

# **Installation Note**

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## **Agilent Technologies ESA-E Series Spectrum Analyzers Low Emissions (Option 060) Retrofit Kit Numbers:**

**E4401-60260 (E4401B)**

**E4402-60030 (E4402B)**

**E4404-60011 (E4404B)**

**E4405-60003 (E4405B)**

**E4407-60009 (E4407B)**



**Agilent Technologies**

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## Introduction

This procedure can be used to retrofit Low Emissions, Option 060, into an E4401B, E4402B, E4404B, E4405B, or E4407B spectrum analyzer. Separate kits are provided for each model number. Several kits contain two or more versions of a part, such as a nameplate or connector label, so that each of these kits can support all options the analyzer may already have. As a result, not all parts in each kit will be used.

Products Affected: .....	E4401B E4402B E4404B E4405B E4407B
Serial Numbers:.....	US00000000/US99999999 MY00000000/MY99999999
Options: .....	120
To Be Performed By: .....	(X) Agilent Technologies Service Center (X) Personnel Qualified by Agilent ( ) Customer
Estimated Installation Time: .....	2.0 Hours
Estimated Verification Time: .....	0.75 Hours

## Installation Kit Parts Lists

### E4401B Opt 060 Retrofit Kit, E4401-60260

Qty	Description	Part Number
1	Chassis Cover	E4401-00067
1	Dress Cover	E4401-00073
1	Front Frame Assembly, Opt 060	E4401-60259
1	Lens/Keypad Assembly	E4401-60256
2	Cap, Connector Cover	E4401-40006
1	Plug, TG	E4401-40020
1	Nameplate, E4401B, 50 Ohm	E4401-80027
1	Connector Label, 50 Ohm	E4401-80003
11	Screw, 3.0 x 8 mm, panhead torx	0515-0372
9	Screw, 3.0 x 10 mm, flathead torx	0515-2600
1	Option 060 Retrofit Kit Installation Note	This note
1	Kit-Firmware Upgrade	Option UE2
1	License Key Certificate	5964-5136 <sup>a</sup>
1	Page Letter	5964-5139 <sup>a</sup>
1	Serial Number Label	9320-6050

a. This part cannot be ordered. The part number is given only to identify the item in this kit.

### E4402B Opt 060 Retrofit Kit, E4402-60030

Qty	Description	Part Number
1	Chassis Cover	E4401-00067
1	Dress Cover	E4401-00073
1	Front Frame Assembly, Opt 060	E4401-60259
1	Lens/Keypad Assembly	E4401-60256
2	Cap, Connector Cover	E4401-40006
1	Plug, TG	E4401-40020
1	Conductive Washer	E4402-20010
1	Wavy Washer, 0.641 ID	3050-2127
1	Type N Spacer	5022-6164

<b>Qty</b>	<b>Description</b>	<b>Part Number</b>
1	Nameplate, E4402B, Std	E4402-80002
1	Nameplate, E4402B, Opt UKB	E4403-80016
1	Connector Label, Std	E4403-80002
1	Connector Label, Opt UKB	E4403-80015
11	Screw, 3.0 x 8 mm, panhead torx	0515-0372
9	Screw, 3.0 x 10 mm, flathead torx	0515-2600
1	Option 060 Retrofit Kit Installation Note	This note
1	Kit-Firmware Upgrade	Option UE2
1	License Key Certificate	5964-5136 <sup>a</sup>
1	Page Letter	5964-5139 <sup>a</sup>
1	Serial Number Label	9320-6050

a. This part cannot be ordered. The part number is given only to identify the item in this kit.

**E4404B Opt 060 Retrofit Kit, E4404-60011**

<b>Qty</b>	<b>Description</b>	<b>Part Number</b>
1	Chassis Cover	E4401-00067
1	Dress Cover	E4401-00073
1	Front Frame Assembly, Opt 060	E4401-60259
1	Lens/Keypad Assembly	E4401-60256
2	Cap, Connector Cover	E4401-40006
1	Plug, TG	E4401-40020
1	Conductive Washer	E4402-20010
1	Wavy Washer, 0.641 ID	3050-2127
1	Type N Spacer	5022-6164
1	Nameplate, E4404B, Std	E4404-80004
1	Nameplate, E4404B, Opt UKB	E4404-80008
1	Connector Label, Std	E4404-80001
1	Connector Label, Opt UKB	E4404-80007
11	Screw, 3.0 x 8 mm, panhead torx	0515-0372
9	Screw, 3.0 x 10 mm, flathead torx	0515-2600
1	Option 060 Retrofit Kit Installation Note	This note
1	Kit-Firmware Upgrade	Option UE2
1	License Key Certificate	5964-5136 <sup>a</sup>
1	Page Letter	5964-5139 <sup>a</sup>
1	Serial Number Label	9320-6050

a. This part cannot be ordered. The part number is given only to identify the item in this kit.

**E4405B Opt 060 Retrofit Kit, E4405-60003**

<b>Qty</b>	<b>Description</b>	<b>Part Number</b>
1	Chassis Cover	E4401-00067
1	Dress Cover	E4401-00073
1	Front Frame Assembly, Opt 060	E4401-60259
1	Lens/Keypad Assembly	E4401-60256
2	Cap, Connector Cover	E4401-40006

<b>Qty</b>	<b>Description</b>	<b>Part Number</b>
1	Plug, TG	E4401-40020
1	Conductive Washer	E4402-20010
1	Wavy Washer, 0.641 ID	3050-2127
1	Type N Spacer	5022-6164
1	Nameplate, E4405B, Std	E4405-80003
1	Nameplate, E4405B, Opt UKB	E4405-80006
1	Connector Label, Std	E4405-80001
1	Connector Label, Opt UKB	E4405-80005
11	Screw, 3.0 x 8 mm, panhead torx	0515-0372
9	Screw, 3.0 x 10 mm, flathead torx	0515-2600
1	Option 060 Retrofit Kit Installation Note	This note
1	Kit-Firmware Upgrade	Option UE2
1	License Key Certificate	5964-5136 <sup>a</sup>
1	Page Letter	5964-5139 <sup>a</sup>
1	Serial Number Label	9320-6050

a. This part cannot be ordered. The part number is given only to identify the item in this kit.

#### **E4407B Opt 060 Retrofit Kit, E4407-60009**

<b>Qty</b>	<b>Description</b>	<b>Part Number</b>
1	Chassis Cover	E4401-00067
1	Dress Cover	E4401-00073
1	Front Frame Assembly, Opt 060	E4401-60259
1	Lens/Keypad Assembly	E4401-60256
2	Cap, Connector Cover	E4401-40006
1	Plug, TG	E4401-40020
1	Conductive Washer	E4402-20010
1	Wavy Washer, 0.641 ID	3050-2127
1	Type N Spacer	5022-6164
1	Nameplate, E4407B, Std	E4407-80003
1	Nameplate, E4407B, Opt UKB	E4407-80006

<b>Qty</b>	<b>Description</b>	<b>Part Number</b>
1	Connector Label, Std	E4407-80001
1	Connector Label, Opt AYZ	E4407-80005
1	Connector Label, Opt UKB	E4407-80007
1	Connector Label, Opt UKB and AYZ	E4407-80008
11	Screw, 3.0 x 8 mm, panhead torx	0515-0372
9	Screw, 3.0 x 10 mm, flathead torx	0515-2600
1	Option 060 Retrofit Kit Installation Note	This note
1	Kit-Firmware Upgrade	Option UE2
1	License Key Certificate	5964-5136 <sup>a</sup>
1	Page Letter	5964-5139 <sup>a</sup>
1	Serial Number Label	9320-6050

a. This part cannot be ordered. The part number is given only to identify the item in this kit.



## Tools Required

T-10 TORX screwdriver

T-15 TORX screwdriver

Flat-blade screwdriver

Heat gun or >1200 W blower drier

Razor blade

## Torque Settings

To avoid potential RFI leakage and prevent connector damage, tighten screws and RF coax cable connectors to the following torque limits:

<b>Item</b>	<b>Torque in Inch-Pounds</b>
SMA Connector	8.5
SMC Connector	5.5
3.5-mm, T-10 TORX screws	14
4-mm, T-15 TORX screws	21
Pozidrive Screws	14

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## Procedure

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**WARNING** Before you disassemble the instrument, turn the power switch to **Standby** and **unplug the instrument**. Failure to unplug the instrument can result in personal injury.

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**CAUTION** Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Refer to the documentation that pertains to your instrument for information about static-safe workstations and ordering static-safe accessories.

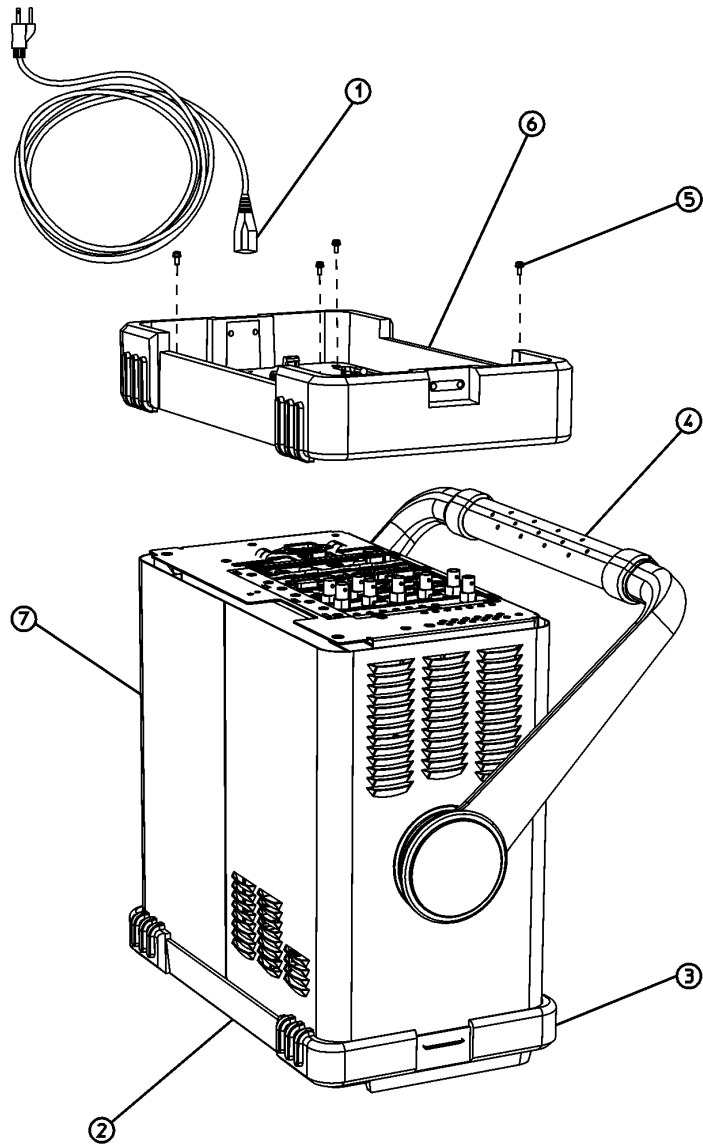
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### Dress Cover Removal

1. Referring to [Figure 1](#), disconnect the analyzer from ac power (1).
2. Remove any adapters or cables (2) connected to the front frame.
3. Carefully place the analyzer on the work surface with the front frame (3) facing down.
4. Position the handle (4) as shown.
5. Remove the four screws (5) that hold the rear frame and dress cover in place.
6. Remove the rear frame (6).
7. Pull the dress cover (7) off towards the rear of the analyzer.

**Figure 1**

**Dress Cover and Rear Frame Removal**

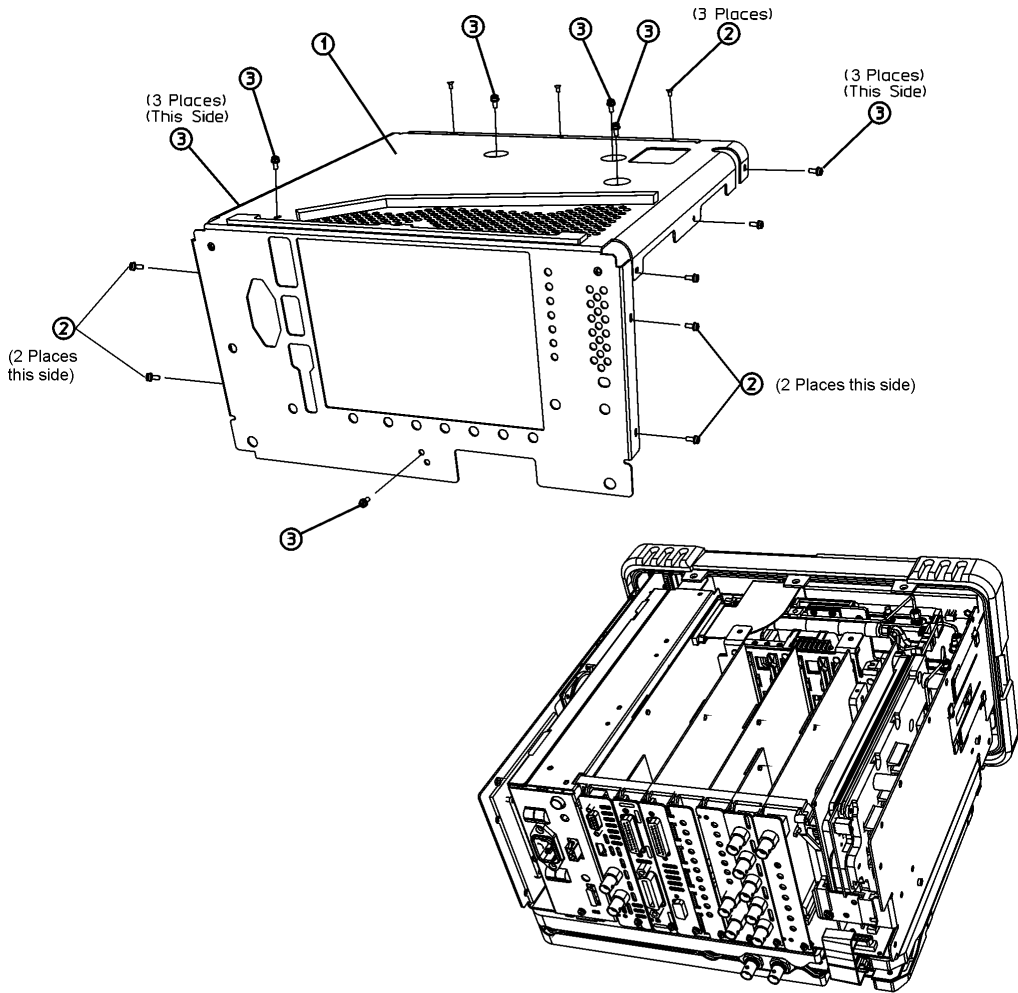


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## Chassis Cover Removal

1. Lay the analyzer flat as shown in [Figure 2](#).
2. Remove the 17 screws (2) and (3) attaching the chassis cover to the chassis. Note that the number of screws attaching the chassis cover may vary with option mixes.
3. Remove the chassis cover (1) from the chassis.

**Figure 2** Chassis Cover Removal



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## A1 Front Frame Assembly

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**CAUTION** Use ESD precautions when performing this replacement procedure.

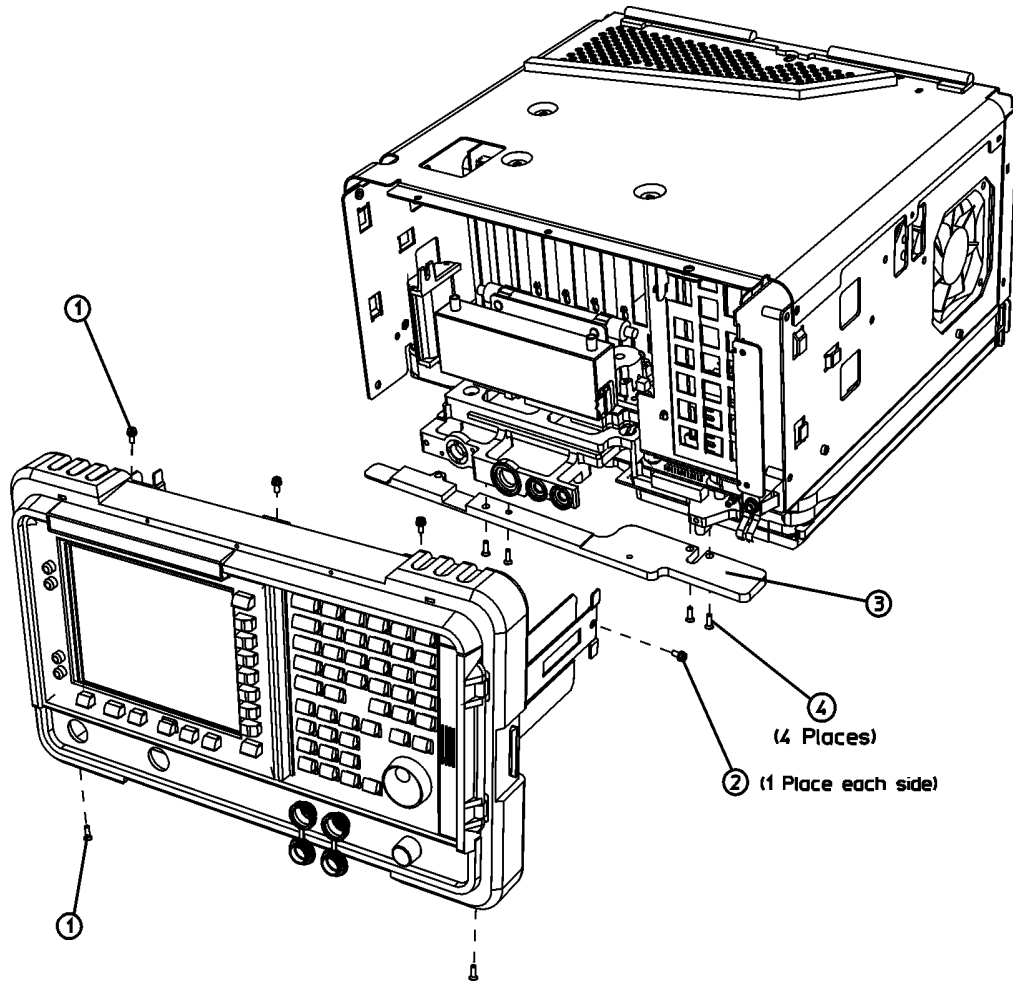
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### Extension

The A1 front frame assembly can be extended from the instrument without detaching any connections.

1. With the instrument still on its face, remove the two screws (1) on the bottom side of the instrument, that secure the front frame to the RF assembly.

**Figure 3** A1 Front Frame Assembly Removal



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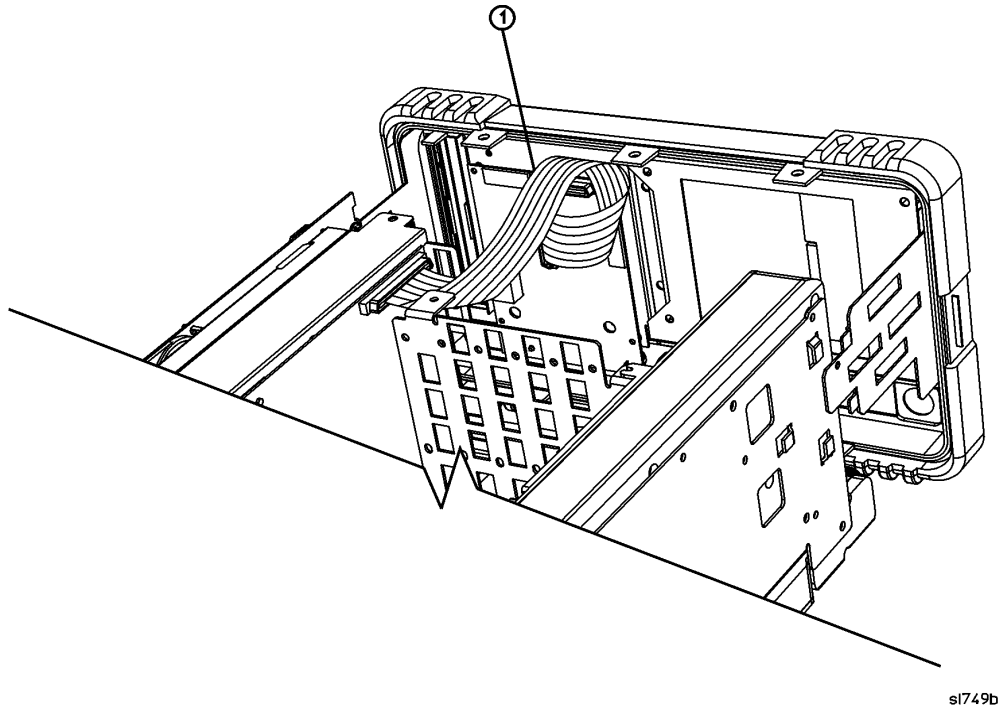
2. Refer to [Figure 3](#). Place the instrument with the top side facing up and remove the remaining two screws (2) that secure the front frame subpanel to the chassis.
3. Slide the front frame forward until it catches on the tabs on the sides of the chassis.

## Removal

To completely remove the A1 front frame assembly, refer to [Figure 3](#) and complete the “[Extension](#)” procedure, then continue with the following steps:

1. Refer to [Figure 4](#). Disconnect the ribbon cable (1) from the A1A1 front panel interface board. Analyzers with Option B7B will have a second ribbon cable connecting to A1A1. Disconnect the second ribbon cable if present.

**Figure 4**                      **Front Frame Ribbon Cable**



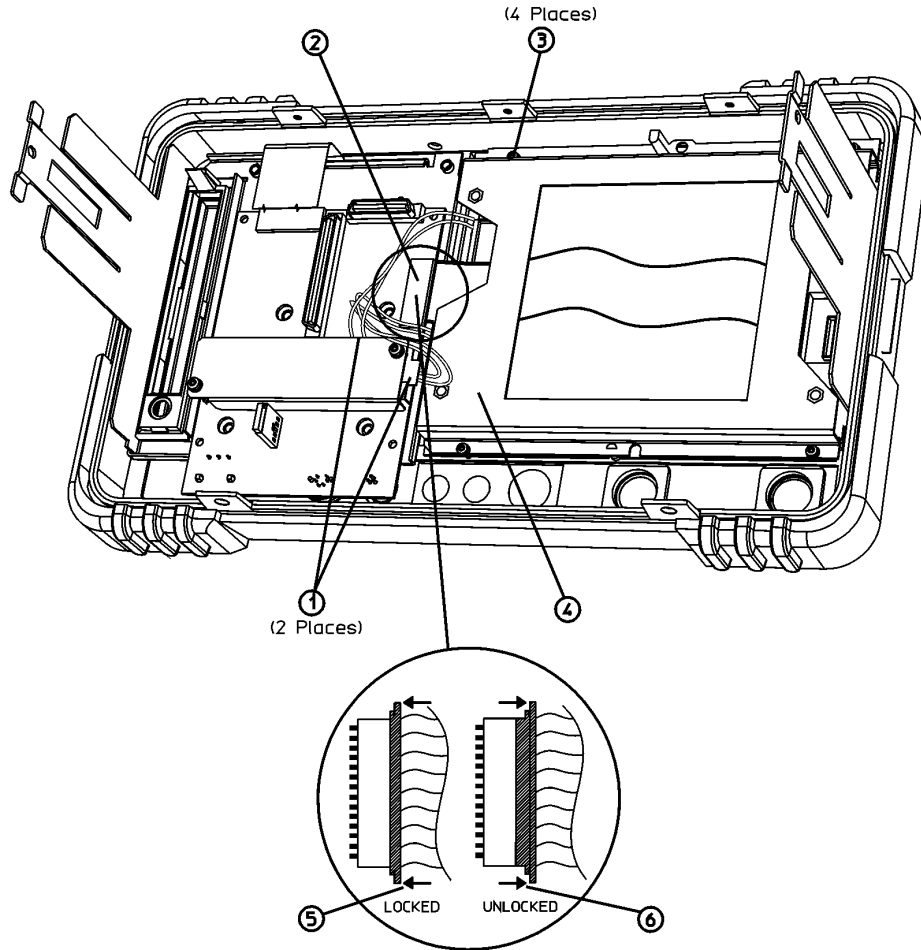
2. Carefully pull the sides of the front frame subpanel away from the chassis and over the tabs on the chassis.
3. Slide the front frame forward to disengage from the chassis assembly.

## A1A2 Display Removal

### Removal

Refer to [Figure 5](#) for the following procedure.

**Figure 5**      **A1A2 Display Removal**



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1. Place the front frame assembly face down on the work surface.
2. Disconnect the two 2-wire backlight cables (1) from the front panel interface inverter board.
3. Disconnect W3 ribbon cable (2) from the front panel interface board.

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**CAUTION**      The W3 display ribbon cable connector (2) is delicate. With a small screwdriver or similar tool, gently push the lock tabs out from the back of the connector. Excessive force on the locking tab can break the retaining clips, and if broken, board replacement will be necessary.

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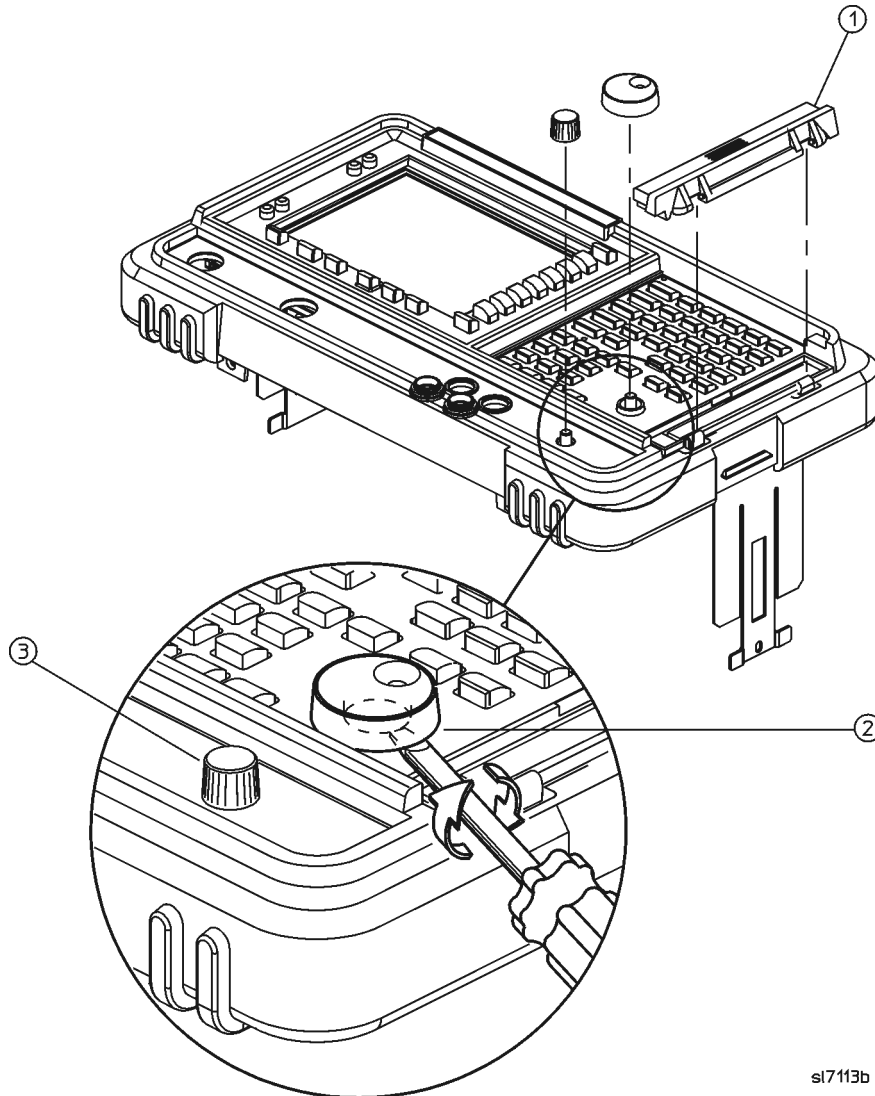
4. Remove the four screws (3) securing the display (in a bracket) (4) to the front frame.

- Carefully lift the display out of the front frame assembly.

## A1A1 Front Panel Interface Board

### Removal

**Figure 6** A1A2 Display Removal



- Remove the volume knob and the RPG knob.

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**TIP** You may need to exert considerable force in order to remove the RPG knob. It may be necessary to pry it off using a screwdriver as shown in [Figure 6](#).

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- Refer to [Figure 7](#). Remove the four screws (10) that secure the A1A1 front panel interface board (11) to the front frame.



3. Remove the front panel interface board from the front frame assembly.

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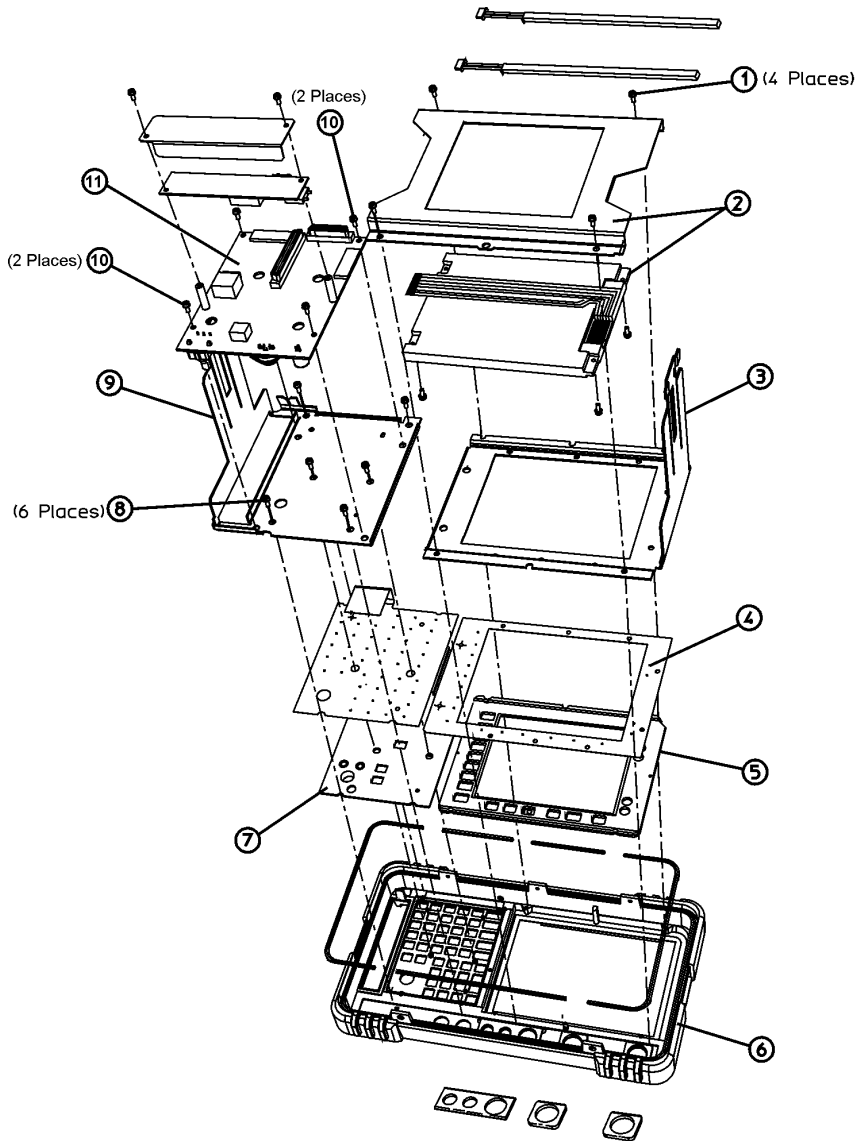
**NOTE** There is a water-seal gasket placed around the volume control shaft that will need to be repositioned during the replacement procedure.

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## Keypad Flex Circuit Removal

### Removal

Figure 7 Front Frame Assembly Parts



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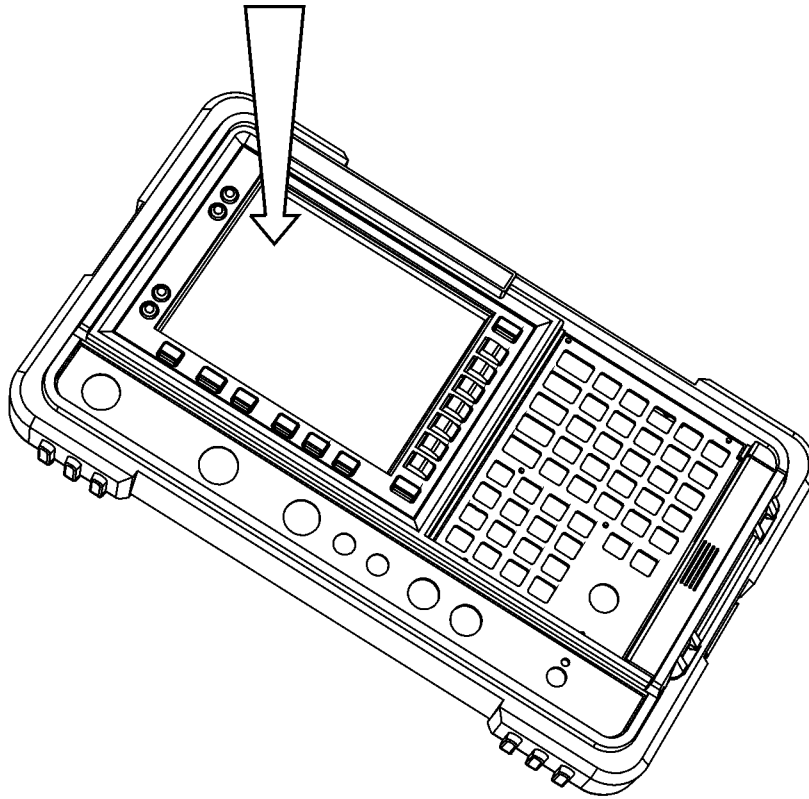
**NOTE**

The lens/keypad assembly is pressed into place, using a strong adhesive instead of hardware. It is made of a plastic material and will bend but not break.

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1. Refer to [Figure 7](#). Remove the support bracket (3).
2. Remove the 6 screws (8) securing the subpanel assembly (9) to the front frame (6).
3. Remove the subpanel assembly (9).
4. Lift out the keypad/flex circuit (4) and the main keypad (7). Be careful to avoid touching the keypad contacts with your fingers.
5. To remove the lens/keypad from the front frame, apply pressure from the front side. Using both thumbs, press in the corner of the lens as shown in [Figure 8](#) until it pops out.

**Figure 8**            **Lens Removal**



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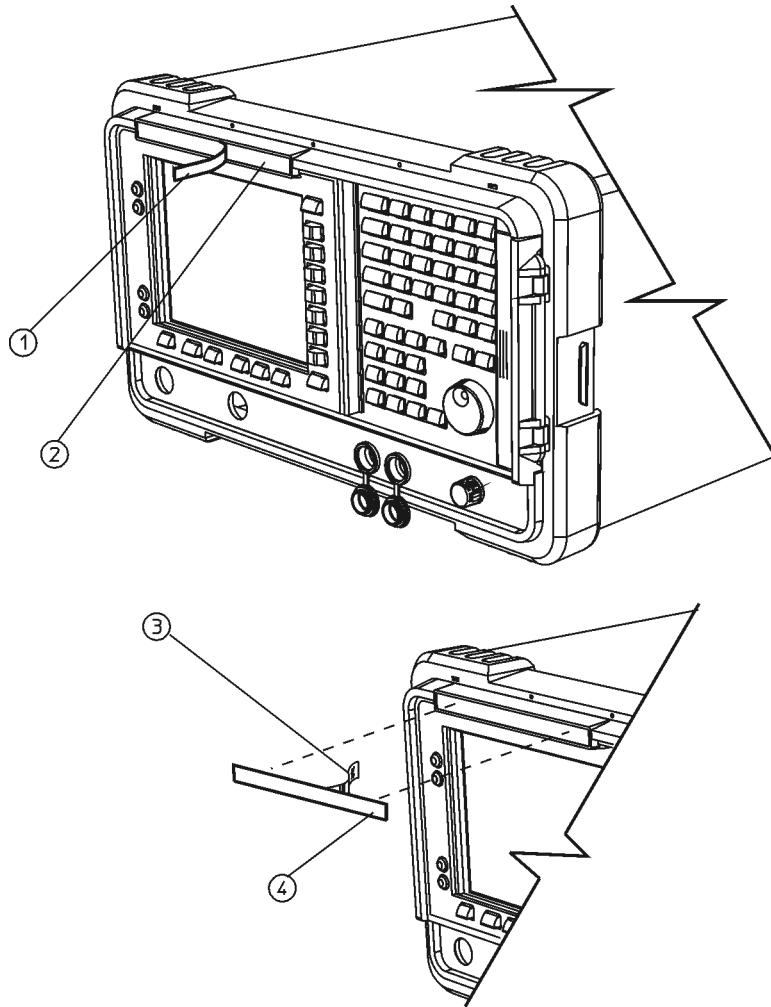
### **Attach Nameplate to Front Frame**

1. Locate the nameplate in the kit. The nameplate is labelled with the analyzer product number (for example, "E4404B") and the analyzer's frequency range. Some kits contain two nameplates, identifying different frequency ranges for the analyzer. For example, the kit for the E4404B will have one nameplate for the standard instrument where the frequency range is 9 kHz to 6.7 GHz and another nameplate for

Option UKB, where the frequency range is 100 Hz to 6.7 GHz. Choose the nameplate that is appropriate for the analyzer being retrofitted.

2. Lay the new front frame included in the kit on the table with the front facing up. Locate the pocket (2) above the display opening where the nameplate will go. Refer to [Figure 9](#).
3. Clean the nameplate pocket (2) with alcohol.
4. Remove the backing (3) from the nameplate (4) and press the nameplate into the pocket (2).

**Figure 9** Nameplate Replacement



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### Attach Connector Label and Connector Covers to Front Frame

1. Locate the connector label in the kit. The connector label has holes to accommodate the various front panel connectors and the volume control. The frequency range of the analyzer appears near the hole next to the INPUT connector. Some kits contain two or more connector labels identifying different frequency ranges and connector configurations. Choose the connector label that is appropriate for the analyzer being retrofitted.

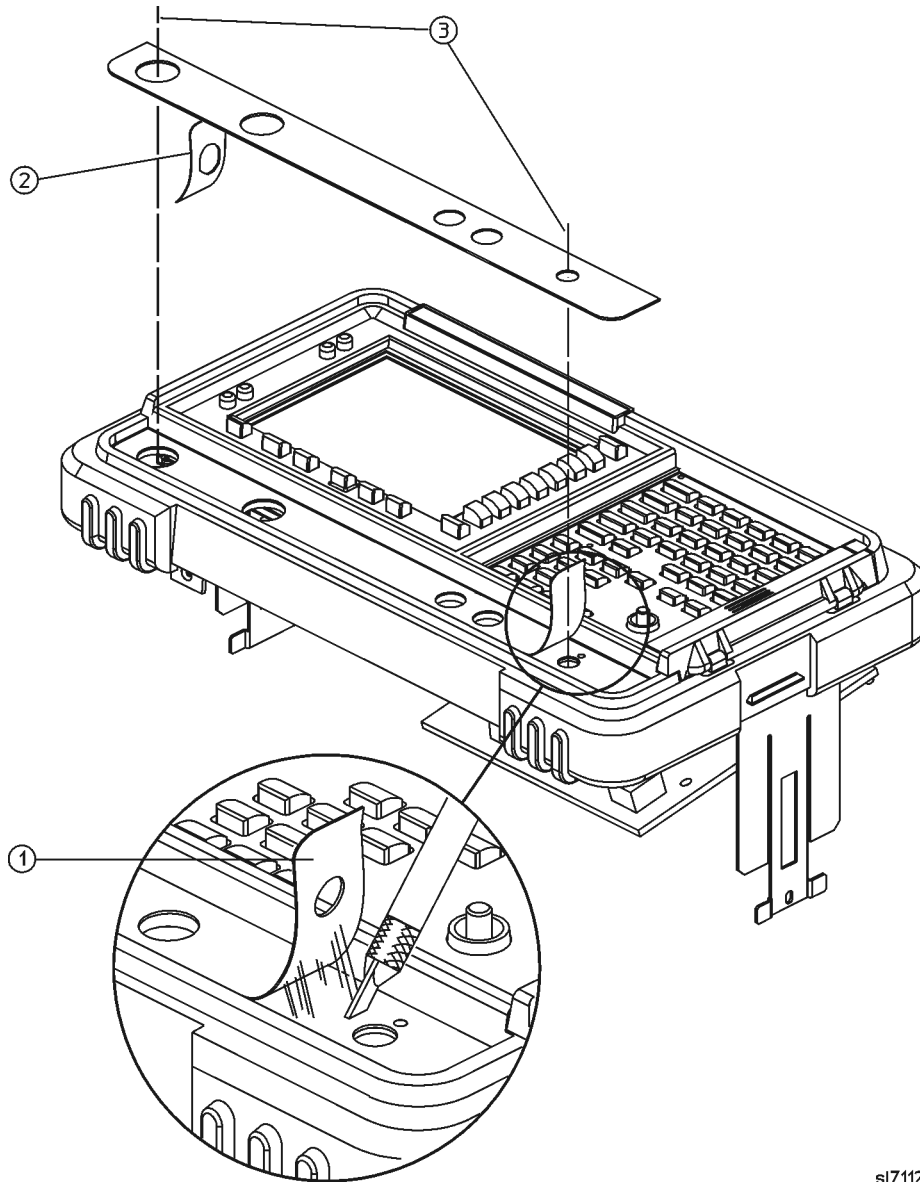
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**NOTE** For the E4407B, there are two connector labels for each frequency range. One label of each pair

is for analyzers which also have external mixing, and the other label is for analyzers which do not have external mixing. Be sure to choose the correct label.

2. Remove the backing (2) off the new label as shown in [Figure 10](#).
3. Align and install the label by placing a finger in the RF OUT and VOLUME holes. Observe the alignment of the INPUT and PROBE POWER holes (3).

**Figure 10** Connector Label Installation



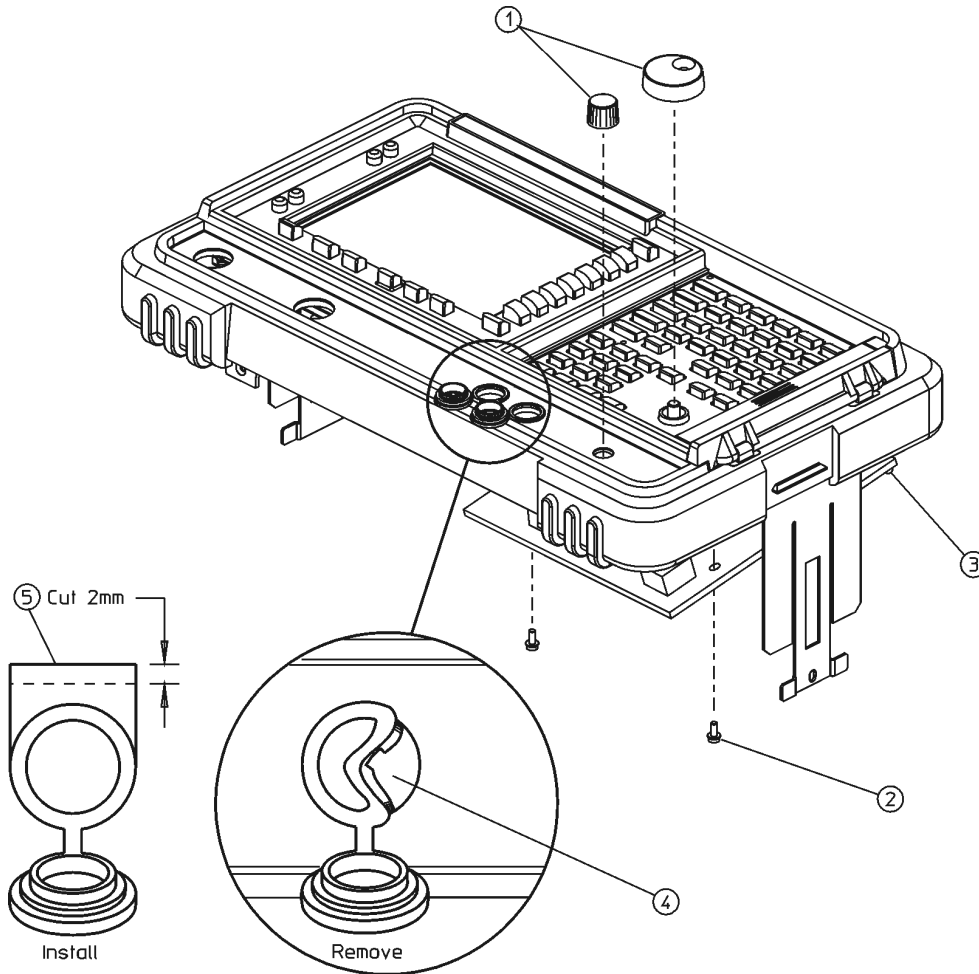
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4. Install the two connector covers from the front panel by pinching them from the sides (4) and installing them through the front of the assembly. See [Figure 11](#).

**TIP** It may be helpful to trim off about 2 mm of the tabs (5) on the connector covers prior to

reinstalling them. This will help in aligning the covers. See [Figure 11](#).

**Figure 11** Connector Covers



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5. Align the connector covers so they open downward as shown.
6. Turn the front frame over so that the inside of the front frame is facing up.
7. If the analyzer is equipped with a tracking generator, a Type-N EMC Seal (included with the front frame) must be installed onto the inside of the front panel behind the RF OUT connector hole. Remove the adhesive backing from the seal and press it into the front frame pocket. The foiled edges must make contact with the top and bottom of the frame pocket.
8. If the analyzer is an E4401B, a Type-N EMC Seal (included with the front frame) must be installed onto the inside of the front panel behind the INPUT connector hole. Remove the adhesive backing from the seal and press it into the front frame pocket. The foiled edges must make contact with the top and bottom of the frame pocket.

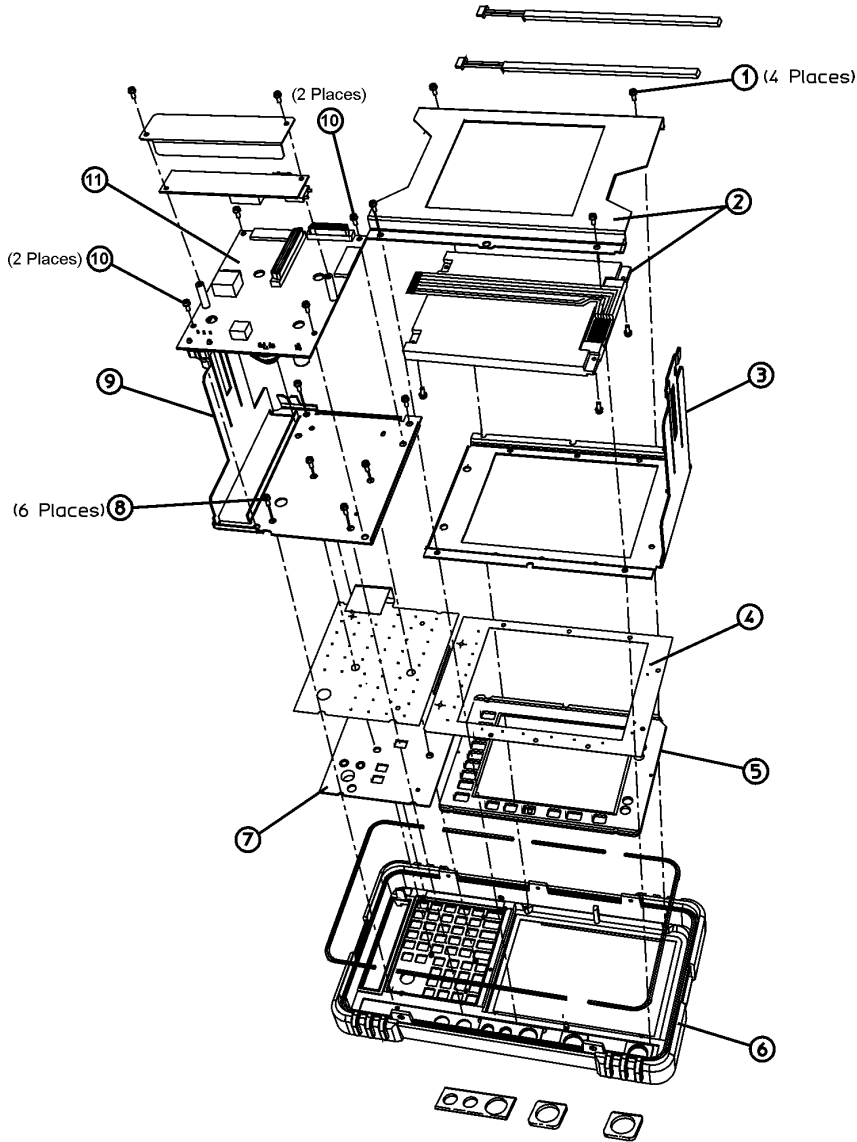
## **Install New Lens/Keypad Assembly**

1. Position the front frame assembly such that the inside of the front frame is facing up.
2. Remove the paper covering the adhesive on the lens/keypad assembly (included in kit).
3. Carefully fit the new lens/keypad into place in the front frame. Press along the edges of the lens from the inside to adhere it to the front frame.
4. Make sure the inside of the lens is clean from contaminants such as lint and fingerprints before proceeding.

## **Replace Keypad/Flex Circuit and A1A2 Display**

1. Refer to [Figure 12](#). Place the main keypad (7) so it lays flat in the front frame (6). Be careful to avoid touching the keypad contacts with your fingers.
2. Lay in the flex circuit (4) so it aligns with the pegs on the front frame and lays flat. A small amount of circuit ripple will be unavoidable.
3. Replace the subpanel (9), and secure with the six screws (8). Tighten them to 9 inch-pounds.
4. Replace the support bracket (3), along with the display (2) and secure with the four screws (1). Tighten them to 9-inch pounds.

**Figure 12 Front Frame Assembly Parts**



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### Replace A1A1 Front Panel Interface Board

1. Refer to [Figure 12](#). Place the front panel interface board (11) in the correct position in the front frame assembly. Make sure the water seal is in place around the volume control shaft.
2. Replace the four screws that secure the board to the front frame. Tighten them to 9 inch-pounds.
3. Connect the W3 display ribbon cable (2) to the front panel interface board.

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**TIP** An easy way to insert this delicate cable into the connector is to place your finger on the cable, in the center of the LCD display, and gently slide the cable toward the connector until they align. Then, providing guidance with the other hand as necessary, slide the cable until the

end slips into the connector.

Ensure the cable end is seated completely and is aligned straight within the connector body.

Continue to hold the cable in place with your finger, and with the other hand gently press the locking tabs (5) into place. Refer to [Figure 6](#).

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**NOTE** If you experience display problems, check this connection.

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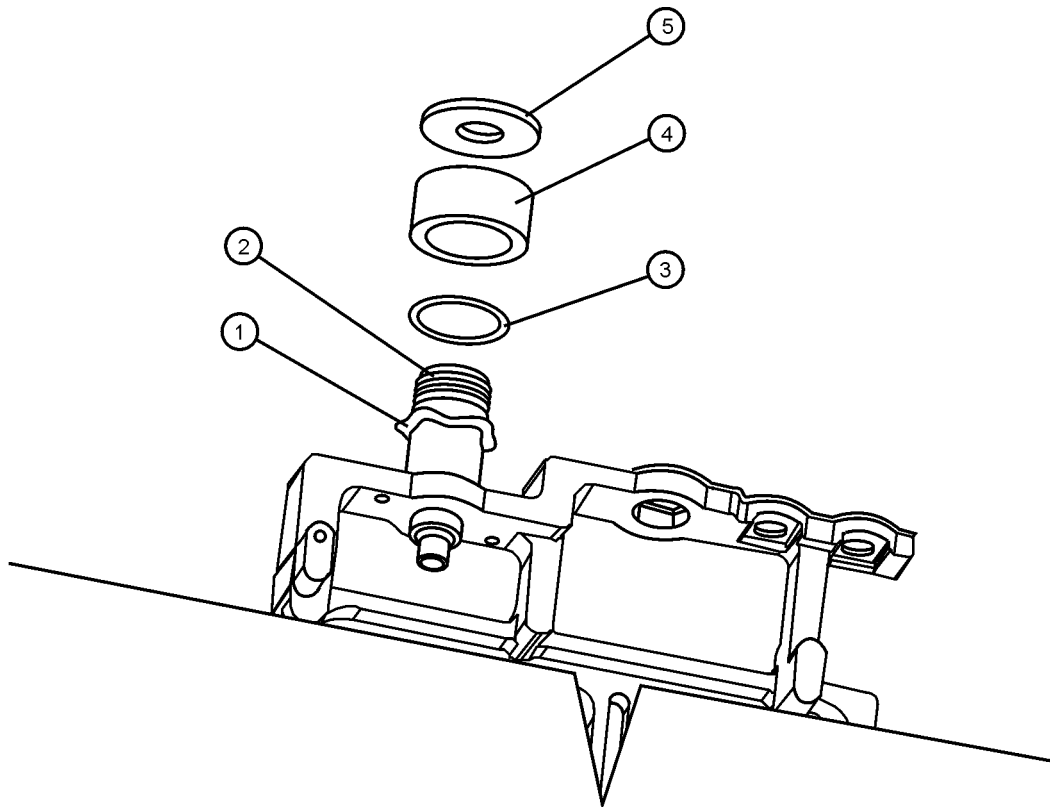
4. Reconnect the two 2-wire backlight cables (1) to the inverter board, making sure that the cables are dressed away from the openings for the control knobs.
5. Press the volume and RPG knobs onto their control shafts.

### Install Type-N Gasket (All models except E4401B)

The following procedure applies only to E4402B, E4404B, E4405B, and E4407B. If the analyzer is an E4401B, proceed to Replace Front Frame.

1. Remove the sleeve and o-ring from the Type N input connector on the A8A1 3 GHz RF assembly. The o-ring will be reused.
2. Locate the wavy washer, conductive washer, and sleeve in the kit.
3. Refer to [Figure 13](#). Install the wavy washer (1) over the Type N connector (2).

**Figure 13** Type N Gasket Installation



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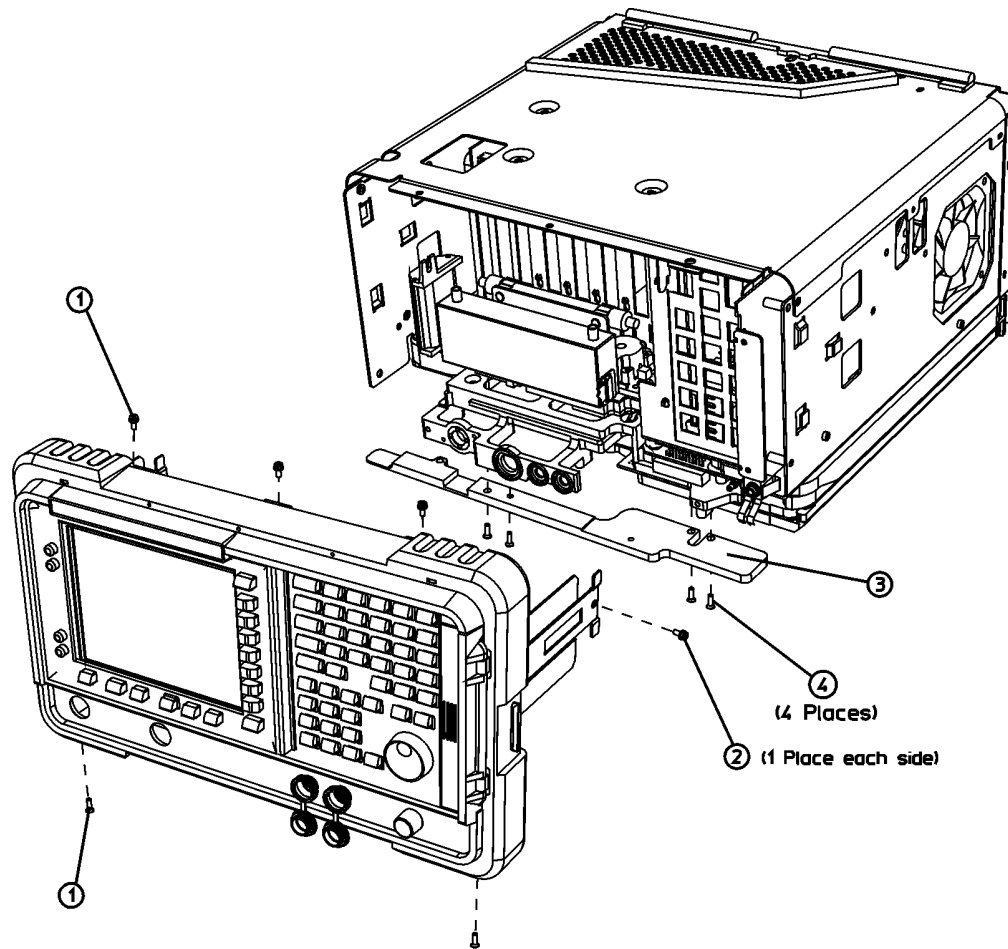


4. The new sleeve has a recess on each end. One recess is deep and the other is shallow. Install the o-ring (3) into the deep recess of the sleeve (4).
5. Install the sleeve (4) over the Type N connector (2) with the o-ring nearest the wavy washer.
6. Install the conductive washer (5) over the Type N connector (2).

## Replace Front Frame Assembly

1. Align the A1 front frame subpanel rails with the chassis as shown in [Figure 14](#).

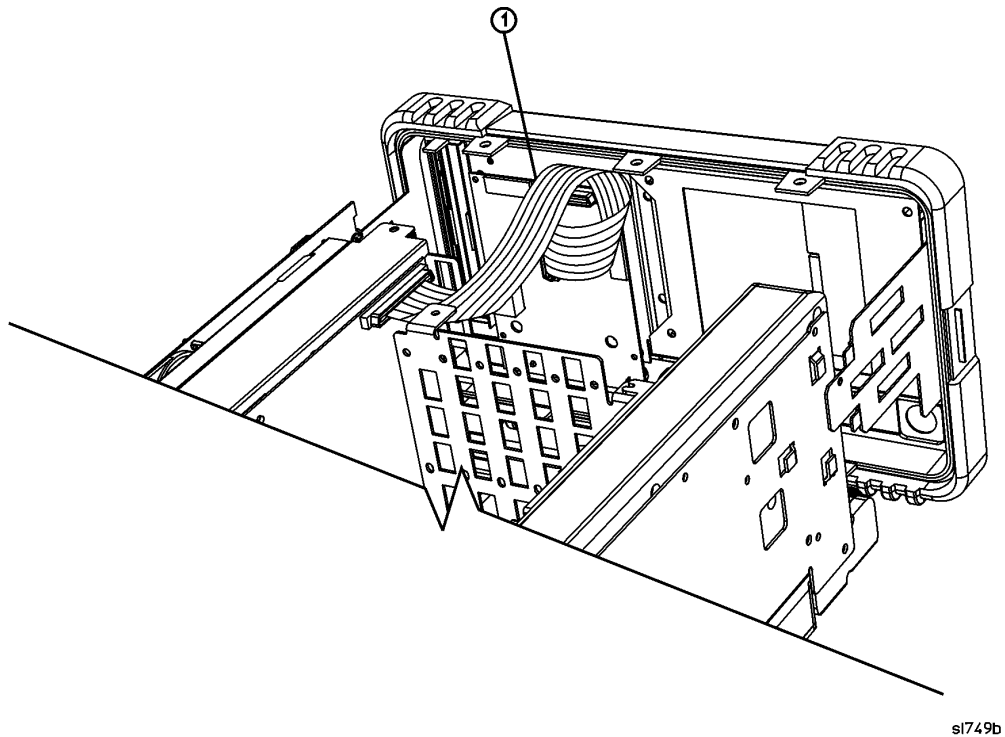
**Figure 14** Front Frame Assembly Replacement



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2. Refer to [Figure 15](#). Connect the ribbon cable (1) to the front frame assembly. If Option B7B is installed, there will be two ribbon cables to connect.

**Figure 15**      **Front Frame Ribbon Cable**

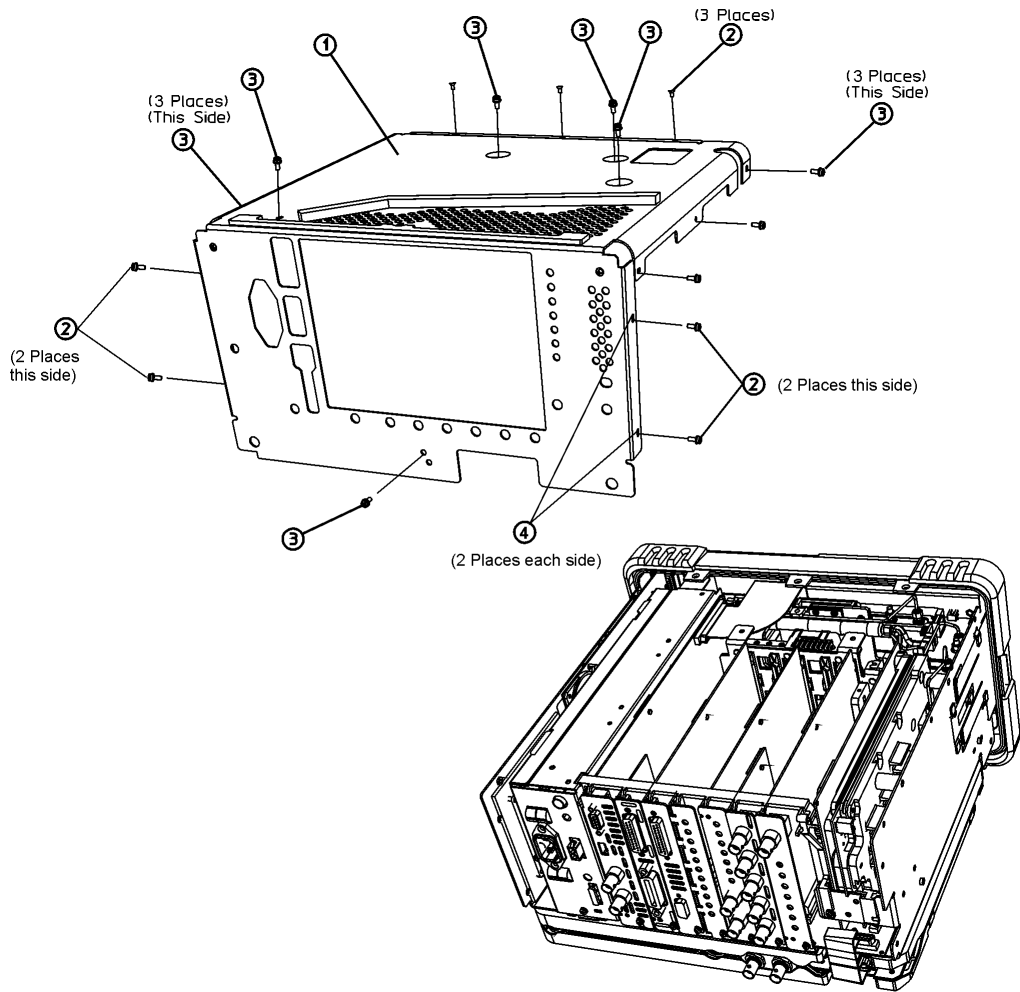


3. Carefully slide the front frame toward the chassis, assuring the ribbon cable(s) are not pinched between assemblies, and the RF input connector lines up correctly with the opening in the front frame.
4. Refer to [Figure 14](#). Replace the screws (1) that secure the front frame to the chassis. Tighten them to 9 inch-pounds.

### **Replace Chassis Cover**

1. A new chassis cover is provided with this kit. However, the original chassis cover removed from the analyzer may be used if it is the newer style. Refer to [Figure 16](#). If the holes on the original chassis cover along the rear sides of the chassis cover (4) have countersinks, the chassis cover is the new style and may be reused. If these holes do not have countersinks, use the new chassis cover provided in the kit.

**Figure 16 Chassis Cover Replacement**



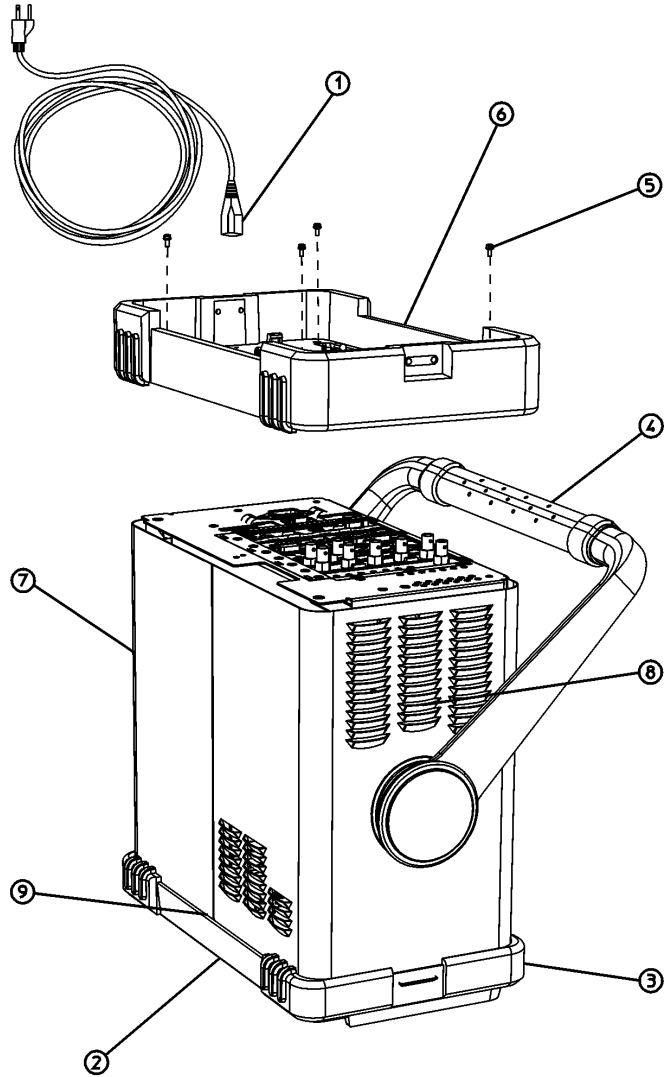
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2. If the original chassis cover is the old style, the serial number label should be removed from it and readhered to the new chassis cover. To remove the serial number label, apply heat to the serial number label using a heat gun or >1200 Watt blow dryer. Use a razor blade to gently peel off the serial number label. While the serial number label is still warm, readhere it in the same location on the new chassis cover.
3. If the serial number label was damaged in the previous step, a replacement serial number label is supplied. Using a typewriter or a fine-point, indelible marking pen, transcribe the analyzer product number and serial number from the old serial number label onto the new label. If space permits, enter all options listed on the original serial number label. Attach the new serial number label onto the new chassis cover in the space marked.
4. Carefully position the chassis cover (1) on the instrument as shown in [Figure 16](#), then lower onto the instrument.
5. Using the screws provided in the kit, replace the 17 screws (2) and (3) as indicated on the instructions on the chassis cover. Tighten the screws to 9 inch-pounds.

## Replace Dress Cover

1. If the chassis cover supplied in the kit was installed in the previous procedure, it will be necessary to also use the new dress cover supplied in the kit. If the original chassis cover was installed in the previous procedure, the original dress cover may be used. If the new dress cover is used, it will be necessary to remove the handle from the original dress cover and mount it onto the new dress cover. Proceed to [step 5](#) if the original dress cover will be reused.
2. To remove the handle from the old dress cover, position the handle towards the rear of the dress cover. Pull outward on the handle's hubs. Rotate the handle a few degrees up and down as you pull outward to release the handle.
3. The new dress cover can accommodate both old and new handles. The handle removed in [step 2](#) was the old style handle, so it will be necessary to remove the backing plate (only used with new handles) from the new dress cover to accommodate the old handle. Use a flat-blade screwdriver or retaining ring pliers to remove the retaining ring securing the backing plate to the dress cover.
4. Position the handle with the hubs over the keyholes on the dress cover and the handle pointed toward the rear of the analyzer. Rotate the handle a few degrees up and down until the handle locks into place. Rotate the handle so that it points toward the top of the dress cover.
5. Refer to [Figure 17](#). Carefully place the spectrum analyzer on the work surface with the front frame (3) facing down.
6. Replace the dress cover, matching the grill (8) on the bottom of the dress cover to the bottom of the analyzer.
7. Fit the leading edge of the dress cover completely into the slot (9) on the back of the front frame assembly.
8. Replace the rear frame assembly (6) using the four screws (5) to fasten the rear frame to the analyzer. Tighten them to 21 inch-pounds.

**Figure 17 Dress Cover, Rear Frame Replacement**



sl745b

## Load New Firmware

1. Turn on the analyzer and wait for the power-on alignments to complete. Check that there are no error messages displayed.
2. Press **System, More, Show System**. Note the firmware revision. If the firmware revision is the same as that supplied with the firmware upgrade kit included in this kit, proceed to ["Functional Testing."](#)
3. If your firmware revision is before the revision supplied in the firmware upgrade kit, then you must upgrade your analyzer firmware. Refer to the installation note supplied with the firmware upgrade kit included in this kit.

## Activate the Option 060 License Key

The license key supplied in this kit allows you to activate Low Emissions (Option 060).

1. Press **System, More, More, Licensing, Option**
2. When you press **Option**, the alpha editor will be activated. For instructions on using the alpha editor, refer to the *Agilent Technologies ESA Spectrum Analyzers User's Guide*.
3. Use the numeric keypad to enter the three-character designation for the option, in this case, "060", that you want to activate.
4. Press **Done** on the alpha editor menu.
5. Press **License Key**. When you press **License Key** the alpha editor will be activated.
6. Use the alpha editor and the numeric keypad to enter the 12-character license key number (for example: D7C374DABD5B) for the option that you want to activate.
7. Press **Done** on the alpha editor menu.
8. Press to turn on the option.

## **Functional Testing**

1. Verify that Option 060 was activated by pressing **System, More, Show System**. Verify that there is an entry which reads, "060: Low Emissions".
2. Perform the following performance verification tests, located in the *Agilent Technologies ESA Spectrum Analyzers Calibration Guide*:
  - Displayed Average Noise Level
  - Residual Responses
3. If you have problems performing either of these tests, get in touch with the nearest Agilent Technologies sales and service office listed in the troubleshooting chapter of the *Agilent Technologies ESA Spectrum Analyzers User's Guide*.