Maintenance Manual

ShockLine™ Vector Network Analyzer

MS46322A

- 1 MHz to 4 GHz
- 1 MHz to 8 GHz
- 1 MHz to 14 GHz
- 1 MHz to 20 GHz
- 1 MHz to 30 GHz
- 1 MHz to 40 GHz

MS46322A 40 GHz ShockLine VNA

Anritsu Company
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USA

Part Number: 10410-00342
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Safety Symbols

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

Symbols Used in Manuals

Danger

This indicates a risk from a very dangerous condition or procedure that could result in serious injury or death and possible loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Warning

This indicates a risk from a hazardous condition or procedure that could result in light-to-severe injury or loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Caution

This indicates a risk from a hazardous procedure that could result in loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Safety Symbols Used on Equipment and in Manuals

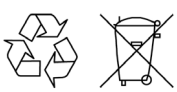
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all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

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

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

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

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



These indicate that the marked part should be recycled.

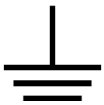
Warning

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

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

Warning

or



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

Warning

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

Caution

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

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

Warning

This equipment is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container. Follow the environmental storage requirements specified in the product data sheet.

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Chapter 4—Troubleshooting

Chapter 5—Assembly Removal and Replacement

Chapter 1 — General Information

1-1 Introduction

This manual provides service and maintenance information for the Anritsu ShockLine MS46322A Vector Network Analyzer. The information includes product description, performance verification procedures, parts removal and replacement procedures, and troubleshooting information.

1-2 Description

The ShockLine MS46322A Vector Network Analyzer is an instrument system that contains a built-in source, test set, and analyzer. Designed for manufacturing application, the ShockLine MS46322A supports remote test programming through LAN communications. Test results can be displayed real time on an external video monitor.

Standard Accessories

Each instrument includes:

- User Documentation USB device –
    - Includes Portable Document Format (PDF) files of the MS46322A Operation Manual, User Interface Reference Manual, Programming Manual, Calibration and Measurement Guide, and the Technical Data Sheet
- Power Cord

Available Options

The main system options are:

- MS46322A-001 – Rack Mount
- MS46322A-002 – Time Domain
- MS46322A-004 – Frequency Option, 1 MHz to 4 GHz, type N(f) test ports
- MS46322A-010 – Frequency Option, 1 MHz to 8 GHz, type N(f) test ports
- MS46322A-014 – Frequency Option, 1 MHz to 14 GHz, type K(m) test ports
- MS46322A-020 – Frequency Option, 1 MHz to 20 GHz, type K(m) test ports
- MS46322A-030 – Frequency Option, 1 MHz to 30 GHz, type K(m) test ports
- MS46322A-040 – Frequency Option, 1 MHz to 40 GHz, type K(m) test ports

Identification Number

All Anritsu MS46322A instruments are assigned a seven-digit ID number (Serial Number), such as “1334203”. This number appears on a decal affixed to the rear panel.

When corresponding with Anritsu Customer Service, please use this identification number with reference to the specific instrument model number, installed options, and serial number. For example, a MS46322A, Option 2, Option 10, Serial Number 1234567.

1-3 Related Documents

Other documents are available for the MS46322A at the Anritsu web site at: www.anritsu.com

- ShockLine MS46322A Series VNA Technical Data Sheet – part number 11410-00751
- ShockLine MS46322A VNA Operation Manual – part number 10410-00335
- ShockLine MS46322A VNA Calibration and Measurement Guide – part number 10410-00336
- ShockLine MS46121A/MS46122A/MS46322A VNA User Interface Reference Manual – part number 10410-00337
- ShockLine MS46121A/MS46122A/MS46322A VNA Programming Manual – part number 10410-00338

1-4 Basic Maintenance

Maintain Operating System Integrity

The Microsoft Windows Embedded operation system on the ShockLine MS46322A is configured for optimum performance when the instrument leaves the factory. To maintain the system's operating integrity, follow proper Windows shutdown procedure and DO NOT modify the operating system configuration, the firewall settings, the system registry, the solid state drive partitions, or the Anritsu user account.

Antivirus Protection, Best Practices

If the VNA is attached to a network, best practices recommend installing antivirus software. Anritsu recommends connecting the instrument only to a secure network.

The user assumes the responsibility to provide virus protection because this is not supplied with the instrument. Contact your network administrator for information about your network security and antivirus protection policies.

Note	Stability of the system is not guaranteed with all antivirus software.

Windows OS Updates

Not all Microsoft updates are compatible with the ShockLine MS46322A VNA and, if installed, may affect the performance of the instrument.

Caution	Changing some of the default Windows settings may cause a loss of instrument control or undesired instrument behavior. Changing the Windows Regional and Language Options settings may cause unstable menu operation. These settings must be maintained as English (United States) as is set at the factory by default.

Solid State Drive Data Backup

Anritsu recommends that you make a backup copy of your critical data stored on the VNA solid state drive as often as possible.

Note	Anritsu reserves the right to reformat or replace the VNAs solid state drive as part of the repair. In such incidence, all user data on the drive will be erased.

Calibration/Certification

Test instruments are often put on a calibration cycle for performance verification in order to provide a quality check or assurance. The details of the performance verification procedures are included in Chapter 2 — Performance Verification.

Repair Service

In the event that the MS46322A VNA requires repair, contact your local Anritsu Service Center. See Section 1-5 "Anritsu Customer Service Centers" for contact information. When contacting Anritsu Service Center, please provide the following information:

- Your company name and address
- The model number and serial number of the instrument
- A detailed description of the problem

1-5 Anritsu Customer Service Centers

For the latest service and sales information in your area, please visit the following URL:

http://www.anritsu.com/contact.asp

Choose a country for regional contact information.

1-6 Recommended Test Equipment

The following test equipment is recommended for use in testing and maintaining the ShockLine MS46322A.

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

Equipment	Critical Specification	Recommended Manufacturer/Model	Use Codes[a]
Calibration Tee (For Opt. 4 & 10)	Frequency: DC to 18 GHz Connector: N(m)	Anritsu Model OSLN50A-18 or TOSLN50A-18	P
Calibration Tee (For Opt. 4 & 10)	Frequency: DC to 18 GHz Connector: N(f)	Anritsu Model OSLN50A-18 or TOSLN50A-18	P
Verification Kit (For Opt. 4 & 10)	Connector: N Type	Anritsu Model 3663-2 (3663-1 is also supported)	P
Torque Wrench	3/4 in Open End Wrench 12 lbf·in (1.35 N·m)	Anritsu Model 01-200	P, A
Adapter	Frequency: DC to 18 GHz Connector: N(m) to K(m)	Anritsu Model 34NK50	P, A
Adapter	Frequency: DC to 18 GHz Connector: N(m) to K(f)	Anritsu Model 34NKF50	P, A
RF Coaxial Cable	Frequency: DC to 40 GHz Impedance: 50 ohm Connector: K(f) to K(m)	Anritsu Model 3670K50-2	P, A
Calibration Tee (For Opt. 14, 20, 30 & 40)	Frequency: DC to 40 GHz Connector: K(m)	Anritsu Model TOSLK50A-40	P
Calibration Tee (For Opt. 14, 20, 30 & 40)	Frequency: DC to 40 GHz Connector: K(f)	Anritsu Model TOSLKF50A-40	P
Verification Kit (For Opt. 14, 20, 30 & 40)	Connector: K Type	Anritsu Model 3668-2 (3668-1 is also supported)	P
Torque Wrench (For Opt. 14, 20, 30 & 40)	5/16 in Open End Wrench 8 lbf·in (0.325 N·m)	Anritsu Model 01-201	P, A
Adapter (For Opt. 14, 20, 30 & 40)	Connector: K(m) to K(f)	Anritsu Model 33KKF50B	P
Adapter (For Opt. 14, 20, 30 & 40)	Connector: K(f) to K(f)	Anritsu Model 33KFKF50B	P, A
Interface Cable	Ethernet: RJ48, cross-over, Cat.5E Ethernet: RJ48, Cat.5E	Anritsu Part Number 3-806-152 Anritsu Part Number 2000-1371-R	P
Personal Computer	Operating System: Windows 7 Interface: Ethernet (RJ-48) Software: National Instruments VISA version 4.4.1 or later	Any	P
System Verification Software	Medium: USB Flash Drive	Anritsu Part Number 2300-560-R (Included with 3663-2 or 3668-2)	P
Calibration Kit (For Opt. 4 & 10)	Frequency: DC to 18 GHz Connector: N Type	Anritsu Model 3653A	A
Calibration Kit (For Opt. 14, 20, 30 & 40)	Frequency: DC to 40 GHz Connector: K Type	Anritsu Model 3652A	A
Frequency Counter	Frequency: 10 MHz to 20 GHz	Anritsu Model MF2412B with Option 3 or MF2412C with Option 3	A

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

Equipment	Critical Specification	Recommended Manufacturer/Model	Use Codes[a]
Power Sensor (For Opt. 4 &10)	Frequency: 10 MHz to 18 GHz Connector Type: N(m)	Anritsu Model MA24118A	A
Power Sensor (For Opt. 14, 20, 30 & 40)	Frequency: 10 MHz to 40 GHz Connector Type: K(m)	Anritsu Model SC8268	A

a.P= Performance Verification; A = Adjustment

1-7 Replaceable Parts and Assemblies

To ensure that the correct options are provided on the replacement assembly when ordering a VNA Module Assembly, all installed instrument options must be declared on the order.

The installed options are listed on a label on the rear panel of the MS46322A. They can also be viewed in the ShockLine Application About box display (Select 9 Help | 1.About Anritsu).

The table below summarizes the available replaceable parts and assemblies with links to Chapter 5, "Assembly Removal and Replacement" detailed procedures

Table 1-2. Replaceable Parts and Assemblies (1 of 2)

Part Number	Description
ND81295	VNA Module Assembly for MS46322A instruments with Option 4
ND81296	VNA Module Assembly for MS46322A instruments with Option 10
ND81297	VNA Module Assembly for MS46322A instruments with Option 14
ND81298	VNA Module Assembly for MS46322A instruments with Option 20
ND81299	VNA Module Assembly for MS46322A instruments with Option 30
ND81300	VNA Module Assembly for MS46322A instruments with Option 40
ND80983	CPU Assembly
ND80984	Solid State Drive with Operating System software and ShockLine Application
ND80997	Solid State Drive with Operating System software and ShockLine Application –For Revision 2 instrument only
ND80994	Back Plane PCB Assembly
ND80995	IO Handler PCB Assembly –For Revision 2 instrument only
ND81163	Front Panel LED PCB Assembly
ND80986	Fan Assembly, Right
ND80987	Fan Assembly, Left
ND80989	Fan Assembly, Rear
3-40-191	Power Supply Assembly
ND80990	19V CPU Main Board Cable Assembly
ND80991	5V Power Supply Cable Assembly

Table 1-2. Replaceable Parts and Assemblies (2 of 2)

Part Number	Description
ND80992	12V & 3.3V Power Supply Cable Assembly
3-513-122	N female Test Port Adapter (For Instruments with Options 4 or 10)
3-75651	K male Test Port Adapter (For Instruments with Options 14, 20, 30 or 40)
3-806-279	RF Cable, SMA(m) to SMA(m), N female Test Port Adapter to VNA Module Assembly (For instruments with Options 4 or 10)
3-806-283	RF Cable, BNC(f) to MCX(m), 10 MHz Ref In or Trigger TTL
3-806-288	Interface Cable, USB Mini B to 4 pin header, VNA Module Assembly to CPU Module
3-806-315	RF Cable, K(f) to K(m), K male Test Port Adapter to VNA Module Assembly (For Instruments with Options 14. 20, 30 or 40)
ND81711	VNA Module 12V Power Cable

Chapter 2 — Performance Verification

2-1 Introduction to Performance Verification

This chapter provides procedures to be used to verify the performance of ShockLine MS46322A.

There are many levels to the concept of VNA "verification" which 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) which are measured using traceable airlines (absolute impedance standards).

An intermediate level which 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 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.

2-2 VNA 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 sections below.

First Tier of Uncertainty – The VNA Calibration

A traceable VNA itself 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 systems 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, skin depth, and 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 values 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, cable stability, and etc. Random measurement error equals measurement error minus systematic measurement error.

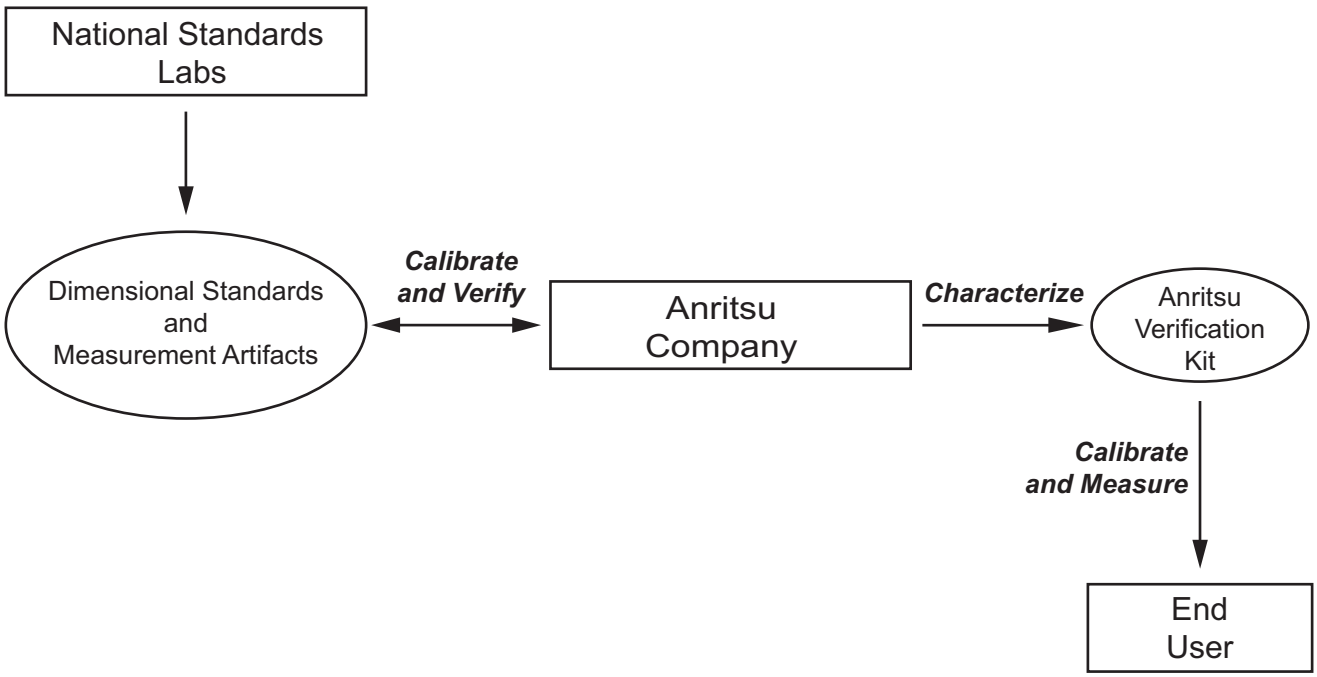
Standards and Verification

Most often instrument end users demand system verifications in order to provide 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

2-3 Process for Creation and Use of a Verification Kit

This process is illustrated in Figure 2-1 below. More information is available from the Anritsu metrology department.



The general process of the creation and use of a verification kit is shown here. A national standards laboratory helps validate the calibration through standards and measured artifacts. At Anritsu Company, these standards and artifacts are used to characterize the components of the verification kit that is sent to the user.

Figure 2-1. Process for Creation and Use of a Verification Kit

2-4 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.

2-5 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:
    - 30 minutes
- Environmental Conditions
    - Temperature
        - For System Verification, 23 °C ± 3 °C, with < 1 °C variation from calibration temperature
        - For other tests, 25 °C ± 5 °C
    - Relative Humidity
        - 20-50% recommended

2-6 System Verification

The System verification procedures verify the measurement capabilities of the VNA, calibration kit, test port cables, 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 MS46322A System Verification Software – 2300-560-R, in conjunction with the appropriate Anritsu Calibration and Verification Kits listed in the table below.

Table 2-1. Equipment Required for System Verification

Equipment	Critical Specification	Recommended Manufacturer/Model
Calibration Kit (For Opt. 10 & 14)	Frequency: DC to 18 GHz Connector: N (m)	Anritsu Model OSLN50A-18 or TOSLN50A-18
Calibration Kit (For Opt. 10 & 14)	Frequency: DC to 18 GHz Connector: N (f)	Anritsu Model OSLN50A-18 or TOSLN50A-18
Verification Kit (For Opt. 10 & 14)	Connector: N Type	Anritsu Model 3663-2 (3663-1 is also supported)
Adapter (For Opt. 10 & 14)	Frequency: DC to 18 GHz Connector: N(m) to K(m)	Anritsu Model 34NK50
Adapter (For Opt. 10 & 14)	Frequency: DC to 18 GHz Connector: N(m) to K(f)	Anritsu Model 34NKF50
Torque Wrench (For Opt. 10 & 14)	3/4 in. Open End Wrench 12 lbf·in (1.35 N·m)	Anritsu Model 01-200
Calibration Tee (For Opt. 20, 30 & 40)	Frequency: DC to 40 GHz Connector: K(m)	Anritsu Model TOSLK50A-40
Calibration Tee (For Opt. 20, 30 & 40)	Frequency: DC to 40 GHz Connector: K(f)	Anritsu Model TOSLKF50A-40
Verification Kit (For Opt. 20, 30 & 40)	Connector: K Type	Anritsu Model 3668-2 (3668-1 is also supported)
Torque Wrench (For Opt. 20, 30 & 40)	5/16 in Open End Wrench 8 lbf·in (0.325 N·m)	Anritsu Model 01-201
Adapter (For Opt. 20, 30 & 40)	Connector: K(m) to K(f)	Anritsu Model 33KKF50B
Adapter (For Opt. 20, 30 & 40)	Connector: K(f) to K(f)	Anritsu Model 33KFKF50B
RF Coaxial Cable	Frequency: DC to 40 GHz Impedance: 50 ohm Connector: K(f) to K(m)	Anritsu Model 3670K50-2
Interface Cable	Ethernet: RJ48, cross-over, Cat.5E Ethernet: RJ48, Cat.5E	Anritsu Part Number 3-806-152 Anritsu Part Number 2000-1371-R
Personal Computer	Operating System: Windows 7 Interface: Ethernet, RJ-48 Software: National Instruments VISA version 4.4.1 or later	Any
System Verification Software	Medium: USB Flash Drive	Anritsu Part Number 2300-560-R (Included with 3663-2 or 3668-2)
Caution – The use of non-Anritsu calibration kits or verification kits is not supported.		

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

The impedance transfer standards 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.

Pass/Fail status of the measurements is displayed on the computer. The software can also provide hardcopy (printout) of the test reports which include the measured data, the measurement uncertainties, and the Pass/Fail status.

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 Vector Network Analyzer (at Anritsu).

The Factory Standard Vector Network Analyzer 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 *En*, 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:

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

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 *En* 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 results is very 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 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.

2-7 System Verification Procedure

The System Verification procedure is described below. The procedure assumes that the System Verification Software has been installed to an External Personal Computer running Microsoft Windows Operating System and the National Instruments VISA runtime.

Equipment Required

- Personal Computer:
  - With Microsoft Windows Operating System
  - With National Instruments VISA runtime
  - Ethernet interface cable
- Anritsu Calibration Kit (Refer to Table 2-1, “Equipment Required for System Verification” on page 2-5)
- Anritsu Verification Kit (Refer to Table 2-1)
- Anritsu Test Port Cables (Refer to Table 2-1)

Special Precautions

When performing the procedures, observe the following precautions:

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

Test Sequence

The user can run all the automated tests in a consecutive fashion or run individual test selectively.

If all are selected, the test sequence is:

- VNA Calibration
- Airline (DAT) Measurements
- Airline (UNC) Uncertainty Computation [Pass/Fail Determination]
- Beatty Airline (DAT) Measurements
- Beatty Airline (UNC) Uncertainty Computation
- 20 dB Offset (Pad) (DAT) Measurements
- 20 dB Offset (Pad) (UNC) Uncertainty Computation
- 50 dB Offset (Pad) (DAT) Measurements
- 50 dB Offset (Pad) (UNC) Uncertainty Computation

Test Reports

Each test generates a data report file in TEXT(ASCII) file format. The data report files can be viewed and printed either using the software built-in “Print” function or other software applications, such as Notepad or other word processors. The data report files are:

- 20DB OFFSET (UNC) #VER.TXT
- 50DB OFFSET (UNC) #VER.TXT
- AIRLINE (UNC) #VER.TXT
- BEATTY (UNC) #VER.TXT

These files can be found in the following folder on the hard drive of the PC Controller:

C:\Anritsu ShockLine Verification\VNA_Reports\MS46322A_xxxxxxx

[where xxxxxxx is the serial number of the MS46322A being tested]

Procedure

1. Turn on power to the PC controller.
2. Use a Cat5-E Ethernet cable to connect the ShockLine MS46322A to a Local Area Network port that is close to the PC controller. Alternatively, use a Cat5-E Ethernet Crossover cable to connect the ShockLine MS46322A directly to the PC Controller Ethernet port. Refer to the MS46322A Operation Manual, PN 10410-00335, for setup procedures.
3. Turn on the ShockLine MS46322A and allow the instrument to warm up for 30 minutes.
4. For Instruments with N(f) Test Ports, prepare the test equipment as follows:
   a. Install the 34NK50 and 34NKF50 Adapters to the 3670K50-2 Through Cable. Use torque wrench to tighten the K connectors to insure that the connections do not work themselves loose during the test.
   b. Install the Through Cable with the Adapter to Port 2 of the ShockLine MS46322A.
5. For Instruments with K(m) Test Ports, prepare the test equipment as follows:
   a. Install the 33KKF50B adapter to the male end of the 3670K50-2 Through Cable. Use torque wrench to tighten the K(m) to K(f) connection so it does not work itself loose during the test.
   b. Install the female end of the Through Cable to Port 2 of the ShockLine MS46322A.
   c. Install the 33KFKF50B adapter to Port 1 of the ShockLine MS46322A
6. Run the ShockLine MS46322A Verification software on the PC.
7. Verify that the PC controller is communicating with the ShockLine MS46322A.
8. Insert the USB flash drive that is supplied with the verification kit to an available USB port on the PC controller. Set the data location of the verification software to the USB flash drive when prompted.
9. Follow the directions that are displayed on the computer to perform calibration with the appropriate calibration kit.

Caution	Use an appropriate torque wrench to insure proper connection of calibration devices during calibration.

10. Follow the directions on the computer to perform measurements of the four impedance transfer standards of the verification kit.
11. After all tests have been completed, print the test results and attach the printouts to the test record in Appendix A, “ShockLine MS46322A Test Record”

If Verification Fails

If the verification fails, then check the quality, cleanliness, and installation methods for the calibration and verification components. Specifically, check:

- The VNA test port connectors
- The calibration tee
- The impedance transfer standards
- The test port cables, for damage and cleanliness
- The test port cables, for proper connection and torquing
- The test port cables, for phase stability

These are the most common causes for verification failures.

Chapter 3 — Adjustment

3-1 Introduction

This chapter contains procedures that are used to restore and optimize the operation of the MS46322A Vector Network Analyzer.

3-2 Source Level Adjustment Procedure

This section provides the procedure to restore or optimize the operation of MS46322A related to the RF leveling at the VNA Test Ports.

Note	Performing Source Level adjustment procedure is normally not required after the VNA assembly has been replaced. Each replacement VNA assembly is fully pre-calibrated / pre-adjusted prior to shipping from the factory.

Equipment Required

- Anritsu Model MA24118A USB Power Sensor (For Instruments with N(f) test ports)
- Anritsu Model SC8268 USB Power Sensor (For Instruments with K(m) test ports)

Procedure

1. Install the PowerXpert Analysis and Control software that is supplied with the USB power sensor to the MS46322A. This will install the Windows driver needed to control the USB power sensor.
2. Power on the VNA and allows the instrument to warm up for at least 45 minutes.
3. Exit the ShockLine Application software.
4. Insert the USB Power Sensor Interface cable into an open USB port of the VNA. Wait for Windows to load the USB power sensor driver.
5. Use Windows Explorer to locate a file named AC_GUIMain.exe.config in the following folder:

   C:\Program Files\Anritsu Company\ShockLine\ Application
6. Right-click on AC_GUIMain.exe.config file and select Open with Notepad.
7. Locate Setting Name="InstrumentType" and change its value from 2 to 3 as shown below:

```
<Setting Name="InstrumentType" serializeAs="String">
    <value>3</value>
</Setting>
```

8. Save the change.
9. Launch the ShockLine Application software from the Windows desktop.
10. Select Power button on the right side menu and then select Power Cal button.

Note	The Power Cal button will only show up when the InstrumentType value of AC_GUIMain.exe.config file is changed to 3.

Port 1 Source Power Cal

11. Verify that Port Selection: Port 1 is shown on the Power Cal menu. If not, select the Port Selection button to change to Port 1. Refer to Figure 3-1.

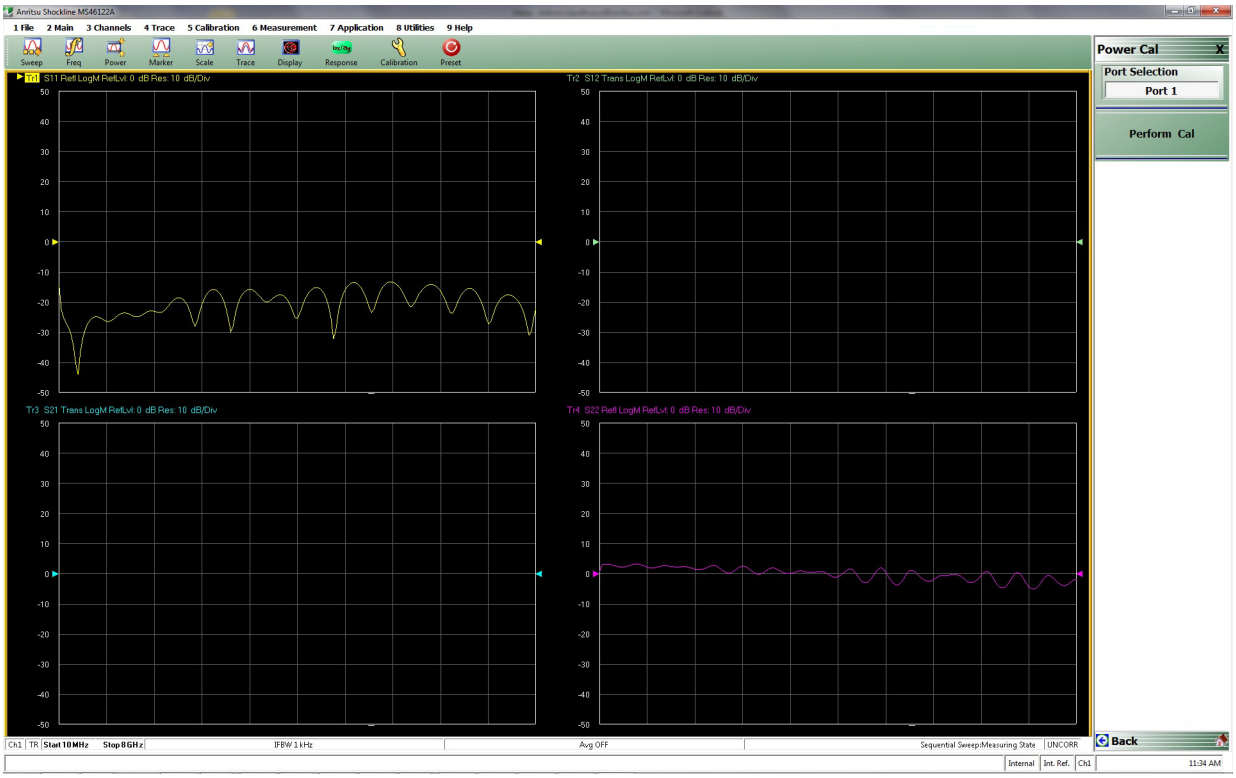


Figure 3-1. Power Cal Menu

12. Select the Perform Cal button and the Power Calibration dialog box appears. See Figure 3-2.

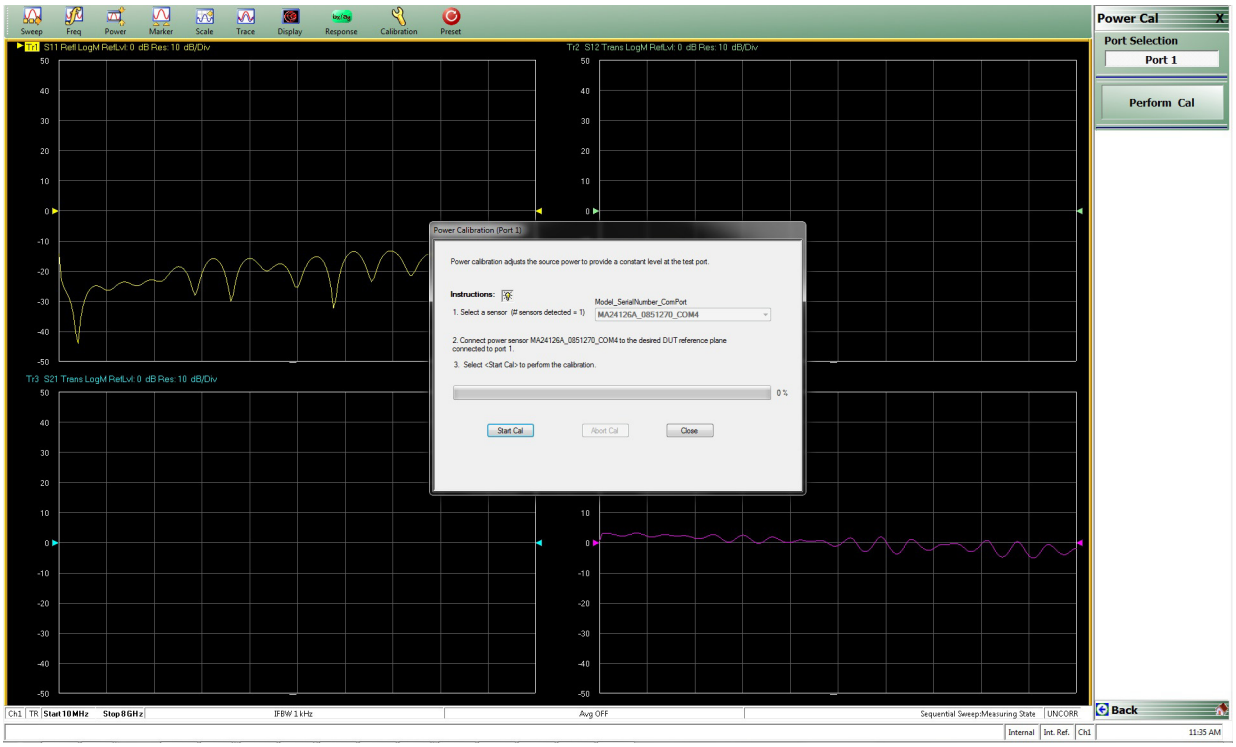


Figure 3-2. Power Cal Dialog Box

13. Select the sensor using the drop-down menu.

14. Connect the power sensor to VNA Port 1.

15. Select the Start Cal button to begin the calibration (adjustment).

16. When the calibration is complete, select the Close button and disconnect the power sensor from VNA Port 1.

Port 2 Source Power Cal

17. Select the Port Selection button to change to Port 2.

18. Select Perform Cal button and the Power Calibration dialog box appears.

19. Connect the power sensor to VNA Port 2.

20. Select the Start Cal button to begin the calibration.

21. When the calibration is complete, select the Close button and disconnect the power sensor from VNA Port 2.

22. Select File | Exit to shut down the ShockLine Application software.

23. Change the InstrumentType value back to 2 in the AC_GUIMain.exe.config file.

24. Launch the ShockLine Application software from the Windows desktop. The new calibration coefficients will take effect afterward.

3-3 IF Adjustment Procedure

This section provides the procedure to restore or optimize the operation of MS46322A related to the IF level in the VNA Receivers.

Note	Performing IF adjustment procedure is normally not required after the VNA module assembly has been replaced. Each replacement VNA module is fully pre-calibrated / pre-adjusted prior to shipping from the factory.

Equipment Required

- For Instruments with N(f) test ports:
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 34NK50 N(m) to K(m) Adapter
  - Anritsu Model 34NKF50 N(m) to K(f) Adapter
- For Instruments with K(m) test ports:
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 33KFKF50B K(f) to K(f) Adapter

Procedure

1. Power on the VNA and allows the instrument to warm up for at least 45 minutes.

2. Connect the through cable between Port 1 and Port 2.

3. Select the Calibration button on the right side menu.

4. Select IF Cal button and follow the prompt to perform the calibration.

5. Select File | Exit to shut down the ShockLine Application software.

6. Launch the ShockLine Application software from the Windows desktop. The new calibration coefficients will take effect afterward.

3-4 Time Base Adjustment Procedure

This section provides the procedure to adjust the internal Time Base in the MS46322A.

Note	Performing Time Base adjustment procedure is normally not required after the VNA module assembly has been replaced. Each replacement VNA module is fully pre-calibrated / pre-adjusted prior to shipping from the factory.

Equipment Required

- For Instruments with N(f) test ports:
  - Anritsu Model MF2412x Frequency Counter with Option 3
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 34NK50 N(m) to K(m) Adapter
  - Anritsu Model 34NKF50 N(m) to K(f) Adapter
- For Instruments with K(m) test ports:
  - Anritsu Model MF2412x Frequency Counter with Option 3
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 33KFKF50B K(f) to K(f) Adapter

Procedure

1. Power on the Frequency Counter and then press the Preset key.
2. Power on the VNA and allow the instrument to warm up for at least 45 minutes.
3. Connect the Through cable between the Frequency Counter Input 1 and VNA Port 1.
4. On the VNA, select the System button on the right-side menu.
5. Select the Diagnostics button.
6. The **Diagnostics Access** dialog box appears providing an entry field to enter the diagnostics access password as shown below in Figure 3-3.

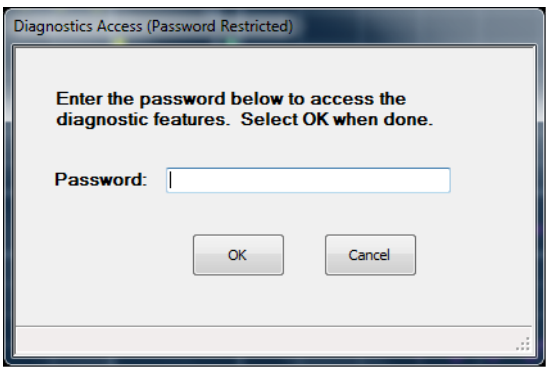


Figure 3-3. Diagnostics Access Dialog Box

7. Enter the password ModVna in the Password field and click OK.
8. Select Hardware Cal button, then the Time Base Cal button.
9. Change the DAC Number value in the **Time Base Calibration** dialog box as shown in Figure 3-4 so that the frequency displayed on the frequency counter is within 5 GHz ± 2 kHz.

.

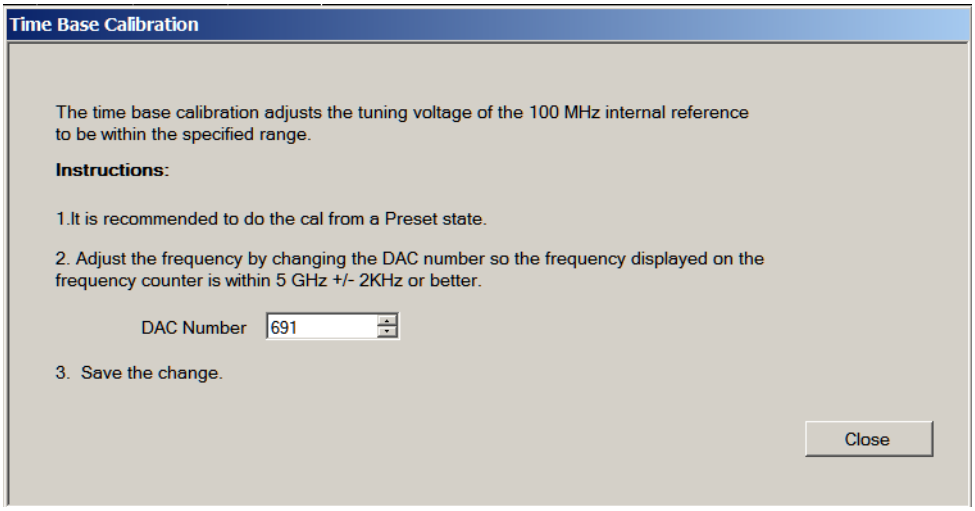


Figure 3-4. Time Base Calibration Dialog Box

10. Click the Close button when done.

3-5 Factory RF Calibration (RF Cal)

The Factory RF Calibration represents a subset of a 12-term calibration so that simple reflection and transmission standards will read somewhat close to their true value, even without a User Measurement Calibration.

Equipment Required

- For Instruments with N(f) test ports:
  - Anritsu Model 3653A N Connector Calibration Kit
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 34NK50 N(m) to K(m) Adapter
  - Anritsu Model 34NKF50 N(m) to K(f) Adapter
- For Instruments with K(m) test ports:
  - Anritsu Model 3652A K Connector Calibration Kit
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 33KFKF50B K(f) to K(f) Adapter

Procedure

1. Power on the VNA and allows the instrument to warm up for at least 45 minutes.
2. If the length of the through line cable is not known, perform the Length Determination Procedure in Section “Through Line Length Determination Procedure” on page 3-9.
3. Preset the VNA and then select the System button on the right-side menu.
4. Select the Diagnostics button.
5. The **Diagnostics Access** dialog box appears providing an entry field to enter the diagnostics access password as shown in Figure 3-3.
6. Enter the password ModVna in the Password field and click OK button.
7. Select Factory Cal button to display the **Factory Cal** menu (Figure 3-5).

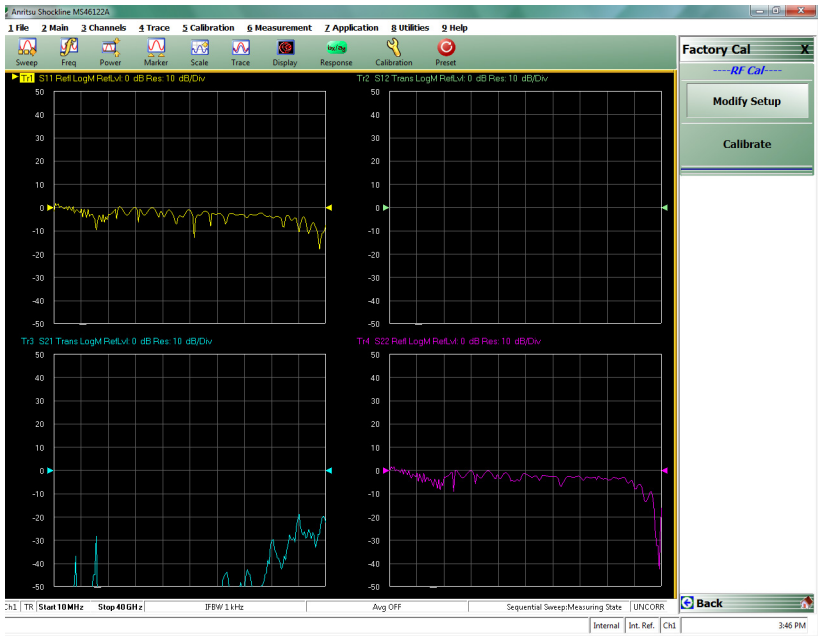


Figure 3-5. Factory Cal Menu

8. Select the Modify Setup button to display the **Factory RF Cal Setup** dialog box.

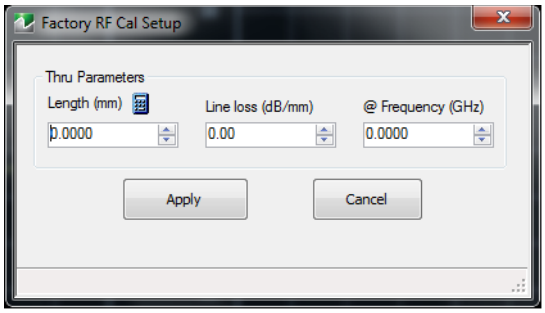


Figure 3-6. Factory RF Cal Setup Dialog

9. Change the parameters in the dialog box as shown in the table below, then click the Apply button when done.

Table 3-1. Parameters Changes for Factory RF Calibration

Thru Length (mm)	Line Loss (dB/mm)	@ Frequency (GHz)
Actual length of through including adapters, if used.	0.009 After the value above is entered, it will round up to 0.01.	70

10. Select the Calibrate button to display the **Factory RF Cal** dialog box (Figure 3-7).

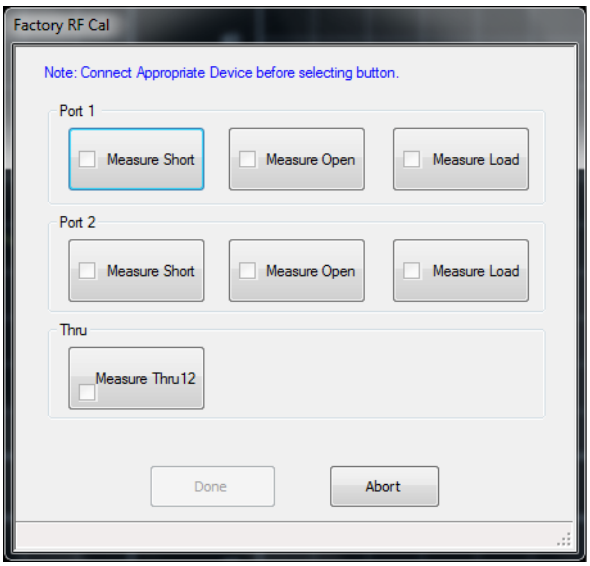


Figure 3-7. Factory RF Cal Dialog

11. Connect each calibration standard from the calibration kit in sequence to the appropriate port. Click the appropriate button when ready.
12. When all seven (7) calibration standards have been measured, click the Done button to complete the procedure.

3-6 Through Line Length Determination Procedure

This procedure is used to determine the length of the through line cable (including adapters) that is used for Factory RF Calibration.

Equipment Required

- For Instruments with N(f) test ports:
  - Anritsu Model 3653A N Connector Calibration Kit
- For Instruments with K(m) test ports:
  - Anritsu Model 3652A K Connector Calibration Kit

Procedure

1. Power on and warm up the VNA for at least 45 minutes.
2. Preset the VNA.
3. Select the Frequency button on the right side menu and set the number of points to 801.
4. Select the Calibration button.
5. Insert the USB memory device from the calibration kit into the USB port on the front panel of the instrument. The LED indicator on the USB memory device will flash and then light constantly.
6. Select the Cal Kit/AutoCal Characterization button, then select the Install Kit/Charac button to display the **Load** dialog box (Figure 3-8).

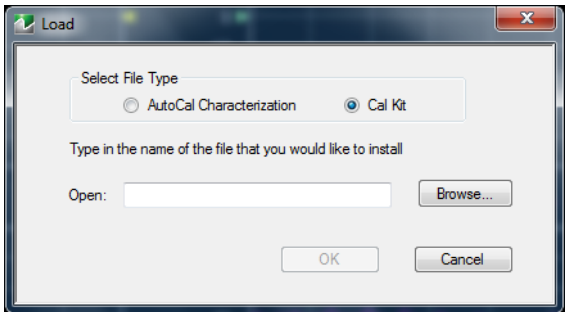


Figure 3-8. Load (Characterization/Cal Kit) Dialog Box

7. Select the Cal Kit radio button and then click the Browse button.
8. Locate Removable Disk (x:), where x is the drive letter designated to the USB drive by Windows.
9. Double-click Removable Disk (x:), then select the "xxxxxxxxx.ccf" file, and then click Open.
10. In the **Load** dialog box, click OK to load the coefficients.
11. Click the Back icon to return to the **Calibration [TR]** menu.
12. Select the Calibrate button and then the Manual Cal button.
13. Select the 1-Port Cal button and then Edit Cal Params button.
14. Uncheck Test Port 2 and change Test Port 1 DUT Connector as follows:
    a. For Instruments with N(f) Test Ports – N-Conn(M)
    b. For Instrument with K(m) Test Ports – K-Conn(F)
15. Click the OK button when done, then click on the Back icon to return to the previous men.
16. Select the Port 1 Reflective Devices button.

17. Connect the open calibration standard to VNA Port 1 and then select the Open button to start the measurement. When done, a check mark appears on the Open button to indicate the existence of a calibration.

18. Disconnect the Open, connect the Short calibration standard to VNA Port 1, and then select the Short button to start the measurement.

19. Disconnect the Short, connect the Load calibration standard to VNA Port 1, and then select the Load button to start the measurement.

20. Disconnect the Load from VNA Port 1 and click the Done button.

21. Connect a short to one end of the through cable (DUT).

22. Connect the open end of the through cable to VNA Port 1.

23. Select the Measurement button, then click the Reference Plane button, and then click the Auto button.

24. Subtract the value below from the displayed Distance value. This is the Length of the through cable used for the Factory RF Calibration.

- **a.** For N connector through cable – 8.966 mm
- **b.** For K connector through cable – 5 mm

25. Enter 0 to the Distance button to reset the value.

Chapter 4 — Troubleshooting

4-1 Introduction

This chapter provides information about troubleshooting tests that can be used to check the MS46322A Vector Network Analyzer for proper operation. These tests are intended to be used as a troubleshooting tool for identifying the faulty components and checking the functionality of internal components and sub-assemblies in the MS46322A VNA.

Only qualified service personnel should replace internal assemblies. Major subassemblies that are shown in the replaceable parts list are typically the items that may be replaced.

Because they are highly fragile, items that must be soldered may not be replaced without special training. Removal of RF shields from PC boards or adjustment of screws on or near the RF shields will de tune sensitive RF circuits and will result in degraded instrument performance.

4-2 General Safety Warnings

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

Warning	Hazardous voltages are presented inside the instrument when AC line power is connected. Before removing any covers, turn off the instrument and unplug the AC power cord.

Caution	Many assemblies and modules in the MS46322A VNA contain static-sensitive components. Improper handling of these assemblies and modules may result in damage to the assemblies and modules. Always observe the static-sensitive component handling precautions.

4-3 Troubleshooting Test – Power Supply DC Check

This procedure verifies that the expected DC voltages are present at the Power Supply and the Back Plane PCB Assembly in the MS46322A VNA.

Equipment Required

- Digital Multimeter

Reference Figures

- Figure 4-1 shows the Power Supply +3.3V terminal, +12V terminal and their respective Ground terminals.
- Figure 4-2 shows both the front and back sides of the Back Plane PCB Assembly to help locate the E1 test point and the P16 5V connector.
- Figure 4-3 shows the location of P17 VNA 12V Power Supply connector on the front side of the Back Plane PCB Assembly.

Figure 4-1. Power Supply Output Terminals

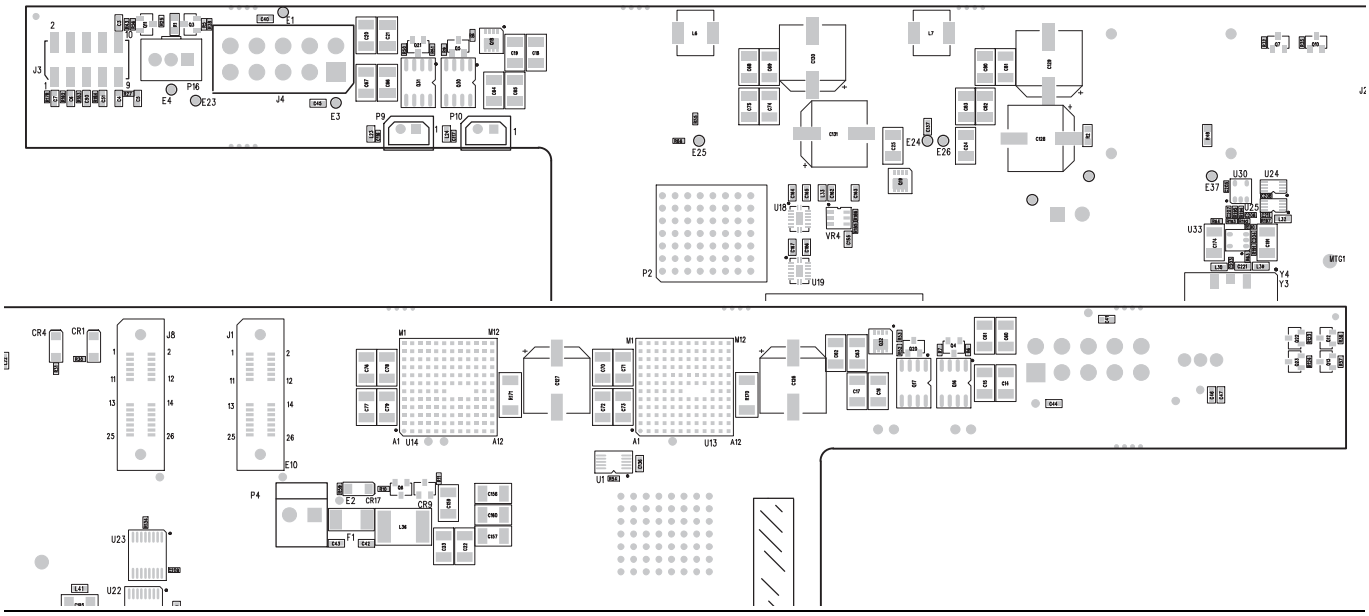


Figure 4-2. Back Plane PCB Assembly

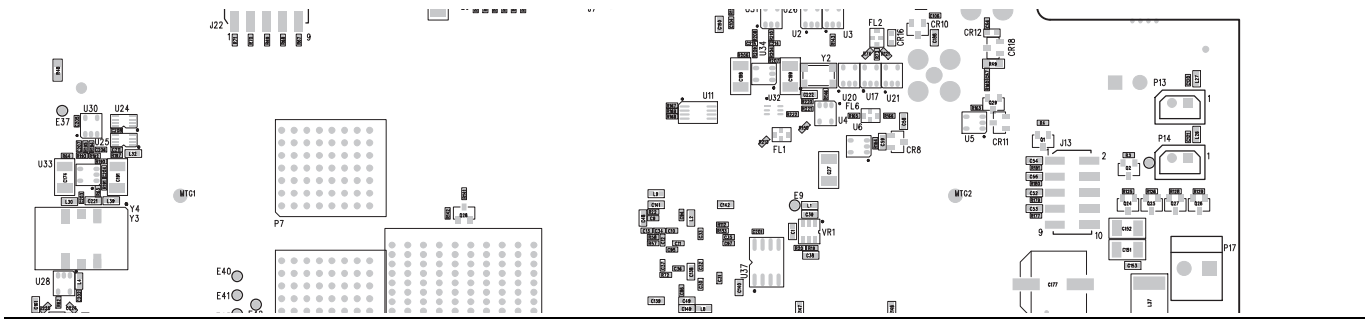


Figure 4-3. Location of P17 VNA 12V Power Supply Connector

Procedure

1. Turn off the MS46322A VNA and unplug the AC power cord, mouse, keyboard and external monitor.

2. Remove the top cover.

3. Re-connect the AC power cord, mouse, keyboard and external monitor.

4. Turn the MS46322A VNA on.

5. Use the digital multimeter to measure the DC voltages at the test points stated in Table 4-1.

Table 4-1. Expected DC Bias Voltages

Test Point	Common	Expected Voltage
Power Supply +3.3V Terminal	Power Supply +3.3V GND Terminal	+3.3 V
Power Supply +12V Terminal	Power Supply +12V GND Terminal	+12 V
Back Plane PCB Assy P16 pin 3	Back Plane PCB Assy P16 pin 2	+5 V
Back Plane PCB Assy P4 pin 1 (or E2)	Back Plane PCB Assy P4 pin 2	+19 V
Back Plane PCB Assy P17 pin 1	Back Plane PCB Assy P17 pin 2	+12 V

Note	When measuring the DC voltage on Back Plane PCB Assembly (except P17), place the test probes on the back side of the specified connector.

6. If the +3.3V or +12V are not present at the terminals, replace the power supply.

7. If the +5 V is not present at P16 of the Back Plane PCB Assembly, replace the power supply

8. If the +19V is not present at P4, replace the Back Plane PCB Assembly.

9. If the +12V is not present at P17, replace the Back Plane PCB Assembly.

4-4 Troubleshooting Test - Non-Ratio Power Level Check

The Non-Ratio Power Level Check is very useful to verify if the VNA Module Assembly is faulty.

Equipment Required

- For Instruments with N(f) test ports:
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 34NK50 N(m) to K(m) Adapter
  - Anritsu Model 34NKF50 N(m) to K(f) Adapter
- For Instruments with K(m) test ports:
  - Anritsu Model 3670K50-2 Through Cable
  - Anritsu Model 33KFKF50B K(f) to K(f) Adapter

Procedure

1. For instruments with N(f) test ports, install the 34NK50 and 34NKF50 adapters to the 3670K50-2 RF Coaxial Cable to convert both ends into N(m) connector port.
2. For instrument with K(m) test ports, install 33KFKF50B adapter to the male end of the 3670K50-2 RF Coaxial Cable.
3. Turn on the MS46322A.
4. Connect the coaxial cable between test port 1 and test port 2.
5. Select Trace 1 and then select Display | Trace Format. Set Trace Format to Log Mag.
6. Select Response | User-defined. The User-defined menu appears.
7. Set Numerator to A1, Denominator to 1, and Driver Port to Port 1.
8. Use a mouse to move the Reference Line to one graticule below top scale.
9. Repeat Step 4 thru step 7 for Trace 2, setting Numerator to B2, Denominator to 1, and Driver Port to Port 1.
10. Repeat Step 4 thru step 7 for Trace 3, setting Numerator to B1, Denominator to 1, and Driver Port to Port 2.
11. Repeat Step 4 thru step 7 for Trace 4, setting Numerator to A2, Denominator to 1, and Driver Port to Port 2.
12. Observe whether any portions of these traces show any abnormality (e.g. very low power level).

4-5 Troubleshooting Turn-on Problems

Unit Cannot Boot Up

Unit cannot boot up, no activity occurs when the **Operate/Standby** key is pressed:

1. Perform Power Supply DC Check as described in "Troubleshooting Test - Power Supply DC Check" on page 4-2.
   a. Based on the test results, replace either the Power Supply or the Back Plane PCB Assembly.
2. If all voltages are present and the CPU Fan is not running, then replace the CPU Assembly.

Unit Cannot Boot into Windows OS environment

1. Remove the solid state drive from the VNA and attach it to a USB to SATA Adapter.
2. Install the USB to SATA Adapter to a USB port of a Personal Computer that has anti-malware installed.
   a. If the PC could not recognize the solid state drive, replace it with a new solid state drive.
3. Perform the malware scan.
   a. If malware is found, remove the malware, then install the solid state drive back to the VNA and verify if the VNA can boot into Windows and launch ShockLine Application.
   b. If problem still exists, replace the solid state drive.

Unit Cannot Launch ShockLine Application

Unit can boot to Windows but does not launch ShockLine Application:

1. ShockLine Application Software update may not have completed. Re-install software.
2. Verify if the +12V DC is present at P17 of Back Plane PCB Assembly. If not present, replace the Back Plane PCB Assembly.
3. Verify if the USB Mini B cable connector is inserted all the way into the USB Mini connector on the VNA Module Assembly.
4. If problem still exists, replace the solid state drive.

4-6 Troubleshooting Operating Problems

Frequency Related Problems

If the instrument exhibits frequency related problem, do the following:

1. Perform "Time Base Adjustment Procedure" on page 3-5. If it does not help, go to next step.
2. Apply external 10 MHz Reference to the rear panel 10 MHz Ref In.
3. If the problem does not show with the external reference, the problem is in the internal reference oscillator. Replace the VNA Module Assembly.

RF Power Related Problems

If the instrument exhibits RF Power Related Problems, do the following:

1. Perform "Troubleshooting Test - Non-Ratio Power Level Check" on page 4-5.
2. If the power level shows any abnormality, do the following:
   a. Verify that the coaxial cable connection between test port adapter and VNA Module Assembly. Re-torque if necessary.
   b. Verify that the test port adapter is worn or damaged. Replace the test port adapter if necessary.

c. Replace VNA Module Assembly.

4-7 Troubleshooting Measurement Problems

If the MS46322A measurement quality is suspect, the following paragraphs provide guidelines and hints for determining possible quality problems.

VNA Measurement Quality

The quality of MS46322A VNA measurements is determined by the following test conditions and variable:

- The condition of the MS46322A.
- The quality and condition of the interface connections and connectors.
- The quality and condition of the calibration components, through cables, adapters and fixtures.
- The surrounding environmental conditions at the time of the measurement.
- The selection and performance of the calibration for the DUT being measured.

Checking Possible Measurement Problems

When determining possible measurement problems, check the following items:

1. Check the DUT and the calibration conditions:

a. Ensure that the Calibration Components Coefficients data has been installed into the VNA for the Calibration Kit in use.

b. Ensure that the proper calibration was done for the device being measured:

- For high insertion-loss device measurements, the calibration should include isolation, high number of averages, and narrow IF Bandwidth setting during calibration.
- For high return-loss device measurements, a high quality precision load should be used during calibration.

c. Check the condition of DUT mating connectors and their pin depth.

d. If possible, measure an alternate known good DUT.

e. Check if the environment is stable enough for the accuracy required for the DUT measurement.

- The VNA should not be subjected to variations in temperature.
- The VNA should not be placed in direct sun light or next to a changing cooling source, such as a fan or air conditioning unit.

2. Check the calibration using known good components from the calibration kit. If measurements of these devices do not produce good results, try the following:

a. Check through-cable stability including condition and pin depth. Replace with a known good cable, if necessary.

b. Check condition and pin depth of calibration kit components. Replace with known good components, if necessary.

c. Check condition and pin depth of test port adapters. Replace with known good ones if necessary.

3. Check the system performance as described in Chapter 2, “Performance Verification”

Chapter 5 — Assembly Removal and Replacement

5-1 Introduction

This chapter describes the removal and replacement procedures for the various assemblies. Illustrations (drawings or photographs) in this manual may differ slightly from the instrument that you are servicing, but the basic removal and replacement functions will remain as specified. The illustrations are meant to provide assistance with identifying parts and their locations.

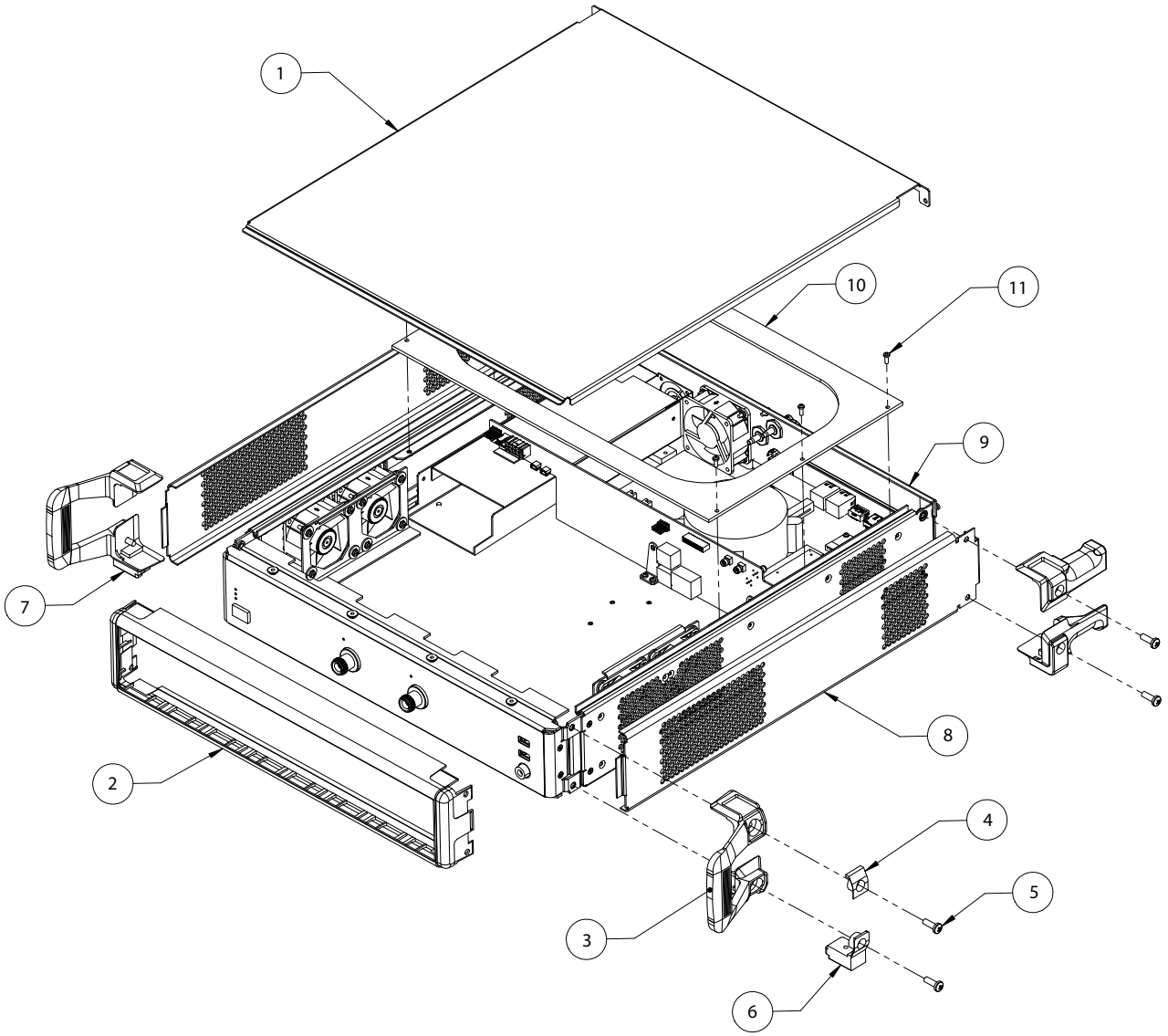
5-2 Electrostatic Discharge Prevention

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 MS46322A Vector Network Analyzer.

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

5-3 Basic Assembly Overview

Figure 5-1 on page 5-2 shows the basic assembly overview of MS46322A Vector Network Analyzer.



1 – Top Cover
2 – Front Panel Bezel
3, 4, 5 – Right Handle, Top Handle Insert and Green screw
6, 7 – Bottom Handle Foot
8 – Side Cover
9 – Rear Panel
10 – Stiffener plate
11 – Stiffener plate mounting screw

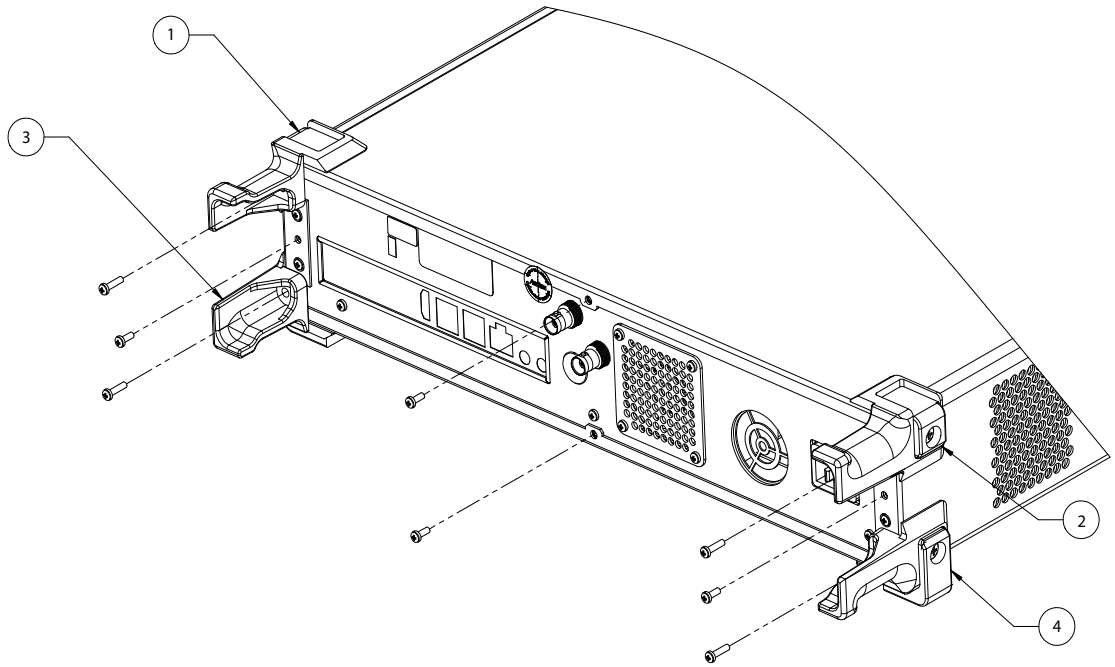
Figure 5-1. MS46322A Basic Assembly Overview

5-4 Disassembly Procedure

Use this procedure to prepare the MS46322A for removal and replacement procedures for all of its replaceable components. Other than the front panel cables, all replacement components require this common disassembly procedure.

Common Disassembly Procedure

1. Prepare a clean and static free work area. Make sure that the work area is well grounded. Cover the work surface with a soft, clean anti-static mat.
2. Provide all personnel with appropriate anti-static grounding wrist straps and similar equipment.
3. Power down the VNA and unplug the AC power cord.
4. Place the VNA on the anti-static mat.
5. Refer to Figure 5-2 on page 5-3 and remove the top cover as follows:
   a. Remove the two top rear feet.
   b. Remove the center screw that secures the top cover to the chassis.
   c. Slide the top cover back and then lift the top cover off the instrument.



1. Top Right Foot
2. Top Left Foot
3. Bottom Right Foot
4. Bottom Left Foot

Figure 5-2. MS46322A Rear Panel

6. Remove the six Phillips screws that secure the stiffener plate to the chassis. Refer to Figure 5-1 on page 5-2.
7. Removing the bottom cover is required when replacing the Power Supply, the Solid State Drive or the high frequency VNA Module Assembly. Refer to Figure 5-2 on page 5-3 and use the following steps to remove the bottom cover:
   a. Carefully flip over the instrument so the bottom side is now facing upward.
   b. Remove the two bottom rear feet.
   c. Remove the center screw that secures the bottom cover to the chassis.
   d. Slide the top cover back and then lift the bottom cover off the instrument.

5-5 VNA Module Assembly

Use this procedure to replace the VNA Module Assembly. It is secured to the chassis by five (5) Phillips screws and five (5) standoffs.

Replacement Parts

- VNA Module Assembly for MS46322A with Option 4 – ND81295
- VNA Module Assembly for MS46322A with Option 10 – ND81296
- VNA Module Assembly for MS46322A with Option 14 – ND81297
- VNA Module Assembly for MS46322A with Option 20 – ND81298
- VNA Module Assembly for MS46322A with Option 30 – ND81299
- VNA Module Assembly for MS46322A with Option 40 – ND81300

Reference Figures

- Figure 5-3, “Location of VNA Module Cable Clamp” on page 5-5
- Figure 5-4, “Low Frequency VNA Module Assembly Location Diagram (Options 4 and 10)” on page 5-6
- Figure 5-5, “Low Frequency VNA Module Assembly (Options 4 and 10)” on page 5-7
- Figure 5-6, “High Frequency VNA Module Assembly Location Diagram (Options 14, 20, 30 and 40)” on page 5-8

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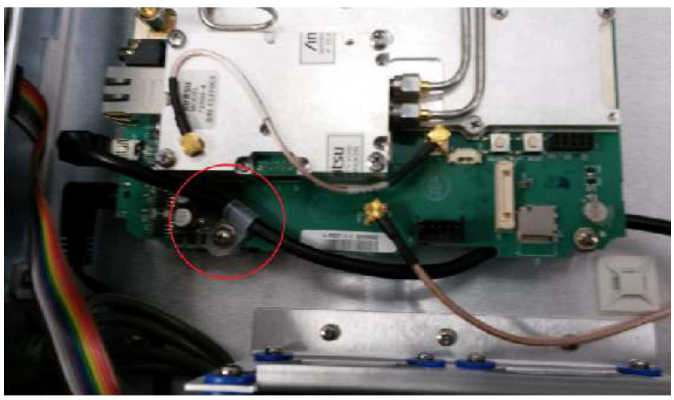
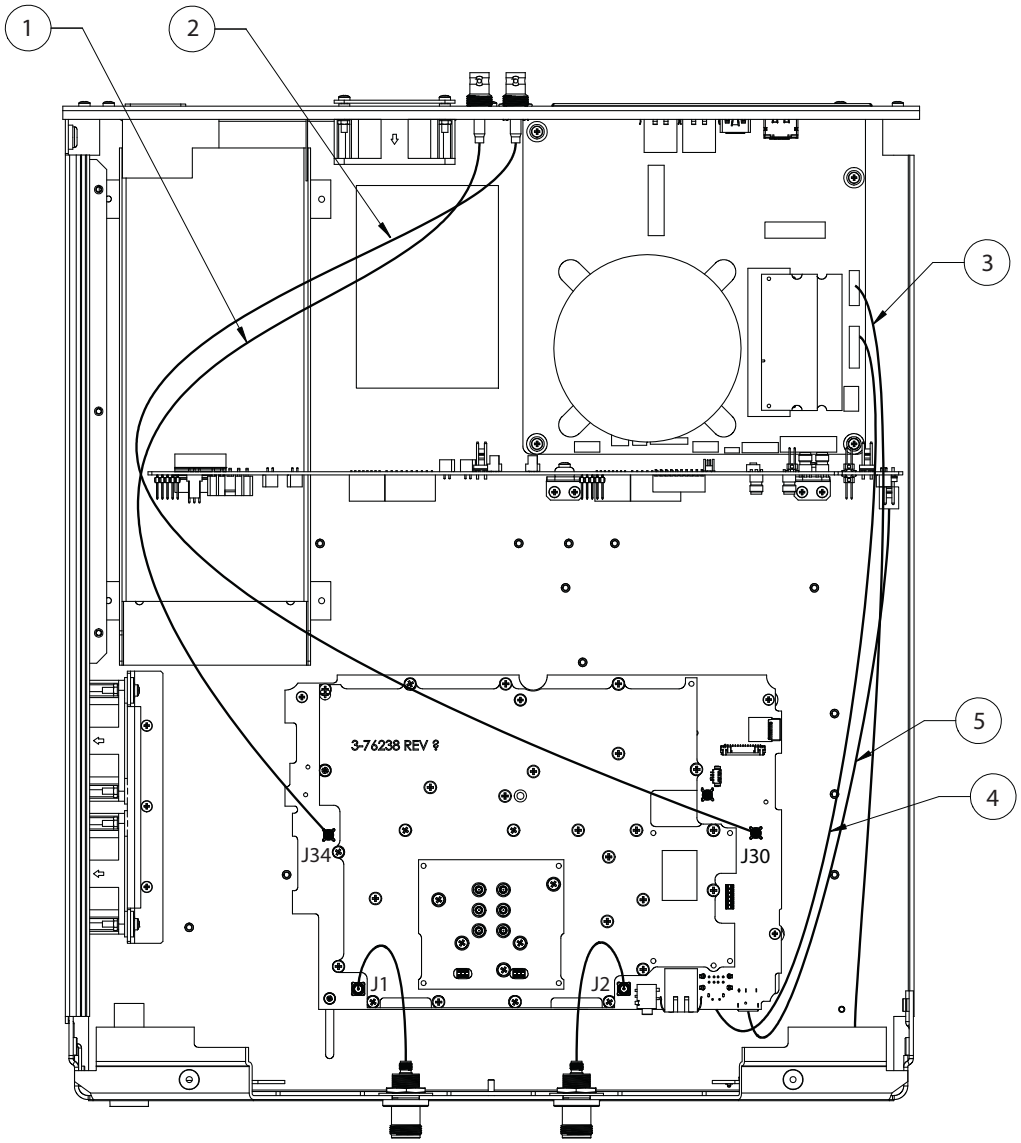
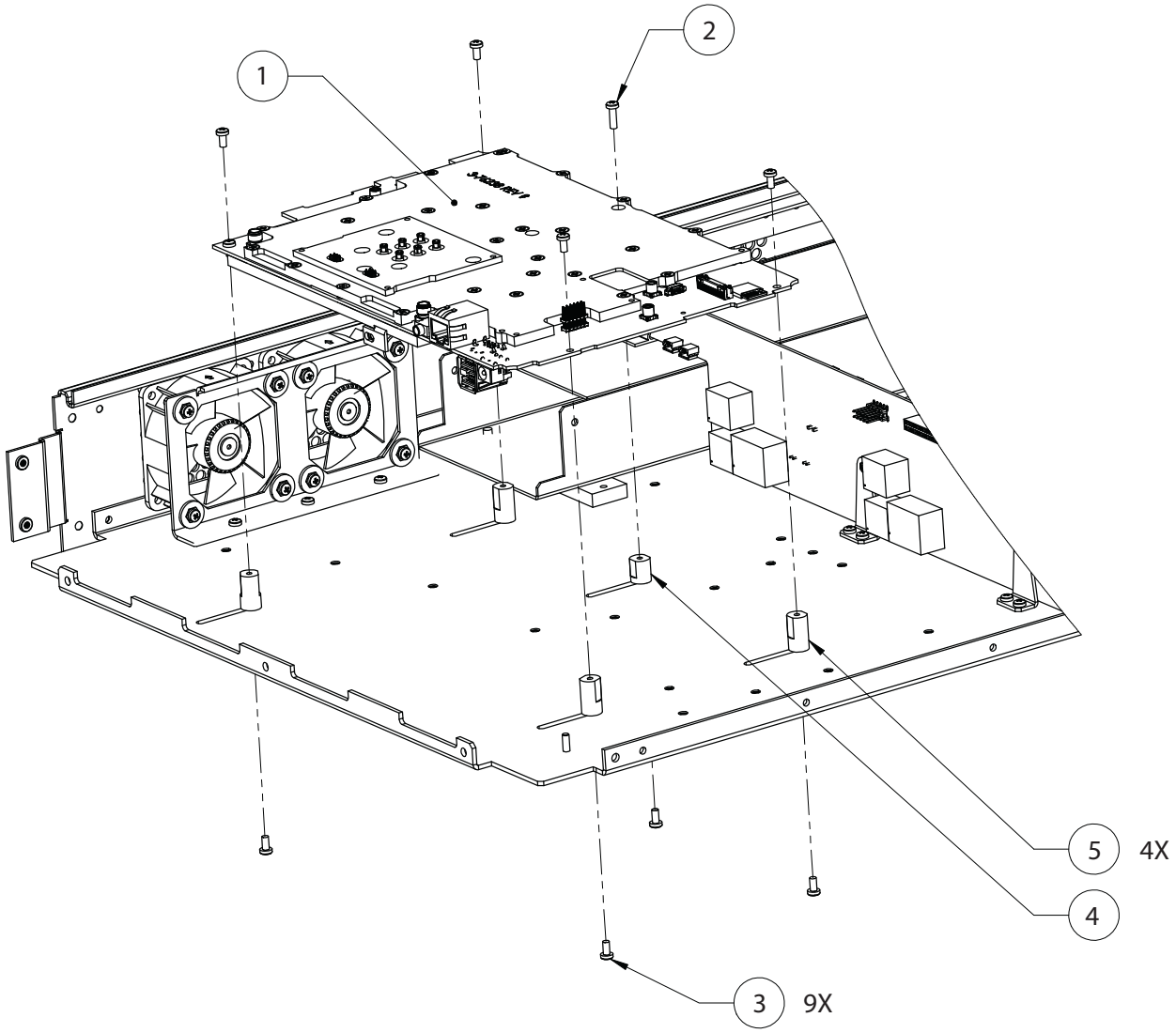


Figure 5-3. Location of VNA Module Cable Clamp



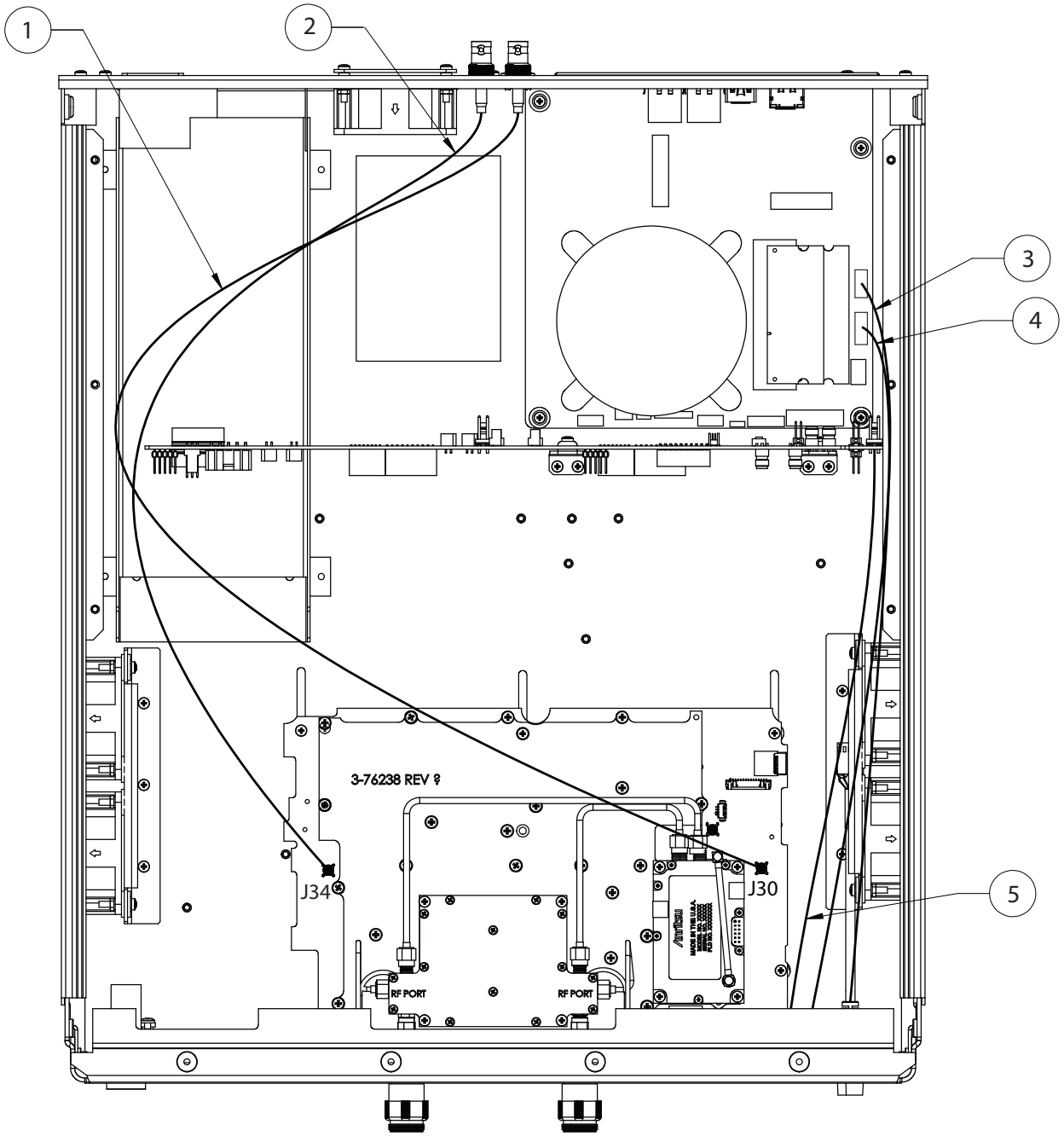
1 – 10 MHz Ref In Cable
2 – Trigger TTL In Cable
3 – Front Panel USB Interface Cable
4 – VNA Module Assembly USB Interface Cable
5 – VNA Module Assembly +12V Power Supply Cable

Figure 5-4. Low Frequency VNA Module Assembly Location Diagram (Options 4 and 10)



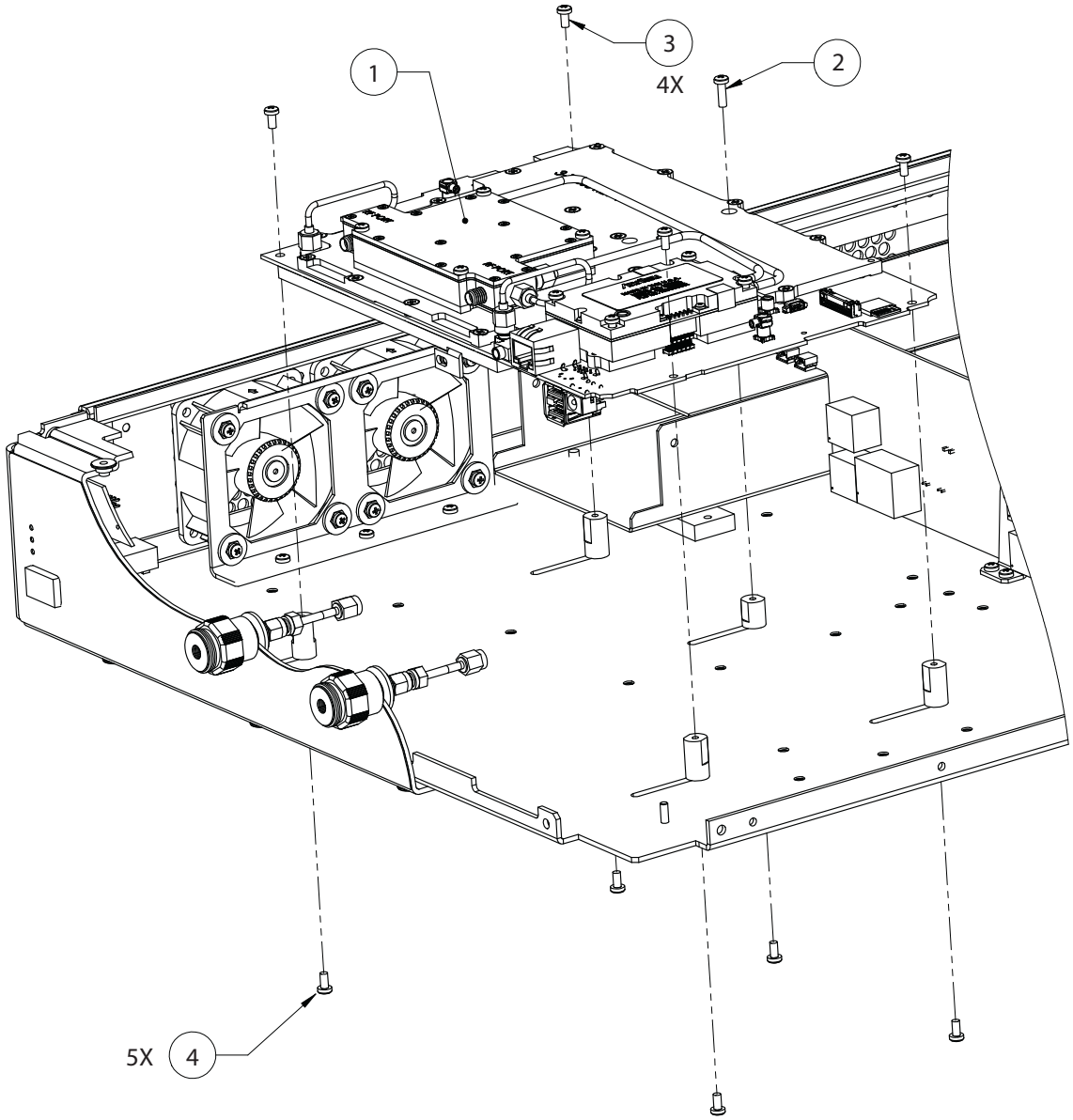
1 – VNA Module Assembly
2 – Long Mounting Screw (1)
3 – Short Mounting screws (9)
4 – Short Standoff (1)
5 – Tall Standoffs (4)

Figure 5-5. Low Frequency VNA Module Assembly (Options 4 and 10)



1 – 10 MHz Ref In Cable
2 – Trigger TTL In Cable
3 – Front Panel USB Interface Cable
4 – VNA Module Assembly USB Interface Cable
5 – VNA Module Assembly +12V Power Supply Cable

Figure 5-6. High Frequency VNA Module Assembly Location Diagram (Options 14, 20, 30 and 40)



1 – VNA Module Assembly
2 – Long Mounting screw (1)
3 – Short Mounting screws (4)
4 – Standoff Mounting screws (5)

Figure 5-7. High Frequency VNA Module Assembly (Options 14, 20, 30 and 40)

Replacement Procedure (For instruments with Options 4 and 10)

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the Stiffener Plate.
3. Disconnect the 10 MHz Ref In Cable from J30 of the VNA Module Assembly.
4. Disconnect the Trigger TTL In Cable from J34 of the VNA Module Assembly.
5. Disconnect the VNA Module Assembly 12V Power Supply Cable from P17 of the Back Plane PCB Assembly.
6. Disconnect the VNA Module Assembly USB Interface Cable from the CPU Module.
7. Disconnect the flexible coaxial cables from J1 and J2 of the VNA Module Assembly.
8. Remove the five screws that secure the VNA Module Assembly to the standoffs and then remove the cable clamp from the power supply cable and USB interface cable.
9. Carefully remove the VNA Module Assembly from the chassis.
10. Disconnect the 12V Power Supply Cable from the VNA Module Assembly.
11. Disconnect the USB Interface Cable from the VNA Module Assembly.
12. Connect the 12V Power Supply Cable to the replacement VNA Module Assembly.
13. Connect the USB Interface Cable to the replacement VNA Module Assembly.
14. Place the replacement VNA Module Assembly on the standoffs and secure with screws that were removed in Step 8. Install the cable clamp prior installing the screw that is near the power supply connector. See Figure 5-3 on page 5-5.
15. Connect the flexible coaxial cables to J1 and J2 of the VNA Module Assembly.
16. Torque the connections above to 8 in-lb.
17. Connect the 10 MHz Ref In Cable to J30 of the VNA Module Assembly.
18. Connect the Trigger TTL In Cable to J34 of the VNA Module Assembly.
19. Connect the VNA Module Assembly 12V Power Supply Cable to P17 of the Back Plane PCB Assembly.
20. Connect the VNA Module Assembly USB Interface Cable to the CPU Module.
21. Install the Stiffener Plate.
22. Install the top cover.

Replacement Procedure (For Instruments with Options 14, 20, 30 and 40)

1. Remove the top and bottom covers as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the Stiffener Plate.
3. Disconnect the 10 MHz Ref In Cable from J30 of the VNA Module Assembly.
4. Disconnect the Trigger TTL In Cable from J34 of the VNA Module Assembly.
5. Disconnect the VNA Module Assembly 12V Power Supply Cable from P17 of the Back Plane PCB Assembly.
6. Disconnect the VNA Module Assembly USB Interface Cable from the CPU Module.
7. Disconnect the flexible coaxial cables from J1 and J2 of the VNA Module Assembly.
8. Loosen the five (5) screws that secure the VNA Module Assembly to the chassis standoffs.
9. Place the instrument on its side and loosen the five (5) screws that secure the standoffs to the chassis on the bottom so that the VNA Module Assembly can be sliding backward.
10. Place the instrument on its bottom.
11. Disconnect the semi-rigid coaxial cables from Port 1 and Port 2 Inputs of the VNA Module Assembly.
12. Carefully slide the VNA Module Assembly backward.
13. Remove the five screws that secure the VNA Module Assembly to the standoffs and then remove the cable clamp from the power supply cable and USB interface cable.
14. Carefully remove the VNA Module Assembly from the chassis.
15. Disconnect the 12V Power Supply Cable from the VNA Module Assembly.
16. Disconnect the USB Interface Cable from the VNA Module Assembly.
17. Connect the 12V Power Supply Cable to the replacement VNA Module Assembly.
18. Connect the USB Interface Cable to the replacement VNA Module Assembly.
19. Place the replacement VNA Module Assembly on the standoffs and secure with screws that were removed in Step 8. Install the cable clamp prior installing the screw that is near the power supply connector. See Figure 5-3 on page 5-5.
20. Connect the semi-rigid coaxial cables to Port 1 and Port 2 of the VNA Module Assembly.
21. Torque the connections above to 8 in-lb.
22. Place the instrument on its side and tighten the five (5) screws that secure the standoffs.
23. Place the instrument on its bottom.
24. Connect the 10 MHz Ref In Cable to J30 of the VNA Module Assembly.
25. Connect the Trigger TTL In Cable to J34 of the VNA Module Assembly.
26. Connect the VNA Module Assembly 12V Power Supply Cable to P17 of the Back Plane PCB Assembly.
27. Connect the VNA Module Assembly USB Interface Cable to the CPU Module.
28. Install the Stiffener Plate.
29. Install the top and bottom covers.

5-6 CPU Assembly

Use this procedure to replace the CPU Assembly.

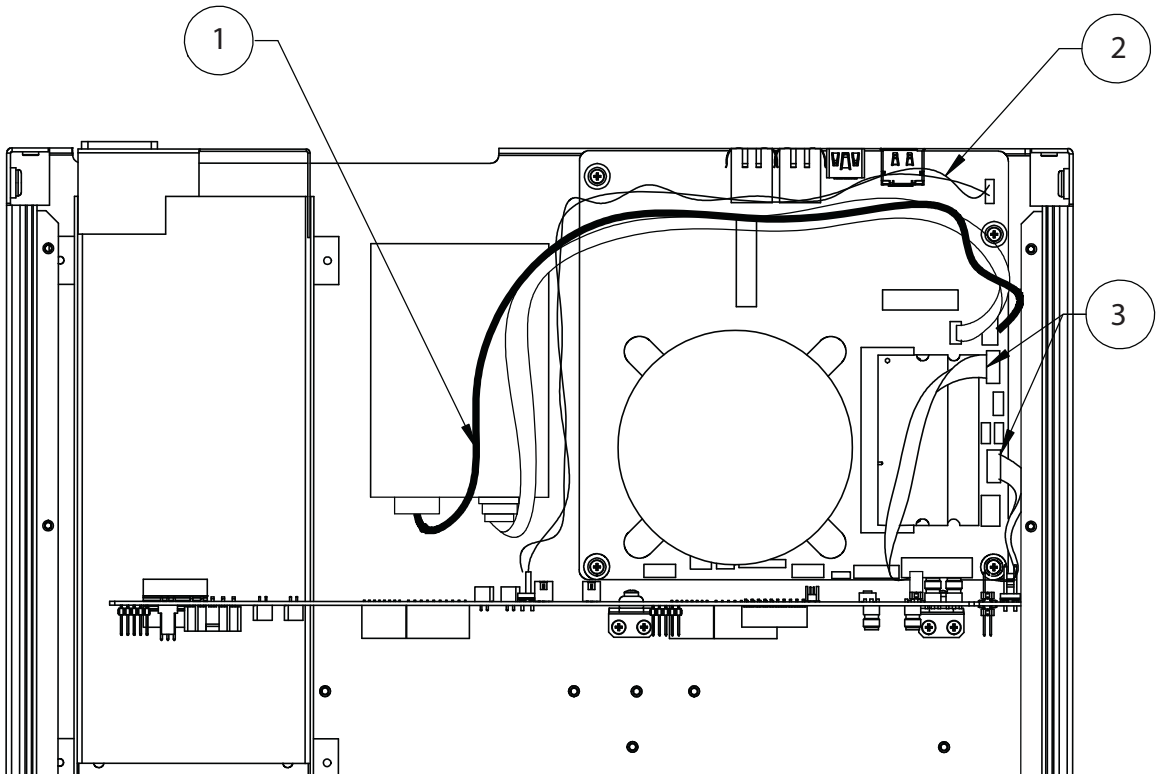
The CPU Assembly has the Main Processor and SODIMM modules already installed and has been pre-tested as a single assembly.

Replacement Part

- CPU Assembly – ND80983

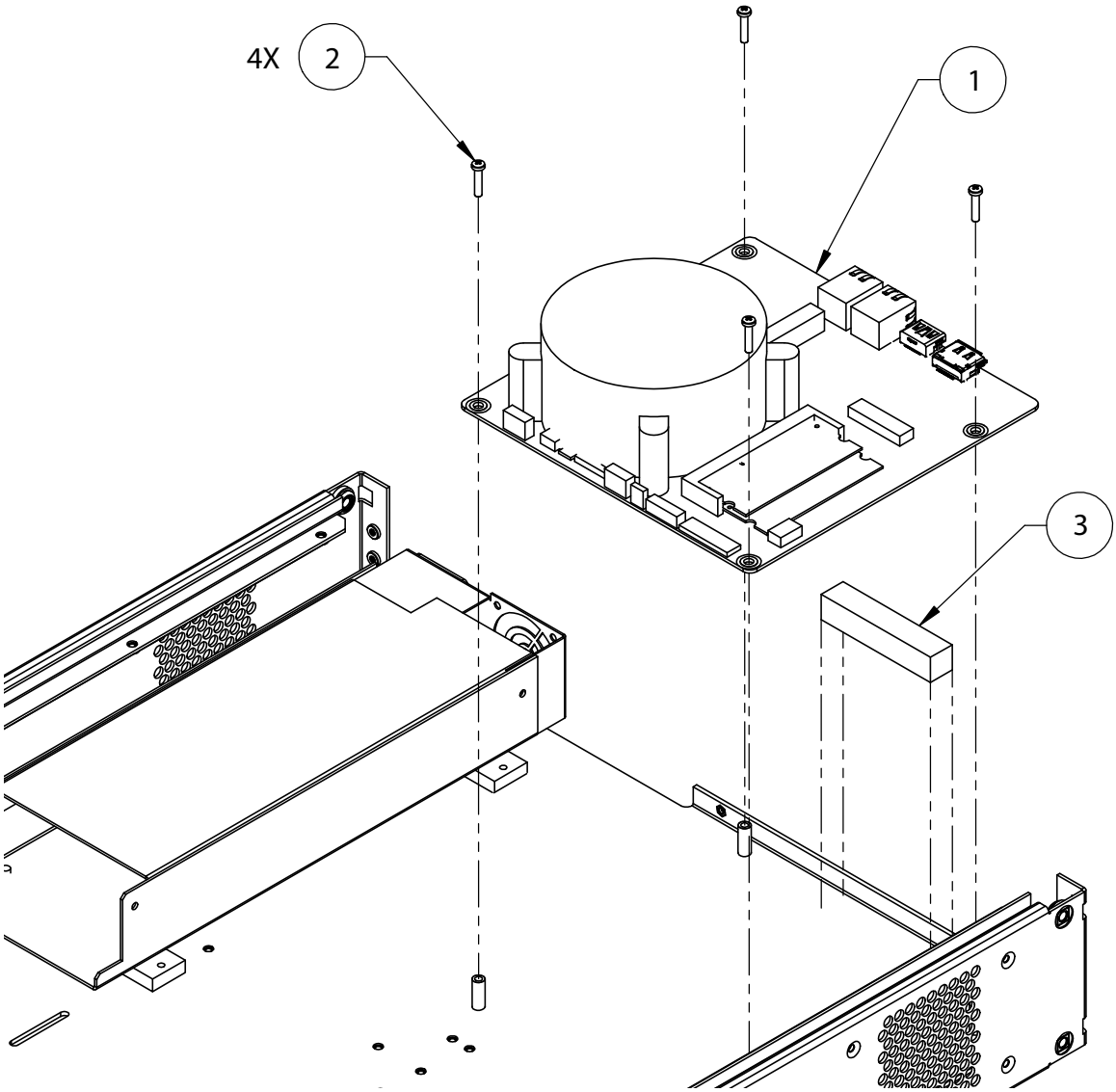
Reference Figures

- Figure 5-8, “CPU Assembly Cable Connections” on page 5-12
- Figure 5-9, “CPU Assembly” on page 5-13



1 – Solid State Drive Power Cable
2 – CPU Assembly Power Supply Cable
3 – Cables

Figure 5-8. CPU Assembly Cable Connections



1 – CPU Assembly
2 – Mounting Screws
3 – Silicone block

Figure 5-9. CPU Assembly

Replacement Procedure

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the Stiffener Plate.
3. Unplug all the cable harnesses connected to the CPU Assembly.
4. Remove the four Phillips screws that secure the CPU Assembly to the chassis.
5. Remove the CPU Assembly.
6. Install the replacement CPU Assembly.
7. Secure the CPU Assembly with screws that were removed in Step 4.
8. Re-connect all the cable harnesses.
9. Install the Stiffener Plate.
10. Install the top cover.

5-7 Solid State Drive

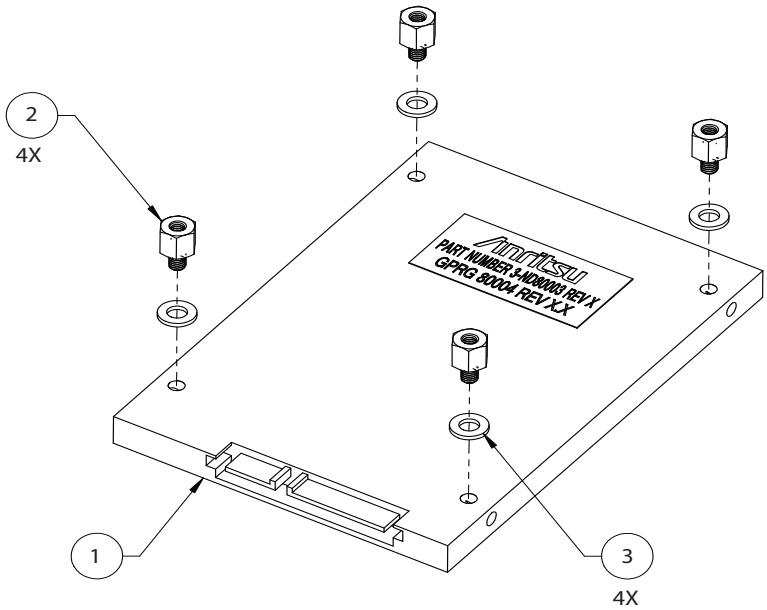
Use this procedure to replace the solid static drive.

Replacement Part

- Revision 1 Instrument Solid State Drive – ND80984
- Revision 2 Instrument Solid State Drive – ND80997

Reference Figure

- Figure 5-10, “Solid State Drive” on page 5-15



1 – Solid State Drive
2 – Washers
3 – Standoffs

Figure 5-10. Solid State Drive

Replacement Procedure

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the Stiffener Plate.
3. Unplug the SATA cable and Power cable from the solid state drive.
4. Flip over the instrument with the bottom cover facing upward.
5. Remove the bottom cover.
6. Place the instrument on its left side.
7. Remove the four screws that secure the solid static drive to the chassis. While removing the last screw, use one hand to hold the solid state drive so it will not drop unexpectedly.
8. Remove the standoffs and washers and install them to the replacement solid state drive.
9. Secure the replacement solid state drive to the chassis with the screws that were removed in Step 7.
10. Install the bottom cover.
11. Place the instrument on its bottom side.
12. Re-connect the SATA cable and Power cable to the solid state drive.
13. Install the Stiffener Plate.
14. Install the top cover.

Replacement Procedure for Revision 2 Instrument

1. Use a flat head screwdriver to loosen the two captive screws that secure the solid state drive to the rear panel of the instrument.
2. Pulling gently, remove the solid state drive from the chassis.
3. Insert the replacement solid state drive through the drive slot on the rear panel.
4. Press the solid state drive into its mating socket on the IO Handler PCB assembly and gradually tighten the two flat head captive screws with a flat head screwdriver.

5-8 Back Plane PCB Assembly

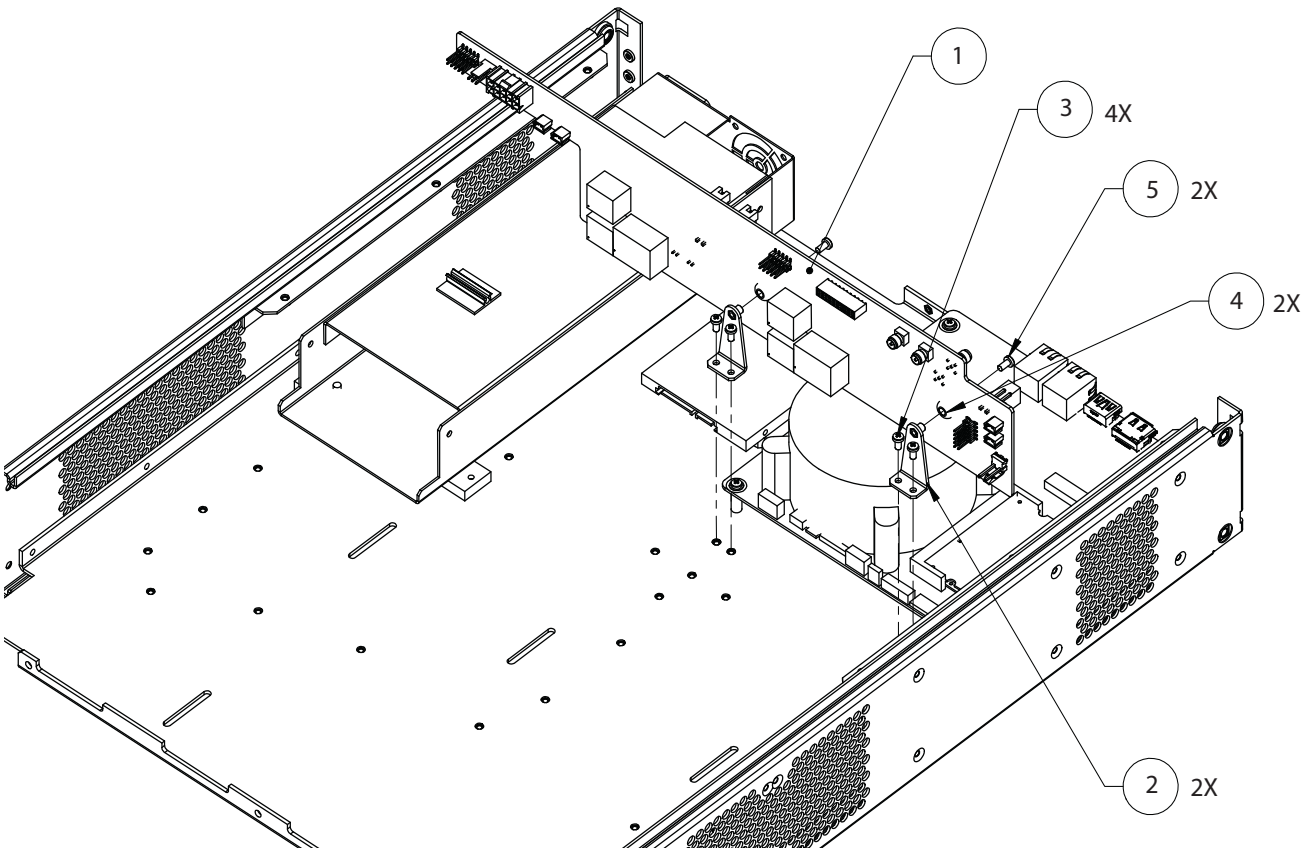
Use this procedure to replace the Back Plane PCB Assembly.

Replacement Part

- Back Plane PCB Assembly – ND80994

Reference Figure

- Figure 5-11, “Back Plane PCB Assembly” on page 5-17



1 – Back Plane PCB Assembly
2 – Mounting Bracket
3 – Bracket Mounting Screw
4 – Isolator
5 – PCB Mounting Screw

Figure 5-11. Back Plane PCB Assembly

Replacement Procedure

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the stiffener plate.
3. Disconnect the VNA Module 12V Power Supply Cable from P17.
4. Disconnect the PC ON/OFF/RST ribbon cable from J2.
5. Disconnect the PC USB Interface ribbon cable from J12.
6. Disconnect the IO Handler PCB cable from J7 (For units with Option 5 only).
7. Disconnect the cable harness from J1.
8. Disconnect the PC 19V cable harness from the P4.
9. Disconnect the rear panel fan power supply harness from J13.
10. Disconnect the front panel LED interface ribbon cables from J3 and J13.
11. Disconnect the Power Supply harness cables from J4 and P16.
12. Disconnect the left Fan Assembly power supply harnesses from P9 and P10.
13. Disconnect the right Fan Assembly power supply harnesses from P13 and P14.
14. Remove the four Phillips screws that secure the Back Plane PCB Assembly mounting brackets to the chassis. See Figure 5-11 on page 5-17.
15. Remove the PCB mounting screws and separate the mounting brackets from the PCB assembly. Be sure not to lose the two isolators.
16. Install the mounting brackets and isolators onto the replacement Back Plane PCB Assembly. Do not tighten the PCB mounting screws.
17. Install the replacement Back Plane PCB Assembly to the chassis and secure it with the screws that were removed in Step 15.
18. Tighten the PCB mounting screws.
19. Re-connect all the cables.
20. Install the stiffener plate.
21. Install the top cover.

5-9 IO Handler PCB Assembly

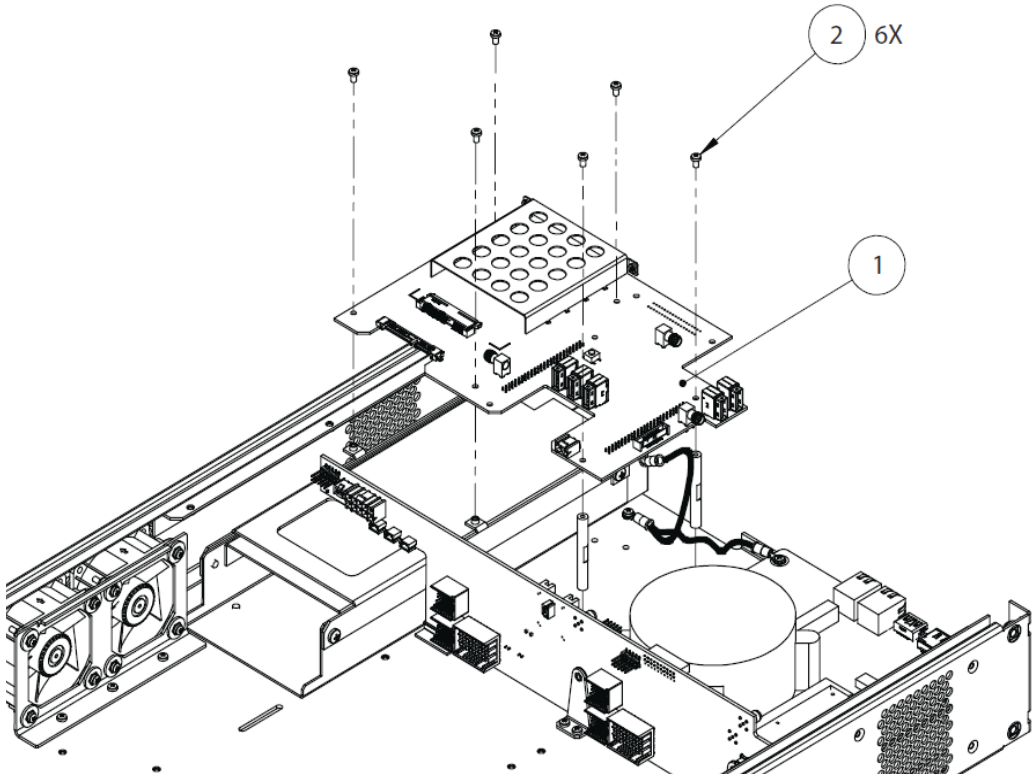
Use this procedure to replace the IO Handler PCB assembly. The IO Handler PCB assembly is being used in Revision 2 instrument only.

Replacement Parts

IO Handler PCB Assembly – ND80995

Reference Figures

Figure 5-12 shows the location of the IO Handler PCB assembly.



1. IO Handler PCB Assembly	**2.** Mounting Screw

Figure 5-12. IO Handler PCB Assembly

Replacement Procedure for IO Handler PCB Assembly

1. Remove the top cover as described in the “Common Disassembly Procedure” on page 5-3.
2. Remove the stiffener plate.
3. Remove the solid state drive.
4. Unplug the SATA cable and solid state drive power cable from the IO Handler PCB assembly.
5. Remove the six Phillips screws that secure the IO Handler PCB assembly to the chassis and then remove it from the chassis.
6. Install the replacement IO Handler PCB assembly and secure it with screws that were removed in Step 5.
7. Re-connect the SATA cable and solid state drive power cable.
8. Install the solid state drive.
9. Install the stiffener plate and then the top cover.

5-10 Fan Assemblies

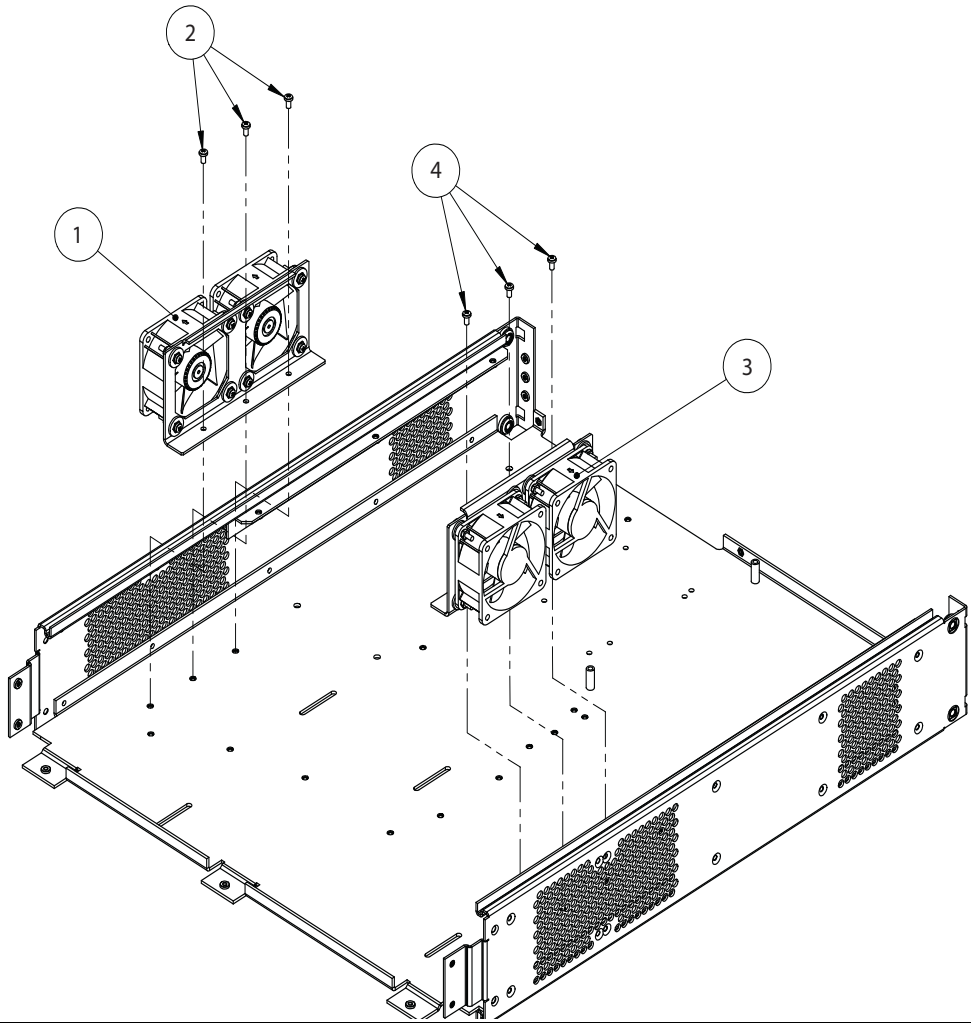
Use this procedure to replace the Fan Assemblies.

Replacement Parts

- Fan Assembly, Right – ND80986
- Fan Assembly, Left – ND80987
- Fan Assembly, Rear – ND80989

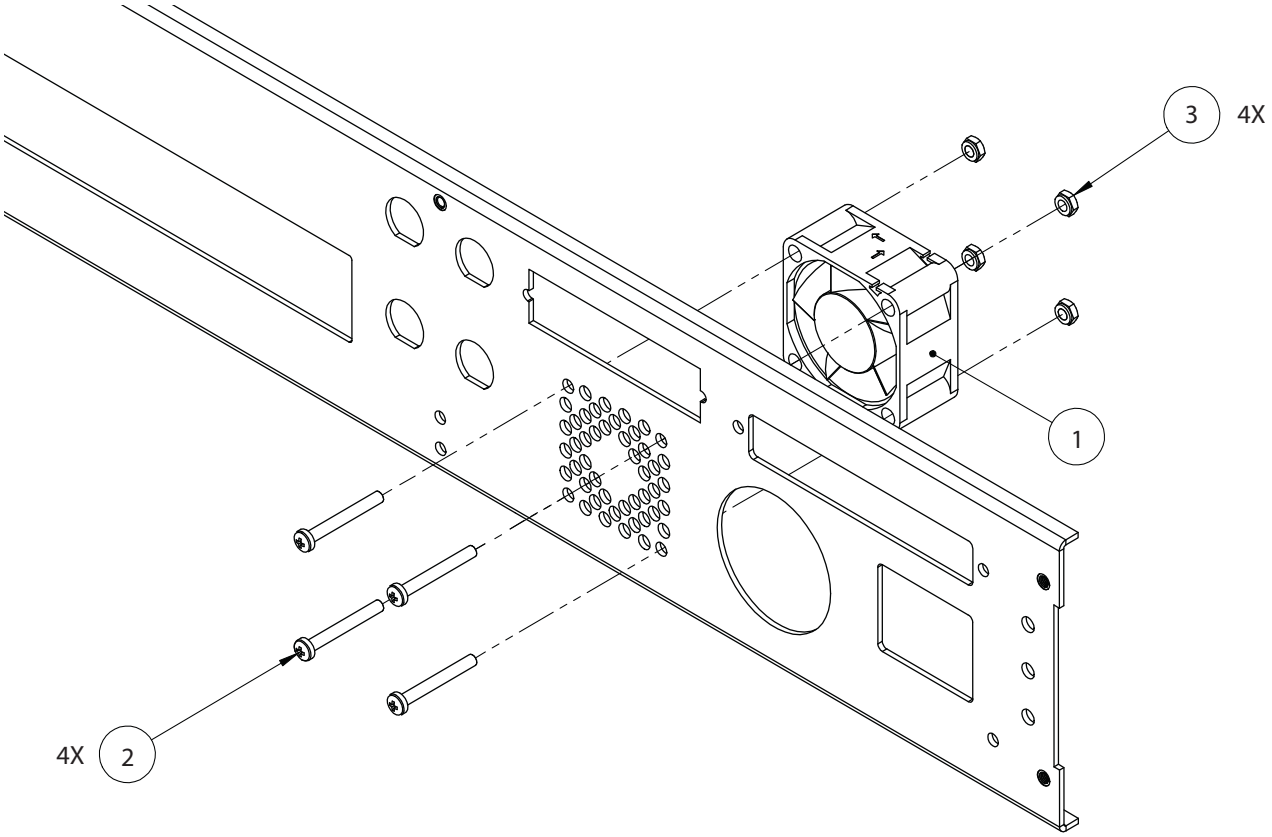
Reference Figures

- Figure 5-13, “Left and Right Fan Assemblies” on page 5-20
- Figure 5-14, “Rear Fan Assembly” on page 5-21



1 – Left Fan Assembly
2 – Mounting Screw
3 – Right Fan Assembly
4 – Mounting Screw

Figure 5-13. Left and Right Fan Assemblies



1 – Rear Fan Assembly
2 – Mounting Screw
3 – Hex Nut

Figure 5-14. Rear Fan Assembly

Replacement Procedure for Right Fan Assembly

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the stiffener plate.
3. Disconnect the fan assembly power cables from P13 and P14 of the Back Plane PCB Assembly.
4. Remove the three Phillips screws that secure the fan bracket to the chassis. See Figure 5-13 on page 5-20.
5. Remove the Right Fan Assembly.
6. Install the replacement fan assembly and secure it with the screws that were removed in Step 4.
7. Connect the fan assembly power cables to P13 and P14 of the Back Plane PCB Assembly.
8. Install the stiffener plate.
9. Install the top cover.

Replacement Procedure for Left Fan Assembly

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the stiffener plate.
3. Disconnect the fan assembly power cables from P9 and P10 of the Back Plane PCB Assembly.
4. Remove the three Phillips screws that secure the fan bracket to the chassis. See Figure 5-13 on page 5-20.
5. Remove the Right Fan Assembly.
6. Install the replacement fan assembly and secure it with the screws that were removed in Step 4.
7. Connect the fan assembly power cables to P9 and P10 of the Back Plane PCB Assembly.
8. Install the stiffener plate.
9. Install the top cover.

Replacement Procedure for Rear Fan Assembly

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the stiffener plate.
3. Disconnect the Fan Assembly power cable from P12 of the Back Plane PCB Assembly.
4. Remove the mounting screws and hex nuts that secure the fan assembly to the rear panel. See Figure 5-14 on page 5-21
5. Remove the fan assembly.
6. Install the replacement fan assembly to the rear panel. Note that the direction of the air flow is inward.
7. Secure the fan assembly with the screws and nuts that were removed from Step 4. Be sure to install the Ground wire lug between the fan assembly and nut at the upper right corner of the fan assembly.
8. Connect the fan power cable to P12 of the Back Plane PCB Assembly.
9. Install the stiffener plate.
10. Install the top cover.

5-11 Power Supply Assembly

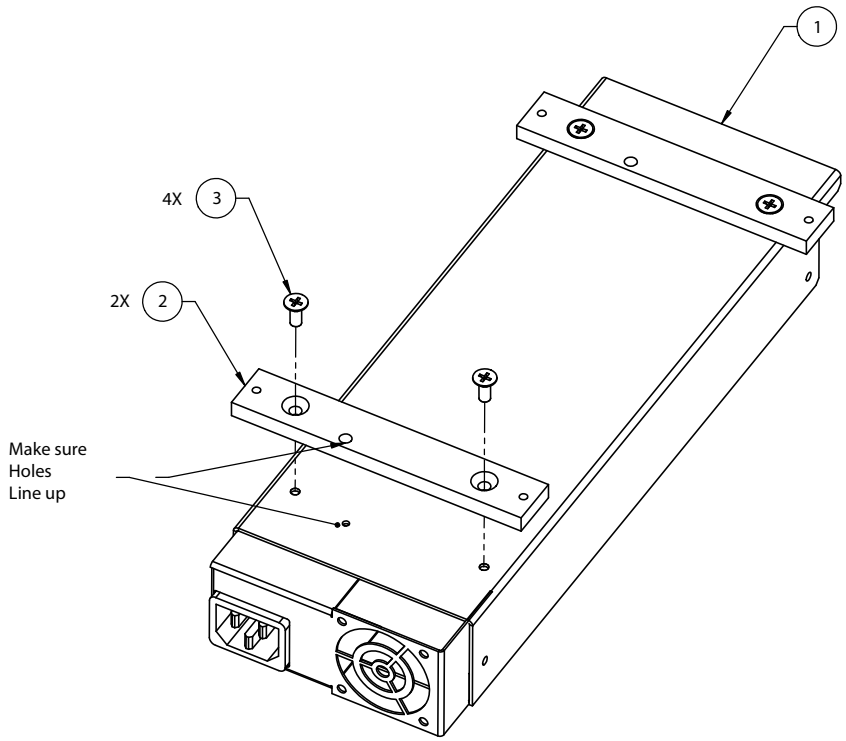
Use this procedure to replace the Power Supply Assembly.

Replacement Part

- Power Supply Assembly – 3-40-191

Reference Figures

- Figure 5-15 below shows how the power supply mounting bars are installed to the power supply.
- Figure 5-16 on page 5-24 shows a power supply with IO Handler PCB Mounting Bracket installed on Revision 2 instrument.
- Figure 5-17 on page 5-25 shows the power supply cable connections.

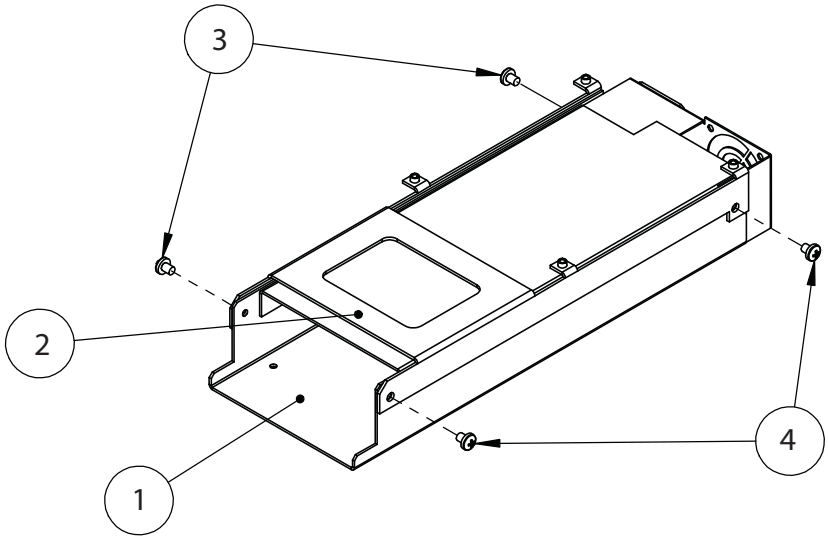


1 – Power Supply

2 – Mounting Bar

3 – Mounting screw

Figure 5-15. Power Supply with Mounting Bars installed

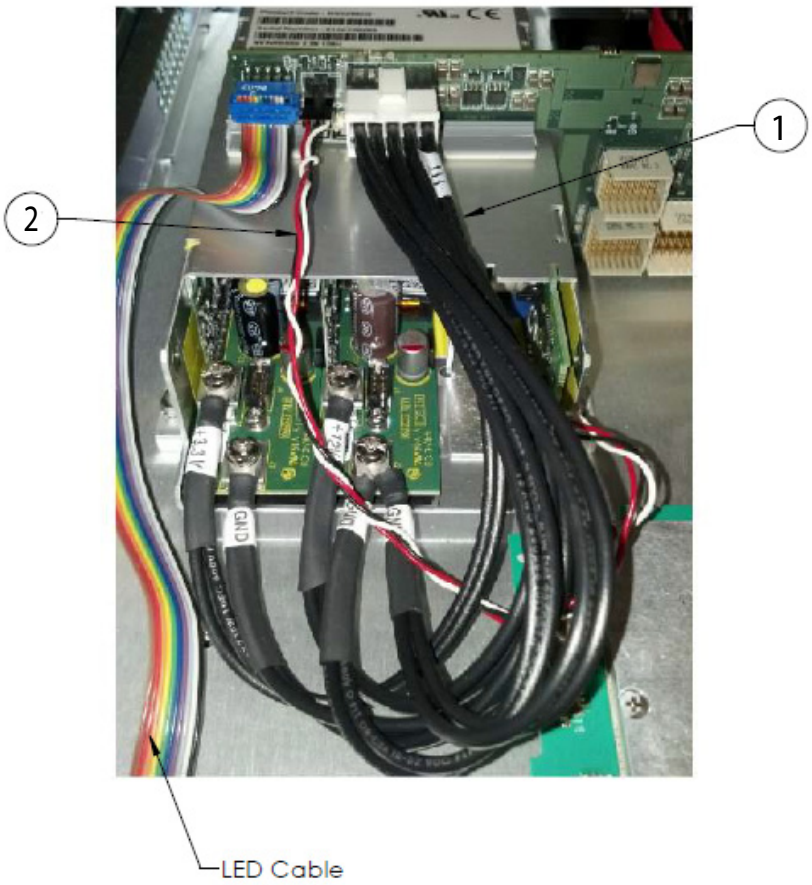


1 – Power Supply

2 – IO Handler PCB Mounting Plate

3 – Mounting screw

Figure 5-16. Power Supply with IO Handler PCB Mounting Plate installed, Revision 2 Instrument



1 – 12V Power Supply Cable Harness

2 – 5V Power Supply Cable Harness

Figure 5-17. Power Supply Cable Harness Connection

Replacement Procedure

1. Remove the top cover as described in the "Common Disassembly Procedure" on page 5-3.
2. Remove the Stiffener Plate.
3. For Revision 2 instrument, do the following:
   a. Remove the solid state drive. Refer to Section 5-7 "Solid State Drive" on page 5-15 for removal procedure.
   b. Remove the IO Handler PCB Assembly. Refer to Section 5-9 "IO Handler PCB Assembly" for removal procedure.
4. Remove the VNA Module Assembly. Refer to Section 5-5 "VNA Module Assembly" for removal procedure.
5. Remove the Back Plane PCB Assembly. Refer to Section 5-8 "Back Plane PCB Assembly" for removal procedure.
6. Refer to Figure 5-17 on page 5-25. Use a Phillips screwdriver to loosen the terminal screws and then remove the 3.3V/12V Power Cable Harness and 5V Power Cable Harness from the Power Supply.
7. Flip over the instrument so the bottom cover is facing upward.
8. Remove the bottom cover.
9. Place the instrument on its left side.
10. Remove the five Phillips screws that secure the power supply to the chassis. Use one hand to hold the power supply in place to prevent it to drop unexpectedly.
11. Remove the power supply from the chassis.
12. For Revision 1 instrument, remove the two Mounting Bars from the power supply. Install the two Mounting Bars to the replacement power supply. Refer to Figure 5-15 on page 5-23
13. For Revision 2 instrument, remove the IO Handler PCB Mounting Bracket from the power supply. Install the IO Handler PCB Mounting Bracket to the replacement power supply. Refer to Figure 5-16 on page 5-24.
14. Re-connect the 5V power supply cable harness that was removed in Step 6.
15. Install the power supply to the chassis. Be sure to re-attached the Ground wire lug with a hex nut to the corner near the rear fan assembly.
16. Place the instrument on the working surface with the bottom of the instrument facing up.
17. Install the bottom cover.
18. Flip over the instrument so the top side is now facing upward.
19. Install the Back Plane PCB Assembly.
20. For Revision 2 Instrument, install the IO Handler PCB Assembly and then the solid state drive.
21. Power on the instrument.
22. Use a digital volt meter to measure the unloaded +3.3V and +12V output voltage.
23. Using a tuning screwdriver, adjust the voltages to +3.7V and +12.5V respectively.
24. Re-connect the 3.3V/12V cable to the power supply.
25. Install the stiffener plate.
26. Install the top cover.

5-12 Test Port Adapter

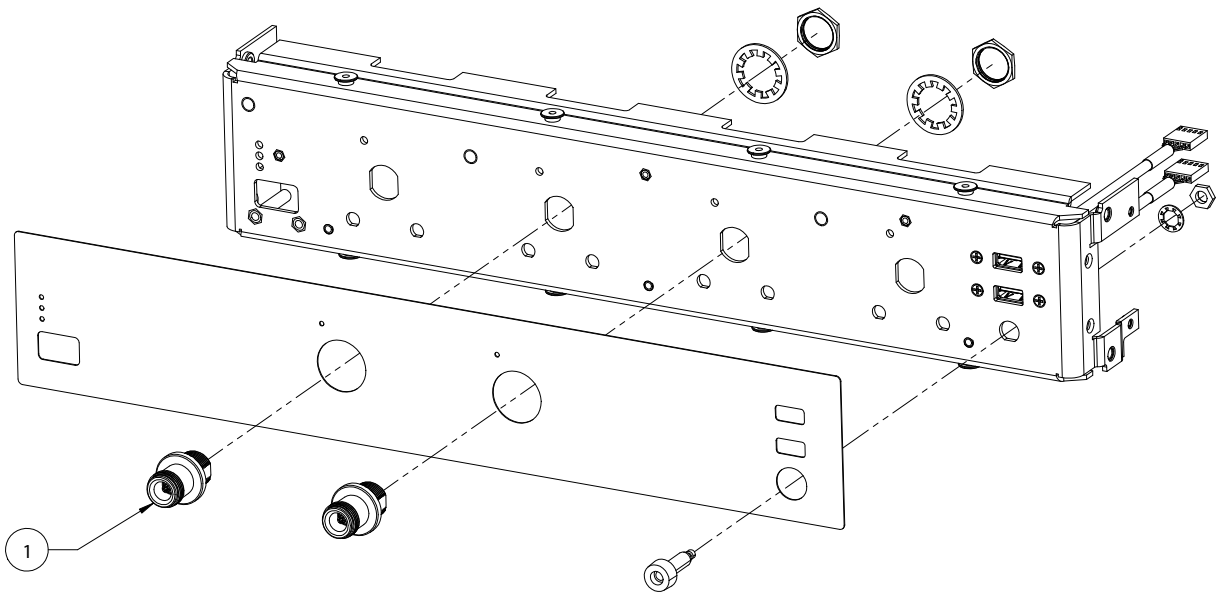
Use this procedure to replace the Front Panel Test Port Adapters.

Replacement Parts

- N(f) Test Port Adapter – 3-513-122
- K(m) Test Port Adapter – 3-75651

Reference Figures

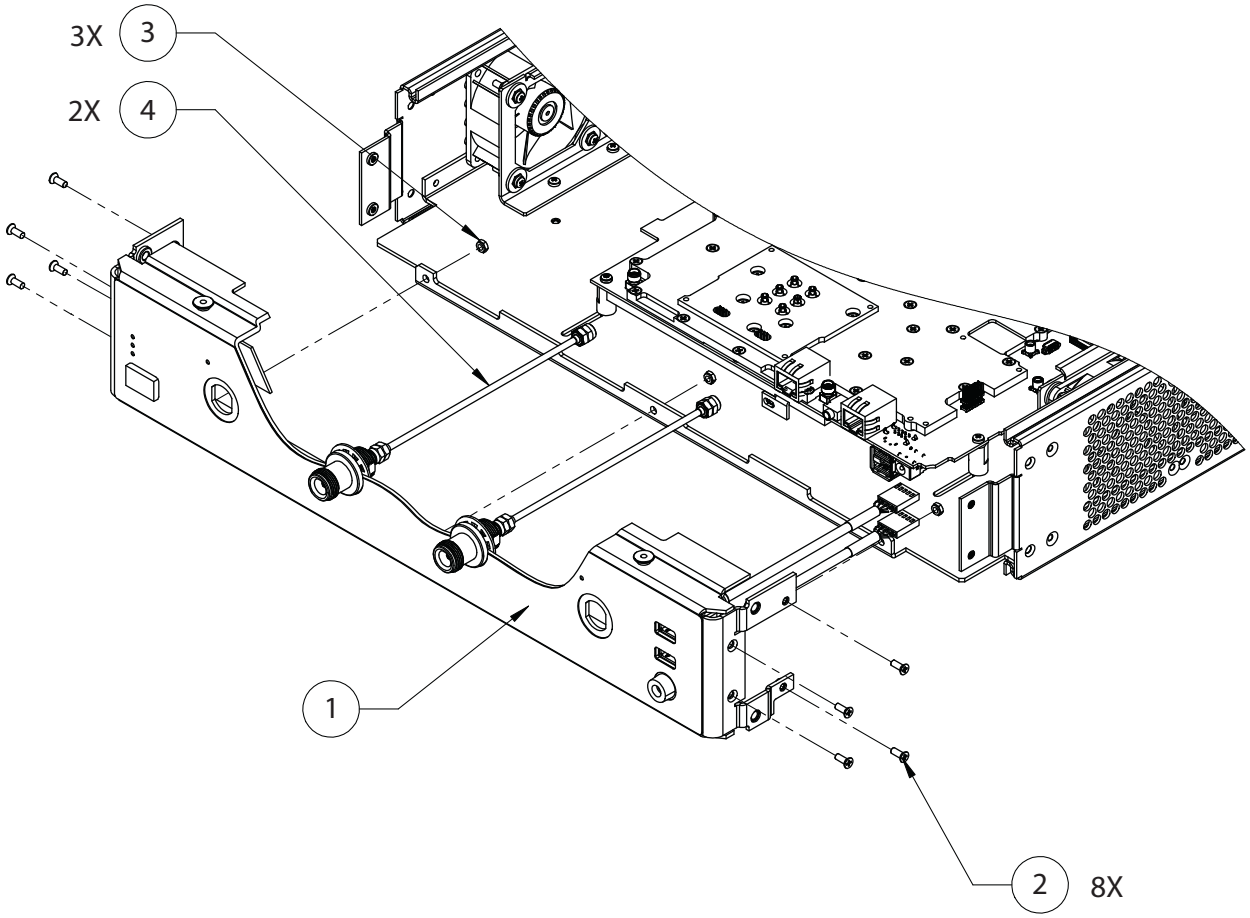
- Figure 5-18, “Test Port Adapter Mounting” on page 5-27
- Figure 5-19, “N(f) Test Port Adapter (For Instruments with Options 4 and 10)” on page 5-28
- Figure 5-20, “K(m) Test Port Adapter (For Instruments with Options 14, 20, 30 and 40)” on page 5-29



1 – Test Port Adapter

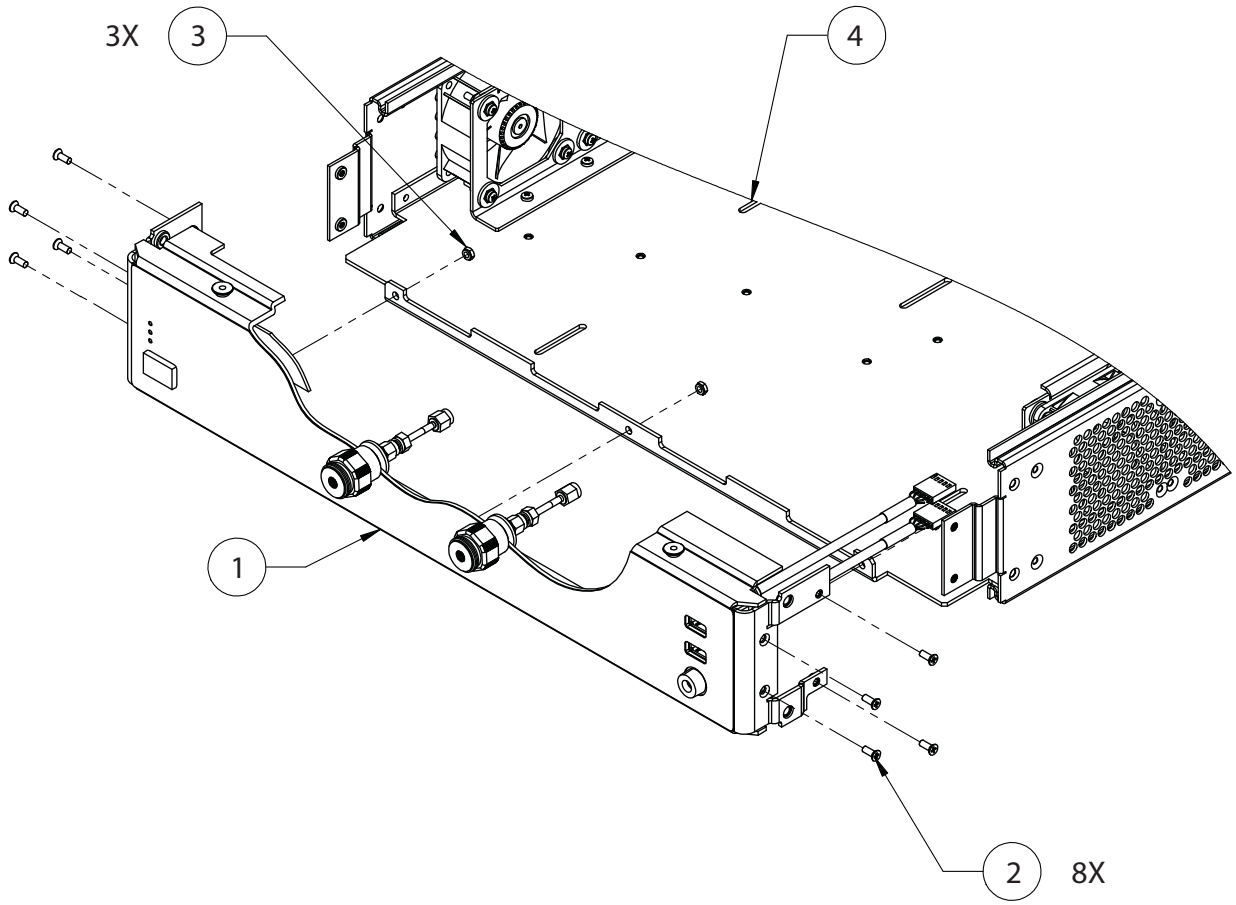
Note: Washer and Hex Nut are included in replacement Test Port Adapter package

Figure 5-18. Test Port Adapter Mounting



1 – Front Panel
2 – Mounting Screws (8)
3 – Nuts (3)
4 – Flexible Coaxial Cables (2)

Figure 5-19. N(f) Test Port Adapter (For Instruments with Options 4 and 10)



1 – Front Panel
2 – Mounting Screws (8)
3 – Nuts (3)
4 – Chassis

Figure 5-20. K(m) Test Port Adapter (For Instruments with Options 14, 20, 30 and 40)

Replacement Procedure – N(f) Test Port Adapter

1. Remove the top cover as described in the “Common Disassembly Procedure” on page 5-3.
2. Disconnect the flexible coaxial cable from the SMA(f) connector of the test port adapter. SeeFigure 5-19 on page 5-28.
3. Use a ratchet wrench with 3/4 inch deep socket to remove the hex nut that secures the test port adapter to the front panel.
4. Remove the test port adapter from the front panel. See Figure 5-18 on page 5-27.
5. Install the replacement test port adapter to the front panel. Install the washer and then the hex nut. Tighten the hex nut with fingers.
6. Use a ratchet wrench with the 3/4 inch deep socket to tighten the hex nut.
7. Re-connect the flexible coaxial cable to the SMA(f) connector of the test port adapter.
8. Install the top cover.

Replacement Procedure – K(m) Test Port Adapter

1. Remove the top cover as described in the “Common Disassembly Procedure” on page 5-3.
2. Remove the High Frequency VNA Module Assembly as described in “Replacement Procedure (For Instruments with Options 14, 20, 30 and 40)” on page 5-11.
3. Disconnect the coaxial cables from the K(f) connector of the test port adapter. See Figure 5-20 on page 5-29.
4. Use a ratchet wrench with 1/2 inch deep socket to remove the hex nut that secures the test port adapter to the front panel.
5. Remove the test port adapter from the front panel. See Figure 5-18 on page 5-27.
6. Install the replacement test port adapter to the front panel. Install the washer and then the hex nut. Tighten the hex nut with fingers.
7. Use a ratchet wrench with the 1/2 inch deep socket to tighten the hex nut.
8. Re-connect the flexible coaxial cable to the K(f) connector of the test port adapter.
9. Re-install the High Frequency VNA Module Assembly.
10. Install the top cover.

5-13 Front Panel LED PCB Assembly

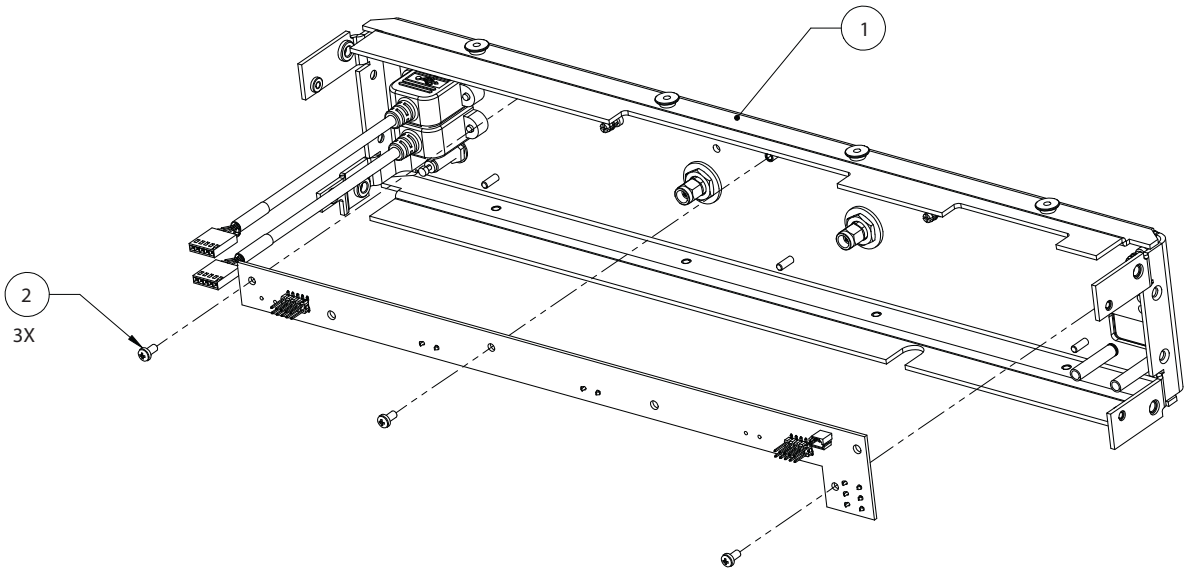
Use this procedure to replace the Front Panel LED PCB Assembly.

Replacement Part

- Front Panel LED PCB Assembly – ND81163

Reference Figure

- Figure 5-21, “Front Panel LED PCB Assembly” on page 5-31



1 – Front Panel
2 – Front Panel LED PCB Assembly Mounting Screws (3)

Figure 5-21. Front Panel LED PCB Assembly

Replacement Procedure – Instruments with N(f) Test Ports

1. Remove the top cover and handles as described in the "Common Disassembly Procedure" on page 5-3.
2. Disconnect the flexible coaxial cables from the SMA(f) connector of the test port adapters. SeeFigure 5-19 on page 5-28.
3. Disconnect the Front Panel USB interface cables from the CPU Module.
4. Disconnect the LED control ribbon cable from the left side of the Front Panel LED PCB Assembly.
5. Remove the eight (8) Phillips screws on both sides of the front panel.
6. Remove the three (3) nuts that secure the front panel to the bottom of the chassis.
7. Remove the Front Panel from the chassis.
8. Remove the three (3) screws that secure the Front Panel LED PCB Assembly to the chassis.
9. Install the replacement Front Panel LED PCB Assembly to the front panel and secure with the screws that were removed in Step 8.
10. Re-install the Front Panel to the chassis.
11. Re-connect the flexible coaxial cables to the SMA(f) connector of the test port adapters.
12. Re-connect the Front Panel USB interface cables to the CPU Module.
13. Re-connect the LED control ribbon cable to the left side of the Front Panel LED PCB Assembly.
14. Install the handles.
15. Install the top cover.

Replacement Procedure – Instruments with K(m) Test Ports

1. Remove the top cover, bottom cover and handles as described in the "Common Disassembly Procedure" on page 5-3.
2. Place the instrument on its side and loosen the five (5) screws that secure the standoffs to the chassis on the bottom so that the VNA Module Assembly can be sliding backward.
3. Place the instrument on its bottom.
4. Disconnect the semi-rigid coaxial cables from Port 1 and Port 2 Inputs of the VNA Module Assembly.
5. Carefully slide the VNA Module Assembly backward.
6. Disconnect the Front Panel USB interface cables from the CPU Module.
7. Disconnect the LED control ribbon cable from the left side of the Front Panel LED PCB Assembly.
8. Remove the eight (8) Phillips screws on both sides of the front panel.
9. Remove the three (3) nuts that secure the front panel to the bottom of the chassis.
10. Remove the Front Panel from the chassis.
11. Remove the three (3) screws that secure the Front Panel LED PCB Assembly to the chassis.
12. Install the replacement Front Panel LED PCB Assembly to the front panel and secure with the screws that were removed in Step 11.
13. Re-install the Front Panel to the chassis.
14. Re-connect the coaxial cables to the VNA Module Assembly.
15. Place the instrument on its side and tighten the five (5) screws that secure the standoffs to the chassis on the bottom.
16. Place the instrument on its bottom.
17. Re-connect the Front Panel USB interface cables to the CPU Module.
18. Re-connect the LED control ribbon cable to the left side of the Front Panel LED PCB Assembly.

19. Install the handles.

20. Install the top cover and bottom cover.

Appendix A — Test Records

A-1 Introduction

This appendix provides test record that can be used to record the performance of the ShockLine MS46322A.

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 form is available:

Instrument Information

Serial Number:	Firmware Revision:	Operator:
Options:		Date:

A-2 ShockLine MS46322A Test Record

System Performance Verification

_____ Attached Verification Report

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