

Installation Note

**Agilent Technologies
E4402B/E4404B/E4405B/E4407B
Spectrum Analyzers and
E7402A/E7403A/E7404A/E7405A EMC Analyzers
High Stability Frequency Reference (Option 1D5)
Retrofit Kit**



Agilent Technologies

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Introduction

This procedure can be used to retrofit the High Stability Frequency Reference (Option 1D5) into any E4402/4/5/7B Spectrum Analyzer or E7402/3/4/5A EMC Analyzer.

Products Affected:	E4402B / E4404B / E4405B / E4407B E7402A / E7403A / E7404A / E7405A
Serial Numbers:.....	US00000000/US99999999 MY00000000/MY99999999
Options:	1D5
To Be Performed By:	(X) Agilent Technologies Service Center () Personnel Qualified by Agilent () Customer
Estimated Installation Time:	3.0 Hours
Estimated Verification Time:	2.0 Hours

Installation Kit Parts List

Item	Description	Part Number
1	Precision Frequency Reference Oscillator	1813-1065
2	1D5 Upgrade Label	7121-5246
3	Option 1D5 Installation Note	this note
4	Screw, SMM3 x 14mm (Qty. 41)	0515-2994

NOTE After the hardware modifications have been made, you must run the 10MHz Reference Frequency Adjustment. ESA/EMC Performance Verification and Adjustment Software is required to perform this adjustment, but is not included in this kit. Obtain the software by ordering the Service Documentation and Software Option (Option 0BW)

Tools Required

- T-10 TORX screwdriver
- T-15 TORX screwdriver
- High quality soldering iron
- Electric torque driver (highly recommended)
- Needle nose pliers
- Adjustment Software

The Performance Verification and Adjustment Software may be obtained by ordering the Service Documentation and software (Option 0BW).

- Black permanent marker

Torque Settings

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

Item	Torque in Inch-Pounds
SMA Connector	9
3.5-mm, T-10 TORX screws	9
4-mm, T-15 TORX screws	21

Procedure

This procedure will guide you through the process of upgrading an E4402/4/5/7B ESA-E Series Spectrum Analyzer or an E7402/3/4/5A EMC Analyzer with the optional Precision Frequency Reference (Option 1D5).

While some of the drawings may display a slightly different model than the one being upgraded, none of the differences should have any affect on the upgrade itself.

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

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.

Verify Need for 1D5 Upgrade

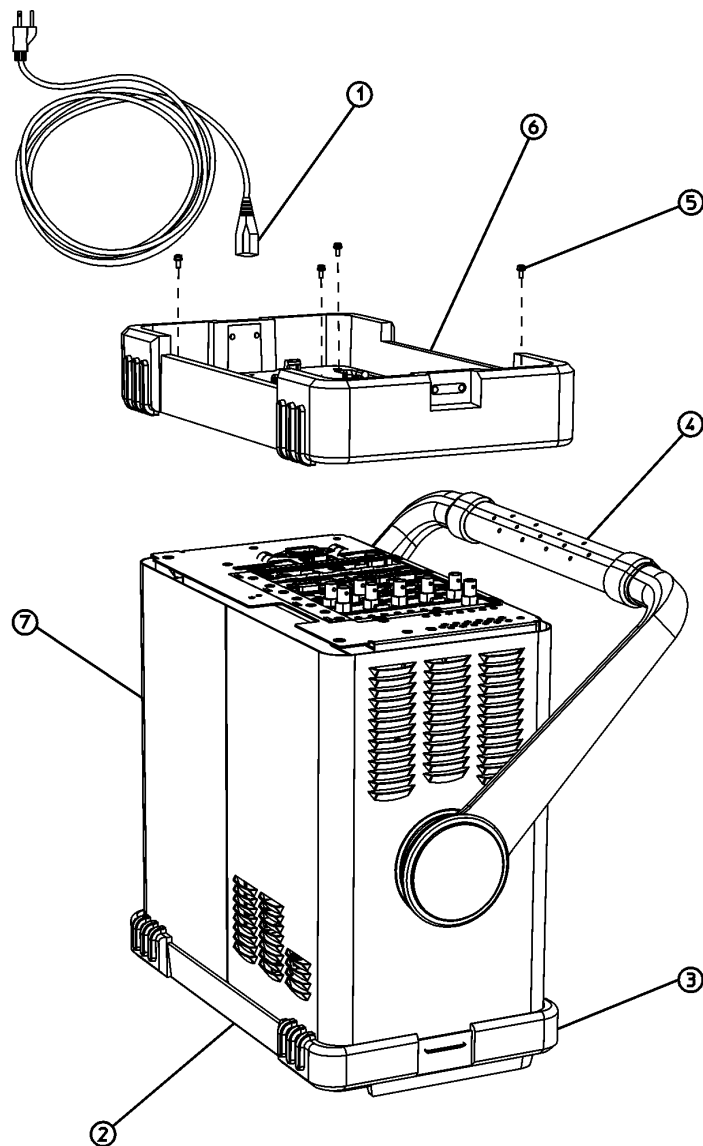
Due to the complexity of this upgrade, and the fact that this option was also shipped as a part of a few different option bundles, it would be a good idea to verify that the instrument being upgraded truly does not have this option before proceeding with this upgrade.

1. With the power on, verify that Option 1D5 does not identify by pressing **System, More, Show System**. There should not be an entry which reads, "1D5: Hi Stability Freq Ref".

Dress Cover Removal

1. Refer to [Figure 1](#) and 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

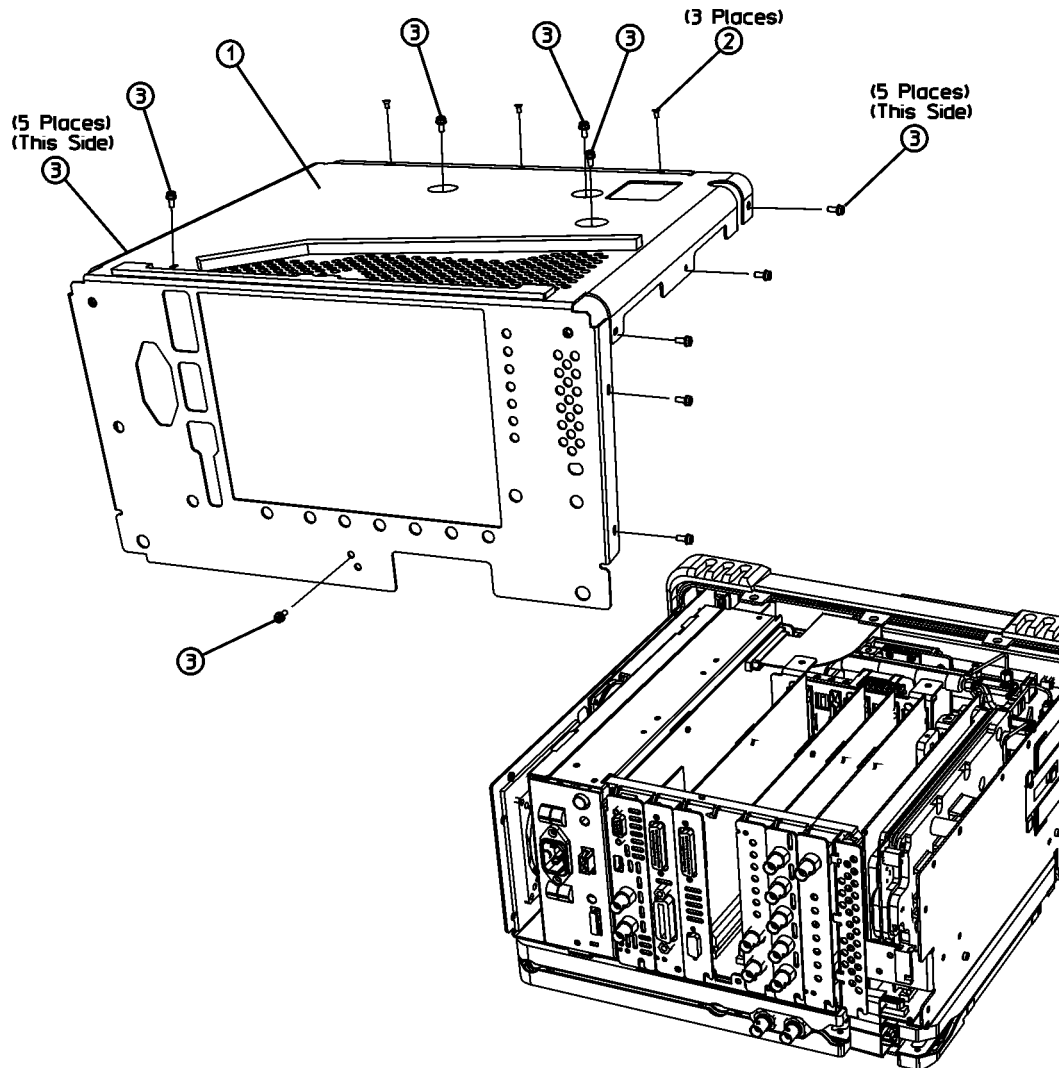


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Chassis Cover Removal

1. Refer to [Figure 2](#) and lay the analyzer flat.
2. Remove the 15 screws (2) and (3) attaching the chassis cover to the chassis. Note that the number of screws attaching the chassis cover may vary depending upon which options are installed.
3. Remove the chassis cover (1) from the chassis.

Figure 2 Chassis Cover Removal



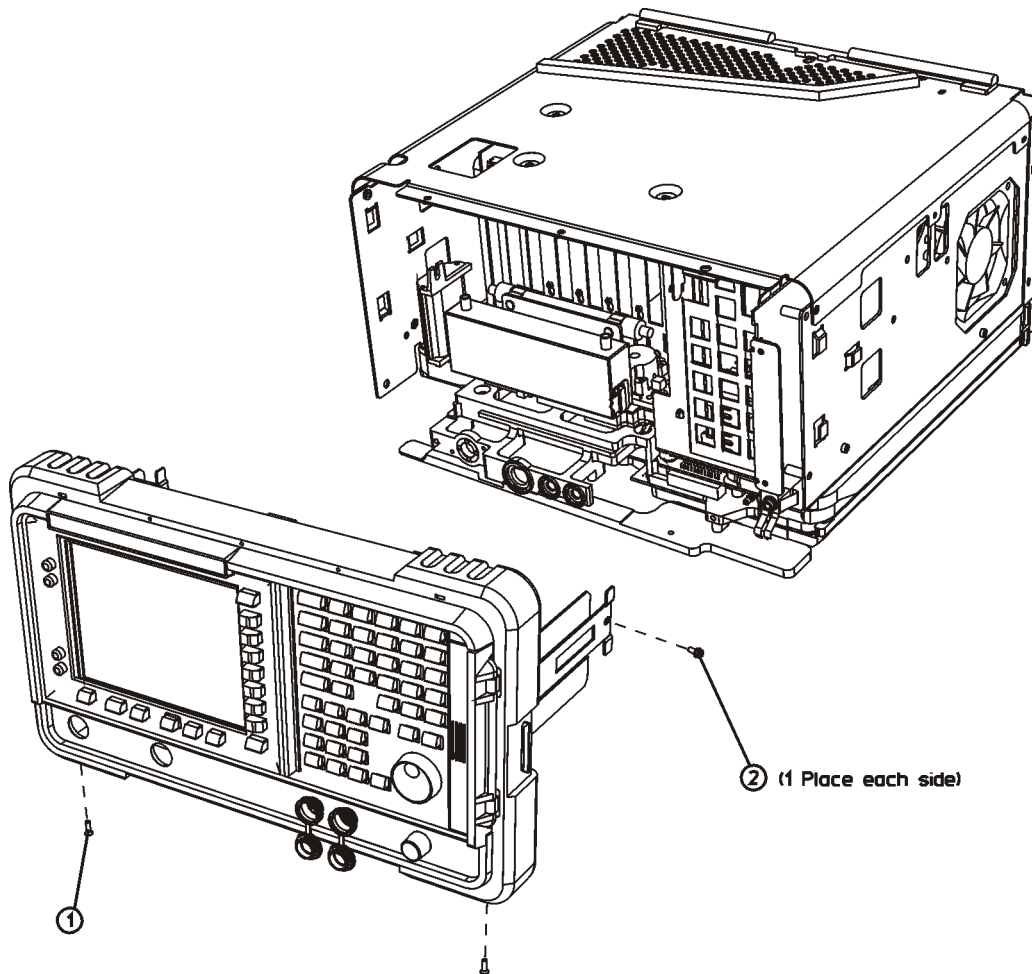
A1 Front Frame Assembly

CAUTION Use ESD precautions when performing this replacement procedure.

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

1. Refer to [Figure 3](#). 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

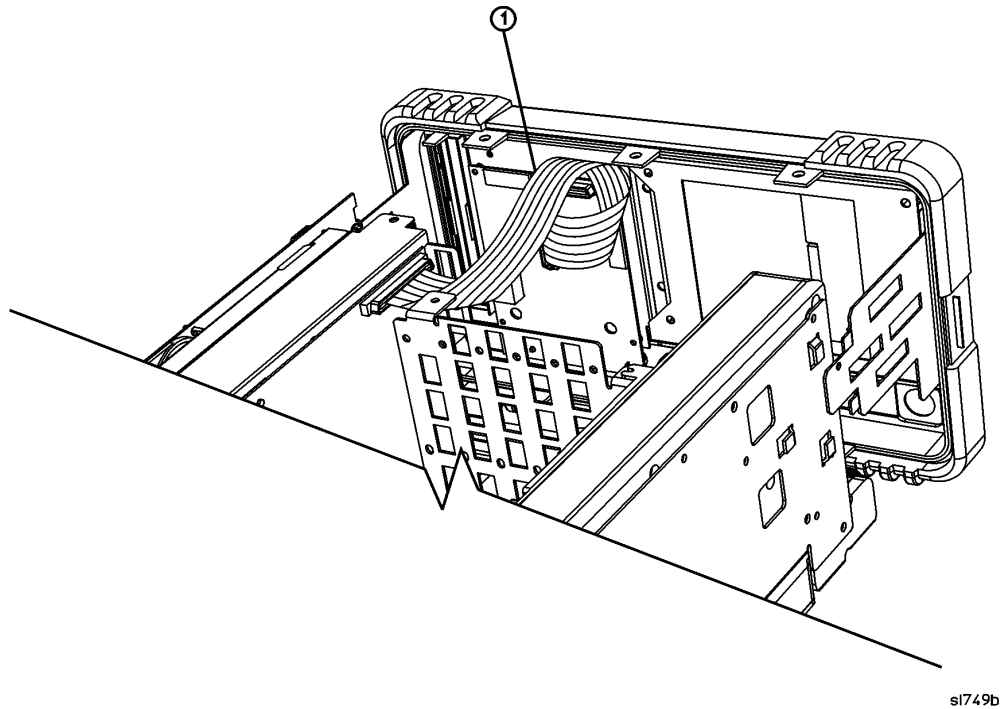


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2. Place the instrument with the top side facing up and remove the remaining two screws (2) that secure the front frame subpanel to the chassis.
3. Slide the front frame forward until it catches on the tabs on the sides of the chassis.

4. 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**



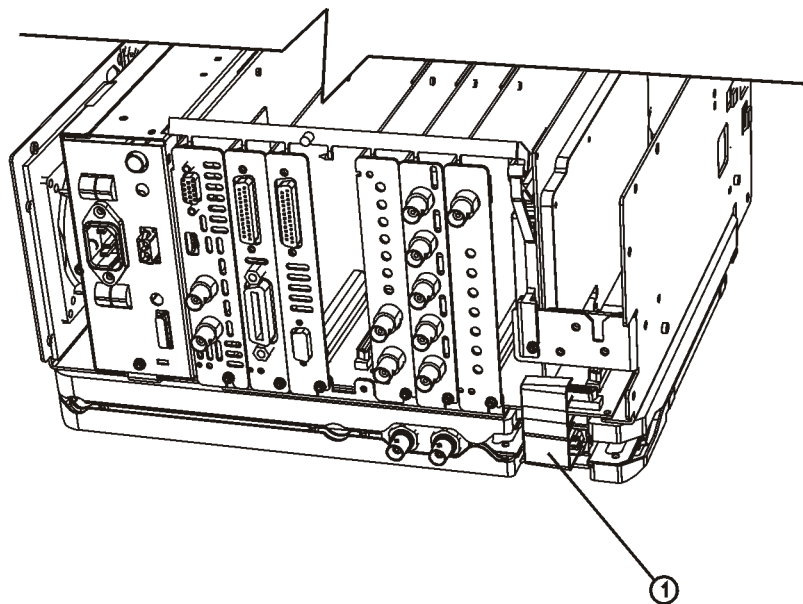
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5. Carefully pull the sides of the front frame subpanel away from the chassis and over the tabs on the chassis.
6. Slide the front frame forward to disengage from the chassis assembly.

Disconnect and Remove the RF Assembly

1. Refer to [Figure 5](#). Disconnect the RF assembly control ribbon cable (1).

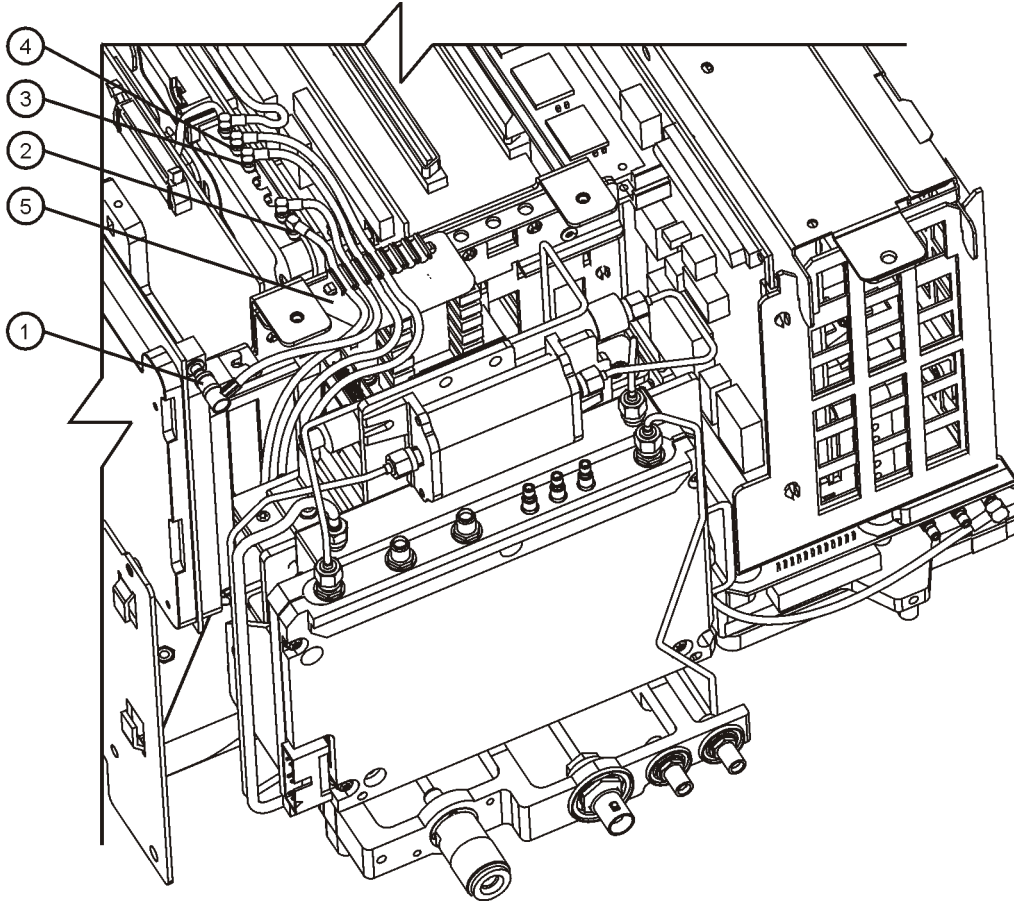
Figure 5 **Disconnect RF Assembly Control Cable**



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2. Refer to [Figure 6](#), if the instrument is equipped with option B7E remove the 3 MMCX cables (2,3,4) and free them from the cable spacer (5). If the instrument is not equipped with option B7E just remove the SMB IF Input cable (1).

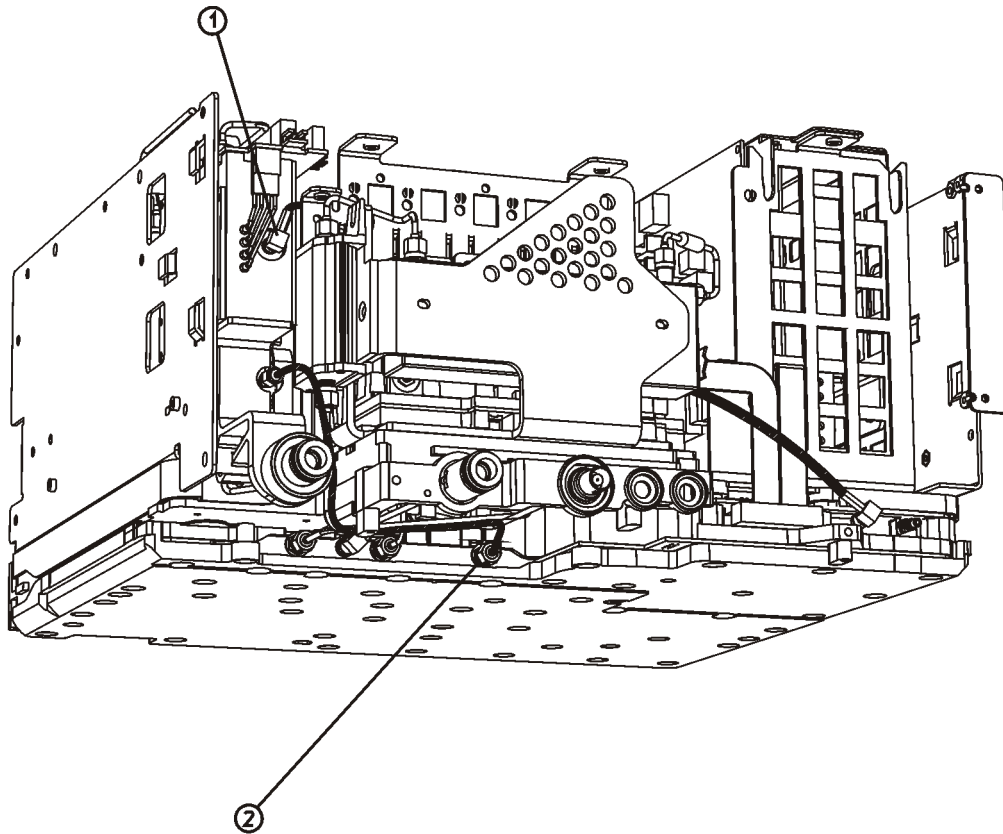
Figure 6 **Disconnect RF Assembly IF and Calibrator Cables**



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3. If the instrument is an E4402B or E7402A and has a Tracking Generator (Option 1DN), refer to [Figure 7](#):
Disconnect the SMB cable (1) from the tracking generator assembly
Disconnect the SMA cable (2) from the RF assembly

Figure 7 **Disconnect Tracking Generator Cables (E4402B and E7402A)**



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4. If the instrument is an E4404B, E4405B, E4407B, E7403A, E7404A, or E7405A, refer to [Figure 8](#):

Disconnect the frequency extension ribbon cable (1) from A7A4

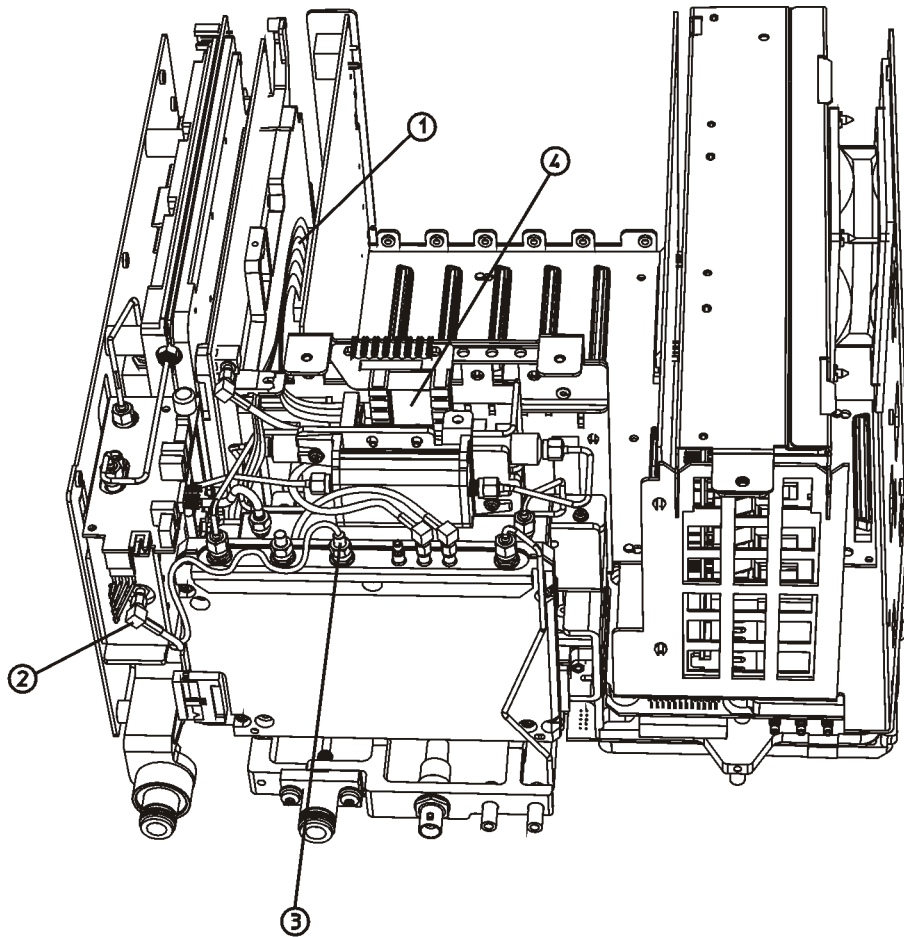
If the instrument has a Tracking Generator (Option 1DN), refer to [Figure 8](#):

Disconnect the SMB cable (2) from the tracking generator assembly

Tuck the cable end with the yellow tag away behind the microcircuits (4) of the RF assembly

Disconnect the SMA cable (3) from the LOIS assembly

Figure 8 **Disconnect Microcircuit and Tracking Generator Cables**
(E4404/5/7B and E7403/4/5A)

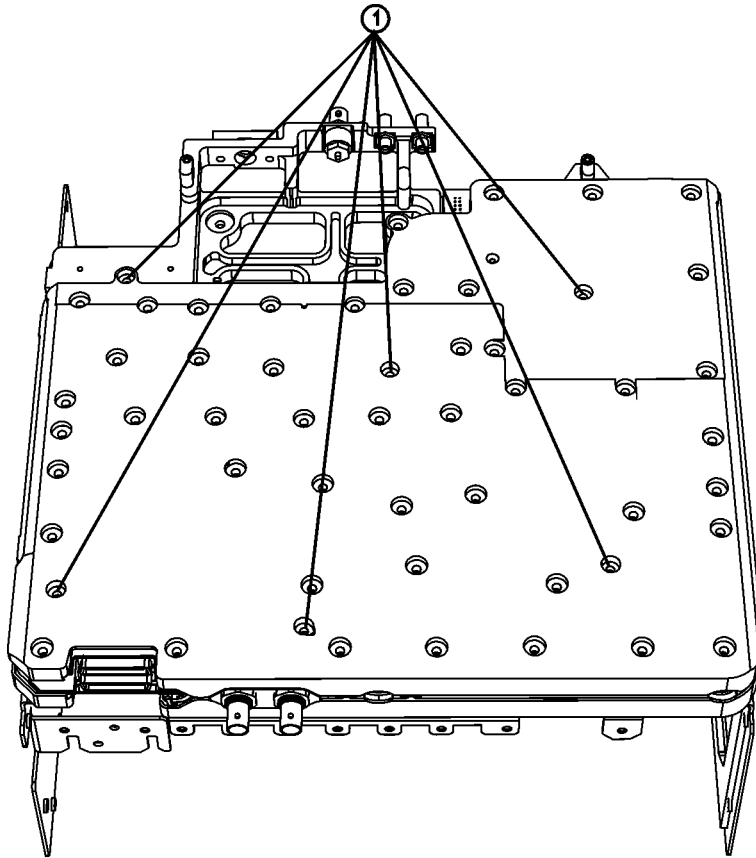


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5. Refer to [Figure 9](#), put the analyzer upside down and remove the six screws (1) marked “RF Deck” securing the RF assembly to the chassis.
6. Carefully lift the RF assembly from the chassis.

CAUTION The cables and assemblies are easily damaged. Once removed, it is best to lay the RF assembly flat on a work surface. Do not rest it against any of the microcircuits or cables.

Figure 9 Remove the RF Deck Screws

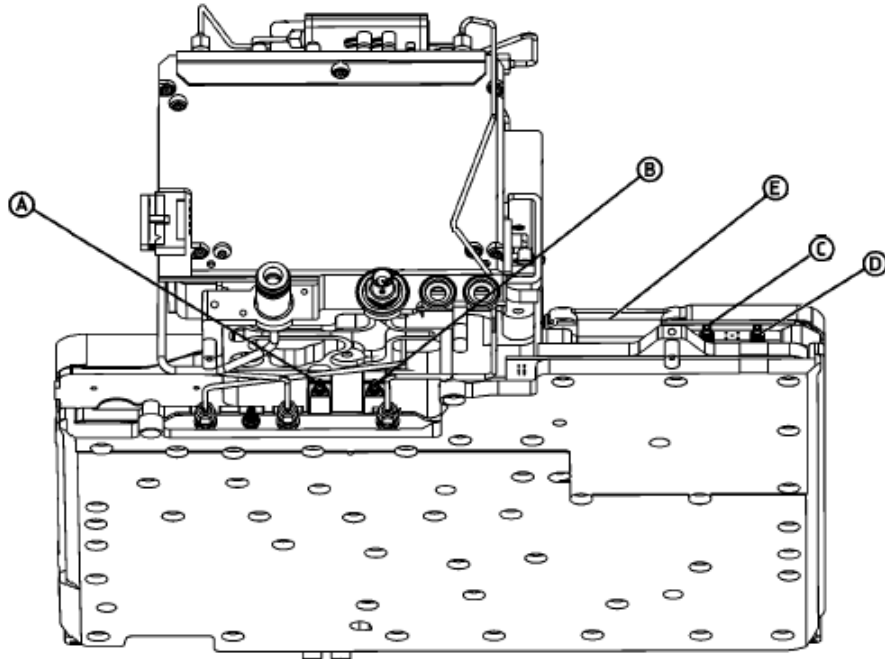


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Remove the Reference/Third Converter Board Assembly

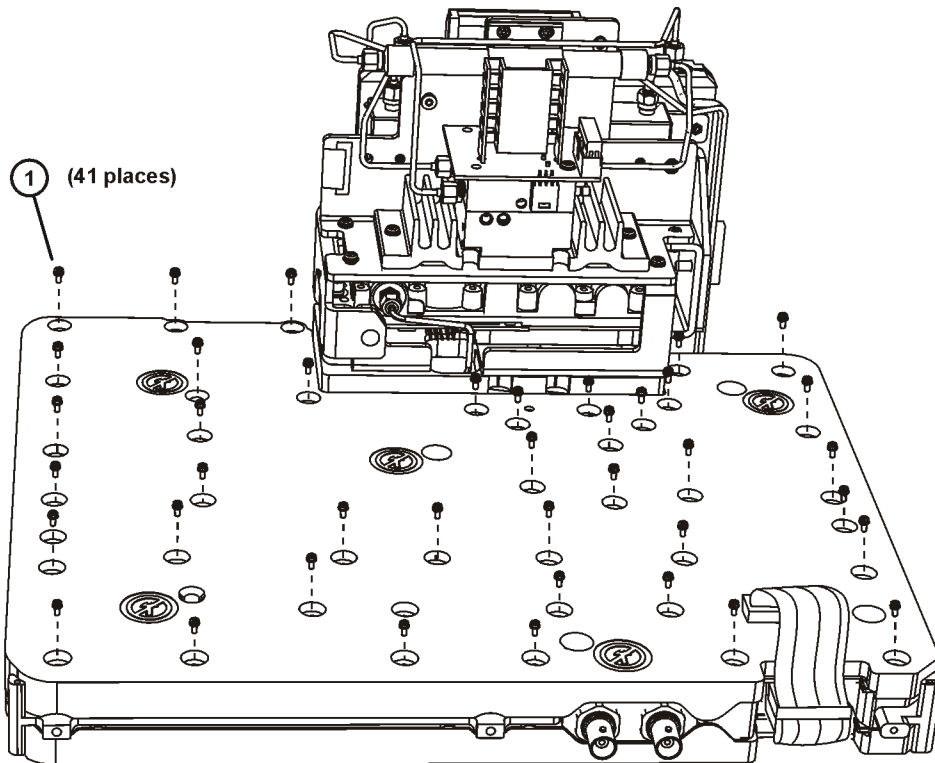
1. Refer to [Figure 10](#), disconnect the 3 SMB cables (A,B,D) from the RF assembly.
2. Disconnect the Attenuator/Second Converter control ribbon cable (E).
3. If present, disconnect the TG 600 MHz SMB cable (C).

Figure 10 Remove the Outer Reference/Third Converter Board Cables



4. Refer to [Figure 11](#), remove the 41 screws that attach the RF Deck Top Cover. The screws can be discarded, as new ones are provided with this kit. An electric torque driver is highly recommended for this operation.
5. Carefully remove the RF Deck Top Cover to expose the Reference/Third Converter Board assembly.
6. Once the cover has been removed inspect the gasketing material in the bottom-side of the cover to be sure that it is intact. Some of the gasketing material may have stuck to the circuit board and will need to be repositioned.

Figure 11 **Remove the RF Deck Top Cover Screws**

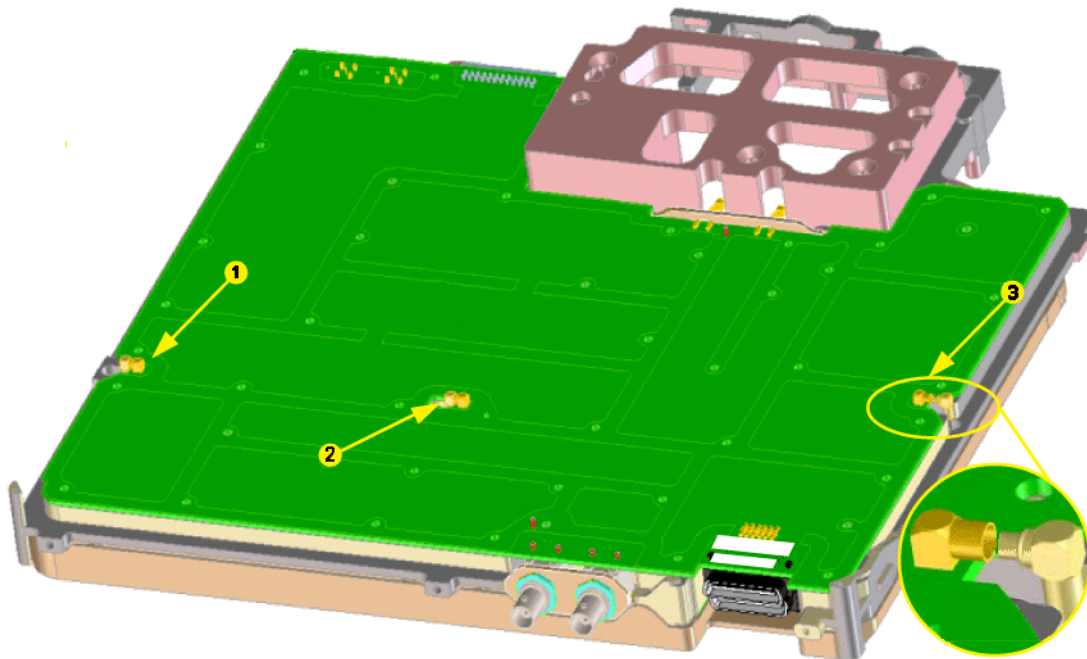


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7. Refer to [Figure 12](#), remove the 3 internal MMCX cables by gently un-snapping them using a pair of needle-nosed pliers.
8. Carefully remove the Reference/Third Converter board assembly from the RF assembly.
9. Once the board has been removed inspect the gasketing material in the top-side of the center casting to be sure that it is intact. Some of the gasketing material may have stuck to the circuit board and will need to be repositioned.

CAUTION There are many parts on the Reference/Third Converter board assembly that are sensitive to not only ESD but also to physical damage. Because of these parts be sure to carefully set the board flat on a clean and static free work surface.

Figure 12 Removing the Reference/Third Converter Board MMCX Cable



Solder the OCXO to the Reference/Third Converter Board Assembly

1. Refer to [Figure 13](#). insert the OCXO into the Reference/Third Converter board from the bottom side as shown.
2. Carefully solder the 6 pins of the OCXO to the board as shown in [Figure 14](#).

CAUTION Do not overheat the board during the soldering process, as this could cause permanent damage.

Figure 13 OCXO Location on the Reference/Third Converter Board

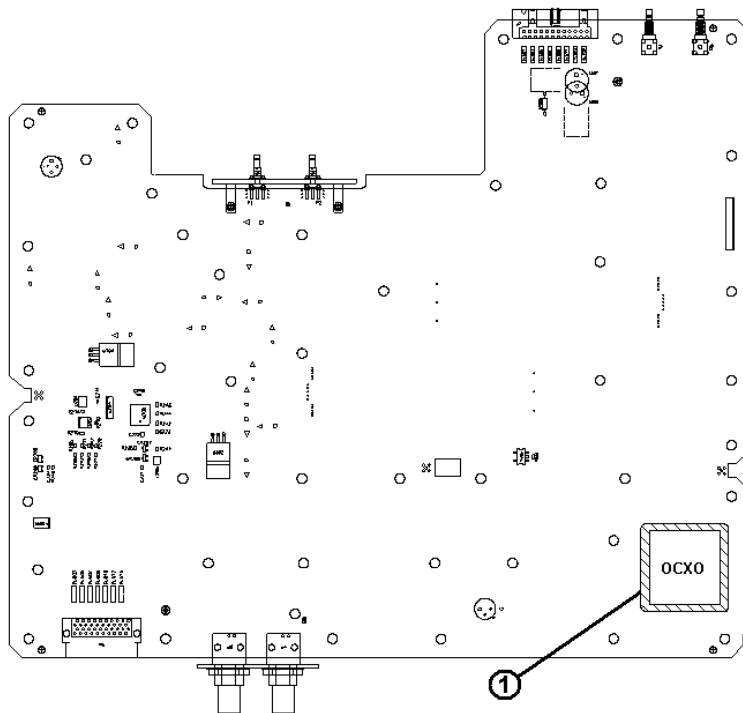
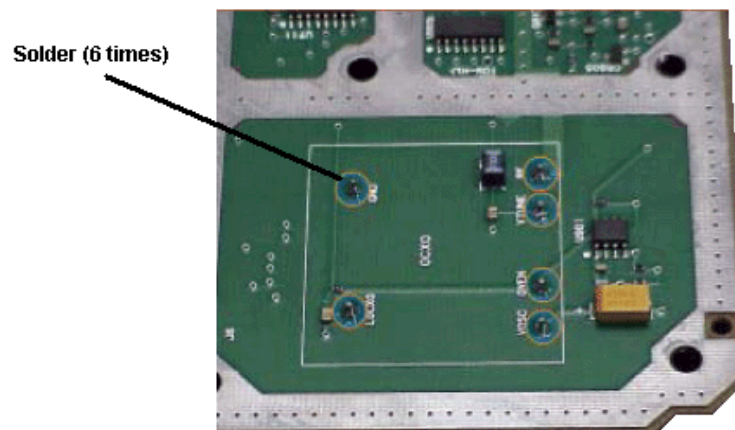


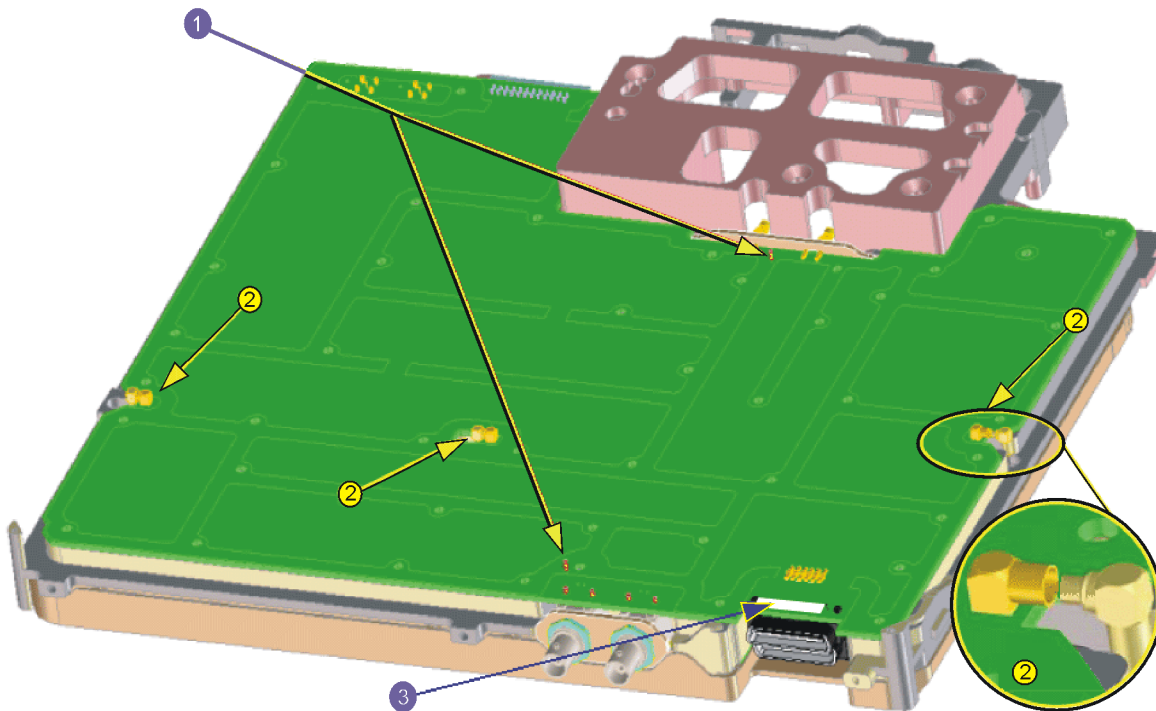
Figure 14 OCXO Solder Location



Reinstall the Reference/Third Converter Board Assembly

1. Refer to [Figure 15](#), after inspecting the placement of the gasketing material place the modified Reference/Third Converter board onto the RF assembly using the two guide pins (1) to position it properly.
2. Re-connect the 3 MMCX cables (2) to the board by gently snapping them into place.
3. To avoid any confusion, if a future replacement of this board assembly is required, use a black permanent marker to line out the board part number that is located on the label (3) attached to the board as shown in [Figure 15](#).

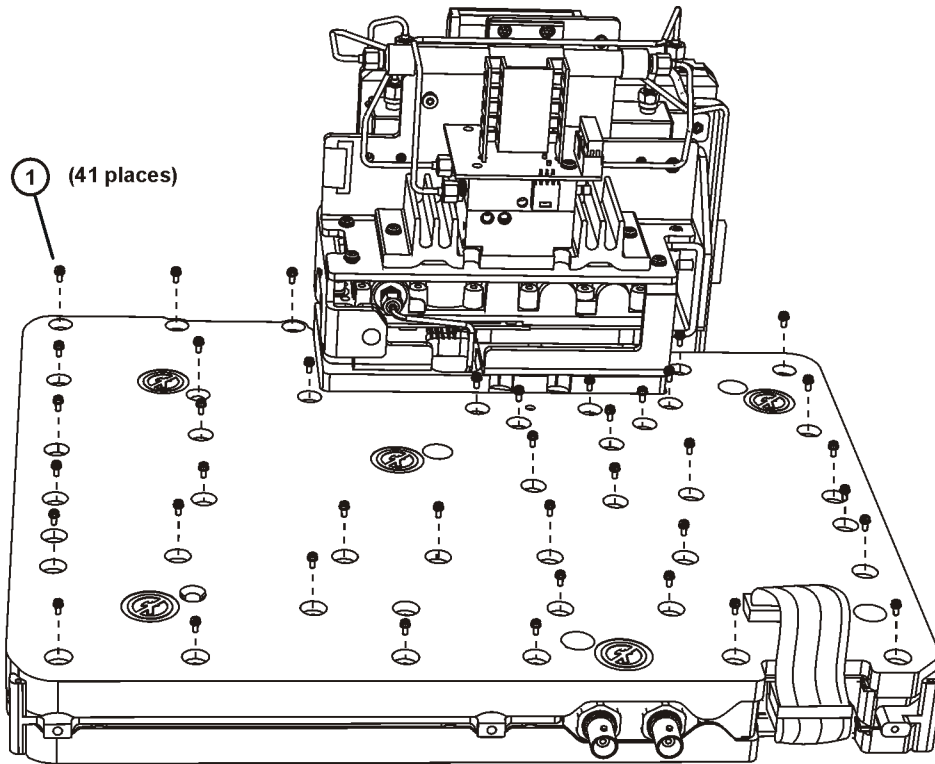
Figure 15 Replacing the Reference/Third Converter Board



4. After inspecting the placement of the gasketing material in the RF assembly top cover carefully place it back onto the RF assembly and loosely install the 41 new screws that were provided with this kit as shown in [Figure 16](#).
5. Using the Torquing Pattern provided ([Figure 17](#)), torque all 41 of the cover screws to 9 inch-pounds. An electric torque driver is highly recommended for this operation.
6. Repeat the torquing procedure at least 3 times.

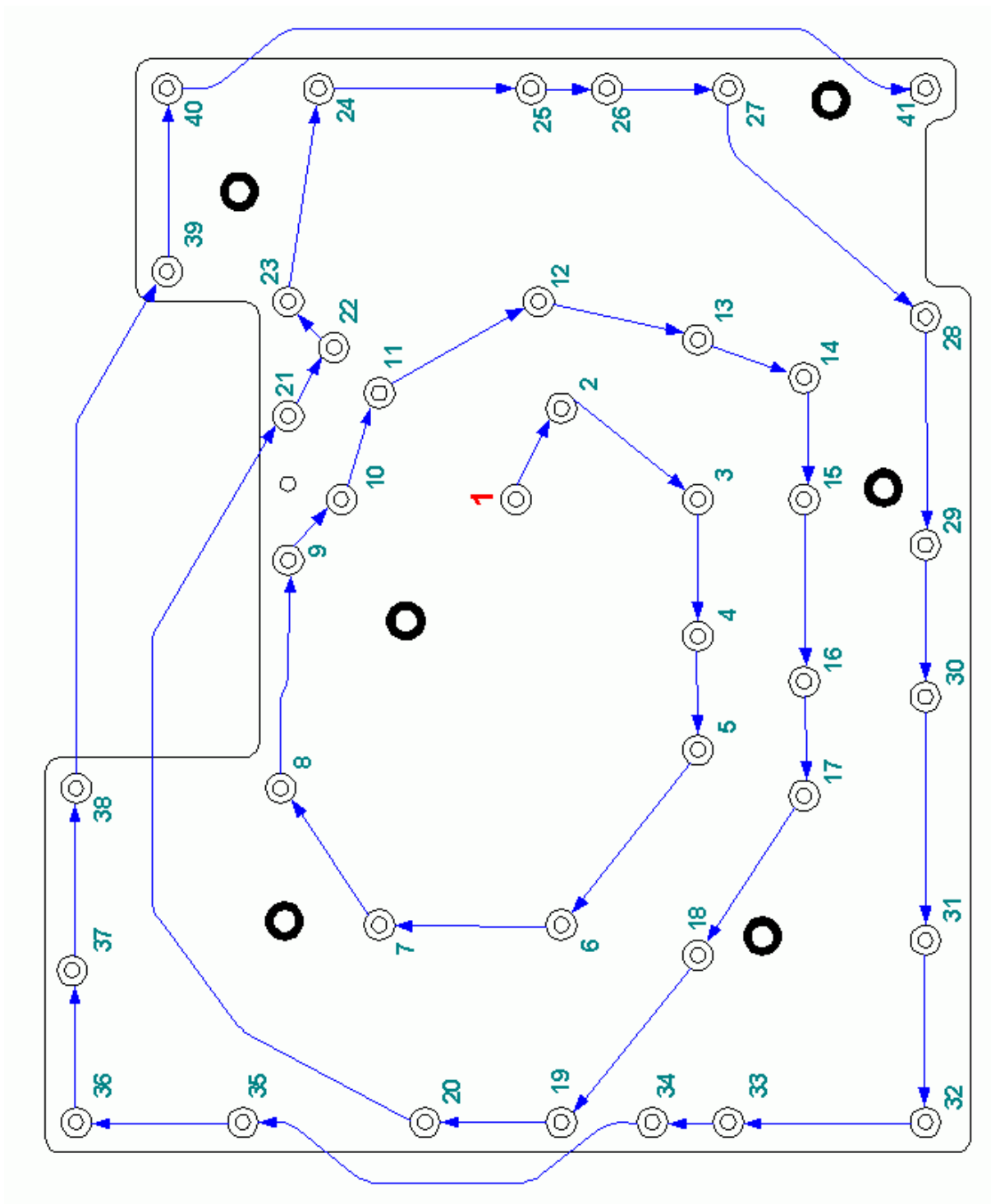
NOTE It is very important to follow the prescribed cover torquing procedure. Without doing so, some screws will not get properly tightened and may come loose. This could not only cause damage due to electrical components being shorted, but could also compromise both the internal and external EMI shielding of the instrument, and thus performance could be degraded.

Figure 16 **Re-install the RF Deck Top Cover and Screws**



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Figure 17 RF Deck Top Cover Screw Torquing Pattern

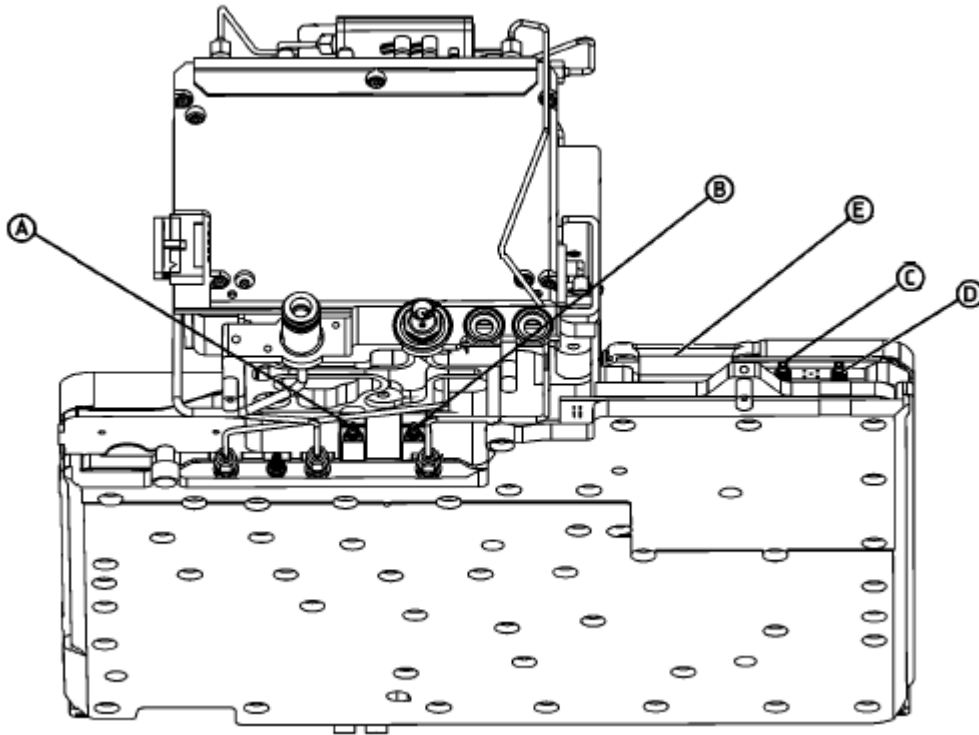


7. Refer to [Figure 18](#) and the Cable Identification table below, re-connect the 3 SMB cables (A,B,D).
8. Re-connect the Attenuator/Second Converter control ribbon cable (E).
9. If present, re-connect the TG 600MHz SMB cable (C).

Cable Identification (Figure 18)

Cable	Description	To - From	Identification Label
A	600 MHz to 2nd Conv.	A8A1A1P1 - A8A2J4	none
B	321.4 MHz IF Input	A8A1A1J2 - A8A2J2	none
C	600 MHz Aux. Out	A8A1A1P3 - A2A2J5	Yellow (#4)
D	21.4 MHz IF Out	A8A1A1P5 - A3J2	Red (#2)
E	Atten/2nd Conv. Drive	A8A1A1P7 - A8A2 & A8A5	Ribbon Cable

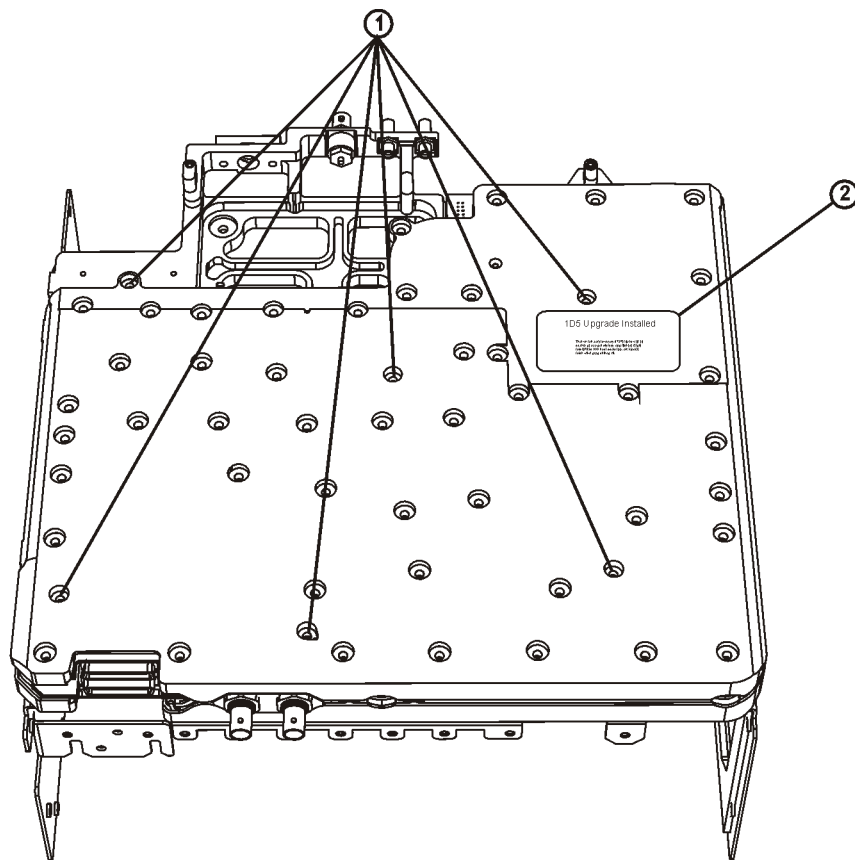
Figure 18 Re-install the Outer Reference/Third Converter Board Cables



Replace and Re-connect the A8 3.0 GHz RF Assembly

1. Position the analyzer upside down on the work surface.
2. Refer to [Figure 21](#). Tuck the cables away behind the microcircuits (4).
3. Refer to [Figure 19](#). Lower the RF assembly onto the chassis taking care not to pinch any cables.
4. Replace the six screws (1) securing the RF assembly to the chassis, and tighten them to 9 inch-pounds.
5. Attach the supplied “1D5 Upgrade Installed” label to the bottom side of the RF assembly as shown in [Figure 19](#) (2).
6. If an identification label for the RF Assembly can be found on the assembly, use a black permanent marker to line-out the part number on it to avoid any confusion in the future if this assembly needs replacement.

Figure 19 **Replace RF Assembly**



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7. If the instrument is an E4402B or E7402A and has a Tracking Generator (Option 1DN), refer to [Figure 20](#):

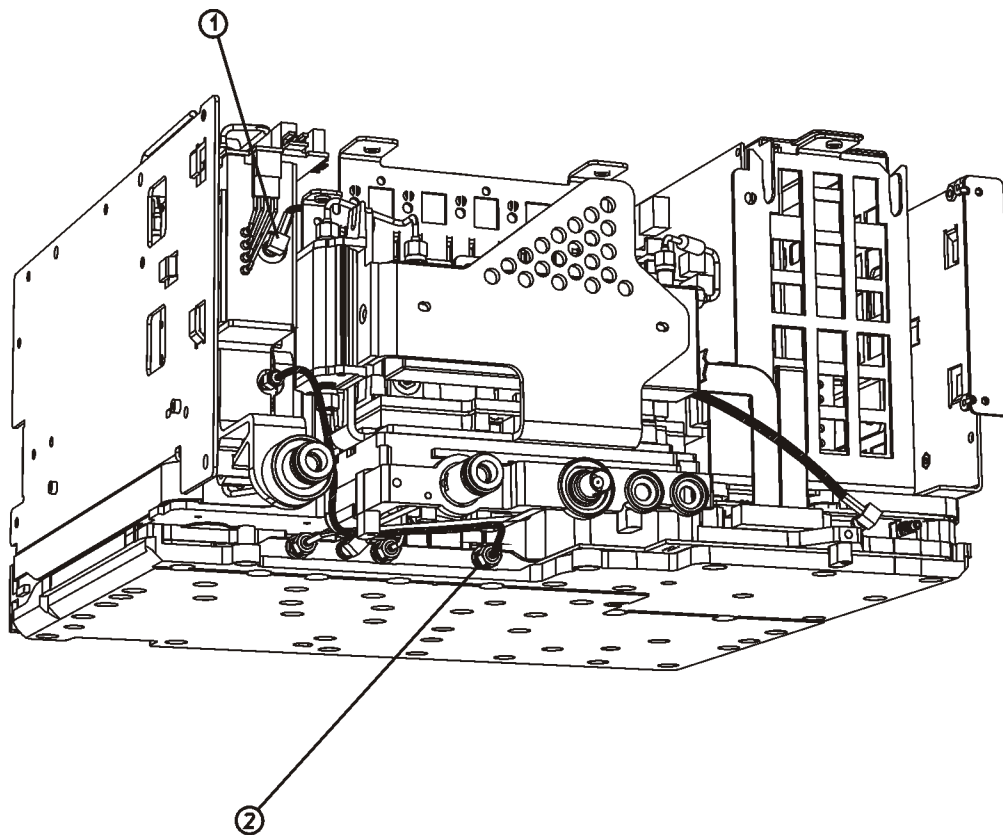
Re-connect the SMB cable (1) to the tracking generator assembly

Re-connect the SMA cable (2) to the RF assembly and torque to 9 inch-pounds

Cable Identification (Figure 20)

Cable	Description	To - From	Identification Label
1	TG 600 MHz Input	A8A1A1J3 - A2A2J5	Yellow (#4)
2	TG LO Input	A8A1A2J5 - A2A1J3	none

Figure 20 Reconnect Tracking Generator Cables (E4402B and E7402A)



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8. If the instrument is an E4404B, E4405B, E4407B, E7403A, E7404A, or E7405A, refer to [Figure 21](#):

Re-connect the frequency extension ribbon cable (1) to A7A4

If the instrument has a Tracking Generator (Option 1DN), refer to [Figure 21](#):

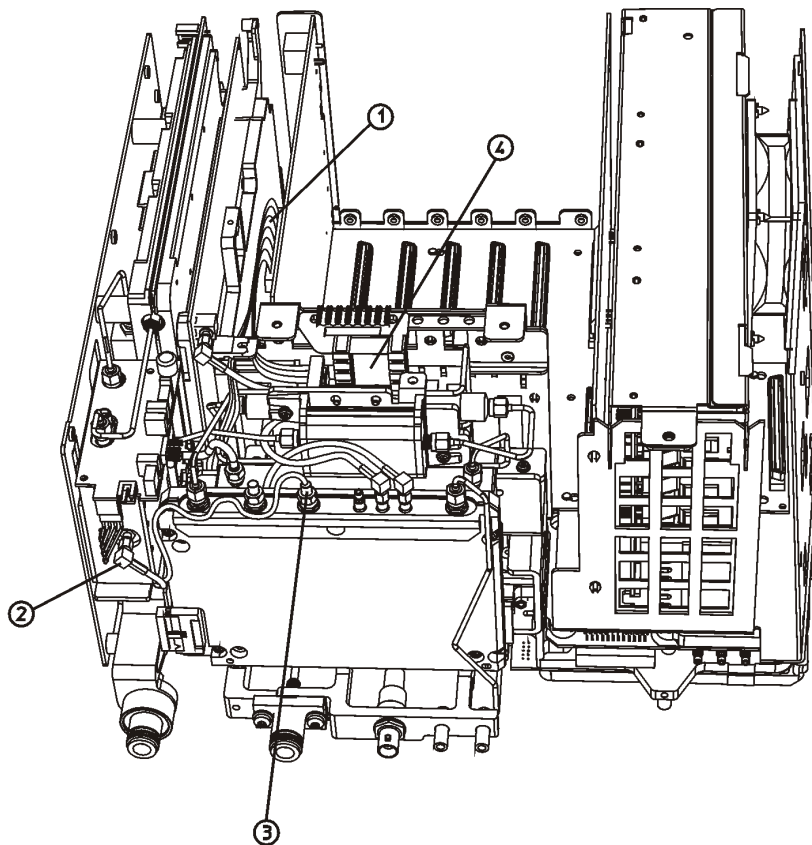
Re-connect the SMB cable (2) to the tracking generator assembly

Re-connect the SMA cable (3) to the LOIS assembly

Cable Identification (Figure 21)

Cable	Description	To - From	Identification Label
1	RYTHM/LOIS Control	A7A4J2 - A8A4 & A8A6	Ribbon Cable
2	TG 600 MHz Input	A2A2J5 - A8A1A1P3	Yellow (#4)
3	TG LO Input	A2A1J3 - A8A4J3	none

Figure 21 Re-connect Microcircuit Control and Tracking Generator Cables (E4404/5/7B and E7403/4/5A)



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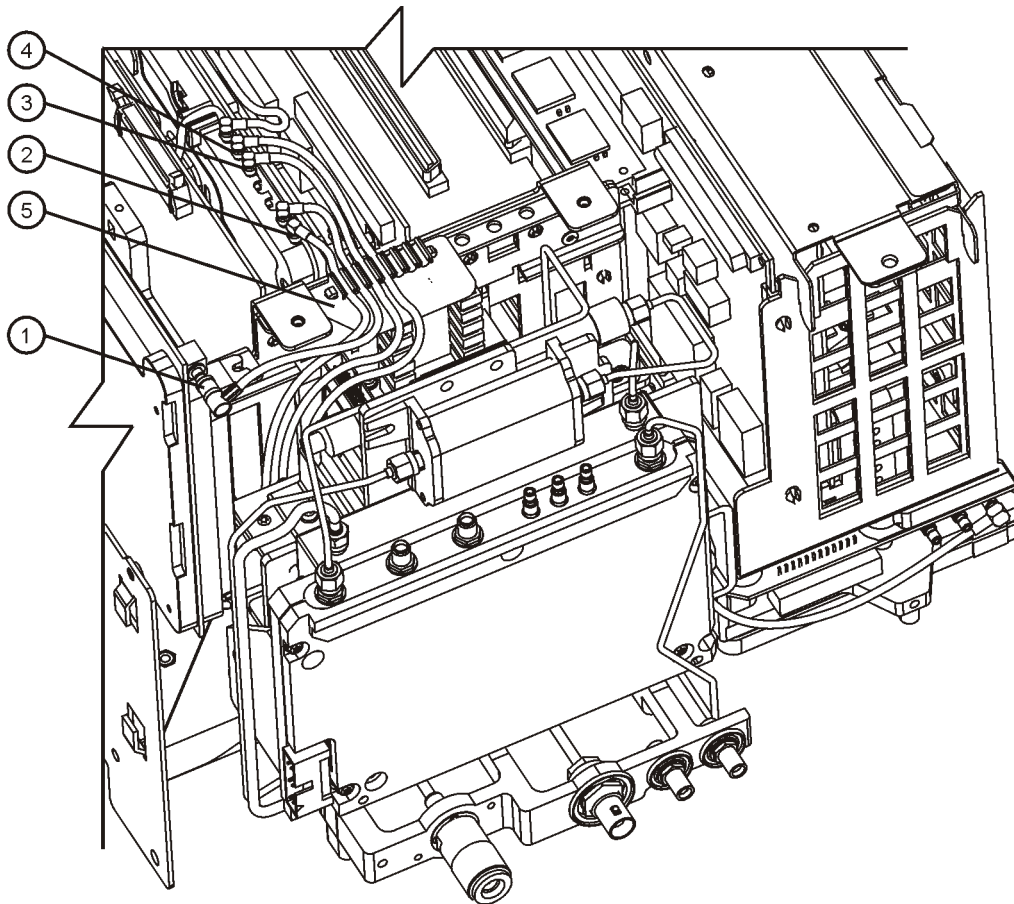
9. Refer to [Figure 22](#) and the Cable Identification table below, if the instrument is equipped with option B7E re-connect the 3 MMCX cables (2, 3, 4) and secure them to the cable spacer (5). If the instrument is not equipped with option B7E re-connect the SMB IF Input cable (1).

Cable Identification (Figure 22)

Cable	Description	To - From	Identification Label
1	21.4 MHz DDRF IF Output	A3J2 - A7A8J10	none
1 ^a	21.4 MHz IF Input	A3J2 - A8A1A1P5	Red (#2)
2	21.4 MHz DDRF IF Input	A7A8J11 - A8A1A1P5	Red (#2)
3	50 MHz DDRF Cal Input	A7A8J7 - A8A1A2J4	Brown (#1)
4	50 MHz DDRF Cal Output	A7A8J6 - A8J2	Black (#0)

a. w/o Option B7E

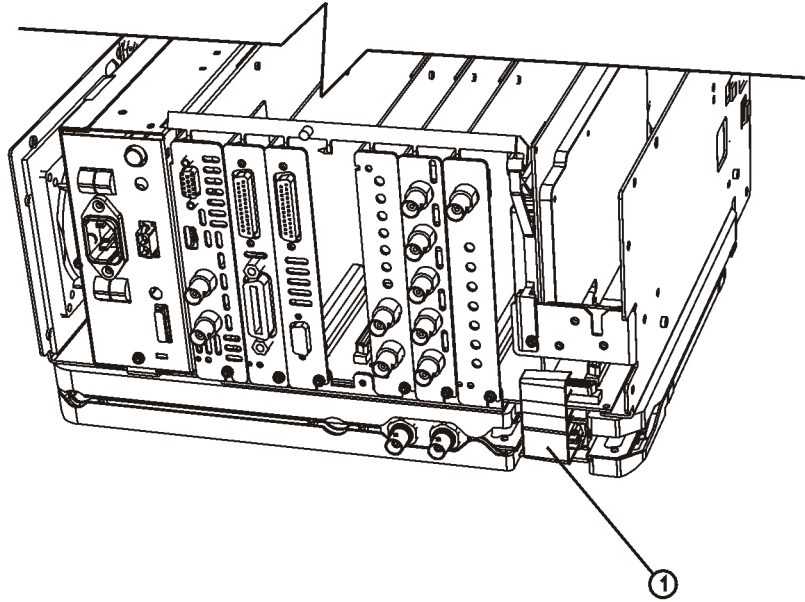
Figure 22 Re-connect RF Assembly IF and Calibrator Cables



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10. Refer to [Figure 23](#). Re-connect the RF assembly control ribbon cable (1).

Figure 23 **Re-connect RF Assembly Control Cable**

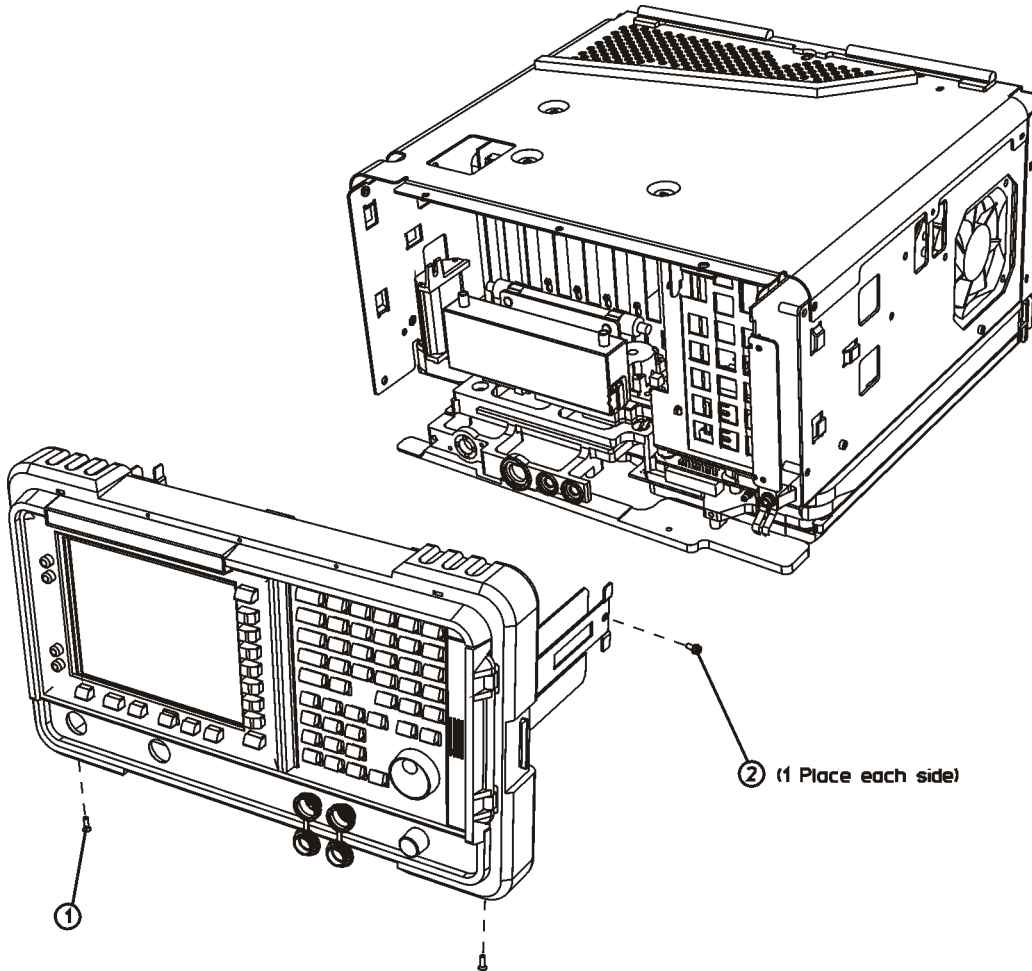


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Replace Front Frame Assembly

1. Align the A1 front frame subpanel rails with the chassis as shown in [Figure 24](#).

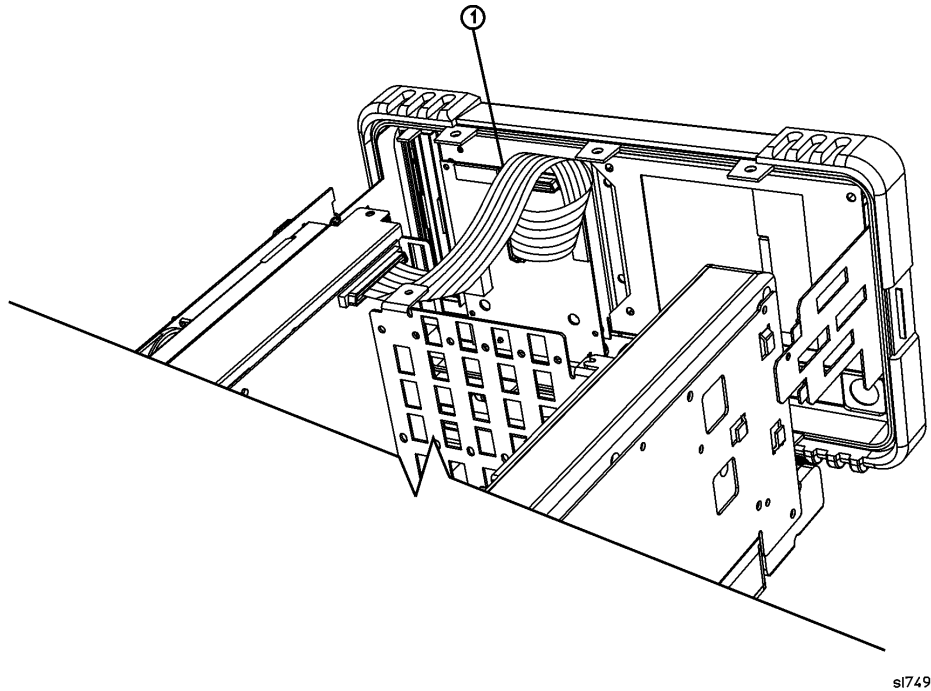
Figure 24 Front Frame Assembly Replacement



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2. Refer to [Figure 25](#). Connect the ribbon cable (1) to the front frame assembly. If Option B7B is installed, there will be two ribbon cables to connect.
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.

Figure 25 **Front Frame Ribbon Cable**



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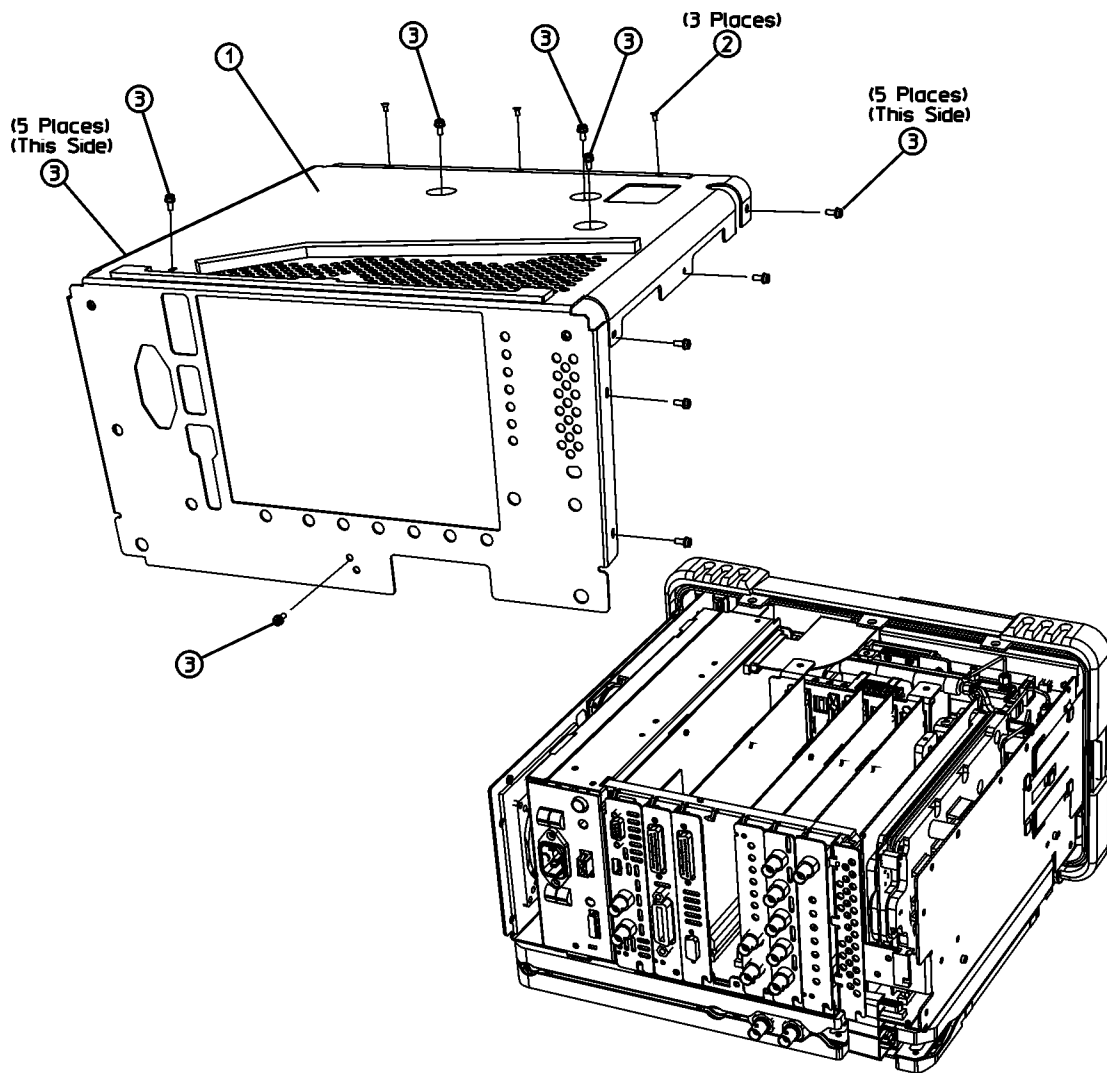
4. Refer to [Figure 24](#). Replace the screws that secure the front frame to the chassis (2) and to the RF assembly (1). Tighten them to 9 inch-pounds.

Replace Chassis Cover

NOTE If the instrument being upgraded does not have a GPIB interface (Option A4H) you will want to install one temporarily at this point, before the covers are put on, so that the adjustments and automated performance verification test software can be run.

1. Carefully position the chassis cover (1) on the instrument as shown in [Figure 26](#), then lower onto the instrument.
2. Replace the 17 screws (2) and (3) as indicated on the instructions on the chassis cover. Tighten the screws to 9 inch-pounds.

Figure 26 Chassis Cover Replacement

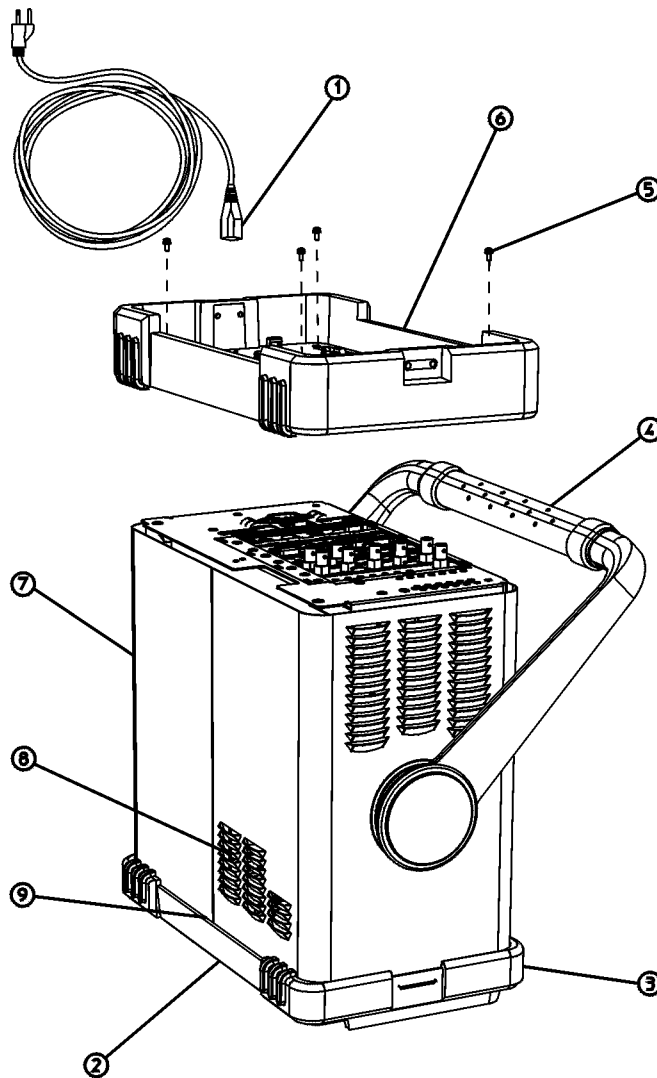


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Replace Dress Cover

1. Refer to [Figure 27](#). Carefully place the spectrum analyzer on the work surface with the front frame (3) facing down.
2. Replace the dress cover, matching the grill (8) on the bottom of the dress cover to the bottom of the analyzer.
3. Fit the leading edge of the dress cover completely into the slot (9) on the back of the front frame assembly.
4. 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 27 Dress Cover, Rear Frame Replacement



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Verify Hardware Installation

1. With the power on, verify that Option 1D5 identifies by pressing **System, More, Show System**. There should be an entry which reads, "1D5: Hi Stability Freq Ref".

Re-program the Reference/Third Converter Board Header

Since the configuration of the Reference/Third Converter board assembly has been changed the programmed header on the board must also change to reflect this. A Visual Basic program is provided for this task.

1. Press **System, More, Show Hdw** and note the part number and serial number of the Reference/Third Converter Board, which should have an Assembly Name of "Reference & 321.4 MHz IF" at this point.

Part Number: _____

Serial Number: _____

2. Connect the instrument being upgraded to a PC via GPIB interface.
3. Download the latest version of the "1D5 Upgrade Utility" and instructions.txt file from:

<http://mktwww.soco.agilent.com/field/service/signal/esa/retrofit/utilities/>

4. Following the directions provided in the instruction.txt file, run the upgrade utility to update the board header information to reflect the hardware upgrade that has just been made.
5. Press **System, More, Show Hdw** and note the part number and serial number of the Reference/Third Converter Board, which should have an Assembly Name of "Reference & 321.4 MHz IF" at this point.

Part Number: _____

Serial Number: _____

6. Verify that while the Assembly Name and Part Number of this board assembly has changed, the Serial Number has not.

Adjustments and Performance Verification

1. Perform the following adjustments, located in the Adjustment Software.
 - 10 MHz Reference Frequency Adjustment
 - 50 MHz Amplitude Reference Adjustment
2. Perform the following performance verification tests, located in the analyzer Calibration Guide:
 - 10 MHz Precision Reference Frequency Accuracy
 - Noise Sidebands
 - Residual FM
 - Absolute Amplitude Accuracy
 - Frequency Response
 - Displayed Average Noise Level
 - Residual Responses