Keysight Add Configurable Test Set and Source Attenuators Upgrade Kit

To Upgrade PNA N5231A or N5232A Option 400 to Option 416

Upgrade Kit Order Numbers:
N5231AU-416 or N5232AU-416

Keysight Kit Number: N5232-60102

KEYSIGHT TECHNOLOGIES

Installation Note

NOTICE: This document contains references to Agilent Technologies. Agilent's former Test and Measurement business has become Keysight Technologies. For more information, go to **www.keysight.com.**

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Safety Notes

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

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.**

CAUTION	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution note until the indicated conditions are fully understood and met.

Description of the Upgrade

This upgrade adds the following items to your N5231A Option 400 or N5232A Option 400 network analyzer:

- 60 dB source step attenuator with bracket and wire harness
- front panel jumpers
- cable guards for front panel jumpers
- front panel overlay replacement
- new cables

After installation of this upgrade, your analyzer will be an N5231A Option 416 or N5232A Option 416.

Getting Assistance from Keysight

By internet or phone, get assistance with all your test and measurement needs.

Contacting Keysight

Assistance with test and measurements needs and information on finding a local Keysight office are available on the Web at:
http://www.keysight.com/find/assist

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

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

If You Have Problems With the Upgrade Kit Contents

Keysight stands behind the quality of the upgrade kit contents. If you have problems with any item in the kit, email Keysight Component Test Division (CTD) Support at **support_ctd-soco@keysight.com**, or telephone the CTD Hotline at (707) 577-6802 and leave a voice mail message. Please include details of the problem.

Getting Prepared

CAUTION The PNA contains extremely sensitive components that can be ruined if mishandled. Follow instructions carefully when making cable connections, especially wire harness connections.

The person performing the work accepts responsibility for the full cost of the repair or replacement of damaged components.

To successfully install this upgrade kit, you will need the following:

- A license key - refer to "License Key Redemption" below.
- A PDF copy or a paper copy of the PNA Service Guide - refer to "Downloading the Online PNA Service Guide" below.
- An ESD-safe work area - refer to "Protecting Your Workspace from Electrostatic Discharge" below.
- Correct tools - refer to "Tools Required for the Installation" on page 6.
- Enough time - refer to "About Installing the Upgrade" on page 6.
- Test equipment for the post-upgrade adjustments and full instrument calibration. To view the equipment list, click the Chapter 3 bookmark "Tests and Adjustments" in the PDF Service Guide[1].

License Key Redemption

NOTE The enclosed Option Entitlement Certificate is a receipt, verifying that you have purchased a licensed option for the PNA of your choice. You must now use a Keysight Web page to request a license key for the instrument that will receive the option.

To enable the option product, you must request a license key from: http://www.keysight.com/find/softwarelicense. To complete the request, you will need to gather the following information:

- From the certificate
  - ❑ Order number
  - ❑ Certificate number
- From your instrument
  - ❑ Model number
  - ❑ Serial number
  - ❑ Host ID

The instrument information is available on the network analyzer – on the analyzer's **Help** menu, click **About Network Analyzer**.

If you provide an email address, Keysight will promptly email your license key. Otherwise, you will your receive your license key via postal mail.

1. See "Downloading the Online PNA Service Guide" on page 5.

Downloading the Online PNA Service Guide

To view the online Service Guide for your PNA model number, use the following steps:

1. Go to *www.keysight.com*.
2. In the Search box, enter the model number of the analyzer (Ex: N5232A) and click **Search**.
3. Click Technical Support > Manuals.
4. Click Service Manual.
5. Click the service guide title to download the PDF file.
6. When the PDF of the Service Guide is displayed, scroll through the Contents section bookmarks to locate the information needed.

Protecting Your Workspace from Electrostatic Discharge

For information, click on the Chapter 1 bookmark, "Electrostatic Discharge Protection" in the PDF Service Guide[1].

ESD Equipment Required for the Installation

Description	Keysight Part Number
ESD grounding wrist strap	9300-1367
5-ft grounding cord for wrist strap	9300-0980
2 x 4 ft conductive table mat and 15-ft grounding wire	9300-0797
ESD heel strap (for use with conductive floors)	9300-1308

1. See "Downloading the Online PNA Service Guide" on page 5.

Tools Required for the Installation

Description	Qty	Part Number
T-10 TORX driver - set to 9 in-lbs (1.02 N.m)	1	N/A
T-20 TORX driver - set to 21 in-lbs (2.38 N.m)	1	N/A
5/16-in (8 mm) nutsetter or open end torque wrench - set to 10 in-lbs (1.13 N.m)	1	N/A

CAUTION Use a 5/16-in torque wrench set to 10 in-lbs on all cable connections except the front panel and rear panel bulkhead connectors. Torque these connections to 21 in-lb.

About Installing the Upgrade

Products affected	N5231A and N5232A Option 400
Installation to be performed by	Keysight service center or personnel qualified by Keysight
Estimated installation time	2 hours
Estimated adjustment time	0.5 hour
Estimated full instrument calibration time	4.5 hours

Items Included in the Upgrade Kit[1]

Check the contents of your kit against the following list. If any part is missing or damaged, contact Keysight Technologies. Refer to "Getting Assistance from Keysight" on page 3.

Table 1 Contents of Upgrade Kit N5232-60102

Ref Desig.	Description	Qty	Part Number
--	Installation note (this document)	1	N5232-90102
A29	Source 60 dB step attenuator	1	33321-60082
--	Bracket (for A29 source 60 dB step attenuator)	1	N5235-00012
--	Machine screw, M3 x 8, pan head (to attach bracket to step attenuator; to attach attenuator assembly to deck)	5	0515-0372
--	Cable clamp	13	1400-1334
--	Front panel overlay	1	N5232-80006
--	Front panel jumper cable guard	1	N5232-00004
		4	N5232-00003
--	Dust caps for test ports	4	1401-0214
W30	RF cable, front panel jumper	9	N5222-20091
W42	RF cable, A20 MASSQuad (main out) to A29 60 dB step attenuator	1	N5232-20057
W43	RF cable, A20 MASSQuad (main switch input) to A29 60 dB step attenuator	1	N5232-20056
W44	RF cable, A20 MASSQuad (A) to PORT 1 SOURCE OUT	1	N5232-20050
W45	RF cable, A20 MASSQuad (B) to Port 2 SOURCE OUT	1	N5232-20058
W46	RF cable, A20 MASSQuad to Port 3 SOURCE OUT	1	N5232-20060
W47	RF cable, A20 MASSQuad (D) to Port 4 SOURCE OUT	1	N5232-20062
W48	RF cable, PORT 1 CPLR THRU to A25 test port 1 bridge coupler (thru)	1	N5232-20051
W49	RF cable, PORT 2 CPLR THRU to A26 test port 2 bridge coupler (thru)	1	N5232-20051
W50	RF cable, PORT 3 CPLR THRU to A27 test port 3 bridge coupler (thru)	1	N5232-20051
W51	RF cable, PORT 4 CPLR THRU to A28 test port 4 bridge coupler (thru	1	N5232-20051
W52	RF cable,A25 test port 1 bridge coupler (arm) to PORT 1 CPLR ARM	1	N5232-20052
W53	RF cable, A26 test port 2 bridge coupler (arm) to PORT 2 CPLR ARM	1	N5232-20052
W54	RF cable, A27 test port 3 bridge coupler (arm) to PORT 3 CPLR ARM	1	N5232-20052
W55	RF cable, A28 test port 4 bridge coupler (arm) to PORT 4 CPLR ARM	1	N5232-20052
W56	RF cable, A20 MASSQuad (Ref) to Reference SOURCE OUT	1	N5232-20054
W57	RF cable, Port 1 RCVR A IN to A24 mixer brick	1	N5232-20053

1. In addition to the upgrade kit, the shipment includes an Option Entitlement Certificate. Refer to "License Key Redemption" on page 4 for important information about this certificate.

Table 1 Contents of Upgrade Kit N5232-60102

Ref Desig.	Description	Qty	Part Number
W58	RF cable, Port 2 RCVR B IN to A24 mixer brick	1	N5232-20059
W59	RF cable, Port 3 RCVR C IN to A24 mixer brick	1	N5232-20061
W60	RF cable, Port 4 RCVR D IN to A24 mixer brick	1	N5232-20063
W61	RF cable, Reference RCVR R1 IN to A24 mixer brick	1	N5232-20055
--	Wire harness, A19 test set motherboard J8 to A29 60 dB step attenuator	1	8121-0982

NOTE Extra quantities of items such as protective plastic caps, screws, cable ties, and cable clamps may be included in this upgrade kit. It is normal for some of these items to remain unused after the upgrade is completed.

Installation Procedure for the Upgrade

The network analyzer must be in proper working condition prior to installing this option. Any necessary repairs must be made before proceeding with this installation.

WARNING **This installation requires the removal of the analyzer's protective outer covers. The analyzer must be powered down and disconnected from the mains supply before performing this procedure.**

Overview of the Installation Procedure

Step 1. Obtain a Keyword and Verify the Information.

Step 2. Remove the Outer Cover.

Step 3. Remove the Inner Cover.

Step 4. Remove the Front Panel Assembly.

Step 5. Remove Some Existing Cables.

Step 6. Assemble the A29 Source Attenuator Assembly.

Step 7. Install the A29 Source Attenuator Assembly.

Step 8. Install the Cables.

Step 9. Secure the Hex Nuts on the Front Panel Bulkhead Connectors.

Step 10. Remove the Old Lower Front Panel Overlay.

Step 11. Reinstall Front Panel Assembly.

Step 12. Install the New Lower Front Panel Overlay.

Step 13. Install Front Panel Jumpers.

Step 14. Reinstall the Inner Cover.

Step 15. Reinstall the Outer Cover.

Step 16. Enable Option 416.

Step 17. Perform Post-Upgrade Adjustments and Calibration.

Step 18. Prepare the PNA for the User.

Step 1. Obtain a Keyword and Verify the Information

Follow the instructions on the Option Entitlement Certificate supplied to obtain a license key for installation of this upgrade. Refer to "License Key Redemption" on page 4.

Verify that the model number, serial number, and option number information on the license key match those of the instrument on which this upgrade will be installed.

If the model number, serial number, or option number do not match those on your license key, you will not be able to install the option. If this is the case, contact Keysight for assistance before beginning the installation of this upgrade. Refer to "Contacting Keysight" on page 3.

Once the license key has been received and the information verified, you can proceed with the installation at step 2.

Step 2. Remove the Outer Cover

For instructions, click the Chapter 7 bookmark "Removing the Covers" in the PDF Service Guide[1].

Step 3. Remove the Inner Cover

For instructions, click the Chapter 7 bookmark "Removing the Covers" in the PDF Service Guide[1].

Step 4. Remove the Front Panel Assembly

For instructions, click the Chapter 7 bookmark "Removing and Replacing the Front Panel Assembly" in the PDF Service Guide[1].

Step 5. Remove Some Existing Cables

NOTE	Leave the gray flexible cables, the wire harnesses, and the ribbon cables connected where possible. **Any that are removed should be labeled for reconnection later.**

NOTE	Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables may be necessary but do not over-bend them.

NOTE	When removing a cable, also remove the plastic cable clamp, if present. It is normal for some of the cable clamp's adhesive to remain.

1. Place the analyzer bottom-side up on a flat surface.

Remove the following cables. To see an image showing the location of these cables, click the Chapter 6 bookmark "Bottom RF Cables, Standard 4-Port Configuration, Option 400" in the PDF Service Guide[1].

These RF cables may be discarded - they will not be reinstalled.

- W34 (N5232-20044) A20 MASSQuad B to A26 test port 2 bridge coupler (thru)

1. See "Downloading the Online PNA Service Guide" on page 5.

- W32 (N5232-20064) A20 MASSQuad jumper cable
- W33 (N5232-20046) A20 MASSQuad A to A25 test port 1 bridge coupler (thru)
- W38 (N5232-20043) A26 test port 2 bridge coupler (arm) to A24 mixer brick
- W37 (N5232-20045) A25 test port 1 bridge coupler (arm) to A24 mixer brick
- W35 (N5232-20042) A20 MASSQuad C to A27 test port 3 bridge coupler (thru)
- W36 (N5232-20040) A20 MASSQuad D to A28 test port 4 bridge coupler (thru)
- W40 (N5232-20039) A28 test port 4 bridge coupler (arm) to A24 mixer brick
- W41 (N5232-20047) A20 MASSQuad to mixer brick
- W39 (N5232-20041) A27 test port 3 bridge coupler (arm) to A24 mixer brick

These cables must be saved - they will be reinstalled.

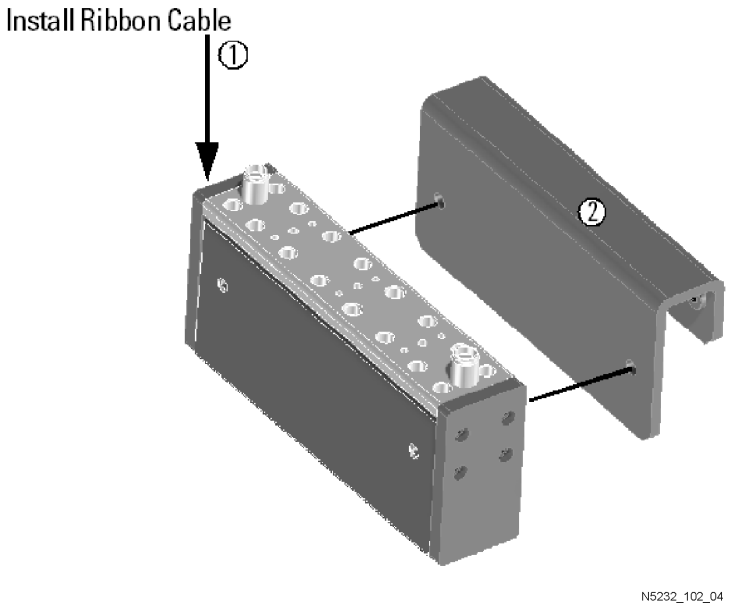
- W10 (N5232-20081) A24 mixer brick to test set deck cable bracket
- W9 (top-side cable) (N5235-20041) A10 13.5 GHz LO Synthesizer board to test set deck cable bracket
- W31 (N5232-20049) A20 MASSQuad to test set deck cable bracket

Step 6. Assemble the A29 Source Attenuator Assembly

Refer to Figure 1 for this step of the procedure. New parts are listed in Table 1 on page 7.

1. Gather the A29 source attenuator (33321-60082) and install the ribbon cable (8121-0982).
2. Install bracket N5235-00012 on the source attenuator using two screws (0515-0372) with the bracket. Use a T-10 TORX driver set to 9 in-lbs to tighten the screws.

Figure 1 Source Attenuator Assembly

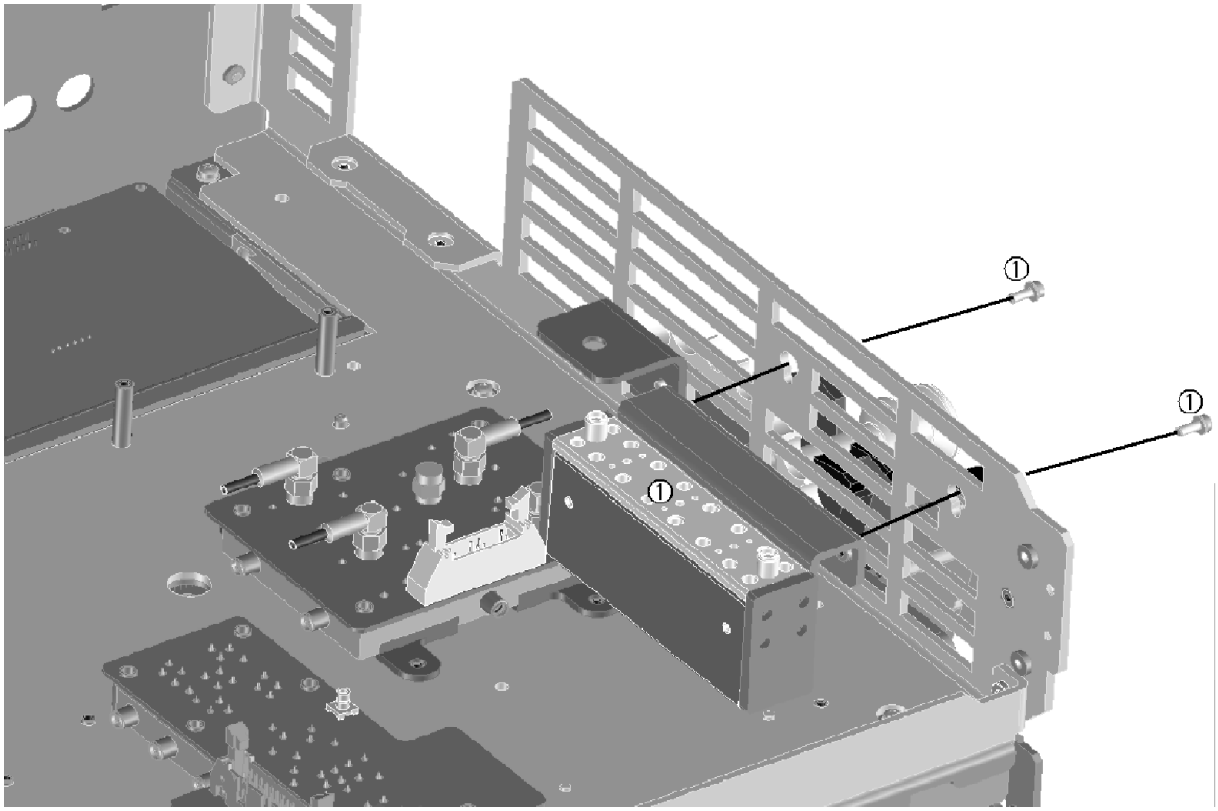


Step 7. Install the A29 Source Attenuator Assembly

Refer to Figure 2 for this step of the procedure. New parts are listed in Table 1 on page 7.

1. Install the A29 source attenuator assembly to the side of the chassis as shown, using two screws (0515-0372). Use a T-10 TORX driver set to 9 in-lbs to tighten the screws.

Figure 2 Source Attenuator Installation



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Step 8. Install the Cables

CAUTION Follow instructions carefully when making cable connections, especially wire harness connections. Incorrect connections can destroy components, resulting in additional customer costs.

CAUTION Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables may be necessary but do not over-bend them.

CAUTION Use a 5/16-in torque wrench set to 10 in-lbs on all cable connections except the front and rear panel bulkhead connectors. On these, use a 9 mm nutsetter or open end torque wrench set to 21 in-lb.

Install the Semirigid Cables

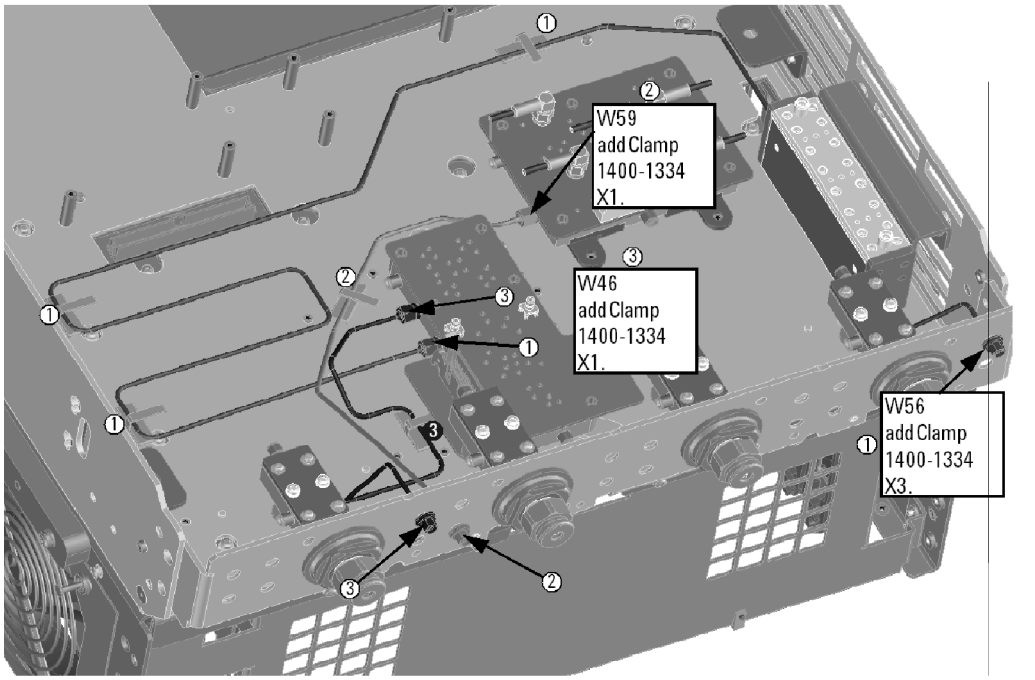
To see an image showing the location of these cables, click the Chapter 6 bookmarks "Bottom RF Cables, 4-Port Configuration, Option 416" in the PDF Service Guide[1]. New parts are listed in Table 1 on page 7.

Install the following new cables in the order listed.

- W56 (N5232-20054) A20 MASSQuad (Ref) to Reference SOURCE OUT

* As shown in Figure 3, install three cable clamps (part number 1400-1334) to secure W56 (part number N5232-20054).

Figure 3 Location of Cable Clamps to Secure W46, W56, and W59



N5232_102_01

- W59 (N5232-20061) Port 3 RCVR C IN to A24 mixer brick

* As shown in Figure 3, install one cable clamp (part number 1400-1334) to secure W59 (part number N5232-20061).

- W46 (N5232-20060) A20 MASSQuad to Port 3 SOURCE OUT

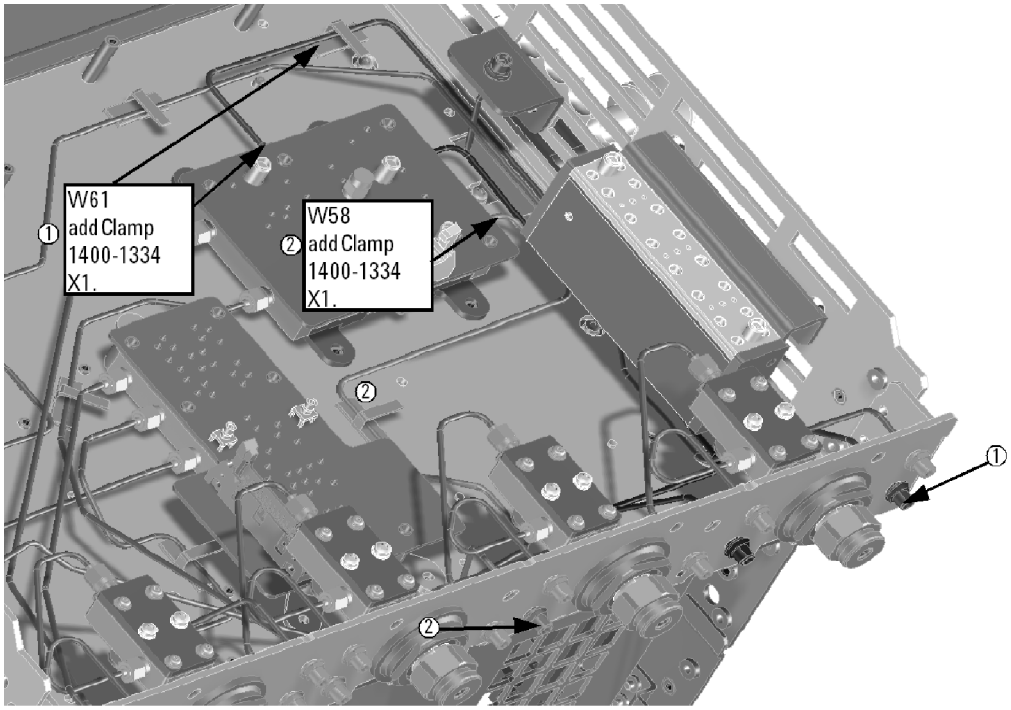
* As shown in Figure 3, install one cable clamp (part number 1400-1334) to secure W46 (part number N5232-20060).

- W60 (N5232-20063) Port 4 RCVR D IN to A24 mixer brick
- W47 (N5232-20062) A20 MASSQuad (D) to Port 4 SOURCE OUT
- W31 (reuse) (N5232-20049) A20 MASSQuad to test set deck cable bracket
- W61 (N5232-20055) Reference RCVR R1 IN to A24 mixer brick

1. See "Downloading the Online PNA Service Guide" on page 5.

* As shown in Figure 4, install one cable clamp (part number 1400-1334) to secure W61 (part number N5232-20055).

Figure 4 Location of Cable Clamps to Secure W61 and W58



N5232_102_02

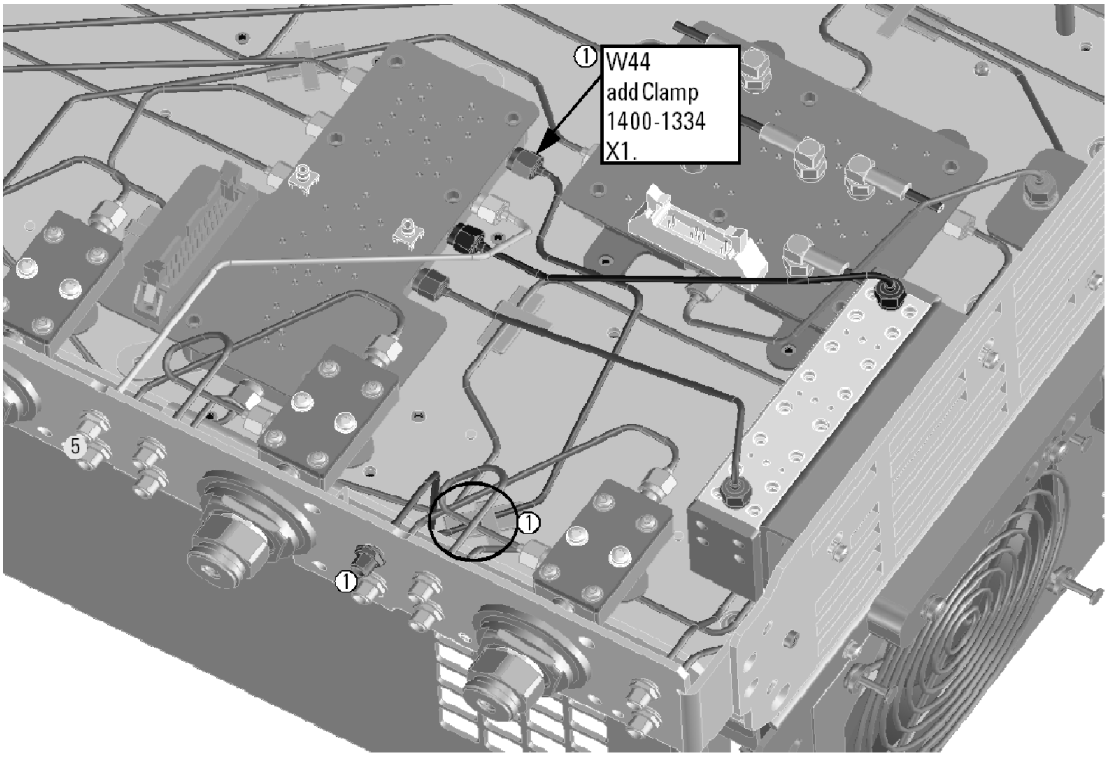
- W58 (N5232-20059) Port 2 RCVR B IN to A24 mixer brick

* As shown in Figure 4, install one cable clamp (part number 1400-1334) to secure W58 (part number N5232-20059).

- W57 (N5232-20053) Port 1 RCVR A IN to A24 mixer brick
- W9 (reuse) (N5235-20041) A10 13.5 GHz LO Synthesizer board to test set deck cable bracket
- W44 (N5232-20050) A20 MASSQuad (A) to PORT 1 SOURCE OUT

* As shown in Figure 5, install one cable clamp (part number 1400-1334) to secure W44 (part number N5232-20050).

Figure 5 Location of Cable Clamps to Secure W44



N5232_102_03

- W10 (reuse) (N5232-20081) A24 mixer brick LO In to test set deck cable bracket
- W43 (N5232-20056) A20 MASSQuad (main switch input) to A29 60 dB step attenuator
- W42 (N5232-20057) A20 MASSQuad (main out) to A29 60 dB step attenuator
- W45 (N5232-20058) A20 MASSQuad (B) to Port 2 SOURCE OUT
- W48 (N5232-20051) PORT 1 CPLR THRU to A25 test port 1 bridge coupler (thru)
- W49 (N5232-20051) PORT 2 CPLR THRU to A26 test port 2 bridge coupler (thru)
- W50 (N5232-20051) PORT 3 CPLR THRU to A27 test port 3 bridge coupler (thru)
- W51 (N5232-20051) PORT 4 CPLR THRU to A28 test port 4 bridge coupler (thru)
- W52 (N5232-20052) A25 test port 1 bridge coupler (arm) to PORT 1 CPLR ARM
- W53 (N5232-20052) A26 test port 2 bridge coupler (arm) to PORT 2 CPLR ARM
- W54 (N5232-20052) A27 test port 3 bridge coupler (arm) to PORT 3 CPLR ARM
- W55 (N5232-20052) A28 test port 4 bridge coupler (arm) to PORT 4 CPLR ARM

Install the Wire Harness

To see an image showing the location of this wire harnesses, click the Chapter 6 bookmarks "Bottom Ribbon Cables and Wire Harnesses, 4-Port, Option 416" in the PDF Service Guide[1]. New parts are listed in Table 1 on page 7.

If not already done, connect this wire harness:

- 8121-0982 A19 test set motherboard J8 to A29 60 dB step attenuator

Step 9. Secure the Hex Nuts on the Front Panel Bulkhead Connectors

Some of the new cables that were installed in the previous step connect to the front panel bulkhead. These cables were shipped with hex nuts. If not already done, secure the cable connectors to the front panel bulkhead with the hex nuts, torquing to 21 in-lbs.

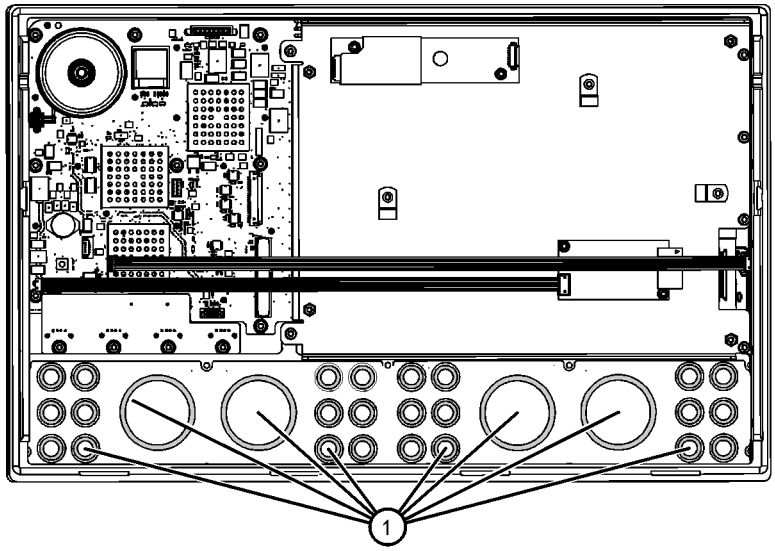
Step 10. Remove the Old Lower Front Panel Overlay

Refer to Figure 6 for this step of the procedure. New parts are listed in Table 1 on page 7.

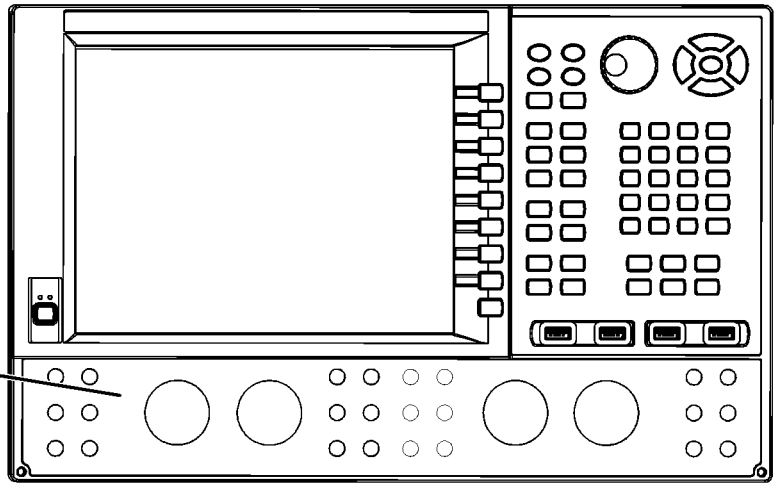
1. From the back side of the front panel, use a blunt object in the cutouts in the lower front dress panel to push on the old overlay (item ①) and separate it from the front dress panel.
2. From the front side of the front panel, pull off the overlay completely and discard it.
3. Remove any adhesive remaining on the front panel.

1. See "Downloading the Online PNA Service Guide" on page 5.

Figure 6 Lower Front Panel Overlay Replacement



Old lower front-panel overlay visible through cutouts from rear of front panel.
Push here to release old front-panel overlay.



New lower front-panel overlay.
Align loosely to opening before pressing firmly.

N5225_105_04

Step 11. Reinstall Front Panel Assembly

For instructions, click the Chapter 7 bookmark “Removing and Replacing the Front Panel Assembly” in the PDF Service Guide[1].

Step 12. Install the New Lower Front Panel Overlay

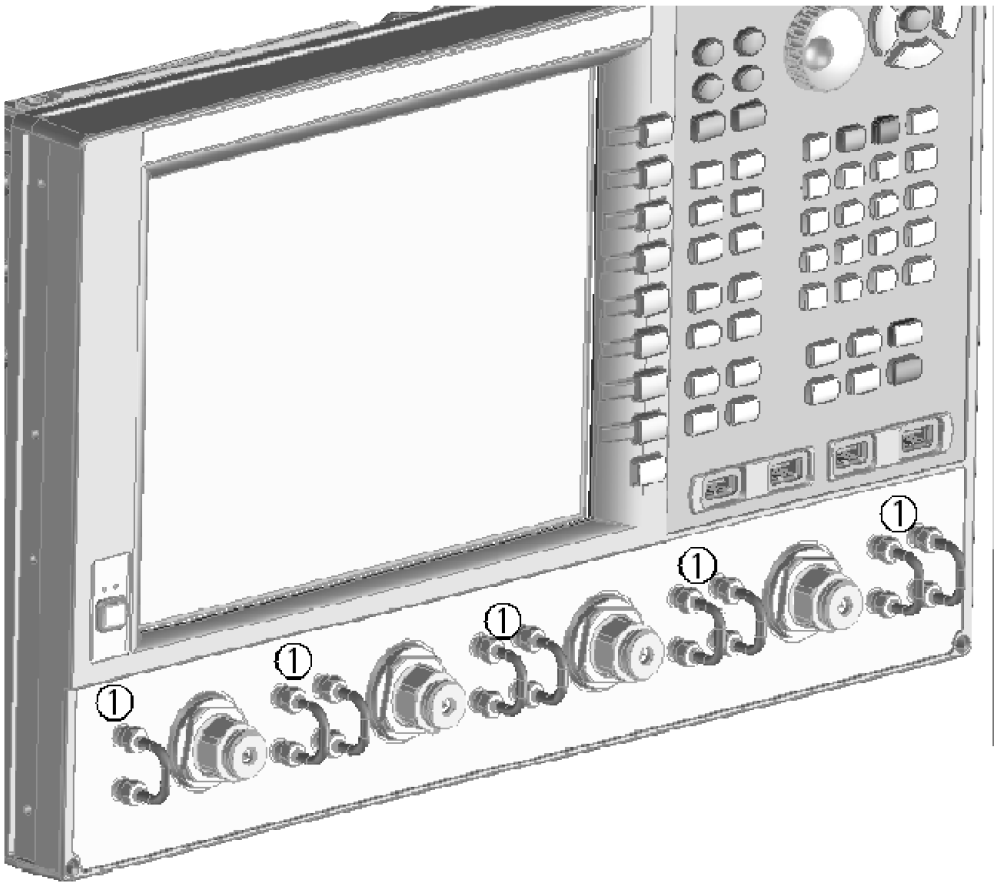
Refer to Figure 6 on page 17 for this step of the procedure. New parts are listed in Table 1 on page 7.

1. Remove the protective backing from the new front panel overlay, N5232-80006 (item ②).
2. Starting from either side, *loosely* place the overlay in the recess on the lower front panel, ensuring that it fits tightly against the edges of the recess.
3. Once the overlay is in place, press it firmly onto the frame to secure it.

Step 13. Install Front Panel Jumpers

As shown in Figure 7, install nine front panel jumper cables (part number N5222-20091). Torque to 10 in-lbs.

Figure 7 Front Panel Jumper Cables Installation



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Step 14. Reinstall the Inner Cover

For instructions, click the Chapter 7 bookmark “Removing the Covers” in the PDF Service Guide[1].

1. See “Downloading the Online PNA Service Guide” on page 5.

Step 15. Reinstall the Outer Cover

For instructions, click the Chapter 7 bookmark "Removing the Covers" in the PDF Service Guide[1].

Step 16. Enable Option 416

Procedure Requirements

- The analyzer must be powered up and operating to perform this procedure.
- The Network Analyzer program must be running.
- A keyboard must be connected to the network analyzer.

Option Enable Procedure

1. To start the option enable utility, press UTILITY System, then Service, then Option Enable. An option enable dialog box will appear.
2. Click the arrow in the **Select Desired Option** box. A list of available options will appear.
3. In the **Select Desired Option** list, click **416 - Configurable Test Set**.
4. Using the keyboard, enter the license key in the box provided. The license key is printed on the the license message you received from Keysight. Enter this key *exactly* as it is printed on the message.
5. Click **Enable**.
6. Click **Yes** in answer to the displayed question in the **Restart Analyzer?** box.
7. When the installation is complete, click **Exit**.

Option Verification Procedure

Once the analyzer has restarted and the Network Analyzer program is again running:

1. On the analyzer's **Help** menu, click **About Network Analyzer**.
2. Verify that "416" is listed after "Options:" in the display. Click **OK**.

NOTE If Option 416 has not been enabled, perform the "Option Enable Procedure" again. If the option is still not enabled, contact Keysight Technologies. Refer to "Getting Assistance from Keysight" on page 3.

1. See "Downloading the Online PNA Service Guide" on page 5.

Step 17. Perform Post-Upgrade Adjustments and Calibration

Adjustments

The following adjustments must be made due to the hardware changes of the analyzer.

- source adjustment
- receiver adjustment

These adjustments are described in the PNA Service Guide and in the PNA on-line HELP. A list of equipment required to perform these adjustments is also found in the service guide.

To view this service guide information, click the Chapter 3 bookmark "Tests and Adjustments" in the PDF Service Guide[1].

After the specified adjustments have been performed, the analyzer should operate and phase lock over its entire frequency range.

Operator's Check

Perform the Operator's Check to check the basic functionality of the analyzer. For instructions, click the Chapter 3 bookmark "Tests and Adjustments" in the PDF Service Guide[1].

If you experience difficulty with the basic functioning of the analyzer, contact Keysight. Refer to "Contacting Keysight" on page 3.

Calibration

Although the analyzer functions, its performance relative to its specifications has not been verified. It is recommended that a full instrument calibration be performed using the analyzer's internal performance test software. To view information on the performance test software, click the Chapter 3 bookmark "Tests and Adjustments" in the PDF Service Guide[1].

Step 18. Prepare the PNA for the User

1. If necessary, reinstall front jumper cables.
2. Install the cable guards, pushing them over the front jumper cables until the cushioning material touches the front panel of the PNA.
3. Install the dust caps on the test ports.
4. Clean the analyzer, as needed, using a damp cloth.

1. See "Downloading the Online PNA Service Guide" on page 5.

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