VectorStar™ MN469xC Series Multiport Test Set

VectorStar MN4694C, K Connectors, for the MS4642A/B or MS4644A/B VNA
VectorStar MN4697C, V Connectors, for the MS4645A/B or MS4647A/B VNA
# Table of Contents

## Chapter 1—General Information

1-1 Introduction ................................................................. 1-1  
   Models ................................................................................. 1-1  
   Naming Conventions .......................................................... 1-1  
1-2 Identification Number ........................................................ 1-1  
1-3 Contacting Anritsu ............................................................ 1-1  
1-4 Related Manuals and Documentation ...................................... 1-2  
   Product Information, Compliance, and Safety ........................ 1-2  
   VectorStar™ MS464xB Series Vector Network Analyzers ............. 1-2  
   VectorStar ME7838 Series 2-Port BB/mmW VNA Measurement System . 1-2  
   VectorStar™ ME7838A4 Multiport BB/mm-Wave VNA Measurement System . 1-2  
   VectorStar MN469xC Series Multiport VNA Measurement System .... 1-2  
1-5 Calibration, Verification, and System Performance Verification .... 1-3  
1-6 VectorStar Multiport VNA System Overview ......................... 1-4  
1-7 Electrostatic Discharge (ESD) Prevention ............................. 1-7  
1-8 Recommended Test Equipment ............................................. 1-8  

## Chapter 2—Replaceable Parts

2-1 Introduction ................................................................. 2-1  
2-2 Exchange Assembly Program ............................................. 2-1  
2-3 Replaceable Parts ............................................................ 2-1  

## Chapter 3—Performance Verification

3-1 Introduction .................................................................... 3-1  
   Performance Verification Procedures ...................................... 3-1  
3-2 Traceability and Uncertainty ................................................ 3-2  
   First Tier of Uncertainty - The VNA Calibration ....................... 3-2  
   Second Tier of Uncertainty - Systematic Measurement Errors ...... 3-2  
   Third Tier of Uncertainty - Random Measurement Error ........... 3-2  
   Standards and Verification ................................................... 3-2  
3-3 Electrostatic Discharge Prevention ....................................... 3-3  
3-4 Calibration and Measurement Conditions ............................. 3-3  
3-5 S-Parameters Measurements Verification ............................... 3-4  
   Verification Result Determination ........................................ 3-4  
   Equipment Required ......................................................... 3-5  
   Special Precautions ......................................................... 3-6  
   Procedure ......................................................................... 3-6
Table of Contents (Continued)

3-6 Directivity and Test Port Match Verification .................................................. 3-7
   Equipment Required for VNA System with MN4694C ........................................... 3-7
   Equipment Required for VNA System with MN4697C ........................................... 3-7
   Procedure ........................................................................................................... 3-7

3-7 Test Port Power Verification .............................................................................. 3-17
   Equipment Required ............................................................................................ 3-17
   Procedure ........................................................................................................... 3-17

3-8 Noise Floor Verification ...................................................................................... 3-18

Chapter 4—Troubleshooting

4-1 Introduction ....................................................................................................... 4-1
4-2 General Safety Warnings ................................................................................... 4-1
4-3 Troubleshooting Strategy ................................................................................... 4-1
   Suggested Troubleshooting Steps ..................................................................... 4-1
4-4 Troubleshooting – Test Set Fails to Power Up .................................................... 4-2
   Line Source and Interface Checks .................................................................... 4-2
   Power Supply Voltage Check .......................................................................... 4-2
4-5 Troubleshooting – RF Switch Functional Check .................................................. 4-4
   Equipment Required for VNA System with MN4694C ........................................ 4-4
   Equipment Required for VNA System with MN4697C ........................................ 4-4
   Procedure ........................................................................................................... 4-4
4-6 Troubleshooting – Directivity and Test Port Match Failure ............................... 4-5
   Equipment Required for VNA System with MN4694C ........................................ 4-5
   Equipment Required for VNA System with MN4697C ........................................ 4-5
   Directivity Failure Troubleshooting Procedure ................................................. 4-5
   Test Port Match Failure Troubleshooting Procedure ........................................... 4-5

Chapter 5—Component Replacement

5-1 Introduction ....................................................................................................... 5-1
5-2 Equipment Required ........................................................................................... 5-1
5-3 Removing the Covers .......................................................................................... 5-2
5-4 Location of Major Components and Sub-assemblies ......................................... 5-3
5-5 GPIB-Parallel Interface PCB Replacement ....................................................... 5-4
5-6 Rear GPIB Connector PCB Replacement .......................................................... 5-5
5-7 Control PCB Assembly Replacement ................................................................ 5-7
5-8 Power Supply Replacement ............................................................................... 5-8
5-9 Low Band Switch ............................................................................................... 5-9
   A4 Replacement ................................................................................................ 5-9
   A5 Replacement ................................................................................................ 5-10
   A6 Replacement ................................................................................................ 5-11
   A7 Replacement ................................................................................................ 5-12
Table of Contents (Continued)

5-10 Low Band Bridge ................................................................. 5-13
   A20, A21 Replacement ......................................................... 5-13
5-11 High Band SPDT Switch Control PCB Assembly ...................... 5-14
   A12, A13, A18 or A19 Replacement ....................................... 5-14
5-12 High Band SPDT Switch Assembly ....................................... 5-15
   A12 Replacement .............................................................. 5-15
   A13 Replacement .............................................................. 5-16
   A18 Replacement .............................................................. 5-17
   A19 Replacement .............................................................. 5-18
5-13 Diplexer Assembly ......................................................... 5-19
   A8 Replacement .............................................................. 5-19
   A10 Replacement .............................................................. 5-20
5-14 Test Port Connector Replacement ....................................... 5-21
5-15 Port Coupler ................................................................. 5-22
   A14 Replacement .............................................................. 5-22
   A15 Replacement .............................................................. 5-23
5-16 Fan Assembly Replacement .............................................. 5-24

Appendix A—Test Records

A-1 Introduction ................................................................. A-1
A-2 MN4694C Multiport VNA System Test Record ......................... A-2
   Instrument Information for MN4694C .................................. A-2
   S-Parameters Measurements Verification ................................ A-2
   Calibration Residuals Verification – Directivity and Test Port Match A-2
   Test Port Match for MN4694C VNA System ............................. A-3
   Test Port Power for MN4694C ............................................ A-3
   Noise Floor for MN4694C .................................................. A-3
A-3 MN4697C Multiport VNA System Test Record ......................... A-4
   Instrument Information for MN4697C .................................. A-4
   S-Parameters Measurements Verification ................................ A-4
   Calibration Residuals Verification – Directivity and Test Port Match A-4
   Test Port Match for MN4697C ............................................ A-5
   Test Port Power for MN4697C ............................................ A-5
   Noise Floor for MN4697C .................................................. A-5

Appendix B—Specifications

B-1 Technical Data Sheet ....................................................... B-1
Chapter 1 — General Information

1-1 Introduction
This manual provides general service and maintenance instructions for Anritsu MN469xC Series Multiport Test Set. It contains procedures for:

- Testing the system for proper operation
- Verifying System Performance in conjunction with a 2-port MS4640A or MS4640B VectorStar VNA
- Troubleshooting tests and techniques
- Locating and replacing failed parts in the MN469xC Series Test Set

Models
The MN469xC Series family includes two models:

- MN4694C – 70 kHz to 40 GHz, K Connectors, for MS4642A or MS4642B, and MS4644A or MS4644B VNA
  - MS4642A/B, K Connectors, 10 MHz to 20 GHz, 70 kHz with low frequency option
  - MS4644A/B, K Connectors, 10 MHz to 40 GHz, 70 kHz with low frequency option
- MN4697C – 70 kHz to 70 GHz, V Connectors, for MS4645A or MS4645B, and MS4647A or MS4647B VNA
  - MS4645A/B, V Connectors, 10 MHz to 50 GHz, 70 kHz with low frequency option
  - MS4647A/B, V Connectors, 10 MHz to 70 GHz, 70 kHz with low frequency option

Naming Conventions
Throughout this manual, the term “Test Set” is used interchangeably to refer to the MN469xC Series Multiport Test Set, the term “VNA” is used interchangeably to refer to MS464xA or MS464xB VectorStar Vector Network Analyzer, and the term “Multiport VNA System” is used interchangeably to refer to MS464xA/B VectorStar Vector Network Analyzer / MN469xC Test Set Multiport VNA System.

1-2 Identification Number
All Anritsu instruments are assigned an unique identification number (up to seven-digit), such as “090201” or “1010222”. This number appears on a decal affixed to the rear panel. Please use this identification number during any correspondence with Anritsu Customer Service about Anritsu instruments.

1-3 Contacting Anritsu
To contact Anritsu, please visit:
https://www.anritsu.com/contact-us

From here, you can select the latest sales, service and support contact information in your country or region, provide online feedback, complete a "Talk to Anritsu" form to get your questions answered, or obtain other services offered by Anritsu.

Updated product information can be found on your product page:

On this web page, you can select various tabs for more information about your instrument. Included is a “Library” tab which contains links to all the latest technical documentation related to this instrument.
1-4 Related Manuals and Documentation

All documents listed in this section are available on the VectorStar™ User Documentation USB Memory Device 2300-564-R, except for the Calibration, Verification, and System Performance Verification documents, which are included on a separate USB memory device included in each kit.

Product Information, Compliance, and Safety

- VectorStar Product Information, Compliance, and Safety (PICS) – 10100-00063

VectorStar™ MS464xB Series Vector Network Analyzers

- MS464xB Series VNA Technical Data Sheet – 11410-00611
- MS464xB Series VNA Operation Manual – 10410-00317
- MS464xB Series VNA Measurement Guide – 10410-00318
- MS464xB Series VNA User Interface Reference Manual – 10410-00319
- MS464xB Series VNA Maintenance Manual – 10410-00320
- MS464xB Series VNA Programming Manual – 10410-00322
- MS464xB Series VNA Programming Manual Supplement – 10410-00323
- MS464xB Series VNA User Help System – 10450-00040
- MS464xB Series VNA User Documentation USB Memory Device 2300-564-R

VectorStar ME7838 Series 2-Port BB/mmW VNA Measurement System

- ME7838A Modular BB/mm-Wave Technical Data Sheet (TDS) – 11410-00593
- ME7838D Modular BB/mm-Wave Technical Data Sheet (TDS) – 11410-00778
- ME7838E Modular BB/mm-Wave Technical Data Sheet (TDS) – 11410-00767
- ME7838A Modular BB/mm-Wave Quick Start Guide (QSG) – 10410-00292
- ME7838D Modular BB/mm-Wave Quick Start Guide (QSG) – 10410-00732
- ME7838E Modular BB/mm-Wave Quick Start Guide (QSG) – 10410-00729
- ME7838A Modular BB/mm-Wave Installation Guide (IG) – 10410-00293
- VectorStar Broadband/Banded Millimeter-Wave Modules (RM) – 10410-00311
- ME7838 Series Modular BB/mm-Wave Maintenance Manual (MM) – 10410-000306

VectorStar™ ME7838A4 Multiport BB/mm-Wave VNA Measurement System

- ME7838A4 4-Port Broadband VNA Technical Data Sheet (TDS) – 11410-00704
- ME7838A4 4-Port Broadband VNA Quick Start Guide (QSG) – 10410-00735
- ME7838A4 4-Port Broadband VNA Installation Guide (IG) – 10410-00734
- ME7838A4 4-Port Broadband VNA Maintenance Manual (MM) – 10410-00736
- Broadband/Banded Millimeter-Wave Module Reference Manual (RM) – 10410-00311

VectorStar MN469xC Series Multiport VNA Measurement System

- MN469xC Series Multiport VNA Measurement System Technical Data Sheet – 11410-00777
- MN469xC Series Multiport Test Set Installation Guide – 10410-00737
- MN469xC Series Multiport Test Set Quick Start Guide – 10410-00738
- MN469xC Series Multiport Test Set Maintenance Manual – 10410-00730
Calibration, Verification, and System Performance Verification

- MN4765B O/E Calibration Module Technical Data Sheet (TDS) – 11410-00843
- MN4765B O/E Calibration Module Operation Manual (OM) – 10410-00742
- 365xx-x Mechanical Calibration Kit Reference Manual – 10410-00278
- 366X-1 Verification Kits (3666-1 3.5mm Connectors, 3668-1 K Connectors, 3669B-1 V Connectors) and 2300-579 Performance Verification Software (PVS) User Guide – 10410-00270
- 366X-1 Verification Kit and 2300-579 PVS Quick Start Guide – 10410-00285
- 3659 Calibration/Verification Kit and 2300-580 Performance Verification Software (PVS) User Guide for BB-mmW ME7838D with 0.8 mm Connectors – 10410-00327
1-5 VectorStar Multiport VNA System Overview

An overall block diagram of the VectorStar Multiport VNA system is shown in Figure 1-1.

The Anritsu MN469xC Series Multiport Test Set provides multiple test port capabilities for the Anritsu VectorStar MS464xB/MS464xA Series Vector Network Analyzer. The MN469xC Series Test Set contains a switch matrix and switch matrix controller that facilitates multiple test port connections to the device under test. The test set is controlled by the connected VectorStar VNA (except for power on/off) via the IEEE-488 General Purpose Interface Bus (GPIB).

The MN469xC Series Test Sets only contribute loss to the source and test paths, and uncorrected (raw) port directivity and match. Therefore, system performance is specified when connected to a base 2-port VectorStar VNA with option 51 (Direct Access Loops). If additional options are added to the base VectorStar VNA that affect its port performance, those effects must also be added to these system specifications. Specifically, adding option 6x, Active Measurement Suites will affect available test port power and dynamic range.
1-6  MN469xC Multiport Test Set Functional Description

A block diagram of the MN469xC Series Multiport Test Set is shown in Figure 1-2.

---

The VectorStar VNA sends switch control commands via the GPIB bus to the GPIB to Parallel Digital Interface PCB Assembly in the test set. The logic in this PCB is translated by the 4-Port Test Set Control PCB to the appropriate levels at any given time to control each one of the SPDT RF switches in the test set.
The MN469xC test set contains eight SPDT RF switches. Four switches, A4, A5, A6 and A7, operate in low band frequencies below 2.5 GHz. Four switches, A12, A13, A18 and A19, operate in high band frequencies from 2.5 GHz and beyond.

Any one or two test ports may be selected for forward and/or reverse measurements. There is an LED above each test port (Ports 3 and 4). When the connection paths are set via GPIB commands, the test port LEDs will light according to the connections. A lit LED over a test port indicates that it is selected as an active test port.

There is an LED next to the Power switch. When AC power is first applied, the Power LED will light.

**Low Band Operation – 70 kHz to 2.5 GHz**

The A4 Low Band Switch routes the stimulus signal from the VectorStar VNA Low Band Source 2 Output to either Port 3 through the A20 Port 3 Low Band Bridge, A8 Diplexer/Bias Tee Assembly and then A14 Port 3 Coupler or to Port 4 through the A21 Port 4 Low Band Bridge, A10 Diplexer/Bias Tee Assembly and then A15 Port 4 Coupler.

The A6 Low Band Switch routes the stimulus signal from the VectorStar VNA Low Band Source 1 to either Port 1 or Port 2 back on the host VNA. It does this by routing back into the source loops so the VNA bridges/couplers are employed.

The reflected or transmitted signal measured at Port 3 passes directly through the A14 Port 3 Coupler and A8 Diplexer/Bias Tee Assembly, and then is coupled via the A20 Low Band Bridge to the A5 Low Band Switch.

The reflected or transmitted signal measured at Port 4 passes directly through the A15 Port 4 Coupler and A10 Diplexer/Bias Tee Assembly, and then is coupled via the A21 Low Band Bridge to the A5 Low Band Switch.

The A5 Low Band Switch routes the measured reflected or transmitted signal from either Port 3 or Port 4 to the VectorStar VNA Low Band b2 Input.

Reflected or transmitted signals arriving at ports 1 or 2 are coupled within the host VNA and the b1 or b2 signals are routed to the A7 Low Band Switch where they are multiplexed onto the VNA's b1 input.

**High Band Operation – 2.5 GHz and beyond**

The A12 High Band Switch routes the stimulus signal from the VectorStar VNA Low Band Source 2 Output to either Port 3 through the A8 Diplexer/Bias Tee Assembly and then A14 Port 3 Coupler or to Port 4 through the A10 Diplexer/Bias Tee Assembly and then A15 Port 4 Coupler.

The A19 High Band Switch routes the stimulus signal from the VectorStar VNA High Band Source 1 to either Port 1 or Port 2 back on the host VNA. It does this by routing back into the source loops so the VNA bridges/couplers are employed.

The reflected or transmitted signal measured at Port 3 is coupled via the A14 Port 3 Coupler to the A13 High Band Switch.

The reflected or transmitted signal measured at Port 4 is coupled via the A15 Port 4 Coupler to the A13 High Band Switch.

Reflected or transmitted signals arriving at Ports 1 or 2 are coupled within the host VNA and the b1 or b2 signals are routed to the A13 High Band Switch where they are multiplexed onto the VNA's b1 input.

The A18 High Band Switch routes the measured reflected or transmitted signal from either Port 3 or Port 4 to the VectorStar VNA High Band b2 Input.
1-7 Electrostatic Discharge (ESD) Prevention

All electronic devices, components, and instruments can be damaged by electrostatic discharge. It is important to take preventive measures to protect the instrument and its internal subassemblies from electrostatic discharge.

An ESD safe work area and proper ESD handling procedures that conform to ANSI/ESD S20.20-1999 or ANSI/ESD S20.20-2007 is mandatory to avoid ESD damage when handling subassemblies or components found in the MN469xC Series test sets.

Take steps to eliminate the static charges built-up on coaxial cables prior to connecting them to the VNA System test ports. This can be done by terminating one end of the cable with the short from the calibration kit and then grounding the outer conductor of the connector of the cables.
1-8 Recommended Test Equipment

Below, Table 1-1 provides a list of recommended test equipment needed for the performance verification and troubleshooting procedures presented in this manual.

Table 1-1. Recommended Test Equipment List (1 of 2)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Critical Specification</th>
<th>Recommended Manufacturer and Model</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration Kit</td>
<td>Connector Type: K</td>
<td>Anritsu Model 3652A</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Through Cable</td>
<td>Frequency: DC to 40 GHz Connector Type: K male to K female</td>
<td>Anritsu Model 3670K50-2 (Qty 2)</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Verification Kit</td>
<td>Connector Type: K</td>
<td>Anritsu Model 3668-1</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Adapter</td>
<td>Type: V female to K female</td>
<td>Anritsu Model 34VFKF50</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Adapter</td>
<td>Type: K male to K female</td>
<td>Anritsu Model 33KKF50B (Qty 2)</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Air Line</td>
<td>Connector Type: K</td>
<td>Anritsu Model SC7760</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Offset Termination</td>
<td>Return Loss: 20 dB Connector Type: K female</td>
<td>Anritsu Model SC4808 or SC7888</td>
<td>MN4694C</td>
</tr>
<tr>
<td>Calibration Kit</td>
<td>Connector Type: V</td>
<td>Anritsu Model 3654D</td>
<td>MN4697C</td>
</tr>
<tr>
<td>Extension Cable</td>
<td>Frequency: DC to 70 GHz Connector Type: V male to V female</td>
<td>Anritsu Model 3670V50A-2 (Qty 2)</td>
<td>MN4697C</td>
</tr>
<tr>
<td>Verification Kit</td>
<td>Connector Type: V</td>
<td>Anritsu Model 3669B-1</td>
<td>MN4697C</td>
</tr>
<tr>
<td>Adapter</td>
<td>Type: V male to V female</td>
<td>Anritsu Model 33VVF50C (Qty 2)</td>
<td>MN4697C</td>
</tr>
<tr>
<td>Air Line</td>
<td>Connector Type: V</td>
<td>Anritsu Model T2025-2</td>
<td>MN4697C</td>
</tr>
<tr>
<td>Offset Termination</td>
<td>Return Loss: 20 dB Connector Type: V female</td>
<td>Anritsu Model SC5727</td>
<td>MN4697C</td>
</tr>
<tr>
<td>Power Meter</td>
<td>Power Range: −70 to +20 dBm</td>
<td>Anritsu Model ML2437A or ML2438A</td>
<td>All Models</td>
</tr>
<tr>
<td>Power Sensor</td>
<td>Frequency: 70 kHz to 70 GHz Connector Type: V male</td>
<td>Anritsu Model SC7770</td>
<td>All Models</td>
</tr>
<tr>
<td>Adapter</td>
<td>Type: N male to V female</td>
<td>Pasternack Model PE9720</td>
<td>All Models</td>
</tr>
<tr>
<td>PC Controller</td>
<td><strong>Configuration:</strong></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>– 1 gigahertz (GHz) or faster</td>
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<tr>
<td></td>
<td>– 32-bit (x86) or 64-bit (x64) processor</td>
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<tr>
<td></td>
<td>– At least 2 GB RAM</td>
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<td></td>
<td>– Windows 7 (32-bit or 64-bit)</td>
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</tr>
<tr>
<td></td>
<td>– 20 MB Hard disk free space</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– 1024x768 Display Resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– CD-ROM Drive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– USB 2.0 Type A Port</td>
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<tr>
<td></td>
<td>– National Instruments</td>
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<tr>
<td></td>
<td>– GPIB Controller and Driver</td>
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<tr>
<td></td>
<td>– National Instruments</td>
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<tr>
<td></td>
<td>– NI-VISA Version</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Models</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1-1. Recommended Test Equipment List (2 of 2)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Critical Specification</th>
<th>Recommended Manufacturer and Model</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Software</td>
<td>–</td>
<td>Anritsu 2300-531-R</td>
<td>All Models</td>
</tr>
<tr>
<td>Torque Wrench</td>
<td>5/16&quot; (8 mm) Torque End Wrench, set to 8 lbf · in (0.9 N · m)</td>
<td>Anritsu 01-201, use with 01-204 below.</td>
<td>All Models</td>
</tr>
<tr>
<td>Torque Wrench</td>
<td>1/2&quot; (12.7 mm) Torque End Wrench, set to 36 lbf · in (4.063 N · m)</td>
<td>Mountz MTBN10 or equivalent with 1/2&quot; socket.</td>
<td>All Models</td>
</tr>
<tr>
<td>Torque Wrench</td>
<td>13/16&quot; (20.6 mm) Torque Socket Wrench, set to 15 lbf · ft (20.34 N · m)</td>
<td>Craftsman 009-44594 or equivalent with 13/16&quot; deep socket on 3/8&quot; (9.525 mm) drive</td>
<td>All Models</td>
</tr>
<tr>
<td>End Wrench</td>
<td>5/16&quot; (8 mm) End Wrench</td>
<td>Anritsu 01-204, use with 01-201 above</td>
<td>All Models</td>
</tr>
</tbody>
</table>
Chapter 2 — Replaceable Parts

2-1  Introduction
This chapter provides replaceable parts information for MN469xC Series Multiport Test Sets.

2-2  Exchange Assembly Program
Anritsu maintains a module exchange program for selected subassemblies. If a malfunction occurs in one of these sub-assemblies, the defective item can be exchanged. Upon receiving your request, Anritsu will ship the exchange subassembly to you. You then have 45 days in which to return the defective item. All exchange subassemblies or RF assemblies are warranted for 90 days from the date of shipment, or for the balance of the original equipment warranty, whichever is longer.

Please have the exact model number and serial number of your equipment available when requesting this service, as the information about your equipment is filed according to the instrument model and serial number. For more information about this program, contact your local Anritsu Service Center.

2-3  Replaceable Parts

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Part Description – Drawing “A” Number</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-989</td>
<td>GPIB-Parallel Interface PCB Assembly</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-2000-989</td>
<td>GPIB-Parallel Interface PCB Assembly</td>
<td>All Models; RoHS compliant</td>
</tr>
<tr>
<td>ND70926&lt;R&gt;</td>
<td>High Band SPDT Switch Control PCB Assembly – Mounts on top of A12, A13, A18, A19</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-ND70926&lt;R&gt;</td>
<td>High Band SPDT Switch Control PCB Assembly – Mounts on top of A12, A13, A18, A19</td>
<td>All Models; RoHS compliant</td>
</tr>
<tr>
<td>ND70927&lt;R&gt;</td>
<td>Control PCB Assembly</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-ND70927&lt;R&gt;</td>
<td>Control PCB Assembly</td>
<td>All Models; RoHS compliant</td>
</tr>
<tr>
<td>3-40-183</td>
<td>Power Supply</td>
<td>All Models</td>
</tr>
<tr>
<td>ND70078&lt;R&gt;</td>
<td>Low Band Bridge – A20, A21</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-64016&lt;R&gt;</td>
<td>Low Band Bridge – A20, A21</td>
<td>All Models; RoHS compliant</td>
</tr>
</tbody>
</table>

Note: Instruments shipped to European Union countries after 22nd July, 2017 are compliant with the requirements in the RoHS Directive, officially known as Directive 2011/65/EU. RoHS compliant replacement parts must be used to repair RoHS compliant instruments.

Table 2-1 lists the replaceable parts found in the MN469xC Series Test Set. See Figure 2-1 for locations.
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Part Description – Drawing “A” Number</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND70079&lt;R&gt;</td>
<td>Low Band Switch – A4, A5, A6, A7</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-ND70079&lt;R&gt;</td>
<td>Low Band Switch – A4, A5, A6, A7</td>
<td>All Models; RoHS compliant</td>
</tr>
<tr>
<td>70241&lt;R&gt;</td>
<td>High Band SPDT Switch Assembly, V Connector, 70 GHz – A12, A13, A18, A19</td>
<td>MN4697C; non-RoHS compliant</td>
</tr>
<tr>
<td>3-70241&lt;R&gt;</td>
<td>High Band SPDT Switch Assembly, V Connector, 70 GHz – A12, A13, A18, A19</td>
<td>MN4697C; RoHS compliant</td>
</tr>
<tr>
<td>70242&lt;R&gt;</td>
<td>High Band SPDT Switch Assembly, K Connector, 40 GHz – A12, A13, A18, A19</td>
<td>MN4694C; non-RoHS compliant</td>
</tr>
<tr>
<td>3-70242&lt;R&gt;</td>
<td>High Band SPDT Switch Assembly, K Connector, 40 GHz – A12, A13, A18, A19</td>
<td>MN4694C; RoHS compliant</td>
</tr>
<tr>
<td>74278&lt;R&gt;</td>
<td>Diplexer Assembly, V Connector, 70 GHz – A8, A10</td>
<td>MN4697C; non-RoHS compliant</td>
</tr>
<tr>
<td>3-74278&lt;R&gt;</td>
<td>Diplexer Assembly, V Connector, 70 GHz – A8, A10</td>
<td>MN4697C; RoHS compliant</td>
</tr>
<tr>
<td>74277&lt;R&gt;</td>
<td>Diplexer Assembly, K Connector, 40 GHz – A8, A10</td>
<td>MN4694C; non-RoHS compliant</td>
</tr>
<tr>
<td>3-74277&lt;R&gt;</td>
<td>Diplexer Assembly, K Connector, 40 GHz – A8, A10</td>
<td>MN4694C; RoHS compliant</td>
</tr>
<tr>
<td>66245&lt;R&gt;</td>
<td>Port Coupler, V Connector, 70 GHz – A14, A15</td>
<td>MN4697C; non-RoHS compliant</td>
</tr>
<tr>
<td>3-66245&lt;R&gt;</td>
<td>Port Coupler, V Connector, 70 GHz – A14, A15</td>
<td>MN4697C; RoHS compliant</td>
</tr>
<tr>
<td>66480&lt;R&gt;</td>
<td>Port Coupler, K Connector, 40 GHz – A14, A15</td>
<td>MN4694C; non-RoHS compliant</td>
</tr>
<tr>
<td>3-66480&lt;R&gt;</td>
<td>Port Coupler, K Connector, 40 GHz – A14, A15</td>
<td>MN4694C; RoHS compliant</td>
</tr>
<tr>
<td>34YK50C</td>
<td>K Test Port Connector – Mounts on A14, A15</td>
<td>MN4694C</td>
</tr>
<tr>
<td>34YV50C</td>
<td>V Test Port Connector – Mounts on A14, A15</td>
<td>MN4697C</td>
</tr>
<tr>
<td>3-62109-42</td>
<td>RF Cable, V Connector, VNA to Test Set, Front Panel</td>
<td>MN4697C</td>
</tr>
<tr>
<td>3-67357-38</td>
<td>RF Cable, K Connector, VNA to Test Set, Front Panel</td>
<td>MN4694C</td>
</tr>
<tr>
<td>62112-80</td>
<td>RF Cable, SMA Connector, VNA Bx to Test Set Bx, Rear Panel</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-62112-80</td>
<td>RF Cable, SMA Connector, VNA Bx to Test Set Bx, Rear Panel</td>
<td>All Models; RoHS compliant</td>
</tr>
<tr>
<td>62112-81</td>
<td>RF Cable, SMA Connector, VNA Src to Test Set Src, Rear Panel</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-62112-81</td>
<td>RF Cable, SMA Connector, VNA Src to Test Set Src, Rear Panel</td>
<td>All Models; RoHS compliant</td>
</tr>
<tr>
<td>Part Number</td>
<td>Part Description – Drawing “A” Number</td>
<td>Use</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>ND71327</td>
<td>Fan Assembly, Rear Panel</td>
<td>All Models; non-RoHS compliant</td>
</tr>
<tr>
<td>3-ND83592</td>
<td>Fan Assembly, Rear Panel</td>
<td>All Models; RoHS compliant</td>
</tr>
</tbody>
</table>
See Table 2-1, “Replaceable Parts List” on page 2-1 for identification of Replacement Part Numbers.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply</td>
<td>A10</td>
<td>Diplexer/Bias-Tee</td>
</tr>
<tr>
<td>2</td>
<td>Cooling Fan Assembly</td>
<td>A12</td>
<td>High Band SPDT Switch</td>
</tr>
<tr>
<td>3</td>
<td>Control PCB Assembly</td>
<td>A13</td>
<td>High Band SPDT Switch</td>
</tr>
<tr>
<td>4</td>
<td>GPIB–Parallel Interface Board</td>
<td>A14</td>
<td>Port Coupler</td>
</tr>
<tr>
<td>5</td>
<td>Test Port Connectors</td>
<td>A15</td>
<td>Port Coupler</td>
</tr>
<tr>
<td>A4</td>
<td>Low Band Switch</td>
<td>A18</td>
<td>High Band SPDT Switch</td>
</tr>
<tr>
<td>A5</td>
<td>Low Band Switch</td>
<td>A19</td>
<td>High Band SPDT Switch</td>
</tr>
<tr>
<td>A6</td>
<td>Low Band Switch</td>
<td>A20</td>
<td>Low Band Bridge</td>
</tr>
<tr>
<td>A7</td>
<td>Low Band Switch</td>
<td>A21</td>
<td>Low Band Bridge</td>
</tr>
<tr>
<td>A8</td>
<td>Diplexer/Bias-Tee</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2-1. Location of Major Components and Subassemblies
Chapter 3 — Performance Verification

3-1 Introduction

This chapter contains procedures that can be used to verify the performance of the VectorStar Multiport Vector Network Analyzer System which comprises the MS464xA/B VNA and MN469xC Test Set.

There are many levels to the concept of VNA “verification” that ultimately is a comparison against expected behaviors.

- On the explicit VNA hardware level are operational checkout items such as port power and noise levels.
- On the calibrated instrument level (which includes the VNA and the calibration kit or AutoCal Automatic Calibrator) are the residual specifications (corrected directivity, source match, load match, and tracking) that are measured using traceable airlines (absolute impedance standards).
- An intermediate level that can look at overall system behavior (VNA, calibration kit, cables, environment) in a traceable fashion is through the use of a verification kit. While not intended for day-to-day use, the verification kit can provide a periodic check on system behavior without going through the rigor needed for full residual analysis (which can usually be done less often).

While there are many ways of verifying VNA performance, sometimes simpler procedures are desired. The use of a verification kit, available from Anritsu, is a simpler method of verifying the measurement capabilities of the instrument by analyzing the measurement of artifacts that are traceable to national standards laboratories.

Performance Verification Procedures

The procedures include the following tests:

- “S-Parameters Measurements Verification” on page 3-4 or “Directivity and Test Port Match Verification” on page 3-7
- “Test Port Power Verification” on page 3-17
- “Noise Floor Verification” on page 3-18

Note: As the MN469xC Series Test Set provides multiple test port capabilities for the Anritsu VectorStar MS464xA or MS464xB Series Vector Network Analyzer, they do not have any performance specifications separate from the VectorStar VNA. Therefore, MN469xC Test Set must be verified with a 2-port VectorStar VNA as a system. The frequency range that can be verified will be limited by the 2-port VectorStar VNA.

Note: The 2-port VectorStar VNA should be verified as a stand-alone unit. Consult the VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268, or the VectorStar MS4640B Series VNA Maintenance Manual – 10410-00320 prior to performing these system tests.
3-2 Traceability and Uncertainty

Vector network analyzers (VNAs) are precision instruments for making high frequency and broadband measurements in devices, components, and instrumentations. The accuracy of these measurements is affirmed by demonstrated and adequate traceability of measurement standards. Metrological traceability, per International vocabulary of metrology, JCGM 200:2008, is property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty. For the accuracy of VNAs and quality assurance by users, two standard approaches were created to ensure sound metrology traceability. One is to construct tight uncertainty budget and specifications in three tiers from the ground up, and the other is to develop a calibration hierarchy for systematic verification. The three-tier process is depicted in the following sections.

First Tier of Uncertainty - The VNA Calibration

A traceable VNA itself for coverage from 70 kHz to 70 GHz requires proper calibration for several key quantities, e.g., frequency, power level, and high level noise, via traceable standards to the SI units. Each contributing uncertainty was evaluated at the time of instrument calibration.

The inception of a precision VNA is accuracy-enhanced 50 ohm impedance, which is characterized in lieu of coaxial transmission lines all with proper propagation properties throughout the whole measurement system, including the device-under-test. A transmission line for VNAs is best represented by a coaxial airline, which was precisely selected and machined based on the electromagnetic properties such as conductivity and skin depth, etc. Therefore, the dimensional measurement accuracy of the airline gives out the first tier of measurement uncertainty of impedance quantity.

Second Tier of Uncertainty - Systematic Measurement Errors

The second tier of uncertainty, corrected or residual uncertainty, is the result of the accuracy enhancement of VNA calibration to remove systematic errors. Systematic measurement errors are components of measurement error that, in replicate measurements, remains constant or varies in a predictable manner. This accuracy enhancement is usually the function of calibration kits. The choice of calibration kits used will dictate the level of uncertainties for the intended measurements or applications.

Third Tier of Uncertainty - Random Measurement Error

The third tier of uncertainty is random measurement error that, in replicate measurements, varies in an unpredictable manner. The examples are connector repeatability and cable stability, etc. Random measurement error equals measurement error minus systematic measurement error.

Standards and Verification

Most often, instrument end users demand system verifications in order to provide a quality check or assurance. This is accomplished by utilizing a set of known or characterized devices, e.g., verification kit, for comparison. It can also be done by using devices that are different from the calibration kit. The calibration hierarchy of verification uncertainty is built through unbroken chain comparisons with the national standards.

- Physical standards → airline dimensionality → impedance standard → residuals and port parameters
- Basic power standards → power sensors → power accuracy specifications
- Basic time standards → frequency reference source → frequency accuracy
3-3  Electrostatic Discharge Prevention

All electronic devices, components, and instruments can be damaged by electrostatic discharge. Thus, it is important to take preventative measures to protect the instrument from damage caused by electrostatic discharge.

Prior to connecting a test port cable to the VNA test port, take steps to eliminate the static charges built-up on the test port cable. This can be done by terminating the open-end of the cable with the short from the calibration kit and then grounding the outer conductor of the connector on the cable.

3-4  Calibration and Measurement Conditions

Extremes in the surrounding environmental conditions and the condition and stability of the test port connectors, through-cable, and calibration kit determine system measurement integrity to a large extent. These are all user controlled conditions, and as such, should be evaluated periodically for impact on system performance. If these conditions vary significantly with time, the system verification procedures should be performed more often than the recommended annual cycle.

The standard conditions specified below must be observed when performing any of the operations in this chapter – both during calibration and during measurement.

- Warm-up Time: 90 minutes
- Temperature: For System Verification, 23 °C ± 3 °C with < 1 °C variation from calibration temperature
  For other tests, 25 °C ± 5 °C
- Relative Humidity: 20 % to 50 % recommended
3-5 S-Parameters Measurements Verification

The following test verifies S parameter measurement capabilities of the MS4640A/B VNA, MN469xC Test Set, calibration kit, test port cable, and any required adapters as a system by analyzing the measurement of artifacts that are traceable to national standards laboratories. The procedures are automated by using the MS464XX System Verification software, which can be found on the USB memory device that is supplied with each 3668-1 or 3669B-1 Verification Kit.

The MS464XX System Verification software guides the user to perform a full 12 Term calibration on the 4-port VNA System by using the appropriate calibration tees, to measure the S parameters of the impedance transfer standards in the verification kit, and to verify that the measured values are within the specified measurement uncertainty limits.

The impedance transfer standards that are contained in the verification kit are:

- 20 dB Attenuation Standard
- 50 dB Attenuation Standard
- 50 ohm Air Line Standard
- 25 ohm Mismatch (Beatty) Standard

The devices in the verification kit are selected based on their ability to stress the envelope of possible measurement parameters while still providing a very stable and repeatable behavior. The key attribute of the devices is that of long term stability.

Verification Result Determination

The software verification process compares the measured S-parameter data of the impedance transfer standards against the original standard (characterization) data for those devices that was obtained using the Factory Standard MS464XX Vector Network Analyzer (at Anritsu).

The Factory Standard MS464XX system is traceable to NIST through the impedance Standards of the Anritsu Calibration laboratory. These standards are traceable to NIST through precision mechanical measurements, NIST-approved microwave theory impedance derivation methods, and electrical impedance comparison measurements.

At each frequency point, the verification measurement is compared to the characterization measurement in the context of the uncertainties. If the delta between the two measurements is consistent with the uncertainty window, the measurement is considered acceptable at that point.

The metric of comparison, termed $E_n$, is a check to see if the measurement differences are consistent with the uncertainty windows of both the characterization and the verification measurements. The quantity is shown in the formula below:

$$E_n = \frac{|X_{xy}^{\text{char}} - X_{xy}^{\text{ver}}|}{\sqrt{U_{xy}^{\text{char}}^2 + (U_{xy}^{\text{ver}})^2}}$$

where:

- The numerator contains the magnitude or phase of S-parameters measured during characterization (by Anritsu) and during verification (by the user).
- The denominator contains the respective uncertainties.

These uncertainties are calculated based on the VNA, the calibration kit, and repeatability. If this quantity $E_n$ is less than 1, then the measurements during the two phases are within the overlap of the uncertainties and one can consider the measurements “equivalent” and, in some sense, verified.
The quality of the verification result is dependent on the degree of care taken by the user in maintaining, calibrating, and using the system. The most critical factors are:

- The stability and quality of the devices in the calibration kit and the verification kit.
- The condition of the VNA test port connectors and test port cables.
- The pin depths of all connectors and the proper torquing of connections. These same factors also affect the VNA measurement quality.

Consult the reference manual supplied with Anritsu Calibration Kits and Verification Kits for proper use, care, and maintenance of the devices contained in these kits.

**Equipment Required**

- Personal Computer with Microsoft Windows Operating System
- National Instruments GPIB interface
- GPIB interface cable
- Anritsu Calibration Kit (refer to Table 3-1, “Required Calibration and Verification Equipment”)
- Anritsu Verification Kit (refer to Table 3-1)
- Anritsu Test Port Cables (refer to Table 3-1)

**Table 3-1. Required Calibration and Verification Equipment**

<table>
<thead>
<tr>
<th>Model</th>
<th>Calibration Kit</th>
<th>Verification Kit</th>
<th>Test Port Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS4644A/B+MN4694C</td>
<td>3652A</td>
<td>3668-1</td>
<td>3670K50-2 (Qty 2)</td>
</tr>
<tr>
<td>MS4644A/B+MN4694C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS4645A/B+MN4697C</td>
<td>3654D</td>
<td>3669B-1</td>
<td>3670V50A-2 (Qty 2)</td>
</tr>
<tr>
<td>MS4647A/B+MN4697C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note** The use of non-Anritsu calibration kits or verification kits is not supported.
Special Precautions

When performing the procedures, observe the following precautions:

- Minimize vibration and movement of the system, attached components, and test cable.
- Clean and check the pin depth and condition of all adapters, test port cables, calibration components, and impedance transfer standards.
- Pre-shape the test cable so as to minimize its movement during calibration and measurement activities.

Procedure

1. Set up the MS464XX VNA and MN469XC Test Set per the MN469xC Series Test Set Installation Guide, part number 10410-00737.
2. Power up the test set and VNA per the Power Up Sequence of the MN469xC Series Test Set Installation Guide. Allow the system to warm up at least 90 minutes.
3. Using the GPIB interface cable to connect the external computer/controller to the VNA rear panel system GPIB connector. It is the upper GPIB port labeled IEEE488.2 GPIB.
4. Power up the external computer/controller.
5. Install the female to female phase equal insertable adapter from the calibration kit to Port 1 of the MS464xx VNA. This converts Port 1 from a male test port to a female test port.
6. Install the female to female phase equal insertable adapter from the calibration kit to Port 3 of the MN469xC. This converts Port 3 from a male test port to a female test port.
7. Install the Test Port Cable to Port 2 of the MS464xx VNA and then the male to female phase equal insertable adapter from the calibration kit to the open end of the cable.
8. Install the Test Port Cable to Port 4 of the MN469xC and then the male to female phase equal insertable adapter from the calibration kit to the open end of the cable.
9. Run the MS464XX System Verification software.
10. Insert the USB memory device (also called a “USB flash drive”) supplied with the verification kit to an available USB port on the external computer/controller. Set the data location of the verification software to the USB memory device when prompted.
11. Follow the directions displayed on the computer to perform calibration with the appropriate calibration kit.
12. Follow the directions on the computer to perform measurements of impedance transfer standards of the appropriate verification kit.
13. Pass/Fail status of the measurements is displayed on the computer. The software can also provide a hard copy printout of the measured data, measurement uncertainties, and the impedance transfer standards used.
14. If the verification fails, check the connectors of the VNA test ports, calibration kit devices, the impedance transfer standards, and test port cables for damage, cleanliness, and proper connection and torquing. Also check the phase stability of the test port cables. These are the most common causes for verification failures.
### 3-6 Directivity and Test Port Match Verification

The following test can be used to verify the corrected directivity and port match of each test port of the VectorStar Multiport VNA System.

#### Equipment Required for VNA System with MN4694C
- Calibration Kit, K Connector, Anritsu Model 3652A
- Phase Equal Adapter, K(m) to K(f) Anritsu Model 33KKF50B (Qty 2; in addition to the two adapters in 3652A)
- Air Line, K Connector, Anritsu Model SC7760
- 20 dB Offset Termination, K(f) Connector, Anritsu Model SC4808 or SC7888

#### Equipment Required for VNA System with MN4697C
- Calibration Kit, V Connector, Anritsu Model 3654D
- Phase Equal Adapter, V(m) to V(f) Anritsu Model 33VVF50C (Qty 2; in addition to the two adapters in 3654D)
- Air Line, V Connector, Anritsu Model T2025-2
- 20 dB Offset Termination, V(f) Connector, Anritsu Model SC5727

#### Procedure

15. Install the MS464xA/B VNA on the MN469xC Test Set per the VectorStar MN469xC Multiport Test Set Installation Guide – 10410-00737. Power on the MN469xC Test Set first.

16. Install four Phase Equal Adapters on the two MN469xC test ports and on the two VNA test ports.

17. Power on the MN469xC Test Set.

18. Power on the MS464xA/B VNA and allow it to complete self test.

19. Allow both VNA and Test Set to warm up for at least one hour.

20. Preset the VNA.
   - Ensure that Trace 1 is set to S11, Trace 2 set to S12, Trace 3 set to S21, and Trace 4 set to S22.

21. Select Sweep Setup | Freq-based Seg. Sweep Setup

22. When the Freq-based Seg. Sweep Setup Table appears on the bottom of the display, do the following:
   - Enter the information into the Setup Table on the bottom of the VNA display per Table 3-2 on page 3-8 for MN4694C or Table 3-3 on page 3-8 for MN4697C.
   - Omit the frequency bands that are outside of the frequency coverage of the 2-port VectorStar VNA.
   - Select Add to add a new segment.

---

**Note**

Use the Anritsu 01-204 Torque Wrench to tighten the adapters to the MN469xC test ports so they will not loosen during the calibration steps and adversely affect the calibration quality.

**Note**

If the VNA is powered up before the test set, the VNA application will stay in 2-port mode and only 2-port mode features and functions will be available.
23. Select Save Table to File
   a. Enter the file name and click OK to save the Table.

24. Select Back | Sweep Type | Segmented Sweep (Freq-based)

25. Ensure that Tr1 is highlighted. If not, move the mouse pointer over Tr1 and click to select.

26. Select Display | Trace Format | Log Mag

27. Change Display Trace Format of Tr2, Tr3, Tr4 to Log Mag.

### Table 3-2. VectorStar VNA Segmented Sweep Setup for VNA System with MN4694C Test Set

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th># of Pts</th>
<th>IFBW</th>
<th>P1 Src Pwr</th>
<th>P2 Src Pwr</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 kHz</td>
<td>200 kHz</td>
<td>11</td>
<td>10 Hz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>300 kHz</td>
<td>1 MHz</td>
<td>21</td>
<td>10 Hz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>2 MHz</td>
<td>9 MHz</td>
<td>21</td>
<td>10 Hz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>10 MHz</td>
<td>998 MHz</td>
<td>51</td>
<td>10 Hz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>1000 MHz</td>
<td>2499 MHz</td>
<td>51</td>
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<td>+5 dBm</td>
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<tr>
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<td>5000 MHz</td>
<td>51</td>
<td>1 kHz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>5001 MHz</td>
<td>20000 MHz</td>
<td>401</td>
<td>1 kHz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>20001 MHz</td>
<td>38000 MHz</td>
<td>601</td>
<td>1 kHz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>38001 MHz</td>
<td>40000 MHz</td>
<td>51</td>
<td>1 kHz</td>
<td>+5 dBm</td>
<td>+5 dBm</td>
</tr>
</tbody>
</table>

### Table 3-3. VectorStar VNA Segmented Sweep Setup for VNA System with MN4697C Test Set

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th># of Pts</th>
<th>IFBW</th>
<th>P1 Src Pwr</th>
<th>P2 Src Pwr</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 kHz</td>
<td>200 kHz</td>
<td>11</td>
<td>10 Hz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>300 kHz</td>
<td>1 MHz</td>
<td>21</td>
<td>10 Hz</td>
<td>−8 dBm</td>
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</tr>
<tr>
<td>2 MHz</td>
<td>9 MHz</td>
<td>21</td>
<td>10 Hz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>10 MHz</td>
<td>998 MHz</td>
<td>51</td>
<td>10 Hz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
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<td>1000 MHz</td>
<td>2499 MHz</td>
<td>51</td>
<td>1 kHz</td>
<td>−8 dBm</td>
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<td>51</td>
<td>1 kHz</td>
<td>−8 dBm</td>
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<tr>
<td>20001 MHz</td>
<td>38000 MHz</td>
<td>601</td>
<td>1 kHz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>38001 MHz</td>
<td>40000 MHz</td>
<td>51</td>
<td>1 kHz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>40001 MHz</td>
<td>50000 MHz</td>
<td>201</td>
<td>1 kHz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>50001 MHz</td>
<td>65000 MHz</td>
<td>151</td>
<td>1 kHz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>65001 MHz</td>
<td>67000 MHz</td>
<td>51</td>
<td>1 kHz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
<tr>
<td>67001 MHz</td>
<td>70000 MHz</td>
<td>51</td>
<td>1 kHz</td>
<td>−8 dBm</td>
<td>−8 dBm</td>
</tr>
</tbody>
</table>
28. Select Response | Tr2 | S22
29. Select Tr3 | More Single Mode | S33
30. Select Tr4 | More Single Mode | S44
31. Insert the Calibration Kit Components Coefficients USB Memory Stick into one of the front panel USB ports.
32. Select Calibration | Cal Kit/AutoCal Characterization | Install Kit/Charac.
33. Select Cal Kit file type and then click the Browse button. See Figure 3-1 below.

![Install Dialog Box](image1.png)

**Figure 3-1.** Install Dialog Box

34. Select the file with “.ccf” file extension and then click the Open button. See Figure 3-2 below.

![Open Dialog Box](image2.png)

**Figure 3-2.** Open Dialog Box

35. Click on the OK button and then the Install button to install the Calibration Kit Components Coefficients.
36. Select Calibration | Calibrate | Manual Cal | 1-Port Cal | Modify Cal Setup | Edit Cal Params
37. Change all DUT Connector settings to K-Conn(F) for MN4694C or V-Conn(F) for MN4697C in the One Port Cal Setup dialog box. Click the OK button when done. See Figure 3-3 below.

Figure 3-3.  One Port Cal Setup Dialog Box
38. Select Back to return to the One Port Cal/s Menu. See Figure 3-4 below.

**Figure 3-4.** One Port Cal/s Menu
39. Select Port 1 Reflective Device to display the Refl. Device(s) Menu. See Figure 3-5 below.

40. Connect the Open from the Calibration Kit to Port 1 of the VNA.

**Note** Use the Anritsu 01-201 torque wrench from the Anritsu 365xx Calibration Kit to tighten the connection to improve the quality of the calibration. Do the same for other calibration standards (e.g. Short and Load) in subsequent steps.

41. Select Open.

**Note** A check mark will appear on the button when the measurement or process is complete. See examples on right side of Figure 3-5 above.

42. Disconnect the Open from Port 1 and connect the Short.

43. Select Short

44. Disconnect the Short from Port 1 and connect the termination.

45. Select Load

46. Select Back to return to previous menu.
47. Select Port 2 Reflective Device
48. Connect the Open from the Calibration Kit to Port 2 of the VNA.
49. Select Open.
50. Disconnect the Open from Port 2 and connect the Short.
51. Select Short
52. Disconnect the Short from Port 2 and connect the termination.
53. Select Load
54. Select Back to return to previous menu.
55. Select Port 3 Reflective Device
56. Connect the Open from the Calibration Kit to Port 3 of MN469xC.
57. Select Open.
58. Disconnect the Open from Port 3 and connect the Short.
59. Select Short
60. Disconnect the Short from Port 3 and connect the termination.
61. Select Load
62. Select Back to return to previous menu.
63. Select Port 4 Reflective Device
64. Connect the Open from the Calibration Kit to Port 4 of MN469xC.
65. Select Open.
66. Disconnect the Open from Port 4 and connect the Short.
67. Select Short
68. Disconnect the Short from Port 4 and connect the termination.
69. Select Load
70. Select Back to return to previous menu.
71. Select Done
72. Select Tr1 | Trace | Trace Max
73. Connect the Air Line to Port 1 and then terminate the Air Line with the Offset Termination.

**Caution**  Finger tighten only. Do not use torque wrench to tighten the connector connection for this step.

74. Select Scale | Auto Scale Active Trace
75. Select Marker
76. Click Mkr 1, Mkr 2 and Mkr 3 to turn these markers On.
77. Using the mouse to move Mkr 1 and Mkr 3 to adjacent peaks of the ripple with the greatest negative trough (or adjacent troughs if the ripple has the greatest positive peak) in the frequency band of interest as shown in Figure 3-6 on page 3-14 below. For frequency band information, in Appendix A, “Test Records”, refer to either:
   • Table A-1, “Directivity Record for MN4694C Multiport VNA System” on page A-2 for MN4694C
   • Table A-3, “Directivity Record for MN4697C Multiport VNA System” on page A-4 for MN4697C
78. Position Mkr 2 to the bottom of the trough (or to the top of the peak if the ripple has the greatest position peak.)

79. Sum the magnitude values of Mkr 1 and Mkr 3 at the peaks (or troughs) and divide the result by two. This is the average value of the two peaks (or troughs) Refer to the example formula below:

\[
\text{Average Value} = \frac{(\text{Mkr 1} + \text{Mkr 2})}{2} = \frac{(-15.9634 \text{ dB}) + (-15.641 \text{ dB})}{2} = -15.8022 \text{ dB}
\]

80. Calculate the peak-to-peak ripple value (absolute difference of the Mkr 2 value and the Average Value) as follows:

\[
\text{dB}_{p-p} = |\text{Mkr 2 value} - |\text{Average Value}| = 17.452 \text{ dB} - 15.8022 \text{ dB} = 1.6498 \text{ dB}
\]

81. Use a RF measurement chart in Figure 3-7 on page 3-15 to find the corresponding return loss value of the peak-to-peak ripple value.

- Example: The corresponding Return Loss value of 1.6498 dB_{p-p} is approximately 20 dB
82. Also find the corresponding Ref + X or Ref – X value from the RF measurement chart.

The first three columns are conversion tables for return loss, reflection coefficient, and SWR.

The last four columns are values for interactions of a small phasor X with a large phasor (unity reference) expressed in dB related to the reference.

The RF Measurement Chart can be used to determine the uncertainty due to bridge/autotester VNA directivity. The “X dB Below Reference” column represents the difference between the directivity and the measured reflection (return loss). The “Ref + X dB” and “Ref – X dB” values are 360°. Therefore, the peak-to-peak ripple (1 ± X) is the total measurement uncertainty caused by the error signal.

For example, if a 30 dB return loss is measured with a 40 dB directivity autotester, the X dB Below Reference value is 10 dB. The Ref + X dB value is 2.3866 dB and the Ref – X dB value is 3.3018 dB.

The actual return loss is between 27.6134 dB (–30 + 2.3866) and 33.3018 dB (–30 – 3.3018). The peak-to-peak ripple on a swept measurement will be 5.6884 dB. If the error and directivity signals are equal, the Ref + X dB value equals 6 dB (voltage doubling causes a 6 dB change) and the Ref – X dB value becomes infinite, since the two signals are equal in amplitude and 180° out of phase (zero voltage).

![RF Measurement Chart](image-url)

83. Use the following formula to calculate the directivity:
For ripple with a negative trough:

\[ \text{Directivity} = \text{Return Loss value} + |\text{Mkr 2 value}| - |\text{Ref - X value}| \]

For ripple with a positive peak:

\[ \text{Directivity} = \text{Return Loss value} + |\text{Mkr 2 value}| + |\text{Ref + X value}| \]

Example:

\[ \text{Directivity} = 20 \text{ dB} + 17.452 \text{ dB} - 0.9151 \text{ dB} = 36.5369 \text{ dB} \]

84. Record the directivity value into the Port 1 Measured column of the following applicable table in Appendix A:

- Table A-1, “Directivity Record for MN4694C Multiport VNA System” on page A-2 for MN4694C
- Table A-3, “Directivity Record for MN4697C Multiport VNA System” on page A-4 for MN4697C.

85. Repeat Step 77 to Step 84 for other frequency bands listed in Table A-1 for MN4694C or Table A-3 for MN4697C in Appendix A.

86. Disconnect the Offset Termination from the Air Line and connect a short.

87. Select Scale | Auto Scale Active Trace

88. Repeat Step 77 to Step 81. Record the Return Loss value into the appropriate table and the Port 1 Measured column in Appendix A:

- Table A-2, “Test Port Match Record for MN4694C Multiport VNA System” on page A-3 for MN4694C
- Table A-4, “Test Port Match Record for MN4697C Multiport VNA System” on page A-5 for MN4697C.

89. Repeat Step 88 for other frequency bands listed in Table A-2 for MN4694C or Table A-4 for MN4697C in Appendix A.

90. Disconnect the Short from the Air Line and then disconnect the Air Line from the Test Port.

91. Select Trace | Trace Next

92. Connect the Air Line to the next Test Port (e.g. Port 2 for S22, Port 3 for S33 or Port 4 for S44) on MN469xC and then terminate the Air Line with the Offset Termination.

93. Repeat Step 74 to Step 90 to verify the Directivity and Port Match of the Test Port being tested.

94. Repeat Step 91 to Step 93 for the rest of the Test Ports on MN469xC.
3-7 Test Port Power Verification

The following test can be used to verify the test port power of each test port of the VectorStar Multiport VNA System meets specification.

Note Perform this test only when the 2-Port VectorStar VNA has Option 51 installed.

The Test Port Power verification are automated by using the VectorStar MS4640A/B Instrument Test Software, CDROM part number 2300-531-R. The software guides you through the measurement of the Test Port Power level. Refer to the VectorStar MS4640A/B Series VNA 2300-531-R System Verification Software Quick Start Guide - 10410-00291, for details about running the software.

Equipment Required

- Power Meter, Anritsu Model ML2437A or ML2438A
- Power Sensor, Anritsu Model SC7770
- Adapter, N male to V female, Pasternack Model PE9720
- Calibration Kit, K Connector, Anritsu Model 3652A
- Calibration Kit, V Connector, Anritsu Model 3654D

Procedure

1. Power on the power meter allow to warm up for at least 15 minutes.
2. Connect the N male to V female adapter to the power meter calibrator port.
3. Connect the sensor to the power meter calibrator port. Zero and calibrate the power sensor.
4. Disconnect the power sensor from the calibrator port and install an adapter (34VFKF50 or 33VFVF50C) to convert the power sensor input to a female connector.
5. Place the MS464xA/B VNA on top of the MN469xC Test Set and connect the front and rear panel cables per the VectorStar MN469xC Multiport Test Set Installation Guide – 10410-00288.
6. Power on the MN469xC Test Set first.

Note If the VNA is powered up before the test set, the VNA application will stay in 2-port mode and only 2-port mode features and functions will be available.

7. Power on the MS464xA/B VNA and allow it to complete self test.
8. Allow both VNA and Test Set to warm up for at least one hour.
9. Run the VectorStar MS4640A/B Instrument Test Software and follow the instructions to perform the test port power level measurements.
10. After the automated test is complete, print the test result and attached it the Test Records in Appendix A.
3-8 Noise Floor Verification

This test verifies the noise floor performance of the VectorStar Multiport VNA system at the test port of the MN469xC.

The Noise Floor test procedures are automated by using the VectorStar MS4640A/B Instrument Test Software, CDROM part number 2300-531-R.

The software guides you through the calibration process and the measurement of the noise floor. The software then computes the test results which are expressed in RMS values.

Refer to the VectorStar MS4640A/B Series VNA 2300-531-R System Verification Software Quick Start Guide – 10410-00291, for information about required equipment and details about running the software.

After the automated test is complete, print the test result and attached it the Test Records in Appendix A.
Chapter 4 — Troubleshooting

4-1 Introduction

This chapter provides information about troubleshooting tests that can be used to check the MN469xC Multiport Test Set for proper operation. These tests are intended to be used as a troubleshooting tool for checking the functionality of the components and sub-assemblies in the test set.

4-2 General Safety Warnings

Many of the troubleshooting procedures presented in this chapter require the removal of instrument covers to gain access to subassemblies and modules. When using these procedures, please observe the warning and caution notices.

| Warning | Hazardous voltages are present inside the instrument when AC line power is connected. Before removing any covers, turn off the instrument via the Main power switch on the front panel and unplug the AC power cord. |
| Caution | Many assemblies and modules in the MN469xC contain static-sensitive components. Improper handling of these assemblies and modules may result in damage to the assembly and modules. Always observe the static-sensitive component handling precautions. |

4-3 Troubleshooting Strategy

The VectorStar Multiport VNA System consists of two instruments:

- The 2-Port VectorStar MS4640A/B Series VNA
- The VectorStar Multiport MN469xC Test Set

A good understanding of the VectorStar Multiport VNA System operation is an important aid to troubleshooting system failures. Refer to the descriptions of system operation, and block diagrams located in Section 1-5 “VectorStar Multiport VNA System Overview” on page 1-4 and Section 1-6 “MN469xC Multiport Test Set Functional Description” on page 1-5.

It is also imperative to isolate whether the system fault is in the VectorStar VNA or the MN469xC Test Set.

Suggested Troubleshooting Steps

The suggested troubleshooting steps for MN469xC Test Set are as follows:

- Identify whether the fault is unique to the MN469xC Test Set (e.g. Unable to power on, etc.).
- Verify whether the fault is related to system setup and installation (e.g. GPIB cable, GPIB Address, inter-connect RF cable condition and connection and etc). Refer to VectorStar MN469xC Series Multiport Test Set Installation Guide – 10410-00288.
- Verify whether the 2-Port VectorStar VNA is in good condition by itself. Refer to the MS4640A Series VNA Maintenance Manual – 10410-00268, or the MS4640B Series VNA Maintenance Manual – 10410-00320.
- Perform the troubleshooting tests in this chapter.
- If possible, swap the suspected faulty component or PCB with the component or PCB from the known working switching signal path.
  - For example, if you suspect that Port 1/Port 2 Low Band Switch is faulty, swap it with the Port 3/Port 4 Low Band Switch.
4-4 Troubleshooting – Test Set Fails to Power Up

If the MN469xC test set fails to power up when connected to an AC power source and the **Power** key is pressed, perform the power supply checks described below.

**Warning**

| Hazardous voltages are present inside the instrument when AC line power is connected. Turn off the instrument and disconnect the AC line cord before removing any covers. Troubleshooting or repair procedures should only be performed by qualified service personnel who are fully aware of the potential hazards. |

**Line Source and Interface Checks**

1. Verify that the AC power source is providing stable power at the correct line voltage.

**Note**

The MN469xC is designed to automatically sense and operate with AC line voltage in the range of 85 to 264 Volt AC, with a frequency range of 47 to 63 Hz.

2. Verify the AC power cord is in good condition.

3. Verify the power line fuse is installed and that is not blown (open).

**Power Supply Voltage Check**

1. Turn off the test set and disconnect the AC power cord from the instrument. Ensure that all external front and rear panel cable connections to the test set are also disconnected.

2. Remove the top cover.
   - Refer to **Section 5-3 “Removing the Covers” on page 5-2**.

3. Re-connect the power cord to the test set and turn it on.

4. Using a digital multi-meter or oscilloscope, measure the expected DC power supply voltages on the 4-Port Test Set Control PCB at the P4 connector pins or test points listed in **Table 4-1** below.
   - See **Figure 4-1, “4-Port Test Set Control PCB P4 Connector Location” on page 4-3** below for test point locations.

5. If any of the DC voltage is much lower than the expected value, replace the power supply (part number 3-40-183).
   - Refer to **Section 5-8 “Power Supply Replacement” on page 5-8**.

**Table 4-1. Power Supply Voltages**

<table>
<thead>
<tr>
<th>Measured Pin</th>
<th>Common Pin</th>
<th>Expected DC Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4 pin 1 (or TP7)</td>
<td>P4 pin 2</td>
<td>−15 V</td>
</tr>
<tr>
<td>P4 pin 4 (or TP6)</td>
<td>P4 pin 2</td>
<td>+15 V</td>
</tr>
<tr>
<td>P4 pin 5 (or TP5)</td>
<td>P4 pin 2</td>
<td>−5.5 V</td>
</tr>
<tr>
<td>P4 pin 8 (or TP2)</td>
<td>P4 pin 2</td>
<td>+5.5 V</td>
</tr>
</tbody>
</table>
Figure 4-1. 4-Port Test Set Control PCB P4 Connector Location
4-5 Troubleshooting – RF Switch Functional Check

This section provides the procedures to check if the respective RF switches of each test port are working properly.

| Note | Port 1 and Port 2 share the same set of RF switches. Port 3 and Port 4 share a separate set of RF switches. |

Equipment Required for VNA System with MN4694C
- Anritsu Model 3652A K Connector Calibration Kit (For MN4694C)
- Anritsu Model 3670K50-2 K Connector Through Cable (For MN4694C)

Equipment Required for VNA System with MN4697C
- Anritsu Model 3654D V Connector Calibration Kit (For MN4697C)
- Anritsu Model 3670V50B-2 V Connector Through Cable (For MN4697C)

Procedure

1. Set up the VNA for S11 Log Mag graph type Single Display.
2. Connect a short to Port 1 of the VNA.
3. Observe if there is any abnormality in the S11 trace (e.g. power roll off in the low frequency band, power drop off in the entire low band or high band, and etc.).
4. If no abnormalities are observed, then the switches are working properly for Port 1.
5. Change the VNA display for S22.
6. Disconnect the Short from Port 1 and connect it to Port 2 of the VNA.
7. Observe if there is any abnormality in the S22 trace (e.g. power roll off in the low frequency band, power drop off in the entire low band or high band, and etc.).
8. If no abnormalities are observed, then the switches are working properly for Port 2.
9. If abnormalities are observed, determine if the fault is in the Source Channel RF switch or b Channel RF switch by do the following:
   a. Change the VNA display for S31.
   b. Connect a through cable between Port 1 and Port 3.
   c. Observe if the same abnormality appears on S31 trace.
   d. If yes, check the control cable connection to the respective b Channel RF Switch, replace the High Band SPDT Switch Control PCB (if applicable), and then replace the respective b Channel RF Switch.
      - For example, if abnormality is shown below 2.5 GHz, replace the b Channel Low Band Switch.
   e. If no, check the control cable connection to the respective Source Channel RF Switch, replace the High Band SPDT Switch Control PCB (if applicable), and then replace the respective Source Channel RF Switch.
10. Repeat Step 1 through Step 9 for Port 3 and Port 4 of the test set. Set the VNA display for S33, S44 and then S13 for the tests.
4-6 Troubleshooting – Directivity and Test Port Match Failure

This section provides the test procedures to isolate the cause of failure when the test set fails either the
directivity and test port match tests. Refer to Section 3-6 “Directivity and Test Port Match Verification”
on page 3-7 above for VNA setup information.

Equipment Required for VNA System with MN4694C
- Calibration Kit, K Connector, Anritsu Model 3652A
- Phase Equal Adapter, K(m) to K(f) Anritsu Model 33KKF50B (Qty 2)
- Air Line, K Connector, Anritsu Model T2023-2
- 20 dB Offset Termination, K(f) Connector, Anritsu Model SC4808

Equipment Required for VNA System with MN4697C
- Calibration Kit, V Connector, Anritsu Model 3654D
- Phase Equal Adapter, V(m) to V(f) Anritsu Model 33VVF50C (Qty 2)
- Air Line, V Connector, Anritsu Model T2025-2
- 20 dB Offset Termination, V(f) Connector, Anritsu Model SC5727

Directivity Failure Troubleshooting Procedure
1. Use a different Termination from the Calibration Kit to perform an One Port Cal on Port 1 of the
VectorStar Multiport VNA System.
2. Verify if the system passes the directivity test.
3. If the system passes, the cause of the failure is caused by a defective termination in the Calibration Kit.
4. If the system fails, do the following:
   a. Separate the test set from the 2-port VectorStar VNA.
   b. Re-install the front panel and rear panel loop cables to the VectorStar VNA.
   c. Perform an One Port Cal on Port 1 of the VectorStar VNA.
   d. Verify that directivity of 2-port VNA configuration are the same as those of 4-port VNA
      configuration.
   e. If yes, the failure is caused by the termination in the calibration kit.
   f. If no, replace the respective b Channel RF Switch (Low Band Switch or High Band SPDT Switch,
      depending on frequencies that the failure occurs).

Test Port Match Failure Troubleshooting Procedure
1. Separate the test set from the 2-Port VectorStar VNA.
2. Re-install the front panel and rear panel loop cables to the VectorStar VNA.
3. Perform an One Port Cal on Port 1 of the VectorStar VNA.
4. Verify that test port match of 2-port VNA configuration are the same as those of 4-port VNA
   configuration.
5. If yes, the failure is caused by the Open and Short in calibration kit.
6. If no, do the following:
   a. Replace the Diplexer.
   b. Replace the respective Source Channel RF Switch.
Chapter 5 — Component Replacement

5-1 Introduction
This chapter provides procedures for removing and installing replaceable components and sub-assemblies in the MN469xC Series Multiport Test Set.

5-2 Equipment Required
All procedures require the use of the following tools:
- Either a #1 or #2 size Phillips screwdriver
- 5/16 inch open end wrench
- Anritsu 01-201 (8 lbf·in) 5/16 inch torque wrench.

Some procedures require the use of the following tools:
- Small jewelers Phillips screwdriver
- Right angle (offset) #1 size Phillips screwdriver
- Right angle (offset) 5/16 inch open end wrench (for loosening RF connectors inside the front panel)
- Adjustable wrench, 4 inch length, 9/16 inch Jaw Opening
- 36 lbf·in Torque Wrench with 1/2” Open End Head – Mountz MTBN10 with 1/2” Open End Head or equivalent.
- 15 lbf·in Torque Wrench with 13/16” Socket – Craftsman 009-44594 with 13/16” deep socket on 3/8” drive or equivalent.

Caution: Always use a torque wrench calibrated to 8 lbf·in when tightening the RF connectors on semi-rigid RF cables. Over-torquing will cause damage to the RF connectors.
5-3 Removing the Covers

1. Switch the VectorStar VNA and the MN469xC Test Set power off and remove the power cords.
2. Remove the MN469xC Test Set from the VectorStar VNA by disconnecting all cable connections and separating the test set from the VectorStar VNA.
3. Remove covers as shown in Figure 5-1 on page 5-2.

| Caution | Green-headed screws have metric threads. Be sure to retain all of the screws and reinstall them in their original location. |

4. Installation is reverse of removal.

---

Removal Steps – Top, Bottom, or Side Covers

1. Remove foot end screws
   - Upper for top cover removal
   - Lower for bottom cover removal
2. Remove foot side screws then left and right feet
   - Upper feet for top cover removal
   - Lower feet for bottom cover removal
3. Remove upper center screw for top cover removal. Remove lower center screw for bottom cover removal.
4. Lift and slide top (or bottom) cover toward rear of chassis
5. Remove stiffener plate.
6. Front handles are removed only if the front panel or side panels require removal.
7. To remove side a panel, remove the center screw from rear side panel flange then slide the side panel toward the rear and out.

Figure 5-1. MN469xC Test Set Cover Removal
5-4 Location of Major Components and Sub-assemblies

Figure 5-2 below shows the location of major components and sub-assemblies in the MN469xC Series Multiport Test Set.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply</td>
<td>A12</td>
<td>0.04-70GHz SPDT SWITCH</td>
</tr>
<tr>
<td>2</td>
<td>Control Board</td>
<td>A13</td>
<td>0.04-70GHz SPDT SWITCH</td>
</tr>
<tr>
<td>3</td>
<td>GPIB–Parallel Interface Board</td>
<td>A14</td>
<td>70GHz TEST COUPLER</td>
</tr>
<tr>
<td>A4</td>
<td>Low Band Switch</td>
<td>A15</td>
<td>70GHz TEST COUPLER</td>
</tr>
<tr>
<td>A5</td>
<td>Low Band Switch</td>
<td>A18</td>
<td>0.04-70GHz SPDT SWITCH</td>
</tr>
<tr>
<td>A6</td>
<td>Low Band Switch</td>
<td>A19</td>
<td>0.04-70GHz SPDT SWITCH</td>
</tr>
<tr>
<td>A7</td>
<td>Low Band Switch</td>
<td>A20</td>
<td>Low Band Bridge</td>
</tr>
<tr>
<td>A8</td>
<td>Diplexer/Bias-Tee, V Conn</td>
<td>A21</td>
<td>Low Band Bridge</td>
</tr>
<tr>
<td>A10</td>
<td>Diplexer/Bias-Tee, V Conn</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See Table 2-1, "Replaceable Parts List" on page 2-1 for identification of Engineering “A” Numbers.
5-5 GPIB-Parallel Interface PCB Replacement

Assemblies: 2000-989 or 3-2000-989

This section provides a procedure for removing and replacing the GPIB-Parallel Interface PCB Assembly in the test set.

1. Remove the top cover from the test set. Refer to Section 5-3 “Removing the Covers” on page 5-2.
2. Remove the board as illustrated Figure 5-3.

1. Disconnect the two cables from the connectors as shown in the illustration.
2. Un-solder (de-solder) the black and red power wires on the left side of the PCB.
3. Remove the four mounting screws.
4. Slightly lift and slide the PCB board toward chassis center and then lift it away from the chassis.
5. Installation is reverse of the removal procedure.

Figure 5-3. GPIB-Parallel Interface PCB Removal Steps
5-6 Rear GPIB Connector PCB Replacement

Assemblies: 2000-989 or 3-2000-989

This section provides a procedure for removing and replacing the Rear Panel GPIB Connector PCB in the test set.

Note: The Rear Panel GPIB Connector PCB Assembly is a part of the GPIB-Parallel Interface PCB Assembly Replacement Kit, part number 2000-989.

1. Remove the top cover from the test set. Refer to Section 5-3 “Removing the Covers” on page 5-2.
2. Remove the board as illustrated in Figure 5-4.

Note: Ensure that the two jumper wires are installed as shown in Figure 5-5 on page 5-6.

1. Disconnect the ribbon cable from the GPIB-Parallel Interface PCB Assembly. Refer to Figure 5-3.
2. Use an adjustable spanner wrench to un-screw the two hex nuts from the rear panel.
3. Remove the GPIB Connector PCB Assembly from the rear panel. Refer to Figure 5-4.
4. To replace the GPIB Connector PCB Assembly, reverse the order of the removal procedure.

Figure 5-4. GPIB Connector PCB Assembly Removal
1. Jumper #1 goes from pin 12 of the GPIB connector to pin 13 of the GPIB connector.
2. Jumper #2 goes from pin 12 of the GPIB connector to pin 1 of the Dip Switch connector

Figure 5-5.  Back side of GPIB Connector PCB Assembly
5-7 Control PCB Assembly Replacement

Assemblies: ND70927<R> or 3-ND70927<R>

This section provides a procedure for removing and replacing the 4-Port Test Set Control PCB in the test set.

1. Remove the top cover from the test set. Refer to Section 5-3 “Removing the Covers” on page 5-2.
2. Remove the board as illustrated in Figure 5-6.

---

1. Disconnect the two GPIB PCB ribbon cables from J13 and J15.
2. Disconnect the GPIB PCB power cable from J35.
3. Disconnect the Power Supply Load cable from P6.
4. Disconnect the Power Supply cables from P1 and P3.
5. Disconnect the Front Panel Power Indicator LED cable from P7.
6. Disconnect the Fan Power cable from J34.
7. Disconnect the Front Panel Port Indicator LED cables from P17 and P18.
8. Disconnect the four switch control cables from J17, J18, J19 and J20.
9. Remove the six mounting screws from the PCB.
10. Lift the Control PCB away from the test set chassis.
11. Assembly is reverse of the removal procedure.

Figure 5-6. Test Set Control PCB Assembly Replacement
5-8 Power Supply Replacement

Assemblies: 3-40-183

1. Remove the top cover and left cover from the test set. Refer to Section 5-3.
2. Remove the board as illustrated in Figure 5-7.

---

Figure 5-7. Power Supply Replacement

1. At the rear of the power supply, disconnect the 3 Pin Connector which connects to the rear panel AC input module.
2. Disconnect the ground wire from the power supply.
3. At the front of the power supply, disconnect the Power Supply Output Cable Harness.
4. Remove the four mounting screws from the power supply.
5. Lift the power supply from the chassis.
6. Assembly is reverse of the removal procedure.
5-9 Low Band Switch

Assemblies: ND70079<R> or 3-ND70079<R> – A4, A5, A6, A7

This section provides procedures for removing and replacing each Low Band Switch in the test set. There are four Low Band Switches, A4, A5, A6 and A7. In Figure 5-2 on page 5-3 above, refer to the A4, A5, A6, and A7 engineering references. The replacement procedures for each module vary slightly.

A4 Replacement

1. Remove the top cover from the test set.
   - Refer to Section 5-3.
2. Replace the A4 module as illustrated in Figure 5-8.

Note: Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

---

1. Disconnect the RF cable from the J1 connector of the A4 module and the Rear Panel.
   - **Note:** The GPIB–Parallel Interface Board may have to be removed in order to remove the A4 RF cable. See Section 5-5 for GPIB board removal.
2. Remove the two Phillips mounting screws from the module.
3. Disconnect the two connectors from J2 and J3 connectors, then disconnect the control cable from the module side and remove the module.
4. Installation is the reverse of removal.

**Figure 5-8.** A4 Low Band Switch Replacement
A5 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the A5 module as illustrated in Figure 5-9.

**Note**  Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

---

1. Disconnect the RF cable from the J1 connector of the A5 module and carefully lift it out of the way.
2. Remove the two phillips mounting screws from the module.
3. Disconnect the two connectors from J2 and J3 connectors, then disconnect the control cable from the module side and remove the module.
4. Installation is the reverse of removal.

**Figure 5-9.**  A5 Low Band Switch Replacement
A6 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the A6 module as illustrated in Figure 5-10.

**Note** Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

1. Disconnect the RF cable from the J1 connector of the A6 module and the Rear Panel.
2. Remove the two phillips mounting screws from the Module.
3. Disconnect the two RF cables from J2 and J3 connectors, then disconnect the control cable from the module side and remove the module.
4. Installation is the reverse of removal.

**Figure 5-10.** A6 Low Band Switch Replacement
A7 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the A7 module as illustrated in Figure 5-11.

**Note** Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

1. Disconnect the RF cable from the J1 connector of the A7 module and the Rear Panel. 
   **Note:** The GPIB–Parallel Interface Board may have to be removed in order to remove the A7 RF cable. See Section 5-5 for GPIB board removal.
2. Remove the two phillips mounting screws from the module.
3. Disconnect the two RF cables from J2 and J3 connectors, then disconnect the control cable from the module side and remove the module.
4. Installation is the reverse of removal.

**Figure 5-11.** A7 Low Band Switch Replacement
5-10 Low Band Bridge

Assembly: ND70078<R> or 3-64016<R> – A20, A21

This section provides a procedure for removing and replacing the Low Band Bridges in the test set. There are two Low Band Bridges, A20 and A21. Refer to Figure 5-2 on page 5-3 for physical location on the chassis.

A20, A21 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the A20 or A21 module as illustrated in Figure 5-12.

**Note** Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

---

2. Disconnect the two RF cables from the JB connector on each bridge and rotate them out of the way, then remove the two bracket mounting screws. (The JB connector is the one facing upward).
3. Remove the A20/A21 assembly
4. Remove and replace the A20 or A21 module as shown.
5. Installation is the reverse of removal.

**Figure 5-12.** A20/A21 Low Band Bridge Replacement
5-11 High Band SPDT Switch Control PCB Assembly

Assembly: ND70926<R> or 3-ND70926<R>

This section provides a procedure for removing and replacing the High Band SPDT Switch Control PCB Assembly. The Switch Control PCB Assembly is mounted on top of the High Band SPDT Switch Assemblies A12, A13, A18, and A19; Parts 70241 or 70242.

A12, A13, A18 or A19 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the Switch Control PCB as illustrated in Figure 5-13.

Caution
Do not force the Control PCB onto the Switch Assembly. The Control PCB must be in good alignment with the Switch contact pins.

1. High Band Switch Control Board locations
2. Control Board Removal:
   Disconnect the switch control cable from the High Band SPDT Switch Control PCB Assembly.
   Remove the three mounting screws from the Switch Control PCB. (Save the screws and washers).
   Unplug the Switch Control PCB from the High Band SPDT Switch.
3. Installation is the reverse of removal.

Figure 5-13. High Band SPDT Switch Control PCB Assembly,
5-12 High Band SPDT Switch Assembly

Assemblies: 70241<R>/70242<R> or 3-70241<R>/3-70242<R>

This section provides a procedure for removing and replacing the High Band SPDT Switch Assembly, A12, A13, A18 and A19. Refer to Figure 5-2 on page 5-3 for module locations.

A12 Replacement

**Note** Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the Switch Assembly as illustrated in Figure 5-14.

---

1. Disconnect the RF cables connected at J2 and J3 of the A18 assembly to provide clearance and then perform the following:
   - Disconnect and remove the RF cable between J2 of A12 and J2 of A10.
   - Disconnect and remove the RF cable between J3 of A12 and J2 of A8.
2. Remove the Switch Control Board from A12 per the procedure in Section 5-11, and then remove the three (3) support standoffs.
3. Remove the four A12 switch mounting screws from the bracket.
4. Disconnect the semirigid cable from J1 of the switch and remove the switch from the chassis.
5. Installation is the reverse of removal.

**Figure 5-14.** A12 High Band SPDT Switch Assembly
A13 Replacement

**Note**  
For this procedure, a right angle wrench is required to loosen the RF cable connectors attached at the front panel. Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the A13 Switch Assembly as illustrated in Figure 5-15.

---

1. Remove the Switch Control Board and the 3 standoffs from the A12 switch per the procedure in Section 5-11, then disconnect and remove the RF cables between J2 and J3 of A13 and the front panel connector. Use a right angle wrench to loosen the connector attached at the front panel.
2. Remove the four A13 switch mounting screws from the bracket.
3. Disconnect the RF cable from J1 of A13 and lift the module out of the chassis.
4. Installation is the reverse of removal.

**Figure 5-15.** A13 High Band SPDT Switch Assembly
A18 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the Switch Assembly as illustrated in Figure 5-16.

**Note** Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

---

1. Remove Switch Control Board and the 3 standoffs from the switch per the procedure in Section 5-11, then disconnect the cables from J2 and J3 of the switch and gently move them clear of the connectors.
2. Remove the four (4) switch mounting screws from the bracket.
3. Disconnect the semirigid cable from J1 of the switch and remove the switch from the chassis.
4. Installation is the reverse of removal.

**Figure 5-16.** A18 High Band SPDT Switch Assembly
A19 Replacement

Note

For this procedure, a right angle wrench is required to loosen the RF cable connectors attached at the front panel. Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the Switch Assembly as illustrated in Figure 5-17.

1. Remove the Switch Control Board and the 3 standoffs from the A19 switch per the procedure in Section 5-11, then disconnect the RF cables from J2 and J3 of A19 and their respective front panel connectors. If needed, use a right angle wrench to loosen the connectors attached at the front panel.
2. Remove the four A13 switch mounting screws from the bracket.
3. Disconnect the RF cable at A13-J1 to remove the module.
4. Installation is the reverse of removal.

Figure 5-17. A19 High Band SPDT Switch Assembly
5-13 Diplexer Assembly

Assemblies: 74277<R>/3-74277<R> or 74278<R>/3-74278<R> – A8, A10

This section provides a procedure for removing and replacing the two Diplexer Assemblies A8, and A10. Refer to Figure 5-2, “Location of Major Components and Subassemblies” on page 5-3.

Note

The DC bias leads must be desoldered from the module prior to removal. Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

A8 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the Diplexer Assembly as illustrated in Figure 5-19.

---

Figure 5-18. A8 Diplexer Assembly

1. Remove the RF cable that connects between J3 of the Diplexer A8 and J3 of Switch A12.
2. Remove the four (4) A8 mounting screws, loosen the J2 RF connector nut between A8 and A14, then gently pry the module away from A14 while loosening the RF cable nut at J1.
3. Desolder the DC Bias wires from A8 and then remove it from the chassis.
4. Installation is the reverse of removal.

Figure 5-18. A8 Diplexer Assembly
A10 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.

Note

The DC bias leads must be desoldered from the module prior to removal. Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

2. Replace the Diplexer Assembly as illustrated in Figure 5-19.

1. Disconnect and remove the RF cable that connects between J3 of the A10 Diplexer and J2 of A12 Switch.

2. Remove the four (4) A10 mounting screws. Disconnect J2 from the A15 module and, while applying lateral pressure to the module, disconnect the RF cable at A10-J1.

3. Desolder the DC Bias wires from the module and then remove it from the chassis.

4. Installation is the reverse of removal.

Figure 5-19. A10 Diplexer Assembly
5-14 Test Port Connector Replacement

Assemblies: 34YK50C or 34YV50C

This section provides instructions for removing and replacing the Test Port Connectors.

1. Loosen and remove the Test Port Connector using a 1/2" torque wrench.
2. Carefully screw the new Test Port Connector onto the threaded coupler shaft, making sure that the connector center pin is correctly aligned.
3. After tightening to finger tight, Torque the Test Port Connector using a 1/2" torque wrench set to 36 lbf·in.

Figure 5-20. A15 Port Coupler Assembly
5-15 Port Coupler

Assemblies: 66245<R>/3-66245<R> or 66480<R>/3-66480<R> – A14, A15

This section provides instructions for replacing the Port Coupler in the test set. There are two Port Couplers, A14 and A15, installed in the test set. Refer to Figure 5-2 on page 5-3 for physical locations.

A14 Replacement

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Remove the A8 Diplexer Assembly as instructed in Section 5-13.

Note

De-soldering of the DC Bias wires from the A8 Diplexer Assembly is *not* required. Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

3. Replace the A14 Port Coupler Assembly as illustrated in Figure 5-21.

---

1. Remove the Test Port Connector, the Port Connector Nut, and the Thrust Washer from the front panel.
2. Disconnect the RF cable from the A14 coupled port. Remove the coupler mounting screws using a right angle Phillips screwdriver. (If a right angle driver is not available the front panel must be removed to gain access to forward screw on the coupler.)
3. Remove the A14 Coupler from the chassis and separate the spacer from the front of the coupler.
4. Installation is the reverse of removal. When installing the test port connector, torque to 15 lbf·in using a torque wrench.

Figure 5-21. A14 Port Coupler Assembly
**A15 Replacement**

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Remove the A10 Diplexer Assembly as instructed in Section 5-13.

**Note**  
De-soldering of the DC Bias wires from the A10 Diplexer Assembly is *not* required. Use Anritsu 01-201 Torque Wrench to tighten all RF connectors when installing the module.

3. Replace the A15 Port Coupler Assembly as illustrated in Figure 5-22.

---

1. Remove the Test Port Connector, the Port Connector Nut, and the Thrust Washer from the front panel.
2. Disconnect the RF cable from the A15 coupled port. Use a right angle Phillips screwdriver to remove the two mounting screws that secure the Port Coupler to the bracket. (If a right angle driver is not available the front panel must be removed to gain access to forward screw on the coupler.)
3. Remove the A15 Coupler from the chassis and separate the spacer from the front of the coupler.
4. Installation is the reverse of removal. When installing the test port connector, torque to 15 lbf·in using a torque wrench.

**Figure 5-22.** A15 Port Coupler Assembly
5-16 Fan Assembly Replacement

Assembly: ND71327 or 3-ND83592

This section provides a procedure for removing and replacing the rear panel fan assembly in the test set.

1. Remove the top cover from the test set as instructed in Section 5-3.
2. Replace the Fan Assembly as illustrated in Figure 5-23.

**Note**

When installing the fan, make sure the arrow mark on the fan is pointing away from the rear panel to ensure proper airflow direction.

---

1. Disconnect the fan power cable from the J34 connector of the Test Set Control PCB Assembly
2. Remove the 4 fan guard mounting screws from the rear panel. Hold the fan mounting nuts with an open end wrench.
3. Remove the grounding wire.
4. Installation is the reverse of removal. Make sure the arrow mark on the fan is pointing away from the rear panel to ensure proper airflow direction. Ensure the grounding wire is reattached.

**Figure 5-23.** Cooling Fan Assembly
Appendix A — Test Records

A-1 Introduction

This appendix provides test records that can be used to record the performance of MN469xC in conjunction with a 2-Port VectorStar VNA.

As the MN469xC Series Test Set provides multiple test port capabilities for the Anritsu VectorStar MS464xA/B Series Vector Network Analyzer, they do not have any performance specifications separate from the VectorStar VNA. Therefore, MN469xC Test Set must be verified with a 2-port VectorStar VNA as a system. The frequency range that can be verified will be limited by the 2-port VectorStar VNA.

Make a copy of the following Test Record pages and document the measured values each time performance verification is performed. Continuing to document this process each performance verification session provides a detailed history of the instrument’s performance.

The following test record forms are available:

- “MN4694C Multiport VNA System Test Record” on page A-2
  - Table A-1, “Directivity Record for MN4694C Multiport VNA System” on page A-2
  - Table A-2, “Test Port Match Record for MN4694C Multiport VNA System” on page A-3
- “MN4697C Multiport VNA System Test Record” on page A-4
  - Table A-3, “Directivity Record for MN4697C Multiport VNA System” on page A-4
  - Table A-4, “Test Port Match Record for MN4697C Multiport VNA System” on page A-5
A-2 MN4694C Multiport VNA System Test Record

Instrument Information for MN4694C

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<tr>
<th>MN4694C Serial Number:</th>
<th>Operator:</th>
<th>Date:</th>
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<td>VectorStar VNA Model:</td>
<td>VectorStar VNA Serial Number:</td>
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<td>MS4642B [ ] MS4644B [ ]</td>
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System Performance can be verified either by using Verification Kit to perform S-Parameters Measurements Verification using Verification Kit or using airline to perform verification of system calibration residuals such as Directivity and Test Port Match. Only one of these tests is required to verify the system performance.

S-Parameters Measurements Verification

This test is automated using the MS464XX System Verification software that is included with 3668-1 Verification Kit.

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<td>Pass/Fail criteria is determined from EnR:</td>
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<tr>
<td>EnR ≤ 1 = PASS</td>
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<tr>
<td>EnR &gt; 1 = FAIL</td>
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<tr>
<td>Where EnR = Ma-Mb/√(Ua²+Ub²)</td>
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Test Data Report generated by the MS464XX System Verification software is attached. [ ]

Calibration Residuals Verification – Directivity and Test Port Match

Table A-1. Directivity Record for MN4694C Multiport VNA System

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<thead>
<tr>
<th>Freq (GHz)</th>
<th>Port 1 (VNA Measured (dB))</th>
<th>Port 2 (VNA Measured (dB))</th>
<th>Port 3 (Test Set Measured (dB))</th>
<th>Port 4 (Test Set Measured (dB))</th>
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Appendix A — Test Records

Test Port Match for MN4694C VNA System

Table A-2. Test Port Match Record for MN4694C Multiport VNA System

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<tr>
<th>Freq (GHz)</th>
<th>Port 1 (VNA) Measured (dB)</th>
<th>Port 2 (VNA) Measured (dB)</th>
<th>Port 3 (Test Set) Measured (dB)</th>
<th>Port 4 (Test Set) Measured (dB)</th>
<th>Specification</th>
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Note: This section applies to MN4694C Multiport VNA Systems with MS4642A/B or MS4644A/B VNAs equipped with Option 51 – Front Panel Loops.

This test is automated using the MS464XX Instrument Test software, CD-ROM part number 2300-531-R. Test Data Report generated by the MS464XX Instrument Test software is attached. [ ]

Test Port Power for MN4694C

This test is automated using the MS464XX Instrument Test software, CD-ROM part number 2300-531-R. Test Data Report generated by the MS464XX Instrument Test software is attached. [ ]

Noise Floor for MN4694C
A-3 MN4697C Multiport VNA System Test Record

Instrument Information for MN4697C

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<th>Operator:</th>
<th>Date:</th>
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Note: System Performance can be verified either by using Verification Kit to perform S-Parameters Measurements Verification using Verification Kit or using airline to perform verification of system calibration residuals such as Directivity and Test Port Match. Only one of these tests is required to verify the system performance.

S-Parameters Measurements Verification

This test is automated using the MS464XX System Verification software that is included with 3668-1 Verification Kit.

Note: Pass/Fail criteria is determined from EnR:
- EnR < 1 = PASS
- EnR > 1 = FAIL
Where EnR = Ma-Mb/√(Ua²+Ub²)

Test Data Report generated by the MS464XX System Verification software is attached.

Calibration Residuals Verification – Directivity and Test Port Match

Table A-3. Directivity Record for MN4697C Multiport VNA System

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**Test Port Match for MN4697C**

Table A-4. Test Port Match Record for MN4697C Multiport VNA System

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<th>Port 1 (VNA) Measured (dB)</th>
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<th>Specification</th>
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**Test Port Power for MN4697C**

Note

This section applies to MN4697C Multiport VNA Systems with MS4645A/B or MS46447A/B VNAs equipped with Option 51 – Front Panel Loops.

This test is automated using the MS464XX Instrument Test software, CD-ROM part number 2300-531-R. Test Data Report generated by the MS464XX Instrument Test software is attached. [ ]

**Noise Floor for MN4697C**

This test is automated using the MS464XX Instrument Test software, CD-ROM part number 2300-531-R. Test Data Report generated by the MS464XX Instrument Test software is attached. [ ]
Appendix B — Specifications

B-1 Technical Data Sheet

Use this tab to store the latest version of the VectorStar technical data sheets:

- VectorStar MS4640A Series VNA Technical Data Sheet – 11410-00435
- VectorStar MS4640B Series VNA Technical Data Sheet – 11410-00611
- VectorStar MN469xC Series Multiport Test Set Technical Data Sheet – 11410-00777

Updated product information can be found on your product page:

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Morgan Hill, CA 95037-2809
USA