

Agilent Technologies N4421B Option H67

User's and Service Guide

Use this manual with the following documents:

PNA Series Network Analyzer On-line Help System



Agilent Technologies

Manufacturing Part Number: N4421-90001

Printed in USA

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WARNING	Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.
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Statement of Compliance

This product has been designed and tested in accordance with the standards listed on the Manufacturer's Declaration of Conformity, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature – 0 to 55 °C, unless otherwise noted.)
- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- *Nominal* values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.

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General Information

Description

The [Agilent Technologies N4421B Option H67](#) is a 10 MHz to 67 GHz S-parameter Test Set for use with the E8361A Option 014/550 providing 4-port error corrective measurement capability.

E8361A Performance Network Analyzer information, data sheets, white papers, or manuals can be viewed or printed by visiting <http://www.agilent.com/find/pna>.

Agilent does not supply accessories, such as the test port cables and DUT control cables with the N4421BH67.

Content List

Agilent Part Number	Description	Qty
0515-1499	Screw, M3.5 x 0.6 (4 mm)	8
1600-1423	Lock-Link	4
5023-0132	Locking Feet	1
AW00268	Label "Port 3" ¹	1
N4421-20009	Long Interconnect RF Access Jumpers	4
N4421-20010	Short Interconnect RF Access Jumpers	4
N4421-90001	User's and Service Guide	1

1. Place the label "Port 3" above the PNA Port 2 silkscreen. Port 2 on the PNA is referenced as Port 3 throughout the N4421BH67 User's and Service Guide. Continue to use it as Port 2 when using the PNA as a standalone instrument.

General Specifications

Power Requirements

Verify that the required ac power is available at all necessary locations before installing the Test Set to the PNA.

- Three-wire power cables (which provide a safety ground) must be used with all instruments.
- Air-conditioning equipment (or other motor-operated equipment) should not be placed on the same ac line that powers the Test Set and PNA.
- [Table 1](#) contains the maximum VA rating and BTU/hour rating for the instrument. This table can be used to determine the electrical and cooling requirements.

Line power (single phase)

100/120/220/240V 50/60Hz
40 Watts maximum

NOTE Values are based on 120 Vac supplied to the instrument at 60 Hz.

Table 1 Power Requirements

Standard Equipment		
Instrument	Maximum VA Rating	Maximum BTU/Hour
N4421BH67	80	274

Dimensions and Space Requirements

Standard installation of the N4421BH67 and PNA includes configuration and installation on a customer-provided lab bench or table top of adequate size and strength. Refer to [Table 2](#) and [Table 3](#).

Table 2 System Dimensions

Item	Weight
Required Bench Top Dimension:	
Clearance above the bench	43 cm (17 in)
Width	127 cm (50 in)
Depth	102 cm (40 in)
Weight	55 kg (110 lb)

Table 3 Instrument Dimensions

Model	Weight	Height	Width	Depth
N4421BH67	11.8 kg (26lb)	13.5 cm (5.25 in)	43.5 cm (17.1 in)	47.0 cm (18.5 in)
E8361A	29 kg (64 lb)	28.0 cm (11.0 in)	43.5 cm (17.1 in)	47.0 cm (18.5 in)
Total	40.8 kg (90 lb)	41.5 cm (16.25 in)	43.5 cm (17.1 in)	47.0 cm (18.5 in)

Maximum Power Levels

CAUTION It is recommend that you do not operate components near damage or maximum levels. The power levels should be kept at less than 3 dB, preferably 6 dB, below damage and maximum levels.

Table 4 Power Levels

Test Setup	Power Level
Maximum N4421BH67 RF Power Levels for Access and Test Ports:	
SOURCE OUT	+15 dbm/20 Vdc
CPLR THRU	+15 dbm/20 Vdc
CPLR ARM	+15 dbm/20 Vdc
A IN	+15 dbm/20 Vdc
B IN	+15 dbm/20 Vdc
PORT 2 and PORT 4	+15 dbm/20 Vdc

NOTE Refer to your PNA–L specifications to determine the Maximum Input Power Levels for the Access and Test Ports.

NOTE Refer to your PNA–L specifications to optimize the power levels in the receivers.

NOTE Damage and maximum levels are not necessarily the optimum level.

Operation

This section will describe how to setup and operate the [Agilent Technologies N4421B Option H67](#) with the E8361A 2-Port Series Network Analyzer.

The [Agilent Technologies N4421B Option H67](#) can be configured for many applications. Included in this document are two typical configurations:

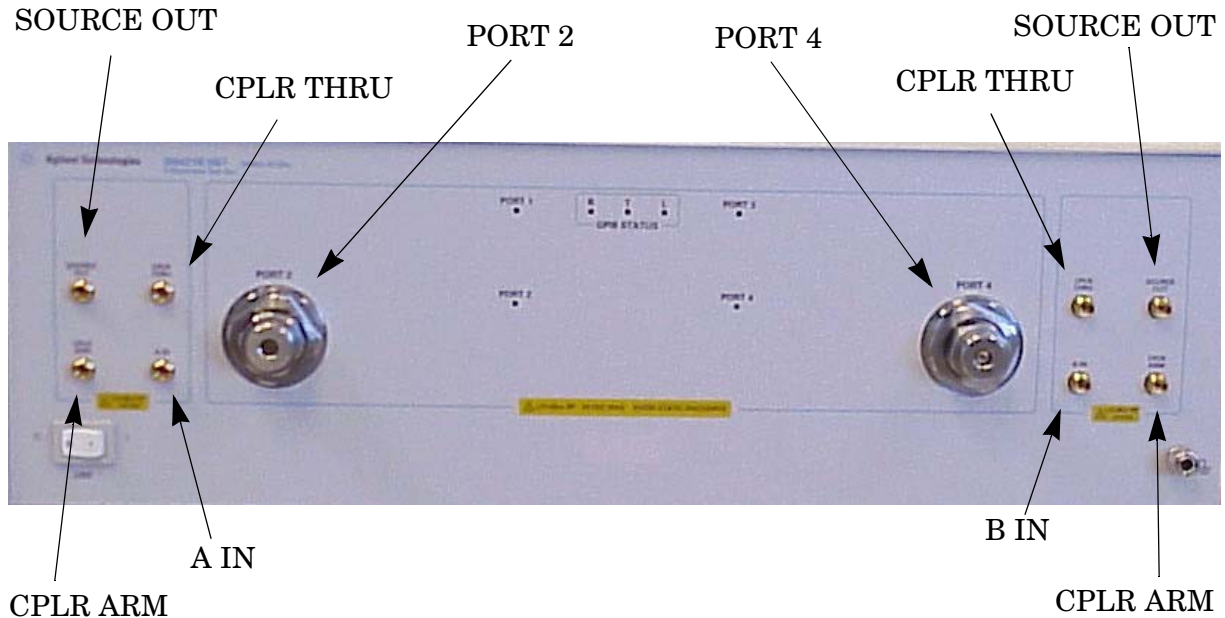
- Agilent N4421BH67 Shipped Configuration, see [Figure 1 on page 7](#).
- Agilent N4421BH67 Setup Configuration, see [Figure 9 on page 14](#).

NOTE The internal firmware of the Agilent E8361A 2-Port PNA-L Series Network Analyzer should have firmware revision A.06.01.05 or greater.

Power levels may differ from those indicated on the PNA when the Test Set is connected.

N4421BH67 Multiport Test Set

Figure 1 Front Panel (Multiport Test Set)



Test Set Status LEDs

PORT 1 – On = Port 1 (located on the PNA) is the source.

PORT 2 – On = Port 2 (located on the Test Set) is the source..

PORT 3 – On = Port 3 (located on the PNA) is the source. (aka. Port 2)

PORT 4 – On = Port 4 (located on the Test Set) is the source.

Port 2 and Access Ports – SMA (female)

SOURCE OUT – Test Port 1 Source Output from PNA.

CPLR THRU – Source Output to PNA Port 1 from the Test Set switch.

CPLR ARM – A Channel Input from the PNA Port 1.

A IN – A Channel Output from the Test Set.

Port 4 and Access Ports – SMA (female)

SOURCE OUT – Test Port 3 Source Output from the PNA.

CPLR THRU – Source Output to PNA Port 3 from the Test Set switch.

CPLR ARM – B Channel Input from PNA Port 3.

B IN – B Channel Output from the Test Set.

Test Ports – 1.85 mm Bulkhead Test Ports (female)

Line Switch

0 – OFF

1 – ON, Power LED On

Figure 2 Rear Panel (Multiport Test Set)



Line Module

Line Module

The line fuse, as well as a spare, reside within the line module. Refer to [Figure 2](#). [Figure 3 on page 9](#) illustrates where the fuses are located and how to access them.

Available Fuses

- **United States (115 V orientation)**
Fuse (F 2.5 A/250V, 2110-1334) U.L. listed and CSA certified
- **Europe (230 V orientation)**
Fuse (F 2.5 A/250V, 2110-1334) IEC listed and U.L. recognized certified

WARNING For continued protection against fire hazard replace line fuse only with same type and rating:

- United States—F 2.5A/250V, Part Number 2110-1334
- Europe—F 2.5A/250V, Part Number 2110-1334

The use of other fuses or material is prohibited.

Figure 3 Line Fuse

System Setup

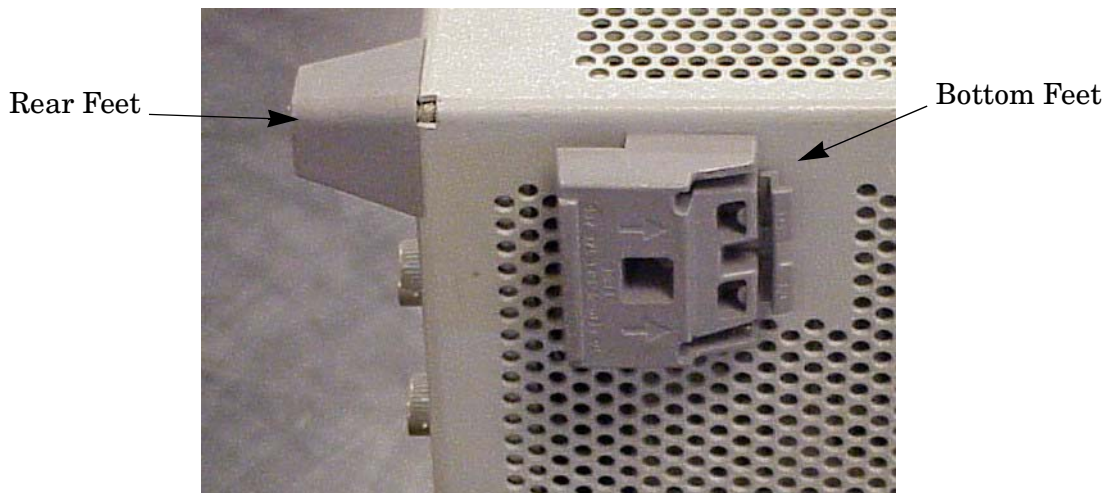
Attaching the Test Set to the PNA

This step is not necessary if you plan to place the Network Analyzer and Test Set in an equipment rack.

Preparing the Network Analyzer

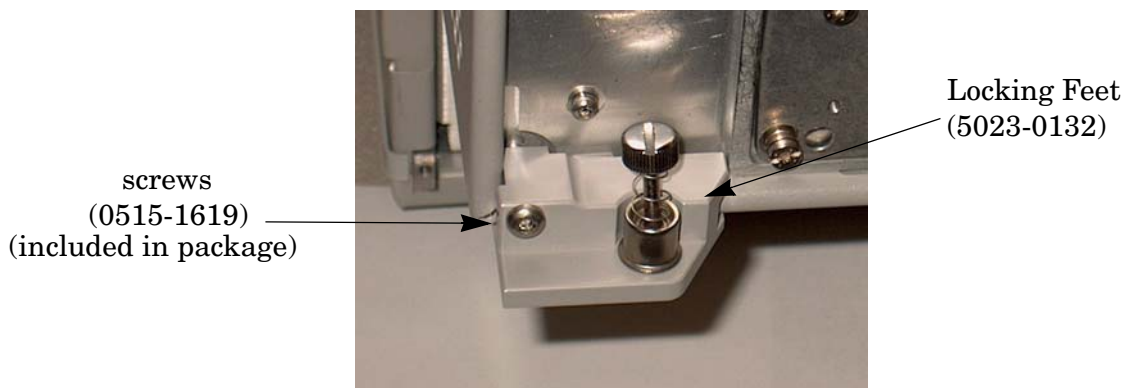
1. Remove the feet from the bottom of the network analyzer. Refer to [Figure 4](#).

Figure 4 Rear and Bottom Feet



2. Remove the 2 lower rear feet and screws (0515-1619) from the rear panel on the network analyzer. Refer to [Figure 4](#).
3. Install the two rear locking feet (5023-0132) using screws (0515-1619), where the rear feet were removed. Refer to [Figure 5](#).

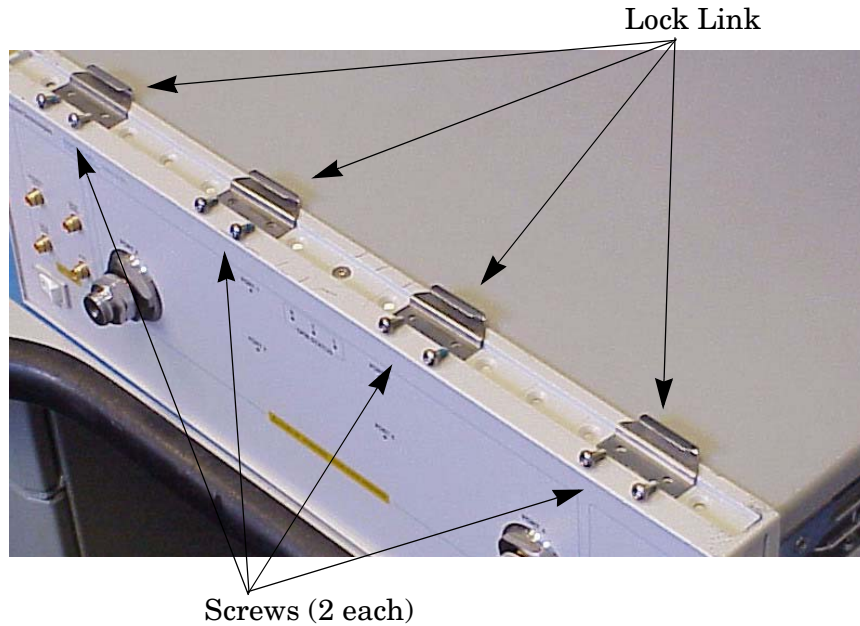
Figure 5 Installing Lock Feet



4. Remove the front frame top trim strip from the Test Set.

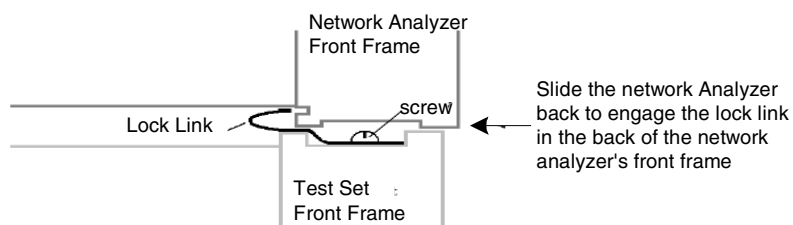
5. Install the four lock links (1600-1423) on the top of the front frame, using 8 screws (0515-1499). Refer to [Figure 6](#).

Figure 6 Lock Links



6. Place the network analyzer on top of the Test Set and ensure that the front frame of the network analyzer is positioned slightly forward of the locks that are attached to the Test Set. Slide the network analyzer back so the locks engage the front frame of the analyzer. Refer to [Figure 7](#).

Figure 7 Locking the Analyzer's



7. Secure the network analyzer's lower locking feet to the Test Set upper locking feet, using the spring-loaded screws on the locking feet. Refer to [Figure 8](#). If the network analyzer's lower locking feet are not aligned with the screw holes in the Test Set's upper locking feet, loosen the screws securing the feet to the instrument slightly to align.

Figure 8 Locking Feet Screws



RF Cable Connections

Figure 9 on page 14 illustrates the setup configuration of the N4421BH67 Multiport Test Set and how it should be configured to the E8361A 2-Port PNA-L Series Network Analyzer for normal use. If this is the first use, proceed to “Performance Initialization” on page 18 for the steps necessary for a full calibration.

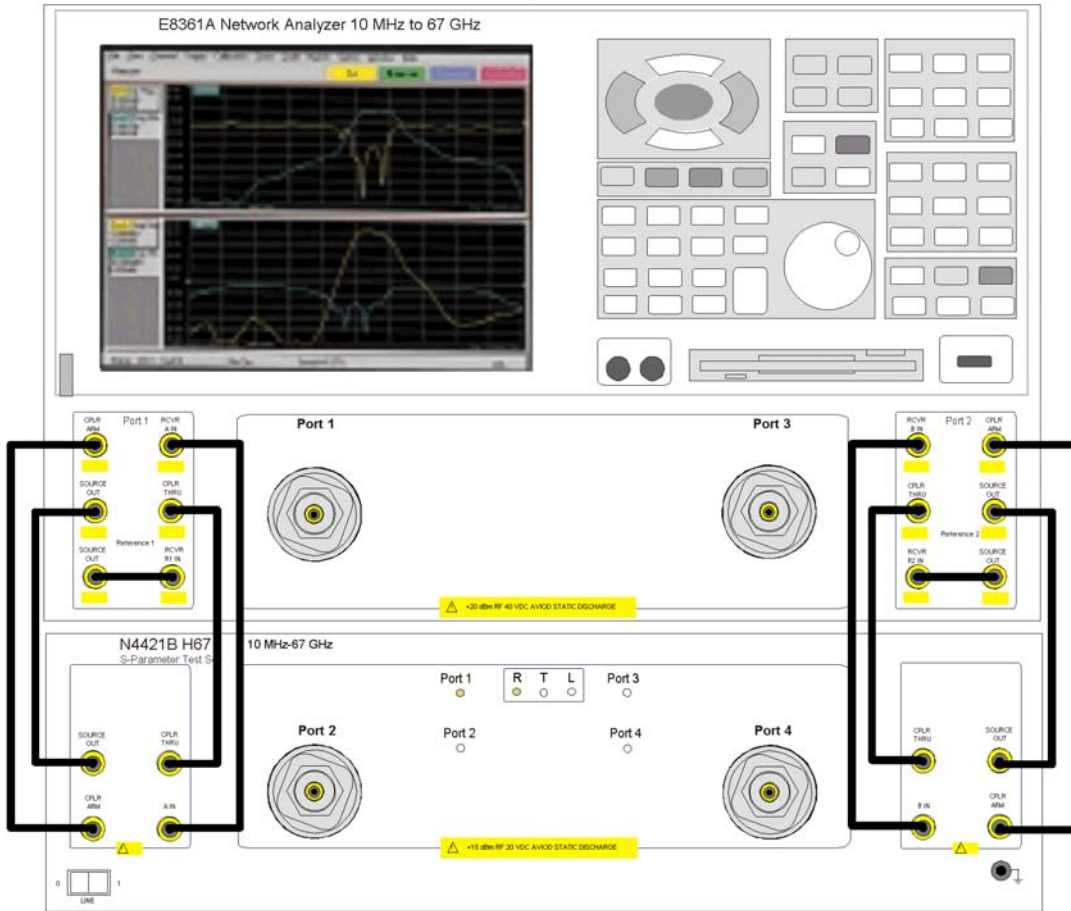
1. The RF cables supplied with this option connect between the E8361A 2-Port PNA-L Series Network Analyzer and the N4421BH67 test set. Torque each cable to 8 in-lb. Connect the cables as listed in Table 5.

CAUTION Over-torque will cause damage to the test set and may cause connectors to spin or become loose.

Table 5 Cable Connection

RF Cables	From (PNA)	To (Test Set)
N4421-20010	Port 1 SOURCE OUT	Port 2 SOURCE OUT
N4421-20010	Port 1 CPLR THRU	Port 2 CPLR THRU
N4421-20009	Port 1 CPLR ARM	Port 2 CPLR ARM
N4421-20009	Port 1 RCVR A IN	Port 2 A IN
N4421-20010	Port 3 SOURCE OUT	Port 4 SOURCE OUT
N4421-20010	Port 3 CPLR THRU	Port 4 CPLR THRU
N4421-20009	Port 3 CPLR ARM	Port 4 CPLR ARM
N4421-20009	Port 3 RCVR B IN	Port 4 B IN

Figure 9 N4421BH67 Setup Configuration



Firmware Revision Verification

To correctly use the N4421BH67 with the PNA, it is necessary to insure that the correct firmware is installed in the PNA. The following steps will guide the user to verify and/or load the latest revision of firmware.

1. Verify PNA firmware is A.06.01.05 or greater.
2. If not, navigate to <http://na.tm.agilent.com/pna/firmware> to download the latest firmware.

Enabling 4-Port Capability

The following steps enable the PNA to communicate properly with the N4421BH67 configuring the PNA from a 2-port instrument into a 4-port system.

NOTE Option 550 must be installed on the PNA for use with the H67 in 4-Port mode.

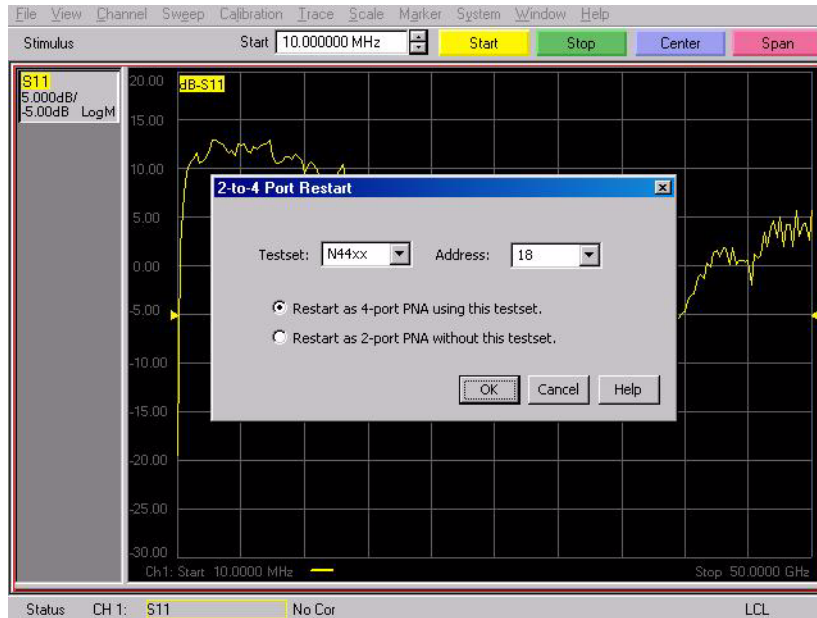
1. Select **System > Configure > 4-Port Capability** on the PNA. Refer to [Figure 10](#).

Figure 10 4-Port Capability Enabled



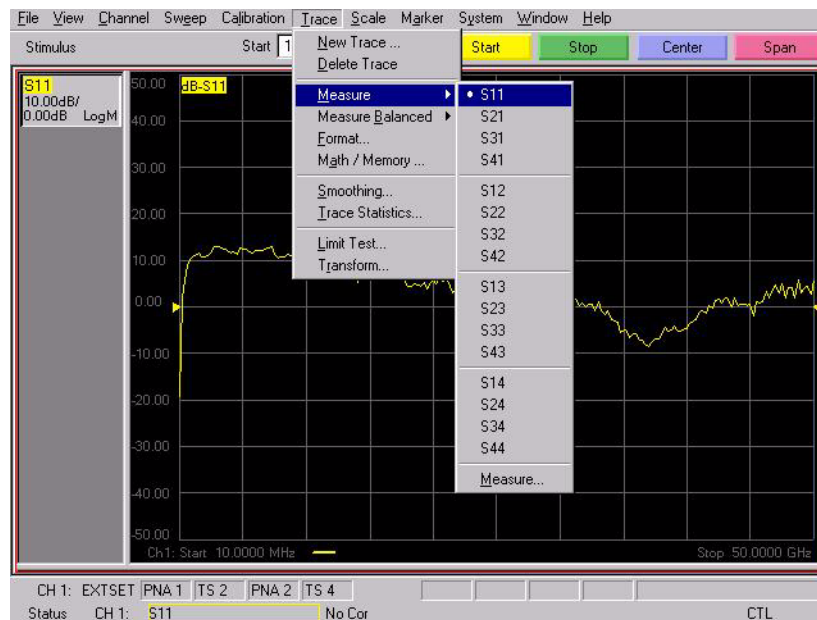
2. Insure that “Restart as 4–Port PNA using this testset” is selected. If not, select it, then press **OK**. The PNA application will restart. Refer to [Figure 11](#).

Figure 11 2-to-4 Port Restart



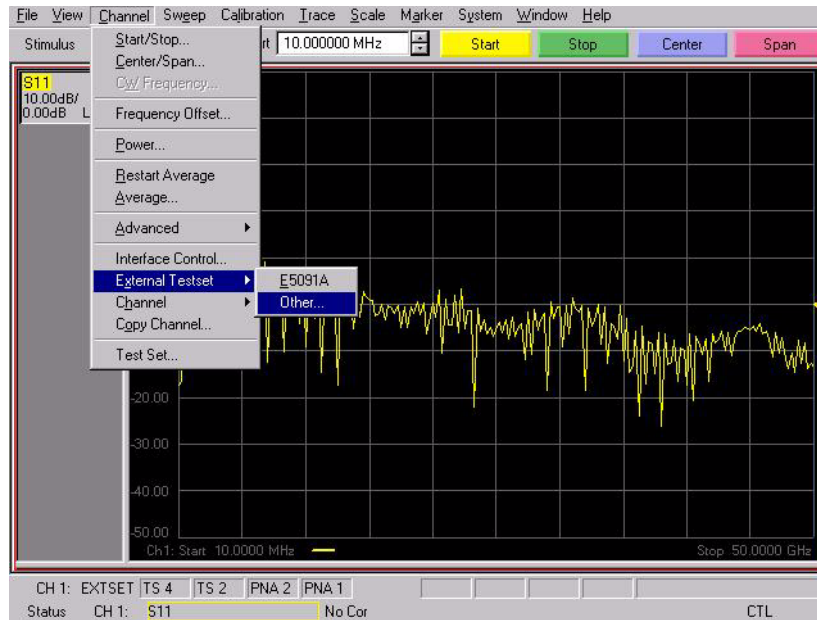
3. After the PNA has restarted, verify that the PNA is operating in 4–port mode by selecting **Trace > Measure**. You should see references to Port 4 in the measurement list, such as S41, S42, etc. Refer to [Figure 12](#).

Figure 12 Checking for 4-Port Capability



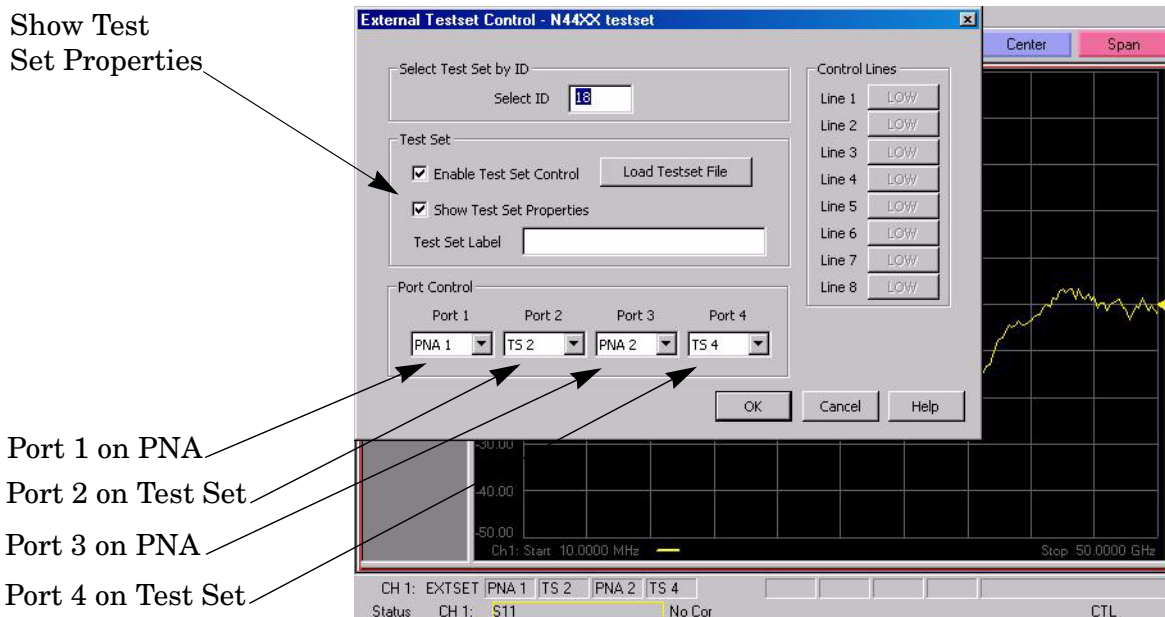
4. Select **Channel > External Testset > Other**. Refer to [Figure 13](#).

Figure 13 Controlling the External Test Set



5. The PNA and the N4421BH67 is now configured as a 4–Port system and the Port Control drop–down menus allow the user to specify which port of the PNA and Test Set is designated as one of the four ports of the 4–Port System. The default is shown in Port Control in [Figure 14](#). The Test Set properties are displayed on the PNA and are enabled by “Show Test Set Properties.” Refer to [Figure 14](#).

Figure 14 Port Mapping



Show Test Set Properties

Port 1 on PNA

Port 2 on Test Set

Port 3 on PNA

Port 4 on Test Set

Performance Initialization

Overview

Performance Initialization for the [Agilent Technologies N4421B Option H67](#) requires that the user be familiar with the equipment and components listed in [Table 6](#). The sequence of this procedure is very important and must be followed or the performance accuracy and results may vary from the reference plots provided. Refer to the following sections:

- [“Equipment Required” on page 18.](#)
- [“Determining the RF Cable Length” on page 20.](#)
- [“PNA Ports 1 & 3 Adaptor Removal Cal” on page 24.](#)
- [“PNA Source Port Adaptor Removal Cal” on page 28](#)
- [“Full System 4–Port Adaptor Removal Cal” on page 36.](#)

Equipment Required

This section provides an Equipment List and setup of the PNA and PNA Test Set.

Table 6 Equipment List

Description	Qty
E8361A Network analyzer 10 MHz to 67 GHz (with firmware 6.0)	1
N4694A ECal module or 85058B/E Cal Kit (or equivalent)	1
N4697E/F 1.85 mm RF (F–F) cable, 28 inch minimum or equivalent	1
1.8 mm male short (or equivalent)	1
GPIB Cable 0.5 meter (or equivalent)	1
RF long PNA/TS jumper cables (N4421-20009)	4
RF short PNA/TS jumper cables (N4421-20010)	4

PNA Initial Setup

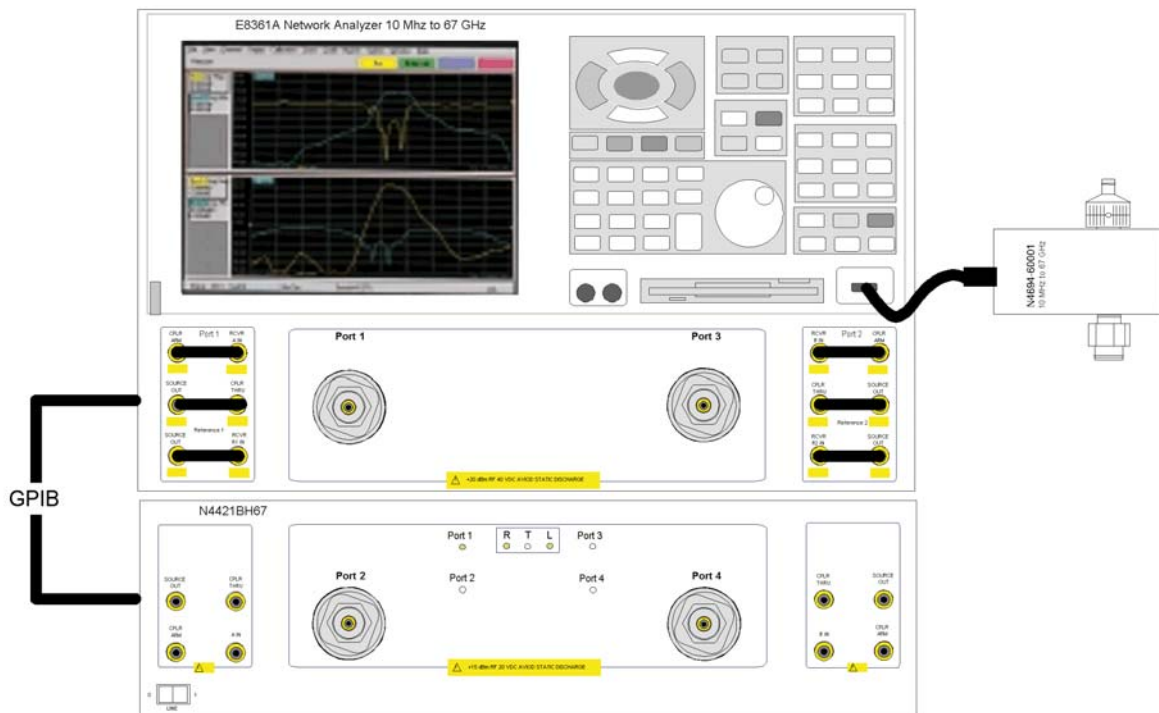
The PNA Initial Setup illustrates the connections between the PNA and the Test Set using a GPIB cable and the short jumper cables on the PNA. The PNA must be positioned on top of the Test Set. Refer to [Figure 15](#).

Table 7 PNA Initial Setup

Start Frequency:	10 MHz
Stop Frequency:	67 GHz
Power Level:	-17 dBm
IF Bandwidth:	100
Number of Points:	401
System Configure:	4-Port Capability

1. Connect the ECal module to the PNA's USB port.
2. Configure the PNA as indicated in [Table 7](#).
3. Once the ECal module, Test Set and PNA have been ON for a minimum of a half hour proceed to the next section.

Figure 15 PNA/Test Set Initial Setup



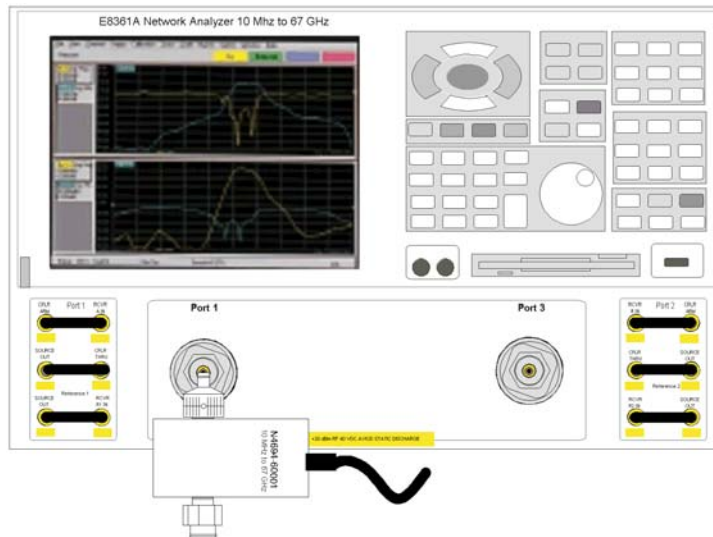
Determining the RF Cable Length

To take full advantage of the 4-Port PNA and the N4421BH67 Test Set, the first step is to determine the electrical delay of the RF cable used throughout the calibration and normalization.

Procedure

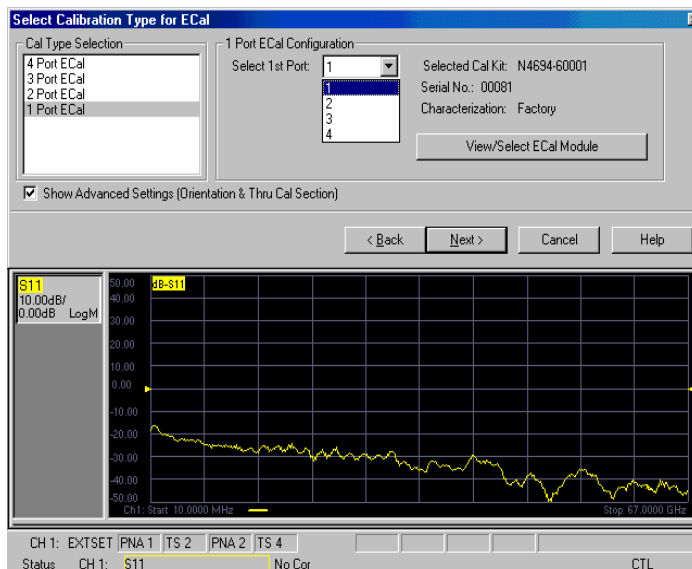
1. Connect Port A (female) of the ECal module to Port 1 of the PNA. Refer to [Figure 16](#).

Figure 16 ECal Port A to PNA Port 1

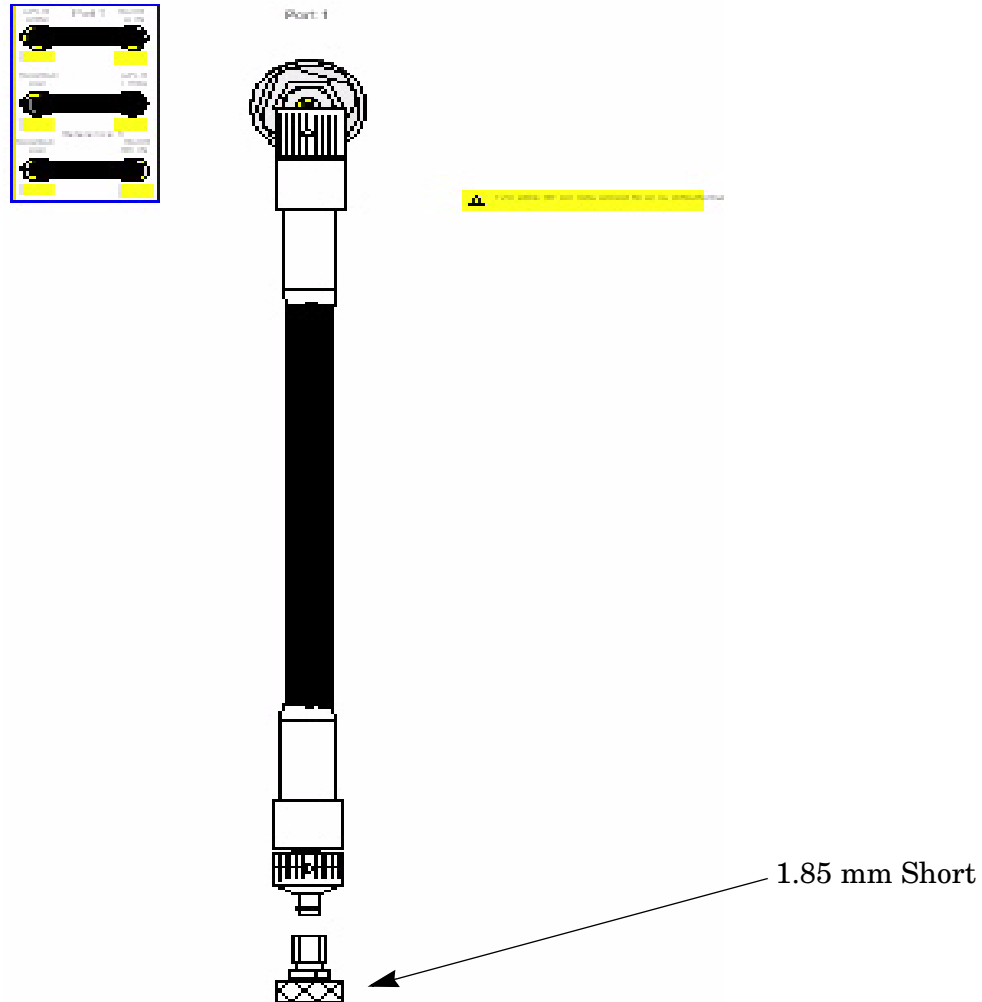


2. Perform a 1-Port ECal calibration on Port 1 of the PNA. Refer to [Figure 17](#).

Figure 17 1-Port ECal at PNA Port 1



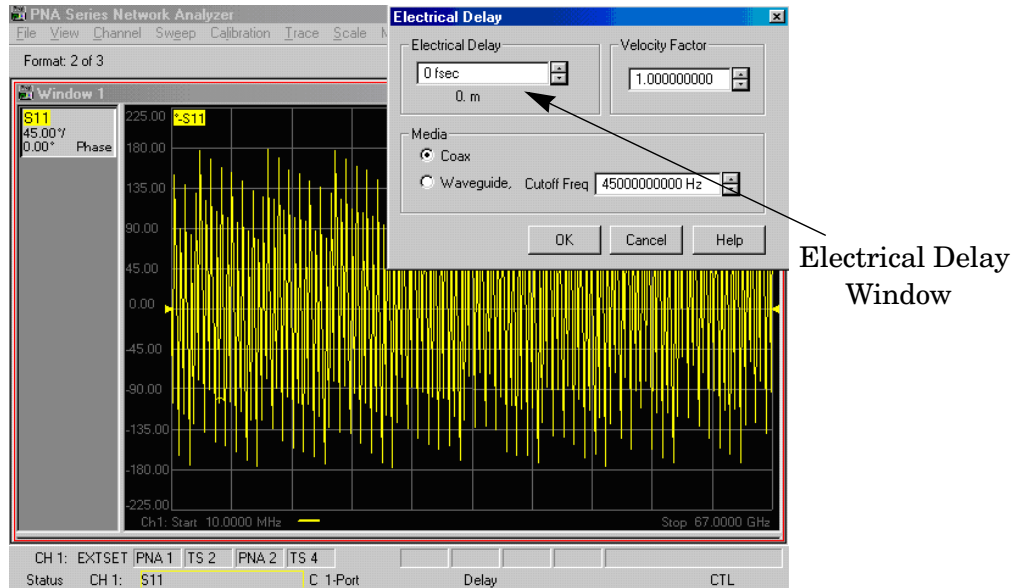
3. After the 1-Port calibration has been completed, disconnect the ECal and connect the RF cable (N4697F (F-F)) to Port 1 of the PNA. Refer to [Figure 18](#).
4. Connect the 1.85 mm Short (male) to the end of the RF cable. Refer to [Figure 18](#).

Figure 18 RF Cable

5. Select **Trace > Format > Phase**.
6. Set the Scale Phase Offset to 150 °.

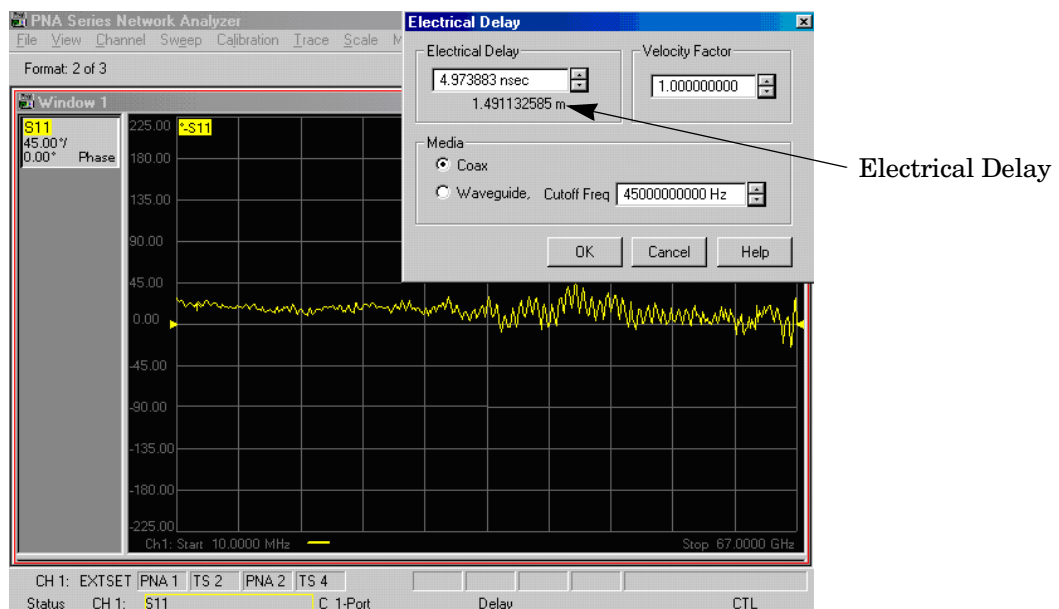
7. Select **Scale > Electrical Delay**. Adjust the Electrical Delay using the front panel knob until a flat response can be seen across the display. **Figure 19** shows the initial response prior to any adjustment for the delay.

Figure 19 Initial Response



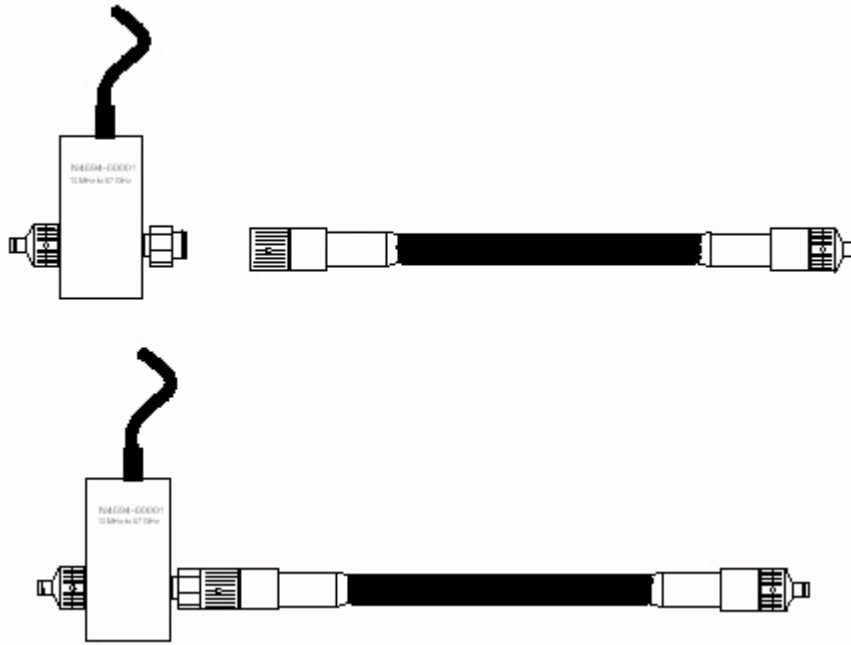
8. Once adjusted as shown in **Figure 20**, record the Electrical Delay (ns) shown under the Electrical Delay window. In this example, using the N4697F (F-F) cable, the delay was measured at 4.973883 ns. Divide the Electrical Delay by 2, equalling 2.4869415. This number will be used in **Step 5** on page 27, **Step 6** on page 31, and **Step 10** on page 41.

Figure 20 Electrical Delay



9. Select **Trace > Format > Log-Mag**.
10. Connect the ECal to the RF cable as shown in [Figure 21](#).

Figure 21 Connecting the ECal to the RF Cable



NOTE The procedure that follows instructs the user to move the ECal from one port to another. It is important to maintain the cable orientation throughout the calibration. Referring to [Figure 21](#), the ECal should be disconnected from both the cable and the instrument, then moved from the left side to the right side of the cable, instead of simply disconnecting only the ends connected to the instrument and flipping them around. This will cause mismatched reflections and inaccurate normalization.

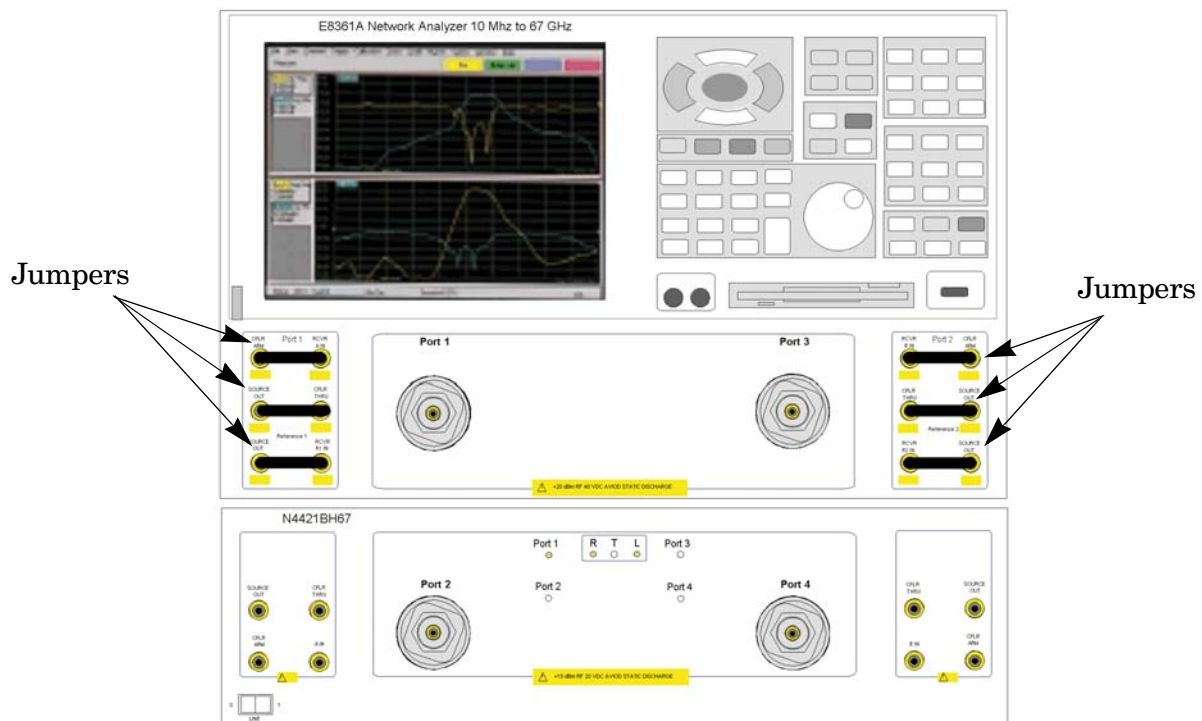
PNA Ports 1 & 3 Adaptor Removal Cal

This section provides the reference or baseline calibration to remove the loss transmission and reflection tracking error terms of the PNA. The error terms for this base calibration will be used to normalize the system cal and extract the effects of the test set on the system. These error terms will be stored in memory to normalize the PNA and Test Set. Recall that a label “Port 3” has been placed over or near the PNA Port 2 and will be referenced from this point forward as Port 3.

Procedure

1. Configure the PNA using the short jumpers (provided with PNA) as shown in [Figure 22](#).

Figure 22 Connect the short jumpers to the PNA



2. Perform a 2-Port Adaptor Removal Calibration for Ports 1 and 3. Refer to [Figure 23](#).

Figure 23 2-Port Calibration using the ECal

Select Calibration Type for ECal

Cal Type Selection

- 4 Port ECal
- 3 Port ECal
- 2 Port ECal
- 1 Port ECal

2 Port ECal Configuration

Select 1st Port: 1

Select 2nd Port: 3

Selected Cal Kit: N4694-60001

Serial No.: 00081

Characterization: Factory

View/Select ECal Module

Show Advanced Settings (Orientation & Thru Cal Section)

< Back Next > Cancel Help

Electronic Calibration: Select DUT Connectors

Connectors Cal Kits

DUT Port 1: 1.85 mm female

DUT Port 3: 1.85 mm female

N4694-60001 ECal

N4694-60001 ECal

Cal Method: 2-Port, Adapter Removal, SOLT, SOLT

< Back Next > Cancel Help

Electronic Calibration: Advanced Settings

Thru Calibration Options (Cal Type: 2-Port)

Thru Cal Method:

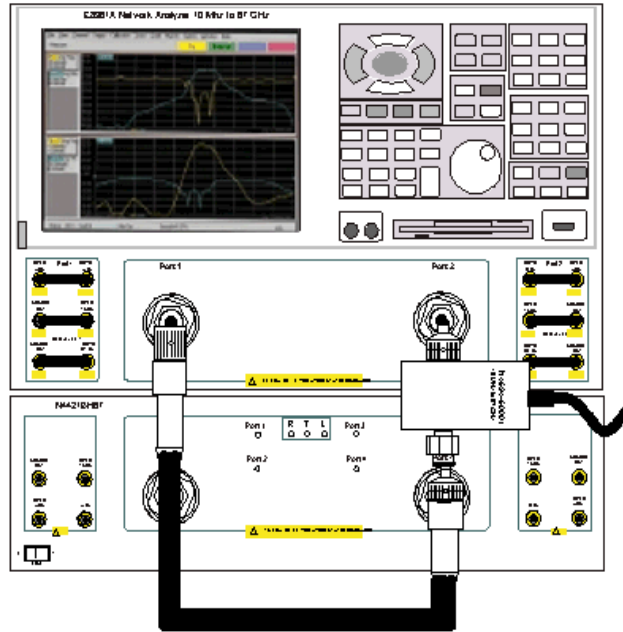
Thru #1: 1-3 Adapter Removal Mod Stds

Do orientation (auto sensing of port connections) Choose delta match

< Back Next > Cancel Help

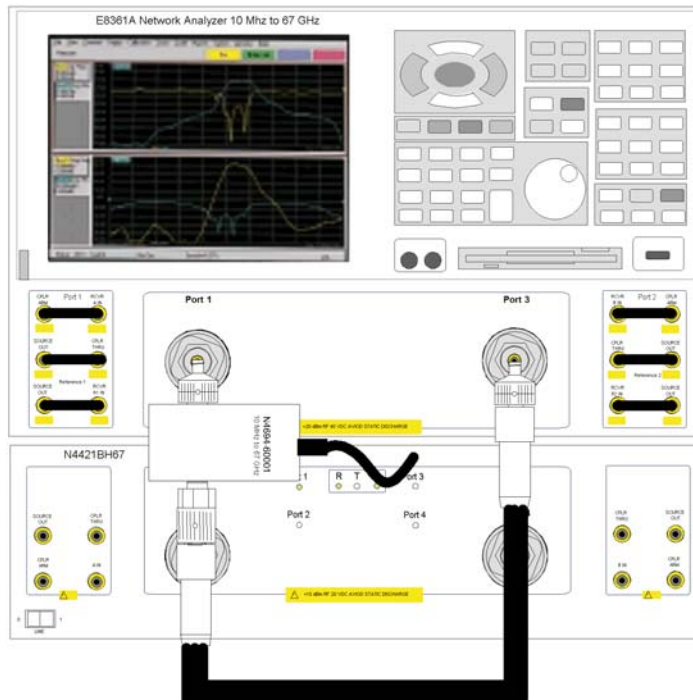
3. The Adaptor Removal Calibration instructions will prompt the user to connect the analyzer with the ECal and RF cable as shown in [Figure 24](#).

Figure 24 ECal at Port 3, RF Cable at Port 1



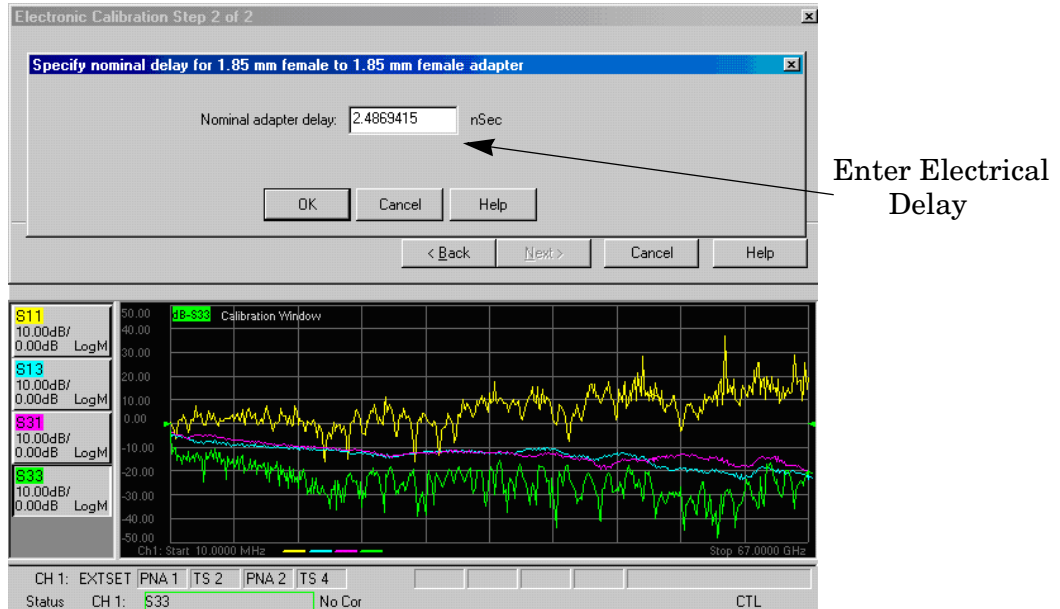
4. The Adaptor Removal Calibration instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 25](#).

Figure 25 ECal at Port 1, RF Cable at Port 3



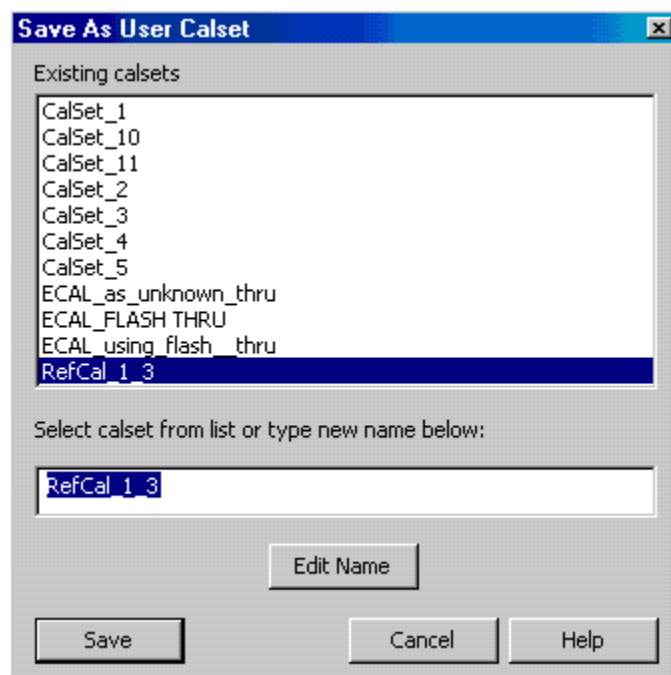
- The Adaptor Removal Calibration instructions will require you to enter the delay number calculated in Step 8 on page 22 for the electrical delay of the RF cable.

Figure 26 Nominal Adapter Delay



- Complete the calibration and save the calibration as User Calset “RefCal_1_3”. This calibration file will be used in several steps.

Figure 27 Saving the Calibration



PNA Source Port Adaptor Removal Cal

This section provides the steps to normalize the PNA source loss (Transmission Tracking Errors) through the connected Test Set.

Procedure

1. On the PNA, remove both the Port 1 and Port 3 jumpers that connect from the SOURCE OUT to the CPLR THRU.
2. Connect the Test Set to the PNA using the jumpers (N4421-20010). Refer to [Figure 28](#) and [Table 8](#).

Figure 28 Test Set to PNA Connections

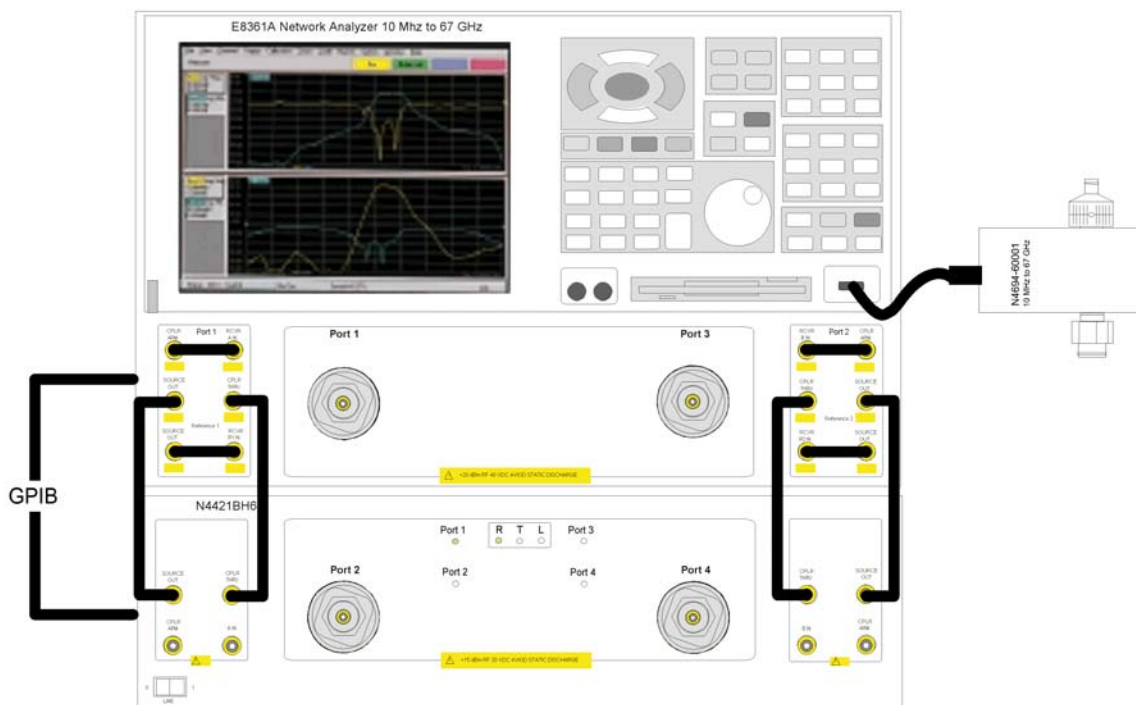


Table 8 PNA to Test Set Connections

PNA	Test Set	Part Number
Port 1 - SOURCE OUT	Port 2 - SOURCE OUT	N4421-20010
Port 1 - CPLR THRU	Port 2 - CPLR THRU	N4421-20010
Port 3 - SOURCE OUT	Port 4 - SOURCE OUT	N4421-20010
Port 3 - CPLR THRU	Port 4 - CPLR THRU	N4421-20010

3. Perform a 2-Port Adaptor Removal Calibration for Ports 1 and 3. Refer to [Figure 29](#).

Figure 29 2-Port Cal for PNA Ports 1 & 3

Select Calibration Type for ECal

Cal Type Selection

- 4 Port ECal
- 3 Port ECal
- 2 Port ECal**
- 1 Port ECal

2 Port ECal Configuration

Select 1st Port: 1

Select 2nd Port: 3

Selected Cal Kit: N4694-60001

Serial No.: 00081

Characterization: Factory

View/Select ECal Module

Show Advanced Settings, Orientation & Thru Cal Section

< Back Next > Cancel Help

Electronic Calibration: Select DUT Connectors

Connectors

DUT Port 1: 1.85 mm female

DUT Port 3: 1.85 mm female

Cal Kits

N4694-60001 ECal

N4694-60001 ECal

Cal Method: 2-Port, Adaptor Removal, SOLT, SOLT

< Back Next > Cancel Help

Electronic Calibration: Advanced Settings

Thru Calibration Options (Cal Type: 2-Port)

Thru Cal Method: Adapter Removal

Thru #1: 1-3

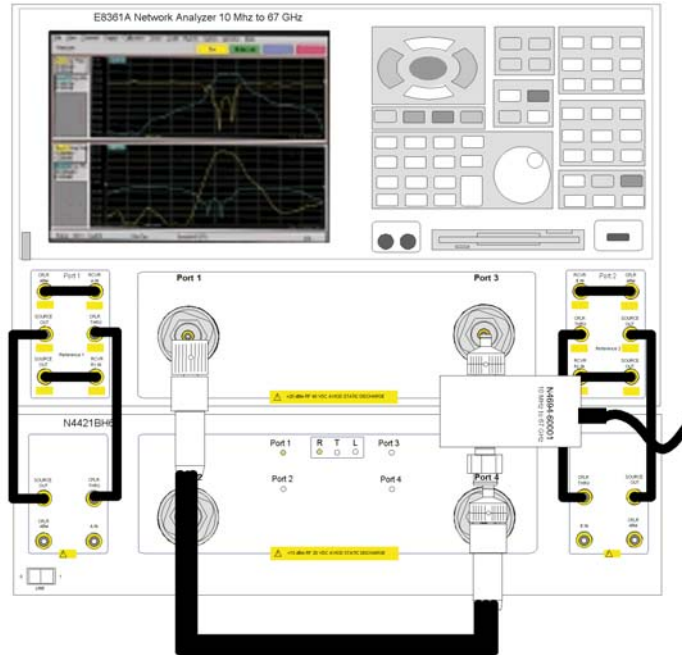
Mod Stds

Do orientation (auto sensing of port connections) Choose delta match

< Back Next > Cancel Help

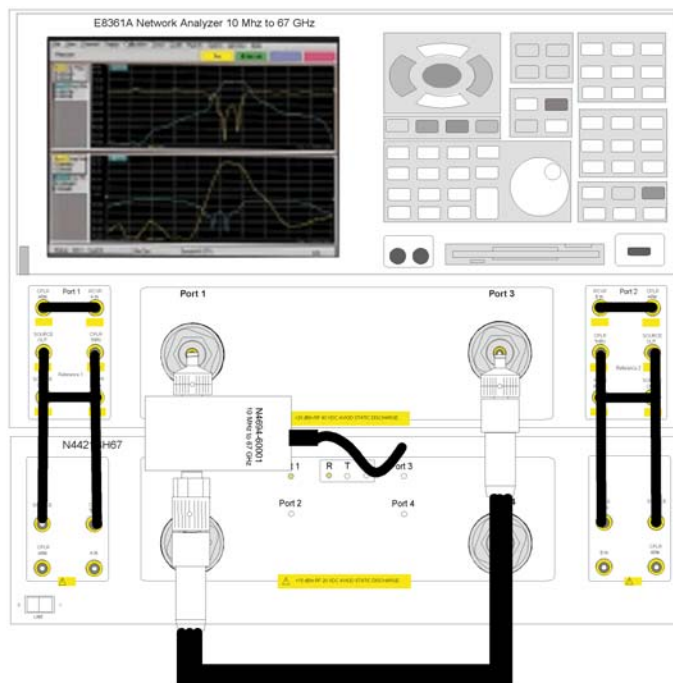
- The Adaptor Removal Calibration instructions will prompt the user to connect the analyzer with the ECal and RF cable as shown in [Figure 30](#).

Figure 30 ECal at Port 3, RF Cable at Port 1



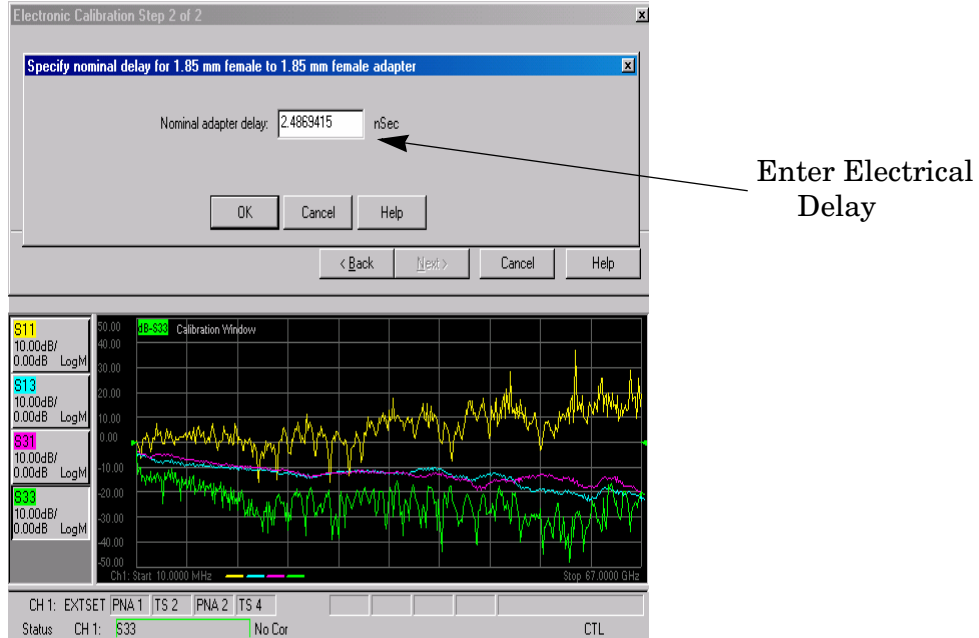
- The Adaptor Removal Calibration instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 31](#).

Figure 31 ECal at Port 1, RF Cable at Port 3



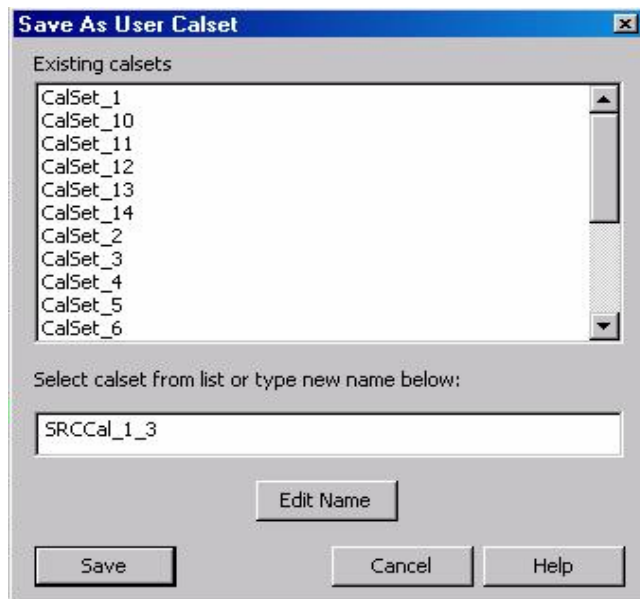
- The Adaptor Removal Calibration instructions will require you to enter the delay number calculated in [Step 8 on page 22](#) for the electrical delay of the RF cable.

Figure 32 Nominal Adapter Delay



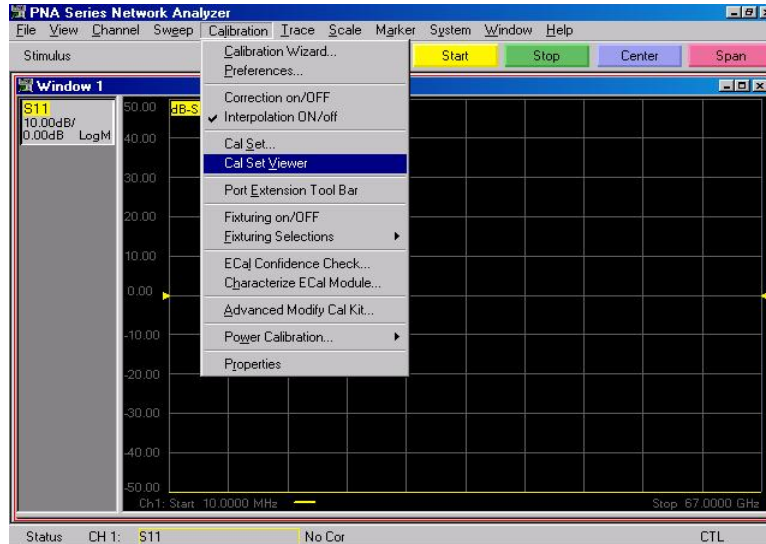
- Complete the calibration and save the calibration as User Calset “SRCCal_1_3”.

Figure 33 Saving the Calibration



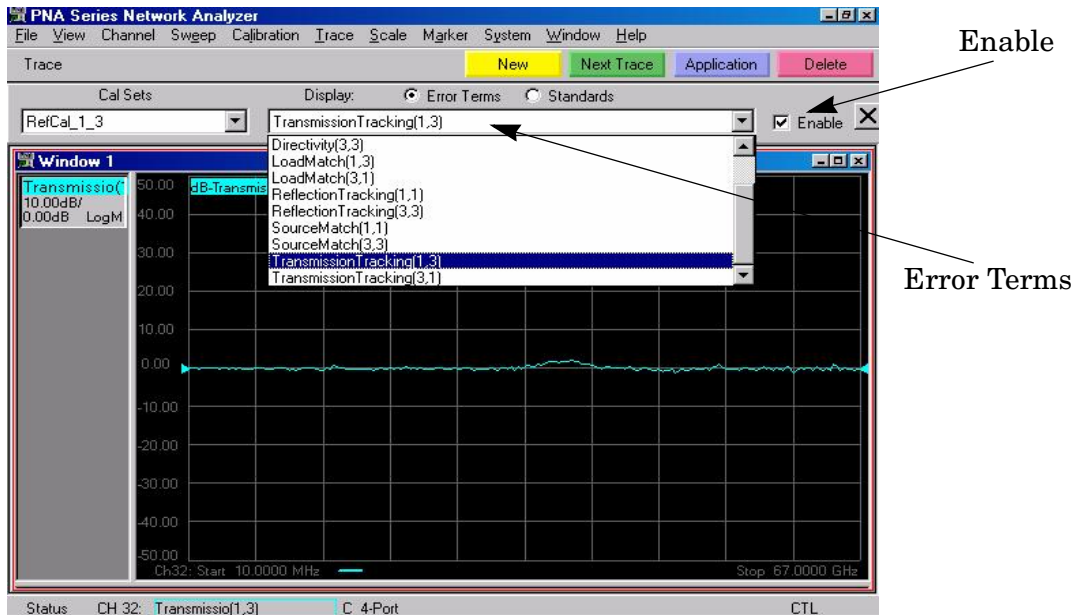
- With the calibration “SRCCal_1_3” complete, using the drop-down menus, select the “Cal Set Viewer” as shown in Figure 34.

Figure 34 Cal Set Viewer



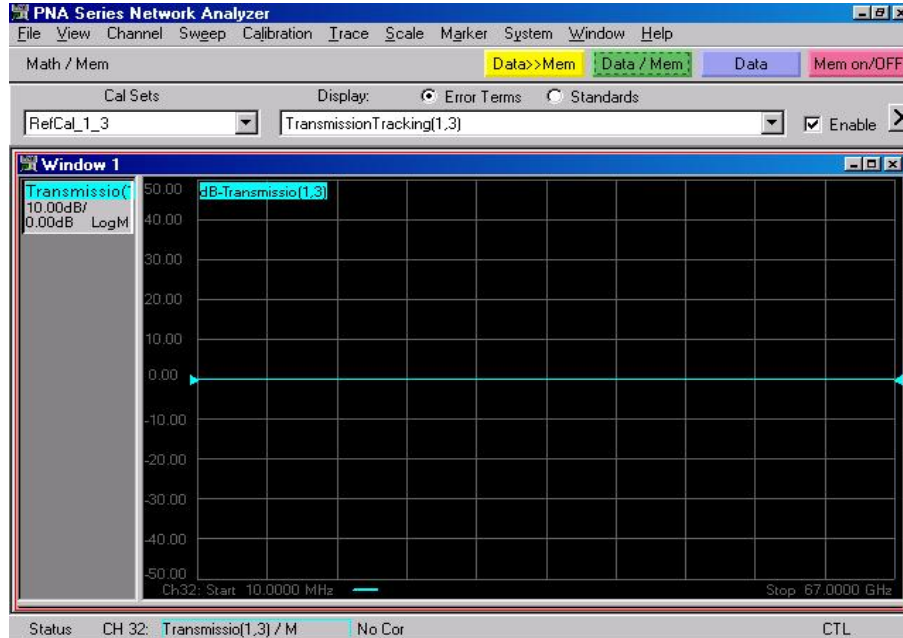
- In the CalSets drop-down menus on the left, select “RefCal_1_3”. In the center drop-down menu, select **TransmissionTracking(1,3)** and insure that both the Enable and Error Terms are checked as shown in Figure 35.

Figure 35 Transmission Tracking(1,3)



10. Normalize the PNA TransmissionTracking(1,3) term by selecting **Data>Mem** and **Data/Mem** as shown in Figure 36.

Figure 36 Normalize Transmission Tracking(1,3)



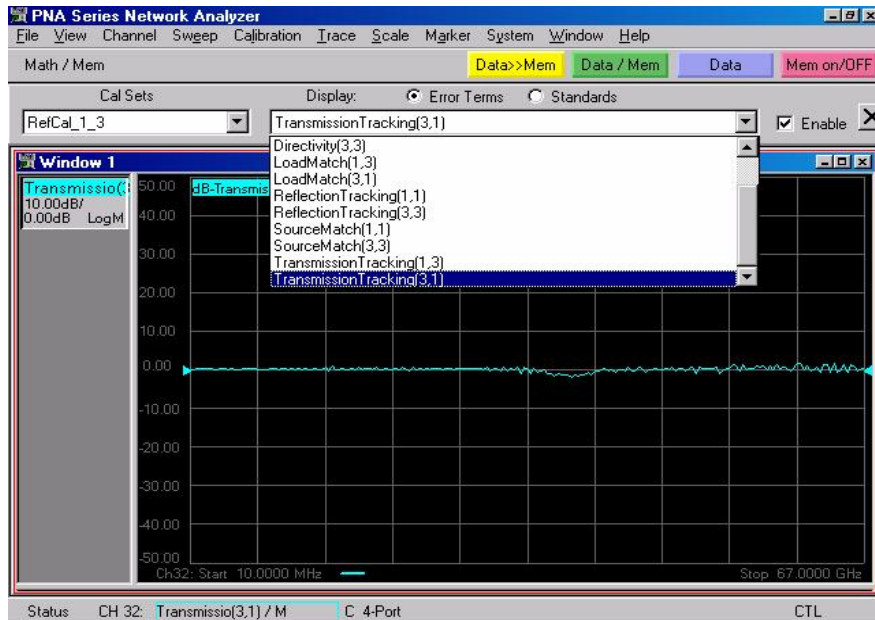
11. From the CalSets drop-down menu, select “**SRCCal_1_3**” and then select the **TransmissionTracking(1,3)** term in Figure 37. This is the Port 1 Source loss.

Figure 37 Port 1 Source Loss



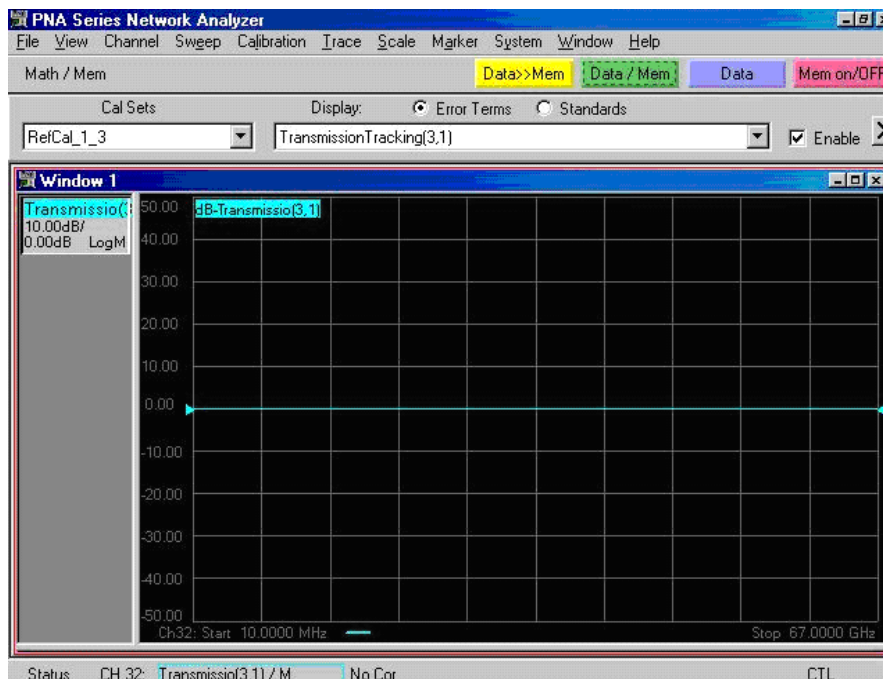
- Repeat the procedure for the TransmissionTracking(3,1). Select “RefCal_1_3” from the CalSets drop-down menu. In the drop-down menu on the right, select the TransmissionTracking(3,1) term as shown in Figure 38.

Figure 38 Transmission Tracking(3,1)



- Normalize the PNA TransmissionTracking(3,1) term by selecting Data>Mem and Data/Mem as shown in Figure 39.

Figure 39 Normalize Transmission Tracking(3,1)



- From the CalSets drop-down menu, select “**SCRCal_1_3**” and then select the **TransmissionTracking(3,1)** term in Figure 40. This is the Port 3 Source loss.

Figure 40 Port 3 Source Loss



Full System 4-Port Adaptor Removal Cal

This section provides the test calibrations that will remove the transmission and reflection tracking errors and source loss from the “PNA Source Port Adaptor Removal Cal” on page 28. The error terms from “PNA Source Port Adaptor Removal Cal” will be stored into memory to normalize the PNA and Test Set ports, resulting in receiver loss. The Load Match and Source Match can be extracted “Full System 4-Port Adaptor Removal Cal”.

Procedure

1. Remove both the Port 1 and Port 3 jumpers that connect from the CPLR ARM to the RCVR A/B IN.
2. Connect the Test Set to the PNA using the jumpers (N4421-20009). Refer to Table 9.

Figure 41 Test Set to PNA Connections

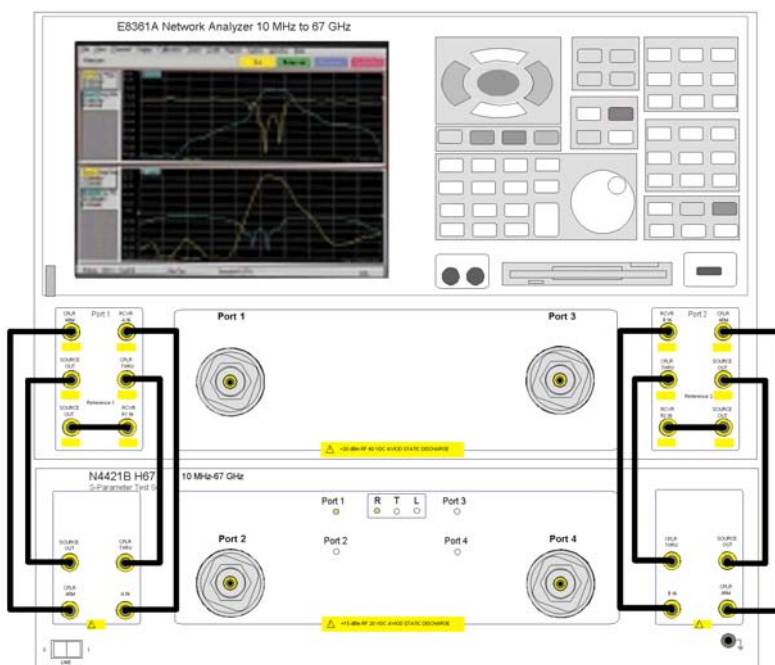
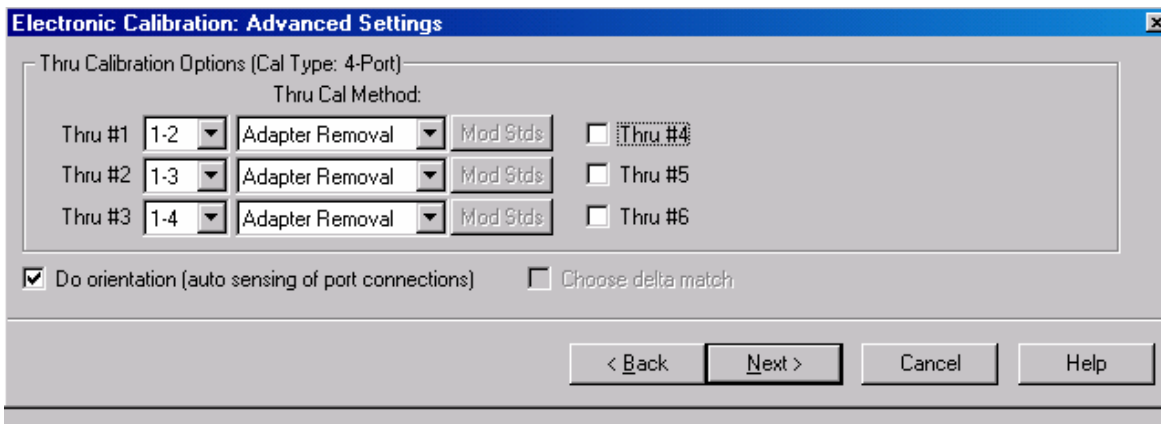
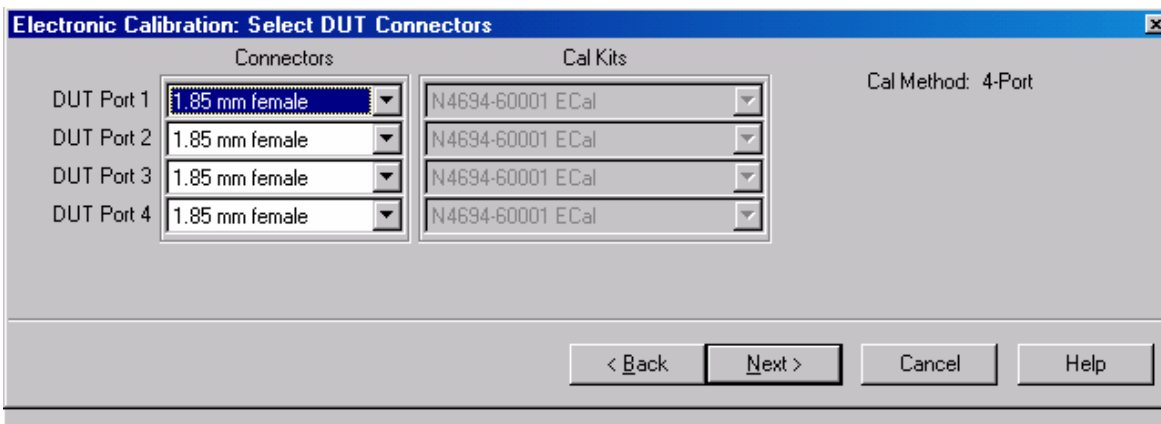
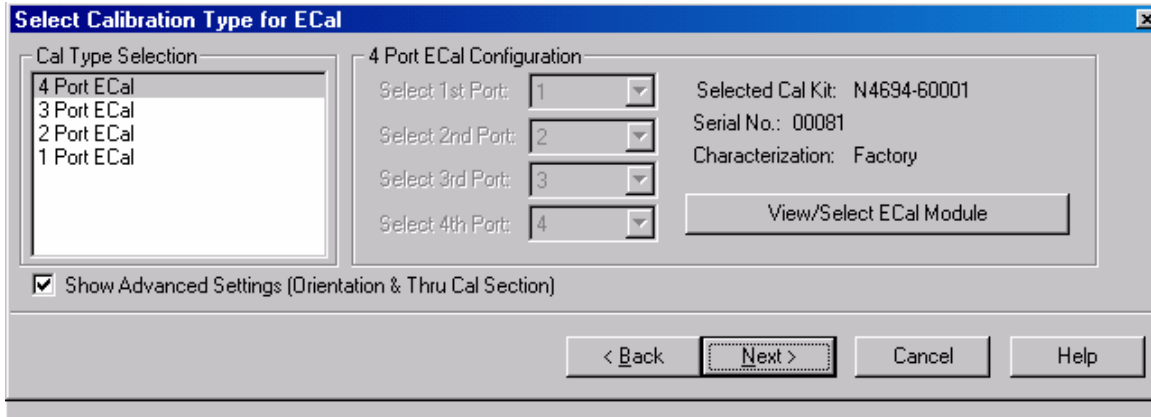


Table 9 PNA to Test Set Connections

PNA	Test Set	Part Number
Port 1 - CPLR ARM	Port 2 - CPLR ARM	N4421-20009
Port 1 - RCVR A IN	Port 2 - A IN	N4421-20009
Port 3 - CPLR ARM	Port 4 - CPLR ARM	N4421-20009
Port 3 - RCVR B IN	Port 4 - B IN	N4421-20009

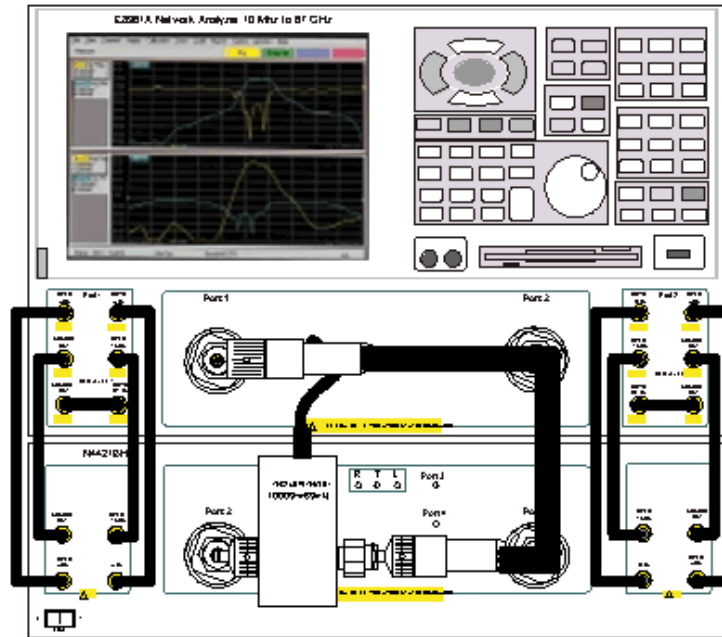
3. Perform a 4-Port Calibration with Adaptor Removal indicated for ALL.
Refer to [Figure 42](#)

Figure 42 4-Port Calibration



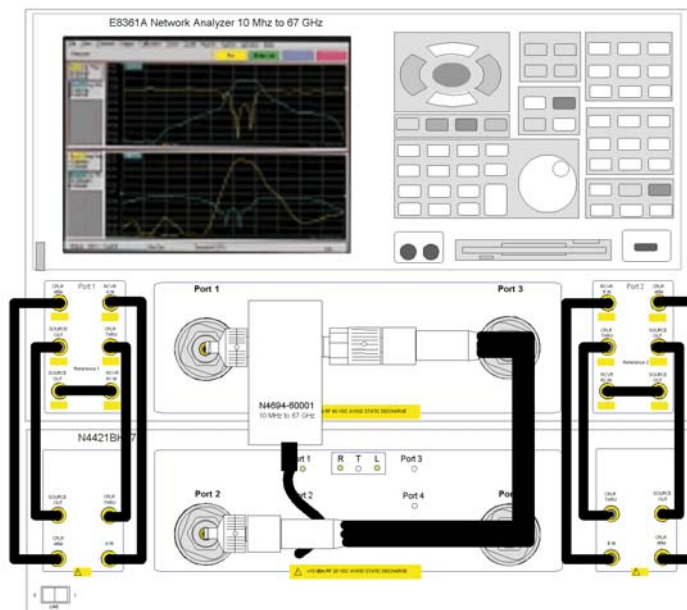
- The Adapter Removal Cal instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 43](#).

Figure 43 ECal at Port 2, RF Cable at Port 1



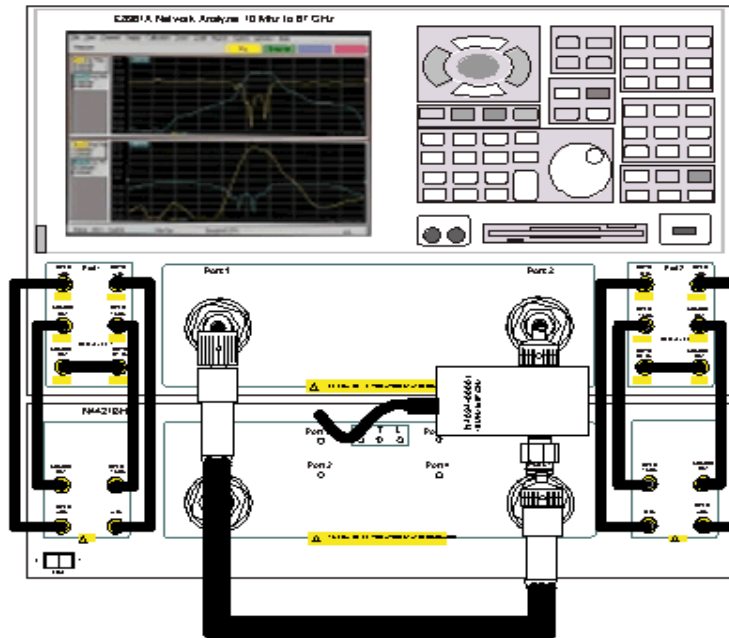
- The Adapter Removal Cal instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 44](#).

Figure 44 ECal at Port 1, RF Cable at Port 2



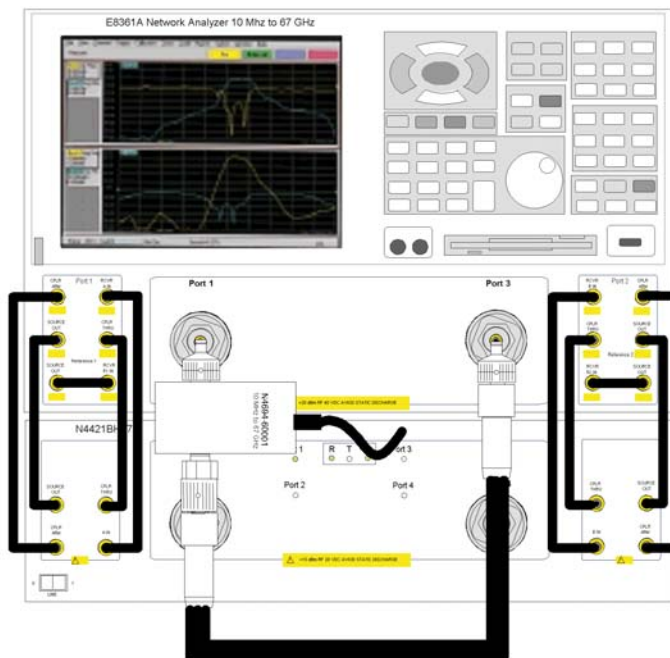
- The Adapter Removal Cal instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 45](#).

Figure 45 ECal at Port 3, RF Cable at Port 1



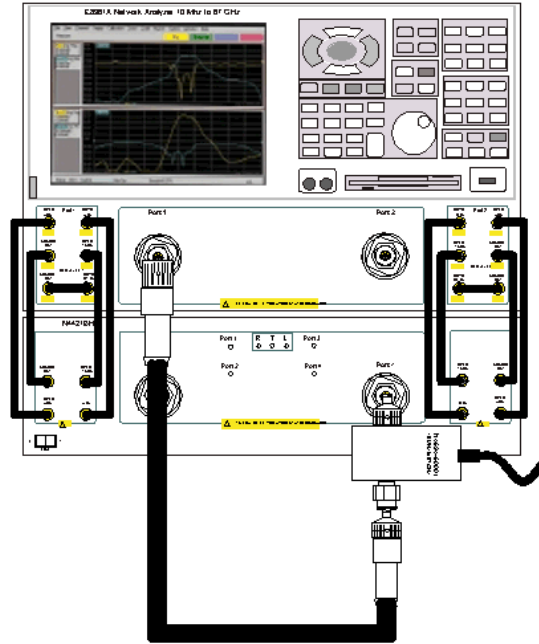
- The Adapter Removal Cal instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 46](#).

Figure 46 ECal at Port 1, RF Cable at Port 3



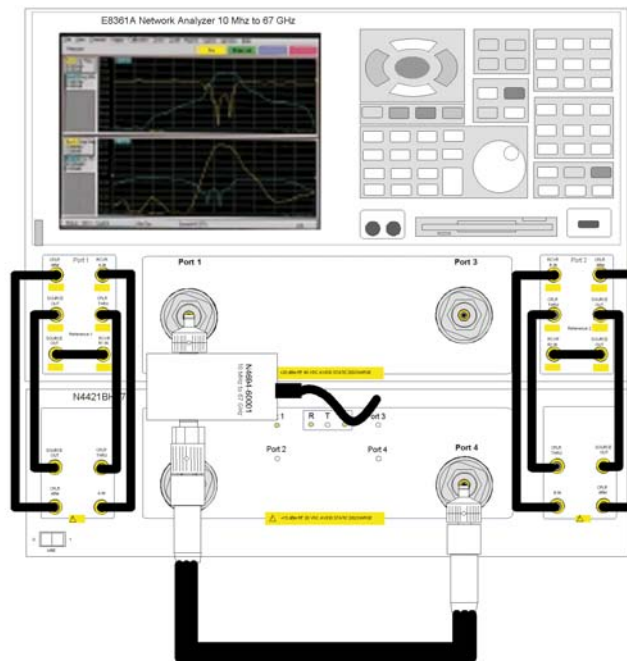
- The Adapter Removal Cal instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 47](#).

Figure 47 ECal at Port 4, RF Cable at Port 1



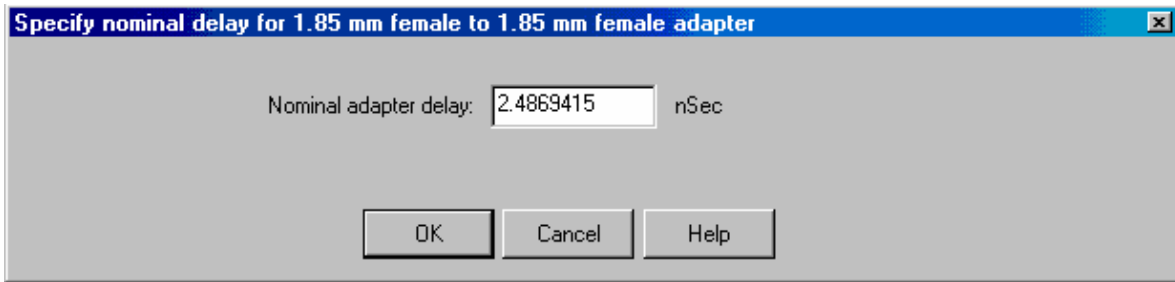
- The Adapter Removal Cal instructions will prompt the user to connect the ECal and RF cable as shown in [Figure 48](#).

Figure 48 ECal at Port 1, RF Cable at Port 4



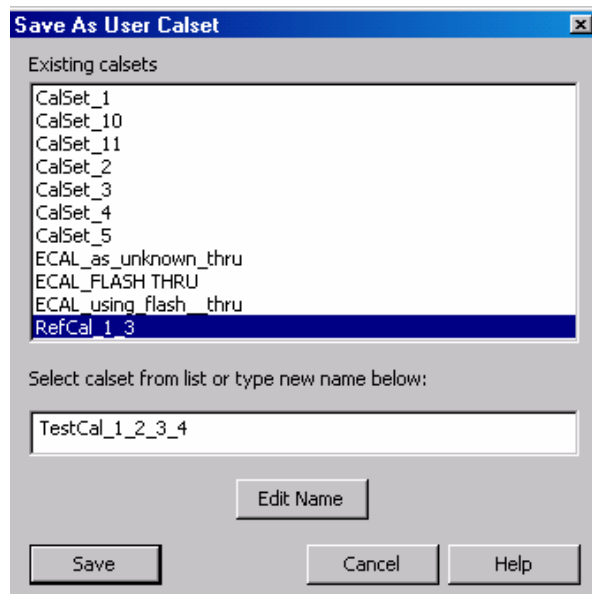
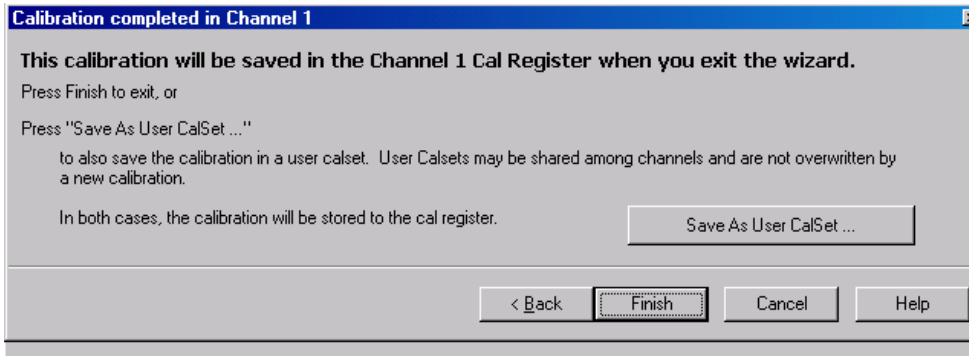
10. Enter the cable length delay from [Step 8 on page 22](#) three times for 1–2, 1–3 and 1–4. Refer to [Figure 49](#).

Figure 49 Specify Nominal Adapter Delay



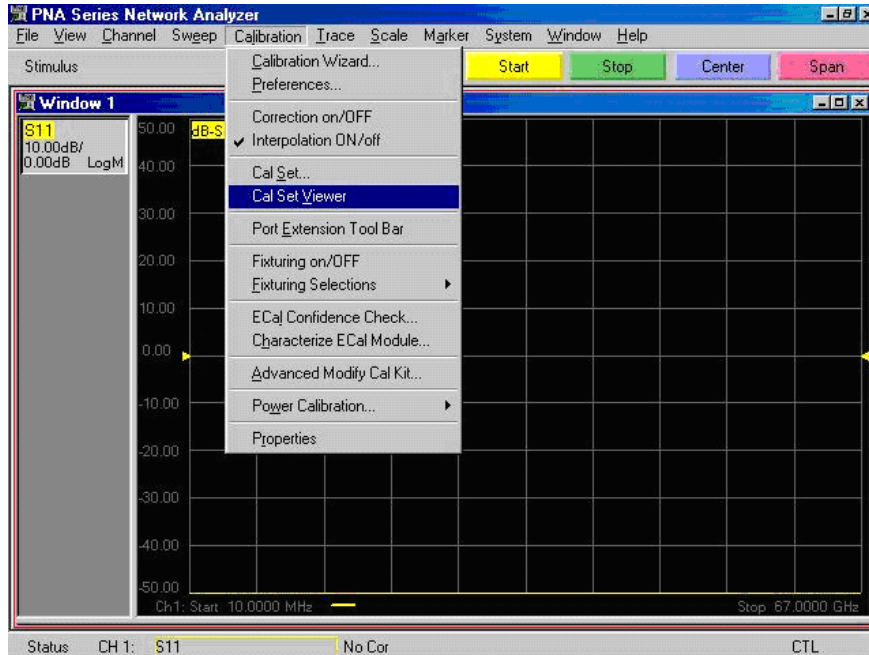
11. Complete the calibration by selecting **“Save As User CalSet”** using the name **“TestCal_1_2_3_4”**. Refer to [Figure 50](#).

Figure 50 Calibration Complete



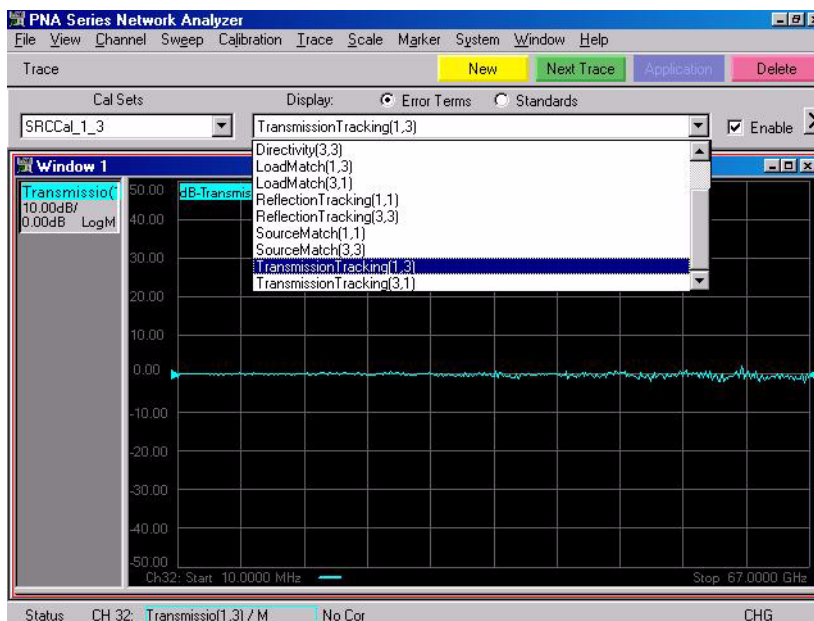
12. Once the TestCal_1_2_3_4 is complete, using the drop-down menus, select “Cal Set Viewer”. Refer to Figure 51.

Figure 51 Cal Set Viewer



13. From the Cal Sets drop-down menu, select “SRCCal_1_3”. Select Transmission Tracking(1,3) in the center drop-down. Refer to Figure 52.

Figure 52 SRCCal_1_3 with Transmission Tracking (1,3)



14. Select **Data>Mem**, and then select **Data/Mem** to normalize the Transmission Tracking(1,3). Refer to [Figure 53](#).

Figure 53 SRCCal Transmission Tracking(1,3) Normalized



15. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **Transmission Tracking(1,3)** term. Save this plot. Refer to [Figure 54](#). This is the Port 1 receiver loss.

Figure 54 TestCal_1_2_3_4 with TrTx(1,3)



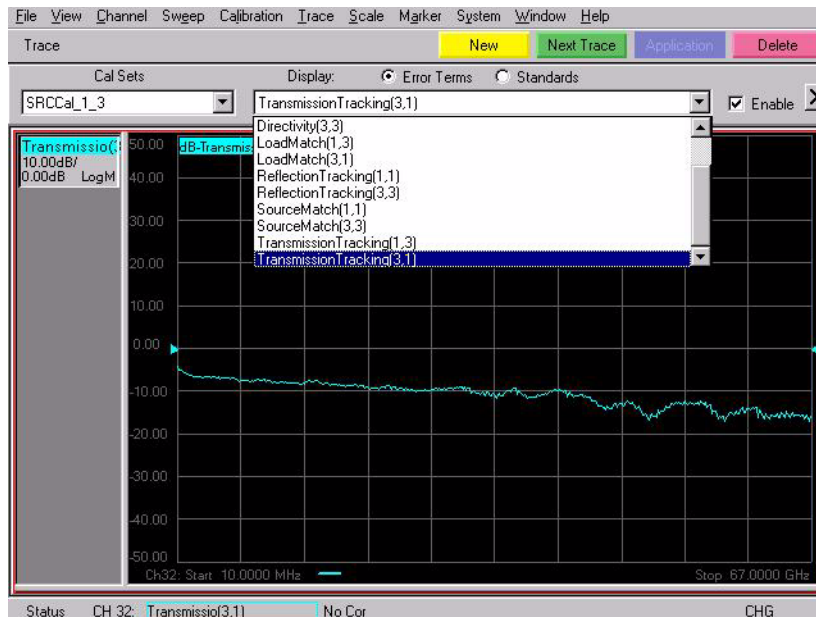
- From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **Transmission Tracking(2,3)** term. Save this plot. Refer to [Figure 55](#). This is the Port 2 receiver loss.

Figure 55 TestCal_1_2_3_4 with TrTx(2,3)



- From the Cal Sets drop-down menu, select “**SRCCal_1_3**”. Select **Transmission Tracking(3,1)** in the center drop-down. Refer to [Figure 56](#). This is repeating [Step 15 on page 43](#) but using the Transmission Tracking(3,1) error term.

Figure 56 SRCCal_1_3 with TxTr(3,1)



18. Select **Data>Mem**, and then select **Data/Mem** to normalize the Transmission Tracking(3,1). Refer to [Figure 57](#).

Figure 57 SRCCal Transmission Tracking(3,1) Normalized



19. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **Transmission Tracking(3,1)** term. Save this plot. Refer to [Figure 58](#). This is the Port 3 receiver loss.

Figure 58 TestCal_1_2_3_4 with TrTx(3,1)



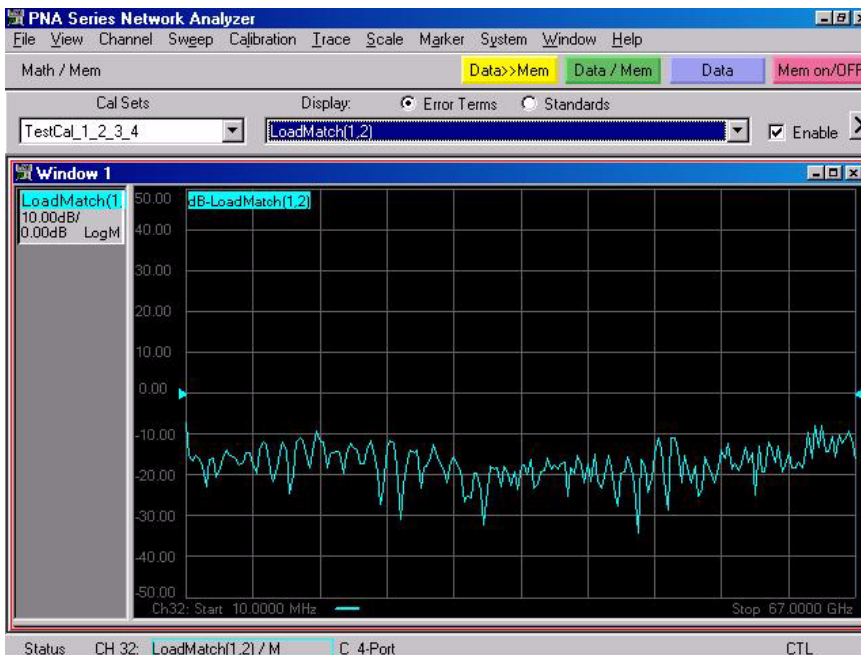
20. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **Transmission Tracking(4,1)** term. Save this plot. Refer to [Figure 59](#). This is the Port 4 receiver loss.

Figure 59 TestCal_1_2_3_4 with TrTx(4,1)



21. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **LoadMatch(1,2)** term. Save this plot for Load Match for Port 1. Refer to [Figure 60](#).

Figure 60 TestCal_1_2_3_4 with Load Match(1,2) Error Term



- From the Cal Sets drop-down, select “TestCal_1_2_3_4”. Next, select the LoadMatch(2,1) term. Save this plot for Load Match for Port 2. Refer to Figure 61.

Figure 61 TestCal_1_2_3_4 with Load Match(2,1) Error Term



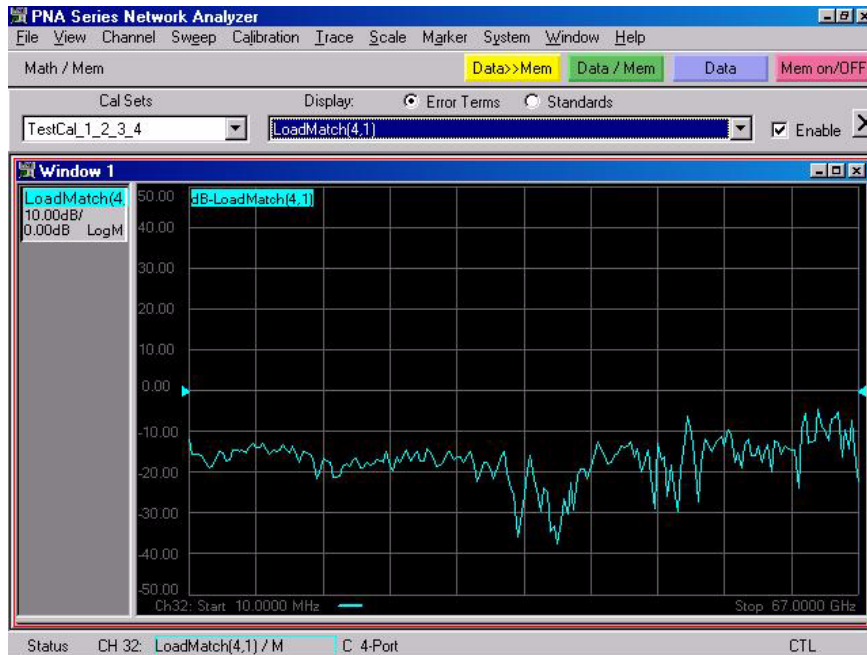
- From the Cal Sets drop-down, select “TestCal_1_2_3_4”. Next, select the LoadMatch(3,1) term. Save this plot for Load Match for Port 3. Refer to Figure 62.

Figure 62 TestCal_1_2_3_4 with Load Match(3,1) Error Term



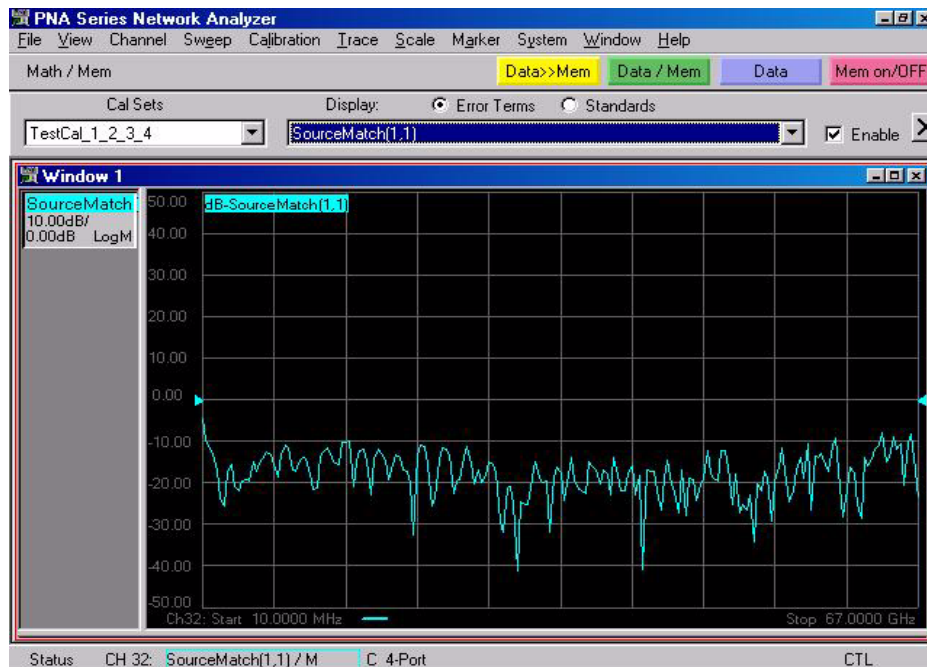
24. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **LoadMatch(4,1)** term. Save this plot for Load Match for Port 4. Refer to [Figure 63](#).

Figure 63 TestCal_1_2_3_4 with Load Match(4,1) Error Term



25. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **SourceMatch(1,1)** term. Save this plot for Source Match for Port 1. Refer to [Figure 64](#).

Figure 64 TestCal_1_2_3_4 with Source Match(1,1) Error Term



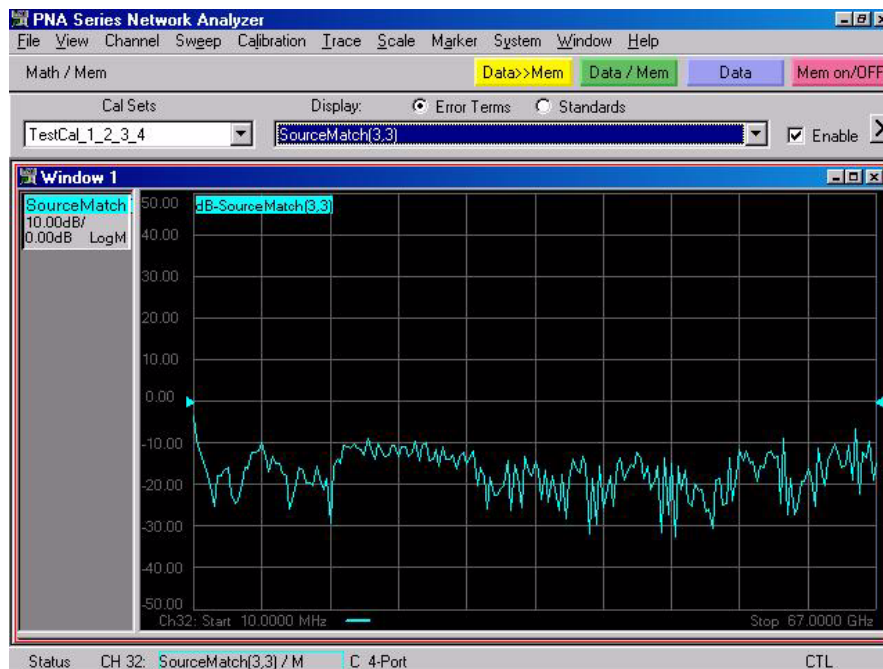
26. From the Cal Sets drop-down, select “TestCal_1_2_3_4”. Next, select the **SourceMatch(2,2)** term. Save this plot for Source Match for Port 2. Refer to [Figure 65](#).

Figure 65 TestCal_1_2_3_4 with Source Match(2,2) Error Term



27. From the Cal Sets drop-down, select “TestCal_1_2_3_4”. Next, select the **SourceMatch(3,3)** term. Save this plot for Source Match for Port 3. Refer to [Figure 66](#).

Figure 66 TestCal_1_2_3_4 with Source Match(3,3) Error Term



28. From the Cal Sets drop-down, select “**TestCal_1_2_3_4**”. Next, select the **SourceMatch(4,4)** term. Save this plot for Source Match for Port 4. Refer to [Figure 67](#).

Figure 67 TestCal_1_2_3_4 with SourceMatch(4,4) Error Term



Specification

Specifications for the N4421BH67 Multiport Test Set are nominal. System performance for the PNA and Test Set are not provided. A functional certificate is only offered for the N4421BH67.

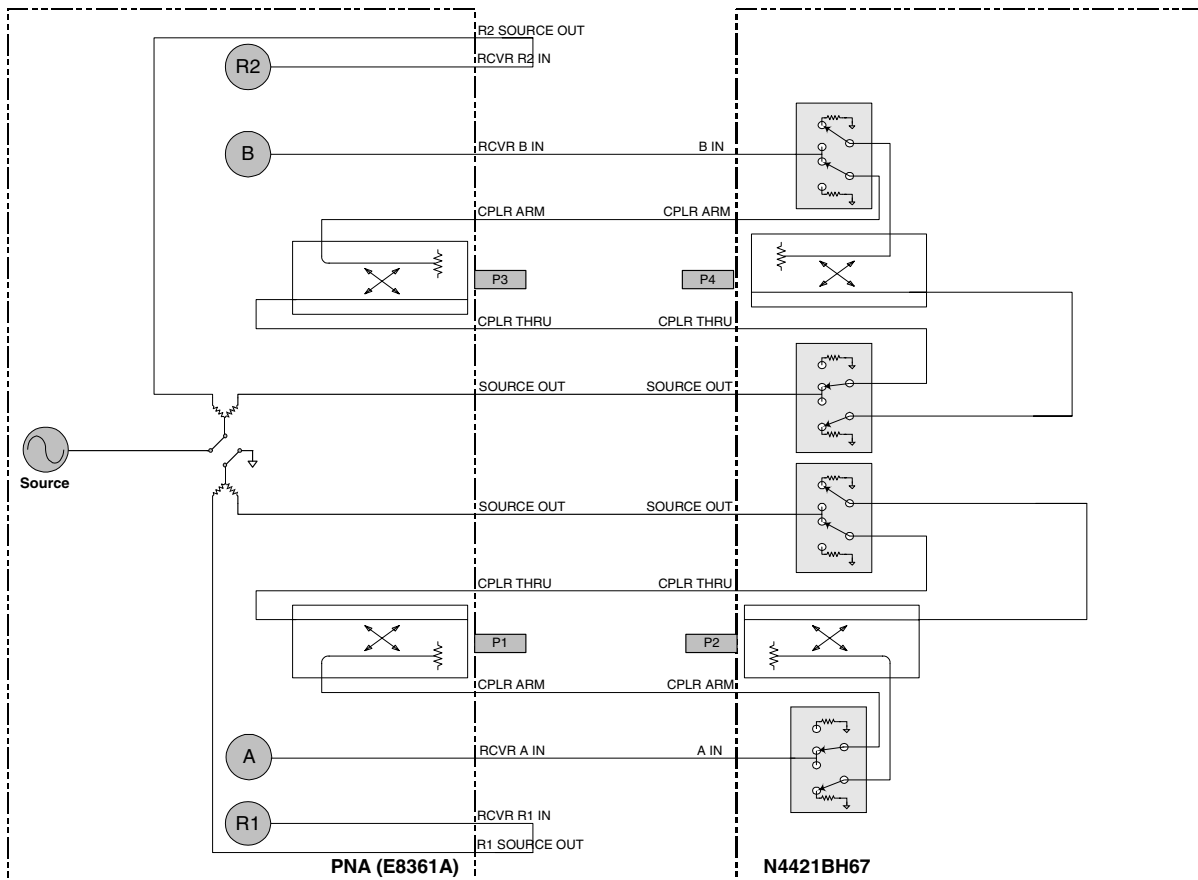
NOTE Nominal specifications are based on 1 to 2 unit's performance.

Declaration of Conformity

For a copy of the manufacturer's Declaration of Conformity for this apparatus, contact your local Agilent Technologies office or sales representative on ["Contacting Agilent Sales and Service Offices"](#) on page 58.

Block Diagram

Figure 68 Block Diagram for the N4421BH67



Servicing the N4421BH67 Multiport Test Set

Replaceable Parts

Table 10 Replaceable Parts for the N4421BH67

Description	Agilent Part Number	Qty
Power Supply	0950-3491	1
OEM GPIB Interface board	1150-7952	1
Bulkhead Connector, 1.85 mm (f)	5065-4673	8
Coupler 1.85MM	5087-7225	2
Microcircuit 67GHz switch	5087-7317	4
Semi - Rigid Cable	N4421-20001	1
Semi - Rigid Cable	N4421-20002	1
Semi - Rigid Cable	N4421-20003	1
Semi - Rigid Cable	N4421-20004	1
Semi - Rigid Cable	N4421-20005	2
Semi - Rigid Cable	N4421-20006	2
Semi - Rigid Cable	N4421-20007	2
Semi - Rigid Cable	N4421-20008	2
Semi - Rigid Cable	N4421-20009	4
Semi - Rigid Cable	N4421-20010	4
Switch Control board	N4421-63011	1
ALC AMP power cable 18in - 4 POSN to 4 POSN, twisted pair	Z5623-60048	4

Return to Agilent Technologies factory for servicing or repair. Refer to [“Contacting Agilent Sales and Service Offices”](#) on page 58.

WARNING No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.

WARNING These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

Shipping Instructions

You must always call the Agilent Technologies Instrument Support Center to initiate service before retuning your instrument to a service office. See [“Contacting Agilent Sales and Service Offices” on page 58](#). Always transport or ship the instrument using the original packaging if possible. If not, comparable packaging must be used. Attach a complete description of the failure symptoms.

Safety and Regulatory Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

Before Applying Power

Verify that the product is configured to match the available main power source. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Connector Care and Cleaning

If alcohol is used to clean the connectors, the power cord to the instrument must be removed. All cleaning should take place in a well ventilated area. Allow adequate time for the fumes to disperse and moist alcohol to evaporate prior to energizing the instrument.

WARNING **To prevent electrical shock, disconnect the Agilent Technologies model N4421B from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

Compliance with Canadian EMC Requirements

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Complies with European EMC Directive 89/336/EEC, amended by 93/68/EEC

- IEC/EN 61326
- CISPR Pub 11 Group 1, class A
- AS/NZS 2064
- ICES/NMB-001

Complies with European Low Voltage Directive 73/23/EEC, amended by 93/68/EEC

- IEC/EN 61010
- Canada: CSA C22.2 No. 61010
- USA: UL 61010B

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrrordnung-3. GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA<70 dB	Lpa<70 dB
Operator Position	am Arbeitsplatz
Normal Operation	normaler Betrieb
per ISO 7779	nach DIN 45635 t. 19

Warnings

WARNING **The WARNING notice denotes a hazard. It calls attention to a procedure, practice, or the like, which if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

Warnings applicable to this instrument are:

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **For continued protection against fire hazard replace line fuse only with same type and rating:**

- **United States—F 2.5A/250V, Part Number 2110-1334**
- **Europe—F 2.5A/250V, Part Number 2110-1334**

The use of other fuses or material is prohibited.

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

WARNING **The power cord is connected to internal capacitors that may retain dangerous electrical charges for 5 seconds after disconnecting the plug from its power supply.**

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).**

Cautions

CAUTION The CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Cautions applicable to this instrument are:











CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding (by not using this cord) can cause instrument damage.

CAUTION This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

CAUTION Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1:2000, and 664 respectively.

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
	This symbol indicates the product meets the Australian Standards.
	This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).
	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is OFF or in STANDBY position.
	Safety Earth Ground. This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Contacting Agilent Sales and Service Offices

Assistance with test and measurement needs, and information on finding a local Agilent office are available on the Internet at:

<http://www.agilent.com/find/assist>

You can also purchase accessories or documentation items on the Internet at:

<http://www.agilent.com/find>

If you do not have access to the Internet, contact your field engineer.

NOTE In any correspondence or telephone conversation, refer to the product by its model number and full serial number. With this information, the Agilent representative can determine whether your unit is still within its warranty period.
