Section 4
PERFORMANCE TESTS

4-1. INTRODUCTION

The procedures in this section test the instrument's electrical performance using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section 3 under Operator's Checks.

NOTE

If the performance tests are to be considered valid, the following conditions must be met:

a. The Signal Generator must have a 30-minute warmup.

b. The line voltage must be 100, 120, 220, or 240 Vac (+5%, −10%) from 48 to 440 Hz. The Voltage Selector Cam must be in the proper position. Refer to Figure 2-1.

c. The ambient temperature must be 0 to 55° C for the Level Accuracy and Flatness Test.

4-2. EQUIPMENT REQUIRED

Equipment required for the performance tests is listed in Table 1-2, Recommended Test Equipment. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

4-3. PERFORMANCE TEST RECORD

Results of the performance tests may be tabulated on Table 4-2 which is the Performance Test Record. The Performance Test Record located at the end of this section lists all of the tested specifications and their acceptable limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

4-4. CALIBRATION CYCLE

This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked using the following performance tests at least once each year.

4-5. ABBREVIATED PERFORMANCE TESTING

In most cases, it is not necessary to perform all of the tests in this section. Table 4-1 shows which tests are recommended for various situations. The Operator's Checks in Section 3 should be the first step in all testing situations.

4-6. TEST PROCEDURES

It is assumed that the person performing the following tests understands how to operate the specified test equipment. Equipment settings, other than those for the Signal Generator, are stated in general terms. For example, a test might require that a spectrum analyzer's resolution bandwidth be set to 100 Hz; however, the time per division setting would not be specified and the operator would set that control so that the analyzer operates correctly.

It is also assumed that the person performing the tests will supply whatever cables, connectors, and adapters are necessary.

Table 4–1. *Abbreviated Performance Tests*

Testing Situations		Section 3 Functional Checks		Performance Test Number and Name				
				1	2	3	4	5
		Basic	HP-IB	Spectral Purity	Output Level Accuracy And Flatness	Modulation	Output Leakage	SWR
Incoming Inspection or Overall Performance Verification		X	X	X	X	X	X	X
After Complete Adjustment		X		X	X	X	X	X
After Repairs to Assembly:	Reference Service Sheet No.							
A1	21	X						
A2	21–24	X						
A3A1	9	X		X		FM		
A3	9	X						
A3	10	X		X		FM		
A3	11	X		X				
A3	12	X		X				
A3	13	X		X		FM		
A3	14	X		X		FM		
A3	15	X		X		FM		
A3	16	X		X				
A4	1	X		X				
A4	2	X		X				
A6	4	X		X	X	AM		
A6	5	X		X	X			
A6	8	X						
A7	9	X		X				
A8	3	X		X				
A9	8	X		X	X		X	X
A10	6	X						
A10	7	X			X	X		
A10	8	X						
A11	17–20	X	X		X	X		
A15	25	X						
A16	25	X						
FL1	3	X		X				

Performance Test 1

SPECTRAL PURITY TESTS

- **Spurious Signals**
- **Residual AM**
- **Residual FM**
- **SSB Phase Noise (1 Hz Bandwidth)**

Specifications

Electrical Characteristics	Performance Limits	Conditions
Spurious Signals:		
Harmonics	< −30 dBc	≤ +7 dBm output levels
Non-harmonics	< −60 dBc	≥ 2 MHz from carrier in CW mode
		> 5 kHz to 2 MHz from carrier in CW mode
	< −60 dBc	0.1 to 130 MHz
	< −72 dBc	130 to 260 MHz
	< −66 dBc	260 to 520 MHz
	< −60 dBC	520 to 1040 MHz
Sub-harmonics	None	
Residual Modulation CW Mode:		
AM (0.5 to 15 kHz Post Detection Noise Bandwidth)	< 0.04%	0.1 to 1040 MHz
FM (0.3 to 3 kHz Post Detection Noise Bandwidth)	< 4 Hz rms	0.1 to 130 MHz
	< 1 Hz rms	130 to 260 MHz
	< 2 Hz rms	260 to 520 MHz
	< 4 Hz rms	520 to 1040 MHz
FM (0.05 to 15 kHz Post Detection Noise Bandwidth)	< 6 Hz rms	0.1 to 130 MHz
	< 1.5 Hz rms	130 to 260 MHz
	< 3 Hz rms	260 to 520 MHz
	< 6 Hz rms	520 to 1040 MHz
SSB Phase Noise		20 kHz offset from carrier
	< −124 dBc/Hz	0.1 to 130 MHz
	< −136 dBc/Hz	130 to 260 MHz
	< −130 dBc/Hz	260 to 520 MHz
	< −124 dBc/Hz	520 to 1040 MHz

Description

Spurious signals are checked using a spectrum analyzer. Residual AM and FM Modulation are checked using a measuring receiver. SSB phase noise is measured using a phase noise measurement system.

Equipment

Spectrum Analyzer .... HP 8568B or HP 8558A/853A (Harmonics/Spurious Tests)
Measuring Receiver .... HP 8902A (Option 003 for Optional Residual FM Tests)
Sensor Module .... HP 11722A
Digital Multimeter .... HP 3466A
AM/FM Test Source .... HP 11715A
Cable (UG-21D/U type N connectors) .... HP 11500B
Cable (UG-88C/U BNC and dual banana plug connectors) .... HP 11001-60001
Synthesized Signal Generator/(LO for Optional Residual FM Test) .... HP 8662A
Phase Noise Measurement System .... HP 3048A

Procedure

Spurious Signals Test

1. Set the spectrum analyzer as follows:

   Center Frequency .... 100 kHz
   Frequency Span .... 30 kHz
   Resolution Bandwidth .... 300 Hz
   Reference Level .... +7 dBm

2. Set the Signal Generator as follows:

   Frequency .... 100 kHz
   Frequency Increment .... 100 kHz
   Amplitude .... +7 dBm
   Modulation .... Off

3. Connect the RF OUTPUT of the Signal Generator to the input of the spectrum analyzer as shown in Figure 4-1. Verify that all harmonics are < −30 dBc, all non-harmonics 2 MHz from the carrier are < −60 dBc, all non-harmonics 5 KHz to 2 MHz from carrier are < −72 dBc, < −66 dBc, < −60 dBc for each frequency band shown in the table, and that there are no sub harmonics as the frequency is incremented from 100 kHz to 1040 MHz.

Spurious Signals	Results	
	Actual	**Max.**
Harmonics	______	< −30 dBc
Non-Harmonics (≥ 2 MHz from carrier)	______	< −60 dBc
5 kHz to 2 MHz from carrier	______	< − 60 dBc, 0.1 tp 130 MHz
	______	< −72 dBc, 130 to 260 MHz
	______	< −66 dBc, 260 to 520 MHz
	______	< − 60 dBc, 520 to 1040 MHz
Sub-Harmonics	______	None

NOTE

Adjust the Center Frequency, Frequency Span, and Resolution Bandwidth controls as required.

Change the frequency increment from 100 kHz to 10 MHz at 10 MHz, if desired.

4. Verify the residual AM of the measuring receiver as follows:

   a. Connect the modulation output of the measuring receiver to the input of the digital multimeter and the AM output of the AM/FM test source to the input of the measuring receiver as shown in Figure 4-2. Nothing should be connected to the audio input of the AM/FM test source.

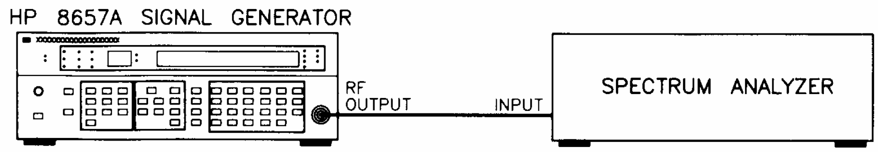


Figure 4–1. *Spurious Signals Test Setup*

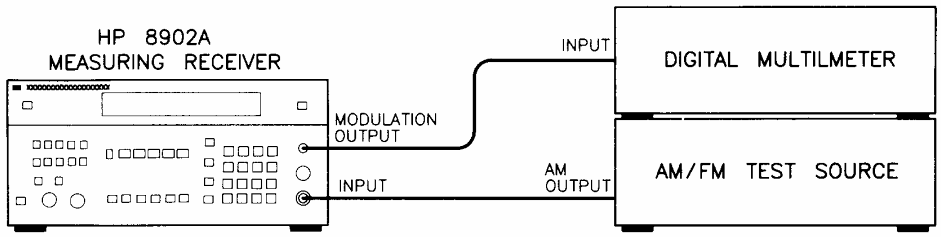


Figure 4–2. *Measuring Receiver Residual AM Verification Test Setup*

Residual AM

NOTE

The residual AM specification of the Signal Generator is not equivalent to the published specification of the HP 8902A Measuring Receiver. To make a valid residual AM measurement, the residual AM of the measuring receiver should be at least 3 dB better than the specification being tested. In order to verify that the residual AM of the measuring receiver is adequate to measure the Signal Generator's residual AM specification, the residual AM of the measuring receiver must be verified to ensure the validity of the measurement. If the Signal Generator's residual AM is measured frequently, it is not necessary to verify the residual AM of the measuring receiver each time; however, it is recommended that it be verified monthly to ensure an accurate measurement.

b. Set the measuring receiver as follows:

Measurement .... Frequency

c. Set the AM/FM test source as follows:

Test Mode .... FM

d. Tune the carrier frequency on the AM/FM test source for a measuring receiver reading of 12.5 ±0.1 MHz.

e. Set the digital multimeter as follows:

Function .... Vac
Range .... 200 mV

f. Set the measuring receiver as follows:

Measurement .... AM
HP Filter .... 50 Hz
LP Filter .... 15 kHz

g. The digital multimeter should indicate 3.28 mV or less.

NOTE

To make a valid residual AM measurement, the residual AM of the measuring receiver should be at least 3 dB better than the specification being tested or 0.028%. With an output sensitivity of 10%/V, the corresponding output level is 2.80 mV.

5. Set the measuring receiver as follows:

   Measurement .... AM
   Detector .... Peak+
   HP Filter .... 50 Hz
   LP Filter .... 15 kHz
   FM De-Emphasis .... Off

6. Set the Signal Generator as follows:

   Frequency .... Any
   Amplitude .... 0.0 dBm
   Modulation .... Off

7. Set the digital multimeter as follows:

   Function .... Vac
   Range .... 200 mV

8. Connect the RF OUTPUT of the Signal Generator to the input of the measuring receiver and the modulation output of the measuring receiver to the input of the digital multimeter as shown in Figure 4-3.

9. The digital multimeter should indicate <4.00 mVrms.

Actual	Maximum
________	< 4.00 mVrms

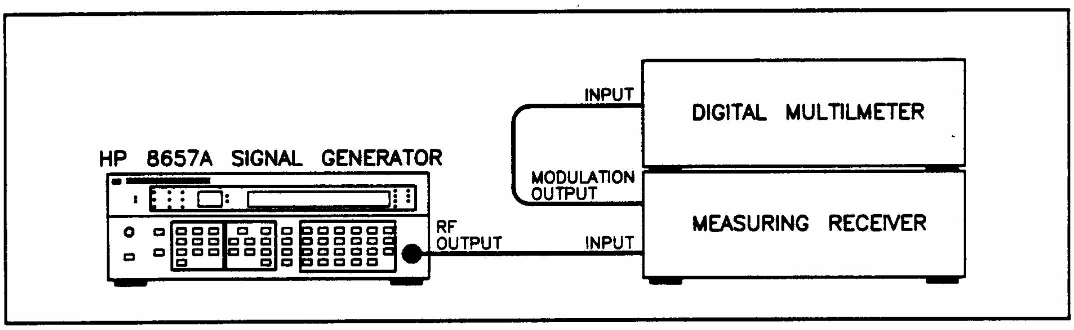


Figure 4–3. *Residual AM Test Setup*

Residual FM

NOTE

A standard HP 8902A can be used to verify the residual FM specifications in the heterodyne band of frequencies. Tests performed at these frequencies will verify that in all probability, the instrument meets its specifications. If the HP 8657A has been repaired or the heterodyne band of frequencies do not pass, the Optional Residual FM Test (steps 10a-13a) should be performed.

10. Set the measuring receiver as follows:

    Measurement .... FM
    Detector .... RMS
    FM De-Emphasis .... Off
    Automatic Operation .... Selected

11. Set the Signal Generator under test as follows:

    Frequency .... Any From Chart
    Amplitude .... 0.0 dBm
    Modulation .... Off

12. Connect the RF OUTPUT of the Signal Generator under test to the input of the measuring receiver as shown in Figure 4-4.

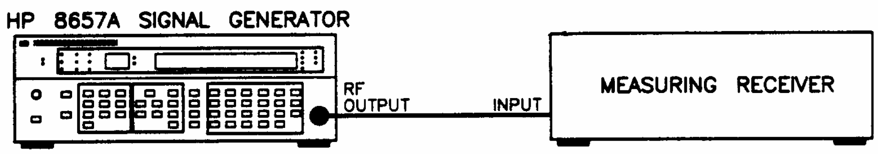


Figure 4-4. Residual FM Test Setup

13. Set the Signal Generator frequency and select the measuring receiver high-pass and low-pass filters as indicated in the following table. Verify that the measured results do not exceed the limits specified.

Signal Generator Frequency (MHz)	Modulation Analyzer Filter		Results (Hz rms)	
	High Pass (Hz)	Low Pass (kHz)	Actual	Max.
0.15 to 129.99999	300	3	________	< 4
0.15 to 129.99999	50	15	________	< 6

Optional Residual FM Test

The Residual FM Test gives confidence that the HP 8657A is passing all its Residual FM specifications. The Residual FM of the HP 8657A can be checked at all frequencies with an HP 8902A Option 003 and an external local oscillator (LO). The residual FM of the external LO must be less than the internal LO of the HP 8902A and the residual FM of the HP 8657A.

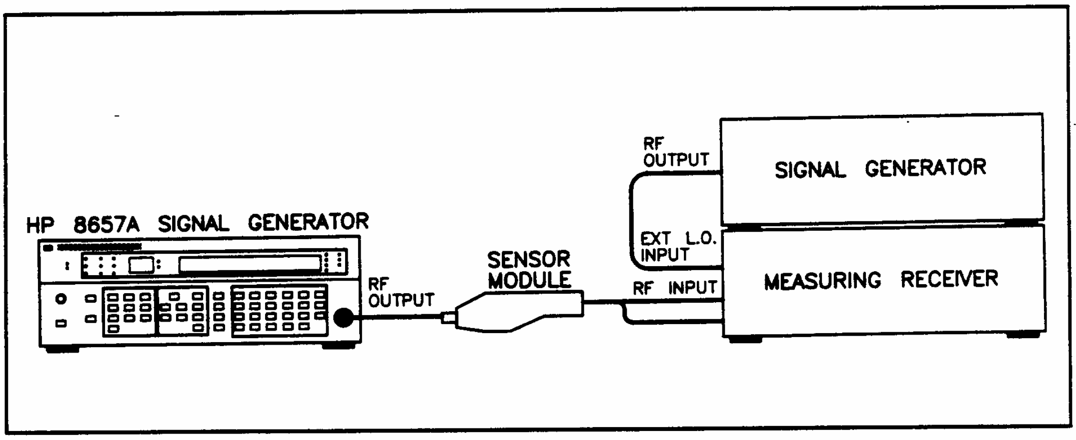


Figure 4–4a. ***Residual Test Setup***

10a. Set the measuring receiver as follows:

Measurement .... FM
Detector .... RMS
FM De-Emphasis .... Off
Automatic Operation .... Selected

11a. Set the Signal Generator under test as follows:

Frequency .... Any From Chart
Amplitude .... 0.0 dBm
Modulation .... Off

12a. Connect the instruments as shown in Figure 4–4a.

13a. Set the Signal Generator frequency and select the measuring receiver high-pass and low-pass filters as indicated in the following table. Verify that the measured results do not exceed the limits specified.

Optional Residual FM Test Specifications

Signal Generator Frequency (MHz)	Modulation Analyzer Filter		Results (Hz rms)	
	High Pass (Hz)	Low Pass (kHz)	Actual	Max.
0.15 to 130	300	3	________	< 4
130 to 260	300	3	________	< 1
260 to 520	300	3	________	< 2
520 to 1040	300	3	________	< 4
0.15 to 130	50	15	________	< 6
130 to 260	50	15	________	< 1.5
260 to 520	50	15	________	< 3
520 to 1040	50	15	________	< 6

SSB PHASE NOISE (1 HZ BANDWIDTH)

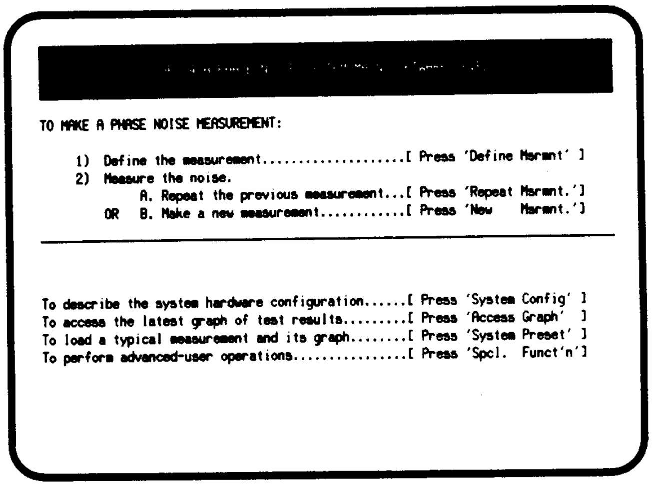
Description

Single-sideband (SSB) phase noise of the HP 8657A is measured at the offset frequency of 20 KHz by the HP 3048A Phase Noise System using its Phase Lock Loop measurement type. The system software provides both the measurement program and the BASIC operating system for the controller. This procedure provides the steps for entering the specific measurement parameters required for this test.

NOTE

This test measures the total SSB phase noise of both generators. This test assumes that the noise level of the reference source you are using is lower than or equal to the noise level of the HP 8657A being tested. If the reference source's phase noise level is equal to the HP 8657A's, the actual noise level for both sources is 3 dB below the level measured by the HP 3048A.

1. The HP 3048's BASIC operating system and system software must be loaded, the HP 8657A's HP-IB address entered, and system operation verified before this test is run. Refer to the HP 3048A Phase Noise Measurement System Operating Manual, Appendix A for the required procedures.
2. If you are not at the HP 3048A's Main Software Level, press the **Done** or **Abort** Softkey. The Main Software Level menu provides access to each of the HP 3048's main functions. You will always return to this menu when you exit the selected function.



Defining the Measurement

3. Press the **Define Msrmt** Softkey to display the Measurement Definition Menu.
4. Press the **Test Files** softkey.
5. Position the curser at the file labeled HP EXAMPLE RF SYNTHESIZER (8662/3 DCFM).
6. Press the **Load File** key. After the HP 3048A has completed the file loading sequence, press the **Done** key.

NOTE

This example file contains many of the measurement parameters required for this test. Table 4-2 lists the paramaters that have been loaded from this file. The following steps will guide you through the process of making the necessary changes to the parameters to meet the specific requirements of this test.

7. Press the **Instr Params** key. Enter a carrier frequency of 640 E+6 Hz. Enter a Detector/Disc. Input frequency of 640 E+6 Hz. Enter a VCO Tuning Constant of 1 E+3 Hz/volt. Enter the Voltage Tuning Range of VCO as 5 volts. The remaining entries do not need to be changed. Press the **Done** key.
8. Press the **Calibr Process** key. Press the **Tuning Const** key to select Compute from expected T. Constant. Press the **Done** key.
9. Press the **Source Control** key. Press the **Ref. Source** key as needed to select 8657A SYSTEM CNTRL. Press the **Done** key when you have completed this operation.

NOTE

The HP 8657A under test is configured as the reference source in this display to enable the HP 3048A to control it using control routines built into the HP 3048A's software. The measurement results will still reflect the noise level of the HP 8657A under test. If you are not able to select the HP 8657A as the reference source using the Ref. Source key, then the HP 8657A has not yet been entered into the HP 3048A's Configuration Table. To enter the HP 8657A, return to the Main Software Menu and press the **System Config** *key.*

10. Press the **Define Graph** key. Enter an appropriate graph title for your test. Press the **Done** key to exit this menu, and then press the **Done** key again to return to the Main Software level.

Beginning the Measurement

11. Press the **New Msrmnt** key to begin the phase noise measurement.
12. When the hardware connect diagram appears in the display, connect the HP 8657A and reference source to the HP 3048A as shown. (Note that the reference source is labeled USERS's DUT on the screen. Figure 4-5 also shows the cable connections for this measurement.)
13. Adjust the reference source's center frequency to 640 MHz and its amplitude to 0 dBm. (The HP 8657A's setting will be adjusted by the HP 3048A via its HP-IB connection.)

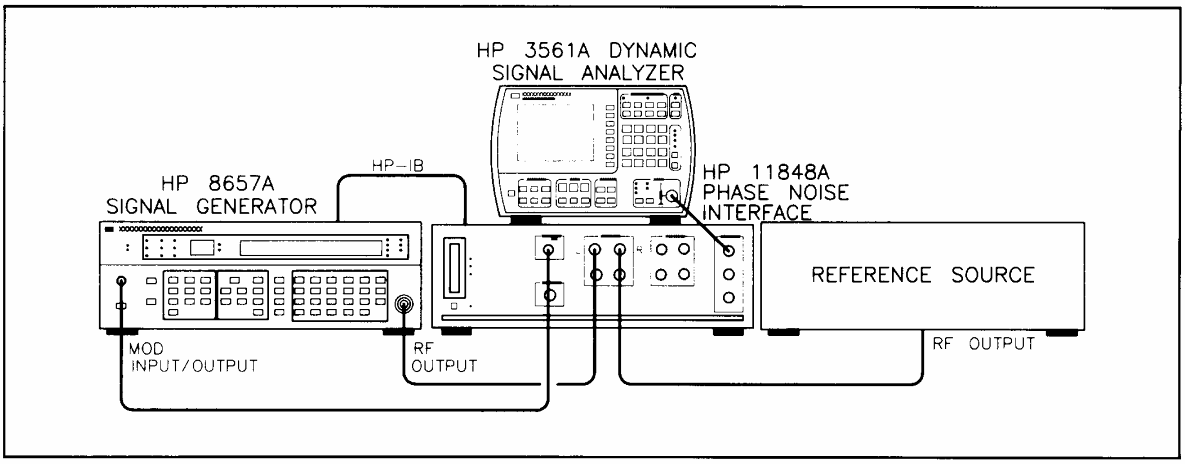


Figure 4–5. *Setup Diagram for SSB Phase Noise Measurement*

14. After you have connected the cables, press the **Proceed** key to run the measurement. (If you wish to measure the phase noise level of the HP 8657A at other center frequency settings after this test is completed, change the center frequency on the reference source to the desired frequency. Enter the desired frequency as the carrier frequency and detector/disc input frequency in the Source and Interface Parameter Entry menu.)

NOTE

If the noise level measured by the HP 3048A exceeds the HP 8657A's specified noise level and the exact noise level of the reference source is not known, the exact level of each source should determined by measuring each source against a third signal source and comparing the measurement results for all three measurements.

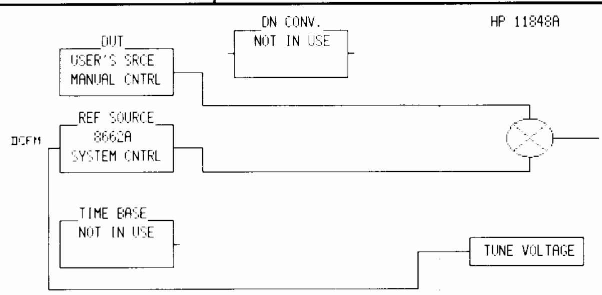
15. The Measured SSB Phase Noise should be at or below the specified value.

Offset from Carrier	SSB Phase Noise		Carrier Frequency (MHz)
	Min.	Actual	
20 kHz	−124 dBc/Hz	______	0.1 to 129
	−136 dBc/Hz	______	130 to 260
	−130 dBc/Hz	______	260 to 520
	−124 dBc/Hz	______	520 to 1040

Table 4–2. *Parameter Data Loaded from HP Example RF Synthesizer (HP 8662/3 DCFM file)*

Parameters	Data
Measurement Type	Phase Noise Using a Phase Lock Loop
Frequency Range	
Start Freq.	1 Hz
Stop Freq.	100 E + 3 Hz
Averages	4
Source Parameters	
Carrier Frequency	500 E + 6 Hz
Detector/Discr. Input Frequency	500 E + 6 Hz
VCO Tuning Constant	25 E + 3 Hz/V
Center Voltage of VCO Tuning Curve	0 Volts
Voltage Tuning Range of VCO	±2 Volts
VCO Tune-Port Input Resistance	600 ohms
Internal Phase Detector	5 MHz to 1600 MHz
Phase Detector Constant	Measure the Detector Constant
VCO Tuning Constant	Measure the VCO Tuning Constant
PLL Suppression	Will be verified

Source Control



Parameters	Data
Define Graph	
Title	RF SYNTHESIZER VERSUS HP 8662/3A USING DC FM.
Minimum X	1 Hz
Maximum X	100 E + 3 Hz
Minimum Y	−170
Maximum Y	0
Graph Type	Single Sideband Phase Noise (dBc/Hz)

Performance Test 2

OUTPUT LEVEL ACCURACY AND FLATNESS TESTS

- **Level Flatness**
- **Absolute Level Accuracy**

Specifications

Electrical Characteristics	Performance Limits	Conditions
Output		
Level Range	+13 dBm to −143.5 dBm +10 dBm to −143.5 dBm	Into 50 ohms 100 kHz to 1 MHz
Resolution	0.1 dB	
Absolute Level Accuracy(1)	≤ ±1.0 dB	Output levels of +7 dBm to −127 dBm
	< ±1.5 dB	> +7 dBm
Level Flatness	≤ ±0.5 dB	Output level setting of 0.0 dBm; frequencies form 100 kHz to 1040 MHz

(1) Absolute level accuracy includes allowances for detector linearity, temperature, flatness, attenuator accuracy, and measurement errors.

Description

Output level accuracy and flatness are verified using a measuring receiver and a sensor module.

Equipment

Measuring Receiver .... HP 8902A
Sensor Module .... HP 11722A

Procedure

Level Flatness

1. Connect the sensor module to the measuring receiver. Zero and calibrate the sensor module and measuring receiver.
2. Connect the sensor module to the Signal Generator as shown in Figure 4-6.

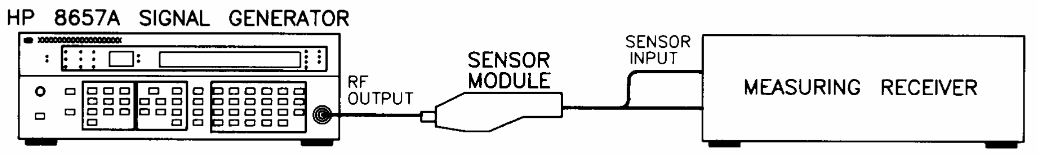


Figure 4–6. *Output Level Accuracy and Flatness Test Setup*

3. Set the measuring receiver as follows:

Measurement .... RF POWER
Display .... LOG
Frequency .... 150 kHz
Frequency Increment .... 100 kHz

4. Set the Signal Generator as follows:

Frequency .... 150 kHz
Frequency Increment .... 100 kHz
Amplitude .... 0.0 dBm
Modulation .... Off

5. Wait for the power measurement to settle and then select DISPLAY RATIO to set a 0.0 dB. reference.
6. Step the Signal Generator and measuring receiver through the frequency range of 150 kHz to 1040 MHz (use 10 MHz steps above 10 MHz) and record the highest and lowest readings.

_______ Highest Reading _______ Frequency

_______ Lowest Reading _______ Frequency

The amplitude variation should not exceed 1.0 dB. Record the maximum variation (highest reading – lowest reading).

_______ <1.0 dB

Absolute Level Accuracy

7. Set the Signal Generator as follows:

Frequency .... 3 MHz
Amplitude .... +13 dBm
Amplitude Increment .... 5 dBm
Modulation .... Off

8. Set the measuring receiver as follows:

   Measurement .... RF POWER

9. Begin decrementing the Signal Generator's amplitude in 5 dB steps. At each step, the measuring receiver reading must be within the tolerances shown in the following Table, RF Output Frequencies. Step the amplitude down to −2 dBm. Change the measuring receiver's measurement to TUNED RF LEVEL. If RECAL or UNCAL is displayed press and release the CALIBRATE key. Continue to step the amplitude down to −127 dBm; and each time RECAL is displayed press and release the CALIBRATE key.

RF Output Frequencies 0.15 to 1040 MHz

Amplitude Setting (dBm)	Minimum (dBm)	Actual (dBm)	Maximum (dBm)
+8.0	+6.5	______	+9.5
+3.0	+2.0	______	+4.0
−2.0	−3.0	______	−1.0
−7.0	−8.0	______	−6.0
−12.0	−13.0	______	−11.0
−17.0	−18.0	______	−16.0
−22.0	−23.0	______	−21.0
−27.0	−28.0	______	−26.0
−32.0	−33.0	______	−31.0
−37.0	−38.0	______	−36.0
−42.0	−43.0	______	−41.0
−47.0	−48.0	______	−46.0
−52.0	−53.0	______	−51.0
−57.0	−58.0	______	−56.0
−63.0	−63.0	______	−61.0
−67.0	−68.0	______	−66.0
−72.0	−73.0	______	−71.0
−77.0	−78.0	______	−76.0
−82.0	−83.0	______	−81.0
−87.0	−88.0	______	−86.0
−92.0	−93.0	______	−91.0
−97.0	−98.0	______	−96.0
−102.0	−103.0	______	−101.0
−107.0	−108.0	______	−106.0
−112.0	−113.0	______	−111.0
−117.0	−118.0	______	−116.0
−122.0	−123.0	______	−121.0
−127.0	−128.0	______	−126.0

Performance Test 3

MODULATION TESTS

- **AC Modulation**
  - AM Indicator Accuracy
  - Incidental Phase Modulation
  - AM Distortion
  - FM Indicator Accuracy
  - Incidental AM
  - FM Distortion
- **DC Modulation**
  - DC FM Center Frequency Accuracy
  - DC FM Center Frequency Stability

Specifications

Electrical Characteristics	Performance Limits	Conditions
Amplitude Modulation		
Depth[1]	0 to 99%	Output levels to < +7 dBm; frequencies from 100 kHz to 1040 MHz.
	0 to 30%	Output levels to +10 dBm; frequencies from 100 kHz to 1040 MHz.
Resolution	1%	
Incidental Phase Modulation	< 0.3 radian peak	30% AM depth and internal rates.
Indicator Accuracy	+2% (±6% of reading)	Depths < 90% and internal rates and levels < +7 dBm.
AM Rates		
Internal	400 and 1 kHz, ±3%	
External	20 Hz to 40 kHz	1 dB bandwidth, ac coupled
AM Distortion	< 1.5%	0 to 30% AM
(internal rates,	< 3%	31 to 70% AM
levels < +10 dBm)	< 4%	71 to 90% AM
FM Modulation		
Maximum Peak Deviation (Δfpk):[2]		
Rates ≥ 25 Hz (ac mode)	99 kHz	0.1 to 130 MHz (fc)
Rates ≥ 50 Hz (ac mode)	50 kHz	130 to 260 MHz (fc)
Rates ≥ 50 Hz (ac mode)	99 kHz	260 to 520 MHz (fc)
Rates ≥ 25 Hz (ac mode)	99 kHz	520 to 1040 MHz (fc)

(1) AM Depth is further limited by the Indicator Accuracy specification.
(2) FM deviation is further limited by the Indicator Accuracy specification.

Electrical Characteristics	Performance Limits	Conditions
FM Modulation (cont'd) Maximum Peak Deviation (Δfpk):[3] (cont'd)		
Rates < 25 Hz (ac mode)	4000 × Rate Hz	0.1 to 130 MHz (fc)
Rates < 50 Hz (ac mode)	1000 × Rate Hz	130 to 260 MHz (fc)
Rates < 50 Hz (ac mode)	2000 × Rate Hz	260 to 520 MHz (fc)
Rates < 25 Hz (ac mode)	4000 × Rate Hz	520 to 1040 MHz (fc)
Rates (dc mode)	99 kHz	0.1 to 130 MHz (fc)
	50 kHz	130 to 260 MHz (fc)
	99 kHz	260 to 520 MHz (fc)
	99 kHz	520 to 1040 MHz (fc)
Center Frequency Accuracy (dc mode)	±500 Hz	0.1 to 130 MHz (fc)
	± 125 Hz	130 to 260 MHz (fc)
	± 250 Hz	260 to 520 MHz (fc)
	± 500 Hz	520 to 1040 MHz (fc)
Stability (dc mode)	< 10 Hz/hour	
Resolution	0.1 kHz	Deviations < 10 kHz
	1 kHz	Deviations ≥ 10 kHz
Incidental AM	< 0.1%	< 20 kHz peak deviation and internal rates: ≥ 500 kHz (fc)
Indicator Accuracy[3]	±5% of reading	At internal rates.
FM Distortion (Total Harmonic Distortion)[4,5]	<0.5%	≥ 3 kHz peak deviations and at internal rates.
FM Rates:		
Internal	400 and 1 kHz, ±2%	
External	dc to 50 kHz	ac coupled, ±1 dB 20 Hz to 50 kHz.
	dc to 100 kHz	±3 dB.

(3) FM deviation is further limited by the Indicator Accuracy specification.
(4) FM distortion only applies at deviation up to 25 kHz or 130 < fc <260 MHz, and 50 kHz for 260 < fc < 520 MHz. Typical total FM distortion (harmonic and non-harmonic) is less that 1.5% for all specified deviations and external rates of dc to 100 kHz.
(5) Typically < 0.5% THD for peak deviations > 1 kHz and at internal rates.

AC MODULATION

Description

AC modulation specifications are verified by measuring the specified parameters with a measuring receiver. Distortion is verified by measuring the demodulated output from the measuring receiver with a distortion analyzer.

Equipment

Measuring Receiver .... HP 8902A
Sensor Module .... HP 11722A
Audio Source .... HP 8903B
AM/FM Test Source .... HP 11715A
Cable (UG-21D/U type N connectors) .... HP 11500B
Cable (UG-88C/U BNC and dual banana plug connectors .... HP 11001-60001

Procedure

AM Indicator Accuracy

1. Connect the RF OUTPUT of the Signal Generator to the input of the measuring receiver as shown in Figure 4-7.

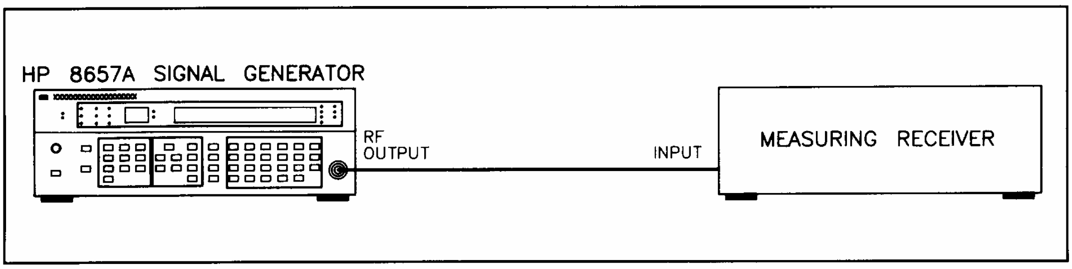


Figure 4–7. *Modulation Test Setup*

2. Set the measuring receiver as follows:

   Measurement .... AM
   Detector .... Peak+
   HP Filter .... 300 Hz
   LP Filter .... 15 kHz
   FM De-Emphasis .... Off
   Automatic Operation .... Selected

3. Set the Signal Generator as follows:

   Frequency .... 100 MHz
   Amplitude .... +7 dBm
   Modulation .... 1 kHz (Int.) AM 10%

4. Set the AM depth to the values listed in the following table and verify that the measured results are within the limits specified.
5. Repeat step 5 with the Signal Generator set to frequencies of 240 MHz, 400 MHz and 1040 MHz.
6. Select the measuring receiver's 50 Hz high-pass filter. Verify the AM accuracy with the Signal Generator frequency at 100 MHz and internal 400 Hz AM modulation.

MHz	AM Depth	Results		
		Min.	Actual	Max.
100	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	______ ______ ______ ______	12.6% 33.8% 76.2% 97.4%
240	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	______ ______ ______ ______	12.6% 33.8% 76.2% 97.4%
400	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	______ ______ ______ ______	12.6% 33.8% 76.2% 97.4%
1040	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	______ ______ ______ ______	12.6% 33.8% 76.2% 97.4%

Incidental Phase Modulation

7. Set the measuring receiver as follows:

Measurement .... Phase Modulation
HP Filter .... 300 Hz
LP Filter .... 15 kHz
Detector .... Peak+

8. Set the Signal Generator as follows:

Frequency .... 100 kHz
Frequency Increment .... 100 kHz
Amplitude .... +7 dBm
Modulation .... 1 kHz (Int.) AM 30%

9. Step the Signal Generator through the frequency range of 150 kHz to 1040 MHz use 10 MHz steps above 10 MHz) and record the highest reading. The highest reading should not exceed the limit specified.

Signal Generator Frequency		Result	
Min.	Max.	Actual	Max.
150 kHz	1040 MHz	______	< 0.3 radian peak

AM Distortion

10. Set the measuring receiver as follows:

Measurement .... 1 kHz Audio Distortion
HP Filter .... 300 Hz
LP Filter .... 15 kHz
Detector .... Peak+

11. Set the Signal Generator as follows:

Frequency .... 10 MHz
Amplitude .... +7 dBm
Modulation .... 1 kHz (Int.) AM 30%

12. Set the AM depth to the values listed in the following table and verify that the measured results do not exceed the limits specified.

13. Repeat step 13 with the Signal Generator set to frequencies of 240 MHz, 400 MHz, and 1040 MHz.

MHz	AM Depth	Results	
		Actual	Max.
100	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%
240	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%
400	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%
1040	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%

FM Indicator Accuracy

14. Set the measuring receiver as follows:

Measurement .... FM
Detector .... Peak+
HP Filter .... 300 Hz
LP Filter .... 3 kHz

15. Set the Signal Generator as follows:

Frequency .... 100 MHz
Amplitude .... +7 dBm
Modulation .... 1 kHz (Int) FM 5 kHz

16. Set FM deviation to the values listed in the following table and verify that the measured results are within the limits specified.

FM Deviation for 100 MHz	Results		
	Min.	Actual	Max.
5.0 kHz	4.75 kHz	______	5.25 kHz
30.0 kHz	28.50 kHz	______	31.50 kHz
70.0 kHz	66.50 kHz	______	73.50 kHz
99.0 kHz	94.05 kHz	______	103.95 kHz

Incidental AM

The incidental AM specification of the Signal Generator is not equivalent to the published specification of the HP 8902A Measuring Receiver. To make a valid incidental AM measurement, the incidental AM of the measuring receiver must be four times better than the specification being tested. In order to verify that the incidental AM of the measuring receiver is adequate to measure the Signal Generator's incidental AM specification, the incidental AM of the measuring receiver must be verified to ensure the validity of the measurement. If the Signal Generator's incidental AM is measured frequently, it is not necessary to verify the incidental AM of the measuring receiver each time; however, it is recommended that it be verified monthly to ensure an accurate measurement.

17. Verify the incidental AM of the measuring receiver as follows:
   a. Connect the FM divide-by-4 output of the AM/FM test source to the input of the measuring receiver and the 50 ohm output of the test oscillator to the audio input of the AM/FM test source, as shown in Figure 4-8.
   b. Set the measuring receiver as follows:

      Measurement .... Frequency

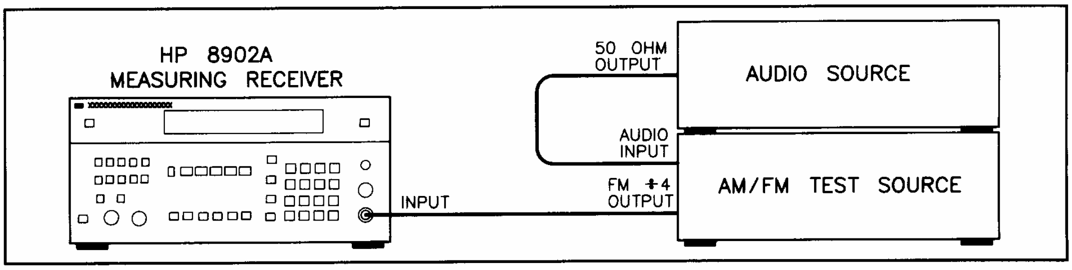


Figure 4-8. *Measuring Receiver Incidental AM Verification Test Setup*

   c. Set the AM/FM test source as follows:

      Test Mode .... FM

   d. Tune the carrier frequency on the AM/FM test source for a measuring receiver reading of 100 MHz ±0.1 MHz.
   e. Set the test oscillator as follows:

      Frequency .... 1 kHz
      Output Attenuator .... −10 dBm
      Amplitude Course .... Fully ccw

f. Set the measuring receiver as follows:

Measurement .... FM
Detector .... Peak+
HP Filter .... 300 Hz
LP Filter .... 3 kHz

g. Increase the output of the test oscillator by rotating the Amplitude Coarse control clockwise until the measuring receiver indicates 20.0 kHz ±0.1 kHz peak deviation.

h. Set the measuring receiver as follows:

Measurement .... AM

i. The modulation must be < 0.02% AM to test the incidental AM of the Signal Generator.

18. Set the measuring receiver as follows:

Measurement .... AM
Detector .... Peak+
HP Filter .... 300 Hz
LP Filter .... 3 kHz

19. Set the Signal Generator as follows:

Amplitude .... +7 dBm
Modulation .... 1 kHz (Int) FM 20 kHz

20. Connect the equipment as shown in Figure 4-7, Modulation Test Setup.

21. Set the Signal Generator frequency to a value within the range specified in the following table and verify that the measured result does not exceed the limit specified.

Signal Generator Frequency		Result	
Min.	Max.	Actual	Max.
10 MHz	1040 MHz	________	< 0.1%

NOTE

Below 10 MHz, the incidental AM of the Signal Generator is less than that of the measuring receiver.

FM Distortion

22. Set the measuring receiver as follows:

Measurement .... FM
Detector .... Peak+
HP Filter .... 300 Hz
LP Filter .... 3 kHz

23. Set the distortion analyzer as follows:

Function .... Distortion
Analyzer Input Select .... Distortion
Frequency .... 1 kHz

24. Set the Signal Generator as follows:

Frequency .... 100.0 MHz
Amplitude .... +7 dBm
Modulation .... 1 kHz (Int) FM

25. Connect the equipment as shown in Figure 4-7, Modulation Test Setup.
26. Verify that the measured Total Harmonic Distortion does not exceed 0.5%.
27. Set the Signal Generator FM deviation to a value within the range specified in the following table and verify that the measured result does not exceed the limit specified.

FM Deviation		Result	
Min.	Max.	Actual	Max.
3 kHz	99 kHz	________	<0.5%

NOTE

At peak deviations less than 3 kHz, residual FM and other type of FM distortion become a greater portion of the distortion reading. If the distortion falls within tolerance at or above 3 kHz, it may be safely assumed that the Signal Generator meets the test requirements.

DC MODULATION

Description

DC FM specifications are verified by measuring the RF OUTPUT frequency offset with a frequency counter.

Equipment

Frequency Counter .... HP 5328B OPT 31

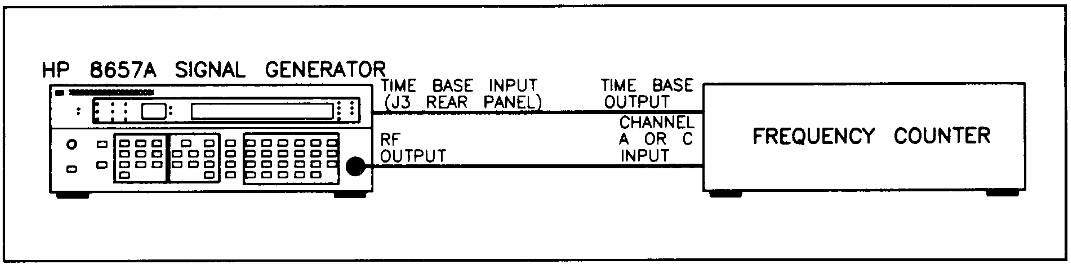


Figure 4–9. *DC FM Test Setup*

Procedure

DC FM Center Frequency Accuracy

28. Connect the RF OUTPUT from the Signal Generator to the INPUT of the frequency counter, and connect the Signal Generator TIME BASE INPUT to the Frequency counter TIME BASE OUTPUT as shown in Figure 4-9.

29. Set the frequency counter as follows:

INPUT .... CHANNEL A
TRIGGER .... CHANNEL A

30. Set the Signal Generator as follows:

Frequency .... 100 MHz
Amplitude .... 0 dBm
Modulation .... DC FM

31. Set the Signal Generator FM deviation to a value for the frequency range specified in the following table. Verify that the measured frequency does not exceed the limits specified.

Frequency (MHz)	DC FM Deviation(kHz)	Frequency Offset(kHz)	Frequency Drift(Hz/Hr)
0.1 to 130	1 to 99	________ ±500 Hz	________ ±10
130 to 260	1 to 50	________ ±125 Hz	________ ±10
260 to 520	1 to 99	________ ±250 Hz	________ ±10
520 to 1040	1 to 99	________ ±500 Hz	________ ±10

DC FM Center Frequency Stability

32. Set the Signal Generator FM deviation and frequency as shown in the table above and verify that the frequency drift does not exceed the limits specified.

Performance Test 4

OUTPUT LEAKAGE TESTS

Specification

Leakage limits are within those specified in MIL STD 461B, and FTZ 1115. Furthermore, less than 1.0 μV is induced in a two-turn, 2.5 cm (1 inch) diameter loop held 2.5 cm (1 inch) away from the front surface and measured into a 50Ω receiver.

Description

Output leakage is verified by holding a loop antenna 2.5 cm (1 inch) from the front surface of the Signal Generator and measuring the resulting signal with a spectrum analyzer.

The loop antenna is suspended in a molding so that when the molding is in contact with a surface, the loop antenna is one inch from the surface.

NOTE

The use of a screen room may be necessary to reduce external radiated interference.

Equipment

One-Inch Loop Antenna .... HP 08640-60501
26 dB Amplifier .... HP 8447D
Spectrum Analyzer .... HP 8558B or HP 8568B
50Ω Termination .... HP 908A

Procedure

1. Connect equipment as shown in Figure 4-10.

NOTE

To avoid disturbing the antenna's field and causing measurement error, grasp the antenna at the end that has the BNC connector.

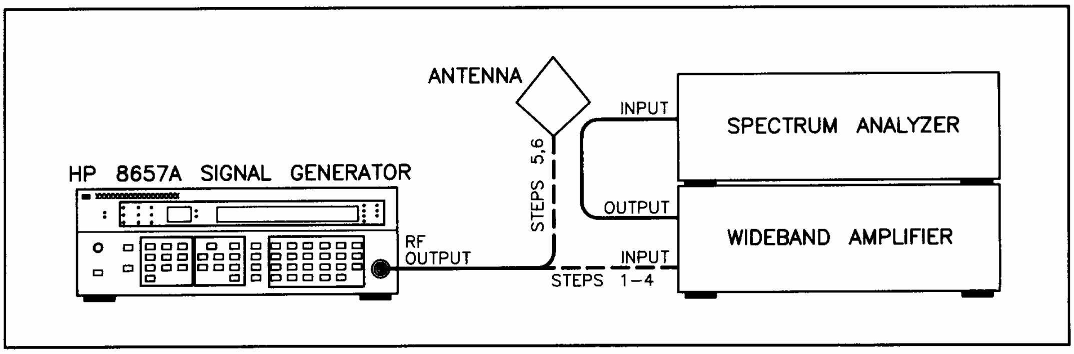


Figure 4-10. *Output Leakage Test Setup*

2. Set the Signal Generator as follows:

   Frequency .... 100 MHz
   Amplitude .... −107 dBm
   Modulation .... Off

3. Set the spectrum analyzer as follows:

   Center Frequency .... 100 MHz
   Input Attenuation .... −40 dB
   Reference Level .... −20 dBm
   Frequency Span .... 20 MHz
   Resolution Bandwidth .... 10 kHz

4. View the signal on the spectrum analyzer and adjust the reference level controls of the spectrum analyzer to set the −107 dBm signal from the Signal Generator to reference graticule line on the spectrum analyzer display. Set the video filter to further separate the signal from the noise. Disconnect the Signal Generator from the spectrum analyzer, and connect a 50 ohm termination to the Signal Generator's RF OUTPUT connector.

5. Connect the one-inch loop antenna to the analyzer through the 26 dB amplifier as shown in Figure 4-10. Hold the end of the loop antenna cylinder in contact with the front surfaces of the Signal Generator. All signals and noise should be below the reference graticule line (i.e.,below −107 dBm).

   ________ < −107 dBm (<1.0 μV) at 100 MHz

6. Repeat step 5 for frequencies of 300, 500, 700, 900, and 1040 MHz.

   ________ < −107 dBm (<1.0 μV) at 300 MHz

   ________ < −107 dBm (<1.0 μV) at 500 MHz

   ________ < −107 dBm (<1.0 μV) at 700 MHz

   ________ < −107 dBm (<1.0 μV) at 900 MHz

   ________ < −107 dBm (<1.0 μV) at 1040 MHz

Performance Test 5

SWR TEST

- **< −4 dBm (10 dB Attenuator Pad Selected)**
- **> −3 dBm (Attenuator Pads Not Selected)**

Specification

Electrical Characteristics	Performance Limits	Conditions
SWR:		
RF OUTPUT	< 2.0, −9.6 dB Return Loss	≥ −3.5 dBm
	< 1.5, −14 dB Return Loss	< −3.5 dBm
Impedance	50 ohms nominal	
Reverse Power	50 watts	RF power to 1040 MHz into RF OUTPUT, dc voltage cannot exceed 25V.

Description

SWR is verified by comparing the reflected power (frequencies 0.5 to 1040 MHz from an RF signal source) to a reference that represents 100% return loss. The reference level is determined by disconnecting the SWR bridge from the Signal Generator under test, and connecting a short to the SWR bridge (100% reflected power) to the spectrum analyzer. The reference is established on the spectrum analyzer display. The SWR bridge is then connected to the Signal Generator under test, and return loss for the frequency is displayed on the spectrum analyzer. The output frequency of Signal Generator under test must be set 100 MHz from the frequency of the RF signal source.

Equipment

RF Signal Source .... HP 8657A
Spectrum Analyzer .... HP 8558B/853A
SWR Bridge .... Wiltron 60N50
Cables (UG-21D/U type N connectors) .... HP 11500B (2 Required)

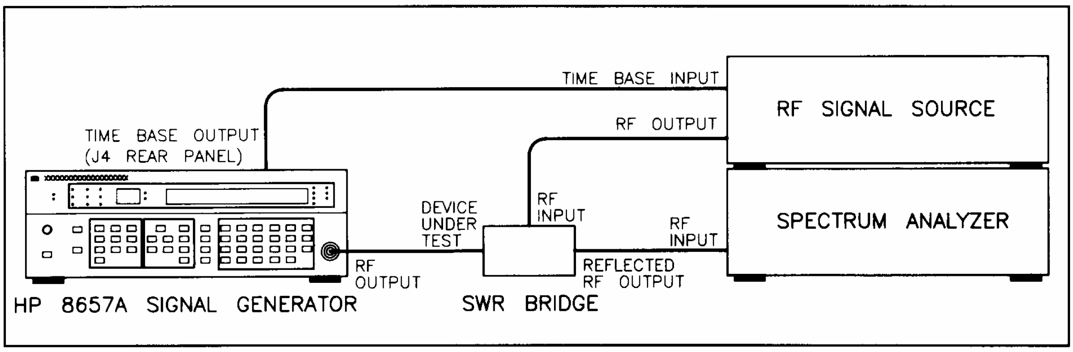


Figure 4-11. *SWR Performance Test Setup (Out of Band)*

Procedure

≤ −4 dBm (10 dB Attenuator Pad Selected)

1. Set the Signal Generator (HP 8657A) as follows:

   Frequency .... 0.1 MHz
   Modulation .... Off
   Amplitude .... −10 dBm

2. Set the spectrum analyzer as follows:

   Frequency Span .... 100 MHz
   Resolution Bandwidth .... 300 kHz
   Reference Level .... 0 dBm
   Center Frequency .... 100 MHz

3. Set the RF signal source as follows:

   Output Level .... +10 dBm
   Frequency .... 100 MHz

4. Connect the equipment as shown in Figure 4-11.
5. With the SWR bridge disconnected from the Signal Generator under test, and a short connected to the SWR bridge, set the reference level on the spectrum analyzer for a 100% reflected signal.
6. Connect the SWR bridge to the Signal Generator's RF OUTPUT connector. The difference, in dB, of the level on the display and the reference is the return loss of the Signal Generator's RF OUTPUT connector. The return loss must be >14 dB.

   ________ 14 dB

7. Repeat steps 3 through 6 with the RF signal source set to any frequency between 5 MHz and 1040 MHz and 100 MHz from the Signal Generator's frequency.

   ________ 14 dB

SWR Test > −3 dBm (Attenuator Pads Not Selected)

SWR, without any attenuation, is verified by the following procedure. Set the amplitude of the Signal Generator under test and turn off the RF signal source. Then the amplitude of the reflected signal from the RF source is set to an equal level with the Device Under Test port shorted. The maximum and minimum voltages in dB are read from the spectrum analyzer to compute the SWR using the equation listed below.

8. Set the Signal Generator (HP 8657A) as follows:

   Frequency . . . . 100 MHz
   Modulation . . . . Off
   Amplitude . . . . −2 dBm

9. Set the spectrum analyzer as follows:

   Frequency Span . . . . 0 Hz
   Resolution Bandwidth . . . . 3 MHz
   Reference Level . . . . 0 dBm
   Center Frequency . . . . 100 MHz
   Scale . . . . LOG 2dB/Div

10. Set the RF signal source as follows:

    Amplitude . . . . −127 dBm
    Modulation . . . . Off
    Frequency . . . . 100 MHz
    RF . . . . Off

11. Connect the equipment as shown in Figure 4-11.
12. With the SWR bridge connected to the Signal Generator under test, and the amplitude of the RF signal source turned off, set a reference on the spectrum analyzer. Tune the frequency of the spectrum analyzer for maximum level on the display.
13. Disconnect the SWR bridge from the Signal Generator under test and connect a short to the Device Under Test port.
14. Set the amplitude of the RF signal source to +13 dBm.
15. Set the amplitude of the RF signal source to the same level on the spectrum analyzer as set in step 12.
16. Remove the short from the SWR bridge, and connect the SWR bridge to the Signal Generator under test.
17. Press and release the Blue SHIFT key. Press and hold the Phase Decrement DOWN key (frequency decrement DOWN key). The level on the spectrum analyzer changes as the phase changes.

NOTE

Each time the Phase Decrement key is released, the Blue SHIFT must be pressed to reselect the Phase Decrement function.

18. Read the maximum and minimum levels from the spectrum analyzer and substitute their value in the following equation and solve for the SWR of the Signal Generator.

_________ <2.0

19. Repeat steps 8 through 18 for each frequency between 5 and 1040 MHz SWR is to be checked.

$$SWR = \frac{1+\rho}{1-\rho} = \frac{E_{max}}{E_{min}}$$

$$E_{max} = A + \rho A$$

$$E_{min} = A - \rho A$$

$$SWR = \frac{E_{max}/A}{E_{min}/A} = \frac{E_{max}}{E_{min}}$$

$$20\ log\ E_{max} = E_{max} dB$$

$$20\ log\ E_{min} = E_{min} dB$$

$$20\ log\ SWR = 20\ log \frac{(E_{max})}{(E_{min})}$$

$$20\ log\ SWR = 20\ log E_{max} - 20\ log E_{min}$$

$$20\ log\ SWR = E_{max}\ dB - E_{min}\ dB$$

$$SWR = 10^{\frac{E_{max}\ dB - E_{min}\ dB}{20}}$$

Performance Test Record

PERFORMANCE TEST 1: SPECTRAL PURITY TESTS

Spurious Signals

Spurious Signals	Results	
	Actual	Max.
Harmonics	________	< −30 dBc
Non-Harmonics (≥ 2 MHz from carrier)	________	< −60 dBc
5 kHz to 2 MHz from carrier	________	< − 60 dBc, 0.1 tp 130 MHz
	________	< −72 dBc, 130 to 260 MHz
	________	< −66 dBc, 260 to 520 MHz
	________	< − 60 dBc, 520 to 1040 MHz
Sub-Harmonics	________	None

Residual AM

The digital multimeter should indicate <4.00 mVrms.

Actual	Maximum
________	< 4.00 mVrms

PERFORMANCE TEST 1: SPECTRAL PURITY TESTS (CONT'D)

Residual FM Test

Signal Generator Frequency (MHz)	Modulation Analyzer Filter		Results (Hz rms)	
	High Pass (Hz)	Low Pass (kHz)	Actual	Max.
0.15 to 129.99999	300	3	______	< 4
0.15 to 129.99999	50	15	______	< 6

Optional Residual FM Test Specifications

Signal Generator Frequency (MHz)	Modulation Analyzer Filter		Results (Hz rms)	
	High Pass (Hz)	Low Pass (kHz)	Actual	Max.
0.15 to 130	300	3	______	< 4
130 to 260	300	3	______	< 1
260 to 520	300	3	______	< 2
520 to 1040	300	3	______	< 4
0.15 to 130	50	15	______	< 6
130 to 260	50	15	______	< 1.5
260 to 520	50	15	______	< 3
520 to 1040	50	15	______	< 6

SSB Phase Noise (1 HZ Bandwidth)

Offset from Carrier	SSB Phase Noise		Carrier Frequency (MHz)
	Min.	Actual	
20 kHz	−124 dBc/Hz	______	0.1 to 129
	−136 dBc/Hz	______	130 to 260
	−130 dBc/Hz	______	260 to 520
	−124 dBc/Hz	______	520 to 1040

PERFORMANCE TEST 2: HARMONIC TESTS

Output Level Accuracy and Flatness Tests

Step the Signal Generator and measuring receiver through the frequency range of 150 kHz to 1040 MHz (use 10 MHz steps above 10 MHz) and record the highest and lowest readings.

_______ **Highest Reading** _______ **Frequency**

_______ **Lowest Reading** _______ **Frequency**

The amplitude variation should not exceed 1.0 dB. Record the maximum variation (highest reading − lowest reading).

_______ **<1.0 dB**

Absolute Level Accuracy

RF Output Frequencies 0.15 to 1040 MHz

Amplitude Setting (dBm)	Minimum (dBm)	Actual (dBm)	Maximum (dBm)
+8.0	+6.5	_______	+9.5
+3.0	+2.0	_______	+4.0
−2.0	−3.0	_______	−1.0
−7.0	−8.0	_______	−6.0
−12.0	−13.0	_______	−11.0
−17.0	−18.0	_______	−16.0
−22.0	−23.0	_______	−21.0
−27.0	−28.0	_______	−26.0
−32.0	−33.0	_______	−31.0
−37.0	−38.0	_______	−36.0
−42.0	−43.0	_______	−41.0
−47.0	−48.0	_______	−46.0
−52.0	−53.0	_______	−51.0
−57.0	−58.0	_______	−56.0
−63.0	−63.0	_______	−61.0
−67.0	−68.0	_______	−66.0
−72.0	−73.0	_______	−71.0
−77.0	−78.0	_______	−76.0
−82.0	−83.0	_______	−81.0
−87.0	−88.0	_______	−86.0
−92.0	−93.0	_______	−91.0
−97.0	−98.0	_______	−96.0
−102.0	−103.0	_______	−101.0
−107.0	−108.0	_______	−106.0
−112.0	−113.0	_______	−111.0
−117.0	−118.0	_______	−116.0
−122.0	−123.0	_______	−121.0
−127.0	−128.0	_______	−126.0

PERFORMANCE TEST 3: MODULATION TESTS

AM Indicator Accuracy

MHz	AM Depth	Results		
		Min.	Actual	Max.
100	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	________ ________ ________ ________	12.6% 33.8% 76.2% 97.4%
240	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	________ ________ ________ ________	12.6% 33.8% 76.2% 97.4%
400	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	________ ________ ________ ________	12.6% 33.8% 76.2% 97.4%
1040	10% 30% 70% 90%	7.4% 26.2% 63.8% 82.6%	________ ________ ________ ________	12.6% 33.8% 76.2% 97.4%

Incidental Phase Modulation

Signal Generator Frequency		Result	
Min.	Max.	Actual	Max.
150 kHz	1040 MHz	________	< 0.3 radian peak

PERFORMANCE TEST 3: MODULATION TESTS (CONT'D)

AM Distortion

MHz	AM Depth	Results	
		Actual	Max.
100	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%
240	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%
400	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%
1040	30% 70% 90%	______ ______ ______	< 1.5% < 3.0% < 4.0%

FM Indicator Accuracy

FM Deviation for 100 MHz	Results		
	Min.	Actual	Max.
5.0 kHz	4.75 kHz	______	5.25 kHz
30.0 kHz	28.50 kHz	______	31.50 kHz
70.0 kHz	66.50 kHz	______	73.50 kHz
99.0 kHz	94.05 kHz	______	103.95 kHz

Incidental AM

Signal Generator Frequency		Result	
Min.	Max.	Actual	Max.
10 MHz	1040 MHz	______	< 0.1%

PERFORMANCE TEST 3: MODULATION TESTS (CONT'D)

FM Distortion

FM Deviation		Result	
Min.	**Max.**	**Actual**	**Max.**
3 kHz	99 kHz	________	<0.5%

DC FM Frequency Accuracy and Stability

Frequency (MHz)	DC FM Deviation(kHz)	Frequency	
		Offset(kHz)	**Drift(Hz/Hr)**
0.1 to 130	1 to 99	________ ±500 Hz	________ ±10
130 to 260	1 to 50	________ ±125 Hz	________ ±10
260 to 520	1 to 99	________ ±250 Hz	________ ±10
520 to 1040	1 to 99	________ ±500 Hz	________ ±10

PERFORMANCE TEST 4: OUTPUT LEAKAGE TESTS

Output Leakage Tests

Connect the one-inch loop antenna to the analyzer through the 26 dB amplifier as shown in Figure 4–10. Hold the end of the loop antenna cylinder in contact with the front surfaces of the Signal Generator. All signals and noise should be below the reference graticule line (i.e.,below −107 dBm).

________ < −107 dBm (<1.0 μV) at 100 MHz

Repeat step 5 for frequencies of 300, 500, 700, 900, and 1040 MHz.

________ < −107 dBm (<1.0 μV) at 300 MHz

________ < −107 dBm (<1.0 μV) at 500 MHz

________ < −107 dBm (<1.0 μV) at 700 MHz

________ < −107 dBm (<1.0 μV) at 900 MHz

________ < −107 dBm (<1.0 μV) at 1040 MHz

PERFORMANCE TEST 5: SWR TESTS

SWR Tests

Connect the SWR bridge to the Signal Generator's RF OUTPUT connector. The difference, in dB, of the level on the display and the reference is the return loss of the Signal Generator's RF OUTPUT connector. The return loss must be >14 dB.

________ 14 dB

Repeat steps 3 through 6 with the RF signal source set to any frequency between 5 MHz and 1040 MHz and 100 MHz from the Signal Generator's frequency.

________ 14 dB

SWR Test > −3 dBm (Attenuator Pads Not Selected)

Read the maximum and minimum levels from the spectrum analyzer and substitute their value in the following equation and solve for the SWR of the Signal Generator.

________ <2.0

Section 5
ADJUSTMENTS

5-1. INTRODUCTION

This section contains adjustments and checks that assure peak performance of the Signal Generator. The instrument should be readjusted after repair or failure to pass a performance test. Allow a 30-minute warm-up prior to performing the adjustments. Removal of the instrument top and bottom covers is required for most adjustments. Included in this section are test setups and diagrams that show the location of each assembly. Adjustment location diagrams are provided in Figure 5-26 at the end of this section. (Removal and disassembly procedures are provided in Section 8.) To determine which performance tests and adjustments to perform after a repair, refer to Table 5-2, Post-Repair Adjustments.

5-2. SAFETY CONSIDERATIONS

Refer to the Safety Considerations page found at the beginning of this manual for a summary of the safety information.

5-3. EQUIPMENT REQUIRED

All adjustment procedures contain a list of required test equipment. The test equipment is also identified by callouts in the test setup diagrams, where included. If substitutions must be made for the specified test equipment, refer to the Recommended Test Equipment table in Section 1 of this manual for the minimum specifications. It is important that the test equipment meet the critical specifications listed in the table if the Signal Generator is to meet is to performance requirements.

5-4. FACTORY-SELECTED COMPONENTS

Factory-selected components are identified on the schematics and parts lists by asterisk (*) which follows the reference designator. The nominal value or range of the components is shown. Manual Update addition and replacement pages provide updated information pertaining to selected components. Table 5-1 lists the reference designator, the basis used for selecting a particular value, the nominal value range, and the service sheet where the component part is shown.

5-5. POST-REPAIR ADJUSTMENTS

Table 5-2 lists the adjustments related to repairs or replacement of any of the assemblies.

5-6. RELATED ADJUSTMENTS

The procedures in this section can be done in any order; however, it is suggested that the power supply voltage, reference voltage, and audio oscillator adjustments be performed first. Changes in these adjustments can affect other adjustments, especially level and modulation accuracies.

WARNING

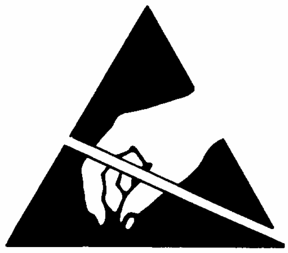
Maintenance described herein is performed with power supplied to the instrument, and protective covers removed. Such maintenance should be performed only by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power should be removed.

***Table 5–1.** Factory Selected Components*

<table>
<tr><th>Reference Designator</th><th>Service Sheet</th><th>Range of Values</th><th>Basis of Selection</th></tr>
<tr><td>A3C23</td><td>16</td><td>33 pF to 47 pF</td><td>Select capacitor so that the output level of the 50 MHz Reference Oscillator can be adjusted to greater than +17 dBm.</td></tr>
<tr><td>A3L6</td><td>16</td><td>680 nH or
470 nH</td><td>Select inductor so that the 50 MHz crystal can be tuned to 50 MHz ±1250 Hz using an external reference.</td></tr>
<tr><td>A3R303</td><td>11</td><td>3.16k to 4.64k</td><td>Nominal value 3.16k. Select alternate values (3.48k or 4.64k) to insure correct operation of Fractional-N IC (A3U17).</td></tr>
<tr><td>A4R6, 7, 10</td><td>1</td><td>See table under "Basis of Selection"</td><td>Attenuator pad selected for −8 dBm input to mixer A4U1. Measure power level at RF Test Point A4TP3 as described in Adjustment 9. Select pad values for −8 dBm to mixer. Level must be checked whenever the A3A1, A4, A8, or FL1 assemblies are replaced.
<table>
<tr><th>Attenuation (dB)</th><th>R6, R10 (ohms)</th><th>HP Part No. (Check Digit)</th><th>R7 (ohms)</th><th>HP Part No. (Check Digit)</th></tr>
<tr><td>2</td><td>422</td><td>0698-7227 (6)</td><td>10</td><td>0698-7189 (9)</td></tr>
<tr><td>3</td><td>287</td><td>0698-7223 (2)</td><td>17.8</td><td>0698-7194 (6)</td></tr>
<tr><td>4</td><td>215</td><td>0698-7220 (9)</td><td>23.7</td><td>0698-7197 (9)</td></tr>
<tr><td>5</td><td>178</td><td>0698-7218 (5)</td><td>31.6</td><td>0698-7200 (5)</td></tr>
<tr><td>6</td><td>147</td><td>0698-7216 (3)</td><td>38.3</td><td>0698-7202 (7)</td></tr>
<tr><td>7</td><td>133</td><td>0698-7215 (2)</td><td>46.4</td><td>0698-7204 (9)</td></tr>
<tr><td>8</td><td>121</td><td>0698-7214 (1)</td><td>51.1</td><td>0698-7205 (0)</td></tr>
<tr><td>9</td><td>110</td><td>0698-7213 (0)</td><td>61.9</td><td>0698-7207 (2)</td></tr>
<tr><td>10</td><td>100</td><td>0698-7212 (9)</td><td>75.0</td><td>0698-7209 (4)</td></tr>
</table></td></tr>
<tr><td>A4C155</td><td>1</td><td>10 pF to 33 pF</td><td>Decrease the value of C155 if the 520–1040 MHz oscillator fails to oscillate at 520 MHz only. Increase C15's value if spurs are present at half the fundamental frequency from 520 to 1040 MHz.</td></tr>
<tr><td>A6C232</td><td>4</td><td>0 or 1.8 pF</td><td>Removed to eliminate spurs at 1200 to 1400 MHz when the RF OUTPUT is 600 MHz to 700 MHz.</td></tr>
<tr><td>A8C5</td><td>3</td><td>47 pF to 82 pF</td><td>Select A8C5 to maximize DC voltage measured at J2 pin 4.</td></tr>
<tr><td>A8C19</td><td>3</td><td>20 pF to 39 pF</td><td>Select A8C19 to maximize DC voltage measured at J2 pin 6.</td></tr>
<tr><td>A8C40</td><td>3</td><td>0 or 1000 pF</td><td>Selected to eliminate a spurious signal at 700 MHz.</td></tr>
</table>

Table 5–2. Post-Repair Adjustments

Assembly Repaired or Replaced	Reference Service Sheet No.	Related Adjustments
A1	21	—
A2	21 - 24	—
A3	11	—
A3	12	15
A3	13	16
A3	14	14
A3	15	17,19
A3	16	5,6
A3A1	9	7,9
A4	1	9,10,11
A4	2	—
A6	4	12,13
A6	5	—
A8	1	9
A8	3	8,9
A9	8	2
A10	6	2
A10	7	3,4,12,13,20,18,21
A10	25	1
A11	17 - 20	—
A16	25	22
FL1	3	9



ATTENTION
Static Sensitive
Devices

When handling equipment containing static sensitive devices, adaquate precautions must be taken to prevent device damage or destruction. Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service circuitry with these devices.

Adjustment 1

POWER SUPPLY VOLTAGE ADJUSTMENT

- **Service Sheets 10 and 25.**

Description

The +5.4 Vdc power supply is adjusted for +5.4 Vdc ±0.02 Vdc at A10J2 pin 10 using a digital multimeter.

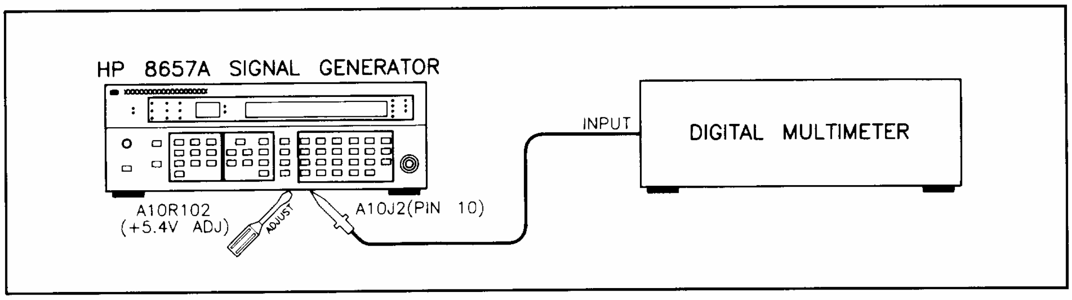


Figure 5–1. *+5.4 Vdc Power Supply Adjustment Setup*

Equipment

Digital Multimeter .... HP 3466A

Procedure

1. Set the digital multimeter as follows:

   Function .... Vdc
   Range 20V

2. Set the Signal Generator as follows:

   Frequency .... 140 MHz
   Amplitude .... −10 dBm
   Modulation .... AM 50%

3. Connect the digital multimeter to A10J2 pin 10. Adjust A10R102 (+5.4V ADJ) for a reading of +5.4 Vdc ±0.02 Vdc on the digital multimeter.

Adjustment 2

REFERENCE VOLTAGE ADJUSTMENT

- **Service Sheet 6**

Description

The +2 Vdc reference is adjusted for +2.000 Vdc ±0.004 Vdc at A10TP12 using a digital multimeter.

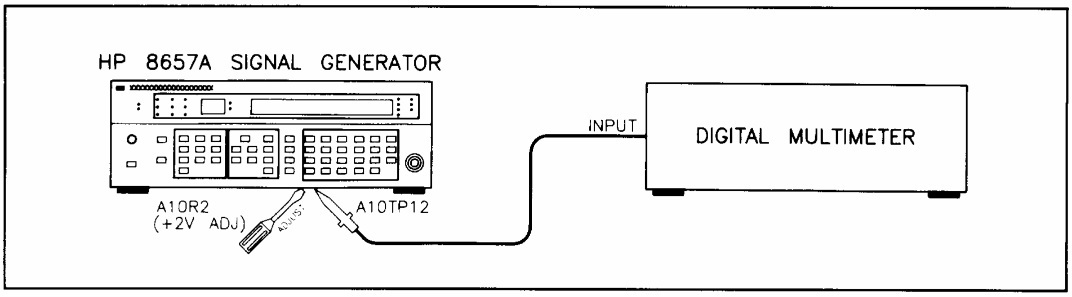


Figure 5–2. *+2 Vdc Reference Adjustment Setup*

Equipment

Digital Multimeter .... HP 3466A

Procedure

1. Set the digital multimeter as follows:

   Function .... Vdc
   Range 20V

2. Set the Signal Generator as follows:

   Frequency .... 140 MHz
   Amplitude .... −10 dBm
   Modulation .... AM 50%

3. Connect the digital multimeter to A10TP12 and adjust A10R2 (+2V ADJ) for a reading of 2.000 Vdc ±0.004 Vdc on the digital multimeter.

Adjustment 3

AUDIO OSCILLATOR LEVEL ADJUSTMENT

- **Service Sheet 7**

Description

The internal 1 kHz modulation source is adjusted to 0.707 Vrms ±0.007 Vrms at A10TP11 (OSC). Then, the internal 400 Hz modulation source is checked to ensure that it is within the same limits.

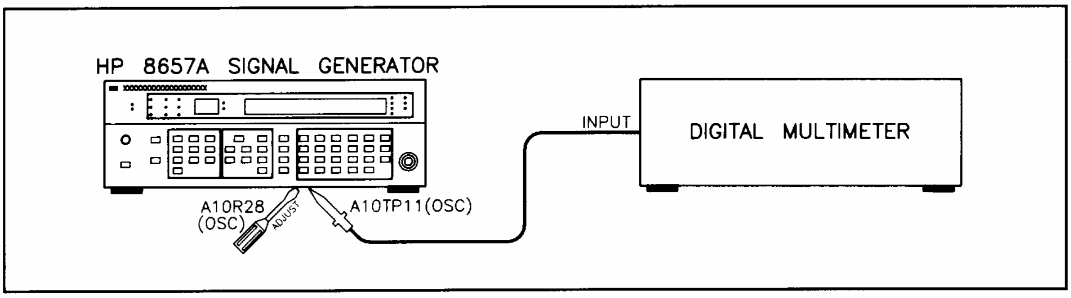


Figure 5-3. *Audio Oscillator Level Adjustment Setup*

Equipment

Digital Multimeter .... HP 3466A

Procedure

1. Set the digital multimeter as follows:

   Function .... Vac
   Range 2V

2. Set the Signal Generator as follows:

   Frequency .... Any
   Amplitude .... Any
   Modulation .... AM
   Source .... 1 kHz

3. Connect the digital multimeter to A10TP11 (OSC).
4. Adjust A10R28 (OSC) for a 0.707 Vrms ±0.007 Vrms reading on the digital multimeter.
5. Select the internal 400 Hz modulation source. Check that the 400 Hz oscillator level is within 0.707 Vrms ±0.007 Vrms. If it is not, repeat step 4 until both readings are within the specified limits.

Adjustment 4

AM OFFSET ADJUSTMENT

- **Service Sheet 7**

Description

The dc offset of the AM Offset Buffer is adjusted for 0.000 Vdc ±0.001 Vdc at A10TP10 (AM) with the reference inputs to the Level DAC and AM% DAC grounded, and the digital input to each programmatically set to zero.

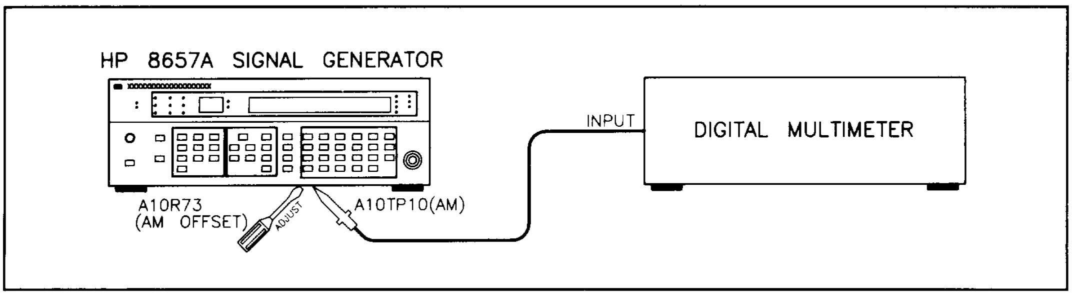


Figure 5–4. *AM Offset Adjustment Setup*

Equipment

Digital Multimeter .... HP 3466A

Procedure

1. Set the digital multimeter as follows:

   Function .... Vdc
   Range .... 200 mV

2. Set the Signal Generator modulation off.
3. Short A10TP7 and A10TP8 to ground.
4. Select Keyboard Invoked Test number 2 by pressing the SHIFT key, and then the INCR SET key. Next, press the AMPTD up-arrow key once to show the number "2" in the MODULATION Display. Press the INCR SET key once to zero the AM and FM modulation DACs. In the AMPLITUDE DISPLAY "00" should be seen to indicate that test number 2 is complete.
5. Connect the digital multimeter to A10TP10 (AM).
6. Adjust A10R73 (AM OFFSET) for 0.000 Vdc ±0.001 Vdc.
7. Remove the two shorts installed in step 3.
8. Press the AMPTD up arrow key five times until "7" is shown in the MODULATION Display.
9. Press the INCR SET key once to exit from the Keyboard Invoked Tests.

Adjustment 5

50 MHZ REFERENCE OSCILLATOR FREQUENCY ADJUSTMENT

- **Service Sheet 16**

Description

The internal 50 MHz Reference Oscillator frequency is adjusted to 50.0000 MHz ±100 Hz by adjusting the TIME BASE OUTPUT for 10.000 000 MHz ±20 Hz (50 MHz reference divided-by-10) using a frequency counter.

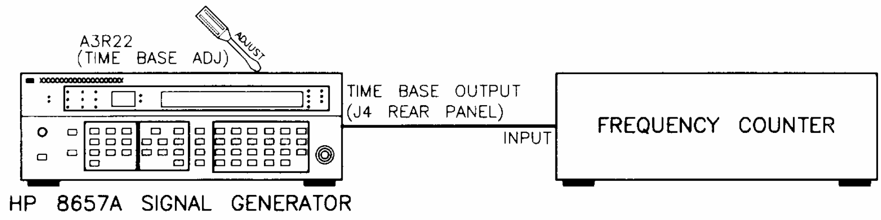


Figure 5–5. *50 MHz Reference Oscillator Frequency Adjustment Setup*

Equipment

Frequency Counter .... HP 5328B
Cable BNC(m) .... HP 10503A

NOTE

If the Signal Generator has Option 001 installed disconnect coaxial cable A16W2 from the rear-panel TIME BASE INPUT connector J3.

Procedure

1. Connect the frequency counter to J4 using the BNC cable.
2. Adjust A3R22 (TIME BASE ADJ) for a frequency counter reading of 10.000 000 MHz ±20 Hz.

Adjustment 6

50 MHZ REFERENCE OSCILLATOR LEVEL ADJUSTMENT

- **Service Sheet 16**

Description

The output power level of the 50 MHz Reference Oscillator is adjusted for a maximum level between +16 and +19 dBm at A3J8 using a measuring receiver.

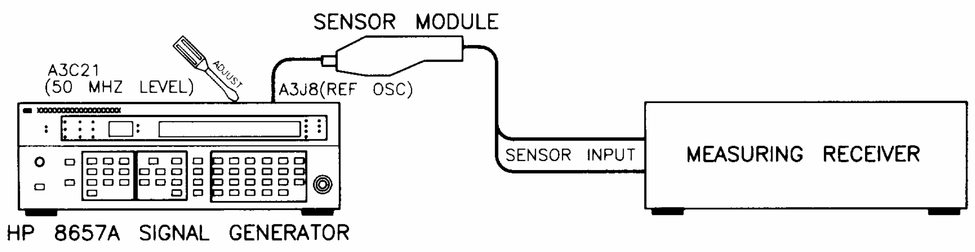


Figure 5-6. *50 MHz Reference Oscillator Level Adjustment Setup*

Equipment

Measuring Receiver .... HP 8902A
Sensor Module .... HP 11722A
Cable BNC(m) to SMC(f) .... HP 08662-60075
Adapter N(f) to BNC(m) .... HP 1250-0077
Adapter BNC(f) to BNC(f) .... HP 1250-0080

PROCEDURE

1. Set the measuring receiver with the sensor module precalibrated and connected as follows:

   Measurement .... RF POWER
   Display .... LOG

2. Disconnect coaxial cable W5 from A3J8 (50 MHz Reference Oscillator output). Connect the sensor module to A3J8 using the appropriate cable and adapters.
3. Press the FREQ key on the measuring receiver for calibration, then press the RF POWER key.
4. Adjust A3C21 (50 MHZ LEVEL ADJ) for a maximum RF Power reading from +16 dBm to +19 dBm. Do not adjust for a reading greater than +19 dBm.

NOTE

Do not remove the 50 MHz Section covers for this adjustment.

5. Disconnect the measuring receiver and reconnect W5 to A3J8.

Adjustment 7

122 MHZ HARMONIC ADJUSTMENT

- **Service Sheet 9**

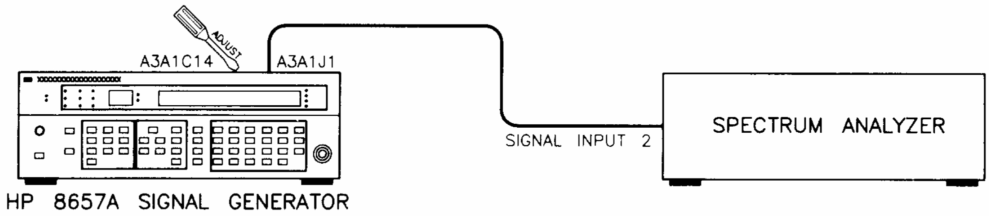


Figure 5–7. *122 MHz Harmonic Adjustment Setup*

Description

The Signal Generator's frequency is set to 539 MHz for a Low Frequency VCO Frequency of 61 MHz. The 122 MHz Harmonic is adjusted for a minimum.

Equipment

Spectrum Analyzer .... HP 8568B or 8558B
Cable BNC(m) to SMC(f) .... HP 08662-60075
Adapter N(f) to BNC(m) .... HP 1250-0077

Procedure

1. Set the spectrum analyzer as follows:

   Center Frequency .... 95 MHz
   Frequency Span .... 100 MHz
   Reference Level .... 0 dBm

2. Set the Signal Generator as follows:

   Frequency .... 539 MHz
   Amplitude .... Any
   Modulation .... Off

3. Connect the output of the A3A1 Assembly at A3A1J1 to the spectrum analyzer SIGNAL INPUT 2 using the appropriate cable and adapter (HP 1250-0077 and HP 08662-60075).
4. Adjust A3A1C14 for minimum 122 MHz harmonic.

Adjustment 8

400 MHZ BANDPASS FILTER ADJUSTMENT

- **Service Sheet 3**

Description

The 400 MHz Bandpass Filter is adjusted to peak the 800 MHz signal at RF Test Point A8TP3 using a measuring receiver.

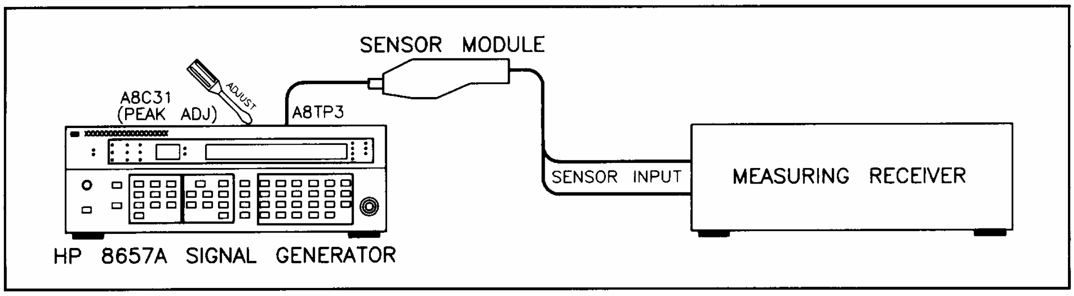


Figure 5–8. *400 MHz Bandpass Filter Adjustment Setup*

Equipment

Measuring Receiver	HP 8902A
Sensor Module	HP 11722A
Adapter Probe	HP 1250-1598
Adapter N(f) to BNC(m)	HP 1250-0077
Adapter BNC(f) to BNC(f)	HP 1250-0080
Cable BNC(m) to SMC(f)	HP 08662-60075

Procedure:

1. Set the measuring receiver with the sensor module precalibrated and connected as follows:

   Measurement .... RF POWER
   Display .... LOG

2. Set the Signal Generator as follows:

   Frequency .... Any
   Amplitude .... −10 dBm
   Modulation .... Off

3. Zero the measuring receiver and wait for the zero LED to go out.
4. Connect the sensor module to the Signal Generator at RF Test Point A8TP3 using an adapter (HP part number 1250-1598).
5. Tune the measuring receiver to 800 MHz and adjust A8C31 (PEAK ADJ) for a maximum RF Power reading.

Adjustment 9

690 TO 740 MHZ IF COMPENSATION ADJUSTMENT AND ATTENUATOR PAD SELECT

- **Service Sheets 1, 3, and 9**

Description

A function generator is used to sweep the A3A1 Low Frequency VCO and provide a swept 690 to 740 MHz IF signal at A4TP3. The IF signal is adjusted for flatness within 3 dB. The average power level of the IF signal is then found and an attenuator pad is selected to provide an average IF input level of −9 dBm to mixer A4U1.

NOTE

The 690 to 740 MHz IF Compensation Adjustment and Attenuator Pad Select must be performed whenever the A3A1, A4, A8, or FL1 assemblies are replaced.

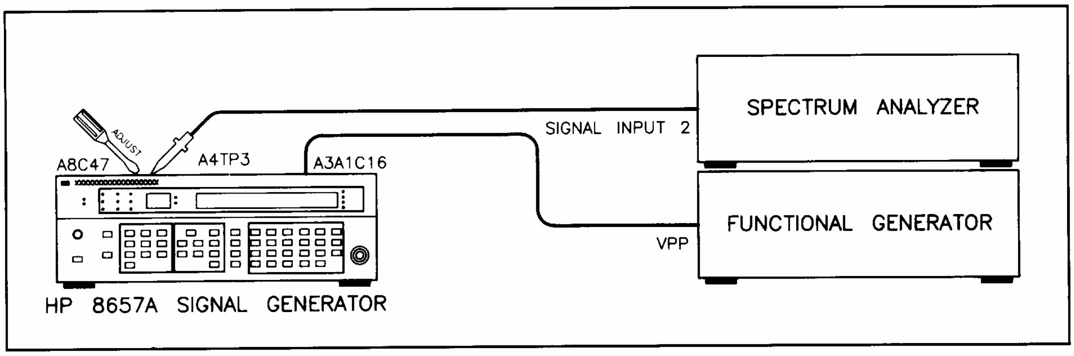


Figure 5-9. *690 to 740 MHz IF Compensation and Attenuator Pad Select*

Equipment

Spectrum Analyzer .... HP 8568A
Function Generator .... HP 3312A
Cable BNC .... HP 8120-1840
Test Leads alligator clips to BNC .... HP 8120-1292
Adapter N(f) to BNC(m) .... HP 1250-0077
Adapter Probe .... HP 1250-1598
Cable BNC(m) to SMC(f) .... HP 08662-60075

Procedure

1. Set the Signal Generator as follows:

   Frequency .... 700 MHz
   Amplitude .... Any
   Modulation .... Off

2. Set the function generator as follows:

   Frequency .... 60 Hz
   Function .... Triangle Wave
   Offset .... On
   Amplitude Range 0
   Symmetry .... Cal
   Modulation .... Off

3. Preset the spectrum analyzer and set as follows:

   RF Input .... Input 2
   Start Frequency .... 690 MHz
   Stop Frequency .... 740 MHz
   Reference Level .... 0 dBm
   Scale .... Log 5dB/Div

4. Remove jumper A3W6 and connect the function generator to the Low Frequency VCO at feedthrough capacitor A3A1C16 using the appropriate cable and adapter.

NOTE

If A4R6 and A4R7 (P/O selectable attenuator pad) are already in the A4 assembly, they must be isolated from the circuit before proceeding with the next step. Replacement A4 assemblies are shipped from the factory without the attenuator pad installed.

5. Connect the spectrum analyzer SIGNAL INPUT 2 to the Signal Generator at A4TP3 using using the appropriate cable and adapters (HP 1250-0780, HP 08662-60075, and HP 1250-1598).
6. Adjust the amplitude and offset of the function generator until the swept IF signal displayed on the spectrum analyzer starts just before 690 MHz and stops just after 740 MHz.
7. Adjust the spectrum analyzer's reference level so that the highest level of the IF signal is even with the top graticule on the CRT.
8. Set the scale of the spectrum analyzer to display 1 dB/Div and adjust the reference level so that the swept IF signal is centered in the spectrum analyzer's display. Set sweep time to 2 seconds.
9. Adjust A8C47 until the difference between the maximum and minimum IF levels is $\leq$ 3 dB.
10. Find the average IF level by dividing the difference between the maximum and minimum IF levels by 2, and then adding the result to the minimum IF level.
11. Refer to Table 5-1 (Factory Selected Components) and select the values of A4R6, R7, and R10 necessary for an average IF level of −10 dBm into mixer A4U1.

Adjustment 10

NOTCH FILTER ADJUSTMENTS

- **Service Sheet 1**

Description

The Signal Generator is placed into Keyboard Invoked Test No. 3 to continuously ramp the High Frequency Loop Amplifier and to sweep the High Frequency VCO. The Signal Generator frequency is set to 650 MHz to select the 50 MHz IF and to not select the 50 MHz Notch Filter. The detected beat notes are monitored with an oscilloscope and the 350, 300, 250, 200, 150, and 100 MHz Notch Filters are adjusted to minimize their associated beat notes. The Signal Generator's frequency is then set to 520 MHz to not select the 50 MHz IF. The 50 MHz Notch Filter is adjusted to minimize it's beat note.

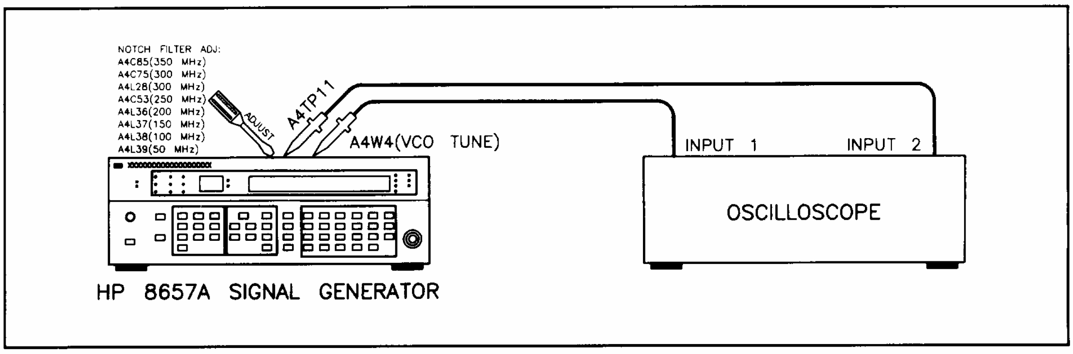


Figure 5–10. *Notch Filters Adjustment Setup*

Equipment

Oscilloscope .... HP 54201A
Oscilloscope Probe (2 required) .... HP 10040A

Procedure

1. Enter Keyboard Invoked Test No. 3 by pressing the SHIFT key, and then the INCR SET key. Next, press the AMPT up-arrow key three times until the number "3" appears in the MODULATION Display, then press INCR SET and "00" should appear in the AMPLITUDE Display.
2. Keyboard Invoked Test No. 3 allows you to enter data to the Signal Generator while the test is running. Press the AMPT up-arrow key four times until a "7" is displayed in the AMPLITUDE Display, then press INCR SET. The Signal Generator will go through it's power-up routine and will then be ready to accept data. The test will continue to run until the Signal Generator is reset.

3. Set the Signal Generator as follows:

   Frequency .... 650 MHz
   Amplitude .... Any
   Modulation .... Off

4. Connect oscilloscope INPUT 1 to the High Frequency VCO Tune at A4W4.

5. Connect oscilloscope INPUT 2 to A4TP11.

6. Set the oscilloscope as follows:

   CHAN

   Channel 1
   Range 40V
   Offset .... 600 mV
   Probe 10:1
   Coupling .... dc, 1 MΩ
   Channel 2
   Range 1.6V
   Offset .... 500 mV
   Probe 10:1
   Coupling .... ac

   TIME

   Mode .... Auto
   Range .... 10 mS
   Reference .... Left

   TRIG

   Source .... Chan 1, + Slope
   Level .... Adjust, 9.6V

   DISPLAY

   Graticle Type .... Grid
   Number of Graphs 2
   Connect Dots .... On
   Data Filter .... On

8. The oscilloscope display for nonadjusted Notch Filters is shown in Figure 5-11.

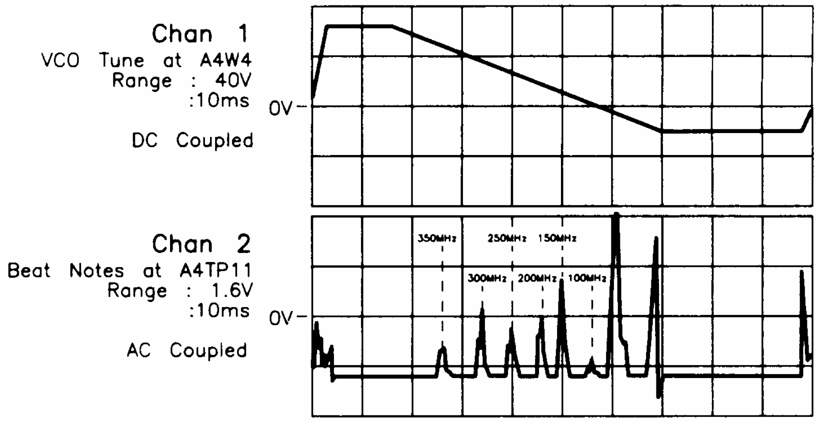


Figure 5-11. *Frequency Response at Notch Filters, 650 MHz Setting.*

9. Readjust the oscilloscope as follows:

DISPLAY

Number of Graphs 1
1: .... Chan 2

10. Observe the oscilloscope Chan 2 display (beat notes) and refer to Figure 5-11. Adjust A4C85 (350 MHz Notch Filter) until you see the 350 MHz beat note change on the display, then adjust the beat note for minimum amplitude.
11. Adjust A4C75 and L28 (300 MHz Notch Filters) for minimum 300 MHz beat note.
12. Adjust A4C53 (250 MHz Notch Filter) for minimum 250 MHz beat note.
13. Adjust A4L36 (200 MHz Notch Filter) for minimum 200 MHz beat note.
14. Adjust A4L37 (150 MHz Notch Filter) for minimum 150 MHz beat note.
15. Adjust A4L38 (100 MHz Notch Filter) for minimum 100 MHz beat note.
16. Set the Signal Generator frequency to 520 MHz and observe the oscilloscope Chan 2 display. The beat note levels should resemble those shown for channel 2 in Figure 5-12. (the 50 MHz beatnotes are shown with nonadjusted levels.) Adjust A4L39 (50 MHz Notch Filter) until the 50 MHz beat notes are at their minimum amplitude.

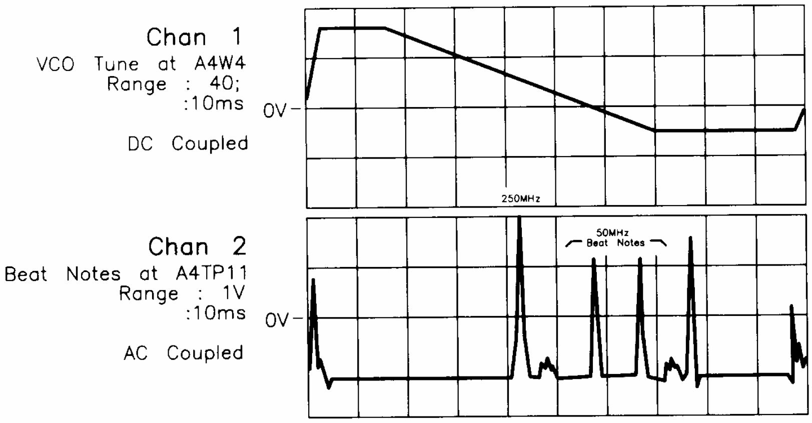


Figure 5–12. *Frequency Response at Notch Filters, 520 MHz Setting.*

17. Adjust A4C75 (300 MHz Notch Filter) to maximize the 250 MHz beat note while keeping the 300 MHz beat note at a minimum. The 250 MHz beat note is not filtered.
18. Set the Signal Generator frequency to 1015 MHz.
19. Adjust A4C85 (350 MHz Notch Filter) to maximize the 300 MHz beat note while keeping the 350 MHz beat note to a minimum. The 300 MHz beat note is not filtered.
20. Reset the Signal Generator by pressing the SHIFT key and then the "0" key.

Adjustment 11

400 MHZ NOTCH FILTER ADJUSTMENT

- **Service Sheet 1**

Description

The 400 MHz Notch Filter is in the circuit all of the time and is adjusted for 1 MHz offset spurious signals from the selected frequency of 551 MHz.

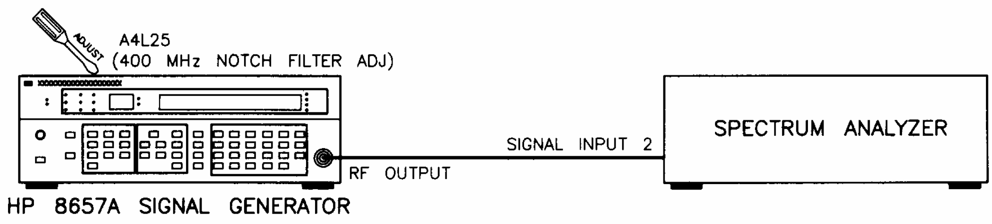


Figure 5–13. *400 MHz Notch Filter Adjustment Setup.*

Equipment

Spectrum Analyzer .... HP 8568B or HP 8558B
Cable (N(m) 2 183 cm) .... HP 11500A

Procedure

1. Set the spectrum analyzer as follows:

   Center Frequency .... 551 MHz
   Frequency Span .... 10 MHz
   Reference Level .... 0 dBm

2. Set the Signal Generator as follows:

   Frequency .... 551 MHz
   Amplitude .... 0 dBm
   Modulation .... Off

3. Connect the Signal Generator RF OUTPUT to spectrum analyzer SIGNAL INPUT 2.
4. Adjust A4L25 for a minimum spurious signal at 500 MHz.

Adjustment 12

LEVEL AND ALC LOOP DETECTOR ADJUSTMENTS

- **Service Sheets 4 and 7**

DESCRIPTION

First, the reference level to the Level Digital to Analog Converter (DAC) is adjusted for +7.00 dBm ±0.02 dB at the Signal Generator's RF OUTPUT. Then the detector bias reference level to the ALC Amplifier is adjusted.

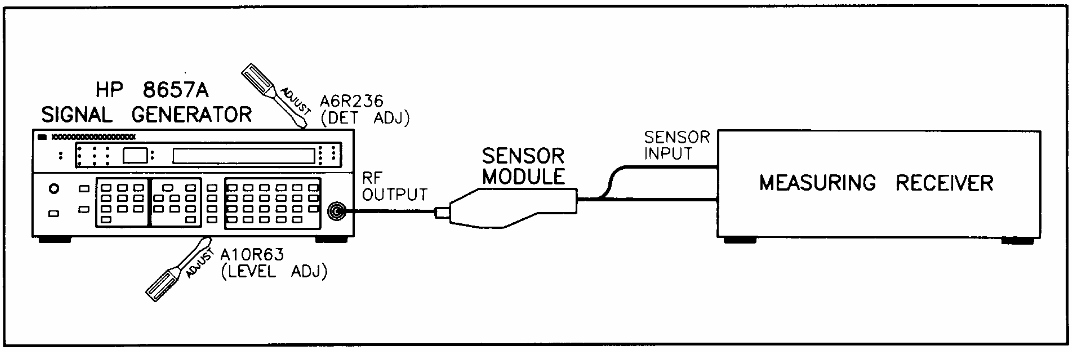


Figure 5-14. *Level and ALC Loop Detector Adjustment Setup*

EQUIPMENT

Measuring Receiver .... HP 8902A
Sensor Module .... HP 11722A

PROCEDURE

1. Set the measuring receiver with the sensor module precalibrated and connected as follows:

   Measurement .... RF POWER
   Display .... LOG

2. Set the Signal Generator as follows:

   Frequency .... 820 MHz
   Amplitude .... +7 dBm
   Modulation .... Off
   Amplitude Increment .... 10 dB

NOTE

Before making the adjustment, the instrument must be warmed up for a minimum of 1/2 hour.

3. Zero the sensor module and connect it to the RF OUTPUT connector on the Signal Generator.
4. Tune the measuring receiver to the Signal Generator frequency by pressing the FREQ key. Press the RF POWER key and adjust A10R63 (LEVEL ADJ) for a reading of +7 dBm ±0.2 dB.
5. Press the RATIO key on the measuring receiver to set a reference level of 0 dB.
6. Step the signal Generator amplitude down to −3 dBm.
7. Adjust A6R236 (DET ADJ) for an RF Power level of −10.00 dB ±0.1 dB on the measuring receiver.
8. Repeat steps 4, 5, 6, and 7 until both readings are within the required tolerance.

Adjustment 13

AM% AND ALC LOOP AM ADJUSTMENTS

- **Service Sheets 4 and 7**

Description

The reference level to the AM% Digital to Analog Converter (DAC) is adjusted for an average amplitude modulation of 21.4%. The AM reference to the ALC Amplifier is adjusted for minimum distortion of the modulation.

NOTE

The AM Offset, and Level and ALC Loop Adjustments must be performed before performing these adjustments. Refer to Adjustment 4 and Adjustment 12.

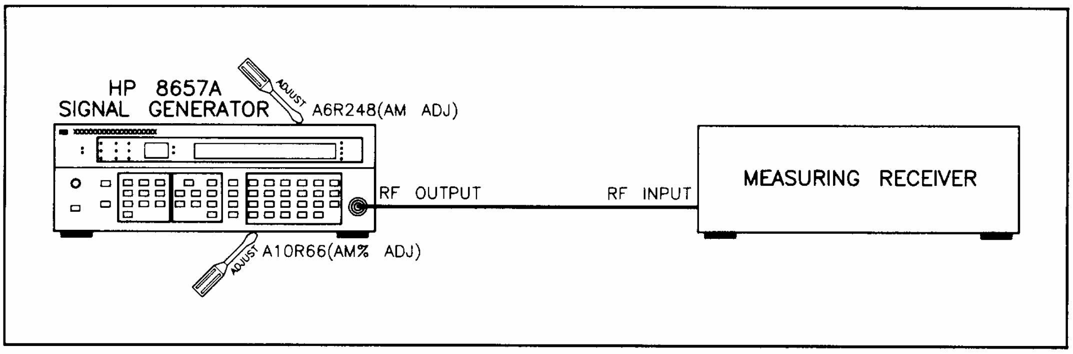


Figure 5-15. *AM% and ALC Loop AM Adjustments Setup*

Equipment

Measuring Receiver .... HP 8902A

Procedure

1. Set the measuring receiver as follows:

   Measurement .... AM
   Detector .... AVG
   HP Filter .... 50 Hz
   LP Filter .... 15 kHz

2. Set the Signal Generator as follows:

   Frequency .... 200 MHz
   Amplitude .... +4 dBm
   Modulation .... AM 30%
   Source .... 1 kHz (Int.)
   Amplitude Increment .... 8 dB

3. Connect the measuring receiver to the RF OUTPUT connector on the Signal Generator and connect the distortion analyzer as shown in Figure 5-15.
4. Adjust A10R66 (AM% ADJ) for a reading of 21.40% on the measuring receiver.

NOTE

Do not remove any of the internal RF covers for this adjustment.

5. Set the Signal Generator as follows:

   Frequency .... 200 MHz
   Amplitude .... −3 dBm
   Modulation .... AM 90%

6. Set the measuring receiver as follows:

   Detector .... PEAK -

6. Adjust A6R248 (AM ADJ) for a minimum reading on the measuring receiver as close to 90% as possible, while keeping the 1 kHz audio distortion less than 4%. Select the Audio Distortion measurement on the measuring receiver for a 1 kHz audio signal to measure the distortion.

Adjustment 14

FM CALIBRATION PRETUNE ADJUSTMENT

- **Service Sheet 14**

Description

The Low Frequency Loop is locked during this adjustment. The output of the integrator is adjusted so that the bottom of the integrator waveform is −6.0 volts. This adjustment assures that the VCO's tune voltage will have sufficient range.

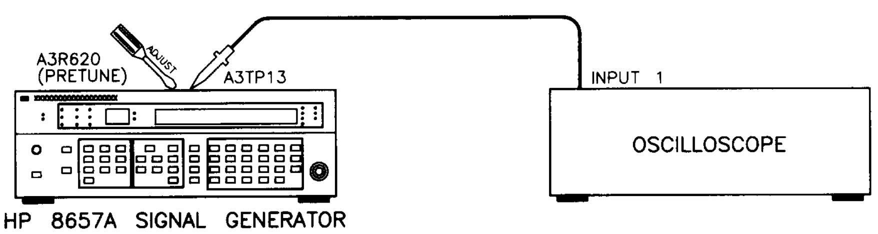


Figure 5–16. *FM Calibration Pretune Adjustment Setup*

Equipment

Oscilloscope	HP 54201A
Oscilloscope Probe	HP 10040A

Procedure

1. Set the oscilloscope as follows:

CHAN

Channel	1
Range	4V
Offset	−5V
Probe	10:1
Coupling	dc, 1MΩ

TIME

Mode	Auto
Range	20 μs
Delay	0 s
Reference	Left

TRIG

Source .... Chan 1, + Slope
Level .... Adjust −5V

DISPLAY

Graticule Type .... Grid
Number of Graphs 1
Connect Dots .... On
Data Filter .... On

2. Set the Signal Generator as follows:

Frequency .... 117 MHz
Amplitude .... Any
Modulation .... Off

3. Connect the oscilloscope probe to A3TP13, Integrator Output.
4. Adjust A3R620 (PRETUNE) for a voltage of −6.0 volts ±0.5 volts at the bottom of the integrator waveform.

Adjustment 15

API 1, 2, 3 AND 4 ADJUSTMENTS

- **Service Sheet 12**

Description

The API, Analog Phase Interpolation, spurious signals are adjusted for −60 dBc using a spectrum analyzer.

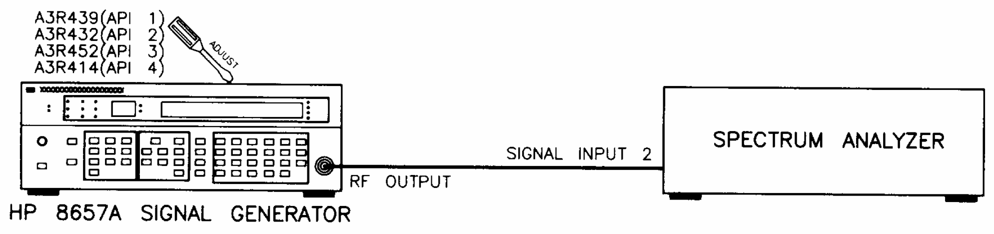


Figure 5-17. *API 1, 2, 3 and 4 Adjustment Setup*

Equipment

Spectrum Analyzer .... HP 8568B
Cable (50 ohm coax, UG-21D/U type N (m) connectors) .... HP 11500A

NOTE

The A3 Assembly must be fastened to RFI cover (MP12) with hex nuts before making API adjustments.

Procedure

1. Set the spectrum analyzer as follows:

   Center Frequency .... 65 MHz
   Frequency Span .... 10 kHz
   Reference Level .... 0 dBm

2. Set the Signal Generator as follows:

   Frequency .... 65 MHz
   Amplitude .... 0 dBm
   Modulation .... Off

3. Connect the RF OUTPUT of the Signal Generator to the spectrum analyzer SIGNAL INPUT 2 as show in Figure 5-17.
4. Offset the Signal Generator frequency by 2 kHz to 65.002 MHz.
5. Adjust A3R439 (API 1) so the spurious signals 1 and 2 kHz from the carrier are −60 dBc.
6. Offset the Signal Generator frequency by 200 Hz to 65.0002 MHz.

7. Adjust A3R432 (API 2) so the spurious signals 1 and 2 kHz from the carrier are −60 dBc.
8. Offset the Signal Generator frequency by 20 Hz to 65.00002 MHz.
9. Adjust A3R452 (API 3) so the spurious signals 1 and 2 kHz from the carrier are −60 dBc.
10. Offset the Signal Generator frequency by 10 Hz to 65.00001 MHz.
11. Set the spectrum analyzer frequency span to 25 kHz.
12. Adjust A3R414 (API 4) so spurious signals 5 and 10 kHz from the carrier are −60 dBc.

Adjustment 16

PEDESTAL ADJUSTMENT

- **Service Sheet 13**

Description

The Sample and Hold circuit current is adjusted for continuous voltage using an oscilloscope.

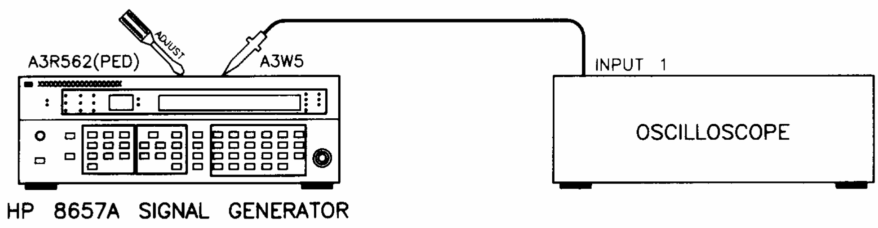


Figure 5-18. *Pedestal Adjustment Setup*

Equipment

Oscilloscope .... HP 54201A
Oscilloscope Probe (1:1) .... HP 10021A

PROCEDURE:

1. Set the Signal Generator as follows:

   Frequency .... 65 MHz
   Amplitude .... Any
   Modulation .... Off

2. Connect oscilloscope INPUT 1 to A3W5.
3. Set the oscilloscope as follows:

   CHAN

   Channel 1
   Range .... 40 mV
   Offset 0.00V
   Probe 1:1
   Coupling .... ac

   TIME

   Mode .... Auto
   Range .... 20 μs real Time
   Delay 0S
   Reference .... Left

TRIG

Source .... Chan 1, + Slope
Level .... Adjust, 5 mV

DISPLAY

Gradicule Type .... Grid
Number of Graphs 1
Connect Dots .... On
Data Filter .... On

4. Refer to Figure 5-19 and adjust A3R562 (PED) for a minimum peak value.

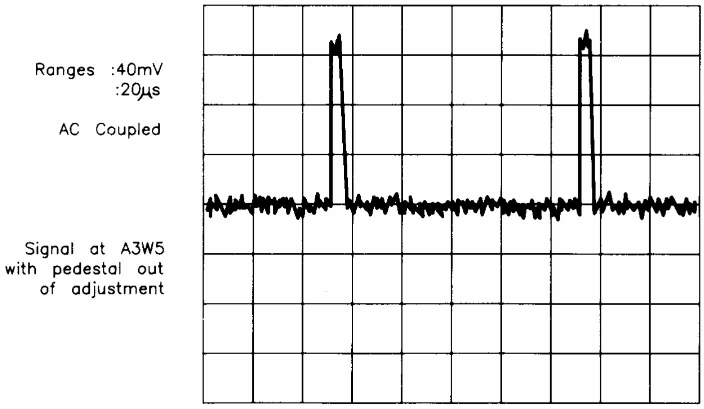


Figure 5–19. *Oscilloscope Display with Pedestal Needing Adjustment*

Adjustment 17

DC FM ADJUSTMENT

- **Service Sheet 15**

Description

The DC FM spurious signals are adjusted using a spectrum analyzer and a dc power supply.

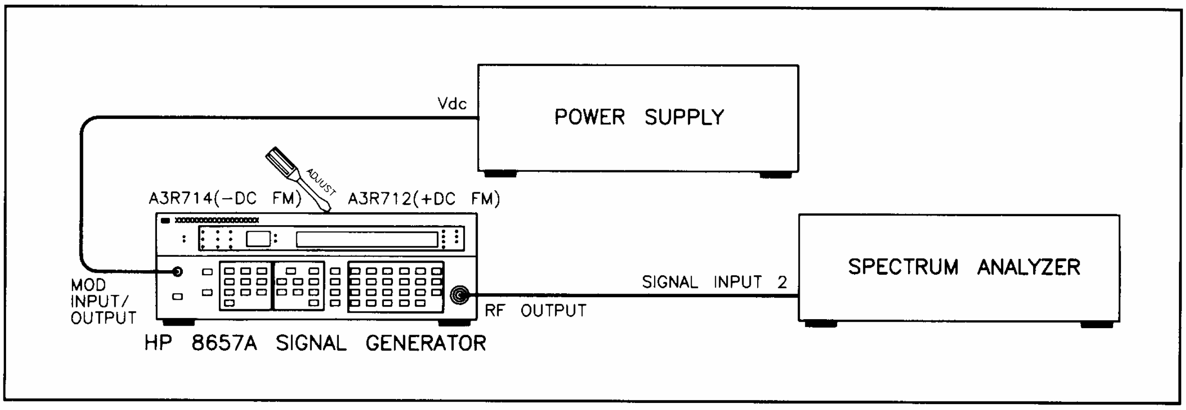


Figure 5–20. *DC FM Adjustment Setup*

Equipment

Spectrum Analyzer .... HP 8568B or 8558B
Power Supply .... HP 6214B
Cable (50 ohm coax, UG-21D/U type N(m) connectors) .... HP 11500A
Cable (112 cm 50 ohm coax, UG-88C/U BNC to dual banana plug) .... HP 11001-60001

Procedure

1. Set the spectrum analyzer as follows:

   Center Frequency .... 66 MHz
   Frequency Span .... 10 kHz
   Reference Level .... 0 dBm

2. Set the power supply as follows:

   Meter .... Volts
   Voltage .... 1 Vdc

3. Set the Signal Generator as follows:

   Frequency .... 66 MHz
   Amplitude .... 0 dBm
   Modulation .... DC FM, 3 kHz

4. Connect the Signal Generator RF OUTPUT to the spectrum analyzer SIGNAL INPUT 2 and the MOD INPUT/OUTPUT to the power supply +1 Vdc as shown in Figure 5-21.

NOTE

The LO EXT Modulation annunciator remains on regardless of the dc input level applied to the MOD INPUT/OUTPUT connector.

5. Adjust A3R712 (+DC FM) so spurious signals are −50 dBc.
6. Connect −1 Vdc to the MOD INPUT/OUTPUT.
7. Adjust A3R714 (−DC FM) so spurious signals are −50 dBc.

Adjustment 18

VOLTAGE OFFSET ADJUSTMENT

- **Service Sheet 7**

Description

The DC offset of the FM Deviation Summing Amplifier is adjusted for 0.000 Vdc ±0.001 Vdc at A10TP6.

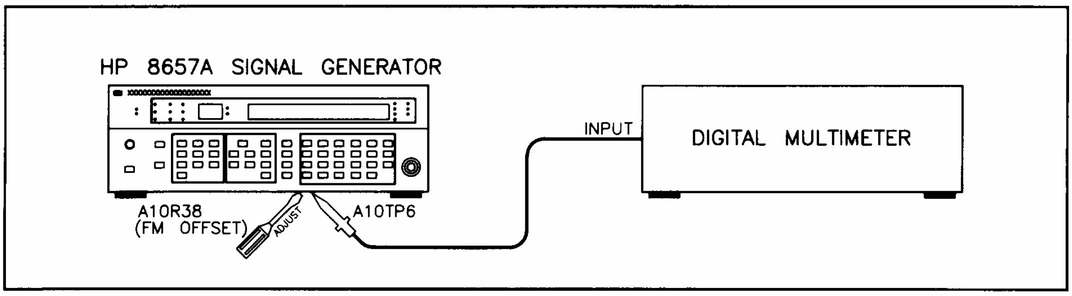


Figure 5–21. *DC FM Offset Adjustment Setup*

Equipment

Digital Multimeter .... HP 3466A

NOTE

The A10 Assembly must be fastened to RFI cover (MP22) with hex nuts before making the Voltage Offset Adjustment

Procedure

1. Set the digital multimeter as follows:

   Function .... Vdc
   Range .... 200 mV

2. Set the Signal Generator as follows:

   Frequency .... 65 MHz
   Amplitude .... Any
   Modulation .... DC FM, 99 kHz

3. Remove any signal connected to the Signal Generator MOD INPUT/OUTPUT connector.
4. Connect the digital multimeter to A10TP6 as shown in Figure 5-21.
5. Adjust A10R38 (FM OFFSET ADJ) for 0.000 Vdc ±0.001 Vdc.

Adjustment 19

FM IN-BAND GAIN ADJUSTMENT

- **Service Sheet 15**

Description

An external modulation signal whose frequency is outside the Low Frequency Loop bandwidth is used to frequency modulate the Signal Generator. The frequency modulation is measured with the EXT FM of the Signal Generator set to 50 kHz for a reference. The external modulation signal is changed to 100 Hz and the FM IN-BAND GAIN is adjusted for the same FM peak deviation.

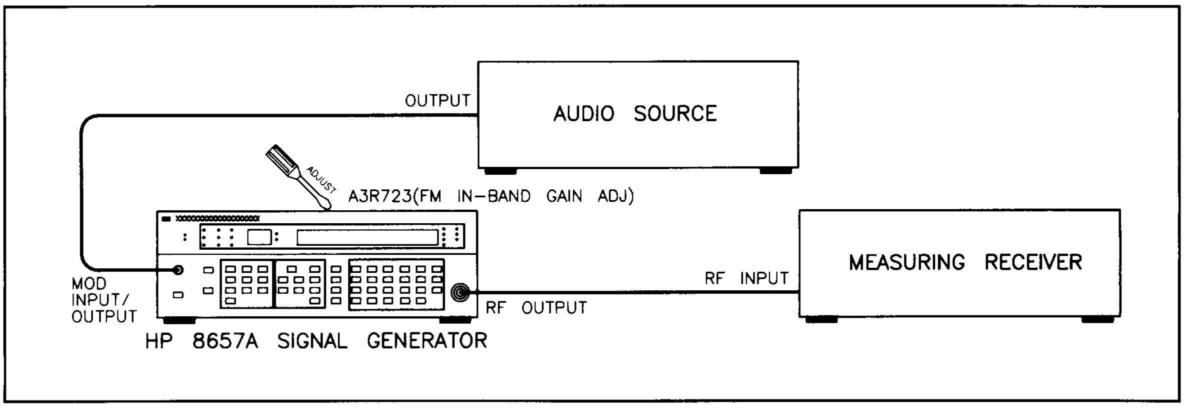


Figure 5-22. *FM In-band Gain Adjustment Setup*

Equipment

Measuring Receiver .... HP 8902A
Audio Source .... HP 8903B
Cable (50 ohm coax, UG-21D/U type N(m) connectors) .... HP 11500A
Cable, BNC Connectors .... HP 10503A

Procedure

1. Set the measuring receiver as follows:

   Measurement .... FM, PEAK+

2. Set the audio source as follows:

   Frequency .... 20 kHz
   Amplitude .... 1.414 Vac

3. Set the Signal Generator as follows:

   Frequency .... 65 MHz
   Amplitude .... 0 dBm
   Modulation .... EXT FM, 50 kHz

4. Connect the Signal Generator RF OUTPUT to the measuring receiver INPUT, and the Signal Generator MOD INPUT/OUTPUT to the audio source OUTPUT as shown in Figure 5-22. The Signal Generator LO EXT and HI EXT LED's should be out.
5. Adjust A10R39 (FM Gain ADJ) if necessary, for a reading of 50.0± 0.2 KHz on the measuring receiver.

NOTE

If it is necessary to adjust A110R39, the FM Deviation Adjustment 20 must be performed.

6. Set the measuring receiver to RATIO and the audio source frequency to 100 Hz.
7. Adjust A3R723 (FM IN-BAND GAIN ADJ) for a reading of 100% on the measuring receiver.
8. Repeat steps 6 through 8 and readjust A3R723 if required.

Adjustment 20

FM DEVIATION ADJUSTMENT

- **Service Sheet 7**

Description

The FM deviation is adjusted with a maximum FM peak deviation of 99 kHz entered into the Signal Generator. The carrier frequency is stepped down in 10 MHz steps from 1040 to 990 MHz and A10R39 is adjusted for an equal error around 99 kHz deviation.

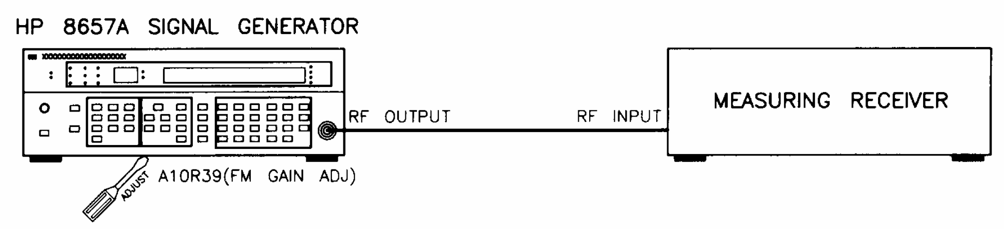


Figure 5-23. *FM Deviation Adjustment Setup*

Equipment

Measuring Receiver .... HP 8902A
Cable (50 ohm coax, UG-21D/U type N (m) connectors) .... HP 11500A

Procedure

1. Set the measuring receiver as follows:

   Measurement .... FM
   Detector .... +Peak
   HP Filter .... 300 Hz
   LP Filter .... 3 kHz

2. Set the Signal Generator as follows:

   Frequency .... 1040 MHz
   Frequency Increment .... 10 MHz
   Amplitude .... +4 dBm
   Modulation .... FM 99 kHz
   Source .... 1 kHz (Int.)

3. Connect the measuring receiver input to the RF OUTPUT connector on the Signal Generator.
4. Adjust A10R39 (FM GAIN ADJ) for a 99.0 kHz deviation reading on the measuring receiver.
5. Step the frequency down from 1040 to 990 MHz and record the deviation at each of the 10 MHz steps.

6. Adjust A10R39 for equal error ±2 kHz from 99 kHz at the frequencies of maximum and minimum peak kHz deviation.

_______________ 1040 MHz

_______________ 1030 MHz

_______________ 1020 MHz

_______________ 1010 MHz

_______________ 1000 MHz

_______________ 990 MHz

Adjustment 21

DC FM OFFSET ADJUSTMENT

- **Service Sheet 7**

Description

The DC Offset of the FM Deviation Amplifier is adjusted for an output frequency error of +10 Hz with DC FM selected.

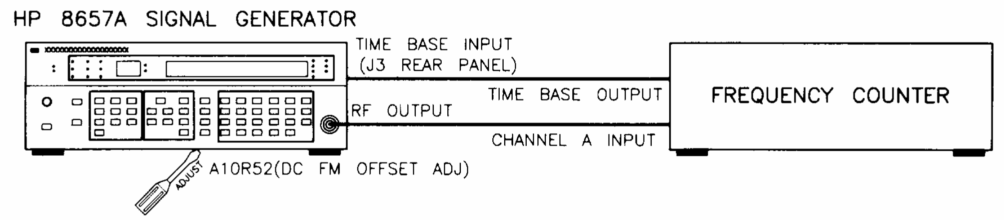


Figure 5–24. *DC FM Frequency Offset Adjustment Setup*

Equipment

Frequency Counter .... HP 5328B
Adapter, N(m) to BNC (f) .... HP 1250-0780
Cable, BNC (2 EA) .... HP 10503A

NOTE

Both the A3 and A10 Assemblies must be fastened to RFI cover (MP22) with hex nuts before making the DC FM Adjustment.

Procedure

1. Set the frequency counter as follows:

   Frequency .... Input A

2. Set the Signal Generator as follows:

   Frequency .... 65 MHz
   Amplitude .... 0 dBm
   Modulation .... DC FM, 99 kHz

3. Connect the Signal Generator RF OUTPUT to the frequency counter CHANNEL A INPUT and the counter time base OUT to the Signal Generator Time Base INPUT as shown in Figure 5-24.
4. Adjust A10R52 (DC FM OFFSET ADJ) for a frequency counter reading of 65.000000 MHz ±10 Hz.

Adjustment 22

OPTION 001 10 MHZ REFERENCE OSCILLATOR FREQUENCY ADJUSTMENT

- **Service Sheet 25**

Description

The Option 001 10 MHz Reference Oscillator frequency is adjusted to 10.000 MHz ±10.0 Hz using a frequency counter.

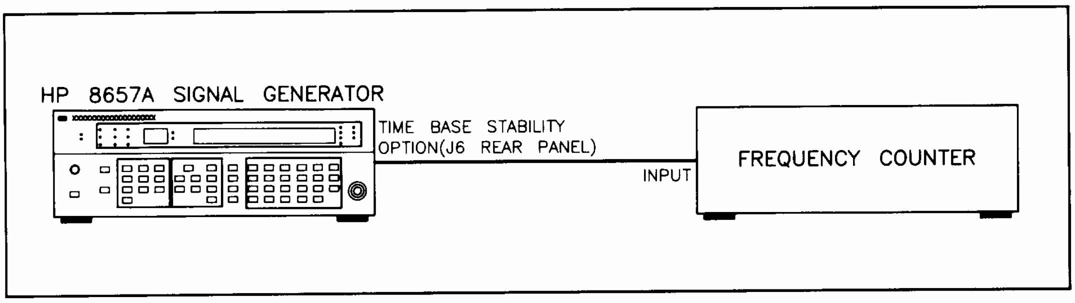


Figure 5–25. *10 MHz Reference Oscillator Frequency Adjustment Setup*

Equipment

Frequency Counter .... HP 5328B

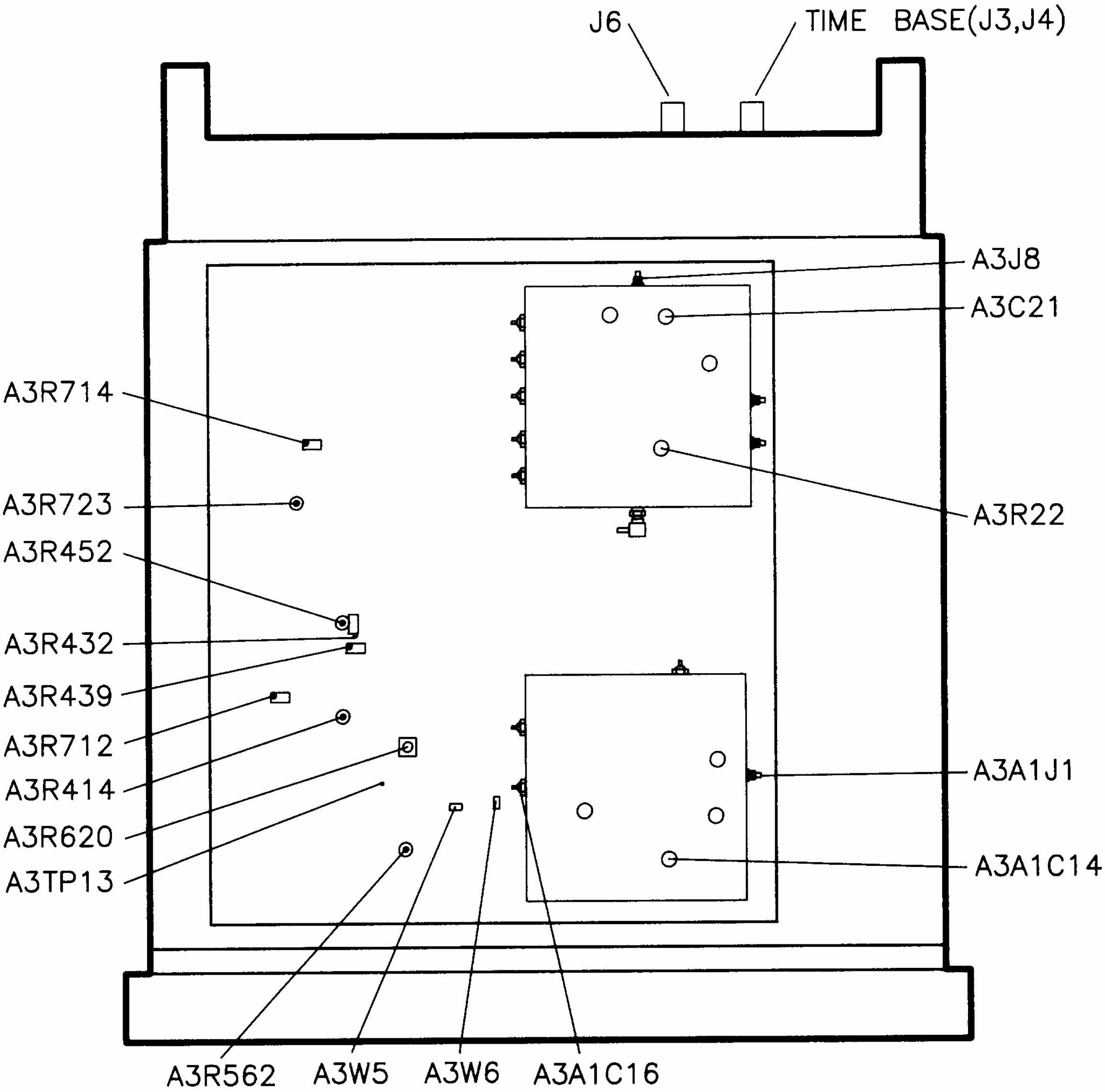
NOTE

Before making the adjustment, the instrument must be warmed up for a minimum of 24 hours.

Procedure

1. Remove the COARSE and FINE screws on the oscillator cover (accessed through the rear panel).
2. Connect the frequency counter to the TIME BASE HIGH STABILITY OPTION connector (J6) on the rear-panel of the Signal Generator.
3. Adjust the COARSE and FINE adjustments for a reading of 10.000 MHz ±10 Hz on the frequency counter.
4. Replace the COARSE and FINE screws.

TOP INTERNAL VIEW - LEVEL 1



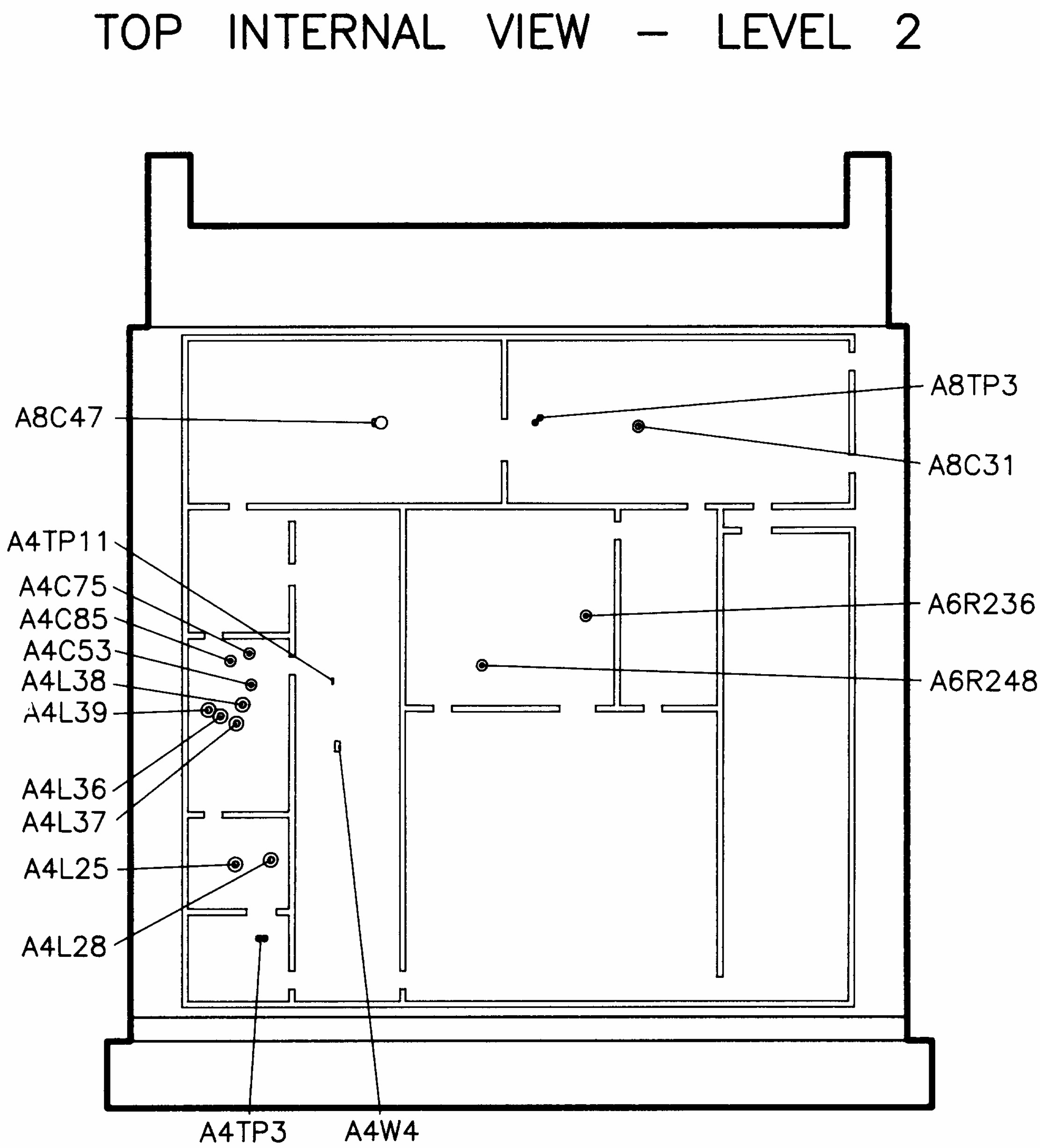


Figure 5-26. *Adjustment Locations*

BOTTOM INTERNAL VIEW – LEVEL 4