

**Agilent Technologies**  
**E4440AU Option H70**  
**Installation Guide**



# **Agilent Technologies E444xAU Option H70**

## **Field Retrofit Kit for the PSA 70MHz IF Output Installation Guide**

**Use this manual for these PSA Models:**

**E4440A/E4443A/E4445A/E4446A/E4448A**

**Agilent Technologies Part Number: E4440-90214**

**Printed in USA May 2003**

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# Agilent Technologies E444xAU Option H70

This chapter guides you through the steps necessary to insure you have received your full order. The steps are:

- Description of Agilent E444xAU Option H70
- Checking the shipment

## **Description**

The E444xAU H70 is a retrofit kit providing parts to install a 70 MHz IF Out (Option H70) to the rear panel in the E4440A/E4443A/E4445A Performance Spectrum Analyzer. The 321.4 MHz IF characteristics are also affected by this option. The E444xAU H70 consists of the parts listed in the next section. Refer to [“Checking the Shipment” on page 1-3](#).



## Checking the Shipment

Check the items received against [Table 1-1](#) to make sure that you have received all the items in your shipment. If there are any signs of damage that may have occurred during shipment, or any accessories appear to be damaged or missing, call your nearest Agilent Technologies sales or service office (refer to [“Contacting Agilent” on page 1-2](#) of Chapter 3 for the nearest office).

**Table 1-1 E444xAU Option H70 Accessories Supplied**

Description	Agilent Part Number	Quantity
Plug Hole .5D NY	6960-0149	1
Lbl LP .20HX.65L “H70”	9320-6209	1
Panel Rear Dress	E4440-00039	1
Loaded PC Board	E4440-60410	1
Cable AY W “40”	E4440-60411	1
Cable AY W “51”	E4440-60412	1
Cable AY W “41”	E4440-60413	1
Product Note	E4440-90213	1
Installation Guide	E4440-90214	1





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## Removal/Installation

Follow the steps outlined below to install your new Agilent E444xAU Option H70, 70MHz IF Output field retrofit kit.

1. Remove the four (4) rear panel feet on the PSA by using a #20 Torx driver. Refer to [Figure 2-1](#) for location of rear panel feet and screws.

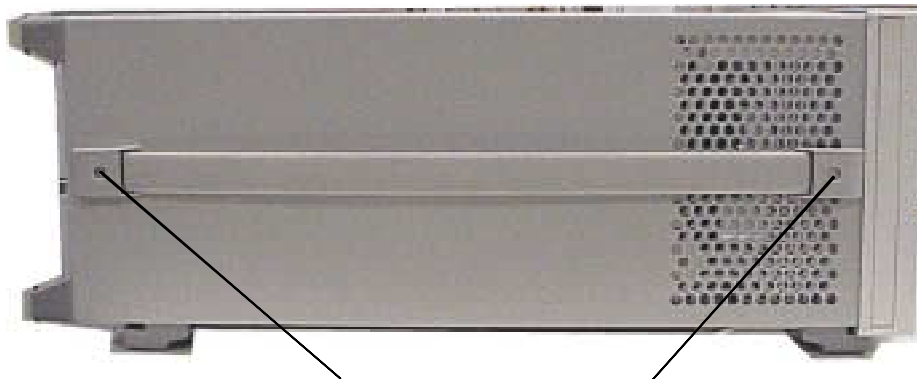
**Figure 2-1** PSA Rear Panel Feet with Screw Location



Remove the four (4) rear panel feet from the instrument with a Torx #20. **Note:** Upon reinstallation the torque is 21 inch pounds.

2. Remove the two (2) Side Handles on the PSA by using a #20 Torx driver. Refer to [Figure 2-2](#) for location of side handles and screws.

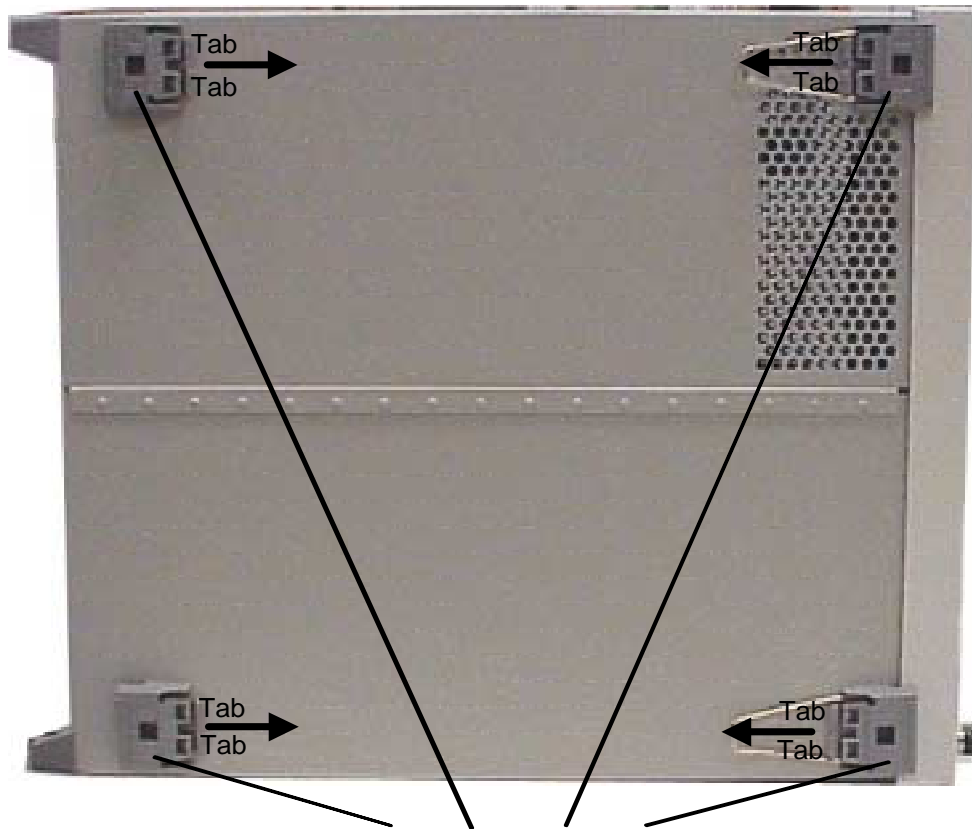
**Figure 2-2** PSA Side Handle with Screw Location



Remove the Side Handle screws on both sides of PSA instrument. Use a Torx #20 driver to remove the screws. **Note:** Upon reinstallation torque the screws on at 21 inch pounds.

3. Remove the four (4) feet from the bottom of the PSA instrument by pulling the tabs away from the instrument and sliding the feet toward the center of the instrument. Refer to [Figure 2-3](#) for location of bottom feet.

**Figure 2-3**      **Bottom Feet Orientation on PSA**

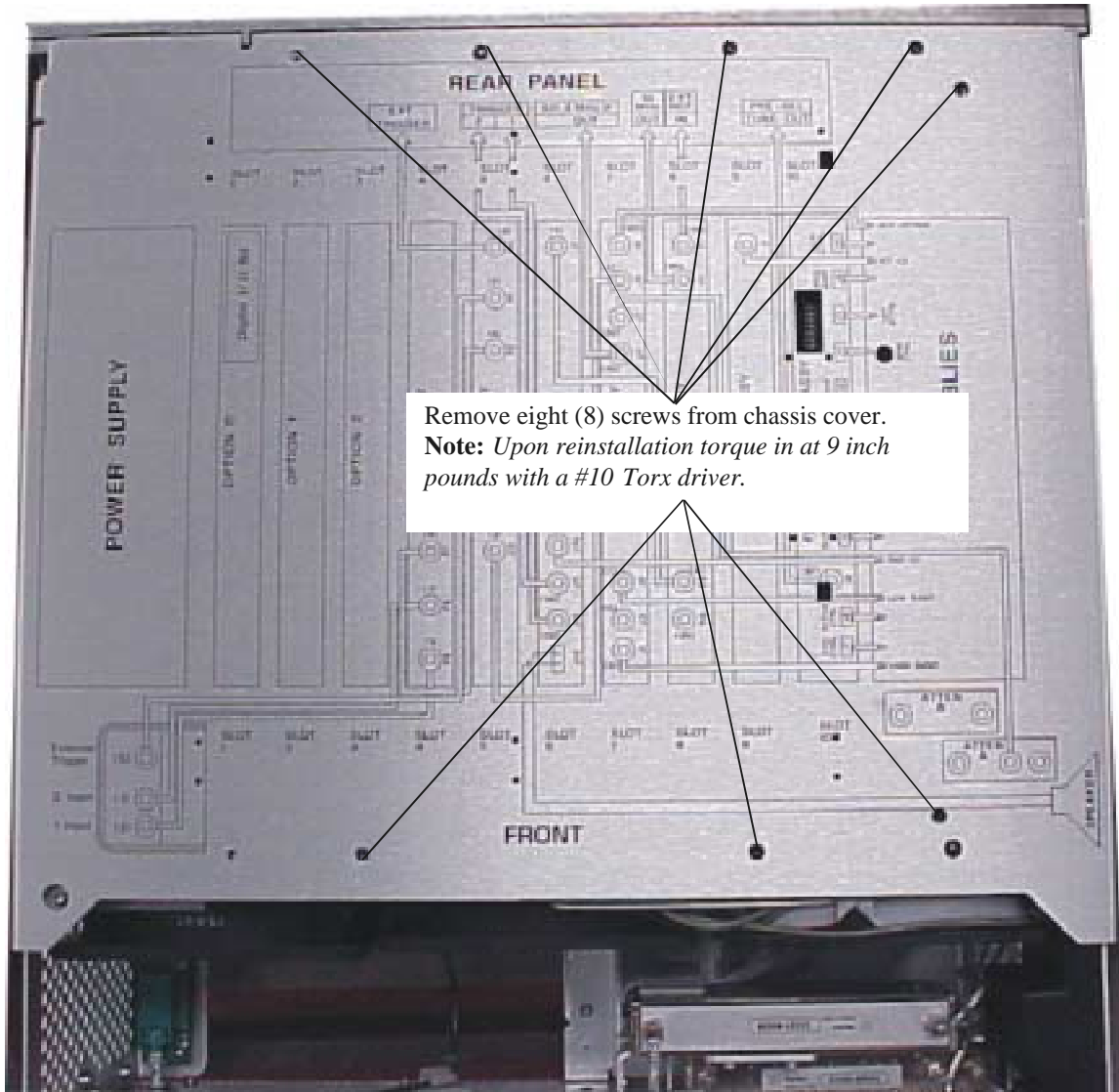


Remove the four (4) feet from the bottom of the PSA instrument. Pull tabs away from bottom of instrument and slide toward center.

4. Slide the Cover from the PSA by pulling it toward the rear direction.

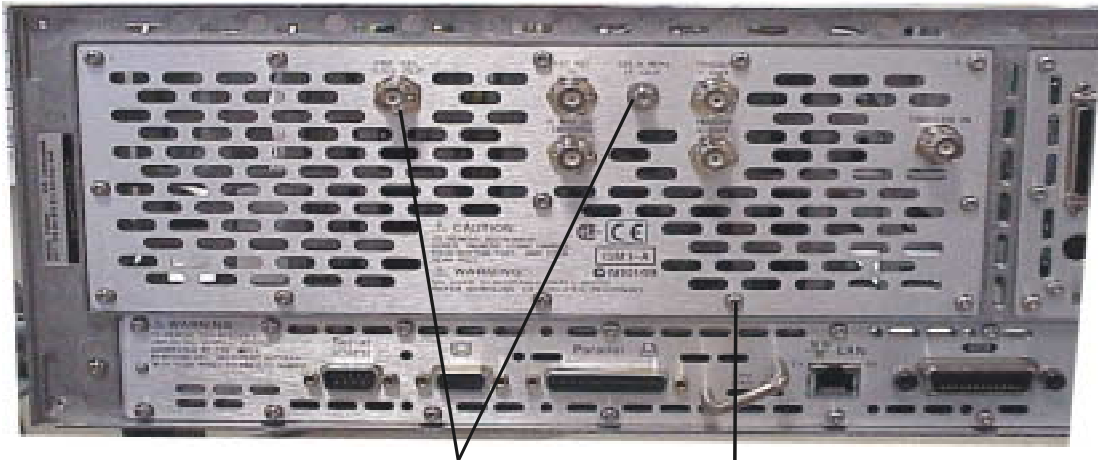
5. Remove the Chassis cover screws with a #10 Torx driver and remove the Chassis cover from the PSA instrument. Refer to [Figure 2-4](#) for location of top screws to remove. There are ten (10) screws to remove from the “speaker” side of the chassis cover and two (2) screws from the “power supply” side of the chassis cover. Place all hardware in a safe location for reinstallation later.

**Figure 2-4 Chassis Cover Screw Location**



6. Remove the rear plate from the rear panel by removing the 6 nuts that hold the BNC (f) connectors, the 1 nut that holds the SMA connector, and the 13 screws from the rear plate. Refer to [Figure 2-5](#) for locations of hardware to be removed from the PSA rear plate.

**Figure 2-5** PSA Rear Plate Connectors and Misc. Hardware



Remove the BNC nuts from the 6 connectors on the rear panel, and the 1 nut on the SMA connector. **Note:** The reinstallation of the BNC nuts will be torqued to 21 inch pounds, and the SMA nut will be torqued at 10 inch pounds.

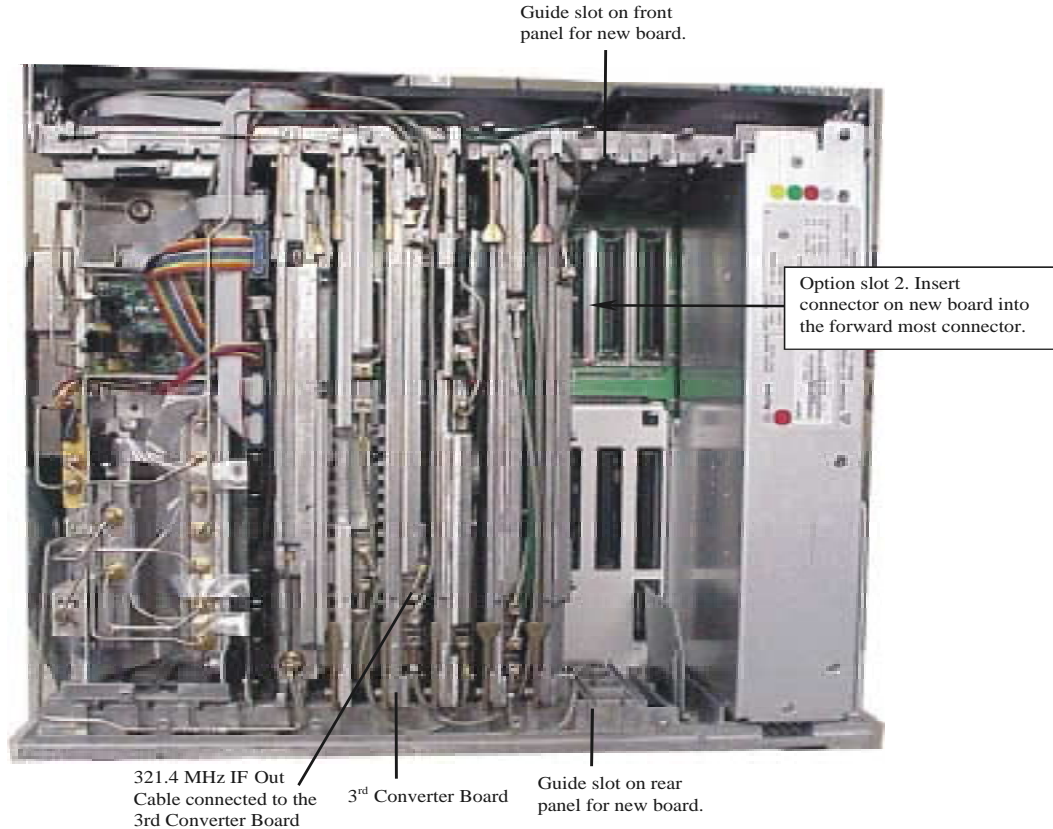
Remove the 13 screws from the rear plate using a Torx #10 driver. **Note:** Reinstallation will be reverse and torqued at 9 inch pounds.

7. Carefully pull the rear plate away from the BNC and SMA connectors. Insure that the cables are labeled so that the BNC connectors are inserted back into the correct holes on the new rear plate upon the reinstallation process.

8. Once the rear plate is removed, find the 321.4 MHz IF Out cable and carefully disconnect from the 3rd Converter Board by gently pulling up with the proper tool, (i.e. needle nose pliers). **Note:** The 321.4 MHz IF Out cable will be the one with the SMA connector end that went to the rear plate. Completely remove the cable from the instrument. Refer to [Figure 2-6](#) for cable location.

9. Insert the new 70MHz IF Board into Option Slot 2 of the PSA instrument. Look for the silk screening on the Mother board that reads "Option 2" for the proper location to insert the 70MHz IF Board. Insert the board into the slot with the connector of the board toward the front frame of the instrument. Insure the metal guides on the edges of the board are inside the grooves of the front and rear frames. Refer to [Figure 2-6](#) and [Figure 2-7](#). Press the board firmly into Option slot 2.

**Figure 2-6**      **Top View of Open PSA Instrument**

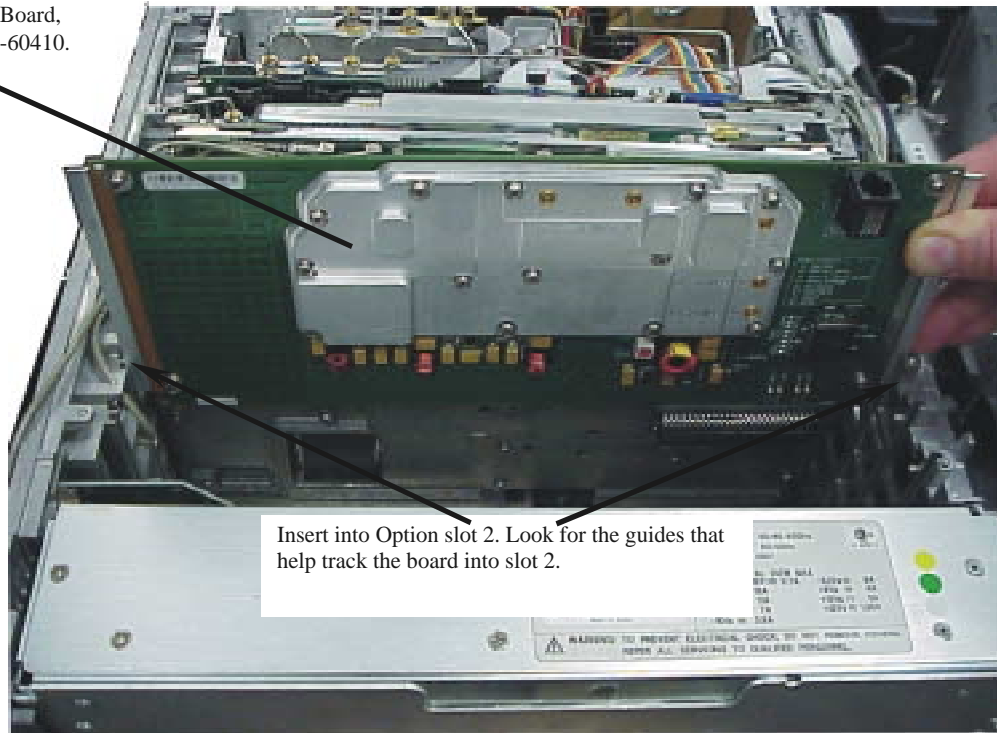


10. Route the new cable, part number E4440-60411(40) from the 321.4 MHz Out connector on the 3rd Converter Board to the 321.4 MHz IF input (J1) on the 70MHz IF Board. Route the 321.4MHz IF Output cable, part number E4440-60412 (51) from the 321.4MHz IF Output connector (J5) on the 70MHz IF Board to the new rear plate, part number E4440-00039 and the 70MHz IF Output cable, part Number E4440-60413 (41) from the 70 MHz IF Out connector (J2) on the 70 MHz IF Board to the rear plate. Refer to [Figure 2-8](#) and [Figure 2-9](#) for proper cable orientation and connector locations on the new 70MHz IF Board. Refer to orientation of existing cables and route the new cables along the top of the front and rear frame between the fingers in a manner to insure that they do not get crushed from the chassis cover upon reinstallation.

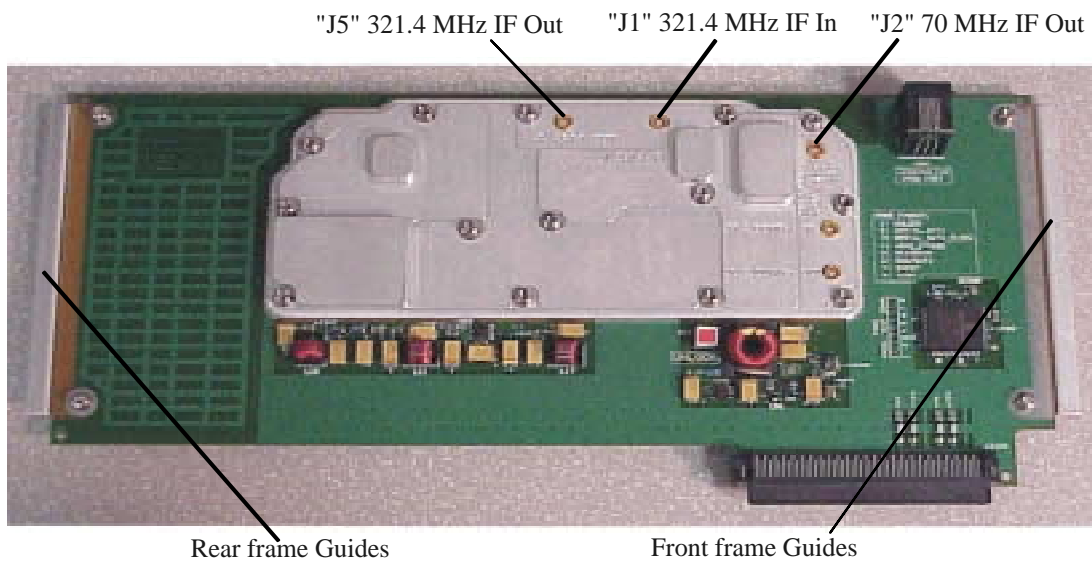


**Figure 2-7** 70 MHz IF Board Insertion into the PSA Instrument

70 MHz IF Output Board,  
part number E4440-60410.



**Figure 2-8** 70 MHz IF Board Connector Layout



11. Reinsert the BNC (f) connectors, washers and nuts to the new rear plate in their respective positions and secure hand tight. Use the

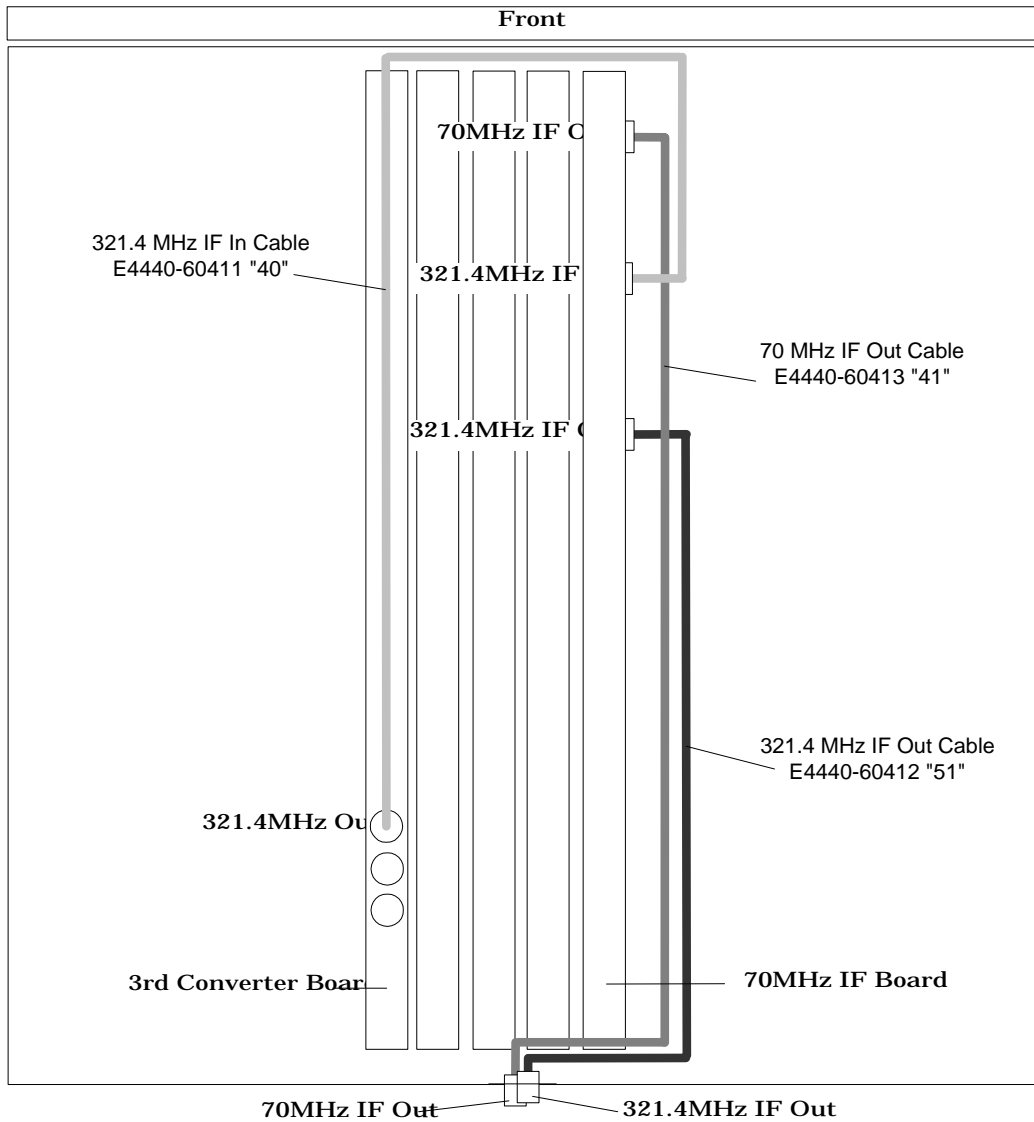
Removal and Installation  
Removal/Installation

removed hardware from step 6 above. Place the washers, and thread the nuts that secure the SMA connectors to the rear plate. Secure the nuts hand tight. Insure the proper cables are routed to the correct locations on the rear plate for the 321.4 MHz IF Out and the 70 MHz IF Out. Secure the new rear plate to the rear panel with the 13 screws removed in step 6 above, torque to 9 inch pounds. **Note:** *Inspect the proper alignment of the rear plate and make sure that there are no cables being crushed by the rear plate installation.* Torque the BNC and SMA nuts down on the rear plate as indicated in the various removal figure call outs. Insert the Plug, part number 6960-0149 into the hole labeled “21.4 MHz IF Out”.

12. Reinstall the chassis cover, instrument cover, side handles, bottom and rear feet in reverse order of the removal process described above.

13. Apply the “H70” label, part number 9320-6209 to the rear panel next to the existing list of options or serial number.

**Figure 2-9 Top View Cable Orientation**



*This concludes the installation of the E444xAU Option H70 into the PSA instrument.*

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## Nominal Characteristics

Review the following table for the nominal characteristics of the 321.4 MHz and 70 MHz IF Output of the E444xA with the new H70 option installed.

**Table 2-1 Nominal Characteristics for the 321.4 and 70 MHz IF**

Parameter	321.4 MHz IF	70 MHz IF
Frequency	321.4 MHz	70 MHz
Conversion Loss	-2 dB $\pm$ 2 dB *	-6 dB $\pm$ 2 dB *
IF Bandwidth		
Low Band < 3 GHz	40 MHz	40 MHz
High Band $\geq$ 3 GHz	30 – 60 MHz **	30 – 60 MHz **

\* Attenuator setting: 0dB. In high band, the Preselector Center routine must be performed to achieve the conversion loss listed in [Table 2-1](#). If applicable, when Option 1DS (100 kHz to 3 GHz Preamp) is on, there will be a 28 dB to 30 dB of gain in the 70 MHz IF output at the rear panel of the PSA. With the Preamp ON the conversion loss outlined in [Table 2-1](#) will be +22 dB.

\*\* Dependent on internal RF path. Typically, 40 MHz bandwidth increases as a function of center frequency, up to approximately 70 MHz with a center frequency of 26 GHz.

While performing the “Align All” routine on the PSA, the 70 MHz IF output will be corrupted due to the systems variable gain circuit stepping through the alignment routine.

The ripple correction in the flatness routine will be non-existent in the 70 MHz IF output since the 70 MHz IF is ported to the rear panel before the IF signal is digitized and used for the flatness correction routine.

## Performance Test

### Description

Example:

This test verifies that the Agilent PSA meets its amplitude accuracy specification for amplitude linearity. In this test, the source is connected to the RF Input through a 10 dB step attenuator. With the attenuator set to 0 dB, the source's output is adjusted for full-scale input. The attenuator is then set to 10 dB and amplitude linearity is checked at -10 dBm. This test checks amplitude linearity at -10, -20, -30, -40, -50, -60, and -70 dB. The source is set to 9.53 MHz, and the 10 dB step attenuator is set to 10, 20, 30, 40, 50, 60, and 70 dB

Example:

This test measures the PSA's amplitude response as a function of frequency. The test calculates the amplitude response relative to the 50 MHz and the peak-to-peak response. A signal is applied to the analyzer at several frequencies. At each frequency the signal amplitude is adjusted to place the signal at approximately the same displayed amplitude. A power meter measures the signal amplitude

### Equipment

Gather the equipment listed in the Tables below to verify the performance of the PSA amplitude at the 70 MHz IF Out on the rear panel.

**Table 2-2 Signal Source Equipment**

Description	Characteristics	Model
Synthesized Sweeper	Frequency: Must sweep 100 MHz around 1 GHz Amplitude: >0 dBm	83620B

**Table 2-3 Analyzer Equipment**

Description	Characteristics	Model
Spectrum Analyzer	Upper Frequency Range: 2 GHz	8562E 8563E

**Table 2-4 Power Meter Equipment**

Description	Characteristics	Model
Power Meter	Absolute Accuracy: $\pm 0.5\%$ Resolution: 0.01 dB Reference Accuracy: 1.2%Power Reference Accuracy: $\pm 0.9\%$ Compatible with Agilent 8480 series power sensors dB relative mode	E4419B E4418A
Power Sensor	Frequency Range: 1 MHz to 4.0 GHz SWR at 50 MHz: $\leq 1.05$ 1 MHz to 4 GHz SWR: $\leq 1.22:1$ Type-N(m), 50 $\Omega$	8482A 8481A

**Table 2-5 Cables**

Description	Characteristics	Part Numbers
APC 3.5 (m)(m) 2 required	DC to 26.5 GHz Length: $\leq 92$ cm (36 in) Insertion Loss: $\sim 2$ dB	8120-4921
SMA	Low-loss, 1 m	5064-5458

**Table 2-6**      **50 Ω Adapters**

<b>Description</b>	<b>Characteristics</b>	<b>Model Number/ Part Number</b>
Adapter, 3.5(f) to 3.5(f) Two required	VSWR: $\leq 1.05:1$	83059B
BNC to dual banana		1251-0781
BNC Tee (f,m,f)		1250-0781
BNC(m) to SMA(f)	VSWR: $\leq 1.13:1$	1250-1700
BNC(f) to SMA(m)		1250-1200
Type N(m) to 3.5mm(m)	VSWR: $\leq 1.08:1$	1250-1743
Type N(m) to APC 3.5(f) Two required	VSWR: $\leq 1.08:1$	1250-1744
Type N(f) to APC 3.5(f)	For the 83620B VSWR: 1.08:1	1250-1745
APC 3.5(m) to APC 3.5(m) Two required	VSWR: $\leq 1.12:1$	1250-1748
APC 3.5(f) to APC 3.5(f)	Connector saver for 83630B VSWR: 1.15:1	1250-1749
Type N(f) to APC 3.5(m) Two required	VSWR: 1.08:1	1250-1750
Type N(f) to N(f)	VSWR: 1.03:1 $\leq 1.3$ GHz ~1.15 $\leq 18$ GHz	1250-1472
Type N(m) to BNC(m)		1250-1473
Type N(m) to N(m)	VSWR: 1.03:1 $\leq 1.3$ GHz ~1.15 $\leq 18$ GHz	1250-1475
Type N(m) to BNC(f)	VSWR: $\leq 1.03:1 \leq 1.3$ GHz ~1.15 $\leq 18$ GHz	1250-1476
Type N(f) to BNC(m)	VSWR: 1.03:1 $\leq 1.3$ GHz ~1.15 $\leq 18$ GHz	1250-1477

## Test Procedure For the 70 MHz IF Out

Follow the steps below to prepare for the amplitude verification of the 70 MHz IF Output on the rear of the PSA.

1. Preset the E444xA PSA and all the test equipment.
2. Run Align All Now on the PSA. Press: [**System**], Alignments, Align All Now.
3. Initialize the test equipment parameters as follows

**Table 2-7 E444xA PSA Signal Analyzer Setup**

Parameter	Setting
Frequency Center Span	1 GHz 0 Hz
Resolution Bandwidth	1 MHz
Attenuation	Need to choose 0 dB since this setting will determine what the IF out level is with respect to the input signal
Frequency Reference	Internal

**Table 2-8 Synthesized Sweeper Setup**

Parameter	Settings
Frequency	1 GHz
Function	CW or Sine
Level	-10 dBm

4. Zero and calibrate the power sensor.
5. Connect the power sensor/power meter to the end of the Type-N cable that is connected to the source. Use an N(f) to N(f) adapter between the power sensor and the cable.
6. Adjust the source amplitude for a power meter reading of -10 dBm.
7. Disconnect the power sensor from the cable and connect the cable to the PSA RF Input.

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**NOTE**

If the PSA has option BAB (APC 3.5 input connector), use an APC 3.5 (f) to N(f) adapter between the PSA and the Type-N cable.

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8. Connect the PSA rear panel 70 MHz IF Out to the RF Input of the spectrum analyzer. Use an SMA or APC 3.5 cable and appropriate adapters as needed.
9. Initialize the spectrum analyzer parameters as follows on Table 1-8.

**Table 2-9 70 MHz Measurement Spectrum Analyzer Settings**

Parameter	Settings
Center Frequency	70 MHz
Span	5 MHz
Res BW	1 MHz
Reference Level	0 dBm
Log Scale	5 dB/Div.

10. Record the amplitude of the 70 MHz Output. The signal level should be -16 dBm +/- 2 dB. This equates to a 6 dB loss between the RF input and the 70 MHz Output port.

### Test Procedure For the 321.4 MHz IF Out

1. Using the previous steps for the 70 MHz IF Out measurements, connect the PSA rear panel 321.4 MHz IF Out to the RF Input of the spectrum analyzer. Use an SMA or APC 3.5 cable and appropriate adapters. Initialize the spectrum analyzer parameters as follows to measure the 321.4 MHz IF Out on the rear of the PSA.

**Table 2-10 321.4 MHz Measurement Spectrum Analyzer Settings**

Parameter	Settings
Center Frequency	321.4 MHz
Span	5 MHz
Res BW	1 MHz
Reference Level	0 dBm
Log Scale	5 dB/Div.

2. Record the amplitude of the 321.4 MHz Output. The signal level should be -12 dBm +/- 2 dB. This equates to a 2 dB loss between the RF Input and the 321.4 MHz Output port.

## Measuring the Bandwidth of the IF Outputs

1. While the spectrum analyzer is still connected to the 321.4 MHz IF Output connector on the rear of the PSA, configure the PSA and test equipment as follows:

**Table 2-11 E444xA PSA Signal Analyzer Setup**

Parameter	Setting
Frequency Center Span	1 GHz 0 Hz
Resolution Bandwidth	1 MHz
Attenuation	Need to choose 0 dB since this setting will determine what the IF out level is with respect to the input signal
Frequency Reference	Internal

**Table 2-12 Bandwidth Measurement Spectrum Analyzer Setup**

Parameter	Settings
Center Frequency	321.4 MHz
Span	100 MHz
Res BW	3 MHz
Reference Level	0 dBm
Log Scale	5 dB/Div.
Trace	MAX Hold

**Table 2-13 Synthesized Sweeper Setup**

Parameter	Settings
Frequency Start Freq Stop Freq	950 MHz 1050 MHz
Function	CW or Sine
Level	-10 dBm

2. While the measuring spectrum analyzer is in max hold, the sweeper is sweeping, and the response of the 321.4 MHz output is displayed on the spectrum analyzer.

3. Press peak search on the spectrum analyzer to place a marker on the peak of the response.
4. Press marker delta on the spectrum analyzer and adjust the delta marker down the skirt of the response to the 3 dB point.
5. Press marker delta again and adjust the marker back through the peak response and down the other skirt until the marker amplitude reads 0 dB. The marker delta frequency is the 3 dB bandwidth of the output port.
6. Refer to the [“Nominal Characteristics” on page 2-10](#) to verify the results of your tests.
7. Connect the spectrum analyzer to the 70 MHz IF Output port on the rear panel of the PSA.
8. Repeat steps 3 through 6.

Removal and Installation  
**Performance Test**

**Service, Safety, and Regulatory  
Information**

## Contacting Agilent

<b>Online assistance:</b> <a href="http://www.agilent.com/find/assist">www.agilent.com/find/assist</a>			
<b>United States</b> <i>(tel)</i> 1 800 452 4844	<b>Latin America</b> <i>(tel)</i> (305) 269 7500 <i>(fax)</i> (305) 269 7599	<b>Canada</b> <i>(tel)</i> 1 877 894 4414 <i>(fax)</i> (905) 282-6495	<b>Europe</b> <i>(tel)</i> (+31) 20 547 2323 <i>(fax)</i> (+31) 20 547 2390
<b>New Zealand</b> <i>(tel)</i> 0 800 738 378 <i>(fax)</i> (+64) 4 495 8950	<b>Japan</b> <i>(tel)</i> (+81) 426 56 7832 <i>(fax)</i> (+81) 426 56 7840	<b>Australia</b> <i>(tel)</i> 1 800 629 485 <i>(fax)</i> (+61) 3 9210 5947	<b>Singapore</b> <i>(tel)</i> 1 800 375 8100 <i>(fax)</i> (65) 836 0252
<b>Malaysia</b> <i>(tel)</i> 1 800 828 848 <i>(fax)</i> 1 800 801 664	<b>Philippines</b> <i>(tel)</i> (632) 8426802 <i>(tel)</i> (PLDT subscriber only): 1 800 16510170 <i>(fax)</i> (632) 8426809 <i>(fax)</i> (PLDT subscriber only): 1 800 16510288	<b>Thailand</b> <i>(tel)</i> outside Bangkok: (088) 226 008 <i>(tel)</i> within Bangkok: (662) 661 3999 <i>(fax)</i> (66) 1 661 3714	<b>Hong Kong</b> <i>(tel)</i> 800 930 871 <i>(fax)</i> (852) 2506 9233
<b>Taiwan</b> <i>(tel)</i> 0800-047-866 <i>(fax)</i> (886) 2 25456723	<b>People's Republic of China</b> <i>(tel)</i> (preferred): 800-810-0189 <i>(tel)</i> (alternate): 10800-650-0021 <i>(fax)</i> 10800-650-0121	<b>India</b> <i>(tel)</i> 1-600-11-2929 <i>(fax)</i> 000-800-650-1101	

## **Safety and Regulatory Information**

### **Introduction**

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

### **Cleaning Instructions**

Clean the instrument cabinet using a damp cloth only.

## Safety Information

### Warnings

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**WARNING** The **WARNING** notice denotes a hazard. It calls attention to a procedure, practice, or the like, which if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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Warnings applicable to this instrument are:

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**WARNING** No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

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**WARNING** If this instrument is not used as specified, the protection provided by the equipment could be impaired. This instrument must be used in a normal condition (in which all means for protection are intact) only.

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**WARNING** For continued protection against fire hazard replace line fuse only with same type and rating:

- United States—F 3A/250V, Part Number 2110-0780
- Europe—F 3.15A/250V, Part Number 2110-0655

The use of other fuses or material is prohibited.

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**WARNING** This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.

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**WARNING** The power cord is connected to internal capacitors that may retain dangerous electrical charges for 5 seconds after disconnecting the plug from its power supply.

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**WARNING** These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

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**WARNING** The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

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**WARNING** This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664 respectively.

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## Cautions

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**CAUTION** The CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

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Cautions applicable to this instrument are:

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**CAUTION** Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding (by not using this cord) can cause instrument damage.

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**CAUTION** This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.










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**CAUTION** Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4° C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

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### Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
ISM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is OFF or in STANDBY position.
	This symbol indicates the product meets the Australian Standards.

**Safety  
Earth  
Ground**



This is a Safety Class I product (provided with a protective earthing terminal). An uninterrupted safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

