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Maintenance Manual

Lightning 37xxxE Series Vector Network Analyzer

Lightning 37247E VNA, K Connectors, 40.0 MHz to 20.0 GHz, Passive Measurements
Lightning 37347E VNA, K Connectors, 40.0 MHz to 20.0 GHz, Active Measurements

Lightning 37269E VNA, K Connectors, 40.0 MHz to 40.0 GHz
Lightning 37369E VNA, K Connectors, 40.0 MHz to 40.0 GHz

Lightning 37297E VNA, V Connectors, 40.0 MHz to 65.0 GHz
Lightning 37397E VNA, V Connectors, 40.0 MHz to 65.0 GHz



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

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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.

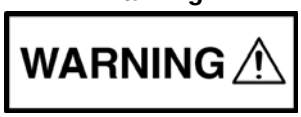
Symbols Used in Manuals

Danger



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

Warning



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

Caution



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

Safety Symbols Used on Equipment and in Manuals

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



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



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



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



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



These indicate that the marked part should be recycled.

For Safety

Warning



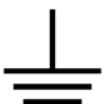
Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.

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

Warning

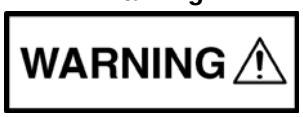


or



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

Warning



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

Warning



Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury if this equipment is lifted by one person.

Caution



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

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

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Chapter 1 — General Information

1-1 Manual Introduction

This manual provides general service and preventive maintenance information for the Anritsu 37xxxE Series models of Vector Network Analyzer (VNA) systems. It contains procedures for:

- Testing the instrument for proper operation.
- Verifying measurement accuracy and traceability to National Institute of Standards and Technology (NIST).
- Troubleshooting a failed instrument to the exchange subassembly level or the subsystem requiring adjustment.
- Adjusting instrument internal sub-systems.
- Locating and replacing failed parts.

Throughout this manual, the terms “37xxxE” and “VNA” will be used interchangeably to refer to all models of the 37xxxE series VNA, unless otherwise noted.

1-2 Chapter Introduction

This chapter provides a general description of VNA systems, system serial numbers, frequency ranges, and related manuals. It also includes service strategy, available service facilities, and static-sensitive component handling precautions, and a list of recommended test equipment.



Figure 1-1. Lightning 37xxxE Series Vector Network Analyzer (VNA) System

1-3 Identification Number

All Anritsu instruments are assigned a six-digit ID number, such as “042503”. This number appears on a decal affixed to the rear panel. Please use this identification number during any correspondence with Anritsu Customer Service about this instrument.

1-4 Online Manuals

This manual is available for download as an Adobe Acrobat™ (*.pdf) file. The file can be viewed using Acrobat Reader™, a free program that is available from Adobe. This file is “linked” such that the viewer can choose a topic to view from the displayed “bookmark” list and “jump” to the manual page on which the topic resides. The text can also be word-searched. Updates to this manual, if any, may also be downloaded from the documents area of the Anritsu Internet site at: http://www.anritsu.com

1-5 System Description

The Anritsu Lightning 37xxxE Analyzers are microprocessor controlled Vector Network Analyzers. Each is a single-instrument system that contains a built-in signal source, a test set, and an analyzer subsystem. These analyzers are produced in six models that cover a range of from 40 MHz to 65 GHz. Below, Table 1-1 lists the frequencies for each model:

Table 1-1. Lightning 37xxxE Models and Frequency Ranges

Measurement Type	Lightning Model Number	Frequency Range	Test Port Connectors
Passive Device Measurement	37247E	40.0 MHz to 20.0 GHz	K Connectors
	37269E	40.0 MHz to 40.0 GHz	
	37297E	40.0 MHz to 65.0 GHz	V Connectors
Passive and Active Device Measurement	37347E	40.0 MHz to 20.0 GHz	K Connectors
	37369E	40.0 MHz to 40.0 GHz	
	37397E	40.0 MHz to 65.0 GHz	V Connectors

1-6 Related Manuals

The following technical documentation is available in support of the Lightning 37xxxE Series VNAs.

- **Maintenance Manual** – The Lightning 37xxxE Vector Network Analyzer Maintenance Manual – 10410-00303 describes maintenance and performance testing, troubleshooting, and replacement part procedures. This document.
- **Technical Data Sheet** – The Lightning 37xxxE Series VNA Technical Datasheet and Configuration Guide – 11410-00573 provides a summary of all instrument specifications and configuration options.
- **Operation Manual** – The Lightning 37xxxE Vector Network Analyzer Operation Manual – 10410-00300 describes the front panel operation for all 37xxxE models. It also contains general information, specifications, and Performance Verification procedures for all models.
- **Programming Manuals** – The Lightning 37xxxE Series Vector Network Analyzer Programming Manual – 10410-00301 describes all 37xxxE GPIB commands and provides programming information for operation of the VNA remotely via the IEEE-488 General Purpose Interface Bus.
- **Calibration Kits, Verification Kits, and Performance Verification Software** – The performance verification software for the instrument is documented in the Lightning 37xxxE Series VNA Software User Guide for Anritsu 2300-480 System Performance Verification User Guide – 10410-00260.
- **User Documentation CD** – This CD includes the OM, PM and TDS described above and is the Lightning 37xxxE Series VNA User Documentation CD – 10920-00058.

1-7 Standard Options

The available 37xxxE Series VNA options are listed below:

- Option 001A: Rack Mounts without Slides
- Option 002A: High Speed Time Domain
- Option 004A: Extra 8 GB SD card (for storing secure data and operating system)
- Option 007A: Replaces K Test Port Connectors with Type GPC-7 connectors
- Option 007N: Replaces K Test Port Connectors with Type N (m) connectors
- Option 007NF: Replaces K Test Port Connectors with Type N (f) connectors
- Option 007S: Replaces K Test Port Connectors with Type 3.5 mm (m) connectors
- Option 015K: Flexible Test Set with Front Panel Access Connections for Samplers (K connectors only)
- Option 015V: Flexible Test Set with Front Panel Access Connections for Samplers (V connectors only)

Contact your local Anritsu representative for information about installing any of the above options for the 37xxxE Series VNA family.

1-8 Service Strategy

This section provides an overview of the VNA service strategy and available service facilities. It also provides references to the information in various locations in this manual needed to accomplish the required service functions.

Functional Assembly Level Troubleshooting

The VNA modular design, extensive built-in diagnostics, and automated service tools are designed to support fast exchange of functional assembly level repairs.

Failed Assemblies

Failed assemblies are not field repairable. Once an assembly is found to be faulty, it should be returned to an authorized Anritsu Service Center for exchange. Refer to the description of the "Exchange Assembly Program" on page 2-1 in Chapter 2, "Replaceable Parts".

Troubleshooting

The procedures for troubleshooting a failed VNA are described in Chapter 7, "Troubleshooting".

Internal Hardware Adjustments and Calibrations

There are five automated internal hardware field calibrations. Two of them are used to characterize the VNA frequency and power generation sub-systems. These calibrations insure fast, consistent phase lock of system frequencies and proper compensation, leveling, and flatness of system power at the front panel test ports.

To conduct these calibrations, you need only connect the appropriate test equipment (counter or power meter) to the VNA and initiate the calibration. The VNA will control itself and the externally connected test equipment to perform measurements and store calibration constants in its internal battery backed RAM (BBRAM).

The procedures for adjusting the VNA are described in Chapter 6, "Adjustments".

Internal Service Log

The VNA continuously monitors itself for proper operation. Should a failure occur, it notifies the user via a failure message on the display screen. (In remote-only operation, it also sets the GPIB Status Byte, if enabled.) It also writes the error message along with some data pertinent to the failure to an internal service log stored in battery backed memory.

The service log can be checked at any time to view (without erasing) all error messages that were written into it. It is capable of storing more than 30 pages of service messages and data. If necessary, the VNA will automatically remove the oldest errors first to make room for new errors.

To check the contents of the service log, use the procedure described in Chapter 4, "Operational Performance Tests".

Note	A printed or electronic file copy of the Service Log (with the failure in question) must be made available to Anritsu when exchanging a failed assembly, or when requesting service support. Refer to Chapter 2, "Replaceable Parts" for further information.

System Test/Certification

Quick operational checkout of the system may be accomplished by the system user or for incoming inspection purposes using the "Operational Checkout" chapter in the Lightning 37xxxE Series VNA Operation Manual – 10410-00300. Those procedures are useful in quickly verifying that the instrument's primary measurement functions are operational and stable. Full operational testing of the system is detailed in Chapter 4, "Operational Performance Tests".

These tests should be performed annually or whenever a measurement problem is suspected. Verification of the system's measurement accuracy and other key performance parameters may be done using the procedures in Chapter 5, "System Performance Verification". This should be performed annually or whenever a measurement problem is suspected.

Servicing Specially Modified Instruments

Instruments with customer-requested special modifications performed by Anritsu will have an identifying Specials Modification number printed on the rear panel. This number will be preceded with the letters SM, that is, SM1234 is special modification number 1234.

Special instruments may have service requirements different from those specified in this manual. Contact your local Service Center if you need more information when servicing such instruments.

1-9 Service Support

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

www.anritsu.com/Contact.asp

Technical Support

Technical service support is available by contacting any Anritsu Worldwide Service Center or service support may be obtained directly from the factory by contacting:

Anritsu Company
ATTN: Customer Service
490 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408)-778-2000
FAX: (408)-778-0239

Service Software

Anritsu 37xxxE Test Software – 2300-178

This software contains a series of automated tests designed to insure the VNA signal paths are functioning properly and capable of supporting stable calibrations and measurements. See the Chapter 4, "Operational Performance Tests" chapter for details.

Anritsu 37xxxE Performance Verification Software – 2300-480

This software is used to verify the VNA's published measurement accuracy and traceability to the U.S. National Institute of Standards and Technology (NIST). See the Chapter 5, "System Performance Verification" chapter for details.

Verification Kits

The Anritsu Verification Kits listed below are used in conjunction with the 37xxxE Performance Verification Software.

Table 1-2. Verification Kit Model Numbers for Lightning 37xxxE Series VNAs

Verification Kit Model Number	Connector Type	Kit Description
Model 3663	N Connector Verification Kit	Contains precision N Connector components with characteristics that are traceable to the NIST. Used for models with Option 7X connectors.
Model 3666	3.5 mm Connector Verification Kit	Contains precision 3.5 mm Connector components with characteristics that are traceable to the NIST. Used for models with Option 7X connectors.
Model 3667	3667 GPC-7 Connector Verification Kit	Contains precision GPC-7 Connector components with characteristics that are traceable to the NIST. Used for models with Option 7X connectors.
Model 3668	3668 K Connector Verification Kit	Contains precision K Connector components that are traceable to the NIST.
Model 3669B	V Connector Verification Kits	Contains precision V Connector components that are traceable to the NIST.

Failed Assembly Exchange Program

The exchange program allows a customer to quickly exchange a failed subassembly for a factory refurbished, fully system-tested unit that is under warranty. This results in significant time and price savings as compared with ordering a new assembly.

Refer to Chapter 2, "Replaceable Parts", for a complete list of exchangeable assemblies for all series 37xxxE models.

1-10 Performance Specifications

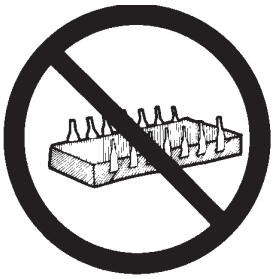
The performance specifications for all Series 37xxxE Series VNA models are contained in the technical data sheet located in Appendix C, "Lightning 37000E Technical Data Sheet". The latest version of the datasheet is available on the Anritsu web site.

1-11 Static Sensitive Component Handling Procedures

The VNA contains components that can be damaged by static electricity. Below, Figure 1-2 illustrates the precautions that should be followed when handling static-sensitive subassemblies and components. If followed, these precautions will minimize the possibilities of static-shock damage to these items.



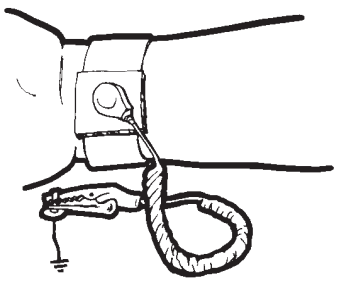
1. Do not touch exposed contacts on any static sensitive component.



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



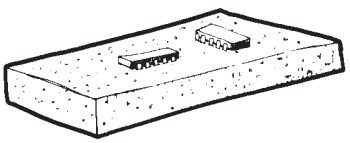
3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.



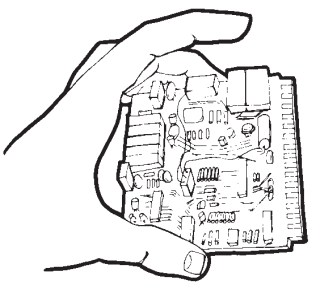
4. Wear a static-discharge wristband when working with static sensitive components.



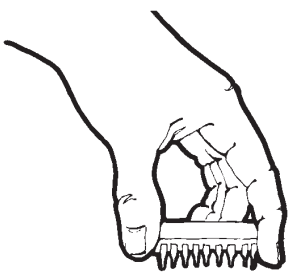
5. Label all static sensitive devices.



6. Keep component leads shorted together whenever possible.



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift & handle solid state devices by their bodies – never by their leads.



9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

10. ADDITIONAL PRECAUTIONS:

- Keep workspaces clean and free of any objects capable of holding or storing a static charge.
- Connect soldering tools to an earth ground.
- Use only special anti-static suction or wick-type desoldering tools.

Figure 1-2. Handling Procedures for Static Sensitive Components (1 of 2)

1 – Do not touch exposed contacts on any static sensitive component.
2 – Do not slide static sensitive component across any surface.
3 – Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.
4 – Wear a static-discharge wristband when working with static sensitive components.
5 – Label all static sensitive devices.
6 – Keep component leads shorted together whenever possible.
7 – Handle PCBs only by their edges. Do not handle by the edge connectors.
8 – Lift and handle solid state devices by their bodies and never by their leads.
9 – Transport and store PCBs and other static sensitive devices in static-shielded containers.
10 – Additional Precautions:
- – Keep work space clean and free of any objects capable of holding or storing a static charge.
- – Connect soldering tools to an earth ground.
- – Use only special anti-static suction or wick-type desoldering tools.

Figure 1-2. Handling Procedures for Static Sensitive Components (2 of 2)

1-12 Recommended Test Equipment

In Table 1-3 below, the recommended test equipment for all Series 37xxxE models is listed. Note the "Use" codes listed in the right hand column of the table which list the applicable maintenance activities for each test instrument.

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

Instrument	Critical Specification	Recommended Manufacturer	Use (Note 2)
Note 1 - Sliding Loads	Calibration Kit with sliding loads listed as Option -1 are only required for Performance Verification.		
Note 2 - Usage Codes	A = Adjustment / Internal Hardware Calibration, O = Operational Testing, P = Performance Verification, T = Troubleshooting		
Computer/Controller	PC with Windows XP or later and National Instruments GPIB hardware and software.	Any	O, P
Test Software	Automates testing of VNA through the GPIB controlled PC	Anritsu 2300-178	O
GPIB Cable	IEEE 488-2 compliant	Anritsu 2100-2, or equivalent	O, P, A
Adapter	Anritsu K to V	Anritsu 34VFK50	A
BNC Cable	Length, 1 m (4 ft.), 2 each	Any	O
Through (Thru) Line	For instruments with GPC-7 connector Test Ports	Anritsu 3670A50-2, 3671A50-2	O, P
	For instruments with K connector Test Ports	Anritsu 3670K50-2, 3671K50-2	
	For instruments with V connector Test Ports	Anritsu 3670V50A-2	
Calibration Kit	For instruments with Option 7A	Anritsu 3651A-1 (Note 1)	O, P
	For instruments with Option 7N or 7NF	Anritsu 3653A	
	For instruments with Option 7S	Anritsu 3650-1 (Note 1)	
	For instruments without Option 7	Anritsu 3652A-1 (Note 1)	
	For model 37x97E	Anritsu 3654D-1	
Performance Verification Software	Automates performance verification testing	Anritsu 2300-480	P
Verification Kit	For instruments with Option 7A	Anritsu 3667	P
	For instruments with Option 7N or 7NF	Anritsu 3663	
	For instruments with Option 7S	Anritsu 3666	
	For instruments without Option 7	Anritsu 3668	
	For model 37x97E	Anritsu 3669B	
Assurance Air Line	For K Connector	Anritsu T2023-2 with K connectors	O
	For V Connector	Anritsu T2025-2 with V connectors	
Offset Termination	For 37xxxE models with K Test Ports	Anritsu 29KF50-15	O
	For 37xxxE models with V Test Ports	Anritsu SC4417	

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

Instrument	Critical Specification	Recommended Manufacturer	Use (Note 2)
Note 1 - Sliding Loads	Calibration Kit with sliding loads listed as Option -1 are only required for Performance Verification.		
Note 2 - Usage Codes	A = Adjustment / Internal Hardware Calibration, O = Operational Testing, P = Performance Verification, T = Troubleshooting		
Frequency Counter	Use one of the two models listed. Frequency: 0.1 to 26.5 GHz Input Impedance: 50 Ohms	Anritsu MF2413B EIP Microwave, Inc., Model 578B, Must be EIP brand with Band 3 input to 26.5 GHz and GPIB interface.	A, O
Digital Multimeter	None	Any	T
Oscilloscope	None	Tektronics, Inc. Model 2445	T

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

Instrument	Critical Specification	Recommended Manufacturer	Use (Note 2)
Note 1 - Sliding Loads	Calibration Kit with sliding loads listed as Option -1 are only required for Performance Verification.		
Note 2 - Usage Codes	A = Adjustment / Internal Hardware Calibration, O = Operational Testing, P = Performance Verification, T = Troubleshooting		
Use either Power Sensor Combination as described below			
Power Meter	Power Range: –30 to +20 dBm (1 mW to 100 mW) Other: GPIB controllable	Anritsu Model ML243xA Power Meter	A, O
Power Sensor	Frequency Range: Useable to the full frequency range of the VNA	Anritsu Model MA2474D, for 40 GHz and below VNAs Anritsu Model SC7770, for 65 GHz VNA models.	A, O

Chapter 2 — Replaceable Parts

2-1 Introduction to Replacement Parts

This chapter provides replaceable parts information for all Lightning 37xxxE VNA models. The major replaceable VNA assemblies and parts are listed and locations shown in this chapter.

2-2 Exchange Assembly Program

Anritsu maintains a module exchange program for selected subassemblies. If a malfunction occurs in one of these subassemblies, the defective item can be exchanged. Upon receiving your request, Anritsu will ship the exchange subassembly to you, typically within 24 hours. 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.

Note	When sending a failed assembly to the factory for exchange, a copy of the Service Log *must always* accompany the failed assembly. This copy may be a printout or a saved electronic copy. Due to the importance of the service log information to the Anritsu factory Service Engineers, the exchange prices are only valid if the service log data is included with the failed assembly.

Please have the exact model number and serial number of your unit available when requesting this service, as the information about your unit is filed according to the instrument's model and serial number.

For more information about the program, contact your local sales representative or call Anritsu Customer Service direct.

2-3 Parts Ordering for Replacement Subassemblies and Parts

All available replacement parts are listed in the four tables below. These parts may be ordered from your local Anritsu service center or directly from the factory at the following address:

Anritsu Company, Customer Service
490 Jarvis Drive, Morgan Hill, CA 95037-2809
Telephone: (408)-778-2000, FAX: (408)-778-0239

Exchange Items

For exchange items, the failed part must be returned to Anritsu. These parts are listed in the three tables below:

- Table 2-1, "Printed Circuit Board Assemblies – Exchange Parts" on page 2-2
- Table 2-2, "RF Source, Test Set, Modules, and Components – Exchange Parts" on page 2-5
- Table 2-3, "Power Supply Module – Exchange Part" on page 2-10

Non-Exchange Items

For non-exchange items, the failed part can be discarded and recycled locally. These parts are listed in:

- Table 2-4, "Miscellaneous Replacement Assemblies and Components – Non-Exchange Parts" on page 2-11.

2-4 Printed Circuit Board Assemblies

Note	The A17 VNA Motherboard PCB Assembly is not a field-replaceable item.

Table 2-1. Printed Circuit Board Assemblies (1 of 3)– Exchange Parts

Reference Designator	Printed Circuit Board Assembly Name	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
A1 PCB	First Local Oscillator	57661-3	ND60314	Chassis Top Side For description, see Figure 2-3, “Major Assemblies Location Diagram – Top View” on page 2-17 for location. To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-4 "A1 to A16 PCBs" on page 8-6.
A2 PCB	Second Local Oscillator	61835-3	61835-3	
A3/A6 PCB	Test A, Test B IF Processor	D38503-3	D38503-3	
A4 PCB	Reference IF Processor	D41794-5	D41794-5	
A5 PCB	Analog to Digital Converter	D38505-4	D38505-4	
A7 PCB	10 MHz/LO3	61181-3	ND62436	
A8 PCB	Source Lock / Separation Control	60866-3	ND60702	
A9 PCB	Main Processor	62414	ND72102	
A13 PCB	I/O #1	D38513-4	D38513-4	
A14 PCB	I/O #2	D38514-3	D38514-3	
A15 PCB	Graphics Processor	63303-3	63303-3	
A16 PCB	I/O Devices Power Distribution	71485-3	71485-3	
A18 PCB	Rear Panel PCB	71882-3	71882-3	Rear Panel Assembly For location, see Figure 8-12, “Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module” on page 8-34 To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-16 "Rear Panel Assembly" on page 8-33 and Section 8-17 "A18 Rear Panel PCB" on page 8-38
A19 PCB	Front Panel Switch PCB	D44279-3	D44279-3	See Figure 2-11, “Front Panel Assembly” on page 2-31 for description. See Section 8-13 "Front Panel Assembly" on page 8-22 for replacement procedure.

Table 2-1. Printed Circuit Board Assemblies (2 of 3)– Exchange Parts

Reference Designator	Printed Circuit Board Assembly Name	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
A20 PCB	Front Panel Switch Control	D44280-3	D44280-3	Front Panel Assembly
–	Keyboard Switch Membrane PCB	D42618	D42618	See Figure 2-11, “Front Panel Assembly” on page 2-31 for description. See Section 8-13 "Front Panel Assembly" on page 8-22 for replacement procedure.
A26 PCB	Keyboard ESD Protection PCB Assembly	58534-3	58534-3	See Figure 2-11, “Front Panel Assembly” on page 2-31 for description. See Section 8-13 "Front Panel Assembly" on page 8-22 for replacement procedure.
A21A1 PCB	Signal Source Yttrium Iron Garnet (YIG) / Bias Control	48512-3	48512-3	Signal Source Assembly For location, see Figure 2-10, “Signal Source Assembly Modules – Part Location Diagram” on page 2-30. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-6 "Signal Source Modules" on page 8-9, and Section 8-8 "A21A1 Source YIG Bias Control PCB" on page 8-15.
A21A2 PCB	Signal Source Control/ALC	61184-3	61184-3	Signal Source Assembly For location, see: Figure 2-10, “Signal Source Assembly Modules – Part Location Diagram” on page 2-30. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-6 "Signal Source Modules" on page 8-9, and Section 8-7 "A21A2 Source Control PCB" on page 8-14.

Table 2-1. Printed Circuit Board Assemblies (3 of 3)– Exchange Parts

Reference Designator	Printed Circuit Board Assembly Name	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
A24 PCB	VME Bus Terminator	D38524-3	D38424-3	Test Set Deck To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-12 "A24 VME Bus Terminator PCB" on page 8-19

2-5 RF Source and Test Set Modules and Components

Table 2-2. RF Source, Test Set, Modules, and Components – Exchange Parts (1 of 5)

Assembly Name	Applicable 37xxxE VNA Models	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
YIG (Yttrium Iron Garnet) Oscillator	All models	ND68037	ND68037	Signal Source Assembly For location, see: Figure 2-10, “Signal Source Assembly Modules – Part Location Diagram” on page 2-30. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-6 "Signal Source Modules" on page 8-9, and Section 8-11 "YIG Oscillator Assembly" on page 8-18.
Switched Filter	All models	D45244	D45244	Signal Source Assembly For location, see: Figure 2-10, “Signal Source Assembly Modules – Part Location Diagram” on page 2-30. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-6 "Signal Source Modules" on page 8-9, and Section 8-9 "Switched Filter Assembly" on page 8-16.
Source Down Conversion Module	All models	D27532	D27532	Signal Source Assembly For location, see: Figure 2-10, “Signal Source Assembly Modules – Part Location Diagram” on page 2-30. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-6 "Signal Source Modules" on page 8-9, and Section 8-10 "Source Down Converter Assembly" on page 8-17.

Table 2-2. RF Source, Test Set, Modules, and Components – Exchange Parts (2 of 5)

Assembly Name	Applicable 37xxxE VNA Models	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
Coupler, 40 GHz	37247E 20 GHz 37347E 40 GHz 37269E 20 GHz 37369E 40 GHz	D29422	D29422	Test Set Chassis For location, see: Figure 2-14, “Model 37247E Test Set Modules” on page 2-37 through Figure 2-17, “Model 37369E Test Set Modules” on page 2-43. To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47.
Coupler, 65 GHz	37297E 65 GHz 37397E 65 GHz	ND52929	ND52929	Test Set Chassis For location, see: Figure 2-18, “Model 37297E Test Set Modules” on page 2-45 and Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47.
Switched Doubler Module (SDM)	37269E 40 GHz 37369E 40 GHz 37297E 65 GHz 37397E 65 GHz	47520	47520	Test Set Chassis For location, see: Figure 2-16, “Model 37269E Test Set Modules” on page 2-41 through Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47. To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47

Table 2-2. RF Source, Test Set, Modules, and Components – Exchange Parts (3 of 5)

Assembly Name	Applicable 37xxxE VNA Models	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
Transfer Switch, 40 GHz	37247E 20 GHz 37347E 20 GHz 37269E 40 GHz 37369E 40 GHz	46535	46535	Test Set Chassis For location, see: Figure 2-14, “Model 37247E Test Set Modules” on page 2-37 through Figure 2-17, “Model 37369E Test Set Modules” on page 2-43 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47
Transfer Switch, 40 GHz for 65 GHz Instruments	37297E 65 GHz 37397E 65 GHz	D27030-2	D27030-2	Test Set Chassis This 40 GHz switch is used in 65 GHz instruments when operating in the 40 GHz band. For location, see: Figure 2-18, “Model 37297E Test Set Modules” on page 2-45 and Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47.
Step Attenuator, 40 GHz	37247E 20 GHz 37347E 20 GHz 37269E 40 GHz 37369E 40 GHz	4612K	4612K	Test Set Chassis For location, see: Figure 2-14, “Model 37247E Test Set Modules” on page 2-37 through Figure 2-17, “Model 37369E Test Set Modules” on page 2-43. To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47

Table 2-2. RF Source, Test Set, Modules, and Components – Exchange Parts (4 of 5)

Assembly Name	Applicable 37xxxE VNA Models	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
Step Attenuator, 65 GHz	37297E 65 GHz 37397E 65 GHz	ND52564	ND52564	Test Set Chassis For location, see Figure 2-18, “Model 37297E Test Set Modules” on page 2-45 and Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47.
Bias Tee, 40 GHz	37247E 20 GHz 37347E 20 GHz 37269E 40 GHz 37369E 40 GHz	48383	48483	Test Set Chassis For location, see: Figure 2-14, “Model 37247E Test Set Modules” on page 2-37 through Figure 2-17, “Model 37369E Test Set Modules” on page 2-43 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47
Bias Tee, 65 GHz	37297E 65 GHz 37397E 65 GHz	53409	53409	Test Set Chassis For location, see: Figure 2-18, “Model 37297E Test Set Modules” on page 2-45 and Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47.

Table 2-2. RF Source, Test Set, Modules, and Components – Exchange Parts (5 of 5)

Assembly Name	Applicable 37xxxE VNA Models	Original Part Number	Replacement Part Number	General Location Description Replacement Procedure
Sampler/Down Conversion Module (*See Note 1 at right.*)	All models	58437	ND61660	Test Set Chassis Note 1: The Sampler/Down Conversion Module and Power Amplifier must be replaced as a single assembly. For location, see: Figure 2-14, “Model 37247E Test Set Modules” on page 2-37 through Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47. To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47
Power Amplifier (*See Note 1 at right.*)	All models	56650		
SPDT Switch	37297E 65 GHz 37397E 65 GHz	29855	29855	Test Set Chassis For location, see: Figure 2-18, “Model 37297E Test Set Modules” on page 2-45 and Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47 To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-21 "Test Set Module Assemblies" on page 8-47.
Source Quadrupler Module (SQM)	37297E 65 GHz 37397E 65 GHz	60129	60129	
MUX Coupler, Port 1 Side	Port 1 Side 37297E 65 GHz 37397E 65 GHz	49470-1	49470-1	
MUX Coupler, Port 2 Side	Port 2 Side 37297E 65 GHz 37397E 65 GHz	49480-1	49480-1	
Shaped Pad	37297E 65 GHz 37397E 65 GHz	64350	64350	
3 dB Fixed Attenuator, V Connectors	37297E 65 GHz 37397E 65 GHz	ND26178	ND26178	
37 GHz Hi-Pass Filter	37297E 65 GHz 37397E 65 GHz	49247	49247	
16.8 GHz Lo-Pass Filter	37297E 65 GHz 37397E 65 GHz	B28612	B28612	

2-6 Power Supply Module

Table 2-3. Power Supply Module – Exchange Part

Assembly Name	Applicable 37xxxE VNA Models	Replacement Part Number	General Location Description Replacement Procedure
Power Supply Module	All models	ND63006	Chassis Top Side For location, see Figure 2-3, “Major Assemblies Location Diagram – Top View” on page 2-17. To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-15 "Power Supply Module" on page 8-29

2-7 Miscellaneous Replacement Assemblies and Components

Table 2-4. Miscellaneous Replacement Assemblies and Components – Non-Exchange Parts (1 of 2)

Assembly Name	Applicable 37xxxE VNA Models	Replacement Part Number	General Location Description Replacement Procedure
Fan	All models	ND54935	Rear Panel Assembly For location, see Figure 8-12, “Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module” on page 8-34. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-16 "Rear Panel Assembly" on page 8-33 and Section 8-18 "Fan Assembly" on page 8-39
LCD Display	All models	15-100	Front Panel Assembly To replace, see: Section 8-3 "Covers" on page 8-2, and Section 8-14 "Liquid Crystal Display (LCD) Assembly" on page 8-28
File Server Device with SD Card Reader	All models	ND72103	Rear Panel Assembly For location, see: Figure 2-6, “File Server Device with SD Card Reader – Inside Chassis View” on page 2-23, Figure 8-14, “File Server Device with SD Card Reader – Outside Chassis View” on page 8-41, and Figure 8-15, “File Server Device with SD Card Reader – Inside Chassis View” on page 8-43. To replace, see: Section 8-3 "Covers" on page 8-2, Section 8-16 "Rear Panel Assembly" on page 8-33 and Section 8-17 "A18 Rear Panel PCB" on page 8-38 Section 8-19 "File Server Device" on page 8-40
USB Hub	All models	2000-1632	Test Set Chassis To replace, see Section 8-20 "USB Hub Assembly" on page 8-45
8 GB SDHC Memory Card with preloaded Operating System	All models	ND72104	Rear Panel See Figure 2-7, “File Server Device with SD Card Reader – Outside Chassis View” on page 2-25.
Ethernet Hub	All models	ND72047	Chassis Top Site

Table 2-4. Miscellaneous Replacement Assemblies and Components – Non-Exchange Parts (2 of 2)

Assembly Name	Applicable 37xxxE VNA Models	Replacement Part Number	General Location Description Replacement Procedure
Backlight Driver PCB for LCD	All models	3-2300-1365	Front Panel Assembly
Basic Measurement Software on USB Memory Device	All models	2300-536	Rear Panel
Backup Battery for A9 PCB	All models	3-633-43	Chassis Top Side
Front Panel Cable, for Option 015K on 20 or 40 GHz VNAs	37247E 20 GHz 37347E 20 GHz 37269E 40 GHz 37369E 40 GHz	B18265-201	Front Panel Assembly Front panel loop cables are mounted externally. When installing, carefully rotate both coupling nuts the same number of turns. Alternate tightening of nuts several times until both are tight. Tightening one nut all the way can cause the cable to be installed tilted to side and result in connection problems.
Front Panel Cable, for Option 015V on 65 GHz VNAs	37297E 65 GHz 37397E 65 GHz	B35569-195	Front Panel Assembly Front panel loop cables are mounted externally. When installing, carefully rotate both coupling nuts the same number of turns. Alternate tightening of nuts several times until both are tight. Tightening one nut all the way can cause the cable to be installed tilted to side and result in connection problems.

2-8 Instrument Covers

The drawing below shows the location of the various chassis covers, associated components, and their mounting hardware.

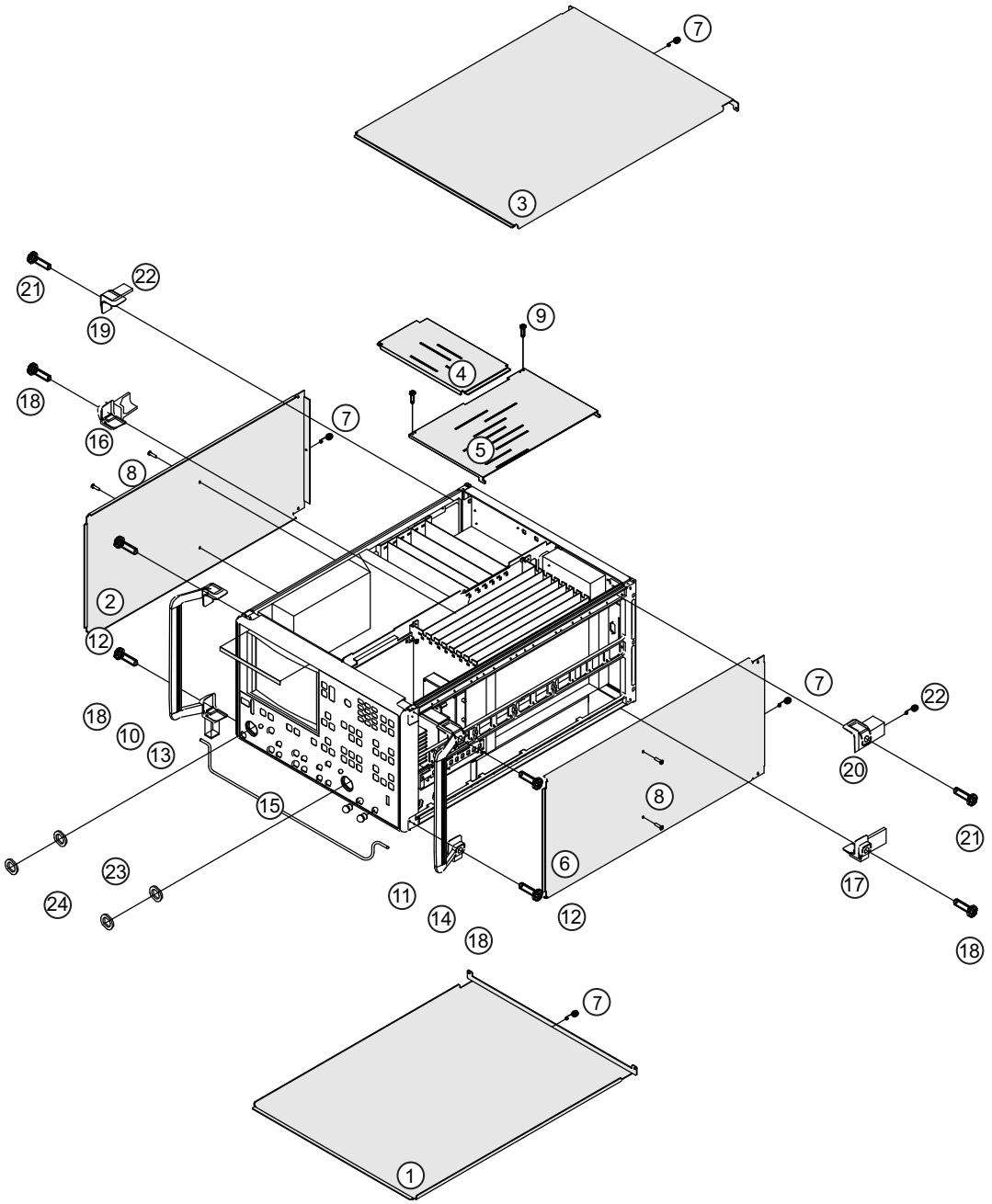


Figure 2-1. Lightning 37xxxE Chassis Covers and Mounting Hardware (1 of 2)

1 – Chassis Cover Bottom
2 – Chassis Cover Left Side
3 – Chassis Cover Top
4 – Small Card Cage Cover
5 – Large Card Cage Cover
6 – Chassis Cover Right Side
7 – Rear screw for top, left, right, and bottom covers, Pan head 6×32 × 0.375”, 1 per cover, 4 total
8 – Middle screws side covers, Pan head 6×32 × 0.312” machine screw, 2 per cover, 4 total
9 – Screws for Large Card Cage Cover, Pan head 4×40 × 0.25” machine screw, 2 total
10 – Left Chassis Handle
11 – Right Chassis Handle
12 – Handle mounting screws, Pan head Phillips 5×24 machine screw with green washer, 2 per handle, 4 total.
13 – Bottom Left Front Chassis Foot
14 – Bottom Right Front Chassis Foot
15 – Chassis Tilt Bail
16 – Bottom Left Rear Chassis Foot
17 – Bottom Right Rear Chassis Foot
18 – Mounting screw for chassis feet, Pan head Phillips 5×24 machine screw with green washer, 1 per foot, 4 total.
19 – Upper Left Rear Foot Holder
20 – Upper Right Rear Foot Holder
21 – Rear foot holder screw, Pan head Phillips 5×24 machine screw with green washer, 1 per holder, 2 total.
22 – Pan head Phillips 6×32 × 0.437” machine screw, 1 per foot/holder, 4 total.
23 – Port Coupler Front Panel Thrust Washer
24 – Port Coupler Front Panel Nut

Figure 2-1. Lightning 37xxxE Chassis Covers and Mounting Hardware (2 of 2)

2-9 Instrument Exploded View

The drawing below shows an exploded view of the complete instrument.

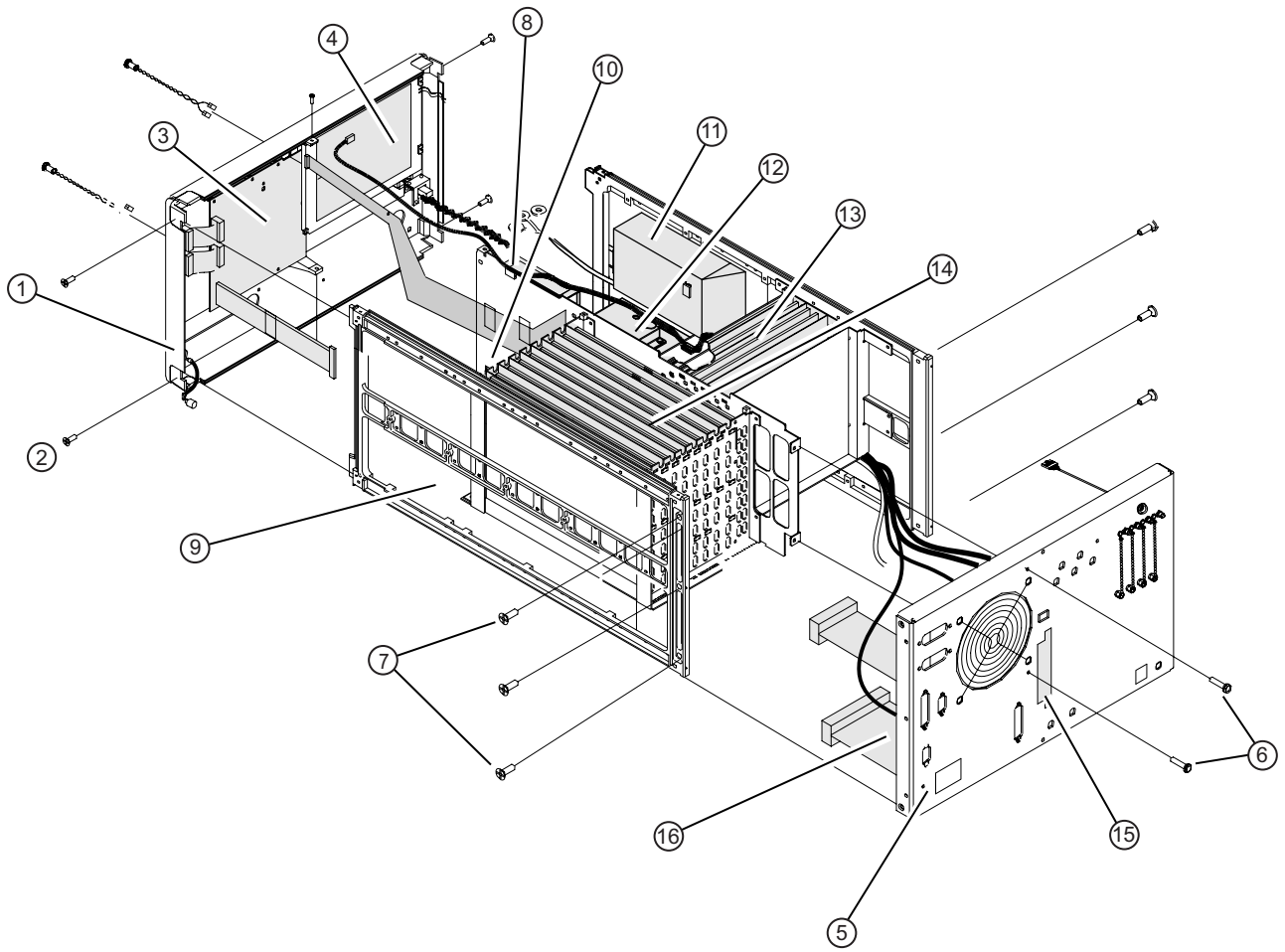


Figure 2-2. Chassis Exploded View (1 of 2)

1 – Front Panel Assembly

2 – Flat head Phillips 8×32 × 0.375” mounting screws, four places, two each side

3 – A19 Front Panel Switch PCB and A20 Front Panel Switch Control PCB

4 – LCD Display Assembly – 15-100

5 – Rear Panel Assembly

6 – Pan head Phillips 6×32 × 0.312” mounting screws, 10 places

7 – Pan head Phillips 6×32 × 0.500” mounting screws, six places, three each side

8 – Ethernet Hub Assembly and Bracket – ND72047

9 – Main Chassis and Card Cage Assembly

10 – Signal Source Module Assembly – Removed here for clarity

11 – Power Supply Module – ND63006

12 – A17 Motherboard PCB – Note that the A26 PCB is located on the A17 PCB near the right front corner of the Front Panel.

13 –A13 to A16 PCB Assemblies

14 – A1 to A9 PCB Assemblies

15 – File Server Device with SD Card Reader Card Slot – ND72103 – Card reader mounted on inside Rear Panel.

16 – A18 Rear Panel PCB – Mounted on inside Rear Panel.

Figure 2-2. Chassis Exploded View (2 of 2)

2-10 Chassis Top Side Assembly Locations

The drawing below shows major part locations in the upper chassis.

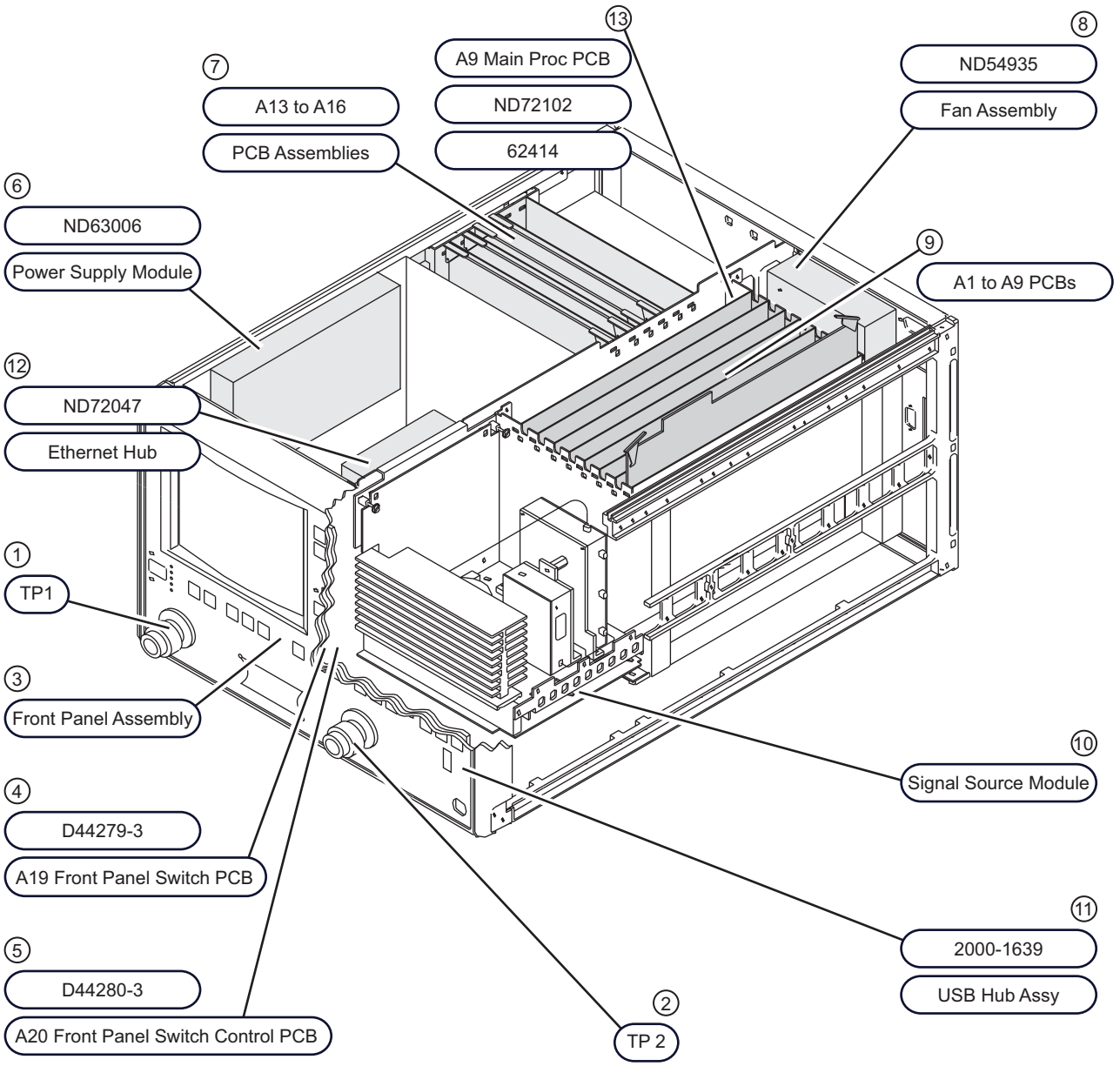


Figure 2-3. Major Assemblies Location Diagram – Top View (1 of 2)

1 – Test Port 1

2 – Test Port 2

3 – Front Panel Assembly

4 – A19 Front Panel Switch PCB – D44279-3 – Behind Front Panel

5 – A20 Front Panel Switch Control PCB – D44280-3 – Behind Front Panel

6 – Power Supply Module – ND63006

7 – Printed Circuit Board Assemblies, A13 to A16:
- A13 – I/O #1 PCB – D38513-4
- A14 – I/O #2 PCB – D38514-3
- A15 – Graphics Processor PCB – 63303-3
- A16 – I/O Devices Power Distribution PCB – 71485-3

8 – Fan Assembly – ND54935

9 – Printed Circuit Board Assemblies, A1 to A9:
- A1 – First Local Oscillator PCB – 57661-3 – ND60314
- A2 – Second Local Oscillator PCB – 61835-3
- A3 – Test A IF PCB – D38503-3
- A4 – Reference IF PCB – D41794-5
- A5 – Analog to Digital Converter – D38505-4
- A6 – Test B IF PCB – D38503-3
- A7 – 10 MHz/LO3 PCB – 61181-3 – ND62436
- A8 – Source Lock / Separation Control PCB – 60866-3 – ND60702

10 – Signal Source Module Assembly

11 – USB Hub and Bracket Assembly – 2000-1639 – Port on front panel, unit mounted on RF Deck.

12 – Ethernet Hub and Bracket Assembly – ND72047

13 – A9 Main Processor PCB – 62414 – ND72102 – With Backup Coin Battery – 3-633-43

Figure 2-3. Major Assemblies Location Diagram – Top View (2 of 2)

Chassis Major Assemblies – Exploded View

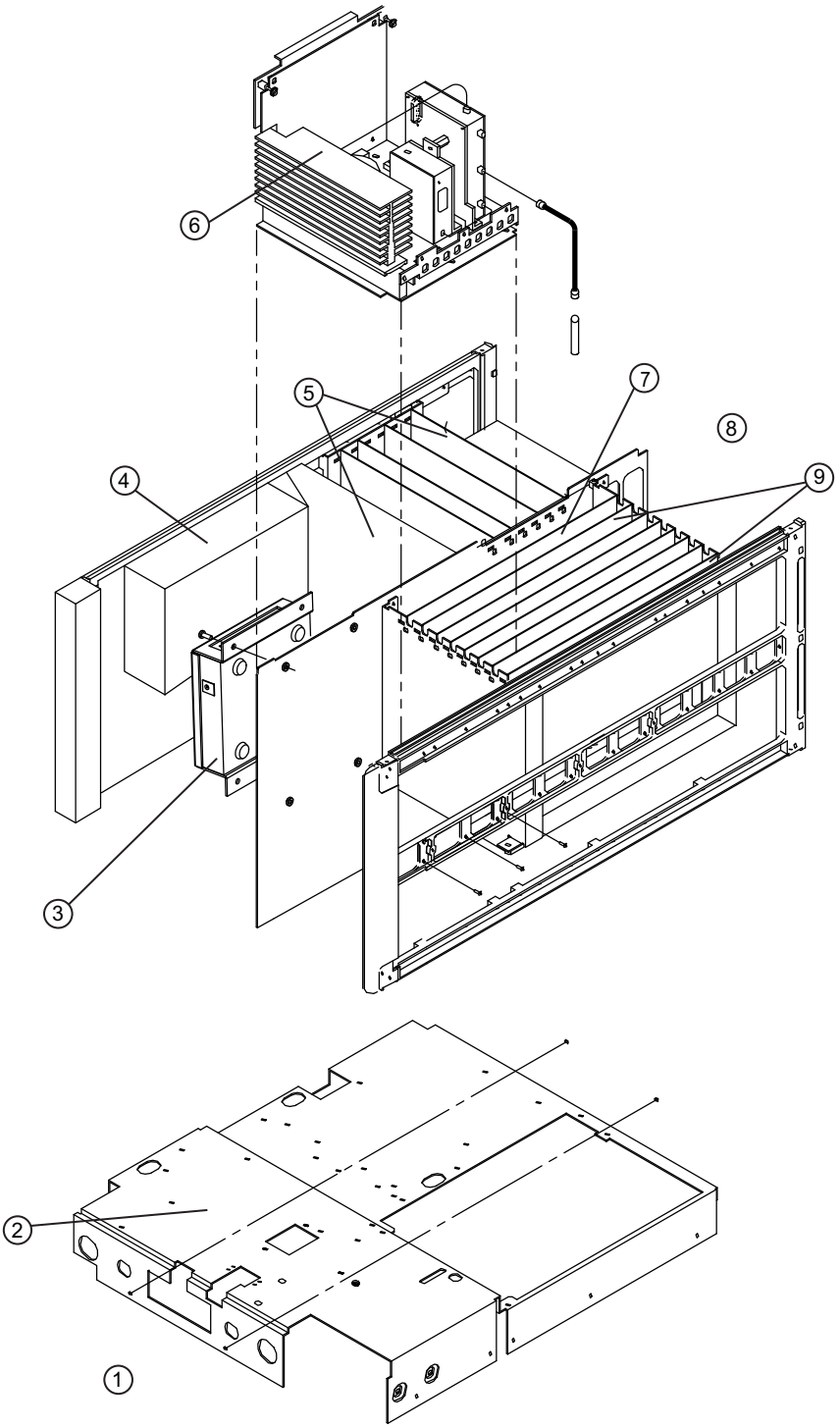


Figure 2-4. Major Internal Assembly Locations (1 of 2)

1 – Front Panel – Not shown her for clarity.

2 – Test Set Chassis

3 – Ethernet Hub Assembly – ND72047

4 – Power Supply Module Assembly – ND63006

5 – A13, A14, A15, and A16 PCBs

6 – Source Module Assembly

7 – A9 Main Processor PCB – ND72102 – 62414

8 – Rear Panel – Not shown here for clarity.

9 – A1, A2, A3, A4, A5, A6, A7, and A8 PCBs

Figure 2-4. Major Internal Assembly Locations (2 of 2)

2-11 File Server Device With SD Card Reader

Cabling Diagram for File Server Device With SD Card Reader

The File Server Device with SD Card Reader – ND72103 assembly is connected to the Ethernet Hub – ND72047 and the USB Hub – 2000-1632 as shown in the cabling schematic below. Detailed drawings of each component are in the sections following.ow the assemblies are interconnected.

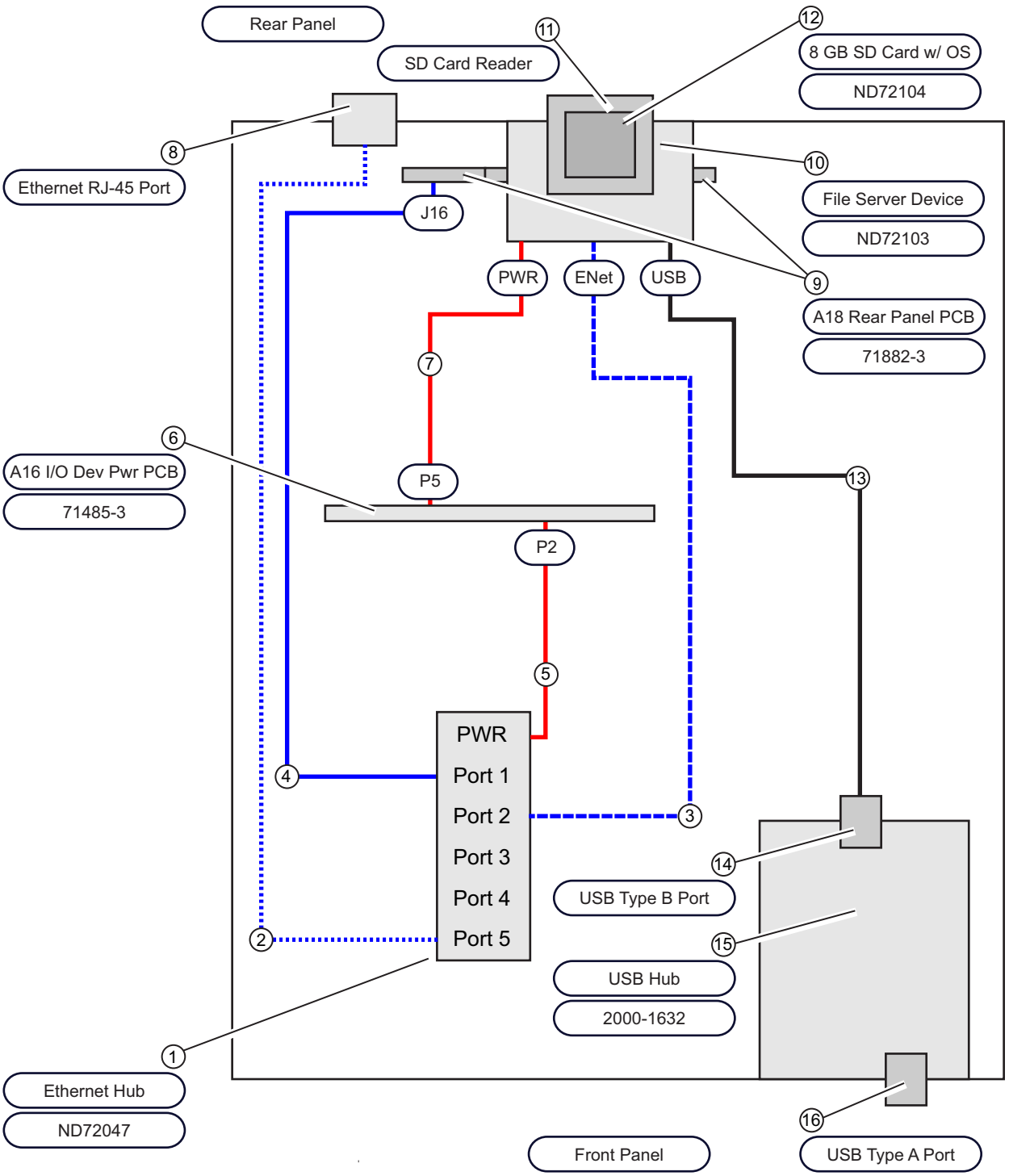


Figure 2-5. Cabling Schematic for File Server Device and Related Devices (1 of 2)

Chassis viewed from top.

1 – Ethernet Hub – ND72047

2 – Cable – Ethernet CAT-5 RJ45 Male to Bulkhead RJ-45 Female – Connects to Ethernet Hub Port 5 and Female connector mounts on rear panel.

3 – Cable – Ethernet CAT-5 RJ-45 Male-Male Cable – Connects to Ethernet Hub Port 2 and File Server Device Ethernet Port.

4 – Cable – Ethernet CAT-5 RJ45 Male-Male Cable – Connects to Ethernet Hub Port 1 and A18 Rear Panel PCB connector J16.

5 – Cable – Power connectors – Connects to Ethernet Hub Power Port and A16 I/O Device Power Distribution PCB connector P2.

6 – A16 I/O Device Power Distribution PCB – 71485-3

7 – Cable – Power connectors – Connects to A16 PCB connector P5 and File Server Device Power Connector.

8 – Rear Panel Ethernet RJ45 Port.

9 – A18 Rear Panel PCB – 71882-3 – PCB is mounted to Rear Panel.

10 – File Server Device with SC Card Reader – ND72103

11 – SD Card Reader – Accessed from outside Rear Panel.

12 – 8 GB SD Card with Lightning 37xxxE Operating System – Plugs into SD Card Reader.

13 – Cable – USB 2.0 Male Type A to USB 2.0 Male Type B – Type A connector plugs into File Server Device – Type B connector plugs into USB Hub.

14 – USB 2.0 Male Type B connector on hub.

15 – USB 2.0 Hub – 2000-1632

16 – Front Panel USB 2.0 Type A Port

Figure 2-5. Cabling Schematic for File Server Device and Related Devices (2 of 2)

File Server Device with SD Card Reader – Inside Chassis View

This view shows the File Server Device mechanical mounting and its primary cable connections.

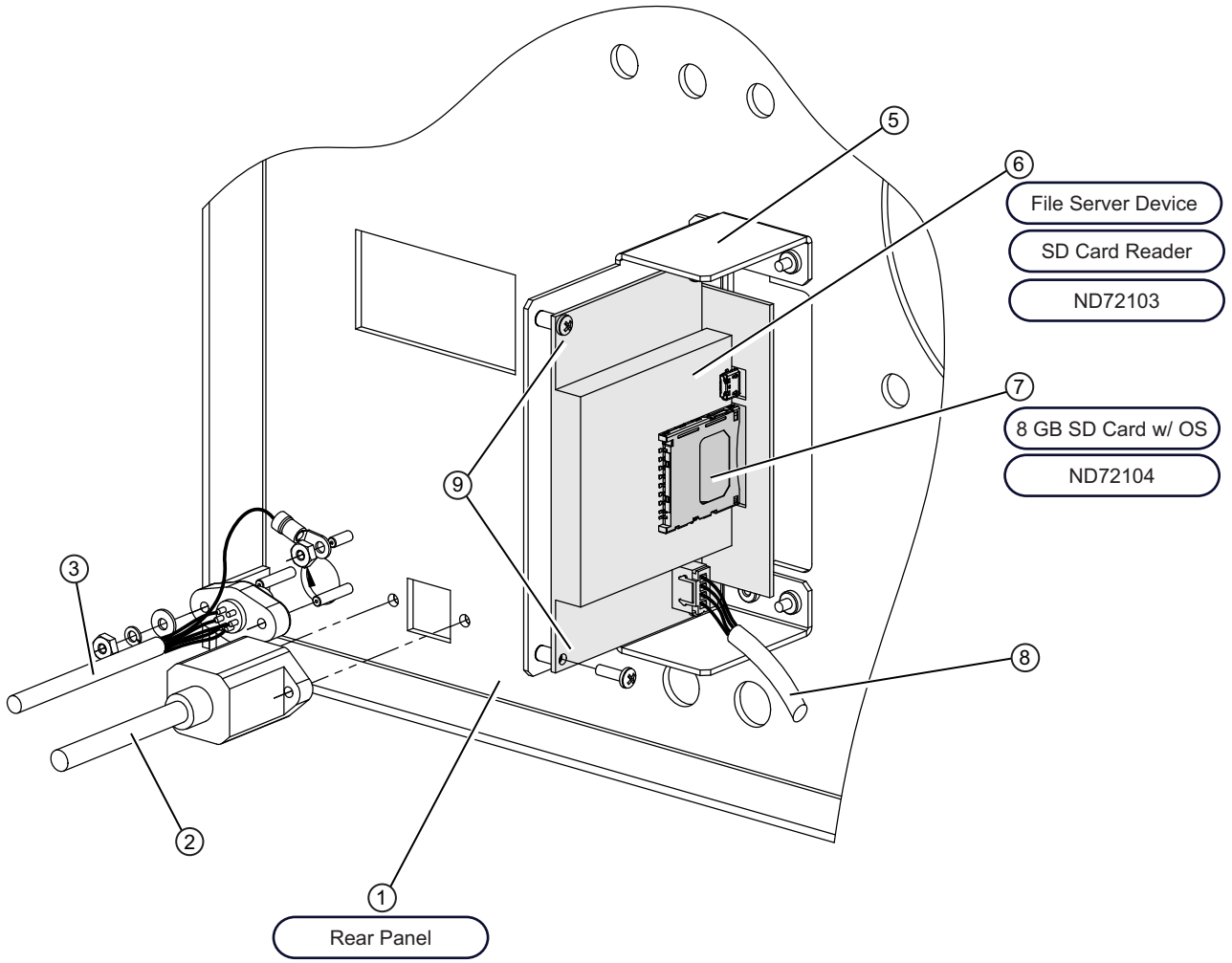


Figure 2-6. File Server Device with SD Card Reader – Inside Chassis View (1 of 2)

Inside Rear Panel – File Server Device with SD Card Reader

1 – Rear Panel – Inside View

2 – Cable – Bulkhead RJ-45 Female to Ethernet CAT-5 RJ45 Male – Connects to Ethernet Hub Port 5 and Female connector mounts on rear panel.

3 – Cable – Bulkhead PS/2 Female to pin connector – Connects to A17 PCB J16 and Female connector mounts on the rear panel.

4 – AC Power Input Module – Removed here for clarity.

5 – Bracket Assembly for File Server Device with SC Card Reader

6 – File Server Device with SD Card Reader – ND72103

7 – 8 GHz SD Card with installed LIghtning 37xxxE Operating System – Removable for replacement or security concerns.

8 – File Server Device mounting screws – Phillips – 2 each

9 – Cable – Power Cable for File Server Device – Connects between File Server Device Power Connector and A16 PCB P6.

Figure 2-6. File Server Device with SD Card Reader – Inside Chassis View (2 of 2)

SD Card Reader – Outside View

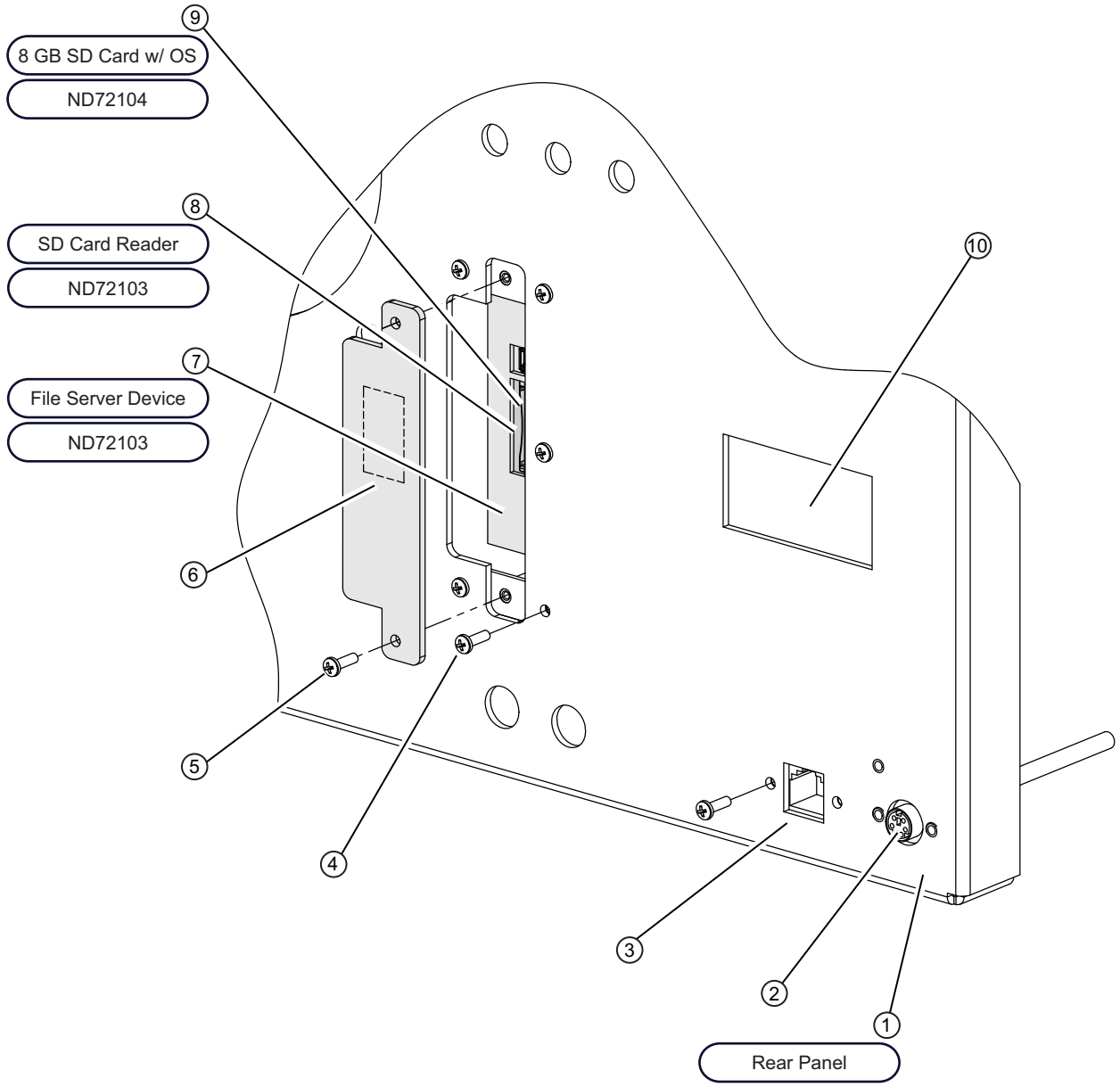


Figure 2-7. File Server Device with SD Card Reader – Outside Chassis View (1 of 2)

Rear Panel – Outside – File Server Device with SD Card Reader

1 – Rear Panel – Outside View

2 – PS/2 Female Connector – Cable – Bulkhead PS/2 Female to pin connector – Connects to A17 PCB J16.

3 – Ethernet RJ-45 Female Connector – CAT-5 Cable – Bulkhead RJ-45 Female to Ethernet CAT-5 RJ45 Male – Connects to Ethernet Hub.

4 – Mounting Screws for File Server Device with SD Card Reader Bracket – Phillips head – 5 each

5 – Mounting Screws for SD Card Reader – Phillips head – 2 each

6 – SD Card Reader Cover

7 – File Server Device with SD Card Reader – ND72103 – Mounted into bracket inside Rear Panel.

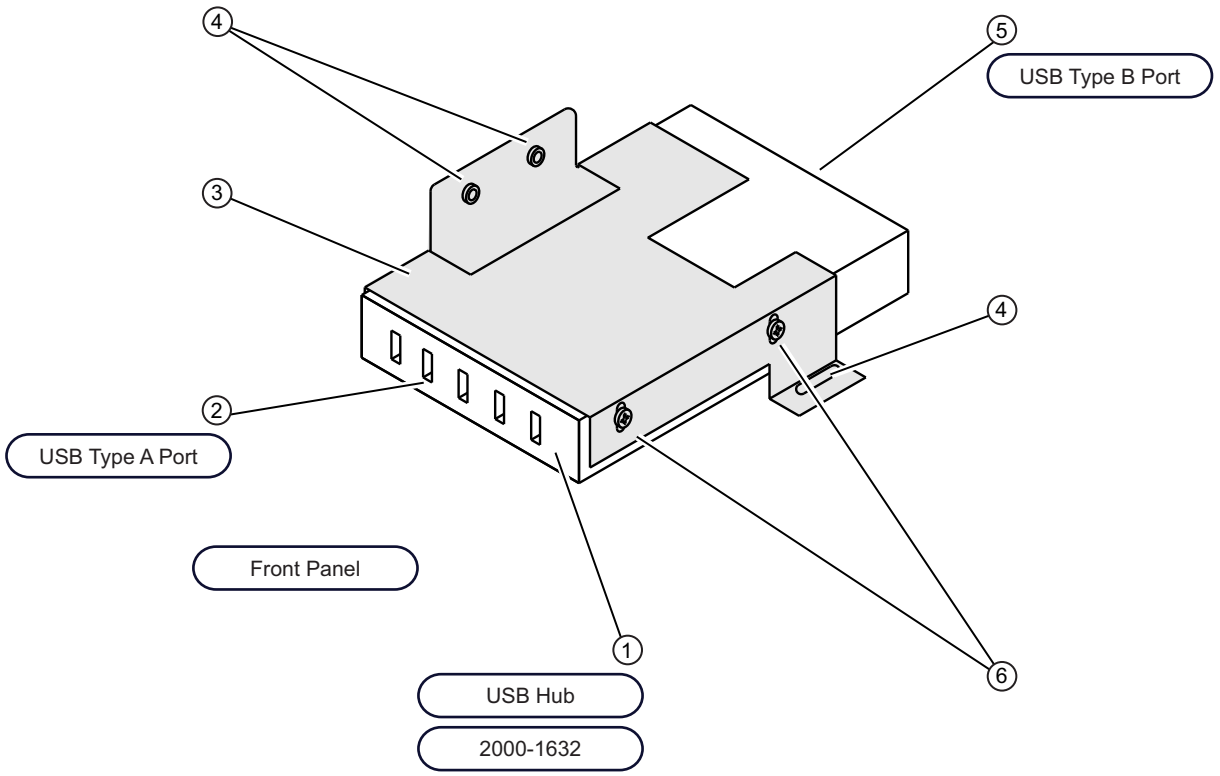
8 – SD Card Reader – Part of the File Server Device.

9 – 8 GN SD Card with installed Operating System – ND72104 – Removable

10 – AC Input Module – Removed here for clarity.

Figure 2-7. File Server Device with SD Card Reader – Outside Chassis View (2 of 2)

2-12 USB Hub Assembly



USB Hub and Front Panel USB Port

1 – USB 2.0 Hub – 2000-1632

2 – USB 2.0 Type A Front Panel Port

3 – Hub Mounting Bracket

4 – Hub Bracket to Chassis Mounting Screws – Phillips head – 3 each

5 – USB 2.0 Type B Female Connector – Not shown here – Connects to USB 2.0 Type B Male to Type A Male Cable – USB 2.0 Type A connector plugs into USB connector on File Server Device with SD Card Reader – ND72103.

6 – USB Hub to Bracket Mounting Screws – Phillips head – 2 each side – 4 total

Figure 2-8. USB Hub and Mounting Bracket

2-13 Ethernet Hub Assembly

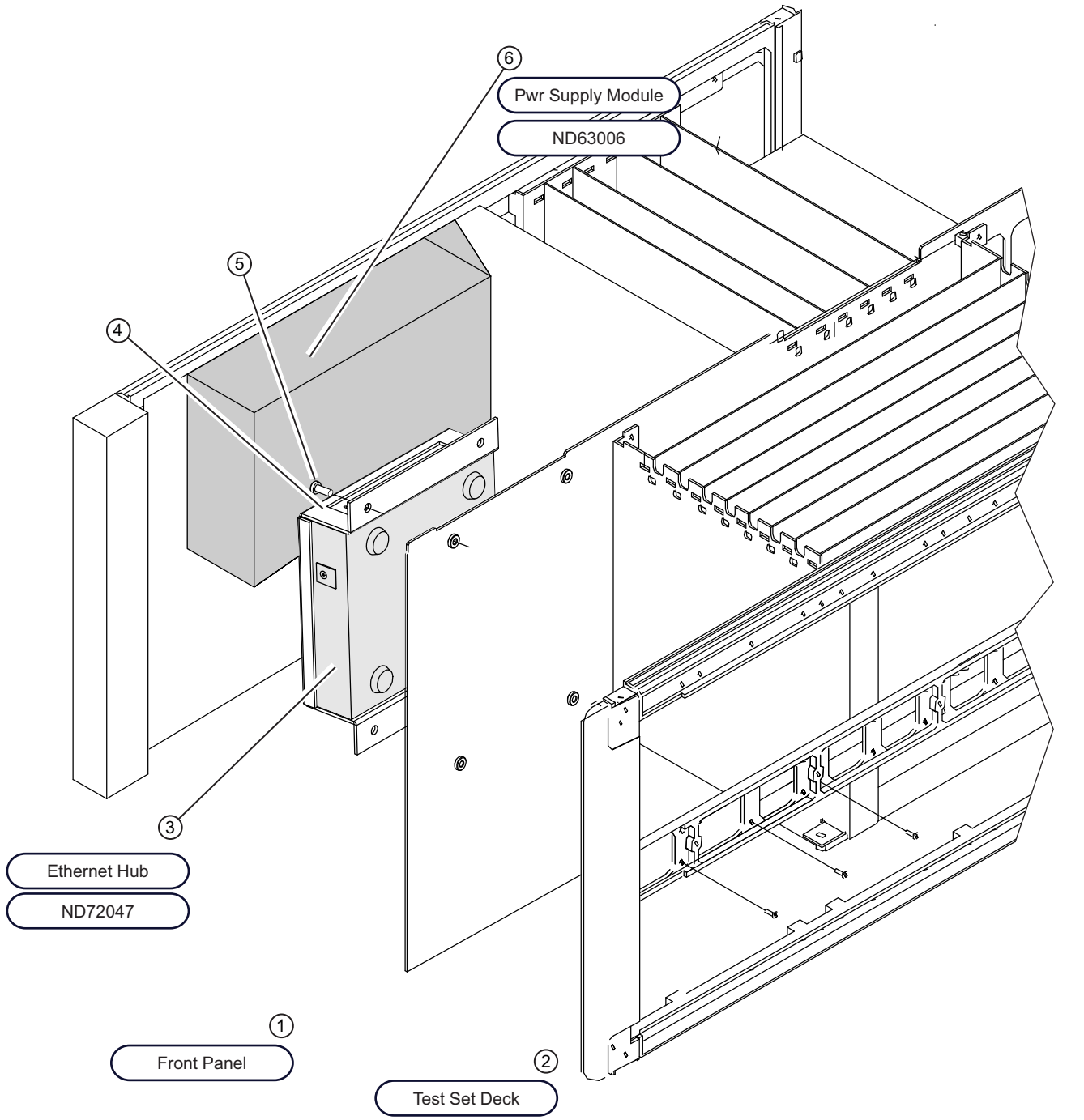


Figure 2-9. Power Supply Module – ND63003 and Ethernet Hub Assembly – ND72047 (1 of 2)

1 – Front Panel – Removed here for clarity.

2 – Test Set Deck Chassis – Mounted below the PCB chassis – Removed here for clarity.

3 – Ethernet Hub – ND72047 – Mounted in bracket – Bracket assembly fastens to chassis center plate in Power Supply Module bay.

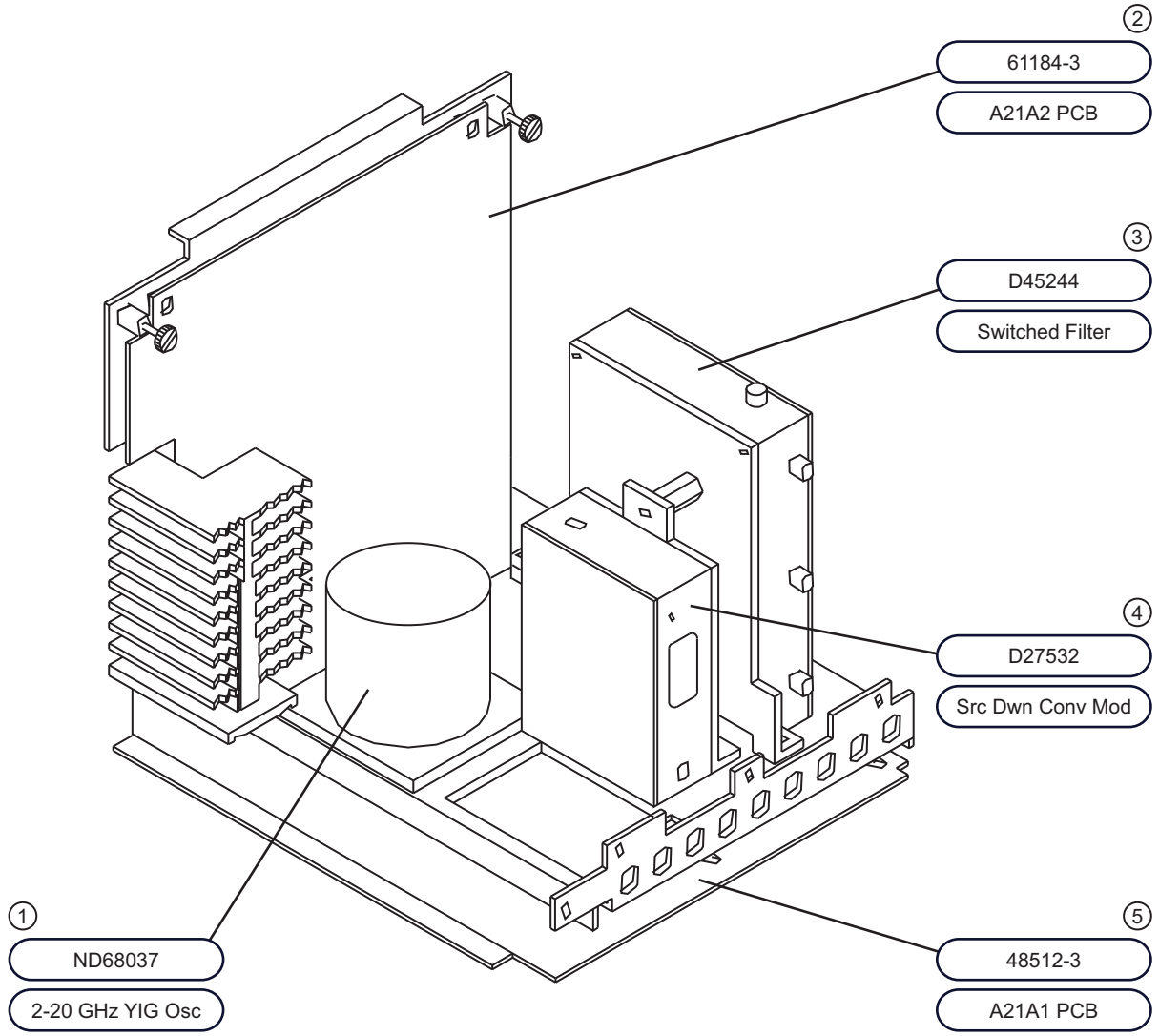
4 – Ethernet Hub Bracket – There are no hub-to-bracket mounting screws. The bracket encloses the hub.

5 – Bracket-to-chassis center plate mounting screws – Phillips head – 4 each.

6 – Power Supply Module – MD63006

Figure 2-9. Power Supply Module – ND63003 and Ethernet Hub Assembly – ND72047 (2 of 2)

2-14 Signal Source Assembly Components



1 – 2-20 GHz YIG Oscillator Assembly – ND68037
2 – A21A2 Source Control PCB Assembly – 61184-3
3 – Switched Filter – D45244
4 – Source Down Converter Module – D27532
5 – A21A1 Source YIG Bias Control PCB Assembly – 48512-3

Figure 2-10. Signal Source Assembly Modules – Part Location Diagram

2-15 Front Panel Assembly

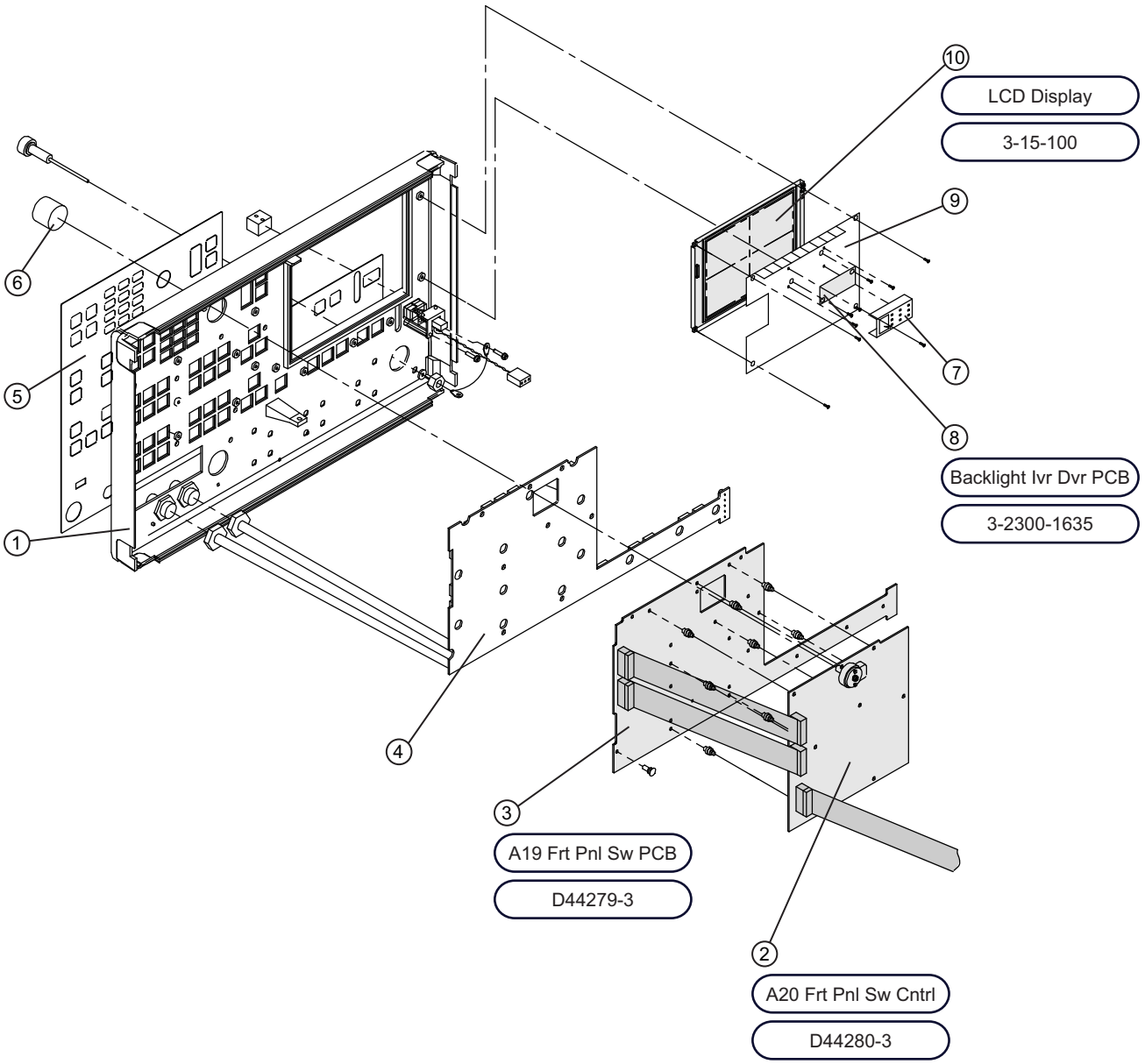


Figure 2-11. Front Panel Assembly (1 of 2)

Front Panel Assembly and Related PCS

1 – Front Panel Assembly

2 – A20 Front Panel Switch Control PCB – D44280-3

3 – A19 Front Panel Switch PCB – D33279-3

4 – Rubber Keypad – D42618

5 – Front Panel Overlay

6 – Knob for Rotary Controller

7 – LCD Backlight Inverter PCB Cover

8 – LCD Backlight Inverter PCB – 3-2300-1635

9 – LCD Protective Panel

10 – LCD Display – 3-15-100

Figure 2-11. Front Panel Assembly (2 of 2)

2-16 Rear Panel Assembly and Components

Rear Panel – Inside Components

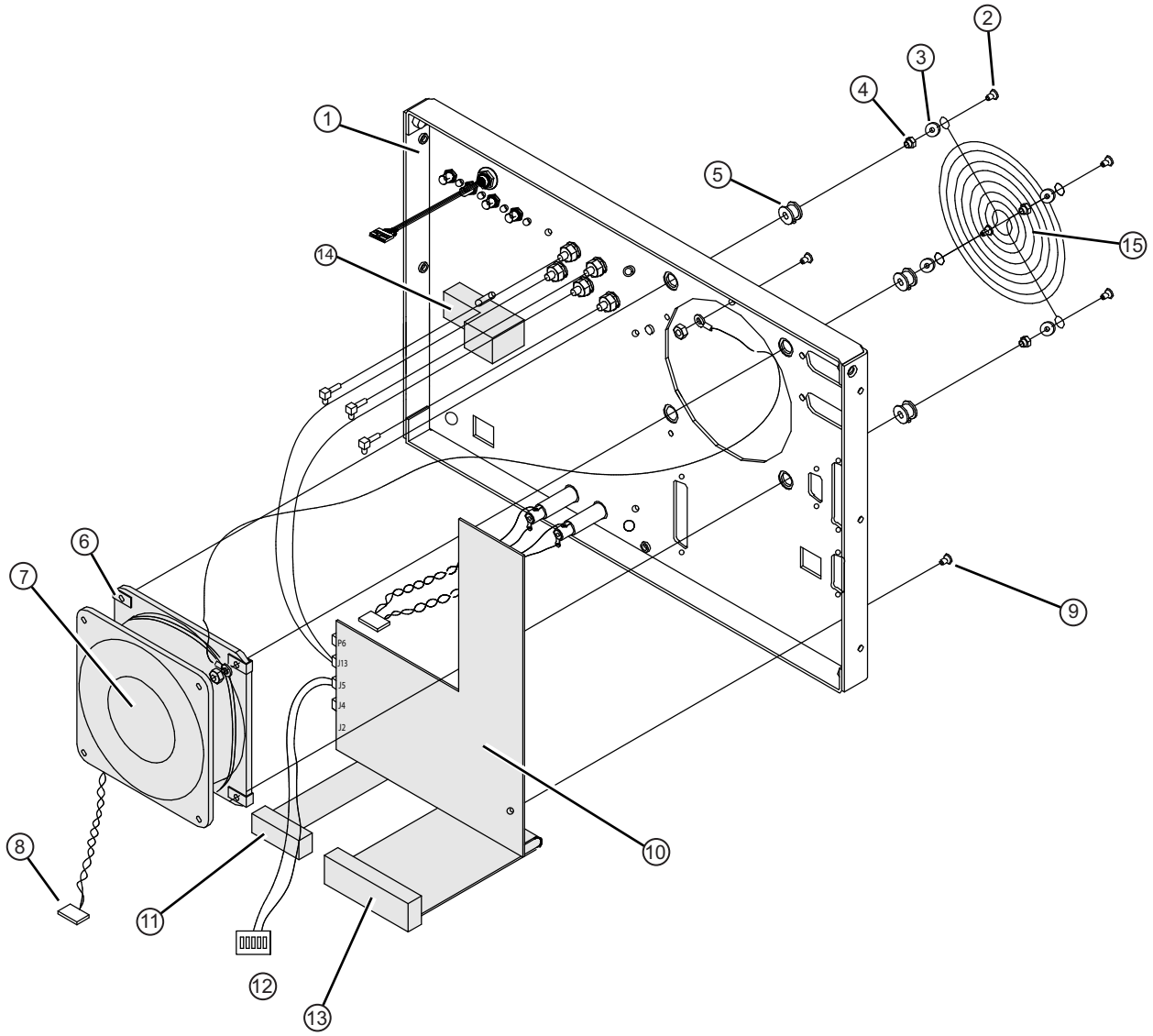


Figure 2-12. Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module (1 of 2)

1 – Rear Panel

2 – Flat head Phillips screw, 6×32 × 0.75”, four places

3 – Flat #6 washer, four places

4 – Standoff #6×0.87”, four places

5 – Vibration isolation grommet, #6, four places

6 – Spring Clip, #6×0.31”×0.25”, four places

7 – Fan Assembly – ND54935

8 – Fan Power Cable – From Fan to A18 P6

9 – A18 mounting screws, Pan head Phillips 6×32 × 0.312”

10 – A18 Rear Panel PCB – 71882-3

11 – Ribbon Cable – From A18 J1 to A17 J19

12 – Connector Header – From A18 J5 to A17 J7

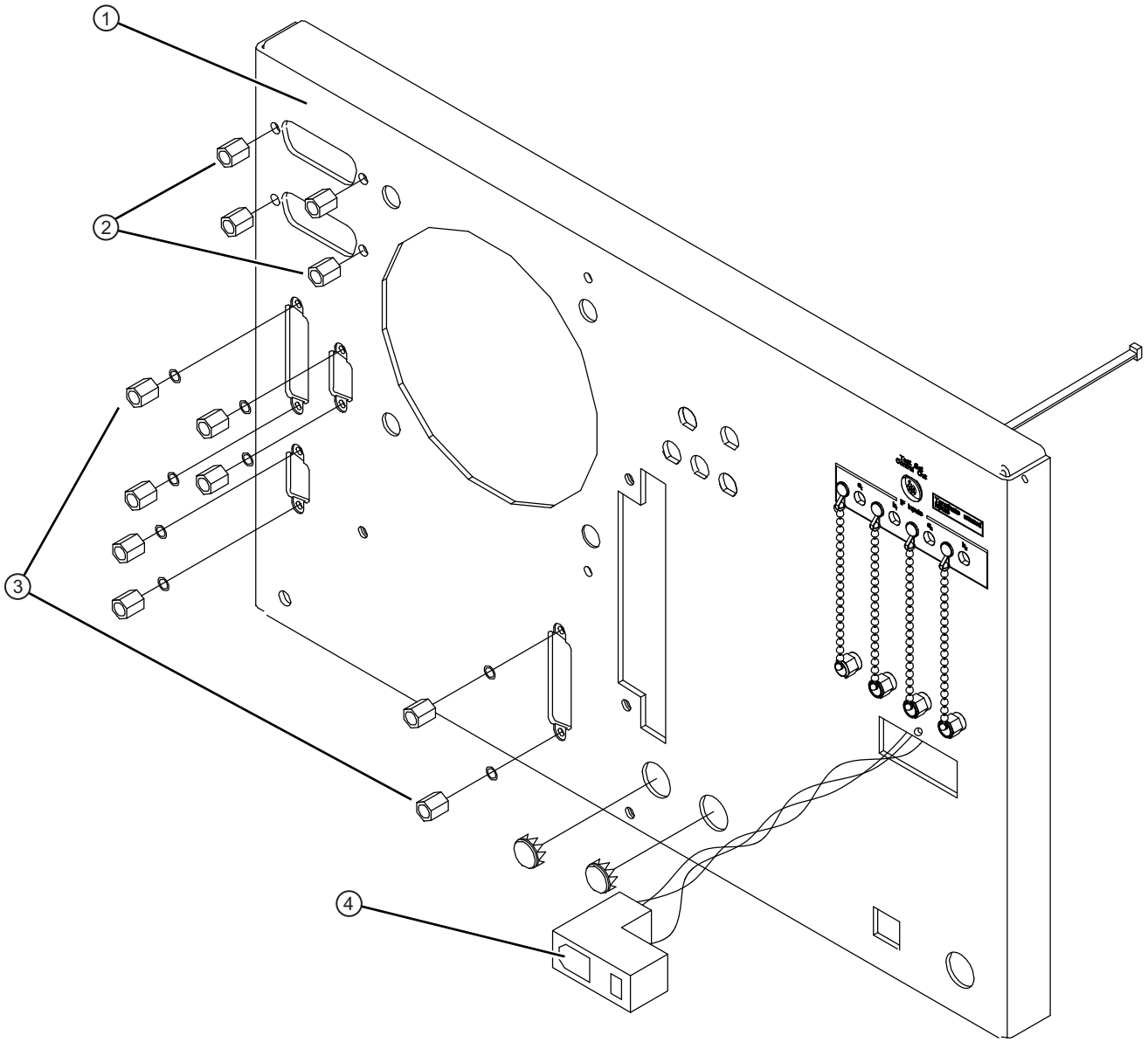
13 – Ribbon Cable – From A18 J14 to A17 J12

14 – AC Power Input Module and Fuses

15 – Fan Finger Guard Grill

Figure 2-12. Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module (2 of 2)

Rear Panel – Outside Components



Remove Rear Panel Connector Screws before removing A18 Rear Panel PCB – 61011-3

1 – Rear Panel

2 – GPIB Connector Hex Mounting Standoff Screws
– Internally threaded to allow connector stacking
– Four places

3 – Connector Hex Mounting Standoff Screws – 4×40 × 0.187”, eight places

4 – AC Port Adapter and Fuse Assembly

Figure 2-13. Rear Panel – Outside Components – Connector Mounting Hex Standoffs for A18 Rear Panel PCB

2-17 37xxxE Test Set Variants

The figures in the sections following show the locations of the Test Set Modules based on the instrument type and options:

- Figure 2-14, “Model 37247E Test Set Modules” on page 2-37
- Figure 2-15, “Model 37347E Test Set Modules” on page 2-39
- Figure 2-16, “Model 37269E Test Set Modules” on page 2-41
- Figure 2-17, “Model 37369E Test Set Modules” on page 2-43
- Figure 2-18, “Model 37297E Test Set Modules” on page 2-45
- Figure 2-19, “Model 37397E Test Set Modules .” on page 2-47

2-18 Test Set Modules – Model 37247E

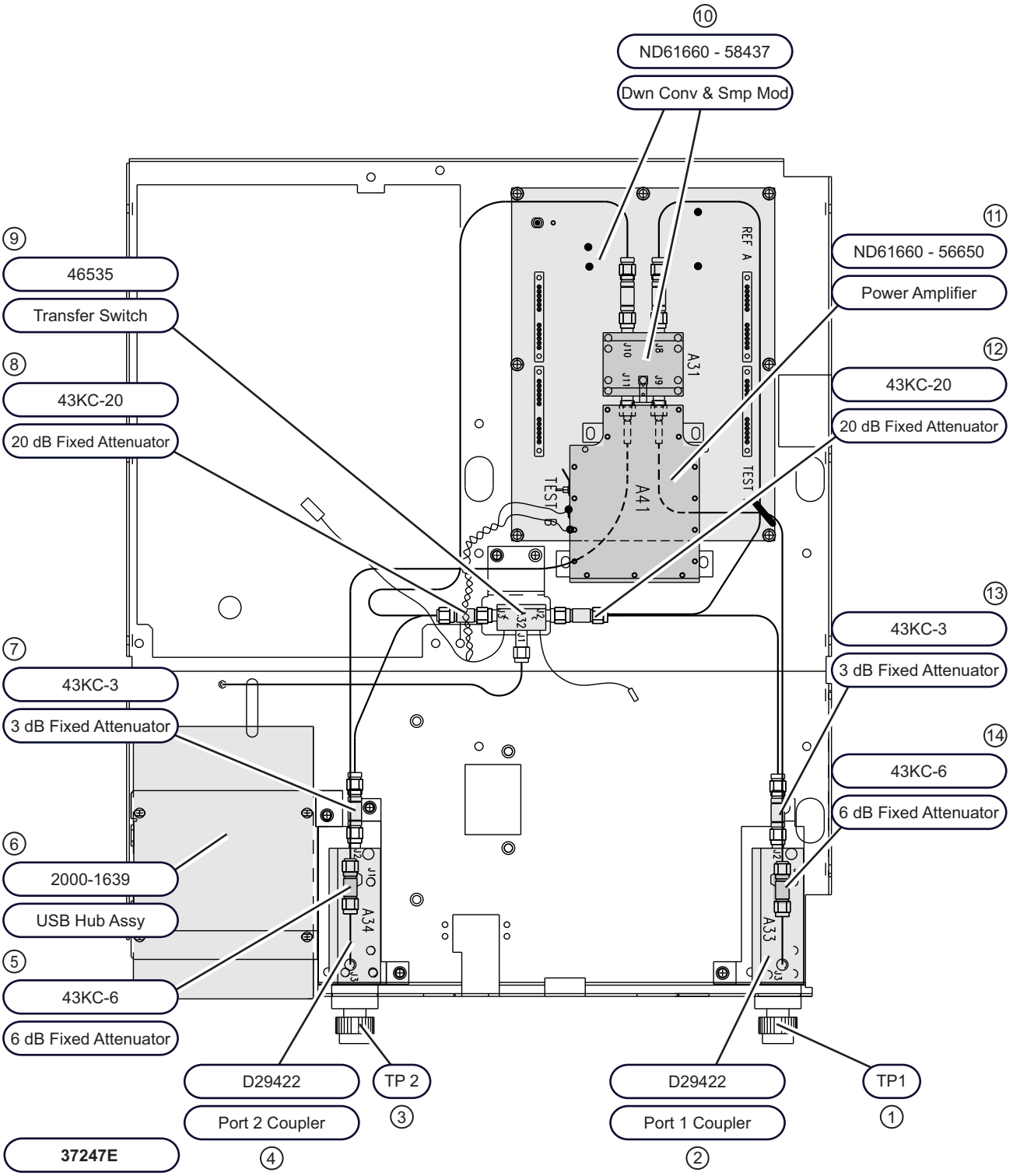


Figure 2-14. Model 37247E Test Set Modules (1 of 2)

1 – Test Port 1

2 – Port 1 Coupler – D29422

3 – Test Port 2

4 – Port 2 Coupler – D29422

5 – 6 dB Fixed Attenuator – 43KC-6

6 – USB Hub Assembly – 2000-1639

7 – 3 dB Fixed Attenuator – 43KC-3

8 – 20 dB Fixed Attenuator – 43KC-20

9 – Transfer Switch – 46535

10 – Down Converter and Sampler Module – 58437 – ND61660

11 – Power Amplifier – 56650 – ND61660

12 – 20 dB Fixed Attenuator – 43KC-20

13 – 3 dB Fixed Attenuator – 43KC-3

14 – 6 dB Fixed Attenuator – 43KC-6

Figure 2-14. Model 37247E Test Set Modules (2 of 2)

2-19 Test Set Modules – Model 37347E

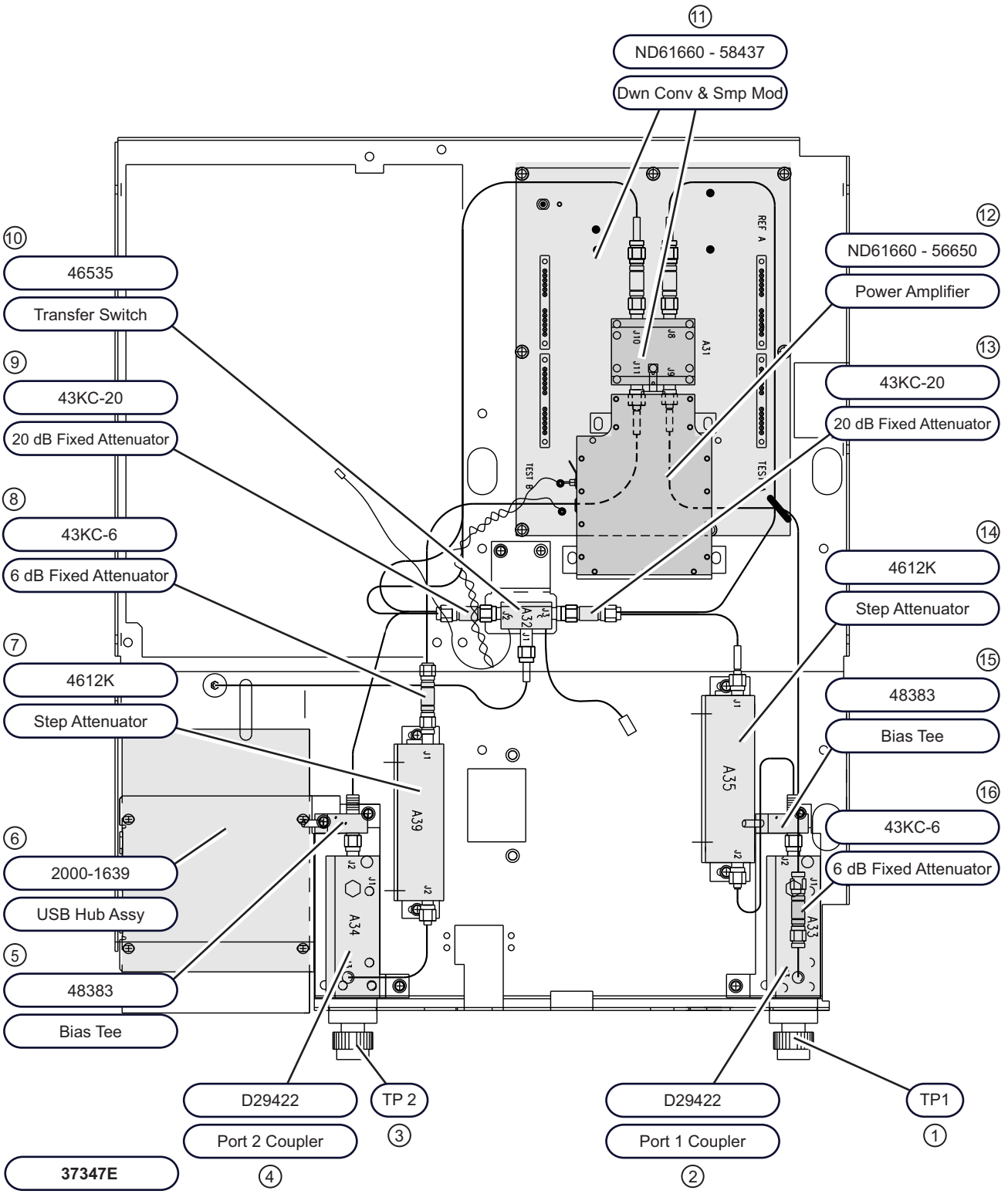


Figure 2-15. Model 37347E Test Set Modules (1 of 2)

1 – Test Port 1

2 – Port 1 Coupler – D29422

3 – Test Port 2

4 – Port 2 Coupler – D29422

5 – Bias Tee – 48383

6 – USB Hub Assembly – 2000-1639

7 – Step Attenuator – 4612K

8 – 6 dB Fixed Attenuator – 43KC-6

9 – 20 dB Fixed Attenuator – 43KC-20

10 – Transfer Switch – 46535

11 – Down Converter and Sampler Module – 58437 – ND61660

12 – Power Amplifier – 56650 – ND61660

13 – 20 dB Fixed Attenuator – 43KC-20

14 – Step Attenuator – 4612K

15 – Bias Tee – 48383

16 – 6 dB Fixed Attenuator – 43KC-6

Figure 2-15. Model 37347E Test Set Modules (2 of 2)

2-20 Test Set Modules – Model 37269E

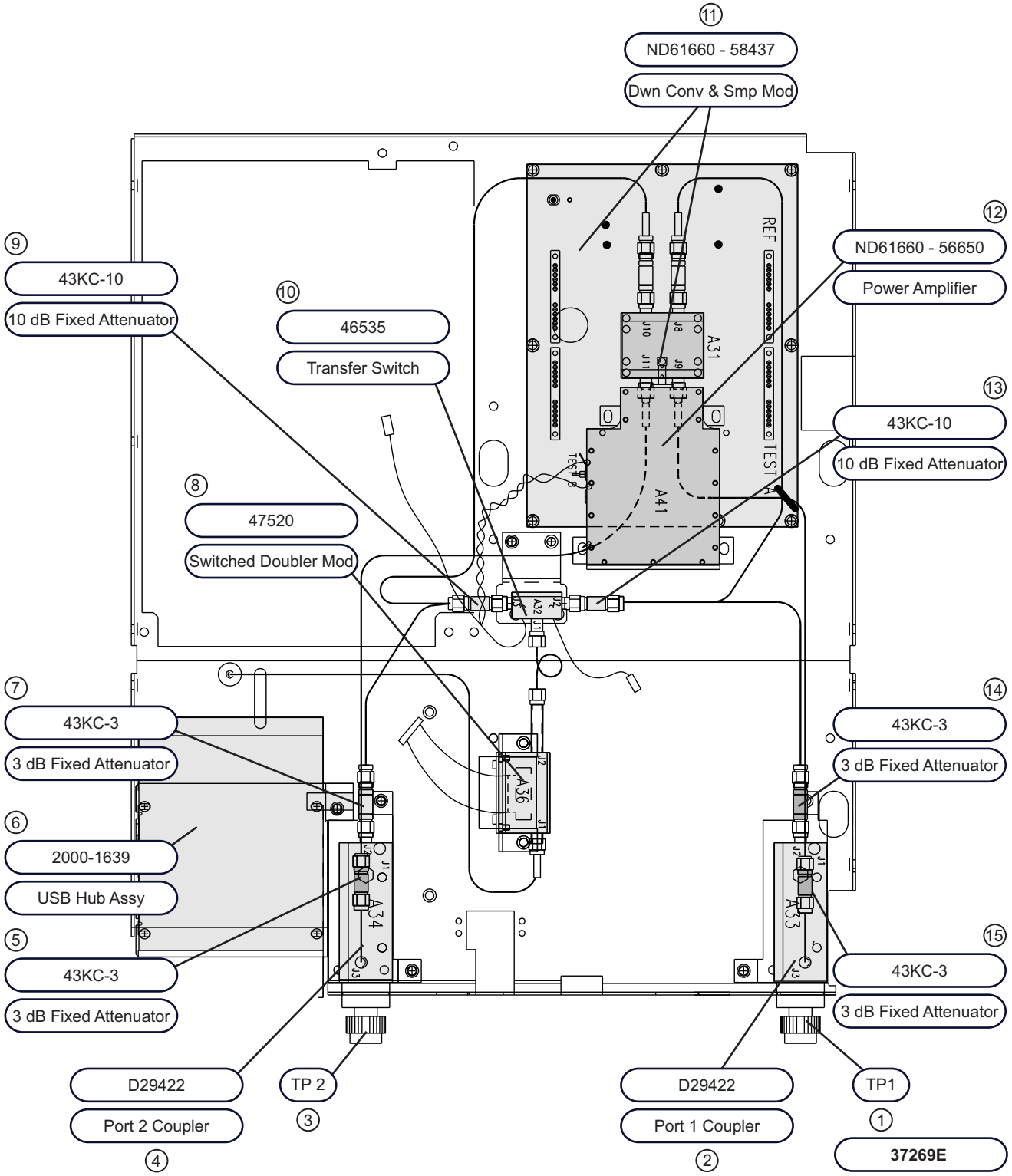


Figure 2-16. Model 37269E Test Set Modules (1 of 2)

1 – Test Port 1

2 – Port 1 Coupler – D29422

3 – Test Port 2

4 – Port 2 Coupler – D29422

5 – 3 dB Fixed Attenuator – 43KC-3

6 – USB Hub Assembly – 2000-1639

7 – 3 dB Fixed Attenuator – 43KC-3

8 – Switched Doubler Module – 47520

9 – 10 dB Fixed Attenuator – 43KC-10

10 – Transfer Switch – 46535

11 – Down Converter and Sampler Module – 58437 – ND61660

12 – Power Amplifier – 56650 – ND61660

13 – 10 dB Fixed Attenuator – 43KC-10

14 – 3 dB Fixed Attenuator – 43KC-3

15 – 3 dB Fixed Attenuator – 43KC3

Figure 2-16. Model 37269E Test Set Modules (2 of 2)

2-21 Test Set Modules – Model 37369E

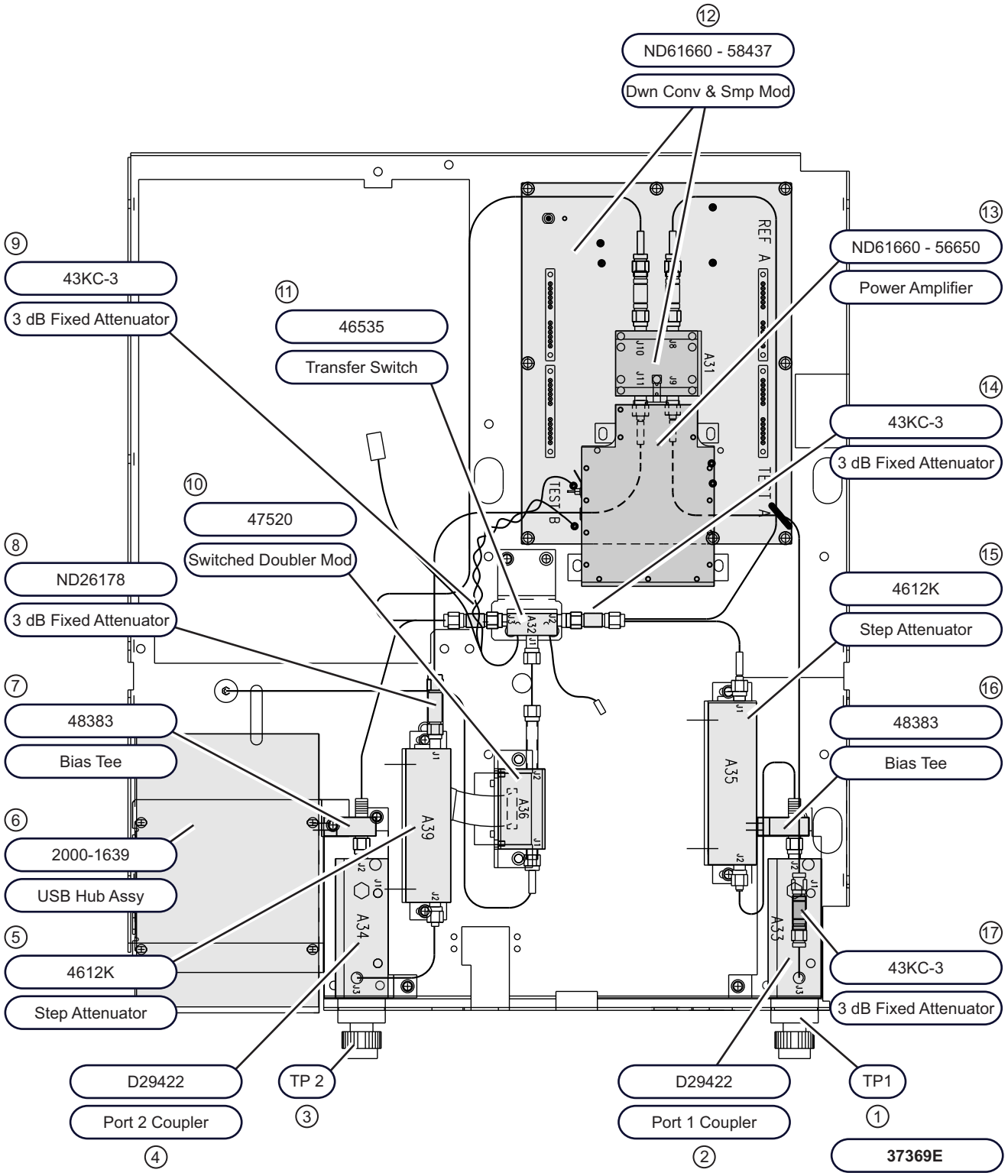


Figure 2-17. Model 37369E Test Set Modules (1 of 2)

1 – Test Port 1

2 – Port 1 Coupler – D29422

3 – Test Port 2

4 – Port 2 Coupler – D29422

5 – Step Attenuator, 40 GHz, 70 dB – 4612K

6 – USB Hub Assembly – 2000-1639

7 – Bias Tee – 48383

8 – 3 dB Fixed Attenuator – ND26178

9 – 3 dB Fixed Attenuator – 43KC-3

10 – Switched Doubler Module – 47520

11 – Transfer Switch – 46535

12 – Down Converter and Sampler Module – 58437 – ND61660

13 – Power Amplifier – 56650 – ND61660

14 – 3 dB Fixed Attenuator – 43KC-3

15 – Step Attenuator, 40 GHz, 70 dB – 4612K

16 – Bias Tee – 48383

17 – 3 dB Fixed Attenuator – 43KC-3

Figure 2-17. Model 37369E Test Set Modules (2 of 2)

2-22 Test Set Modules – Model 37297E

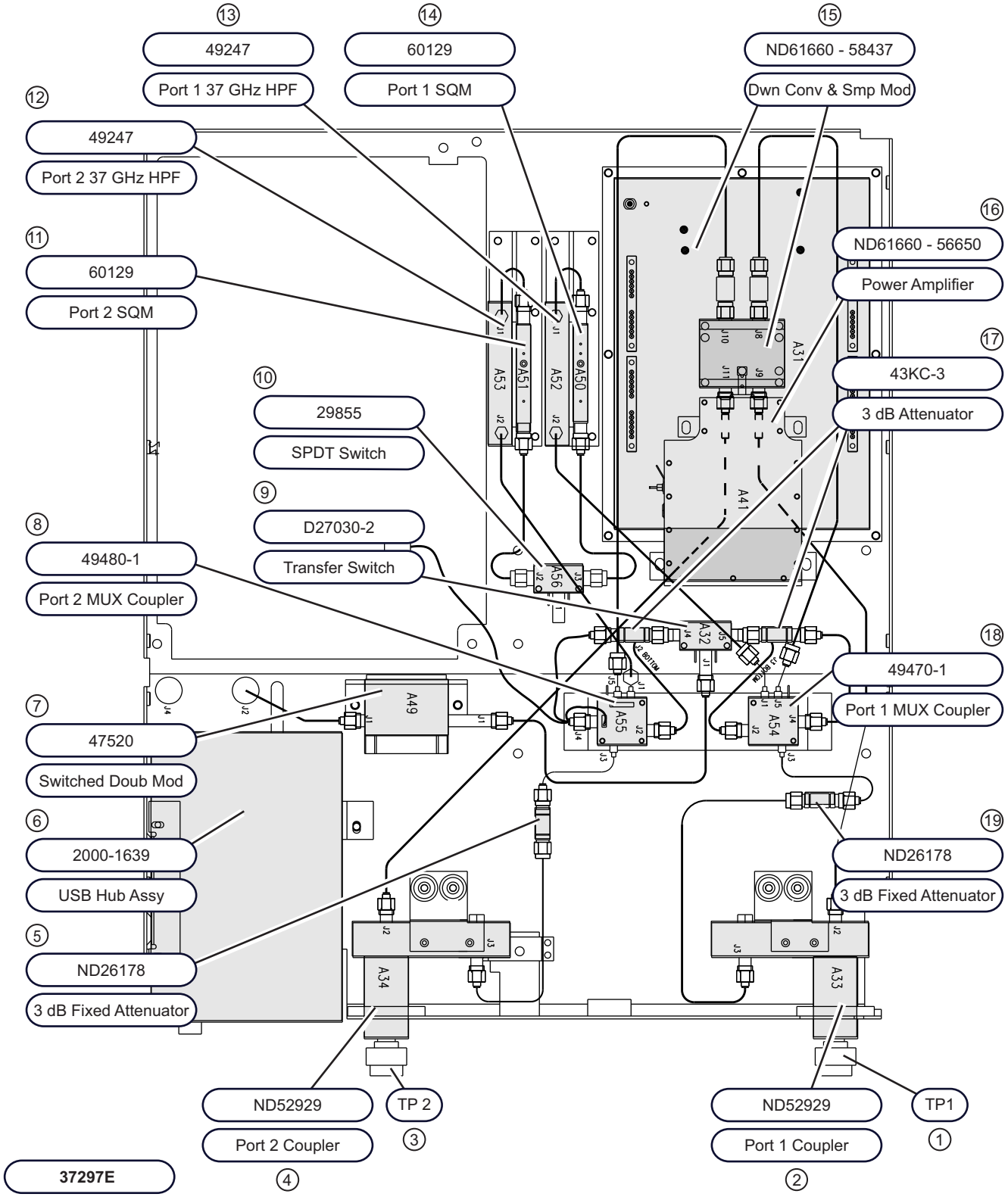


Figure 2-18. Model 37297E Test Set Modules (1 of 2)

1 – Test Port 1

2 – Port 1 Coupler – ND52929

3 – Test Port 2

4 – Port 2 Coupler – ND52929

5 – 3 dB Fixed Attenuator – ND26178

6 – USB Hub Assembly – 2000-1639

7 – Switched Doubler Module – 47520

8 – Port 2 MUX Coupler – 49480-1

9 – Transfer Switch – D27030-2

10 – SPDT Switch – 29855

11 – Port 2 Switched Quadrupler Module (SQM) – 60129

12 – Port 2 37 GHz Hi-Pass Filter (HPF) – 49247

13 – Port 1 37 GHz Hi-Pass Filter (HPF) – 49247

14 – Port 1 Switched Quadrupler Module (SQM) – 60129

15 – Down Converter and Sampler Module – 58437 – ND61660

16 – Power Amplifier – 56650 – ND61660

17 – 3 dB Attenuator – 43KC-3 – 2 each

18 – Port 1 MUX Coupler – 49470-1

19 – 3 dB Fixed Attenuator, 65 GHz – ND26178

Figure 2-18. Model 37297E Test Set Modules (2 of 2)

2-23 Test Set Modules – Model 37397E

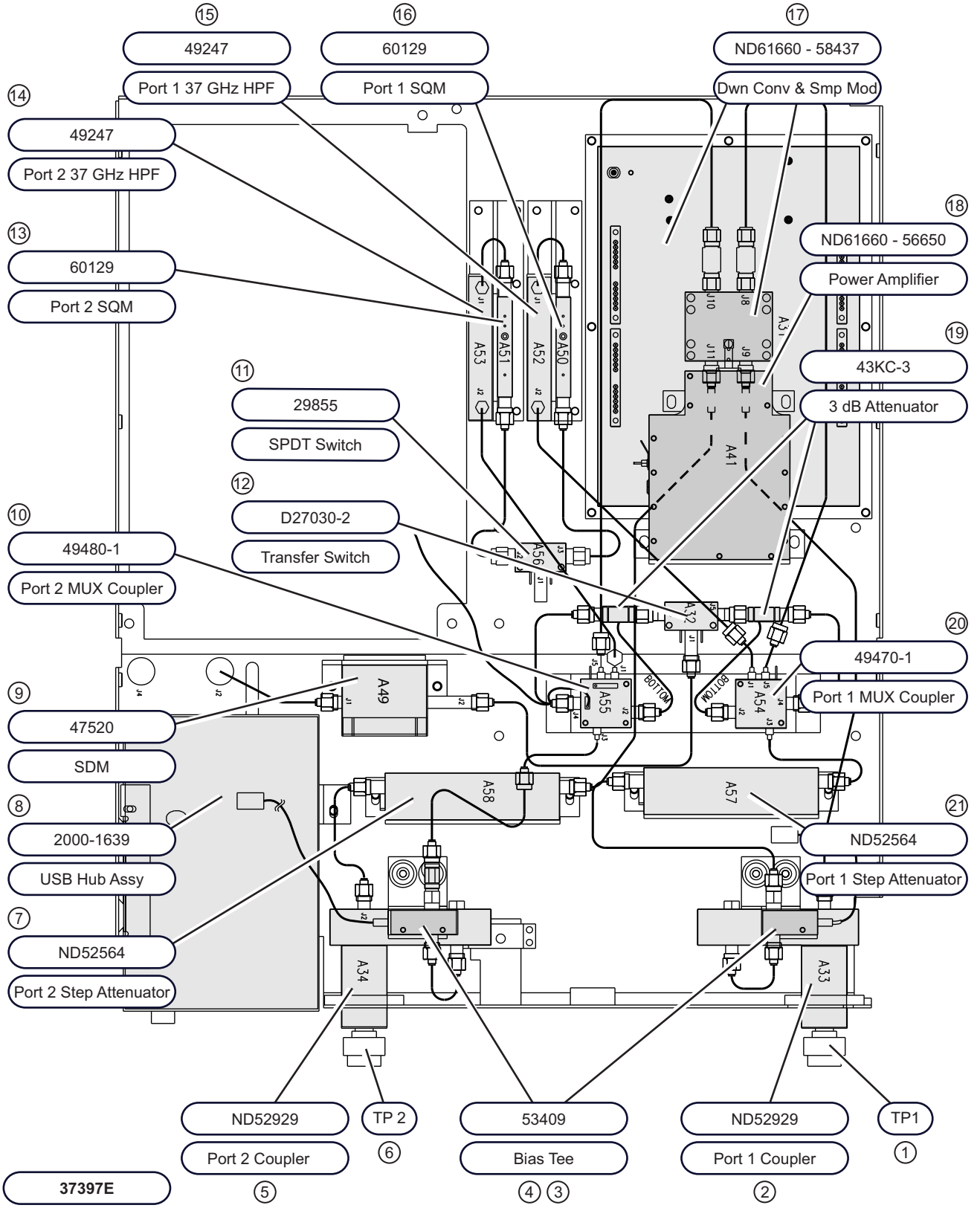


Figure 2-19. Model 37397E Test Set Modules (1 of 2).

1 – Test Port 1

2 – Port 1 Coupler – ND52929

3 – Bias Tee – 53409

4 – Bias Tee – 53409

5 – Port 2 Coupler – ND52929

6 – Test Port 2

7 – Port 2 Step Attenuator – ND52564

8 – USB Hub Assembly – 2000-1639

9 – Switched Doubler Module – 47520

10 – Port 1 MUX Coupler – 49480-1

11 – SPDT Switch – 29855

12 – Transfer Switch – D27030-2

13 – Port 2 Switched Quadrupler Module (SQM) – 60129

14 – Port 2 37 GHz Hi-Pass Filter (HPF) – 49247

15 – Port 1 37 GHz Hi-Pass Filter (HPF) – 49247

17 – Down Converter and Sampler Module – 58437 – ND61660

18 – Power Amplifier – 56650 – ND61660

19 – 3 dB Attenuator – 43KC-3 – 2 each

20 – Port 1 MUX Coupler – 49470-1

21 – Port 1 Step Attenuator – ND52564

Figure 2-19. Model 37397E Test Set Modules (2 of 2).

Chapter 3 — Theory of Operation

3-1 Introduction

This chapter provides a brief overview of the functional assemblies and major parts that comprise a typical 37xxxE VNA system. It also briefly describes the operation of each major assembly.

3-2 System Overview

Ratio Measurement Systems

The Lightning 37xxxE Series Vector Network Analyzers are ratio measurement systems used to measure complex vector signal characteristics (real/imaginary, magnitude/phase, etc) of devices and systems in the 40 MHz to 65 GHz frequency range.

DUT Test and Response Measurements and Display

The VNA performs these measurements by sourcing a stimulus signal to the Device Under Test (DUT) that is connected to the front panel Port 1 and/or Port 2 connectors. (See Figure 3-1 on page 3-2 or Figure 3-3 on page 3-4). It simultaneously measures the DUT response, which consists of reflected and/or transmitted (attenuated, or amplified) signals at the connectors of the DUT. The reflected and/or transmitted signals), and a sample of the stimulus signal, are down converted and then transformed into their real and imaginary vector components. The resultant vector components are measured and converted into digital information. This digital information is sent to the Main Processor PCB where the desired S-parameter data is normalized and then presented to the user via the front panel color display. The display information is also sent to the rear panel VGA Out connector for use with an external VGA monitor.

Output

The normalized measurement information is also sent to the rear panel Printer Out connector for use with an external printer and/or plotter.

User Interface

A front panel keypad, a rotary knob, and an compatible keyboard interface provide user interaction with VNA Main Processor PCB.

System Memories

The system is equipped with a USB Port, an internal SDHC Memory Card, and battery-backed internal memories for storage and retrieval of data and front panel setup information.

IEEE 488.2 GPIB Interface

The VNA implements an IEEE 488.2 interface. This GPIB interface allows an externally connected instrument controller to control the VNA system in the “Remote-Only” mode. All VNA measurement and input/output operations may be controlled remotely in this mode.

Internal Service Log

An internal service log stores a record of system failures, data about the failures, and other key system service information. The service log is implemented using internal battery-backed SRAM memory.

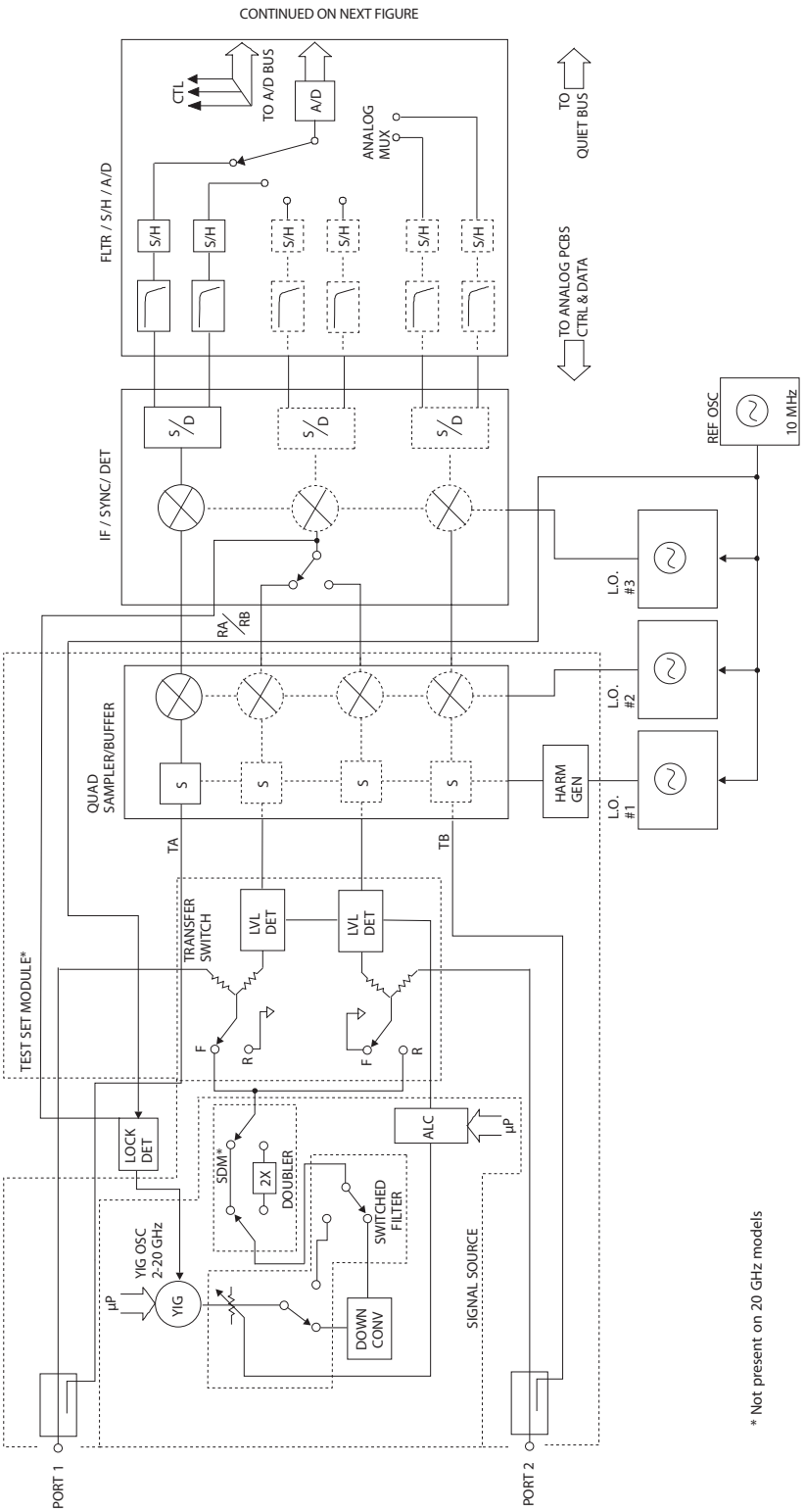


Figure is continued in Figure 3-2, “Block Diagram – RF Source, Typical Test Set, and Receiver Down Conversion Modules – Part 2 of 2” on page 3-3 below.

Figure 3-1. Block Diagram – RF Source, Typical Test Set, and Receiver Down Conversion Modules – Part 1 of 2.

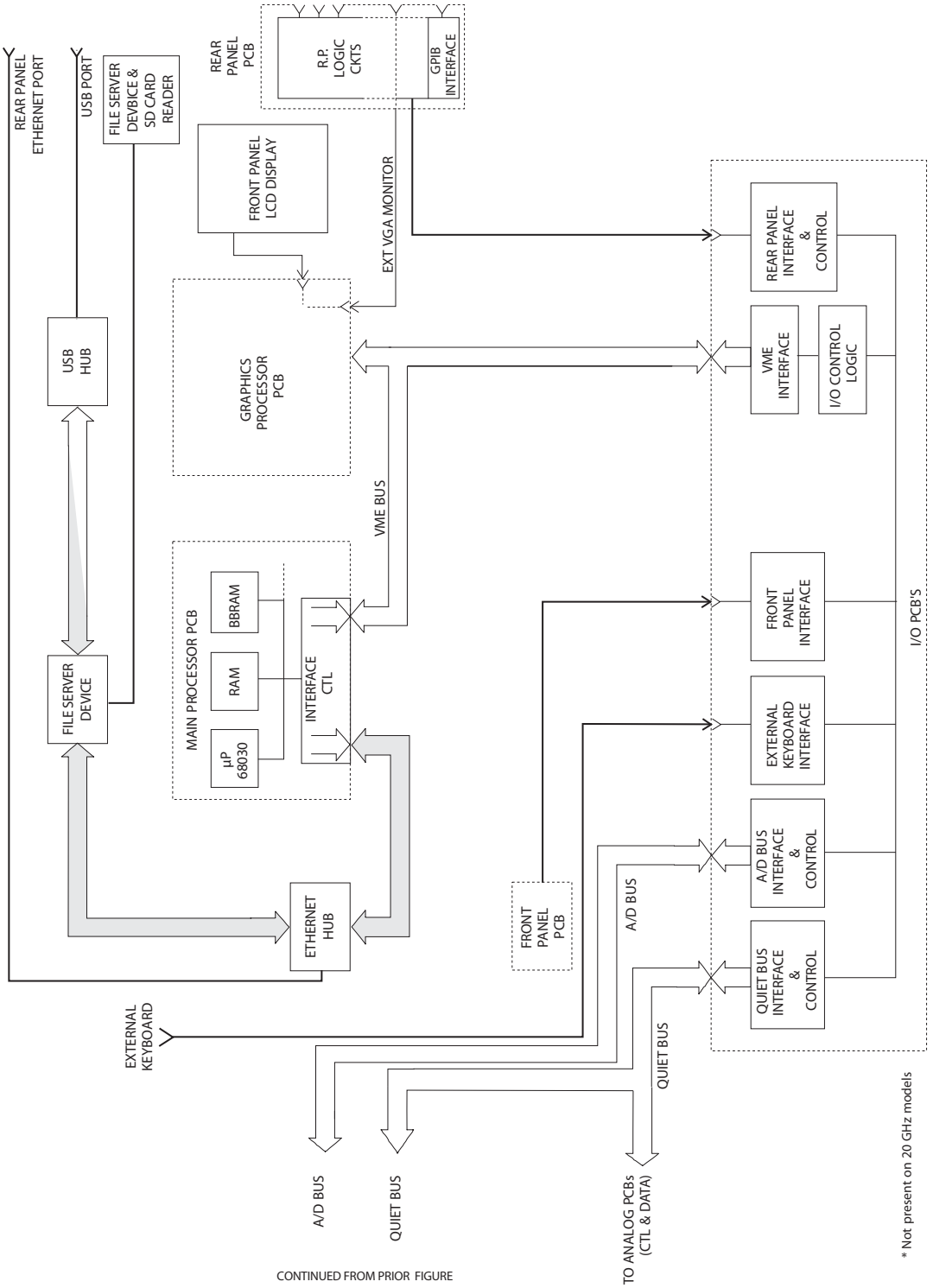
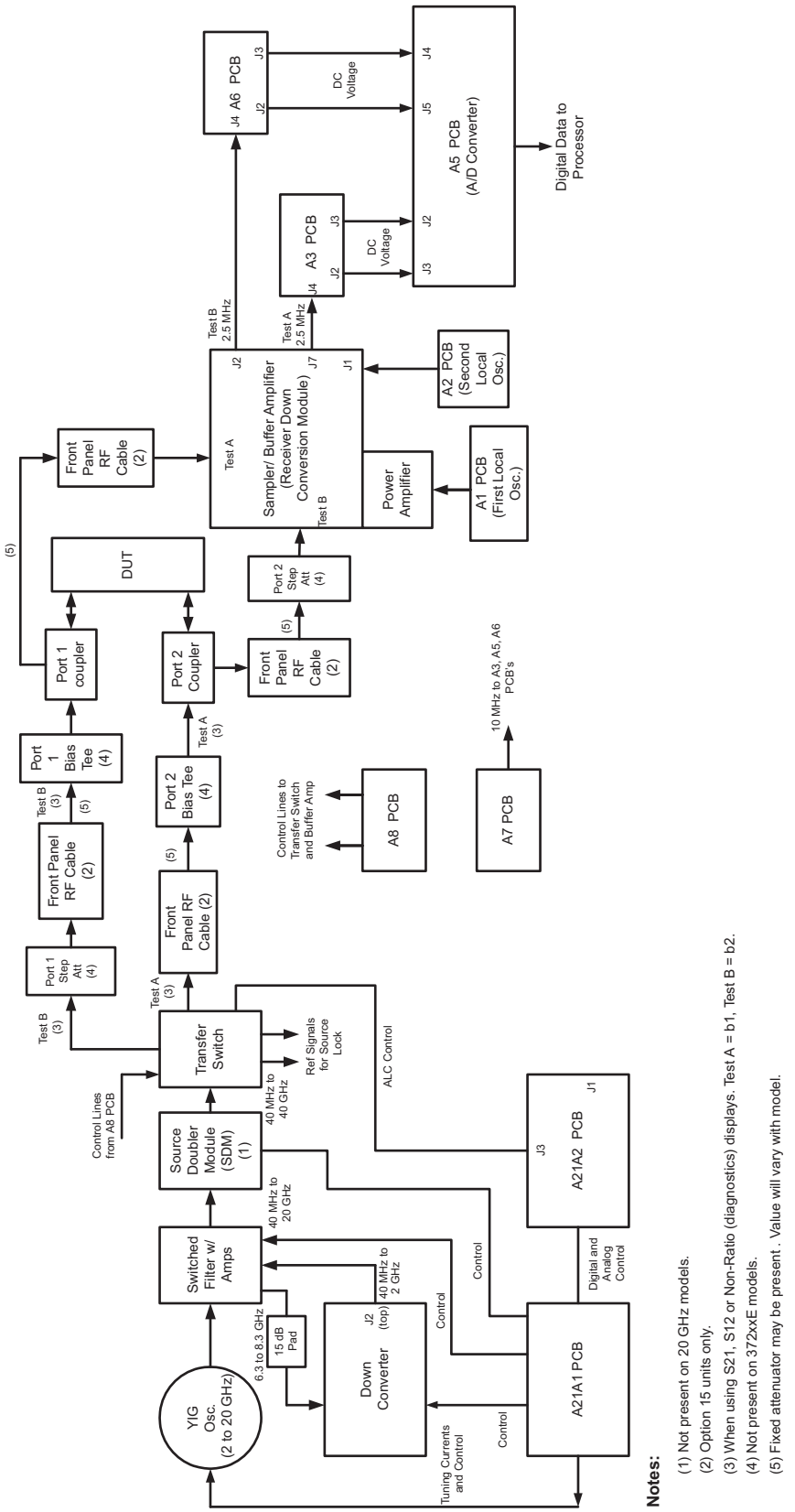


Figure is continued from Figure 3-1, “Block Diagram – RF Source, Typical Test Set, and Receiver Down Conversion Modules – Part 1 of 2.” on page 3-2 above.

Figure 3-2. Block Diagram – RF Source, Typical Test Set, and Receiver Down Conversion Modules – Part 2 of 2



Notes:

(1) Not present on 20 GHz models.
(2) Option 15 units only.
(3) When using S21, S12 or Non-Ratio (diagnostics) displays. Test A = b1, Test B = b2.
(4) Not present on 372xxE models.
(5) Fixed attenuator may be present . Value will vary with model.

Figure 3-3. Block Diagram – Test Signal Paths – 20 GHz and 40 GHz Models

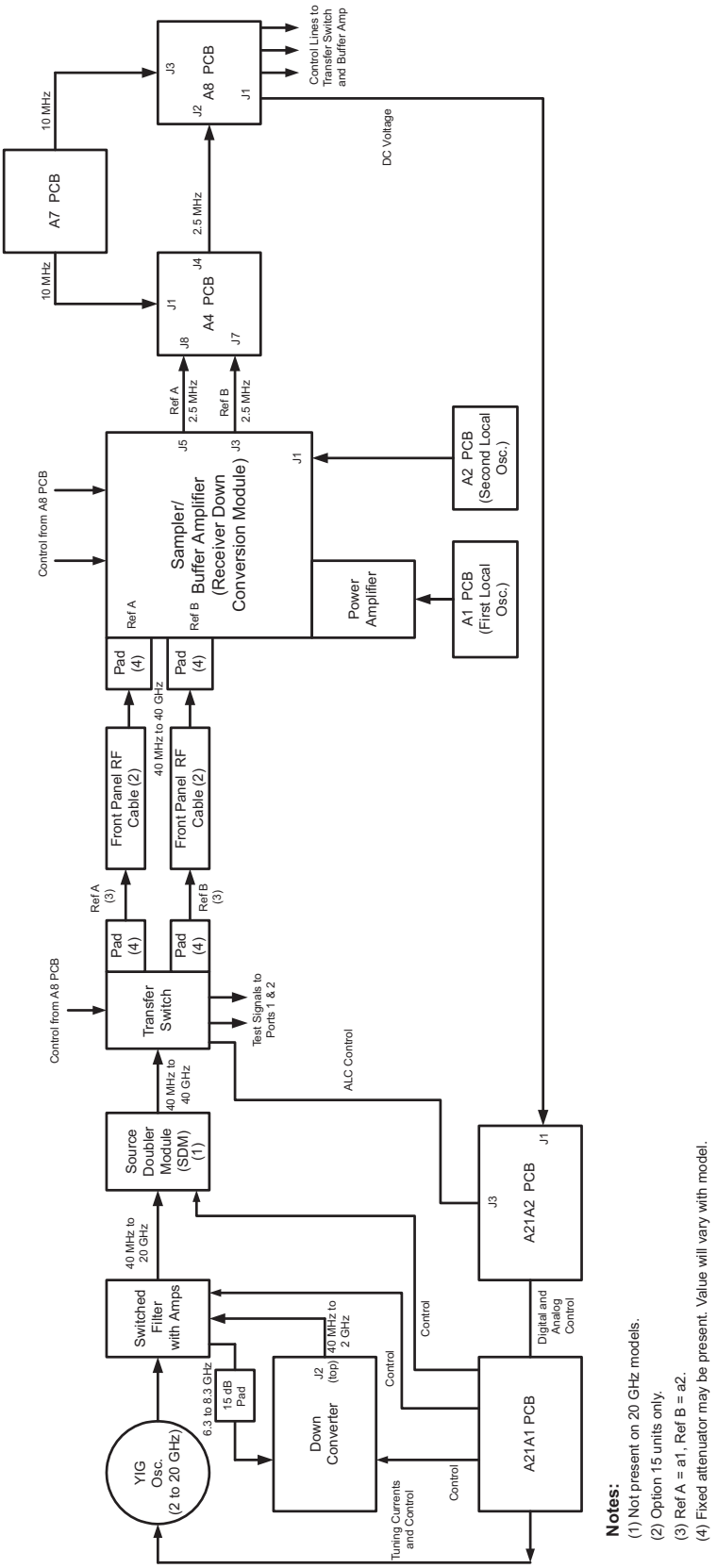


Figure 3-4. Block Diagram – Source Lock Signal Paths – 20 GHz and 40 GHz Models

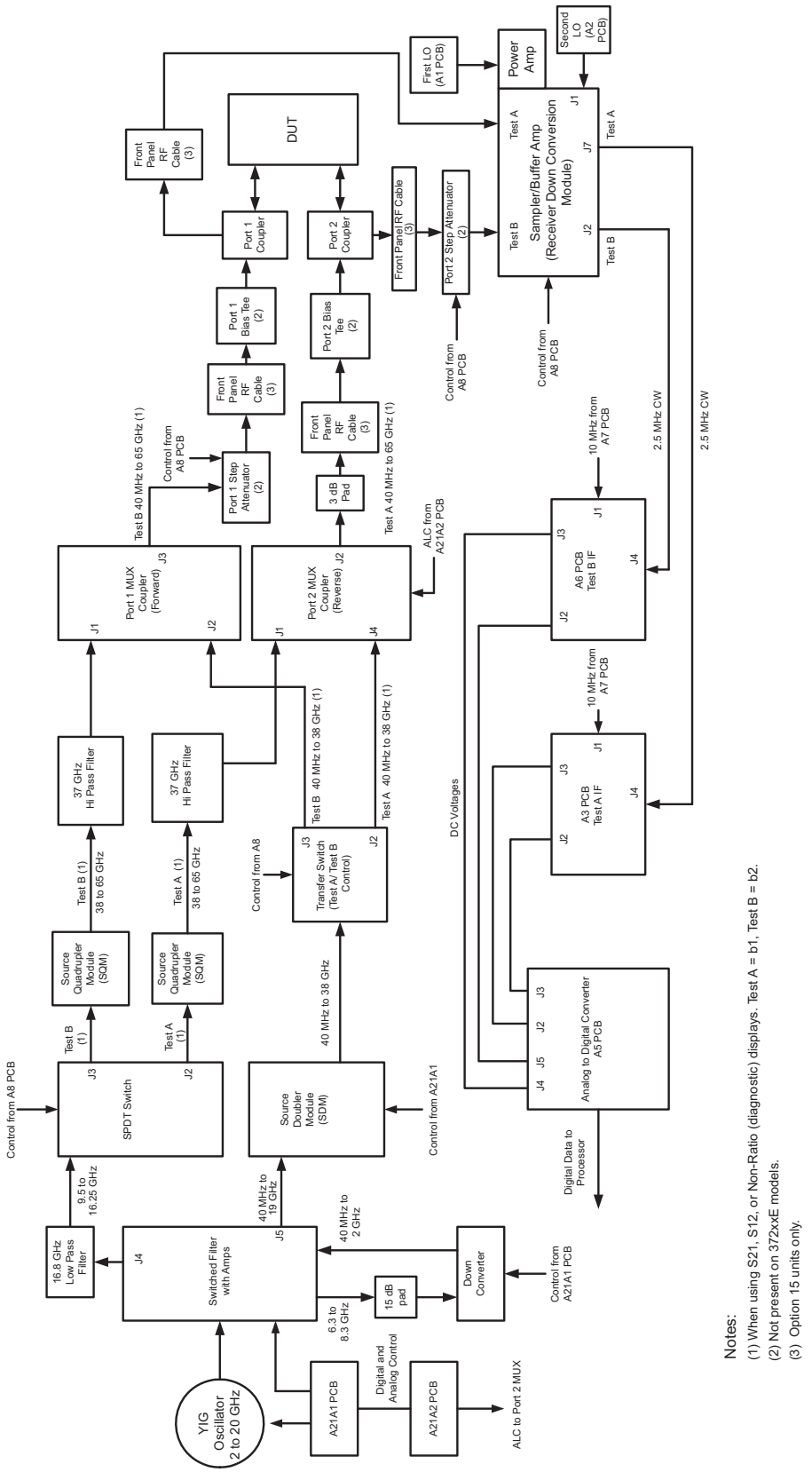


Figure 3-5. Block Diagram – Test Signal Paths – 65 GHz Models

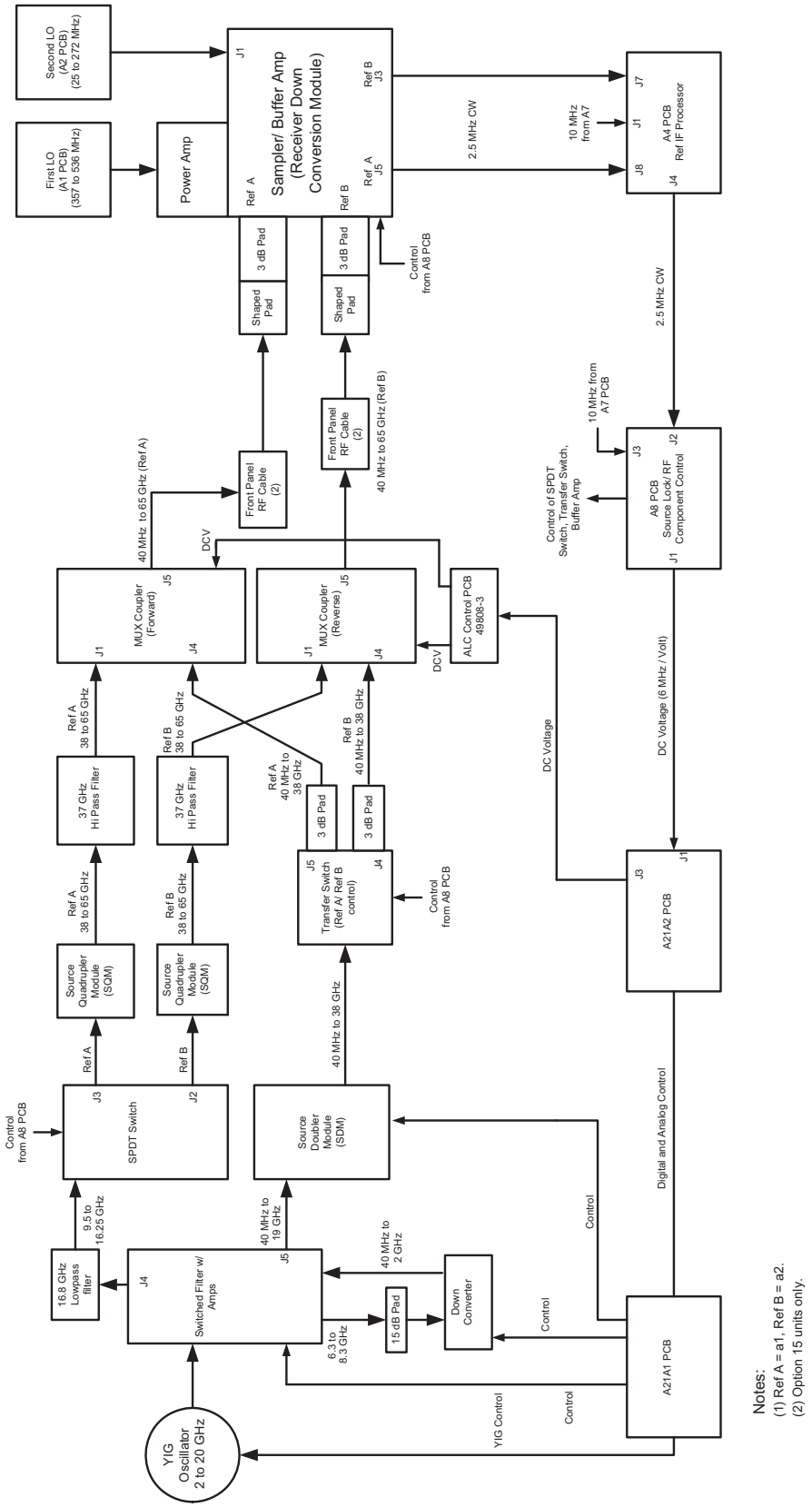


Figure 3-6. Block Diagram – Source Lock Signal Paths – 65 GHz Models

3-3 Analog Subsystem Assemblies

The following sections briefly describe the major assemblies that comprise the VNA Analog Subsystem. Descriptions of the functions performed by each assembly are also included.

Signal Source Module

The Signal Source Module consists of the items listed below; refer to the block diagram of the Analog Subsystem (Figure 3-4 on page 3-5).

- 2-20 GHz YIG Oscillator Assembly
- A21A1 YIG/Bias Controller PCB
- A21A2 Source Control PCB
- Switched Filter Assembly
- Down Converter Assembly

The Signal Source Module is a swept frequency signal generator that produces a phase locked (and leveled) output signal within a range of 40 MHz to 20 GHz. All 37xxxE models employ phase-lock control of the signal source module so that the output frequency is accurate and stable. The output signal is phase locked by the –6 MHz/volt control signal fed back from the A8 Source Lock/Separation Control PCB Assembly (which is described in following sections).

All Series 37xxxE VNA models use a single YIG-tuned oscillator to produce fundamental frequency source signals from 2.0 to 20 GHz. All other output frequencies are derived from the fundamental frequencies generated by the YIG-tuned oscillator. The signal source output frequencies for the low end portion of the frequency range (40 MHz to 2.0 GHz) are produced by down converting YIG fundamental signals in the range of 6.3225 to 8.3 GHz.

For 40 GHz models, the signal source output frequencies for the high end portion of the frequency range (20 to 40 GHz) are produced by the Switched Doubler Module that doubles the YIG fundamental signals in the range of 10 to 20 GHz. The Switched Doubler Module (SDM) is located in the Test Set Module (described below.) The A21A2 Source Control PCB assembly provides all bias and control signals for the SDM. 65 GHz models use an SDM to create frequencies from 20 to 38 GHz, and they use Source Quadrupler Modules (SQMs) to create frequencies above 38 GHz.

The YIG-tuned oscillator generates a high-power RF output signal that has low broadband noise and low spurious content. The frequency of the YIG-tuned oscillator is controlled by means of:

- The YIG main tuning coil
- The YIG FM (fine tuning) coil

The system A9 Main Microprocessor PCB sends the data that represents the desired operating frequency to the A21A2 (Source Control) PCB, which converts the frequency data to analog signals. These signals are then sent to the A21A1 YIG/Bias Controller PCB. This PCB converts the analog signals to YIG main tuning coil current.

The main tuning coil current from A21A1 YIG/Bias Controller PCB coarsely tunes the YIG-tuned Oscillator to within a few megahertz of the final output frequency. The YIG phase-lock loop then fine tunes the YIG-tuned oscillator to the exact output frequency via the FM (fine tuning) coil.

The RF power is controlled by the Automatic Leveling Control (ALC) circuits that are located on the A21A2 Source Control PCB. The input to the ALC circuits is the DC feed-back signal from the leveling detectors located on the Transfer Switch (20 and 40 GHz models) or the MUX couplers (65 GHz models).

Depending on the frequency of operation, the fundamental signal is passed through one of four low-pass filters located in the Switched Filter Assembly. The cut-off frequencies for these filters are 3.3 GHz, 5.5 GHz, 8.4 GHz, and 13.5 GHz, respectively. The switched filter also amplifies the RF signal by 8 to 16 dB, depending on frequency. The signal is then passed through a 20 GHz high pass filter before being routed either directly to the Test Set Module, or to the Down-Converter Assembly.

The signal is switched to the Down-Converter Assembly only when the VNA is operating in the low end portion of its frequency range. The frequency of the output signal from the Source Down Converter Assembly is 40 MHz to 2 GHz. The output signal from the Down Converter Assembly is routed to the Test Set Module.

Test Set Module, 20 GHz and 40 GHz Instruments

The major blocks that comprise the test set module for the 20 GHz and 40 GHz models are:

- Transfer Switch with ALC circuits
- Step Attenuators (not found on 200 series models)
- Bias Tees (not found on 200 Series models)
- Couplers
- Sampler/Down Conversion Module (labeled as “Sampler/Buffer/Amp”)
- Power Amp Assembly
- Source Doubler Module (not found on 20 GHz models)

For 20 GHz and 40 GHz instrument test set modules, refer to:

- Figure 3-3, “Block Diagram – Test Signal Paths – 20 GHz and 40 GHz Models” on page 3-4
- Figure 3-4, “Block Diagram – Source Lock Signal Paths – 20 GHz and 40 GHz Models” on page 3-5

In 20 GHz models, RF from the Source Module is routed to the Transfer Switch.

In 40 GHz models, RF from the Source Module is routed into the Source Doubler Module (SDM) and, if the instrument sweep is set to any frequency above 20.0 GHz, the frequency is doubled. While the frequency of the instrument operation is below 20.0 GHz, the SDM is in a pass-through mode and no doubling occurs. The RF from the SDM output is then routed to the Transfer Switch.

RF Output from the transfer switch is simultaneously routed through two outputs in normal S Parameter operation. In this operation mode, one Reference Signal and one Test Signal is generated. The Reference Signal is critical for the phase locking of the RF Source and is used in the measurement of phase angles. The Test Signal is eventually routed to the Device Under Test and is not related to phase locking of the RF Source.

S Parameter measurements are defined as ratios of the Test to the Reference Signals and are defined as:

- S11 = Test A/Ref A = b1/a1
- S21 = Test B/Ref A = b2/a1
- S12 = Test A/Ref B = b1/a2
- S22 = Test B/Ref B = b2/a2

The full RF path of the Reference Signals is shown in Figure 3-4, “Block Diagram – Source Lock Signal Paths – 20 GHz and 40 GHz Models” on page 3-5.

The full RF path of the Test Signals in a transmission measurement (S21 or S12) is shown in Figure 3-3, “Block Diagram – Test Signal Paths – 20 GHz and 40 GHz Models” on page 3-4.

In a reflection measurement (S11 or S22), Test Signals originate from the Transfer Switch opposite from what is shown in Figure 3-3, “Block Diagram – Test Signal Paths – 20 GHz and 40 GHz Models” on page 3-4, where Test A routes through the RF components on its way to Test Port 1 and Test B routes through the RF components on its way to Test Port 2.

Leveling of the RF is accomplished by detectors in the Transfer Switch that sense the levels of the Reference Signal. This detected signal is sent to the A21A2 PCB in the Source Module.

Test Signals that are routed to the DUT for test have passed through the non-coupled arm of the coupler. Signals that have passed through the DUT (or have reflected back from the DUT) are passed through the coupled arm of the couplers at the test ports. The signal received from the DUT is returned to the Sampler/Down Conversion Module (via the step attenuator for 300 series instruments).

Both Reference signals and both Test Signals are routed into the Sampler/ Down Conversion Modules for down conversion to 2.5 MHz (3rd IF signal). This down conversion is accomplished by using LO1 and LO2 found on the A1 and A2 PCBs. Before use by the Sampler/ Down Conversion Module, the signal from LO1 is amplified by the Power Amplifier assembly (mounted on the Sampler/Down Conversion Module) for a power gain of about 30 dB. (The Power Amplifier and Sampler/Down Conversion Module are tuned to match each other and are not replaceable separately).

The individual Test and Reference 2.5 MHz signals are routed off the Test Set Module to the A3, A4, and A6 IF Processor PCBs as shown in Figure 3-3 on page 3-4 and Figure 3-4, “Block Diagram – Source Lock Signal Paths – 20 GHz and 40 GHz Models” on page 3-5.

Test Set Modules – 65 GHz Instruments

Refer to Figure 3-5, “Block Diagram – Test Signal Paths – 65 GHz Models” on page 3-6 and Figure 3-6, “Block Diagram – Source Lock Signal Paths – 65 GHz Models” on page 3-7 for a graphical representation of the following description. Many RF components found in the 65 GHz models perform nearly identical functions as components in the 20 GHz and 40 GHz models, with the following exceptions:

- Transfer Switch
- SPDT Switch
- Port 1 MUX Coupler
- Port 2 MUX Coupler
- Port 1 and Port 2 Source Quadrupler Modules
- 37 GHz High Pass Filters

For 65 GHz instrument test set modules, refer to:

- Figure 3-5, “Block Diagram – Test Signal Paths – 65 GHz Models” on page 3-6
- Figure 3-6, “Block Diagram – Source Lock Signal Paths – 65 GHz Models” on page 3-7

As in the 20 GHz and 40 GHz models, two Reference Signals and two Test Signals are created. The Reference Signals are used for phase locking of the RF Source and for phase measurements. The Test Signals are routed to the DUT and are not involved in phase locking of the Source Module. One Reference Signal and one Test Signal is generated at any given time during a normal S Parameter measurement.

The formulas for the S Parameters are the same as described above. After the signals are received from the DUT, the down conversion scheme is identical to the 20 GHz and 40 GHz models (described above).

The RF from the Source Module is routed to either the SPDT switch or to the SDM. Signals routed to the SPDT switch will eventually become signals used by the instrument while operating over 38 GHz, and signals routed to the SDM will be used by the instrument while operating below 38 GHz.

When operating below 38 GHz, signals pass through the SDM (through the pass-through or doubling sections) and are routed to the Transfer Switch (a different model switch than is used in the 20 GHz and 40 GHz instruments). The signal path and down conversion scheme is nearly identical to the 20 GHz and 40 GHz instruments, with the exception of the Port 1 and Port 2 MUX coupler circuits, which are used to pass above-38 GHz or below-38 GHz signals at the appropriate time during the sweep. ALC control is accomplished using the Port 1 and Port 2 MUX couplers. When operating above 38 GHz, the signal from the 16.8 GHz lowpass filter of the Source Module is fed into a simple SPDT switch. If the instrument is sweeping in the forward mode (S21 or S11), RF is then switched into the Port 1 (Ref A) Source Quadrupler Module (SQM). If in the reverse mode (S12 or S22), RF is switched into the Port 2 (Ref B) SQM. Signals then pass through the 37 GHz High Pass Filters and Test Signals are created within the Port 1 and Port 2 MUX couplers. Reference Signal paths remain as shown in Figure 3-4 on page 3-5 for all four S Parameters. Test Signal paths for transmission measurements are as shown in Figure 3-5 on page 3-6, but during reflection measurements, Test A and Test B Signal paths are swapped (Test A is emitted from Port 1 during S11, and Test B is emitted from Port 2 during S22 measurements).

A7 PCB 10 MHz Timebase

The 10 MHz system clock is based on an OCXO mounted on the A7 PCB. The A7 PCB also contains a fixed 2.42 MHz Local Oscillator and an 80 kHz calibration signal. The 80 kHz calibration signal is periodically sent to the A3, A4, and A6 PCBs for self-calibration of IF amplifier circuits. (This occurs during the time when the message, “Calibrating IF, please wait” is displayed on the VNA.)

Receiver Module

The Receiver Module consists of the items listed below (refer to Figure 3-4 on page 3-5):

- Quad Sampler/Down Conversion Module with integrated SRD (step recovery diode)
- Power Amplifier
- A1, LO1 PCB
- A2, LO2 PCB

The Receiver Module is based on a four channel, two stage Sampler/Down Conversion module that converts the 40 MHz to 65 GHz signals to 2.5 MHz signals.

The first stage of the Receiver Module uses harmonic sampling to down-convert the four 40 MHz to 65 GHz output signals from the Test Set Module down to 89 MHz signals. Any input signals below 270 MHz are passed directly through the four harmonic samplers to the second stage without down-conversion. The drive signal to each of the harmonic samplers is a comb of harmonics generated by a step recovery diode (SRD).

The Power Amplifier provides the signal that drives the SRD. The input to the Power Amplifier is the 357 to 536.5 MHz signal from the A1 First Local Oscillator (LO1) PCB. Regardless of the operating frequency, the Power Amplifier is biased on at all times to insure optimum thermal stability.

The second stage of the Receiver Module uses the 25.0 to 272.5 MHz signal from the A2 Second Local Oscillator (LO2) PCB to down-convert the 89 MHz signals into four 2.5 MHz IF signals TA, TB, RA, RB (two test signals and two reference signals). Either the Reference A or the Reference B IF signal is selected, as is appropriate for Forward/Reverse operation. The resultant three 2.5 MHz IF signals (Test A, Test B, and Reference A/B) are output to the IF Section. A buffered version of the Reference A/B signal is also fed to the A8 Source Lock/Signal Separation Control PCB as the Source Lock signal.

The Receiver Module can also select the Reference A IF signal that is output to the IF Section via the Test A switch path. This IF signal is used during Line Reflect Line (LRL) Calibrations to ratio the Reference A and Reference B signals.

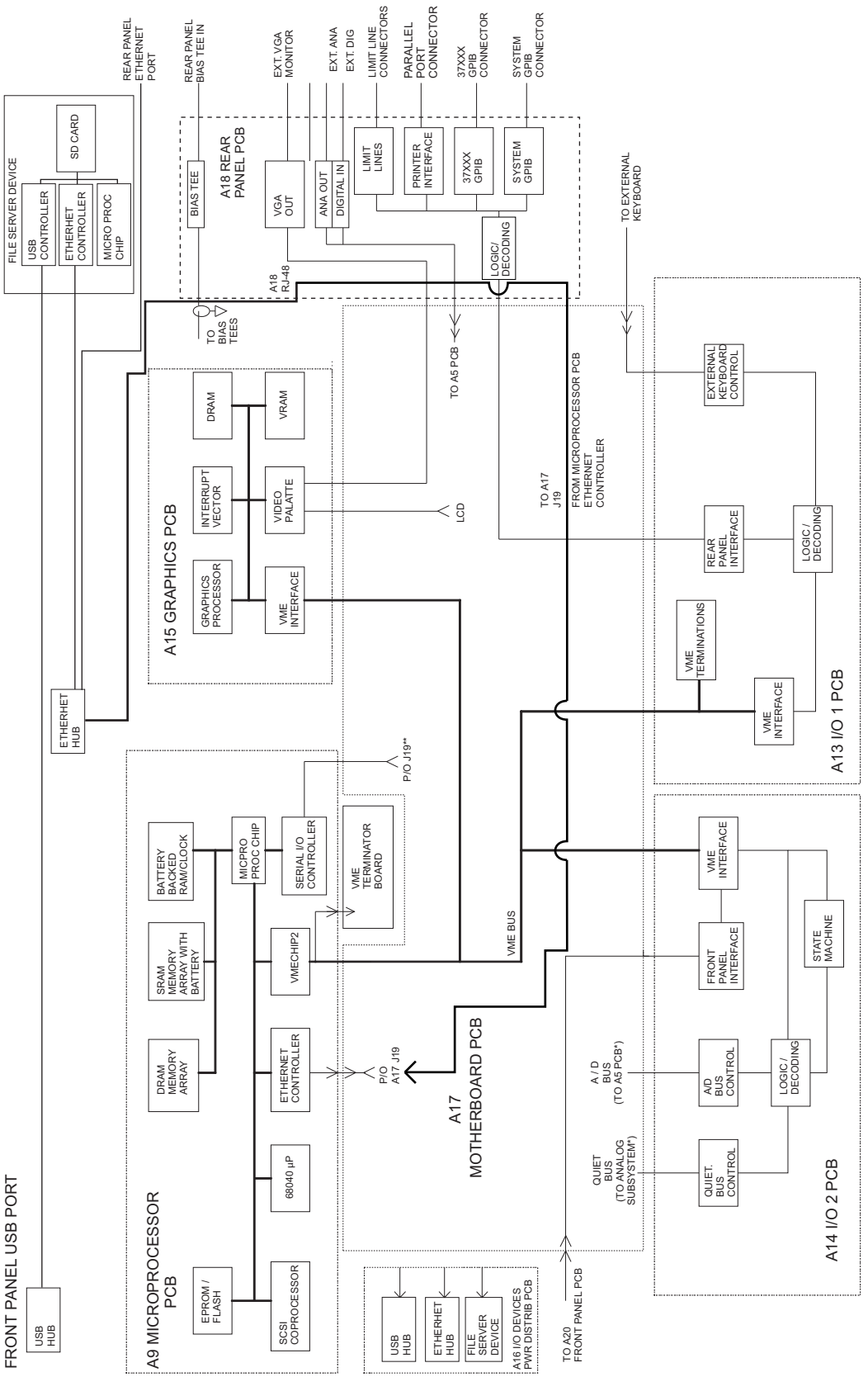


Figure 3-7. Digital Subsystem Block Diagram

A8, Source Lock/Signal Separation and Control PCB

The Source Lock Phase Comparator circuit on the A8 Source Lock/ Signal Separation Control PCB compares the Source Lock (Reference A/B) signal from the Receiver Module with a signal derived from the 10 MHz reference oscillator. The output of this circuit is the –6 MHz/V correction signal, which is routed to the circuit on the A21A2 Source Control PCB that generates the FM coil tuning current signal. This signal is output to the A21A1 YIG/Bias Controller PCB to fine tune the YIG-tuned oscillator to the exact output frequency. When the YIG-tuned oscillator outputs the exact frequency, the two inputs to the phase comparator circuit on the A8 PCB match and the phase-lock loop is locked.

The A8 PCB Assembly also provides bias and control signals to the Test Set and Receiver Modules for operating the following circuits:

- Transfer Switch
- Power Amplifier
- Quad/Down Conversion Module
- Front Panel Forward/Reverse LEDs
- Step Attenuators

IF Section

The IF Section consists of the items listed below (refer to Figure 3-3 on page 3-4):

- A3 Test A IF PCB
- A4, Reference IF PCB
- A5, A/D Converter PCB
- A6, Test B IF PCB
- A7, Third Local Oscillator, LO3, PCB

The IF Section converts the three 2.5 MHz IF signals from the Receiver Module into six DC output signals. The A3 (Test A), A4 (Reference A/B), and A6 (Test B) PCBs down-convert the 2.5 MHz input IF signals to 80 kHz IF signals and then adjust their amplitude for input to the synchronous detector stage of each PCB. Each 80 kHz IF signal is synchronously detected and converted into a pair of DC signals that contain the information for the real and imaginary portions of the original 80 kHz IF signal. Thus, the three IF signals (two test signals and the reference signal) yield six DC signals that fully represent the real and imaginary vector components of the DUT's S-parameters.

The IF Section also checks the 2.5 MHz phase lock signal for proper power level by comparing it to a known reference level on the A4 PCB. A sample of the 2.5 MHz Reference A/B IF signal is sent to the A8 Source Lock/Separation Control PCB assembly for phase locking the signal source module. The A3 and A6 PCBs are functionally identical and physically interchangeable.

A7 PCB, LO3

The A7, Third Local Oscillator (LO3) Assembly, provides a fixed 10 MHz Reference Timebase and a 2.42 MHz Local Oscillator signal that is used on the A3, A4, and A6 PCBs to down-convert the 2.5 MHz IF signals to 80 kHz. It also provides an 80 kHz standard signal for the IF Section Calibration process that occurs automatically approximately every six minutes. This automatic IF Section Calibration is one of the VNA features that ensures rated measurement accuracy. Automatic IF Calibration can be turned off and/or invoked at any time during measurement sweeps.

A5 A/D Converter PCB

The A5 A/D Converter PCB contains a six-channel, two stage, switched-filter sample-and-hold circuit and a 20 bit A/D converter. Each of the six DC signals from the A3, A4, and A6 PCBs are input to a separate channel of the PCB. The first stage of each channel is a low-pass filter with four selectable cutoff frequencies of 10 kHz, 1 kHz, 100 Hz, and 10 Hz. The second stage of each channel is a sample- and-hold amplifier that stores the signals during the A/D conversion process. Each channel is sequentially selected for input to the 20 bit A/D converter.

The A5 A/D Converter PCB also derives the 80 kHz IF Synchronization Signal from the 10 MHz Reference Timebase. Additional functions of the A5, A/D Converter Assembly include:

- Measurement of power supply voltages and other internal nodes of the 37000E for diagnostic purposes.
- Measurement of an externally applied analog input signal. This function is used for service purposes
- External Trigger Input signal processing (from rear panel)
- External Analog Output signal generation (to rear panel)

The A/D converter circuitry located on the A/5 PCB is used as a DVM to measure various internal system analog monitor points on the A1 to A8 and A21A1/ A21A2 PCBs. It is also used to monitor power supply voltages and other critical points throughout the VNA, which can be readout via the Diagnostics Menus. DVM readings are also recorded in the service log for certain system failures.

Note	If this PCB is replaced, switch settings on the new PCB must be changed to match settings of the old PCB.

3-4 Digital Subsystem Assemblies

The following sections briefly describe the major assemblies that comprise the VNA Digital Subsystem. The digital subsystem provides all system control, I/O interface, digital signal processing, and data presentation functions. The major assemblies that comprise the VNA digital PCB subsystem are listed below (refer to Figure 3-5 on page 3-6):

- A9 Main Processor PCB
- A13 I/O Interface #1 PCB
- A14 I/O Interface #2 PCB
- A15 Graphics Processor PCB
- A16 I/O Devices Power Distribution
- A18 Rear Panel Interface
- Rear Panel Assembly
- Front Panel Assembly
- A24 VME Bus Terminator PCB
- File Server Device with SD Card Reader
- USB Hub
- Ethernet Hub

A9 Main Processor PCB Assembly

The major components that comprise the A9 Main Processor PCB are:

- 68040 Microprocessor (with integrated co-processor) – This is the CPU for the 37xxxE system.
- 16 MB SDRAM – This is the main system memory. This memory is volatile (non-battery backed). During normal operation, it stores the 37xxxE software that is loaded from disk at power-up.
- 8 KB BBRAM – This auxiliary memory chip contains a back-up battery that is continuously recharged whenever power is applied. (The back-up battery has a four year minimum life span.) This chip also contains real time and date clock functions. It is used to store low level boot-up parameters, ALC calibration data, source frequency calibration data, and service log header data. Note that the back-up battery is not field replaceable.
- 512 KB SRAM – This auxiliary memory is backed-up by a non-rechargeable Lithium battery that provides 200 days (maximum) of power-off protection. It is used to store current and saved front panel setups, trace/normalization data, current RF calibration data, current sweep frequency data, flat power calibration data, and the service log error list.
- VME Bus interface chip – This chip is used to interface the Main Processor PCB to the A13, A14, and A15 digital PCBs (via the VME bus interface).
- System Boot-Up 1 MB Flash Memory – This memory device contains the boot-up instructions used by the system CPU at power-up.

A13 I/O Interface #1 PCB Assembly

This PCB assembly performs the following functions:

- External Keyboard control – interface for the front panel Keyboard connector
- Interface for the A18 Rear Panel PCB Assembly (below)
- Interface and control for the rear panel IEEE 488.2 GPIB and Dedicated GPIB interface connectors

A14 I/O Interface #2 PCB Assembly

This PCB assembly contains a State Machine controller, decode logic, and bus interface control circuits that perform the following functions:

- Quiet Bus interface control – The Quiet Bus passes control and data signals from the A9 Main Processor PCB to the A1 through A8, and A21 PCBs and returns status and data signals back to the A9 PCB. This bus is managed by the control circuits on the A14 PCB such that it is inactive during the time that a measurement is being taken.

Note	The output data from the A5 A/D Converter PCB is sent to the A9 Main Processor PCB via the Quiet Bus, the A14 PCB, and the VME Bus.

- A/D Bus interface control – During the measurement process, all A/D selection and conversion functions on the A5 PCB are controlled exclusively by the A14 PCB State Machine Controller. This is accomplished via the command lines of the A/D Bus.
- Measurement control functions – The A14 PCB State Machine Controller manages many of the VNA functions during a measurement, as follows:
    - Quiet Bus interface control
    - A/D Bus interface control
        - Sample and Hold control for A5 PCB
        - A/D selection and conversion control for A5 PCB
    - Check for phase lock condition
    - Gain ranging
    - Delay generation for IF Bandwidth setting function

The A14 PCB also provides the interface to the Front Panel A19 and A20 PCBs.

A15 Graphics Processor PCB Assembly

This PCB assembly contains circuitry that simultaneously drives both the LCD display and an external VGA monitor (if used) as follows:

- Receives measurement and display information from the A9 Main Processor PCB and generates screen display (video) information.
- Provides interface and control for the LCD display assembly.
- Provides interface for an external monitor via the rear panel
- VGA Out connector.

A16 I/O Device Power Distribution

The PCB assembly contains power conditioning circuitry for File Server Device with SD Card Reader.

File Server Device with SD Card Reader

This device provides an interface between the A9 Ethernet Port and the internal SD Memory Card.

Ethernet Hub

This device provides additional Ethernet ports to the A9 CPU PCB.

USB Hub

This device provides the front panel USB interface for the A9 CPU PCB.

A24 VME Bus Terminator PCB

This PCB assembly terminates the VME bus to insure stable digital data transfer on the bus. It plugs into the VME bus structure on the bottom surface of the A17 Motherboard Assembly.

3-5 Main Chassis Assemblies

The assemblies described below are the major assemblies mounted to the basic frame of the VNA.

A17 System Motherboard Assembly

The motherboard assembly provides signal routing and D.C. power distribution paths for all major PCB assemblies of the Analog Subsystem (A1 to A8) and the Digital Subsystem (A9 to A16). It also contains the VME Bus, Quiet Bus, A/D Bus structures, and other signal routing paths. It does not contain any active components.

Note	The motherboard assembly is an integral part of the VNA chassis. It is not a field replaceable unit.

Front Panel Assembly

The Front Panel Assembly consists of the following assemblies and parts:

- A19 Front Panel Switch PCB – this assembly contains all of the front panel switches for the VNA.
- A20 Front Panel Control PCB – this assembly contains the decode logic for the switches located on the A19 Front Panel Switch PCB. This PCB interfaces with the A14 I/O Interface #2 PCB Assembly.
- Front Panel LEDs, beeper, keys, controls, and connectors
- Front panel overlay

- Front panel casting

A18 Rear Panel Interface PCB

This PCB assembly contains the rear panel connectors listed below. It also includes the associated circuitry and cabling interfaces that link these connectors (and the rear panel fan assembly) to the A17 Motherboard PCB and other assemblies within the VNA.

- IEEE 488.2 GPIB connector (with associated interface circuits)
- Dedicated GPIB connector (with associated interface circuits)
- Printer Out connector (with associated interface circuits)
- VGA Out connector
- I/O Connector (and associated interface circuits) – This 25 pin miniature D-sub connector contains:
    - Limits Testing Status TTL outputs
    - Port 1 and Port 2 Bias inputs.
    - External Digital In signal (same as External Trigger BNC)
    - External Analog Out signal (same as External Analog Output BNC)

The A18 PCB also contains:

- Routing of –24 Vdc power to the rear panel system fan.
- Routing of External Analog Out and External Trigger Input signals the Mother Board.

Power Supply Module

The Power Supply Module is a single self-contained assembly mounted on the left side wall of the chassis, behind the LCD. This module provides:

- Unregulated +5, +9, ±18, and ±27 VDC supply voltages to the other assemblies of the 37000E
- Thermal and over-current shutdown protection circuitry
- Sensing and input power regulation for operation with 85 to 264 VAC, 48 to 63 Hz, universal AC line input power
- Internal fan cooling (for power supply module)
- Supply voltages distribution

Table 3-1 identifies all 37xxxE DC power supply voltages and lists their usage by the various PCB assemblies. Unless otherwise indicated, supply voltages are regulated on the assembly using them. The analog and digital power supply grounds are isolated.

Note	All power supply voltages listed in Table 3-1 can be accessed via the A/D bus for measurement by the A/D converter circuitry (for example, DVM) located on the A5 A/D PCB assembly.

Table 3-1. 37xxxE Power Supply Voltages and Usages

Voltage	Assemblies Where Used
+5V	A1, A2, A3, A4, A5, A6, A7, A9, A13, A14, A15, A16, A18, A19/A20 – These are part of the Front Panel A21A1/A21A2 – These are part of the Source Module A24 – This is on the External Keyboard PCB
+9V	A1, A2, A7, A8
+18V	A1, A2, A3, A4, A5, A6, A7, A8, A13
-18V	A1, A2, A3, A4, A5, A6, A7, A8, A13
+27V	A1, A2, A5, A7
-27V	A5, A18
The following supply voltages are derived from the +/-18 Vdc supply voltages on the A13 I/O #1 PCB:	
+12V	A9, A15
-12V	A9, A15

Chapter 4 — Operational Performance Tests

4-1 Introduction

The tests in this chapter provide a means of fully testing the 37xxxE VNA system for proper operation and signal stability. These tests are intended to be used as a periodic check of the operational functionality of the VNA.

The tests should be performed in their entirety at least once annually. Although there is no requirement to do so, the tests should generally be run in the sequence presented.

Note	The procedures presented in **Chapter 5, System Performance Verification**, provide the means to test the accuracy of the measurements performed by the VNA.

Please ensure you have read and fully understand the servicing concepts for the VNA presented in Chapter 1, “General Information” prior to continuing with this chapter.

Operational tests for the VNA consist of the following:

- Checking the Service Log
- Self Test
- Automated Operational Tests (includes checking the Service Log and Self Test)

These tests are described in the following sections:

- Section 4-2 “Checking the Service Log” on page 4-2
- Section 4-3 “Self Test” on page 4-4
- Section 4-4 “Performance Tests” on page 4-5
- Section 4-5 “37xxxE Log Magnitude Dynamic Accuracy Test” on page 4-11

4-2 Checking the Service Log

Checking the service log consists of viewing the entries written into the log.

Caution	The service log contains historical information about instrument condition and any failures that may have occurred. It should be cleared only by a qualified service engineer. Clearing the log should only be performed after any problem conditions have been resolved, and a log copy saved electronically and/or printed out.

Procedure

1. Press the **Option Menu** key (Enhancement key group) to display the OPTIONS menu.
2. Select DIAGNOSTICS from menu (left); then select READ SERVICE LOG from the DIAGNOSTICS menu.

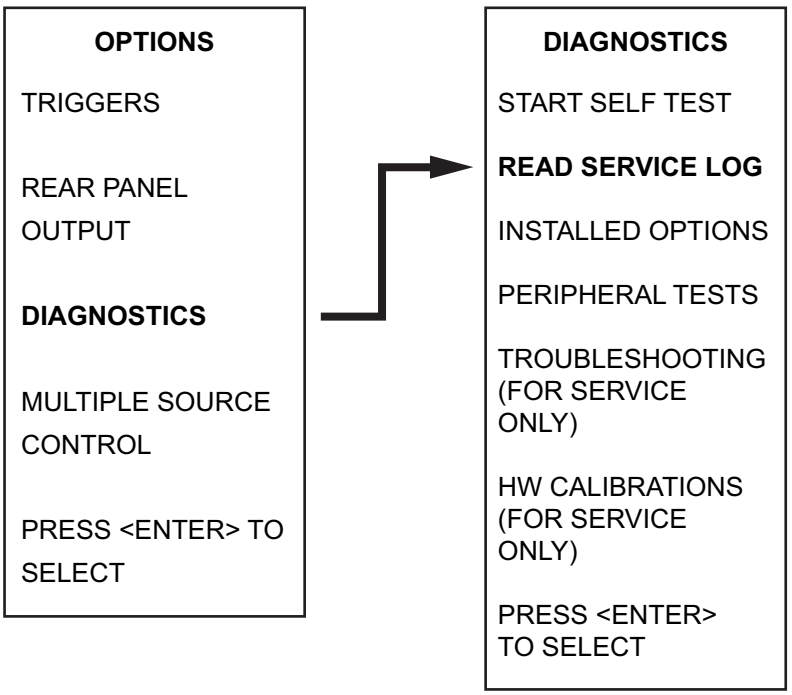


Figure 4-1. Menus – OPTIONS | DIAGNOSTICS | READ SERVICE LOG

3. The VNA displays the contents of the service log.
   - The display consists of a header and an error listing.
   - The header contains a variety of system service information.
   - The error listing contains error messages for failures that may have occurred during operation.

Note	Errors 7201 to 7209, GPIB remote operation programming errors, report that one or more external GPIB programming errors has been detected. These messages do not indicate a VNA system fault. Informational messages 0000 to 0099 report the pass/fail status of a peripheral access. These messages do not indicate a VNA system fault.

- Any other error messages in the service log may indicate an instrument problem and should be investigated. Refer to Chapter 7, "Troubleshooting"for additional information.

Caution	The CLEAR SERVICE LOG menu selection will immediately and permanently clear all the error message entries from the service log. However, it will not clear the header information. The service log contains historical information about instrument condition and any failures that may have occurred. It should be cleared only by a qualified service engineer. Clearing the log should only be performed after any problem conditions have been resolved, and a log copy saved electronically and/or printed out.

4-3 Self Test

The self test performs a series of tests that verify that various internal VNA circuits are functional and operating properly.

Procedure

To start the self test:

1. Press the **Option Menu** key (Enhancement key group) to display the OPTIONS menu.
2. Select DIAGNOSTICS from menu; then select START SELF TEST (below).

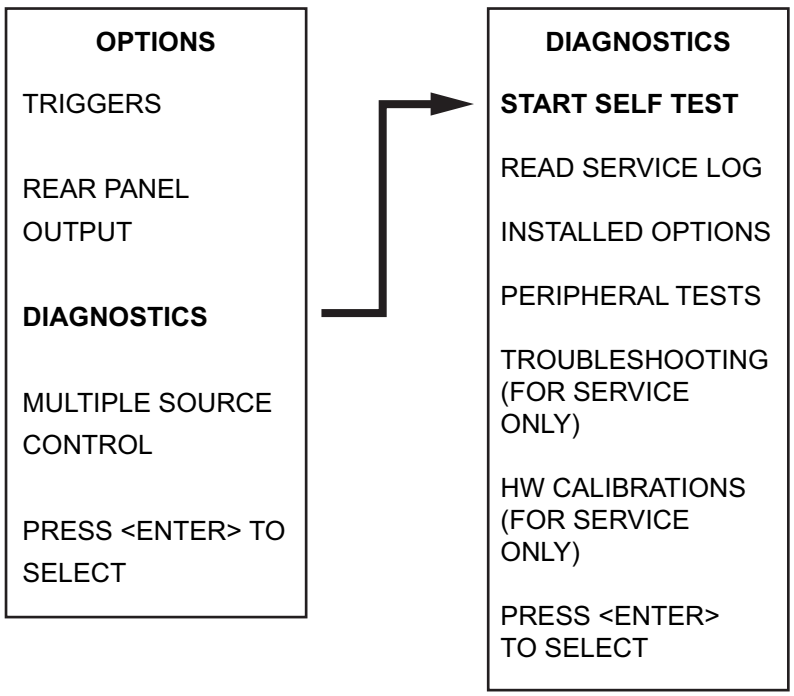


Figure 4-2. Menus – OPTIONS | DIAGNOSTICS | START SELF TEST

3. Wait for test sequence to complete. (Once invoked, this test requires no user interaction or external equipment.)
4. Upon completion, the net pass/fail result of the self test is shown on the display. If the VNA is in remote-only operation, the results are reported via the GPIB output buffer. If the self test fails, detailed error messages will be written into the service log.

Test Failure

If the self test fails:

- Check the service log to view failure messages.
- Proceed to Chapter 7, “Troubleshooting”.

4-4 Performance Tests

The 37xxxE performance tests are contained within one executable program, 3700TEST.EXE, Anritsu Software Part Number 2300-178. The included tests cover most of the RF devices and circuits within the VNA and are applicable for all Lightning 37xxxE VNA models.

The user interface consists of a single display from which the operator can control all aspects of the test program. It is suggested that the tests be performed in the sequence that they are shown on the display (top-to-bottom sequence), but this is not required. Any test may be performed multiple times or in any sequence. These tests should be performed prior to the verification tests described in Chapter 5, System Performance Verification.

The test program determines the model of the VNA and displays the applicable tests. One general test record and several data files will be created on the PC in a folder labeled 37000 for each test.

- This general test record records only Pass, Fail, Not Applicable, or Not Performed for each test.
- The data files record test appropriate numerical data
- All data files are readable and printable by a text reader such as Microsoft Notepad®.

Each test displays instructions for the operator. Some tests will prompt the operator for frequency characteristics of external test equipment connected.

Test Specifications

Specifications are clearly labeled as being "Typical" or "Guaranteed." The following tests have specifications that are guaranteed and are repairable at no charge by Anritsu during the warranty period:

- Low Power Phase Lock
- Port 1 Power
- Source Match
- Directivity
- System Dynamic Range

All tests that are designated guaranteed allow the operator to store numerical test data to a file. Tests having guaranteed specifications must be performed under test program control.

Specifications that are typical are identical to factory specifications for new instruments. Anritsu does not guarantee the VNA will meet these specifications. If a test fails by a small margin, this does not indicate a problem with the instrument.

Required Equipment

- Windows-based PC with Windows XP® or higher.
- National Instruments GPIB interface card and associated software driver compatible with the installed Windows operating system.
- Standard GPIB interface cable, such as Anritsu part number 2100-2, must be connected between the VNA and the PC.
- Anritsu 365X calibration kit that matches the test port connectors of the VNA must be used. A sliding termination is required only if the Source Match or Directivity tests are to be performed. Only the female components of the calibration kit will be used. See Table 1-3, "Recommended Test Equipment" on page 1-8 in Chapter 1, "General Information" for calibration kit descriptions.
- High quality RF cable suitable for the frequency range of the instrument. Anritsu 3670 or 3671 series through lines are strongly recommended.
- High quality female to female adapter, such as Anritsu part number **33KFKF50B**. The adapter is required if the RF cable above does not have a female connector on both ends.

Note	Do not use SMA adapters with white teflon dielectric material. These connector types have very poor connection repeatability for the required high-accuracy measurements.

Additional Required Equipment

- The Frequency Accuracy test requires an EIP brand frequency counter. Most models are acceptable, but GPIB, Band 3, and External 10 MHz reference input capabilities are required.
- The Port 1 Power test requires an Anritsu Model ML24XX power meter with an appropriate power sensor. Other meters and sensors, as shown in Table 1-3, “Recommended Test Equipment” on page 1-8 above are also useable.
- The Source Match test requires an Anritsu Assurance Airline, such as model T2023-2 or T2025-2, typically available only from Anritsu Service Centers.
- The Directivity test requires an Anritsu Assurance Airline and offset termination, such as model 29KF50-15 or SC4417, typically available only from Anritsu Service Centers.

Installation and Launching the Test Program

The program is a stand alone executable requiring that the National Instruments GPIB software parameters all be set to default conditions. The user will be asked to create the folder “C:\37000” for data storage, if that folder does not already exist on the PC. Additionally, the GPIB settings that are required for the 2300-480 Verification Software will also work with the 3700TEST.EXE program.

From your Windows-based PC, run the 3700TEST.EXE program. The program interface similar to the display below appears.

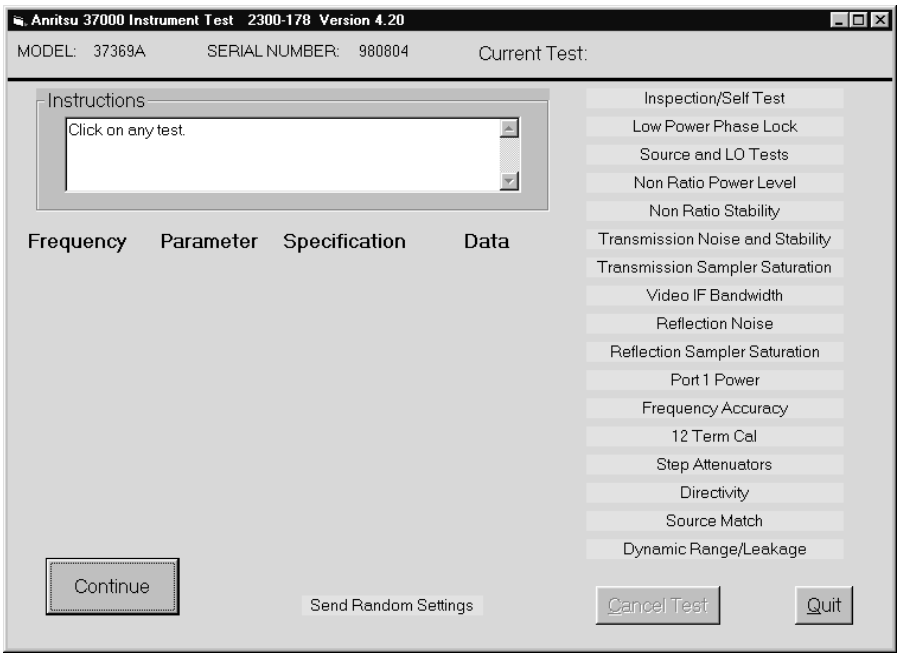


Figure 4-3. 2300-178 Software Interface

Connect the GPIB cable between the PC and the upper GPIB connector of the VNA rear panel (labeled **IEEE 488.2 GPIB**). Turn on the VNA and verify the instrument address is 6 (found under the **Utility Menu Key** | GPIB ADDRESSES).

The program will locate the VNA, and query the operator regarding his/her name, customer name, and Test Port type.

The program will create a file for Pass/Fail information named “123456.SVC” (where 123456 is the serial number of the VNA). If the program locates an existing .SVC file of the same instrument in the 37000 folder, the operator must decide whether to continue storing data to the existing .SVC test record or start a new .SVC record.

The label colors for the tests provide test status:

- Incomplete test labels have a yellow background.
- Passed test labels have a green background.
- Failed test labels have a red background.

Running the Tests

To launch any test, click on the label of the test. In all tests, the operator should not remove the instrument from the Remote condition. Doing so will require restarting the program.

The text box will display instructions to the user. To continue with any test, click on the Continue button, press the **space bar**, or press **<Enter>**. To quit any test, press the **<ESC>** key or click on the Cancel button.

At the completion of the selected test, a Pass or Fail result will be displayed in the text box and written to the .SVC file. If the operator has chosen to record numerical data, it will be saved to the appropriate file. Select Continue to move to the next test.

Description of Tests

Each of the tests is described in the sections below.

Inspection/Self Test

This test performs the extended internal self test, launches the VNA front panel keyboard/knob test, and starts the external keyboard test. The test also prompts the user to check the pin depth of the Test Ports and to check the fuses in the bias tee circuits.

Low Power Phase Lock Test

This test checks the ability of the instrument to maintain source phase lock at minimum source power.

If the test fails, performing a Source Lock Threshold calibration may solve the problem. If this does not solve the problem, it must be corrected by a trained Anritsu Service Engineer.

Source and LO Tests

These tests use built-in VNA diagnostics to check all phase lock loop error voltages of the RF source, LO1, and LO2 of the down conversion section. Each display should fall within the prescribed limit lines.

If the test fails, a minor deviation outside of the limit lines will not cause any performance problem or measurement error. Performing a new Source Frequency calibration, LO1 calibration, or LO2 calibration will typically bring these voltages back into optimum range.

Non-Ratio Power Tests

This test checks the RF power level of the four individual RF paths in the VNA. The complete paths are checked beginning with the RF source and continuing out of the VNA Test Ports through the Down Conversion and A/D circuits. All signal paths, including the front panel Option 15 cables (if installed) are tested.

If the test fails and depending on the severity of the power loss, the RF Source in the VNA may fail to phase lock (in worst cases) or the VNA's system dynamic range may be degraded. Ensure the RF cable between the Test Ports is of good quality and all external cables are connected properly. If this does not solve the problem, it must be corrected by a trained Anritsu Service Engineer.

Non-Ratio Stability Test

This test checks the general stability of the Non-Ratio channels. Raw data is displayed, stored to memory, then divided by itself resulting in a very smooth RF display at high resolution. The quality of this display is checked after 10 sweeps.

If the test fails, a problem seen in both Test Channels (channels 2 and 3 on the VNA) could be caused by a defective RF cable between the Test Ports. A problem seen on only one channel could be caused by a damaged or incorrectly connected Option 15 front panel cable. A problem seen on all four channels could be caused by an insufficient warm-up period. If the problem still exists after these checks, it must be corrected by a trained Anritsu Service Engineer.

Transmission Noise and Stability Test

This test displays the system noise while measuring the default source power (+5 dBm to –15 dBm, depending on model). A short drift test is also performed, testing both Log Magnitude and Phase. The instrument must not be disturbed during the drift test.

If the test fails, the RF cable between the Test Ports is the most likely cause of failure when the problem appears in both S21 and S12. If only S21 or S12 fails, check the Option 15 front panel cables (if installed), then contact a trained Anritsu Service Engineer.

Transmission Sampler Saturation Test

This test ensures that the Samplers of the Down Conversion module are operating within their linear range by checking at default and reduced VNA power.

If the test fails, interior attenuators on the VNA RF deck may have been removed or be the incorrect values. One or more samplers may have degraded requiring replacement of the Sampler/Down Conversion module.

Video IF Bandwidth Test

This performs a test on each IF bandwidth filter found on the A4, A3, and A6 PCBs. The operator must perform a Transmission-Only calibration using the calibration kit.

If the test fails in both S21 and S12, the A4 board is suspect. If only S21 fails, the A6 board is suspect. If only S12 fails, the A3 board is suspect.

Reflection Noise Test

This is identical to Transmission Noise and Stability except that full reflections are installed on the Test Ports, rather than an RF cable.

If the test fails, check the Option 15 front panel cables (if installed), then contact a trained Anritsu Service Engineer.

Reflection Sampler Saturation Test

This test ensures that the Samplers of the Down Conversion module are operating within their linear range by testing with default and lowered source power.

If the test fails, interior attenuators on the VNA RF deck may have been removed or be the incorrect values. One or more samplers may have degraded requiring replacement of the Sampler/Down Conversion module.

Port 1 Power Test

This test measures the RF power present at Port 1 using the VNA default power setting. An Anritsu ML24XX power meter with the appropriate sensor is required. The power data are taken every few hundred MHz, depending on VNA model, so that the test time is 3 to 5 minutes. Data will be written to a file if the operator specifies to do so.

If the test fails, the results may be improved by performing a Port 1 ALC calibration. If this solves the problem, a Port 2 ALC calibration and Source Lock Threshold Calibrations should also be performed. If the test continues to fail, it must be corrected by a trained Anritsu Service Engineer.

Frequency Accuracy Test

This test checks the frequency accuracy of the VNA source. An RF counter with several features is required (see "Additional Required Equipment" on page 4-6 above at the beginning of this section). A precision 10 MHz reference signal (such as that found on an Anritsu MG369XA series synthesizer) should be connected to the rear panel of the counter. Do not use the **37000E 10 MHz OUT** as a reference for the counter.

If the test fails, it is likely that the VNA internal 10 MHz crystal has drifted. If a precision 10 MHz signal is present on the counter, the VNA 10 MHz crystal can be adjusted. The VNA 10 MHz crystal is mounted on the top of the A7 PCB and is adjustable with a potentiometer.

The **10 MHz OUT** connector on the rear panel of the VNA provides the access point for monitoring the frequency of the VNA 10 MHz crystal. After crystal re-adjustment, re-run the Frequency Accuracy test. If the test still fails, the following calibrations will need to be performed (in this order):

1. Source Frequency Cal
2. Port 1 ALC Cal
3. Port 2 ALC Cal
4. Source Lock Threshold Cal

Full 12 Term Calibration

This is a standard OSL measurement calibration, which is required to perform most of the subsequent tests (Step Attenuators, Directivity, Source Match, and System Dynamic Range). The appropriate Anritsu calibration kit with a high density coefficients USB memory device is required (See Table 1-3, "Recommended Test Equipment" on page 1-8 in Chapter 1, "General Information" for calibration kit descriptions.)

The program selects specific frequencies, using discrete fill, and selects other settings for the calibration required by the System Dynamic Range test. The user must have a female sliding termination if the Directivity or Source Match will be tested.

After the calibration is set up by the program, the operator performs the calibration by connecting the required devices and pressing Enter on the VNA to begin the measurement. After the calibration is complete, the operator selects Continue on the program display and the calibration is saved to the VNA hard drive. Saving the calibration to the hard drive allows the user to perform other tests (which default the VNA) at any time and recall the calibration as needed.

Step Attenuator Tests

This will test the accuracy and repeatability of the internal step attenuators. The 12-term calibration must have been performed using the program. This calibration file will be recalled from the VNA's SD Card by the program.

If the test fails, minor failures may occasionally be improved simply by stepping the attenuators up and down for a few minutes to remove oxidation from internal contacts. Major failures of the step attenuators are primarily caused by faults within the attenuators themselves, or perhaps the A8 PCB.

Directivity Test

As stated above, the following are required before performing this test:

1. Sliding Load calibration performed under control of the 12 Term Cal Test
2. Assurance Airline
3. Offset Short

Ensure that no RF cables are attached during the test. The assurance airline and offset short are typically available only from Anritsu Service Centers. The test program will use the ripple extraction technique to derive the corrected directivity of both Test Ports. Numeric data may be saved.

If the test fails, ensure that the pin depth of the Test Ports are within specification and that the center pins are not misaligned. The coupler or bias tee for each Test Port is also a possible cause of failure.

Source Match Test

The following is required to perform this test:

- Sliding Load calibration performed under control of the 12 Term Cal Test
- Assurance Airline
- Short

Ensure that no RF cables are attached during the test. The assurance airline is typically available only from Anritsu Service Centers.

The test program will use the ripple extraction technique to derive the corrected source match of both Test Ports. Numeric data may be saved.

If the test fails, ensure that the pin depth of the Test Ports are within specification and that the center pins are not misaligned. The coupler or bias tee for each Test Port is also a possible cause of failure.

System Dynamic Range Test

This test checks the System Dynamic Range in the forward transmission path. A full 12 Term calibration is required.

If the test fails, ensure that the instrument meets the Port 1 power level specification. Perform Port 1 ALC calibration if needed. If still fails, replace the power amp and buffer amp assembly.

Send Random Settings Test

This test sends random start and stop frequencies and reduces source power in an attempt to expose intermittent failures. If failures occur, details are written to the VNA service log for evaluation by a trained Anritsu Service Engineer. This test will continue indefinitely until stopped by the operator (using the **Escape** key or **Cancel** button) or when 20 errors have occurred.

If the test fails, due to the extreme nature of this test, a very intermittent error may appear (for example, once in several days), which cannot be duplicated by manual testing. If this is the case, it may or may not be prudent (in the view of the user) or successful to attempt a repair. If several errors appear in one day, a significant problem exists and a repair should be performed by an Anritsu Service Engineer.

4-5 37xxxE Log Magnitude Dynamic Accuracy Test

Test Description

This test verifies the measurement accuracy (receiver linearity) of the VNA at power levels that are significantly below 0 dBm.

An external step attenuator that has been accurately characterized for 2 GHz at the Anritsu calibration lab is used. Measurements are made on each step of the attenuator after a CW 12 Terms calibration at 2 GHz with 10 Hz IF Bandwidth has been performed and the VNA has been set to S21 measurement mode. Characteristic VNA uncertainty and uncertainty associated with the step attenuator are part of the criteria used in the Pass or Fail determination for each attenuation step.

Additional Required Equipment

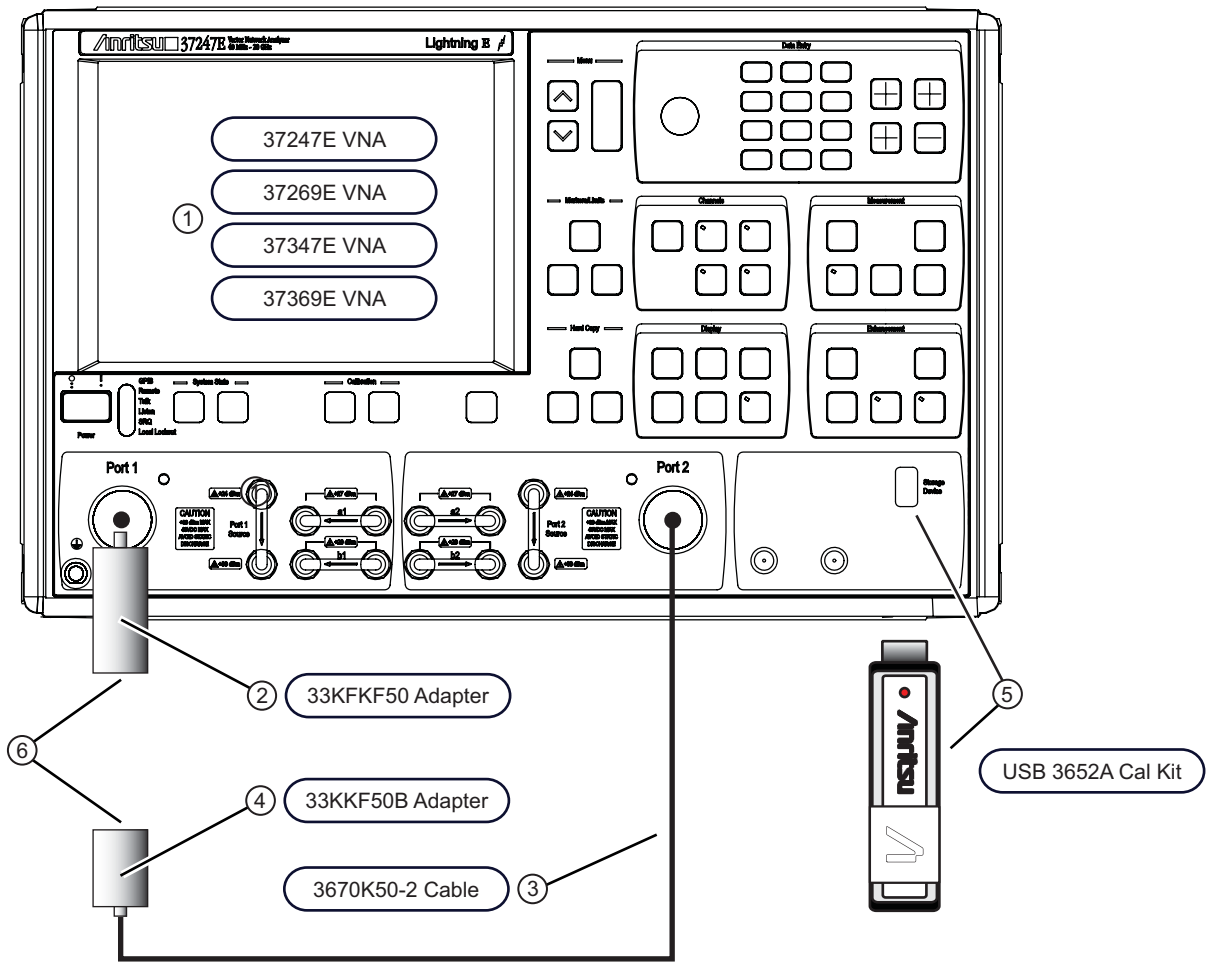
The following equipment is required for the log magnitude dynamic accuracy test:

Table 4-1. Require Equipment – Log Magnitude Dynamic Accuracy Test

Instrument	Critical Specifications	Recommended Manufacturer / Model
Adapter	Type: V (f) to K (f) Quantity: 2	Anritsu Model 34VFKF50 *Only required for 37297E and 37397E*
Calibration Kit	Connector Type: K	Anritsu Model 3652A-1
RF Cable	Frequency: DC to 40 GHz Connector Type: K (m) to K (f)	Anritsu Model 3670K50-2
Step Attenuator	With traceable Characterization Data at 2 GHz	Anritsu Model SC7974
Step Attenuator Control Box	—	Anritsu Model SC3796

Procedure

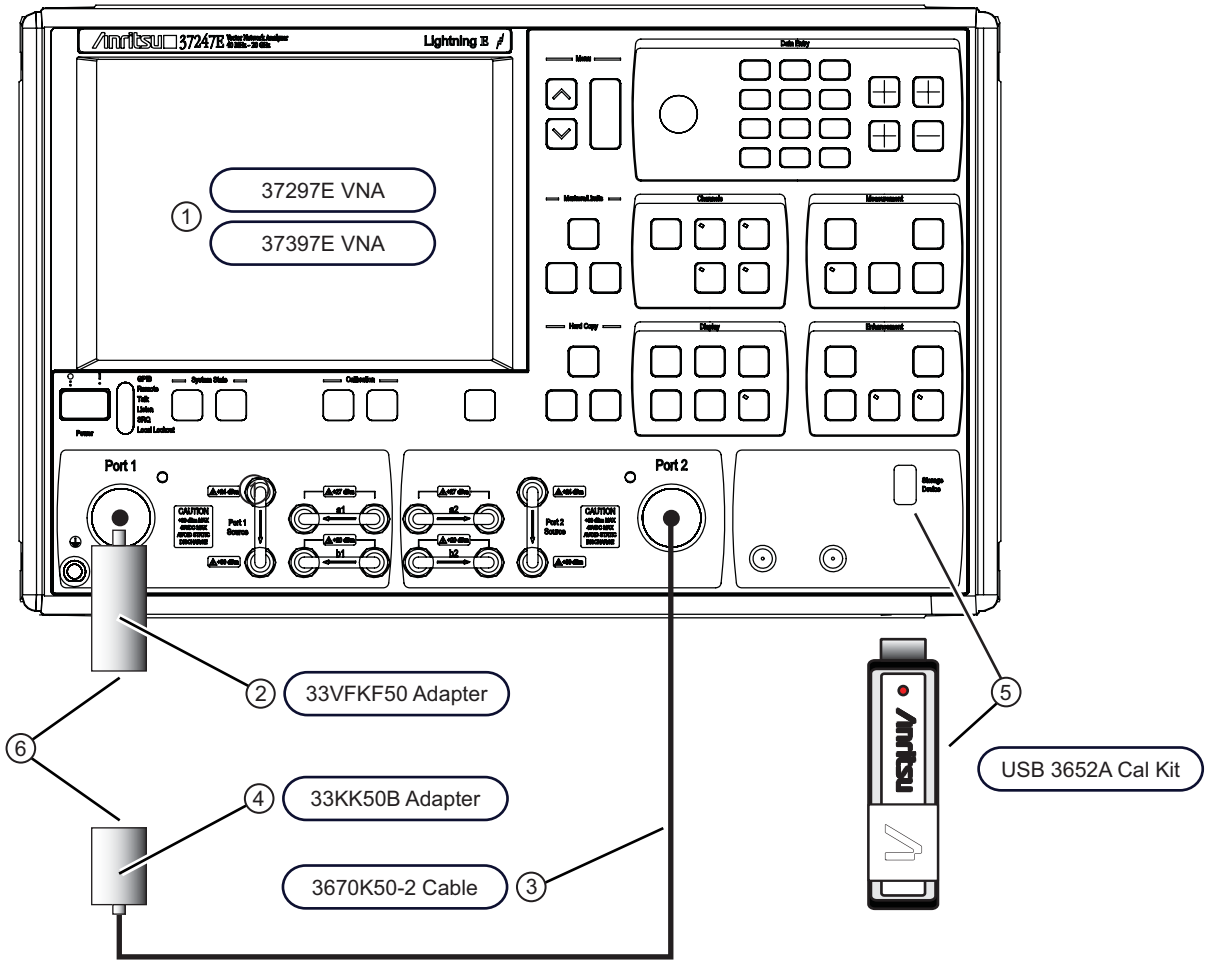
1. Warm up the VNA for at least an hour.
2. Connect adapters, cables, and USB Memory Device as shown in one of the two figures below:
   - For 37x47E 20 GHz and 37x69E 40 GHz VNAs, use the configuration shown in Figure 4-4, “Test Setup for Lightning 37247E, 37269E, 37347E, and 37369E VNAs” on page 4-12 below.
   - For 37x97E 675 GHz VNAs, use the configuration shown in Figure 4-5, “Test Setup for Lightning 37297E and 37377E VNAs” on page 4-13 below.



Test Setup for Lightning 37247E, 37269E, 37347E, and 37369E VNAs

1 – Anritsu Lightning 37xxxE VNA
2 – Anritsu 33KFKF50 Adapter from 3652A Calibration Kit
3 – Anritsu 3670K50-2 Cable
4 – Anritsu 33KKF50B Adapter from 3652A Calibration Kit
5 – Calibration Coefficients on USB Memory Device from 3652A Calibration Kit and USB Port
6 – Insert calibration standards here

Figure 4-4. Test Setup for Lightning 37247E, 37269E, 37347E, and 37369E VNAs



Test Setup for Lightning 37297E and 37397E VNAs

1 – Anritsu Lightning 37xxxE VNA
2 – Anritsu 34VFKF50 Adapters
3 – Anritsu 3670K50-2 Cable
4 – Anritsu 33KK50B Adapter from 3652A Calibration Kit
5 – USB Memory Device from 3652A Calibration Kit
6 – Insert calibration standards here

Figure 4-5. Test Setup for Lightning 37297E and 37377E VNAs

3. Press the **Default Program** key twice on the front panel. This resets the VNA to default factory setting.

4. Insert the Calibration Component Coefficients USB memory device from the **3652A Calibration Kit** into the front panel USB port.

5. Press the **Utility Menu** key. Select CAL COMPONENT UTILITES and then INSTALL KIT INFORMATION to load the calibration component coefficients.

6. Perform a 12 Term calibration as follows:

a. Press the **Begin Cal** key on the front panel

b. Select FULL 12 TERM CAL

c. Select INCLUDE ISOLATION (STANDARD)

d. Select C.W. (1 POINT)

e. Change C.W. FREQUENCY to 2 GHz and then select NEXT CAL STEP

f. Change PORT 1 CONN to K(F)

g. Change PORT 2 CONN to K(M)

h. Select START CAL to start the calibration standard measurements.

7. Install the Broadband Loads to the VNA test port at the ISOLATION DEVICE measurement step. Before measuring the Isolation Devices, make the following changes:

a. Press the **Video IF BW** key

b. Select Minimum (10 Hz)

c. Press the **AVG/Smooth Menu** key

d. Set averages to 4096 (x1) and select RESUME CAL

e. Press the **Enter** key to measure the Isolation Devices

8. Leave the Broadband Loads installed to the VNA test ports for the Broadband Load measurement step. Before starting the measurement, make the following changes:

a. Press the **Video IF BW** key

b. Select Minimum (10 Hz)

c. Press the **AVG/Smooth Menu** key

d. Set averages to 4096 (x1) and select RESUME CAL

e. Press the **Enter** key to measure the Broadband Loads

9. Proceed to install and measure the other calibration standards from the calibration kits and the THROUGHLINE when prompted using the default averaging and IFBW settings.

10. Set up the Display as follows:

a. Press the **Data Points** key on the front panel.

b. Change the POINTS DRAWN IN C.W. setting to 11 points

c. Press the **Channel Menu** key on the front panel.

d. Select **SINGLE CHANNEL**

e. Press the **Ch 3** key on the front panel to display S21 trace only.

f. Press the **Graph Type** key on the front panel.

g. Select LOG MAGNITUDE

h. Press the Video IF BW key

i. Select Minimum (10 Hz)

j. Press the AVG/Smooth Menu key

k. Set averages to 4096 (x1)

l. Press the **Average** key to turn on averaging.

m. Press the **Marker Menu** key on the front panel and turn Marker 1 ON. Use the **Rotary knob** to move the marker to the center of the display.

n. Press the **Readout Marker** key on the front panel.

11. Set all four switches on the **SC3796 Step Attenuator Control Box** to 0 dB.



Figure 4-6. Anritsu SC3796 Step Attenuator Control Box

12. Install the **ribbon cable connector** plug of the step attenuator to the DIP socket of the SC3796 Step Attenuator Control Box.

Warning	The white dots and/or beveled connector corners designate Pin 1 on the ribbon cable connector plug of the step attenuator and the DIP socket of the SC3796 Step Attenuator Control Box. The Pin 1 dot or beveled corner must be aligned together to prevent damage to the step attenuator.

13. Disconnect the Through cable from Port 1 and then install the step attenuator between Port 1 and the Port 2 through cable.

14. Record the M1 value on the display to 0 dB row on Table A-1, "Measured S21 Values and Calculated Step Attenuator Attenuation Values" on page A-2 in Appendix A, "Test Record".

15. Set the first switch on the most right to 10 dB position to set the step attenuator to 10 dB attenuation. Refer to Figure 4-6above.

16. Record the M1 value on the display to 10 dB row on Table A-1 on page A-2.

17. Set the switch from 10 dB back to 0 dB position.

18. Toggle the second switch from the right to 20 dB position to set the step attenuator to 20 dB attenuation.

19. Record the M1 value on the display to 20 dB row on Table A-1.

20. Toggle the first switch to 10 dB position to set the step attenuator to 30 dB attenuation.

21. Record the M1 value on the display to 30 dB row on Table A-1.

22. Set both switches (10 dB and 20 dB) back to 0 dB position.

23. Toggle the third switch from the right to 40 dB position to set the step attenuator to 40 dB attenuation.

24. Record the M1 value on the display to 40 dB row on Table A-1 on page A-2.

25. Toggle the first switch to 10 dB position to set the step attenuator to 50 dB attenuation.

26. Record the M1 value on the display to 50 dB row on Table A-1.

27. Set the first switch from 10 dB position to 0 dB position.

28. Toggle the second switch to 20 dB position to set the step attenuator to 60 dB attenuation.

29. Record the M1 value on the display to 60 dB row on Table A-1.

30. Toggle the first switch to 10 dB position to set the step attenuator to 70 dB attenuation.

31. Record the M1 value on the display to 70 dB row on Table A-1.

32. Set both the first and second switches (10 dB and 20 dB) back to 0 dB position.

33. Toggle the last switch to 40 dB position to set the step attenuator to 80 dB attenuation.

34. Record the M1 value on the display to 80 dB row on Table A-1.

35. Set all switches on the SC3796 Control Box back to 0 dB position.

36. Repeat Step #14 above to Step #35 above nine (9) more times. Record the M1 value to the next available column on Table A-1 in Appendix A.

37. Calculate the attenuation values for 10, 20, 30, 40, 50, 60, 70 and 80 dB attenuation steps of the Step Attenuator using the following formula:

$$\text{Attenuation (x dB)} = \text{Measured Value (x dB)} - \text{Measured Value (0 dB)}$$

Where x = Attenuation Step (for example 10 dB, 20 dB, etc.)

38. Calculate the mean values by summing the 10 calculated values in previous step and then dividing the sum by 10 for each attenuation step of the Step Attenuator. The formula is:

$$\text{Attenuation (x dB) mean} = \frac{[\text{Attenuation (x dB) pass \#1} + \text{Attenuation (x dB) pass \#1} + \ldots + \text{Attenuation (x dB ppass \#10}]}{10}$$

39. Record the calculated mean values to Table A-1, "Measured S21 Values and Calculated Step Attenuator Attenuation Values" on page A-2 in Appendix A.

Analysis of the Measurement

40. Open the data file (using a text editor program such as Notepad in Windows) on the Characterization Disk of the step attenuator on a personal computer and copy the 8 characterization values to Column C in Table A-2, "Log Magnitude/Dynamic Accuracy Test" on page A-3.

- The data for each attenuation step is found on the same line as the nominal attenuation value.
- For example, assume the line reads "–10 = –10.02, 0.05".
- Copy "–10.02" to Column C in Table A-2.
- Do not record the value of "0.05", which is the uncertainty of that attenuation step.

41. Add the values of Column D to Column C to compute the values for the Upper Limit. Record the computed values in Column E.

42. Subtract the values of Column D from Column C to compute the values for Lower Limit. Record the computed values in Column F.

- The uncertainty values in Column C of Table A-2, "Log Magnitude/Dynamic Accuracy Test" on page A-3 are derived values that are a composite of the uncertainty of the VNA and the uncertainty of the step attenuator.

43. Transfer the mean values of each attenuation step of the step attenuator from the worksheet in Table A-1 to Column B of Table A-2.

44. If the mean value in Column B falls between the values of Column E (Upper Limit) and Column F (Lower Limit), the test passes. If the mean value in Column E is outside the Upper and Lower limits, the test fails.

Chapter 5 — System Performance Verification

5-1 Introduction

This chapter provides specific procedures to be used to verify that the VNA is making accurate, traceable S-parameter measurements. The operational performance tests described in Chapter 4 should be performed at least once annually, and prior to verifying the system performance test procedures in this chapter.

Please ensure that you have read and fully understand the servicing concepts for the VNA presented in Chapter 1 prior to continuing with this chapter.

5-2 Calibration and Measurement Conditions

The surrounding environmental conditions and the condition and stability of the test port connectors, through-cable, and calibration kit determine the 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.

Standard Conditions

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

- Warm-up Time:
  - One hour minimum
- Environmental Conditions:
  - Temperature: 23 ±3 degrees C
  - Relative Humidity: 20% to 50% recommended
- Error Correction:
  - Perform software-guided 12-term calibration

Special Precautions

When performing the procedures in this chapter, observe the following precautions:

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

5-3 Measurement Accuracy

The verification procedures described in the following sections verify the published measurement accuracy and measurement traceability for the VNA. The traceability path ultimately leads to the U.S. National Institute of Standards and Technology (NIST).

Verification Software

These procedures require the use of the VNA Verification Software package that is included in the Verification Kit. See Table 1-2, "Verification Kit Model Numbers for Lightning 37xxxE Series VNAs" on page 1-5 in Chapter 1, "General Information" for software part numbers.

The "Standard Conditions" and "Special Precautions" on page 5-1 in the sections above should be observed when performing these procedures.

The verification software performs the following functions:

- It guides the user through a full 12-term calibration of the VNA.
- It guides the user through measurements of the S-parameters of the NIST traceable standards (below).
- It verifies that the measured values are within the specified measurement uncertainty limits.
- It indicates the pass/fail status of the measurements on the display.
- It can also provide a hard copy printout of the measured data, measurement uncertainties, and the standards used.

Note	The total verification uncertainty in these VNA measurements includes the measurement uncertainty of the verification standards and the uncertainty of the VNA itself.

Verification Result Determination

The software verification process compares the measured S-parameter data of the standards against the original standard data for those devices that was obtained using the Factory Standard 37xxxE Vector Network Analyzer System (at Anritsu). The factory Standard 37xxxE VNA 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.

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 and verification kits.
- The condition of the VNA test port connectors and through cables.
- The pin depths of all connectors and the proper torquing of connections.

These same factors also affect the measurement quality of the VNA. Consult the Operating Manuals supplied with the Anritsu Calibration and Verification Kits for proper use, care, and maintenance of the devices contained in these kits.

5-4 Verification Procedure

The performance verification procedure for the Anritsu 37xxxE VNA is described below. The Software Users Guide (embedded within the Verification Program) explains in detail the procedures to be used for the installation and operation of the Verification Software on your computer/controller.

Required Equipment

For additional information on all test equipment requirements, refer to Refer to Table 1-2, "Verification Kit Model Numbers for Lightning 37xxxE Series VNAs" on page 1-5.

Note	Use of non-Anritsu calibration or verification kits is not supported.

- Anritsu 37000 Verification Software which is included in the Verification Kit for the connector type in use.

Note	Install the Lightning 37000 VNA Verification Software on the PC Controller prior to starting the procedure below.

- External computer/controller
- Anritsu Calibration Kit identical to the VNA Test Port connectors.
- Anritsu Verification Kit identical to the VNA Test Port connectors.
- GPIB cable, Anritsu 2100-2, or equivalent
- Anritsu Test Cable Model 3670K50-2 or 3670V50-2 or equivalent

Procedure

1. Using the GPIB cable, connect the external computer/controller to the IEEE 488.2 GPIB Interface port on the VNA rear panel.
2. On the PC Controller, run the 37000 VNA Verification Software.
3. Follow the directions displayed on the computer screen to calibrate the VNA and perform all tests.

If Failures Are Indicated

4. If any failures are indicated, check the connectors of the calibration kit devices and the impedance transfer standards for damage, cleanliness, proper connection, and torquing. These are the most common causes for verification failures.
5. If failures persist, run all of the tests in the 2300-178 program, described in Chapter 4, "Operational Performance Tests".

5-5 VNA Traceability

According to the International Vocabulary of Basic and General Terms in Metrology (VIM), BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, OIML, 2nd ed., 1993, definition 6.10, traceability is defined as:

> "the property of the result of a measurement or the value of a standard that can be related to stated references through an unbroken chain of comparisons all having stated uncertainties."

Stated References

The stated references are stated reference standards. Stated means explicitly set forth in supporting documentation. Reference standard is a standard generally having the highest metrological quality available at a given location or in a given organization from which measurements are derived. The stated references are usually national or international standards.

Unbroken Chain of Comparisons

The unbroken chain of comparisons are the complete, explicitly described, and documented series of comparisons that successively link the value and uncertainty of a result of a measurement with the values and uncertainties of each of the intermediate reference standards to the highest reference standard of which traceability for the result of measurement is claimed.

Stated Uncertainties

The stated uncertainties are the uncertainties of measurement that fulfill the VIM definition as the parameter and is associated with the result of a measurement that characterizes the dispersion of values that could reasonably be attributed to the measurement. The stated uncertainty is evaluated and expressed according to the general rules given in the ISO Guide to the Expression of Uncertainty in Measurement.

Measurement with a VNA

The Vector Network Analyzer (VNA) is one of the most modern and accurate measurement tools for microwave and RF applications, but the VNA requires calibration to enhance its measurement accuracy. There are many ways to define proper measurement traceability for the VNA in lieu of its system complexity and calibration schemes. Scattering Parameters (S-Parameters) are the most common measurements of the vector network analyzer.

Traceability Path for Scattering Parameter Measurements

In the chart below in Figure 5-1, "VNA Traceability Chart" on page 5-5, a widely used traceability path for making scattering parameter measurements is presented. The basic elements in this chart include a calibration kit, a VNA, and a verification kit for each user. The calibration kit is characterized and traceable mainly through impedance standards, for example airlines and proper circuit modeling.

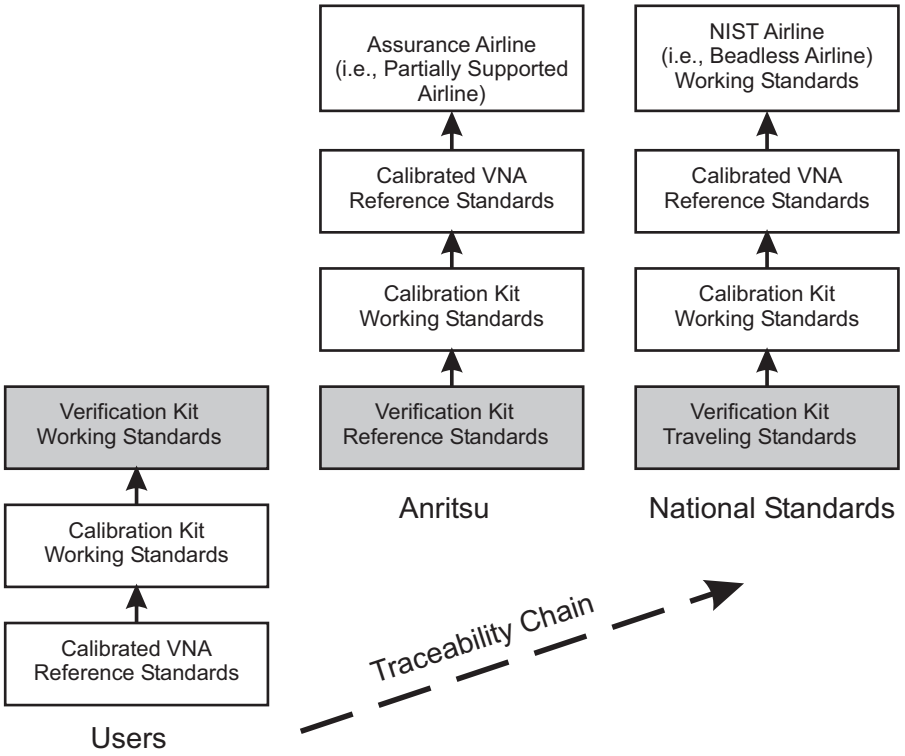


Figure 5-1. VNA Traceability Chart

Vertical Traceability Path

The vertical path is a process that is used by most of the manufacturers and primary standards laboratories. It is impractical for regular users to demonstrate the system traceability before every use; therefore, a verification kit consisting of an airline, mismatch airline, and two fixed attenuators was introduced to perform a routine check for the calibrated system. These components were characterized by their manufacturers or by a standards laboratory, and they have excellent repeatability characteristics.

Horizontal Traceability Path

The horizontal path shows the conventional traceability chain for the verification kit. The stated uncertainty in the verification program comes from three major sources:

- NIST Report
- Anritsu Reference Standards
- Device-under-test (DUT)

Chapter 6 — Adjustments

6-1 Introduction

This chapter contains procedures that are used to restore the calibration of the VNA signal source and the related source lock system assemblies. Use these procedures after various signal source related assemblies have been replaced due to troubleshooting or repair activities.

Please insure that you have read and fully understand the servicing concepts for the VNA presented in Chapter 1, "General Information" prior to continuing with this chapter.

Saving each new calibration file to the hard drive is suggested in these instructions. This is simply creating a backup copy of the file and is not required.

6-2 LO1 Calibration

This procedure uses the VNA internal diagnostics and calibration menus to adjust the A1 1st LO PCB assembly. Perform this calibration procedure if:

- The A1 PCB is replaced.
- The display of DIAGNOSTICS | TROUBLESHOOTING | LO1 MAIN PHASELOCK VOLTAGE is outside of the limit lines.

Required Equipment

- None

Calibration Procedure

Note	Allow the VNA to warm-up at least 30 minutes prior to performing calibration.

Perform the following steps:

1. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
2. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATIONS | LO1 CALIBRATION.
3. Perform the calibration which is completed in less than five seconds.

Post Calibration Actions

4. After the calibration process is completed, perform the following actions, as appropriate:

If calibration passes:

5. Save the calibration data to the SD Card.
6. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
7. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO SD CARD | HW_CAL.LO1.

If calibration fails:

8. Repeat the calibration.
9. If the calibration again fails, replace the A1 PCB and perform the calibration again.

6-3 LO2 Calibration

This procedure uses the VNA internal diagnostics and calibration menus to adjust the A2 second LO PCB assembly. Perform this calibration procedure if:

- The A2 PCB is replaced.
- The display of DIAGNOSTICS | TROUBLESHOOTING | LO2 MAIN PHASELOCK VOLTAGE is outside of the limit lines.

Required Equipment

- None

Calibration Procedure

Note	Allow the VNA to warm-up at least 30 minutes prior to performing calibration.

1. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.

2. Select DIAGNOSTICS from the menu, then select in sequence: H/W CALIBRATIONS | LO2 CALIBRATION.

3. Perform the calibration which is completed in less than five seconds.

Post Calibration Actions

4. After the calibration process is completed, perform the following actions, as appropriate:

If the calibration passes:

5. Save the calibration data to SC Card as follows:

6. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.

7. Select DIAGNOSTICS from menu, then select in sequence:

- H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO SD CARD | HW_CAL.LO2.

If the calibration fails:

8. Repeat the calibration.

9. If the calibration fails, replace the A2 PCB and perform the calibration again.

6-4 Frequency Calibration

This procedure uses the internal VNA diagnostics and calibration menus, in conjunction with a suitable frequency counter (refer to Table 1-3, "Recommended Test Equipment" on page 1-8 above in Chapter 1, "General Information"), to adjust the signal source frequencies throughout the range of the VNA model being calibrated. Perform this calibration procedure if:

- The Source FM/Lock Linearity test in Chapter 4, "Operational Performance Tests" fails.
- Other testing or troubleshooting reveals a possible problem with the signal source frequency accuracy or phase lock loop.
- Any of the following assemblies are replaced:
  - A21A1 Source YIG/Bias
  - A21A2 Source Controller
  - Down Converter
  - YIG Oscillator
  - Switched Filter
- The A9 Processor PCB is replaced and the Source Calibration Data was not previously saved on the SD Card and thus data could not be recalled from the SD Card.

Required Equipment

Refer to Table 1-3 on page 1-8 for additional information about the following equipment:

- Anritsu MF241XB Frequency Counter or equivalent EIP brand counter equipped with Band 3 Input and GPIB capability RF/Microwave Cable
- GPIB cable (Anritsu 2100-2, or equivalent)

Calibration Procedure

Note	Allow the VNA to warm-up at least 30 minutes prior to performing calibration.

1. Press the **Option Menu** key (Enhancement key group) to display the OPTIONS menu.
2. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATION | SOURCE FREQUENCY CALIBRATION (Figure 6-1 below).

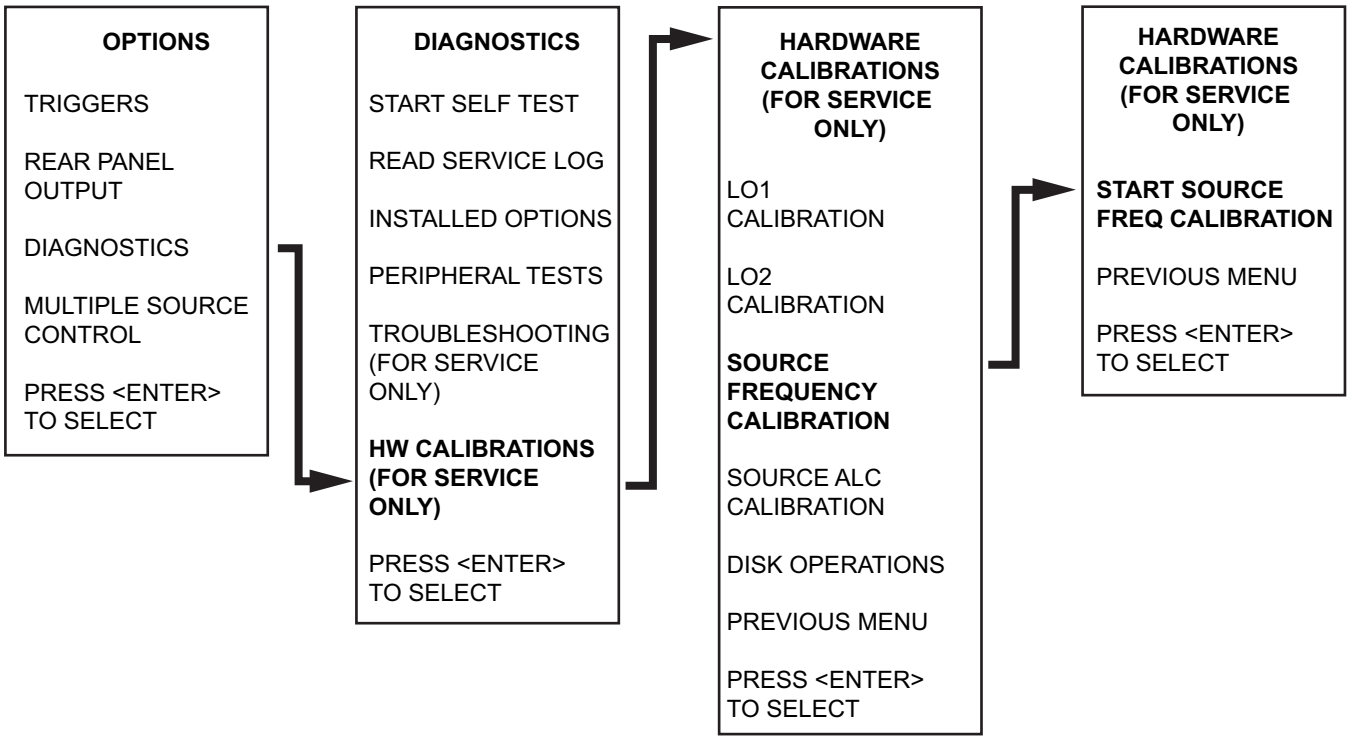
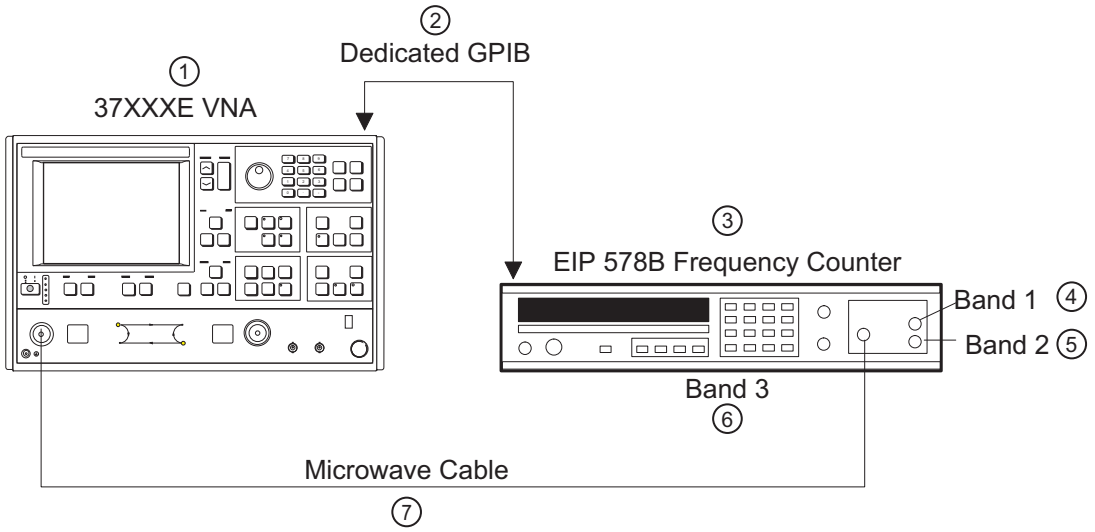


Figure 6-1. Menus – OPTIONS | DIAGNOSTICS | HARDWARE CALIBRATION | SOURCE FREQUENCY CALIBRATION

3. Follow the directions displayed on the screen to set-up and connect the frequency counter to the VNA. Refer also to Figure 6-2 below.

   Select START SOURCE FREQ CALIBRATION from the menu (above).

4. Follow the directions displayed on the VNA screen until the calibration is completed.



1 – Lightning 37xxxE VNA
2 – Dedicated GPIB Cable
3 – EIP 578B Frequency Counter
4 – Frequency Counter Band 1 Connector
5 – Frequency Counter Band 2 Connector
6 – Frequency Counter Band 3 Connector
7 – Microwave Cable

Figure 6-2. Test Setup for Frequency Calibration

Post Calibration Actions

1. After the calibration process is completed, perform the following actions, as appropriate:

If calibration passes:

2. Save the calibration data to the SD Card as follows:
3. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
4. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO SD CARD | HW_CAL.FRE

If calibration fails:

5. Verify that the GPIB cable is connected to the Dedicated GPIB (bottom) connector on the VNA's rear panel.
6. Verify that the frequency counter is functioning correctly, the cable is in good condition, and all connections are secure.
7. Repeat the calibration. If it still fails, then go to Chapter 7, "Troubleshooting".

6-5 RF Power/ALC Calibration

This procedure uses the VNA internal diagnostic and calibration menus, in conjunction with a suitable power meter, to adjust the output power level of the signal source throughout the range of the VNA model being calibrated. Perform this calibration procedure if:

- The "Port 1 Power Test" on page 4-8 in Chapter 4, "Operational Performance Tests"fails.
- Other testing or troubleshooting reveals a possible problem with the RF Power accuracy or the ALC loop.
- Any of the following assemblies are replaced:
  - A21A1 Source YIG/Bias
  - A21A2 Source Controller
  - Down Converter
  - YIG Oscillator
  - Switched Filter
  - Transfer Switch
  - SDM
  - SQM
  - Coupler
  - Port 1 Source Step Attenuator
- The A9 Processor PCB has been replaced and the Source Calibration Data was not previously saved on the SD Card and cannot be recalled from a previously saved file from the SD Card or a USB Memory Device.

Required Equipment

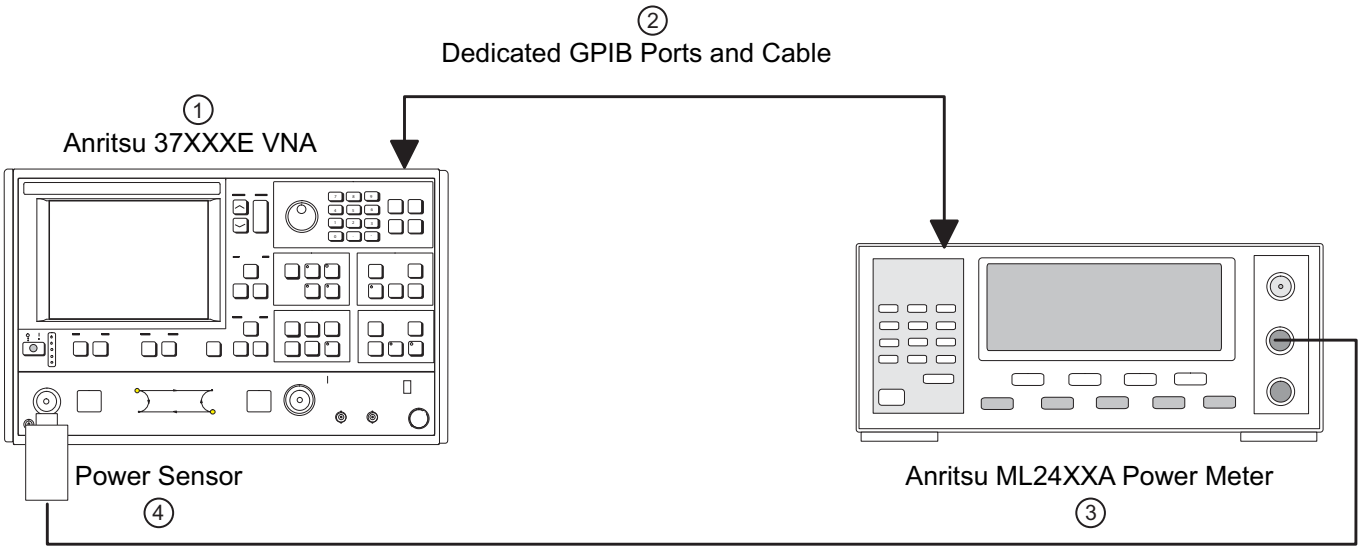
Refer to Table 1-3, "Recommended Test Equipment" on page 1-8 in Chapter 1, "General Information" for additional information about the following equipment:

- Anritsu ML24XXA with Version 2.02 or later, with Anritsu Power Sensors MA2474A (use sensor SC6230 for 65 GHz models)
- GPIB cable, Anritsu 2100-2, or equivalent calibration.

Procedure

Note	Allow the VNA and the power meter to warm-up at least 30 minutes prior to performing calibration.

1. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
2. Select DIAGNOSTICS from menu, then select in sequence:
   - H/W CALIBRATIONS | SOURCE ALC CALIBRATION
   - See Figure 6-1, "Menus – OPTIONS | DIAGNOSTICS | HARDWARE CALIBRATION | SOURCE FREQUENCY CALIBRATION" on page 6-4
3. Follow the directions displayed on the screen to set-up and connect the power meter to the VNA.



1 – Anritsu 37xxxE VNA
2 – Dedicated GPIB Ports and Cable
3 – Anritsu ML24XXA Power Meter
4 – Power Sensor and Cable

Figure 6-3. Equipment Setup for RF Power/ALC Calibration

4. Follow the directions displayed on the VNA screen until the calibration is completed.
5. When Port 1 has been calibrated, connect the Power Sensor to Port 2 and Calibrate Port 2.

Post Calibration Actions

6. After the calibration process is completed, perform the following actions, as appropriate:

If calibration passes:

7. Save the calibration data to the SD Card as follows:
8. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
9. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO SD CARD | HW_CAL.ALC
10. Perform the Port 1 Power test in Section 4-4 “Performance Tests” on page 4-5 located in Chapter 4, “Operational Performance Tests”.

If calibration fails:

11. If the test fails, proceed to Chapter 7, “Troubleshooting” and do the following:
    a. Verify that the GPIB cable is connected to the bottom **Dedicated GPIB** connector on the VNA rear panel.
    b. Verify that the power meter and sensor are functioning correctly, the cables are in good condition, and all connections are secure.
    c. Verify the correct power sensor data exists in the power meter.
    d. Repeat the calibration. If it still fails, then proceed to Chapter 7, “Troubleshooting”

6-6 Source Lock Threshold

This procedure uses the VNA internal diagnostics and calibration menus to adjust the source lock threshold of the phase-lock loop. Perform this calibration procedure:

- If the Low Power Phase Lock Test (Chapter 4) fails.
- Anytime the Port 1 ALC Calibration is performed.
- If the A4 PCB has been replaced.
- If the A8 PCB has been replaced.
- If the A9 Processor PCB has been replaced and the Source Lock Threshold calibration data was not previously saved on the SD Card and the data is not available for recall from the SD Card or a USB Memory Device.
- If the Sampler/Down Conversion Module has been replaced.

Required Equipment

- None

Procedure

Note	Allow the VNA to warm-up at least 30 minutes prior to performing any calibration. Perform the ALC calibration described in Section 6-5 “RF Power/ALC Calibration” on page 6-7 above prior to performing this Source Lock Threshold calibration.

Perform the following steps:

1. If recalibrating a 65 GHz model, install broadband terminations to both ports or install a through line between ports.
2. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
3. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATIONS | SOURCE LOCK THRESHOLD CALIBRATION.
4. Follow the directions displayed on the VNA screen, until the calibration is completed. If the instrument is a 65 GHz model, the calibration will take several hours.

Post Calibration Actions

5. After the calibration process is completed, perform the following actions, as appropriate:

If calibration passes:

6. Save the calibration data to the SD Card as follows:
7. Press the **Option Menu** key in the Enhancement key group to display the OPTIONS menu.
8. Select DIAGNOSTICS from the menu, then select in sequence:
   - H/W CALIBRATIONS | DISK OPERATIONS | SAVE TO SD CARD | HW_CAL.SLT

If calibration fails:

9. Repeat the calibration.
10. If the calibration still fails, proceed to Chapter 7, “Troubleshooting”.

Chapter 7 — Troubleshooting

7-1 Introduction

Please read and understand the notes, warnings, and cautions in this chapter before attempting any troubleshooting or maintenance.

Note	Many of the troubleshooting procedures presented in this chapter require the removal of instrument covers to gain access to printed circuit assemblies and other major assemblies.

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

Caution	Many assemblies in the VNA contain static-sensitive components. Improper handling of these assemblies may result in damage to the assemblies. Always observe the static-sensitive component handling precautions described in Figure 1-2, “Handling Procedures for Static Sensitive Components” on page 1-6 in Chapter 1, “General Information”.

This chapter provides brief information on most failure modes of the 37xxxE instrument family. Only the most basic repairs should be attempted by non-factory-trained technicians. Insufficient care or training will often result in damage to the instrument and cause increased expense and down time. Note that every Anritsu Service Center has factory-trained Service Engineers who can solve all 37xxxE operation problems quickly and reliably, often with warranted repairs.

Before removing the covers of the 37xxxE VNA, be sure that static safety guidelines are followed as detailed in Section 1-11 “Static Sensitive Component Handling Procedures” on page 1-6 in Chapter 1, “General Information”.

7-2 Power-Up Problems

If the instrument is non-functional when power-up is attempted, proceed as follows:

Warning	The main power supply for the instrument is mounted on the left side of the instrument chassis. Remove the power cord before attempting to remove this supply. Simply turning off the power is not sufficient because hazardous voltages are present under the clear plastic cover whenever a power cord is in place.

Procedure

1. Remove the bottom cover as described in Section 8-3 and locate the Power Supply voltage check connectors shown in Figure 7-1 below.

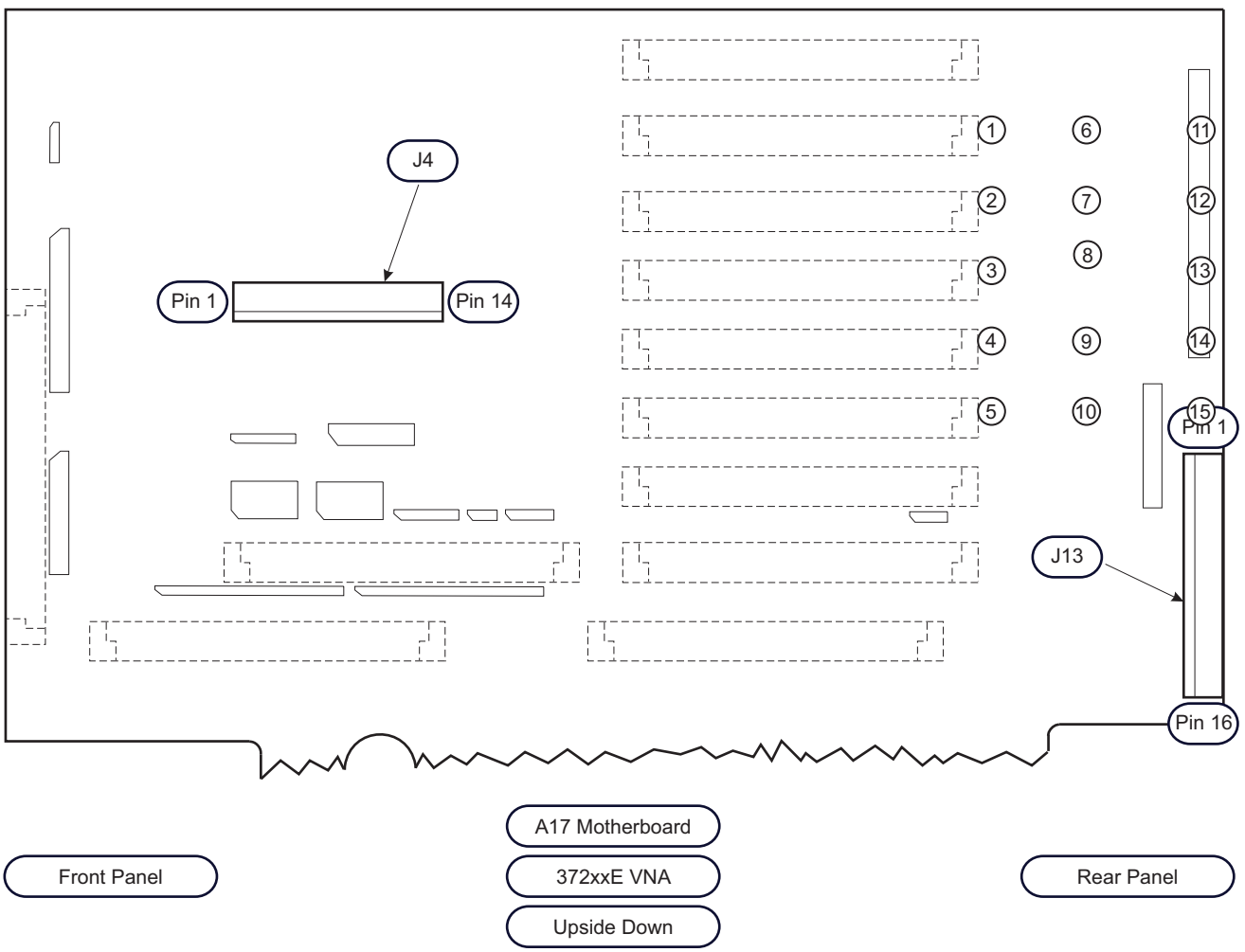


Figure 7-1. 372xxE A17 Motherboard – Location of Power Supply Voltage Check Connections

2. Check the power supply voltages at J4 and J13 of the motherboard. The correct voltages and acceptable AC ripple are listed in Table 7-1 below:

Table 7-1. DC Power Supply Voltage Checks

Connect To			DC Supply Voltage	AC Ripple and Noise
Connector	Common (Pin)	Measure (Pin)		
J13	8	16	0 Vdc	50 mVpp
J13	8	1	+4.8 Vdc to +5.1 Vdc	50 mVpp
J4	4	2	+9 Vdc +5% / –0%	50 mVpp
J4	4	6	+18 Vdc +5% / –0%	50 mVpp
J4	4	10	–18 Vdc +5% / –0%	50 mVpp
J4	4	12	+27 Vdc +5% / –0%	50 mVpp
J4	4	14	–27 Vdc +5% / –0%	50 mVpp

3. If the instrument continuously power cycles approximately once per second, it is possible that a PCB or RF component has developed a short. To troubleshoot this type of problem, lift each PCB (one by one) out of its enclosure and try to restart.

4. If a problem PCB is not found, disconnect each RF component by gently unplugging the bias connector from the motherboard connector. Do not disconnect RF cables.

5. When the faulty PCB or RF component is disconnected, the VNA will power-up, but other error messages will appear. After the defective assembly is identified, it can then be replaced.

7-3 Boot-Up Problems

Boot-up Process Sequences

The boot-up process is controlled by the firmware resided in the internal flash memory on the A9 PCB assembly. The boot-up activities include:

- Testing and initializing the A9 Main Processor PCB
- Communicating with the internal File Server
- Loading the system software from the SD card into memory
    - The Startup firmware first checks if a USB memory stick is inserted to the front panel USB port.
    - If it is, the firmware searches for the system software files on the USB memory stick.
    - If system software files are found, the firmware loads the system software from the USB memory stick into both the internal memory and the SD card.
- Starting operation of the system software

In Figure 7-2 below, the boot-up troubleshooting procedure flow is shown.

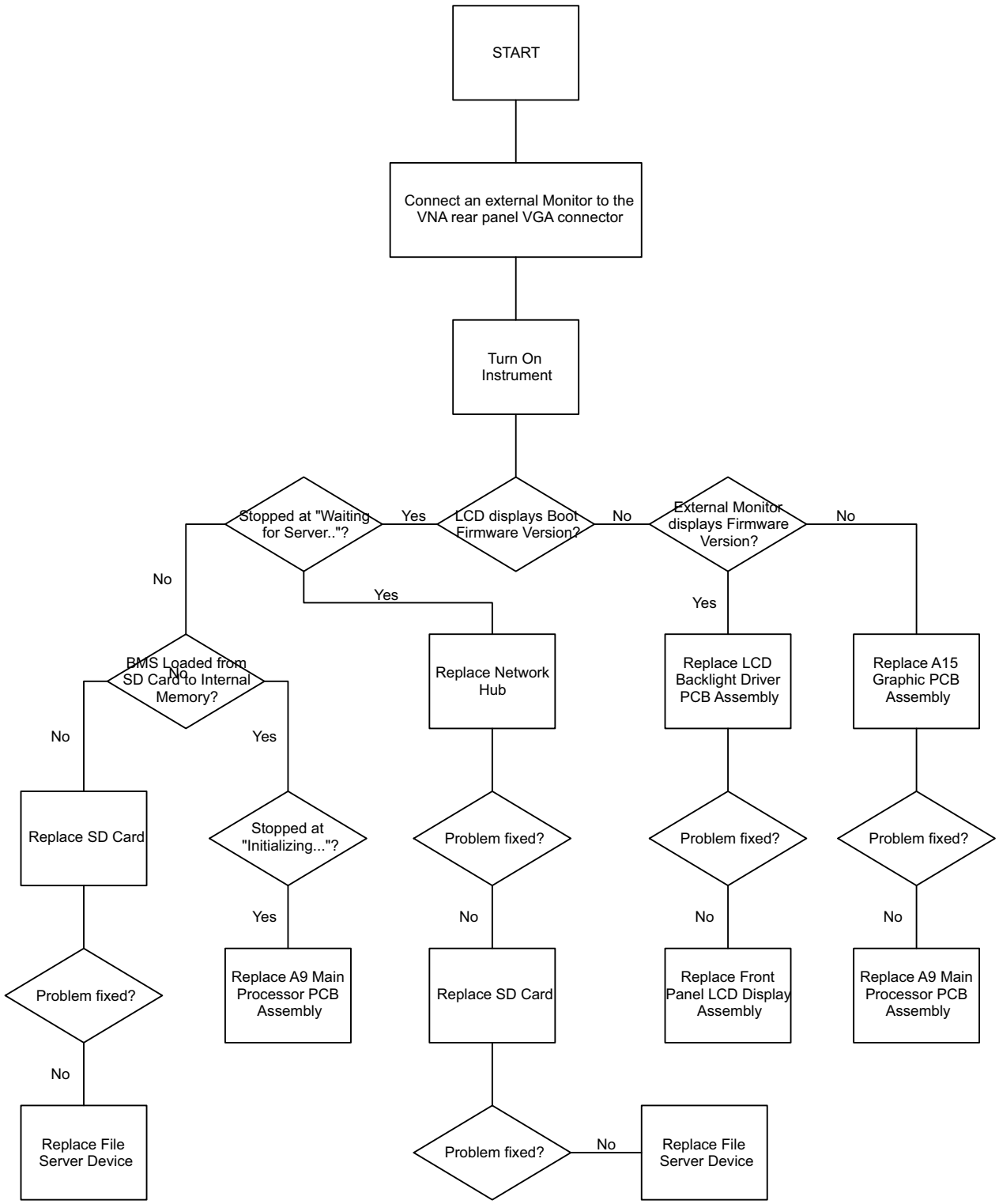


Figure 7-2. Lightning 37xxxE Bootup Problem Troubleshooting Flowchart

At this point, the system software continues the boot-up process by performing the following activities:

- Performing basic communications tests between the digital system and the analog subsystem; this is part of a minimal self test

- Conducting an IF Calibration
- Resetting and loading the front panel state that was in effect prior to the last power down
- Starting the measurement process

Note	The system software fully controls the VNA system after boot-up (with operator intervention and guidance). The system software is only loaded once upon initial power up.

Troubleshooting Boot-up Problems

To start the troubleshooting of boot-up related problems, perform the following preliminary checks:

1. Observe the front panel display during the boot-up process for information as to which part of the process failed or did not execute
2. Verify that the system power supplies are working properly as per Section 7-1
3. Upon completion of the preliminary checks, perform the following procedures, as appropriate.
4. If power supplies are working properly, follow the steps described in flow-char above in Figure 7-2, “Lightning 37xxxE Bootup Problem Troubleshooting Flowchart” on page 7-5.

7-4 Other Boot-Up Problems

Numerical Error Message Displayed

Error messages having a numerical prefix of 01xx through 21xx indicate which PC board is likely to have failed. For example:

- “0311 TA IF COMM FAIL” indicates that the A3 PCB is not communicating correctly.
- “4500 IF Cal Failure” messages usually require analysis of the Service Log. Refer to Section 7-7 “Error Messages During Measurements” on page 7-8.

Loss of Calibration or Saved Setups After Power-Down

If any of the setups shown below are lost after power-cycling, the cause is probably a defective coin-style 3V battery on the A9 PCB. This battery (Panasonic CR2032 or equivalent) is readily available at retail stores.

- **Cal LED** is out after power-cycling (**Cal LED** was ON when power was turned off)
- Front Panel setup does not match setup when power was turned off
- Internal Memories (1 through 10) have lost saved setups
- GPIB addresses have changed

Warming Up … Please Wait

This error message indicates that the 37xxxE is not capable of phase locking the RF Source (internal or external) and is displayed only during the first 5 to 10 minutes after turn-on. There are many possible causes for this failure, such as factory recalibrations being overdue, system hardware being setup incorrectly (external RF Source), or a failed assembly in the instrument.

After approximately 10 minutes, if the problem still exists, Lock Failure messages will usually appear. The following checks should be made (in this order):

1. Check all front panel cables on instruments having Option 15.
2. Press OPTION MENU | RECEIVER MODE keys and ensure that the mode is set to "Standard."
3. Perform a master reset (**Default Program | 0 keys**). Reload the Cal Kit Coefficients data via front panel USB port after this reset.
4. Analyze messages shown in the Service Log. Take note of the date of last calibrations.
5. Troubleshoot lock failure messages as described in this chapter.

7-5 Understanding the Service Log

The VNA Service Log may be viewed under the **Option Menu** | DIAGNOSTICS | Read Service Log key sequence. This log displays general instrument configurations, factory calibration dates, and a list of messages. These messages show instrument problems and other informational messages, such as GPIB programming errors and operator setup problems.

As mentioned in the previous section, error messages having a numerical prefix of 01xx through 21xx indicate which PC board is likely to have failed. For example, "0311 TA IF COMM FAIL" indicates that the A3 PCB is not communicating correctly.

Messages that are labeled "Informational" or those that describe a GPIB command fault or GPIB response time out do not indicate problems with the instrument functionality.

Messages containing the words "Phase Lock Failure" are discussed in Section 7-7 "Error Messages During Measurements" on page 7-9 below.

Messages relating to "warming-up" indicate that the instrument is not source-locking correctly when cold. The 37000E is not malfunctioning in this cold condition since the specified warm-up time has not been achieved.

Messages of "RF Unleveled" are frequently caused by the operator setting the RF Source power above Default. To correct this situation, lower the RF power of the Source (Setup Menu / Test Signals key sequence). If the message, "RF Unleveled" appears with the Source Power set to 0 dB (Default) or lower, a problem exists with the 37000E.

Numerical data with no easily understood identifying labels is of use only to Anritsu Service personnel in the process of PC board repair. PCB repair is a factory-only function.

The following items of information found in the Service Log are highly useful to Service Engineers when troubleshooting errors:

- **SWP=R or SWP=F**
  - This indicates whether the instrument was in forward or reverse sweep when the problem occurred, and is useful in Phase Lock Failure troubleshooting and RF Unleveled problems.
- **PWR –x.x**
  - All 37000E instruments have default power settings of –7 dBm or above shown under the Setup Menu / Test Signals key sequence.
- **SYS x.xxxx**
  - This indicates the approximate frequency at which the problem occurred.
- **<OVL>**

- This indicates “out-of-range”. The internal 37xxxE DVM was not able to measure the voltage. This is particularly useful information when troubleshooting IF Calibration errors.

7-6 Diagnostic Displays

The Diagnostic displays listed below are useful in troubleshooting the 37xxxE problems to the replaceable subassembly level. These displays are found under the Option Menu / Diagnostics / Troubleshooting key sequence. Other troubleshooting displays are for component-level troubleshooting by factory technicians only.

- Non-Ratio Parameters
- LO1 Phase Lock Voltage
- LO2 Main Phase Lock Voltage
- Source Linearity Voltage
- GPIB Test (found under the Diagnostics / Peripheral Tests menu key sequence)

These displays are identical to those shown automatically in the 2300-178 Operational Tests program described in Chapter 4, “Operational Performance Tests”. Information regarding failures of each test is also included in Chapter 4.

After the desired tests have been performed, the user must select “Finished, Recover from Troubleshooting” or press the **Default Program** key to exit this mode.

7-7 Error Messages During Measurements

Lock Failure D or DE (60xx)

The Lock Failure D or DE error message indicates that the source phase locking circuits are not operating. If the instrument is fitted with Option 15 Flexible Test Set, check all of the front panel cables connected in the "a1" and "a2" RF paths. Occasionally, this problem may be solved by performing new recalibrations as described in Chapter 6, "Adjustments".

If the condition persists, the difficult nature of this problem means that the 37xxxE should be returned to an Anritsu Service Center where factory-trained Service Engineers and replacement parts are available.

Note	If the error message also contains the prefixes A, B, or C, the corrective action is found in paragraphs farther down in this section.

The following additional information sources are useful to solve this problem:

- Service Log Information
- Troubleshooting Flowcharts
  - Figure 7-3, "Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only (1 of 3)" on page 7-12 (Figures 7-2 or 7-3)
  - Figure 7-4, "Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only) (2 of 3)" on page 7-13
  - Figure 7-5, "Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only (3 of 3)" on page 7-14
  - Figure 7-6, "Error Code DE Lock Failure Troubleshooting – 20 GHz and 40 GHz Models Only (1 of 1)" on page 7-15
- Block Diagrams for the Source Lock Paths Found in Chapter 3, "Theory of Operation"Chapter 3
  - Figure 3-1, "Block Diagram – RF Source, Typical Test Set, and Receiver Down Conversion Modules – Part 1 of 2." on page 3-2 (Figures 7-2 or 7-3)
  - Figure 3-3, "Block Diagram – Test Signal Paths – 20 GHz and 40 GHz Models" on page 3-4 (Figures 7-2 or 7-3)
  - Figure 3-4, "Block Diagram – Source Lock Signal Paths – 20 GHz and 40 GHz Models" on page 3-5 (Figures 7-2 or 7-3)
  - Figure 3-5, "Block Diagram – Test Signal Paths – 65 GHz Models" on page 3-6 (Figures 7-2 or 7-3)
  - Figure 3-6, "Block Diagram – Source Lock Signal Paths – 65 GHz Models" on page 3-7 (Figures 7-2 or 7-3)
- DC Voltage Tables 7-2 through 7-4
  - Figure 3-1, "Block Diagram – RF Source, Typical Test Set, and Receiver Down Conversion Modules – Part 1 of 2." on page 3-2 (Figures 7-2 or 7-3)
- Power Meter
- DC Voltmeter
- Oscilloscope
- Spectrum Analyzer

Other Lock Failures

Lock Failure A, B...

The "A" indicates a failure of the 10 MHz system clock and all other prefixes and error messages are a result of the 10 MHz clock failure. Replace the A7 PCB.

Lock Failure B, D, E

This indicates that the LO1 (A1 PCB) has failed. Replace the A1 PCB and recalibrate the LO1 as described in Chapter 6, "Adjustments" above.

Lock Failure C, D, E

This indicates that the LO2 (A2 PCB) has failed. Replace the A2 PCB and recalibrate the LO2 as described in Chapter 6, "Adjustments" above.

RF Unleveled

This problem is usually caused by setting the Source power above the instrument capabilities for the frequency range selected. If the Source power is set above default value (0 dB) and reducing the source power causes the message to disappear, the 37000E is not malfunctioning.

If the message appears and the Source power is at default power or lower, the 37000E is not operating correctly. Performing the Source ALC Calibrations (Chapter 6, "Adjustments") may solve the problem. If the problem persists, the difficult nature of this problem means the best solution is to return the VNA to an Anritsu Service Center for repair.

IF Cal Failures (during self-test or measurement)

If only "Test A" is noted on the front panel error messages or <OVL> is present in the Service Log only in the "A" voltages section, the problem is most likely a fault of the A3 PCB.

If only "Test B" is noted on the front panel error messages or <OVL> is present in the Service Log only in the "B" voltages section, the problem is most likely a fault of the A6 PCB.

If only "Ref" is noted on the front panel error messages or <OVL> is present in the Service Log only in the "R" voltages section, the problem is most likely a fault of the A4 PCB.

If there are multiple (usually 3) "IF Cal Failure" error messages on the 37000E front panel or <OVL> appears in the "A," "B," and "R" voltages sections of the Service Log, the problem is most likely a failure of the 10 MHz internal time base. Replace the A7 PCB.

7-8 Measurement Accuracy Problems

All Data on All Channels is Greatly Inaccurate

Refer to the block diagrams in Chapter 3, "Theory of Operation" that are labeled "Signal Paths."

For 65 GHz models, refer to the block diagram of the Test Signal paths (Figure 7-5, "Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only (3 of 3)" on page 7-14Figure 7-4).

Also, refer to:

- Table 7-2, "Typical Reference Signal Values in dBm - 65 GHz Models Only" on page 7-16
- Table 7-3, "Typical Transfer Switch Voltages – D27030 – CW, Single Channel Display – 65 GHz Models Only" on page 7-16
- Table 7-4, "Typical SPDT Switch Voltages – 29855 – CW, Single Channel Display – 65 GHz Models Only" on page 7-16

For Table 7-2, Table 7-3, Table 7-3, and Table 7-4, the use of a spectrum analyzer, oscilloscope, and DVM will be useful to find the defective assembly.

The instrument may be in an unusual setup, such as a non-phase-locked "Receiver" mode, or the internal memory buffers may have corrupt data due to a process that was started, but incorrectly terminated. To correct this problem, press the Default Program key, then the 0 key to return the instrument to normal measurement condition and clear the memory buffers. Reload all of the coefficient disks from the Calibration Kits.

Excessive Ripple in the Display of Low-Loss Devices

Ensure that all of the calibration coefficients are loaded into the VNA. The coefficients may have been erased by a Default Program / 0 reset.

The calibration selected should be 12 Term. Also perform the calibration using sliding terminations rather than broadband fixed terminations.

Insufficient System Dynamic Range

Select “Include Isolation” and increase the RF Source power during the calibration setup.

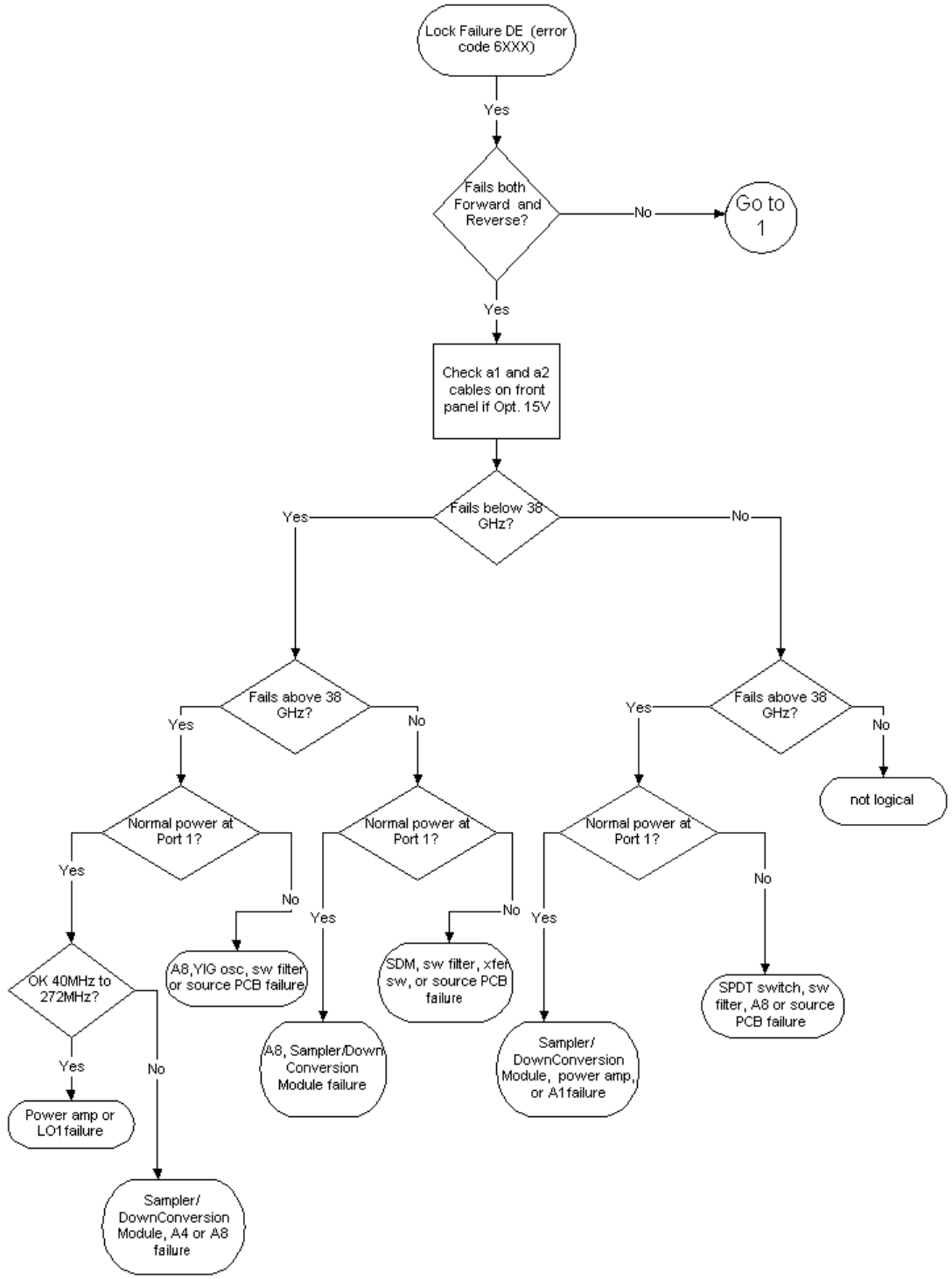
Before measuring the Isolation Devices during the calibration, press the Video IFBW key and select “10 Hz Minimum”.

During the measurement of the DUT, select “10 Hz IF Bandwidth.”

Perform the automated “System Dynamic Range” test found in the 37000 Test Program (described in Chapter 4). If this test fails, the problem is typically solved by replacement of the Sampler/Down Conversion Module.

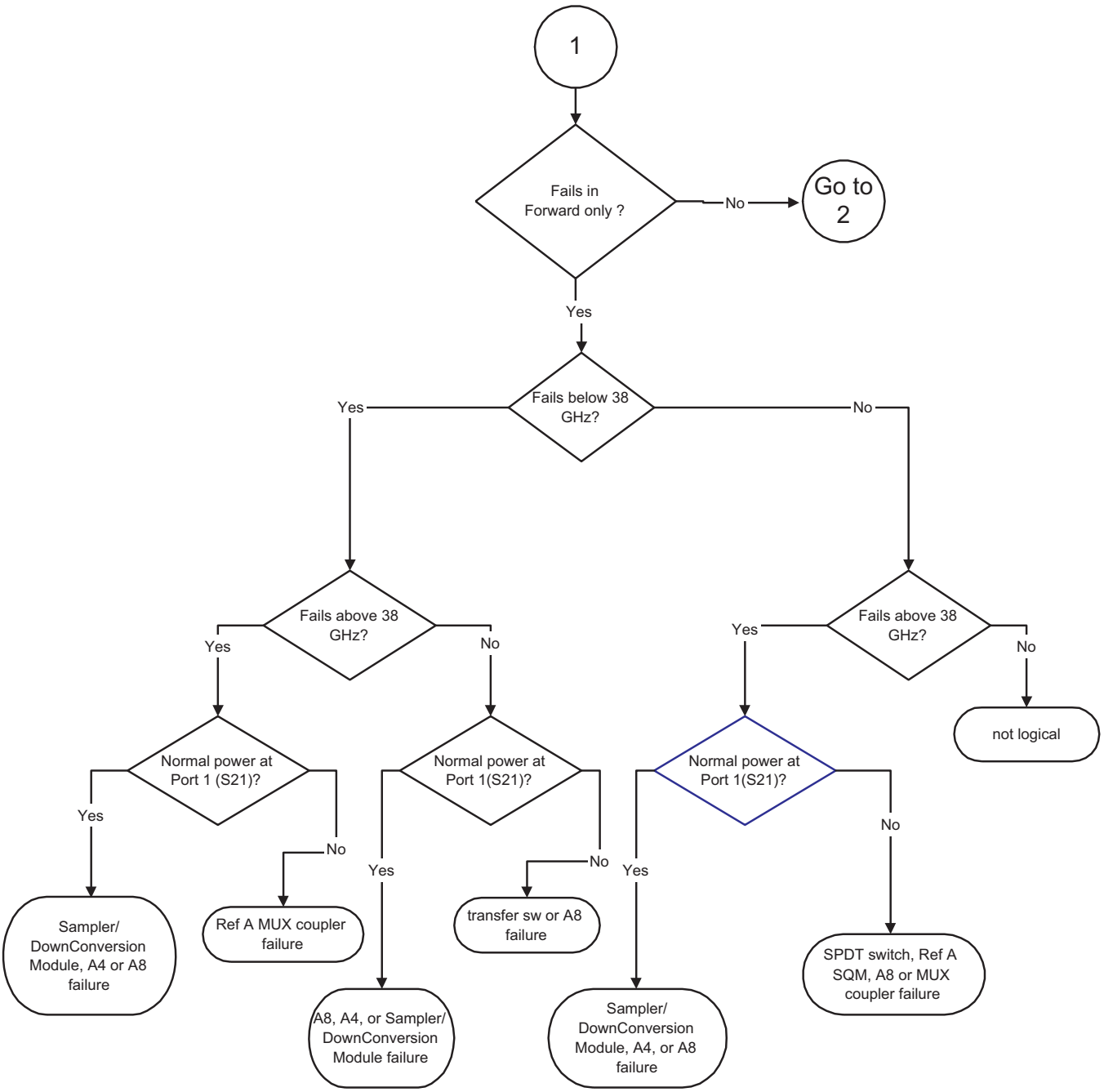
7-9 Non-Response or Other Unusual Behavior

Many problems may be solved simply by performing a Master Reset, which clears all memory buffers and sets the instrument to factory-default settings. To do this, press the **Default Program** key, then the **0** key. Note that this will also clear all setup memories (#1 through #10), and will delete all Calibration Kit coefficients. The Calibration Kit coefficients must be reloaded using the USB Memory Device from the Calibration Kit.



1 – Go to Figure 7-4 on page 7-13

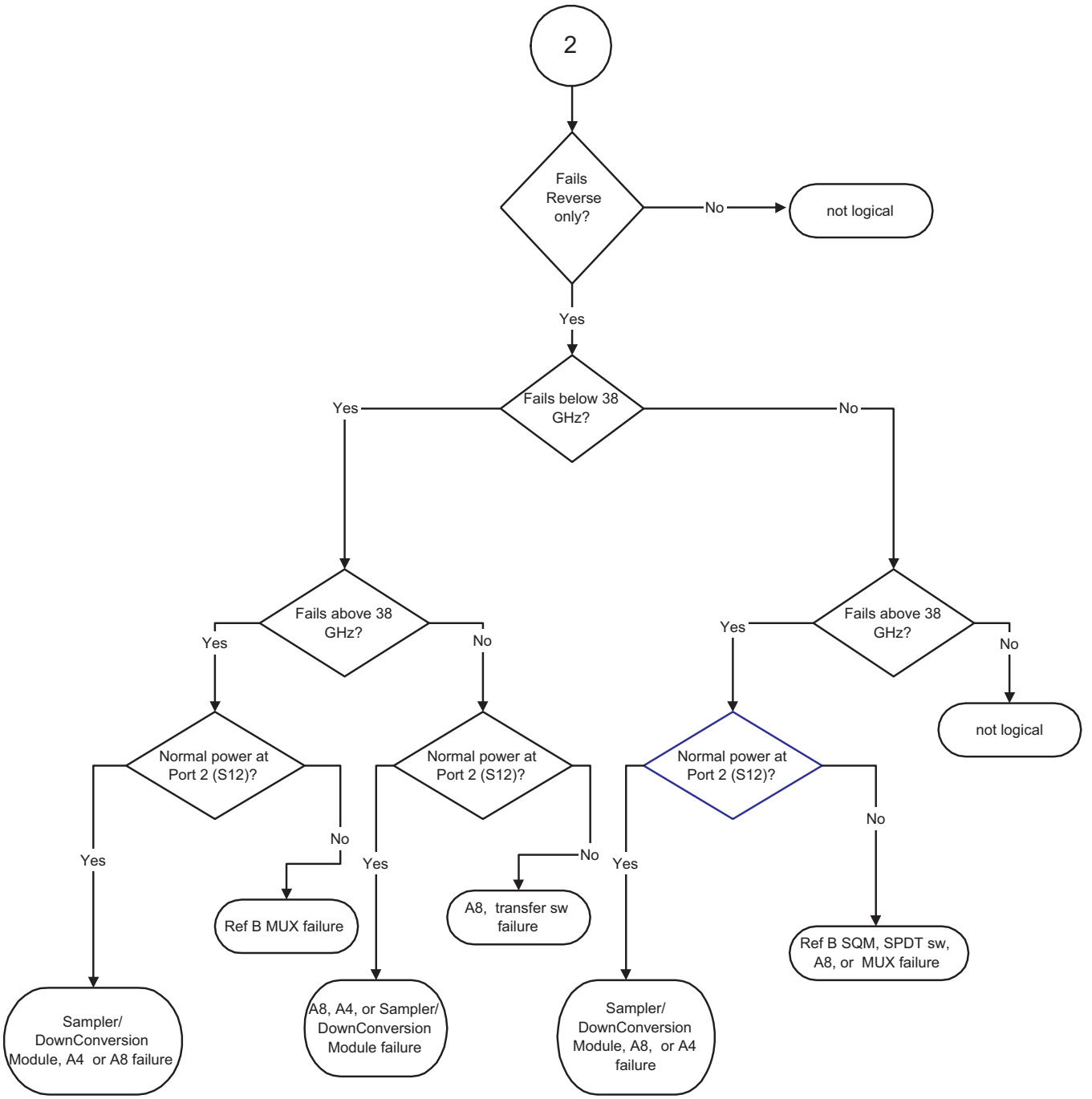
Figure 7-3. Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only (1 of 3)



1 – Go to Figure 7-3 on page 7-12

2 – Go to Figure 7-5 on page 7-14

Figure 7-4. Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only) (2 of 3)



Start – Go to Figure 7-3 on page 7-12

2 – Go to Figure 7-5 on page 7-14

Figure 7-5. Error Code DE Lock Failure Troubleshooting – 65 GHz Models Only (3 of 3)

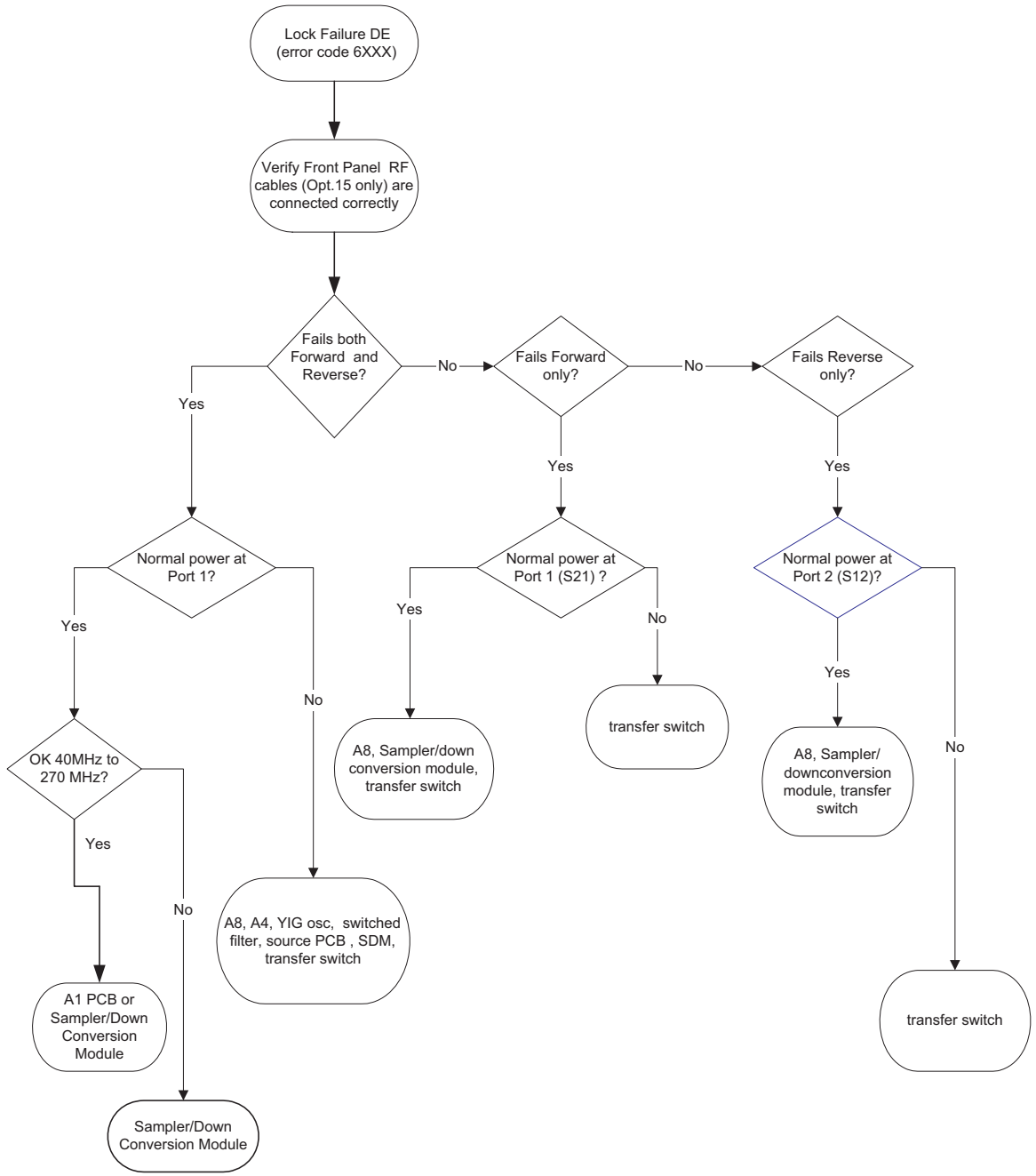


Figure 7-6. Error Code DE Lock Failure Troubleshooting – 20 GHz and 40 GHz Models Only (1 of 1)

Table 7-2. Typical Reference Signal Values in dBm - 65 GHz Models Only

	Measurement in dBm				
Frequency	**SQM In**	**SDM Out**	**MUX J4**	**MUX J1**	**Sampler/Down Conversion Module Input**
20 GHz	NA	+18	+6	NA	–26
37 GHz	NA	+20	+4	NA	–28
40 GHz	+19	NA	NA	+14	–28
50 GHz	+18	NA	NA	+14	–23
65 GHz	+16	NA	NA	+10	–26

Table 7-3. Typical Transfer Switch Voltages – D27030 – CW, Single Channel Display – 65 GHz Models Only

	Below 38 GHz		Above 38 GHz	
Wire Color	**S21**	**S12**	**S21**	**S12**
Brown	+2.0	–3.3	+2.0	+2.0
Black	–6.7	+1.6	+1.6	+1.6
White	+1.6	–6.8	+1.6	+1.6
Grey	–3.3	+2.0	+2.0	+2.0

Table 7-4. Typical SPDT Switch Voltages – 29855 – CW, Single Channel Display – 65 GHz Models Only

Wire Color	Forward	Reverse
Brown	+1.2	–3.7
Grey	–3.7	+1.2

Chapter 8 — Removal and Replacement Procedures

8-1 Introduction

This chapter provides procedures for removing and replacing the 37xxxE field exchangeable assemblies and components. When using these procedures, please observe the warning and caution notices below:

Warning	Hazardous voltages are present inside the instrument when AC line power is connected. Turn off the instrument and remove the line cord before removing any covers or panels.

Caution	Many assemblies in the VNA contain static-sensitive components. Improper handling of these assemblies may result in damage to the assemblies. Always observe the static-sensitive component handling precautions described in Figure 1-2, “Handling Procedures for Static Sensitive Components” on page 1-6 in Chapter 1, “General Information”. 37000E instruments are covered by a three year factory warranty. Unauthorized repair attempts by non-Anritsu service personnel will void this warranty. All RF connections (at the Wxxx cables) should be torqued to 8 lbf·in (“8 inch-pounds”) using the 5/16” 01-201 torque end wrench from a Calibration Kit. Check for RF discontinuities and other failures using the first six to eight tests in the 2300-178 program.

8-2 Required Equipment

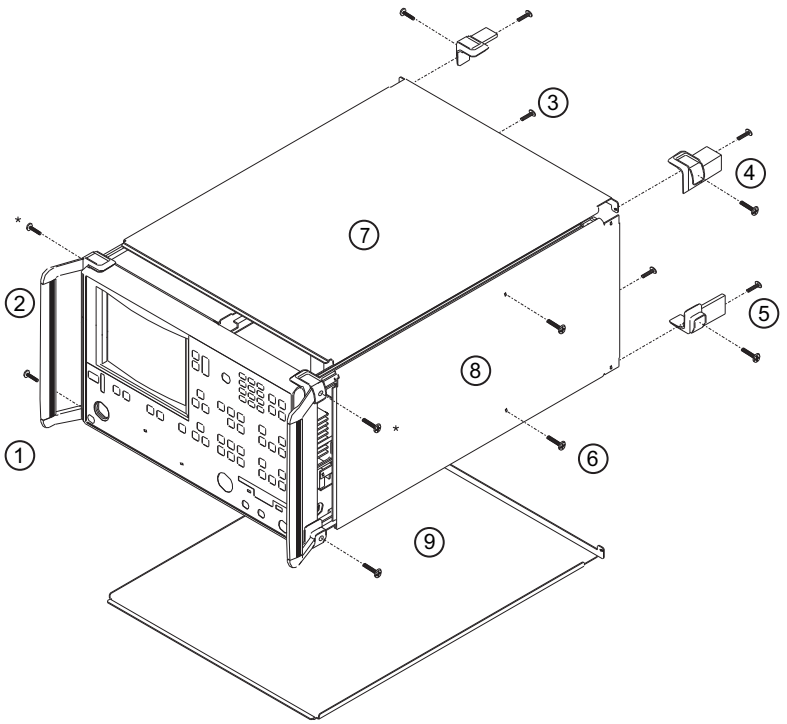
- All procedures in this chapter require the use of either a #1 or #2 size Phillips-head screw driver.
- Most procedures require two 5/16” end wrenches consisting of 5/16” (8 mm) end wrench used in combination with an 5/16” Torque End Wrench set to 8 lbf·in (8 inch pounds or 0.9 N·m) such as an Anritsu 01-201 Torque End Wrench.

8-3 Covers

Adjustment and troubleshooting operations require removal of the top cover. Replacement of some VNA assemblies and parts require removal of all covers. The following procedures describe this process.

Note	It is only necessary to loosen the VNA handle assemblies to remove the top, bottom, or side covers. However, if the front panel is to be removed, remove the handle assemblies at this time.

Identification



1 – Front Handles – Loosen or remove.

2 – Handle mounding screws – Phillips head – two each side – four total

3 – Remove Center Screw – Frees top/bottom covers

4 – Remove two top feet – Phillips head screws – two each foot – four total

5 – Remove two bottom feet – Phillips head screws – two each foot – four total

6 – Remove two side panel screws – Phillips head screws – two each side cover – four total

7 – Top Cover

8 – Side Cover

9 – Bottom Cover

Figure 8-1. Removing Main 37xxxE Chassis Covers

See the Figure 8-2, “37xxxE All Covers Exploded View” on page 8-3 below for detailed description of all 37xxxE covers.

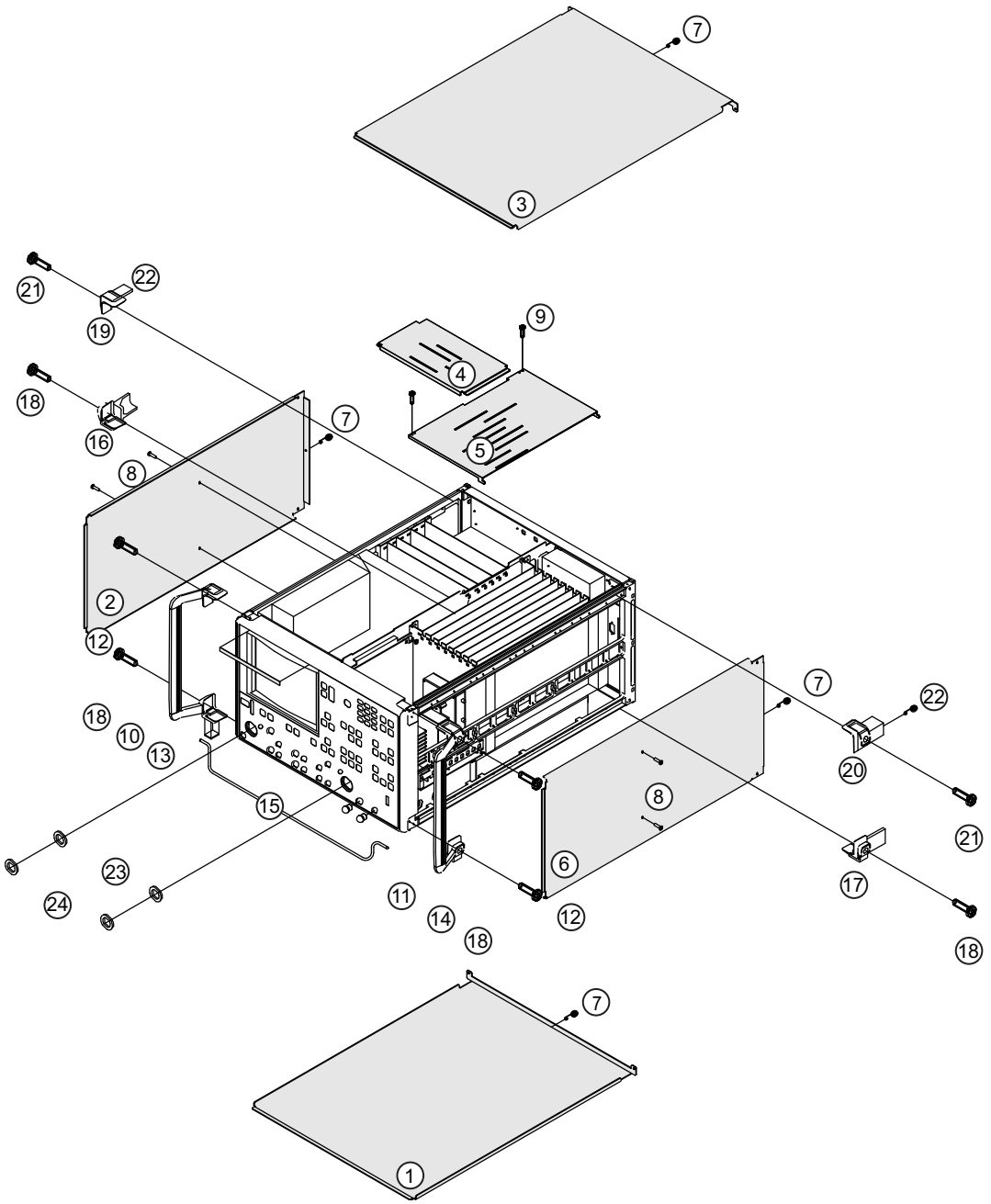


Figure 8-2. 37xxxE All Covers Exploded View (1 of 2)

1 – Chassis Cover Bottom
2 – Chassis Cover Left Side
3 – Chassis Cover Top
4 – Small Card Cage Cover
5 – Large Card Cage Cover
6 – Chassis Cover Right Side
7 – Rear screw for top, left, right, and bottom covers, Pan head 6×32 × 0.375”, 1 per cover, 4 total
8 – Middle screws side covers, Pan head 6×32 × 0.312” machine screw, 2 per cover, 4 total
9 – Screws for Large Card Cage Cover, Pan head 4×40 × 0.25” machine screw, 2 total
10 – Left Chassis Handle
11 – Right Chassis Handle
12 – Handle mounting screws, Pan head Phillips 5×24 machine screw with green washer, 2 per handle, 4 total.
13 – Bottom Left Front Chassis Foot
14 – Bottom Right Front Chassis Foot
15 – Chassis Tilt Bail
16 – Bottom Left Rear Chassis Foot
17 – Bottom Right Rear Chassis Foot
18 – Mounting screw for chassis feet, Pan head Phillips 5×24 machine screw with green washer, 1 per foot, 4 total.
19 – Upper Left Rear Foot Holder
20 – Upper Right Rear Foot Holder
21 – Rear foot holder screw, Pan head Phillips 5×24 machine screw with green washer, 1 per holder, 2 total.
22 – Pan head Phillips 6×32 × 0.437” machine screw, 1 per foot/holder, 4 total.
23 – Port Coupler Front Panel Thrust Washer
24 – Port Coupler Front Panel Nut

Figure 8-2. 37xxxE All Covers Exploded View (2 of 2)

Prerequisites

- Switch the VNA power off
- Remove the power cord.

Procedure

1. Loosen (or remove) the right and left handle assemblies, as follows:

- Place the VNA on its top (bottom-side up).
- Loosen/remove the screws at the sides of the handle assemblies.
- If removing handles, pull them away from unit and set aside.

Caution	The screws with green heads have Metric threads.

2. To remove the top cover:

- Place the VNA in normal (top-side up) position.

- Remove the feet from the two top corners at the rear of the VNA (Figure 8-1 on page 8-2 above).
- Remove the center screw from the rear of the top cover.
- Lift and slide the top cover away from the VNA.

3. To remove the bottom cover:

- Place the VNA on its top (bottom-side up).
- Remove the feet from the two bottom corners at the rear of the VNA.
- Remove the center screw from the rear of the bottom cover.
- Lift and slide the top cover away from the VNA.

4. To remove the left cover:

- Place the VNA on its right side (monitor down).
- If not already done, remove the feet from the two left-side corners at the rear of the VNA.
- Remove two center screws from the left cover.
- Remove the center screw from rear of the left side cover.
- Lift and slide the side cover away from the VNA.

5. To remove the right cover:

- Place the VNA its left side (monitor up).
- If not already done, remove the feet from the two right-side corners at the rear of the VNA.
- Remove the center screw from the rear of the right side cover.
- Remove the center screw from the rear of the right side cover.
- Lift and slide the side cover away from the VNA.

To replace the instrument covers, perform the steps above in the reverse order.

8-4 A1 to A16 PCBs

This section provides instructions for removing and replacing the A1 through A9 and A13 through A16 PCBs, which are located underneath the covers of the large and small card-cages, respectively.

Prerequisites

- Switch the VNA power to off. Remove the power cord.
- Remove the top cover (Section 8-3 “Covers” on page 8-2 above).

Remove/Replace Procedure for A1 to A16 PCBs

1. Place the VNA in normal (top-side up) position.
2. Remove the two screws that secure the large card-cage cover (Figure 8-3 on page 8-7 below).
3. Remove the two aluminum card-cage covers and set them aside.
4. Disconnect any MCX interconnect cables, if required.
5. Lift up on the edge tabs of the selected PCB and lift straight up.
6. If the A5 Analog to Digital Converter PCB is to be replaced, match the DIP switch settings on the to-be-replaced PCB with those on the replacement unit.

To replace the PCBs and covers, perform the steps above in the reverse order.

8-5 Remove/Replace A9 PCB Backup Battery

Use this procedure to replace the A9 Backup Battery – 3-633-43.

Identification

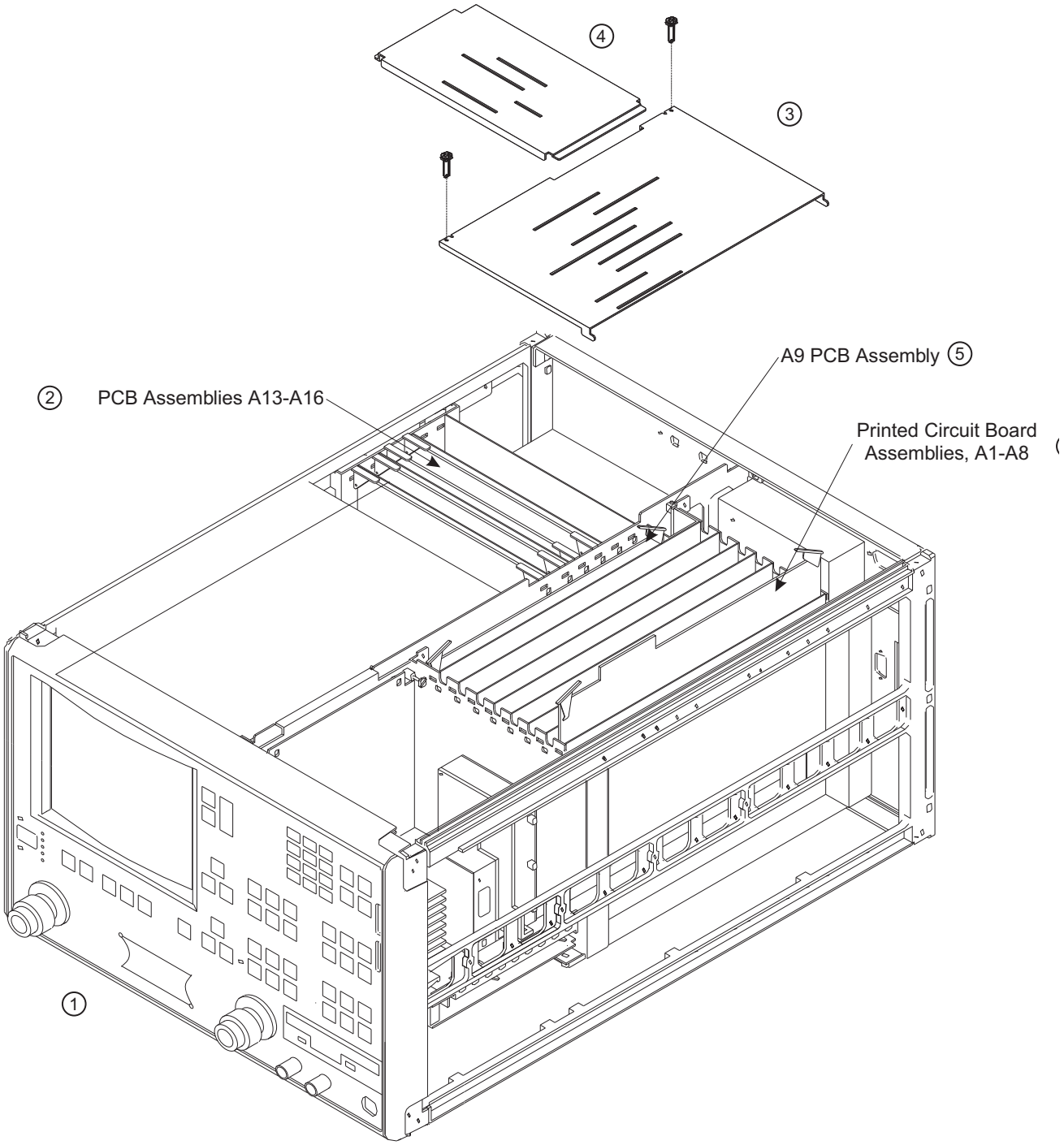


Figure 8-3. A1 to A16 PCB Assemblies Removal Diagram (1 of 2)

1 – Front Panel

2 – A13, A14, A15, and A16 PCBs

3 – PCB Covers

4 – PCB Covers

5 – A9 Main Processor PCB – with Backup Battery – 3-633-43

6 – A1, A2, A3/A6, A4, A5, A7, and A8 PCBs

Figure 8-3. A1 to A16 PCB Assemblies Removal Diagram (2 of 2)

Prerequisites

- Switch the VNA power to off. Remove the power cord.
- Remove the top cover (Section 8-3 “Covers” on page 8-2 above).

Remove/Replace Procedure for A9 Backup Battery

1. Place the VNA in normal (top-side up) position.
2. Remove the two screws that secure the large card-cage cover (Figure 8-3 on page 8-7 below).
3. Remove the two aluminum card-cage covers and set them aside.
4. Lift up on the edge tabs of the selected PCB and lift straight up.
5. Remove the A9 Main Processor PCB assembly.
6. Remove and replace the A9 Backup Battery.

Caution	This procedure only covers the A9 Lithium “Coin” Battery. Do not remove the BBRAM RTC/Battery Chip. Doing so will erase all A9 CPU configuration data and render the A9 PCB inoperable

To replace the A9 PCB and covers, perform the steps above in the reverse order.

- Remove the A9 Main Processor PCB.

8-6 Signal Source Modules

The following sections provide instructions for removing the Signal Source Module assembly for replacement of individual components.

See Section 8-7 “A21A2 Source Control PCB” on page 8-14 below for removal of the A21A2 PCB without removing the entire Source Module assembly.

Removal of individual source components is covered in the following sections:

- Section 8-8 “A21A1 Source YIG Bias Control PCB” on page 8-15
- Section 8-9 “Switched Filter Assembly” on page 8-16
- Section 8-10 “Source Down Converter Assembly” on page 8-17
- Section 8-11 “YIG Oscillator Assembly” on page 8-18

Note	After replacement of any item in the Source Module, all Source calibrations (frequency, ALC, Source Lock Threshold) must be performed. See Chapter 6, “Adjustments”.

Required Equipment

- Connector 5/16” torque end wrench set to 8 lbf·in inch, Anritsu Model 01-201 or equivalent.

Caution	Throughout these procedures, always use the 5/16” torque end wrench set to 8 lbf·in for connecting the Signal Source Module semi-rigid coaxial lines and RF/microwave components. The use of improper tools may damage the connectors, resulting in degraded instrument performance.

Identification

The figure below (Figure 8-4) shows the locations of major assemblies in the chassis top-side. The figure following (Figure 8-5, “Signal Source Module Assemblies Removal Details” on page 8-12) shows the major Signal Source Assembly Module component locations.

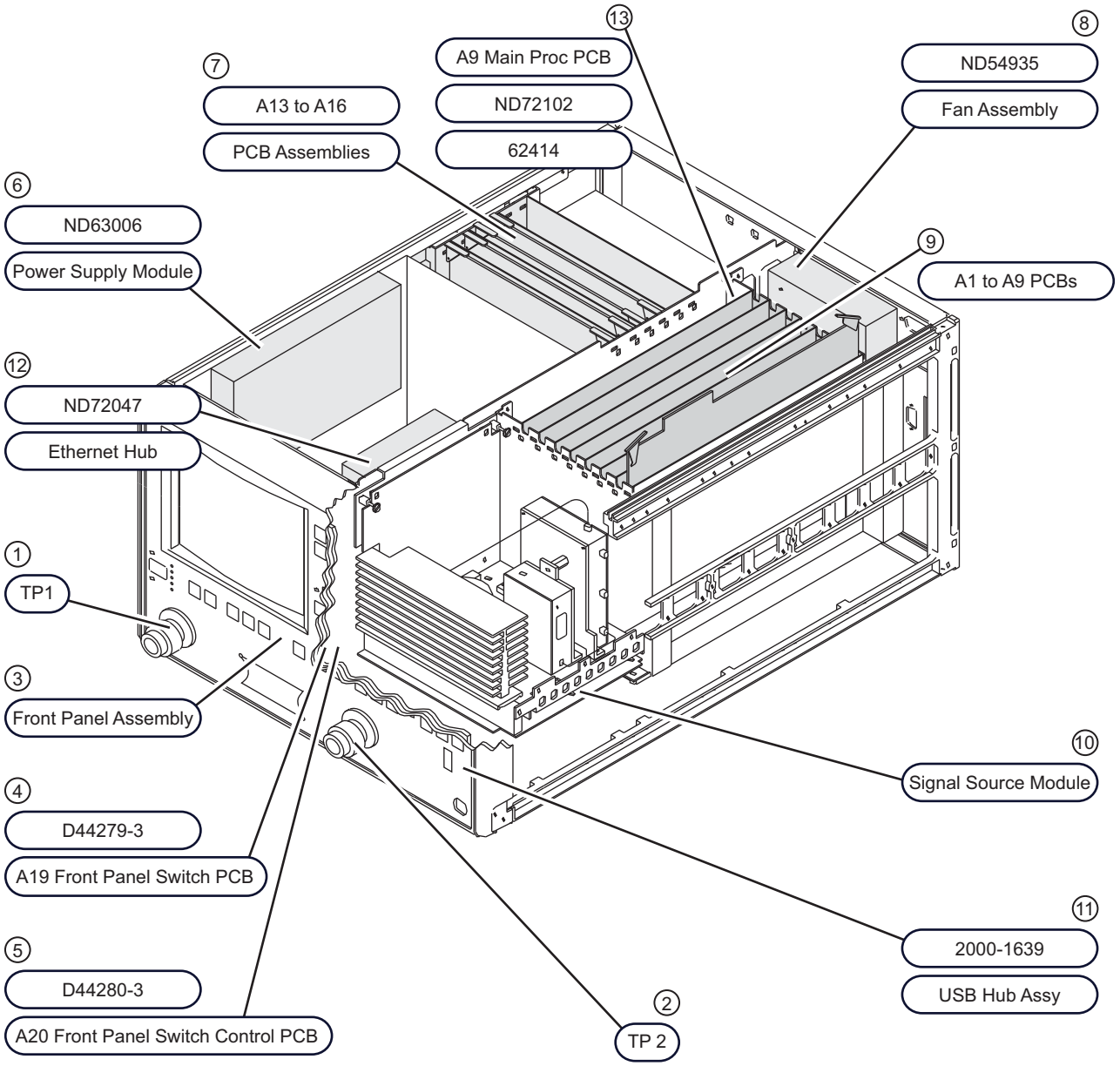
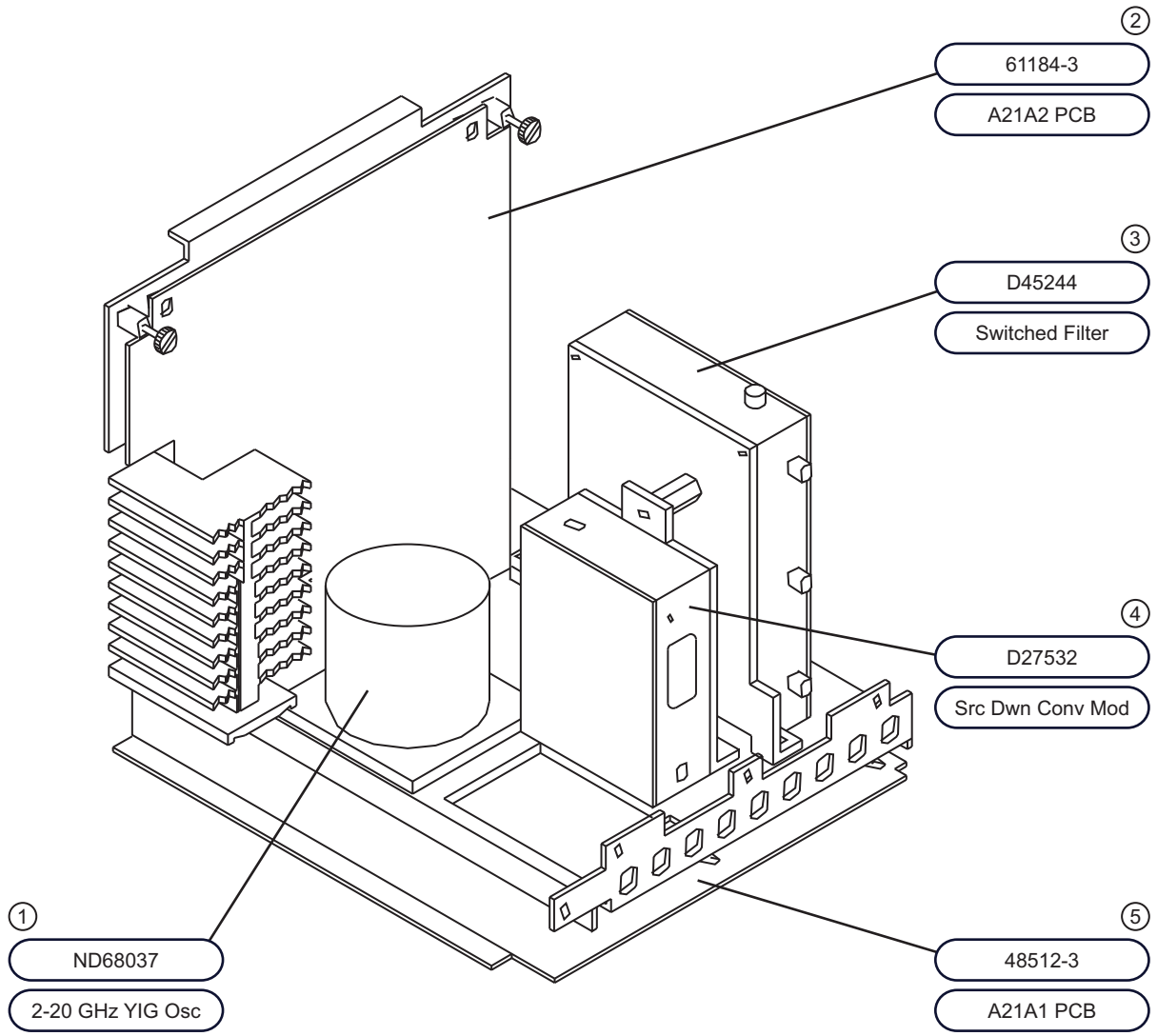


Figure 8-4. Major Assemblies Location Diagram (Top View) (1 of 2)

1 – Test Port 1
2 – Test Port 2
3 – Front Panel Assembly
4 – A19 Front Panel Switch PCB – D44279-3 – Behind Front Panel
5 – A20 Front Panel Switch Control PCB – D44280-3 – Behind Front Panel
6 – Power Supply Module – ND63006
7 – Printed Circuit Board Assemblies, A13 to A16:
  – A13 – I/O #1 PCB – D38513-4
  – A14 – I/O #2 PCB – D38514-3
  – A15 – Graphics Processor PCB – 63303-3
  – A16 – I/O Devices Power Distribution PCB – 71485-3
8 – Fan Assembly – ND54935
9 – Printed Circuit Board Assemblies, A1 to A9:
  – A1 – First Local Oscillator PCB – 57661-3 – ND60314
  – A2 – Second Local Oscillator PCB – 61835-3
  – A3/A6 – Test A, Test B IF Processor PCB – D38503-3
  – A4 – Reference IF Processor PCB – D41794-5
  – A5 – Analog to Digital Converter – D38505-4
  – A7 – 10 MHz/LO3 PCB – 61181-3 – ND62436
  – A8 – Source Lock / Separation Control PCB – 60866-3 – ND60702
  – A9 – Main Processor PCB – 62414 – ND63005
10 – Signal Source Module Assembly
11 – USB Hub Assembly – 2000-1639

Figure 8-4. Major Assemblies Location Diagram (Top View) (2 of 2)



1 – 2-20 GHz YIG Oscillator Assembly – ND68037
2 – A21A2 Source Control PCB Assembly – 61184-3
3 – Switched Filter – D45244
4 – Source Down Converter Module – D27532
5 – A21A1 Source YIG Bias Control PCB Assembly – 48512-3

Figure 8-5. Signal Source Module Assemblies Removal Details

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).

Signal Source Module Assembly Removal Procedure

Use the following procedure to remove the Signal Source Module from the chassis. This step is necessary before any of the module components can be removed or replaced.

1. Turn the instrument upside down and remove the RF cables that pass through the holes drilled in the motherboard (identified as W81, W87, W179, and W180 on different models).
2. Return the instrument to the normal operating position and, using steps below, remove the Source Module.
3. Disconnect the two cables from the A21A2 PCB.
4. Loosen the two captivated metal screws that attach the A21A2 bracket to the instrument frame.
5. Disconnect the ribbon cable from the Down Conversion Module.
6. Remove the cables W347, W235 and the fixed attenuator between them (found on the right side of the Source Module).
7. Remove the three screws on the right side of the instrument frame from the Source Module frame.
8. Lift the Source Module up, and remove by tipping the top to the right to clear the instrument frame.
9. To replace the Signal Source Module, perform the steps above in the reverse order.

8-7 A21A2 Source Control PCB

Use the following procedure to remove/replace the A21A2 Source Control PCB assembly.

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).

Procedure

1. Unfasten two black plastic PCB retainers at the top corners of the A21A2 Source Control PCB. To unfasten, turn screwdriver slot 1/4 turn counter-clockwise.
2. Pull the top of the A21A2 PCB away from the source module chassis back plate to clear PCB retainers. Gently pull up to disconnect the A21A2 PCB from the socket on the A21A1 Source YIG Bias Control PCB.
3. Remove the PCB from the Source Module assembly.
4. To replace the A21A2 Source Control PCB assembly, perform the steps above in the reverse order.

8-8 A21A1 Source YIG Bias Control PCB

Use the following procedure to remove/replace the A21A1 Source YIG Bias Control PCB assembly.

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).
- Remove the Source Module assembly (see Section 8-6 “Signal Source Modules” on page 8-9 above).

Procedure

1. Disconnect the Switched Filter assembly power cable from connector J1 of the A21A1 Source YIG Bias Control PCB. (Pull up gently on ribbon cable to disconnect.)
2. Similarly, disconnect the Down Converter assembly power cable from connector J4 of the A21A1 PCB.
3. Disconnect the YIG Oscillator assembly power cable from connector J3 of the A21A1 PCB. Pull up on the flexible circuit connector handle to disconnect.
4. Remove the screw that fastens the front apron of the source module chassis to the heatsink of the A21A1 PCB. See Figure 8-5 on page 8-12 above.
5. Remove the four screws that fastens the back plate of the source module chassis to the heatsink of the A21A1 PCB.
6. Place the Signal Source Module on a work surface with the back plate down.
7. Unfasten the six PCB retainers on the bottom of the A21A1 PCB. (To unfasten, turn screwdriver slot 1/4 turn counter-clockwise.) Gently separate the A21A1 PCB (including the heat sink) from the Signal Source Module.
8. To replace the A21A1 Source YIG Bias Control PCB assembly, perform the steps above in the reverse order.

8-9 Switched Filter Assembly

Use the following procedure to remove/replace the Switched Filter assembly.

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).
- Remove the Source Module assembly (see Section 8-6 “Signal Source Modules” on page 8-9 above).

Procedure

1. Disconnect the power cable from connector P1 at the rear of the Switched Filter assembly. (Use a small screw driver to pry up gently at each end of the connector, as necessary.)
2. Disconnect the semi-rigid coaxial lines from connector J6 (top) and connector J3 (lower-front) of the Switched Filter assembly.
3. Disconnect the semi-rigid coaxial line from the RF INPUT (top) connector of the Down Converter assembly.
4. Remove the two screws that fasten the Switched Filter assembly to the source module chassis and lift the assembly from the Signal Source Module.
5. Disconnect the semi-rigid coaxial line from connector J1 (bottom) of the Switched Filter assembly. Put this coaxial line aside for re-use.

Note	When replacing the Switched Filter assembly, connect the semi-rigid coaxial line to the bottom connector (J1), before attaching the assembly to the Signal Source Module.

6. To replace the Switched Filter assembly, perform the steps above in the reverse order.

8-10 Source Down Converter Assembly

Use the following procedure to remove/replace the Down Converter assembly.

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).
- Remove the Source Module assembly (see Section 8-6 “Signal Source Modules” on page 8-9 above).

Procedure

1. Disconnect the power cable from connector P1 at the front of the Down Converter assembly.
2. Disconnect the semi-rigid coaxial lines from the RF INPUT connector and RF OUTPUT connector of the Down Converter assembly.
3. Remove the two screws that fasten the Down Converter assembly to the source module chassis and lift the assembly from the Signal Source Module.
4. To replace the Down Converter assembly, perform the steps above in the reverse order.

8-11 YIG Oscillator Assembly

Use the following procedure to remove/replace the YIG (Yttrium Iron Garnet) Oscillator assembly.

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).
- Remove the Source Module assembly (see Section 8-6 “Signal Source Modules” on page 8-9 above).

Procedure

1. Disconnect the YIG Oscillator assembly power cable from connector J3 of the A21A1 PCB. Pull up on the flexible circuit connector handle to disconnect.
2. Disconnect the semi-rigid coaxial line from the connector J6 (top) of the Switched Filter assembly.
3. The YIG Oscillator is fasted in place with four Phillips head screws that in turn hold two retaining brackets. The screws thread into four standoffs which are in turn fastened to the top of the YIG Oscillator Heatsink.
4. Remove the four screws, set aside and then remove the two “half-moon” retaining brackets.
5. Disconnect the semi-rigid coaxial line from the output connector of the YIG Oscillator assembly. Put this coaxial line aside for re-use.

Note	When replacing the YIG Oscillator assembly, connect the semi-rigid coaxial line removed in Step 4 to the output connector of the YIG Oscillator before attaching it to the Signal Source Module.

6. Pull the YIG Oscillator assembly straight up to remove it from the Switched Assembly.
7. To replace the YIG Oscillator assembly, perform the steps above in the reverse order.

8-12 A24 VME Bus Terminator PCB

This section provides instructions for removing and replacing the A24 VME Bus Terminator PCB assembly.

Identification

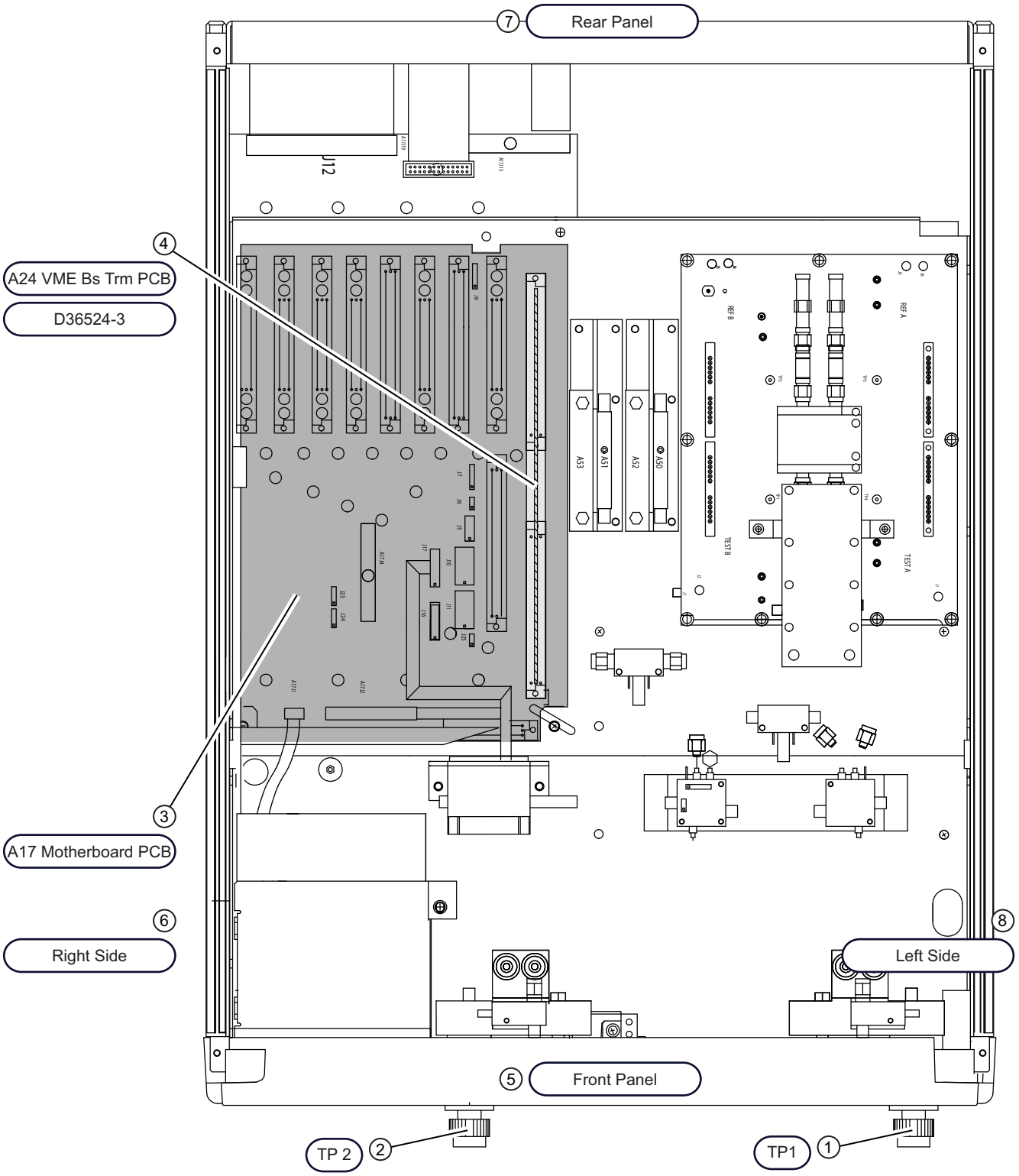


Figure 8-6. Location of the A24 VME Bus Terminator PCB Assembly (1 of 2)

1 – Test Port 1

2 – Test Port 2

3 – A17 Motherboard PCB

4 – A24 VME Bus Terminator PCB – D36624-3

5 – Front Panel

6 – Test Set Chassis Right Side

7 – Rear Panel

8 – Test Set Chassis Left Side

Figure 8-6. Location of the A24 VME Bus Terminator PCB Assembly (2 of 2)

Prerequisites

- Switch VNA power off. Remove the power cord.
- Remove bottom cover (Section 8-3 “Covers” on page 8-2 above).

Remove/Replace Procedure

1. Place the VNA on its top (bottom-side up).
2. Locate the A24 PCB assembly (Figure 8-3). Unplug A24 PCB assembly from the A17 Motherboard PCB by gently pulling straight up on each side.

Caution	Be careful not bend or disturb the hard coax lines located near the right edge of the A24 PCB.

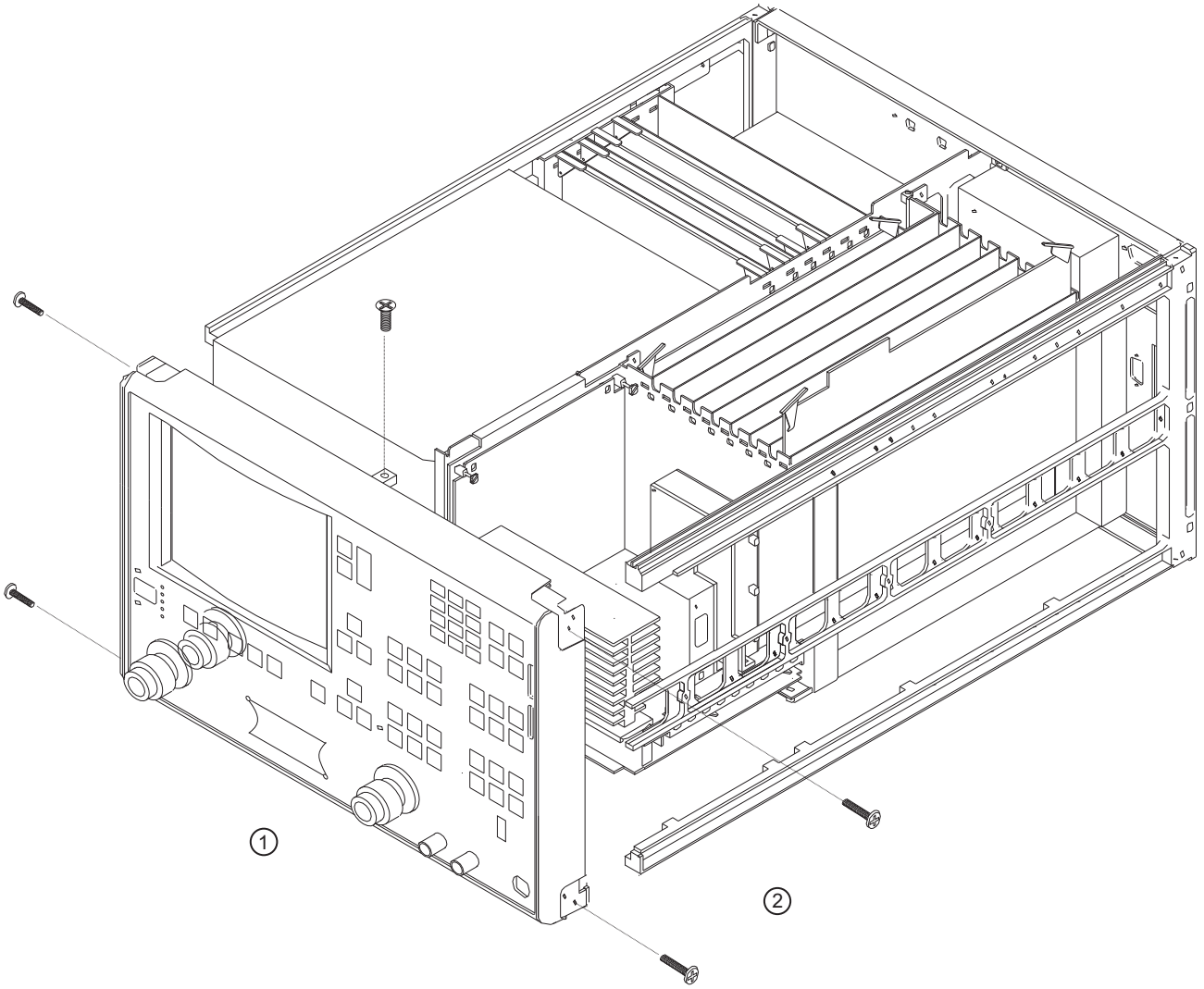
8-13 Front Panel Assembly

This section provides instructions for removing and replacing the VNA Front Panel assembly.

Required Equipment

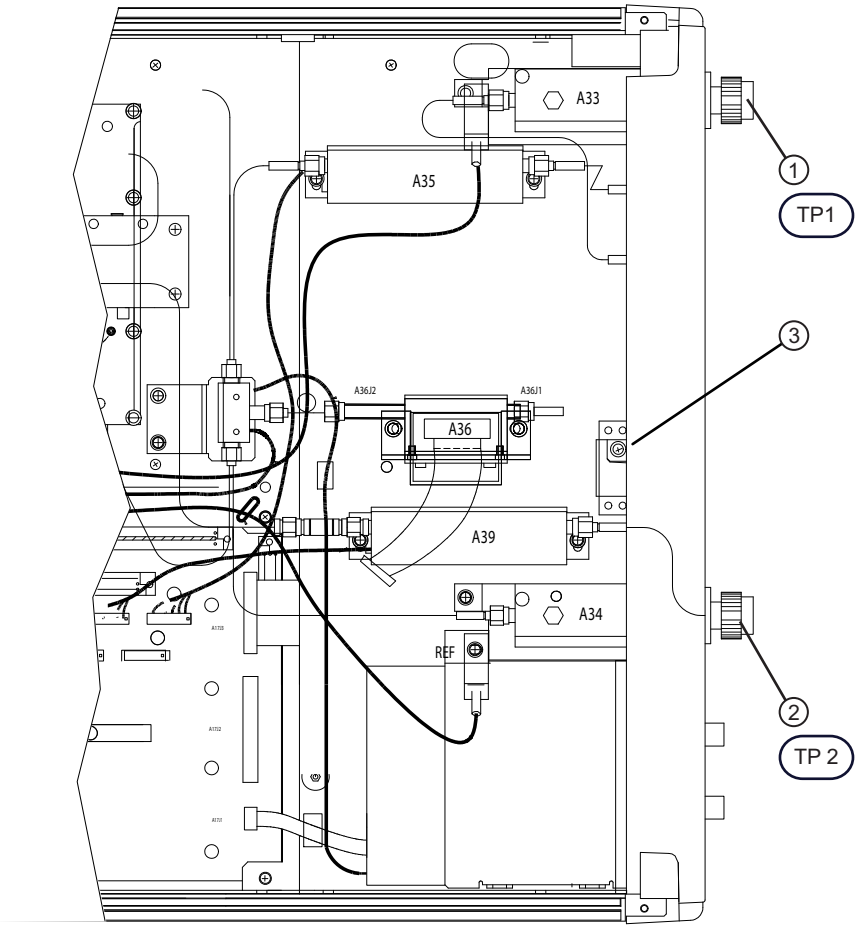
- Open-end wrench, 1 inch
- Hex driver, 3/32”, ball end

Identification



1 – Front Panel Assembly
2 – Mounting screws

Figure 8-7. Removal of Front Panel Assembly



Test Set Bottom View with Front Panel to right. The bottom side center front panel mounting screw is accessible with the instrument upside down. Shown here is a Lightning 37269E VNA. In other instrument models, the modules and their positioning vary, but Front Panel Mounting Screw is in the same location

1 – Test Port 1
2 – Test Port 2
3 – Front Panel Mounting Screw

Figure 8-8. Removal of Test Set Module

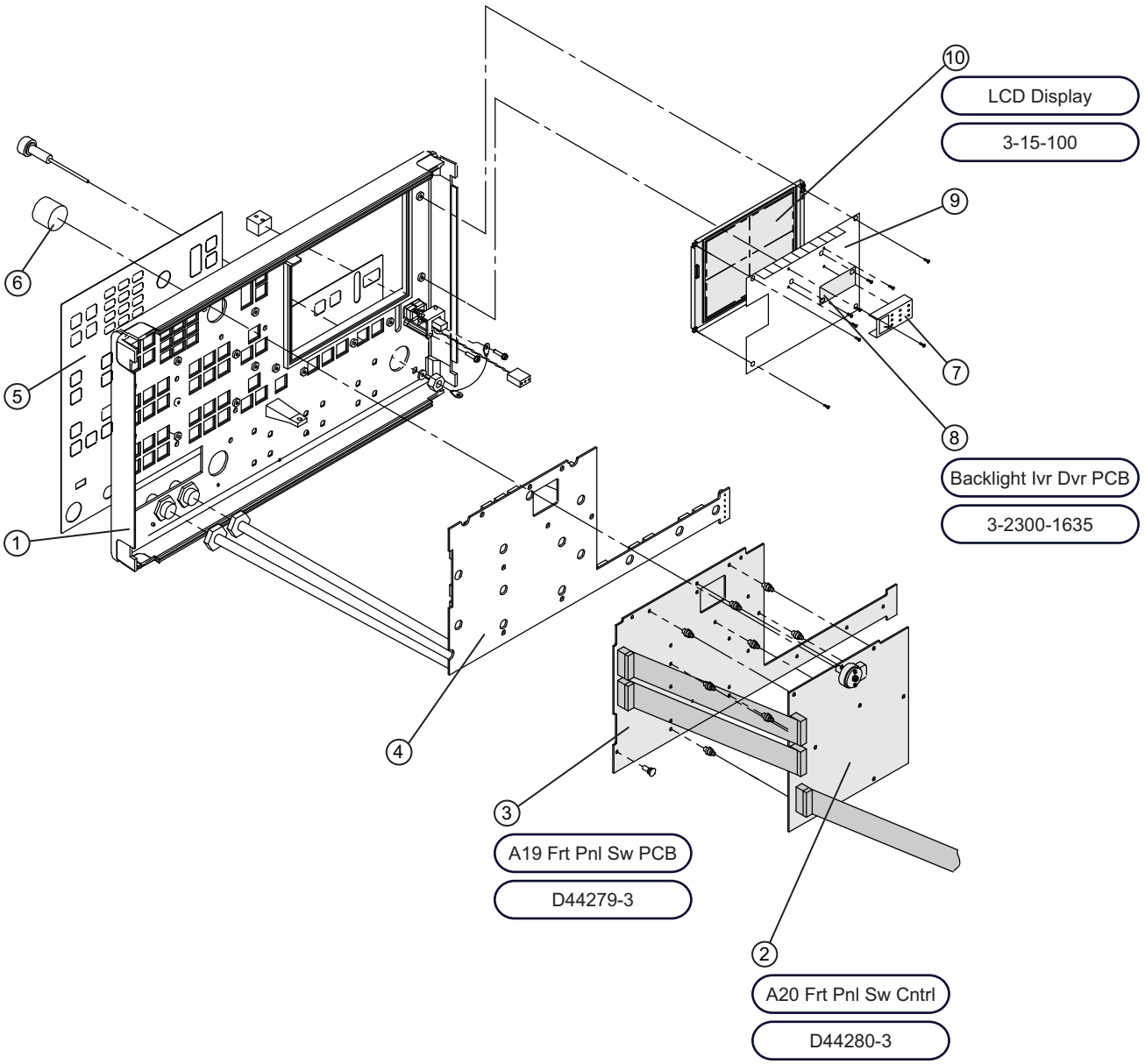


Figure 8-9. Front Panel Assembly (1 of 2)

Front Panel Assembly and Related PCS

1 – Front Panel Assembly

2 – A20 Front Panel Switch Control PCB – D44280-3

3 – A19 Front Panel Switch PCB – D33279-3

4 – Rubber Keypad – D42618

5 – Front Panel Overlay

6 – Knob for Rotary Controller

7 – LCD Backlight Inverter PCB Cover

8 – LCD Backlight Inverter PCB – 3-2300-1635

9 – LCD Protective Panel

10 – LCD Display – 3-15-100

Figure 8-9. Front Panel Assembly (2 of 2)

Prerequisites

- Switch the VNA power to off.
- Remove the power cord.
- Remove the handle assembles and all covers ((Section 8-3 “Covers” on page 8-2 above).

Note	On instruments with Option 15V (found only on 65 GHz instruments), there is a very high risk of damage to RF cables and connectors during re-assembly. Such instruments should be returned to an Anritsu Service Center for repairs to the front panel assembly.

Remove/Replace Procedure

1. Place the VNA in the right side up position.
2. Remove the four corner screws and the top center screw that secure the front panel assembly to the chassis (see was Figure 8-5).
3. Place the VNA upside down with the Test Set bottom-side modules facing up.
4. Remove the screw that fastens the front panel casting extension lip to the Test Set Module tray. (See diagram above in Figure 8-8.)
5. Using a 1” open-end wrench, remove the nuts and washers that secure the Port 1 and Port 2 couplers/bridges to the front panel casting.
6. Disconnect the cable from the front panel Power switch to the power supply control PCB.
7. Disconnect the cable from the front panel Keyboard interface connector to connector J16 on the A17 Motherboard PCB.
8. Disconnect all RF cables that are connected between the RF Deck and the front panel.

373xxE Series Cables

9. On 37347E, 37369E, and 37397E series models only.
   a. Disconnect the cables between the front panel Bias Input BNC connectors to connector P2 on the A18 Rear Panel PCB at A18, P2 end.
   b. Connector A18, P2 is the connector nearest to the bottom lip of the rear panel.

37x97E Series Hardware

10. On 37297E and 37397E 65 GHz models, remove the three hex head screws that attach each coupler to the front panel.

All Models

11. Pull the front panel assembly several inches away from chassis.
12. Disconnect the cable from the A17 Motherboard PCB to connector J1 on the A20 Front Panel PCB.
13. Pull the front panel assembly free and set it aside.
14. To replace the front panel assembly, perform the steps above in the reverse order.

8-14 Liquid Crystal Display (LCD) Assembly

This section provides instructions for removing and replacing the internal LCD assembly. This LCD display needs no periodic maintenance. Its life is estimated to be 50,000 hours by the manufacturer. If the A15 PCB and the backlight driver PCB have been determined to be functioning correctly, replacing the LCD will likely solve display problems.

Caution	Due to the likelihood of damage to RF cables and connectors, Anritsu advises to NOT remove the front panel of 65 GHz instruments having Option 15V to perform this repair.

Identification

See Figure 8-9, “Front Panel Assembly” on page 8-25 above for Front Panel orientation. See Callouts #8, #9, #10, and #11 for LCD components.

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove the right handle, top and bottom covers, and right side cover (see Section 8-3 “Covers” on page 8-2 above).

Remove/Replace Procedure

1. The LCD and shield is held in place by four (4) retaining screws that are clearly visible, but difficult to access.
2. The most appropriate procedure to replace the LCD depends on the presence or absence of Option 15 Front Panel RF Access Cables.
   - If Option 15 is installed, skip ahead to Step 3 below.
   - If Option 15 in NOT installed, skip ahead to Step 8 below.

If Option 15 IS Installed

3. When Option 15 is installed, the front panel should not be removed.
4. In this case, remove the Source Module and the Power Supply to access the 4 LCD retaining screws.
5. Remove the Power Supply as described in Section 8-15 “Power Supply Module” on page 8-29 below.
6. Remove the Source Module assembly as described in Section 8-6 “Signal Source Modules” on page 8-9 below.
7. Skip ahead to Step 10.

If Option 15 IS NOT Installed

8. When Option 15 is not installed, removing the Front Panel is the easier method of accessing the LCD mounting screws.
9. Remove the Front Panel as described in Section 8-13 “Front Panel Assembly” on page 8-22 above.

Install the New LCD

10. Remove the four LCD mounting screws and the connecting cables and remove it from the front panel.

Note	All RF connections (at the Wxxx cables) should be torqued to 8 lbf·in using the 01-201 5/16” torque end wrench from an Anritsu Calibration Kit. Check for RF discontinuities and other failures using the first six to eight tests in the 2300-178 program.

Install the new display by reversing the procedure above.

8-15 Power Supply Module

This section describes removing and replacing the Power Supply module that is mounted on the frame of the instrument behind the LCD.

Prerequisites

1. Remove the power cord from the instrument.
2. Remove the 37xxxE top cover, bottom cover, and left side cover.
    - See Section 8-3 “Covers” on page 8-2 above.

Identification

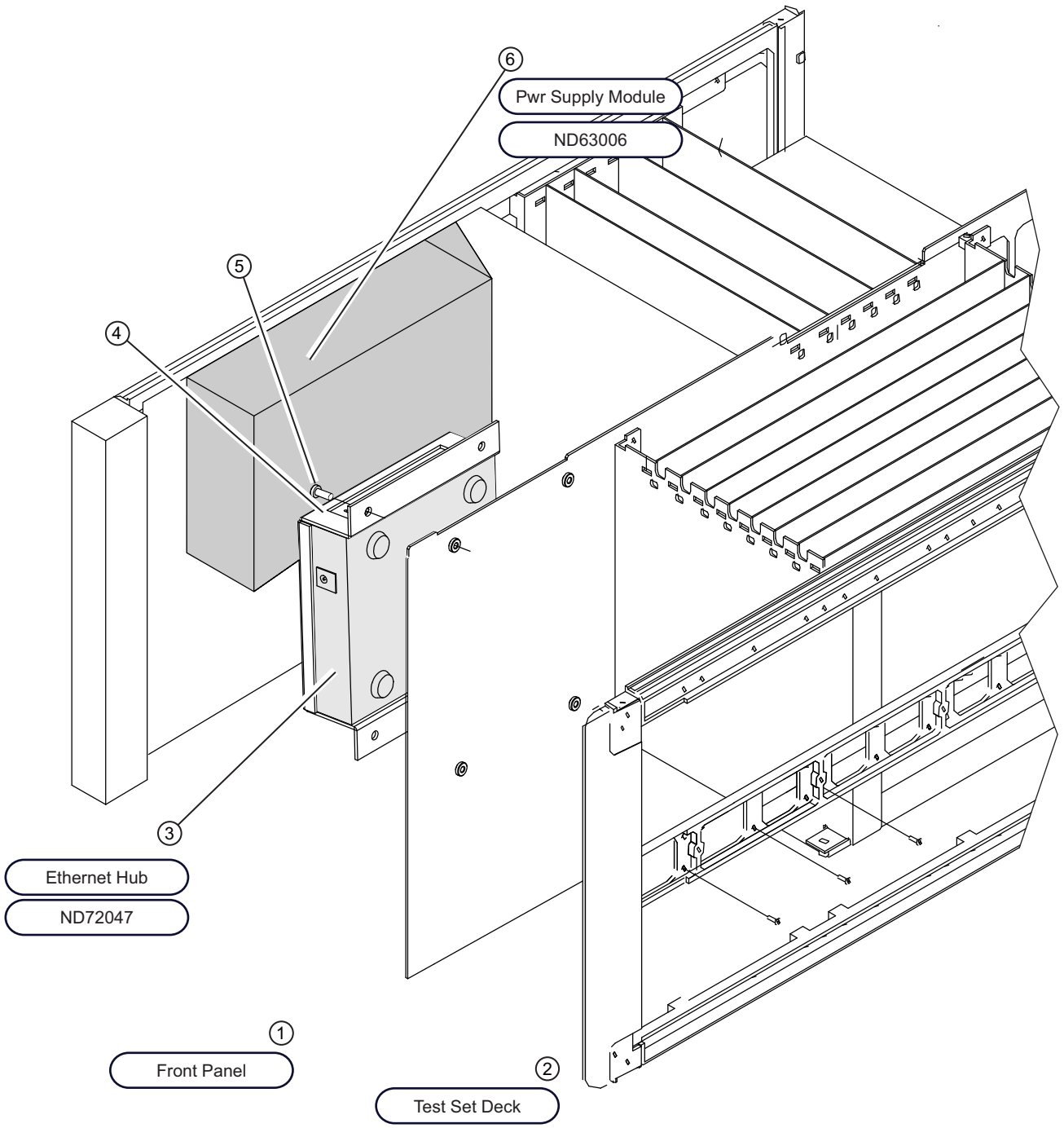


Figure 8-10. Power Supply Module – ND63003 and Ethernet Hub Assembly – ND72047 (1 of 2)

1 – Front Panel – Removed here for clarity.

2 – Test Set Deck Chassis – Mounted below the PCB chassis – Removed here for clarity.

3 – Ethernet Hub – ND72047 – Mounted in bracket – Bracket assembly fastens to chassis center plate in Power Supply Module bay.

4 – Ethernet Hub Bracket – There are no hub-to-bracket mounting screws. The bracket encloses the hub.

5 – Bracket-to-chassis center plate mounting screws – Phillips head – 4 each.

6 – Power Supply Module – MD63006

Figure 8-10. Power Supply Module – ND63003 and Ethernet Hub Assembly – ND72047 (2 of 2)

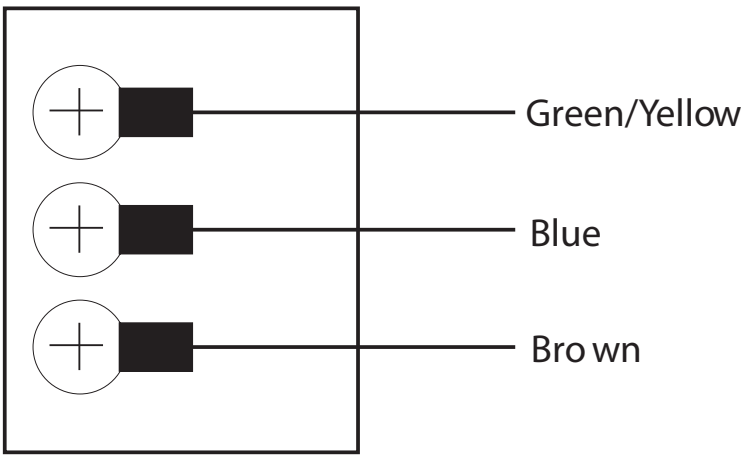
Power Supply Removal

Danger	Failure to remove the power cord before beginning this operation can result in a fatal electric shock.

1. Unplug the large power supply cables from J4 and J13 on the 37000 motherboard.
2. At the small daughter board of the power supply, unplug the power switch wire connector (black and white twisted pair).
3. Remove the power supply from the 37000 frame by removing the six (6) screws that fit through the left side of the frame.
4. Tilt up the front end of the supply so that you can see the clear plastic cover over the Line Voltage wires.
5. Remove the screws holding the clear cover, remove the cover and disconnect the wires.
6. Remove the power supply.

Power Supply Installation

1. Attach the Line Voltage wires to the terminals as shown in Figure 8-11 below.



1 – Green/Yellow Wire and Connector
2 – Blue Wire and Connector
3 – Brown Wire and Connector

Figure 8-11. Power Supply Voltage Wire Connections

2. Reinstall the clear safety cover over the Line Voltage wires.

3. Reinstall the supply by performing the opposite of the removal instructions.

8-16 Rear Panel Assembly

This section provides instructions for removing and replacing the Rear Panel Assembly.

Required Equipment

- Phillips Screwdriver (#2)
- Open-end Wrenches (various sizes)

Identification – Rear Panel Assembly

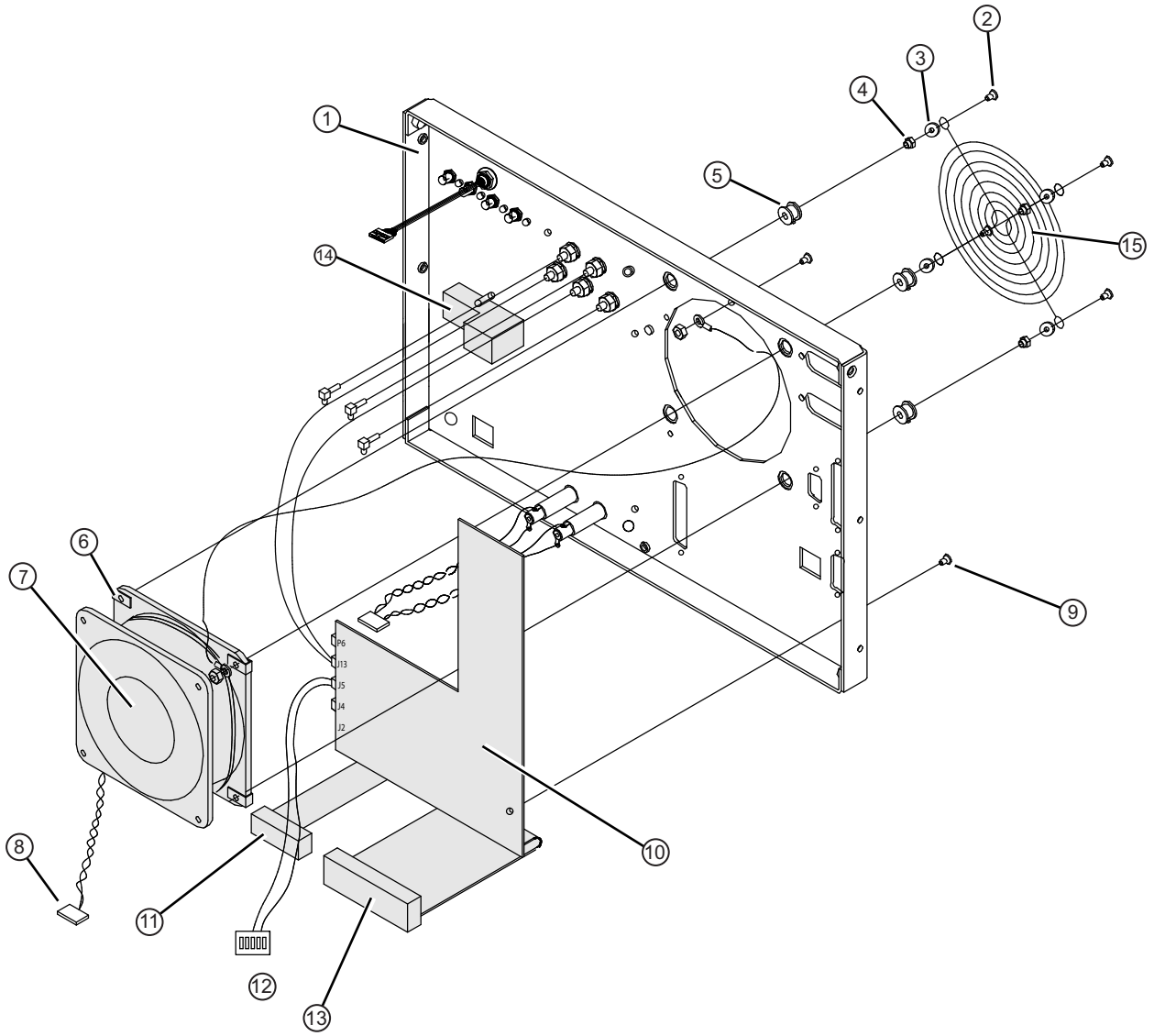


Figure 8-12. Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module (1 of 2)

1 – Rear Panel

2 – Flat head Phillips screw, 6×32 × 0.75”, four places

3 – Flat #6 washer, four places

4 – Standoff #6×0.87”, four places

5 – Vibration isolation grommet, #6, four places

6 – Spring Clip, #6×0.31”×0.25”, four places

7 – Fan Assembly – ND54935

8 – Fan Power Cable – From Fan to A18 P6

9 – A18 mounting screws, Pan head Phillips 6×32 × 0.312”

10 – A18 Rear Panel PCB – 71882-3

11 – Ribbon Cable – From A18 J1 to A17 J19

12 – Connector Header – From A18 J5 to A17 J7

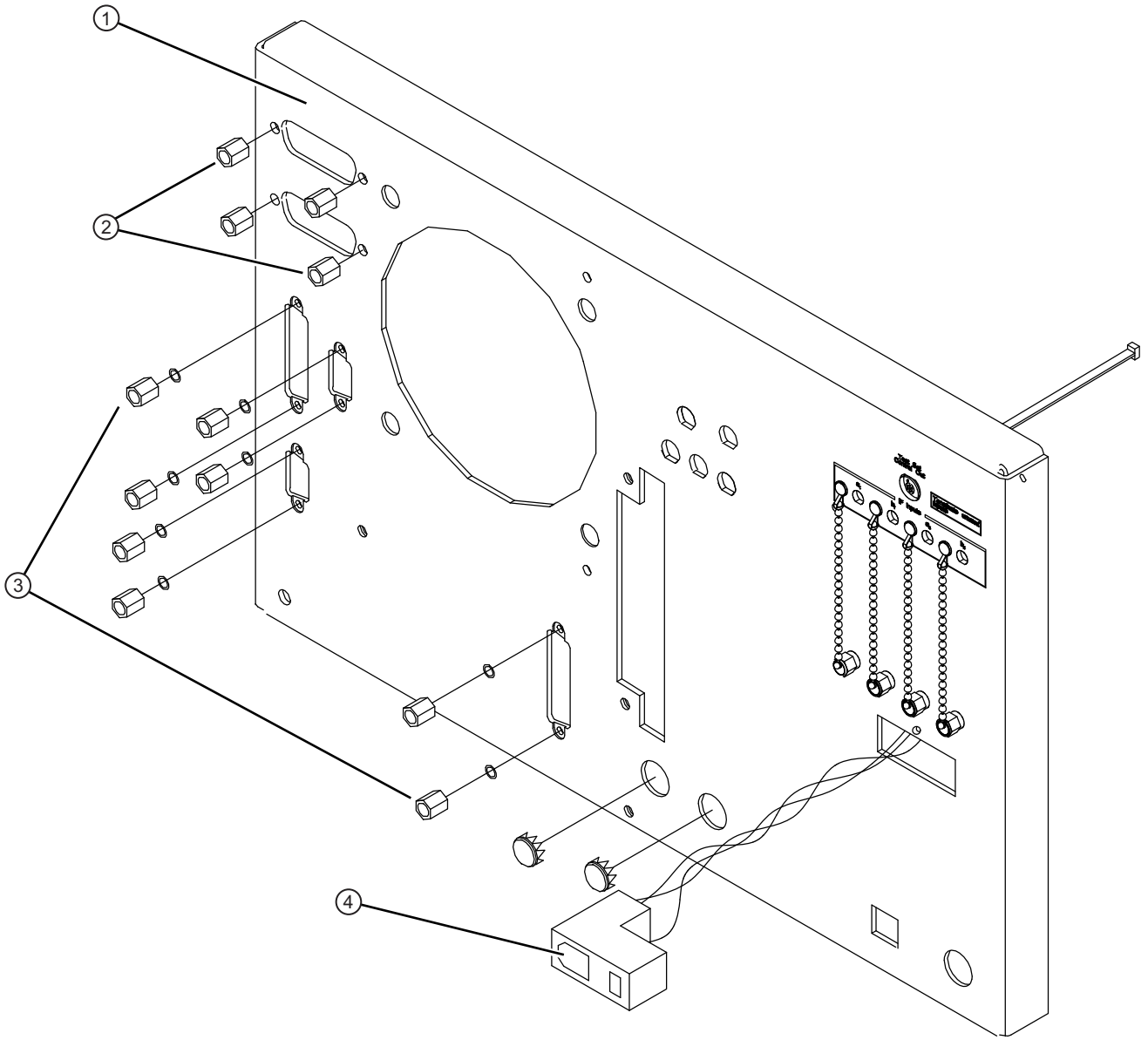
13 – Ribbon Cable – From A18 J14 to A17 J12

14 – AC Power Input Module and Fuses

15 – Fan Finger Guard Grill

Figure 8-12. Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module (2 of 2)

Identification – Rear Panel Outside Components



Remove Rear Panel Connector Screws before removing A18 Rear Panel PCB – 61011-3

1 – Rear Panel

2 – GPIB Connector Hex Mounting Standoff Screws
– Internally threaded to allow connector stacking
– Four places

3 – Connector Hex Mounting Standoff Screws – 4×40 × 0.187”, eight places

4 – AC Port Adapter and Fuse Assembly

Figure 8-13. Rear Panel – Outside Components – Connector Mounting Hex Standoffs for A18 Rear Panel PCB

Prerequisites

- Switch the VNA power to off and remove the power cord.

- Remove all covers (Section 8-3 “Covers” on page 8-2 above).

Note	It is not necessary to remove the rear panel to remove the A18 rear panel PCB.

Remove/Replace Procedure

1. Disconnect all cables which are connected to the rear panel and to the A18 rear panel PCB.
2. Remove the three screws on each side of the chassis that fasten to the rear panel assembly.
3. Remove the two screws located near top and middle of rear panel (near fan-mounting screws).
4. To replace the Rear Panel Assembly, perform the steps above in the reverse order.

8-17 A18 Rear Panel PCB

This section provides instructions for removing and replacing the A18 Rear Panel PCB assembly.

Required Equipment

- Nut Driver, 9/32 inch
- Nut Driver, 3/16 inch
- Phillips Screwdriver (#2)

Identification

See the following figures:

- Figure 8-12, “Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module” on page 8-34
- Figure 8-13, “Rear Panel – Outside Components – Connector Mounting Hex Standoffs for A18 Rear Panel PCB” on page 8-36

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).
- Remove the Rear Panel (see Section 8-16 “Rear Panel Assembly” on page 8-33 above).

Remove/Replace Procedure

1. Disconnect all cables that are connected to the A18 PCB.
2. Remove all eight 3/16” nuts that hold the various rear panel connectors.
3. Remove all four 9/32” nuts holding the GPIB connectors.
4. Remove the Phillips screw located next to the rear panel warning label (lower left corner).
5. Remove the A18 PCB.
6. To replace the A18 Rear Panel PCB assembly, perform the steps above in the reverse order

8-18 Fan Assembly

This section provides instructions for removing and replacing the Rear Panel Fan Assembly.

Identification

See the following figures:

- Figure 8-12, “Rear Panel – Inside Components – A18 PCB, Fan, and AC Adapter Module” on page 8-34
- Figure 8-13, “Rear Panel – Outside Components – Connector Mounting Hex Standoffs for A18 Rear Panel PCB” on page 8-36

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (see Section 8-3 “Covers” on page 8-2 above).
- Remove the Rear Panel (Section 8-16 “Rear Panel Assembly” on page 8-33 above).

Remove/Replace Procedure

1. Place the Rear Panel Assembly on the work surface with the A18 Rear Panel PCB up.
2. Disconnect the two conductor fan power cable at connector P6 of the A18 PCB.
3. Turn the Rear Panel Assembly over, and remove the four screws that fasten the fan guard and fan assembly to the rear panel.
4. Remove the fan guard and separate the fan from the rear panel.
5. To replace the Rear Panel Fan Assembly, perform the steps above in the reverse order.

8-19 File Server Device

This section provides instructions for removing and replacing the File Server Device assembly.

Identification

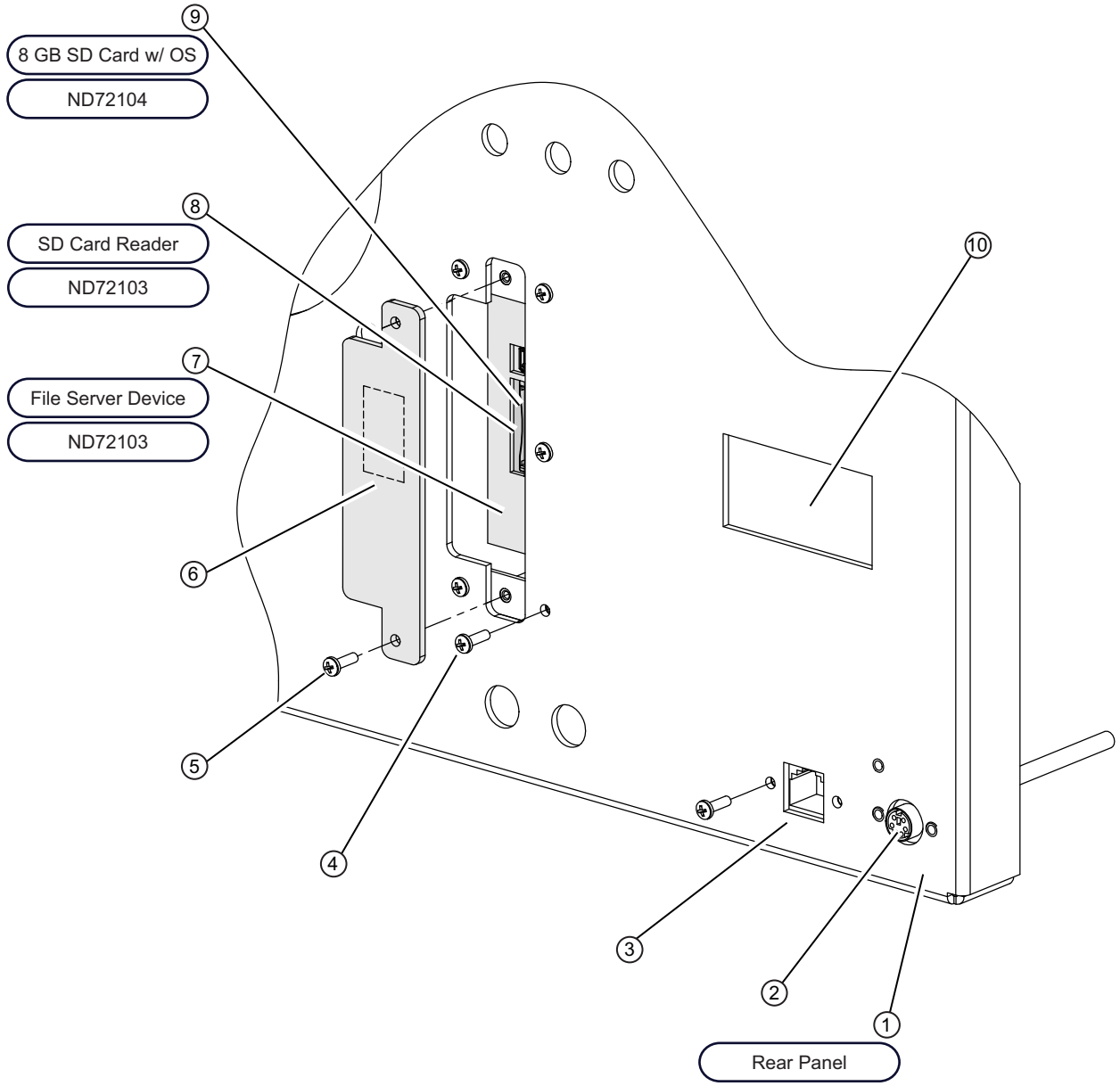


Figure 8-14. File Server Device with SD Card Reader – Outside Chassis View (1 of 2)

Rear Panel – Outside – File Server Device with SD Card Reader

1 – Rear Panel – Outside View

2 – PS/2 Female Connector – Cable – Bulkhead PS/2 Female to pin connector – Connects to A17 PCB J16.

3 – Ethernet RJ-45 Female Connector – CAT-5 Cable – Bulkhead RJ-45 Female to Ethernet CAT-5 RJ45 Male – Connects to Ethernet Hub.

4 – Mounting Screws for File Server Device with SD Card Reader Bracket – Phillips head – 5 each

5 – Mounting Screws for SD Card Reader – Phillips head – 2 each

6 – SD Card Reader Cover

7 – File Server Device with SD Card Reader – ND72103 – Mounted into bracket inside Rear Panel.

8 – SD Card Reader – Part of the File Server Device.

9 – 8 GN SD Card with installed Operating System – ND72104 – Removable

10 – AC Input Module – Removed here for clarity.

Figure 8-14. File Server Device with SD Card Reader – Outside Chassis View (2 of 2)

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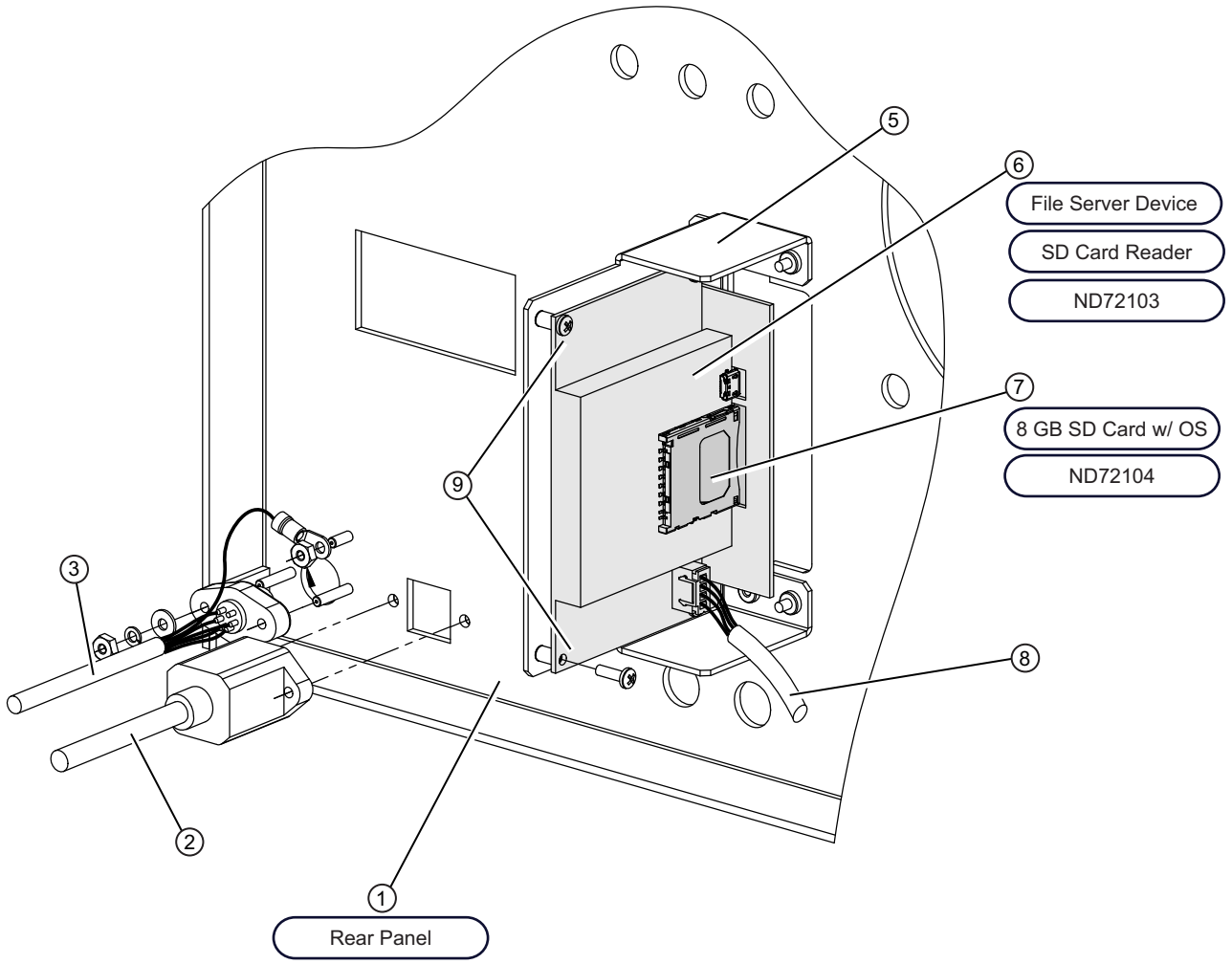


Figure 8-15. File Server Device with SD Card Reader – Inside Chassis View (1 of 2)

Inside Rear Panel – File Server Device with SD Card Reader

1 – Rear Panel – Inside View

2 – Cable – Bulkhead RJ-45 Female to Ethernet CAT-5 RJ45 Male – Connects to Ethernet Hub Port 5 and Female connector mounts on rear panel.

3 – Cable – Bulkhead PS/2 Female to pin connector – Connects to A17 PCB J16 and Female connector mounts on the rear panel.

4 – AC Power Input Module – Removed here for clarity.

5 – Bracket Assembly for File Server Device with SC Card Reader

6 – File Server Device with SD Card Reader – ND72103

7 – 8 GHz SD Card with installed LIghtning 37xxxE Operating System – Removable for replacement or security concerns.

8 – File Server Device mounting screws – Phillips – 2 each

9 – Cable – Power Cable for File Server Device – Connects between File Server Device Power Connector and A16 PCB P6.

Figure 8-15. File Server Device with SD Card Reader – Inside Chassis View (2 of 2)

Prerequisites

- Switch the VNA power to off and remove the power cord.
- Remove all covers (Section 8-3 “Covers” on page 8-2 above).
- Remove the Rear Panel (Section 8-16 “Rear Panel Assembly” on page 8-33 above.

Removal Procedure

1. Turn off the power and disconnect the instrument from the AC mains.
2. Remove rear panel.
3. The Card Reader Cover can stay in place.
4. At the File Server Device, unplug the File Server Device power cable, the Ethernet Cable, and the USB Cable.
5. Undo cable to A16 P5 from the card reader.
6. Remove four screws holding the SD Card Reader Module in place.
7. Remove the SD Card Reader.

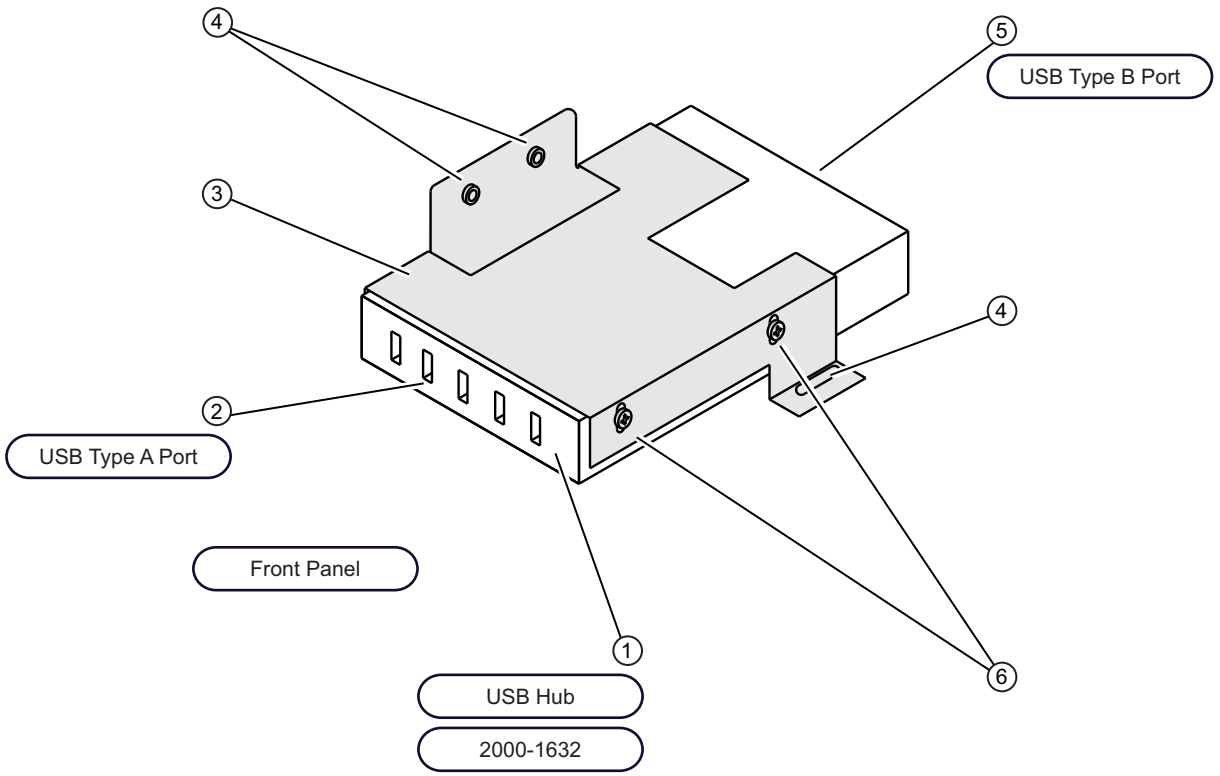
Replacement Procedure

1. Verify that the File Server Device has been programmed before starting the installation.
2. To replace the File Server Device assembly, perform the steps above in the reverse order.

8-20 USB Hub Assembly

This section provides instructions for removing and replacing the File Server Device assembly

Identification



USB Hub and Front Panel USB Port

1 – USB 2.0 Hub – 2000-1632

2 – USB 2.0 Type A Front Panel Port

3 – Hub Mounting Bracket

4 – Hub Bracket to Chassis Mounting Screws – Phillips head – 3 each

5 – USSB 2.0 Type B Female Connector – Not shown here – Connects to USB 2.0 Type B Male to Type A Male Cable – USB 2.0 Type A connector plugs into USB connector on File Server Device with SD Card Reader – ND72103.

6 – USB Hub to Bracket Mounting Screws – Phillips head – 2 each side – 4 total

Figure 8-16. USB Hub and Mounting Bracket

Prerequisites

- Switch the VNA power to off
- Remove the power cord.
- Remove all covers (Section 8-3 “Covers” on page 8-2 above).
- Remove the Rear Panel (Section 8-16 “Rear Panel Assembly” on page 8-33 above.

- Position the VNA upside down.

Remove/Replace Procedure

1. Remove USB cable coming from the Rear Panel USB Port which is connected to Hub Port 5.
2. Remove the screws holding the USB hub bracket in place.
3. Remove the USB power cable.
4. Remove the Bracket and Hub Assembly.
5. Remove the four screws holding the hub into the bracket.
6. Separate hub from bracket.
7. To replace the USB Hub assembly, perform the steps above in the reverse order.

8-21 Test Set Module Assemblies

Replacement of any item on the Test Set Module will require that all Source Calibrations and the Source Lock Threshold Calibration be performed (see Chapter 6, "Adjustments"). Performing all of the tests in the 3700 Test program (see Section 4-4 "Performance Tests" on page 4-5 above in Chapter 4, "Operational Performance Tests") is also strongly suggested.

Required Equipment

- Connector torque wrench (5/16 inch), Anritsu Model 01-201, or equivalent
- 1 inch open-end wrench and 3/32 inch ball end hex wrench (only if couplers are to be replaced)

Caution	Throughout these procedures, always use the 5/16" connector torque wrench for connecting the Test Set Module semi-rigid coaxial lines and RF/microwave components. The use of improper tools may damage the connectors, resulting in degraded instrument performance.

Prerequisites

- Switch the VNA power to off
- Remove the power cord.
- Remove all covers (see Section 8-3 "Covers" on page 8-2 above).
- Position the VNA upside down.

Identification

The following six figures show the locations of all Test Set assembly bottom-side RF components each Lightning 37xxxE VNA model number:

- Figure 8-17, "Test Set Modules – Model 37247E 20 GHz – Passive" on page 8-48
- Figure 8-18, "Test Set Modules – Model 37347E 20 GHz – Passive and Active" on page 8-50
- Figure 8-19, "Test Set Modules – Model 37269E 40 GHz – Passive" on page 8-52
- Figure 8-20, "Test Set Modules – Model 37369E 40 GHz – Passive and Active" on page 8-54
- Figure 8-21, "Test Set Modules – Model 37297E 65 GHz – Passive" on page 8-56
- Figure 8-22, "Test Set Modules – Model 37397E 65 GHz – Passive and Active" on page 8-58

8-22 Test Set Modules – Model 37247E

See "Test Set Module Removal/Replacement Procedures" on page 8-59 for the removal/replacement procedure.

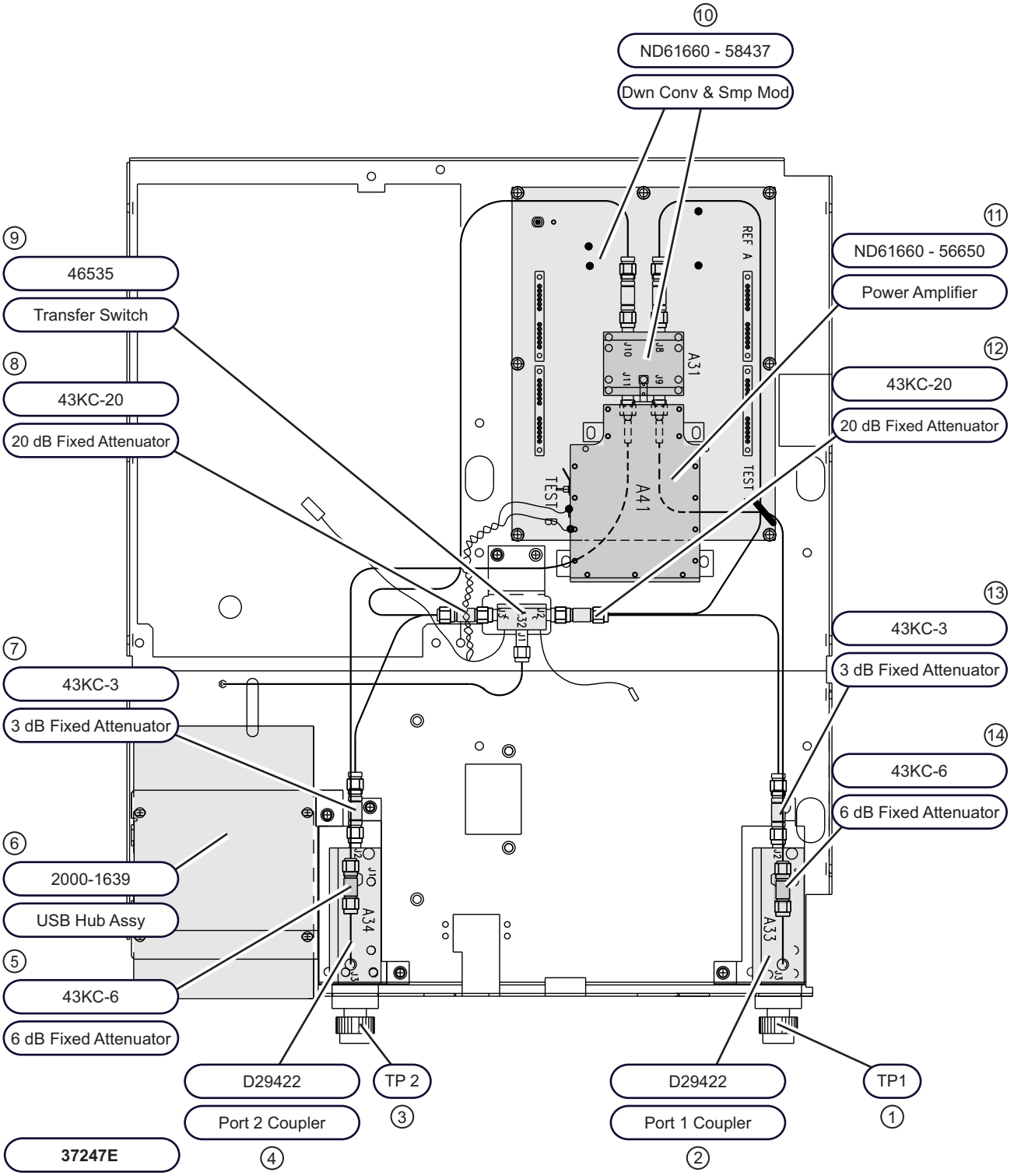


Figure 8-17. Test Set Modules – Model 37247E 20 GHz – Passive (1 of 2)

1 – Test Port 1
2 – Port 1 Coupler – D29422
3 – Test Port 2
4 – Port 2 Coupler – D29422
5 – 6 dB Fixed Attenuator – 43KC-6
6 – USB Hub Assembly – 2000-1639
7 – 3 dB Fixed Attenuator – 43KC-3
8 – 20 dB Fixed Attenuator – 43KC-20
9 – Transfer Switch – 46535
10 – Down Converter and Sampler Module – 58437 – ND61660
11 – Power Amplifier – 56650 – ND61660
12 – 20 dB Fixed Attenuator – 43KC-20
13 – 3 dB Fixed Attenuator – 43KC-3
14 – 6 dB Fixed Attenuator – 43KC-6

Figure 8-17. Test Set Modules – Model 37247E 20 GHz – Passive (2 of 2)

8-23 Test Set Modules – Model 37347E

See "Test Set Module Removal/Replacement Procedures" on page 8-59 for the removal/replacement procedure.

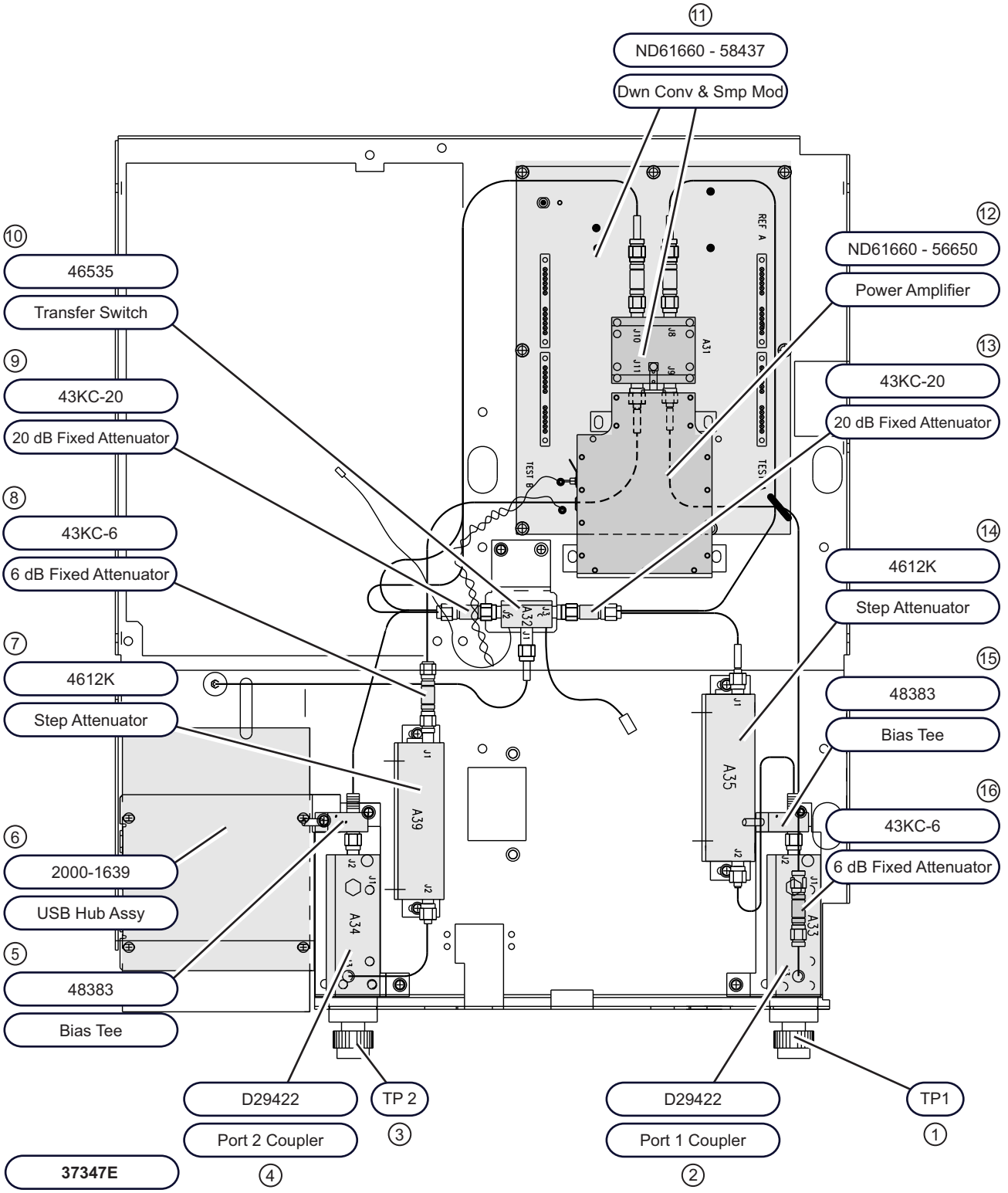


Figure 8-18. Test Set Modules – Model 37347E 20 GHz – Passive and Active (1 of 2)

1 – Test Port 1
2 – Port 1 Coupler – D29422
3 – Test Port 2
4 – Port 2 Coupler – D29422
5 – Bias Tee – 48383
6 – USB Hub Assembly – 2000-1639
7 – Step Attenuator – 4612K
8 – 6 dB Fixed Attenuator – 43KC-6
9 – 20 dB Fixed Attenuator – 43KC-20
10 – Transfer Switch – 46535
11 – Down Converter and Sampler Module – 58437 – ND61660
12 – Power Amplifier – 56650 – ND61660
13 – 20 dB Fixed Attenuator – 43KC-20
14 – Step Attenuator – 4612K
15 – Bias Tee – 48383
16 – 6 dB Fixed Attenuator – 43KC-6

Figure 8-18. Test Set Modules – Model 37347E 20 GHz – Passive and Active (2 of 2)

8-24 Test Set Modules – Model 37269E

See "Test Set Module Removal/Replacement Procedures" on page 8-59 for the removal/replacement procedure.

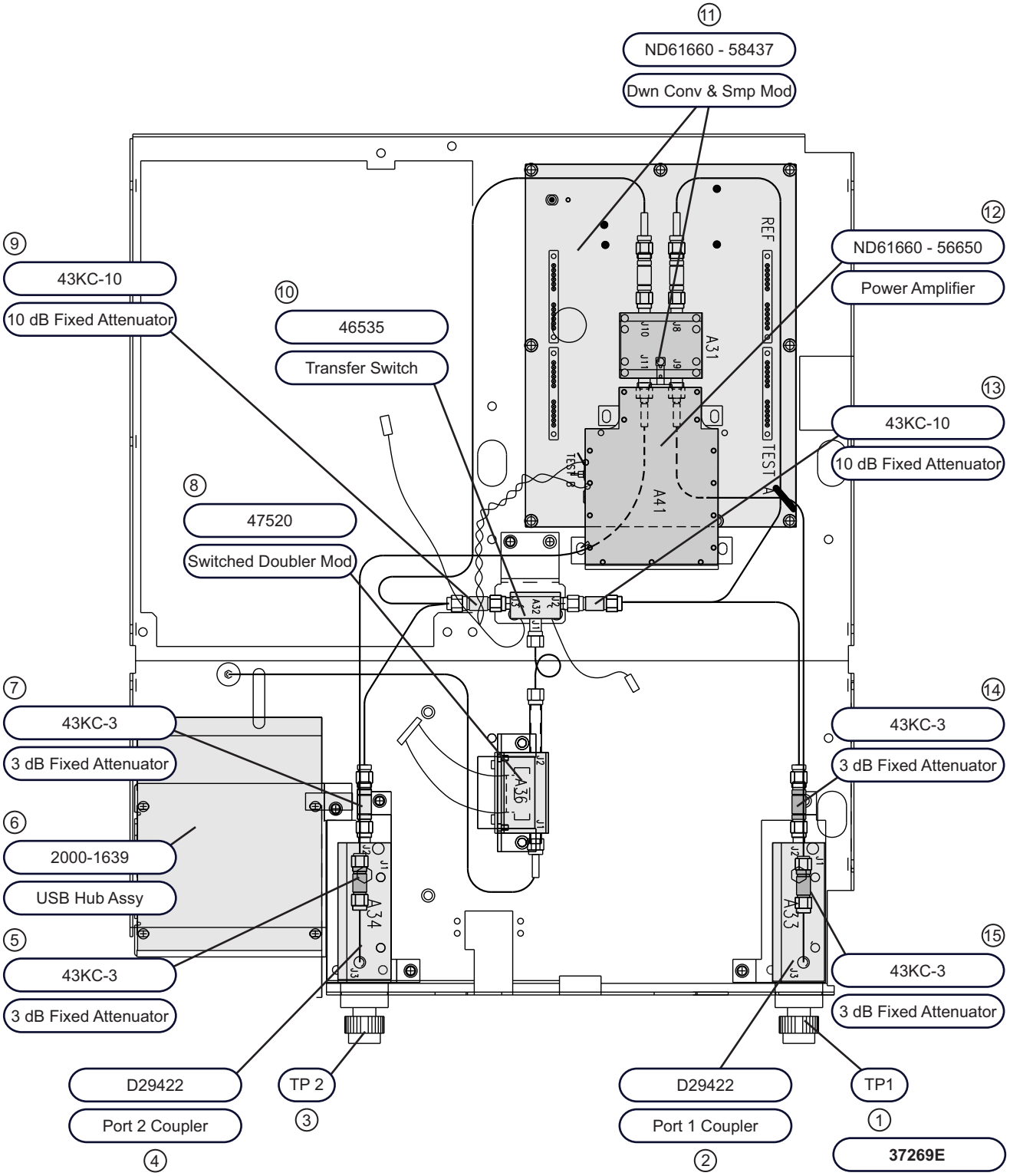


Figure 8-19. Test Set Modules – Model 37269E 40 GHz – Passive (1 of 2)

1 – Test Port 1
2 – Port 1 Coupler – D29422
3 – Test Port 2
4 – Port 2 Coupler – D29422
5 – 3 dB Fixed Attenuator – 43KC-3
6 – USB Hub Assembly – 2000-1639
7 – 3 dB Fixed Attenuator – 43KC-3
8 – Switched Doubler Module – 47520
9 – 10 dB Fixed Attenuator – 43KC-10
10 – Transfer Switch – 46535
11 – Down Converter and Sampler Module – 58437 – ND61660
13 – Power Amplifier – 56650 – ND61660
14 – 3 dB Fixed Attenuator – 43KC-3
15 – 3 dB Fixed Attenuator – 43KC-3

Figure 8-19. Test Set Modules – Model 37269E 40 GHz – Passive (2 of 2)

8-25 Test Set Modules – Model 37369E

See "Test Set Module Removal/Replacement Procedures" on page 8-59 for the removal/replacement procedure.

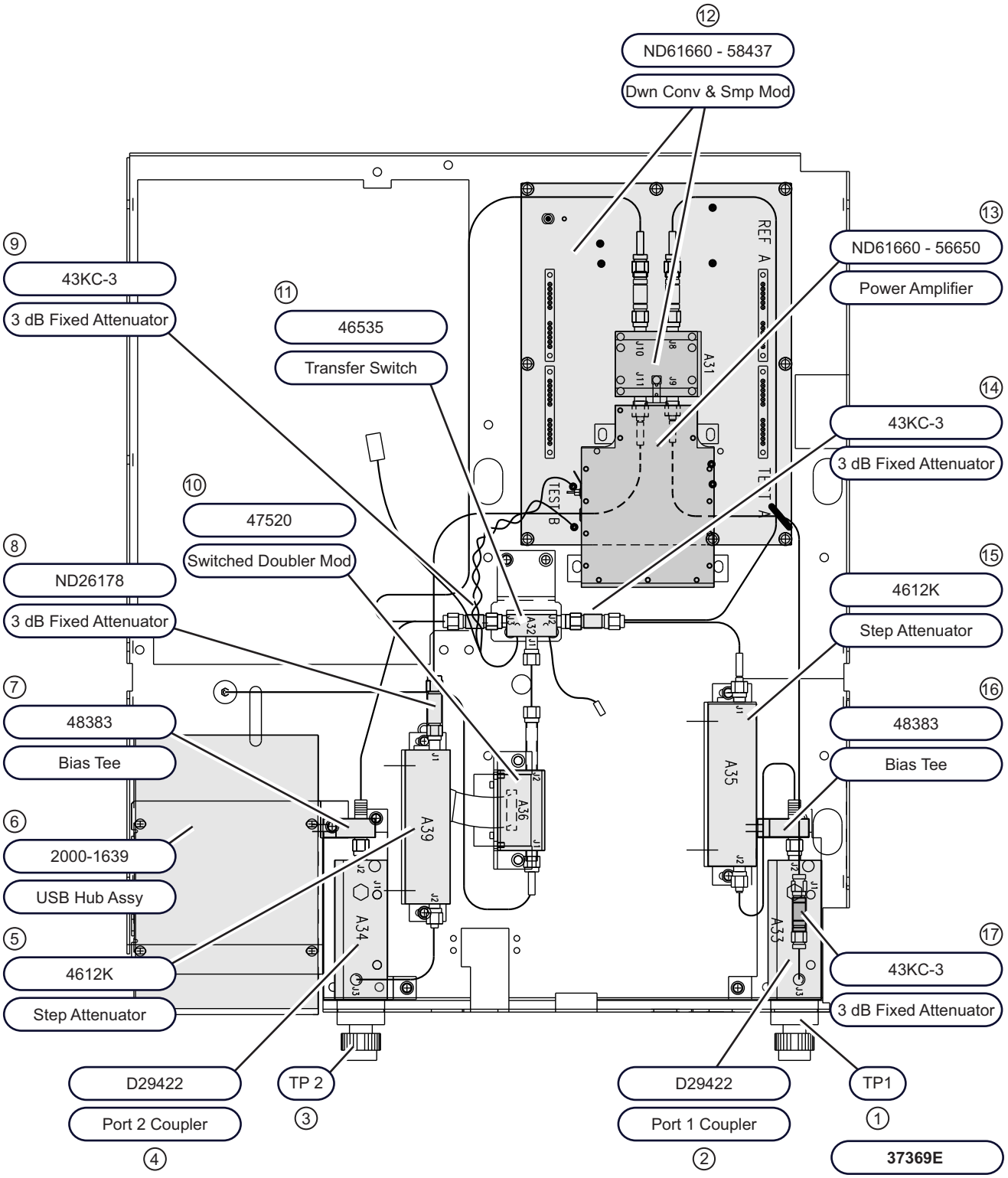


Figure 8-20. Test Set Modules – Model 37369E 40 GHz – Passive and Active (1 of 2)

1 – Test Port 1
2 – Port 1 Coupler – D29422
3 – Test Port 2
4 – Port 2 Coupler – D29422
5 – Step Attenuator, 40 GHz, 70 dB – 4612K
6 – USB Hub Assembly – 2000-1639
7 – Bias Tee – 48383
8 – 3 dB Fixed Attenuator – ND26178
9 – 3 dB Fixed Attenuator – 43KC-3
10 – Switched Doubler Module – 47520
11 – Transfer Switch – 46535
12 – Down Converter and Sampler Module – 58437 – ND61660
13 – Power Amplifier – 56650 – ND61660
14 – 3 dB Fixed Attenuator – 43KC-3
15 – Step Attenuator, 40 GHz, 70 dB – 4612K
16 – Bias Tee – 48383
17 – 3 dB Fixed Attenuator – 43KC-3

Figure 8-20. Test Set Modules – Model 37369E 40 GHz – Passive and Active (2 of 2)

8-26 Test Set Modules – Model 37297E

See "Test Set Module Removal/Replacement Procedures" on page 8-59 for the removal/replacement procedure.

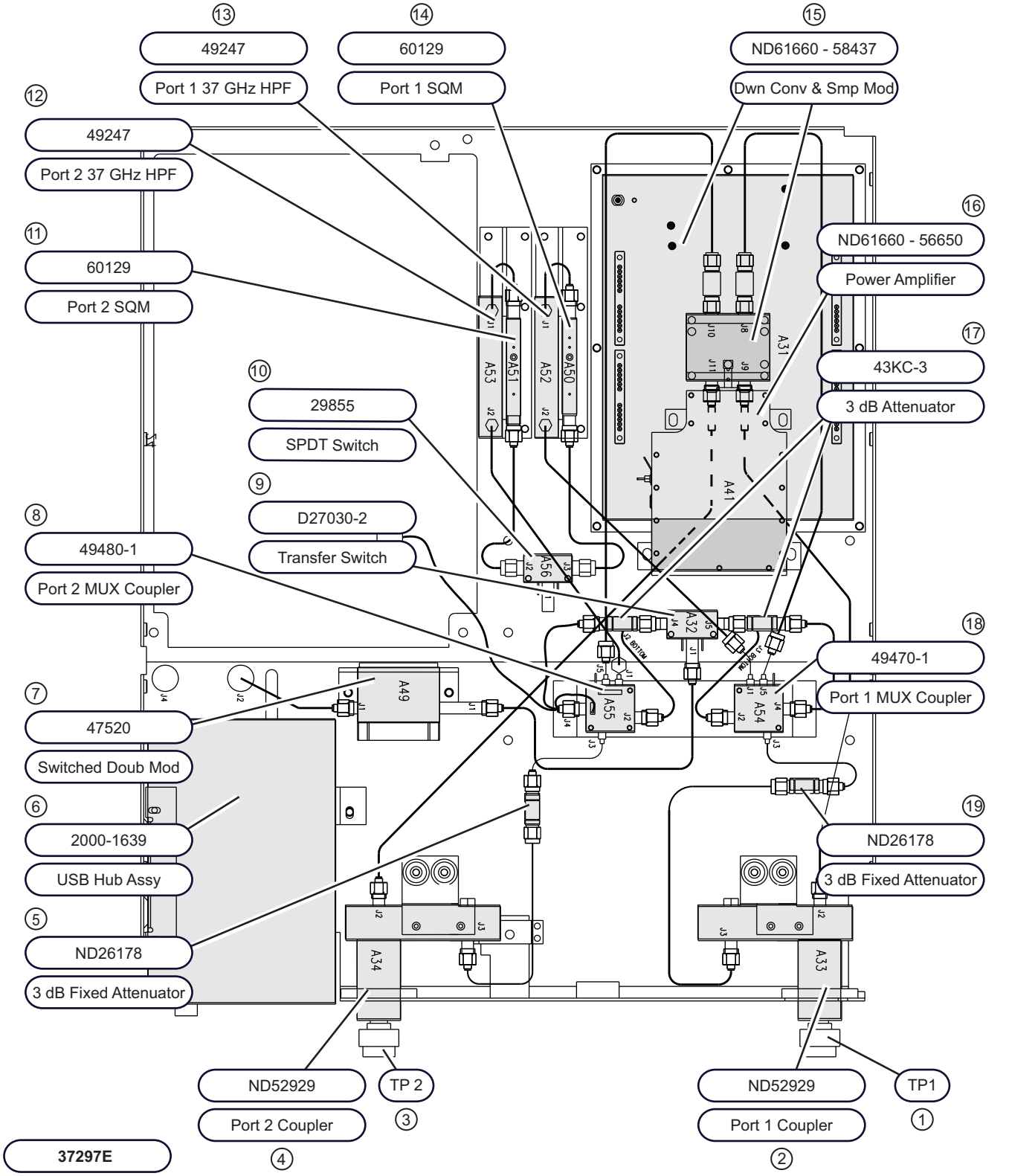


Figure 8-21. Test Set Modules – Model 37297E 65 GHz – Passive (1 of 2)

1 – Test Port 1
2 – Port 1 Coupler – ND52929
3 – Test Port 2
4 – Port 2 Coupler – ND52929
5 – 3 dB Fixed Attenuator – ND26178
6 – USB Hub Assembly – 2000-1639
7 – Switched Doubler Module – 47520
8 – Port 2 MUX Coupler – 49480-1
9 – Transfer Switch – D27030-2
10 – SPDT Switch – 29855
11 – Port 2 Switched Quadrupler Module (SQM) – 60129
12 – Port 2 37 GHz Hi-Pass Filter (HPF) – 49247
13 – Port 1 37 GHz Hi-Pass Filter (HPF) – 49247
14 – Port 1 Switched Quadrupler Module (SQM) – 60129
15 – Down Converter and Sampler Module – 58437 – ND61660
16 – Power Amplifier – 56650 – ND61660
17 – 3 dB Attenuator – 43KC-3 – 2 each
18 – Port 1 MUX Coupler – 49470-1
19 – 3 dB Fixed Attenuator, 65 GHz – ND26178

Figure 8-21. Test Set Modules – Model 37297E 65 GHz – Passive (2 of 2)

8-27 Test Set Modules – Model 37397E

See "Test Set Module Removal/Replacement Procedures" on page 8-59 for the removal/replacement procedure.

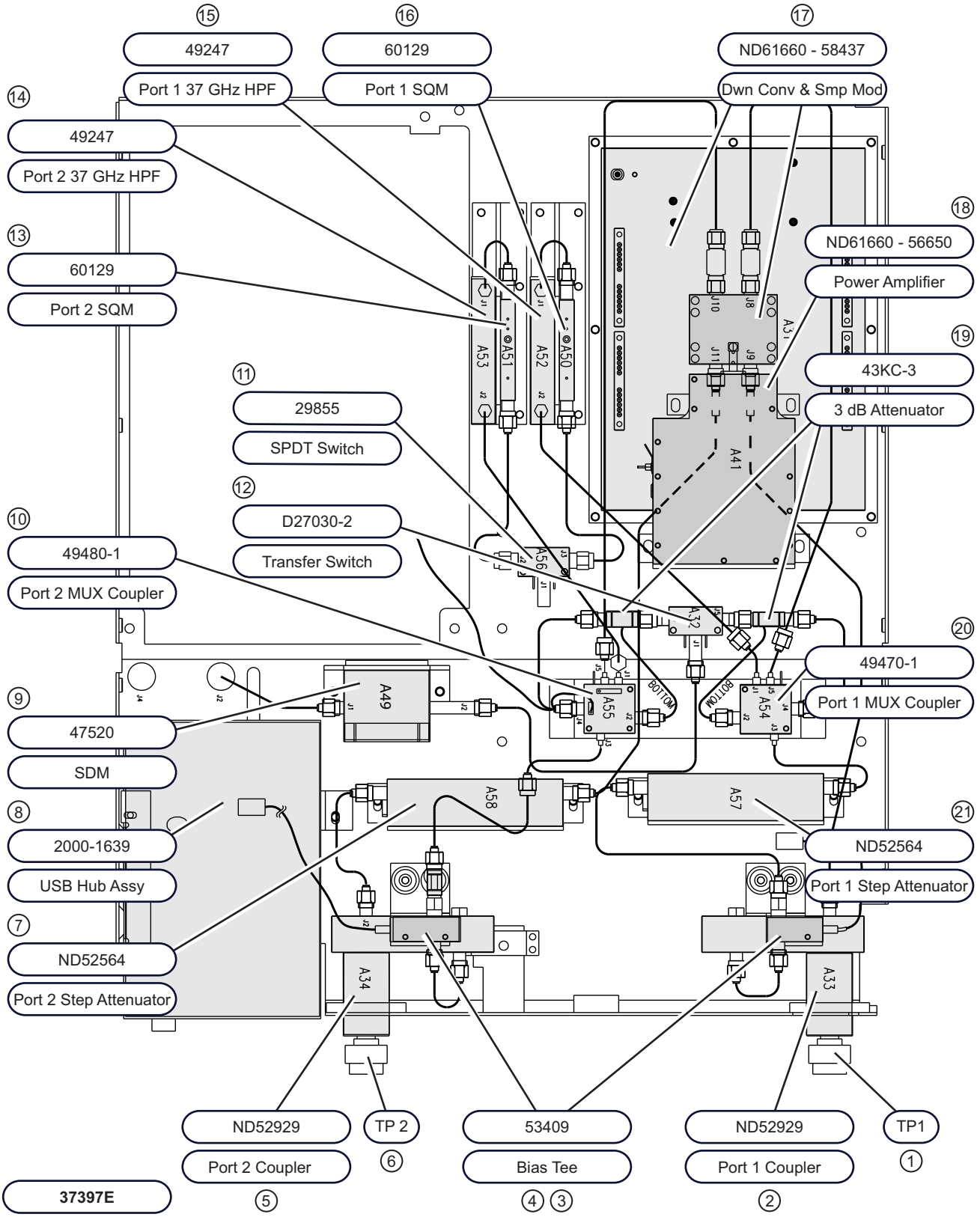


Figure 8-22. Test Set Modules – Model 37397E 65 GHz – Passive and Active (1 of 2)

1 – Test Port 1
2 – Port 1 Coupler – ND52929
3 – Bias Tee – 53409
4 – Bias Tee – 53409
5 – Port 2 Coupler – ND52929
6 – Test Port 2
7 – Port 2 Step Attenuator – ND52564
8 – USB Hub Assembly – 2000-1639
9 – Switched Doubler Module – 47520
10 – Port 1 MUX Coupler – 49480-1
11 – SPDT Switch – 29855
12 – Transfer Switch – D27030-2
13 – Port 2 Switched Quadrupler Module (SQM) – 60129
14 – Port 2 37 GHz Hi-Pass Filter (HPF) – 49247
15 – Port 1 37 GHz Hi-Pass Filter (HPF) – 49247
17 – Down Converter and Sampler Module – 58437 – ND61660
18 – Power Amplifier – 56650 – ND61660
19 – 3 dB Attenuator – 43KC-3 – 2 each
20 – Port 1 MUX Coupler – 49470-1
21 – Port 1 Step Attenuator – ND52564

Figure 8-22. Test Set Modules – Model 37397E 65 GHz – Passive and Active (2 of 2)

Test Set Module Removal/Replacement Procedures

All RF components found on the Test Set Module may be removed and replaced by removal of the associated RF cabling, Phillips-head mounting screws, and unplugging bias cables. Replacement parts supplied by Anritsu have instructions where instructions are necessary.

Take careful note of all warnings and notes printed on the first page of this chapter. RF connectors are easily damaged. RF cable connections that are improperly mated will cause discontinuities resulting in measurement errors.

Appendix A — Test Record

A-1 Introduction

Use this appendix to print out and record test, calibration, and verification information. The following test records are available:

- Section A-2 “37xxxE Log Magnitude Dynamic Accuracy Test Worksheet” on page A-2.
    - This appendix provides the test record that can be used to record the result of the Log Magnitude Dynamic Accuracy Test. Make a copy of the following Test Record pages and document the test results each time the Log Magnitude Dynamic Accuracy Test is performed.

A-2 37xxxE Log Magnitude Dynamic Accuracy Test Worksheet

This appendix section provides the test record that can be used to record the result of the Log Magnitude Dynamic Accuracy Test. Make a copy of the following Test Record pages and document the test results each time the Log Magnitude Dynamic Accuracy Test is performed.

37xxxE Log Magnitude Dynamic Accuracy Test

Instrument Information			
Model:		**Serial Number:**	
Options:			
Comments:			
Operator:		**Date:**	

Table A-1. Measured S21 Values and Calculated Step Attenuator Attenuation Values

	Measured S21 values										
Step Attenuator Setting	**Pass #1**	**Pass #2**	**Pass #3**	**Pass #4**	**Pass #5**	**Pass #6**	**Pass #7**	**Pass #8**	**Pass #9**	**Pass #10**	**Mean Value**
0 dB											
10 dB											
20 dB											
30 dB											
40 dB											
50 dB											
60 dB											
70 dB											
80 dB											
Step Attenuator Setting	**Calculated Step Attenuator Attenuation Values**										**Mean Value**
10 dB											
20 dB											
30 dB											
40 dB											
50 dB											
60 dB											
70 dB											
80 dB											

A-3 37xxxE Log Magnitude Dynamic Accuracy Test Record

Model:	Serial Number:	Date:
Operator:	Step Attenuator ID:	

Table A-2. Log Magnitude/Dynamic Accuracy Test

– A –	– B –	– C –	– D –	– E –	– F –	– G –
Attenuation Device Nominal Value	**Measured Value (Mean)**	**Attenuation Device Characterized (or Traceable Value)**	**Composite Uncertainty**	**Col C + Col D = Upper Limit**	**Col C – Col D = Lower Limit**	**Pass or Fail**
–10 dB			0.107			
–20 dB			0.105			
–30 dB			0.106			
–40 dB			0.105			
–50 dB			0.156			
–60 dB			0.210			
–70 dB			0.330			
–80 dB			0.597			

Appendix B — Connector Care

B-1 Introduction

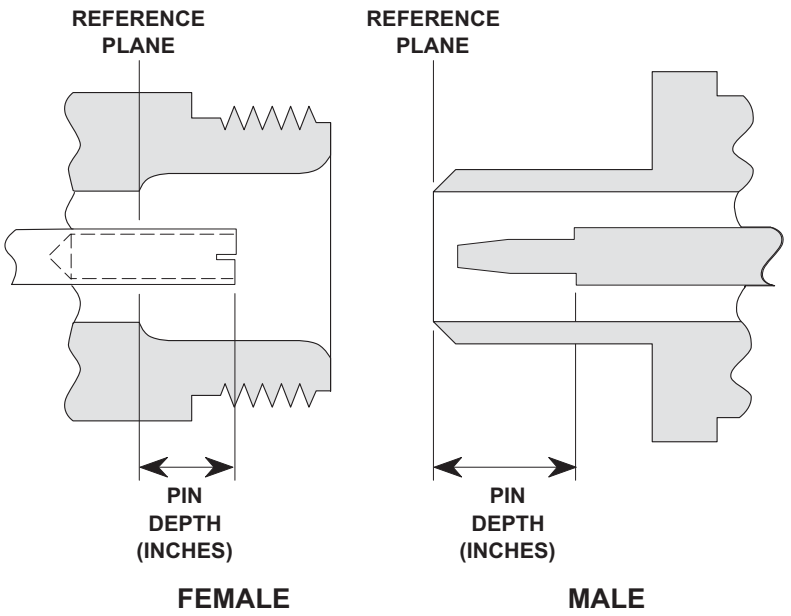
This appendix provides general, precautionary information and instructions pertaining to precision connectors.

B-2 Precautions

The following paragraphs are precautionary notes relating to maintenance considerations for precision connectors

Pin Depth Problems

Based on Anritsu precision components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When a precision component is mated with a connector having a destructive pin depth, damage will likely occur to the precision component's connector. A connector is considered to have destructive pin depth when the center pin is too long in respect to the connector's reference plane (Figure B-1 below).



N Connector Cross Section View

Figure B-1. N Connector Pin Depth Definition

Before mating an unknown or new device with your VNA Port connectors or calibration devices, always measure the pin depth of the device's connectors. Use a Anritsu Pin Depth Gauge, or equivalent, for these measurements (Figure B-1 below). Also, measure the connector pin-depth of a device when intermittent or degraded performance is suspected.

Gauging sets for measuring the pin-depth of precision connectors are available from your nearest Anritsu Service center, or from the factory. Instructions for measuring connector pin-depth are included with the gauging sets.

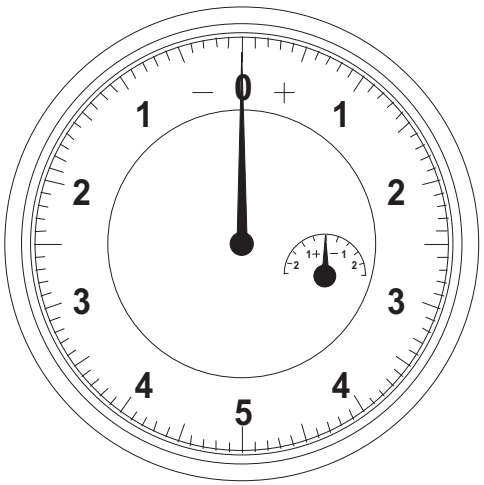


Figure B-2. Pin Depth Gauge

Pin-Depth Tolerance

The center pin of a precision connector has a tolerances measured in mils (one mil = 1/1000 inch). The connectors of test devices may not be precision types and they may not have the proper pin-depth. These connectors should be measured before mating to ensure suitability.

When gauging pin depth, if the connector being measured indicates out of tolerance in the "+" region of the gauge (Table B-1 below), the center pin is too long. Mating under this condition will likely damage the mating connector. On the other hand, if the test device connector indicates out of tolerance in the "–" region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

Table B-1. Connector Pin-Depth Tolerance

Port / Connector Type	Pin Depth in MILS	Gauge Reading
GPC-7	+0.000 –0.003	Same As Pin Depth
N Male	207 –0.000 +0.004	207 +0.000 –0.004
N Female	207 –0.004 +0.000	Same As Pin Depth
3.5 mm Male, Female	–0.000 +0.002	
K Male, Female	+0.0000 –0.0035	
V Male	+0.000 to –0.001	
V Female	+0.000 to –0.001	

Avoid Over Torquing Connectors

Over-torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient, especially on Type N connectors. Should it be necessary to use a wrench to tighten SMA or WSMA connectors, use a torque wrench that breaks at 8 lbf·in (8 inch-pounds).

Never use pliers to tighten connectors.

Avoid Mechanical Shock

Precision connectors are designed to withstand years of normal bench handling. Do not drop or otherwise treat them roughly. They are laboratory-quality devices, and like other such devices, they require careful handling.

Keep Connectors Clean

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

Visual Inspection

Precision connectors should be inspected periodically. Check for the following:

- Bent or broken center pin
- Damaged threads
- Other bent or damaged connector parts
- Dirt or foreign material in connector cavity.

B-3 Repair and Maintenance

Anritsu recommends that no maintenance other than cleaning be attempted by the customer. Any device with a suspected defective connector should be returned to Anritsu for repair and/or service when needed.

Appendix C — Lightning 37000E Technical Data Sheet

C-1 Introduction

The latest version of the Lightning 37xxxE Vector Network Analyzers Technical Date Sheet – 11410-00573 can be downloaded from the Anritsu Internet site at www.anritsu.com.

This data sheet provides performance specifications for all of the model variants in the 37xxxE series.

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