

Installation Note

Agilent PSA Series Spectrum Analyzers Option 423 Switchable Microwave Preselector Bypass Retrofit for Early Instruments



Agilent Technologies

Part Number E4440-90270 Supersedes: E4440-90259
Printed in USA October 2004



E4440-90270

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Switchable Microwave Preselector Bypass Installation Kit

Products Affected:	PSA E4440A PSA E4443A PSA E4445A
Serial Numbers:	US0000 / US4402 MY0000 / MY4402
To Be Performed By:	(X) Agilent Service Center (X) Personnel Qualified by Agilent () Customer
Estimated Installation Time:	4.5 Hours
Estimated Adjustment and Verification Time:	8 Hours

Introduction

This installation note explains how to install the Switchable Microwave Preselector Bypass into early instruments with the serial prefix shown above. Please note that this retrofit kit installs instrument option 123, and that the option 423 kit designator is only an ordering number.

NOTE	<p>The Front End Driver, included in this kit, must be replaced on early instruments because early Front End Drivers cause the instrument to intermittently power on with the preselector bypassed instead of the standard signal path.</p> <p>The SLODA must also be replaced due to LO drive level adjustment settings required for the Dual Mixer.</p>
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Because the mixer in this kit requires the same SLODA LO output that the external mixing option AYZ requires, the two options cannot be installed at the same time.

The retrofit adds a switchable alternate signal path when the analyzer start frequency is above 3.05 GHz. This alternate path bypasses the preselector filter and mixer in the normal highband path. The advantage of bypassing the preselector is that the preselector filter will drift with time and temperature and will cause small amplitude errors.

When the preselector is bypassed, images, multiples and out of band responses will appear on the analyzer display since there is no longer a bandpass filter present to limit the input frequency range of the analyzer. Therefore, the display may show many signal responses even though only one response is the true signal. Since the preselector can be switched in or out easily, it is possible to find a signal in preselected mode and tune to it, then switch the preselector out and measure it.

NOTE	<p>This option is licensed for one instrument model number/serial number combination. The license key will only install on the designated instrument.</p>
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NOTE	<p>The firmware must be revision A.06.05 or greater. If a firmware update is required, the update must be done <i>after</i> the replacement Front End Driver is installed. You will get EEPROM error messages at power-on if you install the new firmware revision before replacing the Front End Driver assembly.</p>
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Contents

Quantity	Description	Agilent Part Number
1	Installation Note	This note
1	Option Upgrade Entitlement Certificate	---
1	Front End Driver	E4440-60259
1	Front End Driver Utility CD	E4440-10027
1	SLODA	5087-7701
1	Rear panel	E4440-00059
3	Hole plug, 0.5 dia	6960-0149
1	Hole plug, 0.25 dia	6960-0076
1	Cable, coax, 28V out	8121-0958
1	Nut, 15/32 for BNC on 28V cable	2950-0035
1	Washer, for BNC mounting	2190-0102
1	Dual mixer	5086-7749
1	Microwave Switch/Bracket Assembly Includes: 2-microwave switches, standoffs, wire harness and mounting bracket.	N/A
1	W80, Cable, semi-rigid, Input Atten to SW1	E4440-20090
1	W81, Cable, semi-rigid, SW1 to RYTHM	E4440-20091
1	W82, Cable, semi-rigid, SW1 to Mixer input.	E4440-20092
1	W83, Cable, semi-rigid, Mixer LO IN to W88	E4440-20093
1	W84, Cable, Semi-rigid, Dual Mixer Out to SW2	E4440-60383
1	W86, Cable (10), coax, 3rd converter to SW2	E4440-60382
1	W87, Cable (2), coax, RYTHM to SW2	E4440-60381
1	W88, Cable, semi-rigid, SLODA LO Out to cable W83	E4440-20087
2	Cable tie 0.062D 0.09W	1400-0294
5	Screw, M3 X 0.5 8 MM-LG	0515-0372
1	50 Ohm Load (SMA)	1810-0118
1	Specifications Guide	---
1	User's Guide	---

Switchable Microwave Preselector Bypass Installation Kit

Tools Required

- T-20 Torx driver
- T-10 Torx driver
- 5/16-inch open end wrench/torque wrench
- 1/4-inch open end wrench
- PSA Series Performance Tests and Adjustment Software, E.01.00 or later
- Test equipment supported by the PSA Series Performance Tests and Adjustment Software.
- PSA Series Spectrum Analyzer and Service Guide. This manual is available as part of the E4440AU, E4443AU, or E4445AU Option OBW kits.
- Microsoft Windows based personnel computer
- Windows 2000, Windows XP Professional
- Firmware A.0 6.00 or later. Download the latest revision form http://www.agilent.com/find/psa_firmware, or order the Firmware Update kit.

Depending on your model number, the firmware update kit is ordered as: Order E444xAU (Qty.1) Option UE2 (Qty. 1), where the “x” is the last digit of the model number. For example: E4440AU option UE2.

Installation Procedure

Before you begin the kit installation:

The instrument should be fully functional and pass all of the power on align tests. If an alignment test fails, either note the failure and go on with the kit installation or repair the problem now. Since the following installation involves removing and replacing cables and removing and reinstalling major assemblies, you must be aware of the instrument status before you begin the kit installation.

Replacing the A13 Front End Driver Assembly

NOTE	Because the Front End Driver may have been replaced previously due to an instrument repair or retrofit, check the Show Hardware screen on the analyzer to determine the vintage of the existing Front End Driver.
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Press: **System, More, Show Hdwr.**

If the Front End Driver is part # E444060259 or greater you do not need to change the Front End Driver assembly.

The Front End Driver Utility CD included in the kit contains a RunTime version of VEE and a VEE program that copies the calibration files stored on the Front End Driver assembly to a temporary location inside the program. The program will pause and instruct the operator to replace the Front End Driver. Once the replacement assembly is installed, the program transfers the data to the replacement Front End Driver. This program can save five hours of adjustment time depending on the calibration status of the instrument. If the VEE program is not used, see the PSA Service Guide Post repair procedures for instructions on which adjustments are required when replacing the Front End Driver assembly.

Installation Procedure using the VEE program

Overview of Procedure

- Determine if your PC requires the Runtime version of VEE.
- Load the FE_Swap.vxe program.
- Run the FE_Swap.vxe program and copy the calibration data from the instrument.
- Remove the instrument outer case and top brace.
- Replace the Front End Driver assembly.
- Restore the calibration data to the replacement Front End Driver.
- Install the rear dress panel and 28V cable.
- Update the instrument firmware if required. It is important that the firmware be updated *after* the Front End Driver assembly is replaced.

Determine Which Downloads Are Required And Perform Downloads.

1. If necessary, install the RunTime VEE program. Insert the Front End Driver Utility CD into your PC and follow the on-screen instructions.
2. Install the FE_Swap.vxe program. This program is on the Front End Driver Utility CD also. Insert the CD into your PC and follow the on-screen instructions to load the program.

Running the FE_Swap.vxe program.

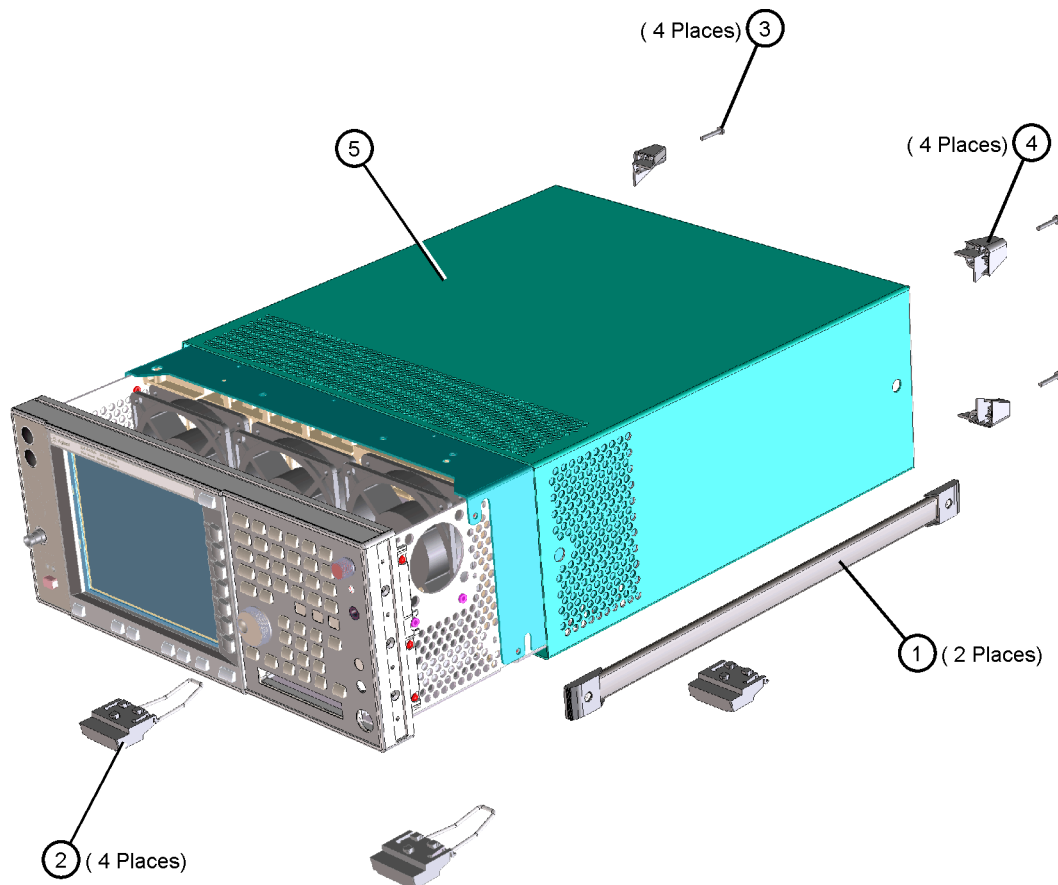
1. Connect the PC to the instrument via a GPIB cable.
2. Go to the location where you saved FE_Swap.vxe and double click to launch the program.
3. Select Start Program.
4. Follow the on-screen procedure to copy the calibration data from the existing Front End Driver assembly. This process can take 20 minutes, depending on the instrument options.
5. Power down the instrument, and disconnect the AC power cord and the GPIB cable.

Remove the Outer Case

CAUTION If the instrument is placed on its face during any of the following procedures, be sure to use a soft surface or soft cloth to avoid damage to the front panel, keys, or input connector.

1. Disconnect the instrument from ac power.
2. Refer to Figure 1. Remove the two handles on the sides of the instrument as shown. Use the T-20 driver to loosen the screws that attach each handle (1). Remove the handles.
3. Remove the four bottom feet (2). Lift up on the tabs on the feet, and slide the feet in the direction indicated by the arrows.
4. Remove the four screws (3) that hold the rear feet (4) in place.
5. Pull the instrument cover (5) off toward the rear of the instrument.

Figure 1 Instrument Outer Case Removal



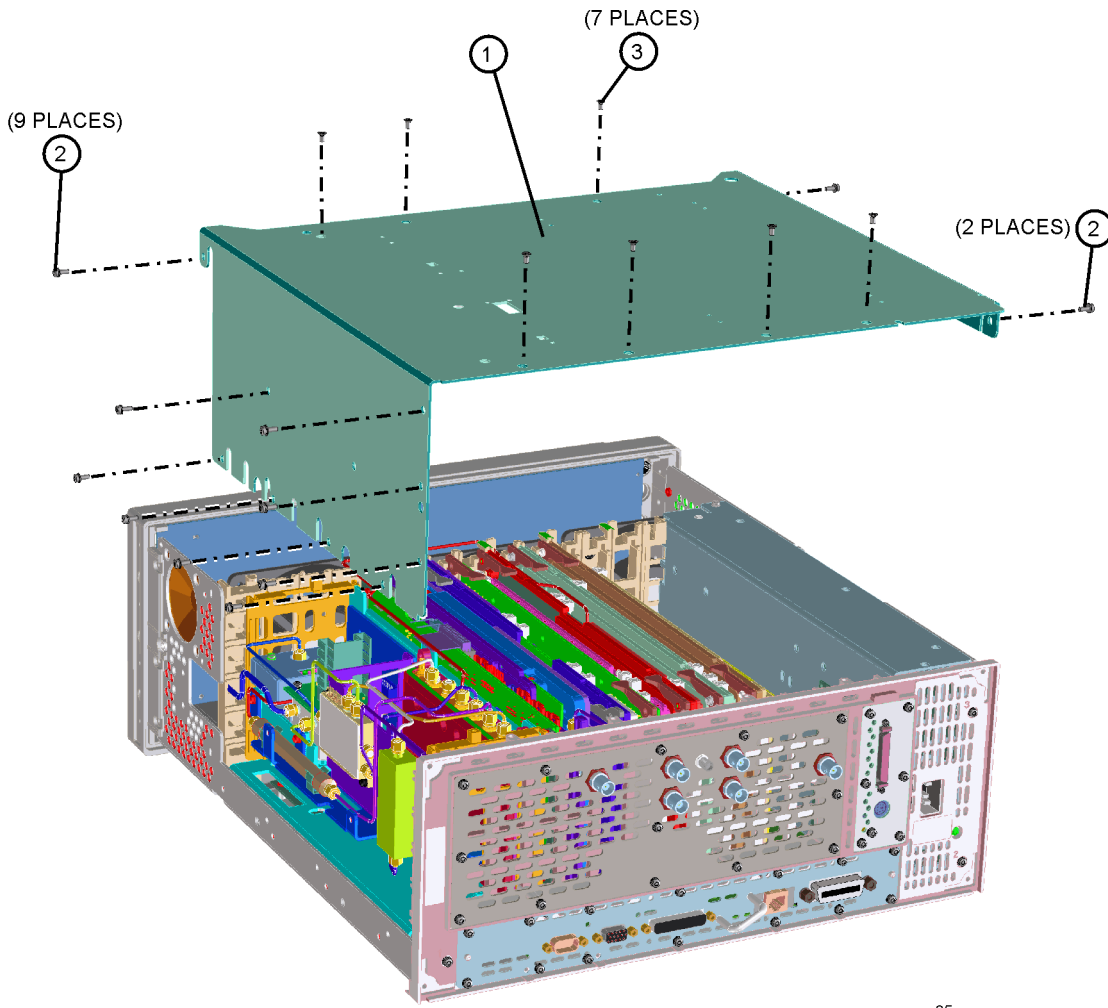
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Installation Procedure

Remove the Top Brace

1. Refer to Figure 2. Use the T-10 driver to remove the top screws (3) (one screw is under the security label), and the side screws (2) attaching the top brace (1) to the deck.
2. Remove the top brace from the deck.

Figure 2 Top Brace Removal



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Install the Kit

Replace the Front End Driver Assembly

1. Locate the A13 Front End Driver assembly. The top brace shows its location, or refer to the service manual.
2. Label the ribbon cable locations so they can be easily reinstalled onto the replacement assembly.
3. Remove the A13 Front End Driver assembly.
4. Install the replacement A13 Front End Driver assembly contained in the kit. Be careful and avoid damaging the cable headers when installing the ribbon cables.

Restore the calibration data to the replacement Front End Driver

1. Connect the AC power line and the GPIB cable to the PSA and power up the instrument.
2. It is important to allow the instrument to complete the boot process and auto align routine before pressing the OK button on the PC screen. The auto align may fail some tests or errors may occur. These errors will be cleared when the calibration data is restored, or the firmware is updated.
3. Click the OK button on the PC screen to transfer the data to the replacement assembly. When the transfer is complete, the PC will redisplay the screen that allows you to change the DUT address, exit the program, or start the program over again.
4. Power down the instrument.

Replace the Rear Dress Panel

1. Check to see if the existing rear panel has a BNC connector marked “Noise Source Drive Out +28V”. If it does, you do not need to replace the rear dress panel or install the 28V cable. Go to “Install the Preselector Bypass” on page 15.
2. Remove the nuts from the rear panel BNC and SMA connectors.
3. Label the BNC and SMA connectors so you can easily reinstall the connectors into the correct holes in the replacement rear panel.
4. Remove the 13 screws that secure the dress rear panel to the rear frame.
5. Remove the dress rear panel.
6. Locate the replacement dress panel and the 28v cable included in the kit.
7. Install the BNC end of the 28V cable into the replacement dress rear panel hole marked “Noise Source Drive Out +28V”. Locate the washer and nut in the kit. Place tape on the 9/16 inch socket to avoid scratching the dress panel. Torque to 236 Ncm (21 in-lbs).
8. Feed the free end of the 28V cable through a rear frame casting hole that lines up with the position of the 28V connector once the dress panel is installed.
9. Attach the SMA connectors to the replacement dress panel. Place tape on the 8 mm socket to avoid scratching the dress panel.

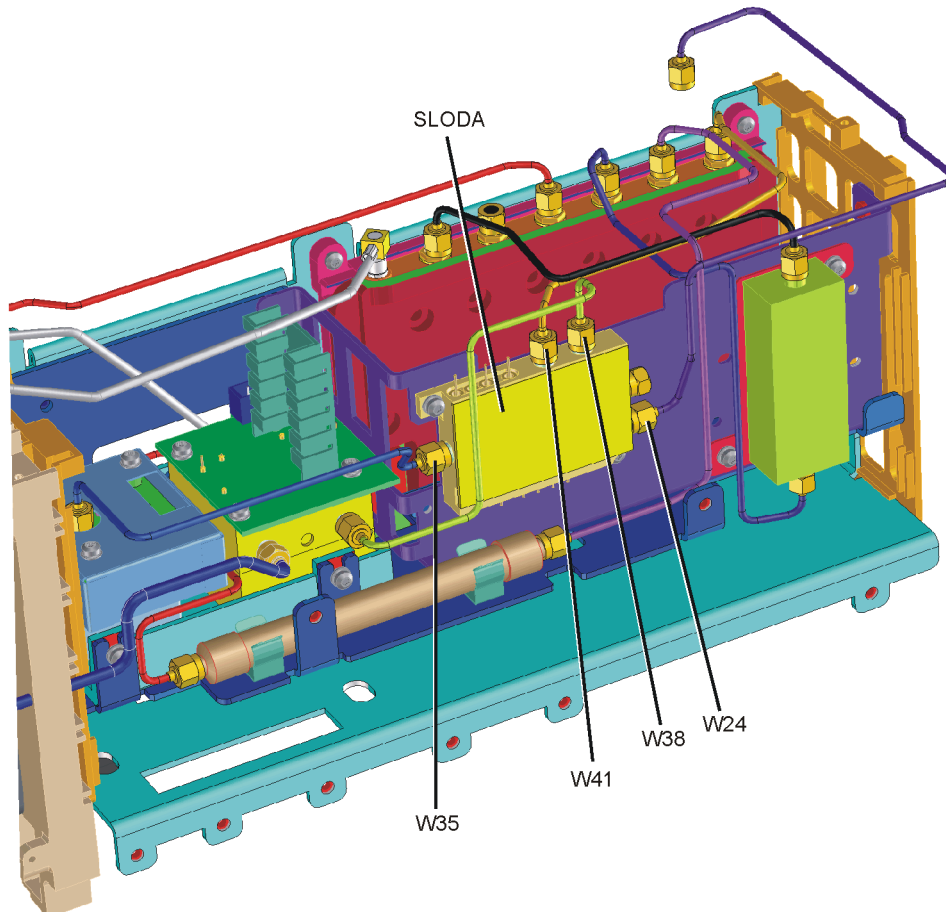
Installation Procedure

10. Attach all BNC connectors to the dress panel. Assure the “D” in the dress panel aligns with the connector and tighten the nut to hold the connector securely.
11. Attach the dress panel to the rear frame with the 13 screws removed earlier. Torque to 101 Ncm (9 in-lbs).
12. Torque the BNC connector nuts to 236 Ncm (21 in-lbs) and the SMA connector nuts to 112 Ncm (10 in-lbs).
13. Install the hole plugs, contained in the kit, into the empty BNC and SMA rear panel holes.
14. Connect the 28V rear panel cable to the jack near the rear of the Front End Driver assembly. The jack is J14 for the E4440, E4443 and E4445A.

Installing the Replacement SLODA

1. Refer to Figure 3. Remove the semi-rigid cables W24, W35, W38, and W41. Also remove the 50 ohm load from the 1st LO Out port.
2. Locate the Dual Mixer in the kit and attach the 50 ohm load just removed, to the Dual Mixer 3.9107GHz OUT port. Doing this now lessens the chance of losing the 50 ohm load.

Figure 3 SLODA Removal

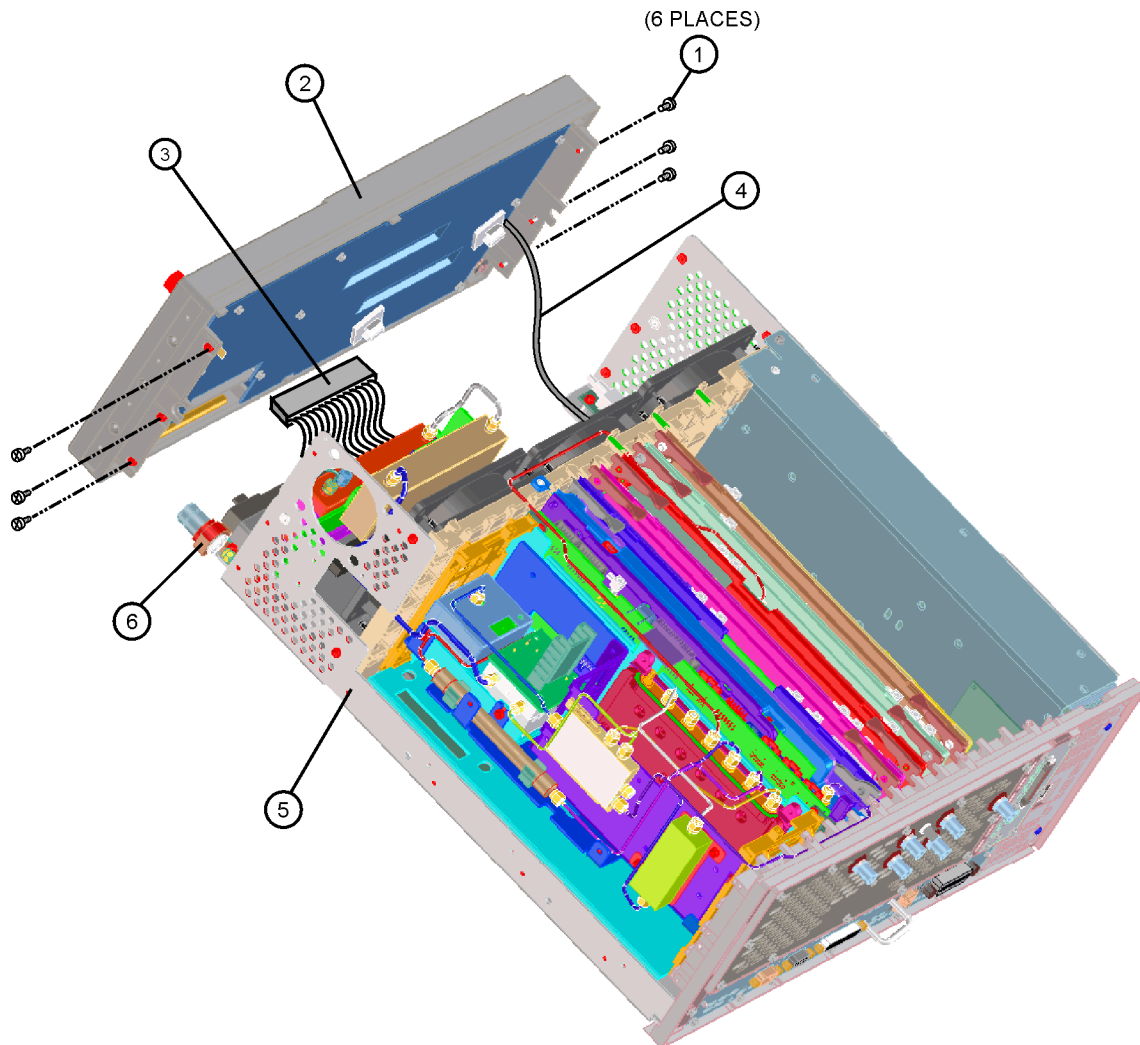


3. Remove the two wire harnesses from the SLODA.
4. Using the T-10 driver, remove the 2 mounting screws and remove the SLODA.
5. Locate the replacement SLODA in the kit and install it on the bracket. Torque the mounting screws to 9 inch pounds.
6. Re-attach the wiring harnesses to SLODA.
7. Replace the cables to the correct locations. Torque the cables to 10 inch pounds.

Remove the Front Frame

1. Refer to Figure 4. Using the T-10 driver, remove the 7 screws (1) that attach the front frame assembly (2) to the deck.
2. Pull the front frame off of the deck until it is disengaged from the disc drive.
3. Using a 9/16" socket drive, remove the nut securing the **Ext Trigger Input BNC** connector. Take care to not scratch the front dress panel.
4. Disconnect the ribbon cable (3) from the A2 front panel interface board. Pull the coaxial cable (4) from the front frame and unclip from the two cable clamps.
5. Lift the front frame assembly away from the deck.

Figure 4 Front Frame Assembly Removal

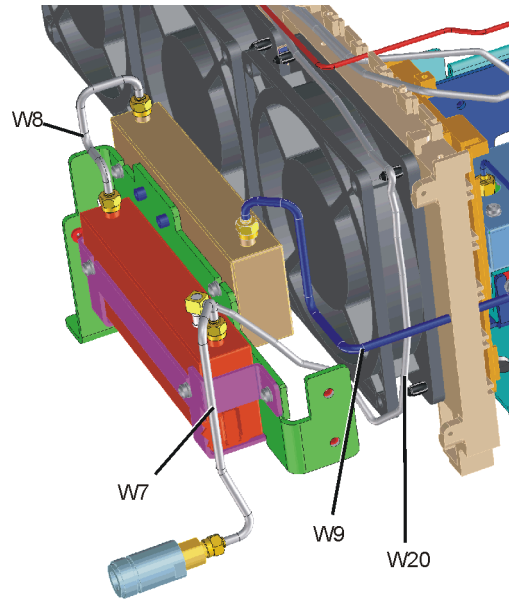


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Install the Preselector Bypass

1. Locate the input attenuators near the RF input and remove the W8, E4440-20068 rigid cable that connects the two attenuators. Refer to Figure 5. This cable will be reused later.

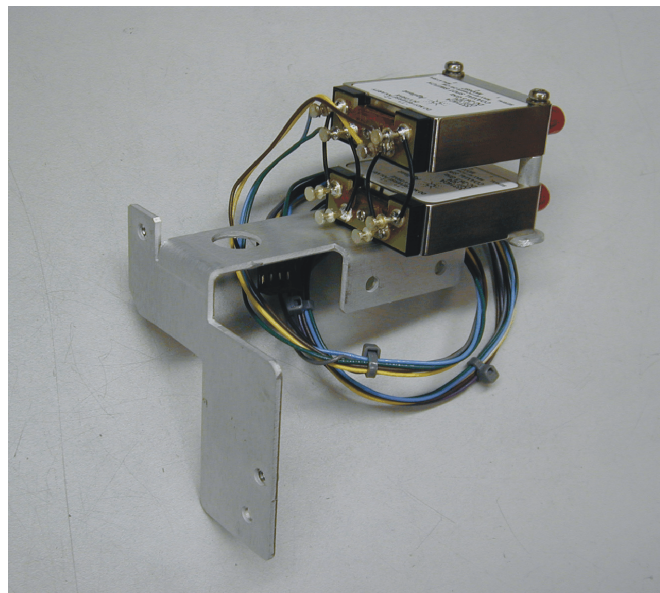
Figure 5 Cable Locations



attencables

2. Locate the switch/bracket assembly in the retrofit kit (Figure 6) and place it over the attenuators as shown in Figure 7. Secure the switch/bracket assembly to the attenuator bracket with the 0515-0372 screws provided in the kit.

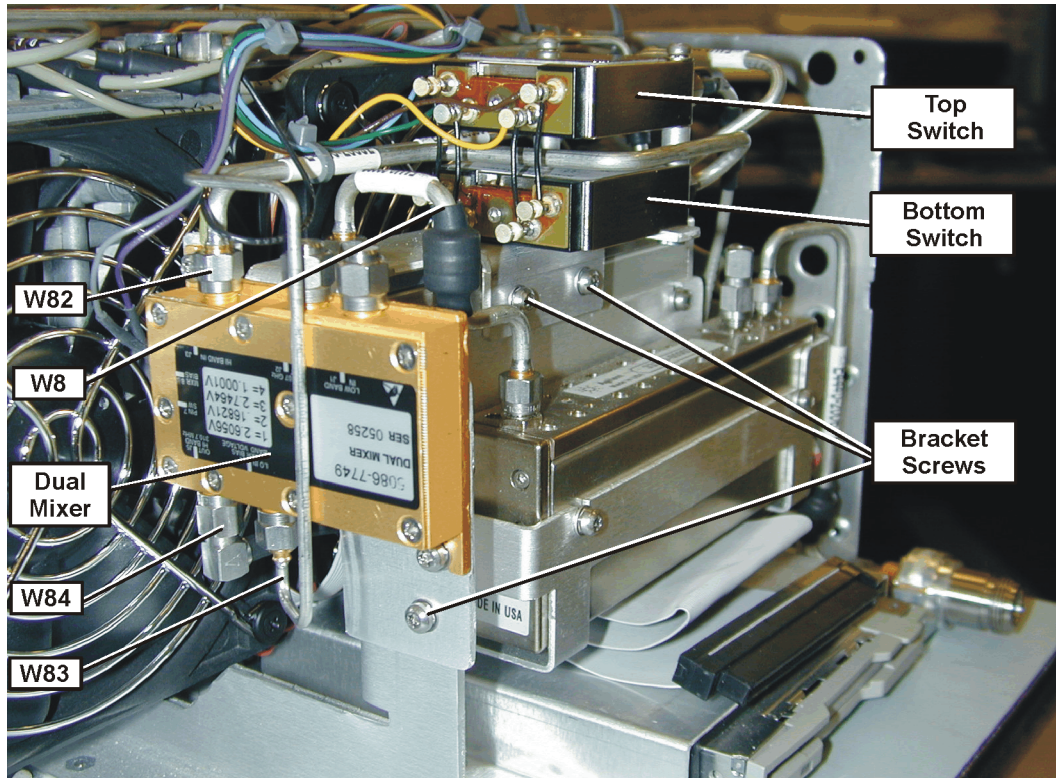
Figure 6 Switch/Bracket Assembly



Installation Procedure

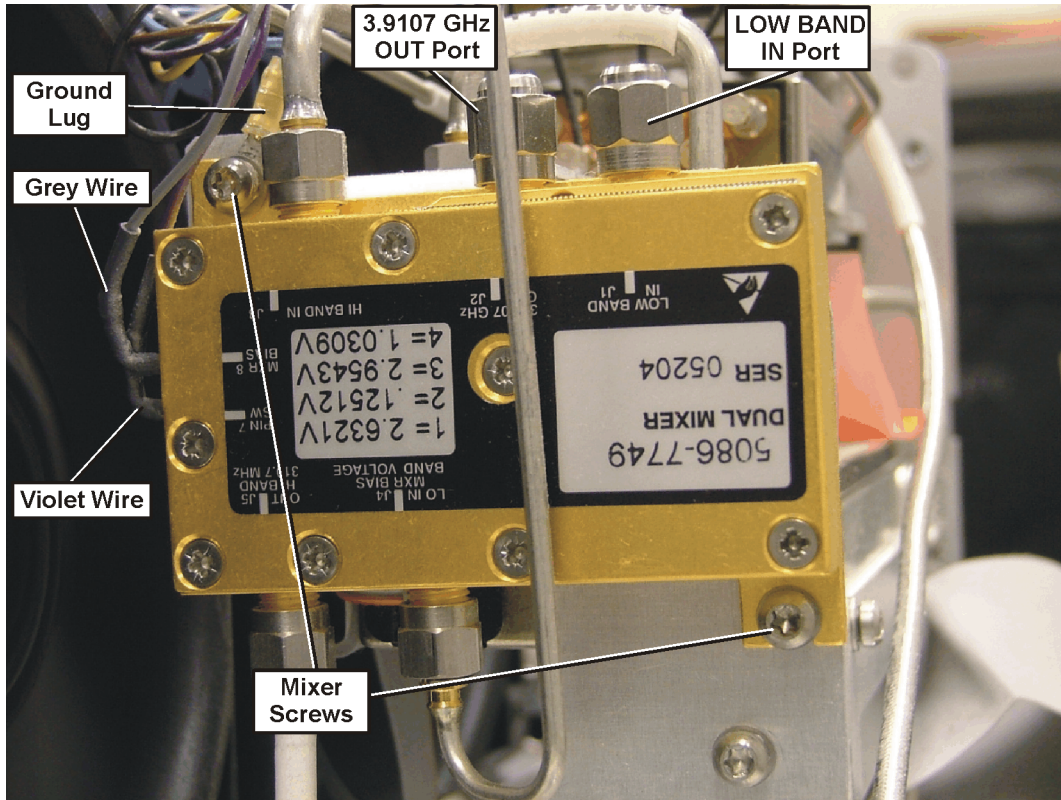
3. Locate the Dual Mixer in the kit. Look at the wire harness attached to the switch/bracket assembly and locate the grey and violet wires.
4. Refer to Figure 8 to determine how the Dual Mixer will attach, but do not attach the mixer yet. Connect the grey wire with the push on connector to the Dual Mixer bias pin. Connect the violet wire with the push on connector to the Pin 7 SW on the Dual Mixer.

Figure 7 Mixer and Cable Locations



5. Refer to Figure 8. Attach the Dual Mixer to the end of the switch bracket using two of the screws in the kit. Before inserting the top screw, locate the black wire with the ground lug that is part of the switch harness. Place the ground lug between the screw head and the mixer body. Torque the mounting screws to 9 in-lbs.

Figure 8 Mixer Installation

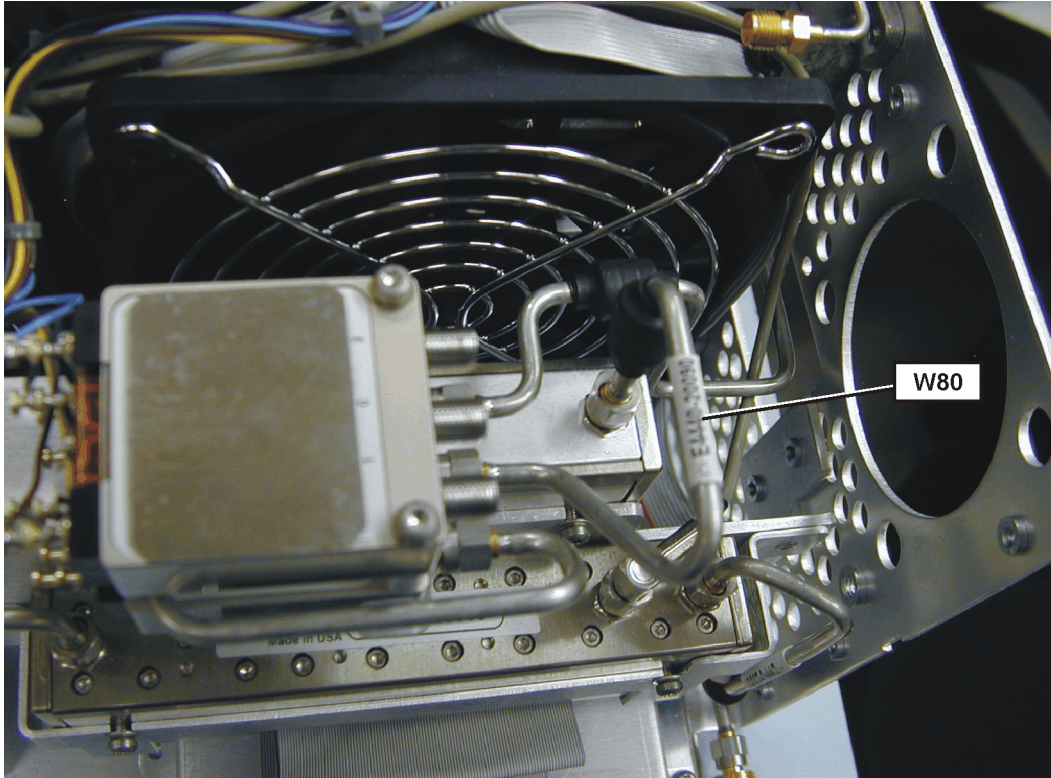


6. Refer to Figure 5. Remove the W9, E4440-20069 rigid cable from the RYTHM to the attenuator. This cable can be discarded.

Installation Procedure

7. Locate the W80, E4440-20090 rigid cable in the kit. Refer to Figure 9. Attach one end of the cable to the bottom switch port C, and the other end to the attenuator connector where you just removed W9. Torque to 10 in-lbs.

Figure 9 Bottom Switch Cables



8. Refer to Figure 10. Re attach the W8 rigid cable between the two attenuators. This is the cable you removed in step 1. Torque to 10 in-lbs.

Figure 10 Cable Locations

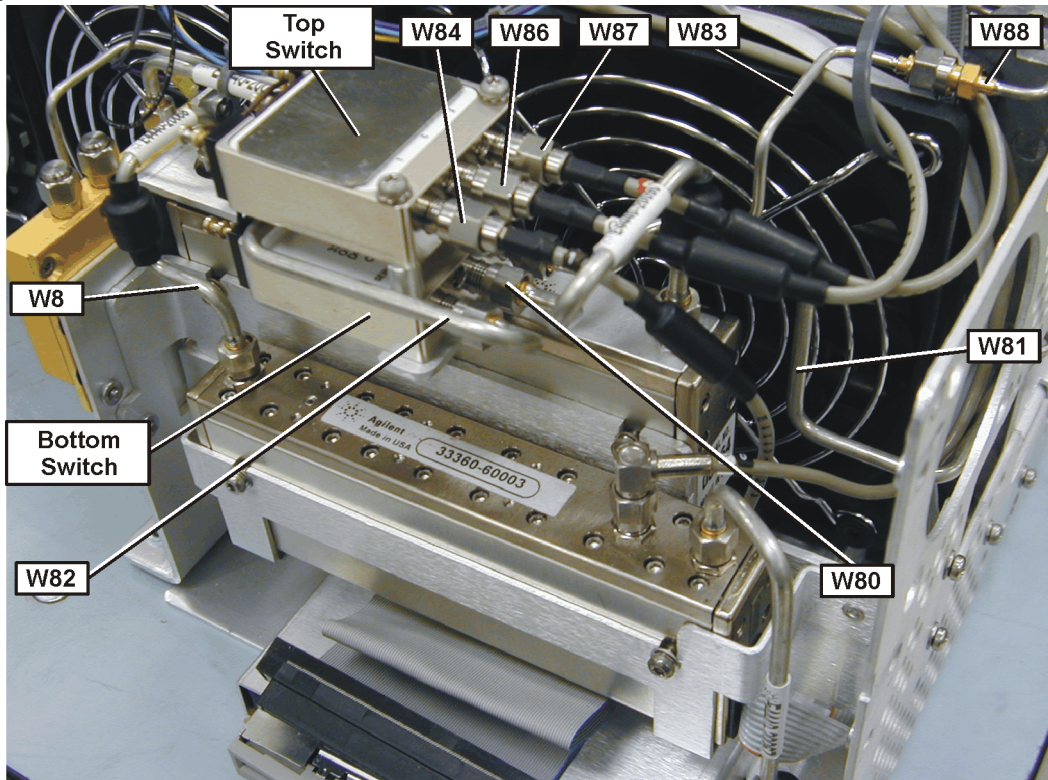
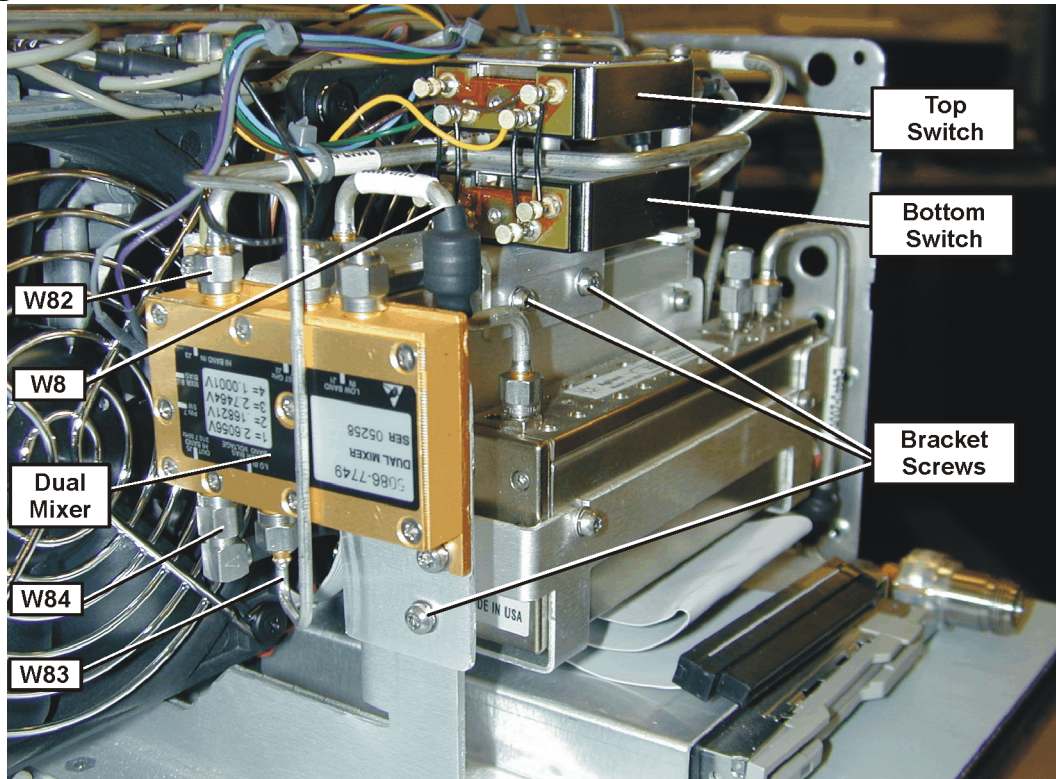


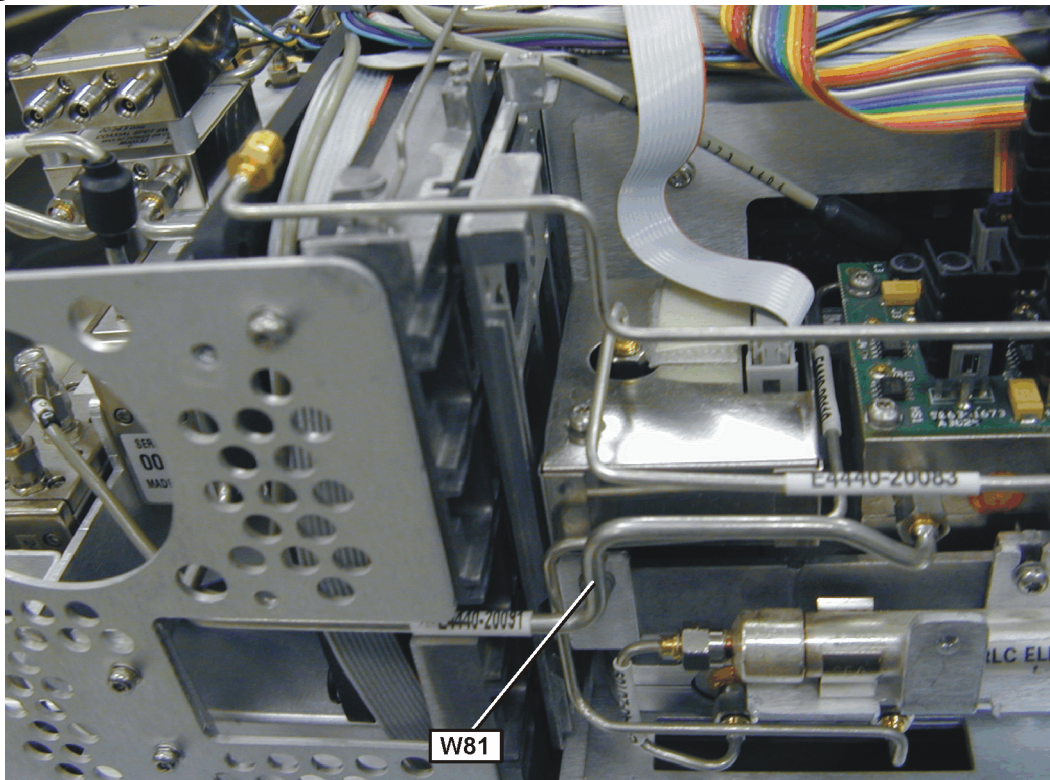
Figure 11 Mixer and Cable Locations



9. Locate the W82 rigid cable in the kit. Refer to Figure 10 and Figure 11. This cable will connect between the bottom switch Port 1, and Dual Mixer port "HI BAND IN J3". The cable must be routed between the switches. To do this, make sure the flat portion of the connector nut is positioned so the end of the cable will fit between the switches. Torque the cable to 10 in-lbs.

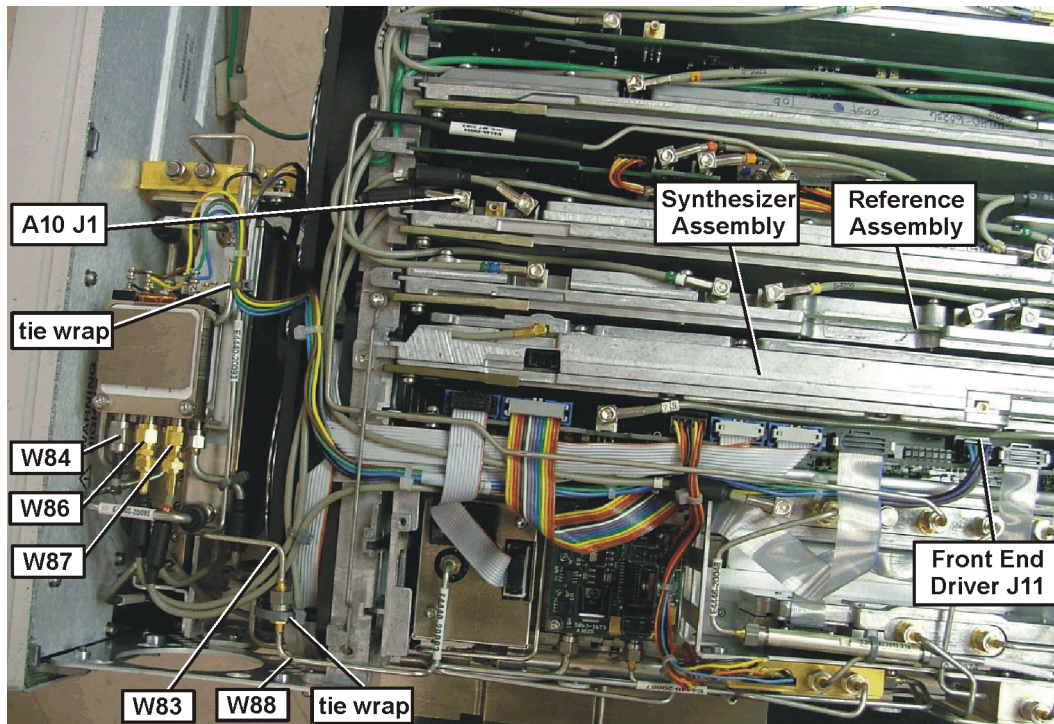
10. Locate the W81 rigid cable in the kit. Refer to Figure 10 and Figure 12. This cable will connect between bottom switch Port 2, and the RYTHM port.

Figure 12 W81 Location



11. Refer to Figure 13. On the instrument, locate the flexible coax “10” cable that connects between the A10 Third Converter J1 and RYTHM. Remove the cable from Third Converter J1.

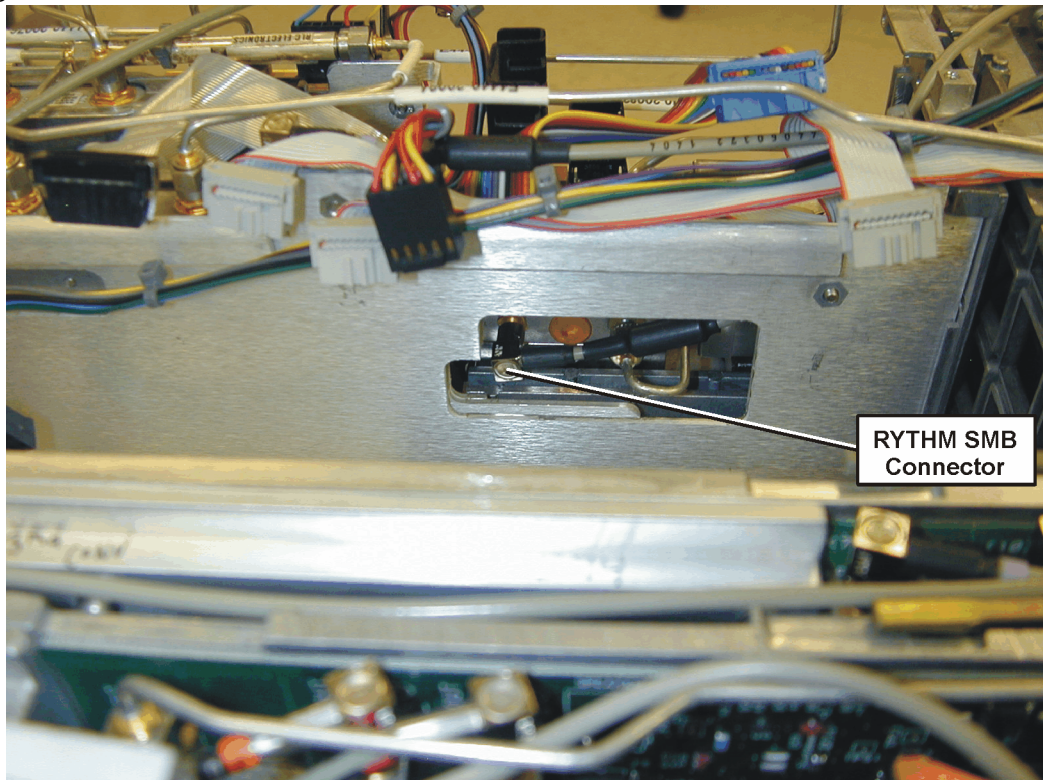
Figure 13 Top View



12. Remove the screw from the cable hold down rod on the mid web to allow the “10” cable and other cables to be free.
13. In order to remove the RYTHM end of the cable, and replace the cable, several board assemblies must be removed. Please note the position and routing of all cables. All of the flexible coax cables are color coded, but the ribbon cables are not.
14. Remove the Front End Driver being careful to avoid damaging the ribbon cables.
15. Remove the Synthesizer assembly after removing the rigid cable and the two retaining screws.
16. Remove the Reference assembly.

17. Locate the “10” cable again, and take note of the cable routing. Refer to Figure 14. Using needle nose pliers, carefully grab the body of the “10” cable smb connector and gently rock the smb connector free of the RYTHM. Discard the cable.

Figure 14 RYTHM SMB Connector



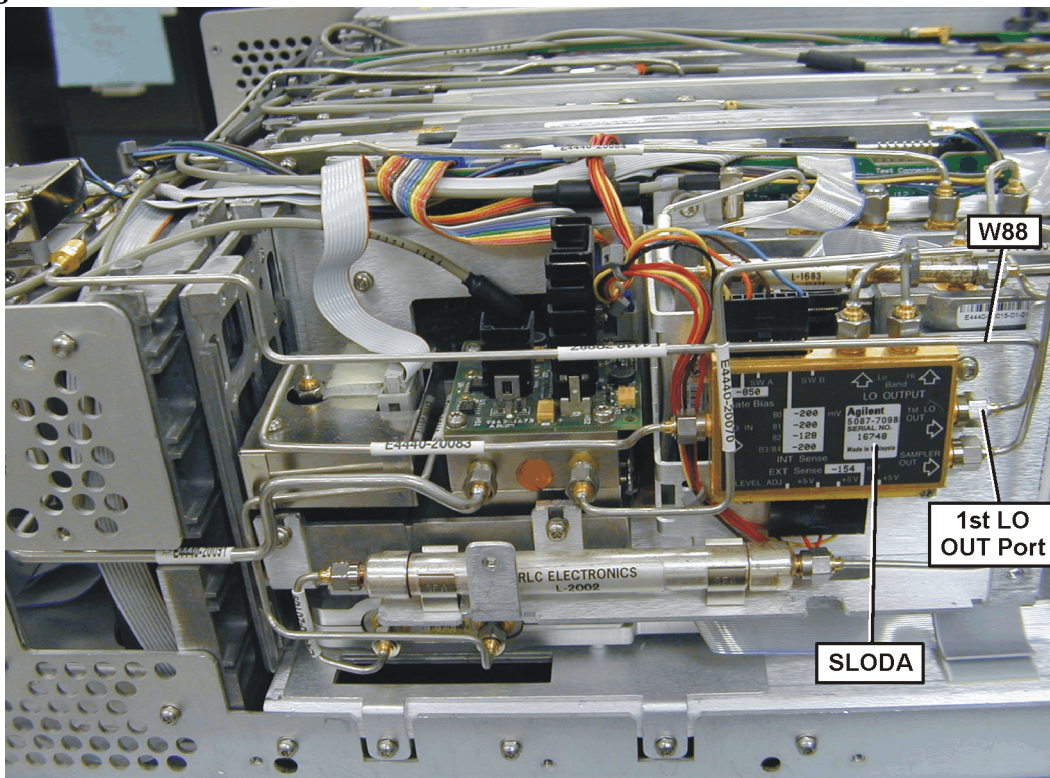
18. Locate the W87 flexible coax in the kit. This cable has a “2” color code and connects from port 2 of the top switch to the smb connector on RYTHM. Route the SMA end of the cable under the W80 semi-rigid cable, and connect it to port 2 of the top switch. Torque to 10 in lbs. Route the cable next to the RF section sheet metal and directly to the RYTHM. Carefully align the SMB end of the cable with the RYTHM connector by looking through the hole in the chassis. Press the SMB connector on.
19. Reinstall the A13 Front End Driver, Synthesizer Assembly and the Reference Assembly. Assure all cables are routed correctly.
20. Locate the W86 flexible coax cable in the kit. This cable has a 10 color code on one end and a “C” on the other end. Refer to Figure 13. Route the SMA end of the cable under the W80 semi-rigid cable, and connect it to the center port of the top switch. Torque to 10 in lbs. Attach the other end of the cable to the A10 Third Converter J1 connector.

NOTE The shrink-wrapped ferrite beads on the cable can be moved slightly to aid cable routing.

Installation Procedure

21. Locate the W84 flexible cable in the kit. This cable has a right-angle SMA connector on one end. Refer to Figure 10 and Figure 11. Route the end of the cable with the straight SMA connector under the W80 semi-rigid cable, and connect it to port 1 of the top switch. Route the cable under the attenuator and to the Dual Mixer “OUT” J5 port. Connect the cable being careful that the right-angle connector is clear of the cooling fan. Torque the connector to 10 in-lbs.
22. Locate the 50 ohm load in the kit and install it on the Dual Mixer, LOW BAND IN port.
23. Assure the 50 ohm load removed earlier from the SLODA is attached to the Dual Mixer 3.9107GHz OUT port.
24. Refer to Figure 15. Locate the SLODA (LO Distribution Amplifier) in the RF section.
25. Locate the W88 rigid cable in the kit. Attach one end to the LO OUT port of the SLODA. The other must lay against the fan near the upper fan mounting hole.

Figure 15 RF Section



26. Locate the W83 rigid cable in the kit. Refer to Figure 16. Attach one end to the Dual Mixer at the “LO IN MIXER BIAS” port. The other end attaches to the W88 cable installed in the previous step. Refer to Figure 17. Assure that when the two cables are joined that the connection lays against the fan near the upper fan mounting hole. You may need to loosen the other end of W88 or W83 to achieve the proper fit. Use both the 1/4-inch and 5/16-inch open-end wrenches to connect the two cables.

Figure 16 W83 Cable

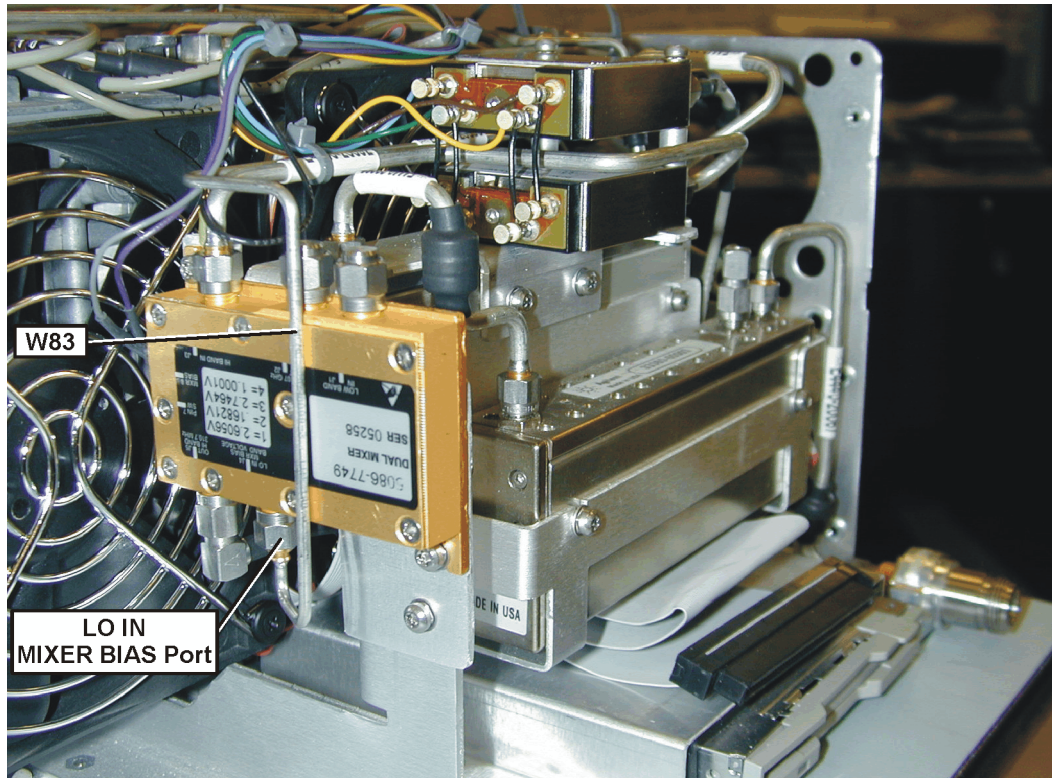
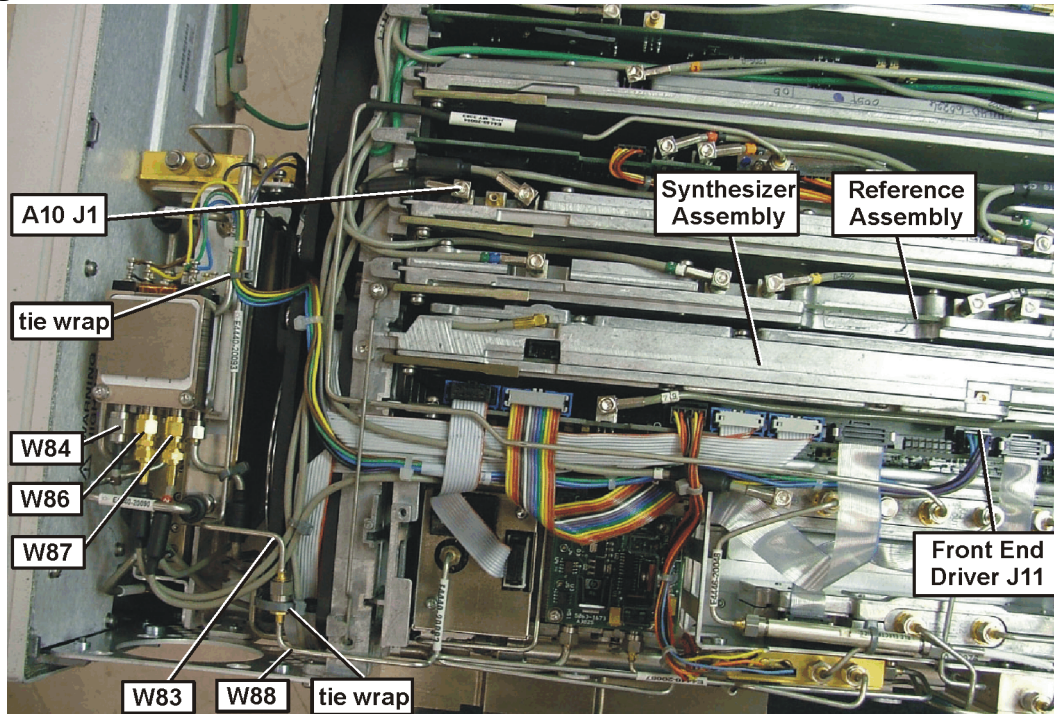


Figure 17 W83/W88 Connection and Wire Harness



27. Attach a tie wrap, included in the kit, around the W83/W88 cable connection at the fan mounting hole.
28. Attach a tie wrap, included in the kit, around the wiring harness and the rigid cable as shown in Figure 17.
29. Connect the wire harness from the switch assembly to the Front End Driver assembly connector J11. Route the harness and cables as shown in Figure 17.
30. Reinstall the cable hold down on the mid web after assuring the cables are routed correctly.
31. The top brace and instrument enclosure must be left off because the instrument requires adjustment later in the retrofit process.

Replace the Front Frame

1. Place the front frame assembly in front of the deck.
2. Connect the ribbon cable (3) to the A2 front panel interface board.
3. Feed the coaxial cable BNC connector through the **External Trigger Input** hole in the front frame, matching the “D” slot. Secure with the nut removed earlier, using a 9/16” socket. Torque to 21 inch pounds.
4. Clip the coaxial cable into the two cable clamps positioned on the front frame shield.
5. Position the front frame on the deck using the alignment bosses on the deck (5). Remember to tuck the ribbon cable under the fans when pushing the frame onto the deck. This will insure proper airflow to cool the instrument. Using the T-10 driver, replace the 7 screws (1) that secure the front frame to the deck. Torque to 9 inch pounds.

Install Firmware A.06.00 or Greater if Needed

1. Press **System, More, Show System**. The Firmware Revision needs to be A.06.00 or later.
2. If the firmware needs to be updated, do the following:
Download the PSA Update Program and the PSA Firmware Procedure from http://www.agilent.com/find/psa_firmware. Follow the directions to install the firmware.

Alternate Method:
Install the Firmware Update Kit E4440AU Option UE2. Follow the directions in the kit.
3. Error messages will appear following firmware upgrade since the instrument requires adjustment.

Install the Option Designator and License Keyword

NOTE The option designator 123 and the license keyword must be entered into instrument memory in addition to the correct firmware before the hardware will function.

1. Locate the License Key Entitlement Certificate in the kit and follow the directions to redeem it. You will receive a License keyword Certificate that has the license keyword required for step 4.
2. Plug in instrument and power up.
3. On the instrument front panel press: **System, More**, until the **Licensing** softkey is visible. Press **Licensing** and **Option**. This will activate the alpha editor menu. Use the alpha editor and the front panel numerical keypad to enter the upper-case option designator 123. Enter the letters using the alpha editor and the numeric keypad to enter the numbers. Press the **Enter** key. Note that 123 now appears on the **Option** key.
4. Press **License Key**. The license key number is a hexadecimal number that will require the entry of both letters and numbers. Use the alpha editor and the front panel numerical keypad to enter the license key number. Your entry will appear in the active function area of the display. If you make a typing error, use the backspace key to correct the error. Check the license key number you entered. Press **Enter, Activate License**.
5. Cycle instrument power and allow instrument to perform the auto align routine.

Perform Adjustments and Performance Tests

The following tests are required to assure the installation was performed correctly. **Perform the adjustments in the order listed.**

NOTE The instrument may not have been in spec before the retrofit was begun. Performing only these tests does not guarantee the instrument meets specifications.

 This procedure requires the use of the PSA Series Performance Tests and Adjustment Software rev E.01.00 or later.

NOTE **The SLODA and Mixer Bias Adjustments require access to the inside of the instrument. After this adjustment, replace the top brace before continuing with the other adjustment and performance tests. The top brace allows correct air flow.**

Adjustments	Performance Tests
SLODA Adjust	Residuals
Dual Mixer Bias Adjustment	Displayed Average Noise Level
Frequency Response Adjustment (Option 123)	Spurious Responses
The need to adjust the instrument as a result of replacing the A13 Front End Driver depends on the status of the instrument calibration previous to installing the replacement Front End Driver. The VEE front end driver utility copied calibration files, but these files may or may not allow the instrument to meet specs. The result of the performance tests will dictate if adjustments are necessary	All Frequency response tests at all frequencies (include Frequency Response (Option 123))

Replace the Outer Case

1. Refer to Figure 1.
2. Slide the instrument cover back onto the deck from the rear. The seam on the cover should be on the bottom. Be sure the cover seats into the gasket groove in the front frame.
3. Replace the four rear feet onto the rear of the instrument. Torque to 236 Ncm (21 in-lb).
4. Use the T-20 driver to replace the handles. Torque to 236 Ncm (21 in-lb).
5. Replace the four bottom feet by pressing them into the holes in the case and sliding them in the opposite direction of the arrows until they click into place. Note that the feet at the front have the tilt stands.

28 V Rear Panel Test

Test the rear panel 28V output by performing the following test:

1. Connect a voltmeter to the rear panel Noise Source Drive Out +28V connector.
2. Press **System, More, More, Service**. Enter the password **-49** and press **Enter**.
3. Press **Service, More, Noise Source ON**. The measured value should be 28V dc +/-0.2 volts

Verify the Option

The following test switches in and out the preselector bypass path while viewing a signal.

Required Equipment

Description	Recommended Model
Signal Source > 4 GHz	Agilent 83630B
High quality, low-loss cable, 3.5 mm	8120-4921
Adapter, N (m) to APC 3.5 (f)	1250-1744
Adapter, APC 3.5 (f) to 3.5 mm (f)	83059B

1. Preset the PSA and signal source.
2. Connect the signal source to the PSA RF input with a high quality low-loss cable.

PSA Settings	
Mode	Spectrum Analysis
Center Frequency	4 GHz
Start Frequency	3.06 GHz
Stop Frequency	10 GHz

Signal Source Settings	
Frequency	4 GHz
Amplitude	-10 dBm

3. The 4 GHz signal should appear on screen. The analyzer is currently using the preselected path.
4. On the PSA, Press **Input / Output, Microwave Preselector OFF**. The preselector is now bypassed.
5. The 4 GHz signal will still be present, however the display may show many other responses. This occurs because the preselector filter that eliminates input frequencies that cause these images, multiples, and out-of-band responses, has been bypassed by the option 123 hardware. You may also notice a step in the noise floor at the 6.6 GHz bandcrossing. This is normal performance of the option123 Dual Mixer.

End of Installation

For assistance, contact your nearest Agilent Technologies Sales and Service Office. To find your local Agilent office access the following URL or call the following telephone number:

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

1-800-452-4844 (8am-8pm EST)

