OPERATING AND SERVICE MANUAL
VOLUME 1

HP 8673C
HP 8673D
SYNTHESIZED SIGNAL GENERATORS
(Including Options 001, 002, 003, 004, 005, 006, 908 and 913)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2332A.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: HP 8673C/D
Date Printed: March 1984
Part Number: 08673-90021

SYNTHESIZED SIGNAL GENERATOR
VOLUME I

This supplement contains important information for correcting manual errors and for adapting manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
2232A, 2410A	Errata Only
2413A, 2417A	Errata Only
2416A, 2446A	Errata Only
2447A, 2452A	Errata Only
2510A, 2511A	Errata Only
2512A, 2513A	Errata Only

Serial Prefix or Number	Make Manual Changes
2530A	1
2552A	1, 2
2608A, 2626A	1
▶2634A , and above	1, 2

▶ NEW ITEM

ERRATA

Page 1-3:

Change Option 908 (Rack Flange Kits) to 5061-9674 and 5061-9677.

Change Option 913 (Rack Flange Kit) to 5061-9773.

Page 1-4, Table 1-1:

Replace the note at the top of the table with the following text.

NOTE

Specifications and characteristics apply after a 1 hour warm-up, over the temperature range 0-55 C° (except specifications for harmonically related spurious signals, RF output level, pulse peak level accuracy, and amplitude modulation; which apply over the range +15 to +35 C°), after an AUTO PEAK operation has been performed. For additional information concerning the use of AUTO PEAK, refer to Sections 3-11 and 3-12.

Specifications for output flatness, absolute level accuracy, and modulation apply only when internal leveling is used.

Page 1-5, Table 1-1:

Change Harmonics, 0.05 to 1.2 GHz, to −35 dBc.

Change the second footnote (**) to read:

"In the 0.05 to <2.0 GHz band, carrier-frequency independent spurious outputs may exist in the >50 MHz to 100 MHz range at <−55 dBc, and in the 10 MHz to 50 MHz range at −40 dBc."

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

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HEWLETT PACKARD

ERRATA (cont'd)

Page 1-7, Table 1-1:

Change Rise and Fall Times		AUTO PEAK executed
to	< 30 ns	0.05 to 0.1 GHz
	< 20 ns	0.1 to < 2.0 GHz
	< 40 ns	2.0 to 26 GHz
Change Overshoot, Ringing to:		
	< 35%	0.05 — 0.1 GHz
	< 25%	0.1—6.6, 7.2—26 GHz
	< 30%	6.6—7.2 GHz

Page 2-4:

Change the Second paragraph to read:

Coaxial Connectors. Coaxial mating connectors used with the RF Output of the Signal Generator should be APC 3.5 female connectors.

Page 2-5, Figure 2-4:

Add the following: **A3W18 HP-IB Adapter** HP part number 5060-9462.

Page 3-6, paragraph 3-11:

Replace the entire paragraph with the following text.

3-11. AUTO PEAK

Major power and pulse modulation specifications are not warranted unless an AUTO PEAK operation has been performed. An AUTO PEAK operation is automatically performed when the frequency changes by more than 50 MHz while AUTO PEAK is enabled. AUTO PEAK is automatically enabled when the instrument is turned on, or when PULSE mode is selected. The front panel AUTO PEAK button toggles the state of the instrument between AUTO PEAK enabled and disabled mode. A user-initiated AUTO PEAK operation may be performed manually at any time by pressing the AUTO PEAK button twice to disable and re-enable AUTO PEAK. The actual peaking operation occurs when the AUTO PEAK is switched from the disabled to enabled mode. Under program control, disabling, enabling, and performing an AUTO PEAK operation can all be controlled separately with the K0, K1, and K2 commands. See Table 3-7.

Page 3-6, paragraph 3-12:

Replace the entire paragraph with the following text.

3-12. PULSE MODE

The automatic execution of the AUTO PEAK function by the instrument's internal microprocessor ensures that key power and pulse specifications are met for nearly all circumstances (see Section 3-11). Three conditions that may necessitate a user-activated AUTO PEAK are: load changes, extreme frequency changes, and, in rare circumstances, frequency changes slightly less than 20 MHz.

(a) Changes of load impedance can shift the center frequency of internal filters and necessitate another AUTO PEAK operation. This could occur if highly reactive loads are switched in and out in automatic test systems.

(b) Large frequency changes cause extreme changes in the self-heating of internal YIG filters. Although most of the resulting drift occurs in 15-20 seconds, complete settling may take up to 15 minutes. Some experimentation may be needed to determine when AUTO PEAK is necessary for this type of measurement.

ERRATA (cont'd)

Page 3-6, paragraph 3-12 (cont'd)

(c) Finally, on rare occasions, pulse overshoot parameters may drift out of specified range for frequency changes just less than 50 MHz.

To be confident of obtaining warranted instrument performance, perform an AUTO PEAK operation just before each measurement is taken.

Another automatic instrument function determines the optimum injected pulse amplitude to the YTM. This occurs during an AUTO PEAK operation, and for vernier power level changes $\geq$ 0.4 dB. During this operation, the instrument switches briefly to CW for about 200 μs. Pulse mode is then re-enabled and the injected pulse amplitude is the correct value to produce fast risetime pulses. Frequency switching speed is slowed to about 100 ms by this process.

If these bursts of CW power are objectionable, they can be eliminated by exploiting the following feature. At any one frequency, when the vernier is used to change the output power level by more than 0.4 dB, a "scratch pad" memory stores the correct injected pulse amplitude for that power level. Subsequent operation at that power level uses the "scratch pad" data instead of switching to CW to update the pulse control parameters. By sweeping over the entire −10 to +10 dBm power range for each frequency of operation, the "scratch pad" memory will contain all the necessary data for pulse operation at any power level, and no further switching to CW will occur at that frequency. A change of frequency erases the memory, and the pulse parameters must be "re-learned."

CHANGE 1

Page 1-3:

Change Option 006 (Chassis Slide Mount Kit) to 1494-0059.
Change Slide Mount Adapter to 1494-0061.

CHANGE 2

Page 3-2, Figure 3-1 (foldout):

A different figure is needed. Mark your manual with a reference to Figure 3-1 in this supplement.

Page 3-2:

Under STORE/RECALL, substitute the following:

STORE/RECALL

Up to nine front panel settings can be stored for later use. All Signal Generator front panel functions can be stored, although OUTPUT LEVEL VERNIER is stored in remote mode only.

SHIFT STO
[ ] [RCL] [3] stores a front panel setting in register 3.

[RCL] [4] recalls a front panel setting stored in register 4 and changes the output of the Signal Generator to the recalled parameters.

Page 3-3:

Mark page 3-3 ("SWEEP"), with a reference to the addition of the page labeled "SYSTEM" in this supplement.

CHANGE 2 (cont'd)

Page 3-6, paragraph 3-13:
Change to read as follows:

3-13. ALC (Automatic Level Control)

Output power leveling for the instrument's frequency range occurs from four sources selected by the operator. These sources are:

a. INTERNAL
b. DIODE
c. PWR MTR (Power Meter)
d. SYS (System)

Above subparagraph "**CAL Adjustments.**" insert the following:

SYS (System). RF output power is leveled externally using a feedback voltage proportional to the system output power in volts per dB. (A system is the Signal Generator with an external amplifier, multiplier, etc.). The reference voltage must be 0 Vdc at 0 dBm system output and change 30 mV per dB. This voltage is connected to the Signal Generator's EXT ALC IN connector.

Pages 3-8 through 3-13, Figures 3-2 through 3-7:
Different figures are needed. Mark your manual with references to Figures 3-2 through 3-7 in this supplement.

Page 3-41, Table 3-7:
A different table is needed. Mark your manual with a reference to Table 3-7 in this supplement.

Revised Material For Page 3-2 (1 of 2)
Sht 1 of 3

FRONT PANEL FEATURES

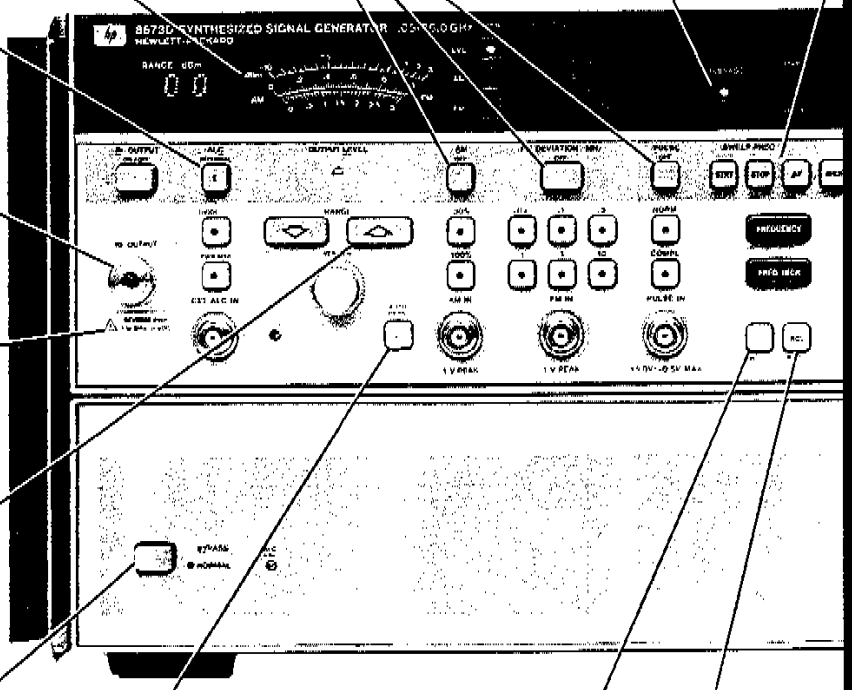
Message key illuminates or flashes to indicate input errors or hardware failures. Depressing the key displays error/malfunction code in frequency display.

Calibrated metering of output level vernier, AM depth, and FM deviation.

Amplitude, frequency, and pulse modulation of microwave carrier via external modulating signals.

Start/stop or ... up to five synt... FREQ keys, w... FREQ, allow c... plication and ...

Leveling of output power by internal, external diode, external power meter, or system references.



Output level settable from +13 to -100 dBm. Resolution is 0.1 dB under HP-IB control.

⚠ The RF Output is protected againt reverse power applications up to 1W. However, for best protection of internal circuitry, do not apply any reverse power.

Output level controlled in 10 dB steps from +10 to -90 dBm with -10 to +3 dB continuous level vernier.

BYPASS/NORMAL key bypasses RF filters in the lower (A5) section. These filters improve spectral purity in the NORMAL mode. For frequencies below 2.0 GHz, the Signal Generator automatically switches to the NORMAL mode. BYPASS mode permits wider sweep ranges in AUTO SWEEP mode.

AUTO PEAK function maximizes available output power at RF connector and optimizes pulse modulation characteristics.

Store and recall up to 9 ... tings for measurement e...

Blue SHIFT key allows access to secondary functions of certain keys. Keys containing shift functions are labeled with that function in blue.

Refer to Figure 3-2 through 3-6 for d... description of these features.

Figure 3-1. Front Panel Features

Revised Material for Page 3-2 (1 of 2)
Sht 2 of 3

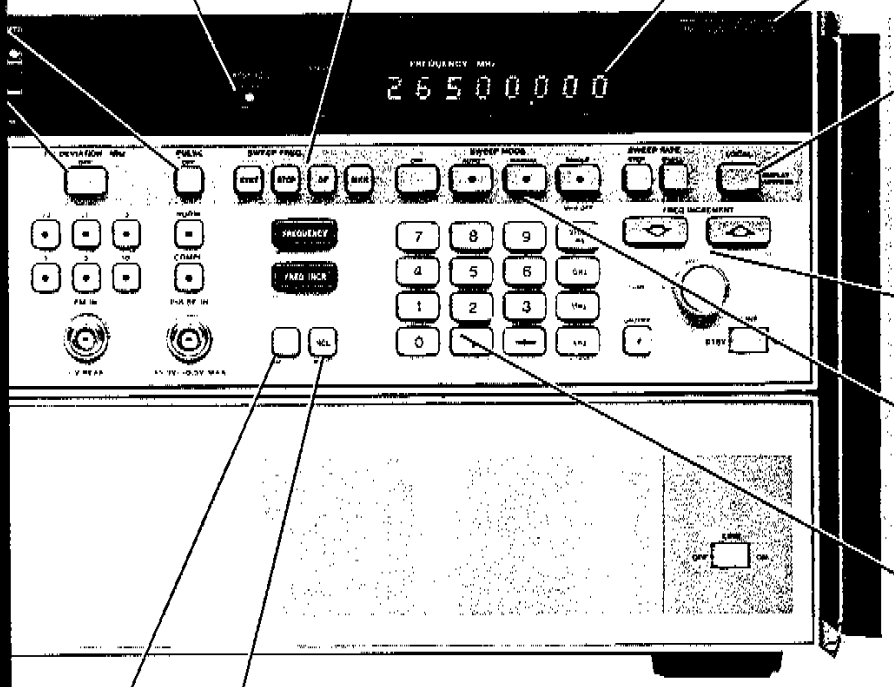
S

sage key illuminates or flashes to
ate input errors or hardware
es. Depressing the key displays
/malfunction code in frequency
ay.

Start/stop or Δf sweep is selectable with up to five synthesized markers. SWEEP FREQ keys, when shifted to SYSTEM FREQ, allow control of frequency multiplication and offset.

11-digit LED display for all frequency related parameters and error/malfunction messages.

Annunciators monitor instrument modes for confidence in operational status.



HP-IB address displayed and set by front panel keystroke sequence.

Rotary pulse generator tuning knob and up/down increment keys change frequency in user-selected steps.

AUTO, MANUAL, and SINGLE digital sweep modes.

Frequency entered by function, data, and unit keys. XFREQ key is used as a units key for entry of frequency multiplication factors.

Store and recall up to 9 front panel settings for measurement efficiency.

IFT key allows access to sec-
functions of certain keys. Keys
ng shift functions are labeled
t function in blue.

**to Figure 3-2 through 3-6 for detailed
iption of these features.**

Figure 3-1. Front Panel Features

Revised Material For Page 3-2 (1 of 2)
Sht 3 of 3

SYSTEM

SYSTEM MODE PRESET CONDITIONS

Press [RCL] [←] to invoke an alternate set of preset conditions more suitable for system mode. (System mode enables the Signal Generator to control a compatible external amplifier, multipler, etc.) These preset conditions are shown below.

RF OUTPUT to **ON**
OFFSET = 0
MULTIPLIER unchanged
RANGE to −70 dBm (except Options 001 and 005)
RANGE to 0 dBm (for Options 001 and 005)
AUTO PEAK to **ON**
Meter Scale to **LVL**
FREQUENCY to 14 000.000 MHz × multiplier
FREQ INCR to 1.000 MHz × multiplier
START to 13 000.000 MHz × multiplier
STOP to 15 000.000 MHz × multiplier
ΔF to 2 000.000 MHz × multiplier
MKRS to **OFF** (initialized to 3, 6, 9, 12, and 18 GHz × multiplier)
SWEEP MODE to **OFF**
STEP to 100 steps (20.000 MHz × multiplier)
DWELL to 20 ms
TUNE knob to **ON**

SYSTEM FREQUENCY (OFFSET and MULTIPLIER)

The SYSTEM FREQ (shifted SWEEP FREQ) keys are used to enter and display offset or multiplied frequencies. (For use with external devices such as multipliers, mixers, etc.)

OFFSET

To set an offset of + (or −) 10 MHz (for example, for use with an external mixer) press:

[SHIFT] [+OFFSET] (or [-OFFSET]) [1] [0] [MHz]

The entered and displayed frequency is 10 MHz *above* (or *below*) the Signal Generator's actual output frequency.

To end the use of the offset function press:

[SHIFT] [+OFFSET] (or [-OFFSET]) [0] [MHz]

MULTIPLIER

To accommodate an external x2 multiplier press:

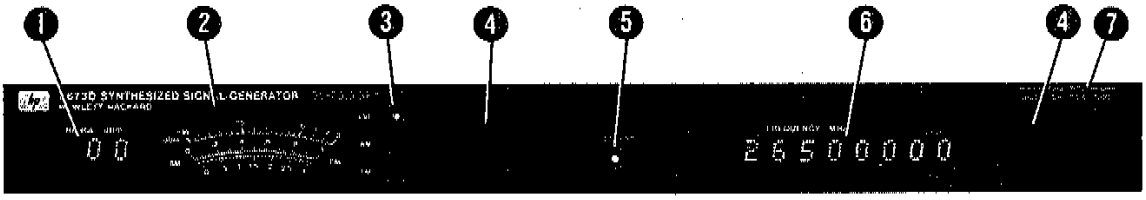
[SHIFT] [MULT] [2] [XFREQ]

The displayed frequency will be twice the signal Generator's actual output frequency.

Note: When in multiplier mode, enter frequencies according to desired output. For example, to obtain 30 GHz, enter 30 GHz into the keyboard. The Signal Generator will output 15 GHz into the x2 frequency multiplier.

To end the use of the multiplier function press:

[SHIFT] [MULT] [1] [XFREQ]



1 RANGE dBm Display. Indicates the selected range of the RF output in 10 dB steps from −90 to +10 dBm. Range is set by the RANGE (◀ and ▲) keys.

2 Meter. Monitors power level, AM depth, or FM deviation. Meter function is selected by the MTR keys.

3 MTR Keys. Select the meter function.

LVL: selects OUTPUT LEVEL VERNIER for −10 to +3 dB scale indication. Read relative to the RANGE dBm display.

AM: selects 30% (read on the 0 to 3 scale) or 100% (read on the 0 to 1 scale) AM depth, full scale. A 1 volt peak signal applied to the AM IN connector develops full scale modulation.

FM: selects FM deviation. Full scale indication read on the 0 to 3 scale is 30 kHz, 300 kHz, or 3 MHz. Full scale indication read on the 0 to 1 scale is 100 kHz, 1 MHz, or 10 MHz. A 1 volt peak signal applied to the FM IN connector develops full scale modulation.

4 Status Annunciators. Display the internal conditions of the Signal Generator.

OFFSET: lights when a frequency offset other than zero is entered. The displayed frequency is higher (+OFFSET) or lower (−OFFSET) than the actual output frequency.

MULTIPLIER: lights when a frequency multiplier greater than one is entered. The displayed frequency is the output frequency times the multiplier.

UNLEVELED: lights when RF OUTPUT is turned off, more power is requested than is available, no signal is applied to EXT ALC IN when PWR MTR, DIODE, or SYS is selected, no signal is applied to PULSE IN when NORM pulse mode is selected, overmodulation occurs in AM mode, or pulse width is less than 100 ns.

FM OVERMOD: lights when the signal applied to the FM IN connector exceeds 1 volt peak or when the modulation index exceeds 5 (2.0 to 6.6 GHz), 10 (6.6 to 12.3 GHz), 15 (12.3 to 18.6 GHz), or 20 (18.6 to 26.0 GHz). The modulation index is equal to the maximum peak deviation divided by f_{mod}. Refer to Table 1-1, Specifications, for additional information.

STANDBY: lights when power is applied but the LINE switch is in the STBY position.

OVEN COLD: lights when the crystal oven is not up to nominal operating temperature.

ϕUNLOCKED: lights when one or more of the phase lock loops is unlocked, the RF OUTPUT is OFF, or the INT-EXT switch is in the EXT position with no external reference connected.

EXT REF: lights when the rear panel INT-EXT switch is in the EXT position.

5 MESSAGE Key. Lights to indicate entry errors and flashes to indicate hardware malfunctions. A two-digit code appears in the FREQUENCY MHz display when this key is pressed. Refer to the pull-out card or the Messages Detailed Operating Instruction for an explanation of the codes.

6 FREQUENCY MHz Display. Normally indicates output frequency. Message codes and previously set values for FREQ INCR, SWEEP FREQ, and SWEEP RATE functions are displayed for as long as their respective keys are pressed.

7 HP-IB STATUS Annunciators. Indicate the status of the Signal Generator when it is operating via the HP-IB.

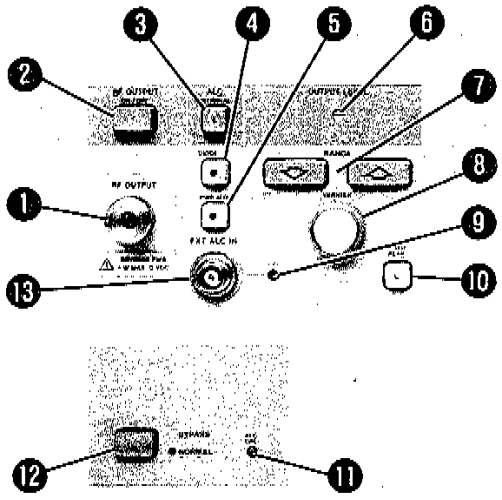
RMT: lights when the Signal Generator is in remote mode.

LSN: lights when the Signal Generator is addressed to listen.

TLK: lights when the Signal Generator is addressed to talk.

SRQ: lights when the Signal Generator is issuing the Require Service message.

Figure 3-2. Displays and Status Annunciators



1 RF OUTPUT Connector. 50 ohm APC 3.5 male connector supplies RF output over the entire frequency range of 0.01 to 26.5 GHz.

2 RF OUTPUT ON/OFF Key. Completely turns off the RF output when set to OFF. Setting the RF output to OFF causes the NOT ϕ LOCKED and ALC UNLEVELED status annunciators to light. When the RF OUTPUT is set to ON, the Signal Generator returns to normal operation.

3 INTERNAL Key. Selects internal circuitry for leveling the output power at the front panel RF OUTPUT connector.

4 DIODE/SYS Key. Normal operation (Diode). Selects external mode for leveling power using an external diode detector. The output of the diode is connected to the Signal Generator's EXT ALC IN connector. Shifted function (SYS). Selects the system leveling mode. RF output power is leveled externally using a feedback voltage proportional to the system output power in volts per dB. (A system is the Signal Generator with an external amplifier, multiplier, etc.). The reference voltage must be 0 VDC at 0 dBm system output and change 30 mV per dB. This voltage is connected to the EXT ALC IN connector. When SYS is selected, both the EXTERNAL and DIODE keys will light.

5 PWR MTR Key. Selects external leveling mode for leveling power using an external power meter. The output of the power meter is connected to the EXT ALC IN connector.

6 Mechanical Meter Zero. Sets meter suspension so that the meter indicates zero when power is removed from the Signal Generator and the Signal Generator is in its normal operating position.

7 OUTPUT LEVEL RANGE Keys (▼ and ▲). Selects the RF output level range in 10 dB steps from −90 to +10 dBm. The selected range is displayed in the RANGE dBm display.

8 OUTPUT LEVEL VERNIER. Adjusts the RF output level over the range of −10 to +3 dB, relative the LVL scale as read on the meter.

9 AUTO PEAK Key. Maximizes power at the output frequency and optimizes pulse shape for pulse modulation.

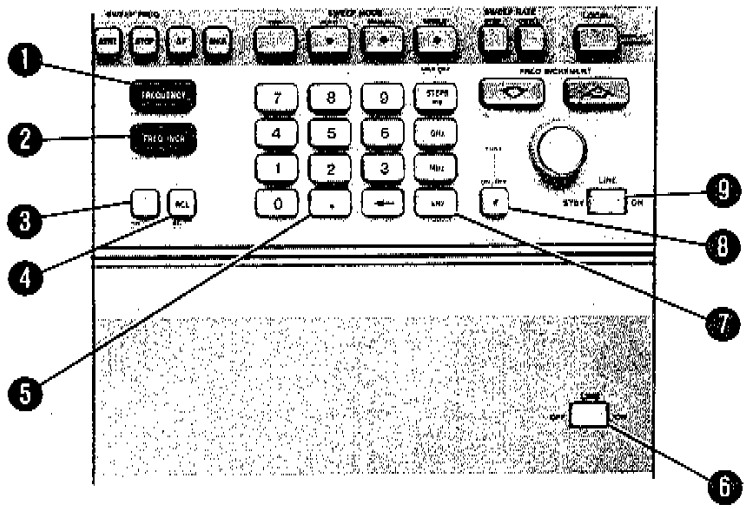
10 CAL Control. Adjusts the power level at the load when using a diode detector or power meter for external leveling in 2—26.5 GHz frequency range.

11 ALC CAL Control. Same as (10) in the 0.01 to <2.0 GHz frequency range.

12 BYPASS/NORMAL key. Used to switch the signal generator between BYPASS and NORMAL modes. The HP 8673C/D has RF filters for improving spectral purity in the NORMAL mode. These filters are bypassed in the BYPASS mode. For frequencies below 2.0 GHz, the signal generator automatically switches to the NORMAL mode.

13 EXT ALC IN Connector. BNC female connector with high input impedance (approximately 50 kΩ). Accepts positive or negative leveling signals from either a diode detector or power meter.

Figure 3-3. Output Level Features



1 FREQUENCY Key. Used as a prefix to the Data and Units keys to set a continuous wave (CW) frequency or center frequency for a ΔF sweep.

2 FREQ INCR Key. Used as a prefix to the Data and Units keys to set the step size for the FREQ INCREMENT ▼ and ▲ keys or the TUNE knob. Pressing the FREQ INCR key recalls the current increment value to the FREQUENCY MHz display (for as long as the key is depressed).

3 SHIFT Key. Used as a prefix to obtain functions of certain keys. Keys containing shifted functions are labeled with that function in blue.

4 RCL/STO Key. Normal operation (RCL). Used as a prefix to a numeric key (a single digit 0—9 to identify the storage register) to recall the contents saved in that register. Shifted function (STO). Used as a prefix to a numeric key (a single digit 1—9 to identify the storage register) to save current instrument settings in an internal register.

RCL0 is used to preset the front panel. Refer to Simplified Operation in this section for a list of preset conditions.

5 Data Keys (0—9, . and ←). Used with Function keys (that is, FREQUENCY, FREQ INCR, and sweep function keys) and Units keys to set value-selectable parameters. Data keys 1—9 are also used with STO and RCL to identify the storage register.

The backspace key (←) clears one digit at a time starting with the least significant digit. It is used only during data entry and before any Units key is pressed.

6 LINE Switch. Applies power to the lower unit of the Signal generator when set to the ON position. When set to the OFF position and 8 is set to the ON position, the FREQUENCY MHz display will show a moving dot display until 9 is set to the ON position.

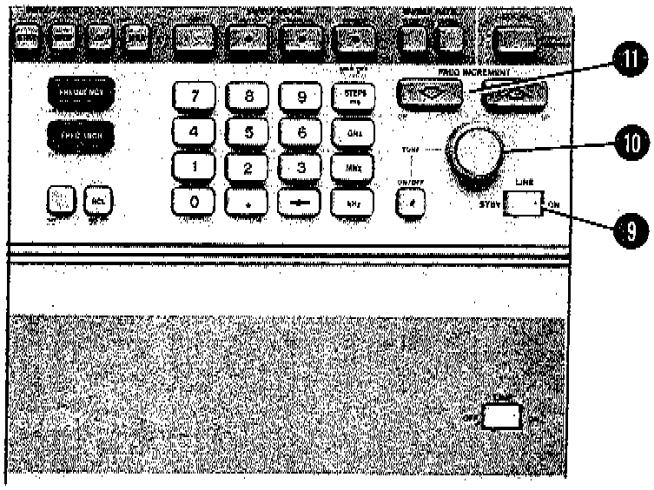
7 Units Keys (MKR OFF/STEPS/ms, GHz, MHz, and kHz). Used as a suffix to Function and Data keys to set value-selectable parameters. Frequency entries can terminate in GHz, MHz, or kHz but they are always displayed in MHz.

The MKR OFF/STEPS/ms key serves as a terminator for setting the number of steps in a sweep, the dwell time in ms, or as a means of turning off markers. The selected function automatically determines the applicable terminator.

The STEPS/ms key contains a shifted function (XFREQ). This function is used as a terminator for the multiplier entry function. Entry sequence is (SHIFT) (START) (m) (n) (STEPS/ms). The digits (m) and (n) represent the multiplier number (1—99) and may be entered as a single digit.

8 TUNE ON/OFF Key. Enables the TUNE knob when ON; disables the TUNE knob when OFF. The key LED lights when it is ON.

Figure 3-4. Frequency Control Features and LINE Switch (1 of 2)

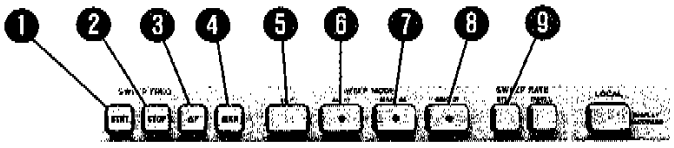


9 LINE Switch. Applies power to the Signal Generator when set to the ON position. Power is supplied to the crystal oven and the battery charger circuit in the STBY and ON positions.

10 TUNE Knob. Changes the CW frequency by the value set with FREQ INCR. The knob is enabled by the ON/OFF key. The knob also serves as a manual sweep mode control.

11 FREQ INCREMENT ◀ and ▲ Keys. Decrease or increase the CW frequency in steps; the step size is set with the FREQ INCR key. Holding either key down causes the frequency to continuously change. These keys also serve as a manual sweep mode control.

Figure 3-4. Frequency Control Features and LINE Switch (2 of 2)



SWEEP FREQ

1 START KEY. Normal operation (START). Used as a prefix to the Data and Units keys to set the beginning frequency of a sweep. Pressing this key displays the present START value in the FREQUENCY MHz display (for as long as the key is depressed). Shifted function (MULT). Used as a prefix to the Data and Units keys. Invokes the multiplier mode of operation and allows entry of the frequency multiplication factor. The entered multiplication factor affects all frequencies; that is, markers, increments, FM deviation, CW, sweep, and center frequencies. The multiplication effect on FM deviation is not indicated on the FM meter.

2 STOP Key. Normal operation (STOP). Used as a prefix to the Data and Units keys to set the ending frequency of a sweep. Pressing this key displays the present STOP value in the FREQUENCY MHz display (for as long as the key is depressed). Shifted function (+ OFFSET). Used as a prefix to the Data and Units keys. Invokes the offset mode of frequency entry and display. Frequency entries will be displayed as entered but the actual instrument output frequency will be the offset amount BELOW the entered and displayed frequency.

3 ΔF Key. Normal operation (ΔF). Used as a prefix to the Data and Units keys to set sweep span. Pressing this key displays the present span value in the FREQUENCY MHz display (for as long as the key is depressed). Center frequency of the span is set with the FREQUENCY key. Shifted function (– OFFSET). Used as a prefix to the Data and Units keys. Invokes the offset mode of frequency entry and display. Frequency entries will be displayed as entered but the actual instrument output frequency will be the offset amount ABOVE the entered and displayed frequency.

4 MKR Key. Enables previously selected marker frequencies when used as a prefix to Data keys 1 through 5. For example, pressing MKR and 1 enables Marker 1. When used as prefix to the Data and Units keys, it sets marker frequencies. For example, pressing MKR, 3, 15, and GHz sets the frequency of Marker 3 to 15 GHz. (The first digit pressed after the MKR key is always the marker number.) Pressing the MKR key displays all currently enabled marker numbers within the set sweep range in the FREQUENCY MHz display. Pressing the MKR key and a Data key displays the present frequency of the requested marker.

SWEEP MODE

5 OFF Key. Disables the sweep.

6 AUTO Key. Starts a repetitive sweep (restarting at the end of each sweep). Executes single sweep only if sweep range includes 2, 3.5, 6, 16, or (HP 8673D only), 22 MHz in NORMAL mode, (see Additional Operating Information, paragraph 3-14).

7 MANUAL Key. Enables the sweep circuitry. It does not start a sweep. The TUNE knob (if enabled) or the FREQ INCREMENT (▼ and ▲ keys) control the sweep.

8 SINGLE Key. Arms the trigger for single sweep and tunes the Signal Generator to the start frequency. The sweep does not begin until the key is pressed again to trigger the sweep. When pressed during a sweep, the in-progress sweep aborts and rearms the trigger.

SWEEP RATE

9 STEP Key. Used as a prefix to the Data and Units keys to set the number of steps or the size of each step of a sweep. When the entry is terminated by STEPS, the number of steps is set. When the

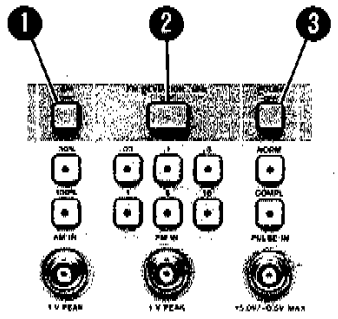
Figure 3-5. Sweep Features and LOCAL Key (1 of 2)

entry is terminated by GHz, MHz, or kHz, the step size is set. When this key is pressed, the number of steps is displayed on the left side of the FREQUENCY MHz display and the step size is displayed on the right side. The maximum number of steps allowed is 9999.

10 DWELL Key. Used as a prefix to the Data and ms keys to set the time interval between sweep steps. Pressing this key displays the present dwell time value in the FREQUENCY MHz display (for as long as the key is depressed). The allowable values for dwell time range from 1 to 255 ms.

11 LOCAL/DISPLAY ADDRESS Key. Returns the Signal Generator to local keyboard control from HP-IB (remote) control provided the instrument is not in local lockout. Also displays the current HP-IB address in the FREQUENCY MHz display for as long as the key is depressed.

Figure 3-5. Sweep Features and LOCAL Key (2 of 2)



1 AM

AM OFF Key. Disables AM.

AM 30% Key. Enables AM and selects 30% full scale modulation for 1 volt peak applied to the AM IN connector.

AM 100% Key. Enables AM and selects 100% full scale modulation for 1 volt peak applied to the AM IN connector.

AM IN Connector. BNC female connector with an input impedance of 600 ohms. 1 volt peak sets full scale modulation as selected by the AM 30% or 100% key. AM depth varies linearly with the input signal level.

2 FM DEVIATION

FM DEVIATION MHz OFF Key. Disables FM.

FM DEVIATION Keys (.03, .1, .3, 1, 3, and 10). Enables FM and selects the peak deviation sensitivity in MHz obtained when a signal is applied to the FM IN connector. The peak deviation is read on the meter. This deviation is not corrected when an external frequency multiplier is used. For example, if a frequency doubler is being used, the actual frequency deviation will be twice that shown on the meter.

FM IN Connector. BNC female connector with an input impedance of 50 ohms. 1 volt peak gives full scale modulation. Deviation varies linearly with the input signal level. Deviation ranges are controlled by the FM DEVIATION keys.

3 PULSE

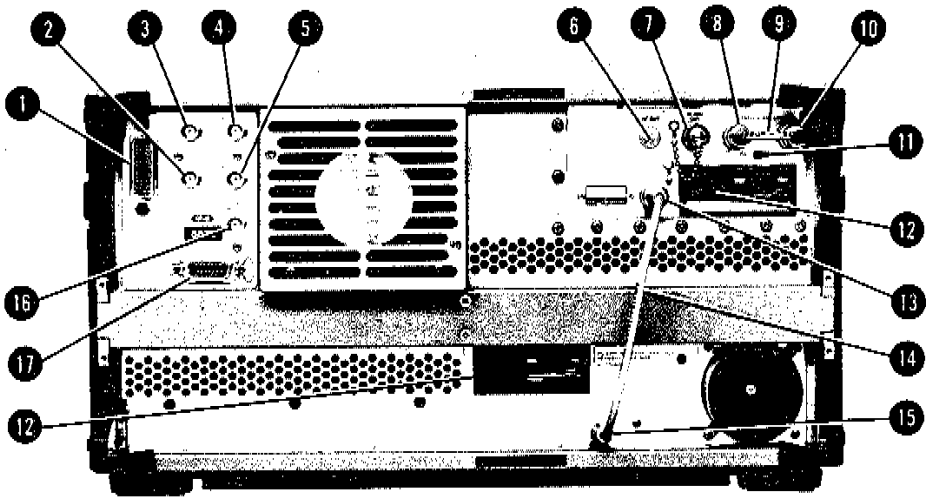
PULSE OFF Key. Disables pulse modulation.

NORM (Normal Mode) Key. Triggers RF output on when the signal to the PULSE IN connector is greater than 2.4 volts.

COMP (Complement Mode) Key. Triggers RF output on when the signal to the PULSE IN connector is less than 0.4 volts.

PULSE IN Connector. BNC female connector with an input impedance of 50 ohms. Accepts TTL levels.

Figure 3-6. Modulation Features



1. **HP-IB Connector.** Connects the Signal Generator to the Hewlett-Packard Interface Bus for remote operation.
2. **FREQ REF.** BNC female connector. Output impedance is 100Ω nominal. Provides a .5 V/GHz ramp that is always on, even when sweep is off.
3. **SWP OUT.** BNC female connector. Output impedance is 100Ω nominal. Provides a 0 to +10V ramp from start to stop. An internal adjustment can set the slope of the ramp from 0 to between +4 and +12V.
4. **TONE MKR.** BNC female connector. Output impedance is 600Ω nominal, 5 kHz sine wave. Can be connected to front panel AM IN to provide AM markers.
5. **PEN LIFT.** BNC female connector. TTL-high lifts pen; TTL-low lowers pen. 100 ms delay to lift or lower pen in single sweep mode.
6. **RF OUT (A3J6).** For Options 004 and 005 only. 50Ω APC 3.5 male output connector.
7. **10 MHz OUT (A3J8).** 0 dBm (nominal) into 50Ω, can be used as an external timebase and for troubleshooting.
8. **FREQ STANDARD Output (A3J9).** 10.000 MHz into 50Ω at +7 dBm (nominal) from the internal frequency standard except when INT/EXT switch is in the EXT position.
9. **Jumper (A3W3).** Normally connects the Internal Frequency Standard Output (A3J9) to the External Frequency Standard Input (A3J10).
10. **FREQ STANDARD Input (A3J10).** Normally connected by A3W3 to A3J9. Also used to connect an external frequency standard of 5 or 10 MHz at 0 dBm to the Signal Generator.
11. **FREQ STANDARD INT/EXT Switch.** Normally left in the INT position. Removes power from internal frequency standard when in the EXT position.
12. **Line Power Modules.** Permit operation from 100, 120, 220, or 240 Vac. The number visible in the window displays the nominal line (mains) voltage for which the module is set (see Figure 2-1). The protective grounding conductor connects to the Signal Generator through this module. The line power fuse is part of this module and is the only part to be changed by the operator.
13. **100 MHz OUT (A3J7).** 0 dBm (nominal) into 50Ω; can be used as an external timebase and for troubleshooting. Reference frequency connected to A5J1 to phase lock internal internal circuits.
14. **Jumper (W60).** Connects the 100 MHz reference output (A3J7) to the reference input A5J1.
15. **100 MHz REF INPUT (A5J1).** Connected to A3J7 by W60 to phase lock internal circuits.
16. **BLANKING/MARKER.** BNC female connector. Output impedance is 100Ω nominal. Provides +5V at the beginning of each frequency change for blanking a swept display (to eliminate display of switching transients). Goes to −5V during remainder of frequency step for Z-Axis intensity marker or to 0V for non-marker frequencies.
17. **AUX Connector.** Allows remote control of frequency increment, display blanking, register recall, and start and stop sweep. Refer to Table 3-3, AUX Connector Functions, for additional information.

Figure 3-7. Rear Panel Features

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: HP 8673C/D
Date Printed: March 1984
Part Number: 08673-90021

SYNTHESIZED SIGNAL GENERATOR
VOLUME I

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
2232A, 2410A	Errata Only
2413A, 2417A	Errata Only
2426A, 2446A	Errata Only
2447A, 2452A	Errata Only
2510A, 2511A,	Errata Only
2512A	Errata Only

Serial Prefix or Number	Make Manual Changes

► NEW ITEM

ERRATA

Page 1-4, Table 1-1:
Add the following at the top of the table.

NOTE

Specifications and characteristics apply after a 1 hour warm-up, over the temperature range 0-55 C° (except specifications for harmonically related spurious signals, RF output level, pulse peak level accuracy, and amplitude modulation, which apply over the range +15 to +35 C°), after an AUTO PEAK operation has been performed. For additional information concerning the use of AUTO PEAK, refer to Sections 3-11 and 3-12.

Specifications for output flatness, absolute level accuracy, and modulation apply only when internal leveling is used.

Page 1-3, Option 913:
Change Rack Flange Kit to HP Part number 5061-2073.

Page 1-5, Table 1-1:
Change Harmonics, 0.05 to 1.2 GHz, to −35 dBc.
Change the second footnote (**) to read:
"In the 0.05 to <2.0 GHz band, carrier-frequency independent spurious outputs may exist in the >50 MHz to 100 MHz range at <−55 dBc, and in the 10 MHz to 50 MHz range at −40 dBc."

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

30 May 1985
3 Pages

HEWLETT PACKARD

Printed in U.S.A.

ERRATA (cont'd)

Page 1-7, Table 1-1:

Change Rise and Fall Times		AUTO PEAK executed
to	< 30 ns	0.05 to 0.1 GHz
	< 20 ns	0.1 to < 2.0 GHz
	< 40 ns	2.0 to 26 GHz
Change Overshoot, Ringing to:		
	< 35%	0.05 – 0.1 GHz
	< 25%	0.1–6.6, 7.2–26 GHz
	< 30%	6.6–7.2 GHz

Page 2-5, Figure 2-4:
Add the following: **A3W18 HP-IB Adapter** HP part number 5060-9462.

Page 3-6, paragraph 3-11:
Replace the entire paragraph with the following text.

3-11. AUTO PEAK

Major power and pulse modulation specifications are not warranted unless an AUTO PEAK operation has been performed. An AUTO PEAK operation is automatically performed when the frequency changes by more than 20 MHz while AUTO PEAK is enabled. AUTO PEAK is automatically enabled when the instrument is turned on, or when PULSE mode is selected. The front panel AUTO PEAK button toggles the state of the instrument between AUTO PEAK enabled and disabled mode. A user-initiated AUTO PEAK operation may be performed manually at any time by pressing the AUTO PEAK button twice to disable and re-enable AUTO PEAK. The actual peaking operation occurs when the AUTO PEAK is switched from the disabled to enabled mode. Under program control, disabling, enabling, and performing an AUTO PEAK operation can all be controlled separately with the K0, K1, and K2 commands. See Table 3-7.

Page 3-6, paragraph 3-12:
Replace the entire paragraph with the following text.

3-12. PULSE MODE

The automatic execution of the AUTO PEAK function by the instrument's internal microprocessor ensures that key power and pulse specifications are met for nearly all circumstances (see Section 3-11). Three conditions that may necessitate a user-activated AUTO PEAK are: load changes, extreme frequency changes, and, in rare circumstances, frequency changes slightly less than 20 MHz.

(a) Changes of load impedance can shift the center frequency of internal filters and necessitate another AUTO PEAK operation. This could occur if highly reactive loads are switched in and out in automatic test systems.

(b) Large frequency changes cause extreme changes in the self-heating of internal YIG filters. Although most of the resulting drift occurs in 15-20 seconds, complete settling may take up to 15 minutes. Some experimentation may be needed to determine when AUTO PEAK is necessary for this type of measurement.

(c) Finally, on rare occasions, pulse overshoot parameters may drift out of specified range for frequency changes just less than 20 MHz.

To be confident of obtaining warranted instrument performance, perform an AUTO PEAK operation just before each measurement is taken.

ERRATA (cont'd)

Page 3-6, paragraph 3-12 (cont'd)

Another automatic instrument function determines the optimum injected pulse amplitude to the YTM. This occurs during an AUTO PEAK operation, and for vernier power level changes >= 0.4 dB. During this operation, the instrument switches briefly to CW for about 200 μs. Pulse mode is then re-enabled and the injected pulse amplitude is the correct value to produce fast risetime pulses. Frequency switching speed is slowed to about 100 ms by this process.

If these bursts of CW power are objectionable, they can be eliminated by exploiting the following feature. At any one frequency, when the vernier is used to change the output power level by more than 0.4 dB, a "scratch pad" memory stores the correct injected pulse amplitude for that power level. Subsequent operation at that power level uses the "scratch pad" data instead of switching to CW to update the pulse control parameters. By sweeping over the entire −10 to +10 dBm power range for each frequency of operation, the "scratch pad" memory will contain all the necessary data for pulse operation at any power level, and no further switching to CW will occur at that frequency. A change of frequency erases the memory, and the pulse parameters must be "re-learned."

CONTENTS

LIST OF ILLUSTRATIONS

TABLES

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

SAFETY EARTH GROUND

An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

WARNINGS

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between the unit under test and this instrument prior to energizing either unit.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the mains supply).

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (see Table of Contents for page references).

Indicates hazardous voltages.

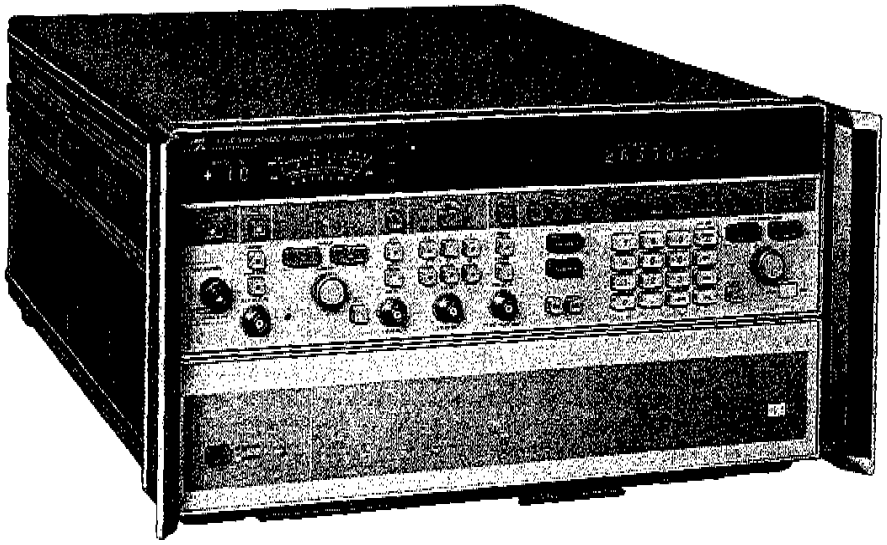
Indicates earth (ground) terminal.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

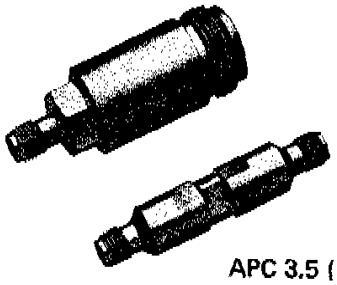
CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.



HP 8673C/D

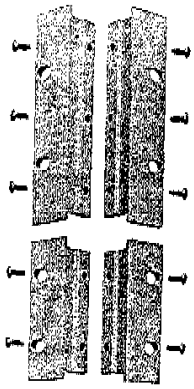
APC-3.5 (F) to TYPE-N (F)
ADAPTER



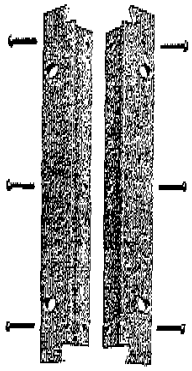
APC 3.5 (F-F)
ADAPTER

LINE POWER CABLE

LINE POWER CABLE



OPTION 908
RACK FLANGE KIT



OPTION 913
RACK FLANGE KIT
FOR INSTRUMENTS WITH HANDLES

Figure 1-1. **HP 8673C/D with Accessories Supplied, and Options 908 and 913 (HP 8673D shown).**

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains information required to install, operate, test, adjust and service the HP 8673C/D Synthesized Signal Generators. Figure 1-1 shows an 8673D Signal Generator with all of its externally supplied accessories.

The 8673C/D Operating and Service manual is divided into two volumes and eight sections as follows:

Volume 1 (Operating Information):
- Section I, General Information
- Section II, Installation
- Section III, Operation
- Section IV, Part 1 Operation Verification

Volume 2 (Service Information)
- Section IV, Part 2 Performance Tests
- Section V, Adjustments
- Section VI, Replaceable Parts
- Section VII, Manual Changes
- Section VIII, Service

The 8673C/D 10 MHz Reference Oscillator A3A8, is a field repairable component. A separate operating and service manual, HP Part No. 10811-90002, is provided for this assembly and should be retained with the 8673C/D manual.

In addition, the following manuals are supplied with the Signal Generator:
- Volume 1 (two copies)
- Volume 2 (one copy)

One copy of Volume 1 (Operating Information) should remain with the instrument for use by the operator. Additional copies of either volume can be ordered separately through your nearest Hewlett-Packard office. The part number is listed on the title page of each volume.

Also listed on the title page of this volume, below the manual part number, is a microfiche part number. This number may be used to order 100 x 150 millimetre (4 x 6 inch) microfilm transparencies of the complete operating and service manual (Volumes 1 and 2). Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement, as well as all pertinent Service Notes.

1-2. SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument may be tested. Supplemental characteristics are listed in Table 1-2. Supplemental characteristics are not warranted specifications, but are typical characteristics included as additional information for the user.

1-3. SAFETY CONSIDERATIONS

This product is a Safety Class I instrument, that is, one provided with a protective earth terminal. The Signal Generator and all related documentation should be reviewed for familiarization with safety markings and instructions before operation. Refer to the Safety Considerations page found at the beginning of this manual for a summary of the safety information. Safety information for installation, operation, performance testing, adjustment, or service is found in appropriate places throughout this manual.

1-4. INSTRUMENTS COVERED BY THIS MANUAL

Attached to the rear panel of the instrument is a serial number plate. The serial number is in the form: 0000A00000. The first four digits and the letter are the serial number prefix. The last five digits are the suffix. The prefix is the same for identical instruments; it changes only when a configuration change is made to the instrument. The suffix, however is assigned sequentially and is different for each instrument. The contents of this manual apply directly to instruments having the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-5. MANUAL CHANGES SUPPLEMENT

An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates that the instrument is different from those documented in this manual. The

MANUAL CHANGES SUPPLEMENT (cont'd)

manual for this newer instrument is accompanied by a Manual Changes supplement. The supplement contains "change information" that explains how to adapt this manual to the newer instrument.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep the manual as current and as accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-6. DESCRIPTION

The HP 8673C Synthesized Signal Generator has a frequency range of 0.05 to 18.6 GHz (0.01 to 18.6 GHz overrange). The HP 8673D Synthesized Signal Generator has a frequency range of 0.05 to 26.0 GHz (0.01 to 26.5 GHz overrange). The output is leveled and calibrated from +12 dBm to −100 dBm, depending on the frequency and options. For additional information, see Table 1-1. AM, FM, and pulse modulation modes can be selected. Frequency, output level, modulation modes, and most other functions can be remotely programmed via HP-IB.

Long-term frequency stability is dependent on the time base, either an internal or external reference oscillator. The internal crystal reference oscillator operates at 10 MHz while an external oscillator may operate at 5 or 10 MHz. The output of the Signal Generator is exceptionally flat due to the action of the internal automatic leveling control (ALC) loop.

External drive signals are required for all modulation modes. AM depth and FM deviation vary linearly with the applied external voltage. Full scale modulation is attained with a 1.0 volt peak signal. Pulse modulation is compatible with TTL levels.

Two ranges of AM depth can be selected: 30% and 100%. The front panel meter can be used to set AM depth. Specified AM rates are from 20 Hz to 100 kHz.

Six ranges of FM deviation are selectable: 0.03, 0.1, 0.3, 1, 3, and 10 MHz. FM peak deviation can be set using the front panel meter. At output frequencies below 6.6 GHz, peak deviation is limited to 10 MHz or five times the modulation frequency, whichever is lower. From 6.6 to 12.3 GHz, peak deviation is limited to the lesser of 10 MHz or ten times the modulation frequency; from 12.3 to 18.6 GHz the lesser of 10 MHz or fifteen times the modulation frequency; from 18.6 to 26.0 GHz the lesser of 10 MHz or twenty times the modulation frequency. Usable modulation rates fall between 100 Hz and 10 MHz.

Pulse modulation has two operating modes: NORM (normal mode) and COMPL (complement mode). In normal mode the RF output is On when the drive signal is the TTL high state. In the complement mode the RF output is On when the drive signal is in the TTL low state.

The Signal Generator is compatible with HP-IB to the extent indicated by the following code: SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP1, DC1, DT1, and C0. The Signal Generator interfaces with the bus via three-state TTL circuitry. An explanation of the compatibility code can be found in IEEE Standard 488 (1978), "IEEE Standard Digital Interface for Programmable Instrumentation" or the identical ANSI Standard MC1.1. For more detailed information relating to programmable control of the Signal Generator, refer to Remote Operation, Hewlett-Packard Interface Bus in Section III of this manual.

1-7. OPTIONS

1-8. Electrical Options

Option 001. The internal 10 dB/step attenuator has been deleted. The specified output level is listed in Table 1-1.

Option 002. The internal 10 MHz crystal reference is removed. An external 5 or 10 MHz reference must be used.

Option 003. A special fan allows operation from 400 Hz power mains, as well as 50—60 Hz.

Option 004. The Signal Generator's RF OUTPUT connector is located on the rear panel. Maximum output power is listed in Table 1-1.

Option 005. The Signal Generator's RF OUTPUT connector is located on the rear panel and the attenuator is removed. This combines Options 001 and 004. The specified output level is listed in Table 1-1.

1-9. Mechanical Options

The following options may have been ordered and received with the Signal Generator. If they were not ordered with the original shipment and are now desired, they can be ordered from the nearest Hewlett-Packard office using the part numbers included in each of the following paragraphs.

Option 006 (Chassis Slide Mount Kit). This kit is extremely useful when the Signal Generator is rack mounted. Access to the internal circuits and components, or the rear panel is possible without removing the Signal Generator from the rack. The Chassis Slide Mount Kit part number is 1494-0017. An adapter (HP part number 1494-0023) is needed if the instrument rack mounting slides are to be mounted in a standard EIA rack. The slides without the adapter can be directly mounted in the HP system enclosures.

Option 908 (Rack Flange Kits). The Signal Generator can be solidly mounted to the instrument rack without handles, using the flange kits. The Rack Flange Kit part numbers are 5061-0074 and 5061-0077. Both kits are required.

Option 913 (Rack Flange Kit for Instruments with Handles). The Signal Generator can be rack mounted with existing handles using this kit. The HP part number for this Rack Flange Kit is 5061-0085.

1-10. ACCESSORIES SUPPLIED

The accessories supplied with the Signal Generator are shown in Figure 1-1.

a. Two power cables are supplied in several configurations, depending on the destination of the original shipment. Refer to Power Cables in Section II of this manual.

b. Additional fuses are shipped only with instruments that are factory configured for 100/120 Vac operation. These fuses have rating of 1.5A and 2.0A. They are for reconfiguring the instrument for 220/240 Vac operation.

c. Two adapters are provided: APC-3.5(F) to TYP-N(F), HP Part No. 1250-1745 and APC-3.5(F-F), HP Part No. 1250-1749.

1-11. EQUIPMENT REQUIRED BUT NOT SUPPLIED

For Option 002 instruments, which lack an internal frequency standard, an external reference must be used. The performance of the external reference should at least match the specifications of the HP Model 10811B Crystal Oscillator. In particular, the frequency should be within ±50 Hz of 10 MHz. When using an external oscillator, microphonically generated or line related spurious signals may increase. SSB phase noise may also be degraded at some offsets from the carrier.

An external signal source is required if amplitude, frequency, or pulse modulation is desired. For AM, the source should have a variable output of 0 to 1V peak into 600Ω, frequency rates up to 100 kHz. For FM, the source should have a variable output of 0 to 1V peak into 50Ω, frequency rates up to 10 MHz, and distortion of less than 1%. For pulse modulation, the source should have TTL output levels (>2.4V for a TTL high state and <0.4V for a TTL low state) and 50 ohms nominal impedance. Pulse repetition frequency rates should be 50 Hz to 1 MHz with transition times <10 ns.

1-12. ELECTRICAL EQUIPMENT AVAILABLE

The Signal Generator has an HP-IB interface and can be used with any HP-IB compatible computing controller or computer for automatic systems applications.

The HP-IB Controller and various ROMs are needed to do the automated SRD Bias, YTM Tune, Flatness and ALC, and Pulse adjustment procedures. Specific equipment needed for automated adjustments are:

Test Cassette HP Part No. 11726-10004
HP 85A Controller
HP 82903A 16K Memory Module
HP 00085-15001 Mass Storage ROM
HP 00085-15002 Plotter/Printer ROM
HP 00085-15003 Input/Output ROM
HP 00085-15004 Matrix ROM
HP 00085-15005 Advanced Programming ROM
HP 3456A Digital Voltmeter
HP 436A/HP 8485A Power Meter and Sensor

The HP 8111A Pulse/Function Generator is adequate for modulating the Signal Generator and meeting stated standards. This remotely programmable signal source is convenient for full remote control of modulation levels and rates.

1-13. RECOMMENDED TEST EQUIPMENT

Table 1-3 lists the test equipment recommended for testing, adjusting and servicing the Signal Generator. Table 1-4 lists the test equipment recommended for Operation Verification only. Essential requirements for each piece of test equipment are described in the Critical Specifications column. Other equipment can be substituted if it meets or exceeds these critical specifications.

Table 1-1. Specifications (1 of 7)*

Electrical Characteristics	Performance Limits	Conditions
FREQUENCY		
Range (8673C)	0.05—18.6 GHz (0.01—18.6 GHz overrange)	
(8673D)	0.05—26.0 GHz (0.01—26.5 GHz overrange)	
Resolution	1 kHz 2 kHz 3 kHz 4 kHz	0.05 to 6.6 GHz 6.6 to 12.3 GHz 12.3 to 18.6 GHz 18.6 to 26.0 GHz (8673D)
Accuracy and Stability	Same as reference oscillator	
Reference Oscillator: Frequency	10 MHz	
Aging Rate	<5 x 10^{-10}/day	After a 10 day warmup (typically 24 hours in a normal operating environment)
Switching Time (for frequency to be within specified resolution and output power to be within 3 dB of set level)	<50 ms	CW and AM modes; AUTO PEAK disabled, NORMAL mode.
SPECTRAL PURITY		
Single-sideband Phase Noise		1 Hz bandwidth; CW mode
0.05—6.6 GHz	<−64 dBc	30 Hz offset from carrier
	<−70 dBc	100 Hz offset from carrier
	<−78 dBc	1 kHz offset from carrier
	<−86 dBc	10 kHz offset from carrier
	<−105 dBc	100 kHz offset from carrier
>6.6—12.3 GHz	<−58 dBc	30 Hz offset from carrier
	<−64 dBc	100 Hz offset from carrier
	<−72 dBc	1 kHz offset from carrier
	<−80 dBc	10 kHz offset from carrier
	<−104 dBc	100 kHz offset from carrier
>12.3—18.6 GHz	<−54 dBc	30 Hz offset from carrier
	<−60 dBc	100 Hz offset from carrier
	<−68 dBc	1 kHz offset from carrier
	<−76 dBc	10 kHz offset from carrier
	<−100 dBc	100 kHz offset from carrier
>18.6—26.0 GHz (8673D)	<−52 dBc	30 Hz offset from carrier
	<−58 dBc	100 Hz offset from carrier
	<−66 dBc	1 kHz offset from carrier
	<−74 dBc	10 kHz offset from carrier
	<−98 dBc	100 kHz offset from carrier

*For temperature specifications, refer to Operating Temperature Range, near the end of this table.

Table 1-1. Specifications (2 of 7)

Electrical Characteristics	Performance Limits	Conditions
SPECTRAL PURITY (cont'd)		
Harmonics	<–40 dBc	0.05 to 1.2 GHz
(up to 26 GHz, normal mode,	<–60 dBc	1.2 to 18.26 GHz (8673C)
power levels ≤ +3 dBm)	<–60 dBc	1.2 to 26 GHz (8673D)
Subharmonics	<–60 dBc*	
Spurious	<–60 dBc**	0.05 to <2.0 GHz
Nonharmonically Related	<–70 dBc	2.0 to 6.6 GHz
	<–64 dBc	>6.6 to 12.3 GHz
	<–60 dBc	>12.3 to 18.6 GHz
	<–58 dBc	>18.6 to 26.0 GHz (8673D)
Power line related and fan rotation related within 5 Hz below line frequencies and multiplies thereof		
0.05—6.6 GHz	<–50 dBc	<300 Hz offset from carrier
	<–60 dBc	300 Hz to 1 kHz offset from carrier
	<–65 dBc	>1 kHz offset from carrier
>6.6—12.3 GHz	<–44 dBc	<300 Hz offset from carrier
	<–54 dBc	300 Hz to 1 kHz offset from carrier
	<–59 dBc	>1 kHz offset from carrier
>12.3—18.6 GHz	<–40 dBc	<300 Hz offset from carrier
	<–50 dBc	300 Hz to 1 kHz offset from carrier
	<–55 dBc	>1 kHz offset from carrier
>18.6—26.0 GHz (8673D)	<–38 dBc	<300 Hz offset from carrier
	<–48 dBc	300 Hz to 1 kHz offset from carrier
	<–53 dBc	>1 kHz offset from carrier
RF OUTPUT		
Output Level:		
Standard Calibrated Output		
Normal Mode	+11 dBm to –100 dBm	0.05 to <2.0 GHz
	+5 dBm to –100 dBm	2.0 to <16.0 GHz
(8673C)	+2 dBm to –100 dBm	16.0 to 18.6 GHz
(8673D)	+6 dBm to –100 dBm	16.0 to 26.0 GHz
Bypass Mode	+8 dBm to –100 dBm	2.0 to <16.0 GHz
(8673C)	+5 dBm to –100 dBm	16.0 to 18.6 GHz
(8673D)	+7 dBm to –100 dBm	16.0 to 26.0 GHz
Option 001 (Delete attenuator)		
Leveled Output		
Normal Mode	+12 dBm to –10 dBm	0.05 to <2.0 GHz
	+7 dBm to –10 dBm	2.0 to <16. GHz
(8673C)	+4 dBm to –10 dBm	16.0 to 18.6 GHz
(8673D)	+9 dBm to –10 dBm	16.0 to 26.0 GHz
Bypass Mode	+10 dBm to –10 dBm	2.0 to <16.0 GHz
(8673C)	+7 dBm to –10 dBm	16.0 to 18.6 GHz
(8673D)	+10 dBm to –10 dBm	16.0 to 26.0 GHz

*In the 21 to 22 GHz frequency range, 3/4 mode subharmonics (15.75 to 16.5 GHz) may exist, –50 dBc.

**In the 0.05 to <2.0 GHz band, carrier-frequency independent spurious outputs <–55 dBc may exist in the 10 to 100 MHz frequency range.

Table 1-1. Specifications (3 of 7)

Electrical Characteristics	Performance Limits	Conditions
RF OUTPUT (cont'd)		
Option 004 (Rear panel output)		
Leveled Output		
Normal Mode	+10 dBm to −100 dBm	0.05 to <2.0 GHz
	+4 dBm to −100 dBm	2.0 to <16.0 GHz
(8673C)	+1 dBm to −100 dBm	16.0 to 18.6 GHz
(8673D)	+4 dBm to −100 dBm	16.0 to 26.0 GHz
Bypass Mode	+7 dBm to −100 dBm	2.0 to <16.0 GHz
(8673C)	+4 dBm to −100 dBm	16.0 to 18.6 GHz
(8673D)	+5 dBm to −100 dBm	16.0 to 26.0 GHz
Option 005 (Options 001 & 004)		
Leveled Output		
Normal Mode	+12 dBm to −10 dBm	0.05 to <2.0 GHz
	+6 dBm to −10 dBm	2.0 to <16.0 GHz
(8673C)	+3 dBm to −10 dBm	16.0 to 18.6 GHz
(8673D)	+7 dBm to −10 dBm	16.0 to 26.0 GHz
Bypass Mode	+9 dBm to −10 dBm	2.0 to <16.0 GHz
(8673C)	+6 dBm to −10 dBm	16.0 to 18.6 GHz
(8673D)	+8 dBm to −10 dBm	16.0 to 26.0 GHz
Remote Programming Absolute Level Accuracy		
0.05 — 6.6 GHz	±1.25 dB	+10 dBm output level range
	±1.00 dB	0 dBm output level range
	±1.50 dB	−10 dBm output level range
	±1.70 dB	−20 dBm output level range
	±2.00 dB	−30 dBm output level range
	±2.00 dB & ±0.1 dB per 10 dB step	<−30 dBm output level range
>6.6 — 12.3 GHz	±1.50 dB	+10 dBm output level range
	±1.25 dB	0 dBm output level range
	±1.75 dB	−10 dBm output level range
	±1.95 dB	−20 dBm output level range
	±2.25 dB	−30 dBm output level range
	±2.25 dB & ±0.1 dB per 10 dB step	<−30 dBm output level range
>12.3 — 18.6 GHz	±1.75 dB	+10 dBm output level range
	±1.50 dB	0 dBm output level range
	±2.10 dB	−10 dBm output level range
	±2.30 dB	−20 dBm output level range
	±2.70 dB	−30 dBm output level range
	±2.70 dB & ±0.2 dB per 10 dB step	<−30 dBm output level range
>18.6 — 26.0 GHz	±2.25 dB	+10 dBm output level range
	±2.00 dB	0 dBm output level range
	±2.55 dB	−10 dBm output level range
	±2.85 dB	−20 dBm output level range
	±3.30 dB	−30 dBm output level range
	±3.30 dB & ±0.2 dB per 10 dB step	<−30 dBm output level range

Table 1-1. Specifications (4 of 7)

Electrical Characteristics	Performance Limits	Conditions
RF OUTPUT (cont'd)		
Manual Absolute Level Accuracy	Add ±0.75 dB to remote programming absolute level accuracy	Absolute level accuracy specifications include allowances for detector linearity, temperature, flatness, attenuator accuracy, and measurement uncertainty.
Remote Programming Output Level Resolution	0.1 dB	
Flatness		
	±0.50 dB	0.05 to <2.0 GHz
	±0.75 dB	0.05 to 6.6 GHz
	±1.00 dB	0.05 to 12.3 GHz
	±1.25 dB	0.05 to 18.6 GHz
	±1.75 dB	0.05 to 26.0 GHz
Output Level Switching Time (to be within ±1 dB of final level)	<25 ms	
PULSE MODULATION		
ON/OFF Ratio	>50 dB	50—250 MHz
	>80 dB	250—26.0 GHz
Rise and Fall Times		AUTO PEAK enabled
	<20 ns	0.05 to <2.0 GHz
	<40 ns	2.0 to 26.0 GHz
Minimum Leveled RF Pulse Width	<100 ns	
Pulse Repetition Frequency	50 Hz to 1 MHz	
Minimum Duty Cycle	<0.0001	When internally leveled; no restriction when unleveled
Minimum Pulse Off-Time	<300 ns	
Maximum Peak Power	Same as in CW mode	
Peak Level Accuracy	±1.5 dB	0.05 to <2.0 GHz
	+1.5/−1.0 dB	2.0 to 26.0 GHz
Overshoot, Ringing	<25%	0.05—6.6, 7.2—26.0 GHz
	<30%	6.6—7.2 GHz
Video Feedthrough	<60 dBc	
AMPLITUDE MODULATION		
Depth	0 to 90%	0 dBm range and below. Output level vernier settings ≤0 dBm (≤ −3 dBm for 8673C, 16.0 to 18.6 GHz).

Table 1-1. Specifications (5 of 7)

Electrical Characteristics	Performance Limits	Conditions
AMPLITUDE MODULATION (cont'd)		
Rates	20 Hz to 100 kHz (dc to 100 kHz, Option H41)	3 dB bandwidth, 30% depth
Sensitivity	(See also indicated Meter Accuracy and Accuracy Relative to External AM Input Level.)	Maximum input 1 Vpk into 600Ω nominal; AM depth is linearly controlled by varying input level between 0 and 1V peak.
30% Range	30%/Vpk	
100% Range	100%/Vpk	
Indicated Meter Accuracy	±11% of reading ±3% of range	100 Hz to 10 kHz rates
Accuracy Relative to External AM Input Level	±9% of reading ±2% of range	100 Hz to 10 kHz rates
Incidental Phase Modulation		(100 Hz to 10 kHz rates; 30% depth)
	<0.4 radians	0.05 to 6.6 GHz
	<0.8 radians	>6.6 to 12.3 GHz
	<1.2 radians	>12.3 to 18.6 GHz
	<1.6 radians	>18.6 to 24.0 GHz
	<2.5 radians	>24.0 to 26.0 GHz
Incidental FM	Incidental phase modulation x modulation frequency	
FREQUENCY MODULATION		
Frequency Response Relative to a 100 kHz Rate	±2 dB, 100 Hz to 3 MHz, ±2 dB, 3 kHz to 3 MHz	30 and 100 kHz/V ranges; .03, 1, 3, and 10 MHz/V ranges
Maximum Peak Deviation	The smaller of 10 MHz or f_{mod} x 5	0.05 to 6.6 GHz
	The smaller of 10 MHz or f_{mod} x 10	>6.6 to 12.3 GHz
	The smaller of 10 MHz f_{mod} x 15	>12.3 to 18.6 GHz
	The smaller of 10 MHz f_{mod} x 20	>18.6 to 26.0 GHz
Sensitivity (peak deviation) Maximum input 1 Vpk into 50Ω nominal	1 Vpk = range maximum deviation.	All ranges; peak deviation is linearly controlled by varying input level between 0 and 1 Vpk
Indicated Meter Accuracy	±12% of reading ±3% of range	100 kHz rate
Accuracy Relative to External FM Input Level	±7% of reading ±3% of range	100 kHz rate
Incidental AM	<5%	Rates <100 kHz; peak deviations ≤1 MHz

Table 1-1. Specifications (6 of 7)

Electrical Characteristics	Performance Limits	Conditions
DIGITAL SWEEP		
Sweep Function	Start/Stop or ΔF (Span) Sweep	
Sweep Modes	Manual, Auto, Single	
Step Size	Maximum equals the maximum width; minimum is equal to the greater of the frequency resolution or span divided by 9999.	Maximum of 9999 frequency points per sweep.
Dwell Time	Set from 1 to 255 ms per step	
Maximum Width:	Restricted to amplifier/filter bands shown.	Filter/amplifier bands NORMAL 0.01 to <2.0 GHz 2.0 to <3.5 GHz 3.5 to <6.0 GHz 6.0 to 18.6 GHz (8673C) 6.0 to <16.0 GHz (8673D) 16.0 to <22.0 GHz (8673D) 22.0 to 26.5 GHz (8673D) BYPASS 2.0 to 18.6 GHz (8673C) 2.0 to <16.0 GHz (8673D) 16.0 to 26.5 GHz (8673D) MANUAL mode, Single Sweep 0.01 to 18.6 GHz (8673C) 0.01 to 26.5 GHz (8673D)
Markers	5 independent, fixed frequency markers set from front panel	Resolution and accuracy are identical to RF output.
REAR PANEL AUXILIARY CONTROL CONNECTOR		
14-Pin Connector	Inputs: Stop Sweep (HP 8410B/C Compatible) Trigger Output Service Function Frequency Increment Frequency Decrement Blank Frequency Display Recall Register 1 Sequential Register Recall Outputs: Trigger HP 8410B/C Compatible) End Sweep Negative Z-axis Blanking Ground	
Input Required	Contact closure to ground or 5 μs, negative true TTL pulse	
Outputs	5 μs negative true TTL pulse	

Table 1-1. Specifications (7 of 7)

Electrical Characteristics	Performance Limits	Conditions
REMOTE PROGRAMMING	All functions HP-IB programmable, except LINE switches	
GENERAL		
Operating Temperature Range	0 to +55°C (except specifications for harmonically related spurious signals, RF output, pulse peak level accuracy, and amplitude modulation, which apply +15 to +35°C).	
Power Requirements:		
Line Voltage (100, 120, 220, or 240V)	+5, −10%	48—66 Hz
Power Dissipation	500 V·A maximum	
Conducted and Radiated Electromagnetic Interference	MIL-STD 461A-1968	Conducted and radiated interference is within the requirements of methods CE03 and RE02 of MIL-STD 461A, VDE 0871, and CISPR publication 11.
Net Weight	42.3 kg (94 lb)	
Dimensions:		For ordering HP cabinet accessories, module sizes are 8-3/4H, 1 MW, 23D (composed of two parts, 3.50 in. high and 5.25 in. high)
Height	234 mm (9.2 in.)	
Width	425 mm (16.8 in.)	
Depth	620 mm (24.4 in.)	

Table 1-2. Supplemental Characteristics (1 of 3)

Supplemental characteristics are intended to provide information useful in applying the instrument by giving typical, but non-warranted, performance parameters. They apply to the 8673C/D in "Normal" mode, CW operation, and with AUTO PEAK on, except where noted.

FREQUENCY

Internal Reference: The internal reference oscillator accuracy is a function of time base calibration ± aging rate, ± temperature effects, and ± line voltage effects. Typical temperature and line voltage effects are $<1 \times 10^{-10}/°C$ and $<5 \times 10^{-10}/+5\%$ to -10% line voltage change. Reference oscillator is kept at operating temperature in STANDBY mode with the instrument connected to mains power. For instruments disconnected from mains power less than 24 hours, the aging rate is $<5 \times 10^{-10}$/day after a 24 hour warmup.

Switching time for frequency to be within specified resolution and output to be within 3 dB of set level (CW and AM modes, AUTO PEAK disabled) is typically <20 ms for frequency changes that do not cross internal filter or amplifier switching points. Filter switching points are 2, 3.5, 6, and 22 GHz. The 8673D has an amplifier switching point at 16 GHz.

External Reference Input: 5 or 10 MHz at a level of 0.1 to 1 Vrms into 50Ω. Stability and spectral purity of the microwave output will be partially determined by characteristics of the external reference frequency.

Reference Outputs: 10 MHz at a level of 0.2 Vrms into 50Ω.

SPECTRAL PURITY

Residual FM in CW and FM Modes, 0.05 to 6.6 GHz* (noise and power line related):

Mode/FM Range	Post-Detection Bandwidth	
	300 Hz—3 kHz	50 Hz—15 kHz
CW, 30, 100, 300 kHz/V and 1, 3 MHz/V	12 Hz rms	60 Hz rms
10 MHz/V	15 Hz rms	75 Hz rms

*Residual FM doubles for 6.6—12.3 GHz, triples for 12.3—18.6 GHz, and quadruples for 18.6—26.0 GHz.

Spurious Signals (CW and AM modes), Option 003 instruments (400 Hz line operation): Power line related and fan rotation related within 5 Hz below line frequency and multiples thereof:

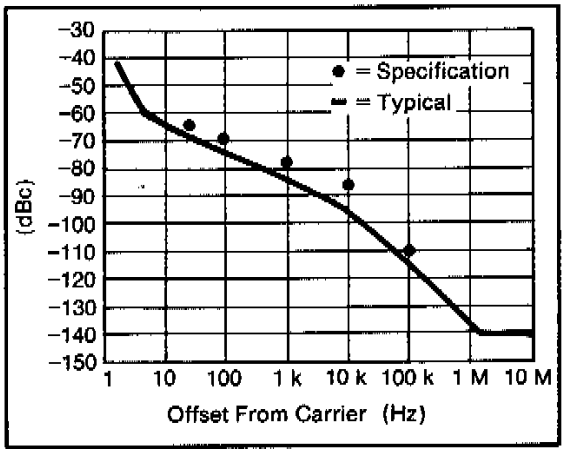
Frequency Range (GHz)	Offset from Carrier		
	<2 kHz	2 to 8 kHz	>8 kHz
2.0–6.6	–40 dBc	–50 dBc	–65 dBc
>6.6–12.3	–34 dBc	–44 dBc	–59 dBc
>12.3–18.6	–30 dBc	–40 dBc	–55 dBc
>18.6–26.0	–28 dBc	–38 dBc	–53 dBc

Harmonics (up to 26 GHz, NORMAL mode, –10 dBm vernier setting on 0 dBm range and below):
<–55 dBc, 0.05 to <1.2 GHz
<–60 dBc, 1.2 to 26.0 GHz

Harmonics (up to 26 GHz, BYPASS mode, output level vernier settings ≤ 0 dBm on 0 dBm range and below): <–45 dBc.

Subharmonics and Multiples Thereof (BYPASS mode):
<–30 dBc, 0.05 to <18.6 GHz
<–20 dBc, >18.6 to 26.0 GHz

Single-sideband Phase Noise (1 Hz BW, CW mode, 0.05 to 6.6 GHz*):



*Add 6 dB for 6.6 to 12.3 GHz, 10 dB for 12.3 to 18.6 GHz, and 12 dB for 18.6 to 26.0 GHz.

Table 1-2. Supplemental Characteristics (2 of 3)

RF OUTPUT

Output Level Switching Time (to be within ±1 dB of final level with no range change):

Operating Mode	Output Level Switching Time
CW	<15 ms
AM and Sweep	<5 ms

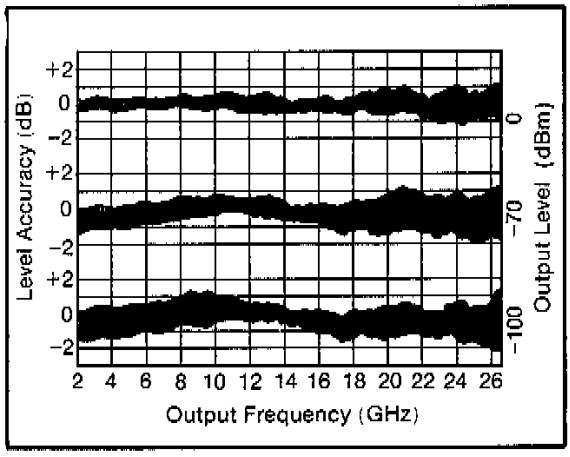
For power settings >0 dBm, changes in frequency of several GHz in one step may require additional AUTO PEAK enabling to stabilize power at the desired level. Spurious output oscillations may occur for settings above +8 dBm.

External leveling device characteristics will determine output flatness, absolute level accuracy, and switching time in external leveling modes.

Impedance: 50 ohms.

Source SWR: <2.0.

Output Level Accuracy:



Typical 8673C/D output level accuracy at 0, –70, and –100 dBm level settings.

PULSE MODULATION

ON/OFF Ratio: >90 dB, 6.6 to 26.0 GHz.

Pulse Width: Pulse widths from 100 ns down to 25 ns are possible with degraded peak power level accuracy relative to CW.

Pulse Input:

Normal Mode: >3V on, <0.5V off
Complement Mode: <0.5V on, >3V off
Impedance: 50Ω nominal
Damage Level:
For source >50Ω it is > +6V.
For source <50Ω it is > +6V or more negative than −0.5V.

Pulse Width Compression: <35 ns.

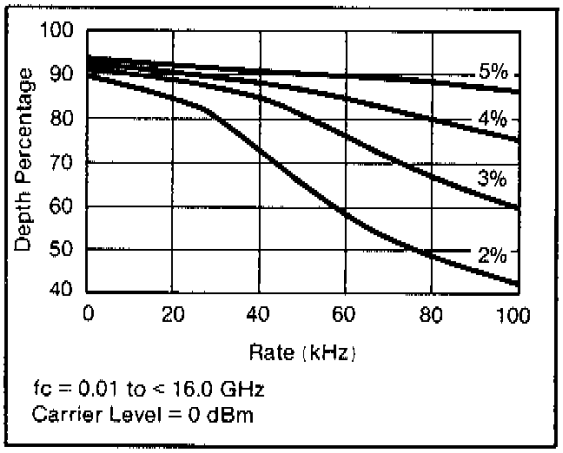
Maximum Delay Time: 150 ns.

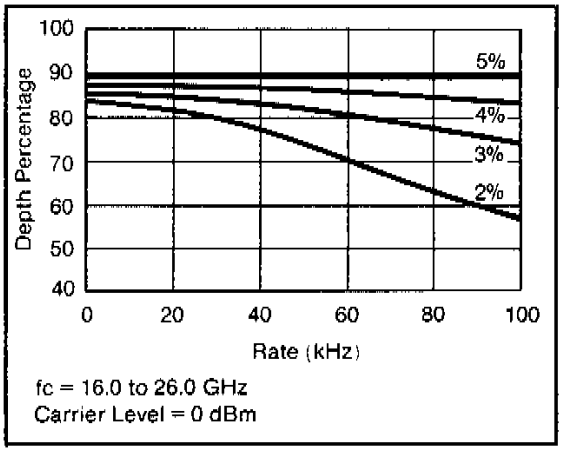
Table 1-2. Supplemental Characteristics (3 of 3)

AMPLITUDE MODULATION

Frequency Response Relative to a 1 kHz Rate: ±0.25 dB, 100 Hz—10 kHz.

Distortion:

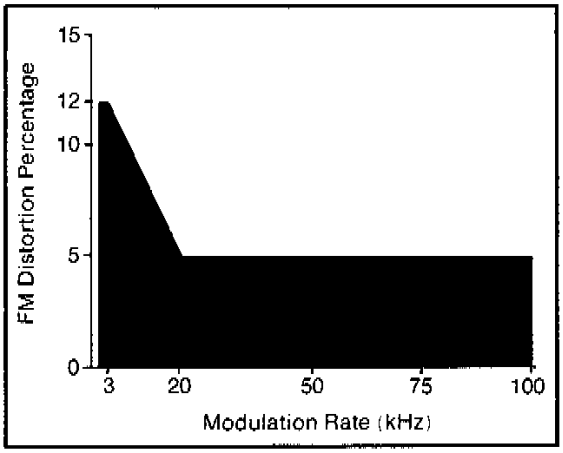




Typical 8673C/D AM distortion versus modulation rate and depth.

FREQUENCY MODULATION

Rates (3 dB bandwidth): 100 Hz to 10 MHz, 30 and 100 kHz/V ranges; 1 kHz to 10 MHz, 300 kHz/V, and 1, 3, and 10 MHz/V ranges.



Typical 8673C/D FM Distortion versus modulation rate.

DIGITAL SWEEP

Rear Panel BNC Sweep Connections:

Sweep Out: 0 to +10V ramp start to stop (maximum adjustable from +4 to +12V)
Sweep Reference: 1V/GHz ramp (+18V maximum)
Z-Axis Blanking/Markers
Tone Marker Output
Penlift

Table 1-3. Recommended Test Equipment (1 of 4)

Instrument	Critical Specifications	Recommended Model	Use*
AC Voltmeter	Range: 1 mV to 10V Accuracy: ±1.5% of full scale ±1.5% of reading Frequency Response: 3 kHz to 3 MHz	HP 400E	P, A
Attenuator, Fixed 3 dB	Range: dc to 1 GHz Accuracy: ±0.5 dB SWR: < 1.3	HP 8491A Option 003	P, A
Attenuator, Fixed 6 dB	Range: dc to 26 GHz Accuracy: ±0.6 dB SWR: < 1.6	HP 8493C Option 006	P
Attenuator, Fixed 10 dB	Range: dc to 12.4 GHz Accuracy: ±0.6 dB SWR: < 1.3	HP 8491A Option 010	P
Attenuator, Fixed 20 dB	Range: dc to 26 GHz Accuracy: ±1.0 dB SWR: < 1.6	HP 8493C Option 020	P, A
Attenuator, 10 dB Step	Range: dc to 26 GHz Accuracy: ±7% SWR: < 2.2	HP 8495D Option 004	P
Audio Analyzer[1]	Frequency Range: 20 Hz to 100 kHz Accuracy: ±4% of full scale	HP 8903A	P
Audio Source[1]	Frequency Range: 20 Hz to 100 kHz Output Level: 1 mV to 6V open circuit Flatness: ±2.5%	HP 8903A	P
Cable, Special Interconnect	Special (see Figure 1-2)	Locally Fabricated	A
Controller, HP-IB	HP-IB compatibility as defined by IEEE Standard 488-1978 and the identical ANSI Standard MC1.1: SH1, AH1, T2, TE0, L2, LE0, SR0, RL0, PP0, DC0, DT0, and C1, 2, 3, 4, 5. Automated adjustment programs require specific test equipment. Therefore no substitute is recommended	HP 85A/82937A/ 00085-15001/ 00085-15002/ 00085-15003/ 00085-15004/ 00085-15005 or HP 85B/82937A/ 00085-15002 through -15005	C, A
Crystal Detector	Frequency Range: 2 to 26 GHz Frequency Response: ±1.5 dB	HP 8473C	P
Current Probe	Frequency Range: 2 to 35 MHz	HP 1110B	A

Table 1-3. Recommended Test Equipment (2 of 4)

Instrument	Critical Specifications	Recommended Model	Use*
Current Tracer	TTL compatible	HP 547A	T
Digital Voltmeter	Automated adjustment programs require specific test equipment. No substitute is recommended.	HP 3456A	P, A, T
Foam Pads (2 required)	43 × 58 cm (17 × 23 in.), 5 cm (2 in.) thick		P
Frequency Counter	Range: 10 MHz to 26.5 GHz Resolution: 100 Hz 10 MHz Frequency Standard Output: ≥0.1 Vrms	HP 5343A	P, A
Frequency Standard	Long Term Stability: Better than 10^{-10}/day	HP 5065A	P, A
Local Oscillator	Range: 10 MHz to 26 GHz Level: 10 MHz to 18.6 GHz — +7 dBm 18.6 to 26 GHz — +5 dBm Single Sideband Phase Noise and Spurious Signals: Same as HP 8340A.	HP 8340A	P, A
Logic Pulser	TTL compatible	HP 546A	T
Mixer	Response: 2 to 26 GHz VSWR, LO: < 2.5:1 VSWR, RF: < 4.0:1	RHG DMS1—26[2]	P
Modulation Analyzer	Frequency Range: 150 to 990 MHz Input Level: −20 to +13 dBm Amplitude Modulation: Rates — 25 Hz to 25 kHz Depth — to 99% Accuracy — ±2% at 1 kHz Flatness — ±0.5% Demodulated Output Distortion — <0.3% for 50% depth; <0.6% for 90% depth Incidental Phase Modulation — <0.05 radians for 50% depth at 1 kHz rate (50 Hz to 3 kHz bandwidth) Frequency Modulation: Rates — 25 Hz to 25 kHz Deviation — to 99 kHz Accuracy — ±2% at 1 kHz	HP 8902A/ HP 11722A	P, A
Oscilloscope	Bandwidth: 100 MHz Vertical Sensitivity: 10 mV/div Vertical Input: 50Ω ac or dc coupled External Trigger Capability	HP 1980A	C, P, A, T

Table 1-3. Recommended Test Equipment (3 of 4)

Instrument	Critical Specifications	Recommended Model	Use*
Power Meter	Automated adjustment programs require specific test equipment. Therefore, no substitute is recommended.	HP 436A	P, A
Power Sensor	Frequency Range: 50 MHz to 26 GHz Input Impedance: 50Ω SWR: < 1.25 Must be compatible with power meter	HP 8485A	P, A
Power Source, Variable Frequency AC	Range: 60 Vac to 240 Vac Frequency: 48 to 400 Hz Accuracy ± 2 Hz	California Instruments 501TC/800T3	P P
Preamp – Power Amp	Preamp Frequency: 100 kHz to 1.3 GHz Gain: 26 ± 6 dB Output Power: > 7 dBm Noise Figure: < 8.5 dB Impedance: 50Ω Power Amp Frequency: 100 kHz to 1.3 GHz Gain: 22 ± 5 dB Output Power: > 6 dBm Noise Figure: < 5 dBm Impedance: 50Ω	HP 8447D HP 8447E Note: HP 8447F is a dual amplifier and will satisfy both requirements.	P P
Probe, 10:1	Must be compatible with the oscilloscope.	HP 10017A	P, A
Pulse Generator	Rate: 10 Hz to 4 MHz Rise and Fall Times: < 5 ns Output Impedance: 50Ω Output Level: 0 to 3.5V Pulse Width: 80 ns to 2 μs	HP 8013B or HP 8111A	C, P, A
Signal Generator	Output Level: −5 to −20 dBm at 240 MHz	HP 8640B	A
Signature Analyzer	Because the signatures are dependent upon the model selected, only the models listed are approved for usage.	HP 5005A/B, HP 5006A	T
Spectrum Analyzer	Frequency Range: 20 Hz to 300 kHz Frequency Span/Division: 20 Hz minimum Noise Sidebands: > 90 dB below CW signal, 3 kHz offset, 100 Hz IF bandwidth Input Level Range: −10 to −60 dBm Log Reference Control: 70 dB dynamic range in 10 dB steps Accuracy: ± 0.2 dB	HP 8556A/ 8552B/141T	P

Table 1-3. Recommended Test Equipment (4 of 4)

Instrument	Critical Specifications	Recommended Model	Use*
Spectrum Analyzer	Frequency Range: 5 Hz to 40 kHz Resolution Bandwidth: 3 Hz minimum Frequency Span/Division: 50 Hz to 500 MHz Amplitude Range: 0 to −70 dB	HP 3580A	P
Spectrum Analyzer System	Frequency Range: 10 MHz to 22 GHz Frequency Span/Division: 1 kHz minimum Amplitude Range: 0 to −70 dB Noise Sideband: > 75 dB down 30 kHz from signal at 1 kHz resolution bandwidth	HP 8566A	P, A
Support Kit	Required for servicing and troubleshooting.	HP 11726A	A, T
Adjustment Cassette	No substitute	HP 11726-10004	A
Sweep Oscillator	Center Frequency: 150 to 200 MHz Center Frequency Resolution: 0.1 MHz Sweep Range: 10 and 200 MHz	HP 86222B/ 8620C	A
Termination 50Ω	50Ω BNC	HP 11593A	P, A
Test Oscillator	Level: 0 to 3V into 50Ω or 300Ω Range: 10 kHz to 10 MHz	HP 3335A or HP 654B	C, P

* C = Operator's Check, P = Performance Tests, A = Adjustments, T = Troubleshooting

[1] The HP 8903A is recommended for the combined use as an analyzer and audio source. A separate audio analyzer and an audio source can be used if critical specifications are met.

[2] RHG Electronics Laboratory, Inc., 161 East Industry Court, Deer Park, NY 11729, Tel. (516) 242-1100, TWX 510-227-6083.

[3] California Instruments, 5150 Convoy Street, San Diego, CA 92111, Tel. (714) 279-8620.

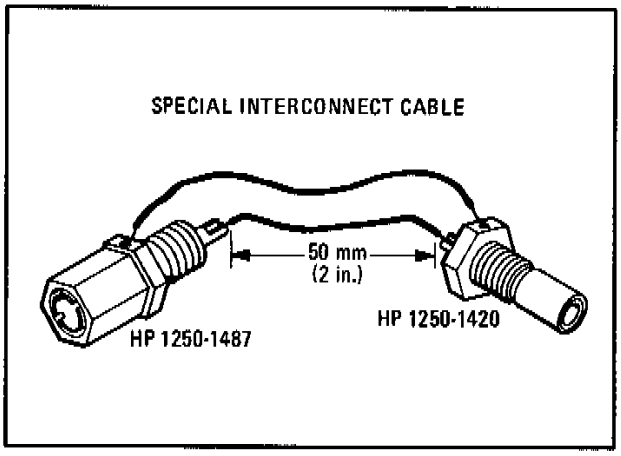


Figure 1-2. Special Interconnect Cable

Table 1-4. Operation Verification Recommended Test Equipment (1 of 2)

Instrument	Critical Specifications	Recommended Model
Attenuator, Fixed 10 dB (two needed)	Range: dc to 12.4 GHz Accuracy: ±0.6 dB SWR: < 1.3	HP 8491A, Option 010
Attenuator, Fixed 10 dB	Range: dc to 26 GHz Accuracy: ±1.0 dB SWR: < 1.6	HP 8493C Option 010
Cable, Semi-Rigid	8" length SMA (m, m)	Locally Fabricated
AC Voltmeter	Accuracy ± 1%	HP 3456A or HP 3455A
Frequency Counter	Range: 10 MHz to 26.5 GHz Resolution: 100 Hz 10 MHz Frequency Standard Output ≥.1 Vrms	HP 5340A or HP 5343A
Local Oscillator	Range: 2 GHz to 19 GHz Level: > +5 dBm	HP 8340A, or HP 8673A/B/C/D
Mixer	Response: 2 to 26 GHz VSWR, LO: ≤ 2.5:1 VSWR, RF: ≤ 4.0:1	RHG DMS1—26[1]
Modulation Analyzer	Frequency Range: 150 to 990 MHz Input Level: −20 to +13 dBm Amplitude Modulation: Rates — 25 Hz to 25 kHz Depth — to 99% Accuracy — ±2% at 1 kHz Flatness — ±0.5% Demodulated Output Distortion — <0.3% for 50% depth; <0.6% for 90% depth Incidental Phase Modulation — <0.05 radians for 50% depth at 1 kHz rate (50 Hz to 3 kHz bandwidth) Frequency Modulation: Rates — 25 Hz to 25 kHz Deviation — to 99 kHz Accuracy — ±2% at 1 kHz	HP 8902A/ HP 11722A or HP 8901A
Oscilloscope	Bandwidth: 100 MHz Vertical Sensitivity: 10 mV/div Vertical Input: 50Ω ac or dc coupled External Trigger Capability	HP 1980A
Power Meter and Sensor	Frequency Range: 50 MHz to 26 GHz Input Impedance: 50Ω SWR: < 1.25 Max Input Level: 15 dBm	HP 436A/HP 8485A or HP 435B/HP 8485A

Table 1-4. Operation Verification Recommended Test Equipment (2 of 2)

Instrument	Critical Specifications	Recommended Model
20 dB Preamp	Preamp Frequency: 100 kHz to 400 kHz Gain: 26 ± 6 dB Output Power: > 7 dBm Noise Figure: < 8.5 dB Impedance: 50Ω	HP 8447D
20 dB Power Amp	Power Amp Frequency: 100 kHz to 400 kHz Gain: 22 ± 5 dB Output Power: > 6 dBm Noise Figure: < 5 dBm Impedance: 50Ω	HP 8447E Note: HP 8447F is a dual amplifier and will satisfy both requirements.
Pulse Generator	Rate: 10 Hz to 4 MHz Rise and Fall Times: < 5 ns Output Impedance: 50Ω Output Level: 0 to 3.5V Pulse Width: 80 ns to 2 μs	HP 8013B or HP 8111A
Spectrum Analyzer	Frequency Range: 50 MHz to 7 GHz Frequency Span/Division: 1 kHz minimum Amplitude Range: 0 to −70 dB	HP 8566A
Test Oscillator	Level: 0 to 3V into 50Ω or 300Ω Range: 10 kHz to 10 MHz	HP 3335A or HP 654B

[1] RHG Electronics Laboratory, Inc., 161 East Industry Court, Deer Park, NY 11729, Tel. (516) 242-1100, TWX 510-227-6083.

SECTION II
INSTALLATION

2-1. INTRODUCTION

This section provides the information needed to install the Signal Generator. Included is information pertinent to initial inspection, power requirements, line voltage selection, power cables, interconnection, environment, instrument mounting, storage and shipment.

2-2. INITIAL INSPECTION

WARNING

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, meters).

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

2-3. PREPARATION FOR USE

2-4. Power Requirements

The Signal Generator requires a power source of 100, 120, 220 or 240 Vac, +5% to −10%, 48 to 66 Hz single phase (for Option 003 instruments, 400 Hz single phase and 120 Vac, +5%, −10% only). Power consumption is 500 VA maximum.

WARNINGS

This is a Safety Class I product (that is, provided with a protective earth terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cables or supplied power cable sets. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an external autotransformer, make sure the auto transformer's common terminal is connected to the neutral (that is, the grounded side of the mains supply).

2-5. Line Voltage and Fuse Selection

CAUTION

BEFORE PLUGGING THIS INSTRUMENT into the mains (line) voltage, be sure the correct voltage and fuses have been selected.

Verify that the line voltage selection cards and the fuses are matched to the power source. Refer to Figure 2-1, Line Voltage and Fuse Selection.

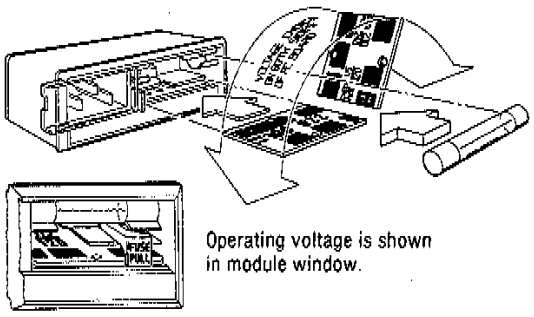
Fuses may be ordered under HP part numbers listed below:

	100—120V		220—240V	
	Rating	HP P/N	Rating	HP P/N
A3F1	4A	2110-0055	2A	2110-0002
A5F1	2.5A	2110-0083	1.5A	2110-0043

2-6. Power Cables

WARNING

BEFORE CONNECTING THIS INSTRUMENT, the protective earth terminal of this instrument must be connected to the protective confuctor of the (mains) power cables. The mains plug shall only be inserted in socket outlets provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).



SELECTION OF OPERATING VOLTAGE

1. Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.
2. Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left corner. Push the card firmly into the slot.
3. Rotate the FUSE PULL lever to its normal position. Insert a fuse of the correct value in the holder. Close the cover door.

WARNING

To avoid the possibility of hazardous electrical shock, do not operate this instrument at line voltages greater than 126.5 Vac with line frequencies greater than 66 Hz (leakage currents at these line settings may exceed 3.5 mA).

Figure 2-1. Line Voltage and Fuse Selection

This instrument is equipped with two three-wire power cables. When connected to an appropriate ac power receptacle, these cables ground the instrument cabinet. The power cable plugs shipped with each instrument depends on the country of destination. Refer to Figure 2-2 for the part numbers of power cables available.

2-7. HP-IB Address Selection

In the Signal Generator, the HP-IB talk and listen addresses can be selected by an internal switch or by a front panel setting. Refer to Table 2-1 for a listing of talk and listen addresses. The address is factory set for a Talk address of "S" and a Listen address of "3". (In binary this is 10011; in decimal this is 19.)

Front Panel HP-IB Address Setting. To set the Signal Generator's HP-IB address set from the front panel, the FRONT PNL ENABLE switch on the HP-IB address switch must be set to "1". To change the address from the front panel, key in the desired address, press the STO key, then press the LOCAL key. Refer to Remote Operation, HP-IB, in Section III for additional information.

Internal Switch Setting. To change the internal HP-IB address switch, proceed as follows:

WARNINGS

Internal switch settings should be changed only by service trained persons who are

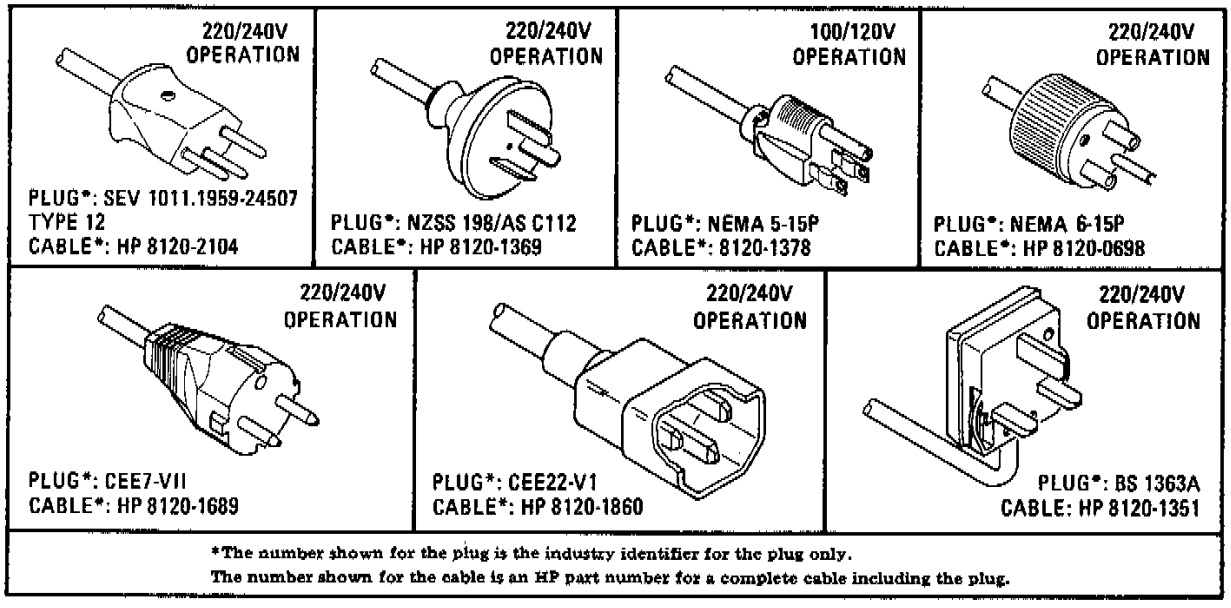


Figure 2-2. Power Cable and Mains Plug Part Numbers

Table 2-1. Allowable HP-IB Address Codes

Address Switches					Talk Address Character	Listen Address Character	Decimal Equivalent
MSB				LSB			
0	0	0	0	0	@	SP	0
0	0	0	0	1	A	!	1
0	0	0	1	0	B	"	2
0	0	0	1	1	C	#	3
0	0	1	0	0	D	$	4
0	0	1	0	1	E	%	5
0	0	1	1	0	F	&	6
0	0	1	1	1	G	'	7
0	1	0	0	0	H	(	8
0	1	0	0	1	I	)	9
0	1	0	1	0	J	*	10
0	1	0	1	1	K	+	11
0	1	1	0	0	L	,	12
0	1	1	0	1	M	–	13
0	1	1	1	0	N	.	14
0	1	1	1	1	O	/	15
1	0	0	0	0	P	0	16
1	0	0	0	1	Q	1	17
1	0	0	1	0	R	2	18
1	0	0	1	1	S	3	19
1	0	1	0	0	T	4	20
1	0	1	0	1	U	5	21
1	0	1	1	0	V	6	22
1	0	1	1	1	W	7	23
1	1	0	0	0	X	8	24
1	1	0	0	1	Y	9	25
1	1	0	1	0	Z	:	26
1	1	0	1	1	[	;	27
1	1	1	0	0	\	<	28
1	1	1	0	1	]	=	29
1	1	1	1	0		>	30

HP-IB Address Selection (cont'd)

WARNINGS (cont'd)

aware of the potential shock hazard of working on an instrument with protective covers removed.

To avoid hazardous electrical shock, the line (mains) power cables should be disconnected before attempting to change the internal HP-IB address switch settings.

a. Set the LINE switches to STBY and OFF. Disconnect the line power cables.

b. Remove the Signal Generator's top cover by removing the two plastic feet from the rear of the top cover and loosening the screw at the middle of the rear edge of the top cover.

c. Remove the A2 Assembly's protective cover.

d. Remove the A2A9 Freq Output HP-IB Assembly. This assembly can be recognized as having one black and one white printed circuit board extractor.

e. Set the switches to the desired HP-IB address (in binary) and the Talk Only or Listen Only condition. The switch is illustrated in Figure 2-3. If both the Talk Only and the Listen Only switches are set to "1", the Talk Only setting overrides the Listen Only setting.

f. Reinstall the A2A9 Assembly.

g. To confirm the setting, press and hold the LOCAL/DISPLAY ADDRESS key on the front panel. The current HP-IB address will be displayed in decimal in the FREQUENCY MHz display.

h. Replace the A2 Assembly's internal cover and the Signal Generator's top cover.

i. Connect the line (mains) power cables to the Line Power Module and set the LINE switches to ON.

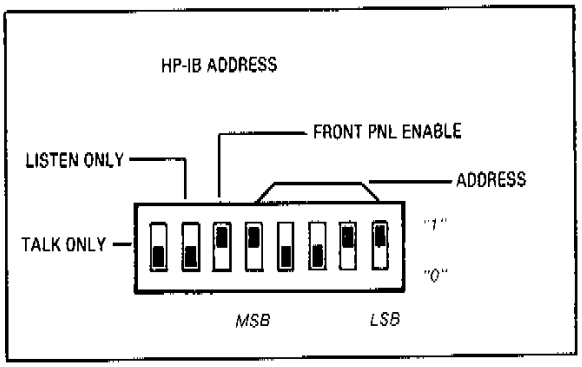


Figure 2-3. HP-IB Address Switch Shown as Set by the Factory

2-8. Interconnections

Interconnection data for the Hewlett-Packard Interface Bus is provided in Figure 2-4.

2-9. Mating Connectors

HP-IB Interface Connector. The HP-IB mating connector is shown in Figure 2-4.

AUX Interface Connector. The rear panel AUX control connector requires a male 14-pin Micro-

Mating Connectors (cont'd)

Ribbon (57 Series) connector. The HP part number is 1251-0142. This connector is also available from Amphenol (Oak Brook, Illinois 60521). Interconnection data for the rear panel AUX control connector is provided in Figure 2-5.

Coaxial Connectors. Coaxial mating connectors used with the Signal Generator should be 50Ω Type N male connectors that are compatible with those specified in US MIL-C-39012.

CAUTION

Using an SMA connector may damage the RF connector unless care is used to avoid excessive torque.

2-10. Operating environment

The operating environment should be within the following limitations:

Temperature ..... 0 to +55°C
Humidity ..... <95% relative
Altitude ..... <4570 metres (15 000 feet)

Specifications for harmonically related spurious signals, RF output, pulse, and amplitude modulation apply +15 to +35°C.

2-11. Bench Operation

The instrument cabinet has plastic feed and fold-away tilt stands for convenience in bench operation. (The plastic feet are shaped to ensure self-aligning of the instruments when stacked.) The tilt stands raise the front of the instrument for easier viewing of the front panel.

2-12. Rack Mounting

WARNING

The Signal Generator weighs 42.3 kg (94 lbs), therefore extreme care must be exercised when lifting to avoid personal injury.

To avoid personal injury and equipment damage, use equipment slides when rack mounting the instrument.

Rack mounting information is provided with the rack mounting kits. If the kits were not ordered with the instrument as options, they may be ordered through the nearest Hewlett-Packard office. Refer to the paragraph entitled Mechanical Options in Section I.

2-13. STORAGE AND SHIPMENT

2-14. Environment

The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature ..... –55 to +75°C
Humidity .....<95% relative
Altitude..... 15 300 metres (50 000 feet)

2-15. Packaging

Preparation for Packaging. Remove handles and/or rack mount flanges before packaging instrument for shipping.

Tagging for Service. If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags located at the back of this manual and attach it to the instrument.

Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. Mark the container "FRAGILE" to assure careful handling. In any correspondence refer to the instrument by model number and full serial number.

Other Packaging. The following general instructions should be used for re-packaging with commercially available materials:

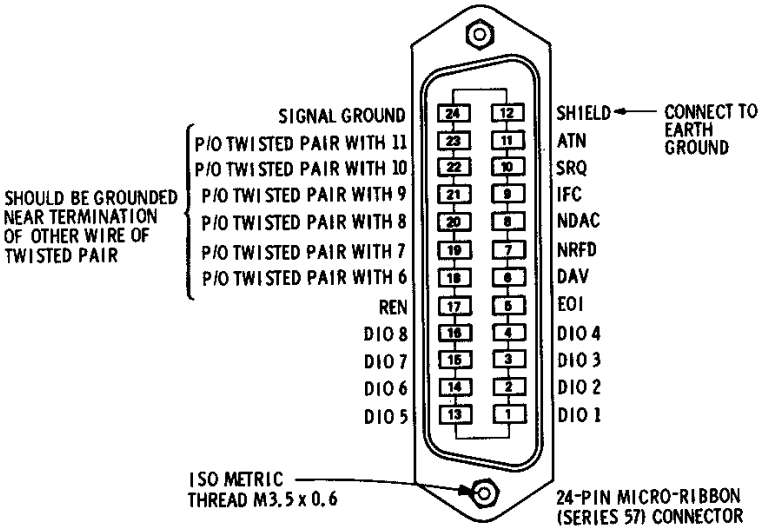
a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, complete one of the blue tags mentioned above and attach it to the instrument.)

b. Use a strong shipping container. A double-wall carton made of 2.4 MPa (350 psi) test material is adequate.

c. Use enough shock-absorbing material (75 to 100 mm layer; 3 to 4 inches) around all sides of the instrument to provide firm cushion and prevent movement in the container. Protect the front panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container "FRAGILE" to assure careful handling.



Logic Levels

The Hewlett-Packard Interface Bus Logic Levels are TTL compatible, i.e., the true (1) state is 0.0 Vdc to +0.4 Vdc and the false (0) state is +2.5 Vdc to +5.0 Vdc.

Programming and Output Data Format

Refer to Section III, Operation.

Mating Connector

HP 1251-0293; Amphenol 57-30240.

Mating Cables Available

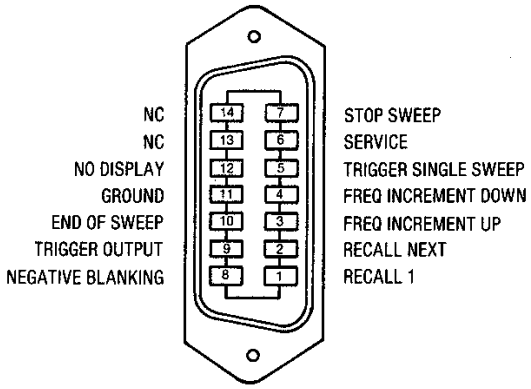
HP 10833A, 1 metre (3.3 ft), HP 10833B, 2 metres (6.6 ft)
HP 10833C 4 meteres (13.2 ft), HP 10833D, 0.5 meteres (1.6 ft)

Cabling Restrictions

1. A Hewlett-Packard Interface Bus system may contain no more than 2 metres (6 ft) of connecting cable per instrument.

2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus system is 20.0 metres (65.6 ft).

Figure 2-4. Hewlett-Packard Interface Bus Connection



14-Pin Micro-Ribbon (57 Series) Connector

Logic Levels

The rear panel AUX connector logic levels are TTL compatible (5 microseconds negative-true TTL pulse or a contact closure to ground).

Internal Jumper Selection

If the signals to the rear panel AUX connector require contact debouncing (e.g., for mechanical switches), an internal jumper must be changed. The jumper is installed at the factory for electronically clean input signals (i.e., those signals that do not require the use of the debounce circuit). The jumper is located on the A2A2 Key-Code board. To change the jumper position, the top cover of the Signal Generator must be removed.

WARNINGS

This task should be performed by service trained persons who are aware of the potential shock hazard of working on an instrument with protective covers removed.

To avoid hazardous electrical shock, the line (mains) power cable should be disconnected before removing the Signal Generator's cover.

The following procedure describes how to locate and change the jumper position.

a. Set the LINE switch to STBY and disconnect the line power cable.

b. Remove the Signal Generator's top cover by removing the two plastic feet from the rear of the top cover and loosening the screw at the middle of the rear edge of the top cover.

c. Remove the A2A2 Key-Code board by gently lifting the board's extractors (the extractors are color-keyed red and black).

d. The jumper is located on the center of the board.

e. To enable the debounce circuit remove the jumper from W2 and reinstall the jumper at W1.

f. Reinstall the A2A2 Key-Code board and the Signal Generator's top cover.

Figure 2-5. AUX Interface Connector

SECTION III
OPERATION

3-1. INTRODUCTION

This section provides complete operating information for the HP 8673C/D Signal Generator. Included are both general and detailed operating instructions, detailed descriptions of the front and rear panel, local and remote operator's checks, and operator's maintenance procedures.

3-2. Operating Characteristics

Table 3-1 briefly summarizes the major operating characteristics of the Signal Generator. This table is not intended to be a complete listing of all operations and ranges but gives a general description of the instrument's capabilities. For more information on the Signal Generator's capabilities, refer to Table 1-1, Specifications, and Table 1-2, Supplemental Characteristics. For information on HP-IB capabilities, refer to the summary contained in Table 3-4, Message Reference Table.

3-3. Local Operation

Information covering front panel operation of the Signal Generator is given in the sections described below. To quickly learn the operation of the instrument, begin with Simplified Operation, Operator's Checks and the instrument's pull-out card. Once familiar with the general operation of the instrument, use the Detailed Operating Instructions for more complete information about operating the Signal Generator.

Turn-On Information. Instructions relating to the Signal Generator's turn-on procedure are presented in paragraph 3-7 to acquaint the user with the general operation of the instrument. The user should perform these procedures prior to using the Simplified Operating instructions, or the Detailed Operating instructions.

Simplified Operation. The instructions located on the inside of this fold provide a quick introduction to front panel operation of the Signal Generator. These instructions are designed to quickly acquaint the new user with basic operating procedures and therefore are not an exhaustive listing of all Signal Generator functions. Additional operating information is given in paragraph 3-10 through 3-14.

Detailed Operating Instructions. The Detailed Operating Instructions provide the complete operating reference for the Signal Generator user. The instructions are organized alphabetically by subject and are placed at the end of this section for easy reference. They are indexed by function in Table 3-2.

Panel Features. Front and rear panel features are described in detail in Figures 3-1 through 3-7.

Operating Information Pull-Out Card. The Operating Information pull-out card is a flexible plastic reference sheet located in a tray below the front panel. It presents general operating instructions. With examples of most of the Signal Generator's features, it is a good learning aid as well as a quick reference.

3-4. Remote Operation

HP-IB. The Signal Generator is capable of remote operation via the Hewlett-Packard Interface Bus (HP-IB). In remote operation, the Signal Generator operates in one of three modes: normal talker listener, talk only or listen only. The HP-IB operating instructions are found in paragraph 3-21 through 3-43. These instructions relate to remote operation, including capabilities, addressing, input and output formats, the status byte, and service requests. At the end of the discussion is a complete summary of all codes.

In addition to the section described above, information concerning remote operation appears in several other locations. General information about HP-IB codes and formats appear on the Operating Information pull-out card. Numerous examples of program strings appear throughout the Detailed Operating Instructions described under Local Operation above.

Auxiliary. The following keyboard functions can be controlled by TTL signals at the rear panel AUX connector:

RECALL 1
FREQ INCREMENT (up and down)
SINGLE Sweep

In addition, several remote-only functions are available. These controls are described in detail in the paragraphs 3-18 through 3-20.

Table 3-1. Operating Characteristics

Frequency	Range: 8673C 0.05 to 18.6 GHz 0.01 to 18.6 GHz overrange 8673D 0.05 to 26.0 GHz 0.01 to 26.5 GHz overrange Resolution 1 kHz 0.05 to 6.6 GHz 2 kHz 6.6 to 12.3 GHz 3 kHz 12.3 to 18.6 GHz 4 kHz 18.6 to 26.0 GHz
Output Level	Range: −90 to +10 dBm in 10 dB steps (except Options 001 and 005) 0 and +10 dBm (Options 001 and 005 only) Vernier: −10 to +3 dB continuously variable
Modulation	AM Sensitivity: 30%/V and 100%/V ranges Maximum Input: 1 Vpk into 600 ohms nominal Rates (3 dB bandwidth): 20 Hz to 100 kHz FM Ranges: 30 kHz/V, 100 kHz/V, 300 kHz/V, 1 MHz/V, 3 MHz/V, and 10 MHz/V Maximum Input: 1 Vpk into 50 ohms nominal Maximum Peak Deviation: the smaller of 10 MHz or f_{mod} x 5 0.05 to 6.6 GHz f_{mod} x 10 >6.6 to 12.3 GHz f_{mod} x 15 >12.3 to 18.6 GHz f_{mod} x 20 >18.6 to 26.0 GHz Rates (3 dB bandwidth): 100 Hz to 3 MHz for 30 kHz/V and 100 kHz/V ranges; 3 kHz to 3 MHz for 300 kHz/V, 1 MHz/V, 3 MHz/V, and 10 MHz/V ranges Pulse Pulse Input: Normal Mode: >3V on, <0.5V off Complement Mode: <0.5V on, >3V off Impedance: 50 ohms nominal RF Output: ON/OFF Ratio: >80 dB Rise and Fall Times: <20 ns 0.05 to <2.0 GHz <40 ns 2.0 to 26 GHz Minimum Leveled Pulse Width: <100 ns Pulse Repetition Frequency: 50 Hz to 1 MHz
Sweep	Configuration: Start-Stop Frequencies or Center Frequency ΔF (Span) Modes: Automatic, Single, and Manual Step Size: as large as sweep span to as small as 1 kHz 2.0 to 6.6 GHz 2 kHz 6.6 to 12.3 GHz 3 kHz 12.3 to 18.6 GHz 4 kHz 18.6 to 26.0 GHz Number of Steps: 1 to 9999 Dwell Time: 1 to 255 ms per step Markers: 5 Markers Rear Panel BNC Sweep Connections: Sweep Out; Sweep Reference; Z-Axis Blanking/Markers; Tone Marker Output; Penlift

3-5. Operator's Checks

Operator's Checks are procedures designed to verify the proper operation of the Signal Generator's main functions. Two procedures are provided as described below.

Basic Functional Checks. This procedure, found in paragraph 3-16, requires a function generator, a microwave frequency counter, a power meter, a power sensor, a crystal detector, and interconnecting cables. It assures that most front panel controlled functions are being properly executed by the Signal Generator.

HP-IB Functional Checks. These procedures, found in paragraph 3-17, require an HP-IB compatible computing controller, an HP-IB interface, and connecting cable. The procedures check all of the applicable bus messages summarized in Table 3-4. The HP-IB Checks assume that front panel operation has been verified by performing the Basic Functional Checks.

3-6. Operator's Maintenance

WARNING

For continued protection against fire hazard, replace the line fuses with 250V fuses of the same rating only. Do not use repaired fuses or short-circuited fuseholders.

Operator's maintenance consists of replacing defective fuses and adjusting the mechanical zero of the front panel meter.

The primary power fuse is located within the Line Power Module Assembly. Refer to Figure 2-1 for instructions on how to change the fuse.

To mechanically zero the front panel meter, set the LINE switch to the STBY position and place the Signal Generator in its normal operating position. Turn the mechanical zeroing adjustment clockwise to move the needle up scale or counterclockwise to move the needle down scale. The zero point is located at the left end of the 0—1 or the 0—3 scales. DO NOT zero on the left end of the top dB scale at -10 because this is not the proper zeroing point.

If the instrument does not operate properly and is being returned to Hewlett-Packard for service, please complete one of the blue tags located at the end of this manual and attach it to the instrument. Refer to Section II for packaging instructions.

FRONT PANEL FEATURES

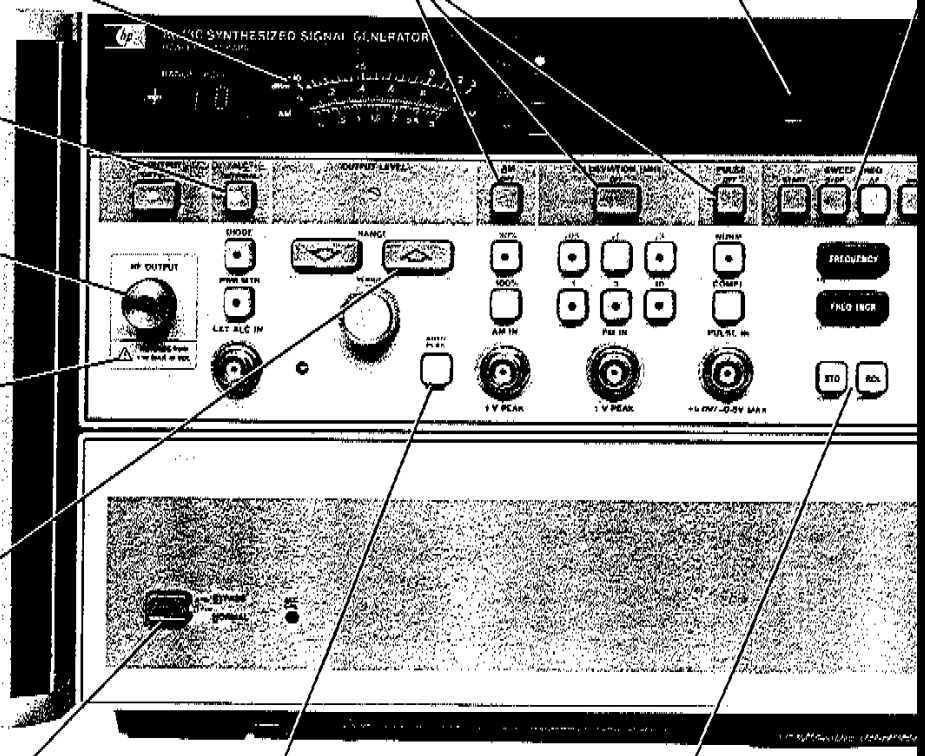
Calibrated metering of output level vernier, AM depth, and FM deviation.

Amplitude, frequency, and pulse modulation of microwave carrier via external modulating signals.

Message key illuminates or flashes to indicate input errors or hardware failures. Depressing the key displays error/malfunction code in frequency display.

Leveling of output power by internal, external diode, or external power meter references.

Output level settable from +13 to −100 dBm. Resolution is 0.1 dB under HP-IB control.



⚠ The RF Output is protected against reverse power applications up to 1W. However, for best protection of internal circuitry, do not apply any reverse power.

Output level controlled in 10 dB steps from +10 to −90 dBm with −10 to +3 dB continuous level vernier.

BYPASS/NORMAL key bypasses RF filters in the lower (A5) section. These filters improve spectral purity in the NORMAL mode. For frequencies below 2.0 GHz, the Signal Generator automatically switches to the NORMAL mode. BYPASS mode permits wider sweep ranges in AUTO SWEEP mode.

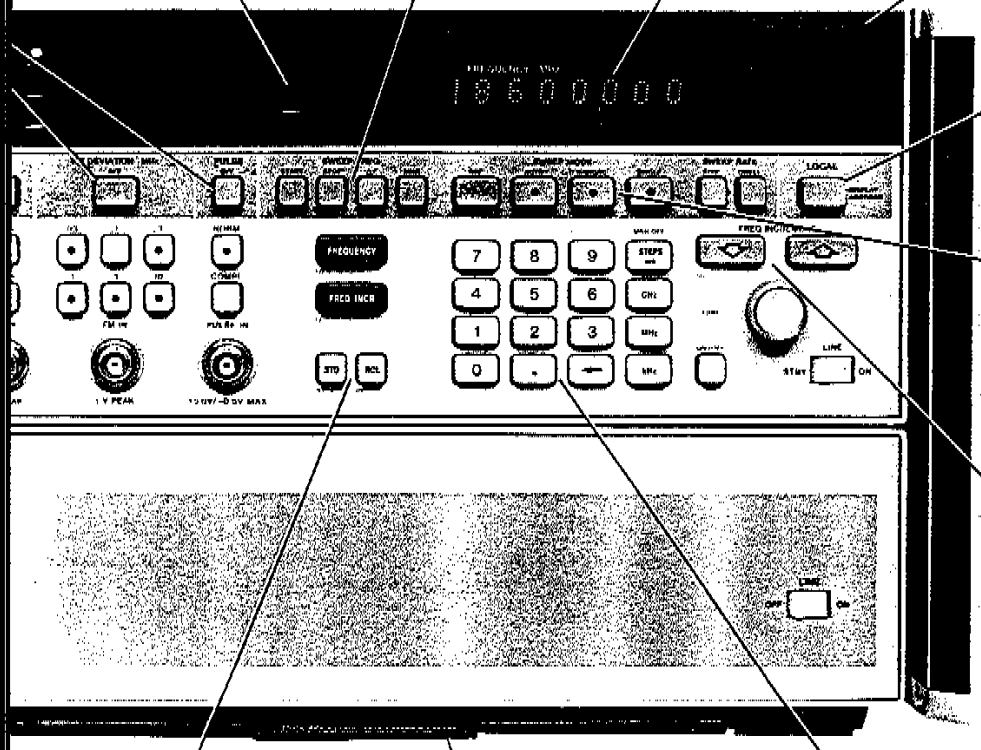
AUTO peak function maximizes available output power at RF connector and optimizes pulse modulation characteristics.

Store and recall up to 9 front panel settings for measurement efficiency.

Refer to Figure 3-2 through 3-6 for de description of these features.

Figure 3-1. Front Panel Features

FIG. 3-1
Sht 2 of 2



efer to Figure 3-2 through 3-6 for detailed escription of these features.

Figure 3-1. Front Panel Features

SIMPLIFIED OPERATION

PRESETTING FRONT PANEL

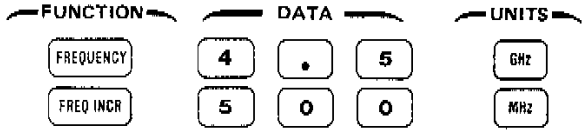
Press [RCL] [0] to set the front panel to the following conditions:

RF OUTPUT to ON
ALC INTERNAL to ON
RANGE to -70 dBm (except Options 001 and 005)
RANGE to 0 dBm (for Options 001 and 005 only)
AUTO PEAK to ON
MTR LVL to ON
AM, FM, and PULSE Modulation to OFF
FREQUENCY to 3000.000 MHz
FREQ INCR to 1.000 MHz
START to 2000.000 MHz
STOP to 4000.000 MHz
ΔF to 2000.000 MHz
MKRS to OFF (initialized to 3, 6, 9, 12, and 15 GHz)
SWEEP MODE to OFF
STEP to 100 steps (20.000 MHz)
DWELL to 20 ms
TUNE Knob to ON
BYPASS/NORMAL to NORMAL

FREQUENCY

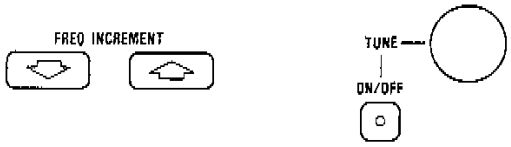
Frequency and frequency increment values are set in a Function-Data-Units format.

For example, to set frequency to 4.5 GHz and frequency increment to 500 MHz:



Frequencies may be entered in GHz, MHz, or kHz, but are always displayed in MHz.

To change the current frequency by the selected increment value, use:



SETTING OUTPUT LEVEL

The output level is set with the RANGE and VERNIER controls.

First press RANGE ⇩ ⇧ to step the output level down or up by increments of 10 dB. The selected range is shown in the RANGE dBm display.

Then, press MTR LVL ○ LVL to select OUTPUT LEVEL VERNIER to be displayed on the meter. Adjust VERNIER ◯ between −10 and +3 dB, as read on the meter.

The output level is determined by adding the meter dBm display to the RANGE dBm display.

To maintain output power at a constant level press ALC INTERNAL ○

Enable AUTO PEAK ○ to ON to maximize power at the output frequency, minimize power of spurious signals and optimize pulse shape for pulse modulation.

STORE/RECALL

Up to nine front panel settings can be stored for later use. All Signal Generator front panel functions can be stored, although OUTPUT LEVEL VERNIER is stored in remote mode only.

STO 3 stores a front panel setting in register 3.

RCL 4 recalls a front panel setting stored in register 4 and changes the output of the Signal Generator to the recalled parameters.

MODULATION

Three types of modulation are available: amplitude (AM), frequency (FM), and pulse. Each type requires an external drive signal. Front panel keys select the maximum percent of AM, FM deviation in MHz, and normal (NORM) or complement (COMPL) pulse mode. For AM and FM, a 1 Vpk signal develops full scale modulation. Modulation varies linearly with the input signal. For pulse modulation, a TTL level positive-true pulse turns RF on in normal mode. A TTL level negative-true pulse turns RF on in complement mode.

MESSAGES

Entry errors, hardware malfunctions, and other significant conditions are indicated by the lighted MESSAGE key.

Press MESSAGE ○ to read the two-digit code in the FREQUENCY MHz display. The codes are explained in the Table 3-8 and on the operating information pull-out card.

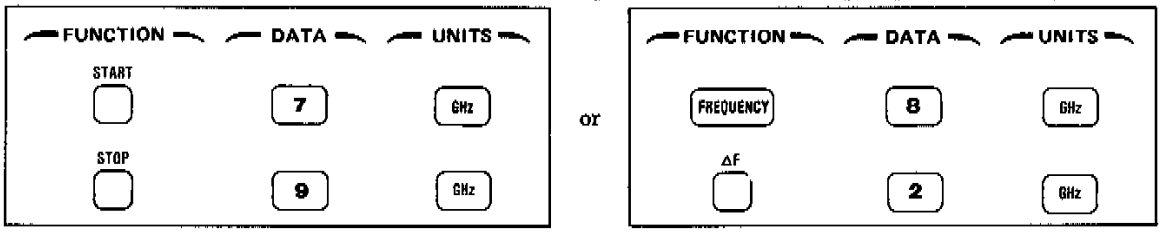
SWEEP

Values for SWEEP FREQ (START, STOP, ΔF, and MKR) and SWEEP RATE (STEP and DWELL) are entered in a Function-Data-Units format.

SWEEP FREQ

The SWEEP FREQ keys set the span of the sweep (that is, the range that the sweep covers). The sweep span can be set with either the START and STOP keys or with the FREQUENCY and ΔF keys.

For example, to set a sweep span of 2 GHz with a start frequency of 7 GHz and a stop frequency of 9 GHz press:



SWEEP RATE

During a sweep, the Signal Generator changes frequency in discrete steps. Sweep rate is determined by the number of steps and the dwell time. The number of steps can be set in either of two ways.

To set the number of steps to be used in a sweep press STEP, use the numeric keys to enter the number of steps, then press STEPS ms.

The sweep span is divided by the number of steps to determine the step size.

To set the step size, press STEP, use the numeric keys to enter the step size, then press GHz or MHz or kHz.

The sweep span is divided by the step size to determine the number of steps.

The dwell time determines how much time elapses before the next frequency step is taken.

To set the dwell time press DWELL, use the numeric keys to enter the time in milliseconds, then press STEPS ms.

SWEEP MODE

To start a sweep press:

AUTO — for a repetitive sweep. If band crossings are required it will perform a single sweep indicated by message 16, and continuous Auto key annunciator light.

MANUAL — for a sweep that is controlled by the TUNE knob or the FREQ INCREMENT Up and Down keys.

SINGLE — for one sweep only. Press this key once to tune the Signal Generator to the start frequency. Then, press this key again to actually initiate the sweep.

To stop a sweep, in any mode, press OFF.

3-7. GENERAL INSTRUCTIONS

WARNINGS

Before the instrument is switched on, all protective earth terminals, extension cords, autotransformers and devices connected to it should be connected to a protective earth grounded socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in personal injury.

Only 250V normal blow fuses with the required rated current shoud be used. Do not use repaired fuses or short circuit fuseholders. To do so could cause a shock or fire hazard.

CAUTIONS

Before the instrument is switched on, it must be set to the voltage of the power source or damage to the instrument may result.

The Signal Generator's RF OUTPUT is protected against reverse power applications up to 1W. However, for greatest protection of expensive internal components, be careful not to apply any reverse power to the RF OUTPUT.

3-8. Turn-On

Turn-On Procedure. The Signal Generator has a standby state and an on state. Whenever the power cable on the upper unit is plugged in, an oven is energized to keep the reference oscillator at a stable operating temperature. If the Signal Generator is already plugged in, set the LINE switches to ON.

If the power cables are not plugged in, follow these instructions.

On the rear panel:

1. Check the selection cards (see Figure 2-1) for correct voltage selection.
2. Check that the fuse ratings are appropriate for the line voltage used. Fuse ratings are printed on the rear panel.
3. Plug in the power cables.

On the front panel, set the LINE switches to ON.

NOTE

The OVEN COLD status annunciator should light to indicate that the Signal Generator requires warming up. The annunciator should turn off within fifteen minutes and the Signal Generator should be ready for general use.

Turn-On Configuration. The Signal Generator turns on to the same control settings it had before it was switched to STBY or even completely off (that is, if line power was removed). The exception to this rule is that it always turns on in local mode.

Turn-On Memory Check. The Signal Generator performs a quick memory check at turn-on. It checks for a failure in ROM (permanent memory) or in RAM (temporary memory), and for the presence of correct data stored in RAM.

NOTE

An internal battery is used to retain data in RAM during standby and off periods. The data restores the last control setup and the nine storage registers.

If a ROM or serious RAM failure occurs, the Signal Generator will attempt to turn on to its last control setup. The Signal Generator might be useable but does require service.

If any, but not all, of the stored data is found to be incorrect, the Signal Generator will turn on to the configuration stored in the first good register. This control setup will then be stored in registers 1 through 9. Incorrect stored data could be caused by even a single bit of data being lost due to line transients, noise or other unpredictable conditions. The Signal Generator should be useable and does not require service unless this situation occurs repeatedly.

If all of the register data has been altered (for example, if the battery failed) the Signal Generator will reinitialize to the front panel preset values stored in register 0 (refer to Simplified Operation for a list of preset values). The initialized control setup will then be stored in all of the registers. The Signal Generator might be useable but does require service.

3-9. Frequency Standard Selection

A FREQ STANDARD INT/EXT switch and two connectors are located on the rear panel. A jumper

Frequency Standard Selection (cont'd)

normally connects the FREQ STANDARD INT connector (A3J9) to the FREQ STANDARD EXT connector (A3J10). The FREQ STANDARD EXT connector can accept a reference signal to be used instead of the Signal Generator's internal frequency standards.

The internal frequency standard is a 10.000 MHz signal at +7 dBm (nominal) with an aging rate of $<5 \times 10^{-10}$/day after warmup (typically 24 hours). When the FREQ STANDARD INT/EXT switch is in the INT position and the jumper is connected between A3J9 and A3J10, the internal reference is enabled.

When the FREQ STANDARD INT/EXT switch is in the EXT position and the jumper is disconnected from the FREQ STANDARD EXT connector, a frequency standard of 5 or 10 MHz at 0 dBm (nominal) can be connected.

NOTE

The EXTERNAL REF status annunciator on the front panel will light when an external reference is being used. Also, the NOT ϕ LOCKED status annunciator may light if the external reference is not of sufficient accuracy in frequency or has an insufficient power level. The external reference must be within ±200 Hz of 10 MHz or ±100 Hz of 5 MHz for reliable locking to occur. If the external reference level is not within the specified limits (0.1 to 1 Vrms into 50 ohms), its level may be sufficient to turn off the NOT ϕ LOCKED status annunciator, giving a false indication of normal operation. In fact, the phase noise of the Signal Generator characteristics may be degraded.

Table 3-2. Index of Detailed Operating Instructions

This table is reserved for the final manual.

3-10. ADDITIONAL OPERATING INFORMATION

Signal Generator performance can be optimized by considering the effect of the following controls on the RF output:

a. AUTO PEAK
b. ALC
c. PULSE Modulation
d. SWEEP Mode
e. SWEEP mode in a Master/Slave configuration

3-11. AUTO PEAK

Power and pulse specifications can be met only if AUTO PEAK is enabled. In this mode, the Signal Generator output is automatically repeaked if the output frequency changes by 20 MHz or more. AUTO PEAK may be toggled on and off by pressing the AUTO PEAK key. It is automatically enabled when pulse mode is selected.

3-12. PULSE MODE

When operating in the pulse mode, there are two things that could require operator attention. They are:

- Load changes
- Output power changes.

If the load changes (for example, if the setting of an external attenuator is changed) the internal filtering of the output pulse shape is degraded. If this happens, the AUTO PEAK key should be turned off and on to optimize the pulse shape.

If power is changed more than 0.4 dB while in the pulse mode, the Signal Generator must momentarily switch to the CW mode to recalibrate for optimum rise time and pulse shape. This momentary change from pulse to CW is not shown by the front panel indicators. However, this momentary switching may be undesirable to the user.

To prevent switching in and out of pulse mode as the level is changed, do the following:

1. Set frequency as desired.
2. Set the RANGE and VERNIER to the highest level to be used.
3. Set the RANGE to 0 dB or lower, and the VERNIER to minimum (maximum counterclockwise).

Once this has been done at a given frequency, the level can be changed within the levels set, without affecting the pulsed output. However, if the frequency is changed the procedure should be repeated.

3-13. ALC (Automatic Level Control)

Output power leveling for the instrument's frequency range occurs from three sources selected by the operator. These sources are:

a. INTERNAL
b. DIODE
c. PWR MTR (Power Meter)

INTERNAL. RF power output from the signal generator is automatically leveled.

DIODE. RF output power is leveled externally using a diode detector connected to the instrument's EXT ALC IN connector.

PWR MTR (Power Meter). RF output power is leveled externally using a power meter connected to the instrument EXT ALC IN connector.

CAL Adjustments. Power leveled at the load is adjusted to agree with the OUTPUT LEVEL Meter when external leveling is used in DIODE or PWR MTR. External leveling techniques are discussed in Hewlett-Packard Application Note 281-5 Microwave Synthesizer Series, May 1981, HP Part Number 5952-8251. Application Note 218-5 specifically applies to the 8672A; however, the main principles of applications also apply to the 8673C/D. Additionally, the input voltage fed back to the 8673C/D EXT ALC IN connector should be within a −1V to +1V range. Polarity is of no consequence because an internal circuit in the 8673C/D performs an absolute value function on the input voltage.

3-14. SWEEP MODE

The HP 8673C/D have RF filters for improving spectral purity in the NORMAL mode. These filters are switched when crossing the following frequencies:

2.0 GHz, 3.5 GHz,
6.0 GHz, 22.0 GHz.

In addition, the HP 8673D has an amplifier that is switched in at 16.0 GHz and above.

If, in the NORMAL mode, an AUTO SWEEP is initiated that crosses any of the above frequencies, only one sweep will be executed. The STOP frequency will be displayed and the sweep halted. The AUTO LED will turn on and the MESSAGE key will display error 16. This feature prevents excessive wear of RF switching relays.

SWEEP MODE (cont'd)

In BYPASS mode, these constraints are removed, except for the 16-GHz switching point in HP 8673D. However, if the frequency goes below 2.0 GHz, the instrument will automatically switch to NORMAL mode.

Sweep frequency ranges that can be swept continuously in the NORMAL and BYPASS modes are listed in Table 1-1.

SWEEP mode in MASTER/SLAVE configuration. In a Master/Slave configuration, two signal generators are interconnected to obtain two swept microwave signals, at a fixed offset from each other. The two instruments are interconnected through Hewlett-Packard Interface Bus (HP-IB). The MASTER is set to HP-IB address 50 and the SLAVE unit is set to HP-IB address 40. The desired sweep start and stop frequencies are set to identical frequencies on both the master and slave instruments. Desired offsets are then entered on the slave unit using the FREQ INCREMENT control. Swept signals from the instruments will be offset by the FREQ INCREMENT value.

In each sweep mode of operation, the designated Slave Unit will have the MAN and SINGLE pushbutton lamps lit. The designated Master Unit will have only the selected mode pushbutton lamp lit. A step-by-step example follows:

a. Interconnect two instruments for HP-IB. Designate one instrument as the Master Unit by setting its HP-IB Address to 50. Designate the other instrument as the Slave Unit by setting its HP-IB Address to 40.

b. On both units, set SWEEP START to 6000 MHz and SWEEP STOP to 12000 MHz. On the Slave Unit set either the number of steps or step size. (As one example: set both master and slave units for 500 steps.)

c. On the Slave Unit select a 50 MHz offset using the FREQ INCR, STEP and the FREQ INCREMENT (▲) or (▼).

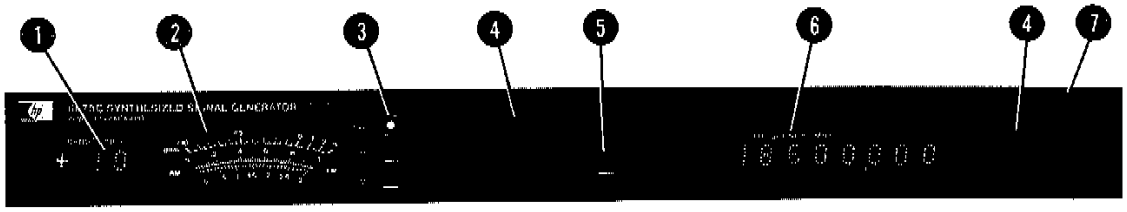
d. Press and hold SWEEP START on the Slave Unit and check for a 50 MHz offset (Display should read 12050 MHz).

e. For AUTO Mode: Press AUTO on Master Unit; Slave Unit will have MAN and SINGLE pushbutton lamps lit.

f. For MANUAL Mode: Press MAN on Master Unit; Slave Unit will have MAN and SINGLE pushbutton lamps lit. On Master Unit enable TUNE ON/OFF. Use the TUNE Knob to tune both Master and Slave Units according to STEP SIZE set on respective units.

g. For SINGLE Mode: On Master Unit, press SINGLE once to enable the sweep. Press it a second time to start one sweep. If SINGLE is pressed during a sweep, the in-progress sweep stops and re-enables.

Disabling Master/Slave Mode. Press SWEEP OFF on both Master and Slave Units. All sweep lamps will be off and only the Master Unit TUNE Knob will cause changes on the Master Unit Display.



1 **RANGE dBm Display.** Indicates the selected range of the RF output in 10 dB steps from −90 to +10 dBm. Range is set by the RANGE (◀ and ▲) keys.

2 **Meter.** Monitors power level, AM depth, or FM deviation. Meter function is selected by the MTR keys.

3 **MTR Keys.** Select the meter function.

LVL: selects OUTPUT LEVEL VERNIER for −10 to +3 dB scale indication. Read relative to the RANGE dBm display.

AM: selects 30% (read on the 0 to 3 scale) or 100% (read on the 0 to 1 scale) AM depth, full scale. A 1 volt peak signal applied to the AM IN connector develops full scale modulation.

FM: selects FM deviation. Full scale indication read on the 0 to 3 scale is 30 kHz, 300 kHz, or 3 MHz. Full scale indication read on the 0 to 1 scale is 100 kHz, 1 MHz, or 10 MHz. A 1 volt peak signal applied to the FM IN connector develops full scale modulation.

4 **Status Annunciators.** Display the internal conditions of the Signal Generator.

ALC UNLEVELED: lights when RF OUTPUT is turned off, more power is requested than is available, no signal is applied to EXT ALC IN when PWR MTR or DIODE is selected, no signal is applied to PULSE IN when NORM pulse mode is selected, overmodulation occurs in AM mode, or pulse width is less than 100 ns.

NOT ϕ LOCKED: lights when one or more of the phase lock loops is unlocked, the RF OUTPUT is OFF, or the INT-EXT switch is in the EXT position with no external reference connected.

FM OVERMOD: lights when the signal applied to the FM IN connector exceeds 1 volt peak or when the modulation index exceeds 5 (2.0 to 6.6 GHz), 10 (6.6 to 12.3 GHz), 15 (12.3 to 18.6 GHz), or 20 (18.6 to 26.0 GHz). The modulation index is equal to the maximum peak deviation divided by f_{mod}. Refer to Table 1-1, Specifications, for additional information.

STANDBY: lights when power is applied but the LINE switch is in the STBY position.

OVEN COLD: lights when the crystal oven is not up to nominal operating temperature.

OUT OF RANGE: lights only in sweep mode when a combination of ΔF and FREQUENCY would cause the sweep frequency to be out of range.

EXTERNAL REF: lights when the rear panel INT-EXT switch is in the EXT position.

5 **MESSAGE Key.** Lights to indicate entry errors and flashes to indicate hardware malfunctions. A two-digit code appears in the FREQUENCY MHz display when this key is pressed. Refer to the pull-out card or the Messages Detailed Operating Instruction for an explanation of the codes.

6 **FREQUENCY MHz Display.** Normally indicates output frequency. Message codes and previously set values for FREQ INCR, SWEEP FREQ, and SWEEP RATE functions are displayed for as long as their respective keys are pressed.

7 **HP-IB STATUS Annunciators.** Indicate the status of the Signal Generator when it is operating via the HP-IB.

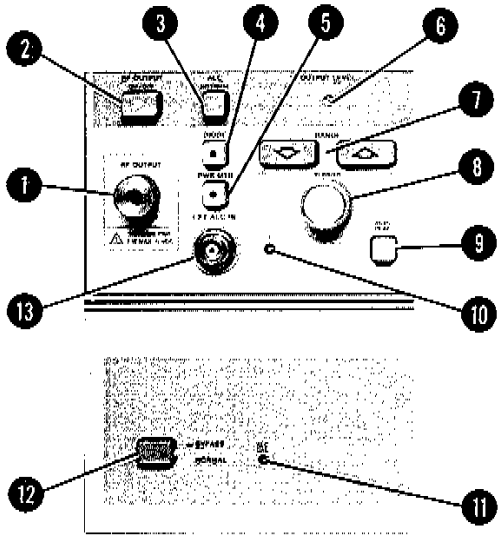
RMT: lights when the Signal Generator is in remote mode.

LSN: lights when the Signal Generator is addressed to listen.

TLK: lights when the Signal Generator is addressed to talk.

SRQ: lights when the Signal Generator is issuing the Require Service message.

Figure 3-2. Displays and Status Annunciators



1. **RF OUTPUT Connector.** 50 ohm APC 3.5 male connector supplies RF output over the entire frequency range of 0.01 to 26.5 GHz.

2. **RF OUTPUT ON/OFF Key.** Completely turns off the RF output when set to OFF. Setting the RF output to OFF causes the NOT ϕ LOCKED and ALC UNLEVELED status annunciators to light. When the RF OUTPUT is set to ON, the Signal Generator returns to normal operation.

3. **INTERNAL Key.** Selects internal circuitry for leveling the output power at the front panel RF OUTPUT connector.

4. **DIODE Key.** Selects external leveling mode for leveling power using an external diode detector. The output of the diode is connected to the EXT ALC IN connector.

5. **PWR MTR Key.** Selects external leveling mode for leveling power using an external power meter. The output of the power meter is connected to the EXT ALC IN connector.

6. **Mechanical Meter Zero.** Sets meter suspension so that the meter indicates zero when power is removed from the Signal Generator and the Signal Generator is in its normal operating position.

7. **OUTPUT LEVEL RANGE Keys (▼ and ▲).** Selects the RF output level range in 10 dB steps from –90 to +10 dBm. The selected range is displayed in the RANGE dBm display.

8. **OUTPUT LEVEL VERNIER.** Adjusts the RF output level over the range of –10 to +3 dB, relative the LVL scale as read on the meter.

9. **AUTO PEAK Key.** Maximizes power at the output frequency and optimizes pulse shape for pulse modulation.

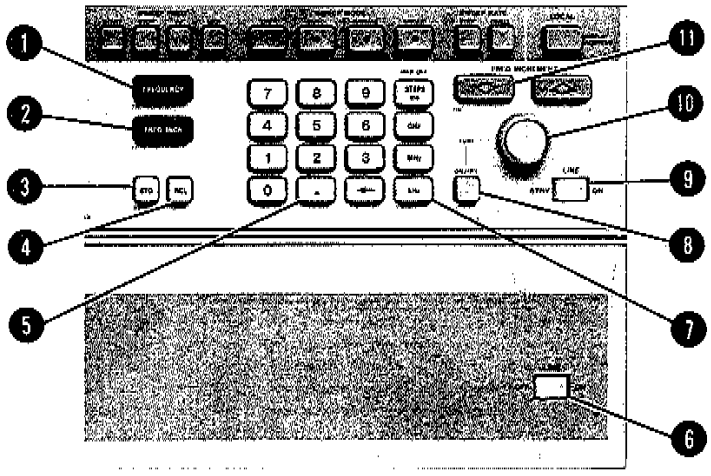
10. **CAL Control.** Adjusts the power level at the load when using a diode detector or power meter for external leveling in 2—26.5 GHz frequency range.

11. **ALC CAL Control.** Same as (10) in the 0.01 to <2.0 GHz frequency range.

12. **BYPASS/NORMAL key.** Used to switch the signal generator between BYPASS and NORMAL modes. The HP 8673C/D has RF filters for improving spectral purity in the NORMAL mode. These filters are bypassed in the BYPASS mode. For frequencies below 2.0 GHz, the signal generator automatically switches to the NORMAL mode.

13. **EXT ALC IN Connector.** BNC female connector with high input impedance (approximately 50 kΩ). Accepts positive or negative leveling signals from either a diode detector or power meter.

Figure 3-3. Output Level Features



1 **FREQUENCY Key.** Used as a prefix to the Data and Units keys to set a continuous wave (CW) frequency or center frequency for a ΔF sweep.

2 **FREQ INCR Key.** Used as a prefix to the Data and Units keys to set the step size for the FREQ INCREMENT ◀▶ and ▲▼ keys or the TUNE knob. Pressing the FREQ INCR key recalls the current increment value to the FREQUENCY MHz display (for as long as the key is depressed).

3 **STO Key.** Used as a prefix to a numeric key (a single digit 1—9 to identify the storage register) to save the current instrument settings in an internal storage register. All front panel functions can be stored, although OUTPUT LEVEL VERNIER can be stored only in remote mode.

4 **RCL Key.** Used as a prefix to a numeric key (a single digit 0—9 to identify the storage register) to recall the contents saved in that register. The instrument settings change to the recalled parameter values.

RCL 0 is used to preset the front panel. Refer to Simplified Operation in this section for a list of preset conditions.

5 **Data Keys (0-9, . and ←).** Used with Function keys (that is, FREQUENCY, FREQ INCR, and sweep function keys) and Units keys to set value-selectable parameters. Data keys 1—9 are also used with STD and RCL to identify the storage register.

The backspace key (←) clears one digit at a time starting with the least significant digit. It is used only during data entry and before any Units key is pressed.

6 **LINE Switch.** Applies power to the lower unit of the Signal generator when set to the ON position. When set to the OFF position and 8 is set to the ON position, the FREQUENCY MHz display will show a moving dot display until 9 is set to the ON positon.

7 **Units Keys (MKR OFF/STEPS/ms, GHz, MHz, and kHz).** Used as a suffix to Function and Data keys to set value-selectable parameters. Frequency entries can terminate in GHz, MHz, or kHz but they are always displayed in MHz.

The MKR OFF/STEPS/ms key serves as a terminator for setting the number of steps in a sweep, the dwell time in ms, or as a means of turning off markers. The selected function automatically determines the applicable terminator.

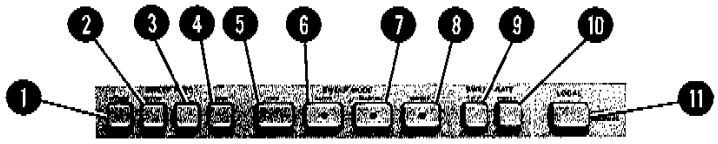
8 **TUNE ON/OFF Key.** Enables the TUNE knob when ON; disables the TUNE knob when OFF. The key LED lights when it is ON.

9 **LINE Switch.** Applies power to the Signal Generator when set to the ON position. Power is supplied to the crystal oven and the battery charger circuit in the STBY and ON positions.

10 **TUNE Knob.** Changes the CW frequency by the value set with FREQ INCR. The knob is enabled by the ON/OFF key. The knob also serves as a manual sweep mode control.

11 **FREQ INCREMENT ◀▶ and ▲▼ Keys.** Decrease or increase the CW frequency in steps; the step size is set with the FREQ INCR key. Holding either key down causes the frequency to continuously change. These keys also serve as a manual sweep mode control.

Figure 3-4. Frequency Control Features and LINE Switch



1 **SWEEP FREQ**
START Key. Used as a prefix to the Data and Units keys to set the beginning frequency of a sweep. Pressing this key displays the present START value in the FREQUENCY MHz display (for as long as the key is depressed).

2 **STOP Key.** Used as a prefix to the Data and Units keys to set the ending frequency of a sweep. Pressing this key displays the present STOP value in the FREQUENCY MHz display (for as long as the key is depressed).

3 **ΔF Key.** Used as a prefix to the Data and Units keys to set sweep span. Pressing this key displays the present span value in the FREQUENCY MHz display (for as long as the key is depressed). Center frequency of the span is set with the FREQUENCY key.

4 **MKR Key.** Enables previously selected marker frequencies when used as a prefix to Data keys 1 through 5. For example, pressing MKR and 1 enables Marker 1. When used as prefix to the Data and Unit keys, it sets marker frequencies. For example, pressing MKR, 3, 15, and GHz sets the frequency of Marker 3 to 15 GHz. (The first digit pressed after the MKR key is always the marker number.) Pressing the MKR key displays all currently enabled marker numbers within the set sweep range in the FREQUENCY MHz display. Pressing the MKR key and a Data key displays the present frequency of the requested marker.

5 **SWEEP MODE**
OFF Key. Disables the sweep.

6 **AUTO Key.** Starts a repetitive sweep (restarting at the end of each sweep). Executes single sweep only if sweep range includes 2, 3.5, 6, 16, or (HP 8673D only), 22 MHz in NORMAL mode, (see Additional Operating Information, paragraph 3-14).

7 **MANUAL Key.** Enables the sweep circuitry. It does not start a sweep. The TUNE knob (if enabled) or the FREQ INCREMENT ◀▬ and ▬▶ keys control the sweep.

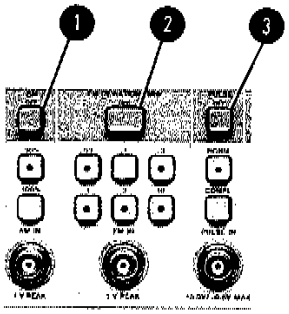
8 **SINGLE Key.** Arms the trigger for single sweep and tunes the Signal Generator to the start frequency. The sweep does not begin until the key is pressed again to trigger the sweep. When pressed during a sweep, the in-progress sweep aborts and rearms the trigger.

9 **SWEEP RATE**
STEP Key. Used as a prefix to the Data and Units keys to set the number of steps or the size of each step of a sweep. When the entry is terminated by STEPS, the number of steps is set. When the entry is terminated by GHz, MHz, or kHz, the step size is set. When this key is pressed, the number of steps is displayed on the left side of the FREQUENCY MHz display and the step size is displayed on the right side. The maximum number of steps allowed is 9999.

10 **DWELL Key.** Used as a prefix to the Data and ms keys to set the time interval between sweep steps. Pressing this key displays the present dwell time value in the FREQUENCY MHz display (for as long as the key is depressed). The allowable values for dwell time range from 1 to 255 ms.

11 **LOCAL/DISPLAY ADDRESS Key.** Returns the Signal Generator to local keyboard control from HP-IB (remote) control provided the instrument is not in local lockout. Also displays the current HP-IB address in the FREQUENCY MHz display for as long as the key is depressed.

Figure 3-5. Sweep Features and LOCAL Key



1 AM

AM OFF Key. Disables AM.

AM 30% Key. Enables AM and selects 30% full scale modulation for 1 volt peak applied to the AM IN connector.

AM 100% Key. Enables AM and selects 100% full scale modulation for 1 volt peak applied to the AM IN connector.

AM IN Connector. BNC female connector with an input impedance of 600 ohms. 1 volt peak sets full scale modulation as selected by the AM 30% or 100% key. AM depth varies linearly with the input signal level.

2 FM DEVIATION

FM DEVIATION MHz OFF Key. Disables FM.

FM DEVIATION Keys (.03, .1, .3, 1, 3, and 10). Enables FM and selects the peak deviation sensitivity in MHz obtained when a signal is applied to the

FM IN Connector. The peak deviation is read on the meter.

FM IN Connector. BNC female connector with an input impedance of 50 ohms. 1 volt peak gives full scale modulation. Deviation varies linearly with the input signal level. Deviation ranges are controlled by the FM DEVIATION keys.

3 PULSE

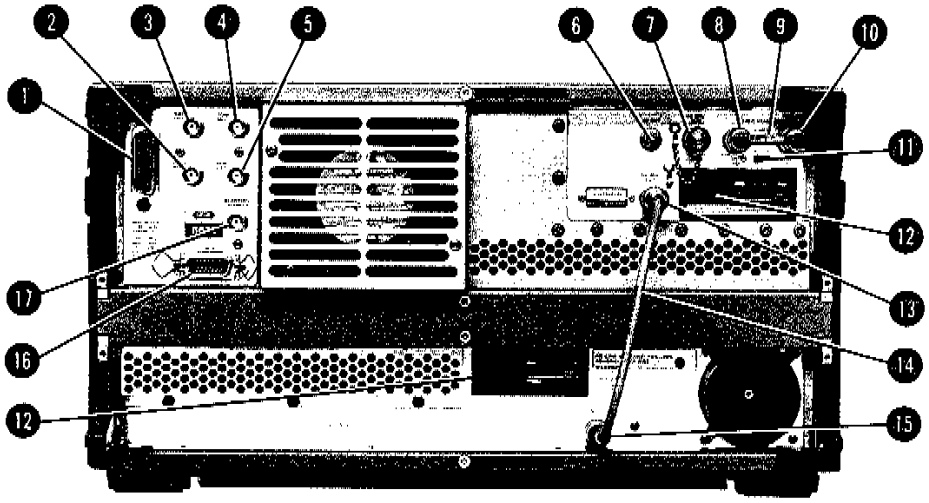
PULSE OFF Key. Disables pulse modulation.

NORM (Normal Mode) Key. Triggers RF output on when the signal to the PULSE IN connector is greater than 2.4 volts.

COMP (Complement Mode) Key. Triggers RF output on when the signal to the PULSE IN connector is less than 0.4 volts.

PULSE IN Connector. BNC female connector with an input impedance of 50 ohms. Accepts TTL levels.

Figure 3-6. Modulation Features



1. **HP-IB Connector.** Connects the Signal Generator to the Hewlett-Packard Interface Bus for remote operation.
2. **FREQ REF.** BNC female connector. Output impedance is 100Ω nominal. Provides a 1V/GHz ramp (+18V maximum) that is always on, even when sweep is off.
3. **SWP OUT.** BNC female connector. Output impedance is 100Ω nominal. Provides a 0 to +10V ramp from start to stop. An internal adjustment can set the slope of the ramp from 0 to between +4 and +12V.
4. **TONE MKR.** BNC female connector. Output impedance is 600Ω nominal, 5 kHz sine wave. Can be connected to front panel AM IN to provide AM markers.
5. **PEN LIFT.** BNC female connector. TTL-high lifts pen; TTL-low lowers pen. 100 ms delay to lift or lower pen in single sweep mode.
6. **RF OUT (A3J6).** For Options 004 and 005 only. 50Ω APC 3.5 male output connector.
7. **10 MHz OUT (A3J8).** 0 dBm (nominal) into 50Ω, can be used as an external timebase and for troubleshooting.
8. **FREQ STANDARD Output (A3J9).** 10.000 MHz into 50Ω at +7 dBm (nominal) from the internal frequency standard except when INT/EXT switch is in the EXT position.
9. **Jumper (A3W3).** Normally connects the Internal Frequency Standard Output (A3J9) to the External Frequency Standard Input (A3J10).
10. **FREQ STANDARD Input (A3J10).** Normally connected by A3W3 to A3J9. Also used to connect an external frequency standard of 5 or 10 MHz at 0 dBm to the Signal Generator.
11. **FREQ STANDARD INT/EXT Switch.** Normally left in the INT position. Removes power from internal frequency standard when in the EXT position.
12. **Line Power Modules.** Permit operation from 100, 120, 220, or 240 Vac. The number visible in the window displays the nominal line (mains) voltage for which the module is set (see Figure 2-1). The protective grounding conductor connects to the Signal Generator through this module. The line power fuse is part of this module and is the only part to be changed by the operator.
13. **100 MHz OUT (A3J7).** 0 dBm (nominal) into 50Ω; can be used as an external timebase and for troubleshooting. Reference frequency connected to A5J1 to phase lock internal internal circuits.
14. **Jumper (W60).** Connects the 100 MHz reference output (A3J7) to the reference input A5J1.
15. **100 MHz REF INPUT (A5J1).** Connected to A3J7 by W60 to phase lock internal circuits.
16. **BLANKING/MARKER.** BNC female connector. Output impedance is 100Ω nominal. Provides +5V at the beginning of each frequency change for blanking a swept display (to eliminate display of switching transients). Goes to −5V during remainder of frequency step for Z-Axis intensity marker or to 0V for non-marker frequencies.
17. **AUX Connector.** Allows remote control of frequency increment, display blanking, register recall, and start and stop sweep. Refer to Table 3-3, AUX Connector Functions, for additional information.

Figure 3-7. Rear Panel Features

3-15. OPERATOR'S CHECKS

3-16. Basic Functional Checks

Description

The purpose of these checks is to give reasonable assurance that the instrument is operating properly.

Each check has been designed to be performed with a minimum of test equipment, and in as short a time as possible. Therefore, although these checks are extremely valuable in identifying malfunctions, they are not a substitute for the Performance Tests in Section IV, which verify that the instrument is performing within its published specifications.

Each check is independent from the others and can be performed separately. Simply press RCL 0 to preset the Signal Generator to a known state before beginning an individual check.

If a malfunction is suspected, the entire procedure should be performed in the order given. Make a note of all the checks that failed. Table 8-6, Overall Troubleshooting, gives the appropriate troubleshooting procedures to follow if the Signal Generator is to be repaired at the user's facility.

If the instrument is to be returned to Hewlett-Packard for repair, fill out a blue repair tag (found at the end of this manual). Include on the back of the tag a list of all checks that failed and attach the tag to the instrument. This will give the repair technician a good description of the malfunction and help assure the best possible service.

Equipment

Test Oscillator	HP 654B
Pulse Generator	HP 8013B
Oscilloscope	HP 1980A
Termination, 50 ohm	HP 8493B, Option 010

Procedure

Turn-On Check

1. Set the upper LINE switch to STBY and the lower LINE switch to OFF. Remove all external cables from the front and rear panels of the Signal Generator, including the power cables connecting the instrument to mains power.
2. Set the rear panel FREQ STANDARD INT/EXT switch to INT.
3. Connect the short jumper (A3W3) between A3J9 and A3J10.
4. Connect the long jumper (W60) between 100 MHz OUT and 100 MHz REF INPUT.
5. After the power cables have been disconnected from the Signal Generator for at least 1 minute, reconnect them to the Signal Generator. Check the front panel of the instrument to verify that the STANDBY and OVEN COLD status annunciators are on.
6. Leave the instrument's upper LINE switch set to STBY until the OVEN COLD status annunciator turns off. This should occur in 15 minutes or less, depending upon how long the Signal Generator was disconnected from mains power. (The OVEN COLD annunciator may flicker off and on temporarily just as the oven stabilization temperature is reached. This is normal operation.) Once the OVEN COLD status annunciator is off set both LINE switches to ON.

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

NOTE

If the MESSAGE key light is on or flashing, the instrument self-diagnostics detected a malfunction during turn-on. Press and hold the MESSAGE key to display the message code in the FREQUENCY MHz display. Any code other than 00 represents an error. Refer to Table 3-8 or the operating information pull-out card for a complete listing of message codes and the malfunctions they represent. Occasionally, due to line transients or other external conditions, the instrument self-diagnostics may indicate a false error. Pressing the MESSAGE key and repeating the turn-on procedure will usually differentiate between real and false errors. Errors that repeat are real.

7. Set the FREQ STANDARD INT/EXT switch to EXT. Verify that the EXT REFERENCE and NOT ϕ LOCKED status annunciators turn on. Set the switch back to INT. The status annunciators should then turn off.

8. Press RCL 0. Verify that the instrument is now preset to the following conditions:
   RF OUTPUT to ON
   ALC INTERNAL to ON
   OUTPUT LEVEL RANGE to −70 dBm
   AUTO PEAK to ON
   Meter scale to LVL
   AM, FM, and Pulse Modulation to OFF
   FREQUENCY to 3000.000 MHz
   FREQ INCR to 1.000 MHz
   START to 2000.000 MHz
   STOP to 4000.000 MHz
   ΔF to 2000.000 MHz
   SWEEP to OFF
   STEP to 100 Steps (20.000 MHz)
   DWELL to 20 ms
   TUNE Knob to ON
   All Status Annunciators off
   MESSAGE key light off
   BYPASS/NORMAL to NORMAL

Frequency Check:

The FREQUENCY MHz display and NOT ϕ LOCKED status annunciator are used to check that the internal phase-lock loops remain phase locked across their tuning range. The actual frequency at the RF OUTPUT connector is not checked. However, this connector can be monitored with a microwave frequency counter or spectrum analyzer for greater assurance that the Signal Generator is operating properly.

9. Press RCL 0.

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

10. Set the Signal Generator frequency to 1.000000 GHz and FREQ INCRMENT to 1.111111 GHz.

11. Step the Signal Generator from 1.000000 GHz to 11.000000 GHz in 1.111111 GHz steps. Verify that the NOT ϕ LOCKED annunciator remains off at each step.

NOTE

Fast stepping or tuning of frequency may cause the NOT PHASED LOCKED LED to flash on momentarily. This is normal and does not indicate a malfunction. Also note that some steps will not exactly equal 1.111111 GHz depending upon the resolution of each frequency band.

12. Set FREQUENCY to 10 MHz and then to 18.6 GHz (HP 8673C) or 26.5 (HP 8673D). (This is the overrange region of operation.) Verify that the NOT ϕ LOCKED annunciator remains off at both frequencies.

Output Level Check:

The Signal Generator's output leveling loop is checked to ensure that it remains locked at all specified power levels. The internal output leveling loop monitors most of the RF output circuitry.

13. Press RCL 0 to set the Signal Generator to a known state.

14. Connect a 50-ohm load or 10 dB attenuator to the Signal Generator's RF OUTPUT connector. (This reduces unwanted power reflections back into the RF OUTPUT connector, thereby preventing a false ALC UNLEVELED annunciator indication.)

15. Set FREQUENCY to 6.6 GHz and Output Level VERNIER to −2 dB.

16. Press the RF OUTPUT key to OFF. Verify that the ALC UNLEVELED and NOT ϕ LOCKED status annunciators turn on and that the meter indicates <−10 dBm.

17. Press the RF OUTPUT ON/OFF key to ON. Verify that the status annunciators turn off and that the meter indicates −2 dB.

18. Step the output level down in 10 dB steps from −70 to −90 dBm using the RANGE key. Then, step the output level up in 10 dB steps from −90 to +10 dBm. Verify that the ALC UNLEVELED annunciator remains off at each step.

19. Set Output Level RANGE to 0 dBm and sweep the Output Level VERNIER from −10 dB to +3 dB. Verify that the ALC UNLEVELED annunciator remains off at all VERNIER settings.

20. Press RCL 0 to set the Signal Generator to a known state.

21. Set frequency to 16.1 GHz.

22. Repeat step 19.

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

23. Set FREQ INCR to 10 MHz. Then, set the output level to the values shown in the following table. Tune from the corresponding start frequency to the stop frequency for each output level. Verify that the indicated power level on the meter remains constant and stable and that the ALC UNLEVELED annunciator remains off. (This ensures that the instrument can generate specified output power and remain leveled.)

STANDARD

Model	Range	Vernier	Start	Stop
HP 8673C/D	+10 dBm	+1 dB	0.05 GHz	1.99 GHz
HP 8673C/D	+10 dBm	−5 dB	2.00 GHz	15.99 GHz
HP 8673C	0 dBm	+2 dB	16.00 GHz	18.60 GHz
HP 8673D	+10 dBm	−4 dB	16.00 GHz	26.00 GHz

OPTION 001

Model	Range	Vernier	Start	Stop
HP 8673C/D	+10 dBm	+2 dB	0.05 GHz	1.99 GHz
HP 8673C/D	+10 dBm	−3 dB	2.00 GHz	15.99 GHz
HP 8673C	+10 dBm	−6 dB	16.00 GHz	18.60 GHz
HP 8673D	+10 dBm	−1 dB	16.00 GHz	26.00 GHz

OPTION 004

Model	Range	Vernier	Start	Stop
HP 8673C/D	+10 dBm	0 dB	0.05 GHz	1.99 GHz
HP 8673C/D	+10 dBm	−6 dB	2.00 GHz	15.99 GHz
HP 8673C	0 dBm	+1 dB	16.00 GHz	18.60 GHz
HP 8673D	+10 dBm	−6 dB	16.00 GHz	26.00 GHz

OPTION 005

Model	Range	Vernier	Start	Stop
HP 8673C/D	+10 dBm	+2 dB	0.05 GHz	1.99 GHz
HP 8673C/D	+10 dBm	−4 dB	2.00 GHz	15.99 GHz
HP 8673C	0 dBm	+3 dB	16.00 GHz	18.60 GHz
HP 8673D	+10 dBm	−3 dB	16.00 GHz	26.00 GHz

Sweep Check:

The FREQUENCY MHz display is used to check the ability of the Signal Generator to SWEEP.

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

24. Press RCL 0 to set the instrument to a known state and press BYPASS/NORMAL to enable BYPASS mode. Then, press the AUTO sweep key. Verify that the FREQUENCY MHz display now shows a start frequency of 2000.000 MHz and a stop frequency of 4000.000 MHz. The AUTO key light should flash once each time a new sweep begins.

25. Press SWEEP OFF. Verify that the FREQUENCY MHz display returns to 3000.000 MHz.

26. Press the MANUAL sweep key. The FREQUENCY MHz display should show 2000.000 MHz. Tune the frequency up by turning the TUNE knob clockwise. Verify that the FREQUENCY MHz display changes in 20 MHz increments and stops at 4000.000 MHz.

27. Tune the frequency down to 2000.000 MHz by turning the TUNE knob counterclockwise. Verify that the FREQUENCY MHz display changes in 20 MHz steps and stops at 2000.000 MHz.

28. Press the SWEEP OFF key and verify that the FREQUENCY MHz returns to 3000.000 MHz.

29. Press the SINGLE sweep key. Verify that the key light turns on and the FREQUENCY display shows 2000.000 MHz.

30. Press the SINGLE sweep key again. A single sweep should now be executed. Verify that the FREQUENCY MHz display changes in 20 MHz steps very rapidly until 4000.000 MHz is reached. The display then returns to the START frequency of 2000.000 MHz.

31. Press the SWEEP OFF key. Verify that the FREQUENCY MHz display returns to 3000.000 MHz.

AM Check:

The front panel meter and ALC UNLEVELED status annunciator are used as an indication of AM. The meter monitors input signal level only, rather than actual AM. A spectrum analyzer can be used to monitor the signal at the RF output connector for greater assurance of AM performance.

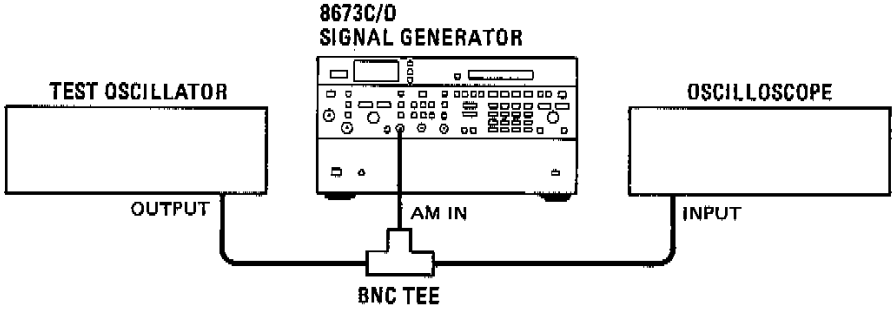


Figure 3-8. AM Functional Check Setup

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

32. Press RCL 0 to preset the Signal Generator to a known state.

33. Set the test oscillator to 10 kHz at a minimum output level or 0V. Then, connect the test oscillator and oscilloscope to the Signal Generator as shown in Figure 3-8.

34. Set the Signal Generator to each setting shown in the table below. For each setting, slowly increase the test oscillator's output level (starting from 0V) while observing the Signal Generator's meter in AM mode. The meter should indicate a smooth and continuous increase in AM depth. When the meter displays the %AM indicated in the table, verify that the oscilloscope shows the corresponding voltage. The ALC UNLEVELED status annunciator should remain off at all times.

ALC UNLEVELED LED	Signal Generator					Oscilloscope
	FREQUENCY	RANGE	VERNIER	AM Key	% AM	Display
Off	1 GHz	0 dBm	0 dB	100%	75	0.75V peak
Off	18 GHz	0 dBm	0 dB	100%	75	0.75V peak
8673D only						
Off	24 GHz	0 dBm	-3 dB	100%	75	0.75V peak
Off	26 GHz	0 dBm	-5 dB	100%	50	0.5V peak
Off	26 GHz	0 dBm	-5 dB	30%	30	1.0V peak

35. Press AM OFF. Disconnect the test oscillator and oscilloscope from the Signal Generator.

FM Check:

The front panel meter is used to monitor input signal level, which is proportional to FM deviation. A spectrum analyzer can be used to monitor the signal at the RF OUTPUT connector for greater assurance of FM performance. The FM OVERMOD status annunciator detects a FM overmodulation condition.

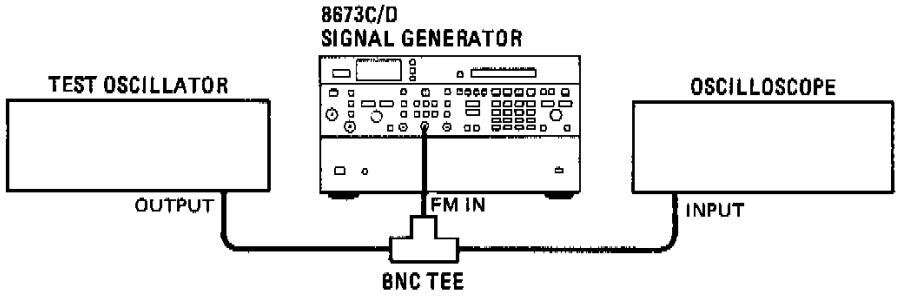


Figure 3-9. FM Functional Check Setup

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

36. Press RCL 0 to preset the Signal Generator to a known state. Set Output Level RANGE to 0 dBm, Output Level VERNIER to 0 dB, and FM DEVIATION range to .03 MHz. Then, set the meter scale to FM.

37. Set the test oscillator to 10 MHz at minimum output level or 0V. Then, connect test oscillator and oscilloscope to the Signal Generator as shown in Figure 3-9.

38. Slowly increase the output level of the test oscillator (starting from 0V) until the Signal Generator's meter reads full scale. Verify that the meter increases slowly and continuously and that the FM OVERMOD status annunciator remains off. The oscilloscope display should be approximately 1V peak.

39. Repeat step 38 for each of the following FM deviation ranges: .1, .3, 1, 3, and 10 MHz.

40. Set the Signal Generator's FM DEVIATION range to 10 MHz. Increase the test oscillator output level until a full scale reading is obtained. Decrease the test oscillator frequency slowly until the Signal Generator's FM OVERMOD status annunciator turns on. This should occur at a modulation frequency of 1 to 2 MHz, (modulation index approximately 6.5).

41. Press FM DEVIATION MHz OFF and disconnect the test oscillator and oscilloscope from the Signal Generator.

Pulse Modulation Check:

Pulse modulation is checked using various front panel status annunciators. Although pulse modulation is not monitored at the RF OUTPUT connector, the status annunciators give a high degree of confidence that pulse modulation is functionally working.

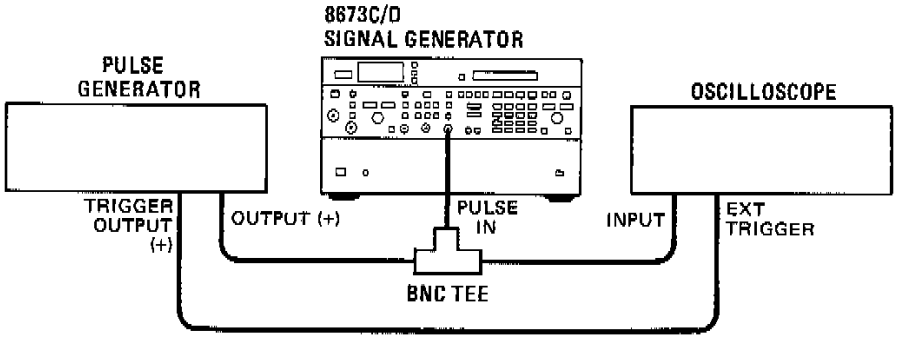


Figure 3-10. Pulse Modulation Functional Check Setup

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

42. Press RCL 0. Set Output Level RANGE to 0 dBm and Output Level VERNIER to 0 dB.

43. Press the PULSE COMPL key. The ALC UNLEVELED status annunciator should remain off.

44. Press the PULSE NORM key. Verify that the ALC UNLEVELED status annunciator turns on. Press PULSE OFF and verify that ALC UNLEVELED status annunciator now turns off.

45. Connect the pulse generator and oscilloscope to the Signal Generator as shown in Figure 3-10.

46. Set the oscilloscope to 50 ohm input impedance and external horizontal trigger.

47. Set the pulse generator to the following:

    pulse period range ..... 20 ns—1 μs
    pulse delay range ..... 35 ns—1 μs
    pulse width range ..... 10 ns—1 μs
    amplitude range ..... 2—5V

    In addition, internal load and normal pulse should be selected. (Internal load places a 50Ω internal load on output pulse for proper impedance matching.)

48. On the pulse generator, adjust the pulse period vernier for an oscilloscope display of 1 pulse per microsecond. Then, adjust the pulse width vernier (and oscilloscope) for an individual pulse width of approximately 150 ns. Adjust the amplitude vernier for a pulse height of approximately 3V peak.

49. With Pulse OFF selected (CW mode), note the indicated power level on the Signal Generator's meter (should be 0 dBm). Press PULSE NORM and PULSE COMPL keys while observing any change in indicated output power level. Indicated level should not vary more than ± 1 dB from the level referenced with pulse off, (CW mode).

50. While in PULSE NORM mode, slowly reduce the pulse width from 150 ns to 50 ns. The ALC UNLEVELED annunciator should come on as 100 ns pulse width is approached. It should remain on down to at least 50 ns. The output level indicated on Signal Generator meter may also vary >1 dB as the ALC UNLEVELED annunciator comes on. This is normal instrument operation, indicating a "pulse unleveled" condition.

51. Set FREQUENCY to 1.0 GHz.

52. Repeat steps 49—50.

53. Press PULSE OFF and disconnect the oscilloscope and test oscillator from the Signal Generator.

Memory Check

54. Set FREQUENCY to 15 GHz and Output Level RANGE to −20 dBm.

OPERATOR'S CHECKS

Basic Functional Checks (cont'd)

55. Turn the Signal Generator's upper LINE switch to STBY, wait 30 seconds, then turn the LINE switch to ON. Verify that the FREQUENCY MHz display shows 15000.000 MHz and the RANGE dBm display shows –20 dBm.

Message Check

56. Press RCL 0 to preset the Signal Generator to a known state. Enter a FREQUENCY of 30 GHz and verify that the FREQUENCY DISPLAY remains at 3000 MHz and the MESSAGE key light turns on.

57. Press and hold the MESSAGE key. The FREQUENCY MHz display should show message code 01 (frequency out of range).

58. Release the MESSAGE key. Verify that the key light turns off.

3-17. HP-IB Functional Checks

Description: These procedures check the Signal Generator's ability to process or send the HP-IB messages described in Table 3-4. Only the Signal Generator, a controller, and an HP-IB interface are needed to perform these checks.

These procedures do not check if all Signal Generator program codes are being properly interpreted and executed by the instrument. However, if the power-up sequence (including the memory checks) and the front panel operation is good, the program codes, in all likelihood, will be correctly implemented.

The validity of these checks is based on the following assumptions:

a. The Signal Generator performs properly when operated via the front panel keys (that is, in local mode). This can be verified by the Basic Functional Checks.

b. The bus controller properly executes HP-IB operations.

c. The bus controller's HP-IB interface properly executes the HP-IB operations.

If the Signal Generator appears to fail any of these HP-IB checks, the validity of the above assumptions should be confirmed before attempting to service the instrument.

The select code of the controller's HP-IB interface is assumed to be "7". The address of the Signal Generator is assumed to be "19" (its address as set at the factory). This particular select code address combination (that is, 719) is not necessary for these checks to be valid. However, the program lines presented here have to be modified for any other combination.

These checks can be performed together or separately. Any special requirements for a check are described at the beginning of the check.

Initial Setup: The test setup is the same for all of the checks. Connect the Signal Generator to the bus controller via the HP-IB interface.

Equipment:

HP IB Controller	HP 9825A/98213A (General and Extended I/O ROM) —or— HP 85F/82903A (16K Memory Module)/00085-15005 (Advanced Programming ROM)
HP-IB Interface	HP 98034A (for HP 9825A) HP 82937A (for HP 85F)

Remote and Local Messages and the LOCAL Key

NOTE: This check determines if the Signal Generator properly switches from local to remote control, from remote to local control, and if the LOCAL key returns the instrument to local control. If the Signal Generator is in remote mode (that is, the front panel RMT annunciator is on), switch the instrument to STBY, then to ON.

OPERATOR'S CHECKS

HP-IB Functional Checks (cont'd)

Description	HP 9825A (HPL)	HP 85F (BASIC)
Send the Remote message (by setting Remote Enable, REN, true and addressing the Signal Generator to listen).	rem 719	REMOTE 719

OPERATOR'S RESPONSE: Check that the Signal Generator's RMT and LSN annunciators are on.

Send the Local message to the Signal	lcl 719	LOCAL 719

OPERATOR'S RESPONSE: Check that the Signal Generator's RMT annunciator is off but its LSN annunciator is on.

Send the Remote message to the Signal Generator	rem 719	REMOTE 719

OPERATOR'S RESPONSE: Check that both the Signal Generator's RMT and LSN annunciators are on. Press the LOCAL key on the Signal Generator. Check that the Signal Generator's RMT annunciator is now off, but that its LSN annunciator remains on.

Sending the Data Message

NOTE: This check determines if the Signal Generator properly issues Data messages when addressed to talk. Before beginning this check, turn the Signal Generator's LINE switch to STBY, then to ON. Then key in RCL 0 to preset the front panel.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Address the Signal Generator to talk and store its output in variable V.	red 719, V	ENTER 719; V
Display the value of V.	dsp V	PRINT V

OPERATOR'S RESPONSE: Check that the Signal Generator's TLK annunciator is on. The controller's display should read 3000000000.00 (HP 9825A) or 3000000000 (HP 85F). This corresponds to the data output shown in the FREQUENCY MHz display.

HP-IB Functional Checks (cont'd)

Receiving the Data Message

NOTE: This check determines if the Signal Generator properly receives Data messages.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Send the first part of the Remote message (enabling the Signal Generator to remote).	rem 7	REMOTE 7
Address the Signal Generator to listen (completing the Remote message), then send a Data message.	wrt 719; "fr15gz"	OUTPUT 719; "FR15GZ"

OPERATOR'S RESPONSE: Check that both the Signal Generator's RMT and LSN annunciators are on and that the FREQUENCY MHz display shows 15000.000 MHz.

Local Lockout and Clear Lockout/Set Local Messages

NOTE: This check determines if the Signal Generator properly receives the Local Lockout message, disabling the LOCAL key. The check also determines if the Clear Lockout/Set Local message is properly received and executed by the Signal Generator. This check assumes that the Signal Generator is in the remote mode.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Send the Local Lockout message.	llo 7	LOCAL LOCKOUT 7

OPERATOR'S RESPONSE: Check that the Signal Generator's RMT annunciator is on. Press the Signal Generator's LOCAL key. The RMT annunciator should remain on.

Send the Clear Lockout/Set Local message.	lcl 7	LOCAL 7

OPERATOR'S RESPONSE: Check that the Signal Generator's RMT annunciator is off.

Return the Signal Generator to remote mode if the remaining checks in this section are to be performed.	rem 719	REMOTE 719

OPERATOR'S RESPONSE: Check that the Signal Generator's RMT annunciator is on.

OPERATOR'S CHECKS

HP-IB Functional Checks (cont'd)

Clear Message

NOTE: This check determines if the Signal Generator properly responds to the Clear message. This check assumes that the Signal Generator is in the remote mode.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Send a Data message that turns AUTO PEAK off.	wrt 719, "k0"	OUTPUT 719; "K0"

OPERATOR'S RESPONSE: Check that the Signal Generator's AUTO PEAK key light is off.

Send the Clear message (turning the Signal Generator's AUTO PEAK function on).	clr 719	CLEAR 719

OPERATOR'S RESPONSE: Check that the Signal Generator's AUTO PEAK key light is on.

Abort Message

NOTE: This check determines if the Signal Generator becomes unaddressed when it receives the Abort message. This check assumes that the Signal Generator is in the remote mode.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Address the Signal Generator to listen.	wrt 719	OUTPUT 719

OPERATOR'S RESPONSE: Check that the Signal Generator's LSN annunciator is on.

Send the Abort message, unaddressing the Signal Generator from listening.	cli 7	ABORTIO 7

OPERATOR'S RESPONSE: Check that the Signal Generator's LSN annunciator is off.

HP-IB Functional Checks (cont'd)

Status Byte Message

NOTE: This check determines if the Signal Generator sends the Status Byte message. Before beginning this check, turn the Signal Generator's LINE switch to STBY, then to on.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Place the Signal Generator in serial-poll mode (causing it to send the Status Byte message).	rds(719)→V	V=SPOLL (719)
Display the value of V.	dsp V	PRINT V

OPERATOR'S RESPONSE: The controller's display should read 12.00 (HP 9825A) or 12 (HP 85F).

Require Service Message

NOTE: This check determines if the Signal Generator can issue the Require Service message (set the SRQ bus control line true). This check can be performed in either local or remote mode.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Send a Data message to set the RQS Mask to 32.	wtb 719, "@1", 32	OUTPUT 719 USING "2A, B"; "@1", 32
Send a Data message containing an invalid HP-IB code. This causes a Require Service message to be sent.	wrt 719, "fr 35 gz"	OUTPUT 719; "FR 35 GZ"

OPERATOR'S RESPONSE: Check that the SRQ annunciator is on.

Read the binary status of the controller's HP-IB interface and store the data in variable V (in this step, 7 is the interface's select code).	rds (7) →V	STATUS 7, 2;V
Display the value of the SRQ bit (in this step 7 is the SRQ bit for the HP 9825A and 5 is the SRQ bit for the HP 85F, numbered from 0).	dsp"SRQ=", bit(7,V)	PRINT"SRQ="; BIT(V,6)

OPERATOR'S RESPONSE: Check that the SRQ value is 1, indicating the Signal Generator issued the Require Service message. Check that SRQ LED is off.

OPERATOR'S CHECKS

HP-IB Functional Checks (cont'd)

Status Bit Message

NOTE: This check determines whether or not the Signal Generator sends the Status Bit message. This check can be performed in either local or remote mode. If the Signal Generator's SRQ annunciator is off, perform the first part of the Require Service Message check before beginning this check.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Configure the Signal Generator to respond to a parallel poll on HP-IB data line DI03.	polc 719, 10	SEND 7; LISTEN 19 CMD 5 SCG 10
Place the Signal Generator in parallel poll mode (causing it to send the Status Bit message) and store the result in variable V.	pol(7) →V	V = PPOLL (7)
Display the value of V.	dsp V	PRINT V

OPERATOR'S RESPONSE: Check that the SRQ annunciator is on and that the response to the parallel poll is 4, indicating that the Signal Generator issued the Status Bit message.

Unconfigure the Signal Generator from responding to a parallel poll.	polu 719	SEND 7; LISTEN 19 CMD 5 SCG 18
Place the Signal Generator in parallel poll mode.	pol(7) →V	V = PPOLL (7)
Display the value of V.	dsp V	PRINT V

OPERATOR'S RESPONSE: Check that the SRQ annunciator is on and that the response to the parallel poll is 0, indicating that Signal Generator is no longer configured to respond to a parallel poll. Then, turn the LINE switch to STBY, then to ON, to turn the SRQ annunciator off.

HP-IB Functional Checks (cont'd)

Trigger Message

NOTE: This check determines if the Signal Generator responds to the Trigger message. This check assumes that the Signal Generator is in remote mode.

Description	HP 9825A (HPL)	HP 85F (BASIC)
Send a Data message to set the Signal Generator's frequency to 9999 MHz.	wrt 719, "fr 9999 mz"	OUTPUT 719; "FR 9999 MZ"
Set the Signal Generator's frequency increment to 1111 MHz.	wrt 719, "fi 1111 mz"	OUTPUT 719; "FI 1111 MZ"

OPERATOR'S RESPONSE: Check that the Signal Generator's frequency is set to 9999 MHz. Then press the Signal Generator's FREQ INCR key to check for an increment of 1111 MHz. This keyboard function is possible in the remote state (even if local lockout is enabled).

Configure the Signal Generator's trigger response to be an INCREMENT (down) function (that is, dn).	wrt 719, "ct dn"	OUTPUT 719;"CT DN"
Send a Trigger message.	trg 719	TRIGGER 719

OPERATOR'S RESPONSE: Check that the Signal Generator's frequency changes to 8888 MHz.

3-18. REMOTE OPERATION, AUXILIARY CONTROL

3-19. AUX Input Lines

A limited number of instrument functions can be controlled through the rear panel AUX connector. These functions are listed in Table 3-3 below.

The input lines are TTL compatible and negative-edge sensitive. They require a minimum of 5 μs between negative edges. Input signals can be generated by clean TTL drivers or by mechanical switches that require debouncing. The Signal Generator has a built-in debouncing circuit that should be enabled or bypassed depending upon which type of driver is used.

The Signal Generator is shipped from the factory configured for electrically-clean control signals (that is, the internal debouncing circuit is bypassed).

Refer to Section II, Installation, for the procedure for enabling or bypassing the debouncing circuit.

NOTE

Section II, Installation, also shows the pinout configuration of the AUX connector as well as information for a recommended mating connector.

3-20. AUX Output Lines

The AUX connector also has a ground line and three TTL-compatible output lines. The output lines are normally held at the high TTL level. The End of Sweep line produces one 5 μs low-going pulse at the end of each sweep. The Trigger line produces one 5 μs low-going pulse when the Signal Generator has made a large frequency change that may cause loss of phase lock in an instrument tracking the Signal Generator. The Negative Blanking line produces –5V for Z-axis blanking of CRT displays that require a negative blanking voltage.

Table 3-3. AUX Connector Functions

	Pin	Function	Description
INPUTS	1	Recall 1	Recalls the contents of internal storage register 1.
	2	Recall Next	Sequential recall of internal storage registers 2 through 9
	3	FREQ INCREMENT Up	Same as FREQ INCREMENT Up key
	4	FREQ INCREMENT Down	Same as FREQ INCREMENT Down key
	5	Trigger Single Sweep	Same as SINGLE key
	6	Service	Same as internal service switch (on A2A2 Key Code Assembly). Refer to Section VIII, Service
	7	Stop Sweep	Stops sweep. Sweep resumes when this line goes high
	12	No Display	Blanks FREQUENCY MHz display when this pin is grounded and the existing display changes
OUTPUTS	8	Negative Blanking	–5V for blanking
	9	Trigger	One pulse when the Signal Generator has made a frequency change that may cause loss of phase lock to an instrument tracking the Signal Generator
	10	End of Sweep	One pulse at end of each sweep
	11	Ground	

3-21. REMOTE OPERATION, HEWLETT-PACKARD INTERFACE BUS

The Signal Generator can be operated through the Hewlett-Packard Interface Bus (HP-IB). Bus compatibility, programming, and data formats are described in the following paragraphs.

All front panel functions (except that of the LINE switch and the backspace key) and remote-only functions are programmable via HP-IB.

A quick test of the Signal Generator's HP-IB interface is described earlier in this section under Remote Operator's Checks. These checks verify that the Signal Generator can respond to or send each of the applicable bus messages described in Table 3-4.

3-22. HP-IB Compatibility

The Signal Generator has a three-state, TTL, HP-IB interface which can be used with any HP-IB computing controller or computer for automatic system applications. The Signal Generator is programmable via the HP Interface Bus. Its programming capability is described by the twelve HP-IB messages listed in Table 3-4. The Signal Generator's compatibility with HP-IB is further defined by the following list of interface functions: SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP1, DC1, DT1, and C0. A more detailed explanation of these compatibility codes can be found in IEEE Standard 488-1978 (and the identical ANSI Standard MC1.1). For more information about HP-IB, refer to the Hewlett-Packard Electronic Instruments and Systems catalog and the booklet titled "Improving Measurements in Engineering and Manufacturing" (HP part number 5952-0058).

3-23. Remote Mode

Remote Capability. The Signal Generator communicates on the bus in both remote and local modes. In remote, most of the Signal Generator's front panel controls are disabled. Exceptions are the LINE switch, the LOCAL key, the MTR keys, the MESSAGE key, and the FREQUENCY, FREQ INCR, SWEEP FREQ and SWEEP RATE keys for displaying "hidden" parameters. However, front panel displays remain active and valid. In remote, the Signal Generator can be addressed to talk or listen. When addressed to listen, the Signal Generator automatically stops talking and responds to the following messages: Data, Trigger (if configured), Clear (SDC), Remote, Local, Local Lockout, and Abort. When addressed to talk, the Signal Generator automatically stops listening and sends one of the following messages: Data, Require Service, or Status Byte. Whether addressed or not, the Signal Generator responds to the Clear (DCL), Local Lockout, Clear Lockout/Set Local, and Abort messages. In addition, the Signal Generator can issue the Require Service message and the Status Bit message.

Local-to-Remote Mode Changes. The Signal Generator switches to remote operation upon receipt of the Remote message. The Remote message has two parts. They are:

a. Remote enable bus control line (REN) set true.

b. Device listen address received once (while REN is true).

When the Signal Generator switches to remote, the RMT annunciator on the front panel turns on. With the exception of VERNIER, which may change by less than 0.1 dB, the Signal Generator's control settings remain unchanged with the Local-to-Remote transition.

3-24. Local Mode

Local Capability. In local, the Signal Generator's front panel controls are fully operational and the instrument responds to the Remote message. The Signal Generator can send a Require Service message, a Status Byte messsage, and a Status Bit message.

Remote-to-Local Mode Changes. The Signal Generator always switches to local from remote whenever it receives the Local message (GTL) when addressed to listen or the Clear Lockout/Set Local message. (The Clear Lockout/Set Local message sets the Remote Enable control line [REN] false.) The Signal Generator can also be switched to local by pressing the front panel LOCAL key (assuming Local Lockout is not in effect). With the exception of VERNIER, which may change by less than 0.1 dB, the Signal Generator's control settings remain unchanged with the Remote-to-Local transition.

Local Lockout. When a data transmission is interrupted, which can happen by pressing the LOCAL key to return the Signal Generator to local mode, the data could be lost. This would leave the Signal Generator in an unknown state. To prevent this, a local lockout is recommended for purely automatic

Table 3-4. Message Reference Table (1 of 2)

HP-IB Message	Appli-cable	Response	Related Commands and Controls	Inter-face Func-tions*
Data	Yes	All front panel functions (except the LINE switch and the Backspace key) and remote-only functions are bus programmable		AH1 SH1 T5 TE0 L3 LE0
Trigger	Yes	If in remote and addressed to listen, the Signal Generator executes a previously selected program code. It responds equally to the Group Execute Trigger (GET) bus command and program code TR (a Data message).	GET	DT1
Clear	Yes	Sets output to 3000.000 MHz at −70 dBm with sweep and modulation off. Resets many additional parameters as shown in Table 3-6. Responds equally to Device Clear (DCL) and Selected Device Clear (SDC) bus commands.	DCL SDC	DC1
Remote	Yes	Remote mode is enabled when the REN bus control line is true. However, remote mode is not entered until the first time the Signal Generator is addressed to listen. The front panel RMT annunciator lights when the instrument is actually in the remote mode.	REN	RL1
Local	Yes	The Signal Generator returns to local mode (front panel control). It responds equally to the Go To Local (GTL) bus command and the front panel LOCAL key.	GTL	RL1
Local Lockout	Yes	The LOCAL key is disabled. Only the controller can return the Signal Generator to local (front panel control).	LLO	RL1
Clear Lockout/ Set Local	Yes	The Signal Generator returns to local (front panel control) and local lockout is cleared when the REN bus control line goes false.	REN	RL1
Pass Control/Take Control	No	The Signal Generator has no controller capability.		C0
Require Service	Yes	The Signal Generator sets the SRQ bus control line true if one of the following conditions exists and it has been enabled by the Request Mask to send the message for that condition: Front Panel Key Pressed, Front Panel Entry Complete, Change in Extended Status, Source Settled, End of Sweep, Entry Error, and Change in Sweep Parameters.	SRQ	SR1
Status Byte	Yes	The Signal Generator responds to a Serial Poll Enable (SPE) bus command by sending an 8-bit byte when addressed to talk. If the instrument is holding the SRQ control line true (issuing the Require Service message) bit 7 (RQS bit) in the Status Byte and the bit representing the condition causing the Require Service message to be issued will both be true. The bits in the Status Byte are latched but can be cleared upon receiving the Clear Status (CS) program code, executing the Output Status function, or executing a serial poll while the SRQ control line is held true.	SPE SPD	T5

Table 3-4. Message Reference Table (2 of 2)

HP-IB Message	Applicable	Response	Related Commands and Controls	Interface Functions*
Status Bit	Yes	The Signal Generator responds to a Parallel Poll Enable (PPE) bus command by sending a bit on a controller selected HP-IB data line.	PPE PPD PPC PPU	PP1
Abort	Yes	The Signal Generator stops talking and listening.	IFC	T5,TE0 LE,LE0

*Commands, Control lines, and Interface Functions are defined in IEEE Std 488-1978. Knowledge of these may not be necessary if your controller's manual describes programming in terms of the twelve HP-IB Messages shown in the left column.

Complete HP-IB capability as defined in IEEE Std 488 and ANSI Std MC1.1 is: SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP1, DC1, DT1, and C0.

Local Mode (cont'd)

applications. Local lockout disables the LOCAL key and allows return-to-local only under program control.

NOTE

Return-to-local can also be accomplished by turning the Signal Generator's LINE switch to STBY, then back to ON. However, this technique has some disadvantages:

a. It defeats the purpose and advantage of local lockout (that is, the system controller loses control of a system element).

b. There are several HP-IB conditions that reset to default states at turn-on.

3-25. Addressing

The Signal Generator interprets the byte on the eight HP-IB data lines as an address or a bus command if the bus is in the command mode. The command mode is defined as attention control line (ATN) true and interface clear control line (IFC) false. Whenever the Signal Generator is addressed (if in local or remote), either the TLK or LSN annunciator on the front panel turns on.

The Signal Generator's Talk and Listen addresses can be set from switches located inside the instrument or from the front panel. The address selection procedure is described in Section II.

The decimal equivalent of the addresses can be displayed in the FREQUENCY MHz display by pressing and holding the LOCAL key. This is the decimal equivalent of the last five bits of both the Talk and Listen ASCII address codes. Refer to Table 2-1 for a comprehensive listing of all valid HP-IB address codes.

Listen Only Mode. If the internal Listen Only switch is set to "1", the Signal Generator is placed in the Listen Only mode. The instrument then responds to all Data messages, and the Trigger, Clear, and Local Lockout messages. It can also respond to a parallel poll with the Status Bit message. However, the Signal Generator cannot send Data messages and cannot respond to a serial poll with the Status Byte message.

The Signal Generator's Listen Only address can also be set from the front panel by keying in 4 0, then pressing the STO key and the LOCAL key. Note that the FRONT PNL ENABLE switch on the internal HP-IB address switch must be set to "1" to allow front panel entries.

Talk Only Mode. If the internal address switches are set to a valid Talk address and the Talk Only switch is set to "1", the Signal Generator is placed in the Talk Only mode. In this mode the instrument is configured to send Data messages whenever the bus is in the data mode. It can also send the Status Byte message in response to a serial poll.

Addressing (cont'd)
The Signal Generator's Talk Only address can also be set from the front panel by keying in 5 0, then pressing the STO key and the LOCAL key. Note that the FRONT PNL ENABLE switch on the internal HP-IB address switch must be set to "1" to allow front panel entries.

3-26. Turn-on Default Conditions

Several HP-IB parameters are reset at turn-on. The parameters and their default conditions are listed below.

- HP-IB Local Mode
- Immediate Execution Mode
- Unaddressed
- Trigger Configuration cleared
- Request Mask cleared
- SRQ cleared

3-27. Displays

The RMT annunciator is on when the Signal Generator is in the remote mode and after it has received its first Data message. The TLK annunciator is on when the Signal Generator is currently addressed to talk; the LSN annunciator is on when the Signal Generator is currently addressed to listen. The SRQ annunciator is on when the Signal Generator is sending the Require Service message.

The MESSAGE key lights for the same conditions in remote as in local. The message can be read in either remote or local when the Signal Generator is under program control. Once the message has been read the key light turns off, whether or not the causing condition has been crorrected.

The FREQUENCY MHz and RANGE dBm displays operate in remote mode just as they do in local. Hidden parameters can still be displayed in the FREQUENCY MHz display by pressing and holding their front panel keys. (This capability is not available to the controller since it cannot hold a program code in the same manner that an operator can hold down a key. However, the Output Active Parameter talk function allows the controller to use its display for showing the current value of hidden parameters.)

3-28. Output Level

Setting output level is the only front panel feature that is not operated in an identical manner in local and remote modes. In local, RANGE is set in steps of 10 dBm and displayed in the RANGE dBm display. The VERNIER knob sets the intermediate values of output power and is read on the meter. In remote, VERNIER is set in 0.1 dB steps. A selection of programming codes allows either combined or independent setting of the RANGE and VERNIER power. The entry format is [Program Code] [Numeric Value] [Units Terminator]. The code LE sets both range and vernier. The code RA sets just the range. The code VE sets just the vernier.

In going from local to remote the output level might change by a fraction of a dB. In going from remote to local the front panel knob takes control. There is no assurance of whether the power will go up, go down, or stay the same.

3-29. Data Messages

The Signal Generator communicates on the interface bus primarily with Data messages. Data messages consist of one or more bytes sent over the bus' data lines when the bus is in the data mode (attention control line [ATN] false). Unless it is set to Talk Only, the Signal Generator receives Data messages when addressed to listen. Unless it is set to Listen Only, the Signal Generator sends Data messages or the Status Byte message when addressed to talk. Virtually all instrument operations available in local mode can be performed in remote mode via Data messages. The major exceptions are changing the LINE switch setting and changing the HP-IB address of the Signal Generator.

3-30. Receiving Data Messages

The Signal Generator responds to Data messages when it is enabled to remote (REN control line true) and it is addressed to listen. The instrument remains addressed to listen until it receives an Abort message or until its talk address or a universal unlisten command is sent by the controller.

Data Message Input Format. The Data message string, or program string, consists of a series of ASCII codes. Each code is typically equivalent to a front panel keystroke in local mode and follows one of three formats:

- [Program Code] [Numeric Value] [Units Terminator] [EOS]
- [Program Code] [Numeric Value] [EOS]
- [Program Code] [EOS]

Receiving Data Messages (cont'd)
Program codes are typically 2 character mnemonics. All codes normally used by the operator to control the Signal Generator are given in Table 3-7, HP-IB Program Codes.

Numeric values are either a single decimal digit, a set of 11 characters or less representing a number, or a string of binary bytes. A string of 11 characters maximum can be expressed in decimal form only. Digits beyond the front panel display capability of a particular parameter are truncated. Therefore, it is best to format the data so that it is rounded to the correct number of digits.

Units terminators are 2 character codes that terminate and scale the associated numeric value. Frequency can be entered in GHz, MHz, kHz, or Hz. Sweep time values are entered in milliseconds. Power values are entered in dB.

End-of-String messages (EOS) can be the ASCII characters Line Feed (LF), semicolon (;), or the bus END message (that is, bus lines EOI true and ATN false). The at sign (@) acts as an EOS when the Signal Generator is in the Deferred Execution mode.

Valid Characters. The ASCII characters used for program strings are: A-Z a-z 0-9 . - + LF , ; @. The alpha program codes can be either upper or lower case since the Signal Generator will accept either type (they can be interchanged). Spaces, unnecessary signs (+, -), leading zeros, and carriage returns (CR) are ignored. However, if a space or other such character were inserted between 2 characters of a program code, the program code would be invalid and any remaining characters in a string might be misinterpreted by the Signal Generator. After receiving an invalid program code, the Signal Generator requires a valid program code before it will respond to numeric entries.

Immediate Execution Mode. ASCII characters can be accepted in the Deferred or Immediate execution modes. Immediate Execution is the default mode at turn-on. It can be set, if necessary, by sending the program code @3. In this mode the Signal Generator produces an End-of-String (EOS) message at the end of each character and does not require one from the controller. The Signal Generator processes each character before accepting the next one. Therefore, the Immediate Execution mode does slow down overall data transfer. However, the Signal Generator can switch faster after the final EOS message than it can in the other mode. This is useful when the system controller is slow enough (data rate <1000 bytes/second) that it cannot take advantage of the Deferred mode's transfer speed or when switching time, independent of message length, is more important than program execution speed.

Deferred Execution Mode. This ASCII mode must be selected by sending the program code @2. In this mode, the Signal Generator accepts strings up to 96 characters at a time, executing the string upon receiving an EOS message. The Signal Generator produces its own EOS message upon receipt of the 96th character in a string. If a block of strings containing more than 96 characters is sent, the first 96 characters are accepted and the Signal Generator holds the bus busy until it executes them. Then the next 96 characters are accepted and so on until the entire block is accepted. If only one string of less than 96 characters is sent, the Signal Generator accepts the strings and frees the bus allowing program execution to continue.

Binary Mode. The Signal Generator's Request Mask is programmed in binary format. Also, learn mode data is sent and received in binary. Binary data is always processed in the Immediate Execution mode.

3-31. Sending the Data Message

The Signal Generator can send Data messages when addressed to talk. It remains configured to talk until it is unaddressed to talk by the controller. To unaddress the Signal Generator, the controller must send the Signal Generator's listen address, an Abort message, a new talk address, or a universal untalk command.

Talk Functions. The types of information that the Signal Generator can send in a Data message are:

- Front Panel Learn Mode
- Special Function Learn Mode
- Messages
- Output Active Parameter
- Output Couple
- Output Lock Frequency
- Test Interface
- Output Status
- Output Request Mask Value (explained later under Sending the Request Mask Value).

Each function is enabled by first addressing the Signal Generator to listen. Then, the Signal Gen-

Sending the Data Message (cont'd)

erator must receive a Data message with the appropriate program code. When the Signal Generator is addressed to talk, it will output data for the selected talk function. If the controller does not repeat the program code or send a new one, the Signal Generator sends data for the last selected talk function when it is addressed to talk. However, it is recommended that a talk function program code be sent each time, prior to addressing the Signal Generator to talk. This will ensure that the Signal Generator sends the appropriate data. Refer to Table 3-5 for a summary of talk functions.

Front Panel Learn Mode. The front panel learn mode uses the controller's memory to learn and store a data string that describes the Signal Generator's current front panel setting. Once an instrument state has been learned, the Signal Generator can be restored to that configuration at a later time. The learn mode requires a controller that can transfer information in binary form.

After receiving an L1 program code (Front Panel Learn Mode) and when addressed to talk, the Signal Generator sends 2 ASCII characters, @ and A, followed by a string of 94 8-bit binary bytes containing information on the front panel configuration. This binary data can then be stored in the controller's memory for future use. In addition, as each configuration goes out onto the bus, it is also stored in the Signal Generator's register 9. The most straight-forward way to program the system controller is to use a loop to read 96 binary characters and store them in an array.

When the Signal Generator is addressed to listen, the binary data can be returned to it in 96-byte strings. When the Signal Generator detects the @A, it will expect the next 94 characters to be in the learn mode string. A checksum is embedded in the string so that possible errors in the storage or transmission of the data will be detected, and the input will be ignored.

Whenever data is being transferred between controller and Signal Generator, it must do so in uninterrupted strings. If a data string is broken or interrupted, the data could be lost or offset, and misinterpreted by the Signal Generator. An offset of data bytes can persist through later data strings until the Signal Generator is eventually switched to standby, then on again.

Special Function Learn Mode. This mode is intended for servicing the Signal Generator. It is similar in operation to the front panel learn mode. After receiving an L2 program code (Special Function Learn Mode) and when addressed to talk, the Signal Generator sends 2 ASCII charcters, @ and 9, followed by a string of 24 8-bit binary bytes. This binary data can then be stored in the controller's memory.

The binary characters are directly related to the digital outputs of the Signal Generator's internal controller. There is no checksum or other error detecting scheme, allowing diagnostic and other special functions that are not normally possible with the Signal Generator. Refer to Section VIII, Service, for additional information.

Messages. This function enables the MESSAGE key to be read under program control. After receiving an MG program code (Message) and when addressed to talk, the Signal Generator sends a two-digit number coded in ASCII followed by a Line Feed (LF) and EOI. The codes represent entry errors and instrument malfunctions. The two-digit codes are explained on the operating information pull-out card and in the Message Detailed Operating Instruction. The Message can always be read by pressing the MESSAGE key, even when the Signal Generator is in remote mode. However, reading the Message once, either in remote or local, clears it to 00 (No Error) whether or not the causing condition has been corrected.

Output Active Parameter. This function allows the user to determine the present value of a specific parameter. After receiving the program code for a value-selectable parameter followed by the program code OA (Output Active) and when addressed to talk, the Signal Generator will output a string over the bus consisting of the following: |Selected Program Code||Current Numeric Value| |Units Terminator||LF and EOI|. Any parameter that has a numeric value associated with it can be interrogated. An exception to this output format is Steps. When the controller sends "SPOA", the Signal Generator returns with the string: SP|Step Size|HZ, SP|Number of Steps|SS,|LF and EOI|. The Signal Generator may output a program code that differs from the code sent to it by the controller. For example, the Signal Generator responds with the program code CF (center frequency) when sent FR (frequency) and MK (marker) when sent M1, M2, M3, M4, or M5 (Markers 1 through 5).

Table 3-5. Talk Functions

Function	Program Code	Signal Generator Output Response to Program Code	Comments
Front Panel Learn Mode	L1	96 Binary Bytes |EOI|	
Special Function Learn Mode	L2	26 Binary Bytes |EOI|	See Section VIII, Service
Message	MG	2 Digits |LF and EOI|	
Output Active Parameter	|Program Code| OA	|Program Code||Numeric Value||Units Terminator||LF and EOI|	Valid Functions: CF, FI, FA, FB, FS, M1-5, DW, LE, VE, RA
	SPOA	SP |Step Size| Hz, SP |# of Steps| SSSP |LF and EOI|	
Output Couple	OC	|START Value|, |Center-Frequency Value|, |Dwell Value||LF and EOI|	Frequency is in Hz; dwell is in seconds.
Output Lock Frequency	OK	FR |Numeric Value| Hz |LF and EOI|	
Test Interface	TI |1 Byte|	1 Byte |EOI|	
Output Status	OS	2 Bytes |EOI|	
Output Request Mask	OR	1 Byte |EOI|	

Sending the Data Message (cont'd)

Output Couple. After receiving the program code OC (Output Couple) and when addressed to talk, the Signal Generator sends a data string that gives the current numeric values for the following parameters in the order listed: [START], [Center Frequency], [DWELL] [LF and EOI]. No program codes prefix the numeric values. Hz is the implied terminator for start and center frequency; seconds is the implied terminator for dwell time.

Output Lock Frequency. This function causes the Signal Generator to output the value of its tuned frequency. After receiving the program code OK and when addressed to talk, the Signal Generator sends the value of the frequency at which it is currently phase locked. The data output from the Signal Generator is in the following format: FR [Numeric Value] HZ [LF and EOI].

Test Interface Function. This function allows testing of the HP-IB interface. After receiving the program code TI, followed by an 8-bit byte representing one or more data lines (see table below) and when addressed to talk, the Signal Generator sends the binary byte that it just received. Refer to Section VIII, Service, for additional information.

HP-IB Data Line	DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
Weight	128	64	32	16	8	4	2	1

Output Status. After receiving the program code OS (Output Status) and when addressed to talk, the Signal Generator sends two binary bytes, each 8 bits wide. The first byte is identical to the Status Byte of the Serial Poll. The second byte is the Extended Status Byte which provides additional information. See Figure 3-8 for a description of each Status Byte. Bits in the main Status Byte are cleared upon execution of the Output Status function or the Clear Status (CS) program code. Bits on the Extended Status Byte are cleared by removing the causing condition and performing the Output Status function.

3-32. Receiving the Clear Message

The Signal Generator responds to the Clear message by assuming the settings detailed in Table 3-6. The Signal Generator responds equally to the Selected Device Clear (SDC) bus command when addressed to listen, and the Device Clear (DCL) bus command whether addressed or not. The Clear message clears any pending Require Service message.

Table 3-6. Response to a Clear Message

Parameter	Condition
Execution Mode	Immediate
Request Mask	Cleared
Require Service (SRQ)	Cleared
Trigger Configuration	Cleared
MESSAGE	Cleared (set to 00)
RF OUTPUT	ON
ALC	INTERNAL
RANGE	−70 dBm
VERNIER	0.0 dB
AUTO PEAK	ON
MTR	LVL
AM, FM, and Pulse Modulation	OFF
FREQUENCY	3000.000 MHz
FREQ INCR	1.000 MHz
START	2000.000 MHz
STOP	4000.000 MHz
ΔF	2000.000 MHz
MKR	OFF
SWEEP MODE	OFF
STEP	100 steps (20.000 MHz)
DWELL	20 ms
TUNE Knob	ON
NORMAL/BYPASS	NORMAL

3-33. Receiving the Trigger Message

The Signal Generator responds to a Trigger message only if a response has been pre-programmed (see Configure Trigger). Otherwise, it ignores a Trigger message. It responds equally to a Trigger message (with bus command GET) and a Data message with program code TR (Trigger).

Configure Trigger. The Signal Generator's response to a Trigger message is set when it receives a Data message containing the program code CT followed by one valid program code. For example, CTW6 causes a single sweep (W6) when the Trigger message is received.

3-34. Receiving the Remote Message

The Remote message has two parts. First, the remote enable bus control line (REN) is held true; second, the device listen address is sent by the controller. These two actions combine to place the Signal Generator in remote mode. Thus, the Signal Generator is enabled to go into remote when the controller begins the Remote message, but it does not actually switch to remote until addressed to listen the first time. When actually in remote, the Signal Generator's front panel RMT annunciator lights.

3-35. Receiving the Local Message

The Local message is the means by which the controller sends the Go To Local (GTL) bus command. If addressed to listen, the Signal Generator returns to front panel control when it receives the Local message.

When the Signal Generator goes to local mode, the front panel RMT annunciator turns off. However, even when in local, if the Signal Generator is being addressed, its front panel LSN or TLK annunciator turns on.

3-36. Receiving the Local Lockout Message

The Local Lockout message is the means by which the controller sends the Local Lockout (LLO) bus command. If in remote, the Signal Generator responds to the Local Lockout Message by disabling the front panel LOCAL key. The local lockout mode prevents loss of data or system control due to someone accidentally pressing front panel keys. If, while in local, the Signal Generator is enabled to remote (that is, REN is set true) and it receives the Local Lockout message, it will switch to remote mode with local lockout the first time it is addressed to listen. When in local lockout, the Signal Generator can be returned to local only by the controller (using the Local or Clear Lockout/Set Local messages), by setting the LINE switch to STBY and back to ON, or by removing the bus cable.

3-37. Receiving the Clear Lockout/Set Local Message

The Clear Lockout/Set Local message is the means by which the controller sets the Remote Enable (REN) bus control line false. The Signal Generator returns to local mode (full front panel control) when it receives the Clear Lockout/Set Local message. When the Signal Generator goes to local mode, the front panel RMT annunciator turns off.

3-38. Receiving the Pass Control Message

The Signal Generator does not respond to the Pass Control message because it does not have this controller capability.

3-39. Sending the Require Service Message

The Signal Generator sends a Require Service message if one or more of the following conditions exist and if it has been pre-programmed to send the message by the Request Mask.

- Front Panel Key Pressed: when the Signal Generator is in local mode and one of the front panel keys is pressed.
- Front Panel Entry Complete: when the Signal Generator is in local mode and is finished processing a front panel entry.
- Change in Extended Status: when one of the bits on the Extended Status Byte changes.
- Source Settled: when the Signal Generator is settled. Switching transients occur when RF and AUTO PEAK are turned on, and when FM ranges and frequency are changed. If the controller responds to the Signal Generator as soon as the source is settled, instead of waiting a specified time, program speed is increased.
- Entry Error: When an invalid keystroke or program command occurs.
- New Sweep Parameters: when the value of START, STOP, ΔF, DWELL, STEP, or any Marker changes.

The Signal Generator can send a Require Service message in either the local or remote mode.

The Signal Generator sends a Require Service message by setting the Service Request (SRQ) bus line true. The SRQ annunciator on the front panel turns on when the Require Service message is being sent. The Require Service message is cleared after the Output Status function or the Clear Status (CS) program code has been executed by the controller.

Request Mask. The Request Mask functions within the Status Byte. It determines which bits can set the RQS bit true (see Figure 3-11) and consequently set the SRQ bus line true.

The Request Mask is set by the program code @1 followed by an 8-bit byte (a Data Message). The value of the byte is determined by summing the weight of each bit to be checked. Each bit, if true, enables a corresponding condition to set the RQS bit true. This message is executed immediately and does not require an End-of-String message to be sent. At turn-on, the Request Mask is cleared (that is, set to 0).

Sending the Request Mask Value (a Data Message). After receiving an OR program code (Output Request Mask) and when addressed to talk, the Signal Generator will send a single binary word (8 bits) that describes the present state of the mask. The bit pattern can be interpreted with the information in Figure 3-11.

NOTE

This byte is sent with the bus EOI line true, thus terminating the message.

3-40. Sending the Status Byte Message

After receiving a Serial Poll Enable bus command (SPE) and when addressed to talk, the Signal Generator sends a Status Byte message. The message consists of one 8-bit byte of which 7 bits correspond to the pattern and descriptions for the Request Mask. The remaining bit, bit 7, is the RQS Request Service bit (see Figure 3-11).

The RQS bit is set when one of the other seven conditions exists and that condition has been enabled by the Request Mask. Bits 1—6 and 8 might be true regardless of conditioning by the Request Mask. However, if a condition has not been selected by the mask, it cannot cause the RQS bit to be set true.

Extended Status Byte. A second status byte is available but can only be accessed via the Output Status function (see explanation under Sending the Data Message). Bit 3 of the Status Byte indicates whether a change has occurred in the Extended Status Byte. If Bit 3 is true, the second status byte should be accessed via the Output Status function to determine the cause of the status change. The bit pattern can be interpreted with the information in Figure 3-11.

3-41. Clearing the Status Byte

Once the Signal Generator sets the SRQ bus line true, it is no longer allowed to alter the Status Byte. If a bit has been enabled and the condition occurs after the SRQ bus line has been set true, the

STATUS BYTE (#1)								
BIT	8	7	6	5	4	3	2	1
WEIGHT	128	64	32	16	8	4	2	1
Condition	Change in Sweep Parameters	RQS Bit Request Service	Entry Error	End of Sweep	Source Settled	Change in Extended Status	Front Panel Entry Complete	Front Panel Key Pressed

EXTENDED STATUS BYTE (#2)								
BIT	8	7	6	5	4	3	2	1
WEIGHT	128	64	32	16	8	4	2	1
Condition	0 (always)	ALC Unleveled	Power Failure/On	Not Locked	External Ref	0 (always)	FM Overmod	Self-Test Failed

Figure 3-11. Status Byte Information

Clearing the Status Byte (cont'd)

bit is stored in a buffer and is read the next time the Signal Generator receives the Serial Poll Enable (SPE) bus command. When addressed to talk (following SPE), the Signal Generator sends the Status Byte message.

After the Status Byte message has been sent it will be cleared if the Serial Poll Disable (SPD) bus command is received, if the Abort message is received, or if the Signal Generator is unaddressed to talk. However, bits stored in the buffer waiting to be read are not cleared. Regardless of whether or not the Status Byte message has been sent, the Status Byte and any Require Service message pending will be cleared if a Clear Status (CS) program code is received or the Output Status function is executed.

NOTE

The Signal Generator must receive a universal untalk command after sending the Status Byte message. Most system controllers send this automatically. However, if a universal untalk command is not sent, the SRQ bus line may not be re-initialized and pending Service Requests may get lost.

3-42. Sending the Status Bit Message

The Signal Generator sends the Status Bit message (if configured) as part of the interface's response byte to the Parallel Poll Enable (PPE) bus command. In order for the Signal Generator to respond to a Parallel Poll Enable bus command it must be assigned a single HP-IB data line by the controller. The controller also assigns the logic level of the bit. Both tasks can be accomplished by the Parallel Poll Configure (PPC) bus command. If the Signal Generator is sending the Require Service message, it will set its assigned status bit true. The Signal Generator can send the Status Bit message without being addressed to talk.

The data line that the Signal Generator is assigned to respond on can be cleared by turning the instrument to STBY or by sending the Parallel Poll Unconfigure (PPU) bus command.

3-43. Receiving the Abort Message

The Abort message is the means by which the controller sets the Interface Clear (IFC) bus control line true. When the Abort message is received, the Signal Generator becomes unaddressed and stops talking or listening.

Table 3-7. HP-IB Program Codes

Program Code	Parameter
AO	AM OFF
AP	Level (RANGE and VERNIER)
A0	AM OFF
A1	AM OFF
A2	AM 30%
A3	AM 100%
NM	NORMAL
BY	BYPASS
B0	NORMAL
B1	BYPASS
CF	Center Frequency
CS	Clear Status
CT	Configure Trigger
CW	CW Frequency
C1	ALC INTERNAL
C2	ALC DIODE
C3	ALC PWR MTR
DB	dB
DF	ΔF
DM	dB
DN	FREQ INCREMENT (Down)
DO	FM DEVIATION OFF
DW	DWELL
D0	FM DEVIATION OFF
D1	FM DEVIATION OFF
D2	FM DEVIATION .03 MHz
D3	FM DEVIATION .1 MHz
D4	FM DEVIATION .3 MHz
D5	FM DEVIATION 1 MHz
D6	FM DEVIATION 3 MHz
D7	FM DEVIATION 10 MHz
FA	START Sweep Frequency
FB	STOP Sweep Frequency
FI	FREQ INCR
FN	FREQ INCR
FR	FREQUENCY
FS	ΔF
F1	FREQ INCR
GZ	GHz
HZ	Hz
IF	FREQ INCREMENT (Up)
IP	Instrument Preset
KZ	kHz
K0	AUTO PEAK OFF
K1	AUTO PEAK ON
K2	AUTO PEAK without extra settling time
LE	Level (RANGE and VERNIER)
L1	Front Panel Learn Mode
L2	Special Function Learn Mode
MG	MESSAGE
MO	Marker(s) OFF
MS	milliseconds
MZ	MHz
M0	Marker(s) OFF
M1	Marker 1
M2	Marker 2
M3	Marker 3
M4	Marker 4
M5	Marker 5
NO	TUNE Knob OFF
N0	TUNE Knob OFF
N1	TUNE Knob ON

Program Code	Parameter
OA	Output Active Parameter
OC	Output Couple
OK	Output Lock Frequency
OL	Front Panel Learn Mode
OR	Output Request Mask
OS	Output Status
PL	Power Level (RANGE and VERNIER)
PO	PULSE OFF
P0	PULSE OFF
P1	PULSE OFF
P2	PULSE NORM
P3	PULSE COMP
RA	RANGE
RC	Recall (RCL)
RD	RANGE Down 10 dB
RF0	RF OFF
RF1	RF ON
RL	Recall (RCL)
RM	RQS Mask
RO	RF OFF
RS	Reset Sweep
RU	RANGE Up 10 dB
R0	RF OFF
R1	RF ON
SD	Slave Down
SF	STEP
SM	MANUAL Sweep
SP	STEP
SS	Steps (suffix)
ST	Store (STO)
SU	Slave Up
SV	Service Function
TI	Test Interface
TR	Execute Trigger
T1	Meter LVL
T2	Meter AM
T3	Meter FM
UP	FREQ INCREMENT (Up)
VE	VERNIER
WO	SWEEP MODE OFF
W0	SWEEP MODE OFF
W1	SWEEP MODE OFF
W2	AUTO Sweep
W3	MANUAL Sweep
W4	SINGLE Sweep
W5	SINGLE Sweep: Arm Only
W6	SINGLE Sweep: Arm and Begin
W7	Master Sweep
W8	Slave Sweep
X0	Marker(s) OFF
X1	Marker 1
X2	Marker 2
X3	Marker 3
X4	Marker 4
X5	Marker 5
Y0	FREQ display off
Y1	FREQ display on
@A	Start of Front Panel Learn Mode
@1	Prefix for Request Mask
@2	Deferred Execution Mode
@3	Immediate Execution Mode
@9	Start of Special Function Learn Mode

Table 3-8. Messages

Code	Definition
00	NO ERROR
Messages 01 — 09 are operator errors. The entry is ignored and the previous values are retained.	
01	FREQUENCY OUT OF RANGE
02	FREQ INCR OUT OF RANGE
04	CANNOT STORE REGISTOR 0
05	STEP SIZE OUT OF RANGE
07	NUMBER OF STEPS OUT OF RANGE
08	DWELL OUT OF RANGE
09	MARKER NUMBER NOT 1 — 5
Messages 10 through 16 are "soft errors" that result from unusual combinations of sweep entries. A message is displayed and all entered values are stored in anticipation that further entries will resolve the conflict.	
10	START FREQ=STOP FREQ. No sweep.
11	SWEEP SPAN RESULTS IN START FREQUENCY OUT OF RANGE. Truncated sweep will result.
12	SWEEP SPAN RESULTS IN STOP FREQUENCY OUT OF RANGE. Truncated sweep will result.
13	NUMBER OF STEPS ADJUSTED TO GIVE STEP SIZE IN EVEN kHz. Press STEP to see result.
14	STEP SIZE TOO SMALL FOR SPAN. Press STEP to see result (maximum number of steps is 9999).
15	STEP SIZE > SPAN. Step size is set to span.
16	BAND CROSSING IN AUTO SWEEP
Messages 20 — 24 are HP-IB errors. The entry is ignored.	
20	INVALID HP-IB CODE
21	HP-IB DATA WITHOUT VALID PREFIX
22	INVALID HP-IB ADDRESS ENTRY
23	TALK FUNCTION NOT PROPERLY SPECIFIED.
24	OUTPUT LEVEL OUT OF RANGE
Messages 30 — 99 are service-related errors. Refer to Section VIII in the manual.	
90	AUTO PEAK MALFUNCTION
92	RECALL CHECKSUM ERROR
95	LOSS OF DATA ON POWER UP
96	MEMORY TEST FAILURE
97	ROM TEST FAILURE, A2A10
98	RAM TEST FAILURE, A2A11
99	RAM NOT FUNCTIONAL AT POWER UP

SECTION IV, Part 1
OPERATION VERIFICATION

4-1. INTRODUCTION

The procedures in this section test the critical electrical performance of the Signal Generator using the specifications of Table 1-1 as the performance standards. Section IV is divided into two parts. Section IV, Part 1, Operation Verification, is contained in Volume 1 of the HP 8673C/D Operating and Service manual and presents tests for checking the major specifications of the Signal Generator. Section IV, Part 2, Performance Tests, is contained in Volume 2 and provides the most comprehensive check of specifications. In addition a simpler functional check is included in Section III under Operators Checks.

4-2. EQUIPMENT REQUIRED

Table 1-4, Operation Verification Test Equipment, lists the equipment recommended for the Operation Verification tests only. Equipment required for the full Performance Tests, Operators Checks, adjustments and troubleshooting is listed in Table 1-3, Recommended Test Equipment. A coded symbol by each equipment explains its intended purpose (troubleshooting, Performance Test, etc). Any equipment that satisfies the critical specifications given in the tables may be substituted for the recommended models except where noted. Some equipment is operated by a controller and the HP-IB and cannot be substituted.

4-3. PERFORMANCE TEST RECORD

Results of the Operation Verification Tests may be tabulated in Table 4-6, Operation Verification Test Record, at the end of Section IV, Part 1, Volume 1. Results of the Performance Tests in Section IV, Part 2, Volume 2, may be tabulated in the Performance Test Record at the end of that section. Each table lists the acceptable limits for each specification tested. If test results are recorded during an incoming inspection of the instrument, they can be used for comparison during periodic maintenance or troubleshooting. The test results may also be useful in verifying proper adjustments after repairs are made.

4-4. TEST PROCEDURES

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

It is also assumed that the operator will select the cables, adapters, and probes required to complete the test setups illustrated in this section.

4-5. OPERATION VERIFICATION

Section IV, Part 1 contains the Operation Verification tests. These tests should be performed after repairing the Signal Generator. They can also be used for incoming inspections and preventative maintenance. They are not intended to be a complete check of specifications, but they will provide 90% confidence that the Signal Generator is meeting its major performance specifications. The Operation Verification can be performed with less time and equipment than the full Performance Tests, in Section IV, Part 2, Volume 2 of this manual.

Operation Verification includes the following tests:

1) Turn-on
2) Frequency Range and Resolution
3) Output Level
4) Frequency and Amplitude Modulation
5) Pulse Modulation

OPERATION VERIFICATION

4-6. TURN-ON CHECKS

Procedure

1. Set the upper and lower LINE switches to ON.

2. Ensure that the message key LED is not flashing. If message key is flashing refer to pull-out card for list of message codes.

3. Press RCL 0. Verify that the instrument is now preset to the following conditions:
   RF OUTPUT to ON
   ALC INTERNAL to ON
   OUTPUT LEVEL RANGE to −70 dBm
   AUTO PEAK to ON
   MTR LVL on
   AM, FM, and PULSE Modulation to OFF
   FREQUENCY to 3000.000 MHz
   FREQ INCR to 1.000 MHz
   START to 2000.000 MHz
   STOP to 4000.000 MHz
   ΔF to 2000.000 MHz
   SWEEP to OFF
   STEP to 100 Steps (20.000 MHz)
   DWELL to 20 ms
   TUNE Knob to ON
   All Status Annunciators off
   MESSAGE key light off
   NORMAL/BYPASS to NORMAL

OPERATION VERIFICATION

4-7. FREQUENCY RANGE AND RESOLUTION

Specification

Electrical Characteristics	Performance Limits	Conditions
FREQUENCY		
Range (8673C)	0.05—18.6 GHz (0.01—18.6 GHz overrange)	
(8673D)	0.05—26.0 GHz (0.01—26.5 GHz overrange)	
Resolution	1 kHz 2 kHz 3 kHz 4 kHz	0.05 to 6.6 GHz 6.6 to 12.3 GHz 12.3 to 18.6 GHz 18.6 to 26.0 GHz (8673D)

Description This test checks the frequency range and resolution in each frequency band using a frequency counter. The full frequency range is further checked by increasing the frequency in 1.111111 GHz steps and ensuring that the Signal Generator remains phase locked at all frequencies.

Equipment Frequency Counter .....HP 5343A

Procedure

1. Connect the equipment as shown in Figure 4-1. Set the Signal Generator rear panel INT/EXT switch to EXT. Remove FREQ STANDARD jumper and connect A3J10 to 10 MHz frequency standard output from counter.

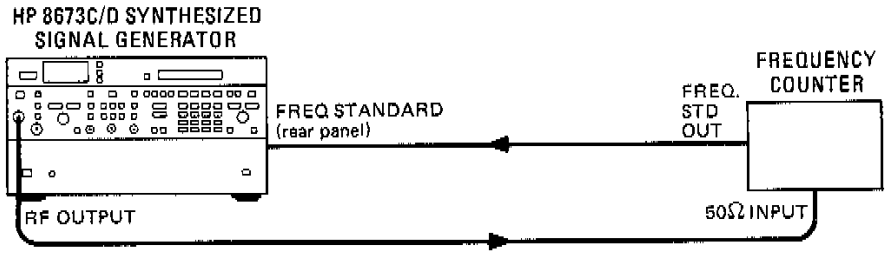


Figure 4-1. Frequency Range and Resolution Test Setup

2. Select 1 kHz display resolution on the counter.

3. Set Signal Generator to 1 GHz, FREQ INCR to 1 kHz, and the output power to 0 dBm. The counter should read 1.000000 GHz ±1 count on the counter.

0.999999 GHz _____ (√) 1.000001 GHz

4. Step frequency up 1 kHz, then step it down 1 kHz while observing the counter. Ensure that the Signal Generator output frequency is accurate within ±1 count.

1 kHz resolution _____ (√)

OPERATION VERIFICATION

FREQUENCY RANGE AND RESOLUTION (cont'd)

Procedure (cont'd)

5. Repeat steps 3 and 4 using frequencies of 4 GHz, 8 GHz, 15 GHz, and, for the HP 8673D, 20 GHz. The Signal Generator frequency should step up by 1, 2, 3, and 4 kHz respectively even though the FREQ INCR is set to 1 kHz. This is due to the minimum resolution in each band.

4.0 GHz, 1 kHz Resolution	_____ (√)
8.0 GHz, 2 kHz Resolution	_____ (√)
15.0 GHz, 3 kHz Resolution	_____ (√)
8673D only	
20.0 GHz 4 kHz Resolution	_____ (√)

6. Set the Signal Generator frequency to 1.0 GHz and FREQ INCR to 1.111111 GHz.

7. Step the Signal Generator from 1.000000 GHz to 11.000000 GHz in 1.111111 GHz steps and read counter frequency at each step. (Some steps will not exactly equal 1.111111 GHz, depending upon the resolution of each frequency band). The counter reading should agree with the Signal Generator front panel reading within ±1 count. In addition the Signal Generator NOT PHASED LOCKED front panel LED should remain off at all frequencies.

2.111 111 GHz	2.111 110 GHz	_____ (√)	2.111 112 GHz
3.222 222 GHz	3.222 221 GHz	_____ (√)	3.222 223 GHz
4 333 333 GHz	4.333 332 GHz	_____ (√)	4.333 334 GHz
5.444 444 GHz	5.444 443 GHz	_____ (√)	5.444 445 GHz
6.555 555 GHz	6.555 554 GHz	_____ (√)	6.555 556 GHz
7.666 666 GHz	7.666 665 GHz	_____ (√)	7.666 667 GHz
8.777 778 GHz	8.777 777 GHz	_____ (√)	8.777 779 GHz
9.888 888 GHz	9.888 887 GHz	_____ (√)	9.888 889 GHz
11.000 000 GHz	10.999 999 GHz	_____ (√)	11.000 001 GHz

NOTE

Fast stepping or tuning of frequency may cause the NOT PHASED LOCKED LED to flash on momentarily. This is normal and does not indicate a malfunction.

8. Disconnect the frequency standard cable and replace the jumper removed in step 1. Set the switch to INT.

OPERATION VERIFICATION

4-8. OUTPUT LEVEL

Specification

Electrical Characteristics	Performance Limits	Conditions
RF OUTPUT		
Output Level:		
Standard Calibrated Output*		
Normal Mode	+11 dBm to −100 dBm	0.05 to <2.0 GHz
	+5 dBm to −100 dBm	2.0 to <16.0 GHz
(8673C)	+2 dBm to −100 dBm	16.0 to 18.6 GHz
(8673D)	+6 dBm to −100 dBm	16.0 to 26.0 GHz
Bypass Mode	+8 dBm to −100 dBm	2.0 to <16.0 GHz
(8673C)	+5 dBm to −100 dBm	16.0 to 18.6 GHz
(8673D)	+7 dBm to −100 dBm	16.0 to 26.0 GHz
Flatness		
	±0.50 dB	0.05 to <2.0 GHz
	±0.75 dB	0.05 to 6.6 GHz
	±1.00 dB	0.05 to 12.3 GHz
	±1.25 dB	0.05 to 18.6 GHz
	±1.75 dB	0.05 to 26.0 GHz
Absolute Level Accuracy		
0.05 — 6.6 GHz	±2.00 dB	+10 dBm output level range
	±1.75 dB	0 dBm output level range
	±2.25 dB	−10 dBm output level range
	±2.45 dB	−20 dBm output level range
	±2.75 dB	−30 dBm output level range
	±2.75 dB & ±0.1 dB per 10 dB step	<−30 dBm output level range

*For Options 001, 004, 005, see Table 1-1.

Description

High level checks are made with a power meter. Low level accuracy is checked using a spectrum analyzer.

Equipment

Power Meter	HP 436A
Oscilloscope	HP 1980A
Power Sensor	HP 8485A
Preamplifier, 20 dB	HP 8447D
Power Amplifier, 20 dB	HP 8447E
Attenuator, 10 dB (2)	HP 8491A Option 010
Spectrum Analyzer	HP 8566A

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

NOTE

A power meter with an analog meter such as an HP 435B can be substituted for the HP 436A/1980A combination.

Procedure

1. Connect equipment as shown in Figure 4-2.

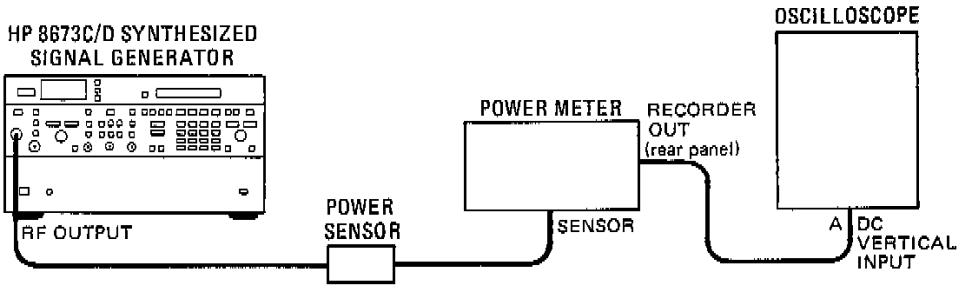


Figure 4-2. High Level Accuracy and Flatness Test Setup

Output Level

2. Set Signal Generator to 50 MHz, and FREQ INCR to 100 MHz. Set AUTO PEAK to ON. Set output level to the output listed in line a, 0 dB Reference column, of Table 4-1.

NOTE

Use the appropriate part of Table 4-1 to find the 0dB reference level for the power meter, and to record the frequency and check for satisfactory performance.

3. Set oscilloscope to dc coupled, 0.05 V/division. Adjust controls to center the dc voltage on the display. Press dB(ref) on power meter to establish a 0 dB reference. Power meter should now read 0.0 dB.

4. Step the Signal Generator from 50 MHz to 1950 MHz in 100 MHz steps while observing oscilloscope for minimum power indication. (The display is proportional to the Signal Generator output power). Record the worst case frequency in Table 4-1.

5. Set the Signal Generator to the frequency recorded. Ensure that output level can be set to ≥0 dB as read on the power meter. This will ensure that the specified maximum leveled output power is available at all frequencies in this range.

6. Set Signal Generator to 2.0 GHz and FREQ INCR to 200 MHz. Set output power to the level listed in line b of the table, as read on the Signal Generator output meter.

7. Press dB (ref) on power meter to establish a 0 dB reference.

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

Procedure (cont'd)

8. Tune the Signal Generator in 200 MHz steps from 2 to 16 GHz, adjusting the power meter's calibration factor and recording the worst case frequency. Readjust the output power to ≥0 dB reference at the recorded frequency to ensure that the specified power is available at all frequencies in this range.

9. Repeat step 7 and 8 with the Signal Generator in the BYPASS mode using the output level listed in line c.

10. Repeat steps 7 and 8, starting at 16.0 GHz, with FREQ INCR of 200 MHz. Use NORMAL/BYPASS switch settings and output levels listed in lines d and e, or lines f and g, as appropriate for your instrument.

Table 4-1. Maximum Leveled Output Power (1 of 2)

Standard Instrument				
	Frequency Range	0 dB Reference Level	Worst Case Frequency	(√)
HP 8673C/D				
a) NORMAL	50—1950 MHz	11 dBm	_____	____
b) NORMAL	2.0—16.0 GHz	5 dBm	_____	____
c) BYPASS	2.0—16.0 GHz	8 dBm	_____	____
HP 8673C:				
d) NORMAL	16.0—18.0 GHz	2 dBm	_____	____
e) BYPASS	16.0—18.0 GHz	5 dBm	_____	____
HP 8673D:				
f) NORMAL	16.0—26.0 GHz	6 dBm	_____	____
g) BYPASS	16.0—26.0 GHz	7 dBm	_____	____
OPTION 001				
	Frequency Range	0 dB Reference Level	Worst Case Frequency	(√)
HP 8673C/D				
a) NORMAL	50—1950 MHz	12 dBm	_____	____
b) NORMAL	2.0—16.0 GHz	7 dBm	_____	____
c) BYPASS	2.0—16.0 GHz	10 dBm	_____	____
HP 8673C:				
d) NORMAL	16.0—18.0 GHz	4 dBm	_____	____
e) BYPASS	16.0—18.0 GHz	7 dBm	_____	____
HP 8673D:				
f) NORMAL	16.0—26.0 GHz	9 dBm	_____	____
g) BYPASS	16.0—26.0 GHz	10 dBm	_____	____

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

Table 4-1. Maximum Leveled Output Power (2 of 2)

OPTION 004				
	Frequency Range	0 dB Reference Level	Worst Case Frequency	(√)
HP 8673C/D				
a) NORMAL	50—1950 MHz	10 dBm	_____	____
b) NORMAL	2.0—16.0 GHz	4 dBm	_____	____
c) BYPASS	2.0—16.0 GHz	7 dBm	_____	____
HP 8673C:				
d) NORMAL	16.0—18.0 GHz	1 dBm	_____	____
e) BYPASS	16.0—18.0 GHz	4 dBm	_____	____
HP 8673D:				
f) NORMAL	16.0—26.0 GHz	4 dBm	_____	____
g) BYPASS	16.0—26.0 GHz	5 dBm	_____	____
OPTION 005				
	Frequency Range	0 dB Reference Level	Worst Case Frequency	(√)
HP 8673C/D				
a) NORMAL	50—1950 MHz	12 dBm	_____	____
b) NORMAL	2.0—16.0 GHz	6 dBm	_____	____
c) BYPASS	2.0—16.0 GHz	9 dBm	_____	____
HP 8673C:				
d) NORMAL	16.0—18.0 GHz	3 dBm	_____	____
e) BYPASS	16.0—18.0 GHz	6 dBm	_____	____
HP 8673D:				
f) NORMAL	16.0—26.0 GHz	7 dBm	_____	____
g) BYPASS	16.0—26.0 GHz	8 dBm	_____	____

Level Flatness

11. Set Signal Generator frequency to 50 MHz and output level to —5 dBm in the 0 dBm range. Set the power meter for 0 dB reference at this level.

12. Tune to 1950 MHz in 100 MHz steps while observing the oscilloscope for minimum power indication. Record the minimum output power, as read on the power meter, for the .05 — <2 GHz frequency range, in Table 4-2.

13. Continue tuning to 6.550 GHz and record minimum power for the 0.05—6.6 GHz range. Continue tuning to 12.550 GHz, then 18.550 GHz and for the HP 8673D, 25.550 GHz. Record the minimum power for each range in Table 4-2.

14. Repeat steps 11 through 13, but this time record maximum power levels for each of the specified ranges.

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

Procedure (cont'd)

15. Compute the total ±variation for each range listed below.

NOTE

The plus and minus specification for power output is not referenced to a particular frequency. The specification rather, represents the total power variation over the entire frequency range.

Table 4-2. Level Flatness

Frequency Range	Level Flatness Calculations		
0.05 — <2.0 GHz	Minimum	_____	
	Maximum	_____	
	Total Variation	_____	≤1.0 dB
0.05 — 6.6 GHz	Minimum	_____	
	Maximum	_____	
	Total Variation	_____	≤1.50 dB
0.05 — 12.3 GHz	Minimum	_____	
	Maximum	_____	
	Total Variation	_____	≤2.00 dB
0.05 — 18.6 GHz	Minimum	_____	
	Maximum	_____	
	Total Variation	_____	≤2.50 dB
HP 8673D only: 0.05 — 26 GHz	Minimum	_____	
	Maximum	_____	
	Total Variation	_____	≤3.5 dB

High Level Accuracy

16. Set Signal Generator to 50 MHz, OUTPUT LEVEL RANGE to 0 dBm and output level to −10 dBm as read on the Signal Generator front panel meter. Ensure that actual power level, as read on power meter, is within the limits in Table 4-3.

17. Repeat step 16 for the other frequencies and power levels shown in Table 4-3.

Table 4-3. High Level Accuracy (1 of 2)

Frequency	Output Level Range	Output Level	Minimum Limit	Measured	Maximum Limit
50 MHz	0 dBm	−10 dBm	−11.75 dBm	_____	−8.25 dBm
		−5	−6.75 dBm	_____	−3.25 dBm
		0	−1.75 dBm	_____	+1.75 dBm
		+3	+1.25 dBm	_____	4.75 dBm
	+10 dBm	0	−2.00 dBm	_____	+2.00 dBm
		+11	+9.00 dBm	_____	+13.00 dBm
	−10 dBm	−10 dBm	−12.25 dBm	_____	−7.75 dBm
	−20 dBm	−20 dBm	−22.45 dBm	_____	−17.55 dBm

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

Table 4-3. High Level Accuracy (2 of 2)

Frequency	Output Level Range	Output Level	Minimum Limit	Measured	Maximum Limit
1.9 GHz	0 dBm	-10 dBm	-11.75 dBm	_____	-8.25 dBm
		-5	-6.75 dBm	_____	-3.25 dBm
		0	-1.75 dBm	_____	+1.75 dBm
		+3	+1.25 dBm	_____	+4.75 dBm
	+10 dBm	0	-2.00 dBm	_____	+2.00 dBm
		+11	+9.00 dBm	_____	+13.00 dBm
2.0 GHz	0 dBm	-10 dBm	-11.75 dBm	_____	-8.25 dBm
		-5	-6.75 dBm	_____	-3.25 dBm
		0	-1.75 dBm	_____	+1.75 dBm
		+3	+1.25 dBm	_____	+4.75 dBm
	+10 dBm	0	-2.00 dBm	_____	+2.00 dBm
		+5	+3.00 dBm	_____	+7.00 dBm
18 GHz	0 dBm	-10 dBm	-12.25 dBm	_____	-7.75 dBm
		-5	-7.25 dBm	_____	-2.75 dBm
		0	-2.25 dBm	_____	+2.25 dBm
		+3	+0.75 dBm	_____	+5.25 dBm
	+10 dBm	0	-2.50 dBm	_____	+2.50 dBm
		+5	+2.50 dBm	_____	+7.50 dBm

Low Level Accuracy

18. Connect equipment as shown in Figure 4-3.

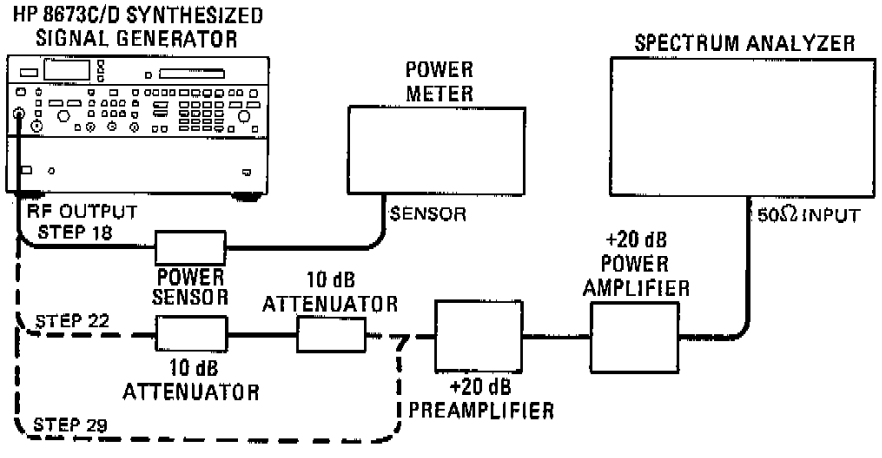


Figure 4-3. Low Level Accuracy Test Setup

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

Procedure (cont'd)

19. Set Signal Generator to 95 MHz, RANGE to −20 dBm. Set VERNIER for 0 dBm as read on the Signal Generator output meter.

20. Peak the Signal Generator with the AUTO PEAK key.

21. Adjust the VERNIER for a power meter reading of −20 dBm ± 0.01 dB.

22. Disconnect the power meter and connect the Signal Generator to the spectrum analyzer as shown in Figure 4-3.

23. Set the spectrum analyzer vertical sensitivity so that the peak of the signal is set to the center horizontal graticule as a reference. This calibrates the center graticule line for an absolute reference power level of −20 dBm.

24. Set the range of the Signal Generator to −30 dBm and adjust the Signal Generator VERNIER for a reading of 0 dBm on the Signal Generator output meter.

25. Increase the spectrum analyzer sensitivity level 10 dB with the IF sensitivity control. This should bring the signal level back up near the center graticule line.

26. Read the difference between the new signal level and the center reference graticule in dB. Calculate the actual power as follows.

    Signal Generator RANGE (step 24) _____ dBm
    Difference measured in step 26 _____ dB
    Actual level _____ dBm

    Record the actual level in Table 4-4. It should be within the limits listed.

27. Repeat steps 24 through 26 with Signal Generator settings of −40 and −50 dBm in step 24.

28. Record the Signal Generator signal level (at −50 dBm) on the spectrum analyzer display.

    Range −50 dBm _____ dBm

29. Remove the two 10 dB attenuators, set the spectrum analyzer IF sensitivity 20 dB higher, and set the vertical sensitivity to bring the signal back to the same reference level recorded in step 28. This calibrates the center graticule line for an absolute reference power level of −50 dBm.

30. Repeat steps 24 through 26 with Signal Generator settings of −60 dBm through −90 dBm.

OPERATION VERIFICATION

OUTPUT LEVEL (cont'd)

Table 4-4. Low Level Accuracy

OUTPUT LEVEL RANGE	Corrected Power Levels		
-30 dBm	-32.75	_____	-27.25
-40 dBm	-42.85	_____	-37.15
-50 dBm	-52.95	_____	-47.05
-60 dBm	-63.05	_____	-56.95
-70 dBm	-73.15	_____	-66.85
-80 dBm	-83.25	_____	-76.75
-90 dBm	-93.35	_____	-86.65

OPERATION VERIFICATION

4-9. FREQUENCY AND AMPLITUDE MODULATION

Specification

Electrical Characteristics	Performance Limits	Conditions
AMPLITUDE MODULATION		
Indicated Meter Accuracy	±11% of reading ±3% of range	100 Hz to 10 kHz rates
Accuracy Relative to External AM Input Level	±9% of reading ±2% of range	100 Hz to 10 kHz rates
FREQUENCY MODULATION		
Indicated Meter Accuracy	±12% of reading ±3% of range	100 kHz rate
Accuracy Relative to External FM Input Level	±7% of reading ±3% of range	100 kHz rate

Description

FM and AM accuracies are checked directly at low frequencies using a modulation analyzer. AM is checked at frequencies above 2 GHz by mixing down to a 100 MHz IF and measuring with a modulation analyzer.

Equipment

Modulation Analyzer	HP 8902A/11722A
Test Oscillator	HP 3335A
Ac Voltmeter	HP 3456A
Local Oscillator	HP 8340A
Mixer	RHG DMS1-26
Attenuator, 10 dB	HP 8493C Option 010

Procedure

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

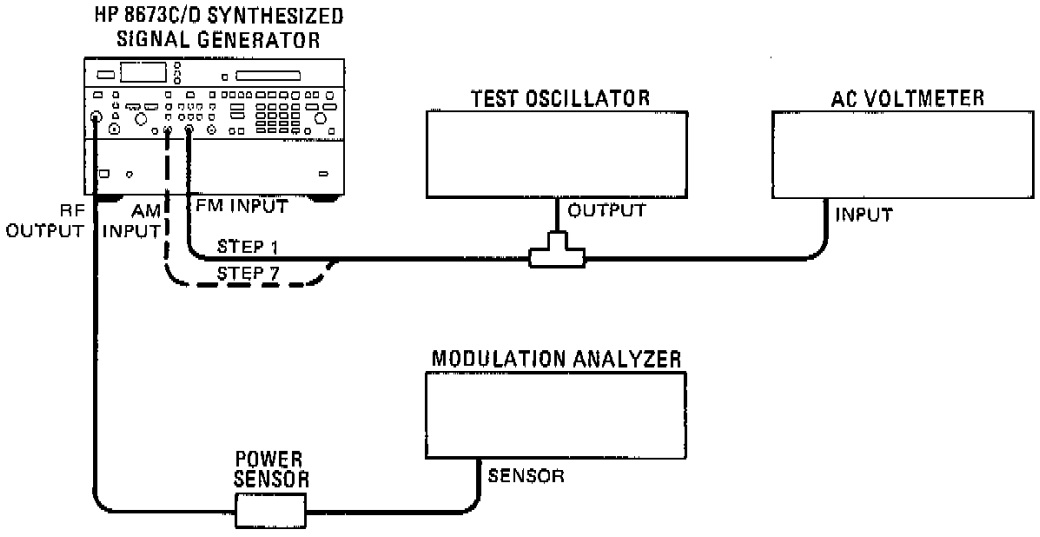


Figure 4-4. FM/AM Accuracy Test Setup

OPERATION VERIFICATION

FREQUENCY AND AMPLITUDE MODULATION (cont'd)

Procedure (cont'd)

Frequency Modulation

2. Set Signal Generator to 100 MHz, 1 MHz FM RANGE and meter to FM. Set test oscillator to 100 kHz frequency and 283 mVrms as read on the voltmeter. This corresponds to 400 kHz peak deviation with a modulation index = 4.

3. The Signal Generator front panel meter should read 400 ±78 kHz.

Indicated Meter Accuracy 322 kHz _____ 478 kHz

4. Read actual FM deviation on modulation analyzer. FM deviation should be 400 ±58 kHz.

Relative FM Accuracy 342 kHz _____ 458 kHz

5. Reduce test oscillator frequency from 100 kHz to 50 kHz. Verify that the FM OVERMOD front panel LED is on. This indicates that the modulation index has been exceeded. Increase test oscillator frequency to 100 kHz. FM OVERMOD LED should turn off.

FM OVERMOD Annunciator _____ (√)

Amplitude Modulation

6. Set Signal Generator to 500 MHz, FM off, AM to 100 % RANGE, and meter to AM.

7. Connect test oscillator to AM INPUT. Set test oscillator frequency to 10 kHz and output level to 636 mVrms. This corresponds to 90% AM depth.

8. Signal Generator front panel meter should read 90% AM depth ± 10%.

Indicated Meter Accuracy 80% _____ 100%

9. Read actual AM depth on modulation analyzer. Modulation analyzer should read 90% AM depth ± 10.1%.

Relative AM Accuracy 500 MHz 79.9% _____ 100.1%

10. Connect equipment as shown in Figure 4-5.

11. Set local oscillator to 3.0 GHz frequency and output level to +7dBm.

12. Set the Signal Generator to 0 dBm on 0 dBm RANGE, frequency to 3.1 GHz, 100% AM RANGE.

13. Set test oscillator frequency to 10 kHz and amplitude to 0.636 Vrms as read on the voltmeter.

14. Modulation analyzer should read an actual AM depth of 90% ±10.1%.

3.1 GHz 79.9% _____ 100.1%

OPERATION VERIFICATION

FREQUENCY AND AMPLITUDE MODULATION (cont'd)

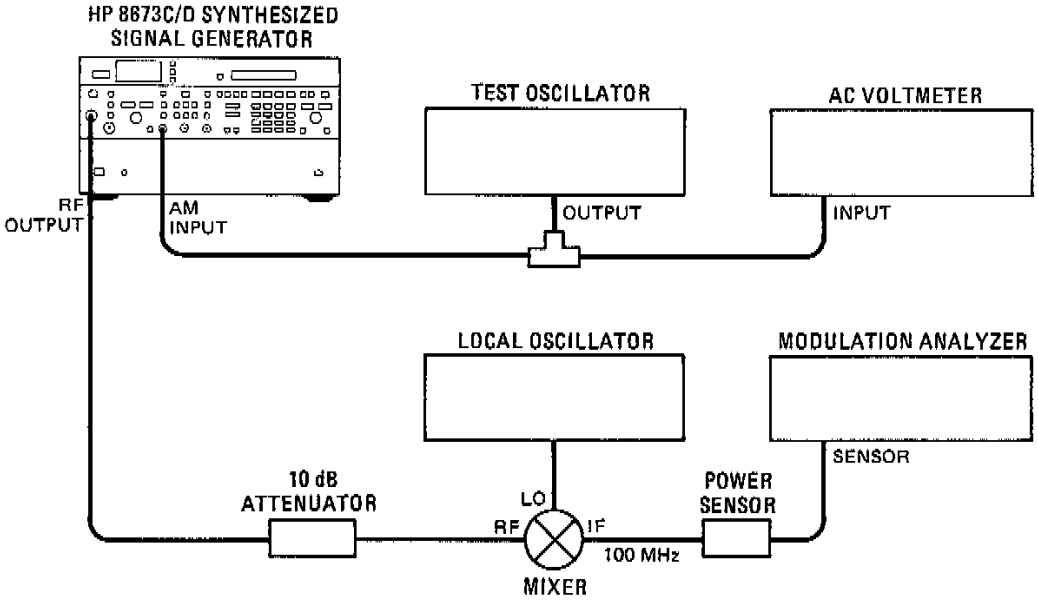


Figure 4-5. AM Accuracy Test Setup

15. Set the frequency of the local oscillator to 17 GHz and the Signal Generator to 17.1 GHz. Set the output power of the Signal Generator on an HP 8673C to −3 dBm in the 0 dBm RANGE. For HP 8673D, leave output power set to 0 dBm.

    The modulation analyzer should read 90 ± 10.1%.

    17.1 GHz 79.9% _____ 100.1%

OPERATION VERIFICATION

4-10. PULSE MODULATION

Specification

Electrical Characteristics	Performance Limits	Conditions
PULSE MODULATION		
ON/OFF Ratio	>55 dB	50—250 MHz
	>80 dB	0.25—26.0 GHz
Rise and Fall Times		AUTO PEAK enabled
	<20 ns	0.05 to <2.0 GHz
	<40 ns	2.0 to 26.0 GHz
Peak Level Accuracy	±1.5 dB	0.05 to <2.0 GHz
	+1.5/−1.0 dB	2.0 to 26.0 GHz
Overshoot, Ringing	<25%	0.05—6.6, 7.2—26.0 GHz
	<30%	6.6—7.2 GHz

Description

Rise time, overshoot, ringing, and peak level accuracy are measured at 50 MHz with an oscilloscope. On-off ratio is measured at 50 MHz and at 6.7 GHz with a spectrum analyzer. A local oscillator and mixer is used with an oscilloscope to measure peak level accuracy at 6.7 GHz, and to measure rise time, overshoot and ringing at 6.7, 12, 18 and 19.6 GHz. The IF frequency used is 50 MHz.

Equipment

Spectrum Analyzer	HP 8566A
Pulse Generator	HP 8013B
Oscilloscope	HP 1980A
Local Oscillator	HP 8340A
Preamplifier, 20 dB	HP 8447D
Power Amplifier, 20 dB	HP 8447E
Mixer	RHG DMS1-26
Attenuator, 10 dB (2)	HP 8491A Option 010
Attenuator, 10 dB	HP 8493C Option 010

Procedure

1. Connect equipment as shown in figure 4-6.

Rise Time, Overshoot and Ringing at 50 MHz

2. Press RCL 0 on the Signal Generator. Set FREQUENCY to 50 MHz, RANGE and VERNIER to 0 dBm, and PULSE to NORM.

3. Set pulse generator to 1 MHz PRF, 200 ns width, and 2V peak output level. Set Channels A and B of the oscilloscope to 50 ohm input impedance.

4. Center the 50 MHz RF pulse waveform on the oscilloscope display. Adjust the oscilloscope vertical position and sensitivity controls so that the pulse base line is one division from the bottom graticule line and 5 divisions high in peak amplitude. See Figure 4-7.

OPERATION VERIFICATION

PULSE MODULATION (cont'd)

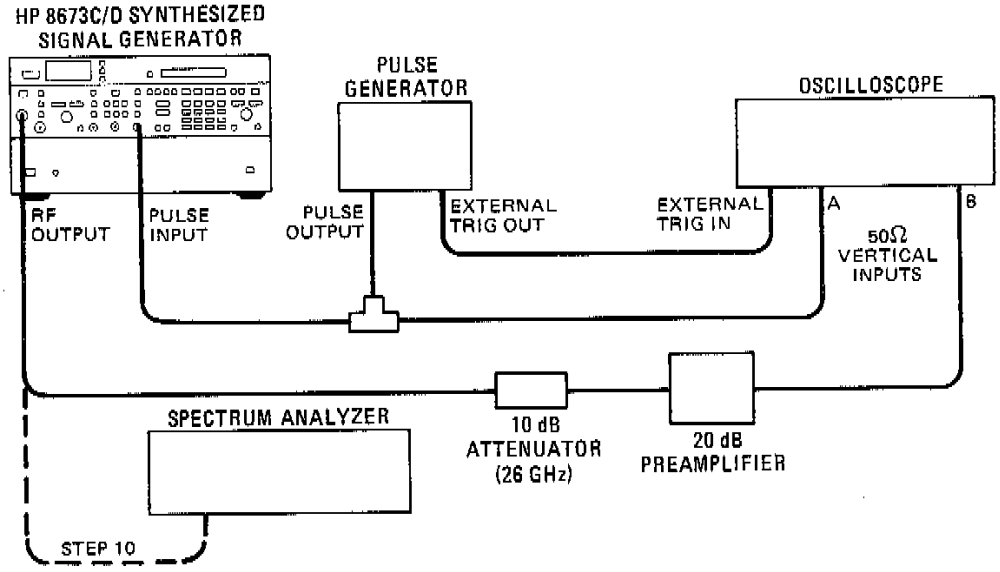


Figure 4-6. Low Frequency Pulse Test Setup

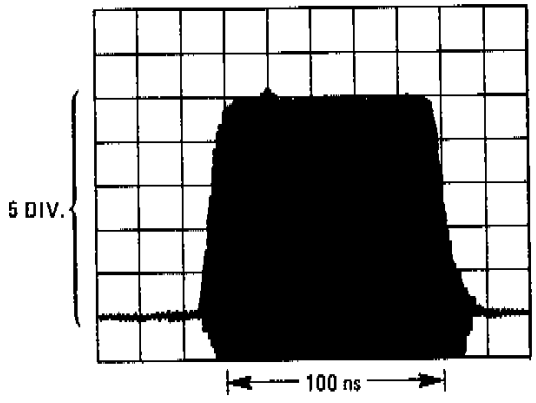


Figure 4-7. Risetime, Overshoot and Ringing Measurement

5. Measure the pulse rise time, overshoot and ringing. Record the results.

Rise Time (10% to 90%.)	_____ 20 ns
Overshoot and ringing	_____ 25%

Peak Level Accuracy at 50 MHz

6. Adjust the pulse width on the pulse generator for a 100 ns RF pulse as displayed on the oscilloscope.

7. Switch Signal Generator to PULSE OFF mode.

OPERATION VERIFICATION

PULSE MODULATION (cont'd)

Procedure (cont'd)

8. Adjust the oscilloscope vertical sensitivity for a display 5 divisions above the pulse base line. The peak of the CW signal is now the CW peak reference level. See Figure 4-8.

NOTE

Do not adjust the vertical position controls after the CW peak reference level and pulse base line have been set.

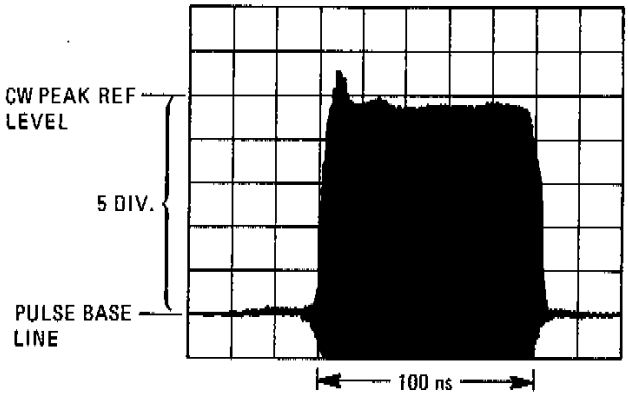


Figure 4-8. Pulse Level Accuracy Measurement

9. Switch back to PULSE NORM. Measure the difference between the CW peak reference level and the average peak pulse level excluding any over/undershoot. Record the peak level accuracy.

NOTE

The error can be read in percent. Using 5 divisions CW peak reference, each division represents 20% error. Measured error must be within the limits of −15.8% (−0.8 division) and +18.8% (+0.9 division) on the oscilloscope display. This is equal to ±1.5 dB peak level accuracy.

Peak Level Accuracy — 50 MHz −15.8% _____ +18.8%

ON/OFF Ratio at 50 MHz and 6.7 GHz

10. Disconnect the RF output from the 10 dB attenuator and amplifier. Connect it to the input of the spectrum analyzer as shown in Figure 4-6.

11. Press the PULSE OFF switch on the Signal Generator.

12. Adjust spectrum analyzer to display the 50 MHz CW signal so that the peak of the signal is at the top of the display. The resolution bandwidth should be set for 300 Hz or less, and the span per division to 2kHz or less, to reduce noise.

13. Disconnect the pulse generator signal from the Signal Generator PULSE IN. Press the PULSE NORM switch. The signal level should be at least 55 dB below the reference established in PULSE OFF mode.

ON/OFF Ratio — 50 MHz _____ 55 dB

OPERATION VERIFICATION

PULSE MODULATION (cont'd)

Procedure (cont'd)

14. Change the Signal Generator frequency to 6.7 GHz and repeat steps 11 through 13. The signal level should be at least 80 dB below the reference.

ON/OFF Ratio — 6.7 GHz _____ 80 dBc

15. Connect equipment as shown Figure 4-9.

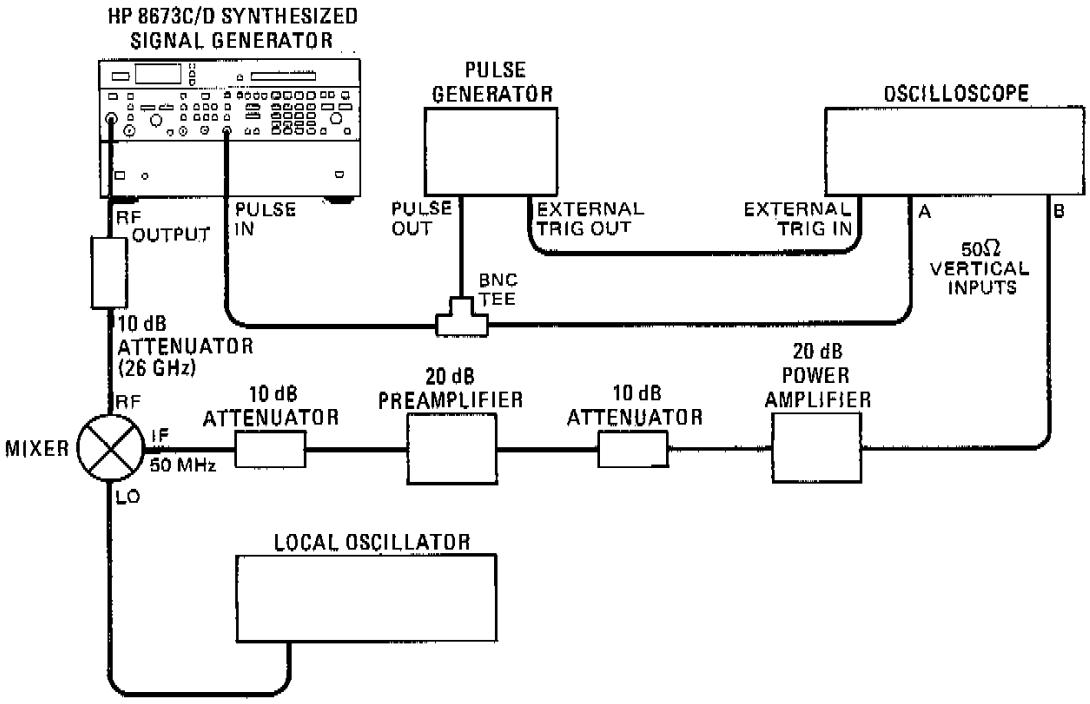


Figure 4-9. High Frequency Pulse Test Setup

16. Set the local oscillator to 6.75 GHz and output level to +7 dBm. Set the Signal Generator to 6.7 GHz. Set RANGE to 0 dBm and the VERNIER to −10 dBm. This will result in a 50 MHz IF pulse modulated signal displayed on the oscilloscope.

17. Center the waveform on the oscilloscope display. Adjust the oscilloscope vertical position and sensitivity controls so that the pulse base line is one division from the bottom graticule line, and 5 divisions in peak amplitude. See Figure 4-7. Measure rise time and overshoot. Record results in Table 4-5.

Rise Time at 6.7 GHz _____ 40 ns

Overshoot and Ringing at 6.7 GHz _____ 30%

OPERATION VERIFICATION

PULSE MODULATION (cont'd)

Procedure (cont'd)

18. Repeat steps 7, 8, and 9 to measure peak level accuracy.

19. Repeat measurement, for risetime and overshoot, at 12 and 18 GHz, keeping the local oscillator frequency 50 MHz above the Signal Generator frequency. For the HP 8673D, repeat also at 19.6 GHz.

Table 4-5. Risetime, Overshoot, and Peak Level Accuracy

Signal Generator Frequency	Local Oscillator Frequency	Rise Time	Overshoot and Ringing	Peak Level Accuracy
6.7 GHz	6.75 GHz	___ 40 ns	___ 30%	−10.8 _____ +18.8%
12 GHz	12.05 GHz	___ 40 ns	___ 25%	
18 GHz	18.05 GHz	___ 40 ns	___ 25%	
HP 8673D: 19 GHz	19.05 GHz	___ 40 ns	___ 25%	

Table 4-6. Operation Verification Test Record (1 of 4)

Hewlett-Packard Company
Model HP 8673C/D
Signal Generator
Serial Number _____ Tested by _____
Date _____

Para. No.	Test		Results Min.	Actual	Max.
4-7.	**FREQUENCY RANGE AND RESOLUTION**				
	Accuracy		(GHz)		(GHz)
	1.000 000		0.999 999	_____ (√)	1.000 001
	Resolution				
	1.0 GHz, 1 kHz Resolution			_____ (√)	
	4.0 GHz, 1 kHz Resolution			_____ (√)	
	8.0 GHz, 2 kHz Resolution			_____ (√)	
	15.0 GHz, 3 kHz Resolution			_____ (√)	
	8673D only				
	20.0 GHz, 4 kHz Resolution			_____ (√)	
	Accuracy (GHz)				
	All readings within ± one count		(GHz)		(GHz)
	2.111 111 GHz		2.111 110	_____ (√)	2.111 112
	3.222 222 GHz		3.222 221	_____ (√)	3.222 223
	4.333 333 GHz		4.333 332	_____ (√)	4.333 334
	5.444 444 GHz		5.444 443	_____ (√)	5.444 445
	6.555 555 GHz		6.555 554	_____ (√)	6.555 556
	7.666 666 GHz		7.666 665	_____ (√)	7.666 667
	8.777 778 GHz		8.777 777	_____ (√)	8.777 779
	9.888 888 GHz		9.888 887	_____ (√)	9.888 889
	11.000 000 GHz		10.999 999	_____ (√)	11.000 001
4-8.	**OUTPUT LEVEL**				
	Output Level				
	Frequency and Power at Minimum Power Point				
	50 — 1950 MHz				
	Frequency _____				
	Minimum power, NORMAL	Standard	+11 dBm	_____ (√)	
		Option 001	+12 dBm	_____ (√)	
		Option 004	+10 dBm	_____ (√)	
		Option 005	+12 dBm	_____ (√)	
	2.0 — <16.0 GHz				
	Frequency _____				
	Minimum power, NORMAL	Standard	+5 dBm	_____ (√)	
		Option 001	+7 dBm	_____ (√)	
		Option 004	+4 dBm	_____ (√)	
		Option 005	+6 dBm	_____ (√)	
	BYPASS	Standard	+8 dBm	_____ (√)	
		Option 001	+10 dBm	_____ (√)	
		Option 004	+7 dBm	_____ (√)	
		Option 005	+9 dBm	_____ (√)	

Table 4-6. Operation Verification Test Record (2 of 4)

Para. No.	Test		Results Min.	Actual	Max.
4-8.	**OUTPUT LEVEL (cont'd)**				
	8673C only				
	16.0 — 18.6 GHz				
	Frequency _____				
	Minimum power, NORMAL	Standard	+2 dBm	_____ (√)	
		Option 001	+4 dBm	_____ (√)	
		Option 004	+1 dBm	_____ (√)	
		Option 005	+3 dBm	_____ (√)	
	BYPASS	Standard	+5 dBm	_____ (√)	
		Option 001	+7 dBm	_____ (√)	
		Option 004	+4 dBm	_____ (√)	
		Option 005	+6 dBm	_____ (√)	
	8673D only				
	16.0 — 26.0 GHz				
	Frequency _____				
	Minimum power, NORMAL	Standard	+6 dBm	_____ (√)	
		Option 001	+9 dBm	_____ (√)	
		Option 004	+4 dBm	_____ (√)	
		Option 005	+7 dBm	_____ (√)	
	BYPASS	Standard	+7 dBm	_____ (√)	
		Option 001	+10 dBm	_____ (√)	
		Option 004	+5 dBm	_____ (√)	
		Option 005	+8 dBm	_____ (√)	
	Level Flatness (Total Variation)				
	0.05—26.0 GHz ±0.50 dB			_____	1.00 dB
	0.05—6.6 GHz ±0.75 dB			_____	1.50 dB
	0.05—12.3 GHz ±1.00 dB			_____	2.00 dB
	0.05—18.6 GHz ±1.25 dB			_____	2.50 dB
	8673D only				
	0.05—26.0 GHz ±1.75 dB			_____	3.50 dB
	High Level Accuracy				
	50 MHz	Output Level			
	0 dBm Range	−10 dBm	−11.75 dBm	_____	−8.25 dBm
		−5 dBm	−6.75 dBm	_____	−3.25 dBm
		0 dBm	−1.75 dBm	_____	+1.75 dBm
		+3 dBm	+1.25 dBm	_____	+4.75 dBm
	+10 dBm Range	0 dBm	−2.00 dBm	_____	+2.00 dBm
		+11 dBm	+9.00 dBm	_____	+13.00 dBm
	−10 dBm Range	−10 dBm	−12.25 dBm	_____	−7.75 dBm
	−20 dBm Range	−20 dBm	−22.45 dBm	_____	−17.55 dBm
	1.9 GHz				
	0 dBm Range	−10 dBm	−11.75 dBm	_____	−8.25 dBm
		−5 dBm	−6.75 dBm	_____	−3.25 dBm
		0 dBm	−1.75 dBm	_____	+1.75 dBm
		+3 dBm	+1.25 dBm	_____	+4.75 dBm
	+10 dBm Range	0 dBm	−2.00 dBm	_____	+2.00 dBm
		+11 dBm	+9.00 dBm	_____	+13.00 dBm

Table 4-6. Operation Verification Test Record (3 of 4)

Para. No.	Test		Results Min.	Actual	Max.
4-8.	**OUTPUT LEVEL (cont'd)**				
	High Level Accuracy (cont'd)				
	2.0 GHz	Output Level			
	0 dBm Range	−10 dBm	−11.75 dBm	_____	−8.25 dBm
		−5 dBm	−6.75 dBm	_____	−3.25 dBm
		0 dBm	−1.75 dBm	_____	+1.75 dBm
		+3 dBm	+1.25 dBm	_____	+4.75 dBm
	+10 dBm Range	0 dBm	−2.00 dBm	_____	+2.00 dBm
		+5 dBm	+3.00 dBm	_____	+7.00 dBm
	18.0 GHz				
	0 dBm Range	−10 dBm	−12.25 dBm	_____	−7.25 dBm
		−5 dBm	−7.25 dBm	_____	−2.75 dBm
		0 dBm	−2.25 dBm	_____	+2.25 dBm
		+3 dBm	+0.75 dBm	_____	+5.25 dBm
	+10 dBm Range	0 dBm	−2.50 dBm	_____	+2.50 dBm
		+5 dBm	+2.50 dBm	_____	+7.50 dBm
	Low Level Accuracy				
	95 MHz	Output Level Range			
		−30 dBm	−32.75 dBm	_____	−27.25 dBm
		−40 dBm	−42.85 dBm	_____	−37.15 dBm
		−50 dBm	−52.95 dBm	_____	−47.05 dBm
		−60 dBm	−63.05 dBm	_____	−56.95 dBm
		−70 dBm	−73.15 dBm	_____	−66.85 dBm
		−80 dBm	−83.25 dBm	_____	−76.75 dBm
		−90 dBm	−93.35 dBm	_____	−86.65 dBm
4-9.	**FREQUENCY AND AMPLITUDE MODULATION**				
	FM Input and Meter Accuracy				
	IndicatedMeter Accuracy				
	1 MHz Range, 400 kHz Deviation		322 kHz	_____	478 kHz
	Accuracy Relative to External FM Input				
	1 MHz Range, 400 kHz Deviation		342 kHz	_____	458 kHz
	FM OVERMOD Annunciator			_____ (√)	
	Amplitude Modulation				
	Meter Accuracy				
	10 kHz Rate, 90% AM		80%	_____	100%
	Accuracy Relative to External AM Input				
	10 kHz Rate, 90% Depth				
	500 MHz		79.9%	_____	100.1%
	3.1 GHz		79.9%	_____	100.1%
	17.1 GHz		79.9%	_____	100.1%

Table 4-6. Operation Verification Test Record (4 of 4)

Para. No.	Test	Results		
		Min.	Actual	Max.
4-10.	**PULSE MODULATION**			
	Rise Time, Overshoot and Ringing			
	50 MHz Rise Time		_____	20 ns
	Overshoot and Ringing		_____	25%
	Peak Level Accuracy			
	50 MHz	−15.8%	_____	+18.8%
	On-Off Ratio (dB below reference signal)			
	50 MHz		_____	−55 dBc
	6.7 GHz		_____	−80 dBc
	Rise Time, Overshoot and Ringing			
	6.7 GHz Rise Time		_____	40 ns
	Overshoot and Ringing		_____	30%
	Peak Level Accuracy	−10.8%	_____	+18.8%
	12 GHz Rise Time		_____	40 ns
	Overshoot and Ringing		_____	25%
	18 GHz Rise Time		_____	40 ns
	Overshoot and Ringing		_____	25%
	8673D only			
	19 GHz Rise Time		_____	40 ns
	Overshoot and Ringing		_____	25%