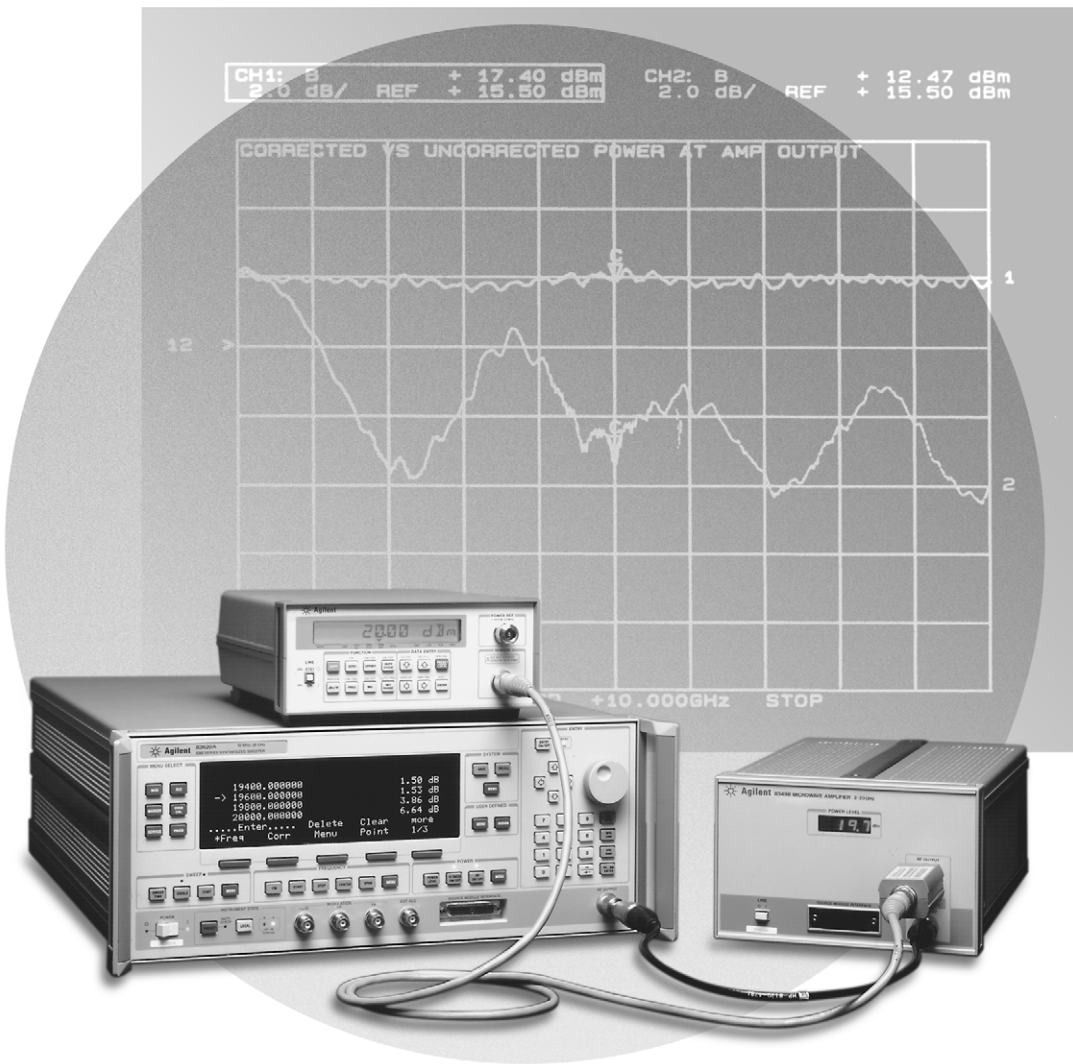


Obtaining Flat Test Port Power with the Agilent 8360's User Flatness Correction Feature

Product Note 8360-2



Agilent Technologies

Innovating the HP Way

Introduction

The 8360 series synthesized sweepers provide extremely flat power at your test port, for testing power sensitive devices such as amplifiers, mixers, diodes or detectors. The user flatness correction feature of the 8360 synthesized sweepers 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 1, a

table of power level corrections is created for the frequencies where power level variations or loss occur (see figure 2). These frequencies may be sequential linear steps or arbitrarily spaced. To allow the correction of multiple test setups or frequency ranges, the user may save as many as eight different measurement setups (including correction tables) in the internal storage registers of the 8360.

This note illustrates how to utilize the user flatness correction feature by providing step-by-step instructions for several common measurement examples.

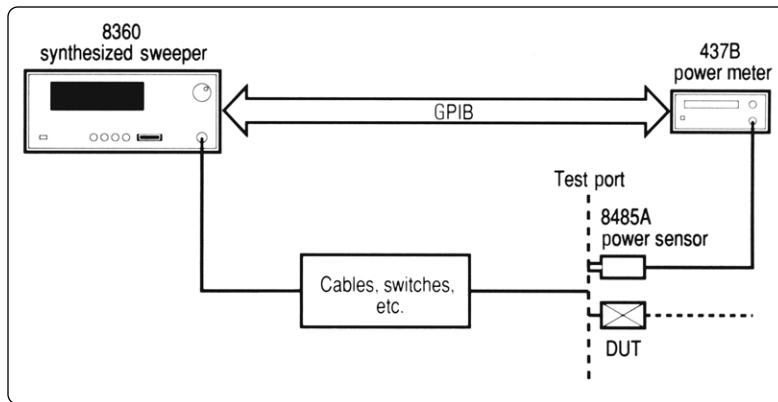


Figure 1. Basic system configuration using an 437B power meter for automatic user flatness correction data entry

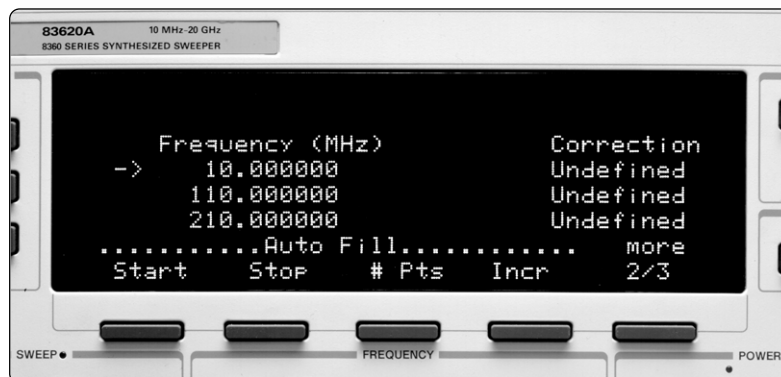


Figure 2. 8360 displaying the user flatness correction table

Theory of operation

A major contribution of the 8360 series synthesized sweepers is their unparalleled leveled output power accuracy and flatness. This is achieved by using a digital (vs. 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 that 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 (see figure 3). The factory-generated internal calibration data of an 8360 is digitally segmented into 1601 data points across the start/stop frequency span set by the user. Subsequently, these points are converted into 1601 reference voltages for the ALC loop.

The digital ALC control scheme not only delivers excellent power accuracy and flatness at the output port of the instrument, but also provides the means to execute the user flatness correction feature of the 8360. Generally, a power meter is used to create a table of correction data that will produce flat power at the test port. The user 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 source. This is summed with the internal calibration data of the 8360 (see figure 4). When user flatness correction is enabled, the sum of the two arrays will produce the 1601 reference voltages for the ALC loop.

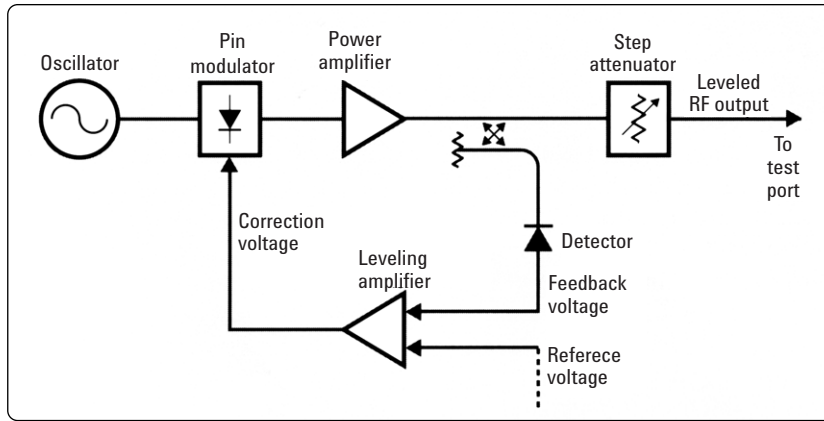


Figure 3. Simplified automatic leveling circuitry

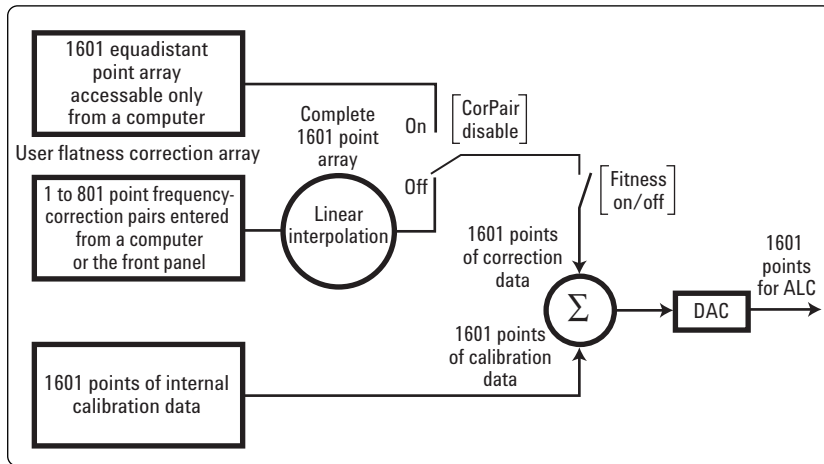


Figure 4. ALC calibration correction - summing user flatness correction array with internal calibration array

If the correction frequency span is only a subset of the start/stop frequency span set on the source, no corrections will be 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.

When utilizing user flatness correction, do not exceed the 8360 ALC operating range. Exceeding the ALC range will cause the output power to become unlevelled and eliminate the benefits of user flatness correction. The ALC range can be determined by subtracting the minimum output power (-20 dBm) from the maximum specified power¹. An Agilent 83620B has an ALC range of ≥ 30 dB ($\geq +10$ to -20 dBm).

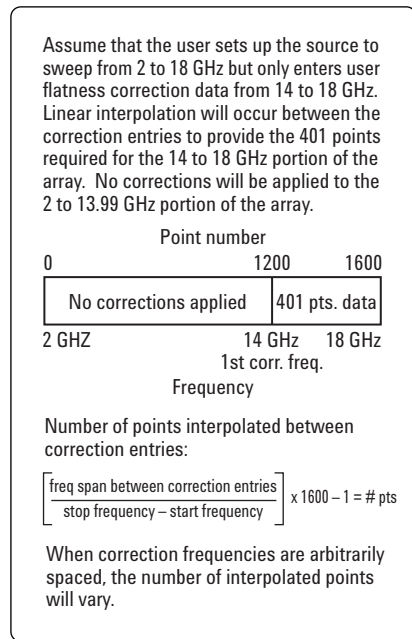


Figure 5. Array configuration example

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 ($P_{0 \text{ max}} - P_{\text{path loss}}$). For example, if an 83620B 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 will provide the maximum available power to the device under test (DUT).

The following glossary reviews the terms that will be used throughout this note:

array - the 1601 user flatness correction points that will be summed with the internal calibration data of the Agilent 8360. The array covers the entire start/stop frequency range the user sets on the instrument.

correction table - the user-supplied entries in the array. Each entry in the table has a correction component and an associated frequency component. user flatness correction

correction frequency - the frequency component of an entry where a correction has been or will be measured and entered in the table.

correction frequency span - the frequency span between the first and last correction frequency.

correction data - the power level correction components of entries in the table.

cal factor - the calibration factors displayed on the power sensor. By entering the appropriate cal factor for each measurement frequency on a power meter, one can calibrate the power meter to a particular power sensor across the chosen frequency range.

¹When the optional step attenuator is ordered on an 8360 with firmware released prior to November 1990, the attenuator will need to be uncoupled if the full ALC range is required. This can be accomplished by selecting POWER [MENU] [Uncoupl Atten].

Configuration examples

The following examples demonstrate the user flatness correction feature:

1. Using an Agilent 437B power meter to automatically enter correction data for a swept 2 to 18 GHz measurement.
2. Manually entering correction data for a stepped (list mode) measurement.
3. Automatically entering correction data for an arbitrary list of correction frequencies when making swept mm-wave measurements.
4. Making scalar analysis measurements with automatically-entered correction data that compensates for power variations at the output of a directional bridge.
5. Setting up user flatness corrections in computer controlled measurement systems.

Each example illustrates how to set up user flatness correction for a different measurement requirement. You may 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 will add but not delete correction frequencies. Refer to the *8360 User's Guide* for a more detailed description of the operating modes, hardkeys, softkeys, and other features.

To simplify the execution of these examples, the keys to be selected have been bracketed to differentiate them from other text. The 8360 front panel hardkeys are capitalized, while the softkeys they access are in italics.

For example: POWER [MENU] - POWER refers to the source's functional grouping, [MENU] refers to the hardkey the user must select in that function. *Auto Fill [Start] - [Start]* refers to the softkey the user selects to enter the first correction frequency for the auto fill feature.

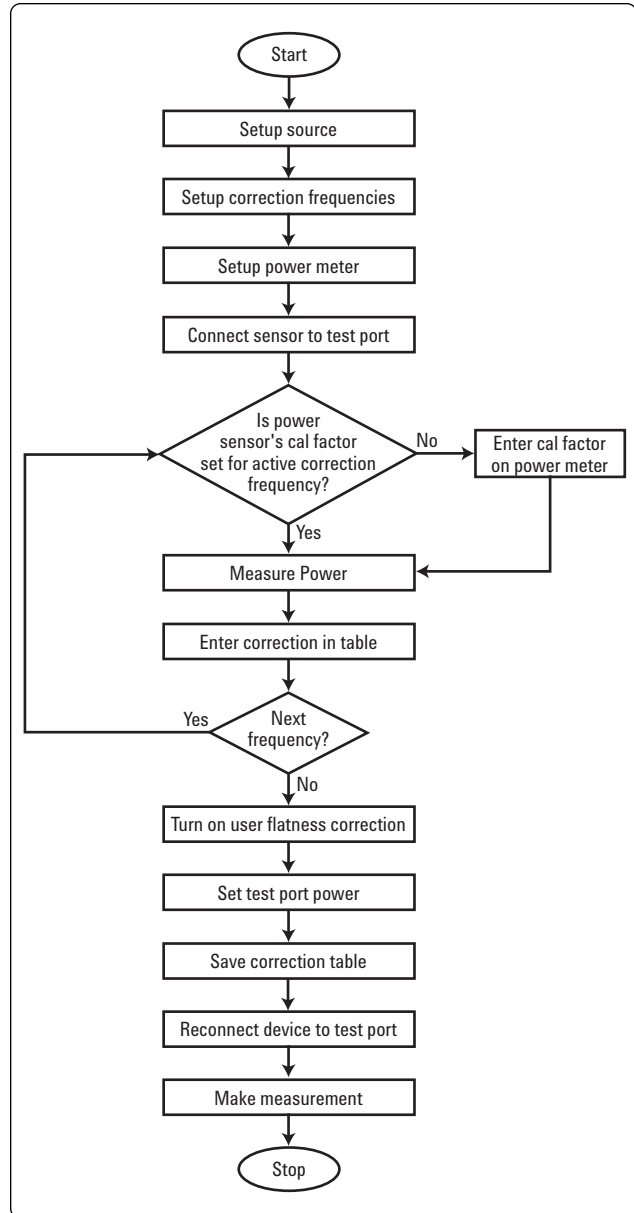


Figure 6. User Flatness Correction flowchart

Data entry methods for user flatness correction

User flatness correction data is obtained by connecting a power meter sensor at the desired test port and calibrating the measurement system. To make an accurate power meter measurement, the power meter must be calibrated to the power sensor by attaching the sensor to the "POWER REF" output and performing a calibration. (It is assumed that the user is already familiar with calibrating and zeroing the power meter in use.) The accuracy of the power meter measurement is also dependent on the accuracy of the calibration factors used during the measurement; the calibration factors must be set for each individual correction frequency prior to making the measurement. There are three methods of user flatness correction data entry which are primarily determined by the type of power meter available.

A 437B power meter facilitates automatic entry of correction data. Since the 8360 communicates with the power meter over GPIB, it must be the system controller during the data entry process. Only the 437B is capable of receiving frequency information

from the source, and incorporating the appropriate power sensor calibration factor in the power measurement (the user should be familiar with selecting and editing the calibration factor tables). The 8360 then retrieves the power measurement data and inputs the appropriate correction data in the array.

For power meters other than the 437B, the test port power must be manually measured at each correction frequency. At any given correction frequency, the user must enter the appropriate power sensor cal factor, measure the power, and then enter the correction data in the user flatness correction array from the front panel of the 8360 (see Example 2).

Automatic test systems may be programmed to interrogate the source for the test frequency, enter the appropriate power sensor cal factor, make the power meter measurement (with any power meter), and send the data to the source so it can place the appropriate correction data in the table. The 437B is recommended since it is capable of internally storing the cal factor information for different power sensors. Other power meters will require a look-up table of power sensor cal factors in the program.

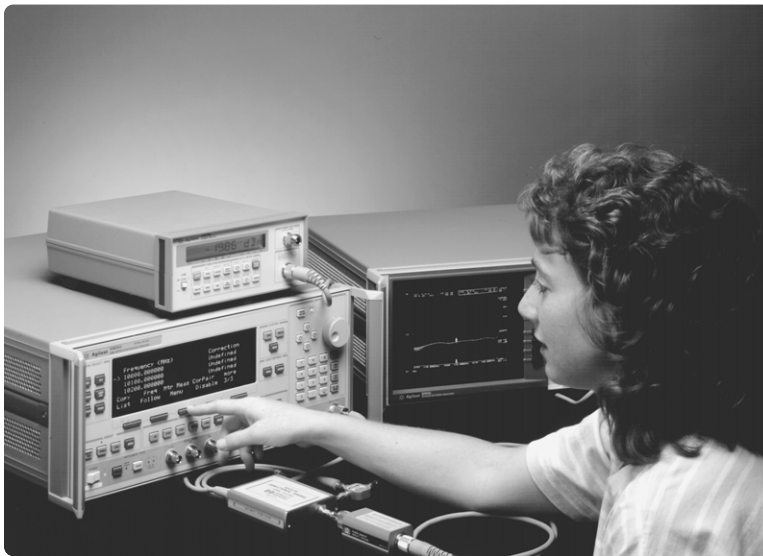


Figure 7. Basic system configuration using an 437B Power Meter for automatic User Flatness Correction data entry

Example 1: Swept measurement with automatically entered corrections

This example illustrates how to set up a 2 to 18 GHz swept measurement with a correction frequency every 100 MHz (see figure 1 for system configuration). The auto fill feature is used to increment the correction frequencies across the entire measurement range. A 437B power meter automatically enters correction data into the array.

When additional correction points are desired, use the auto fill feature to enter new correction frequencies in the required portion of the frequency span. When the 437B is used, the meter measurement menu's (*[Mtr Meas Menu]*) *Meas Corr [Undef]* softkey may be utilized to measure just the correction data for the additional points. The correction table should be cleared before entering an entirely new list of correction frequencies.

This example assumes that there is a 5 dB path loss in the measurement system attached to an 83620A. To provide the maximum available power to the device under test, a test port power of +5 dBm is selected. With user flatness correction enabled, the source will provide +10 dBm at the RF output port and +5 dBm at the test port.

Command	Description
Setup source parameters	
[PRESET]	Reset source to a known state
FREQUENCY [START] 2 GHz	Set start frequency to 2 GHz
FREQUENCY [STOP] 18 GHz	Set stop frequency to 18 GHz
POWER [POWER LEVEL] 10 dBm	Set power to +10 dBm (maximum specified power)
Access user flatness correction menu	
POWER [MENU]	Access power softkey menu
[more]	Display next softkey menu
[Fitness Menu]	Access flatness softkey menu
Clear flatness array	
[Delete Menu]	Access delete array softkey menu
Delete [All]	Clear array
MENU SELECT [PRIOR]	Exit delete menu Display previous softkey menu
[more]	Display next softkey menu
Enter frequencies in flatness array	
Auto Fill [Start] 2 GHz	Set first frequency in user flatness array to 2 GHz
Auto Fill [Stop] 18 GHz	Set last frequency of the user flatness array to 18 GHz
Auto Fill [Incr] 100 MHz	Set frequency increment to every 100 MHz from 2 to 18 GHz
Calibrate the power meter to the power sensor in use	
Connect 437B's power sensor to test port	
Verify GPIB cable connection between source and power meter	
Enter and store in the power meter the power sensor's cal factors for correction frequencies in the array	
[more]	Display next softkey menu
Enter correction data into array	
[Mtr Meas Menu]	Access the automatic data entry power meter menu
Meas Corr [All]	Input the correction data
Remove power meter sensor from test port; do not reconnect device	
POWER [FLTNES ON/OFF]	Enable user flatness correction
POWER [POWER LEVEL] 5 dBm	Set test port power +5 dBm ($P_{0 \text{ max}} - P_{\text{path loss}}$)
[SAVE] n	Save the source parameters including the correction table in an internal register
Reconnect device under test	

**Example 2:
Frequency list measurement with
manually entered corrections**

The following example demonstrates how to enter correction data when using a power meter other than the 437B (see figure 8 for the system configuration). This example also introduces two features of the 8360: frequency follow, which simplifies the data entry process, and list mode, which 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 correction data. Simultaneously, the source test frequency is updated to the selected correction frequency without exiting the correction table.

To further simplify the data entry process, the 8360 allows the user 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 will automatically calculate

the appropriate correction and enter it into the table. If the user already has a table of correction data prepared, it can be entered directly into the correction table from the keypad on the front panel of the 8360.

With the list mode feature, the user 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 8360 will step 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 will be determined as if no offset is entered. When user flatness correction and list mode (with offsets) are enabled, the 8360 will adjust the output power by an amount equivalent to the sum of the correction data and offset for each test frequency. The user must make sure that the resulting power level is still within the ALC range of the source.

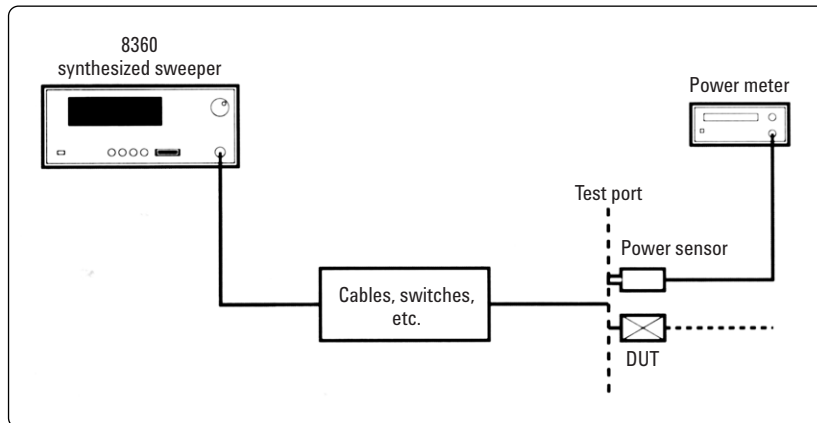



Figure 8. Basic system configuration for applications using a power meter other than the 437B

Command	Description
Setup source parameters	
[PRESET]	Reset source to a known state
POWER [POWER LEVEL] 5 dBm	Set test port power to +5 dBm ($P_{0 \text{ max}} - P_{\text{path loss}}$)
Create frequency list	
FREQUENCY[MENU]	Access the frequency softkey menu
<i>[more]</i>	Display next softkey menu
<i>[Fitness Menu]</i>	Access the frequency list softkey menu
<i>Enter List [Freq] 5 GHz</i>	Enter 5 GHz as the first frequency
<p>Entering a frequency automatically sets the offset and dwell to 0 dB and 10 ms, respectively Enter 18, 13, 11, and 20 GHz from the keypad</p>	
Access user flatness correction menu	
POWER [MENU]	Access power softkey menu
<i>[more]</i>	Display next softkey menu
<i>[Fitness Menu]</i>	Access flatness softkey menu
Clear flatness array	
<i>[Delete Menu]</i>	Access delete array softkey menu
<i>Delete [All]</i>	Clear array
MENU SELECT [PRIOR]	Leave delete menu
	Display previous softkey menu
<i>[more]</i>	Display next softkey menu
<i>[more]</i>	Display next softkey menu
<i>[Copy List]</i>	Copy the frequency list into the correction table in a sequential order
<i>[Freq Follow]</i>	Set source to the active correction frequency in the flatness array (i.e when the arrow points to the 5 GHz correction data point in the correction table, the source is also set to a CW frequency of 5 GHz)
<i>[more]</i>	Display next softkey menu
<p>Calibrate the power meter to the power sensor in use Connect power meter sensor to test port Enter the cal factor for first correction frequency (5 GHz)</p>	
Enter correction data into table	
POWER [FLTNES ON/OFF]	Enable User Flatness Correction; power meter will display corrected data
<i>Enter [Corr]</i>	Enter correction data - rotate knob until power meter displays desired power level (5 dBm)
	Allow entry of next frequency correction
<p>Enter in the power meter the sensor's cal factor for the next frequency in the array Repeat until each correction has been entered</p>	
[SAVE]n	Save the source parameters including the correction table in an internal register
<p>Remove power meter sensor from test port and reconnect device</p>	
Activate List Mode	
SWEEP [MENU]	Access sweep softkey menu
<i>Sweep Mode [List]</i>	Select frequency list mode

**Example 3:
Swept mm-wave measurement with
arbitrary correction frequencies**

The focus of this example is on using user flatness correction to obtain flat power at the output of the 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 83554 source module.

It is time consuming to perform large quantities of power meter measurements. To reduce this time, we will select non-sequential correction frequencies in order to target specific points or sections of the measurement range that we will assume are more sensitive to power variations. This will greatly expedite setting up the user flatness correction table. The amount of interpolated correction points

between non-sequential correction frequencies will vary. This example uses the 437B to automatically enter correction data into the array.

Note: Turn off the 8360 prior to connecting the source module interface (SMI) cable, or damage may result.

Configure the measurement system as shown in figure 9a or 9b. When the 8360 is preset, the following occurs:

- The source module's frequency span is displayed on the source.
- The 8360 leveling mode is automatically changed from internal to "module leveling."
- The source module's maximum specified power is set and displayed.

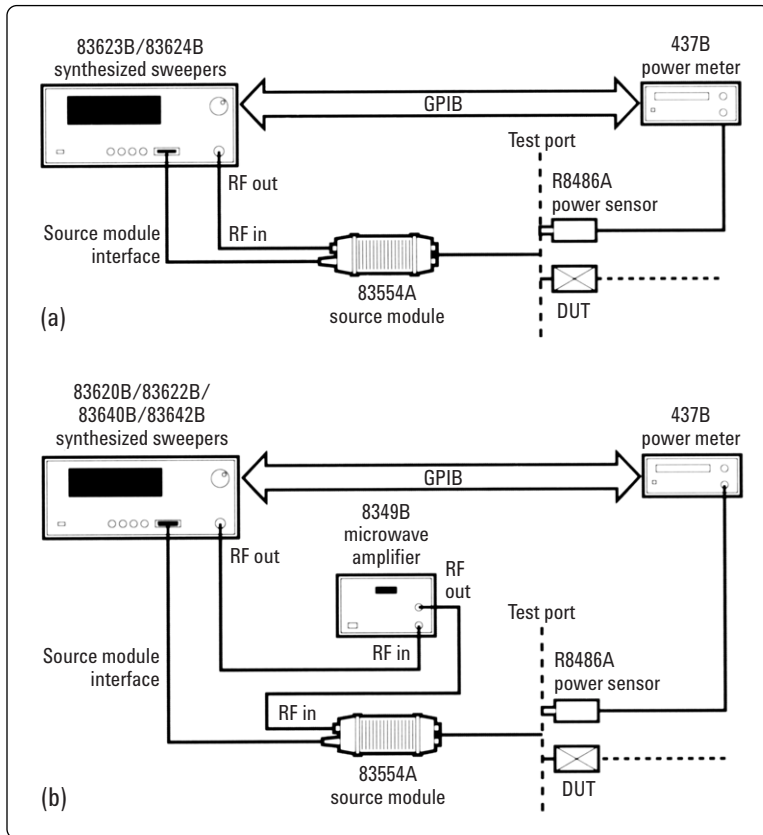


Figure 9. (a) mm-wave module hookup diagram with high power 8360 (83623B/24B), (b) hookup diagram with standard 8360 using an Agilent 8349B amplifier

Command	Description
Turn off source	
Connect Source Module Interface cable	
Turn on source	
Setup source parameters	
[PRESET]	
FREQUENCY [START] 26.5 GHz	Set start frequency to 26.5 GHz
FREQUENCY [STOP] 40 GHz	Set stop frequency to 40 GHz
POWER [POWER LEVEL] 7 dBm	Set source module power to +7 dBm for maximum power to device under test
Access User Flatness Correction Menu	
POWER [MENU]	Access power softkey menu
[more]	Display next softkey menu
[Fitness Menu]	Access flatness softkey menu
Clear flatness array	
[Delete Menu]	Access delete array softkey menu
Delete [All]	Clear array
MENU SELECT [PRIOR]	Exit delete menu
	Display previous softkey menu
Enter non-sequential frequencies into array	
Enter [Freq] 26.5 GHz	Enter 26.5 GHz as the first correction frequency in flatness array
Enter [Freq] 31 GHz	Enter 31 GHz as the second frequency
Enter [Freq] 32.5 GHz	Enter 32.5 GHz as the third frequency
Enter [Freq] 40 GHz	Enter 40 GHz as the last frequency
Calibrate the power meter to the power sensor in use	
Connect 437B's power sensor to test port	
Verify GPIB cable connection between source and power meter ²	
Enter and store in the power meter, the power sensor's cal factors for correction frequencies in the array ²	
[more]	Display next softkey menu
[more]	Display next softkey menu
Enter correction data into array	
[Mtr Meas Menu]	Access the automatic data entry power meter menu
Meas Corr [All]	Input the correction data
[SAVE] n	Save the source parameters including the correction table in an internal register
Remove power meter sensor from test port and reconnect device	
POWER [FLTNESS ON/OFF]	Enable user flatness correction

² U, V and W band power sensors are not available from Agilent. For these frequency bands 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 ML83A is not capable of internally storing power sensor cal factors, manual correction data entry is required (see Example 2).

**Example 4:
Scalar analysis measurement
with user flatness corrections**

The following example demonstrates how to setup a scalar analysis measurement (using an 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 source, then configure the system as shown in Figure 10.

Since this example uses a 437B power meter to automatically enter correction data into the array, it is necessary to turn off the 8757 system interface so that the source can temporarily control the power meter over GPIB. When the correction data entry process has been completed, enable user flatness correction and set the desired test port power level. Then store the correction table and source configuration in the same register that contains the analyzer configuration. Reactivate the 8757 system interface and recall the stored register. Make sure that user flatness correction is still enabled before making the measurement.

When a 437B power meter is used to automatically enter the correction data, the correction calibration routine will automatically turn off any active modulation and then reactivate the modulation upon the completion of the data entry process. Therefore, the scalar pulse modulation that is automatically enabled in a scalar measurement system will be disabled during a 437B correction calibration.

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 a 8757 disk will not erase the current array; therefore a user may recall an array from an internal register, then recall an associated file from a disk.

Note: The 8360's rear panel language and address switches must be set to 7 and 31 (all 1s), to allow the user to change the language or address of the source via the front panel. The default settings are TMSL and 19, respectively.

Command	Description
[PRESET] source	Reset to a known state
Set the source to Analyzer mode	
SYSTEM [MENU]	Access system softkey menu
[GPIB Menu]	Access GPIB softkey menu
Programming Language	Select analyzer language as the instrument's external interface language
[Analyzer]	Asterisk = active function

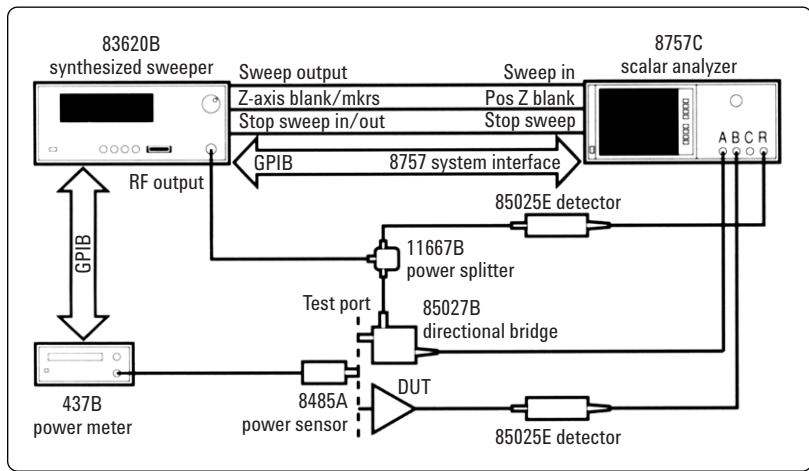


Figure 10. Scalar system configuration

Command	Description
[PRESET] analyzer	Reset analyzer and source to a known state

Setup source parameters

FREQUENCY [START] 2 GHz	Set start frequency to 2 GHz
FREQUENCY [STOP] 20 GHz	Set stop frequency to 20 GHz
POWER [POWER LEVEL] n dBm	Set power to maximum available leveled power

Set up the appropriate measurement (i.e. gain for an amplifier) on the analyzer
 Calibrate the measurement (thru and short/open calibration)

[SAVE] 1	Store analyzer's configuration and source parameters in storage register 1
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Turn off the 8757 System Interface on the analyzer

[SYSTEM]	Access system softkey menu
[MORE]	Display next softkey menu
[SWEEP MODE]	Display sweep softkey menu
[SYSINTF ON OFF]	Deactivate the 8757 system interface

Access User Flatness Correction menu

POWER [MENU]	Access power softkey menu
[more]	Display next softkey menu
[Flatness Menu]	Access flatness softkey menu

Clear flatness array

[Delete Menu]	Access delete array softkey menu
Delete [All]	Clear array
MENU SELECT [PRIOR]	Exit delete menu
[more]	Display previous softkey menu

[more]	Display next softkey menu
--------	---------------------------

Enter correction frequencies in array

Auto Fill [Start] 2 GHz	Set first frequency in user flatness array to 2 GHz
Auto Fill [Stop] 20 GHz	Set last frequency of the user flatness array to 20 GHz
Auto Fill [Incr] 100 MHz	Set frequency increment to every 100 MHz from 2 to 20 GHz

Calibrate the power meter to the power sensor in use
 Connect 437B's power sensor to test port
 Verify GPIB cable connection between source and power meter
 Enter and store in the power meter, the power sensor's cal factors for correction frequencies in the array

[more]	Display next softkey menu
--------	---------------------------

Enter correction data into array

[Mtr Meas Menu]	Access the automatic data entry power meter menu
Meas Corr [All]	Input the correction data

Remove power meter sensor from test port; do not reconnect device

POWER [FLTNESS ON/OFF]	Enable user flatness correction
POWER [POWER LEVEL] n dBm	Set test port power to $P_{0 \max} - P_{\text{path loss}}$ for maximum leveled power
[SAVE] 1	Store array in storage register 1

Reactivate the 8757 System Interface

[SYSINTF ON OFF]	The source will preset
[RECALL] 1	Recall source parameters from storage register 1

Reconnect device under test

Example 5: Computer controlled measurements with user flatness corrections

This section focuses on computer controlled measurement systems. The following program interrogates the source and a 437B power meter for frequency and power information respectively. The source (83620B) is programmed to sweep from 2 to 20 GHz, with user flatness corrections every 100 MHz and +5 dBm leveled output power. It is assumed that the path losses do not exceed 5 dBm and that the 437B power meter already has its power sensor's calibration factors stored in sensor data table 0. If another power meter is utilized, 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.

TMSL commands (see figure 11a) are used to set up the source parameters and enter correction frequencies and data into the user flatness correction table. The TMSL commands are written in capitalized and lower case letters. The capitalized portion of each command illustrates the short form. Commands may be written in either the short or the long form, or any combination of the two. Refer to the *8360 User's Guide* for more details on TMSL commands.

```

10  !Assign the address of the source and power meter
20  ASSIGN @Source TO 719
30  ASSIGN @Meter TO 713
40  INTEGER Error_flag
50  ABORT 7
60  !
70  !Set up source
80  OUTPUT @Source; "**RST"
90  OUTPUT @Source; "FREQuency:MODE SWEep; START 2 GHZ;
STOP 20 GHZ"
100 OUTPUT @Source; "SWEep:TIME 200 MS"
110 OUTPUT @Source; "POWer:LEVel 5
DBM;:INITiate:CONTinuous ON"
120 OUTPUT @Source; "**OPC?"           !Is operation complete?
130 ENTER @Source; Done
140 !
150 !Set up power meter
160 OUTPUT @Meter; "PR"
170 OUTPUT @Meter; "FA"
180 OUTPUT @Meter; "TR0"
190 !
200 !Zero power meter
210 OUTPUT @Source; "POWer:STATe OFF" !Make sure RF is off!
220 Zero_meter (@Meter, Error_flag)
230 IF Error_flag THEN
240     BEEP
250     CLEAR SCREEN
260     PRINT "Error: Meter did not complete zeroing operation!"
270 ELSE
280 !
290 !Set up correction frequencies in User Flatness Correction table
300 OUTPUT @Source; "CORRection:FLATness ";
310 Start_freq=2
320 Stop_freq=20
330 Increment=.1
340 Freq=Start_freq
350 WHILE Freq<Stop_freq
360     OUTPUT @Source; Freq; "GHZ, 0 DB, ";
370     Freq=Freq+Increment
380 END WHILE
390 OUTPUT @Source; Freq; "GHZ, 0 DB"
400 OUTPUT @Source; "POWer:STATe ON"
410 !
420 !Enter data in User Flatness Correction table
430 OUTPUT @Source;
"CALibration:PMETer:FLATness:INITiate? USER"
440 ENTER @Source; Freq
450 WHILE Freq>0
460     Power=FNRead_meter(@Meter, Freq)
470     OUTPUT @Source;
"CALibration:PMETer:FLATness:NEXT?"; Power; " DBM"
480     ENTER @Source; Freq
490 END WHILE
500 END IF
510 END

```

```

520 !
530 SUB Zero_meter (@Meter, INTEGER Error_flag)
540 OUTPUT @Meter; "CS"
550 OUTPUT @Meter; "ZE"
560 Max_attempts=30
570 Attempts=0
580 Zeroing=1
590 Finished=0
600 WHILE Zeroing AND NOT Finished
610     Attempts=Attempts+1
620     Meter_stat=SPOLL (@Meter)
630     IF Attempts>Max_Attempts THEN Zeroing=0
640     IF BIT (Meter_stat,1) THEN Finished=1
650     WAIT 1
660 END WHILE
670 IF NOT Zeroing THEN
680     Error_flag=1
690 ELSE
700     Error_flag=0
710 END IF
720 SUBEND
730 !
740 DEF FNRead_meter(@Meter, Freq) !Beginning of power
meter measurement
routine
750     OUTPUT @Meter; "SE0EN" !Select sensor data table 0
760     Freq$=VAL$(Frequency)
770     OUTPUT @Meter; "FR"&Freq$&"GZ"
780     OUTPUT @Meter; "TR2"
790     ENTER @Meter; Power$
800     P0=VAL(Power$)
810     Flips=0
820     Slope=0
830     REPEAT
840         OUTPUT @Meter; "TR2"
850         ENTER @Meter; Power$
860         P1=VAL(Power$)
870         Slope2=SGN(P2-P1)
880         IF Slope2<>Slope THEN
890             Flips=Flips+1
900             Slope2=Slope
910         ELSE
920             IF Slope2=0 THEN Flips=Flips+.2
930         END IF
940         P0=P1
950     UNTIL Flips>=3
960     Power=(P0+P1)/2
970     RETURN Power
980 FNEEND

```

Figure 11a. TMSL commands

Note: The 8360's rear panel language and address switches must be set to 7 and 31 (all 1s), to allow the user to change the language or address of the source via a computer. The default settings are TMSL and 19 respectively.

The following program (see figure 11b) illustrates how to transfer 1601 points from a file called "Corr_data", into the user flatness correction array using the "CORRection:ARRay" TMSL command. The "Corr data" file contains correction data for a specific start/stop frequency span set on the source. There are no frequency components associated with these correction data points; any change to the source start and/or stop frequencies will make the correction data invalid. When the 1601-point user flatness correction array is loaded into the source, it is stored in a special nonvolatile memory location that is only accessible from a computer. The source can store only one 1601-point array at a time. These correction data points can not be displayed on the 8360.

Once this correction array has been loaded into the source, it may be reactivated at any time by selecting the [*CorPair Disable*] softkey and enabling user flatness correction. As long as [*CorPair Disable*] is active, any correction table that is accessible from the front panel of the 8360 is disabled (see figure 4). This softkey is located next to the [*Mtr Meas Menu*] in the [*Fitness*] softkey menu.

```
10 DIM Array (0:1600)
20 ASSIGN @Source TO 719
30 ASSIGN @File TO "Corr_data"
40 ENTER @File; Array (*)
50 ASSIGN @File TO *
60 OUTPUT @Source; "CORR:ARR"
70 OUTPUT @Source; Array(*)
80 END
```

Figure 11b. Program

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