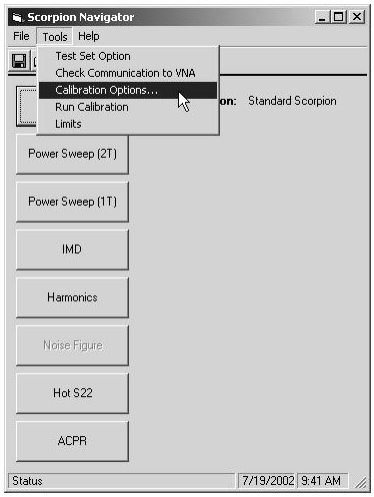
- Exit: Exits the Scorpion Navigator software.

Help

The Help function is not available in the current software.

Tools

The Tools menu (below) displays a drop-down list that provides two collateral options described below. The Calibration Options and Run Calibration are described in Chapter 4.



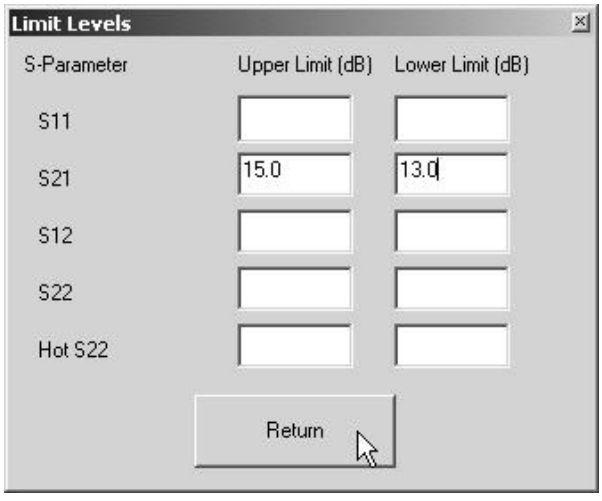
a. Check Communications to VNA: Runs a test to check that the VNA communicates with the PC. Run this option first to ensure that the TMATS setup is correct and functioning properly. If so, dialog boxes appear like those shown below.

If the VNA fails communication, you will see the following dialog box.

The most likely causes of failed connections are:

- ❑ Defective GPIB cable or connector
- ❑ GPIB address not set to 6
- ❑ GPIB controller malfunction

b. Limits: Provides for setting limits for S-Parameter measurements. Refer to the MS462XX OM for more information on setting limits.



Chapter 4
Operations, Calibration

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Chapter 4
Operations, Calibration

4-1 Introduction

Measurements always include a degree of uncertainty due to imperfections in the measurement system. The measured value is always a combination of the actual value plus the systematic measurement errors. Calibration, as it applies to network analysis, characterizes the systematic measurement errors and subtracts them from the measured value to obtain the actual value. Each of the ME7842B measurements requires a calibration to account for measurement uncertainties. This chapter describes the measurement calibration operations of the Model ME7842B Tower Mounted Amplifier Test System software.

4-2 Operation, General

Refer to Chapter 3 for general operation and setup of the ME7842B.

4-3 Test Equipment

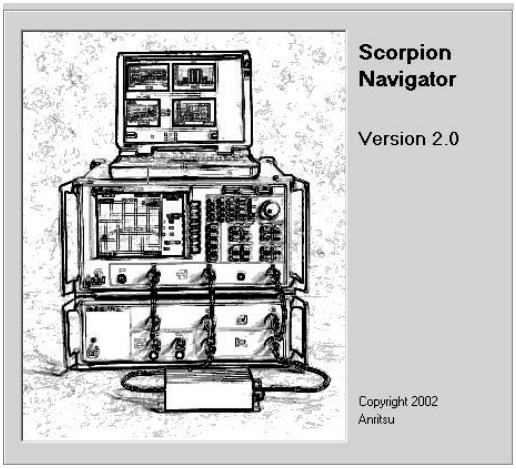
A power meter, power sensor, and Type N calibration component kit is required for power level and S-Parameter calibrations. Additionally, the MG3681 Digital Modulation Signal Generator is supported for ACPR measurements on W-CDMA devices.

4-4 General

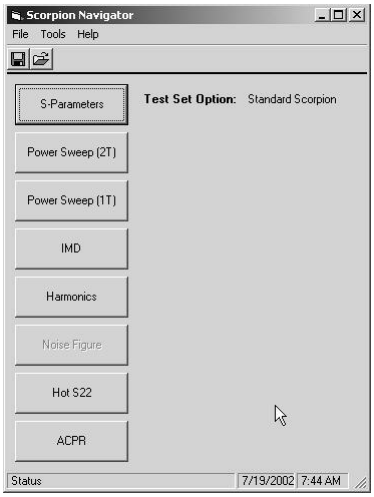
Calibration operations are described in the following paragraphs.

Step 1. Click on Start, Programs, Navigator V2.0, then Navigator V2.0 (Figure 3-2, page 3-6) to start the software.

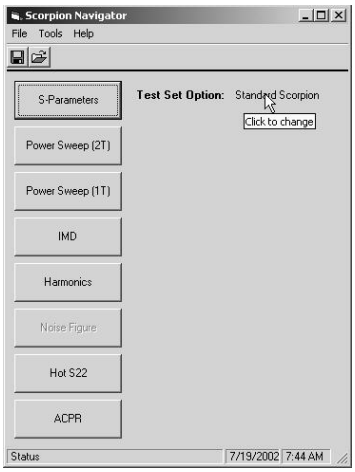
The Scorpion Navigator flash screen (below) briefly appears, then the main screen.



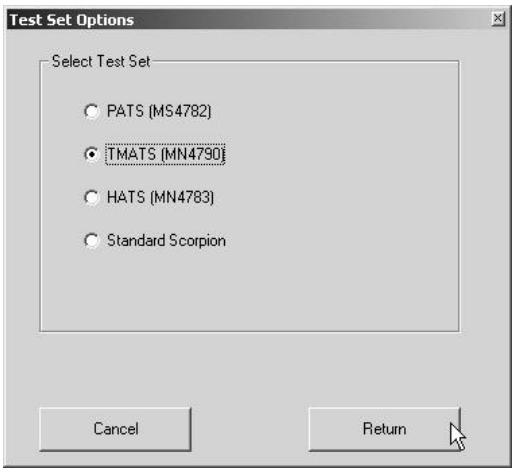
The main Scorpion Navigator dialog box (below) provides access to all software options.



Step 2. Select the TMATS test set by clicking the test set option (below) or by clicking Tools then Test Set Options.

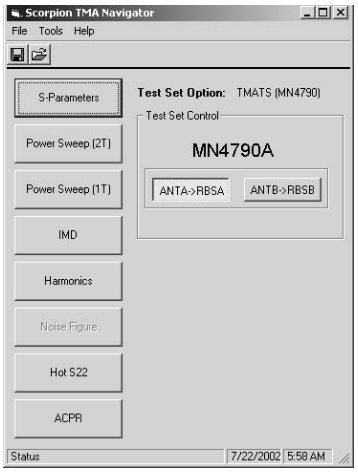


The Test Set Options dialog box appears (below).



Step 3. Select the TMATS (MN4790A) Test Set and click Return.

Selecting the TMATS (MN4790A) test set adds a “Test Set Control” interface to the main Scorpion Navigator dialog box (below).

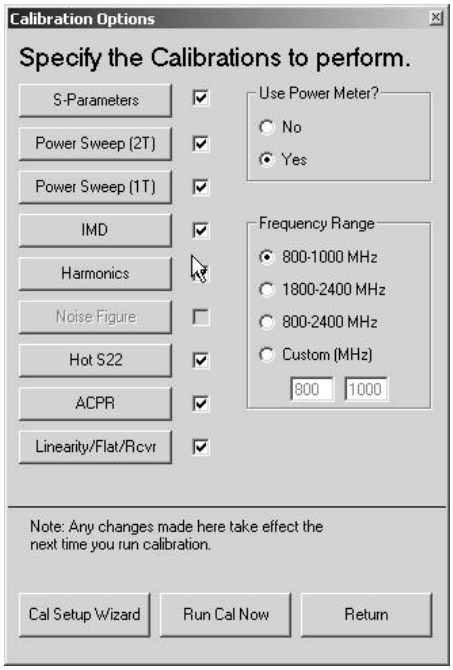


The MN4790A is controlled by GPIB. Selecting TMATS ensures that the proper commands are sent to the test set. The switches in the test set are set to the appropriate path as soon as the button is clicked.

Step 4. Before making any measurements, the system must be calibrated. Select Tools then Calibration Options.”

The Calibration Options dialog box appears (below).

Each software module has its own calibration settings. If a module is dimmed, then Scorpion Navigator did not detect that this option is installed on the connected Scorpion. If the module is checked, then a calibration will be performed for that measurement.

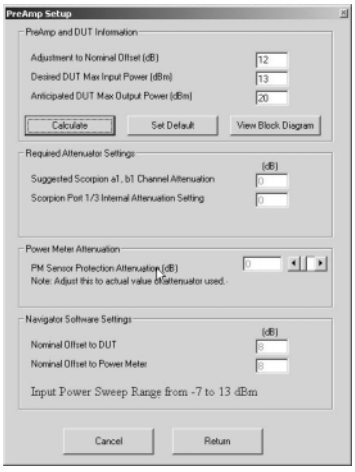


The **Use Power Meter?** Option specifies whether to perform Linearity and Flat Power calibrations with a Power Meter connected to the dedicated GPIB port on the Scorpion.

Global Frequency Range applies to all calibrations. Some Modules (like S-Parameters and Noise Figure) may override this global setting.

The **Cal Setup Wizard** lets you specify the exact hardware configuration in your measurement system.

Step 5. Click Cal Setup Wizard to configure your hardware. The PreAmp Setup dialog box appears (below).



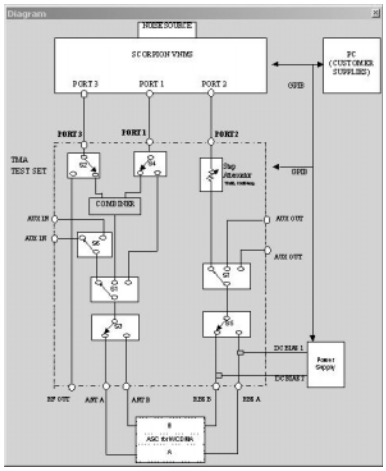
This form helps you set up the ME7842B for calibration.

Button Control Description

Set Default: The default settings assume that you are using a standard MN4790A test set and a DUT that needs a maximum calibrated input power of +5 dBm and produces a maximum output power of +30 dBm.

Calculate: When you move to a new field, the parameters are "calculated." You can enter a number and then press the "Calculate" button to make sure the parameters are being calculated.

View Block Diagram: Pressing this button causes a block diagram to appear (below).



This diagram provides a graphic indication of the input and output locations.

Cancel: Aborts the Setup Wizard and returns to the Calibration Options form.

Return: Returns to the Calibration Options form.

PreAmp and DUT Information

Many power amplifier measurements require higher power input to the DUT than the Scorpion sources are able to generate. TMATS users will insert preamps (or driver amps) into the measurement setup to boost the RF power from the Scorpion sources to a level desirable for measurement.

To properly set up the calibration, Scorpion Navigator needs to know the gain of this preamplifier in the frequency range being measured. If the gain varies in the frequency range, then the maximum gain value should be used.

Adjustment to Nominal Offset (dB): By default, enter a Nominal Offset of -4 into the Navigator Software settings to account for the standard condition of including a combiner into the test setup. If a preamp is inserted before the DUT, then enter the gain as a positive adjustment. For example, a preamp with 12 dB gain should be entered as 12.

If extra attenuation is added in front of the DUT, then enter this value as a negative number. A 10 dB pad permanently inserted into the path before the DUT would be entered as -10.

If the combiner loss is actually 7 dB, enter -3 in this field. Check that the "Nominal Offset to DUT" is calculated as expected before continuing.

Desired DUT Max Input Power (dBm): Used to set the desired maximum input power. Many amplifier measurements involve sweeping the input power to the DUT. Scorpion Navigator needs to know the maximum desired RF power at the input to the DUT. By default, enter 0 dBm into this field. The software will attempt to calibrate the instrument so that swept power measurements will achieve the desired Max Input Power. Assume that the Scorpion sources can sweep in the -15 to +5 dBm range. If a combiner is added with 4 dB of loss, then this range becomes -19 to +1 dBm (default case). If a preamp with 12 dB of gain is added after the combiner (or two matching 12 dB preamps before the combiner), then the sweep range is -7 to +13 dBm (as shown above).

Anticipated DUT Max Output Power (dBm): Used to set the maximum output power. Assuming that the maximum input power is applied to the DUT, what is the expected maximum DUT output power? Scorpion Navigator needs to know this to help set the test set attenuator during calibration and measurement. With a Standard Scorpion or TMATS setup, you will need to limit the DUT Max output power to be less than 25 dBm.

Required Attenuator Settings

Configure the Scorpion Port 1/3 for the Internal Attenuation Setting

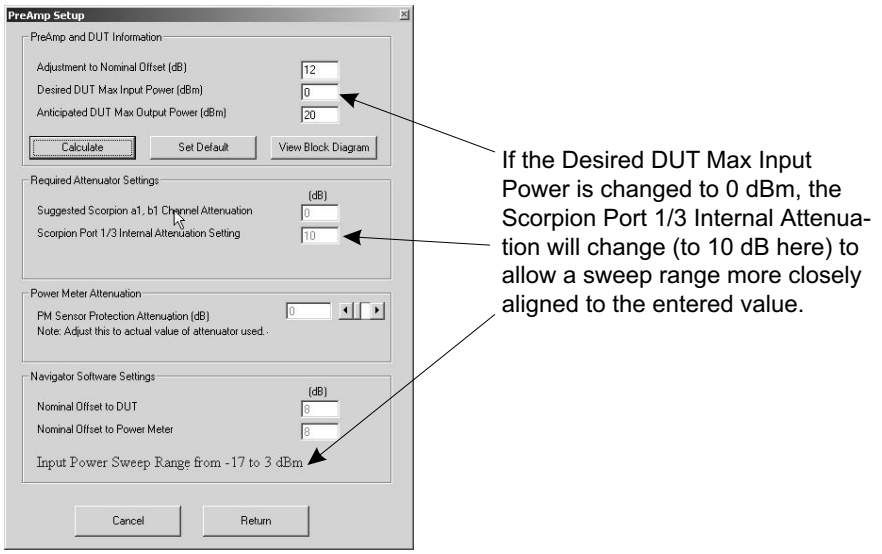
Power Meter Attenuation

When preamps are used in the system, the calibration strategy is to add a known attenuator before the power meter while acquiring the linearity calibration and the flat power calibration. Scorpion Navigator first suggests an attenuator value to use, but this value should be adjusted to exactly match the value of the attenuator.

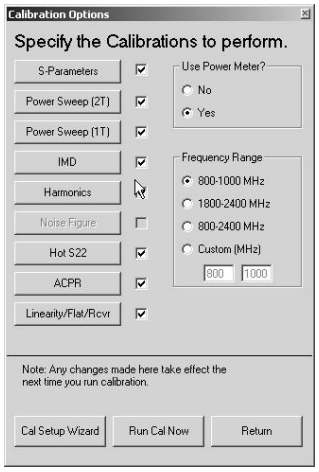
Navigator Software Settings

The Cal Wizard adjusts the Nominal Offsets automatically based on the software's knowledge of the loss through the test set.

Example:
Adjusting Nominal Offset and Desired DUT Max Input Power

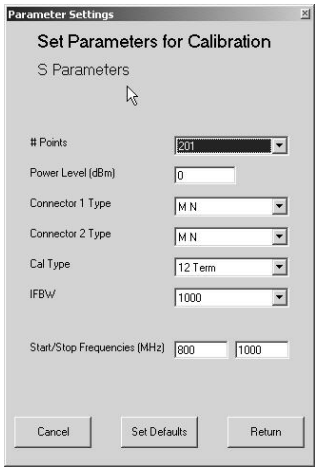


Step 6. Setup the calibration options by selecting Tools and Calibration Options... The Calibrations Options dialog box will appear (below).



Step 7. Click on each of the available calibration module buttons to open the Parameter Settings dialog box and set the parameters for that particular calibration procedure as follows:

S-Parameter Calibration Options



 # Points: The number of points can be set from 3 to 1601 points. Calibration is performed on this number of points. During a measurement, the number of points may be decreased, but may not be increased to more than the value set during this calibration.

Power Level (dBm): The lower limit is -85 plus the Nominal Offset. The upper limit is 10 plus the Nominal Offset. It is suggested that this value agree with the flat power calibration level and that this not be changed significantly (such that the attenuation changes) during measurements.

Connector Type: M=Male, F=Female, SMA, N, K, 3.5 mm or Special

Cal Type:

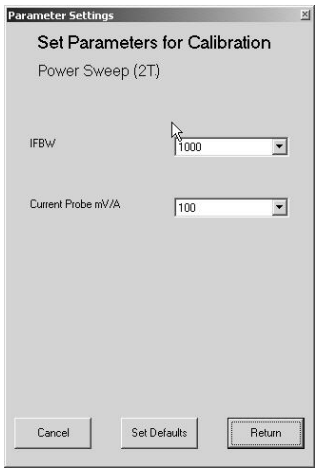
- Manual Calibrations—12 Term (allows S11, S21, S12, S22), 1 Path 2 Port Fwd (S11 and S21 only), Fwd Transmission (S21 only), Rev Reflection (S22 only), LRL
- Autocal—Full 2 Port Cal (S11, S21, S12, S22)

IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control). This may be changed during a measurement.

Start/Stop Frequencies: These settings will over-ride the global settings.

2 Tone Power Sweep Calibration Options

2 Tone Power Sweep is an IMD Mode Measurement where the input power to the DUT is swept over a maximum 25 dB range. The calibration relies on an accurate Linearity calibration and an accurate Receiver calibration.

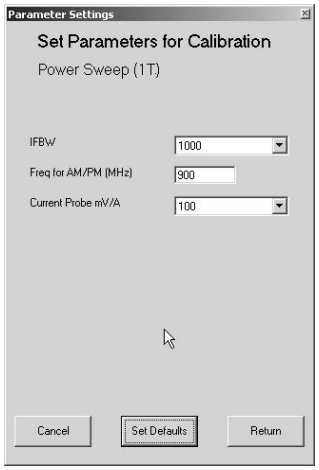


IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control).

Current Probe Setting: 10, 100 or 1000 mv/Amps.

1 Tone Power Sweep Calibration Options

1 Tone Power Sweep is a T/R Mode Measurement where the input power to the DUT is swept over a maximum 25 dB range. The calibration relies on an accurate Linearity calibration and an accurate Receiver calibration.



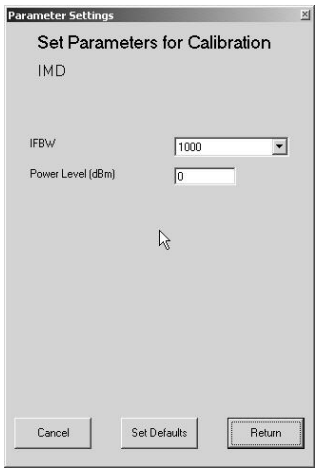
IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control).

Freq for AM/PM (MHz): This frequency should be within the Global Frequency Range. Calibrations for AM/PM measurements are only performed at 1 Frequency as specified here.

Current Probe Setting: 10, 100 or 1000 mv/Amps.

IMD Calibration Options

IMD Calibration allows CW IMD measurements, Swept Frequency IMD products, and TOI. The calibration relies on an accurate Flat Power calibration and an accurate Receiver calibration.

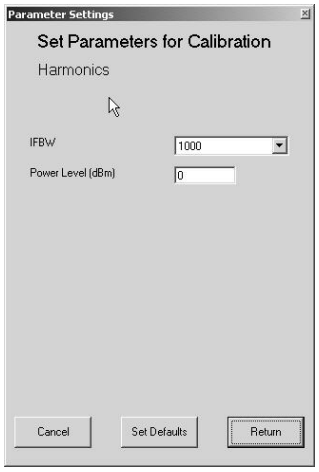


IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control). This is simply an initial IFBW setting and may be changed at measurement time.

Power Level (dBm): This level is set prior to doing an IMD calibration. This calibration allows for Input Referred measurements. Note that any Input Referred measurement must be performed at this power level.

Harmonics Calibration Options

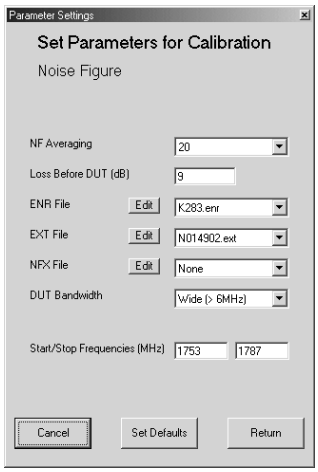
Harmonics Calibration relies on an accurate Flat Power calibration (if you are interested in absolute power levels) and performs a quick Receiver calibration over the entire frequency range of the Scorpion. For limited bandwidth test sets (such as PATS), measurements outside the bandwidth of the test set may be degraded.



IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control). This is an initial IFBW setting and may be changed at measurement time.

Power Level (dBm): This level is shared with IMD calibration setup (if you change the level here, it will change in IMD also). This is an initial setting and may be changed at measurement time.

Noise Figure Calibration Options
Noise Figure measurements allow you to compare the decrease (or degradation) in signal-to-noise ratio through the DUT.



NF Averaging: Sets the number of points to average over the specified measurement range.

Loss Before DUT(dB): If a network (attenuator) is placed between Port 1 and the input of the DUT, the contribution to ENR reduction can be entered here. This method should only be used for networks which have flat frequency response (loss is constant over frequency).

ENR File: Excess Noise Ratio (ENR) tables are unique for each noise diode and must be selected to match the diode in use for the noise figure measurement.

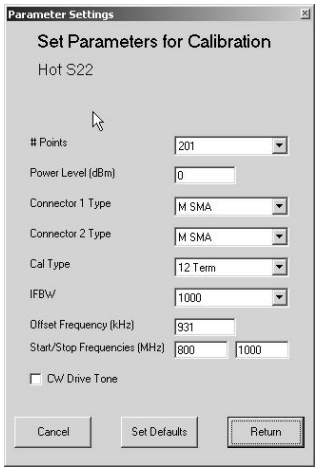
EXT File: When the network ahead of the DUT does not have flat frequency response, the 2-Port S-Parameters of the network can be measured and the Scorpion can compute the correction file for the path from the rear panel of the instrument all the way to the DUT input connector.

NFX File: The NFX file characterizes the network between the port 1 connector and the DUT input connector. The file is a user generated .S2P file of the four S-Parameters for the user inserted network.

DUT Bandwidth: Specifies the bandwidth of the DUT.

Start/Stop Frequencies (MHz): Specifies the Start and Stop frequencies for the test.

Hot S22 Calibration Options



 # Points: The number of points can be set from 3 to 1601 points. Calibration is performed on this number of points. During a measurement, the number of points may be decreased, but may not be increased to more than the value set during this calibration.

Power Level (dBm): The lower limit is -85 plus the Nominal Offset. The upper limit is 10 plus the Nominal Offset. It is suggested that this value agree with the flat power calibration level and that this not be changed significantly (such that the attenuation changes) during measurements.

Connector Type: M=Male, F=Female, SMA, N, K, 3.5 mm or Special

Cal Type:

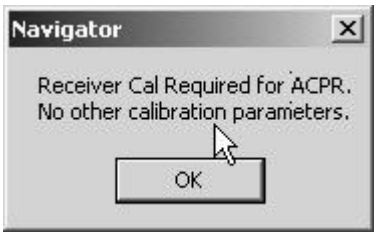
- Manual Calibrations—12 Term (allows S11, S21, S12, S22), 1 Path 2 Port Fwd (S11 and S21 only), Fwd Transmission (S21 only), Rev Reflection (S22 only), LRL
- Autocal—Full 2 Port Cal (S11, S21, S12, S22)

IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control). This may be changed during a measurement.

Start/Stop Frequencies: These settings will over-ride the global settings.

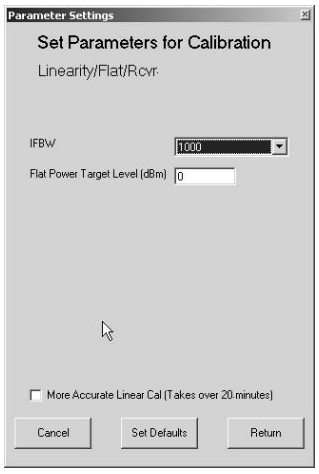
ACPR Calibration Options

ACPR calibration does not have any user settable parameters. The calibration procedure relies on an accurate receiver calibration and sets up the Scorpion in the correct mode to acquire the raw data necessary to calculate ACPR in Scorpion Navigator.



Linearity/Flat/Receiver Calibration Options

These calibrations form the basis of many other calibrations and are performed over the global frequency range.



The order of these calibrations is important:

a. Linearity Calibration: This calibration adjusts the Scorpion Sources to apply accurate input power levels to the DUT at all power levels across the frequency range.

b. Flat Power Calibration

c. Receiver Calibration

IFBW: 100 to 30,000 (lower IFBW settings are difficult to synchronize with GPIB control). This is the IFBW used in performing the Receiver calibration.

Flat Power Target Level (dBm): This is the input power required at the DUT for IMD, Harmonics, and S-Parameters.

Step 8. After the calibration parameters are set, click the Run Cal Now button on the Calibration Options dialog box or select Tools and Run Calibration on the main Scorpion Navigator dialog box. This starts the calibration. After the calibration is started, screens will display depending on the check boxes selected in the Calibration Options dialog box. All checked items will be calibrated. Scorpion Navigator determines order, as follows:

a. Linearity

b. Flat

c. Receiver

d. Hot S22

e. S-Parameter

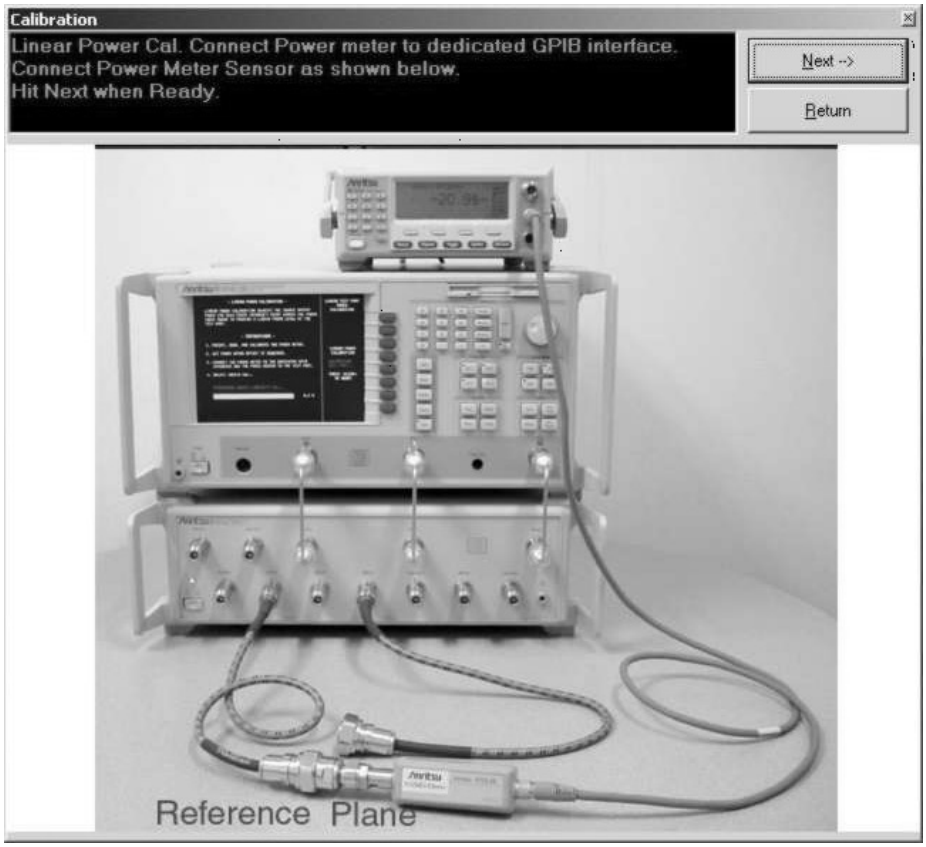
f. Power Sweep

g. IMD, Harmonics

h. ACPR

The calibration screens are straight forward. In general, follow the instructions before clicking the Next button. The PC's Enter key should execute Next. Clicking the Return button should return Scorpion Navigator to the main Scorpion Navigator dialog box and abort the calibration procedure. However, the Scorpion will retain the calibrations that were completed.

The Linearity Power Calibration starts by displaying the following screen.



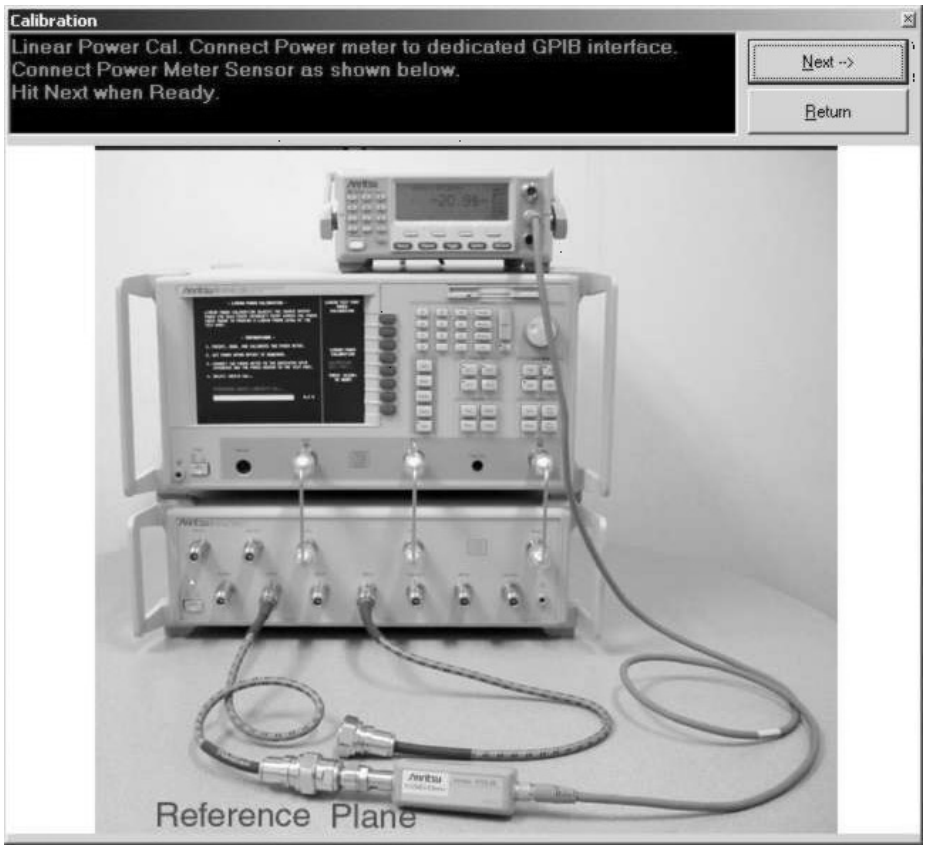
Step 9. Before clicking the Next button, connect the power meter to the point where power enters the DUT. This becomes the power reference plane as shown above.

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

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

The linear power calibration takes up to five minutes to complete. It calibrates the output power at the reference plane for both internal sources (power out of Port 1 then Port 3) according to the target power across the frequency range set in the calibration specification file. When the test completes, the Next button will become available.

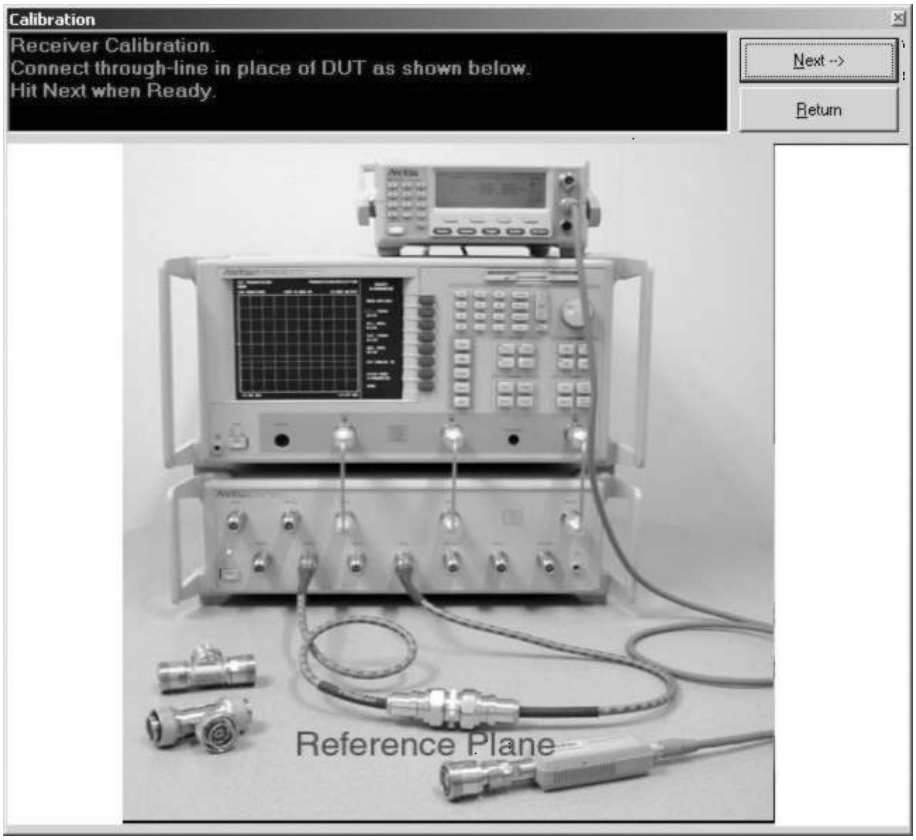
Step 10. Press Next to initiate the Flat Power Calibration (below).



The flat power calibration takes less than one minute to complete. It calibrates the output power at the reference plane for both internal sources (power out of Port 1, then Port 3) according to the target power across the frequency range set in the calibration specification file. When the test completes, the "Next" button will become available.

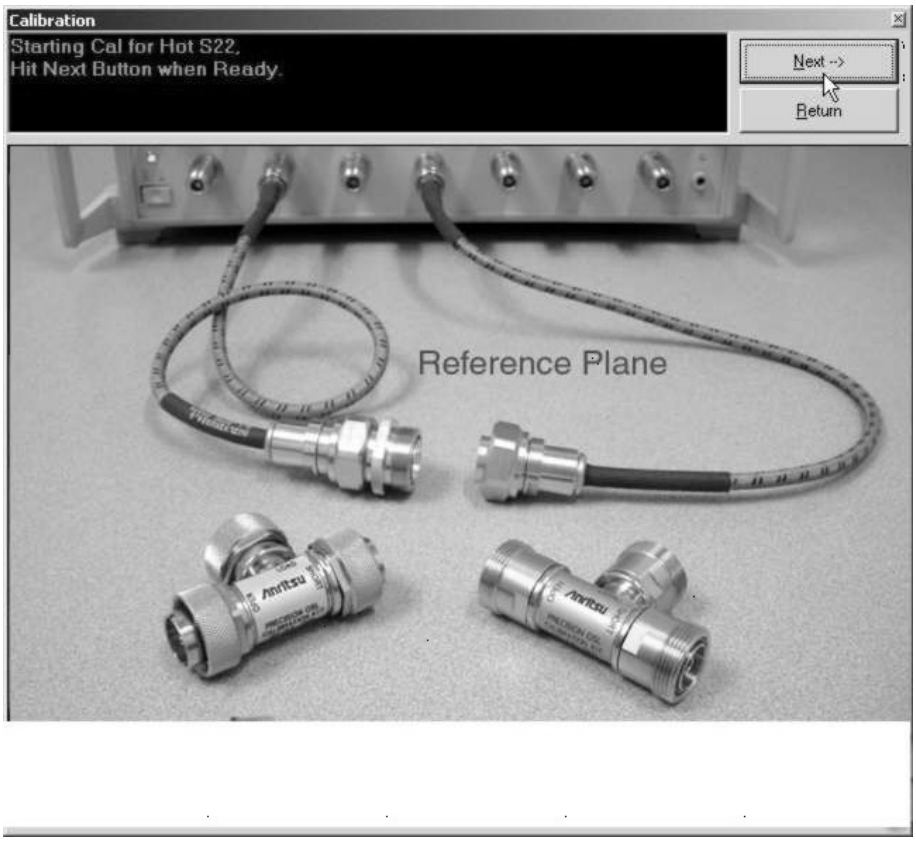
Step 11. Before pressing Next to initiate the Receiver Calibration, dis-

connect the power sensor and connect a through line between Test Ports 1 and 2 on the MN4790A Test Set, as shown below.



Step 12. Press Next to perform a Receiver Calibration.

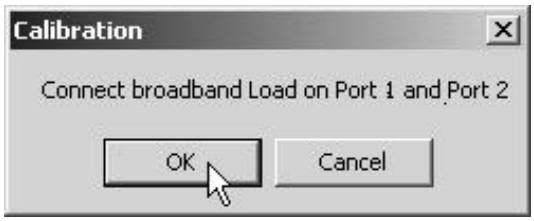
Step 13. If the Hot S22 box is checked, it is the next calibration to appear. Hot S22 is a return loss measurement of an amplifier's output port (Port 2) while stimulus is applied to its input port. Software prompts provide you with instructions and setup the Scorpion to make calibrated measurements on your DUT. At the completion of the calibration, the measurement information is saved to a *.cal file.



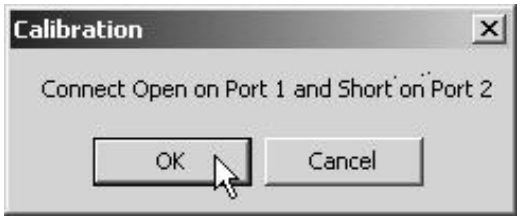
Step 14. To run this program, click Next to begin the prompts (following page).

Step 15. The 3753R Calibration Kit contains a disk with calibration data. The data has to be installed from the MS463B front panel. To do so, place the floppy disk from the kit into the MS4623B disk drive. Press the Cal key, then COMPONENTS UTILITIES/INSTALL KIT INFO FROM FLOPPY DISK softkeys.

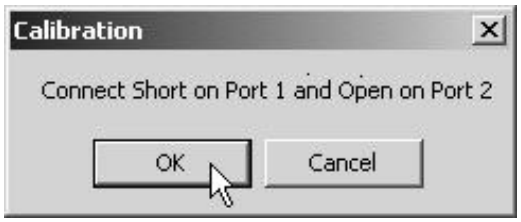
Step 16. Press OK for the next step (below). Connect the broadband Load to Port 1 and Port 2.



Step 17. Press OK for the next step (below). Connect the Open to Port 1 and the Short to Port 2.



Step 18. Press OK for the next step (below). Connect the Short to Port 1 and the Open to Port 2.



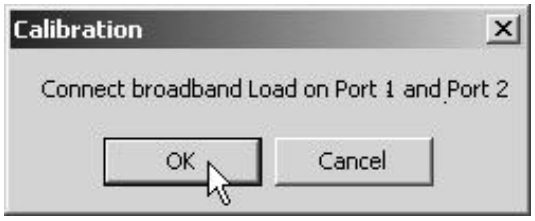
Step 19. Press OK for the next step (below). Connect the throughline between Port 1 and Port 2.

Step 20. Press OK to complete the Hot S22 calibration.

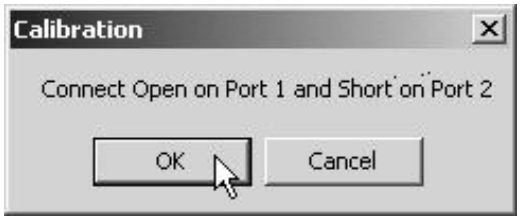
Step 21. If the S-Parameters box is checked, it is the next calibration. The prompts cause the Scorpion to be placed into a state where it is ready to make calibrated measurements on your DUT.

Step 22. Press Next for the next step (below). The 3753R Calibration Kit contains a disk with calibration data. The data has to be installed from the MS4623B front panel. To do so, place the floppy disk from the kit into the MS4623B disk drive. Press the Cal key then COMPONENTS UTILITIES/INSTALL KIT INFO FROM FLOPPY DISK softkeys.

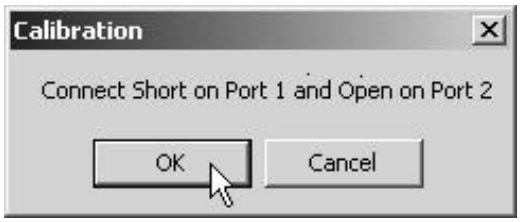
Step 23. Press "OK" for the next step (below). Connect the broadband Load to Port 1 and Port 2.



Step 24. Press OK for the next step (below). Connect the Open to Port 1 and the Short to Port 2.



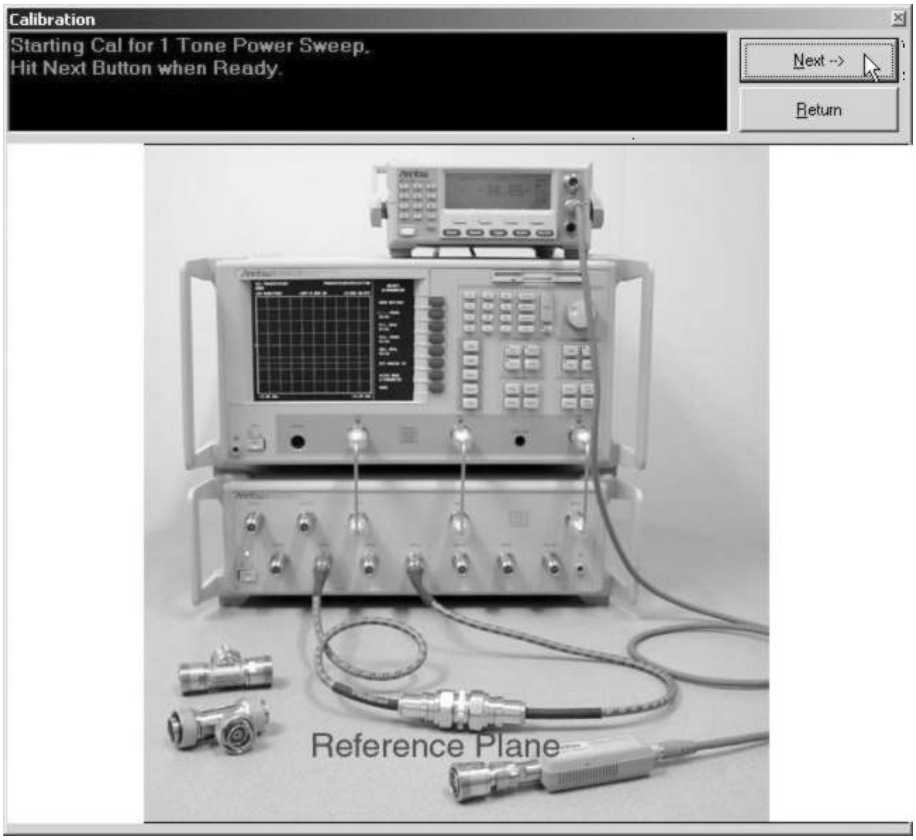
Step 25. Press OK for the next step (below). Connect the Short to Port 1 and the Open to Port 2.



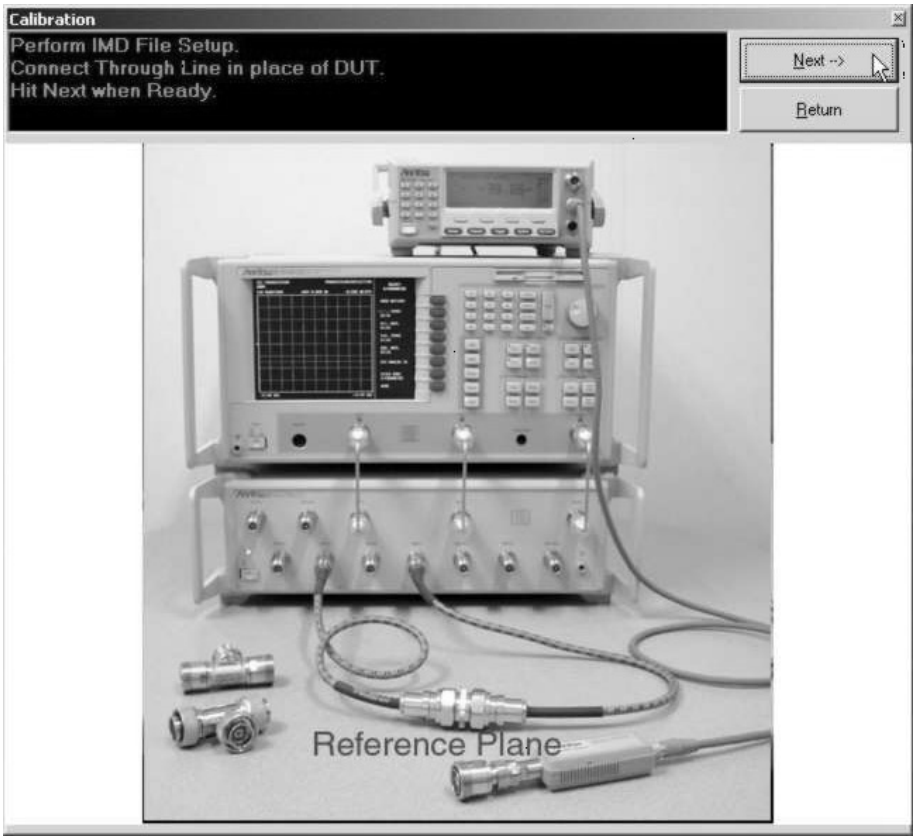
Step 26. Press OK for the next step (below). Connect the throughline between Port 1 and Port 2.

Step 27. Press OK to complete the S-Parameter calibration.

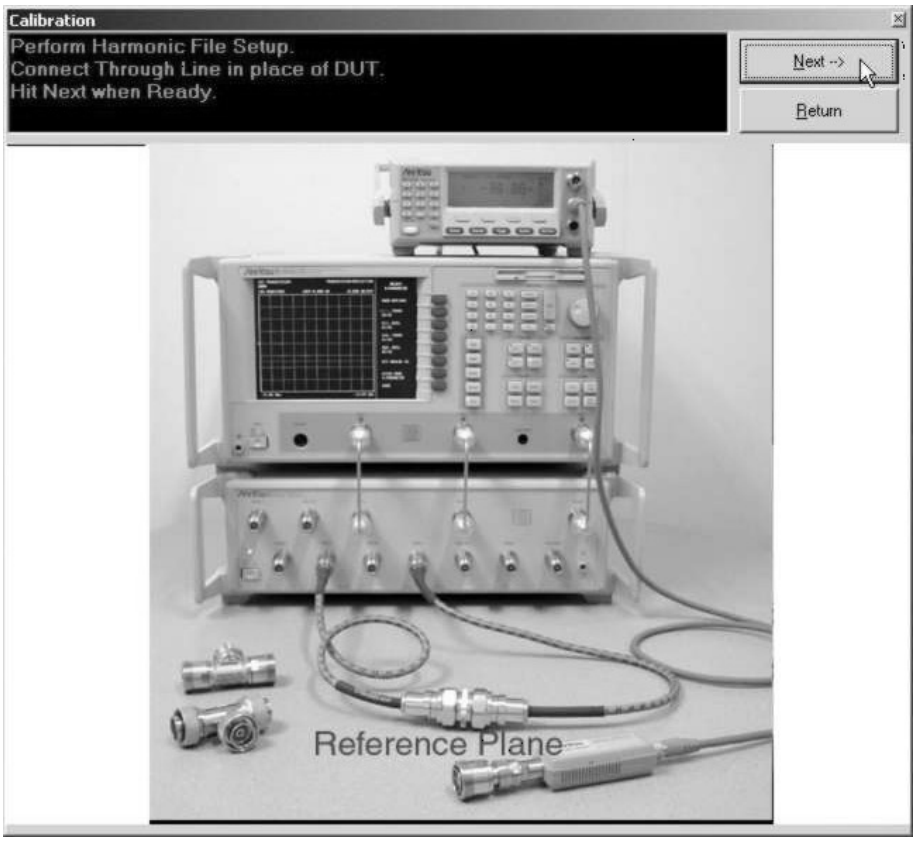
Step 28. If the 1 Tone Power Sweep (1T) or 2-Tone Power Sweep (2T) box is checked, it is the next calibration to appear. Connect the throughline between test ports 1 and 2 on the MN4790A test set and click Next.



Step 29. If the IMD box is checked, it is the next calibration to appear. Follow the prompt and connect a throughline between Test Ports 1 and 2 on the MN4790A Test Set.

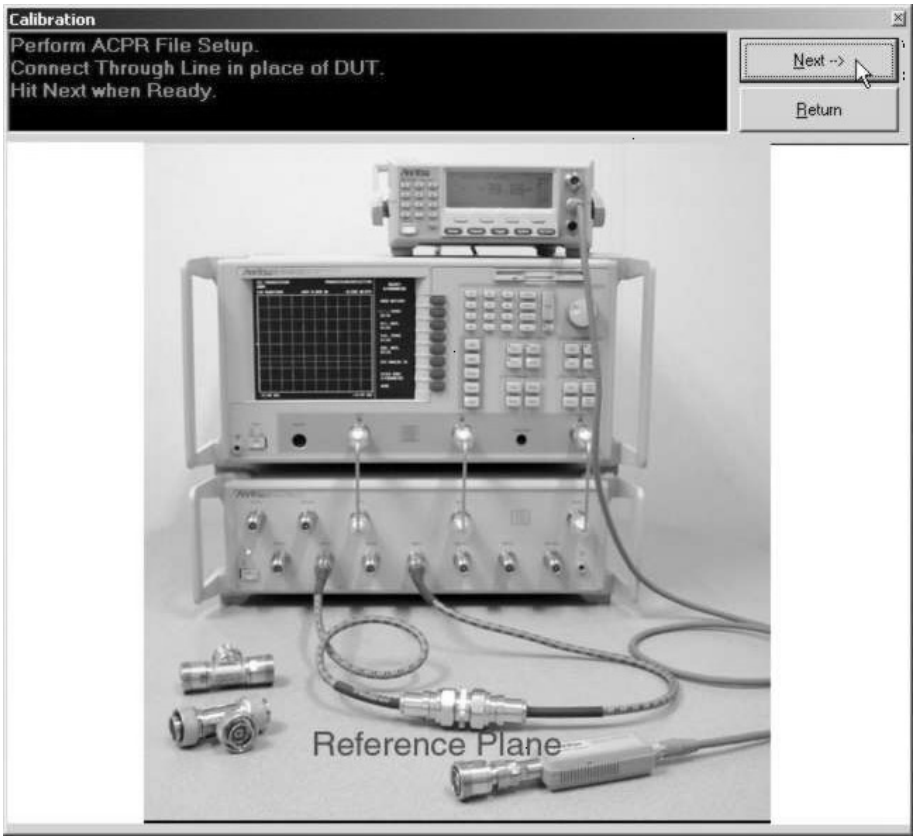


Step 30. Press Next to begin the Harmonics Calibration (below).



Step 31. Connect the throughline between test ports 1 and 2 on the MN4790A test set and click Next.

Step 32. If checked, the ACPR calibration is the next calibration to appear. Connect the throughline between test ports 1 and 2 on the MN4790A test set.



Step 33. Press Next to begin the calibration.

At the completion of the calibration procedure the software returns to the Main Scorpion Navigator dialog box and you are ready to perform calibrated measurements. At this point, even if you exit the Scorpion Navigator software and turn off the Scorpion, the set of calibrations just acquired remains current and available the next time the Scorpion Navigator is started and the Scorpion is turned on and connected.

Chapter 5
Operations, Measurement

Table of Contents

Chapter 5
Operations, Measurement

5-1 Introduction

This chapter describes the eight measurements available with the ME7842B software:

- S-Parameters
- K-Factor
- Power Sweep
- IMD
- Harmonics
- Noise Figure
- Hot S22
- ACPR.

5-2 Operation, General

Refer to Chapter 3 for general operation and setup of the ME7842B.

5-3 Measurement Calibration

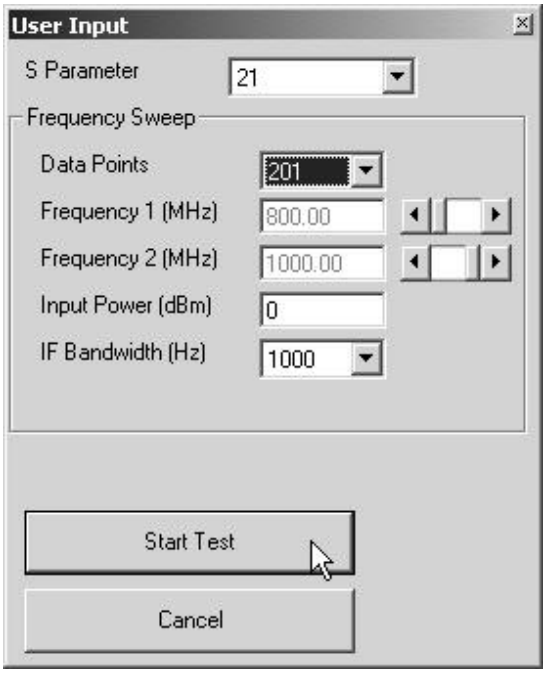
Measurements always include a degree of uncertainty due to imperfections in the measurement system. The measured value is always a combination of the actual value plus the systematic measurement errors. Calibration, as it applies to network analysis, characterizes the systematic measurement errors and subtracts them from the measured value to obtain the actual value. Each of the ME7842B measurements requires a calibration to account for measurement uncertainties. Refer to Chapter 4 for measurement calibration procedures.

5-4 S-Parameter Tests

This test measures the scattering parameters (S-Parameters). The test module comprises six tests: S11, S12, S21, S22, overlay of all S-Parameters (ALL), and K-Factor (this test is described in paragraph 5-5). In each case, the measurement screens are similar. This procedure will present a test screen for the "S21" measurement and will describe certain differences at the end of the procedure.

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The inputs required for this test are described below:



- **S-Parameter:** Drop down options are set to S21 for this procedure. Other selections include S11, S12, S22, ALL (overlay of all S-Parameters), and K-Factor (paragraph 5-5).
- **Data Points:** Drop down options indicate the number of data points in the frequency sweep.
- **Frequency 1 (MHz):** Lower frequency or start frequency.
- **Frequency 2 (MHz):** Upper frequency or stop frequency.
- **Input Power (dBm):** Input power level, in dBm.
- **IF Bandwidth (Hz):** Intermediate frequency bandwidth for the test, in Hertz.

- **Select Start Test:** Observe that the S-Parameter test screen (Figure 5-1) appears.

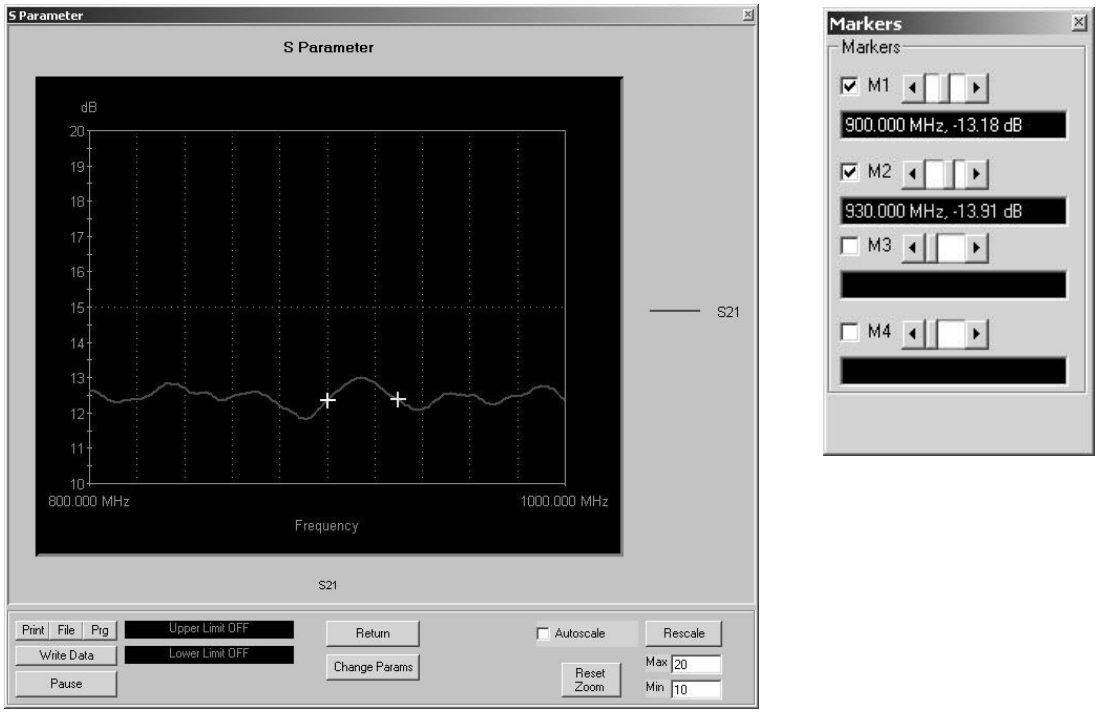
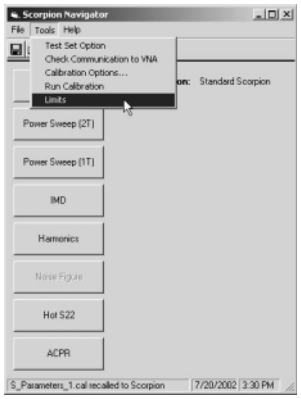


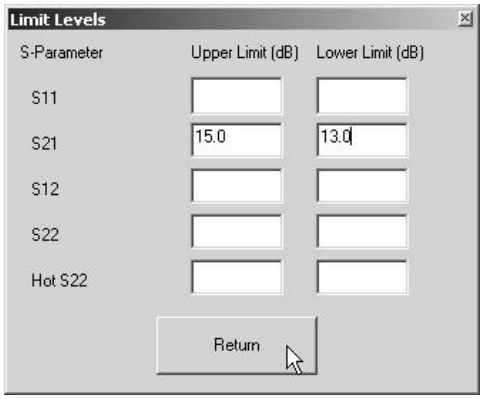
Figure 5-1. *S-Parameters Test Screen for S21*

Button panel and test screen display options:

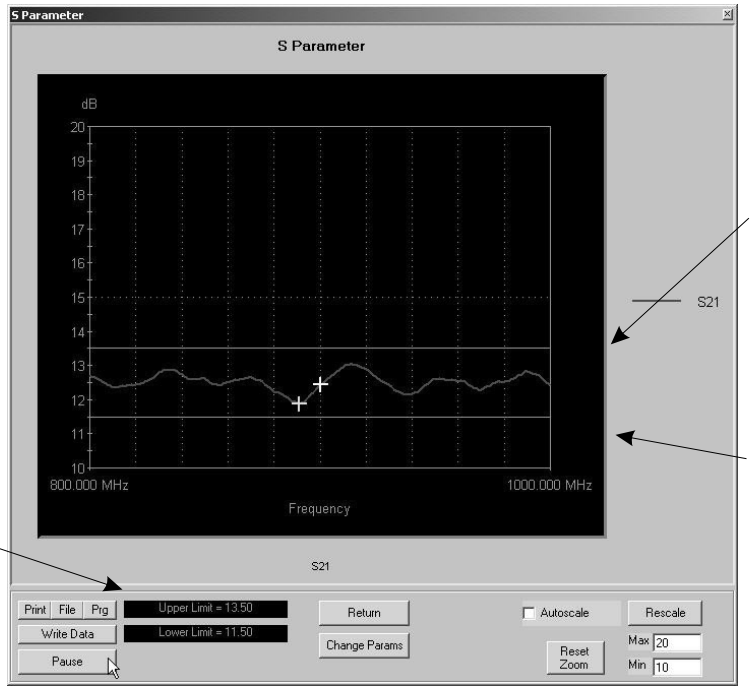
- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set its parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.



- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Upper Limit/Lower Limit:** To display limit lines, set their values by clicking the Tools and Limits menus from the main Scorpion Navigator dialog box (left). This opens the Limit Levels dialog box (below).



The Limit lines will be displayed on the S-Parameter test screen (below).

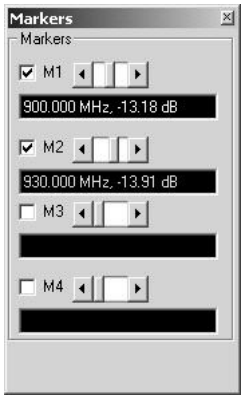


The limit line values are displayed here and will change color to green or red depending on the pass/fail condition.

The upper limit line displays green if all the data points are less than the upper limit and displays red if any data point is greater than the upper limit.

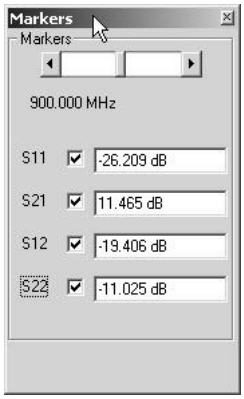
The lower limit line displays green if all the data points are greater than the lower limit and displays red if any data point is less than the lower limit.

- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Reset Zoom:** You can drag the cursor on the graph to zoom in on the selected area. To undo the zoom and return to full scale, click the Reset Zoom button
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.



Markers Screen Options for S11, S21, S12, and S22 (left):

- **M1:** Checking M1 turns marker 1 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.
- **M2:** Same as above.
- **M3:** Same as above.
- **M4:** Same as above.



Markers Screen Options for ALL (left):

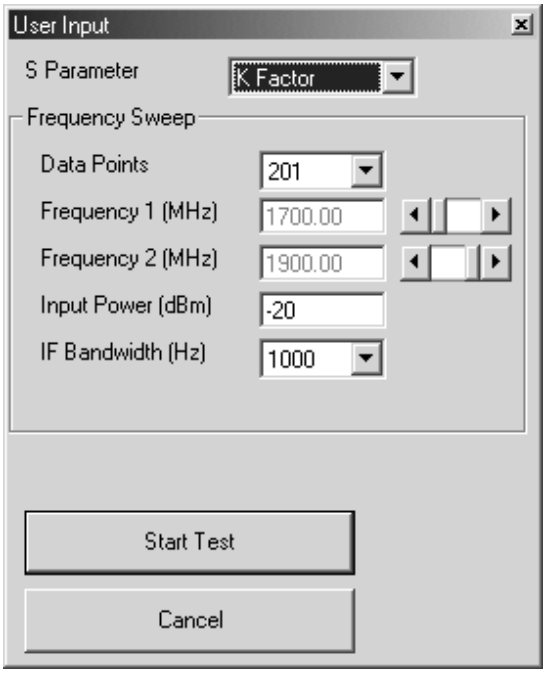
- **Marker Slider:** Moves the marker between data points.
- **Frequency Display:** Displays the marker's frequency.
- **S11:** Checking this box displays the S11 input return loss trace.
- **S21:** Checking this box displays the S21 gain trace.
- **S12:** Checking this box displays the S12 output isolation trace.
- **S22:** Checking this box displays the S22 output return loss trace.

5-5 S-Parameter Test: K-Factor

This test describes the K-Factors measurement. K-Factor is a measurement of stability and is calculated from the real and imaginary data of all four S-Parameters. K-Factor is a stability factor of interest for amplifier designers.

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The inputs required for this test are described below:



- **S-Parameter:** Select K-Factor in the S-Parameter drop down options for this measurement.
- **Data Points:** The drop down options indicate the number of data points in the frequency sweep.
- **Frequency 1 (MHz):** Lower frequency or start frequency.
- **Frequency 2 (MHz):** Upper frequency or stop frequency.
- **Input Power (dBm):** Input power level, in dBm.
- **IF Bandwidth (Hz):** Intermediate frequency bandwidth for the test, in Hertz.

- **Select Start Test:** Observe that the test screen (Figure 5-2) appears.

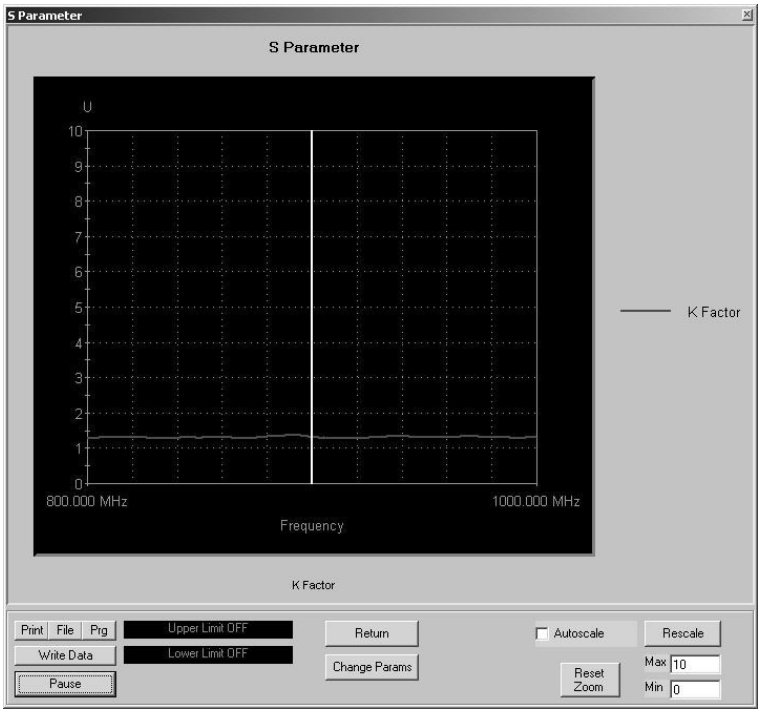
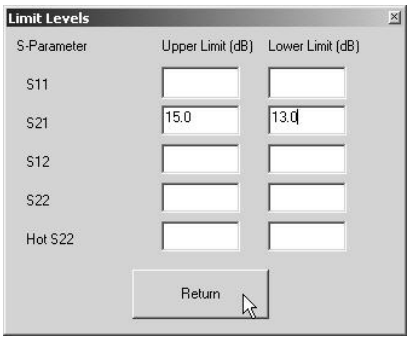


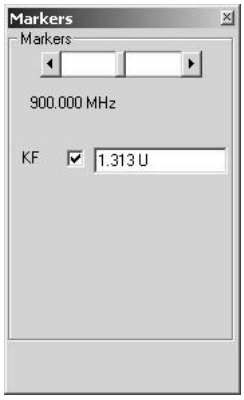
Figure 5-2. *S-Parameters Test Screen for K-Factor*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set its parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.



- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Upper Limit/Lower Limit:** To display limit lines, set their values by clicking the Tools and Limits menus from the main Scorpion Navigator dialog box (Chapter 4). This opens the Limit Levels dialog box (left).
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Reset Zoom:** You can drag the cursor on the graph to zoom in on the selected area. To undo the zoom and return to full scale, click the Reset Zoom button
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.



Markers Screen Options for K-Factor (left):

- **Marker Slider:** Moves marker between data points.
- **Frequency Display:** Displays marker frequency.
- **KF:** Displays the K-Factor value. The “U” stands for units.

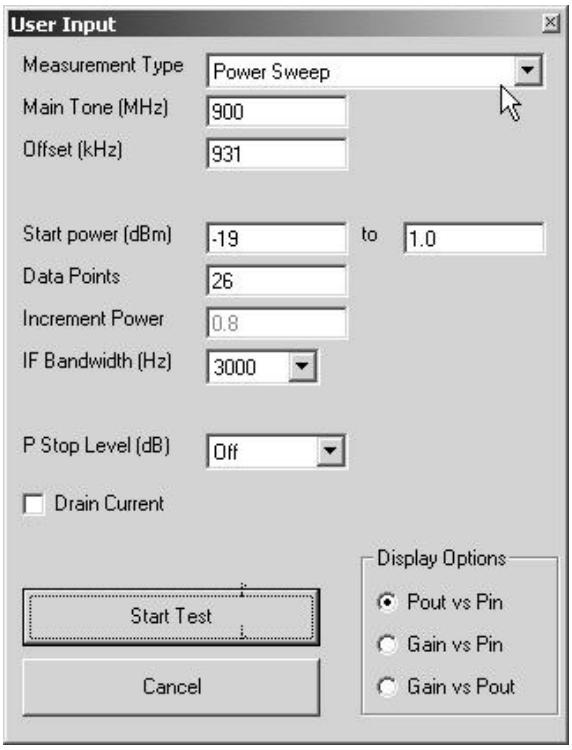
5-6 Power Sweep: Two Tone

This measurement module has four variations of possible Measurement Types: Power Sweep (single frequency), Multi Frequency Power Sweep, Gain, and IMD.

Single Frequency Power Sweep

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen (left). The input fields are described below:



- **Measurement Type:** The drop down menu options include Power Sweep (single frequency), Multi Freq Power Sweep (uses 3 frequencies), Gain, and IMD. Set the measurement type to "Power Sweep" for this test.
- **Main Tone (MHz):** CW Frequency setting for source 1.
- **Offset (KHz):** Specifies the separation (in KHz) for the Scorpion Source 2 (Source 2 will be set to the Main Tone + Offset frequency).
- **Start Power (dBm):** Power will be swept starting at the start power (input RF power to DUT). Both sources are simultaneously set to each power setting. The stop power is also entered in the "to" field.
- **Data Points:** Number of data points in the power sweep.
- **Increment Power (dBm):** Value to increment power for each data point (calculated and displayed only).
- **IF Bandwidth (Hz):** Specifies the effective IF Bandwidth to use for this measurement. Scorpion Navigator sometimes uses a combination of averaging and IFBW settings to achieve an effective IF Bandwidth.
- **PStop Level (dB):** Provides the ability to set the PStop value based on the level of gain compression. Drop down options include compression levels of 1 dB through 10 dB in 1 dB increments, and OFF. If OFF is selected, then the P Stop equals the value entered in the "to" field above. If the selected compression occurs, PStop for all subsequent power sweeps is reset to one increment before the P_{in} value where this compression level is reached.

- **Drain Current Check box:** When checked, the drain current is measured and the Power Added Efficiency (PAE) is calculated and displayed. Selecting this option when no current probe is present will slow down the measurements considerably. If checked, then you must specify the DC power in order to get an accurate PAE measurement.
- **Display Options:** Specifies what is presented on the X and Y axes during the measurement. The first parameter is displayed on the Y-axis and the second on the X-axis. For example, in "Gain vs. P_{out}" Scorpion Navigator will display Gain on the Y-axis and P_{out} on the X-axis. The display options for the various measurement types are shown below:
  - Power Sweep
    - P_{out} vs. P_{in}
    - Gain vs. P_{in}
    - Gain vs. P_{out}
  - Overlay Power Sweep
    - P_{out} vs. P_{in}
    - Gain vs. P_{in}
    - Gain vs. P_{out}
  - Multifrequency Power Sweep
    - Gain
    - P_{out}
  - IMD Offset Sweep
    - Gain
    - P_{out}

- **Select Start Test:** Observe that the test screen (Figure 5-3) appears.

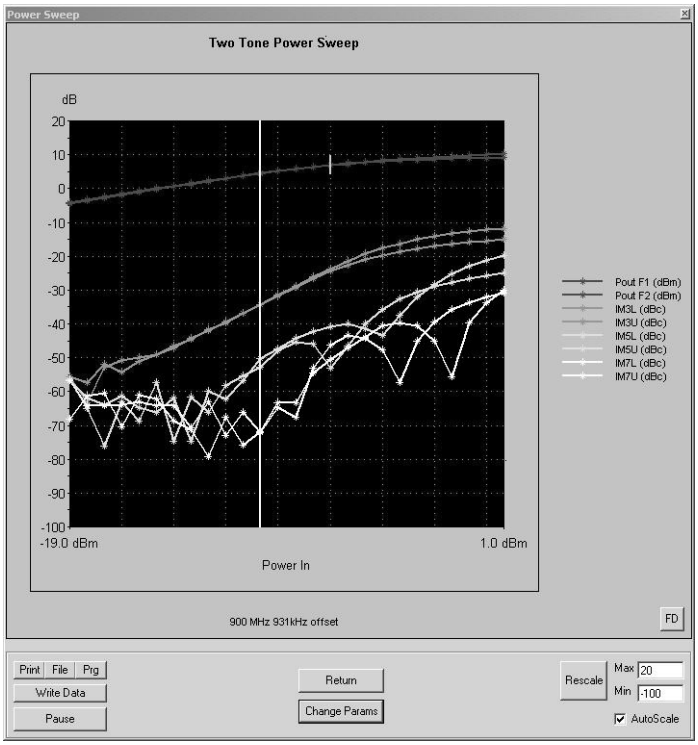


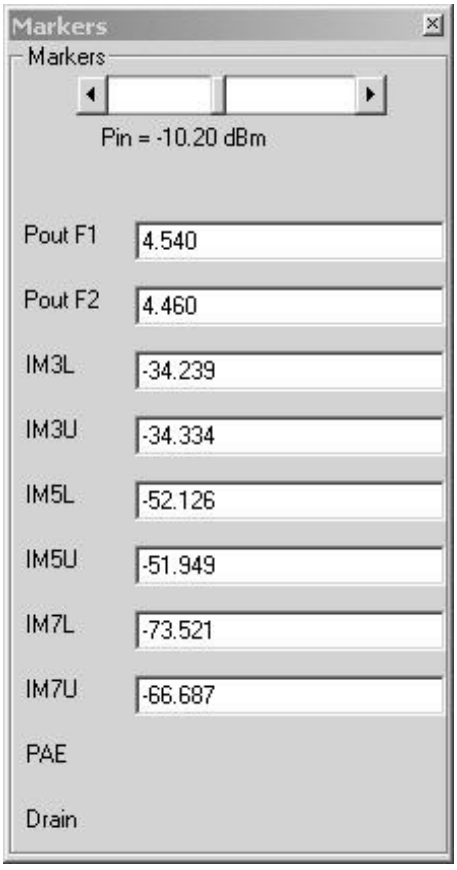
Figure 5-3. *Single Frequency Power Sweep Test*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options (left):



- **Markers slider:** Moves the marker between data points
- **Power In Reading:** Indicates the input power value
- **P_{out} F1:** Power output at frequency 1
- **P_{out} F2:** Power output at frequency 2
- **IM3L:** Intermodulation product 3 lower sideband
- **IM3U:** Intermodulation product 3 upper sideband
- **IM5L:** Intermodulation product 5 lower sideband
- **IM5U:** Intermodulation product 5 upper sideband
- **IM7L:** Intermodulation product 7 lower sideband
- **IM7U:** Intermodulation product 7 upper sideband
- **PAE:** Power-added efficiency percentage
- **Drain:** Drain current value

NOTE

PAE and **Drain** may be on or off according to the check box in the User Input dialog box.

- **2D Chart Control Properties:** With the mouse over the graph area, use a right click to bring up a form for setting custom lines and symbols on the graph display (Figure 5-4).

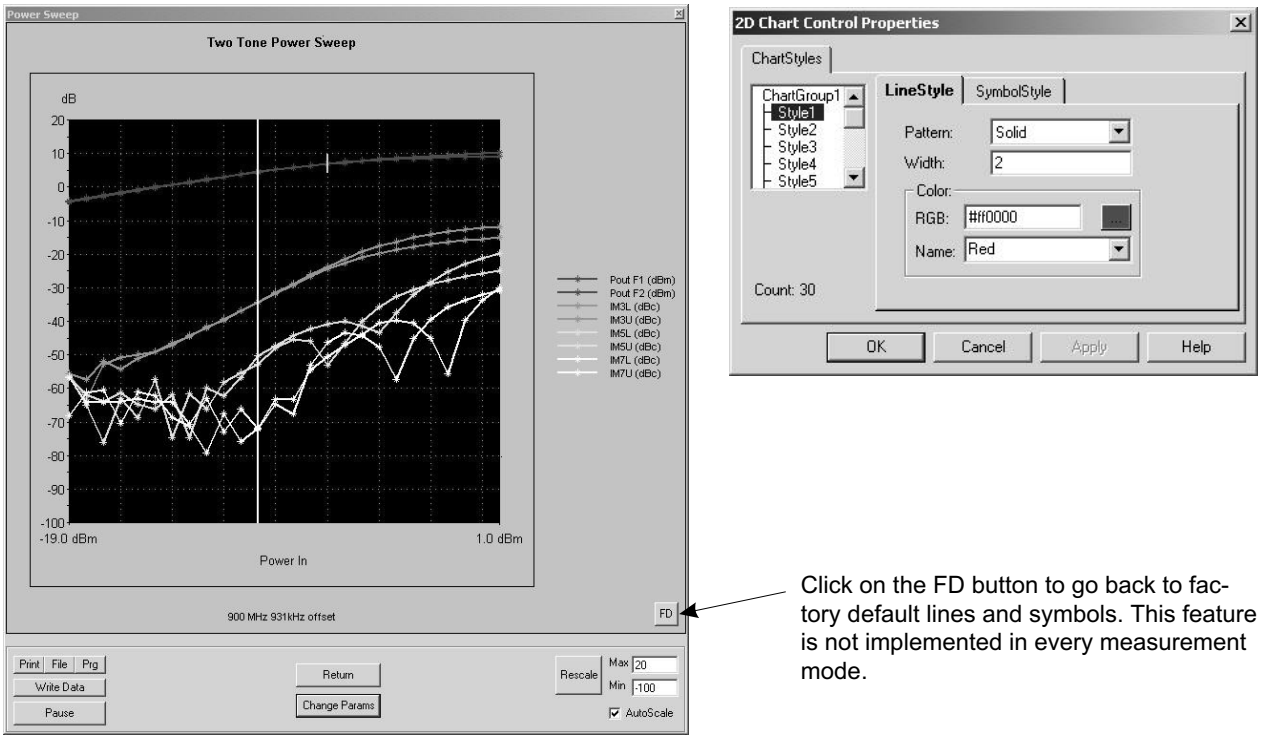
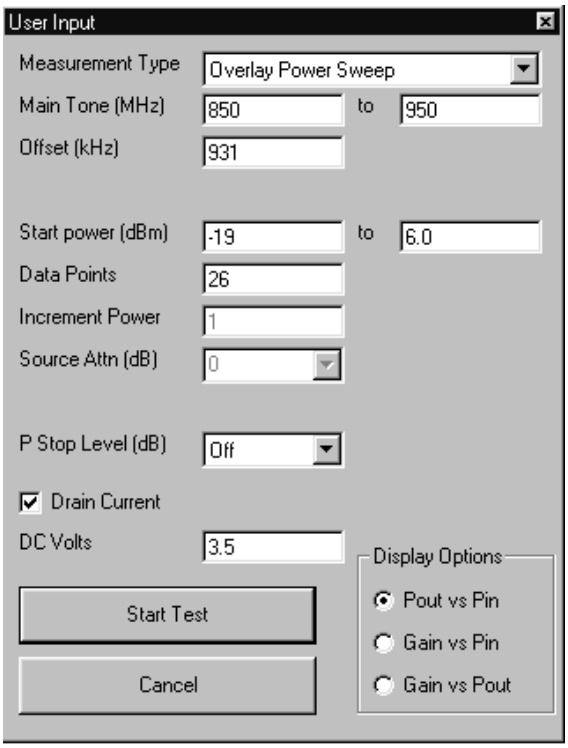


Figure 5-4. *2D Chart Control Properties*

Overlay Power Sweep

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen (left). The input fields are described below:



- **Measurement Type:** Drop down options. Set to "Multi Freq Power Sweep" for this test.
- **Main Tone (MHz):** CW Frequency setting for source 1. The user may set a lower tone and upper tone. The software will sweep three frequencies (the two input plus one between) and the RF input power to produce the display data.
- **Offset (kHz):** Offset frequency for Source 2 (Source 2 will be set to Main Tone + Offset).
- **Start Power (dBm):** Power will be swept starting at the start power (input RF power to DUT). Both sources are simultaneously set to each power setting. The stop power is also entered in the "to" window.
- **Data Points:** Number of data points in power sweep.
- **Increment Power (dBm):** Value to increment power for each data point (calculated and displayed only).
- **Source Attn (dB):** Value of Source attenuation, between 0 and –70 (calculated and displayed only).
- **Drain Current Check box:** When checked the drain current is measured and power added efficiency is calculated and displayed.
- **PStop Level (dB):** Provides the ability to set the PStop value based on the level of gain compression. Drop down options include compression levels of 1 dB through 10 dB in 1 dB increments, and OFF. If OFF is selected, then the P Stop equals the value entered in the "to" window above. If the selected compression occurs, P Stop for all subsequent power sweeps is reset to one increment before the P_{in} value where this compression level is reached.

- **Select Start Test:** Observe that the test screen (Figure 5-5) appears.

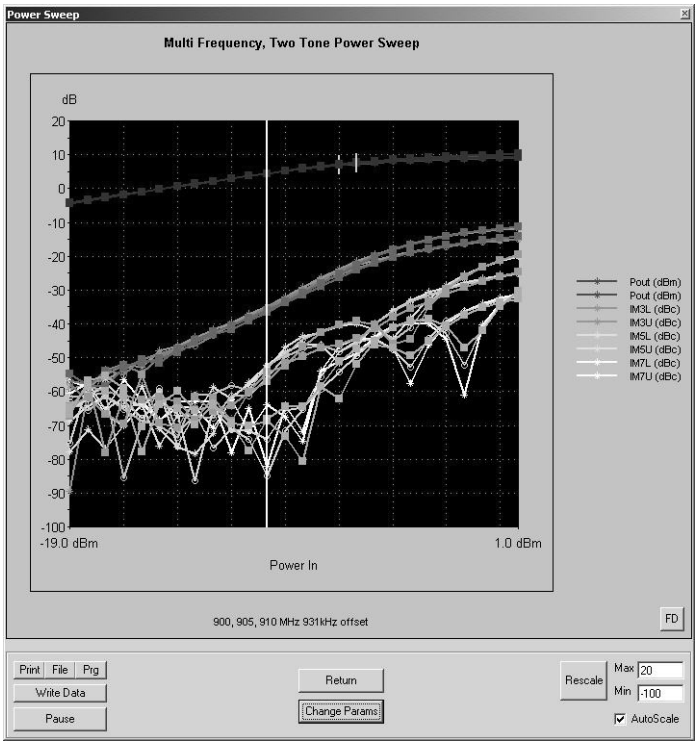


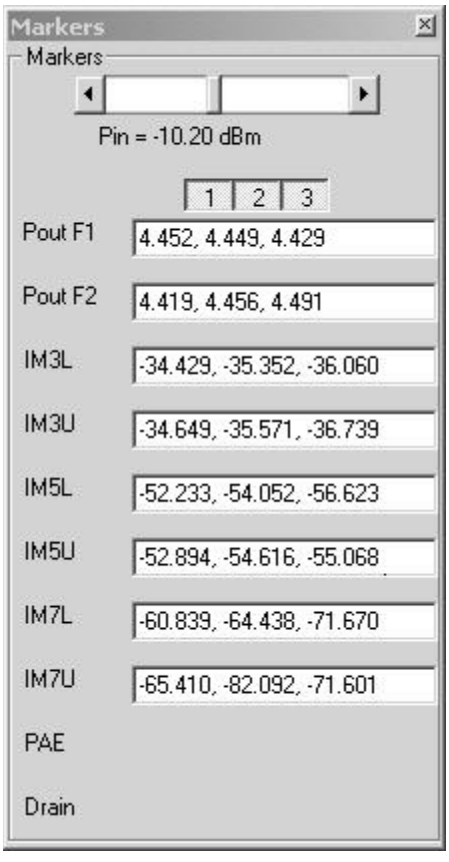
Figure 5-5. *Overlay Power Sweep Test*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options (left):



- **Markers slider:** Moves the marker between data points
- **P_{out} F1:** Power output at frequency 1
- **P_{out} F2:** Power output at frequency 2
- **IM3L:** Intermodulation product 3 lower sideband
- **IM3U:** Intermodulation product 3 upper sideband
- **IM5L:** Intermodulation product 5 lower sideband
- **IM5U:** Intermodulation product 5 upper sideband
- **IM7L:** Intermodulation product 7 lower sideband
- **IM7U:** Intermodulation product 7 upper sideband
- **PAE:** Power-added efficiency percentage
- **Drain:** Drain current value

NOTE

PAE and **Drain** may be on or off according to the check box in the User Input dialog box.

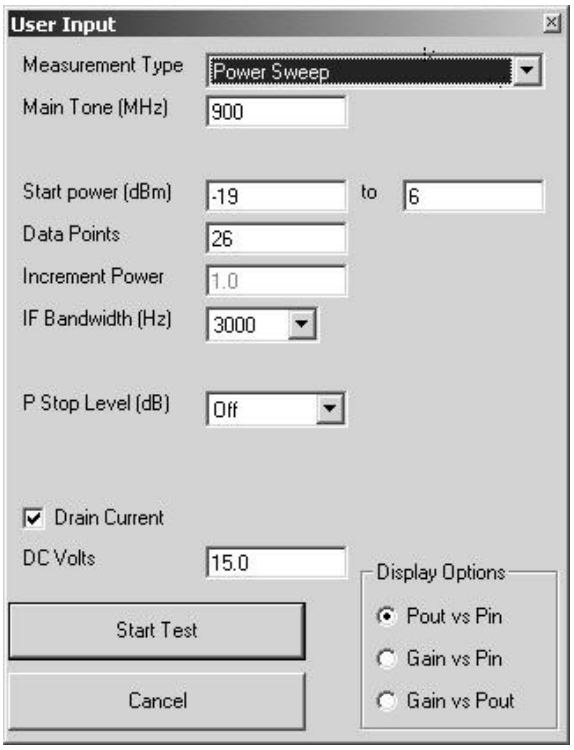
5-7 Power Sweep: One Tone

This measurement module has three variations of possible Measurement Types: Power Sweep (single frequency), Multi Frequency Power Sweep, Gain and IMD.

Single Frequency Power Sweep

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The input fields are described below:



- **Measurement Type:** The drop down menu options include Power Sweep (single frequency), Multi Freq Power Sweep (uses three frequencies), Gain, and IMD. Set the measurement type to "Power Sweep" for this test.
- **Main Tone (MHz):** CW Frequency setting for source 1.
- **Offset (KHz):** Specifies the separation (in KHz) for the Scorpion Source 2 (Source 2 will be set to the Main Tone + Offset frequency).
- **Start Power (dBm):** Power will be swept starting at the start power (input RF power to DUT). Both sources are simultaneously set to each power setting. The stop power is also entered in the "to" field.
- **Data Points:** Number of data points in the power sweep.
- **Increment Power (dBm):** Value to increment power for each data point (calculated and displayed only).
- **IF Bandwidth (Hz):** Specifies the effective IF Bandwidth to use for this measurement. Scorpion Navigator sometimes uses a combination of averaging and IFBW settings to achieve an effective IF Bandwidth.
- **PStop Level (dB):** Provides the ability to set the PStop value based on the level of gain compression. Drop down options include compression levels of 1 dB through 10 dB in 1 dB increments, and OFF. If OFF is selected, then the P Stop equals the value entered in the "to" field above. If the selected compression occurs, P Stop for all subsequent power sweeps is reset to one increment before the P_{in} value where this compression level is reached.

- **Drain Current Check box:** When checked, the drain current is measured and the Power Added Efficiency (PAE) is calculated and displayed. Selecting this option when no current probe is present will slow down the measurements considerably. If checked, then you must specify the DC power in order to get an accurate PAE measurement.
- **Display Options:** Specifies what is presented on the X and Y axes during the measurement. The first parameter is displayed on the Y-axis and the second on the X-axis. For example, in "Gain vs. P_{out}" Scorpion Navigator will display Gain on the Y-axis and Pout on the X-axis. The display options for the various measurement types are shown below:
  - Power Sweep
    - P_{out} vs. P_{in}
    - Gain vs. P_{in}
    - Gain vs. P_{out}
  - Overlay Power Sweep
    - P_{out} vs. P_{in}
    - Gain vs. P_{in}
    - Gain vs. P_{out}
  - Multifrequency Power Sweep
    - Gain
    - P_{out}
  - IMD Offset Sweep
    - Gain
    - P_{out}

- **Select Start Test:** Observe that the test screen (Figure 5-6) appears.

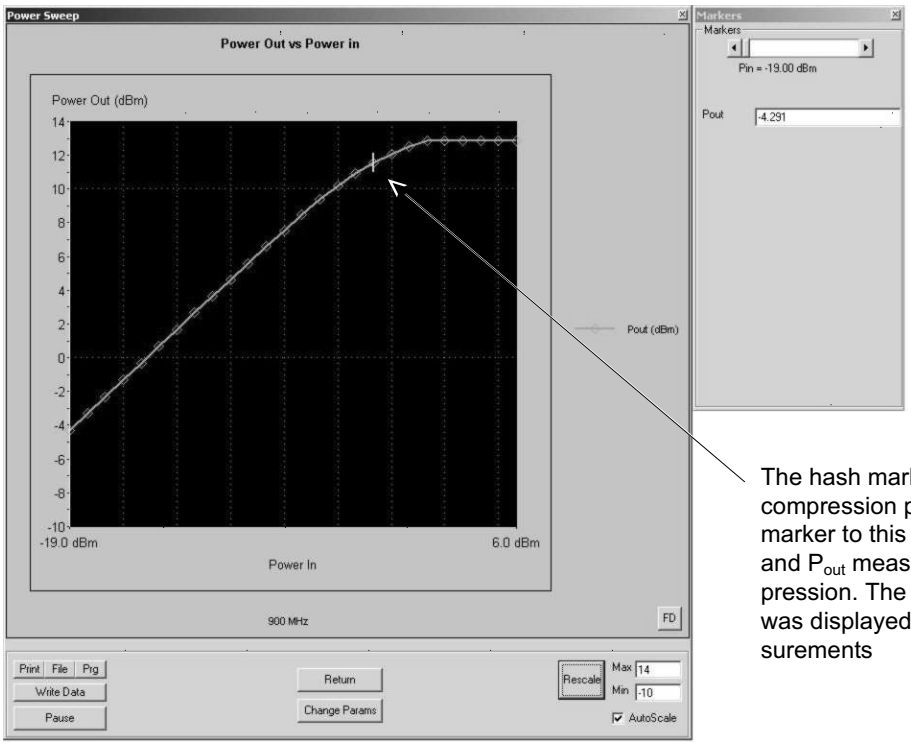


Figure 5-6. *Single Frequency Power Sweep Test*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

- **Markers slider:** Moves marker between data points
- **P_{in}:** Displays the power input at marker
- **P_{out}:** Displays the power output at marker

Power Sweep 1T:
Gain vs. Power In

- **Select Start Test:** Observe that the test screen (Figure 5-7) appears.

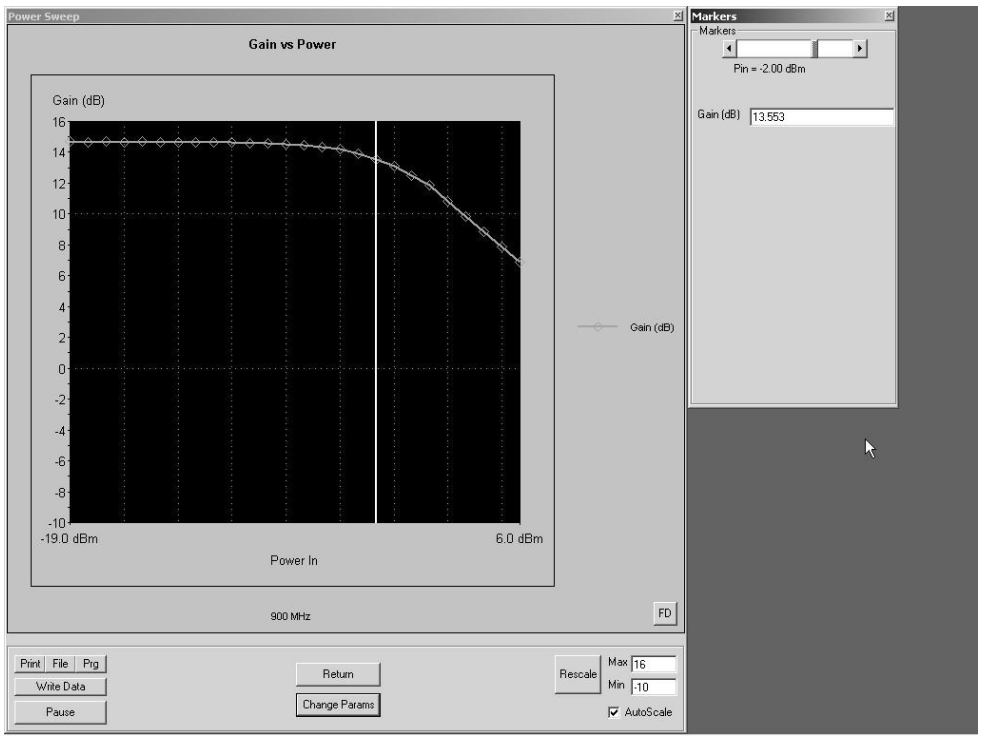


Figure 5-7. *Single Frequency Power Sweep Test, Gain vs. Power In*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV

and S2P files are comma delimited text files and can be opened in a Microsoft Excel spreadsheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

- **Markers slider:** Moves marker between data points
- **P_{in}:** Displays the power input at marker
- **Gain:** Gain (in dB) is measured at the CW frequency for each power level in the power sweep. (Could also be called Gain compression measurement.)

Power Sweep 1T:
Gain and Normalized
Phase vs. Power In

- **Select Start Test:** Observe that the test screen (Figure 5-8) appears.

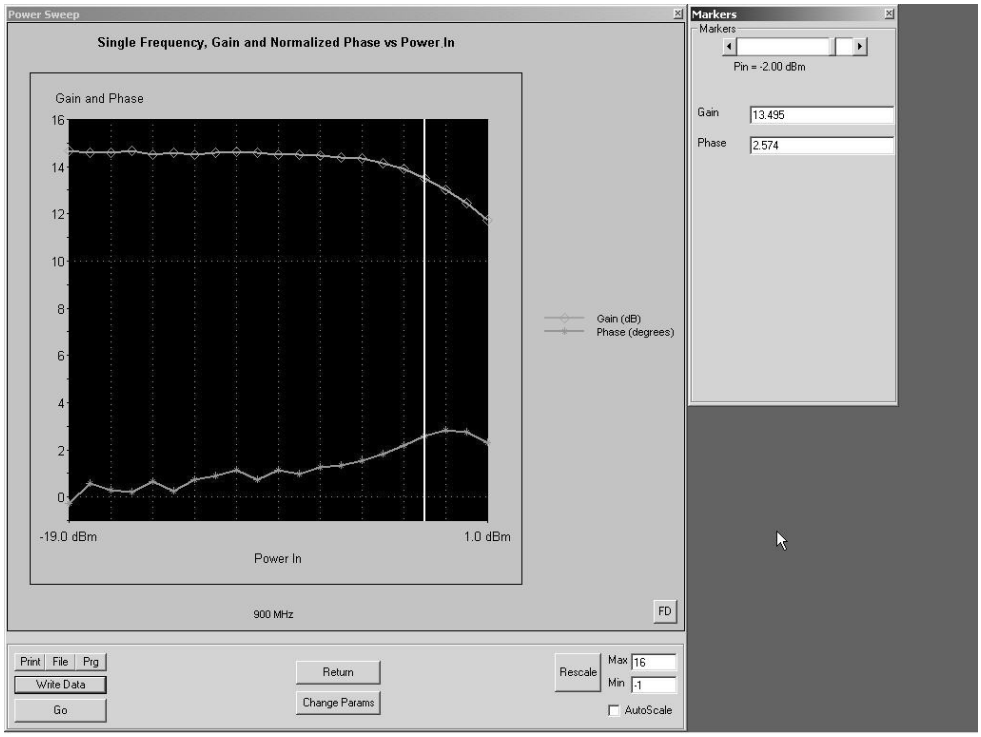


Figure 5-8. *Single Frequency Power Sweep Test, Gain and Normalized Phase vs. Power In*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on

the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spreadsheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

- **Markers slider:** Moves marker between data points
- **P_{in}:** Displays the power input at marker
- **Gain:** Gain (in dB) is measured at the CW frequency for each power level in the power sweep. (Could also be called Gain compression measurement.)
- **Phase:** Phase is an AM/ΦM measurement/display. The phase at the initial power level of the power sweep is used as a normalized level (zero). As the power is swept, the Phase displayed is the difference from the normalized value.

Power Sweep 1T: Multi-frequency 1 dB Compression Points

- **Select Start Test:** Observe that the test screen (Figure 5-9) appears.

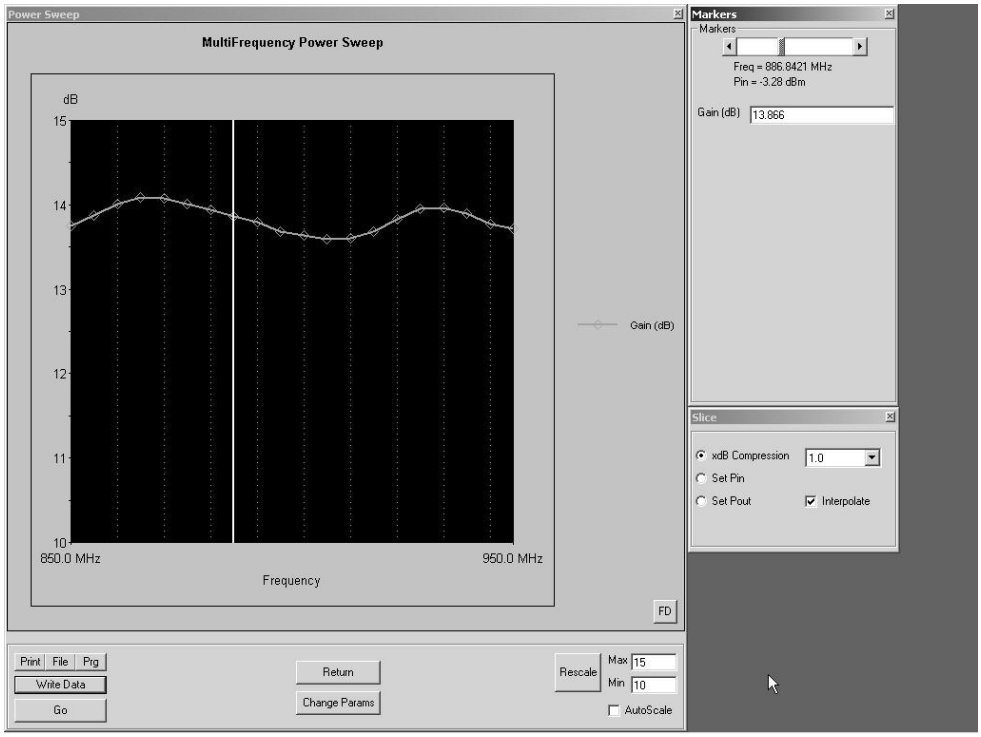


Figure 5-9. *Single Frequency Power Sweep Test, Multi-frequency 1 dB Compression Points*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on

the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spreadsheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

- **Marker Slider:** Moves marker between data points
- **Freq:** Displays the marker frequency
- **P_{in}:** Displays the power input at marker
- **Gain:** Gain (in dB) is measured at the CW frequency for each power level in the power sweep. (Could also be called Gain compression measurement).

Slice Screen Options:

- **xdB Compression:** Specifies to plot the Gain (in dB) or P_{out} (output power in dBm) at the xdB compression point (x = 0.5 to 3 dB) for each frequency.
- **Set P_{in}:** Specifies to plot the Gain or P_{out} at a fixed Input Power level for each frequency.
- **Set P_{out}:** specifies to plot the Gain or Pout at a fixed Output Power level for each frequency.
- **Interpolate:** Uses linear interpolation to smooth the displayed data.

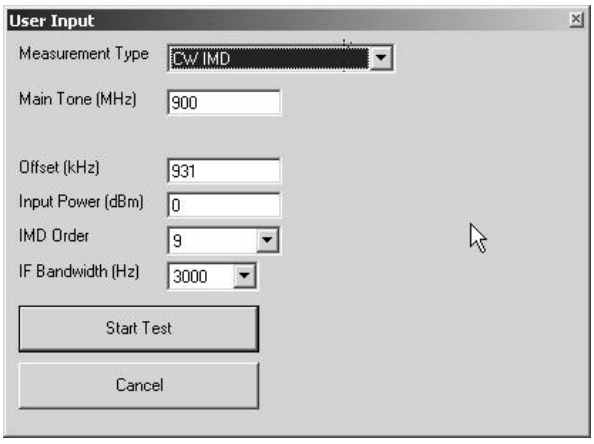
5-8 IMD

This test measures inter-modulation distortion.

CW IMD

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The input fields are described below:



- **Measurement Type:** Allows selection of three different IMD measurements.
- **Main Tone (MHz):** CW frequency (in MHz) setting for source 1.
- **Offset (KHz):** Offset frequency (in KHz) for Source 2 (Source 2 will be set to Main Tone + Offset).
- **Input Power (dBm):** The power at the input of the DUT from each tone (Note that total power into the device is approximately 3 dB higher than the specified input power since the power of the two tones is added together).
- **IMD Order:** Specifies IMD 3, 5, 7 or 9. In CW IMD, selecting 9 will display all IMD products.
- **IF Bandwidth:** Specifies the IF Bandwidth to use for this measurement.

- **Select Start Test:** Observe that the test screen (Figure 5-10) appears.

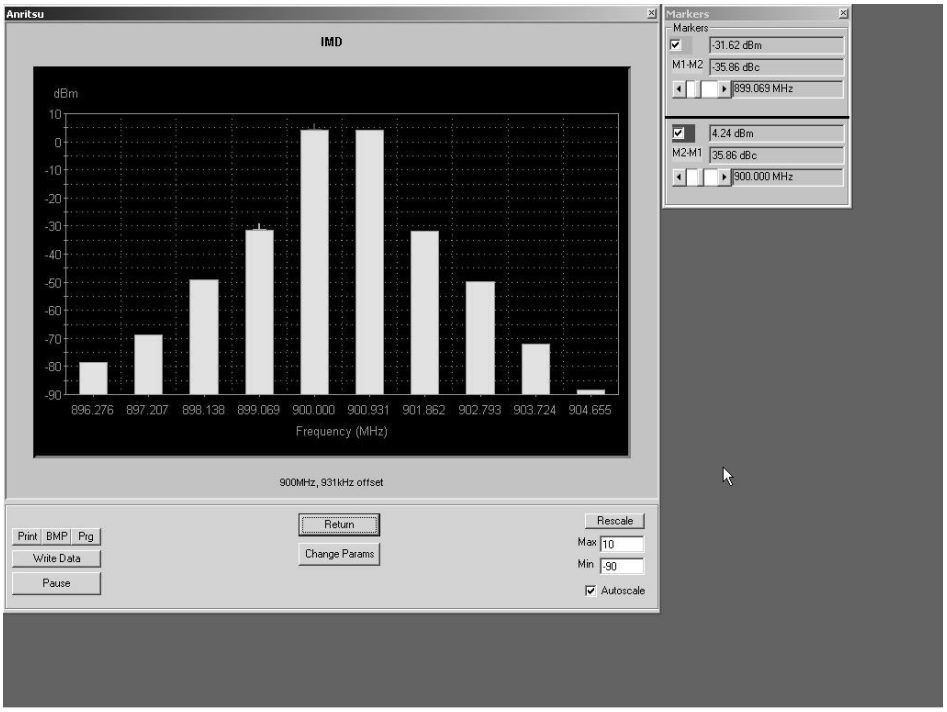


Figure 5-10. *CW Intermodulation Distortion Test Screen*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then Click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

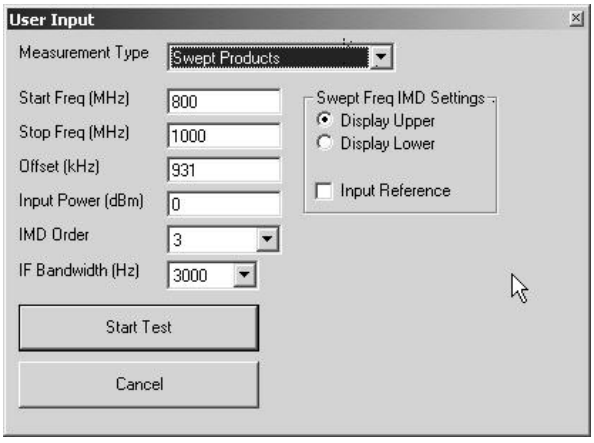
Markers Screen Options:

- **M1-M2 Check box:** Turns M1-M2 feature on or off.
- **M1-M2 Readout:** Displays the value of M1 minus M2.
- **M1 Slider:** Moves M1 between displayed harmonics. A blue + symbol appears on the top of the selected harmonic.
- **M2-M1Checkbox:** Turns M2-M1 feature on or off.
- **M2-M1 Readout:** Displays the value of M2 minus M1.
- **M2-M1 Slider:** Moves M2 between displayed harmonics. A blue + symbol appears on the top of the selected harmonic.

Swept IMD

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The input fields are described below:



- **Measurement Type:** Allows selection of three different IMD measurements.
- **Main Tone (MHz):** CW frequency (in MHz) setting for source 1.
- **Offset (KHz):** Offset frequency (in KHz) for Source 2 (Source 2 will be set to Main Tone + Offset).
- **Input Power (dBm):** The power at the input of the DUT from each tone (Note that total power into the device is approximately 3 dB higher than the specified input power since the power of the two tones is added together).
- **IMD Order:** Specifies IMD 3, 5, 7 or 9. In CW IMD, selecting 9 will display all IMD product.
- **IF Bandwidth:** Specifies the IF Bandwidth to use for this measurement.
- **Display Upper:** Displays the Upper IMD product or TOI measurement.
- **Display Lower:** Displays the Lower IMD product or TOI measurement.
- **Input Reference:** Relies on the IMD calibration.

- **Select Start Test:** Observe that the test screen (Figure 5-11) appears

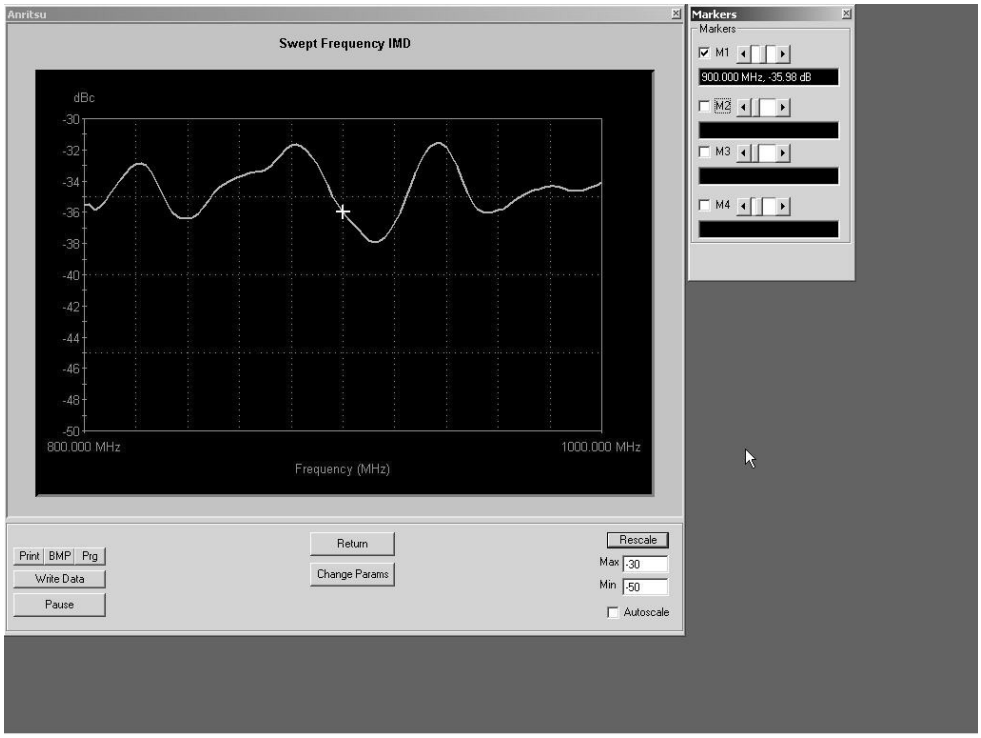


Figure 5-11. *Swept Frequency IMD*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

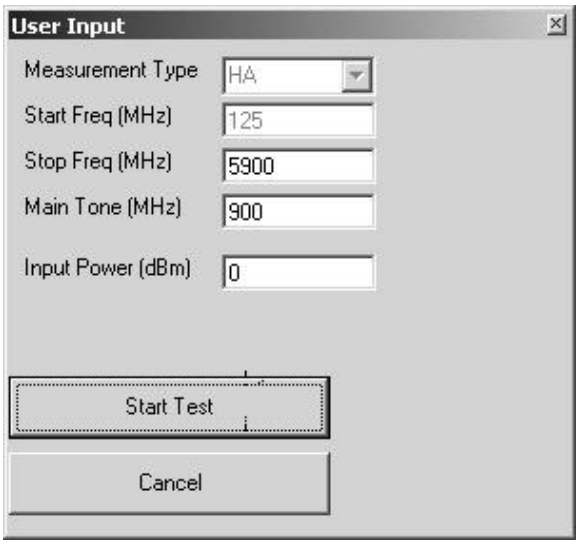
- **M1:** Checking M1 turns marker 1 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.
- **M2:** Checking M2 turns marker 2 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.
- **M3:** Checking M3 turns marker 3 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.
- **M4:** Checking M4 turns marker 4 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.

5-9 Harmonics

The harmonics test measures and displays the harmonics of the device under test.

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The input fields are described below:



- **Measurement Type:** Already set to "HA" for Harmonics—input disabled
- **Start Frequency (MHz):** Lower frequency to be displayed. Typically set to a value less than or equal to the main tone.
- **Stop Frequency (MHz):** Upper Frequency to be displayed. Set to a value less than the system's maximum frequency (for example, the MS4623B is set to a maximum of 5000 MHz).
- **Main Tone (MHz):** CW Frequency setting for source 1.
- **Input Power:** Input RF power to DUT.

- **Select Start Test:** Observe that the test screen (Figure 5-12) appears.

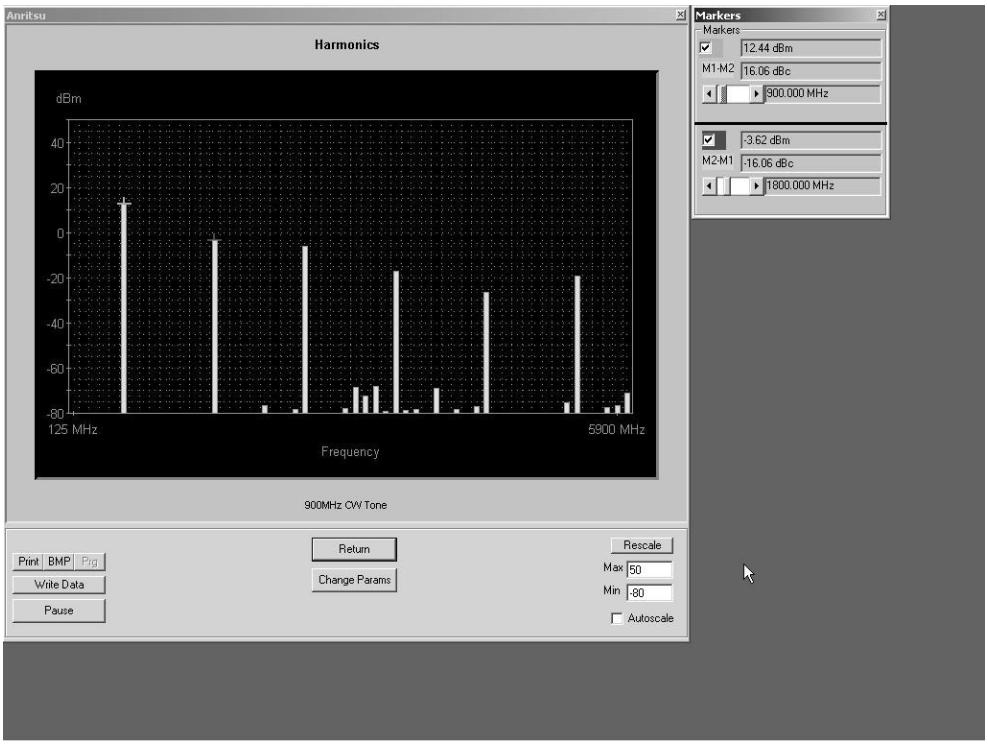


Figure 5-12. *Harmonics Test Screen*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Disabled for this test.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

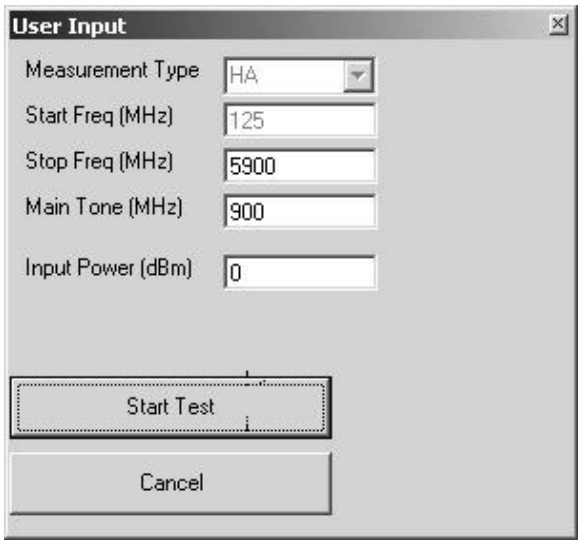
- **M1-M2 Check box:** Turns M1-M2 feature on or off.
- **M1-M2 Readout:** Displays the value of M1 minus M2.
- **M1 Slider:** Moves M1 between displayed harmonics. A blue + symbol appears on the top of the selected harmonic.
- **M2-M1Checkbox:** Turns M2-M1 feature on or off.
- **M2-M1 Readout:** Displays the value of M2 minus M1.
- **M2-M1 Slider:** Moves M2 between displayed harmonics. A red + symbol appears on the top of the selected harmonic.

5-10 Noise Figure

The Nosie Figure test measures and displays the noise in the device under test.

Procedure: Prepare the ME7842B as shown in Chapter 3.

Enter the appropriate test values in the displayed User Input screen. The input fields are described below:



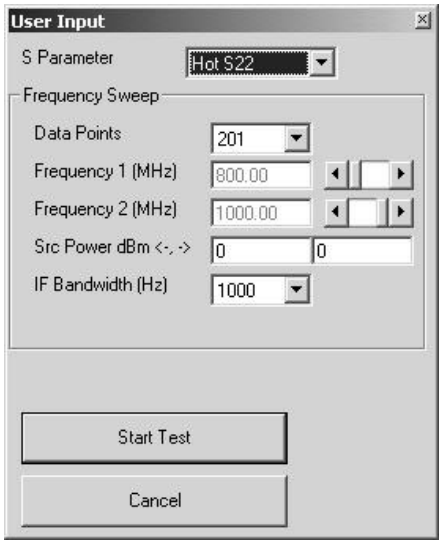
- **Measurement Type:** Already set to "HA" for Harmonics – input disabled.
- **Start Frequency (MHz):** Lower frequency to be displayed. Typically set to a value less than or equal to the main tone.
- **Stop Frequency (MHz):** Upper Frequency to be displayed. Set to a value less than the system's maximum frequency (for example, for MS4623B is set to a max of 5000 MHz).
- **Main Tone (MHz):** CW Frequency setting for source 1.
- **Input Power:** Input RF power to DUT.

5-11 HOT S22

The output match of a power amplifier under excited conditions is critical information that has a strong bearing on efficiency, output power, stability, and often the economic viability of the design. One way of dealing with this information—primarily in power devices operating well away from compression or in somewhat matched amplifiers— is a quasi-linear measurement of S22 while the amplifier is operating under normal drive. Such a measurement is termed hot S22 and it can provide some information on the degree of mismatch in the system, potential operational stability, and the effects of the amplifier's performance on subsequent stages or an antenna.

In the TMATS, the Hot S22 measurement uses one source (Source 2) to provide stimulus to the DUT input port while the other source (Source 1) provides a pilot tone injected to the output of the DUT for measuring S22 at the DUT output port.

Procedure: Prepare the ME7842B as shown in Chapter 3.



Enter the appropriate test values in the displayed User Input screen. The input fields are described below:

- **S-Parameter:** Already set to "Hot S22" for test – input disabled.
- **Data Points:** Drop down options – number of data points in frequency sweep.
- **Frequency 1 (MHz):** Lower frequency to be displayed. Typically set to a value less than or equal to the main tone. Can be reset using slider control.
- **Frequency 2 (MHz):** Upper Frequency to be displayed. Set to a value less than the system's maximum frequency (for example, for MS4623B set to a max of 5000 MHz). Can be reset using slider control.
- **Src Power dBm <-,->:** Source power level, in dBm.
- **IF Bandwidth (Hz):** Intermediate frequency value, in Hertz.

- **Select Start Test:** Observe that the test screen (Figure 5-13) appears.

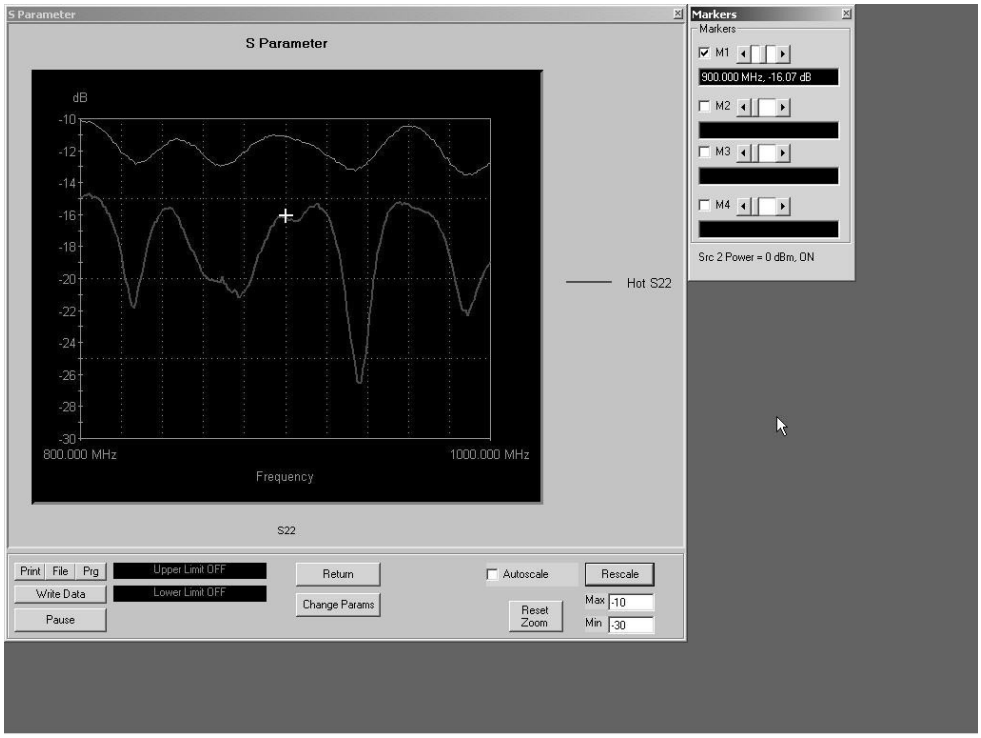
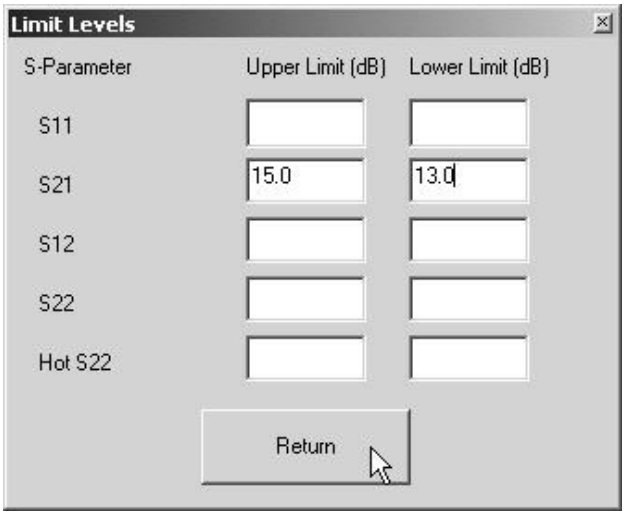


Figure 5-13. *Hot S22 Test Screen*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Generates a stand-alone program file that will set up the measurement being displayed.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.



- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Upper Limit/Lower Limit:** To display limit lines, set their values by clicking the Tools and Limits menus from the main Scorpion Navigator dialog box (Chapter 3). This opens the Limit Levels dialog box (left).
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Reset Zoom:** You can drag the cursor on the graph to zoom in on the selected area. To undo the zoom and return to full scale, click the Reset Zoom button
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

- **M1:** Checking M1 turns marker 1 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.
- **M2:** Same as above
- **M3:** Same as above
- **M4:** Same as above
- **Status:** The status of Source 2 is displayed at the bottom of the markers screen. The source may be toggled on and off and the power level may be changed.

The TMATS Hot S22 measurement provides the following additional features:

- Ability to vary the DUT input excitation power level (Source 2 of Scorpion, at Port 1) while observing the Hot S22 response. After clicking on the graph, pressing U on the PC keyboard increases the input excitation power level by 0.5 dB. Pressing D decreases it by 0.5 dB. The actual input excitation power (in dBm) is displayed on the PC screen.
- Ability to turn the amplifier input excitation source (Source 2 of Scorpion, at Port 1) ON and OFF while observing the Hot S22. After clicking on the graph, pressing Shift S turns Source 2 OFF. Pressing S turns it ON. This basically provides a comparison of S22 parameters.
- Ability to capture the Hot S22 plot at a given excitation level (history plot on the PC screen) for comparison with other levels. After clicking on the graph, pressing C captures (creates history plot). Pressing Shift C removes it.
- Ability to show Hot S22 Smith Chart on the Scorpion Screen while Log Magnitude is displayed on the PC screen. The Scorpion display can be selected by the Scorpion front panel controls during the measurement (below).

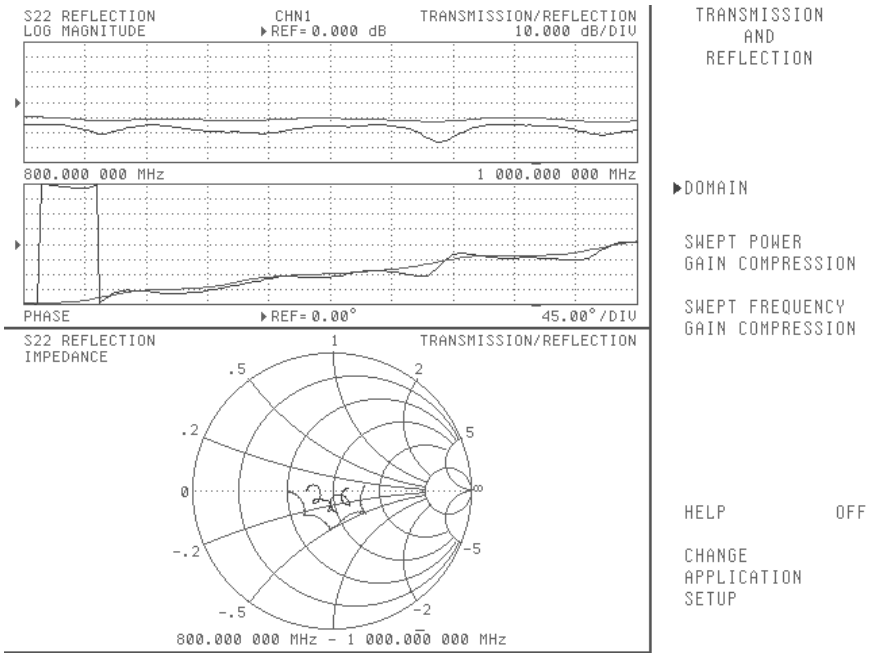


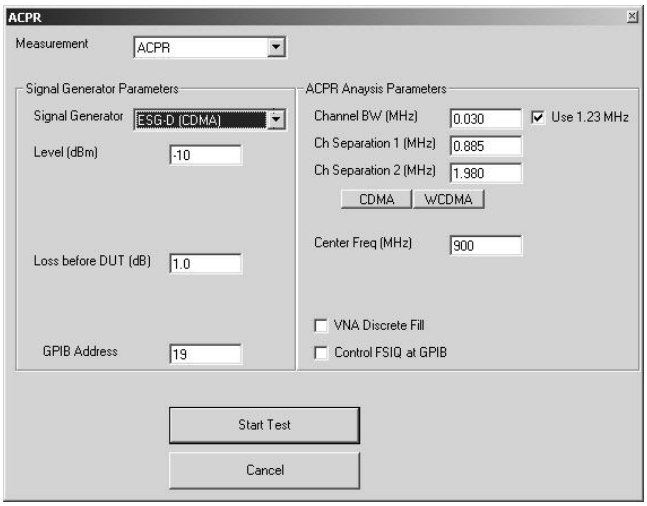
Figure 5-14. *Hot S22 Coordinated Display on Scorpion to Show Magnitude/Phase and Smith Chart*

5-12 ACPR

This section describes the screens that guide the user through the adjacent channel power ratio (ACPR) measurement. ACPR is fully described in Anritsu Application Note 11410-00264, which is available from your local representative or from our Internet site, *www.anritsu.com*.

CW Measurements

Procedure: Prepare the ME7842B as shown in Chapter 3.



Enter the appropriate test values in the displayed User Input screen. The input fields are described below:

- **Signal Generator Parameters:** Provides controls for the Signal Generator: Anritsu MG3681 for WCDMA, Agilent ESG for CDMA and WCDMA. In addition, Scorpion Navigator will support manual setup of the modulated signal.
  - Signal Generator: Displays the signal generator model number. Choose from drop-down list.
  - Level (dBm): Displays the signal generator signal level.
  - Loss before DUT (dB): Accounts for the loss between the signal generator output and the DUT input. The level set at the signal generator is adjusted by this value. Enter the loss as a positive number.
  - GPIB Address: Displays the signal generator GPIB address.
- **ACPR Analysis Parameters:** Provides controls for signal analysis. Scorpion Navigator will support the R&S FSIQ series of analyzers for comparison purposes only. The Scorpion handles the brunt of ACPR analysis.
  - Channel BW (MHz): Frequency width of the center channel of the ACPR measurement.
  - Ch Separation 1 (MHz): Specifies the distance between the center channel and the Adjacent Channel. For CDMA this is typically 885 MHz and for WCDMA this is typically 5 MHz.
  - Ch Separation 2 (MHz): Specifies the distance between the center channel and the Alternate Channel. For CDMA this is typically 1.990 MHz and for WCDMA this is typically 10 MHz.

- Use 1.23 MHz Check box: Specifies for a CDMA measurement to use 1.23 MHz as the center channel bandwidth and 30 KHz as the Alternate and Adjacent channel bandwidths.
- CDMA and WCDMA: Automatically enters typical parameters for CDMA or WCDMA measurements.
- Center Freq (MHz): Specifies the center frequency for the measurement. This will also be sent to the signal generator if it is not set for manual control.
- VNA Discrete Fill: Uses the Scorpion discrete fill function to increase the number of data points in the measurement bands and decreases the number of points outside the measurement bands. This will increase the measurement accuracy.
- Control FSIQ at GPIB: Specifies that an FSIQ is connected via GPIB and will be set to perform ACPR measurements through a split-out channel.

- **Select Start Test:** Observe that the test screen (Figure 5-15) appears.

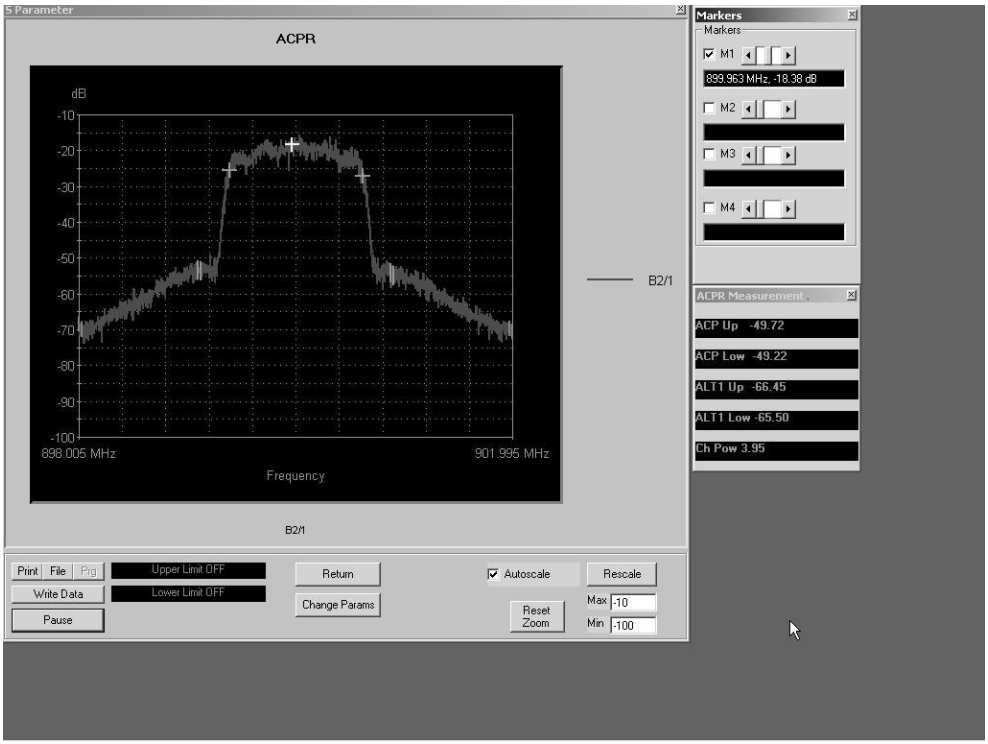


Figure 5-15. *ACPR Test Screen*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set it's parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Disabled for this test.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files and can be opened in a Microsoft Excel spread-sheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Upper Limit/Lower Limit:** To display limit lines, set their values by clicking the Tools and Limits menus from the main Scorpion Navigator dialog box (Chapter 4). This opens the Limit Levels dialog box (left).
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Reset Zoom:** You can drag the cursor on the graph to zoom in on the selected area. To undo the zoom and return to full scale, click the Reset Zoom button
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

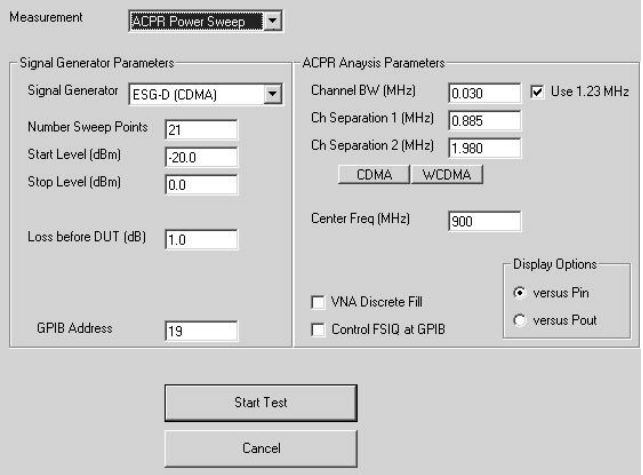
- **M1:** Checking M1 turns marker 1 on or off (checked or unchecked). If the marker is on, the slider sets the marker's frequency. The window below displays the marker's numerical frequency and amplitude values.
- **M2:** Same as above.
- **M3:** Same as above.
- **M4:** Same as above.

ACPR Measurement Screen:

- **ACP Up:** Displays the measured upper value.
- **ACP Low:** Displays the measured lower value.
- **ALT1 Up:** Displays the upper alternate value.
- **ALT1 Low:** Displays the lower alternate value.
- **Ch Pow:** Displays the channel power.

ACPR Power Sweep Measurements

Procedure: Prepare the ME7842B as shown in Chapter 3.



Enter the appropriate test values in the displayed User Input screen. The input fields are described below:

- **Signal Generator Parameters:**Provides controls for the Signal Generator: Anritsu MG3681 for WCDMA, Agilent ESG for CDMA and WCDMA. In addition, Scorpion Navigator will support manual setup of the modulated signal.
  - Signal Generator: Displays the signal generator model number. Choose from drop-down list
  - Number Sweep Points: Specifies the number of different power levels to be used in the measurement
  - Start Level (dBm): Specifies the initial power level to set the signal generator
  - Stop Level (dBm): Specifies the final power level to set the signal generator
  - Loss before DUT (dB): Accounts for the loss between the signal generator output and the DUT input. The level set at the signal generator is adjusted by this value. Enter the loss as a positive number.
  - GPIB Address: Displays the signal generator GPIB address.
- **ACPR Analysis Parameters:** Provides controls for signal analysis. Scorpion Navigator will support the R&S FSIQ series of analyzers for comparison purposes only. The Scorpion handles the brunt of ACPR analysis.
  - Channel BW (MHz): Frequency width of the center channel of the ACPR measurement.
  - Ch Separation 1 (MHz): Specifies the distance between the center channel and the Adjacent Channel. For CDMA this is typically 885 MHz and for WCDMA this is typically 5 MHz.
  - Ch Separation 2 (MHz): Specifies the distance between the center channel and the Alternate Channel. For CDMA this is typically 1.990 MHz and for WCDMA this is typically 10 MHz.

- Use 1.23 MHz Check box: Specifies for a CDMA measurement to use 1.23 MHz as the center channel bandwidth and 30 KHz as the Alternate and Adjacent channel bandwidths.
- CDMA and WCDMA: Automatically enters typical parameters for CDMA or WCDMA measurements.
- Center Freq (MHz): Specifies the center frequency for the measurement. This will also be sent to the signal generator if it is not set for manual control.
- VNA Discrete Fill: Uses the Scorpion discrete fill function to increase the number of data points in the measurement bands and decreases the number of points outside the measurement bands. This will increase the measurement accuracy.
- Control FSIQ at GPIB: Specifies that an FSIQ is connected via GPIB and will be set to perform ACPR measurements through a split-out channel.

- **Display Options:** Refers to the parameter to display on the X-axis. For this measurement, P_{in} is being varied (or swept) and P_{out} is measured; however, P_{out} may still be used as the X-axis parameter.

- **Select Start Test:** Observe that the test screen (Figure 5-16) appears.

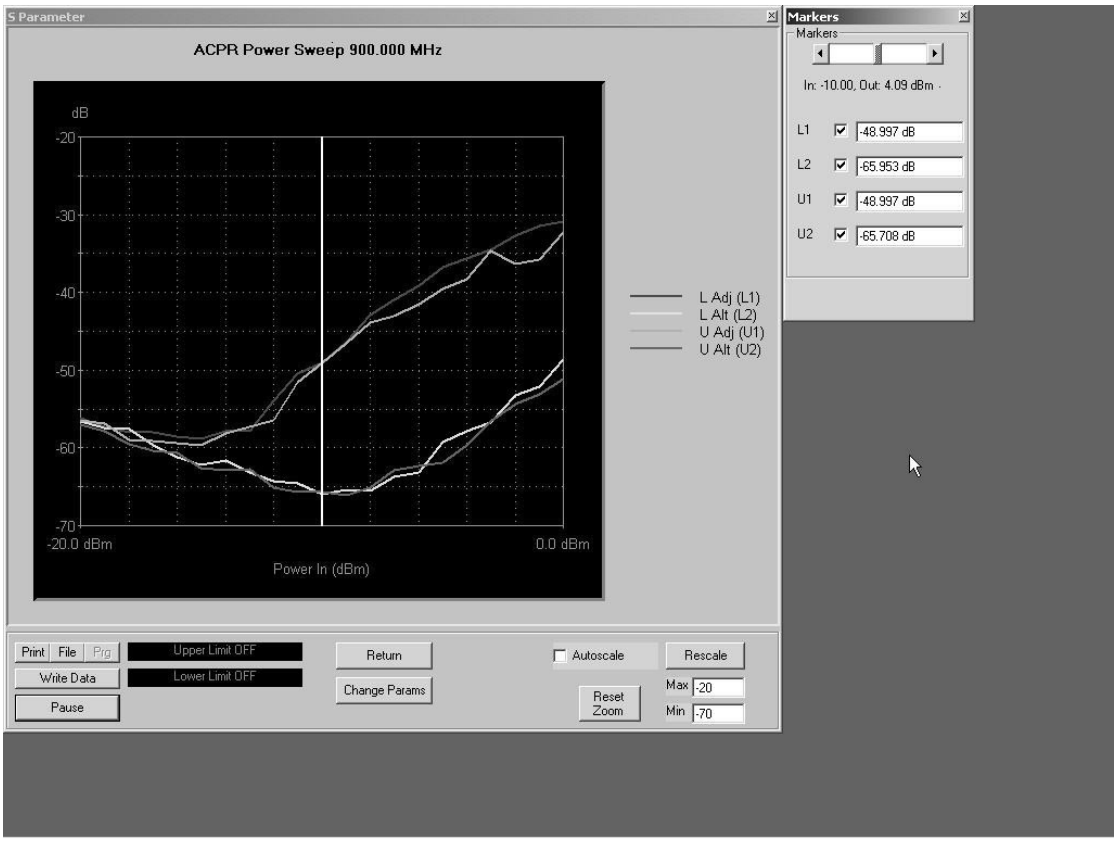
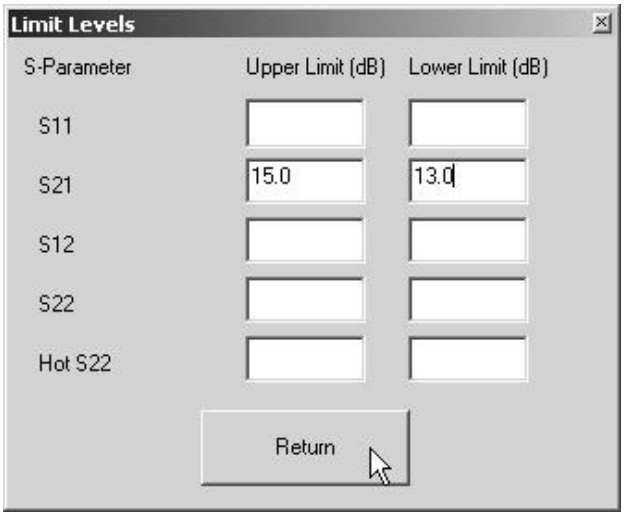


Figure 5-16. *ACPR Test Screen*

Button panel and test screen display options:

- **Print:** Sends the screen graphic to the printer. A printer dialog box will allow you to assign the printer and set its parameters.
- **File:** Sends the screen graphic as a bitmap to a file. A File dialog will allow you to set the file-name and location.
- **Prg:** Disabled for this test.
- **Write Data:** Writes two data files to the C:\Program Files\TMATS\Datafiles folder; the file name will have a time stamp. One data file has a ".csv" file extension and the other has a ".s2p" file extension. *For example:* "S17-16-19-29.csv (and s2p)" was created on the 17th day of the month at 4:19:29 PM. CSV and S2P files are comma delimited text files



and can be opened in a Microsoft Excel spreadsheet.

- **Pause:** Stops the measurement sweeps and turns off all RF power from the Scorpion Sources.
- **Upper Limit/Lower Limit:** To display limit lines, set their values by clicking the Tools and Limits menus from the main Scorpion Navigator dialog box (Chapter 3). This opens the Limit Levels dialog box (left).
- **Return:** Returns to the main Scorpion Navigator dialog box.
- **Change Params:** Returns to the User Input screen.
- **Autoscale Check box:** If Autoscale is checked, Scorpion Navigator automatically scales the display to include all the data. To manually scale the display, uncheck the Autoscale box, enter a Max and Min value, and then click the Rescale button.
- **Reset Zoom:** You can drag the cursor on the graph to zoom in on the selected area. To undo the zoom and return to full scale, click the Reset Zoom button
- **Max/Min:** Sets the maximum and minimum display values. Click Rescale after changing the values.
- **Rescale:** Click the Rescale button to adjust the Y-axis.

Markers Screen Options:

- **L1:** Lower Adjacent Channel Power
- **L2:** Lower Alternate Channel Power
- **U1:** Upper Adjacent Channel Power
- **U2:** Upper Alternate Channel Power

Chapter 6
Performance Verification Procedures

Table of Contents

Chapter 6
Performance Verification Procedures

6-1 Introduction

This chapter provides quick operational checkout procedures that may be used to insure that the Model ME7842B Tower Mounted Amplifier Test System is operational. For the full performance verification procedure, refer to the MN4790A Maintenance Manual, Anritsu part number 10410-00245.

6-2 Required Equipment

The following equipment is required to perform the operational checkout procedure:

- ❑ Anritsu 3670NN50-2 through cable or equivalent
- ❑ Anritsu 3753R or 3753LF N connector Calibration Kit

6-3 Procedures

The operational checkout procedures include three sections and should be followed in the presented order. Prior to starting these tests:

- ❑ Set up the MS4623B and MN4790A as described in Section 2-4, Hardware Installation.
- ❑ Install Scorpion Navigator Software to a Personal Computer with a National Instruments GPIB interface card as described in Section 2-5, Software Installation.

Setup:

Step 1. Turn on the MS4623B VNMS.

Step 2. After boot up is complete, press the Default key and select the CONTINUE soft key to reset the instrument.

Step 3. Turn on the MN4790A Test Set.

Step 4. Start the Scorpion Navigator Software. Refer to Figure 3-2 on page 3-6.

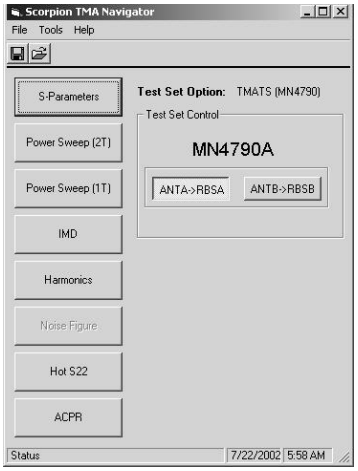
Step 5. On the MS4623B, press the Hold key to turn off the sweep hold.

Step 6. On the PC, start Scorpion Navigator. Refer to Section 3-3, Using Scorpion Navigator Software on page 3-6.

Step 7. Click Tools on the Toolbar and select the TMATS (MN4790A) test set by clicking the test set option.

Step 8. Click the Return button to return to the main menu. Two new buttons appear on the main menu display.

The ANTA -> RBSA button should look indented as shown below.



Transmission Test: The following procedure provides a quick transmission test:

Step 1. Connect the through cable between the ANT A Port and the RBSA Port.

Step 2. Press the Ch 3 key on the MS4623B.

Step 3. Press the Display key and select the DISPLAY MODE soft key, then the SINGLE CHANNEL soft key.

Step 4. Press the Display key and select the GRAPH TYPE soft key, then the LOG MAGNITUDE soft key.

Step 5. Observe the S21 display. Verify that the minimum amplitude is at least -35 dB and no big glitches are seen on the trace. Refer to Figure 6-1 on the following page.

Step 6. On the PC, click the ANTB -> RBSB button.

Step 7. Connect the through cable between the ANT B Port and the RBS B Port.

Step 8. Observe the S21 display. Verify that the minimum amplitude is at least -35 dB and no big glitches are seen on the trace. Refer to Figure 6-1 below.

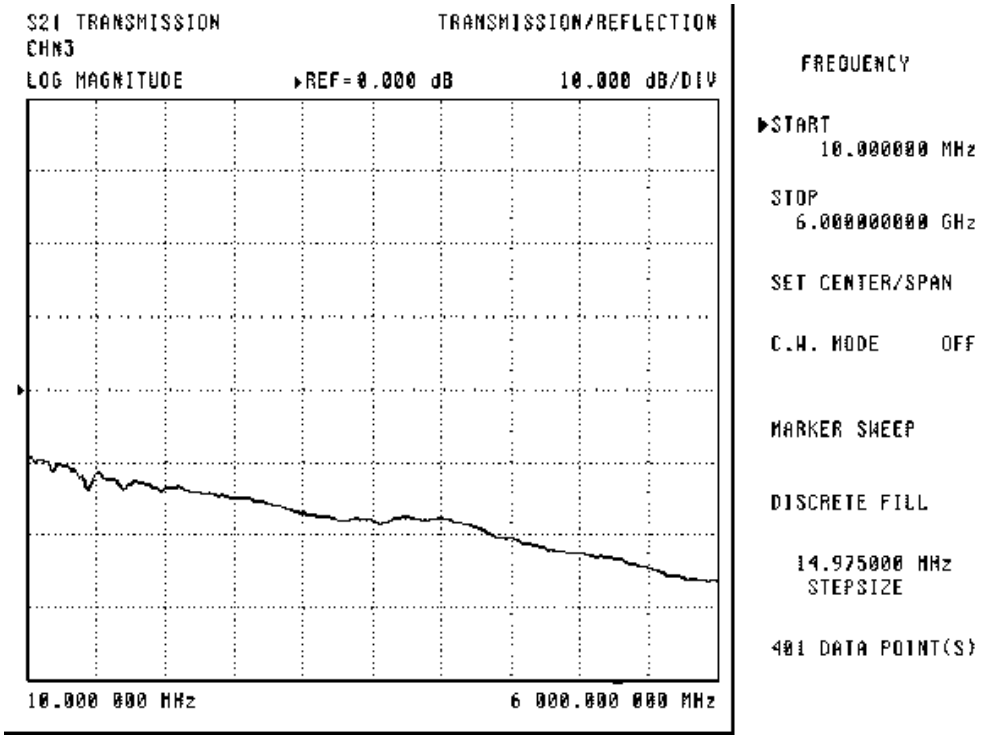


Figure 6-1. *S21 Transmission Display Plot*

Reflection Test: The following procedure provides a quick reflection test:

Step 1. Connect a through cable to the RBS A Port.

Step 2. On the PC, click the ANTA -> RBSA button.

Step 3. Click Tools and then select Calibration Options.

Step 4. Uncheck all the white squares except the square for S-Parameters.

Step 5. Select the Custom (MHz) button under Frequency Range.

Step 6. Enter 10 into the box on the left and 6000 into the box on the right. See Figure 6-2 below.

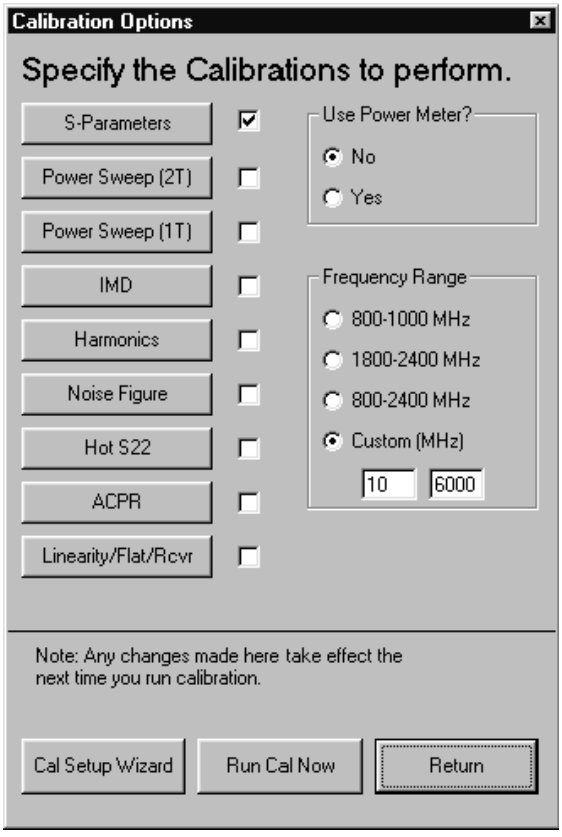


Figure 6-2. *Calibration Options Screen*

Step 7. Click the S-Parameters button.

Step 8. On the Parameter Settings Menu, below, change the settings as follows:

- # Point: 201
- Connector 1 Type: F N
- Connector 2 Type: M N
- Cal Type: 12 Term
- IFBW: 100

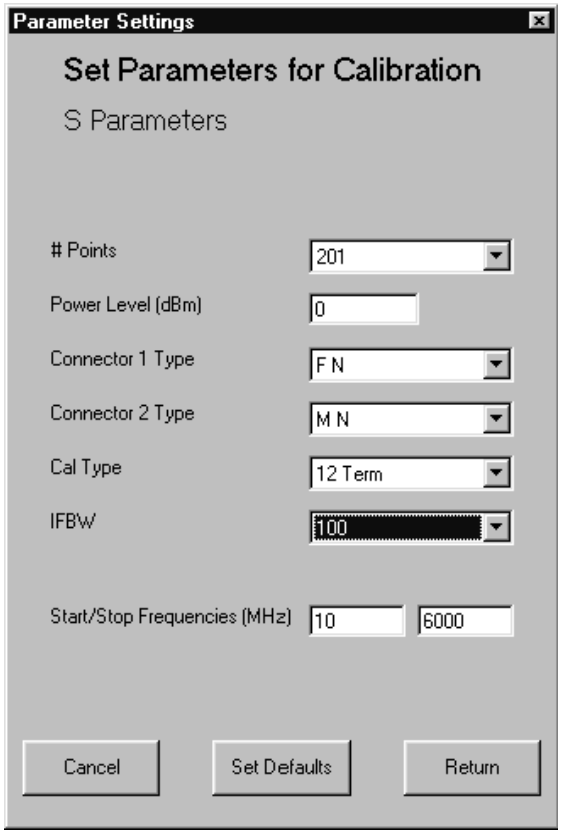


Figure 6-3. *Parameter Settings Screen*

Step 9. Click Return to display the previous menu.

Step 10. Click the Run Cal Now button. A Calibration menu will be displayed on the PC monitor. See Figure 6-4 below.

Figure 6-4. *S-Parameter Calibration Screen*

Step 11. Click the Next button to continue. An instruction box appears on the PC as shown in Figure 6-5 below.

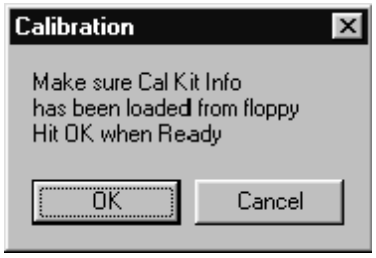


Figure 6-5. *Calibration Dialog Box*

Step 12. On the MS4623B, press the Cal key and select the MORE soft key.

Step 13. Insert the Component Calibration Coefficients disk from the Calibration Kit into the floppy drive of the MS4623B.

Step 14. Select the COMPONENT UTILITIES soft key and then the INSTALL KIT INFO FROM FLOPPY DISK soft key. This will load the Cal Kit information to the instrument.

Step 15. After the Cal Kit information is loaded, click the OK button on the PC.

Step 16. The next dialog box appears as shown in Figure 6-6 below.

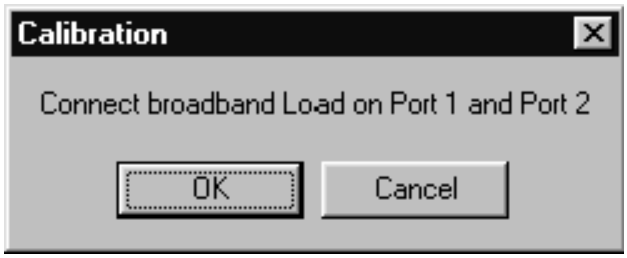


Figure 6-6. *Calibration Dialog Box*

Step 17. Connect broadband loads to the ANT A Port (Port 1) and the open end of the through cable that is connected to the RSB A Port (Port 2). Click the OK button to continue. Note that the broadband loads are used in this step.

Step 18. When the next dialog box appears, as shown in Figure 6-7 below, connect an Open to the ANT A Port and a Short to the RSB A Port. Click the OK button to continue.

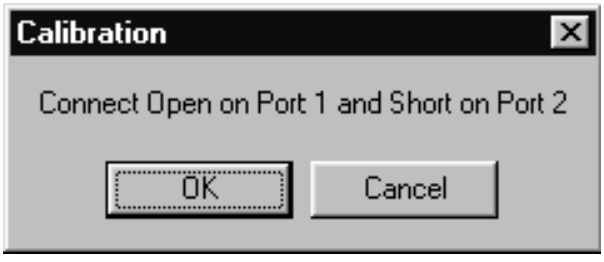


Figure 6-7. *Calibration Dialog Box*

Step 19. When the next dialog box appears, as shown in Figure 6-8 below, connect a Short to the ANT A Port and an Open to the RSB B Port. Click the OK button to continue.

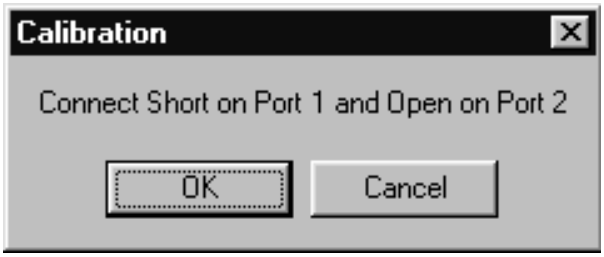


Figure 6-8. *Calibration Dialog Box*

Step 20. When the next dialog box appears, as shown in Figure 6-9 below, connect the through cable to the ANT A Port. Click the OK button to continue.

Figure 6-9. *Calibration Dialog Box*

Step 21. After the calibration is complete, the main menu will appear on the PC monitor.

Step 22. Click the S-Parameters button to display the User Input Menu, Figure 6-10 below. On this menu, change the S-Parameter setting to 11.

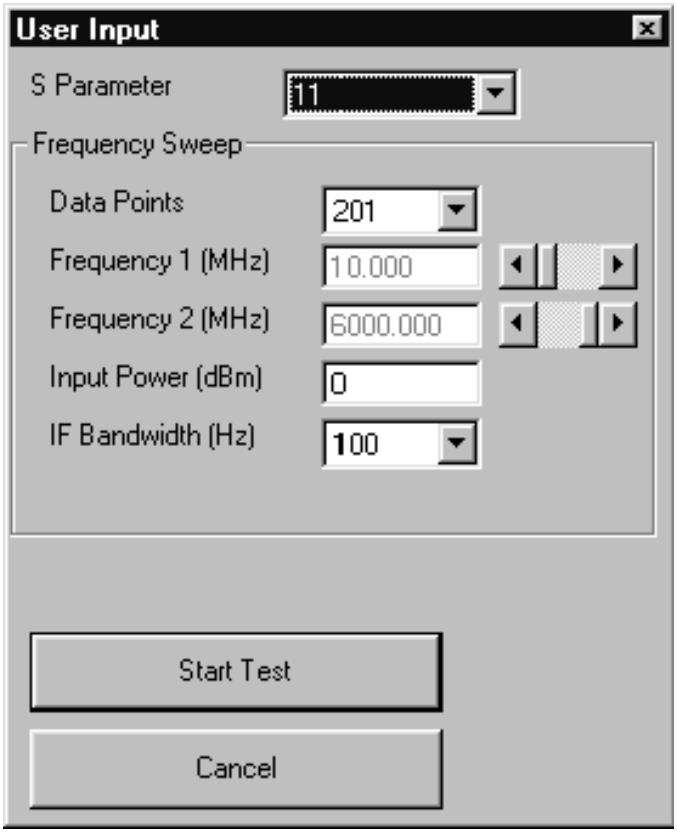


Figure 6-10. *User Input Dialog Box*

Step 23. Disconnect the through cable from the ANT A Port. Leave the other end of the cable connected to the RBS A Port.

Step 24. Connect the broadband loads that were not used during the calibration process to the ANT A Port and the open end of the through cable.

Step 25. Click the Start Test button. The test result will be displayed on the PC monitor. Refer to Figure 6-11 on the following page.

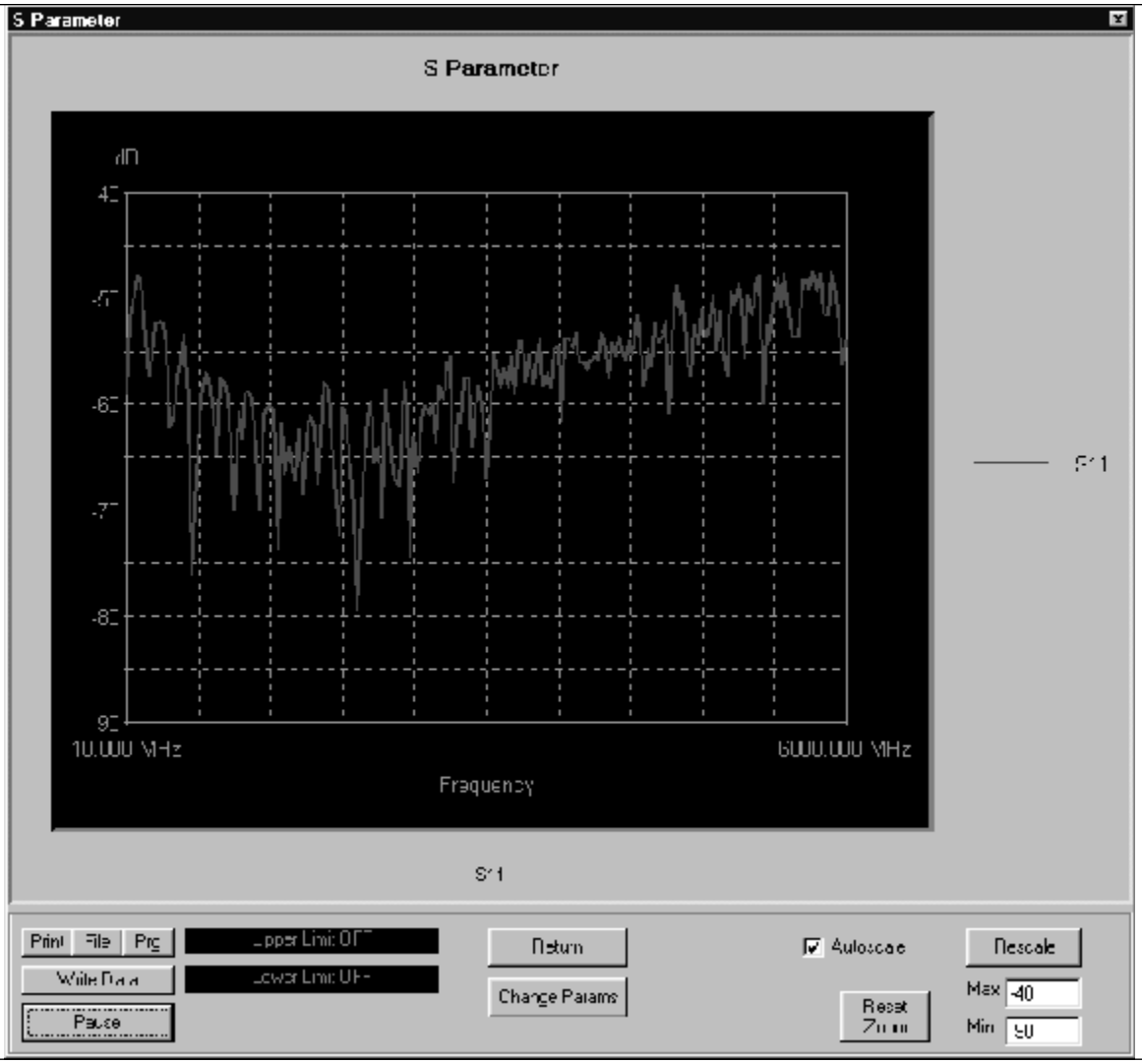


Figure 6-11. *S-Parameter Measurement Display*

Step 26. Verify that the magnitude is less than -40 dB from 10 MHz to 3000 MHz and less than -35 dB from 3000 MHz to 6000 MHz.

Step 27. Click the Change Params button.

Step 28. Change the S-Parameter setting to 22 as shown in Figure 6-12, below.

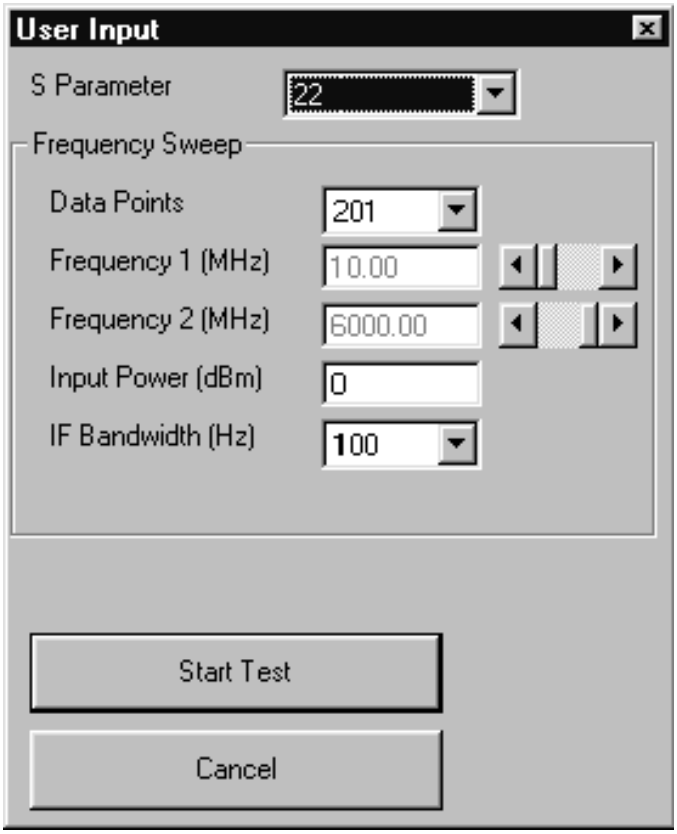


Figure 6-12. *User Input Dialog Box*

Step 29. Click the Start Test button. The test result will be displayed on the PC monitor as shown in Figure 6-13 on the following page.

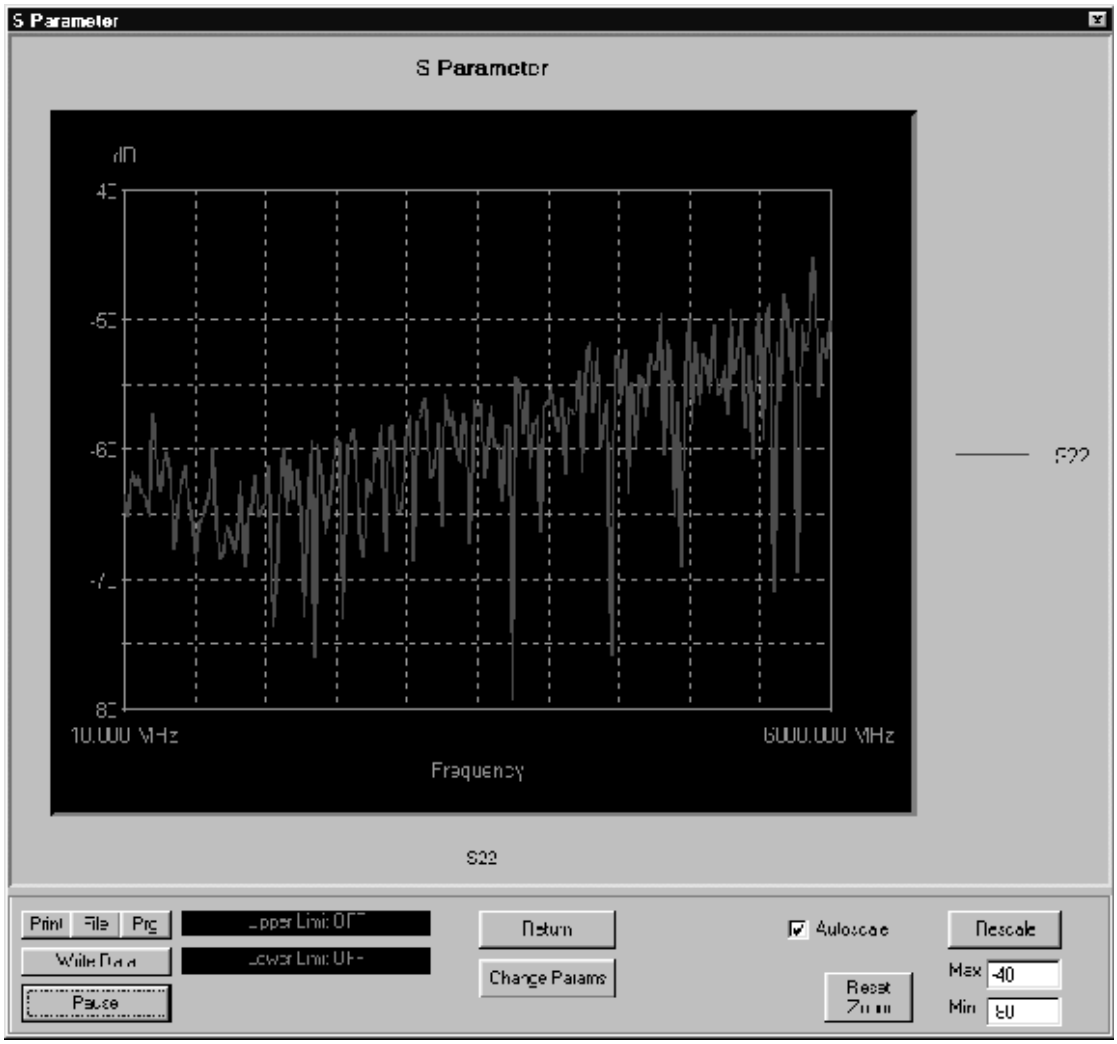


Figure 6-13. *S-Parameter Measurement Display*

Step 30. Verify that the magnitude is less than -40 dB from 10 MHz to 3000 MHz and less than -35 dB from 3000 MHz to 6000 MHz.

Step 31. Click the Return button to go back to the main menu.

Step 32. Click the ANTB -> RBSB button on the Scorpion Navigator main menu. Refer to Figure 6-14 on the following page.

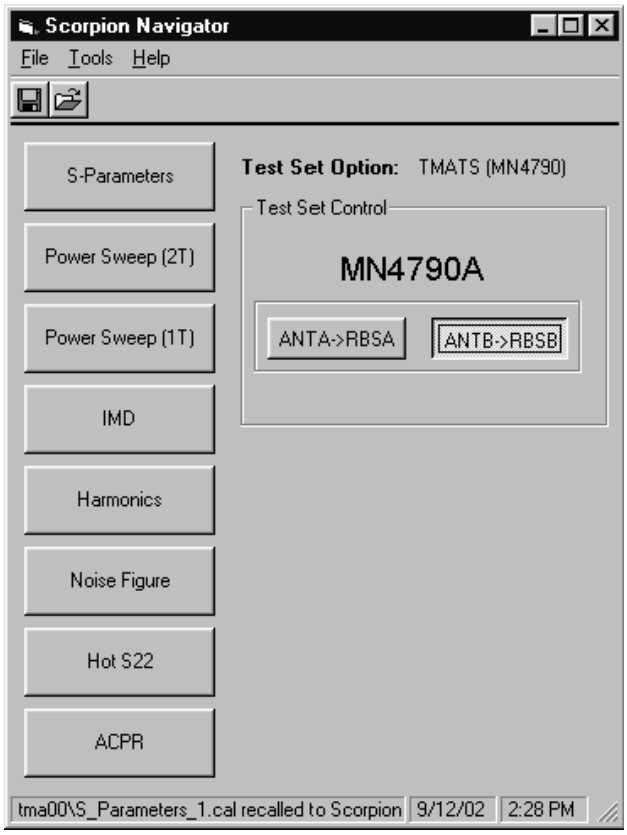


Figure 6-14. *Scorpion Navigator Main Menu*

Step 33. Disconnect the through cable from the RBS A port and connect it to the RBS B port.

Step 34. Repeat steps 10 through 30. Substitute ANT B and RBS B for ANT A and RBS A, respectively, in each of these steps.

Step 35. When all the tests are complete, exit the Scorpion Navigator software by clicking File on the Toolbar and select Exit.

Chapter 7
Maintenance

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Chapter 7
Maintenance

7-1 Introduction

This chapter provides the information necessary for maintenance of the MN4790A Test Set. Operator maintenance is limited to troubleshooting and repairs that can be made without removing the instrument covers. All other maintenance should be performed by qualified service technicians.

WARNING

There are no operator serviceable components inside. Refer servicing of the instrument to qualified service technicians.

To prevent the risk of electrical shock or damage to precision components, ***do not*** remove the equipment covers.

7-2 Troubleshooting

Troubleshooting by the operator consists of determining the cause of failure of the test set to power up. Table 7-1 provides the necessary troubleshooting steps.

Table 7-1. *Troubleshooting*

Test Set will not turn on

Normal Operation: When the test set is connected to the power source and the POWER switch is pushed in, the light over the switch should illuminate and the instrument should power up. If it does not:

Step 1. Disconnect the ME7842B from the power source, then check the line fuse on the rear panel (refer to Section 7-3).

If the fuse is defective, replace.

If the fuse is good, go to the next step.

Step 2. Check to see if power is available at the power receptacle.

If not, move to a working receptacle.

If power is available, go to the next step.

Step 3. Check the power cable.

If defective, replace.

If good, call a service technician.

7-3 Checking/Replacing the Line Fuse

The value of the line fuse used in the test set is printed on the rear panel next to the line voltage module.

Procedure: Replace the defective line fuse as follows (Figure 7-1):

Step 1. Remove the power cord from the rear panel line voltage module.

Step 2. Pull out the fuse holder assembly.

Step 3. Remove the fuse.

Step 4. Change the fuse and install the fuse holder assembly.

Step 5. Reconnect the power cord.

Step 6. Reconnect the test set to the power source.

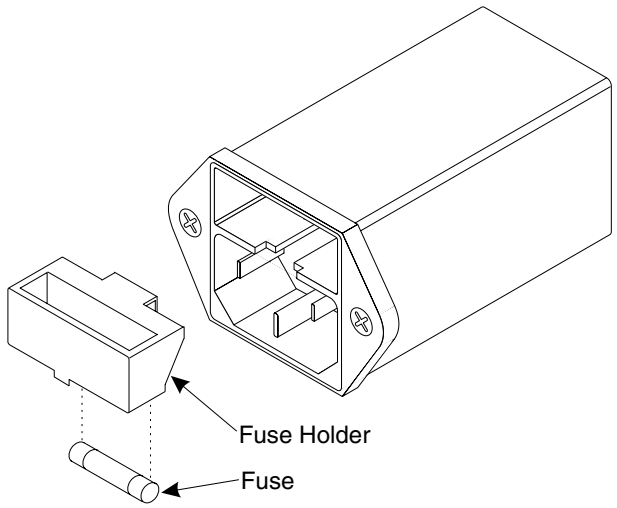

Figure 7-1. *Replacing the Line Fuse*

7-4 Replacing the Power Supply Fuse

The test set power supply has an internal 2.5A, type F fuse. Upon failure, the fuse should be replaced by a qualified service technician. Refer your instrument to the nearest Anritsu service center for service. Anritsu service centers are listed in Table 2-1 on page 2-9.

Appendix A
Programming the MN4790A

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Appendix A
Programming the MN4790A

A-1 Introduction

This chapter outlines the programming of the computer/controller required for configuring, resetting, and setting switch positions using the internal GPIB to Parallel Digital Interface PCB of the MN4790A. This PCB takes IEEE 488.2/GPIB input commands from the computer/controller to set up the parallel digital switch control lines.

ActiveX programming modules are installed within the AnSwitch.dll file and provide GPIB control of the internal MN4790A TMA Test Set switches. These ActiveX modules plug into a wide variety of popular software environments with Visual Basic for Applications (VBA) features and provide for 28 preprogrammed case settings.

Additional programming information is provided for manually setting the control bits for each individual switch in the test set. Figure A-1 (page A-4) shows the MN4790A switch layout for Case 1 and Table A-1 (pages A-11 to A-13) provides a switch control bit signal legend.

A-2 Configuring the PCB

The following set of commands configures the test set and saves the setup to Flash memory. After executing the following sequence of commands the configuration is automatically recalled at power turn-on.

The following code example is Visual Basic and assumes the GPIB address is 4.

```
idev = ildev(0, 4, 0, T10s, 1, 4096)
If(idev <0) Then
Call MsgBox("Could not open Device")
End If

Call ibclr(idev)
If(ibsta% And CMPL) Then
Debug.Print "Talking to GPIB Board"
End If

Call Send(0, 4, "CAL:LOCK 0", NLend)
Call Send(0, 4, "*CLS", NLend)
Call Send(0, 4, "SYST:COMM:GPIB:ADDR 4", NLend)
Call Send(0, 4, "SYST:COMM:GPIB:EXT 1", NLend)
Call Send(0, 4, "CONFIGURE:OUTPUT(@1, 2, 3,4,5)", NLend)
Call Send(0, 4, "CONFIGURE:OUTPUT:POLARITY 1", NLend)
Call Send(0, 4, "CONFIGURE:OUTPUT:HAND OFF", NLend)
Call Send(0, 4, "FORMAT:LISTEN HEX", NLend)
Call Send(0, 4, "CAL:LOCK 1", NLend)
Call Send(0, 4, "*CLS", NLend)
```

A-3 Programming to a Case

This section illustrates the MN4790A switch configuration and provides the sample code for a few preprogrammed switch settings.

Case 1 IMD on A Path

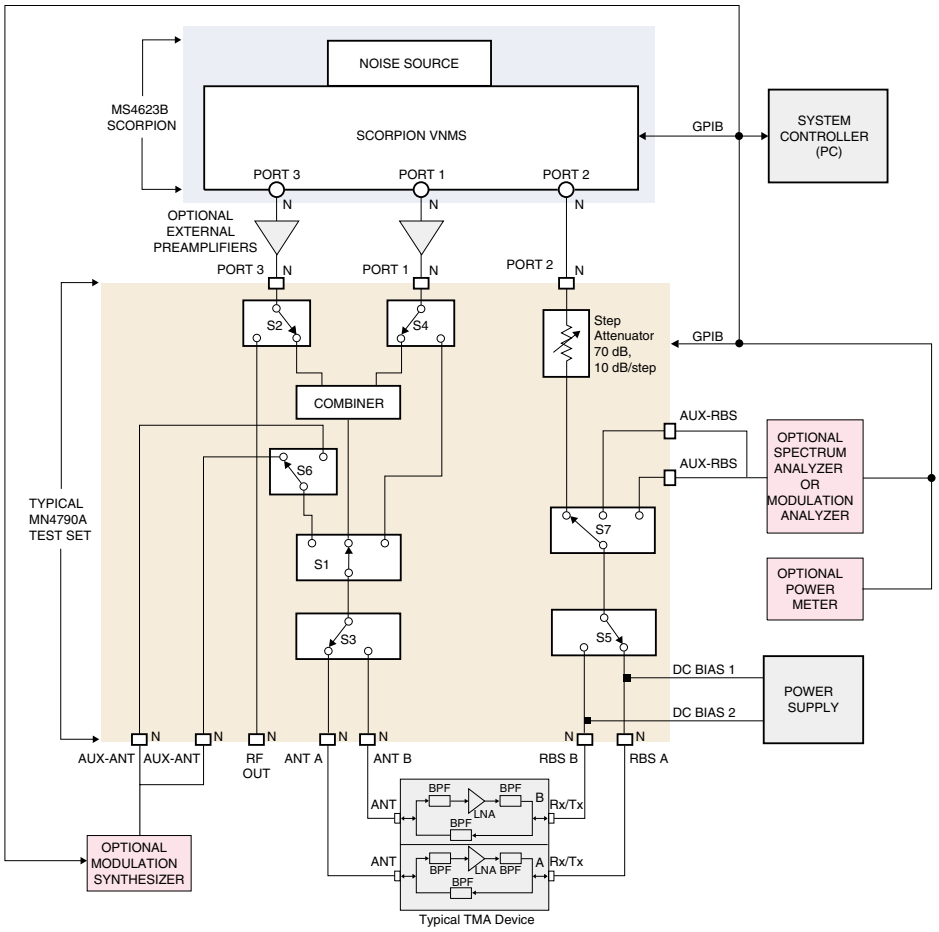

Figure A-1. *MN4790A Switch Setting for Case 1: IMD on A Path*

```
Dim clsSwitch As Object

Public Sub Main ()
   Set clsSwitch = CreateObject ("answitch.clsMN4790")
   'Open GPIB session at address 4
   clsSwitch.openSession (4)

   'Send test set command
   clsSwitch.setswitch (1)

   Set clsSwitch = Nothing
End Sub
```

Case 2 IMD on B Path

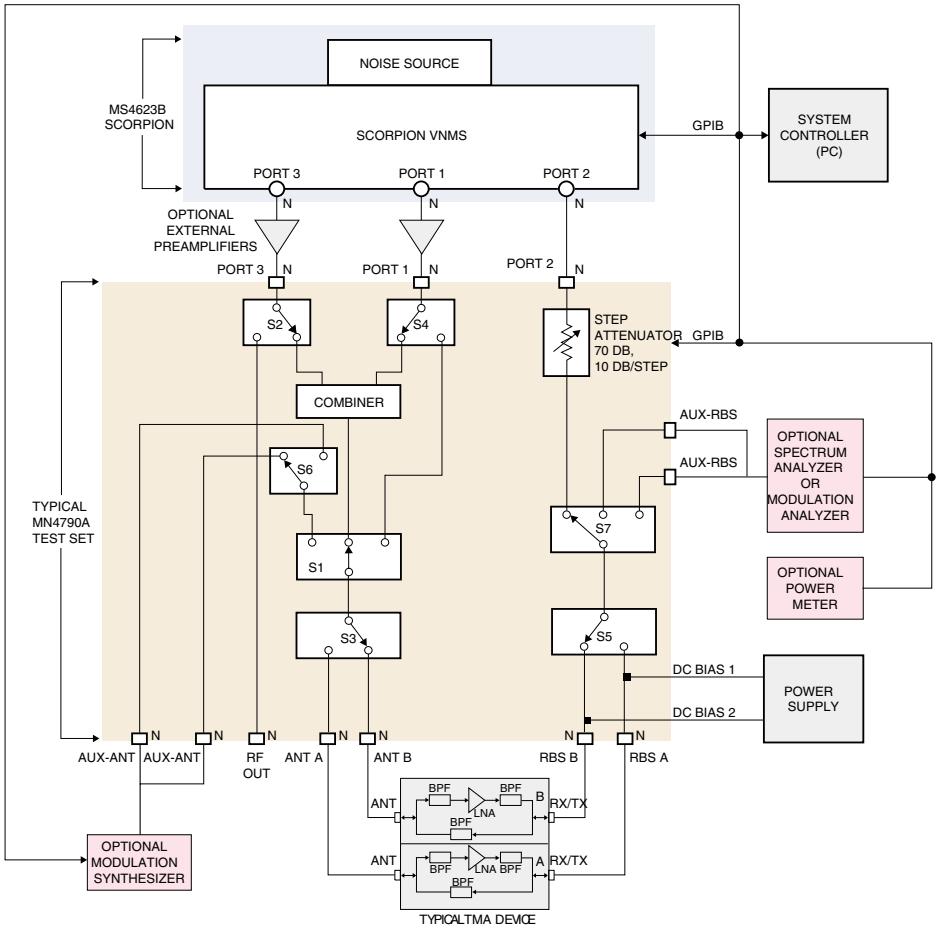

Figure A-2. *MN4790A Switch Setting for Case 2: IMD on B Path*

```
Dim clsSwitch As Object

Public Sub Main ()

   Set clsSwitch = CreateObject ("answitch.clsMN4790")
   'Open GPIB session at address 4
   clsSwitch.openSession (4)

   'Send test set command
   clsSwitch.setswitch (2)

   Set clsSwitch = Nothing

End Sub
```

Case 3 Noise Figure on A Path

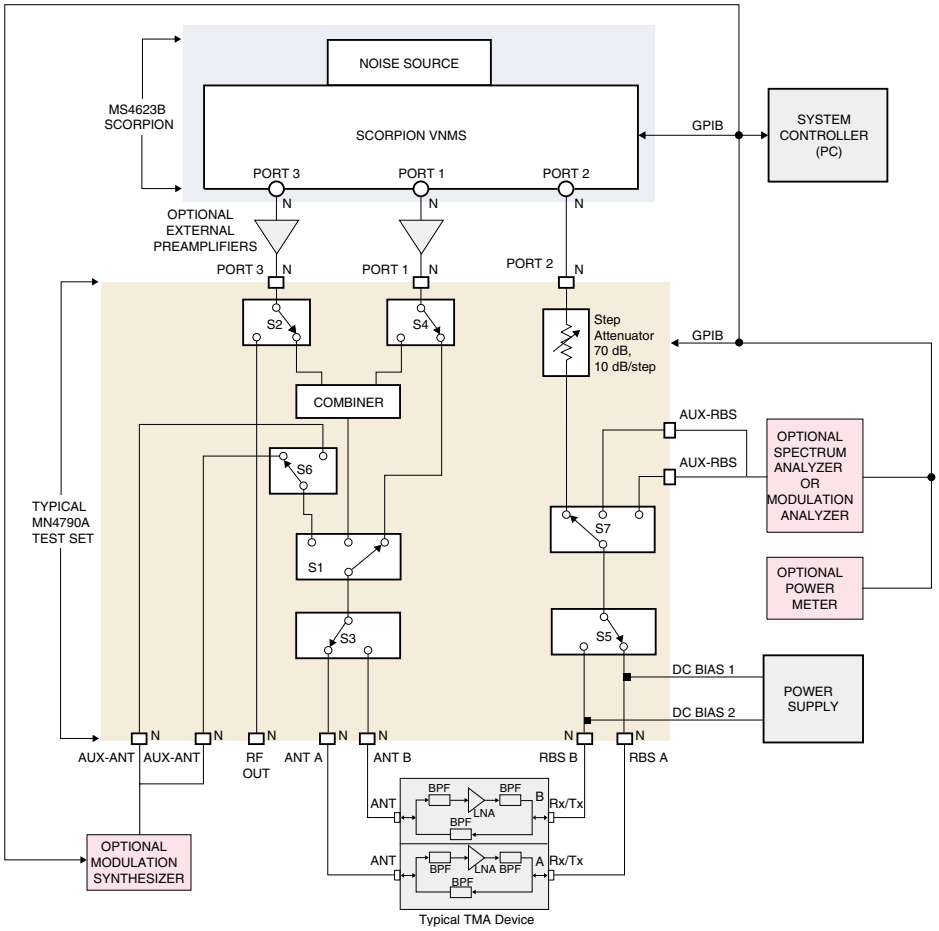

Figure A-3. *MN4790A Switch Setting for Case 3: Noise Figure on A Path*

```
Dim clsSwitch As Object

Public Sub Main ()

   Set clsSwitch = CreateObject ("answitch.clsMN4790")
   'Open GPIB session at address 4
   clsSwitch.openSession (4)

   'Send test set command
   clsSwitch.setswitch (3)

   Set clsSwitch = Nothing

End Sub
```

Case 4 Noise Figure on B Path

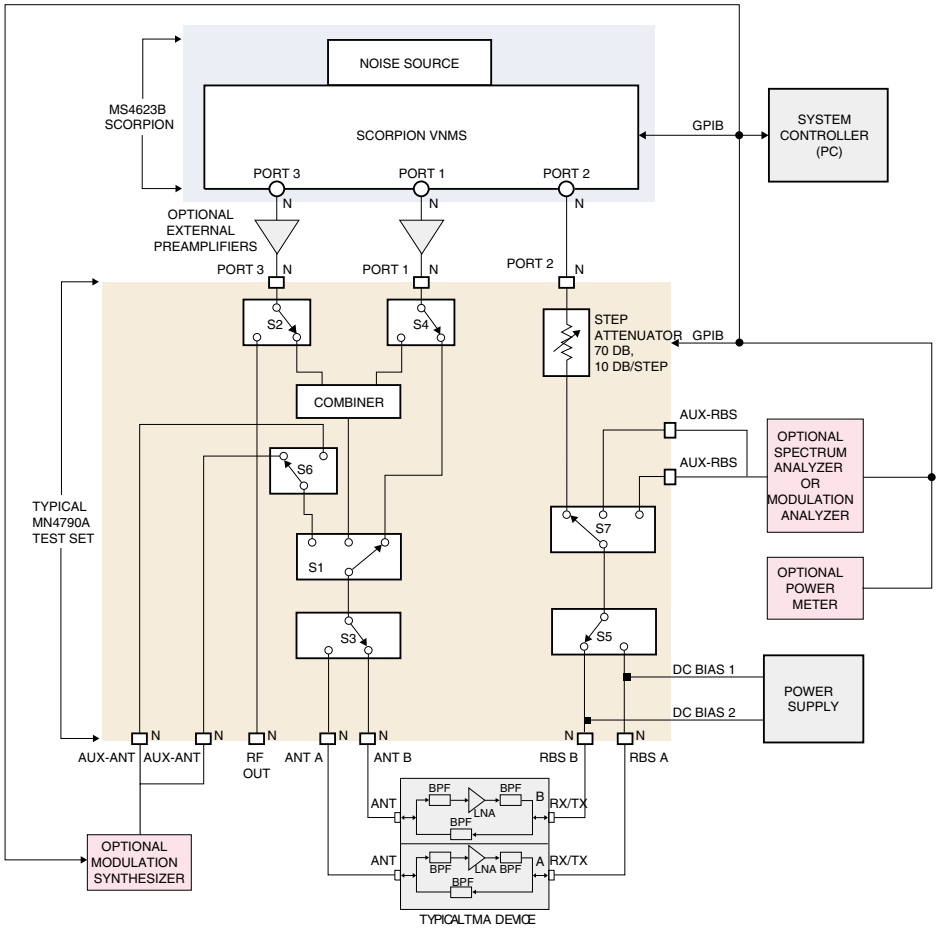

Figure A-5. *MN4790A Switch Setting for Case 4: Noise Figure on B Path*

```
Dim clsSwitch As Object

Public Sub Main ()

   Set clsSwitch = CreateObject ("answitch.clsMN4790")
   'Open GPIB session at address 4
   clsSwitch.openSession (4)

   'Send test set command
   clsSwitch.setswitch (4)

   Set clsSwitch = Nothing

End Sub
```

A-4 Manually Setting the Bits

This section provides programming examples of manually setting the internal test set switches to the previously described four cases. All possible switch configurations can be set by inferring the value of the five control bytes (Val1, Val2,...,Val5) using Table A-1 (pages A-11 to A-13).

Case 1 IMD on A Path

```
Dim clsSwitch As clsMN4790A

Public Sub Main ()

    Set clsSwitch = New clsMN4790A
    'Open GPIB session at address 4
    clsSwitch.openSession (4)

    'Send test set command
    clsSwitch.V1 = 0
    clsSwitch.V2 = 0
    clsSwitch.V3 = 0
    clsSwitch.V4 = 86
    clsSwitch.V5 = 122

    Set clsSwitch = Nothing

End Sub
```

Case 2 IMD on B Path

```
Dim clsSwitch As clsMN4790A

Public Sub Main ()

    Set clsSwitch = New clsMN4790A
    'Open GPIB session at address 4
    clsSwitch.openSession (4)

    'Send test set command
    clsSwitch.V1 = 0
    clsSwitch.V2 = 0
    clsSwitch.V3 = 0
    clsSwitch.V4 = 102
    clsSwitch.V5 = 121

    Set clsSwitch = Nothing

End Sub
```

Case 3 Noise Figure on A Path

```
Dim clsSwitch As clsMN4790A

Public Sub Main ()

    Set clsSwitch = New clsMN4790A
    'Open GPIB session at address 4
    clsSwitch.openSession (4)

    'Send test set command
    clsSwitch.V1 = 0
    clsSwitch.V2 = 0
    clsSwitch.V3 = 0
    clsSwitch.V4 = 150
    clsSwitch.V5 = 230

    Set clsSwitch = Nothing

End Sub
```

Case 4 Noise Figure on B Path

```
Dim clsSwitch As clsMN4790A

Public Sub Main ()

    Set clsSwitch = New clsMN4790A
    'Open GPIB session at address 4
    clsSwitch.openSession (4)

    'Send test set command
    clsSwitch.V1 = 0
    clsSwitch.V2 = 0
    clsSwitch.V3 = 16
    clsSwitch.V4 = 102
    clsSwitch.V5 = 121

    Set clsSwitch = Nothing

End Sub
```

Note

The manually programmed Case 4 has the attenuator set for 10 dB of attenuation.

Table A-1. *MN4790A Switch Control Bit Programming Legend (1 of 3)*

Case	A13	C13	A14	C14	A15	C15	A16	C16	A17	C17	A18	C18	A19	C19	A20	C20	40 dB Step A21	Spare C21	20 dB Step A22	Spare C22	10 dB Step A23	Spare C23	A24	C24
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	2	4	8	16	32	64	128	1	2	4	8	16	32	64	128	1	2	4	8	16	32	64	128

Table A-1. *MN4790A Switch Control Bit Programming Legend (2 of 3)*

Case	Active Low		Active High to Select										Active Low to Select								
	Attn/P2 SW7_J1 A25	AuxOut1 SW7_J2 C25	Aux_In2 SW6_J1 A26	Aux_In1 SW6_J2 C26	RBS_A SW5_J1 A27	RBS_B SW5_J2 C27	P1IMD SW4_J1 A28	P1NF SW4_J2 C28	ANT_B SW3_J1 A29	ANT_A SW3_J2 C29	P3bypass SW2_J1 A30	P3IMD SW2_J2 C30	P1NF SW1_J3 A31	AuxOut2 SW7-3 C31	Aux_Ins SW1_J1 A32	Combiner SW1_J2 C32	Val1	Val2	Val3**	Val4	Val5
1	0	1	1	0	1	0	1	0	0	1	0	1	1	1	1	0	0	0	0	86	122
2	0	1	1	0	0	1	1	0	1	0	0	1	1	1	1	0	0	0	0	102	121
3	0	1	1	0	1	0	0	1	0	1	1	0	0	1	1	1	0	0	0	150	230
4	0	1	1	0	0	1	0	1	1	0	1	0	0	1	1	1	0	0	0	166	229
5	0	1	0	1	1	0	0	1	0	1	0	1	1	1	0	1	0	0	0	154	186
6	0	1	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0	0	170	181
7	1	1	1	0	1	0	1	0	0	1	0	1	1	0	1	0	0	0	0	87	90
8	1	1	1	0	0	1	1	0	1	0	0	1	1	0	1	0	0	0	0	103	89
9	1	1	1	0	1	0	0	1	0	1	1	0	0	0	1	1	0	0	0	151	198
10	1	1	1	0	0	1	0	1	1	0	1	0	0	0	1	1	0	0	0	167	197
11	1	1	0	1	1	0	0	1	0	1	0	1	1	0	0	1	0	0	0	155	154
12	1	1	0	1	0	1	0	1	1	0	1	0	1	0	0	1	0	0	0	171	149
13	1	1	0	1	1	0	0	1	0	1	1	0	1	0	0	1	0	0	0	155	150
14	1	1	0	1	0	1	0	1	1	0	1	0	1	0	0	1	0	0	0	171	149
15	0	1	1	0	1	0	1	0	0	1	0	1	1	1	1	0	0	0	0	86	122
16	0	1	1	0	0	1	1	0	1	0	0	1	1	1	1	0	0	0	0	102	121
17	0	1	1	0	1	0	0	1	0	1	1	0	0	1	1	1	0	0	0	150	230
18	0	1	1	0	0	1	0	1	1	0	1	0	0	1	1	1	0	0	0	166	229
19	0	1	1	0	1	0	0	1	0	1	0	1	1	1	0	1	0	0	0	150	186
20	0	1	1	0	0	1	0	1	1	0	1	0	1	1	0	1	0	0	0	166	181
21	1	0	1	0	1	0	1	0	0	1	0	1	1	1	1	0	0	0	0	85	122
22	1	0	1	0	0	1	1	0	1	0	0	1	1	1	1	0	0	0	0	101	121
23	1	0	1	0	1	0	0	1	0	1	1	0	0	1	1	1	0	0	0	149	230
24	1	0	1	0	0	1	0	1	1	0	1	0	0	1	1	1	0	0	0	165	229
25	1	0	0	1	1	0	0	1	0	1	0	1	1	1	0	1	0	0	0	153	186
26	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0	0	169	181
27	1	0	0	1	1	0	0	1	0	1	1	0	1	1	0	1	0	0	0	153	182
28	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	1	0	0	0	169	181
	1	2	4	8	16	32	64	128	1	2	4	8	16	32	64	128	Port1*	Port2*	Port3*	Port4*	Port5*

Table A-1. *MN4790A Switch Control Bit Programming Legend (3 of 3)*

Case	VNA1	VNA3	Combiner	VNA2	Aux_In1	Aux_In2	AuxOut1	AuxOut2	Step Attenuator
1	ANT A	ANT A	Yes	RBS A	x	x	x	x	0
2	ANT B	ANT B	Yes	RBS B	x	x	x	x	0
3	ANT A	Bypass	No	RBS A	x	x	x	x	0
4	ANT B	Bypass	No	RBS B	x	x	x	x	0
5	x	x	x	RBS A	ANT A	x	x	x	0
6	x	x	x	RBS B	ANT B	x	x	x	0
7	ANT A	ANT A	Yes	x	x	x	x	RBS A	0
8	ANT B	ANT B	Yes	x	x	x	x	RBS B	0
9	ANT A	x	No	x	x	x	x	RBS A	0
10	ANT B	x	No	x	x	x	x	RBS B	0
11	x	x	x	x	ANT A	x	x	RBS A	0
12	x	x	x	x	ANT B	x	x	RBS B	0
13	x	Bypass	x	x	x	x	x	RBS A	0
14	x	Bypass	x	x	x	x	x	RBS B	0
15	ANT A	ANT A	Yes	RBS A	x	x	x	x	0
16	ANT B	ANT B	Yes	RBS B	x	x	x	x	0
17	ANT A	Bypass	No	RBS A	x	x	x	x	0
18	ANT B	Bypass	No	RBS B	x	x	x	x	0
19	x	x	x	RBS A	x	ANT A	x	x	0
20	x	x	x	RBS B	x	ANT B	x	x	0
21	ANT A	ANT A	Yes	x	x	x	RBS A	x	0
22	ANT B	ANT B	Yes	x	x	x	RBS B	x	0
23	ANT A	x	No	x	x	x	RBS A	x	0
24	ANT B	x	No	x	x	x	RBS B	x	0
25	x	x	x	x	ANT A	x	RBS A	x	0
26	x	x	x	x	ANT B	x	RBS B	x	0
27	x	Bypass	x	x	ANT A	x	RBS A	x	0
28	x	Bypass	x	x	ANT B	x	RBS B	x	0

Attenuation	Val3
0	0
10	16
20	4
30	20
40	1
50	17
60	5
70	21

Notes:

* Ports on the MN4790A Control Board.

** Val3 values are set to the desired attenuation as indicated in the table above.

x Indicates that the port is not used.

Subject Index