Agilent Technologies
8360 L-Series Swept CW Generator
(Including Option 001, 004, and 008)
User's Guide

Serial Number Prefixes:

This manual applies to any swept CW generator with the model and serial number prefix combination shown below. You may have to modfiy this manual so that it applies *directly* to your instrument version. Refer to the "Instrument History" chapter.

Agilent Technologies 83623L/30L
3844A and Below

Agilent Technologies 83640L/50L
4040A and Below

Agilent Technologies

.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Agilent Technologies will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instructions when properly installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. AGILENT TECHNOLOGIES SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. AGILENT TECHNOLOGIES SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products. For any assistance, contact your nearest Agilent Technologies Sales and Service Office.

Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument.

WARNING

Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

CAUTION

Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

General Safety Considerations

CAUTION

- Before switching on this instrument, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed.

- Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

- Before switching on this product, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed. Assure the supply voltage is in the specified range.

- **Ventilation Requirements:** When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

- This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664, respectively.

Note

The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.

PREFACE

This manual provides user information for the 8360 L-Series Swept CW Generator.

Instruments Covered By This Manual

This manual applies to instruments having a serial number prefix listed on the title page (behind the "Documentation Map" tab). Some changes may have to be made to this manual so that it applies directly to each instrument; refer to Chapter 5, "Instrument History", to see what changes may apply to your instrument.

A serial number label (Figure 0-1) is attached to the instrument's rear panel. A prefix (four digits followed by a letter), and a suffix (five digits unique to each instrument), comprise the instrument serial number.
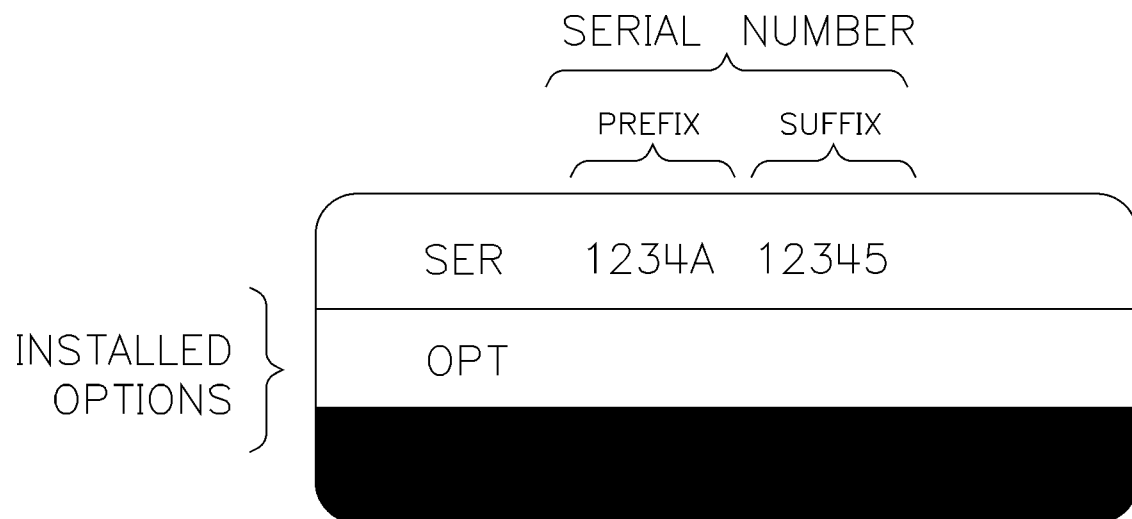

serial

Figure 0-1. Typical Serial Number Label

User's Guide Organization

Tabs divide the major chapters of this manual. The contents of each chapter is listed in the Table of Contents.

HP/Agilent 8360 L-Series Documentation

Documentation Map

For a pictorial representation of the 8360 L-Series documentation, see the *"Documentation Map"* at the front of this manual.

Ordering Manuals

A manual part number is listed on the title page of this manual. You may use it to order extra copies of this manual. See *"Replaceable Parts"* in *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide* for a complete list of 8360 documentation and ordering numbers.

Typeface Conventions

The following conventions are used in the 8360 L-Series documentation:

Italics Italic type is used for emphasis, and for titles of manuals and other publications.

`Computer` Computer type is used for information displayed on the instrument. For example: In this sequence, `POWER LEVEL` is displayed.

(Hardkeys) Instrument keys are represented in "key cap." You are instructed to *press* a hardkey.

`Softkeys` Softkeys are located just below the display, and their functions depend on the current display. These keys are represented in "softkey." You are instructed to *select* a softkey.

Regulatory Information

This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

Manufacturer's Declaration

Note   This is to certify that this product meets the radio frequency
interference requirements of Directive FTZ 1046/1984. The German
Bundespost has been notified that this equipment was put into
circulation and has been granted the right to check the product type
for compliance with these requirements.

Note: If test and measurement equipment is operated with
unshielded cables and/or used for measurements on open set-ups, the
user must insure that under these operating conditions, the radio
frequency interference limits are met at the border of his premises.

Model 8360 L-Series Swept CW Generator

Note   Hiermit wird bescheinigt, dass dieses Gerät/System in
Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84
funkentst"rt ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses
Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung
der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zustzinformation für Mess-und Testgeräte:

Werden Mess- und Testgeräte mit ungeschirmten Kabeln und/oder
in offenen Messaufbauten verwendet, so ist vom Betreiber
sicherzustellen, dass die Funk-Entst"rbestimmungen unter
Betriebsbedingungen an seiner Grundstücksgrenze eingehalten
werden.

Declaration of Conformity

<table>
<tr><td colspan="2" align="center">DECLARATION OF CONFORMITY
According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014</td></tr>
<tr><td>Manufacturer's Name:</td><td>Agilent Technologies, Inc.</td></tr>
<tr><td>Manufacturer's Address:</td><td>1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799
USA</td></tr>
<tr><td colspan="2">Declares that the products</td></tr>
<tr><td>Product Name:</td><td>Synthesized Sweeper</td></tr>
<tr><td>Model Number:</td><td>83623L, 83630L, 83640L, 83650L</td></tr>
<tr><td>Product Options:</td><td>This declaration covers all options of the above products.</td></tr>
</table>

Conform to the following product specifications:

EMC: IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998

Standard	Limit
CISPR 11:1990 / EN 55011-1991	Group 1, Class A
IEC 61000-4-2:1995+A1998 / EN 61000-4-2:1995	4 kV CD, 8 kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1995	3 V/m, 80 - 1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV sig., 1 kV power
IEC 61000-4-5:1995 / EN 61000-4-5:1996	0.5 kV L-L, 1 kV L-G
IEC 61000-4-6:1996 / EN 61000-4-6:1998	3 V, 0.15 –80 MHz
IEC 61000-4-11:1994 / EN 61000-4-11:1998	1 cycle, 100%

Safety: IEC 61010-1:1990 + A1:1992 + A2:1995 / EN 61010-1:1993 +A2:1995
CAN/CSA-C22.2 No. 1010.1-92

Supplementary Information:
The products herewith comply with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carry the CE-marking accordingly.

Santa Rosa, CA, USA   2 September 2000

Greg Pfeiffer/Quality Engineering Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung −3.GSGV Deutschland).

Acoustic Noise Emmission/Geraeuschemission	
LpA <70 dB	LpA <70 dB
Operator position	am Arbeitsplatz
Normal position	normaler Betrieb
per IS) 7779	nach DIN 45635 t.19

Instrument Markings

⚠   The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

C€   The CE mark is a registered trademark of the European Community.

CSA   The CSA mark is a registered trademark of the Canadian Standards Association.

"ISM1-A"   This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

| This is an ON symbol. The symbol ON is used to mark the position of the instrument power line switch.

⏊   This is an ON symbol. The symbol ON is used to mark the position of the instrument power line switch.

⏻   This is a STANDBY symbol. The STANDBY symbol is used to mark the position of the instrument power line switch.

⏾   This is an OFF symbol. The OFF symbol is used to mark the position of the instrument power line switch.

∼   This is an AC symbol. The AC symbol is used to indicate the required nature of the line module input power.

Table 0-1. Agilent Technologies Sales and Service Offices

UNITED STATES

Instrument Support Center
Agilent Technologies
(800) 403-0801

EUROPEAN FIELD OPERATIONS

Headquarters
Agilent Technologies S.A.
150, Route du Nant-d'Avril
1217 Meyrin 2/Geneva
Switzerland
(41 22) 780.8111

France
Agilent Technologies France
1 Avenue Du Canada
Zone D'Activite De Courtaboeuf
F-91947 Les Ulis Cedex
France
(33 1) 69 82 60 60

Germany
Agilent Technologies GmbH
Agilent Technologies Strasse
61352 Bad Homburg v.d.H
Germany
(49 6172) 16-0

Great Britain
Agilent Technologies Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG41 5DZ
England
(44 118) 9696622

INTERCON FIELD OPERATIONS

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Palo Alto, California, USA
94304-1316
(650) 857-5027

Australia
Agilent Technologies Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
(61 3) 895-2895

Canada
Agilent Technologies (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
Kirkland, Quebec H9J 2X8
Canada
(514) 697-4232

China
China Agilent Technologies
38 Bei San Huan X1 Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

Japan
Agilent Technologies Japan, Ltd.
9-1 Takakura-Cho, Hachioji
Tokyo 192, Japan
(81 426) 60-2111

Singapore
Agilent Technologies Singapore (Pte.) Ltd.
150 Beach Road
#29-00 Gateway West
Singapore 0718
(65) 291-9088

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Agilent Technologies Taiwan
8th Floor, H-P Building
337 Fu Hsing North Road
Taipei, Taiwan
(886 2) 712-0404

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Getting Started

What Is In This Chapter

This chapter contains information on how to use the Agilent 8360 L-Series Swept CW Generator. The information is separated into three sections.

Basic   For the novice user unfamiliar with the 8360 L-Series Swept CW Generator. This section describes the basic features of the swept CW generator.

Advanced   For the user familiar with swept CW generators, but not necessarily familiar with how to use the special features of the 8360 L-Series Swept CW Generator.

Programming   For the user wishing to program an 8360 L-Series Swept CW Generator. This section contains an introduction to Standard Commands for Programmable Instruments language (SCPI), Agilent's implementation of IEEE-488.2-1987, and an introduction to the Analyzer programming language.

Note   If you are unpacking a new swept CW generator, refer to the installation suggestions provided in Chapter 3, "Installation".

How To Use This Chapter

To use this chapter effectively, refer to the tabbed section "Menu Maps". Menu maps can be folded out to be viewed at the same time as the Getting Started information, as illustrated.
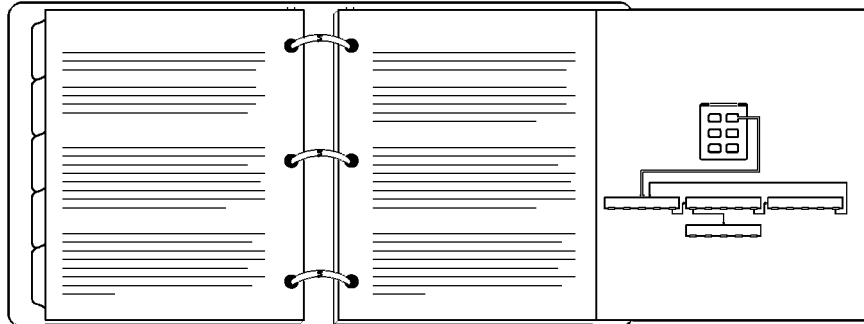
Equipment Used In Examples

The following table lists the equipment used in the operation examples shown in this chapter. You can substitute equipment, but be aware that you may get different results than those shown.

Equipment Used In Examples

Equipment	Recommended Model Numbers
Power Meter	HP/Agilent 436A/437B
Power Sensor	HP/Agilent 8485A
Power Splitter	HP/Agilent 11667B
Oscilloscope	HP/Agilent 1740A
mm-Wave Source Module	HP/Agielnt 83556A
Power Amplifier	HP/Agilent 8349B
Coupler	HP/Agilent 11691D
Detector	HP/Agilent 8474D

Introducing the Agilent 8360 L-Series Swept CW Generators

The 8360 L-Series Swept CW Generators are high performance, broadband frequency swept CW generators.
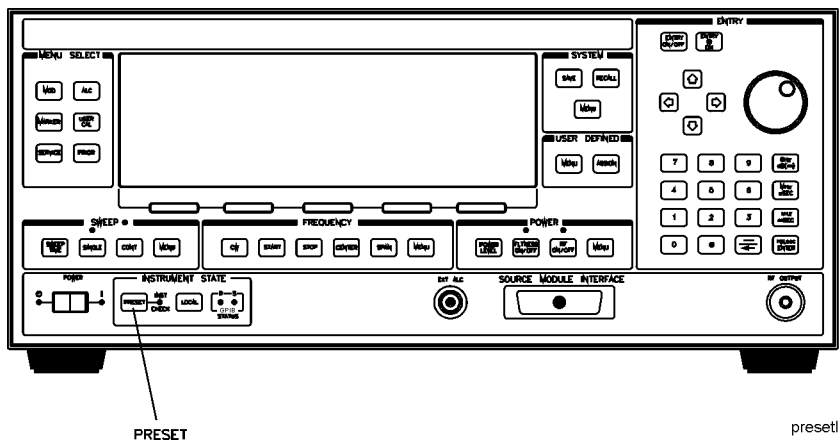
PRESET

presetl

Figure 1-1. The 8360 L-Series Swept CW Generator

(PRESET) initializes the front panel settings and runs the swept CW generator through a brief self-test. In the following examples, unless stated otherwise, begin by pressing (PRESET).

Display Area
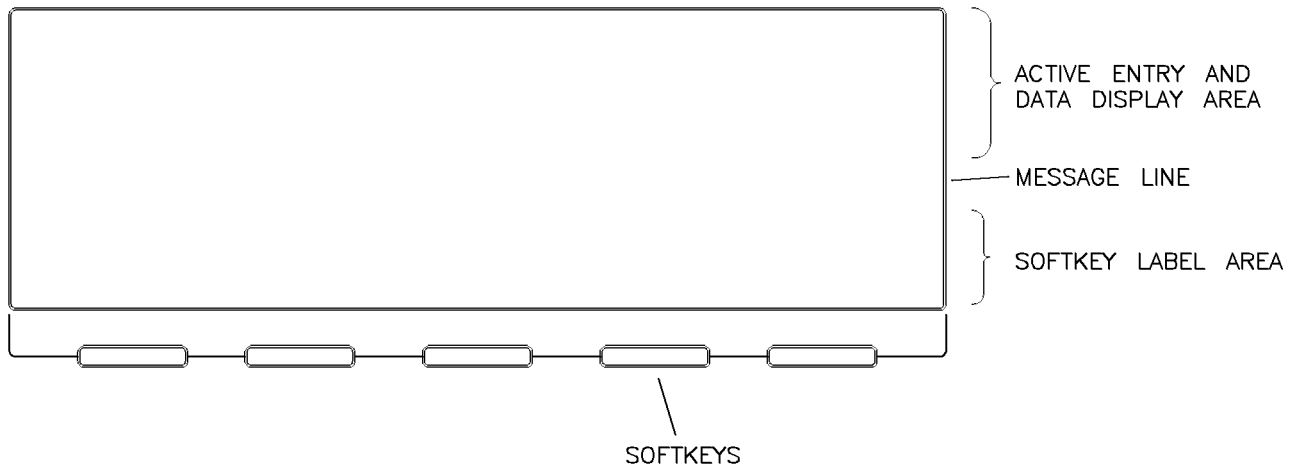
Figure 1-2. Display

Active Entry and Data Display Area: This area typically displays the frequency and power information of the current instrument state. When data entry is expected, the swept CW generator uses all or part of this area to record the entries. The active entry arrow (-->) indicates the active entry function and its current value.

Message Line: This line is used to display:

 ALC level status.
 Unlock information.
 Timebase status.
 RF output status.

Softkey Label Area: This area displays the name of the softkey directly below it.

Softkeys: These keys activate the functions indicated by the labels directly above them.

Entry Area

All function values are changed via the rotary knob and/or keys of the entry area.
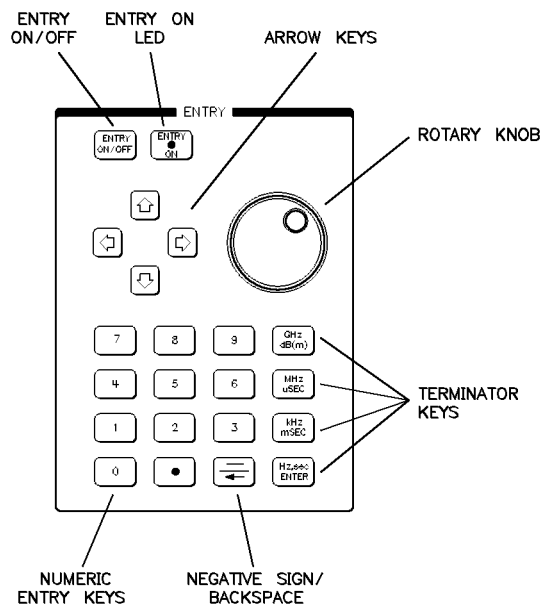
Figure 1-3. Entry Area

The following are active only when the swept CW generator expects an input.

(ENTRY ON/OFF): This key lets you turn off or on the active entry area. Turning off the entry area after a value is entered prevents accidental changes.

ENTRY ON LED: This LED lights when the entry area is active.

Arrow Keys: The up/down arrow keys let you increase or decrease a numeric value. The left/right arrow keys choose a significant digit indicated by an underline.

Rotary Knob: The rotary knob increases or decreases a numeric value. The rotary knob can be used in combination with the left/right arrow keys to change the increment size.

Terminator Keys: After the numeric entry keys are used to enter a value, these keys define the units.

Negative Sign/Backspace Key: If a data entry is in progress, this key backspaces over the last digit entered, otherwise a negative sign is entered.

Numeric Entry Keys: These keys enter specific numbers in the active entry area and must be followed by one of the terminator keys before the function value changes.

CW Operation and Start/Stop Frequency Sweep

CW Operation

CW operation is one of the major functions of the swept CW generator, and is easy to do using front panel keys. In CW operation, the swept CW generator produces a single, low-noise, synthesized frequency. Try this example: Press [CW] [1] [2] [.] [3] [4] [5] [6] [7] [8] [GHz].

Check the active entry area. It indicates:

```
--> CW:  12345.678000 MHz
```

The data display area indicates CW operation and the frequency that you entered. The ENTRY ON LED is lit and the green SWEEP LED is off.

Try other frequencies. Experiment with the rotary knob and the arrow keys as alternate methods of data entry.

Start/Stop Frequency Sweep

The swept CW generator can sweep a frequency span as wide as the frequency range of the instrument, or as narrow as 0 Hz (swept CW).
In start/stop sweep operation, the swept CW generator produces a sweep from the selected start frequency to the selected stop frequency.
For example:

Press [START] [4] [.] [5] [6] [GHz].

Press [STOP] [7] [.] [8] [9] [GHz].

The data display area indicates the start frequency and the stop frequency. The green SWEEP LED is on (periodically off when sweep is retracing). Because this is the active function, the active entry area indicates:

```
--> STOP FREQUENCY:  7890.000000 MHz
```

Any subsequent entries change the stop frequency. To change the start frequency, press [START], which remains the active function until you press a different function key.
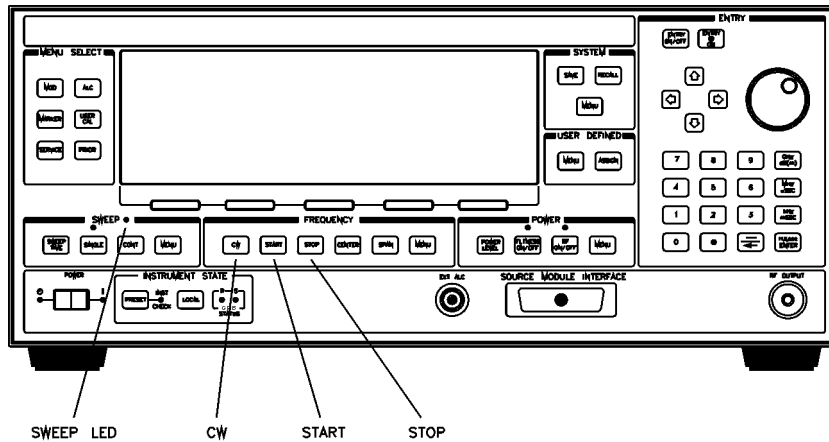
Figure 1-4. CW Operation and Start/Stop Frequency Sweep

CW Operation

1. Press (CW).
2. Enter value.
3. Press terminator key.

Start/Stop Frequency Sweep

1. Press (START).
2. Enter value.
3. Press terminator key.
4. Press (STOP).
5. Enter value.
6. Press terminator key.

Center Frequency/Span Operation

Center frequency/span is another way of establishing swept operation. This is just a different way of defining sweep limits. As an example of center frequency/span operation:

Press (CENTER) (4) (GHz).

Press (SPAN) (1) (GHz).

The swept CW generator is now sweeping from 3.5 to 4.5 GHz (to view these figures, press either (START) or (STOP), then (SPAN)). The data display area indicates the center frequency, as well as, the span. Notice that the green SWEEP LED is on.

While span is the active function, try the rotary knob and arrow keys. This symmetrical increase or decrease of the frequency span about the center frequency is one reason that center frequency/span swept operation is used instead of start/stop frequency sweep.

Another example illustrates the subtleties of center frequency/span.

Press (CENTER) (4) (GHz)

Press (SPAN) (8) (GHz)

Notice that the center frequency changed. This is because the center frequency could not accommodate a span of 8 GHz without exceeding the lower frequency limit of the swept CW generator's specified frequency range. If the low or high frequency range limits are exceeded, the *inactive* (center or span) function is reset. Experiment with the rotary knob and the arrow keys as alternate methods of data entry.
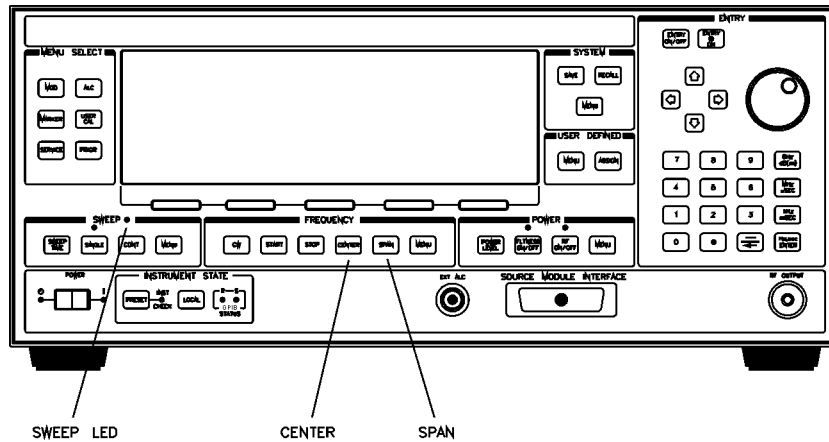
centerl

Figure 1-5. Center Frequency and Span Operation

Center Frequency Operation	Span Operation
1. Press (CENTER).	1. Press (SPAN).
2. Enter value.	2. Enter value.
3. Press terminator key.	3. Press terminator key.

Power Level and Sweep Time Operation

Power Level Operation

The swept CW generator can produce leveled power for CW, swept frequency, or power sweep operation. The selected power level can range from −20 dBm (−110 dBm for Option 001 swept CW generators) to +25 dBm.

For practice: Press (POWER LEVEL) (−) (2) (0) (dB(m)). The active entry area shows:

> `--> POWER LEVEL: −20.00 dBm`

If the selected power level is beyond the range of the swept CW generator, the closest possible power is shown in both the data display area and the active entry area. If the selected power level exceeds the maximum leveled power the swept CW generator is able to produce, the unleveled message `UNLVLED` appears on the message line. Experiment with the rotary knob and the arrow keys as alternate methods of data entry.

Sweep Time Operation

In typical applications the sweep time can vary tremendously, from milliseconds in a network analyzer system, to more than a minute in thermistor-based power meter systems.

Press (START) (4) (GHz).
Press (STOP) (6) (GHz).
Press (SWEEP TIME) (2) (.) (5) (sec).

Watch the green SWEEP LED, it blinks every 2.5 seconds. The LED blinks at each retrace.

For the fastest sweep speed for which all specifications are guaranteed, the swept CW generator must be in automatic sweep time selection.

Refer to menu map 7, SWEEP.
Press SWEEP (MENU).
Select `more 1/3`.

Select `SwpTime Auto`.

Notice that the active entry area indicates:

> `--> SWEEP TIME:  100.0 mSec          AUTO`

When the swept CW generator is in automatic sweep time selection, the active entry area displays `AUTO` along with the current sweep time. Faster sweep speeds than this are possible, turn the rotary knob counter-clockwise until the display no longer changes. Notice that `AUTO` is no longer displayed.

SWEEP TIME   SWEEP LED   POWER LEVEL
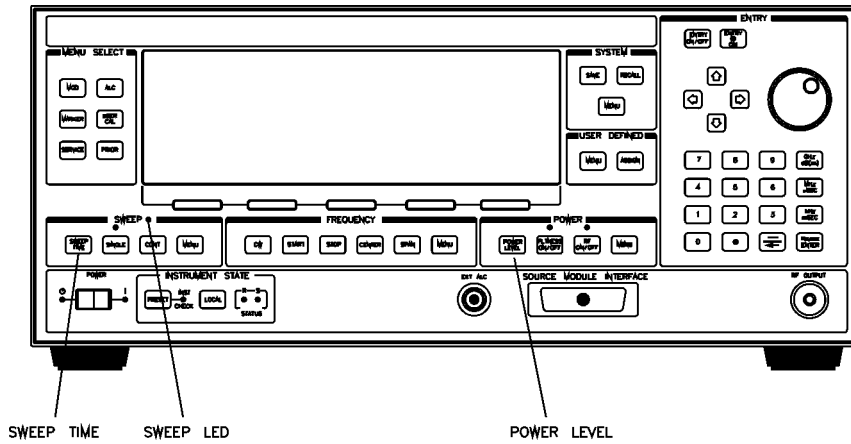
powerl

Figure 1-6. Power Level and Sweep Time Operation

Power Level Operation	**Sweep Time Operation**
1. Press (POWER LEVEL).	1. Press (SWEEP TIME).
2. Enter value.	2. Enter value.
3. Press (dB(m)).	3. Press terminator key.

Continuous, Single, and Manual Sweep Operation

Continuous sweep is the operation mode set when the swept CW generator is preset. It simply means that when the swept CW generator is performing a swept operation, the sweeps will continuously sweep-retrace-sweep-retrace until a different sweep mode is selected. To choose this sweep mode, press (CONT).

To change from continuous sweep to single sweep operation, press (SINGLE). This causes the swept CW generator to abort the sweep in progress and switch to the single sweep mode. This initial keystroke causes the swept CW generator to switch sweep modes, but it does *not* initiate a single sweep. A second keystroke (press (SINGLE)) initiates a single sweep. When the swept CW generator is in single sweep operation, the amber LED above the key lights. When the swept CW generator is actually performing a sweep in single sweep mode, the green SWEEP LED lights.

The manual sweep mode lets you use the rotary knob to either sweep from the start frequency to the stop frequency or to sweep power.

Refer to menu map 7, SWEEP.

Press (PRESET).

Press SWEEP (MENU).

Select Manual Sweep .

The active entry area displays:

```
--> SWEPT MANUAL:   XXXXXXXXX MHz
```

Use the rotary knob to sweep from the start to the stop frequency. The green SWEEP LED is off in manual sweep mode because the sweeps are synthesized.
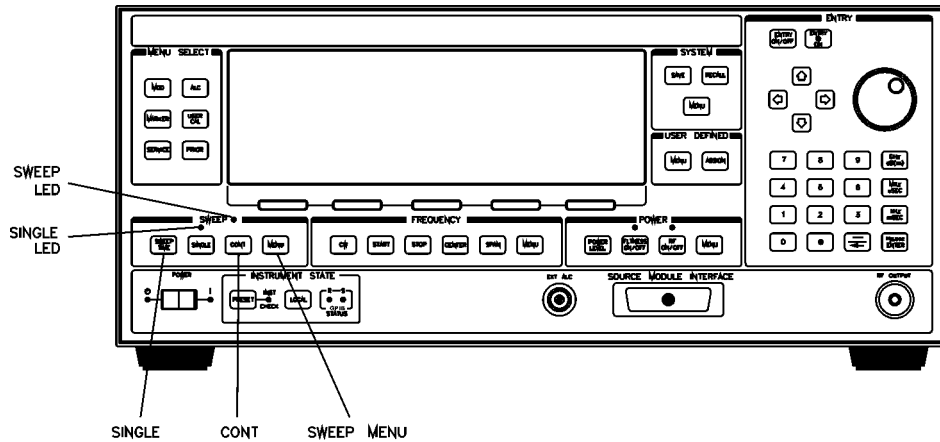
Figure 1-7. Continuous, Single, and Manual Sweep Operation

Single Sweep	Continuous Sweep	Manual Sweep
1. Press (SINGLE).	1. Press (CONT).	1. Press SWEEP (MENU). 2. Press Manual Sweep. 3. Use the rotary knob to adjust frequency.

Marker Operation

The swept CW generator has five frequency markers that can be used as fixed frequency "landmarks," or as variable frequency pointers on a CRT display. To view the marker features of the swept CW generator on a CRT, connect the swept CW generator as shown in Figure 1-8.

Refer to menu map 3, MARKER.
Press (PRESET).
Press (START) (3) (GHz).
Press (STOP) (7) (GHz).
Press (MARKER).
Select `Marker M1` and enter (4) (GHz).

The swept CW generator is sweeping from 3 to 7 GHz, with a 100 ms sweep speed. A frequency marker is set at 4 GHz, which causes an intensified dot to appear on the CRT. To obtain an amplitude spike at that frequency, select `Ampl Markers`. Notice that you can set the amplitude of the spike with the rotary knob or entry keys. To return to the intensified dot representation, select `Ampl Markers` (asterisk off).

Caution   Amplitude markers increase the output power at the marker frequency. Provide protection to devices that could be damaged.

For a second marker, select `Marker M2` and enter (5) (.) (5) (GHz).

This process can be continued for all five markers. Note that the marker displayed in the active entry area is "active" and can be controlled by the rotary knob, arrow keys, and numeric entry keys.

Once the M1 and M2 markers are established, the marker sweep function, softkey `M1--M2 Sweep`, temporarily changes the original start/stop frequencies to those of markers M1 and M2. Select `M1--M2 Sweep`. Notice that the swept CW generator now is sweeping from 4 to 5.5 GHz. Use this function to focus in on a selected portion of the frequency sweep. Select `M1--M2 Sweep` again. This turns the function off and returns the swept CW generator to its original sweep parameters. To change the start/stop frequencies for the swept CW generator, not just temporarily, use the softkey `Start=M1 Stop=M2`.

As an example of the delta marker function:

Select `Marker M3` and enter (6) (.) (7) (GHz).
Select `Delta Marker`.

The frequency difference between marker 3 and marker 1 is displayed, and the CRT trace is intensified between the two markers. The active entry area displays:

--> DELTA MKR (3-1) : 2700.000000 MHz

Marker 1 was chosen because it is selected as the delta marker reference. To change reference markers, select `Delta Mkr Ref`. Select `M2` as the reference. Watch the display change to indicate:

```
--> DELTA MKR (3-2) : 1200.000000 MHz
```

You can choose any of the five markers as a reference, but when delta marker is on, if the reference marker has a frequency value higher than the last active marker, the difference between the frequencies is negative and is displayed as such by the swept CW generator. The CRT display continues to intensify the difference between the two markers.

When delta marker is showing in the active entry area, the ENTRY area is active. Rotate the rotary knob and watch the frequency difference change. The last active marker (in this case, marker 3) changes frequency value, not the reference marker.
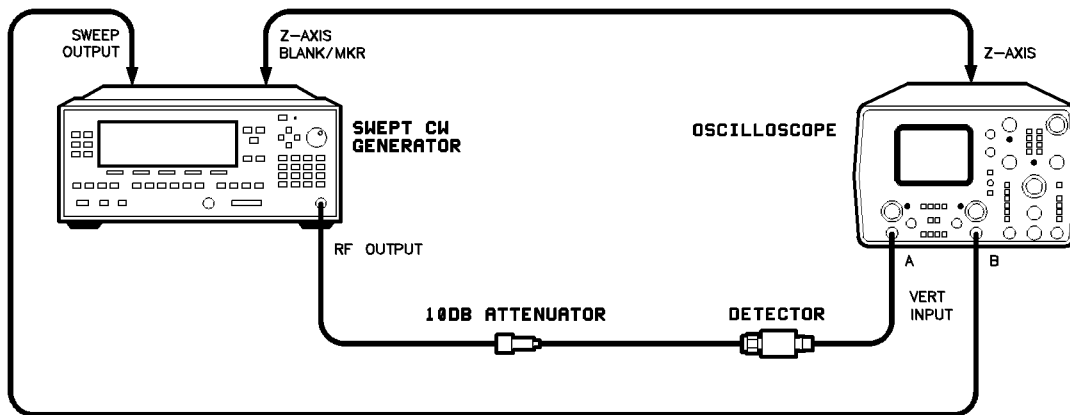
Figure 1-8. Marker Operation

Marker Operation

1. Press (MARKER).
2. Select a marker key (`M1` ... `M5`).
3. Enter value.
4. Press terminator key.

Delta Marker Operation

1. Press (MARKER).
2. Select a marker key (`M1` ... `M5`).
3. Enter value.
4. Press terminator key.
5. Select a different marker key (`M1` ... `M5`).
6. Enter value.
7. Press terminator key.
8. Select `Delta Mkr Ref`.
9. Select one of the previously chosen markers.
10. Press (PRIOR).
11. Select `Delta Marker`.

Saving and Recalling an Instrument State

The save/recall registers store and access a previously set instrument state.

For example, set the swept CW generator to sweep from 3 to 15 GHz at a −10 dB power level, with markers 1 and 2 set at 4.5 and 11.2 GHz.

Press (START) (3) (GHz).
Press (STOP) (1) (5) (GHz).
Press (POWER LEVEL) (−) (1) (0) (dB(m)).
Press (MARKER).
Select Marker M1 (4) (.) (5) (GHz).
Select Marker M2 (1) (1) (.) (2) (GHz).

To save this instrument state in register 1, press (SAVE) (1). To verify that the swept CW generator has saved this state:

Press (PRESET).
Press (RECALL) (1).
Press (MARKER).

The active entry area displays:

    --> RECALL REGISTER: 1 RECALLED

Notice the sweep end points, power level, and the asterisks next to the marker 1 and 2 key labels.

You can save instrument states in registers 1 through 8. Register 0 saves the last instrument state before power is turned off. When power is turned on, register 0 is automatically recalled.
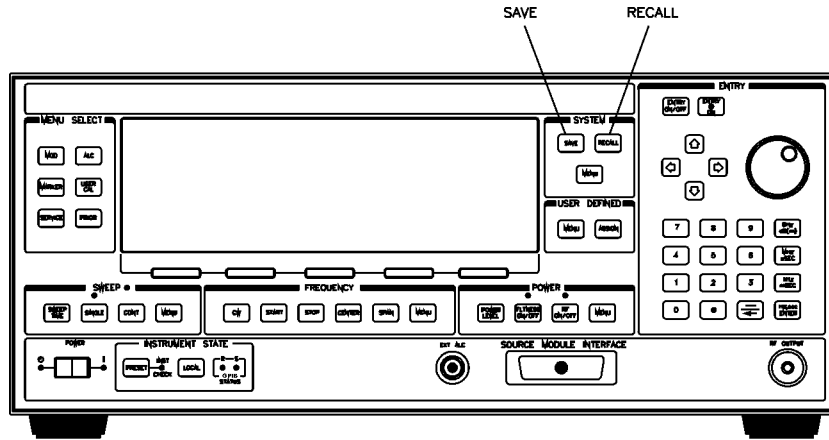
Figure 1-9. Saving and Recalling an Instrument State

Save	Recall
1. Set up swept CW generator as desired.	1. Press (RECALL).
2. Press (SAVE).	2. Press a number 0 through 8.
3. Press a number 1 through 8.	

Power Sweep and Power Slope Operation

Power Sweep Operation

The power sweep function allows the power output to be swept (positive or negative) when the swept CW generator is in the CW frequency mode. The power output of the swept CW generator determines the maximum leveled power sweep that can be accomplished. For this example, refer to the "Menu Map" section.

Zero and calibrate the power meter.

Connect the instruments as shown in Figure 1-10.

Press (CW) (4) (GHz).

Press (POWER LEVEL) (0) (dBm).

Press (SWEEP TIME) (2) (sec) (SINGLE).

Set the power meter to dB[REF] mode.

The swept CW generator is ready to produce a 4 GHz CW signal at 0 dBm power out, with a 2 second sweep rate whenever a single sweep is executed. The power meter is ready to measure the power level relative to a starting point of 0 dBm.

Press POWER (MENU).

Select Power Sweep and enter (7) (dB(m)) (asterisk on).

Press (SINGLE).

Watch the relative power indication on the power meter. At the end of the sweep the power meter indicates +7 dB. The active entry area on the swept CW generator indicates:

```
--> POWER SWEEP:  7.00 dB/SWP
```

Now enter (2) (5) (dB(m)) (power sweep is still the active entry function).

Press (SINGLE).

This time the power meter indicates less than the power sweep requested. Note that the swept CW generator is unleveled, UNLVD. This happens because the swept CW generator's output power at the start of the sweep is 0 dB and the requested power sweep takes the swept CW generator beyond the range where it is able to produce leveled power. The range of the power sweep is dependent on the ALC range and can be offset if a step attenuator (Option 001) is present.

Select Power Sweep to turn this function off (no asterisk).

Press (POWER LEVEL) (−) (2) (0).

On the power meter, press dB[REF] to reset the reference level.

Select Power Sweep (asterisk on).

Press (SINGLE).

The swept CW generator performs a power sweep beginning at
−20 dBm and ending at +5 dBm. The power meter indicates
+25 dB.

Power Slope Operation

This function allows for compensation of high frequency system or
cable losses by linearly increasing the power output as the frequency
increases. For this example, refer to the "Menu Map" section.

Press Power Slope, the active entry area displays:
--> RF SLOPE: X.XX dB/GHz, where X is a numeric value.
Power slope is now active, notice that an asterisk is next to the key
label.

Use the entry keys, rotary knob, or arrow keys to enter a value for
the linear slope.

Press Power Slope again to turn this feature off.
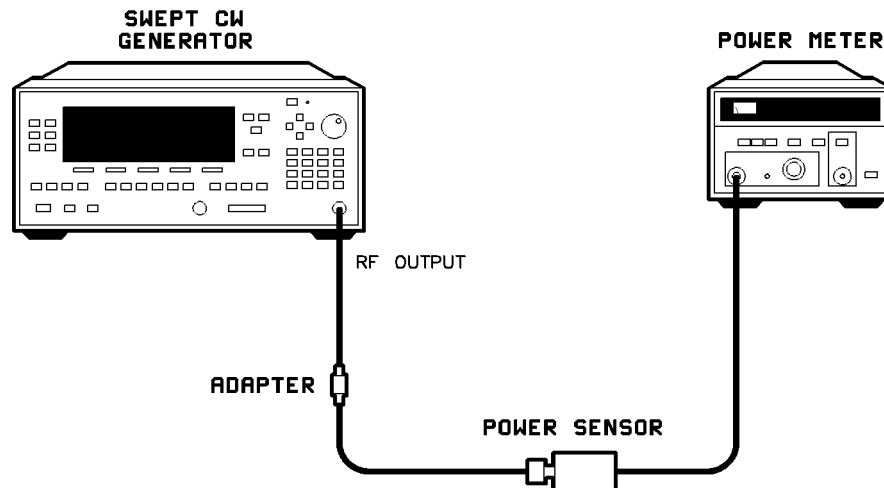
Figure 1-10. Power Sweep and Power Slope Operation

Power Sweep	Power Slope
1. Press POWER (MENU).	1. Press POWER (MENU).
2. Select Power Sweep.	2. Select Power Slope.
3. Enter a value.	3. Enter a value.
4. Press terminator key.	4. Press terminator key.

Getting Started Advanced

This section of Chapter 1 describes the use of many of the unique features of the 8360 L-Series Swept CW Generators. The format used is similar to the one used on the previous pages. When referred to a menu map number, go to the Menu Map tab and unfold the menu map so that you can view it together with the text.

Some menus have more than one page of softkeys. Select the `more m/n` softkey to view the next page of softkeys. `more m/n` is *not* included in the keystrokes given in these procedures.

Table 1-1. Keys Under Discussion in This Section

Paragraph Heading	Keys
Externally Leveling the Swept CW Generator	`Leveling Point ExtDet`
	`Coupling Factor`
	POWER LEVEL
	`Set Atten`
	`Leveling Point PwrMtr`
	`Pwr Mtr Range`
	`Leveling Point Module`
	`Mdl Lev Menu`
Working with Mixers/Reverse Power Effects	`Uncoupl Atten`
	`Leveling Mode Normal`
Working with Spectrum Analyzers/ Reverse Power Effects	`Leveling Mode ALCoff`
	`Leveling Mode Search`
"Optimizing Swept CW Generator Performance"	`Fltness Menu`
	`Delete Menu`
	`Auto Fill Start`
	`Auto Fill Stop`
	`Auto Fill Incr`
	`Mtr Meas Menu`
	FLTNESS ON/OFF
	`Enter Freq`
	`Enter Corr`
	`Freq Follow`
	`List Menu`
	`Copy List`
	`Sweep Mode List`
	`Ext Det Cal`

Table 1-1.
Keys Under Discussion in This Section (continued)

Paragraph Heading	Keys

"Optimizing Swept CW Generator Performance" continued	`Auto Track`
	`Peak RF Always`
	`Peak RF Once`
	
	`Swp Span Cal Once`
	`Swp Span Cal Always`
	
	`FullUsr Cal`
	
	USER DEFINED MENU ASSIGN

Using Step Sweep	`Step Swp Menu`

Creating and Using a Frequency List	`List Menu`
	`Delete Menu`
	`Enter List Freq`
	`Enter List Offset`
	`Enter List Dwell`
	`Pt Trig Menu`

Using the Security Features	`Zero Freq`
	`Save Lock`
	`Clear Memory`
	`Blank Display`

Changing the Preset Parameters	`Save Usr Preset`
	`Preset Mode User`
	PRESET

For more information, each of these keys has a separate entry in Chapter 2.

Externally Leveling the Swept CW Generator

In externally leveled operations, the output power from the swept CW generator is detected by an external sensor. The output of this detector is returned to the leveling circuitry, and the output power is automatically adjusted to keep power constant at the point of detection.

Leveling with Detectors/Couplers /Splitters

Figure 1-11 illustrates a typical setup for external leveling. When externally leveled, the power level feedback is taken from the external negative detector input rather than the internal detector. This feedback voltage controls the ALC system to set the desired RF output. Refer to Figure A-1 in Chapter 2 for a block diagram of the swept CW generator's ALC circuitry.
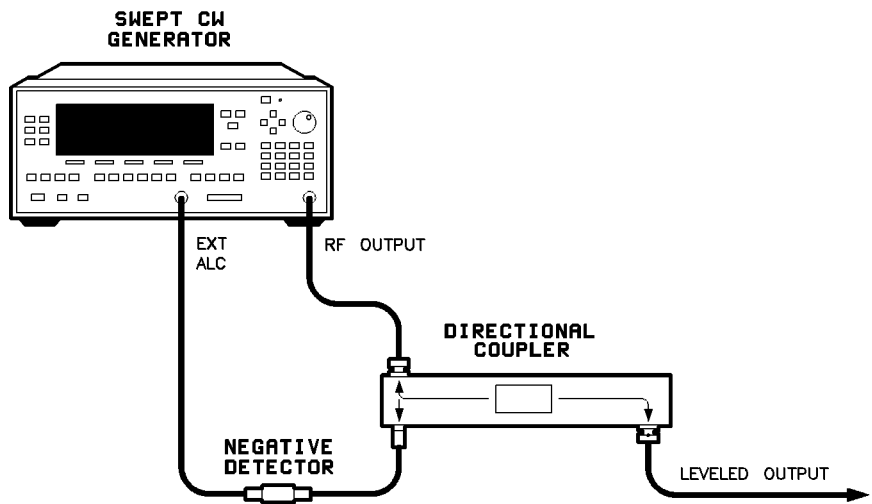
Figure 1-11. ALC Circuit Externally Leveled

To level externally:

1. Set up the equipment as shown. For this example, the detector/coupler setup is used.
2. Refer to menu map 1.
3. Press `ALC`.
4. Select `Leveling Point ExtDet`.
5. Set the coupling factor. Select `Coupling Factor` `−` `2` `0` `dB(m)`.

Note   Power splitters have a coupling factor of 0 dB.

Figure 1-12 shows the input power versus output voltage characteristics for typical HP diode detectors. From the chart, the leveled power at the diode detector input resulting from any external level voltage setting may be determined. The range of power adjustment is approximately −30 dBm to +18 dBm.

Hint   Automatically characterize and compensate for the detector used by performing a detector calibration. Refer to "Using Detector Calibration" in the "Optimizing Swept CW Generator Performance" section.
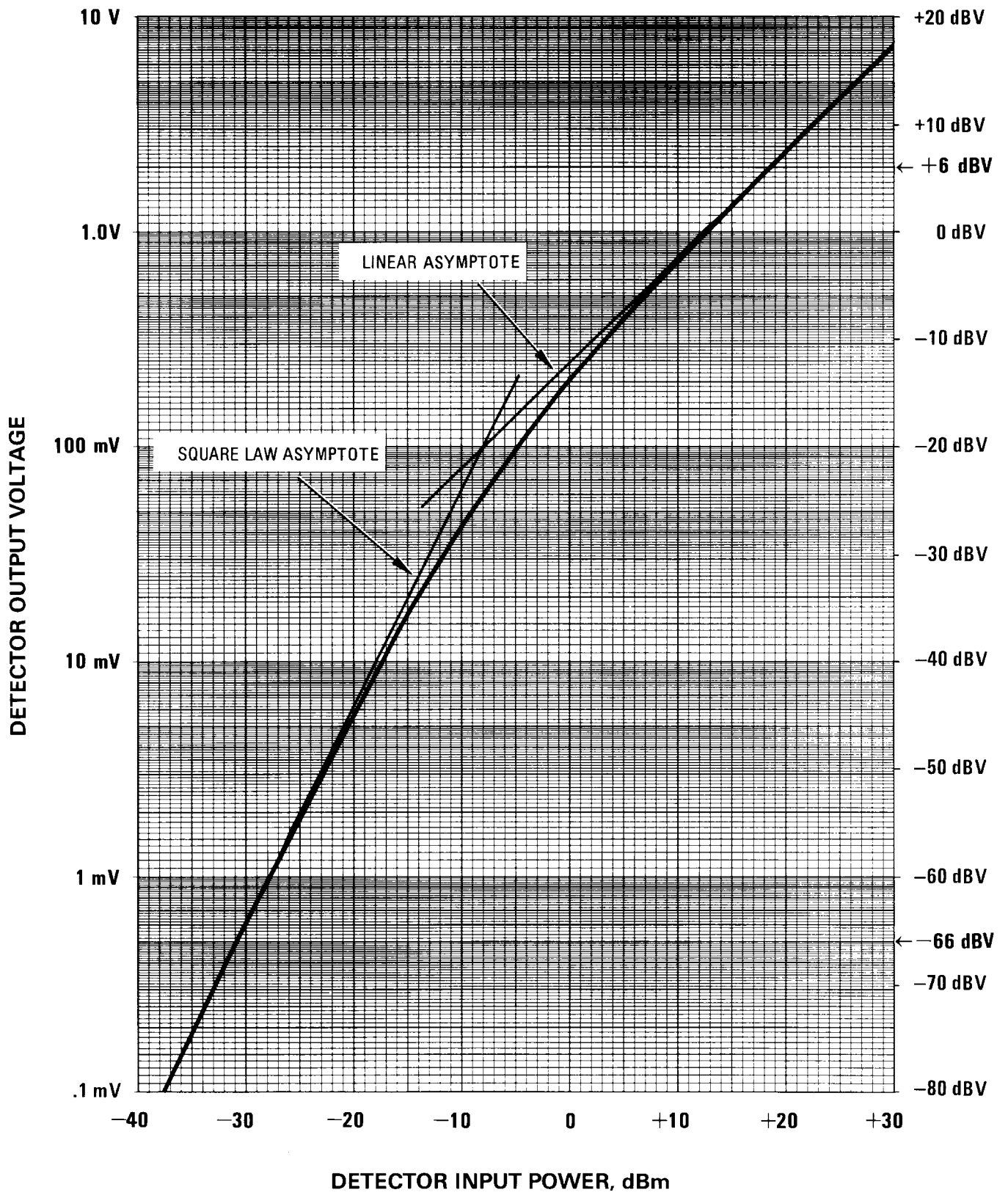
Figure 1-12. Typical Diode Detector Response at 25°C

External Leveling Used With the Optional Step Attenuator

Some external leveling applications require low output power from the swept CW generator. The swept CW generator automatically uncouples the attenuator from the ALC system for *all* external leveling points.

Press (POWER LEVEL). Note the display. It shows:

```
--> ATTEN  0 dB, POWER LEVEL:  0.00 dBm
```

For example, leveling the output of a 30 dB gain amplifier to a level of -10 dBm requires the output of the swept CW generator to be around -40 dBm when leveled. At some frequencies this level is beyond the range of the ALC modulator alone. If so, the `LOW UNLVLED` warning message is displayed. Inserting 40 dB of attenuation results in an ALC level of 0 dBm, which is well within the range of the ALC. At 20 GHz, 30 dB attenuation is a better choice as it results in an ALC level of -10 dBm. This gives a margin for AM or other functions that vary the power level.

For optimum display accuracy and minimum noise, the ALC level should be greater than -10 dBm. This is achieved by using attenuation equal to the tens digit of output power. Example: desired output power $= -43$ dBm; use:

```
--> ATTEN:  40 dB, ALC  -3 dBm
```

1. Press POWER (MENU).
2. Select `Set Atten` (4) (0) (dB(m)).

Hint   To obtain flatness corrected power, refer to "Creating and Applying the User Flatness Correction Array" in the "Optimizing Swept CW Generator Performance" section.

Leveling with Power Meters

Leveling with a power meter is similar to leveling with a diode detector. Figure 1-13 shows the setup for power meter leveling.
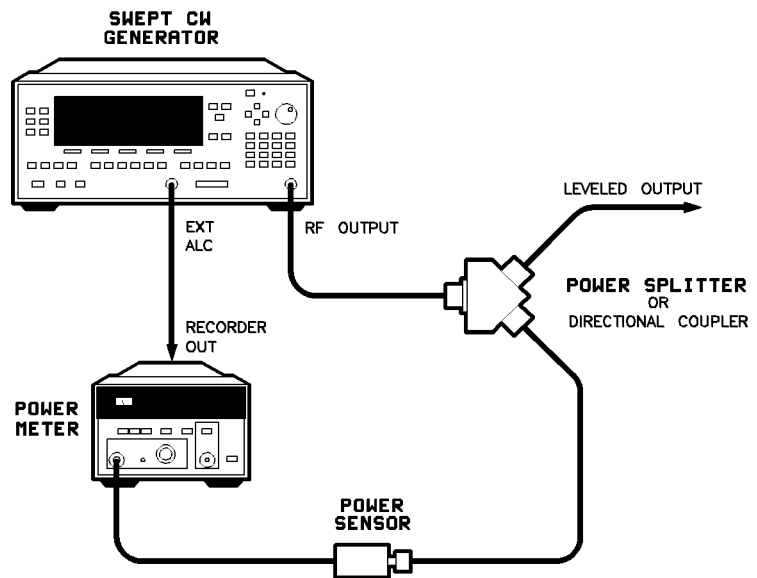
Figure 1-13. Leveling with a Power Meter

1. Set up the equipment as shown. Be sure to set the power meter to manual range mode and note the range.
2. Refer to menu map 1.
3. Press (ALC).
4. Select Leveling Point PwrMtr .
5. Select Pwr Mtr Range . Enter the range value set for the power meter as noted in step 1.
6. Select Coupling Factor , press (0) (dB(m)).

Unlike detector leveling, power meter leveling provides calibrated power out of the leveled RF port.

Hint

To obtain flatness corrected power, refer to "Creating and Applying the User Flatness Correction Array" in the "Optimizing Swept CW Generator Performance" section.

Leveling with MM-wave Source Modules

Millimeter-wave source module leveling is similar to power meter leveling. The following figures illustrate the setups for leveling with a mm-wave source module.
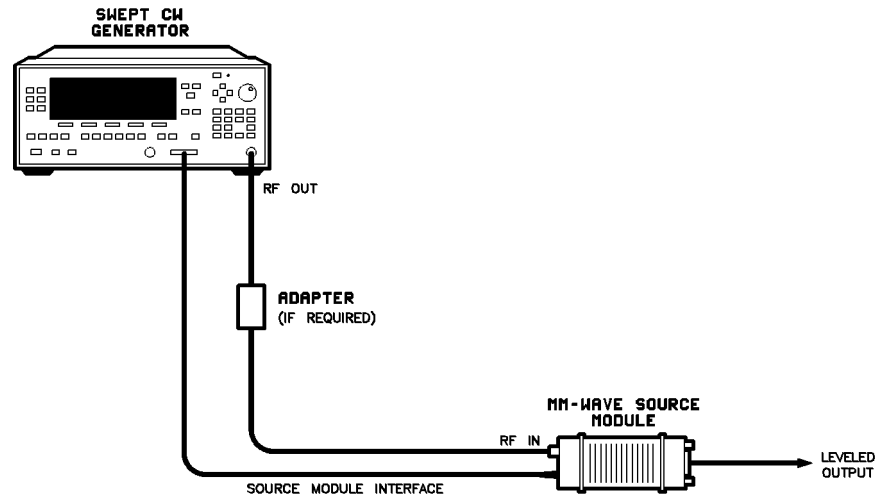
Figure 1-14. MM-wave Source Module Leveling

High power model swept CW generators can externally level mm-wave source modules to maximum specified power without a microwave amplifier.
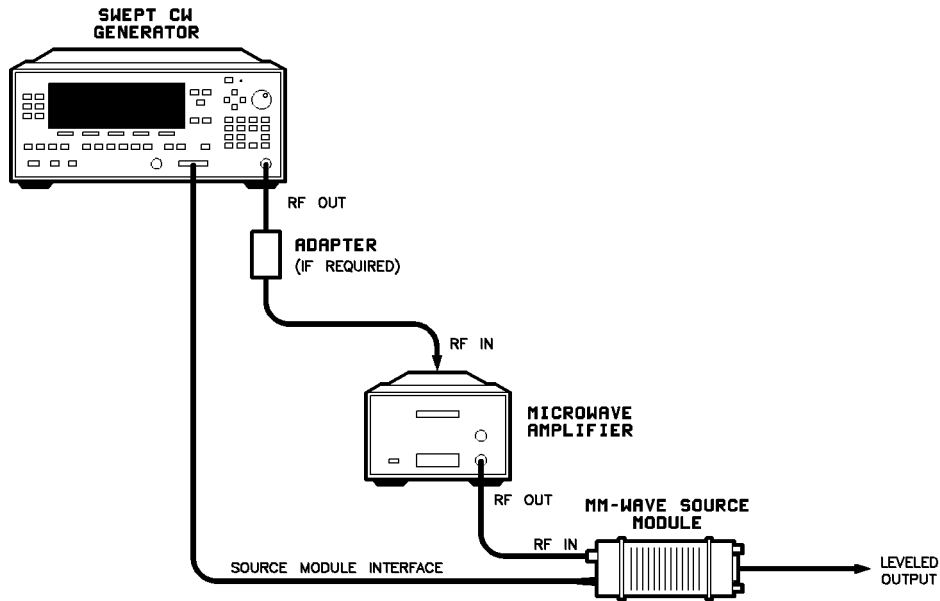
Figure 1-15. MM-wave Source Module Leveling Using a Microwave Amplifier

1. Set up the equipment as shown.
2. Refer to menu map 1.
3. Select `Leveling Point Module`.
4. Select `Module Menu`.
5. Select `Module Select Auto` or `Front` or `Rear`, depending on where the interface connection is made.

All of the ALC data necessary to communicate properly with the swept CW generator is exchanged via the SOURCE MODULE INTERFACE.

Hint

To obtain flatness corrected power, refer to "Creating and Applying the User Flatness Correction Array" in the "Optimizing Swept CW Generator Performance" section.

Working with Mixers/Reverse Power Effects

Note

Uncoupled operation applies to Option 001 swept CW generators only.

Uncoupled operation is useful when working with mixers. Figure 1-16 shows a hypothetical setup where the swept CW generator is providing a small signal to a mixer. The swept CW generator output is −8 dBm, which in `Leveling Mode Normal` results in ATTEN = 0 dB, ALC Level = −8 dBm. The mixer is driven with an LO of +10 dBm, and has LO to RF isolation of 15 dB. The resulting LO feedthrough of −5 dBm enters the swept CW generator's OUTPUT port, goes through the attenuator with no loss, and arrives at the internal detector. Depending on frequency, it is possible for most of this energy to enter the detector. Since the detector responds to its total input power regardless of frequency, this excess energy causes the leveling circuit to reduce its output. In this example the reverse power is actually larger than the ALC level, which may result in the swept CW generator output being shut off.

Figure 1-17 shows the same setup, with uncoupled operation used to produce the same −8 dBm output. In this case, ATTEN = −10 dB, ALC Level = +2 dBm. The ALC level is 10 dB higher, and the attenuator reduces the LO feedthrough by 10 dB. Thus the detector sees a +2 dBm desired signal versus a possible −15 dBm undesired signal. This 17 dB difference results in a maximum 0.1 shift in the swept CW generator output level. To set the swept CW generator to the attenuator uncoupled mode as discussed in this example, do the following:

1. Press POWER (MENU).

2. Select `Set Atten` and press (1) (0) (dB(m)). This step does two things, it uncouples the attenuator from the rest of the ALC system, and it lets you set an attenuator value, in this case, 10 dB.

3. Press (POWER LEVEL) (2) (dB(m)). This sets the ALC level to +2 dBm.

For more information on the ALC or setting power level, refer to (ALC) or (POWER LEVEL) in Chapter 2.
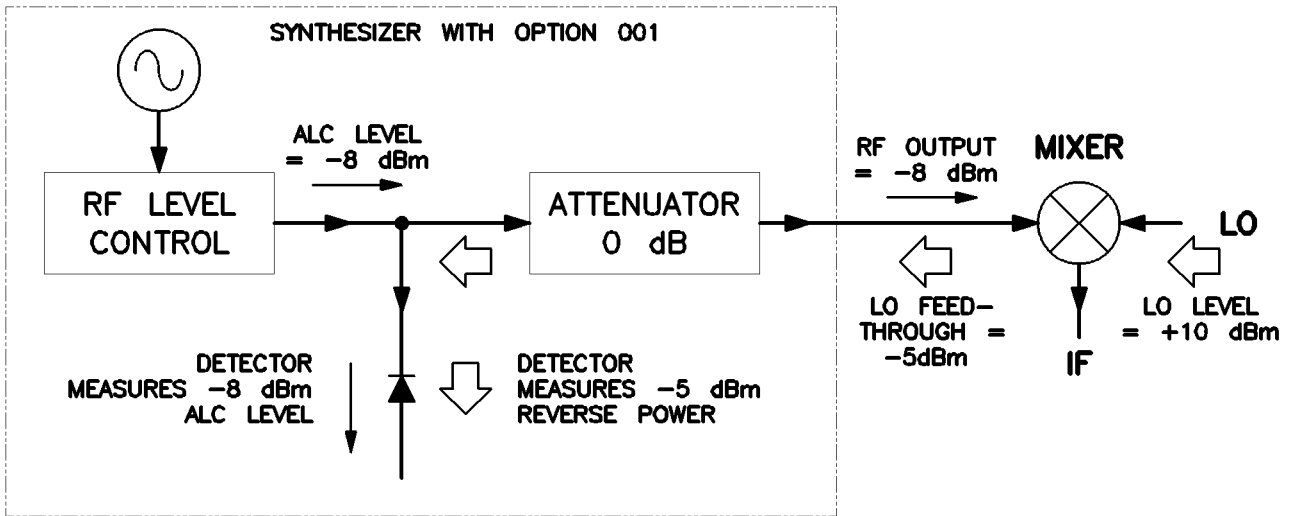
Figure 1-16. Reverse Power Effects, Coupled Operation with −8dBm Output
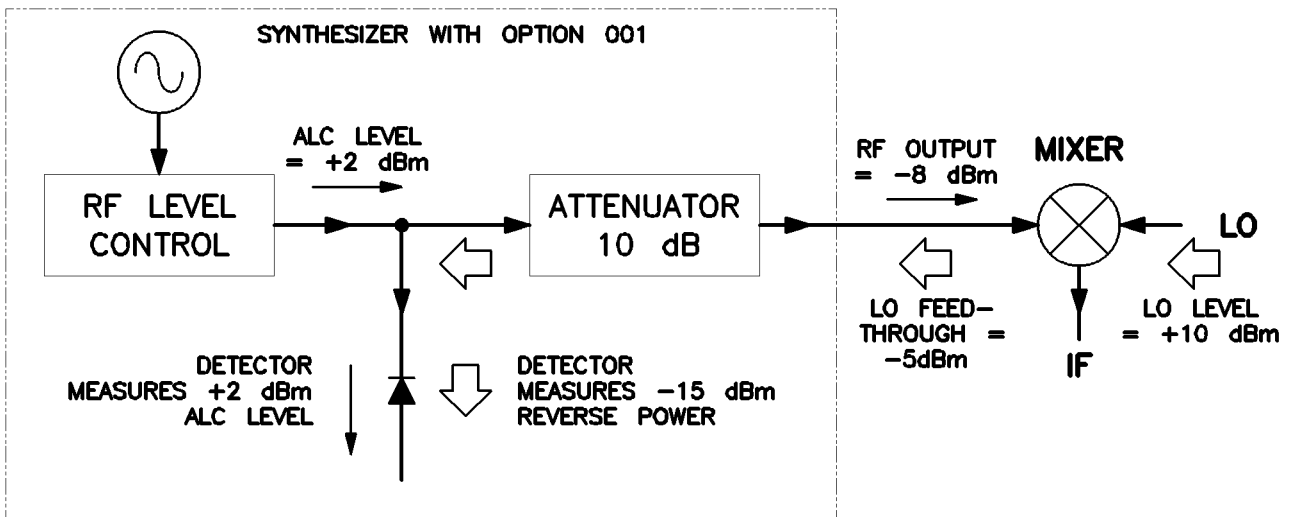
Figure 1-17. Reverse Power Effects, Uncoupled Operation with −8dBm Output

Working with Spectrum Analyzers/Reverse Power Effects

Reverse power is a problem with spectrum analyzers that do not have preselection capability. Some analyzers have as much as +5 dBm LO feedthrough coming out of their RF input, at some frequencies. The effects of reverse power are less in the heterodyne band (0.01 to 2.0 GHz) where the power amplifier provides some broadband matching. Similarly, at frequencies above 2.0 GHz, reverse power that is within 10 MHz of the swept CW generator's frequency may be partially absorbed by the YIG filter. If the frequency difference is small enough to be within the leveling system bandwidth (typically 10 kHz CW, 200 kHz sweep or AM), the effect of reverse power is amplitude modulation of the swept CW generator's output. The AM rate equals the difference in RF frequencies. Reverse power problems may be treated by using the unleveled mode. There are two unleveled modes, ALC off and search.

To set the swept CW generator to the ALC off mode:

1. Refer to menu map 1.
2. Press (ALC).
3. Select `Leveling Mode ALCoff`.

In this mode, the swept CW generator provides RF power with no ALC correction and therefore requires a power meter to set a particular power.

To set the swept CW generator to the search mode:

1. Press (ALC).
2. Select `Leveling Mode Search`.

In this mode, the swept CW generator is in the normal ALC mode until the desired power level is reached, then the ALC is disconnected.

Optimizing Swept
CW Generator
Performance

Creating and Applying the User Flatness Correction Array

The following examples demonstrate the user flatness correction feature:

1. Using an HP/Agilent 437B power meter to automatically enter correction data for a swept 4 to 10 GHz measurement.

2. Manually entering correction data for a stepped (List Mode) measurement.

3. Making swept mm-wave measurements, automatically entering correction data for an arbitrary list of correction frequencies.

4. Making scalar analysis measurements with automatically-entered correction data that compensates for power variations at the output of a directional bridge.

Each example illustrates how to set up correction tables for a different measurement requirement. Modify the instrument setups shown to suit your particular needs. Completed correction tables may be easily edited if more correction data is required for your measurement. Additional correction frequencies may be added by using the auto fill feature or by entering correction frequencies individually. The auto fill feature adds but does not delete correction frequencies.

There are two basic front-panel methods of creating a flatness correction array. The first and quickest method is to use an HP/Agilent 437B power meter. Refer to Figure 1-18 for the setup. The second method is just as accurate, but requires a little more interaction between the operator and the instruments. Figure 1-19 shows the setup for the second method.

Creating a User Flatness Array Automatically, Example 1

In this example, a flatness array containing correction frequencies
from 4 to 10 GHz at 1 GHz intervals is created. An HP/Agilent 437B
power meter controlled by the swept CW generator through the
interface bus is used to enter the correction data into the flatness
array.

For this example, refer to menu map 5, POWER.

1. The equipment setup shown in Figure 1-18 assumes that if the
   setup has an external leveling configuration, the steps necessary
   to correctly level have been followed. If you have questions about
   external leveling, refer to "Externally Leveling the Swept CW
   Generator".

Set up Power Meter

2. Zero and calibrate the power meter/sensor.

3. Enter the appropriate power sensor calibration factors into the
   power meter.

4. Enable the power meter/sensor cal factor array. For operating
   information on the HP/Agilent 437B power, refer to its operating
   and service manual.

5. Connect the power sensor to the point where corrected power is
   desired.
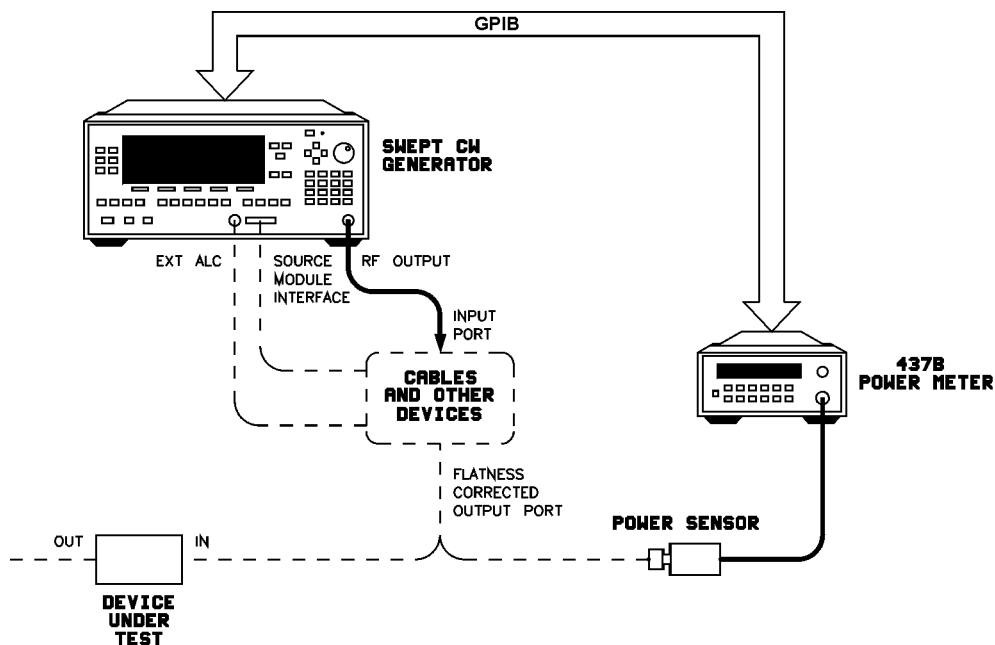
flat1l

Figure 1-18. Creating a User Flatness Array Automatically

No other devices can be connected to the GPIB cable.

Set up Swept CW Generator Parameters

6. On the swept CW generator, press (PRESET).

7. FREQUENCY (START) (4) (GHz), (STOP) (1) (0) (GHz).

8. (POWER LEVEL) (0) (dB(m)).

Access User Flatness Correction Menu

9. Press POWER (MENU). Select `Fltness Menu`.

10. Select `Delete Menu` `Delete All`. This step insures that the flatness array is empty.

11. Press (PRIOR). Leave the delete menu and return to the previous softkey menu.

12. Enter the frequency points at which the correction information will be taken. Choose either the point-by-point entry method `Enter Freq` or the automatic frequency point generation `Auto Fill Start`. For this example, select `Auto Fill Start` (4) (GHz).

13. Select `Auto Fill Stop` (1) (0) (GHz), `Auto Fill Incr` (1) (GHz). Notice that a frequency list starting at 4 and ending at 10 GHz with an increment value of 1 GHz is created.

Enter Correction Data into Array

14. Select `Mtr Meas Menu` `Measure Corr All`. The power meter is now under swept CW generator control and is performing the sequence of steps necessary to generate the correction information at each frequency point.

    If an GPIB error message is displayed, verify that the interface connections are correct. Check the GPIB address of the power meter and ensure that it is the same address the swept CW generator is using (address 13 is assumed). Refer to the menu map 8, System, for the key sequence necessary to reach softkey `Meter Adrs`.

Enable User Flatness Correction

15. When the operation is complete, (a message is displayed) the flatness correction array is ready to be applied to your setup. Disconnect the power meter/sensor and press (FLTNESS ON/OFF) (amber LED on). The power produced at the point where the power meter/sensor was disconnected is now calibrated at the frequencies and power level specified above.

Creating a User Flatness Array, Example 2

This example shows how to use the swept CW generator and a power meter in manual entry mode. This example also introduces two features of the swept CW generator. The softkey `Freq Follow` simplifies the data entry process and the softkey `List Mode` sets up a list of arbitrary test frequencies.

The frequency follow feature automatically sets the source to a CW test frequency equivalent to the active correction frequency in the user flatness correction table. The front panel arrow keys are used to move around the correction table and enter frequency-correction pairs. Simultaneously, the swept CW generator test frequency is updated to the selected correction frequency without exiting the correction table.

To further simplify the data entry process, the swept CW generator allows you to enter correction data into the user flatness correction table by adjusting the front panel knob until the desired power level is displayed on the power meter. The user flatness correction algorithm automatically calculates the appropriate correction and enters it into the table. If you already have a table of correction data prepared, it can be entered directly into the correction table using the front-panel keypad of the swept CW generator.

With the list mode feature, you may enter the test frequencies into a table in any order and specify an offset (power) and/or a dwell time for each frequency. When list mode is enabled, the swept CW generator steps through the list of frequencies in the order entered.

The user flatness correction feature has the capability of copying and entering the frequency list into the correction table. Since the offset in the list mode table is not active during the user flatness correction data entry process, the value of the correction data is determined as if no offset is entered. When user flatness correction and list mode (with offsets) are enabled, the swept CW generator adjusts the output power by an amount equivalent to the sum of the correction data and offset for each test frequency. You must make sure that the resulting power level is still within the ALC range of the swept CW generator.
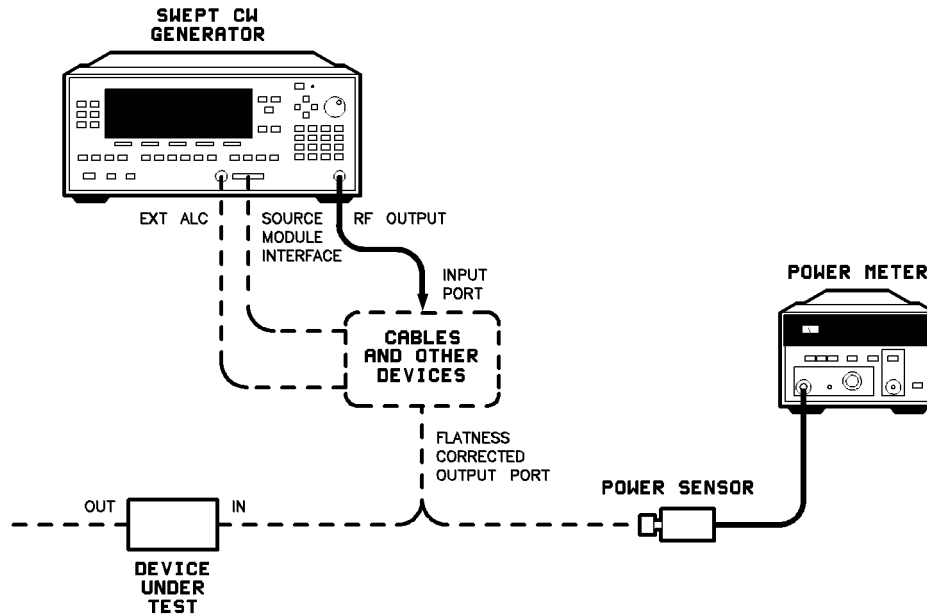
Figure 1-19. Creating a User Flatness Array

For this example, refer to menu map 5, POWER.

1. The equipment setup shown in Figure 1-19 assumes that if your setup has an external leveling configuration, the steps necessary to correctly level have been followed. If you have questions about external leveling, refer to "Externally Leveling the Swept CW Generator".

Set up Power Meter

2. Zero and calibrate the power meter/sensor.

3. Connect the power sensor to the point where flatness corrected power is desired.

Set up Swept CW Generator Parameters

4. On the swept CW generator, press (PRESET).

5. (POWER LEVEL) (5) (dB(m)). This sets the test port power to $+5$ dBm ($P_{o\ max} - P_{path\ loss}$).

Create A Frequency List

6. On the swept CW generator, press FREQUENCY (MENU).

7. Select List Menu Enter List Freq (5) (GHz). This enters 5 GHz as the first frequency in the list array. Entering a frequency automatically sets the offset to 0 dB and the dwell to 10 ms.

8. Enter 18, 13, 11, and 20 GHz to complete this example array.

Access User Flatness Correction Menu

9. Press POWER (MENU). Select `Fltness Menu`.

10. Select `Delete Menu` `Delete All`. This step insures that the flatness array is empty.

11. Press (PRIOR). Leave the delete menu and return to the previous softkey menu.

12. Select `Copy List` This step copies the frequency list into the correction table in *sequential* order.

13. Select `Freq Follow`. This sets the swept CW generator to CW frequency mode to facilitate taking correction information. As you scroll through the correction cells, the swept CW generator produces the corresponding CW frequency at 0 dBm.

14. Select `Enter Corr`. This allows correction value entry.

15. Press (FLTNESS ON/OFF). This step enables user flatness correction.

16. For 5 GHz, set the appropriate power sensor cal factor on the power meter.

17. Use the swept CW generator rotary knob to adjust for a measurement of 0.00 dBm on the power meter. Notice that a correction value is entered at 5 GHz.

18. Use the up arrow key to increment to the next correction cell.

19. For 11 GHz, set the appropriate power sensor cal factor on the power meter.

20. Use the swept CW generator rotary knob to adjust for a measurement of 0.00 dBm on the power meter.

21. Repeat this sequence of steps until all the frequency points have a correction value entered.

Activate List Mode

22. Press SWEEP (MENU). Select `Sweep Mode List`.

23. The flatness correction array is ready to be applied to your setup. Disconnect the power meter/sensor. The power produced at the point where the power meter/sensor was disconnected is now calibrated at the frequencies and power level specified above.

Swept mm-wave Measurement with Arbitrary Correction Frequencies, Example 3

The focus of this example is to use user flatness correction to obtain flat power at the output of the HP/Agilent 83550 series mm-wave source modules. In this case we will use non-sequential correction frequencies in a swept 26.5 to 40 GHz measurement with an HP/Agilent 83554 source module.

The time it takes for a large quantity of power meter measurements can be long, therefore, we selected non-sequential correction frequencies to target specific points or sections of the measurement range that we assume are more sensitive to power variations. This greatly expedites setting up the user flatness correction table. The amount of interpolated correction points between non-sequential correction frequencies varies. This example uses the HP/Agilent 437B to automatically enter correction data into the array.

Note   Turn off the swept CW generator before connecting to the source module interface (SMI) cable, or damage may result.
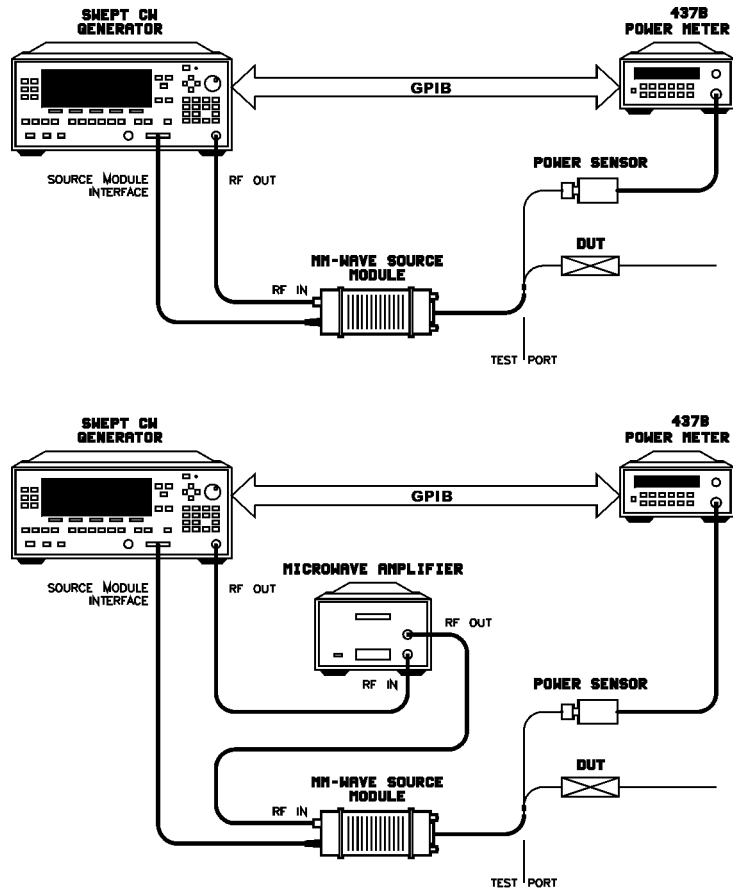
Figure 1-20.
Creating Arbitrarily Spaced Frequency-Correction Pairs in a Swept mm-wave Environment

For this example, refer to menu map 5, POWER.

1. The equipment setup shown in Figure 1-20 assumes that you have followed the steps necessary to correctly level the configuration. If you have questions about external leveling, refer to "Externally Leveling the Swept CW Generator".

Set up Power Meter

2. Zero and calibrate the power meter/sensor.

3. Connect the power sensor to test port.

4. Enter and store in the power meter, the power sensor's cal factors for correction frequencies to be used.

Note   U, V, and W-band power sensors are not available from Agilent. For these frequencies use the Anritsu ML83A Power Meter with the MP715-004 (40 to 60 GHz), the MP716A (50 to 75 GHz), or the MP81B (75 to 110 GHz) power sensors. Since the Anritsu model ML83A Power Meter is not capable of internally storing power sensor cal factors, you must manually correct the data entry. Refer to example 2 for information on manual entry of correction data.

Set up Swept CW Generator Parameters

5. Turn on the swept CW generator and press (PRESET). The following occurs:

   ■ The source module's frequency span is displayed on the swept CW generator.
   ■ The swept CW generator's leveling mode is automatically changed from internal to "module leveling."
   ■ The source module's maximum specified power is set and displayed.

6. Press FREQUENCY (START) (2) (6) (.) (5) (GHz), (STOP) (4) (0) (GHz). The frequency sweep is set from 26.5 to 40 GHz.

7. Press (POWER LEVEL) (7) (dBm). The source module power is set to +7 dBm for maximum power to the device under test.

Access User Flatness Correction Menu

8. Press POWER (MENU). Select `Fltness Menu`.

9. Select `Delete Menu` `Delete All`. This step insures that the flatness array is empty.

10. Press (PRIOR). Leave the delete menu and return to the previous softkey menu.

11. Select `Enter Freq` (2) (6) (.) (5) (GHz), to enter 26.5 GHz as the first correction frequency. Enter 31, 32.5, and 40 GHz to complete the list. Notice that the frequencies are arbitrarily spaced.

Enter Correction Data into Array

12. Select `Mtr Meas Menu` `Measure Corr All`. The power meter is now under swept CW generator control and is performing the sequence of steps necessary to generate the correction information at each frequency point.

    If an GPIB error message is displayed verify that the interface connections are correct. Check the GPIB address of the power meter and ensure that it is the same address the swept CW

generator is using (address 13 is assumed). Refer to the menu map 8, System, for the key sequence necessary to reach softkey `Meter Adrs` .

Enable User Flatness Correction

13. When the operation is complete, (a message is displayed) the flatness correction array is ready to be applied to your setup.

14. To save the swept CW generator parameters including the correction table in an internal register, press (SAVE) (n) (n = number 1 through 8).

15. Disconnect the power meter/sensor and press (FLTNESS ON/OFF) (amber LED on). The power produced at the point where the power meter/sensor was disconnected is now calibrated at the frequencies and power level specified above.

Scalar Analysis Measurement with User Flatness Corrections, Example 4

The following example demonstrates how to set up a scalar analysis measurement (using an HP/Agilent 8757 Scalar Network Analyzer) of a 2 to 20 GHz test device such as, an amplifier. User flatness correction is used to compensate for power variations at the test port of a directional bridge. Follow the instructions to set up the swept CW generator, then configure the system as shown in Figure 1-21.

Note   The swept CW generator's rear panel language and address switches must be set to 7 and 31 (all 1's), to change the language or address of the swept CW generator from the front panel. The programming language must be set to Analyzer. Refer to menu map 8, System, to find the location of softkey `Programming Language Analyzer` (asterisk on = active language).
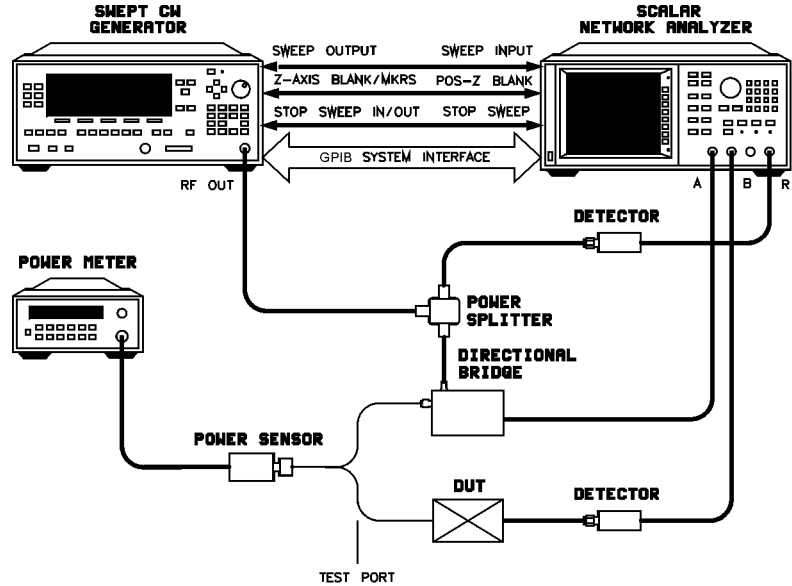
scaflatl

Figure 1-21. Scalar System Configuration

Example Overview

In this example, you use an HP/Agilent 437B power meter to automatically enter correction data into the array. It is necessary to turn off the HP/Agilent 8757 System Interface (controlled from the front-panel of the analyzer) so that the swept CW generator can temporarily control the power meter over GPIB. When the correction data entry process is complete, enable user flatness correction and set the desired test port power level. Then store the correction table and swept CW generator configuration in the same register that contains the analyzer configuration. Re-activate the HP/Agilent 8757 System Interface and recall the stored register. Make sure that user flatness correction is still enabled before making the measurement.

When an HP/Agilent 437B power meter is used to automatically enter the correction data, the correction calibration routine automatically turns off any active modulation, then re-activates the modulation upon the completion of the data entry process. Therefore, the scalar pulse modulation that is automatically enabled in a scalar measurement system is disabled during an HP/Agilent 437B correction calibration.

Note   The user flatness correction array cannot be stored to a disk. You must make sure that the array is stored in one of the eight internal registers. Recalling a file from an HP/Agilent 8757 disk will not erase the current array; therefore you may recall an array from an internal register, then recall an associated file from a disk.

For this example, refer to menu map 5, POWER.

1. The equipment setup shown in Figure 1-21 assumes that you have followed the steps necessary to correctly level the configuration. If you have questions about external leveling, refer to "Externally Leveling the Swept CW Generator".

2. On the analyzer, press (PRESET). Reset the analyzer and swept CW generator to a known state.

Set up System Parameters

3. On the swept CW generator, press FREQUENCY (START) (2) (GHz), (STOP) (2) (0) (GHz). Set the swept CW generator for a frequency sweep of 2 to 20 GHz.

4. Press (POWER LEVEL) (n) (dBm). Where n = maximum available power.

5. On the analyzer, set up the appropriate measurement (i.e. gain for an amplifier). Calibrate the measurement (thru and short/open calibration). Press (SAVE) (1) to store the analyzer's configuration and swept CW generator parameters in storage register 1.

6. Turn off the HP/Agilent 8757 System Interface. Use the analyzer `SYSINTF ON OFF` softkey found under the SYSTEM menu to deactivate the system interface.

Access User Flatness Correction Menu

7. On the swept CW generator, press POWER (MENU). Select `Fltness Menu`.

8. Select `Delete Menu` `Delete All`. This step insures that the flatness array is empty.

9. Press (PRIOR). Leave the delete menu and return to the previous softkey menu.

10. Select `Auto Fill Start` (2) (GHz). Set the first frequency in correction table to 2 GHz.

11. `Auto Fill Stop` (2) (0) (GHz). Set the last frequency in correction table to 20 GHz.

12. `Auto Fill Incr` (1) (0) (0) (MHz). Set the frequency increment to every 100 MHz from 2 to 20 GHz.

Set up Power Meter

13. Zero and calibrate the power meter/sensor.

14. Connect the power sensor to test port.

15. Enter and store in the power meter, the power sensor's cal factors for correction frequencies to be used.

Enter Correction Data into Array

16. Select `Mtr Meas Menu` `Measure Corr All`. The power meter is now under swept CW generator control and is performing the sequence of steps necessary to generate the correction information at each frequency point.

   If an GPIB error message is displayed verify that the interface connections are correct. Check the GPIB address of the power meter and ensure that it is the same address the swept CW generator is using (address 13 is assumed). Refer to the menu map 8, System, for the key sequence necessary to reach softkey `Meter Adrs`.

Enable User Flatness Correction

17. When the operation is complete, (a message is displayed) the flatness correction array is ready to be applied to your setup.

18. Disconnect the power meter/sensor.

19. On the swept CW generator, press (POWER LEVEL) (n) (dBm). Where
    $n = P_{o\ max} - P_{path\ loss}$ for maximum leveled power at the test port.

20. To save the swept CW generator parameters including the correction table in an internal register, press (SAVE) (n)
    (n = number 1 through 8).

Reactivate the 8757 System Interface

21. Set the analyzer to SYSINTF ON, the analyzer and swept CW generator preset.

22. Press (RECALL) (1). Recall the swept CW generator parameters from storage register 1

23. On the swept CW generator, press (FLTNESS ON/OFF) (amber LED on). The power produced at the point where the power meter/sensor was disconnected is now calibrated at the frequencies and power level specified above.

Using Detector Calibration

Detector calibration is useful for characterizing and compensating for negative diode detectors used in external leveling. Detectors may be characterized by three operating regions as shown in Figure 1-12: the square law, the linear, and the transition region. The following steps use an HP/Agilent 437B to automatically characterize the operating regions and use this information to automatically compensate for the detector being used. The equipment setup shown in Figure 1-22 assumes that the steps necessary to correctly externally level have been followed.

Refer to menu map 9, USER CAL.
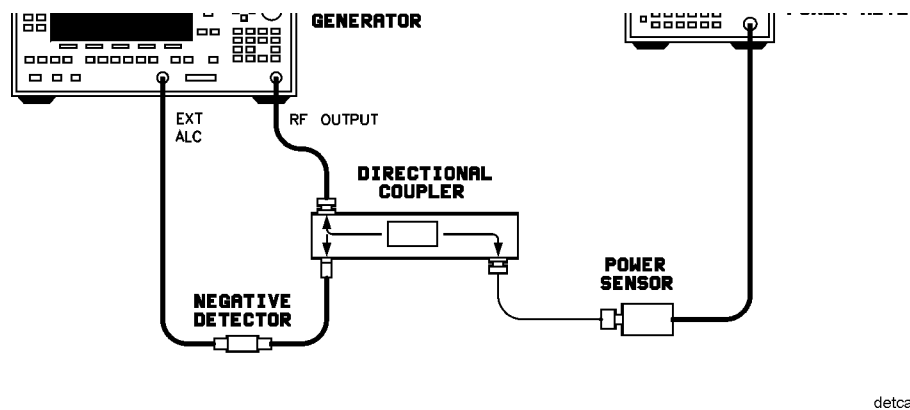
detcall

Figure 1-22. Automatically Characterizing and Compensating for a Detector

1. Connect the power meter as shown.

2. Zero and calibrate the power meter/sensor.

3. Enter the appropriate power sensor calibration factors into the power meter.

4. Enable the power meter/sensor cal factor array. For operating information on the HP/Agilent 437B power meter, refer to its operating and service manual.

5. Connect the power sensor to the output of the coupler (or splitter).

6. On the swept CW generator, set the power level and start/stop frequency information as desired.

7. Press `USER CAL`.

8. Select `Ext Det Cal`. The power meter is now under swept CW generator control and is performing the sequence of steps necessary to generate the compensation information.

   If an GPIB error message is displayed verify that the interface connections are correct. Check the GPIB address of the power meter and ensure that it is the same address the swept CW generator is using (address 13 is assumed). Refer to the menu

map 8, System, for the key sequence necessary to reach softkey `Meter Adrs`.

9. When the operation is complete, (a message is displayed) disconnect the power meter/sensor. The swept CW generator has stored the compensation information in its memory and is using it to calibrate the detector's output voltage relative to power.

Using the Tracking Feature

Peaking

Peaking is the function that aligns the output filter (YTM) so that its passband is centered on the RF output, in CW or manual-sweep mode. Use peaking to obtain the maximum available power and spectral purity, and best pulse envelopes, at any given frequency above 2.0 GHz. The YTM is inactive for the low band frequencies (10 MHz to 2.0 GHz).

To peak at the present CW frequency:

> Press (USER CAL).
> Select Tracking Menu Peak RF Once.

This causes an instantaneous execution of the peaking function. This is a one-time implementation of the peaking, where the function is turned on and then turned off.

To peak at the present CW frequency, and continue to peak at new frequencies as they are entered:

> Press (USER CAL).
> Select Tracking Menu Peak RF Always.

If "peak always" is on (denoted by an asterisk next to the key label) for an extended period of time, the peaking function will automatically repeak every seven minutes.

Tracking

Auto track is a more extensive version of peaking. It causes all of the YTM tracking calibration constants to be aligned and requires approximately 40 to 90 seconds to complete. Tracking is performed from 2.0 GHz to the end of the specified frequency range.

Note   If the swept CW generator does not have a step attenuator, terminate the RF OUTPUT with a good 50Ω impedance match such as a 10 dB attenuator or a power sensor to prevent mistracking.

To enhance the power output and spectral purity of swept modes, and to improve tracking performance (especially in harsh environments having wide temperature variations):

> Press (USER CAL).
> Select Tracking Menu Auto Track.

ALC Bandwidth Selection

The ALC bandwidth defaults at factory preset to the auto selection `ALC Bandwidth Select Auto` which selects the appropriate bandwidth (high or low) for each application. To make the bandwidth selection, the swept CW generator determines which functions are activated and uses the decision tree shown in Figure 1-23.
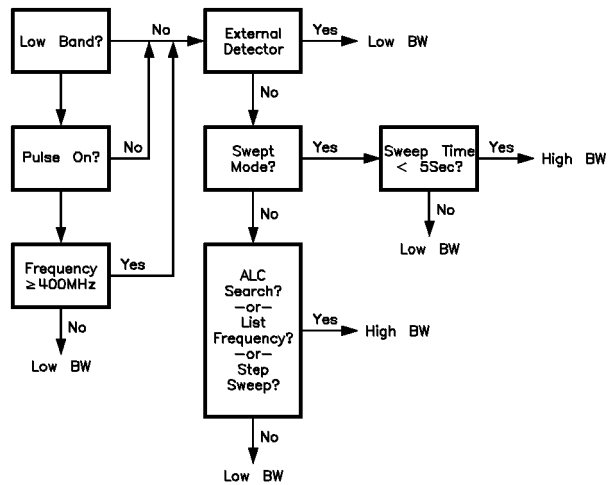
Figure 1-23. Decision Tree for ALC Bandwidth Selection

Using Step Sweep

1. Refer to menu map 2.
2. Press FREQUENCY (MENU).
3. Select `Step Swp Menu`.
4. Select `Step Size`. Enter the desired increment value.
5. Select `Step Points`. Enter the number of points desired.
6. Determine the dwell time desired, select `Step Dwell` and enter a value, or choose the dwell time determined by the ramp mode sweep time, select `Dwell Coupled`.
7. Determine the triggering scheme, select `Step Swp Pt Trig Auto`, `Bus`, or `Ext`.
8. Press SWEEP (MENU).
9. Select `Sweep Mode Step`, to activate the step frequency mode.

Creating and Using a Frequency List

1. Refer to menu map 2.
2. Press FREQUENCY `MENU`.
3. Select `List Menu`.

To use the frequency points of a frequency list to create the frequency portion of the user flatness correction array:

1. Refer to menu map 5.
2. Press POWER `MENU`.
3. Select `Fltness Menu`.
4. Select `Copy List`.

Using the Security Features

To access the security menu:

1. Refer to menu map 8.
2. Press SYSTEM (MENU).
3. Select Security Menu .

Changing the Preset Parameters

1. Set up the swept CW generator in the desired operation state to be used as the preset state.
2. Refer to menu map 8.
3. Press SYSTEM (MENU).
4. Select Save User Preset.
5. Select Preset Mode User.

Whenever the (PRESET) key is pressed, the swept CW generator will return to the operation state setup and saved in steps 1 and 4. The swept CW generator displays:
*** USER DEFINED PRESET RECALLED ***
and also gives you the option of selecting the factory preset state by creating a factory preset softkey.

Getting Started Programming

GPIB, the General Purpose Interface Bus, is the instrument-to-instrument communication system between the swept CW generator and up to 14 other instruments. Any instrument having GPIB capability can be interfaced to the swept CW generator, including non-HP instruments that have "GPIB," "IEEE-488," "ANSI MC1.1," or "IEC-625" capability (these are common generic terms for GPIB; all are electrically equivalent although IEC-625 uses a unique connector). This portion of the manual specifically describes interfacing the swept CW generator to one type of instrument: a computer.

The first part of this section provides general GPIB information. Later, the Standard Commands for Programmable Instruments language (SCPI) is introduced, and example programs are given. For information on programming in the Control Interface Intermediate Language (CIIL), refer to a separate option 700 manual supplement.

Modulation Commands

When programming commands relating to *modulation* are sent to the 8360 L-Series swept CW generator, the commands are parsed but no action is taken on the command. Also, no error message is generated.

GPIB General Information

Interconnecting Cables
Figure C-2 shows the swept CW generator rear-panel GPIB connector and suitable cables, and describes the procedures and limitations for interconnecting instruments. Cable length restrictions, also described in Figure C-2, must be observed.

Instrument Addresses
Each instrument in an GPIB network must have a unique address, ranging in value from 00-30 (decimal). The default address for the swept CW generator is 19, but this can be changed using the `My Adrs` softkey or rear panel switch as described in the reference chapter (Chapter 2) under the "8360 Adrs" entry (the examples in this section use 19 as the address for the swept CW generator). Other instruments use a variety of procedures for setting the address, as described in their operating manuals, but typically either a rear panel switch or a front panel code is used.

GPIB Instrument Nomenclature
An GPIB instrument is categorized as a "listener," "talker," or "controller," depending on its current function in the network.

Listener

A listener is a device capable of receiving data or commands from other instruments. Any number of instruments in the GPIB network can be listeners simultaneously.

Talker

A talker is a device capable of transmitting data or commands to other instruments. To avoid confusion, an GPIB system allows only one device at a time to be an active talker.

Controller

A controller is an instrument, typically a computer, capable of managing the various GPIB activities. Only one device at a time can be an active controller.

Programming the Swept CW Generator
The swept CW generator can be controlled entirely by a computer (although the line POWER switch must be operated manually). Several functions are possible only by computer (remote) control. Computer programming procedures for the swept CW generator involve selecting an GPIB command statement, then adding the specific swept CW generator (SCPI, Analyzer, or CIIL) programming codes to that statement to achieve the desired operating conditions. The programming codes can be categorized into two groups: those that mimic front panel keystrokes; and those that are unique, and have no front panel equivalent.

In the programming explanations that follow, specific examples are included that are written in a generic dialect of the BASIC language. BASIC was selected because the majority of GPIB computers have BASIC language capability. However, other languages can also be used.

GPIB Command Statements

Command statements form the nucleus of GPIB programming; they are understood by all instruments in the network and, when combined with the programming language codes, they provide all management and data communication instructions for the system.

An explanation of the fundamental command statements follows. However, some computers use a slightly different terminology, or support an extended or enhanced version of these commands. Consider the following explanations as a starting point, but for detailed information consult the BASIC language reference manual, the I/O programming guide, and the GPIB manual for the particular computer used.

Syntax drawings accompany each statement: All items enclosed by a circle or oval are computer specific terms that must be entered exactly as described; items enclosed in a rectangular box are names of parameters used in the statement; and the arrows indicate a path that generates a valid combination of statement elements.

The seven fundamental command statements are as follows:

Abort

Abort abruptly terminates all listener/talker activity on the interface bus, and prepares all instruments to receive a new command from the controller. Typically, this is an initialization command used to place the bus in a known starting condition. The syntax is:
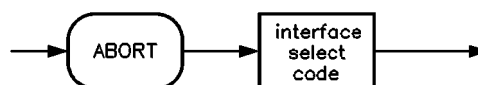
where the interface select code is the computer's GPIB I/O port, which is typically port 7. Some BASIC examples:

```
10   ABORT 7

100  IF V>20 THEN ABORT 7
```

Related statements used by some computers:

ABORTIO (used by HP-80 series computers)

HALT

RESET

Remote

Remote causes an instrument to change from local control to remote control. In remote control, the front panel keys are disabled (except for the (LOCAL) key and the POWER switch), and the amber REMOTE annunciator is lighted. The syntax is:
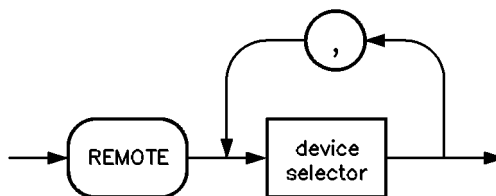
where the device selector is the address of the instrument appended to the GPIB port number. Typically, the GPIB port number is 7, and the default address for the swept CW generator is 19, so the device selector is 719. Some BASIC examples:

```
10    REMOTE 7
```

which prepares all GPIB instruments for remote operation (although nothing appears to happen to the instruments until they are addressed to talk), or

```
10    REMOTE 719
```

which affects the GPIB instrument located at address 19, or

```
10    REMOTE 719, 721, 726, 715
```

which effects four instruments that have addresses 19, 21, 26, and 15.

Related statements used by some computers:

RESUME

Local Lockout

Local Lockout can be used in conjunction with REMOTE to disable the front panel (LOCAL) key. With the (LOCAL) key disabled, only the controller (or a hard reset by the POWER switch) can restore local control. The syntax is:
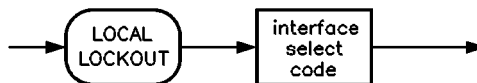
A BASIC example:

```
10    REMOTE 719
20    LOCAL LOCKOUT 7
```

Local

Local is the complement to REMOTE, causing an instrument to return to local control with a fully enabled front panel. The syntax is:
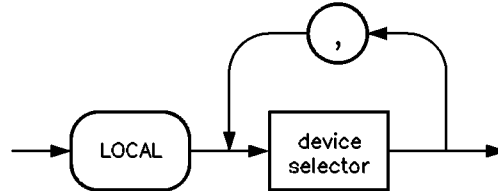
Some BASIC examples:

10   LOCAL 7

which effects all instruments in the network, or

10   LOCAL 719

for an addressed instrument (address 19).

Related statements used by some computers:

RESUME

Clear

Clear causes all GPIB instruments, or addressed instruments, to assume a "cleared" condition, with the definition of "cleared" being unique for each device. For the swept CW generator:

1. All pending output-parameter operations are halted.

2. The parser (the software that interprets the programming codes) is reset, and now expects to receive the first character of a programming code.

The syntax is:
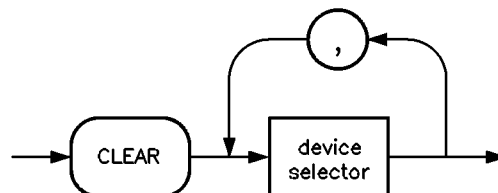
Some BASIC examples:

```
10    CLEAR 7
```

to clear all GPIB instruments, or

```
10    CLEAR 719
```

to clear an addressed instrument.

Related statements used by some computers:

RESET

CONTROL

SEND

The preceding statements are primarily management commands that do not incorporate programming codes. The following two statements do incorporate programming codes, and are used for data communication.

Output

Output is used to send function commands and data commands from the controller to the addressed instrument. The syntax is:
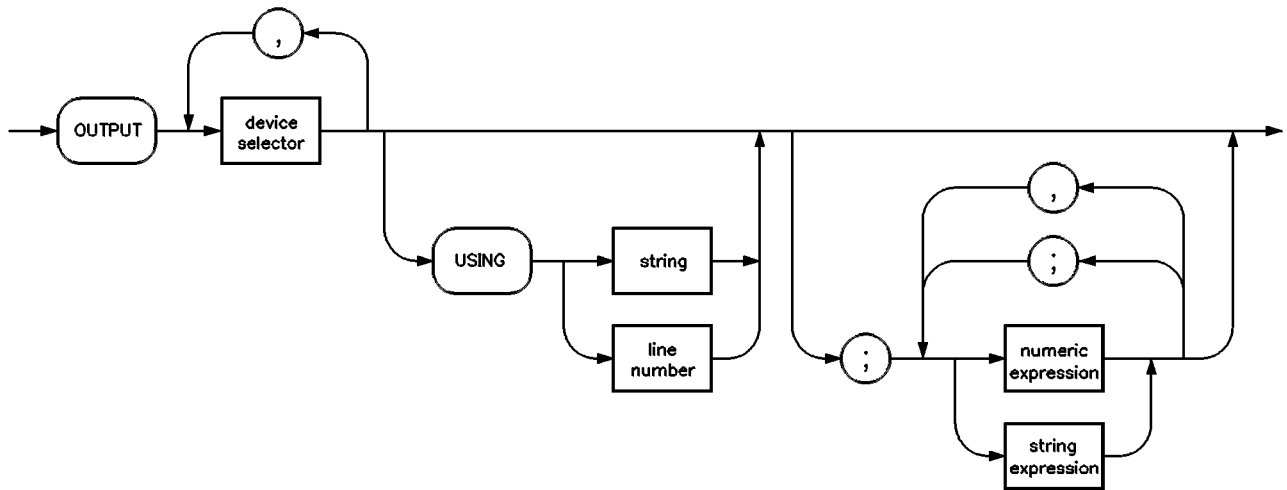
where USING is a secondary command that formats the output in a particular way, such as a binary or ASCII representation of numbers. The USING command is followed by "image items" that precisely define the format of the output; these image items can be a string of code characters, or a reference to a statement line in the computer program. Image items are explained in the programming codes where they are needed. Notice that this syntax is virtually identical to the syntax for the ENTER statement that follows.

A BASIC example:

```
100   OUTPUT 719; "programming codes"
```

The many programming codes for the swept CW generator are listed in the "SCPI Command Summary" in Chapter 2.

Related statements used by some computers:

CONTROL

CONVERT

IMAGE

IOBUFFER

TRANSFER

Enter

Enter is the complement of OUTPUT, and is used to transfer data from the addressed instrument to the controller. The syntax is:
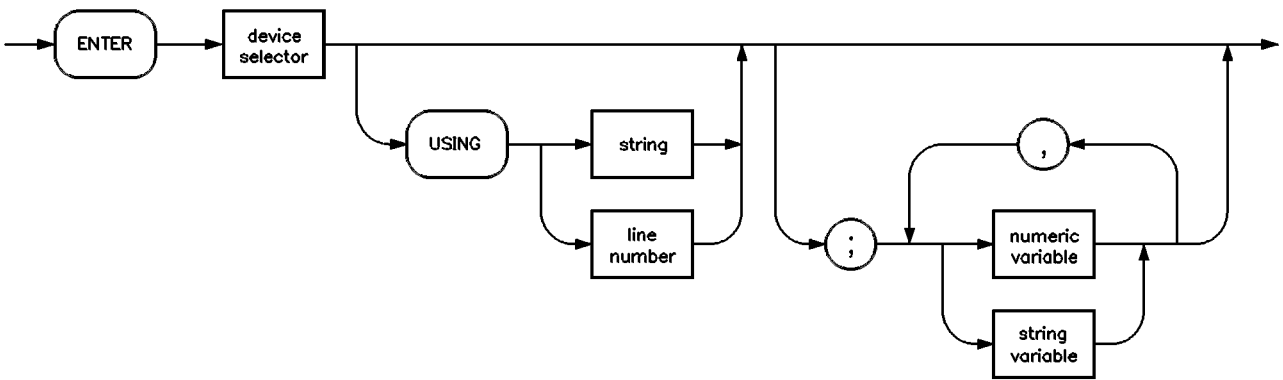
ENTER is always used in conjunction with OUTPUT, such as:

```
100   OUTPUT 719; " ... programming codes ... "
110   ENTER 719; " ... response data ... "
```

ENTER statements are commonly formatted, which requires the secondary command USING and the appropriate image items. The most-used image items involve end-of-line (EOL) suppression, binary inputs, and literal inputs. For example:

```
100   ENTER 719 USING "#, B"; A, B, C
```

suppresses the EOL sequence (#), and indicates that variables A, B, and C are to be filled with binary (B) data. As another example,

```
100   ENTER 719 USING "#, 123A"; A$
```

suppresses EOL, and indicates that string variable A\$ is to be filled with 123 bytes of literal data (123A).

Note	Be careful when using byte-counting image specifiers. If the requested number of bytes does not match the actual number available, data might be lost, or the program might enter an endless wait state.

The suppression of the EOL sequence is frequently necessary to prevent a premature termination of the data input. When not specified, the typical EOL termination occurs when an ASCII LF (line feed) is received. However, the LF bit pattern could coincidentally occur randomly in a long string of binary data, where it might cause a false termination. Also, the bit patterns for the ASCII CR (carriage return), comma, or semicolon might cause a false termination. Suppression of the EOL causes the computer to accept all bit patterns as data, not commands, and relies on the GPIB EOI (end or identify) line for correct end-of-data termination.

Related statements used by some computers:

CONVERT

IMAGE

IOBUFFER

ON TIMEOUT

SET TIMEOUT

TRANSFER

This completes the GPIB Command Statements subsection. The following material explains the SCPI programming codes, and shows how they are used with the OUTPUT and ENTER GPIB command statements.

Getting Started with SCPI

This section of Chapter 1 describes the use of the Standard Commands for Programmable Instruments language (SCPI). This section explains how to use SCPI commands in general. The instrument command summary (at the end of this chapter) lists the specific commands available in your instrument. This section presents only the basics of SCPI. If you want to explore the topic in greater depth, see the paragraph titled, "Related Documents."

Definitions of Terms

This section defines most terms when they are first used, you need a general understanding of the terms listed below before you continue.

controller
A controller is any computer used to communicate with a SCPI instrument. A controller can be a personal computer, a minicomputer, or a plug-in card in a card cage. Some intelligent instruments can also function as controllers.

instrument
An instrument is any device that implements SCPI. Most instruments are electronic measurement or stimulus devices, but this is not a requirement. Similarly, most instruments use an GPIB interface for communication. The same concepts apply regardless of the instrument function or the type of interface used.

program message
A program message is a combination of one or more properly formatted SCPI commands. Program messages always go from a controller to an instrument. Program messages tell the instrument how to make measurements and output signals.

response message
A response message is a collection of data in specific SCPI formats. Response messages always go from an instrument to a controller or listening instrument. Response messages tell the controller about the internal state of the instrument and about measured values.

command
A command is an instruction in SCPI. You combine commands to form messages that control instruments. In general, a command consists of mnemonics (keywords), parameters, and punctuation.

query
A query is a special type of command. Queries instruct the instrument to make response data available to the controller. Query mnemonics always end with a question mark.

Standard Notation

This section uses several forms of notation that have specific meaning.

Command Mnemonics

Many commands have both a long and a short form, and you must use either one or the other (SCPI does not accept a combination of the two). Consider the FREQuency command, for example. The short form is FREQ and the long form is FREQUENCY (this notation style is a shorthand to document both the long and short form of commands). SCPI is not case sensitive, so fREquEnCy is just as valid as FREQUENCY, but FREQ and FREQUENCY are the only valid forms of the FREQuency command.

Angle Brackets

Angle brackets indicate that the word or words enclosed represent something other than themselves. For example, <new line> represents the ASCII character with the decimal value 10. Similarly, <^END> means that EOI is asserted on the GPIB interface. Words in angle brackets have much more rigidly defined meaning than words used in ordinary text. For example, this section uses the word "message" to talk about messages generally. But the bracketed words <program message> indicate a precisely defined element of SCPI. If you need them, you can find the exact definitions of words such as <program message> in a syntax diagram.

How to Use Examples

It is important to understand that programming with SCPI actually requires knowledge of two languages. You must know the programming language of your controller (BASIC, C, Pascal) as well as the language of your instrument (SCPI). The semantic requirements of your controller's language determine how the SCPI commands and responses are handled in your application.

Command Examples

Command examples look like this:

    :FREQuency:CW?

This example tells you to put the string :FREQuency:CW? in the output statement appropriate to your application programming language. If you encounter problems, study the details of how the output statement handles message terminators such as <new line>. If you are using simple OUTPUT statements in HP BASIC, this is taken care of for you. In HP BASIC, you type:

    OUTPUT Source;":FREQuency:CW?"

Command examples do not show message terminators because they are used at the end of every program message. "Details of

Commands and Responses," discusses message terminators in more detail.

Response Examples

Response examples look like this:

```
1.23
```

These are the characters you would read from an instrument after sending a query command. To actually pull them from the instrument into the controller, use the input statement appropriate to your application programming language. If you have problems, study the details of how the input statement operates. In particular, investigate how the input statement handles punctuation characters such as comma and semicolon, and how it handles `<new line>` and EOL.

To enter the previous response in HP BASIC, you type:

```
ENTER Source;CW_frequency
```

Response examples do not show response message terminators because they are always `<new line> <^END>`. These terminators are typically automatically handled by the input statement. The paragraph titled "Details of Commands and Responses" discusses message terminators in more detail.

Essentials for Beginners

This subsection discusses elementary concepts critical to first-time users of SCPI. Read and understand this subsection before going on to another. This subsection includes the following topics:

Program and Response Messages	These paragraphs introduce the basic types of messages sent between instruments and controllers.
Subsystem Command Trees	These paragraphs describe the tree structure used in subsystem commands.
Subsystem Command Tables	These paragraphs present the condensed tabular format used for documenting subsystem commands.
Reading Instrument Errors	These paragraphs explain how to read and print an instrument's internal error messages.
Example Programs	These paragraphs contain two simple measurement programs that illustrate basic SCPI programming principles.

Program and Response Messages

To understand how your instrument and controller communicate using SCPI, you must understand the concepts of program and response messages. *Program messages* are the formatted data sent from the controller to the instrument. Conversely, *response messages* are the formatted data sent from the instrument to the controller. Program messages contain one or more commands, and response messages contain one or more responses.

The controller may send commands at any time, but the instrument sends responses only when specifically instructed to do so. The special type of command used to instruct the instrument to send a response message is the *query*. All query mnemonics end with a question mark. Queries return either measured values or internal instrument settings. Any internal setting that can be programmed with SCPI can also be queried.

Forgiving Listening and Precise Talking

SCPI uses the concept of forgiving listening and precise talking outlined in IEEE 488.2. *Forgiving listening* means that instruments are very flexible in accepting various command and parameter formats. For example, the swept CW generator accepts either `:POWer:STATe ON` or `:POWer:STATe 1` to turn RF output on. *Precise talking* means that the response format for a particular query is always the same. For example, if you query the power state when it is on (using `:POWer:STATe?`), the response is always 1, regardless of whether you previously sent `:POWer:STATe 1` or `:POWer:STATe ON`.

Types of Commands

Commands can be separated into two groups, common commands and subsystem commands. *Common commands* are generally not measurement related. They are used to manage macros, status registers, synchronization, and data storage. Common commands are easy to recognize because they all begin with an asterisk, such as *IDN?, *OPC, and *RST. Common commands are defined by IEEE 488.2. *Subsystem commands* include all measurement functions and some general purpose functions. Subsystem commands are distinguished by the colon used between keywords, as in :FREQuency:CW?. Each command subsystem is a set of commands that roughly corresponds to a functional block inside the instrument. For example, the POWer subsystem contains commands for power generation, while the STATus subsystem contains commands for accessing status registers.

```
          ┌──────────────┐
          │              │
          │     SPCI     │
          │              │
          └──────────────┘
                 │
        ┌────────┴────────┐
┌───────────────┐   ┌───────────────┐
│               │   │               │
│    Common     │   │   Subsystem   │
│   Commands    │   │   Commands    │
│               │   │               │
└───────────────┘   └───────────────┘

*RST                :MEAS:VOLT?
*IDN?               :FREQ 1KHz
```
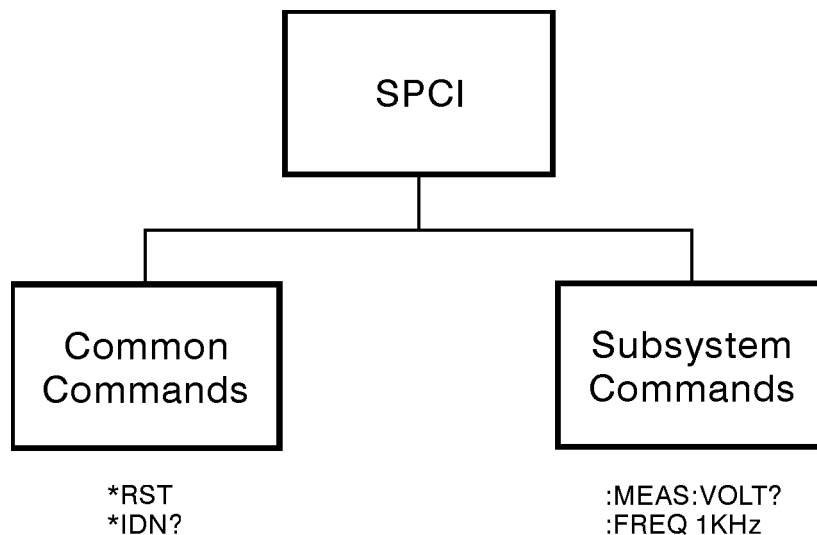
po75b

Figure 1-24. SCPI Command Types

The remaining paragraphs in this subsection discuss subsystem commands in more detail. Remember, some commands are implemented in one instrument and not in another, depending on its measurement function.

Subsystem Command Trees

The Command Tree Structure

Most programming tasks involve subsystem commands. SCPI uses a hierarchical structure for subsystem commands similar to the file systems on most computers. In SCPI, this command structure is called a *command tree*.

```
root                              AA
                   ┌──────────────┼──────────────┐
level  1          BB             CC             DD
              ┌────┼────┐              ┌────┼────┐
level  2    EE   FF   GG             HH        JJ
```
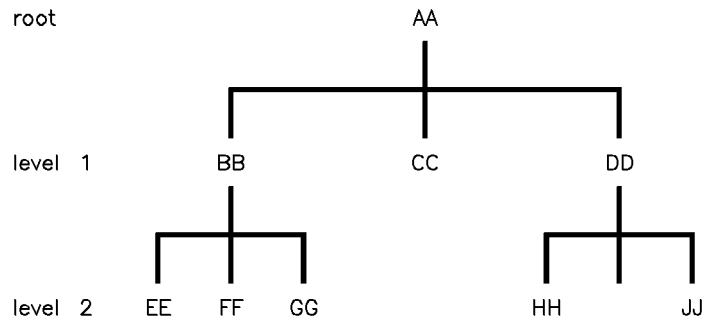
Figure 1-25. A Simplified Command Tree

In the command tree shown in Figure 1-25, the command closest to the top is the *root command*, or simply the *root*. Notice that you must follow a particular *path* to reach lower level subcommands. For example, if you wish to access the `GG` command, you must follow the path `AA` to `BB` to `GG`.

Paths Through the Command Tree

To access commands in different paths in the command tree, you must understand how an instrument interprets commands. A special part of the instrument firmware, a *parser*, decodes each message sent to the instrument. The parser breaks up the message into component commands using a set of rules to determine the command tree path used. The parser keeps track of the *current path*, the level in the command tree where it expects to find the next command you send. This is important because the same keyword may appear in different paths. The particular path you use determines how the keyword is interpreted. The following rules are used by the parser:

■ *Power On and Reset*

  After power is cycled or after *RST, the current path is set to the root.

■ *Message Terminators*

  A message terminator, such as a <new line> character, sets the current path to the root. Many programming languages have output statements that send message terminators automatically. The paragraph titled, "Details of Commands and Responses," discusses message terminators in more detail.

■ *Colon*

When it is between two command mnemonics, a colon moves the current path down one level in the command tree. For example, the colon in `MEAS:VOLT` specifies that `VOLT` is one level below `MEAS`. When the colon is the first character of a command, it specifies that the next command mnemonic is a root level command. For example, the colon in `:INIT` specifies that `INIT` is a root level command.

■ *Semicolon*

A semicolon separates two commands in the same message without changing the current path.

■ *Whitespace*

White space characters, such as `<tab>` and `<space>`, are generally ignored. There are two important exceptions. White space inside a keyword, such as `:FREQ uency`, is not allowed. You must use white space to separate parameters from commands. For example, the `<space>` between LEVel and 6.2 in the command `:POWer:LEVel 6.2` is mandatory. White space does not affect the current path.

■ *Commas*

If a command requires more than one parameter, you must separate adjacent parameters using a comma. Commas do not affect the current path.

■ *Common Commands*

Common commands, such as `*RST`, are not part of any subsystem. An instrument interprets them in the same way, regardless of the current path setting.

Figure 1-26 shows examples of how to use the colon and semicolon to navigate efficiently through the command tree.

                                    AA
                    ┌────────────────┼────────────────┐
                    BB   CC   DD
              ┌─────┼─────┐   ┌───────┼───────┐
              EE   FF   GG   HH   JJ

```
      Ⓡ Ⓓ
      ▼ ▼
1)    :AA:CC
```

Ⓡ Sets current path
   to ROOT

```
      Ⓡ Ⓓ Ⓓ Ⓝ Ⓝ
      ▼ ▼ ▼ ▼ ▼
2)    :AA:BB:EE;FF;GG
```

Ⓝ NO change to
   current path

```
      Ⓡ Ⓓ Ⓓ Ⓝ
      ▼ ▼ ▼ ▼
3)    :AA:DD:HH;JJ
```

Ⓓ Set current path
   DOWN one level

```
      Ⓡ Ⓓ Ⓓ Ⓝ Ⓡ Ⓓ Ⓓ
      ▼ ▼ ▼ ▼ ▼ ▼ ▼
4)    :AA:BB:EE;  :AA:DD:JJ
```
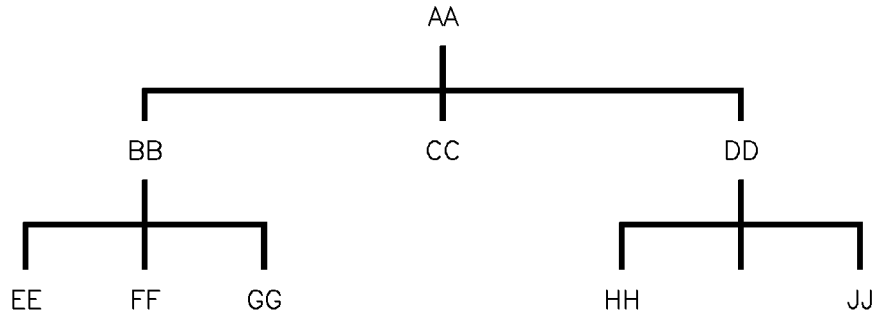
Figure 1-26. Proper Use of the Colon and Semicolon

In Figure 1-26, notice how proper use of the semicolon can save
typing.

Sending this message:

    :AA:BB:EE; FF; GG

Is the same as sending these three messages:

    :AA:BB:EE

    :AA:BB:FF

    :AA:BB:GG

Subsystem Command Tables

These paragraphs introduce a more complete, compact way of documenting subsystems using a tabular format. The command table contains more information than just the command hierarchy shown in a graphical tree. In particular, these tables list command parameters for each command and response data formats for queries. To begin this exploration of command tables, consider a simplified SWEep subsystem for the swept CW generator in both the graphical and tabular formats.
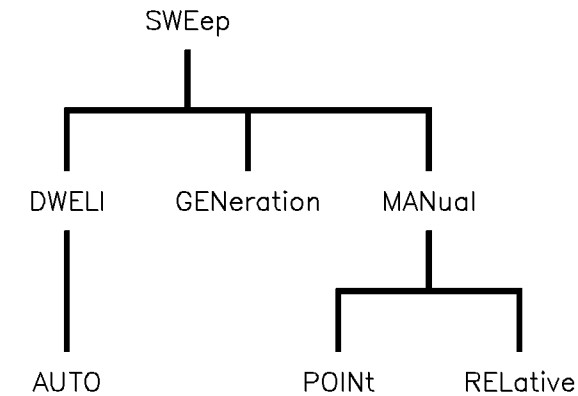
Figure 1-27. Simplified SWEep Command Tree

Table 1-2. SWEep Command Table

Command	Parameters	Parameter Type
:SWEep		
:DWELl		
:AUTO	state	Boolean|ONCE
:GENeration		
:MANual		
:POINt		
[:RELative]		

Reading the Command Table

Note the three columns in the command table labeled *Command*, *Parameters*, and *Parameter Type*. Commands closest to the root level are at the top of the table. Commands in square brackets are implied commands, which are discussed in later paragraphs. If a command requires one or more parameters in addition to the keyword, the parameter names are listed adjacent to the command. Parameters in square brackets are optional parameters, which are discussed in later paragraphs. If the parameter is not in square brackets, it is required and you must send a valid setting for it with

the matching command. The parameter type is listed adjacent to each named parameter.

More About Commands

Query and Event Commands. Because you can query any value that you can set, the query form of each command is not shown explicitly in the command tables. For example, the presence of the swept CW generator `:SWEep:DWELl` command implies that a `:SWEep:DWELl?` also exists. If you see a table containing a command ending with a question mark, it is a *query* only command. Some commands are *events*, and cannot be queried. An event has no corresponding setting if it causes something to happen inside the instrument at a particular instant. For example, `:INITiate:IMMediate` causes a certain trigger sequence to initiate. Because it is an event, there is no query form of `:INITiate:IMMediate`.

Implied Commands. *Implied commands* appear in square brackets in the command table. If you send a subcommand immediately preceding an implied command, but do not send the implied command, the instrument assumes you intend to use the implied command, and behaves just as if you had sent it. Note that this means the instrument expects you to include any parameters required by the implied command. The following example illustrates equivalent ways to program the swept CW generator using explicit and implied commands.

Example swept CW generator commands with and without an implied commands:

    :SWEep:MANual:RELative 6   *using explicit commands*
    :SWEep:MANual 6   *using implied commands*

Optional Parameters. Optional parameter names are enclosed in square brackets in the command table. If you do not send a value for an optional parameter, the instrument chooses a default value. The instrument's command dictionary documents the values used for optional parameters.

Program Message Examples

The following parts of the swept CW generator SCPI command set will be used to demonstrate how to create complete SCPI program messages:

    :FREQuency
       [:CW]
        :MULTiplier
           :STATE
    :POWER
       [:LEVEL]

Example 1: "FREQuency:CW 5 GHZ; MULTiplier 2"

The command is correct and will not cause errors. It is equivalent to sending:
"FREQuency:CW 5 GHZ; :FREQuency:MULTiplier 2".

Example 2: "FREQuency 5 GHZ; MULTiplier 2"

This command results in a command error. The command makes use of the default [:CW] node. When using a default node, there is no change to the current path position. Since there is no command "MULT" at the root, an error results. A correct way to send this is: "FREQ 5 GHZ; FREQ:MULT 2" or as in example 1.

Example 3: "FREQuency:MULTiplier 2; MULTiplier:STATE ON; FREQuency:CW 5 GHZ"

This command results in a command error. The FREQ:CW portion of the command is missing a leading colon. The path level is dropped at each colon until it is in the FREQ:MULT subsystem. So when the FREQ:CW command is sent, it causes confusion because no such node occurs in the FREQ:MULT subsystem. By adding a leading colon, the current path is reset to the root. The corrected command is:
"FREQuency:MULTiplier 2; MULTiplier:STATE ON; :FREQuency:CW 5 GHZ".

Example 4: "FREQ 5 GHZ; POWER 4 DBM"

Notice that in this example the keyword short form is used. The command is correct. It utilizes the default nodes of [:CW] and [:LEVEL]. Since default nodes do not affect the current path, it is not necessary to use a leading colon before POWER.

Parameter Types

As you saw in the example command table for SWEep, there are several types of parameters. The parameter type indicates what kind of values are valid instrument settings. The most commonly used parameter types are numeric, extended numeric, discrete, and Boolean. These common types are discussed briefly in the following paragraphs. The paragraph titled "Details of Commands and Responses" explains all parameter types in greater depth.

Numeric Parameters. Numeric parameters are used in both subsystem commands and common commands. Numeric parameters accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. If an instrument accepts only specific numeric values, such as integers, it automatically rounds numeric parameters to fit its needs.

Examples of numeric parameters:

```
100             no decimal point required
100.            fractional digits optional
-1.23           leading signs allowed
4.56e<space>3   space allowed after e in exponents
-7.89E-01       use either E or e in exponentials
+256            leading + allowed
.5              digits left of decimal point optional
```

Examples of numeric parameters in commands:

```
100 OUTPUT @Source;":FREQuency:STARt 1.0E+09"
110 OUTPUT @Source;":LIST:FREQuency 10.0e+9,1e+7"
```

Extended Numeric Parameters. Most measurement related subsystems use *extended numeric* parameters to specify physical quantities. Extended numeric parameters accept all numeric parameter values and other special values as well. All extended numeric parameters accept `MAXimum` and `MINimum` as values. Other special values, such as `UP` and `DOWN` may be available as documented in the instrument's command summary. Some instruments also let you to send engineering units as suffixes to extended numeric parameters. The SCPI Command Summary lists the suffixes available, if any. Note that extended numeric parameters are not used for common commands or `STATus` subsystem commands.

Examples of extended numeric parameters:

```
100.            any simple numeric values
-1.23           largest valid setting
4.56e<space>3
-7.89E-01
+256
.5

MAX
MIN             valid setting nearest negative infinity
```

Examples of extended numeric parameters in commands:

```
100 OUTPUT @Source;":FREQuency:STOP MAX"
110 OUTPUT @Source;":LIST:FREQuency MAX,MIN"
```

Discrete Parameters. Use discrete parameters to program settings that have a finite number of values. Discrete parameters use mnemonics to represent each valid setting. They have a long and a short form, like command mnemonics. You can use mixed upper and lower case letters for discrete parameters.

Examples of discrete parameters:

INTernal	*level internally*
DIODe	*level using an external diode*
PMETer	*level using an external power meter*
MMHead	*level using a mm-wave source module*

Examples of discrete parameters in commands:

```
100 OUTPUT @Source;":POWer:ALC:SOURce INT"
110 OUTPUT @Source;":POWer:ALC:SOURce mmh"
```

Although discrete parameters values look like command keywords, do not confuse the two. In particular, be sure to use colons and spaces properly. Use a colon to separate command mnemonics from each other. Use a space to separate parameters from command mnemonics.

Boolean Parameters. Boolean parameters represent a single binary condition that is either true or false. There are only four possible values for a Boolean parameter.

Examples of Boolean parameters:

ON	*Boolean TRUE, upper/lower case allowed*
OFF	*Boolean FALSE, upper/lower case allowed*
1	*Boolean TRUE*
0	*Boolean FALSE*

Examples of Boolean parameters in commands:

```
100 OUTPUT @Source;":FM:STATe On"
110 OUTPUT @Source;":AM:STATe 1"
```

Reading Instrument Errors

When debugging a program, you may want to know if an instrument error has occurred. Some instruments can display error messages on their front panels. If your instrument cannot do this, you can put the following code segment in your program to read and display error messages.

```
 10 !
 20 !  The rest of your
 30 ! variable declarations
 40 !
 50 DIM Err_msg$[75]
 60 INTEGER Err_num
 70 !
 80 ! Part of your program
 90 ! that generates errors
100 !
110 !
200 REPEAT
210   OUTPUT @Box;":SYST:ERR?"
220   ! Query instrument error
230   ENTER @Box;Err_num,Err_msg$
240   ! Read error #, message
250   PRINT Err_num,Err_msg$
260   ! Print error message
270 UNTIL Err_num = 0
280 ! Repeat until no errors
290 !
300 !  The rest of your program
310 !
```

Example Programs

The following is an example program using SCPI compatible instruments. The example is written in HP BASIC.

This example is a stimulus and response application. It uses a source and counter to test a voltage controlled oscillator.

Example Program

Description. This example demonstrates how several SCPI instruments work together to perform a stimulus/response measurement. This program measures the linearity of a voltage controlled oscillator (VCO). A VCO is a device that outputs a frequency proportional to an input signal level. Figure 1-28 shows how the hardware is configured.
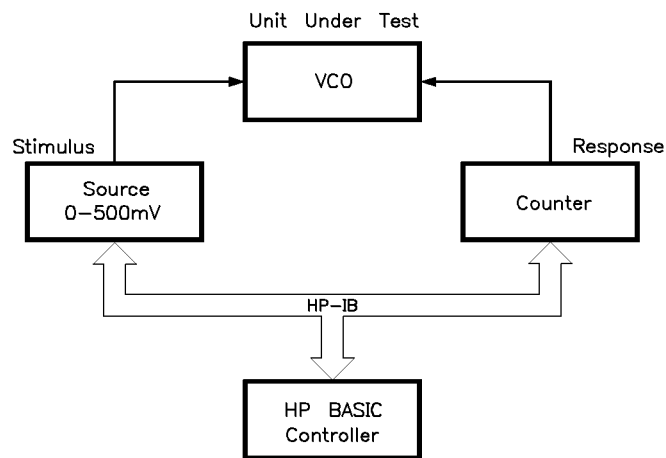
Figure 1-28. Voltage Controlled Oscillator Test Program Listing.

```
20   !
30     INTEGER First,Last,Testpoint,Dummy
40     DIM Id$[70]
50     ASSIGN @Stimulus TO 717
60     ASSIGN @Response TO 718
70   !
80     First=0
90     Last=100
100  !
110    CLEAR @Stimulus
120    CLEAR @Response
130  !
140    OUTPUT @Stimulus;"*RST"
150    OUTPUT @Response;"*RST"
160  !
170    PRINT "Voltage Controlled Oscillator Test"
180    PRINT
190  !
200    PRINT "Source Used ..."
```

```
210    OUTPUT @Stimulus;"*IDN?"
220    ENTER @Stimulus;Id$
230    PRINT Id$
240    PRINT
250  !
260    PRINT "Counter Used ..."
270    OUTPUT @Response;"*IDN?"
280    ENTER @Response;Id$
290    PRINT Id$
300    PRINT
310  !
320    OUTPUT @Stimulus;":OUTPUT ON"
330  !
340    PRINT
350    PRINT "INPUT [mv]","OUTPUT [kHz]"
360    PRINT "----------","------------"
370    PRINT
380  !
390    FOR Testpoint=First TO Last
400      OUTPUT @Stimulus;":SOURCE:VOLT ";VAL$(Testpoint/1000);";*OPC?"
410      ENTER @Stimulus;Dummy
420      OUTPUT @Response;":MEAS:FREQ?"
430      ENTER @Response;Reading
440      PRINT Testpoint,Reading/1000
450    NEXT Testpoint
460  !
470    OUTPUT @Source;":OUTPUT OFF"
480    END
```

Program Comments. Lines 20 to 70: Declare variables and I/O paths for instruments. I/O paths let you use a name for an instrument in `OUTPUT` and `ENTER` statements, instead of a numeric address.

80 to 100: Assign values to the input test limits in mV.

110 to 130: Clear the instrument GPIB interfaces.

140 to 160: Reset each instrument to a known measurement state.

170 to 190: Print the test report title.

200 to 310: Query measurement instruments' identifications for test traceability.

320 to 330: Connect the source output signal to the output terminals.

340 to 380: Print results table header.

390 to 460: This is the main measurement loop. Line 400 contains two commands. `:SOURce:VOLT` sets the output level of the source. `*OPC?` is used to signal that the preceding command has finished executing. To make an accurate measurement, the source output must be allowed to settle. When the output has settled, `*OPC?` places

a 1 in the source Output Queue. The program waits at line 410 until the 1 returned by *OPC? is entered.

Note that following each OUTPUT containing a query is an ENTER to retrieve the queried value. If you do not use paired OUTPUTs and ENTERs, you can overwrite data in the instrument Output Queue and generate instrument errors.

470 to 480: Disconnect output terminals of the instruments from the unit under test, and end the program. All HP BASIC programs must have END as the last statement of the main program.

Details of Commands and Responses

In This Subsection

This subsection describes the syntax of SCPI commands and responses. It provides many examples of the data types used for command parameters and response data. The following topics are explained:

Program Message Syntax

These paragraphs explain how to properly construct the messages you send from the computer to instruments.

Response Message Syntax

These paragraphs discuss the format of messages sent from instruments to the computer.

SCPI Data Types

These paragraphs explain the types of data contained in program and response messages.

Program Message Syntax

These paragraphs examine the construction of SCPI program messages in more detail. Recall that program messages are the messages you send from the computer to an instrument. These program messages contain commands combined with appropriate punctuation and program message terminators. Figure 1-29 illustrates the simplified syntax of a program message.
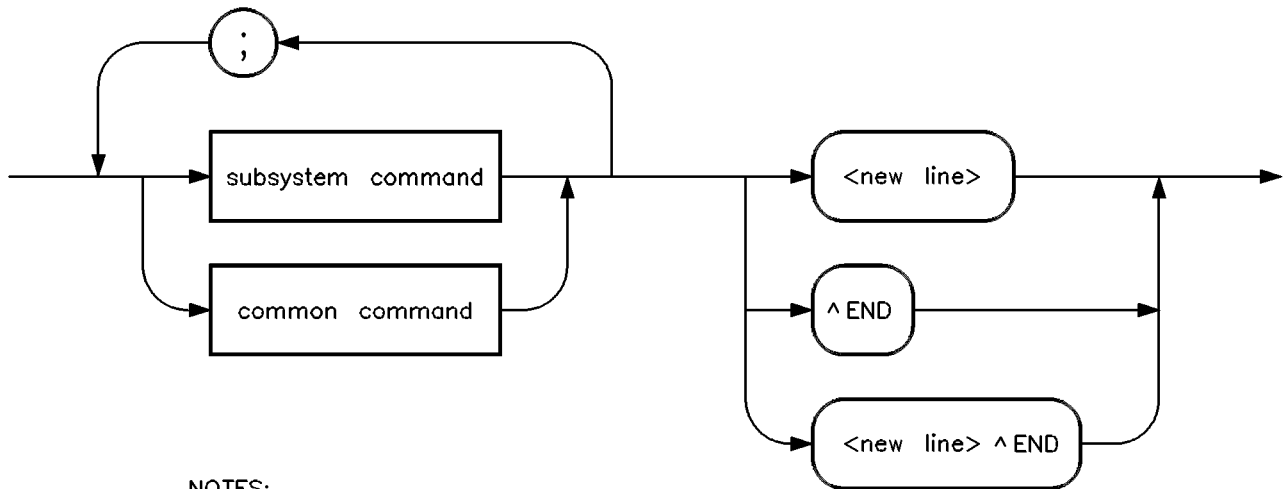
NOTES:

<new line> = ASCII character decimal 10

^END = EOI asserted concurrent with last byte

Figure 1-29. Simplified Program Message Syntax

As Figure 1-29 shows, you can send common commands and subsystem commands in the same message. If you send more than one command in the same message, you must separate them with

a semicolon. You must always end a program message with one of
the three program message terminators shown in Figure 1-29. Use
<new line>, <^END>, or <new line> <^END> as the program message
terminator. The word <^END>> means that EOI is asserted on the
GPIB interface at the same time the preceding data byte is sent.
Most programming languages send these terminators automatically.
For example, if you use the HP BASIC OUTPUT statement,
<new line> is automatically sent after your last data byte. If you are
using a PC, you can usually configure the system to send whatever
terminator you specify.

Subsystem Command Syntax

Figure 1-30 describes the basic syntax of SCPI subsystem commands.
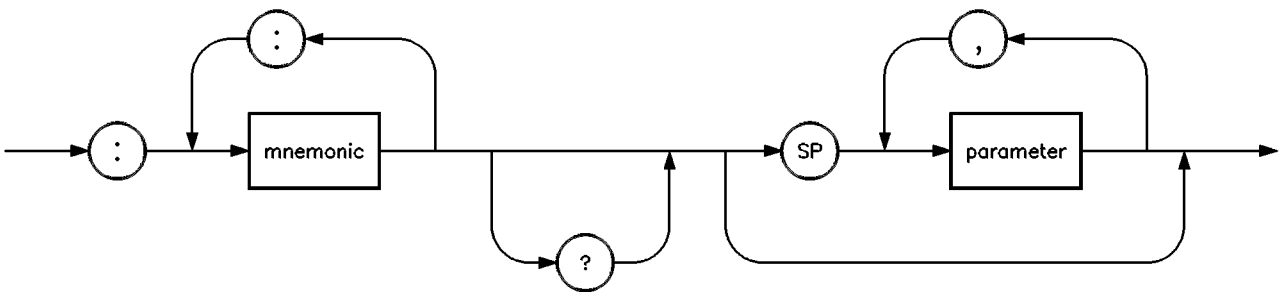
NOTE:

SP = white space, ASCII characters 0_{10} to 9_{10} and 11_{10} to 32_{10}

Figure 1-30. Simplified Subsystem Command Syntax

As Figure 1-30 shows, there must be a <space> between the
last command mnemonic and the first parameter in a subsystem
command. This is one of the few places in SCPI where <space>
is required. Note that if you send more than one parameter with
a single command, you must separate adjacent parameters with a
comma. Parameter types are explained later in this subsection.

Common Command Syntax

Figure 1-31 describes the syntax of common commands.
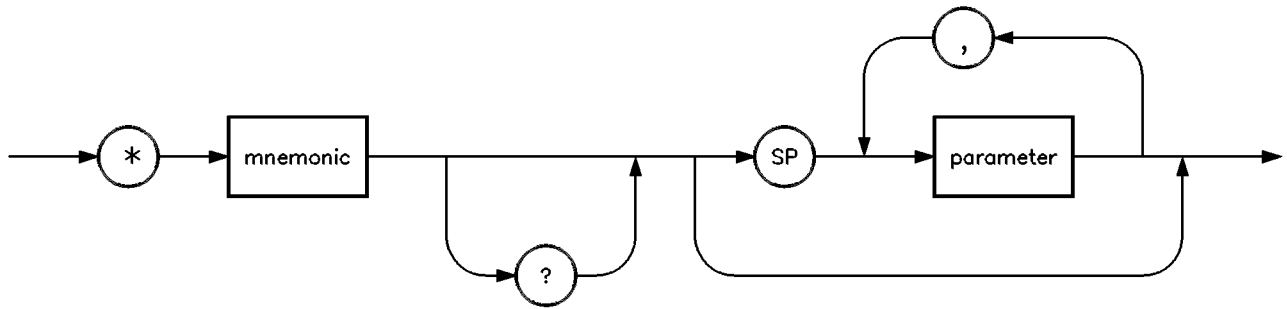
NOTE:

SP = white space, ASCII characters 0_{10} to 9_{10} and 11_{10} to 32_{10}

Figure 1-31. Simplified Common Command Syntax

As with subsystem commands, use a `<space>` to separate a command mnemonic from subsequent parameters. Separate adjacent parameters with a comma. Parameter types are explained later in this subsection.

Response Message Syntax

Figure 1-32 shows a simplified view of response message syntax.
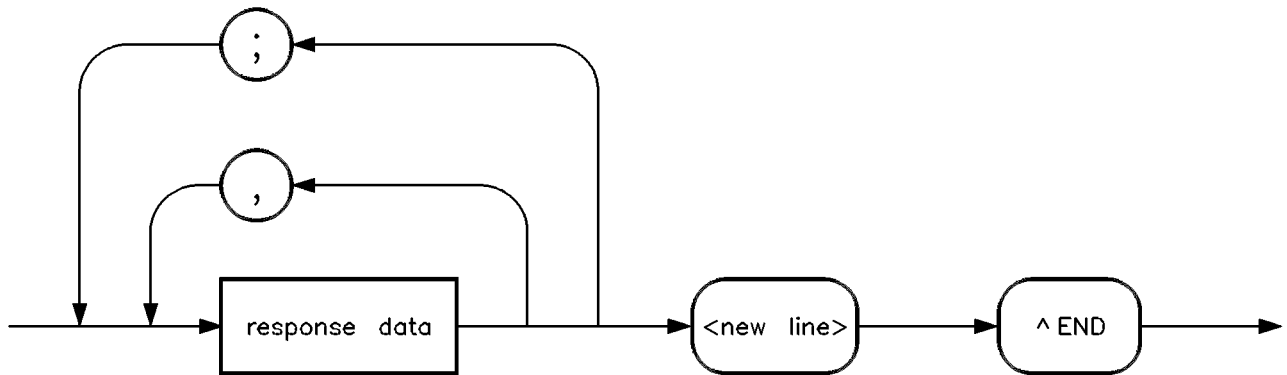
Figure 1-32. Simplified Response Message Syntax

Response messages can contain both commas and semicolons as separators. When a single query command returns multiple values, a comma separates each data item. When multiple queries are sent in the same message, the groups of data items corresponding to each query are separated by a semicolon. For example, the fictitious query `:QUERY1?:QUERY2?` might return a response message of:

`<data1>,<data1>;<data2>,<data2>`

Response data types are explained later in this subsection. Note that `<new line><^END>` is always sent as a response message terminator.

SCPI Data Types   These paragraphs explain the data types available for parameters and response data. They list the types available and present examples for each type. SCPI defines different data formats for use in program messages and response messages. It does this to accommodate the principle of forgiving listening and precise talking. Recall that forgiving listening means instruments are flexible, accepting commands and parameters in various formats. Precise talking means an instrument always responds to a particular query in a predefined, rigid format. Parameter data types are designed to be flexible in the spirit of forgiving listening. Conversely, response data types are defined to meet the requirements of precise talking.

Table 1-3. SCPI Data Types

Parameter Types	Response Data Types
Numeric	Real or Integer
Extended Numeric	Integer
Discrete	Discrete
Boolean	Numeric Boolean
String	String
Block	Definite Length Block
	Indefinite Length Block
Non-decimal Numeric	Hexadecimal
	Octal
	Binary

Notice that each parameter type has one or more corresponding response data types. For example, a setting that you program using a numeric parameter returns either real or integer response data when queried. Whether real or integer response data is returned depends on the instrument used. However, precise talking requires that the response data type be clearly defined for a particular instrument and query. The instrument command dictionary generally contains information about data types for individual commands. The following paragraphs explain each parameter and response data type in more detail.

Parameter Types

Numeric Parameters. Numeric parameters are used in both subsystem commands and common commands. Numeric parameters accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation.

If an instrument setting programmed with a numeric parameter can only assume a finite number of values, the instrument automatically

rounds the parameter. For example, if an instrument has a
programmable output impedance of 50 or 75 ohms, you specified
76.1 for output impedance, the value is rounded to 75. If the
instrument setting can only assume integer values, it automatically
rounds the value to an integer. For example, sending *ESE 10.123
is the same as sending *ESE 10.

Examples of numeric parameters:

100	*no decimal point required*
100.	*fractional digits optional*
-1.23	*leading signs allowed*
4.56e<space>3	*space allowed after e in exponentials*
-7.89E-01	*use either E or e in exponentials*
+256	*leading + allowed*
.5	*digits left of decimal point optional*

Extended Numeric Parameters. Most measurement related
subsystems use extended numeric parameters to specify physical
quantities. *Extended numeric* parameters accept all numeric
parameter values and other special values as well. All extended
numeric parameters accept MAXimum and MINimum as values. Other
special values, such as UP and DOWN may be available as documented
in the instrument's command dictionary. Note that MINimum and
MAXimum can be used to set or query values. The query forms
are useful for determining the range of values allowed for a given
parameter.

In some instruments, extended numeric parameters accept
engineering unit suffixes as part of the parameter value. Refer to the
command summary to see if this capability exists.

Note that extended numeric parameters are not used for common
commands or STATus subsystem commands.

Examples of extended numeric parameters:

100.	*any simple numeric values*
-1.23	*largest valid setting*
4.56e<space>3	
-7.89E-01	
+256	
.5	
MAX	
MIN	*valid setting nearest negative infinity*
-100 mV	*negative 100 millivolts*

Discrete Parameters. Use *discrete parameters* to program settings that have a finite number of values. Discrete parameters use mnemonics to represent each valid setting. They have a long and a short form, just like command mnemonics. You can used mixed upper and lower case letters for discrete parameters.

Examples of discrete parameters used with the ROSCillator subsystem:

INTernal	*internal frequency standard*
EXTernal	*external frequency standard*
NONE	*no frequency standard, free run mode*

Although discrete parameters values look like command keywords, do not confuse the two. In particular, be sure to use colons and spaces properly. Use a colon to separate command mnemonics from each other. Use a space to separate parameters from command mnemonics.

Boolean Parameters. Boolean parameters represent a single binary condition that is either true or false. There are only four possible values for a Boolean parameter.

Examples of Boolean parameters:

ON	*Boolean TRUE, upper/lower case allowed*
OFF	*Boolean FALSE, upper/lower case allowed*
1	*Boolean TRUE*
0	*Boolean FALSE*

Response Data Types

Real Response Data. A large portion of all measurement data are formatted as *real* response data. Real response data are decimal numbers in either fixed decimal notation or scientific notation. In general, you do not need to worry about the rules for formatting real data, or whether fixed decimal or scientific notation is used. Most high level programming languages that support instrument I/O handle either type transparently.

Examples of real response data:

```
    1.23E+0
   -1.0E+2
   +1.0E+2
    0.5E+0
    1.23
-100.0
+100.0
    0.5
```

Integer Response Data. *Integer* response data are decimal representations of integer values including optional signs. Most status register related queries return integer response data.

Examples of integer response data:

0	*signs are optional*
+100	*leading + sign allowed*
-100	*leading sign allowed*
256	*never any decimal point*

Discrete Response Data. *Discrete* response data are similar to discrete parameters. The main difference is that discrete response data return only the short form of a particular mnemonic, in all upper case letters.

Examples of discrete response data:

INTernal	*level internally*
DIODe	*level using an external diode*
PMETer	*level using an external power meter*
MMHead	*level using a mm-wave source module*

String Response Data. *String* response data are similar to string parameters. The main difference is that string response data use only double quotes as delimiters, rather than single quotes. Embedded double quotes may be present in string response data. Embedded quotes appear as two adjacent double quotes with no characters between them.

Examples of string response data:

```
"This IS valid"
"SO IS THIS "" "
"I said, ""Hello!"""
```

Programming
Typical
Measurements

In This Subsection
This subsection illustrates how the general SCPI concepts presented in previous subsections apply to programming real measurements. To introduce you to programming with SCPI, we must list the commands for the swept CW generator. We will begin with a simplified example.

Using the Example Programs
The example programs are interactive. They require active participation by the operator. If you desire to get an understanding of the principles without following all of the instructions, read the "Program Comments" paragraphs to follow the programmed activity.

The GPIB select code is assumed to be preset to 7. All example programs in this section expect the swept CW generator's GPIB address to be decimal 19.

To find the present GPIB address, use the front panel.

Press SYSTEM (MENU).
Select GPIB Menu Adrs Menu My Adrs .

The active entry area indicates the present decimal address. If the number displayed is not 19, reset it to 19.
Press (1) (9) (ENTER). If the swept CW generator does not respond to a front panel address change, set the GPIB address switch (rear panel) to 31 (all ones) enabling front panel changes to both address and interface language.

Now check that the interface language is set to SCPI.

Press (PRIOR).

An asterisk denotes the selected interface language. If an asterisk is not next to the SCPI key label, select Power Up Language SCPI .

Use of the Command Tables

In Table 1-4, notice that a new column titled "Allowed Values" has been added to the command table. This column lists the specific values or range of values allowed for each parameter. A vertical bar (|) separates values in a list from which you must choose one value. The commands listed in the table are only part of all the available SCPI commands of the swept CW generator. For a complete listing of the programming codes see "SCPI Command Summary" in Chapter 2.

Table 1-4. Sample Swept CW Generator Commands

Command	Parameters	Parameter Type	Allowed Values
:CALibration			
:PMETer			
:FLATness			
:INITiate?	flatness array to cal	discrete	USER|DIODE|PMETer|MMHead
:NEXT?	measured power	extended numeric	<num> [lvl suffix]
:CORRection			
:FLATness	801 freq-correction pairs	extended numeric	{<num>[freq suffix], DB}2*801
:FREQuency			
:CENTer	center freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
[:CW]	CW freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
:AUTO	coupled to center freq	Boolean	ON|OFF|1|0
:MODE	free mode	discrete	CW|SWEep|LIST
:STARt	start freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
:STEP			
:AUTO	auto freq step	Boolean	ON|OFF|1|0
[:INCRement]	freq step	extended numeric	20 to 0.01 dB or MAXimum|MINimum
:STOP	stop freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
:MARKer[n]			[n] is 1 to 5, 1 is the default
:FREQuency	marker frequency	extended numeric	specified freq range or MAXimum|MINimum

Table 1-4. Sample Swept CW Generator Commands (continued)

Command	Parameters	Parameter Type	Allowed Values
:POWer			
:ATTenuation	atten setting	extended numeric	0 to 90 [DB] or MAXimum|MINimum|UP|DOWN
:AUTO	coupled atten	Boolean	ON|OFF|1|0
[:LEVel]	output level	extended numeric	specified power range or MAXimum|MINimum|UP|DOWN
:STATe	RF on/off	Boolean	ON|OFF|1|0
:SWEep			
:GENeration	type of sweep	discrete	STEPped|ANALog
:TIME	sweep time	extended numeric	200s to 133 ms or MAXimum|MINimum
:AUTO	auto sweep time switch	Boolean	ON|OFF|1|0
:LLIMit	fastest sweep time	extended numeric	<num>[time suffix] or MAXimum|MINimum

GPIB Check, Example Program 1

This first program is to verify that the GPIB connections and interface are functional. Connect a controller to the swept CW generator via an GPIB cable. Clear and reset the controller and type in the following program:

```
10    Source=719
20    ABORT 7
30    LOCAL Source
40    CLEAR Source
50    REMOTE Source
60    CLS
70    PRINT "The source should now be in REMOTE."
80    PRINT "Verify that the 'REMOTE' LED is on."
90    END
```

Run the program and verify that the REMOTE LED is lit on the swept CW generator. If it is not, verify that the swept CW generator address is set to 19 and that the interface cable is properly connected.

If the controller display indicates an error message, it is possible that the program was entered incorrectly. If the controller accepts the REMOTE statement but the swept CW generator REMOTE LED does not turn on, perform the operational checks as outlined in the respective Operating and Service Manuals to find the defective device.

Program Comments

10: Set up a variable to contain the GPIB address of the source.

20: Abort any bus activity and return the GPIB interfaces to their reset states.

30: Place the source into LOCAL to cancel any Local Lockouts that may have been set up.

40: Reset the source's parser and clear any pending output from the source. Prepare the source to receive new commands.

50: Place the source into REMOTE.

60: Clear the display of the computer.

70: Print a message to the computer's display.

Local Lockout Demonstration, Example Program 2

When the swept CW generator is in REMOTE mode, all the front panel keys are disabled except the LOCAL key. But, when the LOCAL LOCKOUT command is set on the bus, even the LOCAL key is disabled. The LOCAL command, executed from the controller, is then the only way to return all (or selected) instruments to front panel control.

Continue example program 1. Delete line 90 END and type in the following commands:

```
90   PRINT "Verify that all keys are ignored,
             except the 'LOCAL' key."
100  PRINT "Verify that 'LOCAL' causes the
             REMOTE LED to go OFF."
110  PRINT " ..... press CONTINUE"
120  PAUSE
130  REMOTE Source
140  LOCAL LOCKOUT 7
150  PRINT
160  PRINT "Source should now be in LOCAL LOCKOUT mode."
170  PRINT "Verify that all keys (including 'LOCAL')
             have no effect."
180  PRINT " ..... press CONTINUE"
190  PAUSE
200  LOCAL Source
210  PRINT
220  PRINT "Source should now be in LOCAL mode."
230  PRINT "Verify that the swept signal generator's keyboard
             is functional."
240  END
```

To verify and investigate the different remote modes, do the following:

1. Reset the controller.

2. On the swept CW generator: Press (PRESET).

3. Clear the controller display and run the program.

4. Verify that the REMOTE LED on the swept CW generator is lit.

5. From the front panel, attempt to change the start frequency and verify that this is impossible.

6. Verify that all keys except (LOCAL) are disabled.

7. Now press the (LOCAL) key and verify that the swept CW generator REMOTE LED is off and that you can modify any of the sweep functions.

8. Execute a "continue" on the controller. With the controller displaying "LOCAL LOCKOUT mode", verify that the swept CW generator REMOTE LED is again lit.

9. Attempt to change the start frequency and press (PRESET). Verify that this is impossible.

10. Now press the swept CW generator (LOCAL) key and verify that still no action is taken.

11. Execute a "continue" on the controller. With the controller displaying "LOCAL mode", verify that the swept CW generator REMOTE LED is off. Also verify that all sweep functions now can be modified via the front panel controls.

HINT   Note that the swept CW generator (LOCAL) key produces the same result as programming LOCAL 719 or LOCAL 7. Be careful because the LOCAL 7 command places all instruments on the GPIB in the local state as opposed to just the swept CW generator.

Program Comments

90 to 120: Print a message on the computer's display, then pause.

130: Place the source into REMOTE.

140: Place the source into LOCAL LOCKOUT mode.

150 to 190: Print a message on the computer's display, then pause.

200: Return the source to local control.

210 to 230: Print a message on the computer's display.

Setting Up A Typical Sweep, Example Program 3

In swept operation, the swept CW generator is programmed for the proper sweep frequency range, sweep time, power level, and marker frequencies for a test measurement. This program sets up the swept CW generator for a general purpose situation. The instrument is the same as in program 1. Clear and reset the controller and type in the following program:

```
10    Source=719
20    ABORT 7
30    LOCAL 7
40    CLEAR Source
50    REMOTE Source
60    OUTPUT Source;"*RST"
70    OUTPUT Source;"FREQuency:MODE SWEep"
80    OUTPUT Source;"FREQuency:STARt 4 GHZ"
90    OUTPUT Source;"FREQuency:STOP 7 GHz"
100   OUTPUT Source;"POWer:LEVel -5 DBM"
110   OUTPUT Source;"SWEep:TIME 500MS"
120   OUTPUT Source;":MARKer1:STATe ON;FREQuency 4.5GHZ"
130   OUTPUT Source;"MARKer2:STATe ON;FREQuency 6111E6"
140   OUTPUT Source;"*OPC?"
150   ENTER Source;X
160   OUTPUT Source;"POWer:STATe ON"
170   OUTPUT Source;"INITIate:CONTinuous ON"
180   CLS
190   PRINT "Source setup complete."
200   PRINT "Verify that the source is sweeping from"
210   PRINT "4 GHz to 7 GHz at a power of -5 dBm,"
220   PRINT "with a sweeptime of 0.5 seconds."
230   END
```

Run the program.

Program Comments

10: Assign the source's GPIB address to a variable.

20 to 50: Abort any GPIB activity and initialize the GPIB interface.

60: Set the source to its initial state for programming. The *RST state is *not* the same as the PRESET state. For complete details of the instrument state at *RST, see "SCPI Command Summary," in Chapter 2.

70: Select the frequency mode to be SWEEP instead of the default sweep mode of "CW" that was selected with *RST.

80: Set the source start frequency to 4 GHz.

90: Set the source stop frequency to 7 GHz. Note the optional usage of the short-form mnemonic, "FREQ".

100: Set the source's power level to −5 dBm.

110: Set the sweeptime to 500 ms. Notice that upper/lower case in commands does not matter. Also spaces before the suffix ("MS") are not required in SCPI.

120 and 130: Set markers 1 and 2 to a fixed value. Notice that the value for marker 2 does not end with a frequency suffix. Hertz is a default terminator and is understood.

140: Wait until the source has completed setting up the commands that have been sent so far before turning on the output.

150: The ENTER statement causes the program to wait here until the source responds to the previous *OPC? with a '1'.

160: The source has now completed processing the commands. The RF frequency, power, and markers are at their programmed values. Turn on the RF output of the source.

170: Select a continuously initiated sweep instead of the default mode of non-continuous that was selected with *RST.

180: Clear the computer's display.

190 to 220: Print a message on the computer's display.

Queries, Example Program 4

The following example demonstrates the use of query commands and response data formats. Clear and reset the controller and type in the following program:

```
10    Source=719
20    ABORT 7
30    LOCAL 7
40    CLEAR Source
50    REMOTE Source
60    CLS
70    OUTPUT Source;"*RST"
80    OUTPUT Source;"POWER:LEVEL -5 dBm;STATE ON"
90    OUTPUT Source;"FREQ:CW?"
100   ENTER Source;F
110   PRINT "Present source CW frequency is : ";F/1.E+6;"MHz"
120   OUTPUT Source;"POWER:STATE?"
130   ENTER Source;W
140   PRINT "Present power ON/OFF state is : ";W
150   OUTPUT Source;"FREQ:MODE?"
160   DIM A$[10]
170   ENTER Source;A$
180   PRINT "Source's frequency mode is : "&A$
190   OUTPUT Source;"FREQ:CW? MIN"
200   ENTER Source;A
210   PRINT "Minimum source CW frequency is : ";A/1.E+6;"MHz"
220   OUTPUT Source;"FREQ:START?;STOP?"
230   ENTER Source;X,Y
240   PRINT "Swept frequency limits :"
250   PRINT "  Start ";X/1.E+6;"MHz"
260   PRINT "  Stop ";Y/1.E+6;"MHz"
270   END
```

Run the program.

Program Comments

10: Assign the source's GPIB address to a variable.

20 to 50: Abort any GPIB activity and initialize the GPIB interface.

60: Clear the computer's display.

70: Set the source to its initial state for programming.

80: Set up the source power level using a compound message.

90: Query the value of the source's CW frequency.

100: Enter the query response into the variable 'F'. The response always is returned in fundamental units, Hz in the case of frequency.

110: Print the CW Frequency in MHz on the computer display.

120: Query the value of a Boolean function, POWER:STATE.

130: Enter the query response into a variable 'W'. Boolean responses are always '1' for ON and '0' for OFF.

140: Print the value of the POWER:STATE on the computer display.

150: Query the value of a discrete function (FREQ:MODE).

160: Dimension a string variable to contain the response.

170: Enter the response into A$. The response will be a string that represents the function's present value.

180: Print the value of A$ on the computer display.

190: Example usage of a MIN query. This will request the maximum value that the FREQ:CW function can be programmed to.

200: Enter the numeric response into the variable A.

210: Print the value of A on the computer display.

220: This is compound query. Up to 8 parameters can be queried from the swept CW generator at one time using this method. In this example, the start and stop frequencies are interrogated.

230: The responses are read back into the variables X and Y. The order of the responses is the same as the order of the queries. X will contain the START frequency and Y will contain the STOP.

240 to 260: Print the START/STOP frequencies on the display.

Saving and Recalling States, Example Program 5

When a typical sweep, like example program 3, is set up, the complete front panel state may be saved for later use in non-volatile memories called registers 1 through 8. This can be done remotely as a part of a program. Clear and reset the controller and type in the following program:

```
10   Source=719
20   ABORT 7
30   LOCAL 7
40   CLEAR Source
50   REMOTE Source
60   CLS
70   OUTPUT Source;"*RST;FREQ:MODE SWE;STAR 4GHZ
                    ;STOP 5GHZ;:INIT:CONT ON"
80   OUTPUT Source;"*SAV 1"
90   CLS
100  PRINT "A sweeping state has been saved in REGISTER 1."
110  OUTPUT Source;"*RST;FREQ:CW 1.23456GHZ;:POW:LEV -1DBM"
120  OUTPUT Source;"*SAV 2"
130  PRINT "A CW state has been saved in REGISTER 2."
140  PRINT "..... Press Continue"
150  PAUSE
160  OUTPUT Source;"*RCL 1"
170  PRINT "Register 1 recalled. Verify source is sweeping."
180  PRINT "Press Continue."
190  PAUSE
200  OUTPUT Source;"*RCL 2"
210  PRINT "Register 2 recalled."
220  PRINT "Verify source is in CW mode."
230  END
```

Run the program.

Program Comments

10: Assign the source's GPIB address to a variable.

20 to 50: Abort any GPIB activity and initialize the GPIB interface.

60: Clear the computer's display.

70: Set up the source for a sweeping state. Note the combination of several commands into a single message. This single line is equivalent to the following lines:

```
OUTPUT Source;"*RST"
OUTPUT Source;"FREQ:MODE SWEep"
OUTPUT Source;"FREQ:STARt 4 GHZ"
OUTPUT Source;"FREQ:STOP 5 GHZ"
OUTPUT Source;"INIT:CONT ON"
```

80: Save this state into storage register 1.

90: Clear the computer display.

100: Print a message on the computer display.

110: Set up the source for a CW state. Note the combination of several commands into a single message. This single line is equivalent to the following lines:

```
OUTPUT Source;"*RST"
OUTPUT Source;"FREQ:CW 1.23456 GHZ"
OUTPUT Source;"POWer:LEVel -1 DBM"
```

120: Save this state into storage register 2.

130 to 150: Print a message on the computer display and pause.

160: Recall the instrument state from register 1. It should contain the sweeping state.

170 to 190: Print a message on the computer display and pause.

200: Recall the instrument state from register 2. It should contain the CW state.

210 and 220: Print messages on the computer display.

Looping and Synchronization, Example Program 6

Clear and reset the controller and type in the following program:

```
10   Source=719
20   ABORT 7
30   LOCAL 7
40   CLEAR Source
50   REMOTE Source
60   CLS
70   OUTPUT Source;"*RST"
80   OUTPUT Source;"FREQ:START 4 GHZ; STOP 5 GHZ; MODE SWEEP"
90   OUTPUT Source;"POWER:LEVEL -1 DBM; STATE ON"
100  OUTPUT Source;"SWEEP:TIME 1"
110  OUTPUT Source;"*OPC?"
120  ENTER Source;X
130  REPEAT
140     DISP "Enter number of sweeps to take :  [0 to exit]";
150     INPUT N
160     IF N>0 THEN
170        FOR I=1 TO N
180           DISP "Taking sweep number : ";I
190           OUTPUT Source;"INIT:IMM;*OPC?"
200           ENTER \
210        NEXT I
220     END IF
230  UNTIL N=0
240  END
```

Run the program.

Program Comments

10: Assign the source's GPIB address to a variable.

20 to 50: Abort any GPIB activity and initialize the GPIB interface.

60: Clear the computer's display.

70: Set the source to its initial state for programming.

80: Set up the frequency parameters using a compound message.

90: Set up the source's power level and state using a compound message.

100: Set up the source's sweep time to 1 second.

110: Send the *OPC? command to the source to ensure that the previous commands are completed and the source is ready to begin controlled sweeps.

120: Enter the response to the *OPC? into the variable X. The response should be a '1'.

130: Start of the loop.

140 and 150: Prompt the operator for the number of sweeps to take. The number of sweeps to take is stored in the variable N. Enter 0 to quit the program.

160: Don't take any sweeps if N is less than 0.

170: Start a FOR/NEXT loop to take N sweeps.

180: Display the number of this sweep on the computer display.

190: Initiate a single sweep on the source and then wait until the pending operation is complete. Return a '1' when the sweep completes.

200: Enter the response to the *OPC? into the variable X. The program execution will halt on this ENTER statement until the sweep is finished.

210: Repeat the INIT:IMM sequence N times.

220: End of the IF statement to skip sweeps if N is negative.

230: Exit the program if the value of N is 0.

Using the *WAI Command, Example Program 7

The following example illustrates the use of the *WAI command to cause the swept CW generator to perform a synchronous sweep.

```
10    Source=719
20    ABORT 7
30    LOCAL 7
40    CLEAR Source
50    REMOTE Source
60    CLS
70    OUTPUT Source;"*RST"
80    OUTPUT Source;"FREQ:STAR 4GHZ; STOP 5GHZ; MODE SWE"
90    OUTPUT Source;"SWE:TIME 2"
100   OUTPUT Source;"*OPC?"
110   ENTER Source;X
120   FOR I=1 TO 4
130      OUTPUT Source;"INIT"
140      OUTPUT Source;"*WAI"
150      OUTPUT Source;"POW:STAT ON"
160      OUTPUT Source;"INIT"
170      OUTPUT Source;"*WAI"
180      OUTPUT Source;"POW:STAT OFF"
190   NEXT I
200   PRINT "Finished sending commands to source."
210   PRINT "Note that execution is continuing for four cycles."
220   END
```

Run the program.

Program Comments

10: Assign the source's GPIB address to a variable.

20 to 50: Abort any GPIB activity and initialize the GPIB interface.

60: Clear the computer's display.

70: Set the source to its initial state for programming.

80: Set the source up for a sweep, from 4 GHz to 5 GHz.

90: Set the sweep time to 2 second. In SCPI, suffixes are optional if you program in fundamental units (for sweep time, that would be seconds).

100: Send an *OPC? to the source.

110: Enter the query response to the *OPC? into a variable "X". The program execution will halt here until the source has finished processing all the commands up to this point. Once complete, the source will respond to the *OPC? with a "1".

120: Begin a FOR/NEXT loop that is repeated four times.

130: Initiate a sweep on the source.

140: Send a *WAI command to the source. This command causes the source to stop executing new commands until all prior commands and operations have completed execution. In this case, there is a sweep in progress, so no further commands will be executed until the sweep finishes.

150: Turn the RF output of the source ON.

160: Initiate a sweep on the source.

170: Send another *WAI to the source. Although the *WAI command causes EXECUTION of commands to be held off, it has no effect on the transfer of commands over the GPIB. The commands continue to be accepted by the source and are buffered until they can be executed.

180: Toggle the RF STATE to OFF.

190: Repeat the sample exercise.

200 and 210: Print messages on the computer display.

Using the User Flatness Correction Commands, Example Program 8

The following program interrogates the swept CW generator and an HP/Agilent 437B power meter for frequency and power information respectively. The swept CW generator is programmed to sweep from 2 to 20 GHz, with frequency-correction pairs every 100 MHz and +5 dBm leveled output power. For this example, we assume that the path losses do not exceed 5 dBm and that the HP/Agilent 437B power meter already has its power sensor's calibration factors stored in sensor data table 0. If another power meter is used, the power sensor's calibration factors will have to be stored in a look-up table. Modify the program to suit your particular measurement requirements. Up to 801 points may be entered in the user flatness correction table with this program.

SCPI commands are used to set up the source parameters and enter correction frequencies and data into the correction table.

```
10    !ASSIGN THE ADDRESS TO THE SOURCE AND POWER METER
20    DIM A$[5000],B$[5000]
30     ASSIGN @Source TO 719
40     ASSIGN @Meter TO 713
50     INTEGER Error_flag
60     ABORT 7
70    !
80    !SET UP SOURCE
90     OUTPUT @Source;"*RST"
100    OUTPUT @Source;"FREQ:MODE SWE;STAR 2 GHZ;STOP 20 GHZ"
110    OUTPUT @Source;"SWEEP:TIME 200 MS"
120    OUTPUT @Source;"POW:LEV 5 DBM;:INIT:CONT ON"
130    OUTPUT @Source;"*OPC?"
140    ENTER @Source;Done
150   !
160   !SET UP POWER METER
170    OUTPUT @Meter;"PR"
180    OUTPUT @Meter;"FA"
190    OUTPUT @Meter;"TR0"
200   !
210   !ZERO POWER METER
220    OUTPUT @Source;"POW:STAT OFF"
230    Zero_meter(@Meter,@Source,Error_flag)
240    IF Error_flag THEN
250      BEEP
260      CLEAR SCREEN
270      PRINT "ERROR:METER DID NOT COMPLETE ZEROING OPERATION!"
280    ELSE
290   !
300   !SET UP CORRECTION FREQUENCIES IN USER FLATNESS CORRECTION TABLE
310     !OUTPUT @Source;"CORR:FLAT  ";
320      Start_freq=2
330      Stop_freq=20
340      Increment=1
350      N=(((Stop_freq-Start_freq)/Increment)+1)
```

```
360     Freq=Start_freq
370     FOR I=1 TO N
380     A$=A$&VAL$(Freq)&"GHZ,Odb,"
390       Freq=Freq+Increment
400       NEXT I
410       B=LEN(A$)
420       B=B-1
430       B$=A$[1,B]
440       OUTPUT @Source;"CORR:FLAT ";B$
450   ! OUTPUT @Source;"POW:STAT ON"
460   !
470   !ENTER DATA IN USER CORRECTION TABLE
480       OUTPUT @Source;"CAL:PMET:FLAT:INIT? USER"
490       ENTER @Source;Freq
500       WHILE Freq>0
510         Power=FNRead_meter(@Meter,Freq)
520         OUTPUT @Source;"CAL:PMET:FLAT:NEXT? ";VAL$(Power);"DBM"
530         ENTER @Source;Freq
540       END WHILE
550     END IF
560     END
570   !
580     SUB Zero_meter(@Meter,@Source,INTEGER Error_flag)
590     OUTPUT @Source;"Pow:stat off"
600       OUTPUT @Meter;"CS"
610       OUTPUT @Meter;"ZE"
620       Max_attempts=30
630       Attempts=0
640       Zeroing=1590
650       Finished=0
660       WHILE Zeroing AND NOT Finished
670         Attempts=Attempts+1
680         Meter_stat=SPOLL(@Meter)
690         IF Attrmpts>Max_attempts THEN Zeroing=0
700         IF BIT(Meter_stat,1) THEN Finished=1
710         WAIT 1
720       END WHILE
730     OUTPUT @Source;"Pow:stat on"
740       IF NOT Zeroing THEN
750         Error_flag=1
760       ELSE
770         Error_flag=0
780       END IF
790     SUBEND
800   !
810     DEF FNRead_meter(@Meter,Freq)
820       OUTPUT @Meter;"SEOEN"
830       Freq$=VAL$(Freq)
840       OUTPUT @Meter;"FR"&Freq$&"GZ"
850       OUTPUT @Meter;"TR2"
860       ENTER @Meter;Power$
```

```
870     P0=VAL(Power$)
880     Flips=0
890     Slope=0
900     REPEAT
910       OUTPUT @Meter;"TR2"
920       ENTER @Meter;Power$
930       P1=VAL(Power$)
940       Slope2=SGN(P0-P1)
950       IF Slope2Slope THEN
960         Flips=Flips+1
970         Slope2=Slope
980       ELSE
990         IF Slope2=0 THEN Flips=Flips+.2
1000      END IF
1010      P0=P1
1020    UNTIL Flips>=3
1030    Power=(P0+P1)/2
1040    RETURN Power
1050  FNEND
```

Programming the
Status System

In This Subsection
This subsection discusses the structure of the status system used in SCPI instruments, and explains how to program status registers. An important feature of SCPI instruments is that they all implement status registers the same way. The status system is explained in the following paragraphs:

General Status Register Model
These paragraphs explain the way that status registers are structured in SCPI instruments. It also contains an example of how bits in the various registers change with different input conditions.

Required Status Groups
These paragraphs describe the minimum required status registers present in SCPI instruments. These status registers cover the most frequently used functions.

General Status Register Model

The generalized status register model shown in Figure 1-33 is the building block of the SCPI status system. This model consists of a condition register, a transition filter, an event register and an enable register. A set of these registers is called a *status group*.
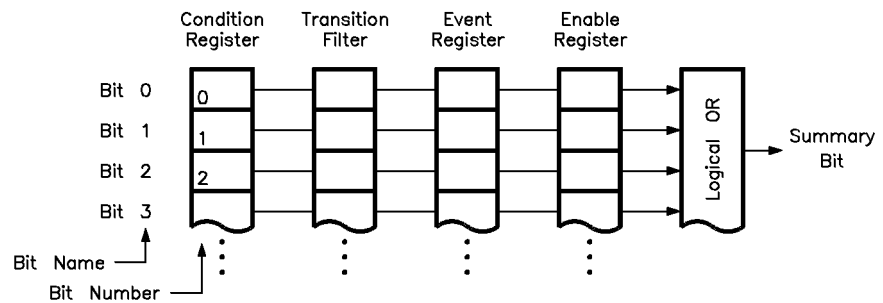
Figure 1-33. Generalized Status Register Model

When a status group is implemented in an instrument, it always contains all of the component registers. However, there is *not* always a corresponding command to read or write to every register.

Condition Register

The *condition register* continuously monitors the hardware and firmware status of the instrument. There is no latching or buffering for this register, it is updated in real time. Condition registers are read-only.

There may or may not be a command to read a particular condition register.

Transition Filter

The *transition filter* specifies which types of bit state changes in the condition register will set corresponding bits in the event register. Transition filter bits may be set for positive transitions (PTR), negative transitions (NTR), or both. Positive means a condition bit changes from 0 to 1. Negative means a condition bit changes from 1 to 0. Transition filters are read-write. Transition filters are unaffected by *CLS (clear status) or queries. They are set to instrument dependent values at power on and after *RST.

Event Register

The *event register* latches transition events from the condition register, as specified by the transition filter. Bits in the event register are latched, and once set they remain set until cleared by a query or a *CLS (clear status). There is no buffering, so while an event bit is set, subsequent events corresponding to that bit are ignored. Event registers are read-only.

Enable Register

The *enable register* specifies the bits in the event register that can generate a summary bit. The instrument logically ANDs corresponding bits in the event and enable registers, and ORs all the resulting bits to obtain a summary bit. Summary bits are in turn recorded in the Status Byte. Enable registers are read-write. Querying an enable register does not affect it. There is always a command to read and write to the enable register of a particular status group.

An Example Sequence

Figure 1-34 illustrates the response of a single bit position in a typical status group for various settings. The changing state of the condition in question is shown at the bottom of the figure. A small binary table shows the state of the chosen bit in each status register at the selected times T1 to T5.
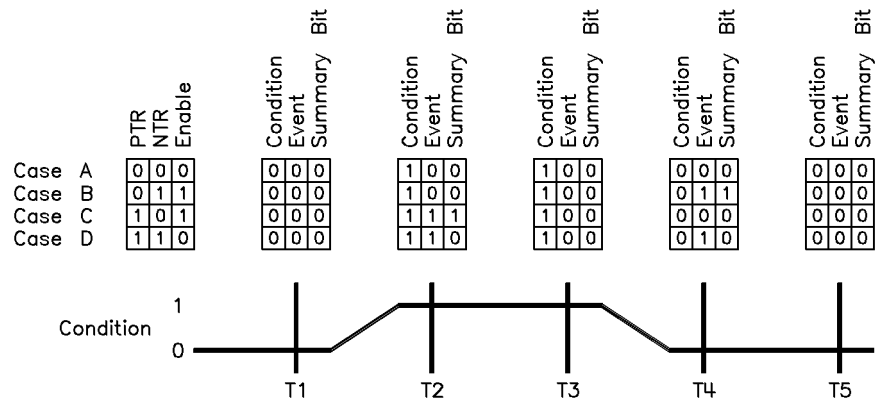
Figure 1-34. Typical Status Register Bit Changes

Programming the Trigger System

In This Subsection   This subsection discusses the layered trigger model used in SCPI instruments. It also outlines some commonly encountered trigger configurations and programming methods. Trigger system topics are explained in the following paragraphs:

Generalized Trigger Model   These paragraphs explain the structure and components of the layered trigger model used in all SCPI instruments.

Common Trigger Configurations   These paragraphs explain the INIT and TRIG configurations implemented in the swept CW generator.

Trigger Command Definitions   These paragraphs provide condensed definitions for the keywords used in this subsection.

Understanding trigger systems requires more technical expertise than most other topics covered in this section. If you find this subsection difficult, keep in mind that you do not have to program the trigger system to make measurements or output signals. Using `MEASure`, `READ`, or `INITiate`, you can avoid having to learn the information in this subsection.

Generalized Trigger Model

Overview

An instrument trigger system synchronizes instrument actions with specified events. An instrument action may be to make a measurement or source an output signal. The events used to synchronize these actions include software trigger commands, changing signal levels, and pulses on BNC connectors. The trigger system also lets you specify the number of times to repeat certain actions, and delays between actions.

Figure 1-35 shows a simplified view of the generalized SCPI trigger model. Instruments may implement some or all of this model to accommodate varying needs. Each unshaded block in Figure 1-35 represents a particular *trigger state*. The generalized trigger model allows an arbitrary number of event-detection states. Note that there can be two paths into a state and two paths out of a state. These are called the downward entrance and exit, and the upward entrance and exit. *Upward* means moving towards the idle state and *downward* means moving towards instrument actions.

An instrument moves between adjacent states, depending on its internal conditions and the commands that you send. When you first turn on power to an instrument, it is in the idle state. You can force the instrument to the idle state using :ABORt or *RST. The initiate and event detection trigger states are essentially a list of conditions that must be satisfied to reach the adjacent states. The sequence operation state signals the instrument hardware to take some action, and listens for a signal that the action has been taken.
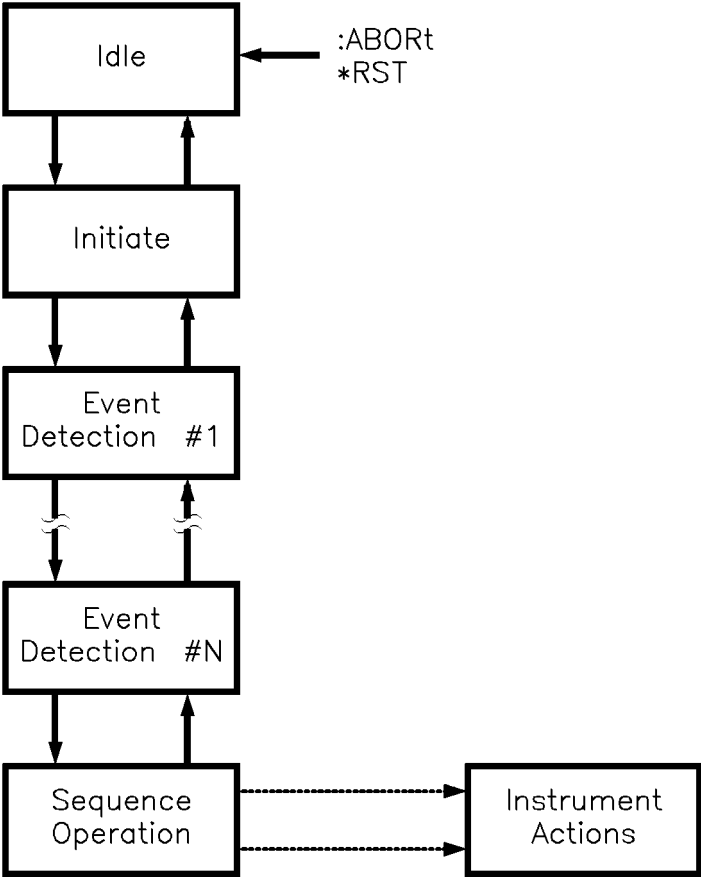
Figure 1-35. Generalized Trigger Model

Details of Trigger States

These paragraphs use flow charts to explain the decision making rules inside each trigger state. These rules govern how the instrument moves between adjacent states. Some of the flow charts reference commands that have not been discussed yet. These commands are explained later in this subsection. Keep in mind that this explanation covers the most general case. Your particular instrument may not implement all of the commands discussed here.

Inside the Idle State. Figure 1-36 illustrates the operation of the *idle* state.
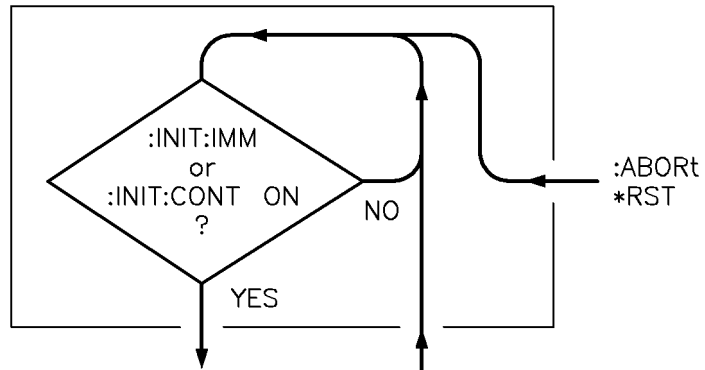
Figure 1-36. Inside the Idle State

Turning power on, or sending *RST or :ABORT forces the trigger system to the idle state. The trigger system remains in the idle state until it is initiated by INITiate:IMMediate or INITiate:CONTinuous ON. Once one of these conditions is satisfied, the trigger system exits downward to the *initiate* state. Note that *RST sets INITiate:CONTinuous OFF.

Whenever the trigger system leaves the idle state, it sets the instrument's Operation Pending Flag. Returning to idle clears the flag. The *Operation Pending Flag* is a special bit inside the instrument that can affect how the instrument responds to certain commands. You need to know this fact when using *OPC, *OPC?, *WAI, and other commands.

Inside the Initiate State. Figure 1-37 illustrates the operation of the *initiate* state.
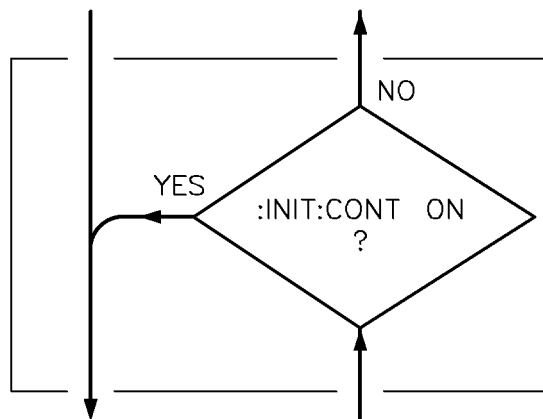
Figure 1-37. Inside the Initiate State

If the trigger system is on a downward path, it travels directly through the initiate state without restrictions. If the trigger system

is on an upward path, and `INITiate:CONTinuous` is `ON`, it exits downward to an event-detection state. If the trigger system is on an upward path and `INITiate:CONTinuous` is `OFF`, it exits upward to the idle state.

Inside Event Detection States. Figure 1-38 illustrates the operation of an arbitrary event detection state named `<state_name>`. Typical `<state_names>`are `TRIGger, ARM, STARt,` and `STOP`.

Normal downward execution is controlled by the source command.

SOURce

The `:<state_name>:SOURce` command specifies which particular input can generate the event required to continue the downward path. If the source chosen is a non-analog signal, such as `IMMediate`, `BUS`, or `TIMer`, no further qualifications are required to generate an event. If, however, an `INTernal` or `EXTernal` analog signal is chosen, additional qualifications may apply. You specify these additional qualifications using appropriate `LEVel`, `SLOPe`, and `HYSTeresis` commands. Sending `*RST` sets the `SOURce` to `IMMediate`.

The downward path also provides a command to override normal operation.

IMMediate

The `:<state_name>:IMMediate` command bypasses event detection, `ECOunt`, and `DELay` qualifications one time. The upward path through the event detection state contains only one condition. A `:<state_name>:COUNt` command sets the number of times the trigger system must successfully exit that event detection state on a downward path. If this condition is satisfied, the trigger system exits upward.
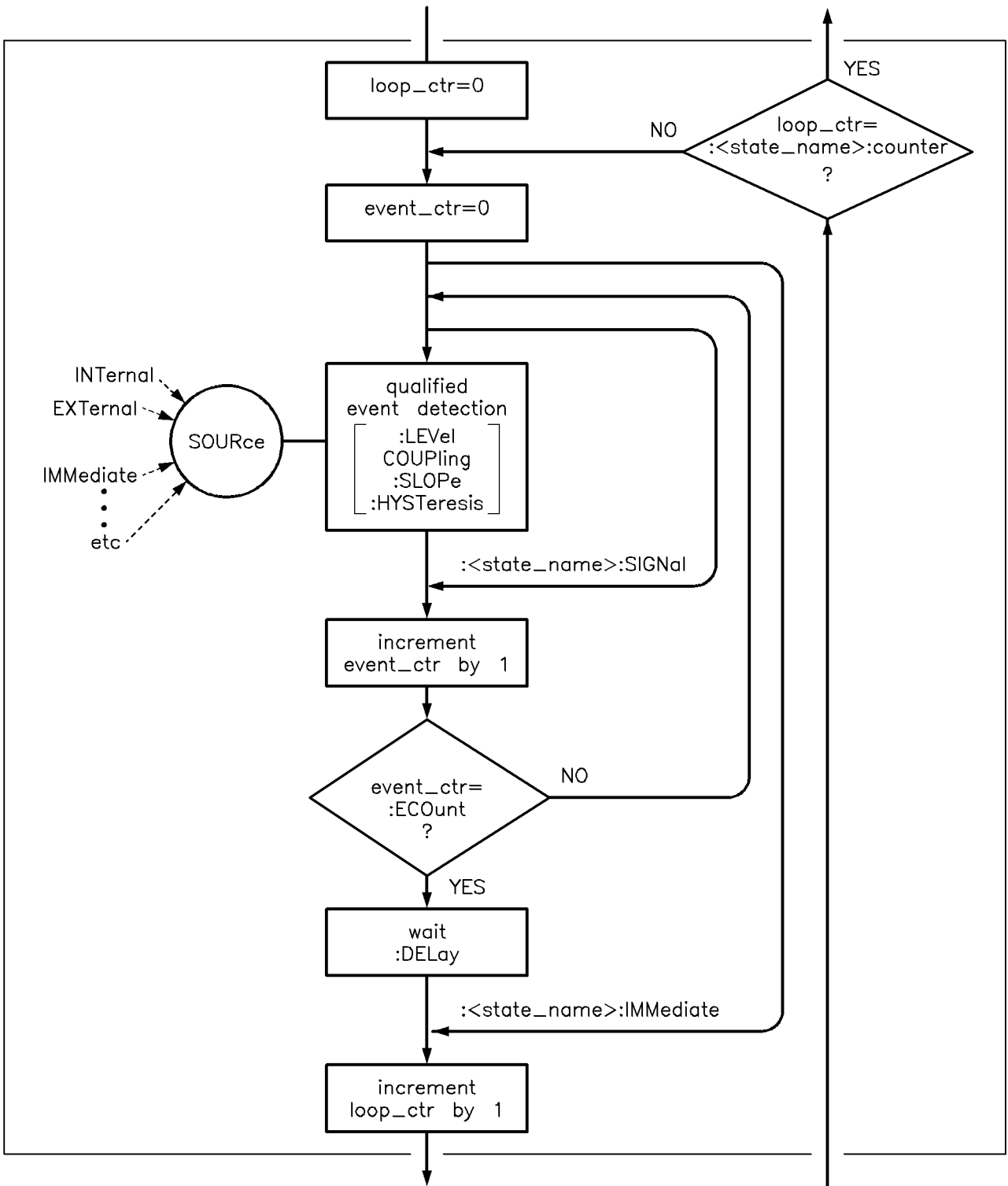
Figure 1-38. Inside an Event Detection State

Inside the Sequence Operation State. Figure 1-39 illustrates the operation of the sequence operation state.

The downward entrance to the Sequence Operation State signals that some instrument dependent action should begin at once. An upward exit is not allowed until the instrument signals that its action is complete. Note that complete can be defined differently for different instruments. For example, consider an instrument that can sweep a range of frequencies starting with f_1 and ending with f_2. The action-complete signal can be defined to coincide with the output of either f_1 or f_2.
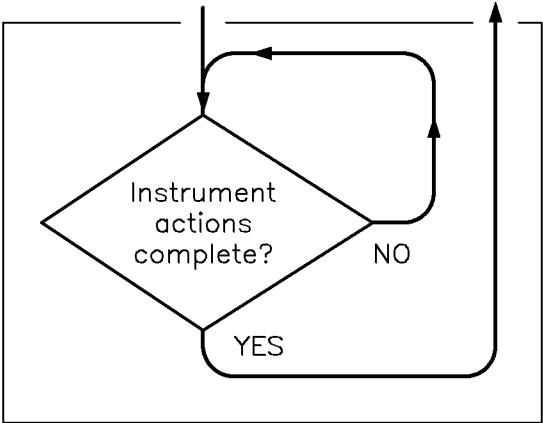
Figure 1-39. Inside the Sequence Operation State

Common Trigger Configurations

In the previous paragraphs, you learned about the basic building blocks allowed in a SCPI trigger system. Generally, an instrument implements only a portion of the trigger features available. These paragraphs discuss the simplest configurations: INIT and TRIG.

The INIT Configuration

The *INIT* configuration is the simplest possible trigger configuration. It uses no event detection states, and requires only two subsystems for programming, `INITiate` and `ABORt`. All SCPI instruments implement these two subsystems.
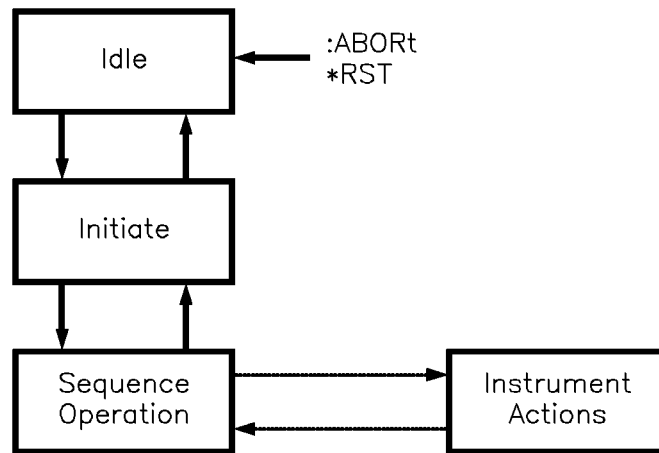
Figure 1-40. The INIT Trigger Configuration

Command	Parameters	Parameter Type
:ABORt		
:INITiate		
[:IMMediate]		
:CONTinuous	*state*	Boolean

Example commands using the INIT trigger configuration:

`:ABORt`	*abort operations, go to idle*
`:INIT:IMM`	*execute one sequence operation*
`:INIT:CONT ON`	*execute sequence operations continuously*
`:INIT:CONT OFF`	*stop sequence operations after the current one is complete*

The TRIG Configuration

Instruments using the *TRIG* configuration include one event
detection state named TRIG, and a corresponding TRIGger
subsystem. And, all SCPI instruments implement the required
INITiate and ABORt subsystems.
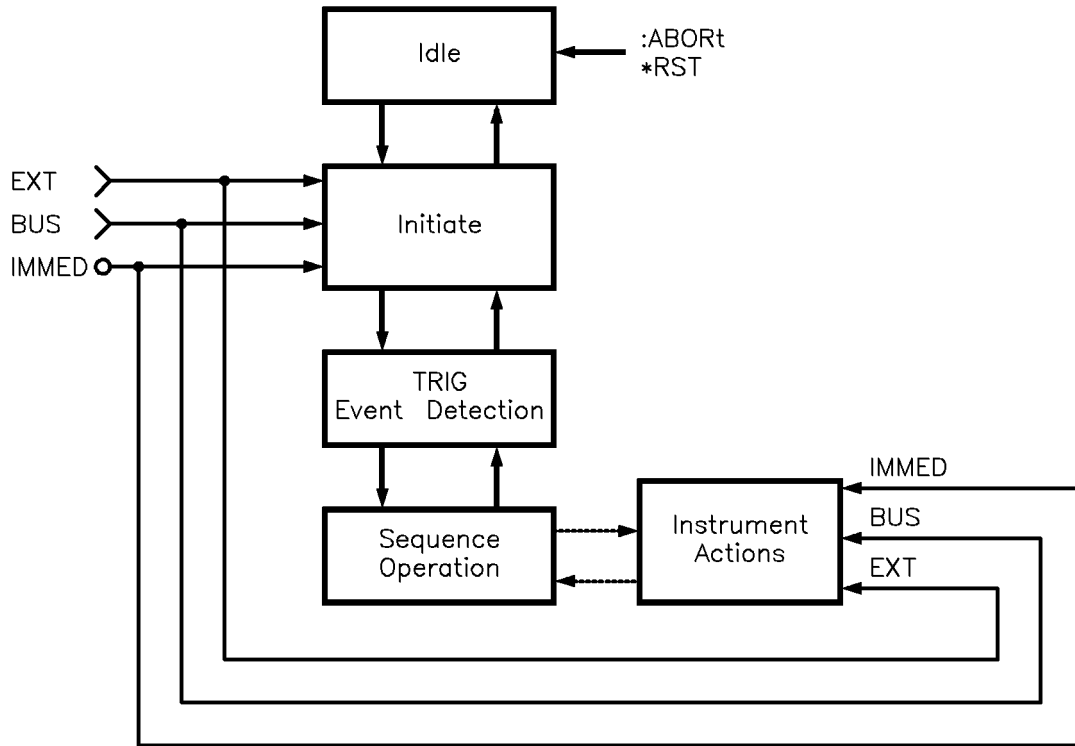
Figure 1-41. The TRIG Trigger Configuration

Description of Triggering in the 8360 L-Series Swept CW Generators

The 8360 L-Series Swept CW Generators follow the SCPI model of triggering. It is a layered model with the structure shown in Figure 1-42.
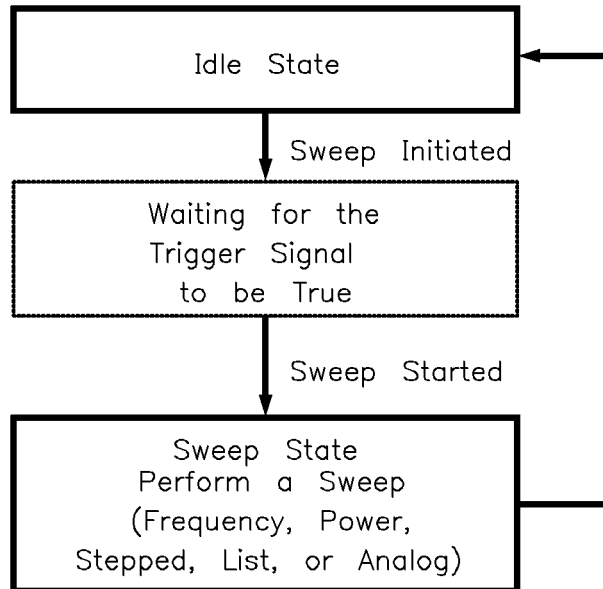
Figure 1-42. 8360 Simplified Trigger Model

The process of sweeping involves all 3 of these states. The IDLE state is where the sweep begins. The IDLE state is left when the sweep is initiated. This can happen on a continuous basis (`INIT:CONT ON`) or on a demand basis (`INIT:CONT OFF`). The functions of continuous and single sweeps are handled by this command. When the `INIT:CONT ON` command is given, the sweep is continuously re-initiated. When in the `OFF` state, the sweep is initiated with the `INIT:IMMediate` command.

Once initiated, the *wait for trigger* state is entered. Here, the trigger signal selected by the `TRIG:SOURce` command is examined until a TRUE condition is detected. These trigger signals are:

IMMediate   This signal is always TRUE.
EXTernal   This is the external trigger input jack. A positive transition on this jack constitutes a TRUE signal.
BUS   This signal is the GPIB <get> (Group Execute Trigger) message or a *TRG command.

When a TRUE signal is found, the sweep is actually started.

The act of producing the sweep in some cases involves the use of trigger signals. For example, the stepped and list sweeps have modes that allow triggering for point-to-point advancement through the sweep. These trigger signals are selected by individual `TRIG:SOURce` commands in the appropriate subsystems (i.e. LIST:TRIGger:SOURce and SWEep:TRIGger:SOURce). The definition of these signals in the swept CW generator cause the sweep

to jump to the next point when the signal becomes TRUE, therefore the first point in the list or stepped sweeps is produced immediately upon starting the sweep. Receiving a trigger signal at the last point causes the IDLE state to be re-entered. Analog sweeps do not use the trigger signals during the sweep (although the trigger signals are needed to start the sweep as described).

The `ABORt` command resets any sweep in progress and immediately returns the instrument to the IDLE state.

The `*WAI`, `*OPC` and `*OPC?` commands indicate a complete operation at the end of the sweep upon re-entry into the IDLE state.

Advanced Trigger Configurations

Because the SCPI layered trigger model is expandable, many more complex trigger configurations are possible.

Trigger Keyword Definitions

The following paragraphs contain condensed definitions of the keywords used in the command tables. Many of the commands in trigger related subsystems are *event commands*. Remember that event commands cannot be queried. Similarly, event commands have no related `*RST` actions or settings. Event commands cause a particular action to take place inside the swept CW generator.

ABORt

The `ABORt` command forces the trigger system to the idle state. Any measurement or output sequence in process is aborted as quickly as possible. *ABORt* does not alter the settings programmed by other commands, unlike `*RST`. *ABORt* is a root level event command and cannot be queried.

IMMediate

The `IMMediate` command provides a one-time override of the normal downward path in an event-detection state. The instrument must be in the specified event detection state when `IMMediate` is received, or an error is generated and the command has no effect. For example, the instrument must be in the TRIG state for `:TRIGger:IMMediate` to work properly. If the instrument is in the idle state, the command has no effect, and an error would be generated. `IMMediate` is an event command and cannot be queried.

ODELay

The `ODELay` command specifies the time between the source settling and the time the trigger out signal is sent. Specifying `:TRIGger:ODELay <num>{time suffix}` instructs the swept CW generator to set the specified time as the delay necessary to ensure proper settling. Sending `*RST` sets `ODELay` to an instrument dependent value, usually zero.

SOURce

The SOURce command selects the trigger source for an event-detection state. Only one source can be specified at a time, and all others are ignored. Sending *RST sets SOURce to IMMediate. The most commonly used sources are:

■ BUS

The event detector is satisfied by either Group Execute Trigger(<GET>) or a *TRG command. <GET> is a low level GPIB message that can be sent using the TRIGGER command in HP BASIC.

■ EXTernal

An external signal connector is selected as the source.

■ IMMediate

Qualified events are generated automatically. There is no waiting for a qualified event.

Related Documents

The International Institute of Electrical and Electronics Engineers.

IEEE Standard 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation. New York, NY, 1987.

This standard defines the technical details required to design and build an GPIB interface (IEEE 488.1). This standard contains electrical specifications and information on protocol that is beyond the needs of most programmers. However, it can be useful to clarify formal definitions of certain terms used in related documents.

IEEE Standard 488.2-1987, IEEE Standard Codes, Formats, Protocols, and Common Commands For Use with ANSI/IEEE Std 488.1-1987. New York, NY, 1987.

This document describes the underlying message formats and data types used in SCPI. It is intended more for instrument firmware engineers than for instrument user/programmers. However, you may find it useful if you need to know the precise definition of certain message formats, data types, or common commands.

To obtain a copy of either of these documents, write to:

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street
New York, NY 10017
USA

Agilent

BASIC 5.0/5.1 Interfacing Techniques. Vol. 2, Specific Interfaces, 1987.

This HP BASIC manual contains a good non-technical description of the GPIB (IEEE 488.1) interface in chapter 12, "The GPIB Interface". Subsequent revisions of HP BASIC may use a slightly different title for this manual or chapter. This manual is the best reference on instrument I/O for HP BASIC programmers.

Agilent. *Tutorial Description of the General Purpose Interface Bus, 1987.*

This book provides a thorough overview of GPIB basics for the GPIB system designer, programmer, or user.

To obtain a copy of either of these documents, contact the Agilent representative listed in your telephone directory.

2

Operating and Programming Reference

How To Use This Chapter

The operating and programming functions of the synthesizer are listed in alphabetical order. Each entry has a complete description, complete programming codes, and a cross reference to the main function group and respective menu map. Cross references to operating and programming examples located in Chapter 1, "Getting Started", are also given.

Error messages, instrument specifications, and menu maps are located in their own tabbed sections. Menu maps can be folded out and viewed at the same time as the alphabetical entry. See the illustration below.
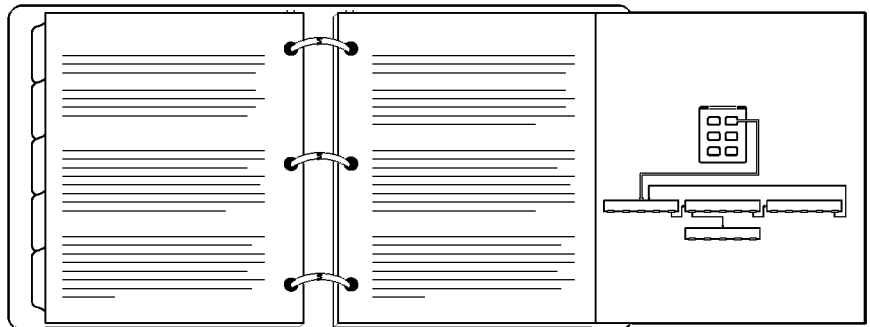
For operator's service information, see the Chapter 4, "Operator's Check and Routine Maintenance". The operator accessible (SERVICE) softkeys are described in that chapter. Complete (SERVICE) menu and softkey information is provided in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide*.

Programming Language Comparison

Table 3-9 cross-references the actions that the instrument can perform with the programming commands that will prompt those actions.

2a

Error Messages

Introduction

This section lists the error messages that may be displayed by the front panel or transmitted by the swept CW generator over the interface bus. Each error message is accompanied by an explanation, and suggestions are provided to help solve the problem. Where applicable, references are given to related chapters of the user's and service guides.

A list of the messages displayed on the message line of the swept CW generator are included in separate list because they are considered status messages rather than error messages.

WARNING

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

Front Panel Error Messages in Alphabetical Order

ABILITY TO SAVE A RECALL REGISTER IS LOCKED OUT: This message occurs when the save/recall registers have been disabled by the save lock feature or by a calibration constant.

ADDR ERROR EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

Auto Track Failed! Cal Not Updated: occurs when auto track has been initiated and for some reason has failed. Refer to Chapter 4 and follow the local operator's check procedures.

BUS ERROR EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

DEFAULTING LANGUAGE: This error message is displayed in conjunction with one of the following messages.

■ Invalid Language set on rear panel switch. The GPIB/Language switch located on the rear panel has been set to an invalid programming language selection. The programming language is defaulted to the previous setting. Check the rear panel switch. See Chapter 3 for information on language selection.

■ OPTION NOT INSTALLED. The language selected and the corresponding firmware/hardware necessary to run that language is not present in the swept CW generator. See Chapter 3 for information on language selection.

DISPLAY IS NOT RESPONDING: Can appear on the front panel emulator if the internal processor can not communicate with the display properly. This error indicates a display failure or a display connector problem.

DIVIDE BY ZERO EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

EEROM FAILED, LOST CAL: This error indicates that the swept CW generator has lost its calibration constants and may not meet specifications. Refer to Chapter 4 and follow the local operator's check procedures. If you are a qualified service technician and this failure occurs, read the Calibration Constants section in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide*.

EEROM Failed !!: This error will only occur if the service adjustment menu is accessed. Specifically, an attempt has been made to write to a test patch and EEROM failed to store the data.

ERROR: CALIBRATION FAILED !!: This error will only occur if the service adjustment menu is accessed. Specifically, an A14 sweep ramp calibration has been attempted and failed. Run the sweep ramp selftest. Refer to the "MENU MAPS" chapter in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide*.

ERROR - Must first enter correction freq: This error occurs when a correction point does not have its corresponding frequency entered first. Refer to "Creating and Applying the User Flatness Correction Array" in Chapter 1.

ERROR: Must first enter a List Frequency !!: This error occurs when a dwell or offset value does not have its corresponding frequency entered first. Refer to "Creating and Applying the User Flatness Correction Array" in Chapter 1.

ERROR: Power Search Failed !!: This error occurs when the ALC is in the ALC search mode and is unable to level to the desired power level. Refer to Chapter 4 and follow the local operator's check procedures.

ERROR: Start must be < Stop !!: This error occurs in association with the frequency list, auto fill, feature. If the start frequency entered is greater than the stop frequency, you will see this error. Correct by entering a start frequency less than the stop frequency.

ERROR: Stop must be > Start !!: This error occurs in association with the frequency list, auto fill, feature. If the stop frequency

entered is less than the stop frequency you will see this error. Correct by entering a stop frequency greater than the start frequency.

Error in Test Patch entry !!: This error will only occur if the service adjustment menu is accessed. Specifically, one of three entries has been attempted.

■ An invalid test patch number.

■ An invalid test patch data point.

■ An invalid parameter of the test patch specification.

Correct by entering a valid parameter.

Freq step must be >= 0 !!: This error occurs in association with the user power flatness menu, auto fill increment, feature. If the increment value entered is less than zero you will see this error. Correct by entering an increment value greater than zero.

FUNCTION LOCKED OUT: This error will only occur if the service adjustment menu is accessed. Specifically, the calibration constant that inhibits access to certain functions has been set. If you need access to the function, contact a qualified service technician.

GPIB SYNTAX ERROR: This indicates that an analyzer language syntax error has been encountered. Review the program to find the syntax error.

ILLEGAL INSTRUCTION EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

INPUT BUFFER EMPTY: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

INPUT BUFFER FULL: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

INVALID LANGUAGE ON REAR PANEL SWITCH: The GPIB/Language switch located on the rear panel has been set to an invalid programming language selection. Check the rear panel switch. See Chapter 3 for information on language selection.

Invalid Save/Recall Register!: There are two cases when this error message is possible.

■ If a save function is attempted to either register 0 or 9.

■ If a recall function is attempted on register 9.

Correct by selecting a valid save/recall register.

LINT1 INTERRUPT: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

LINT2 INTERRUPT: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

LINT6 INTERRUPT: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

Number of pts must be >= 2 !!:   This error occurs in association with the user power flatness, auto fill number of points, feature. If the number of points requested is less than two, you will see this error message. Correct by entering number of points greater than or equal to two.

OPTION NOT INSTALLED: This error occurs when the GPIB language switch is set to a configuration requiring a certain firmware/hardware combination to be present in the swept CW generator. See Chapter 3 for information on language selection and see "Specifications" for information on option available.

PRIV VIOLATION EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

RECALL REGISTERS LOST: This message can appear in association with the security menu feature, memory clear. Also, a weak, dead, or disconnected internal battery can cause this message. Refer to Chapter 4 for instructions on contacting a qualified service technician.

Selftest REQUIRES system interface OFF: This error message indicates that the swept CW generator is connected to a network analyzer and can not run selftest. Correct by disconnecting the system interface cable from the swept CW generator.

SPURIOUS INTERRUPT: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

SYSTEM CONTROLLER ON BUS: This error message is generated when an external controller is active on the GPIB and the swept CW generator has attempted to act as the controller. Disconnect the GPIB interface or return the swept CW generator to LOCAL operation and repeat the request.

TOO MANY CORRECTION PTS REQUESTED: This error occurs in association with the user power flatness menu. The maximum number of correction points has been reached or the addition of the points requested will exceed the maximum. The maximum number of points available is 801.

TOO MANY LIST POINTS REQUESTED: This error occurs in association with the frequency list menu. The maximum number of list points has been reached or the addition of the points requested will exceed the maximum. The maximum number of points available is 801.

TRACE EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

TRAP0 EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

TRAP3 EXCEPTION: This can only be caused by an internal processor error. Refer to Chapter 4 for instructions on contacting a qualified service technician.

Too many test patches !!: This error will only occur if the service adjustment menu is accessed. Specifically, the maximum number of test patches has been reached and can accept no more.

WAIT—SAVING CALIBRATION: This error will only occur if the service adjustment menu is accessed. Specifically, a save calibration has been initiated and not yet completed when another request is made.

WRONG PASSWORD: This error occurs when the service adjustment menu password is entered incorrectly or the wrong password has been used. Qualified service technicians, refer to "ADJUSTMENTS," in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide* for more information.

SCPI Error Messages in Numerical Order

Swept CW Generator Specific SCPI Error Messages

0, No Error: This message indicates that the device has no errors and is currently ready to perform the operations for which it is designed.

1, FUNCTION DISABLED: The particular function invoked has been disabled by a calibration constant. If you need access to the function, contact a qualified service technician.

2, Wrong password: This error occurs when the service adjustment menu password is entered incorrectly or the wrong password has been used. Qualified service technicians, refer to "ADJUSTMENTS," in the *Agilent Technologies 8360 B-Series Swept Signal Generator/ 8360 L-Series Swept CW Generator Service Guide* for more information.

4, Unable to store data in EEROM

5, Not allowed to change address

6, Switch on Processor Board is Set: This error occurs when a service adjustment menu password can not be set because the override switch on the processor is set. Qualified service technicians, refer to "ADJUSTMENTS," in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide* for more information.

Universal SCPI Error Messages

Error Messages From −499 To −400

These error messages indicate that the Output Queue Control of the swept CW generator has detected a problem with the message exchange protocol. This type of error sets the Query Error Bit (bit 2) in the Event Status Register. One of the following has occurred:

- An attempt has been made to read data from the Output Queue when no output is present or is pending.

- Data in the Output Queue has been lost.

Events that generate Query Errors do not generate Command Errors, Execution Errors, or Device-specific Errors.

−440, Query UNTERMINATED after indefinite res
−430, Query DEADLOCKED
−430, Query DEADLOCKED;Output Buffer Full
−420, Query UNTERMINATED
−420, Query UNTERMINATED;Nothing To Say
−410, Query INTERRUPTED

Error Messages From −399 To −300

These error messages indicate that some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. This type of error sets the Device-specific Error (bit 3) in the Event Status Register. Events that generate Device-specific Errors do not generate Command Errors, Execution Errors, or Query Errors.

−350, Too many errors and also −32768
−330, Self-test failed
−330, Self-test failed;Power-On Tests
−313, Calibration memory lost;Defaulted

Error Messages From −299 To −200

These error messages indicate that an error has been detected by the swept CW generator's Execution Control Block. An error of this type sets the Execution Error Bit (bit 4) in the Event Status Register. One of the following events has occurred:

- A data element following a header was evaluated by the swept CW generator as outside of its legal input range or is inconsistent with the swept CW generator's capability.

■ A valid program message can not be properly executed due to some instrument condition.

Execution Errors are reported by the swept CW generator after rounding and expression evaluation operations have taken place. Errors that generate Execution Errors do not generate Command Errors, Device-specific Errors, or Query Errors.

−240, Hardware error; Rear panel GPIB switch
−224, Illegal parameter value
−222, Data out of range;Expected 0-1
−222, Data out of range
−221, Settings conflict
−221, Settings conflict;List Arrays Invalid
−221, Settings conflict;Power And Level Mode
−221, Settings conflict;Power and attenuator
−221, Settings conflict;mm Module Mismatch
−220, Parameter error;Value not allowed
−213, Init ignored
−200, Execution error;No more room in EEROM
−200, Execution error;Option Not Installed

Error Messages From − 199 to − 100

These error messages indicate that a SCPI syntax error has been detected by the swept CW generator's parser. An error of this type sets the Command Error Bit (bit 5) in the Event Status Register. One of the following events has occurred:

■ A syntax error has been detected. Possible errors are: a data element that violates the device listening formats or whose type is unacceptable to the instrument.

■ A semantic error has been detected indicating that an unrecognized header was received.

■ A Group Execute Trigger (GET) was entered into the input buffer inside a SCPI program message.

Events that generate Command Errors do not generate Execution Errors, Device-specific Errors, or Query Errors.

−178, Expression data not allowed
−170, Expression error;Bad terminator
−161, Invalid block data;Bad terminator
−160, Block data error
−160, Block data error;Bad block type
−151, Invalid string data;Bad terminator
−144, Character data too long;>12 chars
−141, Invalid character data;Bad char in token
−138, Suffix not allowed
−131, Invalid suffix;This one not allowed
−123, Exponent too large;Decimal number
−123, Exponent too large;Numeric overflow
−122, RESERVED

−121, Invalid character in number
−120, Numeric data error;Bad format
−120, Numeric data error;Bad terminator
−113, Undefined Header;Query not allowed
−113, Undefined header;Bad mnemonic
−109, Missing parameter
−108, Parameter not allowed;Too many
−105, GET not allowed
−104, Data type error
−104, Data type error;Block not allowed
−104, Data type error;Char not allowed
−104, Data type error;Decimal not allowed
−104, Data type error;Non-dec not allowed
−104, Data type error;String not allowed
−103, Invalid separator

2b

Menu Maps

MENU SELECT

MOD	ALC
MARKER	USER CAL
SERVICE	PRIOR

.... Leveling Point .... more
•Intrnl ExtDet PwrMtr Module 1/3

.... Leveling Mode .... Coupling more
•Normal ALCoff Search Factor 2/3

ALC BW Pwr Mtr Module more
Menu Range Menu 3/3

... ALC Bandwidth Select ...
Low •High •Auto

.... Module Sense ....
•AUTO •Front Rear None

ALC MENU 1

FREQUENCY

CW START STOP CENTER SPAN MENU

... Up/Dn Size ... Freq Freq more
Swept CW Offset Mult 1/3

Zoom List Step Swp CW/CF more
Menu Menu Coupled 2/3

Module more
Menu 3/3

.... Module Sense ....
*AUTO *Front Rear None

.... Enter List .... Delete more
Freq Offset Dwell Menu 1/3

.... Auto Fill .... more
Start Stop # Pts Incr 2/3

...... Global ...... Pt Trig more
Offset Dwell Menu 3/3

All Current

.... List Mode Pt Trig ....
*Auto Bus Ext

Step Step Step Dwell more
Size Points Dwell Coupled 1/3

.... Step Swp Pt Trig .... more
*Auto Bus Ext 2/3

... Step Control ... more
*Master Slave 3/3

FREQUENCY MENU 2

MENU SELECT

MOD	ALC
MARKER	USER CAL
SERVICE	PRIOR

| Marker M1 | Marker M2 | M1--M2 Sweep | Start=M1 Stop=M2 | more 1/3 |

| Marker M3 | Marker M4 | Marker M5 | Center= Marker | more 2/3 |

| Delta Mkr Ref | Delta Marker | Markers All Off | Ampl Markers | more 3/3 |

| .... Delta Marker Reference .... | | | | |
| *M1 | M2 | M3 | M4 | M5 |

MARKER MENU **3**

MENU SELECT

MOD   ALC

MARKER   USER
             CAL

SERVICE   PRIOR

.... Pulse On/Off ....
Scalar

MODULATION   MENU **4**

POWER

○   ○

| POWER LEVEL | FLTNESS ON/OFF | RF ON/OFF | MENU |

Menu 1/3:

| Uncoupl Atten | Set Atten | Up/Dn Power | Power Slope | more 1/3 |

Tracking (from more 1/3):

| Tracking Menu | Power Offset | Fitness Menu | Power Sweep | more 2/3 |

more 3/3:

| Dblr Amp Menu | | | | more 3/3 |

Auto Track menu:

| Auto Track | .... Peak .... Always | RF .... Once | | |

Doubler Amp Mode:

| .... Doubler Amp Mode .... *AUTO | Amp On | Off | | |

Enter menu 1/3:

| ..... Enter ..... *Freq | Corr | Delete Menu | Clear Point | more 1/3 |

Auto Fill 2/3:

| .... Auto Fill .... Start | Stop | # Pts | Incr | more 2/3 |

Copy List 3/3:

| Copy List | Freq Follow | Mtr Meas Menu | CorPair Disable | more 3/3 |

Delete menu:

| .... Delete .... All | Undef | Current | | |

Measure Corr:

| .... Measure Corr .... All | Undef | Current | | |

POWER MENU **5**

MENU SELECT

MOD   ALC

MARKER   USER CAL

SERVICE   PRIOR

| Selftest (Full) | Fault Menu | Unlock Info | | more 1/2 |

| Fault Info1 | Fault Info2 | Fault Info3 | Clear Fault | |

SERVICE MENU 6

SWEEP

SWEEP TIME | SINGLE | CONT | MENU

Manual Sweep | .... Step | Sweep Mode List | .... *Ramp | more 1/3

SwpTime *Auto | ... Start *Auto | Sweep Bus | Trigger Ext ... | more 2/3

TrigOut Delay | StopSwp Menu | more 3/3

Step Size | Step Points | Step Dwell | Dwell Coupled | more 1/3

.... Step *Auto | Swp Pt Bus | Trig Ext .... | more 2/3

... Step Master | Control Slave ... | more 3/3

SWEEP MENU 7

SYSTEM

SAVE   RECALL

MENU

| HP-IB Menu | Altrnate Regs | Disp Status | UsrKey Clear | more 1/3 |

| UsrMenu Clear | Ref Osc Menu | Security Menu | Software Rev | more 2/3 |

| .. Preset *Factory | Mode User | .. Save Preset | User | Dim Display | more 3/3 |

| Adrs Menu | ... Programming Language ... *SCPI | Analyzr | CIIL |

| .... 10MHz Freq *Intrnl | Extrnl | Standard None | .... *Auto |

| Zero Freq | Save Lock | Clear Memory | Blank Display |

| 8360 Adrs | Meter Adrs | Printer Adrs |

MENU SELECT

MOD   ALC

MARKER   USER CAL

SERVICE   PRIOR

Full Usr Cal	Tracking Menu		Freq Cal Menu	more 1/2

Ext Det Cal				more 2/2

Auto Track	... Peak Always	RF ... Once		

.. Swp Span Cal .. Always Once				

USER CAL MENU **9**

2c

Specifications

This section lists the specifications for the Agilent 8360 L-Series Swept CW Generator. In a effort to improve these swept CW generators, Agilent Technologies has made changes to this product which are identified with changes in the serial number prefix.

To check if your swept CW generator specifications are the same as those listed in this section:

1. Locate your instrument model number and serial prefix number in the "Instrument History Changes" table in Chapter 5.
2. Check the right column of this table to determine whether any changes apply to your instrument's model number/serial prefix number combination.
3. If a change is listed, check this change to determine if specifications other than those listed in this section apply. The changes are included in Chapter 5.

Specifications describe warranted instrument performance over the 0 to +55 °C temperature range except as noted otherwise. Specifications apply after full user calibration and in coupled attenuator mode of operation (ALC level greater than −10 dBm). Supplemental characteristics, denoted typical or nominal, are intended to provide information useful in applying the instrument, but are non-warranted parameters.

Frequency

Range

Agilent 83623L: 10 MHz to 20 GHz High Power
Agilent 83630L: 10 MHz to 26.5 GHz
Agilent 83640L: 10 MHz to 40 GHz
Agilent 83650L: 10 MHz to 50 GHz

Resolution

Standard: 1 kHz
Option 008: 1 Hz

Frequency Bands (for CW signals)

Band	Frequency Range	n
0	10 MHz to < 2 GHz	1
1	2 GHz to < 7 GHz	1
2	7 GHz to < 13.5 GHz	2
3	13.5 GHz to < 20 GHz	3
4	20 GHz to < 26.5 GHz[1]	4
5	26.5 GHz to < 33.5 GHz[2]	6
6	33.5 GHz to < 38 GHz[3]	6
7	38 GHz to 50 GHz	8

1 This band is 20 GHz to < 25.5 GHz on the 83640L.

2 This band is 25.5 GHz to < 32 GHz on the 83640L.

3 This band is 32 GHz to < 40 GHz on the 83640L.

Frequency Modes:

CW and Manual Sweep

Accuracy: Same as time base

Switching Time
For Steps Within a Frequency Band:
15 ms + (step size/1 GHz) $\times$ 5 ms
Maximum, or Across Band Switch Points: 50 ms
Step or List Modes within a frequency band:
5 ms + (step size/1 GHz) $\times$ 5 ms[1]

1 Frequencies < 2 GHz, switching time = 6 ms + (step size/1 GHz) $\times$ 5 ms.

Synthesized Step Sweep

Accuracy: Same as time base
Minimum Step Size: Same as frequency resolution
Number of Points: 2 to 801
Switching Time: Same as CW
Dwell Time: 100 μs to 3.2 s

Synthesized List Mode

Accuracy: Same as time base
Minimum Step Size: Same as frequency resolution
Number of Points: 1 to 801
Switching Time: Same as CW
Dwell Time: 100 μs to 3.2 s

Ramp Sweep Mode

Accuracy[2] (sweep time $\geq$ 100 ms and $\leq$ 5 s):
Sweep Widths $>$ n x 10 MHz: Lesser of 1% of sweep width or n x
1 MHz + 0.1% of sweep width.
Sweep Time: 10 ms to 100 seconds, 300 MHz/ms maximum rate

Internal 10 MHz Time Base

Accuracy: Calibration $\pm$ Aging Rate $\pm$ Temperature Effects $\pm$ Line
Voltage Effects
Stability
Aging Rate: 5 x 10^{-10}/day, 1 x 10^{-7}/year
With Temperature: 1 x 10^{-10}/°C, typical
With Line Voltage: 5 x 10^{-10} for line voltage change of 10%, typical

RF Output

Output Power

Maximum Leveled[3]	Standard
83623L	+15
83630L	
Output Frequencies < 20 GHz	+13
Output Frequencies ≥ 20 GHz	+10
83640L	
Output Frequencies < 26.5 GHz	+10
Output Frequencies > 26.5 GHz	+6
83650L	
Output Frequencies < 26.5 GHz	+10
Output Frequencies ≥ 26.5 GHz and < 40 GHz	+5
Output Frequencies ≥ 40 GHz	+2.5

With attenuator (Option 001): Minimum settable output power is −110 dBm. Maximum leveled output power is reduced by 1.5 dB to 20 GHz, 2.0 dB above 20 GHz, and 2.5 dB above 40 GHz.

Minimum Settable
Standard: −20 dBm   Option 001: −110 dBm
Resolution: 0.02 dB
Switching Time: (without attenuator change): 10 ms, typical
Temperature Stability: 0.01 dB/°C, typical

Typical Maxium Available Power

uo71I
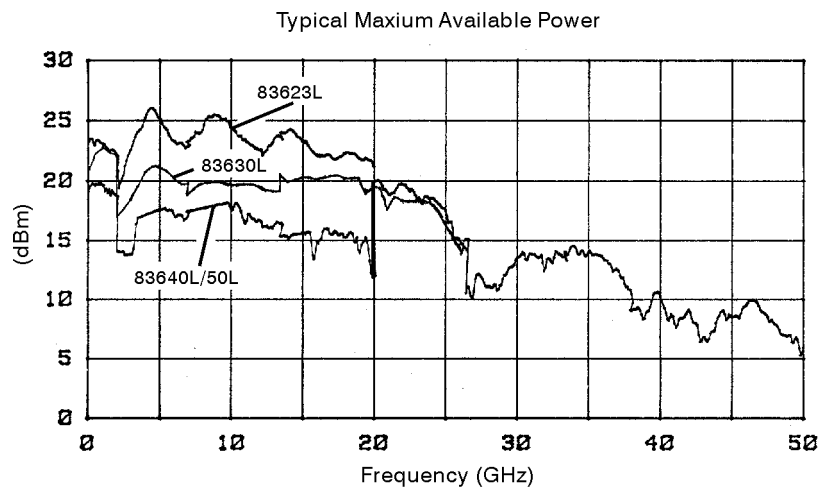
[3] Specification applies over the 0 to 35 °C temperature range (0 to 25 °C for output frequencies > 20 GHz). Maximum leveled output power over the 35 to 55 °C temperature range typically degrades by less than 2 dB.

Accuracy (dB)[4]

Specifications apply in CW, step, list, manual sweep, and ramp sweep modes of operation.

Frequency (GHz)

Power	< 2.0	≥ 2.0 and ≤ 20	> 2.0 and ≤ 40	> 40
> +10 dBm	±1.2	±1.3		
> −10 dBm[5]	±0.6	±0.7	±0.9	±1.7
> −60 dBm	±0.9	±1.0	±1.2	±2.0
≤ −60 dBm	±1.4	±1.5	±1.7	±2.5

Flatness (dB)

Specifications apply in CW, step, list, manual sweep, and ramp sweep modes of operation.

Frequency (GHz)

Power	< 2.0	≥ 2.0 and ≤ 20	> 2.0 and ≤ 40	> 40
> +10 dBm	±0.9	±1.0		
> −10 dBm[5]	±0.5	±0.6	±0.8	±1.5
> −60 dBm	±0.7	±0.8	±1.0	±1.7
≤ −60 dBm	±1.1	±1.2	±1.4	±2.1

[4] Specification applies over the 15 to 35 °C temperature range for output frequencies < 50 MHz.

[5] Specification applies over the 15 to 35 °C temperature range and are degraded 0.3 dB outside of that range.

Typical 83650B/L Power Flatness
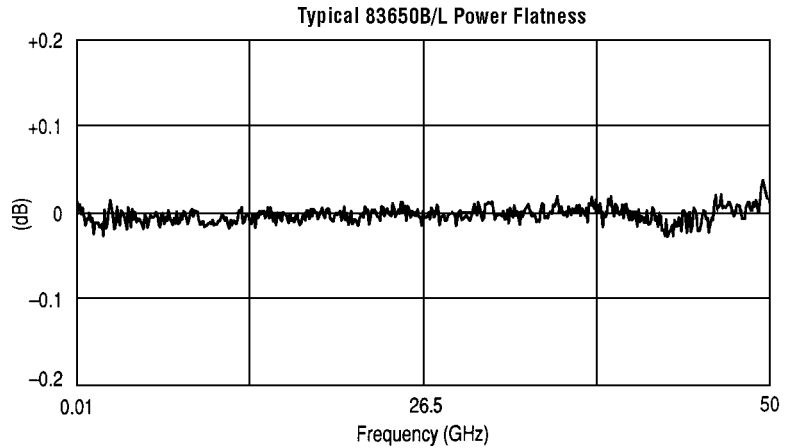
Analog Power Sweep Range: −20 dBm to maximum available power, can be offset using step attenuator.

External Leveling Range
At External HP/Agilent 33330D/E Detector: −36 to +4 dBm
At External Leveling Input: −200 μV to −0.5 volts

Bandwidth
External Detector Mode: 10 or 100 kHz (sweep speed and modulation mode dependent), nominal
Power Meter Mode: 0.7 Hz, nominal

Source Match (internally leveled), typical[6]
< 20 GHz 1.6:1 SWR
< 40 GHz 1.8:1 SWR
< 50 GHz 2.0:1 SWR

[6] Typically 2.0:1 SWR at frequencies below 50 MHz.

Typical ALC Linearity
(Frequencies≤ 20GHz)

Linearity(dB)

+0.5

0

−0.5

−20   −10   0   +10   +20

ALC Level(dBm)
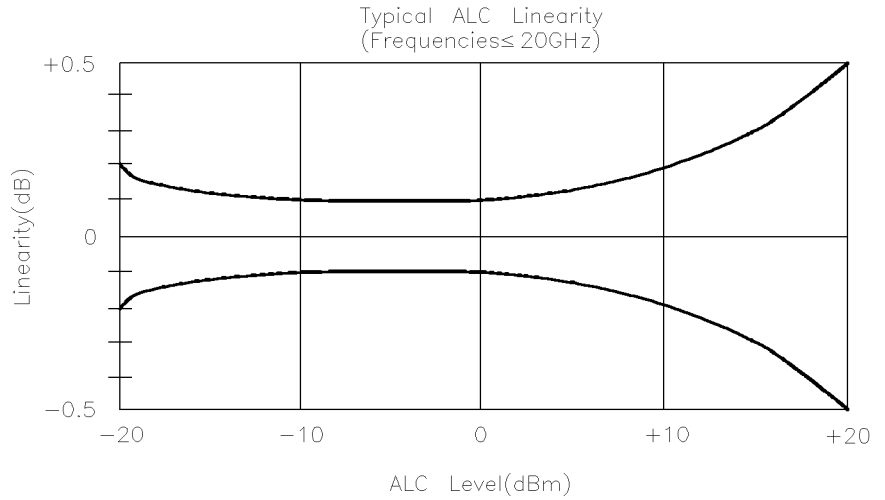
Spectral Purity

Specifications apply in CW, step, list, and manual sweep modes of operation.

Spurious Signals

Harmonics

Output Frequencies	83623L	83630L	83640L	83650L
< 2.0 GHz Standard	-25^7	-30^7	-30^7	-30^7
≥ 2.0 and < 26.5 GHz Standard	-45	-50	-50	-50
≥ 26.5 GHz Standard			-40	-40

Subharmonics

Output Frequencies	83623L	83630L	83640L	83650L
< 7 GHz	None	None	None	None
≥7 and ≤ 20 GHz	-50	-50	-50	-50
> 20 and ≤ 40 GHz		-50	-40^8	-40^8
> 40 GHz				-35^8

[7] Specification is −20 dBc below 50 MHz.

[8] Specification typical below 0 dBm.

Non–Harmonically Related

Output Frequencies:

< 2.0 GHz[9]	−60
≥ 2.0 and < 20 GHz	−60
≥ 20 GHz and ≤ 26.5 GHz	−58
> 26.5 and ≤ 40 GHz	−54
> 40 GHz	−52

[9] Specification applies at output levels 0 dBm and below.

Power–Line Related (< 300 Hz offset from carrier)

10 MHz to < 7 GHz	−55
7 GHz to < 13.5 GHz	−49
13.5 GHz to 20 GHz	−45
> 20 GHz to < 26.5 GHz	−43
26.5 GHz to < 38 GHz[10]	−39
38 GHz to 50 GHz	−37

Single-Sideband Phase Noise (dBc/Hz)

Offset from Carrier

Band(s)	100 Hz	1 kHz	10 kHz	100 kHz
10 MHz to < 7 GHz	−70	−78	−86	−107
7 GHz to < 13.5 GHz	−64	−72	−80	−101
13.5 GHz to 20 GHz	−60	−68	−76	−97
> 20 GHz to < 26.5 GHz	−58	−66	−74	−95
26.5 GHz to < 38 GHz[10]	−54	−62	−70	−91
38 GHz to 50 GHz	−52	−60	−68	−89

Typical Phase Noise (10GHz Carrier)
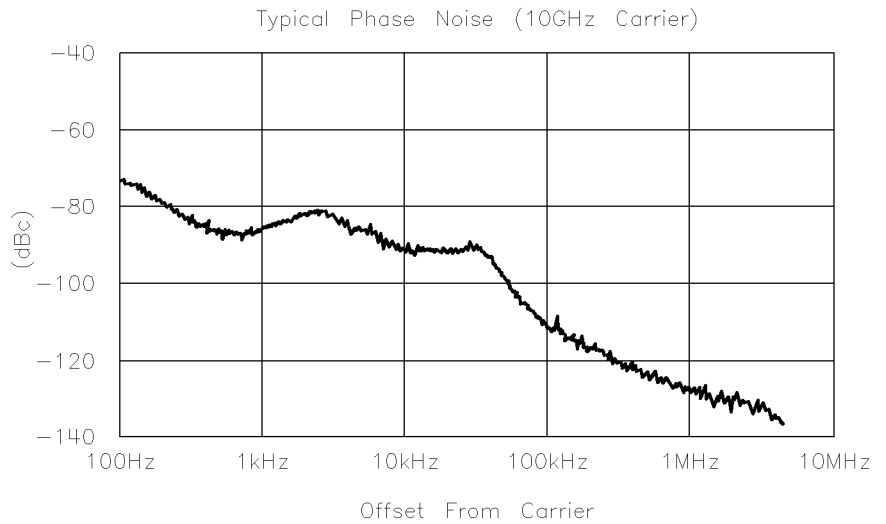
Residual FM (RMS, 50 Hz to 15 kHz bandwidth)

CW Mode or Sweep Widths ≤ n x 10 MHz: n x 60 Hz, typical
Sweep Widths > n x 10 MHz: n x 15 kHz, typical

[10] Frequency range is 26.5 GHz to 40 GHz on the 83640L.

General

Environmental
Operating Temperature Range: 0 to 55 °C

Altitude: Up to 4572 meters

Humidity: 5 to 80% relative at +25 to 40 °C

Enclosure Protection: IP20, according to IEC 529

This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 1010 and 664 respectively.

EMC: Within limits of CISPR Pub. 11/1990 Group 1, Class A, and Mil-Std-461C Part 7 RE02

Warmup Time
Operation: Requires 30 minute warm-up from cold start at 0 to 55 °C. Internal temperature equilibrium reached over 2 hour warm-up at stable ambient temperature.

Frequency Reference: Reference time base is kept at operating temperature with the instrument connected to AC power. Instruments disconnected from AC power for more than 24 hours require 30 days to achieve time base aging specification. Instruments disconnected from AC power for less than 24 hours require 24 hours to achieve time base aging specification.

Power Requirements
48 to 66 Hz; 115 volts (+10/−25%) or 230 volts (+10/−15%); 400 VA maximum (30 VA in standby)

Weight & Dimensions
Net Weight: 27 kg (60 lb)
Shipping Weight: 36 kg (80 lb)
Dimensions: 178 H x 425 W x 648 mm D (7.0 x 16.75 x 25.5 inches)

Adapters Supplied

83623L, 83630L
Type-N (female) − 3.5 mm (female)	Part number 1250-1745
3.5 mm (female) − 3.5 mm (female)	Part number 5061-5311

83640L, 83650L
2.4 mm (female) − 2.92 (female)	Part number 1250-2187
2.4 mm (female) − 2.4 mm (female)	Part number 1250-2188

Inputs & Outputs

Auxiliary Output

Provides an unmodulated reference signal from 2 to 26.5 GHz at a typical minimum power level of -10 dBm. Nominal output impedance 50 ohms. (SMA female, rear panel.)

RF Output

Nominal output impedance 50 ohms. (Precision 3.5 mm male on 20 and 26.5 GHz models, 2.4 mm male on 40 and 50 GHz models, front panel.)

External ALC Input

Used for negative external detector or power meter leveling. Nominal input impedance 120 kΩ, damage level ±15 volts. See RF output specifications. (BNC female, front panel.)

Trigger Input

Activated on a TTL rising edge. Used to externally initiate an analog sweep or to advance to the next point in step or list mode. Damage level $+5.5$, -0.5 volts. (BNC female, rear panel.)

Trigger Output

Outputs a one-microsecond-wide TTL-level pulse at 1601 points evenly spaced across an analog sweep, or at each point in step or list mode. (BNC female, rear panel.)

10 MHz Reference Input

Accepts 10 MHz ±100 Hz, 0 to $+10$ dBm reference signal for operation from external time base. Nominal input impedance 50 ohms. Damage level $+10$, -5 volts. (BNC female, rear panel.)

10 MHz Reference Output

Nominal signal level 0 dBm, nominal output impedance 50 ohms. (BNC female, rear panel.)

Sweep Output

Supplies a voltage proportional to the sweep ranging from 0 volts at start of sweep to $+10$ volts at end of sweep, regardless of sweep width. In CW mode, voltage is proportional to percentage of full instrument frequency range. Minimum load impedance 3 kilohms. Accuracy $\pm0.25\%$, ±10 mV, typical. (BNC female, rear panel.)

Stop Sweep Input/Output

Sweep will stop when grounded externally. TTL-high while sweeping, TTL-low when Agilent 8360 stops sweeping. Damage level $+5.5$, -0.5 volts. (BNC female, rear panel.)

Z-Axis Blanking/Markers Output

Supplies positive rectangular pulse (Approximately +5 volts into 2 kΩ) during the retrace and bandswitch points of the RF output. Also supplies a negative pulse (−5 volts) when the RF is at a marker frequency (intensity markers only). (BNC female, rear panel.)

Volts/GHz Output

Supplies voltage proportional to output frequency at 0.5 volts/GHz (internally switchable to 0.25 or 1 volt/GHz). Maximum output 18 volts. Minimum load impedance 2 kΩ. Accuracy ±0.5%, ±10 mV, typical. (BNC female, rear panel.)

Source Module Interface

Provides bias, flatness correction, and leveling connections to HP/Agilent 83550-series millimeter-wave source modules (Special, front and rear panels.)

Auxiliary Interface

Provides control signal connections to HP/Agilent 8516A S-parameter Test Set. (25-pin D-subminiature receptacle, rear panel.)

Models
  83623L: 10 MHz to 20 GHz High Power
  83630L: 10 MHz to 26.5 GHz
  83640L: 10 MHz to 40 GHz
  83650L: 10 MHz to 50 GHz

Options

Option 001 Add Step Attenuator

With this option, minimum settable output power is −110 dBm. Maximum leveled output power is lowered by 1.5 dB to 20 GHz, and 2 dB above 20 GHz, and 2.5 dB above 40 GHz.

Option 004 Rear Panel RF Output

Moves the RF Output, External ALC Input, Pulse Input/Output, AM Input, and FM Input connectors to the rear panel.

Option 008 1 Hz Frequency Resolution

Provides frequency resolution of 1 Hz.

Option 700 MATE System Compatibility

Provides CIIL programming commands for MATE system compatibility.

Option 806 Rack Slide Kit

Used to rack mount 8360 while permitting access to internal spaces.

Option 908 Rack Flange Kit

Used to rack mount 8360 without front handles.

Option 910 Extra Operating & Service Guides

Provides a second copy of operating and service guides.

Option 013 Rack Flange Kit

Used to rack mount 8360 with front handles. Front handles are standard on the 8360.

Option W30 Two Years Additional Return–To–Agilent Service

Does not include biennial calibration.

3

Installation

This chapter provides installation instructions for the Agilent 8360 L-Series swept CW generator and its accessories. It also provides information about initial inspection, damage claims, preparation for use, packaging, storage, and shipment.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and 664, respectively.

Initial Inspection

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 swept CW generator has been checked mechanically and electrically. The contents of the shipment should agree with the items noted on the packing slip. Procedures for checking the basic operation of the swept CW generator are in Chapter 4, "Operator's Check and Routine Maintenance". You will find procedures for checking electrical performance in the "Performance Tests" chapter of your *Agilent Technologies 8360 B-Series Swept Signal Generator/ 8360 L-Series Swept CW Generator Service Guide.*

If there is any electrical or mechanical defect, or if the shipment is incomplete, notify the nearest Agilent Technologies office. If the shipping container is damaged, or if the cushioning material shows signs of stress, notify the carrier as well as the Agilent Technologies office. Keep the shipping material for the carrier's inspection. The Agilent Technologies office will arrange for repair or replacement without waiting for a claim settlement.

Equipment Supplied

All Agilent 8360 L-Series swept CW generators are sent from the factory with the following basic accessories:

- Rack handles (mounted)
- Power cord
- Software package
- A set of manuals

The following adapters are also shipped with the swept CW generators:

Table 3-1.
Adapter Descriptions and Part Numbers Shipped with
Each Swept CW Generator Model

Agilent 83623L/Agilent 83630L	
Type-N (F) to 3.5 mm (F)	1250-1745
3.5 mm (F) to 3.5 mm (F)	5061-5311
Agilent 83640L/Agilent 83650L	
2.4 mm (F) to K (F)	1250-2187
2.4 mm (F) to 2.4 mm (F)	1250-2188

Options Available

There are several options available on the 8360 L-Series swept CW generators. For descriptive information on all of the options available, refer to Chapter 2c, "Specifications". For installation information on the rack mounting kits, refer to later paragraphs in this chapter. For information on retrofitting options, refer to the "Option Retrofits" chapter in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide*.

Preparation for Use

Enclosure Protection   Position the instrument according to the enclosure protection provided.

- This instrument does not protect against the ingress of water.

- This instrument protects against finger access to hazardous parts within the enclosure.

Power Requirements   The 8360 L-Series swept CW generators require a power source of 115 V (+10/−25%) or 230 V (+10/−15%), 48 to 66 Hz, single-phase. Power consumption is 400 VA maximum (30 VA in standby).

Line Voltage and Fuse Selection   The swept CW generator is provided with a voltage selector (located on the rear panel) to match the swept CW generator to the ac line voltage available at the site of installation. Both the line selector and fuse were selected at the factory to match the ac line voltage expected to be found at the shipping destination. Verify that the voltage selector has been set to the correct line voltage before connecting power to the swept CW generator.

WARNING   **For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.**

Refer to "Routine Maintenance" in Chapter 4 for information on changing fuses.

CAUTION   Before switching on this product, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed. Assure the supply voltage is in the specified range.
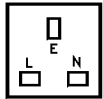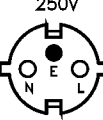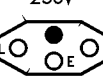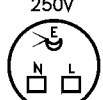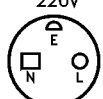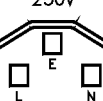
Power Cable   In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. Figure 3-1 shows the styles of plugs available on power cables supplied with Agilent instruments. The part numbers indicated are part numbers for the complete power cable/plug set. The specific type of power cable/plug shipped with the instrument depends upon the country of shipment destination.

WARNING   **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

CAUTION   Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding by not using this cord may cause instrument damage.

The offset prong of the three-prong connector is the grounding pin. The protective grounding feature is preserved when operating the swept CW generator from a two contact outlet by using a three-prong to a two-prong adapter and connecting the green wire of the adapter to ground. An adapter is available (for US connectors only) as part number 1251-0048.

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternately, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

PLUG TYPE [1]	CABLE PART NUMBER[2]	PLUG DESCRIPTION [2]	CABLE LENGTH (inches)	CABLE COLOR	FOR USE IN COUNTRY
250V	8120-1351 8120-1703	Straight BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V	8120-1369 8120-0696	Straight ZNSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V	8120-1689 8120-1692	Straight CEE7-VII 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, Republic of So. Africa, India (unpolarized in many nations)
125V	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	Straight NEMA5-15P 90° Straight NEMA5-15P Straight NEMA5-15P 90° Straight NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan, (100V or 200V), Mexico, Philippines, Taiwan
250V	8120-2104	Straight SEV1011.1959 24507, Type 12	79	Gray	Switzerland
250V	8120-0698	Straight NEMA6-15P			United States, Canada
220V	8120-1957 8120-2956	Straight DHCK 107 90°	79 79	Gray Gray	Denmark
250V	8120-1860	Straight CEE22-VI (System Cabinet Use)			

1. E = Earth Ground; L = Line; N = Neutral.

2. Part number for plug is industry identifier for plug only. Number shown for cable is Part Number for complete cable including plug.

Figure 3-1. AC Power Cables Available

Language Selection

You can operate the swept CW generator using one of three external interface languages: SCPI, Analyzer language, or CIIL (Option 700).

How to View or Change a Language Selection from the Front Panel

Note

To set a programming language from the front panel, the instrument language on the rear panel GPIB switch (L1, L2, and L3 shown in Figure 3-2) *must* be set to 7 (all 1s).

The GPIB menu provides access to the swept CW generator's programming language:

1. Press SYSTEM (MENU).
2. Select `GPIB Menu`.
3. The swept CW generator displays the three language softkeys: `Programming Language SCPI`, `Programming Language Analyzr`, and `Programming Language CIIL`. An asterisk indicates the selected language.
4. Select the desired softkey.

Remember

If the swept CW generator displays `Rear panel GPIB language must be 7 (111) in order to change current language (=XXX)`, the address on the rear panel GPIB switch (Figure 3-2) is set to something other than 7 (all 1s).

Note

If the swept CW generator does not have Option 700, and you select `Power Up Language CIIL`, the instrument displays `*****OPTION NOT INSTALLED*****`.

5. The asterisk indicates the selected softkey, and the swept CW generator displays `LANG:XXXX, ADRS=XX, REV da mo yr`.

How to Select a Language on a Swept CW Generator without a Front Panel

If your swept CW generator does not have a front panel, set the rear panel GPIB switch (Figure 3-2) for the language you want. (See Table 3-2 for language addresses.)

Table 3-2. Language GPIB Addresses

Language	GPIB Address (Decimal)
SCPI	0
Analyzer	1
CIIL	2
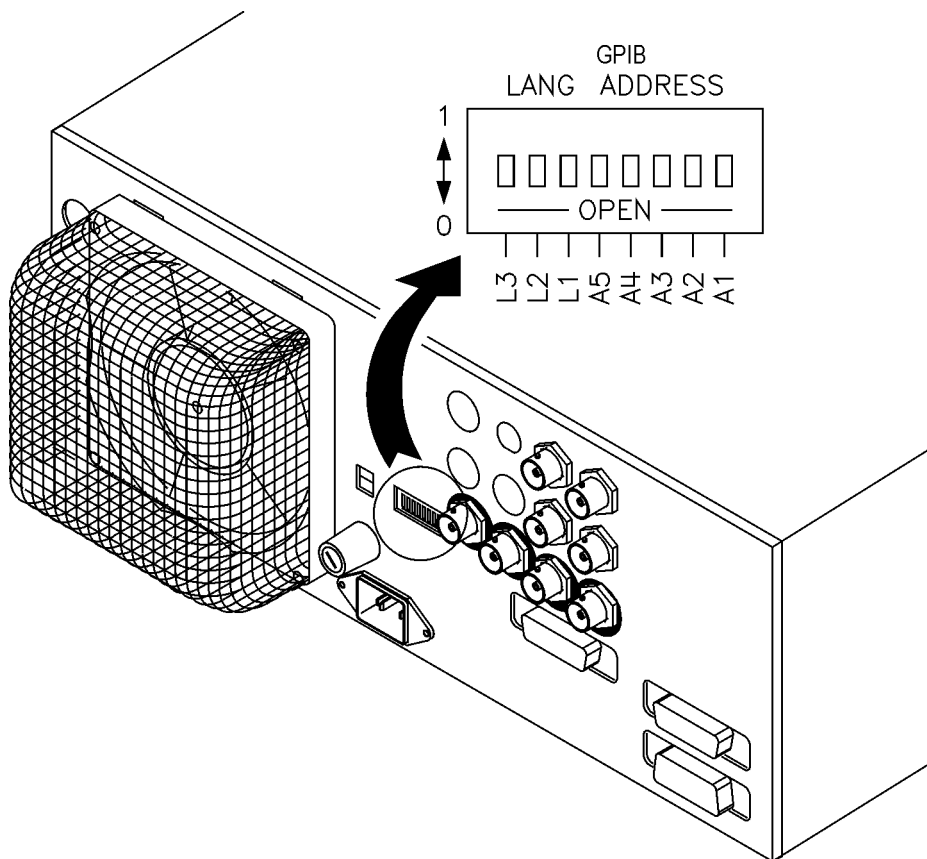
langad

Figure 3-2. Rear Panel GPIB Switch

GPIB Address Selection   In certain applications, the swept CW generator acts as a controller for a power meter and a printer. Because of this, the address menu provides access not only to the swept CW generator's GPIB address, but also to the address at which the swept CW generator expects to see a power meter, and the address at which the swept CW generator expects to see a printer. (See Table 3-3 for factory-set addresses.)

Table 3-3. Factory-Set GPIB Addresses

Instrument	GPIB Address (Decimal)
Swept CW Generator	19
Power Meter	13
Printer	01

How to View or Change an GPIB Address from the Front Panel

Note

To set an GPIB address from the front panel, the instrument address on the rear panel GPIB switch (Figure 3-2) *must* be set to 31 (all 1s).

1. Press SYSTEM (MENU).
2. Select GPIB Menu Adrs Menu.
3. The swept CW generator displays the three address softkeys: 8360 Adrs, Meter Adrs, and Printer Adrs.
4. Select the desired softkey.
5. The swept CW generator displays the address selected for that instrument.
6. If you want to change the address, use the keypad to enter the desired address (0 to 30), then press (ENTER).

Remember

If the swept CW generator displays Rear panel GPIB address must be 31 (11111) in order to change current address (=XX), the address on the rear panel GPIB switch (Figure 3-2) is set to something other than 31 (all 1s).

How to Prevent a Front Panel Change to an GPIB Address

To disable the address softkeys, set the instrument address on the rear panel GPIB switch (Figure 3-2) to any address *other than* 31 (all 1s).

How to Set the GPIB Address on a Swept CW Generator without a Front Panel

If your swept CW generator does not have a front panel, set the address on the rear panel GPIB switch (Figure 3-2) to the address you want (factory default is 19).

Mating Connectors

All of the externally mounted connectors on the instrument are discussed in the "CONNECTORS" section in Chapter 2. If you are interested in the part number for a connector, see "Replaceable Parts" in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide*.

10 MHz Frequency Reference Selection and Warmup Time

To keep the internal timebase frequency reference oven at operating temperature, the swept CW generator must be connected to ac line power. The swept CW generator requires approximately 30 minutes to warm up from a cold start before the OVEN display message goes off. With a stable outside temperature, internal temperature equilibrium is reached after approximately two hours. For additional information on warmup times, see "Specifications," in Chapter 2c.

Operating Environment

Temperature. The swept CW generator may be operated in environments with temperatures from 0 to +55 °C.

Humidity. The swept CW generator may be operated in environments with humidity from 5 to 80% relative at +25 to 40 °C. However, protect the swept CW generator from temperature extremes, which can cause condensation within the instrument.

Altitude. The swept CW generator may be operated at pressure altitudes up to 4572 meters (approximately 15,000 feet).

Cooling. The swept CW generator obtains all cooling airflow by forced ventilation from the fan mounted on the rear panel. Information on cleaning the fan filter is located in "Routine Maintenance" in Chapter 4.

CAUTION

Ensure that all airflow passages at the rear and sides of the swept CW generator are clear *before* installing the instrument in its operating environment. This is especially important in a rack mount configuration.

Chassis Kits

Rack Mount Slide Kit (Option 806)

Option 806 swept CW generators are supplied with rack mount slides and the necessary hardware to install them on the swept CW generator. The following table itemizes the parts in this kit.

Table 3-4. Rack Mount Slide Kit Contents

Quantity	Description
Rack Mount Kit (Includes the following parts)	
2	Rack Mount Flanges
8	Screws
Slide Kit (Includes the following parts)	
2	Slide Assemblies
4	Screws (Inner Slide Assembly)
8	Screws (Outer Slide Assembly)
8	Nuts (Outer Slide Assembly)
Slide Adapter Kit (*NON-HP*, includes the following parts)	
4	Adapter Brackets
4	Adapter Bar
8	Screws (Bracket to Bar)
8	Nuts (Bracket to Slide Assembly)

CAUTION **Ventilation Requirements:** When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Installation Procedure

1. Refer to Figure 3-3. Remove handle trim strips.
2. Remove four screws per side.
3. Using the screws provided, attach the rack mount flanges to the outside of the handles.
4. Remove the side straps and end caps.
5. Remove the bottom and back feet and the tilt stands.
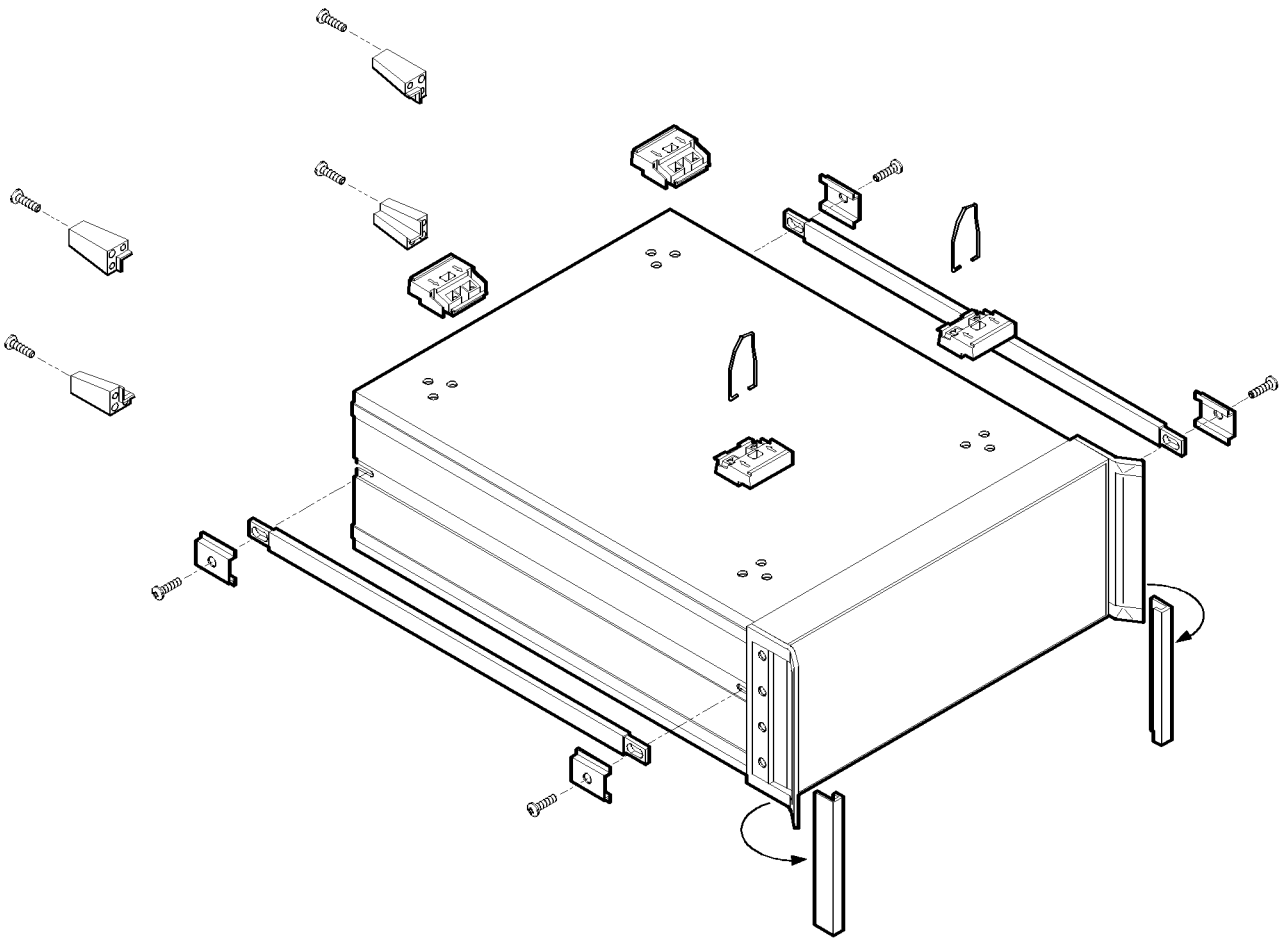
Figure 3-3. Removing the Side Straps and Feet

6. Refer to Figure 3-4. Remove the inner slide assemblies from the outer slide assemblies.

7. To secure the side covers in place, mount the inner slide assemblies to the instrument with the screws provided.

8. With the appropriate hardware, install the outer slide assemblies to the system enclosure.

9. Lift the swept CW generator into position. Align the inner and outer slide assemblies and slide the instrument into the rack. Realign the hardware as needed for smooth operation.

MOUNTING HARDWARE
FOR Agilent
SYSTEMS ENCLOSURES

MOUNTING HARDWARE
FOR NON- Agilent
SYSTEMS ENCLOSURES
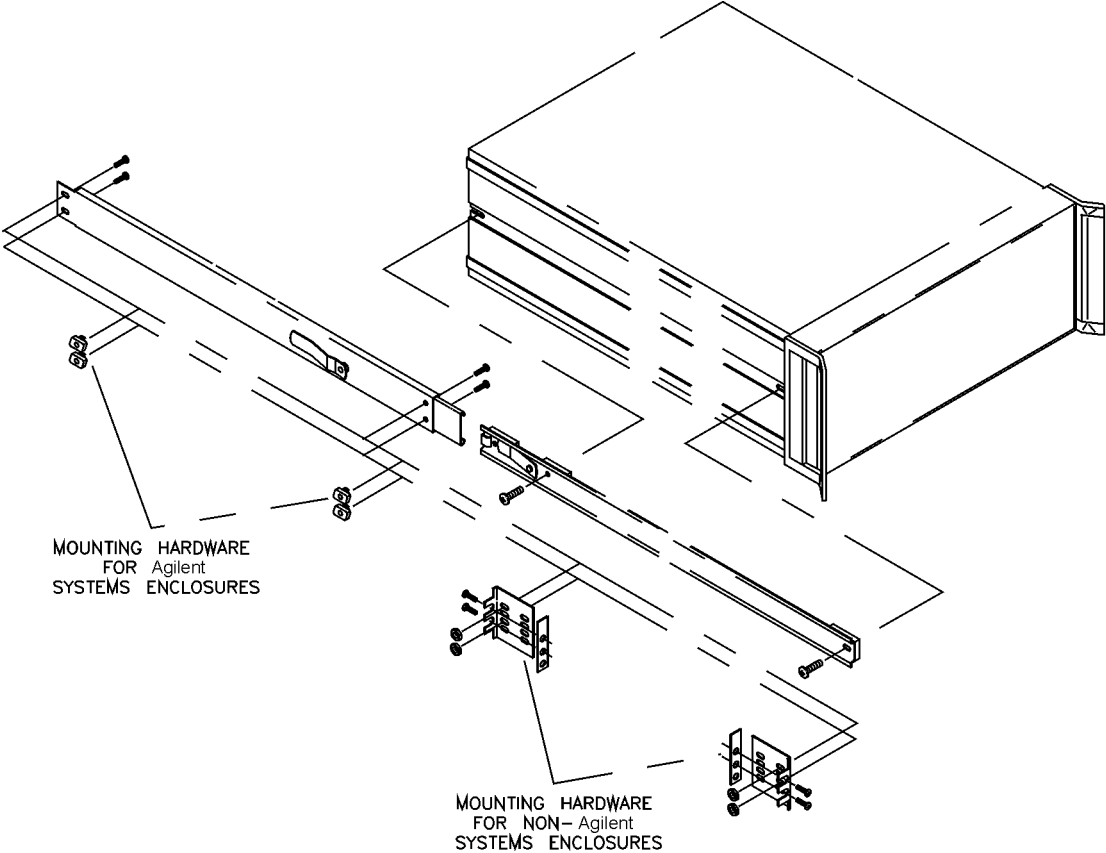
slide

Figure 3-4. Chassis Slide Kit

Rack Flange Kit for Swept CW Generators with Handles Removed (Option 908)

Option 908 swept CW generators are supplied with rack flanges and the necessary hardware to install them on the swept CW generator after removing the instrument handles. The following table itemizes the parts in this kit.

Table 3-5.
Rack Flange Kit for Swept CW Generators with Handles Removed Contents

Quantity	Description
2	Rack Mount Flanges
8	Screws

CAUTION

Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Installation Procedure

1. Refer to Figure 3-5. Remove handle trim strips.
2. Remove the four screws on each side that attach the handles to the instrument; remove the handles.
3. Using the screws provided, attach the rack mount flanges to the swept CW generator.
4. Remove the bottom and back feet and the tilt stands before rack mounting the instrument.
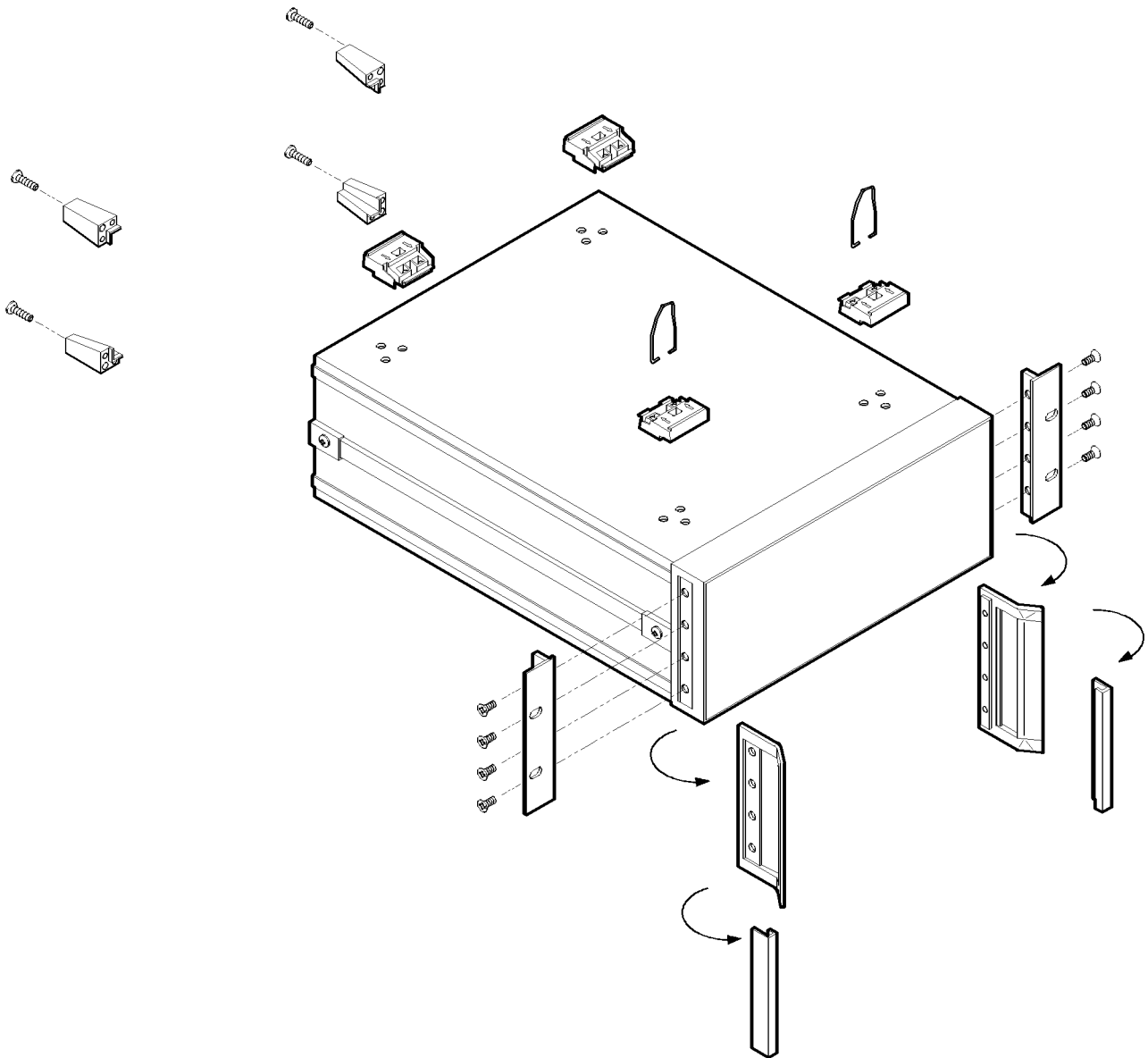
Figure 3-5. Rack Mount Flanges for Swept CW Generators with Handles Removed

Rack Flange Kit for Swept CW Generators with Handles Attached (Option 913)

Option 913 swept CW generators are supplied with rack flanges and the necessary hardware to install them on the swept CW generator without removing the instrument handles. The following table itemizes the parts in this kit.

Table 3-6.
Rack Flange Kit for Swept CW Generators with Handles Attached Contents

Quantity	Description
2	Rack Mount Flanges
8	Screws

CAUTION

Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Installation Procedure

1. Refer to Figure 3-6. Remove handle trim strips.
2. Remove the four screws on each side that attach the handles to the instrument.
3. Using the longer screws provided, attach the rack mount flanges to the outside of the handles.
4. Remove the bottom and back feet and the tilt stands before rack mounting the instrument.
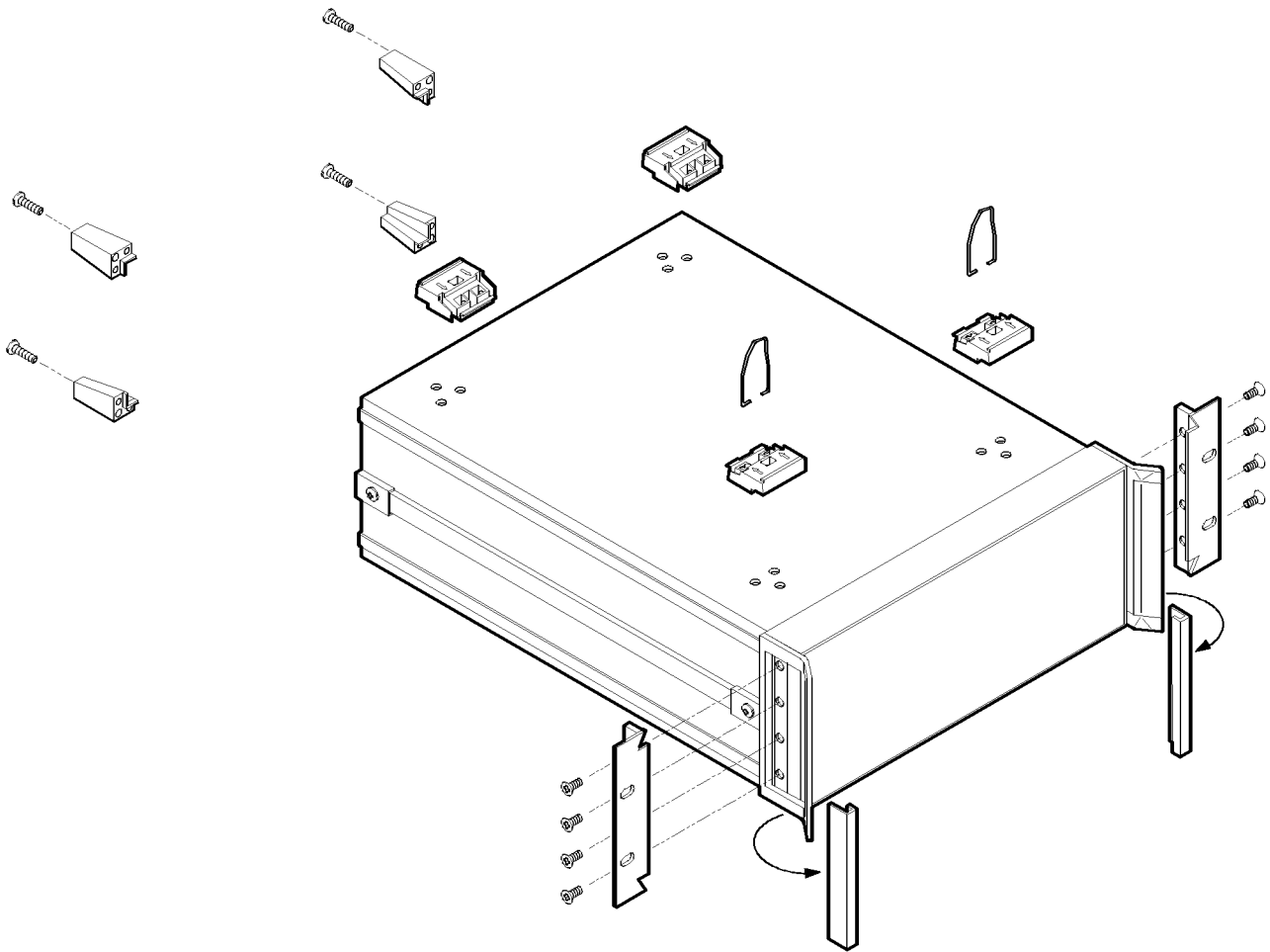
Figure 3-6. Rack Mount Flanges for Swept CW Generators with Handles Attached

Storage and Shipment

Environment The swept CW generator may be stored or shipped within the following limits:

Temperature $-40°$ to $+75$ °C.

Humidity   5% to 95% relative at $0°$ to $+40$ °C.

Altitude   Up to 15240 meters. Pressure approximately 50,000 feet.

The swept CW generator should be protected from sudden temperature fluctuations that can cause condensation.

Package the Swept CW Generator for Shipment

Use the following steps to package the swept CW generator for shipment to Agilent Technologies for service:

1. Fill in a service tag (available at the end of Chapter 4) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:

   ■ Any error messages that appeared on the swept CW generator display
   ■ A completed Performance Test record from the service guide for your instrument
   ■ Any other specific data on the performance of the swept CW generator

CAUTION

Swept CW generator damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton. Styrene pellets cause equipment damage by generating static electricity and by lodging in the swept CW generator fan.

2. Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the swept CW generator and allow at least 3 to 4 inches on all sides of the swept CW generator for packing material.

3. Surround the instrument with at least 3 to 4 inches of packing material, or enough to prevent the instrument from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap^{TM} from Sealed Air Corporation (Hayward, CA 94545). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink Air Cap to reduce static electricity. Wrap the instrument several times in the material to both protect the instrument and prevent it from moving in the carton.

4. Seal the shipping container securely with strong nylon adhesive tape.

5. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to ensure careful handling.

6. Retain copies of all shipping papers.

   In any correspondence, refer to the swept CW generator by model number and full serial number.

Converting HP/Agilent 8340/41 Systems to 8360 L-Series Systems

The following paragraphs are intended to assist you in converting existing HP/Agilent 8340/8341-based systems to 8360 L-Series swept CW generator-based systems. The 8360 L-series swept CW generator may be used where no modulation requirements are needed. Both manual and remote operational differences are addressed.

Manual operation topics are:

- functional compatibility
- front panel operation
- conditions upon instrument preset
- connections to other instruments

Remote operation topics are:

- language compatibility
- status structure
- programming languages

Manual Operation

Compatibility

The 8360 L-Series swept CW generators are designed to be, in all but very few cases, a complete feature superset of the HP/Agilent 8340/8341 synthesized sweepers. The most notable omissions are that the 8360 L-Series does not accept:

- line triggers (ie. 50 or 60 Hz line frequency)

- an external leveling input from positive diode detectors

Front Panel Operation

The 8360 L-Series uses a softkey menu driven approach toward accessing instrument functions versus a front panel key or shift key sequence as with the HP/Agilent 8340/8341.

Instrument Preset Conditions. The factory defined preset conditions for the 8360 L-Series are identical to those for the HP/Agilent 8340/8341. The 8360 L-Series also allows you to define a different set of preset conditions. Refer to "Changing the Preset Parameters" in Chapter 1 for examples and more information. Table 3-7 illustrates the factory instrument preset conditions for the 8360 L-Series and the HP/Agilent 8340/8341. An instrument preset turns off all the functions and then sets the following:

Table 3-7.
Instrument Preset Conditions for the 8360/8340/8341

Function	Condition
Sweep Mode	Full Span
Sweep	Continuous/Auto
Trigger	Free Run
Markers	All Off
Modulation	Off
Frequency Step Size	10% of span
Status Bytes	Cleared
Leveling	Internal
RF Output	On
Power Level	0 dBm
Power Step Size	10 dB
Power Sweep/Slope	0 dB
Storage Registers	Retain current values
HP-IB Address	Retains current value
Status Byte Mask	Unchanged
Extended Status Byte Mask	Unchanged
Language Mode	Unchanged

System Connections

The 8510 Network Analyzer

The 8360 L-Series swept CW generator is compatible with any HP/Agilent 8510 network analyzer with firmware revision 4.0 or higher. To upgrade firmware for an existing 8510, an HP/Agilent 11575C Revision 4.0 Upgrade Kit or an HP/Agilent 11575D Revision 5.0 Upgrade Kit is required.

HP/Agilent 8510 revisions *prior to 6.0 (not inclusive)* require that you use the following connections:

■ SWEEP OUTPUT

■ STOP SWEEP IN/OUT

■ HP-IB INTERFACE

■ AUXILIARY INTERFACE

HP/Agilent 8510 revisions 6.0 and greater use the connections as designated on the rear panel of the swept CW generator. They are:

■ TRIGGER OUTPUT

■ STOP SWEEP IN/OUT

■ HP-IB INTERFACE

■ AUXILIARY INTERFACE

The dedicated HP/Agilent 8510 versions of the 8360 may be configured to power up to one of two possible system languages, network analyzer language, or SCPI (Standard Commands for Programmable Instruments). This configuration is controlled via a switch located on the rear panel of the instrument. The factory default setting for this switch is network analyzer language at an GPIB address of 19. To interface with a network analyzer the language selected must be Analyzer language. Refer to earlier paragraphs in this chapter for the rear panel switch settings.

Note   Models other than the dedicated HP/Agilent 8510 versions are set at the factory for SCPI. To interface with a network analyzer the language selected must be Analyzer language.

The HP/Agilent 8757C/E Scalar Network Analyzer

The connections between the analyzer and the 8360 L-Series
are similar to the connections between the analyzer and the
HP/Agilent 8340/8341. The 8360 L-Series differs from the
HP/Agilent 8340/8341 in one connection only. It is unnecessary to
connect the modulator drive signal from the analyzer to the source.
The 8360 L-Series internally produces the 27.8 kHz modulated
signal necessary for AC mode measurements on the analyzer. The
connections from the 8360 L-Series to the analyzer are:

- Z-AXIS BLANK/MKRS

- SWEEP OUTPUT

- STOP SWEEP IN/OUT

- HP-IB Interface

Configure the general-purpose 8360 L-Series to GPIB address 19
and network analyzer language for operation with the analyzer. For
information on selecting the instrument address and language refer to
earlier paragraphs in this chapter.

The HP/Agilent 83550 Series Millimeter-wave Source Modules

Refer to "Leveling with MM-wave Source Modules" in Chapter 1 for
information and examples.

The HP/Agilent 8970B Noise Figure Meter

Connections from the 8360 L-Series to the HP/Agilent 8970B
noise figure meter are identical to those used with the
HP/Agilent 8340/8341. Configure the 8360 L-Series to an address
corresponding to the source address of the 8970, typically GPIB
address 19, and network analyzer language.

Remote Operation

Language Compatibility

The 8360 L-Series swept CW generators support three GPIB programming languages; network analyzer language, SCPI (Standard Commands for Programmable Instruments), and M.A.T.E. CIIL language (Option 700).

Network Analyzer Language

8360 L-Series network analyzer language is syntactically and semantically identical to the HP/Agilent 8340/8341 GPIB mnemonics. However, fundamental hardware differences such as:

- command execution time,

- instrument diagnostics,

- and other hardware specific functions

exist and prevent executing an unmodified HP/Agilent 8340/8341 program successfully. For example, the 8360 L-Series does not recognize or accept the HP/Agilent 8340/8341 learn string.

Test and Measurement System Language

SCPI is an GPIB programming language developed by Agilent Technologies specifically for controlling electronic test and measurement instruments. It is designed to conform to the IEEE 488.2 standard which provides codes, formats, protocols, and common commands for use with IEEE 488.1-1987 that were unavailable in the previous standard. SCPI provides commands that are common from one Agilent product to another for like functions, thereby eliminating device specific commands.

Refer to "Getting Started Programming" in Chapter 1 for information on SCPI.

Control Interface Intermediate Language

CIIL is the instrument control programming language used in Option 700 8360 L-Series. Like the 8340/8341 E69, the Option 700 8360 L-Series is M.A.T.E.-compatible. Refer to the 8360 Option 700 Manual Supplement for information on this option.

Converting from Network Analyzer Language to SCPI

Table 3-9 illustrates the programming command in network analyzer language and its equivalent SCPI programming command. In the table, numbers enclosed by greater/less than symbols (<>) are parameters. Braces ({}) are used to enclose one or more options that may be used zero or more times. A vertical bar (|) can be read as "or", and it is used to separate alternative parameter options. Optional numeric suffixes for SCPI commands are enclosed in square brackets ([ ]).

Features not available in one of the language modes are marked by a horizontal line in the corresponding column. In the interest of brevity all SCPI commands have been listed in their most concise form. For a complete and comprehensive listing of the swept CW generator SCPI commands, refer to "SCPI COMMAND SUMMARY" in Chapter 2. For explanations of SCPI, refer to "Getting Started Programming" in Chapter 1.

Numeric Suffixes

Numeric suffixes consist of 2 or 3-character codes that terminate and scale an associated value. The numeric suffixes for network analyzer language on the 8360 L-Series and the HP/Agilent 8340/8341 are identical. Table 3-8 lists the 8360 L-Series suffixes. The default unit for each type of suffix is shown in bold type.

Table 3-8. Numeric Suffixes

Suffix Type	Network Analyzer Language	SCPI
Frequency	**HZ**|KZ|MZ|GZ	**HZ**|KHZ|MHZ|GHZ
Power Level	**DB**	**DBM**|W|MW|UW
Power Ratio	**DB**	**DB**
Time	**SC**|MS	**S**|MS|US|NS|PS

Status Bytes

There are two separate and distinct status structures within the 8360 L-Series depending on the GPIB language selected. When network analyzer language is selected, the status structure utilized is structurally and syntactically the same as on the HP/Agilent 8340/8341. This greatly enhances programming compatibility between existing HP/Agilent 8340/8341 programs and network analyzer programs converted or written for the 8360 L-Series.

In the SCPI language mode, the status structure is defined by the SCPI status system. All SCPI instruments implement status registers in the same fashion.

For more information on the status registers, refer to "ANALYZER STATUS REGISTER" and "SCPI STATUS REGISTER STRUCTURE" in Chapter 2.

Table 3-9. Programming Language Comparison

Description	Network Analyzer Language	SCPI Language
ALC		
Leveling mode, external	A2	POW:ALC:SOUR DIOD; :POW:ATT:AUTO OFF
Leveling mode, internal	A1	POW:ALC INT
Leveling mode, mm module	SHA2	POW:ALC:SOUR MMH; :POW:ATT:AUTO OFF
Leveling mode, power meter	A3	POW:ALC:SOUR PMET; :POW:ATT:AUTO OFF
Enable normal ALC operation	A1|A2|A3|SHA2	POW:ALC:STAT ON
Disable ALC and control modulator drive directly	SHA3	POW:ALC:STAT OFF
Set output power, then disable ALC	SHA1	POW:SEAR ON
Uncouple attenuator, control ALC independently	SHPS <num>DB	POW:ATT:AUTO OFF; :POW <num>[DBM]
Frequency		
Set CW frequency	CW <num>freq_suffix	FREQ:CW <num>[freq_suffix] ;MODE CW
Set start frequency	FA <num>freq_suffix	FREQ:STAR <num>[freq_suffix] ;MODE SWE
Set stop frequency	FB <num>freq_suffix	FREQ:STOP <num>[freq_suffix] ;MODE SWE
Set center frequency	CF <num>freq_suffix	FREQ:CENT <num>[freq_suffix] ;MODE SWE
Set frequency span	DF <num>freq_suffix	FREQ:SPAN <num>[freq_suffix] ;MODE SWE
Set swept mode step size	SHCF <num>freq_suffix	FREQ:STEP <num>[freq_suffix]
Set CW mode step size	SHCW <num>freq_suffix	FREQ:STEP <num>[freq_suffix]
Enable frequency offset function	SHFB <num>freq_suffix	FREQ:OFFS <num>[freq_suffix] ;OFFS:STAT ON
Enable frequency multiplier function	SHFA <num>	FREQ:MULT <num>;MULT:STAT ON
Keep multiplication factor on instrument on/off or preset	SHAL	(Refer to user defined preset)
Multiplication factor=1 on instrument on/off or preset	SHIP	(Refer to user defined preset)
Zoom function	SHST	——

Table 3-9. Programming Language Comparison (continued)

Description	Network Analyzer Language	SCPI Language
HP-IB only functions		
Output status byte	OS	*STB? (See SCPI common commands)
Status byte mask	RM <num>	*SRE (See SCPI common commands)
Extended status byte mask	RE <num>	*ESE (See SCPI common commands)
Clear status byte	CS	*CLS (See SCPI common commands)
Output learn string	OL	*LRN? (See SCPI common commands)
Mode string	OM	――
Advance to next bandcross	BC	――
Display updating	DU	DISP ON|OFF
Activate fast phaselock mode	FP	――
Enable front panel knob	EK	SYST:KEY 132 (enable up) SYST:KEY 133 (enable down)
Increment frequency	IF	*TRG (See SCPI common commands)
Input learn string	IL	SYST:ILRN
Keyboard release	KR	――
Select network analyzer mode	NA	――
Output active value	OA	(See SCPI Command Summary)
Output next bandcross frequency	OB	DIAG:OUTP:BAND?
Output coupled parameters	OC	FREQ:STAR?;CENT?;:SWE:TIME?
Output diagnostics	OD	DIAG:OUTP |:FREQ?|:UNL?|:YOD?|:YTMD?
Output fault information	OF	DIAG:OUTP:FAUL?
Output identity	OI	*IDN? (See SCPI common commands)
Output last lock frequency	OK	DIAG:OUTP:FREQ?
Output interrogated value	OP	(See SCPI Command Summary)
Output power level	OR	POW:LEV?

Table 3-9. Programming Language Comparison (continued)

Description	Network Analyzer Language	SCPI Language
Set remote knob	RB	——
Request status byte mask	RE <num>,RM <num>	*SRE <num>, *SRE?, *ESE <num>, *ESE?
Reset sweep	RS	ABOR
Number of steps in a stepped sweep	SN <num>	SWE:POIN <num>
Swap network analyzer channels	SW <1|0>	——
Test HP-IB interface	TI <num>	DIAG:TINT? <num>
Sets sweep time lower limit	TL <num>time_suffix	SWE:TIME:LLIM <num>[time_suffix]
Take sweep	TS	TSW;*WAI
Instrument State		
Instrument preset	IP	SYST:PRES
Local instrument control	LOCAL 7XX	LOCAL 7XX (XX=Source HP-IB address)
Markers [n] is 1 to 5, 1 is default		
Turn on and set marker	Mn <num>freq_suffix	MARK[n]:FREQ <num>[freq_suffix] ;STAT ON
Turn off frequency marker	MnM0	MARK[n] OFF
Enable M1-M2 sweep	MP1	SWE:MARK:STAT ON
Disable M1-M2 sweep	MP0	SWE:MARK:STAT OFF
Move start->M1 stop->M2	SHMP	SWE:MARK:XFER
Enable delta marker	MD1	MARK[n]:DELT? <num>,<num>
Disable delta marker	MD0	MARK OFF
Move marker to center frequency	MC	MARK[n]:FREQ?; :FREQ:CENT <response>[freq_suffix]
Turn off all markers	SHMO	MARK:AOFF
Turn on amplitude markers	AK1	MARK[n]:AMPL ON ;AMPL:VAL <num>[DB]
Turn off amplitude markers	AK0	MARK:AMPL OFF

Table 3-9. Programming Language Comparison (continued)

Description	Network Analyzer Language	SCPI Language
Modulation		
Scalar pulse modulation	SHPM	PULS:SOUR SCAL;STAT ON
Power		
Set power level	PL <num>DB	POW <num>[DBM]
Activate power sweep	PS1	POW:MODE SWE
Deactivate power sweep	PS0	POW:MODE FIX
RF output On	RF1	POW:STAT ON
RF output Off	RF0	POW:STAT OFF
Uncouple internal attenuator and ALC	SHPS	POW:ATT:AUTO OFF
Couple internal attenuator and ALC	PL	POW:ATT:AUTO ON
Set attenuator value and uncouple attenuator	SHSL|AT <num>DB	POW:ATT <num>[DB]
Set power step size	SHPL|SP <num>DB	POW:STEP <num>[DB]|[freq_suffix]
Activate power slope function	SL1 <num>DB	POW:SLOP <num>[freq suffix];STAT ON
Do auto track	SHRP	CAL:TRAC
Continuously peak RF	RP1	CAL:PEAK:AUTO ON
Peak RF once	SHAK	CAL:PEAK
Sweep		
Set sweep time	ST <num>time_suffix	SWE:TIME <num>[time_suffix]
Sweep once	S2|SG	INIT
Single sweep	S2|SG	INIT:CONT OFF;:ABOR;:INIT
Sweep continuously	S1	INIT:CONT ON
Sweep manually	SM|S3	SWE:MODE MAN
Activate step sweep mode	SN|SEST	SWE:GEN STEP;MODE MAN :FREQ:MODE SWE
Activate ramp sweep mode	FA|FB|CF|DF|S1|S2	SWE:GEN ANAL;:FREQ:MODE SWE
Trigger, external	T3	TRIG:SOUR EXT
Trigger, free run	T1	TRIG:SOUR IMM
Trigger, step	TRSB	———

Table 3-9. Programming Language Comparison (continued)

Description	Network Analyzer Language	SCPI Language
System		
Recall an instrument state	RC <0-9>	*RCL <0-8>
Save an instrument state	SV <1-9>	*SAV <1-8>
Activate alternate state sweep	AL1 <1-9>	SYST:ALT <1-8>;ALT:STAT ON
Deactivate alternate state sweep	AL0	SYST:ALT:STAT OFF
Display software revision	(cycle power)	*IDN? (See SCPI common commands)
Select an internal frequency reference	(hardware)	ROSC INT
Select an external frequency reference	(hardware)	ROSC EXT
Display/set HP-IB address	(front panel/hardware)	SYST:COMM:GPIB:ADR <num> (or hardware switch)
Select SCPI	SYST|SCPI[1]	SYST:LANG SCPI (or hardware switch)[1]
Select network analyzer language	SYST:LANG COMP[1]	SYST:LANG COMP[1]
Select CIIL	CIIL (Or hardware)	SYST:LANG CIIL (or hardware switch)
Lock save/recall registers	SHSV	SYST:KEY:DIS SAVE
Unlock save/recall registers	SHRC	SYST:KEY:ENAB SAVE
Purge all instrument memory	SHMZ18HZ SHKZ0HZ	SYST:SEC ON;SEC OFF
Blank instrument display	DU0	DISP OFF

1 Wait one second after executing this command before sending any additional commands or they may be lost or ignored.

4

Operator's Check and Routine Maintenance

WARNING	**No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**

Operator's Checks

The local operator's check (front panel use) allows the operator to make a quick check of the main swept CW generator functions prior to use.

For delete front panel options of the Agilent 8360 L-Series, use the "Front Panel Emulator Software" to perform an operator's check.

Service Information

If the swept CW generator requires service and the routine maintenance procedures do not clear the problem, contact a qualified service technician. A list of Agilent Technologies Sales and Support Offices is provided behind the "PREFACE" tab at the front of this manual. To help the service technician identify the problem quickly, fill out and attach a service repair tag. Service repair tags are provided at the end of this chapter. If a self test error occurs, note the name of the failure and the referenced paragraph number in the failure symptoms/special control settings section of the tag. Provide any information that you feel is important to recreate the failure.

Local Operator's Check

Description   The preliminary check provides assurance that most of the internal functions of the swept CW generator are working. The main check provides a general check of the overall functions of the swept CW generator. No external equipment is needed.

Preliminary Check   Each time the swept CW generator is turned on the swept CW generator performs a series of self tests on the internal CPU, power supplies, and front panel. When the self test is complete, the swept CW generator returns to the same functional configuration that it was in prior to power off. When the (PRESET) key is engaged, the swept CW generator returns to the factory or user preset functional configuration.

1. Turn the swept CW generator on. Note the functional configuration.

2. Turn the swept CW generator off. Verify that the amber STANDBY LED is on.

3. Turn the swept CW generator on. Verify that the amber STANDBY LED is off, and that the green POWER ON LED is on.

   a. Check the display, a cursor will appear in the upper left corner followed by the GPIB language, GPIB address, and the date code of the firmware installed in the swept CW generator.

   b. The display will now indicate the functional configuration noted in step 1.

   c. Check the fan, it should be turning.

Main Check

1. Press (SERVICE).

2. Select `Selftest (Full)`. Check that all tests performed pass.

3. Press (PRESET). If the display indicates a user preset was performed, select `Factory Preset`. Verify that the green SWEEP LED is blinking, the amber RF ON/OFF LED is on, and the red INSTR CHECK LED is off.

4. Press (USER CAL).

5. Select `Tracking Menu`.

   a. If the swept CW generator has Option 001, step attenuator, select `Auto Track`. Wait for the swept CW generator to finish peaking before continuing.

   b. If the swept CW generator has no step attenuator installed, provide a good source match on the output connector (a power sensor or 10 dB attenuator will do). Select `Auto Track`. Wait for the swept CW generator to finish peaking before continuing.

6. Press (PRIOR).

7. Select `Freq Cal Menu`.

8. Select `Swp Span Cal Once`. Verify that status problems do not exist (UNLOCK, UNLVLED, or FAULT). An OVEN status message will appear on the message line if the swept CW generator has been disconnected from ac power. This message will turn off within 10 minutes; if it does not, there may be a problem. If a FAULT message is displayed, refer to menu map 6, Service, to access fault information.

9. Terminate the RF output with a good source match (either a 50Ω load or power sensor). Press (POWER LEVEL). Increase the power level until the unleveled message is displayed on the message line. Decrease the power level until the unleveled message turns off. Note the power level reading. Verify that the swept CW generator can produce maximum specified power without becoming unleveled.

This completes the operator's check. If the swept CW generator does not perform as expected, have a qualified service technician isolate and repair the fault. See "Service Information."

Routine Maintenance

Routine maintenance consists of replacing a defective line fuse, cleaning the air filter, cleaning the cabinet, and cleaning the display. These items are discussed in the following paragraphs.

Table 4-1. Fuse Part Numbers

Voltage	Fuse	Part/Number
115 V	5 A 250 V	2110-0010
230 V	3 A 250 V	2110-0003

WARNING   **For continued protection against fire hazard, replace line fuse only with same type and rating. The use of other fuses or material is prohibited.**

How to Replace the Line Fuse

The value for the line fuse is printed on the rear panel of the swept CW generator next to the fuse holder. See Figure 4-1

1. Turn off the swept CW generator.

2. Remove the ac line cord.

Note   The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.

3. Using a small flat-blade screwdriver, rotate the fuse cap counter-clockwise, and remove the fuse holder.

4. Replace the original fuse.

5. Replace the fuse holder in the rear panel. Using the screwdriver, rotate the fuse cap clockwise to secure the fuse holder in place.

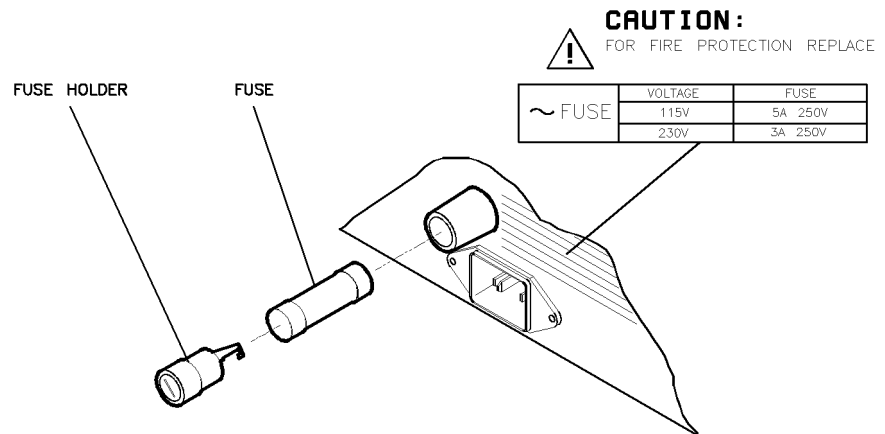6. Reconnect the swept CW generator to line power.

Figure 4-1. Replacing the Line Fuse

How to Clean the Fan Filter

The cooling fan located on the rear panel has a thin foam filter. How often the filter must be cleaned depends on the environment in which the swept CW generator operates. As the filter collects dust, the fan speed increases to maintain airflow (as the fan speed increases, so does the fan noise). If the filter continues to collect dust after the fan reaches maximum speed, airflow is reduced and the swept CW generator's internal temperature increases. If the internal temperature reaches 90 °C the swept CW generator will automatically turn off and the amber STANDBY LED will turn on. Clean the fan filter as follows:

1. Turn off the swept CW generator.

2. Remove the ac line cord.

Note

The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.

3. Remove the screws holding the fan cage. See Figure 4-2.

4. Remove the fan cage from the rear panel.

5. Rinse the fan cage, filter, and the filter retainer in warm water, then dry.

6. Reverse the removal procedure to reassemble the swept CW generator.
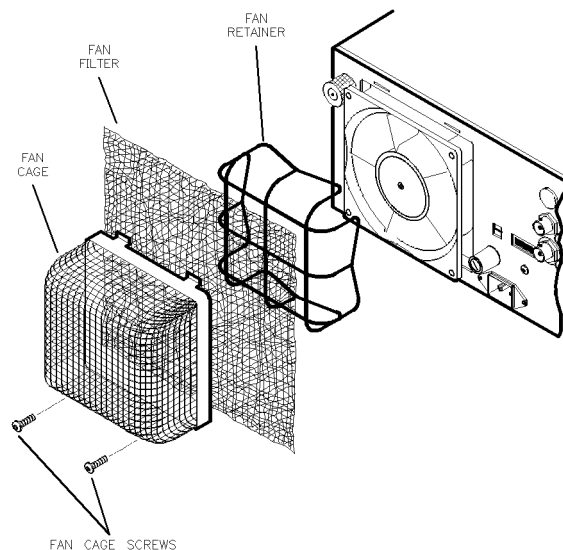
Figure 4-2. Removing the Fan Filter

How to Clean the Cabinet

WARNING

To prevent electrical shock, disconnect the 8360 L-series swept CW generator from the mains before cleaning.

Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

How to Clean the Display Filter

The display of the swept CW generator is protected by a plastic display filter. To clean the display filter, use mild soap or detergent and water, or a commercial window cleaner (ammonia does not hurt the plastic surface). Use a soft, lint-free cloth. Do *not* use abrasive cleaners, tissues or paper towels, which can scratch the plastic.

5

Instrument History

This chapter is left blank until this manual requires changes.

A

Address

Function Group SYSTEM

Menu Map 8

Description The `8360 Adrs` softkey lets you change the GPIB address of the swept CW generator. Enter the address desired using the numeric entry keys or the up/down arrow keys. The address value may be set between 0 and 30. The swept CW generator stores the address value in non-volatile memory. The default address of the swept CW generator is 19.

Programming Codes **SCPI:** SYSTem:COMMunicate:GPIB:ADDRess
Analyzer: NONE

See Also Connectors, `HP-IB Menu`
"Instrument Addresses" in Chapter 1
"Programming Typical Measurements" in Chapter 1

`Adrs Menu`

Function Group SYSTEM

Menu Map 8

Description This softkey accesses the GPIB address menu.

`Meter Adrs`   Controls the system power meter address.

`8360 Adrs`   Can control the swept CW generator's address, depending on the setting of the rear panel GPIB switch.

`Printer Adrs`   Controls the system printer address.

Programming Codes   **SCPI:** NONE, see the individual softkeys listed.
Analyzer: NONE

See Also   `HP-IB Menu`, softkeys listed above.
"Optimizing Swept CW Generator Performance" in Chapter 1
"GPIB Address Selection" in Chapter 3

(ALC)

Function Group	ALC
Menu Map	1

Description   This hardkey accesses the automatic level control (ALC) functions.

ALC BW Menu

Accesses the ALC bandwidth menu.

Coupling Factor

Specifies the coupling factor of an external coupling device and causes the display to indicate the power at the coupler main output.

Leveling Mode ALCoff

Disables the ALC leveling circuits. Relative power level is controlled by means of the level DAC and attenuator. Power is not sensed at any point, and absolute power level is uncalibrated.

Leveling Mode Normal

Sets the swept CW generator to continuous leveling at the specified leveling point.

Leveling Mode Search

The swept CW generator activates power search leveling mode. Similar to ALCoff mode, but first automatically searches for the correct modulator setting so that the desired power level is produced.

Leveling Point ExtDet

Sets the swept CW generator to level power externally. A negative detector output must be connected to the EXT ALC input.

Leveling Point Internal

Sets the swept CW generator to level power internally.

Leveling Point Module

Sets the swept CW generator to level power at the output of a millimeter-wave module. Either an HP/Agilent 8349B or 8355X series millimeter-wave source module must be connected to the SOURCE MODULE INTERFACE.

Leveling Point PwrMtr

Sets the swept CW generator to level power at an external power meter. A power meter's recorder output must be connected to the EXT ALC input.

`Pwr Mtr Range` Specifies the operating range of an external power meter used in an external leveling setup. This causes the swept CW generator display to agree with the power meter's power indication.

The following paragraphs explain the power control (leveling) function of the swept CW generator in detail.

ALC SYSTEM - OVERVIEW

The ALC system, referred to as a system because it encompasses more than one functional area, is shown as a simplified block diagram in Figure A-1. The purpose of this system is to control the amplitude or power level of the RF energy generated by the swept CW generator. It is a feedback control system, in which the output power is measured and compared to the desired power level. If the output power does not equal the desired power, level the ALC system changes the output until they are equal.

Desired power level can be set by either front panel or remote operation. As shown in Figure A-1, the inputs and calibration data are processed by the swept CW generator *CPU*, which uses this information to set the *Level DAC*. In turn, the *Level DAC* sends a controlling voltage to the *Level Control Circuits*.

In swept CW generators with optional step attenuators, the power level at the output connector can be reduced by a maximum of 90 dB, in 10 dB steps. This is in addition to the control capabilities provided by the *Level Control Circuits*.

A *Feedback Signal* to the *Level Control Circuits* can be provided by either internal or external detectors. This signal is the comparison voltage necessary for accurate, stable, power level settings and good source match at various *Leveling Points*. Alternatively, the power level can be set without using feedback. In this mode however, power level is uncalibrated and is subject to drift with temperature.

The following paragraphs describe the operation of the different leveling modes and leveling points.
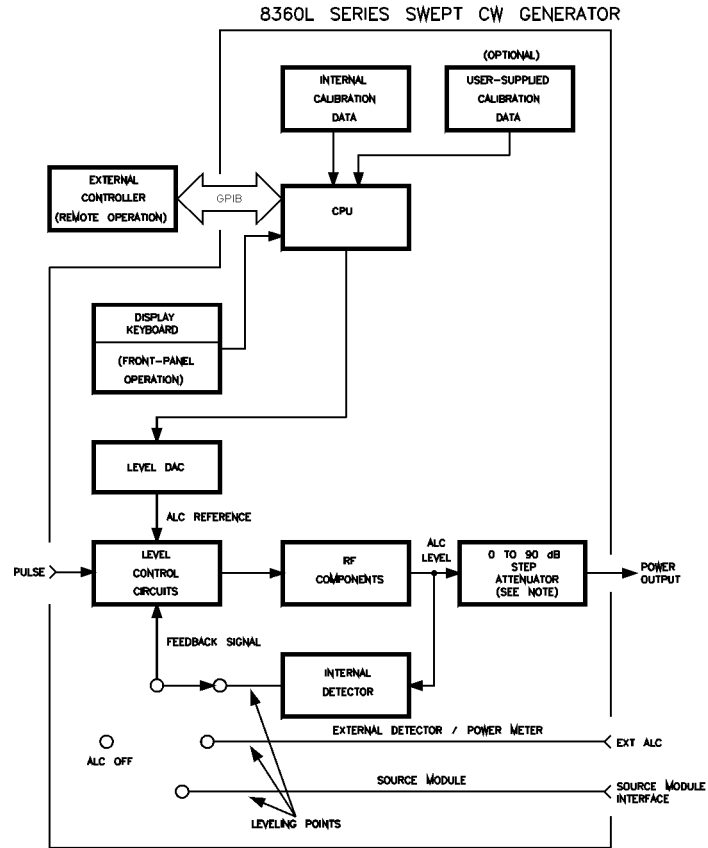
Figure A-1. ALC System Simplified Block Diagram

Note   Two terms are used in the following discussions: power output and ALC level. Power output means actual output power including the effects of the attenuator. ALC level means power levels before the attenuator. In swept CW generators without attenuators, these two terms are equivalent.

Internal Leveling - `Leveling Mode Normal`, `Leveling Point Intrnl`

In this configuration (Figure A-1), power is sensed by a detector internal to the swept CW generator and a dc output from this detector is fed back to the *Level Control Circuits*.

The ALC level is limited at the low end by the *Level Control Circuits* and at the high end by maximum available power. Noise and drift limit the range at the low end to −20 dBm or greater. The combination of RF frequency and RF components (different models of swept CW generator have different RF components) limit the ALC range available at the high end. The internal instructions (firmware) of the swept CW generator limit the ALC level range available for request from −20 to +25 dBm. If the power level requested is higher than the swept CW generator is capable of producing, the maximum available power is produced, and the message line displays `UNLVLED` (unleveled). When the swept CW generator performs frequency sweeps at certain ALC levels, maximum available power can be exceeded during small portions of the sweep; in this case, a flashing `UNLVLED` message appears.

ALC leveling accuracy depends on power level. Although the ALC level is useable from −20 to +25 dBm, it is most accurate from −10 to +10 dBm. This fact is reflected in the performance specifications of the swept CW generator.

Coupled Operation.   Since many applications require power output less than −20 dBm, an optional step attenuator has a range of 0 to 90 dB, in 10 dB steps. With this option, power output down to −110 dBm is achieved when the *Step Attenuator* and *Level Control Circuits* work in conjunction (see Figure A-1). With the attenuator, the ALC level is normally used over the smaller, more accurate portion of its range. Since ALC level accuracy suffers below −10 dBm, and at some frequencies only +1 dBm of RF output is available, the ALC level is set between −10 and 0 dBm. For power less than −100 dBm, the attenuator is set to 90 dB, and the ALC level is used from −10 to −20 dBm. At frequencies where power output above 0 dBm is desired, the attenuator is set to 0 dB, and the ALC level is used from 0 to +25 dBm (or whatever power is available at the RF frequency in use).

Coupled operation is assumed by the swept CW generator unless `Uncoupl Atten` or `Leveling Mode ALCoff` is selected. The proper combination of ALC level and attenuator setting is decided by the firmware. In coupled operation, when desired power output is set via

POWER LEVEL, the ALC level and attenuator are set automatically to provide the most accuracy for the power requested.

Uncoupled Operation. In some applications it is advantageous to control the ALC level and attenuator separately, using combinations of settings that are not available in coupled operation. In uncoupled mode (Uncoupl Atten), when the desired power output is set via POWER LEVEL, only the ALC level is changed. The attenuator setting is changed via Set Atten.

One use of uncoupled operation is power sweep, where the output power linearly tracks the sweep voltage ramp. The swept CW generator can generate power sweeps of up to 40 dB, depending on frequency. The power at the start of the sweep is set via POWER LEVEL (coupled operation) or by a combination of POWER LEVEL and Set Atten (uncoupled operation). The sweep range is entered by selecting Power Sweep. If the sweep range entered exceeds the ALC range (stop power greater than maximum available power), the UNLVLED warning message appears at the end of sweep. No warning is given at the time of entry. If the start power is entered when the swept CW generator is in coupled operation, the ALC level is set no lower than −10 dBm, limiting the available power sweep range. Using uncoupled operation and setting the ALC level to −20 dBm gives an additional 10 dB of sweep range.

External Leveling - Leveling Mode Normal,
Leveling Point ExtDet **or** PwrMtr **or** Module

In externally leveled operations, the output power from the swept CW generator is detected by an external sensor. The output of this detector is returned to the leveling circuits, and the output power is automatically adjusted to keep the power constant at the point of detection. Figure A-2 shows a basic external leveling arrangement. The output of the detected arm of the splitter or coupler is held constant. If the splitter response is flat, the output of the other arm is also constant. This arrangement offers superior flatness over internal leveling, especially if long cables are involved. Flatness may be improved with user flatness correction (FLTNESS ON/OFF, Fltness Menu) applied at the external leveling point.
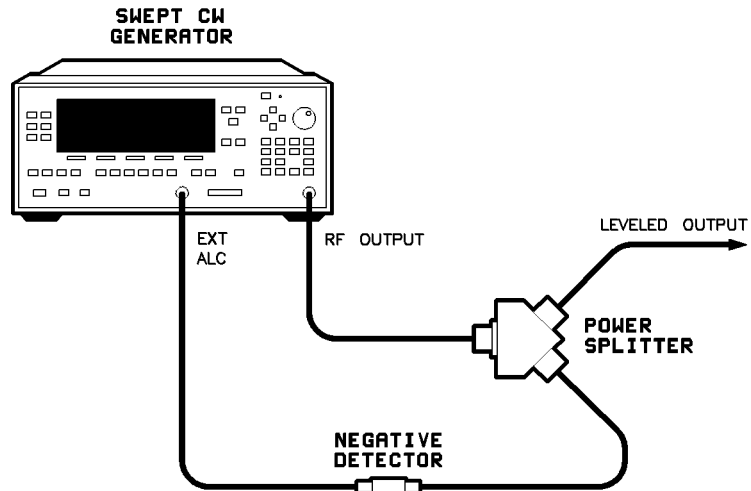
**SWEPT CW
GENERATOR**

EXT
ALC

RF OUTPUT

LEVELED OUTPUT

**POWER
SPLITTER**

**NEGATIVE
DETECTOR**

Figure A-2. Typical External Leveling Hookup

ALC Disabled - `Leveling Mode ALCoff` , `Leveling Mode Search`

ALC Off. In this configuration, the ALC is disabled, power is
not sensed at any point, and therefore the absolute power level is
uncalibrated (see Figure A-1). Direct and separate control of the
RF modulator (p/o *RF Components*) and the attenuator is possible.
The swept CW generator's front panel indicates the attenuator
setting and a reference level. The reference level is an approximate
indication of the attenuation provided by the RF modulator.
Typically the RF amplifier that follows the modulator is saturated
for modulation levels near 0 dB. Therefore the actual change in the
RF output power will not track the indicated reference level until the
amplifier is out of saturation.

The ALC off mode is useful for applications that involve pulse
modulation with extremely narrow pulses. If the pulse is narrow
enough, the ALC may be unable to provide accurate leveling due to
bandwidth limitations.

Search. Search mode is similar to the ALC off mode in that, the
ALC is disabled in order to remove bandwidth limitations. The
essential difference is that, when search mode is enabled, the swept
CW generator searches out the appropriate modulator level such that
the RF output power after the ALC is disabled closely matches the
power prior to search mode being enabled. Specifically, when search
mode is selected the swept CW generator follows this sequence of
steps:

1. All modulation is disabled and the ALC system is closed to
   provide a calibrated reference power.

2. The output power is measured using the internal coupler/detector.

3. The ALC system is disabled (opened).

ALC

4. While monitoring the internal detector, the RF modulator level is varied until the detected power is equivalent to the reference power measured in step 2.

5. Modulation is re-enabled if appropriate.

These steps are performed in approximately 200 μs and are repeated any time power or frequency is changed.

See Also   Softkeys listed above, `Fltness Menu`, (MOD), (POWER LEVEL), `Set Atten`
"Externally Leveling the Swept CW Generator" in Chapter 1
"Working with Mixers/Reverse Power Effects" in Chapter 1
"Working with Spectrum Analyzers/Reverse Power Effects" in Chapter 1

ALC Bandwidth Select Auto

Function Group   ALC

Menu Map   1

Description   This softkey sets the swept CW generator to choose the ALC bandwidth automatically depending on the current sweep and modulation conditions. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI: POWer:ALC:BANDwidth:AUTO ON|1
Analyzer: NONE

See Also   ALC BW Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

ALC Bandwidth Select High

Function Group   ALC

Menu Map   1

Description   This softkey sets the swept CW generator to the ALC high bandwidth position (100 kHz). In this mode, the ALC bandwidth operates in a wide bandwidth for all sweep and modulation conditions. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI: Sending the swept CW generator an ALC bandwidth frequency value of >10 kHz causes it to select the high ALC bandwidth mode.

POWer:ALC:BANDwidth:AUTO OFF|0
POWer:ALC:BANDwidth <freq>[freq suffix] or
MAXimum|MINimum

Analyzer: NONE

See Also   (ALC), ALC BW Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

ALC Bandwidth
Select Low

Function Group ALC

Menu Map 1

Description This softkey sets the swept CW generator to the ALC low bandwidth position (10 kHz).

In this mode, the ALC bandwidth operates in a narrow bandwidth for all sweep and modulation conditions. An asterisk next to the key label indicates that this feature is active.

Programming Codes **SCPI:** Sending the swept CW generator an ALC bandwidth frequency value of ≤10 kHz causes it to select the low ALC bandwidth mode.

POWer:ALC:BANDwidth:AUTO OFF|0
POWer:ALC:BANDwidth <freq>[freq suffix] or
MAXimum|MINimum

Analyzer: NONE

See Also (ALC), ALC BW Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

ALC BW Menu

Function Group ALC

Menu Map 1

Description This softkey reveals the softkeys of the ALC bandwidth select menu.

ALC Bandwidth Select Auto	Sets the ALC bandwidth to be automatically chosen by the swept CW generator, depending on the current sweep and modulation conditions.
ALC Bandwidth Select High	Sets the ALC bandwidth to the high bandwidth position (100 kHz), and to remain there for all sweep and modulation conditions.

ALC Bandwidth Select Low   Sets the ALC bandwidth to the low
                            bandwidth position (10 kHz), and
                            to remain there for all sweep and
                            modulation conditions.

See Also   (ALC)
"Optimizing Swept CW Generator Performance" in Chapter 1

Altrnate Regs

Function Group   SYSTEM

Menu Map   8

Description   This softkey causes the swept CW generator to alternate on
successive sweeps between the present instrument state and a second
instrument state stored in an internal register (1 to 8). Select
Altrnate Regs once to turn it on, a second time to turn it off. An
asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:**

SYSTem:ALTernate:STATe ON|OFF|1|0
SYSTem:ALTernate <num>|MAXimum|MINimum

Analyzer: AL1n, where n= 1 through 8 function on, AL0 function off

See Also   (RECALL), (SAVE)
"Saving and Recalling an Instrument State" in Chapter 1

Ampl Markers

Function Group   MARKER

Menu Map   3

Description   Active markers are normally displayed as intensified dots on a CRT display. With `Ampl Markers` selected, active markers are displayed as amplitude spikes (an abrupt discontinuity in the sweep trace). The marker amplitude can be varied. The swept CW generator displays: `--> AMPLITUDE MARKER SIZE:  XXXX dB` where XXXX represents an amplitude value. Use the rotary knob, the step keys, or the numerical entry keys with the dB(m) terminator key to set the desired value. If a small change is required, the left and right arrow keys can be used to underline the digit to be changed. Select `Ampl Markers` again to return to the normal intensified dot representation. See "Specifications" for the range of acceptable amplitude values. An asterisk next to the key label indicates this feature is active.

Programming Codes   **SCPI:** MARKer:AOFF
Analyzer: AK1 function on, AK0 function off.

See Also   (MARKER)
"Marker Operation" in Chapter 1
"Setting Up A Typical Sweep, Example Program 3" in Chapter 1

ANALYZER STATUS REGISTER

Function Group   NONE

Menu Map   NONE

Description   The following is the status register structure of the swept CW generator when the analyzer programming language is selected. This status structure is the structurally and syntactically the same as on the 8340/41.

OS(2B)   Output Status bytes, is used to read the two 8-bit status bytes from the swept CW generator. The first status byte concerns the cause of an SRQ (Service Request), while the second status byte concerns failures and faults, as follows:

STATUS BYTE (#1)								
Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
Function	SRQ on new frequencies or sweep time in effect.	REQUEST SERVICE (RQS)	SRQ on GPIB or syntax error.	SRQ on End of Sweep	SRQ on RF Settled	SRQ on Changed in Extended Status Byte	SRQ on Numeric Entry Completed (GP-IB or Front Panel)	SRQ on Any Front Panel Key Pressed
EXTENDED STATUS BYTE (#2)								
Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	6	8	4	2	1
Function	Fault Indicator On	RF Unleveled	Power Failure	RF Unlocked	External Frequency Reference Selected	Oven Cold	Over Modulation	Self Test Failed

Status Byte 1

Bit 0: SRQ caused by a key closure on the front panel of the swept CW generator (use the OM code to determine the front panel status).

Bit 1: SRQ caused by the completion of a numeric entry (use the OA code to determine the value of the numerical entry).

Bit 2: SRQ caused by a change in the extended status byte (status byte 2) affected by the RE-coded mask (see the RE code for an explanation of this masking).

Bit 3: SRQ caused by the completion of phase locking and the settling of the RF source (use the OK code to determine the last lock frequency).

Bit 4: SRQ on end-of-sweep or mid-sweep update in NA (network analyzer code) mode.

Bit 5: SRQ caused by GPIB syntax error.

Bit 6: SERVICE REQUEST; by IEEE-488 convention, the instrument needs service from the controller when this bit is set true.

Bit 7: SRQ caused by a change in the coupled parameters (start frequency, center frequency, and sweep time). Use the OC code to determine the new values of the coupled parameters.

Status Byte 2 (Extended Status Byte)

Bit 0: Self test failed at power on or at Instrument Preset. This bit remains latched until this status byte has been read, or until cleared by the CS or CLEAR 719 commands.

Bit 1: Excessive amplitude modulation input.

Bit 2: Oven for the reference crystal oscillator is not at operating temperature.

Bit 3: External reference frequency is selected.

Bit 4: RF is unlocked (UNLOCK appears in the message line). Use OF to determine the source of the unlocked output. This bit remains latched until this status byte has been read, or until cleared by the CS or CLEAR 719 commands.

Bit 5: ac line power interruption has occurred since the last Instrument Preset. This bit also remains latched until read or cleared.

Bit 6: RF is unleveled (use OR to determine present power level). This bit also remains latched until read or cleared.

Bit 7: FAULT message is displayed. Use OF to determine the cause of the fault.

See Also   SCPI STATUS REGISTER
Chapter 3

Arrow Keys

Function Group   ENTRY

Menu Map   NONE

Description   This group of entry keys lets you manipulate numerical values in the active entry line.

⟸ and ⟹ arrow keys identify (by underlining) the digit to be changed. For example, if CW frequency is in the active entry line, and the display indicates:

`--> CW:   10005.000000 MHz`

you may wish to change the 5 to a 6. Press the ⟹ five times until the underline is under the 5. Now use the rotary knob or the ⇑ to change the 5 to a 6. The underlined digit remains the active character in this function until the swept CW generator is preset, turned off, or the underline is moved completely left or right.

The ⇑ and ⇓ arrow keys increment or decrement the numeric value by a predetermined amount. The increment value depends on the active function and the step value set. All increment values are defaulted to their original values when the swept CW generator is preset (unless `Preset Mode User` has defined the default differently).

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   `Fltness Menu` , `List Menu`
"Entry Area" in Chapter 1
"Creating and Applying the User Flatness Correction Array" in Chapter 1

(ASSIGN)

Function Group   USER DEFINED

Menu Map   NONE

Description   This hardkey lets you select any softkey and assign its function to
1 of 12 user defined keys in the (USER DEFINED) Menu. The following
message appears on the swept CW generator display: `--> Press`
`MENU KEY to be assigned.` Complete keypaths are assigned not just
the key label. For example, assigning `List Menu` to the user defined
menu, copies the complete structure (keypath) of that key. All of the
pages and lower level menus are placed within the user defined menu.

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   USER DEFINED (MENU)

`Auto Fill Incr`

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   This softkey is used in two locations: `Fltness Menu` and `List Menu`.

Flatness Menu - When selected, the swept CW generator waits for a frequency increment value to be entered. `--> Increment:` is displayed in the active entry area. A list of frequencies is created automatically, beginning at the auto fill start frequency and always ending with the auto fill stop frequency. The swept CW generator uses the increment value on all points, but if the stop frequency requires a different increment to be used to be exact, the swept CW generator simply ends the frequency list at the stop frequency disregarding the increment value.

If the increment value requested creates a list that exceeds the number of elements available, the following message appears:

   `TOO MANY CORRECTION PTS REQUESTED`

List Menu - When selected, the swept CW generator waits for a frequency increment value to be entered. `--> Increment:` is displayed in the active entry area. A list of frequencies is created automatically, with all points separated by the frequency increment value. The list begins at the auto fill start frequency and ends at a frequency less than or equal to the auto fill stop frequency.

If the increment value requested creates a list that exceeds the number of points available (801), the following message appears:

   `TOO MANY LIST PTS REQUESTED`

Programming Codes   SCPI: NONE, see `Fltness Menu` or `List Menu`
Analyzer: NONE

See Also   `Fltness Menu`, `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Auto Fill #Pts

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   This softkey is used in two locations: `Fltness Menu` and `List Menu`.

Flatness Menu - When selected, the swept CW generator waits for a numeric value representing the number of correction points to be entered. `--> Number of Correction Points:` is displayed in the active entry area. A list of frequencies containing the number of specified points is created automatically. The list begins at the auto fill start frequency and ends at the auto fill stop frequency. The rest of the points are equally spaced between them. A minimum of two points must be entered.

If the number of points requested creates a list that exceeds the number of elements available (801), the following message appears:

```
TOO MANY CORRECTION PTS REQUESTED
```

List Menu - When selected, the swept CW generator waits for a numeric value representing the number of list points to be entered. `--> Number of List Frequencies:` is displayed in the active entry area. A list of frequencies containing the number of specified points is created automatically. The list begins at the auto fill start frequency and ends at the auto fill stop frequency. The rest of the points are equally spaced between them. A minimum of two points must be entered.

If the number of points requested creates a list that exceeds the number of points available (801), the following message appears:

```
Error...too many list points requested.
Points used: 0
Points available: 801
```

Programming Codes   **SCPI:** NONE, see `Fltness Menu` or `List Menu`
Analyzer: NONE

See Also   `Fltness Menu`, `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Auto Fill Start

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   This softkey is used in two locations: `Fltness Menu` and `List Menu`. The operation is the same in both applications.

This softkey enables the entry of a start frequency used to determine the beginning frequency of the automatic filling array. The array is not created until either the increment value or the number of points is assigned. The auto fill start frequency does not affect the swept CW generator start frequency. When `Auto Fill Start` is selected, the active entry area indicates:

```
--> Fill Start: XXXXXXXXX MHz
```

where X represents a numeric value. Unless a previous entry was made, the display indicates the swept CW generator minimum frequency.

Programming Codes   **SCPI:** NONE, see `Fltness Menu` or `List Menu`
Analyzer: NONE

See Also   `Fltness Menu`, `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Auto Fill Stop

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   This softkey is used in two locations: `Fltness Menu` and
`List Menu` . The operation is the same in both applications.

This softkey enables the entry of a stop frequency used to determine
the ending frequency of the automatic filling array. The array is not
created until either the increment value or the number of points is
assigned. The auto fill stop frequency does not affect the swept CW
generator stop frequency. When `Auto Fill Stop` is selected, the
active entry area indicates:

    --> Fill Stop: XXXXXXXXX MHz

where X represents a numeric value. Unless a previous entry was
made, the display indicates the swept CW generator maximum
frequency.

Programming Codes   **SCPI:** NONE, see `Fltness Menu` or `List Menu`
Analyzer: NONE

See Also   `Fltness Menu` , `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Auto Track

Function Group   POWER, USER CAL

Menu Map   5, 9

Description   This softkey optimizes the tracking of the swept CW generator's output filter to the oscillator. Use it to maximize RF power output. The swept CW generator displays: `Peaking At: XXXXX MHz`, where XXXXX represents frequency values. Peaking begins at the low frequency end and steps through to the high end of the frequency range. Auto Track is complete when the display returns to its original state. On swept CW generators without a step attenuator provide a good source match on the RF connector. Use a power sensor or a 10 dB attenuator. If a good source match is not provided, the swept CW generator can mistrack because of excessive reflections at the output.

Programming Codes   **SCPI:** CALibration:TRACk
Analyzer: SHRP

See Also   `Tracking Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Blank Disp

Function Group   SYSTEM

Menu Map   8

Description   When this softkey is selected, it causes the top four lines of the display to blank and remain blank until the (PRESET) key is pressed. Blanking the display prevents sensitive information from being displayed. As an added benefit, remote execution time is reduced because the display does not require refreshing. This key does not disable any other key functions. An asterisk next to the key label indicates this function is active.

Programming Codes   **SCPI:** DISPlay[:STATe] ON|OFF|0|1
Analyzer: SHS11 disables the display, SHS10 re-enables the display

See Also   Security Menu

C

(CENTER)

Function Group FREQUENCY

Menu Map NONE

Description This hardkey lets you select the center frequency for center frequency/frequency span swept operation. When you press (CENTER), the swept CW generator displays: `--> CENTER:  XXXXX MHz` where XXXXX represents a frequency value. Use the entry area to set the desired value.

Certain center frequency and frequency span combinations cause the swept CW generator to limit the value entered. In general, any combination that would cause the swept CW generator to exceed its minimum or maximum specified frequency will be limited.

Programming Codes **SCPI:**

FREQuency:CENTer <num>[freq suffix] or
MAXimum|MINimum|UP|DOWN
FREQuency:MODE SWEep

Analyzer: CF

See Also (SPAN), (START), (STOP)
"Center Frequency/Span Operation" in Chapter 1

Center=Marker

Function Group   MARKER

Menu Map   3

Description   This softkey sets the center frequency of the sweep to the frequency of the most recently activated marker. Select any marker M1 ... M5 , then select Center=Marker to change the center frequency of the sweep to that of the marker. The frequency span does not change unless the new sweep limits fall outside the frequency range of the swept CW generator. In that case, the swept CW generator automatically scales the frequency span to be within the swept CW generator's operating frequency range.

Programming Codes   **SCPI:**

MARKer[n][:FREQuency] ?
FREQuency:CENTer <freq from above>[freq suffix]

Analyzer: MC

See Also   (MARKER)
"Marker Operation" in Chapter 1

Clear Fault

Function Group   SERVICE

Menu Map   6

Description   This softkey clears all the latched fault status indicators.

Programming Codes   **SCPI:** DIAGnostics:OUTPut:FAULts
The above command relays the fault information and clears all faults.
Analyzer: NONE

See Also   Fault Menu

Clear Memory

Function Group   SYSTEM

Menu Map   8

Description   This softkey causes the swept CW generator to return to the factory preset instrument state, after writing alternating ones and zeroes over all state information, frequency lists, and save/recall registers. You can select the number of times to clear memory. When you select Clear Memory , the swept CW generator displays the following in the active entry area:

--> # OF TIMES TO CLEAR MEMORY: X

Enter the number of times the state information should be overwritten. While the swept CW generator is working to overwrite the state information, it flashes the count on the display.

This softkey causes the swept CW generator to recall the original calibration data stored in permanent memory (EEROM) all list and user ALC correction data will be lost.

Programming Codes   **SCPI:**

SYSTem:SECurity:COUNt <n>
SYSTem:SECurity[:STATe] ON
SYSTem:SECurity[:STATe] OFF

The transition from on to off triggers the blanking. Sending the "off" message by itself will do nothing.
Analyzer:

SHMZ18HZ
SHKZ0HZ

See Also   Security Menu
"Using the Security Features" in Chapter 1

`Clear Point`

Function Group   POWER

Menu Map   5

Description   This softkey lets you change the correction value for the active
frequency point to the "Undefined" state.

Programming Codes   **SCPI:** NONE, see `Fltness Menu`
Analyzer: NONE

See Also   (ALC), `Fltness Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

CONNECTORS

BNC Connectors   **AUX OUTPUT** provides a reference signal from 2 to 26.5 GHz at a
typical minimum power level of −10 dBm. Nominal input impedance
is 50 Ω.

EXT ALC allows the swept CW generator to be externally leveled.
This input is used for power meter leveling or negative crystal
detector leveling.

Input impedance in crystal or meter leveling modes is nominally
1 MΩ. See "Specifications" for the signal requirements. Nominal
input impedance is 100 kΩ.

SWEEP OUTPUT provides a voltage range of 0 to +10 V. When
the swept CW generator is sweeping, the SWEEP OUTPUT is
0 V at the beginning of the sweep and +10 V at the end of the
sweep regardless of the sweep width. In CW mode, the SWEEP
OUTPUT ranges from 0 V at the swept CW generator minimum
frequency to +10 V at the specified maximum frequency, with a
proportional voltage for frequencies between the specified minimum
and maximum. When the swept CW generator is in manual sweep
operation the sweep output voltage is a percentage of the span.
Minimum load impedance is 3 kΩ.

STOP SWEEP IN/OUT stops a sweep when this input is pulled
low.

Retrace does not occur, and the sweep resumes when this input is
pulled high.

The open circuit voltage is TTL high and is internally pulled low when the swept CW generator stops its sweep. Externally forcing this input high will not cause damage or disrupt normal operation.

10 MHz REF INPUT accepts a 10 MHz ±100 Hz, 0 to +10 dBm reference signal for operation referenced to an external time base. Nominal input impedance is 50 Ω.

10 MHz REF OUTPUT provides a 0 dBm, 10 MHz signal derived from the internal frequency standard of the swept CW generator. This input is a 50Ω connector that can be used as the master clock reference output for a network of instruments.

TRIGGER INPUT activated on a TTL rising edge. Used to externally initiate an analog sweep or to advance to the next point of a step list or a frequency list.

TRIGGER OUTPUT produces a 1 μs wide TTL-level pulse at 1601 points evenly spaced across an analog sweep, or at each point in a step list or a frequency list.

VOLTS/GHz supplies a voltage that is proportional to the RF output frequency, with a ratio of 0.5 volt output for every 1 GHz of RF frequency (factory setting). This ratio is switchable to either 0.25 or 1 volt. The switch is located on the A12 SYTM assembly, see Adjustments in the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide* for information. This output is designed to drive into 2 kΩ or greater.

Z-AXIS BLANK/MKRS supplies a positive rectangular pulse (approximately +5 V into 2 kΩ) during the retrace and switch points when the swept CW generator is sweeping. This output also supplies a −5 V pulse when the RF output is coincident with a marker frequency.

Multi-pin Connectors

AUXILIARY INTERFACE connector provides control signals to the 8516A S-parameter test set switch doubler. This connector is a 25-pin D-subminiature receptacle located on the rear panel. It is also used for dual swept CW generator measurement systems (two-tone systems). Refer to `Step Control Master` for more information.

Table C-1. Pin Description of the Auxiliary Interface

Pin #	Function	In/Out	Signal Level
1	No Connection		
2	Z-Axis Blanking/Markers	Out	Blank=+5 V Marker=−5
3	Spare		
4	Spare	I/O	TTL
5	Low Stop Sweep	I/O	TTL
6	+5.2 V	Out	TTL
7	No Connection		
8	Divider-Sync	Out	TTL
9	External Trigger	In	TTL
10	Spare	Out	TTL
11	Spare	Out	TTL
12	Low Retrace	I/O	TTL
13	No Connection		
14	Low Marker	Out	TTL
15	Low Qualified Stop Sweep	Out	TTL
16	Spare	Out	TTL
17	Spare	Out	TTL
18	Sweep Output	Out	0 to 10 V ramp
19	Ground		
20	Low Blank Request	In	TTL
21	Spare		
22	No Connection		
23	Spare		
24	Low Source Settled	Out	TTL
25	No Connection		

AUXILIARY INTERFACE

13   1

25   14

RS−232 CABLE
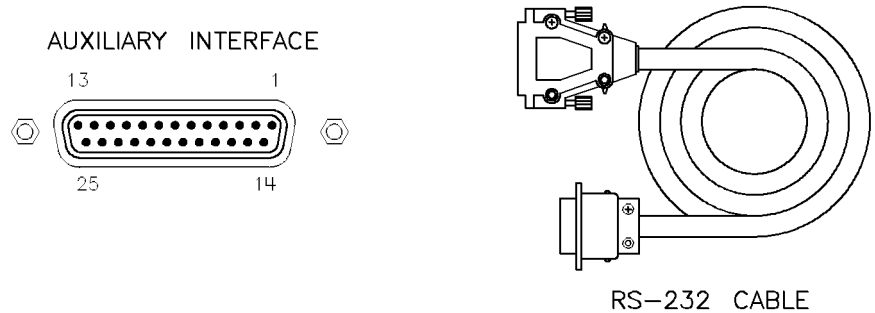
Figure C-1. Auxiliary Interface Connector

GPIB connector allows the swept CW generator to be connected to any other instrument or device on the interface bus. All GPIB instruments can be connected with GPIB cables and adapters. These cables are shown in the accompanying illustration. The adapters are principally extension devices for instruments that have recessed or crowded GPIB connectors.

hpib
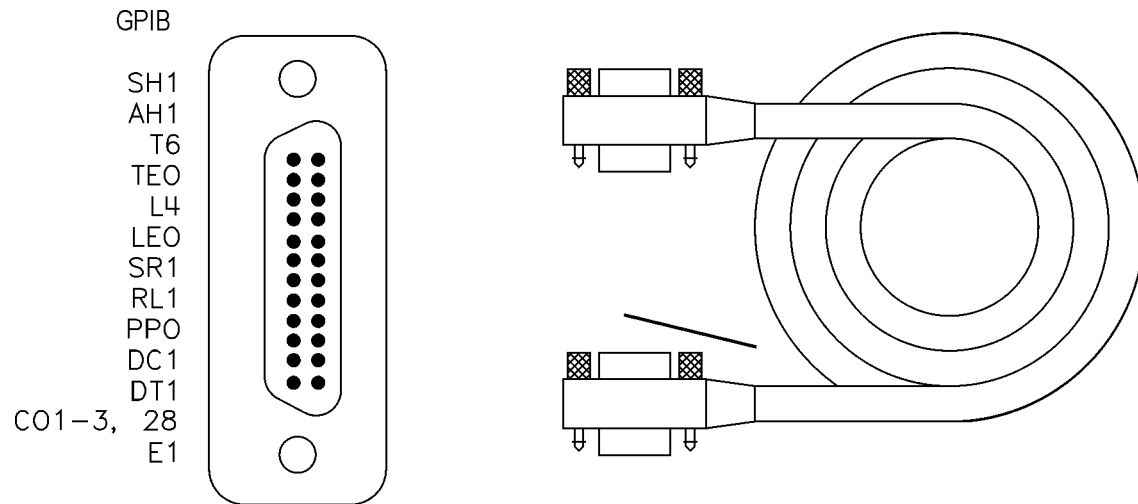
Figure C-2. GPIB Connector and Cable

GPIB Interface Cables Available

GPIB Cable Part Numbers	Lengths
HP/Agilent 10833A	1m (3.3 ft)
HP/Agilent 10833B	2m (6.6 ft)
HP/Agilent 10833C	4m (13.2 ft)
HP/Agilent 10833D	0.5 m (1.6 ft)

As many as 14 GPIB instruments can be connected to the swept CW generator (15 total instruments in the system). The cables can be interconnected in a "star" pattern (one central instrument, with the GPIB cables emanating from that instrument like spokes on a wheel), or in a linear pattern (like boxcars on a train), or any combination pattern. There are certain restrictions:

- Each instrument must have a unique GPIB address, ranging from 0 to 30 (decimal). Refer to `8360 Adrs` for information on setting the swept CW generator's GPIB address.

- In a two-instrument system that uses just one GPIB cable, the cable length must not exceed 4 meters (13 ft).

- When more than two instruments are connected on the bus, the cable length to each instrument must not exceed 2 meters (6.5 ft) per unit.

- The total cable length between all units must not exceed 20 meters (65 ft).

Agilent manufactures GPIB extender instruments (HP/Agilent models 37201A, 37204A/B) that overcome the range limitations imposed by the cabling rules. These extenders allow twin-pair cable operation up 1 km (3,280 ft), and telephone modem operation over any distance. Agilent Sales and Service offices can provide additional information on the GPIB extenders.

The codes next to the GPIB connector, illustrated in Figure C-2, describe the GPIB electrical capabilities of the swept CW generator, using IEEE Std. 488-1978 mnemonics (GPIB, GPIB, IEEE-488, and IEC-625 are all electrically equivalent). Briefly, the mnemonics translate as follows:

SH1	Source Handshake, complete capability.
AH1	Acceptor Handshake, complete capability.
T6:	Talker; capable of basic talker, serial poll, and unaddress if MLA.
TEO	Talker, Extended address; no capability.
L4	Listener, capable of basic listener, and unaddress if MTA.
LEO	Listener, Extended address; no capability.
SR1	Service Request, complete capability.
RL1	Remote Local, complete capability.
PPO	Parallel Poll, no capability.
DC1	Device Clear, complete capability.
DT1	Device Trigger, complete capability.
CO, 1, 2, 3, 28	Controller capability options; CO, no capabilities; C1, system controller; C2, send IFC and take charge; C3, send REN; C28, send I. F. messages.
E1	Electrical specification indicating open collector outputs.

These codes are described completely in the *IEEE Std 488-1978* document, published by The Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, New York 11017.

SOURCE MODULE INTERFACE sends and receives digital and analog signals to and from an HP/Agilent 83550-Series millimeter-wave source module. With the source module connected, the swept CW generator assumes the characteristics of the source module. Refer to Leveling Point Module for more information.
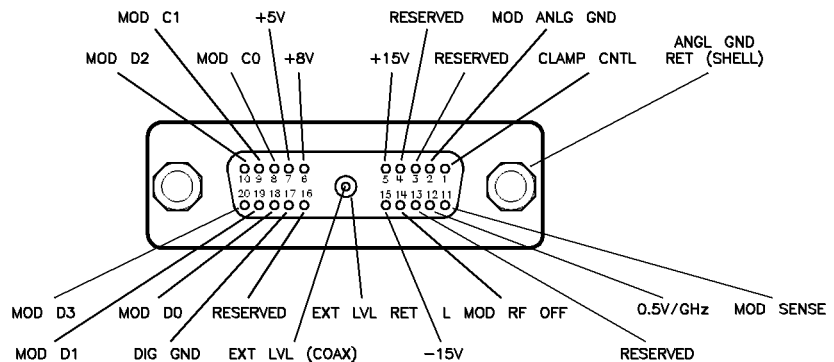
Figure C-3. Interface Signals of the Source Module Connector

The codes indicated on the illustration above translate as follows:

MOD D0	Source module data line zero. Signals MOD D0 through MOD D3 are the mm source module data bus lines (bi-directional).
MOD D1	Data line one.
MOD D2	Data line two.
MOD D3	Data line three.
MOD C0	Source module control line zero. Signals MOD C0 and MOD C1 are the control lines for the read/write to and from the mm source module.
MOD C1	Control line one.
CLAMP CNTL	Source module clamp control (not used).
MOD SENSE	Source module sense. A 1 mA current is injected on this line by the mm source module to indicate its presence. This signal always equals 0 V.
L MOD RF OFF	Low = RF off. Source module RF is turned off.
EXT LVL RET	Source module external leveling return.
EXT LVL	Source module external leveling input, from the mm source module.
0.5 V/GHz	Internal 0.5 V/GHz to the mm source module.

−15 V	Power supply. Range is −14.25 to −15.90 V.
+15 V	Power supply. Range is +14.25 to +16.40 V
+8 V	Power supply. Range is +7.75 to +8.25 V.
+5 V	Power supply. Range is +4.75 to +5.45 V.
DIG GND	Digital ground.
MOD ANLG GND	Source module analog ground.
ANLG GND RET	Analog ground return.

RF Output Connector The swept CW generator is equipped with a precision 3.5 mm male connector (2.4 mm male connector on 40 GHz models). The output impedance, SWR, and other electrical characteristics are listed in "Specifications." When making connections, carefully align the center conductor elements, then rotate the knurled barrel while the mating component remains still. Tighten until firm contact is made.

Take care when working with either of these connectors. If this connector is mechanically degraded in any way, high frequency losses occur. Refer to *Application Note 326, Connector Care*, for more information.

[CONT]

Function Group SWEEP

Menu Map 7

Description This hardkey initiates continuous sweep-retrace cycling of the swept CW generator. The sweep is initiated by one of the trigger functions, while the sweep speed is controlled by the sweep time function. The green LED located above this key lights when the swept CW generator is performing a list, step, or analog sweep.

The LED is off during all of the following: retrace, band crossings, phase locking at the start frequency of each new sweep and during manual sweeps.

Programming Codes **SCPI:** INITiate:CONTinuous ON|1
Analyzer: S1

See Also Manual Sweep , [SINGLE]
"Continuous, Single, and Manual Sweep Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Copy List

Function Group   POWER

Menu Map   5

Description   This softkey lets you copy the frequency information of the frequency list to the flatness correction menu. If there is no frequency list to copy, nothing happens.

Programming Codes   SCPI: NONE, see Fltness Menu
Analyzer: NONE

See Also   (ALC), Fltness Menu

CorPair Disable

Function Group   POWER

Menu Map   5

Description   This softkey lets you disable the user flatness array (frequency-correction pairs) so that the 1601 point flatness array will be applied when (FLTNESS ON/OFF) is on. The 1601 point flatness array is accessible only through the GPIB interface.

Programming Codes   SCPI: CORRection:SOURce[0|1] ARRay
Analyzer: NONE

See Also   Fltness Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

Coupling Factor

Function Group ALC

Menu Map 1

Description This softkey allows specification of the coupling factor of an external coupler/detector used to externally level the swept CW generator output power. Negative coupling factor values are required for valid entry. See "Specifications" for the coupling factor range.

Programming Codes **SCPI:** POWer:ALC:CFACtor <num>[dB]|MAXimum|MINimum
Analyzer: NONE

See Also (ALC)
"Externally Leveling the Swept CW Generator" in Chapter 1

(CW)

Function Group FREQUENCY

Menu Map 2

Description This hardkey lets you select a synthesized continuous wave frequency. When you press (CW), the swept CW generator stops sweeping (green SWEEP LED off) and displays: --> CW: XXXXX MHz where XXXXX represents a frequency value. Use either the rotary knob, the step keys (with or without the left/right arrow keys), or the numerical entry keys with a terminator key to set the desired value. If a small change is desired, use the left and right arrow keys to underline the digit to be changed.

Programming Codes **SCPI:**

FREQuency[:CW] <num>[freq suffix] or
MAXimum|MINimum|UP|DOWN
FREQuency:MODE CW

Analyzer: CW

See Also CW/CF Coupled , (START), (STOP)
"CW Operation and Start/Stop Frequency Sweep" in Chapter 1
"Programming Typical Measurements" in Chapter 1

CW/CF Coupled

Function Group   FREQUENCY

Menu Map   2

Description   This softkey couples the CW function to the center frequency function. Any change initiated in either one of these parameters causes a change in the other.

Programming Codes   **SCPI:** FREQuency:CW:AUTO ON|OFF|1|0
Analyzer: NONE

See Also   (CENTER), (CW)

D

Dblr Amp Menu

Function Group   POWER

Menu Map   5

Description   This softkey accesses the doubler amp mode softkeys. These softkeys are applicable to instrument models with a doubler installed. The doubler has an integral amplifier whose operation is controlled by the instrument firmware. Its use depends on the frequency of operation and on the calibration constants set at the factory. The instrument defaults after preset to this automatic mode of operation which is the specified operation. Softkeys in this menu will allow you to turn the doubler amplifier always on or always off. These two modes are *unspecified* operation for instruments with a doubler installed. These softkeys have no effect on instruments without a doubler.

Doubler Amp Mode AUTO	Sets the doubler amp mode to AUTO. This is the default after preset and must be used for specified performance.
Doubler Amp Mode On	Turns the doubler amplifier on regardless of the frequency of operation. Using this mode results in *unspecified* performance.
Doubler Amp Mode Off	Turns the doubler amplifier off regardless of the frequency of operation. Using this mode results in *unspecified* performance.

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   Softkeys listed above.

Delete Menu

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   In the menu structure there are two occurrences of this softkey. It leads to the delete choices for both the frequency list menu and the power flatness menu.

Delete All   Deletes the complete array.

Delete Current   Deletes the active line in the array.

Delete Undef   Appears in the power flatness menu only. It deletes the points that are undefined.

Programming Codes   **SCPI:** NONE, see Fltness Menu or List Menu
Analyzer: NONE

See Also   Fltness Menu, List Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

Delete All

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   In the menu structure there are two occurrences of this softkey. One occurs in the frequency list menu. The other occurs in the power flatness menu.

In the both applications, this softkey lets you delete all entries in the array with one keystroke.

Programming Codes   **SCPI:** NONE, see Fltness Menu or List Menu
Analyzer: NONE

See Also   Fltness Menu, List Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

Delete Current

Function Group   FREQUENCY, POWER

Menu Map   2, 5

Description   In the menu structure there are two occurrences of this softkey. One occurs in the frequency list menu. The other occurs in the power flatness menu.

In the list menu application, the frequency entry and the associated offset and dwell values in the active line are deleted. The active line is designated by the --> pointer and can be pointing at any of values within the array.

In the flatness menu application, the frequency and associated correction value in the active line is deleted. The active line pointer --> can be pointing to either the frequency value or the correction value.

Programming Codes   SCPI: NONE, see Fltness Menu or List Menu
Analyzer: NONE

See Also   Fltness Menu , List Menu

Delete Undef

Function Group   POWER

Menu Map   5

Description   This softkey occurs in the power flatness menu. It lets you delete only those points that are undefined. Undefined correction values are noted by the display as Undefined.

Programming Codes   SCPI: NONE, see Fltness Menu
Analyzer: NONE

See Also   Fltness Menu

Delta Marker

Function Group   MARKER

Menu Map   3

Description   This softkey causes the difference in frequency between two markers to appear on the swept CW generator display. The frequency difference is indicated in the following format: `--> DELTA MARKER |m - n|   XXXXX MHz` where m= the last marker activated, n= the reference marker, and XXXXX represents some frequency value. On a CRT display, the trace between the two selected markers is intensified. An asterisk next to the key label indicates that this feature is active.

At preset (factory), the swept CW generator is set to measure the difference between M2 and M1 (marker reference). If markers have not been activated after preset, selecting `Delta Marker` indicates the difference between M2 and M1. Both of these markers have an asterisk next to their key label, indicating that they are on.

Whenever `Delta Marker` is selected, it reactivates the last marker selected and makes that marker the "m" frequency. If the delta marker feature is active, selecting a marker causes the "m" frequency to change to the marker selected. If a frequency entry is made when delta marker is in the active entry area, the frequency value of the "m" frequency is changed to the new frequency entry causing the new difference in frequency to be displayed. Negative frequency differences are possible if "n" is greater than "m".

Programming Codes   **SCPI:** MARKer[n]:DELTa? <num>, <num>
Analyzer: MD1 function on, MD0 function off

See Also   (MARKER)
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Delta Mkr Ref

Function Group MARKER

Menu Map 3

Description This softkey displays the five markers available as the delta marker reference. The delta marker frequency is calculated using the equation:

$$f_{\delta m} = f_m - f_{mref}$$

where f_m is the frequency of the active marker and f_{mref} is the frequency of the reference marker.

Programming Codes **SCPI:** MARKer:REFerenc <marker number>
Analyzer: MD1 function on, MD0 function off.

See Also Delta Marker
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Disp Status

Function Group SYSTEM

Menu Map 8

Description This softkey causes the status of various features to be displayed. For example, this is what the swept CW generator displays as its status after a factory preset:

```
Pls=Off                 Lvl=Int     RF Slp=Off
 AM=Off                 ALC=On      Pwr Swp=Off
 FM=Off     UsrCorr=Off             SwpMode=Swept
 Altn=Off   SwpTrig=Auto            AutoCal=None
```

This key is useful when checking the current operation state of the swept CW generator. The following is a listing of the various mnemonics used to indicate status.

Table D-1. Mnemonics used to Indicate Status

Function	Mnemonic	State	Mnemonic
Pulse	Pls	Off Scalar	Off Scalar
AM	AM	Off	Off
FM	FM	Off	Off
Alternate Registers	Altn	Off On	Off On
ALC Leveling Point	Lvl	Internal External Power Meter Source Module	Int Ext Mtr Mod
ALC Leveling Mode	ALC	On Off Search	On Off Srch
Flatness On/Off	UsrCorr	Off On	Off On
Start Sweep Trigger	SwpTrig	Automatic GPIB External	Auto Bus Ext
Power Slope	Rf Slope	Off On	Off On
Power Sweep	Pwr Swp	Off On	Off On
Sweep Mode	SwpMode	Ramp Step List CW Span=0	Swept Step List CW Zero Span
Peak RF Always	AutoCal	On	Peaking or Peak
SwpSpan Cal Always	AutoCal	On	SweptFreq or Freq or Frq

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   STATUS MESSAGES

Doubler Amp Mode AUTO

Function Group   POWER

Menu Map   5

Description   This softkey is applicable to instrument models with a doubler installed. The doubler has an integral amplifier whose operation is controlled by the instrument firmware. The use of the amplifier depends on the frequency of operation and on the calibration constants set at the factory. The instrument defaults after preset to this automatic mode of operation which is the specified operation. This softkey has no effect on instruments without a doubler.

An asterisk next to the key label indicates that this feature is active. This feature is the default after preset.

Programming Codes   **SCPI:**

  POWer:AMPLifier:STATE:AUTO ON|OFF|0|1
  POWer:AMPLifier:STATE:AUTO?

Analyzer: NONE

See Also   Dblr Amp Menu

Doubler Amp Mode Off

Function Group   POWER

Menu Map   5

Description   This softkey is applicable to instrument models with a doubler installed. The doubler has an integral amplifier whose operation is controlled by the instrument firmware. This softkey turns off the automatic mode of operation and turns off the amplifier so that it is never used. This is an *unspecified* mode of operation since the output power may not be at the maximum leveled output power specification at frequencies generated in the doubled mode. This softkey has no effect on instruments without a doubler.

An asterisk next to the key label indicates that this feature is active.

`Doubler Amp Mode Off`

Programming Codes SCPI:

POWer:AMPLifier:STATE ON|OFF|0|1
POWer:AMPLifier:STATE?

Analyzer: NONE

See Also `Dblr Amp Menu`

`Doubler Amp Mode On`

Function Group POWER

Menu Map 5

Description This softkey is applicable to instrument models with a doubler installed. The doubler has an integral amplifier whose operation is controlled by the instrument firmware. This softkey turns off the automatic mode of operation and turns on the amplifier so that it is always used. This is an *unspecified mode* of operation since it can cause increased harmonics and degraded dynamic range at some frequencies. This softkey has no effect on instruments without a doubler.

An asterisk next to the key label indicates that this feature is active.

Programming Codes SCPI:

POWer:AMPLifier:STATE ON|OFF|0|1
POWer:AMPLifier:STATE?

Analyzer: NONE

See Also `Dblr Amp Menu`

Dwell Coupled

Function Group FREQUENCY

Menu Map 2

Description This softkey lets you couple the dwell time for points in the stepped frequency sweep mode to the ramp sweep mode sweep time. The equation to determine the dwell time in the dwell coupled mode is as follows:
Coupled Dwell Time = (sweep time) ÷ (number of step points)

An asterisk next to the key label indicates that this feature is active.

Programming Codes **SCPI:** SWEep[:FREQuency]:DWEL1:AUTO ON|1
Analyzer: NONE

See Also Step Swp Menu

8360 Adrs

Function Group   SYSTEM

Menu Map   8

Description   This softkey lets you change the GPIB address of the swept CW
generator. Enter the address desired using the numeric entry keys
or the up/down arrow keys. The address value may be set between
0 and 30. The swept CW generator stores the address value in
non-volatile memory. The default address of the swept CW generator
is 19.

Programming Codes   **SCPI:** SYSTem:COMMunicate:GPIB:ADDRess
Analyzer: NONE

See Also   Connectors, `HP-IB Menu`
"Instrument Addresses" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Enter Corr

Function Group   POWER

Menu Map   5

Description   This softkey lets you enter a power correction value for a frequency
point in the flatness array. A frequency point must be entered before
a correction value can be accepted, otherwise the following error
message appears:

`ERROR - Must first enter correction freq.`

The up/down arrow keys let you scroll through the frequency points
available for power correction. If no correction value is entered
for a frequency point, the swept CW generator display indicates
`Undefined`. The range of acceptable values is −40 to +40 dB. An
asterisk next to the key label indicates that this feature is active.

Enter Corr

Programming Codes SCPI: NONE, see `Fltness Menu`
Analyzer: NONE

See Also `Fltness Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Enter Freq

Function Group POWER

Menu Map 5

Description This softkey lets you enter a frequency point into the flatness correction array. When the Power `Fltness Menu` is selected, `Enter Freq` is automatically activated. Frequency points must be entered before correction values can be accepted into the array. Frequency points can be entered in any order, and the swept CW generator automatically reorders them beginning with the lowest frequency. One frequency-correction pair is the minimum and 801 is the maximum number of points that can be entered. An asterisk next to the key label indicates that this feature is active.

Programming Codes SCPI: NONE, see `Fltness Menu`
Analyzer:NONE

See Also `Fltness Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Enter List Dwell

Function Group FREQUENCY

Menu Map 2

Description   This softkey lets you enter a dwell time for a frequency point in the frequency list array. A frequency point must be entered before a dwell value can be accepted, otherwise the following error message appears:

ERROR: Must first enter a List Frequency.

The rotary knob and the up/down arrow keys let you scroll through the frequency points available to change the default dwell values. The range of values is 100 μs to 3.2 s. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI: NONE, see List Menu
Analyzer:NONE

See Also   List Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

Enter List Freq

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you enter a frequency point into the frequency list array. The frequency list may contain as few as one and as many as 801 points. The order frequencies are entered is the order they are listed. Additions to an existing list are placed as indicated by the active entry arrow. The rotary knob and the up/down arrow keys let you scroll through the frequencies points. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI: NONE, see List Menu
Analyzer:NONE

See Also   List Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

`Enter List Offset`

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you enter an offset value for a frequency in the frequency list. A frequency point must be entered before a power value can be accepted, otherwise the following error message appears:

`ERROR:  Must first enter a List Frequency.`

The rotary knob and the up/down arrow keys let you scroll through the frequency points available to change the default power values. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** NONE, see `List Menu`
Analyzer:NONE

See Also   `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

ENTRY KEYS

Function Group   NONE

Menu Map   NONE

Description   The entry keys consist of the numeric entry keys (0 through 9), the decimal point key, the negative sign/backspace key, and the terminator keys. These keys are active whenever the ENTRY ON/OFF LED is lit.

See Also   ARROW KEYS, ROTARY KNOB
"Entry Area" in Chapter 1

ENTRY ON/OFF

Function Group	ENTRY
Menu Map	NONE

Description   This softkey lets you turn off (blank) the active entry area and disable the ARROW keys, rotary knob, and entry keys. When any function key (hard or soft) is pressed, the active entry area is reactivated. The yellow LED, ENTRY ON, next to ENTRY ON/OFF indicates whether the entry area is active (LED on=active).

Programming Codes   **SCPI:** No specific code activates ENTRY ON/OFF
Analyzer:EF=off

See Also   Arrow Keys
"Entry Area" in Chapter 1

Ext Det Cal

Function Group	USER CAL
Menu Map	9

Description   This softkey enables the swept CW generator to act as a controller to an HP/Agilent 437B power meter. This softkey causes an immediate execute on the interface bus and generates an GPIB error if no power meter is present on the interface bus or if the swept CW generator is unable to address the power meter. Use external detector calibration to characterize and compensate for an external negative diode detector used in an external leveling configuration.

Programming Codes   **SCPI:**

CALibration:PMETer:DETector:INITiate? DIODe
CALibration:PMETer:DETector:NEXT? <num>[lvl suffix]

Analyzer:NONE

See Also

"Optimizing Swept CW Generator Performance" in Chapter 1

F

Fault Menu

Function Group   SERVICE

Menu Map   6

Description   This softkey accesses the fault information softkeys. Use this softkey if a fault is indicated on the message line.

`Fault Info 1`	Indicates the latched status of PEAK, TRACK, RAMP, SPAN, V/GHZ, and ADC.
`Fault Info 2`	Indicates the latched status of EEROM, PWRON, CALCO, PLLZERO, PLLWAIT, and FNXFER.
`Fault Info 3`	Indicates the latched status of CALYO, CALMAN, TMR CNFLCT, and SEARCH.
`Clear Fault`	Clears all latched fault status messages.

Programming Codes   **SCPI:** DIAGnostics:OUTput:FAULts
This command produces a string of ones and zeroes (16 bits) separated by commas to indicate the latched status of the different fault indicators.

Bit #	Fault Name
0	PEAK
1	TRACK
2	RAMP
3	SPAN
4	V/GHZ
5	ADC
6	EEROM
7	PWRON
8	CALCO
9	PLLZERO
10	PLLWAIT
11	FNFXER
12	CALYO
13	CALMAN
14	TMR CNFLCT
15	SEARCH

Analyzer: NONE

See Also   Softkeys listed above.

Fault Info 1

Function Group   SERVICE

Menu Map   6

Description   This softkey displays the latched status of the following fault messages.

PEAK FAIL   Indicates that the peak algorithm is unable to align the YTM passband to the frequency of the YO. This fault indication is possible only if a peaking or autotrack routine has been initiated.

TRACK FAIL   Indicates that the autotrack algorithm is unable to calculate the calibration constants needed to track the YTM passband to the frequency of the YO. This fault indication is possible only if an autotrack routine has been initiated.

RAMP FAIL   Indicates that the ramp algorithm is unable to adjust the sweep ramp voltage to 10.00 V at the end of the sweep. Initiate a full self-test to gather more information if this fault is indicated.

SPAN FAIL   Indicates that the span algorithm is unable to adjust the YO to achieve the correct frequency at the end of a band. This fault indication is possible only if a sweep span routine has been initiated.

V/GHZ FAIL   Indicates that the internal YO V/GHz line adjusted at power-on or at preset is unable to calibrate. Initiate a full self-test to gather more information if this fault is indicated.

ADC FAIL   Indicates that the ADC (analog-to-digital converter) is not responding to a measurement request within the time-out period. The ADC is used extensively in the operations of the swept CW generator. Initiate a full self-test to gather more information if this fault is indicated.

Programming Codes   SCPI: See Fault Menu .
                        Analyzer: NONE

See Also   Fault Menu

Fault Info 2

Function Group   SERVICE

Menu Map   6

Description   This softkey displays the latched status of the following fault messages.

EEROM FAIL   Indicates that the EEROM (electrically erasable read only memory) has failed to store data properly. Whenever any data is stored in EEROM, the integrity of the data is checked (read back and compared to the data in RAM).

The EEROM is the main storage location for calibration data. If this fault is indicated the present calibration data may be lost.

PWRON FAIL   Indicates that the test of the processor, ROM, RAM and I/O system performed at power-on has failed. The front panel INSTR CHECK LED lights. Initiate a full self-test to gather more information if this fault is indicated.

CALCO FAIL   Indicates that the internal calibration data has been defaulted either deliberately or due to an EEROM failure.

PLLZERO FAIL   Indicates a phase lock loop error caused by either a hardware failure or misadjustment.

PLLWAIT FAIL   Indicates a phase lock loop error caused by either a hardware failure or misadjustment. Initiate a full self-test to gather more information if this fault is indicated.

FNXFER FAIL   Indicates that the transfer of fractional-N data has failed. Initiate a full self-test to gather more information if this fault is indicated.

`Fault Info 2`

Programming Codes   SCPI: NONE
                          Analyzer: NONE

See Also   `Fault Menu`

`Fault Info 3`

Function Group   SERVICE

Menu Map   6

Description   This softkey displays the latched status of the following fault messages.

CALYO FAIL	Indicates that the YO adjusted at power-on or at preset is unable to calibrate. Initiate a full self-test to gather more information if this fault is indicated.
CALMAN FAIL	Indicates that the manual sweep DAC adjusted at power-on or at preset is unable to calibrate. Initiate a full self-test to gather more information if this fault is indicated.
TMR CNFLCT FAIL	Indicates a possible internal software error. Two routines are trying to use the same timer.
SEARCH	Indicates that the ALC search leveling algorithm has failed. This fault indication is possible only if the search leveling mode is on.

Programming Codes   SCPI: NONE
                          Analyzer: NONE

See Also   `Fault Menu`

Fltness Menu

Function Group POWER

Menu Map 5

Description This softkey reveals the softkeys in the flatness correction menu that control user-defined leveling parameters.

Auto Fill Incr	Automatically creates a frequency list with all points separated by the specified increment in a given frequency range.
Auto Fill #Pts	Automatically creates a frequency list containing the specified number of points in a given frequency range.
Auto Fill Start	Sets the start frequency of the flatness correction array that will load automatically when either the number of points or the increment size is specified.
Auto Fill Stop	Sets the stop frequency of the flatness array that will load automatically when either the number of points or the increment size is specified.
Clear Point	Changes the power correction value for the indicated frequency point to the undefined state.
Copy List	Copies the frequency list, (see List Menu), into the frequency parameter of the flatness correction array.
CorPair Disable	Disables the frequency-correction pair array and uses the GPIB transferred 1601 point correction set to apply correction information.
Delete Menu	Reveals the delete softkeys.
Enter Corr	Enables the entry of a power correction value for a frequency point.
Enter Freq	Enables the entry of a single frequency point into the flatness correction array.
Freq Follow	Sets the swept CW generator to CW frequency mode so that the corresponding correction values can be entered.
Mtr Meas Menu	Reveals the softkeys in the power meter measure correction menu.

The softkeys in this menu help front panel users enter and edit flatness correction parameters. These editing softkeys are not accessible over GPIB.

To load correction arrays over GPIB, the correction arrays must be created in the controlling program and then downloaded to the swept CW generator. The corresponding SCPI array creation and control commands are given after the description of this feature.

The 8360 L-Series Swept CW Generator provide extremely flat power to a test port, for testing power sensitive devices such as amplifiers, mixers, diodes or detectors. The user flatness correction feature of the swept CW generator compensates for attenuation and power variations created by components between the source and the test device.

User flatness correction allows the digital correction of up to 801 frequency points (1601 points via GPIB), in any frequency or sweep mode (i.e. start/stop, CW, power sweep etc.). Using a power meter to calibrate the measurement system as shown in Figure F-1, a table of power level corrections is created for the frequencies where power level variations or losses occur (see Figure F-2). These frequencies may be sequential linear steps or arbitrarily spaced. To allow for the correction of multiple test setups or frequency ranges, you may save as many as eight different measurement setups (including correction tables) in the internal storage registers of the swept CW generator.
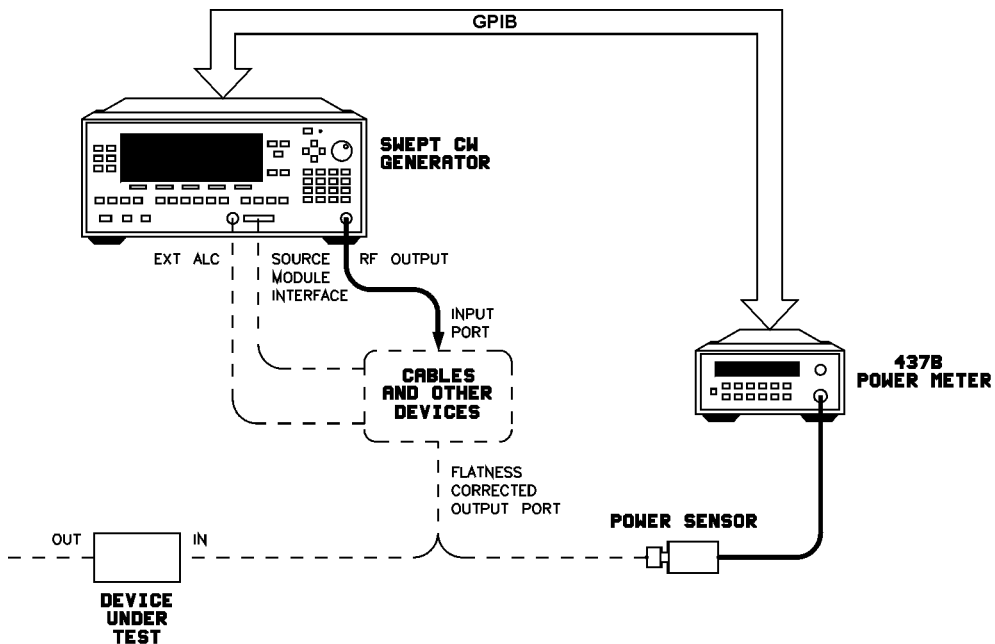
flat1l

Figure F-1. Basic User Flatness Configuration Using an HP/Agilent 437B Power Meter

```
┌──────────────────────────────────────────────────┐
│                                                    │
│       Frequency  (MHz)              Correction     │
│   —>       10.000000               Undefined       │
│           110.000000               Undefined       │
│           210.000000               Undefined       │
│   ................. Auto  Fill  ..................  │
│                                            more    │
│     Start       Stop       # Pts      Incr   2/3   │
│                                                    │
└──────────────────────────────────────────────────┘
        ┌────┐   ┌────┐   ┌────┐   ┌────┐   ┌────┐
```
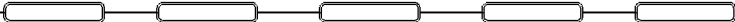
Figure F-2.
User Flatness Correction Table as Displayed by the Swept CW Generator

Theory of operation

The unparalleled leveled output power accuracy and flatness of the
Agilent 8360 L-Series swept CW generator. This is achieved by using
a new digital (versus analog) design to control the internal automatic
leveling circuitry (ALC).

An internal detector samples the output power to provide a dc
feedback voltage. This voltage is compared to a reference voltage
which is proportional to the power level chosen by the user. When
there is a discrepancy between voltages, the power is increased
or decreased until the desired output level is achieved. For
comprehensive theory on the ALC system, refer to the (ALC) entry in
the "A" section of this manual.

The factory-generated internal calibration data of the swept CW
generator is digitally segmented into 1601 data points across the
start/stop frequency span chosen. Subsequently, these points are
converted into 1601 reference voltages for the ALC system. The
digital ALC control scheme not only delivers excellent power
accuracy and flatness at the output port of the swept CW generator,
but also provides the means to execute the user flatness correction
feature.

Generally, a power meter is required to create a table of correction
data that produces flat power at the test port. You may measure
and enter correction data for up to 801 points. The correction data
contained in the table is linearly interpolated to produce a 1601-point
data array across the start/stop frequency span set on the swept CW
generator. The 1601-point data array is summed with the internal
calibration data of the swept CW generator (Figure F-3). When user
flatness correction is enabled, the sum of the two arrays produces the
1601 reference voltages for the ALC system.
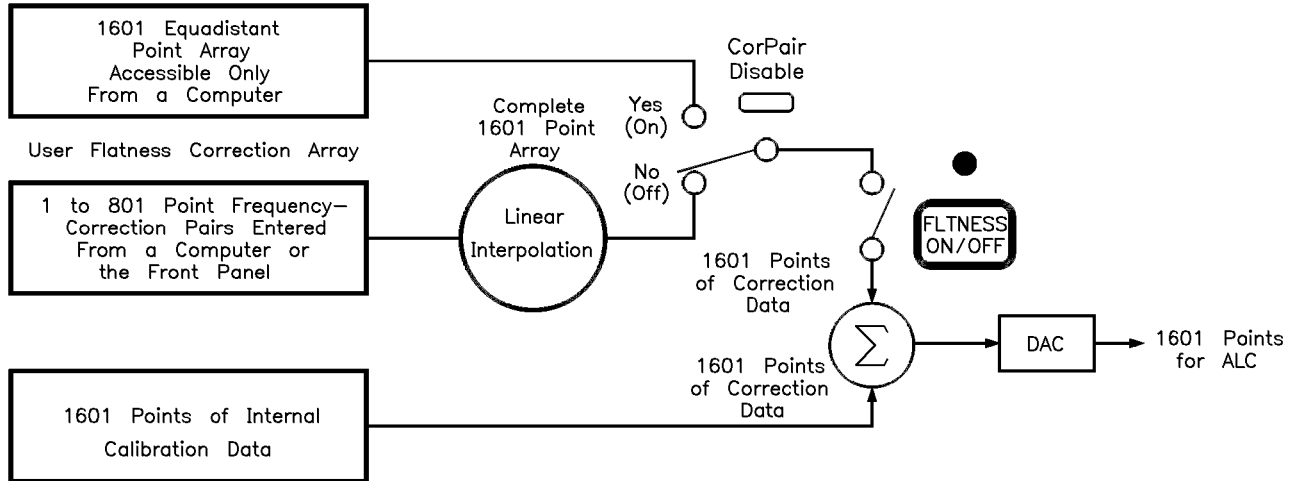
Figure F-3. The Sources of ALC Calibration Correction Data

If the correction frequency span is only a subset of the start/stop frequency span set on the source, no corrections are applied to the portion of the sweep that is outside the correction frequency span. The following example illustrates how the data is distributed within the user flatness correction array.

Assume that the swept CW generator is set to sweep from 2 to 18 GHz, but you only enter user flatness correction data from 14 to 18 GHz. Linear interpolation occurs between the correction entries to provide the 401 points required for the 14 to 18 GHz portion of the array. No corrections are applied to the 2 to 13.99 GHz portion of the array. Refer to Figure F-4.
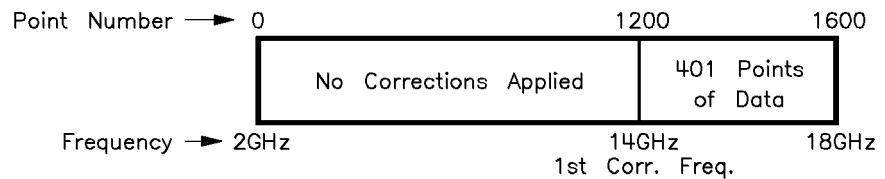
Figure F-4.
Array Configuration when the Correction Data Frequency Span
is a Subset of the Swept CW Generator Frequency Span

Number of points interpolated between correction entries is calculated as follows:

$$\left[\frac{\text{freq. span between correction entries}}{\text{stop frequency} - \text{start frequency}} \right] 1600 - 1 = \text{Number of pts}$$

When correction frequencies are arbitrarily spaced, the number of interpolated points varies.

When utilizing the user flatness correction feature, do not exceed the swept CW generator ALC operating range. Exceeding the ALC range causes the output power to become unleveled and eliminates the benefits of user flatness correction. The ALC range can be determined by subtracting the minimum output power (−20 dBm) from the maximum specified power. When the optional step attenuator is ordered on a swept CW generator, at times it may be necessary to uncouple the attenuator to obtain the full ALC range. This can be accomplished by selecting POWER [MENU] [Uncoupl Atten]. For example, an 83630L has an ALC range of ≥30 dB (≥+10 to −20 dBm).

When user flatness correction is enabled, the maximum settable test port power is equivalent to the maximum available leveled power minus the maximum path loss ($P_{o\ max} - P_{path\ loss}$). For example, if an 83630L has a maximum path loss of 15 dB due to system components between the source output and the test port, the test port power should be set to −5 dBm. When user flatness correction is enabled, this provides the maximum available power to the device under test (DUT).

Programming Codes

SCPI:

■ CORRection:FLATness {<num>[freq suffix],<num>[DB]}2*801

The portion of the above command contained in { } can be entered from one to 801 times. This command creates the frequency-correction pair array similar to the front panel array. The correction entered is at the associated frequency and frequencies in between are determined by linear interpolation.

■ CORRection:FLATness?

This command queries the flatness array created with CORR:FLAT.

■ CORRection:ARRay[i] {<num>[DB]}1601*1601

The portion of the above command contained in {} must be entered 1601 times. This array must contain 1601 evenly spaced correction values. This command creates the 1601-point correction set that has no equivalent front panel entry. If this command is used to enter flatness correction information the CORRection:SOURce command (described below) will be set to array. There is an array for the foreground state (i=0) and for the background state (i=1). If [i] is not specified, the default is the foreground state (i=0).

■ CORRection:ARRay[i]?

This command queries the entire 1601-point correction set.

■ CORRection:SOURce[i] ARRay|FLATness

When the above command is set to flatness CORR:SOUR FLAT, the array chosen is the frequency-correction pair array. When the

command is set to array `CORR:SOUR ARR`, the array chosen is the 1601 point correction set.

■ CORRection:SOURce[i]?

Queries the source of correction.

■ CORRection[:STATe] ON|OFF|1|0

Sets the switch on the user flatness correction feature. This is the same as pressing (FLTNESS ON/OFF) on the front panel.

■ CORRection:STATe?

Queries the condition of the internal switch.

■ CORRection:FLATness:POINts? [MAXimum|MINimum]

The above command returns information on how many frequency-correction pairs were entered using the `CORR:FLAT` command.

Analyzer: NONE

See Also   (ALC), (FLTNESS ON/OFF), List Menu
"Optimizing Swept CW Generator Performance" in Chapter 1
"Programming Typical Measurements" in Chapter 1

(FLTNESS ON/OFF)

Function Group   POWER

Menu Map   5

Description   This hardkey applies flatness correction to the swept CW generator RF output. If no array has been created, pressing this key applies 0 dB of flatness correction at all points. The yellow LED above the hardkey lights when user flatness correction is on.

Programming Codes   **SCPI:** CORRection[:STATe] ON|OFF|1|0
Analyzer: NONE

See Also   (ALC), Fltness Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

Freq Cal Menu

Function Group   USER CAL

Menu Map   9

Description   This softkey accesses the sweep span calibration menu.

Swp Span Cal Always   Performs a sweep span calibration each time the frequency span is changed.

Swp Span Cal Once   Performs a sweep span calibration.

Programming Codes   **SCPI:** NONE, see softkeys listed above.
Analyzer: NONE

See Also   Softkeys listed above.
"Optimizing Swept CW Generator Performance" in Chapter 1

Freq Follow

Function Group   POWER

Menu Map   5

Description   This softkey facilitates the entry of correction values. The swept CW generator generates the corresponding CW frequency at the set power level as you scroll the correction cells of the flatness array. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** NONE, see Fltness Menu
Analyzer: NONE

See Also   Fltness Menu
"Optimizing Swept CW Generator Performance" in Chapter 1

FREQUENCY (MENU)

Function Group   FREQUENCY

Menu Map   2

Description   This hardkey allows access to the frequency functions listed below.

CW/CF Coupled	When this feature is on, the center frequency and the CW frequency is kept equal. Changing either the center frequency or the CW frequency causes the other to change to the same value. An asterisk next to the key label indicates that this feature is active.
Freq Mult	Sets the frequency multiplier value and applies it to all frequency parameters.
Freq Offset	Sets the frequency offset value and applies it to all frequency parameters.
List Menu	Displays the frequency list create/edit softkeys.
Step Swp Menu	Reveals the stepped frequency sweep edit softkeys.
Up/Down Size CW	Sets the frequency step size in the CW frequency mode.
Up/Down Size Swept	Sets the frequency step size in the swept frequency mode.
Zoom	Places the swept CW generator in the CF/ΔF sweep mode, where the rotary knob and numeric entry keys control CF, and the up/down arrow keys control ΔF.

See Also   Softkeys listed above.
"Optimizing Swept CW Generator Performance" in Chapter 1

Freq Mult

Function Group FREQUENCY

Menu Map 2

Description This softkey lets you set a frequency multiplier value and applies it to all frequency parameters. Any integer value between and including ±36 is accepted. Changing the multiplier value changes the display, it does not affect the output of the swept CW generator.

For example:

1. Set the start frequency to 4 GHz.

2. Set the stop frequency to 10 GHz.

3. Set the frequency multiplier to 5.

Note that the display indicates start=20 GHz, stop=50 GHz and asterisks appear next to the frequency data.

4. Now set the stop frequency to 30 GHz. The swept CW generator frequency is 6 GHz, or 30 GHz ÷ 5.

Frequency multiplier and offset are related as shown by the following equation:

Entered value or Displayed Frequency = (Frequency Generated × Multiplier) + Offset value

The factory preset value is 1. An asterisk next to the key label indicates that this feature is active.

Programming Codes **SCPI:**

FREQuency:MULTiplier <num>|MAXimum|Minimum
FREQuency:MULTiplier:STATe ON|OFF|1|0

<num> will be rounded to the nearest integer.
Analyzer: SHFA <n>

See Also FREQUENCY (MENU), Freq Offset

Freq Offset

Function Group FREQUENCY

Menu Map 2

Description This softkey lets you set a frequency offset value and applies it to all frequency parameters. The frequency offset ranges between and including ±110.0 GHz. Changing the frequency offset value changes the display but does not affect the output frequency. Frequency multiplier and offset are related as shown by the following equation:

Entered value or Displayed Frequency = (Frequency Generated × Multiplier) + Offset value

The factory preset value is 0 Hz. An asterisk next to the key label indicates that this feature is active.

Programming Codes SCPI:

FREQuency:OFFSet <num>|MAXimum|MINimum
FREQuency:OFFSet:STATe ON|OFF|1|0

Analyzer: SHFB <n>[Hz|Kz|Mz|Gz|]

See Also FREQUENCY (MENU), Freq Mult

FullUsr Cal

Function Group USER CAL

Menu Map 9

Description This softkey initiates a full swept CW generator user calibration. The calibration performed is instrument state dependent. For example, if the swept CW generator is in ramp sweep mode, a sweep span calibration and an auto track is done. If the swept CW generator has amplitude modulation active on a CW signal, then an RF peaking calibration is performed.

Programming Codes   SCPI:
See the individual types of calibration.
Analyzer: NONE

See Also   Auto Track, Peak RF Always, Peak RF Once,
Swp Span Cal Always, Swp Span Cal Once

G

Global Dwell

Function Group   FREQUENCY

Menu Map   2

Description   This softkey is used to set a dwell time value for *all* points in the frequency list array.

Programming Codes   SCPI: NONE, see `List Menu`
Analyzer:NONE

See Also   `Enter List Dwell`, `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Global Offset

Function Group   FREQUENCY

Menu Map   2

Description   This softkey is used to set an offset value for *all* points in the frequency list array.

Programming Codes   SCPI:NONE, see `List Menu`
Analyzer: NONE

See Also   `Enter List Offset`, `List Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

H

GPIB Address

To set the swept CW generator's GPIB address, refer to "Address" in this manual.

HP-IB Menu

Function Group   SYSTEM

Menu Map   8

Description   This softkey reveals the softkeys in the GPIB control menu.

Adrs Menu	Reveals the softkeys that allow GPIB addresses to be changed.
Programming Language Analyzr	Sets analyzer as the external interface language.
Programming Language CIIL	Sets CIIL as the external interface language.
Programming Language SCPI	Sets SCPI as the external interface language.

Three different programming languages are available:

- **SCPI**, Standard Commands for Programmable Instruments, is the instrument control programming language developed by Agilent to conform to the IEEE 488.2 standard (replacing IEEE 728-1982). The IEEE 488.2 standard provides codes, formats, protocols, and common commands that were unavailable in the previous standard.

- **Analyzer** is the programming language compatible with the HP/Agilent 8340/41 synthesized sweepers system language and many network analyzers.

- **CIIL**, Control Interface Intermediate Language, is the instrument control programming language used in option 700 swept CW generators. Option 700 swept CW generators are M.A.T.E. (Modular Automatic Test Equipment) compatible.

See Also   CONNECTORS, GPIB
"Getting Started Programming" in Chapter 1

Leveling Mode
ALCoff

Function Group   ALC

Menu Map   1

Description   This softkey lets you open the ALC loop. Direct and separate control of the linear modulator circuit (LVL DAC) and attenuator (ATN) is possible (see Figure A-1). The power level must be set using an external indicator (power meter/sensor). If the power level is set when the swept CW generator is in CW mode and then pulse modulation is activated, the peak pulse level equals the CW level. The attenuator value is set via the Set Atten softkey in the POWER menu.

An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI:

POWer:ALC:STATe OFF|0
POWer:ATTenuation:AUTO OFF|0

Analyzer: SHA3

See Also   (ALC), (MOD), Pulse On/Off External , Set Atten
"Working with Mixers/Reverse Power Effects" in Chapter 1

Leveling Mode Normal

Function Group   ALC

Menu Map   1

Description   This softkey lets you set the leveling mode of the swept CW generator to continuous leveling at the desired leveling point. In this mode, the RF OUTPUT is controlled by the automatic level control (ALC) circuit, otherwise referred to as the leveling loop. The attenuator works in conjunction with the ALC to achieve the full range of power levels. At factory preset, ALC normal is the default state. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** POWer:ALC:STATe ON|1
Analyzer: A1, internal normal; A2, external normal; A3, external power meter normal; SHA2, source module normal.

See Also   (ALC)

Leveling Mode Search

Function Group   ALC

Menu Map   1

Description   This softkey causes the ALC to switch off once the desired power level is reached. When this leveling mode is activated, or when power, or frequency is changed, the swept CW generator switches to CW frequency and closes the ALC system until the desired power level is reached. The swept CW generator reverts to its original frequency/modulation state and opens the ALC system. This mode is similar to ALC off mode and is useful for narrow pulse applications. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI: POWer:ALC:STATe SEARch
Analyzer: SHA1

See Also   (ALC), Pulse Modulation
"Working with Spectrum Analyzers/Reverse Power Effects" in
Chapter 1

Leveling Point ExtDet

Function Group   ALC

Menu Map   1

Description   This softkey lets you set the swept CW generator to accept an
external feedback connection from a negative-output diode detector
to level power. The EXT ALC BNC is the input connection for the
required signal. An asterisk next to the key label indicates that this
feature is active.

Programming Codes   **SCPI:**
POWer:ALC[:SOURCce] DIODe
POWer:ATTenuation:AUTO OFF|0
Analyzer:
A2

See Also   (ALC)
"Externally Leveling the Swept CW Generator" in Chapter 1

Leveling Point Intrnl

Function Group   ALC

Menu Map   1

Description   This softkey lets you set the swept CW generator to level at the output of the directional coupler located inside the swept CW generator. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** POWer:ALC[:SOURce] INTernal
Analyzer: A1

See Also   (ALC)

Leveling Point Module

Function Group   ALC

Menu Map   1

Description   This softkey lets you set the swept CW generator to level at the output of an HP/Agilent 8355X series millimeter-wave source module. All models of the 8360 L-Series swept CW generator drive mm-wave source modules. High power models of 8360 drive the mm-wave source modules directly and to specified power levels.

An HP/Agilent 8349B power amplifier is needed in other configurations. The source module interface multi-pin connector provides the communication path between the swept CW generator and mm-wave source module. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** POWer:ALC[:SOURce] MMHead
Analyzer: SHA2

See Also   (ALC), CONNECTORS
"Externally Leveling the Swept CW Generator" in Chapter 1

Leveling Point PwrMtr

Function Group   ALC

Menu Map   1

Description   This softkey lets you set the swept CW generator to level at the power sensor of an external power meter. This mode of operation requires a feedback connection from the power meter to the EXT ALC BNC located on the swept CW generator. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** POWer:ALC[:SOURce] PMETer
Analyzer: A3

See Also   (ALC), CONNECTORS
"Externally Leveling the Swept CW Generator" in Chapter 1

LINE SWITCH

Function Group   NONE

Menu Map   NONE

Description   The line switch (on/off switch) has two positions, off or standby and on. If line power is connected to the swept CW generator and the line switch is set to off, the swept CW generator is in the standby state (amber LED on). Standby provides power to the internal frequency standard oven.

When line power is connected and the line switch is set to on, the swept CW generator power supplies are enabled and a limited self-test is initiated. The CPU self test is performed; power supplies and the front panel processor are checked.

Programming Codes   NONE

See Also   "INSTALLATION" for information on fuses.
"Error Messages" for information on messages displayed at power on.

List Menu

Function Group   FREQUENCY

Menu Map   2

Description   This softkey allows access to the frequency list functions.

`Auto Fill Incr`	Automatically creates a frequency list using the user-specified increment value.
`Auto Fill #Pts`	Automatically creates a frequency list containing a user-specified number of points.
`Auto Fill Start`	Allows the entry of a start frequency for the frequency list.
`Auto Fill Stop`	Allows the entry of a stop frequency for the frequency list.
`Delete Menu`	Reveals the frequency list delete menu.
`Enter List Dwell`	Allows the entry of a dwell time for a frequency point in the frequency list.
`Enter List Freq`	Allows the entry of a frequency point into the frequency list.
`Enter List Power`	Allows the entry of an ALC output power correction value for a frequency in the frequency list.
`Global Dwell`	Automatically sets the dwell time for all points in the frequency list to a user-specified value.
`Global Offset`	Automatically sets the ALC output power correction value for all points in the frequency list to a user-specified value.
`Pt Trig Menu`	Reveals the frequency list in the point trigger menu.

A frequency list consists of two or more frequency points. A frequency point can be any frequency value within the specified frequency range of the swept CW generator and must be entered before a value for either ALC output power offset or dwell time is accepted. The maximum number of frequency points in a frequency list is 801.

Creating a Frequency List

There are two methods of constructing a frequency list:

1. Use the `Enter List Freq` softkey to begin entering frequency points. The list will be generated in the order the values are entered.

2. If the minimum and maximum frequencies of the swept CW
   generator frequency range are not the endpoints desired for the
   frequency list, use the `Auto Fill Start` and `Auto Fill Stop`
   softkeys to define the frequency list endpoints. Then, use either
   the `Auto Fill Incr` or `Auto Fill #Pts` softkeys to create the
   list. A list created by this method is ordered with the lowest
   frequency as the first point and the highest frequency as the last
   point of the frequency list.

Editing Frequency Points

To add a frequency point to the list, place the active entry arrow `-->`
where you want the next frequency point to appear. The frequency
point is added directly after the value indicated by the arrow.

Lists created by the Auto Fill method are appended to an existing
list much the same way frequency points are added to a list. The
newly created list is added between the frequency point indicated by
the active entry arrow and the point directly after it.

Note   If adding a new list of frequencies causes the existing list to exceed
the maximum number of frequency points allowed (801), the new list
is not appended to the existing list. The error message TOO MANY
LIST PTS REQUESTED is displayed.

To remove a frequency point and its associated offset value and dwell
time, use the delete menu (`Delete Current`) softkey. To remove an
entire frequency list, use the delete menu, (`Delete All`) softkey.

Editing ALC Offset and Dwell Time

Once a frequency point has been entered, you can assign an ALC
offset and a dwell time value. Use either the `Enter List Power`
or `Global Offset` softkey to enter offset values. Use either the
`Enter List Dwell` or `Global Dwell` softkey to enter dwell time
values.

The editing softkeys of this menu are not accessible over GPIB.
Frequency lists to be loaded over GPIB must first be created in the
controlling program and then downloaded in their entirety to the
swept CW generator.

Programming Codes   SCPI:

LIST:FREQuency {<num>[freq suffix]|MAXimum|MINimum}
LIST:[POWer]:CORRection {<num>[DB]|MAXimum|MINimum}
LIST:DWELl {<num>[time suffix]|MAXimum|MINimum}

In the above three commands, the entries contained in {} can be
repeated between 1 to 801 times.
LIST:DWELl:POINts? [MAXimum|MINimum]
LIST:FREQuency:POINts? [MAXimum|MINimum]

LIST[:POWer]:CORRection:POINts? [MAXimum|MINimum]

In the above three commands, the swept CW generator responds with the number of points for the named parameter that are in the list array.

If a particular list is shorter than another, an error is generated upon execution. An exception is made for the case where the shorter list is of length 1. In this case, the list of length 1 is treated as though it were a list of equal length, with all values the same. At *RST, all lists for the current state are cleared and reset to a single value.

Analyzer: NONE

See Also (RECALL), (SAVE), Sweep Mode List
"Creating and Using a Frequency List" in Chapter 1

List Mode Pt Trig Auto

Function Group FREQUENCY

Menu Map 2

Description This softkey lets you set the swept CW generator to automatically step through a frequency list, when the swept CW generator is in sweep list mode.

Programming Codes **SCPI:** LIST:TRIGger:SOURce IMMediate
Analyzer: NONE

See Also List Menu , Pt Trig Menu , Sweep Mode List
"Creating and Using a Frequency List" in Chapter 1

List Mode Pt Trig Bus

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you set the trigger point to be the GPIB. When the swept CW generator receives an GPIB trigger, it steps to the next frequency point of the frequency list, provided the swept CW generator is in sweep list mode.

Programming Codes   **SCPI:** LIST:TRIGger:SOURce BUS
Analyzer: NONE

See Also   List Menu , Pt Trig Menu , Sweep Mode List
"Creating and Using a Frequency List" in Chapter 1

List Mode Pt Trig Ext

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you set the trigger point to be an external hardware trigger. When the swept CW generator receives an external hardware trigger, it steps to the next frequency point of the frequency list, provided the swept CW generator is in sweep list mode.

Programming Codes   **SCPI:** LIST:TRIGger:SOURce EXTernal
Analyzer: NONE

See Also   List Menu , Pt Trig Menu , Sweep Mode List
"Creating and Using a Frequency List" in Chapter 1

$\boxed{\text{LOCAL}}$

Function Group	INSTRUMENT STATE
Menu Map	NONE
Description	This hardkey lets you cancel remote operation and return the swept CW generator to front panel operation. The front panel keys are deactivated when the swept CW generator is operated remotely. If the external controller executes a LOCAL LOCKOUT command, pressing the $\boxed{\text{LOCAL}}$ key does not return the swept CW generator to front panel control.
Programming Codes	**SCPI:** LOCAL **Analyzer:** LOCAL
See Also	NONE "Getting Started Programming" in Chapter 1 "Programming Typical Measurements" in Chapter 1

M1--M2 Sweep

Function Group   MARKER

Menu Map   3

Description   This softkey lets you set the swept CW generator to start sweeping at the frequency of marker 1 (M1), and stop sweeping at the frequency of marker 2 (M2). M2 must have a higher frequency value than M1. If M1--M2 Sweep is activated when M2 is at a lower frequency than M1, the values of M1 and M2 are permanently interchanged. While this function is active, the start/stop frequencies of the swept CW generator are changed to the values of M1 and M2. An asterisk next to the key label indicates this feature is active.

Programming Codes   **SCPI:** SWEep:MARKer:STATe ON|OFF|1|0
Analyzer: MP1 function on, MP0 function off.

See Also   Marker M1 , Start=M1 Stop=M2
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Manual Sweep

Function Group   SWEEP

Menu Map   7

Description   This softkey lets you set the swept CW generator to the manual sweep mode of operation. Depending on what parameter is sweeping, you can use either the rotary knob or the ARROW keys to manually sweep between the start/stop limits. In manual sweep mode, the swept CW generator does not automatically retrace at the sweep end point (the user must turn the rotary knob to retrace), and the green SWEEP LED does not light. The resolution of the rotary knob is 0.1% of the sweep span in either start/stop or CF/ΔF mode. The resolution of the ⬆ and ⬇ arrow keys are dependent on the

resolution defined by the ⇐ and ⇒ keys. Frequencies in the manual sweep mode are synthesized, just as they are in CW mode.

There are two major differences between manual sweep and a sweep generated by activating the CW function and rotating the rotary knob or pressing the ARROW keys.

1. The sweep output voltage ramp is 0 to +10 V in both modes, but in CW mode, 0 V corresponds to lowest frequency of the swept CW generator frequency range and +10 V corresponds to the highest frequency of the range. In manual sweep mode, 0 V corresponds to the start frequency *specified* and +10 V corresponds to the stop frequency *specified*. In both cases, the sweep voltage at intermediate frequencies is a linear interpolation of the frequency span. For example, a frequency half-way between the start/stop limits has a sweep voltage of 5 V.

2. The bandcross points in CW mode occur at 2.0, 7, 13.5, 20, 25.5, and 32 GHz.

   In manual sweep mode the bandcrossing points have 200 MHz of flexibility, that is automatically used by the swept CW generator for optimum performance. For example, a 2.0 to 7.1 GHz sweep could be accomplished without any band changes in manual sweep mode.

Programming Codes   **SCPI:** SWEep:MODE MANual|AUTO
This is the command for frequency manual sweep.

POWer:MODE SWEep
POWer:SPAN <num>[lvl suffix]|MAXimum|MINimum
This is the command for power manual sweep.

LIST:MODE MANual
This is the command for manual list sweep.
Analyzer: S3

See Also   Power Sweep , Sweep Mode List
"Continuous, Single, and Manual Sweep Operation" in Chapter 1

(MARKER)

Function Group   MENU SELECT

Menu Map   3

Description   This hardkey allows access to the marker functions.

Ampl Markers	Causes the swept CW generator to display markers as an amplitude pulse.
Center=Marker	Changes the swept CW generator's center frequency to the value of the most recently activated marker.
Delta Marker	Displays the frequency difference between the active marker and the marker designated by the softkey Delta Mkr Ref .
Delta Mkr Ref	Reveals the softkeys in the delta marker reference menu.
M1--M2 Sweep	Causes the swept CW generator to sweep from M1 to M2.
Marker M1	Makes M1 frequency the active function.
Marker M2	Makes M2 frequency the active function.
Marker M3	Makes M3 frequency the active function.
Marker M4	Makes M4 frequency the active function.
Marker M5	Makes M5 frequency the active function.
Markers All Off	Turns off all markers.
Start=M1 Stop=M2	Changes the swept CW generator start and stop frequencies to the values of M1 and M2.

The markers are functional whenever an asterisk appears next to the key label, but only one marker can be *active* at a time. The active marker is indicated in the active entry area.

See Also   Softkeys listed above.
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

`Marker M1`

Function Group	MARKER
Menu Map	3

Description The softkeys labeled `Marker M1` through `Marker M5` function
identically. The softkey turns the marker off/on. When an asterisk
appears next to the key label, it indicates that the marker is on, but
not necessarily active. A marker is only active when it is indicated in
the active entry area.

The active entry area displays the active marker and its frequency
value. Use the rotary knob, the ARROW keys, or the entry keys to
set the frequency. Markers are displayed normally as Z-axis intensity
dots, but can be changed to amplitude pulses (`Ampl Markers`).
When a marker is turned off, the frequency value of that marker
is retained in memory. If the marker is reactivated, the stored
frequency value is recalled for that marker.

The frequency value of M1 and of M2 can also be used to define
parameters in two other marker features: `M1--M2 Sweep` and
`Start=M1 Stop=M2`.

Programming Codes **SCPI:**

MARKer[1][:FREQuency] <num>[freq suffix] or
MAXimum|MINimum
MARKer[1]:STATe ON|OFF|1|0

Analyzer: M1 function on, M0 function off.

See Also `Ampl Markers`, `M1--M2 Sweep`, (MARKER), `MkrRef Menu`,
`Start=M1 Stop=M2`
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Marker M2

Function Group MARKER

Menu Map 3

Description See MARKER M1

Programming Codes SCPI:

MARKer2[:FREQuency] <num>[freq suffix] or
MAXimum|MINimum
MARKer2:STATe ON|OFF|1|0

Analyzer: M2 function on, M0 function off.

See Also Ampl Markers , M1--M2 Sweep , (MARKER), MkrRef Menu ,
Start=M1 Stop=M2
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Marker M3

Function Group MARKER

Menu Map 3

Description See MARKER M1

Programming Codes SCPI:

MARKer3[:FREQuency] <num>[freq suffix] or
MAXimum|MINimum
MARKer3:STATe ON|OFF|1|0

Analyzer: M3 function on, M0 function off.

See Also Ampl Markers , (MARKER), MkrRef Menu
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Marker M4

Function Group   MARKER

Menu Map   3

Description   See `MARKER M1`

Programming Codes   SCPI:

MARKer4[:FREQuency] <num>[freq suffix] or
MAXimum|MINimum
MARKer4:STATe ON|OFF|1|0

Analyzer: M4 function on, M0 function off.

See Also   `Ampl Markers`, `MARKER`, `MkrRef Menu`
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Marker M5

Function Group   MARKER

Menu Map   3

Description   See `MARKER M1`

Programming Codes   SCPI:

MARKer5[:FREQuency] <num>[freq suffix] or
MAXimum|MINimum
MARKer5:STATe ON|OFF|1|0

Analyzer: M5 function on, M0 function off.

See Also   `Ampl Markers`, `MARKER`, `MkrRef Menu`
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Markers All Off

Function Group   MARKER

Menu Map   3

Description   This softkey lets you turn all the markers off. The frequency value given to the markers remains in memory and will be recalled when the marker softkeys are pressed again. Softkeys `Ampl Markers`, `Center=Marker`, and `M1--M2 Sweep` are not affected by turning the markers off. The function (or the frequency values) is retained as the swept CW generator settings.

Programming Codes   SCPI: MARKer:AOFF
Analyzer: SHM0

See Also   `Ampl Markers`, `Center=Marker`, `M1--M2 Sweep`, (MARKER)
"Marker Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Measure Corr All

Function Group   POWER

Menu Map   5

Description   This softkey enables the swept CW generator to act as a controller to command an HP/Agilent 437B power meter to measure flatness correction values at all frequency points defined in the flatness array.

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   `Fltness Menu`, `Mtr Meas Menu`
"Creating and Applying the User Flatness Correction Array" in Chapter 1

Measure Corr Current

Function Group   POWER

Menu Map   5

Description   This softkey lets you enable the swept CW generator to act as a controller to command an HP/Agilent 437B power meter to measure a single flatness correction value at the current flatness array frequency.

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   Fltness Menu, Mtr Meas Menu
"Creating and Applying the User Flatness Correction Array" in Chapter 1

Measure Corr Undef

Function Group   POWER

Menu Map   5

Description   This softkey lets you enable the swept CW generator to act as a controller to command an HP/Agilent 437B power meter to measure flatness correction values for those frequency points of the flatness array that do not have correction values assigned.

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   Fltness Menu, Mtr Meas Menu
"Creating and Applying the User Flatness Correction Array" in Chapter 1

Meter Adrs

Function Group   SYSTEM

Menu Map   8

Description   In cases where the swept CW generator is capable of acting as a controller to an HP/Agilent 437B power meter, this softkey enables you to set the programming address of the power meter. The address value can be set from 0 to 30, with the factory default address set at 13. The address value is stored in non-volatile memory.

Programming Codes   **SCPI:** DIAGnostics:INSTrument:PMETer:ADDRess <num>
Analyzer: NONE

See Also   Adrss Menu
"Optimizing Swept CW Generator Performance" in Chapter 1
Chapter 3

(MOD)

Function Group   MENU SELECT

Menu Map   4

Description   This hardkey allows access to the pulse modulation function.

Pulse   For use with Agilent Technologies scalar analyzers, the swept CW generator offers a scalar pulse modulation mode that provides approximately 2 μs rise and fall times. An internal oscillator provides the 27.778 kHz square wave with no external connections necessary. The slow waveform reduces the spectral width of the output, improving measurements made on filters with steep skirts.

See Also   Pulse On/Off Scalar

Module Menu

Function Group `ALC`

Menu Map 1

Description This softkey accesses the source module selection softkeys. Millimeter-wave source modules can be connected to the swept CW generator source module interface connectors (there is one each on the front and rear panels). These softkeys give you the option of letting the swept CW generator automatically look at both connectors for source modules or telling the swept CW generator to look only at the front or at the rear connector. You can also turn off module sensing completely.

`Module Select AUTO`	Sets the swept CW generator to automatic selection of the source module (selects the front connector if source modules are present at both front and rear connectors). This is the default after preset.
`Module Select Front`	Sets the swept CW generator to select the source module connected to the front panel source module interface connector.
`Module Select Rear`	Sets the swept CW generator to select the source module connected to the rear panel source module interface connector.
`Module Select None`	Disables source module sensing.

Programming Codes **SCPI:** NONE
Analyzer: NONE

See Also Softkeys listed above.

Module Select AUTO

Function Group   POWER and FREQUENCY

Menu Map   2 and 5

Description   This command sets the automatic selection of the millimeter source module interface connector. The swept CW generator looks at both front and rear connectors and determines the type of source module (if any) connected. If a source module is present at both connectors, the swept CW generator selects the front connector as the active one. After selecting the interface the instrument frequency limits and multiplier are altered accordingly. However, the leveling point is *not* changed. See Leveling Point Module to set the swept CW generator to level at the output of the source module.

An asterisk next to the key label indicates this feature is active. This feature is the default after preset.

Programming Codes   SCPI:

SYSTem:MMHead:SELect:AUTO ON|OFF|1|0
SYSTem:MMHead:SELect:AUTO?

Analyzer: NONE

See Also   Module Menu

Module Select Front

Function Group   POWER and FREQUENCY

Menu Map   2 and 5

Description   This command causes the swept CW generator to examine only the front panel source module interface connector to determine the type of source module (if any) connected. The instrument frequency limits and multiplier are altered according to the source module connected. However, the leveling point is *not* changed. See Leveling Point Module to set the swept CW generator to level at the output of the source module.

An asterisk next to the key label indicates this feature is active.

Programming Codes   SCPI:

SYSTem:MMHead:SELect FRONt|REAR|NONE
SYSTem:MMHead:SELect?

Analyzer: NONE

See Also   Module Menu

Module Select None

Function Group   POWER and FREQUENCY

Menu Map   2 and 5

Description   This command disables millimeter source module sensing. The swept CW generator will *not* alter its frequency limits and multiplier even if a source module is connected to either source module interface connector.

An asterisk next to the key label indicates this feature is active.

Programming Codes   SCPI:

SYSTem:MMHead:SELect FRONt|REAR|NONE
SYSTem:MMHead:SELect?

Analyzer: NONE

See Also   Module Menu

Module Select Rear

Function Group   POWER and FREQUENCY

Menu Map   2 and 5

Description   This command causes the swept CW generator to examine only the rear panel source module interface connector to determine the type of source module (if any) connected. The instrument frequency limits and multiplier are altered according to the source module connected. However, the leveling point is *not* changed. See Leveling Point Module to set the swept CW generator to level at the output of the source module.

An asterisk next to the key label indicates this feature is active.

Programming Codes   SCPI:

   SYSTem:MMHead:SELect FRONt|REAR|NONE
   SYSTem:MMHead:SELect?

Analyzer: NONE

See Also   Module Menu

more n/m

Function Group   ALL FUNCTION GROUPS

Menu Map   ALL MENU MAPS

Description   The more n/m softkey allows you to page through the menus. Look at one of the menu maps. Notice the line (keypath) drawn from more n/m. By selecting this softkey, the next page of the menu is revealed. If you are viewing the last page of the menu, selecting more n/m returns the first page of the menu. In this softkey "n" represents the page you are on and "m" represents the total number of pages in the menu.

Programming Codes   SCPI: Not Applicable
Analyzer: Not Applicable

See Also   (PRIOR)

`Mtr Meas Menu`

Function Group   POWER

Menu Map   5

Description   This softkey accesses the meter measure softkeys.

`Meas Corr All`	Measures flatness correction values for all frequency points in the flatness correction array.
`Meas Corr Current`	Measures a flatness correction value for the frequency point currently in the active line of the flatness correction array.
`Meas Corr Undef`	Measures flatness correction values for all frequency points in the flatness correction array that have no correction values assigned.

The meter measure function uses an external HP/Agilent 437B power meter to automatically measure and store power correction values for the frequency points requested.

Programming Codes   SCPI: NONE, see `Fltness Menu`
Analyzer: NONE

See Also   `Flatness Menu`
"Creating and Applying the User Flatness Correction Array" in Chapter 1

P

Peak RF Always

Function Group   POWER, USER CAL

Menu Map   5, 9

Description   This softkey appears in two locations: the POWER `Tracking Menu` and the USER CAL `Tracking Menu`. The operation is the same in both locations.

This softkey causes the swept CW generator, when in CW or manual-sweep output mode, to align the output filter (SYTM) so that its passband is centered on the RF output. Peaking is used to obtain both the maximum available power and spectral purity, and the best pulse, FM envelopes, at a given frequency. This peaking occurs each time the frequency is changed, or every seven minutes. An asterisk next to the key label indicates this function is active.

Programming Codes   **SCPI:** CALibration:PEAKing:AUTO ON|OFF|1|0
Analyzer: RP1 function on, RP0 function off.

See Also   `Auto Track`, `Peak RF Once`, `Tracking Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

Peak RF Once

Function Group   POWER, USER CAL

Menu Map   5, 9

Description   This softkey appears in two locations: the POWER `Tracking Menu` and the USER CAL `Tracking Menu`. The operation is the same in both locations.

This softkey causes an instantaneous, one-time execution of the peaking function when the swept CW generator is in the CW or manual sweep mode. It aligns the output filter (SYTM) so that its passband is centered on the RF output.

Programming Codes   **SCPI:** CALibration:PEAKing[:EXECute]
Analyzer: SHAK

See Also   `Auto Tracking`, `Peak RF Always`, `Tracking Menu`
"Optimizing Swept CW Generator Performance" in Chapter 1

(POWER LEVEL)

Function Group   POWER

Menu Map   NONE

Description   This hardkey lets you control the output power level of the swept CW generator. The swept CW generator has different power leveling modes and leveling points, and as such, the (POWER LEVEL) key controls different aspects of the power level (ALC) system.

The following is an explanation of power level operation in the different ALC system configurations.

In **Normal, Internal**, the (POWER LEVEL) key controls the output power level of the swept CW generator directly. The attenuator (if present) is controlled together with the complete range of the ALC system (+25 to −20 dBm).

When you press POWER LEVEL, the active entry area displays:
`--> POWER LEVEL:  X.XX dBm,`
where X represents a numeric value. The data display area indicates:
`Power(dBm)`
`INT:  X.XX.`

In **Normal, Uncoupled Attenuator**, the POWER LEVEL key controls
the *Level DAC* and *Level Control Circuits* (see Figure A-1)
within the ALC level range (+25 to −20 dBm). The attenuator is
uncoupled from the ALC system and is controlled separately with the
Set Atten key.

When you press POWER LEVEL, the active entry area displays:

`   --> ATTEN  X dB, ALC:  X.XX dBm,`

where X represents a numeric value. The data display area indicates:

`    Power(dBm)`
`  INT:    X.XX .`

In **Normal, External Detector (ExtDet)**, the POWER LEVEL key
controls the output power of the swept CW generator as compared to
the external detector feedback voltage. The attenuator
(if present) is automatically uncoupled from the ALC system and the
POWER LEVEL key controls the *Level DAC* and *Level Control Circuits*
(see Figure A-1) within the ALC level range (+25 to −20 dBm).
This mode of operation requires a feedback connection from a
negative-output diode detector to the EXT ALC connector.

When you press POWER LEVEL, the active entry area displays:

`   --> ATTEN  X dB, EXT POWER:  X.XX dBm ,`

where X represents a numeric value. The data display area indicates:

`    Power(dBm)`
`  EXT:    X.XX .`

In **Normal, Power Meter (PwrMtr)**, the POWER LEVEL key controls
the output power of the swept CW generator as compared to the
feedback voltage of the power meter. The attenuator (if present) is
automatically uncoupled from the ALC system and the POWER LEVEL
key controls the *Level DAC* and *Level Control Circuits* (see
Figure A-1) within a more restricted range of the ALC level.
Instead of the 45 dB range of the ALC in other modes, 12 dB is
available in this mode, with the upper end of the range set by the
Pwr Mtr Range softkey. This mode of operation requires a feedback
connection from the recorder output of a power meter.

When you press POWER LEVEL, the active entry area displays:

```
--> ATTEN   X dB, POWER LEVEL:   X.XX dBm ,
```

where X represents a numeric value. The data display area indicates:

```
    Power(dBm)
MTR:    X.XX .
```

In **Normal, Module**, the POWER LEVEL key controls the output power of the swept CW generator as compared to the feedback voltage from a millimeter-wave source module. The attenuator (if present) is automatically uncoupled from the ALC system and the POWER LEVEL key controls the *Level DAC* and *Level Control Circuits* (see Figure A-1) within the ALC level range (+25 to −20 dBm). This mode of operation requires a feedback connection from the module to the swept CW generator through the SOURCE MODULE INTERFACE.

When you press POWER LEVEL, the active entry area displays:

```
--> ATTEN   X dB, MODULE LEVEL: X.XX dBm ,
```

where X represents a numeric value. The data display area indicates:

```
    Power(dBm)
MDL:    X.XX .
```

In **ALCoff**, there is no feedback voltage to level the power, so power level is uncalibrated. A leveling point is not specified in this mode. The POWER LEVEL key controls the linear modulator directly, from 0 to approximately −80 dB. The attenuator (if present) is automatically uncoupled from the ALC system.

When you press POWER LEVEL, the active entry area displays:

```
--> ATTEN   X dB, REFERENCE:   X.XX dB ,
```

where X represents a numeric value. The data display area indicates:

```
      Ref(dB)
OFF:    X.XX
```

and the message line indicates: UNLVLED.

In **Search**, any of the leveling points can be specified and used as the comparison feedback voltage. Basically, this mode operates the same as ALCoff after the searched-for power level is reached. The active entry area displays different information depending on the leveling point chosen.

Programming Codes   **SCPI:** POWer[:LEVEL] <num>[lvl suffix] or MAXimum|MINimum|UP|DOWN
Analyzer: PL

See Also   (ALC), CONNECTORS, Det Cal Menu , (FLTNESS ON/OFF),
Set Atten , Tracking Menu , Uncoupl Atten
"Programming Typical Measurements" in Chapter 1

POWER (MENU)

Function Group   POWER

Menu Map   5

Description   This hardkey accesses the power function softkeys.

Fltness Menu   Accesses the softkeys in the flatness
                    correction menu.

Power Offset   Changes the displayed power to
                    include an offset, but does not change
                    the output power of the swept CW
                    generator.

Power Slope   Activates the linear, power-per-frequency
                    mode of power output, and makes RF
                    slope (dB/GHz) the active function.

Power Sweep   Activates power sweep mode and makes
                    power sweep (dB/swp) the active
                    function.

Set Atten   Activates uncoupled attenuator as
                    the mode of operation and makes the
                    attenuator value the active function.

Tracking Menu   Accesses the softkeys in the tracking
                    calibration menu.

Uncoupl Atten   Uncouples the attenuator from the ALC
                    system.

Up/Dn Power   Allows you to enter values for the power
                    level step size.

All RF power functions except for power level, flatness on/off, and
RF on/off are contained in the power menu.

POWER (MENU)

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   Softkeys listed previously under this menu key, (ALC),
(FLTNESS ON/OFF), (POWER LEVEL), and (RF ON/OFF).
"Introducing the Agilent 8360 L-Series Swept CW Generators" in
Chapter 1 and "Getting Started Advanced" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Power Offset

Function Group   POWER

Menu Map   5

Description   This softkey changes the mapping of absolute power parameters
on input to the swept CW generator. It does not change the RF
output produced by the swept CW generator. The equation used to
determine the displayed value is:

Entered or Displayed Power = Hardware Power (ALC) + Active Offset

Programming Codes   SCPI:

POWer:OFFset:STATe ON|OFF|1|0
POWer:OFFset <num>[DB]|MAXimum|MINimum|UP|DOWN

Analyzer: NONE

See Also   (POWER LEVEL) and POWER (MENU).

Power Slope

Function Group POWER

Menu Map 5

Description This softkey lets you compensate for system, cable, and waveguide variations due to changes in frequency, by linearly increasing or decreasing power output as the frequency increases. RF slope values may range from −2.50 to +2.50 dB per GHz. The power at the beginning of the sweep equals the current power level. An asterisk next to the key label indicates that this feature is active.

Programming Codes SCPI:

POWer:SLOPe:STATe ON|OFF|1|0
POWer:SLOPe <num>[DB]|MAXimum|MINimum|UP|DOWN

Analyzer: SL1 function on, SL0 function off. Note that because SL functions in the fundamental units of dB/Hz, you program the SL code SLmdt, where m is 1 (on) or 0 (off); d is the numerical value in dB/Hz, and t is either "DB" or the ASCII LF terminator. For example, for a slope of 1.5 dB/GHz use this procedure:

1. 1.5 dB/GHz = 1.5 dB/1,000,000,000 Hz

2. 1.5 dB/1E9 Hz = 1.5E-9 dB/Hz

3. The programming code is "SL11.5E-9 DB"

See Also (POWER LEVEL), Power Sweep
"Power Sweep and Power Slope Operation" in Chapter 1

Power Sweep

Function Group   POWER

Menu Map   5

Description   This softkey enables the power sweep function. RF output power can be swept both positively and negatively over a selected range. The level of the power sweep starting point is the power level programmed. Power sweep widths can be 45 dB wide in either direction. However, the settable power sweep range is dependent on the ALC level set. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI:

POWer:MODE SWEep|FIXed
POWer:STARt <num>[level suffix]|MAXimum|MINimum
POWer:SPAN <num>[level suffix]|MAXimum|MINimum

Analyzer: PS1 function on, PS0 function off.

See Also   (POWER LEVEL), Power Slope
"Power Sweep and Power Slope Operation" in Chapter 1

PRESET

Function Group	INSTRUMENT STATE
Menu Map	NONE

Description   This hardkey (green) causes the swept CW generator to perform a short version of self-test, and initializes the swept CW generator to a standard starting configuration. Two states can be defined for the standard configuration: Factory or User.

Press PRESET at any time to test the swept CW generator and restore to a standard configuration. If the red LED adjacent to the PRESET key (labeled INSTR CHECK) stays on after preset, the swept CW generator failed self-test; refer to *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Troubleshooting Guide*.

Cycling power with the POWER switch does not have the same effect as presetting the swept CW generator. Cycling power causes the swept CW generator to display the programming language, the GPIB address, and the firmware revision date. After the swept CW generator displays this data, it restores its configuration to the state before power was turned off.

Programming Codes   **SCPI:** SYSTem:PRESet[:EXECute]
Analyzer: IP

See Also   Preset Mode Factory , Preset Mode User
"Changing the Preset Parameters" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Preset Mode Factory

Function Group SYSTEM

Menu Map 8

Description This softkey sets the standard starting configuration of the swept CW generator when the (PRESET) key is pressed, as set by the manufacturer. An asterisk next to the key label indicates that this feature is active. The following is a description of the configuration.

- Start sweep at the minimum specified frequency.
- Stop sweep at the maximum specified frequency.
- Power level set at 0 dBm.
- Sweep time set to auto.
- CONT sweep.
- Sweep mode ramp.
- ALC leveling point internal.
- ALC leveling mode normal.
- Markers set to activate at the center frequency of the sweep.
- All function values stored in memory registers 1 through 9 remain in their previous states.
- The checksum of the calibration data is calculated, and if an error is detected, the calibration data in protected memory is used. If the checksum of the protected data is not correct, then default values are used an error message (EEROM FAILED, LOST CAL) is displayed.

Programming Codes **SCPI:** SYSTem:PRESet:TYPE FACTory
Analyzer: IP, which is the same as (PRESET).

See Also (PRESET), Preset Mode User
"Changing the Preset Parameters" in Chapter 1

Preset Mode User

Function Group   SYSTEM

Menu Map   8

Description   This softkey sets the standard starting configuration of the swept CW generator when the (PRESET) key is pressed, as set by the user. You can define any starting conditions: Set up the swept CW generator with the conditions you want, then select Preset Mode User. Now whenever you press (PRESET), the swept CW generator returns to the configuration you set. If preset mode user is set, when you press (PRESET), the swept CW generator displays the following:

*** USER DEFINED PRESET RECALLED ***

You can still do a factory preset. When the user preset mode is active, the softkey Factory Preset appears when you press (PRESET). An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:**SYSTem:PRESet TYPE USER
Analyzer: NONE

See Also   (PRESET), Preset Mode Factory, Save User Preset
"Changing the Preset Parameters" in Chapter 1

Printer Adrs

Function Group   SYSTEM

Menu Map   8

Description   This softkey lets the swept CW generator recognize a printer address between 0 and 30. The swept CW generator can act as a controller for a printer during self-test, if the log-to-a-printer feature is initiated.

Programming Codes   **SCPI:** DIAGnostic:INSTrument:PRINTer:ADDRess <num>
Analyzer: NONE

See Also   Adrs Menu, Selftest (Full)

PRIOR

Function Group   MENU SELECT

Menu Map   NONE

Description   This hardkey lets you view previous menus. All menus visited from the last preset are remembered and displayed in a "last-visited-first-seen" order. Refer to Figure P-1, and follow the arrow paths as indicated.
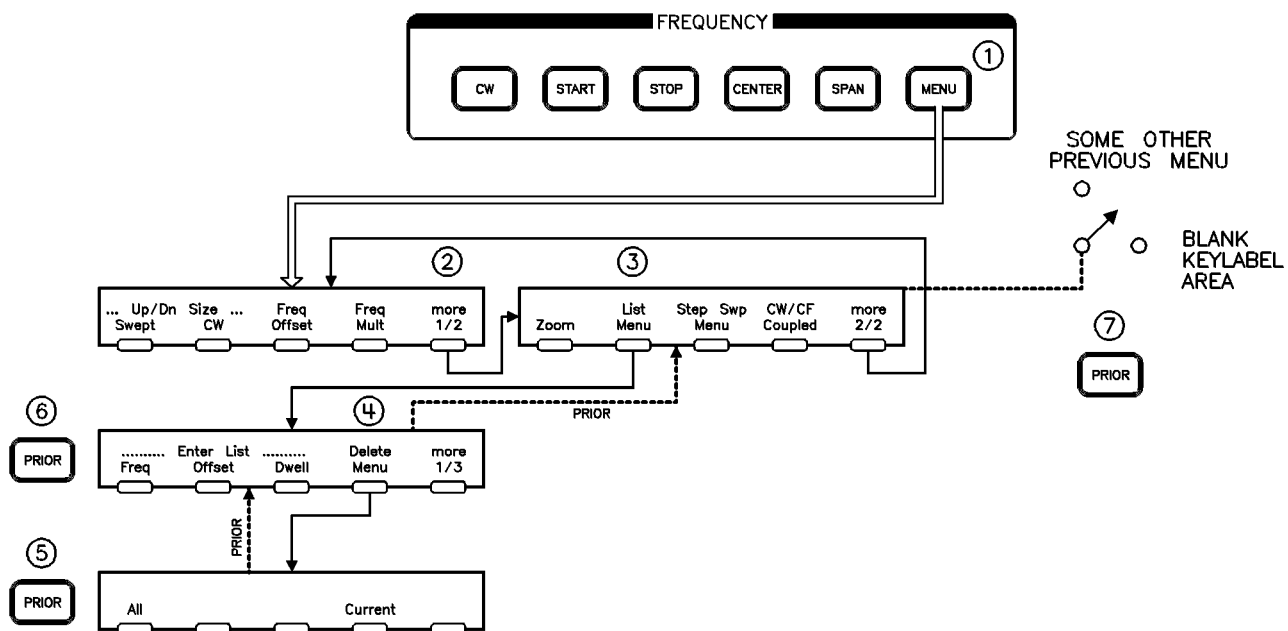
Figure P-1. How PRIOR Works

The sequence of keystrokes that created the movement shown in Figure P-1 is:

1. FREQUENCY MENU
2. more 1/2
3. List Menu
4. Delete Menu
5. PRIOR
6. PRIOR
7. PRIOR

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   more n/m

Programming Language Analyzr

Function Group   SYSTEM

Menu Map   8

Description   This softkey lets you select Analyzer Language as the swept CW generator's interface language. This language uses Agilent 8340/8341 mnemonics and provides Agilent network analyzer compatibility. Any commands issued within 100 ms of a change in language may be ignored or lost. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI: SYSTem:LANGuage COMPatible
Analyzer: NONE

See Also   Adrs Menu, ANALYZER STATUS REGISTER
"Getting Started Programming" in Chapter 1
Chapter 3

Programming Language CIIL

Function Group   SYSTEM

Menu Map   8

Description   This softkey lets you select CIIL as the swept CW generator's external interface language. The use of this language requires the M.A.T.E. option (Option 700) to be installed. Any commands issued within 100 ms of a change in language may be ignored or lost. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** SYSTem:LANGuage CIIL
Analyzer: CIIL

See Also   Adrs Menu
The M.A.T.E. option (Option 700) is documented in a separate manual supplement called, *Agilent Technologies 8360 Series Synthesized Sweepers Option 700 Manual Supplement.*

Programming Language SCPI

Function Group   SYSTEM

Menu Map   8

Description   Standard Commands for Programmable Instruments (SCPI) is the instrument control programming language adopted by Agilent Technologies. SCPI provides commands that are common from one Agilent Technologies product to another, eliminating "device specific" commands.

This softkey lets you select SCPI as the swept CW generator's external interface language. This is the default language set at the factory. Any commands issued within 100 ms of a change in language may be ignored or lost. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** SYSTem:LANGuage SCPI
Analyzer: SYST or SCPI

See Also   Adrs Menu , SCPI COMMAND SUMMARY, SCPI STATUS REGISTER STRUCTURE
"Getting Started Programming" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Pt Trig Menu

Function Group FREQUENCY

Menu Map 2

Description This softkey accesses the list mode point trigger softkeys.

List Mode Pt Trig Auto
Automatically steps the swept CW generator to the next point in the frequency list.

List Mode Pt Trig Bus
Steps the swept CW generator to the next point in the frequency list when an GPIB trigger is received.

List Mode Pt Trig Ext
Steps the swept CW generator to the next point in the frequency list when an external hardware trigger is received.

Programming Codes
SCPI: NONE
Analyzer: NONE

See Also Softkeys listed above, List Menu

Pulse On/Off Scalar

Function Group (MOD)

Menu Map 4

Description This softkey activates pulse modulation mode, and sets the internal pulse generator to produce 27.778 kHz square wave pulses (18 μs pulse width, 36 μs pulse period). The rise and fall times of the RF envelope are approximately 2 μs. These pulses allow proper operation with Agilent scalar network analyzers in ac detection mode. An asterisk next to the key label indicates that this feature is active.

Programming Codes   SCPI:

    PULSe:SOURce SCALar
    PULSe[:STATe] ON|OFF|1|0

Analyzer: SHPM function on, PM0 function off.

See Also   `ALC`, `MOD`
Chapter 3

`Pwr Mtr Range`

Function Group   `ALC`

Menu Map   1

Description   This softkey lets you specify a range of operation
(from +20 to −60 dBm) for an external power meter, when a power
meter is used to level power externally. The factory preset value is
0 dBm. The value specified for `Pwr Mtr Range` directly affects the
power level range for power meter leveling points. When this feature
is active, its current value is displayed in the active entry area.

Programming Codes   SCPI: POWer:RANGe <num>[power suffix]|MAXimum|MINimum
Analyzer: NONE

See Also   `Leveling Point PwrMtr`
"Optimizing Swept CW Generator Performance" in Chapter 1

[RECALL]

Function Group   SYSTEM

Menu Map   8

Description   This hardkey retrieves a front panel setting that was previously stored in a SAVE register (1 through 8).

Programming Codes   **SCPI:** *RCL <num>
The above is an IEEE 488.2 common command.
Analyzer: RCn, where n= a numeric value from 0 to 9.

See Also   [SAVE], SCPI COMMAND SUMMARY
"Saving and Recalling an Instrument State" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Ref Osc Menu

Function Group   SYSTEM

Menu Map   8

Description   This softkey reveals the softkeys in the frequency standard menu.

10 MHz Freq Standard Auto   Automatically selects the frequency standard to be used by the swept CW generator.

10 MHz Freq Standard Extrnl   Sets the swept CW generator to accept an external frequency standard as its reference.

10 MHz Freq Standard Intrnl   Sets the swept CW generator to use its internal frequency standard as its reference.

`10 MHz Freq Standard None`   Sets the swept CW generator
to free-run operation, where no
frequency standard is used.

Programming Codes   **SCPI:** ROSCillator:SOURce:INTernal|EXTernal|NONe
Analyzer: NONE

See Also   Softkeys listed above.

(RF ON/OFF)

Function Group   POWER

Menu Map   NONE

Description   This hardkey turns the RF power output on or off. Press (RF ON/OFF).
If the yellow LED above the hardkey is off, power is off, and `RF OFF`
appears in the message line of the display. Press the key again to
turn on RF power and restore the power value last entered.

Programming Codes   **SCPI:** POWer:STATe ON|OFF|1|0
Analyzer: RF1 power on, RF0 power off.

See Also   (MOD), (POWER LEVEL)

ROTARY KNOB

Function Group   ENTRY

Menu Map   NONE

Description   The rotary knob is active whenever the entry area is on. It controls
a rotary pulse generator that allows analog-type adjustment of the
active entry area. Although the rotary knob has the feel of analog
control, it is actually a digital control that generates 120 pulses per
revolution.

Programming Codes   NONE

See Also   ARROW KEYS, ENTRY KEYS
"Entry Area" in Chapter 1

S

SAVE

Function Group   SYSTEM

Menu Map   8

Description   This hardkey allows up to eight different front panel settings to be stored in memory registers 1 through 8. Swept CW generator settings can then be recalled with the RECALL key. A memory register can be alternated with the current front panel setting using the Atrnate Regs softkey.

The information stored in memory registers is retained in memory indefinitely when ac line power is constantly available, or for approximately three years without line power. Pressing PRESET does not erase the memory registers (1 through 8).

Register 0 is a memory register also. It saves the last front panel settings automatically and can not be accessed through the SAVE key. Likewise, register 9 is reserved for user preset storage and can not be accessed with the SAVE key. Pressing PRESET erases register 0, but not register 9.

Programming Codes   **SCPI:** *SAV <num>
The above is an IEEE 488.2 common command.
Analyzer: SVn, where n= a numeric value from 1 to 8.

See Also   Altrnate Regs , Clear Memory , RECALL , Save Lock
"Saving and Recalling an Instrument State" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Save Lock

Function Group SYSTEM

Menu Map 8

Description This softkey lets you disable the save function. It prohibits the saving of the present instrument state into a save/recall memory register. If this function is active, an error message is displayed. An asterisk next to the key label indicates that this function is active.

Programming Codes **SCPI:** NONE
Analyzer: SHSV locks the registers, SHRC unlocks the registers.

See Also (SAVE), Security Menu
"Saving and Recalling an Instrument State" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Save User Preset

Function Group SYSTEM

Menu Map 8

Description This softkey lets you store the present state of operation to be used as the PRESET state. Set the swept CW generator to the desired operating conditions. Select Save User Preset . The display shows:

    -->   User Defined Preset Saved

To activate this stored information, you must set the preset mode to User.

Programming Codes **SCPI:** SYSTem:PRESet:SAVE
Analyzer: NONE

See Also Preset Mode User
"Changing the Preset Parameters" in Chapter 1

SCPI Conformance Information

The Agilent 8360 L-Series swept CW generators conform to the 1990.0 version of SCPI.

The following are the SCPI confirmed commands implemented by the 8360 L-Series swept CW generators:

- :ABORt
- :CORRection
    [:STATe]
- :DISPlay
    [:STATe]
    [:STATe]?
- :FREQuency
    :CENTer
    :CENTer?
    [:CW]
      :AUTO
      :AUTO?
      [:FIXed]
    [:CW]?
    [:FIXed]
       :AUTO
       :AUTO?
    [:FIXed]?
    :MANual
    :MANual?
    :MODE
    :MODE?
    :SPAN
    :SPAN?
    :STARt
    :STARt?
    :STOP
    :STOP?
- :LIST
    :DWELl
       :POINts?
    :DWELl?
    :FREQuency
       :POINts?
    :FREQuency?
- :MARKer[n]
    :AOFF
    :FREQuency
    :FREQuency?
    :REFerence
    :REFerence?
    [:STATe]
    [:STATe]?
- :POWer
    :ALC

                      :BANDwidth|:BWIDth
                        :AUTO
                        :AUTO?
                    :BANDwidth|:BWIDth?
                  :ATTenuation
                    :AUTO
                    :AUTO?
                  :ATTenuation?
                  [:LEVel]
                  [:LEVel]?
                  :MODE
                  :MODE?
                  :RANGe
                  :SPAN
                  :SPAN?
                  :STARt
                  :STARt?
                  :STOP
                  :STOP?
              ■ :PULM
                  :SOURce
                  :SOURce?
                  :STATe
                  :STATe?
              ■ :ROSCillator
                  :SOURce
                    :AUTO
                    :AUTO?
                  :SOURce?
              ■ :STATus
                  :OPERation
                    :CONDition?
                    :ENABle
                    :ENABle?
                    [:EVENt]?
                    :NTRansition
                    :NTRansition?
                    :PTRansition
                    :PTRansition?
                  :PRESet
                  :QUEStionable
                    :CONDition?
                    :ENABle
                    :ENABle?
                    [:EVENt]?
                    :NTRansition
                    :NTRansition?
                    :PTRansition
                    :PTRansition?
            ■ :SWEep

        :DWELl
          :AUTO
          :AUTO?
        :DWELl?
        :GENeration
        :GENeration?
        :MODE
        :MODE?
        :POINts
        :POINts?
        :STEP
        :STEP?
        :TIME
          :AUTO
          :AUTO?
          :LLIMit
          :LLIMit?
        :TIME?
■ :SYSTem
        :ALTernate
          :STATe
          :STATe?
        :ALTernate?
        :COMMunicate
          :GPIB
            :ADDRess
        :SECurity
          [:STATe]
          [:STATe]?
        :VERSion?
■ :TRIGger
        [:IMMediate]
        :SOURce
        :SOURce?

The following are the SCPI approved commands implemented by the 8360L-Series swept CW generators:

Instrument-specific diagnostic commands:

■ :DIAGnostics
        :ABUS
          :AVERage
          :AVERage?
          :STATus?
        :ABUS?
        :ERRor
          :ADD
        :INSTrument
          :PMETer
            :ADDRess
            :ADDRess?

```
                      :PRINter
                         :ADDRess
                         :ADDRess?
                   :IORW
                   :IORW?
                   :LED
                      :ACTive
                      :ACTive?
                      :ERRor
                      :ERRor?
                      :IOCHeck
                      :IOCHeck?
                   :OSC
                      :FNCW
                      :FNDN
                      :FNUP
                      :HARM
                      :IF
                      :SAMP
                      :YO
                   :OUTPut
                      :BANDcross?
                      :FAULts?
                      :FREQs?
                      :UNLocks?
                      :YODacs?
                      :YTMDacs
                   :SRECeiver
                      :ASTate
                      :ASTate?
                      :BCRoss
                      :MODE
                      :MODE?
                      :RSWeep
                      :SWAP
                      :SWAP?
                   :BUCKet
                      :DIVider
                      :DIVider?
                   :SWEep
                      :ARRay[0|1]
                         :LOCK
                         :LOCK?
                      :ARRay[0|1]?
                   :RESult?
                   :TEST
                      :CONTinue
                      :DATA
                         :DESC?
                         :MAXimum?
```

        :MINimum?
        :VALue?
     :DISable
     :ENABle
     [:EXECute]
     :LOG
        :SOURce
        :SOURce?
        [:STATe]
        [:STATe]?
     :LOOP
     :LOOP?
     :NAME?
     :PATCh
        :DATA
        :DATA?
        :POINts?
        :DELete
     :POINts?
     :RESult?
     :TINT?

The following are the commands implemented by the 8360 L-Series swept CW generators which are not part of the SCPI definition:

■ :CALibration
   :ADJust
     :A4:VCO
     :A5:LGAin
     :A6:VCO
     :A6:SMATch
     :A6:LGAin
     :A6:IFGain
     :A9:OFFSet
     :A10:MGAin
     :A13:REFerence
     :A13:GAIN
     :A14:SRAMp
   :CONStants
     :DEFault
     :NAME?
     :RECall
     :SAVE
   :CONStants?
   :PEAKing
     :AUTO
     :AUTO?
     [:EXECute]
     :FINE
   :PMETer
     :ATTenuation

:ATTenuation?
:DETector
  :INITiate?
  :NEXT?
:FLATness
  :INITiate?
  :NEXT?
:RANGe
:RANGe?
:POWer
 :ARRay
  :POINts?
 :ARRay?
 :ATTenuation
 :ATTenuation?
 :EXTernal
  :ARRay
   :POINts?
  :ARRay?
  :RANGe
  :RANGe?
  :TYPE
  :TYPE?
  :VALue
  :VALue?
  :ZERO
 :TYPE
 :VALue
 :VALue?
 :RANGe
 :RANGe?
 :RECall
 :SAVE
 :ZERO
  :ALL
:SECurity
 :CODE
 :STATe
 :STATe?
:SPAN
 :AUTO
 :AUTO?
 [:EXECute]
:TRACk
■ :CORRection
:ARRay[i]
:ARRay[i]?
:FLATness
 :POINts?
:FLATness?

```
        :SOURce[i]
        :SOURce[i]?
        [:STATe]
        [:STATe]?
■ :FREQuency
     :MULTiplier
        :STATe
        :STATe?
     :MULTiplier?
     :OFFSet
        :STATe
        :STATe?
     :OFFSet?
     :STEP
        :AUTO
        :AUTO?
        [:INCRement]
        [:INCRement]?
■ :INITiate
     :CONTinuous
     :CONTinuous?
     [:IMMediate]
■ :LIST
     :MANual
     :MANual?
     :MODE
     :MODE?
     [:POWer]
        :CORRection
           :POINts?
        :CORRection?
     :TRIGger
        :SOURce
        :SOURce?
■ :MARKer[n]
     :AMPLitude
        [:STATe]
        [:STATe]?
        :VALue
        :VALue?
     :DELTa?
     :MODE
     :MODE?
■ :POWer
     :ALC
        :CFACtor
        :CFACtor?
        :SOURce
        :SOURce?
        [:STATe]
```

[:STATe]?
AMPLifier
  :STATE
    :AUTO
    :AUTO?
  :STATE?
:CENTer
:CENTer?
:OFFSet
  :STATe
  :STATe?
:OFFSet?
:SEARch
:SLOPe
  :STATe
  :STATe?
:SLOPe?
:STATe
:STATe?
:STEP
  :AUTO
  :AUTO?
  [:INCRement]
  [:INCRement]?
■ :STATus
:MSIB
  :CONDition?
  :ENABle
  :ENABle?
  [:EVENt]?
  :NTRansition
  :NTRansition?
  :PTRansition
  :PTRansition?
:SREceiver
  :CONDition?
  :ENABle
  :ENABle?
  [:EVENt]?
  :NTRansition
  :NTRansition?
  :PTRansition
  :PTRansition?
■ :SWEep
:CONTrol
  :STATe
  :TYPE
:MANual
  :POINt
  :POINt?

     [:RELative]
     [:RELative]?
    :MARKer
     :STATe
     :STATe?
     :XFER
    :TRIGger
     :SOURce
     :SOURce?
■ :SYSTem
   :DUMP
    :PRINter
    :PRINter?
   :ERRor?
   :KEY
    :ASSign
    :CLEar
    [:CODE]
    [:CODE]?
    :DISable
    :ENABle
   :LANGuage
   :MMHead
    :SELect
     :AUTO
     :AUTO?
    :SELect?
   :PRESet
    [:EXECute]
    :SAVE
    :TYPE
   :SECurity
    :COUnt
    :COUnt?
■ :TRIGger
   :ODELay
   :ODELay?
■ :TSWeep
■ :UNIT
   :POWer
   :POWer?

SCPI COMMAND SUMMARY

Introduction

This entry is organized as follows:

1. IEEE 488.2 common commands in alphabetical order.

2. Command table of SCPI programming commands.

3. Alphabetical listing of commands with descriptions.

IEEE 488.2 Common Commands

- `*CLS`
Clear the Status Byte, the Data Questionable Event Register, the Standard Event Status Register, the Standard Operation Status Register, the error queue, the OPC pending flag, and any other registers that are summarized in the Status Byte.

- `*ESE <num>`
- `*ESE?`
Sets and queries the value of the Standard Event Status Enable Register.

- `*ESR?`
Queries the value of the Standard Event Status Register. This is a destructive read.

- `*IDN?`
This returns an identifying string to the GPIB. The response is in the following format: `HEWLETT-PACKARD ,model,serial number,DD MMM YY`, where the actual model number, serial number, and firmware revision of the swept CW generator queried is passed.

- `*LRN?`
This returns a long string of device specific characters that, when sent back to the swept CW generator, restores that instrument state.

- `*OPC`
Operation complete command. The swept CW generator generates the OPC message in the Standard Event Status Register when all pending operations have finished (such as, "sweep" or "selftest").

- `*OPC?`
Operation complete query. The swept CW generator returns an ASCII "1" when all pending operations have finished.

● *OPT?

This returns a string identifying any device options.

● *RCL <num>

The instrument state is recalled from the specified memory register. The value range is from 0 to 8.

● *RST

The swept CW generator is set to a predefined condition as follows:

```
CALibration:PEAKing:AUTO OFF
CALibration:POWer:ATTenation 0 DBM
CALibration:POWer:RANGe 1
CALibration:SPAN:AUTO OFF
CORRection:FLATness? returns a 0
CORRection:ARRay clear
CORRection:FLATness:POINts? returns a 0
CORRection:STATe OFF
DIAGnostics:ABUS:AVERage 1
DIAGnostics:TEST:ENABle ALL
DIAGnostics:TEST:LOG:SOURce FAIL
DIAGnostics:TEST:LOG[:STATe] OFF
DIAGnostics:TEST:LOOP OFF
DISPlay[:STATe] ON
FREQuency:CENTer value is (MAX+MIN)/2
FREQuency:CW value is (MAX+MIN)/2
FREQuency:CW:AUTO OFF
FREQuency:MANual value is (MAX+MIN)/2
FREQuency:MODE CW
FREQuency:MULTiplier 1
FREQuency:MULTiplier:STATe OFF
FREQuency:OFFSet 0
FREQuency:OFFSet:STATe OFF
FREQuency:STARt MINimum
FREQuency:STEP calculated from span
FREQuency:STEP:AUTO ON
FREQuency:STOP MAXimum
INITiate:CONTinuous OFF
LIST:DWELl value is 100 μs (MINimum)
LIST:DWELl:POINts? returns a 1
LIST:FREQuency value is (MAX+MIN)/2
LIST:FREQuency:POINts? returns a 1
LIST:MANual 1
LIST:MODE AUTO
LIST[:POWer]:CORRection 0
LIST[:POWer]:CORRection:POINts? returns a 1
LIST:TRIGger:SOURce IMMediate
MARKer[n]:AMPLitude[:STATe] OFF
MARKer[n]:AMPLitude:VALue 2 DBM
MARKer[n]:FREQuency value same as FREQ:CENT *RST value
```

```
MARKer[n]:MODE FREQuency
MARKer[n][:STATe] OFF
POWer:ALC:BANDwidth:AUTO ON
POWer:ALC:CFACtor −16 DBM
POWer:ALC[:SOURce] INTernal
POWer:AMPLifier:STATE:AUTO ON
POWer:ATTenuation:AUTO ON
POWer:CENTer O DBM
POWer[:LEVel] O DBM
POWer:MODE FIXed
POWer:SLOPe O
POWer:SLOPe:STATe OFF
POWer:SPAN O DB
POWer:STARt O DBM
POWer:STATe OFF
POWer:STEP:AUTO ON
POWer:STEP[:INCRement] 10 DB
POWer:STOP O DBM
PULM:SOURce SCALar
PULM:STATe OFF
ROSCillator:SOURce:AUTO ON
SWEep:DWELl 100 μs
SWEep:DWELl:AUTO OFF
SWEep:POINts 11
SWEep:STEP value is (StopMAX-StartMIN)/10
SWEep:TIME MINimum
SWEep:TIME:AUTO ON
SWEep:TIME:LLIMit 10 ms
SWEep:GENeration ANALog
SWEep:MODE AUTO
SWEep:MANual:POINt 1
SWEep:MANual[:RELative] 0.50
SWEep:MARKer:STATe OFF
SYSTem:ALTernate 1
SYSTem:ALTernate:STATe OFF
SYSTem:COMMunicate:GPIB:ADDRess 19
SYSTem:MMHead:SELect:AUTO ON
SYSTem:SECurity:COUNt 1
UNIT:POWer DBM
```

● *SAV <num>

The present instrument state is stored in the specified memory register. The acceptable numeric range is from 1 to 8. An execution error occurs if you try to save state 0.

● *SRE <num> ● *SRE?

Sets and queries the value of the Service Request Enable Register.

● *STB?

Queries the Status Byte. This is a non-destructive read.

● *TRG

This command performs the same function as the Group Execute Trigger command defined by IEEE 488.1.

● *TST?

A full selftest is performed, without data logging or looping, and returns one of the following error codes:

Error Code	Definition
0	Test passed.
1	Test failed.
2	Test not run yet. (This is an unlikely event.)
3	Test aborted.
4	Can not execute the test.
5	Can not execute the test, test skipped.
−1	Unrecognized result, software defect.

● *WAI

This causes the swept CW generator to wait for the pending commands to be completed before executing any other commands. For example, sending the command: TSW;*WAI
allows for synchronous sweep operation. It causes the swept CW generator to start a sweep and wait until the sweep is completed before executing the next command.

Table S-1. 8360 SCPI COMMAND SUMMARY

Command	Parameters	Parameter Type[1]	Allowed Values
:ABORt			
:CALibration			
:PEAKing			
:AUTO	auto RF peak	Boolean	ON|OFF|1|0
[:EXECute]			
:PMETer			
:DETector			
:INITiate?	type of det cal	discrete	IDETector|DIODe
:NEXT?	power correction value	extended numeric	<num> [lvl suffix]
:FLATness			
:INITiate?	flatness array to cal	discrete	USER|DIODE|PMETer|MMHead
:NEXT?	measured power	extended numeric	<num> [lvl suffix]
:SPAN			
:AUTO	auto calibrate state	Boolean	ON|OFF|1|0
[:EXECute]			
:TRACk			
:CORRection			
:ARRay[0|1]	1601 pts of correction	extended numeric	{<num>[DB]}1601*1601
:FLATness	801 freq-correction pairs	extended numeric	{<num>[freq suffix], DB}2*801
:POINts?	num of freq-correction pairs	extended numeric	[MAXimum|MINimum]
:SOURce[0|1]	correction source	discrete	ARRay|FLATness
[:STATe]	state	Boolean	ON|OFF|1|0

1 Parameter types are explained in the "Getting Started Programming" chapter.

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:DIAGnostics			
:ABUS			
:AVERage	ADC averages	extended numeric	<num>
:STATus?			
:INSTrument			
:PMETer			
:ADDRess	power meter address	extended numeric	1 to 31
:PRINter			
:ADDRess	printer address	extended numeric	1 to 31
:IORW	I/O device number and value	extended numeric	<num>, <num>
:OUTPut			
:FAULts?			
:RESult?			
:TEST			
:CONTinue			
:DATA			
:DESC?			
:MAXimum?			
:MINimum?			
:VALue?			
:DISable	disable listed selftests	extended numeric or discrete	{<num>}1*?|ALL
:ENABle	enable listed selftests	extended numeric or discrete	{<num>}1*?|ALL
[:EXECute]		extended numeric	0 to 288
:LOG			
:SOURce	log when	discrete	ALL|FAIL
[:STATe]	state	Boolean	ON|OFF|1|0
:LOOP	state	Boolean	ON|OFF|1|0
:NAME?	selftest number	extended numeric	0 to 288
:POINts?	number of selftests		
:RESult?	condition of selftests		
:TINT?			

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:DISPlay			
[:STATe]	state	Boolean	ON|OFF|1|0
:FREQuency			
:CENTer	center freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
[:CW]	CW freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
:AUTO	coupled to center freq	Boolean	ON|OFF|1|0
:MANual	manual freq	extended numeric	start/stop limits or MAXimum|MINimum|UP|DOWN
:MODE	free mode	discrete	CW|SWEep|LIST
:MULTiplier	freq mult	extended numeric	+36 to −36 or MAXimum|MINimum
:STATe	state	Boolean	ON|OFF|1|0
:OFFSet	freq offset	extended numeric	+99.999 to −99.999 GHz or MAXimum|MINimum
:STATe	state	Boolean	ON|OFF|1|0
:SPAN	freq span	extended numeric	0 to MAX-MIN MAXimum|MINimum|UP|DOWN
:STARt	start freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
:STEP			
:AUTO	auto freq step	Boolean	ON|OFF|1|0
[:INCRement]	freq step	extended numeric	range or MAXimum|MINimum
:STOP	stop freq	extended numeric	specified freq range or MAXimum|MINimum|UP|DOWN
:INITiate			
:CONTinuous	cont sweep	Boolean	ON|OFF|1|0
[:IMMediate]	sweep immediately		

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:LIST			
:DWELl	dwell time	extended numeric	{0.1 to 3200 ms}*801 or {MAXimum|MINimum}1*801
:POINts?			
:FREQuency	list freq	extended numeric	{specified freq range}*801 or {MAXimum|MINimum}1*801
:POINts	num of freq points	extended numeric	[MAXimum|MINimum]
:MANual	num of points to lock on	numeric	1 to maximum defined
:MODE	list sweep mode	discrete	AUTO|MANual
[:POWer]			
:CORRection	correction level	extended numeric	{+40 to −40 DB}1*801 or {MAXimum|MINimum}1*801
:POINts?	num of corr levels	numeric	[MAXimum|MINimum]
:TRIGger			
:SOURce	list trig source	discrete	IMMediate|BUS|EXTernal
:MARKer[n]		[n] is 1 to 5, 1 is the default	
:AMPLitude			
[:STATe]	state	Boolean	ON|OFF|1|0
:VALue	amp marker depth	extended numeric	+10 to −10DB|MAXimum|MINimum
:AOFF			
:DELTa?	difference between two markers	numeric	<num>,<num> 1 to 5
:FREQuency	marker frequency	extended numeric	specified freq range or MAXimum|MINimum
:MODE	marker mode	discrete	FREQuency|DELTa
:REFerence	delta marker ref	numeric	1 to 5
[:STATe]	state	Boolean	ON|OFF|1|0

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:POWer			
:ALC			
:BANDwidth	ALC bwidth	extended numeric	<num>[freq suffix] or MAXimum|MINimum
:AUTO	bwidth selection	Boolean	ON|OFF|1|0
:CFACtor	coupling factor	extended numeric	0 to −90[DB] or MAXimum|MINimum|UP|DOWN
:SOURce	leveling point	discrete	INTernal|DIODe|PMETer|MMHead
[:STATe]	state	Boolean	ON|OFF|1|0
:AMPLifier			
:STATE		Boolean	ON|OFF|1|0
:AUTO		Boolean	ON|OFF|1|0
:ATTenuation	atten setting	extended numeric	0 to 90 [DB] or MAXimum|MINimum|UP|DOWN
:AUTO	coupled atten	Boolean	ON|OFF|1|0
:CENTer	power sweep center	extended numeric	specified power range or MAXimum|MINimum|UP|DOWN
[:LEVel]	output level	extended numeric	specified power range or MAXimum|MINimum|UP|DOWN
:MODE	power mode	discrete	FIXed|SWEep
:OFFSet	power equation offset	extended numeric	<num>[level suffix] or MAXimum|MINimum|UP|DOWN
:STATe	state	Boolean	ON|OFF|1|0
:RANGe	power meter range	extended numeric	−30 to −90DB or MAXimum|MINimum|UP|DOWN
:SEARch	search mode	Boolean	ON|OFF|1|0|ONCE
:SLOPe	power slope	extended numeric	2.5 to −2.5DB/GHZ or MAXimum|MINimum|UP|DOWN
:STATe	state	Boolean	ON|OFF|1|0
:SPAN	power sweep span	extended numeric	+45 to −45DB or MAXimum|MINimum|UP|DOWN
:STARt	power sweep start value	extended numeric	specified power range or MAXimum|MINimum|UP|DOWN
:STATe	RF on/off	Boolean	ON|OFF|1|0
:STEP			
:AUTO	step size determined	Boolean	ON|OFF|1|0
[:INCRement]	step size	extended numeric	20 to 0.01DB or MAXimum|MINimum
:STOP	power sweep stop value	extended numeric	specified power range or MAXimum|MINimum|UP|DOWN

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:PULM			
:SOURce	pulse mod source	discrete	SCALar
:STATe	state	Boolean	ON|OFF|1|0
:ROSCillator			
:SOURce	ref osc source	discrete	INTernal|EXTernal|NONE
:AUTO	state	Boolean	ON|OFF|1|0
:STATus			
:OPERation			
:CONDition?			
:ENABle		numeric	0 to 2047
[:EVENt]?			
:NTRansition	neg transition filter	numeric	0 to 2047
:PTRansition	pos transition filter	numeric	0 to 2047
:PRESet			
:QUEStionable			
:CONDition?			
:ENABle	SRQ enable register	numeric	0 to 2047
[:EVENt]?			
:NTRansition	neg transition filter	numeric	0 to 2047
:PTRansition	pos transition filter	numeric	0 to 2047

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:SWEep			
:CONTrol			
:STATe	dual source mode	Boolean	ON|OFF|1|0
:TYPE	type of sweep control	discrete	MASTer|SLAVe
:DWELl	settling time plus dwell time	extended numeric	0.1 to 3200 ms or MAXimum|MINimum
:AUTO	dwell calculation state	Boolean	ON|OFF|1|0
:GENeration	type of sweep	discrete	STEPped|ANALog
:MANual			
:POINt	step point number	numeric	1 to the number of step points
[:RELative]	percent of sweep	extended numeric	0 to 100%
:MARKer			
:STATe	state	Boolean	ON|OFF|1|0
:XFER	M1=start, M2=stop		
:MODE	manual sweep mode switch	discrete	AUTO|MANual
:POINts	points in step sweep	numeric	<num>|MAXimum|MINimum
:STEP	step size	extended numeric	function of current span MAXimum|MINimum
:TIME	sweep time	extended numeric	200s to 133 ms or MAXimum|MINimum
:AUTO	auto sweep time switch	Boolean	ON|OFF|1|0
:LLIMit	fastest sweep time	extended numeric	<num>[time suffix] or MAXimum|MINimum
:TRIGger			
:SOURce	stepped trig source	discrete	IMMediate|BUS|EXTernal

Table S-1. 8360 SCPI COMMAND SUMMARY (continued)

Command	Parameters	Parameter Type[1]	Allowed Values
:SYSTem			
:ALTernate	save/recall register	numeric	1 to 8|MAXimum|MINimum
:STATe	state	Boolean	ON|OFF|1|0
:COMMunicate			
:GPIB			
:ADDRess	swept CW generator address	numeric	1 to 30
:DUMP			
:PRINter?			
:ERRor?			
:KEY			
:ASSign	key code assign	numeric	0 to 511, 1 to 14 excluding 5 and 10
:CLEar	clears user menu	numeric	1 to 14|ALL
:DISable	save lock	discrete	SAVE
:ENABle	save lock	discrete	SAVE
:LANGuage	language selection	discrete	SCPI|CIIL|COMPatible
:MMHead			
SELect		discrete	FRONt|REAR|NONE
AUTO		Boolean	ON|OFF|0|1
:PRESet			
[:EXEC]			
:SAVE			
:TYPE	preset mode	discrete	FACTory|USER
:SECurity			
:COUnt	memory clear	numeric	0 to 32767|MAXimum|MINimum
[:STATe]	state	Boolean	ON|OFF|1|0
:VERSion?			
:TRIGger			
[:IMMediate]			
:ODELay	output delay	extended numeric	0 to 3.2s
:SOURce	trig source	discrete	IMMediate|BUS|EXTernal
:TSWeep equivalent of :ABORt;INITiate[:IMMediate]			
:UNIT			
:POWer	default power units	string	DBM

● `ABORt`

Causes the sweep in progress to abort and reset. If `INIT:CONT` is `ON` it immediately restarts the sweep. The pending operation flag (driving *OPC, *WAI, and *OPC?) undergoes a transition once the sweep is reset.

● `CALibration:PEAKing:AUTO ON|OFF|1|O`
● `CALibration:PEAKing:AUTO?`

Sets and queries the automatic peaking function. If `AUTO` is `ON`, then a peak is done at regular intervals automatically. After *RST, the setting is `OFF`.

● `CALibration:PEAKing[:EXECute]`

Peaks the SYTM.

● `CALibration:PMETer:DETector:INITiate? IDETector|DIODe`

Initiates the specified calibration. These calibrations require the use of an external power measurement. Once initiated, the swept CW generator sets up for the first point to be measured, and responds to the query with the frequency at which the power is to be measured.

The parameters mean:

`IDETector`	Initiates a calibration of the internal detector logger breakpoints and offsets.
`DIODe`	Initiates a calibration of an external detector's logger breakpoints and offsets.

● `CALibration:PMETer:DETector:NEXT? <num>[lvl suffix]`

The parameter is the measured power that is currently produced by the swept CW generator. You must supply this parameter after measuring the power using an external power meter. The query response is issued after the swept CW generator processes the supplied parameter and settles on the next point to be measured. The query response is:

>0	The frequency [in Hz] that is currently produced.
0	The calibration is complete.
<0	An error has occurred and the calibration is aborted.

● `CALibration:PMETer:FLATness:INITiate?`
`USER|DIODe|PMETer|MMHead`

Initiates the specified calibration. These calibrations require the use of an external power measurement. Once initiated, the swept CW generator sets up for the first point to be measured, and responds to the query with the frequency at which the power is to be measured.

The parameters mean :

`USER`	Initiates a calibration at all of the user flatness points.
`DIODe`	Initiates a calibration of the external flatness. Depends on value of `CALibration:PMETer:RANGe`.

```
PMETer     Initiates a calibration of the power meter flatness.
           Depends on value of CALibration:PMETer:RANGe.
MMHead     Initiates a calibration of the source module flatness.
           Depends on value of CALibration:PMETer:RANGe.
```

● `CALibration:PMETer:FLATness:NEXT? <num>[lvl suffix]`
The parameter is the measured power that is currently produced
by the swept CW generator. You must supply this parameter after
measuring the power using an external power meter. The query
response is issued after the swept CW generator processes the
supplied parameter and settles on the next point to be measured.
The query response is:

>0   The frequency [in Hz] that is currently produced.
 0   The calibration is complete.
<0   An error has occurred and the calibration is aborted.

● `CALibration:SPAN:AUTO ON|OFF|1|0`
● `CALibration:SPAN:AUTO?`
Sets and queries the automatic sweep span calibration.

ON   A calibration is done whenever the sweep span is changed.
OFF   A calibration is done only when
      `CALibration:SPAN[:EXECute]` is sent.

After *RST, the setting is OFF.

● `CALibration:SPAN[:EXECute]`
Causes a sweep span calibration.

● `CALibration:TRACk`
Causes an automatic tracking calibration procedure.

● `CORRection:ARRay[i] {<num>[DB]}1601*1601`
● `CORRection:ARRay[i]?`
Sets and queries the entire 1601-point array of correction values
that can be added to the internal flatness correction array. The
1601-points are added to the internal flatness array synchronized
on the trigger output $1\mu s$ pulses. These TTL-level pulses are 1601
evenly spaced points across an analog sweep, or at each point in step
or list mode. Entering this array causes the `CORRection:SOURce[i]`
command to set to ARRay. There is one array for the foreground
state (i=0) and one for the background state (i=1). If the [i] is not
specified, the default value is i=0. After *RST, these arrays are
cleared.

● `CORRection:FLATness {<num>[freq suffix],<num>[DB]}2*801`
● `CORRection:FLATness?`
Sets and queries an array of up to 801 frequency-correction

pairs. This correction information is used to create a correction array that can be added to the internal calibration array. The correction entered is at the associated frequency. Frequencies in between frequency-correction pair values are determined by linear interpolation. If a value of START or STOP frequency is specified that is outside the limits of the specified frequencies, the correction applied at those points is 0 dB. After *RST, returns a
`MinFreq, 0 DB, MaxFreq, 0 DB` response.

* `CORRection:SOURce[i] ARRay|FLATness`
* `CORRection:SOURce[i]?`
Sets and queries the source of correction.

* `CORRection:FLATness:POINts? [MAXimum|MINimum]`
Returns the number of frequency-correction pairs entered using the `CORR:FLAT` command. After *RST, the value is 2.

* `CORRection[:STATe] ON|OFF|1|0`
* `CORRection[:STATe]?`
Sets and queries the switch on the users ALC correction system. The *RST value is OFF.

* `DIAGnostics:ABUS? <num>`
Reads the analog bus node number and returns the number of millivolts.

* `DIAGnostics:ABUS:AVERage <num>`
* `DIAGnostics:ABUS:AVERage?`
Sets and queries the number of ADC averages to use during the read ADC query. After *RST, the value is 1.

* `DIAGnostics:ABUS:STATus?`
Queries the status of the prior ADC reading. The response is a single byte that is bit-encoded to mean:

Bit 0   Set to 1, if ADC timed out (hardware fault).
Bit 1   Set to 1, if reading was unsettled.
Bit 2   Set to 1, if out of range occurred.

* `DIAGnostics:INSTrument:PMETer:ADDRess <num>`
* `DIAGnostics:INSTrument:PMETer:ADDRess?`
Sets and queries the GPIB address to use for the power meter during swept CW generator calibration routines. Allowable values are 0 through 31. *RST or power on does not effect this value. Default is 13. It is defaulted only when memory is initialized.

* `DIAGnostics:INSTrument:PRINter:ADDRess <num>`
* `DIAGnostics:INSTrument:PRINter:ADDRess?`

Sets the GPIB address of the printer to use during some of the calibration procedures when the swept CW generator assumes GPIB control. *RST and power on do not effect this command. The default is 1. The default value is set at memory initialization only.

- **DIAGnostics:IORW <num>,<num>**
Performs a write to the I/O Device number specified in the first <num> and sets it to the value in the second <num>.

- **DIAGnostics:IORW? <num>**
Reads from the specified I/O device number and returns the response data.

- **DIAGnostics:OUTPut:FAULt?**
Returns a string of 16, 1s and 0s that are equivalent to the fault display.

    Bit 0 = PEAK
    Bit 1 = TRACK
    Bit 2 = RAMP
    Bit 3 = SPAN
    Bit 4 = V/GHz
    Bit 5 = ADC
    Bit 6 = EEROM
    Bit 7 = PWRON
    Bit 8 = CALCO
    Bit 9 = PLLZERO
    Bit 10 = PLLWAIT
    Bit 11 = FNXFER
    Bit 12 = CAL YO
    Bit 13 = CAL MAN
    Bit 14 = TMR CNFLCT
    Bit 15 = SEARCH

- **DIAGnostics:RESult?**
Returns the following information:

    <result>, <test failure>, <manual entry point>

where, **<result>** is one of the following:

0   Diagnosis successful.
1   Cannot diagnose; full selftest must be executed first.
2   No failures found—all selftests passed.
−1   Cannot diagnose; diagnosis routine failed to isolate failure. (software fault)

<test failure> is the test number of the most relevant failure (−999 if parameter is not used, as in <result> of 1).
<manual entry point> is a string response that identifies the paragraph number in the *Agilent Technologies 8360 B-Series Swept*

Signal Generator/8360 L-Series Swept CW Generator Service Guide
to begin the troubleshooting procedure.

● `DIAGnostics:TEST:CONTinue`
Causes the selftest execution to continue when paused for raw data
examination. Does nothing in other conditions.

● `DIAGnostics:TEST:DATA:DESC?`
Returns the description string of the raw data examined during a
selftest. It returns " " in other conditions.

● `DIAGnostics:TEST:DATA:MAXimum?`
Returns the upper test limit for the raw data point examined.
Returns "0" in other conditions.

● `DIAGnostics:TEST:DATA:MINimum?`
Returns the lower test limit for the raw data point examined.
Returns "0" in other conditions.

● `DIAGnostics:TEST:DATA:VALue?`
Returns the raw data value for the raw data point examined.
Returns a "0" in other conditions.

● `DIAGnostics:TEST:DISable {<num>}1*?|ALL`
Prevents the listed selftests from being selected. If `ALL` is sent then
all of the selftests are disabled. *RST causes `DIAG:TEST:ENAB ALL` to
execute.

● `DIAGnostics:TEST:ENABle {<num>}1*?|ALL`
Enables the listed selftests to execute. If `ALL` is sent then all of the
selftests are enabled. *RST causes `DIAG:TEST:ENAB ALL` to execute.

● `DIAGnostics:TEST[:EXECute] <num>`
The specified selftest is executed. Normal instrument operation is
suspended and the instrument state is restored upon exiting the
selftest mode.

● `DIAGnostics:TEST:LOG:SOURce ALL|FAIL`
● `DIAGnostics:TEST:LOG:SOURce?`
Sets and queries the source for the raw data logging. `ALL` specifies
that all raw data points are displayed. `FAIL` selects only those data
points out of the test limits. Both commands are executable in
selftest mode. After *RST, the setting is `FAIL`.

● `DIAGnostics:TEST:LOG[:STATe]?`
● `DIAGnostics:TEST:LOG[:STATe] ON|OFF|1|0`

Selects and queries the raw data logging ON/OFF switch. Both commands are executable in selftest mode.
After *RST, the setting is 0.

● `DIAGnostics:TEST:LOOP ON|OFF|1|0`
● `DIAGnostics:TEST:LOOP?`
Selects and queries the test looping ON/OFF switch. Both commands are executable in selftest mode.
After *RST, the setting is 0.

● `DIAGnostics:TEST:NAME? [<num>]`
Queries the name of a selftest by number. If the number is not specified then an array of all the selftest names is returned.

● `DIAGnostics:TEST:POINts?`
Returns the number of points of selftest that is output using `DIAGnostics:TEST:NAME?` or `DIAGnostics:TEST:RESult?`.

● `DIAGnostics:TEST:RESult? [<num>]`
Queries the result of a selftest, by number. The response is a string containing either *Passed*, *Failed*, or *NotRun*. If <num> is missing, an array of selftest results are returned.

● `DIAGnostics:TINT? <num>`
A test feature that returns the value passed to it. This is used to test the GPIB interface.

● `DISPlay[:STATe] ON|OFF|1|0`
● `DISPlay[:STATe]?`
Sets and queries the display ON/OFF switch.
After *RST, the value is 1.

Frequency Subsystem   Any two frequency setting headers (STARt, STOP, CENTer, or SPAN) may be sent in a single message and the resulting sweep is what was requested. The order of the headers in the message does not make any difference in the final result. When a message is completed, coupling equations are used to fix the unset parameters to the correct values. These equations specify that:

center frequency = (start + stop) / 2
frequency span = (stop − start)

If more than two are sent then the last two in the message are used to determine the sweep and no errors are given.

If only one header is sent in a message, then the assumed pairs are center/span and start/stop. In other words, if only center is sent, then span is kept constant (if possible) while adjusting center to the

requested value. The start/stop frequencies are updated to reflect the changes based on the coupling equations.

The swept CW generator uses "bumping" to move unspecified frequency parameters, but if the final value of any of the frequency headers is the result of bumping, then an error is generated since the user is *not* getting what was specified. This means, to guarantee sequence independence requires sending the frequency pairs in a single message.

Example 1: (present state start = 5 GHz, stop = 6 GHz)

`FREQ:STARt 20 GHZ`	*an error results since the stop frequency is bumped.*
`FREQ:STOP  22 GHZ`	*the final sweep does not generate an error (20 to 22).*

Example 2: (present state start = 5 GHz, stop = 6 GHz)

`FREQ:STOP  22 GHZ`	*no error is generated, start frequency is unchanged.*
`FREQ:STARt 20 GHZ`	*still no error.*

Example 3: (present state start = 5 GHz stop = 6 GHz)

`FREQ:STARt 20 GHZ;STOP 22 GHZ`	*both are fine,*
`FREQ:STOP 22 GHZ;STARt 20 GHZ`	*no errors.*

- `FREQuency:CENTer <num>[freq suffix]|MAXimum|MINimum|UP|DOWN`
- `FREQuency:CENTer? [MAXimum|MINimum]`
Sets and queries the center frequency.
The *RST value is (MAX + MIN)/2.

- `FREQuency[:CW|:FIXed] <num>[freq suffix]|MAXimum|MINimum|UP|DOWN`
- `FREQuency[:CW]? [MAXimum|MINimum]`
- `FREQuency[:FIXed]? [MAXimum|MINimum]`
Sets and queries the CW frequency. This does not change the swept/CW mode switch. *RST value is (MAX + MIN)/2 .
See `FREQ:CENTER` for more information.

- `FREQuency[:CW]:AUTO ON|OFF|1|0`
- `FREQuency[:FIXed]:AUTO ON|OFF|1|0`
- `FREQuency[:CW]:AUTO?`
- `FREQuency[:FIXed]:AUTO?`
Sets and queries the CW/center frequency coupling switch. This switch keeps the two functions coupled together when `ON`. Changing one of them, changes both. *RST setting is `OFF`. See `FREQ:CENTER` for more information.

• `FREQuency:MANual <num>[freq`
`suffix]|MAXimum|MINimum|UP|DOWN`
• `FREQuency:MANual? [MAXimum|MINimum]`
Sets and queries the manual frequency. This controls the output
frequency in swept manual mode. The limits are START and STOP.
*RST value is the same as `FREQ:CENTER`. See `FREQ:CENTER` for more
information.

• `FREQuency:MODE FIXed|CW|SWEep|LIST`
• `FREQuency:MODE?`
Sets and queries the switch that selects either swept, CW or list
operation. *RST value is CW.

• `FREQuency:MULTiplier <num>|MAXimum|MINimum`
• `FREQuency:MULTiplier? [MAXimum|MINimum]`
Sets and queries the frequency multiplier. The numeric value is
rounded to the nearest integer. This function changes mapping of
frequency parameters on input to and output from the swept CW
generator. Changing this does not affect the output frequency of
the swept CW generator. Only the displayed parameters and query
responses are changed.
The equation implied by this is :

$$\text{Entered/displayed frequency} = (\text{Hardware Freq} * \text{Multiplier}) + \text{Offset}$$

After *RST, the value is 1.

• `FREQuency:MULTiplier:STATe ON|OFF|1|0`
• `FREQuency:MULTiplier:STATe?`
Queries and turns the frequency multiplier off and on.
After *RST, the setting is OFF.

• `FREQuency:OFFSet <num>|MAXimum|MINimum`
• `FREQuency:OFFSet? [MAXimum|MINimum]`
Sets and queries the frequency offset. This function changes the
mapping of the frequency parameters on input to and output from
the swept CW generator. Changing this does not affect the output
frequency of the swept CW generator. Only the displayed parameters
and query responses are changed. The equation implied by this is :

$$\text{Entered/displayed frequency} = (\text{Hardware Freq} * \text{Multiplier}) + \text{Offset}$$

After *RST, the value is 0.

• `FREQuency:OFFSet:STATe ON|OFF|1|0`
• `FREQuency:OFFSet:STATe?`

Queries and turns the frequency offset off and on.
After *RST, the setting is OFF.

● FREQuency:SPAN <num>[freq
suffix]|MAXimum|MINimum|UP|DOWN
● FREQuency:SPAN? [MAXimum|MINimum]
Sets and queries the frequency span. See FREQ:CENTER for more
information.

● FREQuency:STARt <num>[freq suffix]
|MAXimum|MINimum|UP|DOWN
● FREQuency:STARt? [MAXimum|MINimum]
Sets and queries the START Frequency. See FREQ:CENTER for more
information. *RST setting is MIN.

● FREQuency:STEP:AUTO ON|OFF|1|O
● FREQuency:STEP:AUTO?
Sets and queries the function switch that controls the calculation of
the frequency step size (FREQ:STEP:INCR). If the response is
AUTO ON, then the swept CW generator selects a step size that is
coupled to the frequency span. The *RST setting is ON.

● FREQuency:STEP[:INCRement] <num>[freq
suffix]|MAXimum|MINimum
● FREQuency:STEP[:INCRement]?
Sets and queries the frequency step size to use for any node in the
frequency subsystem that allows UP and DOWN as parameters. Setting
this value explicitly causes a FREQ:STEP:AUTO OFF command.
The *RST setting is automatically calculated from span.

● FREQuency:STOP <num>[freq
suffix]|MAXimum|MINimum|UP|DOWN
● FREQuency:STOP? [MAXimum|MINimum]
Sets and queries the stop Frequency. See FREQ:CENTER for more
information. *RST setting is MAX.

● INITiate:CONTinuous ON|OFF|1|O
● INITiate:CONTinuous?
Sets and queries the state of the continuous initiation switch. This is
more commonly known as single or continuous sweep. This does not
affect a sweep in progress. *RST setting is OFF.

● INITiate[:IMMediate]
Causes the initiation of a sweep. Useful mainly in the INIT:CONT OFF
mode of operation (single sweep). By combining the *OPC, *WAI
facilities with the INIT:IMM command, the functionality of the

analyzer compatible language *take sweep* and *single sweep* command
can be achieved.

● `LIST:DWELl {<num>[time suffix]|MAXimum|MINimum}1*801`
● `LIST:DWELl? [MAXimum|MINimum]`
Sets and queries the amount of time to dwell at each frequency.
The number of dwells can be queried with `LIST:DWELl:POINts?`.
This dwell is the time after completing phaselock and turning RF
on before changing to the next frequency. After *RST, the value is
100 μs (`MIN`).

● `LIST:DWELl:POINts? [MAXimum|MINimum]`
Returns the number of dwells entered using the `LIST:DWELl`
command. After *RST returns a 1.

● `LIST:FREQuency {<num>[freq suffix]|MAXimum|MINimum}1*801`
● `LIST:FREQuency?`
Sets and queries a list of frequencies that the swept CW generator
phase locks to in the sequence entered when the list mode is selected.
*RST value is the (MAX + MIN)/2.

● `LIST:FREQuency:POINts? [MAXimum|MINimum]`
Returns the number of frequencies that have been entered into the
list frequency array. After *RST returns a 1.

● `LIST:MANual <num>`
● `LIST:MANual?`
Sets and queries the list point number to go to and lock. The value is
a unitless value that is limited between 1 and the maximum number
of points in either of the three arrays. This command has no effect
unless the list mode is set to manual. This value may be bumped if
the number of list frequencies is changed. *RST value is 1.

● `LIST:MODE AUTO|MANual`
● `LIST:MODE?`
Selects and queries whether the list is played back automatically or
manually as described in `LIST:MANual`.

LIST:MODE	LIST:TRIGger:SOURce	How the list is played back.
AUTO	IMMediate	Each new frequency point is stepped to automatically, after waiting the specified DWELl time.
AUTO	BUS	Wait for a <GET> or *TRG over the GPIB before advancing to the next frequency in the list.
AUTO	EXTernal	Wait for a signal to be received on the external input before advancing to the next frequency in the list.
MANual	Don't care	Only the list point specified by LIST:MANual is played back.

*RST state is AUTO.

● LIST[:POWer]:CORRection {<num>[DB]|MAXimum|MINimum}1*801
● LIST[:POWer]:CORRection?
Sets and queries the list of correction levels that correspond to each of the frequencies entered using the LIST:FREQ command. The attenuator is not allowed to change during the list execution. The number of parameters can be from 1 to 801.
After *RST, the value is 0.

● LIST[:POWer]:CORRection:POINts? [MAXimum|MINimum]
Returns the number of correction points that have been entered into the list array. After *RST returns a 1.

● LIST:TRIGger:SOURce IMMediate|BUS|EXTernal
● LIST:TRIGger:SOURce?
Sets and queries the list point-to-point trigger source when in the automatic list mode. See LIST:MODE and INIT:CONT for more details.
*RST state is IMMediate.

● MARKer[n]:AMPLitude[:STATe] ON|OFF|1|0
● MARKer[n]:AMPLitude[:STATe]?
Sets and queries the amplitude marker on/off switch. While [n] may be used, there is really only a single switch for all the markers.
*RST value is OFF.

● MARKer[n]:AMPLitude:VALue <num>[DB]|MAXimum|MINimum
● MARKer[n]:AMPLitude:VALue? [MAXimum|MINimum]
Sets and queries the value of the amplitude marker. While [n] may

be used, there is really only a single value for all the markers.
*RST value is 2 dB.

• `MARKer[n]:AOFF`

Sets all the markers to `OFF` at once. While [n] may be used, there is really only a single switch for all the markers.

• `MARKer[n]:DELTa? <num>,<num>`

This query returns the difference in frequency between the two specified marker numbers.

• `MARKer[n]:FREQuency <num>[freq suffix]|MAXimum|MINimum`
• `MARKer[n]:FREQuency? [MAXimum|MINimum]`

Sets and queries the specified marker frequency (marker number one is the default if [n] is not specified). The value is interpreted differently based on the value of the marker mode.

MARKer[n]:MODE	How the frequency of the marker is determined.
FREQuency	Absolute frequency is used. The limits are confined to the present START and STOP frequency limits.
DELTa	The value is specified with respect to the reference marker. (MARKer[n]:REFerence)

The *RST values are the same as the `FREQ:CENT` command *RST value.

• `MARKer[n]:MODE FREQuency|DELTa`
• `MARKer[n]:MODE?`

Sets and queries the mode of the specified marker. Setting one marker to delta turns all other marker modes to frequency. If [n] is not specified, the default is one. *RST value is `FREQuency`.

• `MARKer[n]:REFerence <n>`
• `MARKer[n]:REFerence?`

Sets and queries which marker is the reference marker for use in the delta mode. While [n] may be used, there is really only a single reference for all the markers. `MARKer1:REFerence 5;` and `MARKer2:REFerence 5;` both set marker 5 as the reference.

• `MARKer[n][:STATe] ON|OFF|1|0`
• `MARKer[n][:STATe]?`

The state of the specified marker is set and queried (marker number one if [n] is not specified). The *RST value for all markers is `OFF`.

Power Subsystem

Any place where dBm is accepted as a suffix, any level suffix is accepted also. In the absence of a suffix, the units are assumed to be as set by the `UNIT:POW` command.

- `POWer:ALC:BANDwidth|:BWIDth <num>[freq suffix]|MAXimum|MINimum`
- `POWer:ALC:BANDwidth?|:BWIDth? [MAXimum|MINimum]`

Sets and queries the ALC bandwidth. This is actually not continuously variable, so the input is rounded to the nearest possible switch position. *RST setting is automatically determined since `AUTO` is `ON`.

- `POWer:ALC:BANDwidth|:BWIDth:AUTO ON|OFF|1|0`
- `POWer:ALC:BANDwidth|:BWIDth:AUTO?`

Sets and queries the automatic ALC bandwidth selection switch. The *RST value is `ON`.

- `POWer:ALC:CFACtor <num>[DB]|MAXimum|MINimum|UP|DOWN`
- `POWer:ALC:CFACtor? [MINimum|MAXimum]`

Sets and queries the coupling factor used when the command `POWer:ALC[:SOURce]` is set to `DIODe` or `PMETer`.

- `POWer:ALC:SOURce INTernal|DIODe|PMETer|MMHead`
- `POWer:ALC:SOURce?`

Sets and queries the ALC leveling source selection switch. The *RST value is `INTernal`.

- `POWer:ALC[:STATe] ON|OFF|1|0`
- `POWer:ALC[:STATe]?`

Sets and queries the state switch of the ALC. The positions are :
ON—normal ALC operation
OFF—open loop ALC mode

When on, the power can be programmed in fundamental units as selected by the `UNIT:POWer` command.

When off, the power is no longer calibrated in absolute units and is set in units of dB of arbitrary modulator setting.

- `POWer:AMPLifier:STATE ON|OFF|0|1`
- `POWer:AMPLifier:STATE?`

Sets and queries the state of the amplifier contained in the doubler (for those models with a doubler installed). Programming a specific value for `POWer:AMPLifier:STATE` sets `POWer:AMPLifier:STATE:AUTO` to `OFF`.

- `POWer:AMPLifier:STATE:AUTO ON|OFF|0|1`
- `POWer:AMPLifier:STATE:AUTO?`

Sets and queries the automatic selection of the doubler amplifier

state. Programming a specific value for `POWer:AMPLifier:STATE` sets
`POWer:AMPLifier:STATE:AUTO` to `OFF`. `*RST` value is `ON`.

● `POWer:ATTenuation <num>[DB]|MAXimum|MINimum|UP|DOWN`
● `POWer:ATTenuation? [MAXimum|MINimum]`
Sets and queries the output attenuation level. Note that when
setting the attenuator level to 10 dB the output power is
decreased by 10 dB. Programming a specified attenuation sets
`POWer:ATTenuation:AUTO OFF`.

● `POWer:ATTenuation:AUTO ON|OFF|1|0`
● `POWer:ATTenuation:AUTO?`
Sets and queries the state of the RF attenuator coupling switch.
Programming a specified attenuation sets
`POWer:ATTenuation:AUTO OFF`.
ON - insures that the amplitude level of the ALC is kept within
optimal limits.
OFF - the attenuator setting is set to the value of `POW:ATT` and left
there. The *RST value is `ON`.

● `POWer:CENTer <num> [lvl suffix]|MAXimum|MINimum|UP|DOWN`
● `POWer:CENTer? [MAXimum|MINimum]`
Sets and queries the center power for power sweep. Default units
(and units for query response) are determined by the `UNIT:POWer`
command.

The coupling equations for power sweep are exactly analogous to
those for frequency sweep. Power sweep is allowed to be negative,
unlike frequency sweeps. See `FREQ:CENT` for a description. *RST
value is 0 dBm.

● `POWer[:LEVel] <num>[lvl suffix]|MAXimum|MINimum|UP|DOWN`
● `POWer[:LEVel]? [MAXimum|MINimum]`
Sets and queries the output level. Default units and units
for the query response are determined by the `UNIT:POWer`
command. Maximum and minimum levels refer to the
leveling mode at the time the command is sent. For example,
`*RST;POWer:LEVel MIN; ALC:SOURce MMHead` has different effects
from `*RST;POWer:ALC:SOURce MMHead; POWer:LEVel MIN`
After *RST, the value is 0 dBm.

● `POWer:MODE FIXed|SWEep`
● `POWer:MODE?`
Sets and queries the setting of the power sweep mode switch. If in
the sweep mode then the output level is controlled by the start,
stop, center and span functions. If in the fixed power mode then the
output is controlled by the `POW[:LEVEL]` command. The *RST value
is `FIXed`.

● POWer:OFFSet <num>[DB]|MAXimum|MINimum|UP|DOWN
● POWer:OFFSet? [MAXimum|MINimum]
Sets and queries the power offset. This function changes mapping of absolute power parameters on input to and output from the swept CW generator. Changing this does not affect the output power of the swept CW generator. Only the displayed parameters and query responses are changed. The equation implied by this is:
The entered or displayed power = Hardware Power + Offset After *RST, the value is 0.

● POWer:OFFSet:STATe ON|OFF|1|0
● POWer:OFFSet:STATe?
Queries and turns the power offset off and on. After *RST, the setting is OFF.

● POWer:RANGe <num>[lvl suffix]|MAXimum|MINimum|UP|DOWN
● POWer:RANGe?
Sets and queries the setting of the power meter range. This is used when the command POWer:ALC:SOURce is set to PMETer.

● POWer:SEARch ON|OFF|1|0|ONCE
● POWer:SEARch?
Sets and queries the power search switch. This has an interaction with POWer:ALC:STATe as described below.

POWer:ALC:STATe	POWer:SEARch	Power Switch Action
ON	ON	ALC is momentarily closed to level at the requested power, and then the modulator is set to the same voltage in open loop mode. This repeats automatically any time that the power level or frequency is changed.
ON	OFF	Normal mode.
ON	ONCE	Immediately performs a power search. This leaves POWer:SEARch in the ON position.
OFF	not applicable	Modulator setting is explicitly set by user.

● POWer:SLOPe <num>[DB/freq
suffix]|MAXimum|MINimum|UP|DOWN
● POWer:SLOPe? [MAXimum|MINimum]
Sets and queries the RF slope setting (dB per Hz).

FREQ:MODE **Affect on Slope**

CW or LIST   Rotates around 0 Hz.

SWEep or   Rotates around the start frequency.
STEP

The *RST value is 0.

● POWer:SLOPe:STATe ON|OFF|1|O
● POWer:SLOPe:STATe?
Sets and queries the power slope state. *RST value is 0.

● POWer:SPAN <num>[DB]|MAXimum|MINimum|UP|DOWN
● POWer:SPAN? [MAXimum|MINimum]
The coupling equations for power sweep are exactly analogous to
those for frequency sweep. Power sweep is allowed to be negative,
unlike frequency sweeps. *RST value is 0.

● POWer:STARt <num>[lvl suffix]|MAXimum|MINimum|UP|DOWN
● POWer:STARt? [MAXimum|MINimum]
Default units and units for query response are determined by the
command UNIT:POWer. The coupling equations for power sweep
are exactly analogous to those for frequency sweep. Power sweep is
allowed to be negative, unlike frequency sweeps.
*RST value is 0 dBm.

● POWer:STATe ON|OFF|1|O
● POWer:STATe?
Sets and queries the output power on/off state. *RST value is OFF.

● POWer:STEP:AUTO ON|OFF|1|O
● POWer:STEP:AUTO?
Sets and queries the function switch that controls how the power step
size (POWer:STEP:INCRement) is determined. If in the automatic
state, then the step size is 1 dB. The *RST setting is ON.

● POWer:STEP[:INCRement] <num>[DB]|MAXimum|MINimum
● POWer:STEP[:INCRement]? [MAXimum|MINimum]
Sets and queries the power step size to be used for any node in the
power subsystem that allows UP and DOWN as parameters. Setting this
value explicitly causes POWer:STEP:AUTO OFF.
The *RST setting is 10 dB.

● POWer:STOP <num>[lvl suffix]|MAXimum|MINimum|UP|DOWN
● POWer:STOP? [MAXimum|MINimum]
Sets and queries the ending power for a power sweep. Default units
and units for query response are determined by the command
UNIT:POWer. The coupling equations for power sweep are exactly
analogous to those for frequency sweep. Power sweep is allowed to be
negative, unlike frequency sweeps. *RST value is 0 dBm.

● ROSCillator:SOURce?
● ROSCillator:SOURce INTernal|EXTernal|NONE

Sets and queries the reference oscillator selection switch. The command to set the switch will cause ROSC:SOUR:AUTO OFF to be done also. The *RST value is automatically determined.

- `ROSCillator:SOURce:AUTO ON|OFF|1|0`
- `ROSCillator:SOURce:AUTO?`

Sets and queries the automatic reference selection switch. The *RST value is 1.

- `STATus:OPERation:CONDition?`

Queries the Standard Operation Condition register.

- `STATus:OPERation:ENABle <num>`
- `STATus:OPERation:ENABle?`

Sets and queries the Standard Operation Enable register. The `STATus:PRESet` value is 0.

- `STATus:OPERation[:EVENt]?`

Queries the Standard Operation Event Register. This is a destructive read.

- `STATus:OPERation:NTRansition <num>`
- `STATus:OPERation:NTRansition?`

Sets and queries the Standard Operation Negative Transition Filter. The `STATus:PRESet` value is 0.

- `STATus:OPERation:PTRansition <num>`
- `STATus:OPERation:PTRansition?`

Sets and queries the Standard Operation Positive Transition Filter. After STATus:PRESet, all used bits are set to 1s.

- `STATUS:PRESet`

This command presets the following enable and transition registers: MSIB, OPERation, QUEStionable, and SRECeiver.

ENABle   Is set to all 0s.

NTRansition   Is set to all 0s.

PTRansition   All bits used are set to 1s. Unused bits remain 0s.

- `STATus:QUEStionable:CONDition?`

Queries the Data Questionable Condition Register.

- `STATus:QUEStionable:ENABle <num>`
- `STATus:QUEStionable:ENABle?`

Sets and queries the Data Questionable SRQ Enable register.
The `STATus:PRESet` value is 0.

● `STATus:QUEStionable[:EVENt]?`
Queries the Data Questionable Event Register. This is a destructive
read.

● `STATus:QUEStionable:NTRansition <num>`
● `STATus:QUEStionable:NTRansition?`
Sets and queries the Negative TRansition Filter for the Data
Questionable Status Register. The `STATus:PRESet` value is 0.

● `STATus:QUEStionable:PTRansition <num>`
● `STATus:QUEStionable:PTRansition?`
Sets and queries the Positive TRansition Filter for the Data
Questionable Status Register. After `STATus:PRESet`, all used bits are
set to 1s.

Sweep Subsystem

Interactions between dwell, sweep time, points, step size, and
frequency span are as follows:
`SWEep:TIME = (5 ms + SWEep:DWELl) × (SWEep:POINts − 1)`
`FREQ:SPAN = SWEep:STEP × (SWEep:POINts − 1)`

SWEep:xx:AUTO switches		
DWELl	**TIME**	**Switch Action**
OFF	OFF	No coupling between SWEep:DWELl, SWEep:TIME and SWEep:POINts.
OFF	ON	No coupling between SWEep:DWELl, SWEep:TIME and SWEep:POINts.
ON	OFF	When SWEEP:TIME or SWEEP:POINts are changed, SWEep:DWELl = (SWEep:TIME / (SWEep:POINts − 1)) − 5 mS. SWEep:DWELl is limited to 100 μs, minimum.
ON	ON	SWEep:DWELl = 100 μs (MINimum). SWEep:TIME = 5.1 ms × (SWEep:POINts − 1)

● `SWEep:CONTrol:STATe ON|OFF|1|0`
● `SWEep:CONTrol:STATe?`
Sets and queries the state of the sweep control.

OFF   Normal source mode.
ON   Use master slave source mode.

*RST value is `OFF`.

● `SWEep:CONTrol:TYPE MASTer|SLAVe`
● `SWEep:CONTrol:TYPE?`

Sets and queries the instrument, whether it is in master or slave mode. This applies in a dual source mode. *RST value is `MASTer`.

- `SWEep:DWELl <num>[time suffix]|MAXimum|MINimum`
- `SWEep:DWELl? [MAXimum|MINimum]`

Sets and queries the amount of time in seconds that the instrument stays (dwell) at each step after reporting a *source settled SRQ* and pulsing the *Trigger Out* line low. This one value is used at each step when in the `SWE:TRIG:SOUR IMM` mode of a stepped sweep. Setting `SWEep:DWELL` sets `SWEep:DWEL1:AUTO OFF`. *RST value is 100 μs.

- `SWEep:DWEL1:AUTO ON|OFF|1|O`
- `SWEep:DWEL1:AUTO?`

Sets and queries the state of the automatic dwell calculation switch. Setting `SWEep:DWELL` sets `SWEep:DWEL1:AUTO OFF`. *RST state is `OFF`.

Combining the Sweep Mode With the Sweep Generation Command to Obtain the Desired Sweep Condition

Description of Sweep Condition	:FREQ :MODE	:POW :MODE	:SWE :MODE	:LIST :MODE	:SWE :GEN
CW Non-swept	CW	FIX	ignored	ignored	ignored
Analog freq sweep	SWE	FIX	AUTO	ignored	ANAL
Manual analog freq sweep	SWE	FIX	MAN	ignored	ANAL
Stepped freq sweep	SWE	FIX	AUTO	ignored	STEP
Manual step freq sweep	SWE	FIX	MAN	ignored	STEP
CW with analog power sweep	CW	SWE	AUTO	ignored	ANAL
CW with manual analog power sweep	CW	SWE	MAN	ignored	ANAL
CW with stepped power sweep	CW	SWE	AUTO	ignored	STEP
CW with manual stepped power sweep	CW	SWE	MAN	ignored	STEP
Analog frequency and power sweep	SWE	SWE	AUTO	ignored	ANAL
Manual analog frequency and power sweep	SWE	SWE	MAN	ignored	ANAL
Stepped frequency and power sweep	SWE	SWE	AUTO	ignored	STEP
Manual stepped frequency and power sweep	SWE	SWE	MAN	ignored	STEP
List sweep	LIST	ignored	ignored	AUTO	ignored
Manual list sweep	LIST	ignored	ignored	MAN	ignored

- `SWEep:GENeration STEPped|ANALog`
- `SWEep:GENeration?`

Sets and queries the type of sweep to be generated: an analog sweep

or a digitally stepped sweep. In either case, all of the other sweep
subsystem functions apply. *RST is ANALog.

- SWEep:MANual:POINt <num>|MAXimum|MINimum
- SWEep:MANual:POINt? [MAXimum|MINimum]

Sets and queries the step point number to go to and lock. The value
is a unitless value that is limited between 1 and the number of points
requested. This command has no effect on the instrument unless:
the sweep mode is set to manual and the sweep generation is set to
stepped mode. *RST value is 1.

- SWEep:MANual[:RELative] <num>
- SWEep:MANual[:RELative]?

Sets and queries a percent of sweep to go to and lock. This command
has no effect unless: the sweep mode is set to manual and the sweep
generation is set to analog. *RST value is 0.50.

- SWEep:MARKer:STATe ON|OFF|1|0
- SWEep:MARKer:STATe?

Sets and queries the state of marker sweep. When ON, the frequency
sweep limits are taken to be the positions of marker 1 and marker 2.
*RST value is 0.

- SWEep:MARKer:XFER

This transfers the values of marker 1 and marker 2 frequencies into
start and stop frequency.

- SWEep:MODE AUTO|MANual
- SWEep:MODE?

Selects and queries the manual sweep mode switch.

AUTO   The sweep is under the control of the INIT and
            SWEEP subsystems.

MANual   FREQ:MANual, SWEep:MANual[:RELative], and
            SWEep:MANual:POINt control the output.

*RST value is AUTO.

- SWEep:POINts <num>|MAXimum|MINimum
- SWEep:POINts? [MAXimum|MINimum]

Sets and queries the number of points in a step sweep. When points
is changed, SWEep:STEP is modified by the equation
STEP = SPAN/POINTS.
Span is normally an independent variable but is changed to STEP
$\times$ POINTS if both of these parameters are changed in the same
message. *RST value is 11.

● `SWEep:STEP <num>[freq suffix]|MAXimum|MINimum`
● `SWEep:STEP? [MAXimum|MINimum]`
Sets and queries the size of each frequency step. `:STEP` is governed by the equation: STEP = SPAN/POINTS.

If you change step size then the number of points will be changed to span/step and a *Parameter Bumped* execution error is reported. If span or points are changed, then STEP= SPAN/POINTS. The step sweep command creates a coupling with sweeptime also. If the number of points is changed through this coupling and `DWELl:AUTO` is `ON` and `TIME:AUTO` is `ON`, then dwell is changed to SWEEPTIME/POINTS. Span is normally an independent variable but is changed to STEP × POINTS if both of these parameters are changed in the same message. *RST value is StopMax-StartMin/10.

● `SWEep:TIME <num>[time suffix]|MAXimum|MINimum`
● `SWEep:TIME? [MAXimum|MINimum]`
Sets and queries the current sweep time. The dwell time can be coupled to sweep time if `SWE:DWEL:AUTO` is `ON`. The dwell time is then governed by the equation DWELl = SWEEPTIME/POINTS. Changing either sweep time or the number of points causes DWELl to be recalculated but does not cause an error. If you attempt to change the dwell time then `:AUTO` is set to `OFF`. If `DWELl:AUTO` is `OFF` then sweep time is independent of the dwell time and the number of points. *RST value is `MIN`.

● `SWEep:TIME:AUTO ON|OFF|1|0`
● `SWEep:TIME:AUTO?`
Sets and queries the automatic sweep time switch.

ON   The value of the sweep time is automatically to minimum.
OFF   Attempting to set a sweep time faster than allowed in the AUTO mode causes this switch to change to `AUTO ON` even if it was previously in the `AUTO OFF` mode.

*RST state is `ON`.

● `SWEep:TIME:LLIMit <num>[time suffix]|MAXimum|MINimum`
● `SWEep:TIME:LLIMit? [MAXimum|MINimum]`
Sets and queries the lower sweep time limit. This value specifies the fastest sweep time that you wants the instrument to allow either on input or when calculated internally when in `AUTO ON` mode. This value must be greater than 10 ms. *RST value is 10 ms.

● `SWEep:TRIGger:SOURce IMMediate|BUS|EXTernal`
● `SWEep:TRIGger:SOURce?`
Sets and queries the stepped sweep point-to-point trigger source. This only applies when `SWEep:GEN` is set to `STEPped`.

● `SYSTem:ALTernate <num>|MAXimum|MINimum`
● `SYSTem:ALTernate? [MAXimum|MINimum]`
Sets and queries the save/recall register number to alternate the foreground state of the instrument. The *RST value is 1.

● `SYSTem:ALTernate:STATe ON|OFF|1|0`
● `SYSTem:ALTernate:STATe?`
Sets and queries the state of the Alternate State function.
*RST setting is `OFF`.

● `SYSTem:COMMunicate:GPIB:ADDRess <n>`
Changes the GPIB's (General Purpose Interface Bus) address.
The *RST value is 19.

● `SYSTem:DUMP:PRINter?`
Causes a dump of the display contents to be made to the GPIB.

● `SYSTem:ERRor?`
Returns the next message in the error queue. The format of the response is : <error number>,<error string>
where the error number is as shown in the "Error Messages" section and error string is :
"<Generic HP-SL string>;<More specific information>"

An example response to `SYST:ERR?` is
`−23,"NUMERIC OVERFLOW;YOU PUT IN A NUMBER TOO BIG"`

● `SYSTem:LANGuage SCPI|CIIL|COMPatible`
Causes the instrument to perform a language switch to another language system.

● `SYSTem:MMHead:SELect:AUTO ON|OFF|0|1`
● `SYSTem:MMHead:SELect:AUTO?`
Sets and queries automatic selection of the millimeter source module interface connector. If the instrument finds a source module connected at both the front and the rear connectors, the source module at the front connector is selected. Programming a specific state via SYSTem:MMHead:SELect sets SYSTem:MMHead:SELect:AUTO to OFF. *RST value is 1.

● `SYSTem:MMHead:SELect FRONt|REAR|NONE`
● `SYSTem:MMHead:SELect?`
Sets and queries the active millimeter source module interface. Programming a specific state (FRONt|REAR|NONE) sets SYSTem:MMHead:SELect:AUTO to OFF. Programming a specific state will cause the instrument to examine the selected interface to determine the type of source module connected. The instrument

frequency limits and multiplier will be altered accordingly. However, the leveling point is *not* changed (see POWer:ALC:SOURce).

● `SYSTem:PRESet[:EXECute]`
Sets the instrument to its "local operation" state. This is the same as pressing the front panel "green" key. There is no corresponding query.

● `SYSTem:PRESet:SAVE`
Saves the present state so it can be used whenever the command `SYSTem:PRESet[:EXECute]` is executed or the front panel "green" key is pressed.

● `SYSTem:PRESet:TYPE FACTory|USER`
● `SYSTem:PRESet:TYPE?`
Sets and queries the type of preset to execute when the `SYSTem:PRESet[:EXECute]` command is given. Factory preset defaults all values to factory specified values. User defined preset defaults all values to a specified state of the instrument that you have saved with `SYSTem:PRESet:SAVE`.

● `SYSTem:SECurity:COUNt <num>|MINimum|MAXimum`
● `SYSTem:SECurity:COUNt? [MINimum|MAXimum]`
Sets and queries the number of times to clear memory when the value of SYSTem:SECurity[:STATe] changes from ON to OFF.
*RST value is 1.

● `SYSTem:SECurity[:STATe] ON|OFF|1|0`
● `SYSTem:SECurity[:STATe]?`
Controls the security mode of the instrument. When in secure mode, any display annunciators that have been disabled cannot be re-enabled without destroying certain stored information. This value is not affected by *RST. When you change the value from ON to OFF, everything except calibration data is initialized or destroyed. In particular, data in instrument state and all save/recall registers are destroyed.

● `SYSTem:VERSion?`
This query returns a formatted numeric value corresponding to the SCPI version number to which the instrument complies. The response has the form YYYY.V where the Ys represent the year version (i.e. 1990) and the V represents an approved revision number for that year. This is a query only and therefore does not have an associated *RST state.

● `TRIGger[:IMMediate]`
Causes the trigger event to occur regardless of other settings in the

subsystem. This event does not affect any other settings in this subsystem.

This command has no effect unless the instrument is in the *wait for trig* state. If the swept CW generator is in the *wait for trig* state, it performs its trigger action. This is an event and has no *RST condition.

- TRIGger:ODELay <num>[time suffix]|MAXimum|MINimum
- TRIGger:ODELay? [MAXimum|MINimum]

Sets and queries the trigger output delay, the time between when the source is settled, (when Bit 1 of the Standard Operation Status Register makes a negative transition), and the trigger out signal is sent.

- TRIGger:SOURce IMMediate|BUS|EXTernal
- TRIGger:SOURce?

Sets and queries the source of the trigger event.

- TSWeep

This is a convenience command that does the equivalent of ABORt;INITiate[:IMMediate].

- UNIT:POWer [lvl suffix]
- UNIT:POWer?

Sets and queries the default power subsystem units.
*RST value is DBM.

SCPI STATUS
REGISTER
STRUCTURE

STANDARD EVENT STATUS GROUP

DESCRIPTION	POWER ON	USER REQUEST (KEY PRESET)	COMMAND ERROR	EXECU-TION ERROR	DEVICE DEPEN-DENT ERROR	QUERY ERROR	REQUEST CONTROL	OPERA-TION COMPLETE
BIT #	7	6	5	4	3	2	1	0

EVENT REGISTER
*ESR?

DECIMAL VALUE	128	64	32	16	8	4	2	1
BIT #	7	6	5	4	3	2	1	0

ENABLE REGISTER
*ESE <num>
*ESE?

DESCRIPTION	STANDARD OPERATION STATUS REGISTER SUMMARY BIT	REQUEST SERVICE (RQS)	STANDARD EVENT STATUS REGISTER SUMMARY BIT	MESSAGE AVAILABLE (MAV)	DATA QUEST-TIONABLE STATUS REGISTER SUMMARY BIT	UNUSED	UNUSED	RESERVED
BIT #	7	6	5	4	3	2	1	0

STATUS BYTE REGISTER
*STB?

DECIMAL VALUE	128	64	32	16	8	4	2	1
BIT #	7	6	5	4	3	2	1	0

SERVICE REQUEST ENABLE REGISTER
*SRE <num>
*SRE?

STANDARD OPERATION STATUS GROUP

DESCRIPTION	RESERVED FOR TMSL DEFINITION			UNUSED	UNUSED	SELF TEST IN PROGRESS	DISPLAY CHANGE	SELF TEST DATA READY	UNUSED ALWAYS (0)	UNUSED ALWAYS (0)	UNUSED ALWAYS (0)	UNUSED ALWAYS (0)	SWEEPING	UNUSED ALWAYS (0)	SETTLING	CALIBRA-TING	
BIT #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	CONDITION REGISTER STAT:OPER:COND?
																	NEGATIVE TRANSITION FILTER STAT:OPER:NTR \<num> STAT:OPER:NTR?
																	POSITIVE TRANSITION FILTER STAT:OPER:PTR \<num> STATus:OPERation:Ptransition?
DECIMAL VALUE	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1	EVENT REGISTER STATus:OPERation?
BIT #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
DECIMAL VALUE	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1	ENABLE REGISTER STAT:OPER:ENAB \<num> STATus:OPERation:Enable
BIT #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Ⓐ

DATA QUESTIONABLE STATUS GROUP

DESCRIPTION	RESERVED FOR TMSL DEFINITIONS		UNUSED	UNUSED	UNUSED	HARDWARE ERROR (FAULT)	SELF TEST FAILED	* CALIBRA-TION ERROR	MODULA-TION ERROR (OVERMOD)	UNUSED ALWAYS (0)	FRE-QUENCY ERROR (UNLOCKED)	TEMP ERROR (OVEN COLD)	* POWER ERROR UN-LEVELED	UNUSED ALWAYS (0)	UNUSED ALWAYS (0)	UNUSED ALWAYS (0)	
BIT #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	CONDITION REGISTER STAT:QUES:COND?
																	NEGATIVE TRANSITION FILTER STAT:QUES:NTR \<num> STAT:QUES:NTR?
																	POSITIVE TRANSITION FILTER STAT:QUES:PTR \<num> STAT:QUES:PTR?
DECIMAL VALUE	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1	ENABLE REGISTER STAT:QUES:ENAB \<num> STAT:QUES:ENAB?
BIT #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
DECIMAL VALUE	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1	EVENT REGISTER STAT:QUES [:EVENT] ?
BIT #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Ⓑ

NOTE:
STAT:PRES
THIS COMMAND PRESETS THE FOLLOWING
ENABLE AND TRANSITION REGISTERS:
OPER, AND QUES.

Security Menu

Function Group   SYSTEM

Menu Map   8

Description   This softkey accesses the security function softkeys.

Blank Display   Turns off the swept CW generator's data display, active entry, and message line areas.

Clear Memory   Writes alternating ones and zeros over all swept CW generator state functions and save/recall registers a selectable number of times, then returns the swept CW generator to the factory-preset state of operation.

Save Lock   Disables the save function.

Zero Freq   Displays zeros for all accessible frequency information.

The features listed above together with the softkeys Freq Offset and Freq Mult provide the swept CW generator with security controls for a variety of situations. The local lockout (LLO) programming command adds security when the swept CW generator is used in an ATE environment. A security calibration constant that can be accessed through the service adjustment menu (requires a password for access) is available also. Refer to the *Agilent Technologies 8360 B-Series Swept Signal Generator/8360 L-Series Swept CW Generator Service Guide* for information on calibration constants.

See Also   Softkeys listed above.
"Using the Security Features" in Chapter 1

Selftest (Full)

Function Group   SERVICE

Menu Map   6

Description   This softkey activates the self-test function of the swept CW generator.

Programming Codes   **SCPI:** *TST?
Analyzer: NONE

See Also   Fault Menu , SCPI COMMAND SUMMARY
Chapter 4, "OPERATOR'S CHECK and ROUTINE MAINTENANCE"

Set Atten

Function Group   POWER

Menu Map   5

Description   This softkey lets you set the attenuator separately from the rest of the ALC system. When an entry is made using this key, the attenuator is automatically uncoupled from the ALC system, so that the (POWER LEVEL) key controls the ALC system apart from the attenuator.

Programming Codes   **SCPI:** POWer:ATTenuation <num>[DB] or
MAXimum|MINimum|UP|DOWN
Analyzer: SHLS <num>[DB|DM]

See Also   (ALC), (POWER LEVEL), Uncoupl Atten
"Working with Mixers/Reverse Power Effects" in Chapter 1

$\boxed{\text{SINGLE}}$

Function Group	SWEEP
Menu Map	7
Description	This hardkey selects single sweep mode, aborts any sweep in progress and initiates a single sweep at a rate determined by the sweep time function.
	If you press $\boxed{\text{SINGLE}}$ in the middle of a continuous sweep, the sweep is aborted and the swept CW generator retraces to the starting point but does not start a sweep. Press $\boxed{\text{SINGLE}}$ a second time to start the sweep. The amber LED above the hardkey is lit when the function is on.
Programming Codes	**SCPI:**
	INITiate:CONTinuous OFF|0 ABORt INITiate[:IMMediate]
	Analyzer: S2
See Also	$\boxed{\text{CONT}}$ "Continuous, Single, and Manual Sweep Operation" in Chapter 1 "Programming Typical Measurements" in Chapter 1

Software Rev

Function Group	SYSTEM
Menu Map	8
Description	This softkey displays the swept CW generator's programming language, GPIB address, and firmware date code.
Programming Codes	**SCPI:** *IDN? **Analyzer:** OI
See Also	GPIB Menu , SCPI COMMAND SUMMARY

SPAN

Function Group   FREQUENCY

Menu Map   2

Description   This hardkey lets you set a value for the frequency span in the center frequency/frequency span mode of swept frequency operation. Press SPAN, and use the entry area to enter the desired value. The swept CW generator sweeps from one half the span below to one half above the center frequency.

Certain center frequency and frequency span combinations cause the swept CW generator to limit the value entered. In general, any combination that causes the swept CW generator to exceed its minimum or maximum specified frequency is limited.

Programming Codes   **SCPI:**

FREQuency:SPAN <num>[freq suffix] or
MAXimum|MINimum|UP|DOWN
FREQuency:MODE SWEep

Analyzer: DF <num> [Hz|Kz|Mz|Gz]

See Also   CENTER, START, STOP
"Center Frequency/Span Operation" in Chapter 1

START

Function Group   FREQUENCY

Menu Map   2

Description   This hardkey activates swept frequency mode and makes the start frequency parameter the active function. Press START and use the entry area to enter the desired value. The start/stop frequency must be separated by at least 2 Hz in order to remain in the frequency sweep mode. If start=stop frequency then the zero span mode is entered.

START

Programming Codes   SCPI:

FREQuency:STARt <num>[freq suffix] or
MAXimum|MINimum|UP|DOWN
FREQuency:MODE SWEep

Analyzer: FA <num> [Hz|Kz|Mz|Gz]

See Also   CENTER , CW , FREQUENCY MENU , SPAN , STOP
"CW Operation and Start/Stop Frequency Sweep" in Chapter 1
"Programming Typical Measurements" in Chapter 1

Start=M1 Stop=M2

Function Group   MARKER

Menu Map   3

Description   This softkey changes the swept CW generator start frequency to the
frequency value of marker 1, and the stop frequency to the frequency
value of marker 2. The swept CW generator has been reset to these
start/stop values, unlike the softkey M1--M2 Sweep that changes the
start/stop values only while active.

Programming Codes   SCPI: SWEep[:FREQuency]:MARKer:XFER
Analyzer: SHMP

See Also   M1--M2 Sweep
"Marker Operation" in Chapter 1

Start Sweep Trigger Auto

Function Group	SWEEP
Menu Map	7
Description	When this softkey is selected, the swept CW generator automatically triggers a sweep. This is the fastest way to accomplish the sweep-retrace cycle. An asterisk next to the key label indicates that this feature is active.
Programming Codes	**SCPI:** TRIGger:SOURce IMMediate **Analyzer:** T1
See Also	(CONT), (SINGLE), Sweep Menu

Start Sweep Trigger Bus

Function Group	SWEEP
Menu Map	7
Description	When this softkey is selected, the swept CW generator waits for an GPIB trigger to trigger a sweep. An asterisk next to the key label indicates that this feature is active.
Programming Codes	**SCPI:** TRIGger:SOURce BUS **Analyzer:** TS
See Also	(CONT), (SINGLE), Sweep Menu

Start Sweep
Trigger Ext

Function Group SWEEP

Menu Map 7

Description When this softkey is selected, the swept CW generator waits for an external hardware trigger to trigger a sweep. Connect the trigger pulse to TRIGGER INPUT. It is activated on a TTL rising edge. An asterisk next to the key label indicates that this feature is active.

Programming Codes **SCPI:** TRIGger:SOURce EXT
Analyzer: T3

See Also (CONT), (SINGLE), Sweep Menu

Step Control
Master

Function Group FREQUENCY

Menu Map 2

Description This softkey lets you designate the swept CW generator as the master control in a dual swept CW generator measurement system. A dual swept CW generator system (two-tone measurement system) facilitates accurate device characterizations by providing one timebase reference for both sources. This technique reduces instabilities from temperature or line voltage fluctuations, or drift.

The swept CW generators can be operated in either ramp sweep or step sweep modes for both fixed offset and swept offset measurements. Figure S-1 shows the connections required for a two-tone system.
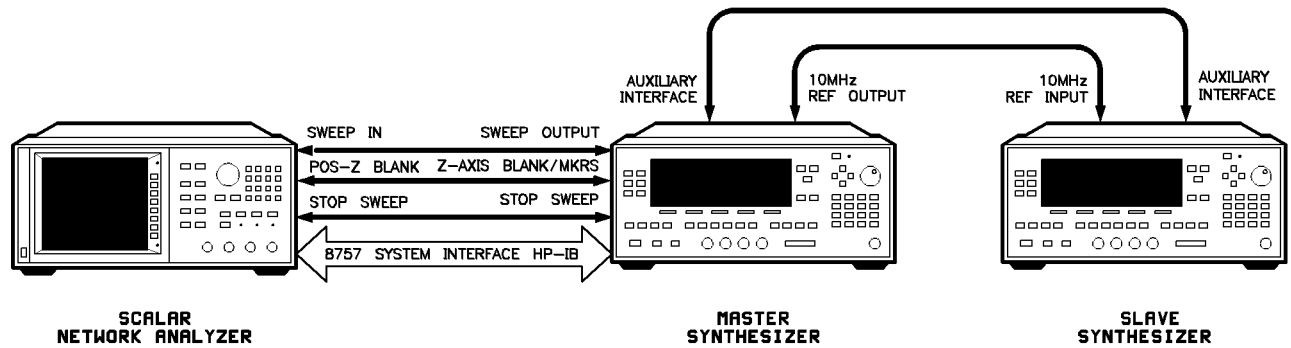
Figure S-1. Connections Required for a Two-Tone Scalar Network Analyzer Measurement System

1. Designate one swept CW generator as the master, the other as the slave.

2. Make the connections.

3. To avoid synchronization problems, always set up the slave (frequency and power) before setting up the master.

4. Set up the master (frequency, power, and sweep time).

5. Set the sweep time on the slave.

6. Configure the swept CW generators for step sweep, or ramp sweep.

7. Select the appropriate triggering scheme.

8. Activate the slave mode on the slave swept CW generator.

9. Activate the master mode on the master swept CW generator.

By connecting the master's 10 MHz reference standard to the slave's 10 MHz reference input, the master swept CW generator's timebase supplies the frequency reference for both swept CW generators.

In step sweep measurements, if the master swept CW generator is not connected to an external controller, it must automatically trigger the steps. Set Step Swp Pt Trig Auto on the master. When a the scalar network analyzer is the step sweep controller, set Step Swp Pt Trig Bus on the master swept CW generator so that the analyzer can trigger the steps.

Programming Codes   SCPI:

   SWEep:CONTrol:STATe ON|OFF|1|0
   SWEep:CONTrol:TYPE MASTer

Analyzer: NONE

See Also   Step Control Slave , Step Swp Menu

Step Control Slave

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you designate the swept CW generator as the slave in a dual swept CW generator measurement system. A dual swept CW generator system (two-tone measurement system) facilitates accurate device characterizations by providing one timebase reference for both sources.

Figure S-1 shows the connections required for a two-tone system. On the message line, the status message **EXT REF** appears indicating the swept CW generator has an external timebase reference. The start and stop frequencies of the slave can be offset above or below those set on the master for fixed offset two-tone measurements.

To synchronize properly for swept offset measurements, the 0 to 10 volt sweep ramp must be actively sweeping on the slave. If a CW frequency is selected as the fixed LO frequency, the sweep ramp is deactivated and the proper synchronization does not occur. Select a center frequency with zero span to keep the slave's voltage sweep ramp active and ensure proper synchronization.

For synthesized step sweep measurements, set the number of sweep points on the slave the same as on the master swept CW generator. If the master swept CW generator is connected to a network analyzer, the analyzer automatically sets the master swept CW generator's step size to match the number of points displayed on the analyzer. Since the slave swept CW generator is not connected to the analyzer, set the slave to match the master swept CW generator. Allow the master to trigger the slave's steps; set **Step Swp Pt Trig Ext** on the slave swept CW generator.

For ramp sweep measurements, on the slave set the sweep time equivalent to the master swept CW generator. If the master is connected to a network analyzer, the slave's sweep time is slightly longer than the master's because the analyzer does not stop the sweep precisely on the last point and if sweep times are set to the same value, the system may lock up.. Use the following formula to determine the slave's sweep time for a system controlled by an analyzer.

$$\text{SweepTime}_{\text{Master}} \times 1.03 = \text{SweepTime}_{\text{Slave}}$$

Setting the slave's sweep time 1.03 times greater, the master's sweep time results in the slave sweep being 97% of the set value. When a reduced sweep is not acceptable, sweep times can be set to the same value. Lock ups can be cleared by reentering the slave's sweep time. For fixed-offset ramp sweep measurements, the same sweep time must

be set on both the master and the slave. Since the master's sweep time is typically determined by the measurement configuration, set the slave to match the master.

For more accurate ramp sweeps, select Swp Span Cal Always on both the master and slave swept CW generators. When this feature is active it calibrates the frequency at the end of every frequency band.

Programming Codes SCPI:

SWEep:CONTrol:STATe ON|OFF|1|0
SWEep:CONTrol:TYPE SLAVe

Analyzer: NONE

See Also Step Control Master , Step Swp Menu

Step Dwell

Function Group FREQUENCY

Menu Map 2

Description This softkey lets you set dwell times for points in the stepped frequency mode of sweep operation. The dwell time for points in step frequency sweep may range from 100 μs to 3.2s. The actual time between points is the sum of dwell and phase lock times.

Select Step Dwell , then use the entry area to enter the desired value.

Programming Codes **SCPI:** SWEep[:FREQuency]:DWELl <num>[time suffix] or MAXimum|MINimum
Analyzer: NONE

See Also Step Swp Menu , Sweep Mode Step

Step Points

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you define the number of step points in a stepped frequency sweep. The number of points in a stepped sweep can range from 2 to 801. `Step Size` and `Step Points` are dependent variables. If you know how many steps are desired in a given sweep, use the softkey `Step Points` to set the desired value The step size will be calculated automatically.

Programming Codes   **SCPI:** SWEep[:FREQuency]:POINts <num>|MAXimum|MINimum
Analyzer: NONE

See Also   `Step Size` , `Step Swp Menu` , `Sweep Mode Step`
"Using Step Sweep" in Chapter 1

Step Size

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you specify the step size in a stepped frequency sweep. The range of increment size is dependent on frequency span and the number of step points desired, as given by the formula: STEP SIZE = SPAN ÷ STEP POINTS. `Step Size` and `Step Points` are dependent variables, as shown by the formula. If a particular step size is desired, use the `Step Size` softkey to set the desired increment. The number of step points is then calculated automatically.

Programming Codes   **SCPI:** SWEep[:FREQuency]:STEP <num>[freq suffix] or
MAXimum|MINimum
Analyzer: NONE

See Also   `Step Points` , `Step Swp Menu` , `Sweep Mode Step`
"Using Step Sweep" in Chapter 1

Step Swp Menu

Function Group   FREQUENCY

Menu Map   2

Description   This softkey reveals the stepped *frequency* sweep entry menu.

Dwell Coupled	Couples the dwell time for stepped sweep points to ramp sweep, sweep time.
Step Control Master	Causes the swept CW generator to act as the master control in a dual swept CW generator measurement setup.
Step Control Slave	Causes the swept CW generator to act as the slave in a dual swept CW generator measurement setup.
Step Dwell	Sets the dwell time for points in stepped sweep.
Step Points	Sets the number of points in a stepped sweep.
Step Size	Sets the increment value for the points in a stepped sweep.
Step Swp Pt Trig Auto	Automatically steps the swept CW generator to the next point in a stepped sweep.
Step Swp Pt Trig Bus	Steps the swept CW generator to the next point in a stepped sweep when an GPIB trigger is received.
Step Swp Pt Trig Ext	Steps the swept CW generator to the next point in a stepped sweep when an external hardware trigger is received.

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   (START), (STOP), Sweep Mode Step , (SWEEP TIME)
"Using Step Sweep" in Chapter 1

Step Swp Pt
Trig Auto

Function Group FREQUENCY

Menu Map 2

Description When this softkey is selected, the swept CW generator automatically steps to the next point in the stepped frequency sweep until all points are swept. The time between points is equal to the sum of the dwell and phase lock times. An asterisk next to the key label indicates that this feature is active.

Programming Codes **SCPI:** SWEep:TRIGger:SOURce IMMediate
Analyzer: NONE

See Also Step Swp Menu , Sweep Mode Step
"Using Step Sweep" in Chapter 1

Step Swp Pt
Trig Bus

Function Group FREQUENCY

Menu Map 2

Description When this softkey is selected, the swept CW generator steps to the next point in a stepped frequency sweep when an GPIB trigger (*TRG, <GET>) is received (leading edge TTL). When the last frequency point is reached and continuous sweep is selected, the next trigger causes the step sweep to return to the start frequency. Connect the trigger signal to the TRIGGER INPUT BNC. An asterisk next to the key label indicates this feature is active.

Programming Codes **SCPI:** SWEep:TRIGger:SOURce BUS
Analyzer: TS

See Also Step Swp Menu , Sweep Mode Step

Step Swp Pt
Trig Ext

Function Group   FREQUENCY

Menu Map   2

Description   When this softkey is selected, the swept CW generator steps to the next point in the stepped frequency sweep when an external hardware trigger is received. When the last frequency point is reached and continuous sweep is selected, the next trigger causes the step sweep to return to the start frequency. Connect the trigger signal to the TRIGGER INPUT BNC. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** SWEep:TRIGger:SOURce EXT
Analyzer: TS

See Also   Step Swp Menu, Sweep Mode Step
"Using Step Sweep" in Chapter 1

(STOP)

Function Group   FREQUENCY

Menu Map   NONE

Description   This hardkey activates swept frequency mode and makes the stop frequency parameter the active function. The start/stop frequency must be separated by at least 2 Hz in order to remain in the frequency sweep mode. If start=stop frequency then the zero span mode is entered.

Programming Codes   **SCPI:**

FREQuency:STOP <num>[freq suffix] or
MAXimum|MINimum|UP|DOWN
FREQuency:MODE:SWEep

Analyzer: FB <num> [Hz|Kz|Mz|Gz]

STOP

SWEEP MENU

Function Group SWEEP

Menu Map 7

Description This hardkey accesses the sweep menu softkeys.

Manual Sweep	Activates manual sweep mode. Depending on what parameter is sweeping, frequency and/or power can be changed manually with the rotary knob or the arrow keys.
Start Sweep Trigger Auto	Automatically triggers a sweep when SINGLE or CONT is pressed.
Start Sweep Trigger Bus	Waits for an GPIB trigger to trigger a sweep when SINGLE or CONT is pressed.
Start Sweep Trigger Ext	Waits for an external hardware trigger to trigger a sweep when SINGLE or CONT is pressed.
Sweep Mode List	Activates the list frequency sweep mode.
Sweep Mode Ramp	Activates the analog frequency sweep mode.
Sweep Mode Step	Activates the stepped frequency sweep mode.
SwpTime Auto	Sets the sweep time to a minimum value for a given span.
TrigOut Delay	Sets the time delay after phase-lock and before a trigger pulse is sent from the ANALYZER INTERFACE BNC. A source settled SRQ is generated.

Programming Codes SCPI: NONE
Analyzer: NONE

See Also Softkeys listed above.
"Programming Typical Measurements" in Chapter 1

Sweep Mode List

Function Group SWEEP

Menu Map 7

Description This softkey activates the step frequency list mode. To use this type of sweep, a frequency list must have been entered, otherwise an error message appears. In this mode, the swept CW generator steps only those frequencies defined by the frequency list. An asterisk next to the key label indicates that this feature is active.

Programming Codes SCPI: FREQuency:MODE LIST
Analyzer: SN

See Also CONNECTORS, List Menu
"Creating and Using a Frequency List" in Chapter 1

Sweep Mode Ramp

Function Group   SWEEP

Menu Map   7

Description   This softkey activates the analog frequency sweep mode. Ramp sweep mode is the factory preset state. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:**

> FREQuency:MODE SWEep
> SWEep[:FREQuency]:GENeration ANALog

Analyzer: NONE

See Also   CONNECTORS, (CONT), Manual Sweep , (SINGLE),
"Programming Typical Measurements" in Chapter 1

Sweep Mode Step

Function Group   SWEEP

Menu Map   7

Description   This softkey activates the stepped frequency step mode. In this mode, the swept CW generator steps from the start frequency to the stop frequency, by the designated frequency step size. Manual, continuous, and single sweeps can be performed in this mode. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:**

> FREQuency:MODE SWEep
> SWEep[:FREQuency]:GENeration STEPped

Analyzer: NONE

See Also   (CONT), Manual Sweep , (SINGLE), Step Swp Menu
"Using Step Sweep" in Chapter 1

Swp Span Cal Always

Function Group   USER CAL

Menu Map   9

Description   This softkey causes a sweep span calibration each time the frequency span is changed. An asterisk next to the key label indicates this feature is active.

Programming Codes   **SCPI:** CALibration:SPAN:AUTO ON|OFF|1|0
Analyzer: NONE

See Also   Freq Cal Menu
"Using Frequency Calibration,"

Swp Span Cal Once

Function Group   USER CAL

Menu Map   9

Description   This softkey activates sweep span calibration immediately and performs it only once. An asterisk next to the key label indicates this feature is active.

Programming Codes   **SCPI:** CALibration:SPAN[:EXECute]
Analyzer: NONE

See Also   Freq Cal Menu
"Using Frequency Calibration,"

(SWEEP TIME)

Function Group   SWEEP

Menu Map   7

Description   This hardkey lets you set a sweep time for frequency sweeps or power sweeps. The sweep time range is 10 ms to 200s, but the fastest sweep time is constrained by the frequency span. The fastest possible sweep can be determined automatically:

1. Press SWEEP (MENU), this reveals the sweep menu keys.
2. Select `more 1/3`, to scroll to the next page of the sweep menu.
3. Select `SwpTime Auto`, to set the sweep time to automatic. The swept CW generator calculates the fastest possible calibrated sweep time for *any* sweep span.

Whenever you press (SWEEP TIME), the active entry area displays the current sweep time and whether the sweep time is coupled to the frequency span (far right hand side displays: `AUTO`). If the word AUTO is not displayed then the sweep time auto function is off.

Programming Codes   **SCPI:** SWEep[:FREQuency]:TIME <num>[time suffix] or MAXimum|MINimum
Analyzer: ST <num> [sc|ms]

See Also   `Power Sweep`
"Power Level and Sweep Time Operation" in Chapter 1
"Programming Typical Measurements" in Chapter 1

SwpTime Auto

Function Group   SWEEP

Menu Map   7

Description   This softkey lets you set the swept CW generator's sweep time to a minimum value for a chosen span and meet all specifications. The sweep time is limited by a 300 MHz/ms sweep rate. An asterisk next to the key label indicates this feature is active.

Programming Codes   SCPI: SWEep:TIME:AUTO ON|OFF|1|0
Analyzer: NONE

See Also   (SWEEP TIME)
"Power Level and Sweep Time Operation" in Chapter 1

SYSTEM (MENU)

Function Group   SYSTEM

Menu Map   8

Description   This hardkey reveals the system menu.

Alternate Regs	Causes the swept CW generator to alternate on successive sweeps between the present instrument state and a second instrument state stored in an internal register.
Dim Display	Dims the swept CW generator's display.
Disp Status	Displays the present status of the swept CW generator.
GPIB Menu	Reveals the GPIB control menu.
Preset Mode Factory	Sets the preset state, as defined by the manufacturer, to be recalled by the (PRESET) key.
Preset Mode User	Sets the preset state, as defined by the user, to be recalled by (PRESET).
Ref Osc Menu	Reveals the frequency standard options menu.
Save User Preset	Stores the present instrument state in a special preset storage register.
Security Menu	Reveals the menu that controls the security features of the swept CW generator.
Software Rev	Causes the swept CW generator to display the date code of its internal software.
UsrKey Clear	Activates the USER-DEFINED (MENU) and lets you delete a *single* key within that menu.

UsrMenu Clear   Activates the USER-DEFINED (MENU)
                    and clears *all* keys in that menu.

Programming Codes   SCPI: NONE
                        Analyzer: NONE

See Also   Softkeys listed above, CONNECTORS, USER-DEFINED (MENU)

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10 MHz Freq Std Auto

Function Group   SYSTEM

Menu Map   8

Description   This softkey sets the swept CW generator to choose its frequency standard automatically. If an external standard is connected to the 10 MHz REF INPUT BNC, then it is chosen as the reference. If no external standard is connected, the internal standard is chosen as the reference. If the internal standard has been disconnected also, the swept CW generator operates in a free run state. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** ROSCillator[:SOURce]:AUTO ON|OFF|1|0
Analyzer: NONE

See Also   Ref Osc Menu

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10 MHz Freq Std Extrnl

Function Group   SYSTEM

Menu Map   8

Description   This softkey tells the swept CW generator to accept an external 10 MHz signal as the frequency reference. The external signal must be applied to the 10 MHz REF INPUT BNC connector located on the rear panel. If no external signal is applied, UNLOCK and EXT REF appears on the message line of the display. An asterisk next to the key label indicates that this feature is active.

`10 MHz Freq Std Extrnl`

Programming Codes   **SCPI:** ROSCillator[:SOURce] EXTernal
Analyzer: NONE

See Also   `Ref Osc Menu`

`10 MHz Freq Std
 Intrnl`

Function Group   SYSTEM

Menu Map   8

Description   This softkey sets the swept CW generator to select the internal 10 MHz signal as the frequency reference. If the internal signal is disconnected or not working properly, `UNLOCK` appears on the message line of the display. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** ROSCillator[:SOURce] INTernal
Analyzer: NONE

See Also   `Ref Osc Menu`

`10 MHz Freq Std
 None`

Function Group   SYSTEM

Menu Map   8

Description   This softkey sets the reference oscillator to a free-run state, where no frequency reference is used. An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** ROSCillator[:SOURce] NONE
Analyzer: NONE

See Also   `Ref Osc Menu`

Tracking Menu

Function Group   POWER, USER CAL

Menu Map   5, 9

Description   In the menu structure there are two occurrences of this softkey. One occurs in the POWER (MENU), the other occurs in the USER CAL (MENU). Both softkeys operate the same way. These softkeys access the tracking menu.

Auto Track   Realigns the swept CW generator's output filter and oscillator to maximize output power for the swept frequency mode.

Peak RF Always   Periodically realigns the swept CW generator's output filter and oscillator to maximize output power for the CW frequency mode.

Peak RF Once   Realigns the swept CW generator's output filter and oscillator to maximize output power for the CW frequency mode.

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   Softkeys listed above.
"Using the Tracking Feature" in Chapter 1

TrigOut Delay

Function Group   SWEEP

Menu Map   7

Description   This softkey lets you specify the amount of time after phase-lock before a trigger pulse is sent out of the TRIGGER OUTPUT BNC. The delay can be set from 0 to 3.2 seconds. An asterisk next to the key label indicates this feature is active.

Programming Codes   **SCPI:** TRIGger:ODELay <num>[time suffix]

Analyzer: NONE

See Also   Start Sweep Trigger Auto , Start Sweep Trigger Bus ,
Start Sweep Trigger Ext

Uncoupl Atten

Function Group	POWER
Menu Map	5
Description	This softkey uncouples the attenuator (if there is one) from the ALC system. It allows independent control of attenuator settings. An asterisk next to the key label indicates that this feature is active.
	To set the attenuator after it is uncoupled, select Set Atten . To view the current ALC and attenuator settings, press (POWER LEVEL).
Programming Codes	**SCPI:** POWer:ATTentuation:AUTO ON|OFF|1|0 **Analyzer:** SHPS <num> [DB|DM] to set the ALC, SHSL <num> [DB|DM] to attenuator. PL causes the attenuator couple to the ALC.
See Also	(ALC), (POWER LEVEL), Set Atten "Working with Mixers/Reverse Power Effects" in Chapter 1

Unlock Info

Function Group	SERVICE
Menu Map	6
Description	This softkey causes the swept CW generator to display lock/unlocked status of all the phase-lock-loops. An asterisk next to the key label indicates this feature is active.
Programming Codes	**SCPI:** DIAGnostics:OUTput:UNLocks? **Analyzer:** SHT3 or SHM4 diagnostics test results.
See Also	STATUS MESSAGES Chapter 4, "OPERATOR'S CHECK and ROUTINE MAINTENANCE"

Up/Down Power

Function Group   POWER

Menu Map   5

Description   This softkey activates the power step size function. It can be set from 0.01 to 20 dB. In this mode, power is stepped by the up/down arrow keys. An asterisk next to the key label indicates this feature is active.

Programming Codes   SCPI:

  POWer:STEP[:INCrement] <num>[DB] or
  MAXimum|MINimum
  POWer:STEP:AUTO ON|OFF|1|0

  Analyzer: SP or SHPL and UP or DOWN

See Also   Up/Dn Size CW , Up/Dn Size Swept
"Programming Typical Measurements" in Chapter 1

Up/Dn Size CW

Function Group   FREQUENCY

Menu Map   2

Description   This softkey lets you set the frequency step size for the CW frequency mode. The step size may be set from 1 Hz to 10 GHz. The factory preset size is 100 MHz. CW frequency is incremented/decremented by pressing the up/down arrow keys.

If an underline cursor appears under a digit in the entry display, then the value will be modified by the up/down arrow keys or the rotary knob. The increment/decrement size in this case is the underlined digit by the power of 10.

If the up/down function is on (asterisk next to key label) and the cursor is not under one of the active entry area digits, then frequency value is changed by the up/down size using either the up/down arrow keys or the rotary knob.

Programming Codes   **SCPI:** FREQuency:STEP[:INCR] <num>[freq suffix] or
MAXimum|MINimum
Analyzer: SF or SHCF <num> [Hz|Kz|Mz|Gz]

See Also   Manual Sweep , Sweep Mode Step , Up/Dn Size Swept

Up/Dn Size Swept

Function Group   FREQUENCY

Menu Map   2

Description   This softkey sets the frequency step size in the swept frequency step
mode. The step size may be set from 1 Hz to 10 GHz. The factory
preset step size is 100 MHz. Step size values are entered using the
entry area.

If an underline cursor appears under a digit in the entry display, then
the value will be modified by the up/down arrow keys or the rotary
knob. The increment/decrement size in this case is the underlined
digit by the power of 10.

If the up/down function is on (asterisk next to key label) and the
cursor is not under one of the active entry area digits, then frequency
value is changed by the up/down size using either the up/down arrow
keys or the rotary knob.

Programming Codes   **SCPI:** FREQuency:STEP[:INCR] <num>[freq suffix] or
MAXimum|MINimum
Analyzer: SF or SHCF <num> [Hz|Kz|Mz|Gz]

See Also   Up/Dn Size CW

Function Group	USER CAL
Menu Map	9

Description This hardkey accesses the user calibration softkeys.

FullUsr Cal Performs a complete alignment as determined by the instrument settings.

Tracking Menu Accesses the softkeys of the tracking menu.

Freq Cal Menu Accesses the Frequency span calibration menu.

Ext Det Cal Uses an external power meter to calibrate an external detector's output voltage relative to power.

Programming Codes NONE

See Also Softkeys listed above.
"Optimizing Swept CW Generator Performance" in Chapter 1

USER DEFINED
MENU

Function Group	USER DEFINED
Menu Map	NONE

Description This hardkey reveals the customized menu created by selecting softkeys and assigning them to this menu. The user defined menu is empty until you assign keys to it. Three sections (12 key assignment locations) of menu are available for key assignment.

Any softkey can be assigned to any of the 12 positions. A softkey assigned to the user defined menu performs as if it is in its home menu. Pressing the PRESET key does not erase the contents of this menu.

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   (ASSIGN), (PRIOR), UsrKey Clear , UsrMenu Clear

UsrKey Clear

Function Group   SYSTEM

Menu Map   8

Description   This softkey lets you recall the user defined menu and remove a *single* softkey that appears in that menu.

1. Select UsrKey Clear . The user defined menu appears in the softkey label area. The active entry area displays:

       ->Press USER Soft Key to Clear
2. Select the softkey you wish to remove from the menu. The active entry area turns off and the softkey is removed from the user defined menu. The user defined menu remains in the softkey label area.

Programming Codes   SCPI: NONE
Analyzer: NONE

See Also   (ASSIGN), USER DEFINED (MENU), UsrMenu Clear

UsrMenu Clear

Function Group   SYSTEM

Menu Map   8

`UsrMenu Clear`

Description   This softkey recalls the user defined menu and removes *all* softkeys assigned to that menu. The empty user defined menu remains in the softkey label area.

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   (ASSIGN), USER DEFINED (MENU), `UsrKey Clear`

Z

Zero Freq

Function Group   SYSTEM

Menu Map   8

Description   This softkey lets you enable a security feature that displays zeroes for all accessible frequency information. Once this security feature is activated, it can be turned off by a front panel (PRESET). An asterisk next to the key label indicates that this feature is active.

Programming Codes   **SCPI:** SYSTem:SECurity[:STATe] ON
Analyzer: NONE

See Also   Security Menu

Zoom

Function Group   FREQUENCY

Menu Map   2

Description   This softkey activates the CF/Span sweep mode (zoom). In this mode, span is controlled by the up/down arrow keys. Center frequency is controlled by the rotary knob or the numeric entry keys. The left and right arrows control the resolution with which the center frequency can be changed. This is a front-panel-only feature and is inaccessible over GPIB.

Programming Codes   **SCPI:** NONE
Analyzer: NONE

See Also   (CENTER), (SPAN)

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