

HP 8935 CDMA Cellular/PCS Base Station Test Set

Reference Guide

Firmware Version: A.01.00 and above

HP Part Number E6380-90019

Revision A

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Product Information

**Manufacturer's
Declaration**

This statement is provided to comply with the requirements of the German Sound Emission Directive, from 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB(A).

- Sound Pressure $L_p < 70$ dB(A).
- At Operator Position.
- Normal Operation.
- According to ISO 7779:1988/EN 27779:1991 (Type Test).

Herstellerbescheinigung

Diese Information steht im Zusammenhang mit den Anforderungen der Maschinenlärminformationsverordnung vom 18 Januar 1991.

- Schalldruckpegel $L_p < 70$ dB(A).
- Am Arbeitsplatz.
- Normaler Betrieb.
- Nach ISO 7779:1988/EN 27779:1991 (Typprüfung).

Safety
Considerations

GENERAL

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

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. This instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

SAFETY EARTH GROUND

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

CHASSIS GROUND TERMINAL

To prevent a potential shock hazard, always connect the chassis ground terminal to earth ground when operating this instrument from a dc power source.

SAFETY SYMBOLS



Indicates instrument damage can occur if indicated operating limits are exceeded. Refer to the instructions in this guide.



Indicates hazardous voltages.



Indicates earth (ground) terminal

WARNING

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

CAUTION

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

Safety Considerations for this Instrument

WARNING



This product is a Safety Class I instrument (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 of the product is likely to make the product dangerous. Intentional interruption is prohibited.



Do not expose to or operate this instrument in outdoor atmospheric conditions such as direct rain, hail, sleet, snow, icing, sunshine or wind. Operate this instrument only within its specified temperature humidity conditions.



This instrument is equipped with internal ground fault circuit interrupter class A.

- **This device does not protect against electrical shock due to contact with both circuit conductors or a fault in supply wiring to product.**
- **Do not use extension cord to connect this product to power receptacle. Attention-ne pas utiliser de rallonge pour raccorder le detecteur-disjoncteur a la prise de courant.**
- **Replace cordset only with HP 8120 series. Attention - Remplacer uniquement par un cordon amovible numero 8120.**
- **Do not use in wet location. Ne pas utiliser dans un emplacement mouille.**

WARNING

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

If this instrument is to be energized via an autotransformer (for voltage reduction), make sure the common terminal is connected to the earth terminal of the power source.

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

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

Servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

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

The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

For Continued protection against fire hazard, replace the line fuse(s) only with 250 V fuse(s) or the same current rating and type (for example, normal blow or time delay). Do not use repaired fuses or short circuited fuseholders. FUSE: T 5.0A

CAUTION

Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause personal injury and/or product damage.

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

This product has autoranging line voltage input, be sure the supply voltage is within the specified range.

Ventilation Requirements: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product 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.

To prevent electrical shock, disconnect instrument from mains (line) before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Product Markings

CE - the CE mark is a registered trademark of the European Community. A CE mark accompanied by a year indicated the year the design was proven.

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

CERTIFICATION	<p>Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory.</p> <p>Hewlett-Packard 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.</p>
WARRANTY	<p>This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will at its option, either repair or replace products which prove to be defective.</p> <p>For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges, duties, and taxes for products returned to HP from another country.</p> <p>HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.</p>
LIMITATION OF WARRANTY	<p>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.</p> <p>NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.</p>
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<p>South Eastern Europe Sales and Service Hewlett-Packard Ges. m.b.h. Liebigasse 1 P.O. Box 72 A-1222 Vienna, Austria Telephone: 43 222 2500 0 Telex: 13 4425</p>	<p>European Multicountry Region Sales and Service Hewlett-Packard S.A. P.O. Box 95 150, Route dv Nant_dl_AVRIL CH-1217 Meyrin 2 Geneva, Switzerland Telephone: (41/22) 780-8111 Fax: (41/22) 780-8542</p>	<p>Northern Europe Sales and Service Hewlett-Packard Nederland B.V. Startbaan 16 1187 XR Amstelveen, The Netherlands P.O. Box 667 Telephone: 31/20 5476911 X 6631 Fax: 31-20-6471825NL</p>

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Product Description

The HP 8935 CDMA Cellular/PCS Base Station Test Set offers full signal generation and analysis capability and support for cellular frequency bands and international PCS frequency bands.

You can perform the following CDMA measurements using the Test Set:

- Signal Quality Measurements
 - Rho (ρ)
 - Time Offset
 - Frequency Error
 - Carrier Feedthrough
- Code Domain Measurements
 - Code Domain Power
 - Code Domain Timing
 - Code Domain Phase
- Average Power
- Channel Power
- Error Vector Magnitude

The Test Set's CDMA generator also has the following capabilities:

- Reverse Channel Source with Data Buffer
- AWGN (built-in calibrated E_b/N_0 levels)

The Test Set also supports CDMA reference clocks and triggers.

In addition to its CDMA measurements and capabilities, the Test Set also provides the following analog measurements:

- AC Level
- AM Depth
- AF Frequency
- DC Level
- Distortion
- Frequency and Frequency Error
- Transmitter Power
- FM Deviation
- Audio Frequency
- SINAD
- SNR

In This Book

- [Chapter 1, “Getting Started,” on page 23](#) familiarizes you with the front panel controls. It introduces the different types of control fields that are used to make measurements
- [Chapter 2, “Operating Overview,” on page 33](#) provides general information about how to change measurement screens and change control field settings. This chapter also provides some utility procedures: calibrating channel power, setting a reference, setting measurement limits, setting a generator/analyzer offset, averaging measurements, saving and recalling setups, and using USER keys.
- [Chapter 3, “Overview of the Test Set’s Built-In Tools,” on page 55](#) introduces the RFTOOLS program. This program automates some measurements: cable fault location, swept return loss, swept and discrete insertion loss, spectrum analyzer self-calibration. The program also includes utilities for printing and data collection.

Basic operation of the built-in signal strength meter, spectrum analyzer, oscilloscope, and code domain analyzer is also included in this chapter.

- [Chapter 4, “CDMA Measurements - Screens and Control Fields,” on page 81](#) explains the measurements that can be made from these screens and the fields that control the measurement’s parameters.

CDMA measurements include average power measurements, channel power measurements, rho measurements (including frequency error, time offset, and carrier feedthrough), EVM measurements (including phase error and magnitude error), and code domain measurements (including timing, phase, and power).

- [Chapter 5, “Analog Measurements - Screens and Control Fields,” on page 115](#) explains the measurements that can be made from these screens and the fields that control the measurement’s parameters.

Analog measurements include ac/dc level, AM depth, AF frequency, distortion, frequency and frequency error, transmitter power, FM deviation, SINAD, and SNR.

- [Chapter 6, “Configuration - Screens and Control Fields,” on page 159](#) explains the configuration controls for the Test Set.
- [Chapter 7, “Connectors,” on page 183](#) describes the function and physical attributes of each connector on the Test Set.
- [Chapter 8, “Accessories, Manuals, Support,” on page 195](#) describes any available upgrades, accessories, training and support for the Test Set.
- [Chapter 9, “Error Messages,” on page 203](#) provides any available information about error recovery when messages are displayed.

Conventions Used in this Book

Screen names are shown as follows: CODE DOM.

Keys are shown in the following typeface: **CDMA Gen**. Shifted functions (labeled in blue above the keys) are accessed by pressing and releasing the blue **Shift** key, and then the key below the blue label.

Fields and messages displayed on the CRT are shown in the following typeface: Input Atten.

The term “Test Set” is used to refer to the HP 8935.

The screens shown in this manual may not exactly match the screens displayed on the Test Set’s CRT. Some differences may be due to control field settings, while other differences may be due to instrument revisions.

Which Document is Required? The following documents are part of the HP 8935 document set. Use the table to help you decide which document you need.

Table 2 Document Navigation

Document	Part Number	Usage
CDMA Application Guide	E6380-90016	Use this manual for basic CDMA measurements and for getting started with the Test Set.
AMPS Application Guide	E6380-90017	Use this manual for making AMPS base station measurements.
Reference Guide	E6380-90019	Use this manual for screen and field descriptions and general operation information about the Test Set.
Programmer’s Guide	E6380-90018	Use this manual to learn HP-IB syntax and for learning how to program the Test Set.
Assembly Level Repair Guide	E6380-90015	Use this manual to perform calibration on the Test Set and for general service information.

1 **Getting Started**

- “Before Connecting a Radio” on page 24
- “Changing the Measurement Screen” on page 25
- “Changing the Control Fields” on page 26
- “Instrument Quick Check” on page 31

Before Connecting a Radio

NOTE The RF IN/OUT port should be used for all transmitter tests when the radio is connected directly to the Test Set. (All UUT transmitter power measurements are made through this port). Off-the-air measurements can be made using the ANT IN port.

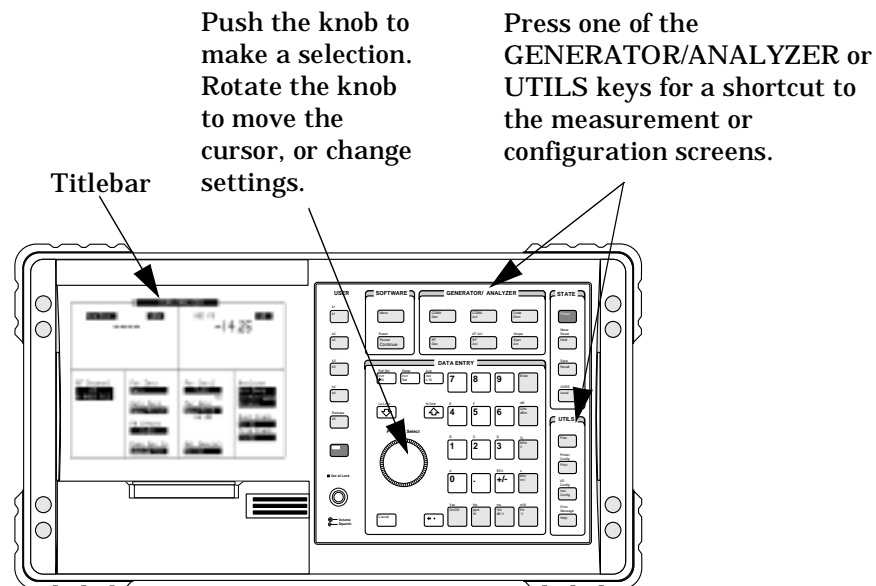
CAUTION Overpower Damage — Refer to the Test Set's side panel for maximum input power level at the RF IN/OUT, DUPLEX OUT, and ANT IN connectors. Exceeding these levels can cause permanent instrument damage.

Changing the Test Set's Display

Changing the Measurement Screen

The measurement screen is changed using the titlebar at the top of the screen and the cursor-control knob, using the GENERATOR/ANALYZER keys, or by using the UTILS keys. Rotate the knob to move the cursor from field to field or to change settings. Press the knob to make selections (see “[Changing the Control Fields](#)” on [page 26](#) for more information about fields).

Figure 1-1 Using the cursor-control Knob or Screen Keys



To change the measurement screen

Step 1. Select the titlebar at the top of the screen (placement of the titlebar may vary slightly on some screens).

Step 2. Select the measurement screen from the list of choices.

OR

Step 1. Press a screen key: CDMA Gen, CDMA Anl, Code Dom, RF Gen, RF Anl, Spec Anl, AF Anl, Scope, Prev, Inst Config, Help, Printer Config, I/O Config, Error Message.

AF Anl, Scope, Printer Config, I/O Config, and Error Message are shifted functions (labeled in blue above a key). You must press and release the blue shift key then the key below the blue label to access the screen (or other function) labeled in blue.

Pressing the Prev key displays the previous screen.

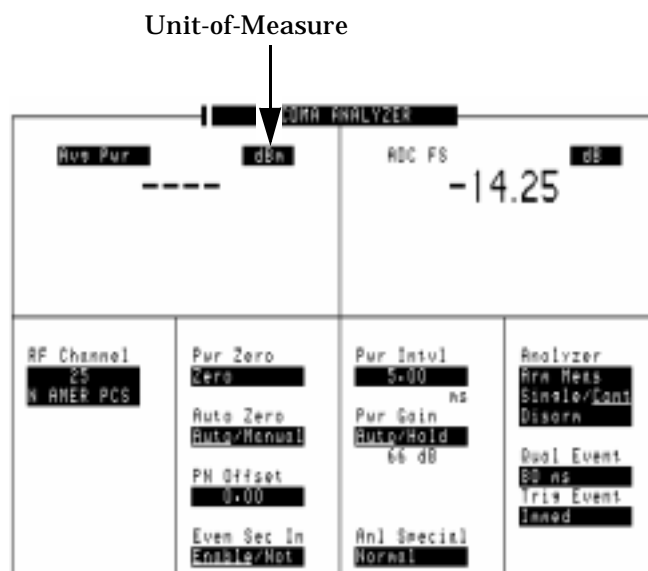
Changing the Control Fields

There are several types of control fields in the Test Set. This section describes some of the different types of fields.

Unit-of-Measure Field

Unit-of-measure can be changed to display measurements in different values or magnitudes. The unit-of-measure field can also be used to turn a measurement on or off (use the On/Off Yes key).

Figure 1-2 Unit-of-Measure Field



To change a unit-of-measure field

- Step 1.** Position the cursor at the unit field on the display.
- Step 2.** Press a key labeled with a different unit-of-measure (such as W).

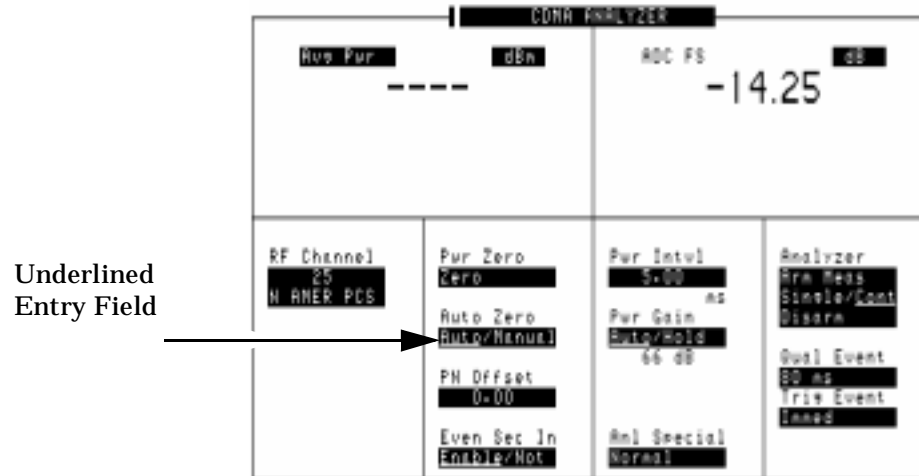
If the new units are valid, the measurement value is displayed in the unit.

If the new units are not valid, the message `Invalid keystroke.` is displayed and the units are not changed.

Underlined Entry Field

Underlined entry fields provide a choice of two settings (toggle).

Figure 1-3 Underlined Entry Field



To Change an underlined entry

Step 1. Position the cursor at the field.

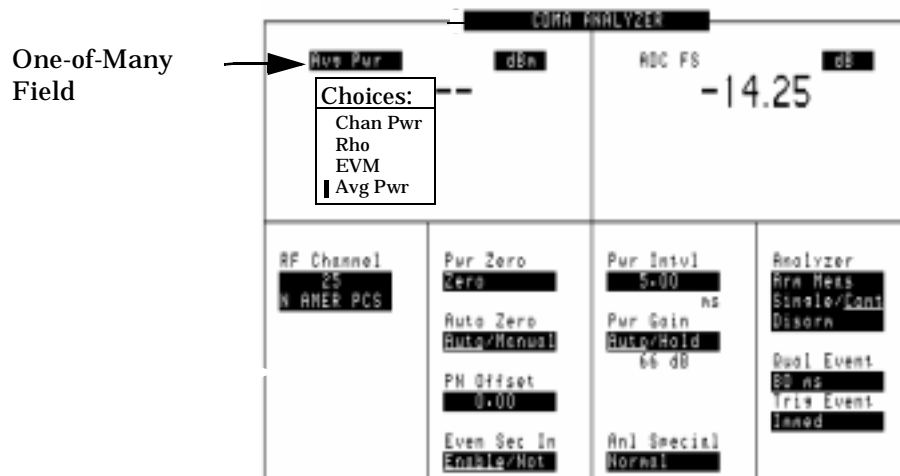
Step 2. Push the cursor-control knob or the Enter key to move the underline under the desired choice.

The underlined setting is immediately activated when selected.

One-of-Many Field

One-of-many fields display a list of choices when selected.

Figure 1-4 One-of-Many Field



To make a one-of-many choice

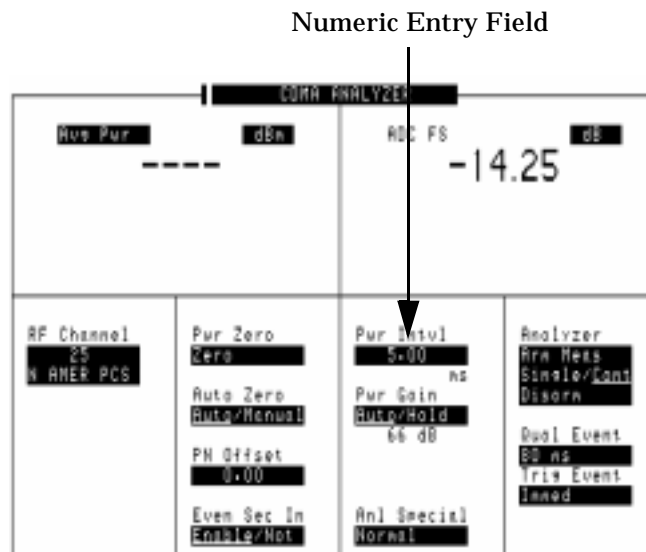
- Step 1.** Position the cursor at the field.
- Step 2.** Push the cursor-control knob or the **Enter** key to display the choices.
- Step 3.** Move the cursor through the choices by turning the knob.
- Step 4.** Push the cursor-control knob or the **Enter** key to make the choice.

The choice is immediately activated when selected.

Numeric-Entry Fields

Values for numeric entry fields can be entered and changed using various methods, depending on your testing needs.

Figure 1-5 Numeric-Entry Field



To change a value

Step 1. Position the cursor at the field.

Step 2. Key in the desired number using the DATA ENTRY keys.

Step 3. Press **Enter** to select the choice.

OR

Step 1. Position the cursor at the field.

Step 2. Push the cursor-control knob (the flashing >> cursor appears).

Step 3. Turn the knob to increment or decrement the value. (The current increment value may not be appropriate for your operation. See [“Changing the Increment or Decrement Setting”](#) on page 42.)

Step 4. Push the cursor-control knob or the **Enter** key to select the choice.

OR

Step 1. Position the cursor at the field.

Step 2. Push the cursor-control knob to highlight the desired choice.

Step 3. Use the up-arrow or down-arrow keys to increment or decrement the value.

Decimal Values

Decimal values are used for most numeric entry fields. The acceptable entries for decimal values are 0 through 9, ., +/-, and EEX.

The +/- key is used for entering negative numbers.

The EEX key is used to enter values in exponential notation. For example to enter 10^{-9} you would enter 1, 0, EEX (Shift, +/-), +/-, 9.

Hexadecimal Values

Hexadecimal (Hex) values are used for entering some signaling parameters. The acceptable entries values are 0 through 9 and A through F. No unit-of-measure is associated with these values.

Hexadecimal values are either entered from the keypad (A through F are shifted functions) or for some fields, values are selected from a list of choices.

How do I Verify that the Test Set is Operating Properly?

If your Test Set powers-up and displays the CDMA ANALYZER screen, but you suspect an instrument problem, use the Instrument Quick Check to verify operation of the basic instrument functions.

If no failure is indicated by this test, but you still suspect a problem, refer to the “Performance Tests” information in the *Assembly Level Repair Manual*.

Instrument Quick Check

Step 1. Set up the quick check:

- a. Remove any connected cables (except for AC or DC power).
- b. Turn instrument power on (if it is not already on).
- c. Press **Preset**.
- d. Press **Inst Config** and set the **RF Display** field to **Freq**.
- e. Press **CDMA Anl** and select the **Avg Pwr** field, then select **Rho** from the **Choices:** menu.
- f. Set the **Tune Freq** field to **800 MHz**.
- g. Set the **Anl Dir** field to **Rev**.
- h. Press **CDMA Gen** and set the **Output Port** field to **RF Out**.
- i. Set the **RF Gen Freq** field to **800 MHz**.
- j. Set the **Amplitude** field to **-40 dBm**.
- k. Set the **Gen Dir.** field to **Fwd**. (The **EQ In/Out** field is displayed.)

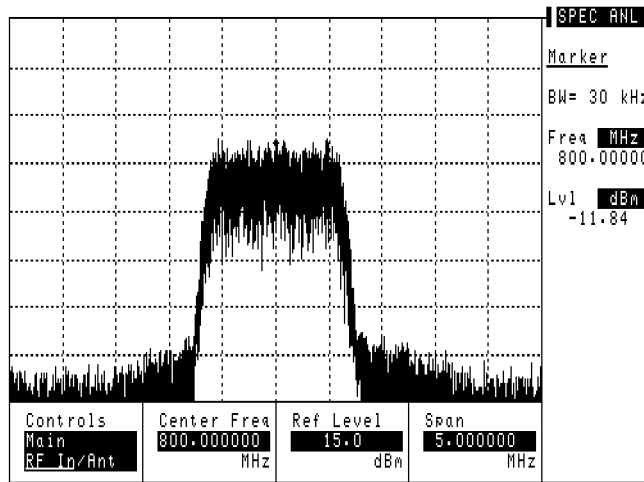
Step 2. Check the following reading:

- a. Rho should be greater than 0.96.

Step 3. Press **Spec Anl** to access the SPEC ANL screen.

You should see the characteristic CDMA spectrum.

Figure 1-6 CDMA Spectrum



2

Operating Overview

- "Displaying CDMA Measurements" on page 34
- "Displaying Analog Measurements" on page 36
- "Using Channel Numbers to Set Analyzer and Generator Frequencies" on page 40
- "Calibrating the Channel Power Measurement" on page 41
- "Changing the Increment or Decrement Setting" on page 42
- "Using Measurement Limit Indicators" on page 43
- "Setting A Measurement Reference" on page 45
- "Averaging Measurements" on page 46
- "Setting an RF Generator/Analyzer Offset" on page 47
- "Saving and Recalling Instrument Setups" on page 48
- "Using USER Keys" on page 51
- "Replacing Batteries" on page 53

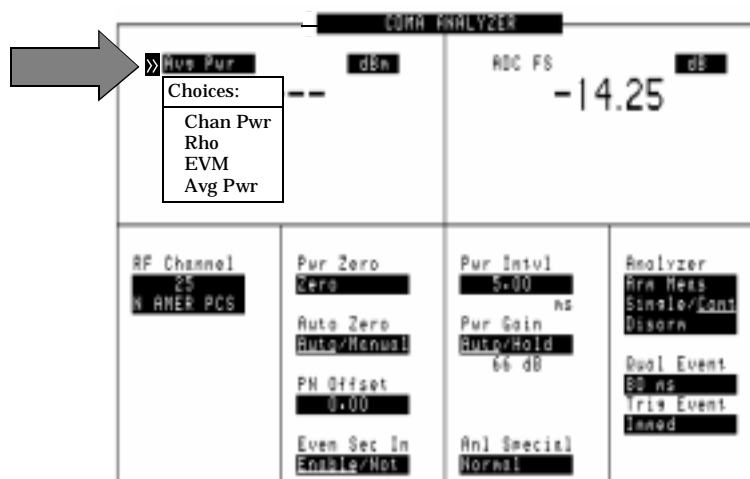
Displaying CDMA Measurements

Channel Power, Rho, EVM, Average Power

You can select channel power, rho, EVM, or average power on the CDMA ANALYZER or CDMA GENERATOR screen as shown in Figure 2-1.

For more information about these measurements see "CDMA Measurements" on page 82.

Figure 2-1 Displaying Channel Power, Rho, EVM, or Average Power



Time Offset, Frequency Error, Carrier Feedthrough

When you select Rho, the Time Offset, Frequency Error, and Carrier Feedthru measurements are displayed. Time offset and carrier feedthrough are also displayed on the CODE DOM screen along with frequency offset.

Frequency Offset

Frequency offset is displayed on the CODE DOM screen.

Magnitude Error, Phase Error

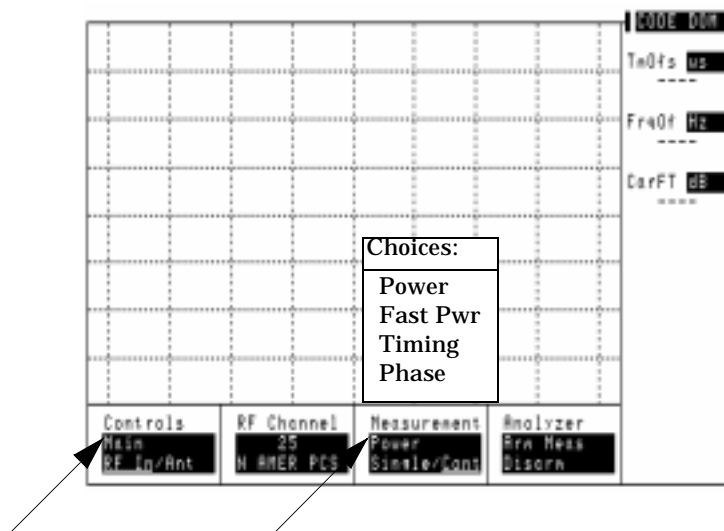
When you select EVM, the Magnitude Error and Phase Error measurements are displayed.

Code Domain Measurements (Power, Timing, Phase)

Code domain measurements are displayed on the CODE DOM screen. To select a code domain measurement, go to the CODE DOM screen and select a measurement from the Measurement field in the Main controls menu.

For more information about code domain measurements see "[Code Domain Measurements](#)" on page 89.

Figure 2-2 Selecting Code Domain Measurements



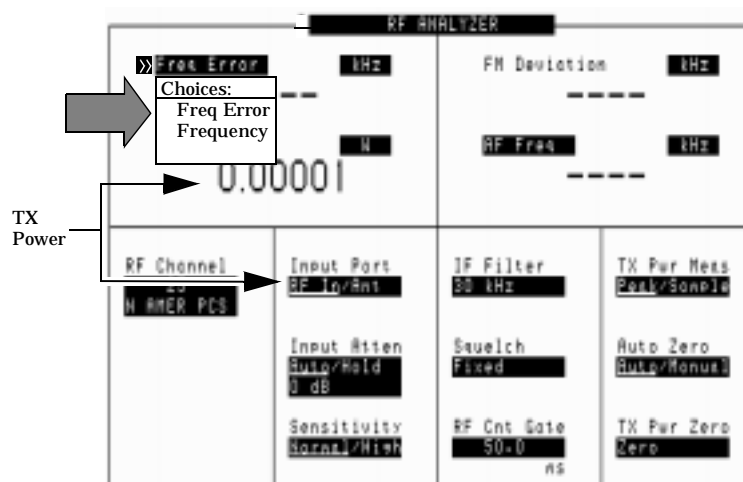
Displaying Analog Measurements

RF Measurements

Frequency Error, Frequency

RF Frequency Error and RF Frequency are displayed on the RF ANALYZER, RF GENERATOR, and AF ANALYZER screens.

Figure 2-3 Displaying RF Frequency Error or RF Frequency, and TX Power



Transmitter (TX)Power

TX Power is only measured and displayed here when the Input Port on the RF ANALYZER screen is set to RF In. If Ant (antenna) is selected, the measurement is replaced by four dashes (- - - -).

You can measure low power levels on the ANT IN port using the spectrum analyzer.

Refer to the ["TX Power Measurement" field on page 120](#) and the ["TX Pwr Zero" field on page 157](#) for more information on measuring transmitter power.

CAUTION Connecting a signal of >60 mW to the ANT IN (antenna) port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts). If the overpower circuit is triggered, remove the signal from the ANT IN port and turn the Test Set off and on to reset it.

Displaying AF Measurements

FM Deviation, AM Depth, AC Level

The AF Anl In setting determines the AF analyzer's input and the measurement displayed in the top-right corner of the measurement area (see figure 2-4). These measurements are displayed on the RF GENERATOR, RF ANALYZER, and AF ANALYZER screens.

Table 2-1 lists the measurement displayed for each AF Anl In setting.

Figure 2-4 Displaying FM Deviation, AM Depth, or AC Level

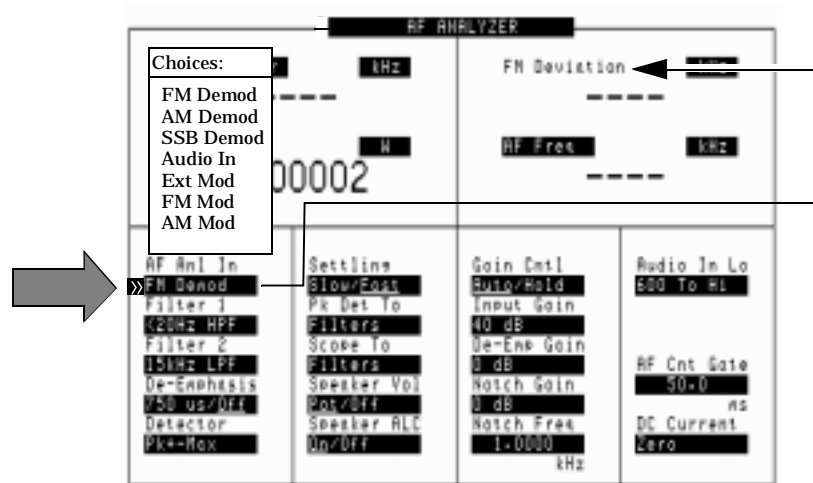


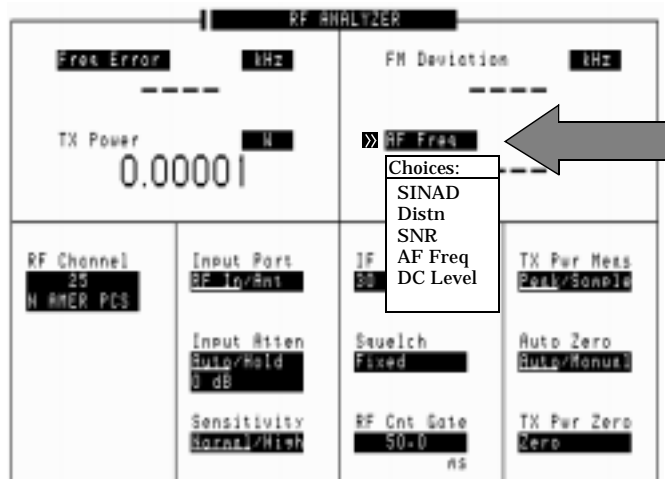
Table 2-1 Measurements Selected with the AF Anl In field

Measurement	AF Anl In Setting
FM Deviation	FM Demod, FM Mod
AM Depth	AM Demod, AM Mod
AC Level	SSB Demod, Audio In, Ext Mod, Audio Out

SINAD, Distortion, SNR, AF Frequency, DC Level,

These measurements are available on the RF GENERATOR, RF ANALYZER, and AF ANALYZER screens. See [figure 2-5](#).

Figure 2-5 Displaying SINAD, Distortion, SNR, DC Level, or AF Frequency

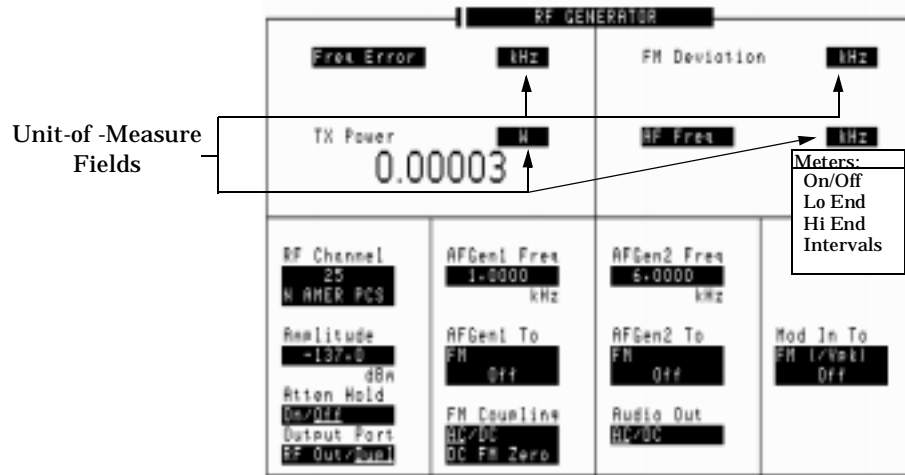


The Distortion measurement is only for a 1 kHz tone.

Selecting SNR (Signal/Noise Ratio) turns off any other audio measurement. For more information on making this measurement, see the [RF Gen Freq field description, on page 148](#).

Displaying Analog Measurement Results on a Meter Scale

Figure 2-6 Displaying the Meter Scale



Measurement results can be displayed on a meter scale. The digital numeric value is still displayed (but smaller) under the meter scale.

To display the meter scale

- Step 1.** Move the cursor to the unit-of-measure field for the measurement you want displayed on the meter.
- Step 2.** Press and release the blue **shift** key, then the **Incr Set** key to access the meter function.
- Step 3.** Select **On/Off** from the **Meters:** menu (or press the **on/off** key).

To set the meter's end points and scale intervals

- Step 1.** Use the knob to select the unit-of-measure field for the measurement you want displayed on the meter.
- Step 2.** Press and release the blue **shift** key, then the **Incr Set** key to access the meter function.
- Step 3.** Select **Hi End**, **Lo End**, or **Interval** from the **Meters:** menu and enter the value for your selection, then press the **Enter** key.
- Step 4.** Repeat steps 2 and 3 until you have set the desired parameters for the meter's scale.

Calibrating the Channel Power Measurement

To calibrate a channel power measurement at the RF IN/OUT port using the internal CDMA generator



- Step 1.** Go to the CDMA ANALYZER screen and choose the Chan Pwr measurement.
- Step 2.** Set the Tune Freq field (or RF Channel field) to the center frequency of your CDMA signal.
- Step 3.** Select the Chn Pwr Cal field and wait until the calibration is complete.

Changing the Increment or Decrement Setting

Specifying An Increment Value for the Arrow Keys or Knob

The **Incr Set** key is used to assign a specific increment value. The increment value may use different units than the field you are incrementing/decrementing. For instance; if the RF generator's **Amplitude** setting is displayed in dB μ V, you could increment in units of dB or mV.

To change the increment/decrement value

- Step 1.** Move the cursor to the numeric entry field to be changed.
- Step 2.** Press **Incr Set**, and enter the desired incremental value and unit-of-measure using the DATA ENTRY keys.
- Step 3.** Use the down-arrow and up-arrow keys   or cursor control knob to increment the field's value. The field's value changes by the value you set for each key press or knob click.

Using the Factor of 10 Increment/Decrement Keys

The **Incr \times 10** and **Incr \div 10** keys change the increment/decrement value by a factor of 10.

For example, if you set the increment for **Tune Freq** to 10 MHz for every click of the knob or push of the down-arrow or up-arrow keys, pushing **Incr \times 10** changes the increment value to 100 MHz.

Using Measurement Limit Indicators

The **Lo Limit** and **Hi Limit** functions are used to define a measurement “window.” You can set a high limit, a low limit, or both. When limits are assigned, **Lo**, **Hi** or both are indicated on the screen.

A measurement that goes above or below the defined limits causes three things to happen:

1. A message appears at the top of the screen indicating a limit was exceeded.
2. The **Lo** or **Hi** indicator flashes.
3. The beeper beeps (if it is has been enabled in the **INSTRUMENT CONFIGURE** screen).

Limits are helpful when you can't watch the Test Set's display while you are making an adjustment on the equipment you are testing or repairing. They are also a convenient way of alerting you to long-term measurement drift.

To set high and low limits

- Step 1.** Position the cursor in front of the unit-of-measure for the measurement for which you are setting limits.
- Step 2.** Press and release the **shift** key, then the down-arrow key to access the **Lo Limit** function, and enter the measurement's low-limit value and its unit-of-measure.¹
- Step 3.** Press and release the **shift** key, then the up-arrow key to access the **Hi Limit** function, and enter the measurement's high-limit value and its unit-of-measure.²

1. The fundamental unit for the limits does not have to be the same as the measurement's units. For instance; when measuring AC Level in Volts, you can set high and low limits in units of dBm.

To reset or remove limits

To *reset* a limit that has been exceeded

- Step 1.** Position the cursor in front of the measurement's unit-of-measure.
- Step 2.** Press and release the **Shift** key, then the down-arrow (or up-arrow key) to access the **Lo Limit (or Hi Limit)** function.
- Step 3.** Press **Enter** or **Shift** then **Hold** to access the **Meas Reset** function.

To *remove* a limit

- Step 1.** Position the cursor in front of the unit-of-measure for the assigned limit.
- Step 2.** Press and release the **Shift** key, then the down-arrow (or up-arrow key) to access the **Lo Limit (or Hi Limit)** function, then press the **On/Off** key.

Setting A Measurement Reference

The reference set (Ref Set) function establishes a measurement reference point. This allows you to make a direct comparison between two measurement results, or between a measurement standard and the actual measurement results.

Depending on the type of measurement, referenced measurements are displayed in one of two ways:

1. *Displayed value = Measurement – Reference.* The difference between the measured value and the reference value is displayed.
or
2. *Displayed value = Measurement ÷ Reference.* A ratio of the measured value to the reference value is displayed. This ratio is expressed in dB.

To set a reference

- Step 1.** Position the cursor in front of the unit-of-measure for the measurement you want to set the reference for.
- Step 2.** Press and release the **Shift** key, then the **Incr +10** key to access the **Ref Set** function.
- Step 3.** Enter a reference value, then press **Enter**. (To use the currently measured value as a reference, just press **Enter**.)
- Step 4.** The Reference indicator shows that an internal reference has been set.
- Step 5.** To turn the reference off press and release the **Shift** key, then the **Incr +10** key to access the **Ref Set** function, and then press the **On/Off** key.

Averaging Measurements

The Avg (average) function allows you to display the average value of a number of measurements. You enter the number of measurement samples used to calculate and display the measurement average. This dampens the effects of rapidly changing measurements, providing a more usable measurement display.

To use measurement averaging

- Step 1.** Position the cursor in front of the measurement's unit-of-measure.
- Step 2.** Press and release the **Shift** key, then the **Incr ×10** key to access the **Avg** function.
- Step 3.** Enter the desired number of measurement samples to be used for calculating the average, then press the knob or the **Enter** key.

or

Press **On/Off** to use the currently-displayed number of samples.
- Step 4.** To turn averaging off, position the cursor in front of the unit-of-measure and press and release the **Shift** key, then the **Incr ×10** key to access the **Avg** function, then press the **On/Off** key.

How the Test Set Averages Measurements

When the averaging function is first enabled, a numeric average is calculated and displayed each time a measurement is made. This continues until the specified number of samples is reached. From that point on, the averaging function performs an exponential filtering operation that mimics an RC filter.

Because of the exponential response, any large measurement changes result in a displayed value that ramps up or down to the actual measured value.

A measurement reset clears the measurement history for all measurements and starts the averaging process over. (Press and release the **Shift** key then the **Hold** key (**Meas Reset**) to reset the measurement.)

Setting an RF Generator/Analyzer Offset

You can set a fixed frequency offset between the RF generator and the RF analyzer. This feature is convenient for testing radios with a fixed transmit/receive frequency offset.

To set an RF Offset

- Step 1.** Go to the INSTRUMENT CONFIGURE screen.
- Step 2.** Set the RF Display field to Freq.
- Step 3.** Set the RF Offset field to On.
- Step 4.** Select the (Gen)-(Anl) field and enter the frequency offset value.
- Step 5.** Go to the RF GENERATOR screen.
- Step 6.** Select the RF Gen Freq field, and rotate the cursor control knob to vary the RF generator's frequency.
- Step 7.** Go to the RF ANALYZER screen. Notice that the Tune Freq value changes to maintain the offset between the generator and the analyzer. (You can use the Prev key to switch between the generator and analyzer screens.)

Saving and Recalling Instrument Setups

The save and recall functions allow you to store different instrument setups and retrieve them later, eliminating the task of re-configuring the Test Set.

The number of available save registers depends on how many changes were made to the *base* instrument setup for each save. (See "[BASE Settings](#)" on page 50.) The smaller the number of changes, the greater the number of save registers that can be used (typically over 200).

Save/Recall register settings can be saved to internal RAM or to a PC card. Saving registers to a PC card allows you to “back up” the settings in case you need to clear them from memory for running large programs, or when a firmware upgrade is performed (see "[Memory Considerations](#)" on page 50).

To save an instrument setup

- Step 1.** Go to the I/O CONFIGURE screen.
- Step 2.** Select the storage media using the Save/Recall field. (The default is internal memory.)
- Step 3.** Make any changes to the instrument that you want to save in a register.
- Step 4.** Press and release the **Shift** key then the **Recall** key to access the **Save** function.
- Step 5.** Use the DATA ENTRY keys or the **Save :** menu to enter the register's name.

To recall an instrument setup

- Step 1.** Select the I/O CONFIGURE screen.
- Step 2.** Select the media to recall settings from using the Save/Recall field. The default is internal memory.
- Step 3.** Press **Recall**.
- Step 4.** Use the knob to select the desired setup to be recalled from the **Recall** menu.

To remove (clear) an individual save register

- Step 1.** Specify where the register is stored using the `Save/Recall` field on the `I/O CONFIGURE` screen.
- Step 2.** Press `Recall`.
- Step 3.** Use the knob to position the cursor in front of the register to be removed from the `Recall` menu at the bottom-right of the screen. The register name and percentage of memory occupied by that register are indicated at the top of the screen.
- Step 4.** Press `Yes On/Off`. A prompt appears, asking if you want to delete the save register.
- Step 5.** Press `Yes On/Off`.

To clear all save registers

- Step 1.** Press `Recall`.
- Step 2.** Use the knob to position the cursor in front of the `*Clr All*` entry in the `Recall` menu at the bottom-right of the screen.
- Step 3.** Press the knob or press `Enter`. A prompt appears at the top of the screen to verify that you want to clear all registers.
- Step 4.** Press `Yes On/Off`.

Register Names

You can use any number, letter, or combination of numbers and letters as a name for storing instrument settings. For instance; if you want to save a setup for testing a “Vulcan7” radio, you can save the setting as “VULCAN7”.

Two register names are reserved for special purposes: `POWERON` and `BASE`.

POWERON Settings

When the Test Set is turned on, it uses a set of instrument setup parameters specified at the time of manufacture. You can have the instrument power up in a different state by making the desired changes to the original settings, and then saving them using the name `POWERON`.

The next time the instrument is turned on, the instrument returns to the state present when you saved the `POWERON` setting. For instance; if the `SCOPE` screen was displayed when `POWERON` was saved, it is the screen that is displayed when you turn the instrument on.

BASE Settings

The *BASE* register contains any field settings the user has saved that are different from the instrument preset state. It establishes a reference point for all future saves. If a base is not saved, the preset state is used as the reference.

When you save an instrument setup, the new setup is compared to the base settings, and any *differences* are stored under the register name you supply. Because only differences are stored, a much larger number of instrument setups can be saved than if the contents of every field was saved.

When you recall an instrument setting, every field is reset to the base settings. The saved settings are then used to re-establish the desired instrument setup.

You can define your own base setting. If your desired settings are very different from the preset values, you may want to change the *BASE* register. This will decrease the amount of memory used to save each setup, and allow you to save many more setups.

CAUTION Since each save/recall register only contains the differences between the setup being saved and the present *base* register settings, changing the base settings causes all other saved setups to be erased from memory (including the *POWERON* setting if one has been saved). Unless you consistently change the same fields to the same value each time you use the instrument, you should avoid creating your own *BASE* settings.

Memory Considerations

When the *Save/Recall* field of the *I/O CONFIGURE* screen is set to *Internal*, programs are saved to the same non-volatile RAM used to create RAM disk(s) and run *IBASIC* programs. By saving a large number of instrument setups, you reduce the amount of RAM available to run programs. If you get a “memory overflow” message while trying to load a program, you must clear one or more save/recall registers to free RAM space.

Instrument Hardware Changes

Recalling a saved register that uses a hardware option that has been removed results in unspecified operation. Re-install the needed option before attempting to recall the associated register(s).

Using USER Keys

You can use user keys to move quickly between fields on the same screen, and to access fields that are not normally available on the screen you are using.

Local user keys are used to move between settings on the screen that is displayed. Five local user keys are available for each screen: k1, k2, k3, k4, and k5. When the user key is pressed, the cursor instantly moves to, and selects, the assigned field; eliminating the need to turn and push the knob. Using these keys removes any other local user keys you may have set up.

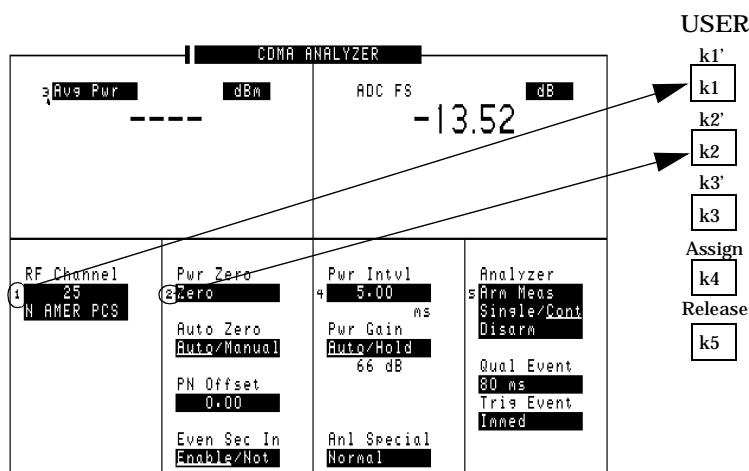
Global user keys are used to access settings that are not available on the current screen. Three global user keys are available: k1', k2', and k3'. (Use the **Shift** key to access the global user keys)

Using Pre-Defined USER Keys

To Use the Pre-Assigned Local USER Keys

- Step 1.** Press and release the **Shift** key, the **k4** key; then the **Enter** key. The numbers 1 through 5 appear in front of various fields. (See [figure 2-8](#).)
- Step 2.** Press the USER keys (k1 to k5) and notice how the cursor immediately moves to the corresponding field.
- Step 3.** To stop using the default user keys, press and release the **Shift** key, then the **k5** key to access the **Release** function; then press the **Enter** key.

Figure 2-8 An Example of Pre-Assigned Local User Keys



Assigning and Releasing USER Keys

When defining user keys, the **Assign** function is used to create key definitions; the **Release** function removes the definitions. Re-assigning a user key to a different field automatically releases it from its previous setting.

To assign local user keys

- Step 1.** Move the cursor to the field that you want to assign to a local user key.
- Step 2.** Press and release the **Shift** key, then the **κ4** key to access the **Assign** function. Then press a USER key (**κ1-κ5**). The user key number appears in front of the field you assigned it to. (Since the cursor is at the newly assigned field, the USER key number is hidden until the cursor is moved.)

To release local user keys

- Step 1.** Display the screen containing the user key assignment to be removed.
- Step 2.** Press and release the **Shift** key, then the **κ5** key to access the **Release** function; then press the USER key (**κ1-κ5**).

To assign global user keys

- Step 1.** Move the cursor to the field you want to assign a global USER key to.
- Step 2.** Press and release the **Shift** key, then the **κ4** key to access the **Assign** function. Then press **Shift** and a USER key (**κ1'- κ3'**). Unlike a local user key, the user key number *does not* appear at this field; instead, a prompt appears at the top of the screen confirming the key assignment.

To release global user keys

- Step 1.** Move the cursor to the field with the global user key assigned to it.
- Step 2.** Press and release the **Shift** key, then the **κ5** key to access the **Release** function. Then press **Shift** and the user key to be released.

Replacing Batteries

There are two methods by which the Test Set backs up its RAM. One is a set of two AA batteries mounted behind the rear panel of the Test Set. You must periodically change these batteries. The second method of RAM backup is an internal battery. It is not user serviceable.

CAUTION Failure to take prompt action may result in loss of RAM data including IBASIC programs and SAVE / RECALL states stored in the RAM.

NOTE Do not use rechargeable batteries.

To change the AA batteries, use the following procedure:

1. Turn off power and unplug the Test Set.
2. Remove the six screws in the rear panel using a TX-15 TORX (R) screwdriver.
3. Remove the rear cover.
4. Replace the AA batteries.
5. Replace and reconnect the rear panel. Dispose of used batteries properly.

3

Overview of the Test Set's Built-In Tools

- "Using RF Tools Program" on page 56
- "Using the Code Domain Analyzer" on page 67
- "Using the Spectrum Analyzer" on page 68
- "Using the Voltmeter and Audio Frequency Counter" on page 70
- "Using the Oscilloscope (Scope)" on page 71
- "Securing a Test Procedure" on page 75
- "Clearing RAM" on page 76
- "Using the LISTOPTS (list options) Program" on page 77
- "Using the DEMO Program" on page 78
- "Using the ST_PLT (store or plot) Program" on page 79

Using RF Tools Program

The RF Tools Program resides in the Test Set's ROM. The following tests and utility programs are available in this program.

See [Figure 3-1 on page 57](#) for instructions on loading the RFTOOLS program.

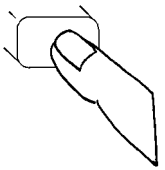











To run the tests or utilities in the RFTOOLS program:

1. Choose the test or utility you want to run from the list of choices.
2. Fill in the parameters that are displayed for each test.

The following tests and utility programs are available in this program.

- ["Swept Gain" on page 58](#)
- ["Discrete Freq Insertion Loss" on page 59](#)
- ["Swept Insertion Loss" on page 59](#)
- ["Swept Return Loss" on page 60](#)
- ["Cable Fault" on page 62](#)
- ["Replot Data Files" on page 65](#)
- ["Transfer Stored Data" on page 65](#)
- ["SA \(spectrum analyzer\) Self Calibration ON/OFF" on page 65](#)
- ["Catalog PC \(Memory\) Card" on page 66](#)
- ["Set Up Printer/Data Collection" on page 66](#)

Figure 3-1 Loading and Running RF Tools

<p>1 Press Menu to display the Software Menu screen.</p> 	<p>2 Position the cursor at Select Procedure Location: and select it.</p> <p>Position</p>  <pre>LOAD TEST PROCEDURE: Select Procedure Location: ██████████ Select Procedure Filename: ██████████</pre> <p>Select</p> 
<p>3 Position the cursor at ROM and select it.</p> <p>Position</p>  <pre>Choices: Card ROM RAM Disk</pre> <p>Select</p> 	<p>4 Position the cursor at Select Procedure Filename: and select it.</p> <p>Position</p>  <pre>LOAD TEST PROCEDURE: Select Procedure Location: ROM Select Procedure Filename: ██████████</pre> <p>Select</p> 
<p>5 Position the cursor at Choices: and select RFTOOLS.</p> <p>Position</p>  <pre>Choices: RFTOOLS XXXXXX YYYYYY</pre> <p>Select</p> 	<p>6 Position the cursor at Run Test and select it. The Software is now loading.</p> <p>Position</p>  <pre>1 Run Test 2 Continue 4 Help</pre> <p>Select</p>  <p>  Loading Time: First time: approximately three minutes. After first time: approximately 15 seconds. </p>

Swept Gain

This test measures the gain of a device by sweeping it over the specified frequency range. In the menu for this test, you can enter the frequency range over which the device is to be swept, the level into the device from the DUPLEX OUT port, and the maximum expected gain.

This test requires two 6-dB pads (attenuators). The pads are put on the Test Set's ANT IN and DUPLEX OUT ports to reduce impedance mismatch error at these ports. A reference level is obtained by connecting a short calibration cable between the pads on the DUPLEX OUT and ANT IN ports. Next, the test device is added between the calibration cable and one of the pads, and a measurement is made of the additional gain from the reference level. The trace of the device gain over the frequency range swept is displayed. The maximum gain is also displayed on the screen.

Discrete Freq Insertion Loss

This test measures the loss of a cable or device at a specified frequency. This test is the most accurate method for measuring insertion loss. In the menu for this test, you can enter the discrete frequency and signal level at which the measurement will be made.

This test requires two 6-dB pads. The pads are put on the ANT IN and DUPLEX OUT ports on the Test Set to reduce impedance mismatch error at these ports. A reference level is obtained by connecting a short calibration cable between the pads on the DUPLEX OUT and ANT IN ports. Next, the test cable or device is added between the calibration cable and one of the pads, and a measurement is made of the addition loss from the reference level. The insertion loss at the specified frequency is displayed on the screen.

NOTE

The insertion loss at the specified frequency is displayed twice. The second display is enlarged for easier reading.

Swept Insertion Loss

This test measures the loss of a cable or device by sweeping it over the specified frequency range. In the menu for this test, you can enter the frequency range over which the cable is to be swept.

This test requires two 6-dB pads. The pads are put on the ANT IN and DUPLEX OUT ports on the Test Set to reduce impedance mismatch error at these ports. A reference level is obtained by connecting a short calibration cable between the pads on the DUPLEX OUT and ANT IN ports. Next, the test cable or device is added between the calibration cable and one of the pads, and a measurement is made of the addition loss from the reference level. The trace of the cable loss over the frequency range swept is displayed. The average loss is also displayed on the screen.

Swept Return Loss

This test radiates a test signal when testing antennas or cables with antennas attached to them. Verify that the level and frequency span used for the test cannot result in interference to other nearby antennas. To minimize interference when running the program, set the power level at the DUPLEX OUT port to the minimum value needed for good measurement resolution. Set the frequency range carefully.

This test measures the return loss of a cable or device in the swept mode. A SWR bridge and two 6 dB pads are connected to the Test Set. The pads are used to reduce impedance mismatch errors between the SWR bridge and the DUPLEX OUT and ANT IN ports on the Test Set. You will be prompted at the start of the test to enter the start and stop frequencies. A reference level is measured first with a short or open on the DUT port of the SWR bridge. Then the return loss is measured with the cable or antenna-under-test. The trace showing return loss over the frequency band selected is displayed on the screen. Measured values for best and worst case return loss are printed at the top of the screen. VSWR can be calculated from the return loss.

The following formula can be used to determine the VSWR from the return loss:

VSWR

$$VSWR = \frac{1 + 10^{\frac{-RL}{20}}}{1 - 10^{\frac{-RL}{20}}}$$

VSWR is sometimes stated as a ratio. For example: 1.2:1 or “one point two to one” VSWR. The first number in the ratio is calculated from the formula above. The second number in the ratio is always one. [Table 3-1](#) and [Table 3-2](#) contain some of the values from this calculation.

Table 3-1 Return Loss (0 to 20 dB) to VSWR

Return Loss (dB)	0	2	4	6	8	10	12	14	16	18	20
VSWR	∞	8.7	4.4	3.0	2.3	1.92	1.67	1.50	1.38	1.29	1.22

Table 3-2 Return Loss (20 to 40 dB) to VSWR

Return Loss (dB)	20	22	24	26	28	30	32	34	36	38	40
VSWR	1.22	1.17	1.13	1.11	1.08	1.07	1.05	1.04	1.03	1.03	1.02

Estimating Antenna Return Loss

If you are measuring the return loss of an antenna connected to the end of a known good feed line, you can determine the approximate return loss of the antenna by subtracting twice the line loss. For example, if you measure a return loss of 24 dB and the line is known to have 2 dB loss, the estimated return loss of the antenna is 20 dB (since there is a total of 4 dB of loss as the signal is sent to the SWR bridge and reflected back to the Test Set). This estimate is in error if the coaxial line and connectors do not have a return loss somewhat greater than 24 dB.

Cable Fault

NOTE

Test Signal Can Cause Interference

When testing cables attached to antennas, test signals will be radiated. Verify that the signal used for the test cannot result in interference to another antenna.

This test operates over a wide frequency band. The test will always operate with a center frequency of 505 MHz. The frequency span however will be determined by the length of the cable measured. Longer cables will use a narrower frequency span. The frequency span equals 990 MHz for cables less than 50 feet long and gets narrower as the cable length increases. It is always safe to assume that the frequency span is less than or equal to 990 MHz.

This test displays the return loss of a transmission line as a function of the distance down the line. A frequency-swept signal from the DUPLEX OUT port is applied through a resistive power divider to the cable-under-test. Signals reflected from faults in the cable are combined with the DUPLEX OUT signal in the power divider and applied to the ANT IN port. The changing interference of the forward and reflected signals, over the swept frequency band, contains information about the distance to one or more faults. The software uses a Fast Fourier Transform (FFT) to convert the frequency domain into the distance domain. The distance displayed on the Test Set's CRT is the physical distance to the fault with correction for the velocity factor of the cable.

Cable Fault Performance

Measurements of the cable fault location can typically be made up to 500 feet on low-loss cables and 300 feet on higher-loss cables. Resolution of the fault location is approximately 0.4 feet for cable lengths up to 50 feet and then linearly increases to 4 feet for a 500 foot cable.

Selecting Cable Type

In the menu for this test, you can enter the following information:

- Cable length
- Cable length units
 - Pressing the knob toggles the selection between feet and meters.
- Cable class
 - Pressing the knob allows selection of Heliax, RG, and custom options.
- The next menu varies depending on the selection for cable class:
 - If `Custom` is selected, you can enter the cable's velocity of propagation constant and attenuation per 100 feet (or meters). The propagation velocity must be a value between 0 and 1.
 - If `RG` is selected, you can enter the cable type with the example `[RG 58/U = 58]`. You must enter a value between 0 and 1000.
 - If `Heliax` is selected, you can enter the cable type. A list of choices (foam, air, and flex of varying thickness) is displayed. Use the knob to select the desired cable type.
- Press `κ1` (or select `Begin Test`) when all the appropriate entries have been made.
- Connect the cables as instructed, and press `κ1` (`Proceed`).

Velocity factors and attenuation. Cables that use polyethylene dielectric typically have a propagation velocity of 0.66, cables that use a teflon dielectric typically have a propagation velocity of 0.70. If the cable attenuation is unknown, enter 0 dB per 100 feet (or meters). Entering 0 dB/100 will produce return loss values lower than actual, but fault distance can be accurately detected.

Typical cable fault return loss measurements. Return loss is a ratio of input power to reflected power. For example, if 100 Watts was applied to a cable and 10 Watts was returned, the return loss is 10 dB ($10 \log (100/10)$). In the same example, if 1 Watt was returned, the return loss is 20 dB ($10 \log (100/1)$). Typical return loss measurements for the cable loss test are listed below:

- Open-Circuit Cable = 0 dB
- Short-Circuit Cable = 0 dB
- 50-Ohm Terminated Cable = 20 to 30 dB
- Antenna = 10 to 20 dB

Return loss measurements below 25 dB should be considered excellent. For best results, the cable output should be terminated in 50 ohms.

Entering Cable Length

The greatest accuracy is obtained when you enter a cable length slightly greater than the actual cable length, considering length uncertainty. If you are not sure of the cable length, enter a value 1.5 times the estimated length. Depending on the return loss of the antenna or device at the end of the cable, you may see a high relative mismatch displayed at the actual length of the cable.

Replot Data Files

This utility allows you to easily retrieve and display plots which were previously stored on an SRAM PC card. One or two plots may be displayed at one time.

No measurements are performed.

Transfer Stored Data

This utility may be used to easily transfer data collection files (test results) from an SRAM PC card over the serial or HP-IB port. You do not need to write an IBASIC program. No measurements are performed.

SA (spectrum analyzer) Self Calibration ON/OFF

This test allows you to check the status of the Test Set's spectrum analyzer, and change the status if you desire.

The RFTOOLS program uses the Test Set's internal spectrum analyzer for making network analyzer measurements. The internal spectrum analyzer performs an automatic self calibration every 5 minutes. This automatic self calibration insures that the spectrum analyzer operates within specified limits regardless of the operating temperature. However, this self calibration can introduce instability in spectrum analyzer output after the Test Set is operating at a constant temperature (after approximately 30 minutes).

Each RFTOOLS test includes two parts; calibration and measurement. If the spectrum analyzer performs a self calibration between the calibration and measurement of the RFTOOLS test, the spectrum analyzer automatic self calibration instability will increase RFTOOLS test measurement error. To avoid this problem, you may use this test to turn off the spectrum analyzer self calibration. This self calibration should only be turned off after the unit has reached a constant powered-on operating temperature (approximately 30 minutes after power-on). By turning the self calibration off, the measurement accuracy and stability of RFTOOLS tests will improve.

Catalog PC (Memory) Card

This utility lists all the files contained on the PC card. The PC card that you want to catalog must be inserted prior to selecting this test.

- LIF file types are denoted by the following prefixes and suffixes:
 - c prefix denotes a program code file
 - l prefix denotes a library file
 - p prefix denotes a procedure file
 - _d suffix denotes a data file
 - _p suffix denotes a plot file
- DOS file types are denoted by the following suffixes:
 - .PGM suffix denotes a program code file
 - .LIB suffix denotes a library file
 - .PRC suffix denotes a procedure file
 - .DAT suffix denotes a data file
 - .PLT suffix denotes a plot file

Set Up Printer/Data Collection

This utility allows you to collect measurement data using a printer or a PCMCIA card. The following table shows the parameters that can be set using this utility. These parameters can also be found on the PRINTER CONFIGURE screen and the I/O CONFIGURE screen.

Table 3-3 Parameters for Set Up Printer and Data Collection

<ul style="list-style-type: none"> • Data Collection <ul style="list-style-type: none"> • Off • Serial 9 <ul style="list-style-type: none"> • Serial Baud • Parity • Data Length • Stop Length • Flow Control <ul style="list-style-type: none"> • None • Xon/Xoff • Hardware • PCMCIA 	<ul style="list-style-type: none"> • Printer <ul style="list-style-type: none"> • Off • Serial 9 <ul style="list-style-type: none"> • Serial Baud • Parity • Data Length • Stop Length • Flow Control <ul style="list-style-type: none"> • None • Xon/Xoff • Hardware • Parallel 15 • HPIB 701 	<ul style="list-style-type: none"> • Printer Configuration <ul style="list-style-type: none"> • Lines/Page • Form feed at start of page • Form feed at end of page • HPIB Address 	<ul style="list-style-type: none"> • Output Heading 1 • Output Heading 2
---	--	---	--

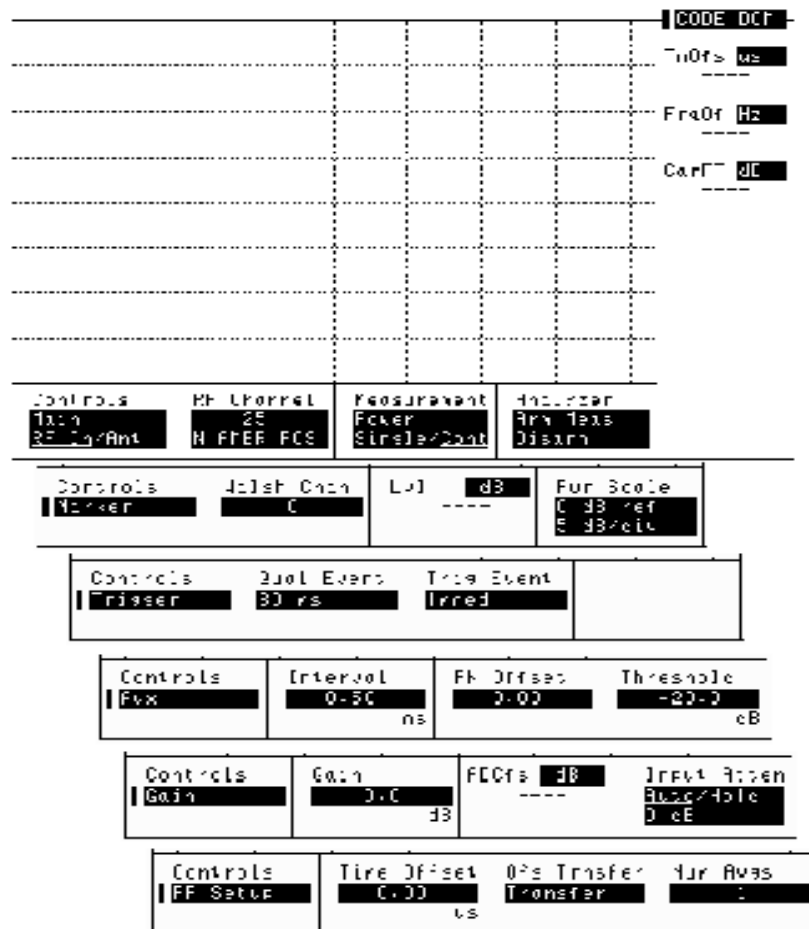
Using the Code Domain Analyzer

The code domain analyzer graphically displays the power, phase, and timing of the CDMA signal's 64 Walsh channels. It is a correlated measurement, requiring an external timing signal, such as the even second clock or the $16 \times$ chip (19.6608 MHz) clock, to initiate a valid measurement.

Selecting the Code Domain Analyzer's Controls Menus

Several levels of menus are used to access the various controls associated with the code domain analyzer. "Control Fields for CDMA Measurements" on page 93 provides a description for each field on the code domain analyzer's menus. See "CDMA Measurements" on page 82 and the *HP 8935 CDMA Base Station Tests Applications Guide* for more information about code domain measurements.

Figure 3-2 Code Domain Analyzer Menus



Using the Spectrum Analyzer

Automatic Calibration

During operation, the spectrum analyzer pauses for approximately 2 seconds every 5 minutes to recalibrate itself. This does not affect the accuracy of displayed measurements, but does cause a brief interruption of the displayed information during the process.

Setting Resolution Bandwidth and Sweep Rate

The resolution bandwidth and sweep rate are determined by the span setting, and cannot be set independently.

These settings are listed in the following table.

Table 3-4 Relationship Between Span, Resolution Bandwidth, and Sweep Rate

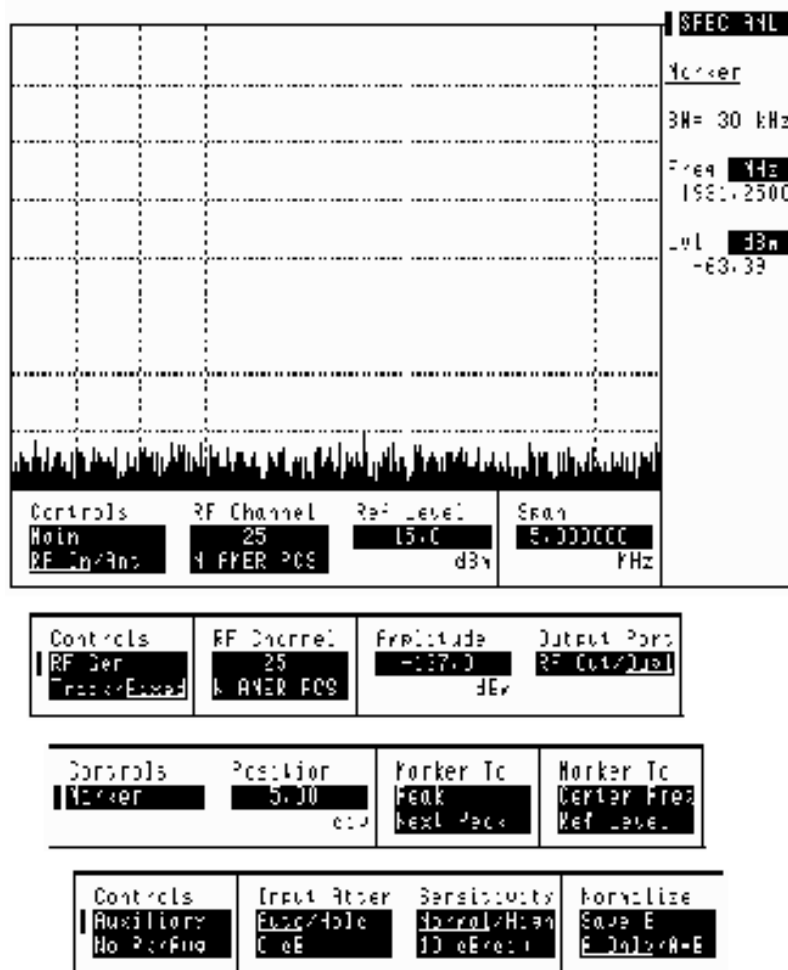
Span	Resolution BW (kHz)	Sweep Rate
<50 kHz	0.3	28.6 kHz/second
<200 kHz	1.0	329.0 kHz/second
<1.5 MHz	3.0	3.0 MHz/second
<3 MHz	30.0	21.4 MHz/second
<18 MHz	30.0	36.3 MHz/second
<200 MHz	300.0	257.0 MHz/second
1 GHz	300.0	1.0 GHz/second

Selecting the Spectrum Analyzer's Controls Menu

Several levels of menus are used to access the various controls associated with the spectrum analyzer (see "Spectrum Analyzer Controls Menu" on page 69).

"Control Fields for Analog Measurements" on page 123 provides a description for each field on the spectrum analyzer's menus.

Figure 3-3 Spectrum Analyzer Controls Menu



Using the Voltmeter and Audio Frequency Counter

The voltmeter can be used to measure ac and dc voltages. The input to the voltmeter is determined by the AF Anl In field on the AF ANALYZER screen.

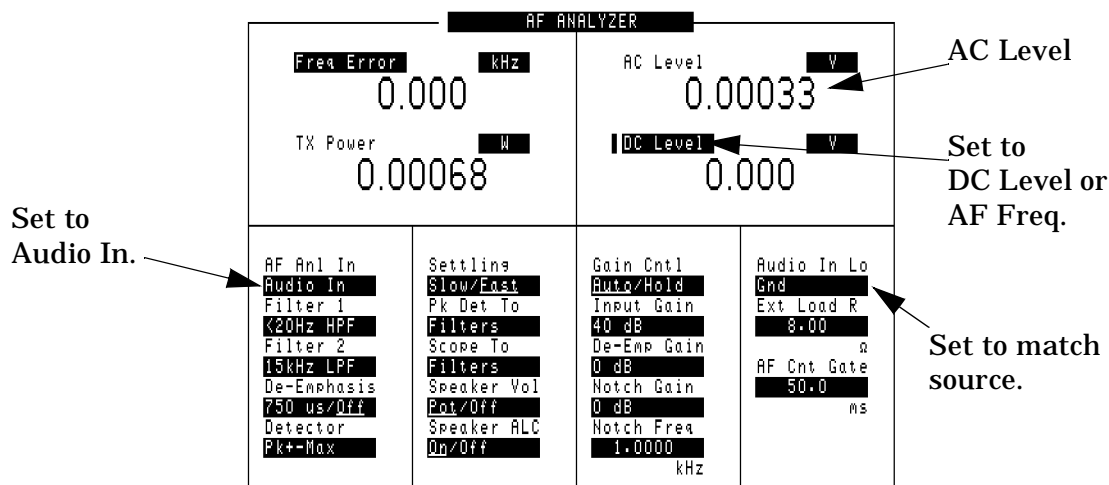
To measure external voltages:

1. Select the AF ANALYZER screen.
2. Set the AF Anl In field to Audio In.
3. Set the Audio In Lo field to match the source you are measuring (600 ohm impedance, floating output amplifier, ground referenced voltage). See the "Audio In Lo" field on page 127 for more information.
4. Connect the signal to be measured to the AUDIO IN connector(s). The AUDIO IN HI connector can be used alone as long as the Audio In Lo field is set to Gnd. The AUDIO IN LO connector must also be used if the Audio In Lo field is set to 600 to Hi or Float.

The ac level is displayed. See Figure 3-4 .

5. Select the lower-right measurement display field. See Figure 3-4 .
 - Select DC Level to display the dc level.
 - Select AF Freq to display the audio frequency.

Figure 3-4 Measuring AC and DC Voltages



Using the Oscilloscope (Scope)

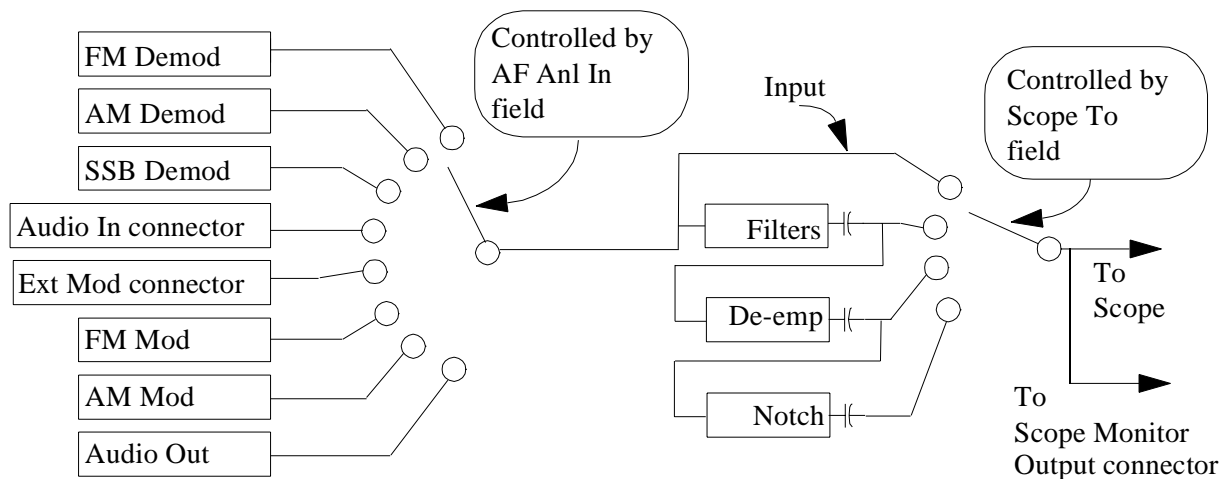
The built-in 50 kHz oscilloscope provides

- multiple triggering formats (internal and external)
- single-shot and pre-trigger viewing for single events
- full marker capability with automatic level and time readout

Time/division, volts/division and vertical offset are displayed and can be changed using the front-panel knob.

Input to the oscilloscope is provided from various sources including direct inputs to the AUDIO IN (HI and LO) and ANALOG MODULATION IN connectors. Oscilloscope functions are accessed from the AF ANALYZER and SCOPE screens.

Figure 3-5 Inputs and Filters for the Oscilloscope



Selecting the Oscilloscope's Input

Step 1. Press **Shift**, then **RF Anl (AF Anl)** to select the AF ANALYZER screen.

Step 2. Select the **AF Anl In** field. A list of choices appears.

Step 3. Select the desired input to the scope:

- **FM Demod** for FM demodulated audio from input signals connected to the RF IN/OUT or ANT IN connectors.
- **AM Demod** for AM demodulated audio from input signals connected to the RF IN/OUT or ANT IN connectors.
- **SSB Demod** for SSB demodulated audio from input signals connected to the RF IN/OUT or ANT IN connectors.
- **Audio In** for a signal connected to the AUDIO IN connector.
- **Ext Mod** for a signal connected to the ANALOG MODULATION IN connector.
- **FM Mod** for the FM modulated audio from the RF generator section.
- **AM Mod** for the AM modulated audio from the RF generator section.
- **Audio Out** for the signal present at the SCOPE MONITOR OUTPUT connector.

The input to the oscilloscope is displayed on the SCOPE screen.

Selecting the Oscilloscope's Filters

Step 1. Press **Shift**, then **RF Anl (AF Anl)** to select the AF ANALYZER screen.

Step 2. Select the **Scope To** field. A list of choices should appear.

Step 3. Select the desired filtering for the signal:

- **Input** if you want no filtering (dc coupled)
- **Filters** to route the audio to the oscilloscope after passing through Filters 1 and 2 (ac coupled).
- **De-emp** to route the audio to the oscilloscope after passing through Filters 1 and 2, and the de-emphasis circuitry (ac coupled).
- **Notch** to route the audio to the oscilloscope after passing through Filters #1 and #2, the de-emphasis circuitry, and notch circuitry (ac coupled).

Triggering the Oscilloscope

You can control following triggering features of the oscilloscope:

- Trigger external or internal
- Automated or normal triggering
- Continuous or single shot triggering
- Trigger level
- Trigger delay

The oscilloscope is triggered using the Trigger menu. Select this menu with the following procedure:

Step 1. Press **Shift**, then **Spec Anl (Scope)** to go to the SCOPE screen.

Step 2. Select the **Controls** field, then choose **Trigger** from the list of choices.

Using the Oscilloscope's Marker

The marker is used to help you make measurements with the oscilloscope. By repositioning the marker, you can measure the level and time.

The marker is controlled using the marker menu. Select this menu with the following procedure:

Step 1. Press **Shift**, then **Spec Anl (Scope)** to go to the SCOPE screen.

Step 2. Select the **Controls** field, then choose **Marker** from the list of choices.

Using IB_UTIL Programs

See "[Securing a Test Procedure](#)" on page 75 for information about the SECURE_IT program. See "[Clearing RAM](#)" on page 76 for information about the RAM_MANAGER program.

COPY_PL

The COPY_PL program allows you to copy procedures and libraries from one PC card to another. See the *HP 8935 Programmer's Guide* for more information about procedures and libraries.

FILE_XFER

The FILE_XFER (file transfer) program transfers files on a PC card to a device attached to either the HP-IB or to SERIAL PORT 9.

RAM_USAGE

The RAM_USAGE program lists the following information about the Test Set's RAM:

- Total RAM installed
- RAM disk allocations
- Save register allocations
- Approximate RAM available for IBASIC programs

Securing a Test Procedure

The password option for securing a test procedure is accessed by loading and running the `SECURE_IT` ROM program. This program is accessed by running the `IB_UTIL` program.

Step 1. Select the SOFTWARE MENU screen.

Step 2. Select the Select Procedure Location: field and choose ROM.

Step 3. Select the Select Procedure Filename: field.

- a. Select `IB_UTIL` from the list of programs. Press Run Test to display a list of procedures; select `SECURE_IT` and follow directions to secure the desired information.

Clearing RAM

RAM can be cleared using the `RAM_MANAGER` program in the Test Set's ROM. This program clears *all* RAM, including any SAVE/RECALL registers saved to Internal RAM.

This program is accessed by running the `IB_UTIL` program.

Step 1. Select the SOFTWARE MENU screen.

Step 2. Select the `Select Procedure Location:` field and choose ROM.

Step 3. Select the `Select Procedure Filename:` field.

- Select `IB_UTIL` from the list of programs. Press `Run Test` to display a list of procedures; select `RAM_MANAGER` and follow directions to clear RAM.

To preserve the SAVE/RECALL registers, do not use the `RAM_MANAGER` program. Instead, load any other test program from a card or from RAM to clear the previous test program, and then reload the desired test.

See the ["Save/Recall" field on page 179](#), and ["Saving and Recalling Instrument Setups" field on page 48](#) for more information about save/recall registers.

Using the LISTOPTS (list options) Program

You can list the options that are installed in your Test Set (if any) using the LISTOPTS program. LISTOPTS also displays the firmware version of your Test Set.

To run the LISTOPTS program

- Step 1.** Select the SOFTWARE MENU screen.
- Step 2.** Select the Select Procedure Location: field and choose ROM.
- Step 3.** Select the Select Procedure Filename: field.
- Step 4.** Select LISTOPTS from the list of programs.
- Step 5.** Press Run Test to run the program and follow the directions on the screen.

Using the DEMO Program

You can use the DEMO program to learn about the capabilities of the Test Set. This program demonstrates some of the most useful features of the Test Set.

To run the DEMO program

- Step 1.** Select the SOFTWARE MENU screen.
- Step 2.** Select the `Select Procedure Location:` field and choose ROM.
- Step 3.** Select the `Select Procedure Filename:` field.
- Step 4.** Select DEMO from the list of programs.
- Step 5.** Press `Run Test` to run the program and follow the directions on the screen.

Using the ST_PLT (store or plot) Program

This program allows you to store a spectrum analyzer, or oscilloscope trace on PC card or to plot a stored trace from a PC card.

To run the ST_PLT program

- Step 1.** Select the SOFTWARE MENU screen.
- Step 2.** Select the Select Procedure Location: field and choose ROM.
- Step 3.** Select the Select Procedure Filename: field.
- Step 4.** Select ST_PLT from the list of programs.
- Step 5.** Press $\kappa 1$ (Run Test) to run the program and follow the directions on the screen.
- Step 6.** Press $\kappa 2$ (Show Info) to display the trace's parameters (such as frequency, level, span, and so forth).

Overview of the Test Set's Built-In Tools
Using the ST_PLT (store or plot) Program

4

CDMA Measurements - Screens and Control Fields

- “Average Power Measurements” on page 82
- “Channel Power Measurements” on page 83
- “Rho Measurements” on page 84
- “Error Vector Magnitude (EVM) Measurements” on page 88
- “Code Domain Measurements” on page 89
- “Control Fields for CDMA Measurements” on page 93

CDMA Measurements

Average Power Measurements

Avg Pwr

Avg Pwr displays the average power level of all signals at the RF IN/OUT port. The units (watts, volts, or dBm) can be changed by positioning the cursor in front of the units field and then pressing the desired units key. (See "Input Port" field on page 136.) Refer to the *HP 8935 CDMA Base Station Tests Applications Guide* for more information about average power measurements.

Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR

ADC FS

ADC FS is displayed when average power is measured. **ADC FS** indicates how close the measured power level is to the maximum allowed input level at the RF IN/OUT port for a particular **Pwr Gain** setting (on the CDMA ANALYZER screen). Changes to **ADC FS** can be made by altering the **Pwr Gain** field setting and by altering the signal level into the RF IN/OUT port. **ADC FS** should be between -1.0 and -10 dB when the **Pwr Gain** field is set to Auto, and can be manually set up to -0.5 dB when set to Hold. The measurement will be aborted if **ADC FS** goes above -0.5 dB. Measurement accuracy may be degraded if **ADC FS** goes below -10 dB.

Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR

Channel Power Measurements

Chan Pwr

Channel power is the absolute power level of the RF signal in a 1.23 MHz bandwidth centered around the RF channel or tune frequency setting. This measurement must be calibrated using the Chan Pwr Cal field each time the tune frequency is changed. Refer to the *HP 8935 CDMA Base Station Tests Applications Guide* for more information about channel power measurements.

ADC FS

ADC FS is displayed when channel power is measured. ADC FS indicates how close the measured power level is to the maximum allowed input level at the RF IN/OUT port for a particular Gain setting (on the CDMA ANALYZER screen). Changes to ADC FS can be made by altering the Gain field setting and by altering the signal level into the RF IN/OUT port. ADC FS should be between -1.0 and -10 dB when the Gain field is set to Auto, and can be manually set up to -0.5 dB when set to Hold. The measurement will be aborted if ADC FS goes above -0.5 dB. Measurement accuracy may be degraded if ADC FS goes below -10 dB.

Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR

Rho Measurements

Rho

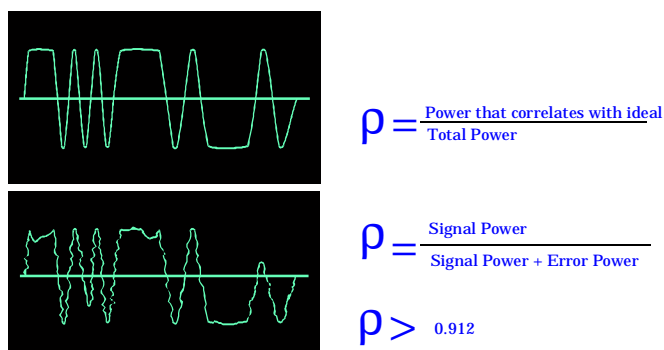
Rho is a measure of CDMA waveform quality which indicates how well the measured signal (the pilot signal transmitted by the base station under test) correlates with the ideal reference waveform (the ideal pilot generated by the Test Set which is mathematically perfect). This measurement is done through a complex DSP algorithm. Perfect correlation is when rho is equal to 1. The CDMA standard specifies 0.912 as the minimum accepted performance for CDMA base stations.

To make rho measurements, the base station needs to be configured to transmit only a pilot signal. The test equipment is then triggered by any of the selectable CDMA clocks.

Many different things can contribute to rho failure; this is a short list of them:

- compression in the linear power amplifier
- phase non-linearities (group delay)
- carrier feedthrough (see "[Carrier Feedthrough](#)" on page 87)
- I/Q magnitude and phase errors (see "[Magnitude Error](#)" on page 88 and "[Phase Error](#)" on page 88)

Figure 4-1 Rho



Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR

Frequency Error

Frequency error is displayed when the `Rho` measurement is selected. Frequency error is the difference between the base station's transmitter frequency and the frequency you enter in the `Tune Freq` field.

Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR

Time Offset

Time offset is displayed when the `Rho` measurement is selected. Time offset is the time difference between the base station's even second and the start of the short sequence. It indicates how well your transmitter's signal is time-aligned to system time. Time offset is measured at the base station's antenna. The displayed value is based on the value entered in the `PN Offset` field. (See the [PN Offset field description, on page 106.](#))

In [Figure 4-2 on page 86](#) the first example is a measurement with a time offset of zero. The beginning of the received data block aligns with the first pilot PN chip of the reference signal. Zero time offset indicates that the trigger event to the CDMA Analyzer coincided with the arrival of the base station signal's first pilot PN chip.

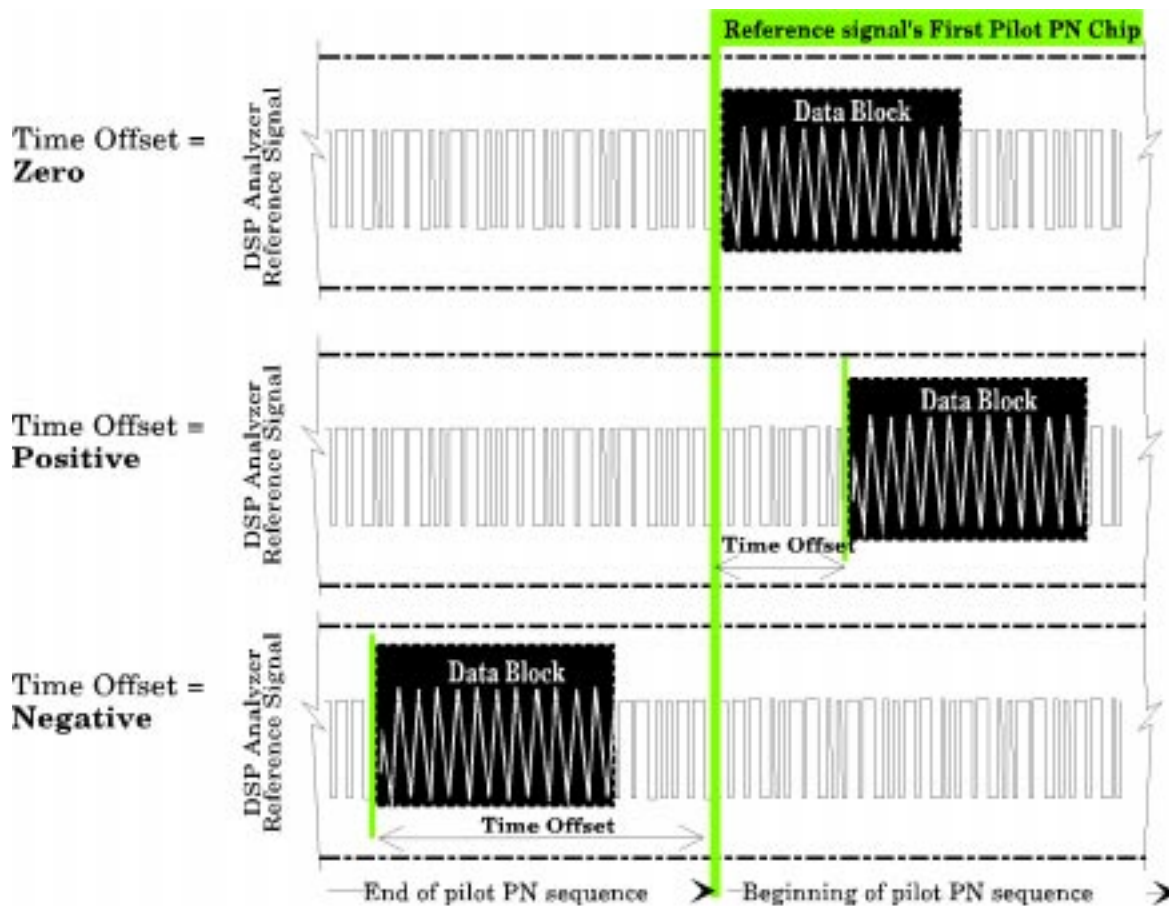
When the base station's signal is delayed relative to the trigger event, time offset will be a positive value. The second example is a measurement with a positive time offset. The beginning of the data block will align with a portion of the reference signal toward the end of a pilot PN sequence. This indicates that the trigger event to the CDMA Analyzer occurred when the base station was still transmitting a pilot PN sequence prior to the first pilot PN chip of the expected sequence.

When the base station's signal is early relative to the trigger event, time offset will be a negative value. The third example is a measurement with a negative time offset. The beginning of the data block will align with a portion of the reference signal after the first pilot PN chip. This indicates that the trigger event to the CDMA Analyzer occurred after arrival of the base station signal's first pilot PN chip.

Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR
- CODE DOM (Code Domain Analyzer)

Figure 4-2 Time Offset

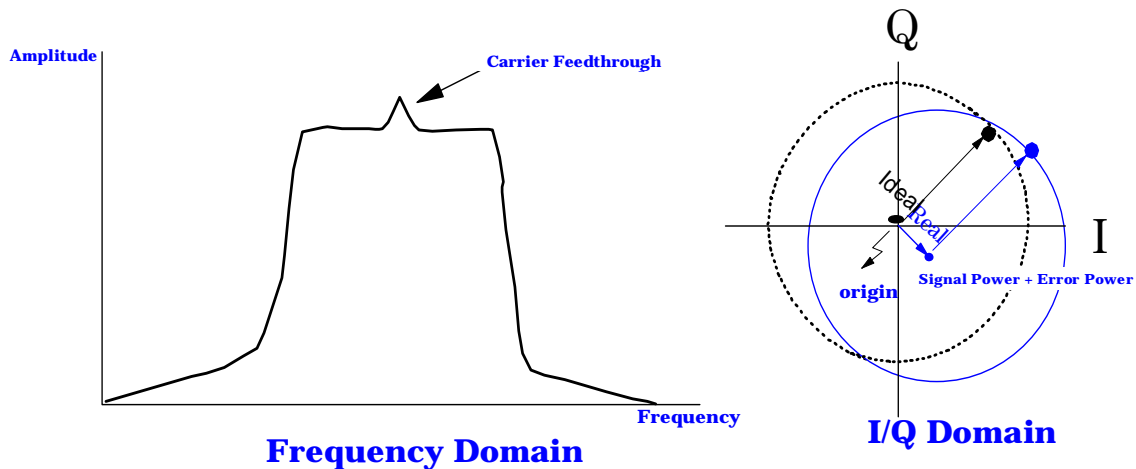


Carrier Feedthrough

Carrier feedthrough is displayed when the ρ measurement is selected. Carrier feedthrough is a common cause of bad ρ measurements. Carrier feedthrough is a result of RF carrier signal feeding through the I/Q modulator and getting on the output circuitry without getting modulated. A good carrier feedthrough level is lower than -25 dB (such as -29 dB).

As shown in the diagram, a perfect constellation is offset by the magnitude of the carrier feedthrough. In the frequency domain, carrier feedthrough can show up as an uncorrelated energy spike that can be seen on the spectrum analyzer by closely scanning the top of the trace. The effects of carrier feedthrough can also show up as higher noise levels on the CODE DOM screen. The inactive Walsh codes will be pushing the -27 dB specification for noise. Carrier feedthrough can be caused by the lack of isolation across the mixer and cavity of the transmitter's I/Q modulator. Shielding can help reduce carrier feedthrough.

Figure 4-3 Carrier Feedthrough



Screens on which this measurement is displayed.

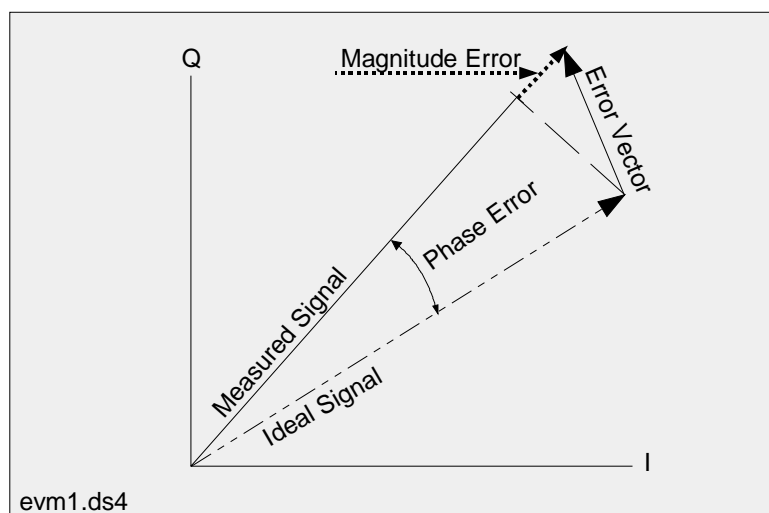
- CDMA ANALYZER
- CDMA GENERATOR
- CODE DOM (Code Domain Analyzer)

Error Vector Magnitude (EVM) Measurements

EVM

EVM is a measurement of the accuracy of the phase and amplitude of the QPSK (Quadrature Phase Shift Keying) or Offset QPSK (OQPSK) modulation. Expressed as a percentage, it is the RMS magnitude value of the error vector which connects the ideal signal phasor to a measured signal phasor at the detection decision points.

Figure 4-4 Components of Error Vector Magnitude



The magnitude of this error vector represents the “error” between the ideal signal and the measured signal.

As part of the measurement, the signal is corrected for clock delay, carrier frequency, carrier phase, and amplitude scaling.

Screens on which this measurement is displayed.

- CDMA ANALYZER
- CDMA GENERATOR

Magnitude Error

Magnitude Error is the difference in the RMS magnitude value (in percent) between the ideal signal phasor and the compensated, measured signal phasor at the detected decision points.

Phase Error

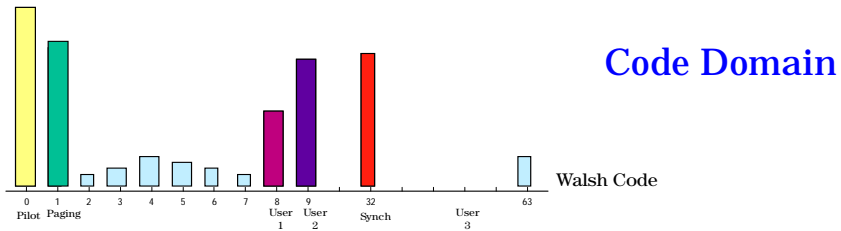
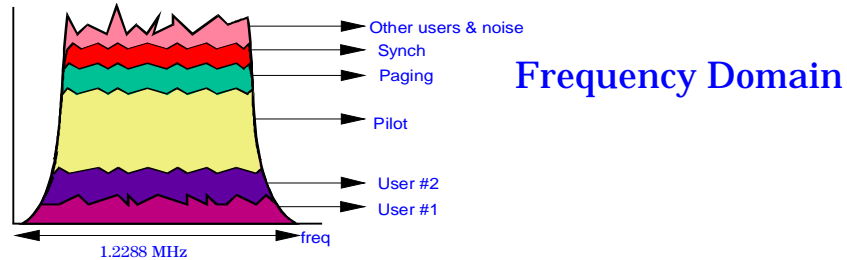
Phase Error is the RMS value of the difference in phase (degrees) between the ideal signal phasor and the compensated, measured signal phasor at the detection decision points.

Code Domain Measurements

The following measurements are displayed on the CODE DOM (code domain analyzer) screen: power, fast power, timing and phase. Measurements are selected from the Measurement field on the Main controls menu.

Time offset (Tm Ofs) and frequency offset (FreqOfs) are always displayed when any code domain measurement is made. Carrier feedthrough (CarFT) is also displayed except when fast power is measured.

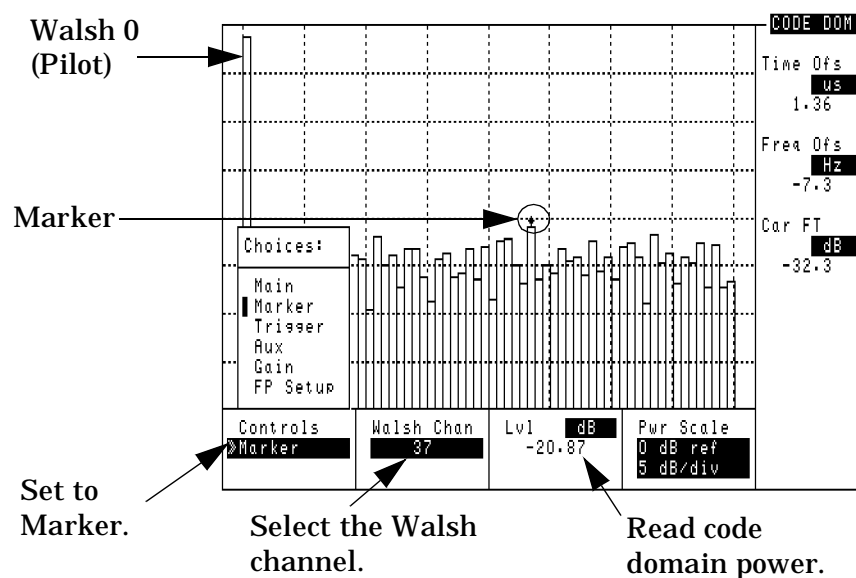
Code Domain Power



Code Domain Power (Power)

Code domain power displays the power in each of the 64 Walsh channels, relative to the total power inside 1.23 MHz bandwidth centered at the tune frequency. The 64 Walsh codes (0 through 63) are represented by a vertical bar on the analyzer's display. Because this is a relative measurement, the unit-of-measure is always dB. This allows a comparison of signal levels between the pilot, sync, paging and traffic channels. (Pilot is about two-thirds of the total energy.)

Figure 4-5 Reading Code Domain Power



Screens on which this measurement is displayed.

- CODE DOM (Code Domain Analyzer)

Fast Power

Fast power is a faster method of measuring code domain power. A value for Time Offset must be transferred from a non-fast power measurement before fast measurements begin, or when changes to any of the following fields occur: Data Rate, PN Offset, CDMA TB, Synth Ref.

See the "[Ofs Trnsfer](#)" field on page 105 for more information.

The number of measurement averages can be entered in the Num Avgs field on the FP Setup menu. This number is used to calculate and display successive code domain power measurements.

Screens on which this measurement is displayed.

- CODE DOM (Code Domain Analyzer)

Code Domain Timing (Timing)

Code domain timing is the difference in time between pilot (Walsh 0) and other Walsh codes with the same forward CDMA channel. In the CODE DOM screen, this measurement is indicated as positive or negative bar with the size of the bar indicating how far ahead or behind the other Walsh channels are relative to the pilot. Signals above the reference are leading in time; signals below the reference are lagging. (See [figure 4-6](#).)

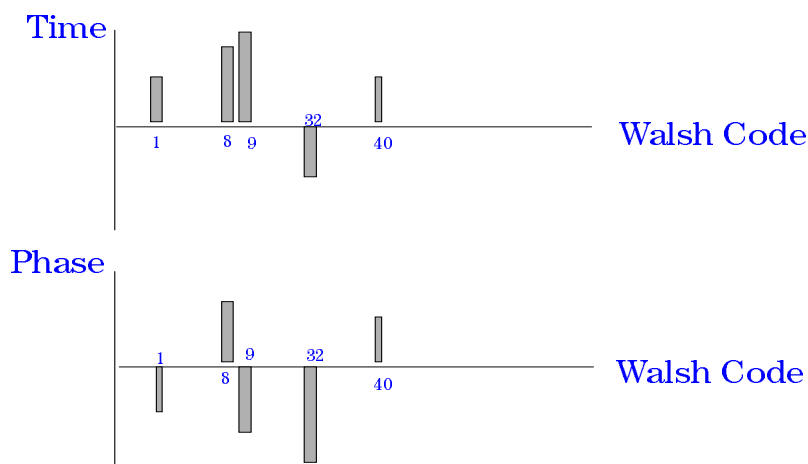
Screens on which this measurement is displayed.

- CODE DOM (Code Domain Analyzer)

Code Domain Phase (Phase)

Code domain phase is the difference in phase between the pilot and other code channels (Walsh codes) within the same forward CDMA channel. It displays the phase error for each of the 64 Walsh channels relative to the pilot channel (Walsh 0). This measurement is indicated as positive or negative bars on the Test Set's CODE DOM screen. The size of the bar indicates how much the phase of other Walsh codes lead or lag the pilot. Signals above the reference are leading in phase; signals below the reference are lagging.

Figure 4-6 Code Domain Timing and Phase



Screens on which this measurement is displayed.

- CODE DOM (Code Domain Analyzer)

Control Fields for CDMA Measurements

ADCfs or ADC FS

ADCfs indicates how close the measured power level is to the maximum allowed input level for the analyzer's Analog-to-Digital Converter (ADC). This level is affected by the Gain setting on the CODE DOM screen, the Input Atten, Gain, and, Pwr Gain settings on the CDMA ANALYZER screen, and the RF level of the signal connected to the Test Set.

For best measurement performance, ADCfs should be between -1.0 and -10 dB. The measurement will be aborted if ADCfs goes above 0 dB. Measurement accuracy may be degraded if ADCfs goes below -10 dB.

Screens on which this field is present

CODE DOM (Code Domain Analyzer) screen: gain controls menu
CDMA ANALYZER (ADC FS)
CDMA GENERATOR (ADC FS)

Amplitude

This field sets the output level of the RF generator to the RF IN/OUT or DUPLEX OUT port. Use the DUPLEX OUT port for signal levels greater than -26 dBm.

Screens on which this field is present

CDMA GENERATOR

Analyzer (CDMA analyzer)

The Analyzer field controls three functions:

- `Arm Meas` arms the CDMA analyzer. The CDMA analyzer needs to be armed only when `Single` (see below) is selected.
- `Single/Cont` selects between “single” measurements and “continuous” measurements.
 - When `Single` is chosen, you must arm each measurement by selecting the `Arm Meas` field (see above).
 - When `Cont` (continuous) is chosen, measurements are automatically armed.

The default selection is `Cont`.

- `Disarm` disarms the CDMA analyzer during single operation. To stop continuous measurements, select `Single`. Selecting `Disarm` does not prevent the analyzer from being re-armed during continuous measurements

Screens on which this field is present

CDMA ANALYZER

Analyzer (code domain analyzer)

This field is used to arm or disarm measurements when making a single measurement (does not affect continuous measurements). Selecting `Disarm` stops the analyzer during a single measurement.

See the "[Measurement](#)" field on page 104 for more information.

Screens on which this field is present

COD DOM (Code Domain Analyzer): main controls menu

Anl Dir

This field is used to select the type of signal (forward or reverse link) to analyze.

- Fwd sets the analyzer to look for base station transmitter data (forward link).
- Rev sets the analyzer to look for mobile transmitter data (reverse link).

Default selection: Fwd

Screens on which this field is present

CDMA ANALYZER

Anl Special

Analyzer special modes change how IQ modulated signals are analyzed.

- Normal sets the CDMA generator and CDMA analyzer to create and analyze signals with standard rotation.
- Inverted sets reverse rotation for I and Q signals; opposite to the direction specified in the IS-95 standards. In this mode, the CDMA generator creates reverse-rotation IQ signals and the CDMA analyzer expects reverse-rotation IQ signals.

Screens on which this field is present

CDMA ANALYZER

Auto Zero

This field is displayed for average power measurements.

Auto is used to automatically zero the average power measurement periodically during operation.

Manual is used to override the Auto feature. When Manual is selected, you must manually zero the average power measurement by selecting the Pwr Zero field.

Screens on which this field is present

CDMA ANALYZER

Car FT

This field is a measurement display field. See "[Carrier Feedthrough](#)" on [page 87](#) for more information about this measurement.

Screens on which this field is present

COD DOM (Code Domain Analyzer)

Chn Pwr Cal

This field is displayed when the channel power measurement is selected. It is used to calibrate the channel power measurement. When this field is selected, an internally generated calibration signal is measured using the average power technique. Channel power is also measured and a correction factor is generated. This correction factor is applied to subsequent channel power measurements. Calibration should be performed whenever a new set of measurements is made and whenever the frequency of the measured signal is changed. See "[Calibrating the Channel Power Measurement](#)" on [page 41](#) for more information.

Screens on which this field is present

CDMA ANALYZER

Controls

Code domain analyzer settings are arranged into several menus that are accessed using the `Controls` field. The control groups are:

- `Main` accesses the `RF In/Ant`, `Tune Freq` (or `RF Channel`), `Measurement`, and `Analyzer` fields.
- `Marker` controls the marker to look at the level of individual Walsh channels.
- `Trigger` accesses the trigger controls: `Qual Event` and `Trig Event`.
- `Aux` accesses the `PN Offset`, `measurement Threshold`, and `measurement Interval` fields.
- `Gain` lets you alter the gain into the CDMA analyzer while reading the `ADCfs` value.
- `FP Setup` accesses the offset transfer and number of averages fields used to make fast power measurements.

Many of these controls are duplicates from the CDMA ANALYZER and CDMA GENERATOR screens.

Screens on which this field is present

COD DOM (Code Domain Analyzer): all menus

CW RF Path

This field selects the path for the RF generator's signal.

- **Bypass** disables the IQ modulator. This mode is used when generating standard AM, FM, or CW signals in the Test Set.
- **IQ** enables the IQ modulator.

See the "[Data Source](#)" field on page 99 for more information.

Screens on which this field is present

CDMA GENERATOR

Data Rate

This field allows receiver testing at data rates of 9.6 or 14.4 Kbps.

If the data buffer is the selected data source, and the data rate is changed, the transmission state will change to Idle. Select Send to resume data output at the new rate.

Choices

- 14.4 Kbps
- 9.6 Kbps

Default selection: 9.6 Kbps

Screens on which this field is present

CDMA GENERATOR

Data Source

This field selects where the baseband quadrature spreader gets its data. This field is removed when the `Gen Mode` field is set to `Noise`.

- `Zeroes` uses a data stream of all 0's that is not encoded before being applied to the baseband quadrature spreader and output.
- `Ext` uses external data from the DATA IN connector. This data is not encoded before being applied to the baseband quadrature spreader.
- `Random` uses 300 frames of random, error-free data. (See `Data Buff` (below) for `Single/Cont`, `Idle/Send` operation.)
- `Data Buff` uses data previously loaded into the data buffer. You can load your own data into the buffer over HP-IB. This data is encoded before baseband quadrature spreading. Choosing this selection displays these additional fields:
 - `Single/Cont`
 - `Single` causes the data stream to be output once when `Send` is selected.
 - `Cont` causes the data stream to be repeated continuously when `Send` is selected. Changing to single operation while sending causes the data to be interrupted after the current 20 ms frame.
 - `Send/Idle`
 - `Send` causes the data stream to be output after two rising edges of the internal 80 ms clock are detected.
 - `Idle` indicates that data from the buffer is not being transmitted. Selecting `Idle` while sending data interrupts the data at the completion of the current 20 ms frame. A data stream of all zeroes (encoded) continues to be transmitted after the initial data stream is interrupted. This is different from the `Zeroes` selection above where the data is not encoded.
 - `Start Frame` specifies the first frame of data to send.
 - `# of Frames` specifies how many frames of data to send.

Screens on which this field is present

CDMA GENERATOR

Even Sec In

This field controls the internal connection of the EVEN SECOND SYNC IN connector to the CDMA analyzer.

- When **Enable** is selected, signals applied to the EVEN SECOND SYNC IN connector synchronize the timing circuits.
- When **Not** is selected, input signals applied to the EVEN SECOND SYNC IN are ignored. This mode may be useful when signals other than an even-second clock are used for synchronization. For example, when using a one-second clock, you would select **Not** after synchronization to prevent the internal even-second clock from being retriggered half-way through its cycle.

Screens on which this field is present

CDMA ANALYZER
CDMA GENERATOR

Freq Err

This measurement display field displays the frequency offset (frequency error). See "[Frequency Error](#)" on page 85 for more information about this measurement.

Screens on which this field is present

COD DOM (Code Domain Analyzer)

Gain

This field sets the IF gain of the CDMA analyzer for rho, EVM, and channel power measurements. (Range: 0 dB to 36 dB in 6 dB steps.)

Gain is adjusted two ways:

- **Auto** measures the signal level and automatically adjusts the gain.
- **Hold** disables automatic operation to allow you to manually enter the desired gain by selecting the current gain setting and entering a new value using the keypad or cursor control knob.

This field is replaced by the **Pwr Gain** field when measuring average power. See the "[Input Atten](#)" field on page 102 for more information.

Screens on which this field is present

CDMA Analyzer
COD DOM (Code Domain Analyzer): gain controls menu

Gen Dir

This field sets the link direction of the CDMA signal.

- **Fwd** (forward) sets the CDMA generator to produce QPSK modulation to imitate a base station. The **EQ Filter** field is automatically set to **EQ_In** to apply an equalizing filter to the I and Q paths as part of the baseband filtering, but it can be changed to **Out**.
- **Rev** (reverse) sets the CDMA generator to produce OQPSK modulation to imitate a mobile station. The **EQ Filter** field is automatically set to **Out** (and cannot be changed) to remove the equalizing filter from the I and Q paths.

Screens on which this field is present

CDMA GENERATOR

Gen Mode

This field selects the type of modulation information sent to the CDMA generator's IQ modulator.

- **Data** allows data to be transmitted to simulate a traffic channel with no additive noise. (See the "[Data Source](#)" field on page 99.)
- **Eb/No** causes a combination of data and White Gaussian Noise (AWGN) noise to be transmitted. The value entered is the ratio between the energy of each information bit (E_b) and the noise spectral density (N_o), expressed in dB.
- **Noise** causes a signal modulated by White Gaussian Noise to be generated. The noise is band limited to 2 MHz and white inside a 1.25 MHz bandwidth centered around the **RF Gen Freq**. This selection removes the **Data Source**, **Start Frame**, and **# of Frames** fields from the screen; those fields are only used with the **Data** and **Eb/No** entries.

Screens on which this field is present

CDMA GENERATOR

Gen Special

Generator special modes change how IQ modulated signals are generated.

- `Normal` sets the CDMA generator and CDMA analyzer to create and analyze signals with standard rotation.
- `Inverted` sets reverse rotation for I and Q signals; opposite to the direction specified in the IS-95 standards. In this mode, the CDMA generator creates reverse-rotation IQ signals and the CDMA analyzer expects reverse-rotation IQ signals.

Screens on which this field is present

CDMA GENERATOR

Input Atten

This field controls the RF attenuators of the Test Set. If an `ADC Overdriven` message is displayed at the top of the screen while making measurements, increase the attenuator setting until the message is no longer displayed. This is the coarse level adjustment for the signal level into the CDMA analyzer. Fine level adjustment is performed using the `Gain` field.

See the "`Gain`" field on page 100 for more information.

NOTE The `Input Atten` setting does not affect, and is not displayed with, the average power measurement.

Screens on which this field is present

CDMA ANALYZER

CODE DOM (Code Domain Analyzer): gain controls menu

Input Port

This field selects which Test Set port to use as the RF input. This field is not displayed when measuring average power, since you *must* use the RF IN/OUT port to measure average power.

CAUTION **Instrument Damage**

To prevent instrument damage, do not exceed the maximum power level labeled at the connectors on your Test Set. The ANT IN connector is for measuring *low level* RF signals. High level (>60 mW) transmitter signals must be measured using the RF IN/OUT port.

Screens on which this field is present

CDMA ANALYZER
CODE DOM (Code Domain Analyzer): main controls menu

Lvl

This measurement displays the relative level of the selected Walsh channel when compared to the total power in a 1.23 MHz bandwidth centered around the `Tune Freq` setting. The measurement is displayed when the code domain analyzer's main controls `Measurement` field is set to `Power` or `Fast Pwr`.

Screens on which this field is present

COD DOM (Code Domain Analyzer): marker controls menu

Meas Intvl

This field determines the length of the data block. The data block is a time record over which correlated measurements are computed. As the interval is increased, measurement time is increased. Increasing the interval gives more accurate measurement results, particularly with frequency error and phase error measurements.

This field is displayed on the CDMA ANALYZER screen when a rho or EVM measurement is selected. It is also displayed on the CODE DOM (Code Domain Analyzer) controls menu.

Screens on which this field is present

CDMA ANALYZER
CODE DOM (Code Domain Analyzer): controls menu

Measurement

This field controls the type of code domain measurement to make: power, timing, or phase. It also controls the measurement "mode."

- Single is used when you want to make one measurement. You must select the Arm Meas function of the Analyzer field before a measurement can be made.
- Cont is used to continuously make measurements. Measurements are automatically re-armed after each measurement.

Screens on which this field is present

COD DOM (Code Domain Analyzer): main controls menu

Num Avgs

The number of averages determines how many measurements are averaged when measuring fast power. Averaging reduces measurement speed.

Screens on which this field is present

COD DOM (Code Domain Analyzer): fast power setup controls menu

Ofs Transfer

This field transfers the time offset value from the time offset measurement (displayed in `TmOfs`) to the `Time Offset` field automatically. Before selecting `Ofs Transfer`, you must make at least one of the following code domain measurements:

- Power
- Timing
- Phase

Operating Considerations

When using this command programmatically, be sure a value for `TmOfs` has been obtained from a power, timing, or phase measurement. (One method of ensuring the measurement has been completed would be to send an HP-IB command to query the results of the `TmOfs` field before sending the transfer command).

Screens on which this field is present

COD DOM (Code Domain Analyzer): fast power setup controls menu

Output Port

This field selects the output port for the signal from the Test Set's RF and CDMA generators.

`RF_Out` selects the RF IN/OUT connector.

`Dupl` selects the DUPLEX OUT connector.

Screens on which this field is present

CDMA GENERATOR

PN Offset

Use this field to enter the PN sequence offset index for your base station. Each whole offset is equal to 64 chips (= 52.08 μ s). Fractional values are rounded off, and can be entered, in increments of 0.015625 (1 chip). Once entered, this value is shared by all CDMA screens.

This value is used by the analyzer when the `Even Sec In` field on the CDMA GENERATOR screen is set to `Enable`.

NOTE When the `Even Sec In` field is set to `Not`, changes to the `PN Offset` field have no effect on the analyzer.

Screens on which this field is present

CDMA ANALYZER
CDMA GENERATOR
CODE DOM (Code Domain Analyzer): auxiliary controls menu

Pwr Gain

This field is used to set the level into the CDMA analyzer when making average power measurements. Levels are set in 6 dB increments. The IF signal level is displayed as ADC FS when average power is measured, and should be between -1.0 and -5 dB for best measurement results.

- `Auto` automatically sets the gain for an ADC FS value in the range of -1 to -5 dB. This is the recommended mode of operation.
- `Hold` lets you override the automatic setting to manually set the gain.

This field is only displayed when an average power measurement is selected.

Screens on which this field is present

CDMA ANALYZER

Pwr Intvl

This field determines the length of the data block when measuring average power. The data block is a time record over which correlated measurements are computed.

Range: 0.25 to 5.00 ms

Screens on which this field is present

CDMA ANALYZER

Pwr Scale

The upper part of this field is used to select the reference level for power measurements (relative to the total power of the entire CDMA channel). The reference is the top line of the screen and defaults to 0 dB.

The lower part of this field is used to select the display resolution for the power measurement; 1, 2 or 5 dB per vertical division.

The power scale fields are displayed in the Marker menu when the Main controls Measurement field is set to Power or Fast Pwr.

Screens on which this field is present

COD DOM (Code Domain Analyzer): marker controls menu

Pwr Zero

Selecting this field calibrates (zeroes) the average power meter. This operation should be performed immediately before making an average power measurement. This field is only displayed if the average power measurement is selected.

Operating Considerations

The Auto Zero field causes average power to be periodically calibrated when set to Auto. If the Auto Zero field is set to Manual, you must use the Pwr Zero field to zero average power. (See the ["Auto Zero" field on page 95](#) for more information.)

Screens on which this field is present

CDMA ANALYZER

Qual Event

This field selects a trigger qualifier. The trigger qualifier serves as a precursor to the CDMA analyzer trigger event. Selecting a trigger qualifier is required when a time-delayed trigger event is desired, or if the trigger signal is externally supplied at the TRIGGER QUALIFIER IN connector.

If a time-delayed trigger is used (see the "[Trig Event](#)" field on page 112), the qualifier starts the delay timer. When the timer expires, a trigger event occurs and a measurement is made.

- None causes the trigger event to be determined solely by the selection in the Trig Event field.
- 27 ms is an internally generated clock signal.
- 20 ms is an internally generated clock signal.
- 80 ms is an internally generated clock signal (default selection).
- 2 s is an internally generated clock signal.
- `Ampl Lo` qualifies a trigger each time the input to the CDMA analyzer rises above -18 dB ADC FS. ADC FS is displayed when the average power measurement is selected, or when adjusting the Gain field on the CODE DOMAIN ANALYZER screen.
- `Ampl Mid` qualifies a trigger each time the input to the CDMA analyzer rises above -12 ADC FS.
- `Ampl Hi` qualifies a trigger each time the input to the CDMA analyzer rises above -6 ADC FS.
- `External` must be selected if the trigger qualifier is provided by an external source. The external signal connects to the TRIGGER QUALIFIER IN connector. A qualifier occurs on the input signal's rising edge.

Screens on which this field is present

CDMA ANALYZER

CODE DOM (Code Domain Analyzer): trigger controls menu

RF Channel

The RF Channel field is displayed when the RF Display field on the INSTRUMENT CONFIGURE screen is set to Chan.

This field displays the current channel number. Channel tuning eliminates the need to enter transmit and receive frequencies directly into the Test Set. Once the radio's RF channel standard is selected, you only have to enter the channel number to automatically set the RF Generator and RF Analyzer to the correct frequency.

Operating Considerations

To utilize the correct transmit and receive frequencies select the appropriate channel standard from the RF Chan Std field on the INSTRUMENT CONFIGURE screen.

Screens on which this field is displayed

CDMA ANALYZER
CDMA GENERATOR
CODE DOM (Code Domain Analyzer): main controls menu

RF Gen Freq

This field specifies the center frequency of the generated CDMA signal. This field is displayed only when the RF Display field on the INSTRUMENT CONFIGURE screen is set to Freq.

NOTE **Channel Tuning**

You can configure the Test Set to allow direct entry of channel numbers (instead of entering the frequency) by using the RF Display field on the INSTRUMENT CONFIGURE screen. See the "[RF Channel](#)" field ([this page](#)) for more information.

Screens on which this field is present

CDMA GENERATOR

RF In/Ant

This field selects the Test Set's RF input.

CAUTION The maximum safe level into the ANT IN connector is 60 mW. Exceeding this level could cause permanent damage to the Test Set.

Screens on which this field is present

CODE DOM (Code Domain Analyzer): main controls menu

Threshold

Enter the measurement display threshold for making code domain timing and phase measurements. Walsh channels that have power levels below the threshold value are not displayed.

Operating Considerations

Querying these measurements for Walsh channels that are below the threshold level using HP-IB will return a default value of 9e99.

Screens on which this field is present

COD DOM (Code Domain Analyzer): auxiliary controls menu

Time Offset

This field allows you to manually enter a time offset. To obtain a value to enter in this field you must make at least one of the following measurements.

- Power
- Timing
- Phase
- Rho

After making the measurement, access the `FP Setup` menu on the `CODE DOM` screen, and enter the value obtained from the `Time OfS` field or, for rho measurements, the `Time Offset` measurement field on the `CDMA ANALYZER` screen.

An entry into the `Time Offset` field can also be made automatically, using the `Ofs Trnsfer` field. See the "[Ofs Trnsfer](#)" field on page 105.

When measuring fast power, the code domain analyzer uses the value in the `Time Offset` field instead of re-measuring the time offset parameters each time a code domain measurement is made.

Screens on which this field is present

`COD DOM` (Code Domain Analyzer): fast power setup controls menu

TmOfs

This measurement field displays the time offset when a rho measurement is made. See the "[Time Offset](#)" field ([this page](#)) for more information about this measurement.

Screens on which this field is present

`COD DOM` (Code Domain Analyzer): all menus

Trig Event

This field determines when the trigger event to the CDMA analyzer occurs. When the selected trigger in this field is qualified by the selection in the `Qual Event` field, the CDMA analyzer is triggered.

Choices

- 27 ms is an internally generated clock.
- 20 ms is an internally generated clock.
- 80 ms is an internally generated clock.
- 2 s is an internally generated clock.
- Delay controls a trigger delay timer, beginning from the positive edge of the selected qualifier. A delay of 20 μ s to 10,000,000 μ s is valid. Initially, the time delay will be 100 μ s.
- Immed triggers immediately after receiving the `Qual Event` signal.

Default selection: Immed.

Screens on which this field is present

CDMA ANALYZER

COD DOM (Code Domain Analyzer): trigger controls menu

Tune Freq

Use this field to enter the center frequency of the CDMA channel you are analyzing. This field is displayed only when the `RF Display` field on the INSTRUMENT CONFIGURE screen is set to `Freq`.

NOTE **Channel tuning**

You can configure the Test Set to allow direct entry of channel numbers (instead of entering the frequency) by using the `RF Display` field on the INSTRUMENT CONFIGURE screen. See the "[RF Channel](#)" field on page 109 for more information.

Screens on which this field is present

CDMA ANALYZER

COD DOM (Code Domain Analyzer): main controls menu

Walsh Chan

This field selects the Walsh channel to move the marker to. The marker can be moved by either entering the Walsh channel number using the keypad, or by using the cursor-control knob.

Screens on which this field is present

COD DOM (Code Domain Analyzer): marker controls menu

5

Analog Measurements - Screens and Control Fields

- "AC Level Measurement" on page 116
- "AM Depth Measurement" on page 116
- "AF Freq Measurement" on page 117
- "DC Level Measurement" on page 117
- "Distn (Distortion) Measurement" on page 118
- "Frequency Measurement" on page 119
- "Frequency Error Measurement" on page 119
- "TX Power Measurement" on page 120
- "FM Deviation Measurement" on page 121
- "AF Freq (Audio Frequency) Measurement" on page 121
- "SINAD Measurement" on page 122
- "SNR Measurement" on page 122
- "Control Fields for Analog Measurements" on page 123

Analog Measurements

AC Level Measurement

The type of measurement shown is dependent on the AF Anl In settings. AC Level is displayed when the AF Anl In field is set to SSB Demod, Audio In, Ext Mod, or Audio Out.

The AC Level measurement field displays either rms potential (voltage) or audio power (Watts or dBm).

See "[Displaying AF Measurements](#)" on page 37, or the "[AF Anl In](#)" field on page 123 for more information.

Screens on which this field is displayed

AF ANALYZER
RF ANALYZER
RF GENERATOR

AM Depth Measurement

This measurement field displays the percent depth of modulation of the AM signal. This measurement is displayed when the AF Anl In field is set to AM MOD or AM DEMOD.

See "[Displaying AF Measurements](#)" on page 37, or the "[AF Anl In](#)" field on page 123 for more information.

Screens on which this field is displayed

AF ANALYZER
RF ANALYZER
RF GENERATOR

AF Freq Measurement

The AF frequency measurement is the audio frequency of the signal present at the input selected in the AF Anl In field (on the AF ANALYZER screen). Four dashes (- - -) indicate that no audio frequency is present to measure.

See "[SINAD, Distortion, SNR, AF Frequency, DC Level](#)," on page 38 for more information. See also the "[AF Anl In](#)" field on page 123.

Screens on which this measurement is displayed

AF ANALYZER
RF GENERATOR
RF ANALYZER

DC Level Measurement

This measurement field displays the dc voltage entering at the source set in the AF Anl In field (on the AF ANALYZER screen).

See "[SINAD, Distortion, SNR, AF Frequency, DC Level](#)," on page 38 for more information. See also the "[AF Anl In](#)" field on page 123.

Operating Considerations

When the AF Anl In field is set to FM Demod or AM Demod, the unit-of-measure is kHz (for FM Demod) or % (for AM Demod). For these two settings this measurement indicates the dc modulation component of the received signal.

Screens on which this field is displayed

AF ANALYZER
RF GENERATOR
RF ANALYZER

Distn (Distortion) Measurement

This measurement field displays the percent of distortion for an audio signal tone.

See "[SINAD, Distortion, SNR, AF Frequency, DC Level](#)," on page 38 for more information.

Operating Considerations

Set the `Notch Freq` field (on the AF ANALYZER screen) to match the AF frequency used for your distortion measurement.

Screens on which this field is displayed

AF ANALZYER
RF ANALYZER
RF GENERATOR

FM Deviation Measurement

This measurement field displays the deviation of FM signals. This measurement is displayed when the `AF Anl In` field (on the AF ANALYZER screen) is set to `FM Demod` or `FM Mod`.

See "[Displaying AF Measurements](#)" on page 37 for more information.

Screens on which this field is displayed

AF ANALZYER
RF ANALYZER
RF GENERATOR

Frequency Measurement

This measurement field displays the center frequency the signal being measured.

Operating Considerations

This measurement cannot be used for measuring CDMA signals; use the CDMA analyzer.

Screens on which this field is displayed

AF ANALZYER
RF ANALYZER
RF GENERATOR

Frequency Error Measurement

This measurement field displays the difference between the Test Set's RF channel or tune frequency setting set and measured signal's frequency.

You can display the frequency error in ppm by pressing the ppm W key.

Operating Considerations

This measurement cannot be used for measuring CDMA signals; use the CDMA analyzer.

Screens on which this field is displayed

AF ANALZYER
RF ANALYZER
RF GENERATOR

TX Power Measurement

Transmitter power measures RF power at the RF IN/OUT port.

Operating Considerations

Only the RF IN/OUT port can be used for measuring TX power. When the `Input Port` is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the spectrum analyzer to measure low-level RF power (≤ 60 mW) at the ANT IN port.

See the ["Input Port" field on page 136](#) or the ["TX Pwr Zero" field on page 157](#) for more information.

CAUTION Connecting a signal of >60 mW to the ANT IN port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of several Watts). If the overpower circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the ANT IN port, and reset using `Meas Reset` (press and release the `Shift` key, then the `Hold` key) or turn the Test Set off and on to reset it.

Screens on which this field is displayed

AF ANALYZER
RF ANALYZER
RF GENERATOR

FM Deviation Measurement

This is the default setting for this measurement field. The FM deviation measurement is the frequency deviation of the carrier. This measurement field is only displayed when the AF Anl In field (on the AF ANALYZER screen) is set to FM Demod or FM Mod.

See the "[Displaying AF Measurements](#)" on page 37 for more information. See also the "[AF Anl In](#)" field on page 123.

Screens on which this field is displayed

AF ANALYZER
RF ANALYZER
RF GENERATOR

AF Freq (Audio Frequency) Measurement

The audio frequency measurement field displays the audio frequency of the signal at the source selected in the AF Anl In field (on the AF ANALYZER screen).

See "[SINAD, Distortion, SNR, AF Frequency, DC Level](#)," on page 38 for more information. See also the "[AF Anl In](#)" field on page 123.

Screens on which this field is displayed

AF ANALYZER
RF ANALYZER
RF GENERATOR

SINAD Measurement

SINAD is the measure of the ratio of the signal+noise+distortion to the noise+distortion produced at the output of a receiver that is the result of a modulated signal input. This ratio is expressed in dB.

See "SINAD, Distortion, SNR, AF Frequency, DC Level," on page 38 for more information.

Screens on which this field is displayed

AF ANALYZER
RF GENERATOR
RF ANALYZER

SNR Measurement

The is signal to noise ratio of the audio input signal.

See "SINAD, Distortion, SNR, AF Frequency, DC Level," on page 38 for more information.

Operating Considerations

- Selecting SNR turns off any other audio measurements.
- The RF generator and audio frequency generator 1 (AFGen1) must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- The AFGen2 To field on the RF GENERATOR screen must be set to Off.
- The audio output of the radio's receiver must be connected to the AUDIO IN port (set the AF An1 In field on the AF ANALYZER screen to Audio In).

Screens on which this measurement is displayed

AF ANALYZER
RF GENERATOR
RF ANALYZER

Control Fields for Analog Measurements

AF Anl In

The audio frequency analyzer input selects the input for the analyzer. When selected, this field displays a list of choices.

Signals can be analyzed from three different types of inputs:

- The output of the AM, FM, or SSB demodulators.
- The AUDIO IN, ANALOG MODULATION IN, and AUDIO OUT connectors.
- The signal present at the AM or FM modulators for the RF generator.

Operating Considerations

Changing this field changes the audio measurement (in the upper-right of the screen) to correspond to the selected signal.

See "[Selecting the Oscilloscope's Input](#)" on page 72 for more information.

Screens on which this field is displayed

AF ANALYZER

AF Cnt Gate

Audio frequency counter gate specifies how long the AF counter samples the signal before displaying the frequency. Specifying a shorter gate time may enable you to see frequency fluctuations that might not be seen using a longer gate time.

Screens on which this field is displayed

AF ANALYZER

AFGen1 Freq

This field sets the frequency for the first audio frequency sinewave generator.

Screens on which this field is displayed

RF GENERATOR

AFGen1 To

This field has two subfields:

- The upper field sets the destination port for audio frequency generator 1
 - FM -RF generator FM modulator
 - AM -RF generator AM modulator
 - Audio Out -AUDIO OUT connector
- The lower field
 - sets FM modulation deviation if the upper field set to FM
 - sets AM modulation depth if the upper field set to AM
 - sets the amplitude of audio signal (volts RMS) at the AUDIO OUT connector if upper field is set to Audio Out
 - turns off the AF generator if the Yes On/Off key is pressed.

Operating Considerations

Simultaneous FM and AM, using both AF generators is not allowed.

AF generators 1 and 2 are automatically turned off any time the CDMA screens are displayed. This prevents accidental amplitude or frequency modulation of the CDMA carrier. The AF generators are turned back on when you exit the CDMA screens (if they were previously turned on).

Screens on which this field is displayed

RF GENERATOR

AFGen2 Freq

This field sets the frequency for the second audio frequency sinewave generator.

Screens on which this field is displayed

RF GENERATOR

AFGen2 To

This field has two subfields:

- The upper field sets the destination port for audio frequency generator 2
 - FM -RF generator FM modulator
 - AM -RF generator AM modulator
 - Audio Out -AUDIO OUT connector
- The lower field
 - sets FM modulation deviation if the upper field set to FM
 - sets AM modulation depth if the upper field set to AM
 - sets the amplitude of audio signal (volts RMS) at the AUDIO OUT connector if upper field is set to Audio Out
 - turns off the AF generator if the Yes On/Off key is pressed.

Operating Considerations

Simultaneous FM and AM, using both AF generators is not allowed.

AF generators 1 and 2 are automatically turned off any time the CDMA screens are displayed. This prevents accidental amplitude or frequency modulation of the CDMA carrier. The AF generators are turned back on when you exit the CDMA screens (if they were previously turned on).

Screens on which this field is displayed

RF GENERATOR

Amplitude

This field adjusts the amplitude of the RF generator.

See for Atten Hold (below) for more information.

Screens on which this field is displayed

RF GENERATOR

SPEC ANL: RF generator controls menu

Atten Hold

Attenuator hold prevents the fixed RF output attenuators from switching in and out, eliminating the loss of the output signal as the level is changed. This function is helpful when making squelch measurements.

Operating Considerations

When this function is set to On, the RF output level is restricted to a range around the present `Amplitude` setting. This range varies with the amplitude setting. Attempting to set an amplitude outside the allowed range results in an error message and beep (if the beeper is on). RF output level accuracy is greatly degraded outside the allowed range.

Screens on which this field is displayed

RF GENERATOR

Audio In Lo

Audio In Lo

This field sets the AUDIO IN LO connector's state.

- `Gnd` causes the center pin of the connector to be connected directly to chassis ground.
- `Float` isolates the center pin of the connector from ground, providing a floating input to the AF analyzer.
- `600 To Hi` establishes a 600-ohm impedance between the center pins of the AUDIO IN LO and AUDIO IN HI connectors. Also, the `Ext Load R` field is removed, since the load is now fixed to 600 ohms.

Screens on which this field is displayed

AF ANALYZER

Audio Out

Audio output coupling selects ac or dc coupling of the AF generator to the AUDIO OUT connector.

Screens on which this field is displayed

RF GENERATOR

Auto/Norm

This field specifies how the trigger level is set.

- `Auto` automatically triggers if a triggering signal is not detected within approximately 50 ms of the last trigger.
- `Norm` requires a specific triggering signal before triggering.

Operating Considerations

Automatic triggering should be used for signals >20 Hz. Normal triggering should be used for signals ≤ 20 Hz.

Also, when measuring ≤ 1 Hz signals, you should set the `Scope To` field in the AF ANALYZER screen to `Input` to provide dc coupling to the oscilloscope's input.

Screens on which this field is displayed

SCOPE: trigger controls menu

Auto Zero

This field is displayed for average power measurements.

Auto is used to automatically zero the TX power measurement periodically during operation.

Manual is used to override the Auto feature. When Manual is selected, you must manually zero the TX power measurement by selecting the TX Pwr Zero field.

Screens on which this field is present

RF ANALYZER

Center Freq

This field sets the tune frequency for the center of the spectrum analyzer's screen. The center frequency field is displayed when the RF Display field on the INSTRUMENT CONFIGURE screen is set to Freq.

Operating Considerations

This field also changes the center frequency of the tracking generator and the RF analyzer.

Screens on which this field is displayed

SPEC ANL: main controls menu

Controls

The spectrum analyzer and oscilloscope settings are arranged in several menus that are accessed using the Controls field. A list of menu options is displayed when the controls field is selected.

See the descriptions for the individual control fields on each menu for more information.

Screens on which this field is displayed

SPEC ANL: all menus

SCOPE: all menus

Cont/Single

This field specifies whether the oscilloscope is continuously triggered (Cont), or if it is only triggered each time Reset is selected (Single).

Screens on which this field is displayed

SCOPE: trigger controls menu

De-Emp Gain

De-Emp Gain

De-emphasis gain displays and selects the desired AF analyzer de-emphasis amplifier gain.

See the "[Gain Cntl](#)" field on page 134 for more information.

Screens on which this field is displayed

AF ANALYZER

De-Emphasis

This setting selects or bypasses the 750 μ s de-emphasis networks in the audio analyzer and internal speaker circuitry.

Screens on which this field is displayed

AF ANALYZER

Detector

This setting selects the type of detector used when measuring and displaying AF signal levels.

Detector Types

- **RMS** displays the root mean square (rms) value of signals.
- **RMS*SQRT2** displays the rms value of a signal multiplied by $\sqrt{2}$.
- **Pk+** displays the positive peak value.
- **Pk-** displays the negative peak value.
- **Pk±/2** adds the positive and negative peak values, and divides the sum by 2.
- **Pk±Max** compares the positive and negative peaks and displays the greater value (polarity is not indicated).
- **Pk+ Hold** displays and holds the positive peak value until the measurement is reset. To reset, use **Meas Reset** (press and release the **Shift** key, then the **Hold** key), select a different detector, or re-select the same detector.
- **Pk- Hold** displays and holds the negative peak value until the measurement is reset. To reset, use **Meas Reset** (press and release the **Shift** key, then the **Hold** key), select a different detector, or re-select the same detector.
- **Pk±/2 Hold** divides the sum of the positive and negative peak values by 2, and displays the value until the measurement is reset. To reset, use **Meas Reset** (press and release the **Shift** key, then the **Hold** key), select a different detector, or re-select the same detector.
- **Pk±Mx Hold** compares the positive and negative peaks and displays the greater value until the measurement is reset. To reset, use **Meas Reset** (press and release the **Shift** key, then the **Hold** key), select a different detector, or re-select the same detector.

HP-IB Example

Operating Considerations

Screens on which this field is displayed

AF ANALYZER

Ext Load R

External load resistance is used to calculate and display AF power. Power is calculated using the voltage measured at the AUDIO IN connections and the resistance value you enter into this field.

This field is displayed only when the `Audio In` field on the AF ANALYZER screen is set to `GND` or `Float`.

Operating Considerations

To display audio power, set the `AC Level` measurement's unit of measure to `W` (watts).

Screens on which this field is displayed

AF ANALYZER

Filter 1

This field selects an audio frequency filter which can be used to condition the audio signal before it is analyzed by the audio frequency analyzer.

The following filter choices are available:

- <20 Hz HPF
- 50 Hz HPF
- 300Hz HPF
- C MESSAGE

Operating Considerations

The audio from the Test Set's speaker is not affected by Filter 1 or Filter 2 settings.

Screens on which this field is displayed

AF ANALYZER

Filter 2

This field selects an audio frequency filter which can be used to condition the audio signal before it is analyzed by the audio frequency analyzer.

The following filter choices are available:

- 300Hz LPF
- 3kHz LPF
- 15kHz LPF
- >99kHz LP
- 6kHz BPF

Operating Considerations

The audio from the Test Set's speaker is not affected by Filter 1 or Filter 2 settings.

Screens on which this field is displayed

AF ANALYZER

FM Coupling

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects ac or dc coupling between the RF generator's frequency modulator and the ANALOG MODULATION IN connector.

Operating Considerations

This field should be set to DC whenever the AFGen2 To field is set to FM; this provides better modulation response at low data rates.

Screens on which this field is displayed

RF GENERATOR

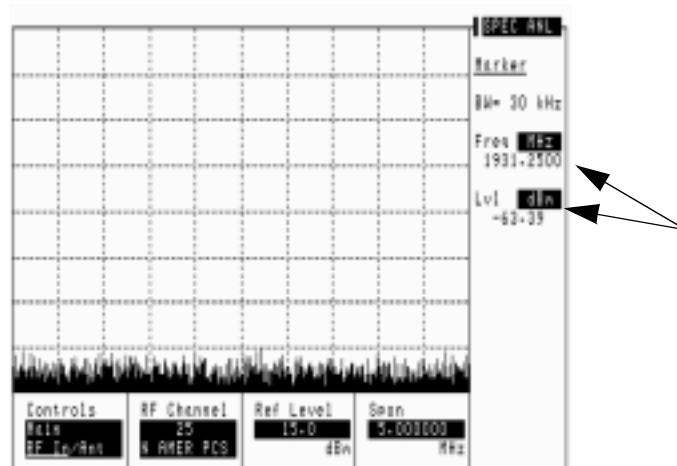
Freq (marker)

Marker frequency displays the frequency at the marker's present position on the spectrum analyzer.

Screens on which this field is displayed

SPEC ANL: all control menus

Figure 5-1 Freq and Lvl Display Fields



Gain Cntl

AF analyzer gain control specifies whether the AF analyzer's gain settings are controlled automatically by AF autoranging (Auto), or by manual control (Hold).

The following settings are affected by AF autoranging:

- Input Gain
- De-Emp Gain
- Notch Gain

Operating Considerations

The normal mode of operation for the Gain Cntl field is Auto, allowing the instrument to adjust the AF gain settings for optimum measurement accuracy.

This field can be set to Hold to disable the autoranging routines to increase measurement speed. However, this requires you to select the desired gain settings manually for each measurement.

Autoranging Interference. After a signal is input, the RF autoranging function (Auto) takes a small amount of time to determine the required input attenuator setting. If your transmitter begins sending information the instant it transmits, the initial part of the demodulated signal may not appear on the oscilloscope. When trying to capture the initial modulation waveform of a signal on the oscilloscope, set the upper field to Hold and set the lower field to an appropriate level for the signal being decoded (start with 40 dB).

Setting the upper field to Hold also prevents the RF autoranging process from interrupting spectrum analyzer operation when a signal is first measured. This can be helpful when you need to see the signal the instant the source is input, but requires you to set the needed amount of input attenuation.

Screens on which this field is displayed

AF ANALYZER

IF Filter

This field selects the desired IF filter bandwidth for modulated signals being analyzed.

Screens on which this field is displayed

RF ANALYZER

Input Atten

Input attenuation sets the amount of input attenuation for the RF IN/OUT and ANT IN connectors. This function controls two settings:

- The upper field determines if you want the instrument to set the attenuation automatically (Auto), or if you want to set the value manually (Hold).
- The lower field displays the present attenuation value, and is used to set the desired attenuation level when the upper area is set to Hold.

Operating Considerations

Autoranging Interference. After a signal is input, the RF autoranging function (Auto) takes a small amount of time to determine the required input attenuator setting. If your transmitter begins sending information the instant it transmits, the initial part of the demodulated signal may not appear on the oscilloscope. When trying to capture the initial modulation waveform of a signal on the oscilloscope, set the upper field to Hold and set the lower field to an appropriate level for the signal being decoded (start with 40 dB).

Setting the upper field to Hold also prevents the RF autoranging process from interrupting spectrum analyzer operation when a signal is first measured. This can be helpful when you need to see the signal the instant the source is input, but requires you to set the needed amount of input attenuation.

Screens on which this field is displayed

RF ANALYZER

SPEC ANL: auxiliary controls menu

Input Gain

This field displays and selects the gain of the AF analyzer's input amplifier. The choices are 0 dB, 20 dB, or 40 dB. Refer to the `Gain Cntl` field more information.

Screens on which this field is displayed

AF ANALYZER

Input Port

This field selects the RF IN/OUT or ANT IN port for making RF measurements. The RF IN/OUT port must be used for making TX power measurements.

Operating Considerations

If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, reset using `Meas Reset` (press and release the `Shift` key, then the `Hold` key), and allow the Test Set to cool off for approximately two minutes before making any other measurements on this port.

The ANT IN (antenna input) connector provides a highly-sensitive input for very low level signals (such as "off the air" measurements). You cannot measure TX (RF) power on the RF ANALYZER screen using the ANT IN port.

CAUTION Connecting a signal of >60 mW to the ANT IN port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of several Watts).

If the overpower circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the ANT IN port, and reset using `Meas Reset` (press and release the `Shift` key, then the `Hold` key) or turn the Test Set off and on.

Maximum signal levels at the RF IN/OUT, DUPLEX OUT, and ANT IN ports are printed on the connector panel. Exceeding these levels can cause permanent instrument damage.

Screens on which this field is displayed

SPEC ANL: RF IN/ANT main controls menu
RF ANALYZER

Internal

Internal

This field selects the trigger source.

- **Internal** uses the signal being displayed for triggering.
- **Ext (TTL)** uses the EXT SCOPE TRIGGER INPUT for triggering. This is a TTL level trigger (approximately 2.5 V).

Screens on which this field is displayed

SCOPE: trigger controls menu

Level (div)

This control is divided into two fields:

The upper field (0 . 00) sets the *internal* trigger level as a function of vertical divisions. The trigger level is indicated by small pointers that appear on each side of the screen (only used for internal triggering).

The lower field (Pos/Neg) specifies whether triggering happens when the waveform being measured is positive-going (Pos), or negative-going (Neg).

Screens on which this field is displayed

SCOPE: trigger controls menu

Lvl (marker)

This measurement field displays the signal level of the signal at the current marker position on the spectrum analyzer. (See [Figure 5-1 on page 133.](#))

Operating Considerations

The unit-of-measure for this field is dependent on the source of the signal being measured. For instance, when measuring a signal from the AUDIO IN connector, the amplitude is measured in Volts. When looking at a signal from the FM demodulator, the amplitude is given in units of kHz.

When the `Vert Offset` field is $\neq 0.00$, the displayed marker level is referenced to the center line generated by the vertical offset feature, not the center line of the screen.

The `Ref Set` function can be used with this measurement to display levels relative to a specific value. (See "[Setting A Measurement Reference](#)" on [page 45.](#))

Screens on which this field is displayed

SCOPE: all control menus

SPEC ANL: all control menus

Marker To Peak+

Marker To Peak+

Peak+ causes the marker to move to the maximum value of the *average* level measured on the display.

Because this functions look at the average value for each displayed pixel, the marker may not appear directly on the displayed peak of a noisy signal.

Screens on which this field is displayed

SCOPE: marker controls menu

Marker To Peak-

Peak- causes the marker to move to the minimum value of the *average* level measured on the display.

Because this functions look at the average value for each displayed pixel, the marker may not appear directly on the displayed peak of a noisy signal.

Screens on which this field is displayed

SCOPE: marker controls menu

Marker To (spectrum analyzer)

These two fields position the marker as follows.

- Peak moves the marker to the highest peak and enters the location in the Position field.
- Next Peak moves the marker to the next peak to the right and enters the location in the Position field.
- Center Freq changes the center frequency value to match the current position of the marker.
- Ref Level changes the reference level setting to match the current position of the marker.

Screens on which this field is displayed

SPEC ANL: marker controls menu

Mod In To

This modulation input field defines how an external modulation source is used with the RF generator. Two fields are used:

- The upper field determines whether the ANALOG MODULATION IN signal is set for AM or FM modulation of the RF GENERATOR.
- The lower field sets the modulation sensitivity. For instance, if FM (/V_{pk}) is selected for the upper field, and you set the lower field to 1.0000 kHz, the RF generator will deviate 1 kHz for every 1 Volt peak at the ANALOG MODULATION IN connector.

Screens on which this field is displayed

RF GENERATOR

No Pk/Avg

This field performs two functions:

Pk Hold (peak hold) prevents the spectrum analyzer from erasing the previous trace each time it sweeps. This causes the traces to 'build-up' on the screen until Off, No Pk/Avg or measurement reset (using Meas Reset (press and release the Shift key, then the Hold key) is performed. This allows the capture of transient signals that are not displayed long enough to view during normal operation.

Avg 1 through 100 (video averaging) enables the spectrum analyzer to display a trace representing the average of several measurements. The number of samples used for measurement averaging range from 1 to 100 (see below). No Pk/Avg and Off function identically. Off is provided to maintain backwards compatibility with earlier firmware and software.

- No Pk/Avg means that peak hold and video averaging are off.
- Pk Hold means that peak hold is on.
- Avg [n] enables video averaging over [n] measurements, where n = 1, 2, 3, 4, 5, 10, 20, 50, or 100
- Off means that peak hold and video averaging are off.

Operating Considerations

After capturing the desired signal, you can use the hold function (press Hold key) to prevent additional signals from building-up on the display.

Screens on which this field is displayed

SPEC ANL: auxiliary controls menu

Normalize

This area performs three display operations:

- `Save B` saves the currently-displayed trace for the A-B operation.
- `A only` provides a continuously-updated display (the “normal” mode of operation).
- `A-B` displays the difference between the trace saved using `Save B` and the currently displayed trace. The comparison can yield either losses or gains in amplitude.

Operating Considerations

The A-B function works correctly only if the center frequency and span settings are the same for both signals.

The reference level (`Ref Level`) can be changed (on the `Main` controls menu) to move the trace below the top line of the display if the A-B function results in a gain.

The `Hold` key can be used to “freeze” the display at any time. This allows you to view a trace before performing the `Save B` or `A-B` functions.

Screens on which this field is displayed

SPEC ANL: auxiliary controls menu

Notch Freq

This field sets the center frequency for the variable frequency notch filter. It is typically used for distortion and SINAD measurements at frequencies below or above the standard 1 kHz notch filter.

Operating Considerations

When the `Notch Coupl` field on the INSTRUMENT CONFIGURE screen is set to `AFGen1`, this filter and the `AFGen1 Freq` field match their settings. A warning message is then displayed if you attempt to set the `AFGen1 Freq` value outside the 300 Hz to 10 kHz range of this filter. When the `Notch Coupl` field is set to `None`, this filter and `AFGen1 Freq` operate independently.

Screens on which this field is displayed

AF ANALYZER

Notch Gain

This field displays and selects the gain of the AF analyzer's notch filter amplifier. This amplifier is only used for making SINAD and distortion measurements. (See the "[Gain Cntl](#)" field on page 134 for more information.)

Screens on which this field is displayed

AF ANALYZER

Offset Freq

Frequency offset (RF generator) sets the difference between the instantaneous frequencies of the tracking generator and the center frequency of the spectrum analyzer.

This field is displayed only when Track is selected in the Track/Fixed field on the RF Gen controls menu.

Operating Considerations

The offset can be a positive or negative value. When set to zero, the tracking generator produces a sweeping signal that matches the spectrum analyzer's tune frequency.

Screens on which this field is displayed

SPEC ANL: RF generator controls menu

Output Port

This field selects the RF generator's output port. Higher RF generator levels are available at the DUPLEX OUT port than at the RF IN/OUT port.

Operating Considerations

CAUTION Applying reverse RF power to the DUPLEX OUT connector can damage the instrument. (A message is displayed when an overpower conditions occurs.) Whenever possible, use the RF IN/OUT connector when testing transceivers to prevent damage from accidental transmitter keying.

If a reverse-power condition triggers the internal protection circuit, remove the reverse-power signal and reset using **Meas Reset** (press and release the **Shift** key, then the **Hold** key) or turn the Test Set off and on to reset it.

Maximum signal levels at the RF IN/OUT, DUPLEX OUT, and ANT IN ports are printed on the connector panel. Exceeding these levels can cause permanent instrument damage.

Screens on which this field is displayed

RF GENERATOR

SPEC ANL: (Fixed) RF generator controls menu

Pk Det To

This field selects the signal source for the peak detectors. This allows you to bypass certain sections of the AF analyzer's circuitry when making ac-level measurements.

- **Filters** analyzes the signal after filtering through Filter 1.
- **De-Emp** analyzes the signal after filtering through Filter 1 and Filter 2, and after de-emphasis.

Screens on which this field is displayed

AF ANALYZER

Port/Sweep

This control performs two functions:

- The upper field specifies the output port of the tracking generator.
- The lower field specifies whether the tracking generator sweeps from low-to-high frequencies (Norm), or from high-to-low frequencies (Invert). (The spectrum analyzer always sweeps from low to high frequencies.) The swept frequency range is determined by the Span setting in the spectrum analyzer's main controls menu.

This field is displayed only when Track is selected in the Track/Fixed field on the spectrum analyzer's RF Gen controls menu.

Operating Considerations

When using the tracking generator, if the output port is set to RF Out, or the main menu Input Port is set to RF In, internal instrument coupling can occur. For the best isolation between the tracking generator and the spectrum analyzer, use Dupl for the output, and Ant for the input.

For measurements on high-power devices, such as amplifiers, use the RF IN/OUT port for the input.

Screens on which this field is displayed

SPEC ANL: RF generator controls menu

Position

This field indicates the number of scale divisions from the left side of the screen to the marker.

Use the DATA ENTRY keys or cursor-control knob to move the marker to any point on the displayed signal.

Screens on which this field is displayed

SCOPE: marker controls menu

SPEC ANL: marker controls menu

Ref Level

Reference level sets the amplitude reference level for the top line of the display. All signals displayed are referenced to this line.

Operating Considerations

The unit-of-measure for the reference can be changed as needed. For instance, 0 dBm, 0.224 V, 107.0 dBmV, and 0.00100 W can all be used to represent the same level.

Screens on which this field is displayed

SPEC ANL: main controls menu

Reset

Reset retriggers the measurement when `Single` triggering is selected. See the "[Cont/Single](#)" field on page 128.

Screens on which this field is displayed

SCOPE: trigger controls menu

RF Channel

The RF Channel field is displayed on the screens listed below when the RF Display field on the INSTRUMENT CONFIGURE screen is set to Chan.

This field displays the current channel number. Channel tuning eliminates the need to set transmit and receive frequencies directly into the Test Set. Once the radio's RF channel standard is selected, you only have to enter the channel number to automatically set the RF Generator and RF Analyzer to the correct frequency.

Operating Considerations

To utilize the correct transmit and receive frequencies select the appropriate channel standard from the RF Chan Std field on the INSTRUMENT CONFIGURE screen.

The lower subfield of the RF Channel field on the spectrum analyzer's RF Gen controls menu also sets the RF channel standard.

Screens on which this field is displayed

RF ANALYZER

SPEC ANL: RF generator or main controls menu

RF Cnt Gate

RF counter gate specifies how long the RF counter samples the signal before displaying the frequency. Specifying a shorter gate time may enable you to see frequency fluctuations that might not be seen using a longer gate time.

Screens on which this field is displayed

RF ANALYZER

RF Gen Freq

This field sets the RF generator's frequency.

This field is displayed on the screens listed below when the **RF Display** field on the INSTRUMENT CONFIGURE screen is set to Freq.

Screens on which this field is displayed

SPEC ANL (When the Controls field is set to "RF Gen")
RF GENERATOR

RF In/Ant

This field selects the input port for the spectrum analyzer.

Operating Considerations

Maximum signal levels are printed on the connector panel.

CAUTION Connecting a signal of >60 mW to the ANT IN port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of several Watts).

If the overpower circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the ANT IN port, and reset using **Meas Reset** (press and release the **Shift** key, then the **Hold** key) or turn the Test Set off and on to reset it.

Using the ANT IN port with the **Sensitivity** field set to **High** can result in uncalibrated operation (a message appears on the screen when this happens). The purpose for the high sensitivity setting is to allow you to look and listen to very low level signals when absolute accuracy is not essential.

See the "[Sensitivity \(spectrum analyzer\)](#)" field on page 150 for more information.

Screens on which this field is displayed

SPEC ANL

Scope To

This field selects the signal source for the oscilloscope. This allows you to bypass certain sections of the AF analyzer's circuitry when viewing and measuring a signal. It also allows you to select measurement paths that include additional gain stages, improving the oscilloscope's resolution when measuring low-level signals.

- `Input` looks at the unfiltered signal directly from the input.
- `Filters` looks at the signal after filtering through Filter 1 and Filter 2.
- `De-Emp` looks at the signal after filtering through Filter 1 and Filter 2, and after 750 μ s de-emphasis (if the `De-emphasis` field is set to 750 μ s.)
- `Notch` looks at the signal after filtering through Filter 1 and Filter 2, after de-emphasis (if used), and after the notch filter.

Screens on which this field is displayed

AF ANALYZER

Sensitivity (RF analyzer)

RF analyzer sensitivity adds about 6 dB of sensitivity for the ANT IN port when High is selected and the `Input Atten` field is set to 0 dB.

Operating Considerations

Selecting High sensitivity may cause spectrum analyzer measurements to be uncalibrated when the ANT IN port is used (a message appears when this occurs).

High-level AM measurements may be distorted when high sensitivity is used with the ANT IN port.

Screens on which this field is displayed

RF ANALYZER

Sensitivity (spectrum analyzer)

This area performs two functions:

- The lower field selects the vertical resolution of the display. You can choose from 1 dB, 2 dB, or 10 dB per graticule.
- The upper field selects Normal or High sensitivity for the RF input. The High setting adds about 6 dB of sensitivity to the ANT IN port (when the `Input Atten` field is set to 0 dB) for looking at very low level signals. However, this setting can cause measurements to be uncalibrated (indicated by a message on the screen). High sensitivity can also cause high-level AM signals to be distorted.

Screens on which this field is displayed

SPEC ANL: auxiliary controls menu

Settling

Settling

This field selects the settling time for making AF measurements. Lower frequency signals require additional settling time (*Slow*). Higher frequency measurements require less settling time (*Fast*).

Operating Considerations

Use *Slow* for ≤ 200 Hz signals. Use *Fast* for > 200 Hz signals.

If the signal being measured is a composite of different frequencies above and below 200 Hz, select the appropriate filtering to analyze the desired signal component.

Screens on which this field is displayed

AF ANALZYER

Span

Sets the span of frequencies to be displayed on the screen.

Operating Considerations

When the tracking generator is used, the span also defines the frequency sweep range.

Spans > 1.5 MHz disable the AF analyzer when the analyzer's AF Anl In field is set to FM Demod, AM Demod, or SSB Demod. This disables all the AF analyzer's measurement and output functions. When the AF analyzer's AF Anl In field is set to any of the other available inputs, such as Audio In or Ext Mod, the speaker and SCOPE MONITOR OUTPUT are not affected when the spectrum analyzer's span is changed.

Screens on which this field is displayed

SPEC ANL: main controls menu

Speaker ALC

Speaker automatic level control enables/disables the ALC function for the instrument's internal speaker. When On is selected, the speaker volume is *independent* of the signal level being measured. When Off is selected, the speaker volume is *dependent* on the signal level being measured.

Screens on which this field is displayed

AF ANALYZER

Speaker Vol

Speaker Volume enables/disables the instrument's internal speaker. When On is selected, the VOLUME control knob operates normally. When Off is selected, the speaker is disconnected.

Screens on which this field is displayed

AF ANALYZER

Squelch

This setting determines the squelch operation when demodulating FM, AM, or SSB signals. Three settings are available:

- `Pot` uses the front-panel SQUELCH knob for squelch level adjustment.
- `Open` disables squelch operation.
- `Fixed` sets the squelch to a fixed level, disabling the front-panel SQUELCH knob control.

Operating Considerations

Most measurements are not displayed on the screen if the incoming signal falls below the squelch level (with the exception of `TX Power`). The measurements are replaced by four dashes (- - -) to indicate they have been squelched.

Oscilloscope measurements are also disabled when the signal has been squelched.

Spectrum analyzer measurements are not affected by the squelch setting (although squelch still affects whether the demodulated signal can be heard while viewing the RF signal).

Trying to read a squelched measurement using HP-IB will cause your program to halt until the squelch is either turned down, a measurement is made, or until a program time-out aborts the measurement.

Screens on which this field is displayed

RF ANALYZER

Time

This measurement displays the time elapsed from the trigger point to the current marker position.

The **Ref Set** function can be used with this measurement to display time relative to a specific position. (See "[Setting A Measurement Reference](#)" on page 45.)

Screens on which this field is displayed

SCOPE: all control menus

Time/div

This field selects the horizontal sweep time per division.

Operating Considerations

The time-per-division is selected from a list of choices.

Screens on which this field is displayed

SCOPE: main controls menu

Track/Fixed

When this field is set to **Track**, the tracking generator is enabled. The tracking generator performs a frequency sweep operation. The start and stop frequencies are determined by the Span setting (main controls menu). The tracking generator allows you to characterize devices (such as filter networks) over wide span of frequencies.

An RF offset can be set between the tracking generator and the center frequency of the spectrum analyzer. This allows you to look at a signal that is related to a source whose frequency is outside the displayed span.

Screens on which this field is displayed

SPEC ANL: RF generator controls menu

Trig-Delay

The trigger delay is used to specify the time relationship between the trigger and displayed signal.

- Positive values delay the measurement trigger by a specific period. The delayed trigger point is the left edge of the screen.
- Negative values perform a pre-trigger function, displaying a section of the waveform before the trigger point. The trigger point is indicated by small pointers that appear at the top and bottom of the screen.

Operating Considerations

Negative Value. The maximum negative delay cannot exceed ten divisions of the current time-per-division setting. For example; if the Time/Div field is set to 1 ms, the maximum allowed negative delay is -10 ms. Larger negative numbers cause an Excessive negative Trig-Delay will be truncated. message.

Positive Values. For Time/Div settings of 50 ms/div and smaller, the maximum delay is 400 ms.

For Time/Div settings of 100 ms/div and larger, the maximum delay is 3200 ms.

Resolution. For delays of 400 ms and less, the resolution is 6.4 ms. For delays greater than 400 ms, the resolution is 51.2 ms. All entries are rounded to the nearest multiple of 6.4 ms or 51.2 ms (depending on the delay value).

Screens on which this field is displayed

SCOPE: trigger controls menu

Tune Freq

This field is displayed when the `RF Display` field on the `INSTRUMENT CONFIGURE` screen is set to `Freq`.

RF analyzer tune frequency sets the center frequency for the RF signal to be analyzed.

Screens on which this field is displayed

RF ANALYZER

TX Pwr Meas

The transmitter power measurement field specifies how transmitter power measurements are made:

- `Peak` can be used to measure AM, FM, and un-modulated (CW) signals.
- `Sample` can be used to measure FM or CW signals with increased measurement speed. This method can only be used with signals having no amplitude modulation component.

Operating Considerations

If you change this field, zero the power measurement (using the `TX Pwr Zero` field) before measuring power.

Screens on which this field is displayed

RF ANALYZER

TX Pwr Zero

The transmitter power zero function establishes a 0.0000 W reference for measuring RF power at the RF IN/OUT port.

Operating Considerations

When power is applied to the RF IN/OUT connector, the temperature of the internal circuitry increases. This can cause changes in the TX power measurement when low power levels are measured immediately following high power measurements.

When alternately making high and low power measurements, always zero the power meter immediately before making the low power measurements; this provides the best measurement accuracy.

If the `Auto Zero` field is set to `Auto`, the TX power measurement is periodically zeroed (automatically). Manual calibration is only needed if `Auto Zero` is set to `Manual`, or if you are measuring highly variable signal levels (as mentioned above).

Screens on which this field is displayed

RF ANALYZER

Vert/div

Vertical sensitivity sets the vertical amplitude per division.

Operating Considerations

The value for this field is selected from a list of choices.

Depending on the AF analyzer's AF An1 In setting, the units for this field may be in Volts, kHz, or Percent (AM). For example; if the AF An1 In field is set to FM Demod, the amplitude is displayed in kHz/div.

Screens on which this field is displayed

SCOPE: main controls menu

Vert Offset

Vertical offset moves the displayed signal above or below the oscilloscope's fixed centerline.

Operating Considerations

A centerline is displayed for the signal when an offset is used.

When the vertical offset is $\neq 0.00$, the marker level is referenced to the center line generated by the vertical offset feature, not the center line of the screen.

Screens on which this field is displayed

SCOPE: main controls menu

6

Configuration - Screens and Control Fields

- ["Configuring the Instrument" on page 160](#)
 - ["Setting the Date and Time" on page 160](#)
 - ["Changing the Beeper's Volume" on page 160](#)
 - ["Turning Off User Messages" on page 160](#)
- ["Configuring for Printing A Screen" on page 161](#)
- ["Control Fields on the Configuration Screens" on page 162](#)

Configuring the Instrument

Setting the Date and Time

The Test Set has a built-in clock that keeps track of the date and time. It is powered by an internal battery to keep it operating when the instrument is off.

To set the date and time

- Step 1.** Access the INSTRUMENT CONFIGURE screen.
- Step 2.** Select the `Date` field and use the DATA ENTRY keys to enter the date (MMDDYY -- October 31, 1997 = 103197).
- Step 3.** Select the `Time` field and use the DATA ENTRY keys to enter the time (HH.MM -- 2:13 pm = 14.13).

Changing the Beeper's Volume

The beeper alerts you to important operating and measurement conditions. It beeps any time a message is displayed at the top of the screen. These messages warn you of conditions such as exceeding the RF input level or trying to set a field to an unacceptable value. Therefore, it is recommended that you do not disable the beeper.

To change the beeper's volume

- Step 1.** Access the INSTRUMENT CONFIGURE screen.
- Step 2.** Select the `Beeper` field to display the volume choices.
- Step 3.** Select the desired choice.

Turning Off User Messages

To turn off user messages

- Step 1.** Access the INSTRUMENT CONFIGURE screen.
- Step 2.** Set the `Display User Mssgs` field to No.

To display user messages

- Step 1.** Access the INSTRUMENT CONFIGURE screen.
- Step 2.** Set the `Display User Mssgs` field to Yes.

Configuring for Printing A Screen

Printing a Screen

To Print A Screen's Contents

- Step 1.** Connect a printer to the appropriate connector (SERIAL 9, PARALLEL 15, HP-IB).
- Step 2.** Go to the PRINTER CONFIGURE screen set the `Printer Port:` field to the appropriate type of printer connection.

If HP-IB is selected, enter the HP-IB address (`Printer Adrs`) of the printer.
- Step 3.** Select the type of printer you are using in the `Model` field. If your printer is not listed, configure your printer to emulate one that is listed. (Some Windows¹-only printers are not supported.)
- Step 4.** Enter a `Print Title` if desired. This text will appear at the top of your printout.
 - a.** Use the knob to select letters, numbers, or symbols from the list (up to 50 characters).
 - b.** Select `Done` from the list when you have finished the title.
- Step 5.** Display the screen you want to print and press `Print`.

To interrupt printing

- Step 1.** Go to the PRINTER CONFIGURE screen.
- Step 2.** Select the `Abort Print` field.

1. Windows is a U.S. trademark of Microsoft Corp.

Control Fields on the Configuration Screens

Abort Print

Select this field to interrupt the printing job in progress.

Abort Print is not directly programmable over the HP-IB.

Screen(s) Where Field is Present

PRINTER CONFIGURE

Antenna In

This field is used to indicate losses or gains between the ANT IN port and the device-under-test.

Enter a *positive* value to indicate a gain (such as an amplifier). The spectrum analyzer's marker level (Lvl) measurement is automatically reduced by that amount. The spectrum analyzer's Ref Level is automatically decreased by the same amount, so the trace position does not appear to change.

Enter a *negative* value to indicate a loss (such as cable loss). The spectrum analyzer marker's level (Lvl) measurement is automatically increased by that amount. The spectrum analyzer's Ref Level is automatically increased by the same amount, so the trace position does not appear to change.

This field is only used when the RF Level Offset field is set to On. See "[RF Level Offset](#)" on page 178.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Base Freq (User Defined)

The base frequency field sets the RF generator reference for channel 0 (zero) when the RF Chan Std field is set to USER-DEF, and the RF Display field is set to Chan.

Channel frequencies are calculated using the following formula:

$$\text{Channel N} = \text{Base Frequency} + (\text{N})(\text{Channel Spacing})$$

The Base Frequency is calculated using the following formula:

$$\text{Base Frequency} = \text{Channel 1 Frequency} - \text{Channel Spacing}$$

For example, if your multi-channel radio's lowest *receive* channel frequency is 870.030 MHz and the system channel spacing is 30 kHz, you would enter 870 MHz in this field. You would also use the Chan Space and (Gen)-(Anl) fields to tell the Test Set where other transmit and receive channel frequencies are in relation to the base frequency, and whether or not the system is duplex.

For more information see the following related topics:

["Chan Space \(User Defined\)" field on page 164](#)

["\(Gen\)-\(Anl\)" field on page 169](#)

["RF Chan Std" field on page 175](#)

["RF Display" field on page 176](#)

Operating Considerations

The value of this field is only used if the RF Display field is set to Chan, and the RF Chan Std field is set to USER-DEF.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Beeper

This field changes the audio beeper volume by selecting the desired level from a list of choices (Off, Quiet, Loud). The beeper always beeps when the instrument is turned on, regardless of this setting.

Operating Considerations

The beeper alerts you any time a message is displayed. Since a message may be removed from the screen before you notice it, it is better to leave the beeper on to alert you to errors during operation.

The beeper's volume setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Chan Space (User Defined)

This field specifies the RF channel spacing when the RF Display field is set to Chan, and the RF Chan Std field is set to USER-DEF.

For example, entering 25 kHz causes a 25 kHz spacing between each channel. If the receive frequency for channel 1 is 150.500 MHz, channel 2's receive frequency would be 150.525 MHz.

Operating Considerations

The value of this field is only used if the RF Display field is set to Chan, and the RF Chan Std field is set to USER-DEF.

For more information see the following related topics:

["Base Freq \(User Defined\)" field on page 163](#)

["\(Gen\)-\(Anl\)" field on page 169](#)

["RF Chan Std" field on page 175](#)

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Data Length

Data Length

This field specifies the number of bits used for each word of serial data when using the serial port.

This setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Date

This field specifies the current date for the internal clock. The date can be read by a controller using HP-IB and printed on test results.

The format is MMDDYY (Month Day Year), using two digits for each term. When entering months January through September (01-09), the leading zero is not displayed when entered. Example; May 5, 1993 is entered as 050593, but is displayed as 50593.

The internal clock still functions when the instrument is turned off.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Display User Messages

This field controls whether or not user messages and prompts are displayed at the top of the screen when a user action is required or an error occurs.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Duplex Out

This field is used to indicate losses or gains between the DUPLEX OUT port and the device-under-test.

- Enter a *positive* value to indicate a gain (such as an amplifier gain). The RF generator's level is automatically set that amount *below* what is indicated in the RF generator's `Amplitude` field. (Example; if this value is 10 dB, and the `Amplitude` field shows 0 dBm, the actual level out this port is -10 dBm.) The value at the output of the external amplifier should then be at the level indicated in the `Amplitude` field.
- Enter a *negative* value to indicate a loss (such as cable loss). The RF generator's level is automatically set that amount *above* what is indicated in the RF generator's `Amplitude` field to compensate. The value at the opposite end of the cable (loss) should then be at the level indicated in the `Amplitude` field; unless the resulting RF generator setting exceeds the maximum output level, then an error occurs: `Input value out of range`. In that case, reduce the `Amplitude` setting, or decrease the `Duplex Out` value.

This field is only used when the `RF Level Offset` field is set to `On`.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Ext Ref In

This field selects the reference frequency of the signal at the EXT REF IN connector. You can select 1, 2, 5, or 10 MHz; 1x, 2x, 4x, 8x, or 16x chip.

Operating Considerations

This signal is used as a reference for, and directly affects, these functions:

- RF Generator Frequency (including the Tracking Generator)
- RF Frequency Counter
- AF Frequency Counter
- RF Analyzer Tune Frequency
- Spectrum Analyzer Center Frequency

AF generators 1 and 2 are not affected by the external reference; they use their own reference.

See "[EXT REF IN](#)" on page 189 for more information.

FF at End:

This field is used to specify if you want the printer to make a form feed (blank page) at the end of printing.

Screen(s) Where Field is Present

PRINTER CONFIGURE

FF at Start:

This field is used to specify if you want the printer to make a form feed (blank page) at the start of printing.

Screen(s) Where Field is Present

PRINTER CONFIGURE

Firmware

This field displays the current firmware revision for your Test Set. The revision number is automatically changed when updated firmware is installed.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Flow Control

The flow control field is used when sending or receiving serial data.

- `None` disables the Xon/Xoff function.
- `Xon/Xoff` lets the Test Set “talk/listen” to the transceiver to alter the rate of the data being sent.
- `Hardware` uses the serial port’s RTS and CTS lines to transfer data at high baud rates.

NOTE Do not turn flow control on (set `Flow Cntl` to `Hardware` in the I/O CONFIGURE screen) for the serial port until you have a device attached to the port that can respond to the flow control communications.

Example: You have a printer attached to SERIAL PORT 9. Before you run any IBASIC software (for example, the RFTOOLS program), you must make sure that the printer is properly connected and that its power is turned on.

Operating Considerations

This setting is retained when the instrument is turned off.

Baud rates of 38400 and above must use `Hardware` flow control.

Screen(s) Where Field is Present

I/O CONFIGURE

Frame Clock Output

This field selects the frame clock signal to send to the FRAME CLOCK OUT connector.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

(Gen)-(Anl)

This field is used with the `RF Offset` field to specify the amount of frequency offset between the RF generator and RF analyzer.

This field is always displayed when the `RF Display` field is set to `Freq`.

See "[Setting an RF Generator/Analyzer Offset](#)" on page 47 for more information.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

(Gen)-(Anl) (User Defined)

This field defines the receiver-transmitter frequency offset when using user-defined channel operation.

Use a *positive* value (such as 45 MHz) when the radio's receive frequency is higher than the transmit frequency.

Use a *negative* value (such as -45 MHz) when the radio's receive frequency is lower than the transmit frequency.

Operating Considerations

The value of this field is only used if the `RF Display` field is set to `Chan`, and the `RF Chan Std` field is set to `USER-DEF`.

For more information see the following related topics:

["Chan Space \(User Defined\)" field on page 164](#)

["RF Chan Std" field on page 175](#)

["RF Display" field on page 176](#)

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

HP-IB Adrs

This field is used to display and change the HP-IB address of the Test Set.

Operating Considerations

The address can be set from 0 to 30 by using the DATA keys, or by pushing and then turning the cursor-control knob.

This setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

IBASIC Echo

This field enables/disables screen and error message echoing from IBASIC.

This setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Inst Echo

This field enables/disables character and screen echoing when using an external ASCII RS-232 terminal or computer to enter or edit IBASIC programs.

This setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Lines/Page:

Lines/Page:

This field is used to specify how many lines are printed per page.

Screen(s) Where Field is Present

PRINTER CONFIGURE

Mode

This field sets the HP-IB operating mode. `Talk&Lstn` is used for normal HP-IB operation. `Control` is used to control external instruments using the Test Set.

This setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Model:

This field is used to specify the type of printer used. If your printer is not listed in the `Choices` menu when you select this field, configure your printer to emulate one of those that is listed. (Some Windows-only printers are not supported.)

Screen(s) Where Field is Present

PRINTER CONFIGURE

Notch Coupl

This field selects if the `Notch Freq` setting of the AF ANALYZER screen is coupled to the `AF Gen1 Freq` setting. When set to `None`, the notch filter and AF generator 1 do not interact. When set to `AFGen1` (coupled), the settings track each other unless the AF generator's frequency is set outside the 300 Hz to 10 kHz limits of the notch filter.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Opt CDMA TB

This control is provided for future enhancements. It must be set to Internal until options are available.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Parity

This field specifies the serial communication parity setting when using the serial ports.

This setting is retained when the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Printer Port:

This field is used to select the port your printer is connected to (Parallel 15, Serial 9, HP-IB).

Screen(s) Where Field is Present

PRINTER CONFIGURE

Print Title:

This field is used to enter up to 50 characters to be displayed at the top of the printout.

Screen(s) Where Field is Present

PRINTER CONFIGURE

Range Hold

These fields enable/disable several autoranging and autotuning routines.

Auto All enables these routines, providing automatic adjustment when making AF or RF measurements.

Hold All disables these routines, requiring you to manually set the affected settings.

The following fields are affected by the **Range Hold** field:

- **Input Atten** in the RF ANALYZER and SPEC ANL screens.
- **Gain Cntl** in the AF ANALYZER screen. This field controls three AF gain setting fields:

Input Gain

De-Emp Gain

Notch Gain

Operating Considerations

The **Hold All** setting is primarily used when the instrument is operated by remote control, such as in an automated test system.

Unless you have very specific reasons for disabling the automatic functions, you should set this field to **Auto All** when operating the instrument manually.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Ref Select

This field selects the timebase reference signal to use for generating and analyzing signals.

- `Auto` automatically selects an external reference if a signal of sufficient level is detected at the EXT REF IN.
- `Internal` uses the Test Set's internal timebase and ignores signals connected to the EXT REF IN connector.
- `External` requires a valid reference signal to be connected to the EXT REF IN connector.

Operating Considerations

The front-panel REFERENCE indicators show which source is selected and whether or not the timebase is phase locked. The Test Set will not operate correctly if it is unlocked.

Locking to an external reference may take several seconds. The lower the frequency the longer it may take to lock to the signal.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

RF Chan Std

Use the RF channel standard field to select the channel standard for the radio-under-test. The RF generator's and the RF analyzer's frequencies are automatically set to correspond to the channel number entered in the RF Channel field. RF Channel replaces the RF Gen Freq and Tune Freq fields on several screens when the RF Display field on the INSTRUMENT CONFIGURE screen is set to Chan.

Each standard has a prefix code that indicates what type of radio to test; mobile station (MS) or land station (LS). For example, if you are testing an AMPS base station, select LS AMPS.

For the NAMPS standards, a third letter is added indicating which frequency band is used: upper, middle, or lower. For example, when testing a base station using the upper band you would select LSU NAMPS.

The USER-DEF selection is used to define your own channel assignments. When selected, you enter the Base Freq, Chan Space, and (Gen)-(Anl) settings.

For more information see the following related topics:

["Base Freq \(User Defined\)" field on page 163](#)

["Chan Space \(User Defined\)" field on page 164](#)

["\(Gen\)-\(Anl\)" field on page 169](#)

Operating Considerations

The channel standard can also be changed in the lower subfield of the RF Channel field on the SPEC ANL, RF GENERATOR, and RF ANALYZER screen.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

RF Display

This field selects the format for entering the RF generator's and RF analyzer's frequencies:

- When **Freq** is selected, you enter the RF generator's and the RF analyzer's frequencies directly using the keypad or knob.
- When **Chan** is selected, the **RF Gen Freq** and **Tune Freq** fields on all screens are replaced by the **RF Channel** field, and only the channel number is entered and displayed.

Channel tuning eliminates the need to enter transmit and receive frequencies directly into the Test Set. Once your radio's RF channel standard is selected, you only have to enter the channel number to automatically set the RF generator and RF analyzer to the correct frequencies.

Operating Considerations

See the "[RF Chan Std](#)" field on [page 175](#) for more information.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

RF Gen Volts

This field specifies whether you want RF voltages expressed as the voltage across a 50 ohm load, or the open circuit voltage (emf).

Operating Considerations

This setting affects the RF generator's and the tracking generator's amplitudes.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

RF In/Out

This field is used to indicate losses or gains between the RF IN/OUT port and the device-under-test.

- Enter a *positive* value to indicate a gain (such as an amplifier gain). When the RF IN/OUT port is used as an output, the RF generator's (or tracking generator's) level is automatically set the specified amount *below* what is indicated in the RF generator's `Amplitude` field. Example; if this value is 10 dB, and the `Amplitude` field shows 0 dBm, the actual level out of this port is -10 dBm.

When this port is used as an input, the `TX Power` measurement and spectrum analyzer's marker level (`Lvl`) are automatically *reduced* by that amount.

- Enter a *negative* value to indicate a loss (such as cable loss). The RF generator's (or tracking generator's) level out this port is automatically set that amount *above* what is indicated in the RF generator's `Amplitude` field.

When used as an input, the `TX Power` and the spectrum analyzer's marker level (`Lvl`) measurements are *increased* by that amount.

This field is only used when the `RF Level Offset` field is set to On.

See the "[RF Level Offset](#)" field on page 178 for more information.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

RF Level Offset

This field enables/disables the RF level offsets entered in the RF In/Out, Duplex Out, and Antenna In fields below it.

- When set to On, the RF generator's amplitude and RF analyzer's power measurement are offset by the values entered in these fields.
- When set to Off, the values in these fields are ignored.

For more information see the following related topics:

["Antenna In" field on page 162](#)

["Duplex Out" field on page 166](#)

["RF In/Out" field on page 177](#)

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

RF Offset

This field is displayed when the RF Display field is set to Freq.

This field enables/disables the RF generator–RF analyzer frequency offset specified in the (Gen)–(Anl) field below it.

Operating Considerations

When an RF offset is used, changing the RF generator's frequency or RF analyzer's tune frequency automatically alters the other setting.

See ["Setting an RF Generator/Analyzer Offset" on page 47](#) for more information.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Save/Recall

This field specifies which memory device the Test Set accesses when the save and recall functions are used.

- **Internal** is a section of internal RAM. RAM is also used for running IBASIC programs, which may require you to delete the save/recall registers if the program is very large.
- **Card** is the front-panel MEMORY CARD (PC card) slot. A **Save/Recall Device is not Present** message is displayed if you try to save or recall an instrument setup when a write-able PC card is not installed in the Test Set.
- **RAM** refers to RAM disks that you can create on internal RAM. Refer to the *Programmer's Guide* for information on creating RAM Disks. This is part of the same memory used when "internal" is specified, and may have to be erased when loading very large IBASIC programs. A **Save/Recall Device is not initialized** message is displayed if you try to save or recall an instrument setup when a RAM disk has not been created.

Screen(s) Where Field is Present

I/O CONFIGURE

Serial Baud

This field selects the baud rate for serial communications when using the serial ports. Selecting this field displays a list of baud rate choices.

This setting is maintained after the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIUGRE

Serial_9 In

This field selects the destination of characters received by the Test Set on the SERIAL PORT 9.

- Inst configures the serial port to connect to an external ASCII terminal or computer to enter IBASIC programs, or to control the Test Set using an external keyboard.
- IBASIC is used to allow the IBASIC controller to read the serial port while a program is running.

Operating Considerations

If a serial printer is connected, the PRINT command causes the printer to take control of the serial port until printing is done.

This setting is maintained after the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Serial No.

This field displays the serial number of the Test Set.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Stop Length

Stop Length

This field specifies the number of stop bits (1 or 2) used for serial communications when using the serial port.

This setting is maintained after the instrument is turned off.

Screen(s) Where Field is Present

I/O CONFIGURE

Time

This field sets the time-of-day for the instrument's 24 hour clock.
(Example, 4:53 PM is entered 16:53)

Operating Considerations

The internal clock still functions when the instrument is turned off.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

Total RAM

This field displays the total amount of RAM available for IBASIC programs and save/recall registers.

Screen(s) Where Field is Present

INSTRUMENT CONFIGURE

7 **Connectors**

Alphabetical Listing of "[Connectors](#)" on page 184

Connectors

10 MHz REF OUT

This connector furnishes a 10 MHz reference for external instruments.

Operating Considerations

NOTE The reference output frequency is always 10 MHz, independent of the selected input reference frequency.

16 × CHIP CLOCK 19.6608 MHz OUT

This output provides a 19.6608 MHz (16 times the CDMA chip rate) square wave with a 50% duty cycle. This signal comes from the CDMA frame clocks.

ANALOG MODULATION IN

This connector provides an external modulation connection to the RF generator.

Operating Considerations

The `Mod In To` field of the RF GENERATOR screen sets the type of modulation (AM or FM).

The `FM Coupling` field on the RF GENERATOR screen selects ac or dc coupling of this signal for FM operation.

ANT IN

The antenna input is used for analyzing low-power RF signals (≤ 60 mW), and is typically used for off-the-air measurements. This port can be selected in the RF ANALYZER, or SPEC ANL screens.

CAUTION Connecting a signal of >60 mW to the ANT IN port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of several Watts).

If the overpower circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the ANT IN port, and reset using **Meas Reset** (press and release the **Shift** key, then the **Hold** key) or turn the Test Set off and on to reset it.

Operating Considerations

TX power cannot be measured using this port; use the RF IN/OUT port. However, low power levels can be measured using this port with the spectrum analyzer.

Additional sensitivity for this port is available using the **Sensitivity** field in the RF ANALYZER and SPEC ANL screens.

AUDIO IN

Two connectors are used to input audio signals to the AF analyzer:

- HI is the main audio signal input connection.
- LO is used for the audio signal reference. Three choices are available using the AF ANALYZER screen's `Audio In Lo` field:
 - `Gnd` connects the center pin through approximately 100 Ω to chassis ground.
 - `Float` is a floating input.
 - `600 To Hi` provides a 600 Ω internal load to match an audio source with an output impedance of 600 Ω .

The measured level is the potential between the HI and LO center pins. The shells of both connectors are at chassis ground.

For more information see the "[AF Anl In](#)" field on page 123, and the "[Audio In Lo](#)" field on page 127.

Operating Considerations

Input impedance is switchable between 1 M Ω in parallel with 95pF, or 600 Ω floating.

This port is selected as the AF analyzer's input using the `AF Anl In` field on the AF ANALYZER screen.

Signals input to the AF analyzer are routed through different filters, amplifiers, and detectors that affect the displayed measurement.

CAUTION The maximum level between the HI and LO center pins is 42 V peak (approximately 30 Vrms). Exceeding this value can cause permanent instrument damage.

AUDIO OUT

This port is used to output signals from audio frequency generators 1 and 2.

Operating Considerations

The output level is set by the AF generators and is not affected by the front-panel VOLUME control.

AC/DC coupling is selected using the `Audio Out` field. This field is available on the `RF GENERATOR` screen.

BASEBAND OUT (I and Q)

These outputs provide buffered versions of the I and Q drive signals.

Operating Considerations

The I and Q drive signals are balanced by DACs that provide the correct dc offset for the I/Q modulator.

Chassis Ground

The chassis ground terminal provides a general chassis connection.

CHIP CLOCK 1.2288 MHz OUT

This output provides a 1.2288 MHz (CDMA chip rate) square wave with a 50% duty cycle. This signal comes from the CDMA frame clocks.

DATA IN

This connector provides a data input to the CDMA generator.

DUPLEX OUT

This connector is an output for the RF generator and tracking generator.

Operating Considerations

The RF generator's output is selected in the `Output Port` field. This field is available on the RF GENERATOR, and SPEC ANL screens.

CAUTION Connecting an RF source of >60 mW to this connector can permanently damage the instrument.

EVEN SECOND SYNC IN

This port is an input for the even second clock from the base station under test. A positive edge on this connector starts two timers. One timer, after reaching terminal counts, starts CDMA frame clocks. The other timer starts pilot PN sequence generation. The `Even Sec In` field on the CDMA GENERATOR screen controls this port. See the ["Even Sec In" field on page 100](#).

EXT REF IN

This connector allows you to input an external reference. The reference frequency is selected using the `Ext Ref In` file on the INSTRUMENT CONFIGURE screen.

Operating Considerations

When a valid signal is applied to the EXT REF IN port, the Test Set automatically switches from internal to external reference if the `Ref Select` field is set to `Auto`.

This signal is used as a reference for, and directly affects, these functions:

- RF Generator Frequency (including the Tracking Generator)

- RF Frequency Counter

- AF Frequency Counter

- RF Analyzer Tune Frequency

- Spectrum Analyzer Center Frequency

AF generators 1 and 2 are not affected using an external reference; they use their own reference.

NOTE The reference output frequency is always 10 MHz, independent of the selected input reference frequency. Electrostatic discharges to the EXT REF IN port of 0.5 kV or above may cause degradation of performance requiring operator intervention.

EXT SCOPE TRIG IN

This connector provides an external oscilloscope's trigger input.

Operating Considerations

When measured with no load on the input, a 5 Volt level is present on the connector due to the internal pull-up resistor design.

FRAME CLOCK OUT

This output provides an external connection to several internal clocks. The clocks are selected using the `Frame Clock Output` field on the `INSTRUMENT CONFIGURE` screen. The frame clock selections are as follows:

- 20.00 ms
- 26.67 ms
- 80.00 ms
- 2.00 s

HP-IB

This connector is optional on the Test Set.

This connector allows communication between the Test Set and other instruments or computers using the Hewlett-Packard Interface Bus (HP-IB).

For more information see the "[HP-IB Adrs](#)" field on page 170.

MEMORY CARD Slot

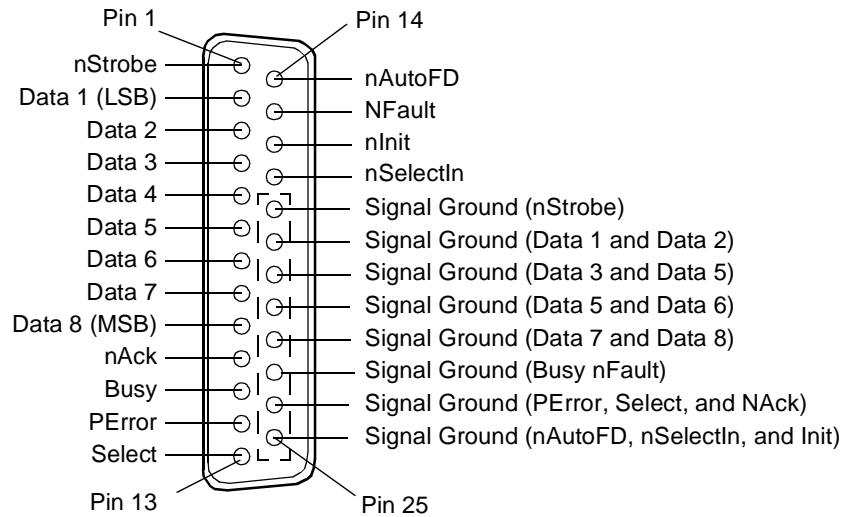
This front-panel opening is where PC cards are inserted.

PARALLEL PORT 15

This port is used with printers requiring a parallel interface when printing screen images or test results. Set the `Printer Port:` field (on the `PRINTER CONFIGURE` screen or `TESTS (Printer Setup)` screen) to `Parallel` to print to this port. Use address `PARALLEL_15` when sending data to this port from IBASIC programs.

Pin numbers are embossed on the connector. Pin assignments are as follows:

Figure 7-1 Parallel Port Pin Assignments



PARALLEL PORT 16

PARALLEL PORT 16 is reserved for future enhancements.

RF IN/OUT

This Type-N connection is used to output signals from the RF generator and to input RF signals.

CAUTION *Overpower Damage* — Refer to the Test Set's connector panel for maximum input power level. Exceeding this level can cause permanent instrument damage.

If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, reset using **Meas Reset** (press and release the **Shift** key, then the **Hold** key), and allow the Test Set to cool off for approximately 2 minutes before making any other measurements on this port.

Operating Considerations

This port must be used when measuring TX (RF) power.

Signals ≤ 60 mW can be input to the ANT IN connector for all RF measurements except TX Power.

This port can be selected on the RF ANALYZER, or SPEC ANL screens.

SCOPE MONITOR OUTPUT

This connector provides an external output from the AF analyzer.

Operating Considerations

The **Scope To** field in the AF ANALYZER screen determines the source of this signal. For more information see the "[Scope To](#)" field on [page 149](#).

The level is not affected by the front-panel VOLUME knob.

SERIAL PORTS 9, 10, and 11

The serial ports are used to input and output serial data for entering programs, printing test results and screen images, and sending test results to a connected controller, disk drive, or terminal.

Operating Considerations

The serial communications settings are defined on the I/O CONFIGURE screen.

SERIAL PORT 9 must be used for serial printing.

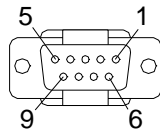
The IBASIC controller sends and receives data to the serial ports using address 9 for the primary port, and 10, 11 for the other ports. For example, to enter data from the primary serial port into a program variable named SDATA, you could use the following command:

```
ENTER SERIAL_9;SDATA
```

To send data from your program out of the primary serial port, you could use the following command:

```
OUTPUT SERIAL_9;SDATA
```

Figure 7-2 Serial Port Pin Assignments



TRIGGER QUALIFIER IN

This input is active when an external trigger qualifier is selected with the `Qual Event` field on the CDMA ANALYZER and CODE DOM screens.

If the trigger is to occur on the TRIGGER QUALIFIER IN signal, select Delay in the `Trig Event` field and select a delay of 0.0 μ s. If the TRIGGER QUALIFIER IN signal is a qualifier, select a trigger source in the `Trig Event` field.

For more information see ["Qual Event" field on page 108](#), and ["Trig Event" field on page 112](#).

VIDEO OUT

This connector provides a signal for using an external video monitor. The signal provides a duplicate of the Test Set's screen.

Operating Considerations

The CRT's Video Output drives a multisync monitor at 19.2 kHz (analog). Examples of this type of monitor include the Electrohome ECM 1410-DMS 14-inch color monitor and the EVM 1242-P4VID 12-inch monochrome monitor.

8 Accessories, Manuals, Support

Modifications

The following information can be found in the HP 8935 Assembly Level Repair Manual:

- Hardware Upgrades/Modifications
- Firmware Upgrades
- Power Cables

Accessories

Table 8-1 Accessories

Description	Ordering Number
None available at this time.	

External Monitor

The CRT's Video Output drives a multisync monitor at 19.2 kHz (analog). Examples of this type of monitor include the Electrohome ECM 1410-DMS 14-inch color monitor and the EVM 1242-P4VID 12-inch monochrome monitor.

Manuals (English and non-English)

Table 8-2 Manuals

Description	Language	Ordering Number
HP 8935 Manuals on CD-ROM	English	E6380-90027
HP 8935 CDMA Application Guide (paper)	English	E6380-90016
HP 8935 Programmer's Guide (paper)	English	E6380-90018
HP 8935 Reference Guide (paper)	English	E6380-90019
HP 8935 AMPS Application Guide (paper)	English	E6380-90017
HP 8935 Assembly Level Repair Manual (paper)	English	E6380-90015
No non-English manuals available at this time.		

Test Software

The Radio Test Software performs automated tests on radios used in various radio communication systems. Each test package is contained on an individual memory card.

Table 8-3 Software

E6385A	HP 8935 Lucent CDMA Cellular/PCS Base Station Test Set Software
E6386A	HP 8935 Samsung CDMA Cellular/PCS Base Station Test Set Software
E6387A	HP 8935 Nortel CDMA Cellular/PCS Base Station Test Set Software

Options

Table 8-4 HP 8935 Options

Order Number	Description
1D5	High Stability Reference

HP Support for Your Instrument

Getting Help

If you have problems using this Test Set, and cannot find the solution in these documents or the Help screens, please use one of the following contacts:

- Your local or regional sales office listed in [table 8-5, "HP Sales and Service Offices" on page 200.](#))
- U.S. Call Center: 800 542-4844
- Korea HP Direct: (82/2) 769-0800
- Canada HP Direct: (800) 387-3154
- European Call center: +31 20 547-9990
- Test and Measurement Organization on the web:
<http://www.tmo.hp.com/>

Parts and service for your Test Set can be ordered by

Customer Training

Hewlett-Packard offers customers a variety of training materials and classes that explain the theory and applications of many HP products. Contact your HP regional sales office to arrange training for you or your group.

Table 8-5 HP Sales and Service Offices

<p>United States of America U.S. Instrument Support Center For Test & Measurement Equipment Repair & Calibration. Englewood, Colorado 80112</p> <p>Telephone: (800) 403-0801 Fax: (888) 857-8161</p>	<p>United States of America Customer Information Center Hewlett-Packard Company Tel: (800) 752-0900</p> <p>6:00 am to 5:00 pm Pacific Time Parts Direct: 1-800-227-8164</p>	<p>United Kingdom Sales and Service Hewlett-Packard Ltd. Cain Road Amen Corner Bracknell, Berkshire RG12 1HN United Kingdom</p> <p>Telephone: 44 344 360000 Fax: 44 344 363344</p>
<p>South Eastern Europe Sales and Service Hewlett-Packard Ges. m.b.h. Liebigasse 1 P.O. Box 72 A-1222 Vienna, Austria</p> <p>Telephone: 43 222 2500 0 Telex: 13 4425</p>	<p>European Multicountry Region Sales and Service Hewlett-Packard S.A. P.O. Box 95 150, Route dv Nant_dl_AVRIL CH-1217 Meyrin 2 Geneva, Switzerland</p> <p>Telephone: (41/22) 780-8111 Fax: (41/22) 780-8542</p>	<p>Northern Europe Sales and Service Hewlett-Packard Nederland B.V. Startbaan 16 1187 XR Amstelveen, The Netherlands P.O. Box 667</p> <p>Telephone: 31/20 5476911 X 6631 Fax: 31-20-6471825NL</p>

<p>Asia Sales and Service Hewlett-Packard Asia Ltd. 22-30/F Peregrine Tower Lippo Center 89 Queensway, Central Hong Kong G.P.O. Box 863 Hong Kong</p> <p>Telephone: 852-848-7777 Fax: 852-868-4997</p>	<p>Japan Sales and Service Yokogawa-Hewlett-Packard Ltd. 3-29-21, Takaido-Higashi Suginami-Ku, Tokyo 168</p> <p>Telephone: 81 3 3331-6111 Fax: 81 3 3331-6631</p>	<p>International Sales Branch Headquarters Sales and Service Hewlett-Packard S.A. 39 Rue Veyrot P.O. Box 365 1217 Meyrin 1 Geneva, Switzerland</p> <p>Telephone: 41-22-780-4111 Fax: 41-22-780-4770</p>
<p>Australia, New Zealand Sales and Service Hewlett-Packard Ltd. P.O. Box 221 31-41 Joseph Street Blackburn, Victoria 3130</p> <p>Telephone: (61/3) 895-2895 Fax: (61/3) 898-9257</p>	<p>Canada Sales and Service Hewlett-Packard (Canada) Ltd. 5150 Spectrum Way Mississauga, Ontario L4W 5G1 Canada</p> <p>Telephone: (416) 206-4725 Fax: (416) 206-4739</p>	<p>Canada Service Center Hewlett-Packard Company 17500 Transcanada Highway S. Serv Road Kirkland, Quebec H9J 2X8 Canada</p> <p>Telephone: (416) 206-3295</p>
<p>Canada Service Center Hewlett-Packard Ltd. 11120 178 Street Edmonton, Alberta T5S 1P2 Canada</p> <p>Telephone: (403) 486-6666 Fax: (403) 489-8764</p>	<p>Latin America Hewlett-Packard Company LAHQ Mexico City Col. Lomas de Virreyes 11000 Mexico D.F. Mexico</p> <p>Telephone: (52/5) 326-4000 Fax: (52/5) 202 7718</p>	

9 **Error Messages**

General Information About Error Messages

Information concerning error messages displayed by the Test Set may be found in one of the following manuals:

- *HP 8935 Programmer's Guide*
- *HP 8935 Assembly Level Repair Manual*
- *HP Instrument BASIC User's Handbook:*
- *A Beginner's Guide to SCPI*

The format of the displayed message determines which manual contains information about the error message. There are four basic error message formats:

- Positive numbered error messages
- IBASIC error messages
- HP-IB error messages
- Text only error messages

The following paragraphs give a brief description of each message format and direct you to the manual to look in for information about error messages displayed in that format.

Positive Numbered Error Messages

Positive numbered error messages are generally associated with IBASIC. Refer to the *HP Instrument BASIC User's Handbook* for information on IBASIC error messages.

Positive numbered error messages take the form:

ERROR XX

For example:

Error 54 Duplicate file name

or

Error 80 in 632 Medium changed or not in drive

Negative Numbered Error Messages

Negative numbers preceding the error messages text correspond to the error conditions outlined in the Standard Commands for Programmable Instruments (SCPI). For more information on SCPI, order the following book,

A Beginner's Guide to SCPI Addison-Wesley Publishing Company ISBN 0-201-56350-9 HP P/N 5010-7166

or contact,

Fred Bode, Executive Director SCPI Consortium

8380 Hercules Drive, Suite P3

La Mesa, CA 91942

Phone: (619) 697-8790, FAX: (619) 697-5955 CompuServe Number: 76516,254

Negative numbered error messages take the form: ERROR -XX <error message>

For example

```
Error -128 Numeric data not allowed
```

or

```
Error -141 Invalid character data
```

IBASIC Error Messages

IBASIC Error Messages are associated with IBASIC operation. IBASIC error messages can have both positive and negative numbers. Refer to the *HP Instrument BASIC User's Handbook* for information on positive numbered error messages. Refer to the HP-IB Error Messages section of the *Programmer's Guide* for information on negative numbered error messages (the error message associated with a negative number is the same for HP-IB errors and IBASIC errors).

IBASIC error messages take the form:

```
IBASIC Error: -XX
```

For example:

```
IBASIC Error: -286 Program runtime error
```

HP-IB Error Messages

HP-IB Error Messages are associated with HP-IB operation. Refer to the Programmers Guide for information on HP-IB error messages.

HP-IB error messages take the form:

HP-IB Error: -XX

or

HP-IB Error

For example:

HP-IB Error: -410 Query INTERRUPTED.

or

HP-IB Error: Input value out of range.

Text Only Error Messages

Text only error messages are generally associated with manual operation of the Test Set. This manual contains information on text only error messages.

Text only error messages can also be displayed while running the Test Set's built-in diagnostic or calibration utility programs. Refer to the *Assembly Level Repair* manual for information on text only error messages displayed while running the Test Set's built-in diagnostic or calibration utility programs.

Text only error messages take the form:

This is an error message.

Input value out of range.

The Message Display

During instrument operation, various messages may appear on the Test Set's display. Prompt-type messages generally appear on the first line of the Test Set's display. General operating and error messages usually appear on the second line of the display. Some messages are persistent; they remain displayed until the error condition no longer exists, or until another persistent message with greater priority occurs. Other messages are only displayed when the error first occurs; they are removed when a key is pressed or the knob is turned, or when an HP-IB command is received. Many of the messages are displayed on the ERROR MESSAGE screen until the instrument is turned off.

Messages that are about error conditions may tell you what to do to correct the error (turn something off, reduce a field's value, press a certain key, and so forth). Messages and prompts are sometimes accompanied by a beep or warble.

NOTE Warbles and Beeps

A warble sound indicates that an instrument-damaging event is occurring. Beeps often occur only with the first occurrence of the message. Prompts are generally silent.

Non-Recoverable Firmware Error

The non-recoverable firmware error is very important. It appears when an unanticipated event occurs that the Test Set's firmware cannot handle. The message appears in the center of the Test Set's display and (except for the two lines in the second paragraph) has the form:

```
Non-recoverable firmware error. Please record the 2 lines of
text below and contact Hewlett-Packard through your local
service center or by calling (800) 827-3848 (USA, collect) and
asking to speak to the Service Engineer.
```

```
'Address error exception'
  at line number 0
```

To continue operation, turn POWER off and back on.

Follow the instructions in the message.

Unfortunately, you will not be able to recover from this condition. You must switch the Test Set off and back on. When you rerun the test where the Error Message occurred, it may not occur again. If it does reappear, it would be helpful to Hewlett-Packard to record exactly what the configuration of the instrument was when the error appeared and contact Hewlett-Packard.

Text Only Error Messages

Operation errors generally occur when you try to do something the Test Set was not designed to do. Most messages tell you what to do to correct the problem, (turn something off, reduce a field's value, press a certain key,...and so forth).

Some common messages are listed here:

- All self tests passed.
- The Test Set did not detect any hardware or firmware failures during its initial self-diagnostics.

This message should always be displayed immediately after instrument turn on.
- Input value out of range.

A number was entered that was too large or small for the selected field, for example, trying to set `AFG1 Freq` to 125 kHz.
- Invalid keystroke.

You used a key that has no function relating to the selected field, for example, pressing the `On/Off` key while the `Filter 1` field is selected.
- Option not installed.

You selected a function that requires optional hardware that is not present.
- Turn off either AM or FM settings.

You tried to create simultaneous AM and FM (using any combination of `AFGen1`, `AFGen2`, and the `Mod In To` field). The Test Set does not provide simultaneous AM and FM.
- Squelch interrupt overflow. Reset using `Meas Reset` (press and release the `Shift` key, then the `Hold` key).

The Test Set temporarily interrupts audio measurements when squelch is first broken to prevent internal switching transients from influencing measurements (except when using the `SCOPE`, `SPEC ANL`, `SERVICE` screens). If squelch is repetitively broken in a period of a few seconds, the duration of measurement interruption becomes too great, and the Test Set stops interrupting the signal. Following measurements may be influenced by transient signals.

`Meas Reset` clears the data buffer used to generate interrupts, resetting the normal squelch operation to eliminate transients.

This condition may occur when monitoring low-level off-the-air signals.

- Cal file checksum incorrect - initializing file.

This error usually occurs after changing the Test Set's firmware ROM's. It is not a problem in that instance, but should not re-appear during subsequent operation of the Test Set.

- One or more self tests failed. Error code: XXXX

An instrument failure was detected when the Test Set was turned on. (For example, having a stuck front-panel key during turn on.) The numbered error message corresponds to a binary-weighted group of errors listed in the *TST Common Command description in the Programmer's Guide.

- Change Ref Level, Input Port or Attenuator (if using Hold).

The RF signal level is either too great or too small for the current input port, attenuator setting, or both. This error often occurs when trying to make a low-level measurement using the RF IN/OUT port with the spectrum analyzer. Make the indicated changes until this message is no longer displayed.

- Change RF Gen Amplitude, Output Port or Atten Hold (if on).

This message appears when the RF Generator's Amplitude field is set too high when using the RF IN/OUT port or when adjusting the amplitude with the Atten Hold field set to On.

- The RF IN/OUT port has a lower maximum output level than the DUPLEX OUT port. Use the DUPLEX OUT port, or reduce the RF generator's level.

If Atten Hold is On, you may be adjusting the amplitude outside of the allowed range. Change the amplitude

- Direct latch write occurred. Cycle power when done servicing.

- The SERVICE screen was accessed and one or more internal latch settings were changed. Turn the instrument off and back on to reset the latches. (This condition can occur during periodic calibration.)

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