# Installation Note

## Agilent PSA Series Spectrum Analyzer E4446A and E4448A

## Option 322 Retrofit Kit (required to retrofit Option 122, 80 MHz Bandwidth Digitizer)

## Option 340 Retrofit Kit (required to retrofit Option 140, 40 MHz Bandwidth Digitizer)

Agilent Technologies

**Part Number E4446-90014**
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E4446-90014

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# Wide Bandwidth Retrofit Kit

## 80 MHz Bandwidth Digitizer Retrofit Kit
## 40 MHz Bandwidth Digitizer Retrofit Kit

| | |
|---|---|
| Products Affected: | PSA E4446A<br>PSA E4448A |
| Serial Numbers: | US4611 /US99999999<br>MY4611 /MY99999999<br>SG4611 /SG99999999 |
| To Be Performed By: | (X) Agilent Service Center<br>( ) Personnel Qualified by Agilent<br>( ) Customer |
| Estimated Installation Time: | 3 Hours (see note 3) |
| Estimated Adjustment and Verification Time: | 3.5 Hours (see note 1) |
| Additional Recommended Task | Agilent recommends that a full calibration be performed to verify instrument specifications (see note 2) |

## Introduction

Option 122, 80 MHz Bandwidth Digitizer or Option 140, 40 MHz Bandwidth Digitizer provides wide IF bandwidth filtering. However, Option 123, Microwave Preselector Bypass must also be installed in the instrument to enable wide IF bandwidth functionality.

There are two reasons Option 123 must also be present:

1. The signal path above 3 GHz is bandwidth limited and drifty as a result of the front end preselector filter. Option 123 Preselector Bypass eliminates these problems.
2. The Option Driver assembly that is part of Option 123 contains memory that is used to store Option 122 or 140 calibration files. The Option Driver assembly is not included in this Option 122 or 140 retrofit kit because Option 123 may already be installed in the E4446A and E4448A. Also, the Option 123 installation must be handled as a separate installation process.

This retrofit kit installs an alternate 80 MHz or 40 MHz wide bandwidth IF path consisting of wide band Analog IF and wide band Digital IF assemblies. Also, a wide bandwidth bandpass filter and lowpass filter replaces the existing bandpass filter in the lowband (<3 GHz) path.

| | |
|---|---|
| **NOTE** | 1. The installation of this kit requires that some performance testing be performed in order to assure the new option is functioning properly. This installation note includes a list of required performance tests. Completing the list of required performance tests does not guarantee the instrument meets all specifications. |

| | |
|---|---|
| **NOTE** | 2. The instrument end user must determine whether they need a full instrument calibration following the installation of the kit. If full calibration is required, arrangements regarding the level of calibration must be made between the end user and the calibration provider. |

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|---|---|
| **NOTE** | 3. Requires Option 123 Option Driver assembly. See Introduction for details. |

| | |
|---|---|
| **NOTE** | This option is licensed for one instrument model number/serial number combination. The license key will only install on the designated instrument. |

## Contents

| Reference Designator | Description | Agilent Part Number |
|---|---|---|
| A31 | Wide Band Analog IF Assembly | E4440-60215 |
| A32 | Wide Band Digital IF Assembly | E4440-60262 |
| FL2 | Bandpass Filter, 3.900 GHz | 0955-1391 |
| FL3 | Lowpass Filter, 4.4 GHz | 0955-0519 |
| W60 | Cable, ribbon, A31 Wide Band Analog IF to A32 Wide Band Digital IF | E4440-60341 |
| W61 | Cable (65), coax, 100 MHz Ref from A11 Reference Assy J2 to A31 Wide Band Analog IF P200 | E4440-60344 |
| W62 | Cable (95), coax, 300 MHz Ref from A11 Reference Assy P4 to A31 Wide Band Analog IF P103 | E4440-60346 |
| W64 | Cable (60), coax, Wide Band IF CAL from A31 Wide Band Analog IF P101 to A10 3rd Converter J6 | E4440-60345 |
| W65 | Cable (40), coax, 321.4 MHz IF from A10 3rd Converter J4 to A31 WB Analog IF P100 | E4440-60385 |
| W66 | Cable (66), coax, 321.4 MHz from A31 WB Analog IF P104 to Rear Panel | E4440-60342 |
| W78 | Cable, semi-rigid, FL2 to FL3 | E4446-20047 |
| W79 | Cable, Semi-rigid, FL3 to A20 Lowband J4 | E4446-20048 |
| | Fastener, hook and loop. Attaches to bandpass filter FL2 and ribbon cable. | 0510-1303 |
| | Installation Note | This note |
| | Option Upgrade Entitlement Certificate | --- |
| | Cable tie .062D .09W | |
| | Basic Mode Guide | |
| | Specification Guide | |

### Tools Required

- ❏ T-20 Torx driver
- ❏ T-10 Torx driver
- ❏ 5/16-inch torque wrench
- ❏ 8 mm deep socket or open end wrench
- ❏ 7/32 inch or 6 mm open end wrench
- ❏ Calibration software. Latest software information and downloads available at http://www.agilent.com/find/calibrationsoftware
- ❏ Test equipment supported by the calibration software.
- ❏ PSA Series Spectrum Analyzer and Service Guide. This manual is available as E4446AU or E4448AU Option OBW.
- ❏ Microsoft® Windows® based personnel computer using LAN connection and CD-ROM drive.
- ❏ GPIB Interface. Agilent 82350B or 82357B. National Instruments PCI-GPIB or GPIB-USB-HS
- ❏ Windows 2000® (Service Pack 4), Windows XP® (Service Pack 2)
- ❏ Download the latest firmware revision (A.11.xx or later) from http://www.agilent.com/find/psa_firmware, or order the Firmware Update kit.

  The firmware update kit is ordered as E4440AU, Option UE2.

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# Installation Procedure

## Preliminary Hardware Verification

With the instrument powered up, press **System**, **More**, **Show Hardware**. Look for the Option Driver in the list of assemblies.

If the Option Driver is listed, proceed with the installation of Option 122 or 140.

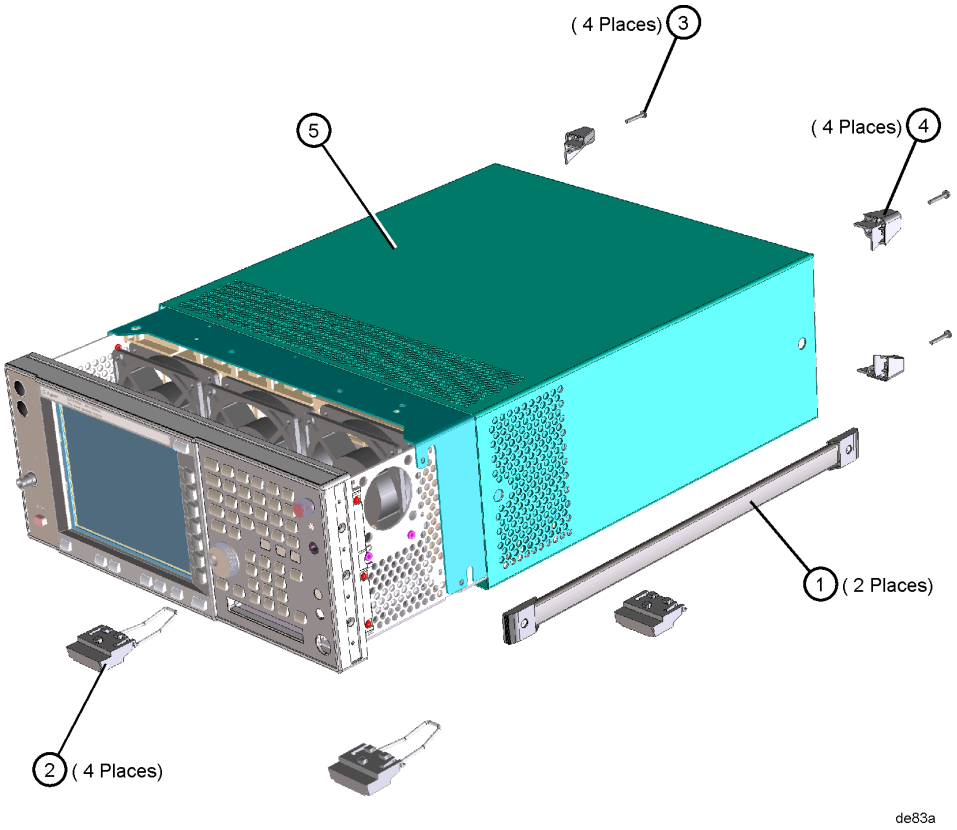
If the Option Driver is not listed, you must install the Option 123, Switchable Microwave Preselector Bypass retrofit kit before installing this Option 122 or 140 retrofit kit. The Option Driver assembly that is part of Option 123 is used to store the Option 122/140 cal factors.

## 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.

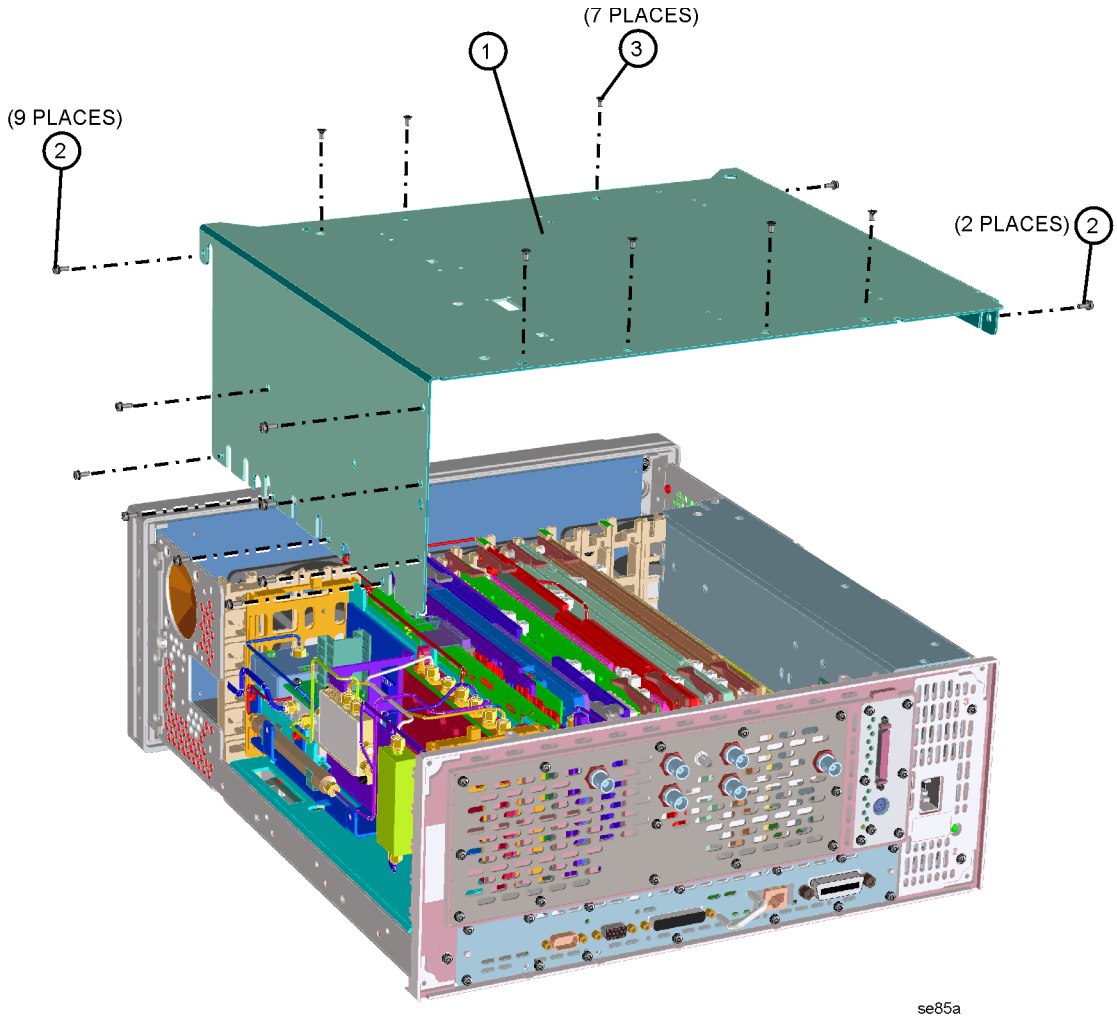
**Figure 1 Instrument Outer Case Removal**



## 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**

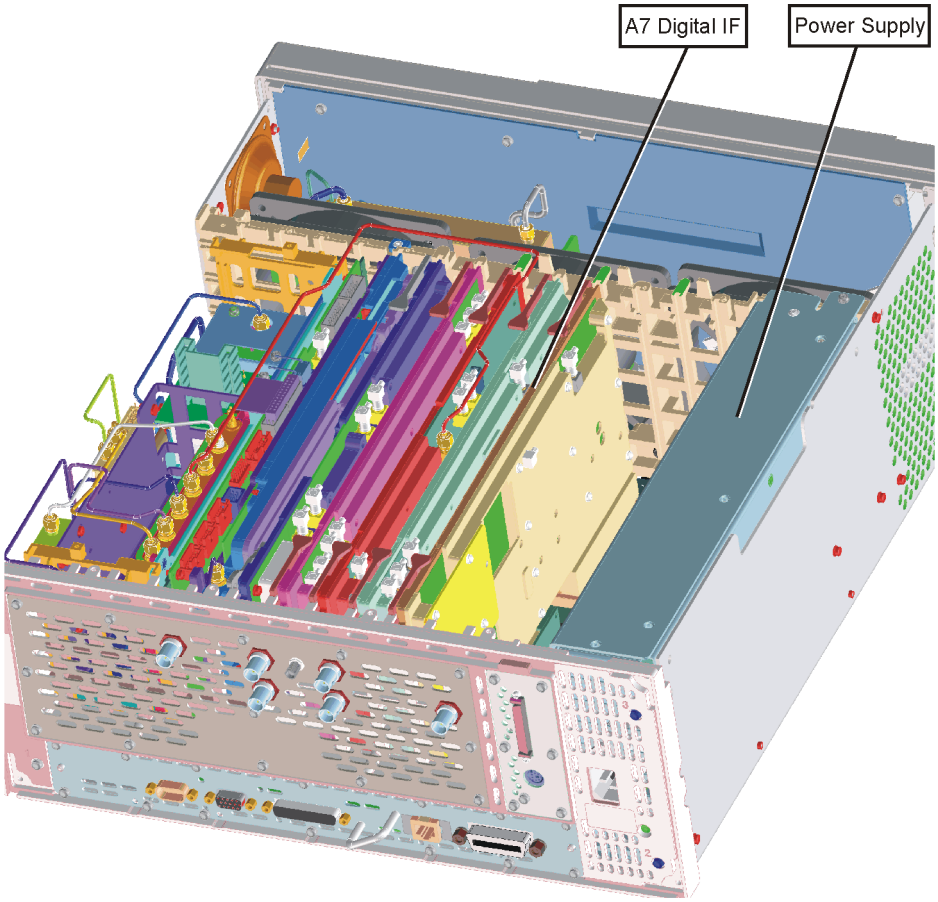


## Install the Retrofit Kit

### Verify Existing Hardware Configuration

1. Locate the A7 Digital IF assembly. It is in the forth card slot from the power supply. Refer to Figure 3.

**Figure 3 A7 Digital IF Assembly Location**




digitalif

2. If the existing A7 Digital IF assembly has large metal casting covers as shown in Figure 3, this Option 322 or 340 retrofit kit is the wrong kit for your instrument. Stop the installation.

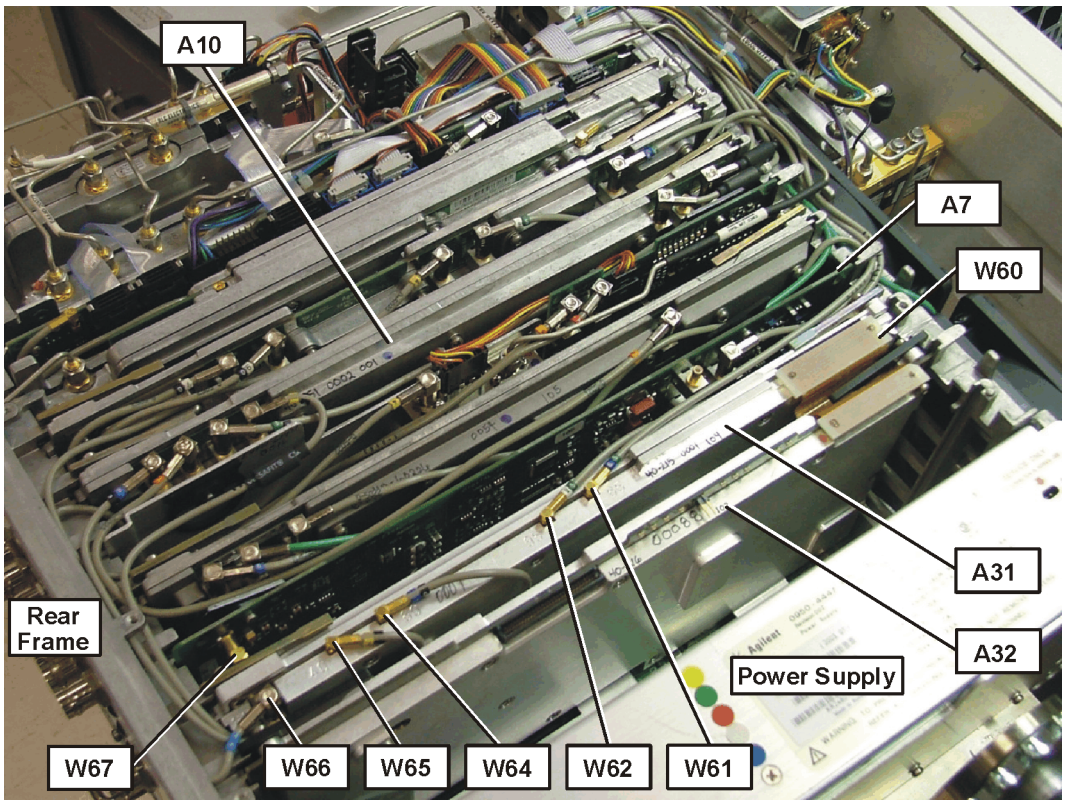
   This Option 322 or 340 retrofit kit is designed for newer instruments that already contain the 2nd generation A7 Digital IF assembly, and other circuit assemblies supported by this newer A7 Digital IF assembly. The 2nd generation A7 Digital IF assembly has no large casting covers.

3. If the existing A7 Digital IF assembly resembles A7 in Figure 4, continue with the installation.

4. Locate the A31 Wideband Analog IF assembly in the kit. This assembly is the one with the MCX connectors visible on top of the board.

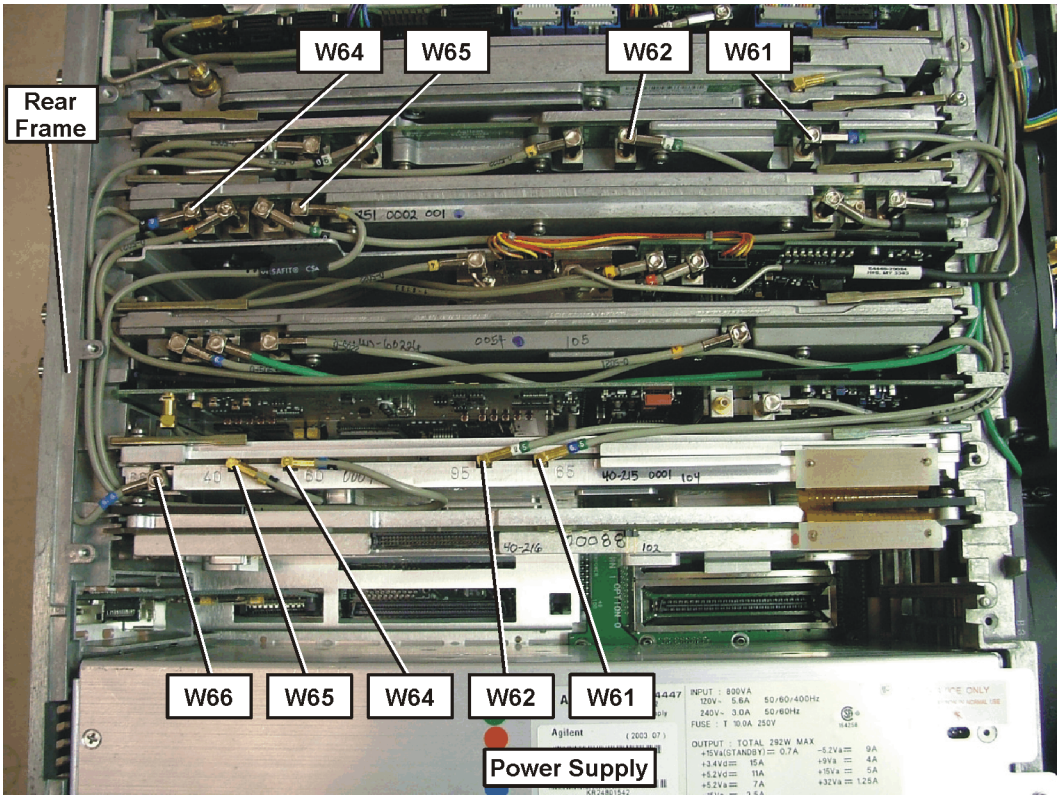
5. Refer to Figure 4. Install the A31 Wideband Analog IF assembly into the board slot next to the A7 Digital IF. This slot is the third slot from the power supply.
6. Locate in the kit, and install the A32 Wideband Digital IF assembly next to the A31 Wideband IF assembly just installed.

**Figure 4 Option 122 Assembly and Cable Locations**




7. Remove all cables from the A10 3rd Converter assembly. Please note that all cables are color-coded and the cable color is silk-screened on the 3rd Converter board. Remove the 3rd Converter from the instrument.
8. Remove the 321.4 MHz IF Out SMA cable from the rear panel. Use the 8mm deep socket or open end wrench. Avoid scratching the dress panel.
9. Locate in the kit, and install the replacement 321.4 MHz IF Out cable W66, that has the 66 color bands. Install the washer between the nut and the rear panel and Torque to 21 inch pounds.
10. Refer to Figure 5. Route the end of the W66, 321.4 MHz Out cable along the rear frame and leave the SMB end near, but not attached to the SMB connector on the A31 Wideband Analog IF. Tuck the cable under the top brace mounting tab so the cable will lay tightly against the rear frame.

**Figure 5 Cable Routing**



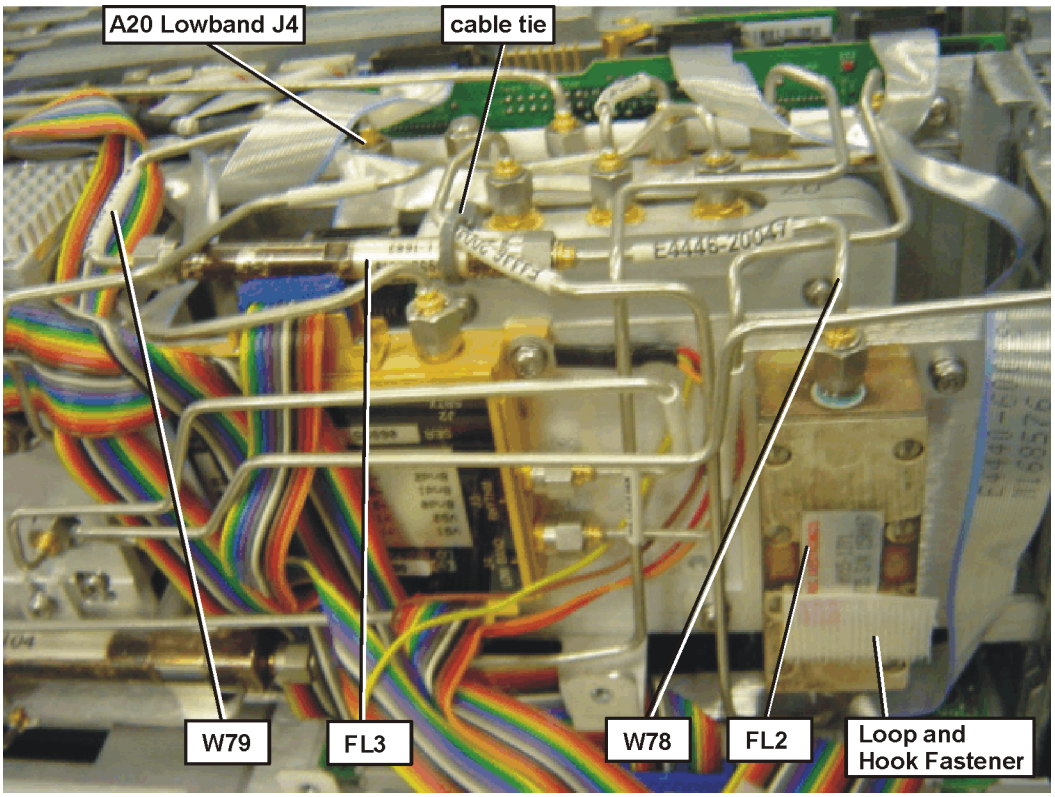

11. Reinstall the A10 3rd Converter assembly. Re-attach all cables being sure to follow the color code on the board.
12. Locate the cable with the “60” color code in the kit. Connect the SMB end to the A10 3rd Converter J6 (60). Route the cable along the rear frame and tuck the cable under the top brace mounting tab so the cable will lay tightly against the rear frame. Continue routing the cable between the A31 Wideband Analog IF and A32 Wideband Digital IF assemblies. This routing is critical. Connect the other end to the A31 Wideband Analog IF at the jack marked “60”.
13. Locate the cable with the “40” color code in the kit. Connect the SMB end to the A10 3rd Converter J4 (40). Route the cable along the rear frame. Continue routing the cable between the A31 Wideband Analog IF and A32 Wideband Digital IF assemblies. This routing is critical. Connect the other end of the cable to the A31 Wideband Analog IF at the jack marked “40”.

14. Attach the W66 cable to the SMB connector on the A31 Wideband Analog IF assembly. This is the cable you left unattached in step 10.
15. Locate the cable with the “95” color code in the kit. Connect the SMB end of the cable to the A11 Reference assembly's 300 MHZ Out connector. Route the cable towards the fans and then between the A7 Digital IF assembly and the A31 Wideband Analog IF assembly. Connect the other end of the cable to the A31 Wideband Analog IF at the jack marked “95”.
16. Locate the cable with the “65”color code in the kit. Connect the SMB end of the cable to the A11 Reference assembly's 100 MHZ Out connector. Route the cable towards the fans and then between the A7 Digital IF assembly and the A31 Wideband Analog IF assembly. Connect the other end of the cable to the A31 Wideband Analog IF at the jack marked “65”.
17. Locate the ribbon cable in the kit. Notice that the cable is marked for proper orientation to assure the WB AIF end and the WB DIF end is connected to the correct wideband IF assembly. Install the cable by sliding the middle of the cable under the board extractor on the A32 wideband Digital IF assembly. Connect the cable to one of the wideband IF assemblies then push the cable down between the two assemblies. Connect the other end of the cable. Assure the connectors are well seated and check that the board extractor lays flat and does not pinch the cable.

### Changes to the RF Section

18. Figure 6 shows the completed installation of replacement filter FL2, the additional filter FL3 and the associated cables. Refer to this figure when completing the rest of the installation, and to determine the location of the components.

**Figure 6 RF Section Part Locations**




19. Locate FL2 in the instrument and completely remove the cable that connects from the top of the filter to the A20 Lowband Assembly at J4. Discard this cable.
20. Pull the ribbon cable away from FL2.
21. Remove the two screws that secure the FL2 bracket.
22. Disconnect the cable from the bottom of FL2.
23. Remove the 3 screws that secure the filter to the bracket and discard the filter.
24. Locate the FL2 replacement filter in the kit and install it on the bracket.
25. Place the filter bracket assembly in the instrument with the two screw heads on the mounting bracket pointing down. Reattach the cable to the bottom of the filter.
26. Attach the filter bracket assembly with the two screws removed previously. Avoid pinching wires behind the bracket. Torque to 9 inch pounds.
27. Locate the loop and hook fastener in the kit. Inspect the fastener on the ribbon cable and determine if it needs to be replaced. Separate the two halves of the loop and hook

fastener and attach the appropriate hook or loop half to FL2. Press the ribbon cable against the filter. See Figure 6.

28. Locate the two semi-rigid cables and the FL3 filter in the kit.
29. Refer to Figure 6. Install the W78 cable from the top of FL2 to FL3. Connect the W79 cable from the other end of FL3 to A20 Lowband Assembly at J4. Use a 7/32 or 6mm open end wrench to hold the center of FL3 when torquing the cable connectors to 10 inch pounds. Torque the cable connection on the bottom of FL2 to 10 inch-pounds.
30. Use the cable tie contained in the kit to secure FL3 to the semi rigid cable that runs over FL3. Securing the filter will prevent problems if the instrument is subjected to excessive vibration or mechanical shock. See Figure 6.

## Replace the Top Brace and Outer Case

1. Refer to Figure 2.
2. Carefully position the top brace on the deck. The alignment pin at the center of the web/fan assembly must mate with the alignment hole on the top brace. Make sure that no coaxial cables will get pinched underneath the brace.
3. Use the T-10 driver to replace and tighten the top screws first; then replace the side screws. Torque to 101 Ncm (9 in-lb).
4. Refer to Figure 1.
5. 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.
6. Replace the four rear feet onto the rear of the instrument. Torque to 236 Ncm (21 in-lb).
7. Use the T-20 driver to replace the handles. Torque to 236 Ncm (21 in-lb).
8. 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.

## Installing the Option Designator and License Keyword

**NOTE** The option designator 122 or 140 and the license keyword must be entered into instrument memory in addition to the correct firmware before the hardware will function.

1. Follow the directions on the Option Upgrade Entitlement Certificate included in the kit. A License Key Certificate that has the license keyword will be e-mailed to you.
2. Plug in instrument and power up. There may be several error messages since new hardware was installed.
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 122 or 140. Enter the letters using the alpha editor and the numeric keypad to enter the numbers. Press the **Enter** key. Note that 122 or 140 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. Following an instrument power cycle, option designator 122 or 140 will appear under the Show System screen (**System**, **More**, **Show System**).

## Install the Latest Firmware

1. 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.

**NOTE** Installing the latest firmware is important when retrofitting these options since files on the option hardware must be updated.

The installation program senses the presence of the Option 122 or Option 140 license and enables the wideband IF circuitry just installed. Unlike some of the other instrument options, there is no check box for Option 122 or Option 140 in the firmware update program.

Once the firmware update process is complete, press **System, More, Show System** and verify that `122` or `140` appears in the option field.

## Perform Test Routines using the Agilent Calibration and Adjustment Software

The latest software information and downloads are available at http://www.agilent.com/find/calibrationsoftware

### Calibration Constant Resets Required

WB IF Cal Constant Reset

Under Test Plan, select Utilities and Calibration Constant Reset. Perform the test listed above.

### Adjustments Required

IF Frequency Response (Wide IF)

Under Test Plan, select Adjustments. Perform the adjustment listed above.

### Performance Testing Required

The performance tests listed below are the minimum set that will verify the hardware retrofit just installed is functioning correctly. Performing only these tests does not guarantee the instrument meets all specifications.

**A full calibration is required to assure the instrument meets all specifications.**

Performance testing requires the use of the calibration software. The latest software information and downloads are available at:
http://www.agilent.com/find/calibrationsoftware

| Performance Tests |
|---|
| Residual Responses |
| Input Noise Density (Wide IF) |
| Spurious Responses |
| Third Order Intermodulation Distortion (Wide IF) |
| Noise Sidebands < 50 kHz Offsets |
| Noise Sidebands > 50 kHz Offsets |
| Absolute Amplitude Accuracy |
| IF Frequency Response (Wide IF) |

### Manually Verify the Option

(**Optional**. Can be done if the installer wants to manually turn on the wideband path.)

Turn on the wideband IF path and view the internal calibration signal as follows:

The wideband IF is only accessible in the Basic instrument mode.

Press **Mode**, **Basic**

Press **Meas Setup**, **IF Path**, **Wide**. This selects the wideband IF path.

Press **Input/Output**, **Input Port**, **IF Align**

Press **IF Align Signal**

Press **Signal Type** and select **Comb**. The comb signal stimulates the wide bandwidth paths.

Press **Meas Setup**, **Res BW** and type in **150 kHz**

You will see a display of the internal comb signal that is generated on the A31 Wideband Analog IF assembly and sent through both the Wideband Analog IF assembly and the A32 Wide Band Digital IF assemblies. Disregarding the center tone, all comb teeth should be within 15 dB of each other, and at least 20 dB above the noise floor.

End of installation.

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

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