Installation Guide

VectorStar™ ME7828A Series Broadband/Millimeter Wave System

High Performance Vector Network Analysis Measurement System from 10 MHz to 110 GHz

Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

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印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
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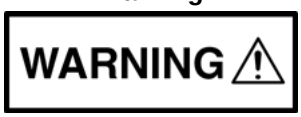
Symbols Used in Manuals

Danger

This indicates a very dangerous procedure that could result in serious injury or death, and possible loss related to equipment malfunction, if not performed properly.

Warning



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

Caution

This indicates a hazardous procedure that could result in loss related to equipment malfunction if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manuals

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

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

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

This indicates a 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

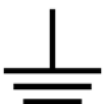
Warning

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.

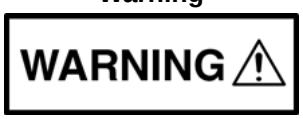
Warning

or



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

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.

Caution

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

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

Table of Contents

Chapter 3—Initial System Checkout

Chapter 1 — System Overview

1-1 Introduction

This manual describes the on-site setup and initial test of the VectorStar ME7828A Broadband/Millimeter Wave Vector Network Analyzer System. The chapters of this installation guide provide the following information:

- Chapter 1 — System Overview: Provides an overview of the broadband system, its major part numbers, options, and components.
- Chapter 2 — System Assembly: Describes the general assembly instructions and cabling procedures for the default broadband system using broadband modules. Also includes cabling exceptions for the millimeter wave system, mostly related to connections to and from the modules.
- Chapter 3 — Initial System Checkout: Provides an initial system checkout for a completely assembled system. Also provides a quick checkout of the PC control system via the IEEE-488 GPIB interface. Once this procedure is complete, the system is ready for full calibration and system performance verification.

1-2 Major Components

The VectorStar ME7828A Series Broadband/Millimeter Wave Vector Network Analyzer Measurement System consists of the following major components:

- VectorStar MS4640A Series Vector Network Analyzer (VNA)
- Two (2) MG37022A Synthesized Signal Generators
- 3738A Broadband Test Set
- Two (2) 3742A-EW Transmission-Reflection Modules, WR-10, 65 GHz to 110 GHz (WR-10 mmW Modules)
- 66670-3 Left MUX Combiner Module
- 66671-3 Right MUX Combiner Module
- 3700C3 Floor Console with Table

1-3 Major Configuration Options

There are three (3) major options available for the VectorStar ME7828A Series Broadband/Millimeter (BB/mm) Wave VNA Measurement System.

Table 1-1. Major Configurations and Components (1 of 2)

ME7828A System	Component Part Number and Description
ME7828A Broadband / Millimeter Wave VNA System	VectorStar MS4647A VNA, 10 MHz to 110 GHz, consisting of: • MS4640A-001, Rack Mount Option • MS4640A-007, Receiver Offset Option • MS4647A-051, Direct Access Loops
	3738A, Broadband Test Set, with: • 3738A-002, Broadband Test Set Interface Cables
	MG37022A, 2 to 20 GHz Synthesized Signal Generator, 2 each, with: • MG37022A-001, Rack Mount Option, 2 each
	3742A-EW, WR-10 mmWave modules, 2 each
	66670-3, Left Combiner, with Bias Tee
	66671-3, Right Combiner, with Bias Tee
	806-206, V (male) to V (female) cable, 61 cm (24”), 2 each
	806-207, V (male) to V (male) cable, 61 cm (24”), 2 each
	3700C3, Floor Console
	ME7828A-SS020, On-Site System Assembly and Verification
ME7828A Option 012 Broadband / Millimeter Wave VNA System	VectorStar MS4647A VNA, to 110 GHz, consisting of: • MS4640A-001, Rack Mount Option • MS4640A-002, Time Domain Option • MS4640A-007, Receiver Offset Option • MS4647A-062, Active Measurement Suite, with two attenuators, bias tees in test set, gain compression, and efficiency measurement software • MS4640A-070, 70 kHz Low Frequency Extension
	3738A, Broadband Test Set, with: • 3738A-002, Broadband Test Set Interface Cables
	MG37022A, 2 to 20 GHz Synthesized Signal Generator, 2 each, with: • MG37022A-001, Rack Mount Option, 2 each
	3742A-EW, WR-10 mmWave modules, 2 each
	66670-2, Left Combiner, with Bias Tee
	66671-2, Right Combiner, with Bias Tee
	806-206, V (male) to V (female) cable, 61 cm (24”), 2 each
	806-207, V (male) to V (male) cable, 61 cm (24”), 2 each
	3700C3, Floor Console
	ME7828A-SS020, On-Site System Assembly and Verification

Table 1-1. Major Configurations and Components (2 of 2)

ME7828A System	Component Part Number and Description
ME7828A Millimeter Wave System VNA	VNA Measurement System to 325 GHz. Optionally to 500 GHz. Consisting of:
	A VectorStar MS4640A Series VNA, selected from one of the following: • MS4642A, 10 MHz to 20 GHz, K connectors, with options -001 Rack Mount, -007 Receiver Offset, and -051 Direct Access Loops • MS4644A, 10 MHz to 40 GHz, K connectors, with options -001, -007, and -051 • MS4645A, 10 MHz to 50 GHz, V connectors, with options -001, -007, and -051 • MS4647A, 10 MHz to 70 GHz, V connectors, with options -001, -007, and -051
	Optionally, add one of the following: • MS464xA-061, Active Measurement Suite with 2 Attenuators • MS464xA-062, Active Measurement Suite with 4 Attenuators
	Optionally, add none, one, or both of the following: • MS4640A-002, Time Domain Option • MS4640A-070, 70 kHz Low Frequency Extension
	3738A, Broadband Test Set, equipped with: • 3738A Option 002, Broadband Test Set Interface Cables
	MG37022A, 2 to 20 GHz Synthesized Signal Generator, 2 each, with: • MG37022A-001, Rack Mount Option, 2 each
	A matched pair of 3740A-x or 3741A-x Millimeter Wave Modules • See Millimeter Wave Module listing in Table 1-2, “Millimeter Wave Module General Specifications and Part Numbers,” on page 1-4 below.
	3700C3, Floor Console

1-4 Millimeter Wave Module Options

The following millimeter wave modules are available for the ME7828A Millimeter Wave VNA Measurement System. If a millimeter wave system is required, at least one pair of modules, matched for a band, are required. Multiple module pairs can be equipped with any VNA system. The general installation and connection requirements for each module pair are identical. See the end sections of Chapter 2 — System Assembly for connection exceptions.

Table 1-2. Millimeter Wave Module General Specifications and Part Numbers

Band / Module Name	Frequency	Anritsu Part Number	Measurement Type
V Band WR-15 mmW Module	50 to 75 GHz	3740A-V, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-V	Forward measurements only. Transmission.
		3741A-V	
E Band WR-12 mmW Module	60 to 90 GHz	3740A-E, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-E	Forward measurements only. Transmission.
		3740A-E	
Extended-E Band WR-12 mmW Module	56 to 94 GHz	3740A-EE, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-EE	Forward measurements only. Transmission.
		3741A-EE	
W Band WR-10 mmW Module	75 to 110 GHz	3740A-W, 2 each	Full 2-port measurements. Transmission/Reflection.
		3741A-W	Forward measurements only. Transmission.
		3740A-W	
Extended W Band WR-10 mmW Module	65 to 110 GHz	3740A-EW, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-EW	Forward measurements only. Transmission/Reflection.
		3741A-EW	Forward measurements only. Transmission.
		3742A-EW	Full 2-port measurements. Transmission/Reflection, with Attenuator.

1-5 3656B Calibration/Verification Kit

The 3656B W1 (1 mm) Calibration and Verification Kit is recommended in applications using 1 mm coaxial cable. The kit comes with the calibration/verification hardware and the system performance verification software. See the VectorStar 3656B Calibration and Verification Kit User Guide, PN: 10410-00285 for additional information.

1-6 Performance Specifications

System performance specifications for the VectorStar ME7828A Series Broadband/Millimeter Wave VNA System are located in the ***VectorStar ME7828A BB/mm Wave System Technical Data Sheet – 11410-00452***, available on the CD-ROM that came with the shipment, or at http://www.us.anritsu.com.

1-7 Related Documentation

This section lists other documents that are available for the VectorStar instrument line.

ME7828A Series BB/mm Wave VNA Measurement System

- VectorStar ME7828A Series Broadband/Millimeter Wave Technical Data Sheet – 11410-00452
- VectorStar ME7828A Series Broadband/Millimeter Wave Quick Start Guide – 10410-00289
- 3656B W1 (1 mm) Calibration/Verification Kit and 2300-496 System Performance Verification Software User Guide for the VectorStar ME7828A and Lightning ME7808A/B/C System – 10410-00286

MS4640A Series Vector Network Analyzer

- VectorStar MS4640A Series VNA Technical Data Sheet – 11410-00432
- VectorStar MS4640A Series VNA Operation Manual – 10410-00266
- VectorStar MS4640A Series VNA Measurement Guide – 10410-00269
- VectorStar MS4640A Series VNA Programming Manual – 10410-00267

MN4690A Series Multiport VNA Measurement System

- MN4690A Series Multiport VNA Measurement System Technical Data Sheet – 11410-00513
- MN4690A Series Multiport Test Set Installation Guide – 10410-00288
- MN4690A Series Multiport Test Set Quick Start Guide – 10410-00290

Calibration, Verification, and System Performance Verification

- 36585K and 36585V Precision Auto Calibrator (AutoCal) Module Reference Manual – 10410-00279
- 3650A, 3652A, and 3654D Mechanical Calibration Kit Reference Manual – 10410-00278
- 366X-1 Verification Kit and 3-2300-527 Performance Verification Software (PVS) User Guide – 10410-00270
- 366X-1 Verification Kit and 3-2300-527 PVS Quick Start Guide – 10410-00285

For additional literature related to the Anritsu VectorStar family of products, refer to:

http://www.us.anritsu.com/VectorStar

Chapter 2 — System Assembly

2-1 Introduction

This chapter describes unpacking, assembly, and cabling procedures for the VectorStar ME7828A Broadband/Millimeter Wave VNA Measurement System.

For assembly and cabling of the Lightning ME7808C Broadband/Millimeter Wave VNA Measurement System, refer to a separate manual, the ***Lightning Series 37xxxD Vector Network Analyzer Operation Manual – 10410-00261***.

2-2 Assembly Notes

The following general assembly notes apply to the unpacking, installation, and assembly procedures:

- Many of the instruments are quite heavy and require at least two people to lift them.
- Instruments should be first loaded into the bottom sections of the floor console to prevent tipping.
- The VNA instrument has fragile RF cables (such as the **Cable Loops**) connected to both the front and rear panels. Be careful not to bend these cables when handling the instrument.
- If the synthesized signal generators are not installed precisely as described below, the system will not function correctly.
- Best practices recommend using an **Anritsu Torque End Wrench – 01-201** to tighten the ME7828A V, K, and SMA/3.5 mm connectors. The correct torque setting is 8 lbf · in (8 inch pounds).
- The following installation tools are required:
    - Connector torque wrenches
    - Phillips screwdriver
    - Flat blade screwdriver
    - Cutter or box knife for pallet banding

2-3 Unpacking the Floor Console

This section describes unpacking the floor console and preparing it for installation of the instruments.

Caution

The empty floor console weighs approximately 66 kg (145 pounds). Use a minimum of two people to remove the floor console from the pallet. Three or more people are recommended.

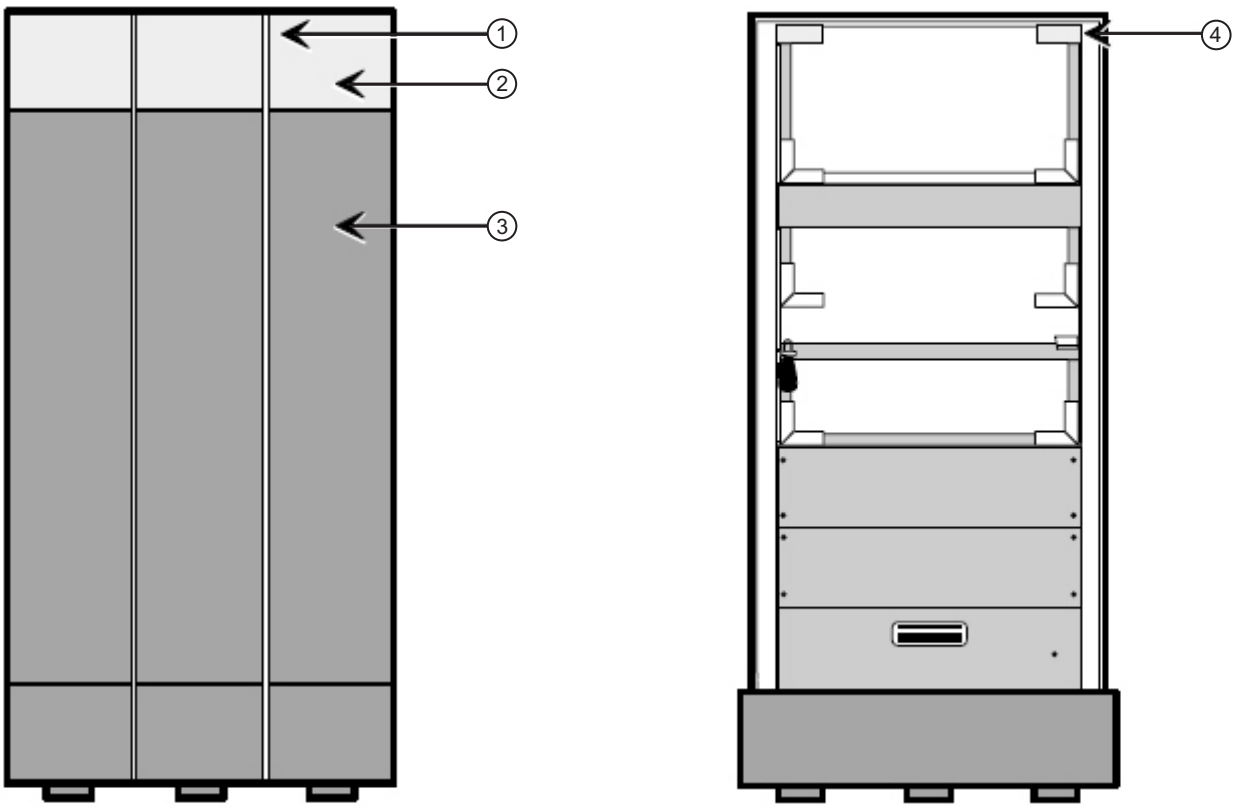


Figure 2-1. Unpacking the Floor Console

Procedure

1. Remove the floor console from its shipping container (top left in Figure 2-1 above).
2. Cut the bands (Callout 1 in Figure 2-1 above).
3. Lift off the top protective cover (Callout 2).
4. Remove the cardboard sleeve (Callout 3) by pulling straight up and away.
5. Remove the packing materials.
6. Remove the writing surface from atop the console and set it aside. You will be directed to complete its assembly in a later step.
7. Prepare the console for removal from the shipping pallet.
8. Insert two lengths of lumber through the top opening in the console (Callout 4).

9. With a minimum of one person stationed on the front side of the console and another person on the back of the console, use the lumber to lift the console off and away from the pallet. Alternatively, you can tilt the console on its back, being careful not to scratch the paint, and remove the pallet.

2-4 Preparing the Floor Console

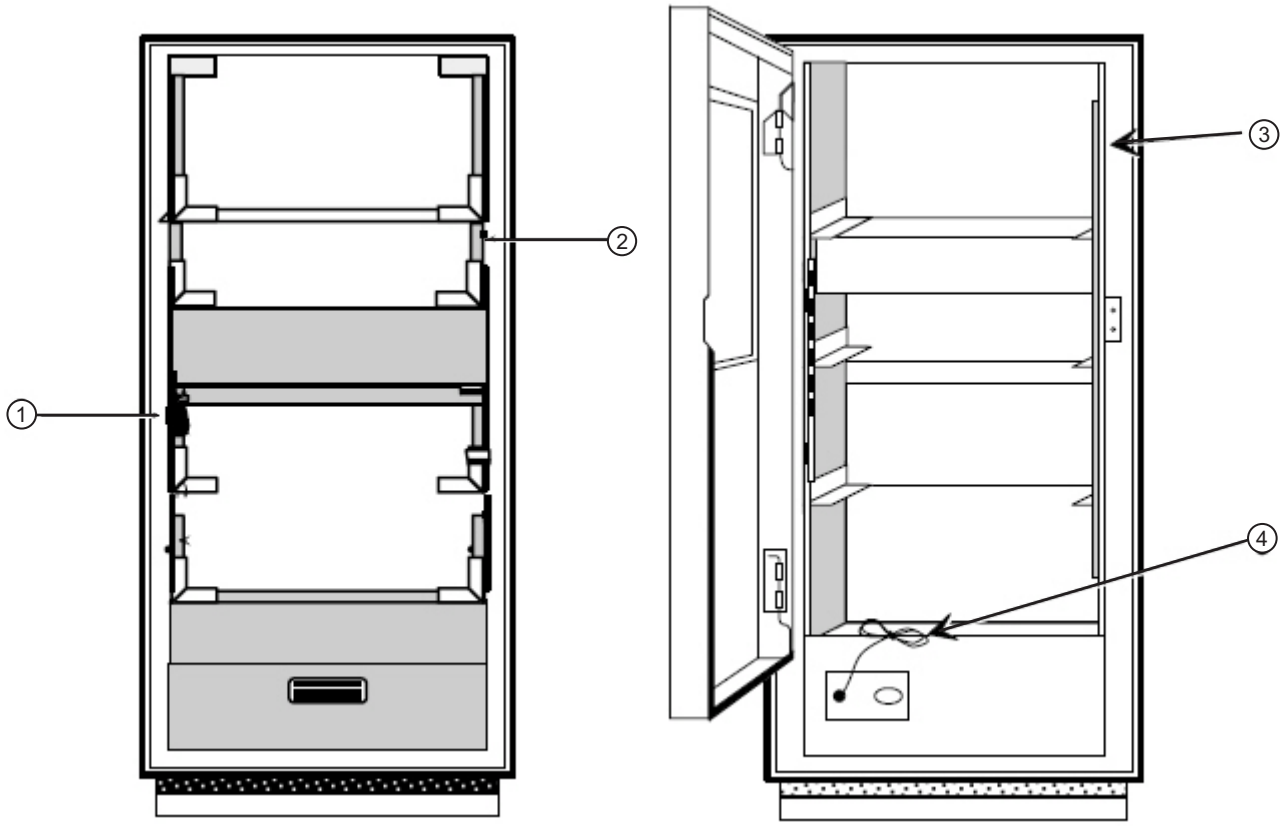
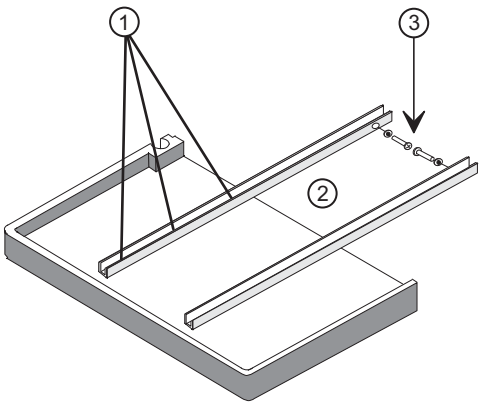


Figure 2-2. Preparing the Floor Console

Procedure

1. Prepare the front of the console (left side of Figure 2-2 above) for installation of the equipment.
2. Cut the tie wrap from the **Wrist Strap/Table Mat ground port** (Callout 1 in Figure 2-2 above), bring it out through the opening above the panel (Callout 2), and let it hang free and out of the way.
3. Prepare the rear of the console (right side of Figure 2-2 above) for installation of the equipment.
4. To open the rear door, lift the handle from the bottom, and when fully extended, twist to the left to open the door latch. The keys to the rear door lock are located in the accessory kit.
5. Open the rear door, cut the tie wraps from the writing-surface rails (Callout 4), and remove the rails from the console.
6. Cut the tie wrap from the **Line Cord** (Callout 4), and uncoil the cord.

2-5 Assembling the Console Table



Console Table Assembly

1 – Rail Attachment Hardware – 10-32 × 1/2” machine screws with #10 split lock washers, in six (6) places.
2 – Install table after installing the ruggedized cable connections between the Test Set and the Signal Generators.
3 – Slide table rails into console and attach to the console rack with two (2) 10-32 × 1/2” machine screws, each with a #10 lock washer and a #10 flat washer.

Figure 2-3. Console Table Assembly

Procedure

Prepare the console table writing surface:

1. Place the table upside down on a clean non-scratch surface.
2. Attach the **first rail** to the table by using **10-32 x 1/2 inch machine screws** each with a **#10 split lock washer** in six (6) places as shown above. Both rails are the same.
3. Attach the **second rail** to the table as above.
4. Set aside two sets of **10-32 x 1/2 inch machine screws**, **#10 flat washers**, and **#10 split lock washers**. These will be used later to attach the table to the floor console after the **Signal Generators** and **Test Set** are in place, and after the **RF** and **LO front cabling** has been installed.
5. Set the table assembly aside for later use.

2-6 Installing the Instruments into the Console

Identification

The figure below shows the placement of the system major components and front panel cabling.

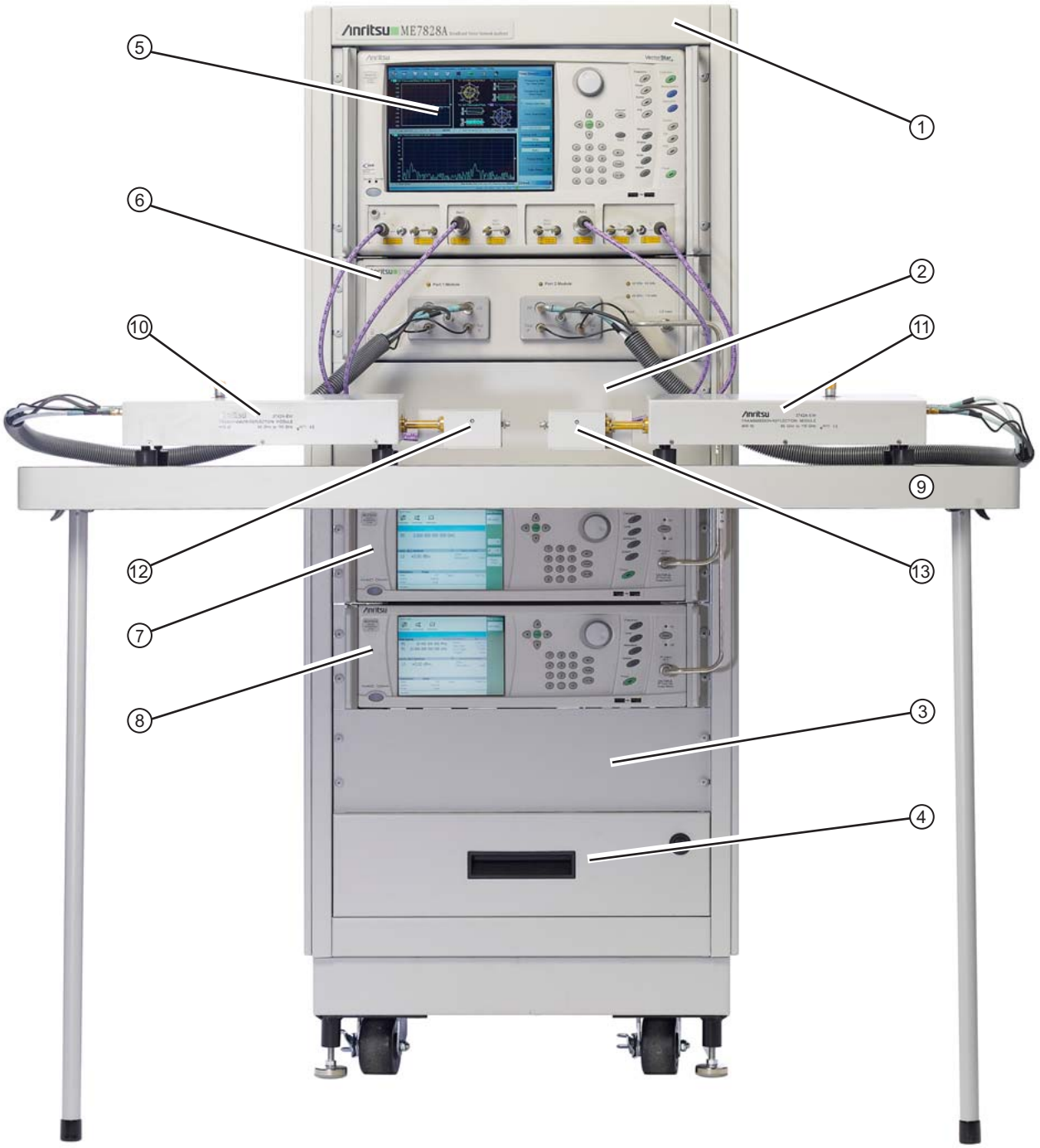


Figure 2-4. Instrument Placement in Floor Console (1 of 2)

Floor Console

1 – 3700C3 Floor Console – Internal rails and mounting shelves installed and positioned at factory.
2 – Blank Panel – Installed at factory
3 – Blank Panel – Installed at factory
4 – Floor Console Drawer – Installed at factory. Contains miscellaneous accessories and hardware.

Vector Network Analyzer

5 – For broadband measurement systems:
– The VNA is a VectorStar MS4647A VNA, 10 MHz to 70 GHz, V Connectors

For millimeter wave measurement systems, the VNA is one of the following:
– VectorStar MS4647A VNA, 10 MHz to 70 GHz, V Connectors
– VectorStar MS4645A VNA, 10 MHz to 50 GHz, V Connectors
– VectorStar MS4644A, 10 MHz to 40 GHz, K Connectors
– VectorStar MS4642A, 10 MHz to 20 GHz, K Connectors
All VNAs have the same form factor and weigh approximately the same.

Instruments, Tables and Modules

6 – 3738A Broadband Test Set
7 – MG37022A Synthesized Signal Generator – Top signal generator for LO Source.
8 – MG37022A Synthesized Signal Generator – Bottom signal generator for RF Source.
9 – Console Table with Rails – Rails are attached the table top on-site,
10 – 3742A-EW Transmission-Reflection Module WR-10 – Left Side
11 – 3742A-EW Transmission-Reflection Module WR-10 – Right Side
12 – 66670-3 WR-10 Left Coupler – Left Side
13 – 66671-3 WR-10 Right Coupler – Right Side

Figure 2-4. Instrument Placement in Floor Console (2 of 2)

Procedure

Refer to Figure 2-4 above for installation of major instruments.

1. The floor console mounting shelves are pre-positioned at the factory and should not be moved.
2. To maintain maximum floor console stability, install instruments starting at the console bottom and work up.
3. The two **MG37022A Signal Generators** are configured at Anritsu for RF/LO functions and the required GPIB address. Each signal generator is identified by a factory-applied tag identifying function, address, and its floor console position.
4. Set the first **MS37022A Signal Generator** into the **Floor Console Shelf 1** (the lowest shelf) and fasten in place with four (4) 10 × 32 pan head Phillips machine screws with a grey plastic washer.
   - This signal generator is **Source 2**, **GPIB Address 5**, and the **RF Source**.
   - See Chapter 3 — Initial System Checkout and the section “Signal Generator GPIB Settings” on page 3-1 for instructions on how to check and/or change the GPIB address.
5. Set the second **MS37022A Signal Generator** into **Floor Console Shelf 2** and fasten in place with four (4) 10 × 32 pan head Phillips machine screws with a grey plastic washer.
   - This signal generator is **Source 1**, **GPIB Address 4**, and **LO Source**.
   - See Chapter 3 — Initial System Checkout and the section “Signal Generator GPIB Settings” on page 3-1 for instructions on how to check and/or change the GPIB address.
6. Install the **3738A Test Set** into **Floor Console Shelf 3** and fasten in place with four (4) 10x32 Phillips machine screws with a grey plastic washer.

7. Install the **VectorStar MS4640A Series VNA** into the top **Floor Console Shelf 4** and fasten in place with four (4) 10x32 Phillips machine screws with a grey plastic washer.
   - The VNA is **GPIB Address 6**.
   - See Chapter 3 — Initial System Checkout and the section "VNA Broadband Configuration" on page 3-2 for instructions on how to check and/or change the GPIB address.

Caution

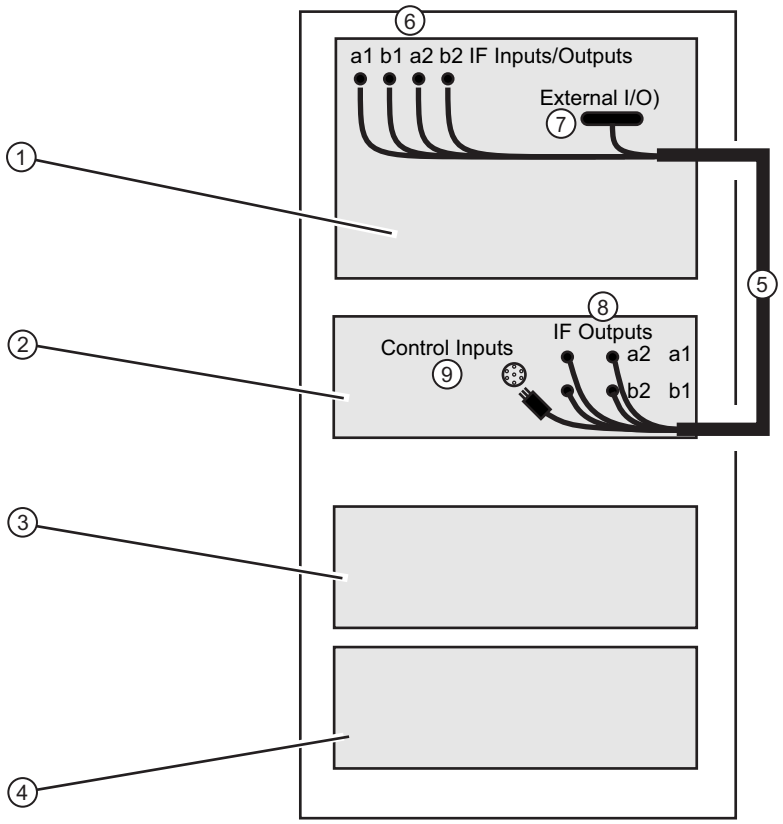
The fully loaded VNA unit weighs approximately 22 kg (50 pounds) and must be installed by at least two people. Before installation, make sure all other floor console mounted instruments have been installed, and that the floor console is carefully positioned on a flat and level surface and that the caster locks are engaged. The recommended best practice is to use two people to lift the unit and two to guide it into its shelf rails.

The test loops on the front and rear panels of the VNA are delicate. Be careful not to bump or bend the test loops.

8. Do not install the **Console Table** until after the **front panel LO** and **RF connection cables** between the **Test Set** and the two **MG37022 Signal Generators** have been installed and connections completed.

2-7 Installing the Rear Panel Control Cabling

This procedure covers installing the rear panel control cabling between the **MS4640A Series VNA** and the **3738A Test Set** as shown below in Figure 2-5.



Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A Broadband/mm Wave Test Set
3 – MS37022A Signal Generator
4 – MS37022A Signal Generator

Cable

5 – Test Set Control Cable Assembly – 70553

VNA Rear Panel

6 – VNA Rear Panel IF Input/Output Connectors – From left to right: a1, b1, a2, b2.
7 – VNA Rear Panel External I/O DB-25P Connector

Test Set Rear Panel

8 – Text Set IF Output Connectors – Top row (left to right) a2 and a1 – Bottom row (left to right) b2 and b1.
9 – Test Set Control Inputs 7-pin circular connector.

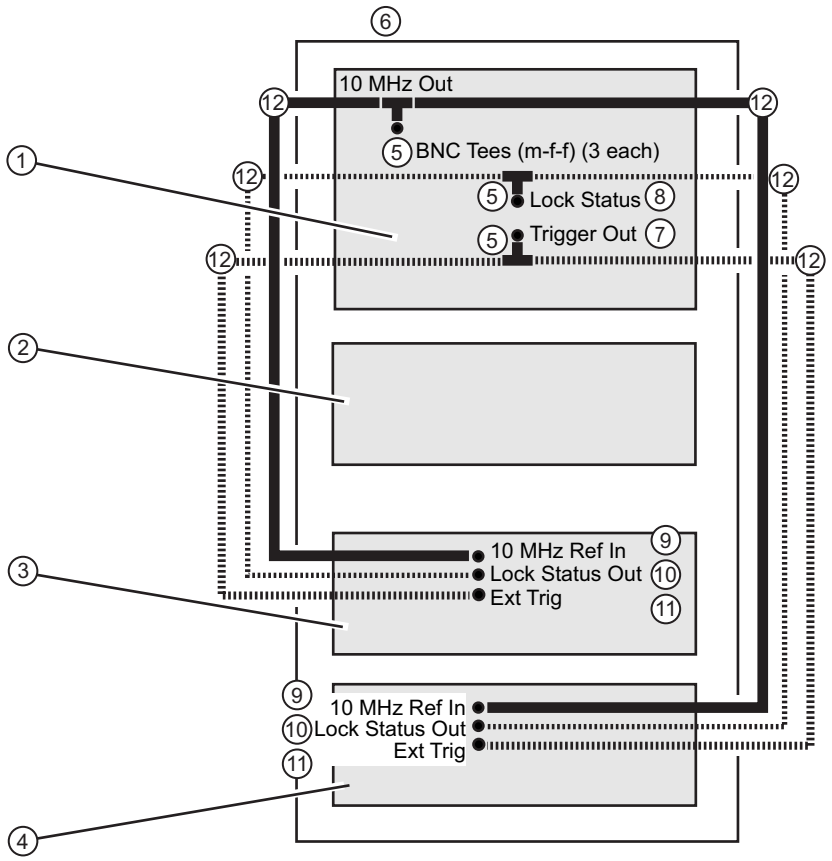
Figure 2-5. Rear Panel Control Cabling

Procedure

1. Carefully position the **Test Set Control Cable Assembly – 70553** on top of the **Test Set** until all connections are made (Figure 2-5 callout 5).
2. Connect the VNA connections first to avoid damaging the cable connectors. At the VNA, make the connections listed in Step 3 through Step 5.
3. Connect the cable **DIN 25-pin D-Sub plug** to the **VNA External I/O 25-pin D-Sub connector**.
4. Tighten the connector screws on the **D-Sub connector**.
5. Connect the labelled SMA cable connectors for **a1**, **a2**, **b1**, and **b2** to the appropriate **a1**, **a2**, **b1**, and **b2 IF Inputs/Outputs** connectors on the VNA. Torque each SMA connector to 8 lbf · in.
6. Route the cable to the top of the **3738A Test Set**. Use a single cable coil positioned on top of the **Test Set** to take up any cable slack.
7. Connect the **7-pin circular plug** on the cable to the matching **Control Input connector** on the **Test Set**.
8. Connect the labelled SMA cable connectors for **a1**, **a2**, **b1**, and **b2** to the appropriate **a1**, **a2**, **b1**, and **b2 IF Outputs** connectors on the **Test Set**. Torque each SMA connector to 8 lbf · in.

2-8 Installing the Rear Panel BNC Cabling

This procedure describes the rear panel BNC cabling between the **MS4040A Series VNA** and the two **MG37022A Signal Generators** as shown below in Figure 2-6.



Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A Broadband/mm Wave Test Set
3 – MS37022A Signal Generator – Top
4 – MS37022A Signal Generator – Bottom

VNA Rear Panel Connectors

5 – VNA Rear Panel BNC Tees (m-f-f) – On 10 MHz Out, Lock Status, and Trigger Out BNC connectors.
6 – VNA Rear Panel 10 MHz Out BNC – Cables route to Signal Generator 10 MHz Ref In BNCs.
7 – VNA Rear Panel Trigger Out BNC – Cables route to Signal Generator Ext Trig BNCs.
8 – VNA Rear Panel Lock Status BNC – Cables route to Signal Generator Lock Status Out BNCs.

Signal Generator Rear Panel Connectors

Connectors are the same for the top and bottom signal generators.
9 – 10 MHz Ref In BNC
10 – Lock Status Out BNC
11 – Ext Trig BNC

Cables

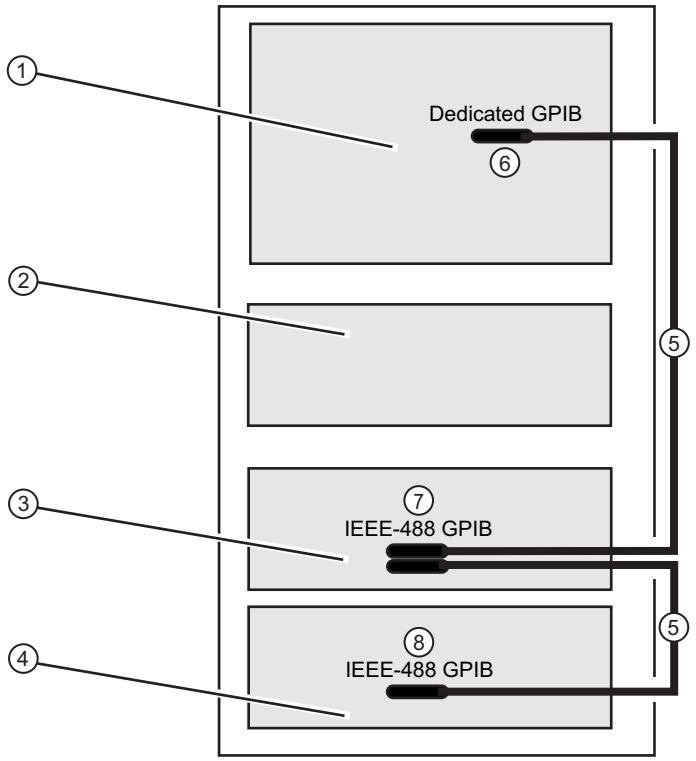
12 – Two (2) BNC coaxial cables, 91 cm (36”) (f-f) – 3-800-124 are attached to each BNC Tee, six (6) cables total.

Figure 2-6. BNC Cabling on Rear Panels

1. At the **MS4040A Series VNA** (callout 1 in Figure 2-6), attach **BNC Tee (m-f-f) connectors – 3-2600-2** (callout 5) to the following rear panel BNC connectors:
   - **10 MHz Out BNC** connector (callout 6)
   - **Trigger Out BNC** connector (callout 7)
   - **Lock Status BNC** connector (callout 8)
2. Route a **BNC 91 cm (36") cable (f-f) – 3-800-124** from the VNA **10 MHz Out BNC Tee** connector to the top MG37022A **10 MHz Ref In BNC** connector (callouts 6 and 9 upper).
3. Route a second BNC cable from the VNA **10 MHz Out BNC Tee** connector to the bottom MG37022A **10 MHz Ref In BNC** connector (callouts 6 and 9 lower).
4. Route a third BNC cable from the VNA **Trigger Out BNC Tee** connector to the top MG37022A **Ext Trig BNC** connector (callouts 7 and 11 upper).
5. Route a fourth BNC cable from the VNA **Trigger Out BNC Tee** connector to the bottom MG37022A **Ext Trig BNC** connector (callouts 7 and 11 lower).
6. Route a fifth BNC cable from the VNA **Lock Status BNC Tee** connector to the top MG37022A **Lock Status Out BNC** connector (callouts 8 and 10 upper)).
7. Route a sixth BNC cable from the VNA **Lock Status BNC Tee** connector to the bottom MG37022A **Lock Status Out BNC** connector (callouts 8 and 10 lower).

2-9 Installing the Rear Panel GPIB Cabling

This procedure covers the rear panel GPIB cabling between the **MS4040A Series VNA** and the two **MG37022A Signal Generators** as shown below in Figure 2-7.



Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A Broadband/mm Wave Test Set
3 – MS37022A Signal Generator
4 – MS37022A Signal Generator

Cables

5 – Two each GPIB 2 m (78.7") (m-m) Cables – 2100-2 – The first cable from VNA to top signal generator. The second cable from top signal generator to bottom signal generator.
6 – VNA Rear Panel Dedicated GPIB connector
7 – Top Signal Generator IEEE-488 GPIB connector
8 – Bottom Signal Generator IEEE-488 GPIB connector

Figure 2-7. Rear Panel GPIB Cabling

1. Attach a **GPIB 2 m (78.7") (M-M) Cable – 2100-2** to the **VNA Dedicated GPIB** connector (callout 6).
2. Route the cable to the **top MG37022A** and attach it to the **IEEE-488 GPIB** connector (callouts 5 and 7).
3. Attach a second **GPIB cable** on top of the GPIB cable in the **MG37022A** (callout 7).
4. Route the cable to the **bottom MG37022A** and attach it to the **IEEE-488 GPIB** connector (callouts 5 and 8).

2-10 Installing the Rear Panel Power Cabling

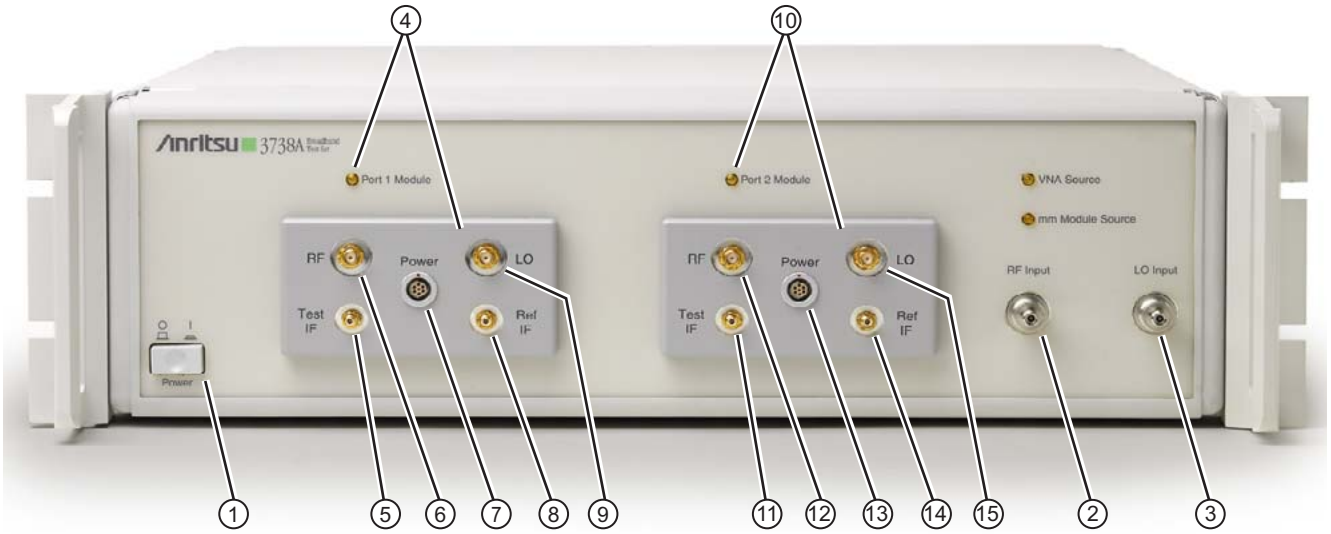
This procedure connects the individual instrument power cords to the main power distribution strip.

Note	The Power Strip plug type and the instrument Power Cords are matched to the standard for the local power mains. The instrument-end of each power cord is always compatible with the instrument-mounted **IEC Type C13 AC Line Socket**. The AC power requirement for the VNA is approximately 350 VA maximum, 90-264 VAC, 47-63 Hz, power-factor controlled. The total AC power requirement for the ME7828A system is approximately 1000 VA.

1. Make sure the main power distribution strip is not connected to AC power.
2. Starting at the bottom **MG37022A Signal Generator**, insert the female end of the power cord into the **IEC C14AC Power Socket** on the rear panel. Route the cable to the nearest power strip outlet. Dress the power cable with cable ties as required.
3. Repeat Step #2 for the top signal generator.
4. Repeat Step #2 for the **3738A Test Set**.
5. Repeat Step #2 for the **MS4640A Series VNA**.

2-11 3738A Test Set Front Panel Connectors

The 3738A Test Set has front panel connectors and controls as described below in Figure 2-8.



1 – On/Off Switch – Off (**|**) = Out – On (**O**) = In
2 – RF Input Port – Connects to the lower MG37022A Signal Generator RF Output 50 Ohm Connector.
3 – LO Input Port – Connects to the upper MG37022A Signal Generator RF Output 50 Ohm Connector.

Port 1 Connectors

4 – Port 1 Module – Five connections between the Test Set and the left side 3742A-EW T-R Module.
5 – Test IF Connector – Connects to the left side 3742A-EW T-R Module and Test IF connector.
6 – RF Connector – Connects to the left side 3742A-EW T-R Module and RF connector.
7 – Power 7-pin Circular Connector – Connects to the left side 3742A-EW T-R Module Power connector.
8 – Ref IF Connector – Connects to the left side 3742A-EW T-R Module Ref IF connector.
9 – LO Connector – Connects to the left side 3742A-EW T-R Module LO connector.

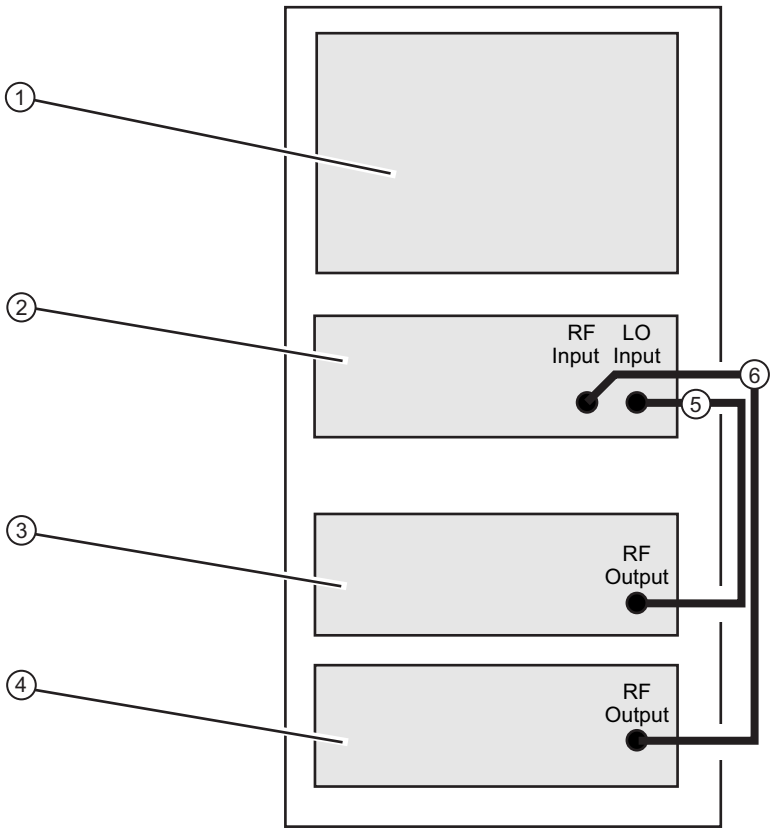
Port 2 Connectors

10 – Port 2 Module – Five connections between the Test Set and the right side 3742A-EW T-R Module.
11 – Test IF Connector – Connects to the right side 3742A-EW T-R Module and Test IF connector.
12 – RF Connector – Connects to the right side 3742A-EW T-R Module and RF connector.
13 – Power 7-pin Circular Connector – Connects to the right side 3742A-EW T-R Module Power connector.
14 – Ref IF Connector – Connects to the right side 3742A-EW T-R Module Ref IF connector.
15 – LO Connector – Connects to the right side 3742A-EW T-R Module LO connector.

Figure 2-8. 3738A Test Set Front Panel Connectors

2-12 Installing the Test Set to Signal Generator RF and LO Cables

This procedure attaches the **RF** and **LO cables** between the Signal Generators and the Test Set.



Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A Broadband/mm Wave Test Set
3 – MG37022A Signal Generator
4 – MG37022A Signal Generator

Cables

5 – Ruggedized Cable – C34429-7 – From 3738A LO Input port to upper MG37022A RF Output
6 – Ruggedized Cable – C34429-8 – From 3738A RF Input port to lower MG37022A RF Output

Figure 2-9. Front Panel Signal Generators to Test Set Cabling

1. Attach the **Anritsu C34429-7 Ruggedized Cable** between the **Test Set LO Input Connector** and the **RF Output 50** Ω connector on the top signal generator.
2. Attach the **Anritsu C34429-8 Ruggedized Cable** between the **Test Set RF Input Connector** and the **RF Output 50** Ω connector on the bottom signal generator.

2-13 Attaching the Console Table to the Floor Console

This procedure attaches the console table to the floor console.

1. On the left front of the floor console, move the black ground wire away from the guide of the table-mounting rail, and install the table by sliding the table rails into the guides.

2. Secure the table rails at the floor console rear rails by using two sets of **10-32 × 1/2 inch machine screws**, **#10 flat washers**, and **#10 split lock washers**.

2-14 Installing the mmWave and MUX Modules

This procedure assembles the modules and combiners, connects the modules to the Test Set, and connects the combiners to the VNA.

Identification

The figure below shows the wiring between front panels of the VNA and Test Set and the connectors on the modules and combiners.

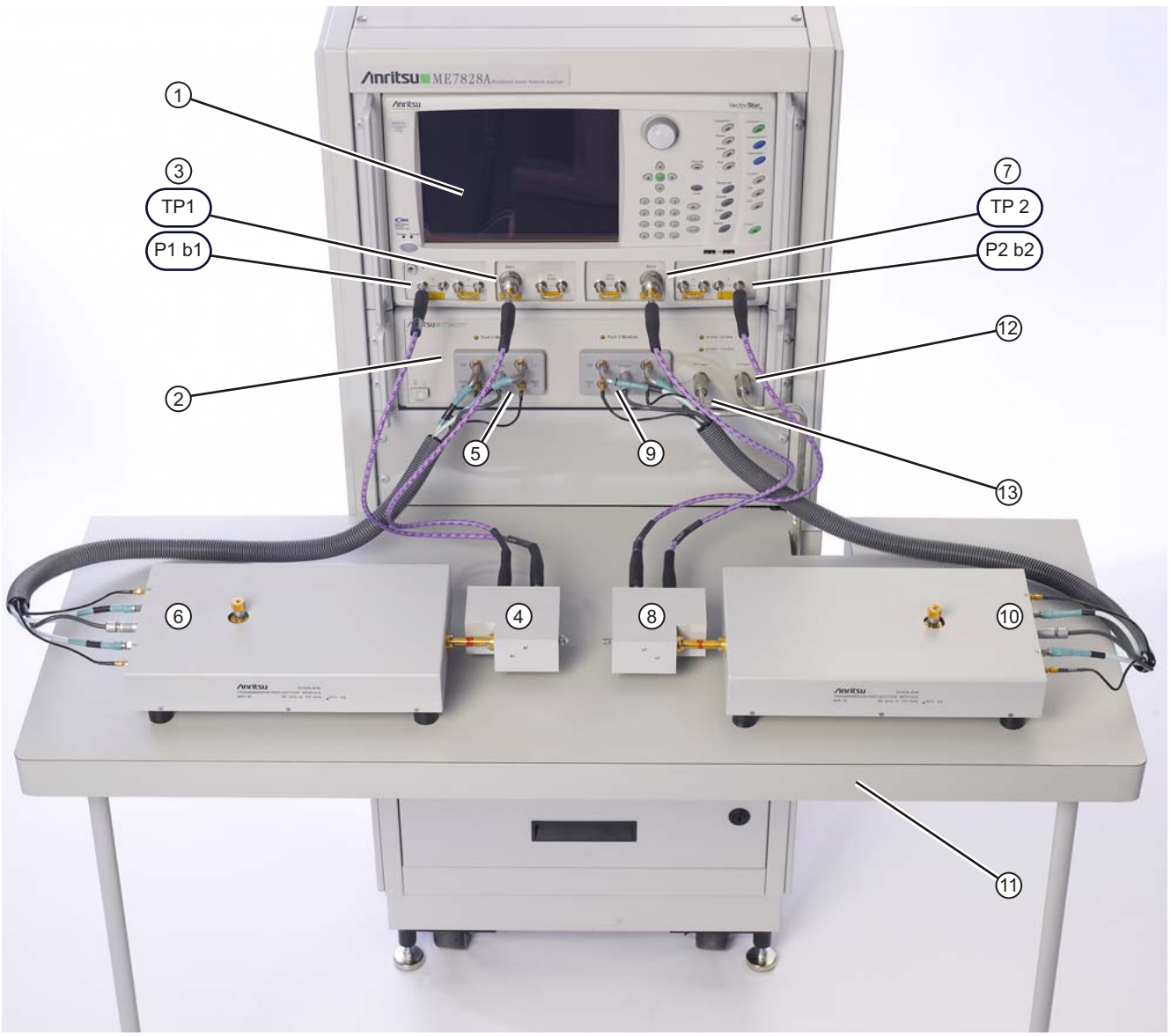


Figure 2-10. Overview of ME7828A Front Panel Cable Connections (1 of 2)

Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A BB/mm Wave Test Set

VNA Port 1

3 – VNA Port 1 connectors – Port 1 b1 Input (at left), Test Port 1 (at right).
4 – 66670-3 Left Combiner – Source (at left) connects to VNA Test Port 1, b Out (at right) connects to VNA b1 input.
5 – 3738A Test Set Port 1 connections – (left to right, top to bottom) RF, LO, Power, Test IF, Ref IF.
6 – 3742A-EW T-R Module connectors – (back to front) Ref IF, RF, Power, LO, Test IF.

VNA Port 2

7 – VNA Port 2 connectors – Test Port 2 (at left), Port 1 b1 Input (at right).
8 – 66671-3 Right Combiner
– b Out (at left) connects to VNA Port 2 b2 Input
– Source (at right) connects to VNA Test Port 2.
10 – 3742A-EW T-R Module connectors – (back to front) Test IF, LO, Power, RF, Ref IF.

Other Components

11 – Console Table
12 – 3738A Test Set RF Input – Ruggedized cable connects to bottom signal generator (not shown) RF Output .
13 – 3738A Test Set LO Input – Ruggedized cable connects to top signal generator (not shown RF Output.

Figure 2-10. Overview of ME7828A Front Panel Cable Connections (2 of 2)

Procedure.

Note	If you are assembling a millimeter wave system, there are no coupler/combiner units and related cables. See Chapter 1 — System Overview and Table 1-2, “Millimeter Wave Module General Specifications and Part Numbers,” on page 1-4 for a listing of millimeter wave modules.

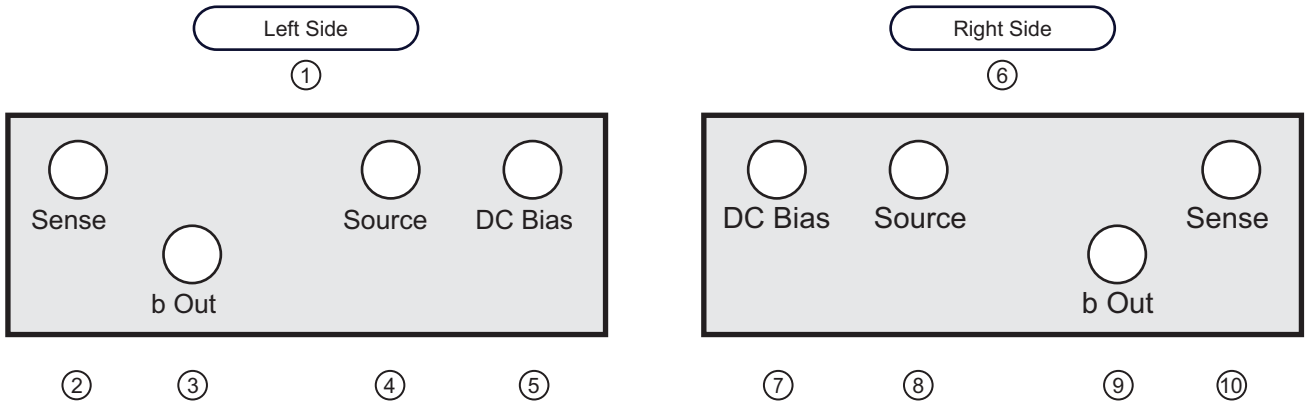
1. Using anti-static procedures, unpack the modules.

Note	Skip Step 2 below if assembling a millimeter wave system. Continue with Step 3 below.

2. Assemble the mmWave modules and the combiner/couplers by using four (4) **Allen Head machine screws** for each waveguide connection. There are two waveguide connections per side, and four connections per system.
3. Place the left and right module/MUX combiner pairs in the approximate position on the console table. The combiner/coupler connectors should face the instrument front panels.

Note	Skip Step 4 below if assembling a millimeter wave system. Continue with Step 5 below.

4. Note the combiner/coupler connectors as shown below in Figure 2-11. These connectors are oriented to face the floor console and the instrument front panels.



Orientation

The combiner connector panels face towards to the rear and towards the VNA/Test Set front panels.

Left Side Combiner Connectors

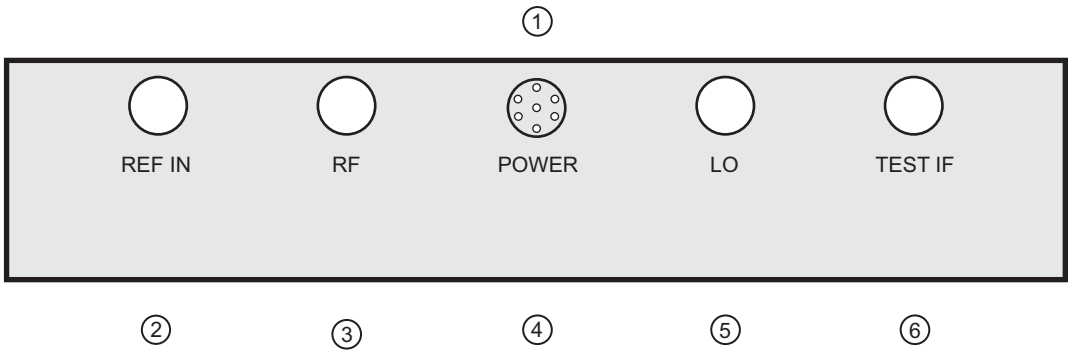
1 – Left Side Combiner – 66670-3
2 – Sense connector
3 – b Out connector
4 – Source connector
5 – DC Bias connector

Right Side Combiner Connectors

6 – Right Side Combiner – 66671-3
7 – DC Bias connector
8 – Source connector
9 – b Out connector
10 – Sense connector

Figure 2-11. WR-10 66670-3 Left and 66671-3 Right Combiner/Coupler Connectors

5. Note the module connectors as shown below in Figure 2-12



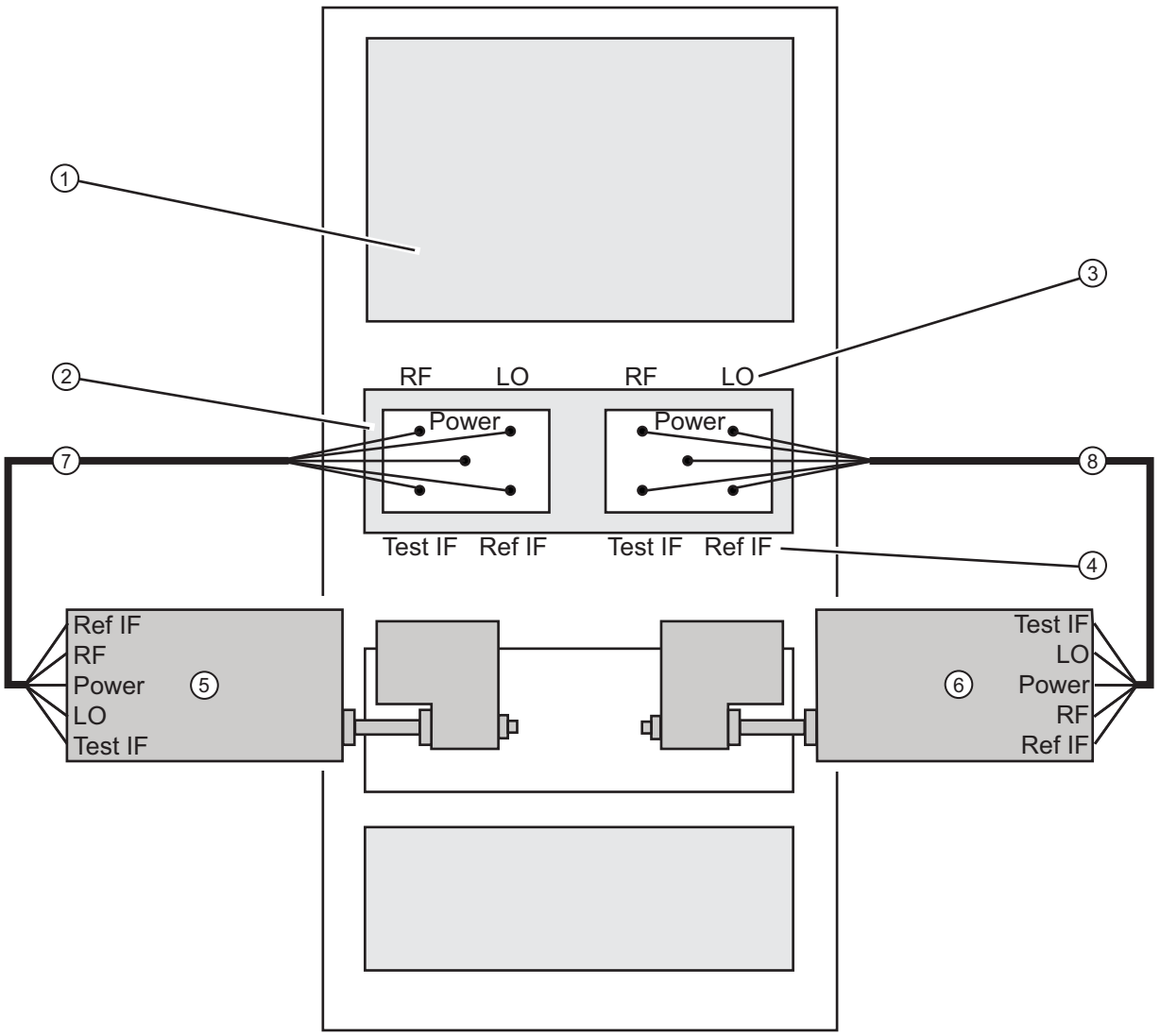
3742A-EW T-R Module

1 – 3742A-EW Transmission-Reflection Module – WR-10 65 GHz to 110 GHz – Left and right module connector panels are the same.
2 – REF IN
3 – RF
4 – POWER
5 – LO
6 – TEST IF

Figure 2-12. 3742A-EW T-R WR-10 Module Connectors

2-15 Connecting the Test Set to the WR-10 mmW Modules

6. Use the first **54094 Cable Assembly** to connect between the **Test Set Port 1 Module** connectors and the left side WR-10 module.



Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A BB/mm Wave Test Set
3 – 3738A RF (upper left), LO (upper right), and Power (center) connectors (same for both ports)
4 – 3738A Test IF (lower right) and Ref IF (lower right) connectors (same for poth ports)

Modules and Cables

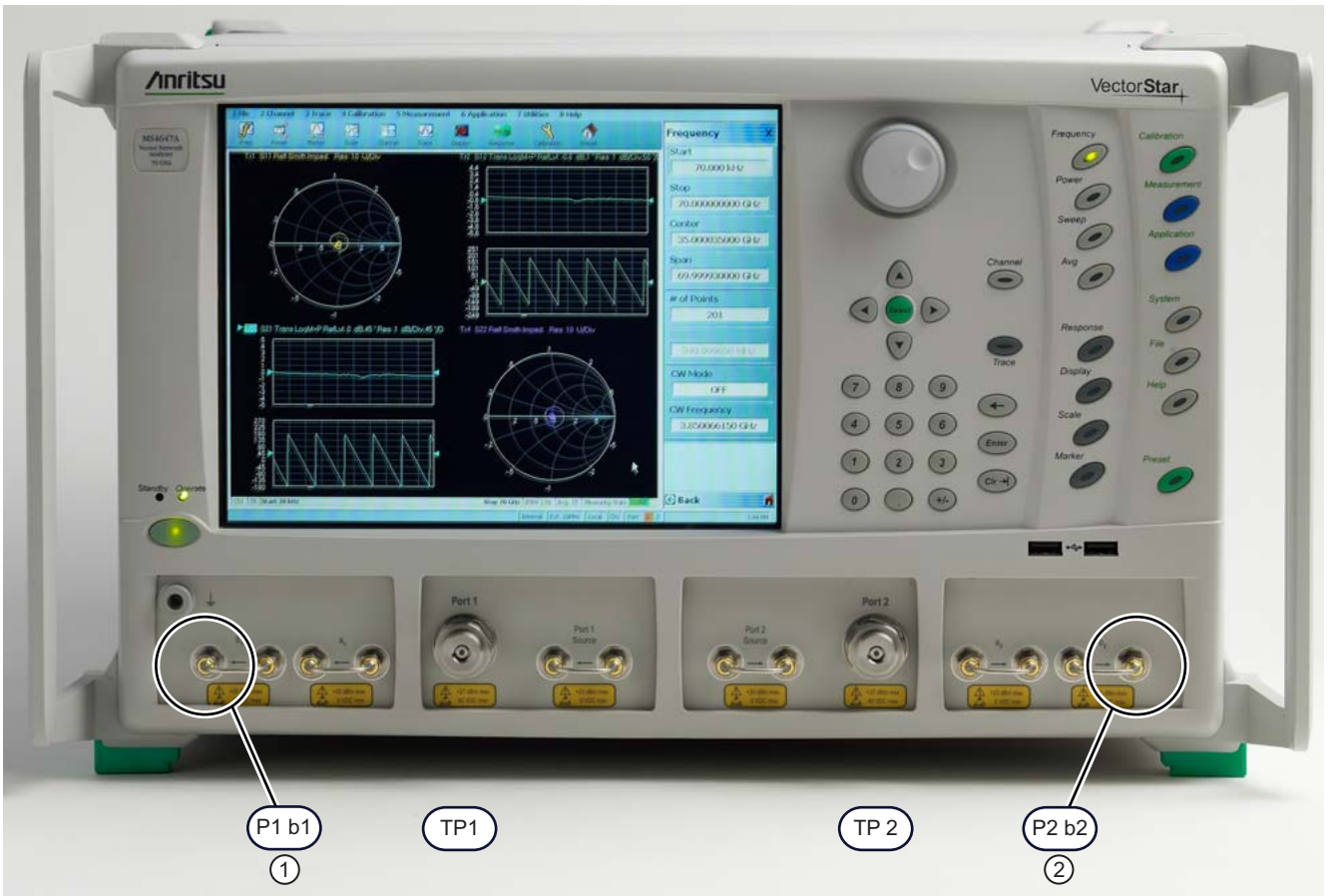
5 – 3742A-EW T-R Module (left side for Port 1)
6 – 3742A-EW T-R Module (right side for Port 2)
7 – Cable Assembly – 54094 – Between 3738A Port 1 connectors and left side 3742A-EW T-R Port 1 connectors.
8 – Cable Assembly – 54094 – Between 3738A Port 2 connectors and right side 3742A-EW T-R Port 2 connectors.

Figure 2-13. Test Set and WR-10 mmW Module Connections

7. Insert the **7-pin circular cable plug** into the **Test Set Port 1 Module Power** connector.
8. Connect the remaining cable plugs to the appropriate connectors on the left side **Test Set Port 1 Module** connectors for **RF**, **LO**, **Test IF**, and **Ref IF**. Torque each cable connection to 8 lbf · in.
9. Route the cable to the left side **3742A-EA WR-10 T-R Module** and connect the leads to the appropriate connectors for **Ref IF**, **RF**, **Power**, **LO**, and **Test IF**. Torque each cable connection to 8 lbf · in.
10. Use the second **54094 Cable Assembly** to connect between the right side **Test Set Port 2 Module** connectors and the right side **3742A-EW WR-10 Module**.
11. Insert the **7-pin circular cable plug** into the **Test Set Port 2 Module Power** connector.
12. Connect the remaining cable plugs to the appropriate connectors on the **Test Set Port 2 Module** connectors for **RF**, **LO**, **Test IF**, and **Ref IF**. Torque each cable connection to 8 lbf · in.
13. Route the cable to the right side **3742A-EA WR-10 T-R Module** and connect the leads to the appropriate connectors for **Ref IF**, **RF**, **Power**, **LO**, and **Test IF**. Torque each cable connection to 8 lbf · in.

2-16 Connecting the Test Set to the Coupler/Combiners

Note	Skip all steps in this section if assembling a millimeter wave system.



1 – Port 1 b1 Input Port – Arrow points toward the port.
2 – Port 2 b2 Input Port – Arrow points toward the port.

Figure 2-14. VNA b1 and b2 Input Port Locations

14. Remove and safely store the **b1 Test Loop** and the **b2 Test Loop** from the VNA front panel. See Figure 2-14 above for location of the test loops, the **<-- b1 input port**, and the **b2 --> input port**.

- The **VNA b1 input** port (callout 1) is the left-most connector on the VNA front panel. The **<-- b1** arrow points to this port.
- The **VNA b2 input** port (callout 2) is the right-most connector on the VNA front panel. The **b2 -->** arrow points to this port.

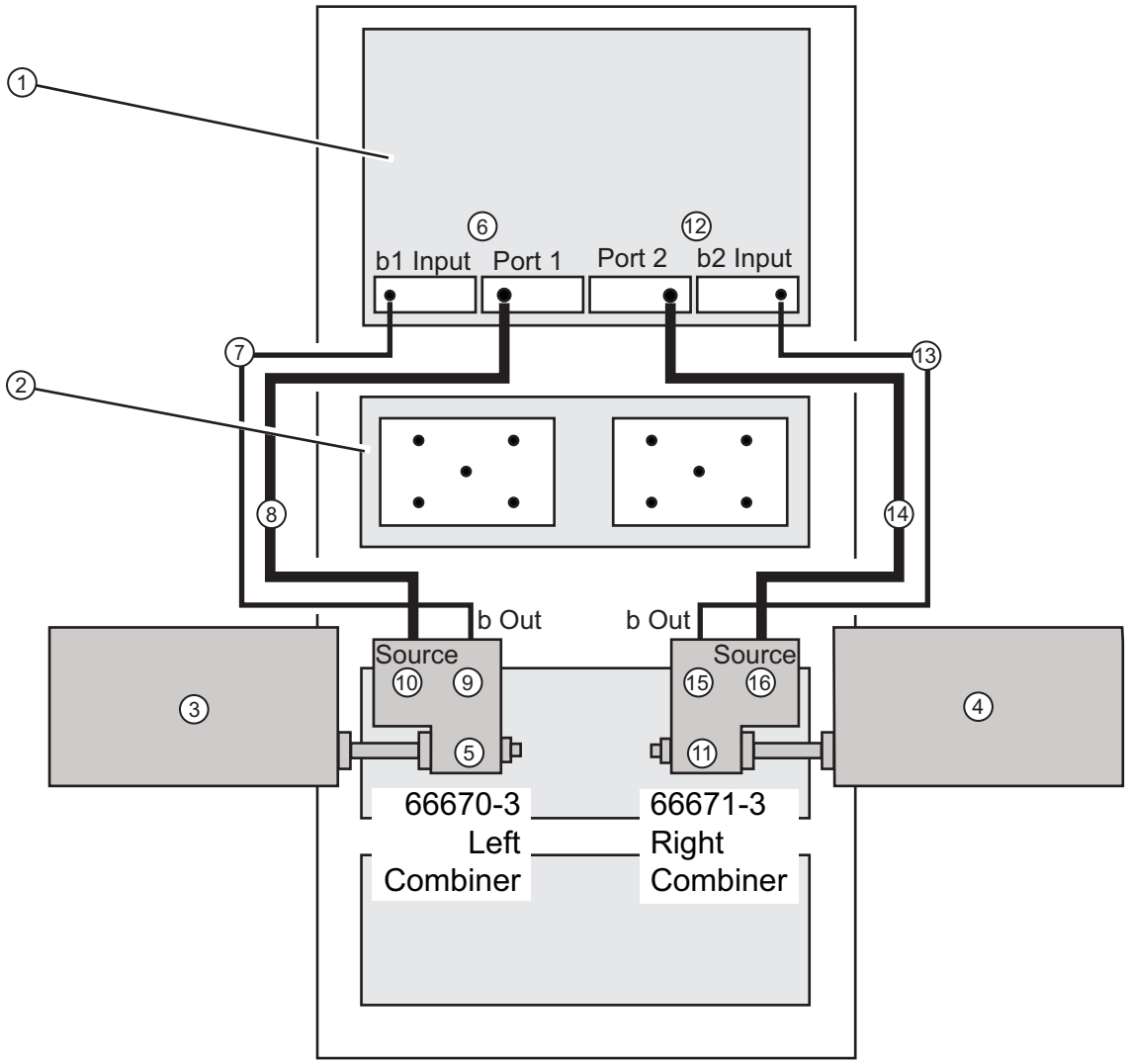


Figure 2-15. VNA to Combiner/Coupler Cable Connections (1 of 2)

Instruments

1 – VectorStar MS4640A Series VNA
2 – 3738A BB/mm Wave Test Set

3742A-EW T-R Modules

3 – 3742A-EW T-R Module (left side for Port 1)
4 – 3742A-EW T-R Module (right side for Port 2)

Left Side WR-10 Coupler/Combiner Module

5 – WR-10 Coupler/Combiner Module – 66670-3 – Left Side
6 – VNA b1 Input Port and Test Port 1
7 – b1 V (m-m) Cable Assembly – 806-207 – Between VNA Port 1 b1 Input and Left Combiner b Out
8 – P1/Source V (m-f) Cable Assembly – Between VNA Test Port 1 and Left Combiner Source.
9 – Left side WR-10 Coupler/Combiner Module Source connector
10 – Left side WR-10 Coupler/Combiner Module b Out connector

Right Side WR-10 Coupler/Combiner Module

11 – WR-10 Coupler/Combiner Module – 66671-3 – Right Side
12 – VNA Test Port 2 and b2 Input Port
13 – b2 V (m-m) Cable Assembly – 806-207 – Between VNA Port 2 b2 Input and Right Combiner b Out.
14– P2/Source V (m-f) Cable Assembly – Between VNA Test Port 2 and Right Combiner Source.
15 – Right side WR-10 Coupler/Combiner Module b Out connector
16 – Right side WR-10 Coupler/Combiner Module Source connector

Figure 2-15. VNA to Combiner/Coupler Cable Connections (2 of 2)

15. Connect the left side coupler/combiner to the VNA. Attach the **V Connector Male-Male Cable** 61 cm (24") (PN 806-207) to the extreme left side VNA **b1** connector, route the cable to the left side **66670-3 WR-10 Coupler/Combiner,** and connect it to the **b Out** connector.

16. Attach the **V Connector Male-Female Cable** 61 cm (24") (PN 806-206) to the left side VNA **P1 connector**, route the cable to the left side **66670-3 WR-10 Coupler/Combiner**, and connect it to the **Source** connector.

17. Connect the right side coupler/combiner to the VNA. Attach the second **V Connector Male-Male 806-207 Cable** to the extreme right side VNA **b2** connector, route the cable to the right side **66671-3 WR-10 Coupler/Combiner**, and connect it to the **b Out** connector.

18. Attach the second **V Connector Male-Female 806-206 Cable** to the right side VNA **P2** connector, route the cable to the right side **66671-3 WR-10 Coupler/Combiner**, and connect it to the **Source** connector.

19. Assembly is complete. The system is ready for initial checkout.

Chapter 3 — Initial System Checkout

3-1 Introduction

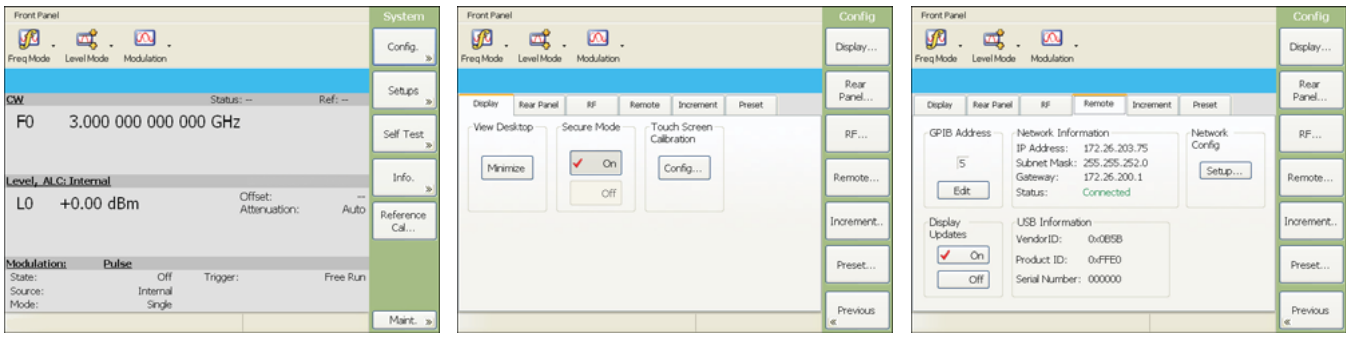
This chapter provides the general initial system checkout for a completely assembled broadband system. Once this procedure is complete, the system is ready for full calibration and system performance verification.

3-2 Power Up

1. Ensure AC main line supply to System Floor Console is turned ON.
2. Turn on the front panel power switches for the 3738A Test Set, the MG37022A LO Signal Generator (upper unit), and the MG37022A RF Signal Generator (lower unit).

3-3 Signal Generator GPIB Settings

1. Set the **LO Synthesizer** (the upper **MG37022A Signal Generator**) to GPIB address of **4** using the steps below. The sequence of menus is shown in Figure 3-1 below.



MG 37022A Signal Generator Menus

1 – SYSTEM Menu
2 – CONFIG (CONFIGURATION) Menu | DISPLAY Tab
3 – CONFIG Menu | REMOTE Tab

Figure 3-1. Setting GPIB Address for MG37022A Signal Generator

2. On the **Signal Generator** front panel, press the **System** key. The System menu appears (Figure 3-1, callout 1).
3. Press the Config. soft key. The System Configuration menu appears (Figure 3-1, callout 2).
4. Press the Remote... soft key. The System Configuration Remote tab appears (Figure 3-1, callout 3).
5. In GPIB Address area, press Edit and then enter a new GPIB address of **4** using the data entry keypad.
6. When done, press the front panel **Enter** key. The **LO Synthesizer** is set to GPIB Address **4**.
7. Set the **RF Synthesizer** (the lower unit) to a GPIB address of 5 by repeating Step 2 through Step 6 above for GPIB Address **5**.

Note	For additional information on configuring the MG3702xA Synthesized Signal Generator, refer to the instrument Operation Manual, PN: 10370-10370.

3-4 VNA Broadband Configuration

Configure the VectorStar VNA for Broadband Operation by performing the following steps:

1. Turn on the VectorStar via front panel. Make sure a USB or PS2 mouse is connected to the VNA.
2. Depending on the instrument preset configuration, do either Step a or Step b below:
   a. If the VNA is configured to preset to the factory as-shipped default configuration:
   Press VNA front panel **Preset** button. The VNA resets to the factory-default configuration, then continue with Step 3.
   b. If the VNA has been configured to a user-defined preset:
   Use the right side menus to navigate to the PRESET SETUP menu, select the Default button, and then click the Preset icon on the icon toolbar. The VNA resets to the factory-default configuration. Continue with Step 3 below.

   MAIN | System | SYSTEM | Setup | SETUP | Preset Setup | PRESET SETUP
3. Select the APPLICATION menu and then select BB/mmWave
4. Select Multiple Source Setup, followed by Ext Source Control. The EXT. SRC CONTROL menu appears.
5. Ensure that both the Ext. Src (Source) 1 and Ext. Src 2 states are ACTIVE.

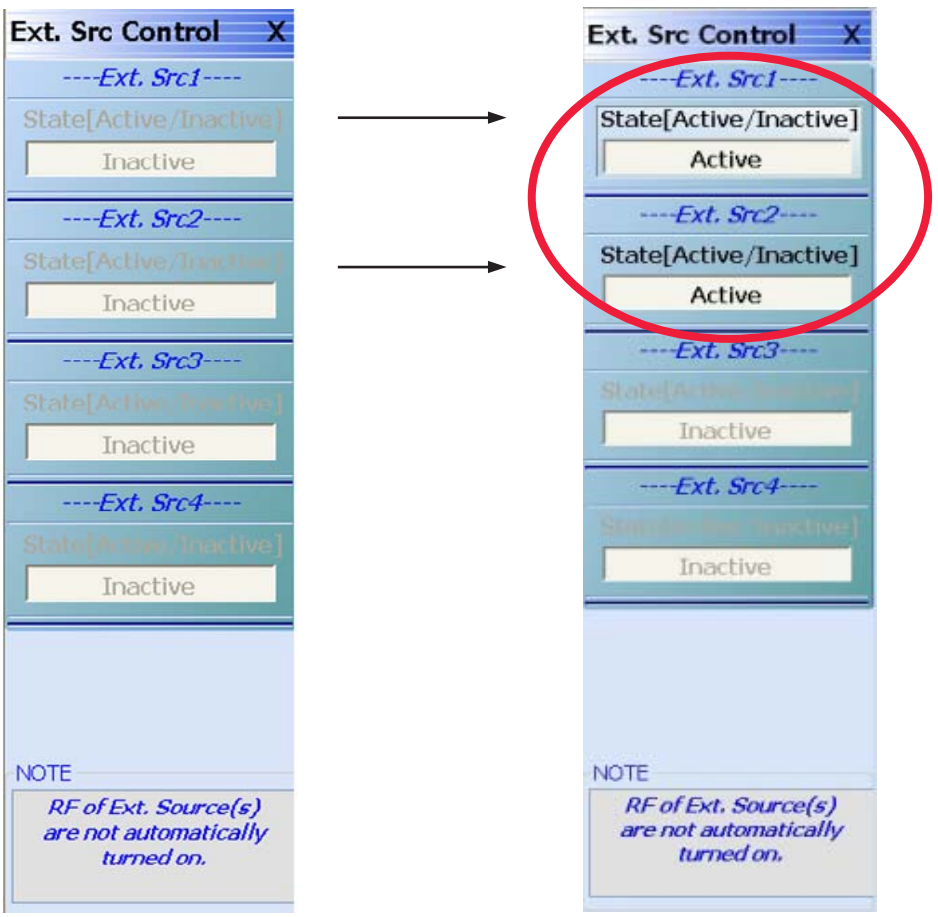


Figure 3-2. MS4640A Series VNA - EXT. SRC CONTROL (External Source Control) Menu

6. Navigate back to the MULTIPLE SOURCE menu

7. Toggle the Ext. Source Fast Trigger mode to ENABLED

Figure 3-3. MULTIPLE SOURCE Menu - Ext. (External) Source Fast Trigger Enabled

8. Navigate to the EXT. SRC ADDR. (EXTERNAL SOURCE ADDRESS) menu.

MAIN | System | SYSTEM | Remote Interface | REMOTE INTER. | Ext. Sources | EXT. SRC ADDR

9. Ensure that Ext. Source 1 is set to **4** and Ext. Source 2 is set to **5**

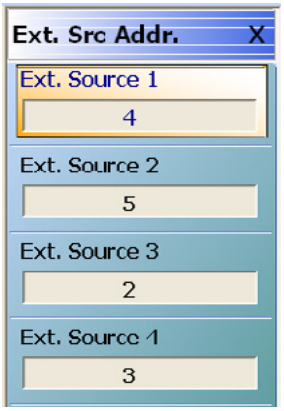


Figure 3-4. EXT. SRC ADDR (External Source Address) Menu

10. At the FREQUENCY menu, set the system Start Frequency to **10 MHz** and Stop Frequency to **110 GHz**.

11. The system should now be sweeping fully from 10 MHz to 110 GHz

3-5 ME7828A Configuration Verification

Procedure

1. Ensure system is sweeping from 10 MHz to 110 GHz, with Trace 1 set to S11, Trace 2 set to S12, Trace 3 set to S21, and Trace 4 set to S22.
2. Select Trace 1 and then select DISPLAY | Trace Format, and set to **Log Mag.**
3. Select the RESPONSE | User-defined. The USER-DEFINED menu appears. Set USER-DEFINED | Numerator to **a1**, Denominator to **1**, and Driver Port to **1**.
4. Using a mouse, move the Reference Line to one graticule below top scale
5. Repeat Steps #2 through #4 for Trace 2, setting: Numerator = **b2**, Denominator = **1**, Driver Port = **2**.
6. Repeat Steps #2 through #4 for Trace 3, setting: Numerator = **b1**, Denominator = **1**, Driver Port = **1**.
7. Repeat Steps #2 through #4 for Trace 4, setting: Numerator = **a2**, Denominator = **1**, Driver Port = **2**.
8. Adjust the **vernier** control on each 3742A-EW module to fully clockwise
9. Connect **shorts** to both W1 connectors on the MUX Combiners, and ensure the resultant display looks similar to Figure 3-5 below.

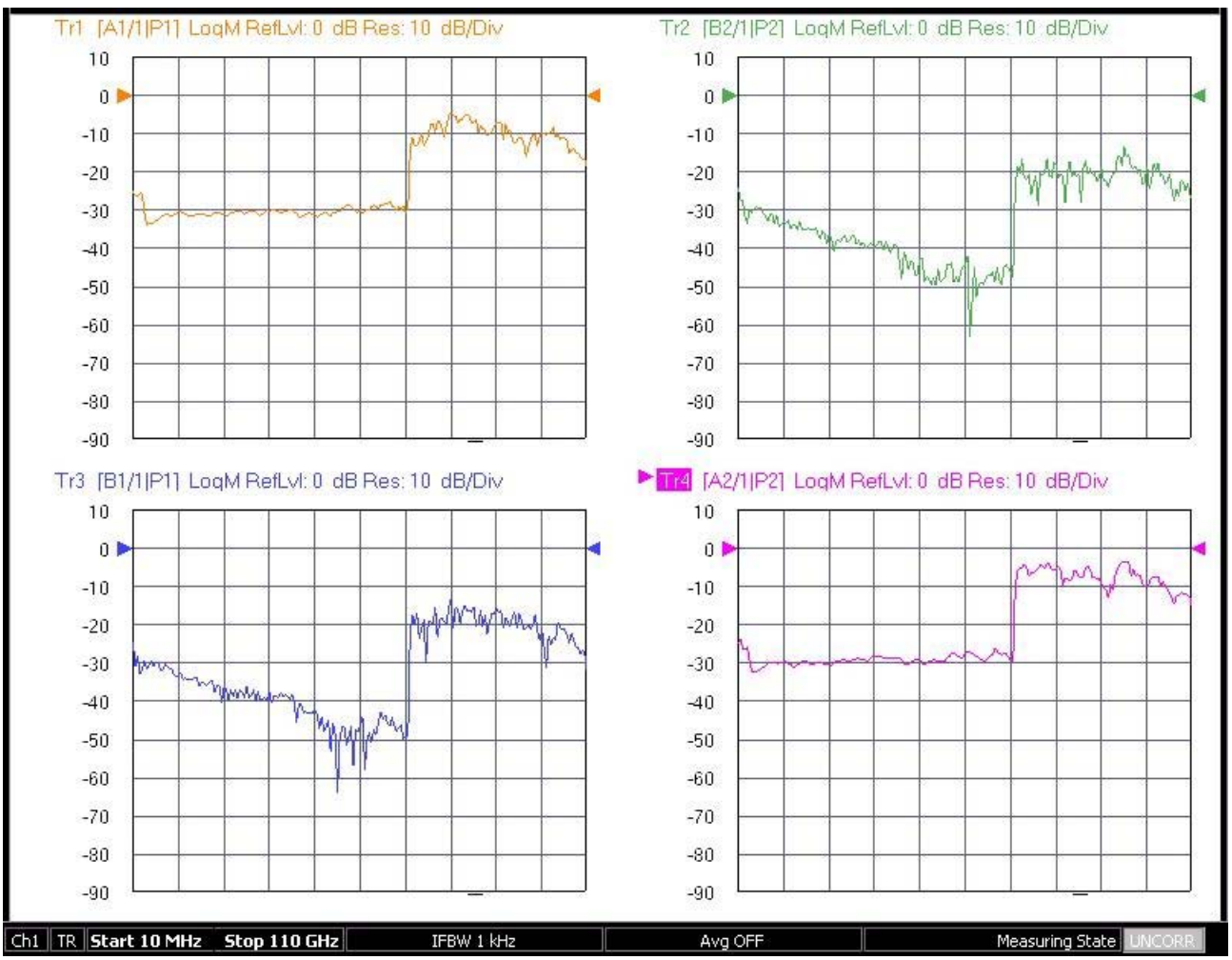


Figure 3-5. Typical VNA Four-Trace Display of Non-Ratioed Parameters for Initial Checkout

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Numerics

A

B

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I

L

M

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