SERVICE NOTE

Supersedes:
None

HP MODEL 8654B SIGNAL GENERATOR
ALL SERIAL NUMBERS

IMPROVED PERFORMANCE TESTS AND ADJUSTMENTS USING THE 8901A

The procedures contained in this Service Note offer a means of testing the modulation functions of the 8654B using the HP 8901A Modulation Analyzer. These procedures may be substituted for the corresponding procedures contained in either of the following 8654B Operating and Service Manuals:

HP 08654-90012
HP 08654-90025

The procedures require less test equipment, are faster and simpler, and are more thorough and accurate than the procedures they replace. The performance tests and adjustments contained in this Service Note are as follows:

A list of recommended test equipment is given in Table 1. A performance Test Record (Table 2) follows the performance tests.

NOTE

In addition to the equipment listed in Table 1 required for the tests and adjustments in this Service Note, the following equipment will be required for complete testing of the 8654B. (See Table 1-2 of the manual for critical specifications and recommended model.)

20 dB Amplifier, 10—520 MHz
20 dB Amplifier, 400—1200 MHz
One-Inch Loop Antenna
10 dB Step Attenuator
Frequency Counter
Oscilloscope
Power Meter and Sensor
Spectrum Analyzer
50Ω Load (2 required)
Double Shielded Cable (2 required)

The following additional equipment is required for Option 003 instruments only.

10 dB Attenuator
Test Oscillator
Tracking Generator
SWR Bridge
50Ω Load
Coaxial Short

IJ/SW/WN

12/80-04

HEWLETT PACKARD

Table 1. Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use*
Digital Voltmeter	Type: ac volts and resistance Frequency: 1 kHz AC Range to 1V AC Accuracy: ±0.5% of reading Resistance Range: to 1 M	HP 3455A	A
Distortion Measurement Set	Audio Source: Frequency Range: 400 Hz to >25 kHz Frequency Accuracy: ±2% Amplitude: to 1Vpk into 600Ω Flatness: ±2% Distortion: <0.1% Distortion Analyzer: Frequency: 400 Hz and 1 kHz Distortion Accuracy: ±1 dB Distortion Range: 1 to 10% full scale AC Voltmeter: Range: to 1 Vrms Frequency: 1 kHz Accuracy: ±2% of range	HP 339A	P, A
FM Deviation Adjustment Board	Resistance substitution circuit. No substitution possible.	HP 08654-60084	A
Modulation Analyzer	Frequency Range: 10 to 520 MHz Input Level: +13 to −7 dBm Amplitude Modulation: Rates: 400 Hz to >20 kHz Depth: to >20 kHz Accuracy: ±2% Flatness: ±1% Demodulated Output Distortion: <0.3% for 50% depth, <0.6% for 90% depth Residual AM: <0.01% rms (<−80 dBc) 50 Hz to 3 kHz bandwidth Peak Incidental FM: <10 Hz Frequency ModulationL: Rates: 400 Hz to >25 kHz Deviation: to 100 kHz Accuracy: ±2% Demodulated Output Distortion: <0.3% Incidental AM: <0.2% for 50 kHz deviation, 400 Hz and 1 kHz rates Residual FML <8 Hz, 500 MHz to 100 MHz, <1 Hz below 100 MHz (300 Hz to 3 kHz bandwidth).	HP 8901A	P, A

*P = Performance Test; A = Adjustment

PERFORMANCE TESTS

P1. AM PERFORMANCE TEST

SPECIFICATION

Characteristic	Performance Limits	Conditions[1]
AM Depth[2]	0 to 90%	
Modulation Rate	dc to >20 kHz	External
External AM Sensitivity	(0.1 ±0.01)% AM/mVpk	400 and 1000 Hz rates AM vernier fully cw position
Indicated AM Accuracy	±(5% of reading +5% of full scale)	400 and 1000 Hz rates
Peak Incidental Frequency Deviation	<200 Hz	400 and 1000 Hz rates 30% AM
Envelope Distortion	<3%	400 and 1000 Hz rates 0 to 70% modulation
	<5%	400 and 1000 Hz rates 70 to 90% modulation
Residual AM	<–55 dBc	50 Hz to 15 kHz post-detection bandwidth averaged rms

[1]Specifications apply from 10 to 520 MHz for output power ≤+10 dBm and over the top 10 dB of output level vernier range unless otherwise specified.
[2]AM is possible above +3 dBm as long as the peak envelope power (carrier output plus AM depth) does not exceed +9 dBm.

DESCRIPTION The 8901A Modulation Analyzer is used to demodulate and measure the AM on the 8654B Signal Generator. AM accuracy, AM flatness, incidental frequency modulation and residual AM are measured directly. A distortion analyzer, connected to the modulation output of the Modulation Analyzer, is used to measure AM distortion.

EQUIPMENT
Distortion Measurement Set .....HP 339A
Modulation Analyzer .....HP 8901A

PROCEDURE *Residual AM*

1. Connect the 8654B Signal Generator RF OUTPUT to the 8901A Modulation Analyzer RF INPUT after setting the Signal Generator controls as follows:

METER .....LEVEL
FREQUENCY RANGE (MHz) .....270—520
FREQUENCY TUNE .....500 MHz
OUTPUT LEVEL Switch .....0 dBm
Output Level VERNIER .....Meter reads +3 dB
AM .....INTERNAL
AM LEVEL .....Fully ccw
FM .....OFF
400 Hz/1 kHz .....1 kHz

PERFORMANCE TESTS

P1. AM PERFORMANCE TEST (Cont'd)

Residual AM (Cont'd)

2. Set the Modulation Analyzer to measure AM with a 50 Hz high-pass and 15 kHz low-pass filter. Set the Modulation Analyzer detector to average. Press AUTO OPERATION. The Modulation Analyzer should read less than 0.35% (i.e., residual AM less than −55 dBc).

Residual AM at maximum Output Level Vernier: _____ 0.35%

3. Set the Signal Generator Output Level VERNIER for a meter reading of −7 dB. The Modulation Analyzer should read less than 0.35%.

Residual AM with Output Level Vernier 10 dB down: _____ 0.35%

Incidental Frequency Modulation

4. Set the Modulation Analyzer high-pass filter to 300 Hz and the detector to read either the positive or negative peak.

5. For each setting of the Output Level VERNIER and modulation frequency shown, adjust the AM LEVEL control for 30% AM as read on the Modulation Analyzer. Set the Modulation Analyzer to measure FM. The frequency deviation should be within the limits shown.

Signal Generator		FM (Hz)	
Vernier Level (dB)	Modulation Frequency	Actual	Maximum
+3	1 kHz	_____	200
−7	1 kHz	_____	200
−7	400 Hz	_____	200
+3	400 Hz	_____	200

AM Sensitivity and Accuracy

6. Reset the Signal Generator controls as follows:

AM LEVEL .....Fully cw
AM .....EXTERNAL
Output Level VERNIER .....Meter reads +3 dB

7. Set the distortion measurement set source frequency to 1 kHz. Set the Modulation Analyzer to measure AM with a 50 Hz high-pass and 15 kHz low-pass filter. Connect the source output to the signal generator AM INPUT and set the source output to the levels shown below. The AM measured on the Modulation Analyzer should be within the limits shown with the Modulation Analyzer detector set to read either the positive or negative peak.

PERFORMANCE TESTS

P1. AM PERFORMANCE TEST (Cont'd)

AM Sensitivity and Accuracy (Cont'd)

Source Level (mVrms)	AM Limits (%)		
	Minimum	Actual	Maximum
636	81.0	_____	99.0
495	63.0	_____	77.0
354	45.0	_____	55.0
212	27.0	_____	33.0
141	18.0	_____	22.0
70.7	9.0	_____	11.0

8. Set the Signal Generator METER to AM. By adjusting either the source level or the Signal Generator AM LEVEL, set the AM for the meter reading indicated below. For each setting the AM measured by the Modulation Analyzer should be within the limits shown with the Modulation Analyzer detector set to read either the positive or negative peak.

AM Set %	AM Limits (%)		
	Minimum	Actual	Maximum
90	80.5	_____	99.5
80	71.0	_____	89.0
60	52.0	_____	68.0
40	33.0	_____	47.0
20	14.0	_____	26.0
10	4.5	_____	15.5

AM Bandwidth

9. Set the Modulation Analyzer high-pass filter to 50 Hz and its low-pass filter to off.

10. By adjusting either the source level or the Signal Generator AM LEVEL, set the AM reading on the Modulation Analyzer as indicated below using a modulation rate of 1 kHz. Set the Modulation Analyzer to reference the AM to 0 dB. Now increase the modulation rate to the maximum indicated and note the dB change in AM. The AM should be between −3 and +3 dB. Repeat for each setting in the table.

AM at 1 kHz (%)	Maximum Modulation Rate (kHz)	AM Limits (dB)		
		Minimum	Actual	Maximum
70	20	−3	_____	+3
90	20	−3	_____	+3

11. Set the Signal Generator METER to LEVEL, set the Output Level VERNIER for a meter reading of −7 dB, then repeat Step 10.

P1. AM PERFORMANCE TEST (Cont'd)

AM Bandwidth (Cont'd)

AM at 1 kHz (%)	Maximum Modulation Rate (kHz)	AM Limits (dB)		
		Minimum	Actual	Maximum
70	20	-3	_____	+3
90	20	-3	_____	+3

AM Distortion

12. Connect the equipment as shown in Figure P1-1. Set the distortion measurement set to measure the distortion on the modulation output. Set the source frequency and either the source level or the Signal Generator AM LEVEL control for the AM readings on the Modulation Analyzer indicated below. The distortion should be within the limits shown.

Source Frequency (Hz)	Signal Generator Level (dB)	AM Depth (%)	Distortion Limits (%)	
			Actual	Maximum
1000	+3	70	_____	3
1000	+3	90	_____	5
1000	-7	90	_____	5
1000	-7	70	_____	3
400	+3	70	_____	3
400	+3	90	_____	5
400	-7	90	_____	5
400	-7	70	_____	3

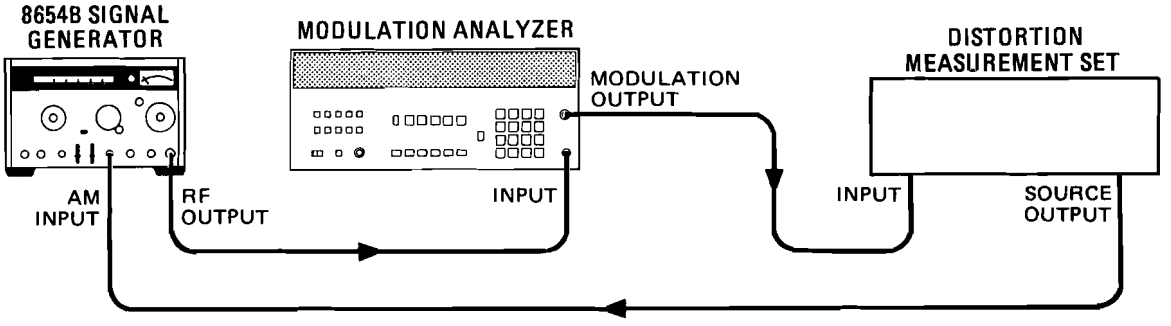

Figure P1-1. AM Distortion Test Setup

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST

SPECIFICATION

Characteristic	Performance Limits	Conditions*
Peak Deviation	0 to 30 kHz 0 to 100 kHz	10 to 520 MHz 80 to 520 MHz
Modulation Rate	dc to >25 kHz	external 3 dB bandwidth
FM Distortion	<2%	400 and 1000 Hz rates, deviations up to 30 kHz
	<3%	400 and 1000 Hz rates, deviations up to 100 kHz
External FM Sensitivity	1 Vpk yields maximum deviation on peak deviation meter	400 and 1000 Hz rates, FM LEVEL vernier fully cw
External FM Sensitivity Accuracy	±12%	400 and 1000 Hz rates, 15 to 35C
	±15%	400 and 1000 Hz rates, 100 kHz deviation range above 130 MHz, 15 to 35C
Indicated FM Accuracy	±(12% of reading +3% of of full scale)	400 and 1000 Hz rates, 15 to 35C
	±(15% of reading +3% of full scale)	400 and 1000 Hz rates, 100 kHz deviation range above 130 MHz, 15 to 35C
Incidental AM	<1%	400 and 1000 Hz rates, 30 kHz deviation
Residual FM on CW	<0.3 ppm	0.3 to 3 kHz post-detection noise bandwidth, averaged rms
	<0.5 ppm	50 Hz to 15 kHz post-detection bandwidth, averaged rms

*Specifications apply from 10 to 520 MHz for output power ≤+10 dBm and over the top 10 dB of output level vernier range unless otherwise specified.

DESCRIPTION The 8901A Modulation Analyzer is used to demodulate and measure the FM on the 8654B Signal Generator. FM accuracy, FM flatness, residual FM and incidental AM are measured directly. A distortion analyzer, connected to the modulation output of the Modulation Analyzer, is used to measure FM distortion.

EQUIPMENT
Distortion Measurement Set .....HP 339A
Modulation Analyzer .....HP 8901A

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST (Cont'd)

PROCEDURE *Residual FM*

1. Connect the Signal Generator RF OUTPUT to the Modulation Analyzer RF INPUT after setting the Signal Generator controls as follows:

METER ..... LEVEL
FREQUENCY RANGE (MHz) ..... 270—520
FREQUENCY TUNE ..... 500 MHz
OUTPUT LEVEL Switch ..... 0 dBm
Output Level VERNIER ..... Meter reads 0 dB
AM ..... OFF
FM ..... OFF

2. Set the Modulation Analyzer to measure FM with an average (rms calibrated) detector. Set its high-pass and low-pass filtering, and the Signal Generator frequency as indicated below. For each setting, the residual FM should be within the limits shown.

Signal Generator Frequency (MHz)	Limits (Hz rms)			
	Modulation Analyzer Filters 300 Hz High-Pass 3 kHz Low-Pass		Modulation Analyzer Filters 50 Hz High-Pass 15 kHz Low-Pass	
	Actual	Maximum	Actual	Maximum
500	_____	150	_____	250
250	_____	75	_____	125
120	_____	36	_____	60
60	_____	18	_____	30
30	_____	9	_____	15
16	_____	5	_____	8

Incidental AM

3. Reset the Signal Generator controls as follows:

FREQUENCY RANGE (MHz) ..... 270—520
FREQUENCY TUNE ..... 500 MHz
FM ..... INTERNAL
400 Hz/1 kHz Switch ..... 1 kHz
FM RANGE (Hz) 30

4. Set the Signal Generator FM LEVEL control for 30 kHz peak deviation as read on the Modulation Analyzer. Set the Modulation Analyzer to measure AM with all high-pass and low-pass filters off. The AM should be less than 1%.

Incidental AM at 1 kHz: _____ 1%

5. Set the Signal Generator 400 Hz/1 kHz switch to 400 Hz and repeat Step 4. The AM should be less than 1%.

Incidental AM at 400 Hz: _____ 1%

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST (Cont'd)

FM Sensitivity and Accuracy

6. Reset the Signal Generator controls as follows:

FREQUENCY RANGE (MHz) .....10—19
FREQUENCY TUNE .....10 MHz
FM .....EXTERNAL
FM LEVEL .....Fully cw

7. Connect the source output of the distortion measurement set to the Signal Generator FM INPUT. Set the source to 0.707 Vrms at 1 kHz. Set the Modulation Analyzer to measure FM peak deviation with a 50 Hz high-pass and 15 kHz low-pass filter.

8. Set the Signal Generator FREQUENCY RANGE (MHz) and FREQUENCY TUNE controls as indicated in the table below. For each setting, the FM peak deviation as read on the Modulation Analyzer should be within the limits shown.

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	Limits (kHz)		
		Minimum	Actual	Maximum
10—19	10	27.8	_____	35.4
10—19	14	27.8	_____	35.4
10—19	19	27.8	_____	35.4
19—35	19	27.8	_____	35.4
19—35	27	27.8	_____	35.4
19—35	35	27.8	_____	35.4
35—66	35	27.8	_____	35.4
35—66	50	27.8	_____	35.4
35—66	66	27.8	_____	35.4
66—130	66	27.8	_____	35.4

9. Set the Signal Generator FM RANGE to 100 kHz. Check that the FM LEVEL control is fully cw. Set the Signal Generator FREQUENCY RANGE (MHz) and FREQUENCY TUNE controls as indicated in the table below. For each setting the peak deviation as read on the Modulation Analyzer should be within the limits shown.

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST (Cont'd)

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	Limits (kHz)		
		Minimum	Actual	Maximum
66—130	80	88	_____	112
66—130	130	88	_____	112
130—270	130	88	_____	112
130—270	190	85	_____	115
130—270	270	85	_____	115
270—520	270	85	_____	115
270—520	400	85	_____	115
270—520	520	85	_____	115

10. Set the Signal Generator METER to FM. Adjust either the source level or the Signal Generator FM LEVEL control for a meter reding of 1.0 (100 kHz peak deviation). For each setting, the FM as measured on the Modulation Analyzer should be as shown with the Modulation Analyzer detector set to read either the positive or negative peak.

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	Limits (kHz)		
		Minimum	Actual	Maximum
270—520	520	82	_____	118
270—520	400	82	_____	118
270—520	270	82	_____	118
130—270	270	82	_____	118
130—270	190	82	_____	118
130—270	130	85	_____	115
66—130	130	85	_____	115
66—130	80	85	_____	115

11. Set the Signal Generator FM RANGE (kHz) to 30. If necessary, adjust FM LEVEL to maintain a meter reading of 1.0 on the 0—1.0 scale which corresponds to 3.16 kHz deviation as read on the 0—3 scale. For each setting the FM peak deviation, measured on the modulation analyzer, should be as shown.

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST (Cont'd)

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	Limits (kHz)		
		Minimum	Actual	Maximum
66—130	66	26.9	_____	36.3
66—130	66	26.9	_____	36.3
35—66	50	26.9	_____	36.3
35—66	35	26.9	_____	36.3
19—35	35	26.9	_____	36.3
19—35	27	26.9	_____	36.3
19—35	19	26.9	_____	36.3
10—19	19	26.9	_____	36.3
10—19	14	26.9	_____	36.3
10—19	10	26.9	_____	36.3

12. Set the Signal Generator FM RANGE switch to 10 kHz. Check that the meter reads approximately full scale, and the peak deviation as read on the Modulation Analyzer is approximately 10 kHz.

13. Set the Signal Generator FM RANGE switch to 3 kHz. Check that the meter reads approximately full scale on the 0—1.0 scale, and the peak deviation as read on the Modulation Analyzer is approximately 3.16 kHz.

FM Bandwidth

14. Reset the Signal Generator controls as follows:

METER.....LEVEL
FREQUENCY RANGE (MHz).....10—19 MHz
FREQUENCY TUNE .....10 MHz
FM RANGE (kHz).....30 kHz

15. Set the Modulation Analyzer to measure FM, detector to read the positive or negative peak, 50 Hz high-pass filter, low-pass filters off.

16. Adjust the source level or the Signal Generator FM LEVEL for 30 kHz peak deviation as measured on the Modulation Analyzer using a 1 kHz modulation rate. Then set the Modulation Analyzer to reference the FM to 0 dB. Increase the modulation rate to 25 kHz and note the change in FM. The reading should be between −3 and +3 dB.

FM Bandwidth: −3 _____ +3 dB

17. Reset the Signal Generator controls as follows:

FREQUENCY RANGE (MHz).....66—130
FREQUENCY TUNE .....80 MHz
FM RANGE (kHz).....100

18. Turn off the Modulation Analyzer ratio display. Adjust the source level or the Signal Generator FM LEVEL for 100 kHz peak deviation as measured on the Modula-

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST (Cont'd)

tion Analyzer using a 1 kHz modulation rate. Then set the Modulation Analyzer to reference the FM to 0 dB. Increase the modulation rate to 25 kHz and note the change in FM. The reading should between -3 and +3 dB.

FM Bandwidth: -3 _____ +3 dB

FM Distortion

19. Reset the Signal Generator control as follows:

FREQUENCY RANGE (MHz) .....10—19
FREQUENCY TUNE .....10 MHz
FM RANGE (kHz).....30

20. Connect the equipment as shown in Figure P2-1. Set either the source output or the Signal Generator FM LEVEL for 30 kHz peak deviation at a 1 kHz rate as measured on the Modulation Analyzer. The distortion should be below the limit shown for both 1 kHz and 400 Hz source frequencies.

NOTE

The frequency of the 8654B should be 10 MHz or above. Below 10 MHz, the 15 kHz low-pass filter on the 8901A Modulation Analyzer will automatically come on.

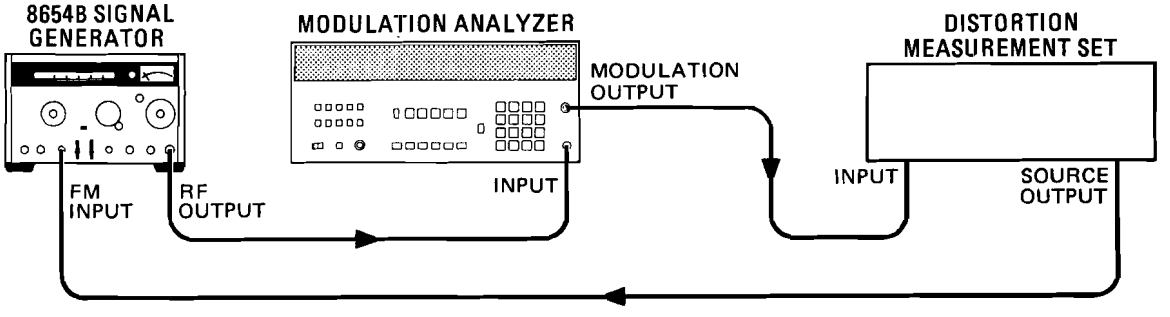

Figure P2-1. FM Distortion Test Setup

PERFORMANCE TESTS

P2. FM PERFORMANCE TEST (Cont'd)

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	Distortion Limits (%)			
		Source Frequency 400 Hz		Source Frequency 1 kHz	
		Actual	Maximum	Actual	Maximum
10—19	10	_____	2	_____	2
10—19	14	_____	2	_____	2
10—19	19	_____	2	_____	2
19—35	19	_____	2	_____	2
19—35	27	_____	2	_____	2
19—35	35	_____	2	_____	2
35—66	35	_____	2	_____	2
35—66	50	_____	2	_____	2
35—66	66	_____	2	_____	2
66—130	66	_____	2	_____	2

21. Set the Signal Generator FM RANGE to 100 kHz. Adjust either the source output or the Signal Generator FM LEVEL for 100 kHz peak deviation as measured on the Modulation Analyzer. Distortion should be below the limit shown for both 1 kHz and 400 Hz source frequencies.

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	Distortion Limits (%)			
		Source Frequency 400 Hz		Source Frequency 1 kHz	
		Actual	Maximum	Actual	Maximum
66—130	80	_____	3	_____	3
66—130	130	_____	3	_____	3
130—270	130	_____	3	_____	3
130—270	190	_____	3	_____	3
130—270	270	_____	3	_____	3
270—520	270	_____	3	_____	3
270—520	400	_____	3	_____	3
270—520	520	_____	3	_____	3

Table 2. Performance Test Record (1 of 4)

Hewlett-Packard Company
Model 8654B
Signal Generator

Tested By _____

Serial Number _____

Date _____

Para. No.	Test Description	Results		
		Minimum	Actual	Maximum
P1	**AM PERFORMANCE TEST**			
	Residual AM			
	Output Level +3 dBm		_____	0.35%
	−7 dBm		_____	0.35%
	Incidental FM			
	Output Level / Mod. Freq.			
	+3 dBm / 1 kHz		_____	200 Hz
	−7 dBm / 1 kHz		_____	200 Hz
	−7 dBm / 400 Hz		_____	200 Hz
	+3 dBm / 400 Hz		_____	200 Hz
	AM Sensitivity and Accuracy			
	AM Input			
	636 mVrms	81.0%	_____	99.0%
	495 mVrms	63.0%	_____	77.0%
	354 mVrms	45.0%	_____	55.0%
	212 mVrms	27.0%	_____	33.0%
	141 mVrms	18.0%	_____	22.0%
	70.7 mVrms	9.0%	_____	11.0%
	AM Set			
	90%	80.5%	_____	99.5%
	70%	61.5%	_____	78.5%
	50%	42.5%	_____	57.5%
	30%	23.5%	_____	36.5%
	20%	14.0%	_____	26.0%
	10%	4.5%	_____	15.5%
	AM Bandwidth			
	+3 dBm			
	AM 70%	−3 dB	_____	+3 dB
	90%	−3 dB	_____	+3 dB
	−7 dBm			
	AM 70%	−3 dB	_____	+3 dB
	90%	−3 dB	_____	+3 dB

Table 2. Performance Test Record (2 of 4)

Para. No.	Test Description	Results		
		Min	Actual	Max
P1 cont'd	**AM Distortion**			
	Source Level 1 kHz AM			
	+3 70		_____	3%
	+3 90		_____	5%
	–7 90		_____	5%
	–7 70		_____	3%
	Source Level 400 Hz AM			
	+3 70		_____	3%
	+3 90		_____	5%
	–7 90		_____	5%
	–7 70		_____	3%
P2	**FM PERFORMANCE TEST**			
	Residual FM			
	Modulation Analyzer Bandwidth			
	300 Hz to 3 kHz			
	Frequency (MHz)			
	500		_____	150 Hz
	250		_____	75 Hz
	120		_____	36 Hz
	60		_____	18 Hz
	30		_____	9 Hz
	16		_____	5 Hz
	Modulation Analyzer Bandwidth			
	50 Hz to 15 kHz			
	Frequency (MHz)			
	500		_____	250 Hz
	250		_____	125 Hz
	120		_____	60 Hz
	60		_____	30 Hz
	30		_____	15 Hz
	16		_____	8 Hz
	Incidental AM			
	1 kHz FM rate		_____	1%
	400 Hz FM rate		_____	1%

Table 2. Performance Test Record (3 of 4)

Para. No.	Test Description		Results		
			Min	Actual	Max
P2 cont'd	**FM Sensitivity and Accuracy**				
	FM Range	Frequency Tune			
	30 kHz	10 MHz	27.8 kHz	_____	35.4 kHz
		14 MHz	27.8 kHz	_____	35.4 kHz
		19 MHz	27.8 kHz	_____	35.4 kHz
		19 MHz	27.8 kHz	_____	35.4 kHz
		27 MHz	27.8 kHz	_____	35.4 kHz
		35 MHz	27.8 kHz	_____	35.4 kHz
		35 MHz	27.8 kHz	_____	35.4 kHz
		50 MHz	27.8 kHz	_____	35.4 kHz
		66 MHz	27.8 kHz	_____	35.4 kHz
		66 MHz	27.8 kHz	_____	35.4 kHz
	100 kHz	80 MHz	88.0 kHz	_____	112 kHz
		130 MHz	88.0 kHz	_____	112 kHz
		130 MHz	88.0 kHz	_____	112 kHz
		190 MHz	85.0 kHz	_____	115 kHz
		270 MHz	85.0 kHz	_____	115 kHz
		270 MHz	85.0 kHz	_____	115 kHz
		400 MHz	85.0 kHz	_____	115 kHz
		520 MHz	85.0 kHz	_____	115 kHz
	100 kHz	520 MHz	82.0 kHz	_____	118 kHz
		400 MHz	82.0 kHz	_____	118 kHz
		270 MHz	82.0 kHz	_____	118 kHz
		270 MHz	82.0 kHz	_____	118 kHz
		190 MHz	82.0 kHz	_____	118 kHz
		130 MHz	85.0 kHz	_____	115 kHz
		130 MHz	85.0 kHz	_____	115 kHz
		80 MHz	85.0 kHz	_____	115 kHz
	30 kHz	66 MHz	26.9 kHz	_____	36.3 kHz
		66 MHz	26.9 kHz	_____	36.3 kHz
		50 MHz	26.9 kHz	_____	36.3 kHz
		35 MHz	26.9 kHz	_____	36.3 kHz
		35 MHz	26.9 kHz	_____	36.3 kHz
		27 MHz	26.9 kHz	_____	36.3 kHz
		19 MHz	26.9 kHz	_____	36.3 kHz
		19 MHz	26.9 kHz	_____	36.3 kHz
		14 MHz	26.9 kHz	_____	36.3 kHz
		10 MHz	26.9 kHz	_____	36.3 kHz
	FM Bandwidth				
	FM Range				
	30 kHz		-3 dB	_____	+3 dB
	100 kHz		-3 dB	_____	+3 dB

Table 2. Performance Test Record (4 of 4)

Para. No.	Test Description	Results		
		Min	Actual	Max
P2 cont'd	**FM Distortion**			
	Source Frequency 1 kHz			
	FM Range / Frequency Tune			
	30 kHz / 10 MHz		_____	2%
	14 MHz		_____	2%
	19 MHz		_____	2%
	19 MHz		_____	2%
	27 MHz		_____	2%
	35 MHz		_____	2%
	35 MHz		_____	2%
	50 MHz		_____	2%
	66 MHz		_____	2%
	66 MHz		_____	2%
	100 kHz / 80 MHz		_____	3%
	130 MHz		_____	3%
	130 MHz		_____	3%
	190 MHz		_____	3%
	270 MHz		_____	3%
	270 MHz		_____	3%
	400 MHz		_____	3%
	520 MHz		_____	3%
	Source Frequency 400 Hz			
	FM Range / Frequency Tune			
	30 kHz / 10 MHz		_____	2%
	14 MHz		_____	2%
	19 MHz		_____	2%
	19 MHz		_____	2%
	27 MHz		_____	2%
	35 MHz		_____	2%
	35 MHz		_____	2%
	50 MHz		_____	2%
	66 MHz		_____	2%
	66 MHz		_____	2%
	100 kHz / 80 MHz		_____	3%
	130 MHz		_____	3%
	130 MHz		_____	3%
	190 MHz		_____	3%
	270 MHz		_____	3%
	270 MHz		_____	3%
	400 MHz		_____	3%
	520 MHz		_____	3%

PERFORMANCE TESTS

A1 DETECTOR BIAS AND AM DISTORTION ADJUSTMENT

REFERENCE Service Sheets 3 and 4.

DESCRIPTION The 8654B Signal Generator is amplitude modulated, and the output demodulated by the 8901A Modulation Analyzer. The RF detector bias is adjusted so that the AM is constant as the RF level is varied over its range. The distortion null is adjusted for minimum distortion at low ALC reference level with a distortion analyzer at the modulation output of the Modulation Analyzer. Since the two adjustments interact the adjustments may need to be repeated.

EQUIPMENT
Distortion Measurement Set .....HP 339A
Modulation Analyzer .....HP 8901A

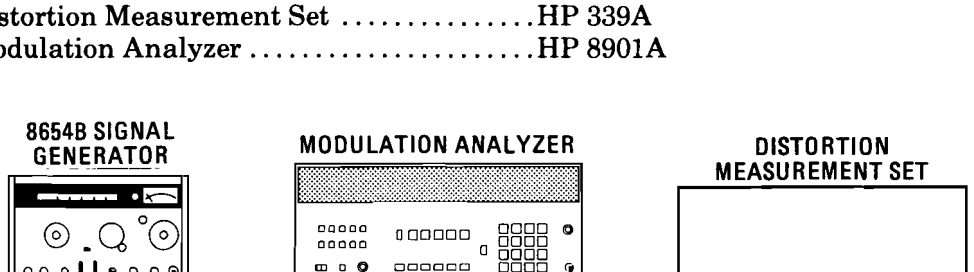

Figure A1-1. Detector Bias and AM Distortion Adjustment Setup

PROCEDURE

1. If the A1 RF Section Assembly cover has not been removed, remove the detector bias access plug on the bottom side of the assembly (see Service Sheet B).

2. Center the Detector Bias potentiometer A1A1R39 (Service Sheet 3) and the Distortion Adjust potentiometer A3R52 (Service Sheet 4).

3. Connect the equipment as shown in Figure A1-1 after setting the Signal Generator controls as follows:

METER.....LEVEL
FREQUENCY RANGE (MHz).....35—66
FREQUENCY TUNE .....50 MHz
OUTPUT LEVEL switch .....0 dBm
Output Level VERNIER .....Meter reads +3 dB
AM .....EXTERNAL
FM .....OFF

4. Set the Modulation Analyzer to measure AM with an average (rms calibrated) detector.

5. Adjust either the source level or the Signal Generator AM LEVEL control for a reading of approximately 20% rms AM (approximately 30% peak) on the Modulation Analyzer using a 400 Hz modulation rate, then set the Modulation Analyzer to reference the AM to 100%.

6. Reset the Signal Generator Output Level VERNIER for a meter reading of –7 dB.

PERFORMANCE TESTS

A1 DETECTOR BIAS AND AM DISTORTION ADJUSTMENT (Cont'd)

7. Adjust A3R52 DIST ADJ for minimum distortion as measured on the distortion analyzer.

8. Adjust A1A1R39 Detector Bias Adjustment for a Modulation Analyzer reading of 100%.

9. Reset the Signal Generator Output Level VERNIER for a meter reading of +3 dB.

10. Repeat steps 5 through 9 until the AM reads between 99.5 and 100.5% relative for both the +3 and −7 dB settings of the Output Level VERNIER. Check that the AM distortion is less than 3%.

11. Perform the AM Sensitivity Adjustment (Paragraph A2), Meter Adjustments (Paragraph 5-20) and AM Performance Check (Paragraph P1).

PERFORMANCE TESTS

A2 AM SENSITIVITY ADJUSTMENT

REFERENCE Service Sheet 4.

DESCRIPTION The 8654B Signal Generator is externally amplitude modulated with level set to give 70% AM. The signal is demodulated by the 8901A Modulation Analyzer. The AM sensitivity is adjusted for 70% AM.

EQUIPMENT
Distortion Measurement Set .....HP 339A
Modulation Analyzer .....HP 8901A

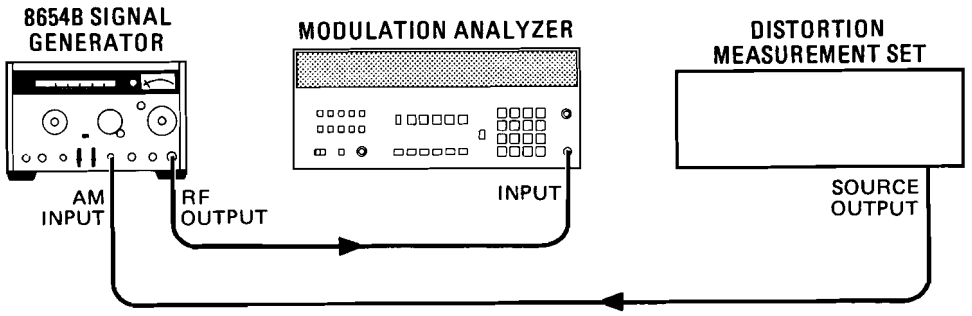

Figure A2-1. AM Sensitivity Adjustment Setup

PROCEDURE 1. Connect the equipment as shown in Figure A2-1 after setting the Signal Generator controls as follows:

METER.....LEVEL
FREQUENCY RANGE (MHz) .....35—66
FREQUENCY TUNE .....50 MHz
OUTPUT LEVEL switch .....0 dBm
Output Level VERNIER .....Meter reads +3 dB
AM .....EXTERNAL
AM LEVEL .....fully cw
FM.....OFF

2. Set the source for 495 mV rms at 1 kHz.

3. Set the Modulation Analyzer to measure AM with a 50 Hz high-pass and 15 kHz low-pass filter. Set the Modulation Analyzer DETECTOR to either PEAK+ or PEAK–.

4. Adjust A3R34 AM GAIN for a Modulation Analyzer reading of between 69.9 and 70.1% AM.

5. Perform the AM Meter Adjustment (Paragraph 5-20) and AM Performance Check (Paragraph P1).

PERFORMANCE TESTS

A3 FM DISTORTION ADJUSTMENT

REFERENCE Service Sheet 6.

DESCRIPTION The 8654B Signal Generator is externally frequency modulated. The FM signal is demodulated using the 8901A Modulation Analyzer and the distortion measured.

EQUIPMENT Distortion Measurement Set .....HP 339A
Modulation Analyzer .....HP 8901A

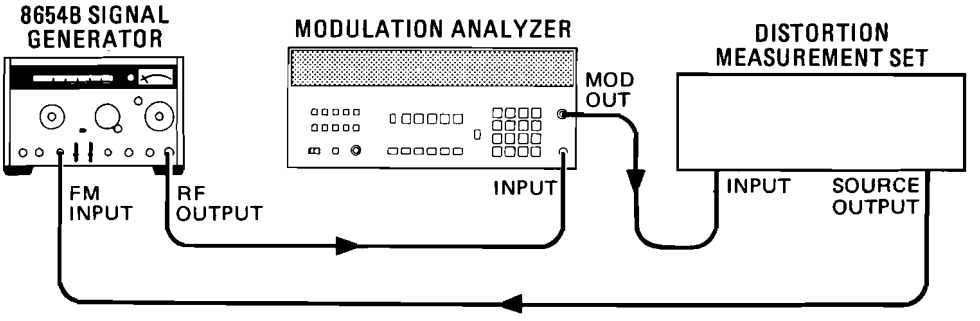

Figure A3-1. FM Distortion Adjustment Setup

PROCEDURE 1. Connect the equipment as shown in Figure A3-1 after setting the Signal Generator controls as follows:

METER .....LEVEL
FREQUENCY RANGE (MHz) .....10—19
FREQUENCY TUNE .....10 MHz
OUTPUT LEVEL switch .....0 dBm
Output Level VERNIER .....Meter reads 0 dB
AM .....OFF
FM.....EXTERNAL
FM RANGE (kHz) 30

2. Set the Modulation Analyzer to measure FM peak deviation with a 50 Hz high-pass and 15 kHz low-pass filter.

3. Adjust either the source level or the Signal Generator FM LEVEL control for 30 kHz peak deviation as read on the Modulation Analyzer using a 1 kHz modulation rate.

4. Adjust A5R107 DIST for minimum distortion.

5. If the peak deviation has changed significantly, reset the Signal Generator FM LEVEL control for 30 kHz peak deviation, then readjust A5R107 for minimum distortion. The distortion should be less than 1.5%.

6. Set the Signal Generator FREQUENCY RANGE (MHz) to 35—66, and FREQUENCY TUNE to 35 MHz. Repeat Steps 2 to 4.

A3 FM DISTORTION ADJUSTMENT (Cont'd)

NOTE

Minimum distortion at 35 MHz might occur at a slightly different setting of A5R107 DIST than at 10 MHz. Note where the pot is set for both frequencies and set it midway between the two positions. The distortion must be less than 1.5% for both frequencies.

7. Perform FM Deviation Adjustment (Paragraph A4).

PERFORMANCE TESTS

A4 FM DEVIATION ADJUSTMENT

REFERENCE Service Sheets 5 and 6.

DESCRIPTION The FM deviation is adjusted for each range. An external source, set to give 30 kHz peak deviation at a 1 kHz rate, is used to frequency modulate the 8654B Signal Generator. The signal is demodulated using the 8901A Modulation Analyzer.

NOTE

Due to the complex nature of this procedure it is important to understand the function of each of the adjustments. As the procedure follows the same sequence as the one given in Paragraph 5-25 of the operating and service manual, please refer to the information presented under DESCRIPTION before beginning.

EQUIPMENT

Distortion Measurement Set	HP 339A
Digital Voltmeter	HP 3455A
Modulation Analyzer	HP 8901A
FM Deviation Adjustment Board	HP 08654-60084

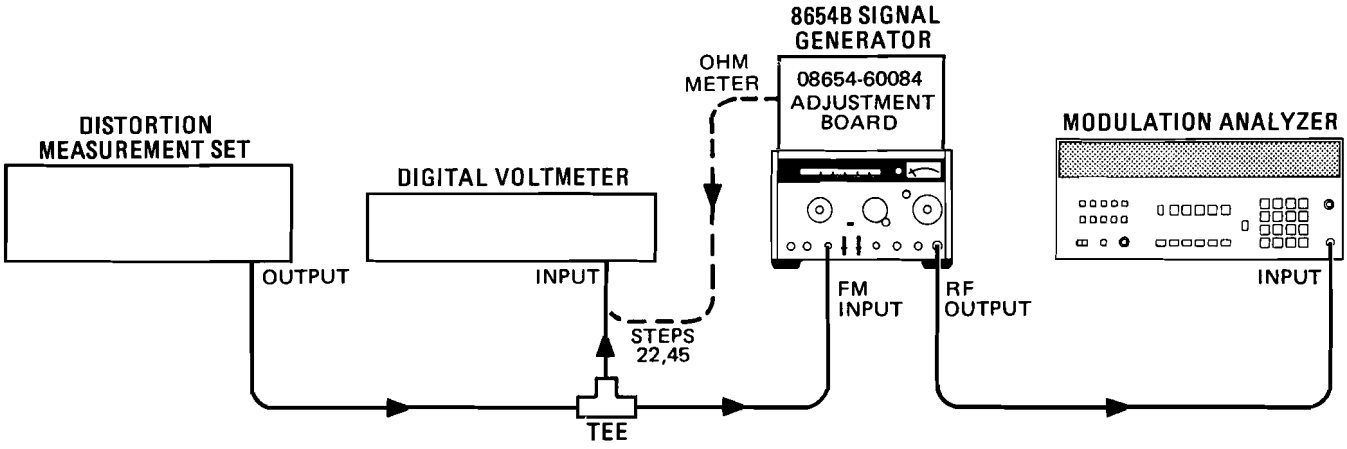

Figure A4-1. FM Deviation Adjustment Setup

PROCEDURE

1. Remove the instrument top cover and mount the FM Deviation Adjustment Board to the rear panel (use two screws from top cover).

2. Remove the two ribbon cables from the A5 FM Driver Board Assembly and connect to the corresponding jacks J1 and J2 on the adjustment board. Connect the three ribbon cables from the adjustment board to corresponding connector jacks A5J1, J2, and J3 on the A5 FM Driver Board Assembly.

3. Connect the equipment as shown in Figure A4-1 after setting the Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	19—35
FREQUENCY TUNE	19 MHz
FINE TUNE	Centered
OUTPUT LEVEL switch	0 dBm

PERFORMANCE TESTS

A4 FM DEVIATION ADJUSTMENT (Cont'd)

Output Level VERNIER .....Meter reads +3 dB
AM .....OFF
FM .....EXTERNAL
FM RANGE (kHz).....30
FM LEVEL .....fully cw

4. Set the adjustment board controls as follows:

BP Switch .....Down
SL Switch.....Down
E Switch .....Down
G Switch .....Down
BP7 Switch .....Down
SL7 Switch.....Down
BP Potentiometer .....fully cw
SL Potentiometer.....fully cw
E Potentiometer .....fully ccw
G Potentiometer.....fully ccw
BP7 Potentiometer .....fully cw
SL7 Potentiometer.....fully cw

5. Set the source output to 671 mV rms (949 mV peak) at a 1 kHz rate as measured on the digital voltmeter (this is equivalent to 30 kHz peak deviation where 1V peak equals 31.6 kHz peak deviation).

6. Set the Modulation Analyzer to measure FM peak deviation with a 50 Hz high-pass and 15 kHz low-pass filter. Set the Modulation Analyzer tuning to track mode.

10 to 270 MHz Adjustments

7. Set the Signal Generator METER to FM.

NOTE

Perform the complete adjustment procedures RANGE BY RANGE in the order given. The adjustments for the 19—35 MHz range must be performed first.

8. Set the FREQUENCY RANGE as listed below, tune across the nominal range and check peak frequency deviation. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

Frequency Range (MHz)
19—35
10—19
35—66
66—130
130—270

PERFORMANCE TESTS

A4 FM DEVIATION ADJUSTMENT (Cont'd)

9. If the frequency deviation is correct, proceed to the next range and repeat Step 8. If all frequencies up to 270 MHz have been checked, proceed to step 27.

NOTE

If the range of frequency deviation is within 3.6 kHz total for all frequencies but is uniformly too high or too low, proceed with the following steps but remove only the resistor related to the "G" adjustment and adjust only G on the adjustment board (BP, SL and E switches down).

On the 19—35 MHz range the gain compensation adjustment G is not used. The overall FM gain adjustment A5R59 GAIN is adjusted on this range. Ensure that the G switch on the adjustment board is down throughout the adjustment of this range.

10. ON THE 19—35 MHz ONLY, if the frequency deviation is uniformly too high or too low, adjust A5R59 GAIN (Service Sheet 6) and check that frequency deviation is between 28.2 and 31.8 kHz for all frequencies. If the frequency deviation is correct proceed to the next range and repeat Step 8.

11. If the frequency deviation is out of tolerance unsolder and lift one end of the resistors shown below.

Frequency Range (MHz)	Resistors			
	BP	SL	E	G
19—35	A5R4(2B)	A5R23(2S)	A5R44(2E)	
10—19	A5R2(1B)	A5R22(1S)	A5R48(1E)	A5R66(1G)
35—66	A5R6(3B)	A5R24(3S)	A5R40(3E)	A5R70(3G)
66—130	A5R8(4B)	A5R25(4S)	A5R38(4E)	A5R72(4G)
130—270	A5R10(5B)	A5R28(5S)	A5R35(5E)	A5R74(5G)

12. Set the BP, SL, E and G switches on the adjustment board up (except 19—35 MHz range — set G switch down).

13. Tune to the frequency listed below. Adjust G potentiometer on the adjustment board (except 19—35 range — adjust A5R59 GAIN) for a Modulation Analyzer reading of 30.0 ±0.1 kHz.

Frequency Range (MHz)	Frequency Set (MHz)
19—35	25
10—19	13.3
35—66	47
66—130	91
130—270	180

PERFORMANCE TESTS

A4 FM DEVIATION ADJUSTMENT (Cont'd)

14. Tune to the top frequency of the range. Adjust E potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.3 kHz.

15. Tune back to the frequency in Step 13. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

16. If the frequency deviation is incorrect, readjust the two potentiometers for best compromise.

17. Tune down in frequency below that of Step 13 until the deviation increases by 0.5 kHz above the deviation at the frequency in Step 13. Adjust BP potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.1 kHz.

18. Tune to the bottom frequency of the range. Adjust SL potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.3 kHz.

19. Tune back to the frequency of Step 13. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

20. If the frequency deviation is incorrect, readjust BP and SL potentiometers on the adjustment board for best compromise.

21. Re-check frequency deviation across the entire range. If the deviation is not between 28.2 and 31.8 kHz for all frequencies, readjust all four adjustments for best compromise.

22. Set all the switches on the adjustment board up. Disconnect the digital voltmeter from the test setup and connect it to the OHM METER connector on the adjustment board.

23. Measure the resistance of the BP, SL, E and G (except 19—35 MHz range) potentiometers by setting the corresponding switch down. Note each resistance value in Table 5-3 of the manual Resistor Selection Record, then return the switch to up.

24. Select the nearest standard value resistors to those measured in Step 23 and solder them in place of the resistors listed in Step 11. Enter these values in Table 5-3. A listing of standard value resistors (±1.0% tolerance) and corresponding HP Part Number is given in Table 5-4 of the manual.

25. Reconnect DIP plugs A1A5P1 and P2 to the A5 FM Driver Board Assembly. (Do not disconnect the test cable from A5J3. However, check that all slide switches on the adjustment board are down.) Tune across the nominal range and check peak frequency deviation. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

NOTE

If the readings are out of tolerance, the error may be due to test cable and contact resistances in the adjustment board. Replace resistors with the next higher standard value and measure again. Allow time for the resistors to cool before making a measurement.

PERFORMANCE TESTS

A4. FM DEVIATION ADJUSTMENT (Cont'd)

26. If all ranges up to 270 MHz have been adjusted, proceed to Step 27; if not, proceed to the next range and begin at Step 2.

270—520 MHz Range Adjustment

27. Connect the FM Deviation Adjustment Board and set the equipment controls as detailed in Steps 2 to 6.

28. Set the FREQUENCY RANGE to 270—520 MHz, tune between 270 and 520 MHz and check peak frequency deviation. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

29. If the frequency deviation is correct, perform the FM Range Adjustment (Paragraph A5) and the FM Performance Check (Paragraph P2).

NOTE

If the range of frequency deviation is within 3.6 kHz total but is uniformly too high or too low, proceed with the following steps but remove only resistor A5R76 (6G) and adjust only potentiometer G on the adjustment board (BP, SL, E, BP7 and SL7 switches down).

30. If the frequency deviation is incorrect, unsolder and lift one end of resistors A5R12 (6B), R14 (7B), R29 (6S), R30 (7E), R33 (6E) and R76 (6G).

31. Set all the switches on the adjustment board up.

32. Tune the frequency to 370 MHz. Adjust G potentiometer on the adjustment board for a Modulation Analyzer reading of 30 ±0.1 kHz.

33. Tune the frequency to 520 MHz. Adjust E potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.3 kHz.

34. Tune the frequency back to 370 MHz and check peak frequency deviation. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

35. If the frequency deviation is incorrect, readjust potentiometers G and E for best compromise.

36. Tune down in frequency until the deviation increases by 1 kHz above the deviation at 370 MHz. Adjust BP potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.3 kHz. Note the carrier frequency.

37. Continue tuning down in frequency to 50 MHz below the frequency noted in Step 36. Note this frequency. Adjust SL potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.3 kHz.

38. Tune back to the frequency noted in Step 36 and check that the peak frequency is between 28.2 and 31.8 kHz for all frequencies.

PERFORMANCE TESTS

A4 FM DEVIATION ADJUSTMENT (Cont'd)

39. If the frequency deviation is incorrect, readjust BP and SL potentiometers on the adjustment board for the best compromise for frequencies between 370 MHz and the frequency noted in Step 37.

40. Continue adjusting down in frequency until the Modulation Analyzer reads 30.8 kHz. Adjust BP7 potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.1 kHz.

41. Tune the frequency to 270 MHz. Adjust SL7 potentiometer on the adjustment board for a Modulation Analyzer reading of 30.0 ±0.3 kHz.

42. Tune back to the frequency noted in Step 37 and check the peak deviation is between 28.2 and 31.8 kHz for all frequencies.

43. If the frequency deviation is incorrect, readjust BP7 and SL7 potentiometers for best compromise.

44. Recheck frequency deviation across the entire range. If the deviation is not between 28.2 and 31.8 kHz for all frequencies readjust required adjustments for best compromise.

NOTE

On this range all adjustments are interactive. Before readjusting any control, consider its effect as shown in Figure 5-7 of the manual, then make only a slight adjustment of the control and note its effect. Adjustment to much better than the tolerance given is not recommended.

45. Set all the switches on the adjustment board up. Disconnect the digital voltmeter from the test setup and connect it to the OHM METER connector on the adjustment board.

46. Measure the resistance of each potentiometer by setting the corresponding switch down. Note the resistance value in Table 5-3 of the manual, Resistor Selection Record, then return the switch to up.

47. Select the nearest standard value resistor to those measured in Step 46 and solder them in place of the resistors listed in Step 30. Enter these values in Table 5-3. A listing of standard value resistors (±1.0% tolerance) and corresponding HP Part Number is given in Table 5-4 of the manual.

48. Reconnect DIP plugs A2A5P1 and P2 to the A5 FM Driver Board Assembly. (Do not disconnect the test cable from A5J3. However, check that all slide switches on adjustment board are down.) Tune across the nominal range and check peak frequency deviation. The Modulation Analyzer should read between 28.2 and 31.8 kHz for all frequencies.

PERFORMANCE TESTS

A4 FM DEVIATION ADJUSTMENT (Cont'd)

NOTE

If the readings are out of tolerance, the error may be due to test cable and contact resistances in the adjustment board. Replace resistors with the next higher standard value and measure again.

Allow time for the resistors to cool before making a measurement.

49. Perform the FM Range Adjustment (Paragraph A5) and the FM Performance Check (Paragraph P2).

PERFORMANCE TESTS

A5. FM RANGE ADJUSTMENT

REFERENCE Service Sheet 6.

DESCRIPTION The 8654B Signal Generator is internally frequency modulated and the signal demodulated using the 8901A Modulation Analyzer. The operation of the FM range switch is checked and resistors selected for proper operation.

EQUIPMENT Modulation Analyzer .....HP 8901A

PROCEDURE:

1. Connect the Signal Generator output to the Modulation Analyzer input after setting the Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	66—130
FREQUENCY TUNE	100 MHz
OUTPUT LEVEL switch	0 dBm
Output Level VERNIER	Meter reads 0 dB
AM	OFF
FM	INTERNAL
FM RANGE (kHz)	30 kHz
400 Hz/1 kHz Switch	1 kHz

2. Set the Modulation Analyzer to measure FM peak deviation with a 50 Hz high-pass and 15 kHz low-pass filter.

3. Adjust the Signal Generator FM LEVEL control for 30.0 ±0.1 kHz peak deviation as measured on the Modulation Analyzer.

4. Set the FM RANGE to 3 kHz. The Modulation Analyzer should read 3.0 ±0.03 kHz. If it does not, insert (but do not solder) a resistor in place of A5R80 (3 kHz) — try 1100 ohms first. Then solder the resistor in place.

NOTE

Take care not to move the FM LEVEL control while setting the FM RANGE switch.

5. Reset the FM RANGE to 30 kHz and adjust the FM LEVEL if necessary for 30.0 ±0.1 kHz peak deviation as measured on the Modulation Analyzer.

6. Set the FM RANGE to 10 kHz. The Modulation Analyzer should read 9.49 ±0.09 kHz. If it does not, insert (but do not solder) a resistor in place of A5R91 (10 kHz) — try 1470 ohms first. Then solder the resistor in place.

7. Reset the FM RANGE to 30 kHz and adjust the FM LEVEL if necessary for 30.0 ±0.1 kHz peak deviation as measured on the Modulation Analyzer.

8. Set the FM RANGE to 100 kHz. The Modulation Analyzer should read 94.9 ±0.9 kHz. If it does not, insert (but do not solder) a resistor in place of A5R84 (100 kHz) — try 34.8 k first. Then solder the resistor in place.

9. Perform the FM Performance Check (Paragraph P2).