Manual Supplement

Agilent Technologies
ESG Family Signal Generators
Option H99 (Revision B)

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1 Option Overview

This supplement provides information for the ESG-D and ESG-DP Option H99 (Revision B) signal generator. This chapter provides a brief overview of the option along with option requirements and compatibility.

Overview

Option H99 (Revision B) provides improved adjacent channel power (ACP) performance over Option H99 (Revision A) for wideband CDMA, and improved ACP over the standard signal generator for IS-95 CDMA and TETRA. This option is compatible with the ESG-D and ESG-DP series signal generators. In addition, it incorporates new softkeys and SCPI commands that provide filtering capability which can be switched in the baseband path.

Option Requirements

Option H99 (Revision B) requires firmware version B.03.50 or greater and the installation of at least one of the following options:

- Option UND (internal dual arbitrary waveform generator)

- Option UN3 (I/Q baseband generator with 1 Mbits of RAM)

- Option UN4 (I/Q baseband generator with 8 Mbits of RAM)

- Option UN8 (real-time I/Q baseband generator)

Option Compatibility

Option H99 (Revision B) is *not* compatible with the following options:

- Option UNA (alternate timeslot power level control)

- Option UNB (higher power with mechanical attenuator)

- Option H98 (W-CDMA receiver test baseband generator)

A9 Output Board

The A9 Output Board, E4400-60188, for Option H99 (Revision B) is a new part. This replaces the Option H99 (Revision A) A9 Output Board, E4400-60155, for all Option H99 signal generator configurations except for the ones that have Option H98 installed. See "Replaceable Parts" on page 4-2 for more information.

An Option H99 replacement kit has been created (E4400-60228) to replace the E4400-60155 A9 Output Board in signal generators without Option H98 installed. See "A9 Output Board E4400-60155" on page 4-2 for more information.

2 Softkey and SCPI Command Reference

This chapter describes the ESG-D and ESG-DP Option H99 (Revision B) signal generator softkeys and SCPI commands.

Softkey Reference

Option H99 (Revision B) signal generators have additional softkeys that control the filtering at the output of the I and Q modulation drivers.

NOTE   The 2.100 MHz baseband filter is automatically selected whenever a wideband CDMA format is activated.

2.100 MHz

Selects a 2.100 MHz lowpass baseband filter at the output of the I and Q modulation drivers. The 2.100 MHz baseband filter is automatically selected when a wideband CDMA format is activated.

Softkey Location: **I/Q** > **Baseband Filter** > **2.100 MHz**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** >
W-CDMA (3GPP 3.1 12-99) > **W-CDMA Define** > **Baseband Filter** > **2.100 MHz**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** > **W-CDMA (Rev 1.0-1.2)** >
W-CDMA Define > **Baseband Filter** > **2.100 MHz**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** > **W-CDMA (Trial 1998)** >
W-CDMA Define > **Baseband Filter** > **2.100 MHz**

Or: **Mode** > **Arb Waveform Generator** > **Dual ARB** > **ARB Setup** > **Baseband Filter** >
2.100 MHz

Baseband Filter

Opens a menu for selecting a filter at the output of the I and Q modulation drivers.

Default: Through

Softkey Location: **I/Q** > **Baseband Filter**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** >
W-CDMA (3GPP 3.1 12-99) > **W-CDMA Define** > **Baseband Filter**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** > **W-CDMA (Rev 1.0-1.2)** >
W-CDMA Define > **Baseband Filter**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** > **W-CDMA (Trial 1998)** >
W-CDMA Define > **Baseband Filter**

Or: **Mode** > **Arb Waveform Generator** > **Dual ARB** > **ARB Setup** > **Baseband Filter**

Through

Removes filtering from the output of the I and Q modulation drivers.

Softkey Location: **I/Q** > **Baseband Filter** > **Through**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** >
W-CDMA (3GPP 3.1 12-99) > **W-CDMA Define** > **Baseband Filter** > **Through**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** > **W-CDMA (Rev 1.0-1.2)** >
W-CDMA Define > **Baseband Filter** > **Through**

Or: **Mode** > **Arb Waveform Generator** > **CDMA Formats** > **W-CDMA (Trial 1998)** >
W-CDMA Define > **Baseband Filter** > **Through**

Or: **Mode** > **Arb Waveform Generator** > **Dual ARB** > **ARB Setup** > **Baseband Filter** >
Through

SCPI Command Reference

Option H99 (Revision B) signal generators have an additional SCPI command that controls the filtering at the output of the I and Q modulation drivers.

Baseband Filter Selection

```
[SOURce:]:DM:BBFilter 2.1MHz|THRough
[SOURce:]:DM:BBFilter?
```

Selects the type of filtering at the output of the I and Q modulation drivers. The choices are a 2.100 MHz baseband filter or through (no filtering). The 2.100 MHz is automatically selected when a wideband CDMA format is activated.

*RST value: Through

3 Calibration

This chapter contains the operation verification and the performance tests specific to testing the ESG-D and ESG-DP Option H99 (Revision B) signal generator.

Operation Verification Tests

The tests listed below are used in place of the operation verification tests with the same names that are described in the ESG Family calibration guide. Use these tests, in addition to the remaining operation verification tests listed in the calibration guide, to check the Option H99 (Revision B) signal generator.

- Power Level Accuracy Check

- AM Accuracy Check

Power Level Accuracy Check

Performing this check will provide a high level of confidence that the power level circuitry of the signal generator is functioning correctly. This check does *not* test the signal generator to warranted specifications. Test points have been reduced and the limits are degraded in order to minimize measurement time and take into account a broad range of measurement uncertainties. To have the signal generator tested to warranted specifications, a complete power level accuracy performance test is required. If you are unable to perform this test, contact your nearest Agilent Technologies service center for information regarding calibration.

Connect the Test Equipment for Setup 1

Figure 3-1   Power Level Accuracy Equipment Setup 1
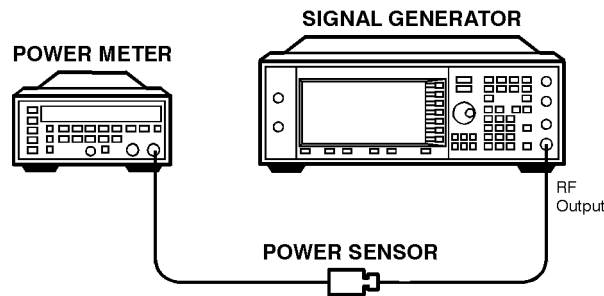
wk7107a

Configure the Signal Generator

1. Preset the signal generator to normal (factory-defined) preset conditions.

2. Press **Frequency**. Enter 277 using the numeric keypad and press the **kHz** terminator softkey.

3. Press **Amplitude**. Enter 7 using the numeric keypad and press the **dBm** terminator softkey.

4. Press **Mod On/Off**. The `MOD OFF` annunciator is displayed.

5. Press **RF On/Off**. The `RF ON` annunciator is displayed.

Configure the Power Meter

1. Zero and calibrate the power meter to the sensor's reference calibration factor.

2. Set the power meter to measure absolute log power (dBm).

Measure the Power Level Accuracy

1. Set the power levels and the frequencies shown in Table 3-1 on page 3-4.

2. Set the power sensor's calibration factor for each frequency.

3. Record the measured power level in Table 3-1 on page 3-4 and compare it to the corresponding limits.

Table 3-1   Power Level Accuracy Measurement Points for Setup 1

Frequency Setting	Power Level Setting (dBm)	Lower Limit (dBm)	Measured Power (dBm)	Upper Limit (dBm)
277 kHz	+7	6.3		7.7
	0	−0.7		0.7
	−15	−15.7		−14.3
2.516 MHz	+7	6.3		7.7
	0	−0.7		0.7
	−15	−15.7		−14.3
270.1 MHz	+7	6.3		7.7
	0	−0.7		0.7
	−15	−15.7		−14.3
990.1 MHz	+7	6.3		7.7
	0	−0.7		0.7
	−15	−15.7		−14.3
1350.1 MHz	+7	6.3		7.7
	0	−0.7		0.7
	−15	−15.7		−14.3
2310.1 MHz	+7	5.9		8.1
	0	−1.1		1.1
	−15	−16.1		−13.9
2985.1 MHz	+7	5.9		8.1
	0	−1.1		1.1
	−15	−16.1		−13.9
3225.1 MHz	+7	5.9		8.1
	0	−1.1		1.1
	−15	−16.1		−13.9
4000 MHz	+7	5.9		8.1
	0	−1.1		1.1
	−15	−16.1		−13.9

Connect the Test Equipment for Setup 2

Figure 3-2   **Power Level Accuracy Equipment Setup 2**
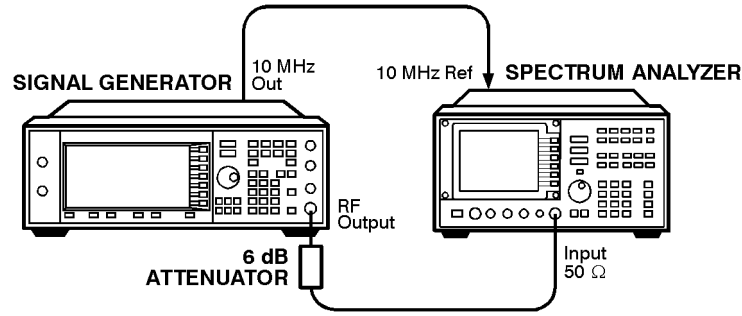
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Configure the Signal Generator

1. Press **Frequency**. Enter 277 using the numeric keypad and press the **kHz** terminator softkey.

2. Press **Amplitude**. Enter −15 using the numeric keypad and press the **dBm** terminator softkey.

Configure the Spectrum Analyzer

1. Preset the spectrum analyzer.

2. Set the analyzer to external 10 MHz reference.

3. Set the center frequency to 277 kHz.

4. Set the frequency span to 100 Hz. (This will result in a 1 Hz resolution bandwidth with a digital filter.)

Measure the Power Level Accuracy

1. Connect the RF OUTPUT of the signal generator through the 6 dB attenuator to the RF input of the spectrum analyzer.

2. Transfer the Measured Power (dBm) column results for each frequency at –15 dBm from Table 3-1 on page 3-4 to the Power Meter Reading for –15 dBm column found in Table 3-2.

3. On the spectrum analyzer, select **Marker Normal Mode** and then select the **Peak Search** function. This activates the marker and sets it to the signal peak.

4. On the spectrum analyzer, ensure that the marker is at the signal peak and use the MKR-> menu to set the marker to the reference level. If necessary, select **Peak Search** to ensure that the marker is at the signal peak.

5. With the marker at signal peak, select the **Marker Delta** function. This will set the marker to measure relative amplitude from a reference of 0 dB. If the marker reads other than 0 dB, select **Marker Normal**, **Peak Search**, and **Marker Delta** until the marker reads 0 dB.

6. Decrease the signal generator amplitude to –55 dBm.

7. Select **Peak Search** to ensure that the spectrum analyzer marker is at the signal peak. Record the marker reading in the Spectrum Analyzer Marker column of Table 3-2.

8. Decrease the signal generator amplitude to –85 dBm.

9. Select **Peak Search** to ensure that the spectrum analyzer marker is at the signal peak. Record the marker reading in the Spectrum Analyzer Marker column of Table 3-2.

10. Return the spectrum analyzer reference level back to –15 dBm and the signal generator amplitude to –15 dBm. Set the signal generator frequency and the spectrum analyzer's center frequency to the next frequency listed in Table 3-2 and repeat the process from Step 3 until all of the frequencies have been measured and recorded.

Calculate the Actual Power Level

1. Calculate and record the Actual Power Level as the sum of the Power Meter Reading for –15 dBm and the Spectrum Analyzer's Marker value.

    For example:

    - Power Meter Reading for –15 dBm at 2.516 MHz = –14.95 dBm

    - Spectrum Analyzer Marker at 2.516 MHz and Power Level Setting at –85 dBm = –70.17 dB

    - Actual Power Level at 2.516 MHz and –85 dBm: (–14.95) + (–70.17) = –85.12 dBm

2. Compare the calculated Actual Power Level value to the corresponding limits.

**Table 3-2**   **Power Level Accuracy Measurement Points for Setup 2**

Frequency Setting	Power Level Setting (dBm)	Power Meter Reading for −15 dBm	Spectrum Analyzer Marker (dB)	Lower Limit (dBm)	Actual Power Level (dBm)	Upper Limit (dBm)
277 kHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
2.516 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
270.1 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
990.1 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
1350.1 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
2310.1 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
2985.1 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
3225.1 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8
4000 MHz	−15		0 (Ref)	N/A	N/A	N/A
	−55			−56.2		−53.8
	−85			−86.2		−83.8

AM Accuracy Check

Connect the Test Equipment

Figure 3-3   AM Accuracy Equipment Setup
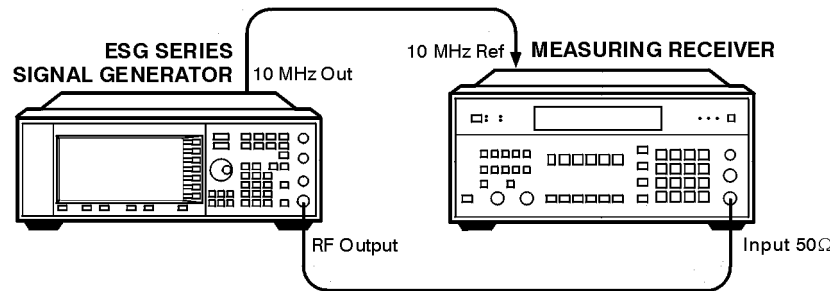
wk719a

Configure the Signal Generator

1. Preset the signal generator to normal (factory-defined) preset conditions.

2. Press **AM** > **AM Off On**. The AM annunciator is displayed.

3. Press the **AM Rate** softkey. Enter 1 using the numeric keypad and press the **kHz** terminator softkey.

4. Press **Amplitude.** Enter 7 using the numeric keypad and press the **dBm** terminator softkey.

5. Check that the MOD ON annunciator is displayed. If not, press **Mod On/Off**.

6. Press **RF On/Off**. The RF ON annunciator is displayed.

Configure the Measuring Receiver

1. Reset the measuring receiver.

2. Set the measuring receiver to AM mode.

3. Turn on Peak+ detector.

4. Turn on the 300 Hz high-pass filter.

5. Turn on the 3 kHz low-pass filter.

Measure the Deviations

1. Set the signal generator to the frequencies, and depths shown in Table 3-3 on page 3-9.

2. Record the AM depths measured and compare them to the limits shown in Table 3-3 on page 3-9.

Table 3-3   AM Accuracy Measurement Points

Frequency	Depth (%)	Limits (%)		
		Lower	**Measured**	**Upper**
200 MHz	30	27.5		32.5
200 MHz	90	84.5		95.5
501 MHz	30	27.5		32.5
501 MHz	90	84.5		95.5
1000 MHz	30	27.5		32.5
1000 MHz	90	84.5		95.5

Performance Tests

The Option H99 (Revision B) signal generator requires one or two other performance tests in addition to the performance tests required by the standard signal generators. The signal generator's option mix will determine whether one or both tests need to be performed. Use the following automated performance tests to check the ACP specifications unique to the Option H99 (Revision B) signal generator:

- Wideband CDMA (Option H99 and 100)

- Wideband CDMA (Option H99 and H97/98)

The standard signal generator performance tests are described in the ESG Family calibration guide.

Wideband CDMA ACP (Option H99 with H97/H98/100)

(Wideband CDMA Adjacent Channel Power Performance Test for Option H99)

These tests measure the energy in both adjacent channels with respect to the main channel and compares the measured energy to the total energy in the main channel. The adjacent channel power is corrected for the noise floor of the spectrum analyzer.

Recommended Equipment

• HP/Agilent 8563E Spectrum Analyzer Option E35
  which consists of the following equipment:

  • HP/Agilent 8563E Option H35 Spectrum Analyzer

  • HP/Agilent 8563E Option K35 Adjacent Channel Power Ratio Test Set for W-CDMA

NOTE   HP/Agilent 8563E Option K37 combines the Option K35 test set with the firmware ROM chips to upgrade existing HP/Agilent 8560 E-Series spectrum analyzers.

Connect the Test Equipment

Figure 3-4   **Test Setup for the WCDMA ACP Performance Test**
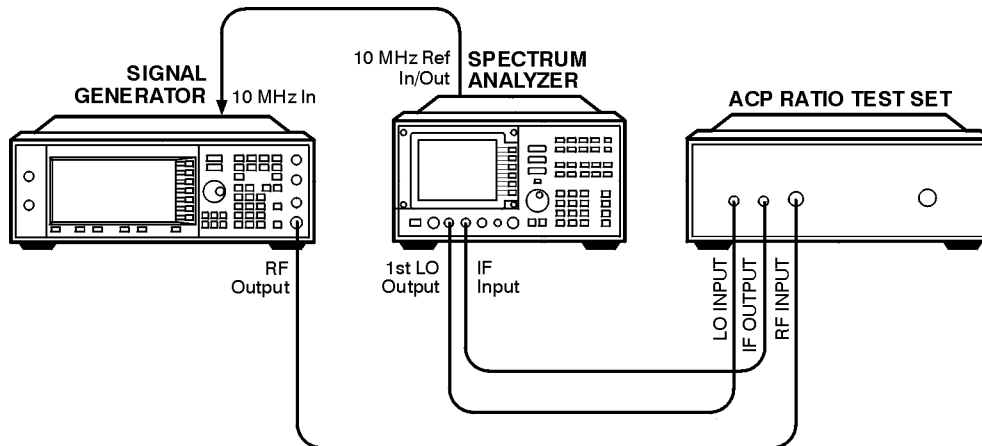
4 Service

The Option H99 (Revision B) signal generator can be serviced by using this supplement, the ESG Family calibration guide, and optional service guide. This chapter provides supporting documentation for servicing Option H99 (Revision B) assemblies.

Replaceable Parts

Option H99 (Revision B) requires a different A9 Output Board than what is used on the standard signal generator. There are two versions of the Option H99 output board, part numbers E4400-60155 (Option H99 Revision A) and E4400-60188 (Option H99 Revision B). The E4400-60155 has been replaced by the E4400-60188 for all Option H99 signal generator configurations that do *not* contain Option H98. Refer to the appropriate following section, depending on which A9 Output Board is currently installed.

A9 Output Board E4400-60155

For most Option H99 signal generator configurations, this board has been replaced by the E4400-60188 A9 Output Board. The E4400-60188 is *not* backwards compatible without using the replacement kit (E4400-60228) created to replace the E4400-60155. Use the following list to determine which output board to use:

- E4400-60155 is used with signal generators that have Option H98 installed.

- E4400-60228, Option H99 replacement kit, is used for all other signal generator configurations. This kit includes the E4400-60188 A9 Output Board.

CAUTION	Option H98 will *not* work if the Option H99 replacement kit, E4400-60228, is installed.

A9 Output Board E4400-60188

This is the Option H99 (Revision B) output board that contains filters in the baseband path and improves wideband CDMA ACP.

CAUTION	The E4400-60188 A9 Output board is *not* backwards compatible (not a direct replacement) with the E4400-60155 A9 Output Board. Refer to "A9 Output Board E4400-60155" above for more information.

A9 Output Board

This section shows the node voltage values, of the A9 output board, for both the ESG-D and ESG-DP Option H99 (Revision B) signal generators. These values can be used to assist in troubleshooting the A9 output board.

NOTE   The node voltages given in the following table are approximate values based on a sample of signal generators. Your signal generator may not reflect these exact values. The resolution of these values varies from node to node. As a guideline, interpret your measurements based on the number of decimal places shown for the expected voltage.

A9 Output Board Abus Nodes (1 of 2)

| Test Conditions	Node Voltages (Corrected Values in Vdc)						
	ALC_MOD	BURST_MOD	ALC_DET	POW_REF_1	POW_REF_2	LOOP_INT	PTAT
Preset; 0 dBm; RF On; No Modulation; 50Ω load on RF output	≈ 0.9012	≈ 19.71 to 19.79	≈ −0.071	≈ 4.66	≈ 4.87	≈ 0.91 to 1.148	≈ 9.48
Preset; 0 dBm; RF Off; No Modulation; 50Ω load on RF output	≈ 0.1	≈ 19	0.0	≈ 5	≈ 5	≈ −10	≈ 8.5 to 9.9
Preset; 20 dBm; RF On (Unleveled)	≈ 20	≈ 19	≈ −0.5	≈ 2.3	≈ 4.1	≈ 12	≈ 8.5 to 9.9
Frequency Set to heterodyne Band; Preset; Frequency ≤ 249.9 MHz; 0 dBm; RF On; No Modulation	≈ 0.2 to 0.5	≈ 19	≈ 0	≈ 4.1 το 4.8	≈ 4.3 το 5.0	≈ 0.0	≈ 8.5 to 9.9
+5.0 Vdc applied to Q INPUT: Preset; 0 dBm; RF On; I/Q On; I/Q Source EXT I/Q; I Input = No Connection; Burst Envelope On; If −0.5 Vdc is applied to Q INPUT, the Q node changes to negative voltage	≈ 0.6 (20 w/ no Q Input)	≈ 4.8 to 5.6	≈ −0.08 to −0.2 (≈ 0.1 w/ no Q Input)	≈ 4.5	≈ 4.8	≈ −0.2 to 0.6 (≈12 w/ no Q Input)	≈ 8.5 to 9.9
+1 Vdc Applied to EXT 1 INPUT: Preset; 0 dBm; RF On; AM On; AM Depth 100%; AM Source Ext 1 DC	≈ 1	≈ 19	≈ 0	≈ 4.6	≈ 4.8		≈ 8.5 to 9.9

A9 Output Board Abus Nodes (2 of 2)

Test Conditions	Node Voltages (Corrected Values in Vdc)						
	I	**Q**	**PRE_LEVEL**	**QUAD**	**GAIN_DET**	**GRD**	**REF_AM**
Preset; 0 dBm; RF On; No Modulation; 50Ω load on RF output	1.5	0	≈ 2.11 to 4.08	≈ 0.73	≈ 1.27	0.0	≈ −0.138 to 0.34
Preset; 0 dBm; RF Off; No Modulation; 50Ω load on RF output	≈ 0.7	≈ 0	≈ 2.1	≈ −1.8	≈ −0.22 to −0.05	0.0	≈ −0.52 to 0.3
Preset; 20 dBm; RF On (Unleveled)	≈ 0.7	≈ 0	≈ 2.1	≈ −1.8	≈ −0.3 to -0.19	0.0	≈ 2.3
Frequency Set to heterodyne Band; Preset; Frequency ≤ 249.9 MHz; 0 dBm; RF On; No Modulation	≈ 0.44	≈ 0	≈ 2	≈ −3	≈ −0.04	0.0	≈ −0.1 to 0.6
+5.0 Vdc applied to Q INPUT: Preset; 0 dBm; RF On; I/Q On; I/Q Source EXT I/Q; I Input = No Connection; Burst Envelope On; If −0.5 Vdc is applied to Q INPUT, the Q node changes to negative voltage	≈ 0.0	≈ 1.1	≈ 2	≈ −1.8	≈ −0.6 (0.0 w/ no Q Input)	0.0	≈ 0.2 to 0.9
+1 Vdc Applied to EXT 1 INPUT: Preset; 0 dBm; RF On; AM On; AM Depth 100%; AM Source Ext 1 DC	≈ 0.7	≈ 0	≈ 2.1	≈ −1.8	-0.2	0.0	≈ 0.9

A9 Output Board Block Diagram

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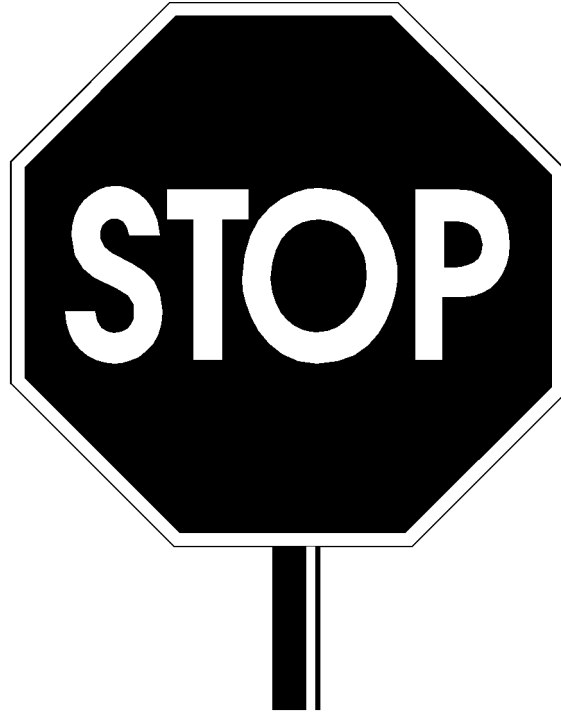
Formt117

AT1 Mechanical Attenuator and A19 RPP Block Diagram Option H99 (Revision B)

Figure 4-1   **AT1 Mechanical Attenuator and A19 RPP Block Diagram**
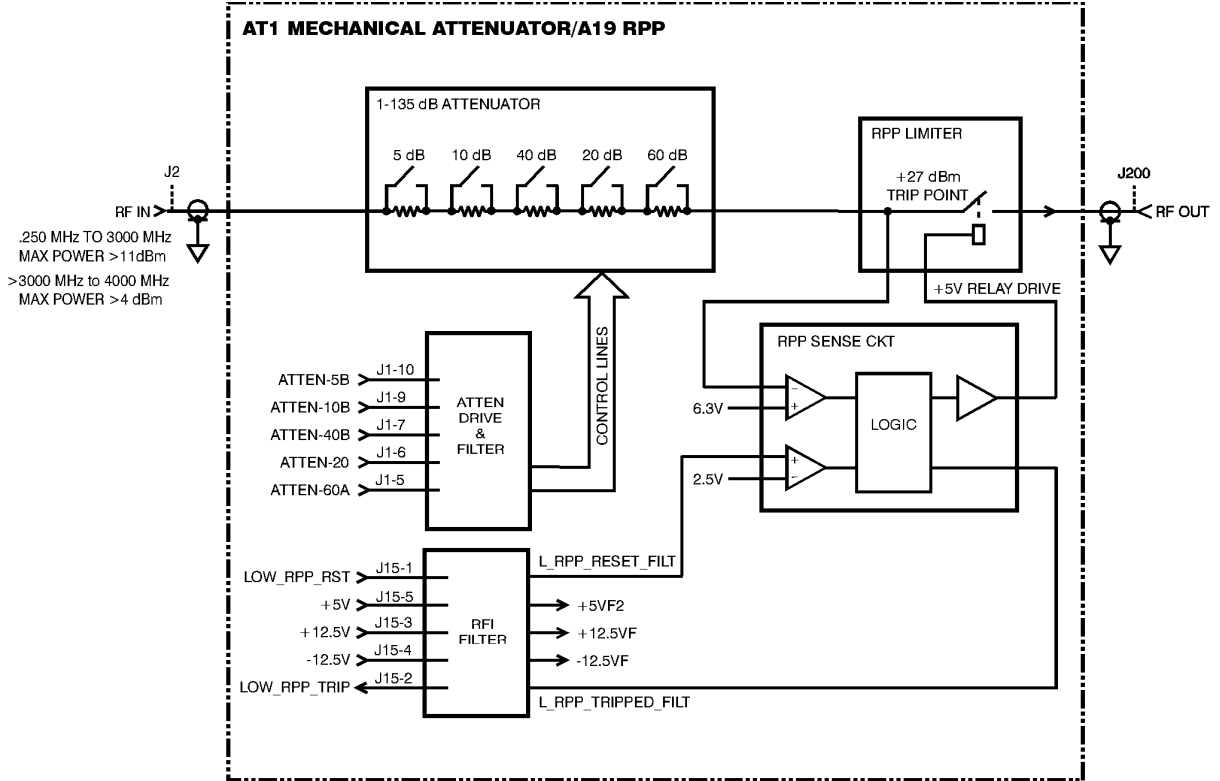
hk715b

Post Repair Procedures

Table 4-1 lists the adjustments and performance tests that must be performed on the Option H99 (Revision B) signal generator after the A9 Output Board is repaired or replaced. Refer to the ESG Family calibration guide for more information on the adjustments and performance tests.

Table 4-1 A9 Output Board Adjustments and Tests

Adjustments	ESG-D	ESG-DP	Performance Tests	ESG-D	ESG-DP
AM Audio Path Offset	•	•	AM Frequency Response	•	•
Burst Modulator Cal	•	•	Burst Modulation On/Off Ratio	•	•
Burst Audio Path Cal	•	•	Digital Mod: Power Level Accuracy	•	•
Prelevel Cal	•	•	Harmonics	•	•
VBLO (Mixer Bias Cal)	•	•	Internal AM Accuracy	•	•
I/Q Gain/Offset Quadrature	•	•	Internal AM Distortion	•	•
Gain Adjust	•	•	Nonharmonics	•	•
ALC Adjustments	•	•	Phase Noise and Residual FM[1]		•
Level Meter Cal	•	•	Power Level Accuracy	•	•
ALC Mod Flatness Cal	•	•	Pulse Modulation On/Off Ratio	•	•
ALC Mod Driver Bias Cal	•	•	Subharmonics	•	
AM Audio Path Gain Cal	•	•	WCDMA (Opt. 100/H99)[2]	•	•
Power Level Accuracy	•	•	WCDMA ACP[2] (Opt. H99 w/ H97 or H98)	•	
LNF Gain Adjust		•	Digital Mod: Internal IQ Quality (Opt. UN3, UN4, UN8)	•	•
			CDMA Adjacent Channel Power (Opt. UN5)	•	•
			Custom IQ RF Mod Quality (Opt. UN8)	•	•

1. This is a manual test.
2. This performance test is described in Chapter 3, "Calibration," of this supplement.

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