Installation Note

Agilent Technologies
E4406A VSA Transmitter Tester
Baseband I/Q (Option B7C) Upgrade Kit
Kit Part Number E4406-60168

Agilent Technologies

Part Number E4406-90209
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Description

This kit provides hardware and installation instructions for the A7 baseband I/Q assembly. See “Installation Procedure” on page 5. The A7 assembly has been tested to verify that it meets all specifications. A functional test is provided to ensure that the A7 assembly was not damaged during shipment and that it has been properly installed. See “Functional Test” on page 13.

Installation requires about two hours and should be performed by a qualified technician.

Kit Contents:

Item Number	Part Number	Description
1	E4406-60158	Baseband I/Q Assembly (with baseband I/Q rear ejector for slot 1)
2	E4406-80041	Front Panel Overlay, Left
3	E4406-00078	Top Brace
4	E4406-60161	I Cable
5	E4406-60162	$\overline{\text{I}}$ Cable
6	E4406-60163	Q Cable
7	E4406-60164	$\overline{\text{Q}}$ Cable
8	2950-0035	Nut Hex 15/32-32 (4)
9	E4406-20115	Standard Rear Ejector (for slot 2)
10	1400-0249	Cable Tie
11	1400-3014	Cable Clip
12	1250-0207	50 Ohm BNC Terminator
13	E4406-90209	Baseband IQ Upgrade Kit Install Note

Before You Start

Follow these steps before you start the installation process:

- Read the section entitled “Safety Considerations” in the user’s guide for the instrument to ensure you are familiar with the safety symbols marked on the instrument.
- Read the section entitled “ESD Information” that is found in the service guide for the instrument. The instrument contains static sensitive components that can be damaged if not properly handled.

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

WARNING **The instrument contains potentially hazardous voltages. Refer to the safety symbols on the instrument and the general safety considerations at the beginning of the service guide before operating the unit with the covered removed. Failure to heed safety precautions can result in severe or fatal injury.**

Service Equipment You Will Need

Description	Agilent Part
TORX Hand Driver - Size T10	8710-1623
TORX Hand Driver - Size T15	8710-1622
TORX Hand Driver - Size T20	8710-1615
9/16 Deep Socket Nut Driver	8720-0008
Diagonal Cutters	8710-1294

Installation Procedure

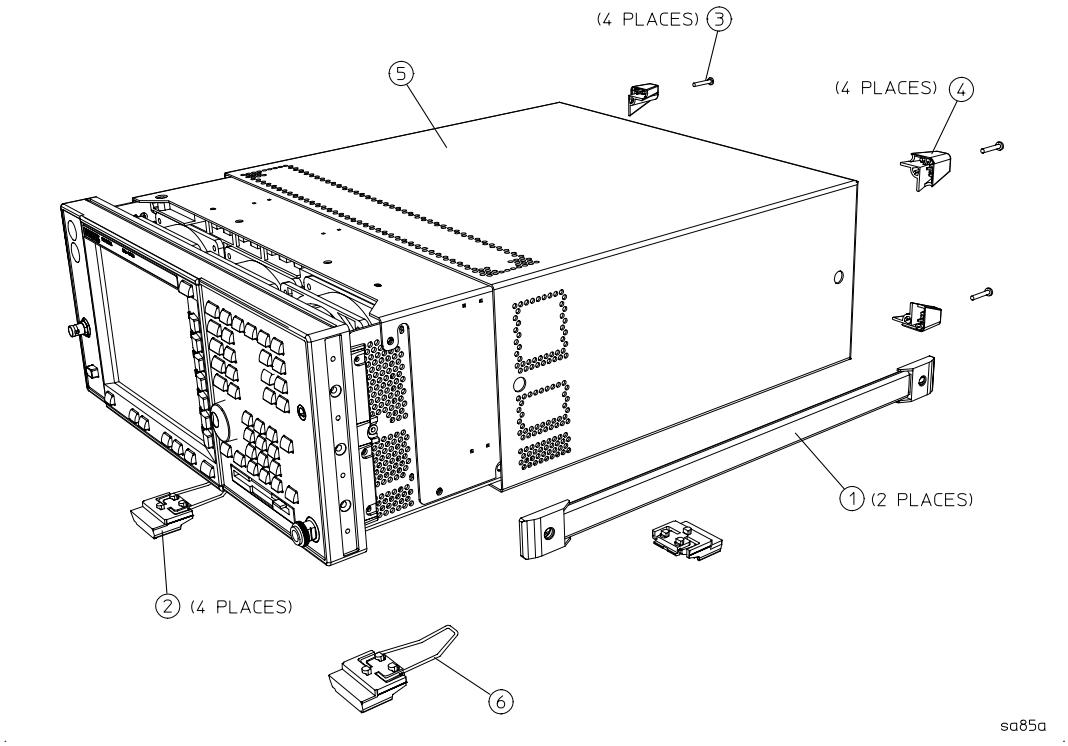
Step 1. Remove the outer case of the instrument

NOTE After installation of the A7 assembly is complete perform the functional test described in "Functional Test" on page 13.

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

1. Disconnect the instrument from ac power.
2. There are two handles on the sides of the instrument that must be taken off. Refer to Figure 1. Using the T-20 driver, loosen the screws that attach each handle **(1)**. Remove the handles.
3. Remove the four bottom feet **(2)**. This is done by lifting up on the tabs on the feet, and sliding the feet in the direction indicated by the arrows.
4. Using the T-15 driver, remove the four screws **(3)** that hold the rear feet **(4)** in place.
5. Pull the instrument cover **(5)** off towards the rear of the instrument.

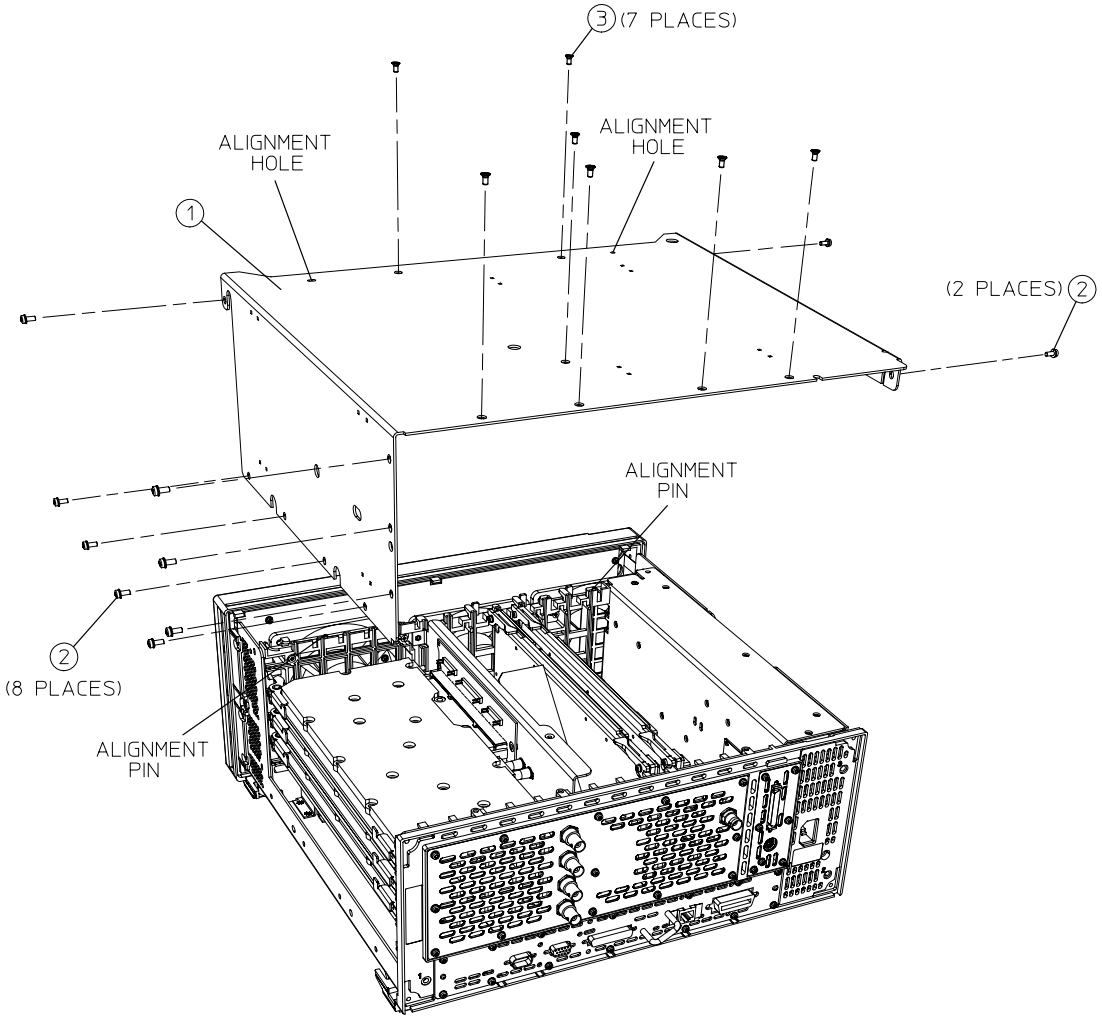
Figure 1 Instrument Outer Case Removal



Step 2. Remove the top brace

1. If you haven't already done so, remove the instrument outer case. Refer to the "Step 1. Remove the outer case of the instrument" on page 5.
2. Using the T-10 driver, remove the 7 top screws **(3)** and the 10 side screws **(2)** attaching the top brace **(1)** to the deck. The top screws are different from the side screws. Be careful not to mix them. Refer to Figure 2 on page 6.
3. The top brace can now be removed from the deck.

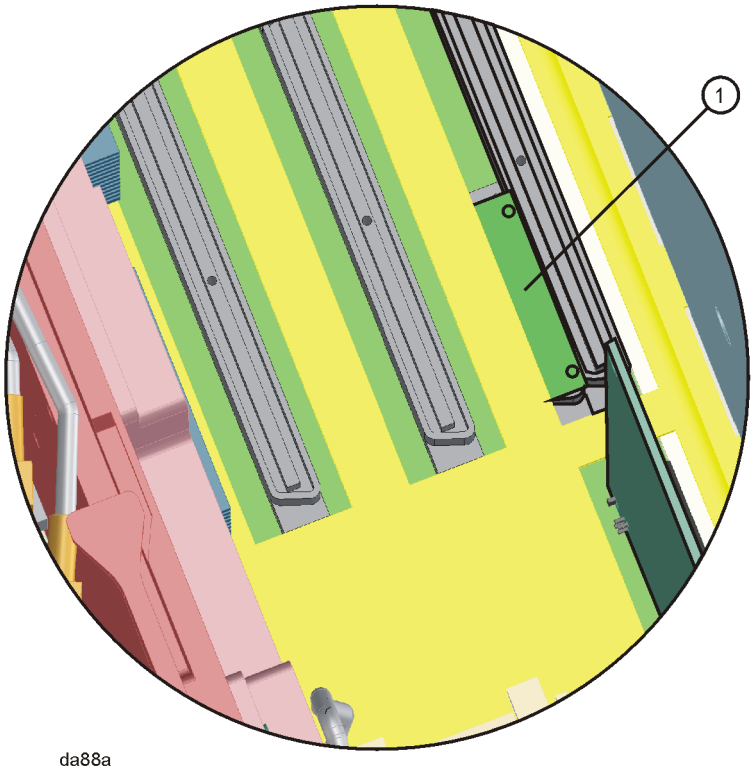
Figure 2 Top Brace Removal



Step 3. Determine where to install the A7 assembly

1. Examine slot 1 to determine if the GPIB capacitor board is installed. The GPIB capacitor board is a small board located between slot 1and slot 2, adjacent to the A25 SCSI board. See item 1 in Figure 3.
2. If the GPIB capacitor board is present you will install the A7 assembly in slot 2. Go to step 4.
3. If the GPIB capacitor board is not present you will install the A7 assembly in slot 1. Go to step 5.

Figure 3 Slot 1 with GPIB Board Installed



Step 4. Attach the standard rear ejector to the A7 assembly

1. Remove the screw that secures the baseband I/Q rear ejector to the A7 assembly, using the T-10 driver. For an illustration of the baseband I/Q rear ejector attached to the A7 assembly see item 1 in Figure 4.
2. Secure the standard rear ejector to the A7 assembly using the screw you removed in step 1. Use the T-10 driver. For an illustration of the standard ejector attached to the A7 assembly see item 1 in Figure 5.
3. Proceed to step 5.

Figure 4 A7 Assembly with Baseband I/Q Rear Ejector Attached

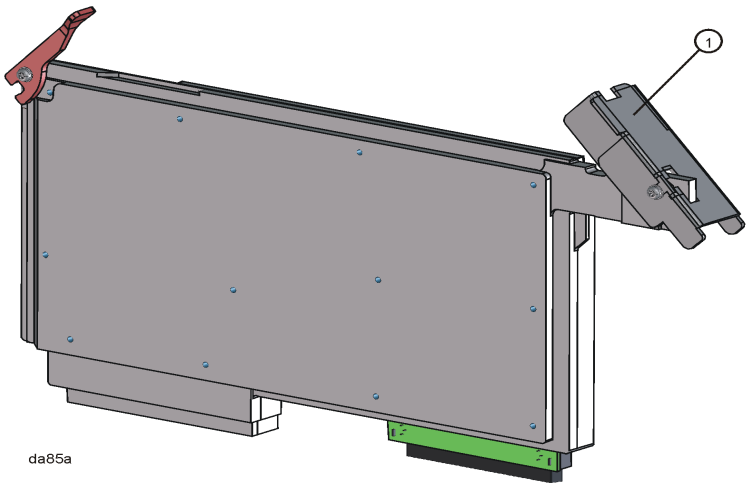
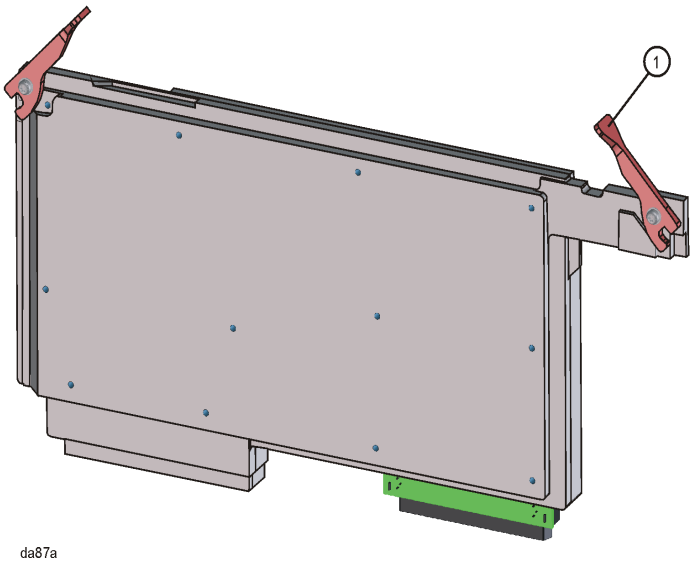


Figure 5. A7 Assembly with Standard Rear Ejector Attached



Step 5. Insert the A7 assembly into the instrument

1. Slide the A7 assembly into the front and rear guides of slot 1 or slot 2 (see "Step 3. Determine where to install the A7 assembly" to identify which slot should be used for your instrument). Figure 6 shows the A7 assembly, with the baseband I/Q rear ejector (item 1), inserted into slot 1. Figure 7 shows the A7 assembly, with the standard rear ejector (item 1), inserted into slot 2.
2. Hook the front and rear ejectors under the tabs located on the rear frame and the mid web of the instrument.
3. Carefully push down on the ejectors to mate the A7 assembly with the motherboard.

Figure 6 A7 Assembly with Baseband I/Q Rear Ejector

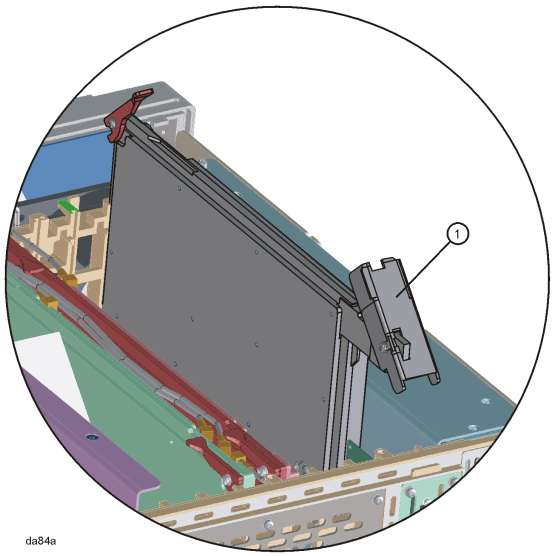
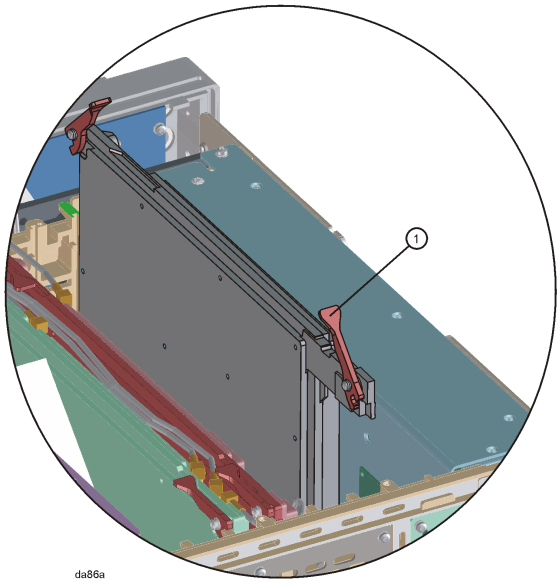


Figure 7 A7 Assembly with Standard Rear Ejector



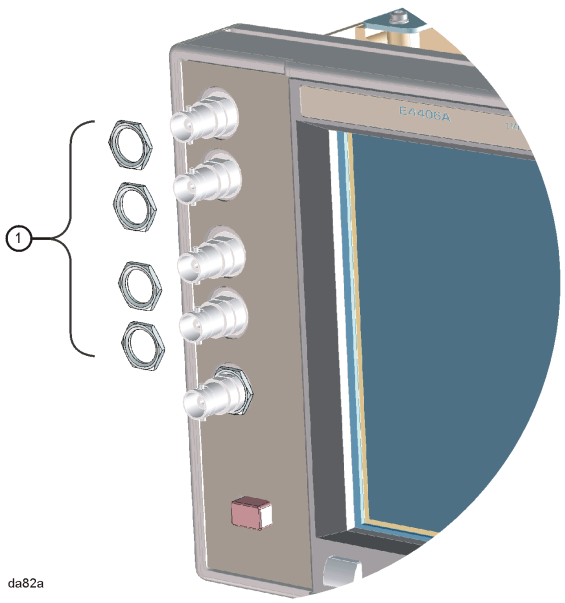
Step 6. Install the baseband I/Q connectors

1. Remove the black plugs that have been inserted in the four connectors located on the left side of the front panel above the **EXT TRIGGER INPUT** connector.
2. Remove the front panel overlay that covers the input connectors on the left side of the instrument.
3. Attach the new front panel overlay (E4406-80041) to the left side of the instrument.
4. Insert the baseband I/Q cable connectors through the rear of the front panel assembly as indicated below.

Cable	Front Panel Location	Cable Identification	Part Number
I	Insert in top opening	12	E4406-60161
Q	Insert in next-to-top opening	14	E4406-60163
$\overline{I}$	Insert in next-to-bottom opening	13	E4406-60162
$\overline{Q}$	Insert in bottom opening	15	E4406-60164

5. Secure the four I/Q baseband connectors to the front panel using four 15/32-32 hex nuts (2950-0035), item 1 in Figure 8. Use the 9/16 deep socket nut driver. See Figure 8.

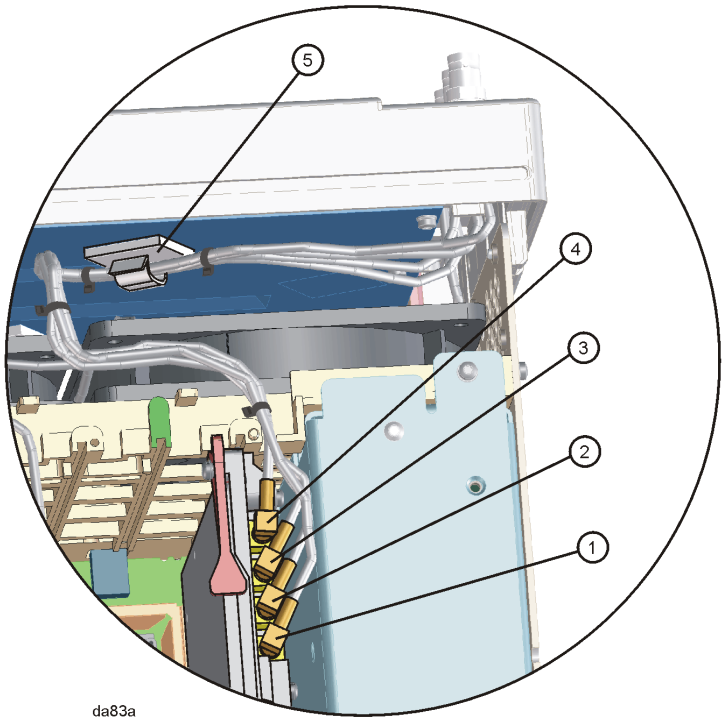
Figure 8 Front Panel Baseband I/Q Connectors



6. Connect the I, $\overline{I}$, Q, and $\overline{Q}$ cables to their respective connectors on the top-front of the A7 assembly. Each connector is labeled both with the I/Q designation and the numerical code of the cable. For example, the $\overline{Q}$ connector is labeled "$\overline{Q}$, 14". In Figure 9:

   Item 1 is the Q (14) cable.
   Item 2 is the $\overline{Q}$ (15) cable.
   Item 3 is the I (12) cable.
   Item 4 is the $\overline{I}$ (13) cable.

Figure 9 Cable Routing from Front Panel to A7 Assembly



7. Attach the cable clip (1400-3014) to the rear of the front panel assembly as shown in item 5 of Figure 9. Use the four cable ties (1400-0249) to make the cable assembly more compact so it is easier to route, first through the cable clip, then to the A7 assembly, as shown in Figure 9.
8. Proceed to step 7 to replace the top brace and the cover of the instrument.

Replacing the top brace and the cover of the instrument

Step 7. Replace the Top Brace

1. Carefully position the new, replacement top brace (E4406-00078) on the deck. Reference the two alignment pins and the two alignment holes. Make sure that no coaxial cables will get pinched underneath the brace.
2. Using the T-10 driver, replace the 7 top screws first, and then the 10 side screws after the top screws are tightened. Torque to 9 inch pounds.

Step 8. Replacing the outer cover of the instrument

1. If the instrument is connected to ac power, disconnect the power cord.
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. Using the T-15 driver, attach the four rear feet with the four screws to the instrument. Torque to 21 inch pounds.
4. Using the T-20 driver, replace the handles. Torque to 21 inch pounds.
5. Replace the four bottom feet by pressing them into the holes in the case and sliding in the opposite direction of the arrows until they click into place. Note that the feet at the front have the tilt stands.

Functional Test

The functional test checks various instrument parameters to ensure with a high degree of confidence that the A7 assembly is operating correctly. The functional test specifically measures the amplitude accuracy of the baseband I/Q assembly. It is recommended as a check of instrument functionality when the A7 assembly is installed, for incoming inspection, and after a repair. The test takes approximately one hour.

Measurement uncertainty analysis is not available for functional tests; the instrument is checked against limits that are wider than the published specifications. The test is designed for the operational temperature range defined in the specifications using a minimum set of test equipment. If a failure occurs, please check the A7 assembly to ensure it is correctly installed and that all cables are correctly positioned and connected. Also check that no cable is pinched or frayed.

Before You Start

You must do the following *before* starting the functional test:

1. Ensure you have the proper test equipment. Refer to the table of equipment below.
2. Turn on the unit under test (UUT). Let it warm-up in accordance with the warm-up requirements found in the instrument specifications document.
3. Ensure that the frequency reference is set to internal by pressing **System**, then **Reference**. Under the **Ref Oscillator** softkey you will see labels for **Int** or **Ext** settings. The **Int** label should be underlined. If not, press the **Ref Oscillator** softkey to set the reference oscillator to internal.

Test Equipment

Instrument	**Critical Specifications**	**Recommended Agilent/HP Model**	**Alternative Agilent/HP Model**
Signal Source: Function/Arbitrary Waveform Generator -or- Synthesize Signal Generator	Frequency: 100 kHz to 55 MHz Harmonic Level: <-30dBc Amplitude Range: -12 to -20 dBm Level Accuracy: +/- 0.5 dB	33120A -or- E443xB	
Terminations: Terminations 50 Ohms	Type BNC (m) Connector Frequency: 100 kHz to 5MHz	1250-0207	
Cables: Type BNC	50 Ohm BNC (2 ft.)	8120-1839	
Adapters: Type	N(m) to BNC (f) adapter	1250-0780	

Baseband I/Q Amplitude Accuracy Test

Test Limits

Amplitude accuracy results should remain within +/-1 dB of the measured source value for all input connector and impedance settings.

Test Description

The amplitude accuracy test measures the absolute amplitude of the baseband I/Q inputs at 100 kHz and 5 MHz. An arbitrary waveform generator or synthesized signal generator is used as the signal source for the test. Most input configurations and ADC voltage ranges for the baseband I/Q signal path are tested.

Procedure

1. Press **Mode**, then **Basic** to select the Basic mode for the UUT.
2. Press **Preset** to preset the UUT.
3. If the auto alignment for the UUT has not been run within the last hour, press **System**, **Alignment**, then **Align All Now** to activate the alignment.
4. Initialize the parameters for the instrument as listed in Table 9-1 by following these steps:
   a. Press **Input**, **Input Port**, **I only**.
   b. Press **Input**, **I/Q Setup**. **I/Q Input Z**, **50 ohms Unbalanced**.
   c. Press **Meas Setup**, **Span**, **200kHz**.

Table 9-1 UUT Initialization for 100kHz Test

Parameter			**Setting**
Mode			Basic
Measure			Spectrum
Input	Input Port		I only
	I/Q Setup	I/Q Input Z	50 ohms
		I/Q Z Ref	50 ohms
	I/Q Range		1 Volt
Span			200 kHz
Resolution Bandwidth			4k Hz

5. Preset the signal source and initialize the test equipment parameters as shown in Table 9-2.

Table 9-2 Signal Source Initialization

Parameter	Setting
Frequency	100 kHz
Level	-16 dBm (100mVPP)
Modulation	Off

6. Perform the following steps for each test setup listed in Table 9-3 on page 16.
   a. Press **Input**, **Input Port** to configure the input port of the instrument.
   b. Press **Input**, **I/Q Setup**, **I/Q Input Z** to configure input impedance.
   c. Press **Input**, **I/Q Range** to select the desired voltage range.
   d. Connect the signal source to the specified I/Q input connector. For balanced measurements (when the I/Q input Z is 600 ohms balanced or 1 M ohm balanced) connect a 50 Ω BNC terminator to the complementary input. The complementary input for I is $\overline{I}$ and for Q is $\overline{Q}$.
   e. Press **Marker**, **Search**.
   f. Record the measured value in the UUT Measured Amplitude column for 100 kHz in Table 9-3.
   g. Compare the measured and nominal values to ensure that the measured value is within the 1dB test limit.
7. Press **SPAN**, **5**, then **MHz** to change the span of the UUT.
8. Change the signal source frequency to 5 MHz.
9. Repeat step 6 and record the measured value in the UUT Measured Amplitude column for 5 MHz.

Table 9-3 Amplitude Accuracy at 100kHz and 5MHz

Input Port	I/Q Input Z	I/Q Range (V)	I/Q Input Connector	UUT Measured Amplitude (dBm)		Nominal Amplitude (dBm)	Test Limits (dB)
				100kHz	5MHz		
I only	50 Ω Unbalanced	1	I input			-16	+/- 1.0
I only	50 Ω Unbalanced	0.25	I input			-16	+/- 1.0
I only	50 Ω Unbalanced	0.125	I input			-16	+/- 1.0
I only	600 Ω Balanced*	1	I input			-22	+/- 1.0
I only	1 MΩ Unbalanced	1	I input			-10	+/- 1.0
I only	1 MΩ Balanced*	1	I input			-10	+/- 1.0
I only	1 MΩ Balanced*	1	$\overline{I}$ input (I bar)			-10	+/- 1.0
Q only	50 Ω Unbalanced	1	Q input			-16	+/- 1.0
Q only	50 Ω Unbalanced	0.25	Q input			-16	+/- 1.0
Q only	50 Ω Unbalanced	0.125	Q input			-16	+/- 1.0
Q only	600 Ω Balanced*	1	Q input			-22	+/- 1.0
Q only	1 MΩ Unbalanced	1	Q input			-10	+/- 1.0
Q only	1 MΩ Balanced*	1	Q input			-10	+/- 1.0
Q only	1 MΩ Balanced*	1	$\overline{Q}$ input (Q bar)			-10	+/- 1.0

* Whenever performing a balanced measurement ensure the complimentary input is terminated (for a balanced input, when the signal source is connected to the I input the $\overline{I}$ input must be terminated).

Determining the Recalibration Due Date

The baseband I/Q assembly in this kit has passed all performance verification tests that are performed at the factory. It has been determined that A7 assembly performance is independent of instrument functionality. It has also been determined that the calibration of this product is not affected by storage prior to its initial receipt by the customer. The recalibration cycle of this unit should be based on the recommended calibration interval calculated from the date of initial use by the customer.

The calibration interval recommended by Agilent Technologies is explained in the appropriate product manual. The customer should apply either the calibration interval recommended by Agilent Technologies or an interval that satisfies the internal quality system requirements of their own organization, calculated from the date of first use of the A7 assembly.

Agilent Technologies Sales and Services Offices

Contact your nearest Agilent Technologies sales and service office by internet, phone, or fax for assistance if you have a problem with the A7 baseband I/Q. See Table 9-4. Please provide the following information:

Model Number: E4406A

Serial Number: XXXXXXXXXX

State that you are having a problem with the A7 baseband I/Q assembly.

Table 9-4 Contacting Agilent

Online assistance: `www.agilent.com/find/assist`

United States
(tel) 1 800 452 4844

Latin America
(tel) (305) 269 7500
(fax) (305) 269 7599

Canada
(tel) 1 877 894 4414
(fax) (905) 282-6495

Europe
(tel) (+31) 20 547 2323
(fax) (+31) 20 547 2390

New Zealand
(tel) 0 800 738 378
(fax) (+64) 4 495 8950

Japan
(tel) (+81) 426 56 7832
(fax) (+81) 426 56 7840

Australia
(tel) 1 800 629 485
(fax) (+61) 3 9210 5947

Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People’s Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101