30 SPW PMEL VAFB CA

HP 8664A, 8665A/B
SYNTHESIZED SIGNAL GENERATOR
(Including Options 001, 003, 004, 008, and 010)

Operation and Calibration Manual

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed:

HP 8664A: 3035A and all *MAJOR* changes that apply to your instrument.
HP 8665A: 2833A and all *MAJOR* changes that apply to your instrument.
HP 8665B: 3020A and all *MAJOR* changes that apply to your instrument.

For additional important information about serial numbers, refer to "INSTRUMENTS COVERED BY THIS MANUAL" in Section 1.

First Edition

Operation and Calibration Manual HP Part 08665-90078

Other Documents Available:
Service Diagnostics Manual HP Part 08645-90104 (A Generic Manual)
Microfiche Operation and Calibration Manual HP Part 08665-90029
Microfiche Service Diagnostics Manual HP Part 08645-90028 (A Generic Microfiche)

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Table 1-1B. HP 8665A/B Specifications (1 of 4)

HP 8665A/B Specifications

Specifications describe the instrument's warranted performance 30 minutes after turn-on. The specifications assume the instrument is operating in the AUTO mode which automatically optimizes the internal hardware configuration for maximum performance.

***Supplemental Characteristics** are intended to provide information useful in applying the instrument by giving typical, but not warranted performance. These characteristics are shown in italics or labeled as "typical".*

Modes

The HP 8665A/B allows you to control the character of the RF output by utilizing the front-panel MODE SELECT keys. Noise performance, FM deviation, and switching speed are three factors that vary based upon the mode selected. With most applications, the HP 8665A/B can be kept in the AUTO mode to allow selection of the "best" (lowest noise) performance. The standard HP 8665A/B is equipped with STD mode 1 for basic instrument performance, while Option 004 allows for improved noise performance in LOW NOISE mode 2. Differences between operating in Mode 1 and Mode 2 are noted under the particular specifications affected.

Frequency

Range: HP 8665A: 100 kHz to 4200 MHz. HP 8665B: 100 kHz to 6000 MHz. Frequency under range to 10 kHz with uncalibrated modulation and output.

Frequency bands: The exact endpoints and their approximations for each frequency band of the instrument are shown below.

Approximate Frequency Band Endpoints (MHz)	Specified Frequency Band Endpoints (MHz)
4120 to 6000[1]	4120 to 6000[1]
3000 to 4120	3000 to 4119.99999999
2060 to 3000	2060 to 2999.99999999
1500 to 2060	1500 to 2059.99999999
1030 to 1500	1030 to 1499.99999999
750 to 1030	750 to 1029.99999999
515 to 750	515 to 749.99999999
375 to 515	375 to 514.99999999
257.5 to 375	257.5 to 374.99999999
187.5 to 257.5	187.5 to 257.49999999
30 to 187.5	30 to 187.49999999
0.1 to 30	0.1 to 29.99999999

Resolution: 0.01 Hz.

Accuracy and stability: Same as reference oscillator.

***Frequency switching time:** STD mode <50 msec, LOW NOISE mode Option 004 <100 msec with FM off, to within .33 ppm of final frequency (i.e. within 1 kHz at 3 GHz carrier frequency).*

Relative phase adjust:
Preset - adjustable in 1° increments.

External input impedance: 50Ω.

Internal reference oscillator

Accuracy and stability: A function of calibration ± aging rate ± temperature effects ± line voltage effects.

	Standard	*High Stability Timebase Option 001*
Aging:	*±2 ppm/year after 1 year*	*$\pm 3\times10^{-10}$/day after 10 days*
Temperature:	*±4 ppm, 0 to +55°C*	*$\pm 6\times10^{-9}$, 0 to +55°C*
Line Voltage:	*±0.1 ppm, ±10%*	*$\pm 1\times10^{-10}$, ±10%*

[1]4200 MHz for HP 8665A.
[2]FM at minimum deviation.

***Electronic frequency control, high stability timebase Option 001 Only:** ±0.01 ppm for ±1V at rear panel connector, voltage range ±10V, input impedance 10k.*

***Output:** 10 MHz, >1V_{rms} level into 50Ω.*

***External reference oscillator input:** Accepts 10 MHz ±5 ppm and a level range of 0.5V to 2V_{rms} into 50Ω.*

Spectral Purity

SSB Phase Noise (CW, AM, or FM[2] operation)
STD mode:

Carrier Frequency (MHz)	Offset Frequency		
	1 kHz (dBc/Hz)	20 kHz (dBc/Hz)	100 kHz (dBc/Hz)
4120 to 6000[1]	−63	−105	−122
3000 to 4120	−63	−105	−122
2060 to 3000	−67	−111	−128
1500 to 2060	−67	−111	−128
1030 to 1500	−73	−117	−134
750 to 1030	−73	−117	−134
515 to 750	−79	−122	−138
375 to 515	−79	−122	−138
257.5 to 375	−85	−128	−143
187.5 to 257.5	−85	−128	−143
30 to 187.5	−73	−117	−132
0.1 to 30	−73	−117	−132

LOW NOISE mode (Option 004):

Carrier Frequency (MHz)	Offset Frequency		
	1 kHz (dBc/Hz)	20 kHz (dBc/Hz)	100 kHz (dBc/Hz)
4120 to 6000[1]	−83	−116	−121
3000 to 4120	−89	−122	−127
2060 to 3000	−89	−122	−127
1500 to 2060	−94	−128	−133
1030 to 1500	−94	−128	−133
750 to 1030	−100	−134	−139
515 to 750	−100	−134	−139
375 to 515	−106	−139	−144
257.5 to 375	−106	−139	−144
187.5 to 257.5	−112	−144	−146
30 to 187.5	−94	−128	−133
0.1 to 30	−100	−131	−133

When using the HP 8665A/B as a phase noise measurement reference, consult the HP 8644-1 product note (P/N 5951-6729) for more information.

Typical SSB phase noise at 1 GHz comparing STD with Low Noise Option 004:

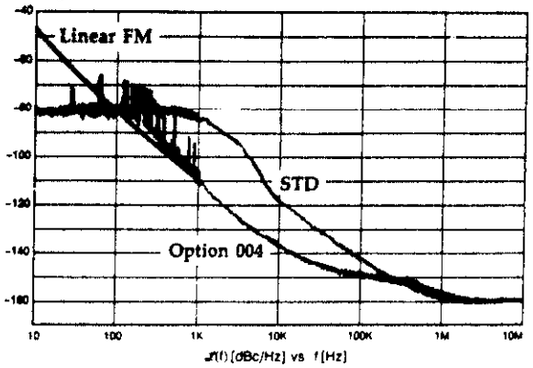


Table 1-1B. HP 8665A/B Specifications (2 of 4)

Typical phase jitter measured in a 100 Hz to 100 kHz BW:

Carrier Frequency (MHz)	STD Mode (psec)	LOW NOISE Mode (Opt. 004) (psec)
0.1 to 187.5	2000 ÷ f_C (MHz)	2000 ÷ f_C (MHz)
187.5 to 2060	5	2
2060 to 6000[1]	5	3

SSB broadband noise floor: *In 1 Hz BW at ≥1 MHz offset from carrier with ≥13 dBm output level:*
<−145 dBc for carrier frequencies ≥ 187.5 MHz, ≤ 6000[1] MHz.
<−134 dBc for carrier frequencies ≥ 10 MHz, <187.5 MHz.

Spurious Signals

Harmonics:
<−30 dBc, output level at +6 dBm.

Subharmonics:
<−75 dBc, 100 kHz to <1030 MHz
<−37 dBc, >1030 MHz

Nonharmonics[3]: <−100 dBc, >10 kHz offset, 187.5 to 2060 MHz, STD mode and LOW NOISE mode Option 004.
<−90 dBc, >10 kHz offset, 0.1 to 187.5 MHz, STD mode and LOW NOISE mode Option 004.
<−90 dBc, >10 kHz offset, 2060 to 6000[1] MHz, STD mode and LOW NOISE mode Option 004.

Residual FM[4] (CW, AM, FM operation):

Carrier Frequency (MHz)	Post Detection Bandwidth			
	0.3 to 3 kHz (Hz rms)		0.05 to 15 kHz (Hz rms)	
	STD mode	LOW NOISE mode Opt.004	STD mode	LOW NOISE mode Opt.004
0.1 to 187.5	<15	<2.5	<20	<8
187.5 to 750	<7.5	<1.25	<10	<4
750 to 1500	<15	<2.5	<20	<8
1500 to 4200	<60	<10	<80	<32

Residual AM: <0.04% AM_{rms}, 0.3 to 3 kHz post detection bandwidth.

SSB AM Noise Floor, offsets >100 kHz:
<−137 dBc/Hz at +13 dBm output, 0.1 to 187.5 MHz.
<−150 dBc/Hz at +13 dBm output, 187.5 to 6000[1] MHz.

Output

Maximum level:
+13 dBm, 0.1 to 6000[1] MHz.
+9 dBm with Pulse Modulation Option 008.

Minimum level: −139.9 dBm.

Display resolution: 0.1 dB.

Absolute accuracy:
±1 dB, output ≥−119.9 dBm, 1 to 1000 MHz.
±1.5 dB, output ≥−119.9 dBm, 1000 to 3000 MHz.
±2 dB, output ≥−119.9 dBm, 3000 to 6000[1] MHz, 0.1 to 1 MHz.
±3 dB, for output <−119.9 dBm, ≥−129.9 dBm, all frequencies.

[3]Internal modulation source off.
[4]Specified for 48 to 63 Hz power line. Typical for 400 Hz power line.
[5]Option 008, Pulse Modulation is required.
[6]HP 8665A only.

Reverse power protection:
HP 8665A; 25 Watts into 50Ω, 0.1 to 2060 MHz.
1 Watt into 50Ω, 2060 to 4200 MHz.
HP 8665B; 1 Watt into 50Ω.
Static protection to 2 kV applies to both.

Third order intermodulation: *<−47 dBc, with two signals at +8 dBm and 25 kHz apart passing through a resistive combiner. Typically decreases 10 dB for every 5 dB of combined level decrease.*

Output level overrange: *Typically 2 dB more than maximum level.*

Output level switching time: *<50 msec.*

SWR and output impedance:
<1.5:1, output <0 dBm. <1.75:1, output ≥0 dBm 0.1 to 3000 MHz. <1.75:1, output <0 dBm, <2.0:1, output ≥0 dBm 3000 to 6000[1] MHz.

Modulation

External modulation input: Coupling is ac or dc for AM and FM modulation. Pulse modulation input is dc coupled. 1V peak input is required for calibrated operation in AM and FM.

Simultaneous modulation: *AM/FM, AM/Pulse[5], FM/Pulse[5], AM/FM Pulse[5].*

Simultaneous internal/external modulation: *FM.*

Amplitude modulation

AM depth: 0 to 99.9%, for output ≤+7 dBm.

AM resolution: 0.1%.

AM indicator accuracy: ±(6% of setting +2% AM), up to 90% depth and 1 kHz rate for carrier frequencies <3000 MHz.

AM Distortion, at 400 Hz and 1 kHz rates:

Depth	Distortion
0 to 30%	<2%
30 to 70%	<4%
70 to 90%[4]	<6%

AM 3 dB bandwidth: >5 kHz, 1 to 10 MHz. >10 kHz, for >10 MHz carrier frequencies.

Incidental phase modulation (at 30% depth and 1 kHz rate):
<0.3 radians peak, 0.1 to 2000 MHz carrier frequency.
<0.6 radians peak, 2000 to 6000[1] MHz carrier frequency.

External AM input impedance: *600Ω.*

Frequency modulation

FM deviation and rate:

Carrier Frequency (MHz)	Max. Pk. Dev. (kHz)		Maximum Rate[7] (3 dB BW) (kHz)
	STD Mode	LOW NOISE Mode Opt.004	
3000 to 6000[1]	20000	400	800
1500 to 3000	10000	200	800
750 to 1500	5000	100	800
375 to 750	2500	50	800
187.5 to 375	1250	25	800
10 to 187.5	5000	100	800
<10	5000[8]	100[8]	800

FM resolution: 2.5% of setting.

[7]Typically the 3 dB BW is >2 MHz for deviations ≤ maximum peak deviation/10.
[8]Except when the carrier frequency minus the FM deviation is ≤90 kHz.

Table 1-1B. HP 8665A/B Specifications (3 of 4)

FM indicator accuracy[1] (dc to 20 kHz rates):
±9% of FM deviation setting plus 10 Hz, STD mode operation.
±11% of FM deviation setting, LOW NOISE mode Option 004.

FM distortion (rates 20 Hz to 20 kHz)<1%, STD mode and LOW NOISE mode Opt. 004.

Carrier frequency accuracy in FM: ±0.6% of deviation setting, ac or dc coupled.

Incidental AM: <0.4%, deviation ≤20 kHz.

***External FM group delay:** <30 µsec for rates ≤ 20 kHz, decreases to <1 µsec at rates above 200 kHz.*

***External FM input impedance:** 600Ω.*

PULSE MODULATION (Opt. 008)

Pulse modulator

On/off ratio: >80 dB.
Rise/fall time (T_r, T_f): <8 ns (10% to 90%).
Maximum output level: +9 dBm.
Output level accuracy: Same as with no pulse modulation.

***Minimum pulse width (P_W):** 10 ns.*
***Overshoot/ringing (V_{OR}):** <25%.*
***Video feedthrough (V_f):** <50 dBc for rates ≤100 kHz.*

Pulse modulation control

The pulse modulator may be controlled by either the internal modulation source or an external signal. These signals control the pulse modulation in one of two ways: direct pulse control, where the pulse modulator is driven by the control signals' timing and width; and internal pulse generator, where the control signal triggers a variable pulse delay and width generator. The positive, negative or both edges of the control signal may be used as the trigger event.

Internal pulse generator

Pulse repetition frequency (PRF): 0.1 Hz to 400 kHz, external trigger dc to 10 MHz.

***Trigger delay (T_d):** <90 ns.*

RF pulse delay (P_d): Variable from 50 ns to 1s in 8 decade ranges with the lowest range being 50 ns to 100 ns.
Accuracy: ±5% of setting ±2 ns.
Resolution: 0.2% of full scale for a given range.

RF pulse width (P_W): Variable from 10 ns to 1s in eight ranges.
Accuracy: ±5% of setting ±2 ns from 200 ns to 1s ±10% of setting ±2 ns from 10 ns to 200 ns.
Resolution: 0.2% of full scale for a given range.

***RF pulse width compression (T_W-P_W):** <20 ns.*

Direct pulse control

Pulse repetition frequency (PRF): 0.1 Hz to 400 kHz, external trigger dc to 10 MHz.

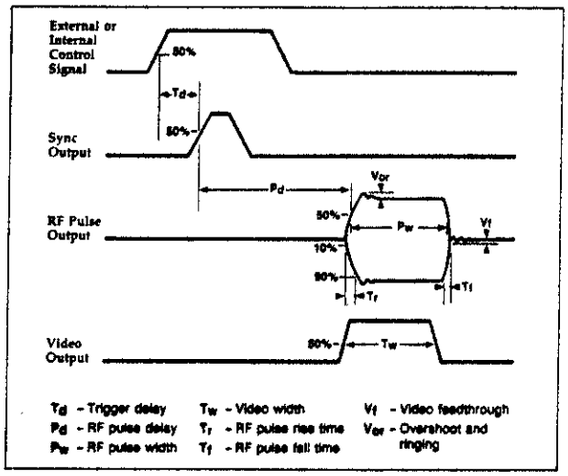
***Trigger delay (T_d):** <30 ns.*
***RF pulse delay (P_d):** <30 ns.*
***RF pulse width (P_W):** Internal control signal; half period of pulse repetition frequency. External control signal set by width of the external signal at TTL high.*
***RF pulse width compression (T_W-P_W):** <20 ns.*

[1] Typical accuracy up to 20 kHz rates and maximum deviations is better than ± 7%.

External inputs and outputs

***External input level:** TTL.*
***External input impedance:** 50Ω or Schottky TTL.*
***Sync output:** TTL level, 50 ns width, into 50Ω.*
***Video output:** TTL level into 50Ω.*

Pulse modulation definitions



Phase modulation

***Maximum phase deviation:** 400 radians, 1030 to 2060 MHz, decreases by half for each frequency band below this band.*
***Phase modulation indicator accuracy:** ±10%.*
***Phase modulation distortion:** <1%.*
***Phase modulation 3 dB bandwidth:** >20 Hz STD mode, >150 Hz LOW NOISE mode Opt. 004.*
***External input impedance:** 50Ω.*

Internal modulation source

Number of sources: Source 1, Source 2, simultaneously available through summation, independently adjustable in frequency, phase, amplitude and waveform. Source 1 may also be internally modulated independently with AM, FM, phase modulation and pulse modulation.

Waveforms: Sine, square, triangle, sawtooth and white Gaussian noise.

Frequency range:
0.1 Hz to 400 kHz, sine and white Gaussian noise.
0.1 Hz to 50 kHz, square, triangle and sawtooth.

***Typical frequency switching time:** <30 msec.*

Frequency resolution: 0.1 Hz.

Frequency accuracy: Same as internal reference oscillator.

Maximum output level: 1V peak into 600Ω.
Typical accuracy including flatness: ±10 mV, output ≤100 kHz.

Output level resolution: <2 mV.
Typically <1 mV.

***Output impedance:** Typically 600Ω.*

Total harmonic distortion: <0.1%, output at 1V peak and ≤20 kHz.
Typically <0.1% to 100 kHz.

Table 1-1B. HP 8665A/B Specifications (4 of 4)

Frequency sweep

Phase continuous sweep

Sweep type: Linear, phase continuous.

Sweep time: 10 msec to 10 sec.

Maximum sweep span:

Frequency Range (MHz)	Maximum Span (MHz)
3000 to 6000[1]	40
1500 to 3000	20
750 to 1500	10
375 to 750	5
187.5 to 375	2.5
10 to 187.5	10
0.1 to 10	10

Digitally stepped sweep

Sweep type: Linear or log, frequency stepped.

Sweep time range: 500 msec to 100 sec. Typical time per step is 90 msec.

X axis output: Nominal 0 to +10V.

Z axis output: Nominal +5V during retrace.

Markers available: 3.

Remote programming

Interface: HP-IB (Hewlett-Packard's implementation of IEEE-488.2-1987). HP-IB select code range: 00 to 30. Interface function is listener and talker.

Control language: Hewlett-Packard Systems Language (HP-SL).

Functions controlled: All front panel functions except power switch and knob.

IEEE-488 functions: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E2.

General

Power requirements: ±10% of 100V, 120V, 220V, or 240V; 48 to 440 Hz; 500 VA maximum.

Operating temperature range: 0 to +55°C.

Storage temperature range: −55 to +75°C.

Leakage: Conducted and radiated interference meets MIL STD 461B RE02 and FTZ 1046. RF leakage is typically <1 μV induced in a two-turn loop antenna 2.5 cm in diameter held 2.5 cm away from the front panel for output levels <0 dBm and carrier frequencies <1 GHz. Option 010 reduces RF leakage to typically <0.1 μV.

Acoustic noise: Typically <5.5 bels.

Internal calibration: The operator can initiate an internal calibration and diagnostic function.

Internal diagnostics: The instrument monitors its operation and will alert the user to most internal malfunctions. Built-in test capability locates circuit malfunctions to allow repair through module or cable replacement.

Calibration interval: Recommended 3 years (MTBC).

Storage registers: 10 full function and 40 frequency/amplitude registers.

Memory erasure: All memory contents except generic calibration data can be erased according to Mil Std 380-380.

Weight: Approximately 31 to 35 kg (68 to 78 lbs) net and 42 to 47 kg (93 to 103 lbs) shipping depending on the options ordered.

Dimensions: Approximately 178H × 425W × 648D mm (7 × 16.75 × 25.5 in.) Option 010 adds 35 mm (1.4 in.) to the depth.

Table 1-2. Recommended Test Equipment (1 of 2)

Instrument Type	Critical Specifications	Recommended Model
Audio Source	Level: 1 Vpk into 50 ohms Frequency: 1 kHz to 100 kHz	HP 3325A
Digital Voltmeter	Range: −40 to +40 V Accuracy: ±0.2% ±0.1 V	HP 3478A
Digitizing Oscilloscope	Vertical Sensitivity: 0.01 mV/div Bandwidth: 1 GHz Time/Div: 1 ns Input: Dual Channel, 50 ohms	HP 54110D with 2 HP 54002A
Distortion Analyzer	Distortion Range: < 0.1% Range: 20 Hz to 100 kHz	HP 339A, HP 8903B, or HP 8903E
Measuring Receiver, Sensor Module (RF), and Sensor Module (Microwave)	Frequency Range: 250 kHz to 1300 MHz Input Level: −127 to +17 dBm Compatible with HP 11793A Microwave Converter RF Power Accuracy: 0.2 dB Tuned RF Level: 0.36 dB RSS Referenced to −10 dBm input Amplitude Modulation: Rates: 20 Hz to 100 kHz Depth: to 90% Accuracy: ±2% at 1 kHz Demodulated Output Distortion: 0.5% for 50% depth; < 1.0% for 90% depth Incidental ΦM: <0.05 radians for 30% depth at 1 kHz rate (50 Hz to 3 kHz bandwidth) Residual AM: < 0.01% rms (0.3 to 3 kHz BW) Frequency Modulation: Rates: 20 Hz to 200 kHz Deviation: to 400 kHz Accuracy: ±3% at 1 kHz Demodulated Output Distortion: <0.3% Incidental AM: 0.2% depth at 20 kHz FM deviation Residual FM: See specifications for External Local Oscillator for Measuring Receiver	HP 8902A Opt. 003 and HP 11722A and HP 11792A Opt. 001

Table 1-2. Recommended Test Equipment (2 of 2)

Instrument Type	Critical Specifications	Recommended Model
Microwave Converter	Input Frequency Range: 0 to 4.4 GHz Compatible with HP 8902A Measuring Receiver.	HP 11793A
Microwave Signal Generator	Frequency Range: 2 to 4.4 GHz Output level: +13 dBm.	HP 8672A
Phase Noise Measurement System	The Performance Tests for SSB Phase Noise are complex and the procedure has been written specifically using the HP 3048A, no substitutions are recommended.	HP 3048A Opt. 101 and Opt. 201
Power Supply	Output Range: −40 to +40 V.	HP 6218C or HP 6236B
Reference Signal Generator	Residual FM: Less than or equal to the specification for the HP 8665A or HP 8665A Opt. 004.	Signal Generator Opt. 004, HP 8662A, or HP 8663A
Spectrum Analyzer, RF	Frequency Range: 0.1 to 12.8 GHz Resolution Bandwidth: <1 kHz to 3 kHz	HP 8562B

Table 3-1. Basic Functional Checks (2 of 2)

Refer to *Operation Guide*	Functions and Operations Verified
Appendix F *Synthesized Audio Oscillator*	Special Functions Audio Level Audio Frequency
Appendix G *Miscellaneous Operating Features*	Amplitude Offset Auto Sequence Clear All Display EMF Frequency Offset Knob Hold Knob Increment Phase Increment/Decrement Sequence Set Sequence

Preliminary Test

INTERNAL VOLTMETER VERIFICATION

Specification

The accuracy of the internal voltmeter is not explicitly specified but it should be ±1% of reading ±0.25 V for the Recal routine to be valid.

Description

A dc voltage is applied to the voltmeter input of the Signal Generator. The voltage is measured by both the Signal Generator's internal voltmeter and an external voltmeter and the two readings are compared.

NOTE

This test should be run before beginning the Performance Tests.

Equipment

Digital Voltmeter ..... HP 3478A
Power Supply .....HP 6218C or HP 6236B

Procedure

1. Remove any connection to the Signal Generator's rear-panel VM IN connector.
2. On the Signal Generator, press INSTR PRESET then key in SPECIAL 180 ENTER to set the internal voltmeter to read the voltage at the Signal Generator's rear-panel VM IN connector. The reading should be between −0.25 and +0.25 V dc.

   Voltmeter Offset: −0.25 _____ +0.25 V dc
3. Connect the dc power supply and digital voltmeter to the Signal Generator's rear-panel VM IN connector using a BNC tee. (If a dual power supply is used, stack the + and − outputs to obtain the 40 V if needed.)
4. Set the power supply to +40 V and set the voltmeter to read +40 V dc. The Signal Generator should display approximately +40, but more importantly it should agree with the reading of the external voltmeter within ±0.65 V dc (that is, ±1% of 40 V ±0.25 V).

   Voltmeter Accuracy at +40 V: −0.65 _____ +0.65 V dc
5. Reverse the power supply leads to produce −40 V at the Signal Generator's VM IN connector. The Signal Generator should display approximately −40 and should agree with the reading of the external voltmeter within ±0.65 V dc (that is, ±1% of 40 V ±0.25 V).

   Voltmeter Accuracy at −40 V: −0.65 _____ +0.65 V dc

Performance Test 1

CARRIER AMPLITUDE TEST

Specification

Characteristic	Performance Limits	Conditions
Output		
Maximum Level	+13 dBm	not Option 008
	+9 dBm	Option 008
Minimum Level	−139.9 dBm	
Absolute Accuracy		output ≥ −119.9 dBm
	±1.5 dB	0.1 to 1 MHz
	±1 dB	1 to 1000 MHz
	±1.5 dB	1000 to 3000 MHz
	±2.0 dB	3000 to 6000 MHz

Description

The carrier amplitude specifications are verified with an HP 8902A Measuring Receiver. The higher amplitudes are measured directly with the measuring receiver's built-in power meter. Lower amplitudes are measured using the very sensitive tuned RF level feature of the measuring receiver. For frequencies beyond the tuning range of the measuring receiver, the signal is down-converted.

Carrier amplitude is set in the instrument both by switching attenuator pads (in 5 dB steps) and also by electronic vernier level control. Both types of amplitude control are checked.

Equipment

Measuring Receiver ..... HP 8902A
Microwave Converter ..... HP 11793A
Microwave Signal Generator ..... HP 8672A
Sensor Module (Microwave) ..... HP 11792A Option 001
Sensor Module (RF) ..... HP 11722A

Procedure

Initial Setup

1. Connect the equipment as shown in figure 3-1. (Connect the RF input of the sensor module directly to the Signal Generator's RF output connector.)

NOTE

Verify that the measuring receiver's calibration factors match the sensor module. (The calibration factors must encompass a frequency range of 0.1 to 1300 MHz. The measuring receiver will display Error 15 if the signal frequency goes outside the calibration factor range.) Also zero the sensor module and calibrate the power measurement using the measuring receiver's built-in power reference.

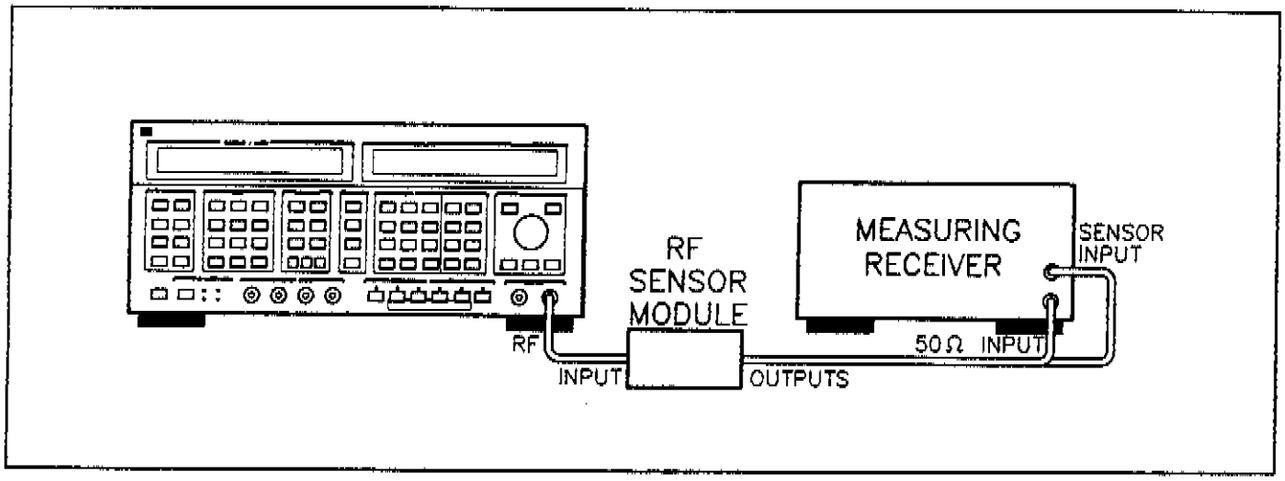


Figure 3-1. Carrier Amplitude (Direct) Test Setup

2. On the Signal Generator, press INSTR PRESET.
3. Preset the measuring receiver, then select the RF power measurement with units of dBm.

Low-Frequency, Maximum Level

4. Set the Signal Generator's carrier frequency and amplitude as indicated in the following table. Also key the frequency into the measuring receiver to invoke the appropriate calibration factor. The carrier amplitude should be within the limits given in the table.

Signal Generator Carrier		Amplitude Limits (dBm)	
Frequency (MHz)	Amplitude (dBm)	Minimum	Actual
Not Option 008			
0.1	+14.5	+13	_____
1	+14	+13	_____
10	+14	+13	_____
100	+14	+13	_____
1000	+14	+13	_____
Option 008			
0.1	+10.5	+9	_____
1	+10	+9	_____
10	+10	+9	_____
100	+10	+9	_____
1000	+10	+9	_____

Low-Frequency, High-Amplitude Accuracy

5. Set the Signal Generator's carrier frequency and amplitude as indicated in the following table. Also key the frequency into the measuring receiver to invoke the appropriate calibration factor. The output power should be within the limits given in the table.

Signal Generator Carrier		Amplitude Limits (dBm)		
Frequency (MHz)	Amplitude (dBm)	Minimum	Actual	Maximum
1000	+6	+5	_____	+7
1000	+7	+6	_____	+8
1000	+8	+7	_____	+9
1000	+9	+8	_____	+10
1000(1)	+10	+9	_____	+11
1000(1)	+11	+10	_____	+12
1000(1)	+12	+11	_____	+13
1000(1)	+13	+12	_____	+14
100(1)	+13	+12	_____	+14
100(1)	+12	+11	_____	+13
100(1)	+11	+10	_____	+12
100(1)	+10	+9	_____	+11
100	+9	+8	_____	+10
100	+8	+7	_____	+9
100	+7	+6	_____	+8
100	+6	+5	_____	+7
10	+6	+5	_____	+7
10	+7	+6	_____	+8
10	+8	+7	_____	+9
10	+9	+8	_____	+10
10(1)	+10	+9	_____	+11
10(1)	+11	+10	_____	+12
10(1)	+12	+11	_____	+13
10(1)	+13	+12	_____	+14
1(1)	+13	+12	_____	+14
1(1)	+12	+11	_____	+13
1(1)	+11	+10	_____	+12
1(1)	+10	+9	_____	+11
1	+9	+8	_____	+10
1	+8	+7	_____	+9
1	+7	+6	_____	+8
1	+6	+5	_____	+7
0.1	+6	+4.5	_____	+7.5
0.1	+7	+5.5	_____	+8.5
0.1	+8	+6.5	_____	+9.5
0.1	+9	+7.5	_____	+10.5
0.1(1)	+10	+8.5	_____	+11.5
0.1(1)	+11	+9.5	_____	+12.5
0.1(1)	+12	+10.5	_____	+13.5
0.1(1)	+13	+11.5	_____	+14.5

(1) Except Option 008

Low-Frequency, Low-Amplitude Accuracy

6. On the Signal Generator, perform the following steps.
   a. Key in FREQ 1000 MHz and AMPTD 6 dBm.
   b. Key in SPECIAL 101 ENTER. The FREQUENCY/STATUS display should show an attenuation of +0.0 dB.
   c. Key in INCR SET 5 dB to set the attenuation increment to 5 dB.
7. On the measuring receiver, press the automatic operation key then select the tuned RF level measurement mode with units of dBm. (For the moment, ignore the uncalibrated and recalibrate annunciators if showing.)
8. On the Signal Generator, increment the attenuation (using the ⇧ key) in 5 dB steps and note the level displayed on the measuring receiver. The carrier amplitude should be within the limits given in the following table.

NOTE

When the recalibration annunciator appears on the measuring receiver's display, press the measuring receiver's CALIBRATE *key, wait for completion of the calibration, then proceed.*

Signal Generator Display		Amplitude Limits (dB REL)		
Attenuation (dB)	Amplitude (dBm)	Minimum	Actual	Maximum
+5	+1	0	_____	+2
+10	−4	−5	_____	−3
+15	−9	−10	_____	−8
+20	−14	−15	_____	−13
+25	−19	−20	_____	−18
+30	−24	−25	_____	−23
+35	−29	−30	_____	−28
+40	−34	−35	_____	−33
+45	−39	−40	_____	−38
+50	−44	−45	_____	−43
+55	−49	−50	_____	−48
+60	−54	−55	_____	−53
+65	−59	−60	_____	−58
+70	−64	−65	_____	−63
+75	−69	−70	_____	−68
+80	−74	−75	_____	−73
+85	−79	−80	_____	−78
+90	−84	−85	_____	−83
+95	−89	−90	_____	−88
+100	−94	−95	_____	−93
+105	−99	−100	_____	−98
+110	−104	−105	_____	−103
+115	−109	−110	_____	−108
+120	−114	−115	_____	−113
+125	−119	−120	_____	−118

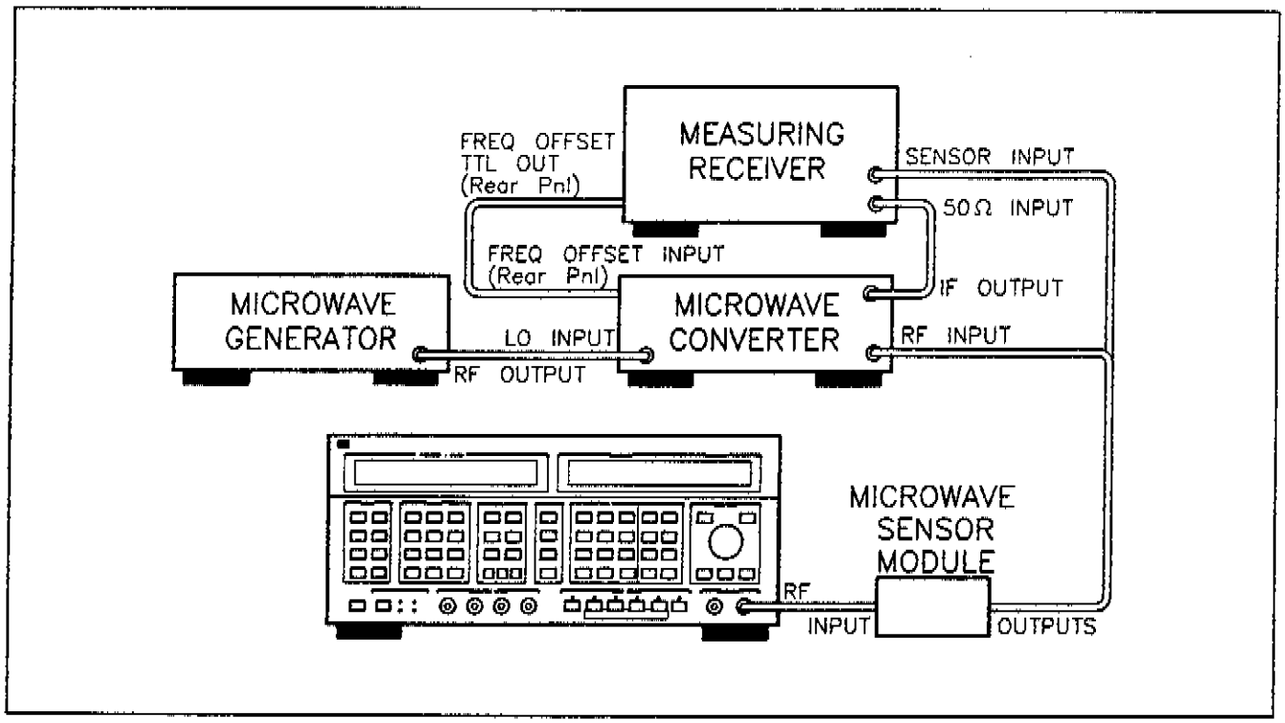


Figure 3-2. Carrier Amplitude (Down-Converted) Test Setup

High-Frequency, Maximum Level

9. Connect the equipment to the microwave converter as shown in figure 3-2. (Connect the microwave input of the sensor module directly to the Signal Generator's RF output connector.)

NOTE

Verify that the measuring receiver's calibration factors match the sensor module. To select the calibration factors for the microwave sensor module, invoke Special Function 27.1. (The calibration factors must encompass a frequency range of 1000 to 6000 MHz.) Also zero the sensor module and calibrate the power measurement.

10. On the Signal Generator, press INSTR PRESET.
11. Preset the measuring receiver, then select the RF power measurement with units of dBm. Key in 27.1 SPCL to select the calibration factors for the microwave sensor module.
12. Set the Signal Generator's carrier frequency and amplitude as indicated in the following table. Also key the frequency into the measuring receiver. The carrier amplitude should be within the limits given in the table.

Signal Generator Carrier		Amplitude Limits (dBm)	
Frequency (MHz)	Amplitude (dBm)	Minimum	Actual
Not Option 008			
2990	+14.5	+13	_____
4200[1]	+15.0	+13	_____
6000[2]	+15.0	+13	_____
Option 008			
2990	+10.5	+9	_____
4200[1]	+11.0	+9	_____
6000[2]	+11.0	+9	_____

(1) HP8665A and HP8665B only.
(2) HP8665B only.

High-Frequency, High-Amplitude Accuracy

13. Set the Signal Generator's carrier frequency and amplitude as indicated in the following table. Also key the frequency into the measuring receiver. The output power should be within the limits given in the table.

Signal Generator Carrier		Amplitude Limits (dBm)		
Frequency (MHz)	Amplitude (dBm)	Minimum	Actual	Maximum
6000[1],[3]	+13	+11.0	_____	+15.0
6000[1],[3]	+11	+9.0	_____	+13.0
6000[3]	+9	+7.0	_____	+11.0
6000[3]	+6	+4.0	_____	+8.0
4200[2]	+6	+4.0	_____	+8.0
4200[2]	+9	+7.0	_____	+11.0
4200[1],[2]	+11	+9.0	_____	+13.0
4200[1],[2]	+13	+11.0	_____	+15.0
2990[1]	+13	+11.5	_____	+14.5
2990[1]	+11	+9.5	_____	+12.5
2990	+9	+7.5	_____	+10.5
2990	+6	+4.5	_____	+7.5

(1) Except Option 008.
(2) HP8665A and HP8665B only.
(3) HP8665B only.

High-Frequency, Low-Amplitude Accuracy (2990 MHz)

14. On the Signal Generator under test, key in SPECIAL 101 ENTER then key in 0 dB. Also key in INCR SET 5 dB.
15. On the microwave signal generator, set the frequency to 3190 MHz and amplitude to +13 dBm. (Ignore amplitude overranging messages.)
16. On the measuring receiver, perform the following steps.
    a. Preset the instrument.
    b. Key in 27.3 SPCL (to set the measuring receiver and microwave converter to the frequency offset mode).
    c. Key in 3190 MHz (to input the LO frequency information into the measuring receiver).
    d. Select the tuned RF level measurement mode with units of dBm.
17. On the Signal Generator under test, key in SPECIAL ENTER then increment the attenuation in 5 dB steps and note the level displayed on the measuring receiver. The carrier amplitude should be within the limits given in the following table.

NOTE

If the recalibration annunciator appears, press the measuring receiver's CALIBRATE *key, wait for completion of the calibration, then proceed.*

Signal Generator Display		Amplitude Limits (dB REL)		
Attenuation (dB)	Amplitude (dBm)	Minimum	Actual	Maximum
+5	+1	−0.5	_____	+2.5
+10	−4	−5.5	_____	−2.5
+15	−9	−10.5	_____	−7.5
+20	−14	−15.5	_____	−12.5
+25	−19	−20.5	_____	−17.5
+30	−24	−25.5	_____	−22.5
+35	−29	−30.5	_____	−27.5
+40	−34	−35.5	_____	−32.5
+45	−39	−40.5	_____	−37.5
+50	−44	−45.5	_____	−42.5
+55	−49	−50.5	_____	−47.5
+60	−54	−55.5	_____	−52.5
+65	−59	−60.5	_____	−57.5
+70	−64	−65.5	_____	−62.5
+75	−69	−70.5	_____	−67.5
+80	−74	−75.5	_____	−72.5
+85	−79	−80.5	_____	−77.5
+90	−84	−85.5	_____	−82.5
+95	−89	−90.5	_____	−87.5
+100	−94	−95.5	_____	−92.5
+105	−99	−100.5	_____	−97.5
+110	−104	−105.5	_____	−102.5

High-Frequency, Low-Amplitude Accuracy (4200 MHz; HP8665A only)

18. On the Signal Generator under test, key in FREQ 4200 MHz and SPECIAL ENTER 0 dB.
19. On the microwave signal generator, set the frequency to 4400 MHz.
20. On the measuring receiver, perform the following steps.
    a. Select the frequency measurement mode.
    b. Key in 27.3 SPCL.
    c. Key in 4400 MHz. (The measuring receivers display should read 4200 MHz.)
    d. Select the tuned RF level measurement mode.
21. On the Signal Generator under test, increment the attenuation in 5 dB steps and note the level displayed on the measuring receiver. The carrier amplitude should be within the limits given in the following table.

Signal Generator Display		Amplitude Limits (dB REL)		
Attenuation (dB)	Amplitude (dBm)	Minimum	Actual	Maximum
+5	+1	−1.0	_____	+3.0
+10	−4	−6.0	_____	−2.0
+15	−9	−11.0	_____	−7.0
+20	−14	−16.0	_____	−12.0
+25	−19	−21.0	_____	−17.0
+30	−24	−26.0	_____	−22.0
+35	−29	−31.0	_____	−27.0
+40	−34	−36.0	_____	−32.0
+45	−39	−41.0	_____	−37.0
+50	−44	−46.0	_____	−42.0
+55	−49	−51.0	_____	−47.0
+60	−54	−56.0	_____	−52.0
+65	−59	−61.0	_____	−57.0
+70	−64	−66.0	_____	−62.0
+75	−69	−71.0	_____	−67.0
+80	−74	−76.0	_____	−72.0
+85	−79	−81.0	_____	−77.0
+90	−84	−86.0	_____	−82.0
+95	−89	−91.0	_____	−87.0
+100	−94	−96.0	_____	−92.0
+105	−99	−101.0	_____	−97.0
+110	−104	−106.0	_____	−102.0

High-Frequency, Low-Amplitude Accuracy (6000 MHz; HP8665B only)

22. On the Signal Generator under test, key in FREQ 6000 MHz and SPECIAL ENTER 0 dB.
23. On the microwave signal generator, set the frequency to 5800 MHz.
24. On the measuring receiver, perform the following steps.
    a. Select the frequency measurement mode.
    b. Key in 27.3 SPCL.
    c. Key in 5800 MHz. (The measuring receivers display should read 6000 MHz.)
    d. Select the tuned RF level measurement mode.

25. On the Signal Generator under test, increment the attenuation in 5 dB steps and note the level displayed on the measuring receiver. The carrier amplitude should be within the limits given in the following table.

Signal Generator Display		Amplitude Limits (dB REL)		
Attenuation (dB)	Amplitude (dBm)	Minimum	Actual	Maximum
+5	+1	−1.0	_____	+3.0
+10	−4	−6.0	_____	−2.0
+15	−9	−11.0	_____	−7.0
+20	−14	−16.0	_____	−12.0
+25	−19	−21.0	_____	−17.0
+30	−24	−26.0	_____	−22.0
+35	−29	−31.0	_____	−27.0
+40	−34	−36.0	_____	−32.0
+45	−39	−41.0	_____	−37.0
+50	−44	−46.0	_____	−42.0
+55	−49	−51.0	_____	−47.0
+60	−54	−56.0	_____	−52.0
+65	−59	−61.0	_____	−57.0
+70	−64	−66.0	_____	−62.0
+75	−69	−71.0	_____	−67.0
+80	−74	−76.0	_____	−72.0
+85	−79	−81.0	_____	−77.0
+90	−84	−86.0	_____	−82.0
+95	−89	−91.0	_____	−87.0
+100	−94	−96.0	_____	−92.0
+105	−99	−101.0	_____	−97.0
+110	−104	−106.0	_____	−102.0

Performance Test 2

AM TEST

Specification

Characteristic	Performance Limits	Conditions
Spectral Purity		
Residual AM	<0.02% rms	0.3 to 3 kHz post-detection bandwidth
Amplitude Modulation		
AM Depth	0 to 99.9% 0 to 99.9%	output < +7 dBm; not Option 008 output < +3 dBm; Option 008
Indicator Accuracy	±(6% of setting + 1%)	to 90% depth; 1 kHz rate to 70% depth; 1 kHz rate; ≥ 3000 MHz (HP8665B only)
Distortion		400 and 1000 Hz rates
	<2% <4% <6%	0 to 30% depth 30 to 70% depth 70 to 90% depth
3 dB Bandwidth	>5 kHz >10 kHz	1 to 10 MHz carrier >10 MHz carrier
Incidental Phase Modulation		at 30% depth; 1 kHz rate
	<0.3 rad peak <0.6 rad peak	0.1 to 2000 MHz carrier >2 GHz carrier

Description

For carrier frequencies below 1300 MHz, the AM specifications are verified directly with an HP 8902A Measuring Receiver. For higher carrier frequencies, the signal is down-converted to within the range of the measuring receiver.

Equipment

Measuring Receiver ..... HP 8902A
Microwave Converter ..... HP 11793A
Microwave Generator ..... HP 8672A

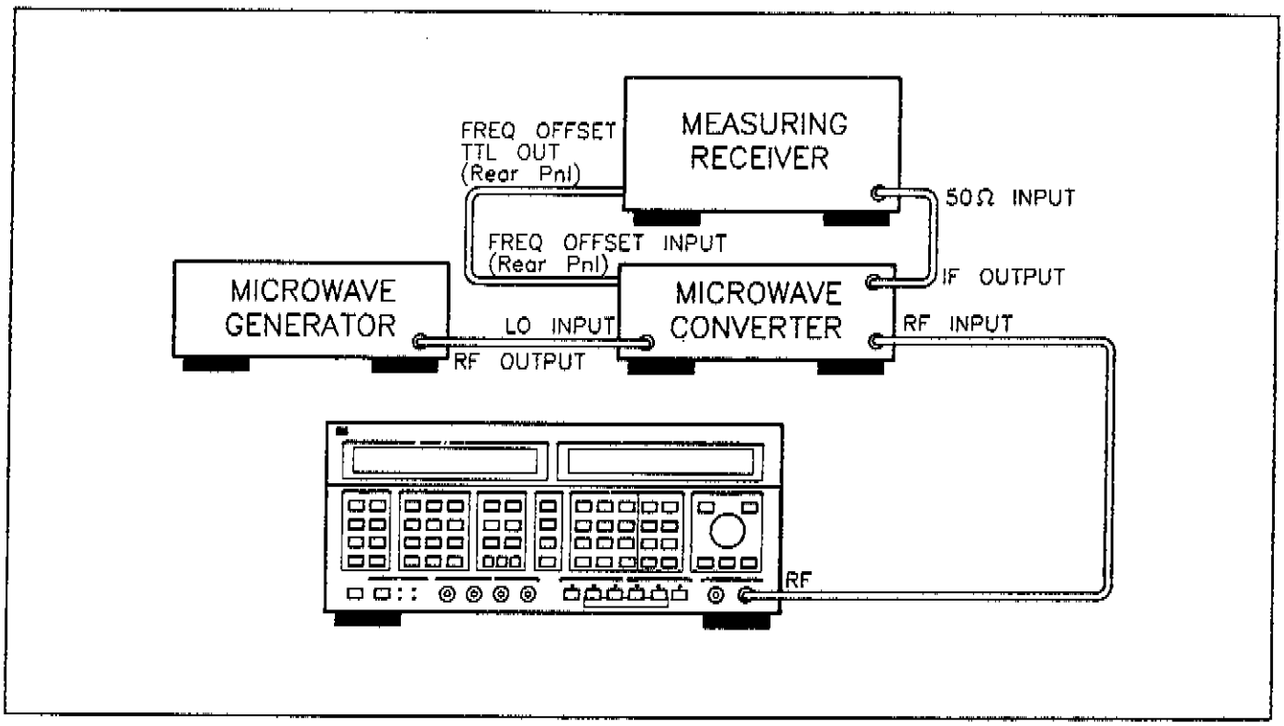


Figure 3-3. AM Test Setup

Procedure

Initial Setup

NOTE

Verify that the measuring receiver's AM is calibrated using its built-in AM calibrator.

1. Connect the equipment as shown in figure 3-3.
2. On the microwave generator, set the frequency to 4400 MHz and amplitude to +13 dBm. (Ignore amplitude overranging messages.)
3. Preset the measuring receiver, then set it as follows.
   a. Select the AM measurement.
   b. Set the high-pass filter to 300 Hz.
   c. Set the low-pass filter to 3 kHz.
   d. Set the detector to RMS.

Residual AM

4. On the Signal Generator, press INSTR PRESET, then set it as follows.
   a. Key in FREQ 1 GHz.
   b. Key in AMPTD 9 dBm.
   c. Key in SPECIAL 100 ENTER OFF to set automatic attenuation to off.
   d. Set the amplitude as indicated in the following table. The residual AM should be within the limits given in the table. (Note that the Signal Generator's AM function is off.)

Signal Generator Carrier Amplitude (dBm)	Residual AM Limits (%)	
	Actual	Maximum
13[1]	_____	0.02
9	_____	0.02
0	_____	0.02

[1] Except Option 008

Indicator Accuracy

5. Set the measuring receiver as follows.
   a. Set the detector to peak± /2 (that is, to average peak+ and peak–). (To do this press the PEAK + and PEAK – keys simultaneously.)
   b. Set the high-pass filter off.
   c. Set the low-pass filter off.
6. On the Signal Generator:
   a. Press INSTR PRESET.
   b. Key in AMPTD 0 dBm.
   c. Key in AM ON. (Note that the modulation source is set to internal with a modulation rate of 1 kHz.)
   d. Set the AM depth and Carrier Frequency as indicated in the following table.

7. For carrier frequencies in the table greater than 1000 MHz:

   a. Set the microwave generator to a frequency 200 MHz from the carrier frequency.

   b. Then on the measuring receiver enable frequency offset mode by keying in 27.3 SPCL followed by the microwave generator frequency (which would be 4400 MHz or 5800 MHz in this case).

   c. The AM depth, as read on the measuring receiver, should be within the limit shown in the table.

Carrier Frequency (MHz)	Signal Generator AM Depth (%)	AM Depth Limits (%)		
		Minimum	Actual	Maximum
1000	10	8.4	_____	11.6
1000	50	46.0	_____	54.0
1000	90	83.6	_____	96.4
4200(1)	10	8.4	_____	11.6
4200(1)	50	46.0	_____	54.0
4200(1)	90	83.6	_____	96.4
6000(2)	10	8.4	_____	11.6
6000(2)	50	46.0	_____	54.0
6000(2)	70	64.8	_____	75.2

(1) HP 8665A only.
(2) HP 8665B only.

Distortion

8. Set the measuring receiver to measure the audio distortion on the demodulated 1 kHz AM and key in 28.0 SPCL to exit frequency offset mode.

9. Set the Signal Generator's AM depth and Carrier Frequency as indicated in the following table.

a. For carrier frequencies in the table greater than 1000 MHz set the microwave generator to a frequency 200 MHz from the carrier frequency.

b. Then on the measuring receiver enable frequency offset mode by keying in 27.3 SPCL followed by the microwave generator frequency (which would be 4400 MHz or 5800 MHz in this case).

c. The AM distortion, as read on the measuring receiver, should be within the limit shown in the table.

Carrier Frequency (MHz)	Signal Generator AM Depth (%)	AM Distortion Limits (%)	
		Actual	Maximum
1000	30	_____	2
1000	70	_____	4
1000	90	_____	6
4200[1]	30	_____	2
4200[1]	70	_____	4
4200[1]	90	_____	6
6000[2]	30	_____	2
6000[2]	70	_____	4

[1] HP 8665A only.
[2] HP 8665B only.

3 dB Bandwidth

10. Set the measuring receiver to measure AM depth.

a. For carrier frequencies in the table greater than 1000 MHz set the microwave generator to a frequency 200 MHz from the carrier frequency.

b. Then on the measuring receiver enable frequency offset mode by keying in 27.3 SPCL followed by the microwave generator frequency (which would be 4400 MHz or 5800 MHz in this case).

c. The AM depth, as read on the measuring receiver, should be within the limit shown in the table.

11. Set the Signal Generator's carrier frequency as indicated in the following table. For each setting perform the following steps.

a. After setting the Signal Generator's carrier frequency, allow the measuring receiver to retune.

b. Key in AUDIO FREQ 1 kHz.

c. Set the measuring receiver ratio display off (if it is on). Then set the ratio back on to establish a new ratio reference. (Also, set the ratio to read in dB, that is, log.)

d. Set the Signal Generator's audio (modulation) frequency as shown in the table.

e. Note the dB change in AM depth on the measuring receiver. The depth should be between −3 and +3 dB (relative).

Signal Generator Settings		Relative AM Depth Limits (dB)		
Carrier Frequency (MHz)	Audio Frequency (kHz)	Minimum	Actual	Maximum
1	5	−3	_____	+3
10	10	−3	_____	+3
100	10	−3	_____	+3
1000	10	−3	_____	+3
4000(1)	10	−3	_____	+3

(1) HP 8665A or HP 8665B only.

Incidental Phase Modulation (1000 MHz)

12. On the Signal Generator, key in AM 30 % and AUDIO FREQ 1 kHz.

13. On the measuring receiver, disable frequency offset mode then set the measuring receiver to read phase modulation (ΦM) and set its detector to peak+ then to peak−. (If the phase modulation reading is fluctuating, average several readings.) The worst-case of the peak+ and peak− phase deviation readings should be 0.3 rad or less.

Incidental ΦM Limit at 1000 MHz: _____ 0.3 rad peak

Note: If your instrument is a HP 8665A do steps 14 and 15 only. If your instrument is a HP 8665B do steps 16 and 17 only.

Incidental Phase Modulation (HP 8665A only)

14. On the measuring receiver:

    a. Key in 27.3 SPCL (to set the measuring receiver and microwave converter to the frequency offset mode) then key in 4200 MHz (to input the LO frequency information into the measuring receiver).

    b. Set the microwave generator to 4200 MHz.

15. On the Signal Generator, key in FREQ 4000 MHz. The worst-case of the peak+ and peak− phase deviation readings should be 0.6 rad or less.

    Incidental ΦM Limit at 4200 MHz: _____ 0.6 rad peak

Incidental Phase Modulation (HP 8665B only)

16. On the measuring receiver:

    a. Key in 27.3 SPCL (to set the measuring receiver and microwave converter to the frequency offset mode) then key in 5800 MHz (to input the LO frequency information into the measuring receiver).

    b. Set the microwave generator to 5800 MHz.

17. On the Signal Generator, key in FREQ 6000 MHz. The worst-case of the peak+ and peak− phase deviation readings should be 0.6 rad or less.

    Incidental ΦM Limit at 6000 MHz: _____ 0.6 rad peak

Performance Test 3

FM TEST (LOW DEVIATIONS AND RATES)

Specification

Characteristic	Performance Limits	Conditions
Spectral Purity		
Residual FM		48 to 63 Hz power line frequency
		0.3 to 3 kHz post-detection bandwidth
	<15 Hz rms	0.1 to 187.5 MHz carrier
	<7.5 Hz rms	187.5 to 750 MHz carrier
	<15 Hz rms	750 to 1500 MHz carrier
	<60 Hz rms	1500 to 6000 MHz carrier
		0.3 to 3 kHz post-detection bandwidth; low noise mode (Option 004)
	<2.5 Hz rms	0.1 to 187.5 MHz carrier
	<1.25 Hz rms	187.5 to 750 MHz carrier
	<2.5 Hz rms	750 to 1500 MHz carrier
	<10 Hz rms	1500 to 6000 MHz carrier
		0.05 to 15 kHz post-detection bandwidth
	<20 Hz rms	0.1 to 187.5 MHz carrier
	<10 Hz rms	187.5 to 750 MHz carrier
	<20 Hz rms	750 to 1500 MHz carrier
	<80 Hz rms	1500 to 6000 MHz carrier
		0.05 to 15 kHz post-detection bandwidth; low-noise mode (Option 004)
	<8 Hz rms	0.1 to 187.5 MHz carrier
	<4 Hz rms	187.5 to 750 MHz carrier
	<8 Hz rms	750 to 1500 MHz carrier
	<32 Hz rms	1500 to 6000 MHz carrier

(Table continued on next page)

(Table continued from previous page)

Characteristic	Performance Limits	Conditions
Frequency Modulation		
Maximum Peak Deviation	20 MHz	3000 to 6000 MHz carrier
	10 MHz	1500 to 3000 MHz carrier
	5 MHz	750 to 1500 MHz carrier
	2.5 MHz	375 to 750 MHz carrier
	1.25 MHz	187.5 to 375 MHz carrier
	5 MHz	10 to 187.5 MHz carrier
		low-noise mode (Option 004)
	400 kHz	3000 to 6000 MHz carrier
	200 kHz	1500 to 3000 MHz carrier
	100 kHz	750 to 1500 MHz carrier
	50 kHz	375 to 750 MHz carrier
	25 kHz	187.5 to 375 MHz carrier
	100 kHz	10 to 187.5 MHz carrier
Maximum Rate (3 dB Bandwidth)	800 kHz	
Indicator Accuracy		dc to 20 kHz rates
	±9% of FM deviation setting	
	±11% of FM deviation setting	low-noise mode (Option 004)
Distortion	<1%	20 Hz to 20 kHz rates
Incidental AM	<0.4% depth	deviation <20 kHz
Carrier Frequency Accuracy in FM	±0.6% of deviation setting	

Description

The FM specifications which can be verified directly with an HP 8902A Measuring Receiver are checked in these tests. The restrictions are that (1) the peak deviation must be less than 400 kHz, (2) the modulation rate must be less than 200 kHz for carrier frequencies, and (3) the local oscillator's residual FM must be no more than the HP 8664 or HP 8665. This latter restriction can be overcome by choosing an external local oscillator with better or equal performance (such as an HP 8662A or a second HP 8664A/8665A/8665B).

Except for the heterodyne band (10 to 187.5 MHz), the FM indicator accuracy is checked at the high end, geometric midpoint, and low end of each carrier range. In instrument operation, a low-pass filter switches in or out at the midpoint. Indicator accuracy is checked at the highest frequency where the lower-frequency filter is in.

This test is followed by Performance Test 4, *FM Test (High Deviations and Rates)*, which uses an HP 3048A Phase Noise Measurement System. This system can measure some FM specifications outside the range of the HP 8902A. Performance Tests 3 and 4 have some overlap.

Equipment

Distortion Analyzer	HP 8903B or HP 8903E
Measuring Receiver	HP 8902A Option 003
Microwave Converter	HP 11793A
Microwave Signal Generator	HP 8672A
Reference Signal Generator	HP 8662A, HP 8663A, HP 8664A, or HP 8665A/B

Procedure

Initial Setup

NOTE

Verify that the measuring receiver's FM is calibrated using its built-in FM calibrator.

1. Connect the equipment as shown in figure 3–4 making note of the following details.
   a. If the measuring receiver does not have series 030 options (high selectivity), remove the rear-panel coaxial jumper from the local oscillator's input and output.
   b. Connect the reference signal generator's output to the measuring receiver's rear-panel local oscillator input.
   c. Connect the Signal Generator-under-test's RF output connector directly to the RF input of the microwave converter.

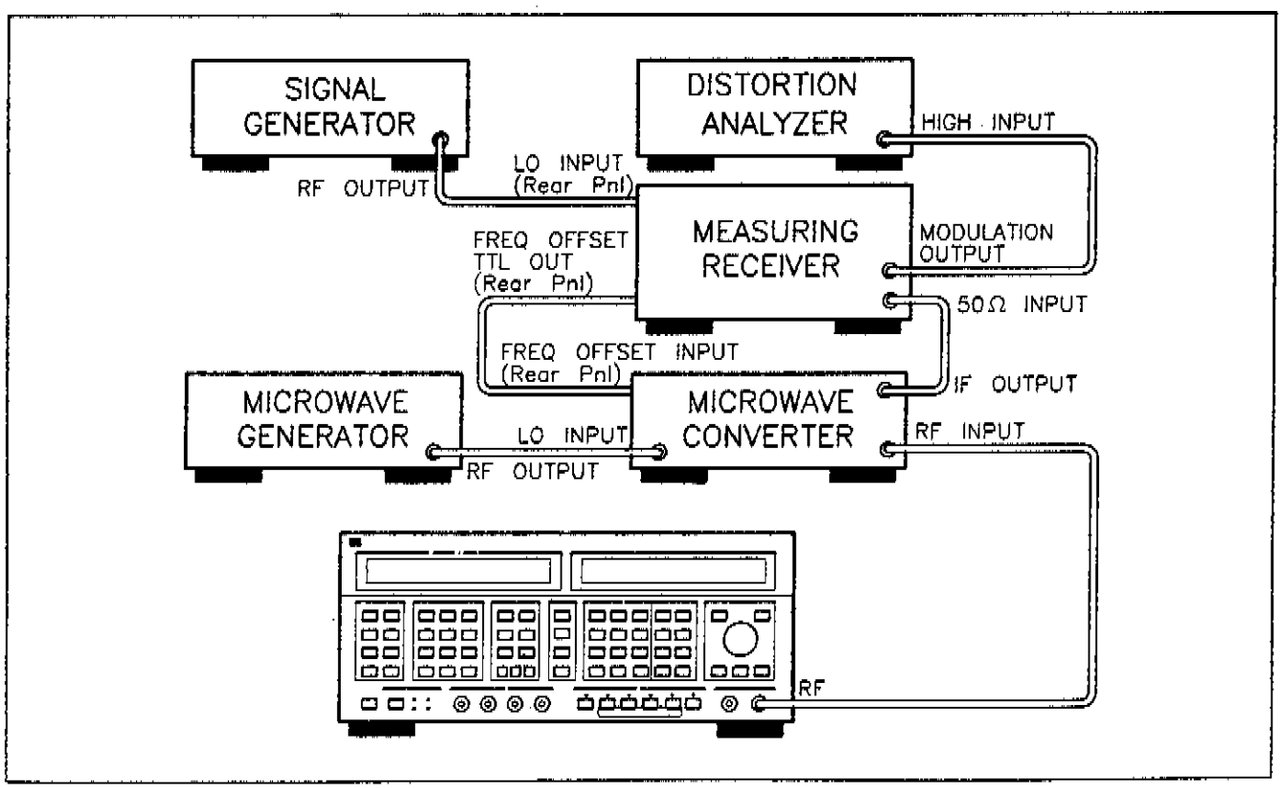


Figure 3–4. FM (Low Deviation and Rates) Test Setup

2. On the microwave signal generator, set the frequency to 4400 MHz and amplitude to +13 dBm. (Ignore amplitude overranging messages.)
3. Set the reference signal generator's carrier to 181.501 MHz at 0 dBm. If the generator is an HP 8665A with Option 004, press MODE 1 in the MODE SELECT key group.
4. On the Signal Generator under test, press INSTR PRESET then key in FREQ 180.001 MHz and AMPTD 0 dBm.
5. Preset the measuring receiver, then set it to read FM with the RMS detector. (If the measuring receiver has series 030 options (high selectivity), invoke special function 23.1 to switch the local oscillator to external.)

Residual FM

6. Set the Signal Generator-under-test's carrier frequency and mode select, the reference signal generator's carrier frequency, and the measuring receiver's high-pass and low-pass filters as indicated in the following table. For each setting, allow the measuring receiver to retune. The residual FM should be within the limits given in the table.

Signal Generator Under Test		Reference Generator Carrier (MHz)	Measuring Receiver Filter		Residual FM Limits (Hz rms)	
Carrier (MHz)	Mode		High-Pass	Low-Pass	Actual	Maximum
180.001	1	181.501	300 Hz	3 kHz	_____	15
180.001	1	181.501	50 Hz	15 kHz	_____	20
740.005	1	741.505	50 Hz	15 kHz	_____	10
740.005	1	741.505	300 Hz	3 kHz	_____	7.5
1200.001	1	1201.501	300 Hz	3 kHz	_____	15
1200.001	1	1201.501	50 Hz	15 kHz	_____	20
1200.004	2(1)	1201.504	50 Hz	15 kHz	_____	8
1200.004	2(1)	1201.504	300 Hz	3 kHz	_____	2.5
740.002	2(1)	741.502	300 Hz	3 kHz	_____	1.25
740.002	2(1)	741.502	50 Hz	15 kHz	_____	4
180.004	2(1)	181.504	50 Hz	15 kHz	_____	8
180.004	2(1)	181.504	300 Hz	3 kHz	_____	2.5

(1) Option 004

7. On the measuring receiver, key in 27.3 SPCL (to set the measuring receiver and the microwave converter to the frequency offset mode) then key in 3200, 4400, or 6000 MHz (to input the LO frequency information into the measuring receiver) depending on the maximum carrier frequency of the Signal Generator-under-test.
8. Set the reference signal generator's carrier frequency to 201.5 MHz.
9. Set the Signal Generator-under-test to its maximum carrier frequency 3200, 4400, or 6000 MHz depending on the model of the Signal Generator-under-test.
10. Set the Signal Generator-under-test's mode select and the measuring receiver's high-pass and low-pass filters as indicated in the following table. For each setting, the residual FM should be within the limits given in the table.

Signal Generator Under Test Mode	Measuring Receiver Filter		Residual FM Limits (Hz rms)	
	High-Pass	Low-Pass	Actual	Maximum
1	300 Hz	3 kHz	_____	60
1	50 Hz	15 kHz	_____	80
2(1)	50 Hz	15 kHz	_____	32
2(1)	300 Hz	3 kHz	_____	10

(1) Option 004

Indicator Accuracy and Distortion

11. If the measuring receiver does not have series 030 options, disconnect the reference generator from the rear panel and re-connect the coaxial jumper. If the measuring receiver has series 030 options, invoke special function 23.0 to switch the local oscillator back to internal.
12. On the Signal Generator under test, press INSTR PRESET, then set it as follows.
    a. Key in FREQ 10 MHz.
    b. Key in AMPTD 0 dBm.
    c. Key in AUDIO FREQ 20 kHz.
    d. Key in FM ON.
13. Preset the measuring receiver, then set it as follows.
    a. Set the measurement mode to FM.
    b. Set the detector to peak±/2 (that is, to average peak+ and peak−.) To do this press the PEAK + and PEAK − keys simultaneously.
14. Set the distortion analyzer to measure the distortion on the demodulated FM which will have an audio rate of 20 kHz. (Select 80 kHz low-pass filtering if available.)
15. On the Signal Generator under test, set the instrument as indicated in the following table. For each setting, perform the following steps.
    a. Set the carrier frequency, peak FM deviation, and Mode Select as indicated in the table.
    b. Read the FM peak deviation on the measuring receiver and the demodulated FM distortion on the distortion analyzer. The FM deviation and distortion should be within the limits shown in the table.

Signal Generator Settings			FM Deviation Limits (kHz peak)			FM Distortion Limits (%)	
Carrier Freq. (MHz)	Peak FM Dev. (kHz)	Mode	Minimum	Actual	Maximum	Actual	Maximum
10	350	1	318.5	_____	381.5	_____	1
180	350	1	318.5	_____	381.5	_____	1
190	350	1	318.5	_____	381.5	_____	1
260	350	1	318.5	_____	381.5	_____	1
370	350	1	318.5	_____	381.5	_____	1
380	350	1	318.5	_____	381.5	_____	1
525	350	1	318.5	_____	381.5	_____	1
745	350	1	318.5	_____	381.5	_____	1
755	350	1	318.5	_____	381.5	_____	1
1060	350	1	318.5	_____	381.5	_____	1
1290	350	1	318.5	_____	381.5	_____	1
1290	100	2(1)	89	_____	111	_____	1
1060	100	2(1)	89	_____	111	_____	1
755	100	2(1)	89	_____	111	_____	1
745	50	2(1)	44.5	_____	55.5	_____	1
525	50	2(1)	44.5	_____	55.5	_____	1
380	25	2(1)	22.25	_____	27.75	_____	1
370	25	2(1)	22.25	_____	27.75	_____	1
260	25	2(1)	22.25	_____	27.75	_____	1
190	25	2(1)	22.25	_____	27.75	_____	1
180	100	2(1)	89	_____	111	_____	1
10	100	2(1)	89	_____	111	_____	1

(1) Option 004

16. Record the FM Deviation for the 380 MHz carrier and Mode 1 for use in Performance Test 4.

    FM Deviation for 380 MHz carrier in Mode 1: _____ kHz

17. On the measuring receiver, key in 27.3 SPCL then key in 2000 MHz.

18. Set the equipment as indicated in the following table. For each setting, perform the following steps.

    a. Set the microwave signal generator (LO) frequency as shown.

    b. On the measuring receiver key in 27.3 SPCL then key in the LO frequency shown in the table.

    c. Set the Signal-Generator-under-test's carrier frequency and Mode Select as indicated in the table.

    d. Read the FM peak deviation on the measuring receiver. The FM deviation should be within the limits shown in the table.

Signal Generator Settings			LO Frequency (MHz)	FM Deviation Limits (kHz peak)			FM Dist. Limits (%)	
Carrier Freq. (MHz)	Peak FM Dev. (kHz)	Mode		Minimum	Actual	Maximum	Actual	Maximum
1800	350	1	2000	318.5	_____	381.5	_____	1
2110	350	1	2310	318.5	_____	381.5	_____	1
2990	350	1	3190	318.5	_____	381.5	_____	1
3010[4]	350	1	3210	318.5	_____	381.5	_____	1
4200[2]	350	1	4400	318.5	_____	381.5	_____	1
6000[3]	350	1	5800	318.5	_____	381.5	_____	1
6000[3]	350	2[1]	5800	311.5	_____	388.5	_____	1
4200[2]	350	2[1]	4400	311.5	_____	388.5	_____	1
3010[4]	350	2[1]	3210	311.5	_____	388.5	_____	1
2990	200	2[1]	3190	178	_____	222	_____	1
2110	200	2[1]	2310	178	_____	222	_____	1
1800	200	2[1]	2000	178	_____	222	_____	1

[1] Option 004

[2] HP8665A only

[3] HP8665B only

[4] HP8665A/B only

Incidental AM

19. Set the Signal Generator under test as follows.
    a. Press MODE 1.
    b. Key in FREQ 100 MHz.
    c. Key in FM 20 kHz.
20. Preset the measuring receiver then set it to read AM. The AM depth should read 0.3% or less.

Incidental AM Limit in Mode 1: _____ 0.3%

Carrier Frequency Accuracy in FM

21. Set the measuring receiver to measure carrier frequency. Set the counter resolution to 10 Hz (special function 7.1).

22. On the Signal Generator under test, press INT (to turn off the internal modulation oscillator) and set MODE SELECT to MODE 1.

23. On the Signal Generator under test, set the carrier frequency and the FM peak deviation as indicated in the following table. For each step press FM OFF then press FM ON and note the shift in carrier frequency as read on the measuring receiver. (The frequency error measurement mode in the measuring receiver can also be used to measure carrier shift.) The carrier shift should be within the limits shown in the table.

NOTE

The FM system in the Signal Generator is turned on but no actual FM is generated because the audio source is turned off.

Signal Generator Settings		Carrier Shift Limits (kHz)	
Carrier Frequency (MHz)	FM Deviation (MHz peak)	Actual	Maximum
150	5	_____	30
300	1.25	_____	7.5
600	2.5	_____	15
1200	5	_____	30

Performance Test 4

FM TEST (HIGH DEVIATIONS AND RATES)

Specification

Characteristic	Performance Limits	Conditions
Frequency Modulation		
Maximum Peak Deviation	20 MHz	3000 to 6000 MHz carrier
	10 MHz	1500 to 3000 MHz carrier
	5 MHz	750 to 1500 MHz carrier
	2.5 MHz	375 to 750 MHz carrier
	1.25 MHz	187.5 to 375 MHz carrier
	5 MHz	10 to 187.5 MHz carrier
		low-noise mode (Option 004)
	400 kHz	3000 to 6000 MHz carrier
	200 kHz	1500 to 3000 MHz carrier
	100 kHz	750 to 1500 MHz carrier
	50 kHz	375 to 750 MHz carrier
	25 kHz	187.5 to 375 MHz carrier
	100 kHz	10 to 187.5 MHz carrier
Maximum Rate (3 dB Bandwidth)	800 kHz	
Indicator Accuracy		dc to 20 kHz rates
	±9% of FM deviation setting	
	±11% of FM deviation setting	low-noise mode (Option 004)
Distortion	<1%	20 Hz to 20 kHz rates

Description

Measurements are made on signals with FM peak deviations up to 20 MHz and rates up to 800 kHz. These signals cannot be made directly by the HP 8902A Measuring Receiver which was used in Performance Test 3. (However, Performance Tests 3 and 4 have some overlap.)

FM is demodulated by an HP 3048A Phase Noise Measurement System. A power splitter and delay line (both supplied with the system) and an RF phase detector (built into the system's interface) are used as a delay-line FM discriminator. The demodulated FM is analyzed by an RF spectrum analyzer (optionally supplied with the system). The test is not run by a system program; rather, the system's interface is manually controlled from the controller's keyboard.

Equipment

Audio Source ..... HP 3325A
Phase Noise Measurement System ..... HP 3048A Option 101

NOTE

Since this test is written specifically for the HP 3048A, no substitute of equipment is recommended.

For this test, the HP 3048A is assumed to have the HP 11848-60132 Noise Floor Test Fixture (supplied with system) and an HP 3585A spectrum analyzer (which must have a 1 MΩ input). The HP 3561A Dynamic Signal Analyzer is required for the system but is not used in this test.

Procedure

Initial Setup and Establishing Quadrature

1. Run Performance Test 3, *FM Test (Low Deviations and Rates)*. Record the values measured in step 16 for use later in this test.
2. Connect the equipment as shown in figure 3–5. Check that the SPECTRUM ANALYZER output connector on the front panel of the HP 11848A Phase Noise Interface is terminated in 50 Ω. Also, check that the delay line connectors are tight.

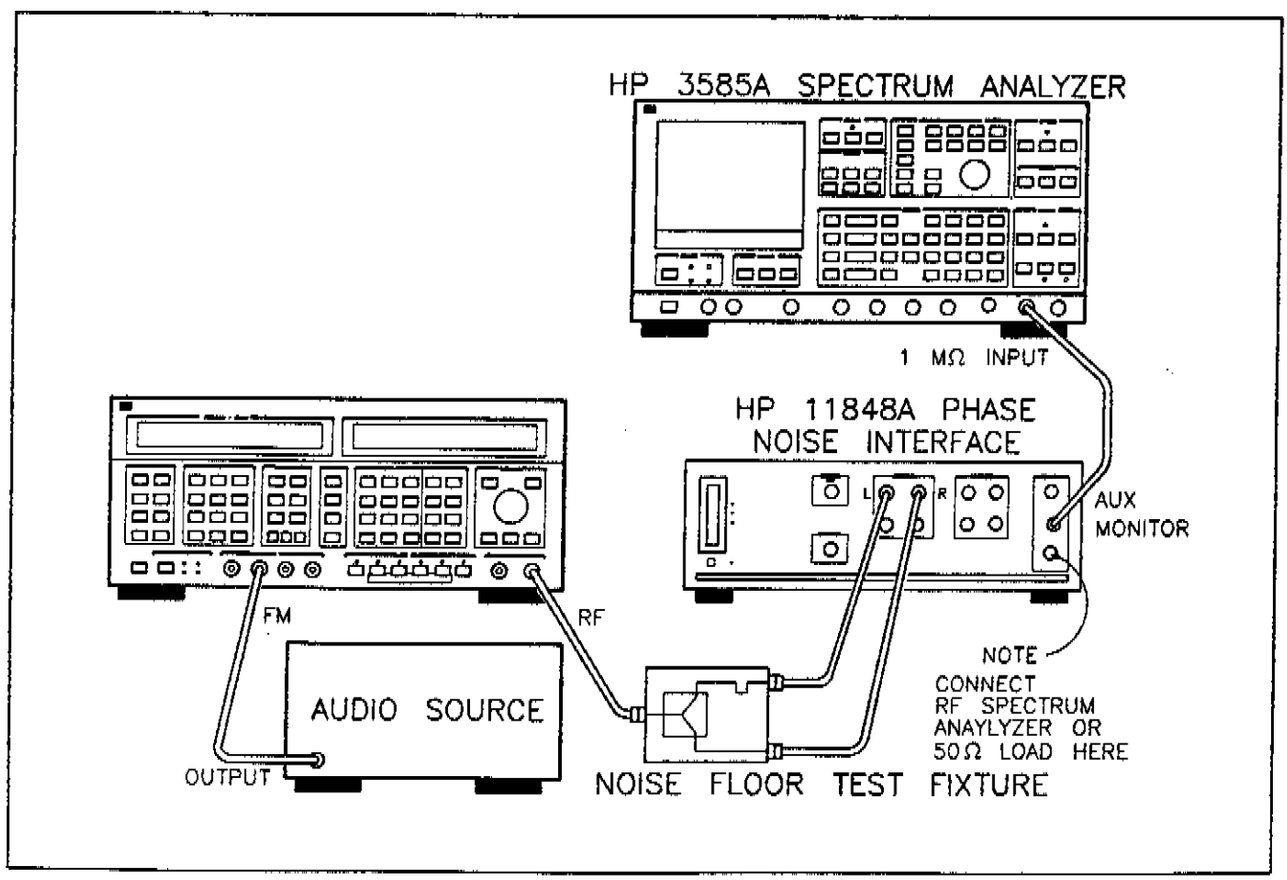


Figure 3–5. FM (High Deviation and Rates) Test Setup

3. On the Signal Generator press INSTR PRESET then key in FREQ 400 MHz and AMPTD 13 dBm. (9 dBm if pulse modulation opt. 008 is installed.)Key in SPECIAL 105 ENTER OFF to turn amplitude muting off.
4. Boot up the phase noise measurement system to the Main Software Menu level then set the system as follows.
   a. Press the [Spcl. Funct'n] softkey available at the Main Software Level menu.
   b. Press the [11848A Control] softkey to initiate manual control of the system's interface.
   c. Press the [Preset] softkey to preset the interface.
   d. Use the cursor control keys to move the cursor to the "SELECTED 'K' SWITCHES:" line then key in 10 and 12. (Refer to figure 3–6.)
   e. Use the cursor control keys to move the cursor to the "SELECTED 'S' SWITCHES:" line then key in 3 while not changing the "8" already present on the line.
   f. Press the [Send Command] softkey to initiate the commands. The display should appear as in figure 3–6 except for the cursor position, the values following "GAIN1:" and "GAIN2:" (which will be entered later), and the bottom line.
5. Tune the Signal Generator's carrier frequency until the front-panel meter of the system's interface reads approximately 0.
6. Set the phase noise measurement system as follows.
   a. Use the system's cursor control keys to move the cursor to the "GAIN1:" line then key in 28.

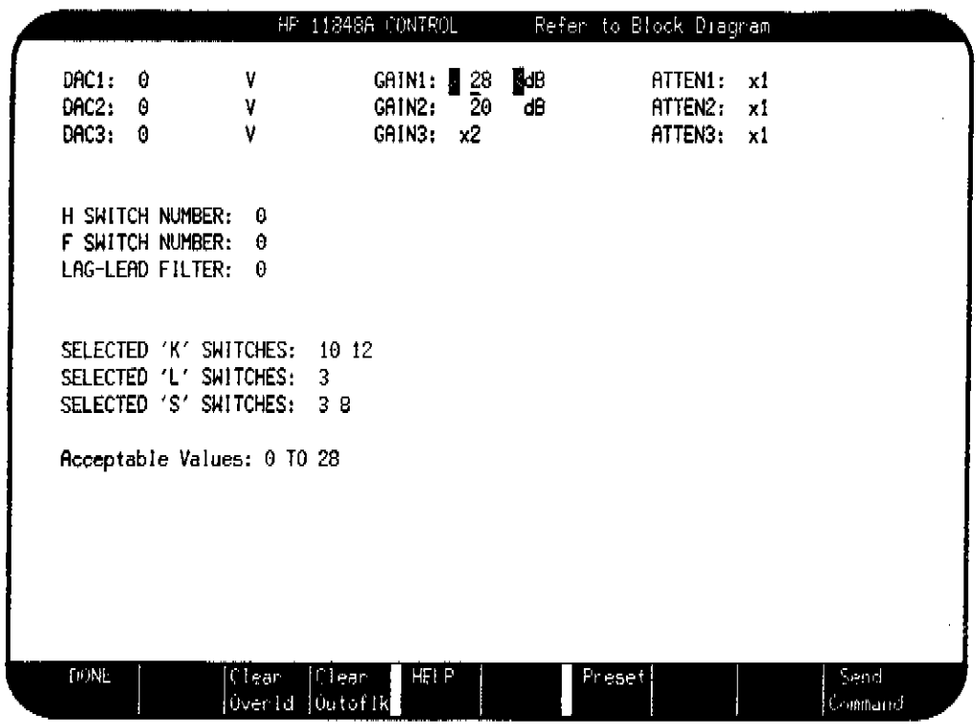


Figure 3-6. HP 11848A Control Display for FM Test

b. Use the system's cursor control keys to move the cursor to the "GAIN2:" line then key in 20.

c. Press the Send Command softkey to initiate the commands. (The display should now appear as in figure 3-6.)

7. Fine tune the Signal Generator's carrier frequency until the front-panel meter of the system's interface reads approximately 0. This establishes quadrature in the interface's phase detector to make it function as a linear phase detector.

8. Set the RF spectrum analyzer to span from 0 to 100 kHz. Set the input impedance to 1 MΩ.

Indicator Accuracy

9. Let *D* equal the value in kHz of FM deviation measured in Performance Test 3, step 16, for a 380 MHz carrier in Mode 1. Calculate 700 – *D*. (For example, if the value for *D* is 340 kHz, 700 – 340 = 360.)

700 Minus the Value of *D*: _____ kHz

10. Set the Signal Generator as follows.

a. Key in FM then the value (700 – *D*) calculated in step 9 above (for example 360) then press kHz.

b. Key in AUDIO FREQ 20 kHz.

11. Adjust the RF spectrum analyzer's reference level so that the 20 kHz signal is at a convenient graticule line near the center of the display. (This line represents 350 kHz peak deviation.)

12. On the Signal Generator, key in FM 2.5 MHz. The 20 kHz signal should increase between 16.4 and 17.8 dB (that is, 17.1 ± 0.7 dB or 2.5 MHz/350 kHz ± 9% expressed in dB).

Indicator Accuracy: 16.4 _____ 17.8 dB

Distortion

13. Note the level of the harmonics of 20 kHz. The harmonics should be greater than 40 dB down from the fundamental (that is, 1% or less).

FM Distortion: _____ –40 dB

Maximum Rate (3 dB Bandwidth)

14. On the Signal Generator, press the INT key to turn the internal FM off then press the EXT AC key.

15. On the audio source, set the frequency to 20 kHz, and set the amplitude to 4.67 dBm (1 Vpk into 600 Ω from a 50 Ω source).

NOTE

The EXT HI *or* EXT LO *annunciators on the Signal Generator may or may not be on. Either condition is acceptable. The level of the modulation input signal is set more accurately by the audio source setting than by the annunciators.*

16. Set the RF spectrum analyzer to span from 0 to 1 MHz. Note the level of the 20 kHz signal.

17. On the audio source, set the frequency to 800 kHz. The 800 kHz signal viewed on the spectrum analyzer should be within 3 dB of the level of the signal which was at 20 kHz.

Maximum Rate: –3 _____ +3 dB

Performance Test 5

SPECTRAL PURITY TEST (SSB PHASE NOISE)

Specification

Characteristic	Performance Limits	Conditions
Spectral Purity		
SSB Phase Noise		CW, AM, or FM (FM at minimum specified deviation)
		1 kHz frequency offset
	−63 dBc/Hz	3000 to 6000 MHz carrier
	−67 dBc/Hz	1500 to 3000 MHz carrier
	−73 dBc/Hz	750 to 1500 MHz carrier
	−79 dBc/Hz	375 to 750 MHz carrier
	−85 dBc/Hz	187.5 to 375 MHz carrier
	−73 dBc/Hz	0.1 to 187.5 MHz carrier
		20 kHz frequency offset
	−105 dBc/Hz	3000 to 6000 MHz carrier
	−111 dBc/Hz	1500 to 3000 MHz carrier
	−117 dBc/Hz	750 to 1500 MHz carrier
	−122 dBc/Hz	375 to 750 MHz carrier
	−128 dBc/Hz	187.5 to 375 MHz carrier
	−117 dBc/Hz	0.1 to 187.5 MHz carrier
		100 kHz frequency offset
	−122 dBc/Hz	3000 to 6000 MHz carrier
	−128 dBc/Hz	1500 to 3000 MHz carrier
	−134 dBc/Hz	750 to 1500 MHz carrier
	−138 dBc/Hz	375 to 750 MHz carrier
	−143 dBc/Hz	187.5 to 375 MHz carrier
	−132 dBc/Hz	0.1 to 187.5 MHz carrier
		1 kHz frequency offset; Mode 2; Option 004
	−83 dBc/Hz	4120 to 6000 MHz carrier
	−89 dBc/Hz	2060 to 4120 MHz carrier
	−94 dBc/Hz	1030 to 2060 MHz carrier
	−100 dBc/Hz	515 to 1030 MHz carrier
	−106 dBc/Hz	257.5 to 515 MHz carrier
	−112 dBc/Hz	187.5 to 257.5 MHz carrier
	−94 dBc/Hz	30 to 187.5 MHz carrier
	−100 dBc/Hz	0.1 to 30 MHz carrier

(Table continued on next page)

(Table continued from previous page)

Characteristic	Performance Limits	Conditions
Spectral Purity		
SSB Phase Noise (cont'd)		20 kHz frequency offset; Mode 2; Option 004
	−116 dBc/Hz	4120 to 6000 MHz carrier
	−122 dBc/Hz	2060 to 4120 MHz carrier
	−128 dBc/Hz	1030 to 2060 MHz carrier
	−134 dBc/Hz	515 to 1030 MHz carrier
	−139 dBc/Hz	257.5 to 515 MHz carrier
	−144 dBc/Hz	187.5 to 257.5 MHz carrier
	−128 dBc/Hz	30 to 187.5 MHz carrier
	−131 dBc/Hz	0.1 to 30 MHz carrier
		100 kHz frequency offset; Mode 2; Option 004
	−121 dBc/Hz	4120 to 6000 MHz carrier
	−127 dBc/Hz	2060 to 4120 MHz carrier
	−133 dBc/Hz	1030 to 2060 MHz carrier
	−139 dBc/Hz	515 to 1030 MHz carrier
	−144 dBc/Hz	257.5 to 515 MHz carrier
	−146 dBc/Hz	187.5 to 257.5 MHz carrier
	−133 dBc/Hz	0.1 to 187.5 MHz carrier
Nonharmonic Spurious Signals		>10 kHz offset frequency
	< −100 dBc	187.5 to 2060 MHz carrier
	< −90 dBc	0.1 to 187.5 MHz carrier
	< −90 dBc	2060 to 6000 MHz carrier

Description

The single-sideband (SSB) phase noise and non-harmonic spurious signals are measured by a system that is specifically designed to measure these parameters—the HP 3048A Phase Noise Measurement System. Measurements are made using a phase detector in a phase lock loop.

This method requires a reference signal generator that must have lower phase noise than the source being tested. A second HP 8664A or HP 8665A/B can be used as this source (and thus both sources are measured as a pair) but the following considerations apply: (1) If the measured results are within specification, both generators meet the specification individually. (2) If the measured results are out of specification, at least one generator is out of specification and a third source must be measured against the first two to determine which one is faulty.

Equipment

Phase Noise Measurement System ..... HP 3048A Option 201
Reference Signal Generator ..... HP 8664A or HP 8665A/B Option 004

NOTE

Option 201 for the HP 3048A adds the 1.2 to 18 GHz phase detector and is required if the phase noise on carriers above 1.6 GHz is to be measured. Measurement of carriers above 1.6 GHz can also be made using a down converter. Refer to the documentation for the HP 3048A.

Option 004 for the reference signal generator is needed only if the Signal Generator under test has Option 004. Neither the reference source nor the Signal Generator under test will be under remote control.

If a suitable reference source is unavailable, the 10 MHz A oscillator in the HP 11848A Phase Noise Interface to the HP 3048A system can be used as reference for a 10 MHz carrier.

Procedure

Initial Setup

1. Connect the equipment as shown in figure 3–7.

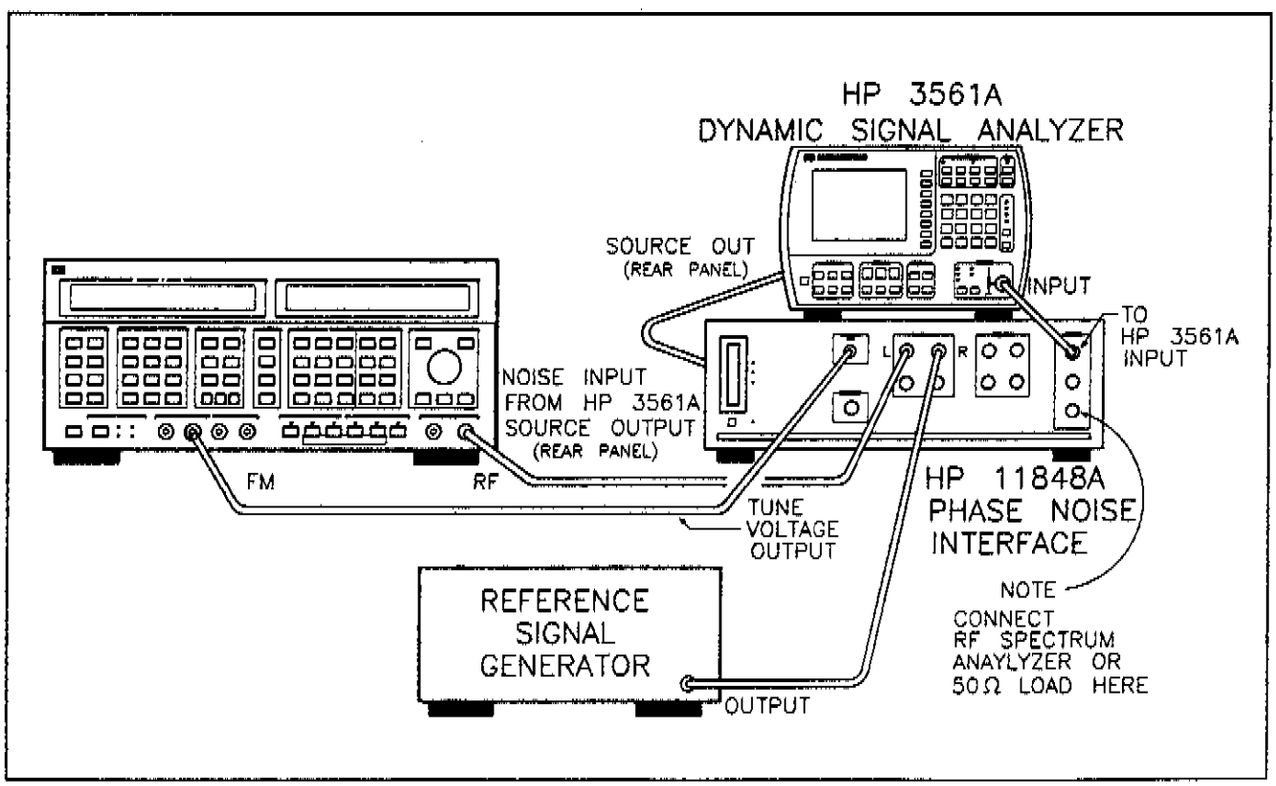


Figure 3–7. SSB Phase Noise Test Setup

2. Set the reference signal generator's carrier to 550 MHz at 6 dBm. If the reference signal generator is an HP8664A or HP 8665A/B with Option 004, select Mode 2.
3. Set the Signal Generator under test as follows.
   a. Press INSTR PRESET.
   b. Key in FREQ 550 MHz.
   c. Key in AMPTD 13 dBm. (9 dBm if pulse modulation Opt. 008 is installed.)
   d. Key in FM 128 Hz.
   e. Press INT in the MODULATION key group to turn the internal modulation source off.
   f. Press EXT DC in the MODULATION key group to enable DC FM.
   g. Press MODE 1 in the MODE SELECT key group.
4. Set the HP 3048A to the Main Software Level menu. Refer to figure 3–8.

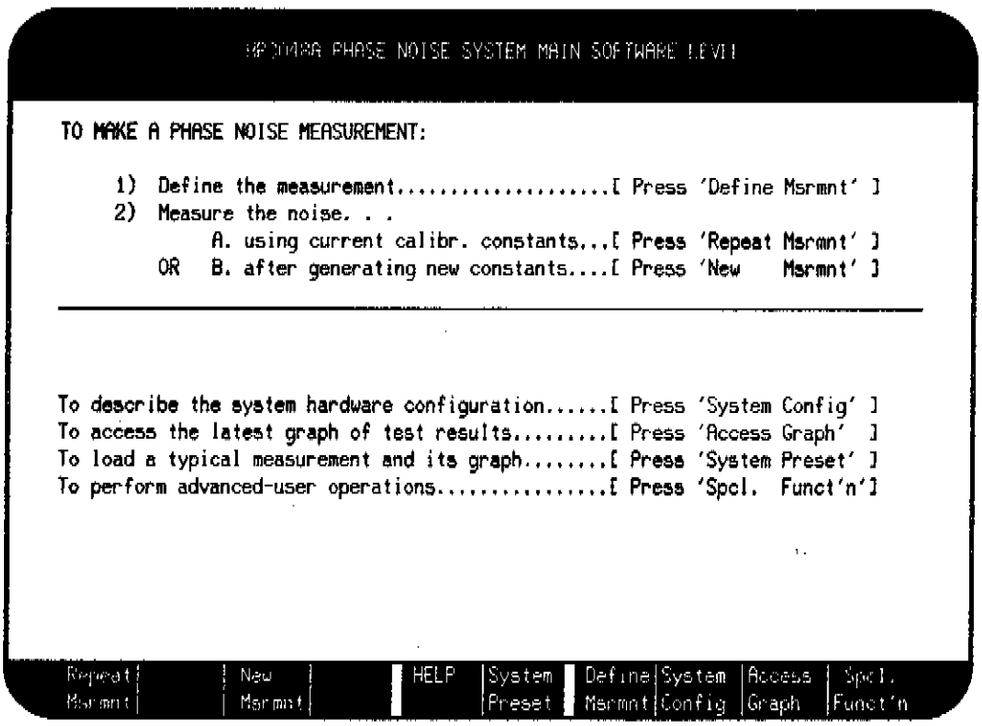


Figure 3–8. Main Software Level Menu

Example Measurement

NOTE

The following steps are the procedure for making a single-sideband phase noise measurement on a 550 MHz carrier in Mode 1. For other carrier frequencies and for Mode 2, the procedure is similar.

If these measurements are to be repeated in the future for this or other HP 8664A or HP 8665A/B generators, it will be advantageous to record the test file entries for each carrier frequency; these test files can be recalled as needed later on instead of having to re-enter them each time.

5. On the HP 3048A press the Define Msrmnt softkey to obtain the Measurement Definition menu. Refer to figure 3-9.

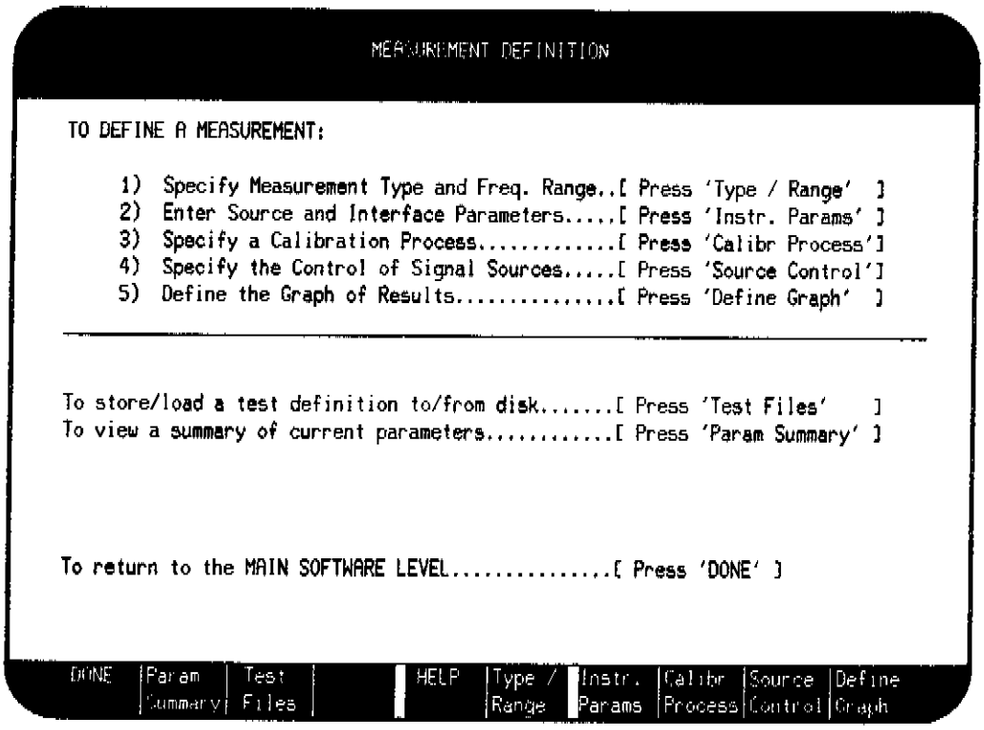


Figure 3-9. Measurement Definition Menu

6. On the HP 3048A press the [Type / Range] softkey to obtain the Measurement Type and Frequency Range Specification menu. Set the measurement type and offset frequency range as shown in figure 3-10. When done, press the [DONE] softkey.

NOTE

The start frequency is shown as 10 Hz. This low offset will slow the measurement time but give a more confidence in the general phase noise performance of the Signal Generator. To measure the phase noise to its specification only, change the start frequency to 1 kHz.

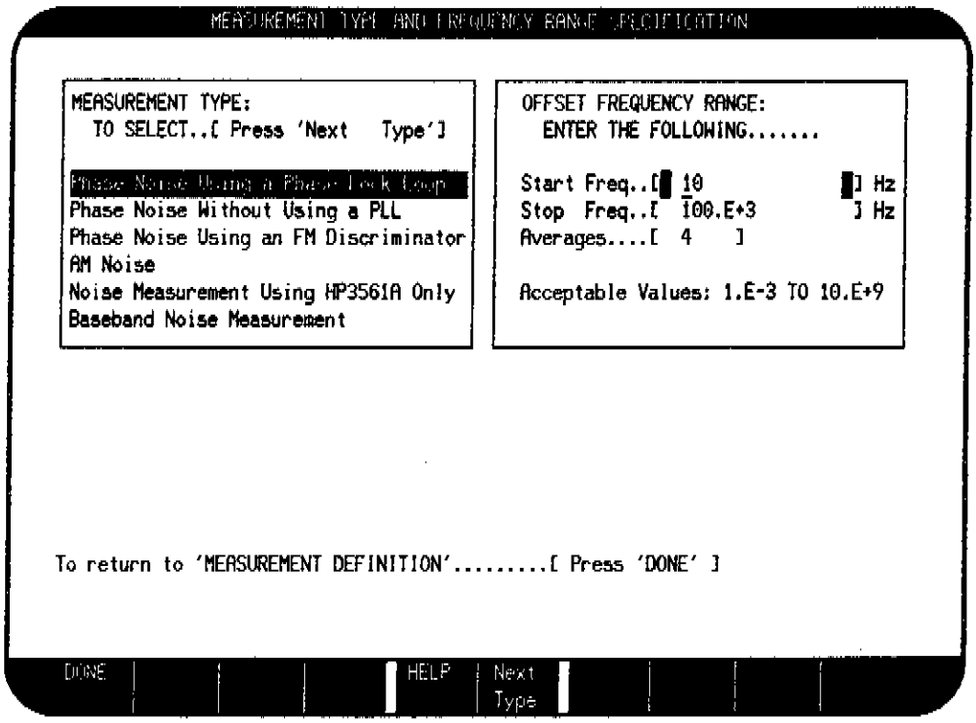


Figure 3-10. Measurement Type and Frequency Range Specification Menu

7. On the HP 3048A press the [Instr. Params] softkey to obtain the Source and Interface Parameter Entry menu. Set the parameters and phase detector as shown in figure 3–11. When done, press the [DONE] softkey.

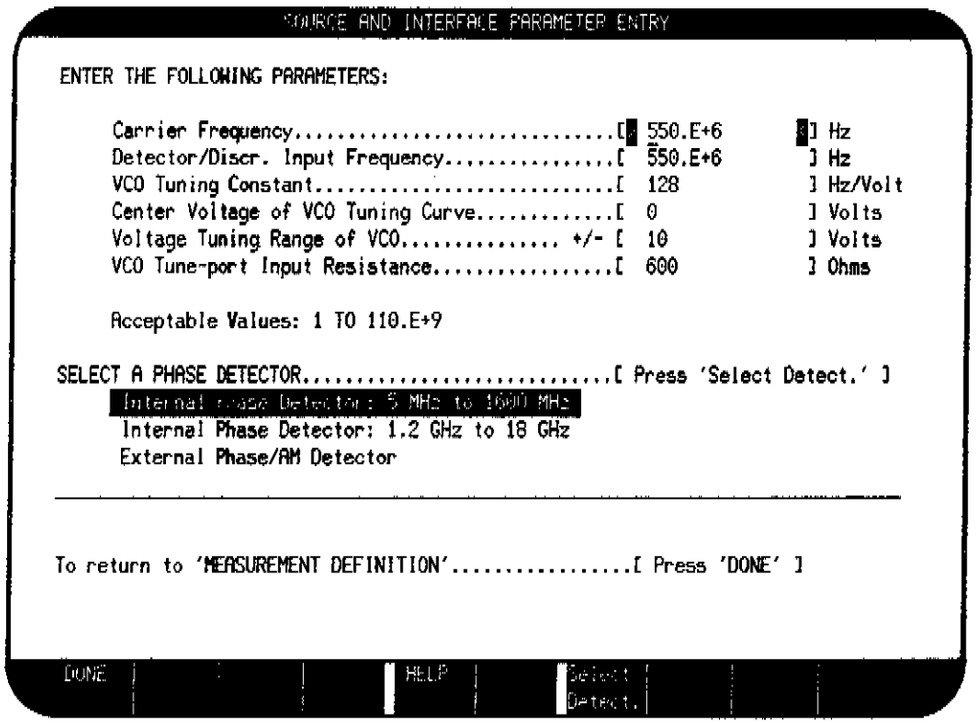


Figure 3–11. Source and Interface Parameter Entry Menu

8. On the HP 3048A press the [Calibr Process] softkey to obtain the Determination of Phase Detector Constant and VCO Tuning Constant menu. Set the method of determining the phase detector and VCO tuning constants and the verification of the phase lock loop suppression as shown in figure 3–12. (The displayed Computed Constant may by be quite different from the one in figure 3–12. It will be updated later.) When done, press the [DONE] softkey.

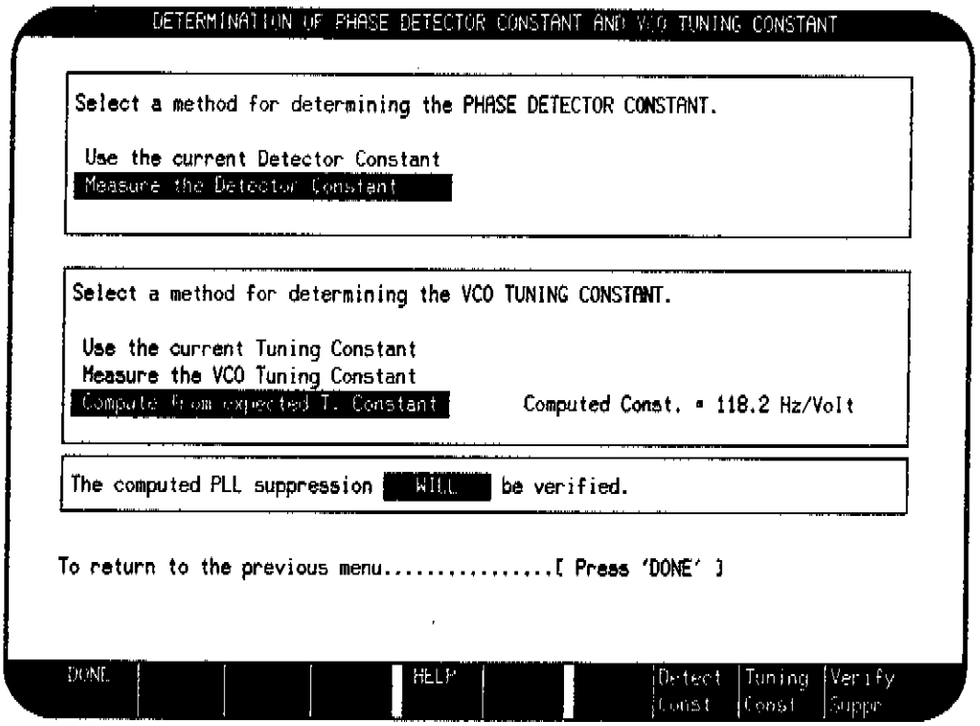


Figure 3–12. Determination of Phase Detector and VCO Tuning Constant Menu

9. On the HP 3048A press the Source Control softkey to obtain the Source Control for Measurement Using a Phase Lock Loop menu. Set the various devices in the system as shown in figure 3–13. When done, press the DONE softkey.

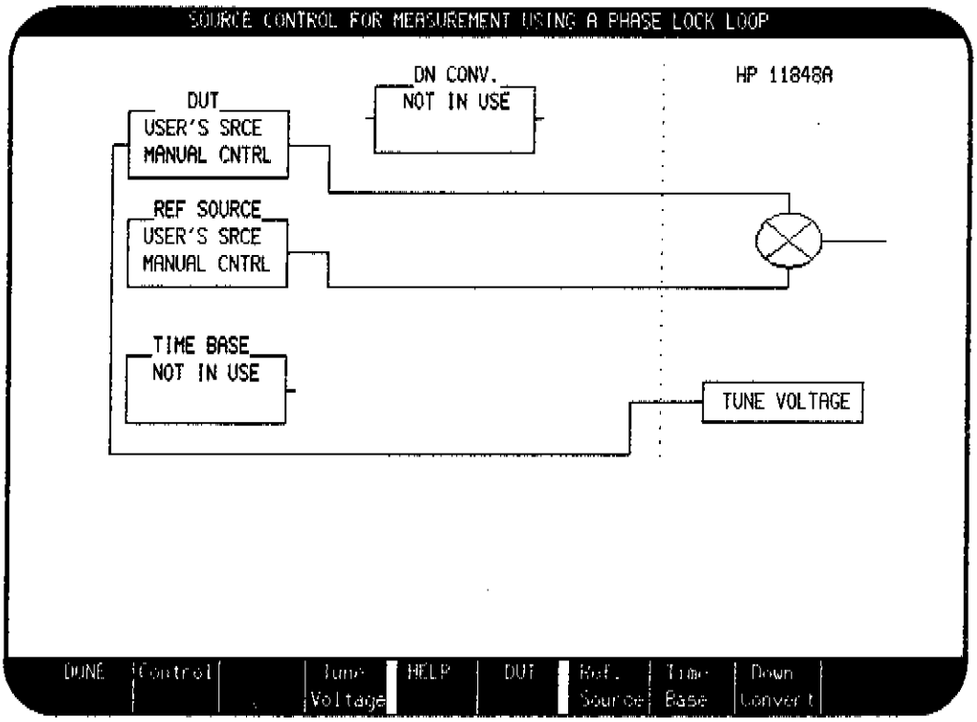


Figure 3–13. Source Control for Measurement Using a Phase Lock Loop Menu

10. On the HP 3048A press the Define Graph softkey to obtain the Graph Definition menu. Set the graph parameters and graph type as shown in figure 3–14. Change the title as appropriate for your particular setup. (You may wish to include the model and serial number of the device under test. For example, "The HP 8665A with serial number 2833A00101." Note that date, time, and carrier frequency information will automatically appear on the measurement result graph.) When done, press the DONE softkey. (For measuring offsets only down to 1 kHz, set the minimum x coordinate to 1 kHz. See the note following step 6.)

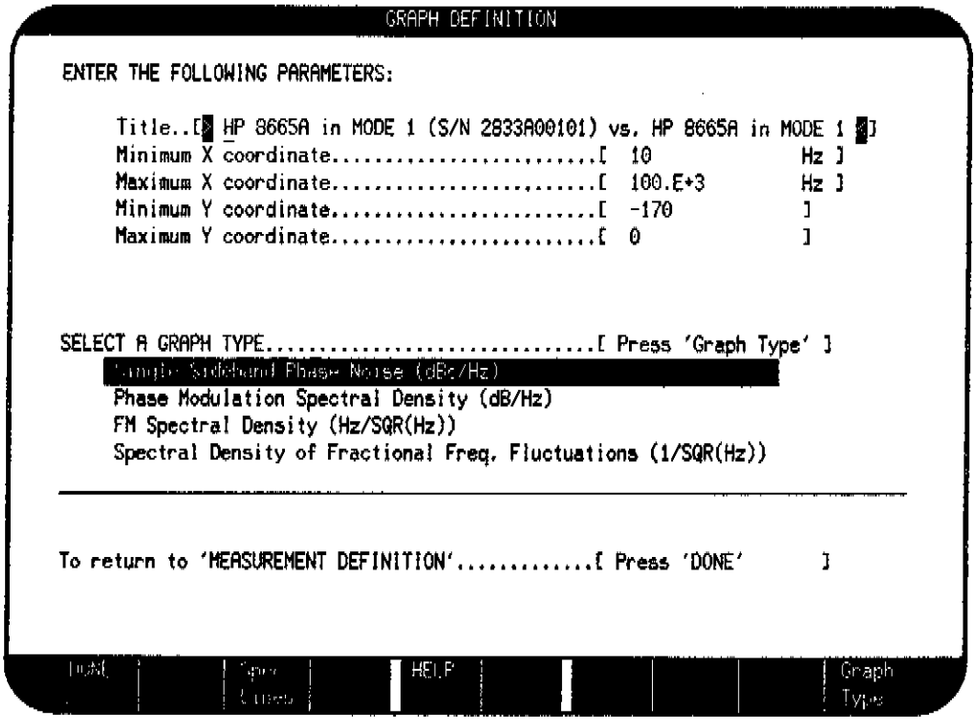


Figure 3-14. Graph Definition Menu

11. On the HP 3048A press the DONE softkey again to obtain the Main Software Level menu.

12. On the HP 3048A press the New Msrmnt softkey then press the Yes, Proceed softkey.

13. When the connect diagram appears on the display, verify that the instrument connections are properly made then press the Proceed softkey. The phase noise measurement should proceed without error and the phase noise plot should appear as in figure 3-15. Ignoring spurious signals, the phase noise ($\mathcal{L}(f)$) should be less than −79 dBc at a 1 kHz offset frequency, less than −122 dBc at 20 kHz, and less than −138 dBc at 100 kHz. Spurious signals for offset frequencies greater than 10 kHz should be down more than 100 dBc.

NOTE

Spurious signals can also be generated by the reference signal generator or may be picked up by interconnecting cables.

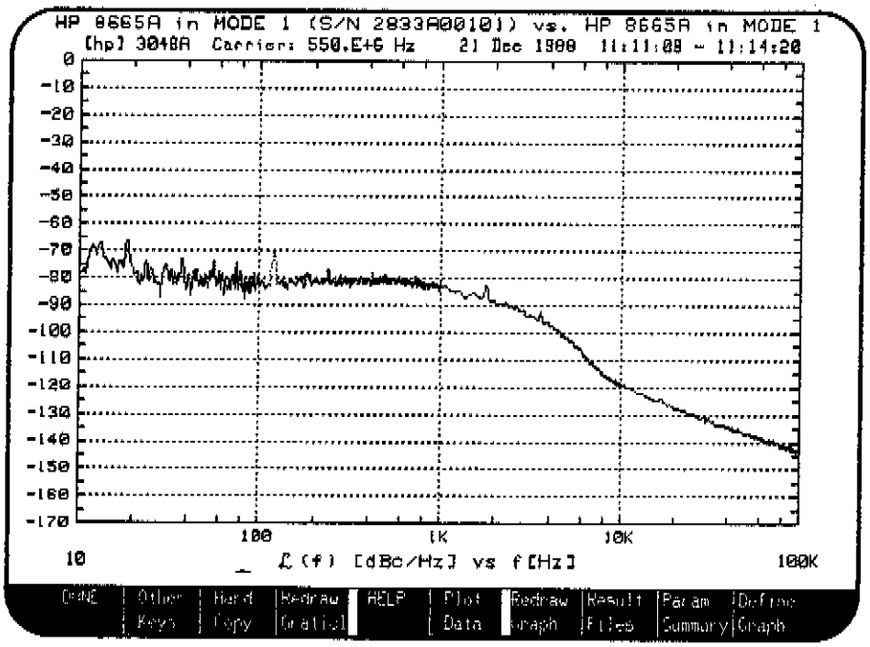
SSB phase noise, 1 kHz offset: _____ −79 dBc
SSB phase noise, 20 kHz offset: _____ −122 dBc
SSB phase noise, 100 kHz offset: _____ −138 dBc

Non-harmonic spurious signals, >10 kHz offset: _____ −100 dBc

NOTE

Figure 3-15 also shows a listing of measurement parameters. This listing with the graph itself can be printed by holding down the keyboard's SHIFT *key and pressing the* Hard Copy *softkey.*

If you intend to make measurements of this same type frequently, the setup information (carrier frequency, tuning constant, source control, etc.) can be easily stored as test files, then loaded as needed. Refer to the HP 3048A Reference Manual *on storing and loading test files.*



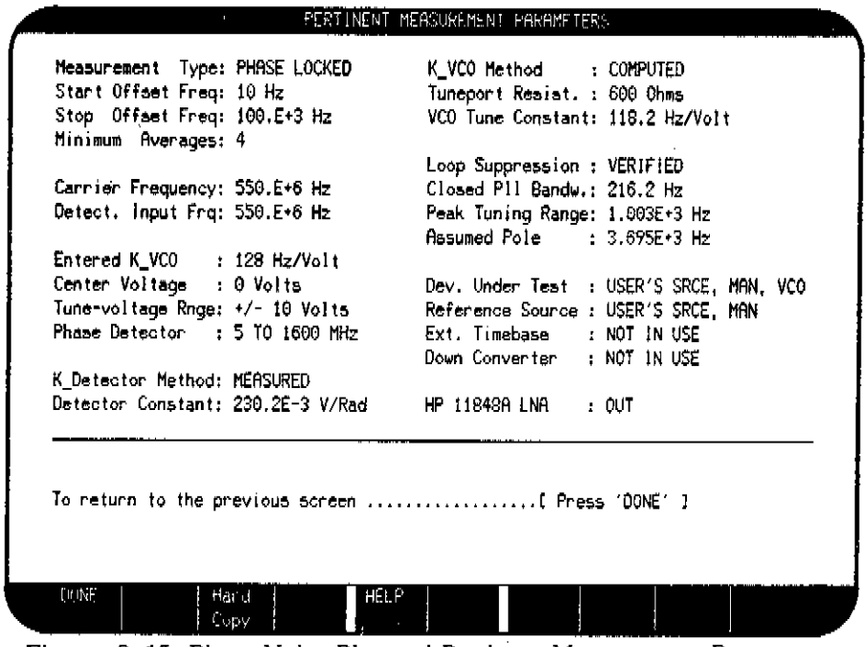


Figure 3-15. Phase Noise Plot and Pertinent Measurement Parameters

Further Measurements (Below 1600 MHz)

14. To measure single-sideband phase noise for other carrier frequencies and modes of operation, set the signal generators and phase noise measurement system as outlined in the following table. The phase noise should be within the limits indicated in the table.

    Spurious signals offset frequencies greater than 10 kHz should be down more than 100 dBc for carrier frequencies 187.5 to 2060 MHz and more than 90 dBc at carrier frequencies between 2060 and 6000 MHz and between 0.1 and 187.5 MHz.

    Non-harmonic spurious signals, >10 kHz offset, 187.5 to 1100 MHz: _____ –100 dBc
    Non-harmonic spurious signals, >10 kHz offset, 0.1 to 187.5 MHz: _____ –90 dBc

Carrier Frequency (MHz)(1)	Sig. Gen. Settings		HP 3048A VCO Tuning (Hz/V)	Phase Noise Limits (dBc)					
				1 kHz Offset		20 kHz Offset		100 kHz Offset	
	Mode Select	FM Peak Dev. (Hz)		Actual	Max.	Actual	Max.	Actual	Max.
1100	1	250	250	_____	–73	_____	–117	_____	–134
1100	2(2)	250	250	_____	–94	_____	–128	_____	–133
550	2(2)	200	200	_____	–100	_____	–134	_____	–139
550	1	200	200	_____	–79	_____	–122	_____	–138
300	1	100	100	_____	–85	_____	–128	_____	–143
300	2(2)	100	100	_____	–106	_____	–139	_____	–144
200	2(2)	100	100	_____	–112	_____	–144	_____	–146
150	2(2)	250	250	_____	–94	_____	–128	_____	–133
150	1	250	250	_____	–73	_____	–117	_____	–132
40	2(2)	250	250	_____	–100	_____	–131	_____	–133

(1) Make the carrier frequency change to the following:
a. the Signal Generator under test,
b. the reference signal generator,
c. the HP 3048A Source and Interface Parameter Entry menu (for Carrier Frequency and Detector/Disc. Input Frequency), and
d. the Graph Definition menu (in the Title).

(2) Option 004

Further Measurements (Above 1200 MHz)

15. Set the level of the reference signal generator to 6 dBm and move its output to the R port of the 1.2 GHz to 18 GHz phase detector of the HP 11848A.

16. Set the level of the Signal Generator being tested to 9 dBm and move its output to the L port of the 1.2 GHz to 18 GHz phase detector of the HP 11848A.

17. Call up the Source and Interface Parameter Entry menu (shown in figure 3-11) and select the phase detector labeled "`Internal Phase Detector: 1.2 GHz to 18 GHz`".

18. Proceed with the measurements using the technique of step 14. The phase noise should be within the limits indicated in the table. Spurious signals should be as indicated below.

Non-harmonic spurious signals, >10 kHz offset, 2100 to 6000 MHz: _____ −90 dBc

Carrier Frequency (MHz)[1]	Sig. Gen. Settings		HP 3048A VCO Tuning (Hz/V)	Phase Noise Limits (dBc)					
				1 kHz Offset		20 kHz Offset		100 kHz Offset	
	Mode Select	FM Peak Dev. (Hz)		Actual	Max.	Actual	Max.	Actual	Max.
4150	1	1000	1000	_____	−63	_____	−105	_____	−122
4150	2[2]	1000	1000	_____	−83	_____	−116	_____	−121
2100	2[2]	500	500	_____	−89	_____	−122	_____	−127
2100	1	500	500	_____	−67	_____	−111	_____	−128

(1) Make the carrier frequency change to the following:
a. the Signal Generator under test,
b. the reference signal generator,
c. the HP 3048A Source and Interface Parameter Entry menu (for Carrier Frequency and Detector/Disc. Input Frequency), and
d. the Graph Definition menu (in the Title).

(2) Option 004

Performance Test 6

SPECTRAL PURITY TEST (HARMONICS)

Specification

Characteristic	Performance Limits	Conditions
Spectral Purity		
Spurious Signals		
Harmonics	< −30 dBc	output <6 dBm
Subharmonics	< −75 dBc < −37 dBc	0.1 to 1030 MHz carrier 1030 to 6000 MHz carrier

Description

Harmonics and subharmonics are observed directly on an RF spectrum analyzer while the Signal Generator is swept slowly over its frequency range.

Equipment

RF Spectrum Analyzer..... HP 8562B or HP 853A/8559A

Procedure

Initial Setup

1. Set the Signal Generator as follows.
   a. Press INSTR PRESET.
   b. Key in AMPTD 6 dBm.
   c. Key in SWEEP TIME 10 s.
2. Set the spectrum analyzer as follows.
   a. Set the frequency span 0 to 10 GHz with compatible resolution bandwidth and display smoothing. (If this span width is not available, use the widest span possible and, as the measurement progresses, readjust the center frequency as needed to span the complete range in segments.)
   b. Set the vertical scale to 10 dB per division log.
   c. Set the vertical sensitivity and attenuation to view a +6 dBm signal with at least 40 dB of uncompressed range.
3. Connect the Signal Generator's RF output connector to the spectrum analyzer's input.

Harmonics

4. Perform the following steps to determine the RF harmonic distortion.

Performance Test 8

INTERNAL AUDIO OSCILLATOR TEST

Specification

Characteristic	Performance Limits	Conditions
Internal Modulation Source		
Distortion	<0.1%	output 1V peak; rate <20 kHz

Description

The distortion of the internal modulation source is measured directly on a distortion analyzer.

Equipment

Distortion Analyzer ..... HP 8903B or HP 8903E

Procedure

1. Connect the input of the distortion analyzer directly to the Signal Generator's AUDIO output connector.
2. Set the distortion analyzer to measure distortion. Set its low-pass filter to 80 kHz or greater.
3. On the Signal Generator press INSTR PRESET.
4. On the Signal Generator, key in the audio frequency as listed in the following table. For each setting measure the audio distortion. The distortion should less than 0.1%.

Audio Frequency Setting (Hz)	Distortion Limits (%)	
	Actual	Maximum
20	_____	0.1
100	_____	0.1
1 000	_____	0.1
10 000	_____	0.1
20 000	_____	0.1

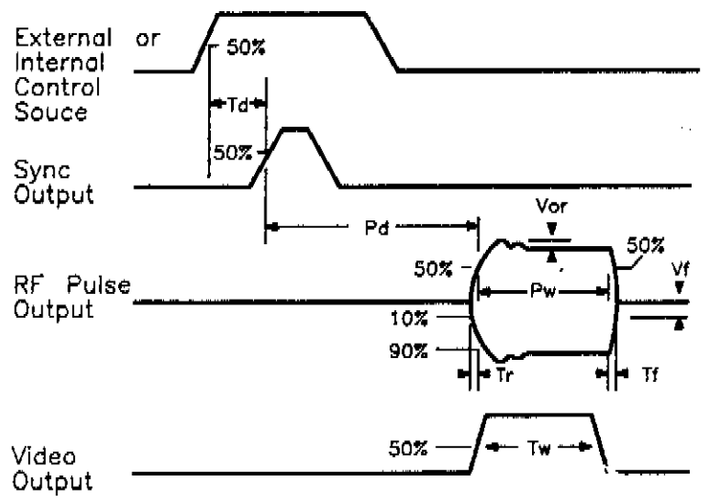
Performance Test 7

PULSE MODULATION TEST (OPTION 008)

Specification

Characteristic	Performance Limits	Conditions
Pulse Modulator		Option 008. See figure below for definitions.
On/Off Ratio	80 dB	
Rise/Fall Time	<8 ns	10% to 90% points
Internal Pulse Generator		Option 008
Pulse Repetition Frequency	0.1 Hz to 400 kHz	
Pulse Delay	50 ns to 1s	
Pulse Delay Accuracy	±5% of setting ±2 ns	
Pulse Width	10 ns to 1s	
Pulse Width Accuracy	±5% of setting ±2 ns ±10% of setting ±2 ns	200 ns to 1s 10 to 200 ns

Pulse Modulation Definitions



Td–Trigger delay Tw–Video width Vf–Video feedthrough

Pd–RF pulse delay Tr–RF pulse rise time Vor–Overshoot and ringing

Pw–RF pulse width Tf–RF pulse fall time

Description

The pulse on/off ratio is measured statically on a spectrum analyzer by setting a CW reference then noting how far the amplitude drops when the Signal Generator is switched to the pulse modulation mode with no pulse input. The other pulse specifications are measured directly with a high-frequency, digitizing oscilloscope.

Equipment

Digitizing Oscilloscope ..... HP 54110D
Spectrum Analyzer ..... HP 8562A or HP 853A/8559A

Procedure

Pulse On/Off Ratio

1. Connect the Signal Generator's RF output to the spectrum analyzer's input.
2. Set the Signal Generator as follows.
   a. Press INSTR PRESET.
   b. Key in FREQ 100 MHz.
   c. Key in AMPTD 9 dBm.
   d. Key in PULSE ON.
   e. Press INT in the MODULATION key group.
   f. Key in AUDIO FREQ 0.5 Hz.
3. Set the spectrum analyzer as follows.
   a. Set the center frequency to 100 MHz.
   b. Set the vertical gain and the input attenuation to view the 9 dBm signal with an 80 dB dynamic range.
   c. Set a span suitable for viewing the RF signal which is switching on and off at a 0.5 Hz rate.

4. Set the Signal Generator's carrier frequency and the spectrum analyzer's center frequency as indicated in the following table. For each carrier frequency, observe the change in amplitude as the Signal Generator is pulsed on and off. The amplitude should drop at least 80 dB between pulse on and pulse off.

Carrier Frequency (MHz)	On/Off Ratio (dB)	
	Minimum	Actual
100	80	_____
200	80	_____
500	80	_____
1499	80	_____
2999	80	_____
4200(1)	80	_____
6000(2)	80	_____

(1) HP 8665A only.
(2) HP 8665B only.

Risetime and Falltime

5. Set the Signal Generator as follows.
   a. Key in FREQ 10 MHz.
   b. Key in AMPTD 0 dBm.
   c. Key in AUDIO FREQ 399 kHz.
6. Connect the Signal Generator's RF output to channel 1 of the oscilloscope.
7. Connect the Signal Generator's rear-panel SYNC output to channel 2 of the oscilloscope. Use the same length cable as in step 6.
8. Set the digitizing oscilloscope as follows.
   a. Preset or autoscale the oscilloscope (if available).
   b. Set the display to view both channel 1 and channel 2 on a split screen.
   c. Set the input coupling of both channels, if necessary, to dc with 50 Ω input impedance.
   d. Set the triggering to trigger on the positive slope of channel 2 at approximately 1V.
   e. Set the sweep speed to 200 ns per division.
   f. Set the timebase delay to 0 ns at center. Channel 1 should show the leading edge of the RF pulse burst. Channel 2 should show an entire synchronization pulse.
   g. Set the sweep speed to 2 ns per division.
   h. Set the delay time (approximately 10 ns) to view the rising edge of the RF and synchronization pulses.
   i. Set the display to now view channel 1 only (channel 2 off and split screen off).
   j. Set the vertical sensitivity of channel 1 to a convenient level (approximately 100 mV per division).
   k. Set the offset to 0V.

9. Set the Signal Generator's carrier frequency as given in the following table. For each setting, measure the 10% to 90% risetime. Compare the waveform with figure 3–16. The risetime should be less than 8 ns. (If the oscilloscope has vertical and horizontal markers, they can be used to simplify these measurements.)

Carrier Frequency (MHz)	Risetime Limits (ns)	
	Actual	Maximum
10	_____	8
20	_____	8
50	_____	8
100	_____	8
200	_____	8
500	_____	8

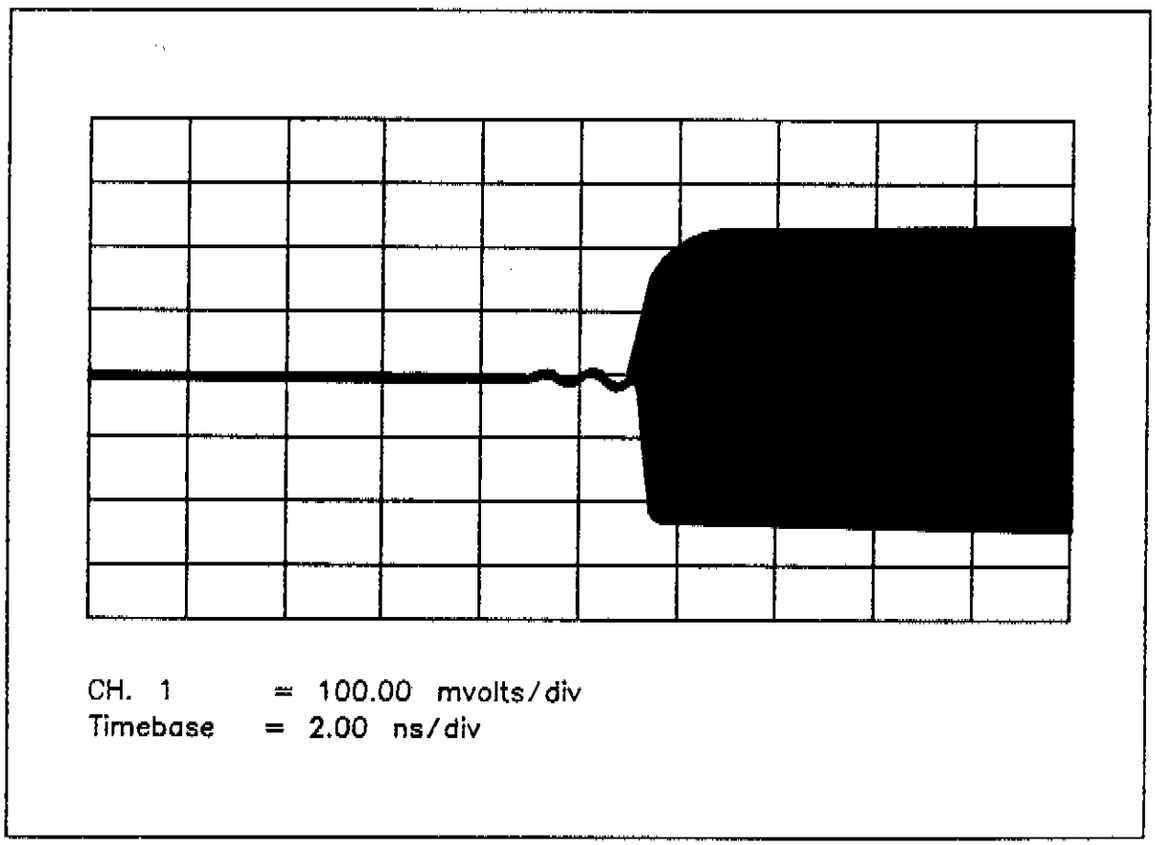


Figure 3–16. Pulse Modulation Pulse Risetime Waveform

10. On the oscilloscope, change the delay time to approximately 1.28 μs and fine adjust the delay to view the falling edge of the RF pulse.
11. Set the Signal Generator's carrier frequency as given in the following table. For each setting, measure the 10% to 90% falltime. Compare the waveform with figure 3-17. The falltime should be less than 8 ns.

Carrier Frequency (MHz)	Falltime Limits (ns)	
	Actual	Maximum
500	_____	8
200	_____	8
100	_____	8
50	_____	8
20	_____	8
10	_____	8

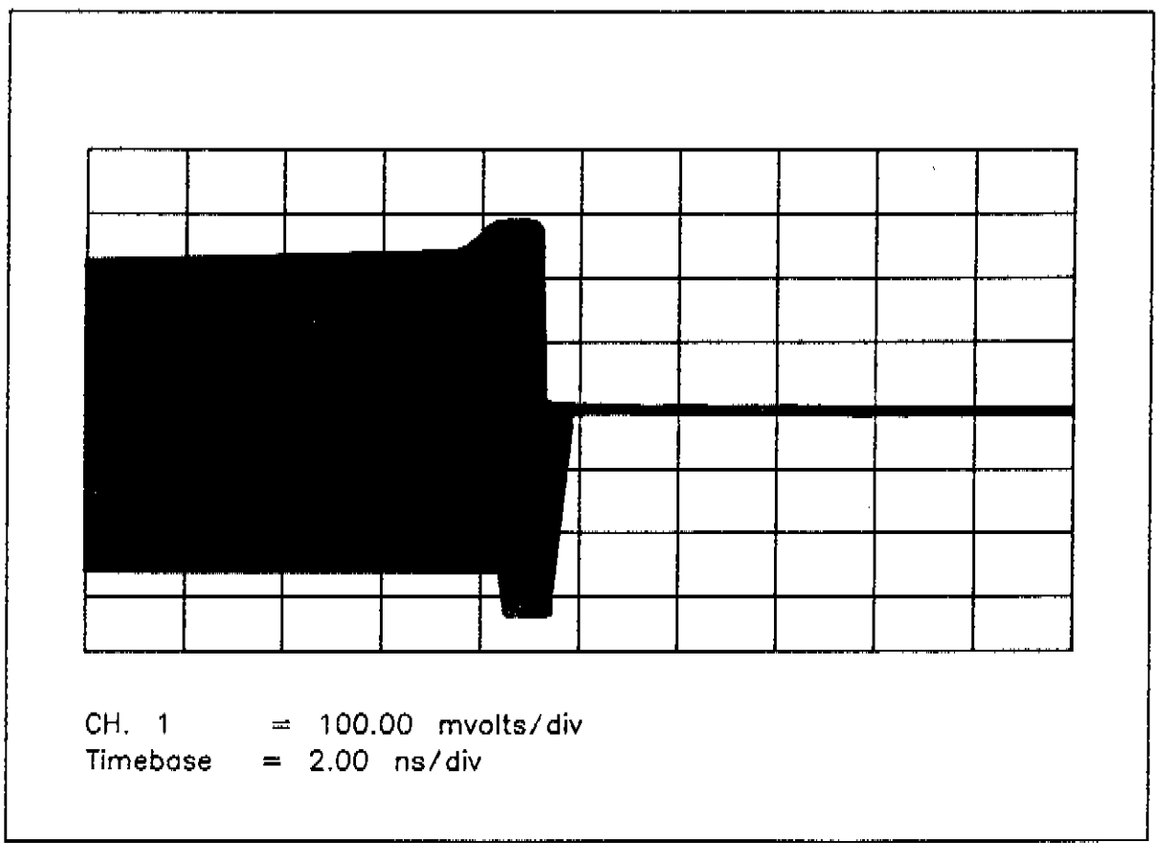


Figure 3-17. Pulse Modulation Pulse Falltime Waveform

Pulse Delay and Width Accuracy

12. Set the Signal Generator as follows.
    a. Key in FREQ 500 MHz.
    b. Key in SPECIAL 211 ENTER.
    c. Rotate the Knob until the display reads "211:Pulse Ctrl Pulse Gen".
    d. Key in SPECIAL 212 ENTER 50 ns. The sets the pulse delay to 50 ns.
    e. Key in SPECIAL 213 ENTER 10 ns. The sets the pulse width to 10 ns.
13. Set the oscilloscope as follows.
    a. Set the display to view both channel 1 and channel 2 on a split screen.
    b. Set the sweep speed to 10 ns per division.
    c. Set the delay time to approximately 40 ns the fine adjust it until the 50% point on the rising edge of the synchronization pulse (channel 2) is one division from the far left. Compare the waveforms with those in figure 3-18.
14. Set the controls as indicated in the following steps and table. For each setting measure the pulse delay and pulse width; the measurements should be within the limits indicated in the table.
    a. On the Signal Generator, set the audio frequency as shown in the table by keying in AUDIO FREQ, then keying in the frequency.

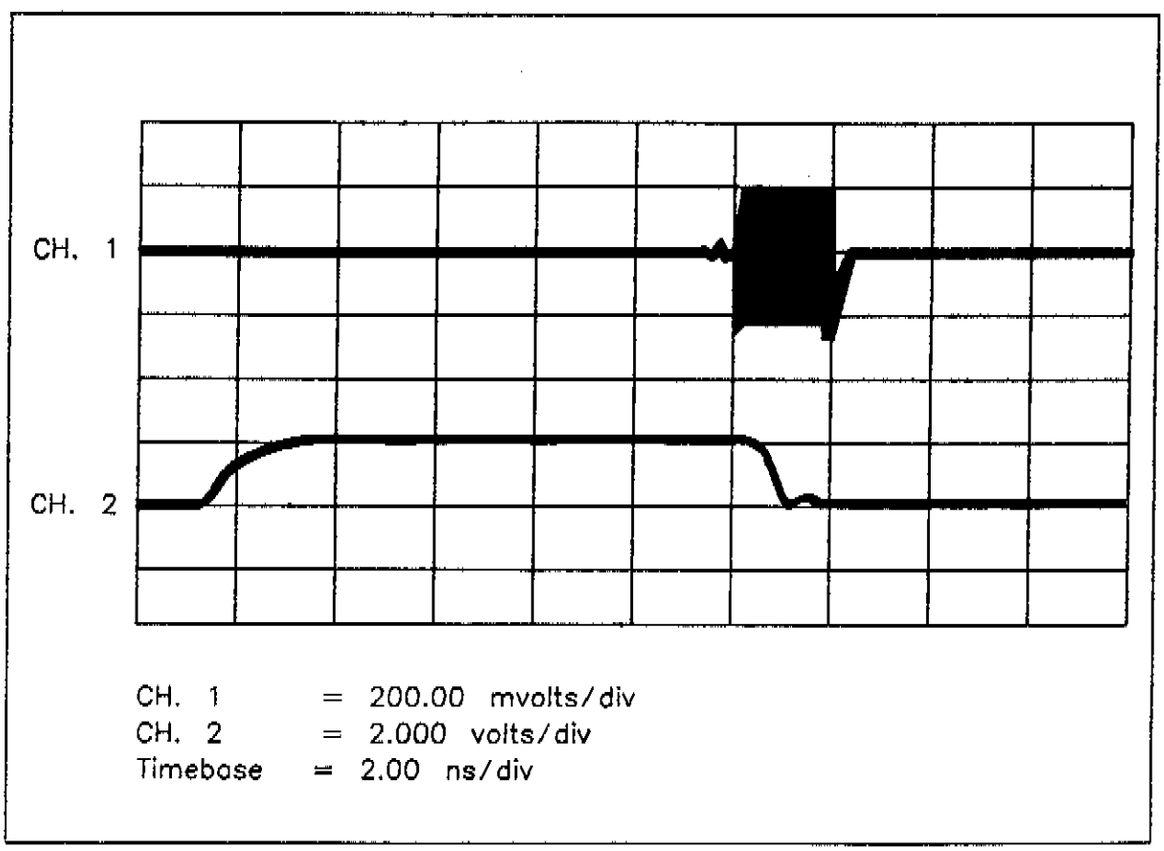


Figure 3-18. Pulse Modulation Synchronization and RF Pulse Waveforms

b. On the Signal Generator, set the pulse delay time as shown in the table by keying in SPECIAL 212 ENTER, then keying in the pulse delay.

c. On the Signal Generator, set the pulse width as shown in the table by keying in SPECIAL 213 ENTER, then keying in the pulse width.

d. On the oscilloscope, set the sweep speed and time delay as shown in the table.

e. Measure the pulse delay time and width. (If the oscilloscope has horizontal markers, they can be used to simplify these measurements.) The times should be within the limits given in the table.

Signal Generator Settings			Oscilloscope Settings		Pulse Delay Limits (ns)			Pulse Width Limits (ns)		
Pulse Frequency (kHz)	Pulse Delay (ns)	Pulse Width (ns)	Sweep Speed (ns/div)	Time Delay (ns)	Minimum	Actual	Maximum	Minimum	Actual	Maximum
399	50	10	40	10	45.5	____	54.5	7	____	13
39.9	500	100	400	100	473	____	527	93	____	107
3.99	5000	1000	4000	1000	4748	____	5252	948	____	1052

Performance Test 8

INTERNAL AUDIO OSCILLATOR TEST

Specification

Characteristic	Performance Limits	Conditions
Internal Modulation Source		
Distortion	<0.1%	output 1V peak; rate <20 kHz

Description

The distortion of the internal modulation source is measured directly on a distortion analyzer.

Equipment

Distortion Analyzer ..... HP 8903B or HP 8903E

Procedure

1. Connect the input of the distortion analyzer directly to the Signal Generator's AUDIO output connector.
2. Set the distortion analyzer to measure distortion. Set its low-pass filter to 80 kHz or greater.
3. On the Signal Generator press INSTR PRESET.
4. On the Signal Generator, key in the audio frequency as listed in the following table. For each setting measure the audio distortion. The distortion should less than 0.1%.

Audio Frequency Setting (Hz)	Distortion Limits (%)	
	Actual	Maximum
20	_____	0.1
100	_____	0.1
1 000	_____	0.1
10 000	_____	0.1
20 000	_____	0.1

Performance Test 9

OPTION 010 LEAKAGE TEST

Specification

2 μV measured into a resonant dipole 1 inch from the instrument's surface (except rear panel) with output level < 0 dBm and all inputs/outputs properly terminated.

Description

Leakage is measured using a resonate dipole. The output of the antenna is amplified by an RF amplifier and measured on a spectrum analyzer. The calibrated output of the signal generator under test is used to calibrate the amplifier/spectrum analyzer combination.

Equipment

Spectrum Analyzer	HP 8560A
RF Amplifier	HP 8447E
Antenna	HP 8644A/K03
Type N 50 ohm load	HP 908A
BNC 50 ohm load	HP 1250-0207

Procedure

Set-Up and Calibration

1. Press the INSTR PRESET key of the signal generator. Then set as follows:

Frequency	1029.1 MHz
Amplitude	2.0 μV

2. Connect the RF Output of the signal generator to the input of the RF Amplifier. Connect the output of the RF Amplifier to the input of the spectrum analyzer.
3. Set the spectrum analyzer center frequency to 1029.1 MHz and input attenuation to 0dB. Set the span so the signal is at least 20 dB above the noise level and the sweep speed is 400 mSec or faster. Try a 100 kHz span as a starting point. Change the reference level so the signal peak in at mid screen. If the spectrum analyzer has display line capability, set a line at the signal peak. This line on the spectrum analyzer display represents a 2 μV signal level from the antenna. All leakage picked up by the antenna must be below this level.
4. Disconnect the cable from the RF Output connector of the signal generator, and connect it to the antenna. Put 50 ohm loads on the RF OUTPUT and all the front panel and rear panel BNC connectors of the signal generator. Set the signal generator RF amplitude to −0.1 dBm.

Measurement

Frequency (MHz)	Length Antenna Element	Max Leakage (dB)[1]
1029.1	5.9 cm (2.30 in)	_____
975.1	6.1 cm (2.40 in)	_____
925.1	6.5 cm (2.56 in)	_____
875.1	7.0 cm (2.74 in)	_____
825.1	7.5 cm (2.95 in)	_____
775.1	8.1 cm (3.18 in)	_____
725.1	8.7 cm (3.44 in)	_____
454.1	14.9 cm (5.87 in)	_____

[1] Upper limit is 0 dB.

5. For each frequency in the above table do the following:
   - Set the signal generator carrier frequency and the spectrum analyzer center frequency to the frequency in the table.
   - Set the antenna elements length to the value given in the table. Measure from the outside of the center hub to the tip of the dipole.
   - Move the antenna over all the surfaces (except the rear panel) of the signal generator keeping the spacers in contact with the covers. This keeps the actual antenna elements 1 inch away from the surface. Do not allow the antenna elements to get closer than 1 inch to the RF Output connector or any of the front panel BNC connectors.
   - Move the antenna slowly. The antenna should move less than one inch per spectrum analyzer sweep cycle.
   - Monitor the signal level displayed on the spectrum analyzer. The signal level must stay below the reference line set above for the test to pass. For each frequency note the maximum signal level in relation to the reference line. Write this value in the table. For example if the highest signal level was 5 dB below the reference, enter - 5.0 in the table.
6. To measure leakage at other frequencies use the formula below to determine antenna element length and follow the procedure in step 5.

$$\ell = \frac{7500}{f} - 1.6$$

Where:

ℓ = antenna element length in centimeters
f = frequency in MHz.

Table 3-2. Performance Test Record (1 of 15)

Hewlett-Packard Company
HP 8665A
Synthesized Signal Generator

Tested By _____

Serial Number _____ **Date** _____

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
1	**CARRIER AMPLITUDE PERFORMANCE TEST**			
	Low-Frequency, Maximum Level			
	Frequency and Amplitude Settings–Not Option 008			
	0.1 MHz; +14.5 dBm	+13 dBm	_____	
	1 MHz; +14 dBm	+13 dBm	_____	
	10 MHz; +14 dBm	+13 dBm	_____	
	100 MHz; +14 dBm	+13 dBm	_____	
	1000 MHz; +14 dBm	+13 dBm	_____	
	Frequency and Amplitude Settings–Option 008			
	0.1 MHz; +10.5 dBm	+9 dBm	_____	
	1 MHz; +10 dBm	+9 dBm	_____	
	10 MHz; +10 dBm	+9 dBm	_____	
	100 MHz; +10 dBm	+9 dBm	_____	
	1000 MHz; +10 dBm	+9 dBm	_____	
	Low-Frequency, High-Amplitude Accuracy			
	Frequency and Amplitude Settings			
	1000 MHz; +6 dBm	+5 dBm	_____	+7 dBm
	1000 MHz; +7 dBm	+6 dBm	_____	+8 dBm
	1000 MHz; +8 dBm	+7 dBm	_____	+9 dBm
	1000 MHz; +9 dBm	+8 dBm	_____	+10 dBm
	1000 MHz; +10 dBm (except Option 008)	+9 dBm	_____	+11 dBm
	1000 MHz; +11 dBm (except Option 008)	+10 dBm	_____	+12 dBm
	1000 MHz; +12 dBm (except Option 008)	+11 dBm	_____	+13 dBm
	1000 MHz; +13 dBm (except Option 008)	+12 dBm	_____	+14 dBm
	100 MHz; +13 dBm (except Option 008)	+12 dBm	_____	+14 dBm
	100 MHz; +12 dBm (except Option 008)	+11 dBm	_____	+13 dBm
	100 MHz; +11 dBm (except Option 008)	+10 dBm	_____	+12 dBm
	100 MHz; +10 dBm (except Option 008)	+9 dBm	_____	+11 dBm
	100 MHz; +9 dBm	+8 dBm	_____	+10 dBm
	100 MHz; +8 dBm	+7 dBm	_____	+9 dBm
	100 MHz; +7 dBm	+6 dBm	_____	+8 dBm
	100 MHz; +6 dBm	+5 dBm	_____	+7 dBm

Table 3-2. Performance Test Record (2 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
1	**CARRIER AMPLITUDE PERFORMANCE TEST (Cont'd)**			
	Low-Frequency, High-Amplitude Accuracy (cont'd)			
	Frequency and Amplitude Settings			
	10 MHz; +6 dBm	+5 dBm	_____	+7 dBm
	10 MHz; +7 dBm	+6 dBm	_____	+8 dBm
	10 MHz; +8 dBm	+7 dBm	_____	+9 dBm
	10 MHz; +9 dBm	+8 dBm	_____	+10 dBm
	10 MHz; +10 dBm (except Option 008)	+9 dBm	_____	+11 dBm
	10 MHz; +11 dBm (except Option 008)	+10 dBm	_____	+12 dBm
	10 MHz; +12 dBm (except Option 008)	+11 dBm	_____	+13 dBm
	10 MHz; +13 dBm (except Option 008)	+12 dBm	_____	+14 dBm
	1 MHz; +13 dBm (except Option 008)	+12 dBm	_____	+14 dBm
	1 MHz; +12 dBm (except Option 008)	+11 dBm	_____	+13 dBm
	1 MHz; +11 dBm (except Option 008)	+10 dBm	_____	+12 dBm
	1 MHz; +10 dBm (except Option 008)	+9 dBm	_____	+11 dBm
	1 MHz; +9 dBm	+8 dBm	_____	+10 dBm
	1 MHz; +8 dBm	+7 dBm	_____	+9 dBm
	1 MHz; +7 dBm	+6 dBm	_____	+8 dBm
	1 MHz; +6 dBm	+5 dBm	_____	+7 dBm
	0.1 MHz; +6 dBm	+4.5 dBm	_____	+7.5 dBm
	0.1 MHz; +7 dBm	+5.5 dBm	_____	+8.5 dBm
	0.1 MHz; +8 dBm	+6.5 dBm	_____	+9.5 dBm
	0.1 MHz; +9 dBm	+7.5 dBm	_____	+10.5 dBm
	0.1 MHz; +10 dBm (except Option 008)	+8.5 dBm	_____	+11.5 dBm
	0.1 MHz; +11 dBm (except Option 008)	+9.5 dBm	_____	+12.5 dBm
	0.1 MHz; +12 dBm (except Option 008)	+10.5 dBm	_____	+13.5 dBm
	0.1 MHz; +13 dBm (except Option 008)	+11.5 dBm	_____	+14.5 dBm

Table 3-2. Performance Test Record (3 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
1	**CARRIER AMPLITUDE PERFORMANCE TEST (Cont'd)**			
	Low-Frequency, Low-Amplitude Accuracy, 1000 MHz			
	Attenuation and Amplitude Settings			
	+5 dB, +1 dBm	−0 dB REL	_____	+2 dB REL
	+10 dB, −4 dBm	−5 dB REL	_____	−3 dB REL
	+15 dB, −9 dBm	−10 dB REL	_____	−8 dB REL
	+20 dB, −14 dBm	−15 dB REL	_____	−13 dB REL
	+25 dB, −19 dBm	−20 dB REL	_____	−18 dB REL
	+30 dB, −24 dBm	−25 dB REL	_____	−23 dB REL
	+35 dB, −29 dBm	−30 dB REL	_____	−28 dB REL
	+40 dB, −34 dBm	−35 dB REL	_____	−33 dB REL
	+45 dB, −39 dBm	−40 dB REL	_____	−38 dB REL
	+50 dB, −44 dBm	−45 dB REL	_____	−43 dB REL
	+55 dB, −49 dBm	−50 dB REL	_____	−48 dB REL
	+60 dB, −54 dBm	−55 dB REL	_____	−53 dB REL
	+65 dB, −59 dBm	−60 dB REL	_____	−58 dB REL
	+70 dB, −64 dBm	−65 dB REL	_____	−63 dB REL
	+75 dB, −69 dBm	−70 dB REL	_____	−68 dB REL
	+80 dB, −74 dBm	−75 dB REL	_____	−73 dB REL
	+85 dB, −79 dBm	−80 dB REL	_____	−78 dB REL
	+90 dB, −84 dBm	−85 dB REL	_____	−83 dB REL
	+95 dB, −89 dBm	−90 dB REL	_____	−88 dB REL
	+100 dB, −94 dBm	−95 dB REL	_____	−93 dB REL
	+105 dB, −99 dBm	−100 dB REL	_____	−98 dB REL
	+110 dB, −104 dBm	−105 dB REL	_____	−103 dB REL
	+115 dB, −109 dBm	−110 dB REL	_____	−108 dB REL
	+120 dB, −114 dBm	−115 dB REL	_____	−113 dB REL
	+125 dB, −119 dBm	−120 dB REL	_____	−118 dB REL
	High-Frequency, Maximum Level			
	Frequency and Amplitude Settings–Not Option 008			
	2990 MHz; +14.5 dBm	+13 dBm	_____	
	4200 MHz; +15.0 dBm (HP 8665A/B)	+13 dBm	_____	
	6000 MHz; +15.0 dBm (HP 8665B)	+13 dBm	_____	
	Frequency and Amplitude Settings–Option 008			
	2990 MHz; +10.5 dBm	+9 dBm	_____	
	4200 MHz; +11.0 dBm (HP 8665A/B)	+9 dBm	_____	
	6000 MHz; +11.0 dBm (HP 8665B)	+9 dBm	_____	

Table 3-2. Performance Test Record (4 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
1	**CARRIER AMPLITUDE PERFORMANCE TEST (Cont'd)**			
	High-Frequency, High-Amplitude Accuracy			
	Frequency and Amplitude Settings			
	6000 MHz; +13 dBm(HP 8665B)	+11.0 dBm	_____	+15.0 dBm
	6000 MHz; +11 dBm (HP 8665B)	+9.0 dBm	_____	+13.0 dBm
	6000 MHz; +9 dBm (HP 8665B, except opt. 008)	+7.0 dBm	_____	+11.0 dBm
	6000 MHz; +6 dBm (HP 8665B, except opt. 008)	+4.0 dBm	_____	+8.0 dBm
	4200 MHz; +6 dBm (HP 8665A/B)	+4.0 dBm	_____	+8.0 dBm
	4200 MHz; +9 dBm (HP 8665A/B)	+7.0 dBm	_____	+11.0 dBm
	4200 MHz; +11 dBm (HP 8665A/B, except opt. 008)	+9.0 dBm	_____	+13.0 dBm
	4200 MHz; +13 dBm (HP 8665A/B, except opt. 008)	+11.0 dBm	_____	+15.0 dBm
	2900 MHz; +13 dBm (except Option 008)	+11.5 dBm	_____	+14.5 dBm
	2900 MHz; +11 dBm (except Option 008)	+9.5 dBm	_____	+12.5 dBm
	2900 MHz; +9 dBm	+7.5 dBm	_____	+10.5 dBm
	2900 MHz; +6 dBm	+4.5 dBm	_____	+7.5 dBm
	High-Frequency, Low-Amplitude Accuracy, 2990 MHz			
	Attenuation and Amplitude Settings			
	+5 dB, +1 dBm	−0.5 dB REL	_____	+2.5 dB REL
	+10 dB, −4 dBm	−5.5 dB REL	_____	−2.5 dB REL
	+15 dB, −9 dBm	−10.5 dB REL	_____	−7.5 dB REL
	+20 dB, −14 dBm	−15.5 dB REL	_____	−12.5 dB REL
	+25 dB, −19 dBm	−20.5 dB REL	_____	−17.5 dB REL
	+30 dB, −24 dBm	−25.5 dB REL	_____	−22.5 dB REL
	+35 dB, −29 dBm	−30.5 dB REL	_____	−27.5 dB REL
	+40 dB, −34 dBm	−35.5 dB REL	_____	−32.5 dB REL
	+45 dB, −39 dBm	−40.5 dB REL	_____	−37.5 dB REL
	+50 dB, −44 dBm	−45.5 dB REL	_____	−42.5 dB REL
	+55 dB, −49 dBm	−50.5 dB REL	_____	−47.5 dB REL
	+60 dB, −54 dBm	−55.5 dB REL	_____	−52.5 dB REL
	+65 dB, −59 dBm	−60.5 dB REL	_____	−57.5 dB REL
	+70 dB, −64 dBm	−65.5 dB REL	_____	−62.5 dB REL
	+75 dB, −69 dBm	−70.5 dB REL	_____	−67.5 dB REL
	+80 dB, −74 dBm	−75.5 dB REL	_____	−72.5 dB REL
	+85 dB, −79 dBm	−80.5 dB REL	_____	−77.5 dB REL
	+90 dB, −84 dBm	−85.5 dB REL	_____	−82.5 dB REL
	+95 dB, −89 dBm	−90.5 dB REL	_____	−87.5 dB REL
	+100 dB, −94 dBm	−95.5 dB REL	_____	−92.5 dB REL
	+105 dB, −99 dBm	−100.5 dB REL	_____	−97.5 dB REL
	+110 dB, −104 dBm	−105.5 dB REL	_____	−102.5 dB REL

Table 3-2. Performance Test Record (5 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
1	**CARRIER AMPLITUDE PERFORMANCE TEST (Cont'd)**			
	High-Frequency, Low-Amplitude Accuracy, 4200 MHz			
	HP 8665A Only			
	Attenuation and Amplitude Settings			
	+5 dB, +1 dBm	−1.0 dB REL	_____	+2.0 dB REL
	+10 dB, −4 dBm	−6.0 dB REL	_____	−2.0 dB REL
	+15 dB, −9 dBm	−11.0 dB REL	_____	−7.0 dB REL
	+20 dB, −14 dBm	−16.0 dB REL	_____	−12.0 dB REL
	+25 dB, −19 dBm	−21.0 dB REL	_____	−17.0 dB REL
	+30 dB, −24 dBm	−26.0 dB REL	_____	−22.0 dB REL
	+35 dB, −29 dBm	−31.0 dB REL	_____	−27.0 dB REL
	+40 dB, −34 dBm	−36.0 dB REL	_____	−32.0 dB REL
	+45 dB, −39 dBm	−41.0 dB REL	_____	−37.0 dB REL
	+50 dB, −44 dBm	−46.0 dB REL	_____	−42.0 dB REL
	+55 dB, −49 dBm	−51.0 dB REL	_____	−47.0 dB REL
	+60 dB, −54 dBm	−56.0 dB REL	_____	−52.0 dB REL
	+65 dB, −59 dBm	−61.0 dB REL	_____	−57.0 dB REL
	+70 dB, −64 dBm	−66.0 dB REL	_____	−62.0 dB REL
	+75 dB, −69 dBm	−71.0 dB REL	_____	−67.0 dB REL
	+80 dB, −74 dBm	−76.0 dB REL	_____	−72.0 dB REL
	+85 dB, −79 dBm	−81.0 dB REL	_____	−77.0 dB REL
	+90 dB, −84 dBm	−86.0 dB REL	_____	−82.0 dB REL
	+95 dB, −89 dBm	−91.0 dB REL	_____	−87.0 dB REL
	+100 dB, −94 dBm	−96.0 dB REL	_____	−92.0 dB REL
	+105 dB, −99 dBm	−101.0 dB REL	_____	−97.0 dB REL
	+110 dB, −104 dBm	−106.0 dB REL	_____	−102.0 dB REL

Table 3-2. Performance Test Record (6 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
1	**CARRIER AMPLITUDE PERFORMANCE TEST (Cont'd)**			
	High-Frequency, Low-Amplitude Accuracy, 6000 MHz			
	HP 8665B Only			
	Attenuation and Amplitude Settings			
	+5 dB, +1 dBm	−1.0 dB REL	_____	+2.0 dB REL
	+10 dB, −4 dBm	−6.0 dB REL	_____	−2.0 dB REL
	+15 dB, −9 dBm	−11.0 dB REL	_____	−7.0 dB REL
	+20 dB, −14 dBm	−16.0 dB REL	_____	−12.0 dB REL
	+25 dB, −19 dBm	−21.0 dB REL	_____	−17.0 dB REL
	+30 dB, −24 dBm	−26.0 dB REL	_____	−22.0 dB REL
	+35 dB, −29 dBm	−31.0 dB REL	_____	−27.0 dB REL
	+40 dB, −34 dBm	−36.0 dB REL	_____	−32.0 dB REL
	+45 dB, −39 dBm	−41.0 dB REL	_____	−37.0 dB REL
	+50 dB, −44 dBm	−46.0 dB REL	_____	−42.0 dB REL
	+55 dB, −49 dBm	−51.0 dB REL	_____	−47.0 dB REL
	+60 dB, −54 dBm	−56.0 dB REL	_____	−52.0 dB REL
	+65 dB, −59 dBm	−61.0 dB REL	_____	−57.0 dB REL
	+70 dB, −64 dBm	−66.0 dB REL	_____	−62.0 dB REL
	+75 dB, −69 dBm	−71.0 dB REL	_____	−67.0 dB REL
	+80 dB, −74 dBm	−76.0 dB REL	_____	−72.0 dB REL
	+85 dB, −79 dBm	−81.0 dB REL	_____	−77.0 dB REL
	+90 dB, −84 dBm	−86.0 dB REL	_____	−82.0 dB REL
	+95 dB, −89 dBm	−91.0 dB REL	_____	−87.0 dB REL
	+100 dB, −94 dBm	−96.0 dB REL	_____	−92.0 dB REL
	+105 dB, −99 dBm	−101.0 dB REL	_____	−97.0 dB REL
	+110 dB, −104 dBm	−106.0 dB REL	_____	−102.0 dB REL

Table 3-2. Performance Test Record (7 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
2	**AM TEST**			
	Residual AM			
	13 dBm carrier (except Option 008)		_____	0.02%
	9 dBm carrier		_____	0.02%
	0 dBm carrier		_____	0.02%
	Indicator Accuracy			
	10% depth	8.4%	_____	11.6%
	50% depth	46.0%	_____	54.0%
	90% depth	83.6%	_____	96.4%
	Distortion			
	30% depth		_____	2%
	70% depth		_____	4%
	90% depth		_____	6%
	3 dB Bandwidth			
	Carrier Frequency and AM Rate Settings			
	1 MHz; 5 kHz	−3 dB	_____	+3 dB
	10 MHz; 10 kHz	−3 dB	_____	+3 dB
	100 MHz; 10 kHz	−3 dB	_____	+3 dB
	1000 MHz; 10 kHz	−3 dB	_____	+3 dB
	4000 MHz; 10 kHz (HP 8665A/B)	−3 dB	_____	+3 dB
	Incidental Phase Modulation			
	1000 MHz carrier		_____	0.3 rad pk
	4000 MHz carrier		_____	0.6 rad pk
	6000 MHz carrier		_____	0.6 rad pk

Table 3-2. Performance Test Record (8 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
3	**FM TEST (LOW DEVIATIONS AND RATES)**			
	Residual FM			
	Frequency, Mode Select, and Bandwidth Settings			
	180.001 MHz; Mode 1; 0.3 to 3 kHz		_____	15 Hz rms
	180.001 MHz; Mode 1; 0.05 to 15 kHz		_____	20 Hz rms
	740.005 MHz; Mode 1; 0.05 to 15 kHz		_____	10 Hz rms
	740.005 MHz; Mode 1; 0.3 to 3 kHz		_____	7.5 Hz rms
	1200.001 MHz; Mode 1; 0.3 to 3 kHz		_____	15 Hz rms
	1200.001 MHz; Mode 1; 0.05 to 15 kHz		_____	20 Hz rms
	1200.004 MHz; Mode 2 (Option 004); 0.05 to 15 kHz		_____	8 Hz rms
	1200.004 MHz; Mode 2 (Option 004); 0.3 to 3 kHz		_____	2.5 Hz rms
	740.002 MHz; Mode 2 (Option 004); 0.3 to 3 kHz		_____	1.25 Hz rms
	740.002 MHz; Mode 2 (Option 004); 0.05 to 15 kHz		_____	4 Hz rms
	180.004 MHz; Mode 2 (Option 004); 0.05 to 15 kHz		_____	8 Hz rms
	180.004 MHz; Mode 2 (Option 004); 0.3 to 3 kHz		_____	2.5 Hz rms
	Maximum Frequency (MHz); Mode 1; 0.3 to 3 kHz		_____	60 Hz rms
	Maximum Frequency (MHz); Mode 1; 0.05 to 15 kHz		_____	80 Hz rms
	Maximum Frequency (MHz); Mode 2 (Option 004); 0.05 to 15 kHz		_____	32 Hz rms
	Maximum Frequency (MHz); Mode 2 (Option 004); 0.3 to 3 kHz		_____	10 Hz rms
	Indicator Accuracy			
	Carrier Frequency, FM Deviation, and Mode Select Settings			
	10 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	180 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	190 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	260 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	370 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	380 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	525 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	745 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	755 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	1060 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	1290 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk

Table 3-2. Performance Test Record (9 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
3	**FM TEST (LOW DEVIATIONS AND RATES) (Cont'd)**			
	Indicator Accuracy (cont'd)			
	Carrier Frequency, FM Deviation, and Mode Select Settings (cont'd)			
	1290 MHz; 100 kHz; Mode 2 (Option 004)	89 kHz pk	_____	111 kHz pk
	1060 MHz; 100 kHz; Mode 2 (Option 004)	89 kHz pk	_____	111 kHz pk
	755 MHz; 100 kHz; Mode 2 (Option 004)	89 kHz pk	_____	111 kHz pk
	745 MHz; 50 kHz; Mode 2 (Option 004)	44.5 kHz pk	_____	55.5 kHz pk
	525 MHz; 50 kHz; Mode 2 (Option 004)	44.5 kHz pk	_____	55.5 kHz pk
	380 MHz; 25 kHz; Mode 2 (Option 004)	22.25 kHz pk	_____	27.75 kHz pk
	370 MHz; 25 kHz; Mode 2 (Option 004)	22.25 kHz pk	_____	27.75 kHz pk
	260 MHz; 25 kHz; Mode 2 (Option 004)	22.25 kHz pk	_____	27.75 kHz pk
	190 MHz; 25 kHz; Mode 2 (Option 004)	22.25 kHz pk	_____	27.75 kHz pk
	180 MHz; 100 kHz; Mode 2 (Option 004)	89 kHz pk	_____	111 kHz pk
	10 MHz; 100 kHz; Mode 2 (Option 004)	89 kHz pk	_____	111 kHz pk
	1800 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	2110 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	2990 MHz; 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	3010 MHz (HP 8665A/B); 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	4200 MHz (HP 8665A); 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	6000 MHz (HP 8665B); 350 kHz; Mode 1	318.5 kHz pk	_____	381.5 kHz pk
	6000 MHz (HP 8665B); 350 kHz; Mode 2 (Option 004)	311.5 kHz pk	_____	388.5 kHz pk
	4200 MHz (HP 8665A); 350 kHz; Mode 2 (Option 004)	311.5 kHz pk	_____	388.5 kHz pk
	3010 MHz (HP 8665A/B); 350 kHz; Mode 2 (Option 004)	311.5 kHz pk	_____	388.5 kHz pk
	2990 MHz; 200 kHz; Mode 2 (Option 004)	178 kHz pk	_____	222 kHz pk
	2110 MHz; 200 kHz; Mode 2 (Option 004)	178 kHz pk	_____	222 kHz pk
	1800 MHz; 200 kHz; Mode 2 (Option 004)	178 kHz pk	_____	222 kHz pk

Table 3-2. Performance Test Record (10 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
3	**FM TEST (LOW DEVIATIONS AND RATES) (Cont'd)**			
	Distortion			
	Carrier Frequency, FM Deviation, and Mode Select Settings			
	10 MHz; 350 kHz; Mode 1		_____	1%
	180 MHz; 350 kHz; Mode 1		_____	1%
	190 MHz; 350 kHz; Mode 1		_____	1%
	260 MHz; 350 kHz; Mode 1		_____	1%
	370 MHz; 350 kHz; Mode 1		_____	1%
	380 MHz; 350 kHz; Mode 1		_____	1%
	525 MHz; 350 kHz; Mode 1		_____	1%
	745 MHz; 350 kHz; Mode 1		_____	1%
	755 MHz; 350 kHz; Mode 1		_____	1%
	1060 MHz; 350 kHz; Mode 1		_____	1%
	1290 MHz; 350 kHz; Mode 1		_____	1%
	1800 MHz; 350 kHz; Mode 1		_____	1%
	2110 MHz; 350 kHz; Mode 1		_____	1%
	2990 MHz; 350 kHz; Mode 1		_____	1%
	3010 MHz (HP 8665A/B); 350 kHz; Mode 1		_____	1%
	4200 MHz (HP 8665A); 350 kHz; Mode 1		_____	1%
	6000 MHz (HP 8665B); 350 kHz; Mode 1		_____	1%
	6000 MHz (HP 8665B); 350 kHz; Mode 2 (Option 004)		_____	1%
	4200 MHz (HP 8665A); 350 kHz; Mode 2 (Option 004)		_____	1%
	3010 MHz (HP 8665A/B); 350 kHz; Mode 2 (Option 004)		_____	1%
	2990 MHz; 200 kHz; Mode 2 (Option 004)		_____	1%
	2110 MHz; 200 kHz; Mode 2 (Option 004)		_____	1%
	1800 MHz; 200 kHz; Mode 2 (Option 004)		_____	1%
	1290 MHz; 100 kHz; Mode 2 (Option 004)		_____	1%
	1060 MHz; 100 kHz; Mode 2 (Option 004)		_____	1%
	755 MHz; 100 kHz; Mode 2 (Option 004)		_____	1%
	745 MHz; 50 kHz; Mode 2 (Option 004)		_____	1%
	525 MHz; 50 kHz; Mode 2 (Option 004)		_____	1%
	380 MHz; 25 kHz; Mode 2 (Option 004)		_____	1%
	370 MHz; 25 kHz; Mode 2 (Option 004)		_____	1%
	260 MHz; 25 kHz; Mode 2 (Option 004)		_____	1%
	190 MHz; 25 kHz; Mode 2 (Option 004)		_____	1%
	180 MHz; 100 kHz; Mode 2 (Option 004)		_____	1%
	10 MHz; 100 kHz; Mode 2 (Option 004)		_____	1%

Table 3-2. Performance Test Record (11 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
3	**FM TEST (LOW DEVIATIONS AND RATES) (Cont'd)**			
	Incidental AM		_____	0.4%
	Carrier Frequency Accuracy in FM			
	Carrier Frequency and FM Deviation Settings			
	150 MHz; 5 MHz pk		_____	30 kHz
	300 MHz; 1.25 MHz pk		_____	7.5 kHz
	600 MHz; 2.5 MHz pk		_____	15 kHz
	1200 MHz; 5 MHz pk		_____	30 kHz
4	**FM TEST (HIGH DEVIATIONS AND RATES)**			
	Indicator Accuracy	16.4 dB	_____	17.8 dB
	Distortion		_____	−40 dB
	Maximum Rate (3 dB Bandwidth)	−3 dB	_____	+3 dB
5	**SPECTRAL PURITY TEST (SSB PHASE NOISE)**			
	SSB Phase Noise			
	Frequency and Mode Select Settings and Offset			
	1100 MHz; Mode 1; 1 kHz		_____	−73 dBc
	1100 MHz; Mode 1; 20 kHz		_____	−117 dBc
	1100 MHz; Mode 1; 100 kHz		_____	−134 dBc
	1100 MHz; Mode 2 (Option 004); 1 kHz		_____	−94 dBc
	1100 MHz; Mode 2 (Option 004); 20 kHz		_____	−128 dBc
	1100 MHz; Mode 2 (Option 004); 100 kHz		_____	−133 dBc
	550 MHz; Mode 2 (Option 004); 1 kHz		_____	−100 dBc
	550 MHz; Mode 2 (Option 004); 20 kHz		_____	−134 dBc
	550 MHz; Mode 2 (Option 004); 100 kHz		_____	−139 dBc
	550 MHz; Mode 1; 1 kHz		_____	−79 dBc
	550 MHz; Mode 1; 20 kHz		_____	−122 dBc
	550 MHz; Mode 1; 100 kHz		_____	−138 dBc
	300 MHz; Mode 1; 1 kHz		_____	−85 dBc
	300 MHz; Mode 1; 20 kHz		_____	−128 dBc
	300 MHz; Mode 1; 100 kHz		_____	−143 dBc
	300 MHz; Mode 2 (Option 004); 1 kHz		_____	−106 dBc
	300 MHz; Mode 2 (Option 004); 20 kHz		_____	−139 dBc
	300 MHz; Mode 2 (Option 004); 100 kHz		_____	−144 dBc

Table 3-2. Performance Test Record (12 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
5	**SPECTRAL PURITY TEST (SSB PHASE NOISE) (Cont'd)**			
	SSB Phase Noise (cont'd)			
	Frequency and Mode Select Settings and Offset (cont'd)			
	200 MHz; Mode 2 (Option 004); 1 kHz		_____	–112 dBc
	200 MHz; Mode 2 (Option 004); 20 kHz		_____	–144 dBc
	200 MHz; Mode 2 (Option 004); 100 kHz		_____	–146 dBc
	150 MHz; Mode 2 (Option 004); 1 kHz		_____	–94 dBc
	150 MHz; Mode 2 (Option 004); 20 kHz		_____	–128 dBc
	150 MHz; Mode 2 (Option 004); 100 kHz		_____	–133 dBc
	150 MHz; Mode 1; 1 kHz		_____	–73 dBc
	150 MHz; Mode 1; 20 kHz		_____	–117 dBc
	150 MHz; Mode 1; 100 kHz		_____	–132 dBc
	40 MHz; Mode 2 (Option 004); 1 kHz		_____	–100 dBc
	40 MHz; Mode 2 (Option 004); 20 kHz		_____	–131 dBc
	40 MHz; Mode 2 (Option 004); 100 kHz		_____	–133 dBc
	Non-Harmonic Spurious (worst case)			
	>10 kHz offset; 187.5 to 1100 MHz		_____	–100 dBc
	>10 kHz offset; 0.1 to 187.5 MHz		_____	–90 dBc
	4150 MHz; Mode 1; 1 kHz		_____	–63 dBc
	4150 MHz; Mode 1; 20 kHz		_____	–105 dBc
	4150 MHz; Mode 1; 100 kHz		_____	–122 dBc
	4150 MHz; Mode 2 (Option 004); 1 kHz		_____	–83 dBc
	4150 MHz; Mode 2 (Option 004); 20 kHz		_____	–116 dBc
	4150 MHz; Mode 2 (Option 004); 100 kHz		_____	–121 dBc
	2100 MHz; Mode 2 (Option 004); 1 kHz		_____	–89 dBc
	2100 MHz; Mode 2 (Option 004); 20 kHz		_____	–122 dBc
	2100 MHz; Mode 2 (Option 004); 100 kHz		_____	–127 dBc
	2100 MHz; Mode 1; 1 kHz		_____	–67 dBc
	2100 MHz; Mode 1; 20 kHz		_____	–111 dBc
	2100 MHz; Mode 1; 100 kHz		_____	–128 dBc
	Non-Harmonic Spurious (worst case)			
	>10 kHz offset; 2100 to 6000 MHz		_____	–90 dBc

Table 3-2. Performance Test Record (13 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
6	**SPECTRAL PURITY TEST (HARMONICS)**			
	Harmonics			
	Frequency Span and Amplitude Settings			
	0.1 to 2999 MHz; 6 dBm		_____	−30 dBc
	3000 to 4200 MHz; 6 dBm (HP 8665A)		_____	−30 dBc
	3000 to 6000 MHz; 6 dBm (HP 8665B)		_____	−30 dBc
	Subharmonics			
	0.1 to 1030 MHz carrier		_____	−75 dBc
	1030 to 6000 MHz carrier		_____	−37 dBc
7	**PULSE MODULATION TEST**			
	On/Off Ratio			
	100 MHz carrier	80 dB	_____	
	200 MHz carrier	80 dB	_____	
	500 MHz carrier	80 dB	_____	
	1499 MHz carrier	80 dB	_____	
	2999 MHz carrier	80 dB	_____	
	4200 MHz carrier (HP 8665A)	80 dB	_____	
	6000 MHz carrier (HP 8665B)	80 dB	_____	
	Risetime			
	10 MHz carrier		_____	8 ns
	20 MHz carrier		_____	8 ns
	50 MHz carrier		_____	8 ns
	100 MHz carrier		_____	8 ns
	200 MHz carrier		_____	8 ns
	500 MHz carrier		_____	8 ns

Table 3-2. Performance Test Record (14 of 15)

Test No.	Test Description	Results		
		Minimum	Actual	Maximum
7	**PULSE MODULATION TEST (cont'd)**			
	Falltime			
	500 MHz carrier		_____	8 ns
	200 MHz carrier		_____	8 ns
	100 MHz carrier		_____	8 ns
	50 MHz carrier		_____	8 ns
	20 MHz carrier		_____	8 ns
	10 MHz carrier		_____	8 ns
	Pulse Delay Accuracy			
	50 ns delay	45.5 ns	_____	54.5 ns
	500 ns delay	473 ns	_____	527 ns
	5000 ns delay	4748 ns	_____	5252 ns
	Pulse Width Accuracy			
	10 ns delay	7 ns	_____	13 ns
	100 ns delay	93 ns	_____	107 ns
	1000 ns delay	948 ns	_____	1052 ns
8	**INTERNAL AUDIO OSCLLATOR TEST**			
	Distortion			
	20 Hz		_____	0.1%
	100 Hz		_____	0.1%
	1 000 Hz		_____	0.1%
	10 000 Hz		_____	0.1%
	20 000 Hz		_____	0.1%

Table 3-2. Performance Test Record (15 of 15)

Test 9 – Leakage Test (Option 010)

Frequency (MHz)	Length Antenna Element	Max Leakage (dB)[1]
1029.1	5.9 cm (2.30 in)	_____
975.1	6.1 cm (2.40 in)	_____
925.1	6.5 cm (2.56 in)	_____
875.1	7.0 cm (2.74 in)	_____
825.1	7.5 cm (2.95 in)	_____
775.1	8.1 cm (3.18 in)	_____
725.1	8.7 cm (3.44 in)	_____
454.1	14.9 cm (5.87 in)	_____

[1] Upper limit is 0 dB.